THE ROLE OF CONFLICT DURING THE ADOPTION OF AGRICULTURE IN THE SOUTHWESTERN JAPANESE ARCHIPELAGO: LATE – FINAL JŌMON AND YAYOI PERIOD TRAUMATIC LESIONS

― 縄文時代から弥生時代における外傷性の損傷についての研究 ―

J. Alyssa White, B.A., B.A., M.Sc.
Merton College
Institute of Archaeology



Thesis submitted for the degree of Doctor of Philosophy
University of Oxford

2023

ABSTRACT

In the global literature on violence and warfare, the Jōmon period of the prehistoric Japanese archipelago is renowned as an example of a complex hunter-gatherer culture with little evidence of violent conflict through its duration, whereas the subsequent agricultural Yayoi period is marked by numerous indicators of violence, including formalised weaponry and fortified villages. How violence was prevented or utilised during large-scale cultural and technological transitions in prehistory is an ongoing area of research, but it is clear that they cannot simply be explained by external pressures, rather the cultural context in which conflict management strategies are played-out is also a large deciding factor in whether or not disputes result in violence.

In order to look at these dynamics with great resolution, this thesis aimed to systematically analyse the arguably most direct evidence for violence – traumatic skeletal lesion – from 29 sites dating to the Late–Final Jōmon (ca. 2540 – 435 BC) through the Yayoi (ca. 900 BC – 250 AD) periods, where agriculture first appeared in the Japanese archipelago. In total 250 Jōmon skulls and 174 Yayoi skeletons were examined for evidence of traumatic lesions likely related to violence. In order to facilitate the data analysis, a method of examining skeletal data in Geographical Information Systems (GIS) using an existing 3D model of the human skeleton was developed. The author modified a freely available 3D model of the skeleton (BodyParts3D licenced through Creative Commons) to be compatible with this thesis' completeness recording methods. 3D features were then added to the model to represent instances of trauma. This novel method allowed for the creation of distinct analytical units which could be easily queried, compiled, and compared at the individual and group levels rather than simply representing completeness and trauma data in *ad hoc* diagrams or through singular 3D visualisations.

The results demonstrate that, although it has been underestimated, the overall rates of violent trauma during the Jōmon are low, but that there are as of yet unexplored patterns in the occurrence of antemortem and perimortem trauma among the males and females of the period. The transition to the Yayoi is marked by an increase in healed trauma among the sites dating to the beginnings of the period. Perimortem trauma and trauma related to weaponry increase from the Early–Middle Yayoi period, but indicators of healed intragroup trauma persist. The implications of these findings are critically evaluated in relation to previous studies in the region and to patterns of violence from two case studies from European prehistory – the Mesolithic-–Neolithic transition and the Bronze Age.

ACKNOWLEDGMENTS

The completion of this thesis would not have been possible without the support and guidance of those around me. Here I would like to extend my sincere thanks to the individuals and institutions that have been integral in making this thesis a reality.

First, I would like to thank my supervisor, Rick Schulting, for his continued and unwavering support of my academic growth and of this project. Thank you for always making time for me in the office or at the pub to discuss our work and for your constant enthusiasm about it. I have loved being your student from my master's through doctorate.

Thank you as well to my co-supervisor, Mark Hudson, who helped put me in a position to study Japanese archaeology from when I was only an undergraduate student. Your continued guidance in the field has been irreplaceable.

A giant thank you to John Pouncett, who took me under his wing from the first year of my doctorate and mentored me in spatial analysis. You have expanded and refined the way I think about my data and, more than that, you have always been a pillar of unwavering support – thank you!

I could not have gathered the data necessary to write this thesis without the generous and always kind support of the institutions that house the Jōmon and Yayoi skeletal collections examined and the staff that continue to diligently and respectfully care for these remains. My sincerest thanks to the Laboratory of Physical Anthropology at the Graduate School of Science at Kyoto University, Kyushu University Museum and Advanced Asian Archaeological Research Center, the Kochi Prefecture Bunkazai Centre and Prefectural Museum of History, the Okayama City Maizo Bunkazai Centre, Doigahama site anthropological museum, and the Nara National Research Institute for Cultural Properties.

I wish to extend a special thanks to the professors, staff, and graduate students at the universities of Kyoto and Kyushu. Dr Shiori Yonemoto and Dr Kyoko Funahashi at Kyushu University have always gone out of their way to help facilitate my research, for which I cannot thank them enough. Thank you as well to Dr Noriko Seguchi who always made me feel welcome during my long stays in Fukuoka and Itoshima, particularly during a wonderful sunset dinner by the seaside in 2018. Thank you to Dr Masato Nakatsukasa at Kyoto University for always being available, welcoming, and willing to provide guidance on the collections at KyoDai and for simultaneously being an absolute pleasure to work with on the Tsukumo No. 24 case. Finally, I would like to thank Dr Takayuki Matsushita for kindly giving me a ride to the train station after I managed to strand myself at the Doigahama site anthropological museum on a Sunday afternoon and for even taking me to visit the Nakanohama site along the way.

This research would not have been possible without the generous financial support of the School of Archaeology and the Meyerstein Fund, Merton College, the Clarendon Fund, and the Sasakawa Fund at the University of Oxford; the EAJS Toshiba International Foundation Fellowship; the Japan Foundation Endowment Committee; and the Great Britain Sasakawa Foundation. Thank you for making my doctoral education and this thesis project possible.

I would also like to thank the examiners of this thesis for taking the time to provide their expert guidance and feedback.

I would like to thank the support network that I had in Oxford that made my student years there such a joy and the city a home. Thank you to my wonderful housemates for being my surrogate family in the UK. Many thanks as well to my officemates who were always up for a laugh and for a chat about research (and for a drink at the pub!).

One of the true joys of being able to work in Japan several summers in a row was continuing to get to know and deeply appreciate the Hirose family. Thank you for taking me in that first time I studied abroad in Kyoto and for thereafter always making a place for me in your family and your homes. Thank you for all the wonderful meals and trips that we enjoyed together. Thank you to my host sisters for putting me up in Tokyo, and thanks to my host dad for always making time for me despite his busy work schedule. Thank you to my host mom for becoming my friend and always being a wonderful companion. And finally thank you to Obā-san Hirose for always taking me out to a delicious meal when I was in town.

I also thank our cats, Hemingway and Fitzgerald, for always making home a place of respite and rest.

Thank you to my family who have supported me in my education, particularly in the final years of my doctorate as they patiently waited for me to *just finish it*. A special thanks to my parents for their support and love through the years. And a particular thanks to my abuelo, Prof José A. Madrigal, a man whose sincere love for learning and mentorship inspired me to pursue academics. You never got to see me finish my doctorate, Abuelo, but I hope that, wherever you are, you will raise a glass in celebration with me.

Finally, I thank my husband, Patrick Donnan, who is undoubtedly my number one supporter. Your unwavering belief in my ability to not only succeed, but to thrive has been one of my greatest inspirations. Most recently, thank you for your loving and patient support as I finished writing this thesis while you also prepared to become a new dad.

Qui Timet Deum Faciet Bona

F o r Joan

TABLE OF CONTENTS

CHAPTER 1 – INTRODUCTION 1

1.1 PROJECT OVERVIEW 1
1.1.1 OVERVIEW OF MATERIALS AND METHODS 4
1.1.2 COMPARATIVE AND SPATIAL ANALYSES 6
1.1.3 BIASES AND LIMITATIONS OF METHODOLOGIES 7
1.2 HYPOTHESES 9
1.3 DEFINING TERMS 10
1.4 THESIS STRUCTURE 11

CHAPTER 2 – THEORY OF VIOLENCE AND WARFARE 14

2.1 INTRODUCTION AND CONTEXT 14
2.2 INFLUENTIAL THEORIES 18
2.2.1 TRIBAL ZONE THEORY 19
2.2.2 VIOLENCE ABOUNDS 20
2.2.3 CULTURAL EVOLUTION THEORY 21
2.2.4 SEDENTISM, AGRICULTURE, AND THE CONSOLIDATION OF POWER 22
2.3 ELABORATING ON THE GENERAL THEMES 25
2.3.1 VICTIM, FIEND, OR SOMETHING IN-BETWEEN 25
2.3.2 THE FAIRER SEX? 26
2.4 SUMMARY 27

CHAPTER 3 – PREHISTORIC CULTURES OF THE JAPANESE ARCHIPELAGO 28

3.1 GENERAL INTRODUCTION 28
3.1.1 INTRODUCTION TO THE PREHISTORIC CULTURES OF JAPAN 30
3.1.2 'JAPANESE' 32
3.1.3 JŌMON–YAYOI TRANSITION 33
3.1.4 A NOTE ON THE DATING OF THE JŌMON AND YAYOI PERIODS 37
3.1.5 SEDENTISM AND SUBSISTENCE 40
3.1.6 MORTUARY PRACTICE 41
3.1.7 TOOLS AND WEAPONS 42
3.1.8 RITUAL 43
3.2 TRANSITION TO THE KOFUN PERIOD 44
3.3 OCCUPATIONAL RISK FACTORS 45
3.4 PREVIOUS TRAUMA ANALYSIS 46
3.4.1 PAST STUDIES OF CONFLICT IN JAPANESE PREHISTORY 46
3.4.1.1 Jōmon Period Skeletal Trauma 47
3.4.1.2 Yayoi Period Skeletal Trauma 50
3.4.1.3 Kofun Period 55
3.4.1.4 Summary of Prehistoric Japan and Evidence for Violent Conflict 55

CHAPTER 4 – VIOLENCE DURING SUBSISTENCE AND TECHNOLOGICAL TRANSITIONS 56

4.1 INTRODUCTION 56
4.2 OVERVIEW 57
4.3 CASE STUDIES: MESOLITHIC TO NEOLITHIC AND NEOLITHIC TO BRONZE AGE EUROPE 61
4.3.1 CRITICAL EVALUATION OF THE EVIDENCE FOR VIOLENCE 62
4.3.1.1.1 Mesolithic 62

4.3.1.1.2 To the Neolithic 67
4.3.1.1.3 To the Bronze Age 75
4.4 CONCLUSION 83

CHAPTER 5 – SITES DETAILS AND SAMPLE 84

5.1 SKELETAL COLLECTIONS EXAMINED 84
5.2 SITE DETAILS 90
5.2.1 JŌMON SITES 90
5.2.1.1 Chūbu 90
5.2.1.1.1 Inariyama 90
5.2.1.1.2 Yoshigo 93
5.2.1.2 Chūgoku 96
5.2.1.2.1 Tsukumo 96
5.2.1.2.2 Toyomatsu-Dōmen Cave 98
5.2.1.2.3 Sarugami Rock-shelter 99
5.2.1.3 Shikoku 100
5.2.1.3.1 Itoku 100
5.2.1.4 Kyūshū 101
5.2.1.4.1 Adaka 101
5.2.1.4.2 Einomaru 102
5.2.1.4.3 Goryō 103
5.2.1.4.4 Kawaji 104
5.2.1.4.5 Kitsuki 106
5.2.1.4.6 Kōjō 106
5.2.1.4.7 Shimokusuda 107
5.2.1.4.8 Wakazono 108
5.2.1.4.9 Yamaga 109
5.2.2 YAYOI SITES 111
5.2.2.1 Chūgoku 111
5.2.2.1.1 Doigahama 111
5.2.2.1.2 Kōra 112
5.2.2.1.3 Minamikata 114
5.2.2.1.4 Nakanohama 115
5.2.2.2 Kinki 118
5.2.2.2.1 Shibu 118
5.2.2.3 Kyūshū 119
5.2.2.3.1 Hirota 119
5.2.2.3.2 Kanenokuma 121
5.2.2.3.3 Mitsunagata 122
5.2.2.3.4 Nagaoka 124
5.2.2.3.5 Ōtomo 124
5.2.2.3.6 Shinmachi 127
5.2.2.3.7 Sudare 128
5.2.2.3.8 Tsukomuta 4 129
5.2.2.3.9 Yokoguma kitsunezuka 130

CHAPTER 6 – METHODOLOGY 132

6.1 OVERVIEW 132
6.2 OSTEOLOGICAL ANALYSES 133
6.2.1 SEX AND AGE-AT-DEATH 133
6.2.2 CONDITION OF SKELETAL REMAINS AND EFFECT ON TRAUMA QUANTIFICATION 135
6.2.2.1 Recording Surface Condition 137

6.2.2.2 Examined Areas and Limitations 138
6.2.2.3 Recording Completeness 141
6.2.3 VIOLENT TRAUMA 146
6.2.3.1 Timing and Characteristics of an Injury 149
6.2.3.2 Distinguishing Trauma and Differential Diagnosis 151
6.2.3.2.1 Blunt Force Trauma: Characteristics 151
6.2.3.2.2 Sharp Force and Projectile Trauma: Characteristics 154
6.2.3.2.3 Recording Trauma 157
6.2.3.3 Two-tier Confidence Scores 157
6.3 SPATIAL AND STATISTICAL ANALYSES 158
6.3.1 MAPS OF THE JAPANESE ARCHIPELAGO AND SITES 158
6.3.2 3D MODEL OF THE HUMAN BODY 159
6.3.2.1 Creating Zones, Calculating Completeness, and Weighting 159
6.3.2.1.1 Mapping Trauma 164
6.3.2.2 Statistical Analyses 164

CHAPTER 7 – SKULL TRAUMA RESULTS AND DISCUSSION 166

7.1 COMPLETENESS AND PRESERVATION 166
7.2 JŌMON SKULL TRAUMA 171
7.3 YAYOI SKULL TRAUMA 177
7.4 YAYOI SKULL TRAUMA PATTERNS 188
7.4.1 NASAL BONE FRACTURES 188
7.4.2 HIROTA SITE 191
7.5 JŌMON AND YAYOI VIOLENT SKULL TRAUMA 191
7.6 SUMMARY 195

CHAPTER 8 – YAYOI TRAUMA RESULTS AND DISCUSSION 196

8.1 COMPLETENESS AND PRESERVATION 196
8.2 OVERVIEW OF YAYOI TRAUMA FOUND 198
8.3 TRAUMA PATTERNS 209
8.3.1 EVIDENCE FOR CASES OF 'OVERKILL' 209
8.3.2 WEAPON TRAUMA 215
8.4 COMPARING RECENT STUDIES ON YAYOI VIOLENT SKELETAL TRAUMA 217
8.5 SUMMARY 220

CHAPTER 9 – COMPARATIVE ANALYSIS OF PREHISTORIC VIOLENCE IN THE SOUTHWESTERN JAPANESE ARCHIPELAGO 222

9.1 CONTEXTUALISING LATE TO FINAL JŌMON PERIOD VIOLENCE 222
9.1.1 TOOL-WEAPONS 223
9.1.2 SITES 226
9.1.3 FEMALE INVOLVEMENT 228
9.1.4 COMPARING JŌMON AND MESOLITHIC RATES OF VIOLENT TRAUMA 230
9.2 CONTEXTUALISING YAYOI PERIOD VIOLENCE 233
9.2.1 INITIAL–EARLY YAYOI 234
9.2.1.1 Nasal Fractures 235
9.2.1.2 Head-taking 237
9.2.1.3 Fortified Sites 242
9.2.2 EARLY–MIDDLE YAYOI 243
9.2.2.1 Weapon Use 245
9.2.2.2 Sex 247
9.2.2.3 Warriorhood 249

9.2.2.4 Overkill 251
9.2.3 MIDDLE–LATE YAYOI 253
9.2.3.1 Large-Scale Conflict? 253

CHAPTER 10 – CONCLUSION 257

10.1 HYPOTHESES AND IMPLICATIONS 257
10.1.1 HYPOTHESIS: THE FIRST 257
10.1.2 HYPOTHESIS: THE SECOND 261
10.1.3 HYPOTHESIS: THE THIRD 263
10.1.4 HYPOTHESIS: THE FOURTH 264
10.1.5 COMPARATIVE ANALYSIS 266
10.2 CONCLUSION 267

REFERENCES 270

CATALOGUE I: SKELETAL DATA I

CATALOGUE II: DOCUMENTATION AND EVALUATION OF TRAUMATIC INJURIES LXXX

LIST OF TABLES

TABLE 3.1: CHRONOLOGY OF PRE- AND PROTOHISTORIC CULTURES OF THE JAPANESE ARCHIPELAGO (G. L. BARNES 2015; K. KOBAYASHI 2017; RHEE ET AL. 2021). *THE FINAL JŌMON PERIOD IS SHORTER IN SW JAPAN (I.E. N KYUSHU AND SE HONSHŪ WHERE THE YAYOI FIRST EMERGED) AND MORE EXTENDED IN NE JAPAN. 500 BC IS AN APPROXIMATE AVERAGE OF THESE. **AS DISCUSSED IN DETAIL, THE ABSOLUTE DATES FOR THE INITIAL PHASE OF THE YAYOI PERIOD ARE CONTESTED CURRENTLY. ***AT THIS POINT THERE ARE BRONZE OBJECTS IMPORTED FROM CHINA THAT ARE WELL DATED. 38
TABLE 5.1: INDIVIDUALS EXAMINED FROM EACH SUB-PERIOD. 84
TABLE 5.2: JŌMON SITES AND NUMBER OF INDIVIDUALS ANALYSED. THE SITE CODES CORRESPOND TO THE MAP LABELS IN FIGURE 5.2. CHRONOLOGY WAS PRIMARILY DETERMINED BY PREVIOUS ANALYSES OF MORTUARY AND CERAMIC TRADITIONS. RADIOCARBON DATES WERE AVAILABLE FOR SOME INDIVIDUALS FROM INARIYAMA AND YOSHIGO SHELL-MOUNDS. FURTHER DETAILS AND REFERENCES CAN BE FOUND IN CATALOGUE I. 89
TABLE 5.3: YAYOI AND KOFUN SITES AND NUMBER OF INDIVIDUALS ANALYSED. THE SITE CODES CORRESPOND TO THE MAP LABELS IN FIGURE 5.2. CHRONOLOGY WAS PRIMARILY DETERMINED BY PREVIOUS ANALYSES OF MORTUARY AND CERAMIC TRADITIONS. RADIOCARBON DATES WERE AVAILABLE FOR SOME INDIVIDUALS FROM ŌTOMO. FURTHER DETAILS AND REFERENCES CAN BE FOUND IN CATALOGUE I. 90
TABLE 6.1: SURFACE CONDITION SCORING METHOD AND HOW IT CORRELATES TO MCKINLEY'S SCORING SYSTEM. 'SFT' REFERS TO SHARP FORCE TRAUMA AND 'BFT' REFERS TO BLUNT FORCE TRAUMA. PHOTOS TAKEN BY JA WHITE, COURTESY OF KYUSHU UNIVERSITY MUSEUM (LEFT), KYOTO UNIVERSITY (MIDDLE), AND THE OKAYAMA CITY MAIZO BUNKAZAI CENTRE (RIGHT). 138
TABLE 6.2: DESCRIPTION OF INJURY MECHANISMS AND RESULTING FRACTURE TYPES AFTER COURT-BROWN ET AL. (2015), LOVELL (1997), AND REDFERN AND ROBERTS (2019). 147
TABLE 7.1: SUMMARY OF THE SKULL COMPLETENESS AND TRAUMA OF THE JŌMON AND YAYOI SAMPLES. 171
TABLE 7.2: ALL TRAUMA FROM THE JŌMON SAMPLE THAT WAS POSSIBLY RELATED TO VIOLENCE. SEE CATALOGUE II FOR DETAILS, IMAGES OF EACH, AND VISUALISATION OF COMPLETENESS. THE NUMBERS IN THE 'ELEMENT' AND 'ELEMENT COMPLETENESS' COLUMNS REFER TO THE INJURY NUMBER ASSIGNED IN CATALOGUE II. (YA = YOUNG ADULT, MA = MIDDLE ADULT, OA = OLD ADULT). 172
TABLE 7.3: PREVALENCE OF RECORDED ZONES WITH TRAUMA FOR THE JŌMON. 173
TABLE 7.4: PREVALENCE OF VIOLENCE-RELATED TRAUMA BY SITE FOR THE JŌMON. *THIS DOES NOT INCLUDE THE PARRY FRACTURE FROM TSUKUMO. 174
TABLE 7.5: ALL SKULL TRAUMA FROM THE YAYOI SAMPLE THAT WAS POSSIBLY RELATED TO VIOLENCE. 'FBT' DENOTES 'FULL BODY TRAUMA' AND 'ST' DENOTES 'SKULL TRAUMA'. THIS EXCLUDES ANY INDIVIDUALS WITH ONLY POSTCRANIAL TRAUMA. SEE CATALOGUE II FOR DETAILS, IMAGES OF EACH, AND VISUALISATION OF COMPLETENESS. THE NUMBERS IN THE 'ELEMENT' AND 'ELEMENT COMPLETENESS' COLUMNS REFER TO THE INJURY NUMBER ASSIGNED IN CATALOGUE II. (YA = YOUNG ADULT, MA = MIDDLE ADULT, OA = OLD ADULT). 178
TABLE 7.6: PREVALENCE OF RECORDED ZONES WITH TRAUMA FOR THE YAYOI. THE TRAUMA LISTED BELOW IS BY ZONE (I.E. IF THE RIGHT AND LEFT PARIETAL BONES FOR A SINGLE INDIVIDUAL WERE IMPACTED BY DIFFERENT INJURIES, THEY WERE BOTH RECORDED AS BEING IMPACTED). 183
TABLE 7.7: PREVALENCE OF VIOLENCE-RELATED TRAUMA BY SITE FOR THE YAYOI. 186
TABLE 7.8: PERCENT OF TRAUMA PER INDIVIDUAL DURING THE JŌMON PERIOD, INTEGRATING DATA FROM NAKAO ET AL. (2016) AND NAKAGAWA ET AL. (2017) WITH THOSE IN THIS STUDY THE VALUES IN BOLD ARE THOSE WHICH HAVE BEEN MODIFIED. *EXCLUDING SITES WERE N < 10. 194
TABLE 8.1: SUMMARY OF THE COMPLETENESS AND TRAUMA OF THE YAYOI SAMPLE BY PERIOD. *NO SUBPERIOD DESIGNATED. 198
TABLE 8.2: ALL TRAUMA FROM THE YAYOI SAMPLE THAT WAS POSSIBLY RELATED TO VIOLENCE (MEDIUM–HIGH LIKELIHOOD). 'FBT' DENOTES 'FULL BODY TRAUMA', 'PCT' DENOTES 'POSTCRANIAL TRAUMA', AND 'ST' DENOTES 'SKULL TRAUMA'. THIS EXCLUDES ANY INDIVIDUALS WITH ONLY POSTCRANIAL TRAUMA. SEE CATALOGUE II

FOR DETAILS, IMAGES OF EACH, AND VISUALISATION OF THEIR COMPLETENESS AND THE LOCATION OF INJURIES. 199
TABLE 8.3: PREVALENCE OF RECORDED ZONES WITH TRAUMA FOR THE YAYOI. NOTE THAT DUE TO THE LOW RECOVERY RATES OF THE HYOID BONE, ITS COMPLETENESS WAS NOT RECORDED FOR THE WHOLE SAMPLE. 204
TABLE 8.4: THE PREVALENCE OF TRAUMA AT EACH YAYOI SITE EXAMINED. 209
TABLE 8.5: PERCENT OF TRAUMA PER INDIVIDUAL DURING THE YAYOI PERIOD, INTEGRATING DATA FROM NAKAGAWA ET AL. (2017) WITH THOSE IN THIS STUDY, EXCLUDING THE CASES THAT HAVE ALREADY BEEN REPORTED AND INCLUDED IN NAKAGAWA AND COLLEAGUES' DATA. THE VALUES IN BOLD ARE THOSE WHICH HAVE BEEN MODIFIED. *EXCLUDING SITES WERE N < 10. **INCLUDING ONE YAYOI INDIVIDUAL WITHOUT A KNOWN SUBPERIOD. 219
TABLE 9.1:SITES WITH INDIVIDUALS WITH VIOLENT TRAUMA DURING THE EUROPEAN MESOLITHIC. REPRODUCED FROM DATA REPORTED IN NAKAGAWA ET AL. (2017) (HTTP://HISASHINAKAO.COM/DATA/). *SEE FOOTNOTE 10 231
TABLE 9.2: HEADLESS BURIALS AND SKULL BURIALS ADAPTED AND TRANSLATED FROM HASHIGUCHI (2007:4–38). *THIS INDIVIDUAL (NAGAOKA SK 95) WAS EXAMINED IN THIS THESIS, BUT AS THE HEAD AND CERVICAL VERTEBRAE ARE SIMPLY MISSING, IT WAS CONSIDERED THAT THERE WAS NOT ENOUGH APPROPRIATE EVIDENCE (I.E. EVIDENCE OF DECAPITATION) TO ATTRIBUTE THE MISSING BONES TO VIOLENT TRAUMA. 240

LIST OF FIGURES

FIGURE 3.1: MAPS OF THE JAPANESE ARCHIPELAGO SHOWING THE CURRENT PREFECTURES OF JAPAN AND THE LARGER REGIONS OF JAPAN AND ITS PREFECTURES (ADMINISTRATIVE BOUNDARIES MAP SOURCE IS GADM): [1]AICHI, [2]AKITA, [3]AOMORI, [4]CHIBA, [5]EHIME, [6]FUKUI, [7]FUKUOKA, [8]FUKUSHIMA, [9]GIFU, [10]GUNMA, [11]HIROSHIMA, [12]HOKKAIDO, [13]HYŌGO, [14]IBARAKI, [15]ISHIKAWA, [16]IWATE, [17]KAGAWA, [18]KAGOSHIMA, [19]KANAGAWA, [20]KŌCHI, [21]KUMAMOTO, [22]KYŌTO, [23]MIE, [24]MIYAGI, [25]MIYAZAKI, [26]NAGANO, [27]NAGASAKI, [28]NARA, [29]NIIGATA, [30]ŌITA, [31]OKAYAMA, [32]OKINAWA, [33]ŌSAKA, [34]SAGA, [35]SAITAMA, [36]SHIGA, [37]SHIMANE, [28]SHIZUOKA, [39]TOCHIGI, [40]TOKUSHIMA, [41]TŌKYŌ, [42]TOTTORI, [43]TOYAMA, [44]WAKAYAMA, [45]YAMAGATA, [46]YAMAGUCHI, AND [47]YAMANASHI. 29
FIGURE 3.2: TOTAL POPULATION ESTIMATES FOR THE JŌMON AND YAYOI PERIODS BASED ON THE RATIO OF THE NUMBER OF RECOVERED SITES TO A PAST POPULATION ESTIMATE BY KOYAMA (1984) IN HABU (2004: 48) TABLE 2.5 AND SHINODA (2012: 40). 37
FIGURE 3.3: TOP: NAGAOKA SITE, INDIVIDUAL SK 100 (TIP OF A BRONZE SWORD IN THE SACROILLIAC JOINT); MIDDLE: SHINMACHI SITE, INDIVIDUAL 24 (STONE ARROWHEAD EMBEDDED IN THE PROXIMAL FEMUR); BOTTOM: SUDARE SITE, INDIVIDUAL K3 (POLISHED STONE SWORD TIP EMBEDDED BETWEEN THE SECOND THORACIC VERTEBRA AND SECOND RIGHT RIB). PHOTOS TAKEN BY THE AUTHOR, COURTESY OF THE KYUSHU UNIVERSITY MUSEUM. 54
FIGURE 4.1: MAP OF THE SPREAD OF FARMING INTO EUROPE AFTER SHENNAN (2018A:12) ADAPTED BY JAW. DATES ARE LISTED AS BP (BC). 62
FIGURE 4.2: MAP OF SITES WITH EVIDENCE FOR VIOLENT TRAUMA AND FOR EVIDENCE OF ATTACKS ON FORTIFIED STRUCTURES DURING THE NEOLITHIC. AFTER SMITH ET AL. (2020:86) AND ADAPTED BY JAW. THE ORIGINAL CREATORS NOTE THAT SOME GAPS IN THE DISTRIBUTION MAY BE DUE TO A LACK OF ENGLISH LANGUAGE LITERATURE IN SOME REGIONS RATHER THAN AN ABSENCE OF VIOLENT CONFLICT. 68
FIGURE 4.3: DISTRIBUTION MAP OF ENCLOSED SITES DURING THE NEOLITHIC AFTER ANDERSEN (1997:278–279) ADAPTED BY JAW. NOT ALL OF THESE ENCLOSURES NECESSARILY SERVED A DEFENSIVE FUNCTION. 71
FIGURE 5.1: PROPORTION OF INDIVIDUALS EXAMINED PER SUB-PERIOD. THIS EXCLUDES YAYOI INDIVIDUALS WITHOUT KNOWN SUB-PERIODS. 85
FIGURE 5.2: DISTRIBUTION OF SITES FROM WHICH SKELETONS WERE ANALYSED. SEE TABLE 5.2 AND TABLE 5.3 FOR SITE CODES. NOTE THAT THE LOCATION OF SHIMOKUSUDA SHELL-MOUND (110) IN FUKUOKA PREFECTURE IS LESS PRECISE THAN THAT OF THE OTHER SITES, ONLY REFLECTING THE TOWN IN WHICH THE SITE WAS LOCATED. 88
FIGURE 5.3: MAP OF INARIYAMA SHELL-MOUND 1922 EXCAVATION ADAPTED FROM KIYONO (1969:171) BY JAW. THE NUMBERS INDICATE BURIAL ID'S, THE 'Y' INDICATES MULBERRY FIELDS, THE "O.." SYMBOLS INDICATE BROAD-LEAF TREES, AND THE "^-" SYMBOLS INDICATE NEEDLE-LEAF TREES. BURIALS NUMBERS SHOW THE KIYONO COLLECTION ID NUMBERS (2XX) AND THE ORIGINAL "FIELD NUMBERS" REPORTED IN THE 1969 VOLUME. 91
FIGURE 5.4: MAP OF YOGHIGO SHELL-MOUND EXCAVATION ADAPTED FROM KIYONO (1949:146) BY JAW. 94
FIGURE 5.5: TSUKUMO SITE MAP ADAPTED BY JAW (ORIGINAL COURTESY OF THE LABORATORY OF PHYSICAL ANTHROPOLOGY, KYOTO UNIVERSITY). 97
FIGURE 5.6: SARUGAMI ROCK-SHELTER SITE. THE AREA MARKED "A" INDICATES THE AREA WHERE HUMAN REMAINS WERE FOUND. MODIFIED FROM KAWAGOE (1978:16) BY JAW. . 99
FIGURE 5.7: LOCATION OF FRAGMENTARY HUMAN REMAINS RECOVERED FROM THE ITOKU SITE (SECTION 4D, LAYER IV B). ADAPTED FROM KŌCHI PREFECTURE CULTURAL FOUNDATION BURIED CULTURAL PROPERTY CENTER (2004:187) BY JAW 101
FIGURE 5.8: MAP OF KAWAJI SHELL-MOUND EXCAVATION ADAPTED FROM KIYONO (1949:149) BY JAW 105
FIGURE 5.9: SHIMOKUSUDA SITE MAP SHOWING THE LOCATION OF HUMAN REMAINS (2–7) AFTER KIYONO (1969:23) ADAPTED BY JAW. 108
FIGURE 5.10: YAMAGA SHELL-MOUND SITE MAP. NO. 1 AND 11 DENOTE THE HUMAN REMAINS RECOVERED OUTSIDE OF THE CONCENTRATION SHOWN IN RED. THE TRENCHES IN WHITE ARE FROM THE 1968 EXCAVATION. ADAPTED FROM YAMAGA SHELL-MOUND SURVEY TEAM (1972) FIGURES 3 AND 26 BY JAW. 110

FIGURE 5.11: DOIGAHAMA SITE MAP SHOWING THE EXTENT OF HUMAN BURIALS FOUND OVER THE COURSE OF 19 EXCAVATIONS AFTER ATTACHED MAPS 1–3 DOIGAHAMA (2010) ADAPTED BY JAW. 111
FIGURE 5.12: KŌRA CEMETERY SCHEMATIC ADAPTED FROM KŌRA SITE RESEARCH GROUP (2005:360) BY JAW. 113
FIGURE 5.13: MAP OF THE SOUTHWEST OF THE MINAMIKATA SITE AFTER (OKAYAMA CITY BOARD OF EDUCATION, 1995:5). ADAPTED BY JAW. 115
FIGURE 5.14: NAKANOHAMA SITE SCHEMATICS FROM THE 1965–1967 (TOP) EXCAVATIONS AND FROM THE 1968–1971(BOTTOM) EXCAVATIONS. ADAPTED FROM TOYŌRA TOWN BOARD OF EDUCATION (1984:14;23) AND YAMAGUCHI PREFECTURE HUMAN RESOURCES DEVELOPMENT FOUNDATION AND YAMAGUCHI PREFECTURE BURIED CULTURAL PROPERTY CENTER (2016:2) BY JAW. 117
FIGURE 5.15: SHIBU SITE DOUBLE BURIAL AFTER NARA NATIONAL CULTURAL PROPERTIES RESEARCH INSTITUTE (1998:9) ADAPTED BY JAW. 119
FIGURE 5.16: HIROTA SITE LOWER STRATUM SCHEMATIC AFTER HIROTA SITE RESEARCH GROUP (2003:26,270–271) ADAPTED BY JAW. 120
FIGURE 5.17:KANENOKUMA SITE MAP AFTER SUPPLEMENTARY FIGURE 2 IN FUKUOKA CITY BOARD OF EDUCATION (1985) ADAPTED BY JAW. 121
FIGURE 5.18: MITSUNAGATA SITE MAP AFTER PLATE 1 IN KANAZEKI ET AL. (1961) ADAPTED BY JAW. 123
FIGURE 5.19: NAGAOKA SITE MAP WITH BURIAL JARS LABELLED AFTER ATTACHED FIGURE 3 IN CHIKUSHINO CITY BOARD OF EDUCATION (1990) ADAPTED BY JAW 124
FIGURE 5.20: ŌTOMO SITE MAP FROM MIYAMOTO (2003:71) ADAPTED BY JAW. 126
FIGURE 5.21: SHINMACHI SITE EXCAVATION AREA 1 WHERE HUMAN REMAINS WERE RECOVERED AFTER SHIMA TOWN BOARD OF EDUCATION (1987:109) ADAPTED BY JAW. 128
FIGURE 5.22: TSUKOMUTA 4 SITE MAP AFTER THE SUPPLEMENTARY MAP IN OGŌRI CITY BOARD OF EDUCATION (2003) ADAPTED BY JAW. 130
FIGURE 5.23: YOKOGUMA KITSUNEZUKA 7 SITE MAP NE SECTOR SHOWING GRAVES EXCAVATED. AFTER SUPPLEMENTAL MAP 2 IN OGŌRI CITY BOARD OF EDUCATION (2010) ADAPTED BY JAW. 131
FIGURE 6.1: FLOWCHART OF PROCESSES WHICH INFLUENCE A ROBUST IDENTIFICATION OF TRAUMA. BOXES IN RED ARE THOSE WHICH INTRODUCE UNCERTAINTY. 135
FIGURE 6.2: 3D REPRESENTATION OF THE ZONES RECORDED FOR THE JŌMON INDIVIDUALS. SEE 6.3.2 FOR DETAILS ON THE 3D MODEL AND ITS PRODUCTION. BONES SHOWN IN WHITE, INCLUDING THE DENTITION, WERE NOT RECORDED FOR COMPLETENESS WHICH WERE GENERALLY RECORDED. 144
FIGURE 6.3: 3D REPRESENTATION OF THE ZONES RECORDED FOR THE YAYOI INDIVIDUALS (KNÜSEL AND OUTRAM 2004). SEE 6.3.2 FOR DETAILS ON THE 3D MODEL AND ITS PRODUCTION. BONES SHOWN IN WHITE, INCLUDING THE DENTITION, WERE NOT RECORDED FOR COMPLETENESS WHICH WERE GENERALLY RECORDED. NOTE THAT THE MODELS OF THE RIGHT PROXIMAL FIRST, RIGHT DISTAL FIFTH, AND LEFT DISTAL FIRST PHALANX WERE NOT CLOSED FEATURES , MEANING THAT AT THIS POINT THEY COULD NOT BE BROKEN UP INTO ZONES. 145
FIGURE 6.4: A CUT MARK PROFILE OR KERF PRODUCED BY A STONE TOOL (AFTER FERNÁNDEZ-JALVO AND ANDREWS 2016:3) SHOWING A V-SHAPED CROSS SECTION, HERTZIAN FRACTURE CONES (MORE COMMON ON THE SHALLOW SIDE) AND A SHOULDER EFFECT (CAUSED BY IRREGULARITIES IN THE STONE TOOL). 156
FIGURE 6.5: AN EXAMPLE OF THE WORKING MODEL. DISPLAYED IS THE COMPLETE MANDIBLE (S1), THE TARGET ZONE (ZONE 1 OF THE LEFT SIDE; S2), THE REMAINING ZONES (S3), AND THE INTERSECTING FACES CREATED BY THE ZONATION PROCESS (S4). 160
FIGURE 6.6: THE PROPORTIONAL SURFACE AREA OF THE BONES OF THE SKULL ANALYSED FOR THE JŌMON SAMPLE. 161
FIGURE 6.7: THE PROPORTIONAL SURFACE AREA OF THE BONES OF THE SKULL ANALYSED FOR THE YAYOI SAMPLE. NOTE THAT THE ONLY DIFFERENCE IN THE PROPORTIONAL SURFACE AREA FROM THE JŌMON IS THE INCLUSION OF THE SPHENOID BONE. 162
FIGURE 6.8: THE PROPORTIONAL SURFACE AREA OF THE BONES ANALYSED FOR THE YAYOI SAMPLE. 162
FIGURE 7.1: THE AVERAGE PRESERVATION OF ALL THE ZONES ANALYSED (CONVERTED TO 1/3 MEASUREMENTS) IN THE SKULL FOR THE ADOLESCENT TO ADULT JŌMON SAMPLE. THE ‘FALSE AVERAGE’ IS THE AVERAGE OF THE ZONES WITHOUT TAKING INTO ACCOUNT THEIR SURFACE AREA. 166

FIGURE 7.2: THIS IS A VISUAL SUMMARY OF THE AVERAGE PRESERVATION OF EACH ZONE OF THE ADOLESCENT TO ADULT JŌMON SAMPLE ANALYSED. NULL VALUES, OR BONES NOT SYSTEMATICALLY RECORDED FOR PERCENT COMPLETENESS, ARE IN WHITE. 167
FIGURE 7.3: THE AVERAGE PRESERVATION OF ALL THE ZONES ANALYSED IN THE SKULL FOR THE YAYOI ADOLESCENT TO ADULT SAMPLE. NOTE THAT THE "FALSE AVERAGE SKULL" IS THE AVERAGE OF THE UNWEIGHTED COMPLETENESS VALUES. THE 'FALSE AVERAGE' IS THE AVERAGE OF THE ZONES WITHOUT TAKING INTO ACCOUNT THEIR SURFACE AREA. 168
FIGURE 7.4: THIS IS A VISUAL SUMMARY OF THE AVERAGE PRESERVATION OF EACH ZONE OF THE ADOLESCENT TO ADULT YAYOI SAMPLE ANALYSED. NULL VALUES, OR BONES NOT SYSTEMATICALLY RECORDED FOR PERCENT COMPLETENESS, ARE IN WHITE. 169
FIGURE 7.5: THE DISTRIBUTION OF WOUNDS TO THE SKULL OF MALES COMPARED TO FEMALES FOR THE JŌMON SAMPLE. 173
FIGURE 7.6: ITOKU SITE REMAINS WITH LESIONS WHICH MATSUI (2005) ARGUED WERE TRAUMATIC IN AETIOLOGY: 1. J002, PROXIMAL LEFT FEMUR; 2. J002, DISTAL LEFT FEMUR; 3. J004, RIGHT FEMUR. THESE INJURIES WERE PREVIOUSLY ATTRIBUTED TO A 'BLADED WEAPON CUT', 'PENETRATING TRAUMA', AND A 'STAB' WOUND RESPECTIVELY. 176
FIGURE 7.7: THE DISTRIBUTION OF WOUNDS TO THE SKULL OF MALES COMPARED TO FEMALES FOR THE YAYOI SAMPLE. 184
FIGURE 7.8: DISTRIBUTION MAP OF NASAL BONE FRACTURES FROM THE YAYOI PERIOD. 185
FIGURE 7.9: DISTRIBUTION MAP OF BLUNT FORCE ANTEMORTEM INJURIES FOUND ON INDIVIDUALS FROM HIROTA. 187
FIGURE 7.10: FREQUENCY OF SKULL TRAUMA BY AGE GROUP IN THE YAYOI SAMPLE. 188
FIGURE 7.11: KŌRA 67 INJURIES: A) HEALED NASAL AND MAXILLARY FRACTURES, B) HEALING FRACTURE TO THE LEFT NINTH RIB, C) HEALED FRACTURE TO THE LEFT TENTH RIB, D) HEALED FRACTURE TO THE LEFT SECOND METACARPAL. 190
FIGURE 8.1: THE AVERAGE COMPLETENESS OF ALL THE ZONES ANALYSED FOR THE YAYOI ADOLESCENT TO ADULT SAMPLE. 196
FIGURE 8.2: A VISUAL SUMMARY OF THE AVERAGE PRESERVATION OF EACH ZONE THAT WAS ASSIGNED A SPECIFIC ZONE (AND NOT A GROUP, WHICH ARE DESCRIBES AND ACCOUNTED FOR NUMERICALLY ONLY) FROM THE YAYOI ADOLESCENT TO ADULT SAMPLE ANALYSED. NULL VALUES, OR BONES NOT ANALYSED, ARE IN WHITE. 197
FIGURE 8.3: THE TYPE OF TRAUMA FOUND IN EACH INDIVIDUAL WITH MEDIUM–HIGH LIKELIHOOD VIOLENT TRAUMA (N = 43). 'MULTI' REFERS TO INDIVIDUALS WHO DISPLAY A COMBINATION OF THE OTHER CATEGORIES. THE 'FBT & PCT' REFERS TO 'FULL BODY TRAUMA AND POSTCRANIAL TRAUMA' AND EXCLUDES INDIVIDUALS WITH ONLY TRAUMA TO THE SKULL. 205
FIGURE 8.4: MEDIUM–HIGH VIOLENCE-RELATED TRAUMA FOUND ON YAYOI FEMALES AND MALES. 206
FIGURE 8.5: THE DISTRIBUTION OF ANTE- AND PERIMORTEM WOUNDS AMONG THE FEMALE AND MALE YAYOI INDIVIDUALS WITH TRAUMA. 207
FIGURE 8.6: CRUDE PREVALENCE AND CAP OF YAYOI TRAUMA FOUND WITHIN DIFFERENT AGE GROUPS. 208
FIGURE 8.7: THE DISTRIBUTION OF THE MEDIUM–HIGH LIKELIHOOD VIOLENCE-RELATED INJURIES ON SHIBU 3 AND 4 AND DOIGAHAMA 124. NOTE THAT INJURIES TO ELEMENTS THAT COULD NOT BE FIRMLY SIDED OR SORTED WERE NOT INCLUDED. 211
FIGURE 8.8: DIAGRAM OF THE IN-SITU EVIDENCE FOR PROJECTILE POINTS IN DOIGAHAMA GRAVE 124 (EXCAVATED IN 1954). A: THE BURIAL SCHEMATIC OF NO. 124. THE FOUR GREY TRIANGLES ARE PROJECTILE POINTS. THE TWO LARGE SHELL BRACELETS ON HIS RIGHT ARM ARE ALSO VISIBLE. B: A PHOTO OF THE BURIAL SHOWING THE PLACEMENT OF THE PROJECTILE POINTS (ON DISPLAY AT THE DOIGAHAMA SITE ANTHROPOLOGICAL MUSEUM, 30 JUNE 2019). C: THE LITHIC AND SHARK TOOTH (108 AND 107) PROJECTILES FOUND IN THE GRAVE. A AND C ARE FROM DOIGAHAMA SITE ANTHROPOLOGY MUSEUM (2014 VOL. 2:295) AND ADAPTED BY JAW. 212
FIGURE 8.9: LINE DRAWING OF INCISED IMAGES ON MIDDLE YAYOI PERIOD POTTERY FROM THE SHIMIZUKAGE SITE IN NARA DISPLAYING TWO FIGURES WITH FEATHER(?) HEADDRESSES AND HOLDING HALBERDS AND SHIELDS. ADAPTED BY JAW FROM TAWARAMOTO TOWN BOARD OF EDUCATION (2009). ORIGINAL VERSION REPORTED IN TAWARAMOTO TOWN BOARD OF EDUCATION (1997). 216
FIGURE 9.1: COMPARISON OF ANTEMORTEM BLUNT FORCE INJURIES TO REPORTED MEASUREMENTS OF STONE RODS FROM KIYONO (1969). BOTTOM IMAGE AND TABLE AFTER KIYONO (1969:157–158). ADAPTED BY JAW. 225

FIGURE 9.2: SCHEMATIC OF GRAVE 24 FROM THE SHINMACHI SITE. ADAPTED FROM SHIMA TOWN BOARD OF EDUCATION (1987:39) BY JAW. 238
FIGURE 9.3: EXAMPLES OF WOODEN WEAPONS FROM THE YAYOI PERIOD (RECOVERED FROM NARA, OSAKA, AND YAMAGUCHI). AFTER HARUNARI (1990:21), ADAPTED BY JAW. 244
FIGURE 9.4: SIMPLE DEPICTION OF BRONZE YAYOI WEAPONS. ADAPTED BY JAW FROM MATSUGI (2017:45). ORIGINAL FROM MATSUGI (2007). 246
FIGURE 9.5: LINE DRAWING OF THE SAKURAGAOKA NO. 5 BRONZE BELL. SEE THE AREA OUTLINED IN RED FOR A DEPICTION OF A VIOLENT ALTERCATION BETWEEN A POSSIBLE MALE(S) AND FEMALE. AFTER HARUNARI (1990:11), ADAPTED BY JAW. 248
FIGURE 9.6: MITSUNAGATA 104 BURIAL SCHEMATIC WITH DETAILED DRAWINGS OF THE IRON RING POMMEL SWORD BURIED ABOVE THE BURIAL JAR AND A BRONZE MIRROR BURIED WITHIN THE BURIAL JAR. AFTER KANAZEKI (1961:161) ADAPTED BY JAW. 250
FIGURE 9.7: SHINPŌ EARLY YAYOI BURIALS NO.1–3 WITH A CLOSE-UP OF THE SCHEMATIC FOR NO. 3 SHOWING THE 17 LITHIC ARROWHEADS FOUND WITH THE REMAINS. AFTER KOBE CITY BOARD OF EDUCATION (2003:17; 20) ADAPTED BY JAW. 252

Chapter 1 – INTRODUCTION

Archaeology of the prehistoric Japanese archipelago continues to be underrepresented in the global anthropological literature. In regards to prehistoric violence and warfare, the Jōmon hunter-gatherer period is often cited as a largely peaceful forager society, whereas the subsequent Yayoi agricultural period is seen as the beginning of warfare among more socially stratified communities in the archipelago (Ferguson 1997; Keeley 2014; Nakao et al. 2016). The archaeological evidence supporting this relatively neat framework of increased violence with the advent of the agricultural period includes hybridised stylistic forms, tool-weapons, specialised weaponry, defensive weaponry, defensive structures, later written accounts from China, and skeletal trauma (Hashiguchi 2007; Kidder 2007; Matsugi 2017; Mizoguchi 2013; Rhee et al. 2021). Of these, skeletal trauma can be argued to be the most direct form of evidence for violence. Specialised weapons are not always implements of violence, and even when they are it can be argued that they were only or primarily used for symbolic purposes unless there is evidence for their use on the human body. Conversely, injuries left on the human body speak to the lived reality of physical violence, and patterns in those injuries reveal details about the lives and struggles of whole communities and cultures. Insofar as skeletal evidence for violent conflict has been used to elucidate the landscape of peace and conflict from the Jōmon to Yayoi periods, studies have yet to consistently compile and record primary data on violent skeletal trauma for the Jōmon to Yayoi periods (see discussion in Chapter 3.4.1). This has resulted in continued sampling and recording biases that obscure any finer scale understanding of the patterns of violent conflict in the prehistoric Japanese archipelago.

1.1 PROJECT OVERVIEW

In light of this context, the aim of this thesis is to systematically analyse the extent and variability of violence during the Late to Final Jōmon period (ca. 2540 – 435 BC) and the Yayoi

period (ca. 900 BC – 250 AD) in northern Kyūshū and southwestern Honshū of the Japanese archipelago. Due to its relatively isolated geographic location as an island situated at the margins of East Asia, both the Japanese archipelago's prehistoric and historic inhabitants have had extended periods of relative cultural isolation and of dramatic transitions with the introduction of new groups, technologies, and subsistence lifeways. The Jōmon people were hunter-gathers who long continued their subsistence economy despite contact with and proximity to continental Neolithic and Bronze Age agricultural groups, particularly the Cheulmun and Mumun cultures of Korea from across the Sea of Japan. The beginning of the Yayoi period is marked by increased contact between immigrants from the mainland and locals in the southwestern Japanese archipelago, resulting in the beginning of large-scale agriculture, metallurgy, contact with imperial China, increased social complexity and consolidation of power into chiefdom-level groups, and what is understood to be a significant increase in violent conflict for the first time in Japanese prehistory. (Kidder 2007; Mizoguchi 2013; Nakagawa et al. 2021).

The latter half of the Jōmon period, which in total spans over 10,000 years from the first development of pottery, is marked by complex, sedentary fisher-hunter-gatherers that spanned the main islands of the Japanese archipelago but were more concentrated in the deciduous forests of the northeast Honshū (Craig et al. 2013; Habu 2004; Imamura 1996; Keally et al. 2004). Despite being in contact with mainland Asia long after the spread of agriculture into the Korean Peninsula, the Jōmon remained primarily hunter-gatherers, only managing and/or partially cultivated some plant species until the very end of the Final Jōmon and the beginning of the Initial Yayoi periods, when evidence of sophisticated dry land and irrigated agriculture begin to occur (Crawford and Yoshizaki 1987; Crawford 2011; D'Andrea et al. 1995; Fuller 2011; Gross and Zhao 2014; Miyamoto 2008; Nasu and Momohara 2015; Sample 1974; K. Tanaka et al. 2016). Some have argued that part of what typified the Jōmon was a resistance to agriculture, therefore it is intriguing why evidence of agriculture, metallurgy, and increasing

social complexity occur and accelerate with the beginnings of the Yayoi period, and how that impacted the remaining Jōmon communities (Hoover and Hudson 2016; Shitara 2017).

The Yayoi period marked the beginning of wet-rice and millet agriculture, bronze metallurgy, iron use, and contact with Early Han China. It is evident that there was an influx of and intermingling with Korean immigrants in northern Kyūshū and southwesern Honshū from changes in pottery and tool typology, identification of Korean-style settlement structures and mortuary practices, and changes in the population morphometrics and genetics (Ding et al. 2011; Dodo and Ishida 1990; Mizoguchi 2013; Rhee et al. 2007; Rhee et al. 2021; Seguchi et al. 2017; Temple 2008). From the Middle Yayoi onwards, there are signs of increasing social complexity and hierarchy, which becomes more pronounced in the later Kofun period (ca. 250 – 538 AD) (Hudson 1992; Mizoguchi 2013). Furthermore, there is ample evidence for the production and use of weapons, both utilitarian and ritual, unlike in the Jōmon period (Hashiguchi 2007; Hudson 1992; Mizoguchi 2013). The Jōmon produced subsistence and ceremonial-related tools that could have been used as weaponry, but nothing that obviously displays a veneration for warrior culture (Habu 2004; Imamura 1996).

The Jōmon are famous for being one of the few prehistoric hunter-gathers with little to no evidence of violence throughout their duration (Nakagawa et al., 2017; Nakao et al., 2016). Conversely, within a relatively short time frame, incidences of clear interpersonal violence increased during the Yayoi period, later resulting in full-scale warfare during the Kofun period and beyond (G. L. Barnes 2007; Fujiwara 2004; Hashiguchi 2007; Mizoguchi 2013). The transition from the Jōmon to Yayoi period is largely thought to have been peaceful, with violence only increasing from the Middle Yayoi onwards. Although it is true that archaeological indicators of formalised, group-level conflict and warrior ideology only begin to become prominent during this period and thereafter, it does not necessarily follow that a true escalation of violent action began then (see discussions in Chapters 3 and 4). Material indicators of violent conflict, especially those that indicate a special regard for it, represent a related, but distinct

cultural phenomenon from physical violence, which can be carried out with even the most basic of tools or none at all. Studies of skeletal trauma have largely relied on original site reports that do not examine the skeletons in a consistent manner, which does not help to ensure accurate interpretation. Moreover, there has been no systematic analysis of the prevalence of violence by age, sex, locale, or time period for the Jōmon or Yayoi periods. Therefore, at this time it is difficult to tease apart how violent conflict and warrior ideologies tie into the adoption of intensive wet-rice agriculture, ideologies held by immigrants, new materials and tools (i.e., prestige goods and/or formalised weapons), increased population density in agricultural communities, and negotiations between indigenous and 'foreign' groups. This thesis is aimed at addressing this issue by systematically examining skeletal material from the end of the Jōmon period and from the Yayoi period where rice agriculture first appeared in Japan.

1.1.1 Overview of Materials and Methods

A total of 250 Jōmon and 174 Yayoi period individuals were analysed. This resulted in a sample size of 406 for Jōmon to Yayoi adolescent to adult aged individuals from 29 southwestern sites dating from the Middle–Late Jōmon through the Late Yayoi periods used in the statistical analyses. As outlined in the British Association of Biological Anthropology (BABAO) 2019 Code of Ethics, the study of the remains of these individuals was a privilege and every effort was made to treat them with all due dignity and respect at every stage of this research project.

The crux of this thesis is the analysis of violence-related skeletal trauma. In the clinical literature, trauma is defined as "a physical wound or injury, such as a fracture or blow" (E. Martin 2015) , although, at times in the palaeopathological literature, a definition of trauma as "an injury to living tissue caused by a force or mechanism extrinsic to the body" (Lovell 1997) has been applied (Margaret A. Judd and Redfern 2016). Within categories of physical wounds

or injuries, those that were most likely to be caused by violence were the focus of this thesis. Hence, forensic classification schemes were applied to archaeological cases (Spitz et al. 2006).

The skeletal data collected for and evaluated in this thesis include re-assessing the age-at-death and sex of individuals, recording the surface condition and completeness of the skeletal remains, and recording the presence and state of any traumatic injuries possibly related to violent conflict. The Jōmon data collection of this project was partially a collaborative effort with Rick J. Schulting and Izumi Braddick. Hence, the recording strategies and methodologies were by necessity designed to be compatible with the other researchers' methods and aims. For the Jōmon skeletons trauma to the skull and ulnae were recorded[1], since metal weapons did not feature at this time and blunt force trauma (BFT) to the skull is more likely to reflect intentional injury than that to the postcrania . Determining whether BFT to the skull is the result of a blow or a fall is not always possible, but it is more feasible when analysing the postcrania (Berryman and Haun 1996; Guyomarc'h et al. 2010; Schulting and Wyoscki 2005). The rest of the skeleton was examined for projectile trauma, though the completeness was not recorded in detail. It should be noted that embedded projectile points are more likely to have been previously found and reported. Fractures to the medial to distal shaft of the ulnae, or 'parry fractures', can at times result from an attempt to block an incoming blow, and are therefore often suspected of being a defensive injury (Byard and Simpson, 2005; Judd, 2008; Lovell, 1997; Smith, 1996). Nevertheless, they can result from other aetiologies, including falls. The completeness of the Jōmon skulls were recorded in detail, but not the ulnae since the latter were not recorded in the

[1] The one exception to this was the analysis of the Jōmon period Itoku site. Postcranial remains were examined from this site as trauma found on the human remains previously (Matsui 2005) were attributed to metal weaponry – which would have been exceptional if confirmed. The original article and report were inconclusive based on the published photographs, hence the human remains were re-examined. The analysis of the individuals at Itoku did not contribute to the statistical analysis carried out in this thesis and the results have already been reported (Hudson et al. 2021).

shared dataset with Schulting and Braddick, hence, only the former were used in any statistical analyses.

The completeness and any traumatic lesions possibly related to violence were recorded for the entire skeleton of each Yayoi individual as metal weaponry is known to date to the period and, hence, sharp force trauma to the postcranial skeleton can be more readily linked to violent trauma (see discussions in Chapters 3 and 6 for more detail on weapon-related trauma). The completeness of each skeletal element was recorded using the zonation method developed by Knüsel and Outram (2004).

1.1.2 Comparative and Spatial Analyses

This data was compared to the data and results of other studies of violence and conflict from the archipelago. Additionally, to place the data from the Japanese archipelago in context, it was compared to evidence of violent conflict during the Mesolithic–Neolithic transition in Europe. In light of the advent of specialised weaponry—both utilitarian and ritual in function—during the Yayoi, its use and meaning will be compared to Bronze Age European weaponry and warrior culture.

In addition to the osteological and palaeopathological analyses employed in this thesis, Geographical Information Systems (GIS) were utilised for spatial analysis. Distribution maps of the sites analysed were created using GIS. Moreover, a novel method of treating the human skeleton as a map in 3D GIS was undertaken as a part of this thesis in collaboration with John Pouncett and Rick Schulting (see Chapter 6.3 for an overview of the methodology). Traumatic injuries are often complex and it is frequently necessary to take great care to represent them well visually. This has been done in a variety of ways, including photographs and photogrammetry; compiled drawings, which are often created to illustrate the distribution of wounds; and high-resolutions scans, which are becoming increasingly common. Scans in particular are in 3D, but are limited to singular visualizations and analysis (Adams et al. 2019;

Constantinescu et al. 2017; Łukasik et al. 2019; Otárola-Castillo et al. 2018). GIS has been used in zooarchaeological studies to represent and calculate minimum number of skeletal elements by using scans of 2D views of bone (Marean et al. 2001). Moreover, shapefiles of different zooarchaeological specimens have been used to more clearly visualise elements present in order to assist in data interpretation (Orton 2010). Nevertheless, the research questions for these projects are fundamentally different than those here and these methods are currently limited to 2D. Hence, in this study a freely available 3D model of the human body was modified to be compatible with the research methods and questions of this thesis. The skeletal model was broken up into units of analysis (recording zones) and attributed with completeness data. Moreover, the distribution and kind of trauma found was represented by creating new 3D features on the model. Using this model to analyse the preservation data and to record the traumatic injuries provides not only an improvement over projecting complex trauma onto a planar surface, but also allowed for faster compilation of data and querying of the database.

1.1.3 Biases and Limitations of Methodologies

In an attempt to employ realistic research strategies in this thesis, differential recording strategies were carried out that reflected limitations *inherent in the archaeological data*. Trauma analysis in archaeology is complicated by a milieu of factors that do not regularly affect clinical studies (D. L. Martin and Harrod 2015), particularly when dealing with prehistoric cases where no historical documents or records can be consulted. Additionally, the greatest source of information, the patient or subject, cannot be interviewed in palaeopathological analysis (Margaret A. Judd and Redfern 2016). Therefore, it is necessary to employ research strategies with these inevitable uncertainties in-mind.

A key limiting factor the study of human disease in the archaeological record is that, in the vast majority of cases, all that remains of the individuals in question are their skeletons,

eliminating the possibility of gathering any information from soft tissue. A relatively limited number of diseases affect skeletal tissue compared to those which affect the soft tissue (Ortner 2003a). The examination of intentionally-inflicted trauma in palaeopathology is complicated by not only the lack of soft tissue to provide additional information about injury type, extent, and timing, but also the fact that damage to the skeletal tissue is often not the goal of an attack. For instance, arrowheads which hit or are embedded in bone are likely to be the exception rather than the rule as the aim of the attack was more than likely not to hit bone (Croft and Ferllini 2007; Letourneux and Pétillon 2008; Schulting and Wyoscki 2005; M. J. Smith et al. 2007). The same logic applies to injuries caused by sharp objects. If a knife is used to stab someone's torso, the intent was not likely to hit the ribs or vertebrae, but rather the organs which they protect. Hence, the biological record of violent conflict that these injuries represent is undoubtably incomplete. Therein sits the dichotomy between past traumatic injuries being the most direct form of violent conflict, while at the same time, accounting for a minimum representation of the phenomenon.

The exception to aiming for or more likely involvement of the skeletal tissue is intentional injury when projectile or sharp weapons/tools are not present. Blunt force injury to the face, skull, and lower arms have been shown to have a higher likelihood of being violent in intent. This is primarily because 1) blunt force injuries to the skull (compared to the postcrania) are more likely to be deadly and/or decapacitating, 2) some blunt force injuries to the ulnae have been shown to likely be defensive (Margaret A. Judd 2008), and 3) injuries to the face tend to reflect an attack on the individual's personhood (Armit 2006; Walker 2001). Moreover, as discussed in the Section 1.1 of this chapter, even if blunt force injuries to the postcrania were violent in intent, differentiating this is simply not feasible with only skeletal evidence. Postcranial fractures are much more likely to be the result of accidents or occupational hazards (Margaret A. Judd and Roberts 1999; Wedel and Galloway 2014). These constraining factors are what shaped the differential recording methods in this thesis, as the potential implements of

violence were distinct from the end of the Jōmon and the Yayoi (Habu 2004; Mizoguchi 2013; Rhee et al. 2021).

Finally, great care was taken towards detailed representations of the completeness of extant skeletons available for examination. How complete and well-preserved the skeleton is directly impacts the ability to identify skeletal trauma, if it was ever present. Therefore, a zonation method (Knüsel and Outram 2004) was used to account for all major elements of the skeleton and the results were weighted by said completeness so that more complete individuals were not over-represented in the data.

*1.2 **HYPOTHESES***

It was hypothesised that

1) although underestimated in the current literature, violence increased from the end of the Jōmon and the beginning of the Yayoi and that this would be most prominent on the edges of the Yayoi territory, as it would possibly mimic an expanding 'frontier' or 'tribal' zone (Ferguson and Whitehead, 1992).

2) The nature of injuries was expected to shift with the introduction of metal weapons, from either primarily blunt force trauma to sharp force trauma or in the region of the body targeted.

3) Given the consolidation of power in northern Kyūshū, it was posited that the most likely group at risk of injury would be adult males (or what were considered to be adult men at the time) (Bary, 2001; Mizoguchi, 2013; Walker, 2001).

4) Lastly, it was hypothesised that the scale of violence would increase through the Late Yayoi period until largely tapering off during the transition to the Kofun period

based on the Chinese accounts of the political landscape of the end of the Yayoi (G. L. Barnes 2007; Kidder 2007).

In the end, this thesis provides an increased understanding of the transition from hunter-gatherer to agricultural societies in Japan through the lens of conflict and of the variability of trauma therein, not just as a transition from a peaceful group to the bloody wars that occurred thereafter.

1.3 DEFINING TERMS

Violence in its broadest sense can be defined as an "action contrary to the nature of a thing" (Wuellner 1956). What constitutes violence can vary culturally, but may include physical, emotional, psychological, sexual, or material violence. Moreover, these kinds of violence are by no means mutually exclusive (Molloy and Grossman 2007; M. J. Smith et al. 2020; Spencer 2010). In the bioanthropological literature, violence among archaeological populations has been explored by examining physical violence and through the lens of structural violence and inequality (Beatrice et al. 2021; Farmer 2004; D. L. Martin and Harrod 2015). A narrower definition of violence is used in this thesis so as to best capture the skeletal trauma being examined – physically aggressive behaviours that cause injury or could potentially cause death (Archer 1994; Williams et al. 1982:366). This may include intragroup (within group) and intergroup (between communities) violence. Smaller scales of violence are considered and highlighted in this thesis, but, within the category of interpersonal violence, warfare is considered and defined as "armed conflict between societies" (Keeley 1996:x). This is an expansive definition of war, which allows for the inclusion of warfare among societies that do not have standing armies, warrior classes, and specialised weaponry, while still capturing the organised conflict between political units. The goal of this thesis is not to simply discover whether the Jōmon and Yayoi cultures were 'peaceful' or 'violent', but rather how violent conflict, as seen through skeletal trauma, fits into the cultural fabric of these societies. This is

especially the case as even ‘peaceful’ modern hunter-gatherer societies have been shown to have high levels of intragroup, socially-sanctioned violence (Kelly 2000). Further relevant anthropological theoretical frameworks that pertain to violence and warfare are explored where relevant in this thesis.

The biocultural approach, emphasising the intersection of human culture and biology and the physical environment, is commonly implemented in biological anthropology (see Dufour 2006). This holistic method of study is employed in this thesis. Particularly, the skeletal trauma analysed and discussed herein is placed within the cultural context of the prehistoric Japanese archipelago and the social, economic, and political changes which were occurring at that time, along with being compared to the patterns of trauma and violence present in Europe in order to illuminate further potential intricacies.

1.4 THESIS STRUCTURE

This thesis takes the following format:

— **Chapter 1 – Introduction**: An introduction to why this thesis project is relevant, and why and how it was carried out.

— **Chapter 2 – Theory of Violence and Warfare**: A brief overview and critique of theories relating to what violence and warfare are, and why they are posited to occur in prehistory. Several key theories are discussed individually in detail.

— **Chapter 3 – Prehistoric Cultures of the Japanese Archipelago**: An introduction to the geography and climate of the Japanese archipelago is presented along with a discussion centring around key aspects of the Jōmon and Yayoi ways of life and previous archaeological analysis. Particular emphasis is given to aspects which might influence this study, such as skeletal preservation, tool use, theories surrounding the transition between the two periods, and previous analysis of violence and skeletal trauma.

— **Chapter 4 – Violence during Subsistence and Technological Transitions**: A brief discussion of violent conflict seen in hunter-gatherers and agriculturalists and a detailed, critical presentation of a case study – violent conflict from the Mesolithic to Bronze Age in Europe – and trends found therein.

— **Chapter 5 – Site Details and Sample**: A numerical, demographic, and geographical summary of the skeletal sample analysed in this study is provided. Moreover, a brief overview of the sites from which each individual was excavated is discussed. When possible, a site map is also provided.

— **Chapter 6 – Methodology**: An overview of the methodological context of the study is provided. Individual discussions pertaining to the kinds of general osteological analysis performed (age, sex, skeletal completeness, and surface condition), to the skeletal trauma analysis performed, why particular criteria and how differential diagnosis were employed, and to the use of 2D and novel 3D spatial analysis in this thesis.

— **Chapter 7 – Skull Trauma Results and Discussion:** The overall condition of the Jōmon and Yayoi skulls are presented and critically evaluated. The trauma found on the Jōmon individuals and on the Yayoi individuals' skulls are presented and critically discussed where necessary. Additionally, a comparison to previous quantitative analyses of Jōmon versus Yayoi trauma is evaluated in light of this data.

— **Chapter 8 – Yayoi Trauma Results and Discussion**: The condition of the Yayoi skeletal sample and the violence-related trauma found is presented and critically assessed. Patterns in the trauma found are discussed in detail and overall trends are compared to previous palaeopathological analyses of Yayoi trauma.

— **Chapter 9 – Comparative Analysis of Prehistoric Violence in the Southwestern Japanese Archipelago**: The trends and patterns found in the Jōmon and Yayoi trauma analysis are discussed in terms of their sociocultural implications and in

relation to wider theoretical discussions about the role of conflict. In order to facilitate this, the results are also discussed in comparison to the cases studies presented in Chapter 4, i.e. the European Mesolithic to Bronze Age.

— **Chapter 10 – Conclusion**: The findings of this thesis and their implications are summarised.

— **Catalogue I: Skeletal Data**: The essential and relevant data of this thesis for the Jōmon and Yayoi individuals analysed are presented in a series of tables. The results of the surface area analysis are also presented per zone examined.

— **Catalogue II: Documentation and Evaluation of Traumatic Injuries**: An overview of the catalogue format and criteria are briefly discussed. Each skeletal lesion evaluated for being related to violent intent are presented and differentially diagnosed. Images for these are presented and, for individuals who are evaluated as having injuries likely sustained due to violence, 3D GIS maps of their overall skeletal preservation and the location of their injuries are provided.

Chapter 2 – THEORY OF VIOLENCE AND WARFARE

2.1 INTRODUCTION AND CONTEXT

Studies of violent conflict and warfare in anthropology and archaeology date to the fields' inception in the 19th century, and are often linked to debates about whether humans are innately violent or peaceful, why violence emerged, and the factors that influence it (e.g. agriculture, sedentism, and state formation) (Ferguson and Whitehead 1992; Ferguson 1997, 2008, 2013; Gat 2006; Keeley 1996, 2014; N. C. Kim and Kissel 2018). At times, the conclusions of these studies are then linked to current affairs and used to predict the future potential of human peace or struggle. These links are not purely practical, offering specific strategies to employ in conflict, nor are they purely descriptive accounts of past interactions. Instead, they are often used to provide a deep context or contrast to current conflicts of contemporary concern. Of course, an understanding of how proceeding generations made war or kept peace is only one factor in how personal and political decisions are made today or in how they help to frame potential courses of action and priorities. Nevertheless, knowledge of past events, both ancient and modern, can have significant impacts on how one categorises relations with friends and foes.

Most studies begin with identifying different kinds of violence and how they can be detected in the archaeological record. Types of physical violence include assassination, cannibalism, duelling, feuding, homicide, punishment, raiding, ritual violence, trophy-taking, punishment, massacre, sacrifice, and warfare (D. L. Martin and Harrod 2015; Otterbein 2004; Scherer 2021; Walker 2001). 'Warfare' in particular is usually isolated and given particular attention at this point, emphasising its political nature, its potentially coercive elements, how it is always at a group level, and how that may differ from complex state or modern political war-making and its justifications (Fry 2012; Keeley 1996; Otterbein 2004). Determining which of these forms of violence might have given rise to specific archaeological evidence can be difficult. Primarily this is because different forms of violent conflict stem from different intents,

but often leave the same kinds of evidence. Therefore, it is only by analysing the data within the context of the population, culture, time period, and environment using a range of archaeological techniques, scientific and traditional, that certain hypotheses can be refuted and more likely scenarios can be further explored (Armit et al. 2006; Walker 2001). The archaeological evidence most often utilised in studying warfare, in particular, includes skeletal trauma, which, if clear, is the most direct evidence; iconography; material culture (i.e. weaponry and armour); and defensive architecture (Armit et al. 2006). Ethnographic and historical documentation are also key resources, but trying to ascertain purely factual accounts of conflict and warfare from the latter can be compounded by the aims of the authors who may be less concerned with providing an accurate picture of the events than attempting to bolster a particular political faction or who may write in a style prone to exaggeration or hyperbole. Moreover, the record may be complicated by misinformation present from a document's inception due to inaccurate accounts or that may have been added with later copies, translations, or interpretations (Farris 1998; Trevelyan 1947). This is not to say that these factors cannot be addressed thoughtfully, but archaeology does not tend to be influenced by the same limitations.

Although arguments about the origins of violence and the human predilection towards it abound, philosophical arguments about the nature of humanity, violent or otherwise, are more complex than the simple presence or absence of evidence of violent conflict in hominins and early human groups. Take, for instance, the profound philosophical framework that grounds Thomas Aquinas' defence of just war as relating to the virtue of charity (Davis 2017; Reichberg 2017). Hence, it is not readily apparent how archaeological evidence, which only provides partial evidence of past human *action*, can directly address questions of *aims* and *motives*, especially on an individual level. This is not to say that questions of causes and intentions behind patterns of behaviour on a societal level cannot be questioned in archaeology and anthropology , simply that tying those investigations into questions of human nature cannot be done without other philosophical arguments that are not to be assumed. Persistent patterns on

a group-level, though, can more easily be tied to larger patterns in, for instance, the economy, environment, and known interactions with other cultures (G. L. Barnes 2007). The individual, often complex, intentions of actions by persons, though, is outside of the reach of prehistoric archaeology in most cases. Nevertheless, there is sufficient evidence from hunter-gather to agricultural societies in prehistory to recognise that violence has been used as a conflict resolution strategy across the globe and likely from the human species' inception (N. C. Kim and Kissel 2018).

Continual evidence of violence in the Old World as well as from the first settlement of the New World is apparent (Chatters 2014; Frayer 1997; N. C. Kim and Kissel 2018; Lambert 2002; Walker 2001). Moreover, violent conflict in more isolated islands, such as Australia and New Guinea, has been well studied (Gat 2015; Knauft et al. 1991). Some have proposed peaceful periods among prehistoric groups. Better known examples of these peaceful periods include the Jōmon of Japan and the Pre-Pottery Neolithic A of the Levant (Fry 2012; Imamura 1996; Nakagawa et al. 2017; Nakao et al. 2016; Otterbein 2004). Nevertheless, peace, whether sustained by culturally mediated norms that mitigate violence or are due to relatively stable conditions, is potentially subject to change with shifting circumstances, such as climatic change, environmental fluctuations, or contact with new groups (Keeley 2014). Yet, if the lack of evidence for violence during the Jōmon period is true (Nakagawa et al. 2017; Nakao et al. 2016), then they would possibly be a notable exception to this, existing over 10,000 years through catastrophic volcanic eruptions and significant climatic fluctuations while maintaining peaceful interactions.

A majority of the literature on conflict emphasises males as the perpetrators of violence. Just as in modern times, males tend to show greater evidence of violent behaviour in prehistory, although there are exceptions (Bengtson and O'Gorman 2017; Hedenstierna-Jonson et al. 2017). The motivations behind males engaging in violent conflict are often believed to revolve around

maintaining or improving social status and obtaining or attracting a mate (Reedy-Maschner and Maschner 1999).

Ethnographic and historical resources are often used to shed light on findings from prehistory. At times, this can help elucidate ways in which aggression can be culturally mediated, including areas of the body preferentially attacked and preferred weaponry (Walker 1997). Even in modernity, many tools and weapons have a great deal of overlap in their style and function. Lack of formalised weapons together with the presence of violence is not uncommon in prehistory. Instead, the development, increase, or treasuring of weapons can be linked to the rise of elites, a warrior culture, or a veneration of heroism (Schulting 2013).

In the archaeological literature, the most popular factors that have been proposed to cause or aggravate conflict are climatic and environmental or political instability, which put pressure on resource availability (Ferguson 1990). The emphasis on nature's fickleness is primarily because it is often well within the capabilities of archaeology, if resources permit, to compare the extent and timing of local and regional climate change with any evidence of violence (Keeley 2014). Another popular suggestion is the trifecta of the adoption of agriculture, increased sedentism, and the development of inequality and social hierarchy that all feed into violent conflicts (Otterbein 2011; Price and Feinman 2010). Other factors include trade and frontier disputes, vengeance, and expressions of male identity or a warrior culture (Boehm 2011; Schulting and Wyoscki 2005; Schulting 2013). Although one explanation may be emphasised in a particular study, it should be understood that many of these factors converge at times, and that violence and warfare have an integral role in structuring overall social behaviour and forms.

The following section will explore some of the driving theories in archaeological and anthropological studies of violence, and explain how they tie into the factors that archaeologists commonly focus upon, as outlined above. These theories were chosen as they frame much of the recent archaeological theories around the origins of war and its causes in among hunter-

gatherer communities and at the transition to agriculture (Ferguson and Whitehead 1992; Keeley 1996; Otterbein 2004).

2.2 Influential Theories

The following theories are usually based on the discussions of two modernist philosophers, Thomas Hobbes (1588-1679) and Jean-Jacques Rousseau (1712-1778), and later anthropologists who were interested in exploring whether those in 'primitive' societies lived peacefully (Keeley 1996; Otterbein 2004). If so, then it could be argued that humans were naturally peaceful and only became violent due to enculturation. Archaeological investigations have by no means supported an existence of the so-called 'peaceful savage', but, more importantly, to begin with it is a rather flawed framework (Keeley 1996). It is apparent now that the simple 'Nature vs. Nurture' debate is just that — simplistic and reductionist (Walker 2001). Human beings live not only in a cultural and mental reality, but are firmly embedded in their sensory, material realities as well. The practice of grounding a majority of the philosophical foundations of this debate on only two Enlightenment philosophers is problematic. It is true that Hobbes and Rousseau have precedence in the debate and made claims that could be tested through anthropological and archaeological means, but philosophies of humanity's inherent character, including aggression and violence, date back to the origins of the field and continue now. Archaeology need not engage, necessarily, in arguments about the morality of war, but further reading of how people have logically framed the concept and motivators of violence or war in society may be worth exploring further. Anthropological theory is fascinating and much needed, but a great deal of it is underpinned by a larger philosophical debate with which many archaeologists do not tend to engage or explore. That being said, such a consideration is not always within the scope of research.

2.2.1 Tribal Zone Theory

Brian Ferguson and Neil Whitehead's 1992 edited volume, *War in the Tribal Zone*, has become a classic in the anthropological study of warfare. In their volume, Ferguson and Whitehead aimed to present anthropological studies of warfare in indigenous societies that take into account the historical contact between them and expanding Western powers. In the introductory chapter, the authors propose that an understanding of the impact of intruding colonial powers is essential to any studies of indigenous warfare, "even at its earliest phases" (Ferguson and Whitehead 1992: 27). They mention that archaeology can be useful in exploring these earliest phases. The authors contend that colonial powers greatly increased indigenous warfare by straining the availability of resources, encroaching on territory, transmitting diseases, imposing new orders by seduction or coercion, and introducing new trade deals that led to a jostling of the previous social order. In later correspondences and publications, the tribal zone theory has been criticised for pacifying the past. Ferguson and Whitehead defend their theoretical approach, stating that it is not 'Rousseauian' or 'Dove'-like, in other words that they are not advocating an image of the peaceful savage (Keeley 1996; Otterbein 2004). Instead, they agree war existed prior to Western contact with indigenous cultures, but not prior to sedentism, increased population density, social hierarchy, trade of prestigious goods, bounded social groups, and dramatic ecological changes (Ferguson and Whitehead 1992, 2000; Ferguson 2008; Whitehead 2000). Hence, Ferguson (2008) has argued that warfare is not an integral part of human society.

The Tribal Zone theory is an interesting way of examining the influences of more powerful political and military entities on non-state societies. Nevertheless, Ferguson and Whitehead limit their analysis by largely focusing on violence related to 'war'. There are instances of relatively peaceful interactions in history and the archaeological record that are more nuanced than an absence of warfare and employ strategies that significantly influence the structure and behaviour of a group. Nevertheless, by excluding examinations of how smaller

human groups in the past handled violence, the authors lack relevant context and understanding for the state-level wars that follow. There is great diversity in how people handle conflict, mediation, and contact across the globe and through different periods that should be taken into account.

2.2.2 Violence Abounds

Lawrence Keeley in *War Before Civilization* (1996) argues that the anthropological literature has perpetuated a false image of peaceful prehistoric cultures. Keeley does not dismiss the existence of more peaceful periods at times, but argues that they are, at some point, impacted by changes that increase stress and lead to conflict (Keeley 2014). Moreover, other archaeologists have taken up the debate, and argued for the presence of violence throughout the archaeological record and have also pointed out gaps in the record due to poor preservation or cultural practices that may make it difficult to definitively identify violent behaviour - absence of evidence is not evidence of absence (Walker 2001). Unfortunately, the archaeological evidence will always be fragmentary and conclusions depend on what pieces remain and how they can be fitted back together.

Conversely, Ferguson and Whitehead (2000) hold that Keeley (1996), especially, is an example of how archaeology has joined the debate on prehistoric warfare, but done so in a confused manner, leading to controversy. They state that those "who have carefully studied the archaeological record come to a very different conclusion [than Keeley]; that war leaves archaeological recoverable traces, and that with few exceptions, evidence is consistent with the relatively recent development of war as a regular practice — substantially after the transition to sedent[ism]" (2000: xv). Nevertheless, the same questions remain as mentioned in the previous section (2.2.1), for what are Ferguson and Whitehead really looking and is it most in line with the evidence at present?

2.2.3 Cultural Evolution Theory

Another popular theory, primarily promoted in literature outside of archaeology, is that of cultural evolution, which applies biological evolutionary theory to the understanding of state development and the 'evolution' of war. This method proposes interesting ways of conceptualising societal relations and attempts to apply other methods of analysis, such as mathematical modelling, but it treats human behaviour in the same way as genetic traits when they are two related, but different phenomena (Bowles 2009; Gat 2006; Turchin 2010; Turchin et al. 2013). Moreover, behaviour is not split into, for example, war and not-war behaviours with specifically coded regions in the DNA, and warfare is not isolated from the rest of societal structure. To quote Ferguson (2008: 34), "[m]aleness is one part of biology, biology is one part of aggressiveness, aggressiveness is one part of combat, and combat is one part of war." Therefore, the supposition that war can be chosen for in a genetic sense would mean that it would have a great selective advantage or an extremely detrimental disadvantage in society in order to make a difference and drive selection. Moreover, genetic fitness in the evolutionary sense is linked to reproductive success, which is not a one-to-one relationship with the suite of traits related to success in warfare (Ferguson 1990). Whether or not warfare was prevalent enough and a great enough pressure on reproductive success in humans' past remains in debate (Bowles 2009, 2012; Fry 2012; Fry and Söderberg 2013). Some have suggested that cooperation can be treated as an 'allele' (or phenotypic expression) of underlying human genetics, reinforced by cultural norms as explaining why humans have a certain predilection to cooperate with truly altruistic intentions outside their kin-groups, and have used mathematical modelling to prove that it is possible (Bowles and Gintis 2011). Yet, the traits being 'selected for' in this framework are not tied

There can be many motivating factors for violence and war, which can be vastly different, whether they involve revenge, desire for status, familial duty, punishment, or self-defence. Moreover, these motivating factors and their resulting intentions will vary depending

on the individual and group-level. The reason that one warrior goes into a fight is often very different than why a political or social group turns to violent means. All the same, archaeologists often cannot definitively distinguish the specific, historical motivations for violent actions. We can hypothesise a variety of situations and motivating factors, but this will mostly be at the group level, where you can see traces of repeated or large-scale behaviours. Therefore, even if one would argue that we can see the evolution of violence in the human species, one will be missing the individual motivations that drive a person to risk death for some purpose, for good or ill.

2.2.4 Sedentism, Agriculture, and the Consolidation of Power

Many scholars tie the development of warfare to the development of sedentism and/or agriculture. Otterbein (2004) argues that war has two origins - one with the evolution of the human species until it declines when animals are domesticated and the second origin with the development of the state. Focusing on the later origin hypothesis, Otterbein disagrees with scholars that believe agriculture goes hand-in-hand with increased conflict, instead he argues that the primary origins of agriculture necessitated conflict-free areas so that people could stay on land suited for crops without moving to more defensible locations (Otterbein 2011). Nevertheless, this makes several assumptions that are not clearly justifiable. For one, it assumes that the impact of warfare or raiding would have to have been sufficiently great enough to impact the daily subsistence activities of the communities. It is also not clear how this would fit into our increasing understanding of the significant complexity and time depth involved in plant domestication (Fuller et al. 2014; Larson et al. 2014). Additionally, it is becoming better known that people were modifying their environments a great deal more than previously realised, even in hunter-gather contexts, that was influencing the genetic composition of nearby species (Crawford 2008). Moreover, humans can modify their landscape or settlement structure to make them more defensible without having to move out of an area. Otterbein is not clear

about at what point would a cessation of fighting have a large enough impact to allow domestication to occur and what would be driving it. There are other social interactions than just wiping each other out if early horticulturalists were in close proximity to raiders. The stronger group could simply put pressure on the other group to provide some form of tribute or otherwise be indebted (Gat 2006). Lastly, how this may impact places, such as the Japanese archipelago, where domesticates later spread and how states thereafter developed is not clear.

Others who argue for a key relationship between sedentism, led by agriculturally focused subsistence, and consolidating power point to the need of past people to find novel methods of managing growing populations, facilitated by more stable food sources and increased production, and subsequent pressures. When a population has reached the point where it is too large to rely on face-to-face level interactions on a daily basis, some have suggested that the signalling of social status or position through material means can be used to create and maintain social identity and/or hierarchy (Schulting and Wyoscki 2005; Turchin 2010).

It has been argued that chiefdoms form as ‘big men’ accumulate followers by gaining recognition in battles against opposing groups and by drawing people in their communities together better than their peers (Otterbein 2004). Whether or not ‘big men’ accumulate power in a genuine wish to better their community or for the purposes of self-aggrandisement, to take on a role with large responsibilities and influence also means to take on a role with high accountability and risk. Therefore, there have to be significant incentives for a person to take on such a leadership position (Hayden and Villeneuve 2010). Although that may be the case, by focusing on aggrandising characters one can overlook other social strategies, like sub-dominance and subordination, as actively chosen strategies (Ames 2010). Moreover, although many argue that ideology is one of the driving forces behind the creation of ‘big men’ or community leaders, it is unlikely that it is the only or primary supporting mechanism for leadership (Hayden and Villeneuve 2010). Nevertheless, once in these positions of power, it is evident that many influential figures abuse the privileges afforded to them.

Another aspect of consolidating power worth exploring are the different kinds of power acquired, gifted, and held by people of influence who might use violence as a means of coming to or exerting their power, and how much fluidity there is in this process. It is reductionist to argue that all interactions in a society are oriented around power relations, but violence and conflict are very closely tied to power within a community or a society at large, especially when social structures are changing rapidly, like during the inception of the Yayoi. To have control in a situation is to have a type of power, and violence is a means of gaining control by subduing a foe.

Agency and Marxist theories have been popular in articulating power relations (Saitta 1994). Tina Thurston (2010) provides a concise overview of power theories in the social sciences and how they have been applied by archaeologists:

> *... for much of the later twentieth century, the primary archaeological frameworks for understanding the creation, management, and use of power were aimed at understanding only the ways in which elites wrested power away from others and exercised authority, usually through the mechanisms proposed by ruling elite theory, environmental/ecological theories, various permutations of structural Marxism and interaction theories… all dependent on the concept of rising elites, rising complexity, the importance of elite-to-elite interactions and the ever-increasing centralization of elite authority over non-elites, who had no power at all (2010: 199).*

In a majority of studies evidence of power is interpreted as "power over", or the ability to exercise authority over those below one, whether this is done through coercion, or by some form of 'thought control' (Dahl 1957; Lukes 1974; Thurston 2010). Another type of power articulated in the social sciences during the late 20th century was "power to", or the ability to alter events, possibly by giving power to those of merit, such as individuals who have distinguished themselves or elders, or individuals with some special quality, such as magical

abilities (Benton 1981; Thurston 2010). Although power may be gifted to members of a society, that can relatively quickly turn into a power that is then exerted over the group with less of their input or control. Lastly, there is the concept of "power with" others, or of resistance against authority (Thurston 2010). No "power over" is ever absolute, and its maintenance depends on cooperation and consensus (Arendt 1969; Bernstein 2011). If this is troubled or fails, then there is always the ability to take back power or at least resist the current structures of power in place, whether that is via modern protests and revolutions or via ancient means of over-throwing of powers.

Although the above concepts of power can be very useful in articulating some class or community relationships, they are by no means complete in and of themselves. For one, 'power' only represents one facet of increased social complexity and how that ties into regulating conflict within a society. Moreover, just one of these often cannot describe the true complexity of a society, composed of different subgroups with different interests. Feinman et al. (2000) admit that, themselves included, archaeologists have "failed to recognize the potential for hierarchy and equality to coexist simultaneously in all human societies". Feinman and colleagues chose to turn to corporate and network strategies in an attempt to analyse power relations as a continuum within the society, especially those that appear complex but that lack a centralised hierarchy.

The following discussion highlights some shortcomings in the discussed theories as a whole and suggests ways in which archaeological studies may continue to expand on the subject.

2.3 Elaborating on the General Themes

2.3.1 Victim, Fiend, or Something In-between

Finding evidence of violent trauma on skeletal remains automatically gives the individual the status of a 'victim'. It is not apparent, though, that this person was the actual

victim, and not the perpetrator, at the time of the assault. A value judgement seems to be passed on most instances of violence in the archaeological record as morally unacceptable. War is hell (or as Hawkeye Pierce in the classic show MASH states, “War isn't Hell. War is war, and Hell is Hell. And of the two, war is a lot worse”), but it is debatable as to whether or not it is at times justifiable and/or necessary. To quote another, but more ancient moralist, “We do not seek peace in order to be at war, but we go to war that we may have peace,” states Augustine in the 5th century A.D. (Letter 189 to Boniface). Consistently suggesting that evidence of violence or war is evidence of the darker side of humanity does not take into account courageous, justifiable action, whether or not we can distinguish it now. Nevertheless, that does not by any means suggest that wholesale slaughter, especially of the weak and defenceless, is morally acceptable either. Simply that, often times, a value judgement should be withheld due to the fragmentary nature of our knowledge. In a clinical setting, individuals are referred to as ‘participants’ to avoid terms of judgement (Shepherd et al. 1990).

2.3.2 The Fairer Sex?

Much of the literature on violence emphasises the role of men in warfare and power struggles, citing the typically higher rates of violent trauma recorded for men, although not universally (Bengtson and O'Gorman 2017; Hedenstierna-Jonson et al. 2017; Schulting and Wyoscki 2005; Walker 2001). Nevertheless, when violent trauma is found on female remains, in order to attribute it to the female actively participating in violent conflict more arguments are needed than for their male counterparts in many cases. Women, even more so than men, are attributed the status of ‘victim’ in these cases, especially if in the burial context she is not associated with any warrior-specific grave goods. However, as mentioned previously, veneration of warriors or warrior elites does not mean that violence does not occur elsewhere in the society. Therefore, a nuanced examination of grave goods, patterns of violent trauma, and other indicative skeletal markers (Sparacello et al. 2015) across the female population,

examination of social structure (e.g., exogenous or endogamous marriage practices), and exploration of potential motivators are all necessary in evaluating whether or not females actively participated in violent conflict and/or if they actively defended their homes when the usual defenders were absent.

On the other hand, while it may be true that men tend to engage more in violence than women, that does not necessarily mean that women were not engaged in the power relations or politics of society. Interestingly, some have suggested that societies with more internal than external conflict tend to have more participation of females in politics, whether in the form of reserved positions for females or unofficial influence (Ross 1986), although he notes exceptions to this pattern. Ross (1986) found that exclusion of women from politics was also likely linked to the amount of intermarriage between communities (whether or not the females were being separated from their close kin and connections) and how much socialisation involved supportive father figures.

2.4 SUMMARY

This chapter has covered some of the basic approaches and theoretical frameworks used in the archaeological study of violence and conflict in pre-history. The focus of this chapter has not been the 'origins' of conflict in the human species, but its different manifestations in relatively more recent populations. By the time of the Late Jōmon to Yayoi periods, violence is a well-established means of resolving conflict, hence the 'origins' of violence debate is not directly relevant to this study. Most of these points outlined in this chapter are still hotly debated and continued investigations will hopefully help to improve archaeologists' ability to make more large-scale comparisons between groups, regions, and time periods that will allow for more complete conclusions to emerge. An overview of how these theories will be applied to this study will be discussed after a background of the Jōmon and Yayoi periods and of previous approaches to studying evidence of violence during them.

Chapter 3 – Prehistoric Cultures of the Japanese Archipelago

3.1 General Introduction

The Japanese archipelago is located off of the northwest coast of Eurasia in the Pacific Ocean. It is composed of four primary islands (Hokkaidō, Honshū, Shikoku, and Kyūshū) and thousands of smaller islands, spanning from approximately 46°N to 24°N and from 123°E to 146°E from Hokkaidō to Okinawa. See Figure 3.1 for a map of the main islands of Japan and its primary regions. The majority of islands fall within the temperate zone, although Hokkaidō has a cooler humid climate and the southern-most islands, Okinawa included, fall within the subtropical zone (Imamura 1996). The archipelago has been inhabited since the Palaeolithic and is now comprised of the nation-state of Japan with over 124 billion inhabitants agriculture (Steinhaus and Kaner 2016).

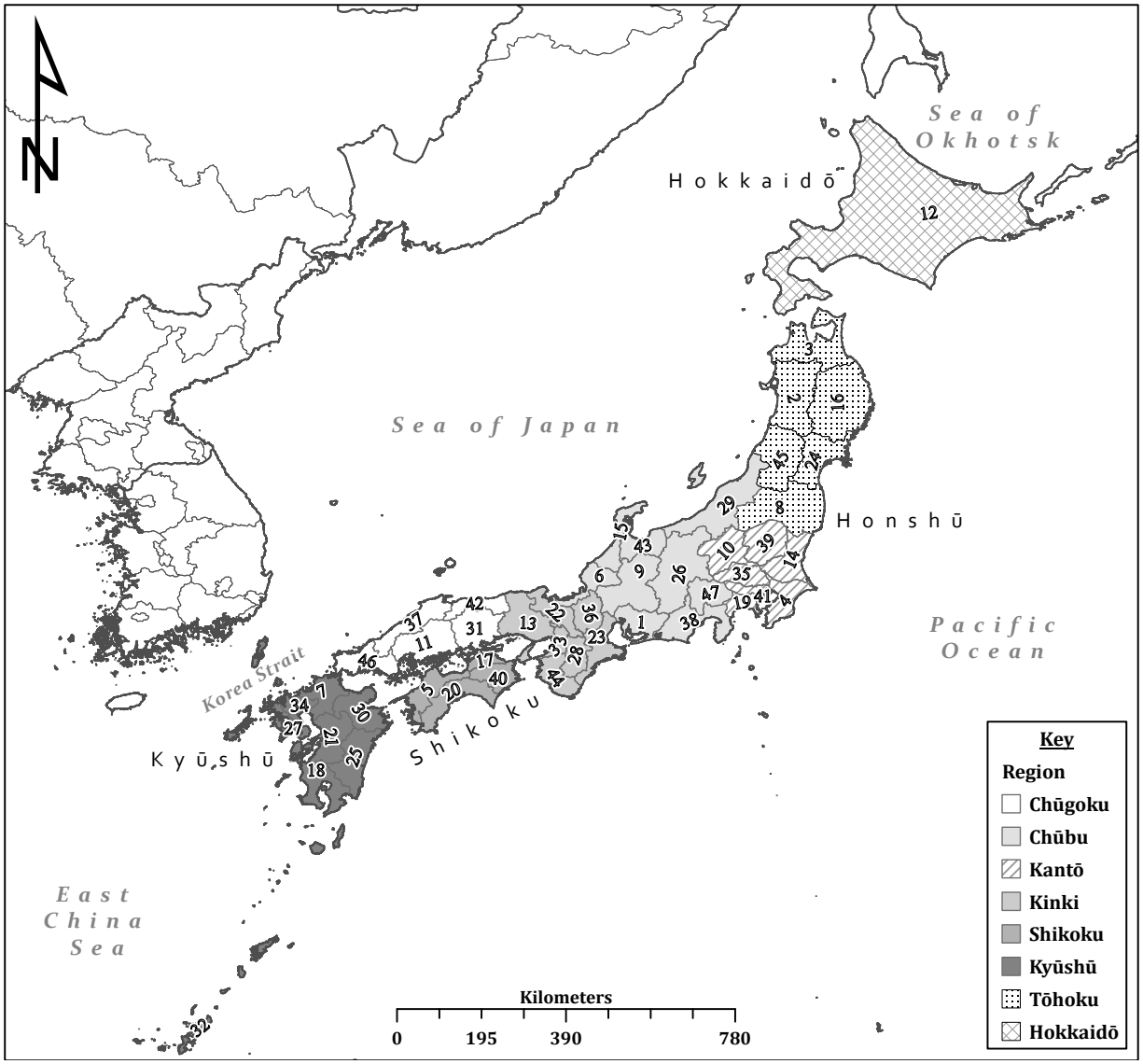


Figure 3.1: Maps of the Japanese archipelago showing the current prefectures of Japan and the larger regions of Japan and its prefectures (administrative boundaries map source is GADM): [1]Aichi, [2]Akita, [3]Aomori, [4]Chiba, [5]Ehime, [6]Fukui, [7]Fukuoka, [8]Fukushima, [9]Gifu, [10]Gunma, [11]Hiroshima, [12]Hokkaido, [13]Hyōgo, [14]Ibaraki, [15]Ishikawa, [16]Iwate, [17]Kagawa, [18]Kagoshima, [19]Kanagawa, [20]Kōchi, [21]Kumamoto, [22]Kyōto, [23]Mie, [24]Miyagi, [25]Miyazaki, [26]Nagano, [27]Nagasaki, [28]Nara, [29]Niigata, [30]Ōita, [31]Okayama, [32]Okinawa, [33]Ōsaka, [34]Saga, [35]Saitama, [36]Shiga, [37]Shimane, [28]Shizuoka, [39]Tochigi, [40]Tokushima, [41]Tōkyō, [42]Tottori, [43]Toyama, [44]Wakayama, [45]Yamagata, [46]Yamaguchi, and [47]Yamanashi.

Within the Japanese archipelago's numerous mountains are many Quaternary volcanos, the ash fall from the eruptions of which are excellent tools for helping to date archaeological sites (Lowe 2011; Machida 2002). Recent research into the acidity of soils in the archipelago demonstrates that the high precipitation, combined with warm temperatures, results in a leaching of the soils and their contents of calcium and other base elements, resulting in more acidic composition (G. L. Barnes 2022). This results in overall very poor preservation of

organic remains, such as bones, when they are buried directly in the soil without any kind of protection, whether in a cave or burial container or alongside high quantities of shells (which are rich in calcium carbonate). The skeletal remains that are preserved from the Jōmon and Yayoi periods were buried in contexts that protected the remains from the acidic soil, which will be discussed subsequently.

Distinct differences in the ecology and in the Jōmon to Yayoi practices between the Northeast and Southwest of the main islands have long been recognised. For one, in the northeast there is a deciduous broad-leaf forest and in the southwest there is a broad-leaf evergreen forest (Imamura 1996). Moreover, when the northeast was booming during the Middle Jōmon, the southwest did not experience a similar boom in population size or subsistence specialisation. Instead there was a gradual increase in population size, although it remained less than that in the northeast, with more influence from the continent (Habu 2014). Examples of this contact can be seen in the presence of Jōmon period pottery and obsidian found in contemporaneous sites in or near the Korean Peninsula and vice versa (Miyamoto 2008; Sample 1974).

3.1.1 Introduction to the Prehistoric Cultures of Japan

For over 10,000 years, the inhabitant of the Japanese archipelago maintained a primarily fisher-hunter-gatherer subsistence lifestyle during what is known as the Jōmon period (ca. 15,540 – 2385 cal BP). The Jōmon is distinguished from the Palaeolithic period primarily due to the invention and use of pottery (Craig et al. 2013). Despite this, the Jōmon is atypical of the Neolithic, as they did not adopt agriculture or domesticated animals as their primary means of subsistence, despite long-term contact with cultures on the mainland which did. The Jōmon are also notable for being partly sedentary, thanks to the storage of some foodstuffs (Habu 2014; Imamura 1996).

Whether the Jōmon period should be considered a part of the Neolithic is contested, The main against argument for including it within the Neolithic is the lack of agriculture (Kaner and Ishikawa 2007). Yet, recently Hudson and colleagues (2020; 2021) argue that the Jōmon cannot be considered completely isolated from global trends during the Neolithic and Bronze Age, even if a resistance to agriculture and metallurgy persisted until the Yayoi.

Even though it is known that the Jōmon were in some contact with the mainland of East Asia, where there was wide-spread, intensive rice and millet agriculture from at least ca. 3500 BC, agriculture in Japan began long after that of China and the Korean Peninsula (Ahn 2010; Crawford and Lee 2003; Fuller 2011; G.-A. Lee 2011; Li et al. 2020; Miyamoto 2014; Shitara 2017). For instance, evidence of this interaction can be seen in the discovery of Jōmon pottery and obsidian tools found in South Korean sites, a mix of Jōmon and Korean Chulmun pottery in sites within the Korean Strait from Tsushima and Iki islands, and similarities in tool morphology and subsistence strategies found in sites in southern Korean peninsula and Northern Kyūshū (Bausch 2017). At times the Jōmon and Yayoi periods are presented as being diachronically opposed, yet doing so can result in neglecting to see how the Jōmon, migrants from the Korean peninsula, and the burgeoning Yayoi culture variably and uniquely intersected. Especially in ways that might not have carried over into historical texts from the Kofun period and beyond (Hudson 2021).

The beginning of intensive wet-rice agriculture is now often considered the defining characteristic of the subsequent Yayoi period (ca. 900 BC – 250 AD). The period is marked by increased immigration from the Korean Peninsula (seen in similar materials goods and housing structures), morphometric and genetic evidence (see 3.1.3), and the beginnings of metal use (first bronze, and then iron) (G. L. Barnes 2007; Mizoguchi 2013; Rhee et al. 2021). The agriculture introduced to Japan was fully developed, quickly leading to irrigated field systems (Rhee et al. 2021). Compared to most of the Old World, agriculture was adopted on the Japanese archipelago relatively late, but when it was it was done quickly in northern Kyūshū and

southwest Honshū in particular, with fully-developed systems alongside an influx of migrants from the Korean Peninsula and metallurgy soon after during the Middle and Late Yayoi periods (G. L. Barnes 2007; Mizoguchi 2013; Rhee et al. 2021). Exactly why there was a shift to agricultural practice and a change in the fundamental social structure at this time has long been debated by Japanese archaeologists.

The end of the Yayoi period is marked by a consolidation of power into central areas and leaders, such as Queen Himiko (卑弥呼) and the Yamato (大和) state, which were first recorded in the Chinese History of the Three Kingdoms c. 221–265 AD (G. L. Barnes 2007; Bary et al. 2001; Rhee et al. 2021). The end of the Yayoi period and the start of the Kofun period constitute the protohistoric period of Japan, as there are no written records from Japan at this time and Chinese imperial scribes and historians recorded testimony about the people of 'Wa' (倭). The chronicles record a period of unrest, the Wa Disturbances (*wakoku dairan* 倭国大乱), among the *guo* (*koku* or *kuni* 國*;* frequently translated as 'polity', 'land', or 'country') of the Wa from 147–189 AD. After which period, the *guo* were united under Himiko. The death of Queen Himiko marks the beginning of the Kofun period (古墳時代; ca. 250–538 AD), which is named after large, elite tumulus burials (*kofun* 古墳) that still dominate the landscape today (G. L. Barnes 2007; Kidder 2007; Mizoguchi 2013; Rhee et al. 2021). Therefore, the Yayoi period is often seen as a transitional phase between a more egalitarian complex hunter-gatherer society and the formation of a burgeoning state-level society that was increasingly in contact with continental powers.

3.1.2 'Japanese'

In this study, as much as possible, using the term 'Japanese' to describe prehistoric people is avoided, especially in the case of the Jōmon, as the prehistoric inhabitants of the Japanese islands are distinct from the modern culture and nation state of Japan in many ways (Hudson 2000). In the case of the Jōmon, it is increasingly argued that their most direct

descendants are the Ainu, an indigenous population in Hokkaidō. Although the northern region of Japan (Tōhoku 東北) may also have a larger Jōmon genetic component, the rest of mainland Japan has a larger genetic component of their Yayoi ancestors, who emigrated from mainland Asia (Cooke et al. 2021; Ding et al. 2011; Dodo and Ishida 1990; Dodo and Kawakubo 2002; Hanihara 1991; Hudson et al. 2020b; Jinam et al. 2015; Kato 2009; Kozintsev 1992; Matsumura 1994; Miyamori et al. 2015; Ossenberg et al. 2006; Turner 1976, 1992; Yamaguchi 1982).

3.1.3 Jōmon–Yayoi Transition

The origins of the Yayoi period are not rooted in a single people or event, rather they are the result of a demographic shift in the population and an influx of new materials, methods, and ideas that intermingled with the native people and traditions with noticeable regional variability, but never truly spread to the northernmost reaches of the archipelago. Exactly why this influx began is still a frequently discussed topic (G. L. Barnes 2007; Hudson 2020; Hudson et al. 2021; Mizoguchi 2013; Rhee et al. 2021).

For instance, Kazuo Miyamoto proposes four stages of grain cultivation distribution across East Asia, and argues that the trigger for the movement from the Korean Peninsula southwards (the fourth stage) was a global cooling phase from ca. 800–750 BC combined with the development of farming societies (Miyamoto 2016). Regional pollen analyses have been completed as well, supporting the claim of climatic fluctuation during this time. The most well-known of which is the analysis of *Pinus* pollen by Y. Sakaguchi (1982, 1983) who identified [1)] an unstable and warm stage between ca. the 21st century BC and the mid-9th century BC, [2)] a cold stage between the mid-9th century BC and the start of the 4th century BC, [3)] a warm stage between the start of the 4th century BC and the early 1st century BC, [4)] and an unstable and cold phase from the early 1st century BC to the mid-8th century AD (Mizoguchi 2013). These broad trends are corroborated by sea surface temperature analysis in Hiroshima Bay, with a cold period found between 1000–330 BC (Kawahata et al. 2017). In terms of the climate for the

Northern Hemisphere, the Younger Dryas Event occurred ca. 10 kya, and is followed by warming during the Holocene until an optimum annual average temperature was reached around 5–6 kya of ca. 2°C warmer than current temperatures. What followed is the cooling that has generally marked the rest of the Holocene (Burroughs 2005).

Miyamoto argues for three stages of genetic and linguistic integration after the 800–750 BC based primarily on pottery typological correlations and changes in stone tools and burial style with climatic cooling phases which presumably would have put pressure on agricultural production. Although, rice has been known to grow in what are now considered rather extreme conditions for the species (i.e. the Shandong province of China and northern Japan), it needs warm conditions and sufficient water to thrive (Crawford 2011; Guedes et al. 2015; K. Tanaka et al. 2016). Miyamoto (2016) argues that the development of farming societies contributes to the movement of Korean communities or individuals, but correlating specific cooling events to this can err towards environmental determinism. He also tends to emphasise the shifting pottery typologies in and of themselves over the human agency behind them without thoroughly discussing the role of pottery in the society. It is questionable how well a typology represent a people, although this theoretical background may be assumed to be understood. Moreover, due to the chronological controversies surrounding the beginning of the Yayoi period (discussed in 3.1.4), whether or not it is possible to directly tie this climatic cooling event to population movement and social change remains in question (Miyamoto 2014, 2016; Shitara 2017).

An integral catalysing force of the Yayoi period were the *toraijin* (渡來人) or the people who migrated from the Korean Peninsula to the Japanese archipelago. The beginning of the Yayoi period corresponds to the Mumun Period (*mumun jidai* 無文時代), the Bronze and Iron Ages of the Korean Peninsula (ca. 1500 – 100 BC). During the Mumun, there is marked craft specialisation, increased population size, the construction of larger agricultural villages along alluvial plains, moated villages with sectioned off portions, shared storage facilities, burials (dolmens and cists) with prestige grave goods, and evidence for selective ‘violent’ burning of

certain types of houses within sites (Bale and Ko 2006; Rhee et al. 2007; Rhee et al. 2021). This led to an increased intensive agriculture and rising social stratification on the Korean Peninsula that caused higher demand for land and more episodes of violence, and resulted in people migrating southwards to the relatively less inhabited southwest of the Japanese mainland (Rhee et al. 2007). Therefore, Rhee (2007) argues that this, coupled with the evidence of occupation of the most fertile land in southernmost Korea, presents a clear set of incentives for people to move southwards through the Korea Strait into the Japanese archipelago. Rhee et al. (2021) go further and suggest that there is evidence for distinct waves of migration based on push/pull dynamics between the southern Korean peninsula and the southwest archipelago during this time:

1. an initial wave into the coastal areas of N Kyūshū during the Middle Mumun/Initial–Early Yayoi period due to the intensification of mixed-crop agriculture, a resulting rise in population size and settlement number, a cooler climate, and social conflict
2. and a second wave into areas such as the Saga Plain in N Kyūshū during the Late Mumun/Middle Yayoi periods due to socio-political turmoil associated with refugees from China's Warring States Period (401–222 BC).

This is tied to evidence of an interaction sphere between the Jōmon and Yayoi and Korean Peninsula cultures on the rather large islands of Tsushima and Iki within the strait (Miyamoto 2008; Tawara 2008) and continued contact and trade even when migration was likely not occurring on a large scale (Rhee et al. 2021).

Appealingly to migrants, the area of N Kyūshū, where the first agricultural villages appear on the Fukuoka Plain, was not heavily populated during the Late or Final Jōmon (Fujio 2021). This makes it more difficult to directly compare the two cultural groups in the area. Yet, there are Yayoi villages which have been argued to exhibit a blending of Songguk-ni culture villages and Jōmon villages (Mizoguchi 2013). Unfortunately, there are few Yayoi human

remains from the Initial–Early Yayoi before burial jar and stone dolmen (*shisekibo* 支石墓) and cist use was implemented on the archipelago[2].

Nevertheless, as the Yayoi spread, there are numerous opportunities to observe their interactions along this kind of 'tribal' or 'frontier zone', if you will. Although not all communities turned from their long-held subsistence practices to agriculture (Hoover and Hudson 2016), most contend that any resistance to it was not hostile based on, for example, changes in pottery styles, burial style, and settlements that resulted in hybridisation and acculturation rather than replacement (Fujio 2014; Mizoguchi 2013; Rhee et al. 2021; Yasuhiro Yamada 2014). In particular, Mizoguchi argues that Yayoi practices were adopted within a Jōmon framework –

> *To put it in a rather simplistic manner, there was only one thing which changed fundamentally at the onset of the Yayoi period: the emergence of rice as the potential single major food group, instead of various seasonal edible plants and animals (Mizoguchi 2013:64).*

The problem with this thesis is that stylistic hybridisation or even integration of different subsistence lifestyles can cooccur with hostilities or even domination. Additionally, there is a question of the scale of particular interactions and how much variability can be observed over time and within a region. Mizoguchi argues based on the findings of Fujiwara (2004) that Yayoi conflict was characterised by small-scale conflicts and raids.

Some argue that immigrants from Korea were relatively few and mainly men who intermingled with local Jōmon women, which they have judged from the small percentage of foreign-style pottery (See discussion in Shitara 2017:15). It has long been known that the

[2] Stone dolmens were an import from the Korean peninsula and were comprised of a large, raised stone cap supported by stones set on the ground over a burial pit or cist, which, at times, contained a wooden coffin. These cists were lined with stone slabs or cobblestone (Rhee et al. 2021). Hence, there is some overlap between the occurrences between stone dolmens and cists, i.e. stone-capped or -lined, burial pits and facilities.

Jōmon and Yayoi are morphometrically distinct, especially in regards to stature and craniometrics (see Rhee et al. 2007: 420, Figure 6) for an imaginative rendering) (Seguchi et al. 2017; Temple et al. 2008). As mentioned previously, there are many indicators that modern Japanese draw more of their ancestry from the Yayoi rather than the Jōmon. Lastly, it is also commonly held that the population increased drastically during the Yayoi period (Figure 3.2), benefiting from the agricultural yield and the advantage of having more offspring in an agricultural community (Habu 2004; Koyama 1984, 1992). This has been supported by recent Bayesian analysis of radiocarbon dates from Kyūshū in the National Museum of Japanese History's database, which found a growth rate between 0.18 and 0.39% per year (Crema and Shoda 2021).

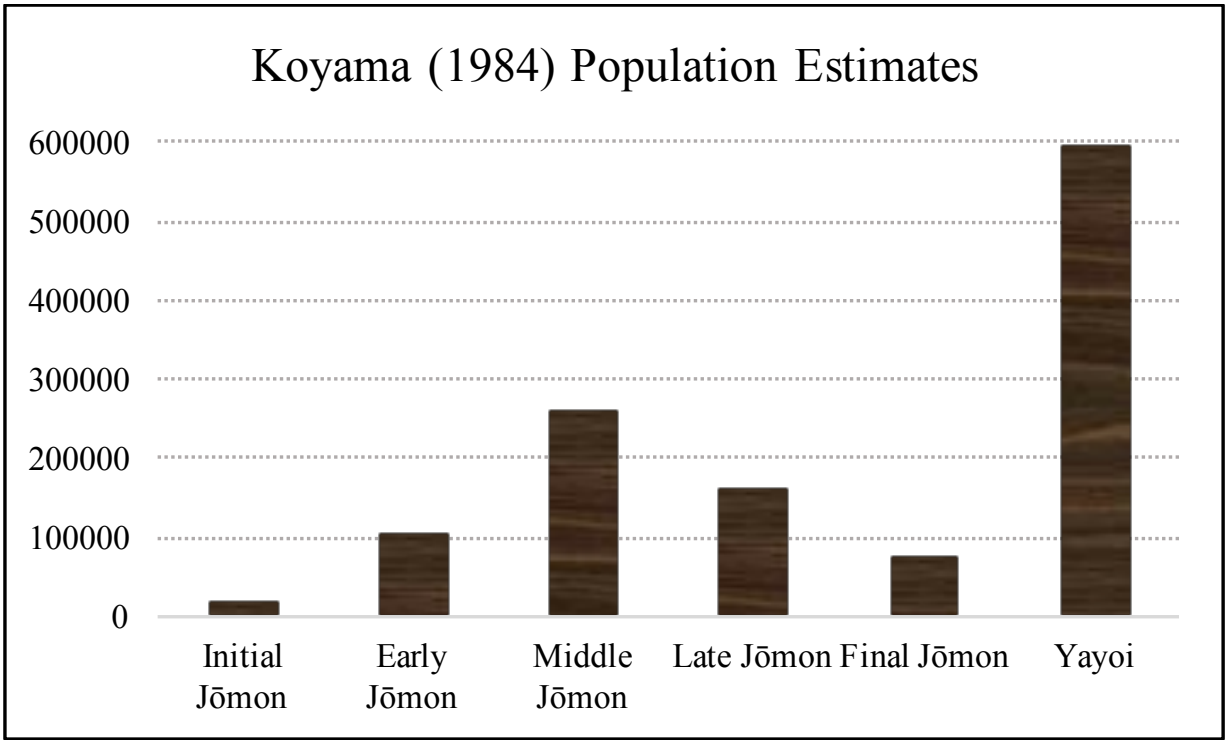


Figure 3.2: Total population estimates for the Jōmon and Yayoi periods based on the ratio of the number of recovered sites to a past population estimate by Koyama (1984) in Habu (2004: 48) Table 2.5 and Shinoda (2012: 40).

3.1.4 A Note on the Dating of the Jōmon and Yayoi Periods

The Jōmon period is subdivided into six sub-periods and Yayoi period is subdivided into four, each of these sub-periods is also split into early, middle, and late periods (Table 3.1).

There is controversy, though, between the absolute dates for some of these sub-periods and the archaeological typochronologies.

*Table 3.1: Chronology of Pre- and Protohistoric cultures of the Japanese archipelago (G. L. Barnes 2015; K. Kobayashi 2017; Rhee et al. 2021). *The Final Jōmon Period is shorter in SW Japan (i.e. N Kyushu and SE Honshū where the Yayoi first emerged) and more extended in NE Japan. 500 BC is an approximate average of these. **As discussed in detail, the absolute dates for the initial phase of the Yayoi period are contested currently. ***At this point there are bronze objects imported from China that are well dated.*

Period	Sub-period	Average Dates
Palaeolithic Period (*kyūsekki jidai* 旧石器時代)		ca. 40,000 – 15,000 BP
Jōmon Period (縄文時代)	***Incipient*** *(sōsōki* 草創期*)*	15,540 – 11,345 cal BP (13,590 – 9,395 cal BC)
	Initial *(sōki* 早期*)*	11,345 – 7050 cal BP (9395 – 5100 cal BC)
	Early *(zenki* 前期*)*	7050 – 5415 cal BP (5100 – 3465 cal BC)
	Middle *(chūki* 中期*)*	5415 – 4490 cal BP (3465 – 2540 cal BC)
	Late *(kōki* 後期*)*	4490– 3220 cal BP (2540 – 1270 cal BC)
	Final *(banki* 晩期*)*	3220 – 2385 cal BP (1270 – 435 ca. BC)*
Yayoi Period (弥生時代)	***Initial*** *(sōki* 早期*)*	ca. 9th – 8th century BC**
	Early *(zenki* 前期*)*	ca. 7th – 4th century BC
	Middle *(chūki* 中期*)*	ca. 4th century BC – 1st century AD***
	Late *(kōki* 後期*)*	ca. 1st – mid-3rd century AD
Kofun Period (古墳時代)		ca. 250 – 538 AD

Absolute dates from the Yayoi period, especially its inception, have been the subject of heated debate in recent years. The relative dating methods that archaeologists have traditionally relied on to date the Yayoi period include extensive pottery typochronologies and bronze objects with known production periods in China that are used to ascertain *terminus post quem* (TPQ) dates. Historical records from China date as far back as the Shang Dynasty (ca. 1200 –

1050 BC) and datable objects found in burial contexts during the Yayoi period include elaborately decorated Early Han Chinese bronze mirrors and one Liaoning type (lute-shaped) bronze dagger (Mizoguchi 2013; Shoda 2007). Analysis of these objects and of the pottery typology, including the burial jars used during the Yayoi (especially beginning with the Middle Yayoi) known as *kamekanbo* (甕棺墓), yielded a date of ca. 500 BC for the beginning of the Yayoi (see discussion in Mizoguchi 2013). In 2003 accelerator mass spectrometry (AMS) radiocarbon dating of early agricultural evidence (i.e. food residue from pot sherds) released by The National Museum of Japanese History (NMJH) has pushed back the beginning of the Early Yayoi by at least 500 years and the beginning of the Middle Yayoi by 200 years. This shifting back of the official dates was and still is hotly debated by the Japanese archaeological community, especially by scholars in Kyūshū (Miyata et al. 2011; Mizoguchi 2013; Normile 2003; Onuki 2005; Rhee et al. 2021; Shoda 2007, 2010). Concerns about the new dates include that they make the Han bronze mirrors and iron tools older than the originals in China, that what the food residues that were dated consist of is unknown, and that the ^{14}C calibration curve for the time around the Yayoi period is plateaued between ca. 730–420 cal BC (Kaner and Ishikawa 2007; Mizoguchi 2013; Shoda 2007). That being said there is a steep drop from ca. 850 cal BC before the plateau and after 420 cal BC as well (Oxcal v4.3.2 Bronk Ramsey (2017); r:5 IntCal 13 atmospheric curve (Bronk Ramsey 2009; Reimer et al. 2013). Lastly, it has consistently been recognised that there is overlap with the end of the Jōmon period and the new Yayoi culture and that there was considerable regional diversity in the adoption of agriculture from its start (Hoover and Hudson 2016; Shitara 2017; Shoda 2007). One of the earlier examples of this was the site of Itazuke (板付遺跡, excavated in the 1970's) in Fukuoka, which is one of the earliest rice farming sites in Japan, but it also yielded what was then thought to be Late Jōmon style pottery (夜臼式土器) (Mizoguchi 2013; Shoda 2007; Yamasaki 2008).

3.1.5 Sedentism and Subsistence

Jomōn settlements showed signs of sedentism from the Early Jōmon onwards, with a peak in population size and density in the northeast during the Middle Jōmon (Crema and Kobayashi 2020; Habu 2004, 2014). This was facilitated by the use of storage pits, from the Incipient Jōmon onwards, used primarily to store nuts (Habu 2004; Imamura 1996). The Jōmon are usually typified as 'complex' fisher-hunter-gatherers, relying heavily on a seasonal cycle of aquatic foods, plant foods, and terrestrial mammals, such as *Cervus nippon* (sika deer) and *Sus scrofa* (wild boar), (see Habu 2004:61, Figure 3.1). They purposefully cultivated and/or managed certain plant species, such as *Castanea crenata* and *Aesculus turbinata* (chestnut trees), *Toxicodendron vernicifluum* (lacquer tree; native to China), *Glycine sp.* (soybean), *E. Lagenaria siceraria* (bottle gourd), *Echinochloa esculenta* (barnyard millet), *Cannabis sativa* (de Barros Damgaard et al.), and *Perilla* to name a few (Crawford and Yoshizaki 1987; Crawford 2008, 2011; D'Andrea et al. 1995; Kitagawa and Yasuda 2004; Matsui and Kanehara 2006; Noshiro and Sasaki 2014).

Rice (*Oryza sativa*) agriculture did not develop on its own in Japan where rice is not naturally present, instead it was introduced by migrants from the Korean Peninsula and/or from the Liaodong Peninsula to northern Kyūshū and southwestern Honshū (Ahn 2010; Fuller 2011; Gross and Zhao 2014; Nasu and Momohara 2015; Rhee et al. 2007; Rhee et al. 2021; Takamiya 2002; K. Tanaka et al. 2016). Often, the beginnings of rice agriculture are emphasised when agriculture is discussed in East Asia (Crawford 2008; Fuller and Castillo 2016; M. Kim 2014). Nevertheless mounting archaeological evidence points to the importance of millet and continuing Jōmon food acquisition practices as well at the inception of agriculture in Japan (Crawford 2008; Endo and Leipe 2022; Hudson 2021; Nasu 2014; Nasu and Momohara 2015).

Mizoguchi (2016) emphasises the, at first, more communal nature of Yayoi agricultural villages, even as they bud off to form new settlements, which created a pool of potential leaders from which to choose. Furthermore, he argues that settlement hierarchy developed in the

Middle Yayoi, consisting of large centres with 'daughter' or satellite settlements. Satellite settlements around these larger centres collapsed in the Late Yayoi, though, and are thought to have been absorbed into the centres themselves, which also began to incorporate more encircling ditches. He argues that this is linked to greater hierarchical control over production and the resulting goods. It also seems feasible that this could be related to a better ability to protect the members of the community at the time of an attack.

3.1.6 Mortuary Practice

Large shell middens (*kaizuka* 貝塚) that accumulated during the Jōmon period were used to inter the dead in pit burials and hence tended to preserve bones much better than the typically acidic soil of the Japanese islands allows. Not all pit burials were made in shell middens, though, and the skeletal material in those is rarely preserved although grave goods may be identifiable, including clay and jade beads, earrings, shell bracelets, pottery, and stone tools (Habu 2004). There are also stone coffin burials, abandoned house burials, and ceramic jars burials for infants. The burials often are placed in clusters or rows within a settlement (Habu 2004; Imamura 1996).

Some burial styles during the Yayoi period also allow for better bone preservation, i.e. jar burials, wooden coffins (*mokkanbo* 木棺墓), or stone cists (*bakoshikisekkan* 箱式石墓). Jar burials used red burnished pottery very similar to the Mumun style pottery (Mizoguchi 2013; Rhee et al. 2021). Jar burial cemeteries tend to be arranged in rows ("linear") or clusters ("compound") from the Early to Middle Yayoi. Koji Mizoguchi (2001, 2005) argues that these can be further split into how genealogy was considered at the time of burial. For the linear cemeteries, Mizoguchi argues that they can be arranged and added to in such a way as to promote the communal nature of the cemetery, emphasising the processional path or a group of burials, not single burials of importance. For the compound cemeteries, he argues that they serve at a more regional level as they are associated with more influential settlements and they

have a greater number of prestige grave goods, indicating that these individuals were of a higher or elite status. Moreover, there tends to be a central figure or burial for clusters of graves, although mtDNA analysis from some cemeteries suggests that they may not have been kin-related. Hence, Mizoguchi argues that for part of this period, the male leaders were chosen and given the power to lead, which then turned into an inherited power over during the later Yayoi. During the Late Yayoi Mizoguchi argues that there was a change to emphasising relationships with certain graves, and, hence, individuals and continuing genealogical succession, at the time of burial.

3.1.7 Tools and Weapons

The Jomōn people produced a variety of tools related to daily life and subsistence practice that could be used in violent conflict, such as stone axes, arrowheads, and spearpoints (Imamura 1996). Moreover, some have suggested that 'stone swords' (*sekken* 石剣) from the Late and Final Jōmon may be an imitation of bronze swords, whereas others argue that they are another variant of phallic stone rods (*sekibō* 石棒) present during the same period (Habu 2004; Hudson et al. 2021). Either of these stone artefact types, if small enough to be manageably held in the hand(s) and swung, could in theory have been used in a violent altercation. Nevertheless, formalised weapons for violent ends have not been identified. Only one bronze knife has been found from the Middle–Final Jōmon Misakiyama site (see discussion in Hudson et al. 2021).

Tools from the Initial Yayoi period onwards changed greatly, first being supplemented with Korean-style polished stone tools (see Rhee 2007: 410, Figure 3), such as sickle shaped reaping knives. Bronze importation and later production began in the first half of the Yayoi. Bronze weapons, which became more stylised and less utilitarian through the Yayoi, were buried in ritual deposits and as grave goods (Hudson 1992; Matsugi 2001; Mizoguchi 2013). Nevertheless, undeniable cases of their use in conflict are known (Hashiguchi 2007; Hudson 1992), as will be discussed further in 3.4.1.2 and in Chapter 8 with the results. Slingstones are

also present in number during the Yayoi (Egami 1971; Hudson et al. 2020a). Arrowheads of various material (bone, lithic, bronze, and iron) continued to be used as well (Matsugi 2001).

Iron was primarily used in farming tools, such as socketed axes, and woodworking tools from the beginning of the Yayoi (Nojima 2014). This changes from the Middle Yayoi when iron forging began from northern Kyūshū to the eastern Inland Seto Sea. The production of iron prestige goods in the form of weaponry increases as well (Mizoguchi 2013). Defensive weapons such as wooden shields (some designed to be held and others to be propped up on the ground) and armour for the upper body have been found (Steinhaus and Kaner 2016). Finally, although rare, there have been findings of crossbow bolts and one crossbow part from Iki, Okinawa, Kyūshū, Shikoku, and western Honshu (Ashiya Board of Education 2007; Hudson 2022).

3.1.8 Ritual

There was a strong ritualistic component to the Jomōn lifestyle, as can be seen in their ceramic figurines (*dogū* 土偶), the abovementioned stone rods or 'swords', clay masks, shell bracelets, tooth ablation, and ceremonial or monumental features, such as the stone circles in Ōyū, Tōhoku (Habu 2004; Kusaka et al. 2008; Yaegashi 1997). Evidence for the ritual and ceremonial aspects of Jōmon life became more highly elaborated from the Middle Jōmon though the Final Jōmon, but the spatial distribution of certain objects (ex. *dogū* vs. clay masks) was not equal (Habu 2004). Ritual tooth ablation from the Late to Final Jōmon carried over through the Yayoi period as well, even in communities in the heart of the early farming villages.

Exactly what the different patterns of tooth ablation first distinguished by H. Harunari (1979, 1986) (see Kusaka et al. 2009: 2290, Figure 1) mean has recently been elaborated on by Kusaka and colleagues (2008; 2009; 2011; 2012; Kusaka et al. 2015; Kusaka et al. 2018; Kusaka 2018; Temple et al. 2011) using human remains from the shell-mound sites of Yoshigo (吉胡貝塚), Ōta (太田貝塚), Inariyama (稲荷山貝塚), and Tsukumo (津雲貝塚). Tooth ablation, a kind of cultural dental modification considered to mark life events such as coming of age, marriage, mourning, or kin/group association, has been found in other East Asian

populations and globally (Burnett and Irish 2017; Domett et al. 2013; Kangxin and Nakahashi 1996; Merbs 1968; Milner and Larsen 1991; Pietrusewsky and Douglas 1993; Tayles 1996). Some of these individuals from Yoshigo, Inariyama, and Tsukumo will be examined in this study. These studies by Kusaka and colleagues identified that individuals with different patterns of tooth ablation have a greater differentiation of $\delta^{13}C$ and $\delta^{15}N$ values than normal in Jōmon groups, possibly suggesting a difference in occupation. What complicates this hypothesis is that these groups may not have been contemporaneous. At some sites individuals with the 4I pattern were more likely to be non-locals, whereas at other sites individuals with the 2C pattern were, but the individuals with these patterns are not synchronous.

During the Yayoi period, many of these same practices persisted in the east and north of the archipelago for longer. New ritual practices, including objects of significance and burial practices, emerged. Some of these practices can be linked to similar ones practiced by cultures on the Korean Peninsula (Mizoguchi 2013; Rhee et al. 2021). These included the ritualisation of new bronze wares, such as weapons, mirrors, and bells. Weapons began being deposited as grave goods and in large ritual deposits by themselves in northern Kyūshū.

3.2 TRANSITION TO THE KOFUN PERIOD

The Late Yayoi to Early Kofun (古墳時代) transition marks the beginning of protohistory in Japan, recorded in the Chinese History of the Three Kingdoms (The History of the Wei Dynasty section) by Chen Shou in the middle of the 3rd century AD (Bary et al. 2001; Brown 1993; Farris 1998). The history records the Wa kingdom and its first rulers, including the shaman Queen Himiko, in power until ca. 248 AD. The Chinese accounts of the Wa chronicle political strife and battle between factions that led to the rise of fewer, more powerful chiefdoms. Moreover, they describe the Wa people as deferring to those of higher rank, clapping to pray, eating with their hands, using oracle bones, having professional abstainers, and rarely breaking the laws which had harsh punishments. The Kofun period's archaeological

evidence of increasingly consolidated political powers are represented in prestige goods, such as bronze mirrors and weapons, body armour, and monumental burials with graded size and wealth (Fujiwara 2012; Mizoguchi 2013; Yoshida 2014).

The following section discusses particular evidence for violent conflict during the Jōmon and Yayoi periods and how it has been addressed.

3.3 Occupational Risk Factors

Risk of accidental traumatic injury, particularly those that could be erroneously confused as violence-related, during the Jōmon to Yayoi period vary by subsistence practices and subsequent occupational hazards. Particularly, postcranial fractures are often examined when evaluating occupational trauma in palaeopathology.

The Jōmon people's fisher-hunter-gatherer subsistence practices involve a variety of activities when moving over diverse terrain and across the sea; when preparing foodstuffs (ex. cultivation and storage); and while hunting, fishing, and foraging, all of which involve the potential for accident.

Although the Yayoi marked the beginning of intensive agriculture on the archipelago, diverse subsistence patterns long existed beside agriculture, such as continued hunting and fishing practices. The amount that communities relied on one or a combination of these practices varied, but along with risks from agricultural work, individuals may have also been at risk for injuries sustained during other food procurement practices. The Yayoi did not see the introduction of large, domesticated animals, which are one of the main causes of injury in ancient and modern agricultural groups who rely on them (see discussion in Judd and Roberts (1999)). Raised storage facilities (高床式倉庫 *takayukashikisōko*) began to occur during the Yayoi (well-known reconstructions can be seen at the Yoshinogari site (吉野ヶ里遺) in Saga Prefecture and the Toro site (登呂遺跡) in Shizuoka Prefecture) (Hirai 1998), which would have created some risk of fall injuries, but falls from great heights, like those from modern grain

silos or large barns, would not have been as high of risk factors. Concerning rice agriculture in particular, those who still practice traditional rice agriculture in modern Thailand, for instance, stuffer from severe pain in the shoulders and neck and moderate pain in the lower back, particularly during the transplanting process (Keawduangdee et al. 2015; Sombatsawat et al. 2019).

In a study comparing trauma associated with hunter-gather, low-intensity agriculture, and high-intensity agriculture practices globally, Lambert and Welker (2016, 2019) argue that both hunter-gatherers and high-intensity agriculturalists suffer from a similar trauma load, whereas low-intensity agriculturalists have a much lower accidental trauma load. The Yayoi would fall under the high-intensity range in this study as landscape modification, i.e. irrigation, was employed. Moreover, Lambert and Welker (2019) found higher rates of trauma based when high-intensity agriculture was carried out in sub-optimal settings, such as in rougher terrain.

Intentionally inflicted trauma is another risk factor for the prehistoric occupants of the Japanese archipelago, which has been looked at in greater detail and with increasing scrutiny in the last decade. An overview of previous violence-related trauma analyses of Jōmon and Yayoi individuals is discussed in the following section.

3.4 Previous Trauma Analysis

3.4.1 Past Studies of Conflict in Japanese Prehistory

It is generally considered that true 'warfare' only began during the Kofun period, culminating the trend of increasing violence and power consolidation during the Yayoi period, whereas the earlier Jōmon period is considered to have been largely peaceful and with very low levels of violence (Nakagawa et al. 2017; Nakagawa et al. 2021; Nakao et al. 2016).

3.4.1.1 Jōmon Period Skeletal Trauma

Currently, is widely held that the Jomōn period was a primarily peaceful time, lacking any kind of purposeful, group-level violence. The most recent summary of Jomōn violence as seen through skeletal evidence is by Nakao and colleagues in 2016, who summarised site reports available on the Nara National Research Institute for Cultural Properties site (http://sitereports.nabunken.go.jp/en) and using summaries by Uchino (2013) and Yamada (2006). The purpose of their analysis was to provide evidence against arguments that violence or warfare (these terms are not distinguished) was prevalent among prehistoric hunter-gatherers and that it increased after the advent of sedentism. Nakao et al. (2016) argue that using a synthesis of the available reports on human skeletal trauma from the Jomōn period across Hokkaidō, Honshū, Shikoku, and Kyūshū shows that the skeletal trauma resulting from violence is extremely low throughout the period with a maximum occurrence of 1.82% among adults. For comparison, even a reported rate of 7.5% violent skeletal trauma has been considered to be extremely low (Walker 1989). Nakao and colleagues acknowledge that some periods, notably the Middle and Final Jomōn, have higher incidence of 3.45% and 2.09% respectively, but do not provide any statistical analysis of this. Their overarching conclusion is that this contributes evidence to the argument that humans are not inherently violent creatures and that war is not found in all places and times. More recently in Nakagawa et al. (2017), including Nakao, they specifically use the accumulated database to argue against Bowles' (2009) mathematical models for estimating the evolution of altruism using the prevalence of warfare.

One of the major drawbacks of this synthesis is that Nakao and colleagues did not assess the skeletal trauma themselves; instead, they relied upon various studies carried out with unaddressed methodological differences. Therefore, although their study is an excellent resource and literature review, the prevalence of trauma reported is likely to be misleading and not fully representative of the material.

For instance, although Nakao et al. provide a prevalence of trauma for adults during the Jomōn period, this doesn't take into account how fragmentary or incomplete the remains of each individual were, which the authors admit is a problem. The more fragmentary the material, the less likely one is to be able to find traumatic lesions. This factor needs to be taken into account in order to fully address the research questions. For instance Uchino (2013) very briefly records how much of the skeleton was preserved (Table 1 in Uchino 2013), but these descriptions are along the lines of "incomplete" or "almost the whole skeleton" or "only below the thigh". This is because, as will be seen in the discussions in 3.4, often researchers are interested in identifying battle patterns and characterising the 'type' of battle during the Jomōn period, not in quantifying the prevalence of violent conflict. Finally, some of the original reports, although not all, that record these instances of violent trauma are quite dated, going as far back as the 1920s or 1950s when osteological analysis was not as advanced as it is today and criteria for the recognition of skeletal trauma were not as well developed (Fujiwara 2004). The main focus of many of these examinations was not to record trauma specifically, but to provide an overall summary of the osteological evidence. Moreover, the calculation of a rate of 'mortality' in these studies is confusing as antemortem injuries are included in the trauma count, which are not directly related to mortality. It is unclear at times which injuries are antemortem or even how many are antemortem.

Finally, Nakao and colleagues' suggestion that if the Jomōn material yields very little evidence for intentional violence and, hence, humans are not inherently violent is flawed. Lack of violence does not necessarily mean a non-violent nature. Actions are socially mitigated and structures can be in place to discourage violence and encourage discourse or peaceful resolutions to conflict (Fry 2012). Archaeological observations are primarily observations of human behaviour, whereas innate human character is a connected, but distinct matter that has to be addressed accordingly.

Recently Matsumoto (2018) draws upon the Jōmon and Yayoi skeletal data from Nakao et al. (2016) and Nakagawa et al. (2017) to further argue that warfare is not an inevitable human practice, despite what she sees as an inherently aggressive human nature. Instead she argues that warfare is based on particular cultural and ethical values that promote inequality, narrow altruism (i.e. only for those in-group or for kin), and consolidation of power. She loosely defines war as entailing large-scale casualties (on the level of 1k people per year in the modern period) involving warriors/soldiers and entailing large-scale social changes (such as the consolidation of power and loyalty to a particular group or leader). Looking to modern ethnographic evidence of 'peaceful' hunter-gatherer societies, she argues that cultural practices that might have been in place during the Jōmon likely promoted equality, equitable distribution of resources, child rearing that emphasised autonomy, a more fluid and equal division of the sexes, a broad concept of altruism, and conflict mitigation strategies (either through territorial avoidance or through an emphasis on peace-keeping discussions).

That being said, Matsumoto relies on the biased and limited data from Nakao and colleagues and on modern ethnographic data from 'peaceful' hunter-gatherers. She does not draw upon the cultural evidence from modern hunter-gatherer groups who participate in warfare, as she does not believe that this is representative of prehistoric hunter-gatherer cultural evolution. This results in a slightly circular argument where the use of some ethnographic evidence is permissible, but presupposes that modern hunter-gatherers who regularly conduct raids or warfare are not representative of prehistoric hunter-gatherers when the evidence is much more variable than this relatively simplistic picture. While it is certainly true that during the Jōmon many of the above cultural attributes may have been in place and played a large role in mitigating persistent, large-scale violent conflict, the question of the role of conflict in Jōmon society requires further investigation and discussion.

Hudson et al. (2020a) draw attention to the fact that despite large population increases and the Jōmon's relative affluence at times, there does not seem to be a corresponding rise in

levels of violence. This is in contrast to what has been previously suggested for the Yayoi period, which had similar pressures but under an agricultural subsistence lifestyle.

3.4.1.2 Yayoi Period Skeletal Trauma

It is generally regarded that the Yayoi period marks the beginning of violent conflict associated with political ends and consolidation of power in Japan. This is mirrored in the emergence of prestige goods, monumental burials, and settlements with elite enclosures (Hudson 1992; Imamura 1996; S. Kobayashi 2014). In the past decade an increased number of studies have begun to focus on the skeletal evidence for violence as well.

Nakagawa and colleagues (2017) employed the same methods as those used for the Jōmon trauma analysis discussed in the previous section to provide a rate of violence for the Yayoi period, finding an average of 3.62% of adults suffered from violence and that the rate of violence rose from the Middle to Late Yayoi. The details of the injuries to some of these individuals is presented for the northern Kyūshū part of the dataset in a subsequent paper (Nakagawa et al. 2021). In this same paper the team used their compiled dataset to examine the correlation between violence and population pressure, estimated by the frequency of burial jars, in northern Kyūshū. Although the results did not suggest a direct correlation between specific regional peaks in population pressure and violence, overall the two were correlated. Nevertheless, using burial jar frequency per regional area as a proxy for population pressure results in the compounding of several factors. The use of burial jars becomes more popular in the Middle Yayoi, and this analysis may be at least partially representing this dynamic, instead of population pressure. Moreover, using relative dating methods does not allow for any understanding of error ranges of the approximate dates or how they may overlap or have temporal gaps within specific typological units.

It is believed that the incidence of skeletal trauma increased from the Middle Yayoi onwards. A synthesis by Fujiwara (2004) divides the injuries found previously on Yayoi

skeletons[3] into three categories: close-quarters combat (using daggers), close combat range (using types of swords which allow more distance between the combatants), and long range (using bows and arrows). He found that the first half of the Yayoi had evidence for many 'killings' from behind (by dagger) and 'killing' from the side and behind (by bow and arrow), which he hypothesises may be the result of battle with several people possibly involving bow and arrows or violent ritual (murder). During the latter half, sharp force trauma (presumably from bronze or iron implements) increased and he noticed evidence for short and long-range conflict, which he proposes could be the result of first attacking with bows and arrows and then finishing off the enemy at close-range with swords. Fujiwara concludes that Yayoi period fighting was small scale with surprise attacks, raids, and betrayal and/or ritual killings during the middle of the period, but the end of the Yayoi was marked by rise of violent group conflict. He attributes this change to a society with increasing power consolidation and the increased availability of bronze weaponry.

In his recent Ph.D. dissertation, Padgett (2020) examined approximately 230 Initial–Late Yayoi individuals' overall skeletal health indicators and evidence of violent trauma in order to better understand the region and temporal patterns in Yayoi violent conflict. Padgett argued that, during the Early Yayoi, projectile and blunt force trauma were most common. Furthermore, he found that during the Middle Yayoi, more males were impacted by violence than females and that there was a greater use of metal weapons with injuries concentrated in particular areas of the body. Isolated skulls with potential penetrating trauma and headless burials point to potential headhunting and trophy displaying. Finally, an in-depth analysis of the possible Late Yayoi massacre associated with a commingled mass grave at the Aoya-Kamijichi (青谷上寺地遺) site was presented.

[3] Note that re-evaluation of some of the cases reported by Fujiwara (2004) in this thesis did not support the aetiology of weapon trauma. For instance, the healed (Colles) fracture to the distal radius of Nagaoka K32 was reported by Fujiwara to represent a blunt force blow from a weapon, when this injury is much more likely to be associated with an accidental fall (Court-Brown et al. 2015; Mays 2006; Wedel and Galloway 2014).

Yoshinogari is one of the largest and most well-known Yayoi sites. Excavations of the site began in the 1980's. The site was occupied from the Early to Late Yayoi period and has a large moat with other enclosures and associated burials (mounds, jar burials, pit graves, and wooden coffin graves), some of which are known to have evidence of violent trauma (Hudson and Barnes 1991; Saga Prefecture Board of Education 2014). During the Late Yayoi the moated settlement expanded and is the largest known of its kind for that period. There were also inner moats and wooden watchtowers around the northern and southern enclosures, within which is evidence for ritual ceremonies and/or elite residence (Steinhaus and Kaner 2016). At the site there are a few graves with headless burials that are thought to be associated with trophy-taking/headhunting. It is unknown if examination of what remains of the vertebrae for a majority of these individuals yielded any indicators of sharp force trauma. Only recently has the skeletal report for Yoshinogari been published (Saga Prefecture Board of Education 2020) and, unfortunately, no other analyses on the nature of the trauma present has been able to be reported as of yet. In coming years, analysis of the Yoshinogari remains will greatly aid in examining the trauma of the Saga Plain during the Yayoi.

Hudson and colleagues (2020a) note that Hashiguchi's 2007 synthesis of violence during the Yayoi, comprising around 260 individuals, showed a rise in trauma into the early part of the Middle Yayoi, but a drop from there into the Late Yayoi. Moreover, the evidence for violence moves inland with the spread of the early rice villages.

In 2011 Fujiwara undertook an analysis of 300 moated settlements, and analysed their chronology, distribution, scale, and classification. First, he establishes that moated settlements were not the norm among Yayoi settlements or those from the Korean Peninsula. This is not surprising as it would not be expected for a majority of individuals to reside in fortified settlements. He also found many moated enclosures that were not associated with settlements, and a few that were large-scale and located on high ground. Fujiwara found a great deal of variability in their distribution and suggested that these settlements might indicate differential

farming communities. This is interesting because it raises questions about how unique or what exactly distinguished moated settlements, especially large examples like those at the Yoshinogari site, from these other farming communities in proximity.

Since it is not a question as to whether or not violent conflict occurred in the Yayoi, which it certainly did (see photos of clear, well-known cases in Figure 3.3) unlike in the Jomōn studies, recent research has instead focused on classifying the 'type' of warfare that occurred during the Yayoi period (Fujiwara 2004; Hashiguchi 2007; Mizoguchi 2013). Therefore, the Yayoi can be seen as a transitional phase between the peaceful Jomōn and the beginnings of politically motivated warfare of the Kofun and later periods. It is perhaps sometimes taken for granted that there was an eventual transition to statehood. The migrants to the islands and the native Jomōn, eventually, became indistinguishable in parts of the archipelago, especially where agriculture first appeared. Therefore, it would be of interest to explore the regional diversity seen in moated settlements and see if the pattern also holds in evidence of skeletal trauma as well in the future.



Figure 3.3: Top: Nagaoka site, Individual SK 100 (tip of a bronze sword in the sacroilliac joint); Middle: Shinmachi site, Individual 24 (stone arrowhead embedded in the proximal femur); Bottom: Sudare site, Individual K3 (polished stone sword tip embedded between the second thoracic vertebra and second right rib). Photos taken by the author, courtesy of the Kyushu University Museum.

The skeletal evidence for violent conflict is flawed in many of the same ways discussed in 3.4.1.1. Without consistent recording of skeletal remains throughout the Yayoi record, it becomes difficult to begin to quantify and critically analyse patterns of violent conflict, such as if some groups are more targeted or at risk. Moreover, it does not immediately follow that skeletons that exhibit a prevalence of injuries to certain areas of the body provide proof of a form of battle tactic. Other factors should be discussed as a possibility, such as how within group conflict might play out in less formalised settings. If the skeletons are not found in mass

graves or within tightly dated clusters, how these patterns of wounds relate to each other becomes less clear.

3.4.1.3 Kofun Period

There is ample evidence for violent conflict and high regard for warrior status (whether actual or symbolic) in the form of armour (lamellar armour beginning in the 5th century), elaborate bronze and iron weaponry, horses (trappings), and evidence of chiefdom and early state hierarchical class differentiation (G. L. Barnes 2007; Kidder 2007; Mizoguchi 2013; Steinhaus and Kaner 2016). Unfortunately, many of the skeletal remains in the monumental keyhole tombs have deteriorated, leaving only the grave goods. The Kofun period comes to a close with the beginning of the imperial state in Japan (Asuka period) in 538 AD.

3.4.1.4 Summary of Prehistoric Japan and Evidence for Violent Conflict

The Jōmon and Yayoi periods represent two distinct, but intricately tied ways of life in terms of subsistence, contact with outsiders, religion and ritual, and social structure. How the transition between these two periods was negotiated by newcomers to the Japanese archipelago and by the local Jōmon population still has room to be expanded upon. Evidence of prehistoric violence from the Japanese archipelago tends to focus on classifying how war was carried out in the periods preceding state formation in approximately the late 5th century AD (G. L. Barnes 2007), and placing that within the story of increased complexity and class differentiation. Further analysis of not just the classification of violence, but also how it was used during the Jōmon to Yayoi transition and whether it was truly as peaceful as has been assumed, between communities, at the level of the sexes, and on the margins of the Yayoi expansion would add greatly to the understanding of exactly why there might have been a record of increasing violence over time, as it is not an inevitable end despite how it may seem looking back at history.

Chapter 4 – VIOLENCE DURING SUBSISTENCE AND TECHNOLOGICAL TRANSITIONS

4.1 INTRODUCTION

As discussed in Chapter 3, the transition from the Jōmon to the Yayoi period, while not a complete break in cultural or genetic continuity, marked massive shifts in technology and subsistence lifestyles beginning in the southwest of the Japanese archipelago. Analysis of how evidence of violent conflict changes and relates to transitions from primarily forager lifestyles to agricultural ones with the subsequent introduction of metal tools will be discussed herein. A brief overview of the topic will be presented and an in-depth, critical discussion of the agricultural and metallurgical transitions in Europe will be presented as a case study.

Although not geographically close or culturally related to Japan, the European Mesolithic to Neolithic and Neolithic to Bronze Age transitions were chosen as case studies as taken together they have several similar patterns and driving forces compared to the Jōmon to Yayoi period transition. These include climatic fluctuations, the introduction of migrants employing agriculture and new technologies, the displacement or migration of hunter-gatherer communities to the peripheries of their former territory, the later changes in trauma patterns accompanied by metal tool use, and the eventual creation of a warrior class (Molloy and Horn 2020; Orschiedt 2020; M. J. Smith et al. 2020). Combined with these factors, the evidence for violence as seen through skeletal trauma (see Chapter 6 for an overview of skeletal trauma) has been more thoroughly documented in this region, which allows for a more nuanced examination of violent conflict.

In Chapter 2.2.4 several theories which argue for an increase in violence with the advent of agriculture and sedentism were critically discussed. Here, how transitions to agriculture have been previously analysed, i.e. the kind of data employed, how they intersect, and the patterns present, will be examined. Ethnographic data will also be included for comparison. Of course, historic, ethnographic records of behaviour are not exact correlates for prehistoric behaviour. Moreover, violent conflict recorded by outside observers may fail to fully recognise the

consequences of colonisation's widespread impact on these communities (Ferguson and Whitehead 1992); nevertheless, ethnographic accounts provide vital evidence for the range and pattern of human culture within different political, subsistence, and environmental contexts.

4.2 OVERVIEW

To begin, it is necessary to examine the apparent conflict resolution patterns employed by indigenous foragers before any substantive dependence on domestic crops and animals. Agriculture is not introduced in a vacuum, and pre-existing dynamics and practices are therefore vital in understanding why practices might have evolved as circumstances changed. Violence and, arguably, warfare can be found among hunter-gatherers, but the rate of that violence is not constant temporally or geographically (Ferguson 2013, 2021; D. L. Martin and Harrod 2015; Scherer 2021); as one would expect of any human cultural practice, it fluctuates with constraining factors and contexts.

Anatomically modern humans evolved during the Pleistocene, ca. 300 kya, on the African continent (Ayala and Cela-Conde 2018; Grün et al. 2020; Hublin et al. 2017). Fossil evidence for these very early humans is understandably very sparse. Hence, it is difficult to elucidate broad patterns of violence among the earliest human foragers (Kissel and Kim 2018). Some of the earliest evidence for interpersonal violence includes the late Pleistocene/Early Holocene sites of Jebel Sahaba in Sudan where 23 of 58 individuals are argued to show evidence of violent conflict (skeletal trauma and *in situ* projectile points; ca. 14–12 kya) and Nataruk, West Turkana in Kenya where 10 of 12 *in situ* individuals show evidence of violent trauma and have been preserved along the lake shore without being purposefully buried (ca. 9.5–10.5 kya) (Mirazon Lahr et al. 2016b, 2016a; Stojanowski et al. 2016; Wendorf 1968). A recent reanalysis of the skeletal evidence for violence from Jebel Sahaba supports the evidence for violence, likely resulting from activities such as raids, skirmishes, and ambushes, from the site. Moreover, researchers found that 41 of 61 individuals (67.2%) showed signs of antemortem and/or

perimortem injuries, and, among these, 16 individuals (26.2%) showed evidence of perimortem injuries, including injuries caused by projectile points (Crevecoeur et al. 2021). Late Stone Age violence in South Africa has been found to be likely routine, but not common, and impacted men, women, and children (Morris 2020). Moreover, given the modern linguistic diversity of the region, it has been argued that strict territoriality was likely practiced at times in order to protect scarce water sources (Humphreys 2007). A recent synthesis of Palaeolithic violent trauma finds no evidence for large-scale conflict in Europe during this time (Orschiedt 2020). Another recent study quantified the incidence of cranial trauma in Europe for the Upper Palaeolithic and found a crude prevalence of 3.5% (30/850) for skeletal elements and a prevalence of 21.4% (3/14) for individuals that are 76–100% complete (compared to 3.5% (42/1285) and 9.8% (23/234) respectively for the sample without regard for differential preservation), with trauma being higher in males and old adults. Nevertheless, this study does not distinguish between potential causes of the cranial trauma found (Beier et al. 2020). Finally, the earliest indications of violence in the Americas via skeletal trauma show a high prevalence of violence (38%), although usually nonlethal, among the few well-preserved individuals (n = 28) (Chatters 2014).

Small-scale conflicts, such as raiding, feuding, and ritualised fighting, have often been associated with hunter-gatherer violence (D. L. Martin and Harrod 2015). This can include raiding other groups for supplies or people, i.e. females or slaves; feuding over particular slights or grievances, such as revenge killings; and heavily regulated forms of violent conflict, such as those seen in ethnographic examples which may lead to consistent patterning of injuries (e.g. Delgado-Darias et al. 2018; Walker 1989; Webb 1995). One example of raiding and feuds among small-scale societies, outside of pastoralists who might raid for livestock, are the Australian Aborigines, who engaged in ceremonial battles and much more lethal raids (Gat 1999).

Determinants of later hunter-gatherer conflict and peace vary globally. Potential causative factors of conflict that can be examined in the archaeological record include evidence of environmental or subsistence change or population pressure. Conflict and its resolution are extremely culturally moderated behaviours in modernity and it was undoubtably no different in prehistory. One archaeological example can be seen in the Archaic period in the Atacama Desert, where violence among hunter-gatherers of the Chinchorro culture does not appear to have fluctuated with material or population change, but rather with some currently unknown cultural motivation (Standen et al. 2020). Kim and Kissel (2018) argue that peace-making and peaceful periods should not be regarded as fragile or as simply the absence of war or group violence, instead they are the result of purposeful choices within a particular cultural context. Hence, when considering periods of fluctuating violence conflict or with apparent low levels of violence, at least at the physical level that archaeologists are able to observe, it should be kept in mind that the centre-point for both conflict and its resolution is cooperation, with individuals working together to solve an issue or in spite of a difficulty (Stanish and Levine 2011). *H. sapiens* being such a highly cooperative species means that group activity will have greater ramifications, whether peaceful or not. In fact, Bowles (2009) even argues that the cooperation and altruism necessary among group members during times of intergroup conflict, may have been a strong positive selective pressure for the survival and proliferation of more cooperative groups.

Despite its significant impacts on everyday life, a transition to agriculture itself might not trigger an increase in violent conflict. Rather, one may expect incidences of violence to increase with the accompanying sociocultural or other subsequent technological change, as has been seen in previous research (Arkush and Tung 2013; Keeley 1996; Lambert 2002; M. J. Smith et al. 2020; Standen et al. 2021). The majority of theories underlying the increase of violence with the transition to agriculture emphasise any change which might put pressure upon existing cultural systems (e.g. population pressure, environmental or climate change, resource scarcity,

and social inequality) and cause them to splinter and break or adapt. The evolution of private property with, or even before, agriculture has been suggested to be a possible within-group conflict mitigator, as individuals respect the demarcation of property because they also benefit from it (Bowles and Choi 2013). Yet, these kinds of pressures can occur among hunter-gatherer communities as well, particularly so-called 'complex' ones. Hence, it raises the question why at times one can see an increase in violence among agricultural groups when, under the same kinds of stressors, levels of violent aggression might be more stable among hunter-gatherers, such as what has been suggested for the Jōmon (see discussion in Chapter 3.4.1).

In complex hunter-gatherers, one can see instances of resource accumulation, such as storage facilities; social stratification; territoriality; increased population density; and greater sedentism, all of which may put strain on equitable or peaceable negotiations (Habu 2004; Rowley-Conwy and Layton 2011; Schulting 2010). The question arises whether it is technological, cultural, or some overlap of these factors that results in increased violent conflict. For instance, Keeley (1996:119–120) points out that estimations of population density are often complicated by such factors as the different carrying capacities of some systems and the options that they allow to those who live there. These options can include the ability to flee or physically avoid possible enemies. Hence, Keeley argues that "warring societies are equally common and peaceable ones equally uncommon at any level of population density". Roksandic (2004b:3) further argues that as no social forms or production modes can be directly linked with conflict or peace, that "all societies will eventually indulge in war."

There is no denying that agriculture tends to generate a different sociocultural dynamic. Agriculture requires more land as population increases, which it can better support and which is needed to sustain it (Bocquet-Appel 2011; Mathieson et al. 2015; Shennan 2018b). It becomes a closed feedback loop with significant repercussions on population and resource pressure, the potential for militarisation, and control of resources. In contrast, hunter-gatherer societies tend be comprised of smaller units and entail a greater level of mobility and

egalitarianism. How these dynamics have been examined from the hunter-gatherer period through the Bronze Age of Europe will be explored below.

4.3 Case Studies: Mesolithic to Neolithic and Neolithic to Bronze Age Europe

The Mesolithic (from ca. 10,000 BP/8050 BC) to Bronze Age (ending in the first millennium BC) of Europe mark a substantial swath of time and space and the beginnings of the Neolithic and Bronze Age vary by region (Estabrook 2014; Orschiedt 2020; B. W. Roberts et al. 2013; Sherratt 2007). The transition from the Mesolithic to the Neolithic marks a subsistence transition whereas the transition from the Neolithic to the Bronze Age marks a technological transition, although both are associated with increased population movement. The Mesolithic in Europe is broadly demarcated by the end of the last glacial, Dryas III, and the beginning of Holocene warming and is associated with sedentary and semi-sedentary hunter-gatherer lifestyles (Estabrook 2014; Orschiedt 2020). The appearance of the Neolithic and the forms it takes are not uniform. Rather, particularly at the beginning the transition involved significant demic and cultural diffusion of new agricultural and herding economies which profoundly impacted population size, social structure, and world views in the region. For instance, in Early Neolithic Britain, ancient (a)DNA analysis suggests that Neolithic individuals were descendants of Aegean farmers (Brace et al. 2019). A map of the initial spread of farming into different parts of Europe can be seen in Figure 4.1. Admixture with local Mesolithic foragers was variable regionally, although initially not common (Haak et al. 2015; Llamas et al. 2020; M. J. Smith et al. 2020). The European Bronze Age (from the mid third to the early first millennium BC) saw a further increase in population size; the formation of new, larger-scale economies (such as wool and salt); the cultivation of new grains; and the eponymous production of copper tin alloy – bronze – which allowed for the creation of new tools, adornments, and weapons (Earle et al. 2015; Frei et al. 2017; Horn and Kristiansen 2018; Müller 2013; B. W. Roberts et al. 2013; Stika and Heiss 2013). The archaeological and

palaeopathological evidence for violence and how and why it occurred during these three periods is evaluated below. See Chapter 6.2.3 for a methodological overview of violent trauma.

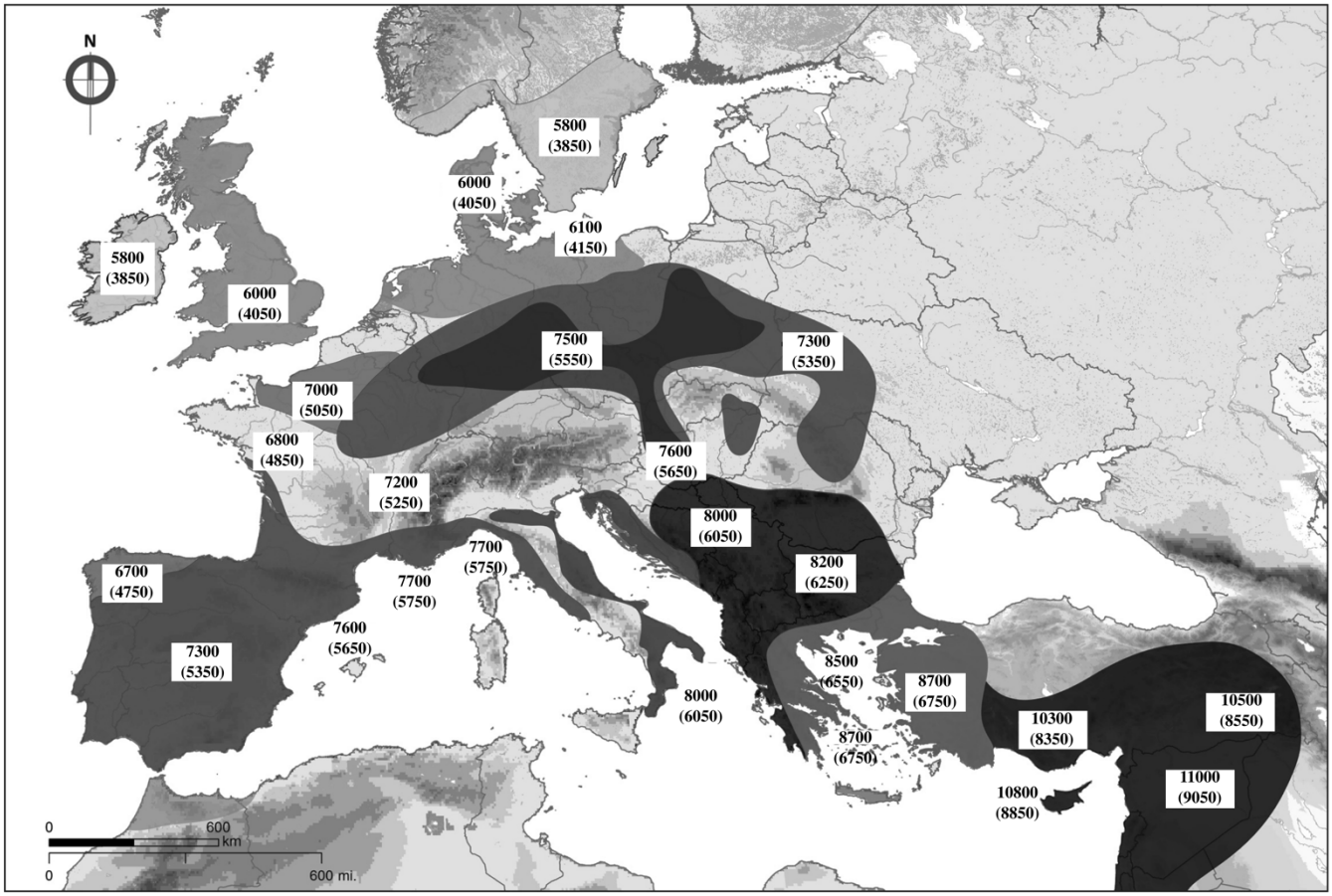


Figure 4.1: Map of the spread of farming into Europe after Shennan (2018a:12) adapted by JAW. Dates are listed as BP (BC).

4.3.1 Critical Evaluation of the Evidence for Violence

4.3.1.1.1 **Mesolithic**

Comparing Mesolithic to Palaeolithic evidence for skeletal trauma proves difficult given the previously discussed disparity in preservation between the Palaeolithic and subsequent periods (Orschiedt 2020). Estabrook (2014) synthesised the available data on Mesolithic violent trauma, reporting 77 individuals with antemortem and perimortem violent trauma. Of these, Estabrook found that compared to the Middle and Upper Palaeolithic, individuals with trauma from the Mesolithic tended to have more severe injuries, although this is partially driven by the large number of perimortem injuries from one site, Ofnet (Frayer

1997), and more injuries caused by projectiles, whereas the rates of blunt force trauma were similar between these periods. Yet, these values still cannot give an indication of 'how' violent the Mesolithic was, at least in terms of individuals with skeletal injuries likely resulting from violence compared to those without such wounds. Moreover, the skeletal trauma discussed, unless otherwise stated, refers to 'crude prevalence' values, i.e. the trauma per individual, irrespective of their completeness and preservation.

Overall, the violence-related skeletal trauma of the European Mesolithic is characterised by blunt force trauma to the skull, projectile trauma, semi-sharp force trauma (i.e., from an implement such as a stone axe), and decapitation/amputation. The tools-turned-weapons employed to cause these injuries have not been found to differ from those used during day-to-day subsistence activities (cf. Chapman 1999). Ostensibly fortified sites are not present during this period.

An example from the Epipalaeolitic/Early Mesolithic (ca. 10,800–9,980 BP) comes from three cemetery sites in the Dnieper Rapids region of Ukraine where out of 82 burials, six individuals (7.3%) had embedded projectile points of which two had multiple injuries, three from Voloshkoe showed amputation of appendages and/or limbs, and an additional six individuals were found with damaged projectile points in association with the remains (Lillie 2004). Lillie argues that young adult (≤ 35 yrs) males and females were preferentially targeted based on the age distribution from Vasilyevka III, which would inflict particular damage to communities; yet over half of the individuals in this sample suspected of dying violently only had projectiles in near association rather than embedded in the bone, which makes interpretation less secure. Nevertheless, the individuals do not appear to have been particularly stressed as one might expect if resources were scarce, hence Lillie proposes that the injuries may reflect territorial disputes around the fruitful fishing area of the Dnieper Rapids, especially as stable carbon and nitrogen isotope analysis shows dependence on aquatic resources. Nevertheless, this does not rule out the possibility of a *perception* of scarcity at the time.

From the Iron Gates Gorge region of Serbia/Romania, Roksandic and colleagues (2004a; 2006) found a very low incidence of violence at four sites (n = 263) along the Danube. Six injuries (2.3% of individuals) were found to have possibly violent trauma, including a parry fracture (the only injury on a female); blunt force depressed fractures to the cranium, particularly to the front right side of the skull; and an embedded projectile point. A majority of these injuries occurred before contact with agricultural groups in the area. Hence, Roksandic et al. (2006) interpret the pattern of violence along this bank of the Danube to be episodic and potentially mitigated through ritualised, nonlethal face-to-face combat. It is worth noting that of the four sites examined, only the larger two assemblages (Lepenski Vir and Vlasac) yielded evidence of violent trauma and that these are geographically adjacent.

Additionally, when compared to the nearby site of Schela Cladovei (n = 57) on the opposite bank of the river, the pattern of trauma seen at the other four sites is in stark contrast to the five individuals with perimortem and 14 individuals with antemortem violent trauma from Schela Cladovei (33.3%), including projectile injuries, parry fractures, and blunt force cranial trauma (McSweeny et al., 2000 in Roksandic et al. 2006). Unlike the other four sites, the dating for Schela Cladovei is well-constrained (5500 – 4489 cal BP), coinciding with the pre-contact period and early Neolithic contact (Bonsall et al. 2000). Moreover, females and males appear to have been more equally targeted. Roksandic et al. (2006) propose this as an example of social substitutability, a possible marker for warfare, however, no discussion of the difference in the pattern of trauma between males and females is discussed to rule out females engaging in combat or female-on-female violence or any other likelihood. Nevertheless, the evidence at Schela Cladovei does suggest the presence of violent conflict within a relatively tight temporal period. Hence, even within the Iron Gates Gorge, highly variable patterns of mortality are seen, although the types of injuries are consistent. It should be noted that trends in the data may be obscured by less fine resolution dating and/or diverse excavation and recording strategies.

Orschiedt (2020) reviews the evidence for violent trauma from Denmark and Sweden from ca. 10,800 – 5,400 BP. He reports a total of 21 individuals with likely violent trauma, including blunt force trauma to the skull (primarily to the frontal and parietal bones) and three projectile injuries (two to the pelvic area and one to the cervical vertebrae), with a frequency of perimortem, fatal injuries below 3% and blunt force injuries for Denmark at 12% and for Sweden at 6.5%.

The trauma found in skull burials at the German cave sites of Ofnet and Hohlenstein-Stadel are also particularly notable. At Ofnet 34 skulls, many with articulated cervical vertebrae of adults and children dating to the Late Mesolithic (ca. 7560 – 7360 BP) were deposited into two pits ('skull nests') with red ochre and thousands of perforated deer teeth and snail shell ornaments (Hedges et al. 1989; Orschiedt 2005). Whether or not this comprises a single burial event is still unclear and a new AMS radiocarbon project is currently underway to further investigate this point (Orschiedt 2020). On the third and fourth cervical vertebrae of nine individuals, cut marks are present on the anterior vertebral bodies, indicating decapitation as the method of skull removal rather than decay and disarticulation (Orschiedt 2005; M. J. Smith et al. 2020). Moreover, in at least eight (Orschiedt 2005, 2020) and as many as 18 cases (Frayer 1997), perimortem blunt force injuries are present on the crania. A recent re-examination by Orschiedt and Schulting supports the higher estimate of trauma (RJ Schulting per comm. 2022). Orschiedt argues that further confirmation of violent injuries is obscured by fragmentation and previous use of reconstructive materials on the skulls which obscure fracture lines and morphology. He further notes that among the more conservative total of eight individuals with traumatic injuries, the two males have injuries to the anterior, whereas the females and children have wounds to the posterior of the cranium; consistent with the males fighting face-to-face and the females and children trying to flee from attackers or being executed.

Whether other individuals from the Ofnet group were possibly killed violently cannot be determined conclusively, but the possibility remains likely given the context. It is entirely

possible that they died violently due to blows or projectile injuries to their postcrania. Given the age distribution, the number of individuals at the site and the possibility of the skull nests comprising a single burial event, the Ofnet sample numbers are close to those of an entire hunter-gatherer community; males, in particular, have been reported as underrepresented and make up only about 33.3% of the sample (Frayer 1997; Orschiedt 2005). Yet, the sex ratio may in fact be closer to 50:50 given the small number of sexed skulls (RJ Schulting per comm. 2022). It has been noted that the lower than expected number of young females in the Asparn-Schletz and Kilianstädten Neolithic massacres may indicate that they were taken as captives (Meyer et al. 2015; M. J. Smith et al. 2020; Teschler-Nicola 2012). In this case, it may be that some males at Ofnet managed to survive the incident. Whether or not the Ofnet Cave skull nests represent a violent Mesolithic massacre or a highly ritualised burial practice (or some combination of the two) is still debated and the data will continue to be obscured by an absence of the postcranial remains and by varied research and preservation protocols over the years the assemblage has been studied.

Comparatively, the skull burial at Hohlenstein-Stadel comprises three individuals (an adult male and female and a child) buried in a pit with red ochre and dating to 7835 ± 80 BP in the Late Mesolithic, as summarised by Orschiedt (2020). The cervical vertebrae of both adults show cut marks, consistent with removal of the head and the child cranium showed signs of the pathological condition hydrocephaly. Notably both Ofnet and Hohlenstein-Stadel occur during the Late Mesolithic possibly representing a new pattern of violent interaction and/or relationship to the dead in the region, although they still predate the Neolithic by centuries.

During the Mesolithic, population size was lower and more sparsely distributed, excepting some coastal and riverine areas, than in the subsequent Neolithic (M. J. Smith et al. 2020). In a contrasting example, Mesolithic Portuguese shell middens, from one of the more densely populated areas of Europe, contain little evidence for violence (Cunha et al. 2004). Trauma found in the area is best explained by accidental injury, as seen in the number of

postcranial fractures, which are difficult to link to intentional wounding (see discussion in Chapter 6.2.3) (Cunha et al. 2004; Orschiedt 2020).

4.3.1.1.2 To the Neolithic

Moving into the Neolithic, the archaeological evidence for human activity increases. Sites are subject to less preservation bias due to time depth, and the human population in Europe grew with the increasing emphasis on agricultural subsistence. Whether or not this is correlated with a rise in violent conflict as compared to the Mesolithic is difficult to confirm given the reasons listed in the previous section; nevertheless, evidence for violent conflict is more prevalent. Figure 4.2 shows a recent compilation of the sites with evidence of violent conflict from the Neolithic via injured skeletal remains and/or sites that show signs of an attack.

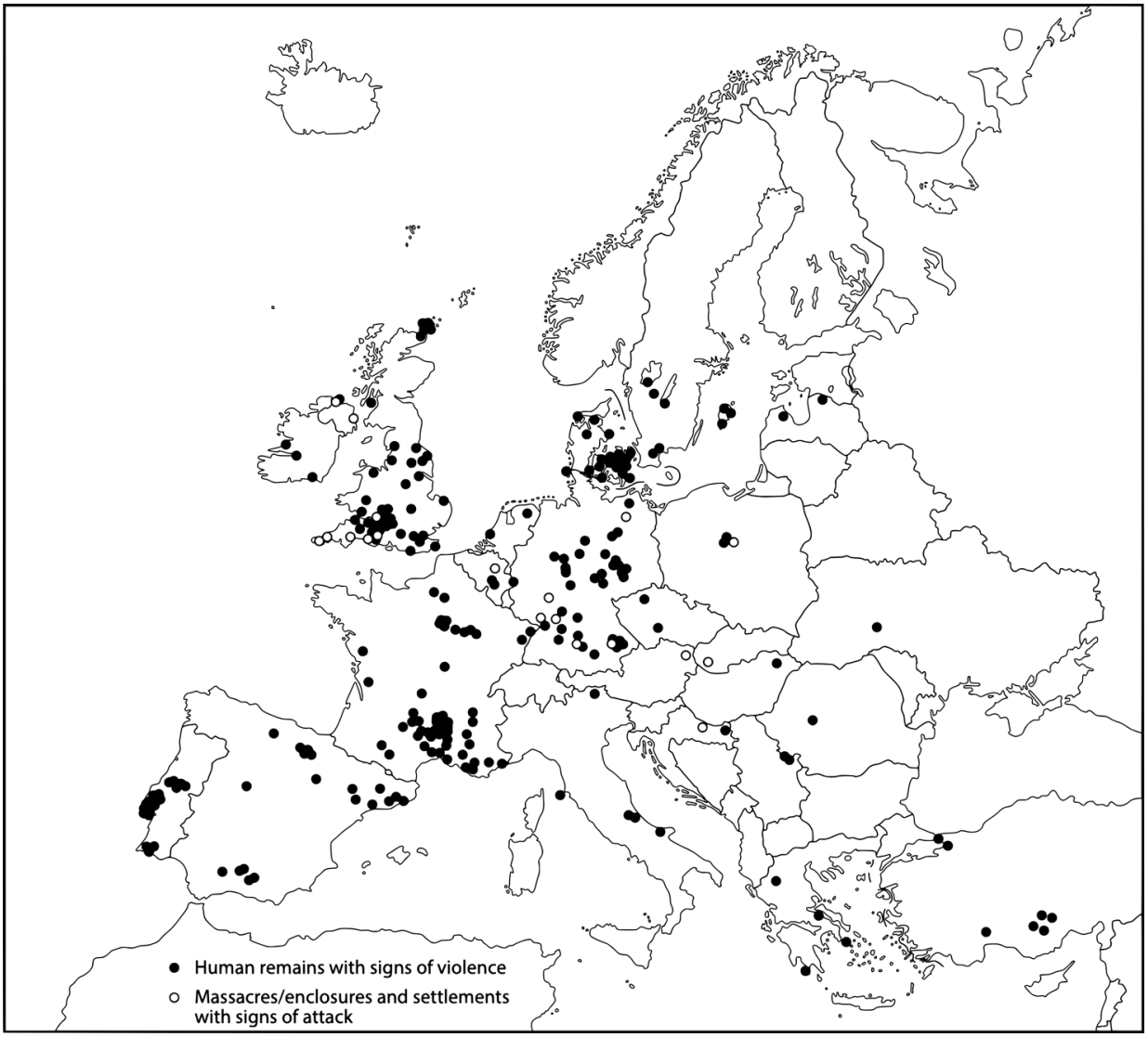


Figure 4.2: Map of sites with evidence for violent trauma and for evidence of attacks on fortified structures during the Neolithic. After Smith et al. (2020:86) and adapted by JAW. The original creators note that some gaps in the distribution may be due to a lack of English language literature in some regions rather than an absence of violent conflict.

With recent advances in aDNA analysis, it is becoming clearer that the introduction of farming, coupled with domesticated fauna, into Europe was accompanied by significant population replacement. This movement likely comprised two waves of migration (Mathieson et al. 2015). If this population movement was accompanied by violent displacement of hunter-gatherer communities, one would expect to see evidence of conflict on the margins of the incoming cultural group. A complicating factor to this is that there is no substantial technological difference between the tool-weapons that a forager compared to a farmer might have employed during the early Neolithic. Weapons from the Neolithic are not substantially

different than those from the Mesolithic, including bows and arrows, axes, clubs, and spears (Christensen 2004; Mercer 1999). Daggers, including ones made of copper during the later Neolithic, and one wooden shield are known from the period as well (Christensen 2004). Yet, some researchers, have looked to the enclosures and fortified sites of the earliest agricultural culture group in central Europe, *Linearbandkeramik* (LBK), for evidence of conflict between the indigenous foragers and new cultural groups (Golitko and Keeley 2007; Keeley and Cahen 1989).

In northeast Belgium, Keeley and Cahen (1989) note a sharp boundary between LBK and Mesolithic forager sites along a loess belt – a 'no man's land'. Most enclosures are found along the boundaries of the LBK cultural zone, raising the possibility that they were defensive structures. Not all of these enclosures show evidence of occupation within them. Of particular interest is the Oleye site, which contains several Neolithic houses within it that appear to have been damaged by fire. Whether this fire damage was due to an attack or to an accident is unclear, but occupation of the houses continued after the event(s).

More broadly during the LBK in Central Europe, Golitko and Keeley (2007) later argue that the structure of LBK enclosed sites served a defensive function. For instance, Y- or V-shaped ditches and complex gates serve defensive functions but would be impractical for other purposes. U-shaped ditches that may have functioned as moats, especially when coupled with internal palisades, are also more likely to be related to a defensive function. Moreover, this does not exclude any kind of corresponding ritual connotation to the site, rather "the symbolic importance of a particular location often derives from its prosaic function – if an enclosure symbolises exclusion, social solidarity, or any of a number of other things, it often does so because it provides a real physical deterrent against entry by outsiders" (Golitko and Keeley 2007:337). Yet, Vanmontfort (2008) contests this interpretation on the basis that analysis of the distribution of microliths along one of these 'no man's land' areas reveals that the loess regions were not inhabited by Mesolithic hunter-gatherers long before the early LBK farmers moved

in. Recent palaeoenvironmental analysis of Late Mesolithic populations do not support a collapse in hunter-gatherer activity related to the 8.2 k cooling event, which affected forested vegetation, and more broad environmental changes during the Holocene (Griffiths and Robinson 2018; Van Maldegem et al. 2021), rather evidence of resilience and reduced mobility under these conditions in noted. Thus, there remains to be found a 'smoking gun' example of late hunter-gatherer and early farmer lethal violent hostilities.

Unlike during the Mesolithic, fortified sites and enclosures were constructed during the Neolithic beginning in the sixth millennium BC (Parkinson and Duffy 2007). The earliest fortifications in Europe date to the seventh millennium BC in Greece (Höckmann, 1990 in Christensen 2004). The creation of fortifications peaked from ca. 5000 – 2800 BC/6950 – 4750 BP, as can be seen in Figure 4.3 (Andersen 1997). Enclosures during the Neolithic vary considerably in size, form, method of construction, and content. Hence, it can be deduced that they also varied in function. Some common features seen in Neolithic enclosures include their placement in locations with a view of the surrounding landscape, banks and/or ditches, surrounding stone or wooden features, entry points, and palisades. Fortified settlements and enclosures without any apparent long-term occupation fall within these categories. Fortifications do not appear to have been constructed to hold against a siege, but to control access and to create barriers which would disadvantage an attacker (Christensen 2004; Parkinson and Duffy 2007). Another important aspect of enclosures is not only their possible use as gathering points, but also the labour input and cooperation which would have been necessary for their construction—labour which could be directed for violent ends while relying on and reinforcing a common group identity (M. J. Smith et al. 2020).

