SEDIMENTOLOGICAL STUDIES IN THE LATE PRECAMBRIAN AND LOWER CAMBRIAN ROCKS OF EAST FINNMARK

Volume 2 Photographs

PLATES

Plate 1 Innerelv Member at Kvalneset

2 Tightly folded Manndraperelv Member east of Ifjord

3 View of uppermost beds of Lillevatn Member, "Areholmen" section

4 Rippled fine sandstone and siltstone laminae near the base of the Innerelv Member, "Areholmen" section

5 Facies I.2, Innerelv Member

6 Facies I.3, Innerelv Member

7 View of 110-140m, main section, Innerelv Member

8 Thin bedded sandstones of Facies I.4, Innerelv Member

9 Ball and Pillow sandstones, Facies I.4, Innerelv Member

10 Lenticular sandstone sitting within pre-existing channel Innerelv Member

11 Facies I.5, Innerelv Member

12 Sets of siltstone with irregular sandstone streaks, Facies I.5, Innerelv Member

13 Symmetrical ripples, Facies I.5, Innerelv Member

14 Facies I.3, Innerelv Member

15 Facies I.3, Innerelv Member, Kunes

16 Upper part of Member II and part of Member III, Dividal Group. Halkkavaare.

17 Facies intermediate between I.2 and I.3, Innerelv Member, Kvalneset

18 Thin-bedded rippled sandstones, Innerelv Member Kvalneset

19 Linguoid ripples, Innerelv Member, Kvalneset

20 Thin-bedded sandstones and siltstone, Lower Sandstone, Manndraperelv Member

Plate 21 Medium to thick-bedded sandstones, Lower Sandstone, Manndraperelv Member

22 Combined flow ripples and ? trail, Lower Sandstone, Manndraperelv Member

23 Basin and Ridge structure, Lower Sandstone, Manndraperelv Member

24 Cross-section of Basin and Ridge structure, Lower Sandstone, Manndraperelv Member

25 Lenticular beds, Lower Sandstone, Manndraperelv Member

26 Innerelv Member - Manndraperelv Member Junction at Isklövervandene

27 Lower Sandstone, Manndraperelv Member, Isklövervandene

28 View of Manndraperelv Member and part of Lower Breivik Member, Adamsfoss

29 Member III, Dividal Group, Halkkavarre

30 Lowest beds of First Coarsening Upward Sequence Manndraperelv Member, Manndraperelv Section

31 Sole of sandstone bed, Unit 2, First Coarsening Upward Sequence, Manndraperelv Member.

32 Flute marks, First Coarsening Upward Sequence Manndraperelv Member

33 Graded sandstones, First Coarsening Upward Sequence, Manndraperelv Member

34 Low angle cross-bedding and ripples, First Coarseining Upward Sequence, Manndraperelv Member

35 25-30m, First Coarsening Upward Sequence, Manndraperelv Member

36 Unit 3, First Coarsening Upward Sequence, Manndraperelv Member

37 Unit 5, First Coarsening Upward Sequence, Manndraperelv Member

38 Cross-bedding in Unit 6, First Coarsening Upward Sequence, Manndraperelv Member

Plate 39 Low angle cross-bedding, channel, and siltstone lens Unit 6, First Coarsening Upward Sequence, Manndraperelv Member

40 General view of Units 6, 7 and 8. First Coarsening Upward Sequence, Manndraperelv Member

41 Unit 8, First Coarsening Upward Sequence, Manndraperelv Member

42 Junction of First and Second Coarsening Upward Sequences, Manndraperelv Member

43 Unitl, Second Coarsening Upward Sequence, Manndraperelv Member

44 Lenticular sandstones of Unit 1, Second Coarsening Upward Sequence

45 Lenticular, amalgamted sandstones at the top of Unit 2, Second Coarsening Upward Sequence

46 General view of Units 3 and 4, Second Coarsening Upward Sequence

47 Detailed vie w of Unit 3, Second Coarsening Upward Sequence

48 Intraformational clasts, Unit 3, Second Coarsening Upward Sequence

49 Symmetrical ripples in Unit 3, Second Coarsening Upward Sequence

50 Siltstones and sandstones of Unit 4, Second Coarsening Upward Sequence

51 Unit 5, Second Coarsening Upward Sequence

52 Sandstone hump of Unit 7, Second Coarsening Upward Sequence

53 Second Coarsening Upward Sequence (Breivik Fm.) Adamsfoss

54 Thin-bedded sandstones and siltstones, Second Coarsening Upward Sequence (Breivik Fm.), Kunes

55 Fault in Lower Breivik Member

Plate 56 Phycodes pedum

57 Various types of sandstones, Lower Breivik Member

58 Facies 1: Lower Breivik Member

59 Laterally persistent sandstones of Facies 2, Lower Breivik Member

60 Irregular sandstones of Facies 2, Lower Breivik Member

61 Laminae and very thin beds of Facies 2, Lower Breivik Member

62 Facies 3, Lower Breivik Member

63 Facies 4, Lower Breivik Member

64 Lenticular beds and interbedded massive siltstone/mudstone, Lower Breivik Member

65 Thrust fault in the Lower Breivik Member Leiopollen

66 Thrust contact between theDividal Group and the Gaissa Nappe

67 Junction between Lower and Upper Breivik Members

68 Siltstones and sandstones of the Upper Breivik Member

69 Bioturbated sandstones and siltstones of the Upper Breivik Member

70 Beds at 3-9m in the Lower Duolbasgaissa Member section

71 Large burrows, Lower Duolbasgaissa Member

72 Primary current lineation overlain by rib and furrow, Lower Duolbasgaissa Member, main section

73 "Balled-up" sandstone 5m below the 20m Quartzite Lower Duolbasgaissa Member main section

74 Bioturbated fine sandstones and siltstones and a grit bed. Lower Duolbasgaissa Member, main Section

75 Sharp base of the 20m Quartzite

Plate 76 General view of the 20m Quartzite

77 Fine sandstones, siltstones and mudstones in the Lower Duolbasgaissa Member above the 20m Quartzite

78 Thick sandstones with syn-depositional deformation structures. Lower Duolbasgaissa Member main section

79 Cross-bedding in the 20m Quartzite at Varned valley (Section 1 of Fig. 59)

80 View of Varnes valley showing 20m Quartzite within the Lower Duolbasgaissa Member

81 The 20m Quartzite at Section 8 of Fig. 59

82 Base of the 20m Quartzite at Section 8 of Fig. 59

83 The Upper Duolbasgaissa Member above the middle branch of the Manndraperelv

84 The Upper Duolbasgaissa Member at Section 1 of Fig. 62.

85 The Upper Duolbasgaissa Member on the northern slope of Breivik valley

86 The Upper Duolbasgaissa Member on the southern slope of Breivik Valley

87 Junction between flat-bedded and low angle cross-bedded fine sandstones and cross-bedded white sandstone. Quartzite 1, Upper Duolbasgaissa Member

88 Large cross-beds at the top of Quartzite 1, Upper Duolbasgaissa Member, south side of Breivik Valley

89 Sandstones of Quartzite 1, Upper Duolbasgaissa Member at Section 7 of Fig. 62

90 Lowest part of Quartzite 2, Upper Duolbasgaissa Member, Breivik Valley section

91 Sharp based and sharp topped sandstones of Quartzite 2, Upper Duolbasgaissa Member

Plate 92 Irregular bedding surfaces with burrows in Quartzite 2, Upper Duolbasgaissa Member

93 View of Section 7 of Fig. 62 Upper Duolbasgaissa Member

94 Climbing ripples in the lower part of Quartzite 2 Upper Duolbasgaissa Member, at Section 7 of Fig. 62

95 Rippled surface within a set of climbing ripples in the lower part of Quarzite 2, Upper Duolbasgaissa Member, at Section 7 of Fig. 62

96 Burrow tubes in vertical section, Quartzite 2, Upper Duolbasgaissa Member, at Section 7 of Fig. 62

97 Burrow tubes in horizontal section. Quartsite 2 Upper Duolbasgaissa Member, at Section 7 of Fig. 62

98 Symmetrical dunes in Quartzite 2, Section 7 Upper Duolbasgaissa Member

99 Cross-bedding at the top of Quartzite 3, Breivik Valley, Upper Duolbasgaissa Member

100 Trough cross-bedding, Quartzite 3, Section 7 Upper Duolbasgaissa Member

101 Specimen of Føyn's "conglomerate"

SCALES USED

Hammers are approximately 30cm long

Tape measure is 5cm square

Lens cap is 5cm in diameter

Biro top is 6cm long

Hand lens is 3.7cm long

Plate 1 (p. 4, 32) Almost flat lying beds of the Innerelv Member at Kvalneset on the east side of the Varanger Peninsula. A dolerite dyke cuts the sediments.

Plate 2 (p. 4) Tightly folded red sandstones of the Manndraperelv Member on the E6 road a few kilometres east of Ifjord. The asymmetry is towards the right (east).

Plate 3 (p.16) Laminated siltstones overlain by lenticular, graded sandstones and cross-bedded siltstones of the uppermost Lillevatn Member. Basal Innerelv Member occurs in the upper left corner. "Areholmen" Section, Digermul Peninsula.

Plate 4 (p.17) Rippled laminae of fine sandstone and siltstone, basal Innerelv Member, "Areholmen" section.

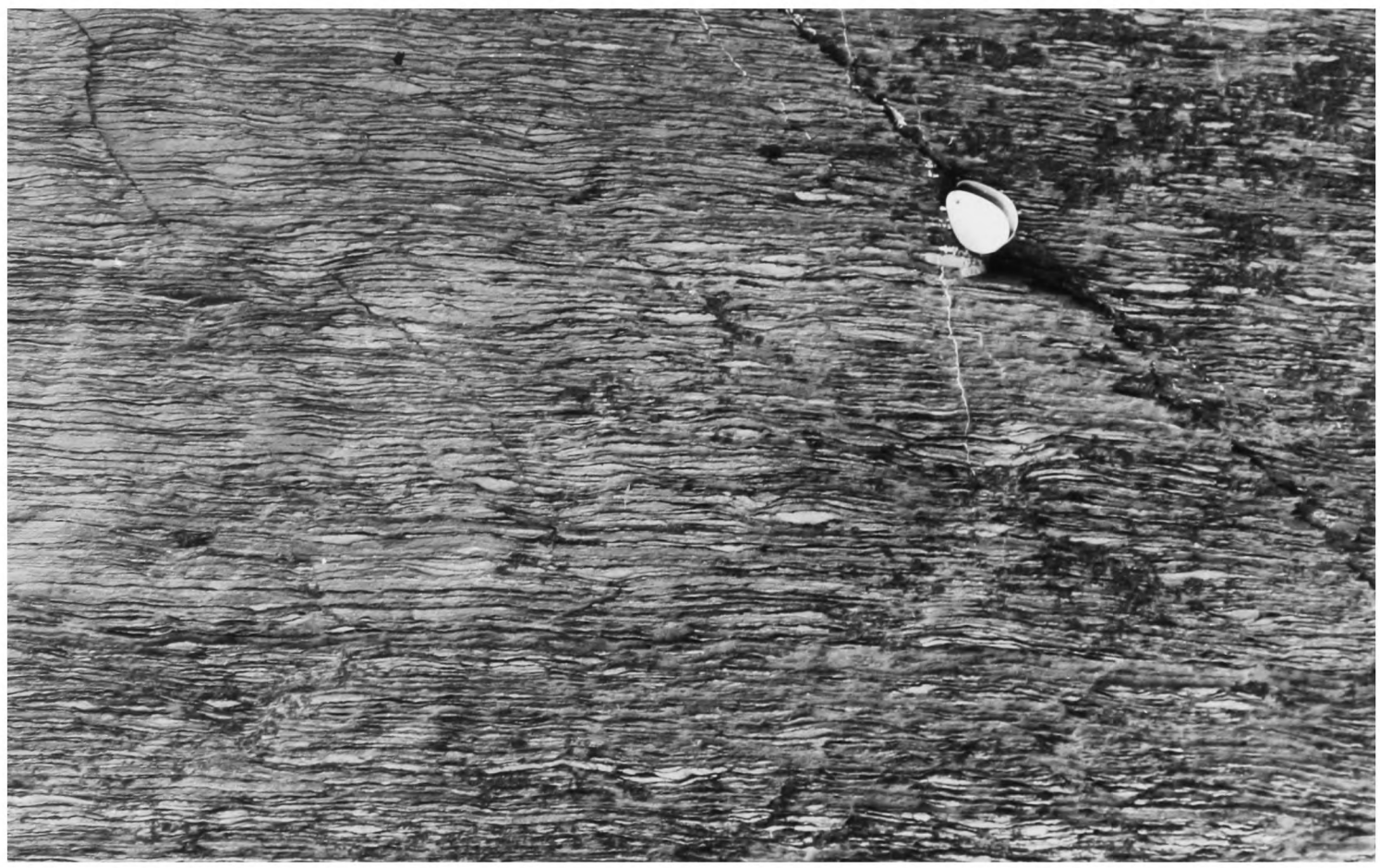

Plate 5 (p.22) Facies I.2 : parallel laminated siltstone with interbedded mudstone. About 145m in the main section of the Innerelv Member, Digermul Peninsula.

Plate 6 (p.22) Facies I.3 Laminae and very thin beds of siltstone and very fine sandstone. About 115m in the main section of the Innerelv Member, Digermul Peninsula.

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Plate 7 (p.23) Facies I.4 : band of thin to thick-bedded sandstones and siltstones underlain by Facies I.3 and overlain by Facies I.2. 110-140m in main section of the Innerelv Member, Digermul Peninsula.

Plate 8 (p.23) Thin bedded sandstones of Facies I.4 at 110m, main section, Innerelv Member.

Plate 9 Ball and pillow sandstones looking down the axis of the preferred orientation of the pillows. Cross-lamination in these beds shows consistent dips perpendicular to this axis towards the right. 120-130m in Main Section of Innerelv Member, immediately north of Manndraperelv, Digermul Peninsula.

(p.23)

Plate 10. Lenticular sandstone interpreted as sitting within a pre-existing channel which had been partly filled with finer grained sediment. The base of this channel is dotted on the photograph. About 195m in main section of the Innerelv Member, Digermul Peninsula.

(p.26)

Plate 11 (p.26)

Facies I.5 : Lenses of irregularly bedded sandstone, siltstone and mudstone; in the upper left is an erosively based sandstone showing parallel lamination and slight grading; in the bottom right (arrowed) there is a sharp angular break between two lenses of siltstone with sandy streaks. Many other discontinuity surfaces are present. About 200m in the main section of the Innerelv Member, Digermul Peninsula.

Plate 12 Smooth contact between two sets of siltstone with irregular sandstone streaks. Close up of lower right part of Pl. 11.

(p.27)

Plate 13 Sharp crested symmetrical ripples formed at the surface of an initially parallel laminated bed. Outcrop of the parallel laminae are seen as contours around the ripples. Beach exposure just south of Larsholmen, Digermul Peninsula.

(p.27)

Plate 14 Facies I.6 : Wavy laminated black siltstone showing abundant truncation of laminae. 220m in main section of Innerelv Member, Digermul Peninsula.

