Re-visiting the Viste skeleton, western Norway

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Introduction

The Viste skeleton is one of a relatively small number in Norway directly ^{14}C-dated to the Mesolithic (see Bergsvik and Storvik (2012) and Sellevold and Skar (1999) for an overview). The remains, identified as those of an adolescent male, were found during excavations in 1907 of a shellmidden within Svartehålå (the 'Black Cave'), located some 8km WNW of Stavanger (Brøgger 1908) (Figures 1 and 2). The shellmidden was recognised from the outset as belonging to the Scandinavian Old Stone Age. However, intrusive burials made in earlier deposits are far from unknown (e.g. Saville and Hallén 1994), and material from much later periods was also present in the cave. Thus, it was not until the publication in 1986 (in this journal in fact!) of a direct radiocarbon date on the skeleton that its long-suspected Mesolithic attribution could be confirmed, with a result of 7420 ± 150 BP (T-3351) (Hufthammer and Meiklejohn 1986). While the skeleton was demonstrated to be Mesolithic, a question arises over its precise placement within the period, due both to the extremely large error term (by today's standards), and to the potential of a marine reservoir effect, well documented for other burials of the period in coastal Scandinavia (Fischer *et al*. 2007; see also Ascough *et al*. 2007). Hufthammer and Meiklejohn (1986) commented that, while the associated stable carbon isotope (δ^{13}C) value of -17.1‰ indicated some consumption of marine protein, it was lower (and hence less 'marine') than the measurements then known for the Danish Ertebølle, which tended to be above -15‰ (Tauber 1981; 1986; see also Fischer *et al*. 2007). The δ^{13}C value would thus not be at odds with the predominantly terrestrial mammalian fauna (especially wild boar) recovered from the site's Mesolithic layers (Bergsvik and Storvik 2012; Indrelid 1979). Taken at face value, then, and assuming terrestrial and marine endpoints of -21‰ and -12‰, respectively, the Viste skeleton's δ^{13}C value of -17.1‰ suggests a contribution of approximately 43% marine protein. In addition to being of interest for palaeodietary reconstruction, this value is crucial in correcting the radiocarbon measurement for the marine reservoir effect. Using this value results in a corrected, calibrated estimate at 95.4% confidence of 6434–5845 cal BC (OxCal 4.2.2, using an appropriate mix of the IntCal13 atmospheric curve and Marine13 curve) (Bronk Ramsey 2013; Reimer *et al*. 2013). This includes a local ΔR marine offset of -1 ± 35 years, calculated from CALIB's Marine Reservoir Correction Database, which further adds to the uncertainty.

Figure 1. The Viste skeleton on display at the Stavanger Museum, Norway (photo: Terje Tveit, Arkeologisk Museum UiS).

As part of a re-presentation of the ‘Viste boy’ to the public by the Stavanger Museum, a long bone sample was sent to the Research Laboratory for Archaeology and the History of Art (RLAHA), initially for stable isotope analysis (particularly as no stable nitrogen isotope measurement (δ^{15}N) had been made in the original analysis). As detailed below, the resulting δ^{13}C and δ^{15}N measurements provided the impetus for a new AMS ^{14}C determination, to refine the original measurement and provide a more precise chronological placement for the Viste skeleton. Here, we report the results of this new analysis.

Sample measurement

The longbone sample from the Viste skeleton was prepared for stable carbon and nitrogen isotope analysis according to the standard protocols in use in the RLAHA, following a modified Longin (1971) method. Measurements were made on a SerCon 'Callisto' CF-IRMS system. An alanine standard was used to correct for machine drift, with a further two-point calibration supplied by a linear regression equation based on the inclusion in the sample run of a US Geological Survey standard (USGS-40, certified δ^{13}C = -26.4‰; δ^{15}N = -4.5‰) and an internal seal bone collagen standard (δ^{13}C = -13.4‰; δ^{15}N = +17.6‰). These effectively bracket the sample values and provide greater accuracy (Coplen *et al*. 2006). Samples were measured in duplicate for both ^{13}C and ^{15}N. For AMS radiocarbon dating, the sample included an ultrafiltration step, designed to minimise contaminants (Brock *et al*. 2010; 2013).

Figure 2: Northwest Europe showing the location of Vistehola (Viste cave)

Results

The AMS radiocarbon determination is 7537 ± 39 BP (OxA-30405). Stable isotope measurements, run separately and in duplicate, average -14.7‰ and 18.4‰ for δ^{13}C and δ^{15}N, respectively (Table 1). Collagen yield (18%) and C:N (3.3) values are well within the acceptable limits for well-preserved collagen (DeNiro 1985; van Klinken 1999).