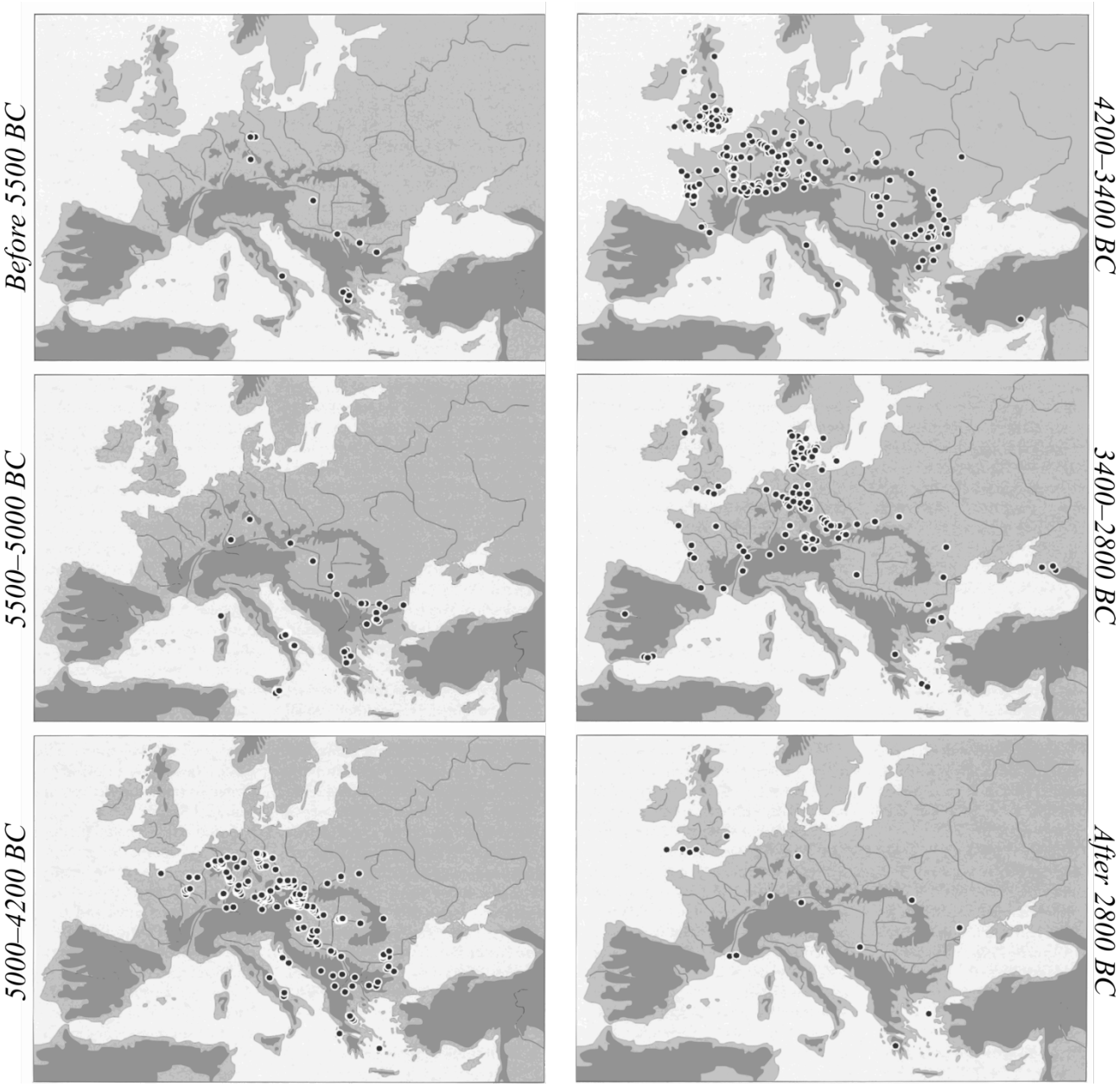


Figure 4.3: Distribution map of enclosed sites during the Neolithic after Andersen (1997:278–279) adapted by JAW. Not all of these enclosures necessarily served a defensive function.

Evidence for violent conflict is seen at Middle Neolithic Britain enclosures such as Crickley Hill near Cheltenham, where over 400 arrow points were found primarily near the entry points and before the palisades of the site. The enclosed settlement site of Carn Brae in Cornwall was destroyed by fire, and at least 800 arrow points were found at the site. The Dorset site of Hambledon Hill's has complex, heavily fortified enclosures of which ca. 120 m of timberwork was destroyed in a fire and in a ditch in the connected south-east enclosure,

Stepleton, the remains of a man who was shot in the back with an arrow and a child were covered by the burning remains of the fortification (Mercer 1989b, 1989a, 1999). In a similar case, the continental site of Goldberg in Germany (Early Neolithic) shows signs of being destroyed by fire (Probst, 1991 in Christensen 2004).

Iconographic depictions of Neolithic battles, although some argue that these represent Mesolithic conflict, are present in caves in eastern Spain (Castellón) which depict groups of over a dozen to a few individuals in combat with bows and arrows and javelins (Beltrán 1982; Christensen 2004; López-Montalvo 2018; Nash 2005). Direct evidence of violent conflict via trauma on the human skeleton during the Neolithic, like during the Mesolithic, can primarily be seen through cranial trauma and projectile injuries. Smith and colleagues (2020:87–88) summarise the evidence for non-lethal and lethal cranial trauma from Denmark, Sweden, northern Spain, Britain, Germany, France, and Portugal. They report a relatively consistent rate of lethal trauma, 3–5% average with a range of 0.5–6.2, and a higher incidence of non-lethal trauma of ca. 7.5 % with a range of 4.4–12.6%. These figures represent a minimum estimate of trauma prevalence, given preservation biases and the fact that often trauma does not affect skeletal tissue. The rate of skeletal trauma is therefore not shockingly high but still represents a significant impact on the populations at the time, especially given the likely size of communities.

During the Early Neolithic LBK period at least four massacre sites have been identified from Germany and Austria – Talheim (n = 34), Asparn-Schletz (n = 67), Schöneck-Kilianstädten (n = 26), and Halberstadt (n = 9). The deposition of individuals at all of these sites is atypical compared to other LBK burials, with individuals deposited contemporaneously with little regard for their persons, without grave goods, in a settlement context, and seemingly without any ritual component (Meyer 2020). At two sites (Asparn-Schletz and Halberstadt), individuals also exhibit carnivore scavenging on their remains, indicating that they were left exposed for a prolonged period (Meyer et al. 2018; Teschler-Nicola 2012). Although there is

some limited evidence for projectile trauma and sharp force injuries among the massacred individuals, the majority show evidence of blunt force cranial trauma. In particular, at Halberstadt trauma is largely concentrated on the posterior cranium, indicating a kind of execution style trauma (Meyer et al. 2018). Postcranial fractures occur as well, but those at Schöneck-Kilianstädten are notable in their patterning. The lower legs were targeted, with 31–42% of fibulae and 53–63% of tibiae showing evidence of perimortem fracturing (Meyer et al. 2015). Finally, the demographics at all sites except Halberstadt are suggestive of the killing of whole communities, except for an underrepresentation of women (and young teenagers at Schöneck-Kilianstädten) who were possibly taken as captives (Bentley et al. 2008; Duering and Wahl 2014; Meyer et al. 2015; Teschler-Nicola 2012). Conversely, at Halberstadt it appears that a non-local group primarily composed of males was summarily executed in a different pattern than the other three massacre sites where the aim seems to have been to wipe out whole groups of people (Meyer 2020). Another recently reported massacre site comes from Potočani, Croatia, where approximately one third of 41 individuals of varying ages and both sexes have multiple perimortem cranial trauma, particularly to the posterior of the cranium (Janković et al. 2021). Although, in some instances violent trauma among males exceeds that of among females, this is not always the case. In particular, the lethal trauma found on males and females from Scandinavia show similar rates (Fibiger et al. 2013; Vegas et al. 2012).

Evidence of cannibalism has been argued to be present during the Early Neolithic. It is unclear whether these instances of cannibalism represent aggressive or funerary cannibalism. The consumption of another's body gives both that body and the one consuming it new meaning, whether they seemingly take on some part of the one being consumed or whether the consumption is meant to honour or in some ways erase the presence of the consumed, a distinction seen between endo- (consumption of deceased kin or community members) and exocannibalism (consumption of enemies). At the site of Herxheim over an estimated 1,000 individuals' heavily processed remains have been recovered from ditches. More recent

excavations and examinations of the conditions of the remains show evidence of heavy processing, resulting in a high degree of fragmentation. It has been argued that cannibalism was practiced at the site due to these processing patterns, along with evidence of marrow extraction, human or carnivore bite marks/gnawing, cut marks, and systematic disarticulation (cf. Boulestin and Coupey 2015). Purposefully broken local and non-local artefacts were also found with the human remains. Given the large number of individuals that are represented among the remains at the site, the relatively short period during which these ritual activities are thought to have occurred (ca. 50 years or less for one ditch), and the representation of diverse and wide-ranging groups of cultural remains, it is unlikely that these represent a case of endocannibalism of one group. Nevertheless, it is unclear whether the rituals and cannibalism at Herxheim is tied to aggression and general unrest at the end of the LBK and/or if it represents a regional congregation centre for particular ritual customs (Boulestin et al. 2009; Boulestin and Coupey 2015; Orschiedt and Haidle 2007). In the Iberian Peninsula, instances of the manufacture of skull cups along with putative cannibalism within a domestic setting have been found in cave sites from the Early and Late Neolithic (Cáceres et al. 2007; Santana et al. 2019).

The tools used by Neolithic farmers to engage in conflict are much the same as those employed by Mesolithic foragers, yet the evidence discussed above demonstrates the difference in sheer scale of and driving forces behind those actions. A greater occurrence of massacres; new, large enclosure sites and ritual centres; cannibalism; captive-taking; and the beginnings of true weapon production all mark deviations from the evidence for Mesolithic conflict. Although evidence of Mesolithic peoples fighting with Neolithic interlopers remains unclear, it is apparent that some form of unrest, possibly primarily between farming communities, existed during the Early Neolithic.

As to why the scale and manifestations of conflict differed in Neolithic cultures, Christenen (2004) and Smith et al. (2020) look to the impact of the new subsistence economy for answers. Christensen (2004) discusses how the level of martial organisation developed over

the course of the Neolithic, but argues that it was nevertheless limited by the technologies available, resulting in assaults and raids typified by not ranging too far from home and by relative brevity. Moreover, Christensen argues that there was more reason for the protection of material resources among farmers than among hunter-gatherers, with the former coming to rely more heavily on stored food and livestock. All of these factors would then lead to an increasing social stratification over the course of the period. Smith et al. (2020) touch on many of the same points, but expand their argument to look at how social inequalities likely became more pronounced during the Neolithic and how this might have affected conflict. The authors argue that what allowed for a shift in the "scale, frequency, and degree of organisation" in Neolithic conflict can be seen in the socioeconomic changes (2020:94). A reliance on domesticated plants and animals drives not only larger family sizes, but also influences the structures of those family – promoting polygamous, exogamous, and patrilocal marriage practices. This would better allow for particular individuals to accumulate more wealth and, hence, influence or power. This accumulation of influence would allow for greater levels of organisation while also creating more material reasons for conflict.

The Corded Ware Culture period at the end of the Neolithic, delineated by another influx of migrants into Europe (Egfjord et al. 2021; Haak et al. 2015), was marked by the first instance of what appear to be dedicated weapons – stone battle axes (M. J. Smith et al. 2020).

4.3.1.1.3 To the Bronze Age

Over the course of the Bronze Age, particularly from the middle of the period onwards, the character of conflict and warfare changed dramatically in Europe, alongside continual growth in economies and population, some of which is associated with migration into the region (Broccard et al. 2021; Haak et al. 2015; Müller 2013). To start, the revolutionary nature of metal tools lies in their hardness and toughness compared to their stone counterparts. Metal will flex and absorb shock better than stone and, hence, can be crafted in to a wider variety of forms

without compromising its integrity (Molloy and Horn 2020). A product of this was the creation of specialised weapons – weapons created for the specific purpose of being used in particular martial styles to inflict harm on other humans, contrasting with tools used in combat that serve equally well as everyday subsistence tools. That being said, the use of bows and arrows, clubs, and wooden counterparts (such as shields) continued (Harrison 2004; Jantzen et al. 2011), but within the new Bronze Age context of conflict.

By the end of the fourth millennium BC, bronze halberds, daggers, and axes begin to occur in the Mediterranean and become more widespread by the early third millennium BC (Molloy and Horn 2020; O'Flaherty 2007; Simpson 1990). The bronze halberd, at times with a bulbous end which could have been used in concert with the piercing/stabbing motion of the blade, was possibly the first metal weapon designed solely for combat. Moreover, the halberd may have been designed to deliver lethal blows to the skull, just as many Mesolithic–Neolithic tools-turned-weapons (O'Flaherty 2007).

The creation of defensive weapons expanded exponentially. The earliest shields come from the Aegean, the first (dating to the seventeenth century BC) of which are figure-of-eight and tower shields which could be hung off of the shoulder for defence (Hiller 1999). By the thirteenth century in the Aegean round shields with a handle replace the body shields. This form of shield became widespread throughout much of Europe (Molloy 2009; Molloy and Horn 2020). Molloy and Horn (2020) emphasise the novelty of the shield not just as a protective measure but how the act of carrying the shield transforms the way in which the body must move while manoeuvring an offensive weapon, such as a sword. Such movement would have no direct parallels in existing craft specialisations and would have required martial training, an entirely new phenomenon. Moreover, shields can be used in coordination with each other to form defensive walls, encouraging coordination and cooperation with companions. By the fifteenth century BC bronze corselets, helmet, and greaves were being produced and by at least the thirteenth century BC a two-plate corselet was being used more widely in Europe and

continued to be popular until the end of the period (Kristiansen 2002; Mödlinger 2018b, 2018a; Molloy and Horn 2020).

The first swords appear in the Aegean between the eighteenth to the sixteenth century BC. They were long and double-edged, but by the fourteenth century BC shortswords had become more common (Molloy 2010). Shortswords are more common throughout Europe during the Bronze Age, although the style varied considerably. Shortswords are particularly effective when used in tight, cutting arcs and when thrusting. Bronze spearheads are present throughout the Bronze Age and could be used for thrusting and lacerating. Bows and arrows continued to be used as long-range weapons during the Bronze Age, with arrowheads made of flint, bone, and bronze (Jantzen et al. 2011; Luik 2006; Molloy and Horn 2020). Finally, the sling, which is present during the Neolithic as well, appears to have co-existed with the bow as a projectile weapon, with lead shots being produced in the Late Bronze Age in some parts of Europe (Vutiropulos 1991).

Stone-built fortifications with bastions appear from the Early Bronze Age in the Aegean. Later massive stone forts in Greece, Croatia, and Italy experience a florescence (Kouka 2016; Molloy and Horn 2020). The *nuraghi* of Sardinia, conical multi-story towers up to 15 m tall and 10 m diameter or more, appear during the Early Bronze Age and continue into the Iron Age. More complex *nuraghi* include features such as enclosing walls, courtyards, and surrounding huts (Blake 1998; Thorpe 2018). Defensible hilltop enclosures and settlements appear during the Early Bronze Age in Iberia and more broadly throughout Europe thereafter, at times with stone and wood defensive structures (Brück 2007; Lull et al. 2014; Molloy and Horn 2020; Osgood 1998; Thorpe 2018). Unlike during the Neolithic, the fortifications tend to be better designed to resist siege tactics and to offer more protection than simply protection by depth. Yet, this kind of fortification and its prevalence is not equal across Europe during the Bronze Age. Moreover, the function of enclosures and fortifications should be understood as multi-faceted, providing defence (at times utilised such as at Velim, Czech Republic (A.

Harding et al. 2007)), but also acting as competitive displays of prestige and power (Hrala et al. 1990; Molloy and Horn 2020; O'Driscoll 2017; Thorpe 2018).

Artistic representations of warriors and combat proliferated during the Bronze Age. Scandinavian rock art depicts an apparent class of maritime warriors wielding swords, spears, bows and arrows, and axes. Rather than solely depicting a class of individuals in ritual combat, depictions of killing also appear, even with simpler weapons present, such as clubs (Bertilsson 2018; Ling and Toreld 2018). The use of the sling is shown in Minoan art (Vutiropulos 1991). Depictions of warriors chasing fleeing opponents with a sword and dogs can be seen in sealings from the Aegean (Molloy 2012).

Molloy and Horn (2020:117) describe the evidence for violent trauma unambiguously related to warfare on human remains as "few [and] widely dispersed," particularly when compared to the evidence for "weaponry and imagery." That being said, it is not clear how other forms of violent conflict would not be of relevance to the patterns thus far discussed for the Bronze Age, even if they were smaller in scale or related to conflict within communities. Undoubtedly, the archaeological context within which individuals are found is of paramount importance, yet even if not found in a battle context, the *pattern* of injuries found can yield a great deal of information. Moreover, the likelihood of finding an individual or a whole group of individuals who have died in warfare becomes increasingly unlikely as the remains may not have been afforded normative burial, and instead may not have been buried at all or have been buried outside of settlement/cemetery contexts. Violent conflict in warfare/battle only represents one small part of conflict, or even a culture of conflict, within society. Of course, often trauma does not impact the skeleton at all, especially when considering the style of fighting most efficient with bladed weapons. If slicing injuries to vital areas, rather than large arcing/slicing motions, were more common with bronze weapons as discussed previously, then it stands to reason that finding evidence of trauma on the skeleton would be less likely. However, as piercing/thrusting motions appear to still be highly effective, and as there is

evidence for previous styles of less-specialised combat, at least some forms of combat may be more commonly represented within the skeletal trauma data from the Bronze Age. Thorpe (2018) briefly discusses and critiques the synthesis undertaken by Peter-Röcher (2007), who argues that the skeletal evidence for violence during the Bronze Age when compared to the Neolithic and Iron Age is very low, rare even. Thorpe notes that Peter-Röcher omits several sites with evidence of violent conflict, including eight British sites, several in Slovakia and Moravia, and sites with large numbers of injured individuals, such as those from Velim (discussed below).

The thirteenth century BC battlefield site of Tollense is characterised by the presence of numerous bronze artefacts, personal artefacts, and ca. 100 individuals found along the river in the Tollense Valley. Due to the waterlogged nature of the site, wooden clubs and hammers have been found in association with the human remains as well. Individuals from the site are predominantly young-middle adult males, but females, adolescents, and children are present as well. Blunt force cranial and embedded, projectile injuries have been found from individuals at the site. As most of the remains are disarticulated, it is difficult to ascertain the extent of trauma on the entire skeleton per individual. Of 38 skulls, three have perimortem injuries and two others have antemortem injuries. As there is no evidence of carnivore scavenging, it is thought that the remains were relatively quickly deposited and covered by alluvial sediment. Radiocarbon dating is consistent with a single event (Brinker et al. 2018; Jantzen et al. 2011; Lidke et al. 2018) and isotopic research points to an assemblage composed of two groups, one local and another more diverse and non-local group (Price et al. 2017). Molloy and Horn (2020) extrapolate from these numbers and the context that this may have represented a battle with participants in the hundreds – *armies*. In addition to the possibility of a much larger scale of combat, the increased mobility during the Bronze Age has direct consequences on the possibility for mobilisation in combat and for longer-ranging conflict (Uckelmann 2018).

Sites with group burials with evidence of skeletal trauma include Sund in Norway, Wassenaar in the Netherlands, Velim in the Czech Republic, and Tormaton in Britain. At Sund, 22 Early Bronze Age individuals were found in a pit with animal remains. Among these individuals only four could be sexed (one female and three males) with 46% representing children and young adolescents and the rest of the sample comprising older adolescents and adults. Among the adult individuals seven (54%) have perimortem sharp force postcranial trauma caused by bronze weapons and of these four are antemortem injuries, suggested repeated episodes of face-to-face violent conflict. Hence, Fyllingen argues that these individuals represented a class of professional warriors (Fyllingen 2003, 2006). Twelve individuals in a mass grave with no indication of grave goods were found at Wassenaar dating to the transition between the Early and Middle Bronze Age. Six individuals are young to middle adult males, but young females, adolescents, infants, and children comprise the rest of the group. Evidence for violence includes perimortem trauma to three males in the group and a small arrowhead with an impact fracture found between the ribs of another male. The skull of a child of ca. three years was found disarticulated (Louwe Kooijmans 1993). At Velim, Middle Bronze Age successive and mass burials have been found in ditches and pits where there is evidence of fire, numerous bronze arrowheads, and a high frequency of traumatic injuries. It has been argued that this may represent a ritual context given its repeated use and the pattern of sharp force trauma, but the remains were not treated similarly to animal remains and a ritual context does not exclude the possibility of violence as well (A. F. Harding 2000; Anthony Harding 2007; Knüsel et al. 2007; Outram et al. 2005; Thorpe 2018). At least four Middle Bronze Age adolescent to middle adult males were recovered from a ditch at Tormaton where they were deposited without any grave goods or particular care for their bodies. Two individuals show clear evidence of perimortem trauma (one with an embedded spear point in his pelvis and another with a cranial injury and a spear embedded in his spine). The latter spear is noted as usually being considered a hunting spear (Osgood 2005).

At the site of Čaška Veles, Macedonia, violence is implied by the burnt remains of a house with children and older adults found inside. Molloy and Horn (2020) point to similar demographics seen in Neolithic massacres discussed previously in this chapter that suggest the possibility of captive-taking. Among the Early Bronze Age Nitra group, from Slovakia and Moravia, out of 237 graves there are at least 59 incidences of violent trauma on males, females, and children. These include blunt and sharp force trauma, particularly to the left side of the skull. Arrowheads found in the rib cages and vertebrae, with at least two embedded in bone, are interpreted as representing evidence for a violent death as well. Postcranial fractures are present, but these are regarded to more likely be the result of accidents (Hårde 2005). Jiménez-Brobeil et al. (2009) compare the frequency of violent trauma in 677 skulls between the Neolithic and Bronze Age in Iberia, finding less trauma compared to the Neolithic during the Copper Age/Early Bronze Age before it increased during the Bronze Age (ca. 3rd millennium BC). All skull injuries showed evidence of healing and there was no evidence of trauma due to arrowheads, although this might have been obscured by excluding postcrania from analysis.

Among 34 Late Bronze Age Mycenaean burials from Athens, only two males show evidence of trauma related to violence, including a penetrating spear injury to a middle adult and three cranial injuries (two antemortem and one perimortem) to an adolescent. Commingled remains of males and females from one tomb have healed metacarpal fractures as well, but it is unclear if these were related to fighting or to accidents. Intriguingly, these individuals were not the young to middle adult males buried with weapons, raising the question of whether the presence of weapons in graves does not demarcate soldiers or rank-and-file fighters, but a particular class within Mycenaean society (S. K. Smith 2009). Nevertheless, it is entirely possible that at least some ‘warrior’ burials, although yielding no evidence of trauma, could be the result of a violent death, just one that did not leave skeletal evidence (Georganas 2018).

The physique of a warrior has been a topic of interest, with imagery, grooming tools, and armour pointing towards an idealised or preferable male form (Molloy 2012; Treherne

1995). Hence, some have investigated whether it is possible to identify a warrior not just by whether they show any indication of a violent death and/or whether they were buried with a warrior's kit, but by the way in which their bodies were trained. Long bone cross-sections and entheseal (or musculoskeletal) markers have been examined to these ends, finding some correlation between individuals buried with particular weapons and humeral asymmetry and general robusticity consistent with archery and horseback (Gentile et al. 2018; Khudaverdyan et al. 2021).

What makes a 'warrior' different than participants in battle that were present during the preceding Mesolithic and Neolithic periods? It is apparent that warriorhood does not simply equate to a combatant or fighter. Instead, it entailed a constructed (male) identity focused on martial training, grooming and ornamentation, and terrestrial or maritime mobility (Frieman et al. 2017; Georganas 2018; Ling and Toreld 2018; Treherne 1995). This identity is not bound simply in social constructs, though: "the self is practically mediated and lived through the body… [and] emerges through sensory exploration with the body as the medium of experience; self-care and beauty maintenance, therefore, play an important part in identity construction" writes Rebay-Salisbury in a review article summarising and expounding upon Treherne's (1995) seminal argument (Frieman et al. 2017:42). Nevertheless, Fontijn (2005) argues that seeing the identity of 'warriorhood' as a consistent, fixed occurrence is inadequate, especially in regards to smaller-scale Bronze Age communities and societies who likely took on aspects of a warrior in "temporal [and] context-dependent" situations. Brück and Fontijn (2018) further argue for caution and greater nuance when examining the Bronze Age social and economic sphere in regards to these male hierarchies.

Finally, although much of the focus here has been on males as warriors and combatants, it is clear that not all violence was directed at a particular warrior segment of society. Moreover, evidence for female involvement within the warrior caste is present, although in lower numbers. This can be seen in the inclusion of females (4.9%) in the 'hunter-warrior' burial style found at

Branč and in the Late Bronze Age to Early Iron Age female warrior burials from Jrapi, Armenia (Bergerbrant 2007; Hårde 2005; Khudaverdyan et al. 2021).

4.4 CONCLUSION

In this chapter the impact of subsistence economies and technological innovations on violent conflict have been discussed and explored. The context of violence shifted radically over the course of the Mesolithic to the Bronze Age in Europe. Yet, some aspects remain the same; injuries due to cranial blunt force trauma and projectile points were consistently present among those who were injured in conflict. The sheer scale of conflict grew with the Neolithic and Bronze Age, reflecting a nexus of overlapping factors, from socioeconomic and political changes with the beginnings of dependence on domesticated plants and animals to increasing population size and density, and the closed feedback loop of innovation and cultural change with the introduction of new technologies, i.e. metallurgy.

Chapter 5 – SITES DETAILS AND SAMPLE

5.1 SKELETAL COLLECTIONS EXAMINED

A total of 424 individuals, comprising 250 Jōmon skulls and 174 Yayoi skeletons have been analysed for evidence of violent trauma (Table 5.1, Figure 5.1). The ulnae of the Jōmon sample were also examined for evidence of parry fractures, but as the completeness for the ulnae were not recorded for each individual (see Chapter 1.1.1), these were not incorporated into the statistical analyses. The Jōmon individuals from the shell-mound sites of Inariyama, Tsukumo, and Yoshigo at Kyoto University were analysed by the author, Prof. Rick J. Schulting (supervisor), and Ms. Izumi Braddick; the rest were analysed solely by the author. The research objectives of RJS and IB differed slightly from those of this thesis and hence necessitated some changes to the method of data collection and analysis. Namely, RJS and IB focused solely on analysing the skull and ulnae of the Jōmon individuals, whereas this project focused on analysing more Jōmon skeletons in the same manner while also incorporating analysis of whole Yayoi skeletons. All of the Yayoi individuals were analysed solely by the author. This and other methodological concerns are discussed in Chapter 6.

Table 5.1: Individuals examined from each sub-period.

Period	**Infant–Child**	**Adolescent–Adult**			**TOTAL**	**TOTAL** *(excluding infants/children)*
		Male	*Female*	*Indet*		
Middle–Late Jōmon 中期～後期	0	4	1	8	13	**13**
Late Jōmon 後期	1	16	14	0	31	**30**
Late–Final Jōmon 後期～晩期	13	59	73	3	148	**135**
Final Jōmon 晩期	2	21	17	18	58	**56**
JŌMON	**16**	**100**	**105**	**29**	**250**	**234**
Yayoi 弥生時代	0	2	1	0	3	**3**
Initial Yayoi 早期	0	4	1	0	5	**5**
Early Yayoi 前期	1	15	5	0	21	**20**
Early–Middle Yayoi 前～中期	0	16	15	1	32	**32**
Middle Yayoi 中期	1	49	27	3	80	**79**
Middle–Late Yayoi 中～後期	0	17	6	0	23	**23**
Late Yayoi 後期	0	5	5	0	10	**10**
YAYOI	**2**	**108**	**60**	**4**	**174**	**172**
ALL	**18**	**208**	**165**	**33**	**424**	**406**

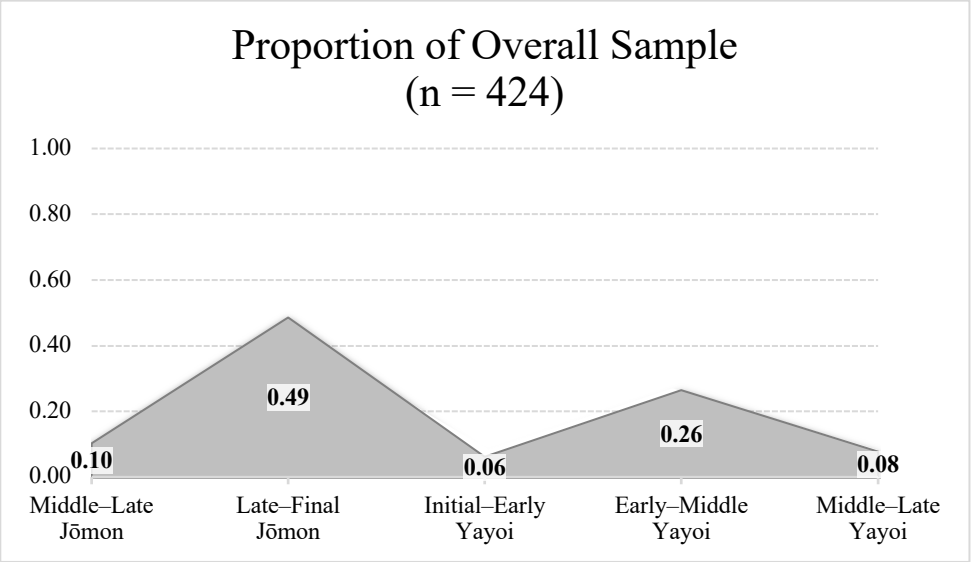


Figure 5.1: Proportion of individuals examined per sub-period. This excludes Yayoi individuals without known sub-periods.

Of all the Jōmon sites analysed, only the postcranial remains from one site were included in the total in Table 5.1. The site, Itoku in Kochi Prefecture, Shikoku, dating to the Final Jōmon and Initial Yayoi, was included in the study because abnormal and violent trauma for the period was previously reported by Matsui (2005). Matsui proposed that the lesions found on the postcrania of several fragmentary and poorly preserved human and animal remains were the result of trauma from projectiles, metal weaponry, and wooden and/or bone pointed implements. Therefore, although the sample did not include substantial cranial fragments, they were included in the overall examination. The completion of the Itoku individuals was recorded using the methodology employed for the Yayoi sample (see Chapter 6.2.2.2).

Data collection took place over five trips between the years of 2016 and 2019 at the Laboratory of Physical Anthropology at the Graduate School of Science at Kyoto University (京都大学), the Kyushu University Museum (九州大学総合研究博物館) and Advanced Asian Archaeological Research Center (AAARC; 九州大学アジア埋蔵文化財研究センター), the Kochi Prefecture Bunkazai Centre (高知県埋蔵文化財センター) and Prefectural Museum of History (高知県立歴史民俗資料館), the Okayama City Maizo Bunkazai Centre

(岡山市埋蔵文化財センター), the Doigahama site anthropological museum (土井ヶ浜遺跡人類学ミュージアム), and the Nara National Research Institute for Cultural Properties (奈良文化財研究所).

Sites for analysis were chosen based on several factors. First, sites had to be accessible to the author. This was largely not a problem, but unfortunately the key site of Yoshinogari was unavailable as the osteological report for this site had yet to be published at the time of data collection, and, as is common in Japan, access is restricted until it was. Nevertheless, individuals from sites thought to be associated with Yoshinogari housed at Kyushu University were available for analysis, as is discussed later in this chapter.

Second, sites with better skeletal surface preservation and individuals with skulls present were preferentially chosen for analysis. The author recognises that this might introduce some bias into the study, particularly as trauma can contribute to greater fragmentation of the skeleton. Much of this thesis dealt with creating primary data on trauma during the Jōmon and Yayoi and there is little to directly compare the results of this thesis to in Japan. Hence, given the general paucity of systematic skeletal analysis of trauma during these two periods and time and funding limitations, the author decided to prioritise skeletons that were better preserved.

Finally, revaluating individuals or sites known to have individuals with trauma was not the aim of this thesis. Nevertheless, although the author was aware that some sites (e.g. Shinmachi, Shibu, and Sudare) had a small number of individuals with previously reported trauma, these were revaluated as they represented the important earlier half of the Yayoi period, for which less human skeletal data are available, and/or because they represent geographical regions less well-represented in the thesis. A great deal of data from the Yayoi comes from Kyūshū, largely because of the excellent skeletal preservation that burial traditions during the Middle Yayoi afforded (Honma 1993). For these varied reasons, there are gaps in geographical and temporal distribution in this study, but these have been addressed as conscientiously as possible, and, hopefully, as this research continues these gaps will lessen with time.

In order to explore further the possible relationship in the major trading and interaction zone within the Tsushima Strait, examination of skeletal remains held at Kyushu University from Iki was attempted. Unfortunately, the preservation of these remains was too poor (fragmentary and fragile) for analysis. Nevertheless, Shinmachi and Ōtomo are located around the Karatsu Bay, which borders the strait.

The majority of analysed Jōmon individuals come from the large shell-mound sites of Inariyama and Yoshigo in Chūbu and Tsukumo in Chūgoku (Figure 5.2 and Table 5.2). The Yayoi sites are largely confined to Northern Kyūshū and the Middle Yayoi period, where and when ceramic burial jars were primarily utilised (see Chapter 3.1.6 for a discussion of Yayoi mortuary practices and skeletal preservation).

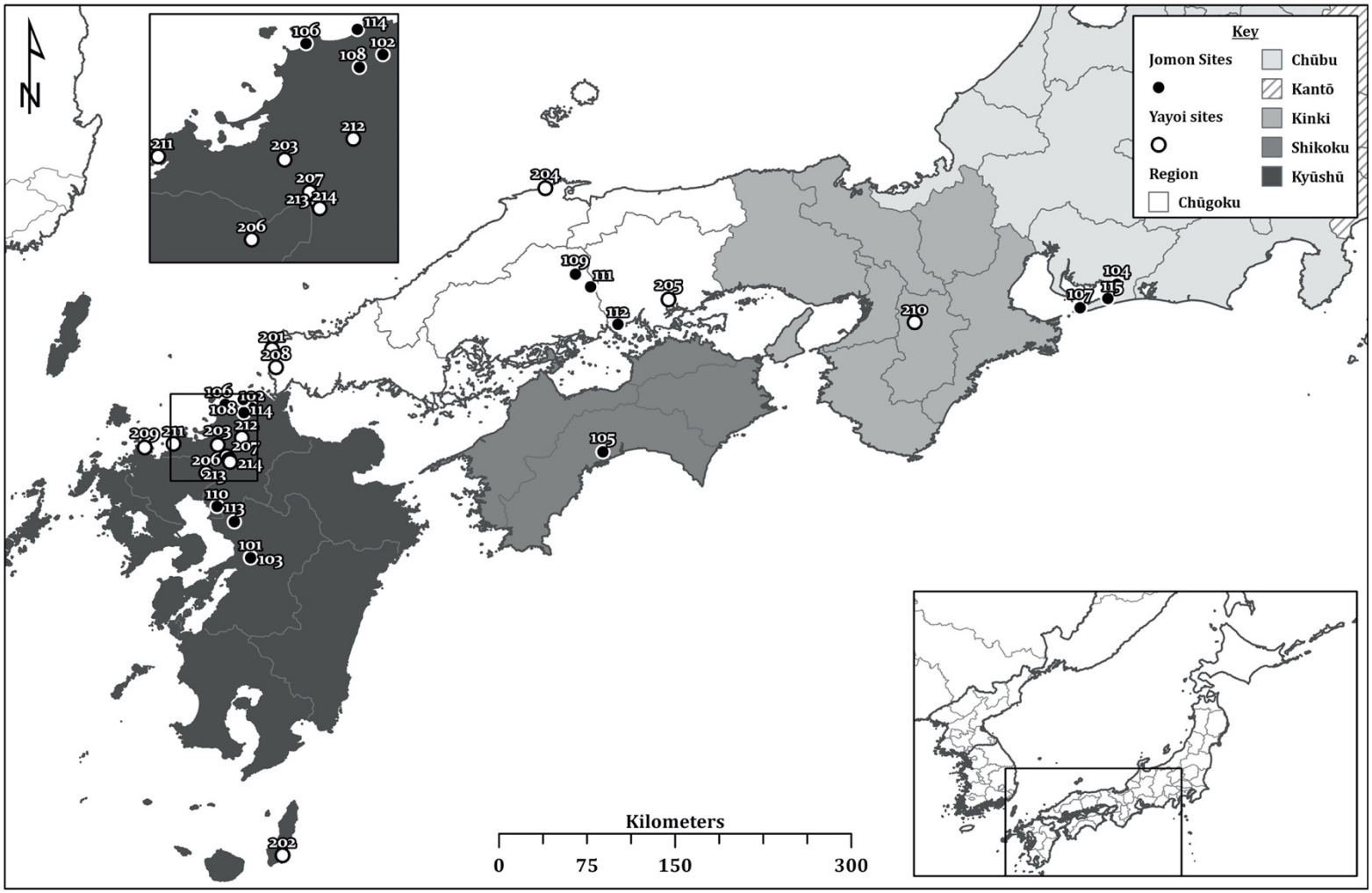


Figure 5.2: Distribution of sites from which skeletons were analysed. See Table 5.2 and Table 5.3 for site codes. Note that the location of Shimokusuda Shell-mound (110) in Fukuoka Prefecture is less precise than that of the other sites, only reflecting the town in which the site

Table 5.2: Jōmon sites and number of individuals analysed. The site codes correspond to the map labels in Figure 5.2. Chronology was primarily determined by previous analyses of mortuary and ceramic traditions. Radiocarbon dates were available for some individuals from Inariyama and Yoshigo Shell-mounds. Further details and references can be found in Catalogue I.

Site Code	***Site***	***Sub-Period***	***n***	***Holding Institution***
101	Adaka Shell-mound 阿高貝塚	Middle–Late Jōmon 中期～後期	**4**	Kyoto U
102	Einomaru Shell-mound 永犬丸貝塚	Late Jōmon 後期	**3**	Kyushu U Mus
103	Goryō Shell-mound 御領貝塚	Final Jōmon 晩期	**6**	Kyushu U Mus
104	Inariyama Shell-mound 稲荷山貝塚	Final Jōmon–Middle Yayoi 後期～弥生時代中期	**37**	Kyoto U
105	*Itoku 伊徳遺跡	Final Jōmon 晩期	**10**	Kochi Pref.
106	Kōjō (Kanezaki) Shell-mound 上八(鐘崎)貝塚	Late Jōmon 後期	**4**	Kyushu U Mus
107	Kawaji Shell-mound 川地貝塚	Late Jōmon 後期	**1**	Kyoto U
108	Kitsuki Shell-mound 木月(古月)貝塚	Late Jōmon 後期	**4**	Kyushu U Mus
109	Sarugami Rock-shelter 猿神岩崖遺跡	Final Jōmon 晩期	**3**	Kyushu U Mus
110	Shimokusuda Shell-mound 下楠田貝塚	Middle–Late Jōmon 中期～後期	**9**	Kyushu U Mus
111	Toyomatsu-Domen Cave 豊松堂面洞窟遺跡	Late Jōmon 後期	**6**	Kyushu U Mus
112	Tsukumo Shell-mound 津雲貝塚	Late–Final Jōmon 後期～晩期	**53**	Kyoto U
113	Wakazono Shell-mound 若園貝塚	Late Jōmon 後期	**3**	Kyushu U Mus
114	Yamaga Shell-mound 山鹿貝塚	Late Jōmon 後期	**10**	Kyushu U Mus
115	Yoshigo Shell-mound 吉胡貝塚	Late–Final Jōmon 後期～晩期	**97**	Kyoto U

* Itoku does not include any substantial cranial remains, but was included because of previous reports that lesions on the postcrania were traumatic in origin (Matsui 2005).

Table 5.3: Yayoi and Kofun sites and number of individuals analysed. The site codes correspond to the map labels in Figure 5.2. Chronology was primarily determined by previous analyses of mortuary and ceramic traditions. Radiocarbon dates were available for some individuals from Ōtomo. Further details and references can be found in Catalogue I.

Site Code	***Site***	***Sub-Period***	***n***	***Holding Institution***
201	Doigahama 土井ヶ浜遺跡	Early–Middle Yayoi 前～中期	**19**	Kyushu U Mus; Doigahama Anth Mus
202	Hirota 広田遺跡	Late Yayoi 後期	**8**	Kyushu U Mus
203	Kanenokuma 金隈遺跡	Early–Late Yayoi 前～後期	**30**	Kyushu U Mus
204	Kōra 古浦遺跡	Early Yayoi 前期	**9**	Kyushu U Mus
205	Minamikata 南方遺跡	Middle–Late Yayoi 中～後期	**6**	Okayama City
206	Mitsunagata 三津永田	Middle–Late Yayoi 中～後期	**24**	Kyushu U Mus
207	Nagaoka 永岡遺跡	Middle Yayoi 中期	**24**	Kyushu U Mus
208	Nakanohama 中の浜遺跡	Early–Middle Yayoi 前～中期	**19**	Kyushu U Mus
209	Ōtomo 大友遺跡	Initial–Middle Yayoi 早～中期	**10**	Kyushu U AAARC
210	Shibu 四分遺跡	Middle Yayoi 中期	**2**	Nara National Research Institute
211	Shinmachi 新町遺跡	Initial–Early Yayoi 早～前期	**4**	Kyushu U Mus
212	Sudare スダレ遺跡	Middle Yayoi 中期	**1**	Kyushu U Mus
213	Tsukomuta 4 津古牟田遺跡４	Middle Yayoi 中期	**4**	Kyushu U AAARC
214	Yokoguma kitsunezuka 横隈狐塚遺跡	Middle Yayoi 中期	**14**	Kyushu U AAARC

Section 5.2 provides an overview of the sites analysed and the extant skeletal collections.

5.2 SITE DETAILS

5.2.1 Jōmon Sites

5.2.1.1 Chūbu

5.2.1.1.1 Inariyama

Inariyama Shell-mound is located in Kozakai, Hoi County near the Inari Shrine on the Toyohashi Plain along the Mikawa Bay in Aichi Prefecture. The skeletal remains examined in

this study were excavated over the course of a week in July of 1922 by Kenji Kiyono with the help of local laborers. He excavated approximately 53 individuals. This did not encompass the entirety of the cemetery as an amateur excavation of the cemetery had been conducted ca. 20 years earlier by the local landowner, Mr Motoyoshi Ōbayashi, which uncovered burials and grave goods near the centre and top of the shell mound. Additionally, Kiyono did not excavate the peripheries of the cemetery as the preservation seemed to be worse in those areas, as indicated by the dotted line in Figure 5.3 (Kiyono 1969).

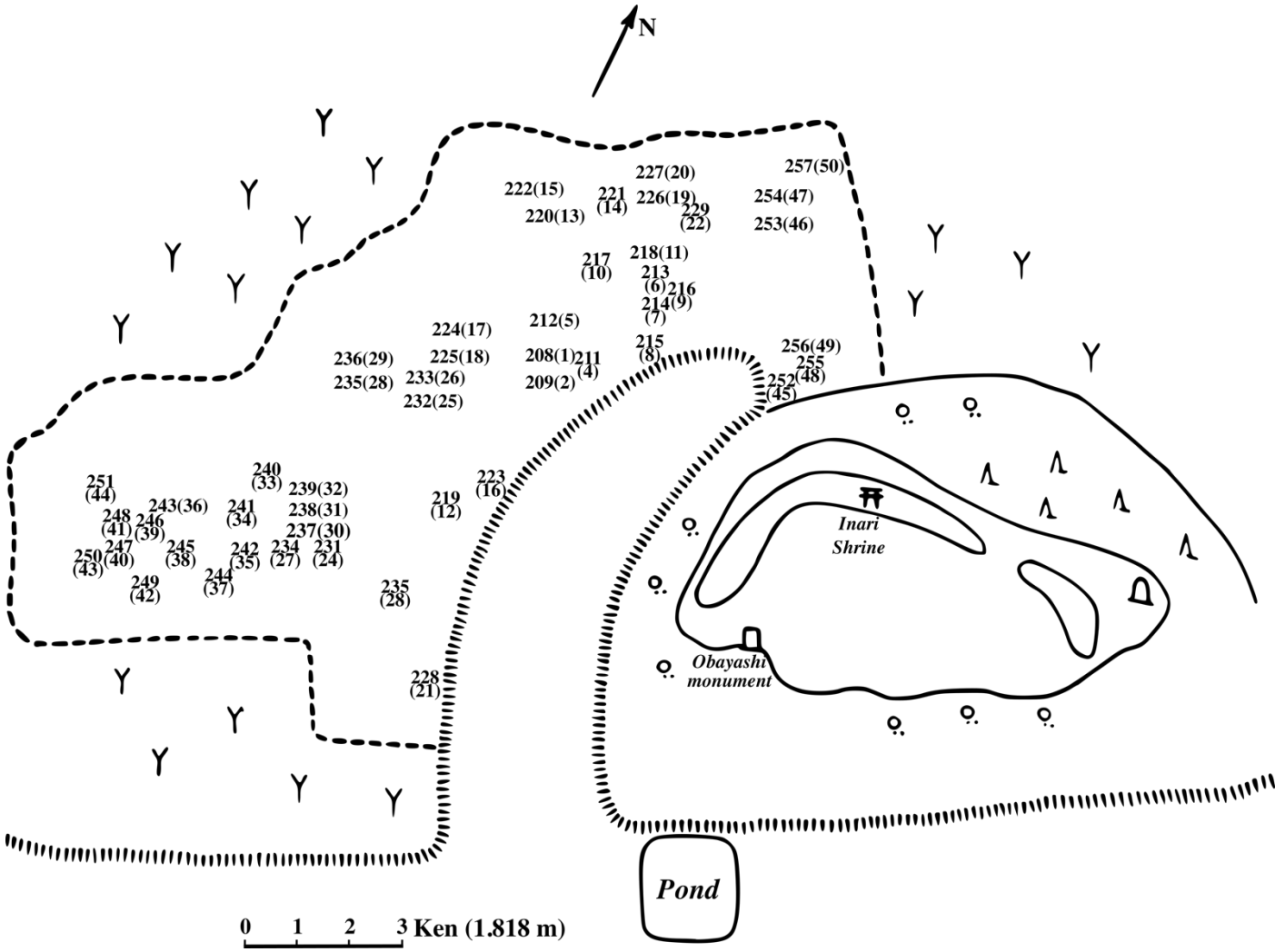


Figure 5.3: Map of Inariyama shell-mound 1922 excavation adapted from Kiyono (1969:171) by JAW. The numbers indicate burial ID's, the 'Y' indicates mulberry fields, the "o.." symbols indicate broad-leaf trees, and the "^-" symbols indicate needle-leaf trees. Burials numbers show the Kiyono collection ID numbers (2XX) and the original "field numbers" reported in the 1969 volume.

Burials consisted of pit burials and at times multiple individuals within the same pit. Grave goods and artefacts found included bone harpoons, bone arrows, antler bow nocks, ground stone axes, stone drills and knives, flint arrowheads, stone 'crowns' (石冠), stone rods and sword-shaped stone rods, carved antler artefacts, perforated tusks and knives made of tusks, earrings or beads made of shell and bird bones, bone rings and cylinders, shell rings, jade and comma-shaped beads or *magatama* (曲玉), dogū, and pottery (Kiyono, 1969).

Analysis of the dentition from Inariyama shows the presence of enamel hypoplasias (64.7% or 33/51 teeth) and carious lesions (5.4% or 18/330 teeth) (Temple 2007). Twenty-nine individuals from Inariyama were recently analysed using AMS radiocarbon dating and stable carbon and nitrogen isotope dietary analysis by Kusaka and colleagues (Kusaka et al. 2008; Kusaka et al. 2015; Kusaka et al. 2018). The radiocarbon dates and stable isotopic values from these studies are provided in Catalogue I. The pottery typology at Inariyama was assigned to the middle of the Final Jōmon period and prior to the dating of the skeletal remains, it was assumed that buried individuals all lived during this period (Sugihara and Toyama 1964). The radiocarbon dating only partially supports this assumption. Three phases were identified dating from the Final Jōmon to Early–Middle Yayoi period (Kusaka et al. 2018: Table 2):

1. Final Jōmon: 3,060–2,760 cal BP (n = 12),
2. Final Jōmon and Early – Middle Yayoi: 2,600–2,380 cal BP (n = 15)
3. Middle Yayoi: 2,140–2,150 cal BP (n = 2).

The different phases correspond to changes in tooth ablation patterns in the sexes, dietary shifts in Phase II with individuals showing a more marine diet, and a flexed burial position being more common from Phase I-II and an extended position more common in Phase II-III. Although the Inariyama cemetery was in use during the Yayoi period, there is no evidence of rice consumption reported in the dietary isotopes or archaeological evidence. Overall the male $\delta^{15}N$ values at Inariyama varied more than female values, indicating some differentiation in consumption, with males potentially having more access to protein sources due to a greater

involvement in activities such as hunting and fishing (Kusaka 2018). Additionally, there is no Ongagawa-type pottery at the site, associated with the Early Yayoi in the Toyohashi Plain, at Inariyama (Kusaka et al. 2018).

5.2.1.1.2 **Yoshigo**

Yoshigo Shell-mound, also known as Yasaki Shell-mound (文献貝塚), was excavated by Kenji Kiyono in October of 1922 and March of 1923, during which time approximately 304 individuals were recovered (Kiyono 1949, 1969). The site was later excavated between 2001–2003 (Yoshigo Shell-mound Historic Site Park 2008). Yoshigo (Figure 5.4) is located along the coast of the Atsumi Peninsula near the town of Tahara in Aichi Prefecture.

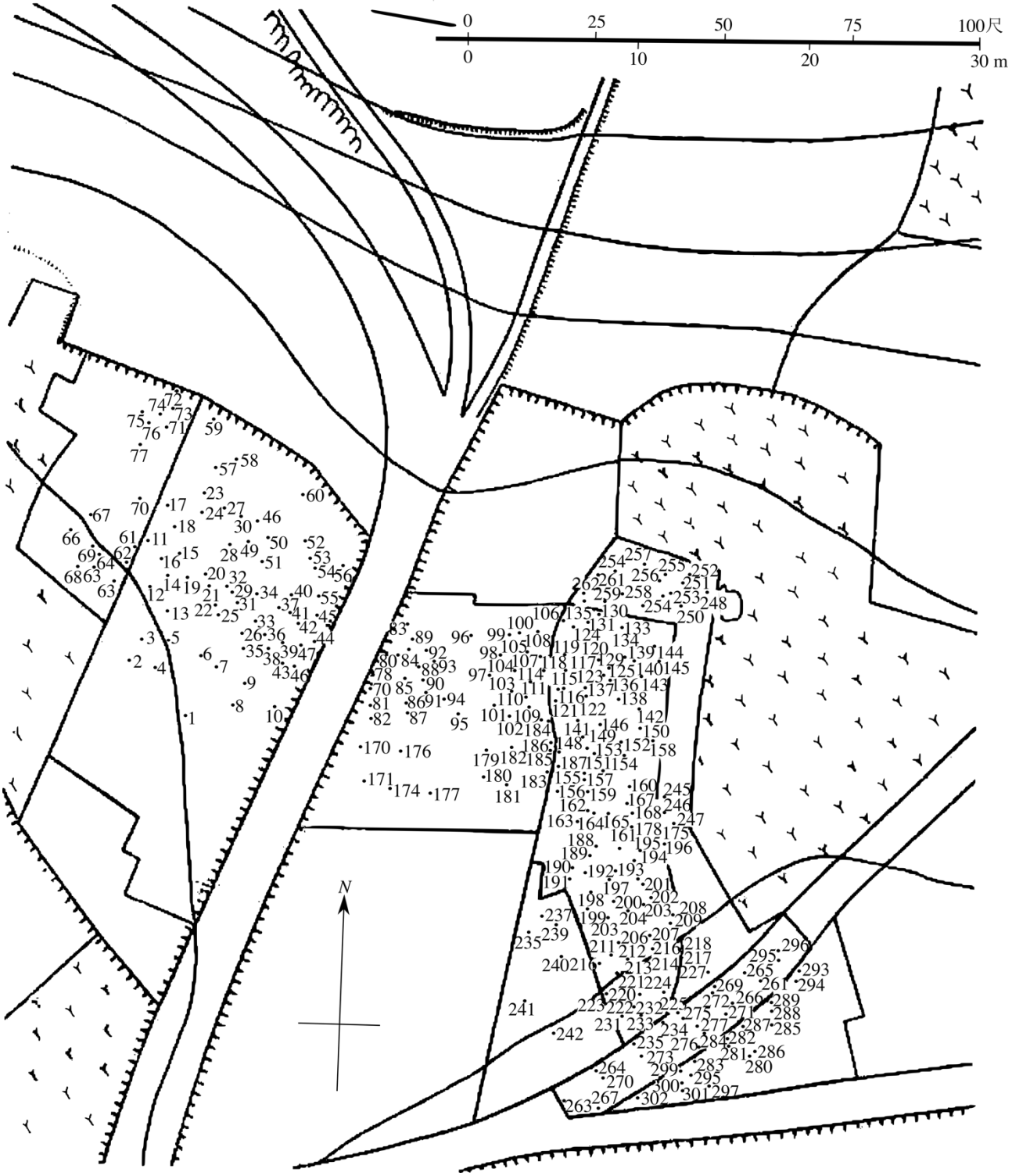


Figure 5.4: Map of Yoghigo shell-mound excavation adapted from Kiyono (1949:146) by JAW.

Double burials occurred in seven cases and there was one grave with three individuals present. Additionally, there were individuals who were added to already existing graves, at which point the bones of the individual initially interred were grouped together in one section

of the pit. Jar burials were used for the remains of infants and young children (Kiyono, 1969:212). Individuals 433 and 512 were adults associated with secondary jar burials (Habu 2004) by Kiyono, but only one of which was significantly larger than those used for subadult remains; unfortunately neither of these were analysed in this study due to time constraints. The remains in these jars also appear to be the result of secondary burials and possibly show evidence of burning. The use of a red pigments was identified on at least eight individuals, three of which were jar burials for subadults.

Accessories found included waist decorations (腰飾り); shell (including limpet, oyster, and snail conch), antler, and tusk rings; bone, shell, and tusk pendants; earrings or beads made from fish vertebrae; polished stone; and ceramics. Other artefacts found included stone drills, stone arrowheads, stone rods, sword-shaped stones, ground stone axe, stone mallets, stone knives, stone crowns, stone weights, grindstones, sword-shaped bone, miscellaneous bone and antler tools, bifurcated bone and antler tools, whale bone tools, antler and bone fishhooks, horn bow nocks, sharpened boar tusk tools, deer antler harpoons, polished clam shells, earthenware ornamentation and vessels, and dogū. The large number of waist decorations found at Yoshigo, 26 in total primarily with males, and their relation to tooth ablation patterns has been investigated by Harunari (2013). He found that a large number of the L-type waist decorations (10) were associated with individuals with 4I pattern tooth ablation, which he associates with a particular clan.

Analysis of the dentition of Yoshigo by Temple (2007) found a high percentage of enamel hypoplasias (44.7% or 133/297 teeth) and caries (11.4% or 135/1181 teeth) compared to Inariyama and Tsukumo. Previous analysis of antemortem fractures at the site did not reveal any cranial fractures (Nakai et al. 1999). Instead, Nakai et al. found a majority of healed fractures on the small bones of the hand and feet. Kusaka et al. (2009) analysed the strontium isotopic values ($^{87}Sr/^{86}Sr$) of 39 individuals from Yoshigo, and identified approximately 14 non-locals (36%). The non-locals were a mix of sexes and there was no apparent distinction in

tooth ablation or grave goods between them, although the individuals with 2C ablation patterns may have included more non-locals. Additionally, paleodietary Bayesian modelling was carried out using the carbon and nitrogen isotopic values for 38 individuals from Yoshigo and 17 from Inariyama, finding that an estimated 66% of the diet consisted of C3 plants, 24% of marine resources, and 10% of terrestrial mammals, with a decreased dependence on marine foods in adulthood (Kusaka 2018). The $\delta^{15}N$ values at Yoshigo showed the same trend as those at Inariyama (Kusaka 2018).

Radiocarbon analysis of three Yoshigo individuals has been published so far with dates ranging from ca. 3190 to 2770 BP or ca. 3200–2800 cal BP, fitting within possibly the Late and certainly the Final Jōmon (Kusaka et al. 2009). More extensive dating on the site needs to be carried out to investigate the posited temporal differences within different sectors of the cemetery and to investigate any overlap with the Yayoi period as well (Kiriyama and Kusaka 2017; Kiyono 1969; Kusaka et al. 2009; Tsutaya et al. 2016).

5.2.1.2 Chūgoku

5.2.1.2.1 Tsukumo

Tsukumo Shell-mound was first discovered during construction work in the 1860's and excavated in 1915. Excavation of human remains from Tsukumo continued through 1921, with Kenji Kiyono overseeing the largest of these (Figure 5.5). Over 130 skeletons were recovered from the site. Tsukumo was excavated again in the 2000's, with no recovery of human remains, and a resulting study of the faunal evidence has been conducted by Tomioka (Tomioka 2020). The site is located near the Seto Inland Sea southeast of Kasaoka, Okayama Prefecture (Kiyono et al. 1920; Kiyono 1969).

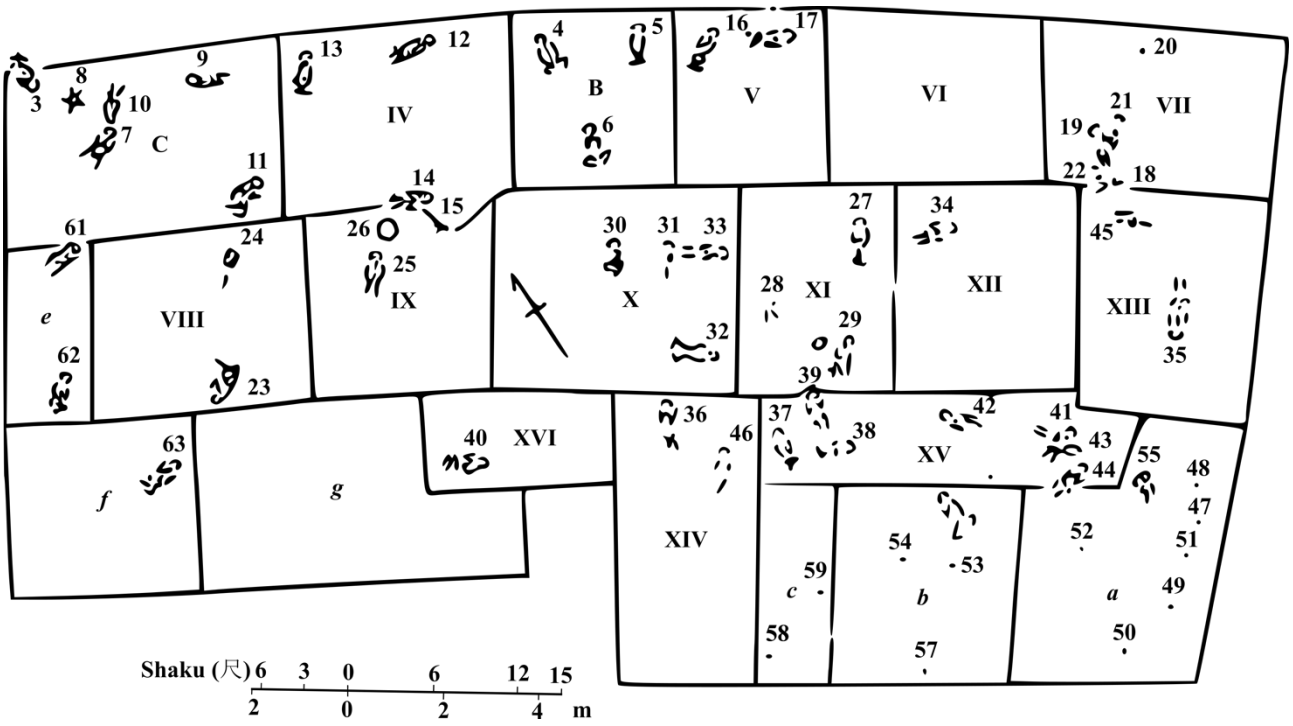


Figure 5.5: Tsukumo site map adapted by JAW (original courtesy of the Laboratory of Physical Anthropology, Kyoto University).

Graves consisted of pit burials and a majority of individuals were in a contracted position. Jar burials for infants were present. Some individuals show evidence of burning. Personal ornaments found included waist decorations, shell rings, and deer antler earrings or beads and arm decorations. Individual 34 is notable in having 15 shell rings in total. Other artefacts found included stone arrowheads, weight stones, a side scraper, a grindstone, green stone beads, bone arrow notches, and pottery (Kiyono et al. 1920; Kiyono 1969).

Enamel hypoplasias (61.7% or 84/136 teeth) and caries (9.6% or 65/675 teeth) were found among the individuals from Tsukumo (Temple 2007). Vlok (2020) analysed the evidence for disease in 30 individuals from Tsukumo as a part of her doctoral thesis. Vlok found that all individuals examined, adult and subadult, had at least one osteoblastic lesion. Specifically, 46.7% (14/30) of all individuals showed evidence of infectious disease such as possible mastoiditis and vertebral osteomyelitis, 63.6% (7/11) of subadults and 100% (19/19) of adults showed pathology consistent with scurvy, and 69.2% (18/26) of individuals showed lesions

consistent with childhood anaemia. Vlok posits that the high prevalence of scurvy may be the result of an increased reliance on terrestrial foods. These foods might have been produced using a processing method that deceased the available Vitamin C in the diet, such as nuts processing. Individuals that showed signs of scurvy, though, do not appear to have an increased risk of morbidity, if fact the opposite seems to have been the case. The high incidence of anaemia Vlok attributes to a combination of nutritional stress, parasitic infection, and general infection.

Kusaka et al. (2010) conducted stable isotopic analysis of fifty-three individuals from Tsukumo (averaging –16.5‰ ± 1.3 in $\delta^{13}C$ and 12.2‰ ± 2.0 in $\delta^{15}N$) and found that compared to the other sites in the Sanyo region, Ota and Funamoto, Tsukumo appeared to rely more heavily on terrestrial sources of food. Strontium isotopic analysis of 37 individuals found no evidence of nonlocals (Kusaka et al. 2012).

Radiocarbon dating for a large segment of the individuals from the site is underway, but unpublished. One initial date has been reported for individual No. 24 of 3090 ± 25 BP calibrating to 1370–1010 cal BC, which falls within the early part of the Final Jōmon period, but the site is thought to primarily date to the Late–Final Jōmon period based on pottery typology (White et al. 2021).

5.2.1.2.2 Toyomatsu-Dōmen Cave

The Toyomatsu-Dōmen Cave site is located along the Amada River in the village of Toyomatsu in Hiroshima Prefecture and associated with the Taishaku Gorge site group. The site was discovered in 1964 and over the course of fifteen field seasons from 1977 to 1983 (Kawase 1978; Nakahashi 1984) eleven individuals dating to the Late Jōmon have been recovered from the site. These were all crouched burials that were covered with limestone rocks, and contained no grave goods. The Late Jōmon period assignment is based on the stratigraphy (Nakahashi and Nagai 1980; Nakahashi 1984).

5.2.1.2.3 Sarugami Rock-shelter

The Sarugami Rock-shelter site (Figure 5.6) is located in a limestone rock shelf, spanning ca. 12 m north to south, off the Taishaku River in the Taishaku Gorge near Tōjō in Hiroshima Prefecture. The site was first discovered in 1972 during a survey of the gorge and excavated from July to August in 1977. Five individuals were recovered from the site (2 adults and 3 subadults) in secondary graves covered by limestone stones of various sizes (Kawagoe 1978; Nagai and Nakahashi 1979). Pottery of various styles, stone arrowheads, and a shell ring associated with one of the burials were recovered during the excavation (Kawagoe 1978). The burials have been dated to the Final Jōmon period based on the typology of the accompanying shell ring (Nagai and Nakahashi 1979).

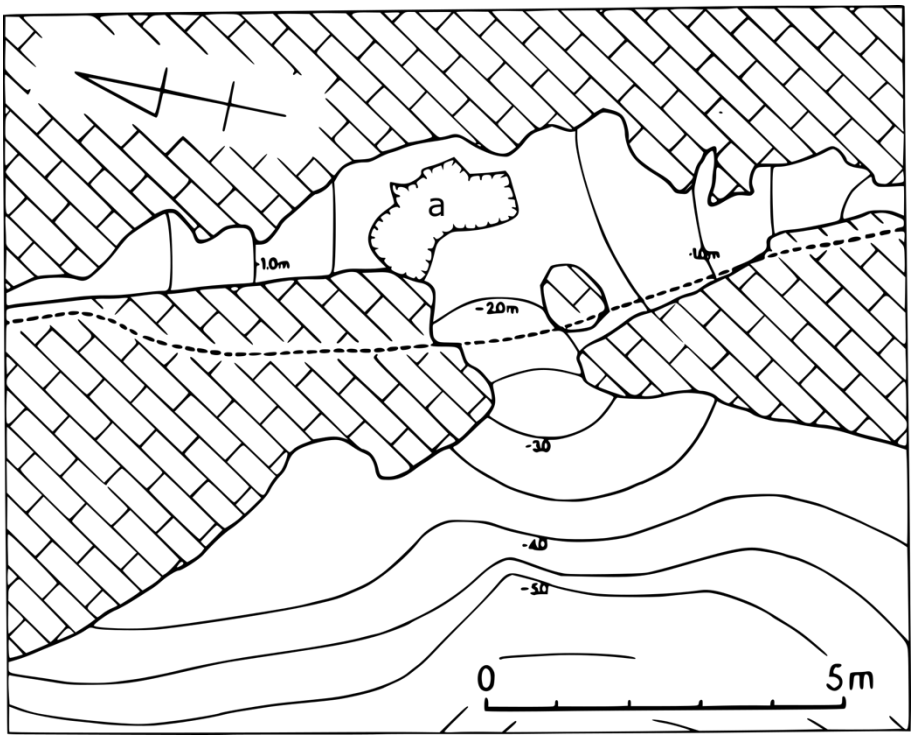


Figure 5.6: Sarugami Rock-shelter site. The area marked "a" indicates the area where human remains were found. Modified from Kawagoe (1978:16) by JAW.

5.2.1.3 Shikoku

5.2.1.3.1 Itoku

The Itoku site is located in Tosa, Kōchi Prefecture. It was excavated during the construction of an expressway through the city from 1997 to 1998 by the Kochi Prefecture Buried Cultural Property Center. The site spans from the Late Jōmon to the Middle Ages, but the human remains were excavated from the Jōmon component of the site. Specifically, a total of 25 fragmentary human bones and teeth were excavated from a sedimentary layer in a valley bordering a Jōmon settlement. The deposit is thought to relate to everyday waste and ritual practice (Figure 5.7). In association with these remains were a large amount of pottery and stone tools, elaborate lacquerware, a wooden hoe, dogū, and deer and boar bones. The animal bones recovered from the area show signs of butchery, some of which has been attributed to metal tools. Early Yayoi pottery and metal tools have been found at the site, but analysis of the animal remains was beyond the scope of this thesis. Chinese-style lacquerware has also been identified at the site (Hudson et al. 2021). The deposit associated with the human remains is thought to date to the second half of the Final Jōmon period based on the pottery typology and radiocarbon dating of two of the human femora – J2 (sample 1: 2837 ± 33; sample 2: 2960 ± 34 BP) and J10 (2989 ± 44 BP). When calibrated in OxCal v 4.4.4 (Reimer et al. 2020) the dates fall between 3335 to 2859 cal BP, which coincides largely within the Final Jōmon. The average stable carbon (–20.3‰ $\delta^{13}C$) and nitrogen (6.2‰ $\delta^{15}N$) values from these two individuals showed a particularly terrestrial, C3 plant-dependent diet, with a possible reliance on food such as acorns or chestnuts, possible residues of which were found in the pottery at the site) for protein and, potentially, some freshwater aquatic resources (Kōchi Prefecture Cultural Foundation Buried Cultural Property Center 2004).

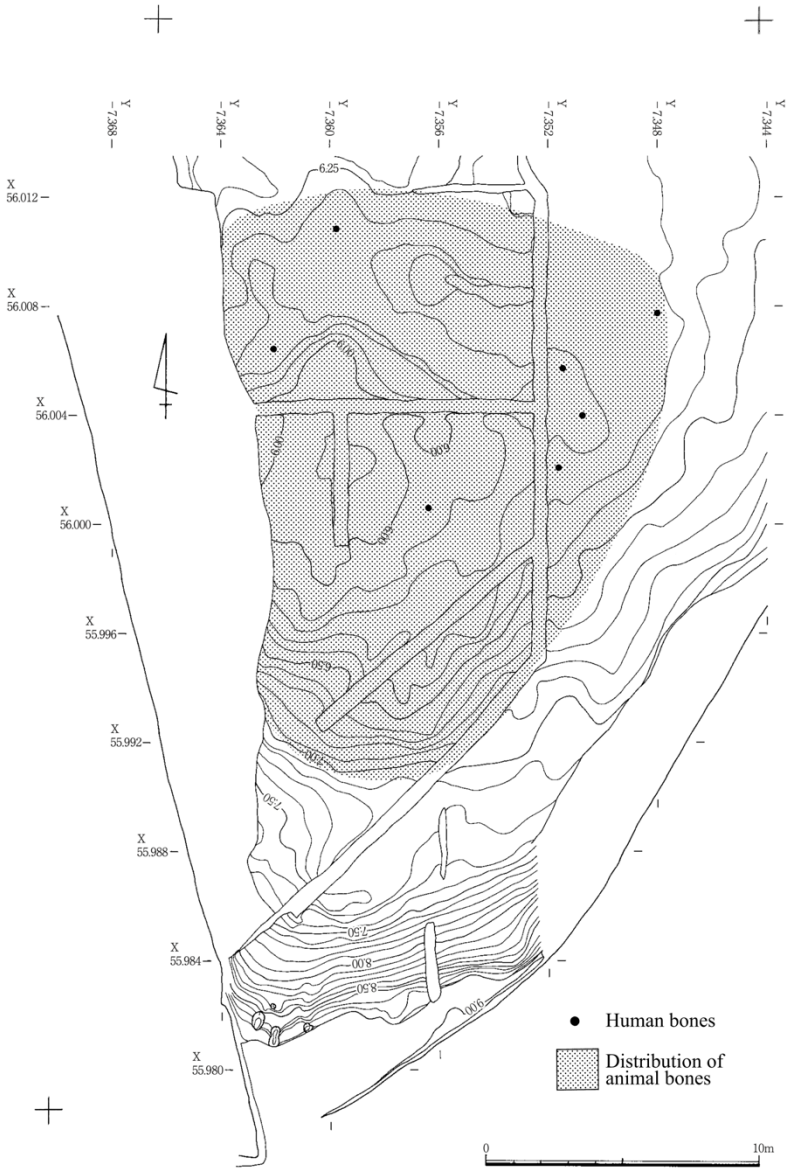


Figure 5.7: Location of fragmentary human remains recovered from the Itoku site (section 4D, Layer IV B). Adapted from Kōchi Prefecture Cultural Foundation Buried Cultural Property Center (2004:187) by JAW.

5.2.1.4 Kyūshū

5.2.1.4.1 Adaka

Adaka Shell-mound, located in Jōnan city in Kumamoto Prefecture, was first discovered and excavated in 1916 and is well known for the style of Jōmon pottery named after the site. It is associated with the nearby shell-mound of Kurobashi (黒橋貝塚) and it is likely that they comprised a large, continuous shell-mound along a tributary of the Hamadogawa River. Both

sites have been excavated ten times over the course of the eight decades by numerous individuals (Kumamoto Prefecture Board of Education 2005). Human remains at the site were first found in 1916 (n = ~50). Kenji Kiyono excavated a few individuals in 1920 and it appears that some skeletons from later excavations to the site were donated to the Kiyono collection not long after as well, including one from Dr Haruo Yamazaki (No. 3074) as noted by a card in the box at Kyoto U (Kiyono 1925). Pottery, stone tools and animal bones were also recovered from the site (H. Kobayashi 1965). The site dates from the Middle to Late Jōmon period based largely on the pottery and artefact typology. Later excavations took place at the site before several large excavations in the 1970's and 1990's, but these were not recorded (Kumamoto Prefecture Board of Education 2005).

5.2.1.4.2 Einomaru

Einormaru Shell-mound was discovered in 1933 when Yayoi period pottery was discovered at the site. The site spans from the Early Jōmon period through the medieval period. Located along the Kanayama River in Kitakyushu in Fukuoka Prefecture, the site was excavated in the 1954 by Iwao Takenaka whose finds included Jōmon and post-Yayoi pottery (Kitakyūshū City Board of Education 1972). A further excavation of the Jōmon component was carried out in 1958, uncovering a commingled burial of several individuals[4] (Takenaka 1985). In 1969, during a land development project, the site was excavated twice more, once in February and once in September, with the latter led by the Kitakyushu City Board of Education (Kitakyūshū City Board of Education 1972). During the second excavation in 1969 at least another two individuals were excavated. The burials appear to have been dated to the Late Jōmon using a combination of stratigraphic analysis and associated pottery typology, reported

[4] Takenaka (1985) reports four commingled individuals buried within a 1 x 2 metre area, but the Kyūshū University catalogue (1988) provides a minimum number of individuals of eight.

on in the Kyūshū University Medical School catalogue (Kyushu University School of Medicine 1988; Takenaka 1985)

Over the course of these initial three excavations, oyster shells were the most common shellfish found and deer, bird, and boar were the most common mammals found. Pottery from the Early to Late Jōmon along with stone axes, end scrapers, and cores were recovered from Einomaru (Kitakyūshū City Board of Education 1972; Takenaka 1985). Further excavations were carried out in the late 1980's and 1990's, but no skeletons from these excavations were included in this analysis. One skeleton excavated in 1988 was radiocarbon dated to 3770 ± 470 BP (4230 ± 612 cal BP calibrated in OxCal ver. 4.4.4 (Reimer et al. 2020)), but given the error range of this date, the lack of a reservoir correction, and its lack of association with the other burials, its date cannot be taken as indicative of the age of the other eleven individuals excavated previously (Kitakyūshū City Education and Culture Agency 1994).

5.2.1.4.3 Goryō

In 1930 Hisao Kobayashi excavated seven individuals from Goryō Shell-mound, located in Toyoda village, Shimomashiki District, in Kumamoto Prefecture. The pottery associated with them appears to date from the Final Jōmon, but the details of the excavation were not published. In 1951 Takeo Kanaseki and colleagues excavated another three individuals from the same shell layer, which date to the Final Jōmon based on the stratigraphy and pottery typology[5] (Kanaseki et al. 1955).

[5] There is some doubt about the dating of at least one of the burials excavated in 1951 (II(2)) as it appears to be a reburial and associated with an iron tool. They conclude, though, that as II(2) shows the same pattern of tooth ablation as the others, that he should be dated to the Final Jōmon as well (Kanaseki et al., 1955:94). Radiocarbon dating of this individual might help to clarify this matter in the future.

5.2.1.4.4 Kawaji

Kawaji Shell-mound is located on the western-most tip of the Atsumi Peninsula, Aichi Prefecture, 3 km from the current coast (Aichi Prefecture Buried Cultural Property Center 1995; Kiyono 1969). The site has also been known as Kameyama Shell-mound (亀山貝塚). In 1922 Kiyono excavated Jōmon period artefacts and approximately 23 individuals from the site (Figure 5.8), mostly from the shell layer and in a crouched position, of which only 4 were examined in this study due to preservation (Kiyono 1949, 1969). Later excavations were carried out in 1991 and 1993, finding three more burials in total. The material excavated by Kiyono is thought to date to the Late Jōmon period, based primarily on the pottery seriation, but later excavations at the site showed use from the Final Jōmon as well (Aichi Prefecture Buried Cultural Property Center 1995).

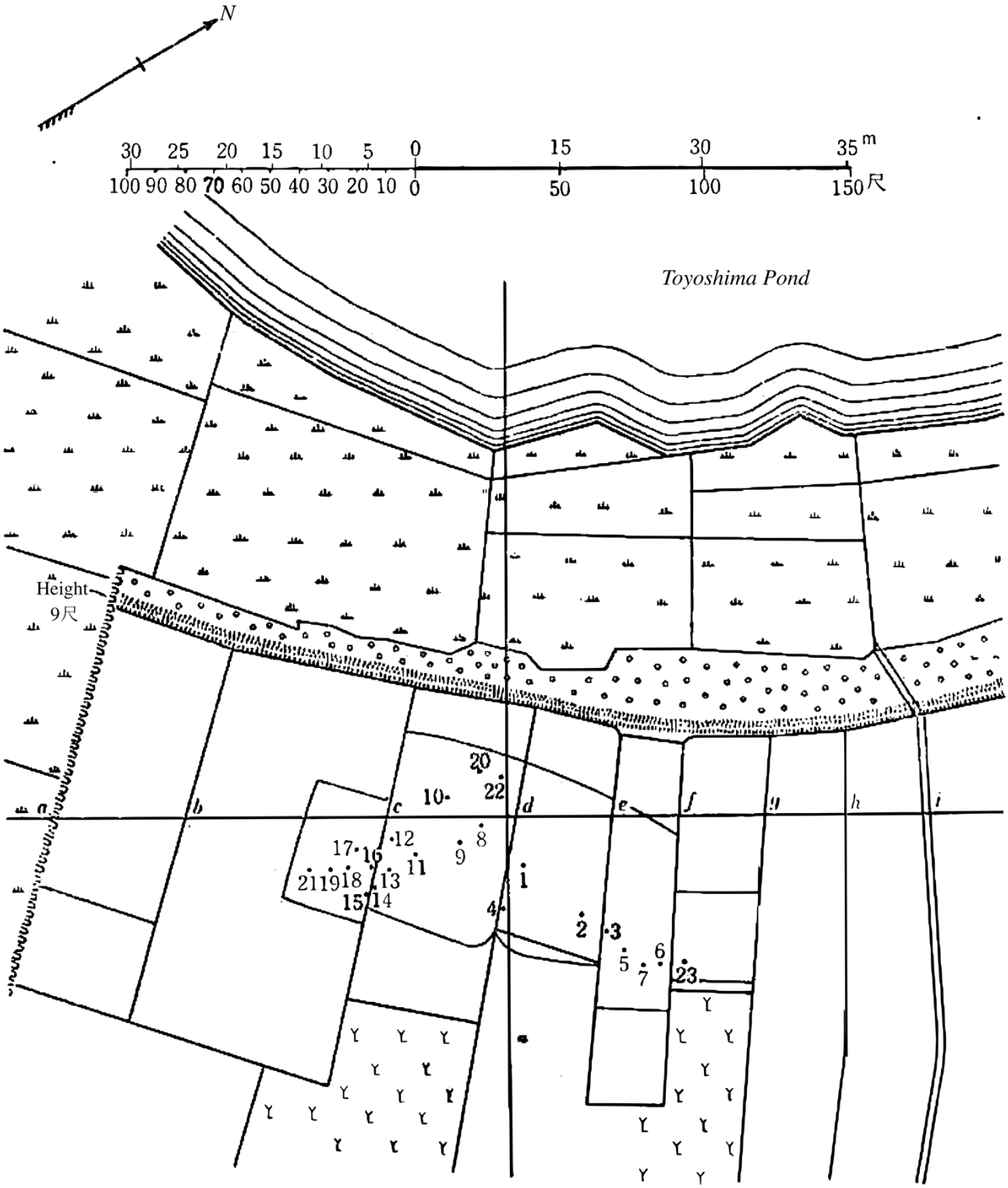


Figure 5.8: Map of Kawaji shell-mound excavation adapted from Kiyono (1949:149) by JAW

Artefacts found included disk-shaped stone and fish vertebrae earrings or beads, stone arrowheads, tools similar in shape to Yayoi ground stone knives, stone crowns, stone rods, chipped stone axes (and associated debitage), semi-ground stone axes, stone weights, stone mortar and pestle, grindstones, antler arrowheads, miscellaneous bone and antler tools (although not elaborately decorated), shell rings, pot sherds, ceramic masks, and ceramic weights (Kiyono 1969). The stable carbon and nitrogen values of nine individuals from Kawaji have been examined, with an average of –15.0‰ ± 1.0 for $\delta^{13}C$ and 12.5‰ ± 1.5 for $\delta^{15}N$, suggesting a mixed marine and terrestrial diet (Kusaka et al. 2010).

5.2.1.4.5 Kitsuki

Kitsuki Shell-mound is located on the western bank of the former Onga Lagoon in Kurate in Fukuoka Prefecture. The site was first recognised in the feudal period and shells from the site reportedly were used to create the lime for Fukuoka Castle. During the Edo period a lime business was centred around the shells. Kitsuki was first formally excavated in 1920 in response to construction in the area and a subsequent excavation was carried out in 1963, both of which yielded human remains thought to date to the Late Jōmon based on their associations. Particularly, a well-preserved skull was found in 1963. Other finds included shellfish, pottery, stone tools (stone axes and obsidian arrowheads), and animal (boar and deer) and fish bones (Kurate City Magazine Editorial Committee 1974).

5.2.1.4.6 Kōjō

The Kōjō, or Kanezaki (鐘崎), Shell-mound is located in Kanezaki, Munakata in Fukuoka Prefecture near the coast and was discovered by Yukio Tanaka in 1932 (Munakata Museum Electronic Bulletin Committee 2009). The site is located along the slope of a mountain and currently ca. 150 m from the coastline. Kōjō was first excavated by Yukio Tanaka and Takeshi Kagamiyama in 1934. A further two excavations were carried out in 1952 and in 1963,

during which time human remains were recovered. Charcoal, burnt soil, and a concentration of stone tools, including obsidian arrowheads, polished stone axes, and stone knives, suggested that this was a habitation site. In the shell layer, a mix of shells from marine and freshwater creatures were found, including clams and molluscs. Bone tools (fishhooks and spears) and animal and fish bones were also found. Personal adornments found included a shark tooth and vertebrae pendants, deer antler hairpins, and shell rings (Harada and Ogawa 1955; Kyushu University School of Medicine 1988; Munakata Museum Electronic Bulletin Committee 2009, 2010; Y. Tanaka 1936). The pottery of the site (Kanezaki style) is thought to date to the early half of the Late Jōmon period (Sakamoto 2018). Five individuals were recovered from the site in total (Kyushu University School of Medicine 1988; Munakata Museum Electronic Bulletin Committee 2009).

5.2.1.4.7 Shimokusuda

The Shimokusuda (or Futagawa 二川遺跡) site is located in Ōmuta City, Fukuoka Prefecture. The site was first reported in 1919 and in 1920 Kiyono excavated the site and recovered human remains of five individuals (Figure 5.9). Unfortunately, by the time he excavated the site, much of it had already been disturbed and destroyed due to the harvesting of shells for lime production. Based on the pottery typology found, the site is thought to date to the Middle–Late Jōmon period. Other artefacts found include stone tools (arrowheads, drills, axes, knives, rods, whetstones, pestle, and weights) and bone and antler tools (Kiyono 1969; Miyama City History Editorial Committee 2017).

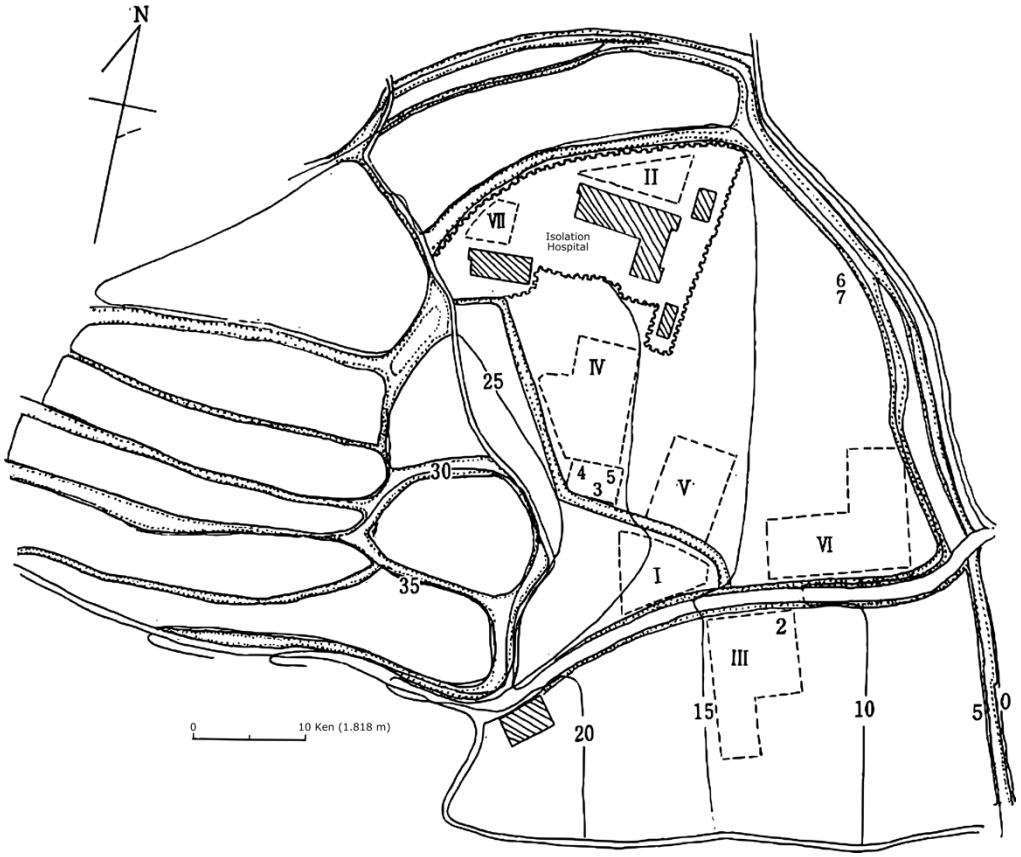


Figure 5.9: Shimokusuda site map showing the location of human remains (2–7) after Kiyono (1969:23) adapted by JAW.

5.2.1.4.8 Wakazono

Wakazono Shell-mound is located on the left bank of the Kikuchi River in Kikusui, Kumamoto Prefecture. It was known before it was first excavated in 1977, during which time fragmentary human remains were recovered, but prior to this no dedicated research had been carried out at the site or published about it. There is some modern disturbance of the site, but a majority of the finds fall within the Jōmon period, with some later Kofun and medieval components as well. Jōmon artefacts found include pottery, stone tools (obsidian arrowhead, ground stone axes, stone weights, and chipped stone tools), shellfish (primarily marine), and animal (deer, boar, and bird) and fish bones. The pottery dates the site to the Middle–Late Jōmon period. A subsequent excavation in 1980 recovered human remains that according to the Kyūshū University catalogue comprise three individuals dating to the Late Jōmon period from

the site, although the site report only shows a detailed image of a single internment (Kikusui Town Board of Education 1981; Kumamoto Prefecture Board of Education 1978; Kyushu University School of Medicine 1988).

5.2.1.4.9 Yamaga

Yamaga Shell-mound is located in Ashiya, Fukuoka Prefecture, near the mouth of the Onga River. The Einomaru and Kitsuki Shell-mounds are nearby. The site was discovered by Iwao Takenaka in 1953, in 1955 a skeleton (No. 1) with 11 shell rings was recovered. This discovery spurred on the first formal excavations at the site which were carried out by the Ashiya City Board of Education in 1962, 1965, and 1968. During the 1965 excavation three individuals were found (two adults and one infant) and both adult skeletons had accessories such as shark tooth earrings, deer antler waist decorations, animal bone hairpins, and shell rings. In 1968 another 13 individuals were excavated (Figure 5.10). Other artefacts recovered from the site included pottery, stone tools (arrowheads, axes, weights, blades, and grindstones), and bone tools (projectile points, fishhooks, and spears). Animal remains found included dog, fish, boar, and deer bones. The Late Jōmon dating of the skeletal remains is based on the stratigraphy, radiocarbon dates of three shells, and pottery typology. One of the radiocarbon dates on the shells (no. 3) did not yield consistent results, but the other two, from different layers, yielded dates of 5274 BP (5577–5307 cal BP calibrated in OxCal v. 4.4.4) falling in the Early Jōmon and 3376 BP (3441–2710 cal BP calibrated in OxCal v. 4.4.4) falling around the Late Jōmon (Heaton et al. 2020; Yamaga Shell-mound Survey Team 1972). Bausch (2017) has argued that the presence of Chulmun-style fishhooks and the large number of *Glycymeris albilineata* clam shell rings on females buried during the Late Jōmon at Yamaga that are similar to those seen in Middle–Late Chulmun are evidence of the involvement of Yamaga in a ‘Korea Strait Fishermen Interaction Sphere’.

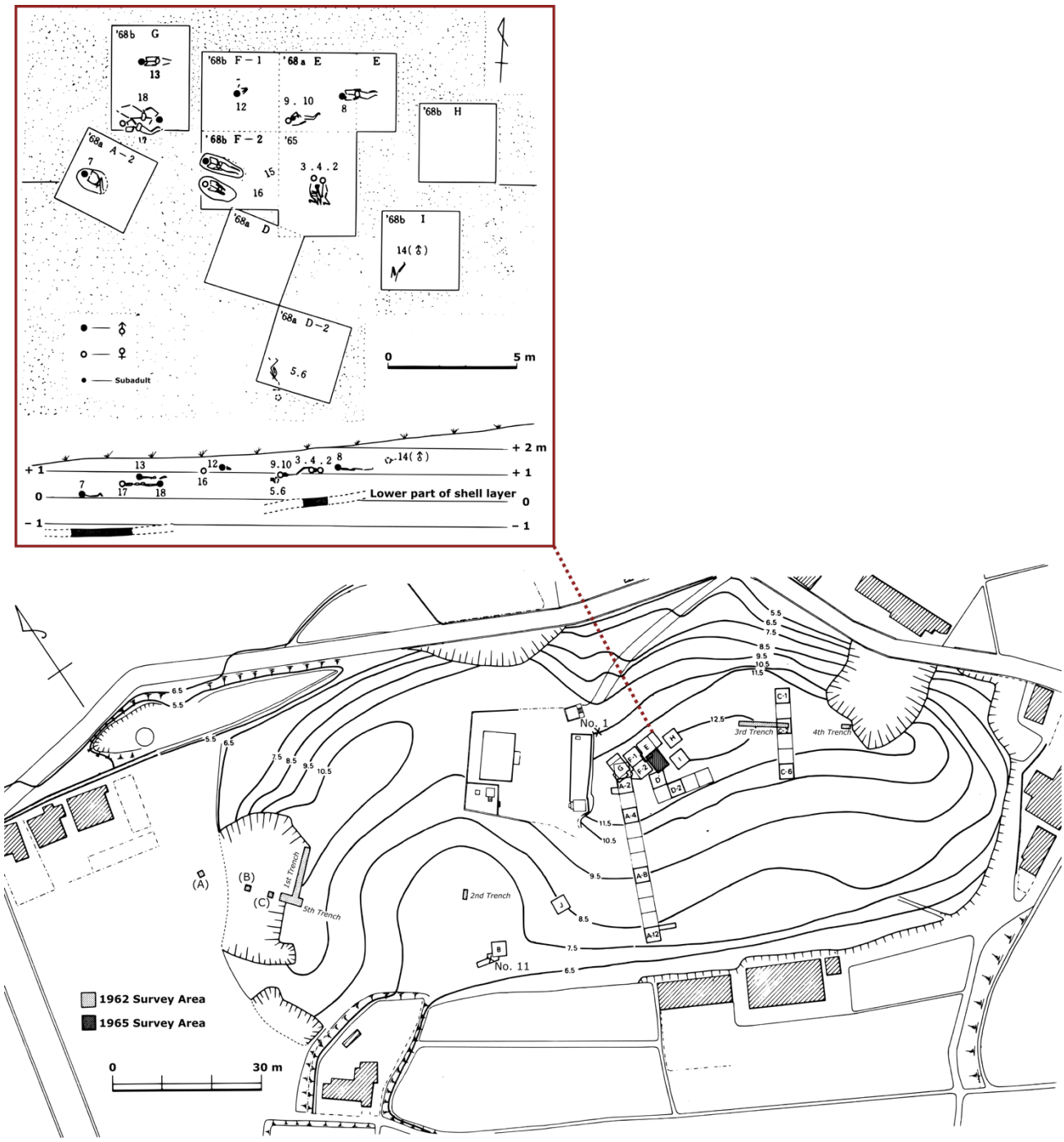


Figure 5.10: Yamaga Shell-mound site map. No. 1 and 11 denote the human remains recovered outside of the concentration shown in red. The trenches in white are from the 1968 excavation. Adapted from Yamaga Shell-mound Survey Team (1972) Figures 3 and 26 by JAW.

5.2.2 Yayoi Sites

5.2.2.1 Chūgoku

5.2.2.1.1 Doigahama

The Doigahama site is located in Shimonoseki, Yamaguchi Prefecture near the Hibiki Sea coast. Although the existence of the site was recognised previously, excavation began in 1953 and lasted through 2000, totally 19 excavation seasons, during which time approximately 297 Yayoi individuals from pit, stone lined, and stone cist graves were recovered (Figure 5.11). The burials mainly date to the Early through Middle Yayoi period based on the pottery typology and stratigraphy. Secondary internments at the site were common as well with commingled remains and clusters of skulls. Grave goods included pottery, shell rings, magatama, beads (glass, jade, amazonite, and jadeite), and stone and shark tooth arrowheads. A few burials (n = 9) dating to the middle ages and later were present. Stable C and N isotopic analysis of 32 individuals suggests a diet based on C_3 plants and marine foods (Doigahama Site Anthropology Museum 2014). Temple and Larsen (2007) found 17.3% out of 1417 teeth had carious lesions at the site.

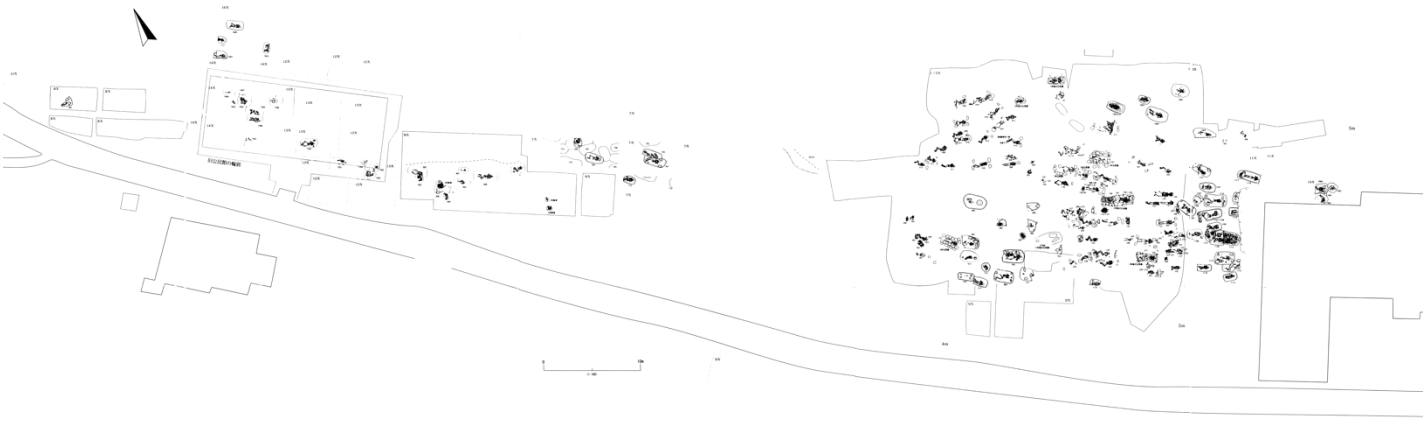


Figure 5.11: Doigahama site map showing the extent of human burials found over the course of 19 excavations after attached maps 1–3 Doigahama (2010) adapted by JAW.

5.2.2.1.2 **Kōra**

The Kōra site is located in Kashima on the Shimane Peninsula, Shimane Prefecture. Kashima is bordered by Mt. Hongū to the south and Mt. Misaka to the north and Kōra is located near the coast on an aeolian sand dune and along the left bank of the Sada River in the valley between the mountains. The site was first surveyed informally in 1948 and one individual and prehistoric artefacts were found by Kiyoshi Yamamoto and his classmates, although the fact that artefacts and human remains were present in the area was known before WWII. The first formal excavation of the site occurred in 1961 and another three occurred between then and 1964, during which time 51 individuals were recovered from the sand dune (Figure 5.12). The human remains date primarily from the Early Yayoi but one appears to be associated with the Middle Yayoi and seven from the Kofun period, based on the pottery typology and stratigraphy. Due to time constraints, the Early Yayoi remains only were examined in this study (Kōra Site Research Group 2005).

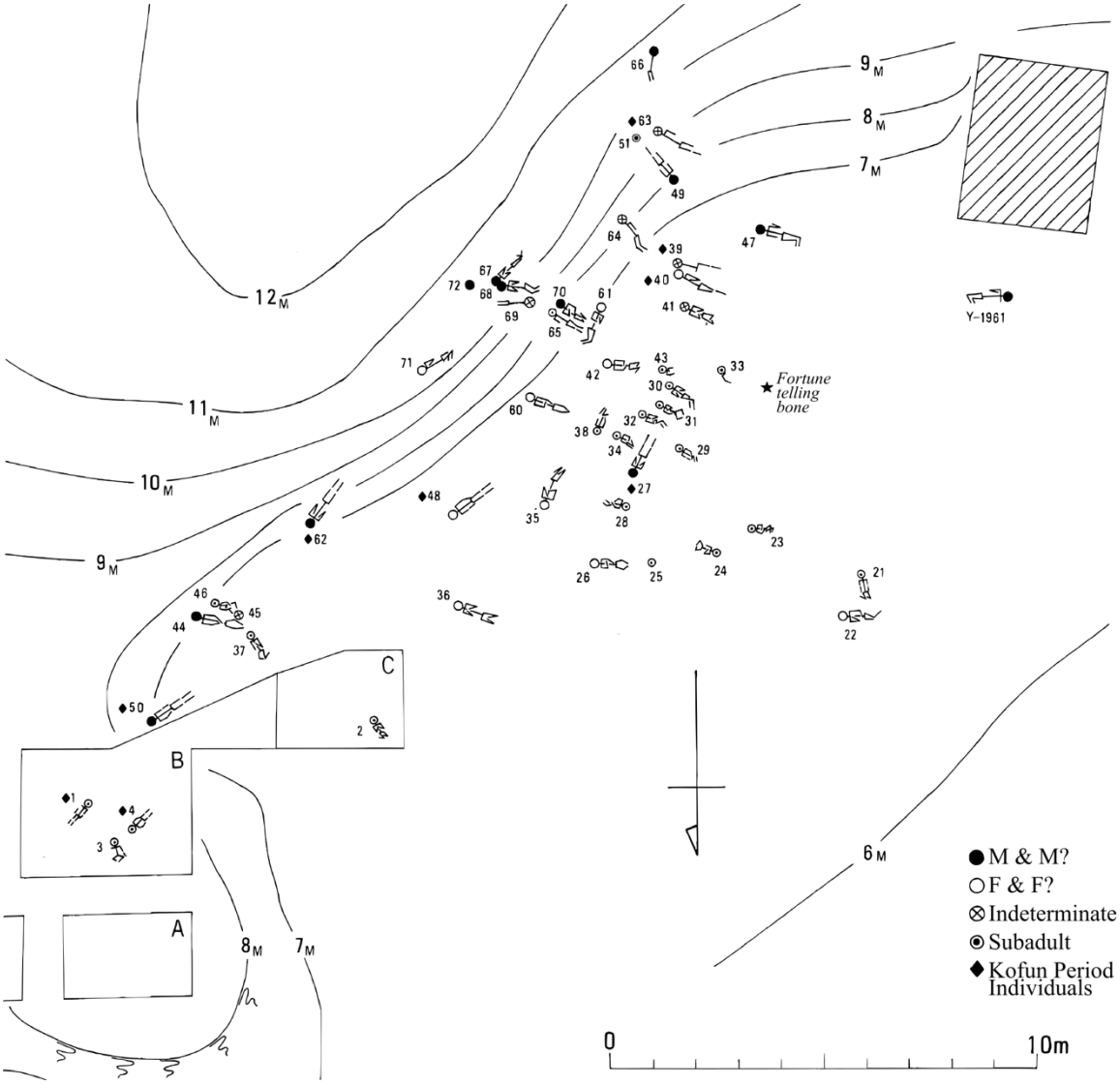


Figure 5.12: Kōra cemetery schematic adapted from Kōra Site Research Group (2005:360) by JAW.

Grave goods included pottery, shell beads, tube beads and magatama, shell rings and balls, and a deer metatarsal which appears to have been used for fortune telling. Fake bait fishing lures, miscellaneous bone tools, and a stone and bone arrowheads were also present at the site. Copper staining was present on six individuals (20, 21, 49, 60, Yamamoto III, and 1401). Furthermore, a Colles fracture was reported for No. 35. Instances of cranial deformation, noted as similar to that seen in the Hirota site, have been identified. Due to the high shell content in the sand, preservation was good overall. Tooth ablation has been noted as well. The burials were largely supine (flexed and extended) burials (Kōra Site Research

Group 2005). Temple and Larsen (2007) found 14.1% of 487 teeth had carious lesions at the site.

5.2.2.1.3 Minamikata

The Minamikata site is located in Kokutai, Okayama City, Okayama Prefecture along the Asahi River. Since the construction of a hospital in the area in 1992, intermittent excavations have been carried out at the site. Approximately ten human burials have been excavated thus far between 1994 and 1995. The artefacts date from the Early Yayoi period through the medieval period. The Yayoi component is thought to likely be associated with a nearby contemporaneous village given the varied nature of finds (Okayama City Board of Education 1994, 1995).

No grave goods were associated with the remains examined in this study (Figure 5.13) to help date them, but they are associated with the late Middle–Late Yayoi period component of the site and artefacts from these periods were numerous at the site. Most burials were crouched and in earthen pits, but No. 7 and 8 were scattered and likely represent a reburial event. Additionally four burials show evidence of rearrangement or disturbance of the axial skeleton, particularly the cervical vertebrae and skulls. Fragmentary human remains were also found mixed in the soil associated with other artefacts. The possibility of more grave pits originally being present was noted as well. Hence, it is posited that the use of family or ancestral remains in some ritual context is likely (Okayama City Board of Education 1994, 1995).

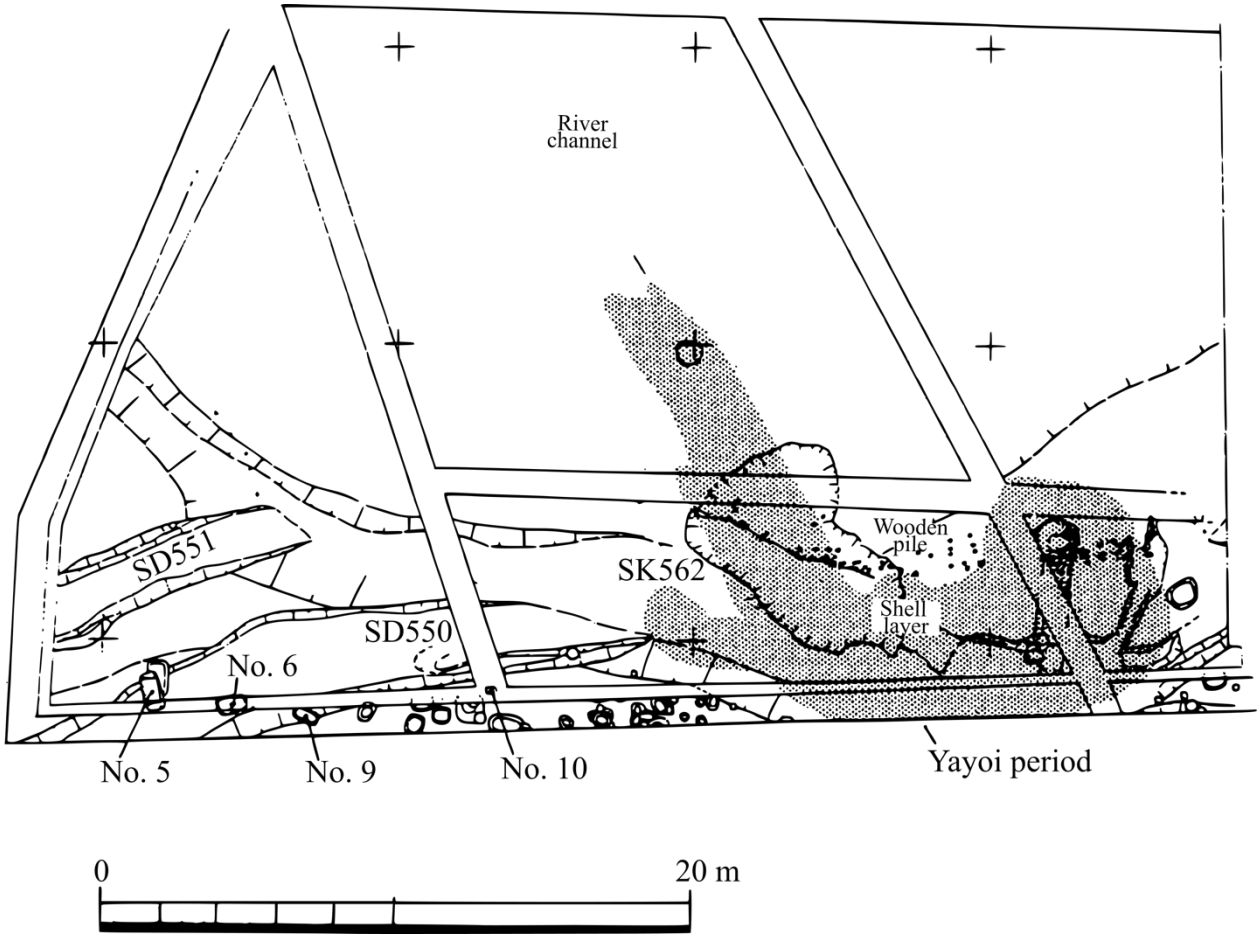


Figure 5.13: Map of the southwest of the Minamikata site after (Okayama City Board of Education, 1995:5). Adapted by JAW.

5.2.2.1.4 Nakanohama

The Nakanohama site is located adjacent to and overlapping a modern graveyard on a low lying coastal plain in what is now Toyōra, Shimonoseki City, Yamaguchi Prefecture ca. 15.5 km as the crow flies from the Doigahama site. The site was first discovered in 1960 and large excavations were carried out eight times from then through 1971 and again in 2010. At least 103 Yayoi individuals have been excavated from the site, primarily in stone cists or covered graves, but group, commingled burials were also numerous and pit and jar burials were present as well (Figure 5.14). Additionally, reburial appears to have been a common funerary practice. The cemetery is thought have been used for an extended period during the Early to Middle Yayoi period based on the pottery typology. Yayoi period artefacts recovered included

pottery, a ground stone sword tip, a stone axe, a bronze sword, a bronze dagger tip, beads (shell, jasper, and jadeite), shell rings, stone arrowheads, a stone dagger, and miscellaneous iron pieces (Toyōra Town Board of Education 1984; Yamaguchi Prefecture Human Resources Development Foundation and Yamaguchi Prefecture Buried Cultural Property Center, 2016).

It has been argued that the similarity in skeletal morphology and grave goods between Nakanohama and Doigahama indicate some affinity and interaction between them. Additionally, the alluvial lowlands of the area would be suitable for wetland rice cultivation. Nearby, the oldest iron hoe in Japan was found at the Yamanokami site (山の神遺跡) and an Early Yayoi moated settlement is present to the south (Yamaguchi Prefecture Human Resources Development Foundation and Yamaguchi Prefecture Buried Cultural Property Center, 2016).



Figure 5.14: Nakanohama site schematics from the 1965–1967 (top) excavations and from the 1968–1971(bottom) excavations. Adapted from Toyōra Town Board of Education (1984:14;23) and Yamaguchi Prefecture Human Resources Development Foundation and Yamaguchi Prefecture Buried Cultural Property Center (2016:2) by JAW.

5.2.2.2 Kinki

5.2.2.2.1 Shibu

The Shibu site is located in Kashihara, Nara Prefecture along the right bank of the Asuka River. In 1996, during excavations at the Fujiwara Palace site, which was the capital of the Yamato state ca. AD 694, a Yayoi component was confirmed. The Yayoi component of the site consisted of a double moated settlement with evidence of rice agriculture. Only two individuals (No. 3 and 4; Figure 5.15) from the site were well preserved enough to analyse in this study. Yayoi period skeletal remains from the Kinki region are relatively rare as preservation tends to be poor. Individuals No. 3 and 4 were buried in a double pit burial with a wooden covering in the vicinity of the settlement moat (Nara National Cultural Properties Research Institute 1996; Oyabu 2006).

A stone arrowhead was located between the ninth and tenth ribs of No. 3, but there are no grave goods. The burial is thought to date to the Middle Yayoi based on the typology of a nearby collection of potsherds. Other findings from the site include stone tools (axes, stone reaping knives, arrowheads), wood and bone tools, a boar scapula thought to be used for fortune telling, other fragmentary animal bones (deer and boar), and archaeobotanical remains (including adzuki beans and carbonised rice). Evidence of perimortem trauma on both individuals, extensive in the case of the male, has been described previously, but this will be discussed in greater detail in Chapters 8.3.1 and 9.2 (Nara National Cultural Properties Research Institute 1996, 1998; Nara Prefecture Archaeological Institute of Kashihara Museum 2014; Oyabu and Katayama 2001; Oyabu 2006).

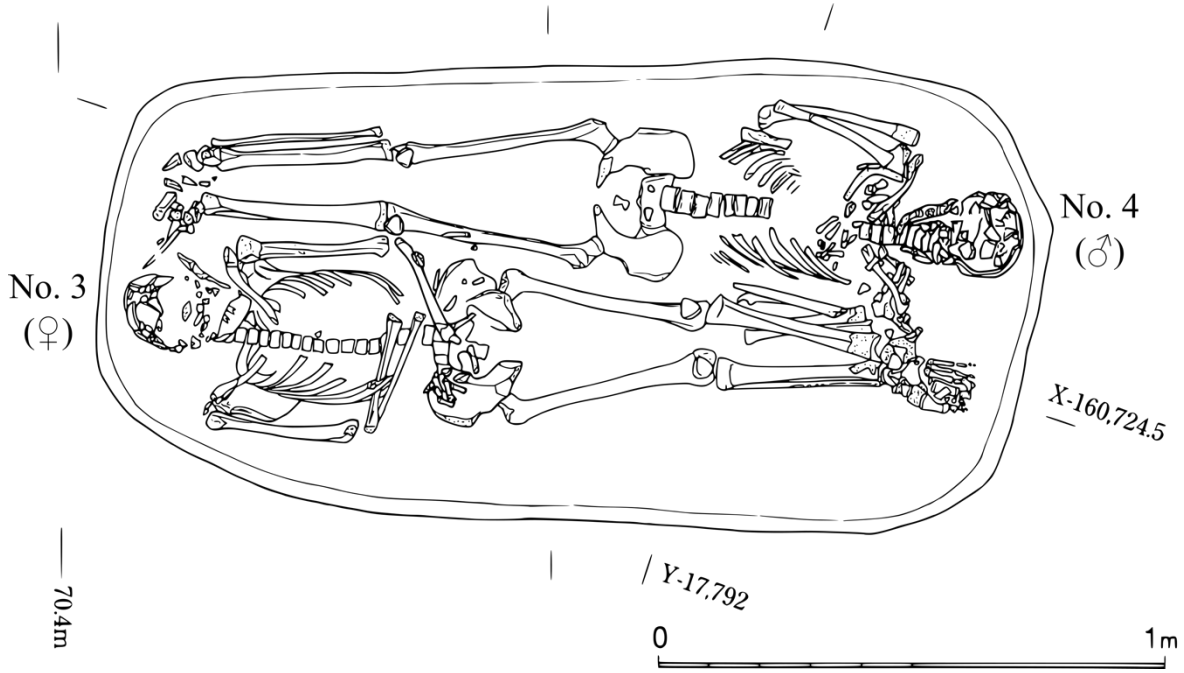


Figure 5.15: Shibu site double burial after Nara National Cultural Properties Research Institute (1998:9) adapted by JAW.

5.2.2.3 Kyūshū

5.2.2.3.1 Hirota

The Hirota site is located in on Minami Tanegashima, Kagoshima Prefecture. Tanegashima is located ca. 43 km from the tip of the Ōsumi Peninsula of southern Kyūshū and acted as a part of the "Trail of Shells" which connected the Ryūkyū islands with Kyūshū in prehistory. Hirota is located near the Hirota River, which is thought to have provided alluvial soil suitable for agriculture. The site is located on a sand dune, near the coast of on the southeast of the island. The site was first discovered in 1955 when a section of the dune collapsed. Three excavations were conducted between then and 1959. Approximately 90 burial features with about 157 individuals were found. All of the individuals examined in this study come from these excavations, although later excavations from 2005–2006 have been conducted (Agency for Cultural Affairs 2008). In the upper levels bone assemblages, composed of two or more individuals, were most common and likely comprised secondary burials. In the lower levels primary burials in unmarked pit graves or in graves with a stone cap or lined with stone were

most common (Figure 5.16). The site dates from the Late Yayoi to Late Kofun period based on typological analysis of pottery and glass beads and radiocarbon dating of the upper layers (Hirota Site Research Group 2003). Only a portion of those dating to the Late Yayoi were examined for this study.



Figure 5.16: Hirota site lower stratum schematic after Hirota Site Research Group (2003:26,270–271) adapted by JAW.

The Hirota skull shape is notable as its flattened occipital region indicates some form of artificial cranial deformation (see Ch. 7.4.2 and Catalogue II for details). Tooth extraction was still common and their stature was markedly lower (average 154 cm in males and 142.8 cm in females) (Hirota Site Research Group 2003). Temple and Larsen (2007) found 11.0% out of 1009 teeth had carious lesions. The average $\delta^{13}C$ of 15 individuals from Hirota is –18.8‰.,

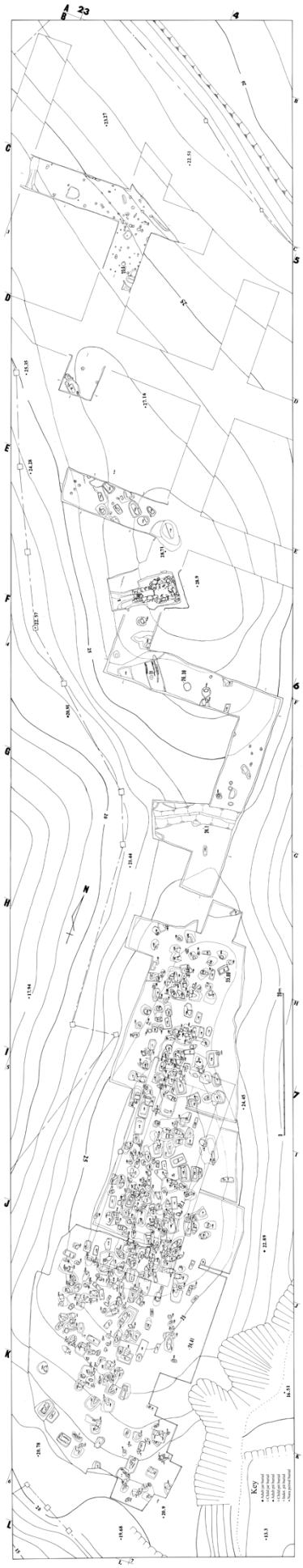


Figure 5.17:Kanenokuma site map after supplementary Figure 2 in Fukuoka City Board of Education (1985) adapted by JAW.

which is similar to those from other Yayoi sites in Yamaguchi and Kyūshū, such as Doigahama and Kanenokuma, after the introduction of rice agriculture. Common grave goods from the Yayoi component included ornately engraved shell pendants, shell beads, and pottery. The nearby Torinomine site is another sand dune cemetery, with approximately 26 individuals buried there, dating to the same period and is thought to show evidence of interaction with the Hirota group based on similar morphology and shell artefacts (Hirota Site Research Group 2003).

5.2.2.3.2 Kanenokuma

The Kanenokuma site is located in what is now southeast Fukuoka, Fukuoka Prefecture along the Mikasa River. The site was first discovered in 1968 and excavated six times between then and 1982. In total 348 jar, 27 pit, and 2 stone coffin burials were excavated and the remains of 136 individuals were recovered (Figure 5.17). Based on the typology of the burial jars, a majority of the burials date to the Middle Yayoi, but some appear to date from the end of the Early Yayoi through the beginning of the Late Yayoi as well. Grave goods included shell rings, stone beads, pottery, and stone arrowheads and swords (Fukuoka City Board of

Education 1970, 1971, 1985). Temple and Larsen (2007) found 11.6% of 1106 teeth had carious lesions at the site.

5.2.2.3.3 Mitsunagata

The Mitsunagata site is located in Mitsu, Saga Prefecture and is thought to be associated with the Yoshinogari site complex, possibly forming part of a *guo* as described in the *Wei zhi* (G. L. Barnes 2007; Kidder 2007). The site was excavated in 1953 and 1954 during which time 52 individuals were recovered from jar burials and stone cists (Figure 5.18). Notable grave goods were associated with No. 104 who was buried with a bronze mirror and a ring-pommel iron sword. Additional findings included another two Han bronze mirrors, glass and jasper beads, shell and iron rings, and bronze arrowheads. The cemetery is thought to date from the Middle–Late Yayoi based on the typology of the excavated pottery (Kanazeki et al. 1961; Kidder 2007; Ushijima 1954).

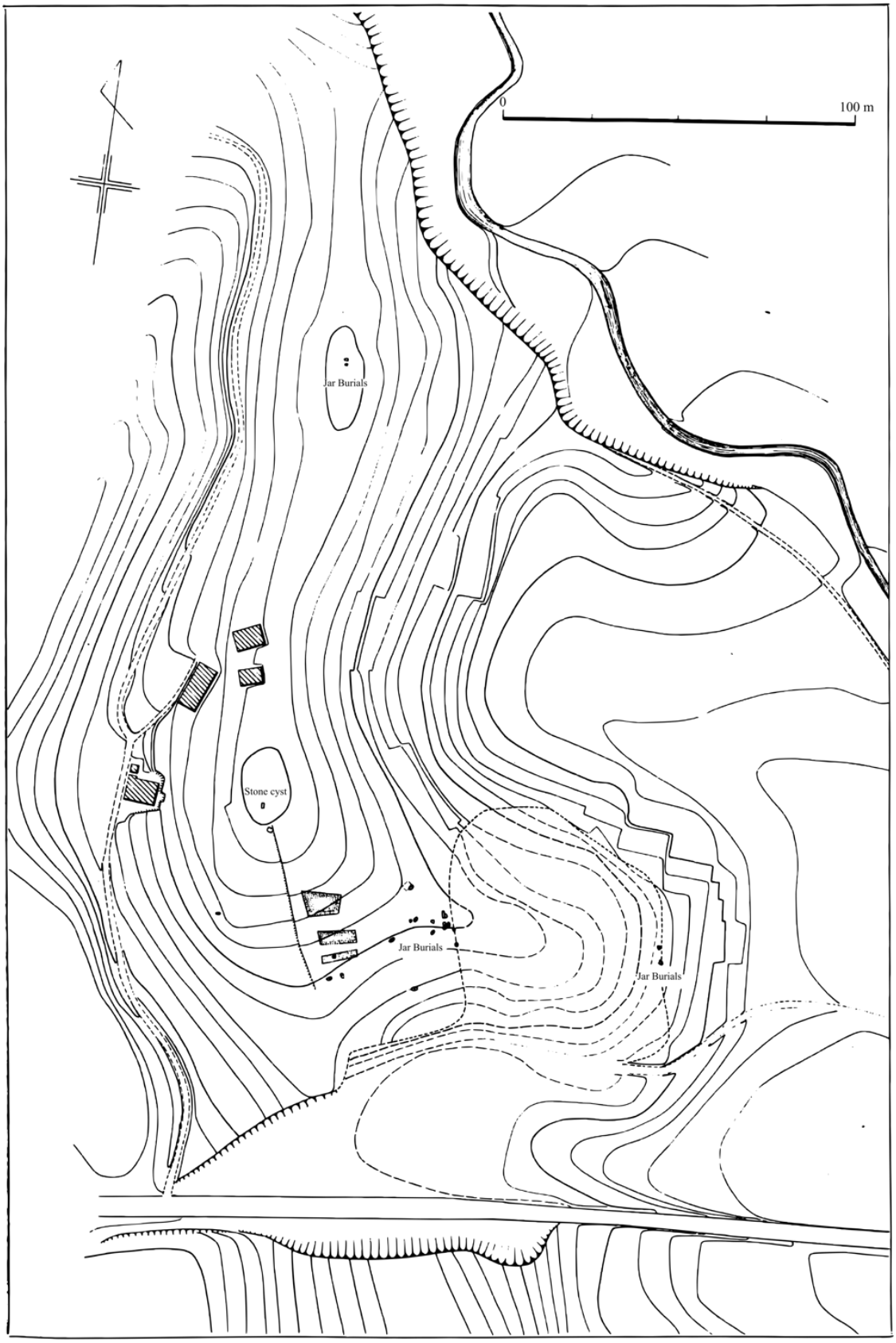


Figure 5.18: Mitsunagata site map after Plate 1 in Kanazeki et al. (1961) adapted by JAW.

5.2.2.3.4 Nagaoka

The Nagaoka site is located in Chikushina, Fukuoka Prefecture. First found in 1972, the site was excavated three times between then and 1988, uncovering 153 jar burials, 21 wooden coffin burials, and 9 pit burials arranged in double rows along a path that is thought to lead to a large-scale settlement, but this has not been investigated further as it is covered by modern development (Figure 5.19). From these a total of approximately 53 individuals were recovered. It has been noted previously that two individuals were found to still have the tips of bronze daggers embedded in their bones. Other artefacts found include a broken stone sword and pottery. Dating is largely based on the chronology of the burial jars and the site is thought to date to the second half of the Middle Yayoi (Chikushino City Board of Education 1981, 1990; Fukuoka Prefecture Board of Education 1977; Mizoguchi 2013; Takesue 1999). Temple and Larsen (2007) found 12.8% of 328 teeth had carious lesions at the site.

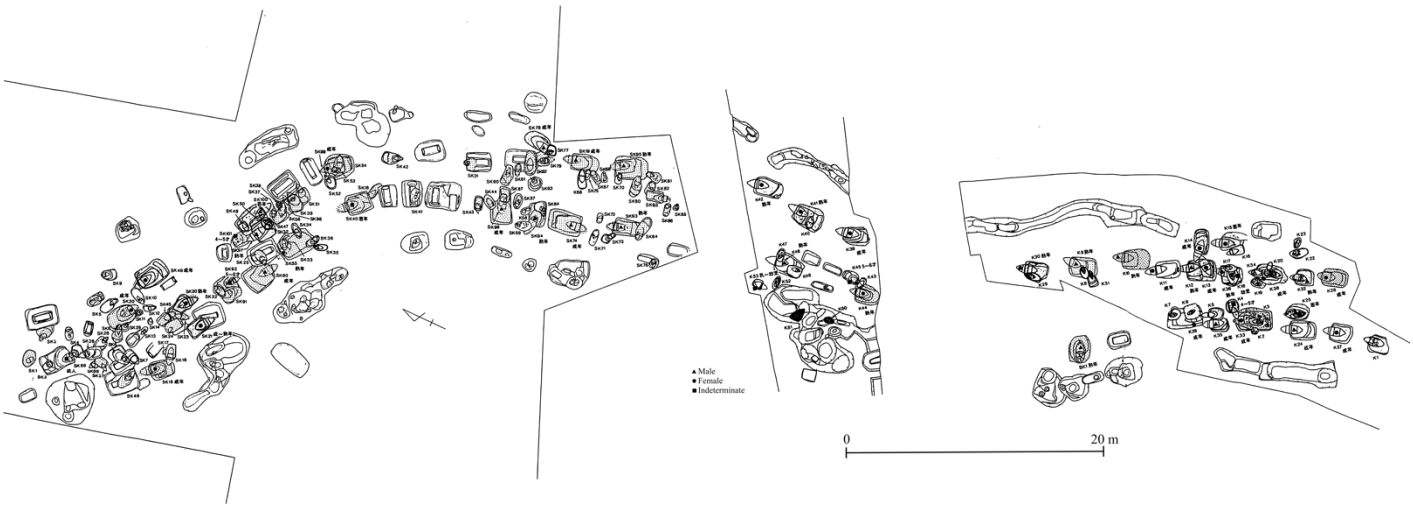


Figure 5.19: Nagaoka site map with burial jars labelled after attached Figure 3 in Chikushino City Board of Education (1990) adapted by JAW

5.2.2.3.5 Ōtomo

The Ōtomo site is located in Yobuko, Saga Prefecture on the Higashimatsūra Peninsula. From 1968 to 1980 the site was excavated four times and from 1999 to 2000 twice more. During the initial excavations around 100 individual skeletons were recovered and during the fifth and sixth excavations another 50 were excavated (Figure 5.20). Only the skeletons from the latter

excavations were available for analysis in this study. A mixture of stone dolmens in a Korean style, jar, and stone dolmen and cist graves were excavated. It is possible that some burials also contained wooden coffins, but this could not be conclusively determined. These date from the end of the Final Jōmon/Initial Yayoi through the Kofun period, but not continuously based on radiocarbon dating of 18 individuals with a range of dates from 2540–2303 to 1705–1485 cal BP. Stable carbon and nitrogen analysis of these same individuals indicate that they had a large marine component (40–60%) to their diet, although there is some indication of greater reliance on C3 plants, presumably rice, over time. It has been noted that morphologically the Ōtomo individuals resemble Jōmon rather than Yayoi peoples (Nakahashi 2001), but there is some variability within the site. Grave goods at the site include pottery, shell rings, iron tools, cylindrical beads, and an obsidian stone tool (Miyamoto 2001, 2003).

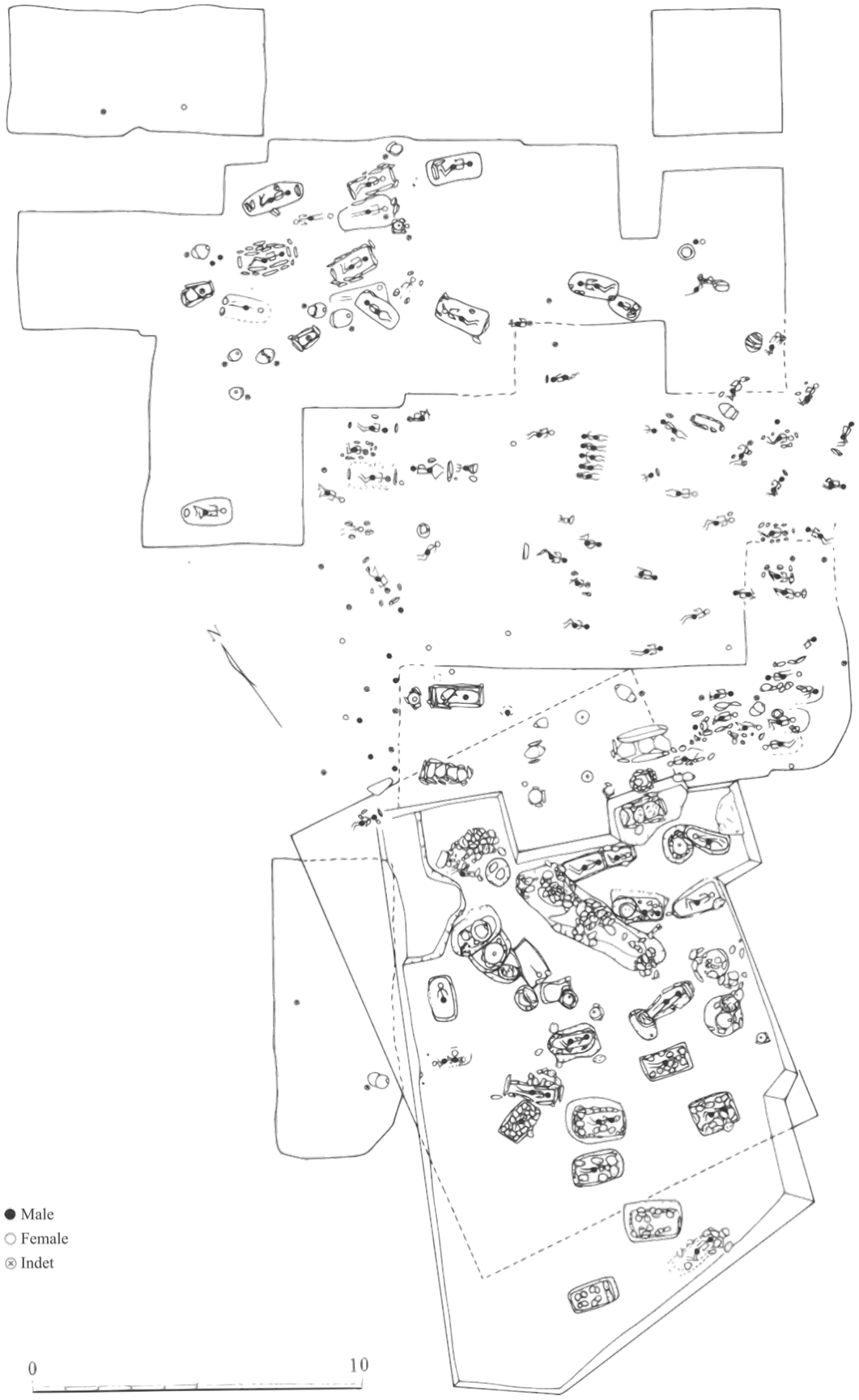


Figure 5.20: Ōtomo site map from Miyamoto (2003:71) adapted by JAW.

5.2.2.3.6 Shinmachi

The Shinmachi site is located in Itoshima, Fukuoka Prefecture. Shinmachi was excavated three times between 1985 and 1989, although its existence had been known since the Taisho era. Human remains from the site were not well preserved. During the initial excavation 14 individuals were recovered, but well over double that number of jar, pit, and stone dolmen and cist graves have been excavated. Artefacts from the site include pottery, ceramic weights, magatama, glass and jasper beads, stone tools (including spindle wheels, weights, whetstones, arrowheads, and axes), iron tools (including arrowheads, knives, and an axe), bronze arrowheads, and Chinese coins (one dating to the reign of the Chinese emperor Wang Mang (BC 9–23) during the Xin Dynasty and another to the Han Dynasty which would have been in circulation between BC 175–120). One individual has a stone arrowhead embedded in their femur. The site is thought to date from the Initial to Middle Yayoi periods based primarily on pottery typology (Mizoguchi 2013; Shima Town Board of Education 1987, 1988, 1990). See Figure 5.21 for a schematic of the Initial–Early Yayoi graves.

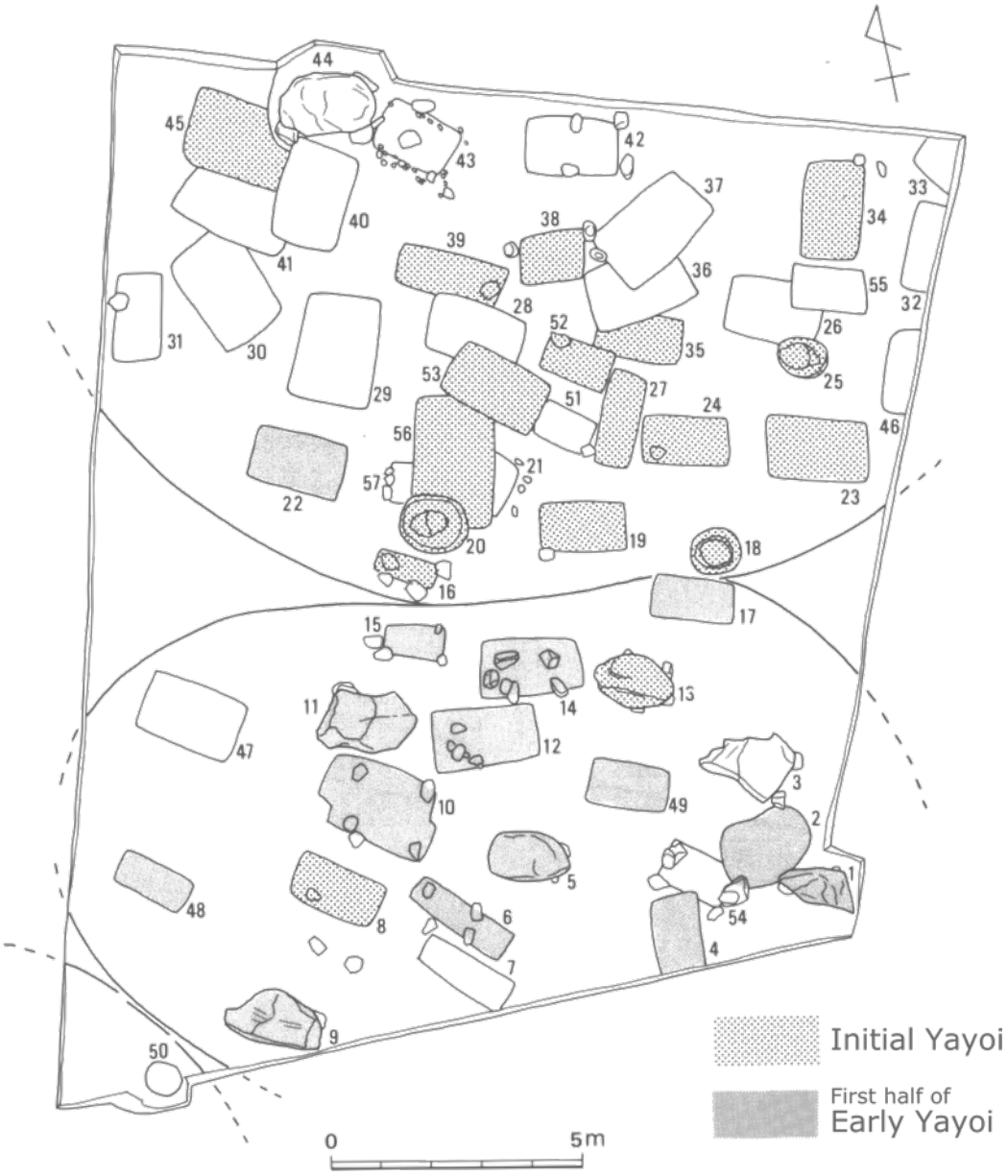


Figure 5.21: Shinmachi site excavation area 1 where human remains were recovered after Shima Town Board of Education (1987:109) adapted by JAW.

5.2.2.3.7 Sudare

The Sudare site is located in Honami, Fukuoka Prefecture to the west of the Honami River. Nearly the entire plateau that the site sits on was excavated in 1975. It appears that the western portion of the site was an Early Yayoi settlement, but some burial jars were found in the area as well. In the eastern cemetery portion of the site ca. 70 jar, pit, and wooden coffin graves were excavated. The cemetery component of the site is believed to date to the Middle Yayoi based primarily on the pottery typology, the grave styles, and the grave assemblages.

Artefacts found included pottery, shell rings, stone tools (axe, sickle, reaping knives, and swords), and an iron axe. One individual (K-3) is known to have a ground stone sword point embedded in his back (Honami Town Board of Education 1976).

5.2.2.3.8 Tsukomuta 4

The Tsukomuta site has been excavated in four parts in Ogōri, near Chikushino City were the large Kuma Nishioda site is located, in Fukuoka Prefecture. The nearby Tsuko-tsuchitori site moated settlement dates to the same period as the Tsukomuta site. Tsukomuta was first excavated in 1987. In excavation area 1 there is evidence for intermittent settlement activity from the Middle Yayoi through the Nara period and in all excavation areas Yayoi period burials have been found. During the 2001 excavation at Tsukumota 4 investigators excavated 96 jar burials, 1 stone coffin, and 1 stone covered grave from which 23 skeletons were recovered (Figure 5.22). Grave goods and ritual deposits included pottery and some stone tools (ex. axe fragment). Based on the style of the majority of graves (i.e. the jar burials) it is thought that this portion of the site primarily dates to the Middle Yayoi period (Ogōri City Board of Education 2003).

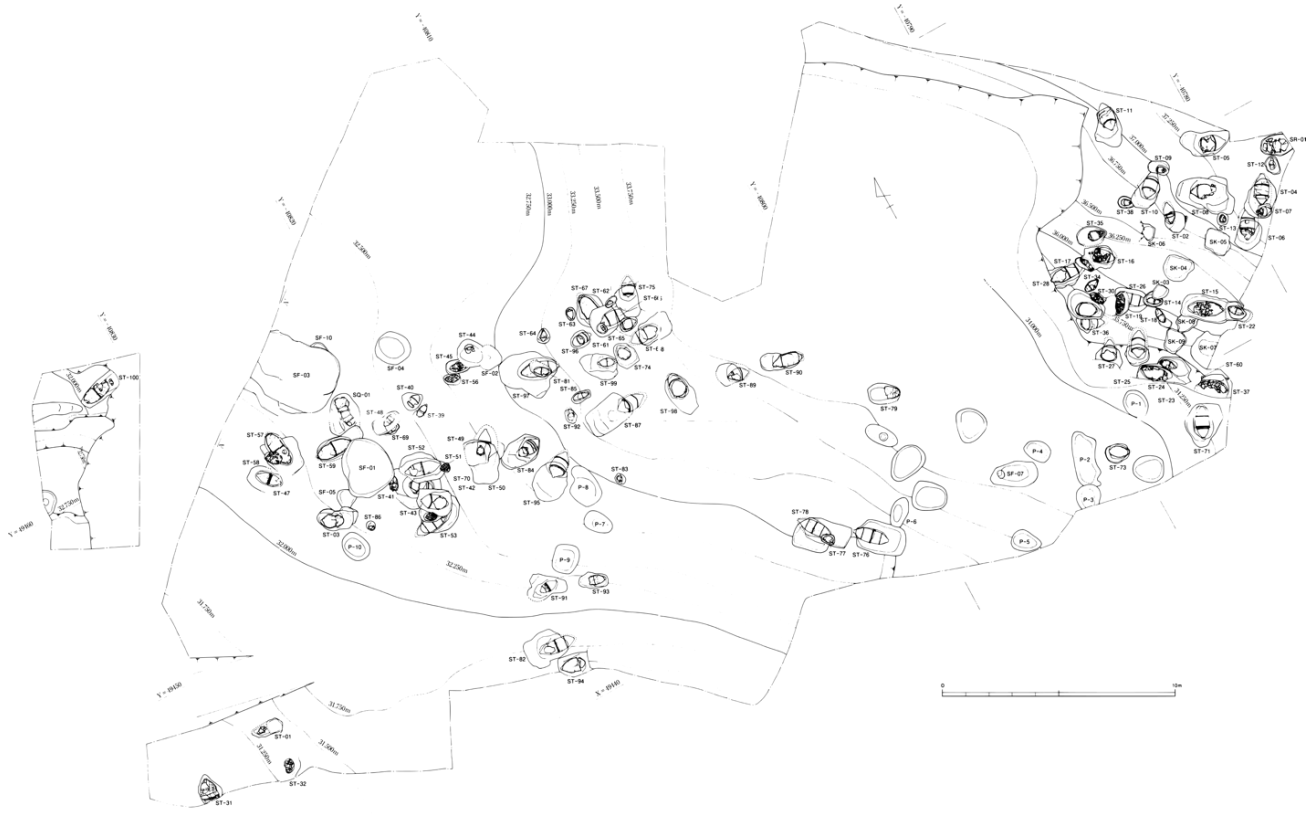


Figure 5.22: Tsukomuta 4 site map after the supplementary map in Ogōri City Board of Education (2003) adapted by JAW.

5.2.2.3.9 Yokoguma kitsunezuka

The Yokoguma kitsunezuka site is also located in Ogōri, Fukuoka Prefecture. The site has been excavated in seven parts as of 1999. The skeletal remains excavated in 1999 in area 7 (Figure 5.23) were available for study for this project, although during the second excavation in the 1980's 375 Middle Yayoi period graves were excavated. At Yokoguma kitsunezuka 7 an Early Yayoi settlement, a Middle Yayoi cemetery, and a Kofun component were found. The Middle Yayoi graves included 215 jar, 16 wooden casket, and 24 pit graves along with 5 ritual deposits. From these pottery, stone tools (arrowheads, swords, axes, scrapers, knives, and slingstones) and bronze swords were excavated and over 50 individuals were recovered. Individual No. 197 was found with the tip of a bronze sword in the thoracic vertebra of an adolescent female. The dating of this component is primarily based upon the typology of the graves (Ogōri City Board of Education 2010).

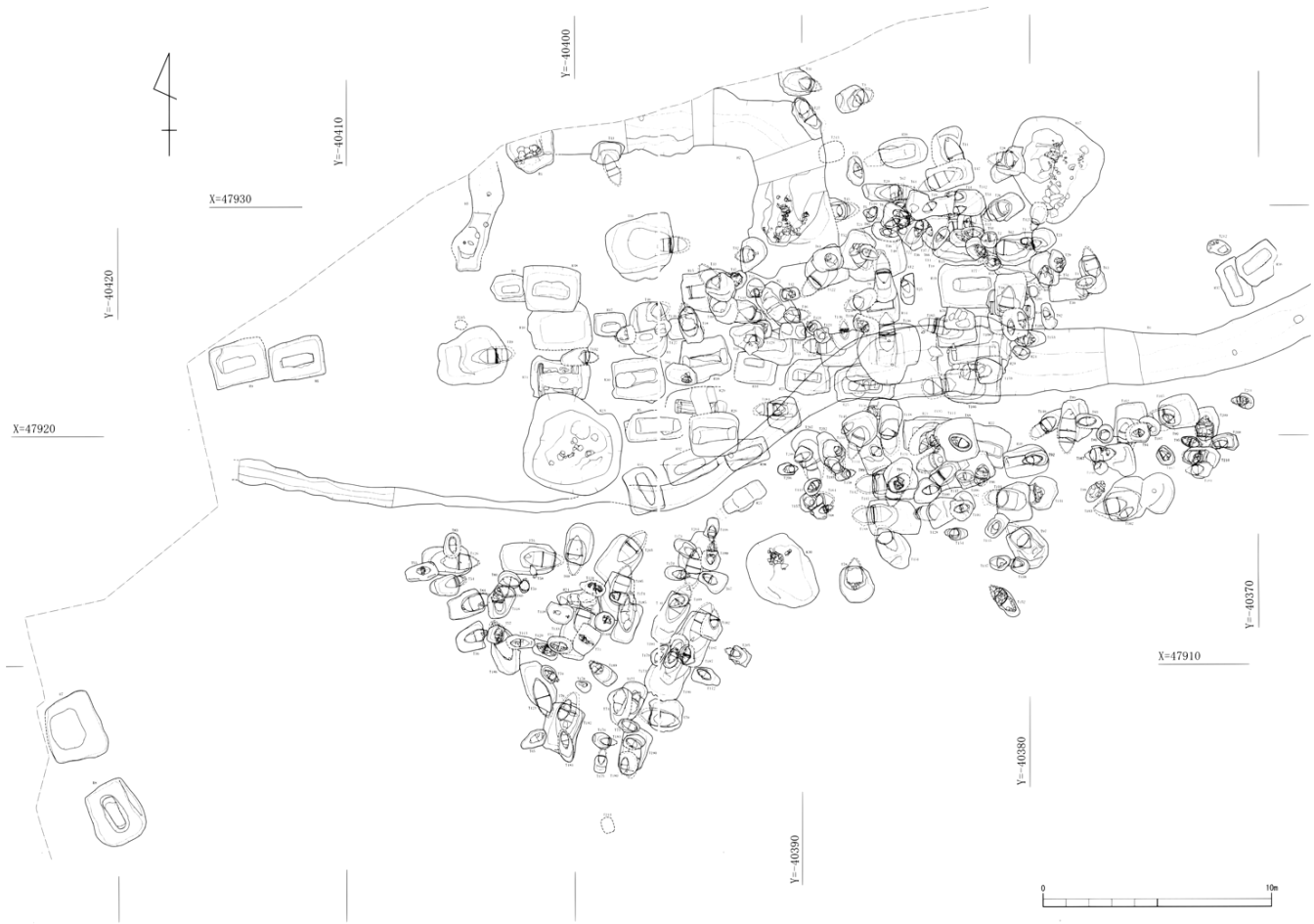


Figure 5.23: Yokoguma kitsunezuka 7 site map NE sector showing graves excavated. After supplemental map 2 in Ogōri City Board of Education (2010) adapted by JAW.

Chapter 6 – METHODOLOGY

6.1 OVERVIEW

The main focus of this thesis was to begin to explore in a more thorough and systematic fashion the ways in which evidence of skeletal trauma can help to elucidate the roles of violence and, potentially, warfare during the Late–Final Jōmon and Yayoi periods in the southwestern Japanese archipelago. The main challenge creating the basic dataset necessary to begin to explore this question was that there was a lack of studies dedicated to looking for skeletal trauma across sites and periods. Site report researchers, methodologies, and project aims vary considerably, especially over the course of time, and skeletal trauma can be easy to miss if one is not looking for it. Hence, the primary methodological aim of the study was to lay the framework for better quantifying exactly how many and how well preserved each examined skeleton was and what skeletal trauma potentially caused by violent conflict was present.

In order to be consistent with the analyses carried out by RJS and IB on the larger Jōmon sample and to help ensure that differences in methodologies between site reports did not skew the data, age-at-death and sex were re-evaluated for each individual upon examination. Previous studies have examined stature and indicators of systemic stress patterns, as discussed in Chapter 5, at many of these sites and site reports also regularly include estimated stature. Therefore, these were not a primary focus of this study.

Spatial analyses were carried out in two capacities to assist analyses in this study, firstly to aid in creating distribution maps of sites and secondly to use a 3D model of the human body as a map to analyse preservation data and to record the traumatic injuries. The use of the 3D model provides not only an improvement over projecting complex trauma onto a planar surface, but allowed quick compilation, overlaying, and querying of the database.

6.2 OSTEOLOGICAL ANALYSES

6.2.1 Sex and Age-at-Death

Sex and age estimations for all skeletons analysed have previously been reported in summary catalogues (ex. Kyushu University School of Medicine 1988) and site reports. Age profiles were broken up into different categories at times and these differ from the age categories used in this study, outlined in *Standards for Data Collection from Human Skeletal Remains* (Buikstra et al. 1994). Hence, age and sex estimations were reassessed by the author to ensure accuracy and consistency. Sex, [male (M), probably male (M?), female (F), probable female (F?), or indeterminate (I)] was estimated using the methods outlined in *Standards* (Buikstra et al. 1994). Estimations were made based on morphological characteristics of the os coxae and skull. For the os coxae, estimations based on greater sciatic notch morphology were more common than those made using the subpubic region (with an overall preservation of ~32% in the Yayoi sample, see Ch. 8.1 for more details) since it is a more fragile area and does not preserve as well. Morphological features of the skull used to estimate sex included the nuchal crest, supra-orbital margins, supra-orbital ridge, and mental eminence. The mastoid process was examined as well, but in most cases this was found to be the least sexually dimorphic of features in the Jōmon and Yayoi populations.

Estimation of age-at-death, when all of the necessary elements were present, was evaluated by examination of dental wear and the auricular surface in individuals with fully fused bones. Therefore, there may be some differentiation in the age group assigned in this study compared to those previously published. In order to be consistent with the methods employed by RJS and IB, tooth wear was used as one of the aging methods in this study. Due to their inorganic composition, dental enamel in particular tends to preserve well in the archaeological record even when bone is more degraded. Hence, examination of tooth wear resulting from abrasion of the occlusal surfaces of the dentition can be a useful way of evaluating the relative age of individuals in a group. Although there are a number of factors

which can influence dental occlusal surface wear, such as the use of teeth as tools, different diets among the sexes, type of diet, and so on (Clement and Hillson 2012; Molnar 1971; B. H. Smith 1984), it is nevertheless a cumulative process over the course of one's life. If the factors which influence it are relatively stable throughout a person's life within a particular community, then it follows that a majority of individuals of greater age will demonstrate greater occlusal wear than their younger counterparts. Molars, in particular, are useful for beginning to estimate age at death categories, as M1 erupts around 6 years, M2 around 12 years, and M3 around 18 years of age and as molars were not extracted as a part of the common ritual tooth ablation practices. Hence, wear on M1 will be greater than wear on M3, representing approximately 13–14 more years of wear (Brothwell 1972; Miles 1962).

In this study, occlusal wear for each individual's left lower molars (M1–M3), upper and lower premolars (3 and 4), and upper incisors and canines were recorded when present. General descriptions of the dentition were made and a wear stage (following Smith (1984)'s eight wear stage categories) were noted. Smith's system was used as it was simple to implement and similar to the methods employed by RJS and IB. If the left dentition was not present or well enough preserved to record, then the right wear stage was recorded. Moreover, if the left and right wear patterns were dramatically different, then this was noted as well. This was then used to determine the relative age of the individual within the population, whether they were relatively young, of medium age, or older adults (Miles 1962).

Auricular surfaces of the os coxae tended to be well-preserved enough among the Jōmon and Yayoi sample to use for age estimation as well and to provide an additional check against the estimated dental age. The method used was that developed by Igarashi and colleagues (2005) as its reference sample was comprised of 700 modern Japanese individuals (see also Ost 2022). If the age estimation found via the two methods differed significantly, this uncertainty was noted. Finally, although examination of subadults was not the primary aim of this thesis, age estimation of children and adolescents was carried out via examination of epiphyseal fusion

and the timing of dental eruption (Buikstra et al. 1994; Ubelaker 1999). When applicable and when preservation allowed, non- or partial fusion of skeletal elements which fuse into adulthood, such as the sacrum and clavicle, were noted and employed to inform on the age-at-death.

It should be noted that the goal of these age estimation techniques was not to tie the individual to an exact chronological age, but rather to provide details about their age profile within the population at large (i.e. are younger or older individuals showing a higher prevalence of potentially fatal injuries). Nevertheless, in the case of children and adolescents, more detailed age estimations were provided based on dental development and bone fusion. Finally, it should be noted that it has been posited that trauma is cumulative with age, yet it has also been found in the anthropological and forensic literature that individuals with trauma are also more likely to die earlier (Boldsen et al. 2015; Eriksson et al. 2016; Mitchell et al. 2017).

6.2.2 Condition of Skeletal Remains and Effect on Trauma Quantification

Trauma analysis in archaeological assemblages is often a matter of weighing likelihoods and, usually, lacks a control group to account for the uncertainties which affect the identification of trauma by the examiner (see discussion in Chapter 1.1.3; Figure 6.1).

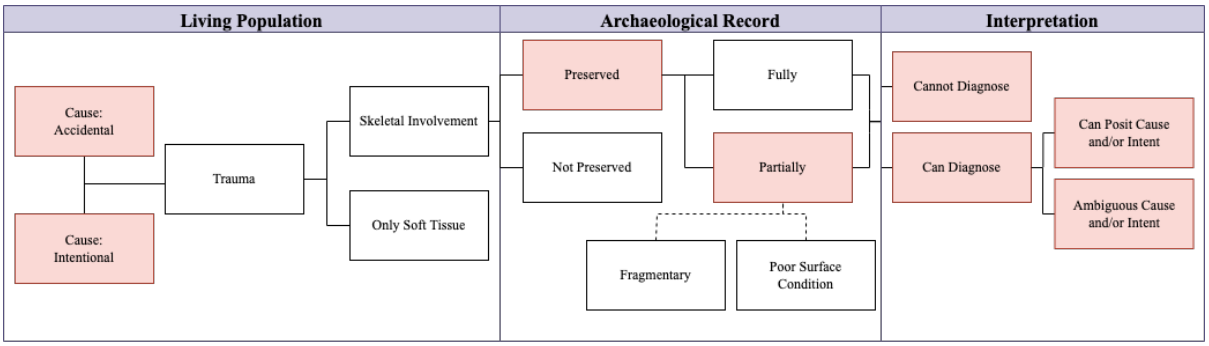


Figure 6.1: Flowchart of processes which influence a robust identification of trauma. Boxes in red are those which introduce uncertainty.

Analysis of skeletal trauma depends on having sufficiently well-preserved remains for examination in order to identify potential traumatic lesions, when the trauma occurred, and the

potential cause. The better preserved an assemblage is, the more likely it is to yield evidence of trauma and will therefore skew results if simply combining prevalence data from well and poorly preserved remains (Robb 1997). Many studies exclude skeletal elements that are less than 75% complete from analysis in order to not over or under-represent the prevalence of trauma (Bennike 1985:56–59; Fibiger et al. 2013; Margaret A. Judd 2002a). Robb (1997:131–134) used the skeletal trauma prevalence for region of the body examined for trauma that were at least 50% complete, but then also used this to estimate what a 'lowest-common-denominator' of the prevalence of trauma might be. An alternative approach is to create 'composite' crania by combining two fragmentary halves when the preservation is poor to assess patterns of injuries (Schulting and Wysocki (2005).

Additionally, studies may further attempt to account for completeness or preservation bias by calculating the rate of trauma by element (with a particular cut-off for preservation; 'true prevalence') rather than by individuals ('crude prevalence') (Fibiger et al. 2013). An early example of the former can be found in Lovejoy and Heiple's work, which calculated the fracture rates for only complete elements (i.e. the percent of total fractured bones out of total bones observed) (1981). Recording of trauma by segment has consistently been encouraged (Buikstra et al. 1994; C. Roberts 2000), but a definitive strategy for deciding which segment or the cut-off for completeness of a segment is a matter of interpretation (Margaret A. Judd 2002a). Moreover, 'True' prevalence is a misnomer; of course this prevalence rate is still at its essence an estimation, not a certainty. Evaluating trauma by element also disassociates analysis from the level of the *individual*, a level of interpretation that archaeologists are ultimately interested in, particularly as it aids in comparative studies and in regards to life history approaches (Shennan and Sear 2021).

Walker (1997) accounted for fragmentary preservation by calculating the 'Effective Number of People' for the nasal area and cranial vault of his sample, based on the preservation of each region. The method employed by Walker is the closest to that used in this study.

Nevertheless, Walker's completeness estimates do not taking into account the different sizes and surface areas of each bone.

The approach taken in this thesis aims to more accurately depict the nature of the data itself, or trauma on variably preserved and complete skeletons. Therefore, the completeness of the elements examined was recorded and taken into account in numerical summaries and statistical analyses. Rather than constraining the analysis to individuals that are arbitrarily judged to be sufficiently 'complete', each skull and/or postcranial skeleton is weighted by how complete they are. Therefore, the values per site, demographic group, and time period better summarise the incidences of trauma without overestimating its prevalence in more complete groups. A zonation method (Knüsel and Outram 2004) was used to record completeness, allowing for the data to be calculated at both coarser and finer scales. The aim was to create a framework where the data can be manipulated at various resolutions and which better accounts for inherent biases in calculating prevalence of traumatic injuries, at least when it comes to preservation. Details on how the zonation method was used to estimate completeness are discussed later in this chapter (6.3.2.1).

6.2.2.1 Recording Surface Condition

Poor surface condition of skeletal remains can preclude the possibility of confidently diagnosing trauma. Unfortunately, descriptions or scores of surface area preservation are not systematically provided in the osteological reports of the collections examined. Therefore, a score of the overall condition of the skeleton was assigned to each individual in this study, which is outlined in Table 6.1

The scoring system used in this study was developed with the identification of traumatic injuries in mind and is coarser than McKinley's 2004 scoring system for recording erosion and abrasion of human bone. McKinley encourages recording the condition of each bone fragment, as preservation can be quite variable within one individual. Nevertheless, such a detailed

recording of surface condition would be cumbersome when dealing with large assemblages. Instead, an overall score was assigned, which is a less precise but still informative approach. Each skeleton was given a score of 1, 2, or 3 (Table 6.1). Intermediate scores were also recorded (i.e. 1.5 or 2.5).

Table 6.1: Surface condition scoring method and how it correlates to McKinley's scoring system. 'SFT' refers to sharp force trauma and 'BFT' refers to blunt force trauma. Photos taken by JA White, courtesy of Kyushu University Museum (left), Kyoto University (middle), and the Okayama City Maizo Bunkazai Centre (right).

1: Good Condition Can see SFT and BFT	**2: Fair Condition** Difficult to see shallow SFT	**3: Poor Condition** Difficult to see small depressed fractures
		
Tsukumo 24	*Mitsunagata 5*	*Minamikata SK1789*
Correlation with McKinley's 2004 Scoring System		
Grade 0–1	Grade 2–3	Grade 4–5+

Unlike with the completeness data, this is not mathematically incorporated into the final prevalence values as it cannot be as easily quantified per individual. Instead, the surface condition scores were used as a preliminary indicator of how well the analysis could be carried out. If the surface condition is 3 or 'Poor' condition, confidently identifying traumatic lesions is not likely possible. Therefore, skeletons analysed were all in Good to Fair condition (1–2.5).

6.2.2.2 Examined Areas and Limitations

Completeness was recorded differently for the Jōmon and Yayoi remains. For the Jōmon, only the larger bones of the skull and ulnae were recorded. For the Yayoi, the

completeness of almost the entire skeleton, not including the internal bones on the crania and the dentition, was systematically recorded. The rest of the Jōmon skeletons were examined for evidence of projectile trauma, but the completeness was not recorded, based on the recording strategies already implemented by RS for the Jōmon. Differential recording strategies were implemented in order to prioritise the bones most likely impacted by violent trauma per cultural period, given the limited time available for analysis (see Chapter 1.1.3 for a discussion on why these reflect inherent constraints in the archaeological data; see also Figure 6.1). Not only are the Jōmon and Yayoi differentiated by subsistence lifeways and the specialised tools associated with them, but also by the use and production of metal tools and weaponry. Therefore, the kind of trauma to be expected and reported previously is distinctive.

Given the likelihood of violent trauma to be concentrated on the skull and ulnae (Redfern and Roberts 2019), recording of completeness and examination of trauma to these regions was prioritised for the Jōmon remains. The entirety of the skeleton was also examined for evidence of projectile trauma as well, but this is more likely to have been reported previously. Embedded projectiles are especially more likely to have been recorded as part of the general osteological observations covered in the skeletal reports.

Certain areas of the body are more likely to be targeted in violent conflict. Clinical studies cannot be used as direct correlates to archaeological populations; nevertheless, they do provide an indicator of the likelihood of patterns of trauma in a population. In particular, it has been found that trauma of the cranial vault and maxillofacial region in adults is more likely to result from violence than falls or other accidental trauma (Brink et al. 1998; Hussain et al. 1994). When discriminating between whether a depressed cranial fracture was caused by a fall or blow, the ‘hat brim line’ (HBL) rule has been applied at times, particularly in the German and English literature. Although the definition varies slightly between these two traditions, generally the rule states that injuries that occur above the HBL, or the area of maximum circumference, of the skull are more likely to have resulted from a blow and those below are

more likely to result from a fall if the induvial was standing and fell from their height onto flat floor without intermediate objects (Ehrlich and Maxeiner 2002; Kremer et al. 2008). Kremer et al. (2008) further argue that this should be paired with an analysis of the lateralisation of the injuries. Yet, further studies have continued to find that simplistic application of this rule cannot be applied. Instead, an analysis of the biomechanics of the force behind the blow, the presence of other injuries, and their patterning within a group is necessary (Bruno et al. 2014; Fracasso et al. 2011; Guyomarc'h et al. 2010; Kranioti 2015; Lefévre et al. 2015; Ta'ala et al. 2006). It should also be kept in mind that these cases are restricted to modern circumstances and that the patterns of trauma, particularly, for homicide cases might not fully represent the range and aims of diverse prehistoric violence.

In a martial sense, targeting the head in a conflict is reasonable whether one is trying to stun, disable, or kill their opponent. It is a bed of vital and vulnerable tissues and any significant damage to them can yield an immediate and advantageous turn in conflict. The face is also in many ways the most recognisable and distinctive part of a person and might be targeted for this reason, such as in cases of headhunting or fracturing of the maxillofacial bones (Armit 2006; Berrios and Grady 1991; Walker 2001). Conversely, postcranial blunt force fractures are harder to conclusively relate to violent rather than accidental causality, but fractures to the torso (ribs and scapula) and forearm, including the hands, are more likely to be effected in violent encounters in some cultural contexts (Brickley and Smith 2006; Walker 1997).

Notably, transverse fractures to the diaphysis of the ulnae have been argued to be more closely tied to violent encounters, since it is common to guard with the arms against an incoming blow. Of course, this is not the only way that the ulnae can be fractured, and fractures to the diaphysis of the ulnae can also accompany more severe fractures to the radii, often resulting from trying to brace a fall with the hands (Byard and Simpson 2005; Margaret A. Judd 2008; Lovell 1997; M. O. Smith 1996). Ulnar fractures to the medial or distal diaphysis were dismissed from analyses if associated with radial fractures, but are described in Catalogue II.

Contrary to the Jōmon, from early in its inception, the Yayoi culture was accompanied by metal weaponry and tool use. Sharp force trauma (SFT) from bladed weapons have previously been noted as becoming much more prevalent during this period (see discussion in Chapter 3.4.1.2). Therefore, it is more likely that linear marks to the postcrania would yield information about violent trauma since it is less likely that a cut (laceration) would be the result of an accident compared to a fracture in the same location. Of course, SFT or projectile trauma can be the result of accidents, but the likelihood of these injuries being consistently and repeatedly the result of accidents is not likely. Therefore, the entirity Yayoi skeletons were examined for evidence of trauma, and the completeness was recorded for all but the smaller and internal bones of the crania (ethmoids vomer, palatine, nasal conchae, and lacrimal bones) and the dentition. The completeness of the smaller, internal bones of the crania were not recorded because they were less likely to be preserved given their small size and fragility. Dentition was generally recorded as a part of the dental attrition recorded, but the percent completeness of each tooth present was not recorded in the interest of time. Dental fracturing is possible and has been noted in clinical and archaeological reports of trauma, but cannot as easily be linked to intentional violence on its own (Muelleman et al. 1996). When dental fracturing was present, it was noted and discussed accordingly. The feet were recorded for completeness, but it is recognised that it is unlikely that they would show evidence of violent trauma, unless the individual was defending themselves while on their back, which has been noted particularly in cases of sexual assault against females (Spitz et al. 2006).

6.2.2.3 Recording Completeness

The Jōmon data housed at Kyoto University, as mentioned in the previous chapter, was collected by three researchers and intended to be used in their distinctive projects, of which RS's had already begun before the inception of this thesis. Therefore, the completeness recording zones vary between the Jōmon and Yayoi individuals as the aims and methods of the

projects differed. Nevertheless, the aim was to make these recording strategies and those used previously as comparable to each other and other studies as possible by making them scalable.

The recording zones for the Jōmon skulls are displayed in Figure 6.2. The ulnae were given a completeness score in tenths when present and recorded by JAW. In order to systematically account for the preservation of the skeletal elements in the Yayoi remains, Knūsel and Outram's 2004 zonation method of skeletal elements was used (Figure 6.3). The only differences between the Jōmon and the Yayoi recording of the skull is that the occipital is split into left and right zones for the Jōmon (instead of being treated as one bone) and the mandible is split into left and right (instead of fourteen zones) for the Jōmon and the sphenoid is not recorded as it is in the Yayoi. Therefore, when comparing the Jōmon to Yayoi, the sphenoid has been ignored; as it would be unlikely that the sphenoid would be solely impacted, this should not introduce any bias. The zones that differed between the two samples were averaged when necessary for comparison (ex. the values for the left and right side of the occipital for the Jōmon). Additionally, the zones were measured in tenths (units of ten out of 100%.), whereas the Yayoi zones were recorded in thirds (i.e. if less than 1/3 was present, at least 1/3 of the zone is present, 2/3 are present, or fully complete) as many more zones were recorded in total. In order to ensure that the comparisons between the two datasets were not compounded by these factors, the Jōmon completeness values were converted to thirds and the Yayoi values (excluding the sphenoid as this was not recorded for the Jōmon) were only compared to the Jōmon cranial data.

Because bones could not always be assigned a specific zone on the skeleton or if doing so was of too great a use of limited time in the field, then certain groups of zones were recorded in bulk. For instances, fragmentary vertebrae might be recorded as 'three 2/3 complete cervical bodies (zone 1)'. Therefore, these zones recorded in bulk, especially fragmentary ribs or vertebrae or phalanges, are visually underrepresented in the results sections, but are fully taken into account in numerical summaries.

There are inherent biases with using a zonation method to record and quantify preservation. The estimates produced will be prone to inter-observer bias and, as has frequently been discussed in zooarchaeological studies, it does not account for any overlap between the zones (Marean et al. 2001). The latter is less of an issue in this study as it is not dealing with the identification of the minimum number of individuals (MNI) in highly fragmentary assemblages. For both periods of analysis, the main burial rite includes single internments. There are some multiple burials, but identifying the MNI in cases where preservation is adequate is usually relatively straightforward. Where preservation is poor and there is high fragmentation, trauma is less likely to be recorded, and hence such cases were largely excluded from analysis. Hence, recording by zones provides a relatively quick and easy way of quantifying the completeness of the skeletal remains. This particular zonation method was chosen as it ensures that all of the major elements of the bones examined were evaluated.

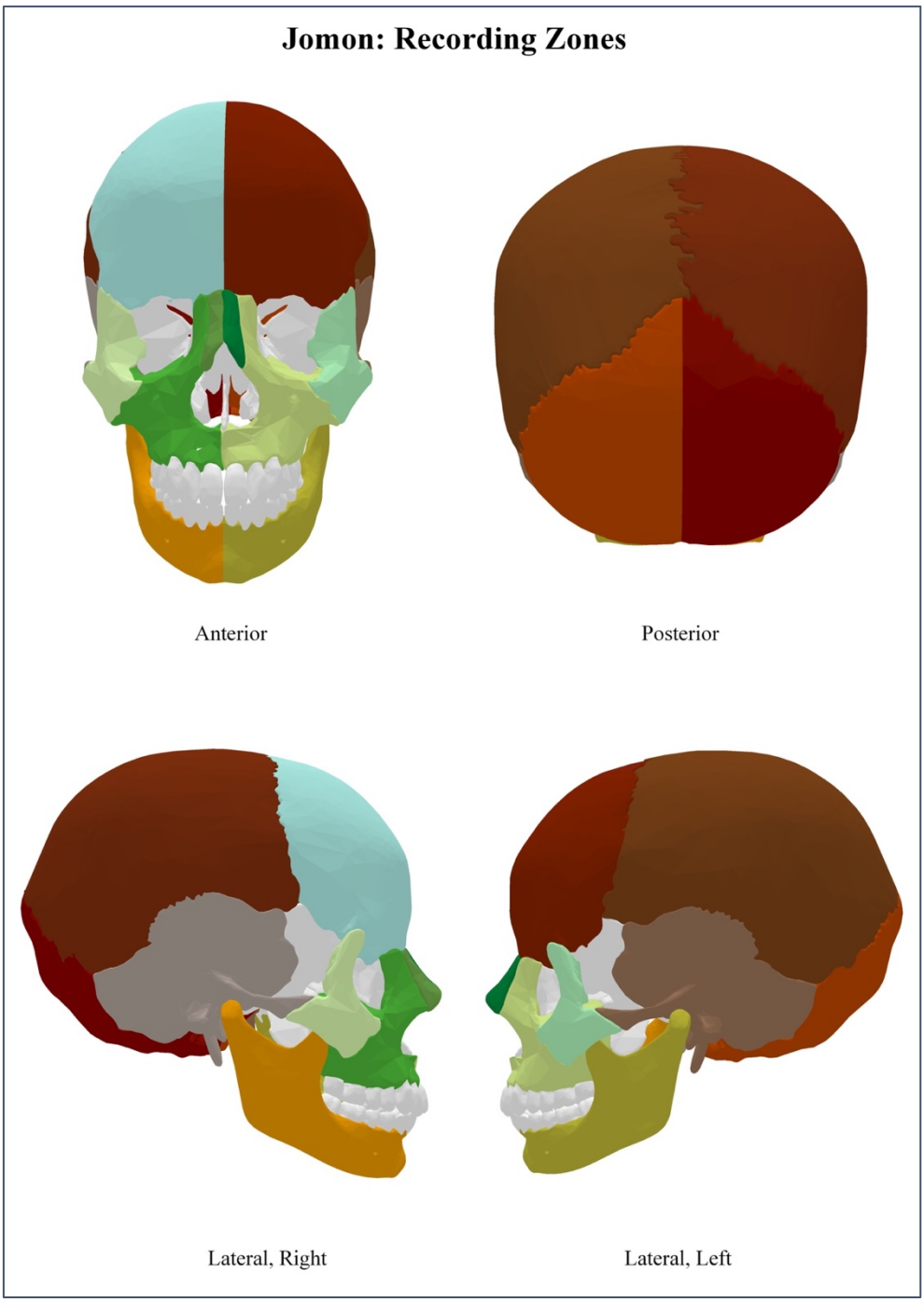


Figure 6.2: 3D representation of the zones recorded for the Jōmon individuals. See 6.3.2 for details on the 3D model and its production. Bones shown in white, including the dentition, were not recorded for completeness which were generally recorded.

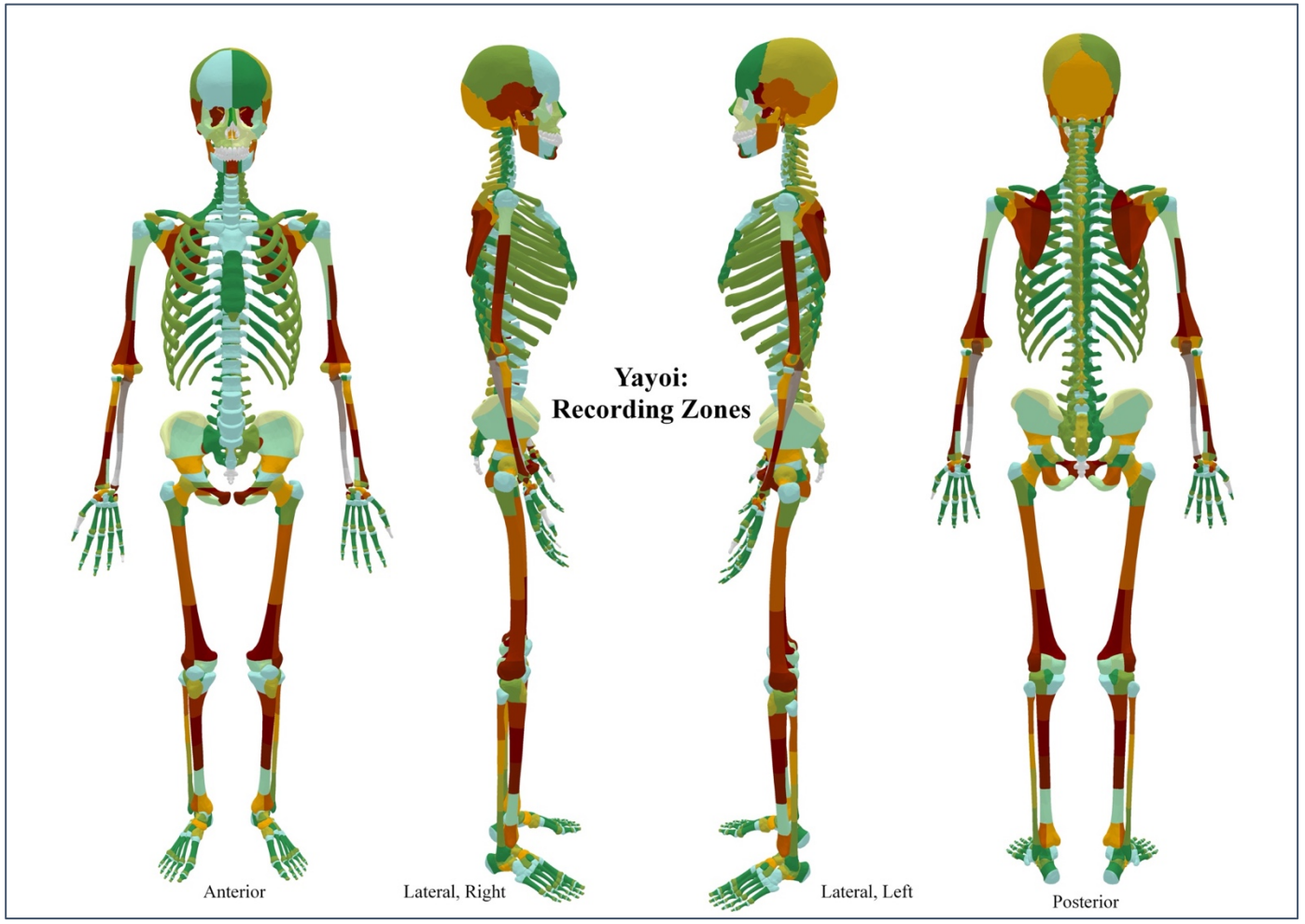


Figure 6.3: 3D representation of the zones recorded for the Yayoi individuals (Knüsel and Outram 2004). See 6.3.2 for details on the 3D model and its production. Bones shown in white, including the dentition, were not recorded for completeness which were generally recorded. Note that the models of the right proximal first, right distal fifth, and left distal first phalanx were not closed features , meaning that at this point they could not be broken up into zones.

6.2.3 Violent Trauma

Trauma is a "physical wound or injury" (E. Martin 2015) caused by 1) movement outside of the normal physiological range and 2) bearing loads greater than the physiological resistance, resulting in a failure of the structure (Bierry and Ehlinger 2020; Court-Brown et al. 2015). The causal force or material may be direct (such as crushing or stab injuries) or indirect (such as shoulder dislocation after impact from a fall) (Bierry and Ehlinger 2020; Lovell 1997; Redfern and Roberts 2019). Bone is an plastic material, and will fail, beginning with microcracking, either deforming or fracturing, under tensile stress more than compressive stress (Berryman and Haun 1996; Currey 1970; Johnson 1985; Shipman et al. 1986; Symes et al. 2012; Zephro and Galloway 2014). Types of trauma affecting the skeleton largely fall into fractures, understood in its broadest sense to apply to any discontinuity of the bone (Hamblen and Simpson 2007), and dislocations/subluxations (Bennike 2008; Lovell 1997; Mays 2010; Ortner 2003a; Waldron 2009).

Fractures, discontinuities in skeletal tissue, are 'complete' when the injured bone is broken into distinct parts. Common incomplete fractures include depressed and greenstick fractures. Additionally, fractures are 'compound' when the wound is open and more susceptible to infection or 'simple' when the wound is closed with unbroken skin. Basic forces (compression, tension, torsion, shear, and bending) exerted on bone lead to predictable fracture patterns. Fractures resulting from sudden, overwhelming force are the most common, but continued stress over time may also result in fatigue or stress fractures. Pathological fractures results from already compromised bone (due to conditions such as neoplasm, cysts, brittle bones, infection, and so on) failing under everyday levels of force (Aufderheide and Rodríguez-Martín 1998; Bennike 2008; Court-Brown et al. 2015; Galloway et al. 2014a; Gozna 1982; Lovell 1997; Mays 2010; Redfern and Roberts 2019; Tencer 2006). See Table 6.2 for a summary of fracture types and associated forces (after Court-Brown et al. 2015; Lovell 1997; Redfern and Roberts 2019), but note that there are multiple fracture classification schemes,

many of which are particular to specific bones (Court-Brown et al. 2015). As a discontinuity in the bone, sharp force trauma can also be considered as a fracture (Hamblen and Simpson 2007).

Table 6.2: Description of injury mechanisms and resulting fracture types after Court-Brown et al. (2015), Lovell (1997), and Redfern and Roberts (2019).

Injury Mechanism	Fracture Type
Direct	***Penetrating***: Partial or complete penetration of bone cortex
	Comminuted: Bone is broken into 2+ pieces
	Transverse: Force applied in a line perpendicular to long axis of the bone (margins may be stepped due to tensile failure)
	Crush: 1) *depression*: crush to one side of bone; 2) *compression:* crushing to both sides; 3) *pressure:* force applied to growing bones
Indirect	***Spiral***: rotational and longitudinal stress on the long axis
	Oblique: Rotational and angular stress on long axis
	Torus; greenstick: Bending of the bone due to longitudinal compression; common in children (incomplete fractures)
	Impacted: Bone ends are driven into each other
	Burst: Found in the spine due to vertical compression
	Comminuted: Force splits in several directions and forms a ‘‘T’’or ‘‘Y’’shape
	Avulsion: Fracture due to tension at ligament or tendon attachment
Stress	Due to repetitive force, usually perpendicular to long axis
Pathological	A fracture caused by an underlying disease state (e.g., Paget’s disease, osteomalacia, or osteoporosis)

There is little agreement in the palaeopathological literature on how to categorise trauma, but most contain some permutation of fractures (traumatic and pathological), weapon injuries (sharp force and projectile), and dislocations with a variable inclusion of dental trauma, parturition, body modifications, myositis ossificans, scalping, Harris lines, and surgery (including trepanation) (cf. Margaret A. Judd and Redfern 2016:360–361). Those that focus on intentionally inflicted injuries focus on trauma which is most likely related to violence .

Forensic classifications of trauma, coined by Werner Spitz, are useful when describing violent or intentionally inflicted skeletal trauma and will be applied in this thesis (Spitz et al.

2006). These have been mentioned previously in this study and include blunt force trauma (BFT), sharp force trauma (SFT), and projectile trauma. BFT is caused by a blunt object impacting the bone at a low velocity and SFT by a sharp object impacting the bone, which can result in a variety of linear marks, including incisions or cuts, stabs, and cleft or chop marks (Fernández-Jalvo and Andrews 2016; Loe 2017; Symes et al. 2012). Additionally, intermediate injuries known as 'semi-sharp' force trauma were distinguished, such as that caused by a stone axe, which can combine features of blunt and sharp force trauma (Dettmeyer et al. 2014; Schulting and Bradley 2013; Wahl and Trautmann 2012). As it is not always clear from the wound morphology in archaeological collections whether a hole in the bone created via trauma is due to a projectile (involving an object (arrow, spear, etc) propelled through the area via some force) or due to the tip of a sharp weapon (such as a sword, dagger, or halberd) puncturing the bone. Therefore, the term 'penetrating[6] trauma' was used as a catch-all to describe traumatic holes in the bone that may be consistent with projectile trauma or that may be something closer to puncture marks.

The biomechanics of how bone responds to external force varies depending on the properties of the particular bone, including density and contour, and on the properties and velocity of the force. While taking into account how these two variables interact with each other, at times it is possible to determine the nature of the blow or assault and the manner of implement used to carry it out. Although, this must be done with caution in skeletal material

[6] This is not to be confused with the clinical definition of penetrating trauma (when a foreign object pierces the skin and creates an open wound), which includes stab wounds (Lotfollahzadeh and Burns 2022; Velmahos et al. 2017; Waes et al. 2013). This distinction was made in order to create a category of the *skeletal* trauma without splitting up injuries that assuredly were caused by projectiles (i.e. wounds with embedded arrowheads) and injuries that may represent projectile wounds (as illustrated by traumatic holes in the bone) but may also represent puncture wounds, injuries that formed due to a concentrated force over a small area of bone, (Lovell 1997; Symes et al. 2012) created with the tips of weapons such as swords and halberds. This was done to avoid introducing unwarranted confidence in the causal method of an injury.

especially, as the soft tissue is what usually provides the most information in helping to identify a possible weapon used (Court-Brown et al. 2015; Spitz et al. 2006).

6.2.3.1 Timing and Characteristics of an Injury

Fracture repair mimics the process of skeletal growth through a combination of endochondral ossification, when cartilage is replaced by bone, and intramembranous healing, when bone is directly deposited, processes. Macroscopic healing of bone fractures via endochondral ossification, which is primarily relevant to unstable fractures, involves three main phases: 1. hematoma formation and inflammation; 2. soft and hard callus formation, which provides stability; and 3. remodelling during which the bone heals as near to its previous state as possible. This occurs more quickly and so thoroughly in children that it can be difficult to identify past fractures (Court-Brown et al. 2015; Ortner 2003a; Shantz et al. 2015; Symes et al. 2012).