(p.29)

Plate 15 Rippled siltstones and very fine sandstone of Facies I.3. 15m below the top of the Innerelv Member, Kunes.

(p.31)

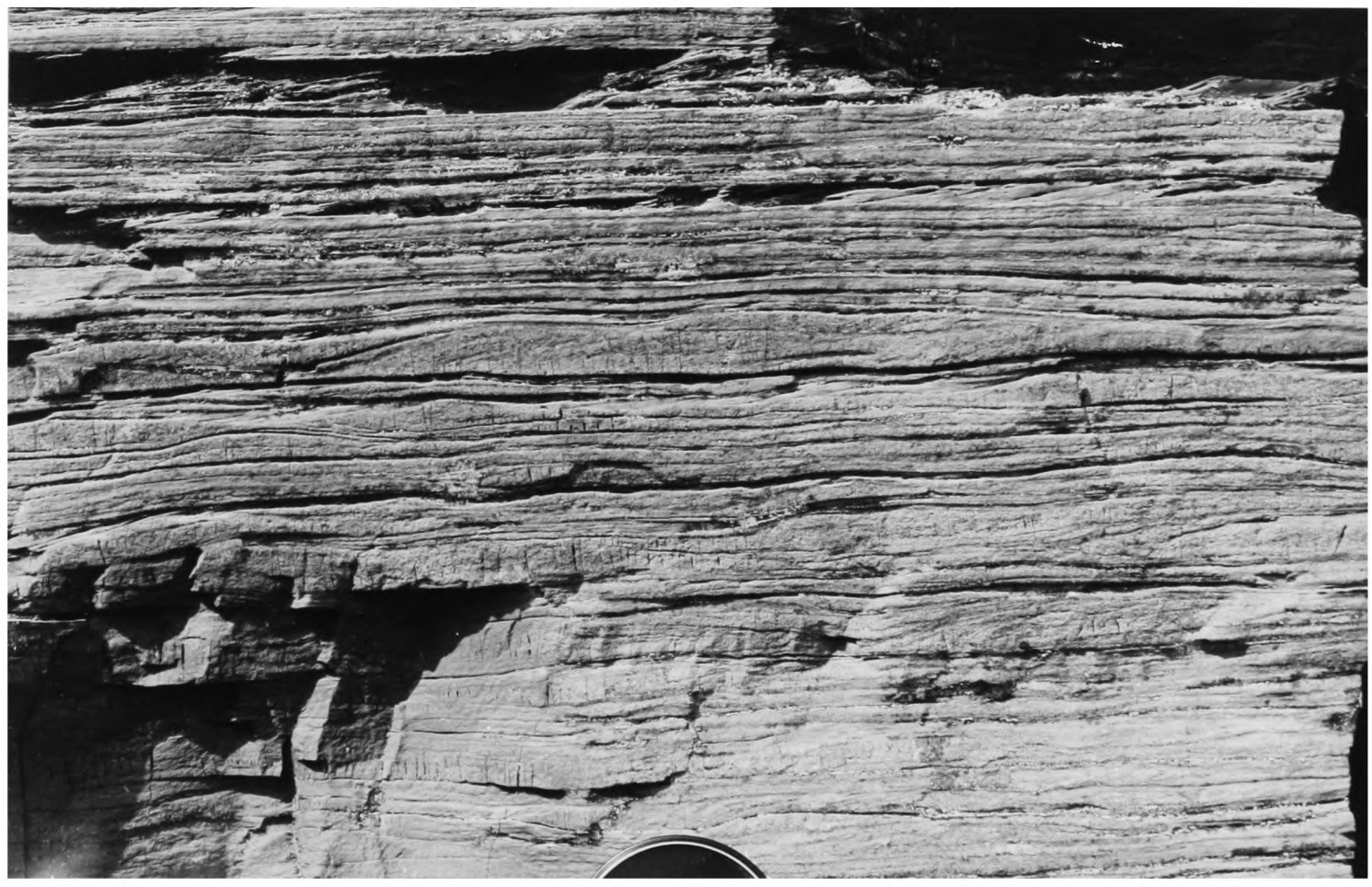

Plate 16 View of the uppermost 15m of Member II (= Innerelv Member) of the Dividal Group at Halkkavarre. Lenticular sandstones and silt-filled channels occur in the uppermost 5m. Member III overliés these beds very sharply.

(p.32,45)

Plate 17 Laminae and very thin beds of siltstone and very fine sandstone with unidirectional ripples showing flow from right to left. Facies intermediate between I.2 and I.3. Eastern end of the exposure below road, Kvalneset.

(p.32)

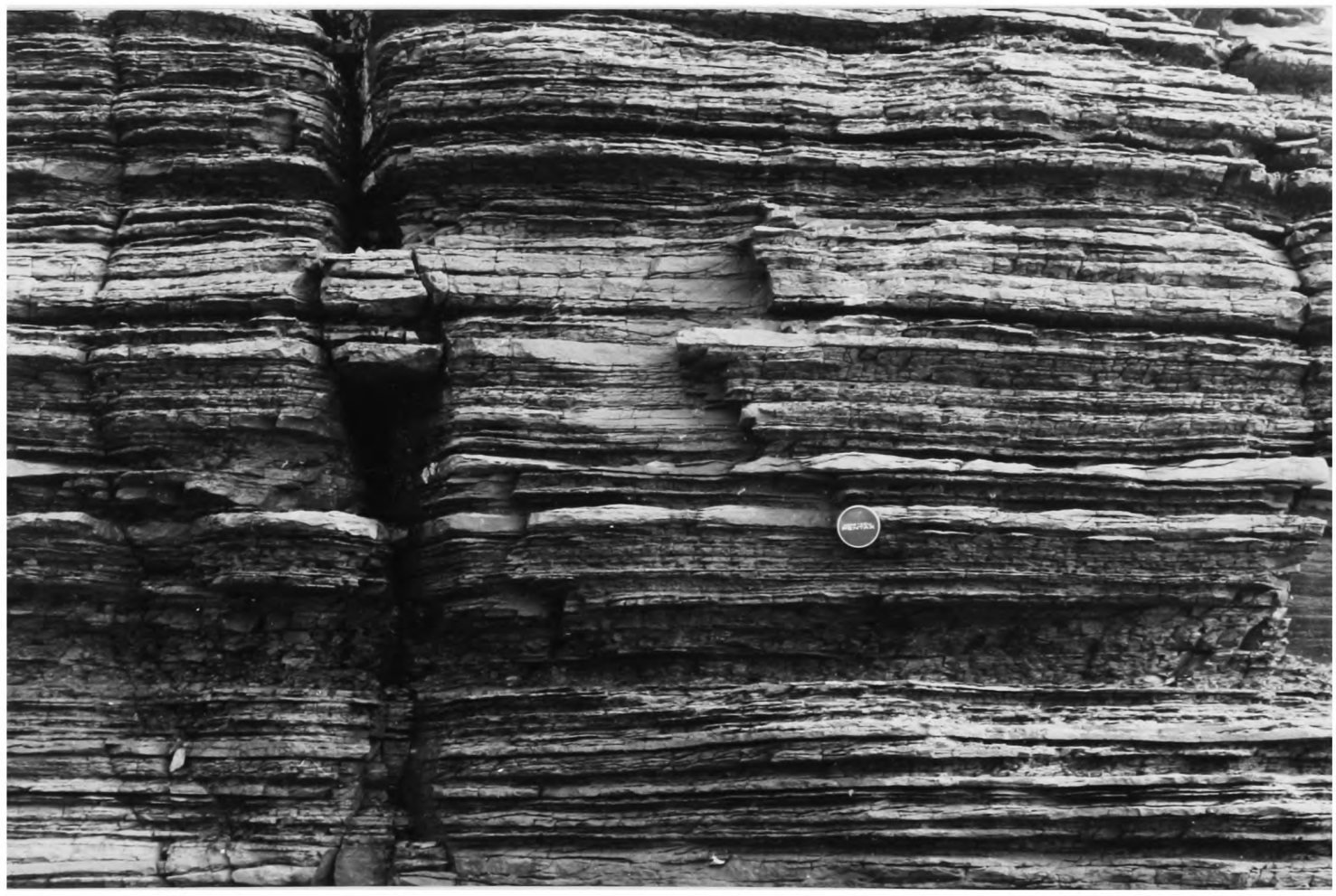

Plate 18 Thin-bedded sandstones interbedded with siltstone and showing internal cross-lamination. Irregular top is rippled. Beach exposure, Kvalneset.

(p. 32)

Plate 19 Linguoid ripples on surface of the upper sandstone bed of Pl.15 showing current flow from left to right. Beach exposure, Kvalneset.

(p. 32)

Plate 20 Thin-bedded, red, very fine sandstone with interbedded siltstones. 15m above the base of the Manndraperelv Section, Digermul Peninsula : Lower Sandstone, Manndraperelv Member.

(p. 40)

Plate 21 Medium to thick-bedded sandstones of the Lower Sandstone, Manndraperelv Member. Coast north of Manndraperelv.

(p. 40)

Plate 22 Rounded asymmetrical ripples showing flow from left to right. Possible simple trail present in ripple hollow. About 20 m below the top of the Lower Sandstone, Manndraperelv Member, coast north of Manndraperelv.

(p.41)

Plate 23 Irregular basin and ridge topography on top of a sandstone bed. About 15 m below the top of the Lower Sandstone, Manndraperelv Member, coast north of Manndraperelv.

(p.41)


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Plate 24 Basin and ridge topography draped by a silty layer and then by another sandstone bed. Locality as Pl. 29.

(p.41)

Plate 25 Irregularly bedded sandstones dipping almost vertically in coast exposure north of Manndraperelv. Beds are 10-15m below the top of the Lower Sandstone, Manndraperelv Member.

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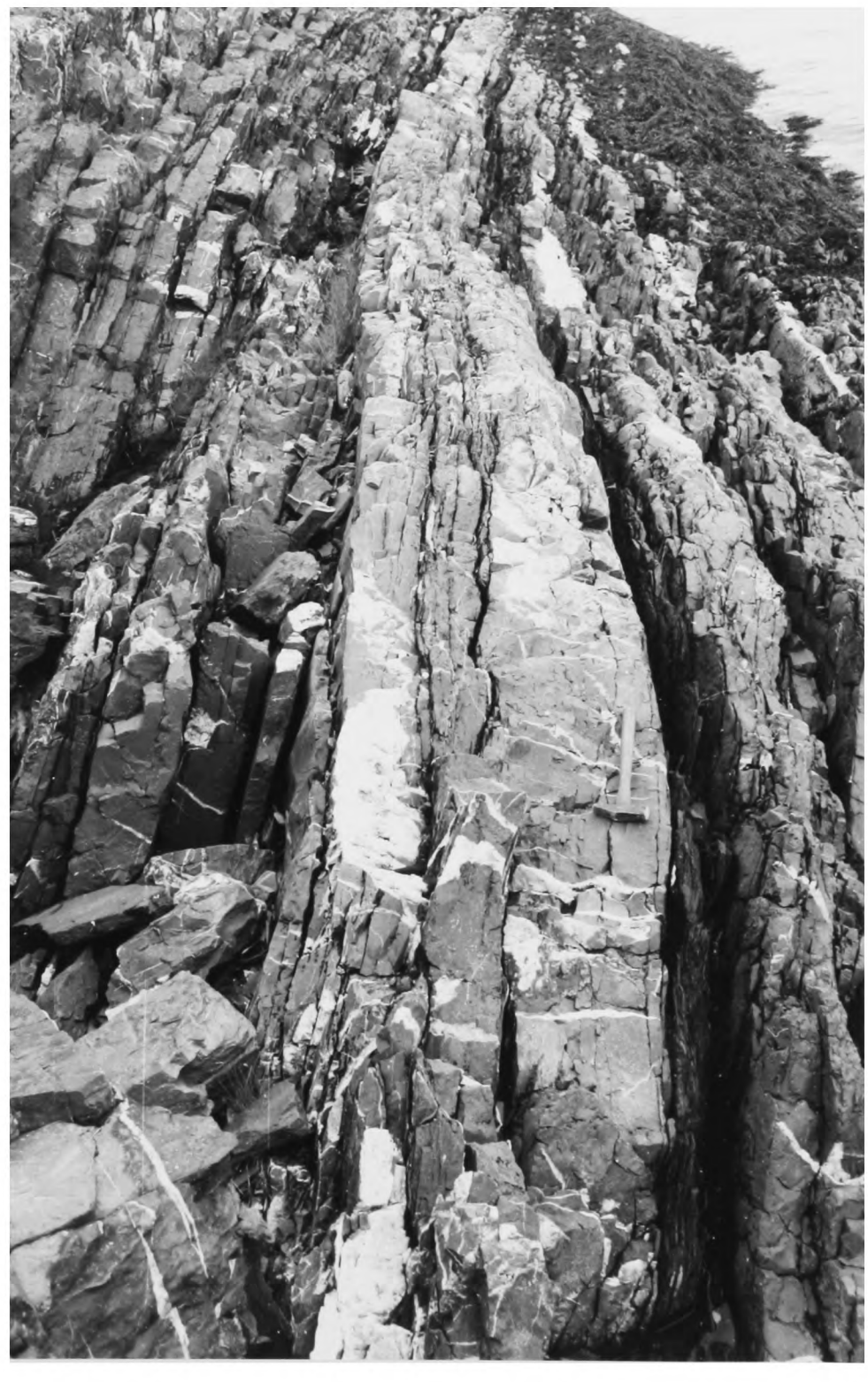


Plate 26 Green cleaved mudstones of the Innerelv Member abruptly overlain by a coarse white sandstone (marking the base of the Manndraperelv Member) which passes up into red sandstones. Near Isklövervandene above the road between Ifjord and Vestertana.

(p.44)

Plate 27 Typical red sandstones of the Manndraperelv Member, near Isklövervandene.