Assuming a marine endpoint of -12‰, the $\delta^{13}C$ value of -14.7‰ suggests a contribution of 70 ± 10‰ marine-derived dietary protein. While it serves for present purposes, both the marine and terrestrial endpoints would benefit from further investigation (i.e., through the isotopic analysis of archaeological fauna at Viste – see below), as they can vary regionally. Using this value, and the local ΔR marine offset of -1 ± 35 years, the date of the Viste skeleton is 6255–6025 cal BC (95.4% confidence), most likely 6211–6091 cal BC (68.2%) (Figure 3).

Run A			*Run B*			*Average*		
$\delta^{13}C$‰	*$\delta^{15}N$‰*	*C:N*	*$\delta^{13}C$‰*	*$\delta^{15}N$‰*	*C:N*	*$\delta^{13}C$‰*	*$\delta^{15}N$‰*	*C:N*
-14.9	18.2	3.36	-14.6	18.5	3.29	-14.7	18.4	3.32

Table 1: Results of duplicate stable carbon and nitrogen isotope runs

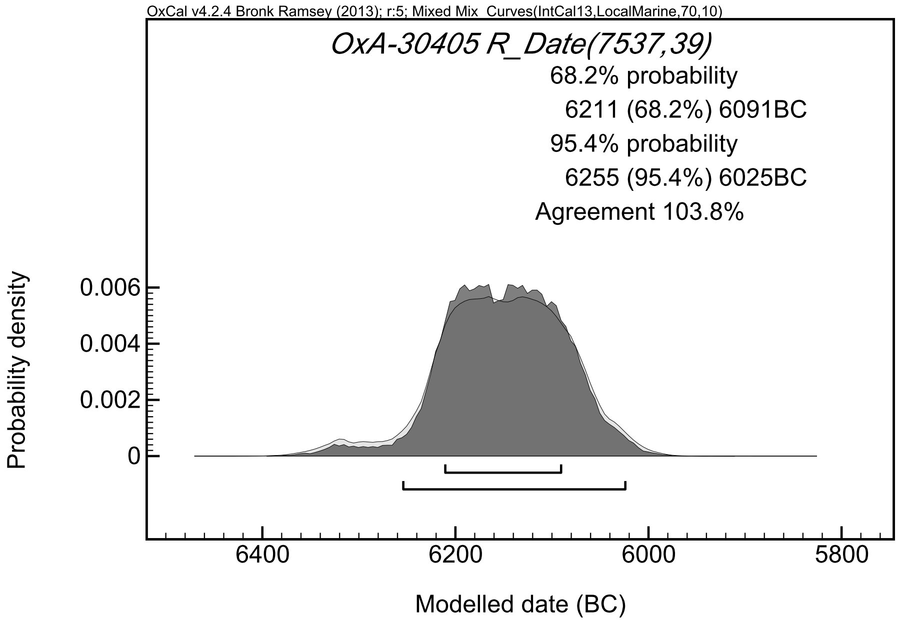

Figure 3: Plot of the calibrated date for the Viste skeleton, with reservoir correction (70 ± 10% marine) and local ΔR offset (-1 ± 35 years)

Discussion

The new date of 6255–6025 cal BC for the Viste skeleton is consistent with the original determination, in fact sitting in the middle of that range. However, the new result is considerably more precise, giving a 95% confidence range of just over two centuries rather than the nearly six centuries of the original. Moreover, this correspondence can be seen as somewhat fortuitous, since a marine reservoir correction of the original determination using the higher marine dietary contribution would have resulted in a significantly younger date. As seen in Figure 4, the Viste burial is still closer in date to the previous radiocarbon results for the underlying Layer I than for the Layer II shell midden in which the skeleton was found, a fact commented on by Hufthammer and Meiklejohn (1986). However, it should also be noted that there are only two radiocarbon dates from Layer II, and they are wildly disparate.

The new $\delta^{13}C$ value of -14.7‰ indicates a considerably higher consumption of marine foods than the previously published measurement of -17.1‰, and so is rather more consistent with measurements on Danish Ertebølle coastal humans; however, it is now more at odds with the dominance of terrestrial fauna in the cave than initially thought. Bergsvik and Storvik (2012) also commented on the unexpected preponderance of terrestrial fauna at Viste, based on the site's coastal location near the Bay of Visteviken. However, this discrepancy is probably more apparent than real, since given the early date of the excavation, it is unlikely that fish bones were adequately recovered. There is also the potential issue of differential processing and disposal of different classes of fauna: fish, for example, may have been processed mainly on the shoreline and their bones disposed of there. The recovery of some 29 bone fishhooks and a small number of bone harpoons suggest that fishing was a concern of those using the cave (Indrelid 1979).