Identifying trauma involves identifying discontinuities in the skeletal tissue or remodelled bone characteristic of an injury. Yet, one of the more contentious aspects of characterizing an injury is determining whether the injury occurred before (*antemortem*), around (*perimortem*), or after (*postmortem*) a person's death. If an individual lived long enough to have an osseous response to the injury, then the injury is classified as 'antemortem'. The earliest signs of healing include rounding of fracture edges, macroscopic polishing, and pitting (Barbian and Sledzik 2008; Galloway et al. 2014b; Maples 1986). This does not preclude the possibility that an individual could die from complication of the injury, simply that they lived long enough after the event at which the injury was acquired to have an osseous response. Nevertheless, precisely how long it takes for new bone formation to be visible on a macroscopic and/or microscopic level is highly debatable. Estimates range from approximately seven to ten days to at least two weeks and is highly dependent on the health and age of the individual (Aufderheide and Rodríguez-Martín 1998; Barbian and Sledzik 2008; Chege et al. 1996;

Maples 1986; Sauer 1998; Wieberg and Wescott 2008). 'Perimortem' trauma refers to lesions that are consistent with injury to living (wet) bone, which behaves in a ductile manner, and show no sign of healing. This could be because the individual died before having an osseous response or the injury occurred close to the time of death, when the bone may display characteristics of 'wet' or fresh bone fracturing. This is because damage has occurred before the bone collagen has degraded enough, resulting in a harder and more brittle material, and before significant moisture loss to alter how well the bone can withstand stress. Perimortem fracturing is marked by obtuse or acute fracture angles and smooth fracture edges. 'Postmortem' damage are is not characteristic of fresh-bone fracturing and/or is not patinated (i.e. not have the same colour as the surrounding bone) (Galloway et al. 2014b; Johnson 1985; Moraitis and Spiliopoulou 2006; Moraitis et al. 2009; Ubelaker 2015; Wieberg and Wescott 2008). The problems surrounding the 'perimortem interval' have led some to suggest that the categorisation of post- and perimortem trauma be overhauled, proposing that trauma instead be described as being typical of 'fresh' or 'dry' bone *within* a post- or perimortem context. This would provide more clarity in terms of describing whether trauma occurred before or after death (when this can be determined) (Steadman 2022; Wieberg and Wescott 2008). Nevertheless, the classification scheme of ante-, peri-, and postmortem was maintained as determination of the time of death is not possible in the archaeological context and as it is most consistent with other studies.

Perimortem and postmortem trauma potentially related to scavenging, trampling, and other taphonomic conditions was evaluated critically. For instance, terrestrial carnivore scavenging patterns and characteristics (such as fractures, gouges, disarticulation, U-shaped and shallow linear marks, scooped edges, notches, pits, punctures, and rounding of bone edges) were identified when present and distinguished from trauma related to violent intent even if these showed evidence of occurring during the perimortem interval (Fernández-Jalvo and Andrews 2016; Johnson 1985; Sorg 2019; Ubelaker 1997). Additionally, linear marks resulting

from trampling activity can obfuscate interpretation. These tend to be clusters of shallow linear marks oriented in different directions, but they can show similar characteristics to injuries caused by stone tools (Fernández-Jalvo and Andrews 2016; Noe-Nygaard 1989). Therefore, linear marks were critically evaluated in light of this when found.

6.2.3.2 Distinguishing Trauma and Differential Diagnosis

Unlike in a clinical setting, it is not possible to rely on any soft tissue damage or reported pain and impaired movement. Hence, in an anthropological setting it is necessary to rely on the degree and pattern of injury (Hamblen and Simpson 2007; Wedel and Galloway 2014). Differential diagnoses of all traumatic injuries were carried out (described as needed in Catalogue II), resulting in the two-tier confidence scores discussed in the following section (Lawler 2017). In all cases, the skeleton was examined, for evidence of traumatic lesions and conditions possibly related to them (i.e. osteoporosis, dispersed injuries related to the same event, etc.). Potential traumatic lesions were evaluated in comparison to normal skeletal variation or other pathologies that can be confused with trauma as well (Bennike 2008; Corron et al. 2017; Klaus and Lynnerup 2019; Köhler and Wilk 1968; Moraitis and Spiliopoulou 2006; Ortner 2003b; Rodríguez-Martín 2006). When describing any pathological traits an effort was made to adhere to standard nomenclature (Manchester et al. 2016).

6.2.3.2.1 Blunt Force Trauma: Characteristics

Constraining the discussion to blunt force fractures more likely to be related to violent conflict (as discussed in Sections 1.1.3 and 6.2.2.2), blunt force trauma to the crania is discussed in more detail herein. The sequence of these fractures has been defined as 1) skull indentation without fracture; 2) inner table fracture; 3) both outer and inner table fracture; 4) depressed fracture with localized comminution; and 5) outer table crushed into diploe (Gordon et al. 1988 in Aufderheide and Rodríguez-Martín 1998). Features consistent with this kind of injury

include adhering bone fragments on the edges of the injury (due to the elastic nature of wet bone), concentric or radiating (stellate or linear) fractures, bevelling or flaking on the inner table, and, possibly, a *contrecoup* fracture on the other side of the cranium (Aufderheide and Rodríguez-Martín 1998; Bennike 2008; Berryman and Haun 1996; Gurdjian et al. 1950; Novak 2007; Schulting and Wyoscki 2005). Perimortem fractures to the crania tend to have oblique angles, rather than right angles, at their margins. Bevelling and, overall, larger fragments are also characteristic features of perimortem cranial trauma (Bennike 2008; Buikstra and Ubelaker 1994; Schulting and Wyoscki 2005; Spitz et al. 2006). So-called 'depressed' fractures to the crania, a type of crush (comminuted) fracture, are caused by larger objects impacting at a low velocity on a head not resting on a surface (Ruchonnet et al. 2019). A concave depressed fracture to the outer table has been noted to be the most common cranial injury found in palaeopathology. When fractured, the sharp inner table may lacerate the brain, which can result in haemorrhage, seizures, infection (Aufderheide and Rodríguez-Martín 1998).

When differentiating whether a lesion was traumatic, cranial anomalies were considered, including retained mendosal sutures, scaphocephaly, bilateral parietal thinning, bilateral enlarged parietal foramina, meningoceles, and dermoid cysts (E. Barnes 2008; Camp and Nash 1944; Ortner 2003b). Hence, the diagnosis of depressed cranial fractures were subject to additional restrictions in order to ensure that blunt force injuries were not confused with other conditions. In Catalogue II, care was taken to describe the presence or absence of biparietal thinning or enlarged foramina as were descriptions of the margins and shape of the lesions, as lytic lesions tend to have more scalloped and irregular margins (E. Barnes 2008; Camp and Nash 1944; Ortner 2003b). Lesions less than 5 mm in diameter and more shallow than 0.5 mm in depth were not considered traumatic in aetiology (Köhler and Wilk 1968; Krakowka 2017; Loe 2017; Standen and Arriaza 2000). Although the exact cut-offs are arbitrary, these criteria were applied to be consistent with other studies and to maintain a conservative approach. It should be note that conditions such as dermoid cysts with associated bone lysis, though rare,

can grow to over 10 cm (Fanous et al. 2014; Hoang et al. 2019; Shah et al. 2012). Care was taken to always check if involvement of the inner table was present when evaluating BFT to the crania, but it should be kept in mind that even if the inner table was not involved, it does not mean that the defect is not traumatic in aetiology, simply that the force might not have been great enough to damage the inner table as well (Standen and Arriaza 2000).

Fractures to the face were also evaluated in this thesis. Clinical studies have consistently shown a link between nasal fractures and interpersonal violence (Bakardjiev and Pechalova 2007; Bataineh 1998; Bonavolonta et al. 2017; Businger et al. 2012; Çil and Kahraman 2013; de la Cova 2010; Hussain et al. 1994; Kyrgidis et al. 2013; J. H. Lee et al. 2010; Roccia et al. 2016; Salentijn et al. 2013; Schneider et al. 2015; Walker 1997). Nasal bones are usually broken distally where they are thinner and isolated fractures of the frontal processes of the maxilla are the most common after nasal fractures (Walker 1997; Wedel and Galloway 2014). Nasal fractures resulting from violence tend to be characterised by low velocity, lateral impact to the bone, often resulting in a resulting lateral deviation of the nasal bones (Magalhães et al. 2020; Murray et al. 1986; Stranc and Robertson 1979). High velocity force is more likely to result in associated fracturing of the ethmoid and orbital bones as well (Fraioli et al. 2008). Stranc and Robertson (1979) classify Stage 1 and 2 nasal fractures to be isolated to said bones, but Stage 3 requires greater force and causes other, associated, facial fractures. These injuries are more difficult to repair and may not allow for a return to the normal nasal profile. Han et al. (2011) have created a more recent classification system of nasal fractures, but this is more useful for radiographic examination. Magalhães et al. recently discussed the lack of standardised recording methods in palaeopathology for nasal fractures and the relatively few studies which report them in detail (2020:106). Although Magalhães and colleagues' paper was published after all data collection for this thesis was completed, a majority of their recommended recording strategies were met – side of fracture and deviation, other facial fractures, and bone

remodelling. Assessment of associated fracturing to the nasal septum is impeded by generally poor preservation of this delicate element.

In previous archaeological studies, fractures to the lower arms, hands, and torso have been found to also be associated with conflict (Brickley and Smith 2006; Brickley 2006; Margaret A. Judd 2002b; Lorentz and Casa 2020; Walker 1997). Consideration was given to the pattern of fractures and how they might relate to conflict or whether they were more likely to result from falls. Fresh bone dynamics characterise perimortem fractures, which are marked by obtuse or acute angles along with smooth and patinated edges, although at times hackle marks (small fissures) may be at times observed on fracture edges (Johnson 1985; Wieberg and Wescott 2008). Early antemortem fractures can be identified by rounding of fracture edges, macroscopic polishing, and pitting, whereas more completely healed fractures may be identified by the presence of a callus (or the formation of one), and remodelled bone. In the case of complications, infection, poor alignment, bone shortening, osteomyelitis, necrosis, and auricular changes may be present (Aufderheide and Rodríguez-Martín 1998; Barbian and Sledzik 2008; Bennike 2008; Galloway et al. 2014b; Maples 1986). Additional fractures were noted in Catalogue II when found in order to be clear as to why they were not being included as Medium–High likelihood violent trauma.

6.2.3.2.2 Sharp Force and Projectile Trauma: Characteristics

Sharp force trauma represents "penetrating wounds that cut, chop, or stab with a sharp edge that slices or cuts tissues" (Ortner 2003b:54). Cut marks are generally considered to be the most easily identifiable trauma on the skeleton and result in incised wounds (or 'kerfs') (Boylston 2000; Symes et al. 2010). They are characterised by linearity, smooth and clean edges, a flat and polished surface, parallel scratch marks (at times), and an opposite margin that is usually more irregular (Bennike 2008; Knüsel 2005). Depending on the directionality and tool employed , linear marks caused by SFT can be further subdivided, into categories such as chop

or scoop, point insertions or notched, saw, and peeling or shaved defects to name a few (Kimmerle and Baraybar 2008). Stab or puncture wounds are deeper than they are wide, but still exhibit polished margins (Spitz et al. 2006). Metal, bladed weapons result in cleaner and smoother linear marks, whereas linear marks created by stone tools or weapons (Figure 6.4). tend to present a rougher appearance, may have shoulder effects, and tend to be wider (Fernández-Jalvo and Andrews 2016; Greenfield 1999). Anthropogenic linear marks tend to present a V-shaped cross-section whereas linear marks produced in the taphonomic environment, such as by scavengers, tend to be U-shaped (Fernández-Jalvo and Andrews 2016; Johnson 1985; Sorg 2019; Ubelaker 1997). The presence of a V-shaped linear mark does not necessarily mean that it was anthropogenic in nature. V-shaped marks can be produced by trampling (Fernández-Jalvo and Andrews 2016) or, even, large animals (White et al. 2021), but the latter tend to be present in cluster or more shallowly or, even, with a variety of scraping and linear marks. Finally, dull metal blades have been found to produce a |_| shape as well (Greenfield 1999). Each case was evaluated critically in this thesis for whether or not a linear mark was likely anthropogenic.

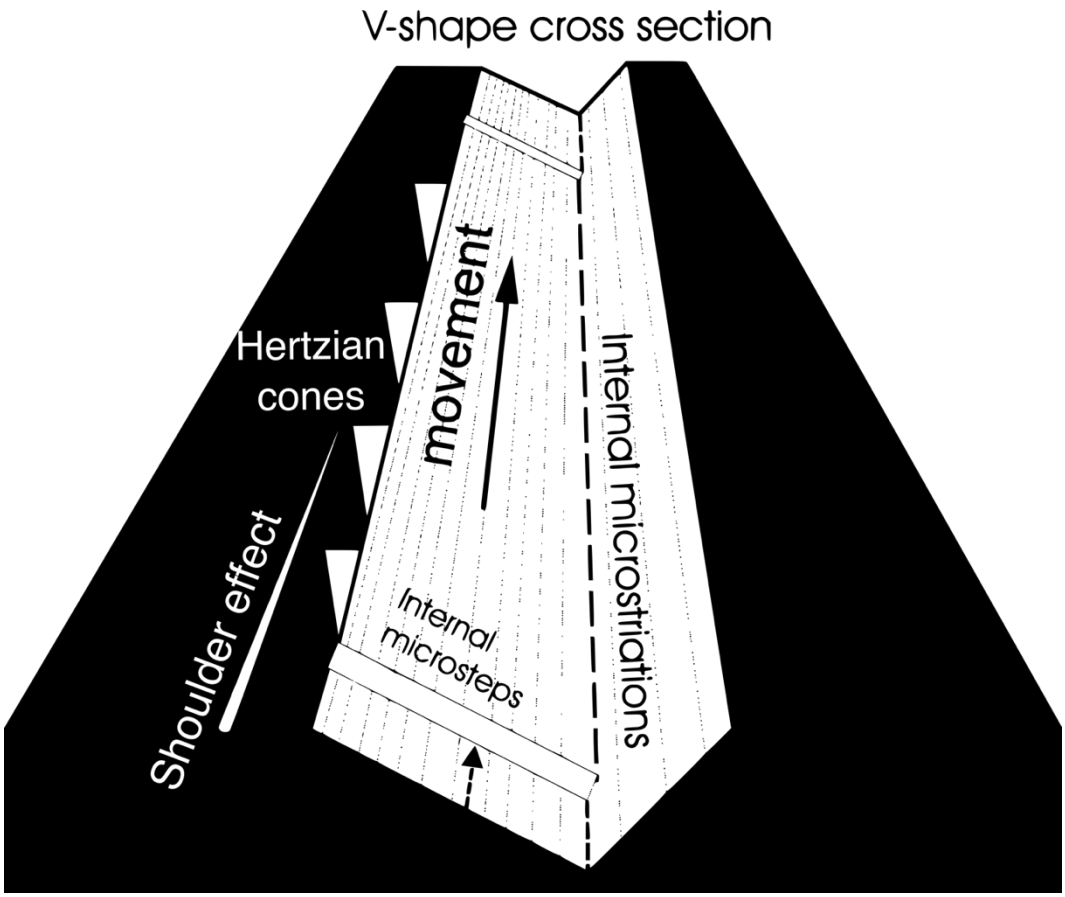


Figure 6.4: A cut mark profile or kerf produced by a stone tool (after Fernández-Jalvo and Andrews 2016:3) showing a v-shaped cross section, Hertzian fracture cones (more common on the shallow side) and a shoulder effect (caused by irregularities in the stone tool).

Projectile injuries are marked by penetrating or grazing lesions and the nature of the injury relies greatly on the velocity of the projectile. Fractures similar to those found in BFT may be present (Bennike 2008; Berryman and Symes 1998; Byrnes and Gaddis 2023; Ortner 2003b:54). When the projectile penetrates the bone, they may produce apertures which mimic their shape. Entrance and exit wounds, with associated bevelling, may be present if the impacting force is great enough. Drag marks, a cut-like mark produced by the projectile grazing bone, with or without associated fractures may be present as well (Forsom and Smith 2017; Knüsel 2005; Redfern and Roberts 2019; M. J. Smith et al. 2007; Wood and Fitzhugh 2018). Projectile or, even, puncture injuries may still have the weapon/tool still embedded in the bone, sometimes with evidence of healing (Figure 3.3). The most likely projectile weapons for the Jōmon and Yayoi periods are arrowheads and slingstones (see discussion in 3.1.7), although

the latter need not necessarily penetrate in order to also cause blunt force trauma (Vinuthinee et al. 2015).

6.2.3.2.3 Recording Trauma

Macroscopic examination (and additional microscopic photography if needed) was employed in trauma diagnosis. Funding restrictions did not allow for allocation of funds for radiographs for this thesis. When potential trauma was identified, it was described in detail (characteristics, side and location, degree of healing if present, type of fracture and injury mechanism if appropriate, potential causal weapons if appropriate), the location and characteristics were recorded and drawn on a skeletal chart, the dimensions measured with a plastic-tipped digital sliding calliper, the angle was measured when appropriate with a plastic goniometer, and digital and microscopic (Dino-lite AM3113T) photographs were taken by the author. The trauma was then mapped onto a 3D model (see 6.3.2) A summary of all traumatic or potentially traumatic lesions assessed in this study can be found in the Catalogues.

6.2.3.3 Two-tier Confidence Scores

Confidence scores were assigned twice to each recorded lesion in an effort to be transparent about the level of certainty for each case (Loe 2017; Schulting and Wyoscki 2005). First, the likelihood of a lesion being traumatic in aetiology was evaluated, and a score of 'Low', 'Medium', or 'High' likelihood of such was assigned. Only injuries that were given 'Medium' to 'High' scores, corresponding to the classification of at least 'highly consistent with' a traumatic cause as defined in the Istanbul terminological framework (UN 2004:36) and recommended by Appleby et al. (2015) and Buikstra et al. (2017), were used in analysis.

Second, the likelihood that a lesion resulted from a violent assault or conflict was scored from Low to High, and only those that were evaluated to be of 'Medium' to 'High' likelihood were used in the analysis, which is not to say that these injuries necessarily did result from

conflict, simply that they were more likely to given the type and location of trauma. It is recognised that some of these may be due to accidents, such as falls, but, as there is no patient to interview, an estimation was made based on the available evidence. Given the fact that trauma is categorically underrepresented when dealing with skeletal material, the presence of violent trauma is also more than likely being underrepresented as well (see the discussion in Chapter 1.1.3). None of this is said to dismiss the uncertainty present in this kind of analysis (demonstrated in Figure 6.1), instead these confidence scores are assigned in order to acknowledge the inherent, although variable, levels of uncertainty. Details of the scores per individual lesion and the differential diagnosis can be found in Catalogue II.

6.3 Spatial and Statistical Analyses

ArcGIS Pro 2.9.1 (May 2022) was used in two capacities in the analyses. The first involved creating site distribution maps for the southwest of the archipelago. The second was the use of a 3D model of the human body to spatially represent the skeletal preservation and trauma data. The second methodology was developed in conjunction with Dr John Pouncett, University of Oxford, who provided guidance and training to the author. Dr Rick Schulting provided guidance on the direction and application of the methodology. All spatial and statistical analyses were carried out by the author.

6.3.1 Maps of the Japanese Archipelago and Sites

Maps of the Japanese archipelago and site distribution were created using ArcGIS with data from GADM (https://gadm.org/data.html) and Google Earth Pro, but site maps presented in Sites and Samples were traced and modified in Inkscape 1.0 (2020-05-01).

6.3.2 3D Model of the Human Body

A free model of the human body, Body Parts 3D which is licensed under Creative Commons (http://lifesciencedb.jp/bp3d/) and available for download online, was used as the standard model for all individuals in the study. The model (version 4.3i; which can be downloaded in bulk or in parts) is of a white adult male and was produced by BodyParts3D based at the Database Center for Life Science, Japan (Mitsuhashi et al. 2009). The composite model is comprised of a 3D mesh of each element[7] that, once converted to an obj file format in MeshLab 2016.12 (Cignoni et al. 2008), was uploaded into a local 3D scene in ArcGIS Pro.

The use of a standard, white adult male model on which to map completeness and trauma is standard in bioarchaeology, and more broadly in the biological sciences. Hence, a white male model was the most fiscally and logistically available option for this project. Although the standardisation of the human form being a white adult male is not ideal, it does serve as a 'base map' on which to visualise and calculate patterns in a comparable manner at this time.

6.3.2.1 Creating Zones, Calculating Completeness, and Weighting

As discussed in 6.2.2.2, fragmentation methods were used to record the completeness of Jōmon and Yayoi individual skeletal elements. Therefore, in order to make this recording strategy and the model compatible, it was necessary for the author to break the model up into the zones used for recording (Figure 6.2 and Figure 6.3). This was done by creating 3D geometric figures around the area of the zone (i.e. 'bounding boxes'), and saving the intersecting volume between the two as a new 3D feature or 'zone'.

[7] ArcGIS Pro requires that 3D features be closed (i.e. the surfaces completely enclose a volume of space) for certain geoprocessing tools to function. All but three features of the BodyParts3D model are closed. The three open features are the proximal phalanx of the right thumb, the fifth distal phalanx of the right hand, and the distal phalanx of the left thumb. Therefore, the three open features could not be broken up into recording zones for this study and will not reflect completeness values as they were therefore not attributed with said data.

Not all of the zones are the same size and, therefore, could not be treated as equivalent when aggregating the preservation data for individuals or groups. Therefore, the analysed zones were weighted by their proportional area. In order to weight the completeness data of each zone by its size, the surface area of the zones of the model were determined and used as a proxy for the area analysed. The exact dimensions and shape of the model's zones were not equivalent to the actual bones recorded in the field, but the model acted as a good standard estimation for them. If there were paired zones, i.e. the same zone on the left and right ulnae, then the surface areas for these were averaged to make up for any artificial difference introduced in the making of the model and in the creation of the zones.

Calculating the surface area of each zone was more complicated than simply generating the surface area of each shape in ArcGIS Pro. This is because each time a zone was created, new faces, and associated surface area, were added to each feature. For example, if a portion of the mandible is split into a zone, then faces at the superior and inferior of the shape were created where it used to continue uninterrupted in each direction (Figure 6.5).

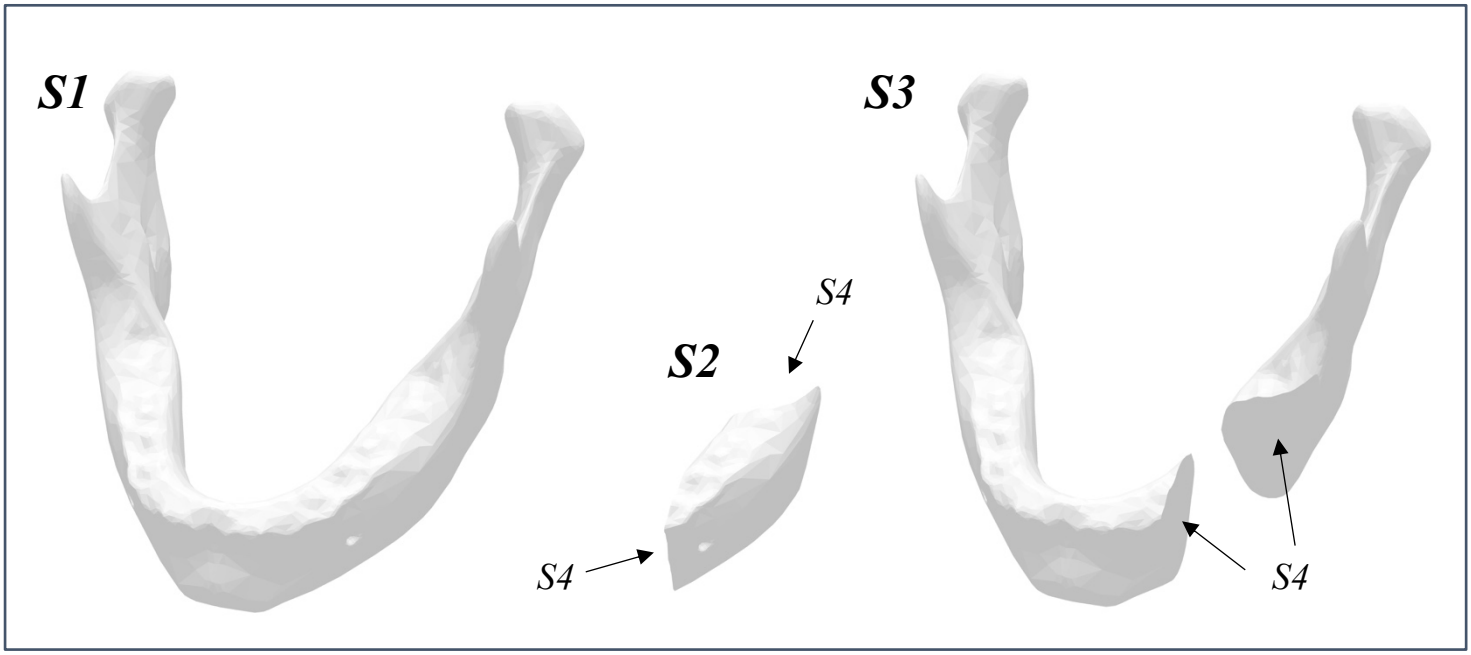


Figure 6.5: An example of the working model. Displayed is the complete mandible (S1), the target zone (Zone 1 of the left side; S2), the remaining zones (S3), and the intersecting faces created by the zonation process (S4).

Therefore, these additional faces (S4) needed to be subtracted from any calculations. In order to do this the surface area of the complete bone or element was calculated (S1), then the surface area of the zone (S2), and finally the surface area(s) of all of the other zones on that bone were combined into one feature with only the intersecting faces to S2 remaining (S3). The surface area of only the external surface of the zone (S4) was then calculated by taking the surface area of S1 and subtracting the values of S2 and S3, all of which was divided by two to account for the created faces (S4) of both S2 and S3. S4 was then subtracted from the surface area of the target zone (S2):

$$S4 = \frac{|S1 - (S2 + S3)|}{2}$$

$$S2 - S4 = External\ surface\ area\ of\ the\ zone$$

This results in the ability to calculate what proportion of the entire area analysed a certain bone or zone comprises (Figure 6.6, Figure 6.7, and Figure 6.8). The surface area of zones with right and left pairs were averaged to account for any small errors in the model or human error in the creation of the zones[8]. Subsequently, the completeness data can be weighted by the surface area of the zone when aggregating multiple zones for analyses.

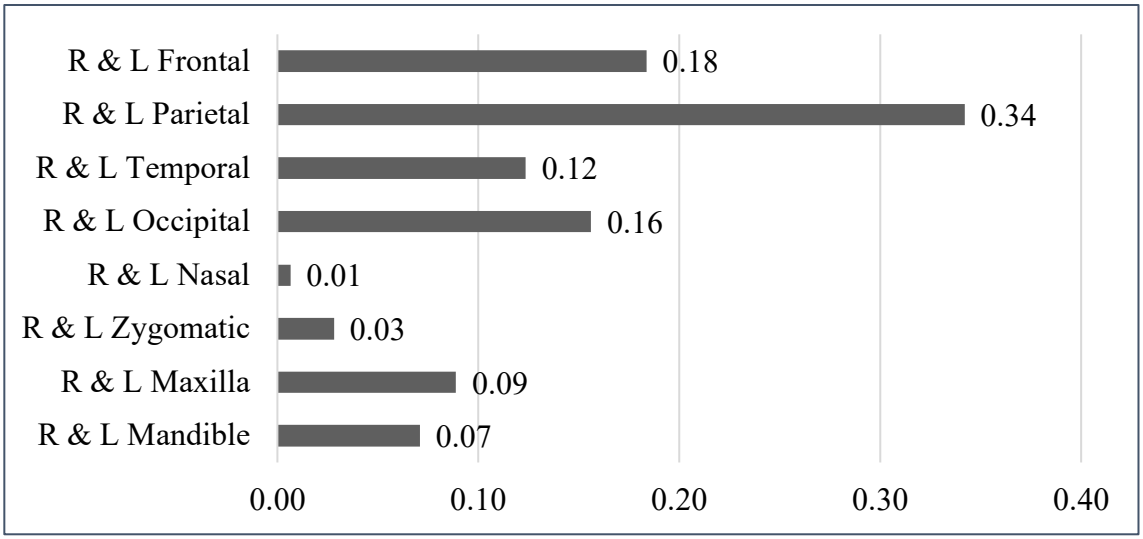


Figure 6.6: The proportional surface area of the bones of the skull analysed for the Jōmon sample.

[8] As discussed in footnote 7, the three open features (all phalanges of the hand) could not be segmented into recording zones, hence the paired zones were not averaged in these three cases.

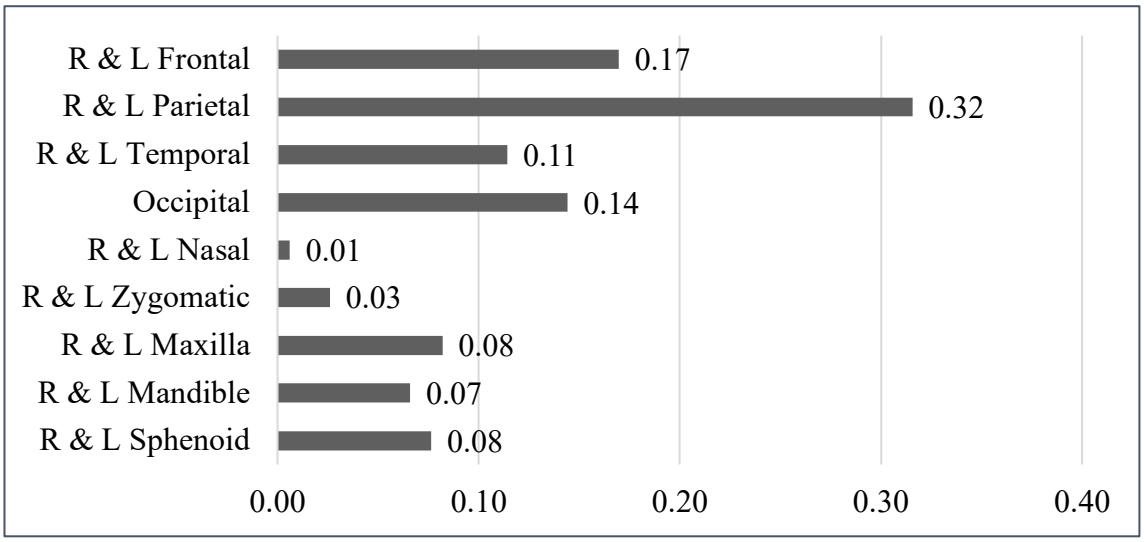


Figure 6.7: The proportional surface area of the bones of the skull analysed for the Yayoi sample. Note that the only difference in the proportional surface area from the Jōmon is the inclusion of the sphenoid bone.

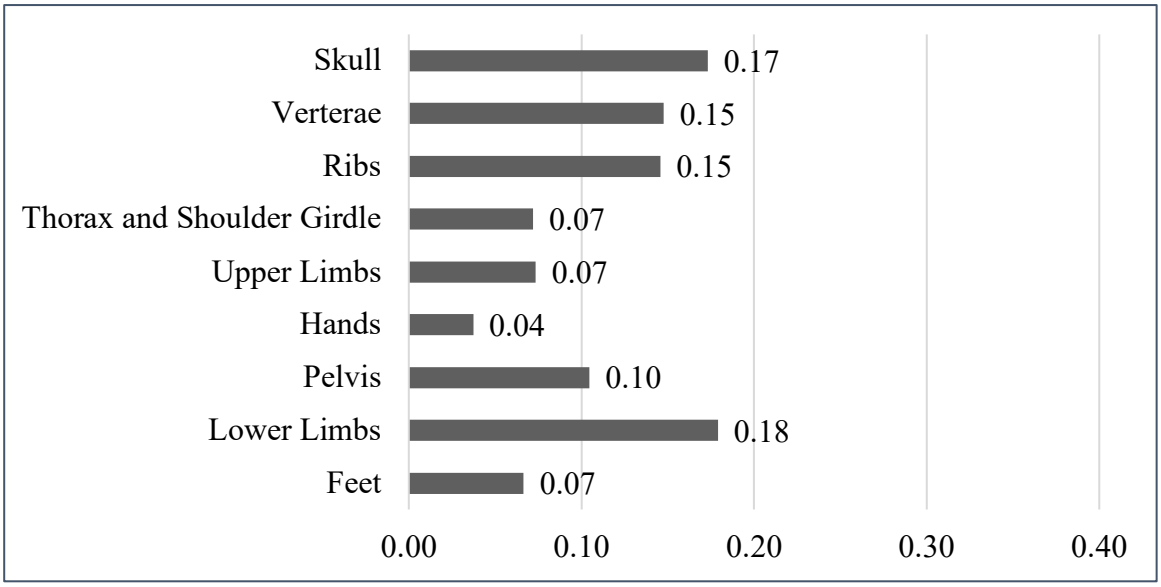


Figure 6.8: The proportional surface area of the bones analysed for the Yayoi sample.

The advantages of a systematic method of calculating skeletal completeness has been noted in the work of Rowbotham et al. (2017) and Bredhauer et al. (2020) who employed skeletal volume estimates from CT scans of individuals in order to calculate the percentage of each bone, and bone segment in the latter publication, in relation to the entire skeletal so that completeness could be estimated in a more robust manner than visually estimating percentages or providing variable descriptions of completeness. Although the method outlined here still

relies on subjective estimates of zone completeness, it is more broadly applicable than CT scanning all individuals in a study. Moreover, by creating zones on a 3D model created by standardising scans of a male model through reference texts and medical illustrations, one eliminates some of the idiosyncrasies between individuals. The goal is to create a standardised estimate of completeness that is comparable between individuals that accounts for fragmentation of bones. Finally, by focusing on surface area estimates rather than volume, it becomes possible to remove the influence of factors such as skeletal mass (which may vary by age and sex (Melton III and Cooper 2001)) from the estimation.

The number of individuals in the study was then multiplied by the weighted completeness to produce a Completeness Adjusted Total (CAT). The CAT represents the percent of individuals remaining to be examined on average. The incidences of trauma (T) were counted as present (1) or absent (0). The number of individuals with antemortem injures plus the number with perimortem injuries were added to get the total injury counts when aggregated. This is because even if one individual had an ante- and perimortem injury, the injuries would represent different assault episodes, whether the cause is understood or not. The incidences of trauma were divided by the CAT to produce a Completeness Adjusted Prevalence (CAP):

$$CAP = \frac{T \text{ (either 0 or 1)}}{CAT}$$

This is not a weighted score of the likelihood of trauma, as some regions of the body are more likely impacted than others. It is simply a weighting of how much of the skeleton was left to observe and whether there was an incidence of trauma. In an ideal scenario, it would be possible to take into account (i.e. weight by) the likelihood that one region of the body or bone would be impacted in a violent encounter and not just by how complete that region or bone is. The problem with doing this in a prehistoric sample especially, is that there is no control population, or clinical data, from these group to estimate the likelihood accurately. It would instead create a bias towards certain patterns of trauma, but this may be appropriate in other cases. Although the method employed in this study may still significantly underestimate the

frequency of violent trauma, it does so in a controlled and scalable manner which better represents the data itself and the variables which influence it.

6.3.2.1.1 Mapping Trauma

Trauma was 'mapped' onto the 3D model and saved as a separate feature class per individual. Representation of shallow or linear traumatic features were drawn onto the model mesh by 'snapping' to its surface. In order to better represent traumatic features that are deeper or take up more surface area, the skeletal model was intersected with another feature and the overlapping area saved as a trauma feature[9]. Trauma features were labelled based on their type and timing per individual and period and this was used to create figures with symbology based on these distinctions.

6.3.2.2 Statistical Analyses

Statistical analyses were carried out in Microsoft Office 365 Excel 16.61 and IBM Statistical Package for the Social Sciences (SPSS) 28.0. Values (i.e. presence or absence of trauma) were weighted by the average completeness of an individual in SPSS using the 'weight cases' function, but tests were carried out with weighted and unweighted values in order to test the rusticity of findings. This is different than the CAP as that depends on creating an adjusted *sample size*, whereas the weighting of cases adjusts the statistical strengths of the traumatic values within the programme.

Only adolescents and adults with Medium–High likelihood violent trauma were included in the statistical analysis of trauma. Additionally, although it is common when assessing 'crude' and 'true prevalence' studies of prehistoric skeletal trauma to exclude trauma on fragments below a certain size, this practice was not employed as the completeness

[9] An online example of this model, applied to the shark attack injuries found on Tsukumo No. 24 and reported in White et al. (2021) can be found at https://arcg.is/1abi5j0.

estimation, summarised in CAP and CAT values, accounts for the overall preservation of an individual. If a fragment was listed as 0, or less than 1/3 present, then it is addressed numerically, but it does not immediately follow that trauma cannot be present. The primary goal behind this methodology was to create a scalable and transferable way of representing two kinds of related data, i.e. completeness and trauma, allowing for the greatest amount of data to be presented as possible. Although this method is novel, others are also formulating new ways of incorporating completeness into trauma estimations (cf. Beier et al. 2020) as completeness has been shown to be associated with trauma frequencies (Lambert and Welker 2019). Finally, previous recent analyses of skeletal trauma from the Jōmon and Yayoi periods report trauma per individual. Primarily discrete burials were analysed in this project with the aim of providing a percentage of trauma per individual rather than per skeletal element that could be compared to other studies in the area.

Pearson's chi-square (χ^2) test was used to test for the relationship of two categorical variables (i.e. presence or absence of trauma in a subset of the data) for sample sizes greater than or equal to twenty. When the expected cell count was less than five, and the assumptions of the $\chi 2$ test were not met, a Fisher's Exact test was used to test association of variables. When dealing with continuous variables, i.e. completeness and surface condition data, tests for normality were carried out, Shapiro-Wilk test, and the appropriate parametric, One-way ANOVA tests and Student's *t*-tests, and non-parametric tests, Mann-Whitney U Test, were used to compare the central tendencies of the data. The significance level was set at $p = 0.05$.

Chapter 7 – Skull Trauma Results and Discussion

7.1 Completeness and Preservation

The overall completeness of the adolescent to adult Jōmon and Yayoi sample can be seen in Figures 7.1–4. As only the state of completion of the skull was systematically recorded for the Jōmon, only the skull of the Yayoi sample is directly comparable.

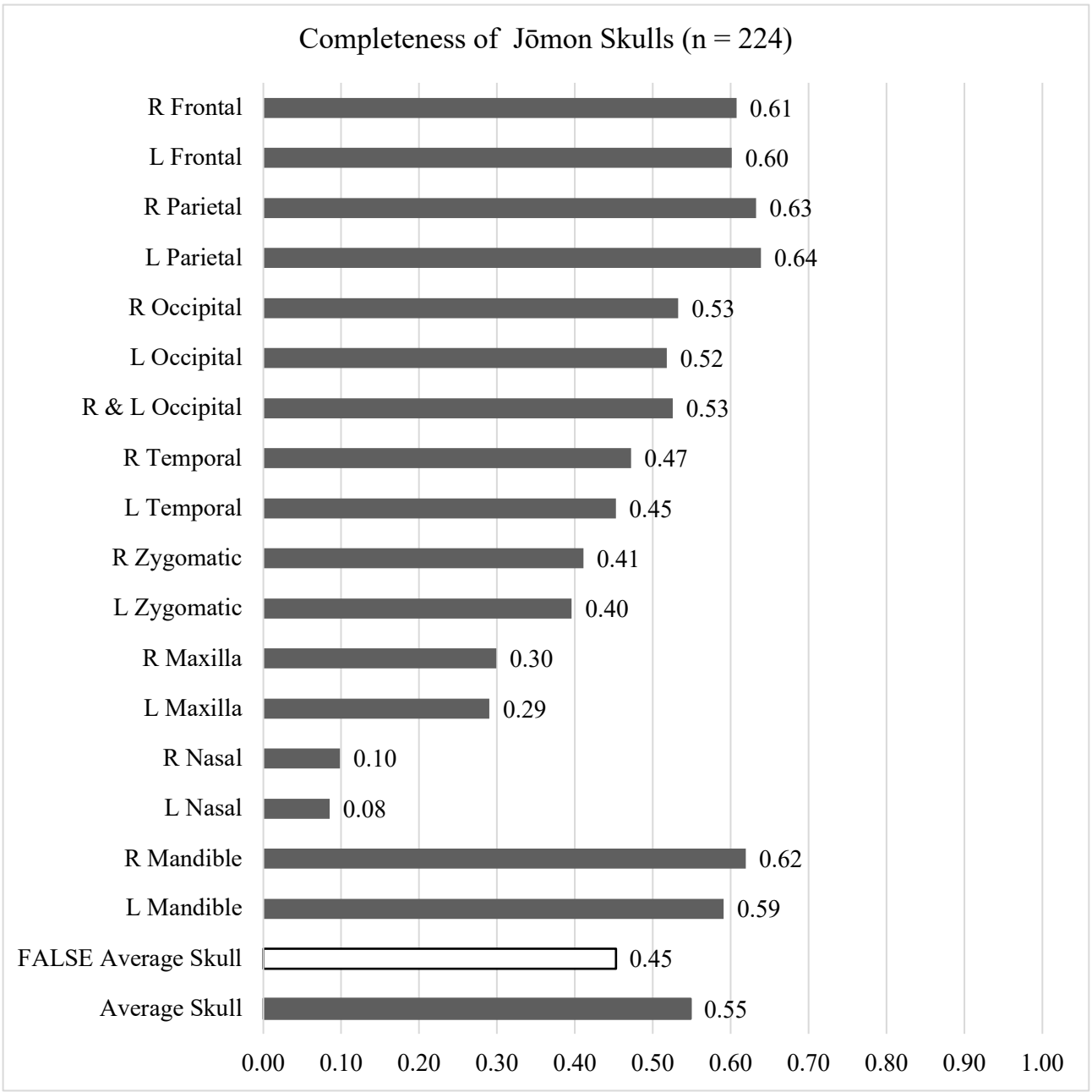


Figure 7.1: The average preservation of all the zones analysed (converted to 1/3 measurements) in the skull for the adolescent to adult Jōmon sample. The 'False average' is the average of the zones without taking into account their surface area.

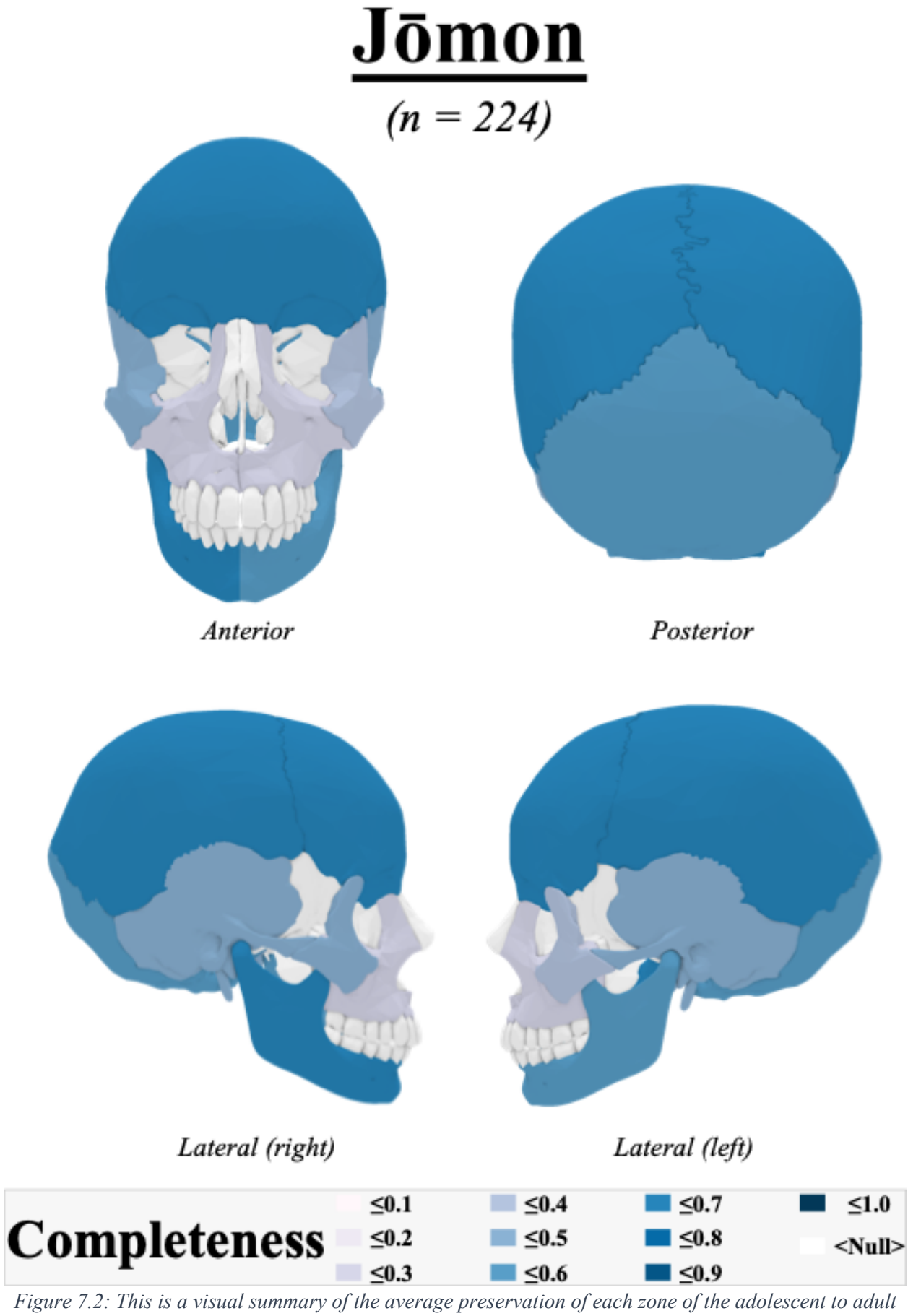


Figure 7.2: This is a visual summary of the average preservation of each zone of the adolescent to adult Jōmon sample analysed. Null values, or bones not systematically recorded for percent completeness, are in white.

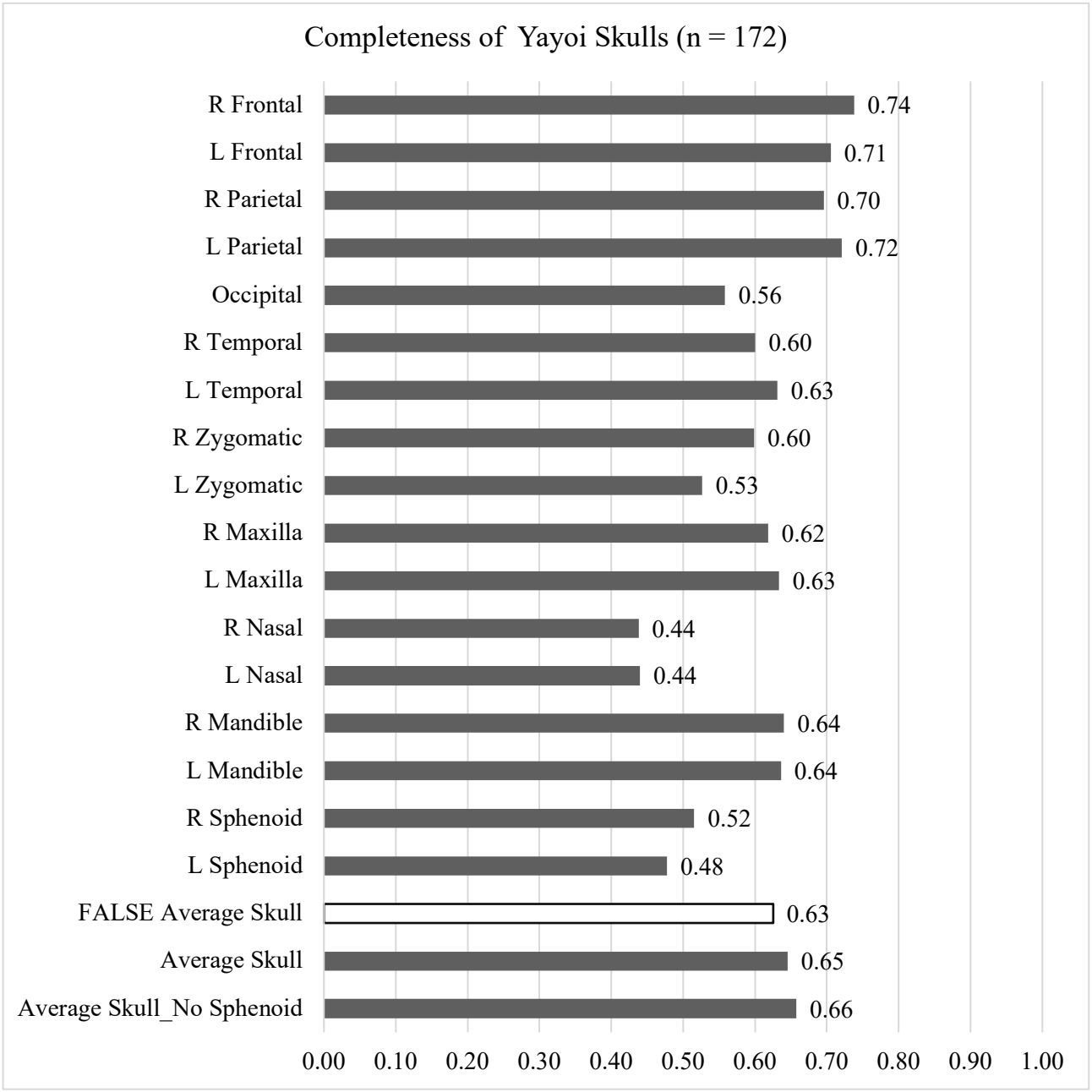


Figure 7.3: The average preservation of all the zones analysed in the skull for the Yayoi Adolescent to Adult sample. Note that the "FALSE Average Skull" is the average of the unweighted completeness values. The 'False average' is the average of the zones without taking into account their surface area.

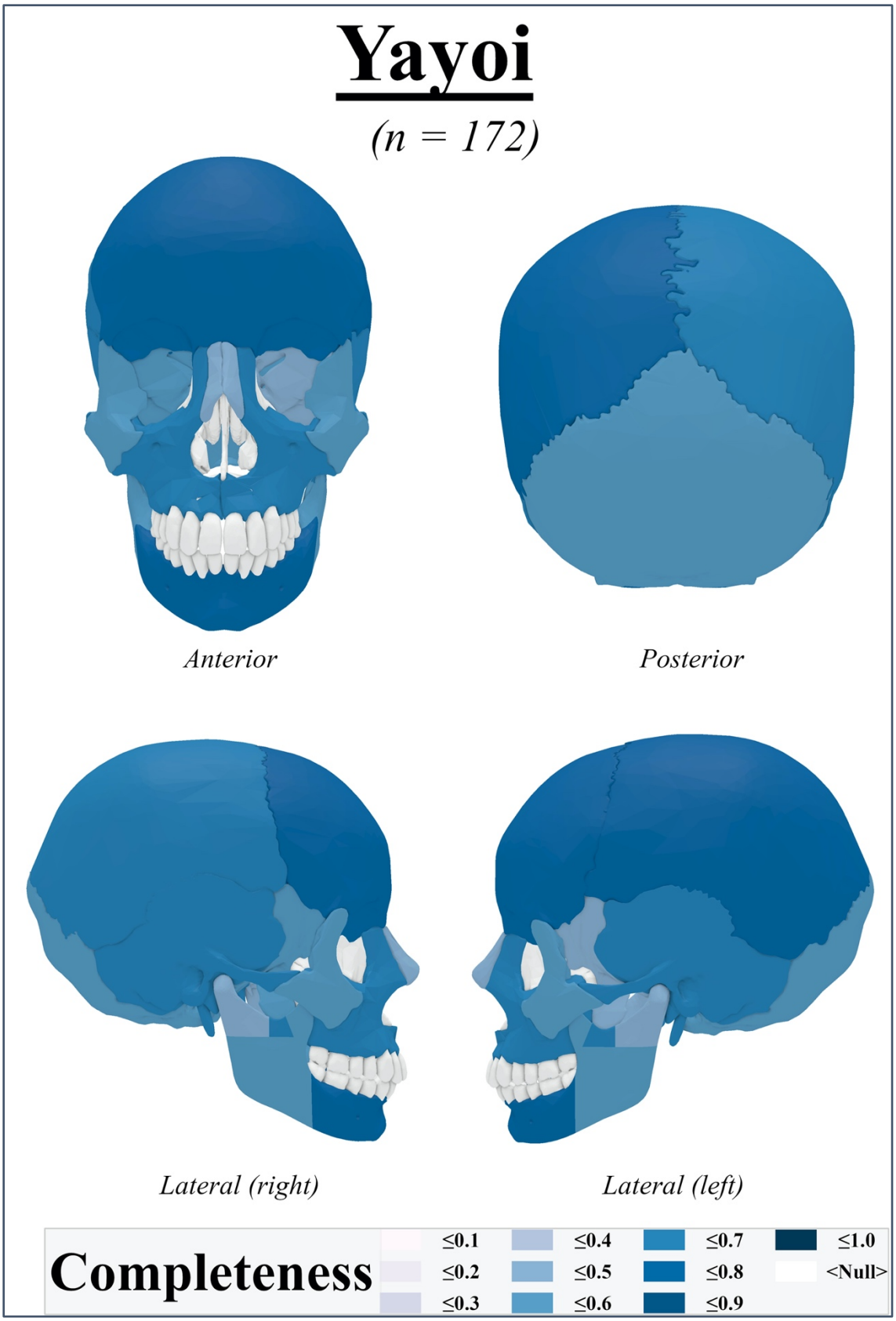


Figure 7.4: This is a visual summary of the average preservation of each zone of the adolescent to adult Yayoi sample analysed. Null values, or bones not systematically recorded for percent completeness, are in white.

Some bones were on average more completely preserved than others in the Yayoi sample, the most notable being the nasal bones. Approximately 9% nasal bones survived in the Jōmon sample, compared with 44% in the Yayoi sample. Additionally, the surface condition (see Chapter 6.2.2.1 for further details) of the Jōmon remains examined (1.17 ± 0.22) was on average significantly better than that of the Yayoi remains (1.55 ± 0.04) (Mann-Whitney U, n = 396, U = 10525.0, p < .001). The Yayoi remains recovered from burial jars, especially, had relatively complete skeletal elements, but acidic erosion on the cortical surface of the bone was more prevalent. The raw data on completeness and surface condition per individual can be found in Catalogue I: Skeletal Data. Catalogue II: Traumatic Injuries, contains figures illustrating the overall preservation of each individual with suspected violent trauma along with details on and photographs of the trauma. Only individuals from this study with Medium to High likelihood violent trauma to the skull were included in the statistical analysis this chapter, as no other trauma is directly comparable between the two samples.

The overall completeness of the Jōmon and Yayoi skulls analysed and the Completeness Adjusted Total (CAT) and Completeness Adjusted Prevalence (CAP) calculations can be seen in Table 7.1 (see Chapter 6.3.2.1 for full detail on how these were calculated). The average completeness of the Yayoi sample, not including the sphenoid bone was significantly greater than that of the Jōmon sample (Student's t-test, n = 396, t = -3.890, p <.001). If the completeness data for the nasal bones were removed from the Jōmon average completeness, it would increase the CAT, but it would also eliminate from analysis a site of potential trauma and thereby inflate the CAP. Although unlikely given the other indicators of low violent conflict, there could have been a similar prevalence of nasal fractures in both groups, but the Jōmon nasal bones were simply much less well preserved. Therefore, the possibility cannot be eliminated at this point by arbitrarily removing some bones from consideration.

Table 7.1: Summary of the skull completeness and trauma of the Jōmon and Yayoi samples.

	n	Skull Completeness	CAT	Trauma	Crude Prevalence	CAP
Jōmon	224	0.55±0.2	123	10	0.04	0.08
Yayoi	172	0.66±0.2	114	34	0.20	0.30
TOTAL	396	0.60±0.1	238	44	0.11	0.19

When calculating the crude and true prevalence, CAT, and CAP, each incidence of violent skull trauma was counted, i.e. if one individual had multiple perimortem injuries this only equalled one event, if an individual had an antemortem and a perimortem injury these equated to two events. It should be noted that although children were excluded from the statistical analysis below, no trauma was found on any of the Jōmon or Yayoi children examined.

7.2 JŌMON SKULL TRAUMA

In the Jōmon sample 11 individuals displayed Medium–High likelihood of violence-related traumatic injuries, of which seven were antemortem and four perimortem (Table 7.2). One of these is an antemortem parry fracture to the right ulna of a female, which cannot be counted towards the CAP, as the completeness of the ulnae was not recorded for the entire sample, and is therefore not included in Table 7.1. Therefore, for skull injuries there is a CAP of 0.08 (10/123) and a crude prevalence of 0.04 (10/224). The CAP of antemortem skull injuries is 0.05 (crude prevalence of 0.03) and 0.03 were perimortem (crude prevalence of 0.02).

Table 7.2: All trauma from the Jōmon sample that was possibly related to violence. See Catalogue II for details, images of each, and visualisation of completeness. The numbers in the 'Element' and 'Element Completeness' columns refer to the injury number assigned in Catalogue II. (YA = young adult, MA = middle adult, OA = old adult).

ID	Site	Period	Age	Sex	Timing	Violent Trauma	Type	Element	Element Completeness
249	Inariyama	Final Jomon	MA-OA	F?	Peri	High	1. Penetrating; 2. BFT	1. R Temporal; 2. R Parietal	1. 2/3; 2. 2/3
255	Inariyama	Final Jōmon–Middle Yayoi	MA-OA	I	Ante	High	BFT	R Parietal	1/3
78-1	Toyomatsu-Dolmen Cave	Late Jomon	YA	F	Peri	High	SFT	R Mandible	1
36	Tsukumo	Late-Final Jomon	MA	M	Ante	Medium	BFT	R Parietal	1
38	Tsukumo	Late-Final Jomon	OA	F	Ante	Medium	BFT	L Parietal	2/3
46	Tsukumo	Late-Final Jomon	MA-OA	M	Ante	Medium	BFT	R Frontal	1/3
9	Yamaga	Mid Late Jomon	MA?	F	Ante	Medium	BFT	L Maxilla	2/3
18	Yamaga	Mid Late Jomon	MA	M	Ante	Medium	BFT	R Frontal	2/3
360-1	Yoshigo	Late-Final Jomon	YA	F	Peri	Medium	BFT	R Parietal	<1/3
378	Yoshigo	Late-Final Jomon	MA-OA	F	Peri	High	Penetrating	L Parietal	2/3
Postcranial trauma:									
20	Tsukumo	Late-Final Jomon	MA	F	Ante	Medium	BFT	R Ulna	N/A

Of those 10 traumatic injuries to the skull, Inariyama 249 has two possible violence-related perimortem injuries. The parietal bones had the greatest number of injuries, six in total (four to the right and two to the left side). Only two injuries were found to the frontal bone and one to the mandible. A full break-down of the bones impacted can be seen in Table 7.3 and Figure 7.5.

Table 7.3: Prevalence of recorded zones with trauma for the Jōmon.

Zone (R&L)	n	Completeness	Trauma	True Prevalence	CAT by Element	CAP by Element
Frontal	344	0.60	2	0.01	208	0.01
Parietal	373	0.64	6	0.02	237	0.03
Occipital	336	0.53	0	0.00	177	0.00
Temporal	315	0.46	1	0.00	146	0.01
Zygomatic	205	0.40	0	0.00	83	0.00
Maxilla	222	0.29	1	0.00	65	0.02
Nasal	71	0.09	0	0.00	6	0.00
Mandible	334	0.60	1	0.00	202	0.00
Ulna	-	-	1	-	-	-

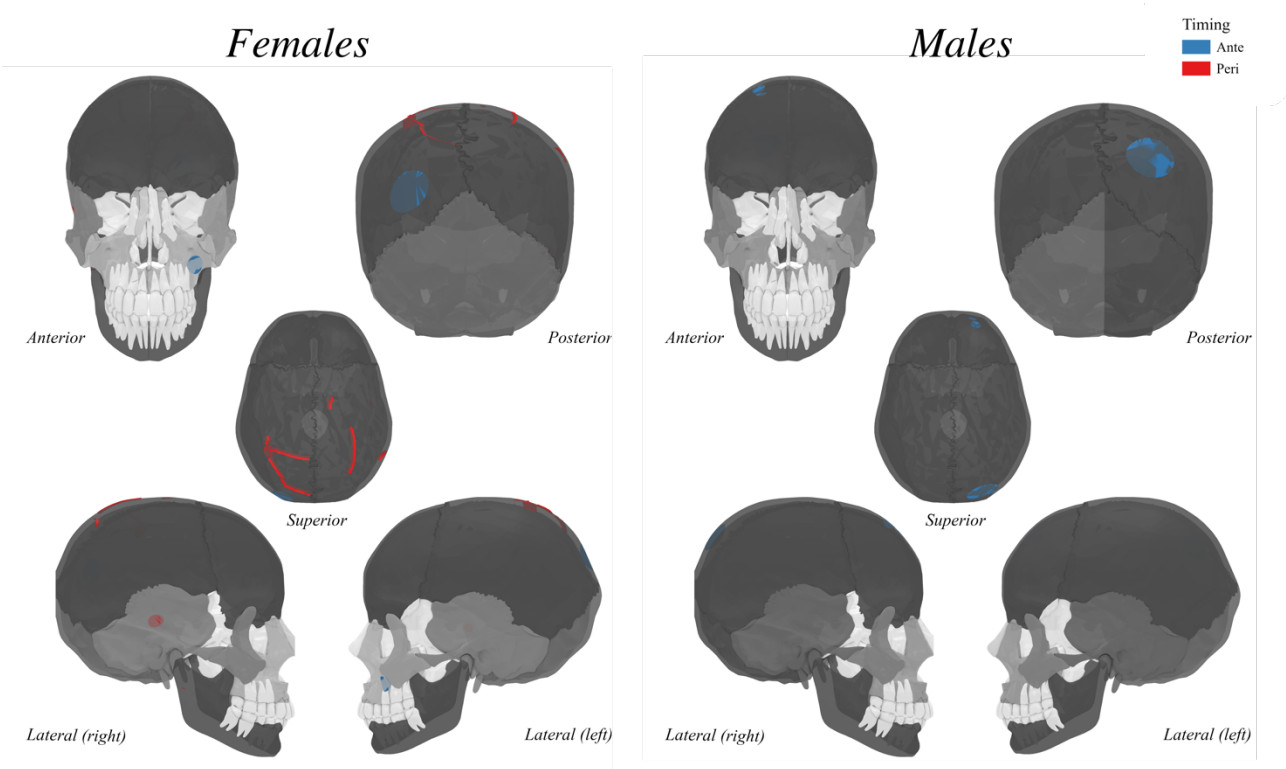


Figure 7.5: The distribution of wounds to the skull of males compared to females for the Jōmon sample.

Out of the 10 individuals with skull trauma, three are male and all exhibit antemortem blunt force trauma (BFT). Six female individuals present with injuries, including all three perimortem (sharp force trauma (SFT) and penetrating trauma) injuries. The perimortem trauma on the females are clustered more towards the posterior half of the skull, indicating that they were not facing the attacker at the moment of injury. Additionally, their number suggests a greater use of lethal force to the female skulls. Two of the antemortem injuries to the males and

one to a female are on the anterior half of the skull. Nevertheless, the difference between adult male and female skull trauma is not statistically significant (Fisher's Exact Test, n = 205, p = 0.499), nor is the weighted difference (Fisher's Exact test, n = 120, p = 0.677). See Chapter 6.3.2.2 for full details on the statistical analyses performed.

Middle adults have the most skull injuries, seven total, and the young adult and old adult groups have three between them. Due to the lack of temporal resolution in the data, based mainly on relative dating methods, it was not possible to rigorously test the difference between sub-periods during the Jōmon. The larger Jōmon cemeteries yielded more individuals with trauma, as would be expected given the larger sample size (Table 7.4). Nevertheless, overall the amount of possible violence-related trauma was low throughout. Yamaga is a smaller site (n=8), but there are two individuals with possible antemortem violent trauma.

Table 7.4: Prevalence of violence-related trauma by site for the Jōmon.
**This does not include the parry fracture from Tsukumo.*

Site	n	Completeness	Trauma	CAT	Crude Prevalence	CAP
Inariyama	36	0.52	2	19	0.06	0.11
Tsukumo*	49	0.64	3	31	0.06	0.10
Toyomatsu-Domen	6	0.47	1	3	0.17	0.36
Yamaga	10	0.59	2	6	0.20	0.34
Yoshigo	88	0.54	2	48	0.02	0.04

As discussed in Chapter 5.1, human postcranial fragments from the Final Jōmon – Initial Yayoi site of Itoku were included in the analysis due to previous reports of associated traumatic injuries. Most notably, Matsui (2005) argued that some were caused by metal implements, which would have been very early metal use in the archipelago. Examination of the Itoku remains did not support Matsui's findings. The human remains from Itoku are in too poor a state to confidently ascribe the lesions found of them to traumatic injuries. The author did not have access to the zooarchaeological remains, which Matsui also identified as having injuries caused by metal implements. The lesions that Matsui identified as traumatic on the human

remains lack the diagnostic characteristics of traumatic injuries, including clear and patinated fracture edges, v-shaped cross-sections, micro-striations, and Hertzian fracture cones (Figure 7.6). This has briefly been reported by the author in Hudson et al. (2021) and further details can be found in Catalogue II.

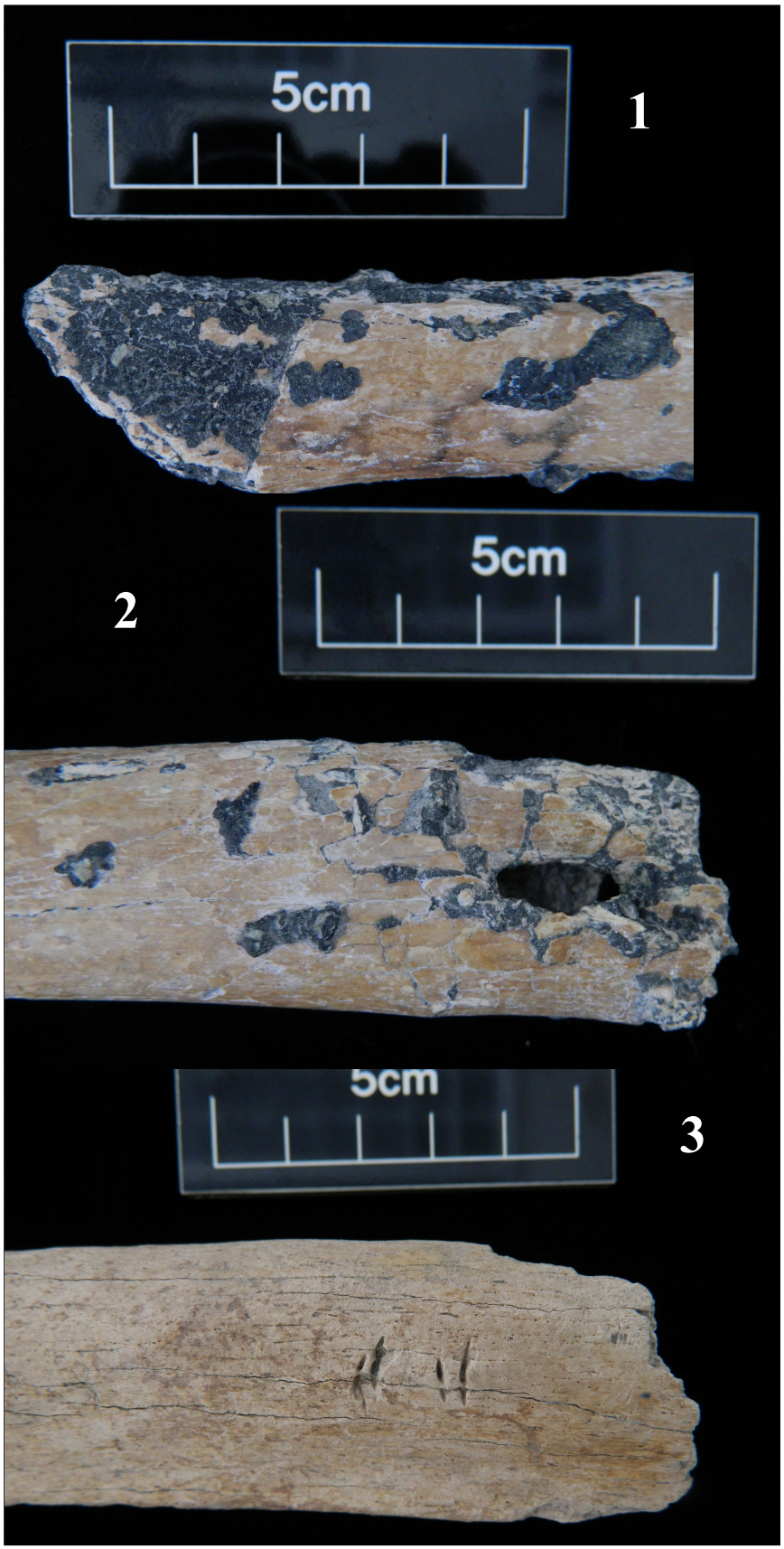


Figure 7.6: Itoku site remains with lesions which Matsui (2005) argued were traumatic in aetiology: 1. J002, proximal left femur; 2. J002, distal left femur; 3. J004, right femur. These injuries were previously attributed to a 'bladed weapon cut', 'penetrating trauma', and a 'stab' wound respectively.

7.3 YAYOI SKULL TRAUMA

Of the Yayoi sample 33 individuals exhibited Medium–High likelihood violence-related injuries to the skull, hence there is a crude prevalence of 0.20 (34/172) and a CAP of 0.30 (34/114) (Table 7.1 and Table 7.5). Five of the individuals listed in Table 7.5 also have trauma to other areas of the body, which will be addressed in greater detail in Chapter 8. Of these there are 29 individuals with antemortem and three with perimortem and one individual with both ante- and perimortem skull injuries. The CAP of antemortem skull injuries is 0.26 (crude prevalence of 0.17) and 0.04 for the perimortem injuries (crude prevalence of 0.02).

Table 7.5: All skull trauma from the Yayoi sample that was possibly related to violence. 'FBT' denotes 'Full Body Trauma' and 'ST' denotes 'Skull Trauma'. This excludes any individuals with only postcranial trauma. See Catalogue II for details, images of each, and visualisation of completeness. The numbers in the 'Element' and 'Element Completeness' columns refer to the injury number assigned in Catalogue II. (YA = young adult, MA = middle adult, OA = old adult).

ID	Site	Period	Age	Sex	Timing	Violent Trauma	Type	Area	Element	Element Completeness
124	Doigahama	Early-Middle Yayoi	MA?	M	Peri	1. High; 2–5. Medium; 6–11. High; 12. Medium; 13. Medium; 14– 24. High; 26–29. High; 31. High	Penetrating, SFT, BFT	FBT	1–2. Frontal; 3. R Mandible; 4. R Parietal and Occipital; 5. L Parietal and Occipital; 6. T7; 7. T10; 8. T10; 9. T11; 10. T11; 11. T12; 12.. T12; 13. L3; 14. L4; 15–17. L Os Coxae; 18–19. R Os Coxae; 20. R 1st Rib; 21–22. R 7th Rib; 23. R 11th Rib; 24. L 7th Rib; 26. L 10th Rib; 27. L 11th Rib; 28. R Femur; 29. L Femur; 31. R Tibia	1–2. 1/3; 3. 1/3; 4. 2/3, 1/3; 5. 1/3; 6. >1/3; 7. 2/3; 8. 2/3; 9. 1; 10. 2/3; 11. 1; 12. 2/3; 13. 2/3; 14. 1; 15. 2/3; 16. 2/3; 17. 1; 18. 2/3; 19. 2/3; 20. 2/3; 21. 2/3; 22. 1; 23. 1; 24. 2/3; 26. 2/3; 27. 2/3; 28. 1; 29. 1; 31. 1
312	Doigahama	Early-Middle Yayoi	YA	F	Ante	1. Medium	BFT	ST	1. R and L Nasal bones	1. 1

ID	Site	Period	Age	Sex	Timing	Violent Trauma	Type	Area	Element	Element Completeness
421	Doigahama	Early-Middle Yayoi	MA	F?	Ante	1. Medium; 10. Medium	BFT	FBT	1. L Parietal; 10. Hyoid	1. 1; 10. N/A
1105	Doigahama	Early-Middle Yayoi	MA	M?	Ante	Medium	BFT	ST	R and L Nasal bones, L Maxilla	2/3, 1
1116	Doigahama	Yayoi	MA	M	Ante	1. Medium	BFT	ST	1. R and L Nasal bones	1. 2/3
A-8	Hirota	Late Yayoi	YA-MA	M	Ante	1–3. Medium 5. Medium	BFT	ST	1. Frontal; 2. L Frontal; 3. R Parietal; 5. L Parietal	1. 2/3; 2. 2/3; 3. 1; 5. 1
C-2	Hirota	Late Yayoi	YA	M	Ante	1. Medium; 2. Medium	BFT, Penetrating	ST	1. L Frontal; 2. L Parietal	1. 2/3; 2. 1
C-5	Hirota	Late Yayoi	YA	F	Ante, Peri?	1. Medium; 2. Medium; 4–7. Medium; 10. High	BFT, Penetrating	FBT	1–5. Frontal; 6–7. L Parietal; 10. L Femur	1–5. 2/3; 6–7. 1; 10. 2/3
D-II-3	Hirota	Late Yayoi	YA	F	Ante	1–5. Medium	BFT	ST	1. L Nasal bone; 2–3. L Parietal; 4–5. R Parietal	1. 2/3; 2–3. 1; 4–5. 1
D-III-2	Hirota	Late Yayoi	YA	M	Ante	1–11. Medium; 12b–17. Medium; 19–20. Medium; 22. Medium; 24–27. Medium	BFT	ST	1–6. Frontal; 7–16. R Parietal; 17–25. L Parietal; 26–27. R Parietal	1–6. 1; 7–16. 1; 17–25. 1; 26–27. 1

ID	Site	Period	Age	Sex	Timing	Violent Trauma	Type	Area	Element	Element Completeness
K61	Kanenokuma	Mid Middle Yayoi	YA	M	Ante	1. Medium	BFT	ST	1. R and L Nasal bones	1. 1
K79	Kanenokuma	Early half Middle Yayoi	YA	M	Ante	1. Medium	BFT	ST	1. L Nasal bone, L Maxilla	1. 1, 1
K102	Kanenokuma	End of the Early Yayoi	YA	M	Ante	1. Medium; 2. Medium	BFT	ST	1. R and L Nasal bones, L Maxilla; 2. L Parietal	1. 1, 1; 2. 1
K139	Kanenokuma	Early half Late Yayoi	MA?	F?	Ante	Medium	BFT	ST	L Parietal	1
K229	Kanenokuma	Early half Middle Yayoi	MA	M	Ante	Medium	BFT	ST	R and L Nasal bones	1, 1
44	Kōra	Early Yayoi	YA-MA	M	Ante	1. Medium	BFT	ST	1. R and L Nasal bones	1. 1
67	Kōra	Early Yayoi	MA	M	Ante	1. Medium	BFT	ST	1. L and R Nasal bones, L Maxilla	1. 1, 1
5	Mitsunagata	Middle-Late Yayoi	MA?	M	Ante	Medium	BFT	ST	R and L Nasal bones	1
104	Mitsunagata	Early half Middle Yayoi	MA	M	Ante	2. Medium	BFT	ST	2. R Frontal	2. 1
127	Mitsunagata	Middle-Late Yayoi	MA	M	Ante	1. Medium	BFT	ST	1. R and L Nasal bones	1. 2/3, 1
K10	Nagaoka	Mid Middle Yayoi	MA	M	Ante	1. Medium; 2. High	BFT, SFT	ST	1. R and L Nasal bones; 2. R Frontal	1. 2/3; 2. 1
G-3-1 No.7357	Nakanohama	Early-Middle Yayoi	A	M?	Ante	Medium	BFT	ST	L Parietal	1/3

ID	Site	Period	Age	Sex	Timing	Violent Trauma	Type	Area	Element	Element Completeness
G-3-1-1-その 2	Nakanohama	Early-Middle Yayoi	MA	M	Ante	1. Medium	Semi-SFT?	ST	1. R Parietal	1. 2/3
2-1 号	Ōtomo	End of the Early Yayoi	MA	M	Ante	Medium	BFT	ST	R and L Nasal bones	1
6 号	Ōtomo	Initial Yayoi	MA	M	Ante	Medium	BFT	ST	R Frontal	1
SK35	Ōtomo	Early Yayoi	MA	M	Ante	Medium	BFT	ST	R and L Nasal bones	1
3 号	Shibu	Middle Yayoi	YA	F	Peri	1. High; 3–10b. High	SFT, Penetrating	FBT	1. L Frontal; 3. L Humerus; 4. L Ulna; 5. Thoracic Vertebra; 6. Thoracic Vertebra; 7. R 10th Rib; 8. L 7th Rib; 9. L 9th Rib; 10a–b. L Femur	1. 1/3; 3. 2/3; 4. 1; 5. 1/3; 6. 1/3; 7.1/3; 8. 1/3; 9. 2/3; 10a–b. 2/3
4 号	Shibu	Middle Yayoi	YA	M?	Peri	1–5. High; 7–8. High; 9. Medium; 10–11b. High	BFT, SFT, Penetrating	FBT	1. R Frontal; 2. L Patella; 3. R Scapula; 4. L Scapula; 5. R Humerus; 7. R Clavicle; 8. L3; 9. L 4th Rib; 10. R Os Coxa; 11a–b. L Os Coxa	1. 2/3; 2. 2/3; 3. 1; 4. 1/3; 5. 1/3; 7. 2/3; 8. 2/3; 9. 1/3; 10. 2/3 11a. 1/3; 11b. 2/3
9	Shinmachi	Early Yayoi	OA	M	Ante	Medium	BFT	ST	R and L Nasal bones	2/3

ID	Site	Period	Age	Sex	Timing	Violent Trauma	Type	Area	Element	Element Completeness
K3	Sudare	Mid Middle Yayoi	MA-OA	M	Ante	1. Medium; 2. High	BFT, Penetrating	FBT	1. R and L Nasal bones; 2. R 2nd Rib, T2	1. 1; 2. 1 ;2/3
21 号	Tsukomuta 4	Middle Yayoi	MA	M	Ante	Medium	BFT	ST	R and L Nasal bones	1
ST-122	Yokoguma kitsunezuka	Middle Yayoi	YA	M	Ante	Medium	BFT	ST	R and L Nasal bones	1
ST-128	Yokoguma kitsunezuka	Middle Yayoi	MA	M	Ante	Medium	BFT	ST	R and L Nasal bones, L Maxilla	1, 1

The nasal bones were most commonly impacted by trauma followed by the parietal bones (Table 7.6). Note that the values presented by zone will overrepresent single events for individuals with more trauma, such as those from Doigahama, Hirota, and Shibu.

Table 7.6: Prevalence of recorded zones with trauma for the Yayoi. The trauma listed below is by zone (i.e. if the right and left parietal bones for a single individual were impacted by different injuries, they were both recorded as being impacted).

Zone (R&L)	n	Completeness	Trauma	True Prevalence	CAT by Element	CAP by Element
Frontal	287	0.72	10	0.03	207	0.05
Parietal	306	0.71	15	0.05	217	0.07
Occipital	140	0.56	1	0.01	78	0.01
Temporal	278	0.62	0	0.00	171	0.00
Zygomatic	226	0.56	0	0.00	127	0.00
Maxilla	256	0.63	5	0.02	160	0.03
Nasal	198	0.44	38	0.19	87	0.44
Mandible	303	0.64	1	0.00	193	0.01

Healed injuries to the parietal bones for both sexes, excluding those from Hirota whose skull injury distribution will be discussed below, are clustered primarily to the posterior left side and, for the males, to the frontal bone as well. Perimortem injuries tend to be more concentrated on the anterior half of the skull and were only associated with individuals with multiple perimortem postcranial injuries as well (Doigahama 124, Shibu 3, and Shibu 4). Males have a greater number of injuries to the facial region, particularly antemortem injuries to the nasal bones. Males have statistically significantly more trauma than females when the cases are unweighted (χ^2 test, n = 168, $df = 1$, $p = 0.026$; Cramer's V test, $V = 0.172$), but, when weighted by the completeness values, the p-value only approach significance (χ^2 test, n = 113, $df = 1$, $p = 0.063$; Cramer's V test, $V = 0.181$).

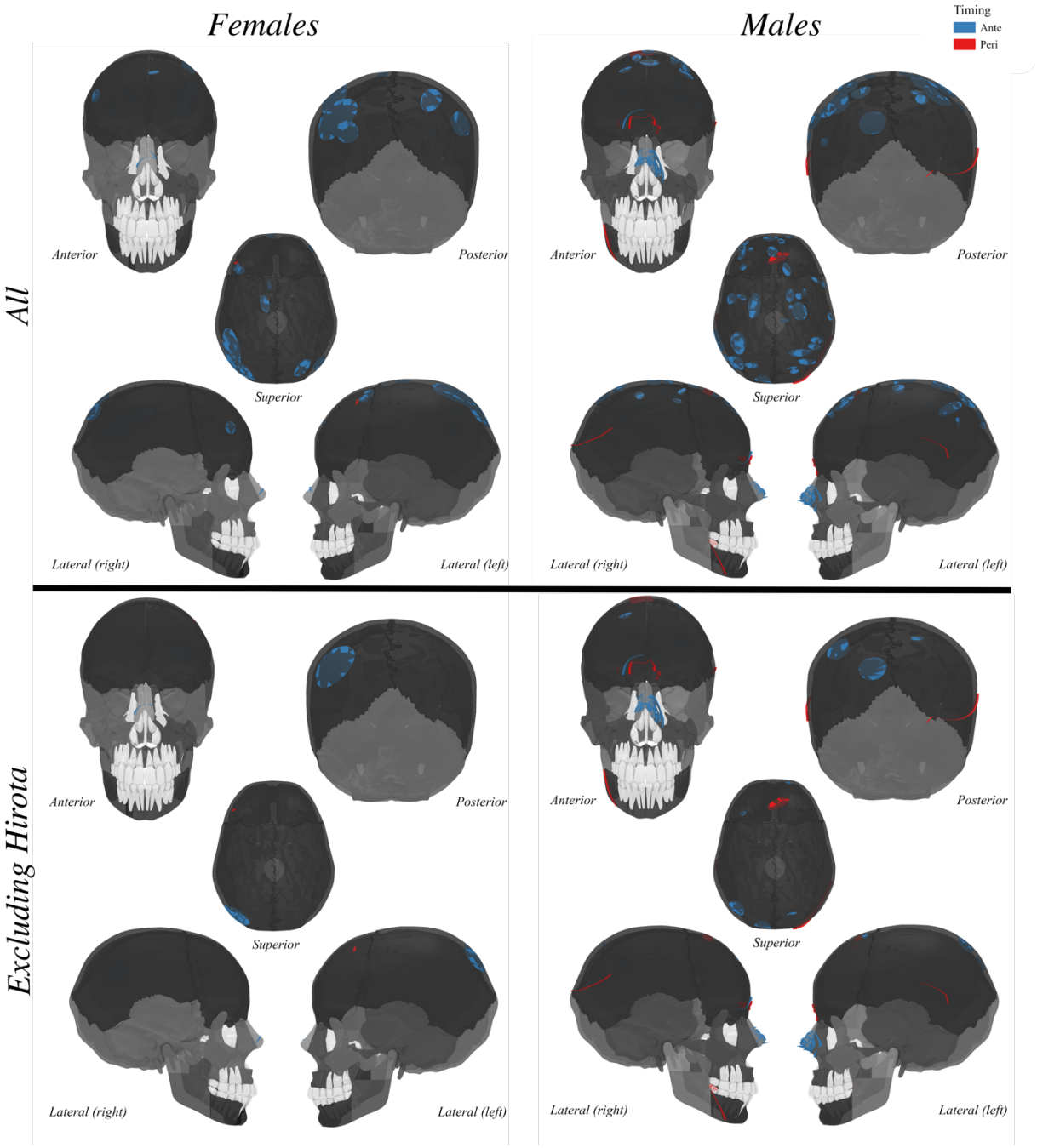


Figure 7.7: The distribution of wounds to the skull of males compared to females for the Yayoi sample.

Twenty individuals have nasal fractures and all but two of these (Doigahama 312, YA Female and Hirota D-II-3 YA Female) are to males (close-up of the distribution pattern in Figure 7.8). A majority of healed nasal fractures have deformation and remodelling consistent with the direction of force towards the right, more severely impacting the left side of the face and consistent with a blow from a right-handed attacker, whether with a bare-handed strike or using the hilt or blunt edge of a weapon.

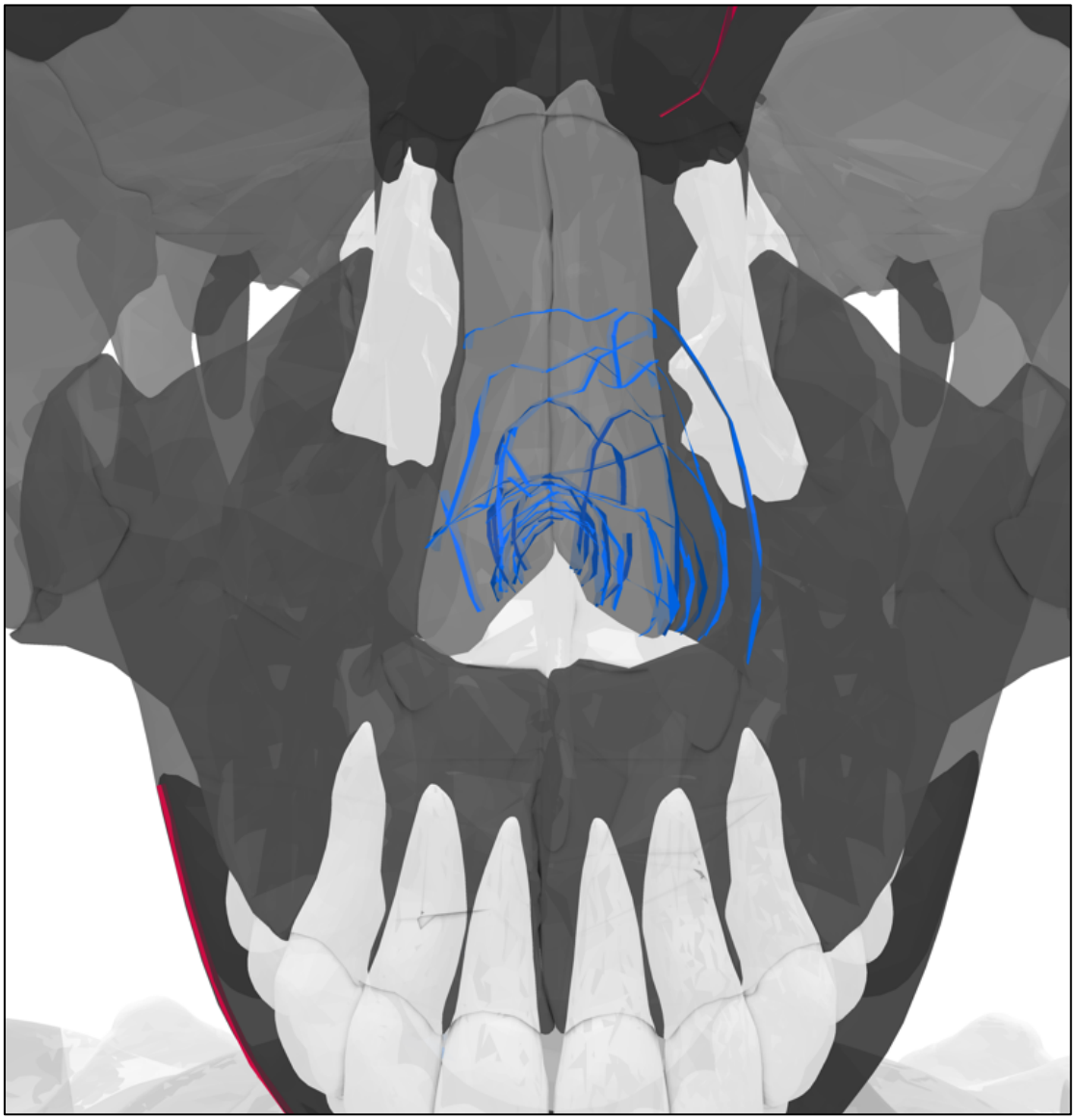


Figure 7.8: Distribution map of nasal bone fractures from the Yayoi period.

Table 7.7: Prevalence of violence-related trauma by site for the Yayoi.

Site	n	Completeness	Trauma	CAT	Crude Prevalence	CAP
Doigahama	19	0.67	5	13	0.26	0.39
Hirota	8	0.76	4	6	0.50	0.66
Kanenokuma	30	0.77	5	23	0.17	0.22
Kōra	9	0.93	2	8	0.22	0.24
Mitsunagata	24	0.59	3	14	0.13	0.21
Nagaoka	24	0.57	1	14	0.04	0.07
Nakanohama	18	0.59	2	11	0.11	0.19
Ōtomo	10	0.43	3	4	0.30	0.70
Shibu	2	0.39	2	1	1.00	≥1.0
Shinmachi	4	0.46	1	2	0.25	0.55
Sudare	1	0.89	1	1	1.00	≥1.0
Tsukomuta 4	4	0.75	1	3	0.25	0.33
Yokoguma kitsunezuka	14	0.77	2	11	0.14	0.19

Every site but Minamikata had individuals with evidence of skull trauma (Table 7.7). The skull trauma at Hirota is anomalous (Figure 7.9). The site is the only one from this study from Kagoshima Prefecture and is located on the island of Tanegashima (see Chapter 5.2.2.3.1 for more details). As discussed in Catalogue II in the section titled "Hirota C5|Young Adult | Male | Late Yayoi", the evidence for cranial modification at the site is also unusual for the region and period. A greater number of individuals from the Hirota site need to be examined in detail to more clearly elucidate the possible cause, but preliminary results suggest that the trauma is almost exclusively above the 'hat brim line' (Kremer et al. 2008) and all individuals affected did not live long into what we now consider to be adulthood. The females have trauma to the frontal and left nasal bones and to the parietal bones. The number of depressions is lower for the females than the males. The injuries to Hirota C-5 (Young Adult Female) are associated with a possible perimortem penetrating wound to the left leg. The shape of particular injuries to Hirota D-II-3 (#2 and 4) and D-III-2 (#6, 5, 12a-c, 14, and 15) appear to have been caused by a long but relatively narrow surface. Conversely some injuries to Hirota C-5 (#2–5 in particular) are small, circular depressions, which could have been caused by implements such as slingstones (Ruchonnet et al. 2019; Skov 2013; Standen et al. 2021; Vinuthinee et al. 2015).

Individual D-III-2 (Young Adult Male) has the largest number of likely blunt force antemortem lesions to the cranium.

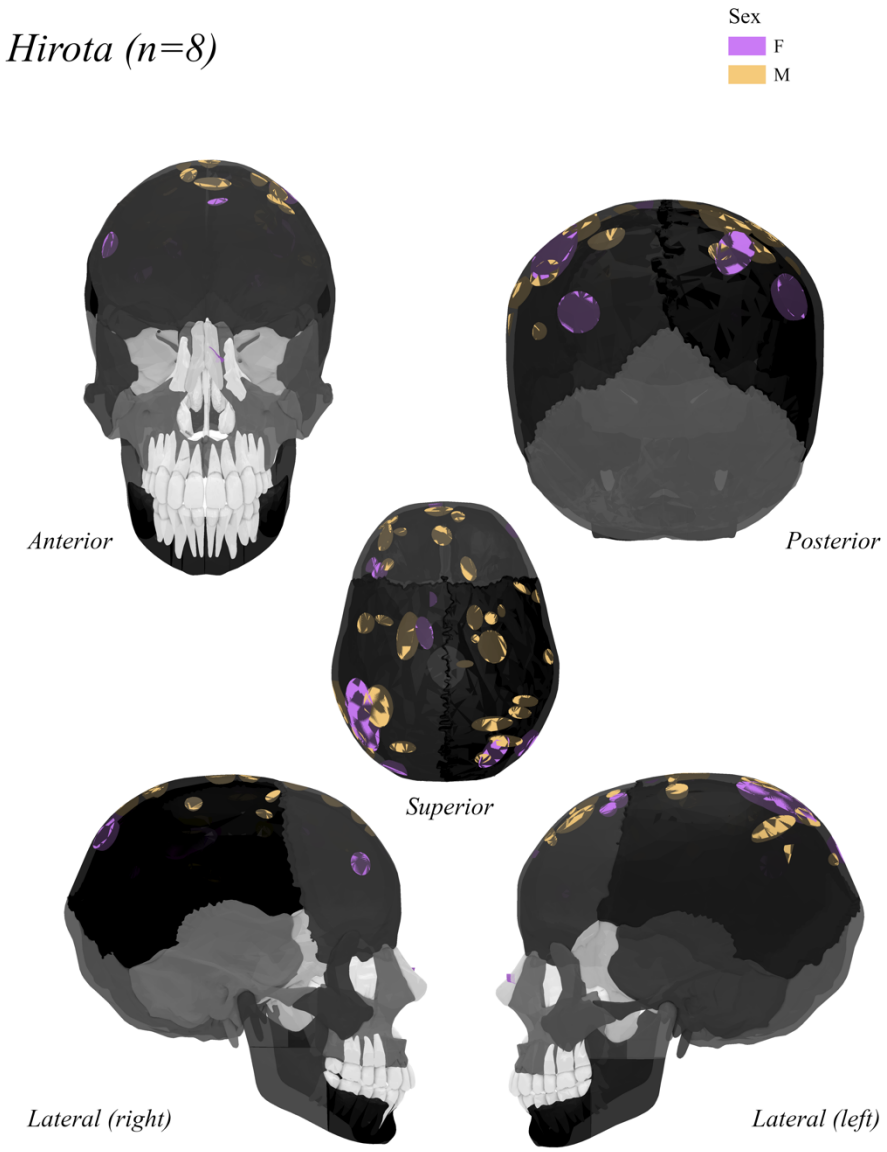


Figure 7.9: Distribution map of blunt force antemortem injuries found on individuals from Hirota.

The majority of injured Yayoi individuals with skull injuries fall into the middle adult age group (Figure 7.10). The second-most common are the young adults and then old adults. This will be discussed in more detail in the subsequent chapter.

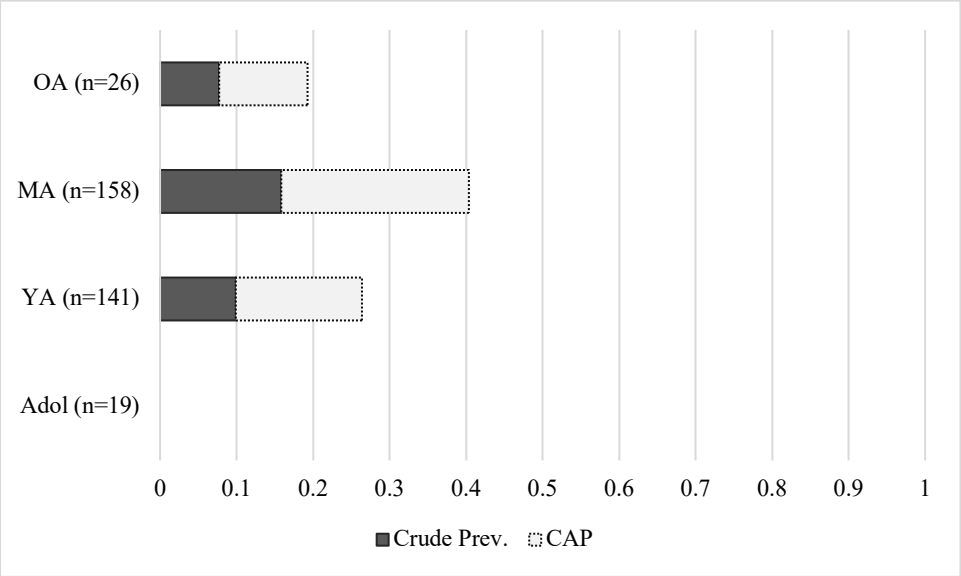


Figure 7.10: Frequency of skull trauma by age group in the Yayoi sample.

Unfortunately, until more individuals from the Initial – Early Yayoi period are examined, it is not possible to robustly compare the earlier stages of the Yayoi period to that of the Middle – Late period.

7.4 YAYOI SKULL TRAUMA PATTERNS

7.4.1 Nasal Bone Fractures

Although the exact patterns vary considerable, clinical studies of maxillofacial fracture rates frequently find that among males, especially young adults (20–29 yrs.), traffic accidents, usually in developing countries, and assaults, usually in developed countries, are the primary causal factors. In the case of assaults, alcohol consumption is also found to be a correlating factor (Bakardjiev and Pechalova 2007; Bataineh 1998; Bonavolonta et al. 2017; Businger et al. 2012; Çil and Kahraman 2013; de la Cova 2010; Hussain et al. 1994; Kyrgidis et al. 2013; Laverick et al. 2008; J. H. Lee et al. 2010; Roccia et al. 2016; Salentijn et al. 2013; Schneider et al. 2015). As the Jōmon and Yayoi people were not zipping about on roadways, fractures caused by traffic accidents can be disregarded. Additionally, the Yayoi period likely did not mark the beginning of alcohol production on the archipelago (Shoda 2021). The maxillofacial

fractures found in the Yayoi are limited to the nasal region, whereas the clinical studies also found a higher prevalence of zygomatic, orbital, and/or mandibular fractures.

In previous archaeological studies that have found high a prevalence of nasal fractures associated with hand-to-hand conflict, corresponding fractures to distal fourth and fifth metacarpals, i.e. 'boxer's fractures', have also been more commonly found. Boxer's fractures result from a poorly executed strike made with a closed fist. If the wrist turns too much on impact and the more force is directed up and not dispersed through the arm but into the distal-most portion of the fourth and fifth metacarpals, it is more likely that they will fracture. Professional boxers are more likely to fracture their second or third metacarpals as they stabilise their wrists better and as they tend to wrap or cover their hands and wrists, but this can also depend on the position of the hand during the strike (Brickley and Smith 2006; Margaret A. Judd 2002b; Lorentz and Casa 2020; Walker 1997). Yet, it should be kept in mind that not only a closed fist can be used to cause a broken nose. The hilt of a bladed weapon or tool could work just as well in non-lethal conflict. Kōra 67 (Mid Adult Male) has, along with healed fractures to his frontal and right and left nasal bones and ribs, a healed fracture to the head of his left second metacarpal (Figure 7.11). The only other metacarpal fracture found was to the proximal diaphysis of the right second metacarpal on a male from the Nagaoka site, individual K9, which is less likely to be the result of a punch gone awry (Kyushu University School of Medicine 1988; Nakahashi 1990). See Catalogue II for photographs and additional details concerning these two cases. As these nasal injuries are mainly confined to males and show a clear sidedness, it is most likely that these represent intracommunity conflict between these males, rather than the result of falls or occupational accidents.

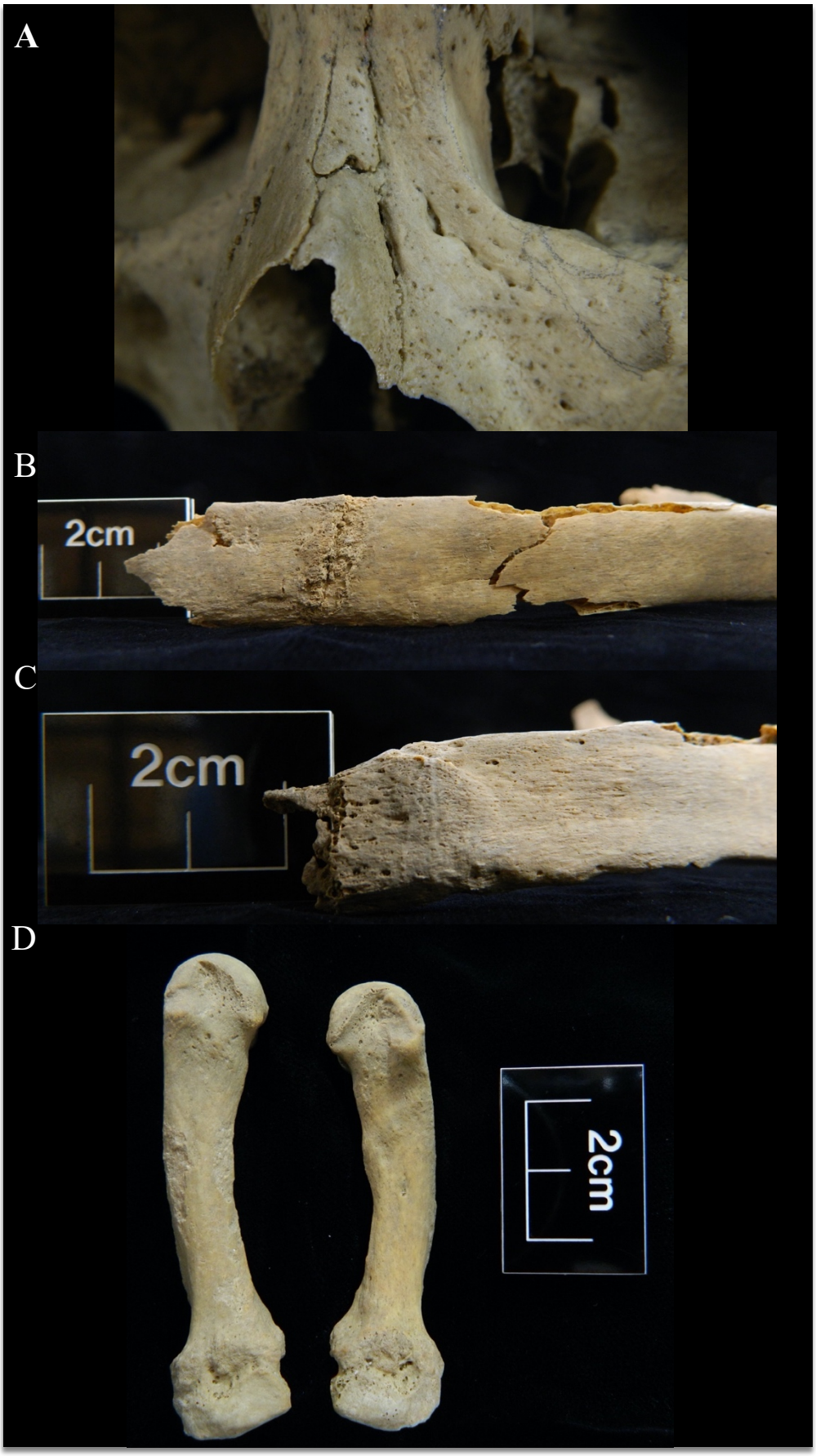


Figure 7.11: Kōra 67 injuries: A) healed nasal and maxillary fractures, B) healing fracture to the left ninth rib, C) healed fracture to the left tenth rib, D) healed fracture to the left second metacarpal.

7.4.2 Hirota Site

Considering that most of the trauma to the Hirota individuals is antemortem and yet is so numerous, it is unlikely that the aim was to kill these individuals. Yet, one can imagine that this would be difficult to control when striking the head multiple times. The possible use of something like a knobbed club may explain the simultaneous creation of multiple smaller BFT injuries. There is also a lack of correspondingly numerous postcranial fracturing, even those that could have been obtained by self-defence (such as parry fractures), suggesting that their hands and arms were out of the way purposefully. Perhaps these injuries are the result of some form of designated nonlethal conflict resolution and/or punishment practiced among this group on Tanegashima to control certain disputes or behaviours (Bandelier 1910:88; Knuckey 1992; Mathew and Boyd 2011; M. O. Smith 2003; Torres-Rouff and King 2014; Webb 1995). It seems unlikely that these were outsiders to the Hirota group, given that they were buried alongside others from the site. Additionally, as Armit recently reiterated, "Ritualised acts were far from being empty gestures dictated by tradition: through their intercession with the supernatural world, for example, through the appeasement or engagement of spirits, gods or ancestors, they were intended to have direct practical outcomes" (2020:443).

7.5 JŌMON AND YAYOI VIOLENT SKULL TRAUMA

The total difference between the Jōmon and Yayoi period violent skull trauma is 15% crude prevalence and 22% CAP difference (Table 7.1). The difference in violent trauma to the skull between all adolescent to adult Jōmon and Yayoi individuals is statistically significant whether the values are unweighted (χ^2 test, n = 396, $df = 1$, $p < 0.001$; Cramer's V test, $V = 0.228$) or weighted (χ^2 test, n = 236, $df = 1$, $p < 0.001$; Cramer's V test, $V = 0.271$).

When comparing the males and females by period, the males are statistically different (unweighted χ^2 test, n =208, $df = 1$, $p < 0.001$; weighted χ^2 test, n = 133, $df = 1$, $p < 0.001$), whereas the females are not (unweighted Fisher's Exact test, n = 165, $df = 1$, $p = 0.357$;

weighted Fisher's Exact test, n = 100, $df = 1$, $p = 0.267$). The difference between the trauma to the skull in the males is largely being driven by the eighteen healed nasal fractures. If individuals with only nasal fracture are removed, the difference between Jōmon and Yayoi males not nearly as strong (unweighted χ^2 test, $p = 0.024$; weighted Fisher's Exact test, $p = 0.108$).

The Jōmon adolescents and adults (n = 224) have an average nasal bone completion of approximately 9%, which gives a CAT of about 20 individuals, whereas the Yayoi (n = 172) have an average preservation of 44%, giving a CAT of about 76 individuals. The CAT here represents the effective number of individuals' nasal bones which have been examined within the sample. If the Jōmon had a similar prevalence of nasal fractures to the Yayoi (20/76 or about 26%), then it would be expected that approximately five nasal fractures would be present, hence the observed difference is statistically significant (weighted by nasal bone completeness Fisher's Exact test, n = 96, $df = 1$, $p = 0.020$). Although, this does not take into account if the anteriorly protruding half of the nasal bone, which is more likely to be affected, was the portion best preserved. Nevertheless, there is more facial trauma present to the Yayoi males than to the Jōmon males.

The higher incidence of perimortem skull trauma to the Jōmon females does not hold true for the Yayoi females. Nevertheless, this is complicated by the presence of metal weapons during the Yayoi period, as the skull was likely less targeted for lethal blows. The only perimortem trauma to the skull among Yayoi individuals found was on those with corresponding perimortem injuries to the postcrania.

Recent large-scale compilation studies of Jōmon and Yayoi violence, as discussed in Chapter 3.4, have focused on drawing data from site reports and summary studies of violent trauma during the Jōmon and Yayoi periods (Nakagawa et al. 2017; Nakagawa et al. 2021; Nakao et al. 2016). Hence, the criteria for identification in each study or report and the criteria for inclusion in the compilation studies are diverse. In the compilation studies, in particular,

they included injuries caused by weapons (ante- and perimortem) anywhere on the skeleton and include individuals with 'weapons' found in the burial where the inference was that they were the cause of death (e.g. an arrowhead in the chest cavity); these were then quantified into a 'mortality rate' (Nakagawa et al. 2017; Nakagawa et al. 2021; Nakao et al. 2016).

Nevertheless, antemortem trauma cannot reasonably used to calculate a 'mortality' rate as one cannot assume that their manner of death was violent even if their bodies tell a story of some history of violent conflict. Instead, antemortem trauma should be examined concurrently but also critically for its own patterns as it might have more to say about particular social or environmental stressors (Brickley and Smith 2006; Brickley 2006; Fibiger et al. 2013; M. A. Judd 2006). For instance, it is not immediately clear from the criteria used whether injuries such as depressed cranial fractures or parry fractures might be included in these values. Yet, as has been discussed in Chapter 6 and Catalogue II, studies of modern and past groups support that statistically these will be more likely to be caused by violence.

Hence, the values calculated by this team will be treated as a count of overall violent trauma here. Finally, even though these studies allowed for a sample of over 4,000, they do not take into account the variable preservation of individuals. There is no bone preservation whatsoever for some of the graves included, which makes it impossible to confirm the presence of trauma (R.J. Schulting, per. comm.). Given these caveats, it is of limited utility to compare the mortality rates produced by Nakao, Nakagawa, and colleagues to the new data produced in this study. Integrating the trauma found in this study with their data results in a very rough estimate of the *minimum* trauma found per subperiod (e.g. Table 7.8 for the Jōmon sample).

*Table 7.8: Percent of trauma per individual during the Jōmon period, integrating data from Nakao et al. (2016) and Nakagawa et al. (2017) with those in this study The values in bold are those which have been modified. *Excluding sites were n < 10.*

Reproduced from Nakagawa et al. (2017:9) Table 1

Phase (Jomon)	Total	Adults	ID	ID excluding children	Adults*	ID*	ID excluding children*	ID/Total	ID excluding children/adults	ID excluding children*/ adults*
Initial	113	39	1	1	28	1	1	0.88%	2.56%	3.57%
Early	216	117	0	0	98	0	0	0.00%	0.00%	0.00%
Middle	371	172	5	5	97	3	3	1.35%	2.91%	3.09%
Late	944	470	7	7	398	6	6	0.74%	1.49%	1.51%
Final	932	471	10	10	430	9	9	1.07%	2.12%	2.09%
Total	2576	1269	23	23	1051	19	19	0.89%	1.81%	1.81%
With data from this study:										
Initial	113	39	1	1	28	1	1	0.88%	2.56%	3.57%
Early	216	117	0	0	98	0	0	0.00%	0.00%	0.00%
Middle	371	172	5	5	97	3	3	1.35%	2.91%	3.09%
Late	944	470	**10**	**10**	398	**9**	**9**	**1.06%**	**2.13%**	**2.26%**
Final	932	471	**18**	**18**	430	**17**	**17**	**1.93%**	**3.82%**	**3.95%**
Total	2576	1269	**34**	**34**	1051	**30**	**30**	**1.32%**	**2.68%**	**2.85%**

In this study, RJS, IB, and the author revaluated several of the sites cited by Nakao, Nakagawa, and colleagues, amounting to approximately 9% of their data. Revaluating these skeletal collections raised the percentage of trauma for the entire Jōmon by 1%. Additionally, in this study the CAP (8%) and crude prevalence (4%) of skull trauma in the Late–Final Jōmon in the southwest is significantly higher than the 1.51% to 2.09% reported previously for the same period throughout the archipelago (Nakagawa et al. 2017).

7.6 SUMMARY

On average the Yayoi sample was better preserved, but the Jōmon sample had better surface condition. The Yayoi had over three times as much trauma as the Jōmon to the skull. Perimortem skull trauma during the Jōmon was mainly restricted to females, whereas in the Yayoi skulls do not seem to have been the primary targets for fatal blows, consistent with a shift to metal weapons that mainly targeted the body rather than the head. During the Jōmon, the majority of injuries were to the parietal bones. Comparatively, during the Yayoi the majority of injuries were to the nasal bones, then the parietal and frontal bones. The Yayoi saw a much greater incidence of facial trauma. The numerous nasal fractures during the Yayoi are largely confined to males and how this might be related to unrest and nonfatal violent conflict resolution among males within communities is discussed further in the following two chapters. The antemortem skull trauma found at the Hirota site are most consistent with nonfatal but violent ritual dispute resolution or some form of sanctioned punishment. In both the Jōmon and Yayoi samples, the incidence of violence peaks among the middle adult individuals, with some inclusion of young and old adults as well.

When compared to other compilation studies, the results from this study emphasise the need for more rigorous and standardised reporting of trauma as traumatic injuries can be easy to miss in collections unless one is looking for them. Hence, it is unsurprising that we found more trauma than was previously reported for the Jōmon period.

Chapter 8 – YAYOI TRAUMA RESULTS AND DISCUSSION

8.1 COMPLETENESS AND PRESERVATION

The overall completeness of the Yayoi sample can be seen in Figure 8.1 and Figure 8.2. Overall, the average completeness of the 172 adolescent to adult Yayoi individuals recorded was 0.33. The skull was the most well-represented, due in large part to the preferential selection of individuals with at least some cranial elements present in order to facilitate comparison with the Jōmon sample in this thesis. Unsurprisingly, the more robust long bones of the arms and legs are also better preserved. As stated in the previous chapter, the surface condition for the Yayoi sample was (1.55 ± 0.04).

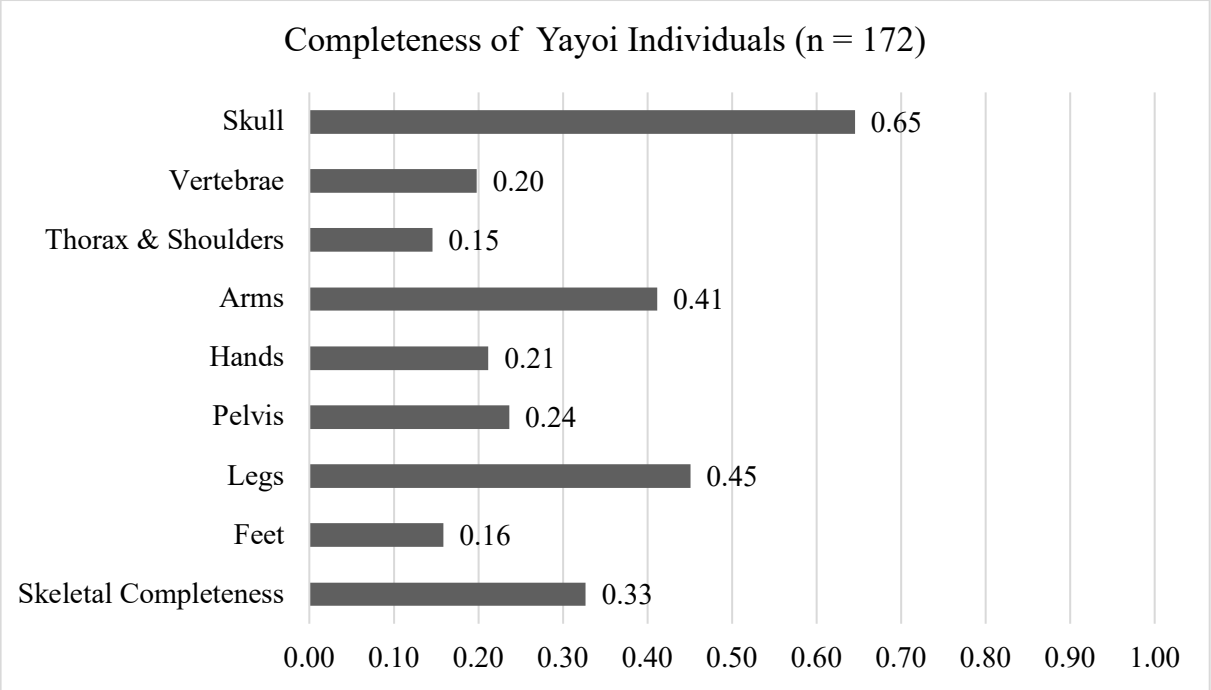


Figure 8.1: The average completeness of all the zones analysed for the Yayoi Adolescent to Adult sample.

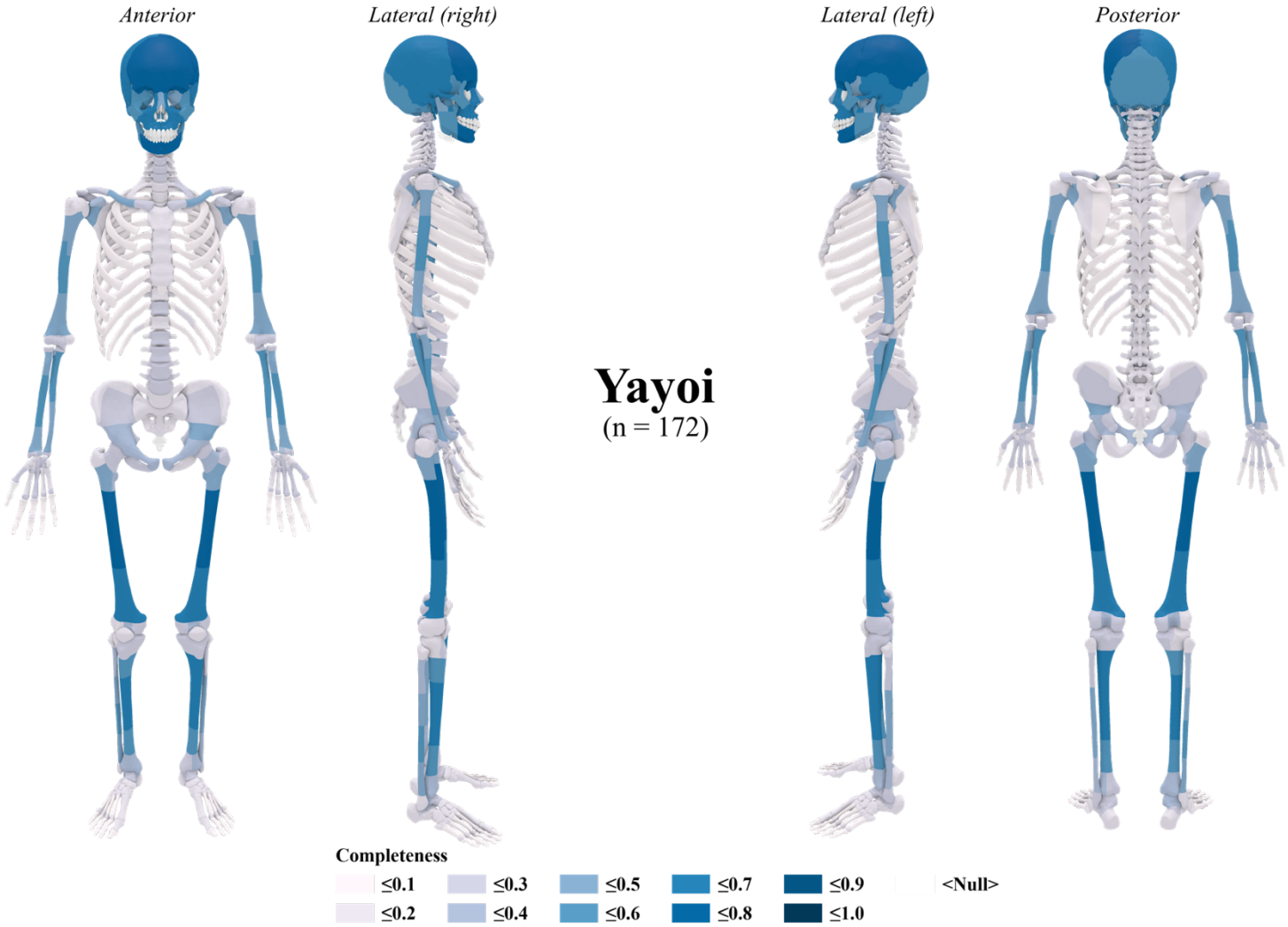


Figure 8.2: A visual summary of the average preservation of each zone that was assigned a specific zone (and not a group, which are describes and accounted for numerically only) from the Yayoi adolescent to adult sample analysed. Null values, or bones not analysed, are in white.

The Completeness Adjusted Total (CAT), total trauma found, trauma crude prevalence, and Completeness Adjusted Prevalence (CAP) for the Yayoi individuals analysed can be seen in Table 8.1. See Chapter 6.3.2.1 for full details on how these were calculated, although note that when the trauma was calculated, each traumatic event was counted (i.e. if an individual had one antemortem and one perimortem injury, two instances of trauma were recorded).

*Table 8.1: Summary of the completeness and trauma of the Yayoi sample by period. *No subperiod designated.*

Period	n	Completeness	CAT	Trauma	Crude Prevalence	CAP
Yayoi*	3	0.34	1	1	0.33	0.97
Initial–Early	24	0.40	10	8	0.33	0.82
Early–Middle	112	0.34	38	26	0.23	0.69
Middle–Late	33	0.24	8	10	0.30	≥1.0
TOTAL	**172**	**0.33**	**56**	**45**	**0.26**	**0.80**

8.2 Overview of Yayoi Trauma Found

Out of the 172 adolescent to adult individuals examined, 43 individuals had Medium–High likelihood violent trauma. Two individuals had both ante- and perimortem injuries. Hence, the total sample has a crude prevalence of trauma of 0.26 (45/172), but a CAP of 0.80 (45/56) (Table 8.1 and Table 8.2). The CAP of antemortem injuries is 0.57 (crude prevalence of 0.19) and 0.23 for perimortem injuries (crude prevalence of 0.08). The difference between the CAP and crude prevalence values is much larger than when only the skull trauma was examined in the previous chapter due to the lower overall skeletal completeness compared to the skull completeness. Nevertheless, as is demonstrated in Table 8.3, Medium–High likelihood violent trauma was found on almost every area of the body but the feet, hence it does not follow that any areas should be excluded from the completeness count. Even if the completeness of the feet is removed, it only lowers the average skeletal completeness to 0.32.

Table 8.2: All trauma from the Yayoi sample that was possibly related to violence (Medium–High likelihood). 'FBT' denotes 'Full Body Trauma', 'PCT' denotes 'Postcranial Trauma', and 'ST' denotes 'Skull Trauma'. This excludes any individuals with only postcranial trauma. See Catalogue II for details, images of each, and visualisation of their completeness and the location of injuries.

ID	Site	Period	Age	Sex	Timing	Violent Trauma (Med–High)	Type	Area	Element	Element Completeness
124	Doigahama	Early–Middle Yayoi	MA?	M	Peri	1. High; 2–5. Medium; 6–11. High; 12. Medium; 13. Medium; 14– 24. High; 26–29. High; 31. High	Penetrating, SFT, BFT	FBT	1–2. Frontal; 3. R Mandible; 4. R Parietal and Occipital; 5. L Parietal and Occipital; 6. T7; 7. T10; 8. T10; 9. T11; 10. T11; 11. T12; 12. T12; 13. L3; 14. L4; 15–17. L Os Coxae; 18–19. R Os Coxae; 20. R 1st Rib; 21–22. R 7th Rib; 23. R 11th Rib; 24. L 7th Rib; 26. L 10th Rib; 27. L 11th Rib; 28. R Femur; 29. L Femur; 31. R Tibia	1–2. 1/3; 3. 1/3; 4. 2/3, 1/3; 5. 1/3; 6. >1/3; 7. 2/3; 8. 2/3; 9. 1; 10. 2/3; 11. 1; 12. 2/3; 13. 2/3; 14. 1; 15. 2/3; 16. 2/3; 17. 1; 18. 2/3; 19. 2/3; 20. 2/3; 21. 2/3; 22. 1; 23. 1; 24. 2/3; 26. 2/3; 27. 2/3; 28. 1; 29. 1; 31. 1
312	Doigahama	Early–Middle Yayoi	YA	F	Ante	1. Medium	BFT	ST	1. R and L Nasal bones	1. 1
421	Doigahama	Early–Middle Yayoi	MA	F?	Ante	1. Medium; 10. Medium	BFT	FBT	1. L Parietal; 10. Hyoid	1. 1; 10. N/A

ID	Site	Period	Age	Sex	Timing	Violent Trauma (Med–High)	Type	Area	Element	Element Completeness
1105	Doigahama	Early–Middle Yayoi	MA	M?	Ante	Medium	BFT	ST	R and L Nasal bones, L Maxilla	2/3, 1
1116	Doigahama	Yayoi	MA	M	Ante	1. Medium	BFT	ST	1. R and L Nasal bones	1. 2/3
A-8	Hirota	Late Yayoi	YA–MA	M	Ante	1–3. Medium 5. Medium	BFT	ST	1. Frontal; 2. L Frontal; 3. R Parietal; 5. L Parietal	1. 2/3; 2. 2/3; 3. 1; 5. 1
C-2	Hirota	Late Yayoi	YA	M	Ante	1. Medium; 2. Medium	BFT, Penetrating	ST	1. L Frontal; 2. L Parietal	1. 2/3; 2. 1
C-5	Hirota	Late Yayoi	YA	F	Ante, Peri?	1. Medium; 2. Medium; 4–7. Medium; 10. High	BFT, Penetrating	FBT	1–5. Frontal; 6–7. L Parietal; 10. L Femur	1–5. 2/3; 6–7. 1; 10. 2/3
D-II-3	Hirota	Late Yayoi	YA	F	Ante	1–5. Medium	BFT	ST	1. L Nasal bone; 2–3. L Parietal; 4–5. R Parietal	1. 2/3; 2–3. 1; 4–5. 1
D-III-2	Hirota	Late Yayoi	YA	M	Ante	1–11. Medium; 12b–17. Medium; 19–20. Medium; 22. Medium; 24–27. Medium	BFT	ST	1–6. Frontal; 7–16. R Parietal; 17–25. L Parietal; 26–27. R Parietal	1–6. 1; 7–16. 1; 17–25. 1; 26–27. 1
K13	Kanenokuma	Mid Middle Yayoi	A	M	Peri	High	SFT	PCT	L Femur	1

ID	Site	Period	Age	Sex	Timing	Violent Trauma (Med–High)	Type	Area	Element	Element Completeness
K61	Kanenokuma	Mid Middle Yayoi	YA	M	Ante	1. Medium	BFT	ST	1. R and L Nasal bones	1. 1
K79	Kanenokuma	Early half Middle Yayoi	YA	M	Ante	1. Medium	BFT	ST	1. L Nasal bone, L Maxilla	1. 1, 1
K102	Kanenokuma	End of the Early Yayoi	YA	M	Ante	1. Medium; 2. Medium	BFT	ST	1. R and L Nasal bones, L Maxilla; 2. L Parietal	1. 1, 1; 2. 1
K139	Kanenokuma	Early half Late Yayoi	MA?	F?	Ante	Medium	BFT	ST	L Parietal	1
K229	Kanenokuma	Early half Middle Yayoi	MA	M	Ante	Medium	BFT	ST	R and L Nasal bones	1, 1
44	Kōra	Early Yayoi	YA–MA	M	Ante	1. Medium	BFT	ST	1. R and L Nasal bones	1. 1
67	Kōra	Early Yayoi	MA	M	Ante	1. Medium	BFT	ST	1. L and R Nasal bones, L Maxilla	1. 1, 1
7 • 8 - A	Minamikata	Middle Yayoi	YA?	M	Peri	2. Medium	SFT	PCT	2. R/L 4th? Metacarpal	2. 1
5	Mitsunagata	Middle–Late Yayoi	MA?	M	Ante	Medium	BFT	ST	R and L Nasal bones	1
32	Mitsunagata	Middle–Late Yayoi	YA	M	Peri	High	Penetrating	PCT	R Illium	2/3
104	Mitsunagata	Early half Middle Yayoi	MA	M	Ante	2. Medium	BFT	ST	2. R Frontal	2. 1
127	Mitsunagata	Middle–Late Yayoi	MA	M	Ante	1. Medium	BFT	ST	1. R and L Nasal bones	1. 2/3, 1
K10	Nagaoka	Mid Middle Yayoi	MA	M	Ante	1. Medium; 2. High	BFT, SFT	ST	1. R and L Nasal bones; 2. R Frontal	1. 2/3; 2. 1

ID	Site	Period	Age	Sex	Timing	Violent Trauma (Med–High)	Type	Area	Element	Element Completeness
SK93	Nagaoka	Middle Yayoi	MA	M	Peri	1–3. High	SFT	PCT	1. R Ulna; 2. R Femur; 3. L Tibia	1. 1; 2. 1; 3. 1
SK95	Nagaoka	Middle Yayoi	MA	M	Peri, Ante	1. High; 1. High	Penetrating	PCT	1. R Ilium; 2. L Humerus	1. >1/3, 2/3; 2. 1
SK100	Nagaoka	Middle Yayoi	Adol	M	Peri	High	Penetrating	PCT	L Sacrum	1/3
G-1-2 No.1	Nakanohama	Early–Middle Yayoi	Adol–YA	F	Peri	1. High; 2. High	SFT	PCT	1. R 2nd Rib; 2. L Clavicle	1. 1; 2. 1
G-3-1 No.7357	Nakanohama	Early–Middle Yayoi	A	M?	Ante	Medium	BFT	ST	L Parietal	1/3
G-3-1-1-その 2	Nakanohama	Early–Middle Yayoi	MA	M	Ante	1. Medium	Semi-SFT?	ST	1. R Parietal	1. 2/3
2-1 号	Ōtomo	End of the Early Yayoi	MA	M	Ante	Medium	BFT	ST	R and L Nasal bones	1
6 号	Ōtomo	Initial Yayoi	MA	M	Ante	Medium	BFT	ST	R Frontal	1
SK35	Ōtomo	Early Yayoi	MA	M	Ante	Medium	BFT	ST	R and L Nasal bones	1
3 号	Shibu	Middle Yayoi	YA	F	Peri	1. High; 3–10b. High	SFT, Penetrating	FBT	1. L Frontal; 3. L Humerus; 4. L Ulna; 5. Thoracic Vertebra; 6. Thoracic Vertebra; 7. R 10th Rib; 8. L 7th Rib; 9. L 9th Rib; 10a–b. L Femur	1. 1/3; 3. 2/3; 4. 1; 5. 1/3; 6. 1/3; 7.1/3; 8. 1/3; 9. 2/3; 10a–b. 2/3

ID	Site	Period	Age	Sex	Timing	Violent Trauma (Med–High)	Type	Area	Element	Element Completeness
4 号	Shibu	Middle Yayoi	YA	M?	Peri	1–5. High; 7–8. High; 9. Medium; 10–11b. High	BFT, SFT, Penetrating	FBT	1. R Frontal; 2. L Patella; 3. R Scapula; 4. L Scapula; 5. R Humerus; 7. R Clavicle; 8. L3; 9. L 4th Rib; 10. R Os Coxa; 11a–b. L Os Coxa	1. 2/3; 2. 2/3; 3. 1; 4. 1/3; 5. 1/3; 7. 2/3; 8. 2/3; 9. 1/3; 10. 2/3 11a. 1/3; 11b. 2/3
9	Shinmachi	Early Yayoi	OA	M	Ante	Medium	BFT	ST	R and L Nasal bones	2/3
24-1	Shinmachi	Initial Yayoi	MA	M	Ante	High	Penetrating	PCT	L Femur	2/3
K3	Sudare	Mid Middle Yayoi	MA–OA	M	Ante	1. Medium; 2. High	BFT, Penetrating	FBT	1. R and L Nasal bones; 2. R 2nd Rib, T2	1. 1; 2. 1 ;2/3
21 号	Tsukomuta 4	Middle Yayoi	MA	M	Ante	Medium	BFT	ST	R and L Nasal bones	1
25 号	Tsukomuta 4	Middle Yayoi	Adol–YA	M	Peri	High	SFT	PCT	L Femur	2/3
ST-41	Yokoguma kitsunezuka	Middle Yayoi	YA	F	Peri	Medium	SFT	PCT	R Clavicle	1
ST-122	Yokoguma kitsunezuka	Middle Yayoi	YA	M	Ante	Medium	BFT	ST	R and L Nasal bones	1
ST-128	Yokoguma kitsunezuka	Middle Yayoi	MA	M	Ante	Medium	BFT	ST	R and L Nasal bones, L Maxilla	1, 1

Table 8.3: Prevalence of recorded zones with trauma for the Yayoi. Note that due to the low recovery rates of the hyoid bone, its completeness was not recorded for the whole sample.

Zone (R&L)	n	Completeness	Trauma	True Prevalence	CAT by Element	CAP by Element
Frontal	287	0.72	10	0.03	207	0.05
Parietal	306	0.71	15	0.05	217	0.07
Occipital	140	0.56	1	0.01	78	0.01
Maxilla	256	0.63	5	0.02	160	0.03
Nasal	198	0.44	38	0.19	87	0.44
Mandible	303	0.64	1	0.00	193	0.01
Thoracic Vertebrae	759	0.19	7	0.01	143	0.05
Lumbar Vertebrae	263	0.19	3	0.01	49	0.06
Clavicle	186	0.35	3	0.02	65	0.05
Hyoid	–	–	1	–	–	–
Scapula	184	0.16	2	0.01	30	0.07
Ribs	1069	0.13	12	0.01	134	0.09
Humerus	224	0.38	3	0.01	86	0.03
Ulna	216	0.44	2	0.01	95	0.02
Metacarpals	544	0.23	2	0.00	128	0.02
Sacrum	51	0.13	1	0.02	7	0.15
Os Coxa	210	0.27	6	0.03	56	0.11
Femur	271	0.49	8	0.03	133	0.06
Patella	75	0.16	1	0.01	12	0.09
Tibia	253	0.46	2	0.01	116	0.02

Out of the 43 individuals with likely violence-related trauma, 15 (0.35) individuals have multiple injuries and, within these, two individuals (Hirota C-5 (YA Female) and Nagaoka SK95 (MA Male)) have possible ante- and perimortem injuries. Based on the CAP values (final column in Table 8.1), the areas most affected include the anterior to lateral skull (0.44–0.05), pelvis (0.11–0.15), thorax and shoulders (0.09–0.05), legs (0.09–0.06), and vertebrae (0.06–0.05).

When examining the type of trauma present per individual (Figure 8.3), blunt force trauma (BFT) to the skull clearly represents the most numerous type of injury, in large part due to the number of nasal fractures and the pattern of trauma at Hirota (see Chapter 7.4 for a detailed discussion). At least part of this rather drastic pattern is likely due to the limits of differentiating between the intent behind blunt force trauma to the skull compared to postcranial remains. Sharp force trauma (SFT) or penetrating trauma to the postcrania are much more likely

to be caused by violent intent than BFT. If individuals with *only* skull trauma are excluded from the sample (Figure 8.3 'FBT & PCT' values), then SFT and penetrating trauma make up a much larger portion of the trauma rates (0.38 (6/16) and 0.25 (4/16) respectively). Moreover, all but one individual who displayed multiple types of trauma (i.e. the 'Multi' category) were found to have evidence of penetrating trauma along with either SFT and/or BFT.

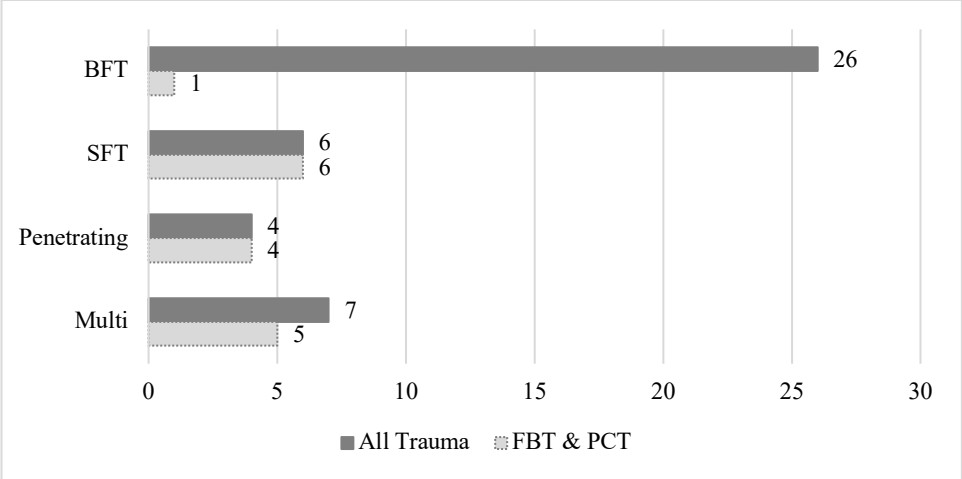


Figure 8.3: The type of trauma found in each individual with Medium–High likelihood violent trauma (n = 43). 'Multi' refers to individuals who display a combination of the other categories. The 'FBT & PCT' refers to 'Full body trauma and Postcranial trauma' and excludes individuals with only trauma to the skull.

As with the analysis of the Yayoi skull trauma, the males have statistically significantly more trauma than females when the cases are unweighted (χ^2 test, n = 168, $df = 1$, $p = 0.007$; Cramer's V test, $V = 0.209$), yet when weighted by the completeness values the p-value are far from approaching completeness (χ^2 test, n = 57, $df = 1$, $p = 0.120$; Cramer's V test, $V = 0.206$). See Figure 8.4 for a full distribution of the Yayoi trauma found, separated by sex.

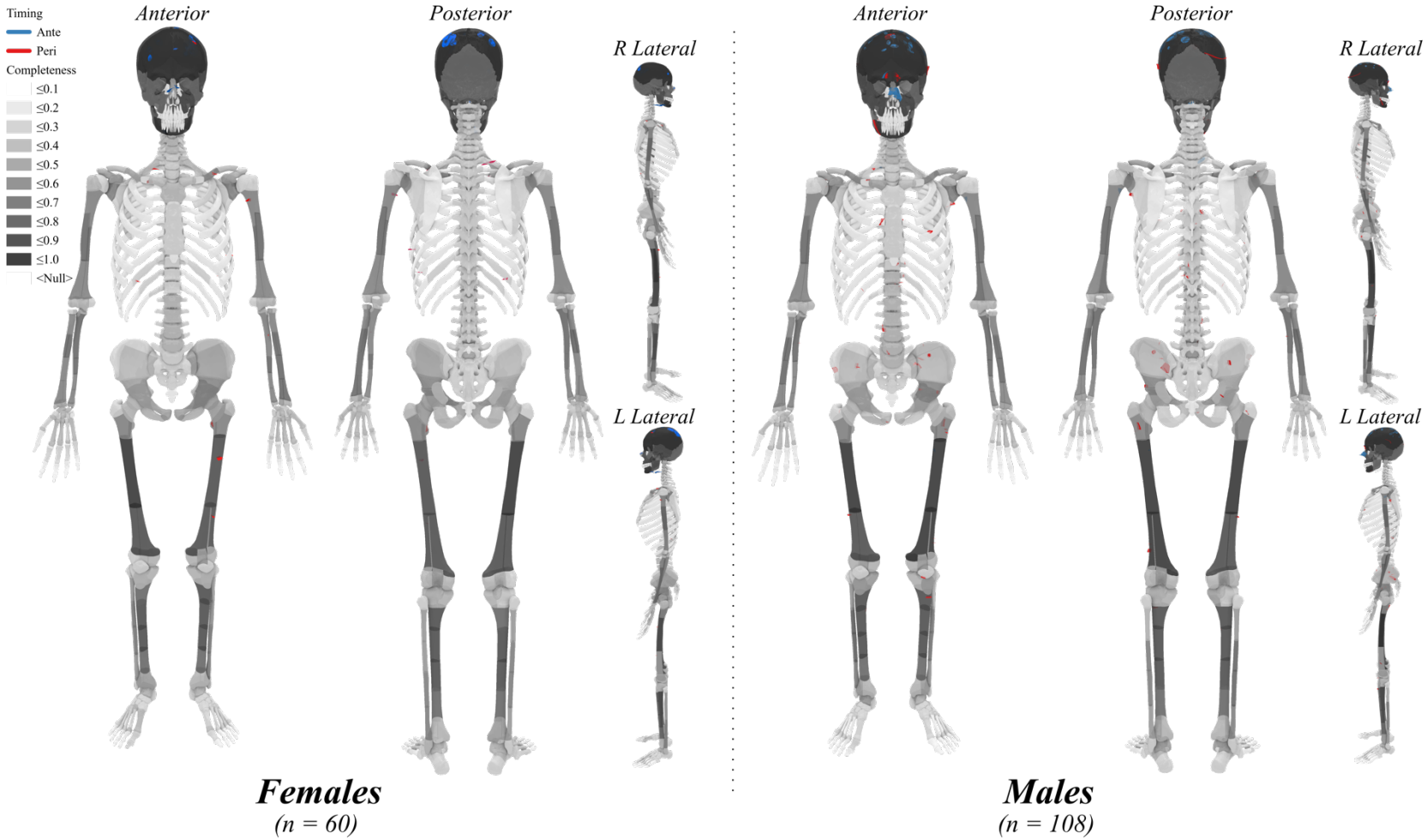


Figure 8.4: Medium–High violence-related trauma found on Yayoi females and males.

The proportion of ante- to perimortem injuries for females is 5:4 and for males is 3:1. Hence, not only do males appear to be more frequently involved in conflict, but they also appear to be engaging in more nonlethal versions of it as well, especially relating to blows to the face given the high number of nasal and associated maxillary fractures. The occurrence of BFT to the face in males does not appear to predict other forms of violence-related trauma being present, as there are 20 nasal fractures and only three individuals have other forms of trauma (Kanenokuma K102 with another cranial BFT, Nagaoka K10 with cranial SFT, and Sudare K3 with a penetrating injury to the back). This is in comparison to females who show near equal proportions of unhealed to survived trauma (Figure 8.5). The trauma to the females is not concentrated to the posterior skeleton, but overall there is more trauma to the left side, although to trauma to Shibu 3 is the most pronounced case of this. Perimortem injuries are also more numerous to the chest and upper left arm and leg as well. The trauma to the males is more widely distributed, but attacks to the back are not uncommon and a focus on the pelvis and anterior to lateral portions of the legs is present as well.

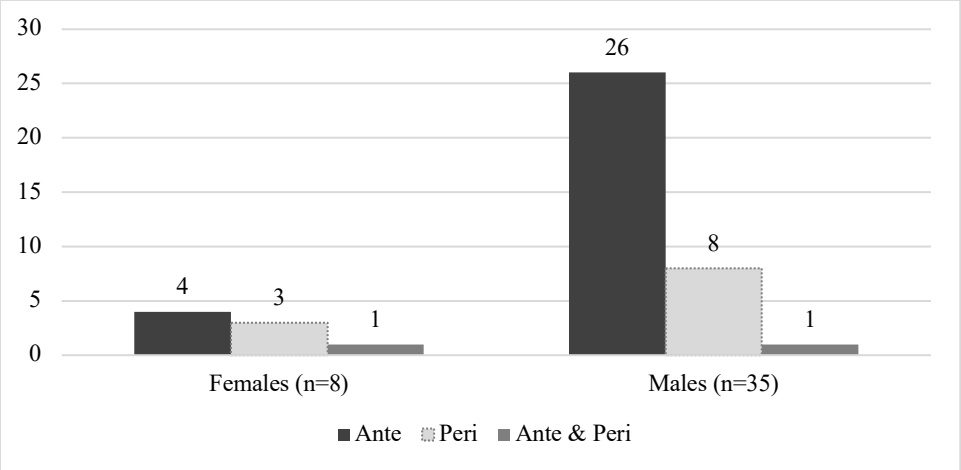


Figure 8.5: The distribution of ante- and perimortem wounds among the female and male Yayoi individuals with trauma.

The prevalence of trauma by age group largely matches the sample sizes of these groups, but larger samples of Adolescent and Old Adult individuals need to be examined if robust conclusions involving age are to be drawn (Figure 8.6).

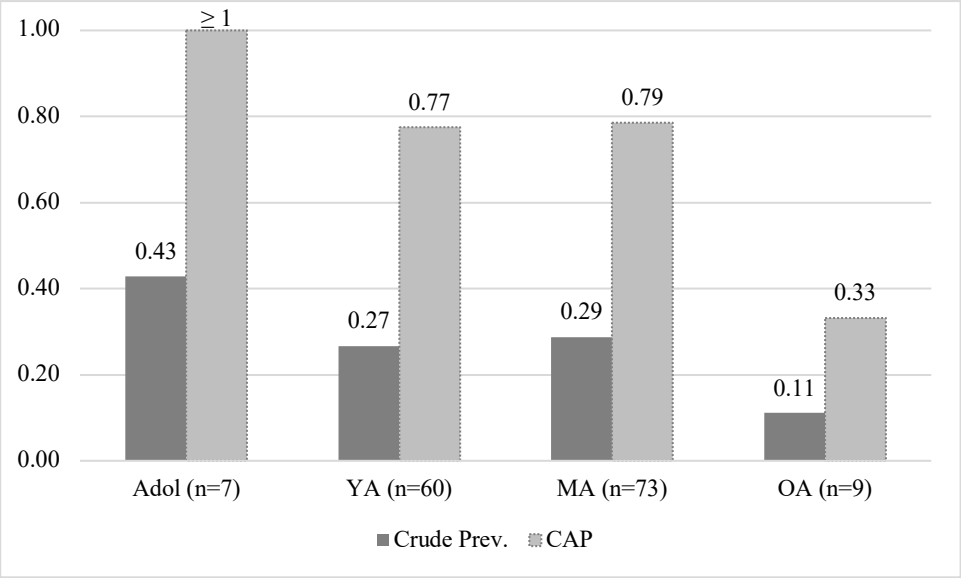


Figure 8.6: Crude prevalence and CAP of Yayoi trauma found within different age groups.

Table 8.1 provides the CAP and crude prevalence by period. Testing for differences between the distinct subperiods is currently difficult due to a lack of finer-resolution chronologies. The sample for the Middle Yayoi is the largest (n = 80 excluding those that include overlap with the Early (n = 32) or Late (n = 23) subperiods). The CAP between the Initial to Middle Yayoi is 0.76 average (crude prevalence 0.28) and there is some indication of it rising in the Middle–Late Yayoi, but this warrants further investigation, especially as the Late Yayoi sample is dominated by two sites – Mitsunagata in Saga Pref. and Hirota on Tanegashima. All but one case of trauma (Shinmachi 24-1, penetrating) found among those from the Initial–Early Yayoi consists of BFT to the skull, with SFT and penetrating trauma only becoming more common in Early–Middle Yayoi sample.

If the broad region is considered, the rates of trauma between the Kyūshū and Chūgoku are similar. There are not enough individuals from the Kinki region to make a comparison, which is in large part due to a preservation bias in burial practices (Honma 1993). Medium–High likelihood violence-related trauma was found from all of the Yayoi sites examined. The lowest CAP among these is 0.32, and the lowest crude prevalence is 0.17 (Table 8.4).

Table 8.4: The prevalence of trauma at each Yayoi site examined.

Site	n	Completeness	Trauma	CAT	Crude Prevalence	CAP
Doigahama	19	0.34	5	6	0.26	0.78
Hirota	8	0.41	5	3	0.63	≥1.0
Kanenokuma	30	0.35	6	11	0.20	0.57
Kōra	9	0.70	2	6	0.22	0.32
Minamikata	5	0.43	1	2	0.20	0.46
Mitsunagata	24	0.21	4	5	0.17	0.80
Nagaoka	24	0.25	4	6	0.17	0.67
Nakanohama	18	0.26	3	5	0.17	0.64
Ōtomo	10	0.32	3	3	0.30	0.95
Shibu	2	0.37	2	1	1.00	≥1.0
Shinmachi	4	0.14	2	1	0.50	≥1.0
Sudare	1	0.65	1	1	1.00	≥1.0
Tsukomuta 4	4	0.35	2	1	0.50	≥1.0
Yokoguma kitsunezuka	14	0.39	3	5	0.21	0.55

8.3 TRAUMA PATTERNS

8.3.1 Evidence for Cases of 'Overkill'

The numerous injuries to three Early–Middle Yayoi individuals – Doigahama 124, Shibu 3, and Shibu 4 – warrant further discussion. 'Overkill' has been defined in the forensic literature as "excessive trauma beyond that necessary to cause death" (Douglas and Douglas 2013:35) and "as the infliction of massive injuries by far exceeding the extent necessary to kill the victim" (Solarino et al. 2019:402). A classic example of this is the assassination of Julius Caesar, who was stabbed 23 times in the Roman senate theatre. In forensic overkill cases a close, long-lasting relationship between victim and perpetrator has been found to be common (Douglas and Douglas 2013; Solarino et al. 2019). The cases of Doigahama and the two Shibu individuals are consistent with an overkill situation, but possibly carried out my multiple attackers in both cases. Each individual, of which two are male (Doigahama 124 and Shibu 4) and one is female (Shibu 3), has at least ten Medium–High likelihood perimortem injuries that are related to violence (Figure 8.7). The injuries to Doigahama 124 more than double those of the Shibu individuals. In all three cases SFT and penetrating trauma were found, and in both males BFT was present as well. The presence of violence-related injuries to these individuals

has previously been investigated, particularly by Oyabu (2001; 2006, 2014, 2018) and Padgett (2020). The re-examination of these individuals conducted for this thesis allowed for the identification of additional injuries (see Catalogue II for details of these). An overall summary of the injuries found on these three individuals follows.

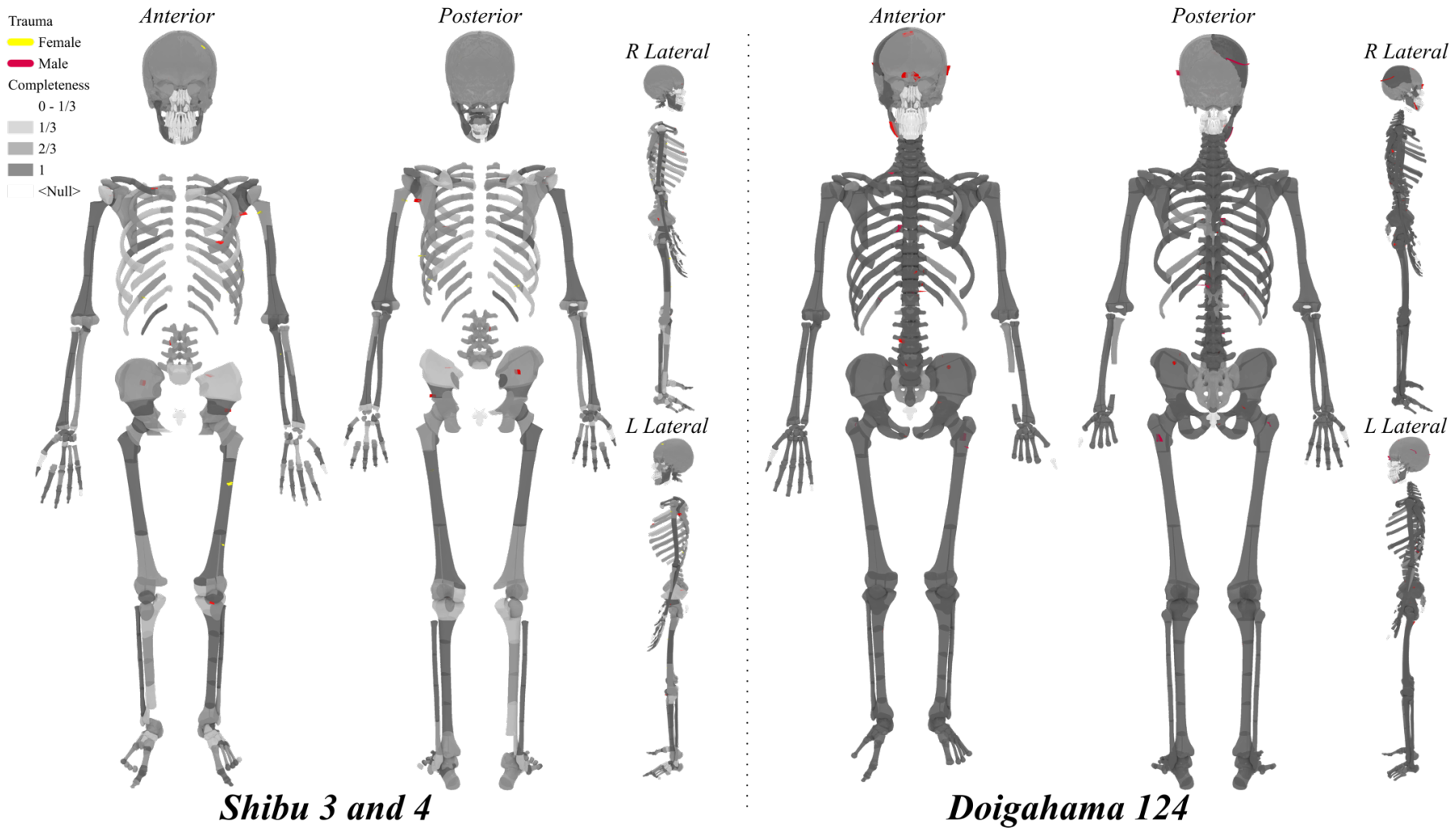


Figure 8.7: The distribution of the Medium–High likelihood violence-related injuries on Shibu 3 and 4 and Doigahama 124. Note that injuries to elements that could not be firmly sided or sorted were not included.

Doigahama 124's perimortem injuries include blunt force fracturing to the skull (with significant fragmentation of the left side of the face especially) and vertebrae; projectile trauma to the frontal bone, vertebrae, ribs, pelvis, femora, and right tibia; SFT to the vertebrae, ribs, and left femur; and possible fracturing to the right knee. A total of five embedded projectile points (Oyabu 2018) and 14 associated lithic (n = 12) and shark tooth (n = 2) projectiles have been found in and with the skeleton (Figure 8.8). This totals to at least 19 arrows being fired at No. 124, in addition to penetrating injuries without clearly associated arrowheads; SFT likely not related to projectile trauma is present to the vertebrae, ribs, and femur; and direct blunt force injuries are present to the face and skull and vertebrae.

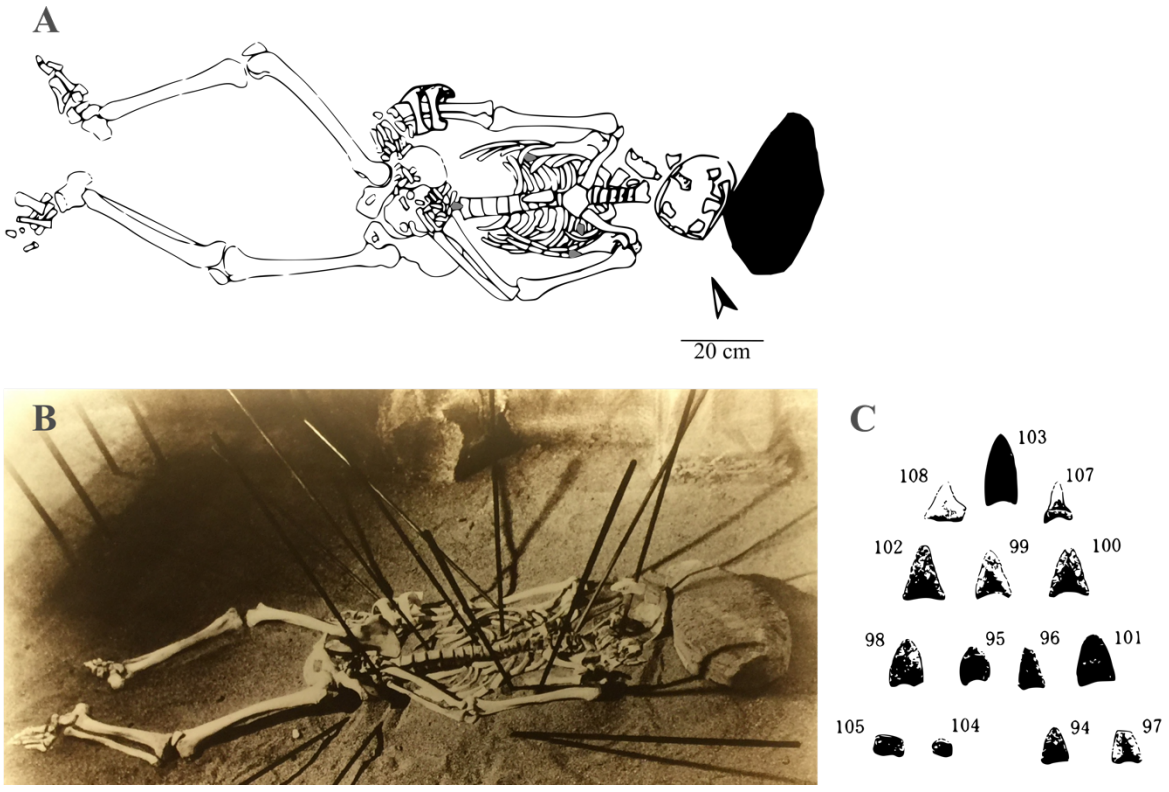


Figure 8.8: Diagram of the in-situ *evidence for projectile points in Doigahama grave 124 (excavated in 1954). A: The burial schematic of No. 124. The four grey triangles are projectile points. The two large shell bracelets on his right arm are also visible. B: A photo of the burial showing the placement of the projectile points (on display at the Doigahama site anthropological museum, 30 June 2019). C: The lithic and shark tooth (108 and 107) projectiles found in the grave.*
A and C are from Doigahama site anthropology museum (2014 vol. 2:295) and adapted by JAW.

There is a patinated fracture line to the medial right patella. Padgett (2020) proposes that this injury to the patella is due to a SFT by a bladed weapon, yet, as the fracture line matches

the contour of the bone rather than represented a more even slice through the bone, an additional hypothesis was proposed – an avulsion fracture. A possible avulsion fracture to the right medial patella is consistent with an abrupt and severe contraction of the quadriceps muscles or a direct blow to or fall onto the bone (see Catalogue II for details). It is reasonable to posit that the injury to the right patella is consistent with an abrupt fall on the feet or to that knee, with the force of the fracture coming from an attempt to stop the fall or from landing on that bone as it comes in contact with the femoral condyles (Court-Brown et al. 2015; Gwinner et al. 2016; Lovell 1997; Wedel and Galloway 2014). As proving that this was the direct result of an assault is difficult, the injury was marked a Low likelihood to be violence-related in and of itself; nevertheless, its presence with the other injuries is worth comment.

The injuries to Doigahama 124 come from the front and back, suggesting either that he was surrounded or that he turned his body at some point during the assault. If the penetrating injury on the superior portion of his frontal bone was caused by a projectile point (as posited by Oyabu (2014) based on the large interna bevel), the impact site is too high to have been fired from the front by someone on the same plane as him. Instead, either the archer must have attacked from above or the arrow was fired while No. 124 was either bent over or kneeling, exposing the top of his head. Alternatively, the perforation may have been caused by a weapon such as a halberd, which is suited to a descending, penetrating blow (O'Flaherty 2007). The SFT likely not associated with projectile point injuries and the BFT trauma to his person may have been therefore been inflicted from a closer distance and, even, on a relatively unresponsive participant. Keeping in mind that what can be surmised about the lethal trauma from the skeleton pales in comparison to what could have been learned from the soft tissue, not only do the sheer number of severe injuries to No. 124 make this an overkill case, but the concentration of deforming and obscuring trauma to the face are also diagnostic. As with the cases of nasal fractures (see Chapter 7.4.1) and headhunting, targeting of the head or face is a way of more quickly debilitating or disorienting an opponent, particularly when bladed weapons are not on-

hand, while simultaneously representing an attack on the personhood and identity of the individual (Armit 2006; Walker 2001).

Turning to the Kinki region, Shibu 3 and 4 were buried together and no other human remains from the site were well preserved enough for analysis (as discussed in Chapter 5.2.2.2.1, see Figure 5.15). Shibu 3's injuries include SFT to the frontal bone, left humerus, left ulna, vertebrae, ribs, and left femur and projectile trauma to the right tenth rib. A lithic arrowhead was found in close association to the right tenth rib (Nara Prefecture Archaeological Institute of Kashihara Museum 2014). Furthermore, Padgett (2020) reports the presence of an embedded lithic point in the medial left femur. The injuries to Shibu 3 are largely to the left side and to the anterior of the skeleton, although the SFT to the thoracic vertebrae are from behind. Shibu 4's injuries include blunt force fracturing to the frontal bone and a rib, and SFT to the left patella, scapulae, right humerus, right clavicle, a lumbar vertebra, and to both pelvic bones. The lesions on Shibu 4 are not as sided as those to No. 3. The lesion to the left patella may have resulted from an attempt to inhibit No. 4's movements. Other than the lesion to the knee and the BFT to the frontal bone, the injuries are mainly clustered around the chest and pelvis. The paired linear marks in the shoulder joint are most consistent with a cut to the joint while the arm was raised, possibly in a defensive motion.

The SFT found on Shibu 3 and 4 are consistent with being caused by metal weapons given how thin and sharp the linear marks are. Moreover, clear linear striations can be seen on the wall of a linear mark to Shibu 3's left seventh rib and the linear mark to Shibu 4's left ilium is very thin (ca. 0.6 mm), but has a triangular character in its centre (ca. 3.0 mm wide) that is consistent with either a metal projectile point or, even, the tip of a longer, bladed metal weapon. The trauma to Shibu 3 and 4 is not as extensive as that to Doigahma 124; nevertheless, the number of injuries on what remains of their skeletons is consistent with an overkill event as even one or two out of the accumulated 20+ injuries would be lethal. They appear to have been set upon by individual(s) with multiple weapons and attacked repeatedly.

8.3.2 Weapon Trauma

The amount of SFT to the legs compared to the arms or hands, which would arguably be more likely to be injured in the normal course of defence, of the Yayoi males was notable. The pelvis was also a site of concentrated trauma, but more of the trauma to it was penetrating than sharp force, consistent with aiming for the trunk of the body with lethal intent. The perimortem SFT injuries to the lateral femora and near the knees make most sense in two ways. The first is if there was a focus on a debilitating strike to the lower body before a killing stroke could be made. The other is if defensive weaponry was being employed, such as the wooden hand-held or standing shields known from the Yayoi (Figure 8.9). If a strike were to slip down or past the shield, a corresponding lacerating strike to the thigh or knee would likely be common, while still keeping the forearms relatively unharmed. That being said, there is one case of SFT to the hand (Minamikata 7 • 8 – A), consistent with a defensive injury such as those seen with individuals who either try to grab an in-coming blade or who raise their hands in defence of the face (Spitz et al. 2006).

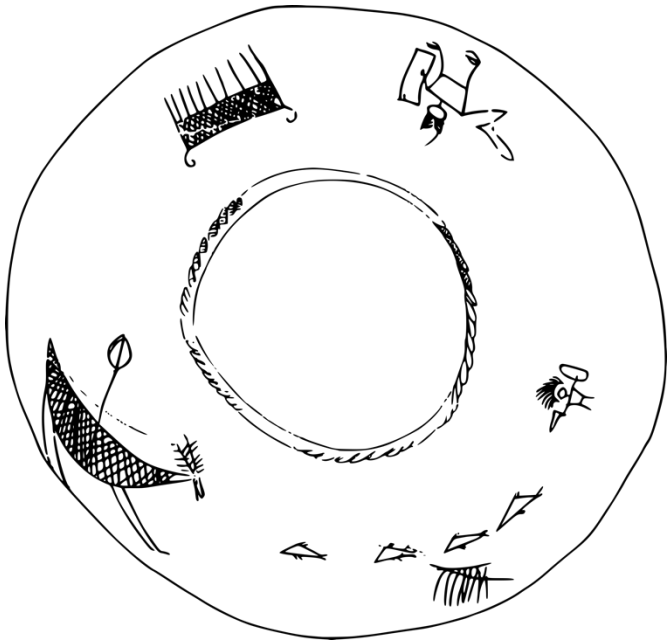


Figure 8.9: Line drawing of incised images on Middle Yayoi period pottery from the Shimizukage site in Nara displaying two figures with feather(?) headdresses and holding halberds and shields. Adapted by JAW from Tawaramoto Town Board of Education (2009). Original version reported in Tawaramoto Town Board of Education (1997).

Injuries most consistent with being caused by tools specifically designed to act as weapons cluster in the Middle Yayoi sample in this study, particularly from the sites of Doigahama, Kanenokuma, Minamikata, Mitsunagata, Nagaoka, Nakanohama, Shibu, Sudare, Tsukomuta 4, and Yokoguma kitsunezuka. Not all of the trauma from these sites is consistent with metal weaponry, particularly the projectile/penetrating trauma that indicates the continued use of bone/tooth or lithic weapons. Nevertheless, the few females impacted (Nakanohama G-1-2 No. 1, Shibu 3, and Yokoguma kitsunezuka ST-41) all show evidence of being attacked with metal weaponry. Interestingly, the SFT to the Nakanohama and Yokoguma kitsunezuka females is concentrated near the clavicles, an area which may have been a target if they were wearing armour. Based on the extant and reconstructed wooden armour types available for the Yayoi period (Fukuoka City Board of Education 1995; Hamamatsu City Board of Education 1997; Steinhaus and Kaner 2016), the shoulder area may have been more exposed and, hence, a target for strikes with weapons such as halberds and daggers that would have allowed for

curving, descending strikes. Finally, the perimortem injuries in this group impacted mainly adolescents and young adults.

8.4 Comparing Recent Studies on Yayoi Violent Skeletal Trauma

Overall, the rate of trauma found within the Yayoi sample is high and much higher than when only the skull trauma from the period was assessed in the previous chapter, with a difference of 50% in CAP and 6% in crude prevalence. This is unsurprising because a greater proportion of the body was examined and because the existence of metal, and formalised weapons in general, make targeting of the postcrania a more appealing martial strategy.

Padgett's (2020) recently completed doctoral dissertation focused on violent conflict during the Yayoi through the examination of skeletal trauma, therefore a comparison of the Padgett dataset with the findings of this thesis may yield additional insights. Padgett analysed 234 Yayoi individuals from 22 sites and the commingled assemblage of Aoya-Kamijichi, which is argued to be a Late Yayoi massacre (MNI = 109) (Inoue and Matsumoto 2001; Katayama 2001). Of these, 213 were counted in the statistical analysis and among them 46 (22%) had injuries consistent with violent trauma from the Initial–Late Yayoi, with a higher incidence of perimortem trauma. This is quite close to the total crude prevalence for Yayoi violent trauma presented in this chapter (26%), although the incidence of antemortem trauma was found to be higher here. The difference in antemortem compared to perimortem trauma rates between the two studies is at least partially explained by nasal fractures being counted towards violent trauma within this study, whereas in Padgett (2020) other indicators were necessary. If individuals with only nasal fractures are excluded from the antemortem trauma in this study (n = 16), then the crude prevalence of antemortem drops to only 9%, which is very close to the rate of perimortem trauma at 8%. Nevertheless, a high frequency of nasal fractures, particularly to the left side, was found by Padgett as well, although females (6.3% or 5/74) were found to have more of them than males (4.3% or 5/110). Overall males did exhibit more violent trauma

(7% difference), but, particularly for the Early Yayoi site of Doigahama (n =75), females were found to have a comparable incidence of violent trauma. Padgett found a higher occurrence of violent BFT during the Early Yayoi, with SFT increasing thereafter, which concurs with the findings here.

As discussed in the previous chapter (7), Nakagawa et al. (2017) compiled trauma data from published Yayoi site reports and two trauma studies in order to examine the rates of violent trauma during the entire Yayoi period. The methodological limitations discussed previously will not be repeated in detail here, but bear in mind that this count should be considered a very rough estimate of the *minimum* trauma found during the Yayoi due to constraining factors such as the likelihood of trauma impacting the skeleton, the portion of the skeleton surviving for analysis, the lack of standardised methods and priorities across all of the compiled analyses and the ease with which trauma may be overlooked within this framework, the variable completeness and preservation of the skeletal remains, and the variable interpretations of what constitutes violent trauma. When the data from this study is added, which constitutes a reassessment of 5% of the Nakagawa et al. data, the overall rate of trauma present for the whole Yayoi period rises by about 1.5% (Table 8.5) The comparatively higher rates for Initial Yayoi violent trauma Nakagawa et al. attribute to the smaller sample sizes of these periods. This may be the case, but the inclusion of additional data for the Initial–Early Yayoi suggest that higher estimate of trauma for these periods may be warranted, particularly if individuals from sites such as Doigahama can be more firmly dated to specific periods rather than covering such a large range.

*Table 8.5: Percent of trauma per individual during the Yayoi period, integrating data from Nakagawa et al. (2017) with those in this study, excluding the cases that have already been reported and included in Nakagawa and colleagues' data. The values in bold are those which have been modified. *Excluding sites were n < 10. **Including one Yayoi individual without a known subperiod.*

Reproduced from Nakagawa et al. (2017:9) Table 1

Phase (Yayoi)	Total	Adults	ID	ID excluding children	Adults*	ID*	ID excluding children*	ID/Total	ID excluding children/adults	ID excluding children*/adults*
Incipient	27	25	6	6	10	5	5	22.22%	24.00%	50.00%
Early	233	156	7	7	115	1	1	3.00%	4.49%	0.87%
Middle	2347	1794	70	66	1541	53	49	2.98%	3.68%	3.18%
Late	691	420	17	17	270	15	15	2.46%	4.05%	5.56%
Total	3298	2395	100	96	1936	74	70	3.03%	4.01%	3.62%
With data from this study:										
Incipient	27	25	**8**	**8**	10	**6**	**6**	**29.63%**	**32.00%**	**60.00%**
Early	233	156	**17**	**17**	115	**11**	**11**	**7.30%**	**10.90%**	**9.57%**
Middle	2347	1794	**84**	**80**	1541	**66**	**62**	**3.58%**	**4.46%**	**4.02%**
Late	691	420	**23**	**23**	270	**21**	**21**	**3.33%**	**5.48%**	**7.78%**
Total**	3298	2395	**133**	**129**	1936	**105**	**101**	**4.03%**	**5.39%**	**5.22%**

Although the Middle Yayoi is often cited as marking the beginnings of warfare in the archipelago, and though there do appear to be clear shifts in the manner and style of conflict during this time, including a tendency for conflict to be more lethal, it is nevertheless not apparent that hostilities themselves were higher at this time, at least if both ante- and perimortem trauma are considered. Intragroup conflict may have been higher during the transitional period in the Yayoi. Compared to the updated rates of the Late to Final Jōmon sample (Table 7.8), the rate of trauma jumps significantly with the Initial–Early Yayoi, and remains ca. 2%+ or higher throughout the Yayoi.

8.5 SUMMARY

The average completeness for the full Yayoi sample was 0.33, less than half of the completeness of just the Yayoi skulls. The rate of trauma was found to be highest during the Initial–Early and Middle–Late Yayoi periods, and lowest during the Early–Middle Yayoi, though this 'lowest' rate is still high. The areas of the body most affected by trauma include the skull, pelvis, thorax and shoulders, legs, and vertebrae. BFT to the skull was the most common form of injury, but SFT and penetrating injuries were the most common to the postcranial remains. SFT and penetrating trauma become much more prevalent from the Middle Yayoi onwards. Patterns in the SFT trauma found in the whole sample may point to more formalised modes of combat, including utilisation of specialised defensive and offensive weaponry. Males engaged in more nonlethal forms of violent conflict than females did, hence when there is evidence for trauma to a female, it is more likely to be perimortem. Three cases of overkill from two sites dating to the Early–Middle Yayoi were examined in detail. The pattern of trauma is suggestive of multiple attackers and weapons for all cases, and, for one, a particular aggression towards the individual's identity or personhood.

Finally, the results from this study were compared to those of two other recent studies, a doctoral thesis and a compilation study, on Yayoi period violent skeletal trauma. The crude

prevalence of the Padgett (2020) dataset was similar to that of this study and overall patterns of conflict were also found to coincide (i.e., the high frequency of nasal fractures, the increase in SFT with time, the probably use of weaponry and armour, and the overall higher occurrence of trauma in males). The results of this chapter were integrated with the findings of Nakagawa et al. (2017). The modified estimated rates of violence for the Yayoi period are overall ca. 1.5% higher after a re-examination of just 5% of the data. Additionally, a higher rate of violence during the Initial–Early Yayoi is suggested.

Chapter 9 – Comparative Analysis of Prehistoric Violence in the Southwestern Japanese Archipelago

It was necessary to split the results of this thesis into two chapters, one focusing on the skull trauma of the Jōmon and Yayoi and the other on the total skeletal trauma of the Yayoi, due to methodological differences. Therefore, the discussion surrounding the comprehensive interpretation of the results from both chapters will be brought together here. This chapter will further elaborate upon the results and discussion thus far of the Late Jōmon to Late Yayoi period violent trauma while also comparing them to the case studies introduced in Chapter 4 – the Mesolithic to Neolithic transition and Bronze Age of Europe.

9.1 Contextualising Late to Final Jōmon Period Violence

Considering how the Jōmon is usually framed as a largely peaceful culture, it bears discussing whether violent conflict still played a role in Jōmon society, even if its incidence was low and not marked by 'warfare'. As has been noted previously, warless societies do not necessarily equate to peaceful societies; violence, even in a milder form, can still be used as a means of conflict resolution through practices such as (capital) punishment and socially-sanctioned, usually nonlethal, violence (Kelly 2000). As Kim and Kissel (2018:164) summarise,

> *Having the capacity to conduct warfare activities does not mean all these populations and societies would have chosen to use such behaviors and tactics. Many of us in the modern world do not engage in warfare, but we are all capable of this sort of behavior… And so, talking about whether we are inherently peaceful or warlike might be setting up a false dichotomy, a question that cannot be answered.*

Based on the results from this thesis, the frequency of violent skull trauma from the Late–Final Jōmon from the southwest of the archipelago was 0.08 (0.05 for antemortem and

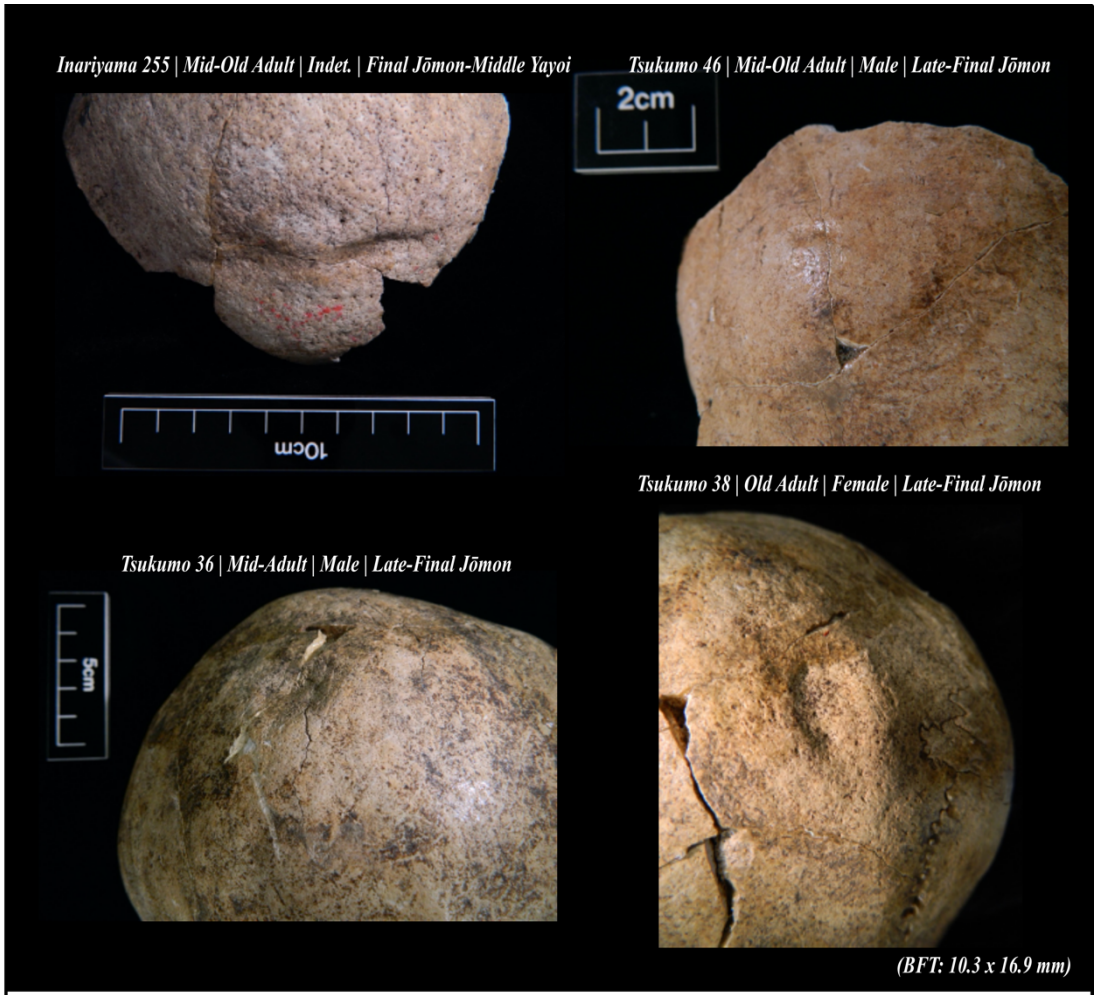
0.03 for perimortem injuries) when accounting for preservation biases in the data. This estimate is well above those made previously (e.g. 1.8% by Nakao et al. 2017), but still represents low levels of violent conflict, particularly when the crude prevalence of 0.04 is compared to other studies (cf. Walker 1989). Of course, it is not possible to determine the patterns of violence being observed based solely on a cumulative rate of trauma, rather it is imperative to analyse the trends therein.

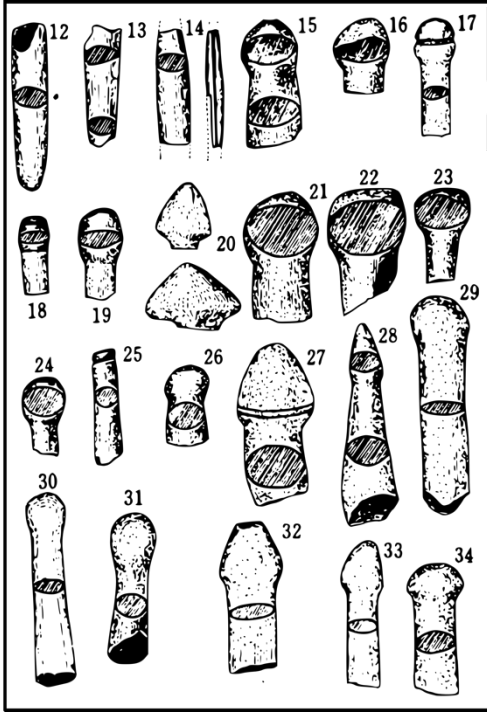
9.1.1 Tool-weapons

One way in which to contextualise the violence observed during these periods is to compare the transition between Jōmon and Yayoi to that of the Mesolithic and Neolithic cultures of Europe (for a background of the latter transition see Chapter 4). Beginning with a comparison of the hunter-gatherers, the Jōmon and European Mesolithic are marked by similar types and rates of violent trauma. As with Mesolithic Europe, the Jōmon had no clear fortified structures, suggesting that creating defensive structures even against a perceived threat of violence was not a priority. Moreover, Jōmon also employed tool-weapons in combat. Although no embedded arrowheads were found among the sample in this study, they have been noted previously for sites in Kyūshū during the Late–Final Jōmon. Evidence of wounds caused by axes have also been reported from the southwest from the end of the Jōmon period (Uchino 2013). The sharp force trauma found on individual 78-1 from Toyomatsu-Domen Cave is consistent with a grazing injury from a thinner stone tool, whereas the perforating perimortem traumata from Yoshigo 378 and Inariyama 249 are consistent with weapons that were circular in cross-section, such as hardened wooden implements, bone/horn tools, or, even, slingstones.

The antemortem blunt force trauma found is most consistent with objects without a sharpened edge, i.e. not axes. These blunt force injuries, particularly those that are circular in profile or rounded and long (see Figure 9.1), are at least consistent in shape with an implement such as a stone rod or ‘sword’. If these were employed in conflict, then they would deviate from

the pattern of tool-weapon used during the Jōmon. The measurements of the injuries are smaller than at least the larger stone rod heads (see Kiyono 1969), but could be caused by only partial impact of the surface or with smaller rods/implements. In the case of Inariyama 255, it may be more likely that the edge of an object such as one of the sword-shaped stone rods caused the injury given its more oblong shape. As discussed in Chapter 3, the use and meaning of stone rods is debated. The antemortem lesions described above could have reasonably been caused by other hard, rounded objects; nevertheless, their potential use as a (usually) nonlethal weapons is certainly possible and at least should not be dismissed based on these findings. Yet, it is difficult to imagine what a 'smoking gun' for the use of stone rods in combat would be. Even an individual with a perimortem blunt force trauma (BFT) injury buried with a stone rod adjacent to the wound would not definitely prove its use to cause the wound. Stone rods and swords, and other ritualistic objects such as *magatama* and *dogū* have been found in Jōmon graves, particularly during the Final period, but their inclusion in these contexts was not common (Nishimura 2018).