(p.44)

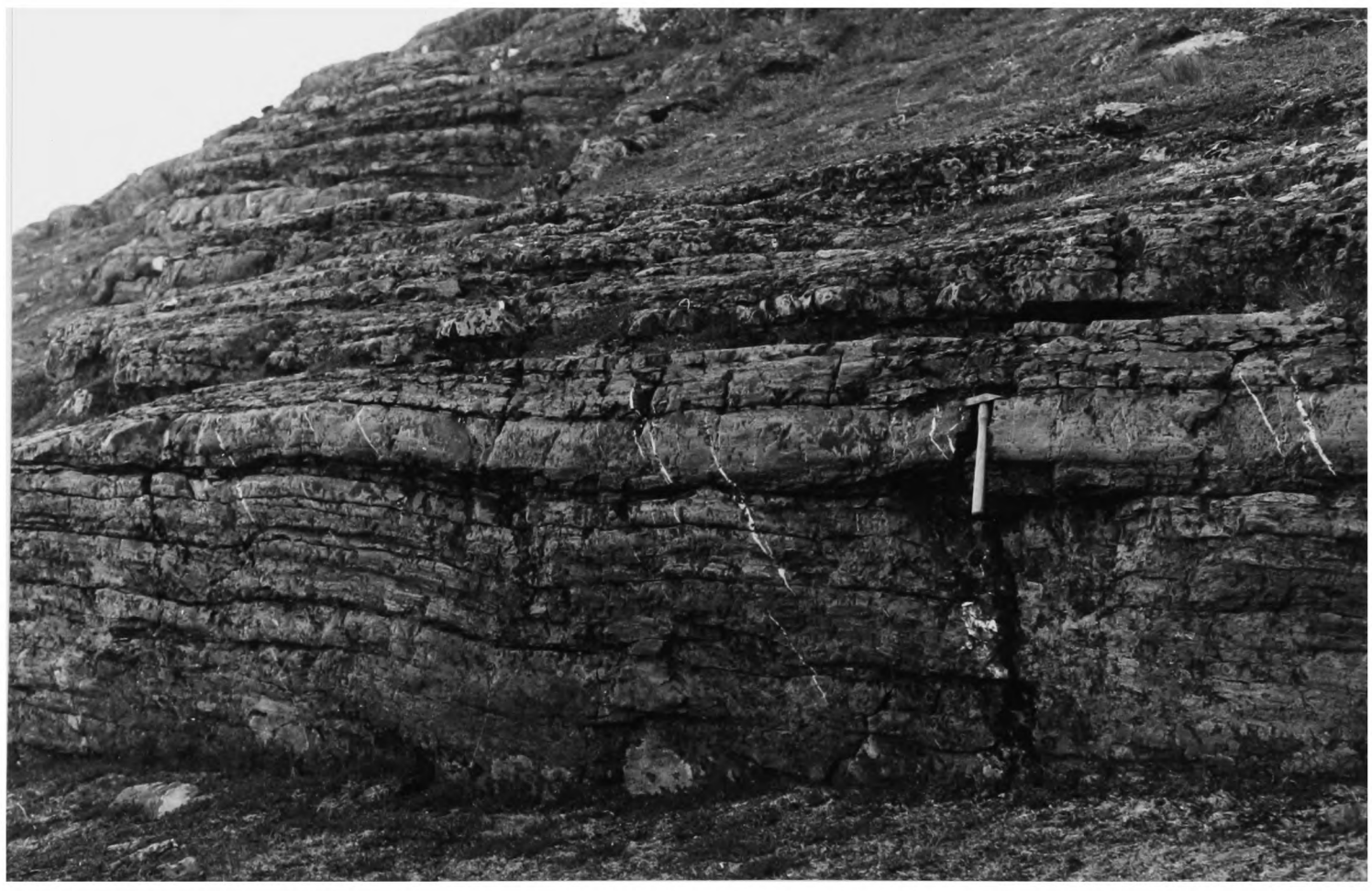


Plate 28 View of the "Adamsfoss" section showing the sandstones of the Manndraperelv Member which is 25m thick. It is overlain by green sandstones and shales and a white sandstone of the Breivik Fm. Man in foreground, bottom right.

(p.44)

Plate 29 Slightly lenticular bedding in the grey sandstones of Member III, Dividal Group. Halkkavarre.

(p.45)


BREIVIK FM.
M.M.
M.M.
I.M.

Plate 30 Upper part of Unit 1 and lowest part of Unit 2, Manndraperelv Section, First Coarsening Upward Sequence, Manndraperelv Member. Unit 1 consisting of clean sandstones interbedded with mudstone, culminates in two medium bedded parallel laminated sandstone beds. Unit 2 consists of very thin, graded siltstone and sandstone beds interbedded with mudstone.

(p. 47)

Plate 31 Sole of a sandstone bed near the base of Unit 2 showing partly eroded burrows and delicate groove marks. Current flow from lower right to top left. First Coarsening Upward Unit, Manndraperelv Member, Manndraperelv Section.

(p. 48)

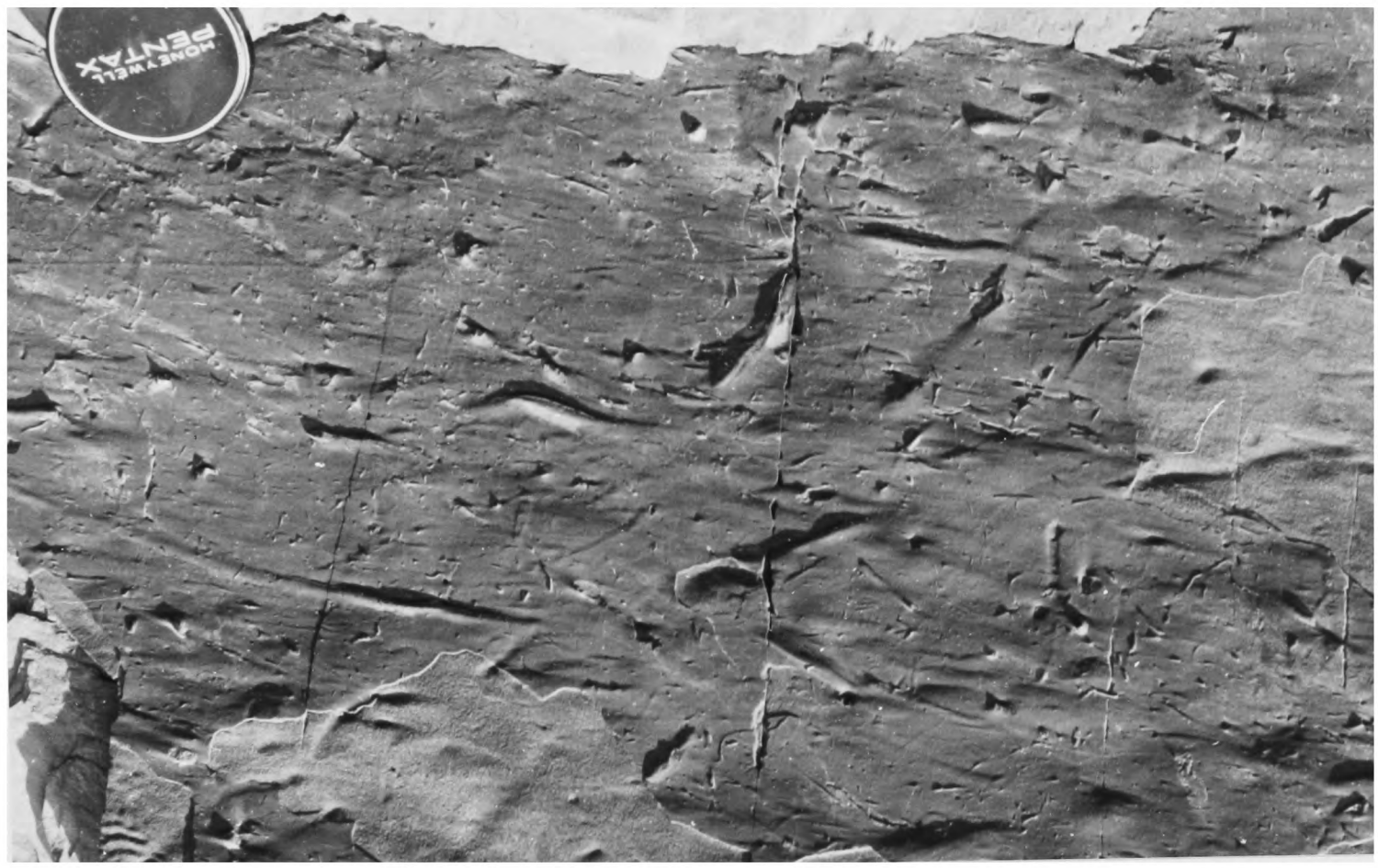

MONEYWELL
PENTAX

Plate 32 Small flute marks on the sole of a sandstone bed near the base of Unit 2. Some delicate groove marks in the lower right of the photo show a divergent direction from that of the flute marks. Current flow from right to left. First Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv section.

(p. 48)

Plate 33 Graded sandstones and interbedded mudstones near the base of Unit 2. Most sandstones appear massive but some show parallel lamination. Cleavage refraction is well seen. First Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv section.

(p. 48)

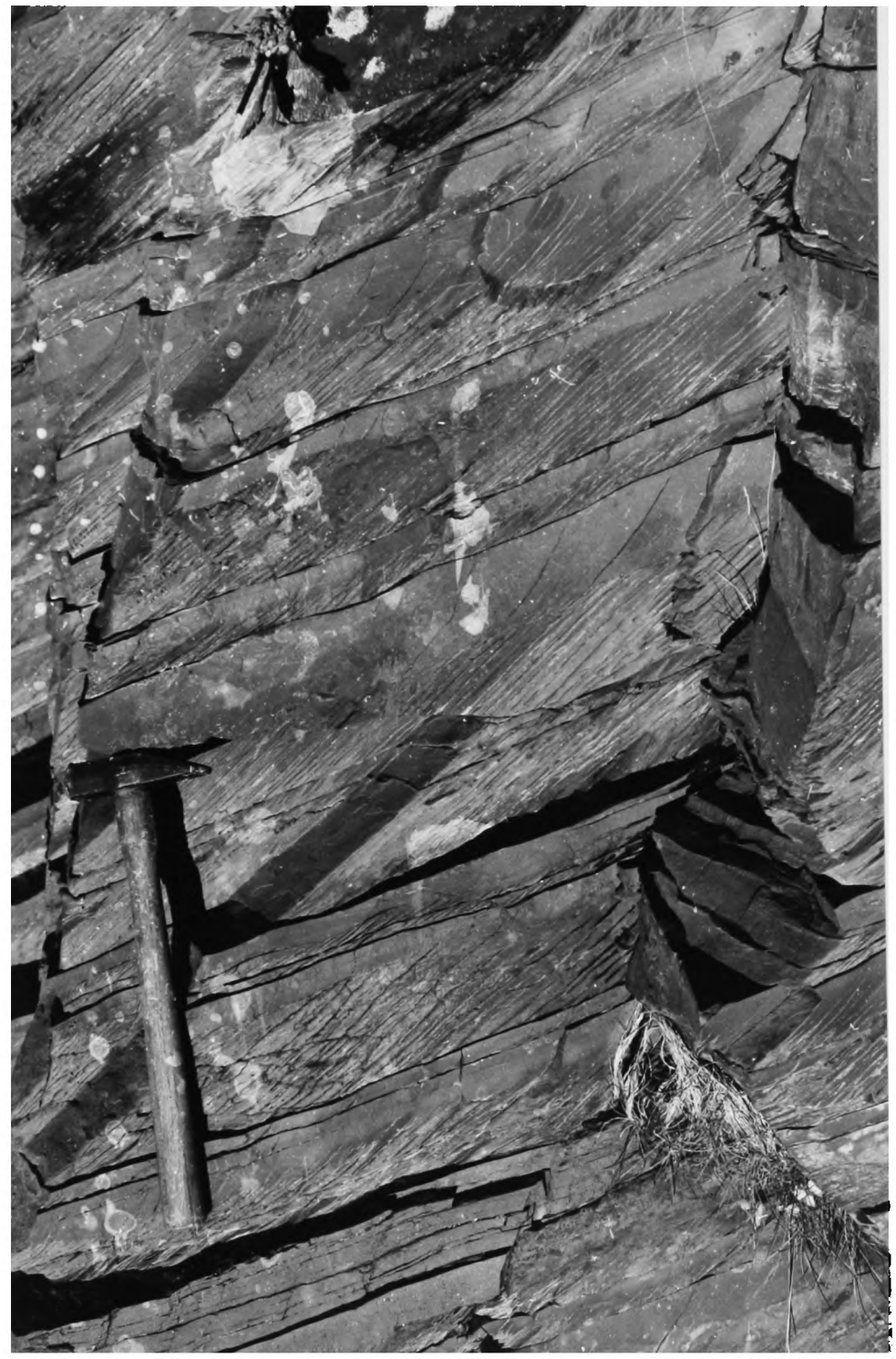


Plate 34 Low angle cross-stratification with thin overlying ripple cross-laminated zone (massive in photo). The other beds are ripple cross-laminated or parallel laminated. About 22m, First Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv Section.

(p.48)

Plate 35 General view of very thin-bedded sandstones intercalated with thicker sandstones in the foreground and background. 25-30m, First Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv Section.

(p.48)

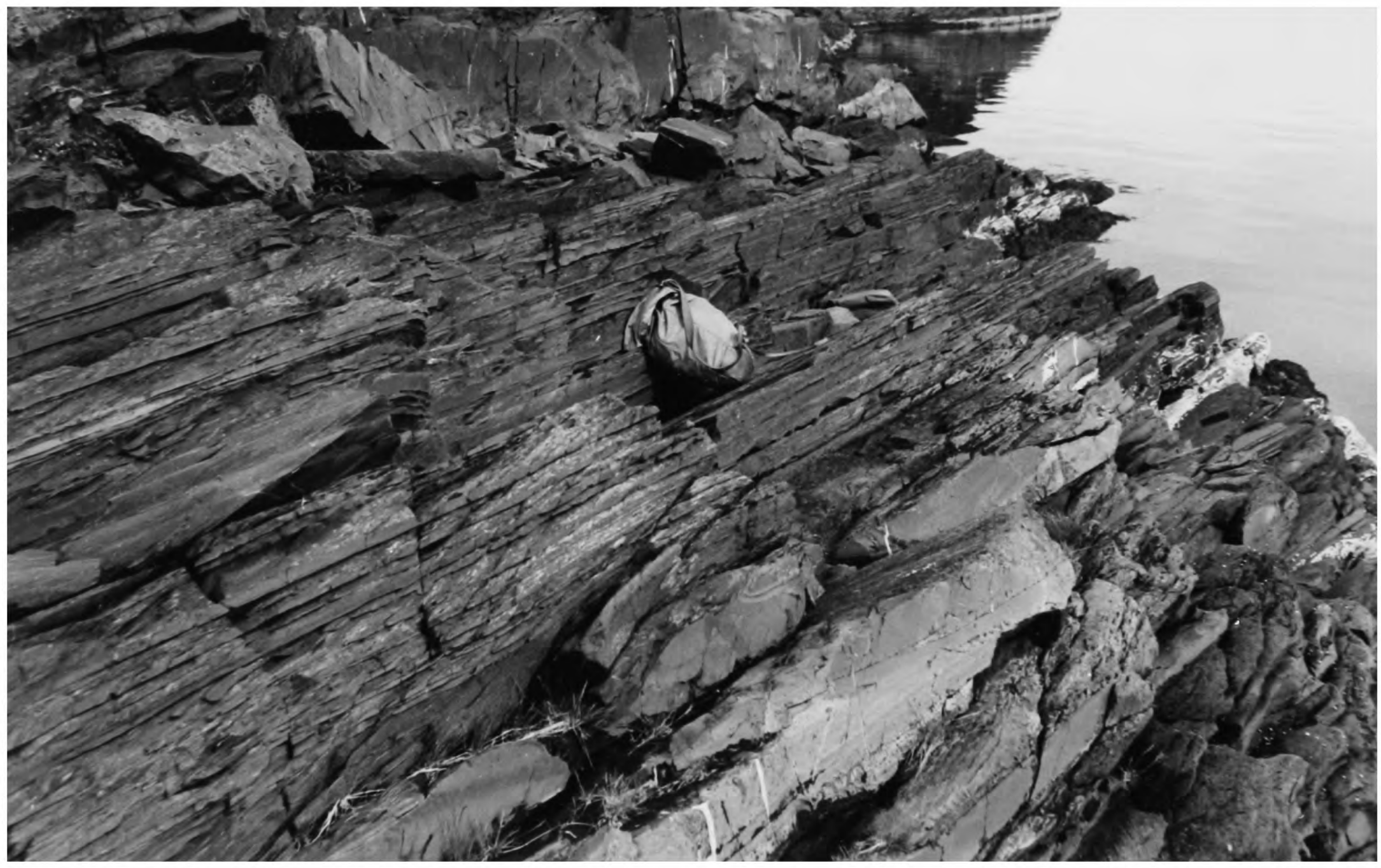


Plate 36 Graded, very lenticular, red sandstones interbedded with cleaved siltstone. Unit 3, First Coarsening Upward Sequence, Manndraperelv section.