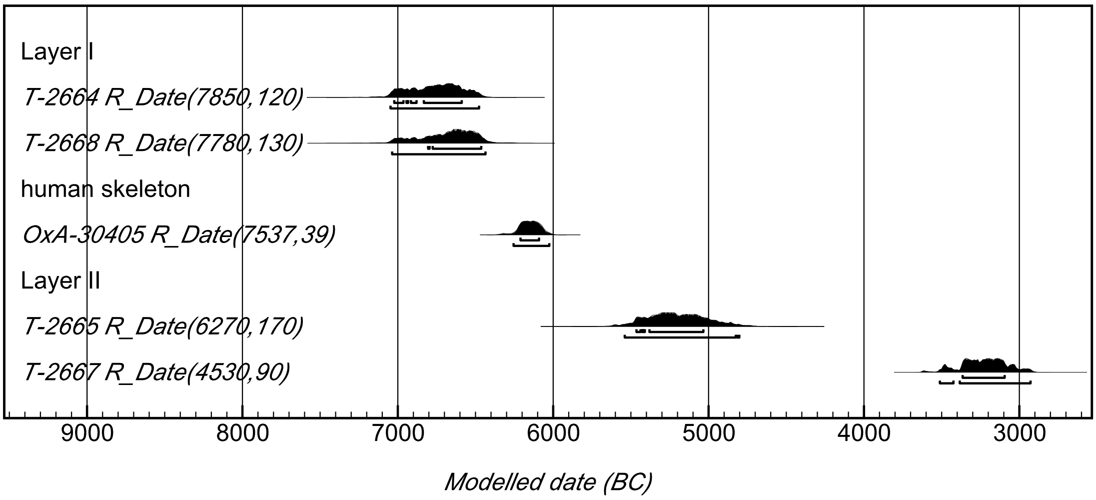

Figure 4: Plot of the calibrated dates for Viste (T- dates from Bergsvik and Storvik 2012)

The Viste skeleton's $\delta^{15}N$ value of 18.4‰ is presently among the highest known in Europe, if not the highest (Schulting 2011; Schulting 2015). This suggests that the Viste boy was consuming high-tropic-level, piscivorous fish and/or sea mammals. The latter might be expected to have featured strongly, although cod – the remains of which were present at the site – also exhibit enriched ^{15}N. In an isotopic study of archaeological cod bones from across medieval northern Europe, Barrett *et al*. (2011) found $\delta^{15}N$ values of ca. 14‰. There would then be an additional trophic level effect of 3–5% on the bone collagen of a human consumer (Bocherens and Drucker 2003), bringing it near the observed value (assuming a very high contribution of cod to the diet). Cod can also be easily stored by drying, making it an attractive resource for northern coastal fisher-hunter-gatherers (Bjerck 2007). But other marine fauna in the region may exhibit even higher $\delta^{15}N$ values, so that at present it is not possible to be more specific about the Viste boy's diet, other than to note that it was very much focussed on the sea. This is particularly so given that isotopic measurements of bone collagen reflect a long-term diet (albeit one emphasising protein intake) average over perhaps 5-10 years. It does not represent, for example, the summer fishing season, or a year or two in which fish happen to have featured particularly strongly.

In addition to the human skeleton, Viste is important for the substantial, diverse faunal assemblage recovered in the two excavation campaigns at Viste, with terrestrial and marine mammals, and numerous species of bird and fish (Brøgger 1908; Lund 1951). A programme of stable carbon and nitrogen isotopic analysis on this material has recently been completed as part of an MSc at Oxford (Drury 2014), with the results currently being prepared for publication. The results will include not only a diverse array of terrestrial and marine fauna, but also ^{14}C dating and stable isotope measurements of a second individual, represented by only a single element, a third metatarsal (Fürst 1909).

The new date and stable isotope data for the Viste skeleton presented here highlights the importance of re-visiting and re-analysing earlier collections. Moreover, in this case the new study provided the impetus for an investigation of the contemporary isotope ecology of the location, based on its abundant faunal remains. This will considerably help refine the diet and dating of the Viste human (and dog!) remains, and will also prove useful for palaeodietary research in western Norway and northwestern Europe more widely.

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