< Stone rods and sword-shaped stone rods from Inariyama Shell-mound (Kiyono 1969:157, Figure 114)

v Measurements of the stone rods to the left (Kiyono 1969:158)

Number	Length (mm)	Neck Width (mm)	Head Width (mm)
15	100.0	36.4 x 21.2	42.4 x 24.2
16	60.6	33.3 x 15.2	42.4 x 18.2
17	84.8	21.2 x 9.1	30.3 x 15.2
18	60.6	19.7 x 9.1	21.2 x 10.6
19	69.7	24.2 x 12.1	34.8 x 12.1
20	48.5	30.3 x 19.7	72.7 x 42.4
21	100.0	42.4 x 30.3	54.5 x 39.4
22	63.6	43.9 x 36.4	60.6 x 45.5
23	72.7	21.2 x 18.2	42.4 x 30.3
24	60.6	21.2 x 15.2	33.3 x 24.2
25	87.9	15.2 x 13.6	18.2 x 15.2
26	63.6	27.3 x 21.2	33.3 x 24.2
27	121.2	45.5 x 36.4	60.6 x 45.5
28	151.5	22.7 x 18.2	27.3 x 16.7
29	166.7	33.3 x 10.6	45.5 x 12.1
30	145.4	24.2 x 10.6	30.3 x 12.1
31	115.1	24.2 x 18.2	33.3 x 24.2
32	115.1	37.9 x 9.1	48.5 x 15.2
33	112.1	21.2 x 12.1	33.3 x 18.2
34	100.0	33.3 x 18.2	45.5 x 27.3

Figure 9.1: Comparison of antemortem blunt force injuries to reported measurements of stone rods from Kiyono (1969). Bottom image and table after Kiyono (1969:157–158). Adapted by JAW.

Large stone rods (ca. 5–20 cm in diameter and at times over 1 m long) are mainly associated with the Middle and Late Jōmon. These larger rods are associated with stone features and pit dwellings. Conversely, during the Late and Final Jōmon, smaller stone rods and variations such as the stone sword shape rods were produced (Habu 2004). Whether these later variations, particularly the stone 'swords', represent skeuomorphs of continental weapons is debated. Although, increasingly it is becoming clear that Final Jōmon cultures were engaging in long-distance trade and that this may be associated with an evolving relationship with non-native forms and concepts (Hudson et al. 2020a; Hudson et al. 2021; Hudson 2022). The potential underlying masculine symbology of stone rods and/or swords need not have changed during the Late to Final Jōmon for them to also have also begun to develop a practical use recalling that of metal weapons, creating something akin to a ritual weapon alongside the changes beginning to occur in the archipelago. This point is made with caution, though, as it is difficult to directly attribute any of the BFT found directly to a stone rod or sword. Whether this change in stone rod/sword form is associated with any significant changes to the rate or character of BFT to the skull among Jōmon remains would require a more in-depth analysis of at least the Middle Jōmon as well.

9.1.2 Sites

There is no indication of a particular 'warrior class' among the European Mesolithic or Jōmon cultures, but it is apparent that individuals at least occasionally engaged in violent altercations. European Mesolithic violent injuries broadly fall into the categories of blunt force trauma to the skull, projectile trauma, semi-sharp force trauma (i.e. stone axe injuries), and decapitation. The Jōmon sample shows many of the same kinds of trauma as the European Mesolithic, although indications of relatively large-scale violence against men, women and children including head-removal, such as the cases of Ofnet and Hohlenstein-Stadel, are absent. The sites of Ofnet and Hohlenstein-Stadel date to the European Late Mesolithic, well before

the first indicators of European Neolithic culture in the region. According to Nakao et al. (2016) the largest number of reported Jōmon individuals with trauma are from the sites of Hegi Cave (枌洞穴遺跡; 4/18 Late Jōmon individuals with trauma) and the Ikawazu Shell-midden (伊川津遺跡; 7/83 Final Jōmon individuals with trauma), which do not resemble a head-removal or massacre pattern. This makes preliminary reports of recent excavations at the Final Jōmon Usu Moshiri site in Hokkaido all the more intriguing. Researchers highlight a secondary group burial (Grave 18) dating to between 2400–2500 BP, contemporaneous with Yayoi groups to the west, which contains the remains of 11 individuals (ten males and one female), eight of whom the researchers argue show evidence of perimortem (n = 5) and antemortem violent sharp and blunt force skull trauma. Hence, the possibility that this was a burial area for those that may have died in conflict has been proposed (Aono and Nagaya 2021; Aono et al. 2021).

Within the Jōmon data in this thesis, the sites with the largest and, hence likely more representative samples were the Final Jōmon–Middle Yayoi site of Inariyama and the Late–Final Jōmon site of Tsukumo. The Completeness Adjusted Prevalence (CAP) values from these sites were 10 to 11% respectively. The other two sites with the most trauma date to the Late Jōmon. Conversely, the large Late–Final Jōmon site of Yoshigo has a CAP of only 4%. Hence, the data here does not support a claim for increasing overall violence between the Late to Final Jōmon. Yet, if the two sites of Inariyama and Yoshigo from Aichi Prefecture, which are just ca. 13.6 km apart from each other as the crow flies, are considered then a different picture emerges. These sites along the Mikawa Bay are the eastern-most sites analysed in this dataset and would have been on the edges of the expanding Yayoi culture (Endo and Leipe 2022). The difference between the two sites does not approach statistical significance, which may in part have to do with the temporal overlap between the sites. If it were possible to separate out individuals firmly dated earlier from Yoshigo and later from Inariyama, it may be possible to more firmly test whether the apparent 6% difference in CAP hints at a possible increase in violent conflict over time.

Continued, comprehensive analyses of the trauma at other Jōmon sites is necessary to more conclusively reject this hypothesis, as is more secure dating of the sites. Particularly as recent radiocarbon dating of some Jōmon sites provides clear evidence of temporal overlap with Yayoi sites elsewhere (Kusaka et al. 2018). With this being the case, it would be worth investigating in greater detail trauma to the rest of the skeleton for these Jōmon groups as the possibility of finding, potentially easy-to-miss, sharp force trauma is therefore higher than was originally posited for this project.

9.1.3 Female Involvement

The prevalence of skull trauma found on Jōmon males compared to females in this thesis is not significantly different. Moreover, the only perimortem trauma and antemortem parry fracture were found on females. There is no indication that females were considered exempt from violent conflict. In their recent summary of violence in the prehistoric Japanese archipelago, Hudson and colleagues (2020a) also highlight the possibility of Jōmon females showing evidence of violent trauma. Between the few examples mentioned by Hudson et al. and those presented here, thus far it appears that the injuries to females are largely to the posterior half of the skull and not the facial region. Given the near equal occurrence of peri- and antemortem trauma among the females in this study, it stands to reason to not simply attribute this trauma to male on female domestic violence. Similarly, violent but largely nonlethal trauma between females, involving face-hitting and fights involving domestic tools (such as digging sticks), has been reported in the ethnographic literature of even relatively 'peaceful' hunter-gatherer societies, but this would be unlikely to account for the more lethal trauma observed (Fabbro 1978; Kelly 2000; R. B. Lee 1979). Alternatively, Hudson et al. (2020a) suggest that the motives of retaliation and revenge in intergroup conflict as a possible explanation, with women (and children) acting as acceptable targets. Violence under circumstances of retaliation and revenge are frequently cited motivations in small communities

(Boehm 2011; Gat 1999; Kelly 2000; Schulting 2013), but, as Hudson and colleagues point out as well, the motivation is not isolated from the structural (from political to kinship to economic frameworks) and superstructural (how people perceive and respond to conflict) underpinnings (Ferguson 1990). The greater occurrence of perimortem, lethal trauma among females, is suggestive of greater intergroup rather than intragroup causal factors. The stumbling block in this theory is that one might also expect to see a higher incidence of male perimortem (or antemortem) trauma indicative of greater face-to-face conflict, which, within the limits of the current dataset, is missing.

Homicide occurs even in 'peaceful', warless societies. Knauft (1987) estimates the rate of homicide (homicide rate = (total homicides/total population)x100,000) among simple hunter-gatherer societies between 30–42 per 100,000 per annum. This equates about one death every 15 to 20 years given their population size (Kelly 2000), with some societies with rates even higher than this. Comparatively, the rate of homicides in Japan in 2018 was 0.2 per 100,000 for males and 0.3 per 100,000 for females (UN Office on Drugs and Crime's International Homicide Statistics database 2018). It is unlikely that the Jōmon rate of homicide would be so high as to significantly dwarf these rates if homicide where the driving factor behind the perimortem trauma present. Moreover, the cause for the higher number of females impacted would remain unanswered. Of course, making a direct comparison to modern estimates that all definitively occurred within a year leaves much to be desired in terms of data resolution, but it does provide some comparative framing for the rates at hand, both ethnographic and archaeological.

Whether or not the pattern of predominately antemortem trauma exhibited among the Jōmon males is a by-product of this particular sample, its size, or whether it is a broader trend remains to be seen, although perimortem trauma to males from this time and region have previously been reported (Uchino 2013). Compared to the Jōmon, the European Mesolithic trauma previously discussed also largely includes violence towards both males and females,

including the cases from the Dnieper Rapids region, Schela Cladovei, Ofnet, and Hohlenstein-Stadel. In the case of Schela Cladovei, Roksandic et al. (2006) suggest that the violence towards females represents social substitutability, with females being targeted even if they were not personally involved in any issues of revenge, retribution, etc. Turning back to the Jōmon, Late–Final Jōmon groups in the western archipelago practiced storage and at least a semi-sedentary lifestyle (Matsumoto et al. 2017). Kelly (2000) posits that these attributes go hand-in-hand with the formation of segmented societies, a level of hierarchical social organisation that supersedes the local community that he argues is key in developing social substitutability.

This is not to imply that females were primarily passive agents or receptacles of violence when it did occur. Females may have played an active role in the defence of their communities and, particularly, in protecting children, especially if their male counterparts were absent. Stable isotopic analyses of the variability in diet between males and females from Inariyama and Yoshigo indicates that males show a greater variability in nitrogen while females show a higher incidence of carious lesions, indicating that males may have been drawing on a wider pool of foods (Kusaka 2018). Additionally, analysis of entheseal changes (or musculoskeletal stress markers (MSM)) of Jōmon males and females indicate different activity patterns among the sexes (Yonemoto 2016). This all suggests that males may have ranged further than females, at times creating situations where females had to be more involved in violent conflict. A lack of fortified sites may be linked to a semi-sedentary lifestyle, although fortifications in complex hunter-gatherer cultures have been documented (Schreiber et al. 2022), or an overall intermittent pattern of conflict that was normally mediated non-violently.

9.1.4 Comparing Jōmon and Mesolithic Rates of Violent Trauma

When comparing the rate of trauma by site between the Jōmon and European Mesolithic, a compiled dataset of European Mesolithic sites with reported cases of trauma which Nakagawa et al. share in their 2017 Yayoi trauma analysis proves useful. The dataset

can be downloaded online at http://hisashinakao.com/data/. The data for sites that show evidence of trauma has been reproduced in Table 9.1[10]. The average crude prevalence of sites with over 20 individuals (n = 13) are similar between the European Mesolithic (9%) and Jōmon cases presented in Chapter 7 (8%).

*Table 9.1:Sites with individuals with violent trauma during the European Mesolithic. Reproduced from data reported in Nakagawa et al. (2017) (http://hisashinakao.com/data/). *See Footnote 10*

Site	State	Period	n	Number of Injured Individuals	Crude Prevalence
Dnieper rapids (Vasilyevka I)	Ukraine	10080-9980 BC	19	2	0.11
Dnieper rapids (Vasilyevka III)	Ukraine	10080-9980 BC	44	5	0.11
Dnieper rapids (Voloshkoe)	Ukraine	10080-9980 BC	19	5	0.26
Lepenski Vir	Serbia-Romania	8900-5500 BC?	184	1	0.01
Gough's Cave	England	8540-7990 BC	1	1	1.00
Culoz sous Balme	France	8270-7310 BC	3	1	0.33
Vlasac	Serbia-Romania	7600-7000 BC?	206	4	0.02
Ofnet	Germany	7560-7360 BC	38	17	0.45
Franchthi Cave	Greece	7550-6050 BC	17	2	0.12
Schela Cladovei	Serbia-Romania	7545-7307 BC	100	5	0.05
Zvejnieki	Latvia	7310-5300 BC?	51	6	0.12
Trou Violet	France	7050-4050 BC	4	1	0.25

[10] Note that the number of injured individuals and the crude prevalence reported in the last row of Table 9.1 originally reported by Nakagawa and colleagues is not representative of the data from which it was drawn. For instance, the data for over 100 sites reported to be without trauma (out of 210 total sites) comes from the work of Meiklejohn and colleagues (Meiklejohn 2009; Meiklejohn et al. 2010; Meiklejohn et al. 2011; Meiklejohn and Woodman 2012; Meiklejohn et al. 2014). None of these studies provide any substantial reporting of the presence of trauma among these assemblages. Rather, they are focused on presenting detailed information about the sites, the minimum number of individuals present, and their chronologies. Hence, the arbitrary cut-off point of n>20 per site was used to estimate the crude prevalence when compared to the Jōmon cases as it is assumed that these would be more accurate estimations given the sample size.

Site	State	Period	n	Number of Injured Individuals	Crude Prevalence
Colombres	Spain	6969-5054 BC	1	1	1.00
Cabeco da Arruda	Portugal	6430-5370 BC	107	4	0.04
Mannlefelsen I	France	6280-5860 BC	1	1	1.00
Stora Bjers	Sweden	6200-4000 BC	1	1	1.00
Vatte di Zambana	Italy	6050-5790 BC	1	1	1.00
Hoëdic	France	6040-4440 BC	14	1	0.07
Cabeco da Amoreira	Portugal	5990-5370 BC	34	1	0.03
Moita do Sebastião	Portugal	5910-5340 BC	85	6	0.07
Cova da Onça	Portugal	5840-5740 BC	36	1	0.03
Birsmatten-Basisgrotte	Switzerland	5720-5020 BC	1	1	1.00
Téviec	France	5640-5220 BC	23	3	0.13
Skateholm I	Sweden	5250-4900 BC	53	2	0.04
De Bruin	Netherlands	5250-4500 BC	7	1	0.14
Gøngehusvej	Denmark	5000 BC	5	1	0.20
Møllegabet II boat	Denmark	after 5000 BC	1	1	1.00
Tybrind, Vig.	Denmark	4490 BC	2	1	0.50
Bøgebakken	Denmark	4340-3860 BC	23	3	0.13
Total European Mesolithic Sample*			**2055**	**80**	**0.04**

Even if the rate of violent conflict during the end of the Jōmon in the southwest was as high as 8%, as suggested by the CAP, the patterns of conflict reviewed thus far do not suggest a trend of persistent or intensive raiding practices (i.e. ‘warfare’). Nevertheless, indicators of lethal trauma associated with which may be associated with motivations such as retaliation and revenge, possibly in concert with some concept of social substitutability, may be present. Moreover, the low incidence of trauma needs continual examination as the understanding of

the cultural context of the Jōmon changes with further research. For instance, analysis of the entire skeleton of individuals that lived during the Final period, which is increasingly understood to have a non-significant overlap with the earliest Yayoi groups, is warranted given the presence of sharp-edged tools and weapons in the archipelago.

9.2 Contextualising Yayoi Period Violence

The difference in archaeological visibility between the Jōmon and Yayoi is not as drastic as that between the European Mesolithic and Neolithic. Nevertheless, according to the studies by Nakao, Nakagawa, and colleagues (2017; 2016) the number of Yayoi individuals recovered is approximately 12% greater than Jōmon individuals. Yet, a majority of these individuals date to the Middle (n = 2347) and Late Yayoi (n = 691) periods. Trying to dissect the role of violent conflict during the very early introduction of agriculture to the Japanese archipelago is difficult, particularly considering the paucity of skeletal remains associated with the very beginning of the Yayoi (Table 8.5). Hence, researchers often look to other indicators of violent conflict. By necessity, these indicators have to be distinguishable from other modes of life or interaction, meaning that they tend to represent more formalised modes of conflict. It should be kept in mind that any patterns of conflict which may carried over from the Jōmon period are rendered even less visible under this framework as they do not involve offensive or defensive weapons *sensu stricto* or fortifications.

Some have purported an initially relatively peaceful integration of Yayoi migrants and lifeways with the Jōmon culture based on the hybridisation of Korean Mumun and native Jōmon style settlements and material culture (see discussion in Chapter 3.1.3), with Mizoguchi (2013) going so far as to suggest that the non-native styles and materials were adopted at least primarily within a Jōmon worldview. On the other hand, it also bears questioning if there could be such a significant migrant population initially moving into northern Kyūshū and southwestern Honshū, even if said migration occurred in waves, that would not have also introduce

fundamentally novel or disparate cultural views which would result in knock-on effects with the local population as well. For instance, the adoption of moated settlements and formalised weapons early in the Yayoi would have certainly been accompanied by some concept as to the context of such specialised tools. Such technologies would have required dedicated training to fully understand and utilise them. This is further compounded by the evidence for violent conflict associated with increasing social complexity and population size from Middle Mumun settlements across the strait (Rhee et al. 2021) and by the developing argument that people on the archipelago may have been more enmeshed in the general process of *bronzisation* than has been argued previously (Hudson et al. 2021; Hudson 2022).

9.2.1 Initial–Early Yayoi

Given the small number of extant skeletal remains attributed to the Initial Yayoi ($n < 30$), if the Initial and Early Yayoi are considered in concert, then in this study a CAP of 82% and a crude prevalence of 33% for ante- and perimortem violent trauma was found and when these findings were added to those of Nakagawa et al. (2017) a resulting estimate ranging between 32% and 11% was found. Nearly across the board, these estimated rates of violent conflict are higher than those for the European Neolithic summarised in Smith et al. (2020), averaging at 10.4%. Admittedly, Smith and colleagues' data compiles evidence for the entire period and draws on a much larger sample size; nevertheless the estimates for violent trauma in the early part of the Yayoi are not trivial. The Initial–Early Yayoi violent trauma analysed in this thesis are exclusively antemortem and affected only males. Moreover, there was only one case of postcranial trauma. Six of these Initial–Early Yayoi injuries include healed nasal fractures.

9.2.1.1 Nasal Fractures

As discussed in Chapter 7, nasal fractures are most likely to be caused by assaults (Bakardjiev and Pechalova 2007; Bataineh 1998; Bonavolonta et al. 2017; Businger et al. 2012; Çil and Kahraman 2013; de la Cova 2010; Hussain et al. 1994; Kyrgidis et al. 2013; Laverick et al. 2008; J. H. Lee et al. 2010; Roccia et al. 2016; Salentijn et al. 2013; Schneider et al. 2015). Whether or not the pattern of nasal fractures marks a departure from Jōmon intragroup conflict is unclear due to the poor preservation. This is not to say that nasal fractures and intragroup conflict were common during the Jōmon, but rather, that given the limitations of the available data, it is not possible make a direct comparison at this time. Nasal fractures were found among 75% of the Initial–Early Yayoi, 42% of the Early–Middle Yayoi, and 33% of the Middle–Late Yayoi of the individuals with trauma in this thesis. Padgett (2020) found a total frequency of nasal fractures among his sample of 5% (10/184) with the Early (6%, 5/79) and Late Yayoi (8%, 2/23) showing the highest frequencies. The difference in rates between this thesis and Padgett's may simply have to do with different sampling choices as Padgett's data only partially overlaps with that of this thesis, even when the same sites were analysed not all of the same individuals were. Particularly, due to the methodological constraints of comparing the Jōmon to the Yayoi in this thesis, priority was given to individuals with at least some skull preservation. Moreover, five nasal fracture cases recorded in this thesis are not noted in Padgett's appendices even when the same individuals were analysed.

All the same, the high number of nasal fractures present in the Yayoi sample in this thesis presents a persistent trend of intragroup, interpersonal conflict, particularly among males (except for the site of Doigahama which appears to have a greater number of females with nasal fractures). Given the predominance of antemortem trauma present from the Initial–Early Yayoi found in this study, it is reasonable to posit that during the beginnings of the Yayoi period that intergroup, lethal trauma, which would arguably be more well-represented via perimortem trauma, may not have been as prevalent as later in the Yayoi period, but that social conflicts

certainly did arise and at times may have taken a violent turn, even if not a lethal one. The nature of these must have entailed blows to the face, not just practices such as wrestling. Interestingly, in modern studies it has been shown that alcohol consumption is correlated with nasal fractures as violent bouts break out more frequently under the influence (Bakardjiev and Pechalova 2007; Bataineh 1998; Bonavolonta et al. 2017; Businger et al. 2012; Hussain et al. 1994; Kyrgidis et al. 2013; J. H. Lee et al. 2010; Roccia et al. 2016; Salentijn et al. 2013; Schneider et al. 2015). Recently, Shoda (2021) summarises the evidence for fermented foods from Korea and Japan, including alcohol. He discusses indicators of fermented fruit alcohol are present from the Jōmon and the production of fermented rice wine production from the Yayoi has been posited (see also Barnes (1990:7)). Moreover, there are indicators for the possible production of fermented millet alcohol from the Korean Bronze Age. Unfortunately, whether or not the consumption of alcohol may have played a role is impossible to test. Nevertheless, possibly moderated and certainly nonlethal violence played a role in conflict resolution during the Yayoi, particularly among some of the earliest agricultural groups in the archipelago.The kinds of trauma present during the Initial–Early Yayoi include BFT to other bones of the skull and one often-cited case of a polished stone arrowhead embedded in the posterior femur of an Initial Yayoi male from Shinmachi (No. 24-1)[11]. Intriguingly in the original 1987 report on the Shinmachi 24 grave, two molars from a younger individual (possibly adolescent) were reported to be found in an adjoining pit below No. 24-1's feet (Figure 9.2) and it is suggested that this might represent an example of head-hunting (see also Hudson 2022; Matsugi 2017).

[11] Note that this case has been classified as antemortem in this thesis (and in Padgett (2020)) rather than perimortem, as is often cited in the literature. In Catalogue II (Figure A344) there is a clear view of the entry point of the arrowhead into the proximal femur, where one can see that the entry wound is characterized by porosity and osseous growth around the fragments of the arrowhead. There is no longer a clear or sharp entry wound and the margins around the arrowhead appear to be rounded and well-healed. Moreover, as can be seen in Catalogue II (Figure A345), there is a clear layer of osseous growth between two of the remaining arrowhead fragments. It should be kept in mind, though, that surface condition of the skeleton is relatively poor (scored as 3).

Nevertheless, as there is no actual evidence of trauma associated, this is difficult to substantiate in any way.

9.2.1.2 Head-taking

The kinds of trauma present during the Initial–Early Yayoi include BFT to other bones of the skull and one often-cited case of a polished stone arrowhead embedded in the posterior femur of an Initial Yayoi male from Shinmachi (No. 24-1)[12]. Intriguingly in the original 1987 report on the Shinmachi 24 grave, two molars from a younger individual (possibly adolescent) were reported to be found in an adjoining pit below No. 24-1's feet (Figure 9.2) and it is suggested that this might represent an example of head-hunting (see also Hudson 2022; Matsugi 2017). Nevertheless, as there is no actual evidence of trauma associated, this is difficult to substantiate in any way.

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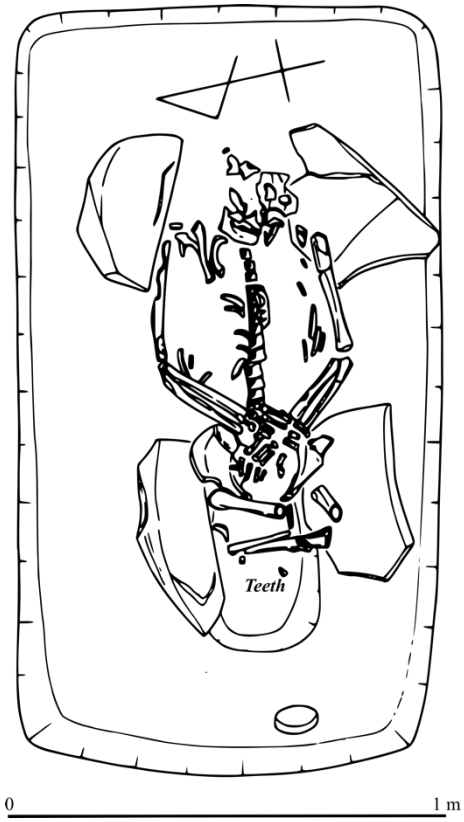


Figure 9.2: Schematic of Grave 24 from the Shinmachi site. Adapted from Shima Town Board of Education (1987:39) by JAW.

Head-hunting practices from the Yayoi period have long been discussed as an attribute of Yayoi violence. Hashiguchi (2007) reports on 18 cases of headless burials (*kubi nashi* 首なし) and skull burials (*kubi dake* 首だけ) (Table 9.2). Only two of these cases are noted to have evidence of trauma to the neck area that would indicate decapitation, which is necessary to confirm that these cases represent traumatic removal of the and in what manner it was performed (Bonogofsky 2011; Nagaoka et al. 2019; Zhou et al. 2020). Note that even if there were perimortem trauma indicting decapitation, it would not be possible to confirm whether or not this took place before or after death based on said trauma. Nevertheless, a fair number of the cases do have some evidence of violent trauma to the skeleton (8/18).

Padgett (2020) argues that individual 227 (Middle Adult, Male) from Kuma Nishioda may represent a case of a skull ‘re-burial’, possibly similar to that seen at Nishi jinmachi as K-

17's skull was buried in a small ceramic vessel above K-18's *kamekan* grave. In the case of Kuma Nishioda 227, Padgett identified three perimortem injuries – one is a penetrating injury that appears to have pierced the frontal bone and continued through to the right parietal and the other is a SFT to the atlas (C1). Unfortunately, based on the images provided, the surface condition of the bone is only fair and appears to obscure the character of at least some of the potential trauma to the skull. Nevertheless, there does appear to be some indication of internal bevelling on the frontal bone and external bevelling on the parietal bone, such as one would see with penetrating injuries that pass through the skull (Aufderheide and Rodríguez-Martín 1998; Bennike 2008; Berryman and Haun 1996; Gurdjian et al. 1950; Novak 2007; Schulting and Wyoscki 2005). As an alternative to the injuries to the cranial vault being a part of a violent assault, Padgett proposed they were caused by mounting of the skull for display, possibly with a spear, but as the skull is buried with the rest of the skeleton, this would imply that the skull was eventually returned after being displayed. The latter point may also raise the question as to whether the head, even the head of an enemy, may have been taken *into* a community rather than only being displayed as a symbol of martial or political power (Bonogofsky 2011).

*Table 9.2: Headless burials and skull burials adapted and translated from Hashiguchi (2007:4–38). *This individual (Nagaoka SK 95) was examined in this thesis, but as the head and cervical vertebrae are simply missing, it was considered that there was not enough appropriate evidence (i.e. evidence of decapitation) to attribute the missing bones to violent trauma.*

Site	ID	Headless burial	Skull burial	Notes
Shinmachi 新町遺跡	24 号-2		X	2 molars, upper incisor(s), etc.
Nishi jinmachi 西新町遺跡	K-18	X		
Nishi jinmachi 西新町遺跡	K-17		X	Possibly the same individual as K-18
Fujisaki 藤崎遺跡	ST15		X	
Carmelite Monastery カルメル修道院内遺跡	ST07		X	
Nagaoka 永岡遺跡	K-95*	X?		Bronze sword in R iliac crest
Kuma Nishioda 隈・西小田遺跡	K-16	X		
Kuma Nishioda 隈・西小田遺跡	K-55	X		Bronze sword found in the L acetabulum
Kuma Nishioda 隈・西小田遺跡	K-77		X	
Kuma Nishioda 隈・西小田遺跡	K-101	X		
Kuma Nishioda 隈・西小田遺跡	K-218	X		Stone arrowheads excavated from pelvis, both femora and tibiae
Kuma Nishioda 隈・西小田遺跡	K315	X		SFT on L femur
Yokokuma kamiuchihata 横隈上内畑遺跡	K-7	X		SFT on L ulna
Yokoguma kitsunezuka 横隈狐塚遺跡	K-157	X		SFT on cervical vertebra 5 and on femur
Yubi umesaka 柚比梅坂遺跡	SJ-1040	X?		
Yubi honmura 柚比本村遺跡	SJ-4438	X		Stone sword embedded in L scapula and thoracic vertebra
Takashi Jinja 高志神社遺跡	SJ-016	X		Missing the top part of cervical vertebra 3
Yoshinogari 吉野ヶ里遺跡	SJ-0329	X		

The potential head-taking seen during the European Mesolithic, such as the skull 'nests' at Ofnet, does not match the pattern seen in the Yayoi cases above, nor do the processing methods found at the European Neolithic site of Herzheim (see Chapter 4.3.1.1.2 for a discussion of these two sites). The closest example to skull clusters found are the skull

groupings found in some Doigahama graves. At Doigahama there are cases of secondary skull burials near the feet of individuals, but often these are not just composed of skulls (other postcranial bones are present as well) and there has yet to be any reported evidence of concentrations of perimortem trauma to these skulls (Doigahama Site Anthropology Museum 2014). Occasional, clear evidence of European Neolithic head-taking has been reported, whereas, going into the Late Bronze Age, deposits of large quantities of human heads showing evidence of traumatic removal at cave sites became more prevalent (cf. Armit 2006). Armit (2006) also reports on headhunting during the European Iron Age, which is associated with detailed iconography depicting, presumably, warriors with large collections of heads, leading to the interpretation of these warriors representing community, and not just individual, power.

Whether the removal, display, or curation of skulls was always or, even, primarily undertaken for violent ends during the Yayoi remains to be fully explored. The significance of the head in death from within a community versus when it is taken by an enemy may differ, but ethnographic studies attest to the head representing social personhood (George 1996). Padgett (2020) places this in the context of the historical Japanese practices of trophy-taking from ca. the 8th century AD and from the medieval Warring States period (*Sengoku Jidai* 戦国時代), pointing out that this kind of trophy-taking may have been preceded by surrender and equated to a kind of political sacrifice undertaken by community leaders. All the same, this would not match the potential Shinmachi 24-2 case as the possible skull burial is of a younger individual, indicating that this may have been a case of a nonviolent secondary skull burial or, opposingly, that it may have involved the taking of a rather young individuals' skull as a particular symbol of power or success. Moreover, the style of these decapitations would be worth exploring further – can it be conclusively said that they were decapitated and from what position (i.e. did the blow come from behind and was it the result of repeated strikes by a particular weapon) (Bonogofsky 2011; Nagaoka et al. 2019; Zhou et al. 2020)? For instance, studies of the decapitation during the medieval period of Japan demonstrate that the method of decapitation

involved at least two cuts (the first stopping in the cervical vertebrae and aiming to quickly extinguish life) and that there may have been an aim to keep the anterior skin of the neck intact (Hirata et al. 2001). All the same, in terms of the head-taking of an outsider Armit (2006:11) highlights that a spiritual or religious component cannot be ignored either –

> *It may also, if the head is seen to retain some form of spiritual force, act to transfer control or ownership of that force from one group to another. Trophy heads thus, effectively, freeze time. They trap the spirit in that liminal zone between life and death, preventing its final departure from the world of the living. Heads may be "adopted," into the community… during which they will remain spiritually-charged and require careful handling, belonging to neither one world nor the other. The eventual termination of this posthumous social life may be a particularly dangerous or difficult moment.*

9.2.1.3 Fortified Sites

Fortified sites and enclosures appear during the European Neolithic and fortified sites appear with the first farming villages in northern Kyūshū. The site of Itazuke (板付遺跡) in Fukuoka is surrounded by a V-shaped ditch and earthen banks with a controlled entry point. A smaller ditch is present inside, which enclosed storage pits during the early use of the site (Hudson et al. 2020a; Yamasaki 2008). As Golitko and Keeley (2007) argue for the European Neolithic, V-shaped ditches are best understood as serving a defensive function. Earthen banks and ditches during the Yayoi would have served a similar function to those found during the European Neolithic, allowing for protection by depth (Christensen 2004; Parkinson and Duffy 2007). Hudson et al. (2020a) summarise the analysis of Yayoi fortifications by Arbousse-Bastide who found that the proportion of fortified sites rose from 18% during the Early Yayoi to 44% by the Late Yayoi. Moreover, Barnes (2007) presents a summary of upland site

construction by Terasawa (2000), demonstrating the construction of coastal upland sites and their spread eastwards during the Late Yayoi. The increase of fortified sites posited to track with the consolidation of power into chiefdom-level hierarchies during the Middle Yayoi and the Wa Disturbances into the Late Yayoi (G. L. Barnes 2007). Nevertheless, fortified sites also serve as a deterrent and as manifestations of perceived threats and displays of power as well (Ibsen et al. 2022; Keeley et al. 2007). These fortifications often are situated to allow for a view of the terrain, have ditches and banks, and wooden fences and stakes, but relatively simple entry points. Moreover, at the large site of Yoshinogari (see Chapter 5), watchtowers and enclosures are present.

9.2.2 Early–Middle Yayoi

Trauma found in this thesis from the Early to Middle Yayoi shows a clear shift towards more perimortem (11 cases out of 34 traumatic incidents; 42%) and weapon-related trauma, coinciding with the ca. 400 BC introduction of bronze swords, halberds, and spears to the archipelago (Hudson 2022). Unlike the European Neolithic, which saw continued use of primarily tool-weapons in conflict, even if the scale of that conflict was greater, the European Bronze Age saw a fundamental shift in martial practices and styles with the creation of specialised weaponry for combat similar to that seen from the early half of the Yayoi onwards (see Chapter 4.3.1.1.3). The introduction of true weapons entails not only a new technology, but also an entirely new kind of craft specialisation. The most biomechanically effective way of moving the human body in a martial setting is not intuitive and this is even more the case when wielding a weapon with particular advantages and disadvantages. In order to take advantage of the reach that these weapons offer and their material strength, some level of training would have been necessary. Hudson (2022) argues that although wooden replicas of Yayoi weapons have been found in ritual deposits, this not exclude their likely use as training tools as well (see Figure 9.3).

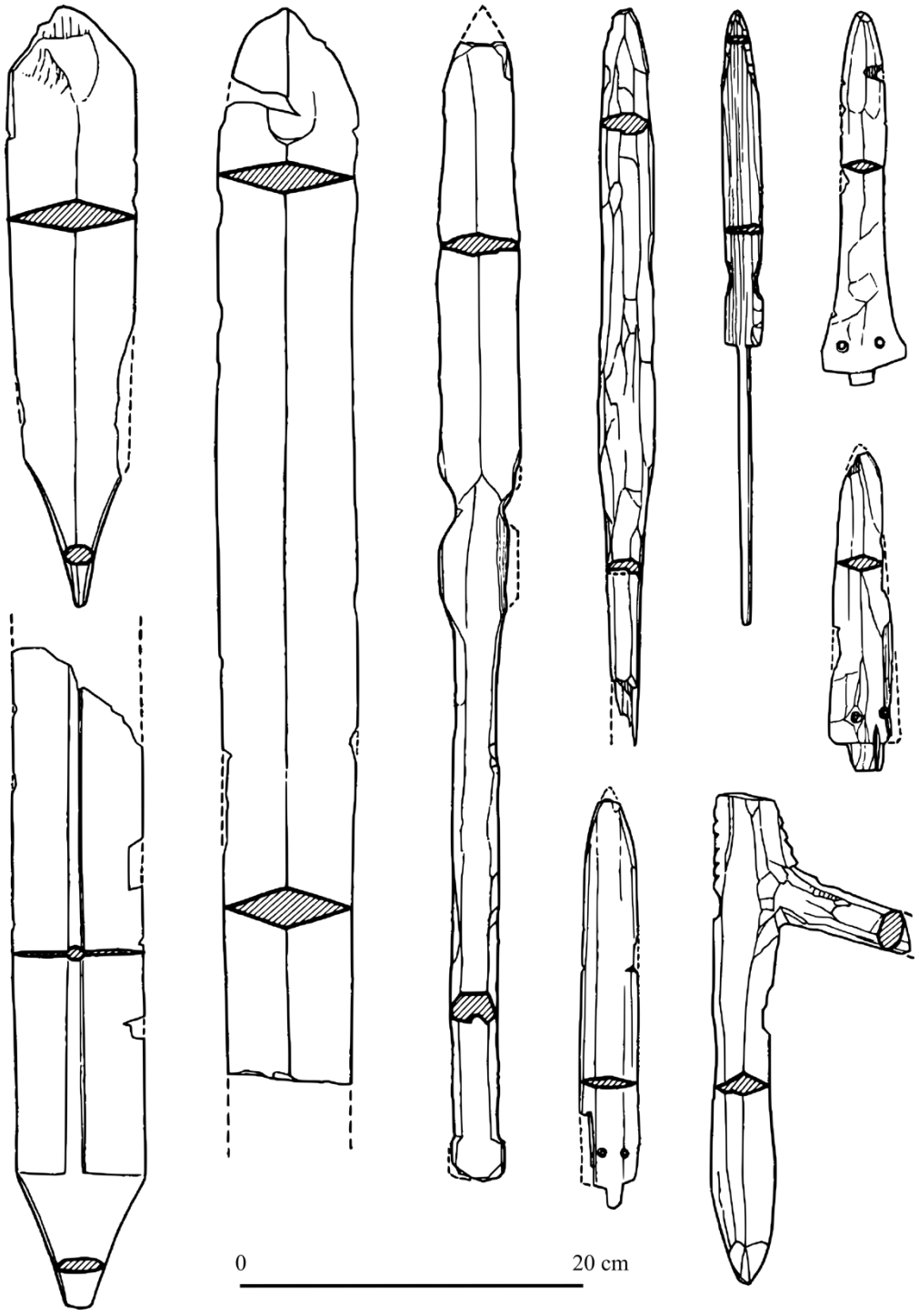


Figure 9.3: Examples of wooden weapons from the Yayoi period (recovered from Nara, Osaka, and Yamaguchi). After Harunari (1990:21), adapted by JAW.

A ritual component to the use of these wooden weapons would have formalised their use rather than anything else. This also raises the question of how this kind of training may have been integrated into socialisation and child-rearing. It is perfectly possible that some

aspect of training for combat or conflict situations was framed as play, allowing for a socialisation of conflict and a possible reflexive consideration of it and 'warriorhood'. Moreover, it is worth considering that some of the antemortem trauma observed among the male Yayoi individuals may be due to martial training and not just intragroup conflicts.

9.2.2.1 Weapon Use

Among these weapons Molloy and Horn (2016) note that although European halberds are specifically designed to harm other humans, that the most effective ways of using them were likely similar to previous kinds of tools(-weapons). Their use would have been more intuitive initially. This is likely the same in the Yayoi case, even more so as halberds are depicted as having relatively short hafts which would have limited their reach, but would also have made their movements easier to control and more like utilising a multi-use tool-weapon, such as an axe (Figure 8.9; Figure 9.4). As discussed in Chapter 8, in Yayoi figurative art, potential warriors are often depicted bearing a shield-halberd combination, even though swords are generally more numerous. The use of a halberd likely would have required less specialised training and, if paired with a shield, not only offered a relatively intuitive weapon that allowed for piercing, slashing, and cutting/slicing motions (Molloy and Horn 2020), but also provided the opportunity to better coordinate with comrades who also carried shields.

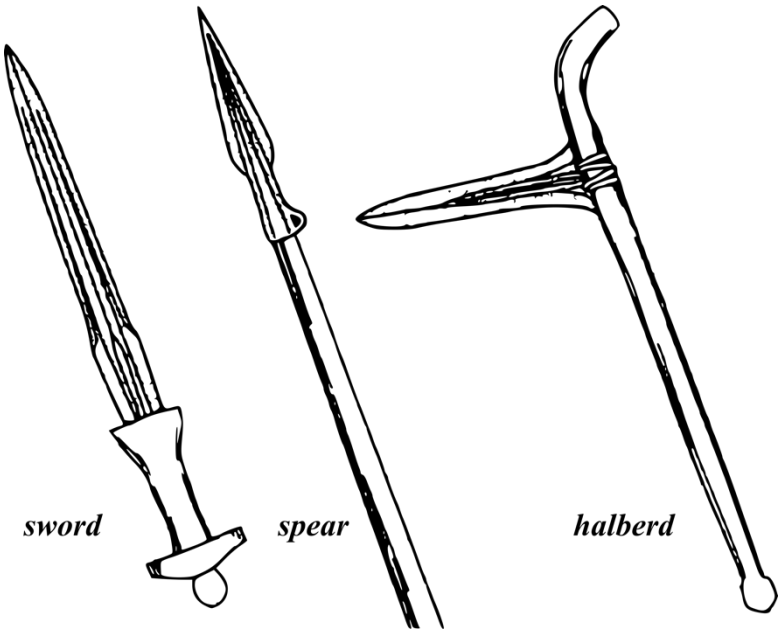


Figure 9.4: Simple depiction of bronze Yayoi weapons. Adapted by JAW from Matsugi (2017:45). Original from Matsugi (2007).

Daggers (such as polished stone daggers (*masei sekken* 魔製石剣) or shorter bronze blades found during the Yayoi period (Matsugi 2017)) have little reach, but can more easily follow the trajectory of an unarmed strike, meaning that, given their smaller size, it is easier to create short arcing and stabbing motions, rather than larger and sweeping attacks, in concert with unarmed strikes in close combat. Piercing and slashing motions would likely have been the most useful. Conversely, swords would have greatly extended the reach of the wielder, allowing for thrusting and lacerating/cutting strikes to be made with a long, tough blade likely in long drawing motions (Molloy and Horn 2020). The Yayoi swords are distinct from what most now think of as Japanese swords and would have differed significantly in their use and function. Moreover, if one were looking for an implement that would be able to perform swift decapitations most efficiently, the thicker and narrower forms of these may have been capable of the job, along with an axe, as would the later and rarer iron swords. As discussed previously, over the course of the Yayoi and into the Kofun, bronze weaponry took on larger and, arguably, more ritualised forms. This included a widening and thinning of sword blades. Hudson (2022) makes the argument that this widening of blades may also have allowed for a greater lacerating

surface and Barnes (2007) argues, given that the narrow-bladed, utilitarian swords were more common in Northern Kyūshū, that their presence still speaks to warfare in the area. Nevertheless, a non-utilitarian, ritualisation of bronze weapons would be unsurprising given the introduction of iron. Spears, of course, provide the greatest reach of the hand-held, bladed weapons discussed, but would have also, like swords, required more specialised knowledge in order to make good use of said reach. All of this being said, stone weaponry either in the form of projectile points or metal weapon skeuomorph proceed the use of metal weapons, but continue to be used after their introduction.

For instance, the skeletal remains of Sudare K3 have an embedded polished stone sword tip and in Doigahama 124 embedded lithic projectile points. Shibu 3 may also have an embedded lithic projectile point (Padgett 2020). Whereas, two Nagaoka individuals, SK95 and SK100, both have embedded bronze sword tips. The other examples of SFT from this period are consistent with being caused by metal weapons, except for Tsukomuta 4 25 which does exhibit shoulder effects near the SFT linear mark potentially consistent with a stone weapon (Fernández-Jalvo and Andrews 2016). Moreover, the possible use of defensive weaponry in the form of wooden shields (and armour) is tentatively supported by the concentration of injuries to the legs and to the clavicles (see 8.3.2).

9.2.2.2 Sex

Out of the 11 individuals with perimortem injuries from the Early–Middle Yayoi, eight are male and three are female, but all show perimortem evidence of weapon-related trauma (either via SFT or penetrating injuries, at times with the weapons still embedded). Harunari (1990) describes the depiction of a male (round head) figure possibly holding a club(?) attacking a female (triangular head) figure on the Sakuragaoka (桜ヶ丘) No.5 bronze bell (*dōtaku* 銅鐸) from Hyōgo Prefecture, which he takes to symbolise a mythical tale or ritual act (Figure 9.5). Kidder (2007) posits that the ‘male’ may have been holding an iron sword and that

the difference in head shape and body size may symbolise distinct ethnic groups. This scene may represent a mythical or ritualistic scene, but based on the above evidence, it is also reasonable to posit that a violent interaction between males and a female (or, possibly, immigrants and a native) would not have been unheard of. More than this, the potential males outnumber the female in this panel, possibly representing a *group* of males carrying out these acts.

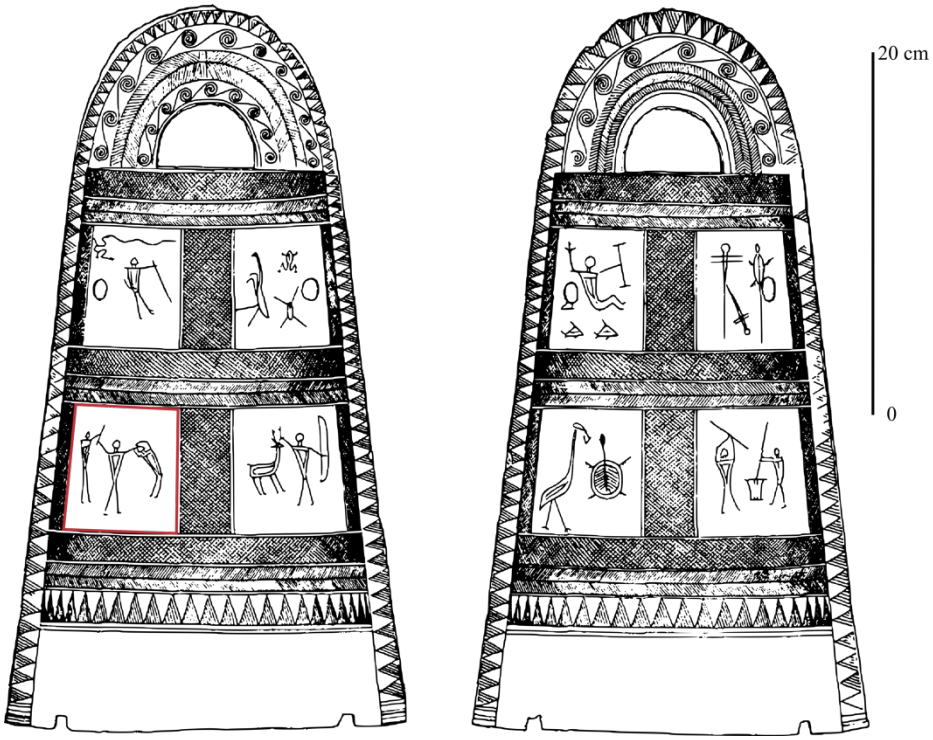


Figure 9.5: Line drawing of the Sakuragaoka No. 5 bronze bell. See the area outlined in red for a depiction of a violent altercation between a possible male(s) and female. After Harunari (1990:11), adapted by JAW.

The figurative art of the Yayoi period is a marked divergence from the more abstract art of the Jōmon, which Hudson (2022) points out may be related to an increased need to communicate with a broader audience. All the same, Yayoi art appears to depict individuals dressed for or engaged in conflict, but these do not emphasise an idealised male form. Moreover, the few examples of Yayoi wooden armour have more geometrical designs, whereas the bronze cuirasses from Europe tend to emphasise the body and musculature (Molloy 2012; Treherne 1995). This is not to say that masculinity does not relate to the image of a 'warrior'

during the Yayoi, but the extent to which individuals embodied a warrior identity is worth exploring.

9.2.2.3 Warriorhood

As discussed in Chapter 4, Fontjin (2005:151–152) argues that Dutch-Belgian Bronze Age warriorhood only constituted a "temporary, context-dependent identity" that likely involved temporary, potentially ritualised, shifts in identity characterised by donning of certain attire. Hudson (2022:23) further argues that Yayoi warriors may have occupied a liminal position within society and that deposited, ritual weapon hordes may represent activities such as cleansing rituals after conflict. Some recognition of said state or role must have persisted given the presence of individuals buried with high quality weapons, even if those individuals were not directly or often involved in the physical aspect of conflict. Prestige goods in the form of weapons as grave goods may have indicated an entirely different class or social status than individuals who typically engaged in the physical exertions of conflict and, at times, war. This social division need not have precluded the possibility of liminality of warriorhood among either those not in power and those who may have been in leadership roles, such as community leaders of acquired status proposed by Mizoguchi (2013). The proposed consolidation of power during the Middle Yayoi leading to an emergent chiefdom level society (cf. G. L. Barnes 2007) would also coincide with 'warriors' or leaders who need not necessarily have evidence of extensive trauma due to deadly combat. All that being said, one cannot ignore the complicating factor of trauma analysis, that it is entirely possible that some individuals may bear no trace of violent trauma on their skeletons, but their soft tissue may have shown such evidence.

One example of this dynamic among those analysed in this thesis is Mitsunagata 104 (Middle Adult, Male; BFT to the frontal bone) from the Middle Yayoi who was buried with an iron ring pommel sword and a bronze mirror, see Figure 9.6 (Kanazeki et al. 1961). Conversely, individuals from Nagaoka, which has some of the clearest and most numerous weapon-related

trauma from the Middle Yayoi, have very few burial goods and all those individuals who display trauma have none.

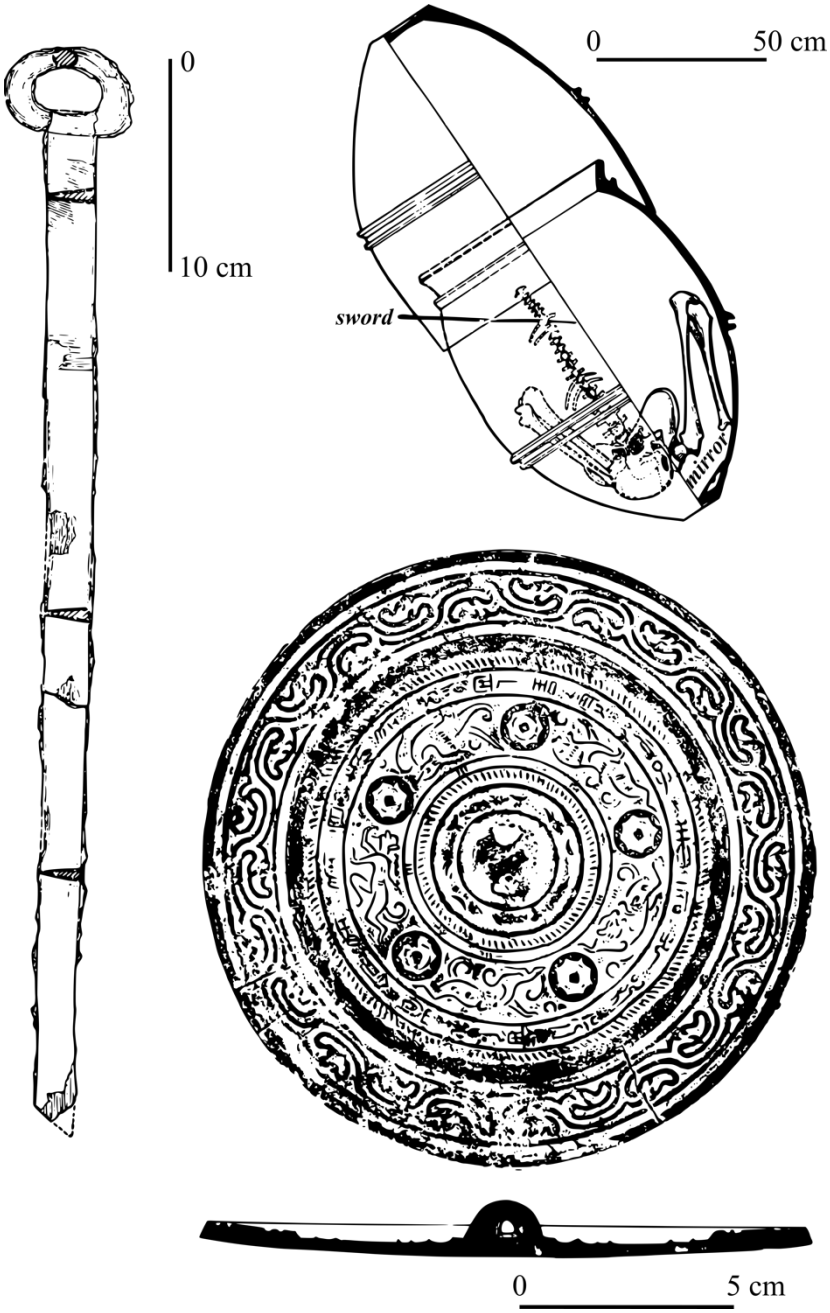


Figure 9.6: Mitsunagata 104 burial schematic with detailed drawings of the iron ring pommel sword buried above the burial jar and a bronze mirror buried within the burial jar. After Kanazeki (1961:161) adapted by JAW.

9.2.2.4 Overkill

Finally, within the Early–Middle Yayoi evidence are the cases of overkill (Doigahama 124 and Shibu 3 and 4) discussed in Chapter 8. Matsugi (2017:39–40) highlights another potential overkill victim from the Early Yayoi component of the Shinpō site (Kobe, Hyōgo Prefecture). Individual No. 3 (Figure 9.7) was found with 17 lithic arrowheads oriented in different directions in the skull and to the torso. The skeleton was in too poor of a condition to confirm any related lesions. Two other individuals were excavated in a row with No. 3 and both have one arrowhead found in the torso region, hence Matsugi posits that they were all killed in the same battle. No. 1 and 3 are thought to be male, but the sex of No. 2 is unclear (Hashiguchi 2007: 34; Hudson 2022; Kobe City Board of Education 2003:15–23). That being said, a perusal of Hashiguchi's 2007 compilation of injured Yayoi individuals reveals over 30 cases of individuals buried in association with four arrowheads or more and few are noted as having any associated skeletal lesions.

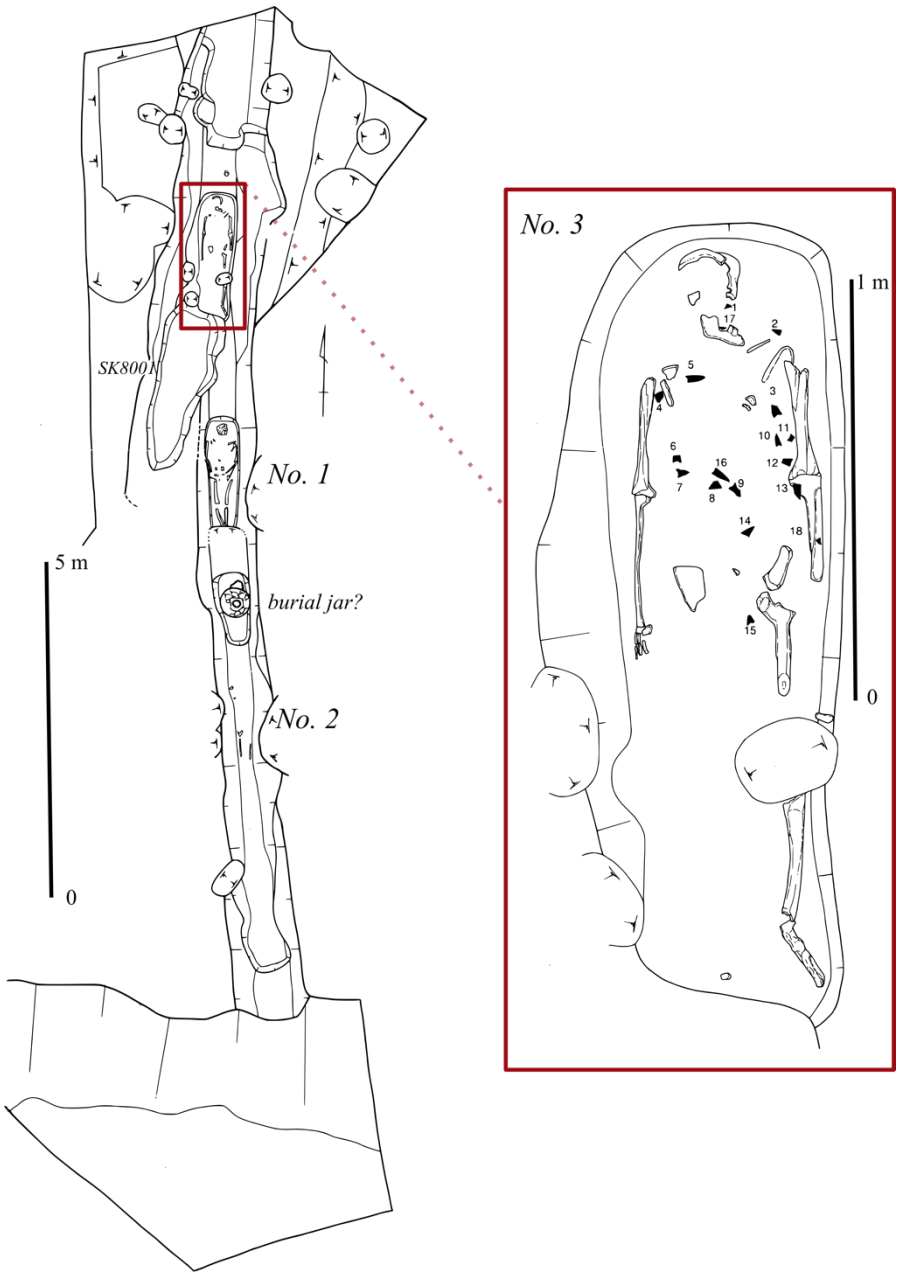


Figure 9.7: Shinpō Early Yayoi burials No.1–3 with a close-up of the schematic for No. 3 showing the 17 lithic arrowheads found with the remains. After Kobe City Board of Education (2003:17; 20) adapted by JAW.

The kind of extreme trauma found on at least Doigahama 124 and the Shibu individuals has been attributed to battle, but the context of this and whether it may be attributed to a different social function are worth exploring further. The supposition that this is a funeral rite involving a form of cleansing (Fukasawa 2002) is unsatisfactory, particularly in light of the variation in injury types (BFT, SFT, and penetrating injuries) seen. More likely explanations for this kind of behaviour are punishment, sacrifice, and/or retribution. In the *Wei Zhi*, crime is

described as rare but punished harshly (Farris 1998). Hudson (2022) points out that the argument that Doigahama 124 was sacrificed as a ritual leader (shaman) by his community due the danger of his power is solely based on the presence of two shell bracelets, but no such distinction is present on the other overkill victims. During the European Neolithic and Bronze Age, projectile trauma continues to be prevalent, but this particular density of trauma on individuals within, presumably, their own community burial grounds does not have a corresponding parallel.

9.2.3 Middle–Late Yayoi

The trauma found from the Middle–Late Yayoi in this thesis are primarily dominated by the sites of Mitsunagata and Hirota. The CAP for these periods is the highest at >1, with the crude prevalence still high at 30%, although the latter is lower than the Initial–Early Yayoi rate. At Mitsunagata a case of penetrating trauma and two cases of nasal fractures are present, which is consistent with the findings from the Early–Middle Yayoi. Conversely, the trauma from Hirota is anomalous to that of the other Yayoi sites, with its examples of multiple antemortem BFT to the skull of males and females. In Chapter 7.4.2 it was suggested that this may reflect a practice such as managed or approved of nonlethal conflict resolution involving the use of clubs (possibly even knobbed clubs) or slingstones within the context of Tanegashima, which is removed from northern Kyūshū and situated within a shell-trade route.

9.2.3.1 Large-Scale Conflict?

Padgett (2020) presents evidence that the Late Yayoi commingled assemblage of Aoya-Kamijichi (青谷上寺地遺跡) in Tottori Prefecture represents a massacre. Aoya-Kamijichi was an Early–Late Yayoi enclosed settlement with multiple V-shaped ditches (Fujiwara 2011; Tottori Prefecture Educational and Cultural Foundation 2002b, 2002a, 2002c).The remains of at least 109 men, women, and children (composed of 5,300 elements) were buried haphazardly

in one such ditch at the site (area SD-38). In the 2002 report this assemblage is attributed to a secondary burial event, but one that occurred very soon after the first burial because brain matter was preserved in three individuals, and since the remains of individuals were discernible and not completely dispersed (Tottori Prefecture Educational and Cultural Foundation 2002c:507). Moreover, it is posited that the injured remains (estimated to belong to ca. 10 individuals) may relate to the Wa Disturbances prior to the solidification of HImiko's power recorded in the *Wei Zhi* (Inoue and Matsumoto 2001; Tottori Prefecture Educational and Cultural Foundation 2002c:511).

When Padgett (2020:415–417) examined 83 elements from the site (minimum number of individuals (MNI) = 31), he found that among the 31 crania analysed (13 Male, 13 Female, 3 Indeterminate, and 2 Subadults), approximately half exhibited evidence of perimortem trauma and a total of 61 out of 83 elements displayed evidence of perimortem trauma. This confirms and expands upon the evidence for perimortem trauma from the site significantly. This trauma included BFT, SFT, and projectile trauma to individuals of both sexes and all ages on the crania and postcrania. The projectile injuries and SFT are all consistent with being caused by metal weapons. Padgett (2020:288) posits that the most likely motive for an attack that targeted people of all ages and likely involved shooting individuals with arrows who were running away, based on the distribution of lesions, would be a motive "stemming from differences in either cultural background or political alliances, or both," which does not remove the possibility of this conflict being related to the Wa Disturbances.

In support of this, a recent radiocarbon analysis of four individuals from the Aoya-Kamijichi (Crania numbers 9 (#27704), 15 (#27893), 23 (#27674), and 33 (7437)) found that crania 9, 15, and 23 all dated to the Late Yayoi (25–230 cal AD (95.4%)) and were excavated from the SD-38 area. Furthermore, these three dates R_Combine (1846 ± 26 cal BP, χ2- Test: df = 2, T = 0.6, 5% 6.0) in OxCal, indicating that they are consistent with a single burial event. This estimated burial event (from 62 to 201 AD at a 95.4% confidence interval) is within the

reported timeframe of the Wa Disturbances as well. Conversely, cranium 33 (not examined by Padgett) was excavated from the National Highway 2 area and dates to the Middle Yayoi (360–50 cal BC) (Hamada et al. 2020).

The scale is larger at Aoyama Kamijichi if the full 100+ individuals were participants of a massacre event, but the findings are consistent with those reported for European Neolithic and Bronze Age massacres (see discussion in Chapter 4). The age and sex distribution, or what can be understood of it given the highly commingled nature of the remains, is consistent with the killing of a whole community, or a large part of it. Padgett (2020) found no evidence within this subsample of the site of underrepresented age ranges or sexes, which would have suggested activities such as captive-taking, even though the gifting of slaves is a recorded practice in the *Wei Zhi* (G. L. Barnes 2007; Hudson 2022).

If this is in fact a massacre assemblage, the scale of this event is larger than anything that has been discussed for the Yayoi thus far, and is indeed consistent with the period of the Wa Disturbances. One reason why this may be the case is the fact that this site lies along the coast – allowing for a maritime access point that would allow for the movements of larger numbers of aggressors into the area. For instance, part of why a battle estimated to be in the scale of hundreds at the European Bronze Age site of Tollense (Chapter 4.3.1.1.3) was the increased mobility at the time due to the use of horses. Larger numbers of people could be transported more quickly, allowing for the aggregation of individuals for peaceful or less than peaceful ends. Nevertheless, during the Yayoi period, rapid transport over land was still limited to moving on foot, which may have made larger-scale conflicts less appealing in which to engage.

With a definition of war as “armed conflict between societies”, based on the above evidence, it is appropriate to classify the type of combat seen during the Yayoi period as ‘warfare’. The scale of said warfare, though, should be understood within its context and within the parameters of its limiting factors. Mizoguchi (2013:20) argues that the type of conflict seen

during the Yayoi is that of “chronic feuds, typical of small-scale societies” *contra* Fujiwara (2004). Although feuding may have played a part in Yayoi conflict, possibly demonstrated by occurrences such as overkill events, this does not sufficiently address the training in and specialisation of martial weapons, the formalisation of warriorhood, the fortification of settlements, or the high rate of trauma for the period. Compared to the European Neolithic and Bronze Age, the Yayoi period demonstrates an entirely different, but related dynamic of violent conflict. The scale of this conflict appear to largely be closer to that of the European Neolithic, but with many of the formalised attributes of the European Bronze Age.

Chapter 10 – CONCLUSION

The aim of this thesis was to systematically analyse the evidence for violent conflict from the Late–Final Jōmon through the Yayoi period through the most direct line of evidence – skeletal trauma. In the end, 250 Jōmon skulls and 174 Yayoi skeletons were analysed in this study from 15 Jōmon and 14 Yayoi sites from the southwestern Japanese archipelago. Within these, the trauma patterns found in 224 and 172 adolescent to adult Jōmon and Yayoi individuals, respectively, were analysed. The average completeness for Jōmon and Yayoi skulls was found to be 0.55 and 0.66 respectively, whereas the average completeness of the full Yayoi skeletons was 0.33. This level of completeness gave an estimated Completeness Adjusted Total (CAT) for the Jōmon skulls of 123, the Yayoi skulls of 114, and the full Yayoi sample of 56. Overall the surface condition of the Jōmon individuals (1.17 ± 0.22) was better than that of the Yayoi individuals (1.55 ± 0.04), relating to most of the former being interred in shell-middens which buffer the otherwise acidic soils dominating the archipelago.

10.1 HYPOTHESES AND IMPLICATIONS

The focus of this thesis was structured around four hypotheses pertaining to the nature of violence and traumatic lesions from the Late Jōmon through the Late Yayoi in the southwest of the Japanese archipelago. These hypotheses are revisited below and evaluated in terms of their predictive power.

10.1.1 Hypothesis: The First

First, it was hypothesised that, although underestimated in the current literature, violence increased from the end of the Jōmon and the beginning of the Yayoi and that this would be most prominent on the edges of the Yayoi territory, as it would possibly mimic an expanding ‘frontier’ or ‘tribal’ zone (Ferguson and Whitehead, 1992).

Overall, the rate of Jōmon violent trauma is low, but this does not mean that violence had no place in their society, even if it did not involve warfare or extensive raiding. Evidence for an incremental build-up of violent conflict from the Late to Final Jōmon was not found when comparing sites with larger sample numbers (i.e. Inariyama (Final Jōmon–Middle Yayoi; 0.10 Completeness Adjusted Prevalence (CAP)), Tsukumo (Late–Final Jōmon; 0.11 CAP), and Yoshigo (Late–Final Jōmon; 0.04 CAP). The other sites with higher rates of trauma were from the Late Jōmon. That being said, two of the eastern-most sites examined in this thesis, Inariyama and Yoshigo in Aichi Prefecture, which would have been situated more on the edges of the Yayoi cultural-world, exhibit a 6% CAP difference with an increase in violent trauma towards the Final Jōmon and into the Yayoi. As these sites overlap temporally, though, further study separating individuals firmly dated earlier from Yoshigo and later from Inariyama, would be necessary to test whether this difference in prevalence represents an increase in violent trauma on the edges of the Yayoi culture.

There were only two Final Jōmon sites studied from Kyūshū, Yamaga (n = 10) and Goryō (n = 6), of which only the former yielded any evidence of potential violent trauma. These two cases from Yamaga were evaluated as being of only Medium violence-related likelihood; nevertheless, the site is located along coast of Fukuoka Prefecture, near where the first Initial Yayoi sites occur. Conversely, Goryō is located further south in Kumamoto Prefecture. The sample size is insufficient to say any more and analysis is hampered by the fewer number of Final Jōmon sites in Northern Kyūshū, but these findings are not inconsistent with a greater incidence of trauma closer to the emerging Yayoi boundary.

The transition from the Jōmon to the Yayoi period was not a sudden change, despite the wide-ranging and substantial changes to the prehistoric cultures of the Japanese archipelago, as has been increasing demonstrated (Hudson et al. 2021; Hudson 2022; Rhee et al. 2021). The transition to new forms of conflict resolution is no exception to this as it appears that, although evidence of violent trauma to the skeleton increased with the advent of the Yayoi, said trauma

was still primarily in the form of blunt force, antemortem injuries, rather than weapon-related trauma. The CAP and crude prevalence of the Jōmon skull violence-related trauma (0.04 and 0.08; with the highest incident being to the parietal bones) was found to be significantly lower than that of the Yayoi (0.20 and 0.30; with the highest incident being to the nasal region).

The trauma found on the entire skeleton of the Yayoi individuals (0.80 CAP) was significantly higher than the skull trauma found, but the crude prevalence of 0.26 was only slightly lower than the skull trauma. This difference in rates is due to poorer postcranial skeletal completeness. As only the completeness and violent trauma of Jōmon skulls were recorded, the trauma from the entire Yayoi skeletons cannot be directly compared to the Jōmon data in this thesis. Nevertheless, the Jōmon results were compared to the compilation analyses by Nakao, Nakagawa, and colleagues (2017; 2016), which are not restricted to analysis of the skull. The results indicate that the trauma for the Jōmon period is being underestimated in the current literature and that it is necessary to thoroughly examine each individual for evidence of traumatic lesions in order to further refine the understanding of the amount and kinds of conflict the Jōmon participated in. Approximately 9% of the individuals previously reported on by Nakao, Nakagawa, and colleagues were revaluated in this thesis, and an increase in observed trauma of 1% for the entire Jōmon was found.

When the results from these studies by Nakao, Nakagawa, and colleagues (2017; 2016) are integrated with those from this thesis, a difference in the crude prevalence of adults with trauma from the Final Jōmon to Early–Initial Yayoi is found to be ca. 10%. This difference is much greater when just considering the Initial Yayoi sample, but the sample size remains small for the Initial Yayoi (n = 25). In this study, a high incidence of blunt force antemortem trauma, particularly to the nasal bones and skull, among males was found during the Initial–Early Yayoi period. This may relate to continued use of tool-weapons and a more ‘Jōmon’ mode of conflict during situations with escalated cultural stressors as migrants and new subsistence technologies become more prevalent within communities.

When considering the geographical distribution of Initial and Early Yayoi sites, the earliest studied in this thesis occur along the coast of Saga and Fukuoka Prefectures – Ōtomo (CAP 0.95) and Shimachi (CAP ≥1.0). Both sites show a high CAP, but also have small sample sizes (n = 14 total). On Honshu, Doigahama (Early–Middle Yayoi; CAP 0.78) and Nakanohama (Early–Middle Yayoi; CAP 0.64) in Yamaguchi Prefecture and Kōra (Early Yayoi; CAP 0.32) in Shimane Prefecture can be tentatively said to show a decreasing rate of trauma away from the northern Kyūshū region. Greater resolution of the chronologies of sites and burials, particularly through radiocarbon dating which allows for direct comparisons to be made with calculable error ranges, would aid greatly in more firmly determining the impact of a 'frontier zone' when considering evidence for violent trauma. The other complicating factor in evaluating this is the patchy representation of human remains based on burial method (see Chapter 3.1.6), which will invariably skew the data. Nevertheless, results here hint at greater incidences of nonlethal violent trauma around the expanding Yayoi cultural borders, and, certainly, a higher incidence of violent trauma during the early part of the Yayoi compared to the end of the Jōmon.

During the early part of the Yayoi, the fully developed agricultural systems and toolkit were being adopted with the expertise that came with them – migrants from across the Tsushima Strait (Rhee et al. 2021). How the local Jōmon and the new migrants managed disputes, which undoubtedly occurred given their different backgrounds, does not appear to have resulted in many or frequent episodes of lethal violence. This may have to do with pre-existing trade or communication networks in place that would have allowed for a foundation for negotiations (Hudson et al. 2021; Hudson 2022; Rhee et al. 2021). Moreover, as the first agricultural villages occurred in areas not as populated by the Jōmon, there may have been less practical reasons for escalating any kind of disagreement (Yamasaki 2008:84). Nevertheless, the potentially high occurrence of non-lethal, healed trauma during the early part of the Yayoi does point to disagreements coming to blows.

In this first hypothesis, the expanding borders of the Yayoi culture are considered in terms of core-periphery relations as a frontier zone, but the end of the Jōmon through to the Yayoi can be considered a frontier zone of the continental powers, namely the Chinese dynastic sphere of influence. A comparison of the violent and accidental or occupational trauma patterns from China and the Korean peninsula would prove useful for examining the influence of martial style and weapon use, along with intensity of, at times purposefully orchestrated, frontier zone conflict (G. L. Barnes 2007) in the Japanese archipelago. Unfortunately, due to the poor preservation and continued curation of archaeological human remains in South Korea, analysis of skeletal trauma patterns at least in the area closest to the archipelago would prove difficult (Pang 2021).

10.1.2 Hypothesis: The Second

Second, it was hypothesised that the nature of injuries would shift with the introduction of metal weapons, from either primarily blunt force trauma to sharp force trauma or in the region of the body targeted.

From the Early–Middle Yayoi there is a marked change in the nature of traumatic injuries found on individuals. The incidence of antemortem trauma remained high, but the occurrence of injuries caused by projectile points and metal weaponry became more common. The one case of suspected Jōmon period violent trauma caused by metal weapons which was previously reported at the Itoku site was not substantiated when re-evaluated for this thesis (Hudson et al. 2021). The shift towards metal weaponry, which is more durable and longer-lasting than lithic tools(-weapons), and the specialised training needed to properly utilise them would not have existed in a cultural or ideological vacuum. The increased incidence of weapon-related trauma may reflect the rising social complexity, consolidation of power, and pressure

on local resources by a growing agricultural population (G. L. Barnes 2007; Mizoguchi 2013; Nakagawa et al. 2021).

The evidence for specialised training during the Yayoi is further suggested by the presence of wooden versions of new offensive weaponry (Hudson 2022). Artistic depictions from the Yayoi show 'warrior' regalia, the use of halberd-shield combinations, and scenes of conflict (Figure 8.9). Patterns of trauma found to the skeleton include projectile trauma to the trunk of the body and the concentration of injuries to the legs and shoulders, which may suggest the use of defensive armour or shield-use. Related to this is the obvious regard within Yayoi art and funerary culture for warriors, whether this correlates to actual battle experience or not, and accoutrements related to warfare. The evidence for weapon-related trauma does not neatly line up with individuals buried with weaponry, as evidenced by the individuals from Nagaoka and Mitsunagata. The position of those that engaged in violent raids or battles may have been liminal and context-dependent. Individuals buried with weaponry but showing no signs of violent skeletal trauma may also be evidence of emergent social hierarchies. Nevertheless, the lack of information on soft tissue trauma, as with all studies limited to skeletal trauma, complicates this interpretation.

The postcranial penetrating trauma (and possible head-taking case) from Shinmachi Grave 24 point towards the possible emergence of increasing severity of intentional violence and/or new skull burial practices. If this is a case of head-taking, it lends credence to an increasing cultural concept or codification of social substitutability as it is unlikely that a younger individual, such as Shinmachi 24-2, would be a target for their own actions and would, instead, act as a symbolic stand-in for a hostile group. That being said, evidence which more clearly indicates that this was in fact a case of violent decapitation are required to more substantially debate this point. Generally, more thorough investigation into evidence of traumatic lesions associated with cases of suspected head-taking (or -hunting) and their

potential causes is greatly needed in order to clarify the nature of the practice and its practicalities.

Finally, it is clear that at least three overkill victims date to the Early–Middle Yayoi and that these cases involved ranged and close-contact attacks in excess of what was needed to incapacitate much less kill the individual. Other cases may be present during the Yayoi period as well, but further confirmation of skeletal lesions are needed to confirm these and any possible temporal and geographical concentrations.

10.1.3 Hypothesis: The Third

Third, it was hypothesised that, given the consolidation of power in northern Kyūshū, the most likely group at risk of injury would be adult males (or what were considered to be adult men at the time) (Bary, 2001; Mizoguchi, 2013; Walker, 2001).

This was found to be largely true. Yayoi, males (35/73) did experience significantly more violent trauma than females (8/52), with three times the number of antemortem injuries to perimortem injuries among those with trauma. The age-group of males with the highest percent of trauma were Middle Adults (54.3%) and Young Adults (31.4%). Yet, females displayed perimortem and antemortem injuries in near equal frequencies (with a proportion of 5:4) and Young Adult females had the highest frequency of trauma (62.5%) followed by Mature Adults (25%). Moreover, the distribution of trauma on the female sample shows some of the same patterns as that on the males, with evidence of healed nasal fractures and injuries to the left side of the body, including perimortem injuries to the thorax, arms, and legs. The sexes are described as having no distinction between them in meetings in the *Wei Zhi,* which Kidder (2007) interprets as having a more informal or less rigidly structured social relationships within the same kin or occupation group. How this overlaps with female involvement in matters of political influence, including warfare and conflict, is worth further research. All the same, it is

apparent that women were not seen as ‘off limits’ when it came to conflict, as is possibly depicted by the art on the bronze bell Sakuragaoka No.5.

Interestingly, the occurrence of violence during the Jōmon was not as restricted to males as in the subsequent Yayoi period. The higher incidence of Jōmon females with evidence of perimortem trauma may be an indicator of social substitutability related to practices such as intergroup revenge and retaliation. When taken within the context of the final part of the Jōmon period being marked by increased evidence of personal ornaments even among the young in the form of grave goods (Pearson 2007), it raises the intriguing possibility of changing social views of the meaning and role of the individual within a community prior to or coinciding with the very beginnings of the Yayoi period. A larger Jōmon dataset covering the Middle period and the eastern archipelago is required to explore this further.

10.1.4 Hypothesis: The Fourth

Fourth, it was hypothesised that the scale of violence would increase through the Late Yayoi period until largely tapering off during the transition to the Kofun period based on the Chinese accounts of the political landscape of the end of the Yayoi (G. L. Barnes 2007; Kidder 2007).

The Late Yayoi data in this thesis is largely comprised of individuals from the sites of Mitsunagata (n = 3) and Hirota (n = 5). Based on the data from this thesis, the scope and scale of Late Yayoi conflict is not clear, although the trauma from Mitsunagata is similar to that observed from the Middle Yayoi sample. Overall, the evidence for skeletal trauma from the Yayoi, particularly the Early–Middle Yayoi onwards, is consistent with warfare defined as “armed conflict between societies”. Nevertheless, further comparable data are needed to address the final hypothesis with any confidence. The crude prevalence and CAP values for the Jōmon–Yayoi periods do not show an exponential increase in violence over time or a sharp drop-off of evidence for trauma at the Late Yayoi, even when combined with previously

reported data (Table 8.5). The scale of conflict and its formalisation do appear to increase over the course of the Yayoi. Evidence for an escalating scale of conflict comes from the possible Late Yayoi Aoya-Kamijichi massacre (Inoue and Matsumoto 2001; Padgett 2020), which possibly correspond to the Wa Disturbances based on radiocarbon dating.

Without further refinement of the chronology of Late Yayoi sites, though, it may be difficult to pin-point how evidence of conflict directly relates to the Chinese historical accounts. Particularly, the documented periods of conflict and peace of the Late Yayoi (ca. 1st – mid-3rd century AD) and Kofun transition include the Wa Disturbances (147–189 AD), Himiko's rise to power and reign (from at least 238 AD), and the 'assassination and murder' of around a thousand individuals that followed Himiko's death (ca. 248 AD) before her female successor, Iyo, was made queen (G. L. Barnes 2007; Kidder 2007). Another complicating factor are the fewer extant Yayoi skeletons from the Late period and Kofun than those from the Middle Yayoi (Honma 1993). All the same, to best examine in detail the evidence, or lack thereof, for violent trauma for the transition to the Kofun period, a greater number of Late Yayoi individuals need to be examined while simultaneously being able to confidently situate them chronologically in the period and in relation to each other. Finally, just because larger-scale conflict may not have been present at the transition to the Kofun period, as would be hypothesised based on the *Wei Zhi*, that does not mean that no violent conflict occurred at the time or will not be evidenced on human remains.

Hirota was included in the analysis with the aim of examining trauma from the wider Yayoi interaction sphere, but the likely violent trauma observed among the Hirota individuals is highly divergent from the other Yayoi trauma patterns, with multiple individuals with numerous apparent healed blunt force depressed cranial fractures. Further study of other individuals from the site and from other communities in the Trail of Shells will be required in order to evaluate how these trauma patterns may relate to the local cultural practices and to the political and economic climate, particularly in regards to the exchange system of prestigious

goods (G. L. Barnes 2007; Hirota Site Research Group 2003). The initial hypothesis for the pattern of numerous antemortem BFT injuries to the skulls of both males and females is that they are the result of culturally sanctioned interpersonal fights, possibly in the form of duels.

Overall, in order to refine many of the findings and resulting hypotheses presented in this thesis, continued investigation of sites for trauma in a more consistent and detailed manner is needed, particularly the large site of Yoshinogari now that the skeletal report has been published. Moreover, further refinement of the chronology of sites and cemeteries, if the preservation allows for it, would aid greatly in allowing for comparisons to be made across sites and regions at a finer-resolution than is currently possible and with an ability to quantify any error associated.

10.1.5 Comparative Analysis

The evidence for violent trauma from the prehistoric southwestern Japanese archipelago was compared to that of the European Mesolithic–Bronze Age. When only taking into account larger assemblages (n>20), the Jōmon were found to overall have a similar rate of trauma compared to the hunter-gatherers of the European Mesolithic. The use of tool-weapons and a lack of fortified sites was noted for both. Tool-weapons were employed as instruments of violence during the Jōmon, but it is worth noting that the blunt force depressed cranial fractures found among the Jōmon sample is not inconsistent with being caused by implements such as the ritual stone rods or swords. Their possible use as weapons has long been debated, but their use in conflict cannot be ruled out based on the evidence presented here. Up to this point there has been no evidence of possible massacre sites such as those of the European Mesolithic (i.e. Ofnet and Hohlenstein-Stadel), but the recently excavated Final Jōmon site of Usu Moshiri in Hokkaido, which overlaps with the Yayoi culture to the south, may provide evidence for larger-scale conflict once fully documented (Aono and Nagaya 2021; Aono et al. 2021).

In the context of European Neolithic to Bronze Age violent conflict points to a form of Yayoi warfare involving Bronze Age ideological concepts of warriorhood, although no evidence of large, staged battles has been found as of yet. Through the course of the Yayoi, at least another two waves of migration into the archipelago occurred and trade relations with the continent continued (Rhee et al. 2021). The new occurrence of fortified settlements from the beginning of the Yayoi onwards, which, whether they ended up being a site of siege or not, imply that a threat of the 'other' was perceived by the community enough to set aside the time and labour to construct and maintain ditches, banks, and designated entry points. Incorporation of similar practices to the European Neolithic were noted, such as continued use of tool-weapons and lithic weapons and the creation of fortified settlements. These come as no surprise considering the overlapping forces of increased sedentism and population growth noted between the European Neolithic and Yayoi, which likely contributed to emerging cultural conceptions of social substitutability, laying the ideological groundwork for larger scale future conflicts.

10.2 Conclusion

Ultimately, this study, and all studies of violent skeletal trauma are restricted by the preservation of skeletal remains, the likelihood of trauma impacting the skeleton, and the ability to, with some measure of confidence, ascribe a violent aetiology to an injury (see Chapter sections 1.1.3, 5.1, and 6.2). Nevertheless, to not thoroughly investigate how the material and written evidence for violence actually *impacted* individuals would be to ignore the most lived, visceral remains of violence.

Much of the work that went into this thesis focused on creating primary, reproducible data on violence-related skeletal trauma for the end of the Jōmon and for the Yayoi period. It is apparent that a great deal more work is needed in creating a greater reservoir of comparative data of this sort for the Japanese archipelago. Comparing general studies is useful, but trauma

needs to be systematically searched for and reported upon in order to begin to reduce the uncertainties inherent in such studies. Hence, it becomes more tenable to represent exactly what biases are influencing the data and interpretation with systematic analyses. Hence, considerable care was taken to represent the data as fully as possible (i.e. through descriptions, measurements, photographs, and 3D maps) in the hopes that it will be possible to use this dataset for a broad range of comparative analyses. Aside from the findings particular to the prehistoric cultures of the Japanese archipelago discussed in the previous section (10.1), more general methodological contributions were made in this thesis.

Novel methodological approaches were applied in order to facilitate the aim of making this data as representative as possible. This included the quantification of surface condition and completeness. It may appear that the weighting of the total number of individuals (i.e. Completeness Adjusted Total (CAT)) and of the prevalence of trauma (i.e. Completeness Adjusted Prevalence (CAP)) by completeness simply inflates the rates of trauma at times. However, to not account for it at all, as in the case of 'crude prevalence' calculations, results in largely unrepresentative data where an individual with only the lower body preserved may be compared to an individual with only the skull preserved as though the comparison is equal and as though the trauma preserved under these conditions is equal.

'True prevalence' begins to address this issue by comparing elements of a certain or similar level of completeness. Even so, excluding possibly useful data that does not meet an arbitrary cut-off also fails to best represent the full range and depth of information available for study. By examining the crude, true, and completeness adjusted prevalence values in concert, it becomes more apparent the kinds of biases which are entering the data, at least in regards to completeness and preservation. CAT and CAP offer a way to begin to consistently account for the likelihood of finding trauma based on completeness by making it clear how much the available information on trauma is being impacted by this particular variable. Finally, the numerous zones used to record the completeness in this thesis were costly in terms of overall

time management, but they also make the data incredibly scalable. Completeness values for zones can be aggregated into completeness per region and/or the values can be confined to smaller or different ranges (e.g. from tenths to thirds as in the case of the Jōmon sample); all while taking into account the relative surface area recorded.

The use of GIS to estimate the relative surface area per zone is just one advantage of having employed 3D spatial analysis for trauma analysis of this thesis. The most obvious outcome of this method of creating distinct spatial analytical units within a 3D model of the human skeleton was the simultaneous visualisation of completeness and trauma per individual or group. The completeness and trauma data could also be queried based on attributed data, such as age, sex, trauma type, etc. This was a more consistent way of representing the data collected than relying on *ad hoc* figures or drawings.

This thesis has contributed to the growing body of research on violent trauma of the prehistoric cultures of the Japanese archipelago, presenting data from over 400 individuals from the Late Jōmon–Late Yayoi periods. The sample in this thesis is not perfectly representative of the periods, due to inherent biases in the archaeological remains and to issues of access to extant skeletons, but the data and analysis presented here are another step forward in understanding how violent conflict and its impact on the human body relate to the major cultural changes at the advent of the early agricultural period in the southwestern Japanese archipelago. It is with hope that continued, consistent research into the study of skeletal trauma from the Jōmon and Yayoi, and even Kofun, periods that we may understand more deeply the lived experiences of these men, women, and children who lived through, and orchestrated, sweeping cultural, political, and technological changes.



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CATALOGUE I: SKELETAL DATA

List of Tables

Table 1: Approximate surface area (SA) of each zone (based on the zonation method by Knüsel and Outram (2004)) analysed in this thesis based on the BodyParts3D skeletal model (https://lifesciencedb.jp/bp3d/) and calculated in ArcGIS Pro. See Ch. 6 for additional details. III

Table 2: General data per Jōmon individual analysed. References per site and for the radiocarbon, stable isotopic, grave goods, and catalogue comments are provided below the table. In the 'Local?' column 'L' denotes local and 'N' denotes non-local. "No" refers to the sample number within this thesis. (A = Adult, Adol = Adolescent, YA = young adult, MA = middle adult, OA = old adult) XIII

Table 3: General data per Yayoi individual analysed. References per site and for the radiocarbon, stable isotopic, grave goods, and catalogue comments are provided below the table. "No" refers to the sample number within this thesis. (A = Adult, Adol = Adolescent, YA = young adult, MA = middle adult, OA = old adult) XXVII

Table 4: Jōmon skull preservation and trauma data. The "No" denotes the sample number within this thesis. The "Med-High Viol" indicates Medium–High likelihood violent trauma and the "Low Viol" indicates Low likelihood violent trauma. In the "Trauma Area" column, "ST" denotes skull trauma and "PCT" denotes postcranial trauma. (A = Adult, Adol = Adolescent, YA = young adult, MA = middle adult, OA = old adult) XLIII

Table 5: Yayoi preservation data. The "No" denotes the sample number within this thesis. "Skull No Sp." refers to the completeness of the skull excluding the sphenoid bone. (A = Adult, Adol = Adolescent, YA = young adult, MA = middle adult, OA = old adult) LIV

Table 6: Yayoi trauma data. The "No" denotes the sample number within this thesis. The "Med-High Viol" indicates Medium–High likelihood violent trauma and the "Low Viol" indicates Low likelihood violent trauma. In the "Trauma Area" column "ST" denotes skull trauma, "PCT" denotes postcranial trauma, and "FBT" denotes full body trauma. (A = Adult, Adol = Adolescent, YA = young adult, MA = middle adult, OA = old adult) LXIII

Table 7: Itoku site preservation and trauma data. "No" refers to the sample number within this thesis. (A = Adult, Adol = Adolescent, YA = young adult, MA = middle adult, OA = old adult) LXXI

Table 1: Approximate surface area (SA) of each zone (based on the zonation method by Knüsel and Outram (2004)) analysed in this thesis based on the BodyParts3D skeletal model (https://lifesciencedb.jp/bp3d/) and calculated in ArcGIS Pro. See Ch. 6 for additional details.

Bone	Zone	SA
Right Frontal	Frontal_1	20971.26459
Left Frontal	Frontal_2	20971.26459
Mandible	LMandible_1	1641.038683
Mandible	LMandible_2	575.7986766
Mandible	LMandible_3	252.7986888
Mandible	LMandible_4	357.0659033
Mandible	LMandible_5	1355.574103
Mandible	LMandible_6	3187.046553
Mandible	LMandible_7	775.6161764
Left maxilla	Maxilla_12	10145.36568
Right maxilla	Maxilla_13	10145.36568
Left nasal	Nasal_14	749.3179577
Right nasal	Nasal_15	749.3179577
Occipital	Occipital_5	35630.46592
Right parietal	Parietal_3	39031.2883
Left parietal	Parietal_4	39031.2883
Mandible	RMandible_1	1641.038683
Mandible	RMandible_2	575.7986766
Mandible	RMandible_3	252.7986888
Mandible	RMandible_4	357.0659033
Mandible	RMandible_5	1355.574103
Mandible	RMandible_6	3187.046553
Mandible	RMandible_7	775.6161764
Left Sphenoid	Sphenoid_8	9434.72083
Right Sphenoid	Sphenoid_9	9434.72083
Left temporal	Temporal_6	14109.2266
Right temporal	Temporal_7	14109.2266
Left zygomatic	Zygomatic_10	3210.274657
Right zygomatic	Zygomatic_11	3210.274657
Atlas	C1_1	342.5236289
Atlas	C1_2	2039.929906
Atlas	C1_3	2039.929906
Atlas	C1_4	773.3339078
Axis	C2_1	1129.171098
Axis	C2_2	1764.943477
Axis	C2_3	1764.943477
Axis	C2_4	1123.711746
Third cervical vertebra	C3_1	1453.859853
Third cervical vertebra	C3_2	1238.16072
Third cervical vertebra	C3_3	1238.16072
Third cervical vertebra	C3_4	943.6051011
Fourth cervical vertebra	C4_1	1223.61919
Fourth cervical vertebra	C4_2	1213.872085
Fourth cervical vertebra	C4_3	1213.872085
Fourth cervical vertebra	C4_4	965.5032874
Fifth cervical vertebra	C5_1	1421.961466
Fifth cervical vertebra	C5_2	1652.300445
Fifth cervical vertebra	C5_3	1652.300445
Fifth cervical vertebra	C5_4	763.6624319
Sixth cervical vertebra	C6_1	1504.231643
Sixth cervical vertebra	C6_2	1583.581338
Sixth cervical vertebra	C6_3	1583.581338
Sixth cervical vertebra	C6_4	996.2367141
Seventh cervical vertebra	C7_1	1701.146264
Seventh cervical vertebra	C7_2	1613.582281
Seventh cervical vertebra	C7_3	1613.582281
Seventh cervical vertebra	C7_4	1294.771037

Bone	Zone	SA
First thoracic vertebra	T1_1	2315.586256
First thoracic vertebra	T1_2	1531.709112
First thoracic vertebra	T1_3	1531.709112
First thoracic vertebra	T1_4	1229.402016
Second thoracic vertebra	T2_1	2611.649123
Second thoracic vertebra	T2_2	1743.868929
Second thoracic vertebra	T2_3	1743.868929
Second thoracic vertebra	T2_4	1131.903923
Third thoracic vertebra	T3_1	2680.902649
Third thoracic vertebra	T3_2	1874.670236
Third thoracic vertebra	T3_3	1874.670236
Third thoracic vertebra	T3_4	1205.179571
Fourth thoracic vertebra	T4_1	2888.532518
Fourth thoracic vertebra	T4_2	2000.527333
Fourth thoracic vertebra	T4_3	2000.527333
Fourth thoracic vertebra	T4_4	864.968789
Fifth thoracic vertebra	T5_1	3104.515176
Fifth thoracic vertebra	T5_2	2289.654661
Fifth thoracic vertebra	T5_3	2289.654661
Fifth thoracic vertebra	T5_4	817.8776846
Sixth thoracic vertebra	T6_1	3433.01826
Sixth thoracic vertebra	T6_2	2534.380106
Sixth thoracic vertebra	T6_3	2534.380106
Sixth thoracic vertebra	T6_4	511.8959685
Seventh thoracic vertebra	T7_1	4029.891739
Seventh thoracic vertebra	T7_2	2555.272686
Seventh thoracic vertebra	T7_3	2555.272686
Seventh thoracic vertebra	T7_4	493.7017385
Eighth thoracic vertebra	T8_1	3980.902383
Eighth thoracic vertebra	T8_2	2587.27201
Eighth thoracic vertebra	T8_3	2587.27201
Eighth thoracic vertebra	T8_4	457.5332022
Ninth thoracic vertebra	T9_1	4516.982092
Ninth thoracic vertebra	T9_2	2627.062104
Ninth thoracic vertebra	T9_3	2627.062104
Ninth thoracic vertebra	T9_4	450.6744509
Tenth thoracic vertebra	T10_1	4761.504698
Tenth thoracic vertebra	T10_2	2802.145623
Tenth thoracic vertebra	T10_3	2802.145623
Tenth thoracic vertebra	T10_4	664.2723944
Eleventh thoracic vertebra	T11_1	5094.141353
Eleventh thoracic vertebra	T11_2	2416.622649
Eleventh thoracic vertebra	T11_3	2416.622649
Eleventh thoracic vertebra	T11_4	819.8886979
Twelfth thoracic vertebra	T12_1	5701.042379
Twelfth thoracic vertebra	T12_2	2292.655746
Twelfth thoracic vertebra	T12_3	2292.655746
Twelfth thoracic vertebra	T12_4	626.8644364
First lumbar vertebra	L1_1	5604.189661
First lumbar vertebra	L1_2	2654.406212
First lumbar vertebra	L1_3	2654.406212
First lumbar vertebra	L1_4	791.8565792
Second lumbar vertebra	L2_1	5759.029923
Second lumbar vertebra	L2_2	2943.657579
Second lumbar vertebra	L2_3	2943.657579
Second lumbar vertebra	L2_4	749.3451185
Third lumbar vertebra	L3_1	6017.705061
Third lumbar vertebra	L3_2	2695.328165
Third lumbar vertebra	L3_3	2695.328165
Third lumbar vertebra	L3_4	1107.218347
Fourth lumbar vertebra	L4_1	6556.253728
Fourth lumbar vertebra	L4_2	2871.617443
Fourth lumbar vertebra	L4_3	2871.617443
Fourth lumbar vertebra	L4_4	778.4216246
Fifth lumbar vertebra	L5_1	7085.114514
Fifth lumbar vertebra	L5_2	3269.54987

Bone	Zone	SA
Fifth lumbar vertebra	L5_3	3269.54987
Fifth lumbar vertebra	L5_4	834.4163325
Left first rib	L1Rib_1	336.7198312
Left first rib	L1Rib_2	2003.552922
Left first rib	L1Rib_3	1741.425132
Left second rib	L2Rib_1	1118.633222
Left second rib	L2Rib_2	1215.989733
Left second rib	L2Rib_3	4781.051203
Left third rib	L3Rib_1	1095.445638
Left third rib	L3Rib_2	2255.122375
Left third rib	L3Rib_3	5384.881373
Left fourth rib	L4Rib_1	1165.881569
Left fourth rib	L4Rib_2	2334.701829
Left fourth rib	L4Rib_3	7030.700927
Left fifth rib	L5Rib_1	1108.187168
Left fifth rib	L5Rib_2	3937.38018
Left fifth rib	L5Rib_3	6820.829765
Left sixth rib	L6Rib_1	1328.666911
Left sixth rib	L6Rib_2	3008.640303
Left sixth rib	L6Rib_3	8072.924946
Left seventh rib	L7Rib_1	1349.820266
Left seventh rib	L7Rib_2	4140.226545
Left seventh rib	L7Rib_3	6861.484328
Left eighth rib	L8Rib_1	1309.658047
Left eighth rib	L8Rib_2	3081.330514
Left eighth rib	L8Rib_3	5863.394569
Left ninth rib	L9Rib_1	1080.011474
Left ninth rib	L9Rib_2	3599.864493
Left ninth rib	L9Rib_3	4607.779173
Left tenth rib	L10Rib_1	1068.91339
Left tenth rib	L10Rib_2	3033.768171
Left tenth rib	L10Rib_3	3983.498012
Left eleventh rib	L11Rib_1	758.4543682
Left eleventh rib	L11Rib_2	2222.868102
Left eleventh rib	L11Rib_3	2895.138474
Left twelfth rib	L12Rib_1	721.3326894
Left twelfth rib	L12Rib_2	922.5786803
Left twelfth rib	L12Rib_3	1748.699292
Right first rib	R1Rib_1	336.7198312
Right first rib	R1Rib_2	2003.552922
Right first rib	R1Rib_3	1741.425132
Right second rib	R2Rib_1	1118.633222
Right second rib	R2Rib_2	1215.989733
Right second rib	R2Rib_3	4781.051203
Right third rib	R3Rib_1	1095.445638
Right third rib	R3Rib_2	2255.122375
Right third rib	R3Rib_3	5384.881373
Right fourth rib	R4Rib_1	1165.881569
Right fourth rib	R4Rib_2	2334.701829
Right fourth rib	R4Rib_3	7030.700927
Right fifth rib	R5Rib_1	1108.187168
Right fifth rib	R5Rib_2	3937.38018
Right fifth rib	R5Rib_3	6820.829765
Right sixth rib	R6Rib_1	1328.666911
Right sixth rib	R6Rib_2	3008.640303
Right sixth rib	R6Rib_3	8072.924946
Right seventh rib	R7Rib_1	1349.820266
Right seventh rib	R7Rib_2	4140.226545
Right seventh rib	R7Rib_3	6861.484328
Right eighth rib	R8Rib_1	1309.658047
Right eighth rib	R8Rib_2	3081.330514
Right eighth rib	R8Rib_3	5863.394569
Right ninth rib	R9Rib_1	1080.011474
Right ninth rib	R9Rib_2	3599.864493
Right ninth rib	R9Rib_3	4607.779173
Right tenth rib	R10Rib_1	1068.91339

Bone	Zone	SA
Right tenth rib	R10Rib_2	3033.768171
Right tenth rib	R10Rib_3	3983.498012
Right eleventh rib	R11Rib_1	758.4543682
Right eleventh rib	R11Rib_2	2222.868102
Right eleventh rib	R11Rib_3	2895.138474
Right twelfth rib	R12Rib_1	721.3326894
Right twelfth rib	R12Rib_2	922.5786803
Right twelfth rib	R12Rib_3	1748.699292
Left clavicle	LClavicle_1	2238.726404
Left clavicle	LClavicle_2	2994.691801
Left clavicle	LClavicle_3	3265.04971
Left scapula	LScapula_1	1899.155713
Left scapula	LScapula_2	607.00167
Left scapula	LScapula_3	573.6102937
Left scapula	LScapula_4	3658.935991
Left scapula	LScapula_5	3106.081964
Left scapula	LScapula_6	2875.878603
Left scapula	LScapula_7	8702.073564
Left scapula	LScapula_8	3229.081871
Left scapula	LScapula_9	8007.873773
Right clavicle	RClavicle_1	2238.726404
Right clavicle	RClavicle_2	2994.691801
Right clavicle	RClavicle_3	3265.04971
Right scapula	RScapula_1	1899.155713
Right scapula	RScapula_2	607.00167
Right scapula	RScapula_3	573.6102937
Right scapula	RScapula_4	3658.935991
Right scapula	RScapula_5	3106.081964
Right scapula	RScapula_6	2875.878603
Right scapula	RScapula_7	8702.073564
Right scapula	RScapula_8	3229.081871
Right scapula	RScapula_9	8007.873773
Manubrium	Sternum_1	6833.316034
Body of sternum	Sternum_2	12509.70877
Xiphoid process	Sternum_3	1098.585739
Left humerus	LHumerus_1	2571.913303
Left humerus	LHumerus_2	2804.423878
Left humerus	LHumerus_3	253.3824605
Left humerus	LHumerus_4	822.828918
Left humerus	LHumerus_5	1343.160761
Left humerus	LHumerus_6	1699.623935
Left humerus	LHumerus_7	4396.392863
Left humerus	LHumerus_8	2832.540718
Left humerus	LHumerus_9	4615.971649
Left humerus	LHumerus_10	1737.451259
Left humerus	LHumerus_11	5338.619444
Left radius	LRadius_1	482.6453967
Left radius	LRadius_2	442.3999602
Left radius	LRadius_3	680.1974594
Left radius	LRadius_4	739.9664723
Left radius	LRadius_5	2353.086008
Left radius	LRadius_6	1173.051664
Left radius	LRadius_7	1209.427488
Left radius	LRadius_8	2262.987092
Left radius	LRadius_9	1502.373708
Left radius	LRadius_10	1056.897042
Left radius	LRadius_J	203.5910244
Left ulna	LUlna_A	149.813828
Left ulna	LUlna_B	149.813828
Left ulna	LUlna_C	1782.474307
Left ulna	LUlna_D	224.5336469
Left ulna	LUlna_E	5350.213735
Left ulna	LUlna_F	1316.085456
Left ulna	LUlna_G	1234.939524
Left ulna	LUlna_H	1203.019672
Left ulna	LUlna_J	567.6077211

Bone	Zone	SA
Right humerus	RHumerus_1	2571.913303
Right humerus	RHumerus_2	2804.423878
Right humerus	RHumerus_3	253.3824605
Right humerus	RHumerus_4	822.828918
Right humerus	RHumerus_5	1343.160761
Right humerus	RHumerus_6	1699.623935
Right humerus	RHumerus_7	4396.392863
Right humerus	RHumerus_8	2832.540718
Right humerus	RHumerus_9	4615.971649
Right humerus	RHumerus_10	1737.451259
Right humerus	RHumerus_11	5338.619444
Right radius	RRadius_1	482.6453967
Right radius	RRadius_2	442.3999602
Right radius	RRadius_3	680.1974594
Right radius	RRadius_4	739.9664723
Right radius	RRadius_5	2353.086008
Right radius	RRadius_6	1173.051664
Right radius	RRadius_7	1209.427488
Right radius	RRadius_8	2262.987092
Right radius	RRadius_9	1502.373708
Right radius	RRadius_10	1056.897042
Right radius	RRadius_J	203.5910244
Right ulna	RUlna_A	149.813828
Right ulna	RUlna_B	149.813828
Right ulna	RUlna_C	1782.474307
Right ulna	RUlna_D	224.5336469
Right ulna	RUlna_E	5350.213735
Right ulna	RUlna_F	1316.085456
Right ulna	RUlna_G	1234.939524
Right ulna	RUlna_H	1203.019672
Right ulna	RUlna_J	567.6077211
Left capitate	L_CAP	1004.555488
Left hamate	L_HAM	911.2140784

Bone	Zone	SA
Left lunate	L_LUN	667.2489618
Left pisiform	L_PIS	310.884315
Left scaphoid	L_SCP	823.0676322
Left trapezium	L_TPM	778.3772081
Left trapezoid	L_TRD	489.7880855
Left triquetral	L_TRI	545.0046079
Right capitate	R_CAP	1004.555488
Right hamate	R_HAM	911.2140784
Right lunate	R_LUN	667.2489618
Right pisiform	R_PIS	310.884315
Right scaphoid	R_SCP	823.0676322
Right trapezium	R_TPM	778.3772081
Right trapezoid	R_TRD	489.7880855
Right triquetral	R_TRI	545.0046079
Left first metacarpal	L1Metacarpal_1	499.6216027
Left first metacarpal	L1Metacarpal_2	860.4623729
Left first metacarpal	L1Metacarpal_3	483.4236356
Left second metacarpal	L2Metacarpal_1	599.6938141
Left second metacarpal	L2Metacarpal_2	1312.046176
Left second metacarpal	L2Metacarpal_3	672.2090559
Left third metacarpal	L3Metacarpal_1	597.181228
Left third metacarpal	L3Metacarpal_2	1290.787582
Left third metacarpal	L3Metacarpal_3	588.9517516
Left fourth metacarpal	L4Metacarpal_1	409.2857733
Left fourth metacarpal	L4Metacarpal_2	948.4473663
Left fourth metacarpal	L4Metacarpal_3	498.3681402
Left fifth metacarpal	L5Metacarpal_1	364.4223729
Left fifth metacarpal	L5Metacarpal_2	914.6708976
Left fifth metacarpal	L5Metacarpal_3	455.286018
Right first metacarpal	R1Metacarpal_1	499.6216027
Right first metacarpal	R1Metacarpal_2	860.4623729
Right first metacarpal	R1Metacarpal_3	483.4236356
Right second metacarpal	R2Metacarpal_1	599.6938141

Bone	Zone	SA
Right second metacarpal	R2Metacarpal_2	1312.046176
Right second metacarpal	R2Metacarpal_3	672.2090559
Right third metacarpal	R3Metacarpal_1	597.181228
Right third metacarpal	R3Metacarpal_2	1290.787582
Right third metacarpal	R3Metacarpal_3	588.9517516
Right fourth metacarpal	R4Metacarpal_1	409.2857733
Right fourth metacarpal	R4Metacarpal_2	948.4473663
Right fourth metacarpal	R4Metacarpal_3	498.3681402
Right fifth metacarpal	R5Metacarpal_1	364.4223729
Right fifth metacarpal	R5Metacarpal_2	914.6708976
Right fifth metacarpal	R5Metacarpal_3	455.286018
Proximal phalanx of left thumb	LH1ProxPhal_1	286.6277132
Proximal phalanx of left thumb	LH1ProxPhal_2	551.7997903
Proximal phalanx of left thumb	LH1ProxPhal_3	195.7128182
Proximal phalanx of left index finger	LH2ProxPhal_1	322.5231724
Proximal phalanx of left index finger	LH2ProxPhal_2	792.470669
Proximal phalanx of left index finger	LH2ProxPhal_3	208.7654728
Proximal phalanx of left middle finger	LH3ProxPhal_1	374.257321
Proximal phalanx of left middle finger	LH3ProxPhal_2	870.1787684
Proximal phalanx of left middle finger	LH3ProxPhal_3	307.7362744
Proximal phalanx of left ring finger	LH4ProxPhal_1	273.175582
Proximal phalanx of left ring finger	LH4ProxPhal_2	823.0583367
Proximal phalanx of left ring finger	LH4ProxPhal_3	198.6596344
Proximal phalanx of left little finger	LH5ProxPhal_1	240.6852307
Proximal phalanx of left little finger	LH5ProxPhal_2	549.6513523
Proximal phalanx of left little finger	LH5ProxPhal_3	162.6468636
Proximal phalanx of right thumb	RH1ProxPhal_1	286.6277132
Proximal phalanx of right thumb	RH1ProxPhal_2	551.7997903
Proximal phalanx of right thumb	RH1ProxPhal_3	195.7128182
Proximal phalanx of right index finger	RH2ProxPhal_1	322.5231724
Proximal phalanx of right index finger	RH2ProxPhal_2	792.470669
Proximal phalanx of right index finger	RH2ProxPhal_3	208.7654728
Proximal phalanx of right middle finger	RH3ProxPhal_1	374.257321
Proximal phalanx of right middle finger	RH3ProxPhal_2	870.1787684
Proximal phalanx of right middle finger	RH3ProxPhal_3	307.7362744
Proximal phalanx of right ring finger	RH4ProxPhal_1	273.175582
Proximal phalanx of right ring finger	RH4ProxPhal_2	823.0583367
Proximal phalanx of right ring finger	RH4ProxPhal_3	198.6596344
Proximal phalanx of right little finger	RH5ProxPhal_1	240.6852307
Proximal phalanx of right little finger	RH5ProxPhal_2	549.6513523
Proximal phalanx of right little finger	RH5ProxPhal_3	162.6468636
Intermediate phalanx of left index finger	LH2InterPhal_1	165.5662575
Intermediate phalanx of left index finger	LH2InterPhal_2	335.5194339
Intermediate phalanx of left index finger	LH2InterPhal_3	125.8249739
Intermediate phalanx of left middle finger	LH3InterPhal_1	222.1844035
Intermediate phalanx of left middle finger	LH3InterPhal_2	455.2287248
Intermediate phalanx of left middle finger	LH3InterPhal_3	139.205036
Intermediate phalanx of left ring finger	LH4InterPhal_1	174.7222918
Intermediate phalanx of left ring finger	LH4InterPhal_2	433.0711771
Intermediate phalanx of left ring finger	LH4InterPhal_3	131.6190773
Intermediate phalanx of left little finger	LH5InterPhal_1	140.4981695
Intermediate phalanx of left little finger	LH5InterPhal_2	262.6429491
Intermediate phalanx of left little finger	LH5InterPhal_3	94.86532357
Intermediate phalanx of right index finger	RH2InterPhal_1	165.5662575
Intermediate phalanx of right index finger	RH2InterPhal_2	335.5194339
Intermediate phalanx of right index finger	RH2InterPhal_3	125.8249739
Intermediate phalanx of right middle finger	RH3InterPhal_1	222.1844035
Intermediate phalanx of right middle finger	RH3InterPhal_2	455.2287248
Intermediate phalanx of right middle finger	RH3InterPhal_3	139.205036
Intermediate phalanx of right ring finger	RH4InterPhal_1	174.7222918
Intermediate phalanx of right ring finger	RH4InterPhal_2	433.0711771
Intermediate phalanx of right ring finger	RH4InterPhal_3	131.6190773
Intermediate phalanx of right little finger	RH5InterPhal_1	140.4981695
Intermediate phalanx of right little finger	RH5InterPhal_2	262.6429491
Intermediate phalanx of right little finger	RH5InterPhal_3	94.86532357
Distal phalanx of left thumb	LH1DistPhal_1	191.0953246

Bone	Zone	SA
Distal phalanx of left thumb	LH1DistPhal_2	275.0419783
Distal phalanx of left thumb	LH1DistPhal_3	106.1074196
Distal phalanx of left index finger	LH2DistPhal_1	107.0544548
Distal phalanx of left index finger	LH2DistPhal_2	169.1220351
Distal phalanx of left index finger	LH2DistPhal_3	78.44769972
Distal phalanx of left middle finger	LH3DistPhal_1	116.9589006
Distal phalanx of left middle finger	LH3DistPhal_2	158.121495
Distal phalanx of left middle finger	LH3DistPhal_3	69.63889711
Distal phalanx of left ring finger	LH4DistPhal_1	80.23901896
Distal phalanx of left ring finger	LH4DistPhal_2	119.6262703
Distal phalanx of left ring finger	LH4DistPhal_3	48.08511145
Distal phalanx of left little finger	LH5DistPhal_1	71.49115005
Distal phalanx of left little finger	LH5DistPhal_2	129.1097972
Distal phalanx of left little finger	LH5DistPhal_3	49.70226485
Distal phalanx of right thumb	RH1DistPhal_1	191.0953246
Distal phalanx of right thumb	RH1DistPhal_2	275.0419783
Distal phalanx of right thumb	RH1DistPhal_3	106.1074196
Distal phalanx of right index finger	RH2DistPhal_1	107.0544548
Distal phalanx of right index finger	RH2DistPhal_2	169.1220351
Distal phalanx of right index finger	RH2DistPhal_3	78.44769972
Distal phalanx of right middle finger	RH3DistPhal_1	116.9589006
Distal phalanx of right middle finger	RH3DistPhal_2	158.121495
Distal phalanx of right middle finger	RH3DistPhal_3	69.63889711
Distal phalanx of right ring finger	RH4DistPhal_1	80.23901896
Distal phalanx of right ring finger	RH4DistPhal_2	119.6262703
Distal phalanx of right ring finger	RH4DistPhal_3	48.08511145
Distal phalanx of right little finger	RH5DistPhal_1	71.49115005
Distal phalanx of right little finger	RH5DistPhal_2	129.1097972
Distal phalanx of right little finger	RH5DistPhal_3	49.70226485
Left pelvis	LOsCoxa_1	4609.3922
Left pelvis	LOsCoxa_2	3545.501056
Left pelvis	LOsCoxa_3	2347.204405
Left pelvis	LOsCoxa_4	1458.312348
Left pelvis	LOsCoxa_5	5510.120416
Left pelvis	LOsCoxa_6	3303.487977
Left pelvis	LOsCoxa_7	1130.34059
Left pelvis	LOsCoxa_8	1123.138964
Left pelvis	LOsCoxa_9	3734.747532
Left pelvis	LOsCoxa_10	17044.79753
Left pelvis	LOsCoxa_11	3768.070709
Left pelvis	LOsCoxa_12	9727.60021
Right pelvis	ROsCoxa_1	4609.3922
Right pelvis	ROsCoxa_2	3545.501056
Right pelvis	ROsCoxa_3	2347.204405
Right pelvis	ROsCoxa_4	1458.312348
Right pelvis	ROsCoxa_5	5510.120416
Right pelvis	ROsCoxa_6	3303.487977
Right pelvis	ROsCoxa_7	1130.34059
Right pelvis	ROsCoxa_8	1123.138964
Right pelvis	ROsCoxa_9	3734.747532
Right pelvis	ROsCoxa_10	17044.79753
Right pelvis	ROsCoxa_11	3768.070709
Right pelvis	ROsCoxa_12	9727.60021
Sacrum	Sacrum_1	5266.572269
Sacrum	Sacrum_2	12374.26696
Sacrum	Sacrum_3	12463.60952
Sacrum	Sacrum_4	4769.889105
Left femur	LFemur_1	3441.039642
Left femur	LFemur_2	1776.723804
Left femur	LFemur_3	5539.027176
Left femur	LFemur_4	5689.559366
Left femur	LFemur_5	3022.55742
Left femur	LFemur_6	15783.71281
Left femur	LFemur_7	6500.690072
Left femur	LFemur_8	9908.68893
Left femur	LFemur_9	4447.65948

Bone	Zone	SA
Left femur	LFemur_10	4485.917162
Left femur	LFemur_11	4991.048635
Left fibula	LFibula_1	2256.778513
Left fibula	LFibula_2	2221.202026
Left fibula	LFibula_3	3330.478605
Left fibula	LFibula_4	3179.257263
Left fibula	LFibula_5	3027.850217
Left fibula	LFibula_6	3266.55681
Left patella	LPatella	3136.867893
Left tibia	LTibia_1	4219.084972
Left tibia	LTibia_2	1146.472494
Left tibia	LTibia_3	4250.659938
Left tibia	LTibia_4	1761.150373
Left tibia	LTibia_5	4454.178413
Left tibia	LTibia_6	2817.291062
Left tibia	LTibia_7	6150.030185
Left tibia	LTibia_8	6375.755281
Left tibia	LTibia_9	5093.487514
Left tibia	LTibia_10	5488.835013
Right femur	RFemur_1	3441.039642
Right femur	RFemur_2	1776.723804
Right femur	RFemur_3	5539.027176
Right femur	RFemur_4	5689.559366
Right femur	RFemur_5	3022.55742
Right femur	RFemur_6	15783.71281
Right femur	RFemur_7	6500.690072
Right femur	RFemur_8	9908.68893
Right femur	RFemur_9	4447.65948
Right femur	RFemur_10	4485.917162
Right femur	RFemur_11	4991.048635
Right fibula	RFibula_1	2256.778513
Right fibula	RFibula_2	2221.202026
Right fibula	RFibula_3	3330.478605
Right fibula	RFibula_4	3179.257263
Right fibula	RFibula_5	3027.850217
Right fibula	RFibula_6	3266.55681
Right patella	RPatella	3136.867893
Right tibia	RTibia_1	4219.084972
Right tibia	RTibia_2	1146.472494
Right tibia	RTibia_3	4250.659938
Right tibia	RTibia_4	1761.150373
Right tibia	RTibia_5	4454.178413
Right tibia	RTibia_6	2817.291062
Right tibia	RTibia_7	6150.030185
Right tibia	RTibia_8	6375.755281
Right tibia	RTibia_9	5093.487514
Right tibia	RTibia_10	5488.835013
Left medial cuneiform	L_CU1	2410.319391
Left intermediate cuneiform	L_CU2	1157.154241
Left lateral cuneiform	L_CU3	1635.162802
Left cuboid	L_CUB	2935.631126
Navicular of left foot	L_NAV	2391.939252
Left calcaneus	LCal_1	2038.352217
Left calcaneus	LCal_2	2465.102054
Left calcaneus	LCal_3	2093.192385
Left calcaneus	LCal_4	1114.383644
Left calcaneus	LCal_5	1233.515009
Left talus	LTal_1	2283.7664
Left talus	LTal_2	1982.219968
Left talus	LTal_3	981.4655901
Left talus	LTal_4	804.1038435
Right medial cuneiform	R_CU1	2410.319391
Right intermediate cuneiform	R_CU2	1157.154241
Right lateral cuneiform	R_CU3	1635.162802
Right cuboid	R_CUB	2935.631126
Navicular of right foot	R_NAV	2391.939252

Bone	Zone	SA
Right calcaneus	RCal_1	2038.352217
Right calcaneus	RCal_2	2465.102054
Right calcaneus	RCal_3	2093.192385
Right calcaneus	RCal_4	1114.383644
Right calcaneus	RCal_5	1233.515009
Right talus	RTal_1	2283.7664
Right talus	RTal_2	1982.219968
Right talus	RTal_3	981.4655901
Right talus	RTal_4	804.1038435
Left first metatarsal	L1Metatarsal_1	1184.843937
Left first metatarsal	L1Metatarsal_2	1827.046398
Left first metatarsal	L1Metatarsal_3	926.6712616
Left second metatarsal	L2Metatarsal_1	779.4266831
Left second metatarsal	L2Metatarsal_2	1256.313818
Left second metatarsal	L2Metatarsal_3	574.8693712
Left third metatarsal	L3Metatarsal_1	726.4796858
Left third metatarsal	L3Metatarsal_2	1287.184549
Left third metatarsal	L3Metatarsal_3	501.8043124
Left fourth metatarsal	L4Metatarsal_1	829.7558322
Left fourth metatarsal	L4Metatarsal_2	1028.592728
Left fourth metatarsal	L4Metatarsal_3	535.6556124
Left fifth metatarsal	L5Metatarsal_1	1029.272032
Left fifth metatarsal	L5Metatarsal_2	1327.899323
Left fifth metatarsal	L5Metatarsal_3	559.3670805
Right first metatarsal	R1Metatarsal_1	1184.843937
Right first metatarsal	R1Metatarsal_2	1827.046398
Right first metatarsal	R1Metatarsal_3	926.6712616
Right second metatarsal	R2Metatarsal_1	779.4266831
Right second metatarsal	R2Metatarsal_2	1256.313818
Right second metatarsal	R2Metatarsal_3	574.8693712
Right third metatarsal	R3Metatarsal_1	726.4796858
Right third metatarsal	R3Metatarsal_2	1287.184549
Right third metatarsal	R3Metatarsal_3	501.8043124
Right fourth metatarsal	R4Metatarsal_1	829.7558322
Right fourth metatarsal	R4Metatarsal_2	1028.592728
Right fourth metatarsal	R4Metatarsal_3	535.6556124
Right fifth metatarsal	R5Metatarsal_1	1029.272032
Right fifth metatarsal	R5Metatarsal_2	1327.899323
Right fifth metatarsal	R5Metatarsal_3	559.3670805
Proximal phalanx of left big toe	LF1ProxPhal_1	557.1824218
Proximal phalanx of left big toe	LF1ProxPhal_2	873.6144491
Proximal phalanx of left big toe	LF1ProxPhal_3	291.128078
Proximal phalanx of left second toe	LF2ProxPhal_1	188.3710712
Proximal phalanx of left second toe	LF2ProxPhal_2	445.7748815
Proximal phalanx of left second toe	LF2ProxPhal_3	165.4423185
Proximal phalanx of left third toe	LF3ProxPhal_1	210.7423627
Proximal phalanx of left third toe	LF3ProxPhal_2	385.3618567
Proximal phalanx of left third toe	LF3ProxPhal_3	121.234092
Proximal phalanx of left fourth toe	LF4ProxPhal_1	230.4071957
Proximal phalanx of left fourth toe	LF4ProxPhal_2	324.7876996
Proximal phalanx of left fourth toe	LF4ProxPhal_3	108.0481683
Proximal phalanx of left little toe	LF5ProxPhal_1	246.0161583
Proximal phalanx of left little toe	LF5ProxPhal_2	328.6096803
Proximal phalanx of left little toe	LF5ProxPhal_3	112.9607677
Proximal phalanx of right big toe	RF1ProxPhal_1	557.1824218
Proximal phalanx of right big toe	RF1ProxPhal_2	873.6144491
Proximal phalanx of right big toe	RF1ProxPhal_3	291.128078
Proximal phalanx of right second toe	RF2ProxPhal_1	188.3710712
Proximal phalanx of right second toe	RF2ProxPhal_2	445.7748815
Proximal phalanx of right second toe	RF2ProxPhal_3	165.4423185
Proximal phalanx of right third toe	RF3ProxPhal_1	210.7423627
Proximal phalanx of right third toe	RF3ProxPhal_2	385.3618567
Proximal phalanx of right third toe	RF3ProxPhal_3	121.234092
Proximal phalanx of right fourth toe	RF4ProxPhal_1	230.4071957
Proximal phalanx of right fourth toe	RF4ProxPhal_2	324.7876996
Proximal phalanx of right fourth toe	RF4ProxPhal_3	108.0481683

Bone	Zone	SA
Proximal phalanx of right little toe	RF5ProxPhal_1	246.0161583
Proximal phalanx of right little toe	RF5ProxPhal_2	328.6096803
Proximal phalanx of right little toe	RF5ProxPhal_3	112.9607677
Intermediate phalanx of left second toe	LF2InterPhal_1	123.8305677
Intermediate phalanx of left second toe	LF2InterPhal_2	179.3306178
Intermediate phalanx of left second toe	LF2InterPhal_3	87.01572641
Intermediate phalanx of left third toe	LF3InterPhal_1	132.0711725
Intermediate phalanx of left third toe	LF3InterPhal_2	157.2297193
Intermediate phalanx of left third toe	LF3InterPhal_3	70.88858127
Intermediate phalanx of left fourth toe	LF4InterPhal_1	100.2733868
Intermediate phalanx of left fourth toe	LF4InterPhal_2	122.6074386
Intermediate phalanx of left fourth toe	LF4InterPhal_3	85.04657586
Intermediate phalanx of left little toe	LF5InterPhal_1	62.66081841
Intermediate phalanx of left little toe	LF5InterPhal_2	46.03853009
Intermediate phalanx of left little toe	LF5InterPhal_3	58.09920951
Intermediate phalanx of right second toe	RF2InterPhal_1	123.8305677
Intermediate phalanx of right second toe	RF2InterPhal_2	179.3306178
Intermediate phalanx of right second toe	RF2InterPhal_3	87.01572641
Intermediate phalanx of right third toe	RF3InterPhal_1	132.0711725
Intermediate phalanx of right third toe	RF3InterPhal_2	157.2297193
Intermediate phalanx of right third toe	RF3InterPhal_3	70.88858127
Intermediate phalanx of right fourth toe	RF4InterPhal_1	100.2733868
Intermediate phalanx of right fourth toe	RF4InterPhal_2	122.6074386
Intermediate phalanx of right fourth toe	RF4InterPhal_3	85.04657586
Intermediate phalanx of right little toe	RF5InterPhal_1	62.66081841
Intermediate phalanx of right little toe	RF5InterPhal_2	46.03853009
Intermediate phalanx of right little toe	RF5InterPhal_3	58.09920951
Distal phalanx of left big toe	LF1DistPhal_1	377.6821417
Distal phalanx of left big toe	LF1DistPhal_2	337.1895724
Distal phalanx of left big toe	LF1DistPhal_3	209.6605353
Distal phalanx of left second toe	LF2DistPhal_1	99.07162151
Distal phalanx of left second toe	LF2DistPhal_2	85.18932477
Distal phalanx of left second toe	LF2DistPhal_3	89.36174313
Distal phalanx of left third toe	LF3DistPhal_1	86.72673212
Distal phalanx of left third toe	LF3DistPhal_2	59.63469199
Distal phalanx of left third toe	LF3DistPhal_3	52.60139536
Distal phalanx of left fourth toe	LF4DistPhal_1	109.7562058
Distal phalanx of left fourth toe	LF4DistPhal_2	62.85482201
Distal phalanx of left fourth toe	LF4DistPhal_3	37.28340391
Distal phalanx of left little toe	LF5DistPhal_1	79.33736979
Distal phalanx of left little toe	LF5DistPhal_2	48.14715092
Distal phalanx of left little toe	LF5DistPhal_3	31.92805135
Distal phalanx of right big toe	RF1DistPhal_1	377.6821417
Distal phalanx of right big toe	RF1DistPhal_2	337.1895724
Distal phalanx of right big toe	RF1DistPhal_3	209.6605353
Distal phalanx of right second toe	RF2DistPhal_1	99.07162151
Distal phalanx of right second toe	RF2DistPhal_2	85.18932477
Distal phalanx of right second toe	RF2DistPhal_3	89.36174313
Distal phalanx of right third toe	RF3DistPhal_1	86.72673212
Distal phalanx of right third toe	RF3DistPhal_2	59.63469199
Distal phalanx of right third toe	RF3DistPhal_3	52.60139536
Distal phalanx of right fourth toe	RF4DistPhal_1	109.7562058
Distal phalanx of right fourth toe	RF4DistPhal_2	62.85482201
Distal phalanx of right fourth toe	RF4DistPhal_3	37.28340391
Distal phalanx of right little toe	RF5DistPhal_1	79.33736979
Distal phalanx of right little toe	RF5DistPhal_2	48.14715092
Distal phalanx of right little toe	RF5DistPhal_3	31.92805135
TOTAL		1427108.1774

Table 2: General data per Jōmon individual analysed. References per site and for the radiocarbon, stable isotopic, grave goods, and catalogue comments are provided below the table. In the 'Local?' column 'L' denotes local and 'N' denotes non-local. "No" refers to the sample number within this thesis. (A = Adult, Adol = Adolescent, YA = young adult, MA = middle adult, OA = old adult)

No	ID	Site	Pref.	^{14}C	±	BP From	BP To	Period (Jōmon)	$\delta^{13}C$	$\delta^{15}N$	Local?	Age	Sex	Grave Goods	Catalogue Comments
J242	567	Adaka	Kumamoto					Middle-Late				MA-OA	M		
J241	3074	Adaka	Kumamoto					Middle-Late				YA–MA	M		
J243	568-A	Adaka	Kumamoto					Middle–Late				YA	M?		
J244	568-B	Adaka	Kumamoto					Middle-Late				MA-OA	F		
J15	?	Einomaru Shell-mound	Fukuoka					Late				A	M	None	
J16	10?	Einomaru Shell-mound	Fukuoka					Late				A	F	None	
J17	その2	Einomaru Shell-mound	Fukuoka					Late				YA-MA	F	None	
J41	I (1)	Goryō Shell-mound	Kumamoto					Final				YA-MA	M	Unknown	I(1)-I(6) Excavated in 1930 by Kobayashi Hisao
J42	I (2)	Goryō Shell-mound	Kumamoto					Final				YA	M	Unknown	I(1)-I(6) Excavated in 1930 by Kobayashi Hisao
J43	I (3)	Goryō Shell-mound	Kumamoto					Final				MA	M	Unknown	I(1)-I(6) Excavated in 1930 by Kobayashi Hisao
J44	I (4)	Goryō Shell-mound	Kumamoto					Final				MA?	F	Unknown	I(1)-I(6) Excavated in 1930 by

No	ID	Site	Pref.	^{14}C	±	BP From	BP To	Period (Jōmon)	$\delta^{13}C$	$\delta^{15}N$	Local?	Age	Sex	Grave Goods	Catalogue Comments
															Kobayashi Hisao
J45	II (1)	Goryō Shell-mound	Kumamoto					Final				MA	M	Unknown	Tsuboi (1967) Skeleton A
J46	II (2)	Goryō Shell-mound	Kumamoto					Final				YA	M	None	Tsuboi Skeleton C
J153	209	Inariyama	Aichi					Final–Middle Yayoi				Child	I		
J154	210	Inariyama	Aichi	2600	30	2730	2380	Final	-17.6	8.8	L	Adol	F?		
J270	212	Inariyama	Aichi	2835	25	2930	2740	Final	-17.6	9.9	L	YA?	M		
J271	213	Inariyama	Aichi					Final–Middle Yayoi				OA	F		
J155	218	Inariyama	Aichi	2390	20	2360	2150	Final	-17.6	10.1	L	MA	F?		
J156	221	Inariyama	Aichi	2365	30	2350	2140	Final	-17.5	9.5		MA-OA	F		
J157	222	Inariyama	Aichi	2815	20	2920	2740	Final	-17.9	9.2		OA	M		
J272	223	Inariyama	Aichi	2815	20	2920	2730	Final	-17.6	9.8		YA	M		
J158	224	Inariyama	Aichi	2625	30	2710	2360	Final	-16.2	9.7	L	MA	I		
J159	225	Inariyama	Aichi	2760	25	2860	2690	Final	-17.4	8.9		YA	F		
J160	228	Inariyama	Aichi	2920	35	3080	2790	Final	-18.2	8.5	L	Adol-YA	F		
J163	230	Inariyama	Aichi	2850	20	2960	2760	Final	-18.5	8.7		YA	F		
J164	231	Inariyama	Aichi	2635	20	2690	2340	Final	-15.0	11.2	N	YA	M		
J165	232	Inariyama	Aichi	2595	20	2680	2320	Final	-15.1	10.4		YA	M		
J166	234	Inariyama	Aichi	2660	20	2690	2350	Final	-14.7	11.5		YA	M		
J167	235	Inariyama	Aichi	2620	20	2680	2310	Final	-14.9	10.7		MA	M?		
J168	236	Inariyama	Aichi	2700	50	2740	2370	Final	-15.1	11.6	L	YA	M		
J169	237	Inariyama	Aichi	2640	30	2690	2330	Final	-14.6	10.8		MA-OA	F		

No	ID	Site	Pref.	^{14}C	±	BP From	BP To	Period (Jōmon)	$\delta^{13}C$	$\delta^{15}N$	Local?	Age	Sex	Grave Goods	Catalogue Comments
J170	238	Inariyama	Aichi	2585	20	2680	2280	Final	-14.5	10.4	L	YA	M		
J171	241	Inariyama	Aichi	2535	20	2700	2350	Final	-17.1	7.3	N	MA	F?		
J172	244	Inariyama	Aichi	2770	40	2930	2730	Final	-19.1	6.3		MA-OA	M		
J173	245	Inariyama	Aichi	3005	25	2880	3030	Final	-18.0	9.0		MA	F		
J174	247	Inariyama	Aichi					Final–Middle Yayoi				YA-MA	F		
J175	248	Inariyama	Aichi					Final–Middle Yayoi				YA	I		
J176	249	Inariyama	Aichi	2880	20	2980	2760	Final	-18.0	9.3	L	MA-OA	F?		
J273	251	Inariyama	Aichi	2560	20	2680	2280	Final	-15.1	10.2	L	YA	M		
J177	252	Inariyama	Aichi					Final–Middle Yayoi				MA	M		
J178	253	Inariyama	Aichi	2540	30	2690	2330	Final	-16.8	9.3	L	YA	F		
J179	254	Inariyama	Aichi					Final–Middle Yayoi				YA	I		
J180	255	Inariyama	Aichi					Final–Middle Yayoi				MA-OA	I		
J181	256	Inariyama	Aichi					Final–Middle Yayoi				MA-OA	M?		
J184	258	Inariyama	Aichi					Final–Middle Yayoi				A	M?		
J161	229-A	Inariyama	Aichi	2620	35	2690	2340	Final	-15.4	9.9	N	MA-OA	F		
J162	229-B	Inariyama	Aichi					Final–Middle Yayoi				A?	I		
J182	257-A	Inariyama	Aichi					Final–Middle Yayoi				A	I		
J183	257-B	Inariyama	Aichi					Final–Middle Yayoi				MA	I		
J185	258-C	Inariyama	Aichi					Final–Middle Yayoi				YA	I		
J245	173	Kawaji	Aichi					Late				OA	M?		

No	ID	Site	Pref.	^{14}C	±	BP From	BP To	Period (Jōmon)	$\delta^{13}C$	$\delta^{15}N$	Local?	Age	Sex	Grave Goods	Catalogue Comments
J246	177	Kawaji	Aichi					Late				YA-MA	M		
J247	181	Kawaji	Aichi					Late				MA-OA	M		
J248	185	Kawaji	Aichi					Late				MA	M		
J19	1	Kitsuki	Aichi					Late				A	M		
J20	1	Kanezaki (Kōjō) Shell-mound	Fukuoka					Late				OA?	F	Unknown	
J23	2	Kanezaki (Kōjō) Shell-mound	Fukuoka					Late				MA	M		Shark tooth ornament that belonged to one of 2-5
J21	3	Kanezaki (Kōjō) Shell-mound	Fukuoka					Late				MA	F		Shark tooth ornament that belonged to one of 2-5
J22	4	Kanezaki (Kōjō) Shell-mound	Fukuoka					Late				Child	I		Shark tooth ornament that belonged to one of 2-5
J1	1	Sarugami Rock-shelter	Hiroshima					Final				YA	M	Shell bracelet	
J2	2	Sarugami Rock-shelter	Hiroshima					Final				YA	F		
J3	3	Sarugami Rock-shelter	Hiroshima					Final				Child	I		
J25	1	Shimokusuda	Fukuoka					Middle-Late				A	M?	Unknown	9 Crania
J26	2	Shimokusuda	Fukuoka					Middle-Late				A	I	Unknown	9 Crania
J27	3	Shimokusuda	Fukuoka					Middle-Late				A	I	Unknown	9 Crania
J28	4	Shimokusuda	Fukuoka					Middle-Late				A	I	Unknown	9 Crania

No	ID	Site	Pref.	^{14}C	±	BP From	BP To	Period (Jōmon)	$\delta^{13}C$	$\delta^{15}N$	Local?	Age	Sex	Grave Goods	Catalogue Comments
J29	5	Shimokusuda	Fukuoka					Middle-Late				A	I	Unknown	9 Crania
J30	6	Shimokusuda	Fukuoka					Middle-Late				A	I	Unknown	9 Crania
J31	7	Shimokusuda	Fukuoka					Middle-Late				A	I	Unknown	9 Crania
J32	8	Shimokusuda	Fukuoka					Middle-Late				A	I	Unknown	9 Crania
J33	9	Shimokusuda	Fukuoka					Middle-Late				A	I	Unknown	9 Crania
J5	64-1	Toyomatsu-Domen Cave	Hiroshima					Later Half				MA-OA?	M	None	
J6	70-1	Toyomatsu-Domen Cave	Hiroshima					Late				A	M	None	
J7	70-2	Toyomatsu-Domen Cave	Hiroshima					Late				A	F	None	
J4	70-3	Toyomatsu-Domen Cave	Hiroshima					Late				MA?	M	None	
J8	78-1	Toyomatsu-Domen Cave	Hiroshima					Late				YA	F	None	
J9	81-1	Toyomatsu-Domen Cave	Hiroshima					Late				MA	F	None	
J186	1	Tsukumo	Okayama					Late-Final	-15.3	13.9	L	MA	F		
J187	2	Tsukumo	Okayama					Late-Final	-16.4	11.9	L	MA	M		
J188	3	Tsukumo	Okayama					Late-Final	-16.4	12.3	L	YA	M		
J189	4	Tsukumo	Okayama					Late-Final	-15.4	13.6	L	MA-OA	F		
J190	5	Tsukumo	Okayama					Late-Final	-15.7	13.0	L	MA	M		
J191	6	Tsukumo	Okayama					Late-Final	-16.3	12.3	L	YA	F		
J192	7	Tsukumo	Okayama					Late-Final	-16.3	12.5	L	MA	F		
J232	8	Tsukumo	Okayama					Late-Final	-14.5	15.0	L	Adol	M		
J193;J194	11	Tsukumo	Okayama					Late-Final	-15.4	13.9	L	YA	F		
J195	12	Tsukumo	Okayama					Late-Final	-16.1	12.5	L	YA	F		
J221	14	Tsukumo	Okayama					Late-Final	-19.5	7.6	L	MA	F		

No	ID	Site	Pref.	^{14}C	±	BP From	BP To	Period (Jōmon)	$\delta^{13}C$	$\delta^{15}N$	Local?	Age	Sex	Grave Goods	Catalogue Comments
J233	16	Tsukumo	Okayama					Late-Final	-16.5	12.5	L	YA	F		
J234	17	Tsukumo	Okayama					Late-Final	-14.6	14.9		OA	F		
J237	19	Tsukumo	Okayama					Late-Final	-16.0	12.8	L	YA	M		
J220	20	Tsukumo	Okayama					Late-Final	-18.1	10.9		MA	F		
J260	23	Tsukumo	Okayama					Late-Final	-15.6	13.3	L	OA	F?		
J196	24	Tsukumo	Okayama					Late-Final	-16.2	12.6	L	YA-MA	M		
J197	25	Tsukumo	Okayama					Late-Final	-19.7	6.6		Adol	F		
J249	27	Tsukumo	Okayama					Late-Final	-15.5	13.3	L	MA	M		
J261	28	Tsukumo	Okayama					Late-Final				Child	I		
J222	29	Tsukumo	Okayama					Late-Final	-14.6	14.4		YA	F		
J225	30	Tsukumo	Okayama					Late-Final	-15.2	11.7	L	MA	M		
J257	32	Tsukumo	Okayama					Late-Final	-16.2	12.4	L	YA-MA	M		
J258	36	Tsukumo	Okayama					Late-Final	-16.5	12.8		MA	M		
J262	37	Tsukumo	Okayama					Late-Final	-15.7	12.9	L	MA	F		
J227	38	Tsukumo	Okayama					Late-Final	-15.5	13.1		OA	F		
J264	39	Tsukumo	Okayama					Late-Final	-19.6	5.4	L	YA	M		
J250	40	Tsukumo	Okayama					Late-Final	-19.1	8.1	L	MA	F		
J251	42	Tsukumo	Okayama					Late-Final	-16.3	13.0	L	MA	F		
J226	44	Tsukumo	Okayama					Late-Final	-19.1	9.1	L	YA	M?		
J265	46	Tsukumo	Okayama					Late-Final	-17.4	12.5	L	MA-OA	M		
J267	52	Tsukumo	Okayama					Late-Final				Child	I		
J268	56	Tsukumo	Okayama					Late-Final				Child	I		
J254	58	Tsukumo	Okayama					Late-Final	-15.6	12.3	L	MA	M		

No	ID	Site	Pref.	^{14}C	±	BP From	BP To	Period (Jōmon)	$\delta^{13}C$	$\delta^{15}N$	Local?	Age	Sex	Grave Goods	Catalogue Comments
J252	59	Tsukumo	Okayama					Late-Final	-15.1	14.4		MA-OA	M?		
J230	60	Tsukumo	Okayama					Late-Final	-17.6	11.4		MA-OA	M		
J253	61	Tsukumo	Okayama					Late-Final	-16.4	13.0		MA	M		
J231	62	Tsukumo	Okayama					Late-Final	-17.6	10.2		MA	F		
J228	65	Tsukumo	Okayama					Late-Final	-17.8	10.0	L	YA-MA	M		
J235	66	Tsukumo	Okayama					Late-Final	-17.1	11.0	L	OA	M		
J239	67	Tsukumo	Okayama					Late-Final	-17.4	11.0	L	MA	F		
J236	70	Tsukumo	Okayama					Late-Final	-17.3	13.0		MA	F		
J256	151	Tsukumo	Okayama					Late-Final	-16.0	14.0	L	MA-OA	M		
J269	164	Tsukumo	Okayama					Late-Final	-17.1	12.1		YA-MA	M?		
J223	13-A	Tsukumo	Okayama					Late-Final	-17.9	10.2	L	MA	M		
J224	13-B	Tsukumo	Okayama					Late-Final				Adol	I		
J255	162-B	Tsukumo	Okayama					Late-Final				MA-OA	F?		
J259	34-I	Tsukumo	Okayama					Late-Final	-16.1	13.0	L	YA	F		
J240	35-A?	Tsukumo	Okayama					Late-Final				A	M		
J263	41-I	Tsukumo	Okayama					Late-Final	-16.0	12.8	L	OA	F		
J229	55-A	Tsukumo	Okayama					Late-Final	-15.6	12.3	L	MA	M		
J238	68-A	Tsukumo	Okayama					Late-Final	-17.3	10.9	L	MA	F		
J266	番外2	Tsukumo	Okayama					Late-Final				Child	I		
J47	1	Wakazono Shell-mound	Kumamoto					Late				A	F	None	

No	ID	Site	Pref.	^{14}C	±	BP From	BP To	Period (Jōmon)	$\delta^{13}C$	$\delta^{15}N$	Local?	Age	Sex	Grave Goods	Catalogue Comments
J48	2A?	Wakazono Shell-mound	Kumamoto					Late				YA?	F	None	Same grave with 2B
J49	2B?	Wakazono Shell-mound	Kumamoto					Late				YA?	F		Same grave with 2A
J34	1	Yamaga Shell-mound	Fukuoka					Mid Late				MA-OA?	F	Shell bracelet	
J51	7	Yamaga Shell-mound	Fukuoka					Mid Late				MA	M	Earring	
J35	8	Yamaga Shell-mound	Fukuoka					Mid Late				A	M	None	
J52	9	Yamaga Shell-mound	Fukuoka					Mid Late				MA?	F	Shell bracelet	9 and 10 funeral
J36	12	Yamaga Shell-mound	Fukuoka					Mid Late				MA	M	Unknown	Later damaged
J37	13	Yamaga Shell-mound	Fukuoka					Mid Late				MA	M	Earring	
J38	15	Yamaga Shell-mound	Fukuoka					Mid Late				YA-MA	M	None	15 crosses 16
J50	16	Yamaga Shell-mound	Fukuoka					Mid Late				MA	F	Earring, Shell bracelet	15 crosses 16
J39	17	Yamaga Shell-mound	Fukuoka					Mid Late				MA	F	Shell bracelet, Shell arm decoration, Leg ornament, Bead ornament	18 crosses 17
J40	18	Yamaga Shell-mound	Fukuoka					Mid Late				MA	M	Unknown	
J54	261	Yoshigo	Aichi					Late-Final				MA	M		
J55	266	Yoshigo	Aichi					Late-Final				A	M		
J56	271	Yoshigo	Aichi					Late-Final				YA	M		
J57	273	Yoshigo	Aichi					Late-Final			L	YA	M		

No	ID	Site	Pref.	^{14}C	±	BP From	BP To	Period (Jōmon)	$\delta^{13}C$	$\delta^{15}N$	Local?	Age	Sex	Grave Goods	Catalogue Comments
J58	274	Yoshigo	Aichi					Late-Final				Child	I		
J59	277	Yoshigo	Aichi					Late-Final				YA	F		
J60	279	Yoshigo	Aichi					Late-Final				OA	F		
J61	281	Yoshigo	Aichi					Late-Final				YA-MA	F		
J62	287	Yoshigo	Aichi					Late-Final			N	MA	M		
J63	292	Yoshigo	Aichi					Late-Final			L	YA	M?		
J64	295	Yoshigo	Aichi	2770	50	3163	2838	Final				A	F		
J65	296	Yoshigo	Aichi					Late-Final				MA-OA	F		
J66	301	Yoshigo	Aichi					Late-Final				OA	F		
J67	302	Yoshigo	Aichi					Late-Final			L	YA	F		
J68	303	Yoshigo	Aichi					Late-Final				YA	F		
J69	304	Yoshigo	Aichi					Late-Final				Adol	F?		
J70	306	Yoshigo	Aichi					Late-Final				YA	F		
J71	307	Yoshigo	Aichi					Late-Final				MA-OA	M		
J72	308	Yoshigo/Yasaki	Aichi					Late-Final				MA	F?		
J75	315	Yoshigo	Aichi					Late-Final				YA-MA	F		
J76	316	Yoshigo	Aichi					Late-Final			N	YA	M?		
J78	322	Yoshigo	Aichi					Late-Final			L	MA	F		
J79	324	Yoshigo	Aichi					Late-Final				A	F		
J80	328	Yoshigo	Aichi					Late-Final				OA	F		
J81	334	Yoshigo	Aichi					Late-Final				YA	M		
J82	341	Yoshigo	Aichi	3190	40	3193	2909	Final			N	Adol	M		
J83	342	Yoshigo	Aichi					Late-Final			L	MA	F		

No	ID	Site	Pref.	^{14}C	±	BP From	BP To	Period (Jōmon)	$\delta^{13}C$	$\delta^{15}N$	Local?	Age	Sex	Grave Goods	Catalogue Comments
J85	347	Yoshigo	Aichi					Late-Final				MA	F		
J86	348	Yoshigo	Aichi					Late-Final				A	F		
J87	349	Yoshigo	Aichi					Late-Final			N	YA	M		
J88	350	Yoshigo	Aichi					Late-Final				OA	M?		
J89	352	Yoshigo	Aichi					Late-Final			L	Adol	F	Hip accessory	
J90	353	Yoshigo	Aichi					Late-Final				YA-MA	F		
J91	354	Yoshigo	Aichi					Late-Final				OA	F		
J92	355	Yoshigo	Aichi					Late-Final				A	M		
J93	356	Yoshigo	Aichi					Late-Final				YA-MA	M		
J94	357	Yoshigo	Aichi					Late-Final			L	YA-MA	F		
J95	358	Yoshigo	Aichi					Late-Final				MA	F		
J98	361	Yoshigo	Aichi					Late-Final				YA	F		
J99	364	Yoshigo	Aichi					Late-Final				OA	M		
J100	368	Yoshigo	Aichi					Late-Final				A	M		
J101	371	Yoshigo	Aichi					Late-Final				Adol	F		
J102	375	Yoshigo	Aichi					Late-Final			L	MA	M	Hip accessory	
J103	378	Yoshigo	Aichi					Late-Final				MA-OA	F		
J104	383	Yoshigo	Aichi					Late-Final			N	MA-OA	M	Hip accessory;earring	
J105;J106	388	Yoshigo	Aichi					Late-Final			L	YA-MA	M		
J107	389	Yoshigo	Aichi					Late-Final				MA	F		
J108	394	Yoshigo	Aichi					Late-Final				A	F		
J109	396	Yoshigo	Aichi					Late-Final			L	MA	M		

No	ID	Site	Pref.	^{14}C	±	BP From	BP To	Period (Jōmon)	$\delta^{13}C$	$\delta^{15}N$	Local?	Age	Sex	Grave Goods	Catalogue Comments
J110	399	Yoshigo	Aichi					Late-Final				MA-OA	F		
J112	402	Yoshigo	Aichi					Late-Final				Child	I		
J113	403	Yoshigo	Aichi					Late-Final				YA	F		
J114	403	Yoshigo	Aichi					Late-Final				YA-MA	F		
J115	404	Yoshigo/Yasaki	Aichi					Late-Final			L	Adol	F?		
J116	405	Yoshigo	Aichi					Late-Final				Child	I		
J117	406	Yoshigo	Aichi					Late-Final				A	F		
J118	407	Yoshigo	Aichi					Late-Final				YA	F		
J123	416	Yoshigo/Yasaki	Aichi					Late-Final				OA	F?		
J124	418	Yoshigo	Aichi					Late-Final				YA	M		
J125	419	Yoshigo	Aichi					Late-Final			N	YA	M	Hip accessory	
J126	420	Yoshigo	Aichi					Late-Final				MA	F		
J127	421	Yoshigo/Yasaki	Aichi					Late-Final				YA	M		
J131	435	Yoshigo	Aichi					Late-Final			L	YA	M		
J132	456	Yoshigo	Aichi					Late-Final				MA	M		
J133	460	Yoshigo	Aichi					Late-Final			N	YA	F		
J134	463	Yoshigo	Aichi					Late-Final				MA	M		
J135	467	Yoshigo	Aichi					Late-Final				Child	I		
J136	481	Yoshigo	Aichi					Late-Final			L	MA	M		
J137	485	Yoshigo	Aichi					Late-Final				MA	F		
J138	488	Yoshigo	Aichi					Late-Final			N	MA	F		
J139	498	Yoshigo	Aichi					Late-Final				YA	M		
J140	499	Yoshigo	Aichi					Late-Final				Child	I		

No	ID	Site	Pref.	^{14}C	±	BP From	BP To	Period (Jōmon)	$\delta^{13}C$	$\delta^{15}N$	Local?	Age	Sex	Grave Goods	Catalogue Comments
J141	501	Yoshigo	Aichi					Late-Final				MA	M		
J142	508	Yoshigo	Aichi					Late-Final				MA-OA	F		
J143	509	Yoshigo	Aichi					Late-Final			L	YA	M	Hip accessory	
J144	523	Yoshigo	Aichi					Late-Final				YA	F		
J145	534	Yoshigo	Aichi					Late-Final			L	MA-OA	F		
J146	535	Yoshigo	Aichi					Late-Final				Child	I		
J147	540	Yoshigo	Aichi					Late-Final			L	MA	F		
J148	548	Yoshigo	Aichi					Late-Final				OA	F?		
J149	551	Yoshigo	Aichi					Late-Final				infant	I		
J150	561	Yoshigo	Aichi					Late-Final				Adol	M		
J73	310-1	Yoshigo	Aichi					Late-Final			L	YA	F		
J74	312-1	Yoshigo	Aichi					Late-Final				Adol	F		
J84	345-1	Yoshigo	Aichi					Late-Final			L	YA-MA	M	Hip accessory	
J96	360-1	Yoshigo	Aichi					Late-Final				YA	F		
J97	360-II	Yoshigo	Aichi					Late-Final				YA	F		
J111	401-A	Yoshigo	Aichi					Late-Final				Child	I		
J119	408-A	Yoshigo	Aichi					Late-Final			N	YA	F		
J120	408-B	Yoshigo	Aichi					Late-Final				YA	I		
J121	414-I	Yoshigo	Aichi					Late-Final				YA	I		
J122	414-II	Yoshigo	Aichi					Late-Final				YA	M		

No	ID	Site	Pref.	^{14}C	±	BP From	BP To	Period (Jōmon)	$\delta^{13}C$	$\delta^{15}N$	Local?	Age	Sex	Grave Goods	Catalogue Comments
J128	424-I	Yoshigo	Aichi					Late-Final				YA	M		
J129	424-III	Yoshigo	Aichi					Late-Final				YA	M		
J130	424-IV	Yoshigo	Aichi					Late-Final				A	M		
J151	522-1	Yoshigo/Yasaki	Aichi					Late-Final				YA	F		
J152	no no.	Yoshigo	Aichi					Late-Final				Child	I		

References per site:

- **Adaka Shell-mound 阿高貝塚** (Kiyono 1925; Kobayashi 1965; Kumamoto Prefecture Board of Education 2005)
- **Einomaru Shell-mound 永犬丸貝塚** (Kitakyūshū City Board of Education 1972; Kitakyūshū City Education and Culture Agency 1994; Kyushu University School of Medicine 1988; Takenaka 1985)
- **Goryō Shell-mound 御領貝塚** (Kanaseki et al. 1955; Kyushu University School of Medicine 1988)
- **Inariyama Shell-mound 稲荷山貝塚** (Kiyono 1969; Kusaka et al. 2008; Kusaka et al. 2011; Kusaka et al. 2015; Kusaka et al. 2018)
- **Kōjō (Kanezaki) Shell-mound 上八(鐘崎)貝塚** (Kyushu University School of Medicine 1988; Munakata Museum Electronic Bulletin Committee 2009, 2010)
- **Kawaji Shell-mound 川地貝塚** (Aichi Prefecture Buried Cultural Property Center 1995; Kiyono 1949, 1969)

- **Kitsuki Shell-mound 木月(古月)貝塚** (Kurate City Magazine Editorial Committee 1974; Kyushu University School of Medicine 1988)
- **Sarugami Rock-shelter 猿神岩崖遺跡** (Kawagoe 1978; Kyushu University School of Medicine 1988; Nagai and Nakahashi 1979)
- **Shimokusuda Shell-mound 下楠田貝塚** (Kiyono 1969; Kyushu University School of Medicine 1988; Miyama City History Editorial Committee 2017)
- **Toyomatsu-Domen Cave 豊松堂面洞窟遺跡** (Kawase 1978; Kyushu University School of Medicine 1988; Nakahashi and Nagai 1980; Nakahashi 1984)
- **Tsukumo Shell-mound 津雲貝塚** (Kiyono et al. 1920; Kiyono 1969; Kusaka et al. 2010; Kusaka et al. 2012; Kusaka et al. 2015)
- **Wakazono Shell-mound 若園貝塚** (Kikusui Town Board of Education 1981; Kumamoto Prefecture Board of Education 1978; Kyushu University School of Medicine 1988)
- **Yamaga Shell-mound 山鹿貝塚** (Kyushu University School of Medicine 1988; Yamaga Shell-mound Survey Team 1972)
- **Yoshigo Shell-mound 吉胡貝塚** (Kiyono 1949, 1969; Kusaka et al. 2008; Kusaka et al. 2009; Kusaka et al. 2015)

Table 3: General data per Yayoi individual analysed. References per site and for the radiocarbon, stable isotopic, grave goods, and catalogue comments are provided below the table. "No" refers to the sample number within this thesis. (A = Adult, Adol = Adolescent, YA = young adult, MA = middle adult, OA = old adult)

No	ID	Site	Pref	^{14}C	±	BP From	BP To	Period (Yayoi)	$\delta^{13}C$	$\delta^{15}N$	Age	Sex	Burial	Grave Goods	Catalogue Comments
Y178	124	Doigahama	Yamaguchi					Early-Middle	-19	11.4	MA?	M	Earthen burial	Flint arrowheads; Shell bracelets; Arrowheads made from shark teeth	Face crushed; Penetrating trauma to forehead
Y154	209	Doigahama	Yamaguchi					Early-Middle			MA	M	Gathered bones		3rd excavation (1955)
Y155	211	Doigahama	Yamaguchi					Early-Middle			MA-OA	F?	Gathered bones		3rd excavation (1955)
Y156	212	Doigahama	Yamaguchi					Early-Middle			YA	M	Gathered bones		3rd excavation (1955)
Y157	213	Doigahama	Yamaguchi					Early-Middle			MA-OA	F?	Gathered bones		3rd excavation (1955)
Y158	216	Doigahama	Yamaguchi					Early-Middle			MA-OA	M?	Gathered bones		3rd excavation (1955)
Y159	217	Doigahama	Yamaguchi					Early-Middle			MA?	M	Gathered bones		3rd excavation (1955)
Y160	229	Doigahama	Yamaguchi					Early-Middle			MA-OA	F?	Gathered bones		3rd excavation (1955)

No	ID	Site	Pref	^{14}C	±	BP From	BP To	Period (Yayoi)	$\delta^{13}C$	$\delta^{15}N$	Age	Sex	Burial	Grave Goods	Catalogue Comments
Y163	231	Doigahama	Yamaguchi					Early-Middle			YA-MA	M?	Gathered bones		3rd excavation (1955)
Y162	233	Doigahama	Yamaguchi					Early-Middle			YA-MA	I	Gathered bones		3rd excavation (1955)
Y153	312	Doigahama	Yamaguchi					Early-Middle			YA	F	Earthen burial		4th excavation (1956)
Y165	409	Doigahama	Yamaguchi					Early-Middle			YA	M	Earthen burial		Red pigment on the face; 5th excavation (1957)
Y164	418	Doigahama	Yamaguchi					Early-Middle			MA-OA	M	Earthen burial		Sacralisation of L5; 5th excavation (1957)
Y151	421	Doigahama	Yamaguchi					Early-Middle			MA	F?	Stone Coffin		
Y168	422	Doigahama	Yamaguchi					Early-Middle			YA	F	Stone Arrangement Burial (distrubed?)		
Y167	912	Doigahama	Yamaguchi					Early 前期			MA?	M	Earthen burial	None	9th excavation (1984)
Y166	1105	Doigahama	Yamaguchi					Early-Middle			MA	M?	Stone Arrangement Burial		11th excavation (1988)
Y152	1116	Doigahama	Yamaguchi					Yayoi			MA	M	Stone Arrangement Burial	One amazonite bead	11th excavation (1988)
Y161	229a	Doigahama	Yamaguchi					Early-Middle			A	F?	Gathered bones		3rd excavation (1955)
Y170	A-5	Hirota	Kagoshima					Late			YA-MA	F?	Earthen burial		

No	ID	Site	Pref	^{14}C	±	BP From	BP To	Period (Yayoi)	$\delta^{13}C$	$\delta^{15}N$	Age	Sex	Burial	Grave Goods	Catalogue Comments
Y171	A-8	Hirota	Kagoshima					Late			YA-MA	M	Earthen burial	Shell ring, shell ball	
Y172	C-2	Hirota	Kagoshima					Late			YA	M	Earthen burial	Shell ring	
Y173	C-5	Hirota	Kagoshima					Late			YA	F	Earthen burial	Shell tocken, shell ball	
Y174	C-8	Hirota	Kagoshima					Late			MA	M	Earthen burial		
Y175	D-II-1	Hirota	Kagoshima					Late			YA	F	Earthen burial		
Y176	D-II-3	Hirota	Kagoshima					Late	-19.5		YA	F	Earthen burial		
Y177	D-III-2	Hirota	Kagoshima					Late	-19.8		YA	M	Earthen burial		
Y41	K102	Kanenokuma	Fukuoka					End of the Early			YA	M	Jar burial		
Y45	K103	Kanenokuma	Fukuoka					End of the Early			A	M	Jar burial	Shell ring/bracelet, Polished stone arrowhead	
Y46	K113	Kanenokuma	Fukuoka					Mid Middle			MA	F	Jar burial		
Y47	K119	Kanenokuma	Fukuoka					Mid Middle			YA	M?	Jar burial		
Y48	K125	Kanenokuma	Fukuoka					Mid Middle			A	M	Jar burial		
Y2	K13	Kanenokuma	Fukuoka					Mid Middle			A	M	Jar burial		
Y49	K130	Kanenokuma	Fukuoka					Mid Middle			MA	F	Jar burial		Fracture of R femur

No	ID	Site	Pref	^{14}C	±	BP From	BP To	Period (Yayoi)	$\delta^{13}C$	$\delta^{15}N$	Age	Sex	Burial	Grave Goods	Catalogue Comments
Y50	K139	Kanenokuma	Fukuoka					Early half Late			MA?	F?	Jar burial		
Y51	K140	Kanenokuma	Fukuoka					Mid Middle			MA?	F	Jar burial		
Y52	K141	Kanenokuma	Fukuoka					Mid Middle			OA	M	Jar burial		
Y53	K175	Kanenokuma	Fukuoka					Early half Middle			A	M	Jar burial		Left tibia posterior osteophyte
Y54	K177	Kanenokuma	Fukuoka					Mid Middle			A	M	Jar burial		
Y55	K215	Kanenokuma	Fukuoka					Early half Middle			YA	M	Jar burial		
Y56	K229	Kanenokuma	Fukuoka					Early half Middle			MA	M	Jar burial		L5 deformity
Y72	K238	Kanenokuma	Fukuoka					Mid Middle			YA	F	Jar burial		
Y73	K272	Kanenokuma	Fukuoka					Late half Middle			OA	F	Jar burial		
Y42	K29	Kanenokuma	Fukuoka					Early half Middle			MA	F	Jar burial		
Y3	K35	Kanenokuma	Fukuoka					Latter half Middle			YA	M	Jar burial		
Y82	K364	Kanenokuma	Fukuoka					Early half Middle			A	M	Jar burial		
Y1	K5	Kanenokuma	Fukuoka					Yayoi			MA	F	Jar burial		

No	ID	Site	Pref	^{14}C	±	BP From	BP To	Period (Yayoi)	$\delta^{13}C$	$\delta^{15}N$	Age	Sex	Burial	Grave Goods	Catalogue Comments
Y4	K56	Kanenokuma	Fukuoka					Mid Middle			YA-MA	F	Jar burial		
Y5	K61	Kanenokuma	Fukuoka					Mid Middle			YA	M	Jar burial		
Y6	K64	Kanenokuma	Fukuoka					Mid Middle			MA	M	Jar burial		
Y7	K72	Kanenokuma	Fukuoka					Early half Middle			OA	M	Jar burial		
Y8	K76	Kanenokuma	Fukuoka					Mid Middle			YA	M	Jar burial		Bilateral acetabular caudal dysplasia
Y43	K79	Kanenokuma	Fukuoka					Early half Middle			YA	M	Jar burial		
Y38	K83	Kanenokuma	Fukuoka					Early half Middle			MA	F	Jar burial		
Y44	K89	Kanenokuma	Fukuoka					Early half Middle			MA	F	Jar burial		Thoracic compression fracture
Y39	K93	Kanenokuma	Fukuoka					Mid Middle			MA	M?	Jar burial		
Y40	K96	Kanenokuma	Fukuoka					Early half Late			MA	M	Jar burial		Osgood–Schlatter disease (tibia)
Y147	35	Kōra	Shimane					Early			MA	F	Earthen burial	Tube-shaped accessories	
Y146	36	Kōra	Shimane					Early			MA	F	Earthen burial	None	

No	ID	Site	Pref	^{14}C	±	BP From	BP To	Period (Yayoi)	$\delta^{13}C$	$\delta^{15}N$	Age	Sex	Burial	Grave Goods	Catalogue Comments
Y144	44	Kōra	Shimane					Early			YA-MA	M	Earthen burial	Tube-shaped accessories	
Y141	67	Kōra	Shimane					Early			MA	M	Earthen burial	None	
Y140	68	Kōra	Shimane					Early			YA-MA	M	Earthen burial	None	
Y148	1411	Kōra	Shimane					Early			YA	M	Earthen burial	Unknown	
Y142	60 の 1	Kōra	Shimane					Early			OA	F	Earthen burial	None	
Y149	山本 III	Kōra	Shimane					Early			MA	M	Earthen burial	Unknown	Blue/green patches
Y150	近藤 I	Kōra	Shimane					Early			MA	F	Earthen burial	Unknown	
Y101	5	Minamikata	Okayama					Middle			MA	F			
Y102	6	Minamikata	Okayama					Middle			Child	I			
Y100	9	Minamikata	Okayama					Middle			MA	F?			
Y97	7 • 8 - A	Minamikata	Okayama					Middle			YA?	M	No grave, comingled		
Y98	7 • 8 - B	Minamikata	Okayama					Middle			A	M?	No grave, comingled		
Y99	7 • 8 - C	Minamikata	Okayama					Middle			A	I	No grave, comingled		
Y57	1	Mitsunagata	Saga					Middle-Late			A	F	Jar burial	None	
Y58	2	Mitsunagata	Saga					Middle-Late			A	M	Jar burial	None	
Y59	3	Mitsunagata	Saga					Middle-Late			MA?	F	Jar burial	None	
Y62	4	Mitsunagata	Saga					Middle-Late			MA?	M	Jar burial	None	

No	ID	Site	Pref	^{14}C	±	BP From	BP To	Period (Yayoi)	$\delta^{13}C$	$\delta^{15}N$	Age	Sex	Burial	Grave Goods	Catalogue Comments
Y61	5	Mitsunagata	Saga					Middle-Late			MA?	M	Jar burial	None	
Y60	7	Mitsunagata	Saga					Middle-Late			A	F	Jar burial	None	
Y69	8	Mitsunagata	Saga					Middle-Late			MA?	M?	Jar burial	None	
Y63	9	Mitsunagata	Saga					Middle-Late			A	M	Jar burial	None	
Y65	10	Mitsunagata	Saga					Middle-Late			MA?	M	Jar burial	None	
Y68	11	Mitsunagata	Saga					Middle-Late			A	M	Jar burial	None	
Y67	12	Mitsunagata	Saga					Middle-Late			MA?	M?	Jar burial	None	
Y66	13	Mitsunagata	Saga					Middle-Late			MA-OA?	M	Jar burial	None	
Y64	14	Mitsunagata	Saga					Middle-Late			A	F?	Jar burial	None	
Y70	32	Mitsunagata	Saga					Middle-Late			YA	M	Jar burial	None	
Y71	101	Mitsunagata	Saga					Late half Middle			MA	M	Jar burial	None	
Y74	104	Mitsunagata	Saga					Early half Middle			MA	M	Jar burial	Bronze mirror; Iron ring pommel sword	
Y75	124	Mitsunagata	Saga					Middle-Late			A	M	Jar burial	None	
Y76	125	Mitsunagata	Saga					Middle-Late			A	M	Jar burial	None	
Y78	126	Mitsunagata	Saga					Middle-Late			MA	M	Jar burial	None	

No	ID	Site	Pref	^{14}C	±	BP From	BP To	Period (Yayoi)	$\delta^{13}C$	$\delta^{15}N$	Age	Sex	Burial	Grave Goods	Catalogue Comments
Y77	127	Mitsunagata	Saga					Middle-Late			MA	M	Jar burial	None	
Y83	1B1	Mitsunagata	Saga					Middle-Late			MA?	M	Jar burial	None	
Y79	A1	Mitsunagata	Saga					Middle-Late			MA?	M	Jar burial	None	
Y81	A2	Mitsunagata	Saga					Middle-Late			A	F	Jar burial	None	
Y80	A3	Mitsunagata	Saga					Middle-Late			A	F	Jar burial	None	
Y11	K10	Nagaoka	Fukuoka					Mid Middle			MA	M	Jar burial	None	Wound to the frontal
Y12	K11	Nagaoka	Fukuoka					Early half Middle			YA?	I	Jar burial	None	
Y14	K12	Nagaoka	Fukuoka					Early half Middle			OA	M	Jar burial	None	
Y15	K15	Nagaoka	Fukuoka					Early half Middle			OA	F	Jar burial	None	
Y16	K24	Nagaoka	Fukuoka					Early half Middle			YA	M	Jar burial	None	
Y13	K25	Nagaoka	Fukuoka					Early half Middle			Adol?	I	Jar burial	None	
Y17	K26	Nagaoka	Fukuoka					Mid Middle			YA	F	Jar burial	None	
Y18	K30	Nagaoka	Fukuoka					Early half Middle			MA	F	Jar burial	None	Textile, head area

No	ID	Site	Pref	^{14}C	±	BP From	BP To	Period (Yayoi)	$\delta^{13}C$	$\delta^{15}N$	Age	Sex	Burial	Grave Goods	Catalogue Comments
Y19	K32	Nagaoka	Fukuoka					Early half Middle			A	M	Jar burial	None	
Y20	K33	Nagaoka	Fukuoka					Early half Middle			YA	F	Jar burial	None	Textile
Y21	K36	Nagaoka	Fukuoka					Early half Middle			MA	F	Jar burial	None	Mandibular joint abnormality
Y22	K38	Nagaoka	Fukuoka					Early half Middle			YA	F	Jar burial	None	
Y23	K39	Nagaoka	Fukuoka					Early half Middle			YA	F	Jar burial	None	Mandibular joint abnormality
Y24	K48	Nagaoka	Fukuoka					Early half Middle			YA-MA	M	Jar burial	None	
Y10	K9	Nagaoka	Fukuoka					Early half Middle			MA	M	Jar burial	None	
Y32	SK100	Nagaoka	Fukuoka					Middle			Adol	M	Jar burial	None	Bronze sword tip (embedded) · stone sword tip
Y25	SK49	Nagaoka	Fukuoka					Early half Middle			YA	F	Jar burial	None	
Y26	SK55	Nagaoka	Fukuoka					Early half Middle			YA?	F	Jar burial	None	Textile on R femur

No	ID	Site	Pref	^{14}C	±	BP From	BP To	Period (Yayoi)	$\delta^{13}C$	$\delta^{15}N$	Age	Sex	Burial	Grave Goods	Catalogue Comments
Y27	SK78	Nagaoka	Fukuoka					Early half Middle			YA-MA	M	Jar burial	None	
Y28	SK90	Nagaoka	Fukuoka					Middle			A	M	Jar burial	None	
Y29	SK93	Nagaoka	Fukuoka					Middle			MA	M	Jar burial	None	
Y30	SK95	Nagaoka	Fukuoka					Middle			MA	M	Jar burial	None	Bronze sword tip embedded
Y31	SK97	Nagaoka	Fukuoka					Middle			YA	M	Jar burial	None	
Y33	SK98	Nagaoka	Fukuoka					Middle			YA	M	Jar burial	None	
Y96	906-3	Nakanohama	Yamaguchi					Mid Middle-Late			YA-MA	M	Stone Coffin	Pottery	Inside same stone coffin 1→5→2→3
Y84	E-1-a	Nakanohama	Yamaguchi					End of the Early			MA?	M	Stone Coffin		Inside same Stone coffin E-1-a, b, c
Y85	E-1-b	Nakanohama	Yamaguchi					End of the Early			MA?	M	Stone Coffin	4 Tsubo (outside of the grave)	Inside same Stone coffin E-1-a, b, c
Y86	E-2-1	Nakanohama	Yamaguchi					End of the Early			Infant	I	Stone Coffin	1 Jasper bead	
Y87	E-2-2	Nakanohama	Yamaguchi					End of the Early			YA	M	Stone Coffin	1 Clam	
Y88	F-2-1? (cist)	Nakanohama	Yamaguchi					Early-Middle			YA	F?	Stone Coffin	None	
Y135	G-1 No.1	Nakanohama	Yamaguchi					Early-Middle			YA	M	Stone Coffin	None	Same cist as others in G-1; 1970 excavation
Y136	G-1-2 No.1	Nakanohama	Yamaguchi					Early-Middle			Adol-YA	F	Stone Coffin	None	Same cist as others in G-1;

No	ID	Site	Pref	^{14}C	±	BP From	BP To	Period (Yayoi)	$\delta^{13}C$	$\delta^{15}N$	Age	Sex	Burial	Grave Goods	Catalogue Comments
															1970 excavation
Y138	G-1-2 No.2	Nakanohama	Yamaguchi					Early-Middle			MA	M	Stone Coffin	None	Same cist as others in G-1; 1970 excavation
Y137	G-1-2 No.3	Nakanohama	Yamaguchi					Early-Middle			OA	F	Stone Coffin	None	Same cist as others in G-1; 1970 excavation
Y132	G-3-1 No.7357	Nakanohama	Yamaguchi					Early-Middle			A	M?	Stone Coffin		(on bag) No. 7357 G-3-1 cist; '69, 3.30; G3.大 1 号 cist 内; 北？側右区; (赤砂中); Same cist as others in G-3; 1969 excavation
Y131	G-3-1-1-その1	Nakanohama	Yamaguchi					Early-Middle			YA	F?	Stone Coffin		Same cist as others in G-3; 1970 excavation
Y134	G-3-1-1-その2	Nakanohama	Yamaguchi					Early-Middle			MA	M	Stone Coffin		Same cist as others in G-3; 1969 excavation
Y89	G-3-6	Nakanohama	Yamaguchi					Early-Middle			MA	F	Stone Coffin	Stone arrowhead (outside the grave)	

No	ID	Site	Pref	^{14}C	±	BP From	BP To	Period (Yayoi)	$\delta^{13}C$	$\delta^{15}N$	Age	Sex	Burial	Grave Goods	Catalogue Comments
Y90	G-4-2-B	Nakanohama	Yamaguchi					Early-Middle			YA	M	Stone Coffin	Bead	Inside same stone coffin G-4-2-A,B,C 同一石館内
Y91	G-4-3-b	Nakanohama	Yamaguchi					Early-Middle			MA	M	Stone Coffin	Tsubo	Inside same stone coffin G-4-3-a,b,c 同一石館内
Y139	H-1-2 No.1	Nakanohama	Yamaguchi					Early-Middle			YA	F	Stone Coffin	None	Same cist as H-1-2 No. 2; 1970 excavation
Y92	I-4-1	Nakanohama	Yamaguchi					Early-Middle			YA	F	Stone Coffin	Many small shell balls	Removal of the L hand/wrist
Y133	藤田 A (Fujita A)	Nakanohama	Yamaguchi					Yayoi			MA?	M	?		Surface find
Y112	1-1 号	Ōtomo	Saga	2600	35	2550	2350	Late half Early	-15.3	12.6	YA-MA	M	Jar Burial		
Y113	2-1 号	Ōtomo	Saga	2310	30	2160	2000	End of the Early	-15	13	MA	M	Jar Burial		Dolmen
Y116	6 号	Ōtomo	Saga	2640	50	2700	2365	Initial	-15.1	12	MA	M	Earthen burial		Dolmen
Y117	8 号	Ōtomo	Saga	2630	45	2620	2355	Initial	-14.7	12	MA-OA	F	Earthen burial		Dolmen
Y118	SK24	Ōtomo	Saga	2300	45	2185	1950	Middle	-15	13.4	MA	M	Jar Burial		
Y119	SK31	Ōtomo	Saga					Early-Middle			YA	F	Earthen burial		
Y120	SK35	Ōtomo	Saga	2240	40	2120	1915	Early	-15.1	12.9	MA	M	Jar Burial		

No	ID	Site	Pref	^{14}C	±	BP From	BP To	Period (Yayoi)	$\delta^{13}C$	$\delta^{15}N$	Age	Sex	Burial	Grave Goods	Catalogue Comments
Y129	C4	Ōtomo	Saga					Early-Middle			YA-MA	M	Stone Coffin	Shell bracelet	
Y130	D1	Ōtomo	Saga					Middle			YA	M	Stone Coffin	None	
Y128	K1	Ōtomo	Saga					End of the Early			MA	F	Jar burial	Shell bracelet	
Y179	3 号	Shibu	Nara					Middle			YA	F			Two peri-mortem injuries; Buried with No. 4
Y180	4 号	Shibu	Nara					Middle			YA	M?			Six peri-mortem injuries; Buried with No. 3
Y36	9	Shinmachi	Fukuoka					Early			OA	M	Dolmen	Tsubo	
Y34	19-1	Shinmachi	Fukuoka					Initial			MA	M	Wooden Coffin	None	
Y37	24-1	Shinmachi	Fukuoka					Initial			MA	M	?	Tsubo	Polished stone arrowhead embedded
Y35	19-2	Shinmachi	Fukuoka					Initial			A	M?	Wooden Coffin	None	
Y9	K3	Sudare	Fukuoka					Mid Middle			MA-OA	M	Jar burial	Polished stone sword tip	Polished stone sword embedded in T2
Y121	10 号	Tsukomuta 4	Fukuoka					Middle			MA-OA	M	Jar Burial		
Y125	11 号	Tsukomuta 4	Fukuoka					Middle			YA	F	Jar Burial		
Y124	21 号	Tsukomuta 4	Fukuoka					Middle			MA	M	Jar Burial		

No	ID	Site	Pref	^{14}C	±	BP From	BP To	Period (Yayoi)	$\delta^{13}C$	$\delta^{15}N$	Age	Sex	Burial	Grave Goods	Catalogue Comments
Y123	25 号	Tsukomuta 4	Fukuoka					Middle			Adol-YA	M	Jar Burial		
Y105	ST-107	Yokoguma kitsunezuka	Fukuoka					Middle			YA-MA	F			
Y106	ST-110	Yokoguma kitsunezuka	Fukuoka					Middle			YA	F			
Y95	ST-122	Yokoguma kitsunezuka	Fukuoka					Middle			YA	M	Jar Burial		
Y127	ST-128	Yokoguma kitsunezuka	Fukuoka					Middle			MA	M			
Y110	ST-131	Yokoguma kitsunezuka	Fukuoka					Middle			Adol-YA	M			
Y107	ST-140	Yokoguma kitsunezuka	Fukuoka					Middle			MA	F			
Y108	ST-142	Yokoguma kitsunezuka	Fukuoka					Middle			Adol-YA	M?			
Y109	ST-144	Yokoguma kitsunezuka	Fukuoka					Middle			MA	M			
Y126	ST-148	Yokoguma kitsunezuka	Fukuoka					Middle			YA	M			
Y103	ST-188	Yokoguma kitsunezuka	Fukuoka					Middle			OA	M	Jar Burial		
Y104	ST-202	Yokoguma kitsunezuka	Fukuoka					Middle			YA?	M			
Y93	ST-39	Yokoguma kitsunezuka	Fukuoka					Middle			MA?	F	Jar Burial		
Y111	ST-41	Yokoguma kitsunezuka	Fukuoka					Middle			YA	F			
Y94	ST-66	Yokoguma kitsunezuka	Fukuoka					Middle			Adol-YA	M	Jar Burial		Healed fracture to the L clavicle

References per site

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- **Yokoguma kitsunezuka 横隈狐塚遺跡** (Ogōri City Board of Education 2010)

Table 4: Jōmon skull preservation and trauma data. The "No" denotes the sample number within this thesis. The "Med-High Viol" indicates Medium–High likelihood violent trauma and the "Low Viol" indicates Low likelihood violent trauma. In the "Trauma Area" column, "ST" denotes skull trauma and "PCT" denotes postcranial trauma. (A = Adult, Adol = Adolescent, YA = young adult, MA = middle adult, OA = old adult)

No	ID	Site	Age	Sex	Surface Condition	Skull Compl	Trauma Timing	Med-High Viol	Low Viol	Trama Type	Trauma Area
J242	567	Adaka	MA-OA	M	1.0	0.07					
J241	3074	Adaka	YA-MA	M	1.0	0.78					
J243	568-A	Adaka	YA	M?	1.0	0.42					
J244	568-B	Adaka	MA-OA	F	1.0	0.39					
J15	?	Einomaru Shell-mound	A	M	1.0	0.78					
J16	10?	Einomaru Shell-mound	A	F	2.0	0.88					
J17	その2	Einomaru Shell-mound	YA-MA	F	1.0	0.66					
J41	I (1)	Goryō Shell-mound	YA-MA	M	1.0	0.85					
J42	I (2)	Goryō Shell-mound	YA	M	1.0	0.87					
J43	I (3)	Goryō Shell-mound	MA	M	1.0	0.62					
J44	I (4)	Goryō Shell-mound	MA?	F	1.0	0.55					
J45	II (1)	Goryō Shell-mound	MA	M	1.0	0.00					
J46	II (2)	Goryō Shell-mound	YA	M	1.0	0.97					
J153	209	Inariyama	Child	I	1.0	0.52					
J154	210	Inariyama	Adol	F?	1.0	0.53					
J270	212	Inariyama	YA?	M	1.0	0.70					
J271	213	Inariyama	OA	F	2.0	0.83					
J155	218	Inariyama	MA	F?	1.0	0.63					
J156	221	Inariyama	MA-OA	F	1.0	0.64					
J157	222	Inariyama	OA	M	1.5	0.36					
J272	223	Inariyama	YA	M	2.0	0.54					

No	ID	Site	Age	Sex	Surface Condition	Skull Compl	Trauma Timing	Med-High Viol	Low Viol	Trama Type	Trauma Area
J158	224	Inariyama	MA	I	1.0	0.76					
J159	225	Inariyama	YA	F	1.0	0.61					
J160	228	Inariyama	Adol-YA	F	2.0	0.65					
J163	230	Inariyama	YA	F	1.0	0.61					
J164	231	Inariyama	YA	M	1.0	0.77					
J165	232	Inariyama	YA	M	1.5	0.70					
J166	234	Inariyama	YA	M	1.0	0.74			X		
J167	235	Inariyama	MA	M?	2.0	0.73					
J168	236	Inariyama	YA	M	1.5	0.75					
J169	237	Inariyama	MA-OA	F	1.0	0.59					
J170	238	Inariyama	YA	M	1.0	0.61					
J171	241	Inariyama	MA	F?	1.0	0.85					
J172	244	Inariyama	MA-OA	M	1.0	0.38					
J173	245	Inariyama	MA	F	1.0	0.76					
J174	247	Inariyama	YA-MA	F	1.0	0.40					
J175	248	Inariyama	YA	I	1.0	0.21					
J176	249	Inariyama	MA-OA	F?	1.0	0.71	Peri	X		Multi	ST
J273	251	Inariyama	YA	M	1.5	0.60					
J177	252	Inariyama	MA	M	1.5	0.36					
J178	253	Inariyama	YA	F	1.0	0.57					
J179	254	Inariyama	YA	I	1.0	0.10					
J180	255	Inariyama	MA-OA	I	1.0	0.27	Ante	X		BFT	ST
J181	256	Inariyama	MA-OA	M?	1.0	0.43					
J184	258	Inariyama	A	M?	1.0	0.08					
J161	229-A	Inariyama	MA-OA	F	2.0	0.59					