(p.40)

Plate 37 Lower part of Unit 5 showing the upward passage from mainly thin, rippled sandstone beds to thicker beds with highly undulatory partings. First Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv Section.

(p.40)

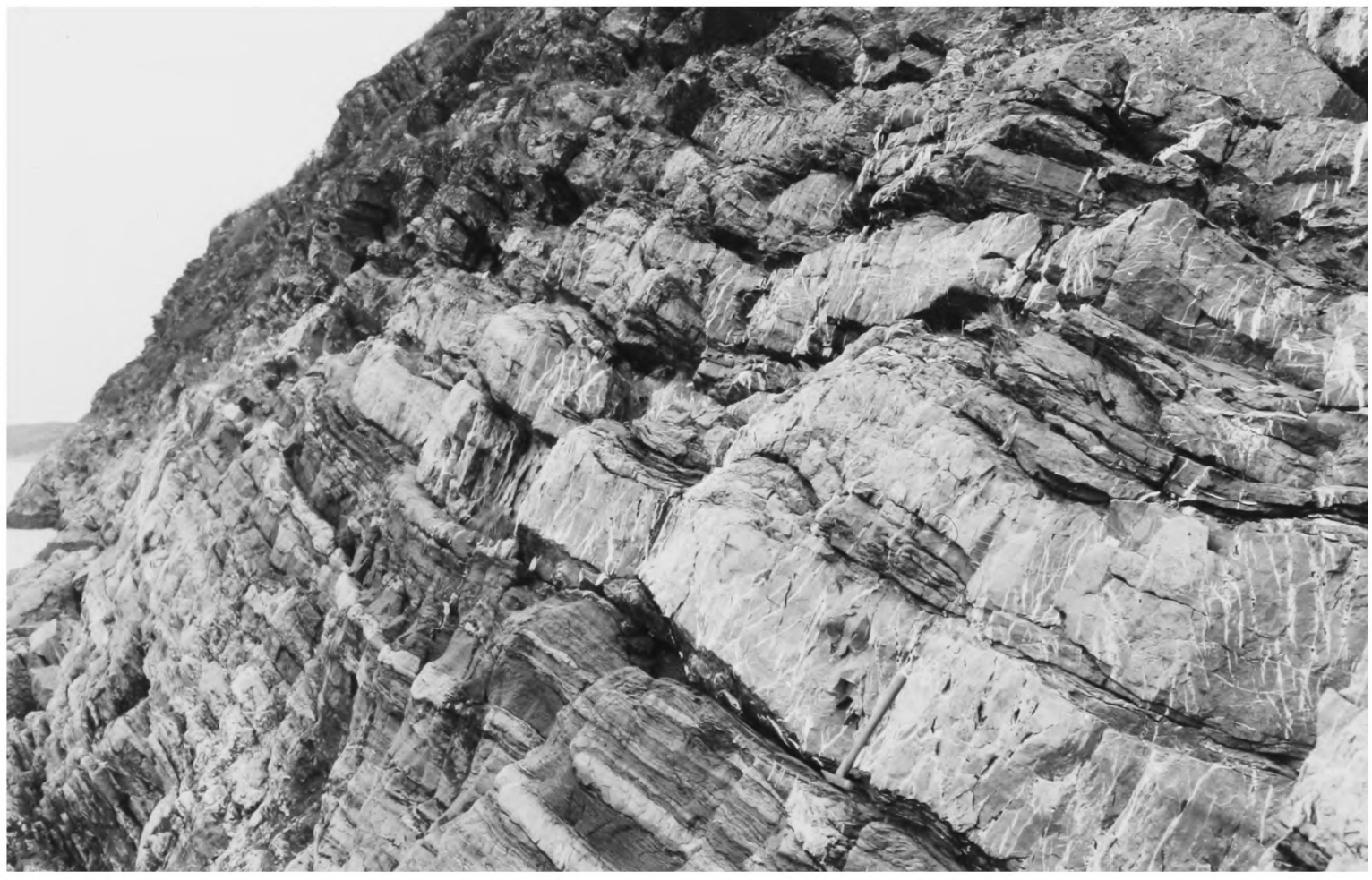


Plate 38 Trough cross-bedded sandstones (Unit 6) overlying more irregularly bedded sandstones (Unit 5). First Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv Section.

(p.51)

Plate 39 Low angle cross bedded sandstones in the foreground with fine parallel lamination. These beds are progressively truncated to the SW (away from camera) by a massive channel sandstone. This is overlain by a thin lens of red siltstone (arrowed) and then by a sandstone with low angle bedding. Unit 6, First Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv Section.

(p.51)

Plate 40 General view of Units 6, 7 and 8. The lens of siltstone in Unit 6 can be seen at the extreme left of the photo arrowed. Note

(p.51) the ball and pillow sandstones within the siltstone of Unit 7 and the gradual upward decrease in bed thickness in Unit 8. First Coarsening Upward Unit, Manndraperelv Member, Manndraperelv Section.

Plate 41 General view of lower part of Unit 8 with red sandstones showing parallel lamination

(p.51) and often passing upward into "ribby" siltstone. First Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv Section.


8
7
6

Plate 42 The junction between the First and Second Coarsening Upward Sequences showing the sharp break between thin-bedded, rippled white sandstones, and mudstones with 1-10cm bedded graded siltstones and muddy sandstones. Manndraperelv Member, Manndraperelv Section.

(p. 51, 68)

Plate 43 General view of Unit 1 showing the variation in bed thickness. The thick bed towards the upper left marks the top of Unit 1 and it is overlain by thin beds of the lower part of Unit 2. About 12m of beds shown. Second Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv Section. Arrow shows position of Plate 44.

(p. 68)

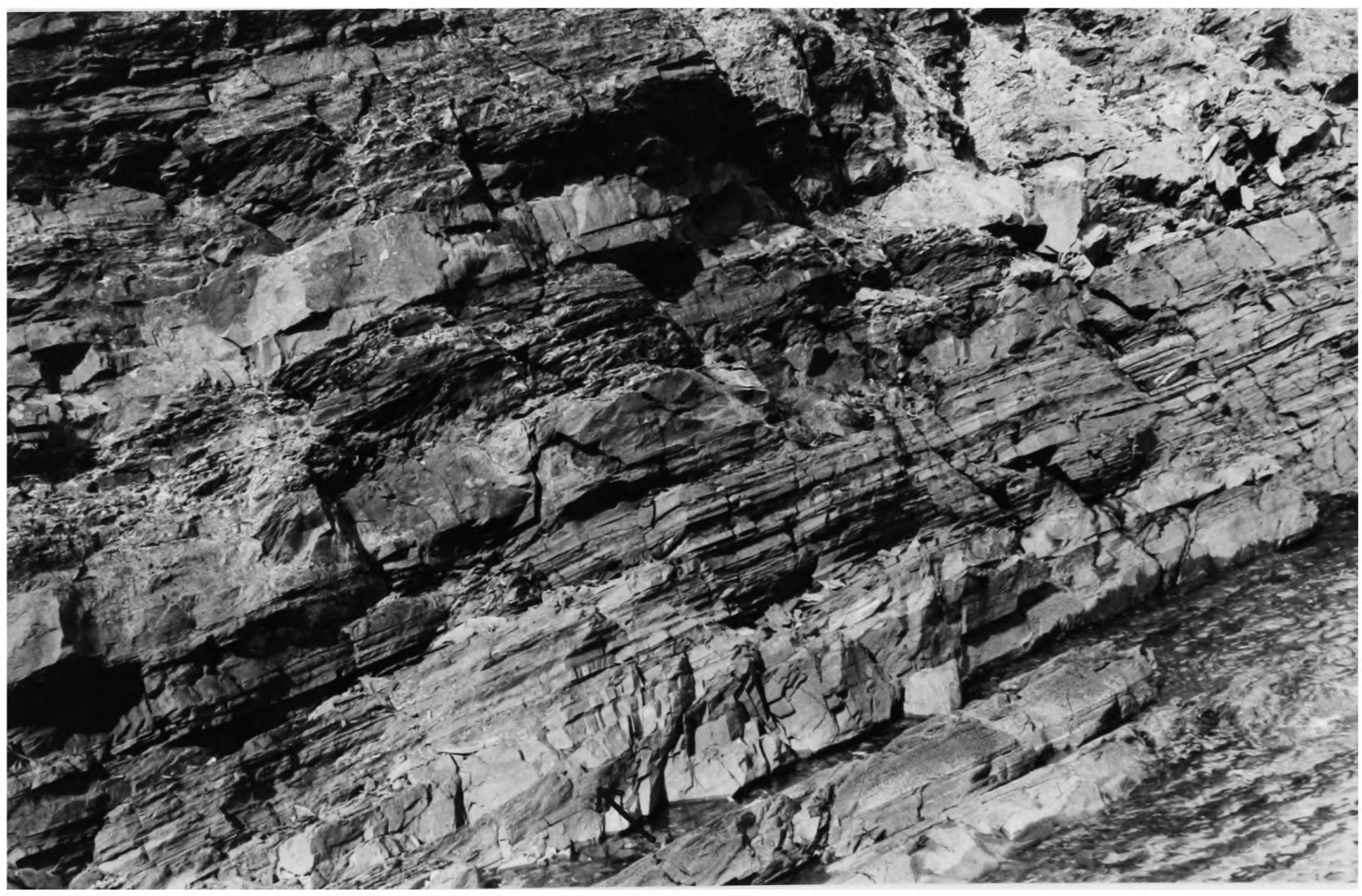


Plate 44 Very lenticular, sharp-based and sharp-topped sandstones interbedded with mudstones in Unit 1. Position shown in Plate 43.

(p.68)

Plate 45 Group of lenticular and partly amalgamated sandstone beds occurring at the top of Unit 2. Cross-bedding seen in bed in foreground. Current directions in several beds are to the southwest, away from the camera. Second Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv Section.

(p.69)

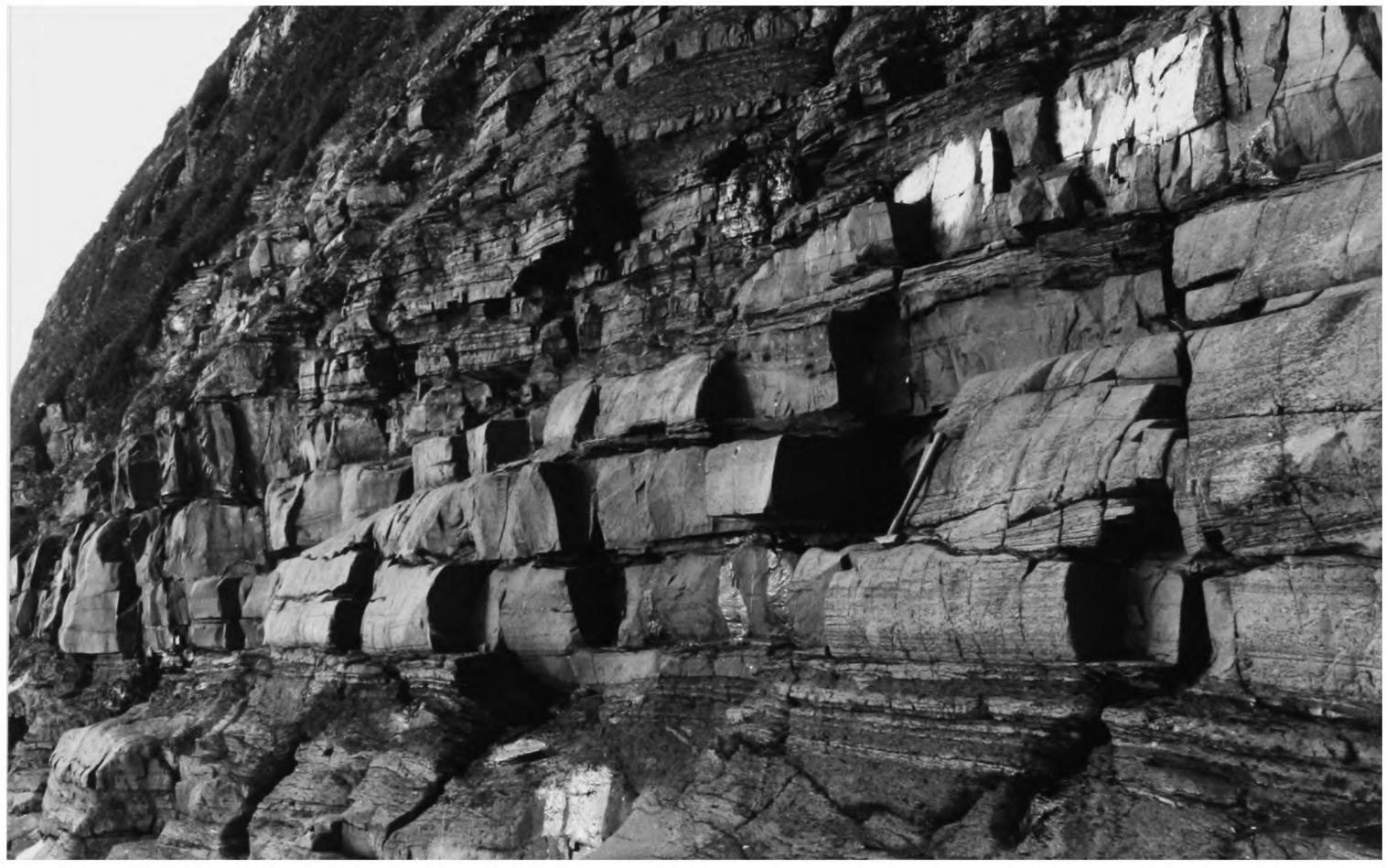
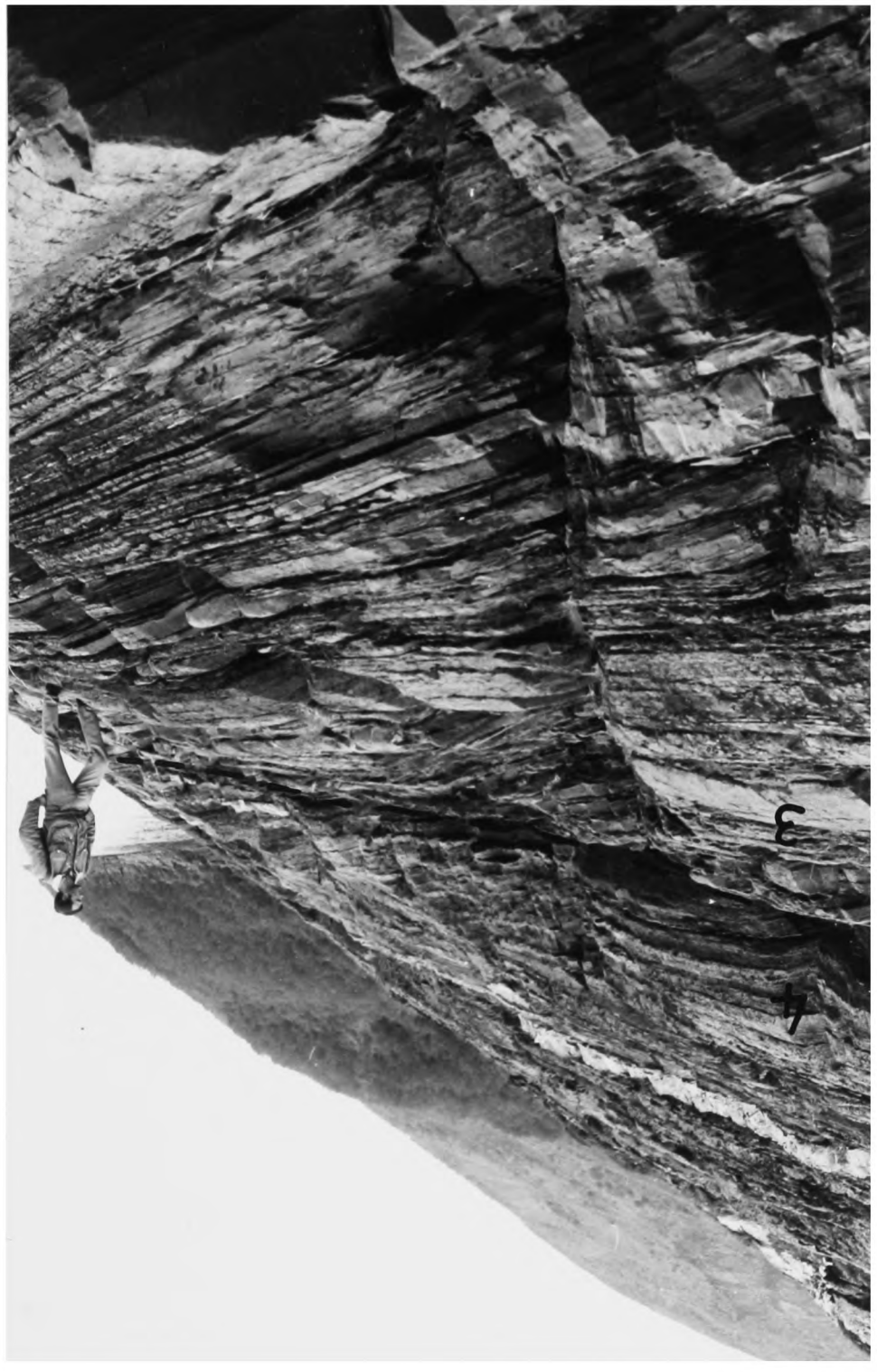


Plate 46 General view of the upper part of Unit 3 and most of Unit 4. The majority of beds in Unit 3 die out laterally within a few tens of metres. Second Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv section.

(p.69)

Plate 47 Detailed view of part of Unit 3 showing irregularly bedded siltstones and very fine sandstones some of which are graded. A thicker, erosively based sandstone occurs at the level of the hammer. Second Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv section.

(p.69)



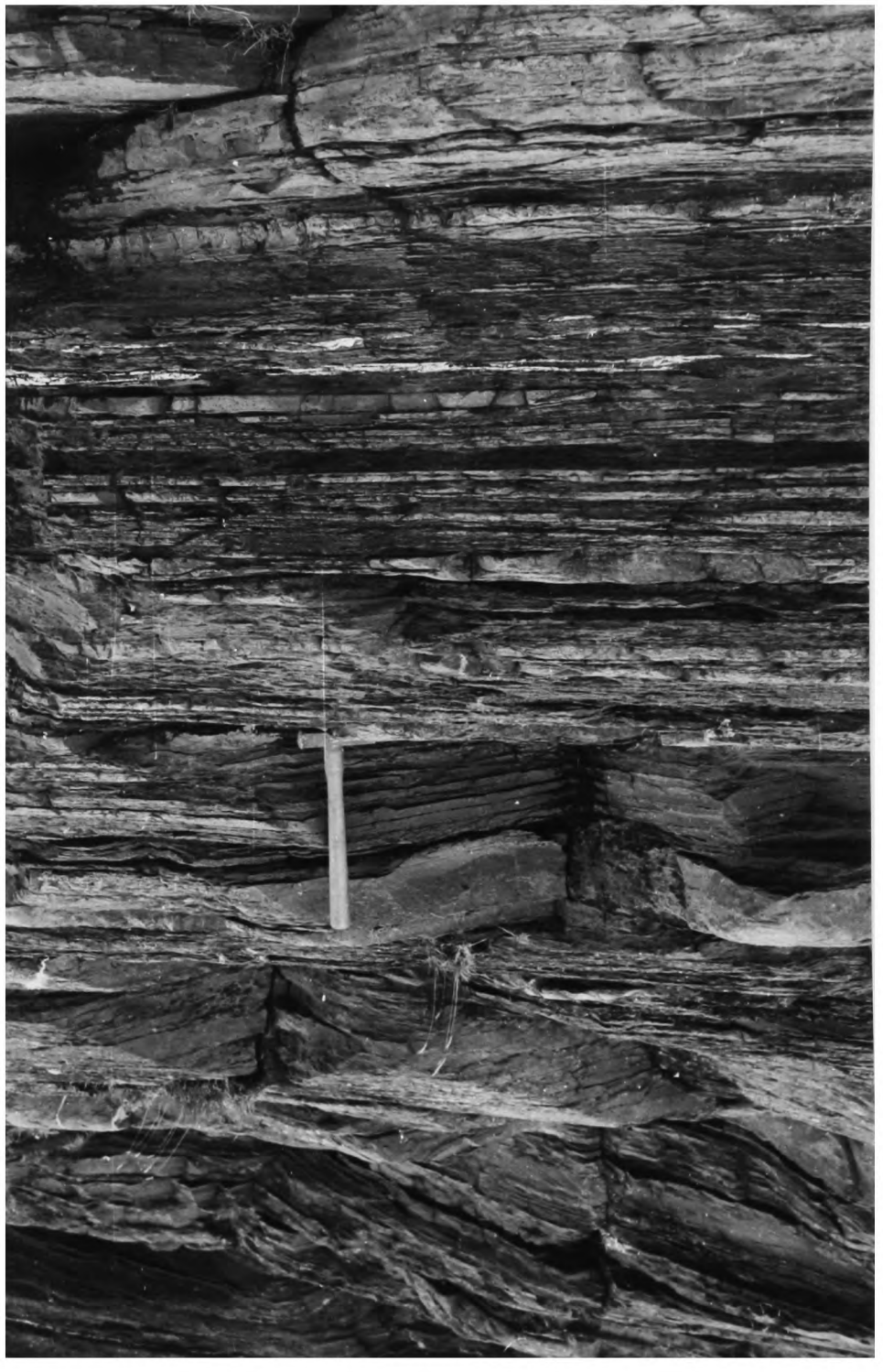
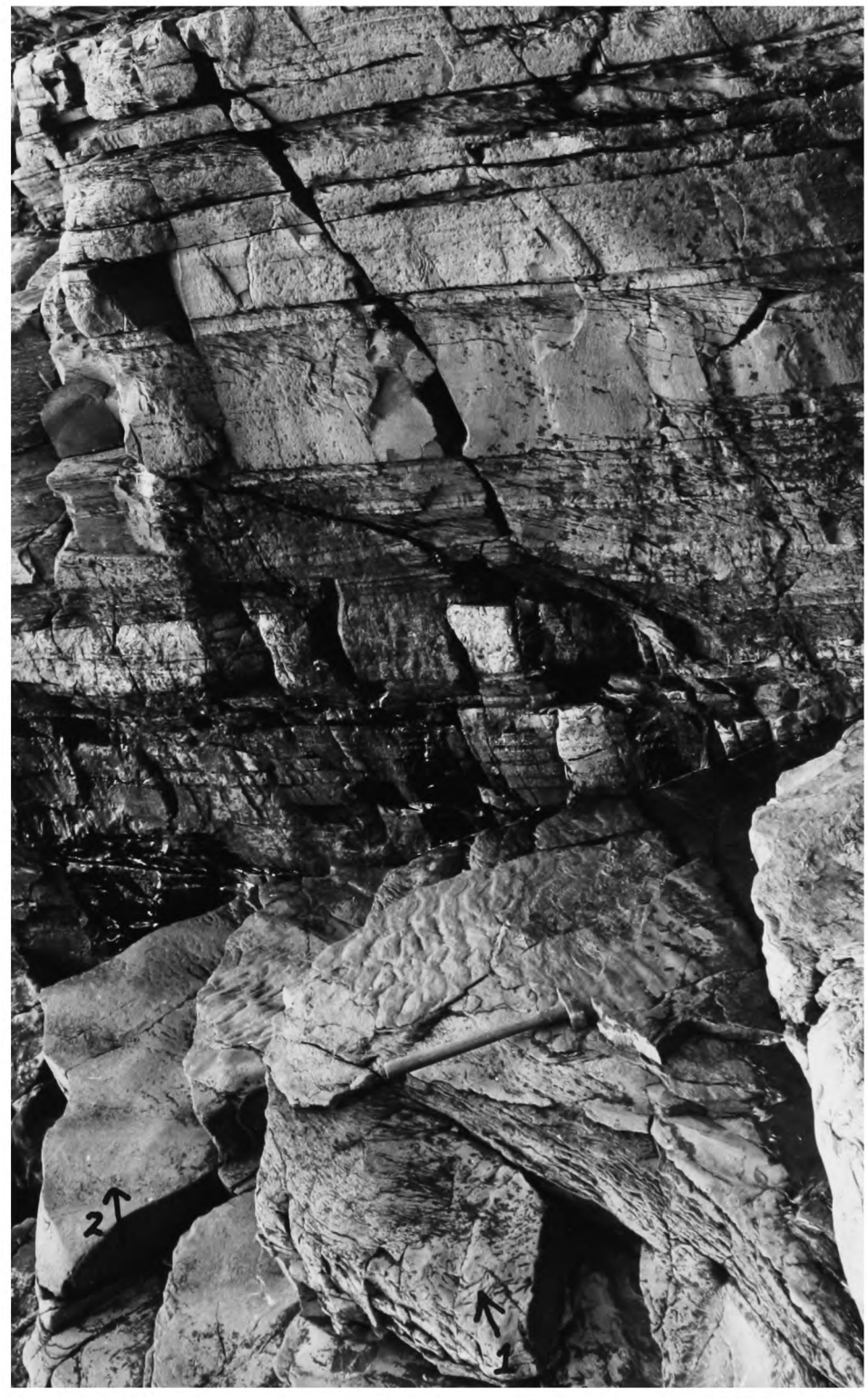


Plate 48 Layer of intraformational sandstone and mudstone clasts overlain by parallel laminated very fine sand and interbedded with lenticular sandstones. Lower part of Unit 3, Second Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv Section.

(p. 69).

Plate 49 Symmetrical ripples on bedding surfaces in the lower part of Unit 3. Other surfaces show rib and furrow (arrow 1) and irregular ripple form at top of trough cross-laminated fine sandstone bed (arrow 2). Second Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv Section.

(p. 70)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1

Plate 50 Red siltstone with interbedded rippled sandstones showing current flow from right to left. Unit 4, Second Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv Section.

(p.70)

Plate 51 5-20cm bedded, fine to medium red sandstone (Unit 5) underlain by red siltstone (Unit 4) and overlain by thinner bedded sandstones (Unit 6), Second Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv Section.

(p.70)