No	ID	Site	Age	Sex	Surface Condition	Skull Compl	Trauma Timing	Med-High Viol	Low Viol	Trama Type	Trauma Area
J162	229-B	Inariyama	A?	I	1.5	0.16					
J182	257-A	Inariyama	A	I	2.5	0.17					
J183	257-B	Inariyama	MA	I	1.5	0.15					
J185	258-C	Inariyama	YA	I	1.0	0.01					
J245	173	Kawaji	OA	M?	1.0	0.43					
J246	177	Kawaji	YA-MA	M	1.0	0.74					
J247	181	Kawaji	MA-OA	M	1.0	0.71					
J248	185	Kawaji	MA	M	1.0	0.78					
J19	1	Kitsuki	A	M	1.0	0.63					
J20	1	Kanezaki (Kōjō) Shell-mound	OA?	F	2.0	0.62					
J23	2	Kanezaki (Kōjō) Shell-mound	MA	M	2.0	0.61					
J21	3	Kanezaki (Kōjō) Shell-mound	MA	F	1.0	0.55					
J22	4	Kanezaki (Kōjō) Shell-mound	Child	I	2.0	0.00					
J1	1	Sarugami Rock-shelter	YA	M	1.0	0.06					
J2	2	Sarugami Rock-shelter	YA	F	1.0	0.06					
J3	3	Sarugami Rock-shelter	Child	I	1.0	0.02					
J25	1	Shimokusuda	A	M?	1.0	0.45					
J26	2	Shimokusuda	A	I	1.0	0.05					
J27	3	Shimokusuda	A	I	1.0	0.06					
J28	4	Shimokusuda	A	I	1.0	0.06					
J29	5	Shimokusuda	A	I	1.0	0.11					
J30	6	Shimokusuda	A	I	1.0	0.24					

No	ID	Site	Age	Sex	Surface Condition	Skull Compl	Trauma Timing	Med-High Viol	Low Viol	Trama Type	Trauma Area
J31	7	Shimokusuda	A	I	1.0	0.18					
J32	8	Shimokusuda	A	I	1.0	0.26					
J33	9	Shimokusuda	A	I	1.0	0.39					
J5	64-1	Toyomatsu-Domen Cave	MA-OA?	M	1.0	0.89					
J6	70-1	Toyomatsu-Domen Cave	A	M	1.0	0.10					
J7	70-2	Toyomatsu-Domen Cave	A	F	1.0	0.26					
J4	70-3	Toyomatsu-Domen Cave	MA?	M	1.0	0.53					
J8	78-1	Toyomatsu-Domen Cave	YA	F	1.0	0.51	Peri	X		SFT	ST
J9	81-1	Toyomatsu-Domen Cave	MA	F	1.0	0.50					
J186	1	Tsukumo	MA	F	1.5	0.96					
J187	2	Tsukumo	MA	M	1.0	0.95					
J188	3	Tsukumo	YA	M	1.0	0.94					
J189	4	Tsukumo	MA-OA	F	1.0	0.98					
J190	5	Tsukumo	MA	M	1.0	0.71					
J191	6	Tsukumo	YA	F	1.0	0.96					
J192	7	Tsukumo	MA	F	1.0	0.70					
J232	8	Tsukumo	Adol	M	2.0	0.80					
J193;J194	11	Tsukumo	YA	F	1.0	0.50					
J195	12	Tsukumo	YA	F	1.0	0.98					
J221	14	Tsukumo	MA	F	1.0	0.77					
J233	16	Tsukumo	YA	F	2.0	0.80					

No	ID	Site	Age	Sex	Surface Condition	Skull Compl	Trauma Timing	Med-High Viol	Low Viol	Trama Type	Trauma Area
J234	17	Tsukumo	OA	F	2.0	0.44					
J237	19	Tsukumo	YA	M	1.0	0.58					
J220	20	Tsukumo	MA	F	1.5	0.00	Ante	X		BFT	PCT
J260	23	Tsukumo	OA	F?	1.0	0.64					
J196	24	Tsukumo	YA-MA	M	1.0	0.90			X		
J197	25	Tsukumo	Adol	F	1.0	0.75					
J249	27	Tsukumo	MA	M	1.0	0.98					
J261	28	Tsukumo	Child	I	1.0	0.30					
J222	29	Tsukumo	YA	F	1.0	0.38					
J225	30	Tsukumo	MA	M	1.0	0.65					
J257	32	Tsukumo	YA-MA	M	1.0	0.66					
J258	36	Tsukumo	MA	M	1.0	0.81	Ante	X		BFT	ST
J262	37	Tsukumo	MA	F	1.0	0.61					
J227	38	Tsukumo	OA	F	1.0	0.53	Ante	X		BFT	ST
J264	39	Tsukumo	YA	M	1.0	0.64					
J250	40	Tsukumo	MA	F	1.0	0.35					
J251	42	Tsukumo	MA	F	1.0	0.39					
J226	44	Tsukumo	YA	M?	1.0	0.86					
J265	46	Tsukumo	MA-OA	M	1.0	0.18	Ante	X		BFT	ST
J267	52	Tsukumo	Child	I	1.0	0.36					
J268	56	Tsukumo	Child	I	1.0	0.50					
J254	58	Tsukumo	MA	M	1.0	0.78					
J252	59	Tsukumo	MA-OA	M?	1.0	0.44					
J230	60	Tsukumo	MA-OA	M	1.0	0.84					
J253	61	Tsukumo	MA	M	1.0	0.91					

No	ID	Site	Age	Sex	Surface Condition	Skull Compl	Trauma Timing	Med-High Viol	Low Viol	Trama Type	Trauma Area
J231	62	Tsukumo	MA	F	1.0	0.00					
J228	65	Tsukumo	YA-MA	M	1.0	0.87			X		
J235	66	Tsukumo	OA	M	1.0	0.87					
J239	67	Tsukumo	MA	F	1.0	0.53					
J236	70	Tsukumo	MA	F	1.0	0.91					
J256	151	Tsukumo	MA-OA	M	1.0	0.70					
J269	164	Tsukumo	YA-MA	M?	1.0	0.30					
J223	13-A	Tsukumo	MA	M	1.0	0.78					
J224	13-B	Tsukumo	Adol	I	1.0	0.00					
J255	162-B	Tsukumo	MA-OA	F?	1.0	0.47					
J259	34-I	Tsukumo	YA	F	1.0	0.83					
J240	35-A?	Tsukumo	A	M	1.0	0.45					
J263	41-I	Tsukumo	OA	F	1.0	0.63					
J229	55-A	Tsukumo	MA	M	1.0	0.07					
J238	68-A	Tsukumo	MA	F	1.0	0.65					
J266	番外 2	Tsukumo	Child	I	1.0	0.25					
J47	1	Wakazono Shell-mound	A	F	1.0	0.54					
J48	2A?	Wakazono Shell-mound	YA?	F	1.0	0.41					
J49	2B?	Wakazono Shell-mound	YA?	F	1.0	0.61					
J34	1	Yamaga Shell-mound	MA-OA?	F	2.0	0.25					
J51	7	Yamaga Shell-mound	MA	M	2.0	0.72					
J35	8	Yamaga Shell-mound	A	M	1.0	0.52					

No	ID	Site	Age	Sex	Surface Condition	Skull Compl	Trauma Timing	Med-High Viol	Low Viol	Trama Type	Trauma Area
J52	9	Yamaga Shell-mound	MA?	F	1.0	0.73	Ante	X		BFT	ST
J36	12	Yamaga Shell-mound	MA	M	2.0	0.02					
J37	13	Yamaga Shell-mound	MA	M	1.5	0.61					
J38	15	Yamaga Shell-mound	YA-MA	M	1.0	0.97					
J50	16	Yamaga Shell-mound	MA	F	1.0	0.83					
J39	17	Yamaga Shell-mound	MA	F	2.0	0.59					
J40	18	Yamaga Shell-mound	MA	M	2.0	0.61	Ante	X		BFT	ST
J54	261	Yoshigo	MA	M	1.0	0.80					
J55	266	Yoshigo	A	M	1.0	0.54					
J56	271	Yoshigo	YA	M	1.0	0.30					
J57	273	Yoshigo	YA	M	2.0	0.67					
J58	274	Yoshigo	Child	I	2.0	0.49					
J59	277	Yoshigo	YA	F	1.0	0.91					
J60	279	Yoshigo	OA	F	1.0	0.88					
J61	281	Yoshigo	YA-MA	F	1.5	0.67					
J62	287	Yoshigo	MA	M	1.0	0.90					
J63	292	Yoshigo	YA	M?	1.0	0.48					
J64	295	Yoshigo	A	F	1.5	0.63					
J65	296	Yoshigo	MA-OA	F	1.0	0.81					
J66	301	Yoshigo	OA	F	1.0	0.72					
J67	302	Yoshigo	YA	F	2.0	0.75					
J68	303	Yoshigo	YA	F	1.0	0.13					
J69	304	Yoshigo	Adol	F?	1.0	0.78					
J70	306	Yoshigo	YA	F	1.0	0.72					
J71	307	Yoshigo	MA-OA	M	1.0	0.59					

No	ID	Site	Age	Sex	Surface Condition	Skull Compl	Trauma Timing	Med-High Viol	Low Viol	Trama Type	Trauma Area
J72	308	Yoshigo/Yasaki	MA	F?	1.0	0.36					
J75	315	Yoshigo	YA-MA	F	1.5	0.58					
J76	316	Yoshigo	YA	M?	1.5	0.70					
J78	322	Yoshigo	MA	F	1.0	0.73					
J79	324	Yoshigo	A	F	1.0	0.66					
J80	328	Yoshigo	OA	F	1.0	0.80					
J81	334	Yoshigo	YA	M	1.0	0.65					
J82	341	Yoshigo	Adol	M	1.0	0.65					
J83	342	Yoshigo	MA	F	1.0	0.55					
J85	347	Yoshigo	MA	F	1.5	0.59					
J86	348	Yoshigo	A	F	1.0	0.32					
J87	349	Yoshigo	YA	M	1.0	0.91					
J88	350	Yoshigo	OA	M?	1.0	0.75					
J89	352	Yoshigo	Adol	F	1.5	0.92					
J90	353	Yoshigo	YA-MA	F	1.5	0.60					
J91	354	Yoshigo	OA	F	1.0	0.55					
J92	355	Yoshigo	A	M	1.0	0.00					
J93	356	Yoshigo	YA-MA	M	1.0	0.04					
J94	357	Yoshigo	YA-MA	F	1.0	0.46					
J95	358	Yoshigo	MA	F	1.0	0.04					
J98	361	Yoshigo	YA	F	1.0	0.57					
J99	364	Yoshigo	OA	M	1.0	0.68					
J100	368	Yoshigo	A	M	1.0	0.65					
J101	371	Yoshigo	Adol	F	2.0	0.40					
J102	375	Yoshigo	MA	M	1.0	0.77			X		

No	ID	Site	Age	Sex	Surface Condition	Skull Compl	Trauma Timing	Med-High Viol	Low Viol	Trama Type	Trauma Area
J103	378	Yoshigo	MA-OA	F	1.0	0.53	Peri	X	X	Penetrating	ST
J104	383	Yoshigo	MA-OA	M	1.5	0.66					
J105;J106	388	Yoshigo	YA-MA	M	1.5	0.81					
J107	389	Yoshigo	MA	F	1.0	0.68					
J108	394	Yoshigo	A	F	1.0	0.18					
J109	396	Yoshigo	MA	M	1.0	0.91					
J110	399	Yoshigo	MA-OA	F	1.5	0.32					
J112	402	Yoshigo	Child	I	1.0	0.47					
J113	403	Yoshigo	YA	F	1.0	0.49					
J114	403	Yoshigo	YA-MA	F	1.0	0.54					
J115	404	Yoshigo/Yasaki	Adol	F?	1.0	0.75					
J116	405	Yoshigo	Child	I	1.5	0.16					
J117	406	Yoshigo	A	F	1.0	0.44					
J118	407	Yoshigo	YA	F	1.0	0.91					
J123	416	Yoshigo/Yasaki	OA	F?	1.0	0.15					
J124	418	Yoshigo	YA	M	1.5	0.63					
J125	419	Yoshigo	YA	M	1.0	0.76					
J126	420	Yoshigo	MA	F	1.0	0.73					
J127	421	Yoshigo/Yasaki	YA	M	1.0	0.76					
J131	435	Yoshigo	YA	M	1.5	0.78					
J132	456	Yoshigo	MA	M	1.0	0.73					
J133	460	Yoshigo	YA	F	1.5	0.66					
J134	463	Yoshigo	MA	M	1.5	0.60					
J135	467	Yoshigo	Child	I	1.0	0.68					
J136	481	Yoshigo	MA	M	1.0	0.73					

No	ID	Site	Age	Sex	Surface Condition	Skull Compl	Trauma Timing	Med-High Viol	Low Viol	Trama Type	Trauma Area
J137	485	Yoshigo	MA	F	1.0	0.05					
J138	488	Yoshigo	MA	F	1.0	0.45					
J139	498	Yoshigo	YA	M	1.0	0.12					
J140	499	Yoshigo	Child	I	1.0	0.34					
J141	501	Yoshigo	MA	M	1.0	0.55					
J142	508	Yoshigo	MA-OA	F	1.0	0.64					
J143	509	Yoshigo	YA	M	1.0	0.44					
J144	523	Yoshigo	YA	F	2.0	0.67					
J145	534	Yoshigo	MA-OA	F	2.0	0.47					
J146	535	Yoshigo	Child	I	1.0	0.13					
J147	540	Yoshigo	MA	F	1.5	0.23					
J148	548	Yoshigo	OA	F?	1.0	0.09					
J149	551	Yoshigo	infant	I	1.0	0.10					
J150	561	Yoshigo	Adol	M	1.0	0.05					
J73	310-1	Yoshigo	YA	F	1.0	0.94					
J74	312-1	Yoshigo	Adol	F	1.0	0.15			X		
J84	345-1	Yoshigo	YA-MA	M	1.0	0.78					
J96	360-1	Yoshigo	YA	F	1.0	0.21	Peri	X		BFT	ST
J97	360-II	Yoshigo	YA	F	1.0	0.01					
J111	401-A	Yoshigo	Child	I	1.0	0.28					
J119	408-A	Yoshigo	YA	F	2.0	0.18					
J120	408-B	Yoshigo	YA	I	1.5	0.06					
J121	414-I	Yoshigo	YA	I	1.0	0.21					
J122	414-II	Yoshigo	YA	M	1.0	0.13					
J128	424-I	Yoshigo	YA	M	1.0	0.83					

No	ID	Site	Age	Sex	Surface Condition	Skull Compl	Trauma Timing	Med-High Viol	Low Viol	Trama Type	Trauma Area
J129	424-III	Yoshigo	YA	M	1.5	0.64					
J130	424-IV	Yoshigo	A	M	1.0	0.38					
J151	522-1	Yoshigo/Yasaki	YA	F	1.0	0.68					
J152	no no.	Yoshigo	Child	I	1.5	0.40					

Table 5: Yayoi preservation data. The "No" denotes the sample number within this thesis. "Skull No Sp." refers to the completeness of the skull excluding the sphenoid bone. (A = Adult, Adol = Adolescent, YA = young adult, MA = middle adult, OA = old adult)

						Completeness									
No	**ID**	**Site**	**Age**	**Sex**	**Surface Cond**	**Skull**	**Skull No Sp.**	**Vert**	**Thorax Shoulders**	**Arms**	**Hands**	**Pelvis**	**Legs**	**Feet**	**Full**
Y178	124	Doigahama	MA?	M	1.0	0.33	0.36	0.67	0.46	0.87	0.87	0.68	0.93	0.72	0.64
Y154	209	Doigahama	MA	M	2.0	0.53	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Y155	211	Doigahama	MA-OA	F?	2.0	0.41	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
Y156	212	Doigahama	YA	M	2.0	0.51	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Y157	213	Doigahama	MA-OA	F?	1.0	0.81	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
Y158	216	Doigahama	MA-OA	M?	1.5	0.80	0.84	0.11	0.09	0.09	0.00	0.00	0.01	0.00	0.18
Y159	217	Doigahama	MA?	M	2.0	0.54	0.58	0.00	0.01	0.16	0.00	0.00	0.37	0.13	0.18
Y160	229	Doigahama	MA-OA	F?	1.0	0.41	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
Y163	231	Doigahama	YA-MA	M?	1.5	0.41	0.44	0.00	0.01	0.16	0.00	0.00	0.37	0.13	0.16
Y162	233	Doigahama	YA-MA	I	1.5	0.15	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Y153	312	Doigahama	YA	F	1.0	0.95	0.94	0.96	0.82	0.98	0.94	0.97	0.94	0.00	0.86
Y165	409	Doigahama	YA	M	1.0	1.00	1.00	0.85	0.74	0.90	1.00	0.92	0.91	0.00	0.83
Y164	418	Doigahama	MA-OA	M	1.0	0.83	0.84	0.40	0.40	0.90	0.74	0.48	0.86	0.68	0.63
Y151	421	Doigahama	MA	F?	1.0	0.92	1.00	0.79	0.38	0.78	0.69	0.37	0.76	0.66	0.66
Y168	422	Doigahama	YA	F	1.0	0.67	0.70	0.28	0.29	0.65	0.13	0.00	0.00	0.01	0.27
Y167	912	Doigahama	MA?	M	1.5	0.67	0.71	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.12
Y166	1105	Doigahama	MA	M?	1.5	0.82	0.83	0.65	0.32	0.84	0.82	0.64	0.79	0.83	0.66
Y152	1116	Doigahama	MA	M	1.0	0.86	0.89	0.69	0.37	0.89	0.81	0.24	0.82	0.63	0.64
Y161	229a	Doigahama	A	F?	1.0	0.58	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10

						Completeness									
No	**ID**	**Site**	**Age**	**Sex**	**Surface Cond**	**Skull**	**Skull No Sp.**	**Vert**	**Thorax Shoulders**	**Arms**	**Hands**	**Pelvis**	**Legs**	**Feet**	**Full**
Y170	A-5	Hirota	YA-MA	F?	2.0	0.49	0.54	0.00	0.03	0.47	0.00	0.00	0.23	0.00	0.17
Y171	A-8	Hirota	YA-MA	M	1.0	0.71	0.77	0.26	0.15	0.65	0.37	0.36	0.61	0.51	0.44
Y172	C-2	Hirota	YA	M	2.0	0.72	0.78	0.04	0.01	0.26	0.33	0.07	0.36	0.05	0.24
Y173	C-5	Hirota	YA	F	1.5	0.65	0.70	0.03	0.03	0.56	0.34	0.16	0.66	0.36	0.34
Y174	C-8	Hirota	MA	M	1.5	0.93	0.95	0.70	0.49	0.89	0.62	0.76	0.91	0.68	0.75
Y175	D-II-1	Hirota	YA	F	1.5	0.47	0.51	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Y176	D-II-3	Hirota	YA	F	1.5	0.87	0.87	0.71	0.28	0.90	0.38	0.55	0.84	0.59	0.64
Y177	D-III-2	Hirota	YA	M	1.5	0.92	0.94	0.45	0.32	0.87	0.87	0.41	0.75	0.58	0.61
Y41	K102	Kanenokuma	YA	M	1.5	0.98	0.98	0.06	0.16	0.44	0.33	0.03	0.32	0.00	0.32
Y45	K103	Kanenokuma	A	M	1.5	0.25	0.27	0.00	0.01	0.34	0.13	0.01	0.58	0.00	0.18
Y46	K113	Kanenokuma	MA	F	1.0	0.96	0.96	0.00	0.00	0.17	0.00	0.00	0.46	0.00	0.26
Y47	K119	Kanenokuma	YA	M?	1.5	0.91	0.90	0.01	0.04	0.14	0.03	0.00	0.59	0.07	0.29
Y48	K125	Kanenokuma	A	M	1.0	0.02	0.02	0.00	0.00	0.30	0.08	0.35	0.70	0.23	0.21
Y2	K13	Kanenokuma	A	M	2.0	0.85	0.84	0.00	0.34	0.53	0.34	0.51	0.66	0.00	0.45
Y49	K130	Kanenokuma	MA	F	1.0	0.82	0.81	0.04	0.04	0.52	0.10	0.44	0.57	0.00	0.35
Y50	K139	Kanenokuma	MA?	F?	1.5	0.86	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15
Y51	K140	Kanenokuma	MA?	F	1.0	0.81	0.79	0.55	0.25	0.67	0.23	0.61	0.72	0.35	0.55
Y52	K141	Kanenokuma	OA	M	1.5	0.94	0.94	0.47	0.32	0.81	0.67	0.61	0.67	0.17	0.58
Y53	K175	Kanenokuma	A	M	1.0	0.92	0.91	0.51	0.08	0.70	0.22	0.35	0.68	0.26	0.49
Y54	K177	Kanenokuma	A	M	1.5	0.96	0.96	0.25	0.08	0.67	0.28	0.02	0.54	0.11	0.39
Y55	K215	Kanenokuma	YA	M	1.5	0.89	0.88	0.05	0.12	0.58	0.36	0.26	0.61	0.33	0.40
Y56	K229	Kanenokuma	MA	M	1.0	0.82	0.81	0.44	0.21	0.70	0.37	0.21	0.59	0.00	0.45
Y72	K238	Kanenokuma	YA	F	1.0	0.73	0.71	0.14	0.14	0.67	0.28	0.49	0.63	0.00	0.40

						Completeness									
No	**ID**	**Site**	**Age**	**Sex**	**Surface Cond**	**Skull**	**Skull No Sp.**	**Vert**	**Thorax Shoulders**	**Arms**	**Hands**	**Pelvis**	**Legs**	**Feet**	**Full**
Y73	K272	Kanenokuma	OA	F	1.5	0.87	0.86	0.07	0.10	0.59	0.02	0.23	0.67	0.17	0.38
Y42	K29	Kanenokuma	MA	F	1.5	0.97	0.97	0.13	0.13	0.57	0.51	0.57	0.51	0.00	0.43
Y3	K35	Kanenokuma	YA	M	2.5	0.77	0.75	0.00	0.10	0.48	0.05	0.15	0.70	0.10	0.34
Y82	K364	Kanenokuma	A	M	1.5	0.45	0.49	0.00	0.08	0.29	0.13	0.03	0.56	0.34	0.25
Y1	K5	Kanenokuma	MA	F	2.0	0.53	0.53	0.00	0.14	0.27	0.18	0.24	0.45	0.00	0.25
Y4	K56	Kanenokuma	YA-MA	F	2.0	0.56	0.57	0.00	0.02	0.27	0.00	0.02	0.56	0.05	0.23
Y5	K61	Kanenokuma	YA	M	2.5	0.86	0.85	0.02	0.06	0.42	0.05	0.00	0.47	0.08	0.29
Y6	K64	Kanenokuma	MA	M	2.0	0.76	0.77	0.25	0.15	0.58	0.50	0.53	0.68	0.14	0.45
Y7	K72	Kanenokuma	OA	M	1.0	0.94	0.93	0.02	0.03	0.00	0.02	0.07	0.22	0.00	0.22
Y8	K76	Kanenokuma	YA	M	1.0	0.46	0.42	0.04	0.09	0.76	0.14	0.16	0.49	0.00	0.27
Y43	K79	Kanenokuma	YA	M	1.0	1.00	1.00	0.67	0.42	0.89	0.77	0.46	0.74	0.00	0.64
Y38	K83	Kanenokuma	MA	F	2.0	0.82	0.81	0.05	0.07	0.33	0.11	0.13	0.26	0.00	0.25
Y44	K89	Kanenokuma	MA	F	1.0	0.84	0.83	0.10	0.26	0.57	0.27	0.25	0.68	0.00	0.42
Y39	K93	Kanenokuma	MA	M?	1.0	0.96	0.96	0.04	0.04	0.52	0.07	0.00	0.53	0.00	0.32
Y40	K96	Kanenokuma	MA	M	1.0	0.84	0.82	0.16	0.02	0.34	0.23	0.09	0.72	0.00	0.34
Y147	35	Kōra	MA	F	1.5	1.00	1.00	0.86	0.87	0.96	1.00	0.80	0.88	0.88	0.90
Y146	36	Kōra	MA	F	1.0	1.00	1.00	0.81	0.83	0.99	1.00	0.86	0.83	0.92	0.88
Y144	44	Kōra	YA-MA	M	1.5	0.89	0.89	0.83	0.82	0.96	0.82	0.94	0.82	0.78	0.86
Y141	67	Kōra	MA	M	1.0	1.00	1.00	0.82	0.72	0.98	1.00	0.74	0.73	0.79	0.82
Y140	68	Kōra	YA-MA	M	1.5	1.00	1.00	0.75	0.74	0.88	0.89	0.68	0.73	0.43	0.77
Y148	1411	Kōra	YA	M	1.5	0.94	0.95	0.74	0.55	0.84	0.56	0.60	0.64	0.58	0.69
Y142	60 の 1	Kōra	OA	F	1.5	0.89	0.89	0.50	0.49	0.66	0.88	0.64	0.71	0.75	0.66
Y149	山本 III	Kōra	MA	M	2.0	0.78	0.84	0.01	0.01	0.51	0.19	0.12	0.19	0.00	0.23

						Completeness									
No	**ID**	**Site**	**Age**	**Sex**	**Surface Cond**	**Skull**	**Skull No Sp.**	**Vert**	**Thorax Shoulders**	**Arms**	**Hands**	**Pelvis**	**Legs**	**Feet**	**Full**
Y150	近藤 I	Kōra	MA	F	1.5	0.79	0.78	0.56	0.33	0.73	0.01	0.47	0.55	0.00	0.49
Y101	5	Minamikata	MA	F	1.0	0.91	0.96	0.83	0.54	0.99	0.97	0.73	0.90	0.86	0.80
Y102	6	Minamikata	Child	I	1.5	0.98	0.98	0.20	0.77	0.70	0.00	0.64	0.67	0.05	0.61
Y100	9	Minamikata	MA	F?	2.0	1.00	1.00	0.93	0.85	0.96	0.83	0.86	0.96	0.89	0.92
Y97	7 • 8 - A	Minamikata	YA?	M	1.0	0.68	0.70	0.17	0.02	0.66	0.00	0.00	0.56	0.29	0.32
Y98	7 • 8 - B	Minamikata	A	M?	1.0	0.11	0.12	0.00	0.00	0.14	0.00	0.00	0.43	0.00	0.11
Y99	7 • 8 - C	Minamikata	A	I	1.0	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.01
Y57	1	Mitsunagata	A	F	1.0	0.63	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
Y58	2	Mitsunagata	A	M	1.5	0.46	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Y59	3	Mitsunagata	MA?	F	1.0	0.88	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15
Y62	4	Mitsunagata	MA?	M	1.0	0.73	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
Y61	5	Mitsunagata	MA?	M	1.0	0.90	0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16
Y60	7	Mitsunagata	A	F	1.0	0.63	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
Y69	8	Mitsunagata	MA?	M?	1.0	0.51	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Y63	9	Mitsunagata	A	M	1.0	0.14	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Y65	10	Mitsunagata	MA?	M	1.5	0.46	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Y68	11	Mitsunagata	A	M	2.0	0.32	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Y67	12	Mitsunagata	MA?	M?	1.0	0.48	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Y66	13	Mitsunagata	MA-OA?	M	1.5	0.40	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
Y64	14	Mitsunagata	A	F?	1.5	0.45	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Y70	32	Mitsunagata	YA	M	1.0	0.00	0.00	0.00	0.00	0.21	0.00	0.36	0.43	0.06	0.13
Y71	101	Mitsunagata	MA	M	1.0	0.95	0.94	0.72	0.37	0.84	0.17	0.70	0.77	0.77	0.68
Y74	104	Mitsunagata	MA	M	1.0	0.98	0.98	0.59	0.15	0.92	0.57	0.82	0.82	0.47	0.64
Y75	124	Mitsunagata	A	M	1.5	0.84	0.83	0.19	0.17	0.21	0.00	0.00	0.65	0.00	0.34

						Completeness									
No	**ID**	**Site**	**Age**	**Sex**	**Surface Cond**	**Skull**	**Skull No Sp.**	**Vert**	**Thorax Shoulders**	**Arms**	**Hands**	**Pelvis**	**Legs**	**Feet**	**Full**
Y76	125	Mitsunagata	A	M	1.0	0.91	0.91	0.40	0.35	0.32	0.00	0.00	0.45	0.00	0.40
Y78	126	Mitsunagata	MA	M	1.0	0.99	0.99	0.57	0.07	0.63	0.00	0.39	0.67	0.00	0.48
Y77	127	Mitsunagata	MA	M	1.0	0.89	0.88	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.19
Y83	1B1	Mitsunagata	MA?	M	2.0	0.57	0.57	0.09	0.04	0.45	0.02	0.55	0.63	0.04	0.33
Y79	A1	Mitsunagata	MA?	M	1.0	0.61	0.66	0.46	0.15	0.52	0.00	0.04	0.14	0.00	0.27
Y81	A2	Mitsunagata	A	F	1.0	0.17	0.19	0.00	0.00	0.11	0.03	0.14	0.60	0.05	0.16
Y80	A3	Mitsunagata	A	F	1.5	0.08	0.06	0.00	0.00	0.19	0.00	0.03	0.68	0.00	0.15
Y11	K10	Nagaoka	MA	M	2.0	0.56	0.61	0.00	0.07	0.34	0.30	0.00	0.46	0.00	0.23
Y12	K11	Nagaoka	YA?	I	1.0	0.43	0.47	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.08
Y14	K12	Nagaoka	OA	M	2.0	0.82	0.80	0.04	0.03	0.67	0.01	0.05	0.49	0.00	0.30
Y15	K15	Nagaoka	OA	F	1.0	0.74	0.72	0.00	0.03	0.00	0.00	0.05	0.20	0.00	0.18
Y16	K24	Nagaoka	YA	M	2.0	0.72	0.77	0.53	0.14	0.88	0.50	0.53	0.54	0.45	0.50
Y13	K25	Nagaoka	Adol?	I	3.0	0.20	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
Y17	K26	Nagaoka	YA	F	2.0	0.03	0.03	0.00	0.03	0.00	0.01	0.10	0.43	0.00	0.10
Y18	K30	Nagaoka	MA	F	2.0	0.78	0.77	0.00	0.03	0.37	0.00	0.10	0.51	0.00	0.27
Y19	K32	Nagaoka	A	M	2.0	0.64	0.65	0.00	0.00	0.06	0.00	0.00	0.16	0.00	0.14
Y20	K33	Nagaoka	YA	F	2.0	0.82	0.82	0.00	0.03	0.22	0.00	0.17	0.48	0.00	0.27
Y21	K36	Nagaoka	MA	F	1.0	0.93	0.93	0.21	0.14	0.67	0.00	0.36	0.70	0.00	0.44
Y22	K38	Nagaoka	YA	F	2.5	0.77	0.79	0.03	0.12	0.33	0.03	0.02	0.40	0.00	0.26
Y23	K39	Nagaoka	YA	F	1.0	0.58	0.63	0.32	0.09	0.38	0.05	0.60	0.69	0.00	0.38
Y24	K48	Nagaoka	YA-MA	M	2.0	0.37	0.40	0.00	0.04	0.06	0.00	0.05	0.29	0.12	0.14
Y10	K9	Nagaoka	MA	M	2.0	0.92	0.91	0.18	0.13	0.16	0.14	0.00	0.52	0.00	0.32
Y32	SK100	Nagaoka	Adol	M	2.0	0.00	0.00	0.11	0.00	0.08	0.00	0.04	0.03	0.00	0.03
Y25	SK49	Nagaoka	YA	F	2.5	0.21	0.23	0.07	0.05	0.43	0.00	0.34	0.69	0.00	0.25

						Completeness									
No	**ID**	**Site**	**Age**	**Sex**	**Surface Cond**	**Skull**	**Skull No Sp.**	**Vert**	**Thorax Shoulders**	**Arms**	**Hands**	**Pelvis**	**Legs**	**Feet**	**Full**
Y26	SK55	Nagaoka	YA?	F	2.5	0.33	0.36	0.00	0.00	0.00	0.00	0.11	0.53	0.06	0.17
Y27	SK78	Nagaoka	YA-MA	M	2.0	0.79	0.78	0.00	0.03	0.35	0.01	0.17	0.67	0.06	0.31
Y28	SK90	Nagaoka	A	M	2.0	0.74	0.75	0.25	0.17	0.69	0.05	0.09	0.54	0.20	0.37
Y29	SK93	Nagaoka	MA	M	1.0	0.86	0.85	0.06	0.16	0.66	0.05	0.12	0.64	0.06	0.37
Y30	SK95	Nagaoka	MA	M	2.0	0.00	0.00	0.05	0.04	0.58	0.01	0.22	0.40	0.00	0.15
Y31	SK97	Nagaoka	YA	M	1.0	1.00	1.00	0.14	0.09	0.77	0.65	0.14	0.55	0.08	0.41
Y33	SK98	Nagaoka	YA	M	2.0	0.15	0.17	0.11	0.07	0.51	0.00	0.37	0.69	0.05	0.26
Y96	906-3	Nakanohama	YA-MA	M	2.0	0.93	0.93	0.45	0.28	0.56	0.17	0.17	0.48	0.11	0.45
Y84	E-1-a	Nakanohama	MA?	M	1.5	0.27	0.29	0.00	0.00	0.12	0.00	0.25	0.68	0.12	0.21
Y85	E-1-b	Nakanohama	MA?	M	1.5	0.32	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Y86	E-2-1	Nakanohama	Infant	I	1.0	0.39	0.41	0.00	0.03	0.30	0.00	0.05	0.76	0.19	0.25
Y87	E-2-2	Nakanohama	YA	M	1.5	0.53	0.57	0.07	0.06	0.08	0.00	0.00	0.17	0.23	0.17
Y88	F-2-1? (cist)	Nakanohama	YA	F?	1.5	0.62	0.65	0.14	0.00	0.00	0.00	0.00	0.00	0.26	0.14
Y135	G-1 No.1	Nakanohama	YA	M	1.5	0.20	0.21	0.58	0.39	0.64	0.53	0.50	0.27	0.10	0.38
Y136	G-1-2 No.1	Nakanohama	Adol-YA	F	1.5	0.51	0.55	0.06	0.10	0.51	0.00	0.00	0.28	0.00	0.21
Y138	G-1-2 No.2	Nakanohama	MA	M	1.5	0.79	0.84	0.21	0.27	0.75	0.81	0.18	0.58	0.05	0.44
Y137	G-1-2 No.3	Nakanohama	OA	F	1.5	0.42	0.46	0.00	0.00	0.00	0.00	0.05	0.22	0.00	0.12
Y132	G-3-1 No.7357	Nakanohama	A	M?	1.0	0.28	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Y131	G-3-1-1-その 1	Nakanohama	YA	F?	2.0	0.78	0.80	0.00	0.00	0.40	0.00	0.00	0.30	0.00	0.22
Y134	G-3-1-1-その 2	Nakanohama	MA	M	1.5	0.79	0.86	0.04	0.03	0.39	0.00	0.13	0.34	0.00	0.25

						Completeness									
No	**ID**	**Site**	**Age**	**Sex**	**Surface Cond**	**Skull**	**Skull No Sp.**	**Vert**	**Thorax Shoulders**	**Arms**	**Hands**	**Pelvis**	**Legs**	**Feet**	**Full**
Y89	G-3-6	Nakanohama	MA	F	1.5	1.00	1.00	0.15	0.14	0.16	0.24	0.92	0.35	0.09	0.41
Y90	G-4-2-B	Nakanohama	YA	M	1.5	0.20	0.21	0.00	0.00	0.00	0.00	0.11	0.48	0.25	0.15
Y91	G-4-3-b	Nakanohama	MA	M	1.5	0.31	0.34	0.39	0.11	0.28	0.52	0.73	0.77	0.41	0.42
Y139	H-1-2 No.1	Nakanohama	YA	F	1.0	0.64	0.64	0.65	0.21	0.62	0.00	0.44	0.60	0.88	0.51
Y92	I-4-1	Nakanohama	YA	F	1.0	0.79	0.85	0.15	0.28	0.93	0.83	0.00	0.22	0.42	0.39
Y133	藤田 A (Fujita A)	Nakanohama	MA?	M	1.5	0.78	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
Y112	1-1 号	Ōtomo	YA-MA	M	2.0	0.49	0.53	0.00	0.04	0.37	0.00	0.11	0.37	0.00	0.20
Y113	2-1 号	Ōtomo	MA	M	1.5	0.67	0.69	0.63	0.38	0.82	0.04	0.34	0.74	0.11	0.53
Y116	6 号	Ōtomo	MA	M	2.5	0.38	0.41	0.03	0.01	0.00	0.45	0.18	0.70	0.24	0.25
Y117	8 号	Ōtomo	MA-OA	F	2.0	0.69	0.69	0.31	0.10	0.56	0.47	0.56	0.34	0.00	0.36
Y118	SK24	Ōtomo	MA	M	1.0	0.00	0.00	0.10	0.05	0.12	0.00	0.15	0.31	0.13	0.11
Y119	SK31	Ōtomo	YA	F	1.5	0.12	0.13	0.04	0.03	0.31	0.20	0.03	0.54	0.37	0.19
Y120	SK35	Ōtomo	MA	M	1.0	0.77	0.75	0.05	0.41	0.81	0.49	0.70	0.73	0.62	0.55
Y129	C4	Ōtomo	YA-MA	M	1.5	0.19	0.20	0.00	0.04	0.49	0.09	0.14	0.78	0.38	0.26
Y130	D1	Ōtomo	YA	M	1.5	0.80	0.86	0.04	0.06	0.77	0.46	0.12	0.60	0.59	0.39
Y128	K1	Ōtomo	MA	F	1.0	0.02	0.03	0.11	0.21	0.72	0.73	0.46	0.57	0.38	0.32
Y179	3 号	Shibu	YA	F	2.0	0.26	0.28	0.13	0.20	0.73	0.43	0.15	0.55	0.44	0.32
Y180	4 号	Shibu	YA	M?	2.0	0.46	0.50	0.36	0.31	0.60	0.61	0.32	0.54	0.36	0.42
Y36	9	Shinmachi	OA	M	2.5	0.94	0.96	0.00	0.02	0.17	0.00	0.00	0.19	0.00	0.21
Y34	19-1	Shinmachi	MA	M	2.5	0.06	0.06	0.04	0.00	0.20	0.09	0.00	0.11	0.00	0.05
Y37	24-1	Shinmachi	MA	M	3.0	0.17	0.19	0.05	0.02	0.43	0.36	0.22	0.32	0.00	0.17
Y35	19-2	Shinmachi	A	M?	2.5	0.56	0.61	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.11

						Completeness									
No	**ID**	**Site**	**Age**	**Sex**	**Surface Cond**	**Skull**	**Skull No Sp.**	**Vert**	**Thorax Shoulders**	**Arms**	**Hands**	**Pelvis**	**Legs**	**Feet**	**Full**
Y9	K3	Sudare	MA-OA	M	2.0	0.90	0.89	0.73	0.47	0.88	0.00	0.47	0.70	0.63	0.65
Y121	10 号	Tsukomuta 4	MA-OA	M	2.0	0.85	0.84	0.34	0.32	0.73	0.00	0.73	0.75	0.34	0.55
Y125	11 号	Tsukomuta 4	YA	F	2.0	0.59	0.60	0.01	0.13	0.53	0.00	0.16	0.56	0.00	0.29
Y124	21 号	Tsukomuta 4	MA	M	2.0	0.85	0.84	0.00	0.03	0.40	0.00	0.03	0.54	0.00	0.28
Y123	25 号	Tsukomuta 4	Adol-YA	M	2.0	0.72	0.72	0.06	0.11	0.25	0.00	0.03	0.59	0.05	0.29
Y105	ST-107	Yokoguma kitsunezuka	YA-MA	F	2.0	0.56	0.59	0.49	0.12	0.59	0.30	0.50	0.66	0.08	0.43
Y106	ST-110	Yokoguma kitsunezuka	YA	F	1.0	1.00	1.00	0.45	0.27	0.76	0.39	0.38	0.80	0.13	0.56
Y95	ST-122	Yokoguma kitsunezuka	YA	M	2.0	0.67	0.68	0.00	0.00	0.08	0.00	0.00	0.29	0.00	0.17
Y127	ST-128	Yokoguma kitsunezuka	MA	M	2.0	0.96	0.95	0.40	0.23	0.42	0.54	0.53	0.78	0.03	0.52
Y110	ST-131	Yokoguma kitsunezuka	Adol-YA	M	2.0	0.76	0.74	0.06	0.03	0.18	0.02	0.26	0.59	0.13	0.30
Y107	ST-140	Yokoguma kitsunezuka	MA	F	2.0	0.90	0.89	0.07	0.09	0.39	0.20	0.00	0.26	0.00	0.27
Y108	ST-142	Yokoguma kitsunezuka	Adol-YA	M?	2.0	0.76	0.74	0.00	0.02	0.18	0.00	0.00	0.46	0.00	0.23
Y109	ST-144	Yokoguma kitsunezuka	MA	M	2.0	0.94	0.95	0.17	0.25	0.74	0.20	0.28	0.64	0.00	0.45
Y126	ST-148	Yokoguma kitsunezuka	YA	M	2.0	0.93	0.93	0.66	0.43	0.83	0.50	0.72	0.70	0.33	0.66
Y103	ST-188	Yokoguma kitsunezuka	OA	M	2.0	0.80	0.79	0.11	0.03	0.62	0.07	0.47	0.58	0.00	0.36
Y104	ST-202	Yokoguma kitsunezuka	YA?	M	2.0	0.62	0.67	0.00	0.02	0.26	0.00	0.21	0.18	0.00	0.19
Y93	ST-39	Yokoguma kitsunezuka	MA?	F	1.5	1.00	1.00	0.43	0.15	0.57	0.41	0.55	0.75	0.11	0.53

						Completeness									
No	**ID**	**Site**	**Age**	**Sex**	**Surface Cond**	**Skull**	**Skull No Sp.**	**Vert**	**Thorax Shoulders**	**Arms**	**Hands**	**Pelvis**	**Legs**	**Feet**	**Full**
Y111	ST-41	Yokoguma kitsunezuka	YA	F	2.0	0.10	0.11	0.46	0.11	0.17	0.16	0.47	0.74	0.31	0.33
Y94	ST-66	Yokoguma kitsunezuka	Adol-YA	M	2.5	0.73	0.77	0.28	0.22	0.64	0.00	0.34	0.63	0.00	0.41

Table 6: Yayoi trauma data. The "No" denotes the sample number within this thesis. The "Med-High Viol" indicates Medium–High likelihood violent trauma and the "Low Viol" indicates Low likelihood violent trauma. In the "Trauma Area" column "ST" denotes skull trauma, "PCT" denotes postcranial trauma, and "FBT" denotes full body trauma. (A = Adult, Adol = Adolescent, YA = young adult, MA = middle adult, OA = old adult)

No	ID	Site	Age	Sex	Trauma Timing	Med-High Viol	Low Viol	Trauma Type	Trauma Area
Y178	124	Doigahama	MA?	M	Peri	X	X	Multi	FBT
Y154	209	Doigahama	MA	M					
Y155	211	Doigahama	MA-OA	F?					
Y156	212	Doigahama	YA	M					
Y157	213	Doigahama	MA-OA	F?					
Y158	216	Doigahama	MA-OA	M?					
Y159	217	Doigahama	MA?	M					
Y160	229	Doigahama	MA-OA	F?					
Y163	231	Doigahama	YA-MA	M?					
Y162	233	Doigahama	YA-MA	I					
Y153	312	Doigahama	YA	F	Ante	X	X	BFT	ST
Y165	409	Doigahama	YA	M			X		
Y164	418	Doigahama	MA-OA	M			X		
Y151	421	Doigahama	MA	F?	Ante	X		BFT	FBT
Y168	422	Doigahama	YA	F					
Y167	912	Doigahama	MA?	M			X		
Y166	1105	Doigahama	MA	M?	Ante	X		BFT	ST
Y152	1116	Doigahama	MA	M	Ante	X		BFT	ST
Y161	229a	Doigahama	A	F?					
Y170	A-5	Hirota	YA-MA	F?					
Y171	A-8	Hirota	YA-MA	M	Ante	X		BFT	ST

No	ID	Site	Age	Sex	Trauma Timing	Med-High Viol	Low Viol	Trauma Type	Trauma Area
Y172	C-2	Hirota	YA	M	Ante	X		Multi	ST
Y173	C-5	Hirota	YA	F	Multi	X		Multi	FBT
Y174	C-8	Hirota	MA	M			X		
Y175	D-II-1	Hirota	YA	F			X		
Y176	D-II-3	Hirota	YA	F	Ante	X		BFT	ST
Y177	D-III-2	Hirota	YA	M	Ante	X		BFT	ST
Y41	K102	Kanenokuma	YA	M	Ante	X		BFT	ST
Y45	K103	Kanenokuma	A	M					
Y46	K113	Kanenokuma	MA	F			X		
Y47	K119	Kanenokuma	YA	M?					
Y48	K125	Kanenokuma	A	M					
Y2	K13	Kanenokuma	A	M	Peri	X		SFT	PCT
Y49	K130	Kanenokuma	MA	F			X		
Y50	K139	Kanenokuma	MA?	F?	Ante	X		BFT	ST
Y51	K140	Kanenokuma	MA?	F					
Y52	K141	Kanenokuma	OA	M					
Y53	K175	Kanenokuma	A	M					
Y54	K177	Kanenokuma	A	M					
Y55	K215	Kanenokuma	YA	M					
Y56	K229	Kanenokuma	MA	M	Ante	X		BFT	ST
Y72	K238	Kanenokuma	YA	F					
Y73	K272	Kanenokuma	OA	F					
Y42	K29	Kanenokuma	MA	F					
Y3	K35	Kanenokuma	YA	M					
Y82	K364	Kanenokuma	A	M					

No	ID	Site	Age	Sex	Trauma Timing	Med-High Viol	Low Viol	Trauma Type	Trauma Area
Y1	K5	Kanenokuma	MA	F					
Y4	K56	Kanenokuma	YA-MA	F					
Y5	K61	Kanenokuma	YA	M	Ante	X	X	BFT	ST
Y6	K64	Kanenokuma	MA	M					
Y7	K72	Kanenokuma	OA	M					
Y8	K76	Kanenokuma	YA	M					
Y43	K79	Kanenokuma	YA	M	Ante	X	X	BFT	ST
Y38	K83	Kanenokuma	MA	F					
Y44	K89	Kanenokuma	MA	F					
Y39	K93	Kanenokuma	MA	M?					
Y40	K96	Kanenokuma	MA	M					
Y147	35	Kōra	MA	F			X		
Y146	36	Kōra	MA	F			X		
Y144	44	Kōra	YA-MA	M	Ante	X		BFT	ST
Y141	67	Kōra	MA	M	Ante	X	X	BFT	ST
Y140	68	Kōra	YA-MA	M			X		
Y148	1411	Kōra	YA	M					
Y142	60 の 1	Kōra	OA	F					
Y149	山本 III	Kōra	MA	M			X		
Y150	近藤 I	Kōra	MA	F					
Y101	5	Minamikata	MA	F					
Y102	6	Minamikata	Child	I					
Y100	9	Minamikata	MA	F?					
Y97	7 • 8 - A	Minamikata	YA?	M	Peri	X		SFT	PCT
Y98	7 • 8 - B	Minamikata	A	M?					

No	ID	Site	Age	Sex	Trauma Timing	Med-High Viol	Low Viol	Trauma Type	Trauma Area
Y99	7 • 8 - C	Minamikata	A	I					
Y57	1	Mitsunagata	A	F					
Y58	2	Mitsunagata	A	M					
Y59	3	Mitsunagata	MA?	F					
Y62	4	Mitsunagata	MA?	M					
Y61	5	Mitsunagata	MA?	M	Ante	X		BFT	ST
Y60	7	Mitsunagata	A	F					
Y69	8	Mitsunagata	MA?	M?					
Y63	9	Mitsunagata	A	M					
Y65	10	Mitsunagata	MA?	M					
Y68	11	Mitsunagata	A	M					
Y67	12	Mitsunagata	MA?	M?					
Y66	13	Mitsunagata	MA-OA?	M					
Y64	14	Mitsunagata	A	F?					
Y70	32	Mitsunagata	YA	M	Peri	X		Penetrating	PCT
Y71	101	Mitsunagata	MA	M					
Y74	104	Mitsunagata	MA	M	Ante	X	X	BFT	ST
Y75	124	Mitsunagata	A	M					
Y76	125	Mitsunagata	A	M					
Y78	126	Mitsunagata	MA	M					
Y77	127	Mitsunagata	MA	M	Ante	X		BFT	ST
Y83	1B1	Mitsunagata	MA?	M					
Y79	A1	Mitsunagata	MA?	M					
Y81	A2	Mitsunagata	A	F					
Y80	A3	Mitsunagata	A	F					

No	ID	Site	Age	Sex	Trauma Timing	Med-High Viol	Low Viol	Trauma Type	Trauma Area
Y11	K10	Nagaoka	MA	M	Ante	X		Multi	ST
Y12	K11	Nagaoka	YA?	I					
Y14	K12	Nagaoka	OA	M					
Y15	K15	Nagaoka	OA	F					
Y16	K24	Nagaoka	YA	M					
Y13	K25	Nagaoka	Adol?	I					
Y17	K26	Nagaoka	YA	F					
Y18	K30	Nagaoka	MA	F					
Y19	K32	Nagaoka	A	M			X		
Y20	K33	Nagaoka	YA	F					
Y21	K36	Nagaoka	MA	F					
Y22	K38	Nagaoka	YA	F					
Y23	K39	Nagaoka	YA	F					
Y24	K48	Nagaoka	YA-MA	M					
Y10	K9	Nagaoka	MA	M			X		
Y32	SK100	Nagaoka	Adol	M	Peri	X		Penetrating	PCT
Y25	SK49	Nagaoka	YA	F					
Y26	SK55	Nagaoka	YA?	F					
Y27	SK78	Nagaoka	YA-MA	M			X		
Y28	SK90	Nagaoka	A	M					
Y29	SK93	Nagaoka	MA	M	Peri	X		SFT	PCT
Y30	SK95	Nagaoka	MA	M	Multi	X		Penetrating	PCT
Y31	SK97	Nagaoka	YA	M					
Y33	SK98	Nagaoka	YA	M					
Y96	906-3	Nakanohama	YA-MA	M			X		

No	ID	Site	Age	Sex	Trauma Timing	Med-High Viol	Low Viol	Trauma Type	Trauma Area
Y84	E-1-a	Nakanohama	MA?	M					
Y85	E-1-b	Nakanohama	MA?	M					
Y86	E-2-1	Nakanohama	Infant	I					
Y87	E-2-2	Nakanohama	YA	M					
Y88	F-2-1? (cist)	Nakanohama	YA	F?					
Y135	G-1 No.1	Nakanohama	YA	M					
Y136	G-1-2 No.1	Nakanohama	Adol-YA	F	Peri	X		SFT	PCT
Y138	G-1-2 No.2	Nakanohama	MA	M			X		
Y137	G-1-2 No.3	Nakanohama	OA	F					
Y132	G-3-1 No.7357	Nakanohama	A	M?	Ante	X		BFT	ST
Y131	G-3-1-1-その 1	Nakanohama	YA	F?					
Y134	G-3-1-1-その 2	Nakanohama	MA	M	Ante	X	X	BFT	ST
Y89	G-3-6	Nakanohama	MA	F					
Y90	G-4-2-B	Nakanohama	YA	M					
Y91	G-4-3-b	Nakanohama	MA	M					
Y139	H-1-2 No.1	Nakanohama	YA	F					
Y92	I-4-1	Nakanohama	YA	F					
Y133	藤田 A (Fujita A)	Nakanohama	MA?	M			X		
Y112	1-1 号	Ōtomo	YA-MA	M			X		
Y113	2-1 号	Ōtomo	MA	M	Ante	X		BFT	ST
Y116	6 号	Ōtomo	MA	M	Ante	X		BFT	ST
Y117	8 号	Ōtomo	MA-OA	F					

No	ID	Site	Age	Sex	Trauma Timing	Med-High Viol	Low Viol	Trauma Type	Trauma Area
Y118	SK24	Ōtomo	MA	M					
Y119	SK31	Ōtomo	YA	F					
Y120	SK35	Ōtomo	MA	M	Ante	X		BFT	ST
Y129	C4	Ōtomo	YA-MA	M					
Y130	D1	Ōtomo	YA	M					
Y128	K1	Ōtomo	MA	F					
Y179	3 号	Shibu	YA	F	Peri	X		Multi	FBT
Y180	4 号	Shibu	YA	M?	Peri	X		Multi	FBT
Y36	9	Shinmachi	OA	M	Ante	X		BFT	ST
Y34	19-1	Shinmachi	MA	M					
Y37	24-1	Shinmachi	MA	M	Ante	X		Penetrating	PCT
Y35	19-2	Shinmachi	A	M?					
Y9	K3	Sudare	MA-OA	M	Ante	X		Multi	FBT
Y121	10 号	Tsukomuta 4	MA-OA	M			X		
Y125	11 号	Tsukomuta 4	YA	F					
Y124	21 号	Tsukomuta 4	MA	M	Ante	X		BFT	ST
Y123	25 号	Tsukomuta 4	Adol-YA	M	Peri	X		SFT	PCT
Y105	ST-107	Yokoguma kitsunezuka	YA-MA	F					
Y106	ST-110	Yokoguma kitsunezuka	YA	F					
Y95	ST-122	Yokoguma kitsunezuka	YA	M	Ante	X		BFT	ST
Y127	ST-128	Yokoguma kitsunezuka	MA	M	Ante	X		BFT	ST
Y110	ST-131	Yokoguma kitsunezuka	Adol-YA	M					
Y107	ST-140	Yokoguma kitsunezuka	MA	F			X		
Y108	ST-142	Yokoguma kitsunezuka	Adol-YA	M?					
Y109	ST-144	Yokoguma kitsunezuka	MA	M					

No	ID	Site	Age	Sex	Trauma Timing	Med-High Viol	Low Viol	Trauma Type	Trauma Area
Y126	ST-148	Yokoguma kitsunezuka	YA	M					
Y103	ST-188	Yokoguma kitsunezuka	OA	M					
Y104	ST-202	Yokoguma kitsunezuka	YA?	M					
Y93	ST-39	Yokoguma kitsunezuka	MA?	F					
Y111	ST-41	Yokoguma kitsunezuka	YA	F	Peri	X		SFT	PCT
Y94	ST-66	Yokoguma kitsunezuka	Adol-YA	M			X		

Table 7: Itoku site preservation and trauma data. "No" refers to the sample number within this thesis. (A = Adult, Adol = Adolescent, YA = young adult, MA = middle adult, OA = old adult)

No	ID	Site	Prefecture	Period (Jōmon)	Age	Sex	Surface Condition	Element	Element Completeness	Trauma Likelihood
J260	J004	Itoku	Kochi	Final	A	I	1.0	R Femur	0.19	Low
J261	J009	Itoku	Kochi	Final	A	I	2.0	L Femur	0.25	Low
J262	J002	Itoku	Kochi	Final	A	I	2.5	L Femur	0.36	Low
J263	J005	Itoku	Kochi	Final	A	I	1.5	L Femur	0.16	Low
J264	J015	Itoku	Kochi	Final	A	I	1.0	L Humerus	0.08	Low
J265	J003	Itoku	Kochi	Final	A	I	1.0	L Femur	0.31	Low
J266	J001	Itoku	Kochi	Final	A	I	1.0	R Tibia	0.36	
J267	J006	Itoku	Kochi	Final	A	I	1.0	R Femur	0.24	
J268	J008	Itoku	Kochi	Final	A	I	1.0	L Femur	0.08	
J269	J018	Itoku	Kochi	Final	A	I	1.0	R Humerus	0.06	

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CATALOGUE II: DOCUMENTATION AND EVALUATION OF TRAUMATIC INJURIES

The following section provides details for all traumatic injuries that were considered as possibly having a violent cause. For each individual traumatic injuries are numbered and evaluated as follows:

- Header: SITE & ID | AGE | SEX | PERIOD
- *Likelihood of traumatic injury*
    - The likelihood of the injury being traumatic in aetiology is provided here. See the Methodology for additional details about this two-tiered ranking system.
- *Likelihood of being violence-related*
    - The likelihood of the injury being related to human violent conflict is provided here. See the Methodology for additional details about this two-tiered ranking system and for details regarding which kinds of injuries in different parts of the body are more likely to be regarded as Medium–High within this ranking.
- *Timing*
    - Whether an abnormality appears to be antemortem, perimortem, or postmortem is provided here. Uncertainty about this determination is also noted when necessary.
- *Assessment of traumatic aetiology*
    - A description of the abnormality, differential diagnosis, and other comments as necessary regarding how the lesion was classified in this study are provided here.
    - Healed BFT or stress/compression fractures to the vertebra are noted when present, but not described in detail as they are not likely to be related to violent trauma.
- *Dimensions*
    - Dimensions for lesions are provided here. Note that, when present, the scale in the photographs is 1 cm.

- *Previously Reported In*
    - References for previous analysis of particular lesions are provided here.
- *Photographs of the lesions*
- *Completeness and trauma maps*
    - These were only made for individuals with trauma ranked as Medium-High likelihood of being the result of violence. Note that at times the line features representing trauma have been extruded from the surface of the bone in order to increase visibility. Additionally, the completeness of ribs, hands, and feet was at times recorded in bulk depending on how fragmentary the remains were in the interest of time. Hence, Catalogue I has the particular values for these areas, but they were not always represented visually here.

INDIVIDUALS

JŌMON PERIOD 縄文時代 **XCV**

Einomaru 10? | Adult | Female | Late Jōmon XCVI
Inariyama 210 | Adolescent | Female? | Final Jōmon XCVII
Inariyama 249 | Mid-Old Adult | Female | Final Jōmon XCIX
Inariyama 251 | Young Adult | Male | Final Jōmon CII
Inariyama 254 | Young Adult | Indet. | Final Jōmon–Middle Yayoi CIV
Inariyama 255 | Mid-Old Adult | Indet. | Final Jōmon–Middle Yayoi CV
Itoku J002 | Adult | Indet. | Final Jōmon CVIII
Itoku J003 | Adult | Indet. | Final Jōmon CXII
Itoku J004 | Adult | Indet. | Final Jōmon CXIII
Itoku J005 | Adult | Indet. | Final Jōmon CXV
Itoku J009 | Adult | Indet. | Final Jōmon CXVII
Itoku J015 | Adult | Indet. | Final Jōmon CXIX
Toyomatsu-Domen Cave 78-1 | Young Adult | Female | Late Jōmon CXXI
Tsukumo 20 | Mid-Adult | Female | Late-Final Jōmon CXXIV
Tsukumo 24 | Young–Mid Adult | Male | Final Jōmon CXXV
Tsukumo 36 | Mid-Adult | Male | Late-Final Jōmon CXXVIII
Tsukumo 38 | Old Adult | Female | Late-Final Jōmon CXXX
Tsukumo 46 | Mid-Old Adult | Male | Late-Final Jōmon CXXXII
Tsukumo 65 | Young-Mid Adult | Male | Late-Final Jōmon CXXXV
Tsukumo 35 A? | Adult | Male | Late-Final Jōmon CXXXVII
Yamaga 9 | Mid-Old Adult? | Female | Mid Late Jōmon CXXXIX
Yamaga 18 | Mid-Adult | Male | Mid Late Jōmon CXLI
Yoshigo 360-1 | Young Adult | Female | Late-Final Jōmon CXLIV
Yoshigo 375 | Mid-Adult | Male | Late-Final Jōmon CXLVII
Yoshigo 378 | Mid-Old Adult | Female | Late-Final Jōmon CL

YAYOI PERIOD 弥生時代 **CLIV**

Doigahama 124 | Mid Adult? | Male | Early-Middle Yayoi CLV
Doigahama 312 | Young Adult | Female | Early-Middle Yayoi CLXXIX
Doigahama 409 | Young Adult | Male | Early-Middle Yayoi CLXXXII
Doigahama 418 | Mid–Old Adult | Male | Early-Middle Yayoi CLXXXV
Doigahama 421 | Mid Adult | Female | Early-Middle Yayoi CXCI
Doigahama 912 | Mid Adult? | Male | Early Yayoi CC
Doigahama 1105 | Mid Adult | Male? | Early-Middle Yayoi CCII
Doigahama 1116 | Mid Adult | Male | Yayoi CCV
Hirota A-8 | Young–Mid Adult | Male | Late Yayoi CCIX
Hirota C-2 | Young Adult | Male | Late Yayoi CCXVII
Hirota C-5 | Young Adult | Male | Late Yayoi CCXXI
Hirota C-8 | Mid Adult | Male | Late Yayoi CCXXXIII
Hirota D-II-1 | Young Adult | Female | Late Yayoi CCXXXVIII
Hirota D-II-3 | Young Adult | Female | Late Yayoi CCXXXIX
Hirota D-III-2 | Young Adult | Male | Late Yayoi CCXLVI
Kanenokuma K13 | Adult | Male | Mid Middle Yayoi CCLVIII
Kanenokuma K61 | Young Adult | Male | Mid Middle Yayoi CCLXI
Kanenokuma K79 | Young Adult | Male | Early Half of Middle Yayoi CCLXIV
Kanenokuma K102 | Young Adult | Male | End of Early Yayoi CCLXVIII
Kanenokuma K113 | Mid-Adult | Female | Mid of Middle Yayoi CCLXXI
Kanenokuma K130 | Mid-Adult | Female | Mid of Middle Yayoi CCLXXII
Kanenokuma K139 | Mid-Adult? | Female? | Early Half of Late Yayoi CCLXXIII
Kanenokuma K229 | Mid-Adult | Male | Early Half of Middle Yayoi CCLXXV
Kanenokuma K272 | Old Adult | Female | Late Half of Middle Yayoi CCLXXVIII
Kōra 35 | Mid Adult | Female | Early Yayoi CCLXXIX
Kōra 36 | Mid Adult | Female | Early Yayoi CCLXXXV
Kōra 44 | Young–Mid Adult | Male | Early Yayoi CCXCI
Kōra 67 | Mid Adult | Male | Early Yayoi CCXCV
Kōra 68 | Young–Mid Adult | Male | Early Yayoi CCCII
Kōra 山本 III (Yamamoto III) | Mid Adult | Male | Early Yayoi CCCV

Minamikata 7 • 8 | Adult | Indet. | Middle Yayoi? CCCVIII
Minamikata 7 • 8 | Young Adult? | Male? | Middle Yayoi? CCCX
Mitsunagata 5 | Mid-Adult? | Male | Middle to Late Yayoi CCCXII
Mitsunagata 32 | Young Adult | Male | Middle to Late Yayoi CCCXIV
Mitsunagata 104 | Mid-Adult | Male | Early Half of Late Yayoi CCCXVI
Mitsunagata 127 | Mid-Adult | Male | Middle to Late Yayoi CCCXIX
Nagaoka K9 | Mid-Adult | Male | Early Half of Middle Yayoi CCCXXII
Nagaoka K10 | Mid Adult | Male | Mid Middle Yayoi CCCXXIII
Nagaoka K32 | Adult | Male | Early Half of Middle Yayoi CCCXXVIII
Nagaoka SK78 | Young-Mid Adult | Male | Early Half of Middle Yayoi CCCXXIX
Nagaoka SK93 | Mid Adult | Male | Middle Yayoi CCCXXX
Nagaoka SK95 | Mid-Adult | Male | Middle Yayoi CCCXXXV
Nagaoka SK100 | Adolescent (>16 yrs.) | Male | Middle Yayoi CCCXL
Nakanohama 906-3 | Young-Mid Adult | Male | Mid Middle-Late Yayoi CCCXLIII
Nakanohama G-3-1 No.7357 | Adult | Male? | Early-Middle Yayoi CCCXLV
Nakanohama 藤田 A (Fujita A) | Mid Adult? | Male | Yayoi CCCXLVIII
Nakanohama G-3-1-1-その 2 | Mid Adult | Male | Early-Middle Yayoi CCCL
Nakanohama G-1-2 No.1 | Adolescent-Yong Adult | Female | Early-Middle Yayoi CCCLIII
Nakanohama G-1-2 No.2 | Mid Adult | Male | Early-Middle Yayoi CCCLVIII
Ōtomo 1-1 | Young-Mid Adult | Male | Late Half of Early Yayoi CCCLX
Ōtomo 2-1 | Mid Adult | Male | End of the Early Yayoi CCCLXII
Ōtomo 6 | Mid Adult | Male | Initial Yayoi CCCLXV
Ōtomo SK35 | Mid Adult | Male | Early Yayoi CCCLXVIII
Ōtomo K1 | Mid Adult | Female | End of the Early Yayoi CCCLXXI
Shibu 3 | Young Adult | Female | Yayoi CCCLXXII
Shibu 4 | Young Adult | Male | Yayoi CCCLXXXVII
Shinmachi 9 | Old Adult | Male | Early Yayoi CDII
Shinmachi 24-1 | Mid-Adult | Male | Middle Yayoi CDIV
Sudare K3 | Mid-Old Adult | Male | Mid Middle Yayoi CDVII
Tsukomuta 4 10 | Mid-Old Adult | Male | Middle Yayoi CDXI
Tsukomuta 4 21 | MidAdult | Male | Middle Yayoi CDXII
Tsukomuta 4 25 | Adolescent-Yong Adult | Male | Middle Yayoi CDXV
Yokoguma kitsunezuka ST-41 | Young Adult | Female | Middle Yayoi CDXIX
Yokoguma kitsunezuka ST-66 | Adolescent-Young Adult | Male | Middle Yayoi CDXXIII
Yokoguma kitsunezuka ST-122 | Young Adult | Male | Middle Yayoi CDXXIV
Yokoguma kitsunezuka ST-128 | Mid Adult | Male | Middle Yayoi CDXXVII
Yokoguma kitsunezuka ST-140 | Mid Adult | Female | Middle Yayoi CDXXXI

KOFUN PERIOD 古墳時代 **CDXXXII**

Kōra 48 | Adolescent | Female | Kofun CDXXXIII
Ōtomo 17-1 | Mid Adult | Male | Early Kofun? CDXXXV
Ōtomo 17-3 | Young Adult? | Female | Early Kofun? CDXXXIX

FIGURE A2: EINOMARU 10? LEFT SIDE OF THE FRONTAL BONE (LATERAL TO THE FRONTAL BOSS) SHOWING A VASCULAR GROOVE WHICH MIMICS SOME OF THE CHARACTERISTICS OF AN ANTEMORTEM CUT MARK. ... XCVI
FIGURE A3: INARIYAMA 210 LEFT, LATERAL VIEW OF THE CRANIA. ARROW INDICATES THE AREA OF INTEREST (WHICH CAN BE SEEN IN GREATER DETAIL IN FIG A4). XCVIII
FIGURE A4: INARIYAMA 210 SUPERIOR, LATERAL VIEW OF THE LEFT PARIETAL BONE SHOWING TWO LINEAR MARKS AND A SCRAPING MARK. XCVIII
FIGURE A5: INARIYAMA 249 RIGHT, LATERAL VIEW OF THE CRANIA..... XCIX
FIGURE A6: INARIYAMA 249 CIRCULAR HOLE ON THE SQUAMA OF THE RIGHT TEMPORAL BONE. C
FIGURE A7: INARIYAMA 249 SUPERIOR VIEW OF THE RIGHT PARIETAL BONE SHOWING THE SEMI-CIRCULAR MARGIN SUSPECTED TO HAVE BEEN ASSOCIATED WITH AN OVAL-SHAPED BLUNT FORCE INJURY. C
FIGURE A8: INARIYAMA 251 SUPEROANTERIOR VIEW OF THE CRANIA. CII
FIGURE A9: INARIYAMA 251 POROUS DEPRESSION ON THE SUPERIOR FRONTAL BONE. CIII
FIGURE A10: INARIYAMA 254 RIGHT FRONTAL BONE SHOWING LIKELY TRAMPLING MARKS. CIV
FIGURE A11: INARIYAMA 255 RIGHT PARIETAL BONE (POSTERIOR SIDE IS TO THE LEFT SIDE OF THE PHOTO) SHOWING TWO DEPRESSED FRACTURES. CVI
FIGURE A12: INARIYAMA 255 RIGHT PARIETAL BONE INNER TABLE SHOWING HEALING FRACTURE LINE. CVI
FIGURE A13: ITOKU J002 PROXIMAL LEFT FEMUR LINEAR ABNORMALITY. CIX
FIGURE A14: ITOKU J002 CLOSE-UP OF LINEAR DEFORMITY ON PROXIMAL LEFT FEMUR SHOWING ITS JAGGED EDGES. CIX
FIGURE A15: ITOKU J002 HOLE IN THE DISTAL LEFT FEMUR. CX
FIGURE A16: ITOKU J002 CLOSE UP OF HOLE IN THE DISTAL LEFT FEMUR. CX
FIGURE A17: ITOKU J002 POSTERIOR VIEW OF THE DISTAL LEFT FEMUR. CXI
FIGURE A18: ITOKU J003 LEFT FEMUR SHOWING PAIRED TAPHONOMIC LESIONS. CXII
FIGURE A19: ITOKU J004 RIGHT FEMUR SHOWING TWO SETS OF LINEAR MARKS ATTRIBUTED TO SCAVENGING. CXIV
FIGURE A20: ITOKU J004 CLOSE-UP OF LINEAR MARKS FOUND ON THE RIGHT FEMUR. CXIV
FIGURE A21: ITOKU J005 LEFT FEMUR SHOWING SERIES OF LINEAR MARKS ARRANGED IN ROWS OF THREE..... CXV
FIGURE A22: ITOKU J005 CLOSE-UP OF DISTAL DIAPHYSIS OF THE LEFT FEMUR SHOWING POSTMORTEM DAMAGE TO THE BONE..... CXVI
FIGURE A23: J009 LEFT FEMUR LINEA ASPERA SHOWING LIKELY TAPHONOMIC DAMAGE. THE SCALE IS 1 CM. CXVIII
FIGURE A24: J009 LEFT FEMUR SHOWING TAPHOMIC DAMAGE. CXVIII
FIGURE A25: ITOKU J015 LEFT HUMERUS SHOWING PATINATED TOOTH MARKS. CXIX
FIGURE A26: ITOKU J015 CLOSE-UP OF LESIONS ON LEFT HUMERUS. CXX
FIGURE A27: TOYOMATSU-DOMEN CAVE 78-1 POSTEROLATERAL VIEW OF THE RIGHT SIDE OF THE MANDIBLE SHOWING A SMALL CUT MARK. CXXI
FIGURE A28: TOYOMATSU-DOMEN CAVE 78-1 POSTERIOR CLOSE-UP OF THE RIGHT SIDE OF THE MANDIBLE SHOWING A SMALL CUT MARK. CXXII
FIGURE A29: TOYOMATSU-DOMEN CAVE 78-1 POSTERIOR CLOSE-UP OF THE RIGHT SIDE OF THE MANDIBLE SHOWING A SMALL CUT MARK. CXXII
FIGURE A30: TSUKUMO 20 RIGHT ULNA SHOWING AN ORGANISED CALLOUS AND LOCALISED POROSITY. CXXIV
FIGURE A31: TSUKUMO 24 POSTEROSUPERIOR VIEW OF THE PARIETAL BONES SHOWING APPROXIMATELY THREE SHALLOW, POROUS DEPRESSIONS. CXXVI
FIGURE A32: TSUKUMO 24 ATLAS AND AXIS SHOWING OSTEOPHYTE FORMATION ON THE ATLAS AND THE MISSING ODONTOID PROCESS AND IRREGULAR AND POROUS SURFACE IN ITS PLACE ON THE AXIS. CXXVII
FIGURE A33: TSUKUMO 36 SUPEROLATERAL VIEW OF THE RIGHT PARIETAL BONE SHOWING A POSSIBLE DEPRESSED FRACTURE..... CXXVIII
FIGURE A34: TSUKUMO 38 LEFT PARIETAL BONE SHOWING A POSSIBLE HEALED DEPRESSED FRACTURE..... CXXX
FIGURE A35: TSUKUMO 46 FRONTAL BONE SHOWING SMALL OVAL DEPRESSION. CXXXII
FIGURE A36: TSUKUMO 46 CLOSE-UP OF POROUS, OVAL DEPRESSION ON THE FRONTAL BONE. CXXXIII
FIGURE A37: TSUKUMO 65 RADII AND ULNAE ANTERIOR VIEW. NOTE THE ABNORMAL MORPHOLOGY OF THE RIGHT RADIUS. CXXXV
FIGURE A38: TSUKUMO 65 RADII AND ULNAE POSTERIOR VIEW. NOTE THE ABNORMAL MORPHOLOGY OF THE RIGHT RADIUS. CXXXVI
FIGURE A39: TSUKUMO 35 A? SUPEROLATERAL VIEW OF THE CRANIA SHOWING CURVED FRACTURE LINES. CXXXVII
FIGURE A40: TSUKUMO 35 A? ANTERIOR VIEW OF THE CRANIA SHOWING CURVED FRACTURE LINES. CXXXVIII
FIGURE A41: YAMAGA 9 ANTERIOR VIEW OF THE MAXILLAE SHOWING A POROUS DEPRESSION ON THE RIGHT MAXILLA..... CXXXIX
FIGURE A42: YAMAGA 18 SUPEROLATERAL VIEW OF THE FRONTAL BONE SHOWING A POROUS DEPRESSION WITH A HOLE IN THE CENTRE. CXLII
FIGURE A43:YOSHIGO 360-1 SUPERIOR RIGHT FRONTAL BONE SHOWING CURVED FRACTURE ARC. CXLIV

FIGURE A44: YOSHIGO 360-1 CLOSE UP OF SUPERIOR RIGHT FRONTAL BONE SHOWING CURVED FRACTURE ARC. CXLV
FIGURE A45: YOSHIGO 375 LATERAL VIEW SHOWING POSSIBLE HEALING PENETRATING TRAUMA OR TREPANATION ON THE SUPERIOR LEFT PARIETAL BONE. CXLVIII
FIGURE A46: YOSHIGO 375 CLOSE-UP VIEW OF HOLE AND HEALING AROUND IT. NOTE THE OSTEOCLASTIC AND OSTEOBLASTIC ACTIVITY AND SMOOTH MARGINS. CXLVIII
FIGURE A47: YOSHIGO 375 INTERNAL VIEW OF THE DEFECT (ANTERIOR IS UP). NOTE THE POROSITY AND SMOOTH MARGINS..... CXLIX
FIGURE A48: YOSHIGO 378 SUPERIOR VIEW SHOWING A POSSIBLE INSTANCE OF PENETRATING TRAUMA TO THE LEFT PARIETAL BONE. NOTE THE SHARP EDGES AND RADIATING FRACTURES. CLI
FIGURE A49: YOSHIGO 378 CLOSE-UP SHOWING THE INTERNAL BEVEL OF THE POTENTIAL PENETRATING TRAUMA. ANTERIOR IS UP. CLI
FIGURE A50: YOSHIGO 378 SUPEROLATERAL RIGHT PARIETAL BONE SHOWING LINEAR MARKS AND SCRAPPING MARKS LIKELY REPRESENTING TRAMPLING..... CLII
FIGURE A51: DOIGAHAMA 124 ANTEROSUPERIOR VIEW OF THE FRONTAL BONE SHOWING AN ELLIPTICAL, SHARP, PATINATED PERFORATION..... CLXI
FIGURE A52: DOIGAHAMA 124 FRONTAL BONE INNER TABLE SHOWING THE INTERNAL BEVEL ASSOCIATED WITH THE PERFORATION. ANTERIOR IS UP. CLXII
FIGURE A53: DOIGAHAMA 124 FRONTAL BONE SHOWING EXTENSIVE PERIMORTEM FRACTURING AROUND THE SUPRANASAL SUTURE. CLXII
FIGURE A54: DOIGAHAMA 124 FRONTAL BONE ENDOCRANIAL VIEW SHOWING EXTENSIVE PERIMORTEM FRACTURING AROUND THE SUPRANASAL SUTURE. CLXIII
FIGURE A55: DOIGAHAMA 124 RIGHT MANDIBLE SHOWING PERIMORTEM FRACTURES THROUGH THE CORPUS OF THE BONE AND CROWN AND ROOT OF THE SECOND MOLAR. CLXIII
FIGURE A56: DOIGAHAMA 124 LATERAL VIEW OF THE CRANIUM SHOWING A SMOOTH, CURVED FRACTURE LINE GOING THROUGHT THE RIGHT PARIETAL BONE AND OCCIPITAL. NOTE THE PATINATED, SEMI-CIRCULAR POCKET OF BONE WHICH HAS BROCKEN OFF. CLXIV
FIGURE A57: DOIGAHAMA 124 LATERAL VIEW OF THE CRANIUM SHOWING A POSSIBLE PERIMORTEM FRACTURE LINE THROUGH THE LEFT PARIETAL BONE AND OCCIPITAL. CLXIV
FIGURE A58: DOIGAHAMA 124 ENDOCRANIAL VIEW OF THE LEFT PARIETAL BONE SHOWING A PATINATED INTERNAL BEVEL. CLXV
FIGURE A59: DOIGAHAM 124 SEVENTH THORACIC VERTEBRA SHOWING A SEMI-CIRCULAR, PATINATED PERFORATION TO THE LAMINA..... CLXV
FIGURE A60: DOIGAHAMA 124 TENTH THORACIC VERTEBRA SHOWING A PERIMORTEM PERFORATION TO THE VERTEBRAL BODY..... CLXVI
FIGURE A61: DOIGAHAMA 124 TENTH THORACIC VERTEBRA SHOWING A DEEP LINEAR MARK TO THE LAMINA. CLXVI
FIGURE A62: DOIGAHAMA 124 ELEVENTH THORACIC VERTEBRA INFERIOR VIEW OF THE VERTEBRAL BODY SHOWING AN EMBEDDED PROJECTILE POINT..... CLXVII
FIGURE A63: DOIGAHAMA 124 ELEVENTH THORACIC VERTEBRA SHOWING A CUT MARK ON THE LAMINA CORRESPONDING TO THE CUT MARK ON THE TENTH THORACIC VERTEBRA. CLXVII
FIGURE A64: DOIGAHAMA 124 TWELFTH THORACIC VERTEBRA SUPERIOR VIEW OF THE VERTEBRAL BODY SHOWING AN EMBEDDED PROJECTILE POINT..... CLXVIII
FIGURE A65: DOIGAHAMA 124 TWELFTH THORACIC VERTEBRA SHOWING A POTENTIAL PERIMORTEM FRACTURE TO THE LAMINA AND INFERIOR ARTICULAR FACET. CLXVIII
FIGURE A66: DOIGAHAMA 124 THIRD LUMBAR VERTEBRA SHOWING A POSSIBLE PERIMORTEM FRACTURE TO THE RIGHT TRANSVERSE PROCESS. CLXIX
FIGURE A67: DOIGAHAMA 124 FOURTH LUMBAR VERTEBRA SHOWING A DEEP CUT MARK TO THE BODY..... CLXIX
FIGURE A68: DOIGAHAMA 124 LEFT ILIUM LATERAL VIEW SHOWING A CIRCULAR PENETRATING WOUND AND A LINEAR MARK TO THE ILIAC CREST. CLXX
FIGURE A69: DOIGAHAMA 124 SUPEROMEDIAL VIEW OF THE LEFT OS COXA AND SACRUM SHOWING A CIRCULAR PENETRATING WOUND TO THE ILIUM AND A LINEAR MARK WITH AN EMBEDDED PROJECTILE POINT ANTERIOR TO THE GREATER SCIATIC NOTCH. CLXX
FIGURE A70: DOIGAHAMA 124 POSERIOR VIEW OF THE RIGHT OS COXA SHOWING A PENETRATING WOUND TO THE SUPERIOR ISCHIUM..... CLXXI
FIGURE A71: DOIGAHAMA 124 RIGHT OS COXA SHOWING AN EMBEDDED PROJECTILE POINT IN THE PUBIS. CLXXI
FIGURE A72: DOIGAHAMA 124 MEDIAL ANGLE OF THE RIGHT FIRST RIB SHOWING A POTENTIAL CUT MARK.. CLXXII
FIGURE A73: DOIGAHMA 124 MEDIAL VIEW OF THE RIGHT SEVENTH RIB'S SHAFT SHOWING A DEEP LINEAR MARK CUTTING THROUGH THE CAUDAL EDGE. CLXXII
FIGURE A74: DOIGAHAMA 124 INFERIOR VIEW OF THE SEVENTH RIGHT RIB SHOWING A DEEP, SHARP LINEAR MARK CUTTING THROUGH THE VERTEBRAL END..... CLXXIII
FIGURE A75: DOIGAHAMA 124 MEDIAL VIEW OF THE ELEVENTH RIB'S SHAFT SHOWING TWO SHARP LINEAR MARKS. CLXXIII

FIGURE A76: DOIGAHAMA 124 SUPEROPOSTERIOR VIEW OF THE LEFT SEVENTH RIB SHOWING AN EMBEDDED PROJECTILE POINT. NOTE THE SHARP POSTERIOR MARGIN OF THE LESION. CLXXIV
FIGURE A77: DOIGHAMA 124 SHAFT OF THE LEFT SEVENTH RIB SHOWING A POTENTIAL PERIMORTEM FRACTURE. CLXXIV
FIGURE A78: DOIGAHAMA 124 MEDIAL VIEW OF THE LEFT ELEVENTH RIB SHOWING A WIDE CHOP MARK TO THE VERTEBRAL END. CLXXV
FIGURE A79: DOIGAHAMA 124 MEDIAL VIEW OF THE LEFT TENTH RIB SHOWING A PATINATED AND SHARP LINEAR MARK. CLXXV
FIGURE A80: DOIGAHAMA 124 RIGHT PATELLA MEDIAL VIEW SHOWING A POTENTIAL AVULSION FRACTURE. CLXXVI
FIGURE A81: DOIGAHAMA 124 LEFT FEMUR SHOWING TWO V-SHAPED AND PATINATED LINEAR MARKS ON THE ANTEROLATERAL DIAPHYSIS. CLXXVI
FIGURE A82: DOIGAHAMA 124 RIGHT TIBIA MEDIAL DIAPHYSIS SHOWING TWO LINEAR MARKS THAT ARE V-SHAPED AND PATINATED. CLXXVII
FIGURE A83: DOIGHAMA 124 FIBULAE SHOWING A POTENTIAL HEALED FRACTURE TO THE LEFT FIBULA. ... CLXXVII
FIGURE A84: DOIGAHAMA 312 POSSIBLE HEALED FRACTURE TO THE NASAL BONES. CLXXX
FIGURE A85: DOIGAHAMA 312 THIRD(?) INTERMEDIATE PHALANX OF THE RIGHT HAND (DORSAL VIEW) SHOWING A DEPRESSED AREA. CLXXX
FIGURE A86: DOIGAHAMA 209 ANTERIOR VIEW OF THE CRANIUM SHOWING A HEALED NASAL FRACTURE. CLXXXIII
FIGURE A87: DOIGAHAMA 409 SHOWING A HEALED FRACTURE TO THE FOURTH RIGHT RIB. CLXXXIII
FIGURE A88: DOIGAHAMA 409 LEFT EIGHTH RIB SHAFT, NEAR THE STERNAL END, SHOWING A HEALED FRACTURE. CLXXXIV
FIGURE A89: DOIGAHMA 409 DORSAL VIEW OF THE LEFT FIRST PROXIMAL AND DISTAL PHALANGES SHOWING A LATERALLY DEFORMED FIRST PHALANX, POROSITY, AND FUSION OF THE TWO PHALANGES. CLXXXIV
FIGURE A90: DOIGAHAMA 418 FOURTH METATARSALS. CLXXXVI
FIGURE A91: DOIGAHAMA 418 HEAD OF THE LEFT FOURTH METATARSAL SHOWING A POSSIBLE HEALED FRACTURE CLXXXVII
FIGURE A92: DOIGAHAMA 418 RIGHT FIFTH(?) RIB SHOWING A POSSIBLE HEALED FRACTURE. CLXXXVII
FIGURE A94: DOIGAHAMA 418 RIGHT EIGHTH(?) RIB ANGLE SHOWING A HYPEROSTOSIS AND A POSSIBLE, VERY FAINT HEALED FRACTURE LINE. CLXXXVIII
FIGURE A93: DOIGAHAMA 418 RIGHT NINTH(?) RIB ANGLE MEDIAL SURFACE SHOWING A CALLUS AND ASSOCIATED POROSITY LIKELY RESULTING FROM A HEALED FRACTURE. CLXXXVIII
FIGURE A95: DOIGAHAMA 418 RIGHT TENTH(?) RIB ANGLE MEDIAL SURFACE SHOWING A CALLUS. NOTE HOW THE RIDGE PROTRUDES SUPERIORLY CLXXXIX
FIGURE A96: DOIGAHAMA 418 LEFT RIB INFERIOR VIEW SHOWING A POSSIBLE PERIMORTEM FRACTURE TO THE ANGLE. NOTE THE SHARP, PATINATED MARGINS. CLXXXIX
FIGURE A97: DOIGAHAMA 418 LEFT RIB MEDIAL VIEW SHOWING A POTENTIAL PERIMORTEM FRACTURE. CXC
FIGURE A98: DOIGAHAMA 418 LEFT RIB SHOWING A POSSIBLE HEALED FRACTURE LINE CXC
FIGURE A99: DOIGAHAMA 421 CLOSE-UP OF THE DEPRESSED FRACTURE TO THE LEFT PARIETAL BONE. CXCIII
FIGURE A100: DOIGAHAMA 421 SUPERIOR VIEW OF THE CRANIA SHOWING A DEPRESSED FRACTURE TO THE LEFT PARIETAL BONE. CXCIII
FIGURE A101: DOIGAHAMA 421 NASAL BONES SHOWING A POSSIBLE FRACTURE TO BOTH DISTALLY. CXCIV
FIGURE A102: DOIGAHAMA 421 RIGHT FOURTH(?) RIB SHAFT SHOWING A POSSIBLE HEALED FRACTURE. CXCIV
FIGURE A103: DOIGAHAMA 421 RIGHT FIFTH(?) RIB SHOWING A POSSIBLE HEALED FRACTURE TO THE SHAFT. NOTE THE INFERIOR DISPLACEMENT OF THE BONE PAST THE DEPRESSED AREA. CXCV
FIGURE A104: DOIGAHAMA 421 POSSIBLE HEALED FRACTURE NEAR THE STERNAL END OF A RIGHT RIB. CXCV
FIGURE A105: DOIGAHAMA 421 LEFT RIB SHOWING A POSSIBLE HEALED FRACTURE NEAR THE STERNAL END. CXCVI
FIGURE A106: DOIGAHAMA 421 RIGHT RIB SHOWING A POSSIBLE HEALED FRACTURE NEAR THE STERNAL END. CXCVI
FIGURE A107: DOIGAHAMA 421 RIGHT RIB NEAR THE STERNAL END SHOWING A LIKELY HEALED FRACTURE. CXCVII
FIGURE A108: DOIGAHAMA 421 LEFT RIB FRAGMENT SHOWING A DEPRESSED AREA. CXCVII
FIGURE A109: DOIGAHAMA 421 HYOID BONE SUPERIOR VIEW SHOWING A POSSIBLE HEALED FRACTURE. CXCVIII
FIGURE A110: DOIGAHAMA 421 CLOSE-UP OF POSSIBLE FRACTURE TO THE HYOID BONE. CXCVIII
FIGURE A111: DOIGAHAMA 912 LATERAL VIEW OF THE CRANIA SHOWING A HEALED LINEAR FRACTURE TO THE LEFT SPHENOID AND PARIETAL BONES. CCI
FIGURE A112: DOIGAHAMA 912 POSTERIOR VIEW OF THE LEFT PARIETAL BONE SHOWING A SHALLOW POROUS DEPRESSION. CCI
FIGURE A113: DOIGAHAMA 1105 ANTERIOR VIEW OF THE CRANIA SHOWING POSSIBLE HEALED FRACTURES TO THE LEFT MAXILLA'S FRONTAL PROCESS AND BOTH NASAL BONES. CCII
FIGURE A114: DOIGAHAMA 1105 LEFT MAXILLA SHOWING A HEALED FRACTURE LINE. CCIII

FIGURE A115: DOIGAHAMA 1105 NASAL BONES SHOWING THAT THEY ARE DEFORMED, ORIENTED INFERIORLY AFTER A POSSIBLE HEALED FRACTURE LINE. CCIII
FIGURE A116: DOIGAHAMA 1116 CRANIA SHOWING A POTENTIALLY HEALED FRACTURE TO THE LEFT AND RIGHT NASAL BONES. CCVI
FIGURE A117: DOIGAHAMA 1116 RIGHT THIRD PROXIMAL PHALANX HEAD SHOWING A THE CIRCULAR MARGIN OF THE ABNORMALITY AND THE GROOVE EXTENDING LATERALLY. CCVI
FIGURE A118: DOIGAHAMA 1116 RIGHT THIRD PROXIMAL PHALANX LATERAL VIEW OF THE HEAD SHOWING THE ENTIRE LESION. CCVII
FIGURE A119: DOIGAHAMA 1116 LEFT MANDIBULAR CONDYLE ANTERIOR VIEW SHOWING ITS DEFORMED MORPHOLOGY. CCVII
FIGURE A120: HIROTA A-8 SUPERIOR VIEW OF THE CRANIA SHOWING A POSSIBLE DEPRESSED FRACTURE TO THE SUPERIOR FRONTAL BONE. CCX
FIGURE A121: HIROTA A-8 CLOSE-UP OF POSSIBLE DEPRESSED FRACTURE TO THE SUPERIOR FRONTAL BONE. ..CCXI
FIGURE A122: HIROTA A-8 LEFT SIDE OF THE FRONTAL BONE SHOWING A SHALLOW, POROUS DEPRESSION. CCXI
FIGURE A123: HIROTA A-8 SUPERIOR VIEW OF THE CRANIUM SHOWING A POROUS DEPRESSION ON THE RIGHT PARIETAL BONE. CCXII
FIGURE A124: HIROTA A-8 CLOSE-UP OF OVAL DEPRESSION TO THE SUPERIOR RIGHT PARIETAL BONE. CCXII
FIGURE A125: HIROTA A-8 LEFT CRANIUM SUPEROLATERAL VIEW SHOWING A DEPRESSION TO THE SUPERIOR LEFT PARIETAL BONE. CCXIII
FIGURE A126: HIROTA A-8 CLOSE-UP OF DEPRESSION ON THE SUPERIOR LEFT PARIETAL BONE. CCXIII
FIGURE A127: HIROTA A-8 CRANIA POSTERIOR VIEW SHOWING A DEPRESSION TO THE LEFT PARIETAL BONE. CCXIV
FIGURE A128: HIROTA A-8 CLOSE-UP OF DEPRESSION TO THE POSTERIOR LEFT PARIETAL BONE. CCXIV
FIGURE A129: RIGHT PROXIMAL PHALANX OF THE FOOT SHOWING A POSSIBLE HEALED OBLIQUE FRACTURE TO THE ARTICULAR SURFACE. CCXV
FIGURE A130: HIROTA C-2 FRONTAL BONE ANTERIOR BONE SHOWING A SHALLOW DEPRESSION. CCXVIII
FIGURE A131: HIROTA C-2 CLOSE-UP OF THE DEPRESSION ON THE FRONTAL BONE. CCXVIII
FIGURE A132: HIROTA C-2 LATERAL VIEW OF THE CRANIA SHOWING A TRIANGULAR PERFORATION TO THE LEFT PARIETAL BONE. CCXIX
FIGURE A133: HIROTA C-2 CLOSE-UP OF THE PERFORATION TO THE LEFT PARIETAL BONE. CCXIX
FIGURE A134: HIROTA C-5 FRONTAL BONE ANTERIOR VIEW SHOWING A SMALL, POROUS DEPRESSION ALONG THE MID-LINE. CCXXIV
FIGURE A135: HIROTA C-5 CLOSE-UP OF THE SMALL, OVAL DEPRESSION TO THE FRONTAL BONE. CCXXIV
FIGURE A136: HIROTA C-5 RIGHT SIDE OF THE FRONTAL BONE SUPERIOR VIEW SHOWING TWO DEPRESSIONS. CCXXV
FIGURE A137: HIROTA C-5 RIGHT SIDE OF THE FRONTAL BONE LATERAL VIEW SHOWING TWO POROUS DEPRESSIONS. CCXXV
FIGURE A138: HIROTA C-5 SUPERIOR VIEW OF THE LEFT SIDE OF THE FRONTAL BONE SHOWING TWO POROUS DEPRESSIONS. CCXXVI
FIGURE A139: HIROTA C-5 CLOSE-UP OF THE TWO POROUS DEPRESSIONS TO THE LEFT SIDE OF THE FRONTAL BONE, ALONG THE CORONAL SUTURE. CCXXVI
FIGURE A140: HIROTA C-5 INNER TABLE OF THE FRONTAL BONE (ANTERIOR IS UP) SHOWING A RING OF POROSITY ASSOCIATED WITH THE DEPRESSION ON THE OUTER TABLE. CCXXVII
FIGURE A141: HIROTA C-5 CRANIUM SUPERIOR VIEW SHOWING A CURVED DEPRESSION TO THE LEFT PARIETAL BONE, NEAR BREGMA. CCXXVII
FIGURE A142: HIROTA C-5 CLOSE-UP OF THE CURVED DEPRESSION TO THE LEFT PARIETAL BONE. CCXXVIII
FIGURE A143: HIROTA C-5 INNER TABLE SHOWING AN ASSOCIATED THIN, CURVED AREA OF BONE. CCXXVIII
FIGURE A144: HIROTA C-5 PARIETAL BONES SUPERIOR VIEW SHOWING A DEPRESSION TO THE LEFT PARIETAL BONE. CCXXIX
FIGURE A145: HIROTA C-5 CLOSE-UP OF THE DEPRESSION TO THE LEFT PARIETAL BONE. CCXXIX
FIGURE A146: HIROTA C-5 LEFT PARIETAL BONE SUPERIOR VIEW SHOWING A CIRCULAR DEPRESSION. CCXXX
FIGURE A147: HIROTA C-5 RIGHT PARIETAL BONE POSTEROSUPERIOR VIEW SHOWING A POROUS DEPRESSION. CCXXX
FIGURE A148: HIROTA C-5 RIGHT PARIETAL BONE SHOWING LOCALISED ABNORMAL HYPEROSTOSIS. CCXXXI
FIGURE A149: HIROTA C-5 LESSER TROCHANTER OF THE LEFT FEMUR MEDIAL VIEW SHOWING A RECTANGULAR GROOVE WITH CLEAR MARGINS. CCXXXI
FIGURE A150: HIROTA C-8 CRANIUM SUPERIOR VIEW OF A LARGE, POROUS DEPRESSION TO THE RIGHT SIDE OF THE FRONTAL BONE. CCXXXIV
FIGURE A151: HIROTA C-8 RIGHT RIB SHOWING A TRANSVERSE RIDGE OF BONE NEAR THE STERNAL END...CCXXXV
FIGURE A152: HIROTA C-8 LEFT SEVENTH(?) RIB SHOWING NEW PERIOSTEAL BONE FORMATION ON THE MEDIAL SURFACE. CCXXXV
FIGURE A153: HIROTA C-8 LEFT RIB SHOWING A POSSIBLE HEALED FRACTURE THAT HAS DEFORMED THE SHAFT. CCXXXVI
FIGURE A154: HIROTA C-8 LEFT RIB SHAFT LATERAL VIEW SHOWING A HEALED FRACTURE. CCXXXVI

FIGURE A155: HIROTA C-8 LEFT RIB SHAFT MEDIAL VIEW SHOWING A HEALED FRACTURE. CCXXXVII
FIGURE A156: HIROTA C-8 RIGHT OS COXA SHOWING A POSSIBLE HEALED FRACTURE TO THE ILIUM. CCXXXVII
FIGURE A157: HIROTA D-II-1 OCCIPITAL BONE SHOWING A POROUS CIRCULAR DEPRESSION. CCXXXVIII
FIGURE A158: HIROTA D-II-3 ANTERIOR VIEW OF THE CRANIUM SHOWING A LIKELY HEALED FRACTURE TO THE LEFT NASAL BONE. CCXL
FIGURE A159: HIROTA D-II-3 CLOES-UP OF THE HEALED FRACTURE TO THE LEFT NASAL BONE. CCXLI
FIGURE A160: HIROTA D-II-3 SUPERIOR VIEW OF THE PARIETAL BONES SHOWING A DEEP, CURVED DEPRESSION TO THE LEFT PARIETAL BONE. CCXLI
FIGURE A161: HIROTA D-II-3 LEFT PARIETAL BONE POSTERIOR VIEW SHOWING AN OVAL DEPRESSION. CCXLII
FIGURE A162: HIROTA D-II-3 CLOSE-UP OF THE CURVED DEPRESSION TO THE LEFT PARIETAL BONE. CCXLII
FIGURE A163: HIROTA D-II-3 PARIETAL BONES POSTEROSUPERIOR VIEW SHOWING AN OVAL DEPRESSION. . CCXLIII
FIGURE A164: HIROTA D-II-3 RIGHT PARIETAL BONE POSTERIOR VIEW SHOWING A POROUS CIRCULAR DEPRESSION. CCXLIII
FIGURE A165: HIROTA D-II-3 RIGHT FIRST RIB SHOWING A POTENTIAL HEALED FRACTURE TO THE ANGLE. . CCXLIV
FIGURE A166: HIROTA D-II-3 RIGHT FIRST POSTERIOR VIEW AND CLOSE-UP OF THE POTENTIAL HEALED FRACTURE. CCXLIV
FIGURE A167: HIROTA D-III-2 ANTERIOR CRANIUM SUPERIOR VIEW WITH POROUS DEPRESSIONS ON THE FRONTAL BONE LABELLED. CCL
FIGURE A168: HIROTA D-III-2 RIGHT SIDE OF THE FRONTAL BONE SHOWING LESIONS 1–3 IN MORE DETAIL. CCL
FIGURE A169: HIROTA D-III-2 LEFT SIDE OF THE FRONTAL BONE SHOWING LESIONS 4–6 IN MORE DETAIL. CCLI
FIGURE A170: HIROTA D-III-2 CRANIUM SUPERIOR VIEW SHOWING DEPRESSIONS TO THE PARIETAL BONES (THOSE ON THE RIGHT ARE LABELLED). CCLI
FIGURE A171: HIROTA D-III-2 SUPERIOR RIGHT PARIETAL BONE SHOWING LESIONS 7–9 IN GREATER DETAIL. . CCLII
FIGURE A172: HIROTA D-III-2 RIGHT PARIETAL BONE POSTEROSUPERIOR VIEW SHOWING LABELLED POROUS DEPRESSIONS. CCLII
FIGURE A173: HIROTA D-III-2 RIGHT PARIETAL BONE POSTEROSUPERIOR VIEW SHOWING LABELLED POROUS DEPRESSIONS. CCLIII
FIGURE A174: HIROTA D-III-2 RIGHT PARIETAL BONE LATERAL VIEW SHOWING LABELLED POROUS DEPRESSIONS NEAR THE CORONAL SUTURE. CCLIII
FIGURE A175: HIROTA D-III-2 LEFT PARIETAL BONE SUPERIOR VIEW SHOWING LABELLED POROUS DEPRESSIONS. CCLIV
FIGURE A176: HIROTA D-III-2 LEFT PARIETAL BONE SUPERIOR VIEW SHOWING LESIONS 17–20 AND 22 IN DETAIL. CCLIV
FIGURE A177: HIROTA D-III-2 LEFT PARIETAL BONE LATERAL VIEW SHOWING LABELLED POROUS DEPRESSIONS. CCLV
FIGURE A178: HIROTA D-III-2 LEFT PARIETAL BONE POSTEROLATERAL VIEW SHOWING A LABELLED POROUS DEPRESSION. CCLV
FIGURE A179: HIROTA D-III-2 RIGHT PARIETAL BONE CLOSE-UP OF LESIONS 27 AND 28. CCLVI
FIGURE A180: KANENOKUMA K13 PROXIMAL DIAPHYSIS OF THE LEFT FEMUR LATERAL VIEW SHOWING A SHARP AND V-SHAPED LINEAR MARK CCLIX
FIGURE A181: KANENOKUMA K13 CLOSE-UP OF THE POSSIBLE CUT-MARK TO THE LEFT FEMUR. CCLIX
FIGURE A182: KANENOKUMA K61 SKULL ANTERIOR VIEW SHOWING THE DEFORMED NASAL BONES. CCLXII
FIGURE A183: KANENOKUMA K61 CRANIUM POSTERIOR VIEW SHOWING A POROUS DEPRESSION TO THE RIGHT PARIETAL BONE. CCLXII
FIGURE A184: KANENOKUMA K79 ANTERIOR VIEW OF THE CRANIUM SHOWING A DEFORMED LEFT NASAL BONE AND LEFT MAXILLA. NOTE THE RIDGE AND DEPRESSION ON THE NASAL BONE AND THE FUSION OF THE NASAL BONE AND MAXILLA. CCLXV
FIGURE A185: KANENOKUMA K79 LEFT THIRD (TOP) AND FOURTH RIBS (BOTTOM) SHOWING POTENTIAL HEALED FRACTURES. CCLXV
FIGURE A186: KANENOKUMA K79 RIGHT THIRD RIB SHOWING A POTENTIAL HEALED FRACTURE TO THE SHAFT NEAR THE STERNAL END. CCLXVI
FIGURE A187: KANENOKUMA K102 CRANIUM ANTERIOR VIEW SHOWING A HEALED FRACTURE TO THE NASAL BONES AND LEFT MAXILLA. CCLXIX
FIGURE A188: KANENOKUMA K102 LEFT PARIETAL BONE LATERAL VIEW SHOWING A POROUS DEPRESSION POSTERSUPERIORLY. CCLXIX
FIGURE A189: KANENOKUMA K113 DISTAL RIGHT AND LEFT RADII SHOWING A POSSIBLE HEALED COLLES FRACTURE TO THE RIGHT. CCLXXI
FIGURE A190: KANENOKUMA K130 FEMORA POSTERIOR VIEW SHOWING A HEALED FRACTURE TO THE LEFT FEMUR. CCLXXII
FIGURE A191: KANENOKUMA K139 CRANIUM POSTEROSUPERIOR VIEW OF THE LEFT PARIETAL BONE SHOWING A POROUS DEPRESSION CCLXXIII
FIGURE A192: KANENOKUMA K229 CRANIUM ANTERIOR VIEW SHOWING DEFORMED NASAL BONES DEPRESSED INFERIORLY. CCLXXV

FIGURE A193:KANENOKUMA 229 CLOSE-UP OF HEALED NASAL FRACTURES. CCLXXVI
FIGURE A194: KANENOKUMA K272 CRANIUM LATERAL VIEW SHOWING MEDIALLY DEPRESSED NASAL BONES. CCLXXVIII
FIGURE A195: KŌRA 35 LEFT AND RIGHT RADII MEDIAL VIEW OF THE DISTAL DIAPHYSIS AND EPIPHYSIS SHOWING THE DEFORMATION OF THE LEFT RADIUS. CCLXXX
FIGURE A196: KŌRA 35 ALL EXTANT RIBS. CCLXXXI
FIGURE A197: KŌRA 35 RIGHT FOURTH RIB POSTERIOR VIEW SHOWING A LIKELY HEALED FRACTURE NEAR THE STERNAL END. CCLXXXI
FIGURE A198: KŌRA 35 RIGHT FIFTH RIB ANTERIOR VIEW SHOWING A LIKELY HEALED FRACTURE NEAR THE STERNAL END. NOTE THE INFERIOR DISPLACEMENT OF THE RIB MEDIAL TO THIS POINT. CCLXXXII
FIGURE A199: KŌRA 35 RIGHT SIXTH RIB ANTERIOR VIEW SHOWING A LIKELY HEALED FRACTURE NEAR THE STERNAL END. CCLXXXII
FIGURE A200: KŌRA 35 RIGHT EIGHTH RIB POSTERIOR VIEW SHOWING A LIKELY HEALED FRACTURE NEAR THE STERNAL END. CCLXXXIII
FIGURE A201: KŌRA 35 RIGHT TENTH RIB ANTERIOR VIEW SHOWING A LIKELY HEALED FRACTURE NEAR THE STERNAL END. CCLXXXIII
FIGURE A202: KŌRA 35 LEFT SECOND RIB SUPEROANTERIOR VIEW SHOWING AN AREA OF DEFORMED BONE (WIDE AND THIN) ON THE SHAFT. CCLXXXIV
FIGURE A203: KŌRA 35 LEFT NINTH RIB ANTERIOR VIEW SHOWING A LIKELY HEALED FRACTURE NEAR THE STERNAL END. CCLXXXIV
FIGURE A204: KŌRA 36 NASAL BONES ANTERIOR VIEW SHOWING A POSSIBLE HEALED FRACTURE TO BOTH. CCLXXXVI
FIGURE A205: KŌRA 36 RIGHT THIRD(?) RIB SHOWING A LINE OF REMODELLED BONE NEAR THE STERNAL END. CCLXXXVII
FIGURE A206: KŌRA 36 RIGHT FOURTH RIB SHOWING A LINE OF POROSITY NEAR THE STERNAL END AND DISUNION OF THE SHAFT WITH SIGNS OF CALLOUS FORMATION ALONG THE FRACTURE MARGINS. CCLXXXVII
FIGURE A207: KŌRA 36 RIGHT FIFTH RIB SUPEROANTERIOR VIEW SHOWING A DEPRESSED AREA NEAR THE STERNAL END AND DISUNION OF THE SHAFT WITH EVIDENCE OF CALLOUS FORMATION AROUND IT. CCLXXXVIII
FIGURE A208: KŌRA 36 LEFT SECOND RIB ANTERIOR VIEW SHOWING A RIDGE OF BONE. CCLXXXVIII
FIGURE A209: KŌRA 36 LEFT THIRD RIB SUPEROANTERIOR VIEW LIKELY SHOWING THE LATERAL HALF OF A FRACTURE IN THE PROCESS OF HEALING. CCLXXXIX
FIGURE A210: KŌRA 36 LEFT FIFTH RIB ANTERIOR VIEW SHOWING A HEALING FRACTURE. CCLXXXIX
FIGURE A211: KŌRA 36 FIFTH LUMBAR VERTEBRA SUPERIOR VIEW. CCXC
FIGURE A212: KŌRA 36 FIFTH LUMBAR VERTEBRA POSTERIOR VIEW SHOWING THE DEFORMED SUPERIOR ARTICULAR FACETS. CCXC
FIGURE A213: KŌRA 44 CRANIUM ANTERIOR VIEW SHOWING THE HEALED FRACTURES TO THE NASAL BONES. CCXCII
FIGURE A214: KŌRA 44 CLOSE-UP OF THE HEALED FRACTURES TO THE NASAL BONES. CCXCII
FIGURE A215: KŌRA 44 ANTERIOR VIEW OF PATELLAE, NOTE THE BILATERAL DEFORMITIES ON THEIR SUPEROMEDIAL ASPECTS. CCXCIII
FIGURE A216: KŌRA 44 MEDIAL VIEW OF THE PATELLAE. CCXCIII
FIGURE A217: KŌRA 67 CRANIUM ANTERIOR VIEW SHOWING HEALED FRACTURES TO THE NASAL BONES AND MAXILLAE. CCXCVII
FIGURE A218: KŌRA 67 CLOSE-UP OF FRACTTURES TO THE NASAL BONES AND RIGHT MAXILLA. CCXCVII
FIGURE A219: KŌRA 67 CLOSE-UP OF FRACTURES TO THE NASAL BONES AND INVOLVEMENT OF THE LEFT MAXILLA. CCXCVIII
FIGURE A220: KŌRA 67 ANTERIOR VIEW OF THE FRONTAL BONE SHOWING A SHALLOW DEPRESSION TO THE RIGHT SIDE. CCXCVIII
FIGURE A221: KŌRA 67 CLOSE-UP OF SHALLOW DEPRESSION ON THE FRONTAL BONE. CCXCIX
FIGURE A222: KŌRA 67 LEFT NINTH RIB SHOWING A HEALING FRACTURE TO THE SHAFT. CCXCIX
FIGURE A223: KŌRA 67 LEFT TENTH RIB SHOWING A HEALED FRACTURE NEAR THE STERNAL END. CCXCIX
FIGURE A224: KŌRA 67 SECOND METACARPALS MEDIAL VIEW SHOWING THE SHORTENED LEFT METACARPAL AND RIDGE OF BONE ON ITS SHAFT. CCC
FIGURE A225: KŌRA 67 HEAD OF THE LEFT SECOND METACARPAL SHOWING A GAP RUNNING THROUGH IT. CCC
FIGURE A226: KŌRA 68 CLAVICLES INFERIOR VIEW SHOWING THE SHORTENED AND DEFORMED RIGHT CLAVICLE. CCCIII
FIGURE A227: KŌRA 68 CALCANEI MEDIAL VIEW SHOWING THE DEFORMITY OF THE RIGHT CALCANEUS. CCCIII
FIGURE A228: KŌRA 68 RIGHT TALUS INFERIOR VIEW SHOWING THE CIRCULAR FRACTURE LINE AND DEPRESSION PROXIMALLY CCCIV
FIGURE A229: KŌRA 山本 III LEFT FEMUR ANTERIOR VIEW. CCCV

FIGURE A230: KŌRA 山本 III LEFT FEMUR PROXIMAL DIAPHYSIS SHOWING NUMEROUS PATINATED LINEAR MARKS. CCCVI
FIGURE A231: KŌRA 山本 III LEFT FEMUR CLOSE-UP OF LINEAR MARKS TO THE PROXIMAL POSTERIOR DIAPHYSIS. CCCVI
FIGURE A232: KŌRA 山本 III LEFT FEMUR CLOSE-UP OF LINEAR MARKS TO THE PROXIMAL LATERAL DIAPHYSIS. CCCVII
FIGURE A233: MINAMIKATA 7•8 METACARPAL SHAFT SHOWING A V-SHAPED PATIANTED CUT MARK. CCCIX
FIGURE A234: MINAMIKATA 7•8 CLOSE-UP OF THE CUT MARK ON THE METACARPAL SHAFT. NOTE THE INTERNAL STRIATIONS. CCCIX
FIGURE A235: MINAMIKATA 7•8 CRANIUM LATERAL VIEW SHOWING A DEEP LINEAR MARK TO THE RIGHT PARIETAL BONE. NOTE THAT THE TEMPORAL BONE WAS PRESENT AND DID NOT SHOW ANY CORRESPONDING LESION. CCCXI
FIGURE A236: MINAMIKATA 7•8 CRANIUM LATERAL VIEW SHOWING A DEEP, WIDE LINEAR MARK TO THE LEFT PARIETAL BONE. NOTE THAT THE TEMPORAL BONE WAS PRESENT AND DID NOT SHOW ANY CORRESPONDING LESION. CCCXI
FIGURE A237: MITSUNAGATA 5 CRANIUM ANTERIOR VIEW SHOWING A HEALED FRACTURE TO THE NASAL BONES. CCCXII
FIGURE A238: MITSUNAGATA 32 MEDIAL VIEW OF THE RIGHT OS COXA SHOWING A PENETRATING WOUND TO THE ILIAC FOSSA. CCCXIV
FIGURE A239: ADAPTED FROM HASHIGUCHI (2007:158) BY JAW. LINE DRAWING OF ARROWHEAD WITH ADHERING BONE FOUND WITH MITSUNAGATA 32. CCCXIV
FIGURE A240: MITSUNAGATA 104 CRANIUM ANTERIOR VIEW SHOWING A POSSIBLE HEALED FRACTURE TO THE RIGHT NASAL BONE. CCCXVII
FIGURE A241: MITSUNAGATA 104 CRANIUM SUPERIOR VIEW OF THE LEFT SIDE SHOWING A POROUS DEPRESSION TO THE FRONTAL BONE. CCCXVII
FIGURE A242: MITSUNAGATA 127 CRANIUM ANTERIOR VIEW SHOWING A HEALED FRACTURE TO THE NASAL BONES. CCCXX
FIGURE A243: MITSUNAGATA 127 FRONTAL BONE INFEROANTERIOR VIEW SHOWING AN OVAL DEPRESSION. CCCXX
FIGURE A244: NAGAOKA K9 DEFORMED RIGHT SECOND METACARPAL. CCCXXII
FIGURE A245: NAGAOKA K10 CRANIUM ANTERIOR VIEW SHOWING A HEALED CUT MARK TO THE RIGHT SUPRAORBITAL MARGIN AND A HEALED FRACTURE TO BOTH NASAL BONES. CCCXXIV
FIGURE A246: NAGAOKA K10 NASAL BONES SHOWING A HEALED FRACTURE. CCCXXIV
FIGURE A247: NAGAOKA K10 INFERIOR VIEW OF THE HEALED CUT MARK TO THE RIGHT SUPRAORBITAL MARGIN. CCCXXV
FIGURE A248: NAGAOKA K10 CLOSE-UP OF HEALED CUT MARK TO THE RIGHT SUPRAORBITAL MARGIN. CCCXXV
FIGURE A249: NAGAOKA K10 RIGHT RADIUS MEDIAL VIEW OF THE DISTAL DIAPHYSIS AND EPIPHYSIS SHOWING A POORLY HEALED COLLES FRACTURE. CCCXXVI
FIGURE A250: NAGAOKA K32 LEFT RADIUS MEDIAL VIEW SHOWING A HEALED COLLES FRACTURE. CCCXXVIII
FIGURE A251: NAGAOKA SK78 RIGHT CLAVICLE ANTERIOR VIEW SHOWING A PROTRUSION OF BONE. CCCXXIX
FIGURE A252: NAGAOKA SK93 RIGHT ULNA MEDIAL VIEW SHOWING A CUT MARK TO THE MID-DIAPHYSIS. CCCXXXI
FIGURE A253: NAGAOKA SK93 CLOSE-UP OF CUT MARK TO THE MEDIAL RIGHT ULNA. CCCXXXI
FIGURE A254: NAGAOKA SK93 RIGHT FEMUR MID-DIAPHYSIS LATERAL VIEW (PROXIMAL IS LEFT) SHOWING A CHOP MARK. CCCXXXII
FIGURE A255: NAGAOKA SK93 CLOSE-UP OF CHOP MARK TO THE RIGHT FEMUR. CCCXXXII
FIGURE A256: NAGAOKA SK93 LEFT TIBIA PROXIMAL DIAPHYSIS ANTERIOR VIEW SHOWING A CUT MARK. CCCXXXIII
FIGURE A257: NAGAOKA SK93 CLOSE-UP OF THE CUT MARK TO THE LEFT TIBIA. CCCXXXIII
FIGURE A258: NAGAOKA SK95 RIGHT OS COXA LATERAL VIEW SHOWING AN EMBEDDED SWORD TIP. CCCXXXVI
FIGURE A259: NAGAOKA SK95 CLOSE-UP LATERAL VIEW OF EMBEDDED SWORD TIP IN THE RIGHT ILIUM. CCCXXXVI
FIGURE A260: NAGAOKA SK95 CLOSE-UP MEDIAL VIEW OF EMBEDDED SWORD TIP IN THE RIGHT ILIUM. CCCXXXVII
FIGURE A261: NAGAOKA SK95 LEFT HUMERUS ANTERIOR VIEW SHOWING THE HOLE IN THE PROXIMAL DIAPHYSIS. CCCXXXVII
FIGURE A262: NAGAOKA SK95 CLOSE-UP OF HOLE AND MARGINS TO THE LEFT HUMERUS ANTERIOR VIEW. CCCXXXVIII
FIGURE A263: NAGAOKA SK95 CLOSE-UP OF HOLE AND MARGINS TO THE LEFT HUMERUS POSTERIOR VIEW. CCCXXXVIII
FIGURE A264: NAGAOKA SK100 LEFT ILIUM AND SACRUM POSTERIOR VIEW SHOWING AN EMBEDDED SWORD TIP. CCCXLI
FIGURE A265: NAGAOKA SK100 LEFT ILIUM AND SACRUM ANTEROLATERAL VIEW SHOWING AN EMBEDDED SWORD TIP. CCCXLI

FIGURE A266: NAKANOHAMA 906-3 RIGHT ULNA LATERAL VIEW SHOWING EXTENSIVE FRACTURING TO THE DIAPHYSIS..... CCCXLIII
FIGURE A267: NAKANOHAMA 906-3 CLOSE-UP OF CURVED, OBLIQUE FRACTURE LINE TO THE RIGHT ULNA. CCCXLIV
FIGURE A268: NAKANOHAMA 906-3 CLOSE-UP OF CURVED, OBLIQUE FRACTURE LINE TO THE RIGHT ULNA DISTAL DIAPHYSIS ANTERIOR VIEW. CCCXLIV
FIGURE A269: NAKANOHAMA G-3-1 NO.7357 CRANIUM POSTERIOR VIEW SHOWING A DEPRESSION TO THE LEFT PARIETAL BONE. CCCXLVI
FIGURE A270: NAKANOHAMA G-3-1 NO.7357 CLOSE-UP OF DEPRESSION TO THE LEFT PARIETAL BONE. CCCXLVI
FIGURE A271: NAKANOHAMA 藤田 A (FUJITA A) CRANIUM ANTERIOR VIEW SHOWING A HEALED FRACTURE TO THE NASAL BONES. CCCXLVIII
FIGURE A272: NAKANOHAMA 藤田 A (FUJITA A) CLOSE-UP OF THE HEALED FRACTURE TO THE NASAL BONES. CCCXLIX
FIGURE A273: NAKANOHAMA G-3-1-1-その 2 PARIETAL BONES SUPERIOR VIEW SHOWING A DEPRESSION TO THE SUPERIOR RIGHT PARIETAL BONE..... CCCL
FIGURE A274: NAKANOHAMA G-3-1-1-その 2 CLOSE-UP OF THE DEPRESSION TO THE SUPERIOR RIGHT PARIETAL BONE..... CCCLI
FIGURE A275: NAKANOHAMA G-3-1-1-その 2 RIGHT FIBULA SHOWING A HEALED FRACTURE TO THE DIAPHYSIS. CCCLI
FIGURE A276: NAKANOHAMA G-1-2 NO.1 RIGHT SECOND RIB SUPERIOR VIEW SHOWING A LINEAR MARK TO THE MEDIAL ANGLE. CCCLIV
FIGURE A277: NAKANOHAMA G-1-2 NO.1 CLOSE-UP OF LINEAR MARK TO THE RIGHT SECOND RIB (SUPERIOR IS DOWN). CCCLIV
FIGURE A278: NAKANOHAMA G-1-2 NO.1 LEFT CLAVICLE SUPERIOR VIEW SHOWING THE SUPERIOR TIP OF A LINEAR MARK TO THE ANTERIOR SHAFT. CCCLV
FIGURE A279: NAKANOHAMA G-1-2 NO.1 CLOSE-UP OF THE CUT MARK TO THE ANTERIOR LEFT CLAVICLE.. CCCLV
FIGURE A280: NAKANOHAMA G-1-2 NO.1 CLOSE-UP OF THE CUT MARK TO THE ANTERIOR LEFT CLAVICLE. CCCLVI
FIGURE A281: NAKANOHAMA G-1-2 NO.1 RIGHT TIBIA MEDIAL VIEW SHOWING OBLIQUE FRACTURES. CCCLVI
FIGURE A282: NAKANOHAMA G-1-2 NO.1 CLOSE-UP OF FRACTURES TO THE RIGHT TIBIA. CCCLVI
FIGURE A283: NAKANOHAMA G-1-2 NO.2 CLAVICLES SUPERIOR VIEW SHOWING A RIDGE ON THE MEDIAL RIGHT CLAVICLE..... CCCLVIII
FIGURE A284: NAKANOHAMA G-1-2 NO.2 CLOSE-UP OF THE RIDGE ON THE RIGHT CLAVICLE. CCCLIX
FIGURE A285: ŌTOMO 1-1 CRANIUM ANTERIOR VIEW SHOWING A HEALED FRACTURE TO THE NASAL BONES. CCCLX
FIGURE A286: ŌTOMO 1-1 CLOSE-UP OF THE HEALED FRACTURE TO THE NASAL BONES..... CCCLXI
FIGURE A287: ŌTOMO 2-1 CRANIUM ANTERIOR VIEW SHOWING A HEALED FRACTURE TO THE NASAL BONES. CCCLXII
FIGURE A288: ŌTOMO 2-1 CLOSE-UP OF THE HEALED FRACTURE TO THE NASAL BONES..... CCCLXIII
FIGURE A289: ŌTOMO 6 FRONTAL BONE ANTERIOR VIEW SHOWING AN OVAL DEPRESSION TO THE SUPERIOR RIGHT SIDE. CCCLXV
FIGURE A290: ŌTOMO 6 CLOSE-UP OF THE OVAL DEPRESSION TO THE SUPERIOR RIGHT SIDE OF THE FRONTAL BONE..... CCCLXVI
FIGURE A291: ŌTOMO SK35 CRANIUM ANTERIOR VIEW SHOWING A HEALED FRACTURE TO BOTH NASAL BONES. CCCLXVIII
FIGURE A292: ŌTOMO SK35 CLOSE-UP OF HEALED FRACTURES TO THE LEFT NASAL BONE. CCCLXIX
FIGURE A293: ŌTOMO SK35 CLOSE-UP OF THE HEALED FRACTURE TO THE RIGHT NASAL BONE. CCCLXIX
FIGURE A294: ŌTOMO K1 DISTAL RIGHT RADIUS ANTERIOR VIEW SHOWING A RIDGE OF BONE ON THE DIAPHYSIS. CCCLXXI
FIGURE A295: SHIBU 3 FRONTAL BONE LEFT SIDE (NEAR THE CORONAL SUTURE) SHOWING A V-SHAPED LINEAR MARK..... CCCLXXIV
FIGURE A296: SHIBU 3 CLOSE-UP OF THE LINEAR MARK TO THE FRONTAL BONE. CCCLXXIV
FIGURE A297: SHIBU 3 LEFT SCAPULA DORSAL VIEW SHOWING A LINEAR MARK. CCCLXXV
FIGURE A298: SHIBU 3 CLOSE-UP OF THE U-SHAPED LINEAR MARK ON THE LEFT SCAPULA. CCCLXXV
FIGURE A299: SHIBU 3 LEFT HUMERUS MEDIAL VIEW SHOWING A LINEAR MARK. CCCLXXVI
FIGURE A300: SHIBU 3 CLOSE-UP OF LINEAR MARK INFERIOR TO THE NECK OF THE LEFT HUMERUS. CCCLXXVI
FIGURE A301: SHIBU 3 CLOSE-UP OF LINEAR MARKS TO THE LEFT HUMERUS..... CCCLXXVI
FIGURE A302: SHIBU 3 CLOSE-UP OF THE LINEAR MARK TO THE LEFT ULNA CCCLXXVII
FIGURE A303: SHIBU 3 LEFT ULNA ANTERIOR DIAPHYSIS SHOWING A LINEAR MARK. CCCLXXVII
FIGURE A304: SHIBU 3 THORACIC VERTEBRA POSTERIOR VIEW SHOWING A LINEAR MARK. CCCLXXVIII
FIGURE A305: SHIBU 3 CLOSE-UP OF THE LINEAR MARK TO THE LEFT LAMINA OF A THORACIC VERTEBRA. CCCLXXVIII
FIGURE A306: SHIBU 3 CLOSE-UP INFERIOR VIEW OF THE LINEAR MARK TO THE LEFT LAMINA OF A THORACIC VERTEBRA. CCCLXXIX

FIGURE A307: A THORACIC VERTEBRA POSTERIOR VIEW SHOWING A DEEP CUT MARK TO THE RIGHT LAMINA. CCCLXXIX
FIGURE A308: SHIBU 3 RIGHT TENTH RIB MEDIAL VIEW SHOWING A LINEAR MARK TO THE INFERIOR SHAFT. CCCLXXX
FIGURE A309: SHIBU 3 CLOSE-UP INFERIOR VIEW OF LINEAR MARK TO THE RIGHT TENTH RIB..... CCCLXXX
FIGURE A310: SHIBU 3 CLOSE-UP MEDIAL VIEW OF LINEAR MARK TO THE RIGHT TENTH RIB. CCCLXXXI
FIGURE A311: SHIBU 3 EXCAVATION PHOTOGRAPH SHOWING A STONE ARROWHEAD (AND ARROWHEAD DETAIL) IN THE RIGHT RIB CAGE. IMAGES FROM NARA PREFECTURE ARCHAEOLOGICAL INSTITUTE OF KASHIHARA MUSEUM (2014:61). CCCLXXXI
FIGURE A312: SHIBU 3 LEFT SEVENTH RIB ANTEROLATERAL VIEW SHOWING A SHARP CUT MARK TO THE INFERIOR MID-SHAFT..... CCCLXXXII
FIGURE A313: SHIBU 3 CLOSE-UP OF CUT MARK TO THE INFERIOR LEFT SEVENTH RIB. NOTE THE CLEAR STRIATIONS ON THE WALL OF THE CUT. CCCLXXXII
FIGURE A314: SHIBU 3 LEFT NINTH RIB ANTEROLATERAL VIEW SHOWING A SHARP CUT MARK TO THE INFERIOR MID-SHAFT..... CCCLXXXIII
FIGURE A315: SHIBU 3 CLOSE-UP OF THE CUT MARK TO THE INFERIOR MIDSHAFT OF THE INFERIOR LEFT NINTH RIB. CCCLXXXIII
FIGURE A316: SHIBU 3 LEFT FEMUR ANTERIOR VIEW SHOWING A SERIES OF CUT MARKS TO THE PROXIMAL DIAPHYSIS..... CCCLXXXIV
FIGURE A317: SHIBU 3 CLOSE-UP OF CUT MARKS TO THE PROXIMAL DIAPHYSIS OF THE LEFT FEMUR..... CCCLXXXIV
FIGURE A318: SHIBU 3 DISTAL LEFT FEMUR ANTERIOR VIEW SHOWING A CUT MARK TO THE MID-DIAPHYSIS AND THE PROBABLE LOCATION OF THE EMBEDDED PROJECTILE POINT REPORTED BY PADGETT (2020)... CCCLXXXV
FIGURE A319: SHIBU 3 CLOSE-UP OF CUT AMRK TO THE LEFT FEMUR ANTERIOR MID-DIAPHYSIS. CCCLXXXV
FIGURE A320: SHIBU 4 FRAGMENT OF THE RIGHT LATERAL SUPERCILIARY ARCH OF THE FRONTAL BONE SHOWING A FRACTURE..... CCCXC
FIGURE A321: SHIBU 4 LEFT PATELLA ANTERIOR VIEW SHOWING A LINEAR MARK TO ITS MEDIAL ASPECT. ... CCCXC
FIGURE A322: SHIBU 4 CLOSE-UP OF A POSSIBLE CUT MARK TO THE LEFT PATELLA CCCXCI
FIGURE A323: SHIBU 4 RIGHT SCAPULA LATERAL VIEW SHOWING A CUT MARK TO THE DORSAL GLENOID FOSSA. CCCXCI
FIGURE A324: SHIBU 4 CLOSE-UP OF THE CUT MARK TO THE GLENOID FOSSA OF THE RIGHT SCAPULA. CCCXCII
FIGURE A325: SHIBU 4 LEFT SCAPULA SHOWING A DEEP CUT MARK TO THE LATERAL BORDER. CCCXCII
FIGURE A326: SHIBU 4 RIGHT HUMERAL HEAD SHOWING A LINEAR MARK..... CCCXCIII
FIGURE A327: SHIBU 4 CLOSE-UP OF THE LINEAR MARK ON THE RIGHT HUMERAL HEAD. CCCXCIII
FIGURE A328: SHIBU 4 CLOSE-UP OF THE FRACTURE TO THE RIGHT HAMATE..... CCCXCIV
FIGURE A329: SHIBU 4 RIGHT HAMATE VIEW FROM THE TRIQUETRAL SHOWING A SMOOTH FRACTURE LINE. CCCXCIV
FIGURE A330: SHIBU 4 RIGHT CLAVICLE SUPERIOR VIEW SHOWING A LINEAR MARK ON THE SHAFT..... CCCXCV
FIGURE A331: SHIBU 4 CLOSE-UP OF THE LINEAR MARK TO THE SUPERIOR SHAFT OF THE RIGHT CLAVICLE. CCCXCV
FIGURE A332: SHIBU 4 THIRD LUMBAR VERTEBRA POSTERIOR VIEW. CCCXCVI
FIGURE A333: SHIBU 4 CLOSE-UP OF THE LIKELY CUT MARK THROUGH THE RIGHT TRANSVERSE PROCESS OF THE THIRD LUMBAR VERTEBRA. CCCXCVI
FIGURE A334: SHIBU 3 LEFT FOURTH RIB SUPERIOR VIEW SHOWING A FRACTURE TO THE SUPERIOR SHAFT NEAR THE STERNAL END..... CCCXCVII
FIGURE A335: SHIBU 3 CLOSE-UP OF THE FRACTURE TO THE SUPERIOR SHAFT OF THE LEFT FOURTH RIB. .. CCCXCVII
FIGURE A336: SHIBU 4 RIGHT ILIUM LATERAL VIEW SHOWING A CUT MARK..... CCCXCVIII
FIGURE A337: SHIBU 4 CLOSE-UP OF THE CUT MARK TO THE RIGHT ILIUM. CCCXCVIII
FIGURE A338: SHIBU 4 LEFT ILIUM LATERAL VIEW SHOWING TWO CUT MARKS. CCCXCIX
FIGURE A339: SHIBU 4 CLOSE-UP OF THE CUT MARK TO THE POSTEROLATERAL LEFT ILIUM. CCCXCIX
FIGURE A340: SHIBU 4 LEFT ILIUM INFERIOR TO THE ANTERIOR INFERIOR ILIAC SPINE SHOWING THE SECOND CUT MARK ON THIS BONE. ..... CD
FIGURE A341: SHIBU 4 CLOSE-UP OF THE CUT MARK INFERIOR TO THE ANTERIOR INFERIOR ILIAC SPINE OF THE LEFT ILIUM. NOTE THE TRIANGULAR SHAPE OF THE DEFECT IN ITS CENTRE. ..... CD
FIGURE A342: SHINMACHI 9 CRANIUM ANTERIOR VIEW SHOWING A HEALED FRACTURE TO THE NASAL BONES. .CDII
FIGURE A343: SHINMACHI 24-1 LEFT FEMUR LATERAL VIEW SHOWING AN EMBEDDED ARROWHEAD PROXIMALLY. ..... CDIV
FIGURE A344: SHINMACHI 24-1 CLOSE-UP OF THE ENTRACE OF THE EMBEDDED ARROWHEAD IN THE LEFT FEMUR. ..... CDV
FIGURE A345: SHINMACHI 24-1 CLOSE-UP OF THE EMBEDDED ARROWHEAD IN THE LEFT FEMUR..... CDV
FIGURE A346: SUDARE K3 CRANIUM ANTERIOR VIEW SHOWING A HEALED FRACTURE TO THE NASAL BONES AND LEFT MAXILLA. ..... CDVIII
FIGURE A347: SUDARE K3 CLOSE-UP OF THE HEALED FRACTURE TO THE NASAL BONES AND LEFT MAXILLA. CDVIII
FIGURE A348: SUDARE K3 SECOND THORACIC VERTEBRA AND RIB POSTERIOR VIEW SHOWING AN EMBEDDED SWORD TIP. ..... CDIX

FIGURE A349: SUDARE K3 SECOND THORACIC VERTEBRA AND RIB ANTEROLATERAL VIEW SHOWING THEIR STATE OF FUSION. ..... CDIX
FIGURE A350: TSUKOMUTA 4 10 RADII ANTERIOR VIEW SHOWING THE HEALED FRACTURE TO THE LEFT RADIUS. ..... CDXI
FIGURE A351: TSUKOMUTA 4 21 ANTERIOR VIEW OF THE CRANIUM SHOWING A HEALED FRACTURE TO THE NASAL BONES. ..... CDXII
FIGURE A352: TSUKOMUTA 4 21 CLOSE-UP OF THE HEALED FRACTURE TO THE NASAL BONES. ..... CDXIII
FIGURE A353: TSUKOMUTA 4 25 LEFT FEMUR LATERAL DISTAL DIAPHYSIS SHOWING TWO CUT MARKS. ..... CDXVI
FIGURE A354: TSUKOMUTA 4 25 CLOSE-UP OF THE LARGER, DISTAL CUT MARK TO THE LATERAL LEFT FEMUR. ..... CDXVI
FIGURE A355: TSUKOMUTA 4 25 CLOSE-UP OF THE SMALLER, PROXIMAL CUT MARK TO THE LATERAL LEFT FEMUR. ..... CDXVII
FIGURE A356: YOKOGUMA KITSUNEZUKA ST-41 RIGHT CLAVICLE INFERIOR VIEW (ANTERIOR IS UP) SHOWING A CUT MARK TO THE POSTERIOR SHAFT NEAR THE STERNAL END. ..... CDXX
FIGURE A357: YOKOGUMA KITSUNEZUKA ST-41 CLOSE-UP OF THE CUT MARK TO THE INFERIOR RIGHT CLAVICLE. ..... CDXX
FIGURE A358: YOKOGUMA KITSUNEZUKA ST-41 CLOSE-UP OF THE ANTERIOR ASPECT OF THE CUT MARK TO THE INFERIOR RIGHT CLAVICLE ..... CDXXI
FIGURE A359: YOKOGUMA KITSUNEZUKA ST-66 LEFT CLAVICLE INFERIOR VIEW SHOWING A HEALED FRACTURE TO THE MID-SHAFT..... CDXXIII
FIGURE A360: YOKOGUMA KITSUNEZUKA ST-122 CRANIUM ANTERIOR VIEW SHOWING A LIKELY HEALED FRACTURE TO THE NASAL BONES..... CDXXIV
FIGURE A361: YOKOGUMA KITSUNEZUKA ST-122 CLOSE-UP OF THE LIKELY HEALED FRACTURE TO THE NASAL BONES..... CDXXV
FIGURE A362: YOKOGUMA KITSUNEZUKA ST-128 CRANIUM ANTERIOR VIEW SHOWING MULTIPLE HEALED FRACTURES TO THE NASAL BONES AND LEFT MAXILLA. ..... CDXXVIII
FIGURE A363: YOKOGUMA KITSUNEZUKA ST-128 CLOSE-UP OF THE HEALED FRACTURES TO THE LEFT NASAL BONE AND MAXILLA. ..... CDXXVIII
FIGURE A364: YOKOGUMA KITSUNEZUKA ST-128 CLOSE-UP OF THE HEALED FRACTURE TO THE RIGHT NASAL BONE..... CDXXIX
FIGURE A365: YOKOGUMA KITSUNEZUKA ST-140 RIGHT FEMUR POSTERIOR VIEW SHOWING A HEALED FRACTURE TO THE MID-DIAPHYSIS. ..... CDXXXI
FIGURE A366: KŌRA 48 CRANIUM ANTERIOR VIEW SHOWING A POSSIBLE HEALED FRACTURE TO THE NASAL BONES..... CDXXXIII
FIGURE A367: KŌRA 48 CLOSE-UP OF THE POSSIBLE HEALED FRACTURE TO THE NASAL BONES. ..... CDXXXIV
FIGURE A368: ŌTOMO 17-1 CRANIUM ANTERIOR VIEW SHOWING TWO DEPRESSED LESIONS TO THE FRONTAL BONES. ..... CDXXXVI
FIGURE A369: ŌTOMO 17-1 FRONTAL BONE SUPERIOR VIEW SHOWING A LINEAR DEPRESSION TO THE LATERAL ASPECT. ..... CDXXXVI
FIGURE A370: ŌTOMO 17-1 CLOSE-UP OF THE LINEAR DEPRESSION TO THE LATERAL RIGHT FRONTAL BONE. ..... CDXXXVII
FIGURE A371: ŌTOMO 17-1 CLOSE-UP OF THE OVAL DEPRESSION TO THE ANTERIOR LEFT FRONTAL BONE. ..... CDXXXVII
FIGURE A372: ŌTOMO 17-1 RIGHT FOURTH METACARPAL SHOWING A RIDGE ON THE ANTERIOR SHAFT. . CDXXXVIII
FIGURE A373: ŌTOMO 17-3 DISTAL RIGHT RADIUS POSTERIOR VIEW SHOWING A HEALED FRACTURE TO THE DIAPHYSIS..... CDXL
FIGURE A374: ŌTOMO 17-3 DISTAL RIGHT RADIUS ANTERIOR VIEW SHOWING A HEALED FRACTURE TO THE DIAPHYSIS..... CDXL

Completeness and Trauma Figures

Figure AA1: Inariyama 249 Completeness and Medium-High perimortem trauma CI
Figure AA2: Inariyama 255 Completeness and Medium–High antemortem trauma. CVII
Figure AA3: Toyomatsu-Domen 78-1 Completeness and Medium–High perimortem trauma. CXXIII
Figure AA4: Tsukumo 36 Completeness and Medium-High antemortem trauma. CXXIX
Figure AA5: Tsukumo 38 Completeness and Medium–High antemortem trauma. CXXXI
Figure AA6: Tsukumo 46 Completeness and Medium–High antemortem trauma. CXXXIV
Figure AA7: Yamaga 9 Completeness and Medium–High antemortem trauma. CXL
Figure AA8: Yamaga 18 Completeness and Medium–High antemortem trauma. CXLIII
Figure AA9: Yoshigo 360-1 Completeness and Medium–High perimortem trauma. CXLVI
Figure AA10: Yoshigo 378 Completeness and Medium–High perimortem trauma. CLIII
Figure AA11: Doigahama 124 Completeness and Medium–High perimortem trauma. CLXXVIII
Figure AA12: Doigahama 312 Completeness and Medium–High antemortem trauma. CLXXXI
Figure AA13: Doigahama 421 Completeness and Medium–High antemortem trauma. CXCIX
Figure AA14: Doigahama 1105 Completeness and Medium–High antemortem trauma. CCIV
Figure AA15: Doigahama 1116 Completeness and Medium–High antemortem trauma. CCVIII
Figure AA16: Hirota A-8 Completeness and Medium–High antemortem trauma CCXVI
Figure AA17: Hirota C-2 Completeness and Medium–High antemortem trauma. CCXX
Figure AA18: Hirota C-5 Completeness and Medium–High antemortem (blue) and perimortem (red) trauma. CCXXXII
Figure AA19: Hirota D-II-3 Completeness and Medium–High antemortem trauma CCXLV
Figure AA20: Hirota D-III-2 Completeness and Medium–High antemortem trauma. CCLVII
Figure AA21: Kanenokuma K13 Completeness and Medium–High perimortem trauma. CCLX
Figure AA22: Kanenokuma K61 Completeness and Medium–High antemortem trauma CCLXIII
Figure AA23: Kanenokuma K79 Completeness and Medium–High antemortem trauma CCLXVII
Figure AA24: Kanenokuma K102 Completeness and Medium–High antemortem trauma CCLXX
Figure AA25: Kanenokuma K139 Completeness and Medium–High antemortem trauma CCLXXIV
Figure AA26: Kanenokuma K229 Completeness and Medium–High antemortem trauma CCLXXVII
Figure AA27:Kōra 44 Completeness and Medium–High antemortem trauma CCXCIV
Figure AA28: Kōra 67 Completeness and Medium–High antemortem trauma. CCCI
Figure AA29: Mitsunagata 5 Completeness and Medium–High antemortem trauma. CCCXIII
Figure AA30: Mitsunagata 32 Completeness and Medium–High perimortem trauma. CCCXV
Figure AA31: Mitsunagata 104 Completeness and Medium–High antemortem trauma. CCCXVIII
Figure AA32: Mitsunagata 127 Completeness and Medium–High antemortem trauma. CCCXXI
Figure AA33: Nagaoka K10 Completeness and Medium–High antemortem trauma. CCCXXVII
Figure AA34: Nagaoka SK93 Completeness and Medium–High perimortem trauma. CCCXXXIV
Figure AA35: Nagaoka SK95 Completeness and Medium–High antemortem (blue) and perimortem (red) trauma. CCCXXXIX
Figure AA36: Nagaoka SK100 Completeness and Medium–High perimortem trauma. CCCXLII
Figure AA37: Nakanohama G-3-1 No.7357 Completeness and Medium–High antemortem trauma. CCCXLVII
Figure AA38: Nakanohama G-3-1-1-その 2 Completeness and Medium–High antemortem trauma. CCCLII
Figure AA39: Nakanohama G-1-2 No.1 Completeness and Medium–High perimortem trauma. .. CCCLVII
Figure AA40: Ōtomo 2-1 Completeness and Medium–High antemortem trauma. CCCLXIV
Figure AA41: Ōtomo 6 Completeness and Medium–High antemortem trauma. CCCLXVII
Figure AA42: Ōtomo SK35 Completeness and Medium–High antemortem trauma. CCCLXX
Figure AA43: Shibu 3 Completeness and Medium–High antemortem trauma, excluding #5 and 6 as the particular thoracic vertebrae affected could not be identified. CCCLXXXVI
Figure AA44: Shibu 4 Completeness and Medium–High perimortem trauma. ..... CDI
Figure AA45: Shinmachi 9 Completeness and Medium–High antemortem trauma. ..... CDIII
Figure AA46: Shinmachi 24-1 Completeness and Medium–High perimortem trauma. ..... CDVI
Figure AA47: Sudare K3 Completeness and Medium–High antemortem trauma. ..... CDX
Figure AA48: Tsukomuta 4 21 Completeness and Medium–High antemortem trauma. ..... CDXIV
Figure AA49: Tsukomuta 4 25 Completeness and Medium–High perimortem trauma. ..... CDXVIII
Figure AA50: Yokoguma kitsunezuka ST-41 Completeness and Medium–High perimortem trauma. ..... CDXXII
Figure AA51: Yokoguma kitsunezuka ST-122 Completeness and Medium–High antemortem trauma. ..... CDXXVI
Figure AA52: Yokoguma kitsunezuka ST-128 Completeness and Medium–High antemortem trauma. ..... CDXXX

Jōmon Period 縄文時代

Einomaru 10? | Adult | Female | Late Jōmon

Likelihood of traumatic injury: Low

Likelihood of being violence-related: N/A

Timing: N/A

Assessment of traumatic aetiology:

Although the margins of the abnormality (Figure A2) are similar to those of an antemortem cut mark (with a v-shape and smooth margins), considering its location and the nearby fossa, it is most likely that this is a vascular groove associated with the middle temporal artery (cf. Schunk and Maruyama 1960). There are no associated abnormalities on the inner table. The crack visible in its centre appears to be due to postmortem damage.

Dimensions: 20.1 mm x 1.7 mm

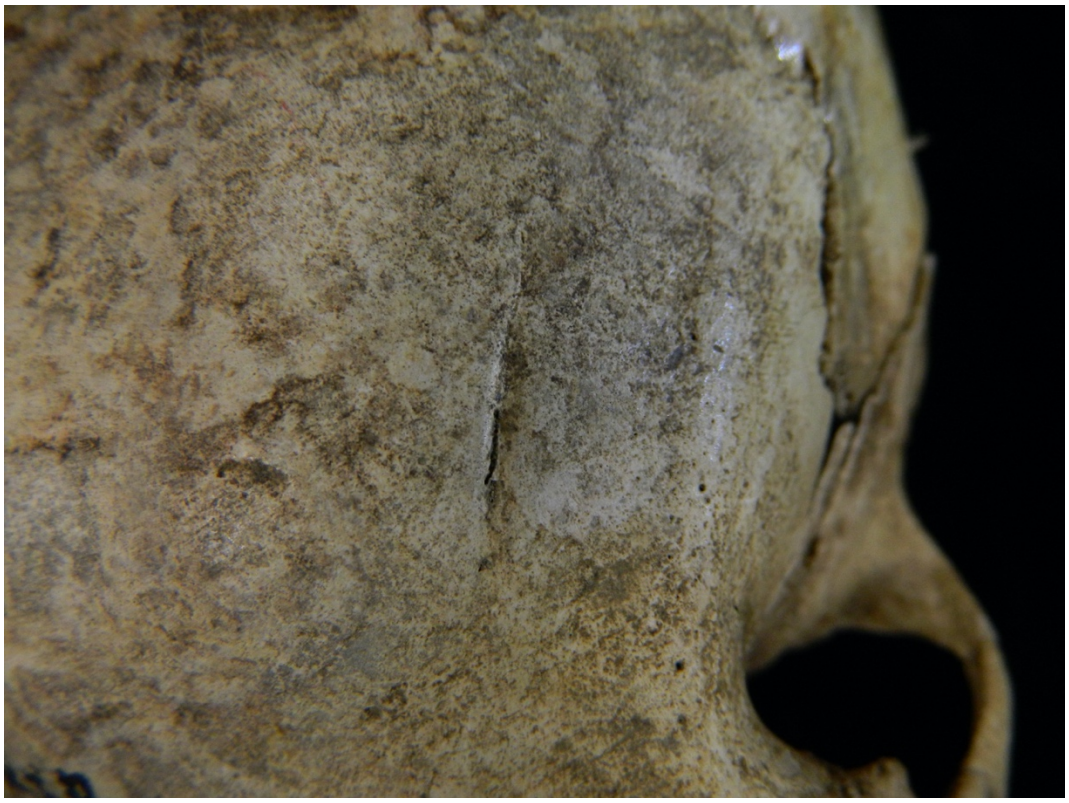


Figure A1: Einomaru 10? left side of the frontal bone (lateral to the frontal boss) showing a vascular groove which mimics some of the characteristics of an antemortem cut mark.

Inariyama 210 | Adolescent | Female? | Final Jōmon

Likelihood of traumatic injury: High

Likelihood of being violence-related: Low

Timing: Perimortem

Assessment of traumatic aetiology:

Linear marks and scrapes to the superior left parietal bone (Figure A3–Figure A4). Two linear marks oriented in the same direction and one scrape superior and posterior to them, overlapping with the larger of the two linear marks. Hertzian fracture cones and shoulder effects are present on the linear marks. The scraping is not present elsewhere on the crania. All deformities are patinated. Trampling marks tend to be more numerous when present, but fewer and larger trampling marks have been found previously (Fernández-Jalvo and Andrews 2016). Hence, this remains a possibility. Conversely it is possible that these marks are the result of cleaning of the crania. Kiyono (1969) describes No. 210 as being buried in a supine position with a young child. The crania was in anatomical position and these lesions are isolated. It is not clear why cleaning flesh from the skull in this particular area would necessitate enough force to produce the two linear marks with no other marks elsewhere. The two linear marks could be the result of violent intent, but their coupling with scrapping marks makes it difficult to differentiate them from trampling marks with any degree of confidence.

Dimensions: Largest linear mark is 11.7 mm long; Smaller (more anterior) linear mark is 4.9 mm; Scrapping mark is 16.3 mm x 5.0 mm

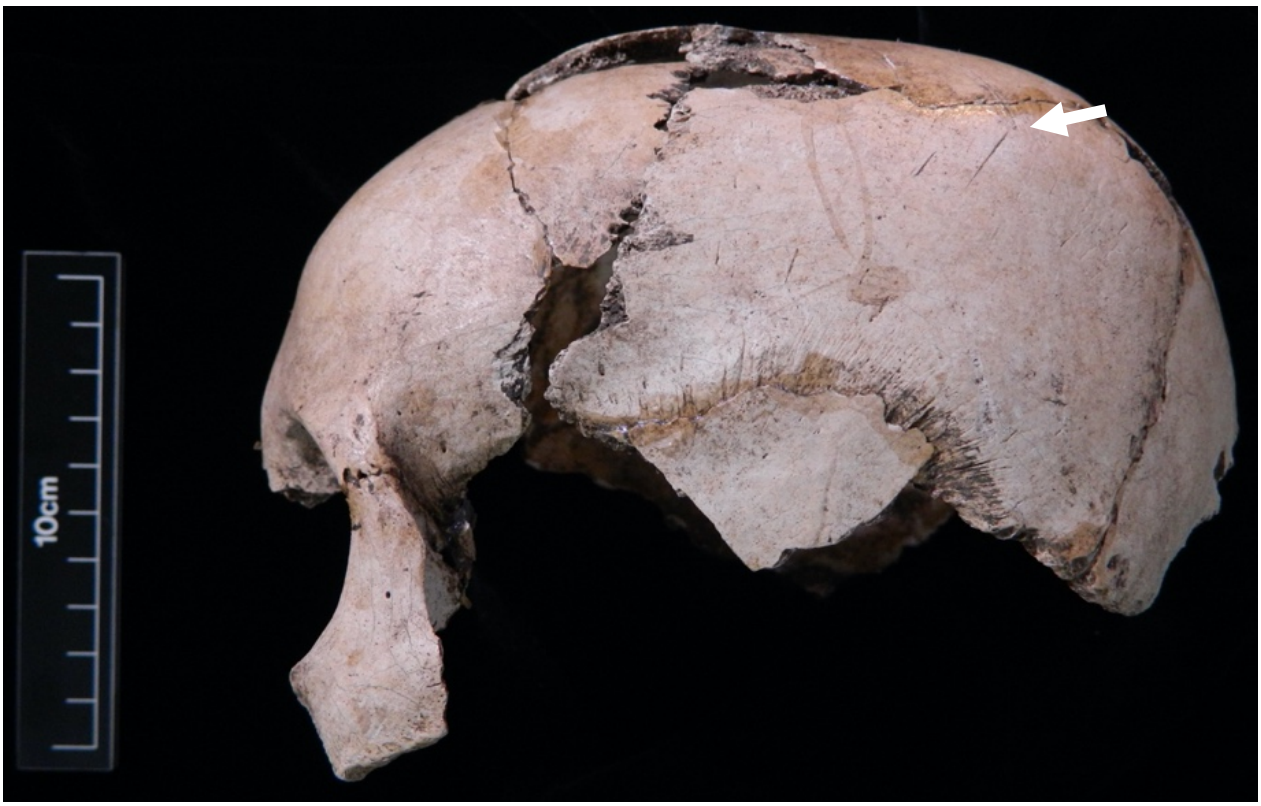


Figure A2: Inariyama 210 left, lateral view of the crania. Arrow indicates the area of interest (which can be seen in greater detail in Fig A4).



Figure A3: Inariyama 210 superior, lateral view of the left parietal bone showing two linear marks and a scraping mark.

Inariyama 249 | Mid-Old Adult | Female | Final Jōmon

Likelihood of traumatic injury: 1. Medium; 2. Medium–Low

Likelihood of being violence-related: High

Timing: Perimortem

Assessment of traumatic aetiology:

1. A circular hole on the squama of the right temporal bone (Figure A5–Figure A6). The margins of the perforation are sharp and there is a slight internal bevel on the posterior margins. The edges of the perforation are slightly jagged, possibly due to later postmortem damage. The bone of the squama is relatively thin, hence this might be the result of a penetrating force or a blunt force injury.

2. A hole with a semi-circular margin on the superior right parietal bone (Figure A7). The semi-circular margin has a patinated internal bevel and could have been a part of a smaller, oval-shaped blunt force injury. Postmortem fracturing characterises the triangular, inferior margins of the hole and the associated fractures radiating superiorly and anteriorly.

Dimensions: 1. 8.7mm x 11.8mm; 2. Rounded edge is 17.5mm



Figure A4: Inariyama 249 right, lateral view of the crania.



Figure A5: Inariyama 249 circular hole on the squama of the right temporal bone.



Figure A6: Inariyama 249 superior view of the right parietal bone showing the semi-circular margin suspected to have been associated with an oval-shaped blunt force injury.

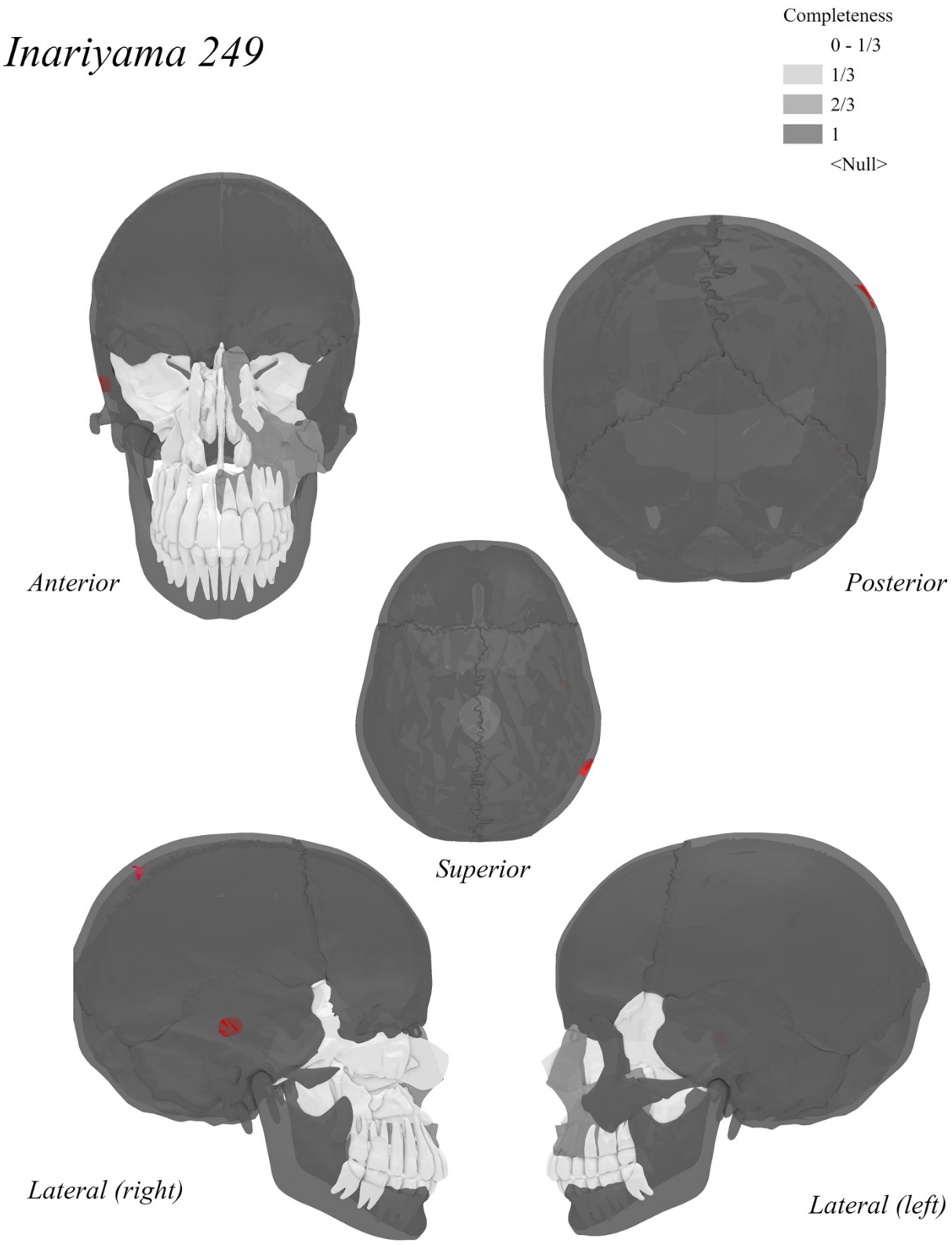


Figure AA1: Inariyama 249 Completeness and Medium-High perimortem trauma

Inariyama 251 | Young Adult | Male | Final Jōmon

Likelihood of traumatic injury: Low

Likelihood of being violence-related: N/A

Timing: N/A

Assessment of traumatic aetiology:

A depression with diffuse porosity with no associated response on the inner table (Figure A8–Figure A9). It's depth does not meet the requirements of a depressed fracture for this study.

Dimensions: 12.7 mm x15.8 mm and 0.3 mm deep



Figure A7: Inariyama 251 superoanterior view of the crania.



Figure A8: Inariyama 251 porous depression on the superior frontal bone.

Inariyama 254 | Young Adult | Indet. | Final Jōmon–Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Low

Timing: Perimortem

Assessment of traumatic aetiology:

Two sets of linear marks and scraping on the right side of the frontal bone (Figure A10). The linear marks have hertzian fracture cones and shoulder effects. Given their clustering and the combination of scraping and linear marks, these are likely the result of trampling.

Dimensions: The linear mark through the superciliary arch is 16.0 mm x 0.8 mm; The one near the temporal line is 16.3 mm long



Figure A9: Inariyama 254 right frontal bone showing likely trampling marks.

Inariyama 255 | Mid-Old Adult | Indet. | Final Jōmon–Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: High

Timing: Antemortem

Assessment of traumatic aetiology:

Large, long depression(s) on the lateral side of the right parietal bone (Figure A11–Figure A12). Porosity present within them and on the inner table. Remodelled bone is also present along the fracture line on the inner table. This could be the result of two blows with the edge of a blunt weapon as there is an area between the two depressions, but the fracture line which can be seen on the inner table is continuous.

Dimensions: The anterior depression is 27.1 mm x 9.3 mm and 2.5 mm deep



Figure A10: Inariyama 255 right parietal bone (posterior side is to the left side of the photo) showing two depressed fractures.



Figure A11: Inariyama 255 right parietal bone inner table showing healing fracture line.

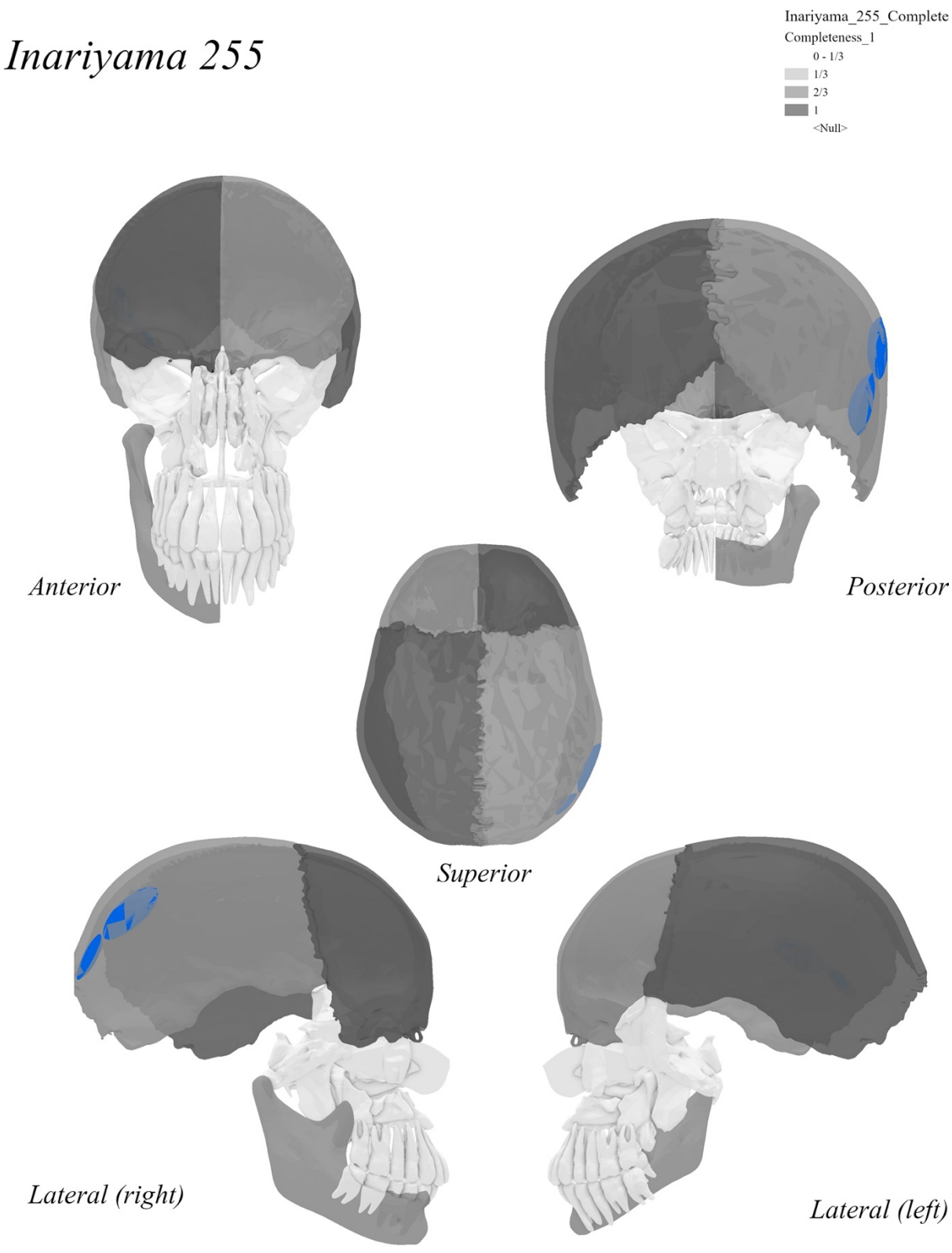


Figure AA2: Inariyama 255 Completeness and Medium–High antemortem trauma.

Itoku J002 | Adult | Indet. | Final Jōmon

Likelihood of traumatic injury: Low

Likelihood of being violence-related: N/A

Timing: Postmortem

Assessment of traumatic aetiology:

1. Originally classified by Matsui (2005) as a 'bladed weapon cut' to the proximal left femur (Figure A13–Figure A14), this linear deformity lacks any of the diagnostic features of a cut mark. This may be due to poor preservation resulting in the loss of clear diagnostic traits, such as patinated and smooth fracture edges, internal striations, Hertzian fracture cones, and so forth.

2. Originally classified by Matsui (2005) as a penetrating injury to the distal left femur (Figure A15–Figure A17), this hole has adhering bone angled inwards towards the hole, but this bone is vertically flaking rather than demonstrating any contours similar to the defect. Once more, it is argued here that the preservation is too poor to make a solid case for a traumatic aetiology here.

Dimensions: 1. Linear deformation is 28.2 mm long; 2. Perforation is 15.2 mm x 5.3 mm

Previously Reported In: Kōchi Prefecture Cultural Foundation Buried Cultural Property Center (2004) and Matsui (2005). Reassessed by JAW in Hudson et al. (2021).

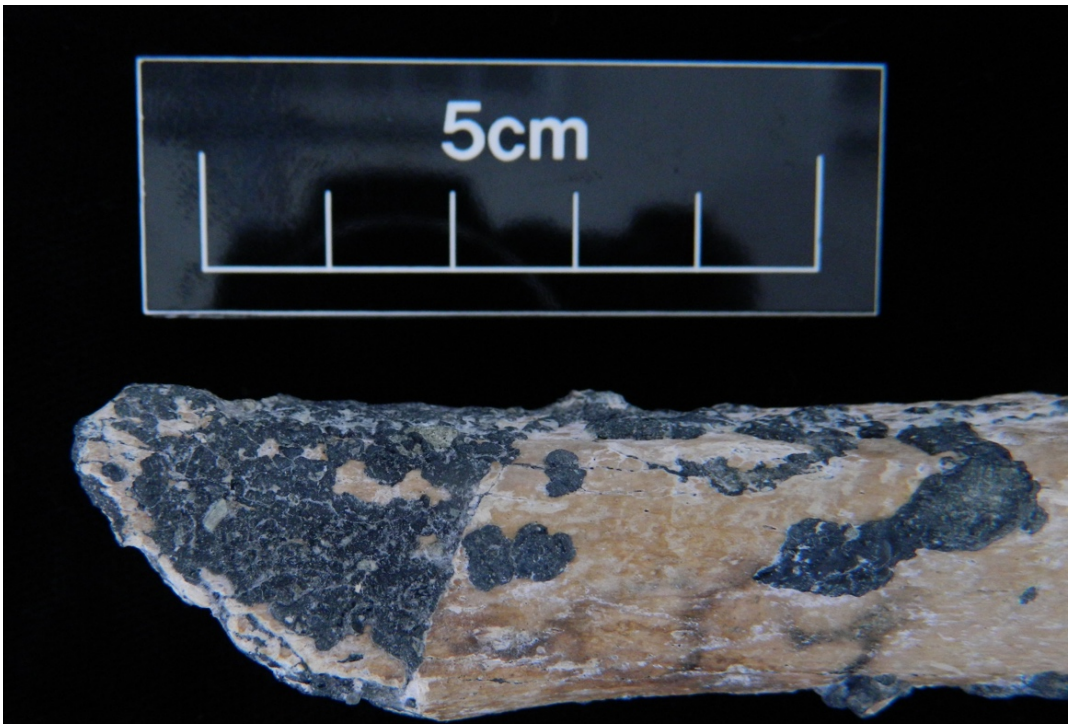


Figure A12: Itoku J002 proximal left femur linear abnormality.

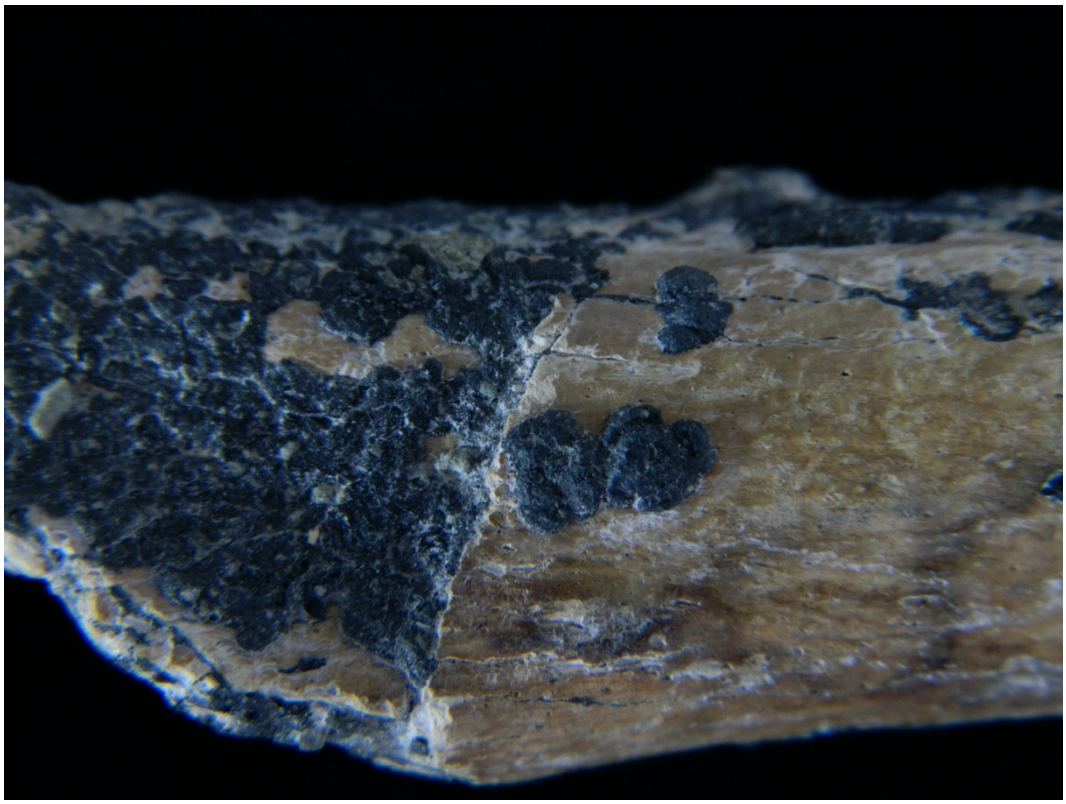


Figure A13: Itoku J002 close-up of linear deformity on proximal left femur showing its jagged edges.

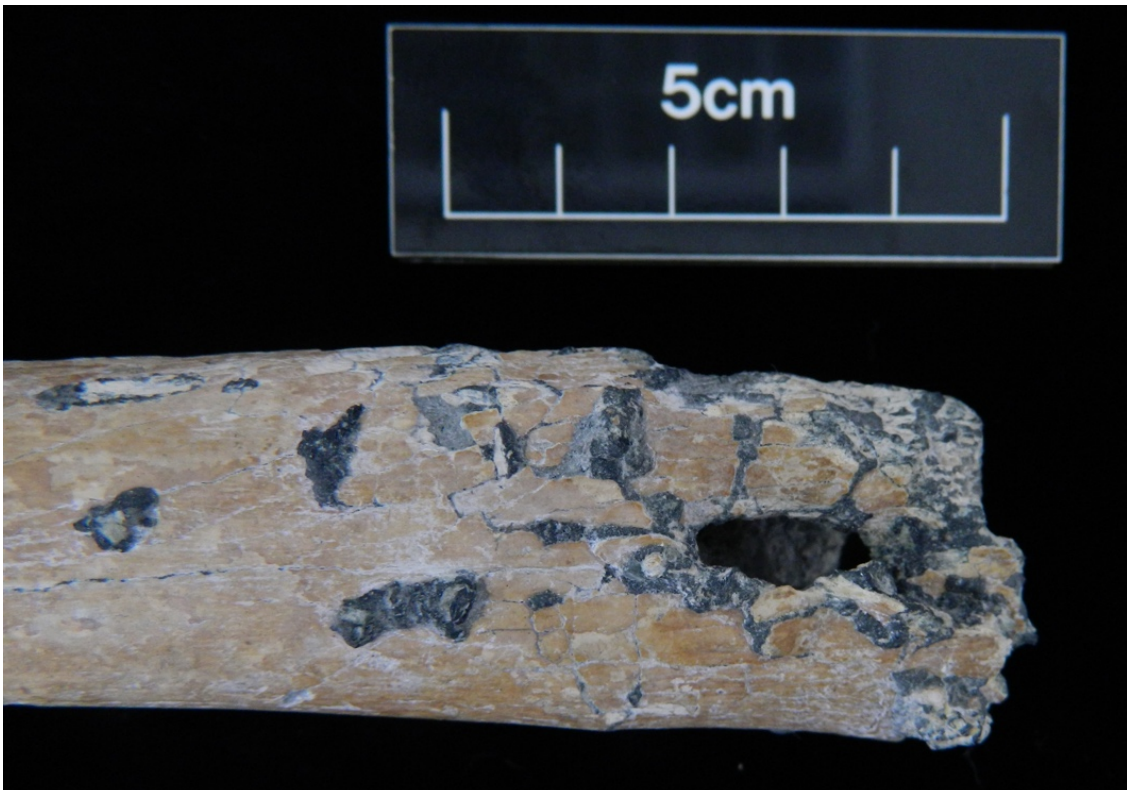


Figure A14: Itoku J002 hole in the distal left femur.

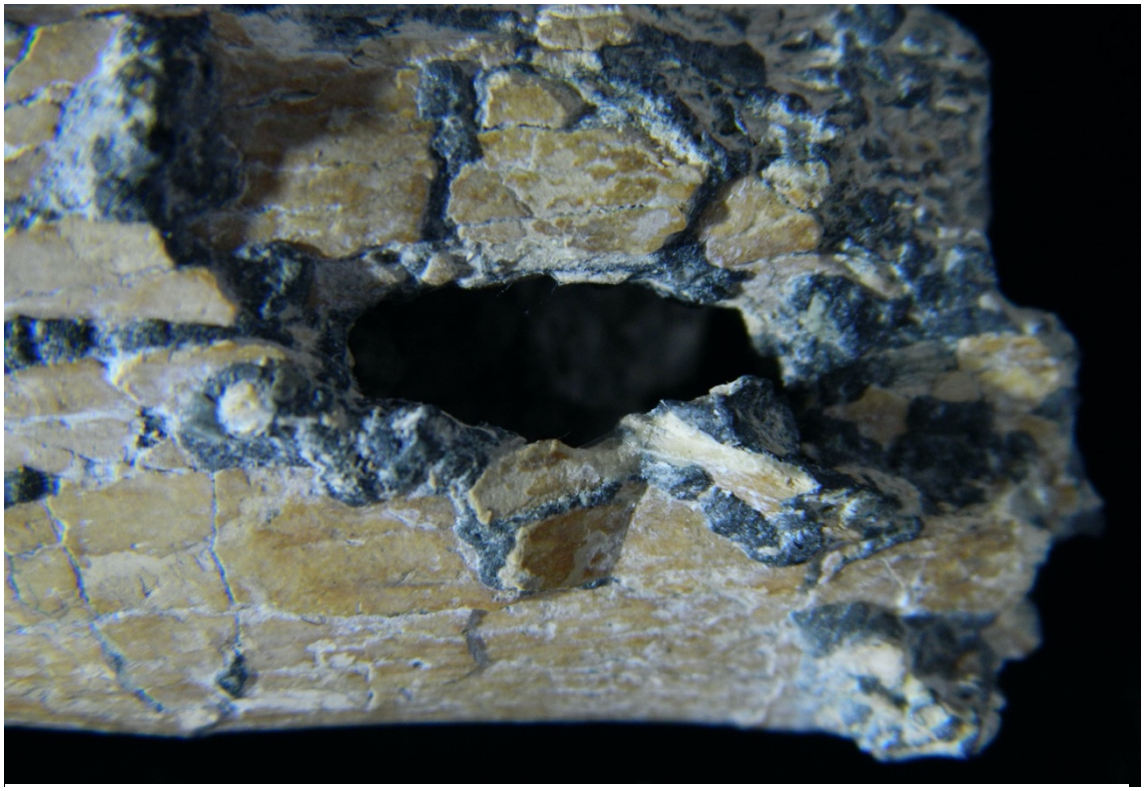


Figure A15: Itoku J002 close up of hole in the distal left femur.

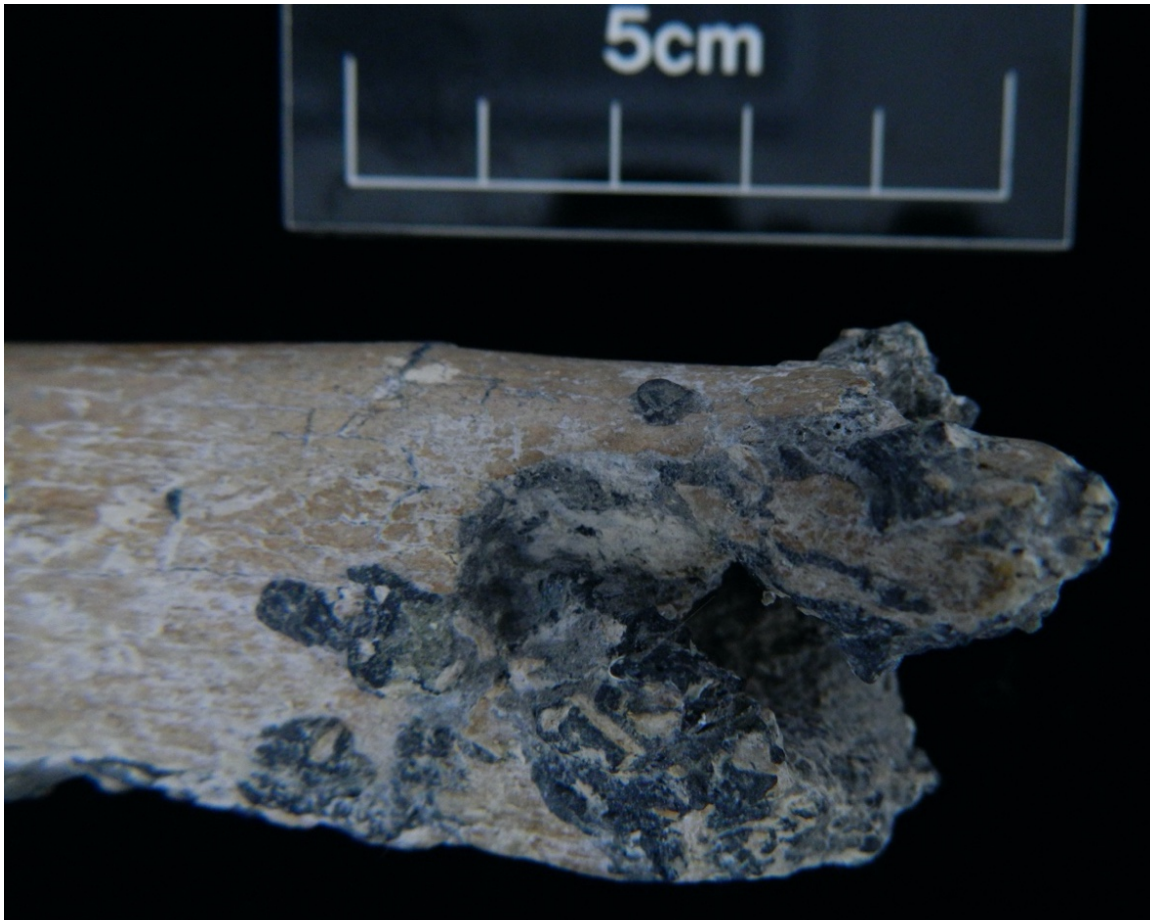


Figure A16: Itoku J002 posterior view of the distal left femur.

Itoku J003 | Adult | Indet. | Final Jōmon

Likelihood of traumatic injury: Low

Likelihood of being violence-related: N/A

Timing: Postmortem?

Assessment of traumatic aetiology:

A small pair of unpatinated lesions similar to others from the site (including J004 and J015 discussed below) on the anteromedial mid-diaphysis of the left femur (Figure A18). These were described as 'stab' wounds by Matsui (2005), but clearer examples of this type of wound at Itoku (i.e. J004) show that the lesion is more u- than v-shaped. The lesions bears more similarity to paired incisor carnivore scavenging than to a stab wound (Fernández-Jalvo and Andrews 2016; Longrich and Ryan 2010). Hence these lesions are attributed to taphonomic processes.

Dimensions: 1.7 mm x 0.6 mm; 2.5 mm x 0.6 mm

Previously Reported In: Kōchi Prefecture Cultural Foundation Buried Cultural Property Center (2004) and Matsui (2005).

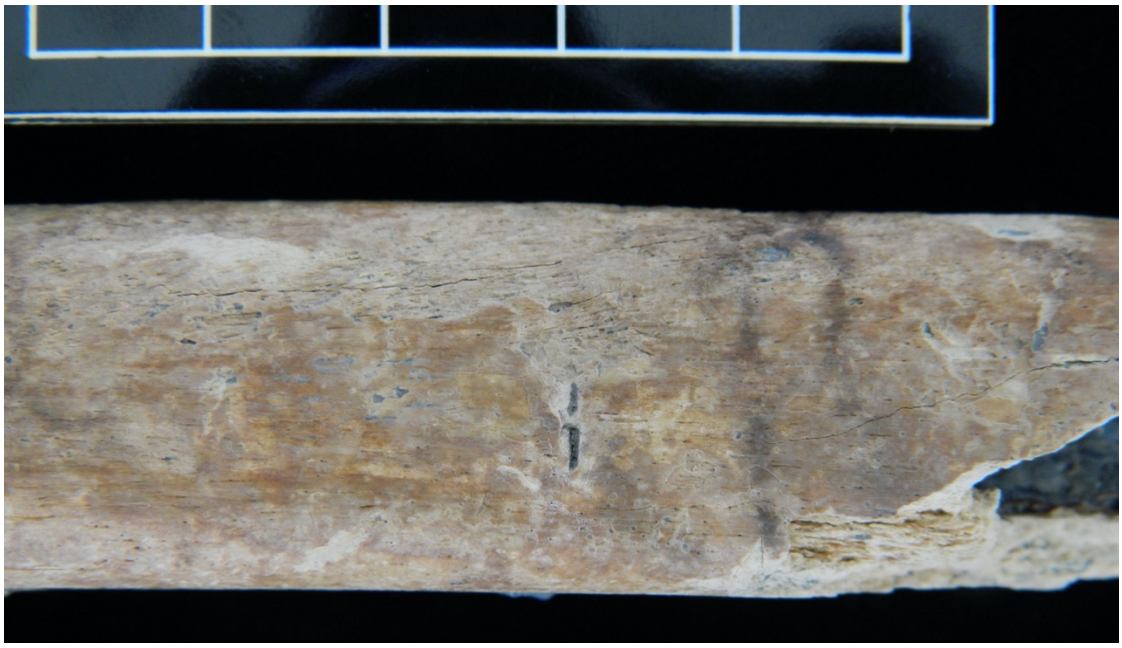


Figure A17: Itoku J003 left femur showing paired taphonomic lesions.