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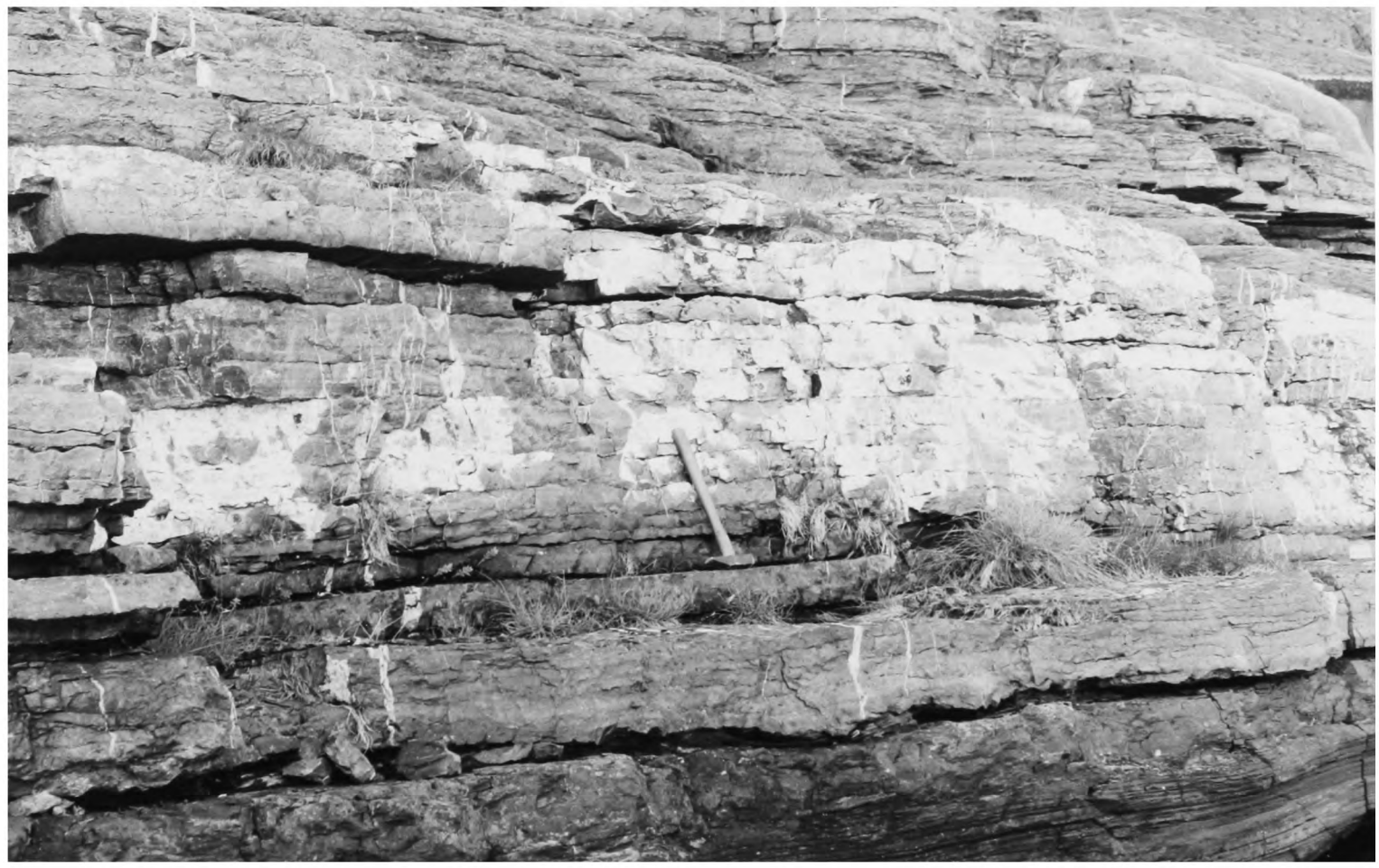
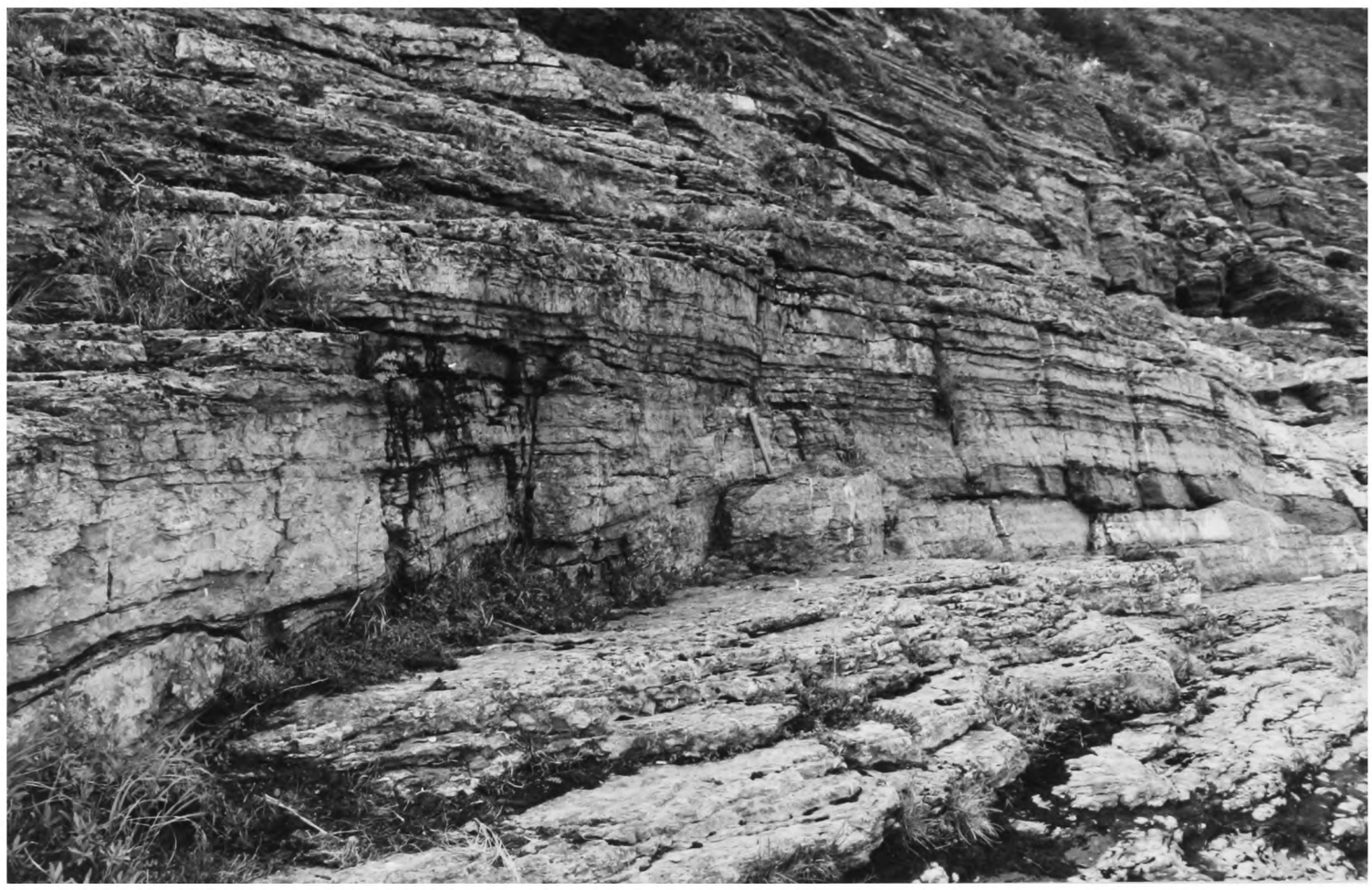


Plate 52 View of the sandstone hump of Unit 7 with the overlying sandstones of Unit 8 passing up into the sandstones and siltstones of the Lower Breivik Member seen in the background. Second Coarsening Upward Sequence, Manndraperelv Member, Manndraperelv Section.

(p.70)

Plate 53 View of the upper part of the Second Coarsening Upward Sequence, (Breivik Formation) in the Adamsfoss section. To the right of the hammer are siltstones with isolated sandstone ripples. These pass up into very thin-bedded sandstones and siltstones and then into 1-15cm bedded white sandstones.

(p.77)



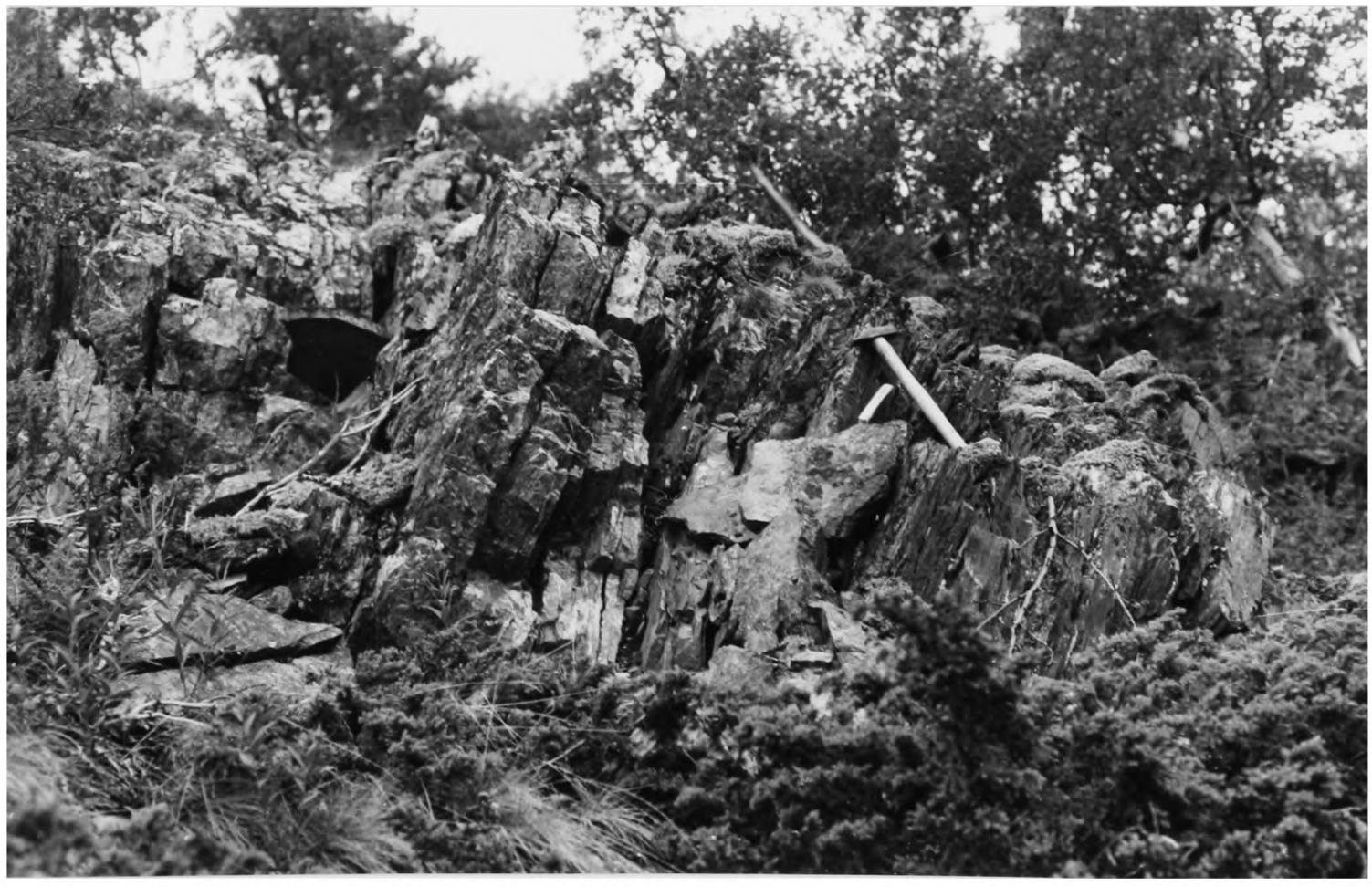


Plate 54 Thin-bedded sandstones interbedded with siltstones. About 9m, Second Coarsening Upward Sequence (Breivik Formation), Kunes (South). Locality 5 of Appendix B.

(P.77)

Plate 55 Fault with downthrow of 10m to the NE cutting the Lower Breivik Member section south of Breivik.

(P.82)

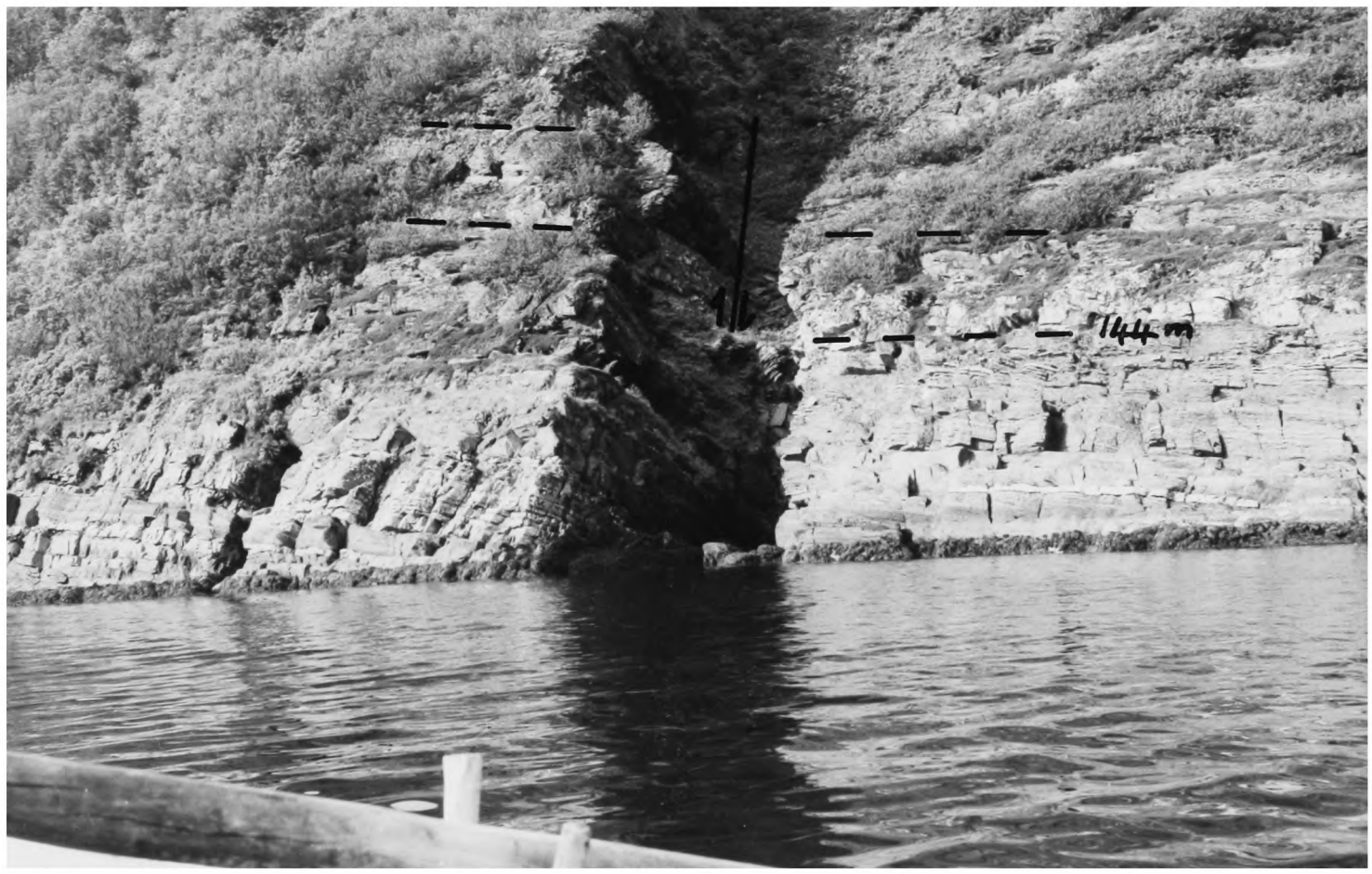

1.44 m

Plate 56 Phycodes pedum on the base of a sandstone bed at 205 m in the Lower Breivik Member section south of Breivik.

(p.83)

Plate 57 Grey, very fine sandstones passing upward through fine sandstones into white, cross-bedded, medium to coarse sandstones (at level of hammer). Lower Breivik Member, about 90 m, section south of Breivik.

(p. 83)

Plate 58 Facies 1: siltstone with laterally persistent coarse siltstones and very fine sandstones. Lower Breivik Member. About 135m section S. of Breivik.

(p.84)

Plate 59 Laterally persistent sandstones of Facies 2. The beds are very fine or fine sandstones except for some distinctly rippled beds of medium sandstone just below the hammer. Lower Breivik Member, about 85m, section S. of Breivik.

(p.85)

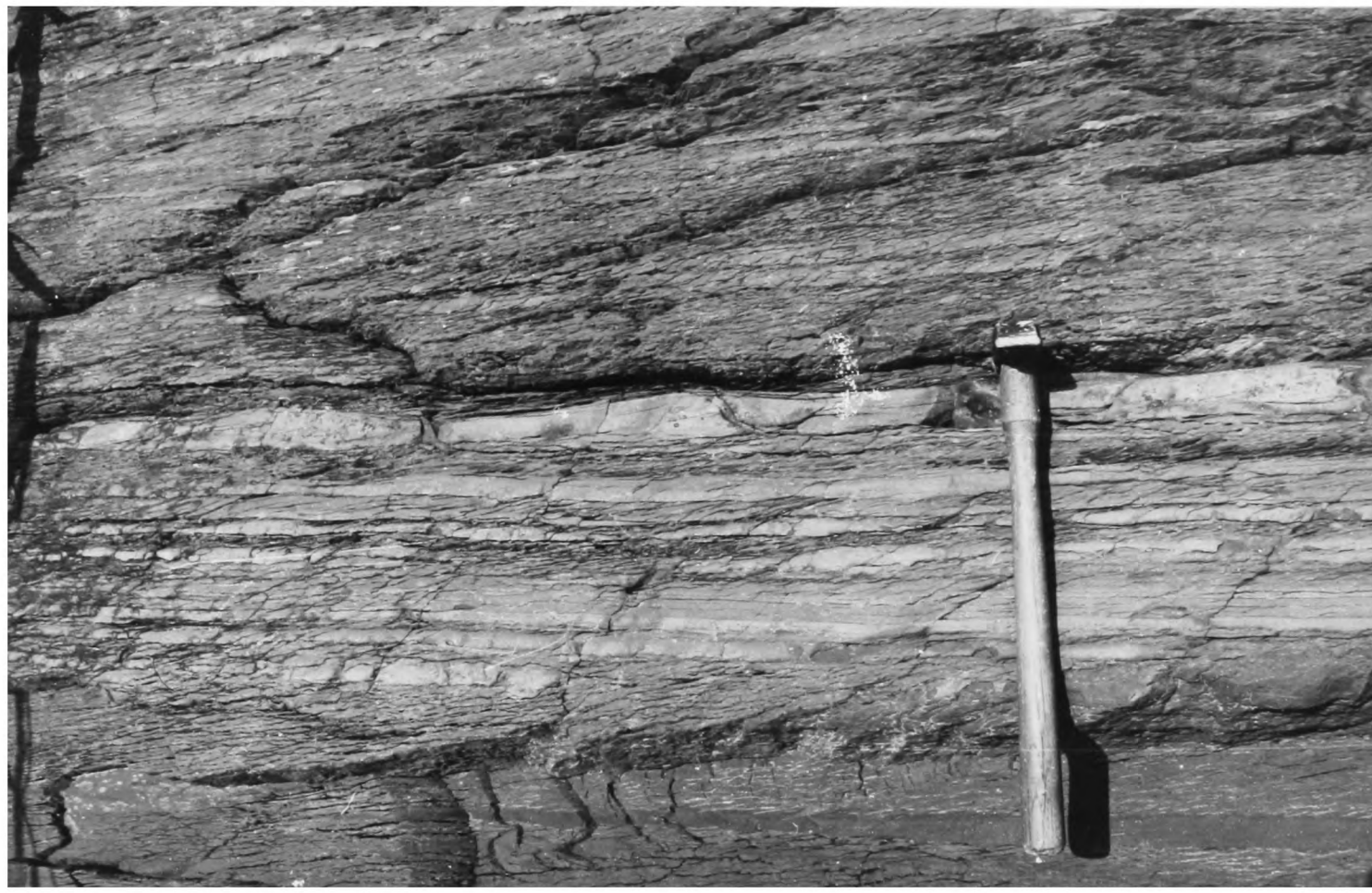


Plate 60 Irregular and somewhat laterally impersistent sandstones of Facies 2. Lower Breivik Member, about 240-245m, section S. of Breivik.

(p.86)

Plate 61 Facies 2: many laminae and very thin rippled beds of very fine sandstone. About 135m in the Lower Breivik Member Section south of Breivik.

(p.86)

Plate 62 Facies 3: erosively based, graded, very fine sandstones with parallel lamination as the predominant internal structure. About 156m in the Lower Breivik Member Section south of Breivik.

(p.86)

Plate 63 Facies 4: cross-bedded medium to coarse sandstones with intraformational pebbles in lower part. Thinner, parallel laminated beds above with mudstone interbeds. About 94m in the Lower Breivik Member Section south of Breivik.

(p.87)

Plate 64 Lenticular beds of Facies 4 sandstone separated by massive siltstone/mudstone. The lowest sandstone bed (by hammer) is a series of isolated dunes. The next sandstone bed above is a dark grey sandstone of Facies 3 type. 215-218m in the Lower Breivik section south of Breivik.

(p.88)

Plate 65 Small thrust fault in the Lower Breivik Member sandstones and siltstones in the Vaderelv Valley. Beds correspond to about 120-125m in Leirpollen section.

(p.92)

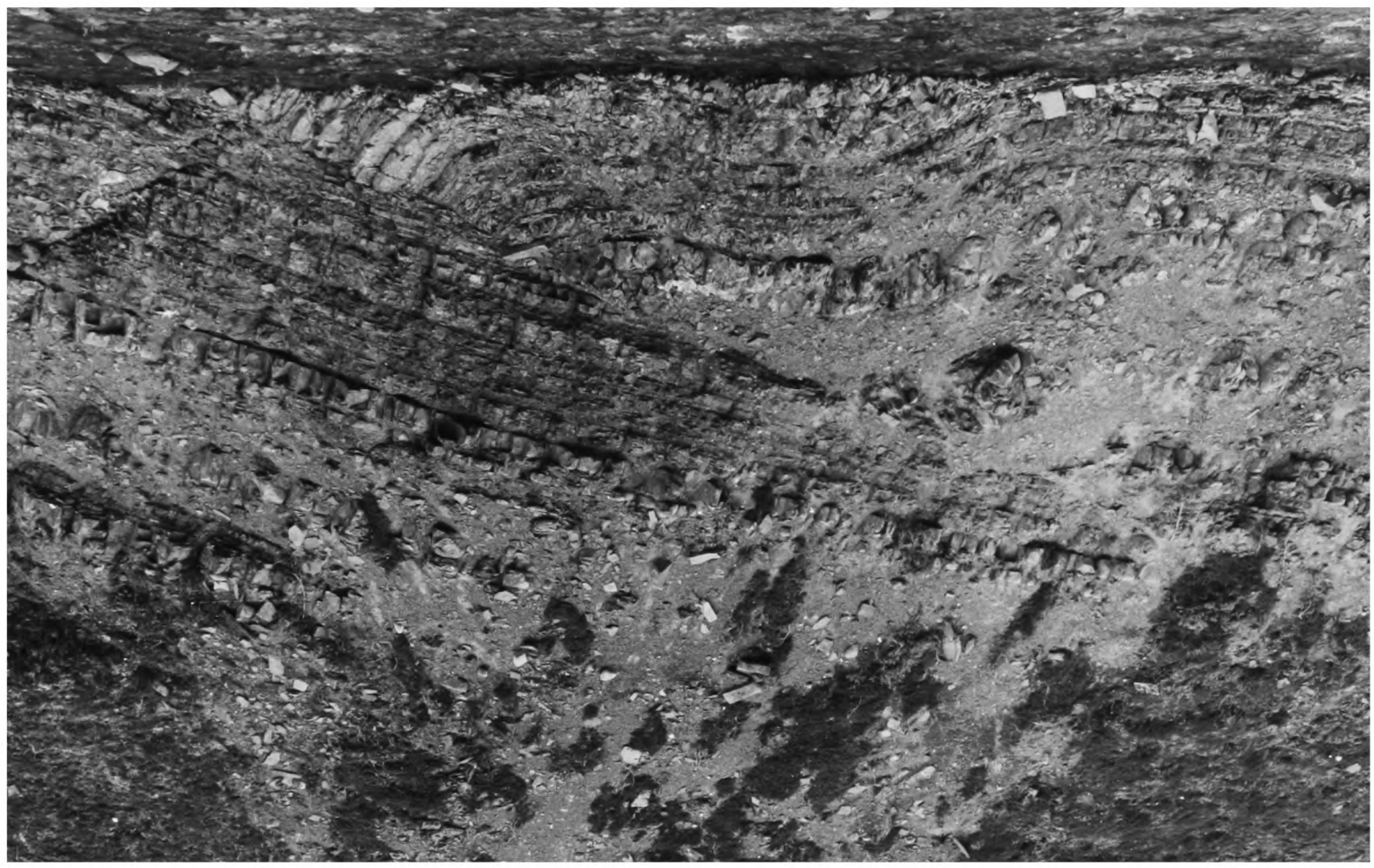


Plate 66 The uppermost beds of the Dividal Group and lowest beds of the Gaissa Nappe in the stream section described by Føyn (1967) at Halkkavarre. Føyn's divisions on the left, new interpretation on the right showing the position of the thrust.

(p. 95)

Plate 67 Sharp junction between Lower and Upper Breivik Members exposed on the coast south of Breivik. Hammer rests on contact.

(p. 98)

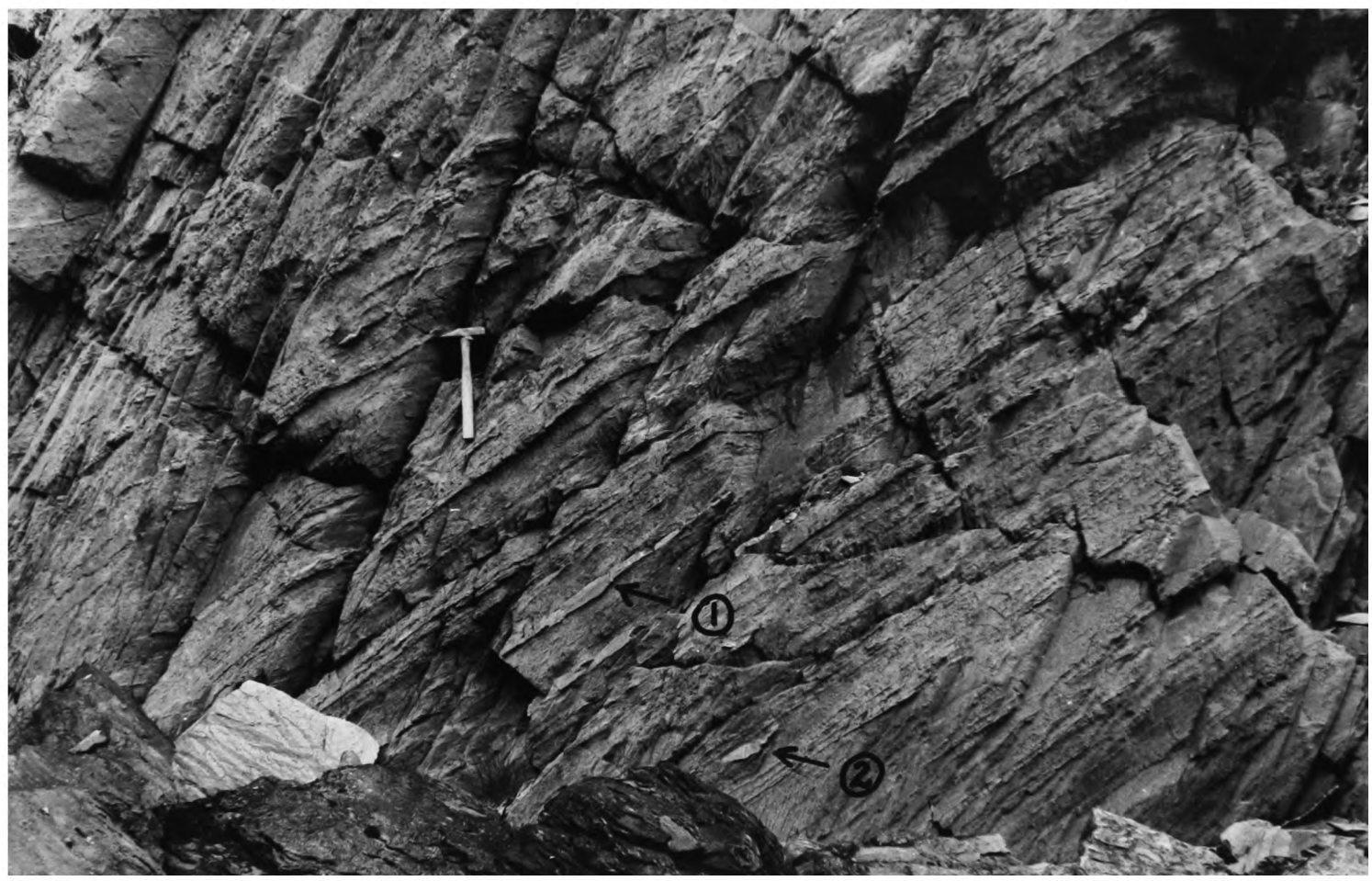

PORSANGER
SST.
GAISSA SANDSTONE FORMATION
THRUST

Plate 68 Laminae and beds (<10cm) of sandstone alternating with siltstone. The sandstones have sharp, sometimes irregularly erosive, bases (arrow 1). Most beds are laterally persistent but some isolated lenses occur (arrow 2). Faulted gulley on coast just south of Breivik.

(p.99)

Plate 69 Strongly bioturbated sandstones and siltstones of the Upper Breivik Member. Note the loaded base of the sandstone just above hammer head. Coast just north of Breivik.

(p.100)


①
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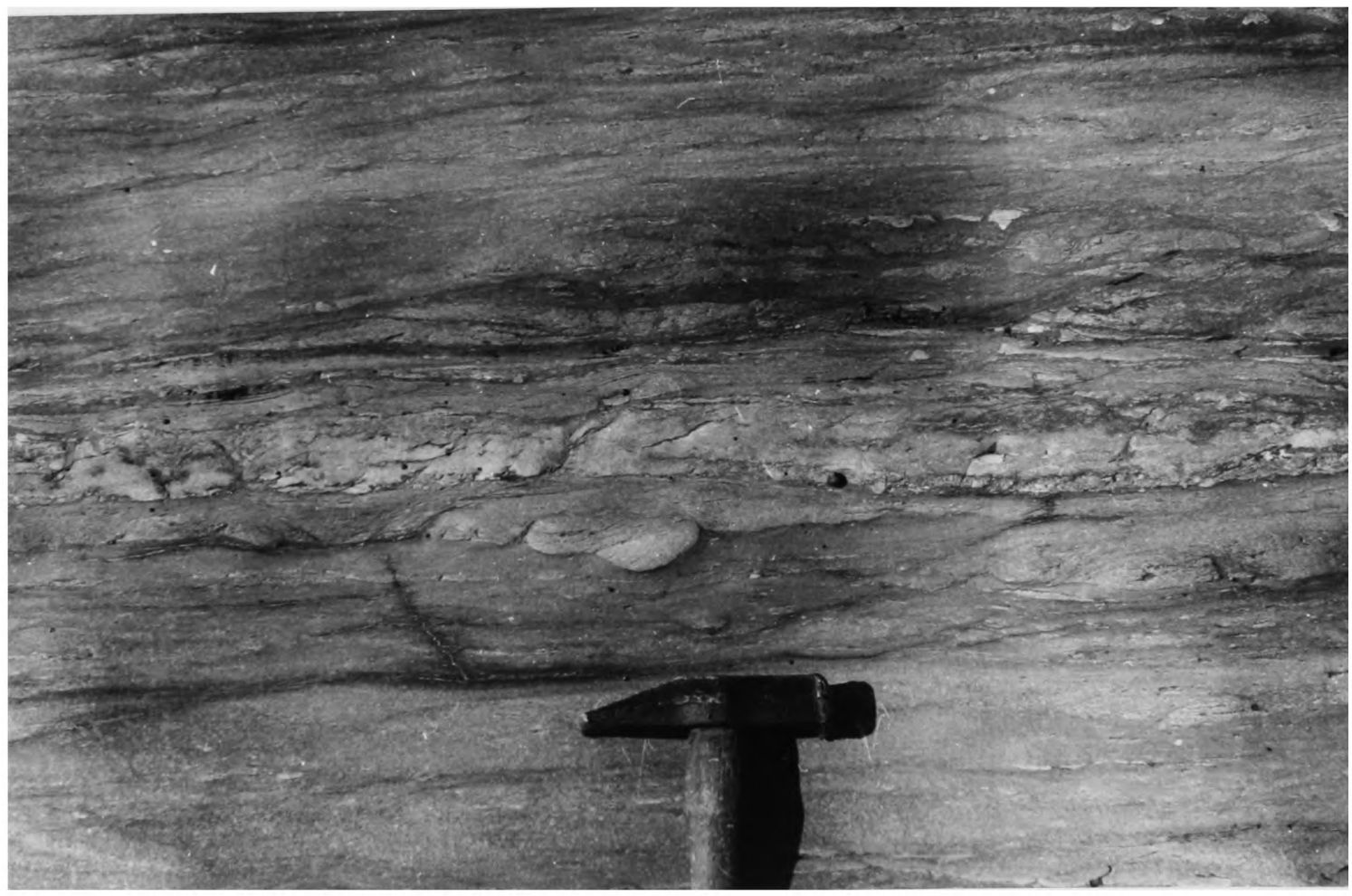


Plate 70 The beds at 3-9m in the Lower Duolbasgaissa Member as exposed on the coast about 1.7km north of Breivik (main section).