Itoku J004 | Adult | Indet. | Final Jōmon

Likelihood of traumatic injury: Low

Likelihood of being violence-related: N/A

Timing: Perimortem

Assessment of traumatic aetiology:

Four patinated, u-shaped paired linear marks originally described as 'stab' wounds by Matsui (2005) on the diaphysis of the right femur (Figure A19–Figure A20). The marks curve distally and the margins of the proximal set of two, in particular, show a dragging motion posteriorly. Similarly to those found on J003, these were classified as taphonomic damage.

Dimensions: Proximal set: proximal line broken into two: 1. 2.0 mm x 0.4 mm, 2. 3.3 mm x 0.8 mm; the distal mark is continuous: 6.7 mm x 0.8 mm

Distal set: proximal line broken into two: 1. 2.2 mm x 0.5 mm; 2. 1.4 mm x 0.5 mm; distal line broken into two as well: 1. 4.6 mm x 0.6 mm; 2. 1.6 mm x 0.3 mm

Previously Reported In: Kōchi Prefecture Cultural Foundation Buried Cultural Property Center (2004) and Matsui (2005). Reassessed by JAW in Hudson et al. (2021).



Figure A18: Itoku J004 right femur showing two sets of linear marks attributed to scavenging.



Figure A19: Itoku J004 close-up of linear marks found on the right femur.

Itoku J005 | Adult | Indet. | Final Jōmon

Likelihood of traumatic injury: Low

Likelihood of being violence-related: N/A

Timing: Postmortem

Assessment of traumatic aetiology:

A series of linear, unpatinated, deep defects on the lateral diaphysis of the left femur (Figure A21–Figure A22). It is possible that these represent a similar taphonomic process as those seen on J003 and J004, but these defects are characterised by rows of three lesions – one long linear mark in the middle and two much smaller ones on either side. Hence, it is possible that the damage to this bone is due to some tool used during the excavation, especially considering the what appears to be trowel or shovel damage on the distal end.

Dimensions: Proximal to distal most: 1. 3 parts: 5.2 mm x 1.0 mm, 2.9 mm x 0.6 mm, and 1.9 mm x 0.6 mm; 2. 2 parts: 3.0 mmm x 0.6 mm and 1.9 mm x 0.5 mm; 3. 2 parts: 2.6 mm x 0.8 mm and 2.8 mm x 0.7 mm; 4. 2 parts: 4.1 mm x 0.8 mm wide and 1.5 mm x 0.2 mm; 5. 7.1 mm x 1.1 mm; 6. 2 parts: 7.2 mm x 1.0 mm and 1.6 mm x 0.5 mm; 7. 3.1 mm x 0.8 mm

Previously Reported In: Kōchi Prefecture Cultural Foundation Buried Cultural Property Center (2004) and Matsui (2005).



Figure A20: Itoku J005 left femur showing series of linear marks arranged in rows of three.



Figure A21: Itoku J005 close-up of distal diaphysis of the left femur showing postmortem damage to the bone.

Itoku J009 | Adult | Indet. | Final Jōmon

Likelihood of traumatic injury: Low

Likelihood of being violence-related: N/A

Timing: Postmortem

Assessment of traumatic aetiology:

Matsui (2005) tentatively suggested that the grooves found on the diaphysis of the left femur (Figure A23–Figure A24) could be due to blunt force trauma. If these were BFT injuries then they would have to be antemortem injuries as no fractured bone can be seen. Yet, there is no evidence of displacement during the process of healing and no healed fracture lines can be seen. Additionally, the surface of the bone has nearly entirely eroded away and the defects present more closely resemble weathering patterns than blunt force injuries to long bones.

Dimensions: Larges is 24.6 mm x 6.7 mm; Two small lesions on the linea aspera: proximal: 4.2 mm x 1.2 mm, distal: 4.0 mm x 1.4 mm

Previously Reported In: Kōchi Prefecture Cultural Foundation Buried Cultural Property Center (2004) and Matsui (2005).

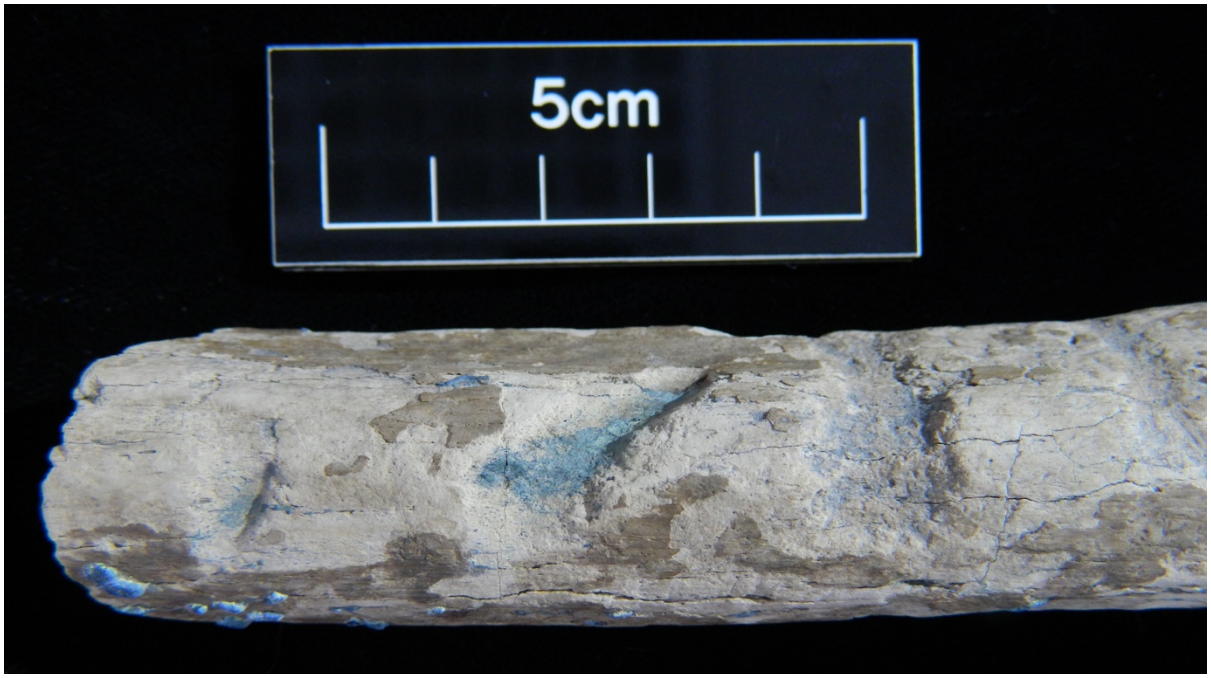


Figure A23: J009 left femur showing taphomic damage.

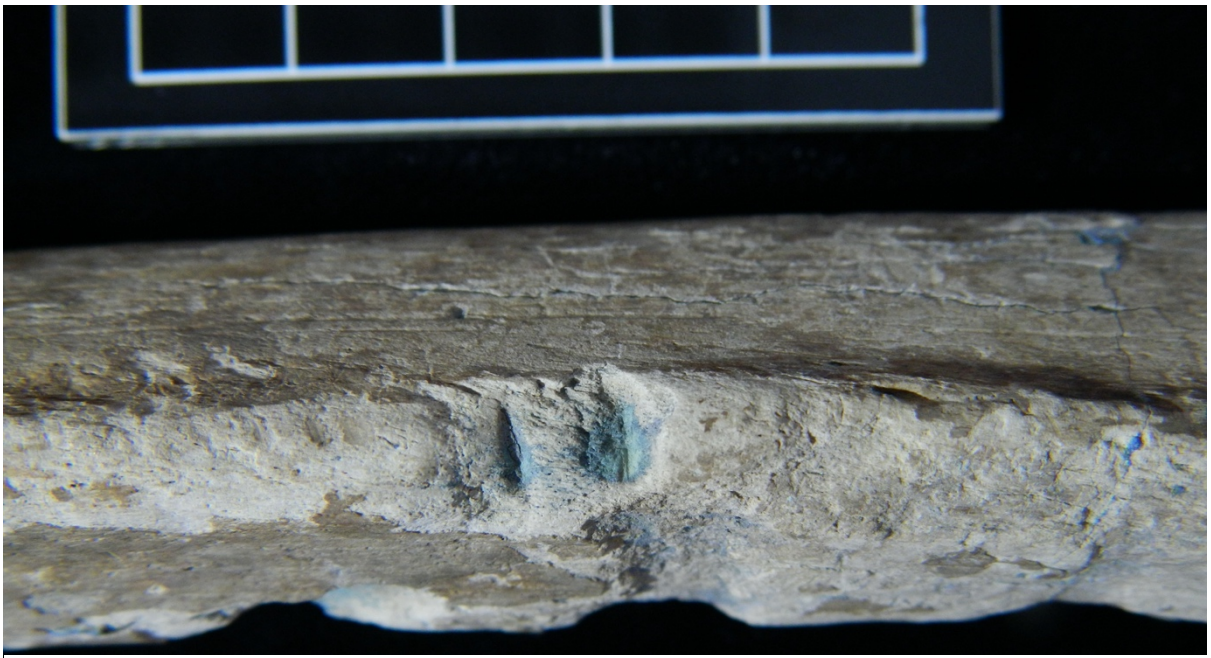


Figure A22: J009 left femur linea aspera showing likely taphonomic damage. The scale is 1 cm.

Itoku J015 | Adult | Indet. | Final Jōmon

Likelihood of traumatic injury: Low

Likelihood of being violence-related: N/A

Timing: Perimortem

Assessment of traumatic aetiology:

Matsui (2005) attributed three patinated lesions on the distal left humerus to stabbing or cutting (Figure A25–Figure A26). The linear marks are shallow and u-shaped in cross-section. Given the shape of the defects (i.e. paired) and how they appear to resemble punctures more than cuts, it is most likely that they represent tooth marks.

Dimensions: Proximal: 1. 2.3 mm x 0.5 mm, 2. 1.6 mm x 0.6 mm; Medial: 9.2 mm x 0.5 mm; Distal 1: 2.3 mm x 0.7 mm and 2. 3 mm x 0.4 mm

Previously Reported In: Kōchi Prefecture Cultural Foundation Buried Cultural Property Center (2004) and Matsui (2005).



Figure A24: Itoku J015 left humerus showing patinated tooth marks.



Figure A25: Itoku J015 close-up of lesions on left humerus.

Toyomatsu-Domen Cave 78-1 | Young Adult | Female | Late Jōmon

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: High

Timing: Perimortem

Assessment of traumatic aetiology:

A possible cut mark on the ascending ramus of the right mandible (Figure A27–Figure A29).

Striations are visible on the walls of the cut and it is patinated.

Dimensions: 5.5 mm in length and 0.6 mm in idth



Figure A26: Toyomatsu-Domen Cave 78-1 posterolateral view of the right side of the mandible showing a small cut mark.



Figure A27: Toyomatsu-Domen Cave 78-1 posterior close-up of the right side of the mandible showing a small cut mark.



Figure A28: Toyomatsu-Domen Cave 78-1 posterior close-up of the right side of the mandible showing a small cut mark.

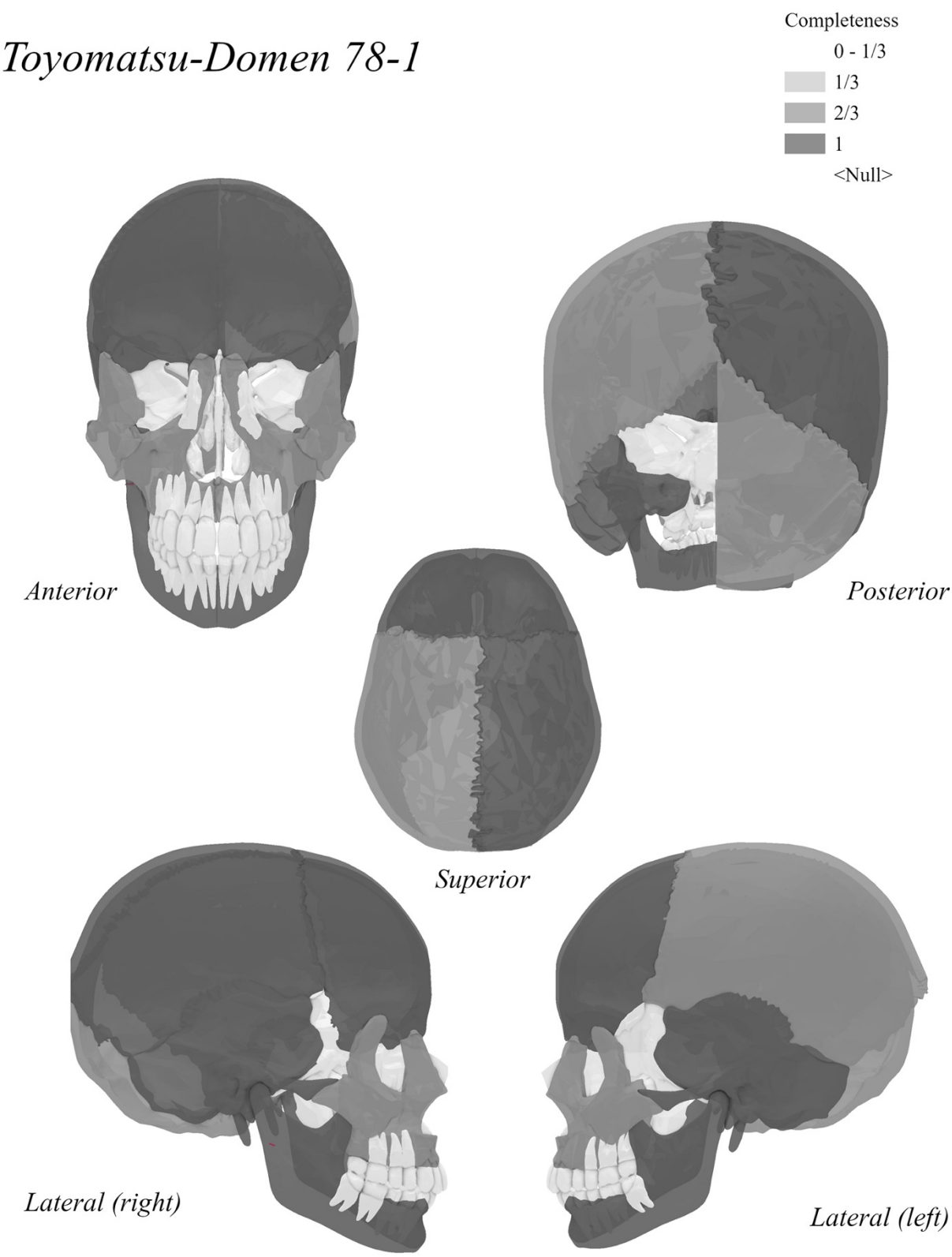


Figure AA3: Toyomatsu-Domen 78-1 Completeness and Medium–High perimortem trauma.

Tsukumo 20 | Mid-Adult | Female | Late-Final Jōmon

Likelihood of traumatic injury: High

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

A non-specific healing fracture to the distal diaphysis of the right ulna (Figure A30). The formation of an organised callous is evident and largest on the anterior, lateral, and medial sides of the bone. There is minimal porosity and it is localised. The interosseous crest is widened and the inferomedial portion of it has a diagonal porous ridge. The right radius shows no signs of similar fracturing.

Burst fractures and a compression fracture are present on the vertebral bodies.

Note that there were no cranial fragments with completeness ≥ 1/3 recorded.

Dimensions: The callus is 31.5 mm x 12.6 mm. The porous ridge 8.7 mm x 2.8 mm and the porosity extends up to 6.6 mm distally.



Figure A29: Tsukumo 20 right ulna showing an organised callous and localised porosity.

Tsukumo 24 | Young–Mid Adult | Male | Final Jōmon

Likelihood of traumatic injury: 1. Medium; 2. Medium; 3. High

Likelihood of being violence-related: 1–3. Low

Timing: 1. Antemortem; 2. Perimortem; 3. Antemortem

Assessment of traumatic aetiology:

1. Three depressions on the posterosuperior right parietal bone (Figure A31). There are no corresponding depressions or thinning on the left parietal bone. Porosity is present within the depressions. There are no corresponding lesions on the inner table. Only one of these has a depth greater than 0.5 mm.

2. A possible case of os odontoideum on the second cervical vertebra (Figure A32). The odontoid process is missing and where it should be located is worn and porous. The corresponding facet on C1 has osteophyte formation superiorly. The occipital condyles appear normal. Congenital absence of the odontoid process is usually marked by a flat surface on the superior body of the axis or a depression in the body, which is not the case for Tsukumo 24. The odontoid process was not recovered and it is possible that it was lost during the excavation process. This is a possible case of os odontoideum resulting from a Type II fracture to the odontoid process, which are most often caused by falls (Bajaj et al. 2010; O'Brien et al. 2015; Sánchez-Aparcero et al. 2018). It should also be noted that the thoracic vertebrae (T6, T7, and T11) show evidence of compression fractures, osteophytes, and Schmorl's nodes and that the lumbar vertebrae (particularly L1 and L4) show significant osteophyte formation on the vertebral bodies.

As this and the possible depressed fractures to the cranium could have occurred during the same incident, such as a fall, these are not considered to have resulted from any kind of conflict.

3. Pervasive perimortem injuries which have been attributed to a fatal shark attack. See full details and photographs in White et al. (2021).

Dimensions: 1. Superior-most depression: 5.8 x 7.4 mm, 0.4 mm deep; Second-most superior depression: 7.5 x 5.5 mm, 0.6 mm deep; Inferior-most depression: 20.2 x 10.7 mm, 0.4 mm deep

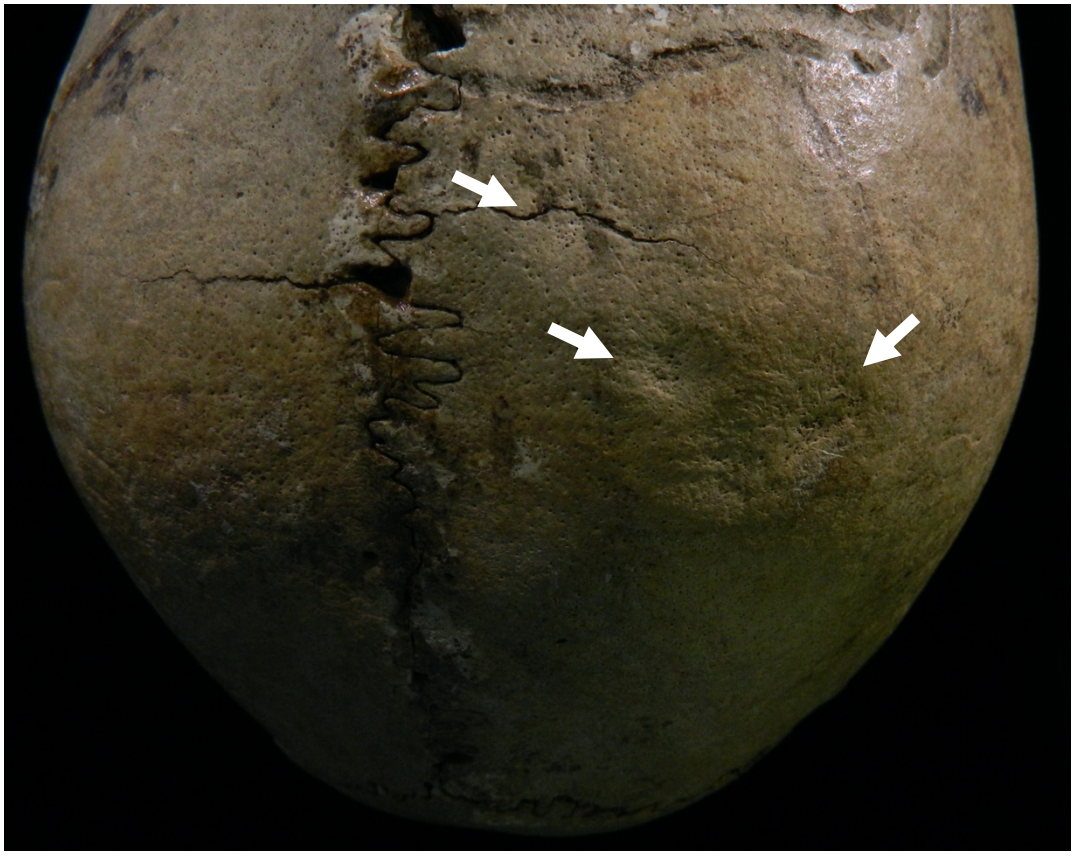


Figure A30: Tsukumo 24 posterosuperior view of the parietal bones showing approximately three shallow, porous depressions.



Figure A31: Tsukumo 24 atlas and axis showing osteophyte formation on the atlas and the missing odontoid process and irregular and porous surface in its place on the axis.

Tsukumo 36 | Mid-Adult | Male | Late-Final Jōmon

Likelihood of traumatic injury: High

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

A porous depression on the superior right parietal bone (Figure A33). There is no corresponding lesion on the inner table. The lesion is porous and lacks any starburst appearance more commonly found in neoplasms (Ortner 2003b). There are no similar lesions elsewhere on the crania.

Burst fractures on the lumbar and thoracic vertebral bodies.

Dimensions: 21.03 x 17.1 mm and 1.4 mm deep



Figure A32: Tsukumo 36 superolateral view of the right parietal bone showing a possible depressed fracture.

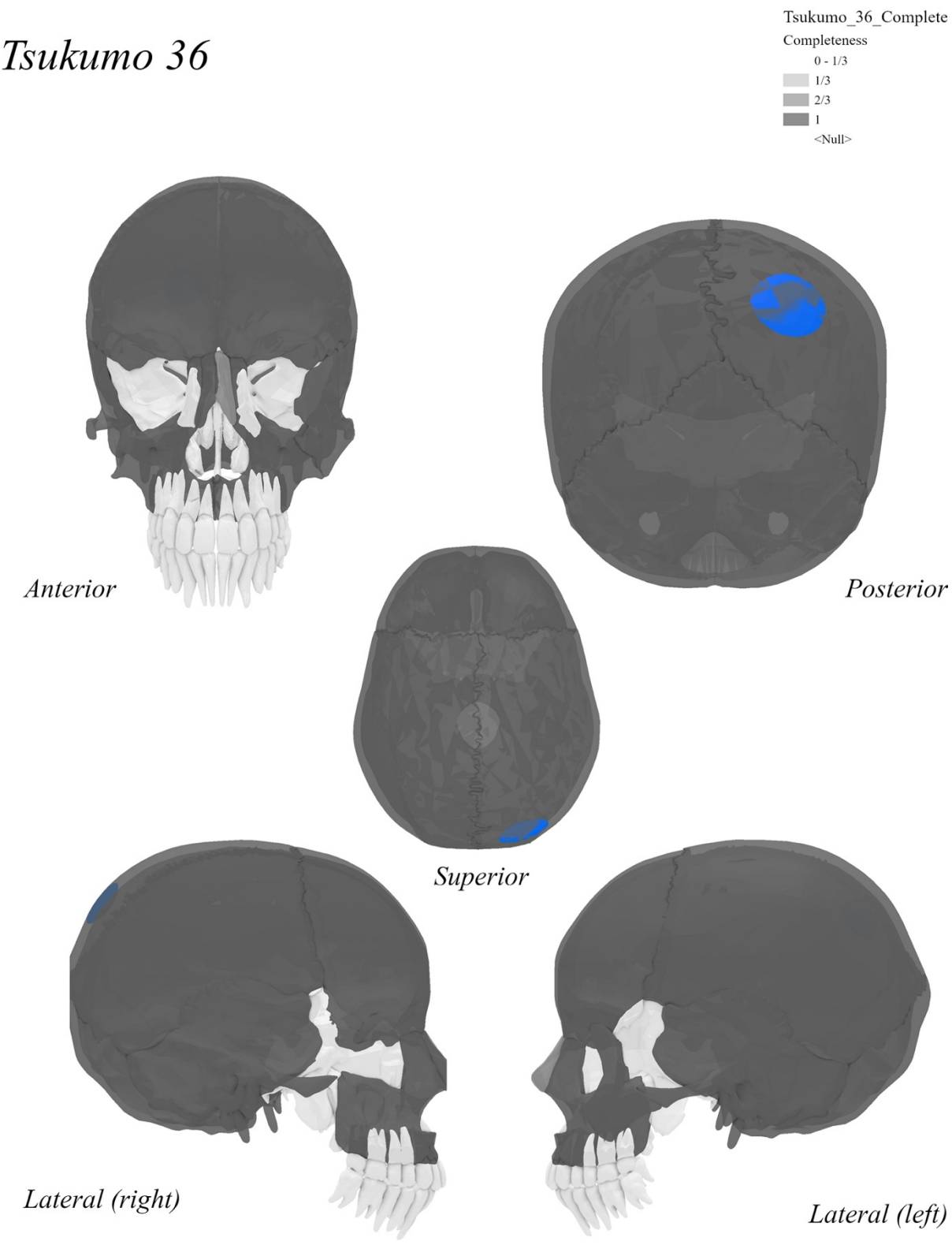


Figure AA4: Tsukumo 36 Completeness and Medium-High antemortem trauma.

Tsukumo 38 | Old Adult | Female | Late-Final Jōmon

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

A crescent-shaped, porous depression with sloping margins on the posterior left parietal bone (Figure A34). There is no associated thinning on the right parietal bone. There is no involvement of the inner table.

Burst fractures and compression fractures are present on the vertebral bodies.

Dimensions: 10.3 x 16.9 mm, 0.7 mm deep



Figure A33: Tsukumo 38 left parietal bone showing a possible healed depressed fracture.

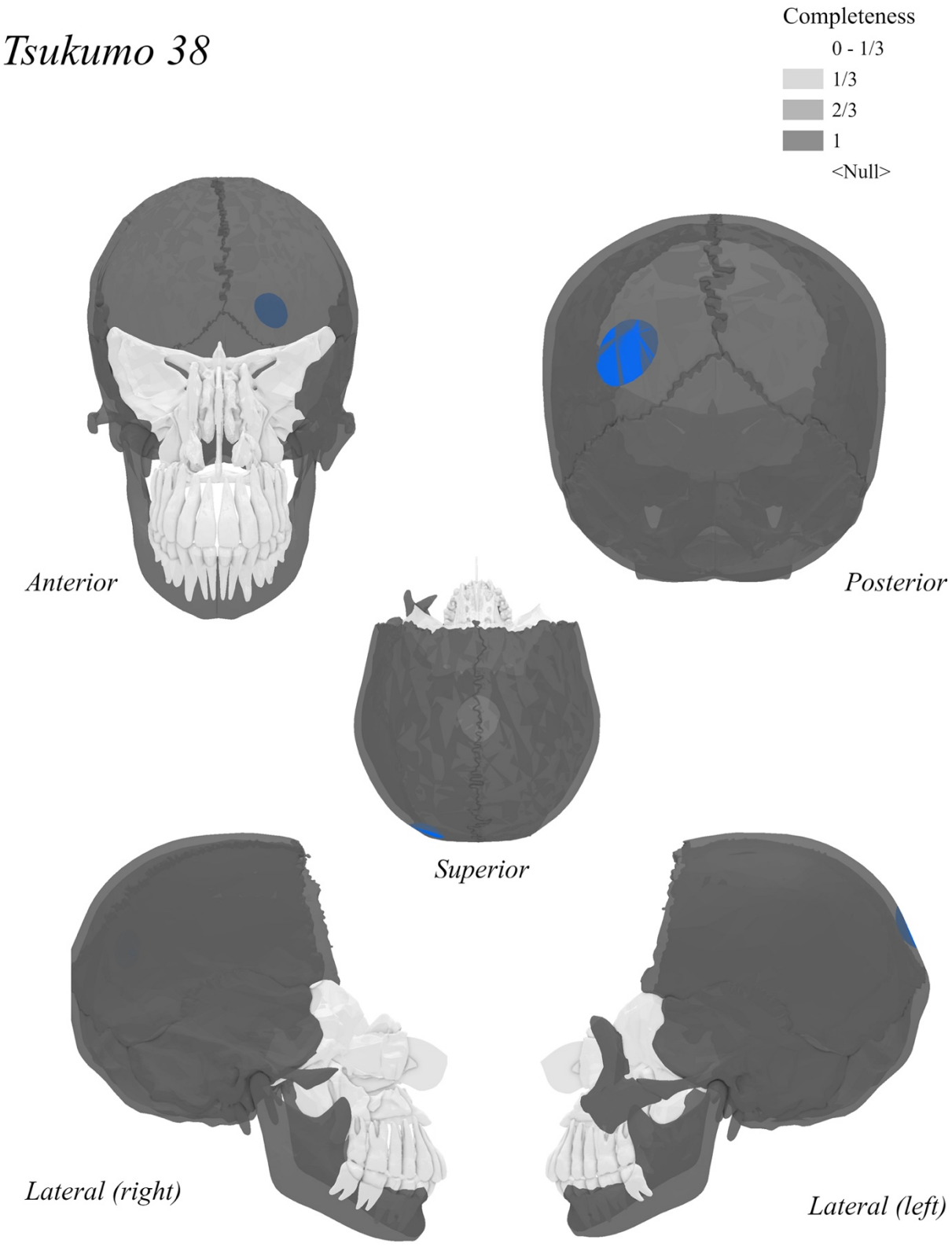


Figure AA5: Tsukumo 38 Completeness and Medium–High antemortem trauma.

Tsukumo 46 | Mid-Old Adult | Male | Late-Final Jōmon

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

An oval-shaped, porous depression on the right frontal bone (Figure A35–Figure A36) possibly representing a healing depressed fracture. No other such depressions were found on the crania. There was no corresponding involvement of the inner table. The lesion is partially obscured by postmortem fracturing and subsequent repair (i.e. glue).

Burst fractures vertebral bodies.

Dimensions: 8.0 mm x 2.7 mm and 0.5 mm deep



Figure A34: Tsukumo 46 frontal bone showing small oval depression.



Figure A35: Tsukumo 46 close-up of porous, oval depression on the frontal bone.

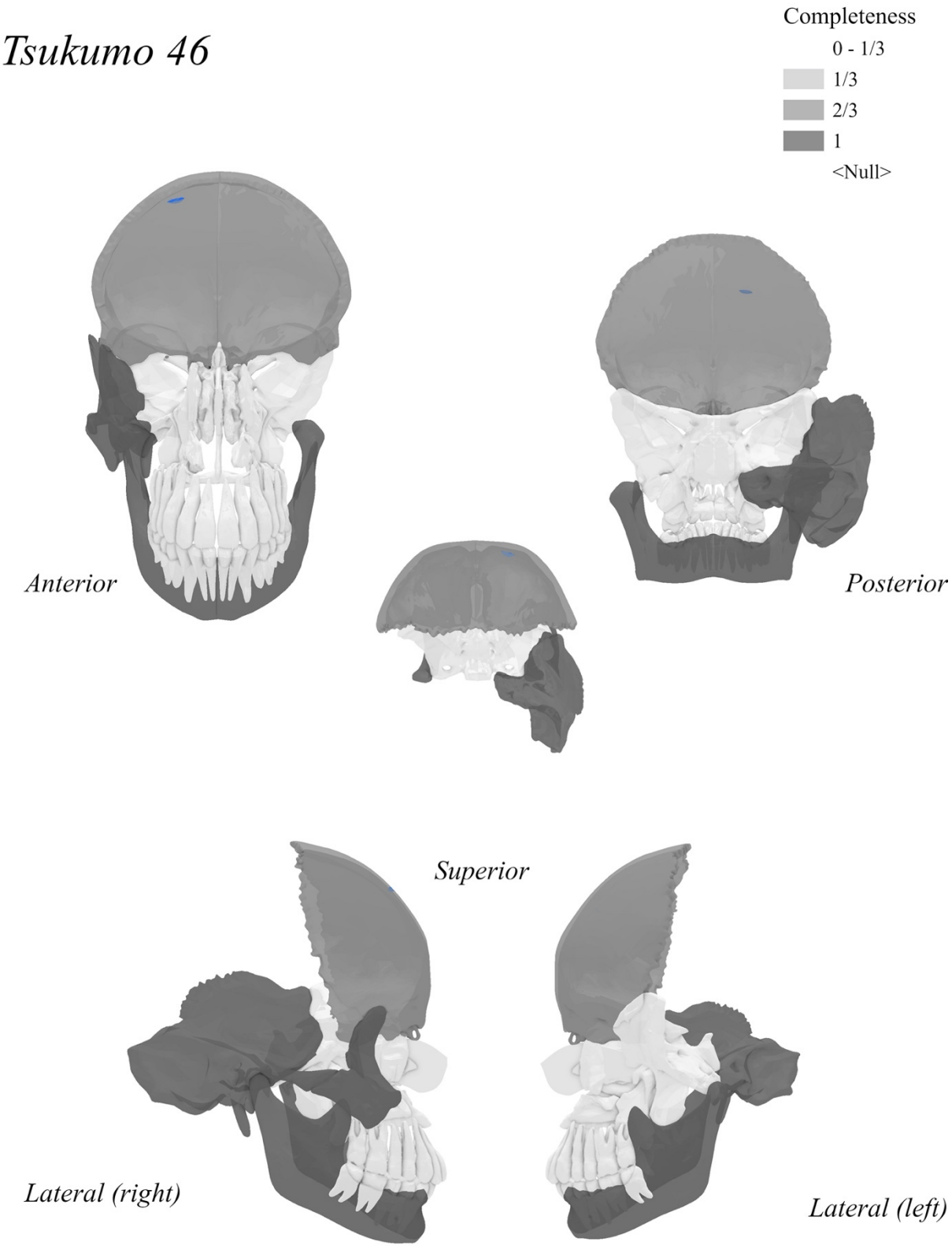


Figure AA6: Tsukumo 46 Completeness and Medium–High antemortem trauma.

Tsukumo 65 | Young-Mid Adult | Male | Late-Final Jōmon

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: Low

Timing: Antemortem

Assessment of traumatic aetiology:

A possible healed oblique or spiral fracture of the proximal diaphysis of the right radius (Figure A37–Figure A38). The shaft is elongated mediolaterally. There is a strongly defined curved ridge on the posterior diaphysis with porosity along it. At this point, the radius is curved medially.

Dimensions: Total area affected is 82.4 mm long



Figure A36: Tsukumo 65 radii and ulnae anterior view. Note the abnormal morphology of the right radius.



Figure A37: Tsukumo 65 radii and ulnae posterior view. Note the abnormal morphology of the right radius.

Tsukumo 35 A? | Adult | Male | Late-Final Jōmon

Likelihood of traumatic injury: Low

Likelihood of being violence-related: N/A

Timing: Perimortem?

Assessment of traumatic aetiology:

A series of curved fractures, indicating a higher collagen content at the time of fracturing, running through the frontal and parietal bones (Figure A39–Figure A40). Fracture lines jump across sutures and the fracture terminating in the left orbital is oblique in angle. Transverse fractures are present as well, but these stop at the curved fractures. Assessment was hindered by the copious amounts of glue and plaster used to reconstruct the crania, obscuring fracture angles and colouration. Additionally, there is no clear impact point.



Figure A38: Tsukumo 35 A? superolateral view of the crania showing curved fracture lines.



Figure A39: Tsukumo 35 A? anterior view of the crania showing curved fracture lines.

Yamaga 9 | Mid-Old Adult? | Female | Mid Late Jōmon

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

A porous depression at the canine fossa of the left maxilla, possibly representing a depressed fracture to the structure (Figure A41) (cf. Cho et al. 2018). The margins are sloping. The right maxilla does not present with a corresponding depression. The superior portion of the depression is deeper and has a porous, curved line. This is marked as 'Medium' likelihood as it is possible that this may simply represent skeletal asymmetry, but its depth, the smooth margins and the porosity within are suggestive of trauma.

Dimensions: 10.9 mm x 12.9 mm and 5.6 mm deep



Figure A40: Yamaga 9 anterior view of the maxillae showing a porous depression on the right maxilla.

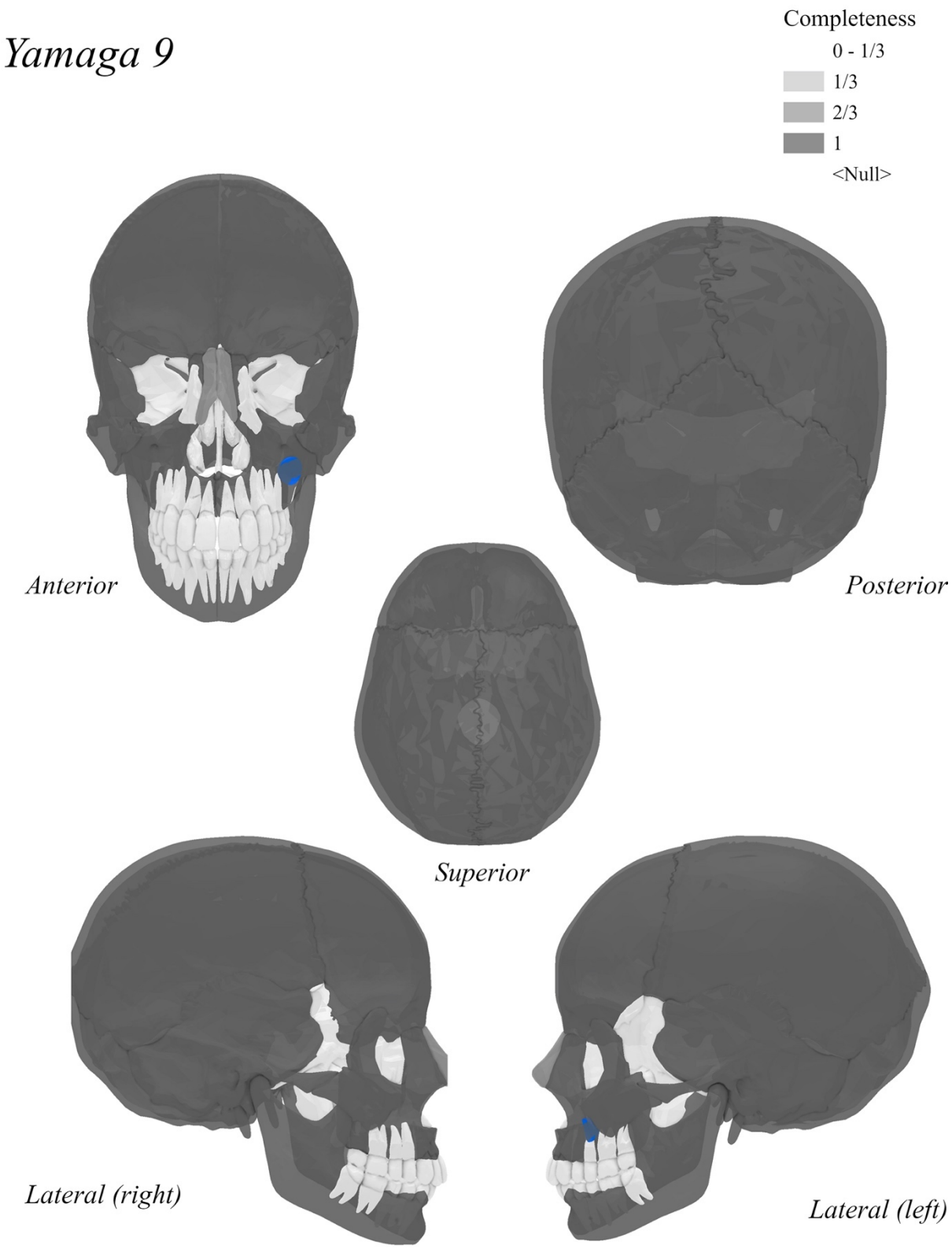


Figure AA7: Yamaga 9 Completeness and Medium–High antemortem trauma.

Yamaga 18 | Mid-Adult | Male | Mid Late Jōmon

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

A porous, oval-shaped depression on the superior right portion of the frontal bone (Figure A42). In the centre of the depression is a hole with smooth, rounded edges, although some postmortem damage is present to the superior margins. A rounded, crescent-shaped ridge runs through the depression's inferior half, passing through the hole. No corresponding lesions on the inner table were found. The presence of ridges and irregularities within antemortem depression fractures are not abnormal and it is possible that the implement used to create the depression, if it was the result of BFT, had some kind of point to it. Whether the hole at the centre might represent a dermal sinus and the surrounding depression a result of a cyst-like growth with bone lysis was considered. The hole does not pass through the inner table, and the depression lacks scalloped margins, which are indicative of osteoclastic activity. The location of the potential cyst does not correspond to clinical cases, with most being located on the occipital, nasion, or parietal bones (Pinhasi and Mays 2008; Srikantha et al. 2012; Weingarten et al. 2020; Wright 1971). Although exactly what implement within the Jōmon tool-kit might have caused a depressed lesion with a hole is not readily apparent, its location and sloping, rounded margins are most consistent with a healed depressed fracture.

Dimensions: 11.7 mm x 6.6 mm and 1.0 mm deep. Perforation is 1.3 mm in circumference.



Figure A41: Yamaga 18 superolateral view of the frontal bone showing a porous depression with a hole in the centre.

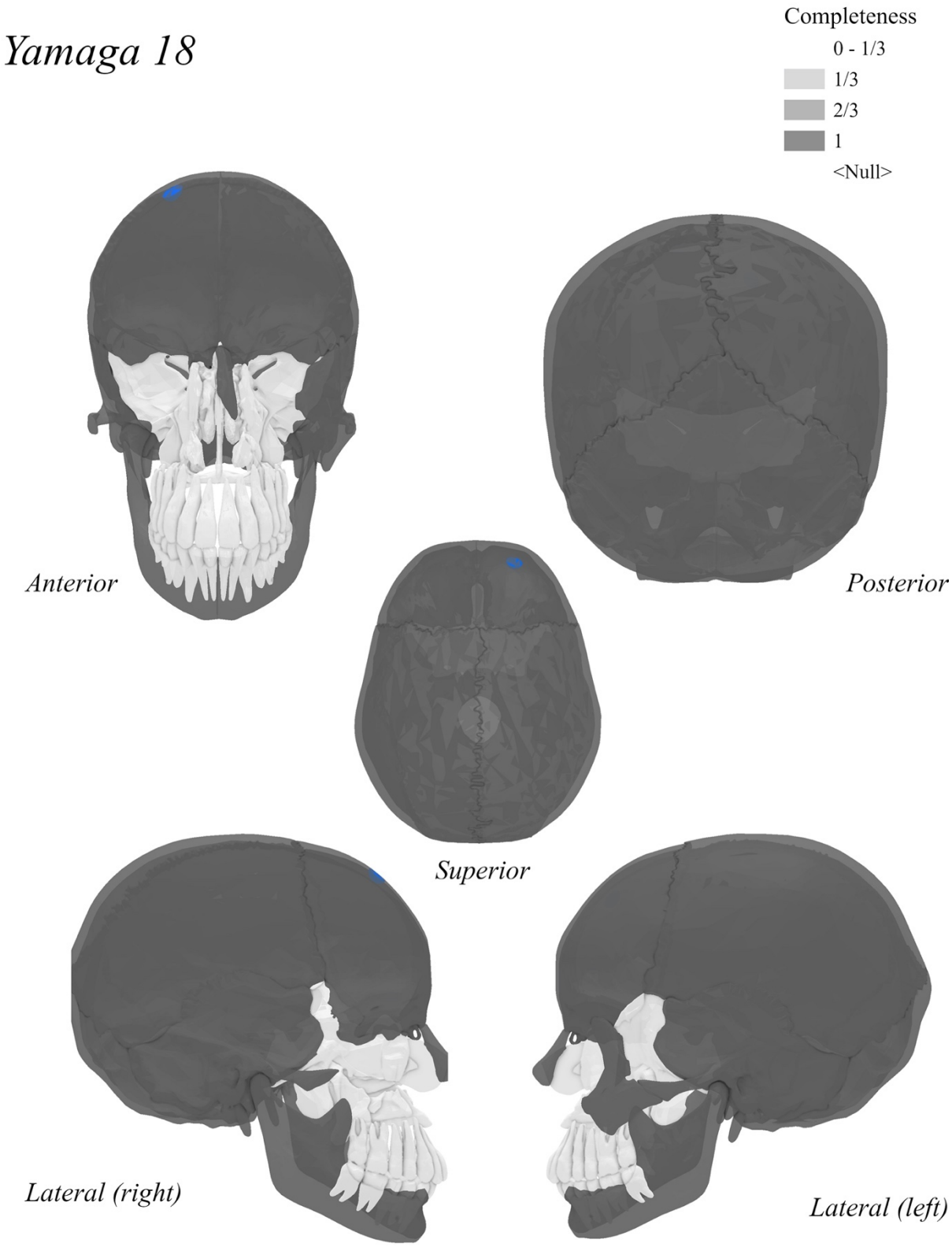


Figure AA8: Yamaga 18 Completeness and Medium–High antemortem trauma.

Yoshigo 360-1 | Young Adult | Female | Late-Final Jōmon

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: Medium

Timing: Perimortem

Assessment of traumatic aetiology:

A semi-circular fracture arc on the right parietal bone (Figure A43–Figure A44). The arc is has an

internal bevel and is patinated. Unfortunately, the surrounding area is highly fragmented and incomplete.

Dimensions: The arc is 15.3 mm long.



Figure A42:Yoshigo 360-1 superior right frontal bone showing curved fracture arc.

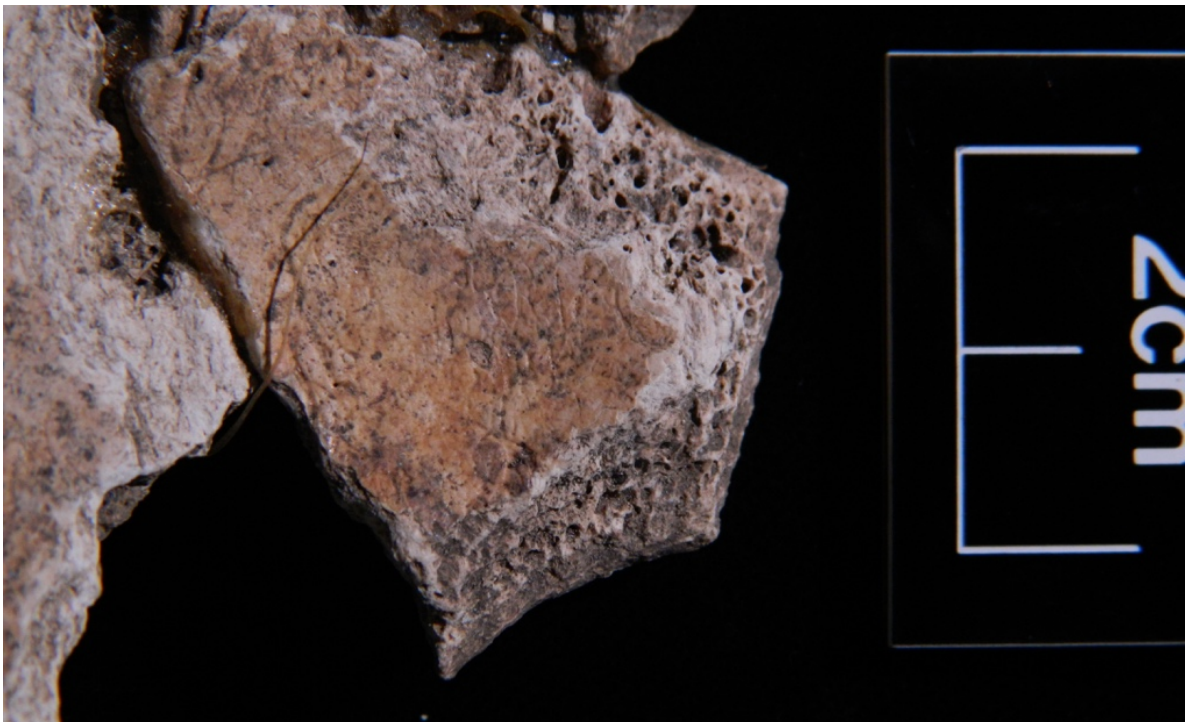


Figure A43: Yoshigo 360-1 close up of superior right frontal bone showing curved fracture arc.

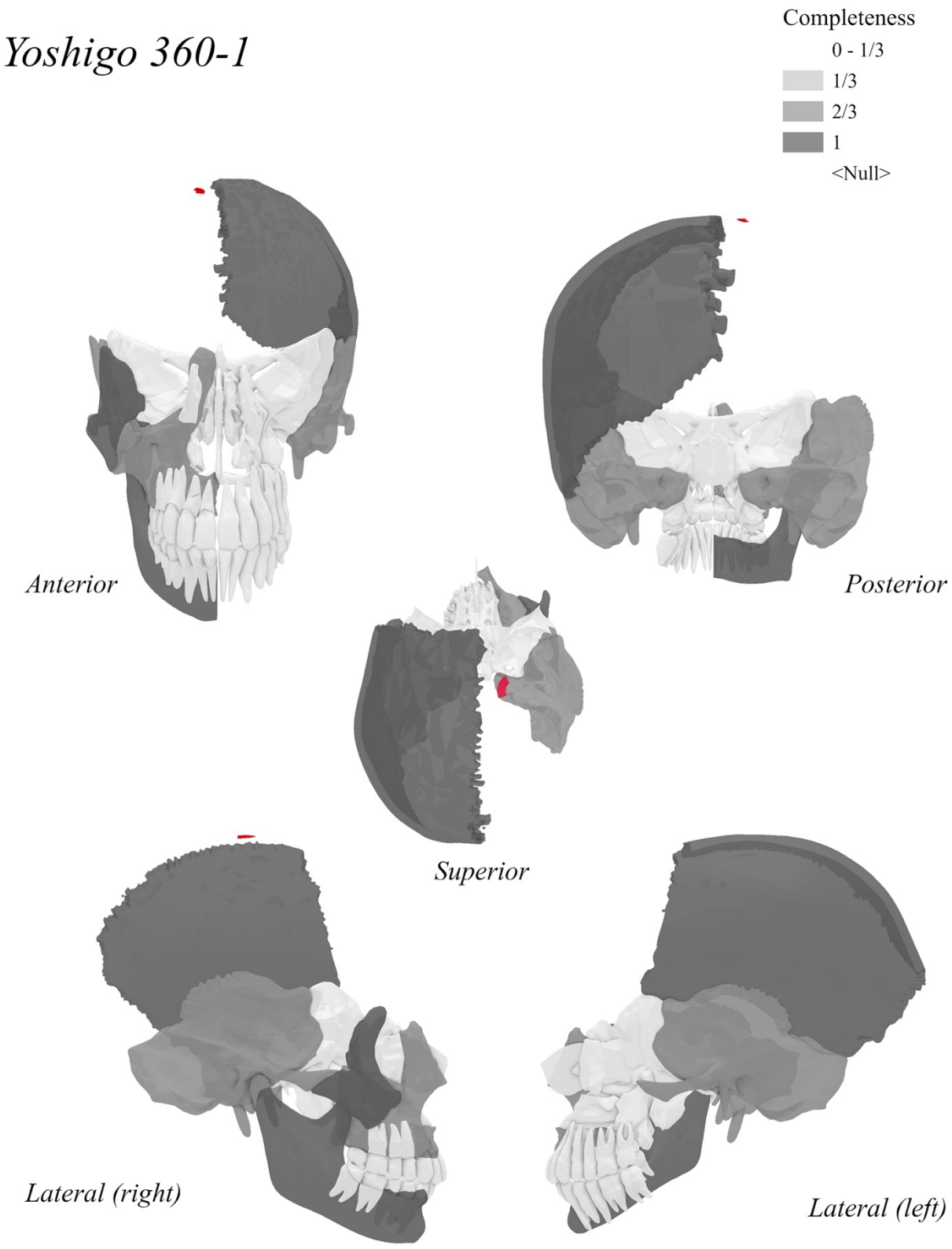


Figure AA9: Yoshigo 360-1 Completeness and Medium–High perimortem trauma.

Yoshigo 375 | Mid-Adult | Male | Late-Final Jōmon

Likelihood of traumatic injury: High

Likelihood of being violence-related: Low

Timing: Antemortem

Assessment of traumatic aetiology:

A hole on the superior left parietal bone with a smooth, sloping margin showing osteoclastic and osteoblastic activity (Figure A45–Figure A47). The inner table still shows some porosity, especially along a small, potentially healing radiating fracture.

This wound could be the result of healed penetrating trauma, although this is rare due to the risk of infection and damage to the brain, or it is possible that this is a healed trepanation. Cases of Neolithic to Iron Age trepanation in China have been found and trepanation of an individual from the Hobi Shell-mound has been suggested before, but the practice has not been reported widely in the Jōmon literature previously (Goto 1986; Hobert and Binello 2017; Yang et al. 2022). If trepanned, the case here matches those having been caried out by stone drills (Giuffra and Fornaciari 2017; Yang et al. 2022). Additionally, it is possible that this defect represents a trepanation carried out as an attempt to help treat a traumatic injury (Aidonis et al. 2021; Andrushko and Verano 2008; Verano 2016).

Unfortunately, as the healing around the wound has obscured any other possible clues. At this stage, it is not possible to differentiate whether this wound represents a penetrating traumatic injury, a trepanation, or some combination of trauma and trepanning.

Dimensions: The depressed area is 18.7 mm x 14.6 mm and 1 mm deep. The central perforation is 6.2 mm x 4.5 mm.



Figure A44: Yoshigo 375 lateral view showing possible healing penetrating trauma or trepanation on the superior left parietal bone.



Figure A45: Yoshigo 375 close-up view of hole and healing around it. Note the osteoclastic and osteoblastic activity and smooth margins.



Figure A46: Yoshigo 375 internal view of the defect (anterior is up). Note the porosity and smooth margins.

Yoshigo 378 | Mid-Old Adult | Female | Late-Final Jōmon

Likelihood of traumatic injury: 1. High; 2. Medium

Likelihood of being violence-related: 1. High; 2. Low

Timing: Perimortem

Assessment of traumatic aetiology:

1. A patinated, roughly circular hole on the superior left parietal bone with an internal bevel and three oblique radiating fractures likely representing a perimortem penetrating injury (Figure A48–Figure A49). The edges of the hole are sharp. The bevel is most pronounced medially.

2. There are a cluster of overlapping linear marks and scrapping on the right parietal bone (Figure A50). All are patinated and some cross postmortem fracture lines. As was argued for Inariyama 210 and 254, these cannot be distinguished from trampling marks.

Dimensions: 1. 10.0 mm x 9.5 mm; 2. Largest is 42.2 mm x 0.3 mm



Figure A47: Yoshigo 378 superior view showing a possible instance of penetrating trauma to the left parietal bone. Note the sharp edges and radiating fractures.



Figure A48: Yoshigo 378 close-up showing the internal bevel of the potential penetrating trauma. Anterior is up.



Figure A49: Yoshigo 378 superolateral right parietal bone showing linear marks and scrapping marks likely representing trampling.

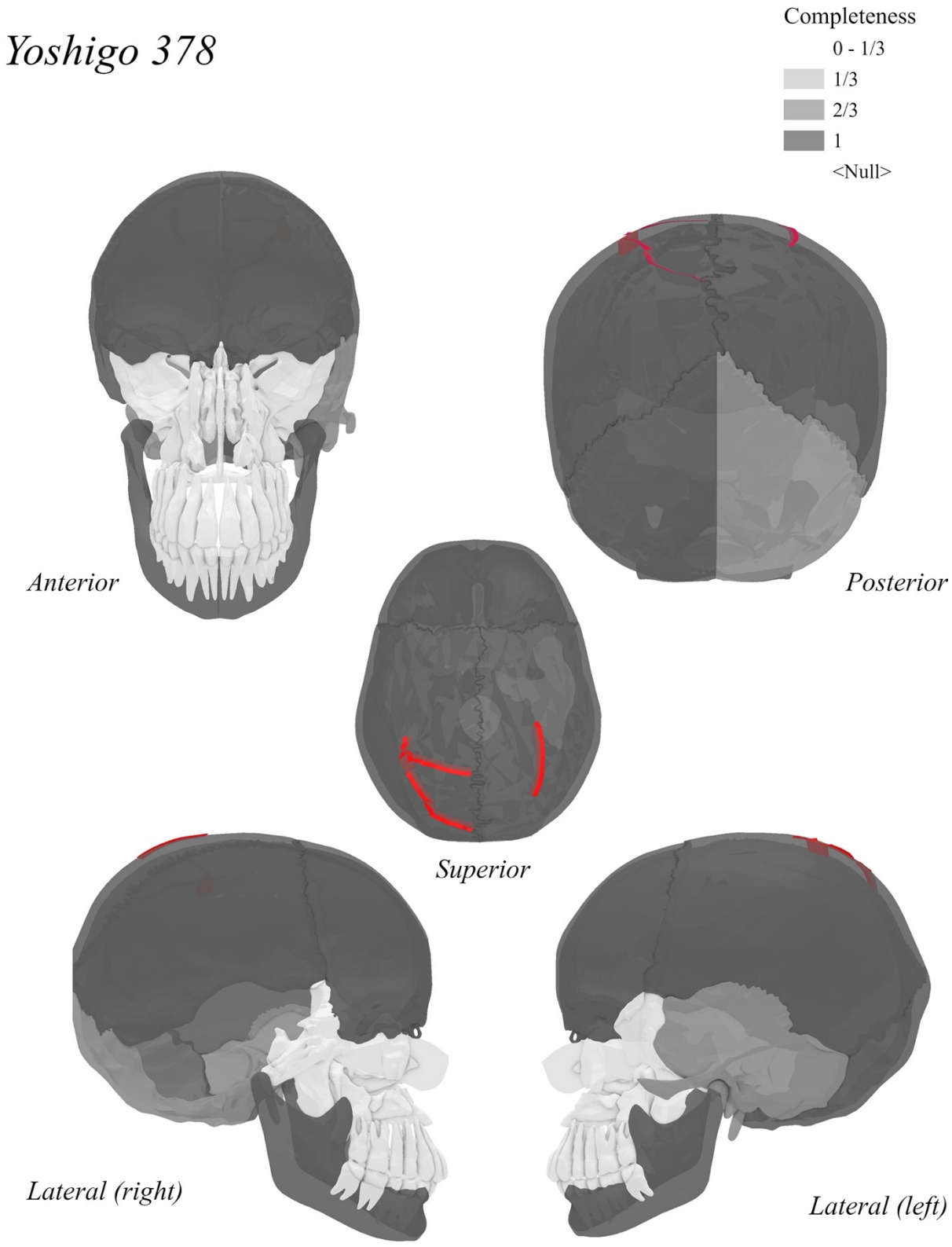


Figure AA10: Yoshigo 378 Completeness and Medium–High perimortem trauma.

Yayoi Period 弥生時代

Doigahama 124 | Mid Adult? | Male | Early-Middle Yayoi

Likelihood of traumatic injury: 1– 3. High; 4. Medium; 5. Medium; 6–11. High; 12. Medium; 13. Medium; 14–19. High; 20. Medium; 21–24. High; 25. Low; 26. Medium; 27. High; 28. Medium; 29. High; 30. Medium; 31. High; 32.High; 33. Medium

Likelihood of being violence-related: 1. High; 2– 5. Medium; 6–11. High; 12. Medium; 13. Medium; 14– 24. High; 25. N/A; 26–29. High; 30. Low; 31. High; 32. Low; 33. Low

Timing: #1–31 Perimortem; #32–33 Antemortem

Assessment of traumatic aetiology:

1. Patinated, elliptical hole on the superior frontal bone, along the sagittal plane (Figure A51–Figure A52). The edges are sharp and there are no early signs of healing. There is a clear internal bevel, widest on the superior margin (Figure A52).

2. A sharp and smooth patinated fracture around the supranasal suture of the frontal bone (Figure A53–Figure A54). The fracture is oblique in cross-section. The surrounding bone is absent.

3. Smooth, patinated, oblique fractures to the corpus of the right mandible and to the right mandibular second molar (Figure A55).

4. Curved fracture line to the right parietal bone which transverses the lambdoidal suture and impacts the occipital bone, although the fracture lines on the occipital bone are not as smooth (Figure A56). There is a semi-circular, patinated section of bone which appears to have been fractured completely along this line. Unfortunately, the fracture edges are largely obscured by glue and wax.

5. Possible perimortem fracturing to the left side of the cranium, including the left parietal and occipital (Figure A57–Figure A58). Fracture edges are smooth in texture but there is post-mortem damage to the margins. There is a clear internal bevel on the inner table of the parietal bone and the posterior half of the curve on the parietal bone is the smoothest.

6. A semi-circular-shaped penetrating trauma to the left lamina of the seventh thoracic vertebra (Figure A59). The margins of the hole are sharp and patinated.

7. On the left side of the vertebral body of the tenth thoracic vertebra, there is roughly elliptical perforation (Figure A60). The margins of the hole are sharp and patinated. The superior margin of the hole is more irregular in shape, either due to postmortem damage or due to damage resulting from removal of the weapon that caused the wound, likely an arrowhead.

8. On the tenth vertebra there is also a deep, v-shaped, patinated cut mark with Hertzian fracture cones that bisects the lamina (Figure A61).

9. A projectile point is embedded in the inferior of the eleventh thoracic vertebra's body, most likely representing the superior aspect of the weapon with the inferior aspect embedded in the twelfth thoracic vertebra's superior vertebral body (#11 below; Figure A62). The injury is v-shaped and patinated.

10. A potential linear mark on the lamina of the eleventh thoracic vertebra (Figure A63). It has sharp margins and is patinated and v-shaped. It likely represents a continuation of the linear mark on the lamina of the tenth thoracic vertebra's lamina (#8).

11. An embedded projectile point in the superior portion of the twelfth thoracic vertebral body (Figure A64). The margins of the defect, particularly laterally, are rougher than on the eleventh thoracic vertebra.

12. A smooth, patinated fracture to the lamina and inferior articular facet of the twelfth thoracic vertebra (Figure A65).

13. A smooth, patinated fracture to the right transverse process of the third lumbar vertebra (Figure A66).

14. A linear mark on the vertebral body of the fourth lumbar vertebra (Figure A67). The superior-most margins of the linear mark are clearest with sharp, patinated margins and a v-shape. The more inferior aspects of the defect suggests a deeper cut into the body and some postmortem damage.

15. A patinated, circular hole penetrates through the left ilium (Figure A68–Figure A69). It is angled slightly inferiorly from the lateral side. There is no associated fracturing around the hole.

16. A patinated, v-shaped linear mark cutting through the left iliac crest (Figure A68). The edges are not as sharp as a potential cut mark, but it is possibly the result of projectile trauma.

17. A sharp, patinated linear mark anterior to the greater sciatic notch of the left os coxa (Figure A69). There is some postmortem damage superiorly, but the inferior margin is sharp. CT scans of the injury in Oyabu (2018) shows an embedded projectile point.

18. A likely projectile injury to the superior ischium of the right os coxa (Figure A70). It is patinated and v-shaped.

19. An embedded projectile point in the pubis of the right os coxa (Figure A71). The surrounding bone has sharp edges and is patinated.

20. On the medial angle of the right first rib there is a potential cut mark (Figure A72). The linear mark is patinated and sharp, but it is obscured by postmortem damage, a fracture, and glue.

21. A sharp, deep, patinated linear mark on the right seventh rib's shaft which cuts through the caudal edge (Figure A73). The inferior portion is damaged, but the superior portion on the linear mark are extremely clear.

22. A deep linear mark to the posterior vertebral end of the right seventh rib (Figure A74). Unfortunately, it is partially obscured by glue. There is postmortem fracturing running along the anterior side of the rib most likely as a result of the impaired structural integrity of the element due to the cut mark. CT scans (c.f. Oyabu 2018) confirm the presence of foreign matter embedded within.

23. Two sharp, v-shaped, patinated linear marks to the medial shaft of the right eleventh rib (Figure A75). The longer, superior linear mark is much sharper and smoother, whereas the more inferior mark has a greater number of hertzian fracture cones along is anterior margin.

24. An embedded projectile point in the vertebral end of the left seventh rib (Figure A76). The posterior margin of the linear mark, in particular, is sharp. The lesion is patinated and some of the embedded material can be seen, CT scans (c.f. Oyabu 2018) show a larger portion internally.

25. A possible perimortem fracture on the shaft, near the sternal end, to the left seventh rib (Figure A77). Unfortunately, the area around it has been coated in wax. Yet, what is visible shows sharp and smooth patinated fracture edges.

26. A patinated and sharp linear mark on the medial aspect of the left tenth rib near the vertebral end (Figure A78). It is partially obscured by adhesives and the posterior margin of the defect appears to have postmortem damage, but what remains of the anterior margin is clear and the lesion is v-shaped.

27. A wide and smooth chop mark to the medial vertebral end of the left eleventh rib (Figure A79). The lesion has sharp margins and is patinated. The anterior margin is rougher, as would be characteristic of bone being peeled way at the point of terminal impact, after the weapon finished it's slicing trajectory.

28. A linear mark on the greater trochanter of the right femur, likely representing penetrating trauma. Postmortem damage to the site obscures it somewhat but the lesion is patinated and v-shaped. See Oyabu (2018) for images.

29. On the anterior and proximal diaphysis of the left femur there are two linear marks which are patinated, sharp, and v-shaped (Figure A80). On the posterosuperior aspect there is a penetrating wound (see Oyabu (2018) for images).

30. On the medial right patella there is a transverse vertical fracture consistent with an avulsion fracture, usually caused by an abrupt and sever contraction of the quadriceps muscles or a direct blow to or fall on the bone (Figure A81). As there is no rounding of the margins, no deformation of the bone and no corresponding abnormality on the left patella, and a lack of cortical bone involvement or any abrasion, it is unlikely this represents a rare congenital condition such as a unilateral bipartite patella. Direct trauma to the bone is more likely to produce commuted

fractures (Court-Brown et al. 2015; Gwinner et al. 2016; Lovell 1997; Wedel and Galloway 2014).

31. On the medial proximal diaphysis right tibia there is at least one patinated v-shaped linear mark, possibly the result of projectile trauma as its margins and walls are rougher than seen in a simple cut mark (Figure A82). There is another small linear mark anteriorly, but this one is not as deep or clear, but may represent a linear mark from the projectile as it moved or bounced once it came in contact with the bone. These lesions closely matches lithic projectile impact 'drag marks' in their shape and in the presence of flaking noted in experimental studies (O'Driscoll and Thompson 2014; Smith et al. 2007). Moreover, given the numerous projectile points both embedded in the bone and found in the grave, it is most logical to attribute this lesion to projectile point injury.

32. A possible well-healed left distal diaphysis fibular fracture (Figure A83). The bone is deformed anteromedially.

33. Two left phalanges (intermediate and distal) are fused.

Compression fractures are present on the thoracic and lumbar vertebrae.

Dimensions: 1. 18.2 mm x 7.3 mm; 2. Longest fracture line ca. 40.7 mm long; 3. 29.2 mm long fracture line; 4. Curved fracture line ca. 43.5 mm long; 5. Endocranial bevel is ca. 49.7 mm x 9.7 mm; 6. 7.7 x 1.5 mm; 7. 14.8 mm long; 8. 12.2 x 4.9 mm; 9. 14.2 mm x 2.9 mm and the embedded piece is 7.7 x 1.5 mm; 10. 7.5 x 0.2 mm; 11. 12.8 x 4.4 mm and the embedded piece is 5.6 x 1.4 mm; 12. Fracture line is ca. 7.0 mm long; 13. 4.2 mm x 7.2 mm; 14. 7.0 x 0.5 mm; 15. 6.7 x 5.8 mm; 16. 5.2 x 9.4 mm; 17. 14.5 x 4.3 mm and 2.5 mm deep; 18. 18.6 x 5.1 mm and 3.5 mm deep; 19. 7.9 x 2.1 mm and the embedded piece is ca. 3.2 x 2.1 mm; 20. 4.3 mm x 0.6 mm; 21. 7.3 mm x ca. 3.8 mm; 22. 17.7 mm x 0.6 mm; 23. Longer linear mark is 7.5 mm x 0.7 mm and the shorter is 5.5 mm x 1.2 mm; 24. 3.3 mm wide x 10.1 mm long and the embedded piece is 4.4 x 1.0 mm; 25. ca. 8.4 mm fracture line; 26. 8.4 mm x 3.1 mm;

27. 8.0 x 9.4 mm; 28. 18.2 x 2.3 mm; 29. 5.9 and 3.7 mm long; 30. 16.6 x 8.4 mm; 31. 9.0 x 3.0 mm

Previously Reported In: #1–3, 9, 11, 14–19, 22, 24, 28, and 29 in Oyabu (2014, 2018); #30 in Padgett (2020)



Figure A50: Doigahama 124 anterosuperior view of the frontal bone showing an elliptical, sharp, patinated perforation.



Figure A51: Doigahama 124 frontal bone inner table showing the internal bevel associated with the perforation. Anterior is up.

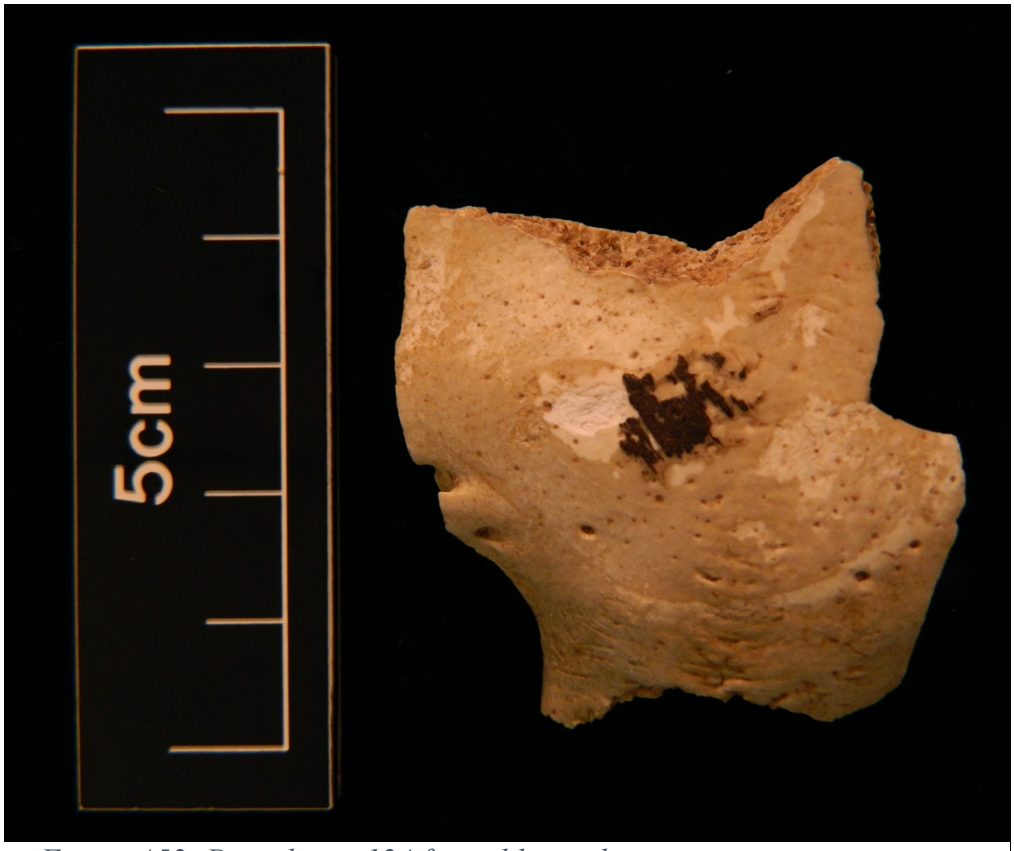


Figure A52: Doigahama 124 frontal bone showing extensive perimortem fracturing around the supranasal suture.



Figure A53: Doigahama 124 frontal bone endocranial view showing extensive perimortem fracturing around the supranasal suture.

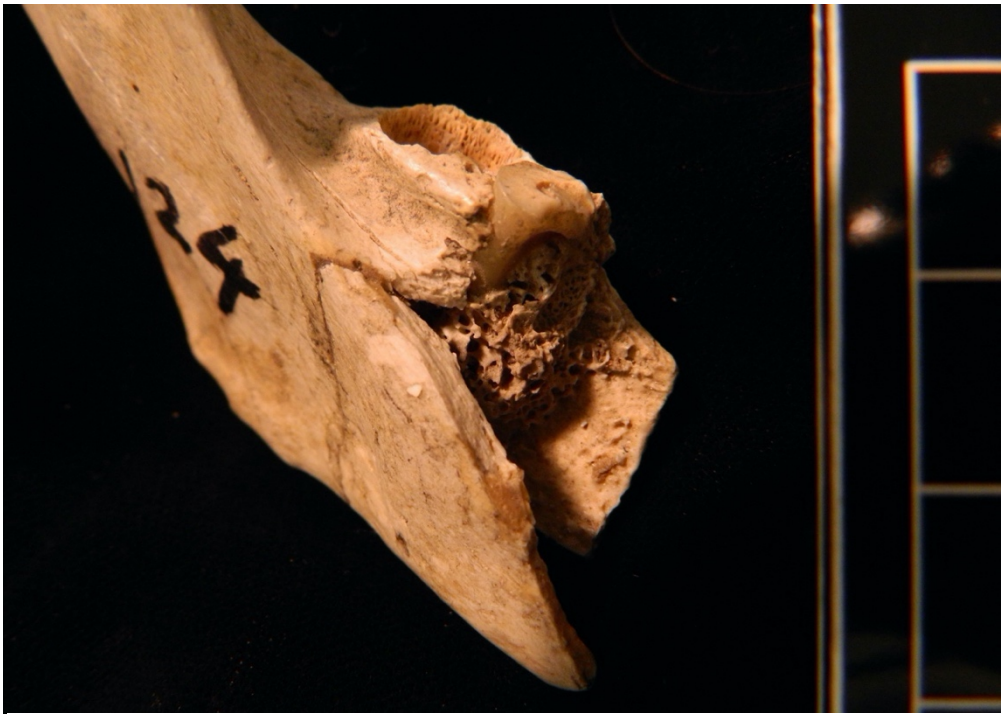


Figure A54: Doigahama 124 right mandible showing perimortem fractures through the corpus of the bone and crown and root of the second molar.

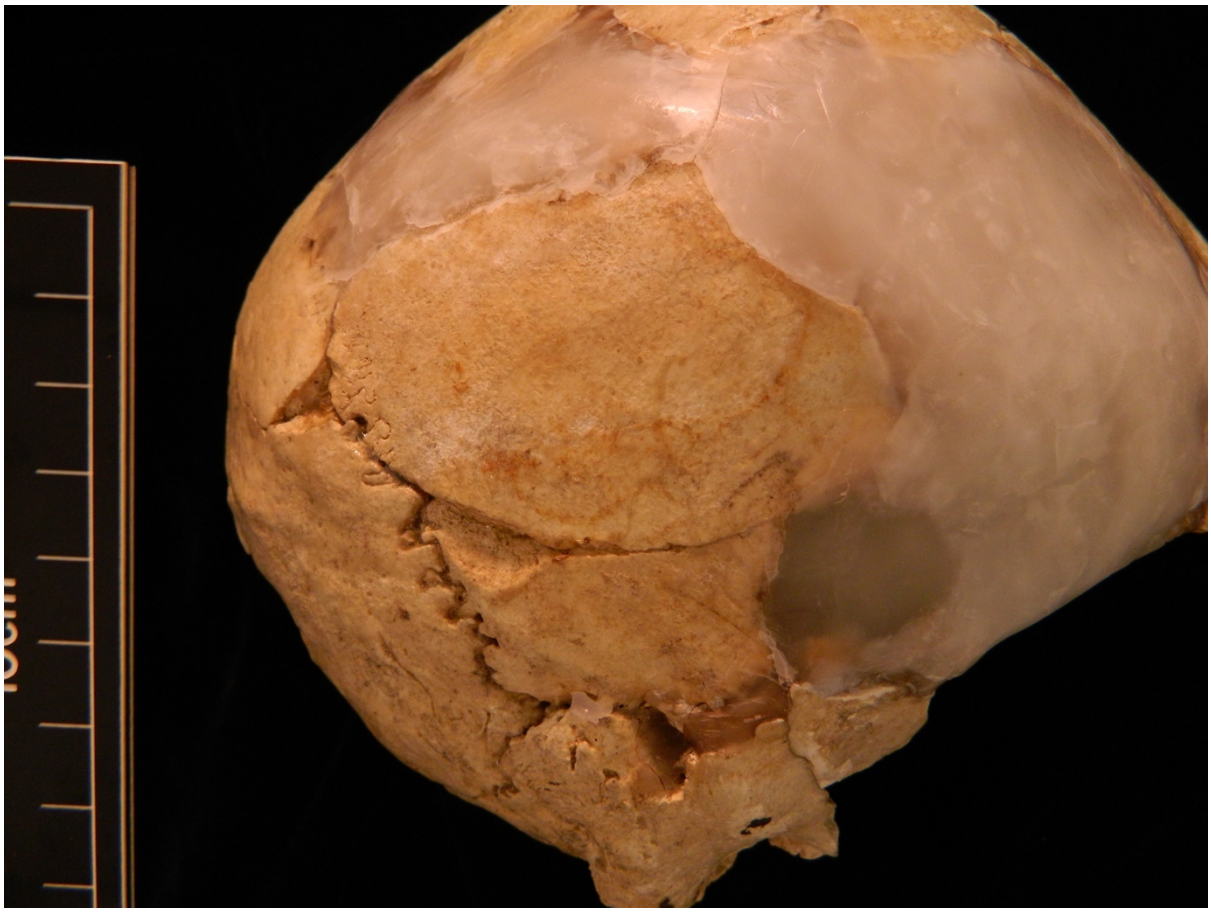


Figure A55: Doigahama 124 lateral view of the cranium showing a smooth, curved fracture line going throught the right parietal bone and occipital. Note the patinated, semi-circular pocket of bone which has brocken off.



Figure A56: Doigahama 124 lateral view of the cranium showing a possible perimortem fracture line through the left parietal bone and occipital.

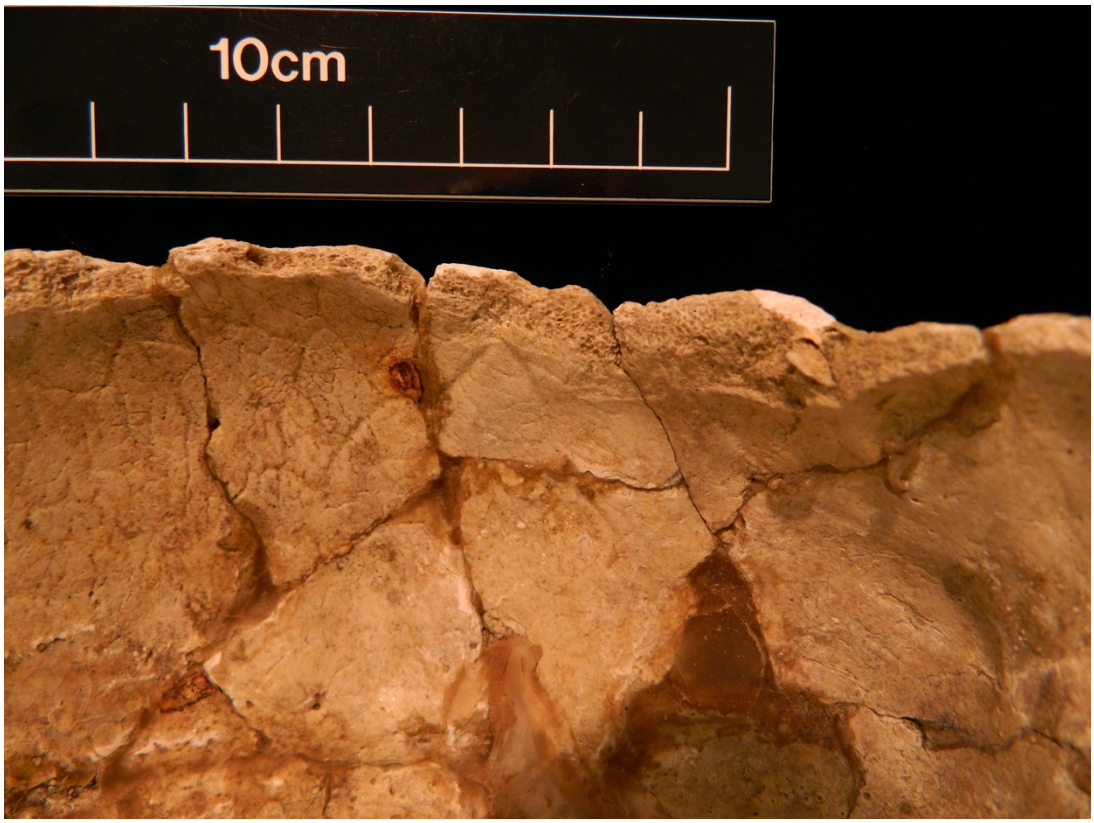


Figure A57: Doigahama 124 endocranial view of the left parietal bone showing a patinated internal bevel.



Figure A58: Doigaham 124 seventh thoracic vertebra showing a semi-circular, patinated perforation to the lamina.



Figure A59: Doigahama 124 tenth thoracic vertebra showing a perimortem perforation to the vertebral body.

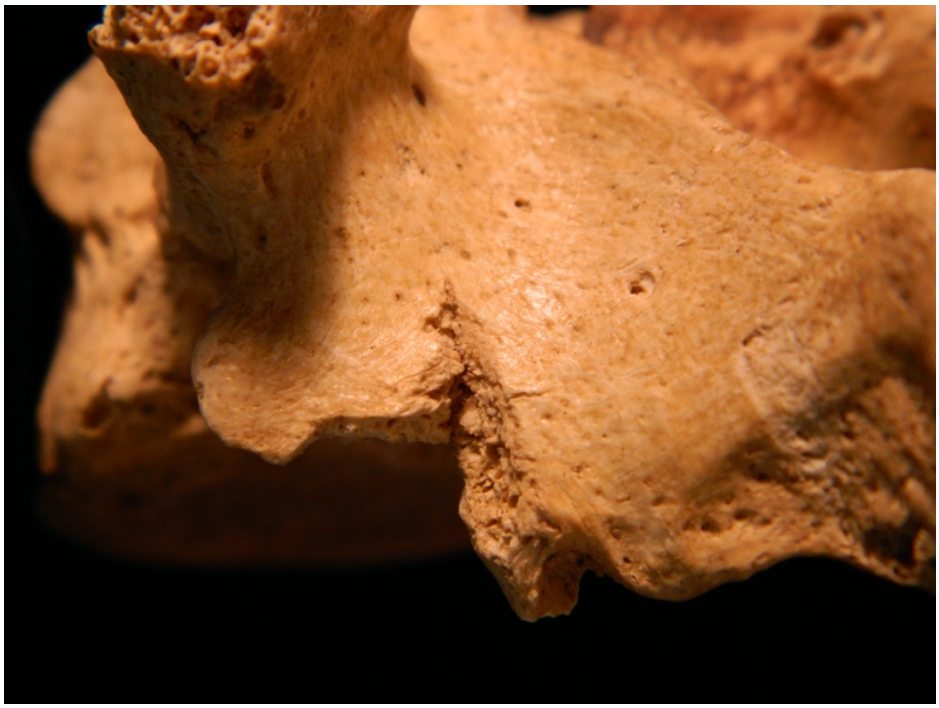


Figure A60: Doigahama 124 tenth thoracic vertebra showing a deep linear mark to the lamina.



Figure A61: Doigahama 124 eleventh thoracic vertebra inferior view of the vertebral body showing an embedded projectile point.



Figure A62: Doigahama 124 eleventh thoracic vertebra showing a cut mark on the lamina corresponding to the cut mark on the tenth thoracic vertebra.

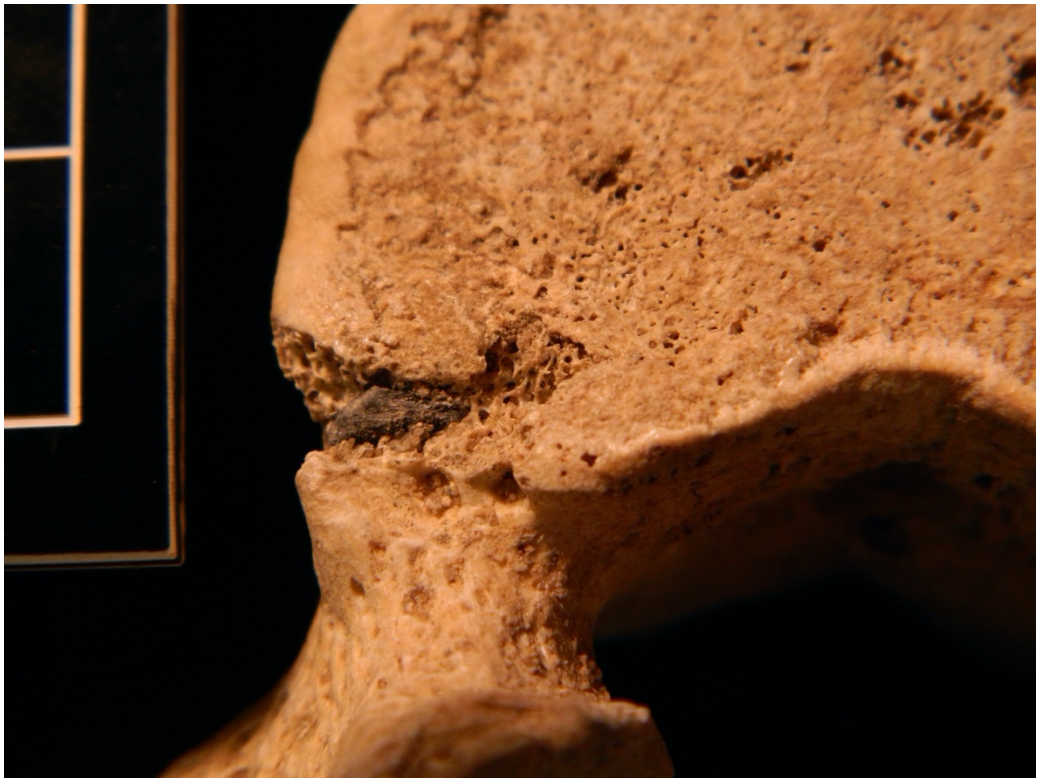


Figure A63: Doigahama 124 twelfth thoracic vertebra superior view of the vertebral body showing an embedded projectile point.

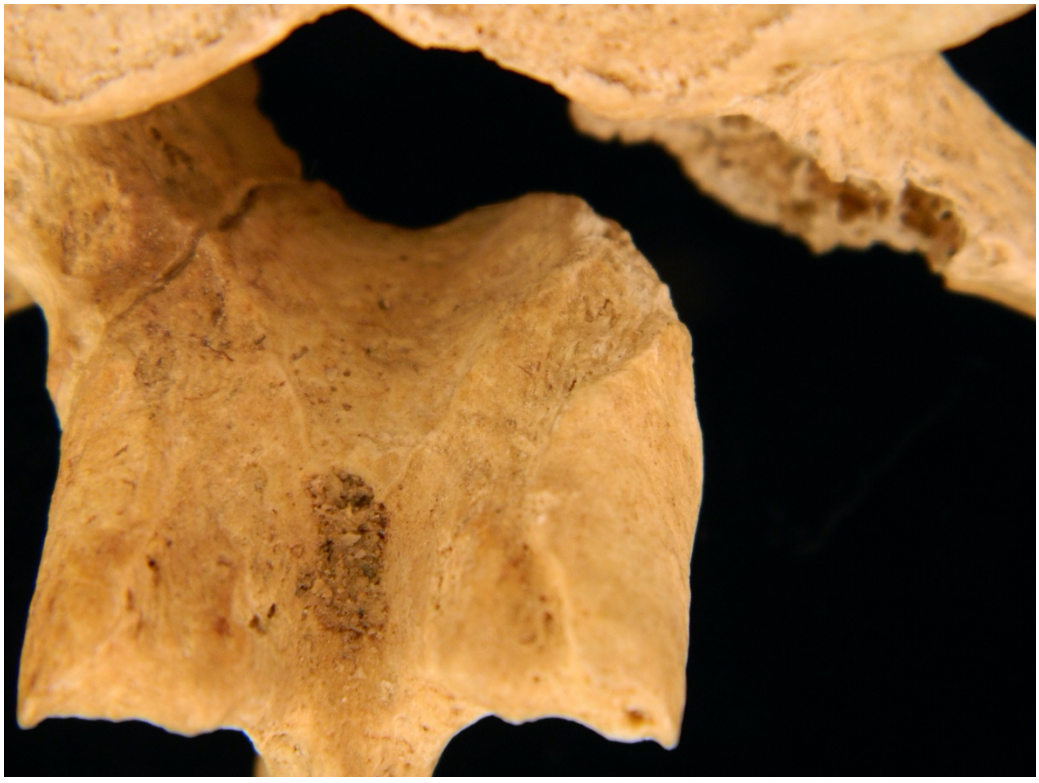


Figure A64: Doigahama 124 twelfth thoracic vertebra showing a potential perimortem fracture to the lamina and inferior articular facet.

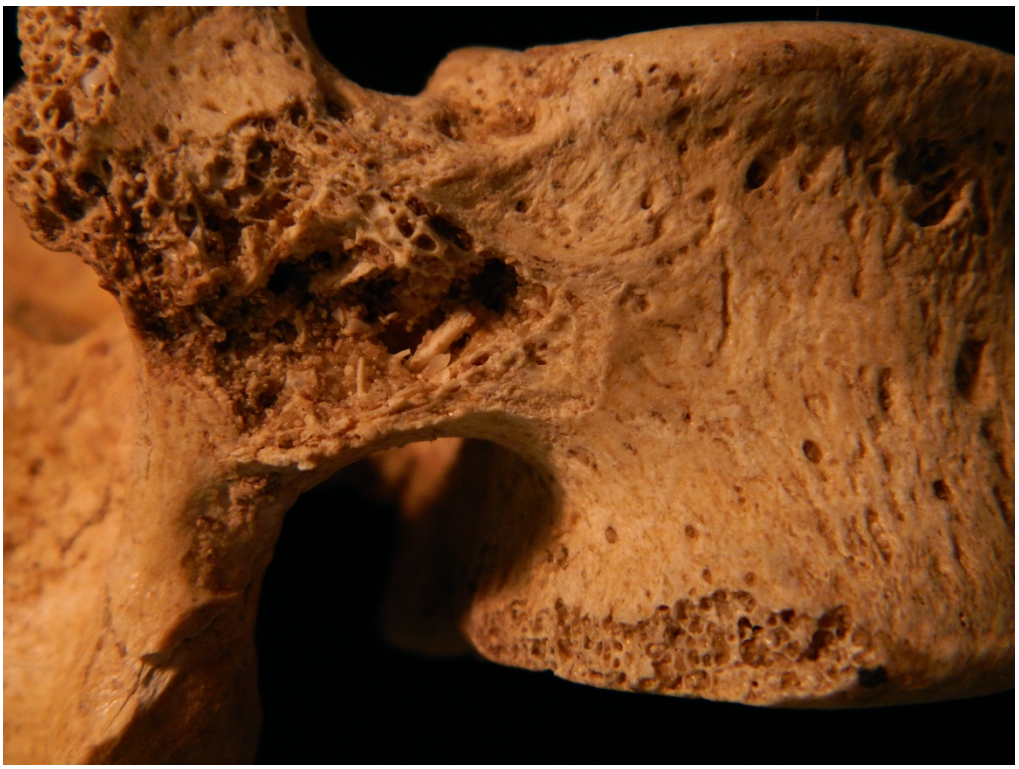


Figure A65: Doigahama 124 third lumbar vertebra showing a possible perimortem fracture to the right transverse process.



Figure A66: Doigahama 124 fourth lumbar vertebra showing a deep cut mark to the body.

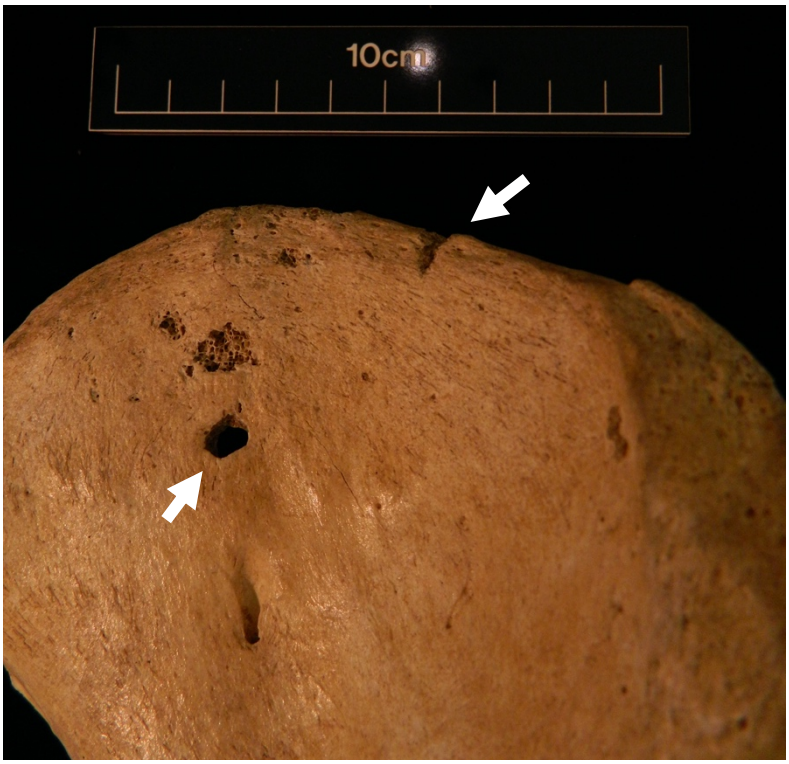


Figure A67: Doigahama 124 left ilium lateral view showing a circular penetrating wound and a linear mark to the iliac crest.

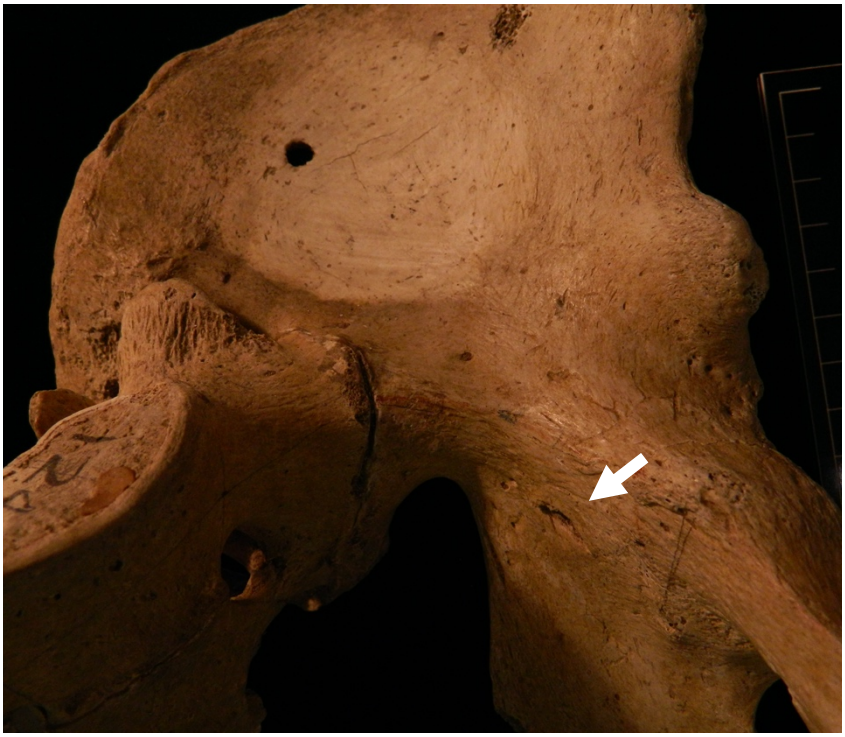


Figure A68: Doigahama 124 superomedial view of the left os coxa and sacrum showing a circular penetrating wound to the ilium and a linear mark with an embedded projectile point anterior to the greater sciatic notch.



Figure A69: Doigahama 124 poserior view of the right os coxa showing a penetrating wound to the superior ischium.

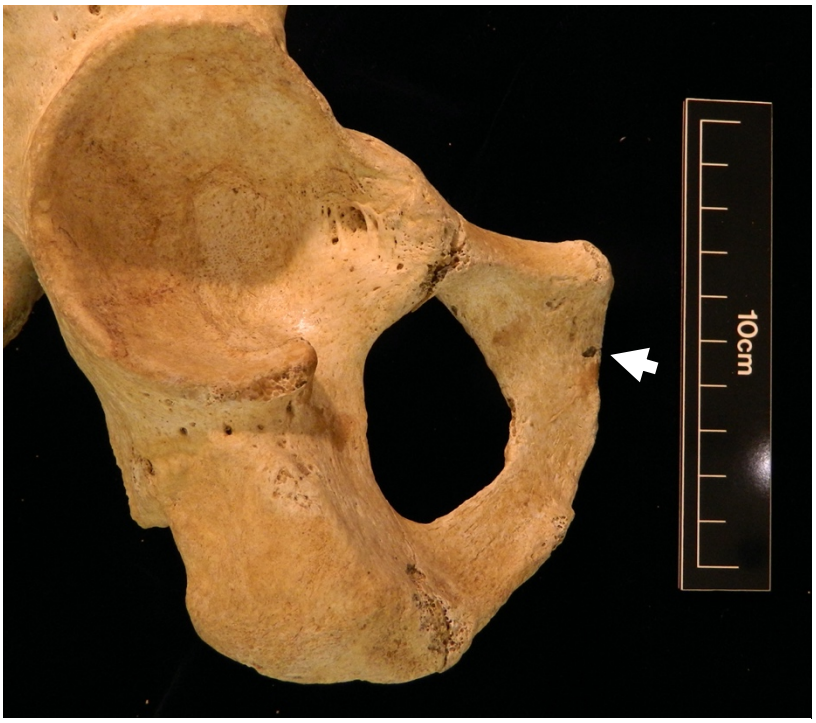


Figure A70: Doigahama 124 right os coxa showing an embedded projectile point in the pubis.

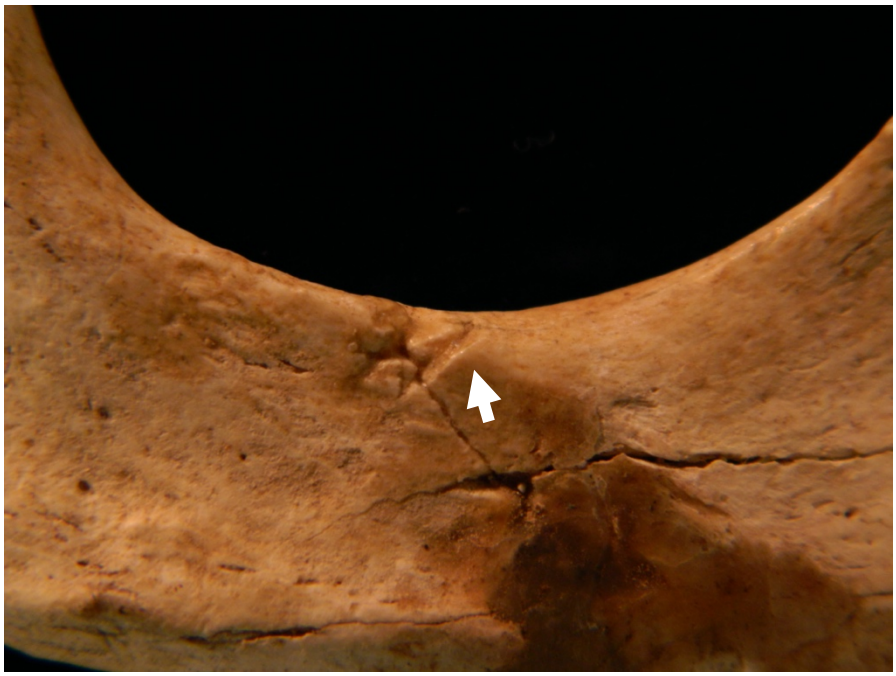


Figure A71: Doigahama 124 medial angle of the right first rib showing a potential cut mark.



Figure A72: Doigahma 124 medial view of the right seventh rib's shaft showing a deep linear mark cutting through the caudal edge.



Figure A73: Doigahama 124 inferior view of the seventh right rib showing a deep, sharp linear mark cutting through the vertebral end.



Figure A74: Doigahama 124 medial view of the eleventh rib's shaft showing two sharp linear marks.



Figure A75: Doigahama 124 superoposterior view of the left seventh rib showing an embedded projectile point. Note the sharp posterior margin of the lesion.



Figure A76: Doighama 124 shaft of the left seventh rib showing a potential perimortem fracture.

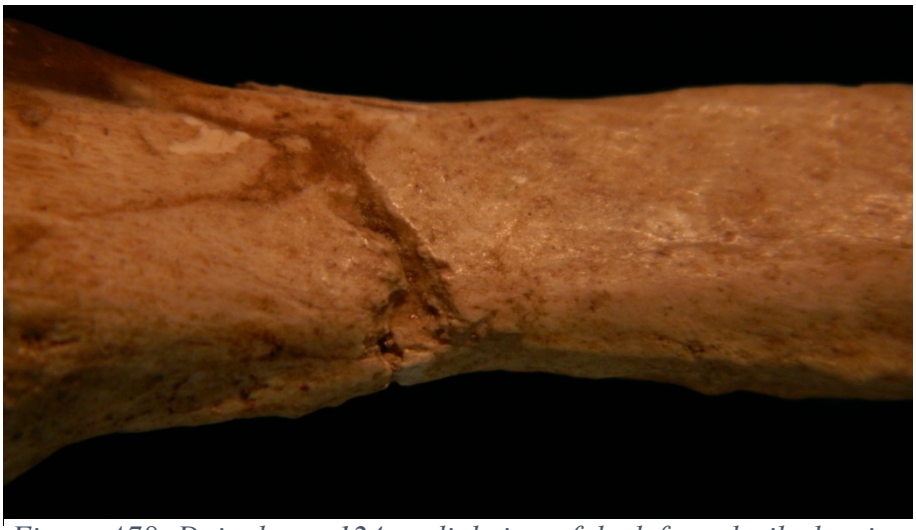


Figure A78: Doigahama 124 medial view of the left tenth rib showing a patinated and sharp linear mark.



Figure A77: Doigahama 124 medial view of the left eleventh rib showing a wide chop mark to the vertebral end.



Figure A80: Doigahama 124 left femur showing two v-shaped and patinated linear marks on the anterolateral diaphysis.



Figure A79: Doigahama 124 right patella medial view showing a potential avulsion fracture.



Figure A81: Doigahama 124 right tibia medial diaphysis showing two linear marks that are v-shaped and patinated.



Figure A82: Doighama 124 fibulae showing a potential healed fracture to the left fibula.

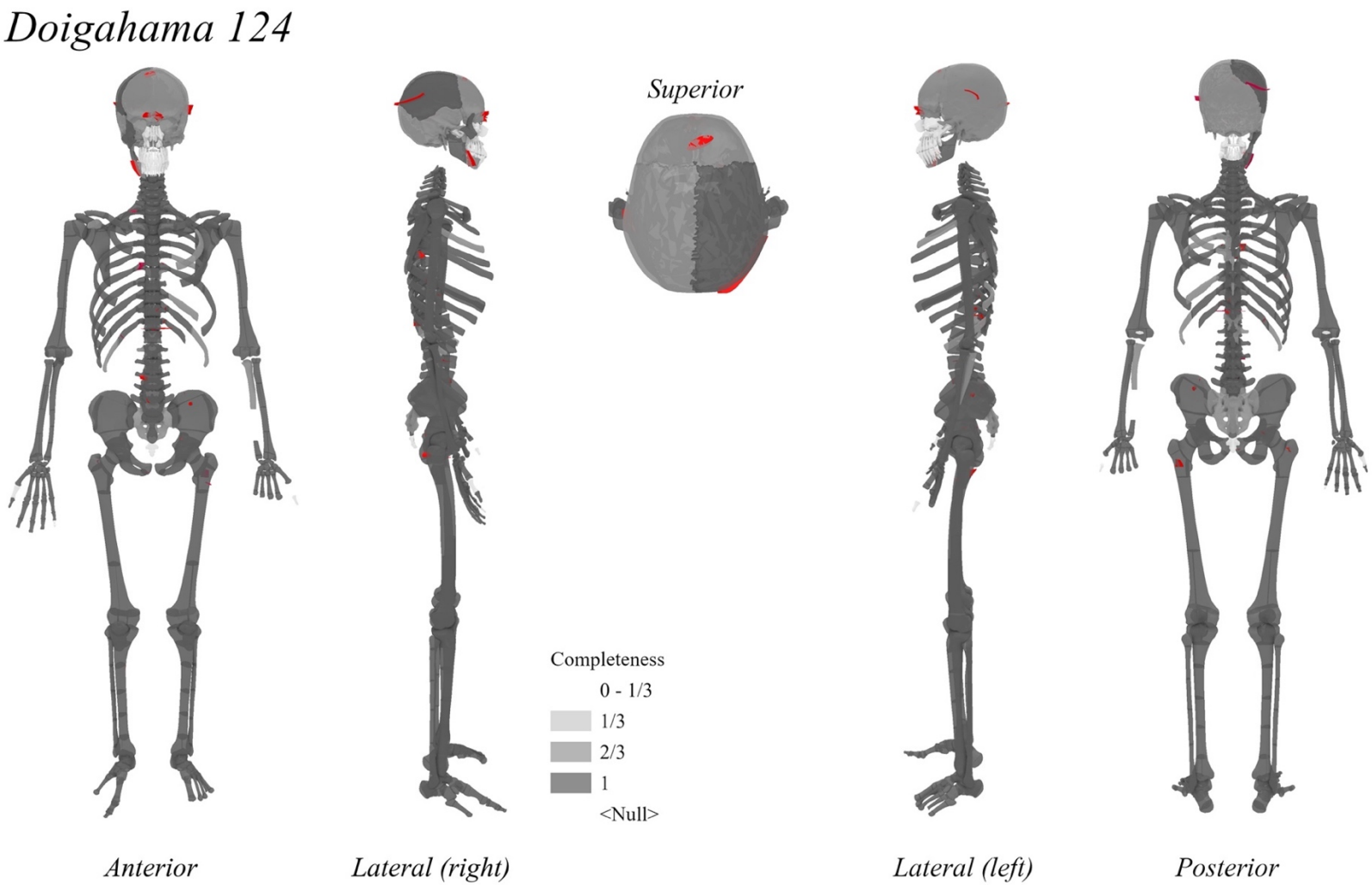


Figure AA11: Doigahama 124 Completeness and Medium–High perimortem trauma.

Doigahama 312 | Young Adult | Female | Early-Middle Yayoi

Likelihood of traumatic injury: 1. Medium; 2. Medium

Likelihood of being violence-related: 1. Medium; 2. Low

Timing: Antemortem

Assessment of traumatic aetiology:

1. A possible healed fracture to the nasal bones. A faint ridge runs through them and the suture deviates slightly at the point where this ridge crosses (Figure A84).

2. There is a linear depression, with two points where the depression is deeper, on the third(?) right intermediate phalanx (Figure A85). There is no bone lysis or porosity. The palmar surface of the bone appears normal. Aetiology considered included a healed incomplete oblique fracture and partial compression of the bone in association with a benign tumour, i.e. a giant-cell tumour of the tendon sheath (GCTTS). Yet, in the cases of GCTTS, the entire diameter of the phalanx tends to be compressed (Alves 2011; Slavchev et al. 2011). Nevertheless, without a radiograph of the defect it is difficult to say more in this case.

Dimensions: 1. Possible fracture line is ca. 14.5 mm x 0.8 mm; 2. 9.5 mm x 4.1 mm and 0.9 mm deep



Figure A83: Doigahama 312 possible healed fracture to the nasal bones.



Figure A84: Doigahama 312 third(?) intermediate phalanx of the right hand (dorsal view) showing a depressed area.

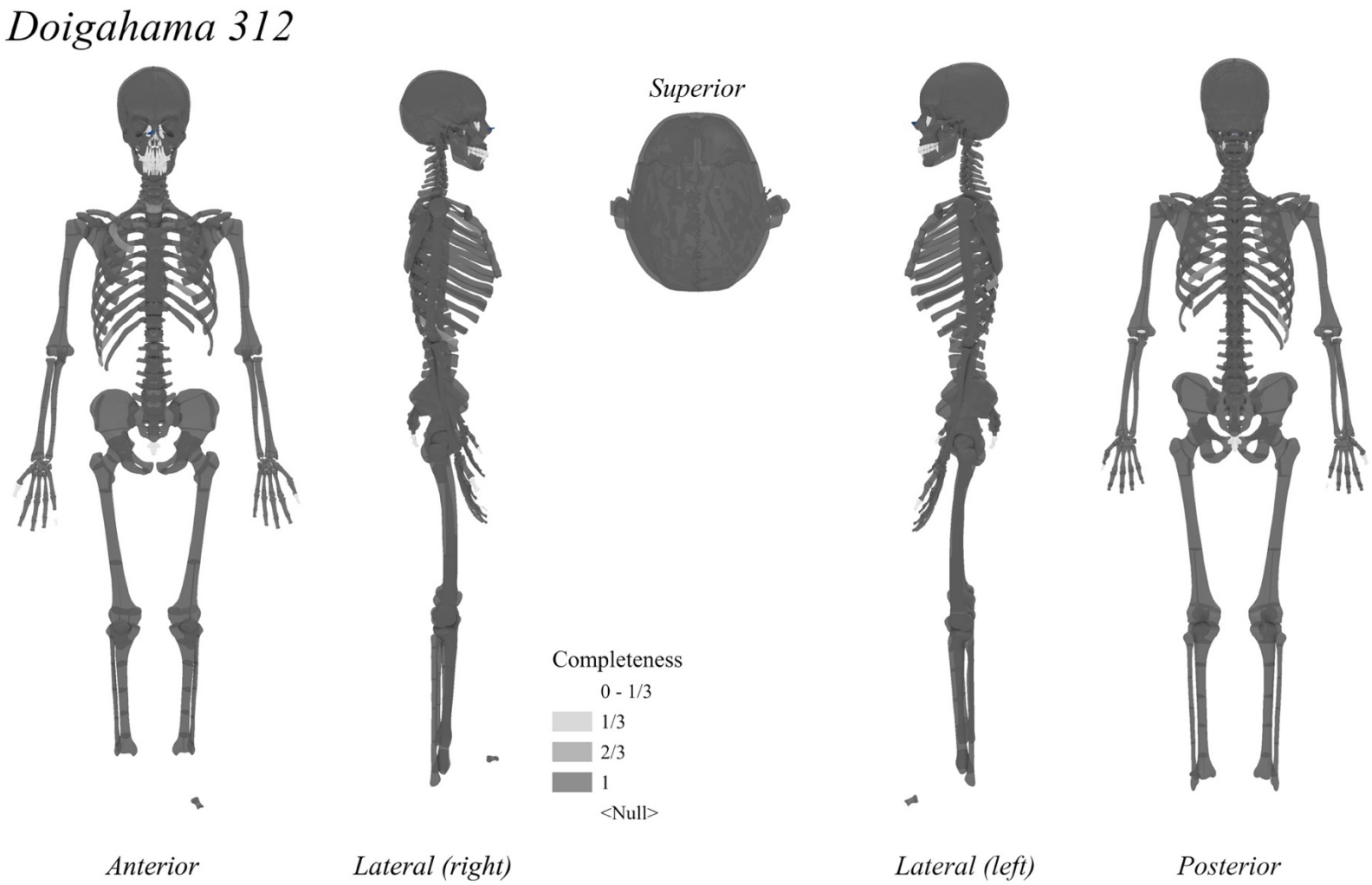


Figure AA12: Doigahama 312 Completeness and Medium–High antemortem trauma.

Doigahama 409 | Young Adult | Male | Early-Middle Yayoi

Likelihood of traumatic injury: 1. High; 2. Medium; 3. High ; 4. Medium

Likelihood of being violence-related: 1–4. Low

Timing: Antemortem

Assessment of traumatic aetiology:

1. A healed fracture to the right and left nasal bones (Figure A86). The left nasal bone is primarily impacted with the bone deformed and depressed lateral to the nasal suture. The suture is fused at the fracture line. On the right nasal bone, a semi-circular fracture line can be seen.

2. A potential healed transverse fracture to the sternal end of the right fourth rib (Figure A87). There is a ridge of bone on the anterior surface and posteriorly a faint line of remodelled bone.

3. A possible healed fracture to the left eight rib (Figure A88). There is a deformed area of bone on the anterior shaft with depressed areas.

4. A likely healed fracture to the proximal first left phalanx (Figure A89). The lateral half of the phalanx head is depressed. The distal phalanx is fused with the proximal angled laterally. The fused area is porous and nodules of bone are present.

All of the injuries are well-healed, hence it is not possible to differentiate events, although porosity is much more pervasive in the case of #4. Nasal and rib fractures are commonly caused by falls and assaults. Falls from standing heights are less like to impact the torso and falls from greater heights less likely to impact the skull (Brickley 2006; Lovell 1997; Wedel and Galloway 2014). It is not possible to confidently differentiate between these potential causes, especially as a majority of the trauma is to the left side of the body and fall to the left side could more easily explain the non-transverse fracture to the left eighth rib and to the phalanx.

Compression fractures to the vertebral bodies.

Dimensions: 1. Total area is 6.7 mm long x 5.7 mm wide and ca. 0.9 mm deep; 2. 16.4 mm x 4.5 mm; 3. 17.1 mm x 13.8 mm and 0.5 mm deep; 4. Affected area is 5.7 mm x 11.8 mm.



Figure A85: Doigahama 209 anterior view of the cranium showing a healed nasal fracture.

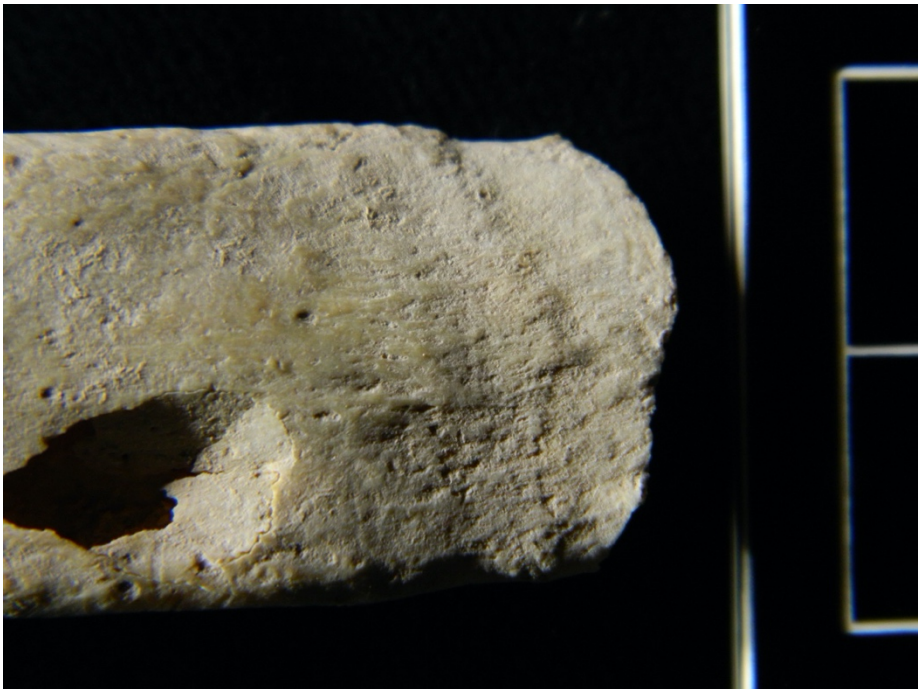


Figure A86: Doigahama 409 showing a healed fracture to the fourth right rib.



Figure A87: Doigahama 409 left eighth rib shaft, near the sternal end, showing a healed fracture.



Figure A88: Doigahma 409 dorsal view of the left first proximal and distal phalanges showing a laterally deformed first phalanx, porosity, and fusion of the two phalanges.

Doigahama 418 | Mid–Old Adult | Male | Early-Middle Yayoi

Likelihood of traumatic injury: 1. Medium; 2. High; 3. Low; 4. Medium; 5. High; 6. Medium; 7. Medium

Likelihood of being violence-related: 1–7. Low

Timing: 1–5; 7. Antemortem; 6. Perimortem

Assessment of traumatic aetiology:

1. A possible transverse fracture to the head of the left fourth metatarsal (Figure A90–Figure A91). There is a partially closed fracture line with irregular osseous formation within it transversely cutting the head. There is no similar defect on the right metatarsal.

2. A healed fracture to the right fifth(?) rib (Figure A92). There is an uneven line of bone, possibly representing a transverse fracture) lateral to a slight depression on the shaft.

3. A healed fracture to the right eighth(?) rib (Figure A93). A faint line of remodelled bone on the medial surface.

4. A faint ridge of bone corresponding to a raised and deformed area likely representing a healed fracture near the vertebral end of the right ninth(?) rib (Figure A94).

5. A depressed area of bone with a corresponding raised fracture line near the vertebral end of the right tenth(?) rib (Figure A95). A lip of bone is protruding from the superior shaft as well. The fracture location corresponds well to the possible fractures on the eighth and ninth ribs.

6. A possible perimortem fracture line along the angle of a left rib (Figure A96–Figure A97). The fracture margins are smooth and patinated.

7. A possible healed fracture near the sternal end of a left rib (Figure A98). The medial surface has a thin furrow running obliquely with porosity along the superior and inferior edges of the rib.

Compression (wedge) fractures are present on the thoracic vertebrae.

Dimensions: 1. 17.2 mm x 0.8 mm; 2. Depressed area is 8.8 mm x 16.4 mm and 0.5 mm deep; 3. 0.8 mm x 16.4 mm; 4. 16.5 mm x 0.2 mm; 5. 16.4 mm x 8.0 mm and 0.6 mm deep; 6. 12.3 mm x 13.7 mm; 7. 14.4 mm x 0.4 mm



Figure A89: Doigahama 418 fourth metatarsals.



Figure A90: Doigahama 418 head of the left fourth metatarsal showing a possible healed fracture.



Figure A91: Doigahama 418 right fifth(?) rib showing a possible healed fracture.



Figure A92: Doigahama 418 right eighth(?) rib angle showing a hyperostosis and a possible, very faint healed fracture line.



Figure A93: Doigahama 418 right ninth(?) rib angle medial surface showing a callus and associated porosity likely resulting from a healed fracture.



Figure A94: Doigahama 418 right tenth(?) rib angle medial surface showing a callus. Note how the ridge protrudes superiorly.



Figure A95: Doigahama 418 left rib inferior view showing a possible perimortem fracture to the angle. Note the sharp, patinated margins.

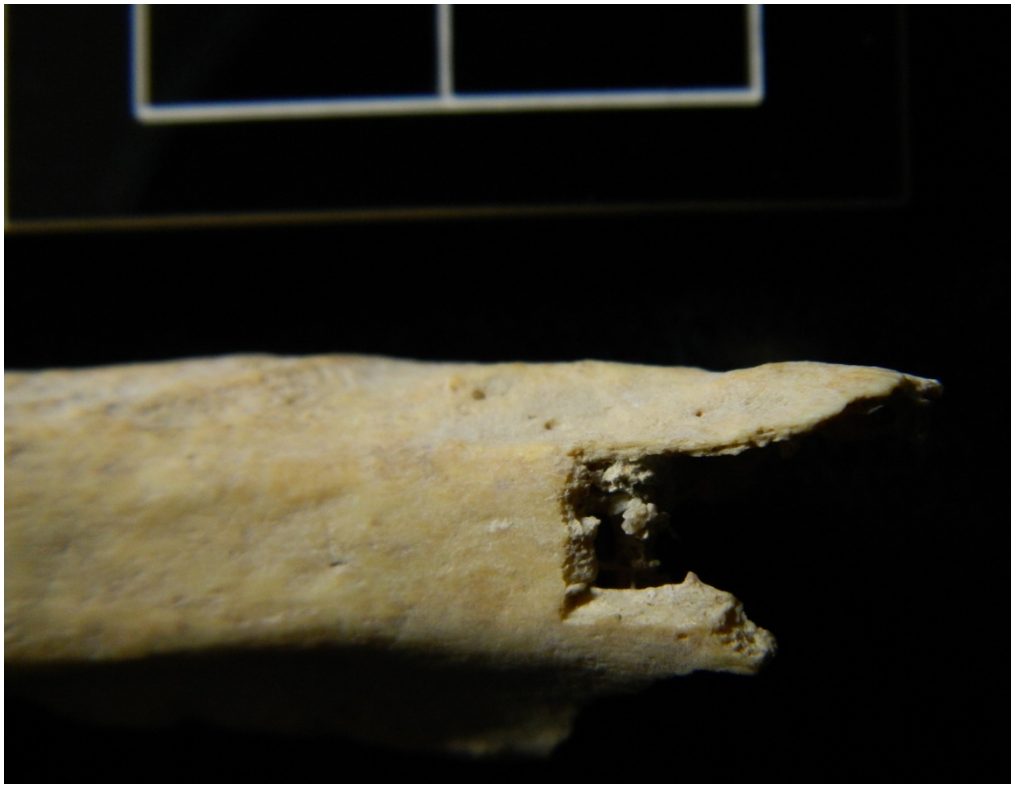


Figure A96: Doigahama 418 left rib medial view showing a potential perimortem fracture.



Figure A97: Doigahama 418 left rib showing a possible healed fracture line.

Doigahama 421 | Mid Adult | Female | Early-Middle Yayoi

Likelihood of traumatic injury: 1. High; 2. Medium; 3–6. High; 7. Medium; 8. High; 9. Medium; 10. Medium

Likelihood of being violence-related: 1. Medium; 2–9. Low; 10. Medium

Timing: Antemortem

Assessment of traumatic aetiology:

1. A smooth, roughly cylindrical depression on the superior left parietal bone (Figure A100–Figure A99). There is some porosity at its deepest point. There was no endocranial activity found. The margins of the depression are sloping. There is no similar depression on the right side.

2. Possible healed fracture to the left and right nasal bones (Figure A101). They are depressed medially and slightly deformed in shape, but due to partial preservation, no more can be said.

3. A compressed area on the shaft of the right fourth(?) rib anterior to a ridge of bone (Figure A102). The medial aspect of the shaft, in particular, has two slightly curved furrows of bone running transversely.

4. A compressed area on the shaft of the right fifth(?) rib, but slightly posterior to that on the fourth rib (Figure A103). The shaft is displaced inferiorly after the possible fracture line.

5. A depressed area after a possible fracture line near the sternal end of a right rib (Figure A104).

6. A slightly depressed area lateral to the sternal end on a left rib (Figure A105). There is a ridge of bone bordering it laterally which likely represents a fracture line.

7. A compressed area bordered by rough ridges of bone on the medial and lateral surfaces near the sternal end of a right rib (Figure A106).

8. A broad, flatted area of bone and an uneven ridge of bone laterally near the sternal end of a right rib (Figure A107). There is likely some malalignment during healing of the fracture as the more anterior portion is oriented slightly inferiorly.

9. A fragmentary area of bone that is deformed, raised and broadened superiorly, on a left(?) rib shaft fragment (Figure A108).

Numbers 3 through 9 are consistent with multiple healed fractures to the ribs, yet whether they all occurred at once or represent separate event is unclear.

10. A deformity between the body and greater horn of the hyoid bone (Figure A109–Figure A110). A common variation of the hyoid bone is bilateral or unilateral lack of fusion of the body and greater horn (B. S. de Bakker et al. 2019; Kopuz and Ortug 2016; Wedel and Galloway 2014). Here the left greater horn and body are fused and appear normal. The margins of the defect are smooth anteriorly, but there is post-mortem damage on the posterior margin. The anterior margins are smooth and it appears that there is a gap between the body and greater horn superiorly. The inferior half is fused, but protrudes inferiorly. Fractures to the hyoid bone are exceedingly rare and their preservation in the archaeological record is also uncommon (Keerthi and Quadri 2016). It is possible that this represents a healed fracture (c.f. Cutuk et al. 2012; Rifai and Tawab 2016; Sawatari and Alshamrani 2019; Zakaria et al. 2014). Later examination of the bone with radiography would be useful in confirming this diagnosis. It is most likely that a fracture to the hyoid resulted from strangulation or a blow to the throat (H. M. de Bakker et al. 2020; Porr et al. 2012; Wedel and Galloway 2014).

Burst and compression fractures are present on multiple vertebral bodies.

Previously Reported In: # 1 reported in Doigahama Site Anthropology Museum (2014)



Figure A99: Doigahama 421 superior view of the crania showing a depressed fracture to the left parietal bone.

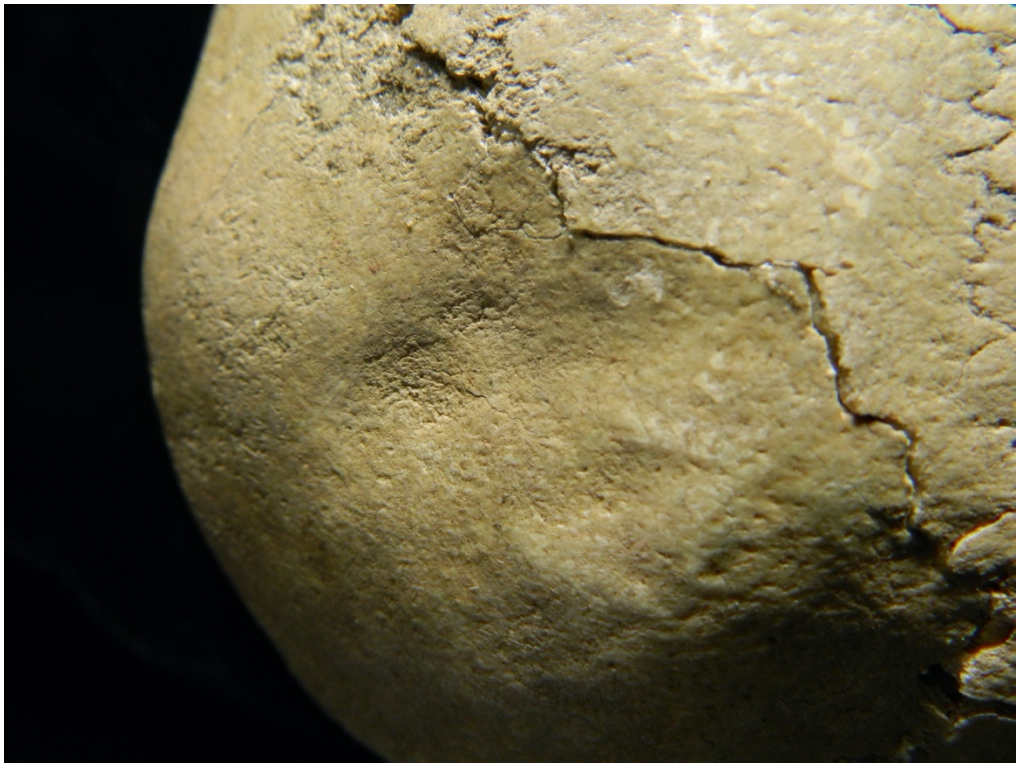


Figure A98: Doigahama 421 close-up of the depressed fracture to the left parietal bone.

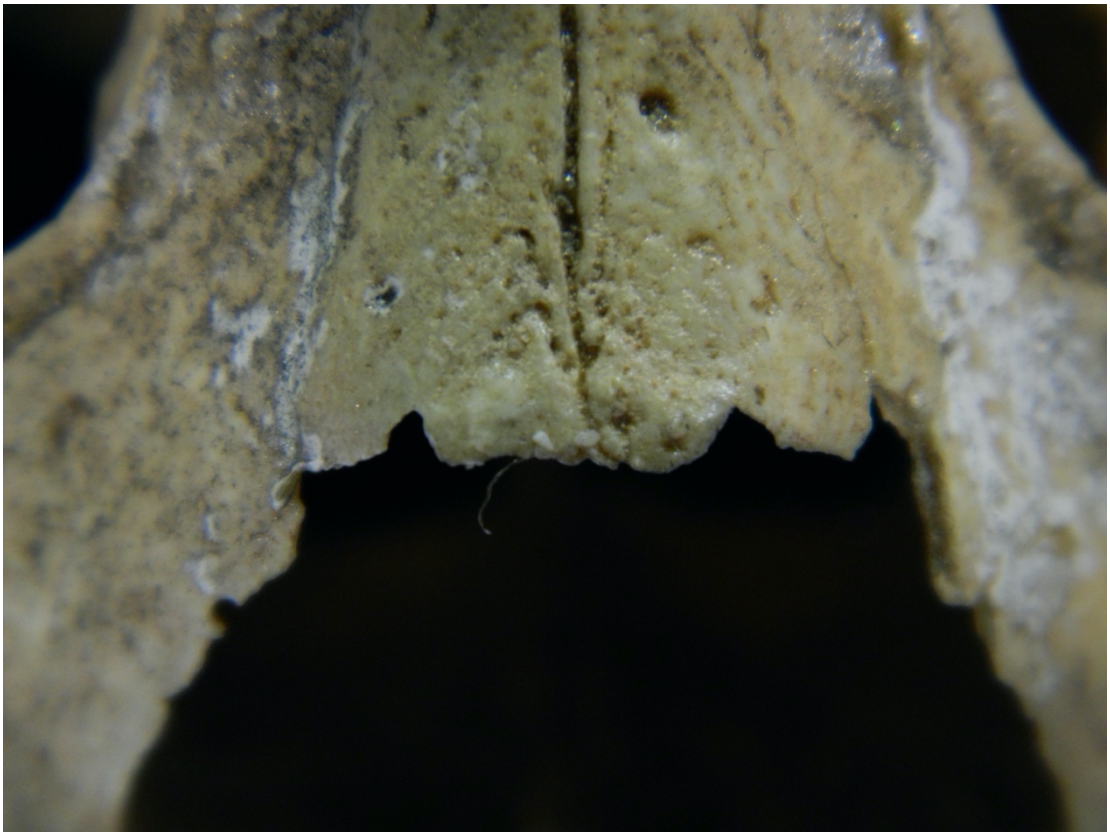


Figure A100: Doigahama 421 nasal bones showing a possible fracture to both distally.



Figure A101: Doigahama 421 right fourth(?) rib shaft showing a possible healed fracture.



Figure A102: Doigahama 421 right fifth(?) rib showing a possible healed fracture to the shaft. Note the inferior displacement of the bone past the depressed area.

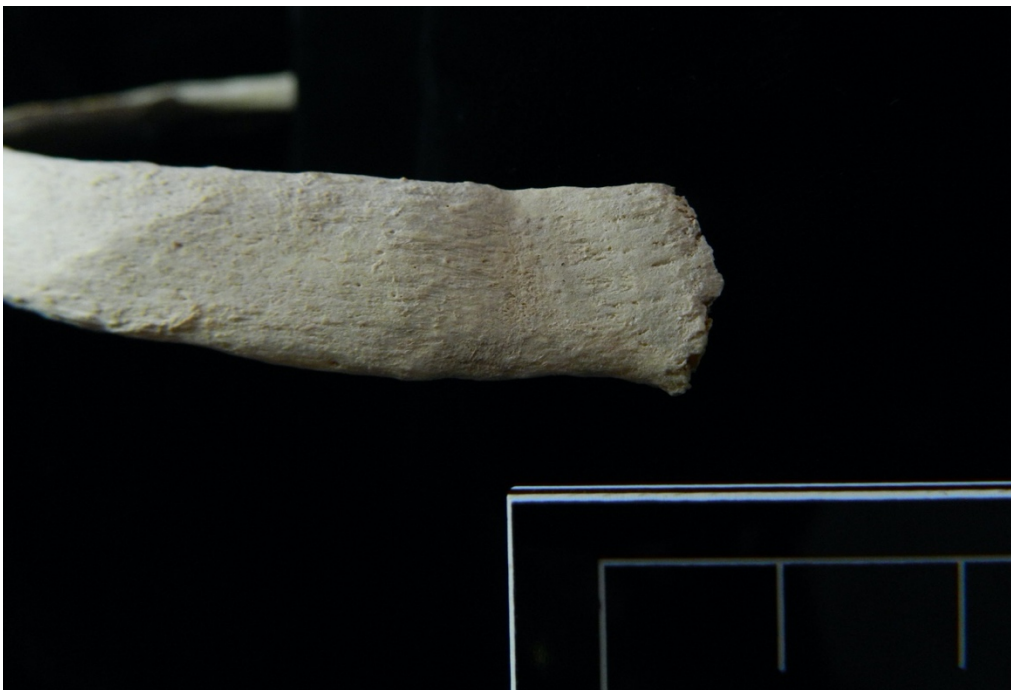


Figure A103: Doigahama 421 possible healed fracture near the sternal end of a right rib.

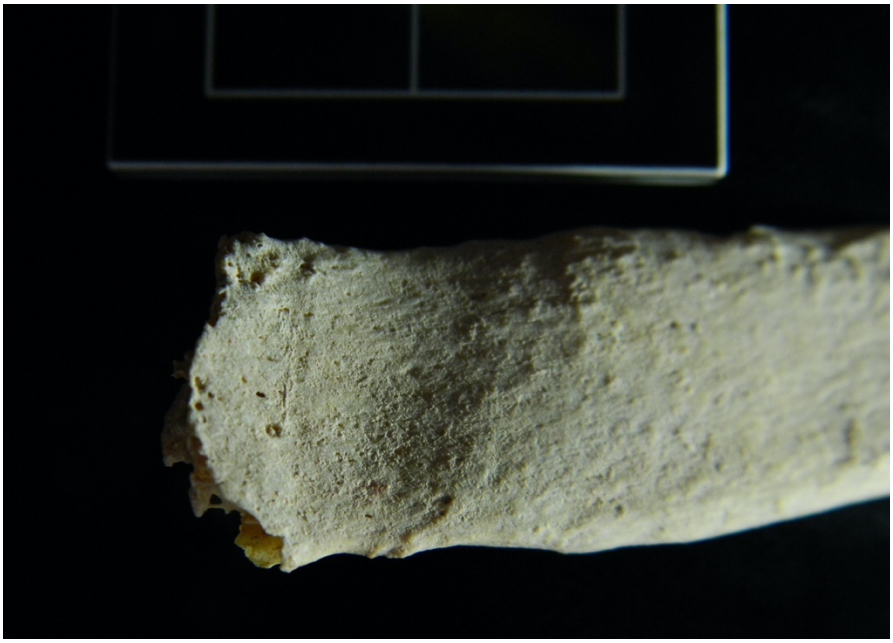


Figure A104: Doigahama 421 left rib showing a possible healed fracture near the sternal end.



Figure A105: Doigahama 421 right rib showing a possible healed fracture near the sternal end.



Figure A106: Doigahama 421 right rib near the sternal end showing a likely healed fracture.



Figure A107: Doigahama 421 left rib fragment showing a depressed area.



Figure A108: Doigahama 421 hyoid bone superior view showing a possible healed fracture.



Figure A109: Doigahama 421 close-up of possible fracture to the hyoid bone.

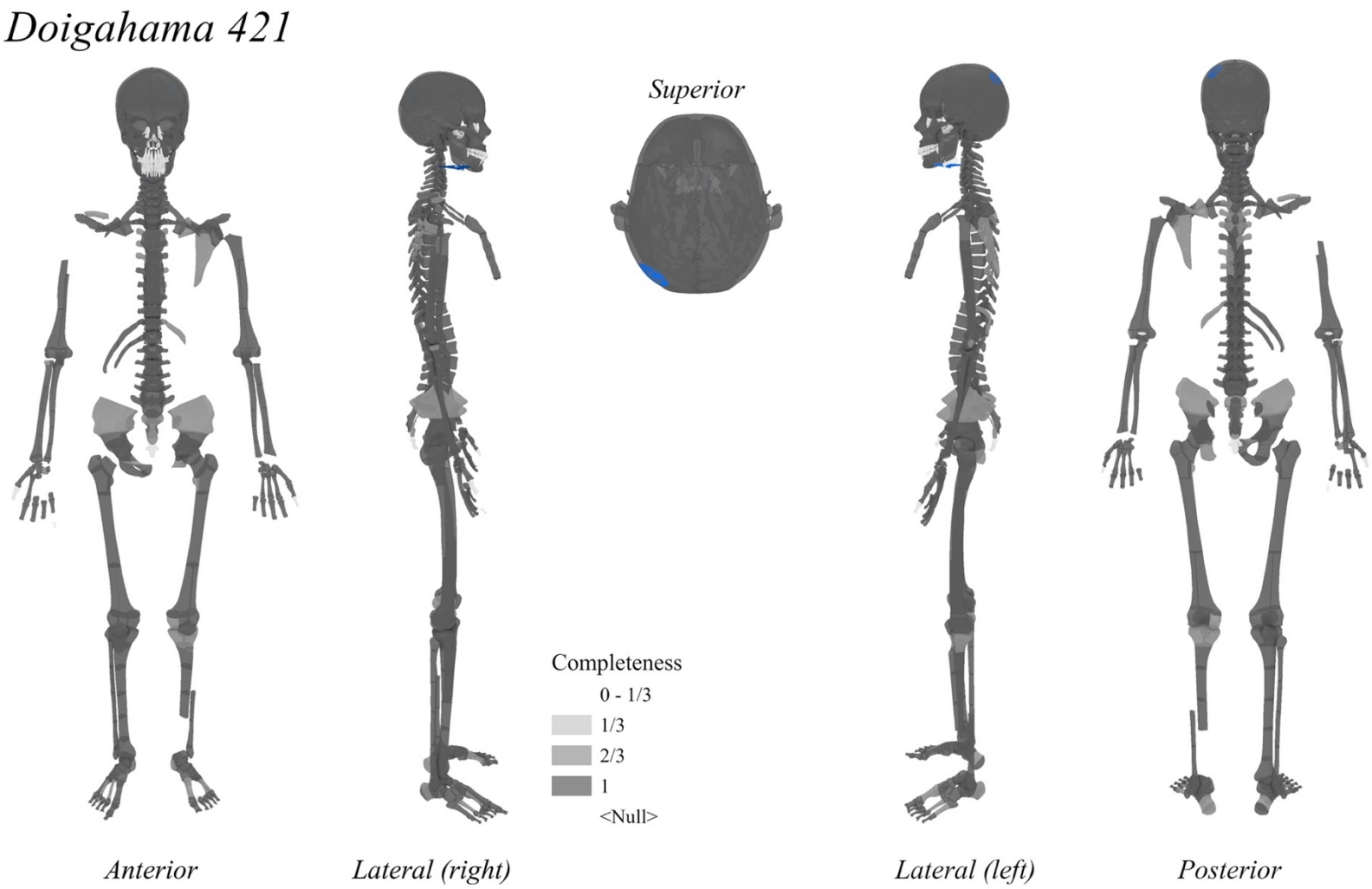


Figure AA13: Doigahama 421 Completeness and Medium–High antemortem trauma.

Doigahama 912 | Mid Adult? | Male | Early Yayoi

Likelihood of traumatic injury: 1. High; 2. Medium

Likelihood of being violence-related: 1–2. Low

Timing: Antemortem

Assessment of traumatic aetiology:

1. An almost entirely closed linear fracture running from the left sphenoid bone up through the parietal bone (Figure A111). There is minimal porosity around the fracture. A partial associated fracture line can be seen on the inner table. The lesion begins more anterior than it would if this was an abnormal vascular groove of the middle temporal artery or middle meningeal artery (Schunk and Maruyama 1960) and resembles a previously reported case (Redfern and Roberts 2019). Linear fractures tend to occur due to the impact of a significant mass but low force and tend to be associated with the force being dispersed over a larger area (ex. a wider impact site) than those seen in depressed fractures (Martin and Harrod 2015; Wedel and Galloway 2014). Yet, Dyer and Fibiger (2017) have also found that linear fractures may result from a direct blow from an object with a flat surface, like a flat club.

2. A ovular, porous depression on the posterior left parietal bone (Figure A112). There is no similar defect on the right side and no endocranial activity associated with it.

Dimensions: 1. 117.2 mm x 2.1 mm; 2. 11.2 mm x 1.9 mm and 0.9 mm deep



Figure A110: Doigahama 912 lateral view of the crania showing a healed linear fracture to the left sphenoid and parietal bones.



Figure A111: Doigahama 912 posterior view of the left parietal bone showing a shallow porous depression.

Doigahama 1105 | Mid Adult | Male? | Early-Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

A possible healed fracture to the left maxilla and nasal bones (Figure A113–Figure A115). The left maxilla has a circular linear defect, partially closed, and from that point anteriorly is depressed medially (Figure A114). The nasal bones are fragmented, but what remains of their most anterior portion shows a light inferiorly depressed area distal to a likely fracture line (Figure A115).

Burst and compression fractures are present on the thoracic and lumbar vertebrae.

Dimensions: nasals: 2.0 mm x 3.6 mm (of what remains); maxilla: 13.5 mm long fracture line, depressed area medially ca. ca. 12.2 mm x 10.1 mm



Figure A112: Doigahama 1105 anterior view of the crania showing possible healed fractures to the left maxilla's frontal process and both nasal bones.



Figure A113: Doigahama 1105 left maxilla showing a healed fracture line.



Figure A114: Doigahama 1105 nasal bones showing that they are deformed, oriented inferiorly after a possible healed fracture line.

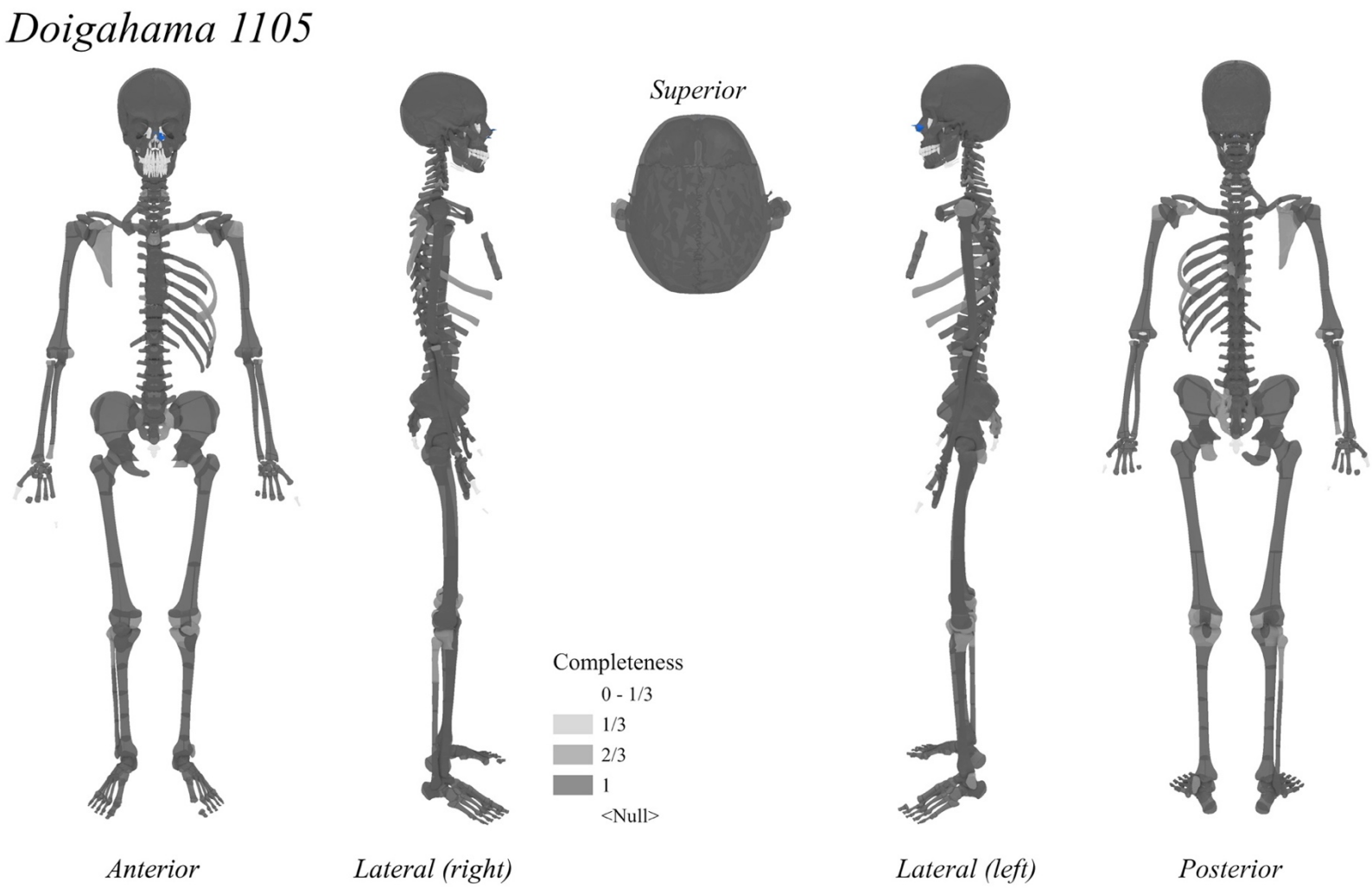


Figure AA14: Doigahama 1105 Completeness and Medium–High antemortem trauma.

Doigahama 1116 | Mid Adult | Male | Yayoi

Likelihood of traumatic injury: 1. Medium; 2. Medium; 3. Low

Likelihood of being violence-related: 1. Medium; 2. Low; 3. Low

Timing: Antemortem

Assessment of traumatic aetiology:

1. A depressed area to the mid left nasal bone, anterior to which is an oval-shaped area of deformed bone, raised in the centre and slightly depressed inferiorly on the edges) with some involvement of the right nasal bone at the tip, likely representing a healed fracture (Figure A116).

2. There is a curved, relatively sharp abnormality on the lateral head of the right third proximal phalanx of the hand (Figure A117–Figure A118). The proximal margins are well-defined and the interior of the defect is porous. The margins taper to an edge distally. There is also a small porous groove running transversely through most the rest of the dorsal, proximal edge of the epiphysis. No associated intermediate phalanx remains. It is possible that this represents an oblique (unstable) unicondylar fracture (type II-B to II-C) with nonunion of the fractured bone (Freeland and Sud 2001).

3. The left mandibular condyle is deformed and the mandibular notch widened (Figure A119). There is no clear fracture line visible` macroscopically to suggest that it is related to a traumatic injury.

Dimensions: 1. 11.9 mm x 12.0 mm; 2. Curved area 5.9 mm wide; Porous line 3.7 mm x 0.3 mm



Figure A115: Doigahama 1116 crania showing a potentially healed fracture to the left and right nasal bones.



Figure A116: Doigahama 1116 right third proximal phalanx head showing a the circular margin of the abnormality and the groove



Figure A117: Doigahama 1116 right third proximal phalanx lateral view of the head showing the entire lesion.

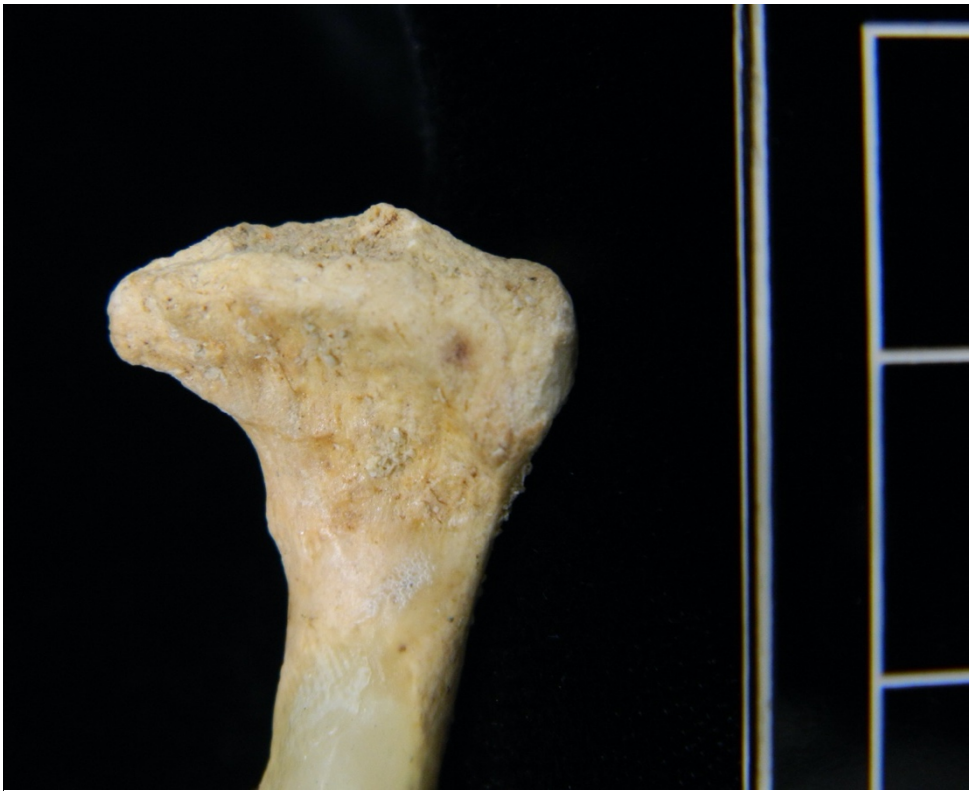


Figure A118: Doigahama 1116 left mandibular condyle anterior view showing its deformed morphology.

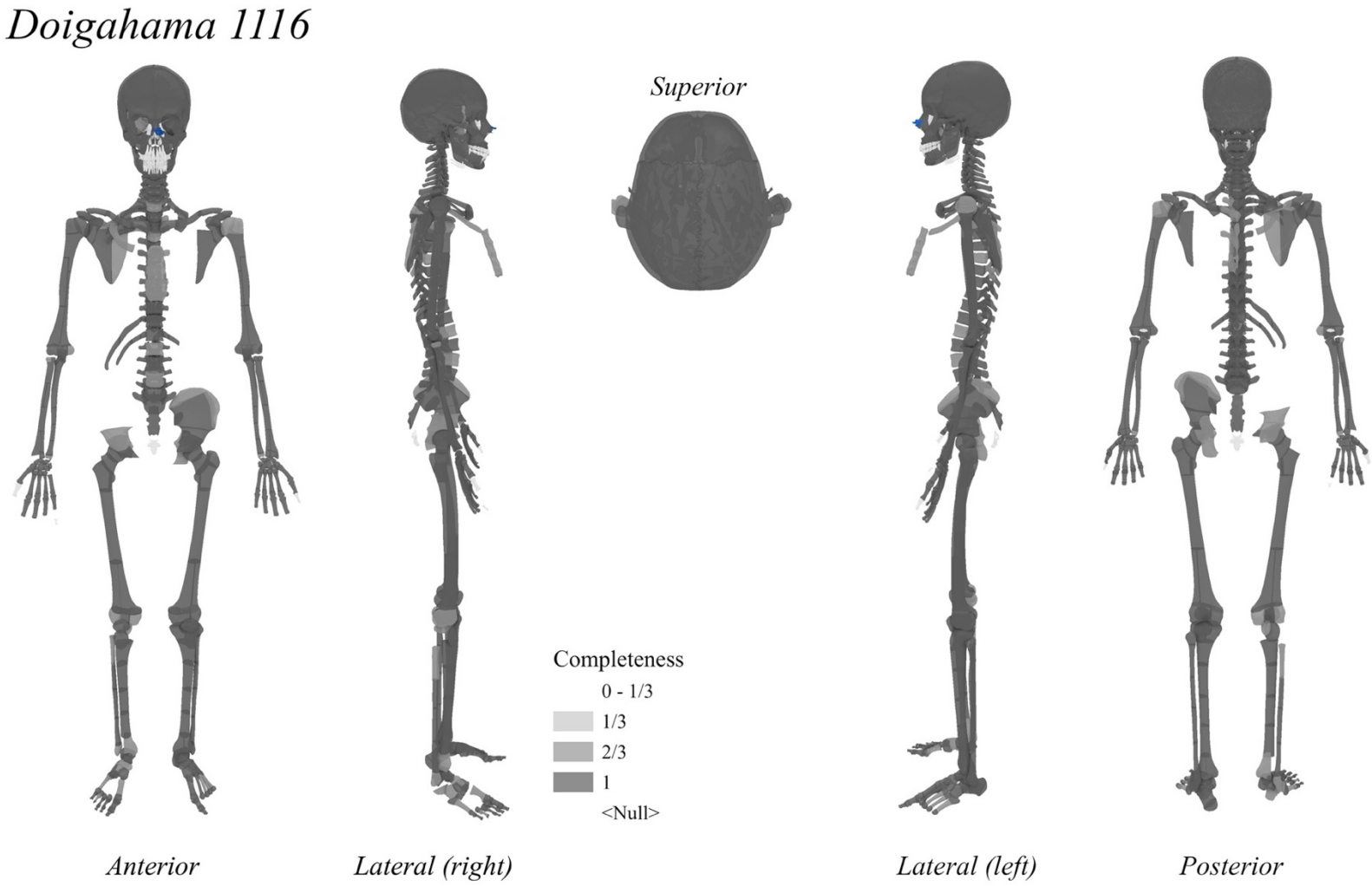


Figure AA15: Doigahama 1116 Completeness and Medium–High antemortem trauma.

Hirota A-8 | Young–Mid Adult | Male | Late Yayoi

Likelihood of traumatic injury: 1–3. High; 4. Low; 5. High; 6. High

Likelihood of being violence-related: 1–3. Medium; 4. N/A; 5. Medium; 6. Low

Timing: Antemortem

Assessment of traumatic aetiology:

1. A porous depression to the mid-line of the superior frontal bone (Figure A120–Figure A121). The corresponding inner table is impressed medially. The defect is comma-shaped with sloping margins.

2. A shallow and porous oval-shaped depression along the sagittal suture of the left side of the frontal bone (Figure A122). There is no associated involvement of the inner table. The margins of the abnormality are sloping and steepest anteriorly.

3. A small, circular depression on the superior right parietal bone (Figure A123–Figure A124). Remodelling and porosity are present in the middle of the depression. No corresponding lesion on the inner table was noted.

4. A shallow oval depression to the left parietal bone with minimal porosity within it (Figure A125–Figure A126). There is no corresponding activity on the inner table. The inferior margin is steepest and the margins are sloping.

5. A deep oval-shaped depression with sloping margins to the posterior left parietal bone (Figure A127–Figure A128). Not as deep as lesion #1. There is porosity present within the depression at its centre. There is no corresponding response on the inner table.

6. A possible oblique fracture to the head of a right proximal phalanx of the foot (Figure A129). The lateral articular surface is displaced proximally and a porous groove runs across it. Two other phalanges of the feet also appear to have oblique grooves running through them, but these are not as clear.

Dimensions: 1. 12.7 mm x 8.0 mm and 2.3 mm deep; 2. 4.8 mm x 3.4 mm and 0.7 mm deep; 3. 7.5 mm x 7.8 mm and 0.9 mm deep; 4. 12.8 mm x 5.0 mm and 0.4 mm deep; 5. 13.9 mm x 7.1 mm and >0.5 mm deep; 6. 9.9 mm x 5.5 mm



Figure A119: Hirota A-8 superior view of the crania showing a possible depressed fracture to the superior frontal bone.



Figure A120: Hirota A-8 close-up of possible depressed fracture to the superior frontal bone.



Figure A121: Hirota A-8 left side of the frontal bone showing a shallow, porous depression.



Figure A122: Hirota A-8 superior view of the cranium showing a porous depression on the right parietal bone.



Figure A123: Hirota A-8 close-up of oval depression to the superior right parietal bone.



Figure A124: Hirota A-8 left cranium superolateral view showing a depression to the superior left parietal bone.



Figure A125: Hirota A-8 close-up of depression on the superior left parietal bone.



Figure A126: Hirota A-8 crania posterior view showing a depression to the left parietal bone.



Figure A127: Hirota A-8 close-up of depression to the posterior left parietal bone.



Figure A128: Right proximal phalanx of the foot showing a possible healed oblique fracture to the articular surface.

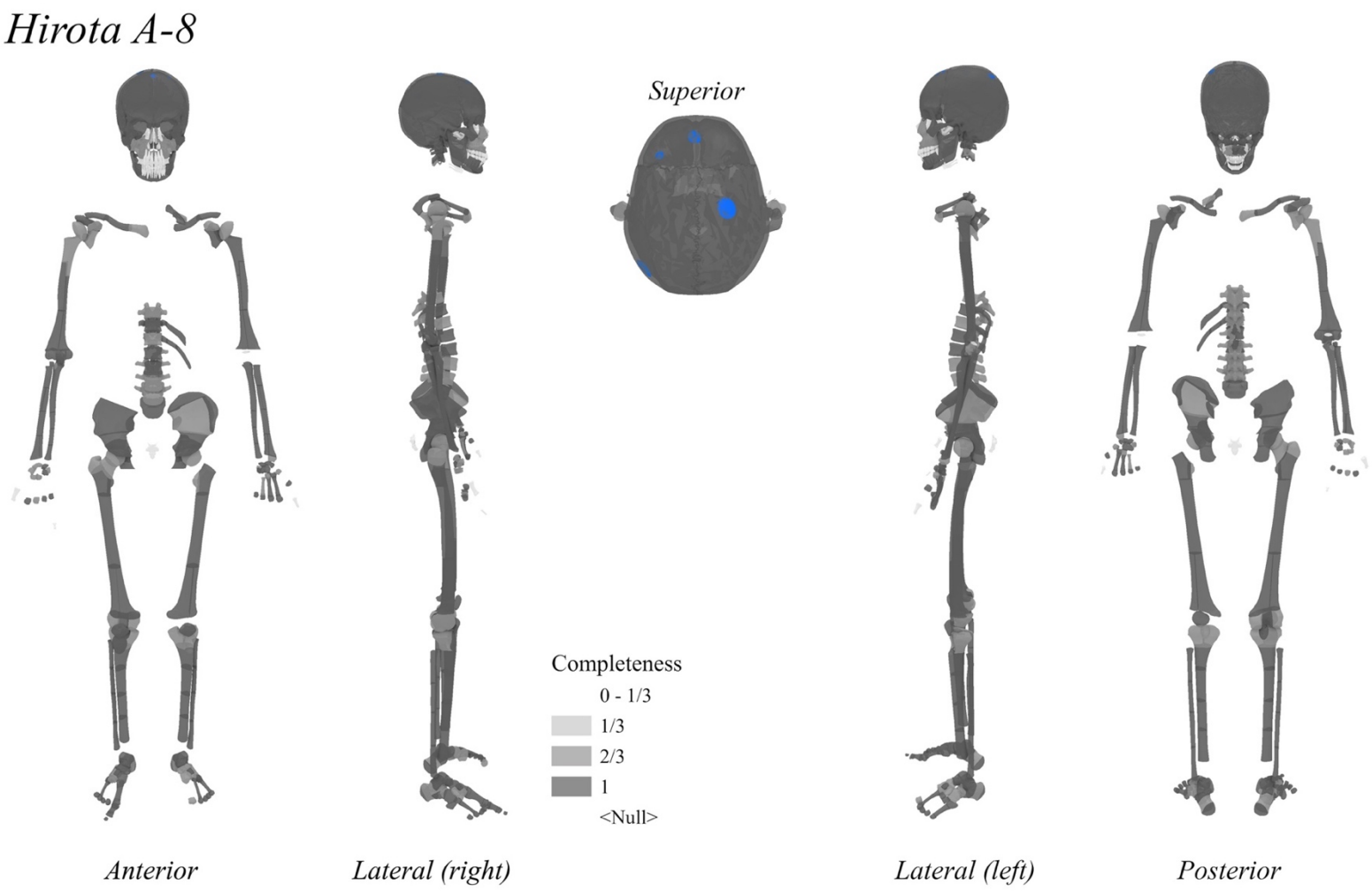


Figure AA16: Hirota A-8 Completeness and Medium–High antemortem trauma.

Hirota C-2 | Young Adult | Male | Late Yayoi

Likelihood of traumatic injury: 1. Medium; 2. High

Likelihood of being violence-related: 1. Medium; 2. Medium

Timing: Antemortem

Assessment of traumatic aetiology:

1. A porous, small circular depression near the left frontal boss (Figure A130–Figure A131). The margins are sloping and are steepest inferiorly. There is no corresponding endocranial activity.

2. A perforation on the lateral left parietal bone (Figure A132–Figure A133). It is difficult to see if there is any endocranial activity as the meningeal grooves slightly obscure this area, although there is a corresponding very shallow and small depression of bone. The defect is triangular in shape and comes to a rounded point at its deepest. There is no hole extending through the cranial tables. There is no porosity present. The margins of the lesion are rounded and sloping.

Dimensions: 1. 6.1 mm x 6.4 mm and 0.7 mm deep; 2. 4.0 mm x 3.2 mm and 1.5 mm deep



Figure A129: Hirota C-2 frontal bone anterior bone showing a shallow depression.

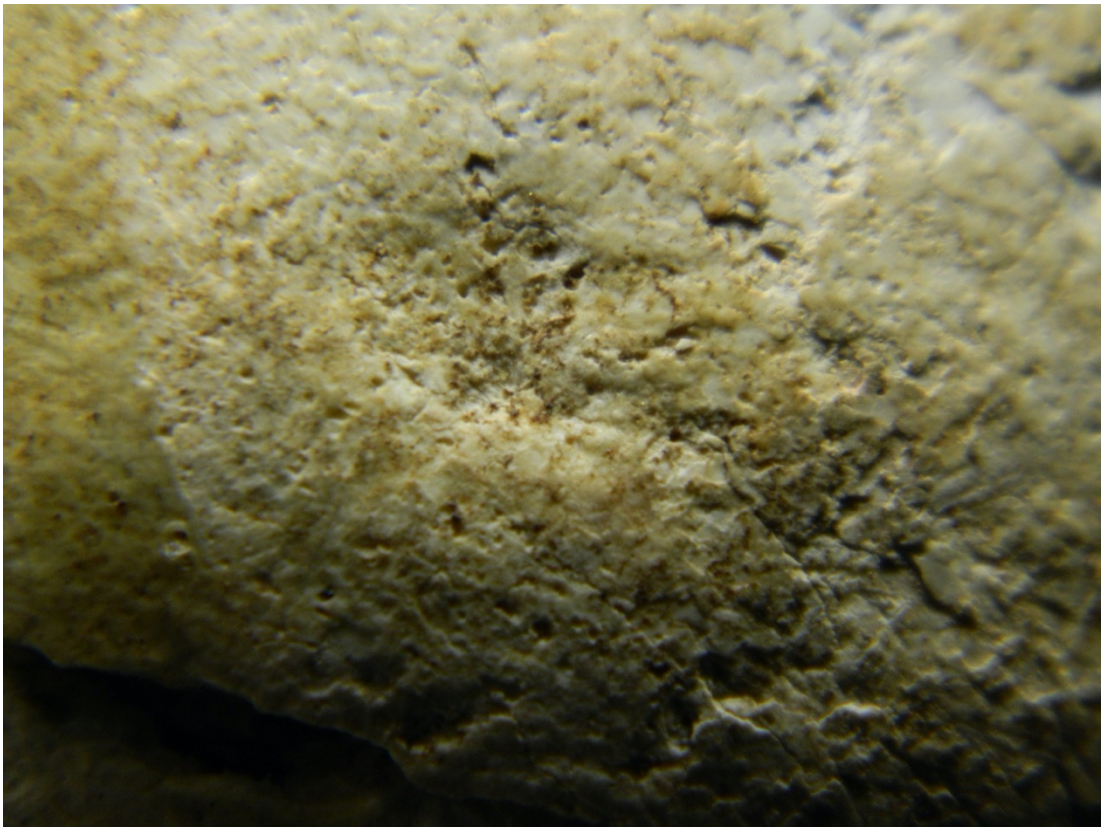


Figure A130: Hirota C-2 close-up of the depression on the frontal bone.

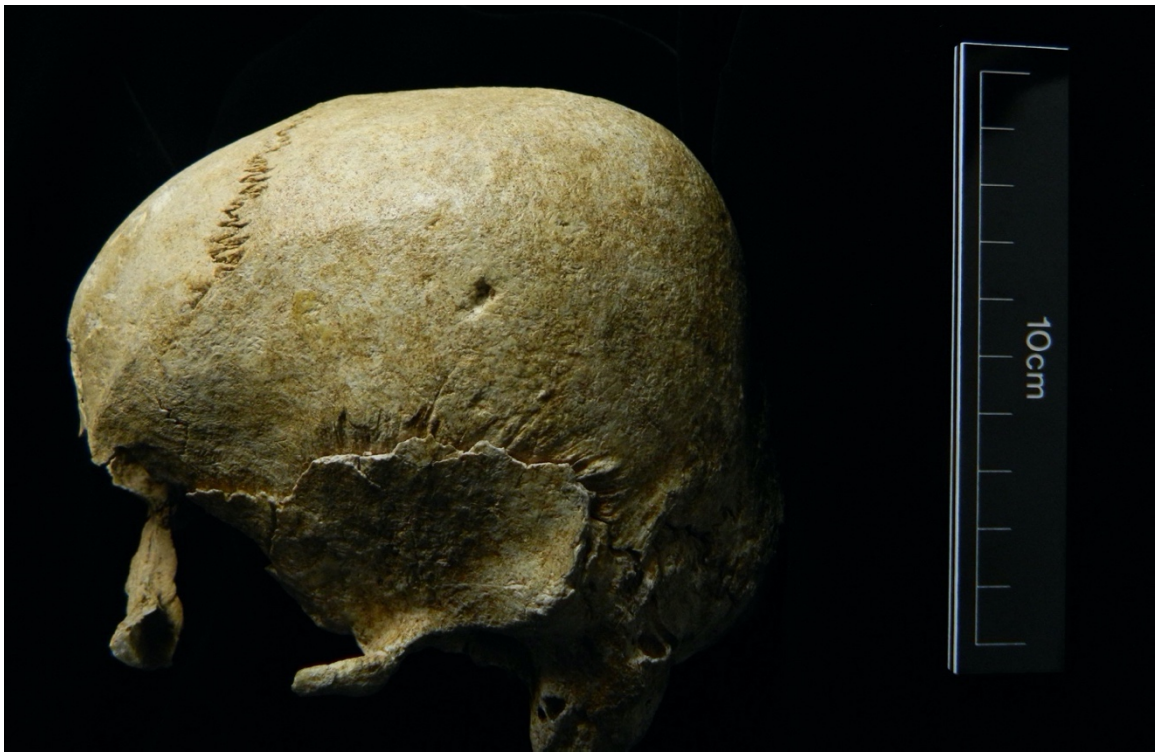


Figure A131: Hirota C-2 lateral view of the crania showing a triangular perforation to the left parietal bone.

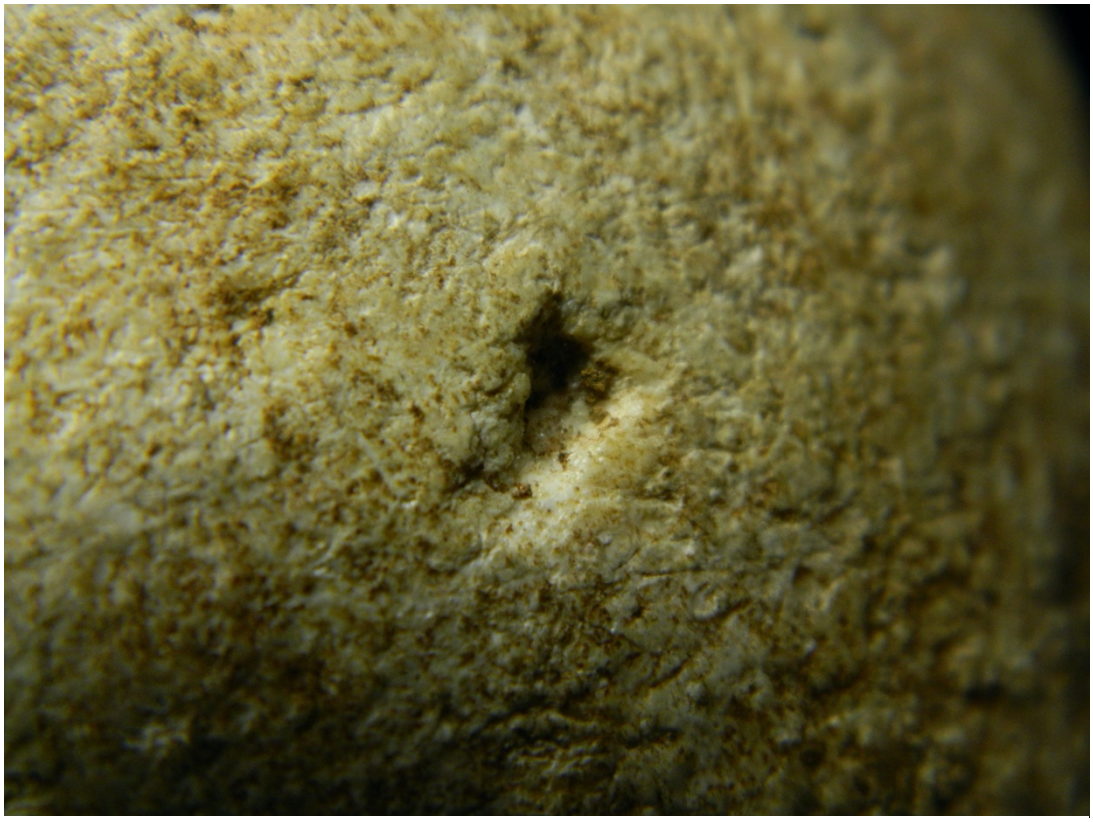


Figure A132: Hirota C-2 close-up of the perforation to the left parietal bone.

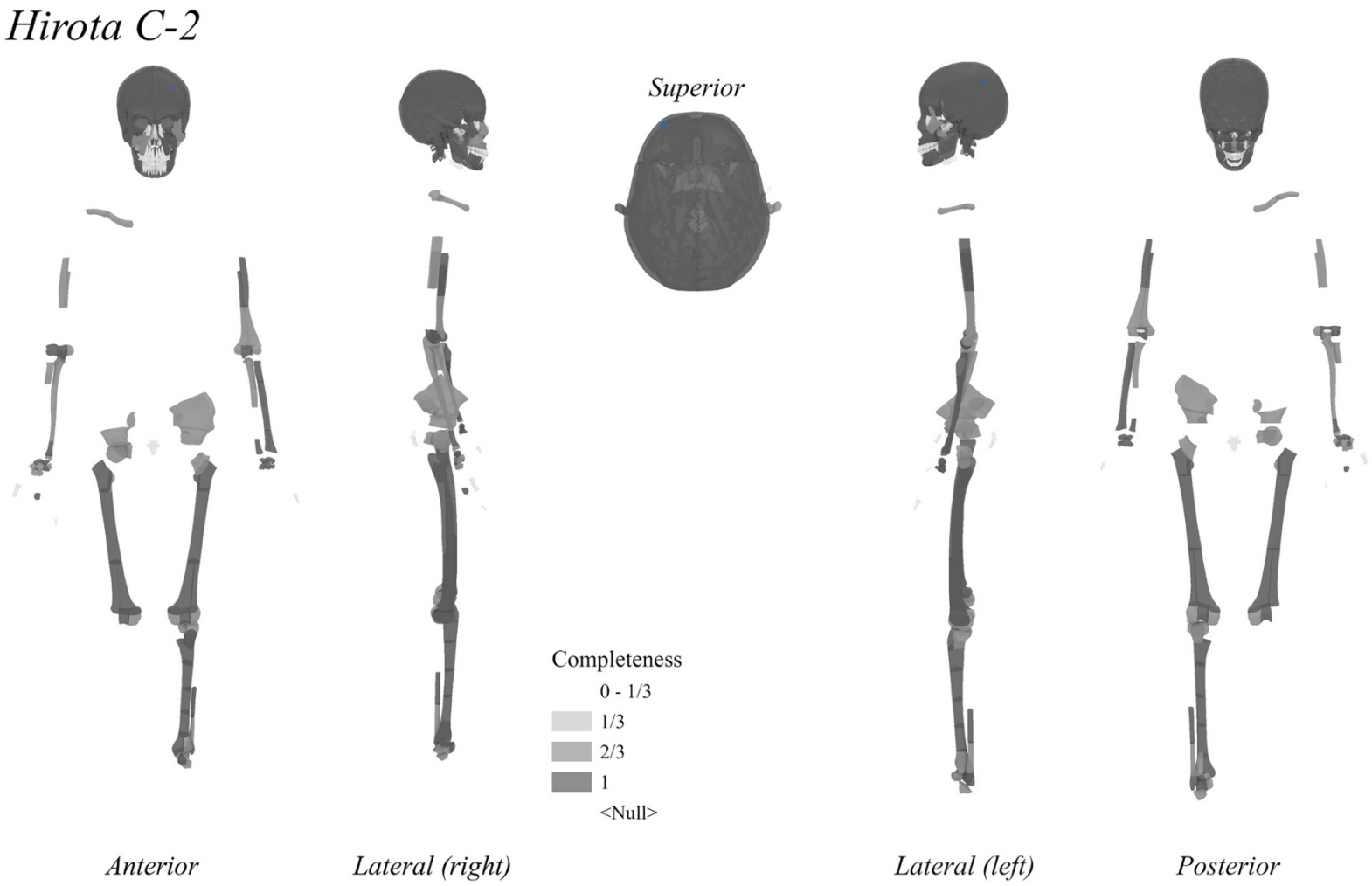


Figure AA17: Hirota C-2 Completeness and Medium–High antemortem trauma.

Hirota C-5 | Young Adult | Male | Late Yayoi

Likelihood of traumatic injury: 1. Medium; 2. Medium; 3. Low; 4–7. Medium; 8. Low; 9. Low; 10. Medium

Likelihood of being violence-related: 1. Medium; 2. Medium; 3. N/A; 4–7. Medium; 8–9. N/A; 10. High

Timing: 1–9. Antemortem; 10. Perimortem?

Assessment of traumatic aetiology:

1. A small oval-shaped porous depression on the mid frontal bone (Figure A134–Figure A135). The margins are sloping and are steepest inferiorly. No corresponding response is present on the inner table.

2. The anterior of two depressions on the right side of the frontal bone, superior to the temporal line (Figure A136–Figure A137). The depression is semi-circular with sloping margins that are steepest anteroinferiorly. Porosity is present particularly at its deepest point.

3. The posterior of two depressions on the right side of the frontal bone, superior to the temporal line (Figure A136–Figure A137). This depression is shallower but with clearer margins and a possible healed concentric fracture superoanteriorly. No concentrations of porosity are present. Remodelled bone is present in the centre of the depression.

4. Another paired set of circular depressions to the frontal bone, but along the coronal suture on the left side of the bone (Figure A138–Figure A139). The more lateral of the two is shallower with sloping margins. There is some porosity within it, but this this is obscured by postmortem fracturing.

5. The more medial of the two is located almost directly along the suture (Figure A138–Figure A140). There is little porosity present within it and its margins are demarcated with remodelled bone. There is a small corresponding porous ring present on the inner table. (Figure A140).

6. A curved, porous depression near bregma on the left parietal bone (Figure A141–Figure A142). Glue used to secure the cranial bones together coats at least half of the abnormality and

obscures it somewhat. The margins of the depression are sloping and composed of remodelled bone. There is an associated area of thinner bone on the inner table (Figure A143).

7. A curved, porous depression on the superior left parietal bone (Figure A144–Figure A145). The margins are not smooth, but are sloping. It is located within a area of porotic hyperostosis. There is postmortem damage to this area on the inner table.

8. A small, circular depression to the left parietal bone (Figure A146). A postmortem fracture bisects it. There is postmortem damage to this area on the inner table as well.

9. A circular depression on the posterosuperior right parietal bone (Figure A147). Porosity and remodelled bone are present within the depression and it has sloping margins but it is obscured by glue and postmortem fracturing.

It has been suggested that those at Hirota performed some form of cranial modification as particularly their occipital regions tend to be compressed anteriorly and at times there is associated asymmetry (S. Yonemoto, Personal communication). Unintentional cranial modification is also possible, and can be caused by infants laying on a hard surface without much movement, such as being carried on a cradle-board. Depressed cranial fractures are not listed as an associated condition to this (Najarian 1999; Redfern and Roberts 2019; Tubbs et al. 2006). There is pervasive porotic hyperostosis throughout the skull, particularly superiorly and anteriorly on the frontal bone and asymmetrical fovea are present on the parietal, frontal, and occipital bones. On the posterosuperior right parietal bone there is an area of abnormal hyperostosis (Figure A148).

There are a number of possibly healing antemortem depressed fractures listed above. These lesions are not well-delineated or scalloped, but have sloping margins. All of the defects have circular or oval shapes and do not have irregularly shaped margins as one might see is lytic lesions, even possibly healing ones (Buikstra 2019; Köhler and Wilk 1968). Several other individuals from Hirota show multiple healing depressions to the cranium and possible cranial modification, discussed herein.

10. A porous rectangular groove to the anterior of the lesser trochanter of the left femur, possibly representing penetrating trauma (Figure A149). The groove is wide and curved, the margins are clearly defined and it does not come to a sharp point. The margins are rough and suffer from some postmortem damage.

Dimensions: 1. 10.4 mm x 3.3 mm and 0.9 mm deep; 2. 10.5 mm x 5.0 mm and 0.8 mm deep; 3. 9.5 mm x 6.4 mm and 0.4 mm deep; 4. 8.3 mm x 6.9 mm and 0.8 mm deep; 5. 8.6 mm x 12.7 mm and 1.0 mm deep; 6. 11.4 mm x 6.3 mm and 1.0 mm deep; 7. 12.4 mm x 6.6 mm and 0.8 mm deep; 8. 9.8 mm x 8.4 mm and 0.7 mm deep; 9. 10.3 mm x 9.8 mm and 1.0 mm deep; 10. 12.5 mm x 3.6 mm and 5.4 mm deep



Figure A133: Hirota C-5 frontal bone anterior view showing a small, porous depression along the mid-line.



Figure A134: Hirota C-5 close-up of the small, oval depression to the frontal bone.



Figure A135: Hirota C-5 right side of the frontal bone superior view showing two depressions.



Figure A136: Hirota C-5 right side of the frontal bone lateral view showing two porous depressions.

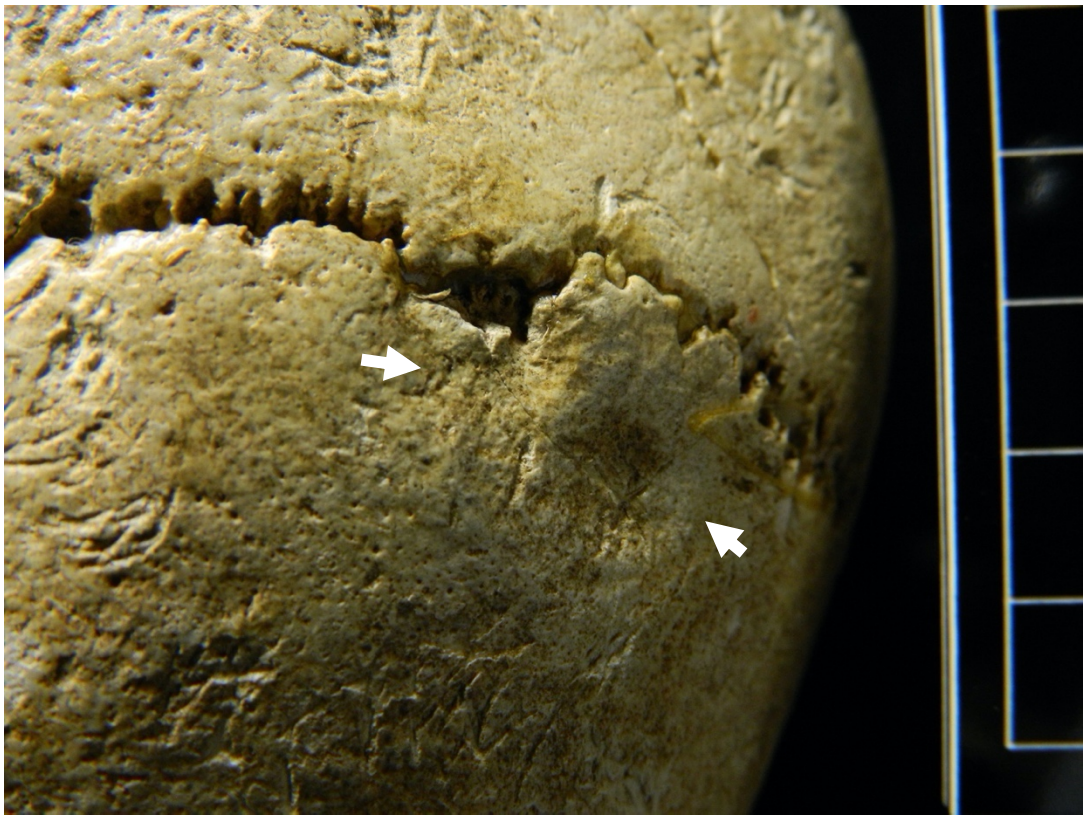


Figure A137: Hirota C-5 superior view of the left side of the frontal bone showing two porous depressions.

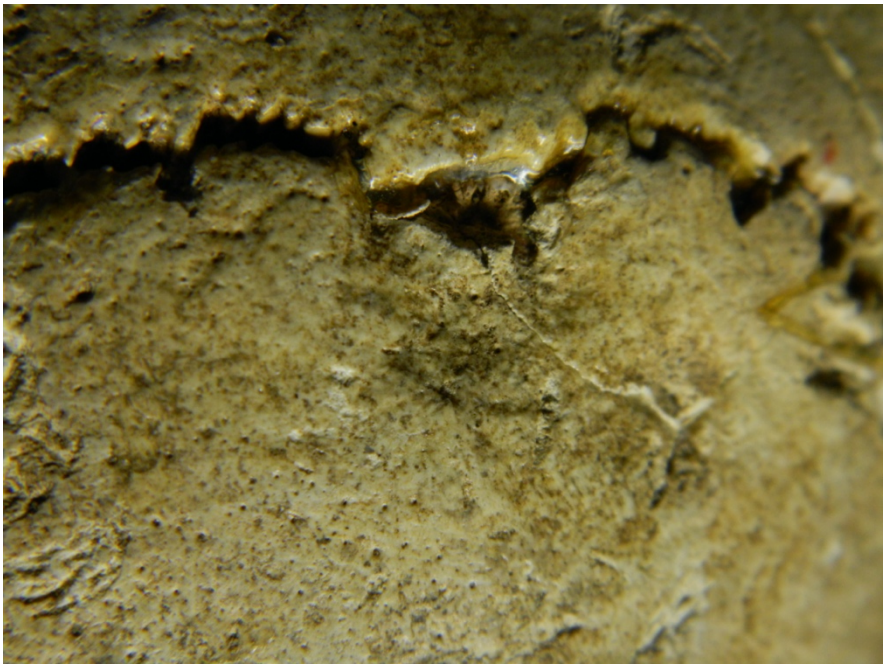


Figure A138: Hirota C-5 close-up of the two porous depressions to the left side of the frontal bone, along the coronal suture.

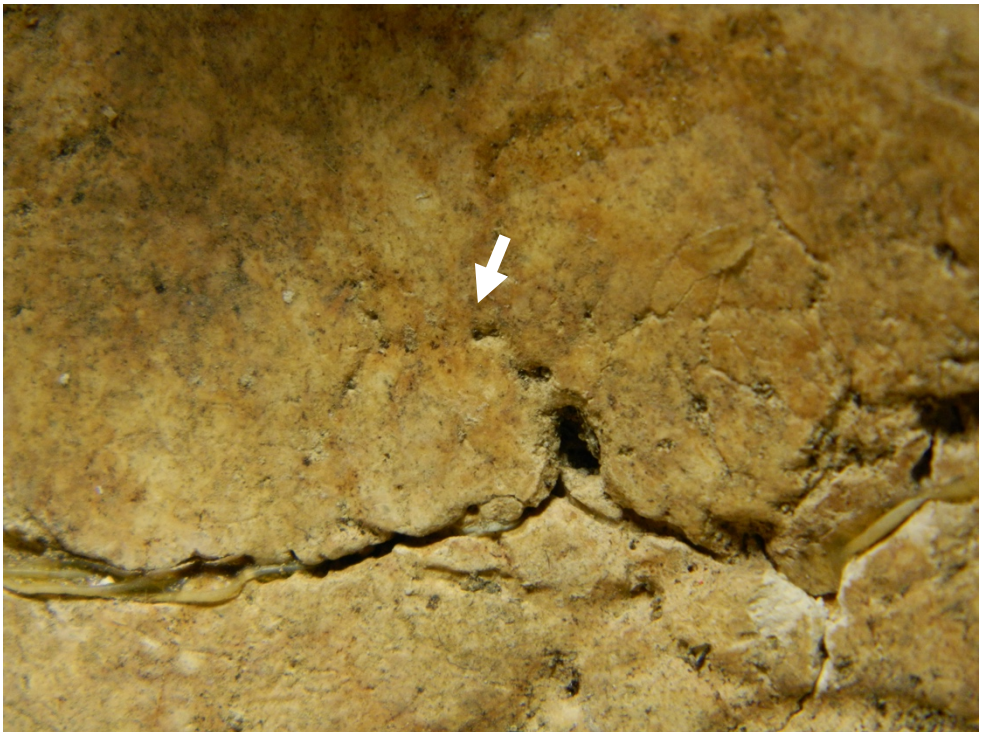


Figure A139: Hirota C-5 inner table of the frontal bone (anterior is up) showing a ring of porosity associated with the depression on the outer table.



Figure A140: Hirota C-5 cranium superior view showing a curved depression to the left parietal bone, near bregma.

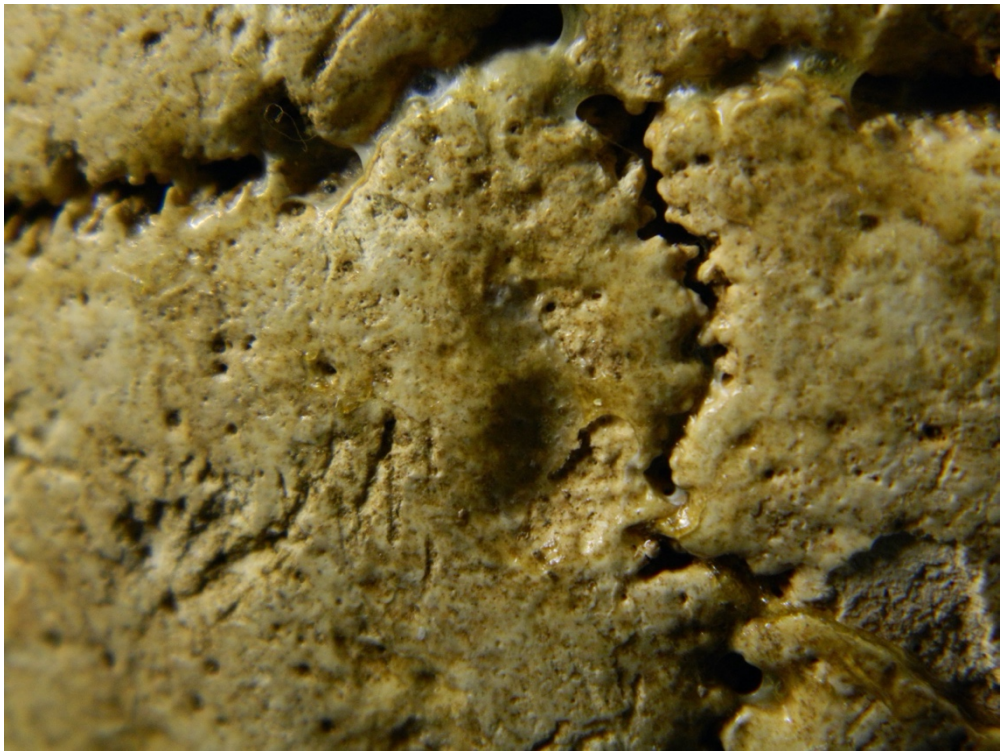


Figure A141: Hirota C-5 close-up of the curved depression to the left parietal bone.

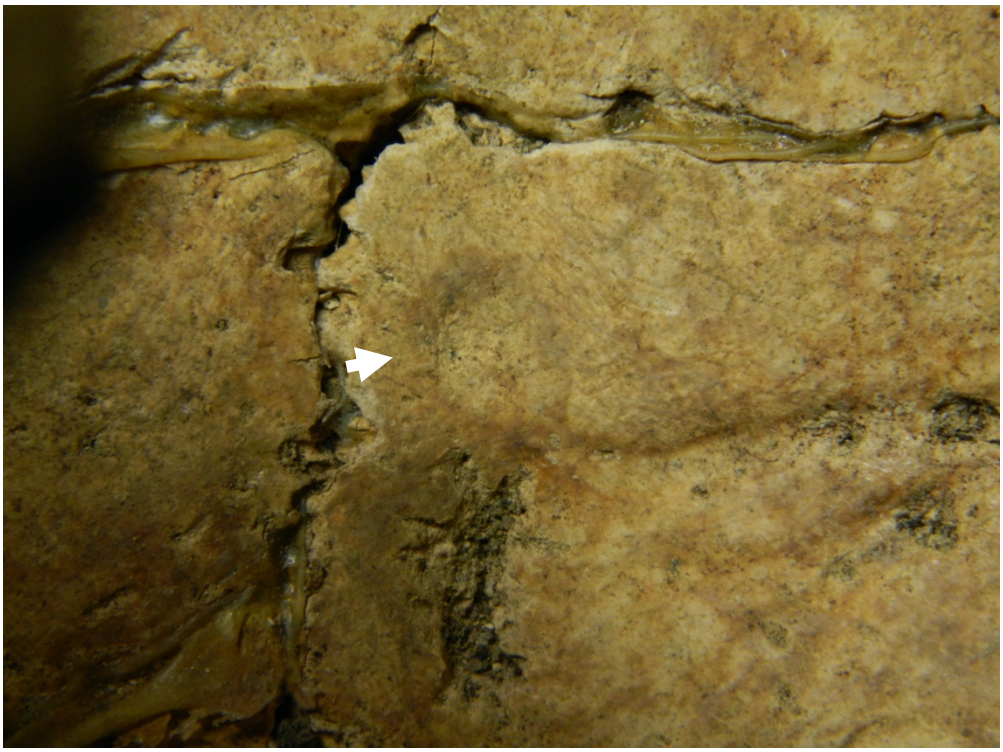


Figure A142: Hirota C-5 inner table showing an associated thin, curved area of bone.

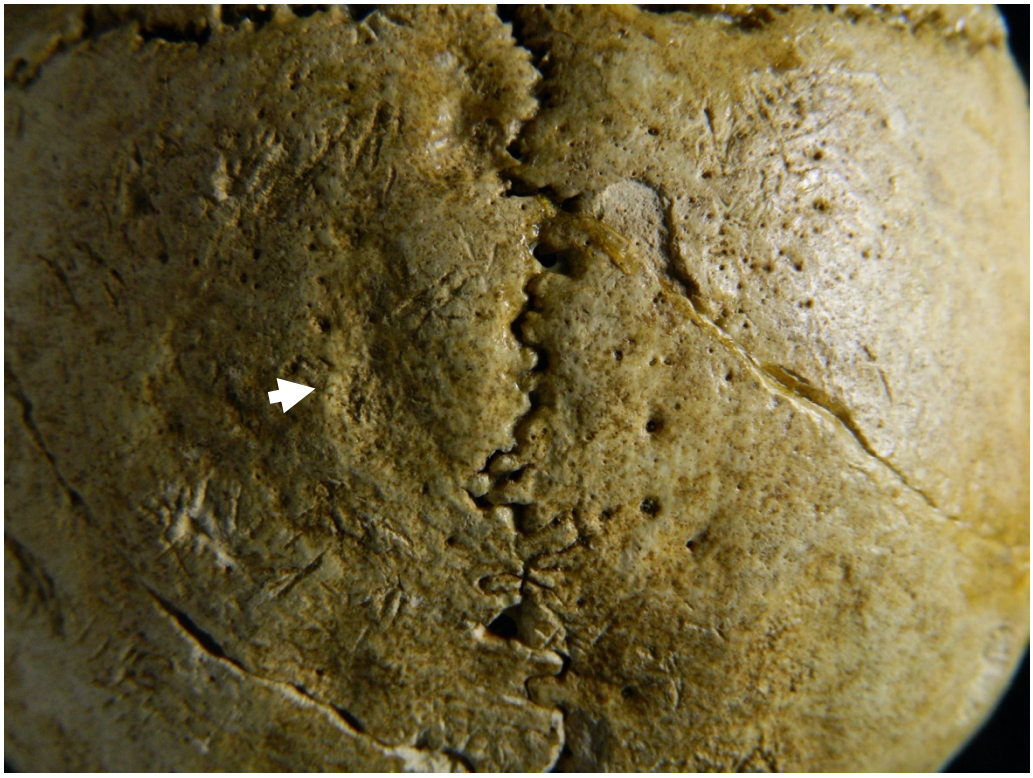


Figure A143: Hirota C-5 parietal bones superior view showing a depression to the left parietal bone.

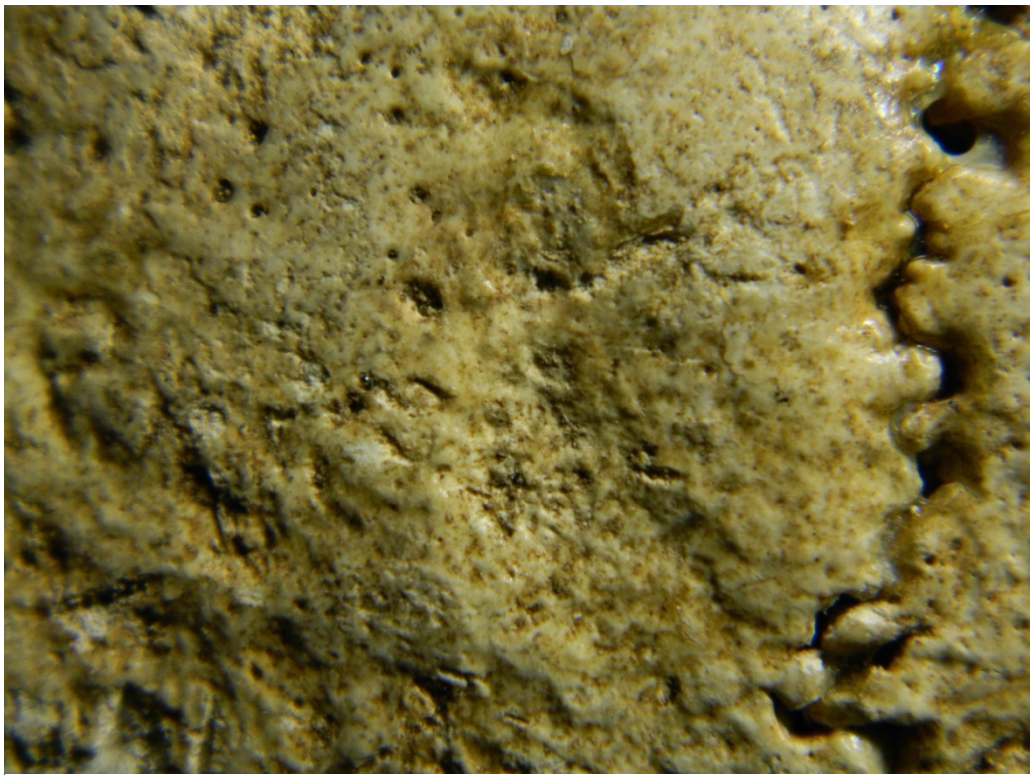


Figure A144: Hirota C-5 close-up of the depression to the left parietal bone.



Figure A145: Hirota C-5 left parietal bone superior view showing a circular depression.



Figure A146: Hirota C-5 right parietal bone posterosuperior view showing a porous depression.

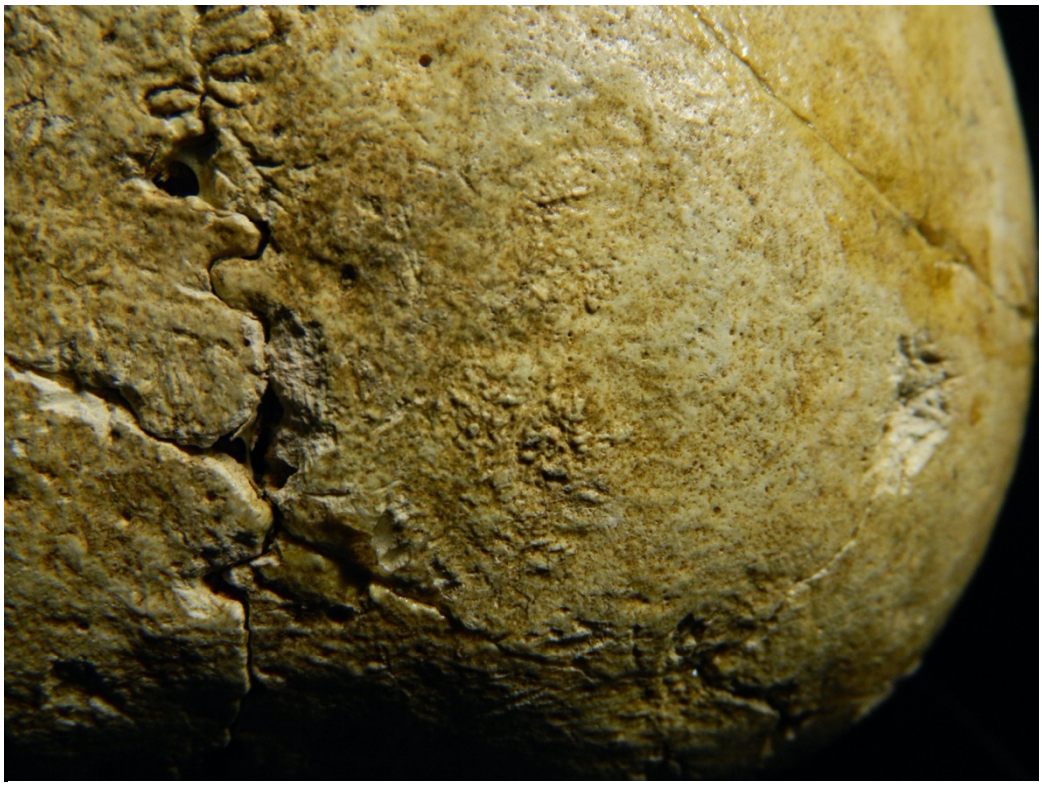


Figure A147: Hirota C-5 right parietal bone showing localised abnormal hyperostosis.

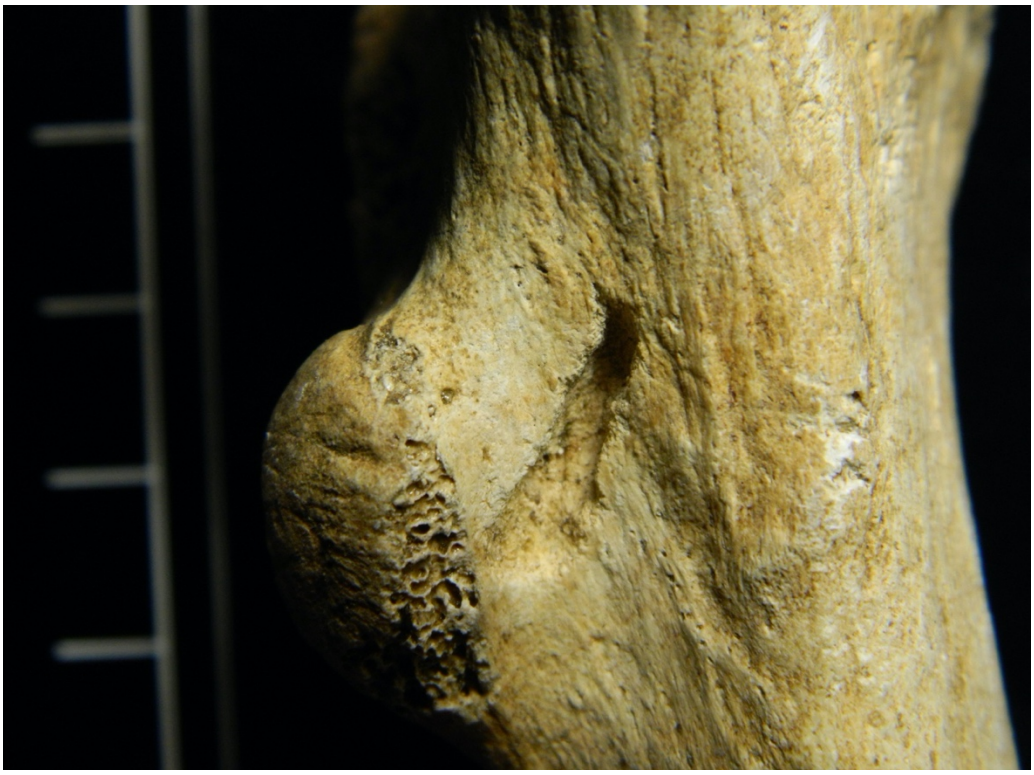


Figure A148: Hirota C-5 lesser trochanter of the left femur medial view showing a rectangular groove with clear margins.

Hirota C-5

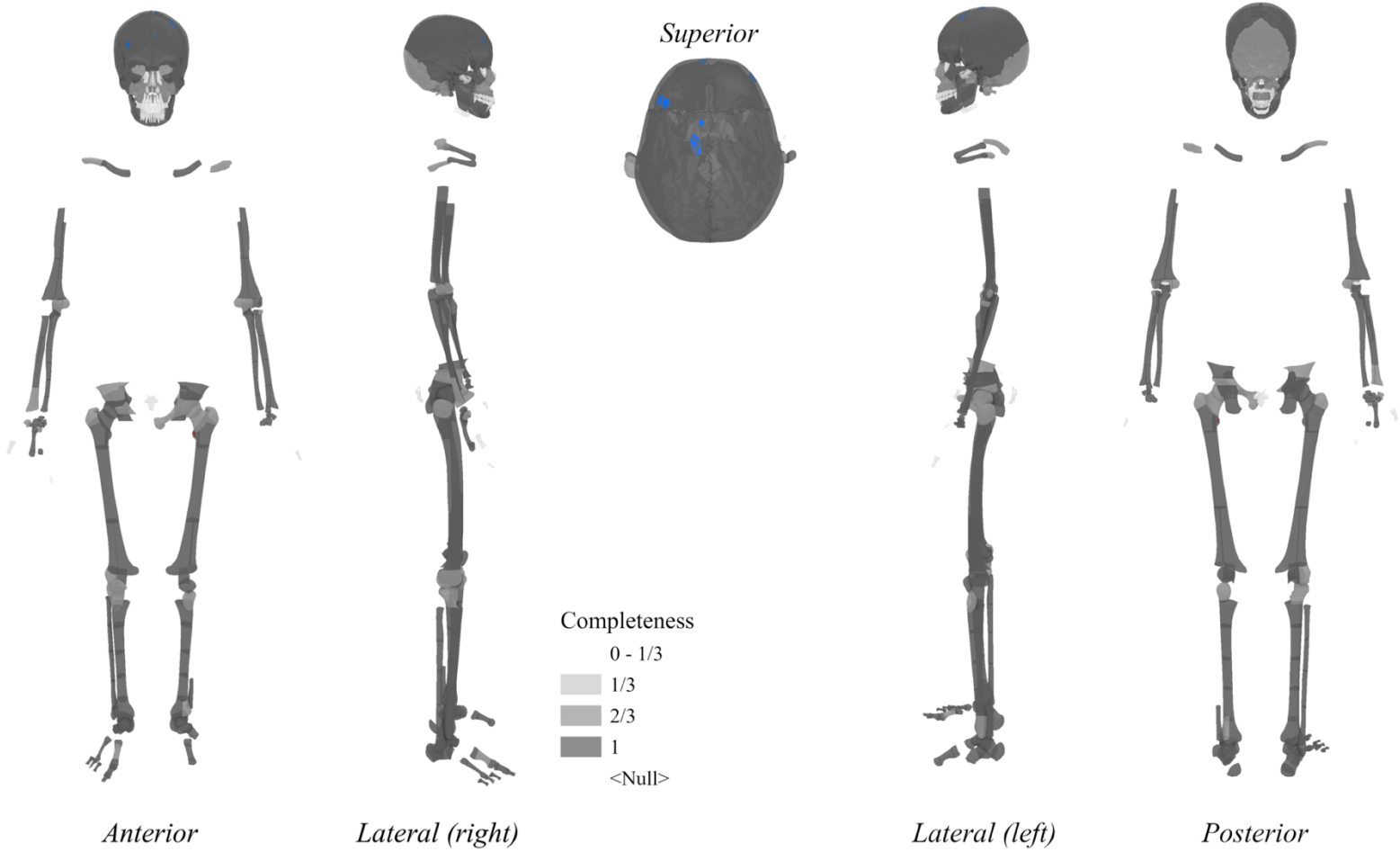


Figure AA18: Hirota C-5 Completeness and Medium–High antemortem (blue) and perimortem (red) trauma.

Hirota C-8 | Mid Adult | Male | Late Yayoi

Likelihood of traumatic injury: 1. Medium; 2. Low; 3. Low; 4– 6. High

Likelihood of being violence-related: 1. Low; 2. N/A; 3. N/A; 4– 6. Low

Timing: Antemortem

Assessment of traumatic aetiology:

1. A large and roughly circular depression to the superior right side of the frontal bone (Figure A150). The margins are sloping and the medial aspect is most porous. A faint groove of bone can be seen on the inner table, but as the skull is so complete, it was difficult to get a better view of the lesion.

2. A transverse ridge of bone on a right rib, near the sternal end (Figure A151). There is a corresponding groove on the medial surface. The bone is fragmented and there is no substantial displacement or deformity of the bone.

3. Periosteal new bone formation on the left seventh(?) rib (Figure A152). It is possible that this relates to a callous formation, but the bone is fragmented, making it difficult to say more.

4. A depressed area on the lateral surface of a left rib, with a possible healed fracture line slightly posterosuperior to it (Figure A153). The same depression can be seen on the medial surface.

5. A deformed area of a left rib shaft (Figure A154). Laterally the likely healed fracture is raised with an uneven and porous texture. The medial portion is smoother but there is a porous line of bone clearly visible (Figure A155).

6. A dense ridge of bone extending from the ilium of the right os coxa (Figure A156), possibly representing a Duverney's fracture with associated myositis ossificans traumatica (Aufderheide and Rodríguez-Martín 1998; Wedel and Galloway 2014). The fracture line goes through the iliac pillar/fossa up to iliac crest and possibly has another associated fracture line extending towards the posterior gluteal line.

Due to co-occurrence of multiple severe blunt force fractures to the cranium and postcranium, these are not considered likely to be related to interpersonal violence.

Dimensions: 1. 34.3 mm x 43.3 mm and 0.9 mm deep; 2. Groove on medial surface is 12.3 mm x 0.6 mm; 3. 22.3 mm x 13.7 mm; 4. 17.6 mm x 14.6 mm and 0.6 mm deep; 5. 18.0 mm x 14.7 mm; 6. 111.5 mm x ca. 6.8 mm wide with osseous protrusions as large as 14.7 mm x 43.2 mm



Figure A149: Hirota C-8 cranium superior view of a large, porous depression to the right side of the frontal bone.



Figure A150: Hirota C-8 right rib showing a transverse ridge of bone near the sternal end.



Figure A151: Hirota C-8 left seventh(?) rib showing new periosteal bone formation on the medial surface.



Figure A152: Hirota C-8 left rib showing a possible healed fracture that has deformed the shaft.



Figure A153: Hirota C-8 left rib shaft lateral view showing a healed fracture.



Figure A154: Hirota C-8 left rib shaft medial view showing a healed fracture.

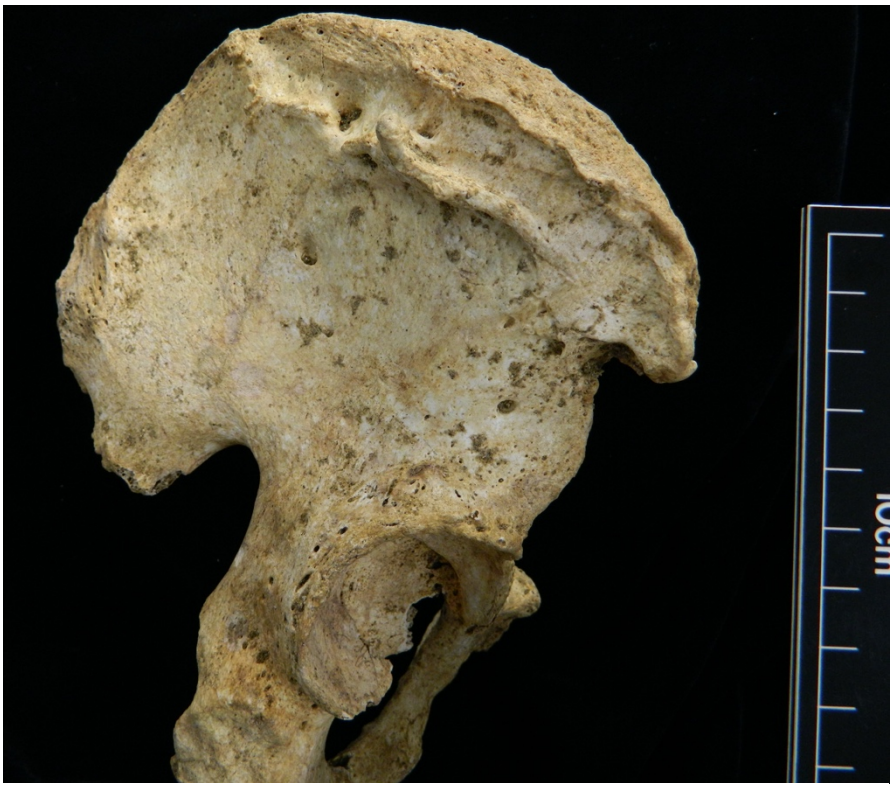


Figure A155: Hirota C-8 right os coxa showing a possible healed fracture to the ilium.

Hirota D-II-1 | Young Adult | Female | Late Yayoi

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: Low

Timing: Antemortem

Location: R Occipital

Assessment of traumatic aetiology:

A circular, porous depression to the right occipital bone, lateral to the occipital planum (Figure A157). There are no clear fracture edges present and the margins are sloping. Some porosity in this area can also be seen on the inner table. Remodelled bone can be seen at the margins.

Dimensions: 13.3 mm x 11.5 mm and 1.8 mm deep

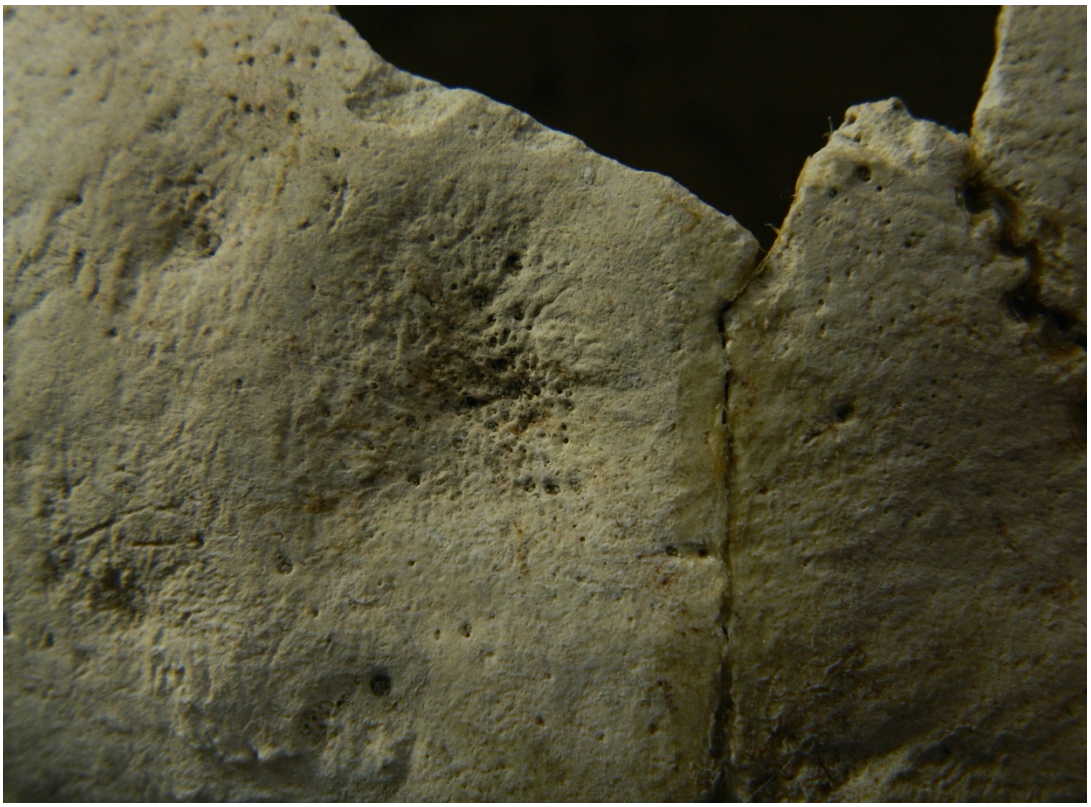


Figure A156: Hirota D-II-1 occipital bone showing a porous circular depression.

Hirota D-II-3 | Young Adult | Female | Late Yayoi

Likelihood of traumatic injury: 1– 4. High; 5. Medium; 6. Medium

Likelihood of being violence-related: 1–5. Medium; 6. Low

Timing: Antemortem

Assessment of traumatic aetiology:

1. A smooth fracture line bisecting the left nasal bone (Figure A158–Figure A159). It is difficult to see this in detail due to a coating of wax that obscures the right nasal bone in particular. The superior margin of the fracture is rounded.

2. A deep curved depression with a deeper, porous groove running through the centre on the left parietal bone (Figure A160–Figure A161). Remodelled bone is present, particularly on the superior margins. The margins of the depression are sloping. It is possible to see faint fracture lines on the inner table.

3. An oval-shaped depression to the posterior left parietal bone (Figure A162). The margins are well-defined and sloping. There is some porosity within the depression. Faint fracture lines can be seen on the inner table.

4. A porous, oval depression (similar in shape to that of #2) on the posterior right parietal bone (Figure A163). The margins are sloping and remodelled bone is present within it.

5. A circular, porous depression to the posterior right parietal bone (Figure A164). It is slightly obscured by adhering material. The margins are clear and sloping. It is possible to see a faint associated fracture line on the inner table.

6. A ridge of bone between the tubercle and head of the right first rib (Figure A165–Figure A166). Posteriorly the bone protrudes in this area. No similar deformity on the left first rib. There is no significant porosity.

Dimensions: 1. 4.4 mm long curve and 0.3 mm gap; 2. 30.9 mm x 17.2 mm and 1.4 mm deep; 3. 19.4 mm x 14.7 mm and 1.0 mm deep; 4. 20.8 mm x 8.4 mm and 0.8 mm deep; 5. 12.6 mm x 9.4 mm and 0.9 mm deep; 6. 11.6 mm x 9.3 mm



Figure A157: Hirota D-II-3 anterior view of the cranium showing a likely healed fracture to the left nasal bone.

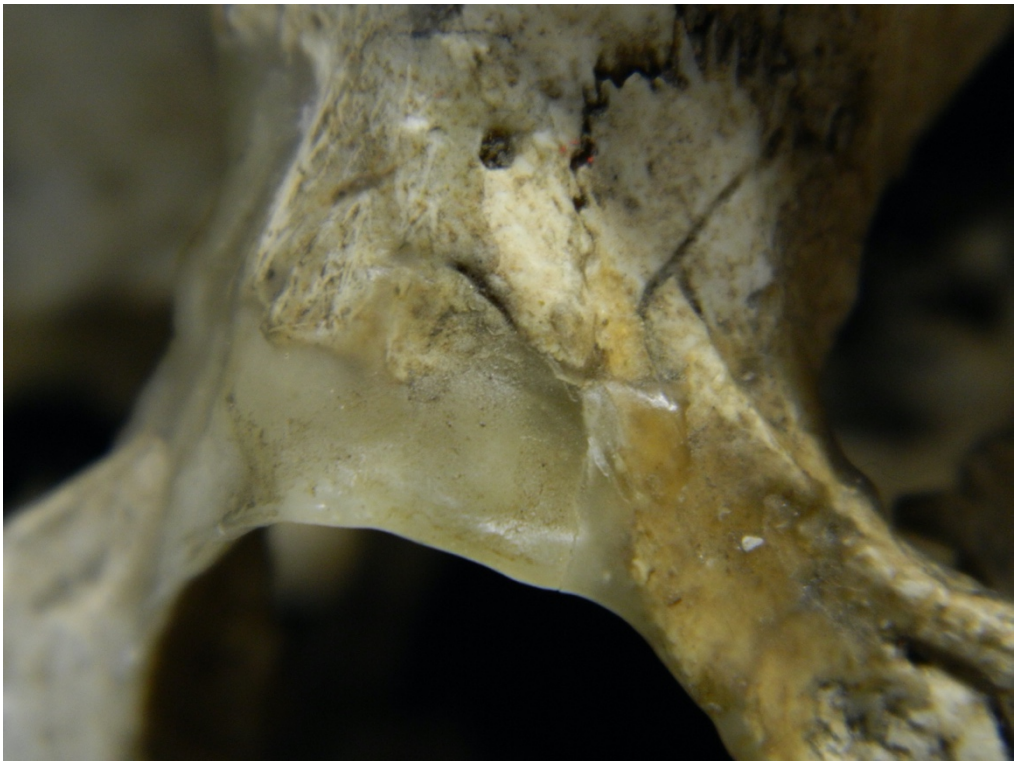


Figure A158: Hirota D-II-3 cloes-up of the healed fracture to the left nasal bone.



Figure A159: Hirota D-II-3 superior view of the parietal bones showing a deep, curved depression to the left parietal bone.



Figure A161: Hirota D-II-3 close-up of the curved depression to the left parietal bone.



Figure A160: Hirota D-II-3 left parietal bone posterior view showing an oval depression.



Figure A162: Hirota D-II-3 parietal bones posterosuperior view showing an oval depression.

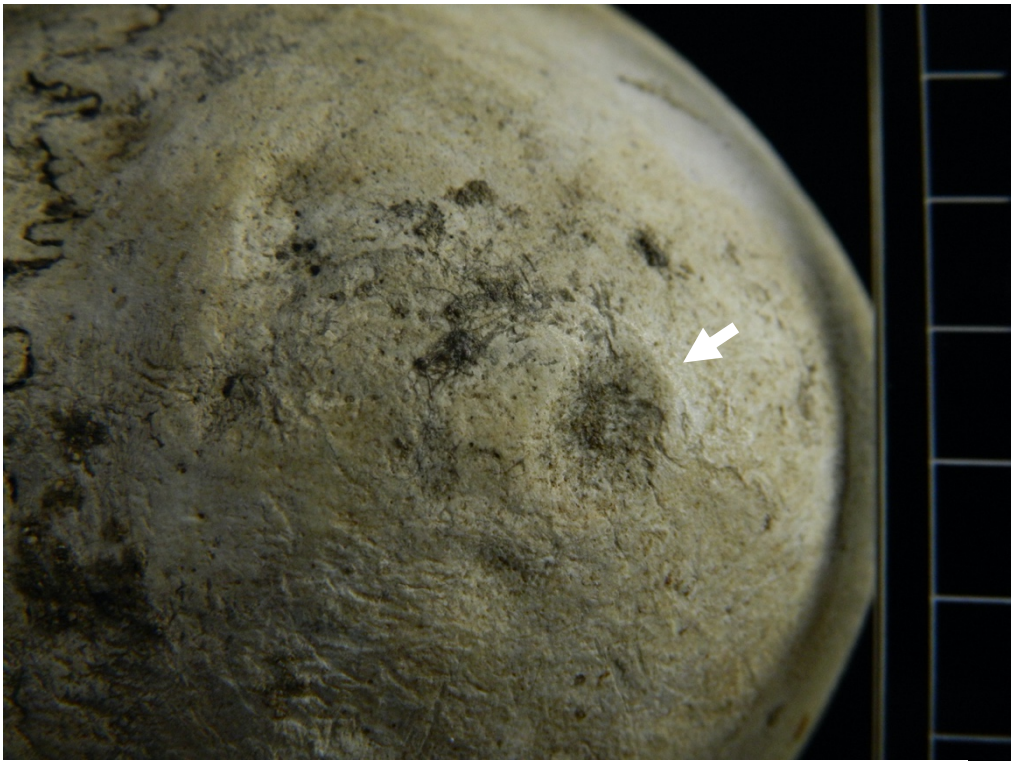


Figure A163: Hirota D-II-3 right parietal bone posterior view showing a porous circular depression.



Figure A164: Hirota D-II-3 right first rib showing a potential healed fracture to the angle.

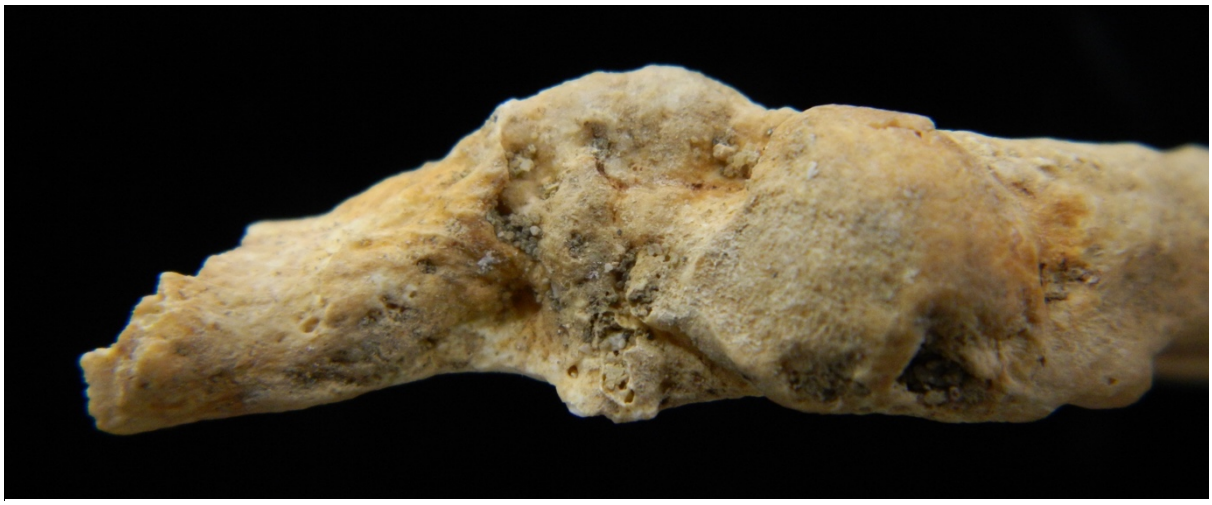


Figure A165: Hirota D-II-3 right first posterior view and close-up of the potential healed fracture.

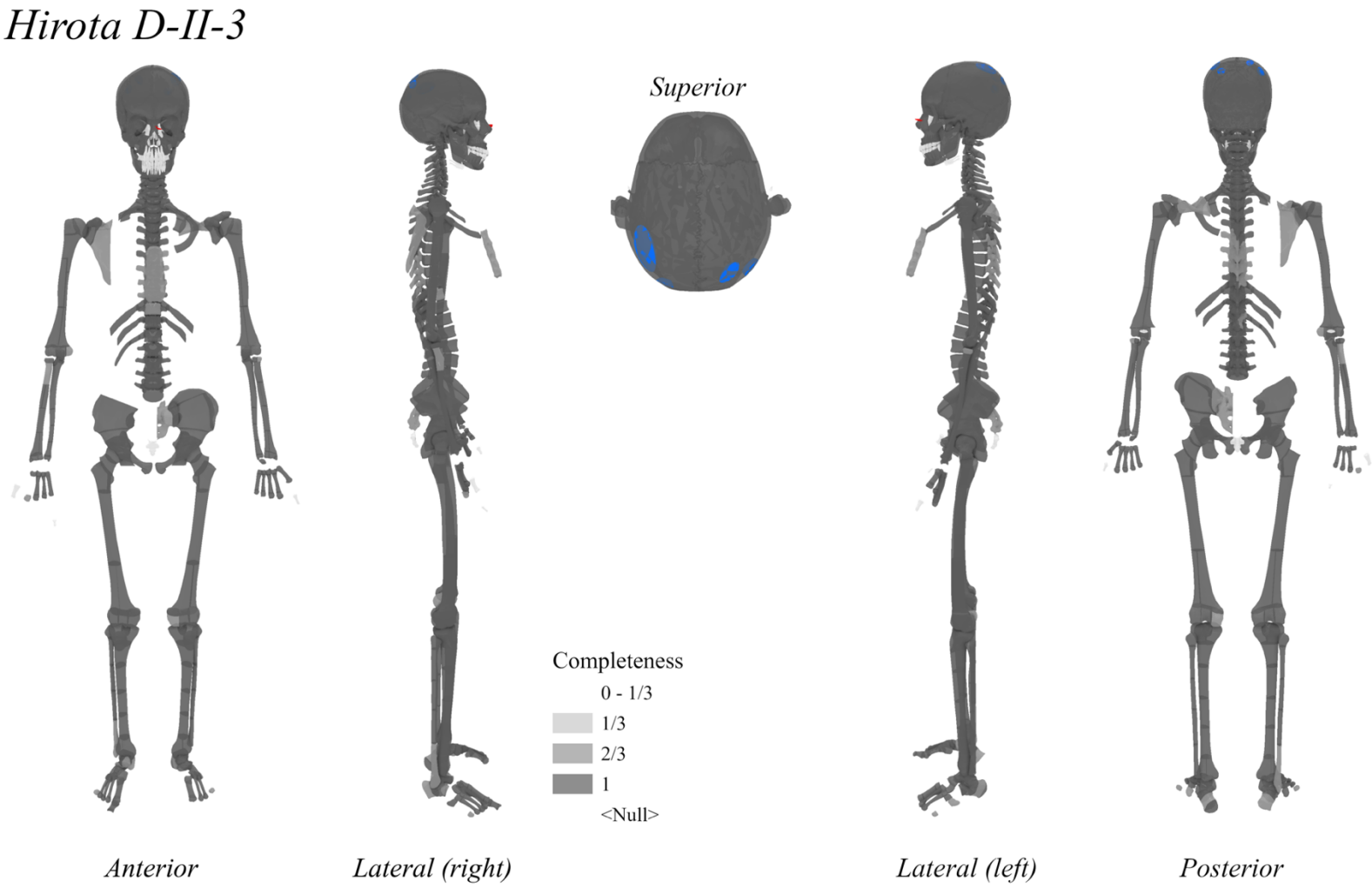


Figure AA19: Hirota D-II-3 Completeness and Medium–High antemortem trauma.

Hirota D-III-2 | Young Adult | Male | Late Yayoi

Likelihood of traumatic injury: 1. High; 2. High; 3. Medium; 4–7. High; 8. Medium; 9. High; 10. Medium; 11. Medium; 12a. Low; 12b. High; 12c. High; 13–17. Medium; 18. Low; 19. Medium; 20. High; 21. Low; 22. Medium; 23. Low; 24. Medium; 25. High; 26. Medium; 27. Medium ; 28. Low

Likelihood of being violence-related: 1–11. Medium; 12a. N/A; 12b–17. Medium; 18. N/A. 19–20. Medium; 21. N/A; 22. Medium; 23. N/A; 24–27. Medium; 28. N/A

Timing: Antemortem

Assessment of traumatic aetiology:

Approximately 25 porous depressions on the frontal and parietal bones are described below. All are porous unless otherwise noted. No associated fracture lines were noticed on the inner table, but due to the completeness, it was difficult to see the inner table well. All of the lesions have sloping margins, unless otherwise stated.

Whether this may be a case of taphonomic deformation was considered. Although porosity is present, the cortical bone is largely intact does not show any signs of erosion, weathering, or dry-bone breakage. The closest taphonomic cases found to that of the Hirota sample are those of plastic deformation in a wet or low pH depositional environment from trampling (or compression from a gravel substrate) which resulted in punctures with raised, plastically deformed bone around them. Nevertheless, close examination of these shows exposed cancellous bone (Marín-Monfort et al. 2014).

1. An oval depression along the mid-line of the frontal bone (Figure A167–Figure A168).

2. A semi-circular depression to the anterior of the frontal bone (Figure A167–Figure A168). The margins are steepest medially. It is partially obscured by depositional material.

3. An oval depression near the coronal suture on the superior aspect of the frontal bone. It is partially obscured by depositional material (Figure A167–Figure A168).

4. A small, oval depression to the right side of the superolateral frontal bone (Figure A167 andFigure A169).

5. An oval depression to the right side of the superolateral frontal bone (Figure A167 andFigure A169).There is a shallow ridge running between it and #6.

6. An oval depression right side of the superolateral frontal bone (Figure A167 andFigure A169).

7. An oval depression to the superior right parietal bone (Figure A170–Figure A171). The margins are well-defined and pitting is present within. A faint impression of this lesion can be seen on the inner table.

8. A small, circular depression to the superior right parietal bone (Figure A170–Figure A171).

9. An oval depression superior right parietal bone (Figure A170–Figure A171). Margins are well-defined. Porosity is dense anteriorly within the depression.

10. A small, circular depression to the superior right parietal bone (Figure A170 and Figure A172).

11. A small oval depression to the superior right parietal bone (Figure A172).

12a–c. Three long oval depressions on the posterosuperior right parietal bone (Figure A172–Figure A173). The anterior-most (a) is the shallowest and the posterior-most (c) the deepest.

13. An elliptical depression on the lateral right parietal bone (Figure A174Figure A173).

14. A depression with a similar shape on the #12 depressions on the posterior right parietal bone (Figure A171–Figure A172).

15. A depression with a similar shape on the #12 depressions on the posterior right parietal bone (Figure A171–Figure A172).

16. An elliptical depression on the posterior right parietal bone (Figure A173).

17. A long, curved depression on the superior left parietal bone (Figure A175–Figure A177).

18. A small, shallow curved depression on the superior left parietal bone (Figure A175–Figure A177).

19. A small, roughly oval-shaped depression on the superior left parietal bone (Figure A175–Figure A177). Its margins are steepest anteriorly.

20. A semi-circular shaped depression on the superior left parietal bone (Figure A175–Figure A177). The anteromedial margins are almost sharp and the slope is uneven there. A faint area of thinner bone can be seen on the inner table.

21. A shallow, oval depression on the posterosuperior left parietal bone (Figure A177).

22. An oval depression on the posterosuperior left parietal bone (Figure A175–Figure A177).

23. A shallow oval depression on the posterosuperior left parietal bone (Figure A177).

24. A long oval depression on the lateral left parietal bone (Figure A177).

25. A deep semi-circular depression to the posterior left parietal bone with significant pitting where it is deepest (Figure A178).

26. A triangular-shaped depression on the lateral right parietal bone, along the coronal suture (Figure A174). It does not have significant porosity like most of the others. The inferior margin may correspond to a line of porosity on the inner table.

27. An oval depression on the lateral right parietal bone, along the coronal suture (Figure A174 and Figure A179). It also lacks significant porosity.

28. A curved depression on the lateral right parietal bone, along the coronal suture (Figure A174 and Figure A179). It has more irregular margins than others described above.

Dimensions: 1. 6.0 mm x 12.3 mm and 0.5 mm deep; 2. 10.7 mm x 7.7 mm and 1.0 mm deep; 3. 13.4 mm x 4.3 mm and 0.8 mm deep; 4. 8.9 mm x 5.1 mm and 0.5 mm deep; 5. 6.7 mm x 14.8 mm and 0.5 mm deep; 6. 17.6 mm x 6.5 mm and 0.8 mm deep; 7. 15.5 mm x 6.8 mm and 1.4 mm deep; 8. 3.9 mm x 4.5 mm and 0.5 mm deep; 9. 8.0 mm x 3.8 mm and 1.1 mm deep; 10. 4.7 mm x 4.2 mm and 0.7 mm deep; 11. 2.0 mm x 7.3 mm and 0.6 mm deep; 12a. 13.4 mm x 3.3 mm and 0.3 mm deep; 12b. 16.1 mm x 5.2 mm and 0.6 mm deep; 12c. 15.0 mm x 5.1 mm and 0.8 mm deep; 13. 5.7 mm x 12.6 mm and 0.6 mm deep; 14. 3.7 mm x 14.2 mm and 0.5 mm deep; 15. 6.8 mm x 15.6 mm and 0.5 mm deep; 16. 9.5 mm x 3.9 mm and

0.6 mm deep; 17. 13.5 mm x 4.0 mm and 0.9 mm deep; 18. 1.9 mm x 6.8 mm and 0.3 mm deep; 19. 3.7mm x 7.3 mm and 0.8 mm deep; 20. 9.3 mm x 8.3 mm and 0.6 mm deep; 21. 3.8 mm x 7.9 mm and 0.4 mm deep; 22. 14.7 mm x 8.7 mm and 0.7 mm deep; 23. 5.1 mm x 11.8 mm and 0.4 mm deep; 24. 5.4 mm x 18.0 mm and 0.8 mm deep; 25. 7.5 mm x 7.5 mm and 2.0 mm deep; 26. 7.9 mm x 5.6 mm and 0.9 mm deep; 27. 8.6 mm x 4.3 mm and 0.8 mm deep; 28. 5.0 mm x 12.5 mm and 0.8 mm deep



Figure A166: Hirota D-III-2 anterior cranium superior view with porous depressions on the frontal bone labelled.

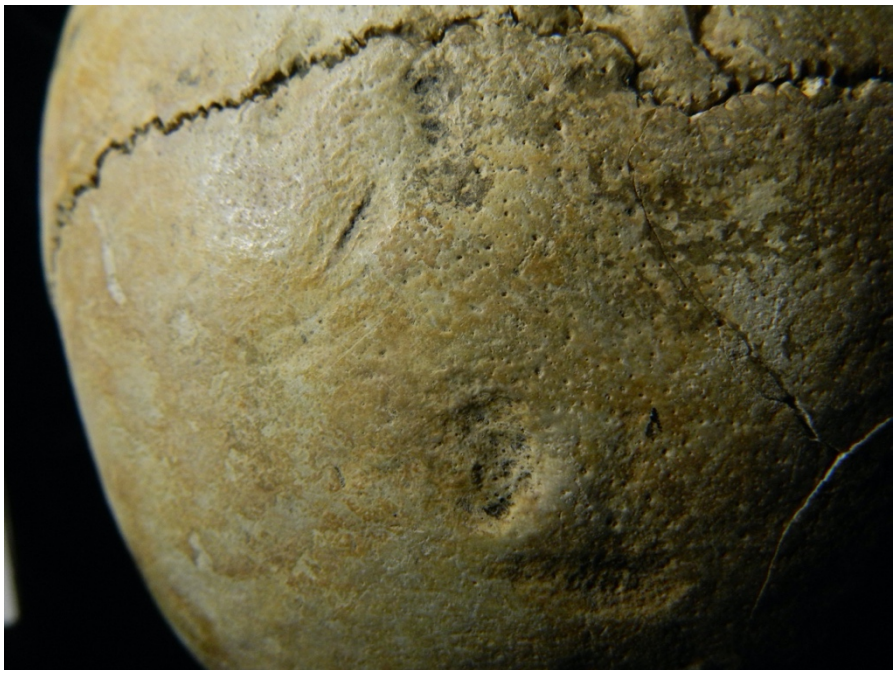


Figure A167: Hirota D-III-2 right side of the frontal bone showing lesions 1–3 in more detail.



Figure A168: Hirota D-III-2 left side of the frontal bone showing lesions 4–6 in more detail.

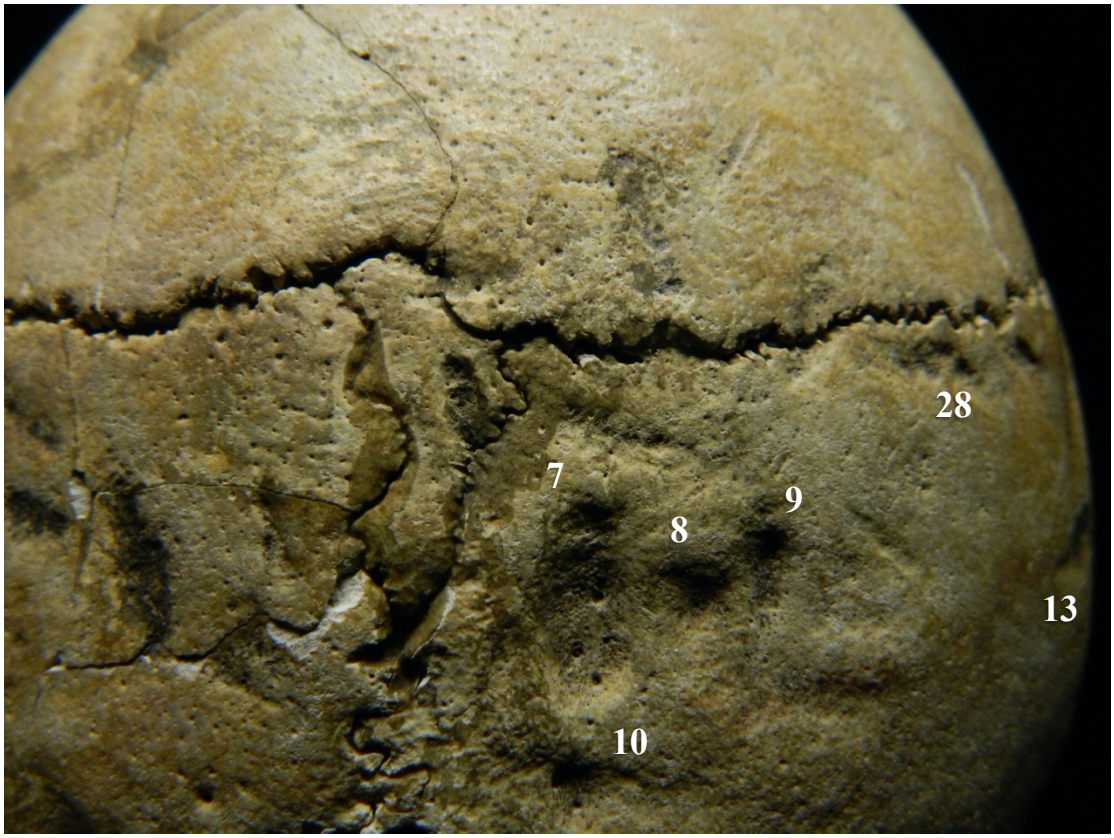


Figure A169: Hirota D-III-2 cranium superior view showing depressions to the parietal bones (those on the right are labelled).



Figure A170: Hirota D-III-2 superior right parietal bone showing lesions 7–9 in greater detail.

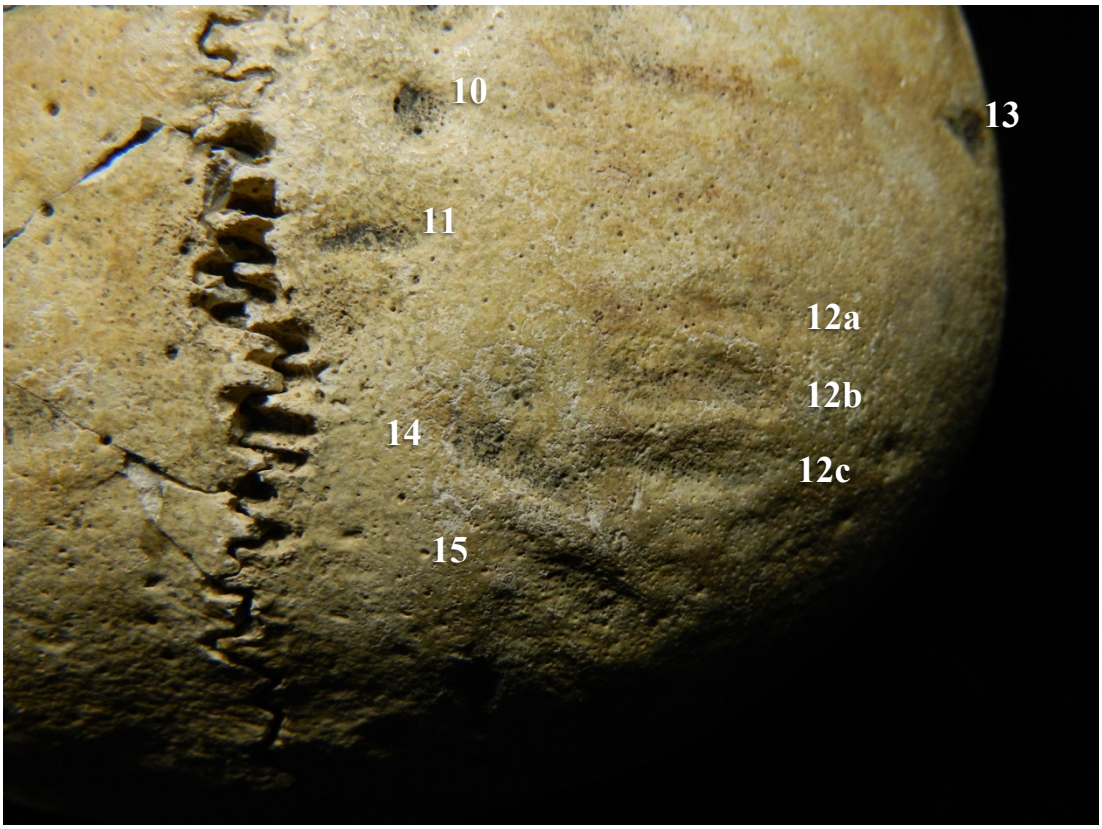


Figure A171: Hirota D-III-2 right parietal bone posterosuperior view showing labelled porous depressions.



Figure A172: Hirota D-III-2 right parietal bone posterosuperior view showing labelled porous depressions.

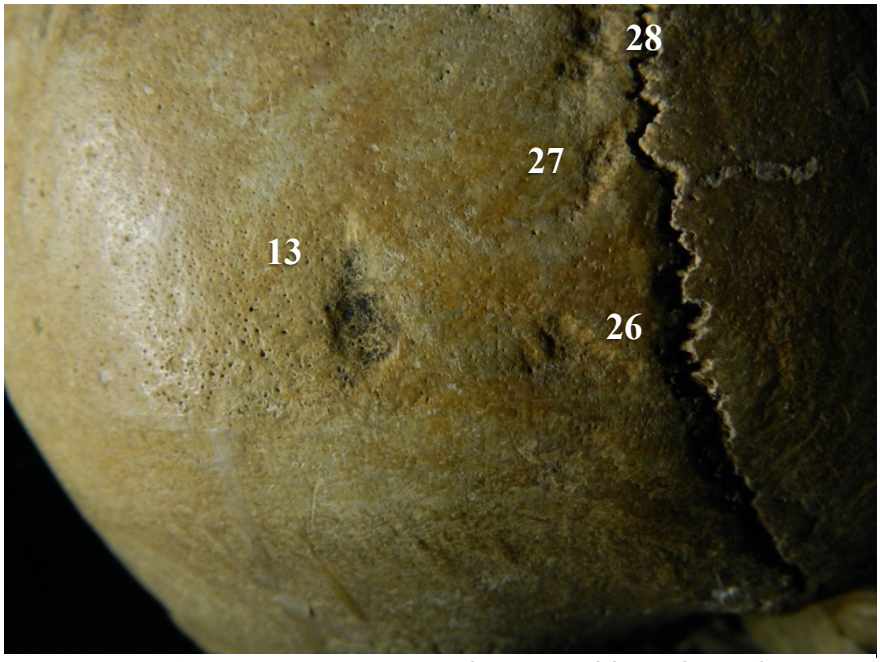


Figure A173: Hirota D-III-2 right parietal bone lateral view showing labelled porous depressions near the coronal suture.

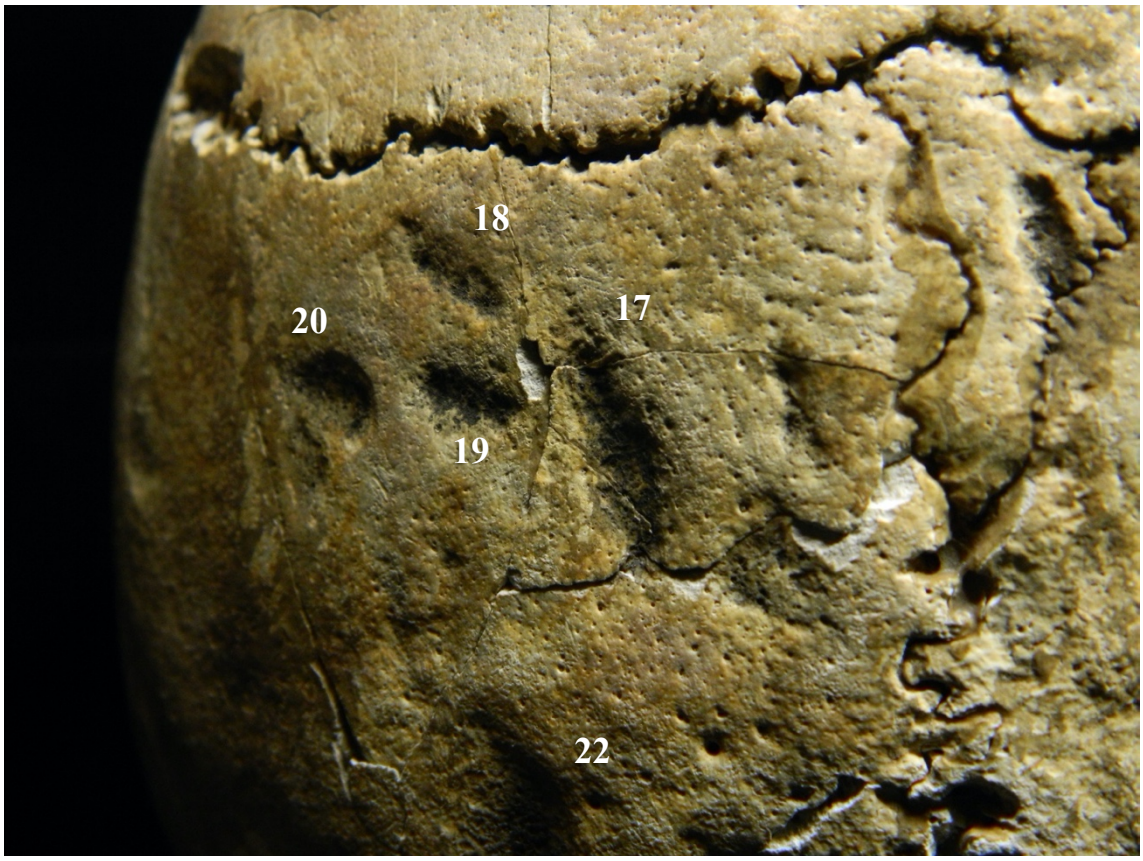


Figure A174: Hirota D-III-2 left parietal bone superior view showing labelled porous depressions.



Figure A175: Hirota D-III-2 left parietal bone superior view showing lesions 17–20 and 22 in detail.



Figure A176: Hirota D-III-2 left parietal bone lateral view showing labelled porous depressions.

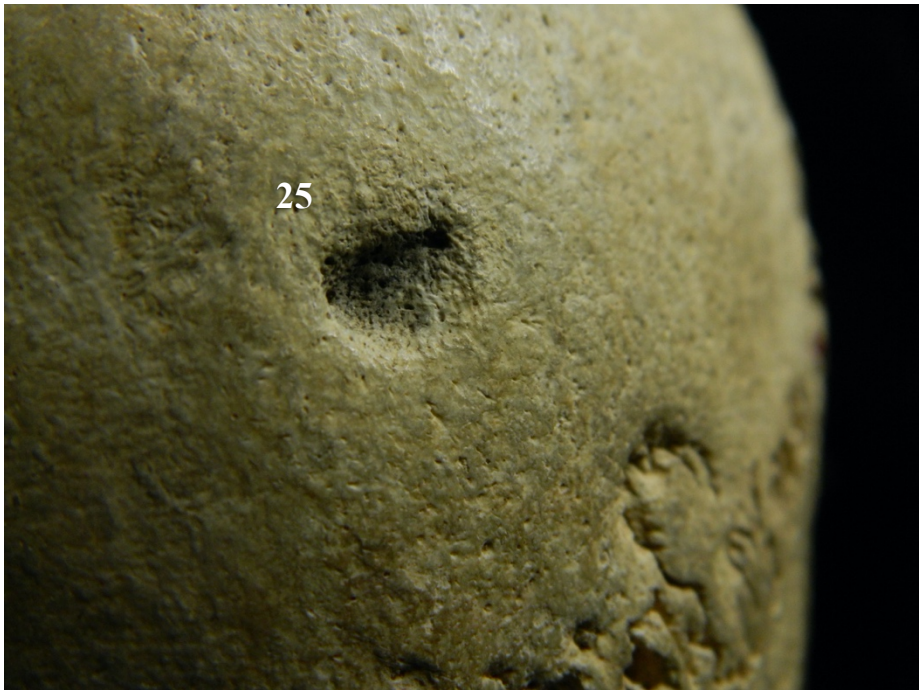


Figure A177: Hirota D-III-2 left parietal bone posterolateral view showing a labelled porous depression.

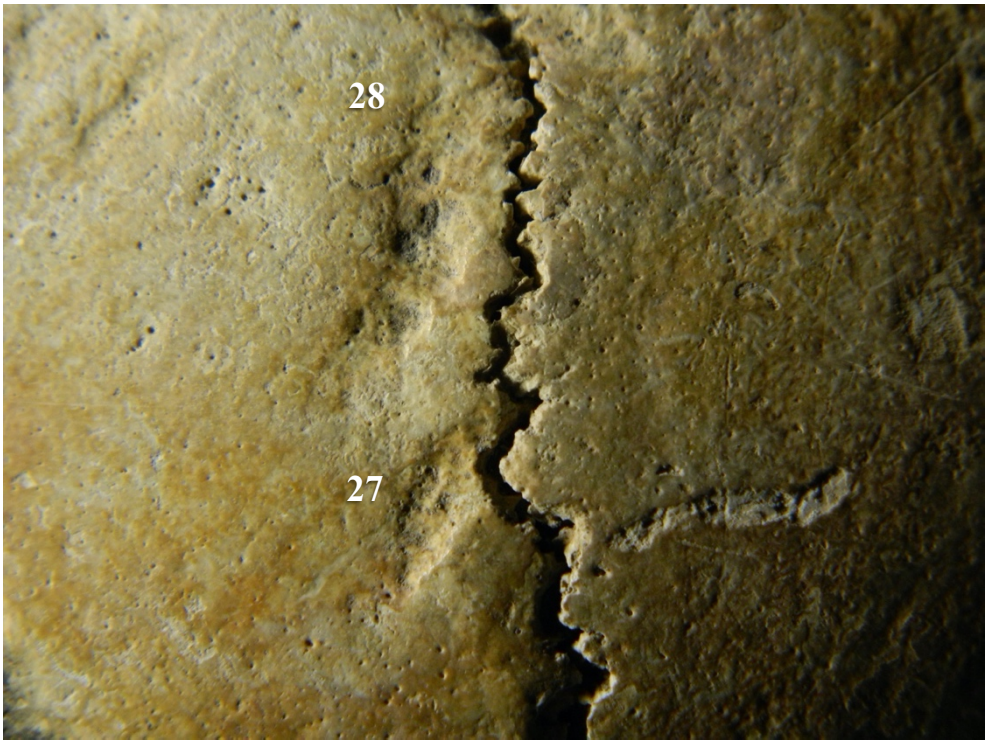


Figure A178: Hirota D-III-2 right parietal bone close-up of lesions 27 and 28.

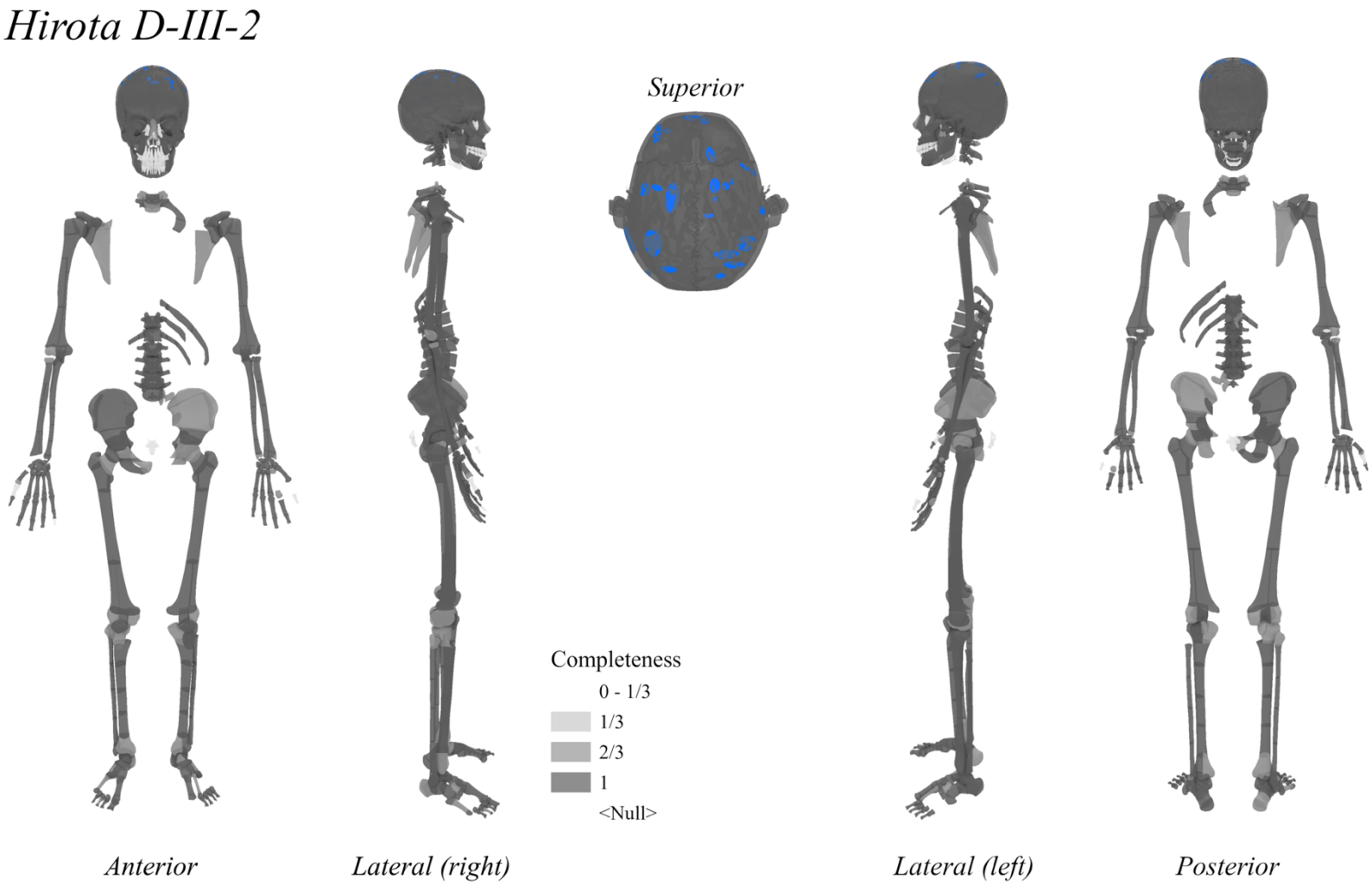


Figure AA20: Hirota D-III-2 Completeness and Medium–High antemortem trauma.

Kanenokuma K13 | Adult | Male | Mid Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: High

Timing: Perimortem

Assessment of traumatic aetiology:

A small cut mark to the lateral proximal shaft of the left femur (Figure A180–Figure A181). The margins are sharp and it is v-shaped. Some striations can be seen on the walls. There are no associated shoulder effects present, typical of stone tools (Fernández-Jalvo and Andrews 2016).

Dimensions: 3.4 mm x 0.4 mm



Figure A179: Kanenokuma K13 proximal diaphysis of the left femur lateral view showing a sharp and v-shaped linear mark



Figure A180: Kanenokuma K13 close-up of the possible cut-mark to the left femur.

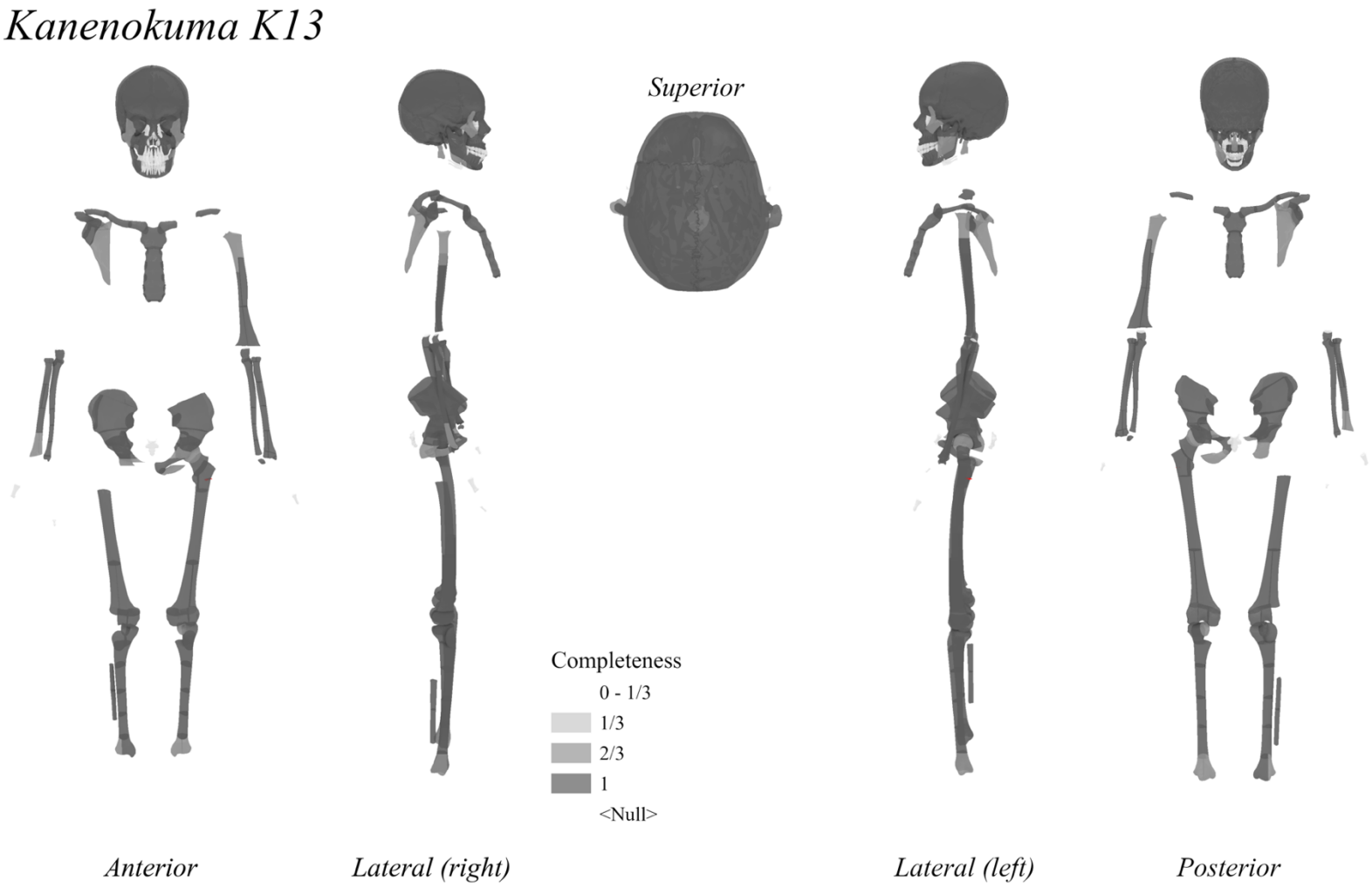


Figure AA21: Kanenokuma K13 Completeness and Medium–High perimortem trauma.

Kanenokuma K61 | Young Adult | Male | Mid Middle Yayoi

Likelihood of traumatic injury: 1. High; 2. Low

Likelihood of being violence-related: 1. Medium; 2. N/A

Timing: Antemortem

Assessment of traumatic aetiology:

1. The anterior-most portion of the nasal bones are deformed. The suture between them is fused and anterior to that the tips of the nasal bones are depressed inferiorly and slightly to the right (Figure A182).

2. A porous, circular depression to the posterior right parietal bone (Figure A183). There is a ridge running transversely through it. The margins are sloping.

Dimensions: 2. 15.49 mm x 14.49 mm and 1.01 mm deep



Figure A181: Kanenokuma K61 skull anterior view showing the deformed nasal bones.



Figure A182: Kanenokuma K61 cranium posterior view showing a porous depression to the right parietal bone.

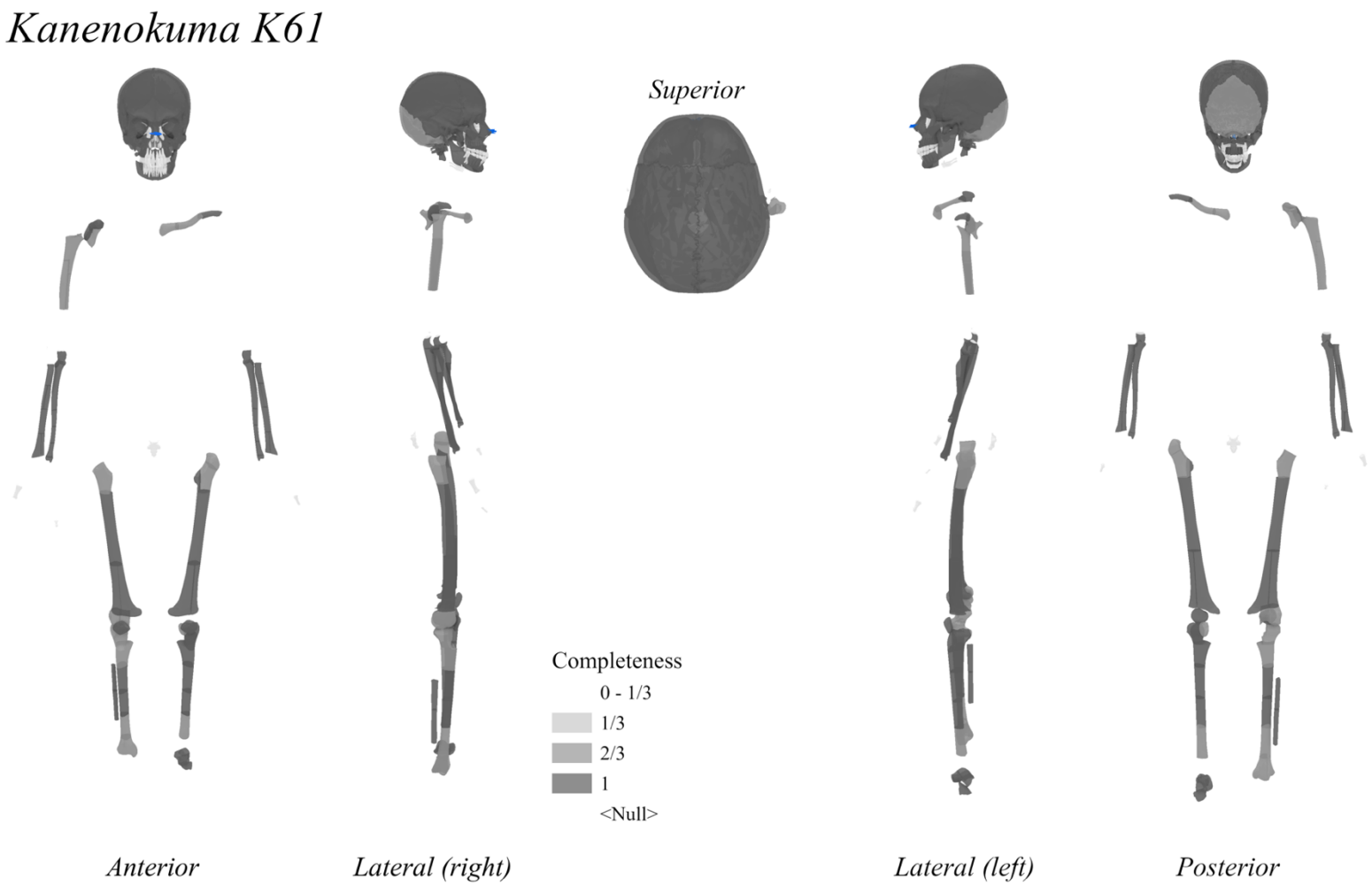


Figure AA22: Kanenokuma K61 Completeness and Medium–High antemortem trauma.

Kanenokuma K79 | Young Adult | Male | Early Half of Middle Yayoi

Likelihood of traumatic injury: 1. Medium; 2. Medium; 3. High; 4. Medium

Likelihood of being violence-related: 1. Medium; 2– 4. Low

Timing: Antemortem

Assessment of traumatic aetiology:

1. A ridge of bone on the left nasal bone with an associated depression anteriorly and a porous line of bone between the left nasal bone and the left maxilla. The area anterior to them is depressed inferiorly (Figure A184).

2. A widened, deformed area of bone with thin grooves on either side of the shaft of the left third rib (Figure A185).

3. A thin groove running vertically through the left fourth rib with a deformed area of bone (Figure A185). The rib has healed slightly out of alignment. Some porosity is present.

4. A widened area of bone on the shaft of the right third rib, near the sternal end (Figure A186). There is possible involvement of the right third rib as well, but there is no clear fracture line visible on it.

Dimensions: 1. 8.8 mm x 2.7 mm; 2. 36.2 mm x 0.66 mm; 3. Groove is 2 mm x 0.63 mm 4. 25.5 mm x 0.69 mm



Figure A183: Kanenokuma K79 anterior view of the cranium showing a deformed left nasal bone and left maxilla. Note the ridge and depression on the nasal bone and the fusion of the nasal bone and maxilla.



Figure A184: Kanenokuma K79 left third (top) and fourth ribs (bottom) showing potential healed fractures.



Figure A185: Kanenokuma K79 Right third rib showing a potential healed fracture to the shaft near the sternal end.

Kanenokuma K79

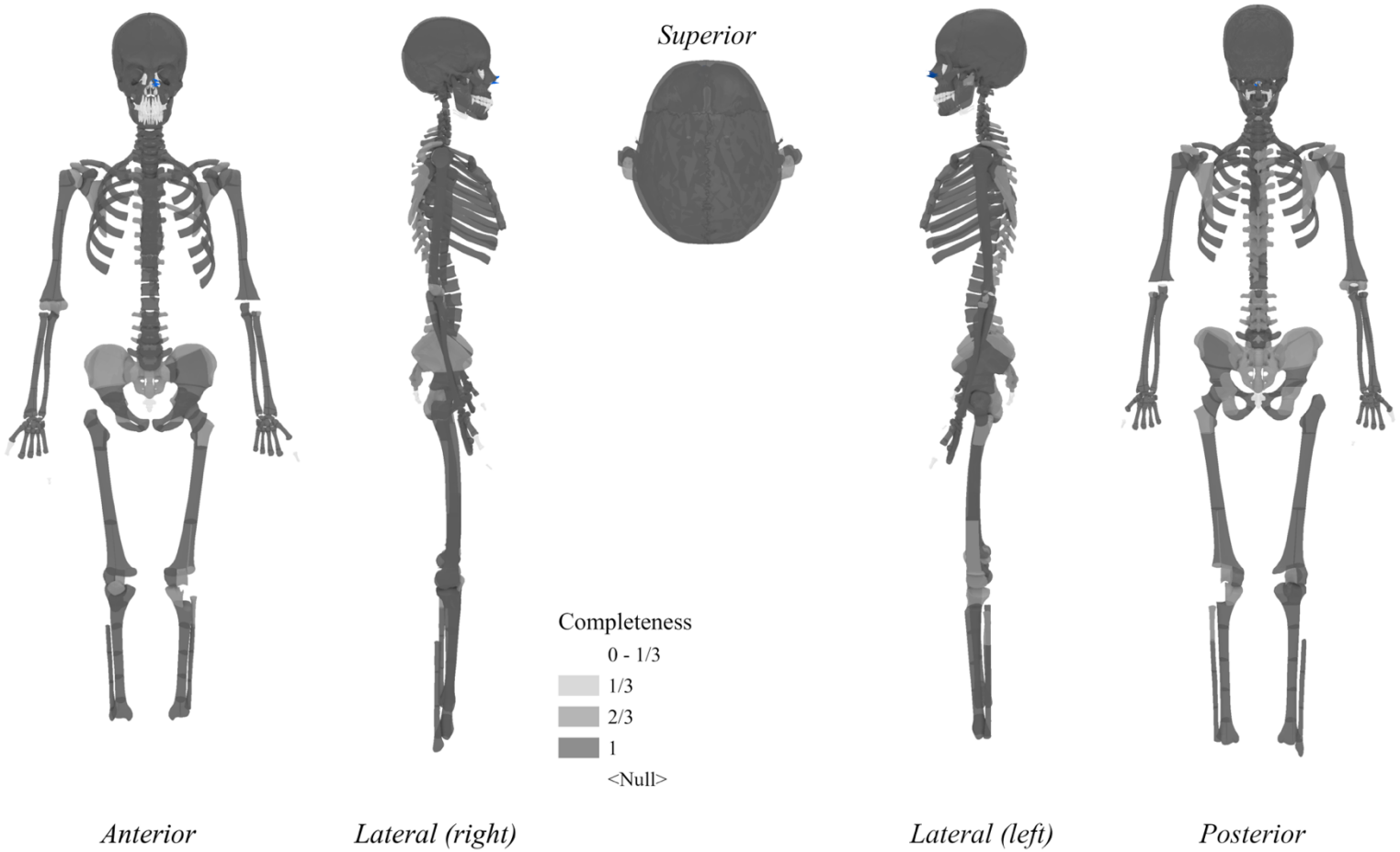


Figure AA23: Kanenokuma K79 Completeness and Medium–High antemortem trauma.

Kanenokuma K102 | Young Adult | Male | End of Early Yayoi

Likelihood of traumatic injury: 1. High; 2. Medium

Likelihood of being violence-related: 1. Medium; 2. Medium

Timing: Antemortem

Assessment of traumatic aetiology:

1. The nasal bones and left maxilla are deformed (Figure A187). There are clear healed fracture lines through each, anterior to which the bones are depressed inferiorly and to the right.

2. A circular cranial depression with porosity on the posterosuperior left parietal bone (Figure A188). No associated changes on the inner table were observed.

Dimensions: 1. 26.6 mm x 12.8mm; 2. 16.5 mm x 12.4 mm and 0.5 mm deep



Figure A186: Kanenokuma K102 cranium anterior view showing a healed fracture to the nasal bones and left maxilla.

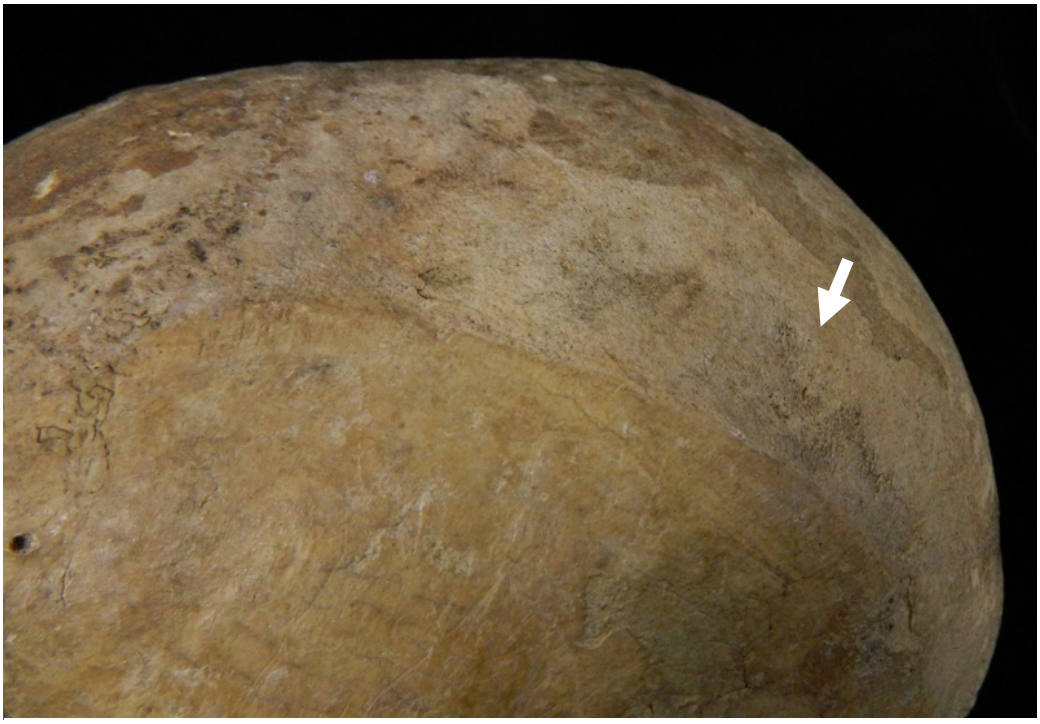


Figure A187: Kanenokuma K102 left parietal bone lateral view showing a porous depression postersuperiorly.

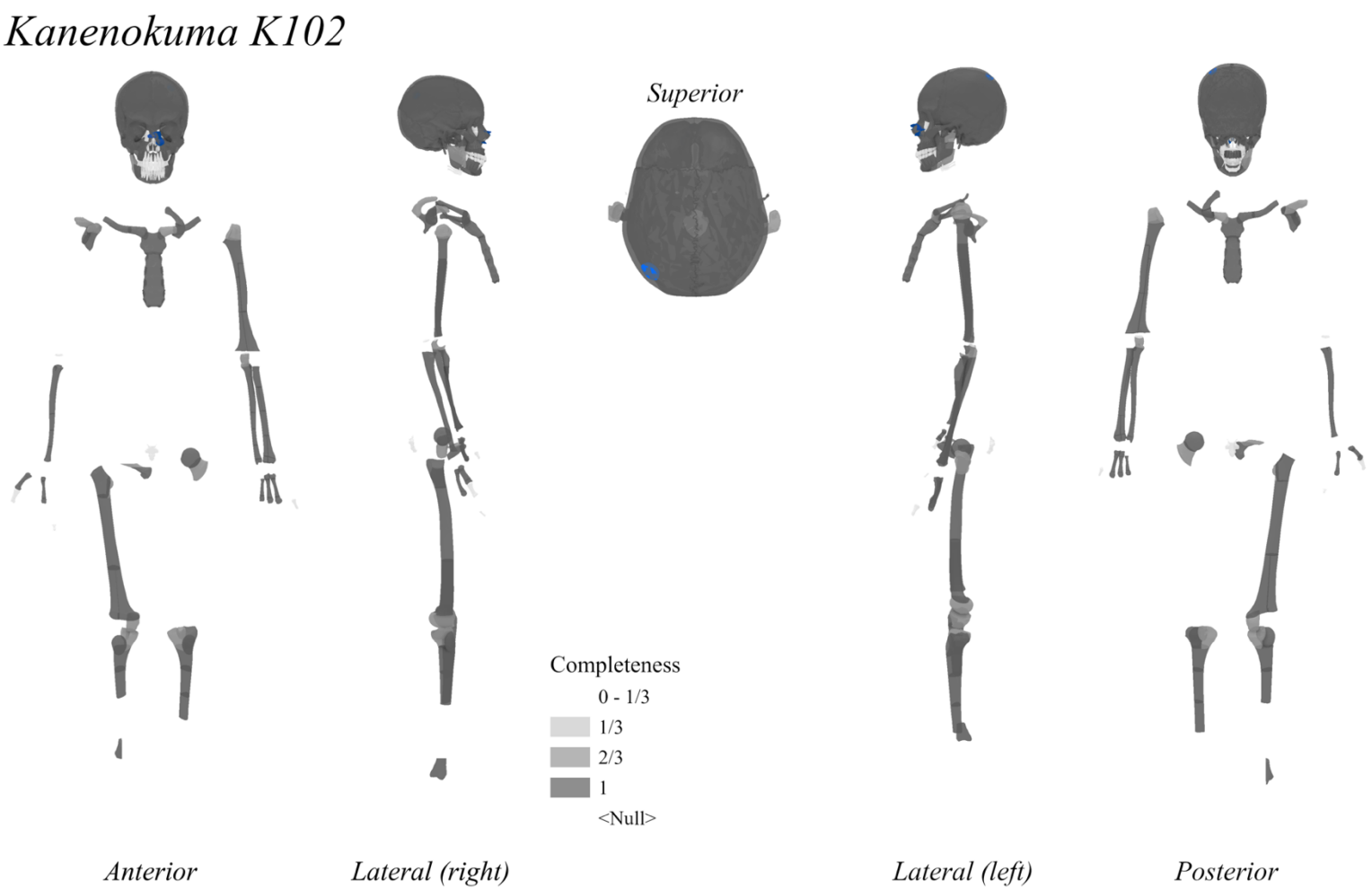


Figure AA24: Kanenokuma K102 Completeness and Medium–High antemortem trauma.

Kanenokuma K113 | Mid-Adult | Female | Mid of Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Low

Timing: Antemortem

Assessment of traumatic aetiology:

A transverse ridge of bone on the distal diaphysis of the right radius, possibly representing a healed Colles fracture (Figure A189).



Figure A188: Kanenokuma K113 distal right and left radii showing a possible healed Colles fracture to the right.

Kanenokuma K130 | Mid-Adult | Female | Mid of Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Low

Timing: Antemortem

Assessment of traumatic aetiology:

The left femur is deformed (Figure A190). Unlike the right femur, it is shortened and along what is likely a healed fracture that was not properly set before healing.

Previously Reported In: Kyushu University School of Medicine (1988)



Figure A189: Kanenokuma K130 femora posterior view showing a healed fracture to the left femur.

Kanenokuma K139 | Mid-Adult? | Female? | Early Half of Late Yayoi

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

An oval, porous depression to the posterosuperior left parietal bone (Figure A191). No similar depression is present on the right parietal bone. It is partly obscured by depositional material. The margins are sloping.

Dimensions: 13.7 mm x 23.2 mm and 0.8 mm deep



Figure A190: Kanenokuma K139 cranium posterosuperior view of the left parietal bone showing a porous depression.

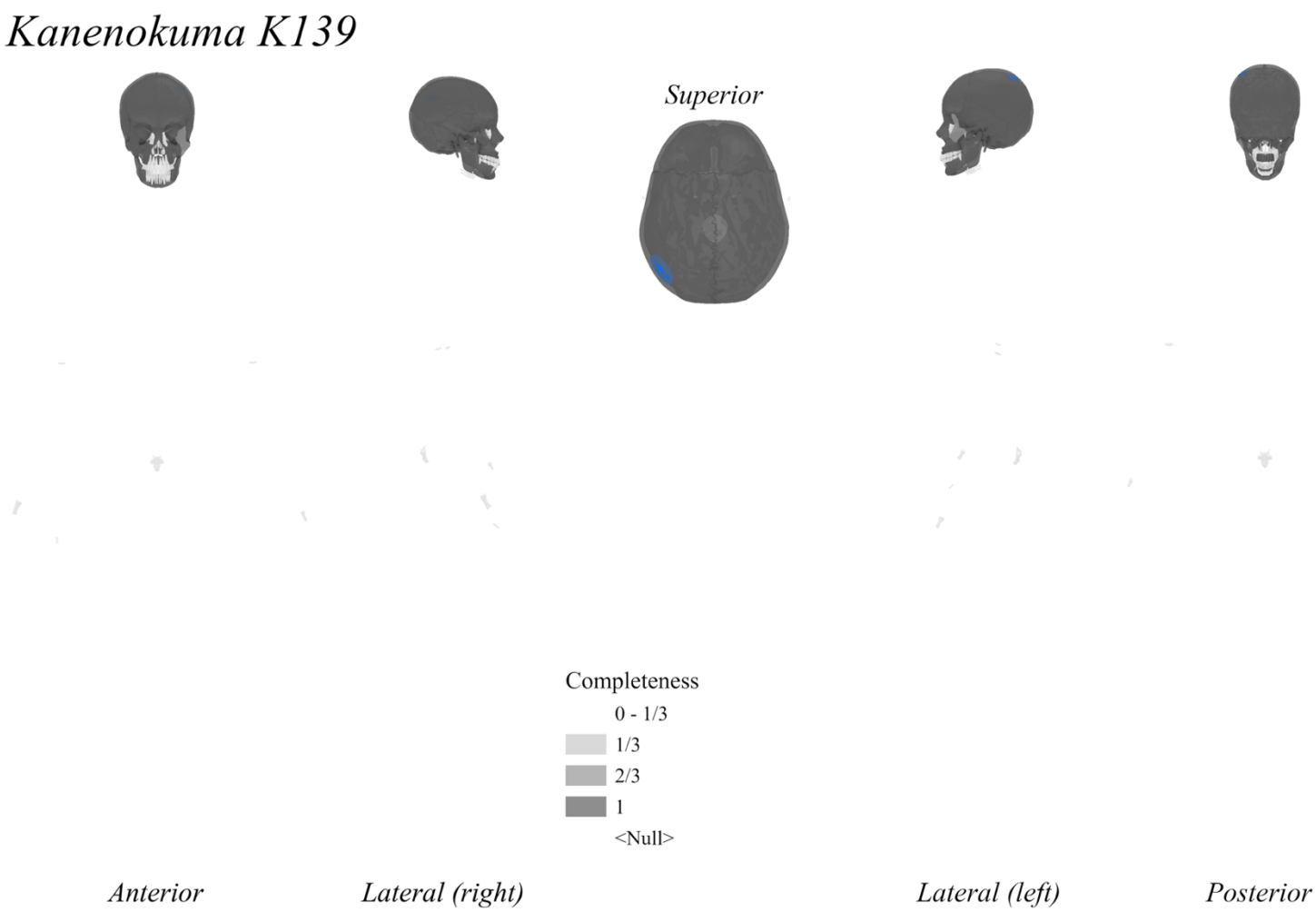


Figure AA25: Kanenokuma K139 Completeness and Medium–High antemortem trauma.

Kanenokuma K229 | Mid-Adult | Male | Early Half of Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

The most anterior portion of the nasal bones are deformed and depressed inferiorly (Figure A192–Figure A193). Depositional material partly obscures them.



Figure A191: Kanenokuma K229 cranium anterior view showing deformed nasal bones depressed inferiorly.



Figure A192:Kanenokuma 229 close-up of healed nasal fractures.

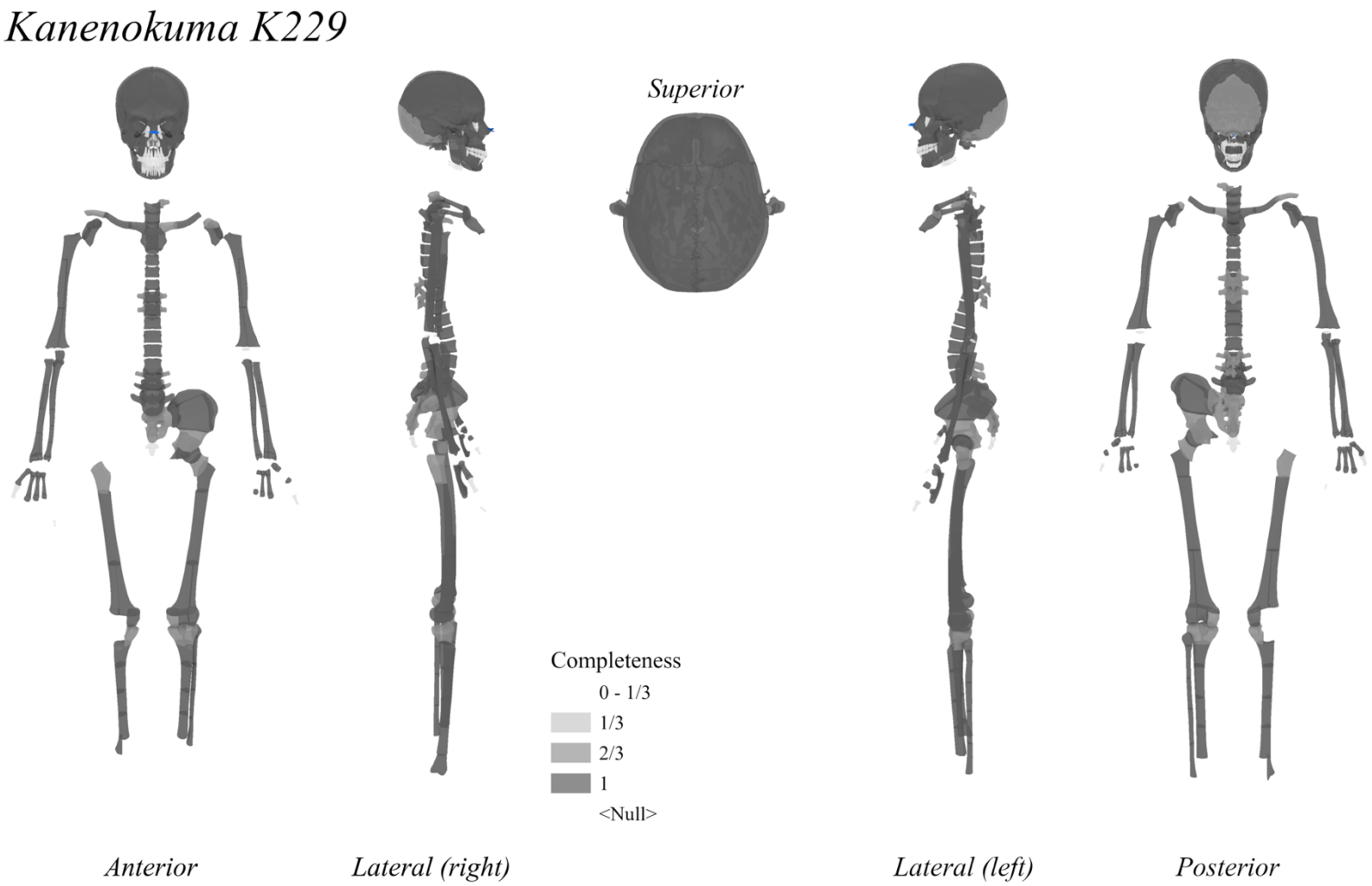


Figure AA26: Kanenokuma K229 Completeness and Medium–High antemortem trauma.

Kanenokuma K272 | Old Adult | Female | Late Half of Middle Yayoi

Likelihood of traumatic injury: Low

Likelihood of being violence-related: N/A

Timing: Antemortem

Assessment of traumatic aetiology:

Medially depressed nasal bones, particularly at their mid-point (Figure A194). No clear fracture line present.

Dimensions: Depressed area is 13.2 mm x 17.2 mm



Figure A193: Kanenokuma K272 cranium lateral view showing medially depressed nasal bones.

Kōra 35 | Mid Adult | Female | Early Yayoi

Likelihood of traumatic injury: 1–6. High; 7. Medium; 8. High

Likelihood of being violence-related: 1–8. Low

Timing: Antemortem

Assessment of traumatic aetiology:

1. The distal left radius is deformed and displaced posteriorly (Figure A195). The left carpals have some lipping and porosity as well. The left ulnar styloid process is deformed as well.

2. The anterior right fourth rib near the sternal end is depressed and the posterior surface has a ridge of bone running vertically along its surface (Figure A196–Figure A197). Some porosity is present medially. There is also a depressed area near the sternal end of the right third rib, but there is no clear fracture line.

3. A ridge of bone followed by an uneven depression near the sternal end of the anterior right fifth rib (Figure A196 and Figure A198). The posterior surface has two wide lines of uneven remodelled bone. From the fracture line medially, the rib shaft is oriented inferiorly.

4. A curved ridge of bone on the anterior and posterior surfaces of the shaft of the right sixth rib near the sternal end (Figure A196 and Figure A199).

5. Two uneven ridges of bone with some porosity on the right eighth rib near the sternal end (Figure A196 and Figure A200). These are more raised on the posterior surface. There is some porosity present on the right ninth rib in this area, but no fracture line is present.

6. A curved ridge of bone right near the anterior sternal end of the tenth rib (Figure A196 and Figure A201). On the posterior surface there is corresponding groove.

7. A deformed area of bone on the shaft of the left second rib (Figure A196 and Figure A202). It is demarcated by two ridges of bone. The area is wide and thinner than the rest of the shaft. There is a thin groove of bone corresponding to this on the posterior surface.

8. A ridge of bone near the sternal end of the left ninth rib (Figure A196 and Figure A203). The ridge is uneven and medial to it the bone is displaced inferiorly. Corresponding grooves are present on the posterior surface.

Compression fractures to the thoracic and lumbar vertebrae.

Dimensions: 1. Total affected area 35.7 mm x 2.7 mm; 2. Depressed area is 7.8 mm x 18.1 mm, Ridge is 1.3 mm x 19 mm; 3. 1.9 mm x 15.9 mm; 4. Depressed area is 4.4 mm x 16.6 mm; 5. Anterior ridge is 1.7 mm x 13.7 mm; 6. Anterior porous line is 9.9 mm x 0.7 mm; 7. 8.0 mm x 14.9 mm; 8. 1.1 mm x 12.0 mm



Figure A194: Kōra 35 left and right radii medial view of the distal diaphysis and epiphysis showing the deformation of the left radius.



Figure A195: Kōra 35 all extant ribs.



Figure A196: Kōra 35 right fourth rib posterior view showing a likely healed fracture near the sternal end.



Figure A197: Kōra 35 right fifth rib anterior view showing a likely healed fracture near the sternal end. Note the inferior displacement of the rib medial to this point.



Figure A198: Kōra 35 right sixth rib anterior view showing a likely healed fracture near the sternal end.



Figure A199: Kōra 35 right eighth rib posterior view showing a likely healed fracture near the sternal end.

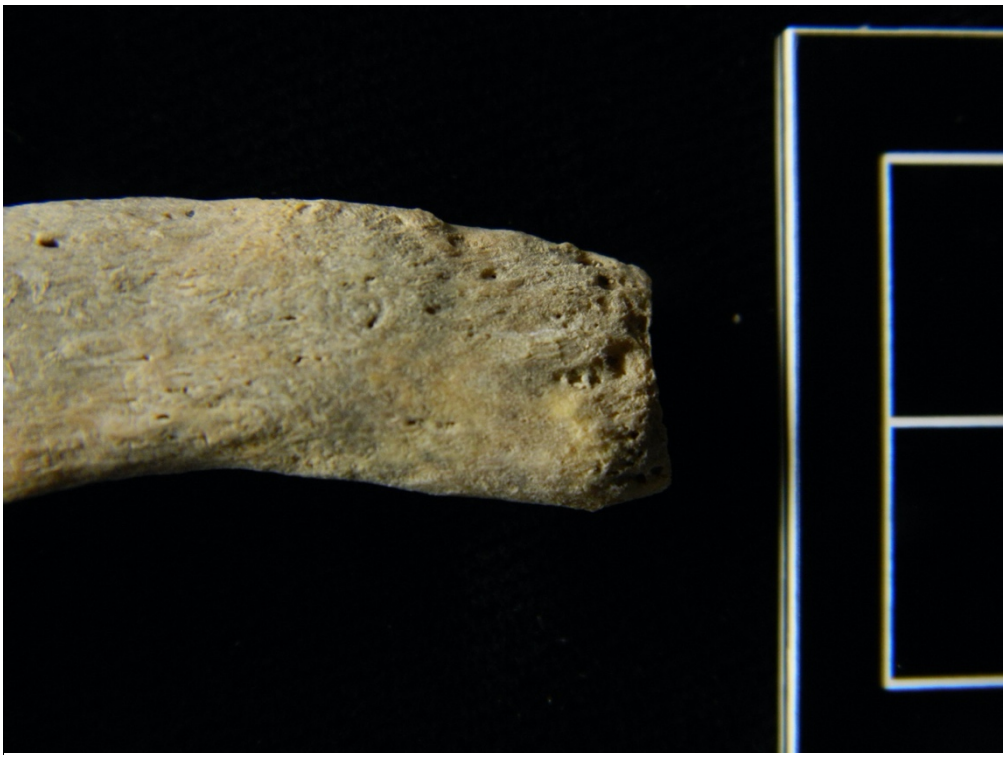


Figure A200: Kōra 35 right tenth rib anterior view showing a likely healed fracture near the sternal end.



Figure A201: Kōra 35 left second rib superoanterior view showing an area of deformed bone (wide and thin) on the shaft.

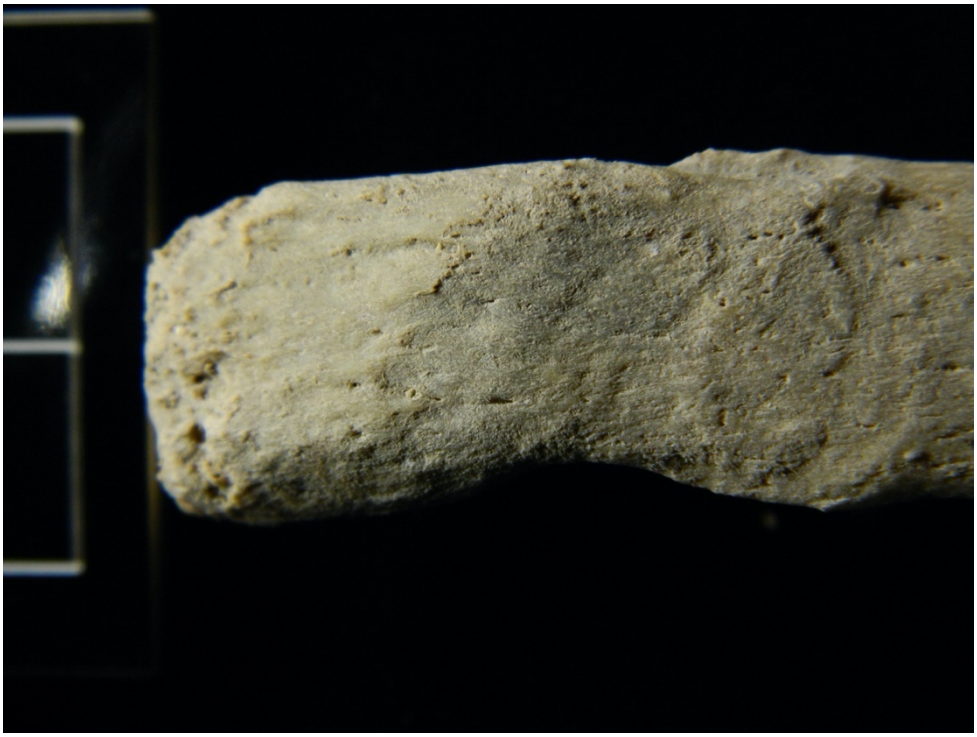


Figure A202: Kōra 35 left ninth rib anterior view showing a likely healed fracture near the sternal end.

Kōra 36 | Mid Adult | Female | Early Yayoi

Likelihood of traumatic injury: 1–3. Medium; 4–7. High; 8. Medium; 9. High; 10. Medium

Likelihood of being violence-related: 1–10. Low

Timing: Antemortem

Assessment of traumatic aetiology:

1. The anterior-most point of both nasal bones are depressed inferiorly (Figure A204). There is no porosity present.

2. A line of remodelled bone on the anterior and posterior surfaces of the right third(?) rib near the sternal end, possibly representing a healed transverse fracture (Figure A205).

3. A line of porosity on the anterior shaft of the right fourth rib with an associated wide groove on the posterior shaft near the sternal end, possibly representing a healed transverse fracture (Figure A206).

4. Disunion of the shaft of the right fourth rib (Figure A206).Woven bone formation is present along the margins of the fracture.

5. A line of porosity (on the anterior and posterior surfaces) and associated depressed area near the sternal end of the right fifth rib (Figure A207).

6. Disunion of the shaft of the right fifth rib (Figure A207). It is similar to #4, but located slightly more laterally and the fracture line is more transverse. Woven bone formation is present along the margins of the fracture, particularly on the superior surface.

7. An oblique ridge of bone near the sternal end of the left second rib (Figure A208). Some porosity is present along it. On the posterior surface there is an associated wide groove.

8. One half of a healing fracture to the left third rib near the sternal end (Figure A209). The rest of the anteromedial aspect of the rib is not present. The margins of the fracture are uneven with significant porosity and new periosteal bone formation representing callous formation.

9. A fracture near the sternal end of the left fifth rib with woven bone joining the two halves of the fracture together. (Figure A210).

10. Spondylolysis of the fifth lumbar vertebra (Figure A211–Figure A212). Unlike in congenital cases (Ortner 2003a), the fracture area is uneven and porous (Figure A212). *Par interarticularis* fractures tend to be stress related caused by anterior shearing forces (Syrmou et al. 2010; Waldron 2009; Wedel and Galloway 2014).

At least two traumatic events are represented above: 1. Fully healed fractures (#1, 2–3, 5, and 7) and 2. Fractures in the process of callous formation (#4, 6, 8, and 9?).

Dimensions: 1. 3.5 mm x 4.9 mm; 2. 14.4 mm x 1.8 mm; 3. 17.6 mm x 2.1 mm; 4. 15.3 mm x 6.8 mm; 5. 18.5 mm x ca. 1.1 mm; 6. 6.0 mm x 7.4 mm; 7. 15.9 mm x 4.6 mm; 8. 14.7 mm x 4.1 mm; 9. 18.2 mm x 2.9 mm

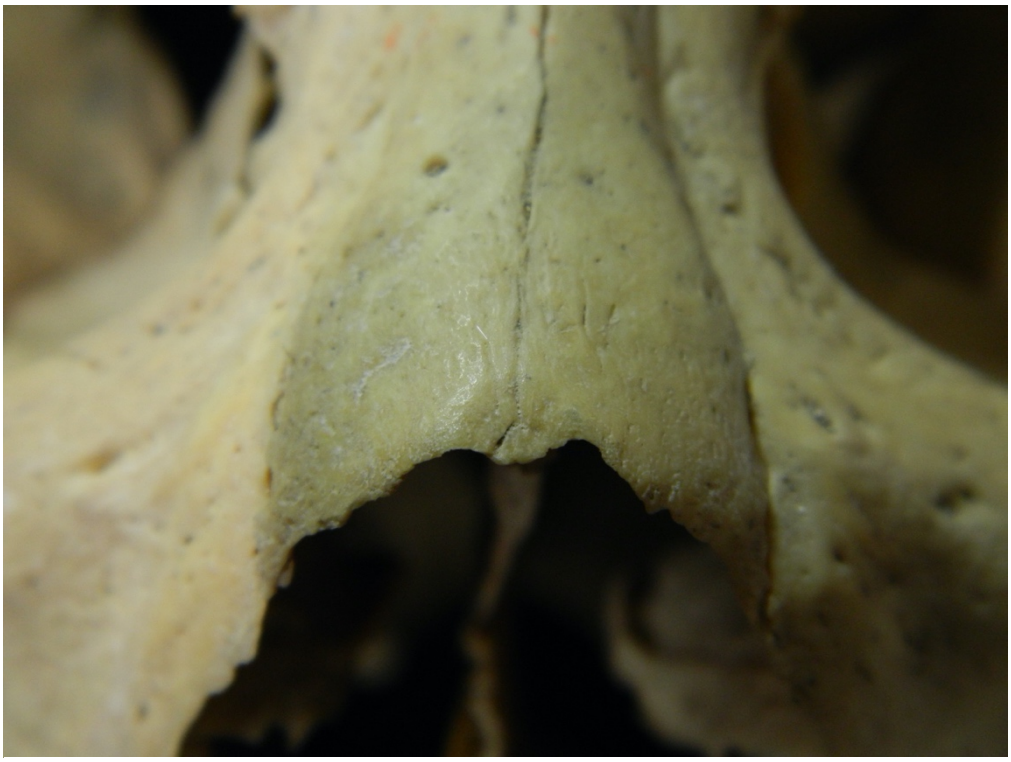


Figure A203: Kōra 36 nasal bones anterior view showing a possible healed fracture to both.



Figure A204: Kōra 36 right third(?) rib showing a line of remodelled bone near the sternal end.



Figure A205: Kōra 36 right fourth rib showing a line of porosity near the sternal end and disunion of the shaft with signs of callous formation along the fracture margins.



Figure A206: Kōra 36 right fifth rib superoanterior view showing a depressed area near the sternal end and disunion of the shaft with evidence of callous formation around it.



Figure A207: Kōra 36 left second rib anterior view showing a ridge of bone.



Figure A208: Kōra 36 left third rib superoanterior view likely showing the lateral half of a fracture in the process of healing.

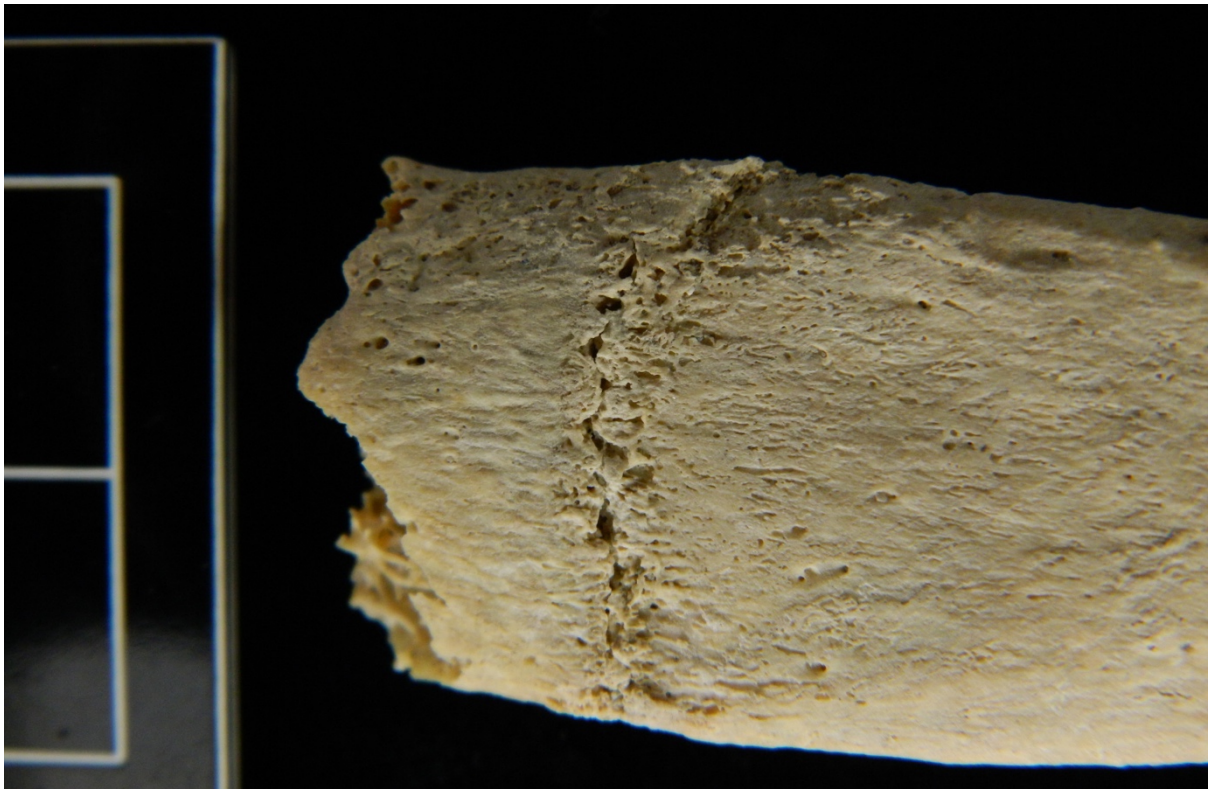


Figure A209: Kōra 36 left fifth rib anterior view showing a healing fracture.



Figure A210: Kōra 36 fifth lumbar vertebra superior view.



Figure A211: Kōra 36 fifth lumbar vertebra posterior view showing the deformed superior articular facets.

Kōra 44 | Young–Mid Adult | Male | Early Yayoi

Likelihood of traumatic injury: 1. High; 2. Low

Likelihood of being violence-related: 1. Medium; 2. N/A

Timing: Antemortem

Assessment of traumatic aetiology:

1. The right and left nasal bones are deformed (Figure A213–Figure A214). The left nasal bone has a semi-circular depression and is fused to the right nasal bone anteriorly. The right nasal bone is depressed where it is fused to the left nasal bone and a small portion of its distal-most point is displaced.

2. The superomedial aspect of the patellae have semi-circular deformations (Figure A215–Figure A216), possibly representing a congenital absence as this is the most common location for a bipartite pattern and as the margins are smooth (Court-Brown et al. 2015).

Burst and compression fractures are present on the vertebrae.

Dimensions: 1. 11 mm x ca. 19.2 mm



Figure A212: Kōra 44 cranium anterior view showing the healed fractures to the nasal bones.



Figure A213: Kōra 44 close-up of the healed fractures to the nasal bones.



Figure A214: Kōra 44 anterior view of patellae, note the bilateral deformities on their superomedial aspects.



Figure A215: Kōra 44 medial view of the patellae.

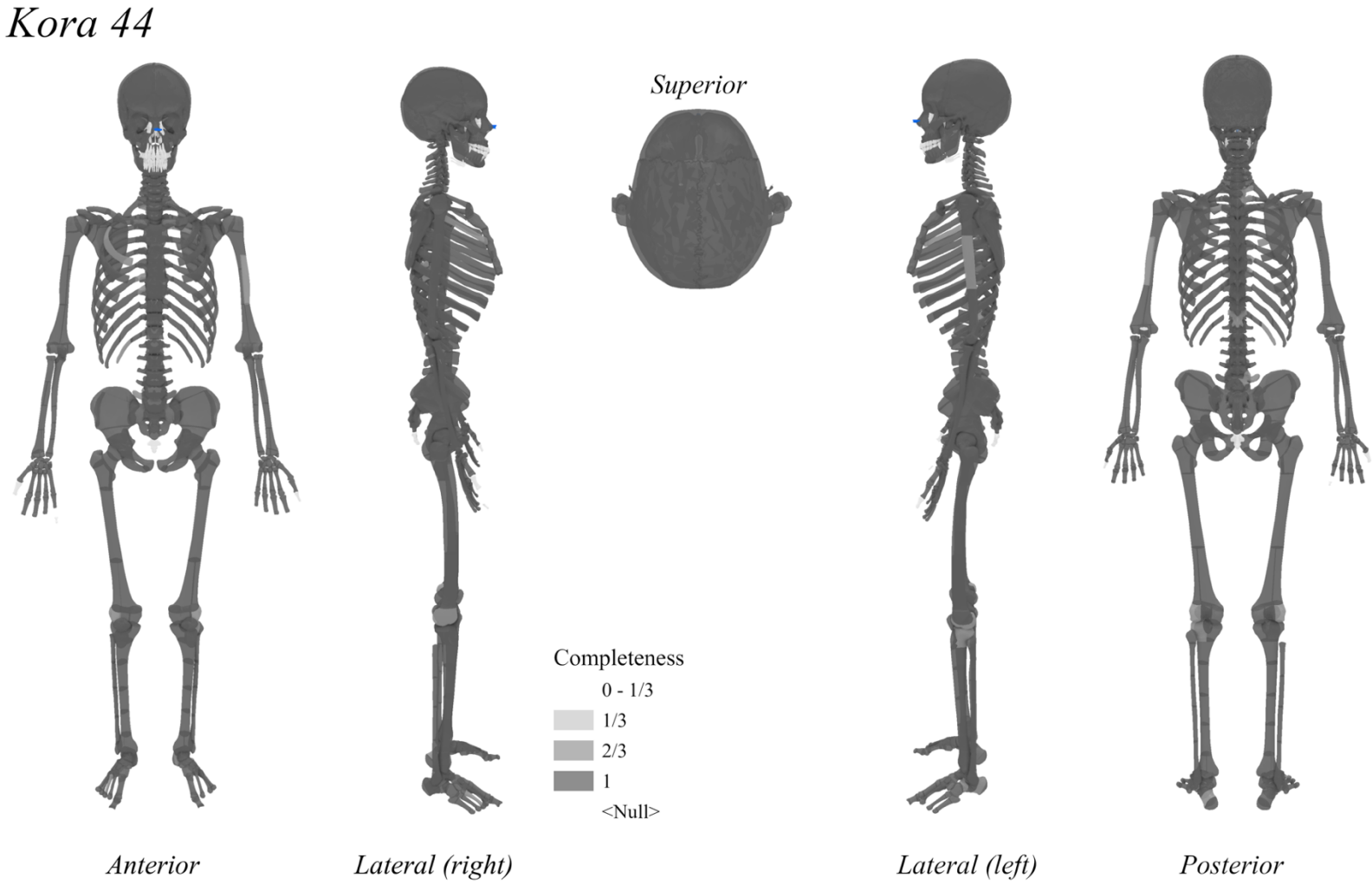


Figure AA27:Kōra 44 Completeness and Medium–High antemortem trauma.

Kōra 67 | Mid Adult | Male | Early Yayoi

Likelihood of traumatic injury: 1. High; 2. Low; 3. High; 4. High; 5. Medium

Likelihood of being violence-related: 1. Medium; 2. N/A; 3–6. Low

Timing: Antemortem

Assessment of traumatic aetiology:

1. Healed fractures to both nasal bones and maxillae (Figure A217–Figure A219). The right nasal bone appears to have been fractured into three parts, but these have fused back together. The anterior-most edges of the right nasal bone are depressed inferomedially. There is a semi-circular fracture arc on the right frontal process of the maxilla near the suture with the nasal bone. The left nasal bone was fractured in half and did not fuse back together. The margins of the fracture are rounded. The nasal suture is diverted at this point. The anterior half of the left nasal bone is uneven and deformed inferomedially. There is slight involvement of the left maxilla along the suture line.

2. A small depression to the right side of the frontal bone (Figure A220–Figure A221). Porosity is present within and a ridge of bone runs through it vertically.

3. A healing incomplete oblique fracture to the left ninth rib shaft (Figure A222). Woven bone formation is present across the fracture margins.

4. A ridge of bone near the sternal end of the left tenth rib, likely representing a healed fracture (Figure A223). Posteriorly there is a corresponding depressed area. From the point onwards, the rib is angled slightly inferiorly.

5. The left second metacarpal is shortened with a ridge of bone possibly representing a healed oblique fracture to the digit (Figure A224). Additionally, the head of the left second metacarpal shows a possible disunion of the head with a gap present dorsally and medially (Figure A225). Possible compression fractures present on the thoracic vertebrae.

Dimensions: 1. The area affected on the right nasal bone and maxilla is 15.3 mm long. The transverse fracture through the left nasal bone is 5.2 mm. The area affected on the left nasal

bone and maxilla is 15.2 mm x 4.1 mm. 2. 8.2 mm x 5.8 mm and deepest at 0.4 mm; 3. 19.5 mm x 9.8 mm; 4. 8.4 mm x 1.6 mm; 5. 0.9 mm x ca. 6.1 mm



Figure A216: Kōra 67 cranium anterior view showing healed fractures to the nasal bones and maxillae.

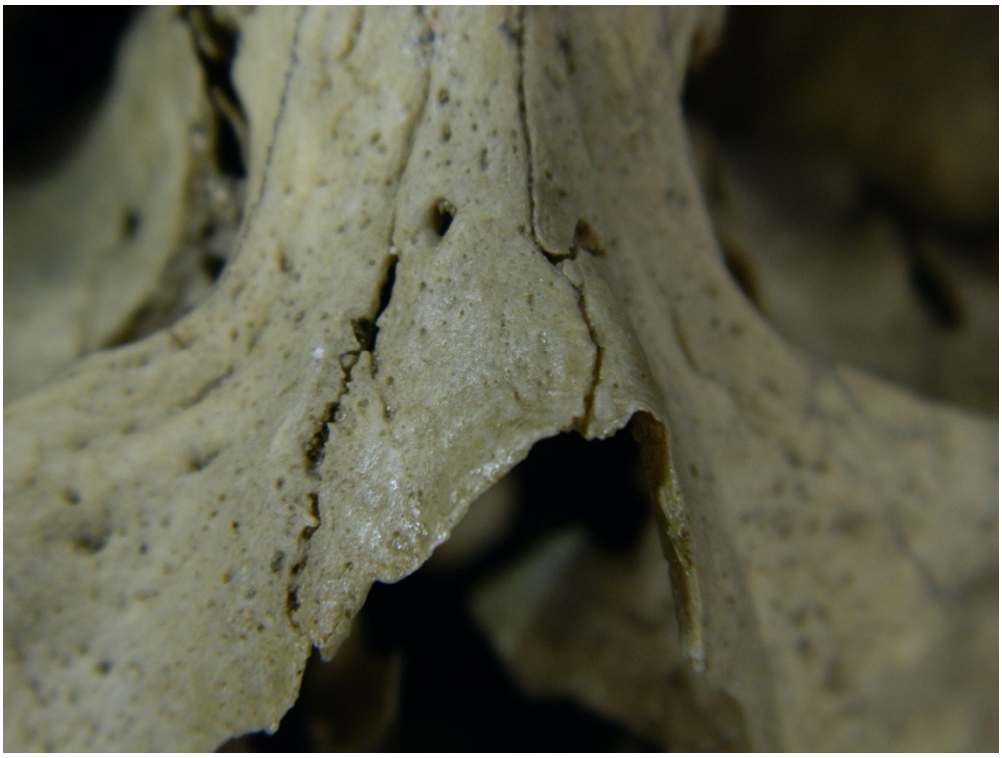


Figure A217: Kōra 67 close-up of fracttures to the nasal bones and right maxilla.



Figure A218: Kōra 67 close-up of fractures to the nasal bones and involvement of the left maxilla.

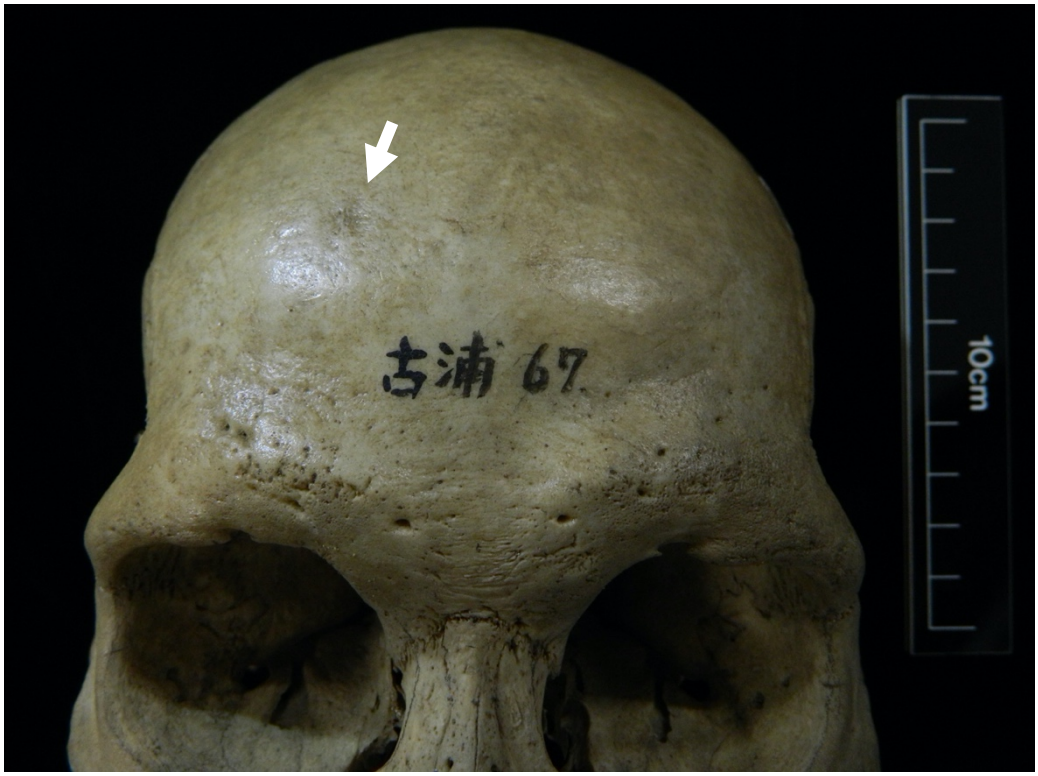


Figure A219: Kōra 67 anterior view of the frontal bone showing a shallow depression to the right side.

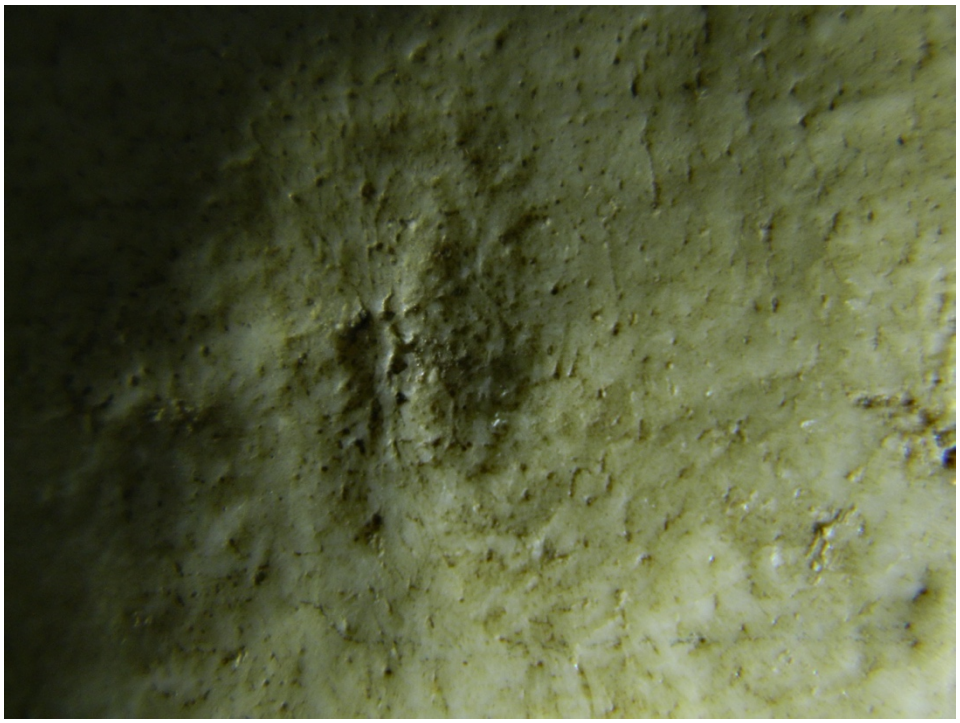


Figure A220: Kōra 67 close-up of shallow depression on the frontal bone.



Figure A221: Kōra 67 left ninth rib showing a healing fracture to the shaft.



Figure A222: Kōra 67 left tenth rib showing a healed fracture near the sternal end.



Figure A223: Kōra 67 second metacarpals medial view showing the shortened left metacarpal and ridge of bone on its shaft.



Figure A224: Kōra 67 head of the left second metacarpal showing a gap running through it.

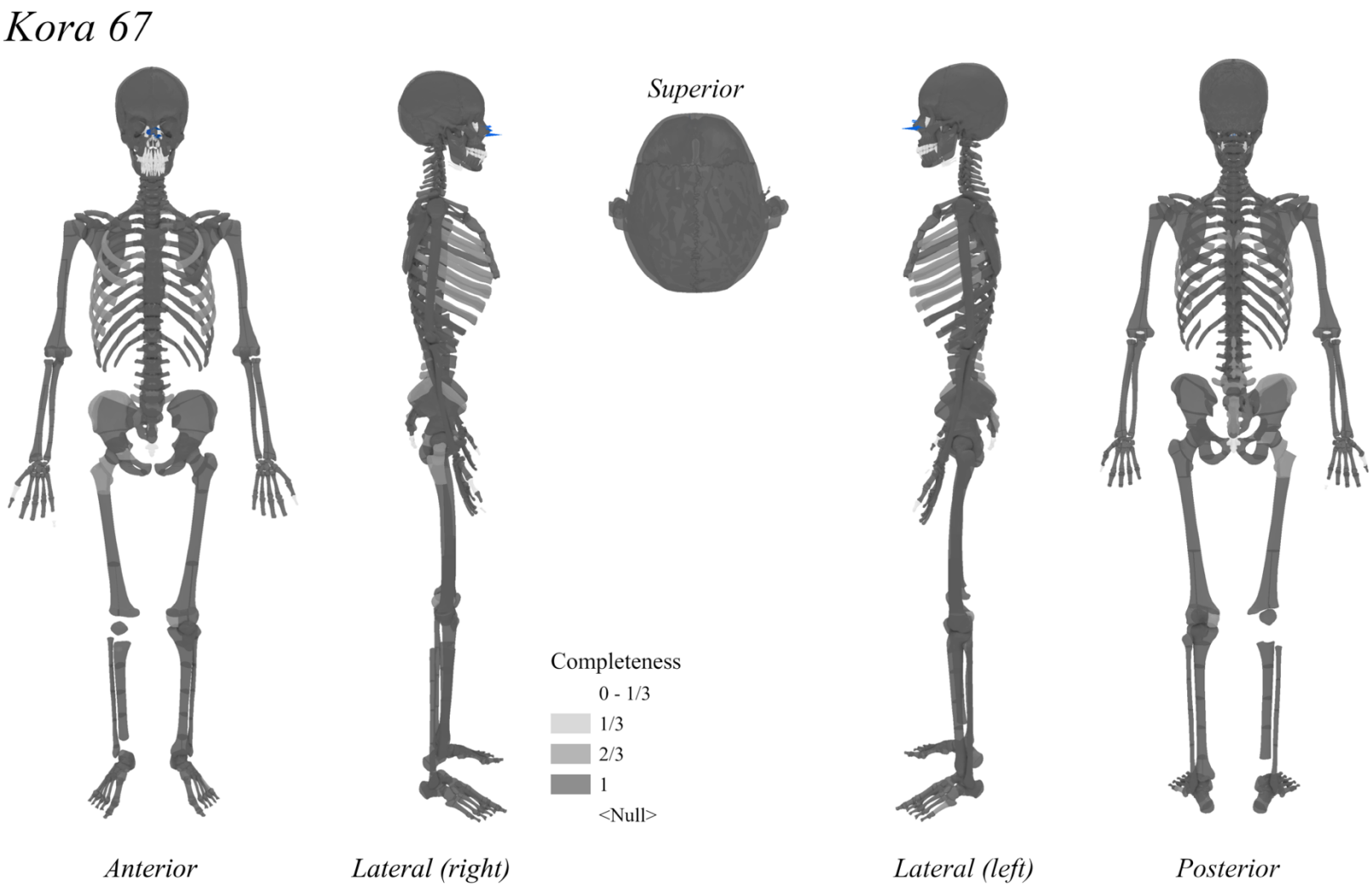


Figure AA28: Kōra 67 Completeness and Medium–High antemortem trauma.

Kōra 68 | Young–Mid Adult | Male | Early Yayoi

Likelihood of traumatic injury: 1–2. High

Likelihood of being violence-related: 1–2. Low

Timing: Antemortem

Assessment of traumatic aetiology:

1. An oblique ridge on a shortened right clavicle, consistent with a healed fracture (Figure A226). Porosity is present around the ridge. The manubrium's right clavicular notch is elongated anteriorly and lipping is present on the left first costal not and on the first rib.

2. A deformed right calcaneus with a ridge of bone through the body (Figure A227). The proximal articular facet with the talus is depressed with at least two ridges of bone present. Distal to the calcaneal tuber there is also porosity and the whole articular facet for the talus has been deformed. On the medial side there are two ridges of bone that are not present on the left calcaneus. There is also a pit-like depression on the superolateral side, proximal to the articulation with the cuboid. On the right talus, the proximal-most point of the calcaneal articular surface has a porous, depressed ridge of bone (Figure A228).

Dimensions: 1. 60.7 mm x 21.5 mm; 2. The proximal ridge/depression on medial face is 26.5 mm x 3.4 mm and ca. 4.6 mm deep. On the right talus the area affected is 7.9 mm x 0.6 mm and 0.9 mm deep



Figure A225: Kōra 68 clavicles inferior view showing the shortened and deformed right clavicle.



Figure A226: Kōra 68 calcanei medial view showing the deformity of the right calcaneus.



Figure A227: Kōra 68 right talus inferior view showing the circular fracture line and depression proximally

Kōra 山本 III (Yamamoto III) | Mid Adult | Male | Early Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Low

Timing: Perimortem

Assessment of traumatic aetiology:

Patinated, v-shaped linear marks (at least 53) extend along the diaphysis of the left femur (Figure A229–Figure A232). No similar marks are present on the rest of the skeleton. The linear marks are of varying depths and at least two have serrated margins.

Given the concentration of lesions on this one bone and their number, it is not likely that these are related to interpersonal violence.

Dimensions: The serrated linear marks are up to 9.3 mm long and 1.4 mm wide. Unserrated linear marks are between 2.8 to 8.9 mm long and widest at 1.6 mm.



Figure A228: Kōra 山本 III left femur anterior view.



Figure A229: Kōra 山本 III left femur proximal diaphysis showing numerous patinated linear marks.

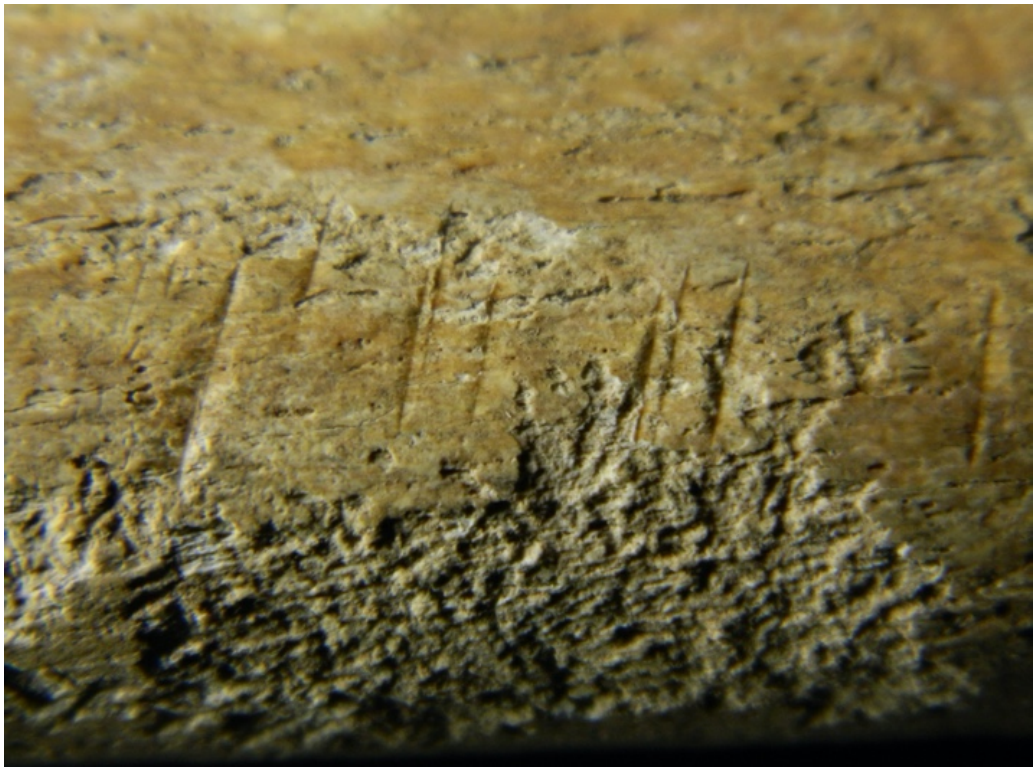


Figure A230: Kōra 山本 III left femur close-up of linear marks to the proximal posterior diaphysis.



Figure A231: Kōra 山本 III left femur close-up of linear marks to the proximal lateral diaphysis.

Minamikata 7 • 8 | Adult | Indet. | Middle Yayoi?

Likelihood of traumatic injury: High

Likelihood of being violence-related: Medium

Timing: Perimortem

Assessment of traumatic aetiology:

A sharp, patinated, v-shaped linear mark to the dorsal side of a metacarpal shaft (Figure A233–Figure A234). The margins are sharp and internal striations can be seen on the walls more common of a metal implement. Although manipulation and cleaning of remains was not uncommon during the Yayoi period and the skull from Minamikata seems to indicate some processing or display of remains, the depth, lack of any other marks (such as evidence of more shallow cuts or scraping), and location of this lesion all make it more likely that this cut is the result of an assault.

Dimensions: 5.0 mm x 1.1 mm



Figure A232: Minamikata 7•8 metacarpal shaft showing a v-shaped patianted cut mark.



Figure A233: Minamikata 7•8 close-up of the cut mark on the metacarpal shaft. Note the internal striations.

Minamikata 7 • 8 | Young Adult? | Male? | Middle Yayoi?

*Possibly the same individual as above as the remains of two individuals recovered in a co-mingled, scattered condition .

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: Low

Timing: Perimortem

Assessment of traumatic aetiology:

Two deep, patinated linear marks on the parietal bones (Figure A235–Figure A236). The linear marks extend under the articulation with the squamous portion of the temporal bones, but no associated lesions are seen on the temporal bones. Hence, the skull must have been partially disarticulated at the time when the lesions were made.

These lesions are too deep to be vascular grooves, additionally one would expect to see them on the temporal bone as well if they were (Schunk and Maruyama 1960). Nor are they consistent with being abnormal insertions of the temporalis muscle. Padgett (2020) has proposed mounting of skulls as trophies during the Yayoi period, but it does not match this pattern. It is unclear why this might be associated with postmortem processing of the remains as well as they were found disarticulated.

Dimensions: Left: 31.9 mm x 2.6 mm; Right: 37.7 mm x 6.4 mm



Figure A234: Minamikata 7•8 cranium lateral view showing a deep linear mark to the right parietal bone. Note that the temporal bone was present and did not show any corresponding lesion.

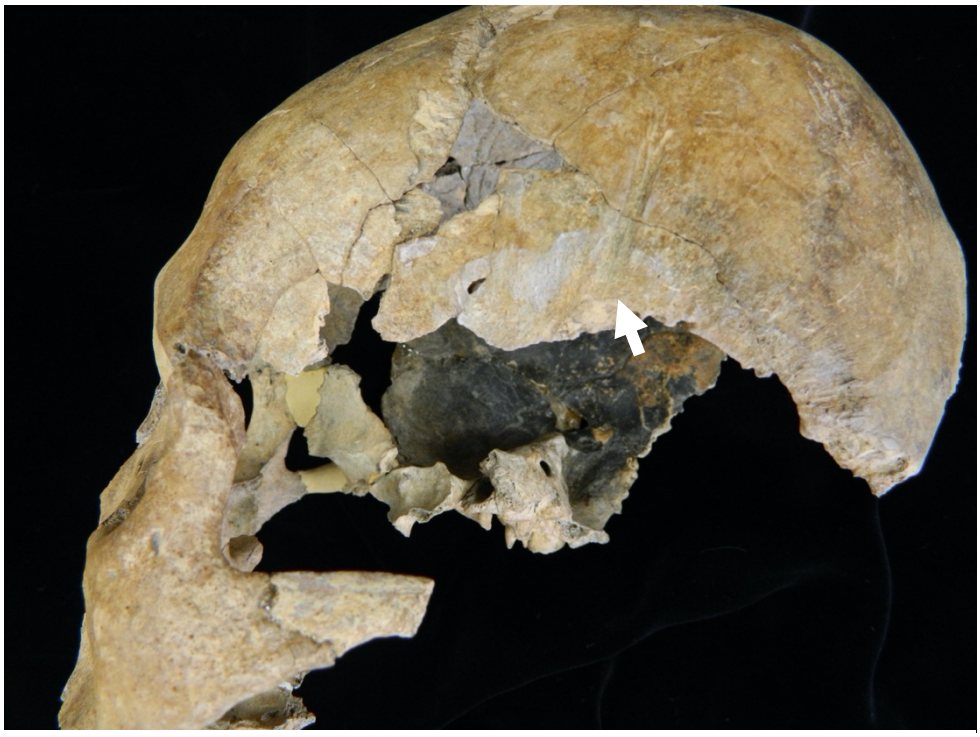


Figure A235: Minamikata 7•8 cranium lateral view showing a deep, wide linear mark to the left parietal bone. Note that the temporal bone was present and did not show any corresponding lesion.

Mitsunagata 5 | Mid-Adult? | Male | Middle to Late Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

The right and left nasal bones are deformed anteriorly and oriented to the left (Figure A237).

The nasal suture is closed from the healed fracture line anteriorly.

Dimensions: 13.2 mm x 7.8 mm



Figure A236: Mitsunagata 5 cranium anterior view showing a healed fracture to the nasal bones.

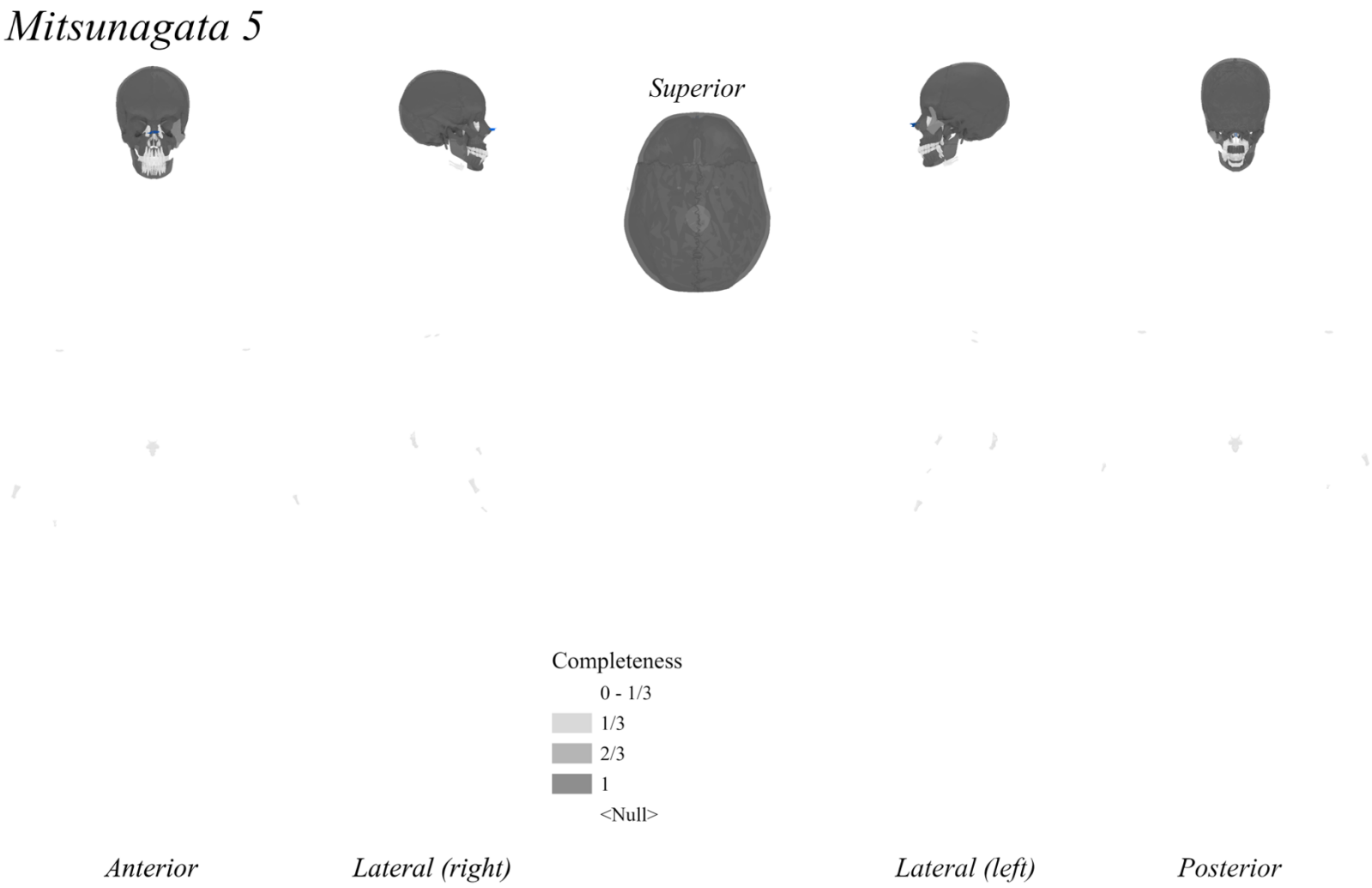


Figure AA29: Mitsunagata 5 Completeness and Medium–High antemortem trauma.

Mitsunagata 32 | Young Adult | Male | Middle to Late Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: High

Timing: Perimortem

Assessment of traumatic aetiology:

A sharp linear mark to the medial right iliac fossa (Figure A238). There is a semi-circular adhering piece of bone.

Dimensions: 9.6 mm x 1.4 mm gap (4.2 mm with adhering bone)

Previously Reported In: Hashiguchi (2007) attributes this to a metal projectile. Hashiguchi also describes an arrowhead with adhering bone found near the right distal femur (Figure A239).

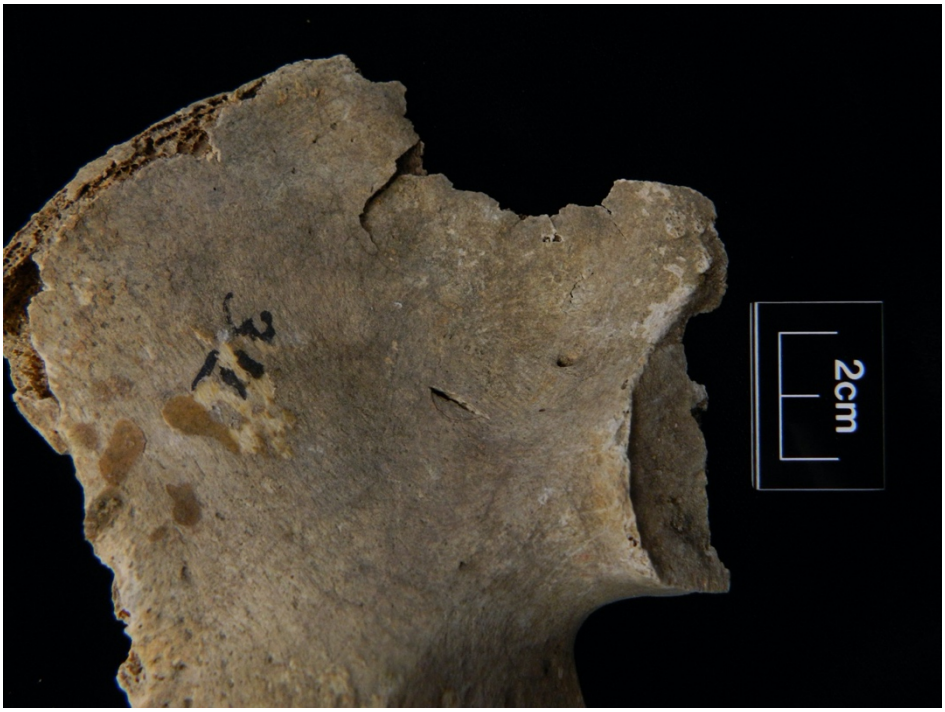


Figure A237: Mitsunagata 32 medial view of the right os coxa showing a penetrating wound to the iliac fossa.

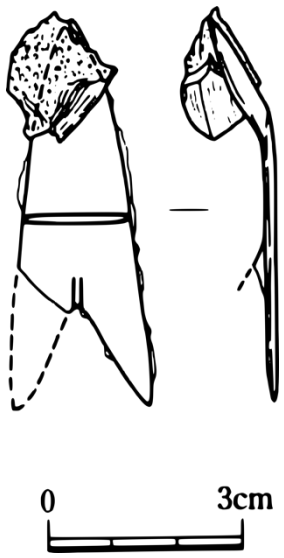


Figure A238: Adapted from Hashiguchi (2007:158) by JAW. Line drawing of arrowhead with adhering bone found with Mitsunagata 32.

Mitsunagata 32

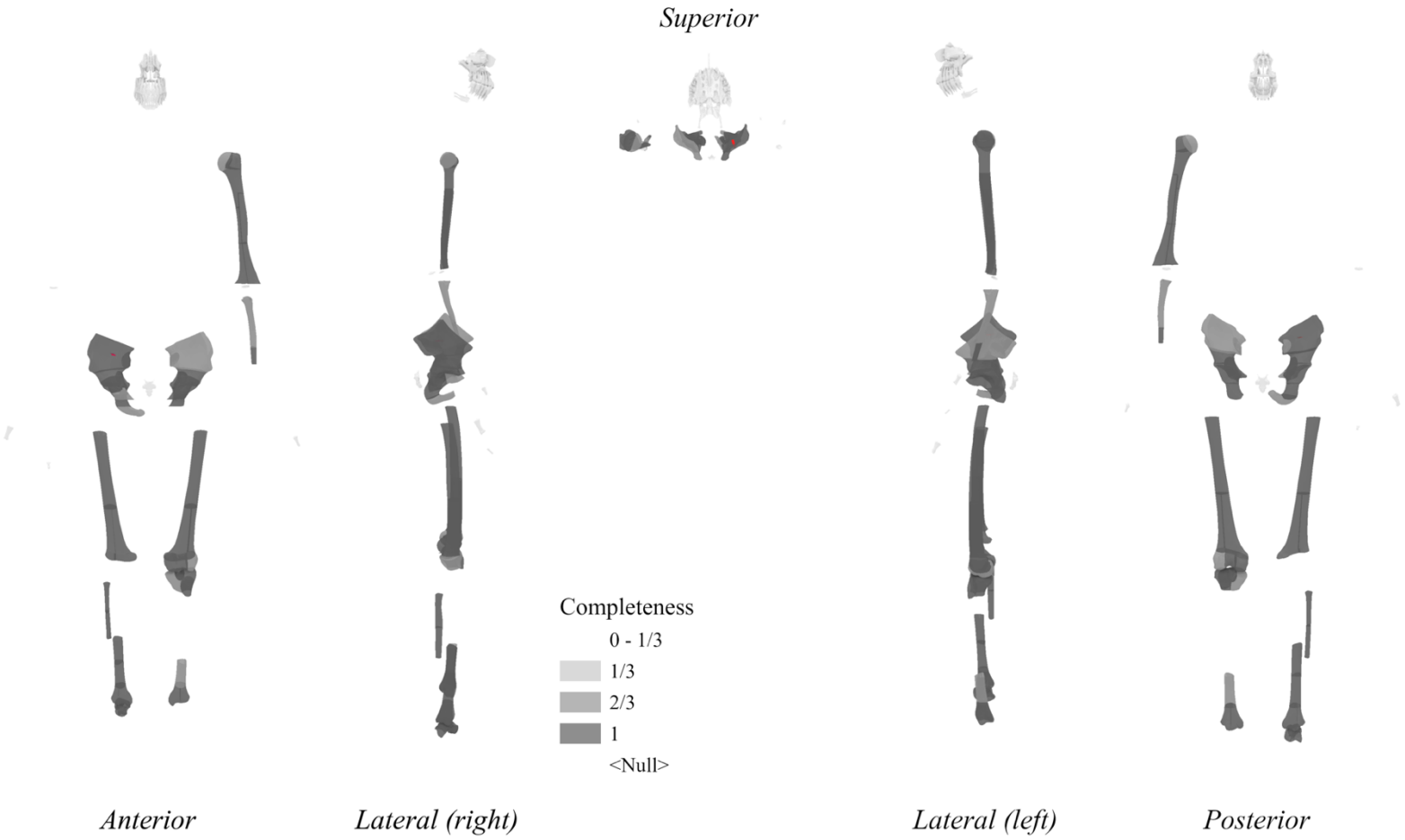


Figure AA30: Mitsunagata 32 Completeness and Medium–High perimortem trauma.

Mitsunagata 104 | Mid-Adult | Male | Early Half of Late Yayoi

Likelihood of traumatic injury: 1. Medium; 2. Medium

Likelihood of being violence-related: 1. Low; 2. Medium

Timing: Antemortem

Assessment of traumatic aetiology:

1. A deformed area of bone on the anterior right nasal bone (Figure A240). The nasal bones are too fragmentary to say more.

2. A porous depression to the left side of the superior frontal bone, near the coronal suture (Figure A241). The margins are sloping and steepest anteriorly. It is partially obscured by a red pigment.

Burst fractures are present on the vertebral bodies.

Dimensions: 1. 3.7 mm x 3.5 mm; 2. 7.0 mm x 4.2 mm and 0.6 mm deep



Figure A239: Mitsunagata 104 cranium anterior view showing a possible healed fracture to the right nasal bone.



Figure A240: Mitsunagata 104 cranium superior view of the left side showing a porous depression to the frontal bone.

Mitsunagata 104

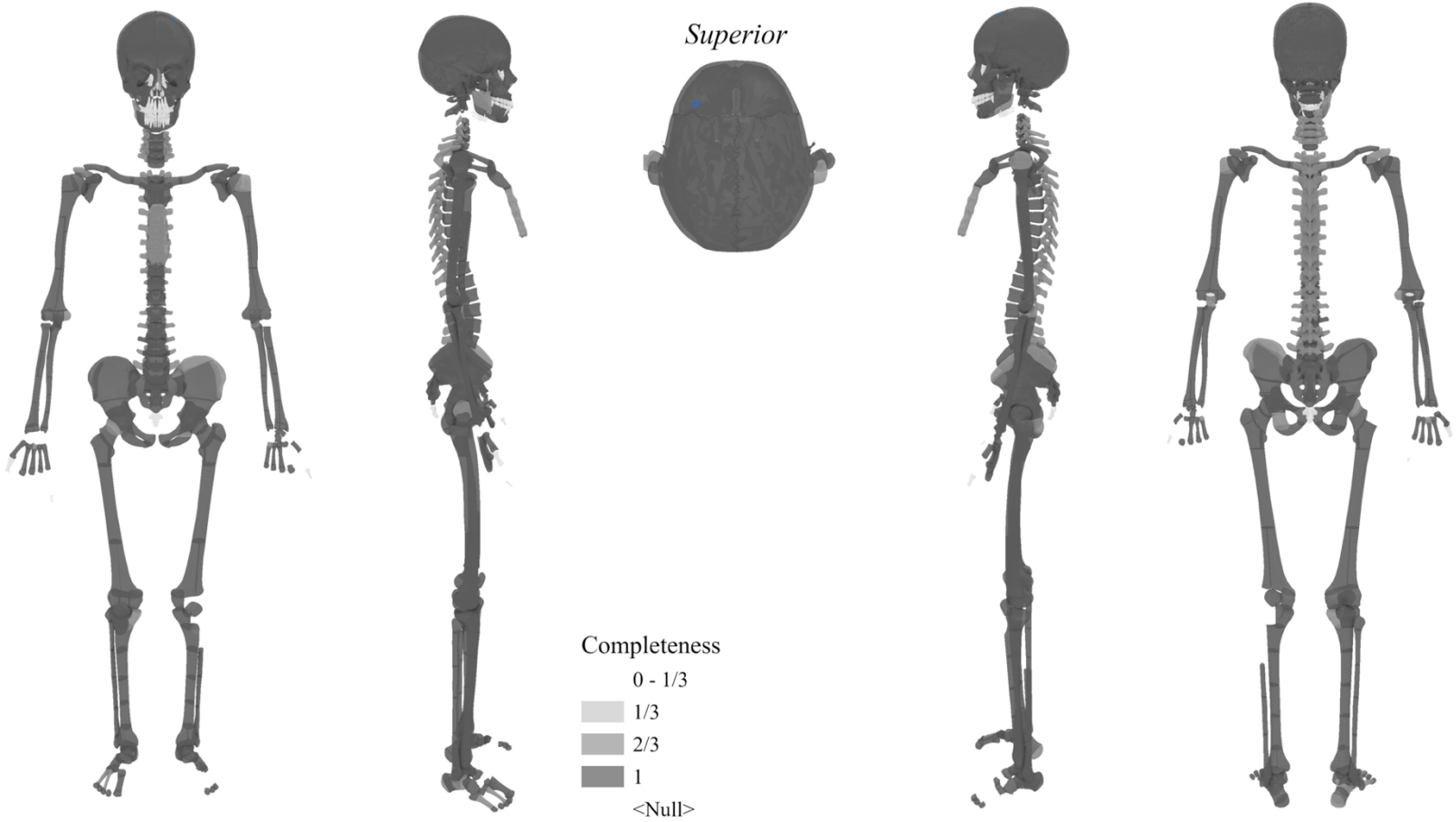


Figure AA31: Mitsunagata 104 Completeness and Medium–High antemortem trauma.

Mitsunagata 127 | Mid-Adult | Male | Middle to Late Yayoi

Likelihood of traumatic injury: 1. High; 1. Low

Likelihood of being violence-related: 1. Medium; 2. N/A

Timing: Antemortem

Assessment of traumatic aetiology:

1. The right and left anterior nasal bones are fused together anteriorly and deformed along a semi-circular line (Figure A242). The left nasal bone is more completely preserved and it is possible to see this line on it. The deformed nasal bones are oriented to the left.

2. A shallow porous depression to the lateral left superciliary arches of the frontal bone (Figure A243). There is no similar defect on the right side. There is a ridge of bone running along the sagittal plane in the middle of the depression. There is no corresponding lesion on the inner table. The lateral eyebrows are the most common location for dermoid cysts (Shah et al. 2012), yet this depression lacks scalloped margins.

Dimensions: 1. 6.0 mm long; 2. 11.4 mm x 6.4 mm (note: it was difficult to take the depth here without incorporating the superciliary arches)



Figure A241: Mitsunagata 127 cranium anterior view showing a healed fracture to the nasal bones.



Figure A242: Mitsunagata 127 frontal bone inferoanterior view showing an oval depression.

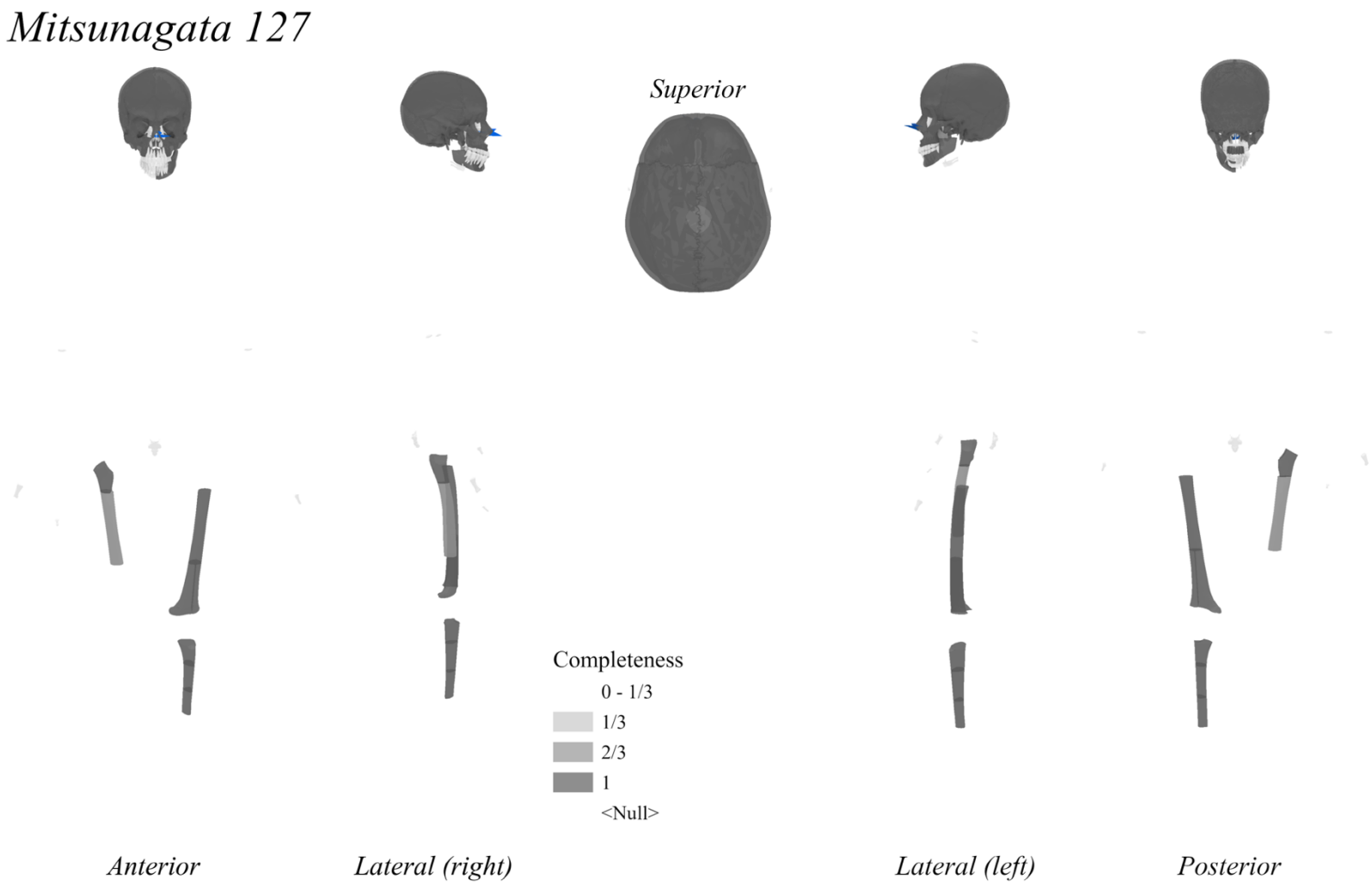


Figure AA32: Mitsunagata 127 Completeness and Medium–High antemortem trauma.

Nagaoka K9 | Mid-Adult | Male | Early Half of Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Low

Timing: Antemortem

Assessment of traumatic aetiology:

A malunion of the right second metacarpal after a fracture (Figure A244). The shaft is shortened and displaced.

Previously Reported In: Nakahashi (1990)



Figure A243: Nagaoka K9 deformed right second metacarpal.

Nagaoka K10 | Mid Adult | Male | Mid Middle Yayoi

Likelihood of traumatic injury: 1–3. High

Likelihood of being violence-related: 1. Medium; 2. High; 2. Low

Timing: Antemortem

Assessment of traumatic aetiology:

1. A healed circular fracture line to both nasal bones (Figure A245–Figure A246). Anterior to this the nasal bones are depressed inferiorly.

2. A linear mark with smooth margins to the supraorbital margin (Figure A245 andFigure A247–Figure A248). It bisected the frontal bone and during healing it has only partially fused back together. The margins of a v-shaped cut can be seen at the supraorbital margin (Fig. A246). It continues into the orbit by at least 3.8 mm. There is a fracture line radiating out from this point along the frontal bone, but it is covered by an adhesive.

3. A deformed distal right radius (Figure A249). A ridge of bone is present on the anterior diaphysis and from that point distally, the bone is displaced posteriorly. There is significant hyperostosis, particularly on the proximal surface. The articular surfaces are also deformed .The head of the ulna has significant lipping and is flattened. This is consistent with a poorly healed Colles fracture.

Dimensions: 1. 9.9 mm wide; 2. From the margin of the orbit the cut mark extends 14.7 mm medially.

Previously Reported In: #2–3 in Nakahashi (1990)



Figure A244: Nagaoka K10 cranium anterior view showing a healed cut mark to the right supraorbital margin and a healed fracture to both nasal bones.



Figure A245: Nagaoka K10 nasal bones showing a healed fracture.



Figure A246: Nagaoka K10 inferior view of the healed cut mark to the right supraorbital margin.



Figure A247: Nagaoka K10 close-up of healed cut mark to the right supraorbital margin.



Figure A248: Nagaoka K10 right radius medial view of the distal diaphysis and epiphysis showing a poorly healed Colles fracture.

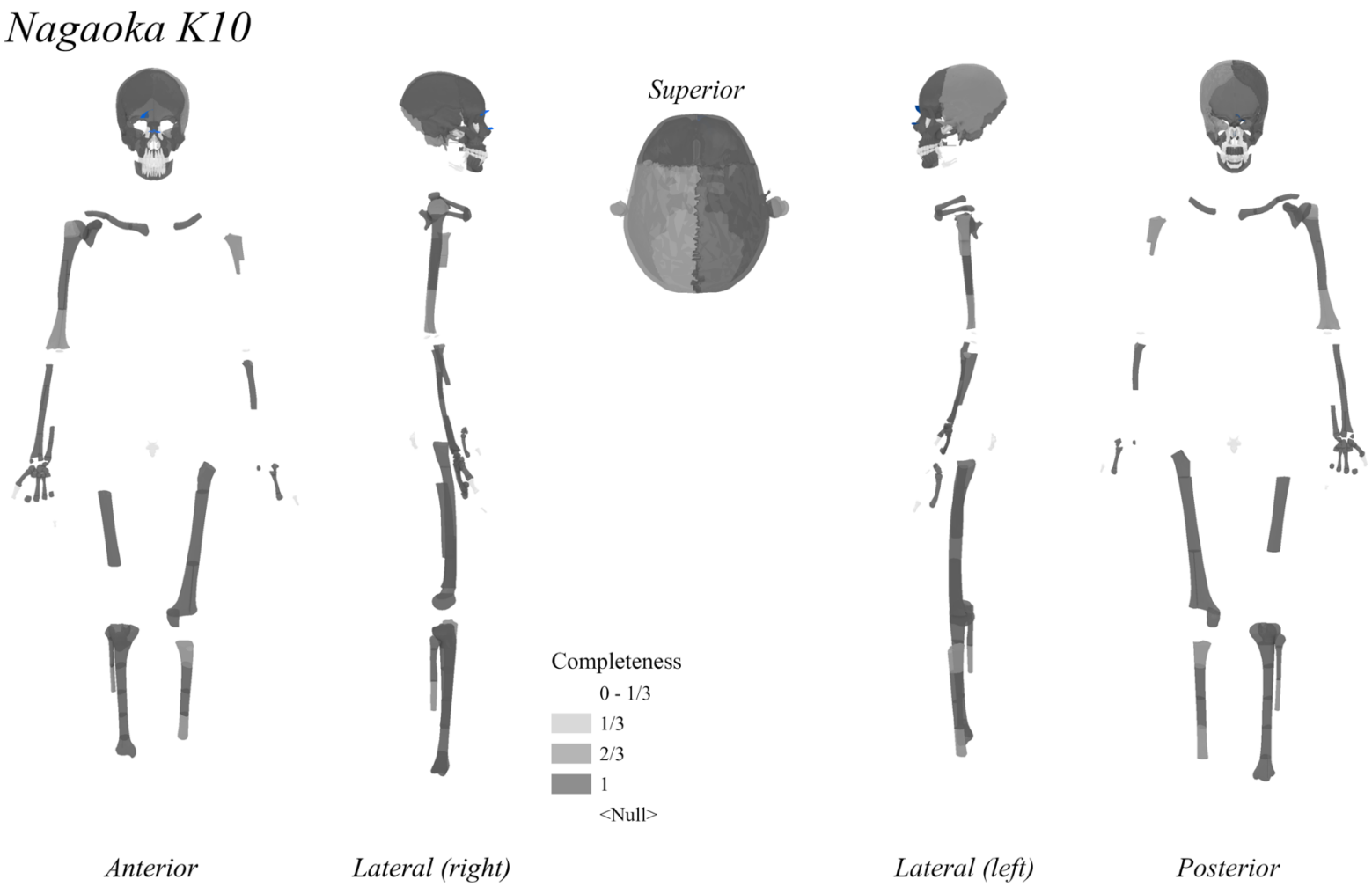


Figure AA33: Nagaoka K10 Completeness and Medium–High antemortem trauma.

Nagaoka K32 | Adult | Male | Early Half of Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Low

Timing: Antemortem

Assessment of traumatic aetiology:

A deformed distal left radius (Figure A250). There is a ridge of bone on the posterior distal diaphysis and a depression on the anterior side. The bone is displaced posteriorly distal to this ridge and the articular surfaces are deformed. Hyperostosis is present as well. This is consistent with a poorly healed Colles fracture.

Previously Reported In: Nakahashi (1990)



Figure A249: Nagaoka K32 left radius medial view showing a healed Colles fracture.

Nagaoka SK78 | Young-Mid Adult | Male | Early Half of Middle Yayoi

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: Low

Timing: Antemortem

Assessment of traumatic aetiology:

A thick protrusion of bone on the anterior right clavicle, possibly representing a healed incomplete fracture (Figure A251). There is no similar abnormality on the left clavicle.

Dimensions: 35 mm x 5.8 mm and 9.9 mm thick



Figure A250: Nagaoka SK78 right clavicle anterior view showing a protrusion of bone.

Nagaoka SK93 | Mid Adult | Male | Middle Yayoi

Likelihood of traumatic injury: 1–3. High

Likelihood of being violence-related: 1–3. High

Timing: Perimortem

Assessment of traumatic aetiology:

1. A patinated, v-shaped linear mark to the medial right ulnar diaphysis (Figure A252–Figure A253). There is no corresponding mark on the medial right radius. The margins of the linear mark are sharp and striations can be seen on the walls. The cut is angled proximally. There is no corresponding linear mark on the radius, and it is possible that the arm was raised and pronated in a defensive motion when this injury was acquired.

2. A patinated, v-shaped linear mark to the lateral mid-diaphysis of the right femur (Figure A254–Figure A255). The distal margin is sharp with internal striations. The proximal margin shows larger Hertzian fracture cones consistent with a chop mark angled proximally.

3. A long, thin linear mark to the anteromedial proximal diaphysis of the left tibia (Figure A256–Figure A257). There is postmortem damage to the proximal margin, but the linear mark is otherwise patinated and v-shaped. Internal striations can be seen on the distal wall of the cut.

Dimensions: 1. 3.2 mm x 0.9 mm; 2. 10 mm x 1.9 mm; 3. 11.2 mm x 0.2 mm



Figure A251: Nagaoka SK93 right ulna medial view showing a cut mark to the mid-diaphysis.



Figure A252: Nagaoka SK93 close-up of cut mark to the medial right ulna.



Figure A253: Nagaoka SK93 right femur mid-diaphysis lateral view (proximal is left) showing a chop mark.

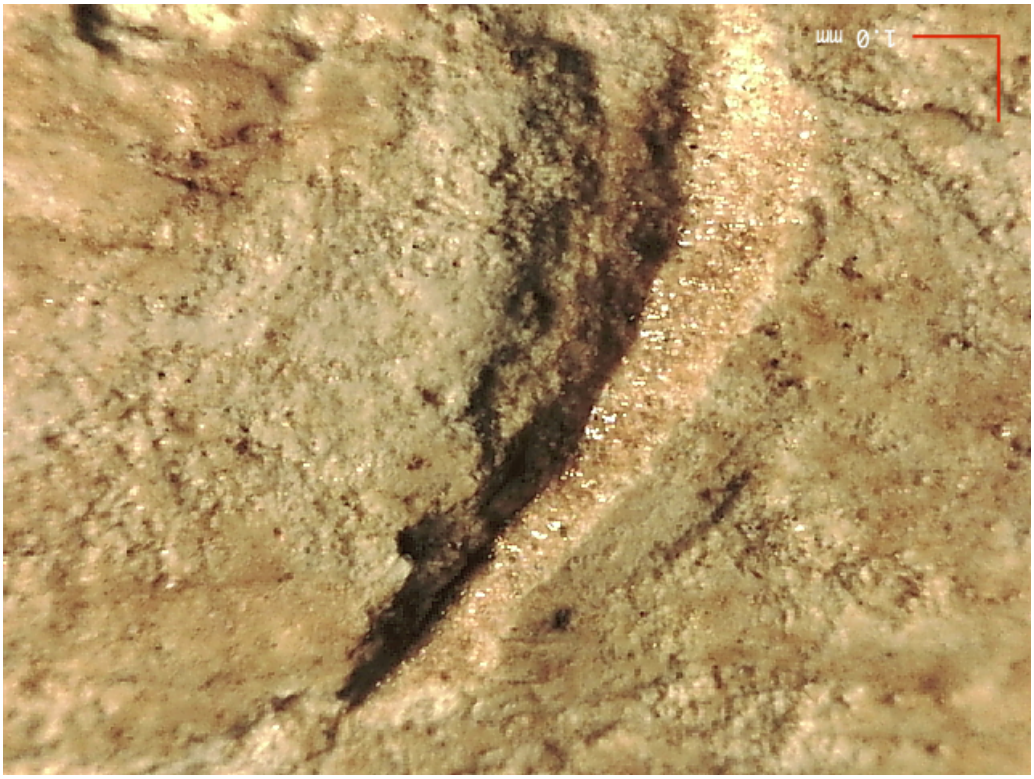


Figure A254: Nagaoka SK93 close-up of chop mark to the right femur.



Figure A255: Nagaoka SK93 left tibia proximal diaphysis anterior view showing a cut mark.



Figure A256: Nagaoka SK93 close-up of the cut mark to the left tibia.

Nagaoka SK93

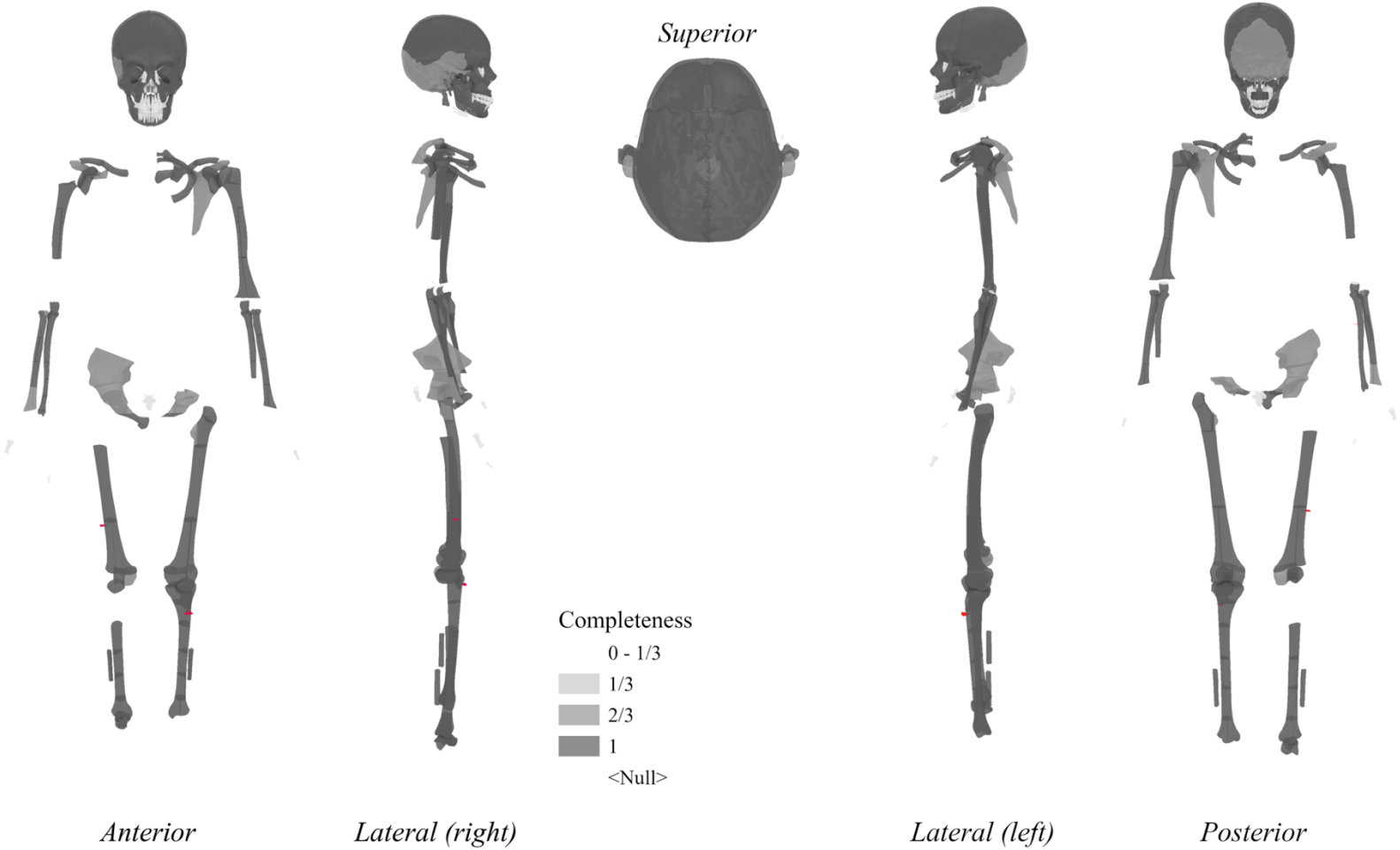


Figure AA34: Nagaoka SK93 Completeness and Medium–High perimortem trauma.

Nagaoka SK95 | Mid-Adult | Male | Middle Yayoi

Likelihood of traumatic injury: 1. High; 2. Medium

Likelihood of being violence-related: 1. High; 2. High

Timing: 1. Perimortem; 2. Antemortem

Assessment of traumatic aetiology:

1. A bronze sword tip is embedded in the right iliac crest (Figure A258–Figure A260). The tip of the sword can be seen medially (Figure A260). There is no sign of healing around the wound, although oxidation of the bronze has impacted the surface condition of the surrounding bone.

2. A hole on the medial left humerus, beneath the surgical neck (Figure A261–Figure A263).The margins of the defect are rounded and remodelled is visible particularly on the posterior surface. The inferior margin of the hole is v-shaped and angled proximally. No known common congenital defects to the area resembling this condition were found (Lewis 2019; Ortner 2003a) and it is consistent with a healed penetrating wound. The right humerus does not have any such defect.

Dimensions: 1. 14.2 mm x 5.1 mm; 2. Hole is 6.8 mm x 2.3 mm and the entire affected area is 12.2 mm x 5.2 mm.

Previously Reported In: #1 in Nakahashi (1990)



Figure A257: Nagaoka SK95 right os coxa lateral view showing an embedded sword tip.



Figure A258: Nagaoka SK95 close-up lateral view of embedded sword tip in the right ilium.



Figure A259: Nagaoka SK95 close-up medial view of embedded sword tip in the right ilium.



Figure A260: Nagaoka SK95 left humerus anterior view showing the hole in the proximal diaphysis.



Figure A261: Nagaoka SK95 close-up of hole and margins to the left humerus anterior view.



Figure A262:Nagaoka SK95 close-up of hole and margins to the left humerus posterior view.

Nagaoka SK95

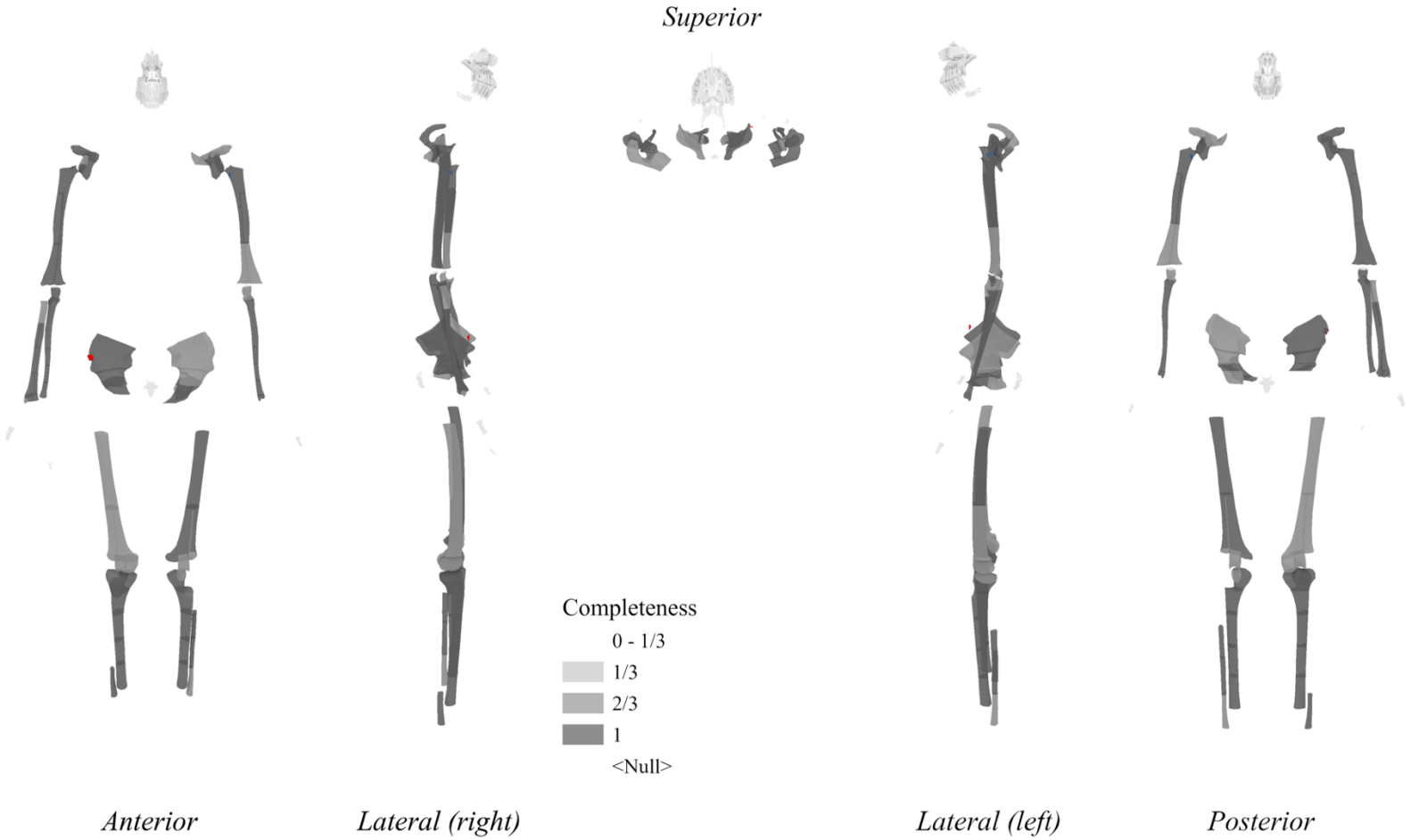


Figure AA35: Nagaoka SK95 Completeness and Medium–High antemortem (blue) and perimortem (red) trauma.

Nagaoka SK100 | Adolescent (>16 yrs.) | Male | Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: High

Timing: Perimortem

Assessment of traumatic aetiology:

A bronze sword tip embedded in the unfused left sacrum (Figure A264–Figure A265). The bone around the sword tip is sharp and patinated. There are no signs of rounding of bone or porosity or pitting present. The sword tip is angled proximally.

Dimensions: 53.6 mm x 22 mm

Previously Reported In: Nakahashi (1990)



Figure A263: Nagaoka SK100 left ilium and sacrum posterior view showing an embedded sword tip.

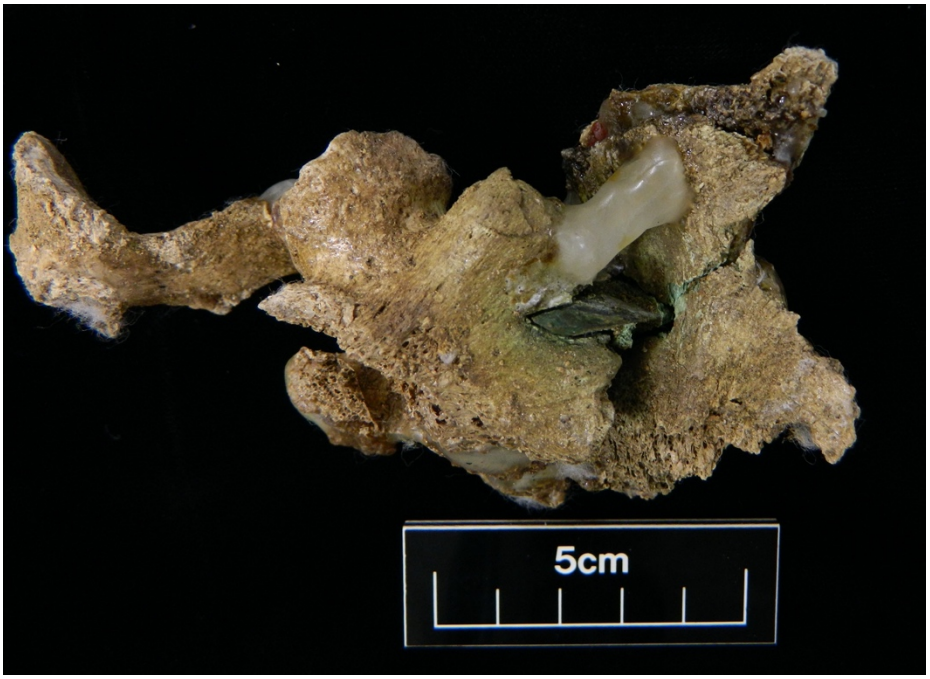


Figure A264: Nagaoka SK100 left ilium and sacrum anterolateral view showing an embedded sword tip.

Nagaoka SK100

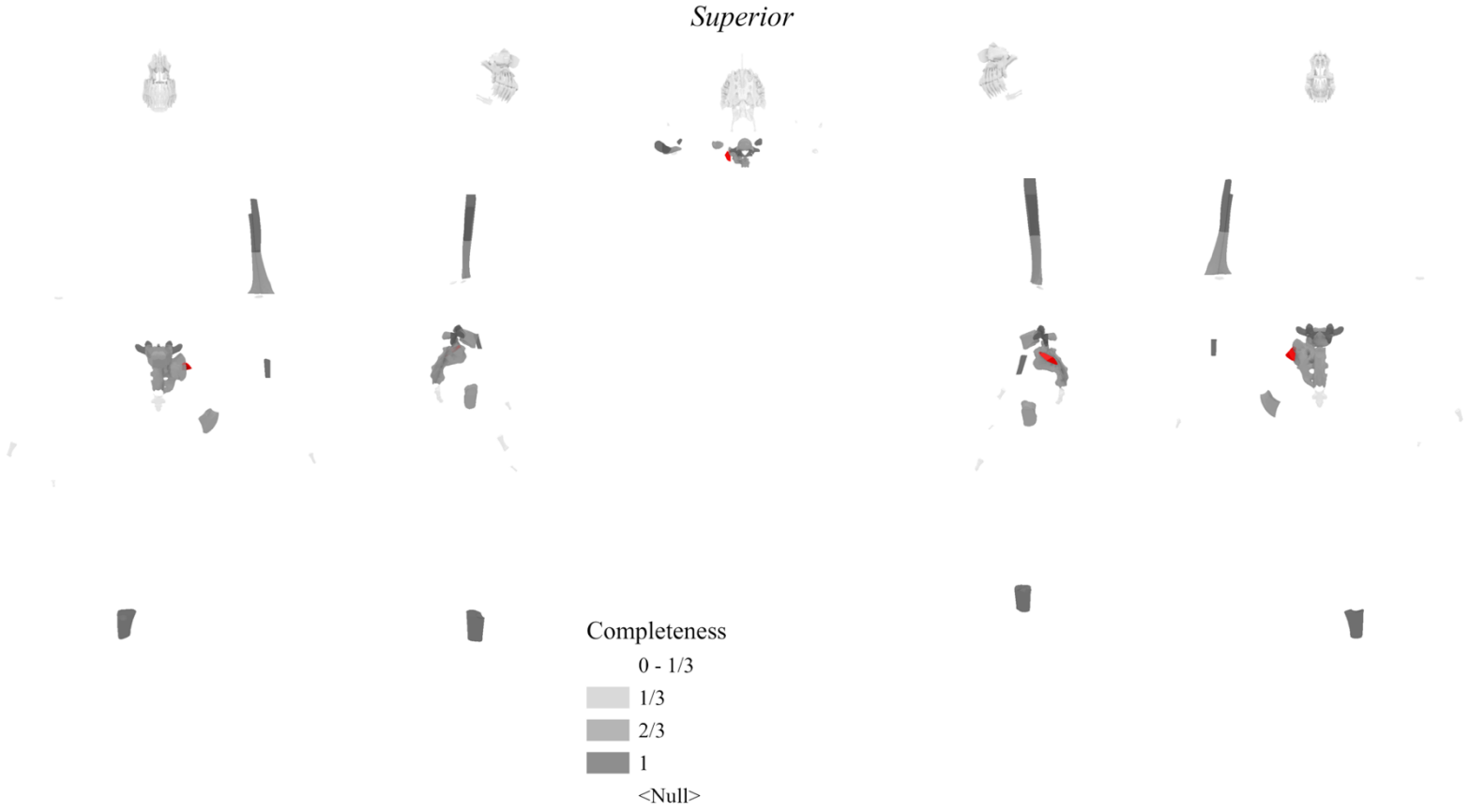


Figure AA36: Nagaoka SK100 Completeness and Medium–High perimortem trauma.

Nakanohama 906-3 | Young-Mid Adult | Male | Mid Middle-Late Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Low

Timing: Perimortem

Assessment of traumatic aetiology:

Multiple oblique, patinated, and smooth fractures on the diaphysis of the right ulna, possibly representing a spiral fracture (Figure A266–Figure A268).

Burst and compression fractures are present on the thoracic and lumbar vertebrae.

Dimensions: At least 114.8 mm long



Figure A265: Nakanohama 906-3 right ulna lateral view showing extensive fracturing to the diaphysis.

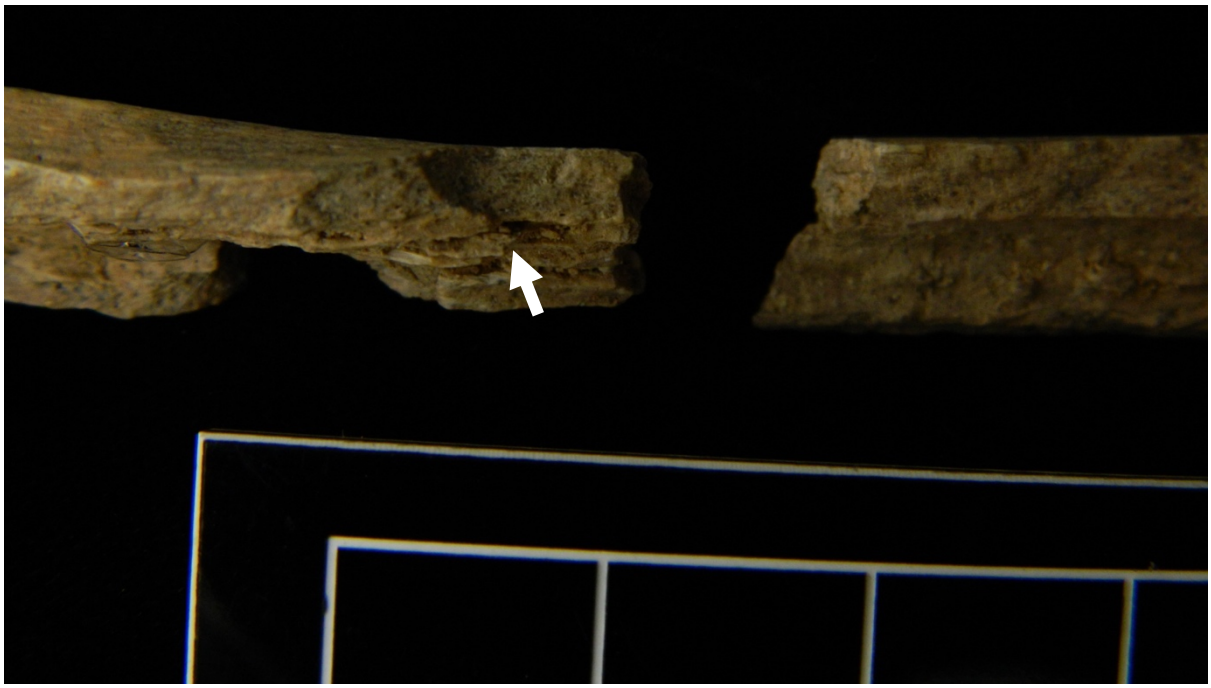


Figure A266: Nakanohama 906-3 close-up of curved, oblique fracture line to the right ulna.

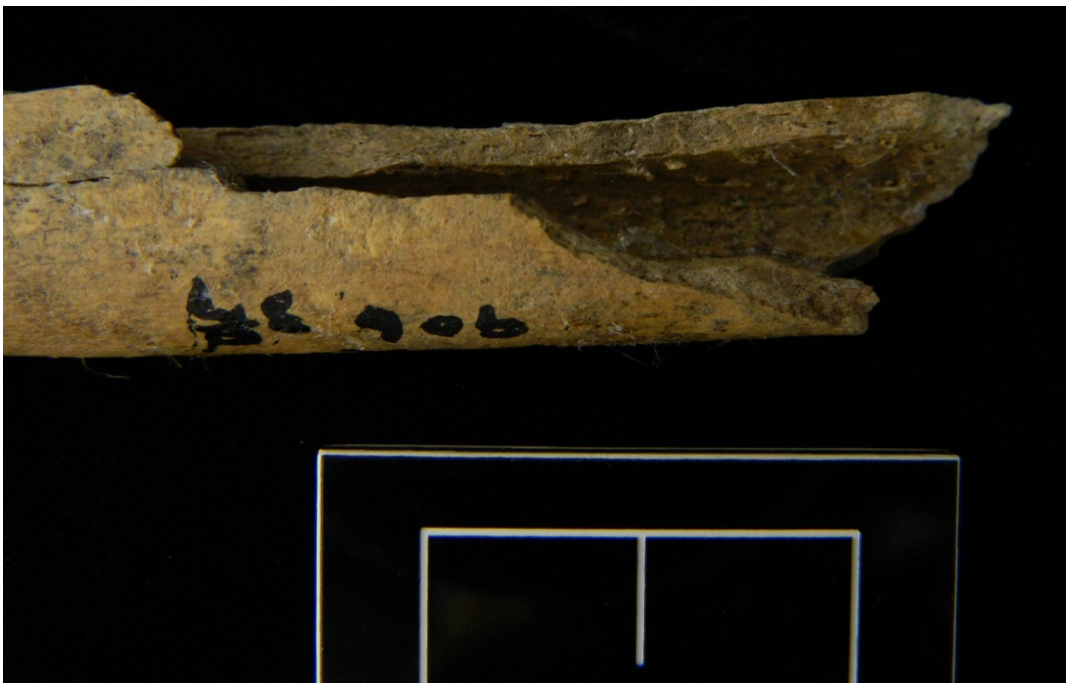


Figure A267: Nakanohama 906-3 close-up of curved, oblique fracture line to the right ulna distal diaphysis anterior view.

Nakanohama G-3-1 No.7357 | Adult | Male? | Early-Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

A porous circular depression to the posterosuperior left parietal bone (Figure A269–Figure A270). The margins are sloping and there is no corresponding lesion on the inner table. The medial margin is steepest. There is no corresponding depression on the right parietal bone.

Dimensions: 14.0 mm x 20.0 mm and 1.4 mm deep



Figure A268: Nakanohama G-3-1 No.7357 cranium posterior view showing a depression to the left parietal bone.

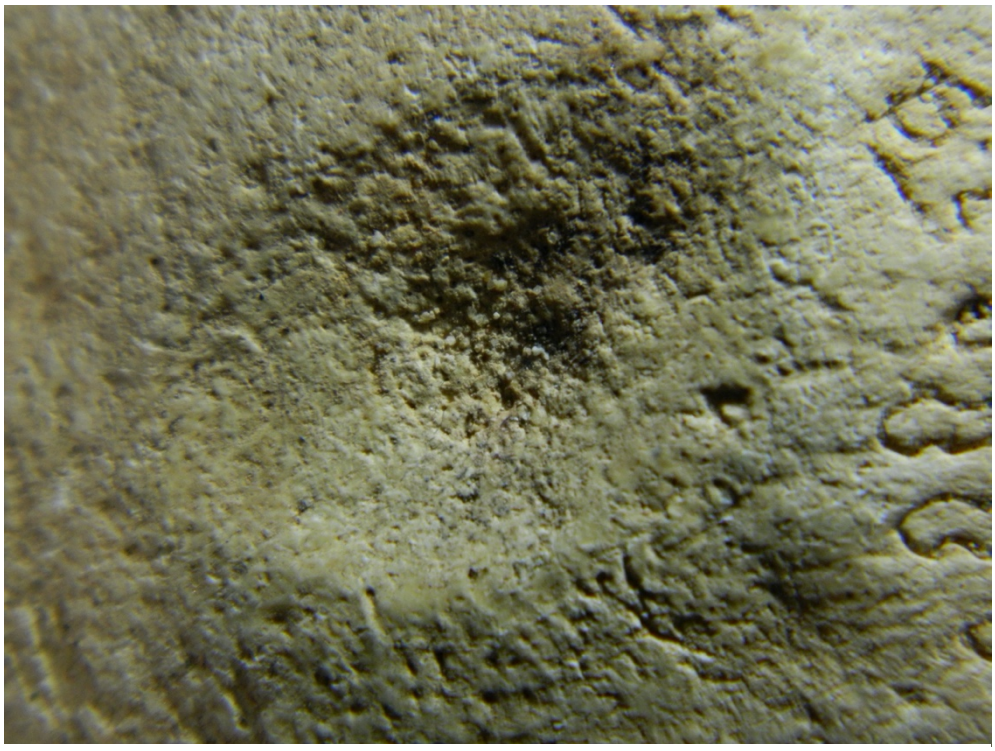


Figure A269: Nakanohama G-3-1 No.7357 close-up of depression to the left parietal bone.

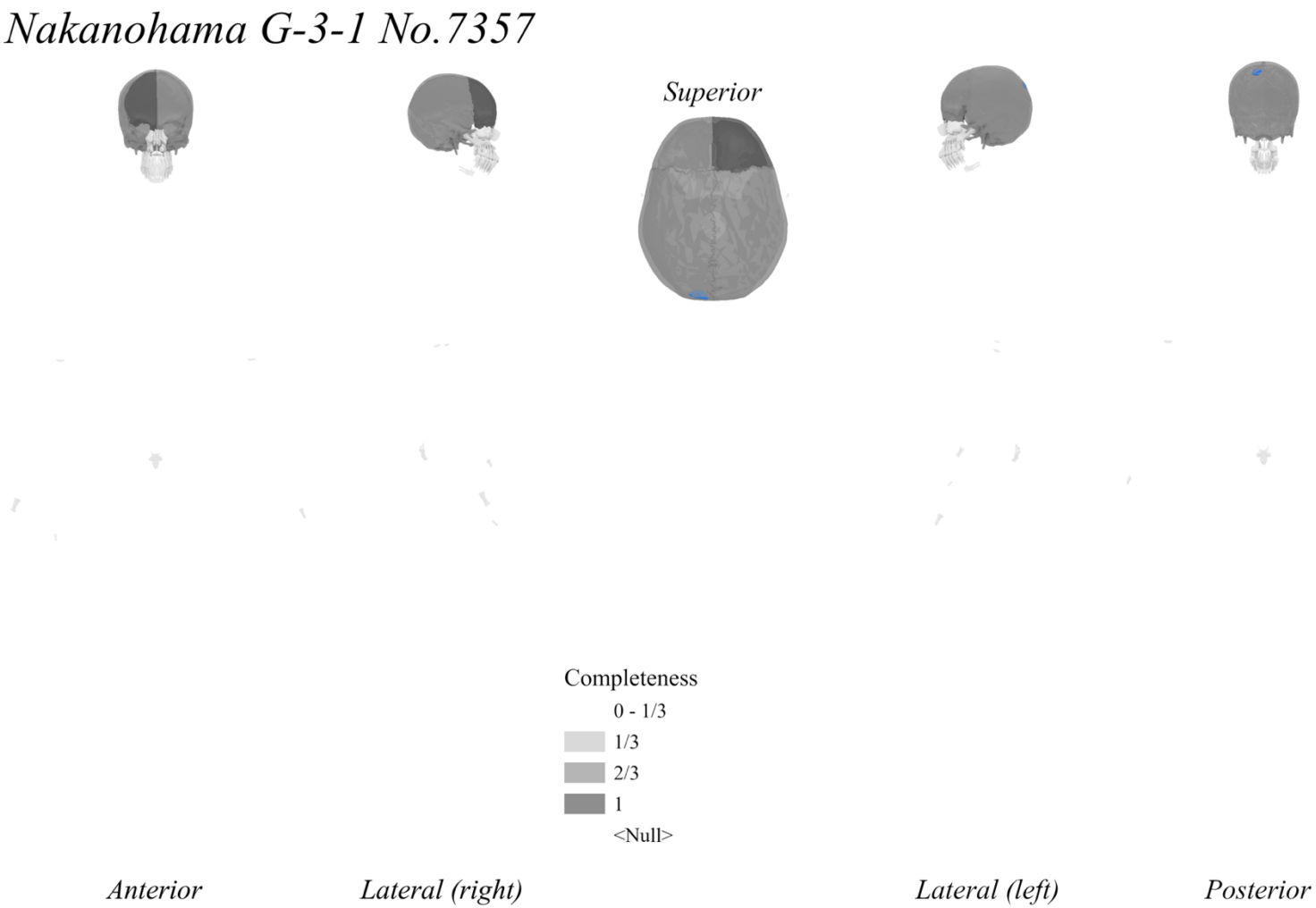


Figure AA37: Nakanohama G-3-1 No.7357 Completeness and Medium–High antemortem trauma.

Nakanohama 藤田 A (Fujita A) | Mid Adult? | Male | Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Low

Timing: Antemortem

Assessment of traumatic aetiology:

A healed fracture line to the anterior-most point of the nasal bones (Figure A271–Figure A272). The suture between them is fused. The area distal to the fracture line is depressed inferiorly and deformed.

Dimensions: 5.1 mm x 5.6 mm



Figure A270: Nakanohama 藤田 A (Fujita A) cranium anterior view showing a healed fracture to the nasal bones.



Figure A271: Nakanohama 藤田 A (Fujita A) close-up of the healed fracture to the nasal bones.

Nakanohama G-3-1-1-その 2 | Mid Adult | Male | Early-Middle Yayoi

Likelihood of traumatic injury: 1. Medium; 2. High

Likelihood of being violence-related: 1. Medium; 2. Low

Timing: Antemortem

Assessment of traumatic aetiology:

1. A healed depression with porosity to the posterosuperior right parietal bone (Figure A273–Figure A274). There is no corresponding lesion on the inner table. There is a small, thin groove in the middle of the depression and extending slightly medially as well. The latter could be a small, healed radiating fracture or it is possible that this represents a semi-sharp force traumatic lesion (i.e. bone was hit with an edged weapon/tool).

2. A healed non-specific fracture to the right fibula (Figure A275). There is minimal porosity and the diaphysis is deformed

Dimensions: 1. 7.0 mm x 8.9 mm and of 1.7 mm deep; 2. 51.0 mm x 24.4 mm



Figure A272: Nakanohama G-3-1-1-その 2 parietal bones superior view showing a depression to the superior right parietal bone.



Figure A273: Nakanohama G-3-1-1-その 2 close-up of the depression to the superior right parietal bone.



Figure A274: Nakanohama G-3-1-1-その 2 right fibula showing a healed fracture to the diaphysis.

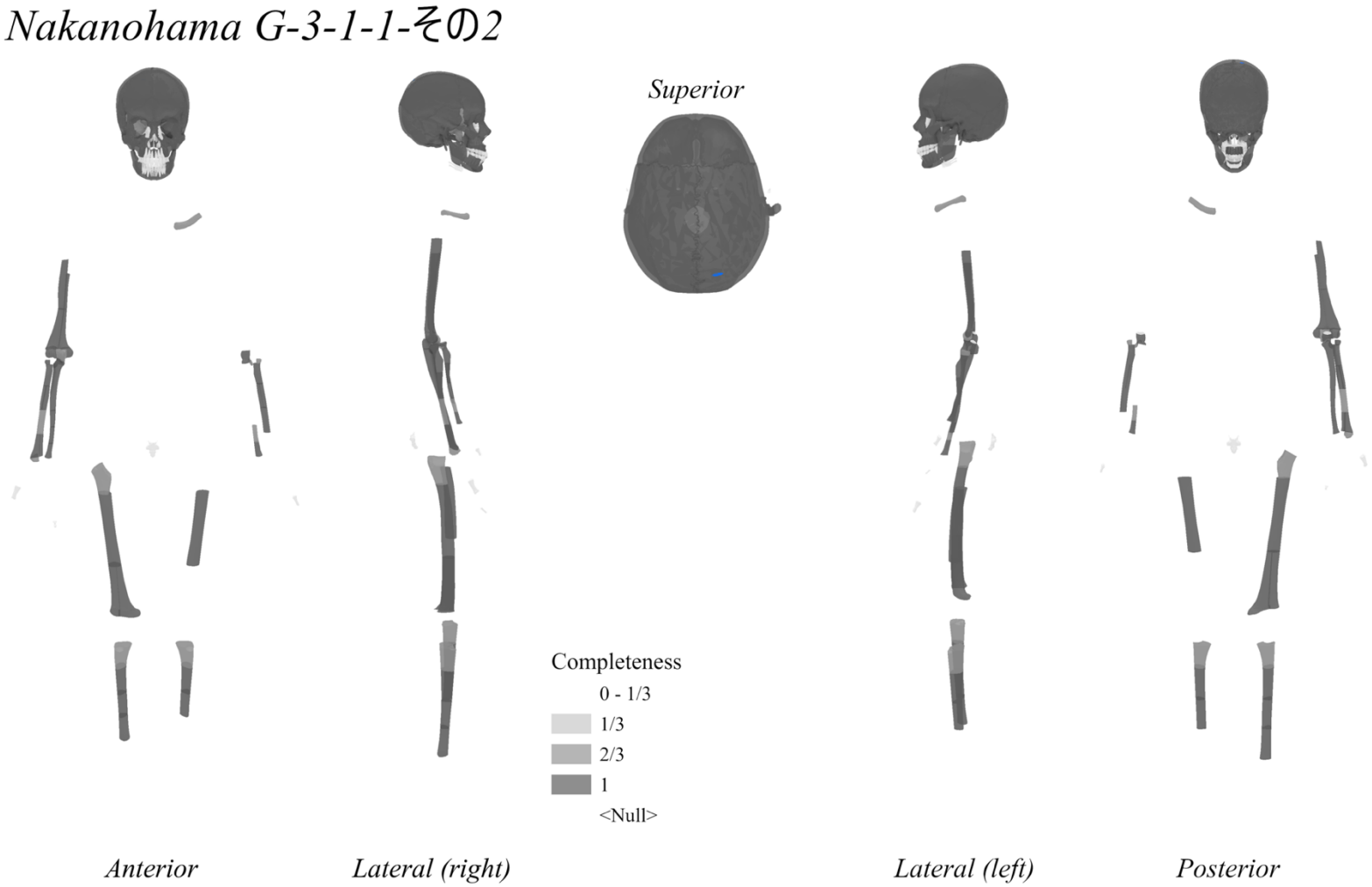


Figure AA38: Nakanohama G-3-1-1-その 2 Completeness and Medium–High antemortem trauma.

Nakanohama G-1-2 No.1 | Adolescent-Yong Adult | Female | Early-Middle Yayoi

Likelihood of traumatic injury: 1. High; 2. High; 3. Low

Likelihood of being violence-related: 1. High; 2. High; 3. N/A

Timing: Perimortem

Assessment of traumatic aetiology:

1. A patinated, sharp linear mark to the superomedial right second rib (Figure A276–Figure A277). There is some postmortem damage to the more anterolateral margin .The linear mark is v-shaped and the medial wall has internal striations. The lateral wall is characterised by Hertizan fracture cones. It is consistent with a chop mark by a metal weapon from behind and above. No signs of healing (i.e. osteoclastic or osteoblastic activity). There are no nearby ribs, vertebrae, clavicle and scapula remain to examine for corresponding lesions.

2. A patinated, sharp linear mark to the anterior left clavicle lateral to the mid-diaphysis (Figure A278–Figure A280). The linear mark is v-shaped, but depositional material is embedded within it (as much as safely could be removed was by the Kyushu U. curator). The lateral margin is sharpest and the medial margin has Hertzian fracture cones and a larger area inferiorly which seems to have been peeled or shaved away as the weapon as removed.

3. Oblique, curving fracture lines on the mid to distal diaphysis of the right tibia (Figure A281–Figure A282). The fracture walls are patinated, but not smooth.

Dimensions: 1. 8.1 mm x 2.6 mm wide and 1.5 mm deep; 2. 10.3 mm x 4.2 mm and 1.1 mm deep



Figure A275: Nakanohama G-1-2 No.1 right second rib superior view showing a linear mark to the medial angle.



Figure A276: Nakanohama G-1-2 No.1 close-up of linear mark to the right second rib (superior is down).



Figure A277: Nakanohama G-1-2 No.1 left clavicle superior view showing the superior tip of a linear mark to the anterior shaft.

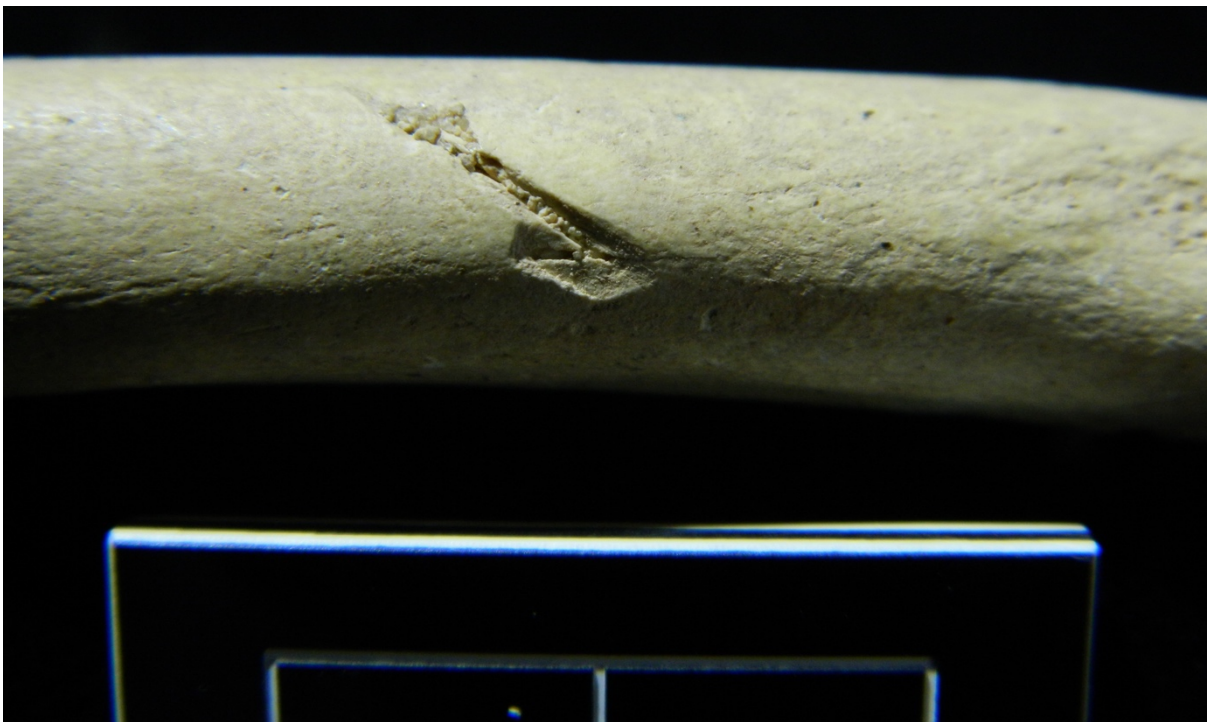


Figure A278: Nakanohama G-1-2 No.1 close-up of the cut mark to the anterior left clavicle.

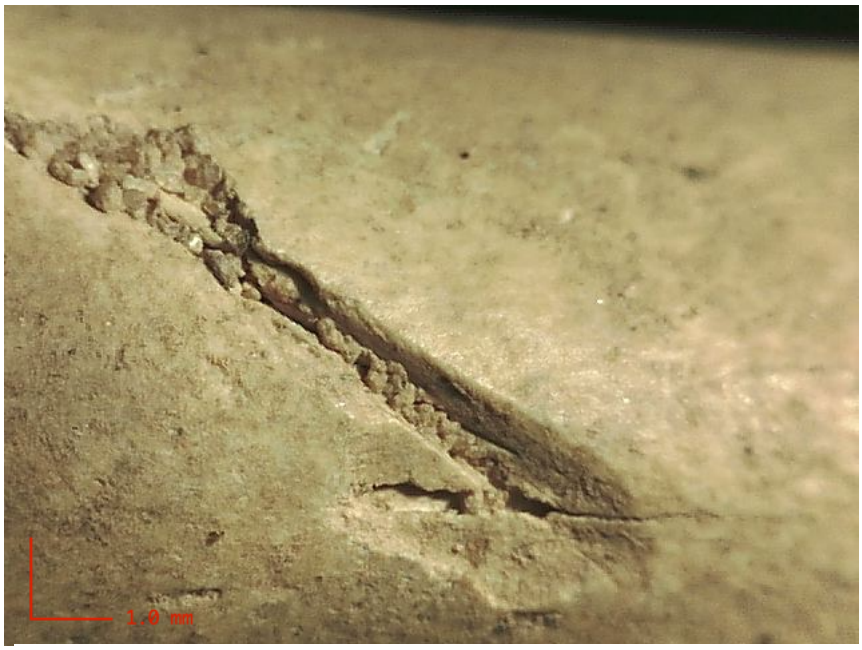


Figure A279: Nakanohama G-1-2 No.1 close-up of the cut mark to the anterior left clavicle.



Figure A280: Nakanohama G-1-2 No.1 right tibia medial view showing oblique fractures.



Figure A281: Nakanohama G-1-2 No.1 close-up of fractures to the right tibia.

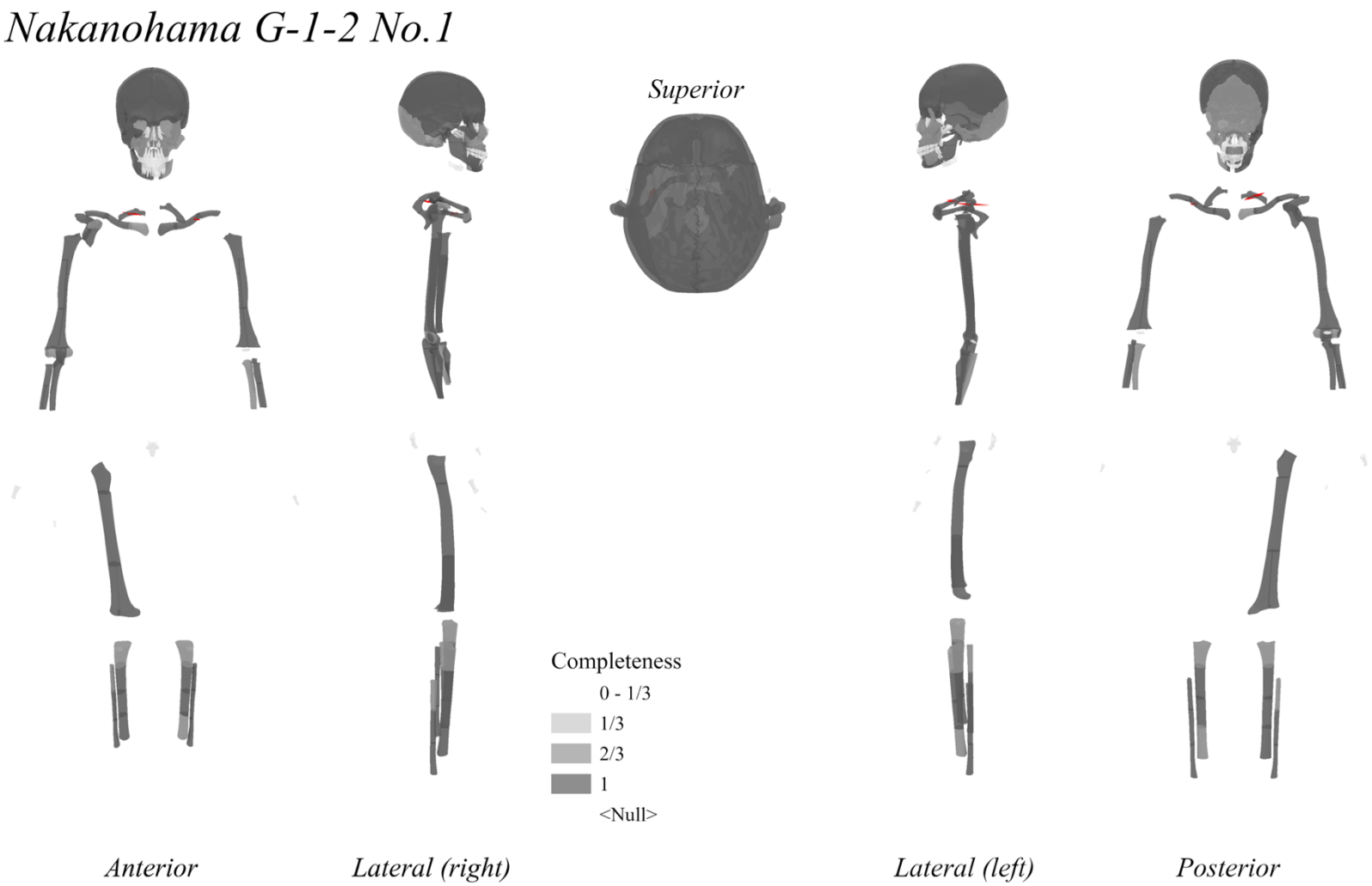


Figure AA39: Nakanohama G-1-2 No.1 Completeness and Medium–High perimortem trauma.

Nakanohama G-1-2 No.2 | Mid Adult | Male | Early-Middle Yayoi

Likelihood of traumatic injury: Low

Likelihood of being violence-related: N/A

Timing: Antemortem

Assessment of traumatic aetiology:

A wide ridge of bone on the medial right clavicle, possibly representing an incomplete fracture (Figure A283–Figure A284). The left clavicle is incomplete and it is not possible to confirm if a corresponding abnormality is present on it as well. No porosity is present.

Dimensions: 13.7 mm x 4.0 mm



Figure A282: Nakanohama G-1-2 No.2 clavicles superior view showing a ridge on the medial right clavicle.



Figure A283: Nakanohama G-1-2 No.2 close-up of the ridge on the right clavicle.

Ōtomo 1-1 | Young-Mid Adult | Male | Late Half of Early Yayoi

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: Low

Timing: Antemortem

Assessment of traumatic aetiology:

The distal-most point of the remaining nasal bones are fused and the right nasal bone is inferiorly depressed distal to a likely healed fracture line (Figure A285–Figure A286). Due to the fragmentation and lack of clear directionality, it was marked as a Low for the second tier.

Dimensions: 3.0 mm x 3.6 mm



Figure A284: Ōtomo 1-1 cranium anterior view showing a healed fracture to the nasal bones.



Figure A285: Ōtomo 1-1 close-up of the healed fracture to the nasal bones.

Ōtomo 2-1 | Mid Adult | Male | End of the Early Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

A deformity to the middle of the nasal bones (Figure A287–Figure A288). The left nasal bone is depressed medially and the right bulges out laterally in the same area. The nasal suture is fused from this point distally. The distal-most point of the nasal bones is depressed inferiorly and to the left.

Dimensions 14.9 mm x 13.4 mm



Figure A286: Ōtomo 2-1 cranium anterior view showing a healed fracture to the nasal bones.

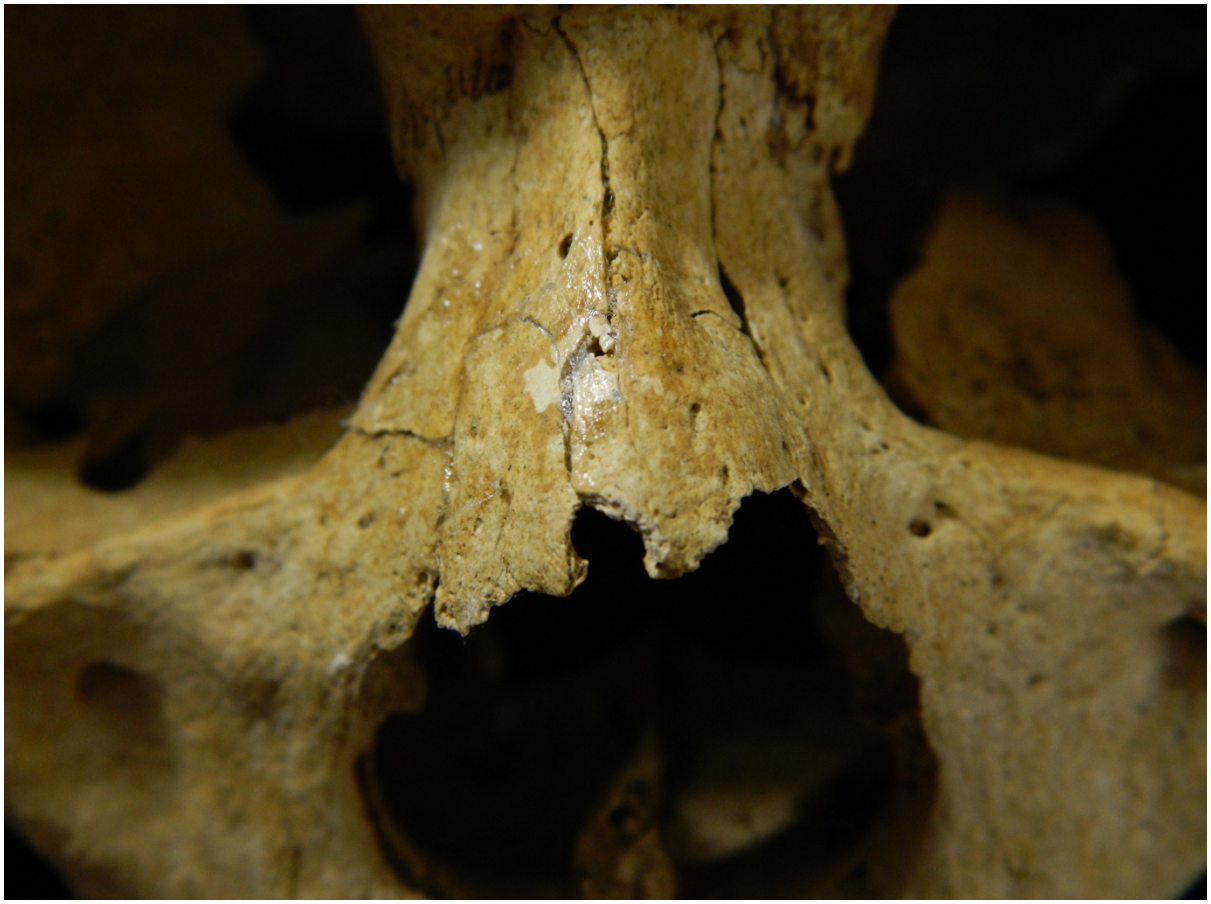


Figure A287: Ōtomo 2-1 close-up of the healed fracture to the nasal bones.

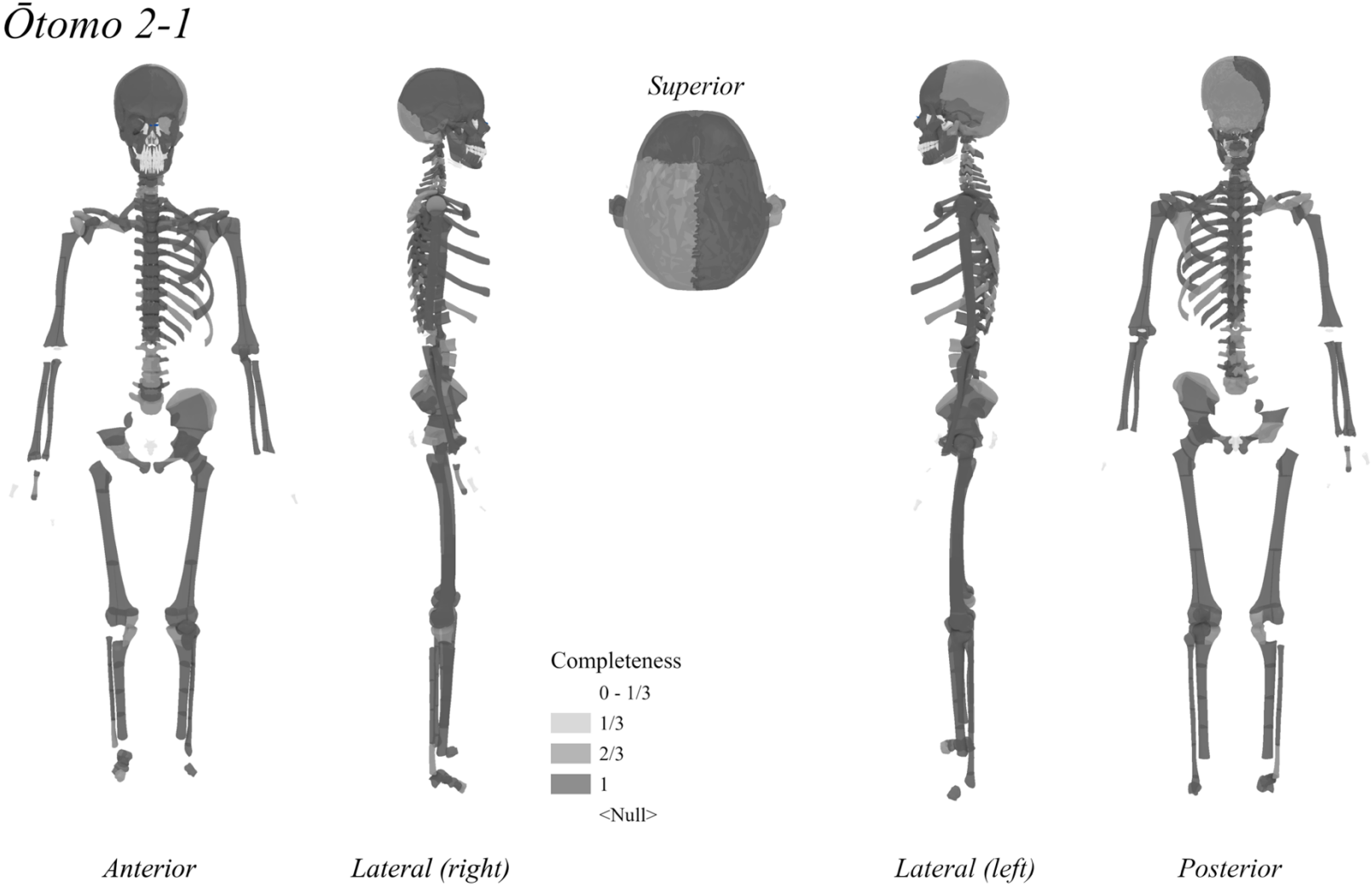


Figure AA40: Ōtomo 2-1 Completeness and Medium–High antemortem trauma.

Ōtomo 6 | Mid Adult | Male | Initial Yayoi

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

An oval-shaped depression to the superior right side of the frontal bone (Figure A289–Figure A290). There is no corresponding lesion on the inner table. The lateral portion of the depression is obscured by post-mortem damage. The margins are sloping and porosity is present within it.

Dimensions: 13.5 mm x 3.5 mm (due to how narrow the depression is and because of the postmortem damage, depth could not be taken)



Figure A288: Ōtomo 6 frontal bone anterior view showing an oval depression to the superior right side.



Figure A289: Ōtomo 6 close-up of the oval depression to the superior right side of the frontal bone.

Ōtomo 6

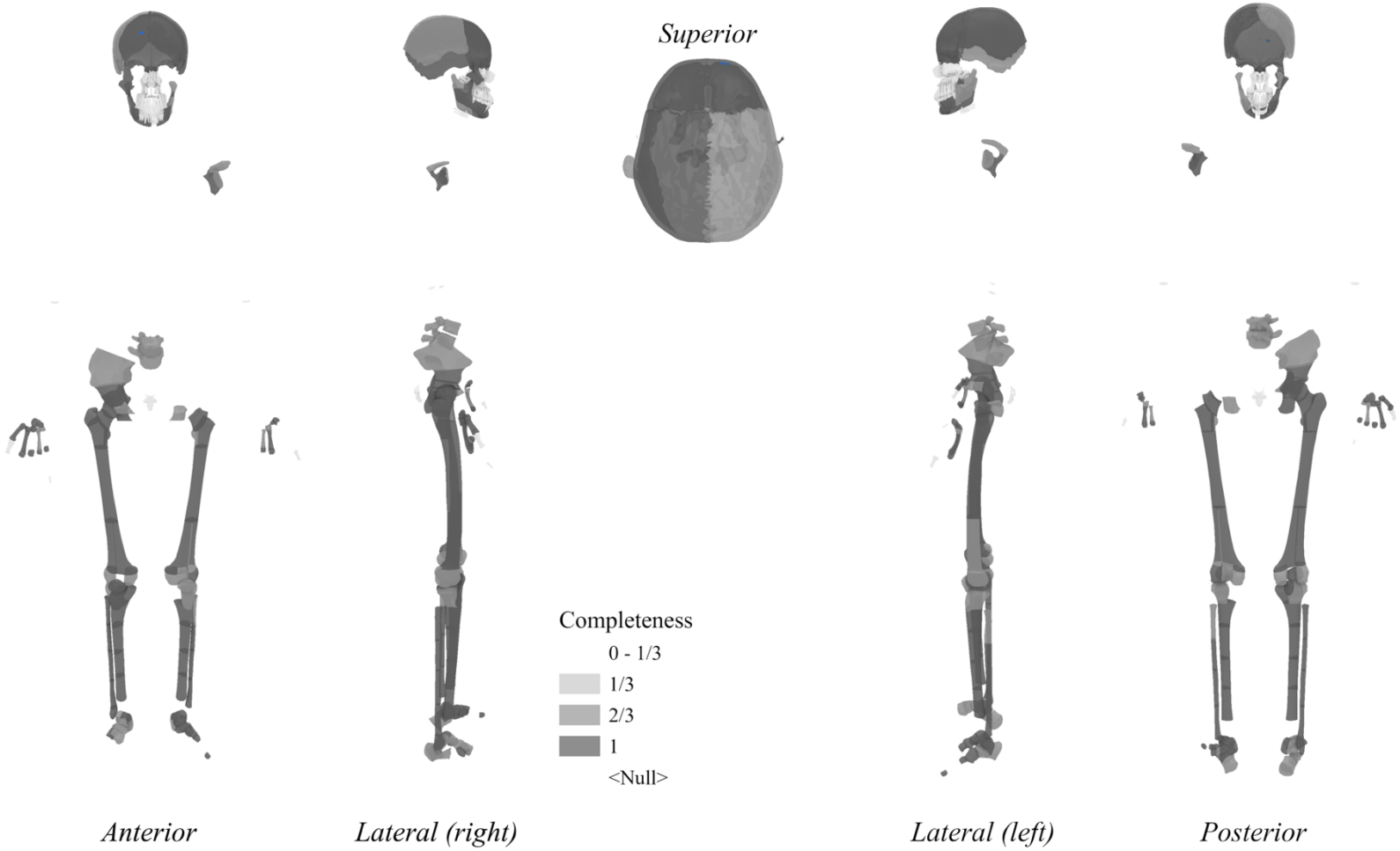


Figure AA41: Ōtomo 6 Completeness and Medium–High antemortem trauma.

Ōtomo SK35 | Mid Adult | Male | Early Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

Two semi-circular ridges of bone on the left nasal bone and a v-shaped ridge on the right nasal bone. Both nasal bones are deformed, depressed inferiorly and to the right, distal to these points (Figure A291–Figure A293). The nasal suture is partially fused distal to the fracture line

Dimensions: 8.1 mm x 13.1 mm



Figure A290: Ōtomo SK35 cranium anterior view showing a healed fracture to both nasal bones.



Figure A291: Ōtomo SK35 close-up of healed fractures to the left nasal bone.

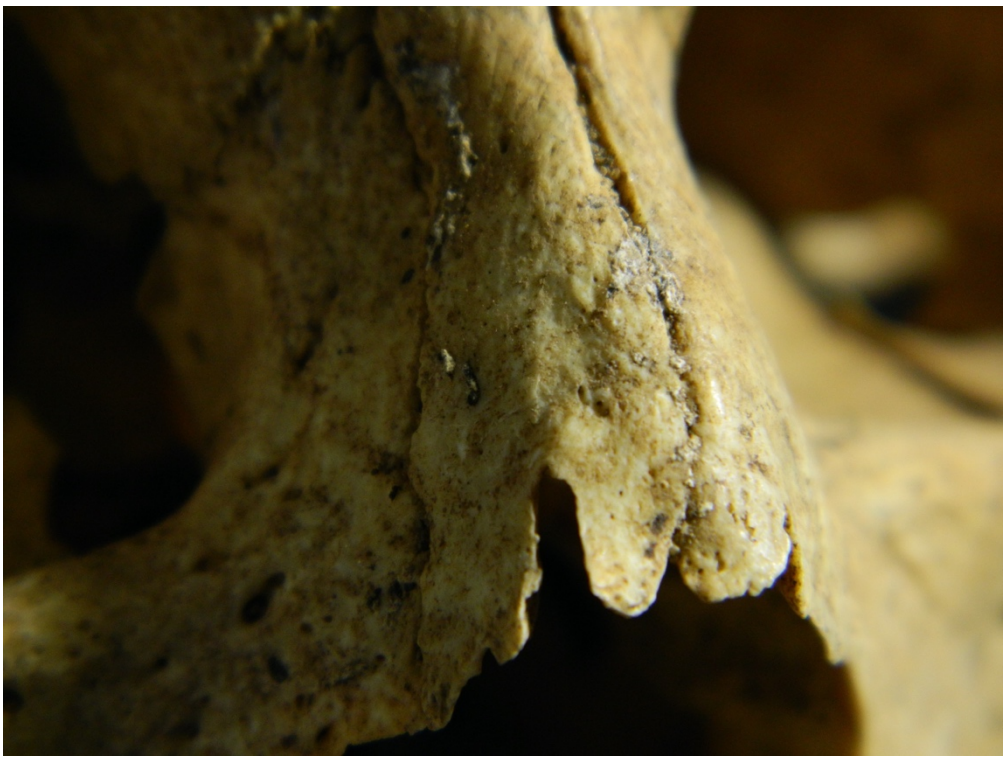


Figure A292: Ōtomo SK35 close-up of the healed fracture to the right nasal bone.

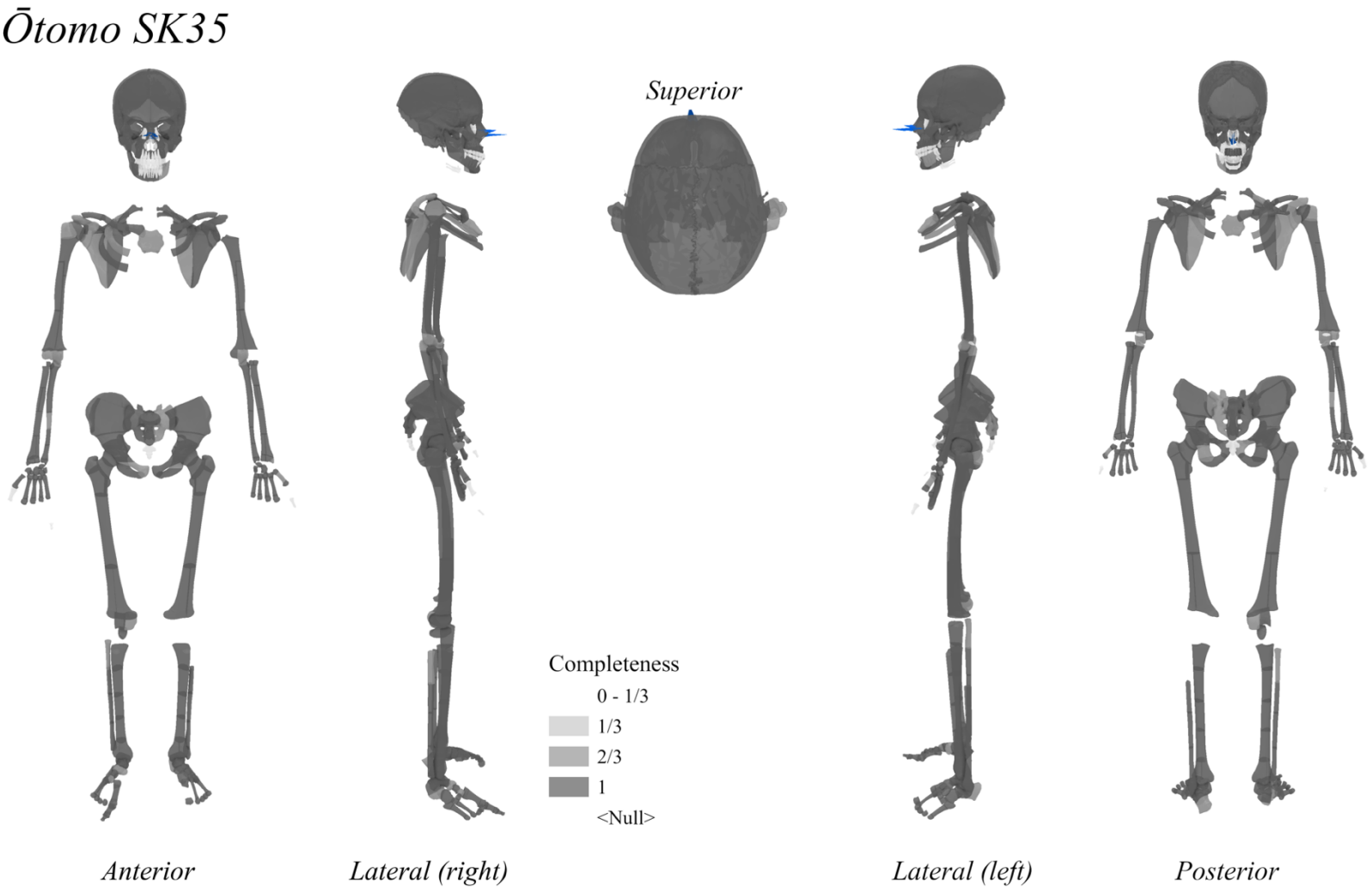


Figure AA42: Ōtomo SK35 Completeness and Medium–High antemortem trauma.

Ōtomo K1 | Mid Adult | Female | End of the Early Yayoi

Likelihood of traumatic injury: Low

Likelihood of being violence-related: N/A

Timing: Antemortem

Assessment of traumatic aetiology:

A ridge of bone on the anterior distal diaphysis of the right radius, but the ridge is shallow and there is no notable deformation (Figure A294).

Compression fractures present on the lumbar vertebrae.



Figure A293: Ōtomo K1 distal right radius anterior view showing a ridge of bone on the diaphysis.

Shibu 3 | Young Adult | Female | Yayoi

Likelihood of traumatic injury: 1. Medium; 2. Low; 3. Medium; 4. Medium; 5–6. High; 7. Medium; 8–10a. High; 10b. Medium

Likelihood of being violence-related: 1. High; 2. N/A; 3–10b. High

Timing: Perimortem

Assessment of traumatic aetiology:

1. A v-shaped linear mark to the superolateral left side of the frontal bone, possibly representing a cut mark (Figure A295–Figure A296). The surface condition of this fragment is poor, which obscures the patination of the mark, but intact cortical bone does correspond to the mark which is patinated. Potential Hertzian fracture cones are also present.

2. A u-shaped linear mark on the dorsal surface of the left scapula (Figure A297–Figure A298). The medial end is destroyed by postmortem damage. There is no similar lesion on the right scapula. Given the shape of the mark and its only partial completion, it was not convincingly consistent with a traumatic injury.

3. At least one v-shaped and patinated linear mark to the anteromedial left humerus, inferior to the neck (Figure A299–Figure A301). There is some postmortem damage obscuring it, particularly through the middle. There are two linear marks interior to it, but these are not as clear.

4. A small, patinated linear mark with sharp margins to the anteromedial diaphysis of the left ulna (Figure A302–Figure A303).

5. A thin, patinated linear mark which cuts inferiorly through the left lamina of a thoracic vertebra (Figure A304–Figure A306).

6. A deep, v-shaped, patinated linear mark to the right lamina of thoracic vertebra (Figure A307). There is some postmortem damage to its margins and walls.

7. A sharp, patinated linear mark to the inferomedial shaft of the right tenth rib (Figure A308–Figure A310). The posterior margin is especially sharp with a wider wall on the anterior. There

is postmortem damage inferiorly. Note that the original excavation photo of Shibu 3 shows a stone arrowhead near the ninth rib, but not embedded in said rib (Nara Prefecture Archaeological Institute of Kashihara Museum 2014). It is reasonable to think that this arrowhead could have grazed the tenth rib and not have been removed from the chest before burial (Figure A311).

8. A linear mark which cuts through the inferior mid-shaft of the left right rib (Figure A312–Figure A313). The wall of the cut is striated, consistent with a metal weapon. Unfortunately, the rest of the cut is absent due to postmortem damage.

9. A sharp, patinated, and v-shaped linear mark to the inferior mid-shaft of the left ninth rib (Figure A314–Figure A315). Postmortem damage is present on the inferior aspect.

10a. A series of patinated and sharp linear marks to the proximal anterior diaphysis of the left femur (Figure A316–Figure A317). Postmortem damage to the cortical bone does obscure parts of the linear marks, but particularly the two larger cut marks remain clear and are v-shaped. The largest cut mark (in the centre) has a sharp distal margin and the proximal margin has Hertzian fracture cones.

10b. A small, patinated linear mark to the anterior mid-diaphysis of the left femur (Figure A319–Figure A318). Postmortem damage obscures its lateral half, but what remains is v-shaped and clear.

Dimensions: 1. 10.5 mm x 0.8 mm; 2 . 4.9 mm x 0.2 mm; 3. 7.0 mm x 0.2 mm; 4. 2.7 mm long (too thin to measure); 5. 4.3 mm long (too thin to measure); 6. 15.9 mm x 2.9 mm; 7. 7.0 mm x 2.2 mm; 8. 15.9 mm x 1.5 mm; 9. 7.2 mm long (too thin to measure); 10a. Largest cut is 18.4 mm x 0.9 mm and second largest (distal to the largest) is 11.6 mm long; 10b. 3.4 mm x 0.2 mm

Previously Reported In:#6 and 10 in Oyabu (2006); #9 in Padgett (2020). Additionally, Padgett reports an embedded lithic projectile point to the medial epicondyle of the left femur (Possible location is indicated in Fig. A316).



Figure A294: Shibu 3 frontal bone left side (near the coronal suture) showing a v-shaped linear mark.



Figure A295: Shibu 3 close-up of the linear mark to the frontal bone.



Figure A296: Shibu 3 left scapula dorsal view showing a linear mark.



Figure A297: Shibu 3 close-up of the u-shaped linear mark on the left scapula.



Figure A298: Shibu 3 left humerus medial view showing a linear mark.

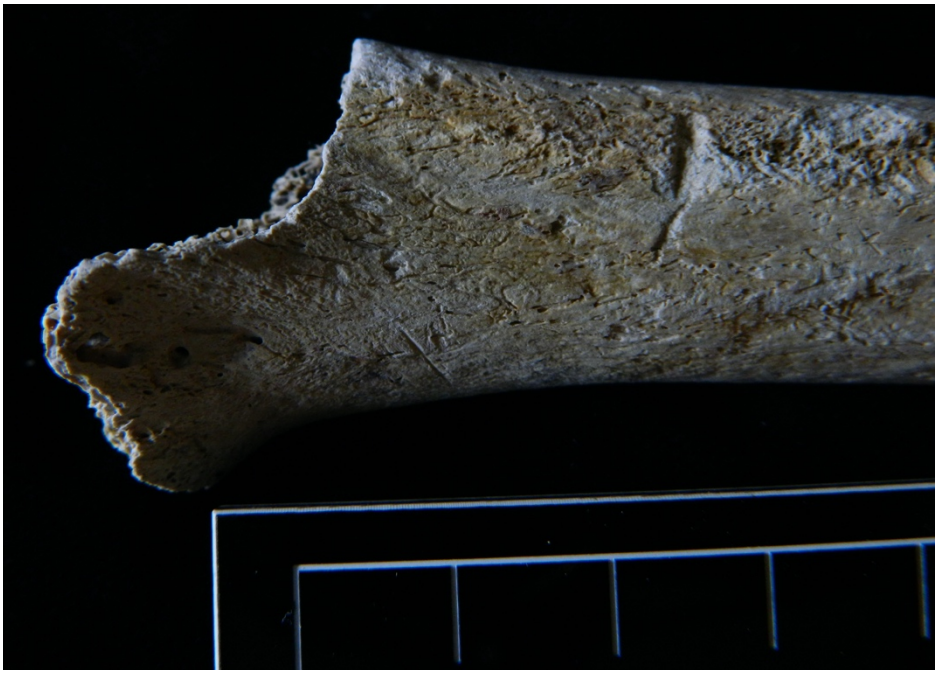


Figure A299: Shibu 3 close-up of linear mark inferior to the neck of the left humerus.



Figure A300: Shibu 3 close-up of linear marks to the left humerus.



Figure A302: Shibu 3 left ulna anterior diaphysis showing a linear mark.



Figure A301: Shibu 3 close-up of the linear mark to the left ulna



Figure A303: Shibu 3 thoracic vertebra posterior view showing a linear mark.

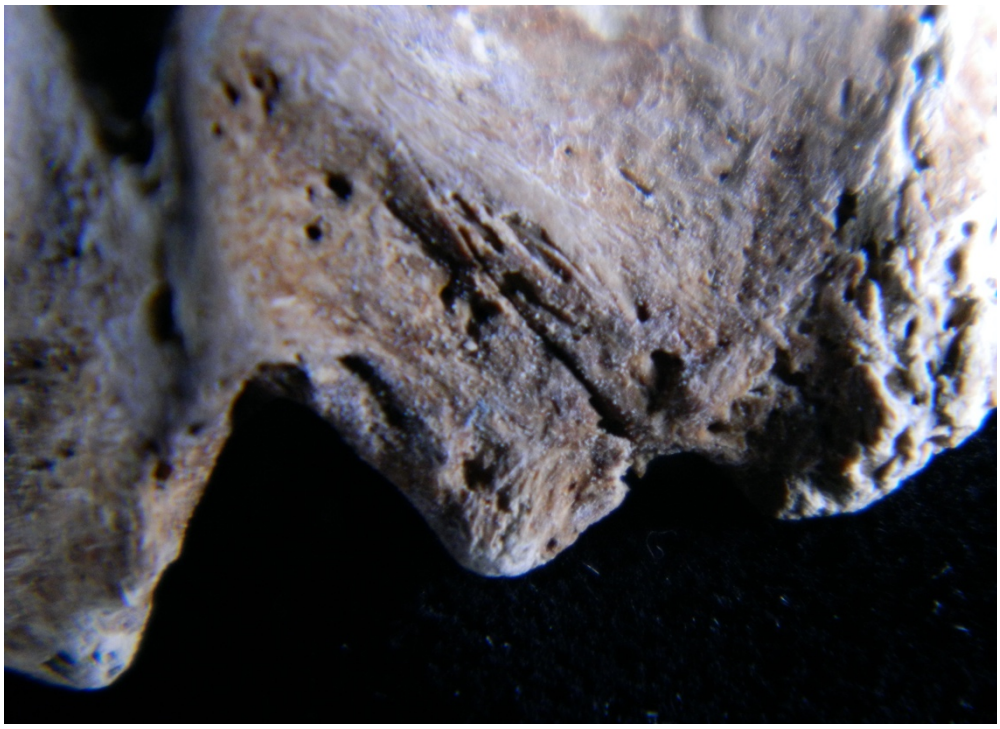

Figure A304: Shibu 3 close-up of the linear mark to the left lamina of a thoracic vertebra.



Figure A305: Shibu 3 close-up inferior view of the linear mark to the left lamina of a thoracic vertebra.



Figure A306: A thoracic vertebra posterior view showing a deep cut mark to the right lamina.



Figure A307: Shibu 3 right tenth rib medial view showing a linear mark to the inferior shaft.

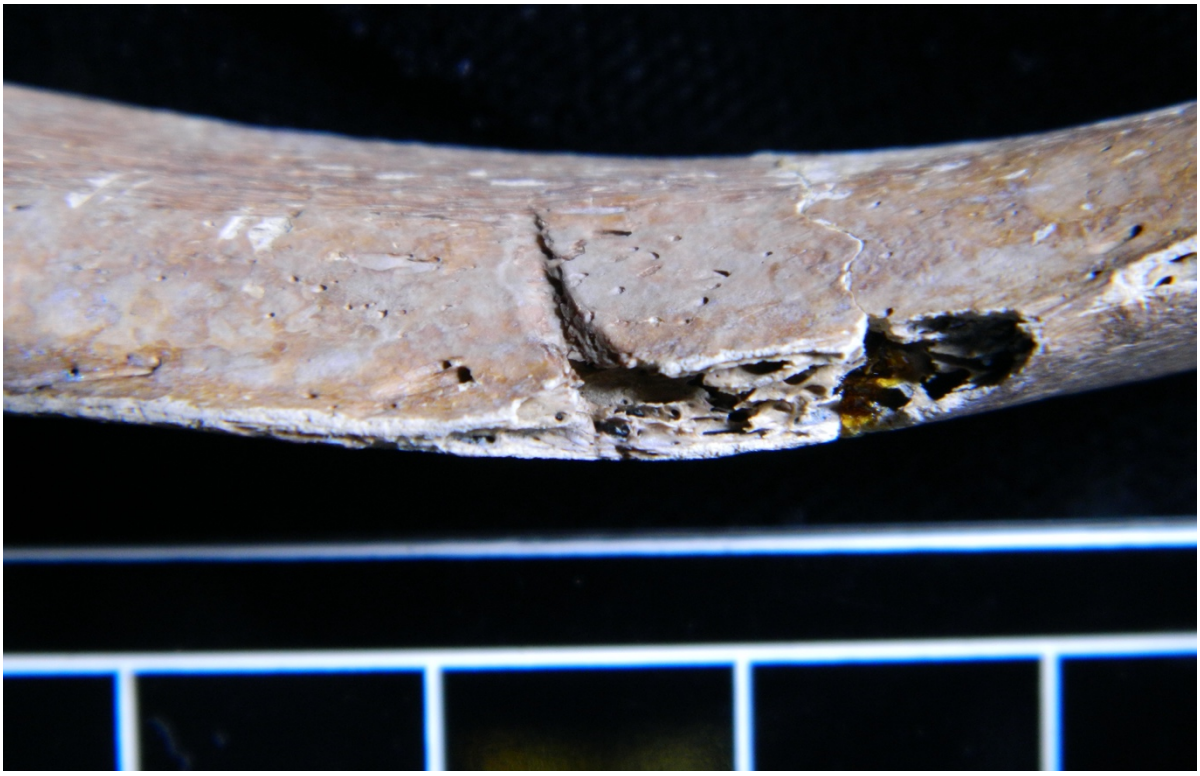


Figure A308: Shibu 3 close-up inferior view of linear mark to the right tenth rib.



Figure A309: Shibu 3 close-up medial view of linear mark to the right tenth rib.

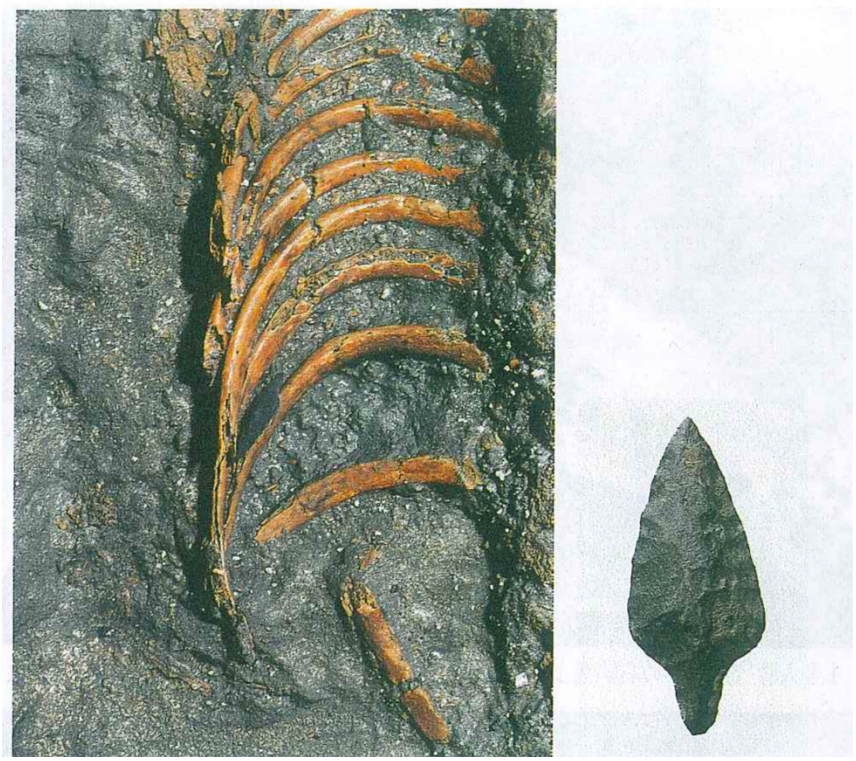


Figure A310: Shibu 3 excavation photograph showing a stone arrowhead (and arrowhead detail) in the right rib cage. Images from Nara Prefecture Archaeological Institute of Kashihara Museum (2014:61).



Figure A311: Shibu 3 left seventh rib anterolateral view showing a sharp cut mark to the inferior mid-shaft.

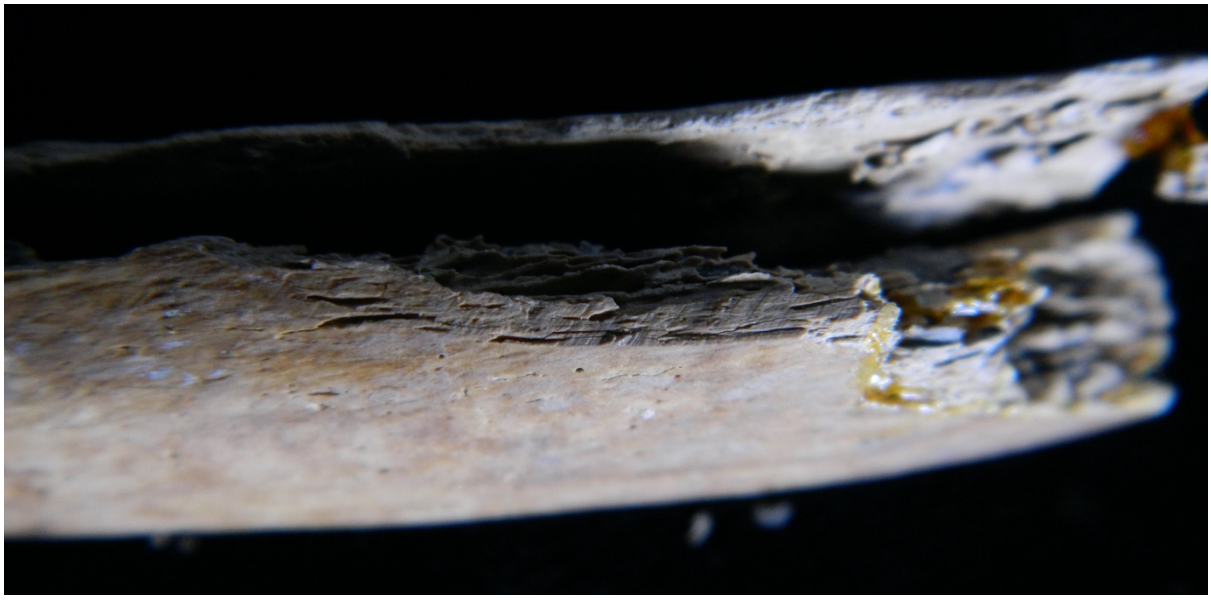


Figure A312: Shibu 3 close-up of cut mark to the inferior left seventh rib. Note the clear striations on the wall of the cut.

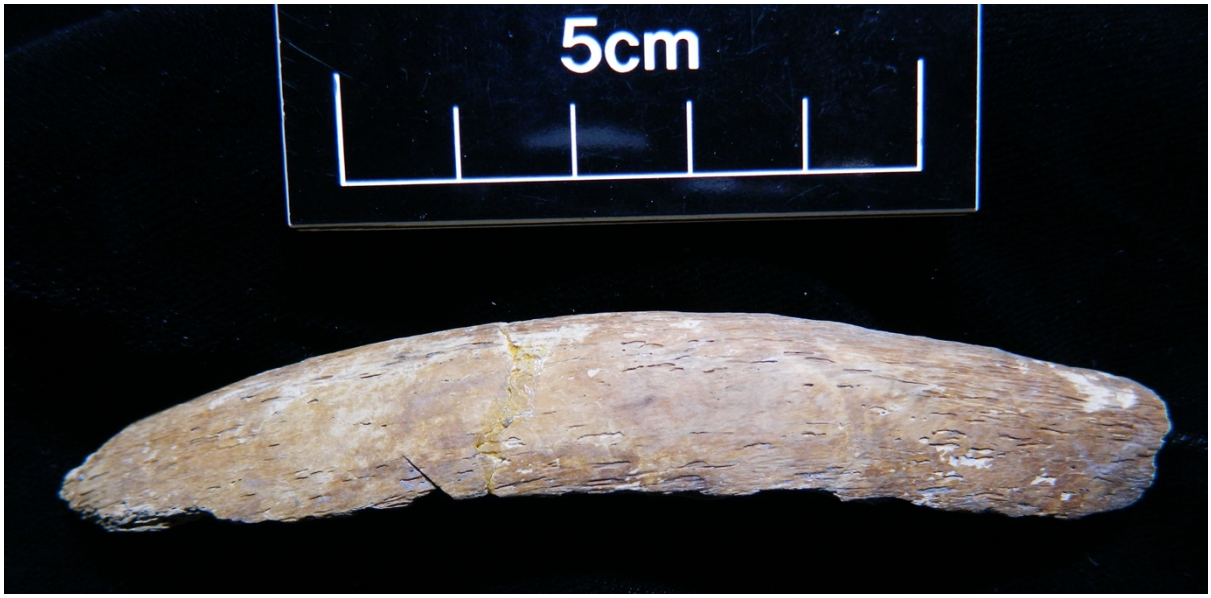


Figure A313: Shibu 3 left ninth rib anterolateral view showing a sharp cut mark to the inferior mid-shaft.



Figure A314: Shibu 3 close-up of the cut mark to the inferior midshaft of the inferior left ninth rib.

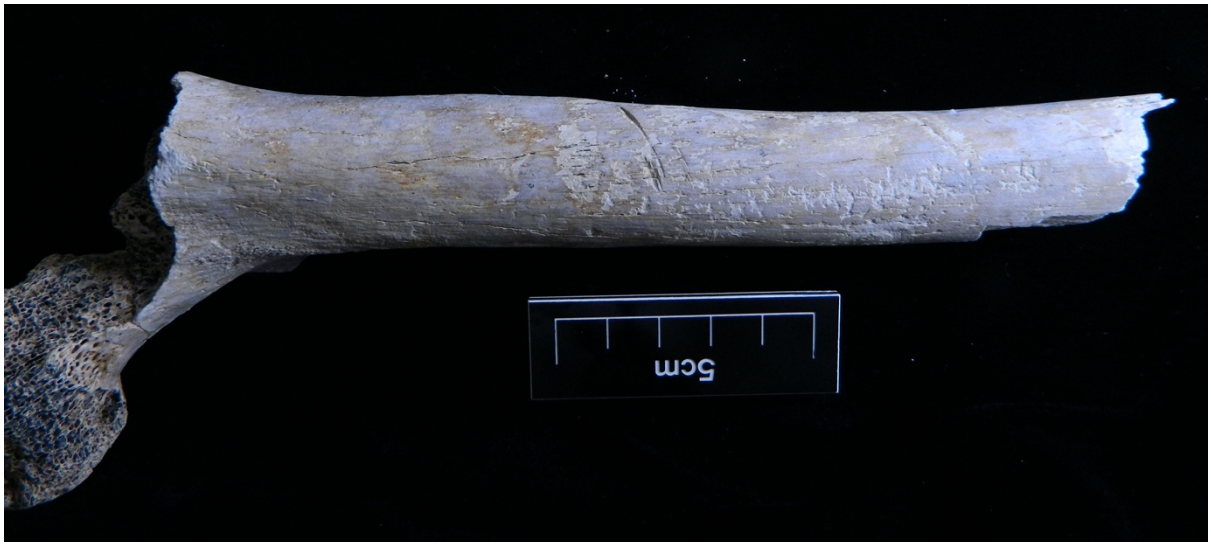


Figure A315: Shibu 3 left femur anterior view showing a series of cut marks to the proximal diaphysis.



Figure A316: Shibu 3 close-up of cut marks to the proximal diaphysis of the left femur.



Figure A317: Shibu 3 distal left femur anterior view showing a cut mark to the mid-diaphysis and the probable location of the embedded projectile point reported by Padgett (2020).



Figure A318: Shibu 3 close-up of cut amrk to the left femur anterior mid-diaphysis.

Shibu 3

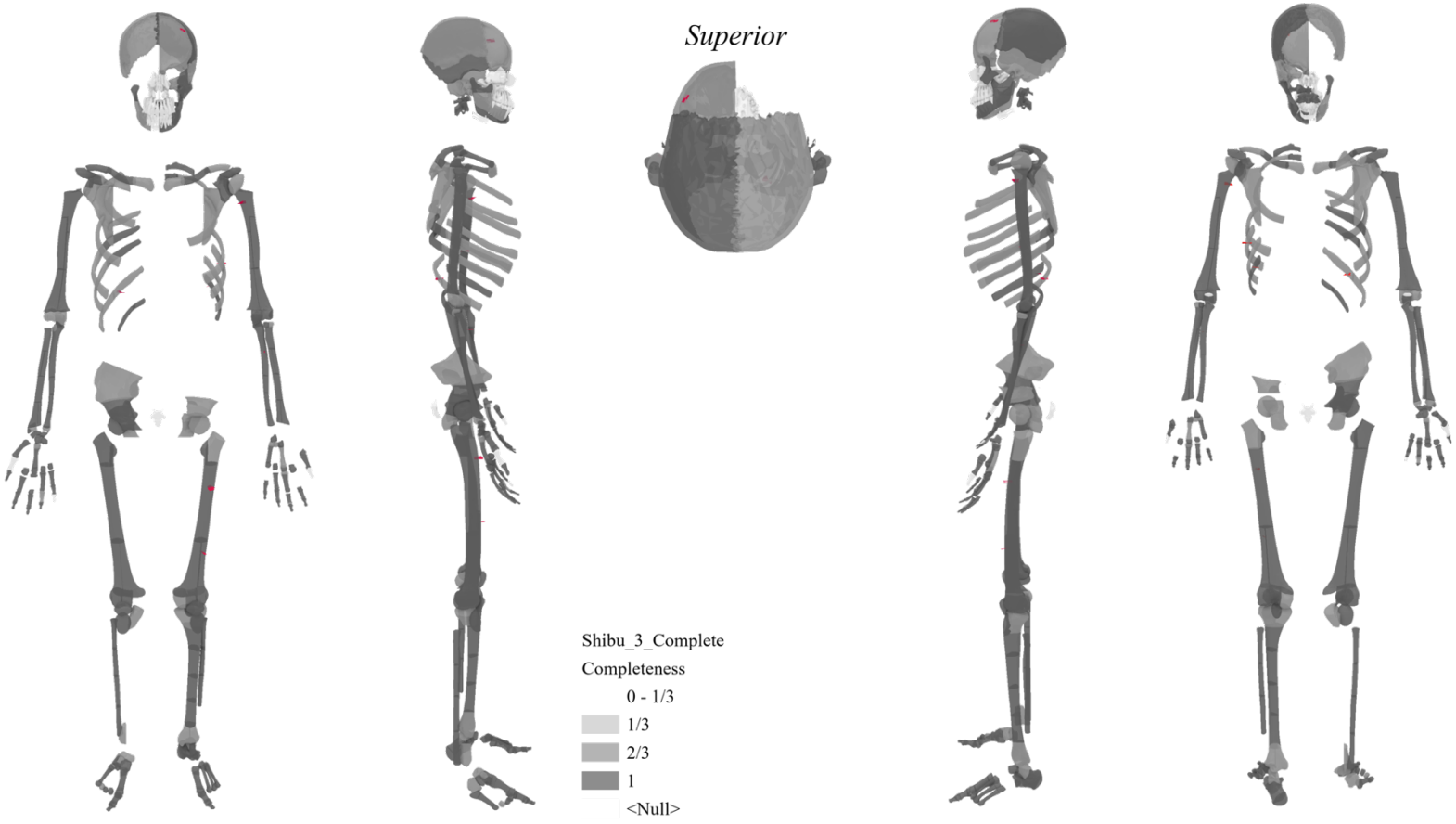


Figure AA43: Shibu 3 Completeness and Medium–High antemortem trauma, excluding #5 and 6 as the particular thoracic vertebrae affected could not be identified.

Shibu 4 | Young Adult | Male | Yayoi

Likelihood of traumatic injury: 1. Medium; 2. Medium; 3. Medium; 4. High; 5. Medium; 6. Low; 7–9. Medium; 10–11. High

Likelihood of being violence-related: 1–5. High; 6. N/A; 7–8. High; 9. Medium; 10–11. High

Timing: Perimortem

Assessment of traumatic aetiology:

1. A patinated fracture to the lateral superciliary arch of the right frontal bone (Figure A320). The inferior fracture margin is particularly sharp and smooth, but postmortem damage to the bone is significant.

2. A sharp, v-shaped linear mark on the medial left patella (Figure A321–Figure A322). Postmortem damage and weathering to the area is significant, but the patination is consistent with this in the cut.

3. A sharp, patinated linear mark on the dorsal glenoid fossa of the right scapula (Figure A323–Figure A324). The defect is v-shaped and thin. It extends onto the ventral surface as well. Hertzian fracture cones can be seen on the margins of the cut. Postmortem damage has obscured the more dorsal part of the lesion. See #5 as well.

4. A deep and sharp linear mark to the on the lateral border of the left scapula, extending ventrally (Figure A325). The cut is patinated and v-shaped. There is some postmortem damage laterally.

5. A patinated linear mark to the head of the right humerus (Figure A326–Figure A327). The lesion has a sharp margin superiorly and possible Hertzian fracture cones inferiorly. If this is a cut mark by a metal blade the location of it is abnormal, but anatomically possible. Considering the corresponding lesion to the glenoid fossa of the right scapula (#3), one can posit that the most reasonable way for a blade to have made such a mark is for the arm to have been elevated superiorly (abducted) and rotated anteriorly, exposing the head of the humerus and glenoid fossa more easily. This could possibly be achieved when raising one's arm in defence, covering

the head, from an attack to the side or back. Given the fracture to the right side of the frontal bone, this is quite plausible.

6. A smooth, patinated fracture to the dorsal right hamate (near the articular with the triquetral) (Figure A328–Figure A329).

7. A shallow linear mark on the superior shaft of the right clavicle bone near the sternal end (Figure A330–Figure A331). The defect is patinated and v-shaped, but there is postmortem damage to the surface of the bone, along with some depositional material, which partially obscures it. Possible Hertzian fracture cones can be seen on the medial margin.

8. A patinated fracture to the right transverse process of the third lumbar vertebra (Figure A332–Figure A333). The superior portion margin is particularly smooth and it possibly is the result of a cut through the bone. Some postmortem damage obscures the fracture anteriorly.

9. A smooth, patinated fracture to the superior shaft of the left fourth rib (Figure A334–Figure A335). Postmortem damage is present medially. No striations can be seen on the wall of the fracture.

10. A sharp and deep patinated linear mark on the lateral right ilium (Figure A336–Figure A337). Hertzian fracture cones are present on the margins of the cut. The anterior margin of the cut is sharpest.

11a. A sharp and deep, but thin patinated linear mark to the posterolateral left ilium (Figure A338–Figure A339). Hertzian fracture cones are present along the margins of the cut. There is some indication of a triangular edge in the middle of the superior margin.

11b. A deep, patinated linear mark with an obvious triangular shape to the middle of the margins (Figure A338 and Figure A340–Figure A341). Striations can be seen in the margins, along with Hertzian fracture cones. The direction of this appears to be more consistent with a stab than a slice.

Dimensions: 1. 28.4 mm x 14.1 mm; 2. 13.2 mm x 1.5 mm; 3. 7.1 mm long; 4. 14.0 mm x 1.9 mm and 3.2 mm deep; 5. 11.7 x 2.2 mm; 6. 11.6 mm x10.9 mm; 7. 6.5 mm x 0.8 mm; 8. 10.1

mm x 13.4 mm; 9. 12.0 mm x 4.0 mm; 10. 11 mm x 2.8 mm; 11a. 20.9 mm x 0.4 mm; 11b. 16.7 mm x 0.6 mm excluding the triangular aspect, which is 4.1 mm x 3.0 mm

Previously Reported In: #1, 4, 8, 10, and 11 in Oyabu (2006); #7 in Padgett (2020). Padgett also reports a SFT to the proximal left femur

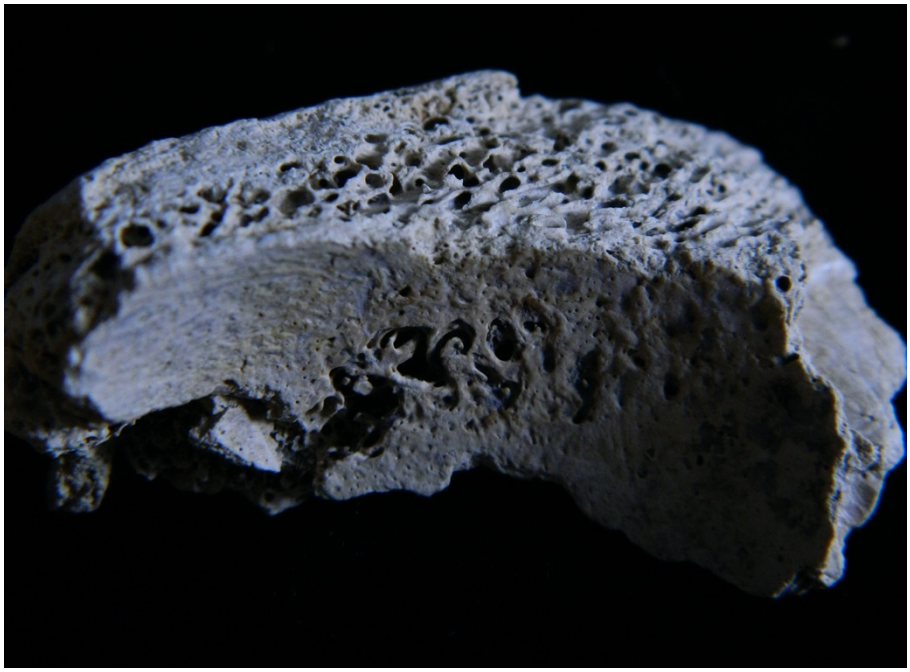


Figure A319: Shibu 4 fragment of the right lateral superciliary arch of the frontal bone showing a fracture.



Figure A320: Shibu 4 left patella anterior view showing a linear mark to its medial aspect.



Figure A321: Shibu 4 close-up of a possible cut mark to the left patella .



Figure A322: Shibu 4 right scapula lateral view showing a cut mark to the dorsal glenoid fossa.



Figure A323: Shibu 4 close-up of the cut mark to the glenoid fossa of the right scapula.


Figure A324: Shibu 4 left scapula showing a deep cut mark to the lateral border.

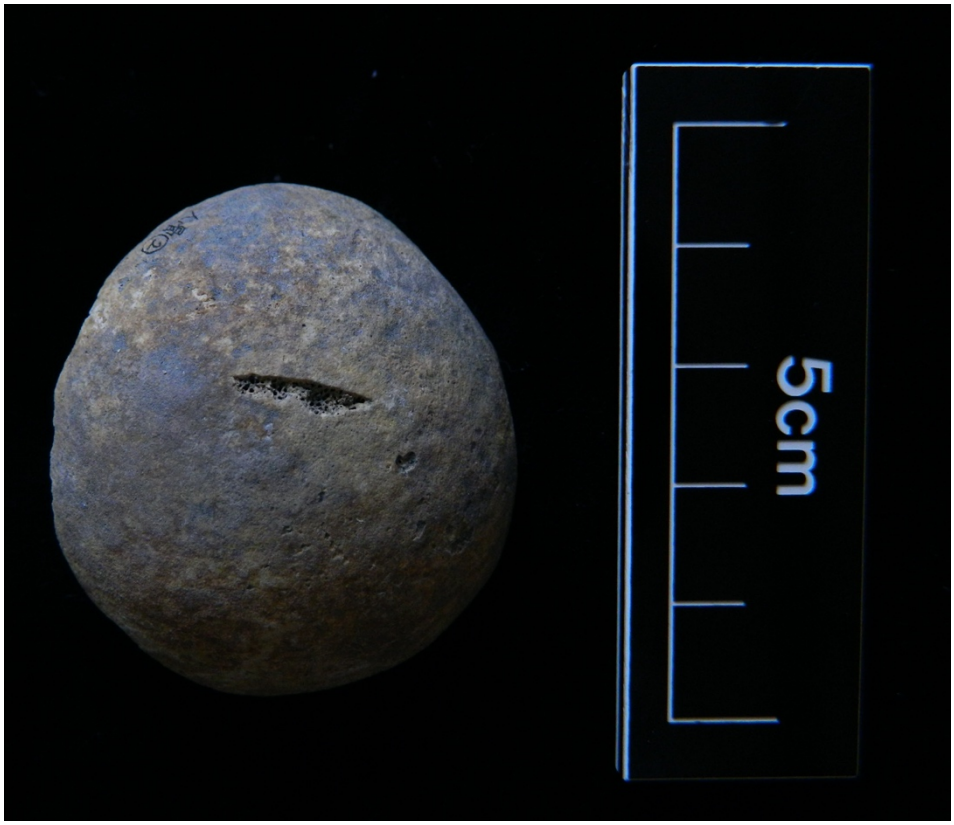


Figure A325: Shibu 4 right humeral head showing a linear mark.



Figure A326: Shibu 4 close-up of the linear mark on the right humeral head.

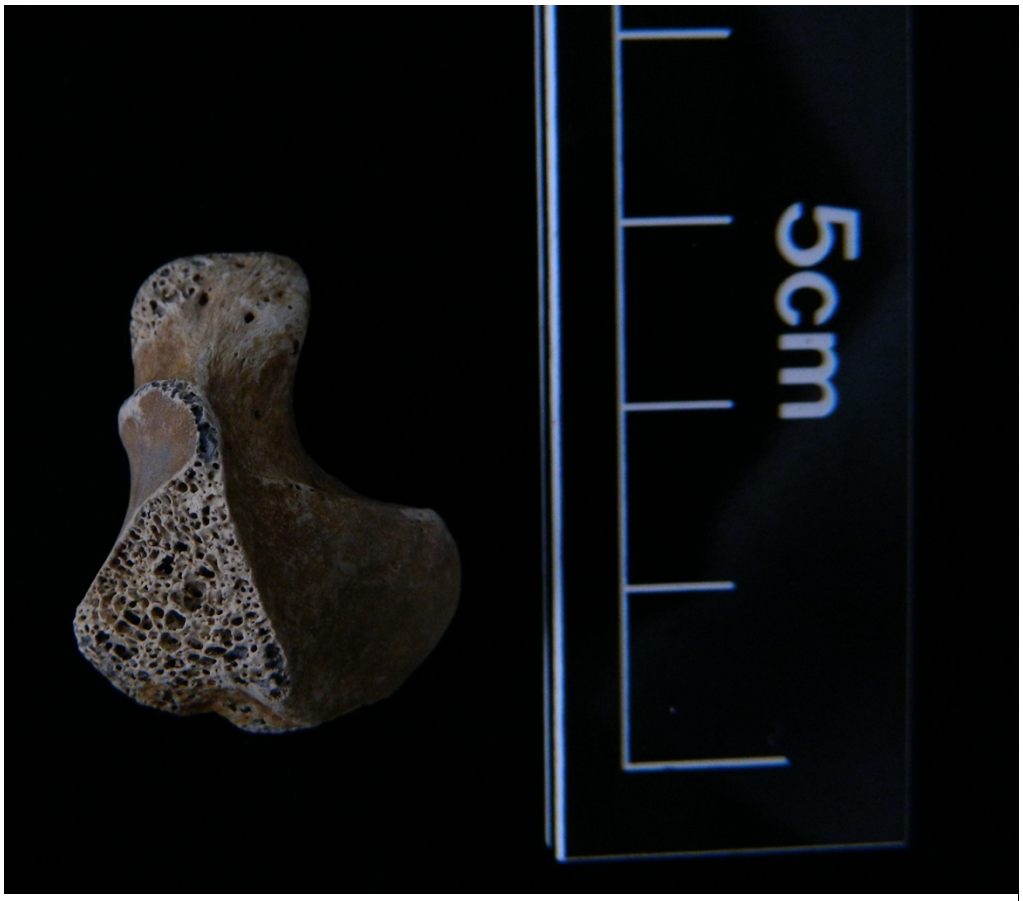


Figure A328: Shibu 4 right hamate view from the triquetral showing a smooth fracture line.



Figure A327: Shibu 4 close-up of the fracture to the right hamate.



Figure A329: Shibu 4 right clavicle superior view showing a linear mark on the shaft.



Figure A330: Shibu 4 close-up of the linear mark to the superior shaft of the right clavicle.



Figure A331: Shibu 4 third lumbar vertebra posterior view.



Figure A332: Shibu 4 close-up of the likely cut mark through the right transverse process of the third lumbar vertebra.



Figure A333: Shibu 3 left fourth rib superior view showing a fracture to the superior shaft near the sternal end.



Figure A334: Shibu 3 close-up of the fracture to the superior shaft of the left fourth rib.

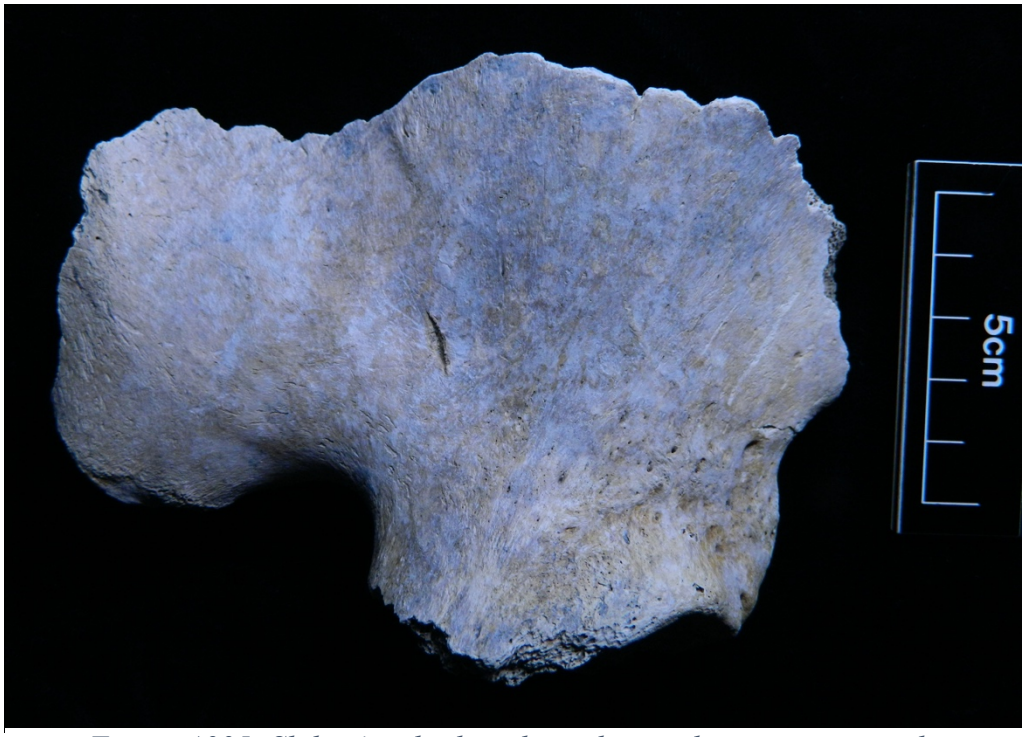


Figure A335: Shibu 4 right ilium lateral view showing a cut mark.



Figure A336: Shibu 4 close-up of the cut mark to the right ilium.

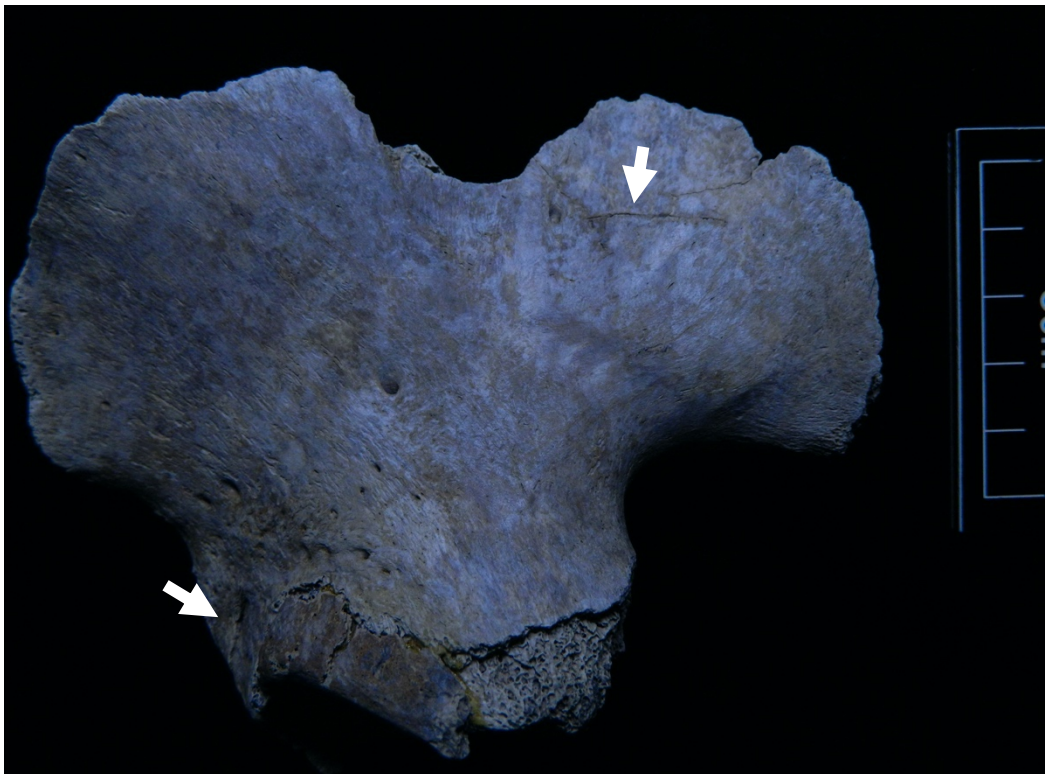


Figure A337: Shibu 4 left ilium lateral view showing two cut marks.



Figure A338: Shibu 4 close-up of the cut mark to the posterolateral left ilium.

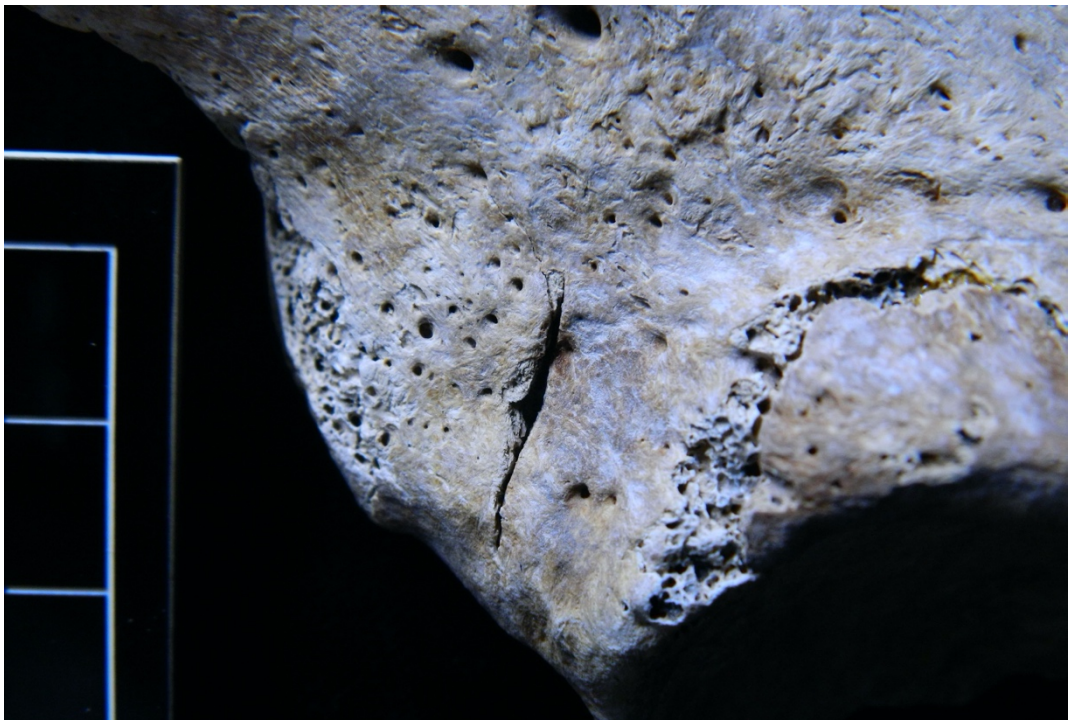


Figure A339: Shibu 4 left ilium inferior to the anterior inferior iliac spine showing the second cut mark on this bone.



Figure A340: Shibu 4 close-up of the cut mark inferior to the anterior inferior iliac spine of the left ilium. Note the triangular shape of the defect in its centre.

Shibu 4

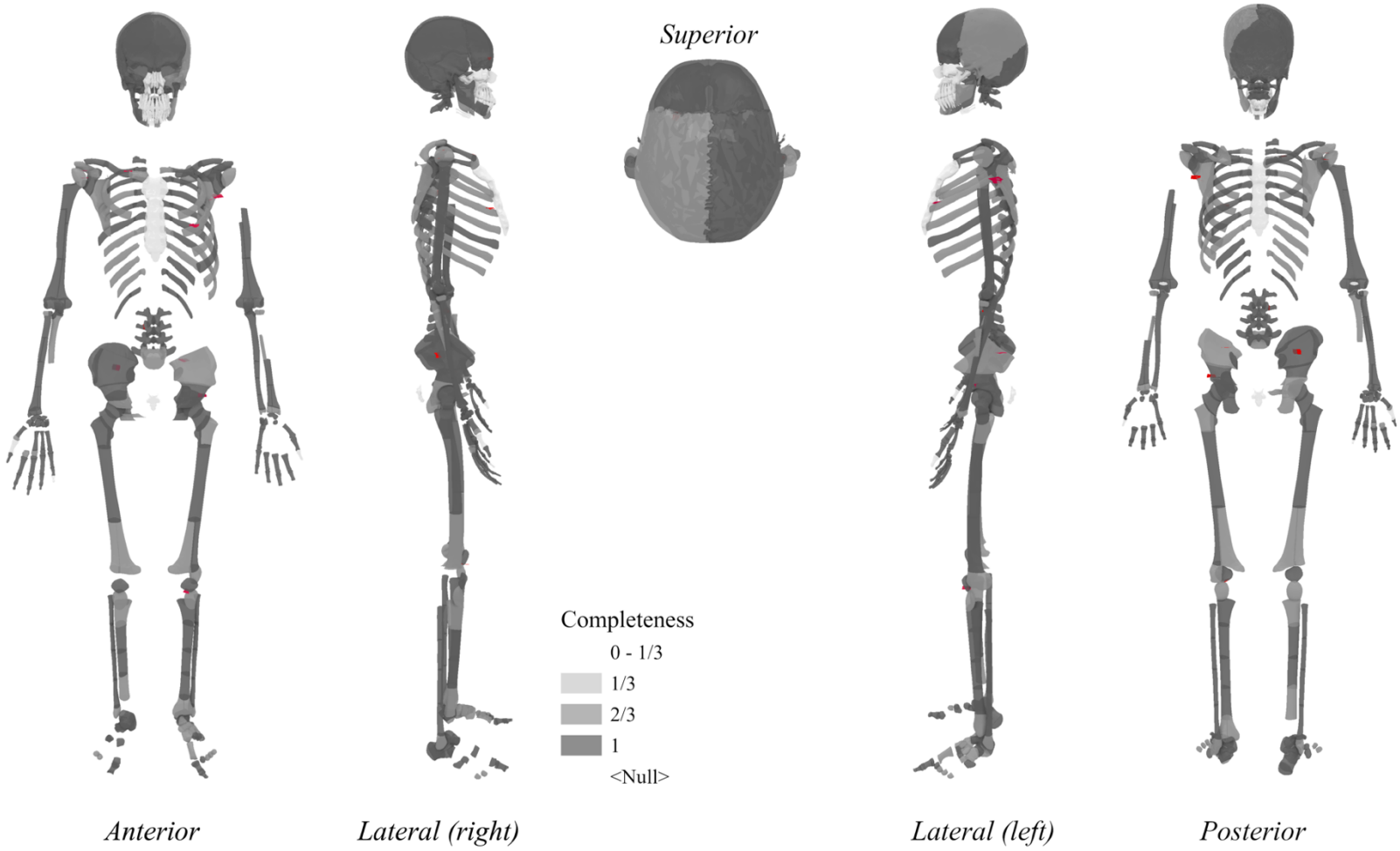


Figure AA44: Shibu 4 Completeness and Medium–High perimortem trauma.

Shinmachi 9 | Old Adult | Male | Early Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

A semi-circular fracture to the anterior-most area of both nasal bones (Figure A342). Distal to this the nasal bones are deformed, rounded and oriented to the left. The nasal suture deviates at this point as well.

Dimensions: 15.7 mm x 7.4 mm



Figure A341: Shinmachi 9 cranium anterior view showing a healed fracture to the nasal bones.

Shinmachi 9

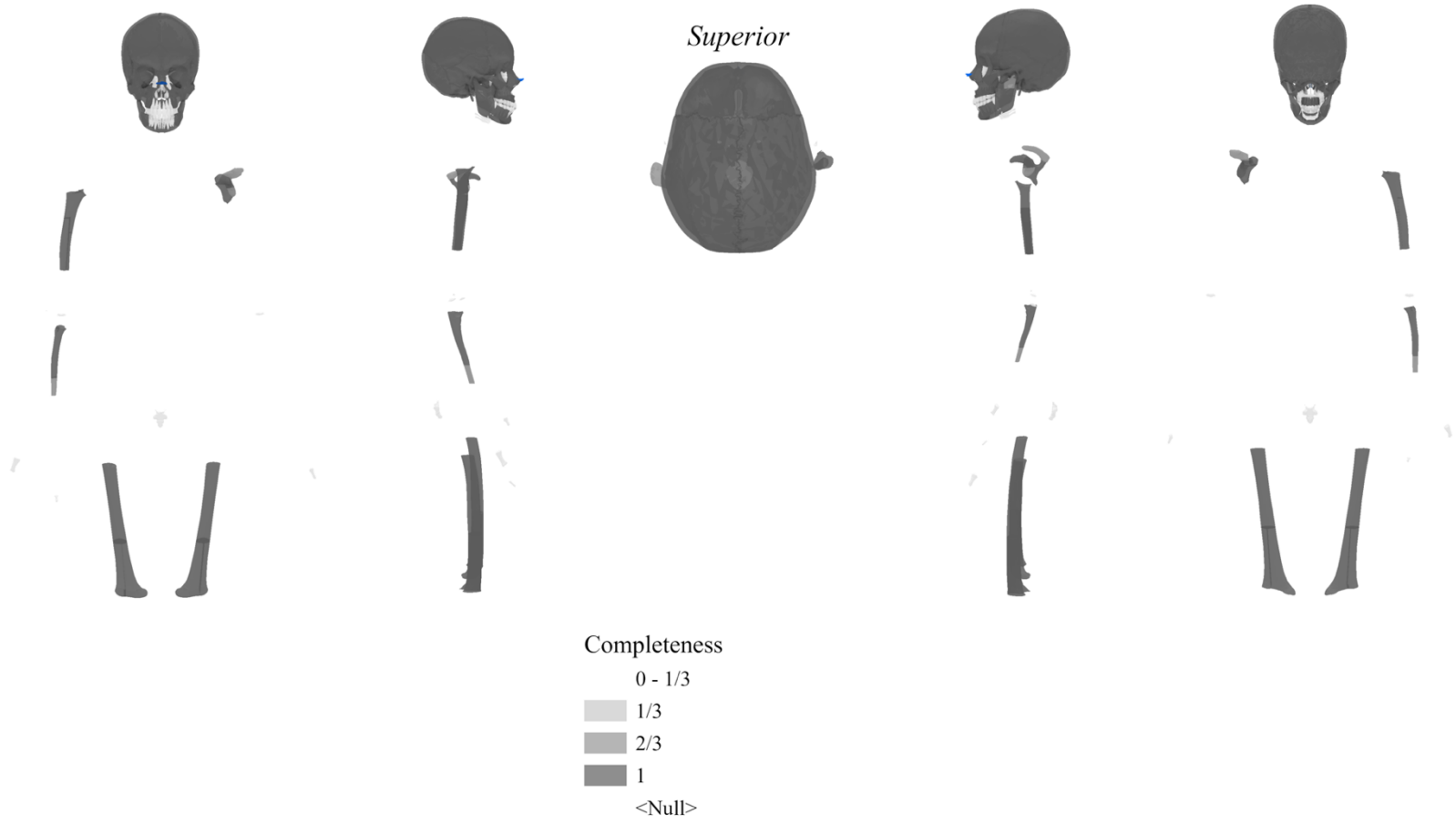


Figure AA45: Shinmachi 9 Completeness and Medium–High antemortem trauma.

Shinmachi 24-1 | Mid-Adult | Male | Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: High

Timing: Antemortem

Assessment of traumatic aetiology:

A greenstone projectile point is embedded in the proximal diaphysis of the medial left femur (Figure A343–Figure A345). It is angled anteroinferiorly. The arrowhead is fragmented and remodelled bone and porosity can be seen most clearly where it enters the one posteriorly (Figure A345).

Dimensions: 26 mm long arrowhead

Previously Reported In: Shima Town Board of Education (1987)



Figure A342: Shinmachi 24-1 left femur lateral view showing an embedded arrowhead proximally.



Figure A344: Shinmachi 24-1 close-up of the embedded arrowhead in the left femur.



Figure A343: Shinmachi 24-1 close-up of the entrace of the embedded arrowhead in the left femur.

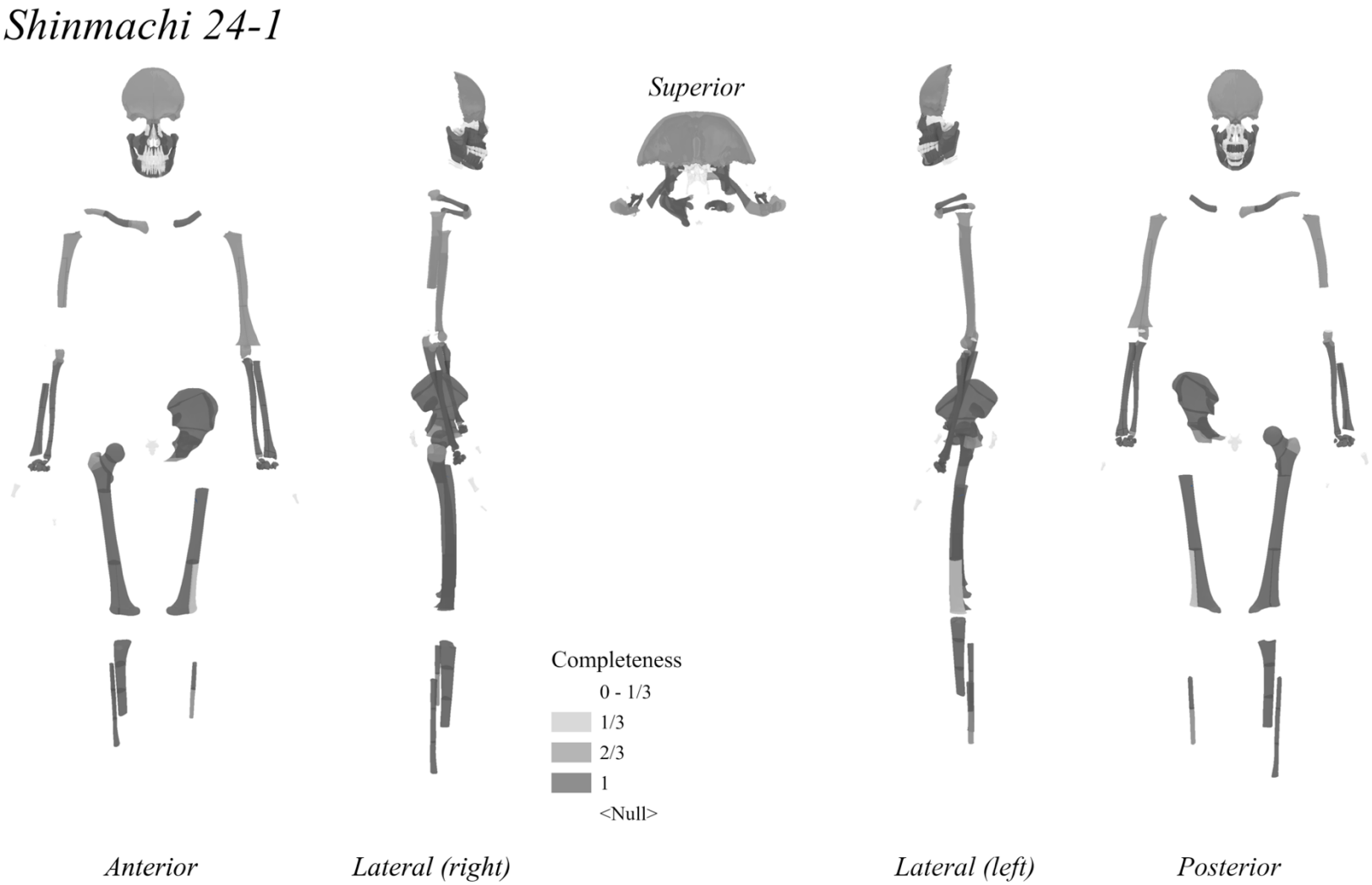


Figure AA46: Shinmachi 24-1 Completeness and Medium–High perimortem trauma.

Sudare K3 | Mid-Old Adult | Male | Mid Middle Yayoi

Likelihood of traumatic injury: 1–2. High

Likelihood of being violence-related: 1. Medium; 2. High

Timing: Antemortem

Assessment of traumatic aetiology:

1. The nasal bones are deformed, depressed inferiorly and to the right (Figure A346–Figure A347). There is a healed curved fracture line from the left maxilla's frontal process through the right nasal bone. Where it passes through, the nasal suture is fused.

2. A polished stone sword tip is embedded in the articulation point between the right second rib and the second thoracic vertebra (Figure A348–Figure A349). It is angled inferomedially. There is significant remodelling present around the weapon and the rib and vertebra are fused together. The tip of the sword penetrates into the intervertebral canal.

Dimensions: 1. 5.3 mm wide; 2. The sword tip is ca. 33 mm long, but this is difficult to measure.

Previously Reported In: #2 in Honami Town Board of Education (1976). Additionally, Padgett (2020) reports an antemortem rib fracture to the right side.



Figure A345: Sudare K3 cranium anterior view showing a healed fracture to the nasal bones and left maxilla.



Figure A346: Sudare K3 close-up of the healed fracture to the nasal bones and left maxilla.

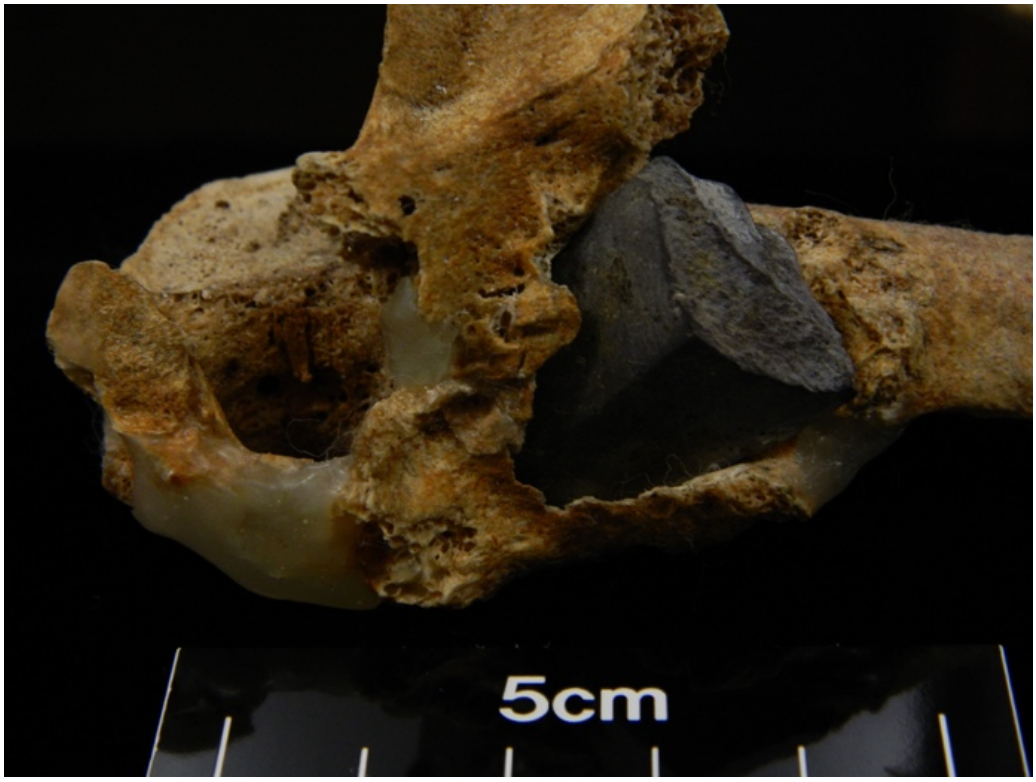


Figure A347: Sudare K3 second thoracic vertebra and rib posterior view showing an embedded sword tip.



Figure A348: Sudare K3 second thoracic vertebra and rib anterolateral view showing their state of fusion.

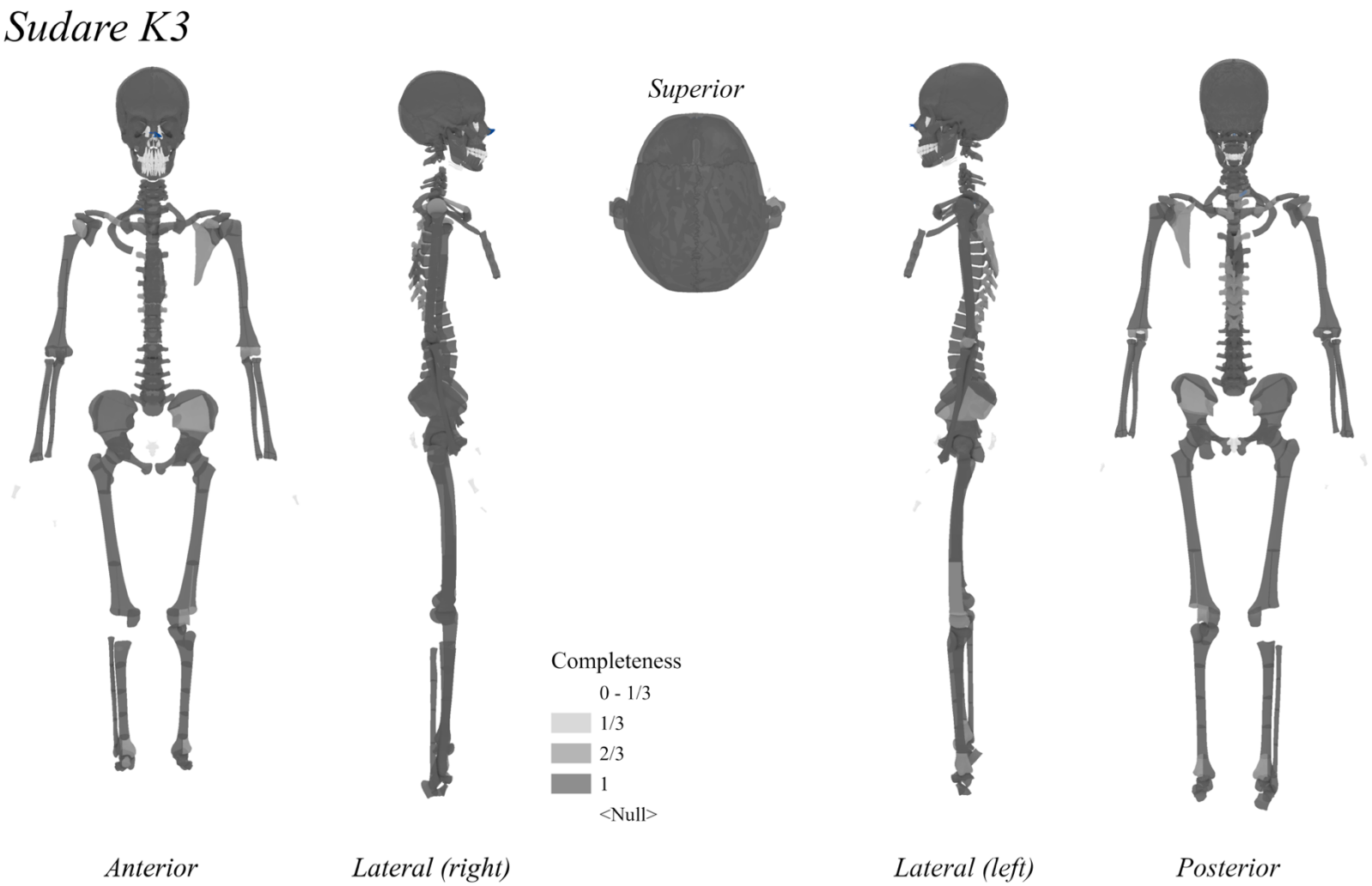


Figure AA47: Sudare K3 Completeness and Medium–High antemortem trauma.

Tsukomuta 4 10 | Mid-Old Adult | Male | Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Low

Timing: Antemortem

Assessment of traumatic aetiology:

A poorly healed oblique(?) fracture to the mid-diaphysis of the left radius (Figure A350). The proximal shaft is displaced almost 180 degrees laterally. There is no corresponding fracture to the ulna.

Dimensions: 40.1 mm long

Previously Reported In: Ogōri City Board of Education (2003)



Figure A349: Tsukomuta 4 10 radii anterior view showing the healed fracture to the left radius.

Tsukomuta 4 21 | MidAdult | Male | Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

A healed fracture to the middle of both nasal bones (Figure A351–Figure A352). The lateral right nasal bone did not fully fuse together at the point of fracture during healing. The nasal suture is fused at this point and anteriorly. The nasal bones are depressed and oriented to the left.

Dimensions: 11 mm x 16.1 mm



Figure A350: Tsukomuta 4 21 anterior view of the cranium showing a healed fracture to the nasal bones.



Figure A351: Tsukomuta 4 21 close-up of the healed fracture to the nasal bones.

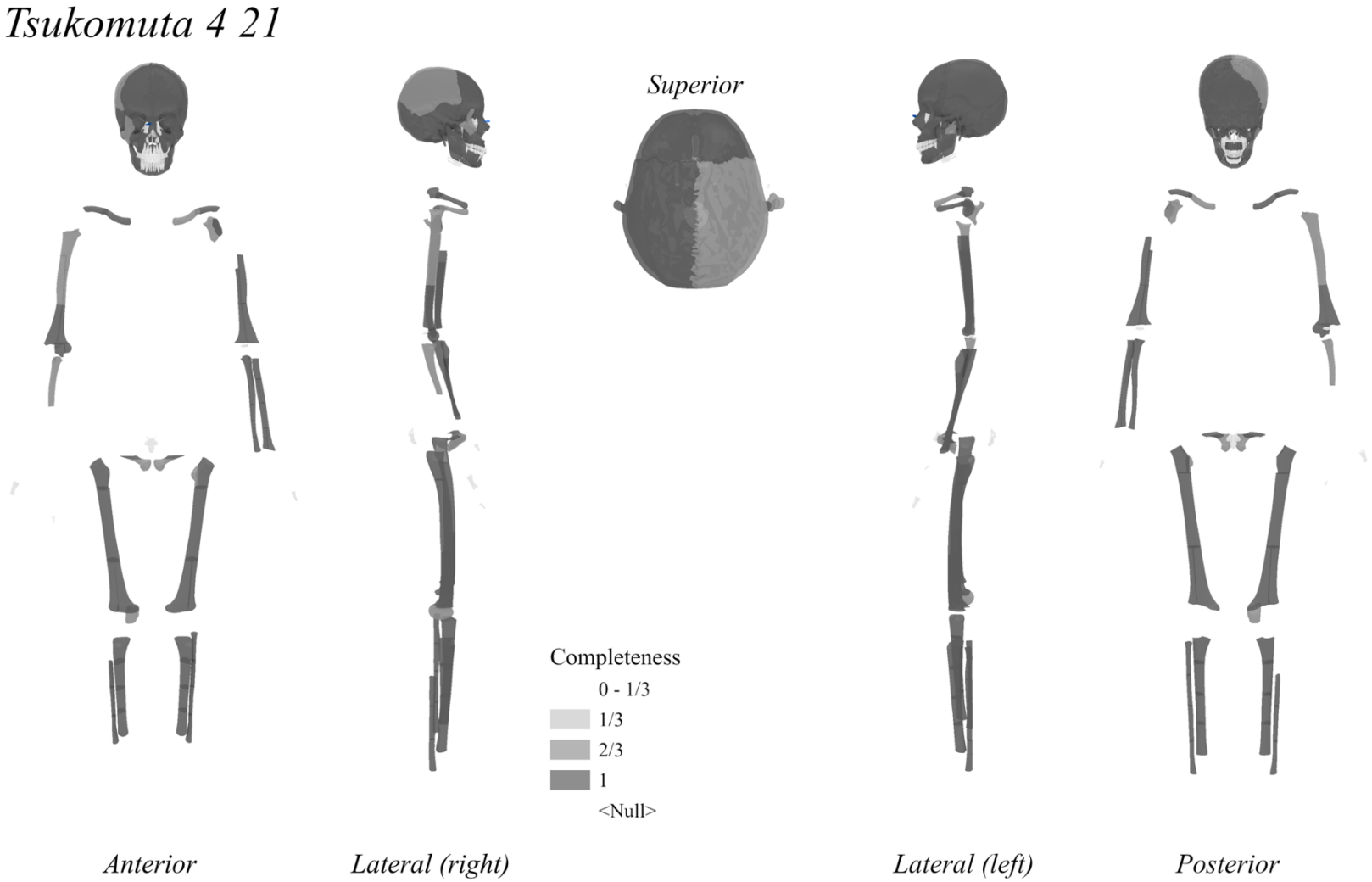


Figure AA48: Tsukomuta 4 21 Completeness and Medium–High antemortem trauma.

Tsukomuta 4 25 | Adolescent-Yong Adult | Male | Middle Yayoi

Likelihood of traumatic injury: 1. High; 2. Medium

Likelihood of being violence-related: 1. High; 2. High

Timing: Perimortem

Assessment of traumatic aetiology:

1. A long patinated linear mark to the lateral distal diaphysis of the left femur (Figure A353–Figure A354). There are clear striations within and evidence of shoulder effects. The margins are sharp. The distal edge is wider, possibly indicating a cut from that direction.

2. A much smaller, but sharp and patinated linear mark at the same angle to the lateral distal left femur as well (Figure A353 and Figure A355).

Unlike #1–2, there are clusters of unpatinated linear marks to the right fibula most likely representing excavation damage.

Dimensions: 1. 16.8 mm x1.1 mm; 2. 2.9 mm long

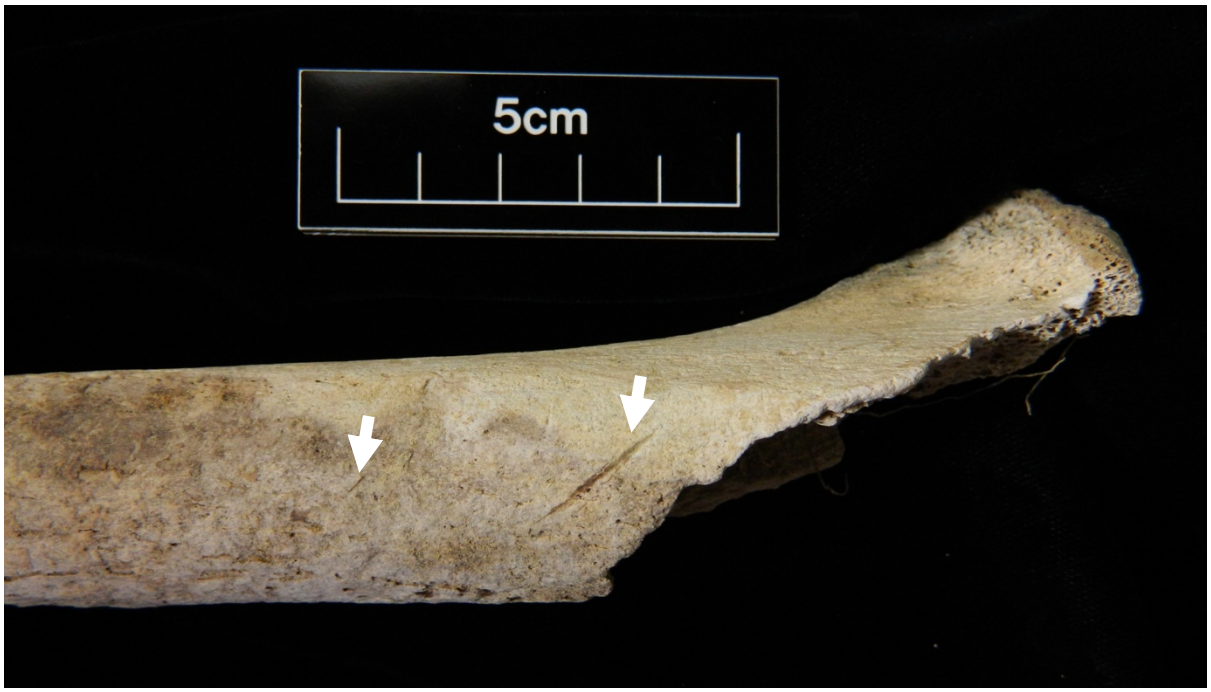


Figure A352: Tsukomuta 4 25 left femur lateral distal diaphysis showing two cut marks.



Figure A353: Tsukomuta 4 25 close-up of the larger, distal cut mark to the lateral left femur.

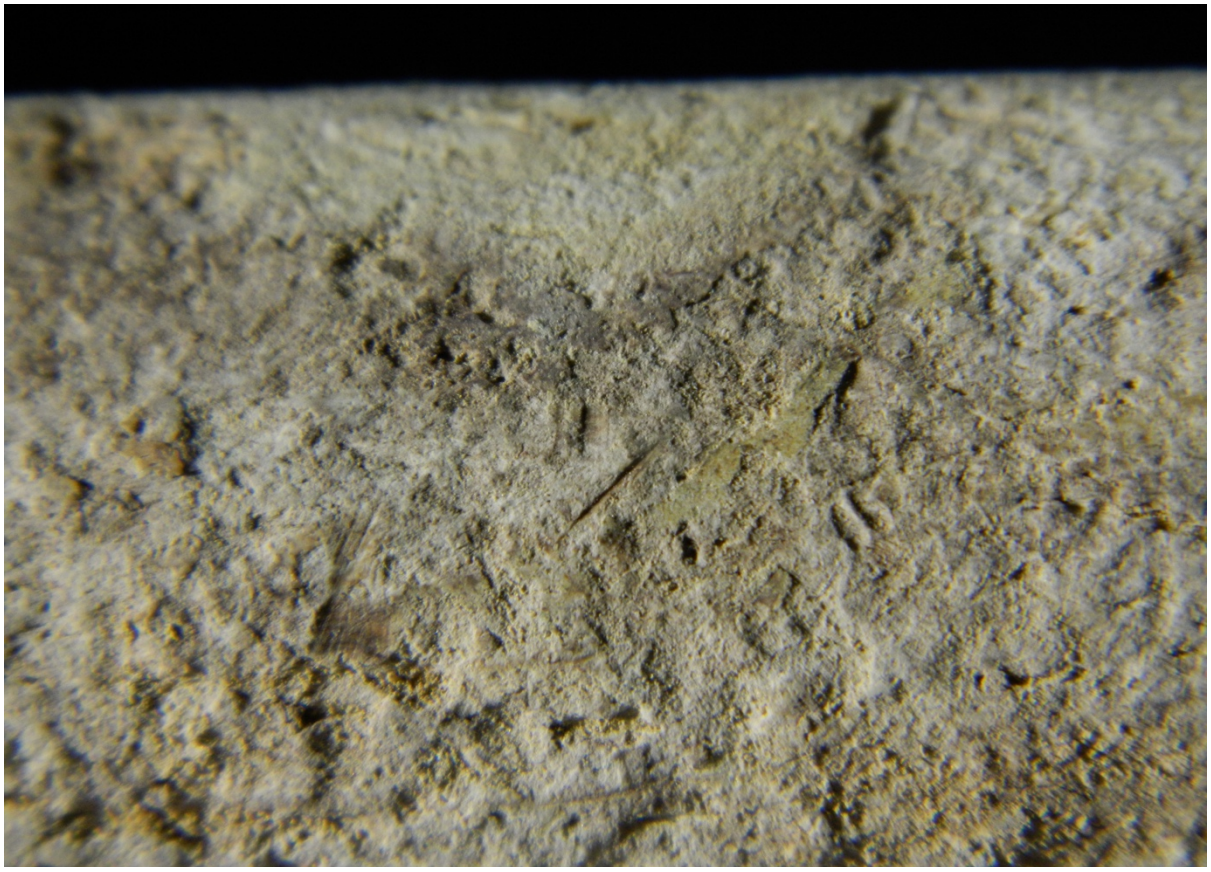


Figure A354: Tsukomuta 4 25 close-up of the smaller, proximal cut mark to the lateral left femur.

Tsukomuta 4 25

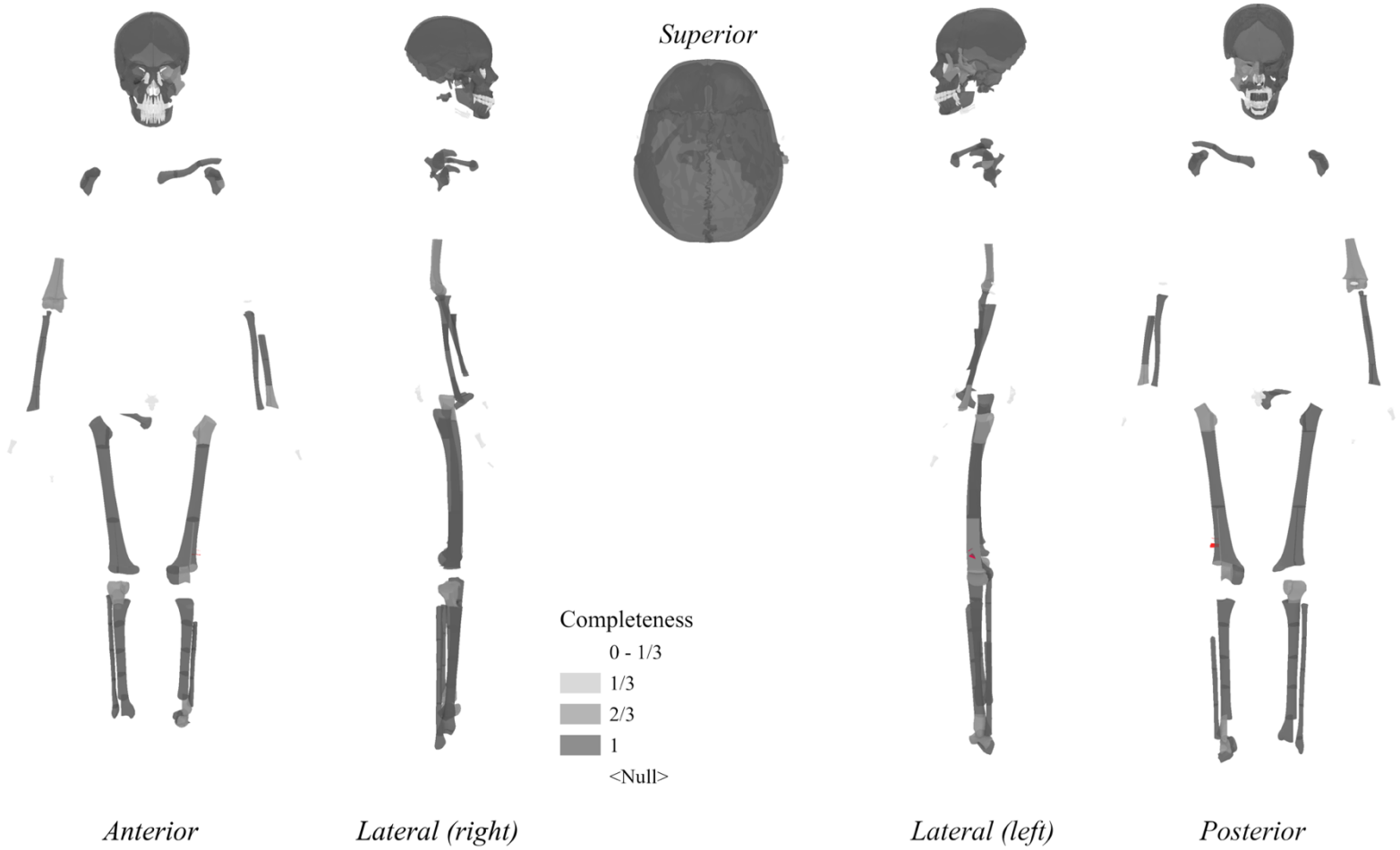


Figure AA49: Tsukomuta 4 25 Completeness and Medium–High perimortem trauma.

Yokoguma kitsunezuka ST-41 | Young Adult | Female | Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Medium

Timing: Perimortem

Assessment of traumatic aetiology:

A deep, v-shaped, and patinated linear mark to the inferior right clavicle (Figure A356–Figure A358). The lateral margin is widest posteriorly, with striations clearly present on its wall (Figure A358). Hertzian fracture cones are present on the medial margin. The direction of the cut is posterolateral. The nearby right rib and cervical vertebrae are not present and the scapula is only partially preserved. A likely explanation for the odd orientation of this cut is an attack to the neck from behind and angled inferiorly.

Postmortem cleaning and/or modification at the site has been suggested based of bones being found out of anatomical position within the *kamekan* (Ogōri City Board of Education 2010). ST-41 was found in anatomical position and no other sharp force lesions were found what remains of the skeleton. A bronze sword tip was found inserted into another individual's thoracic vertebra (No. 197) and both stone and metal weapons were found at the site. Therefore, given the likely fatal location of the injury, given the trajectory of the blade, and the context, it is reasonable to posit that this injury is due to lethal intent.

Dimensions: 21.2 mm x 5.2 mm



Figure A355: Yokoguma kitsunezuka ST-41 right clavicle inferior view (anterior is up) showing a cut mark to the posterior shaft near the sternal end.



Figure A356: Yokoguma kitsunezuka ST-41 close-up of the cut mark to the inferior right



Figure A357: Yokoguma kitsunezuka ST-41 close-up of the anterior aspect of the cut mark to the inferior right clavicle

Yokokumakitsuneka ST-41

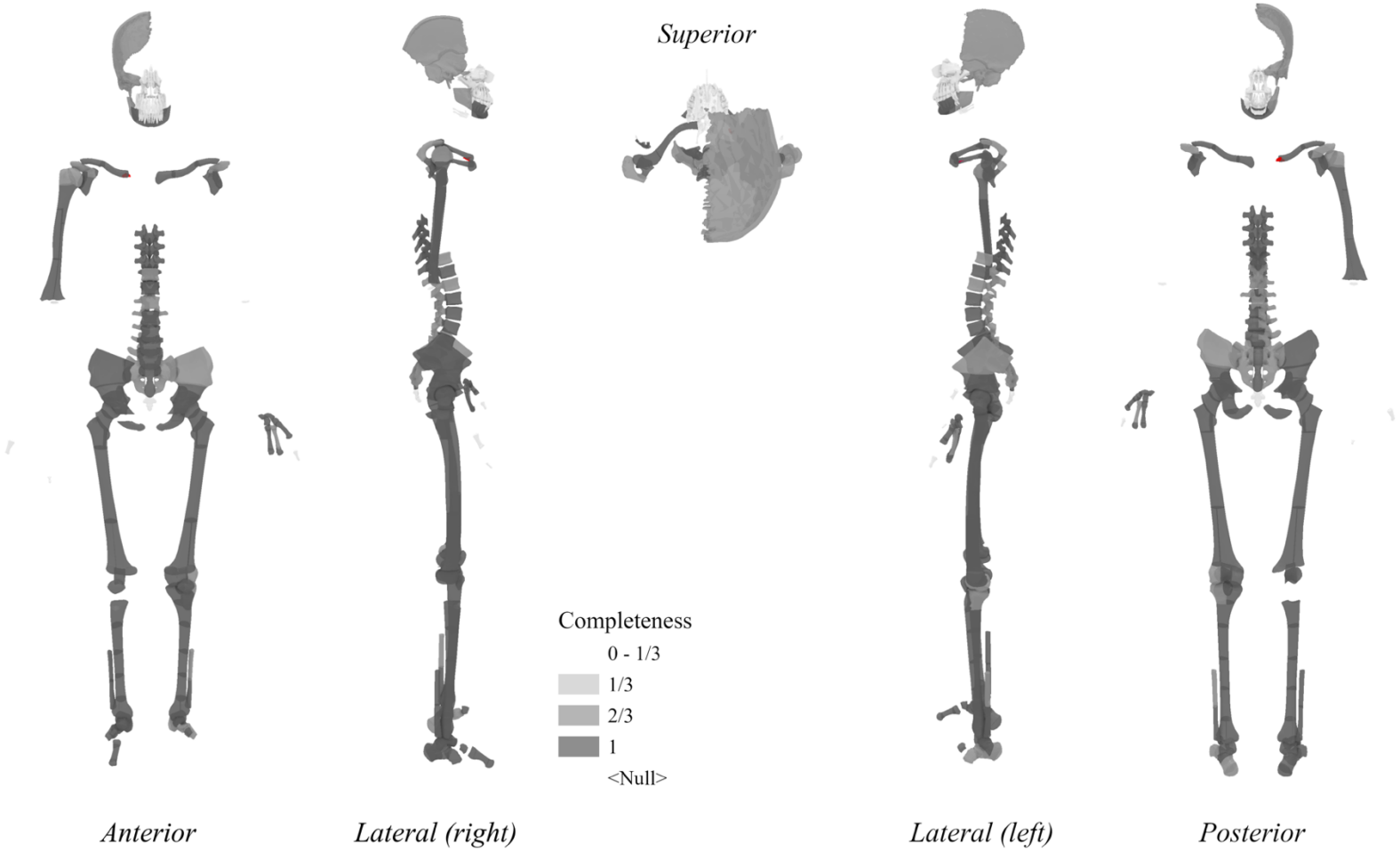


Figure AA50: Yokoguma kitsunezuka ST-41 Completeness and Medium–High perimortem trauma.

Yokoguma kitsunezuka ST-66 | Adolescent-Young Adult | Male | Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Low

Timing: Antemortem

Assessment of traumatic aetiology:

A misaligned left clavicle with a groove of bone running through its shaft, most likely representing a healed fracture (Figure A359).

Burst fractures are present on the thoracic vertebral bodies.

Dimensions: 25.4 mm x 11.7 mm. The groove is 2.3 mm wide.

Previously Reported In: Ogōri City Board of Education (2010)



Figure A358: Yokoguma kitsunezuka ST-66 left clavicle inferior view showing a healed fracture to the mid-shaft

Yokoguma kitsunezuka ST-122 | Young Adult | Male | Middle Yayoi

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

Deformed distal halves of the nasal bones (Figure A360–Figure A361). Depositional material does obscure the area, but a clear inferior and medial depression of the right nasal bone is present. Additionally, there is a raised area along the nasal suture.

Dimensions: 8.2 mm long



Figure A359: Yokoguma kitsunezuka ST-122 cranium anterior view showing a likely healed fracture to the nasal bones.



Figure A360: Yokoguma kitsunezuka ST-122 close-up of the likely healed fracture to the nasal bones.

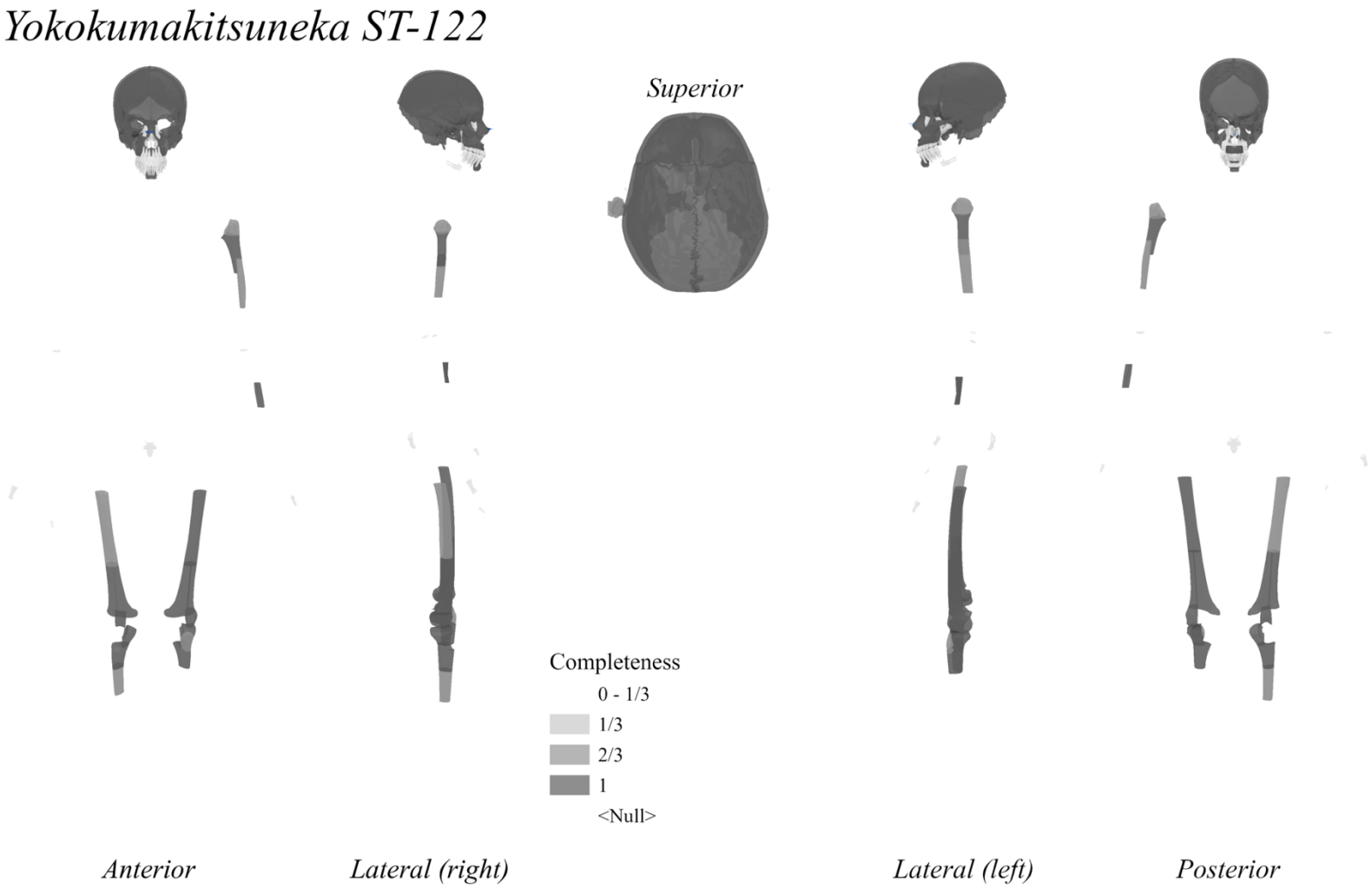


Figure AA51: Yokoguma kitsunezuka ST-122 Completeness and Medium–High antemortem trauma.

Yokoguma kitsunezuka ST-128 | Mid Adult | Male | Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

Multiple healed fractures to the nasal bones and the frontal process of the left maxilla (Figure A362–Figure A364). There is a partially open healed circular fracture on the left maxilla and nasal bone. More distally on the nasal bones, there is a smaller curved healed fracture primarily on the right nasal (which appears as a groove), but it also crosses over onto the left nasal bone. The nasal suture is fused at this point and the left nasal bone is slightly depressed inferiorly and to the right.

Possible compression and burst fractures are present on the thoracic vertebrae.

Dimensions: Maxillary open fracture is 16.5 mm x 0.6 mm, the superior left nasal fracture is 3.9 mm x 1.4 mm, the second, inferior left nasal fracture is 8.3 mm long, and the right nasal fracture is 9.5 mm long.



Figure A361: Yokoguma kitsunezuka ST-128 cranium anterior view showing multiple healed fractures to the nasal bones and left maxilla.

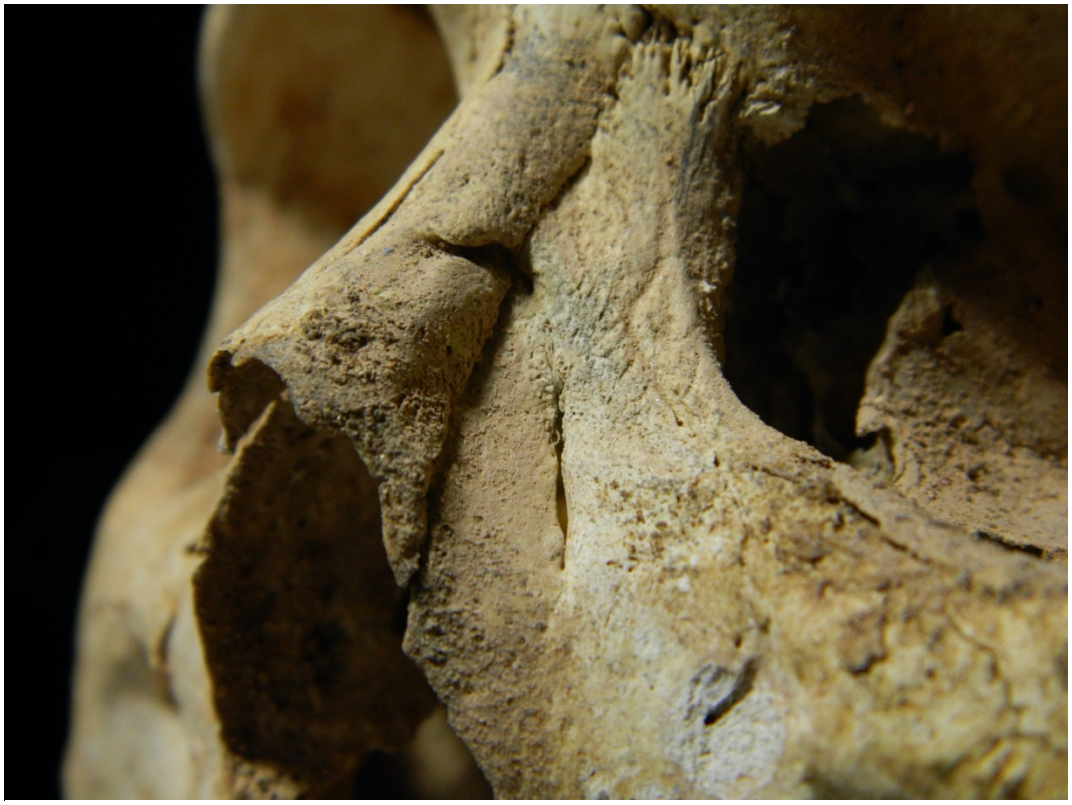


Figure A362: Yokoguma kitsunezuka ST-128 close-up of the healed fractures to the left nasal bone and maxilla.



Figure A363: Yokoguma kitsunezuka ST-128 close-up of the healed fracture to the right nasal bone.

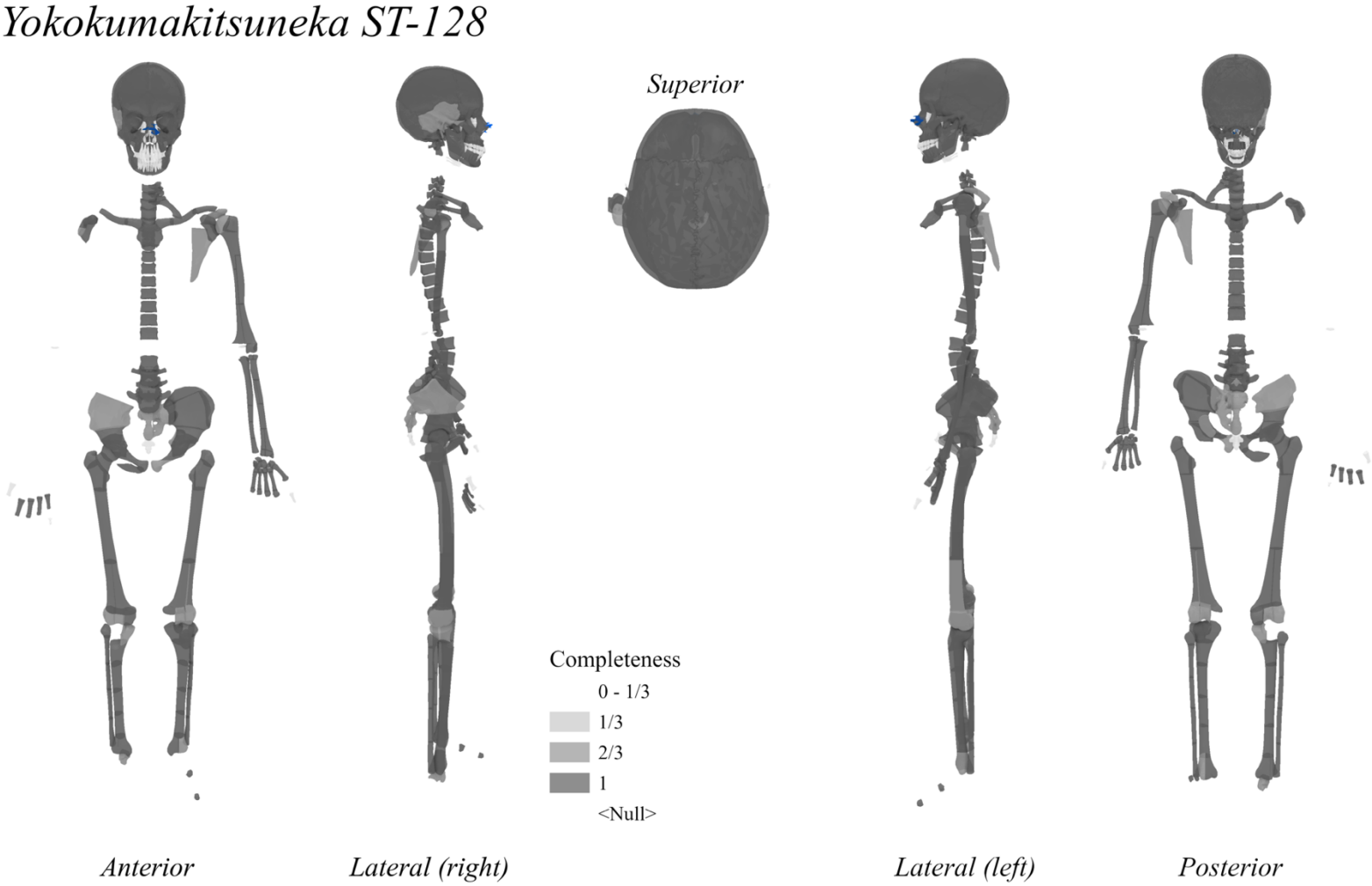


Figure AA52: Yokoguma kitsunezuka ST-128 Completeness and Medium–High antemortem trauma.

Yokoguma kitsunezuka ST-140 | Mid Adult | Female | Middle Yayoi

Likelihood of traumatic injury: High

Likelihood of being violence-related: Low

Timing: Antemortem

Assessment of traumatic aetiology:

A well-healed nonspecific (possibly transverse?) fracture to the mid-diaphysis of the right femur (Figure A365). The shaft is displaced laterally and angled medially. The linea aspera is widened considerably.

Dimensions: The possible fracture line is 48.4 mm

Previously Reported In: Ogōri City Board of Education (2010) (including a radiograph image)



Figure A364: Yokoguma kitsunezuka ST-140 right femur posterior view showing a healed fracture to the mid-diaphysis.

Kofun Period 古墳時代

Kōra 48 | Adolescent | Female | Kofun

Likelihood of traumatic injury: Medium

Likelihood of being violence-related: Medium

Timing: Antemortem

Assessment of traumatic aetiology:

A roughly circular depression demarcated by a clear line on the right nasal bone (Figure A366–Figure A367). Porosity is present on the nasal bones around this point. There is no clear involvement of the maxilla. The right nasal bone is depressed inferomedially. The left nasal bone near the nasal suture shows some signs of lipping.

Dimensions: 7.2 mm x 10.0 mm



Figure A365: Kōra 48 cranium anterior view showing a possible healed fracture to the nasal bones.



Figure A366: Kōra 48 close-up of the possible healed fracture to the nasal bones.

Ōtomo 17-1 | Mid Adult | Male | Early Kofun?

Likelihood of traumatic injury: 1. Medium; 2. High; 3. Low

Likelihood of being violence-related: 1. N/A; 2. Medium; 3. N/A

Timing: Antemortem

Assessment of traumatic aetiology:

1. A linear depression on the right superolateral side of the frontal bone, possibly representing a healed SFT (Figure A368–Figure A370). The margins are sloping and dispersed porosity is present within it and inferior to it.

2. An oval shallow depression to the anterior left frontal bone (Figure A368 and Figure A371). A nearly complete circular fracture line is visible, superolateral to which there is a lightly deeper area of bone with remodelled bone joining the two parts of the defect. No corresponding lesions on the inner table are visible.

3. A curved ridge on the anterior right fourth metacarpal (Figure A372). It is shorter than the left fourth metacarpal.

Dimensions: 1. 10.6 mm x 2.1 mm and 0.6 mm deep; 2. 10.5 mm x 0.6 mm and 0.5 mm deep; 3. 7.5 mm x 2.4 mm



Figure A367: Ōtomo 17-1 cranium anterior view showing two depressed lesions to the frontal bones.

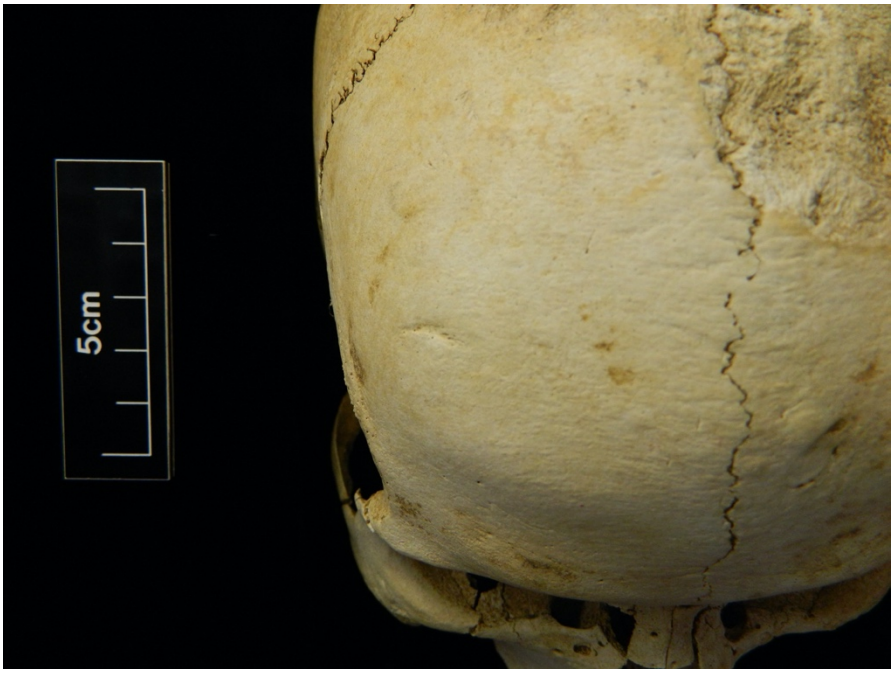


Figure A368: Ōtomo 17-1 frontal bone superior view showing a linear depression to the lateral aspect.



Figure A369: Ōtomo 17-1 close-up of the linear depression to the lateral right frontal bone.



Figure A370: Ōtomo 17-1 close-up of the oval depression to the anterior left frontal bone.



Figure A371: Ōtomo 17-1 right fourth metacarpal showing a ridge on the anterior shaft.

Ōtomo 17-3 | Young Adult? | Female | Early Kofun?

Likelihood of traumatic injury: High

Likelihood of being violence-related: Low

Timing: Antemortem

Assessment of traumatic aetiology:

The distal diaphysis of the right radius is deformed (Figure A373–Figure A374). The distal diaphysis is displaced posterlaterally. The fracture line visible posteriorly indicates that it was likely an oblique (or spiral?) fracture.

Dimensions: fracture area 34.6 mm long and widest at 13.8 mm

Previously Reported In: Miyamoto (2001)



Figure A373: Ōtomo 17-3 distal right radius anterior view showing a healed fracture to the diaphysis.



Figure A372: Ōtomo 17-3 distal right radius posterior view showing a healed fracture to the diaphysis.

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