(p.102)

Plate 71 Large horizontal burrows forming radial patterns beneath the base of a sandstone bed. 24m in main section of Lower Duolbasgaissa Member.

(p.103)

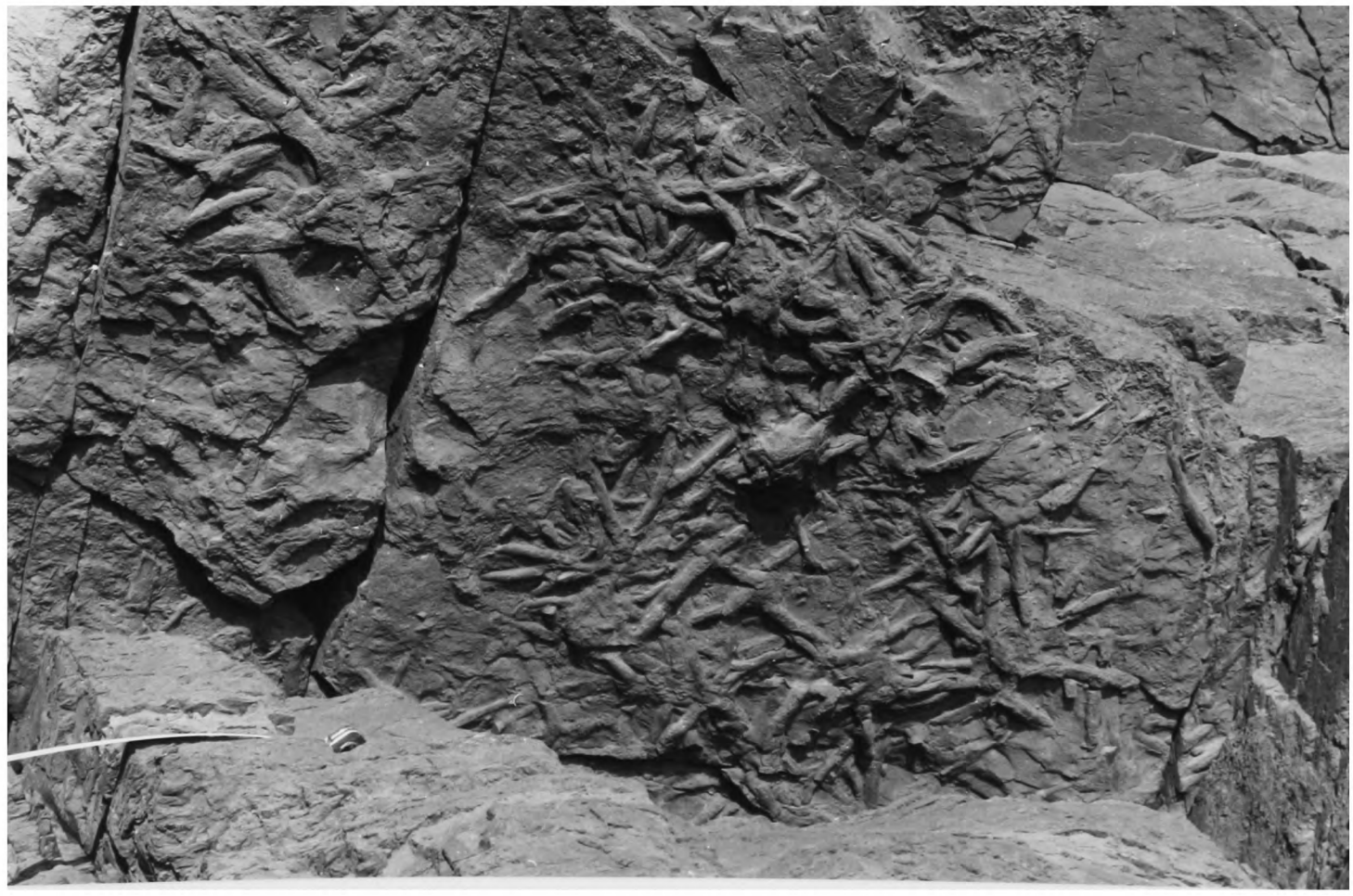


Plate 72 Underneath view of a fine sandstone bed showing primary current lineation (on right hand side) overlain by rib and furrow. Lower Duolbasgaissa Member, main section.

(p.103)

Plate 73 "Balled-up" sandstone occuming 5m below the 20m Quartzite. Just below this sandstone is a thin "grit" bed and very thin-bedded sandstones and siltstones. 50-58m in the main section, Lower Duolbasgaissa Member.

(p.103)

Plate 74 Bioturbated fine sandstones and siltstones. A typical cross-laminated sandstone is seen level with the base of the hammer. A "grit" bed above the hammer has an irregular ripple morphology on its top surface. Lower Duolbasgaissa Member main section, 50m.

(p.104)

Plate 75 Sharp planar base of the 20m Quarzite with granule conglomerate overlying cleaved siltstone. Main section, Lower Duolbasgaissa Member.

(p.104)

Plate 76 General view of the 20m Quartzite on the left with thinner bedded sandstones above. Lower Duolbasgaissa Member, main section.

(p.104)

Plate 77 Irregularly bedded fine sandstones, siltstones and mudstones seen in the Lower Duolbasgaissa Member above the 20m Quartzite in the shore exposure 2km N. of Breivik.

(p.105)

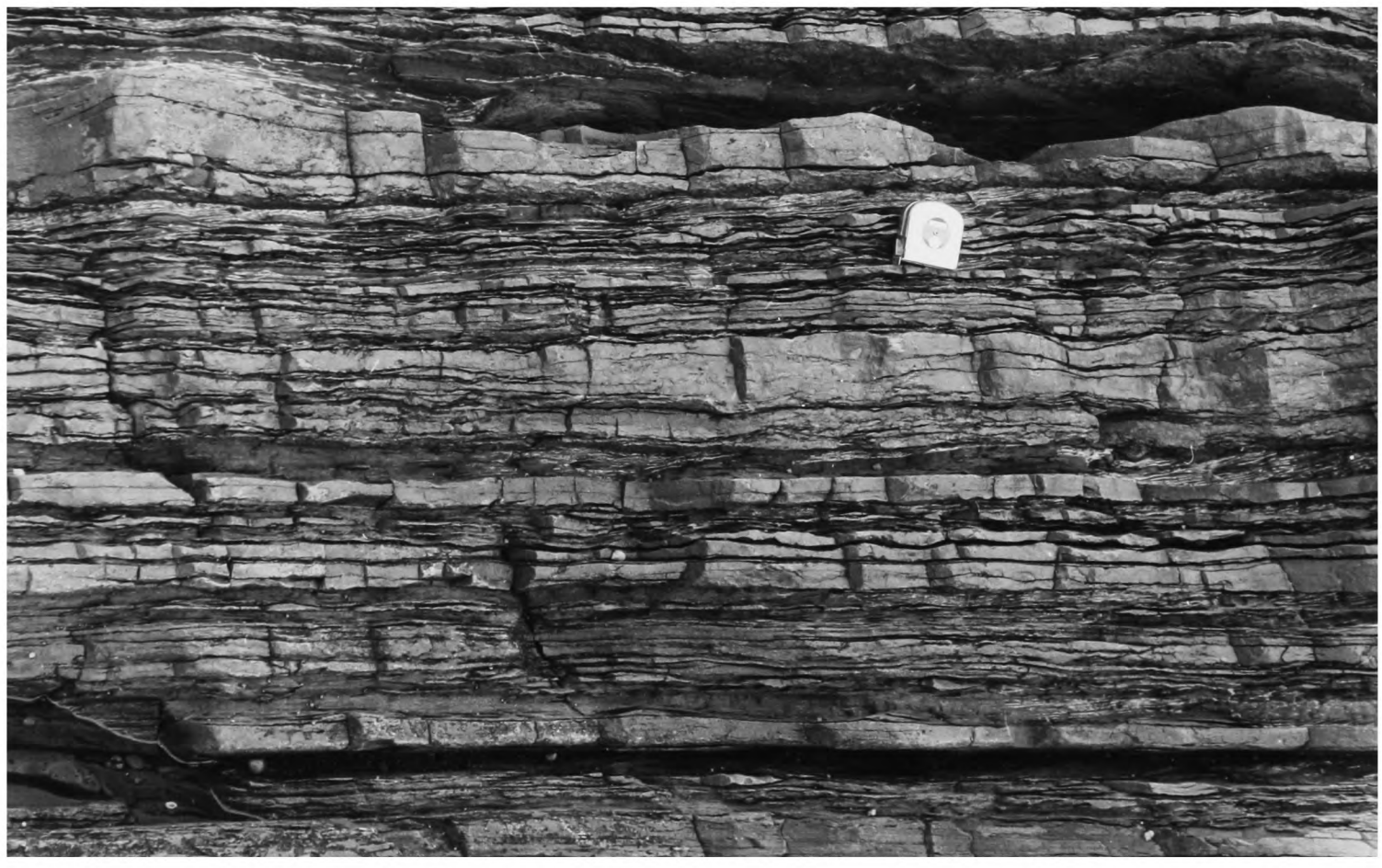


Plate 78 Thick sandstone beds above the level of the hammer show syn-depositional deformation which produces pseudo cross-bedding. Lower Duolbasgaissa Member main section.

(p.105)

Plate 79 Typical cross-bedding of the 20m Quartzite at Varnes valley (section 1 of Fig. 59).

(p.107)

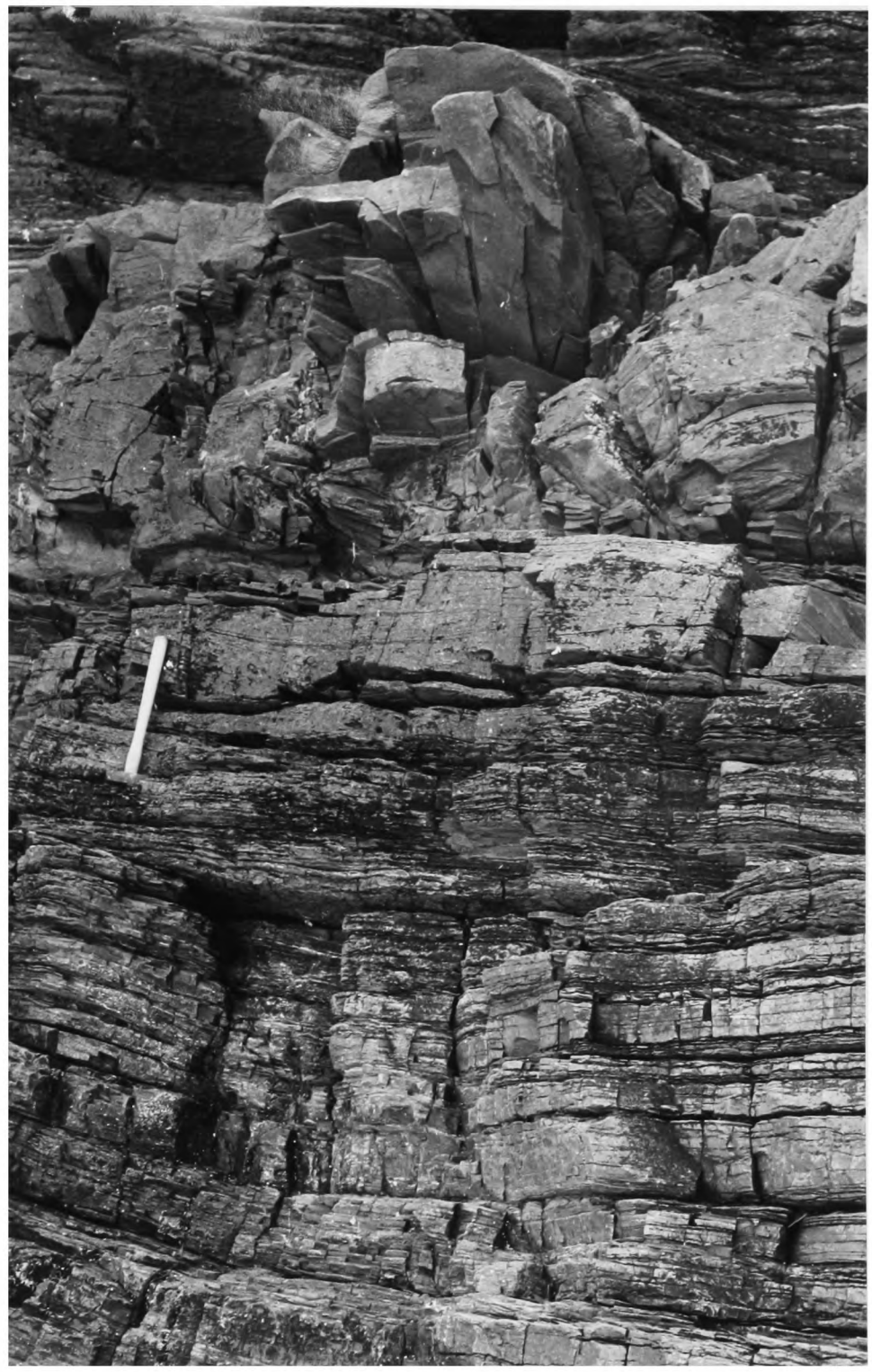


Plate 80 View of Varnes Valley (section 1) showing the 20m Quartzite, the upper part of the Lower Duolbasgaissa Member with a number of thick-bedded sandstones, and part of the white sandstones of the Upper Duolbasgaissa Member.

(P.167)

Plate 81 Two main sandstone bands of the 20m Quartzite at Section 8 of Fig. 59, Lower Duolbasgaissa Member.

(P.167)


U.D.M.
L.D.M.
20m


2
1

Plate 82 Base of 20m Quartzite resting on flaggy sandstones with low-angle cross-bedding at section 8 of Fig. 59. The base is at the level of the top of the hammer head and the lowest beds of the Quartzite are flat bedded fine sandstones.

(p.107)

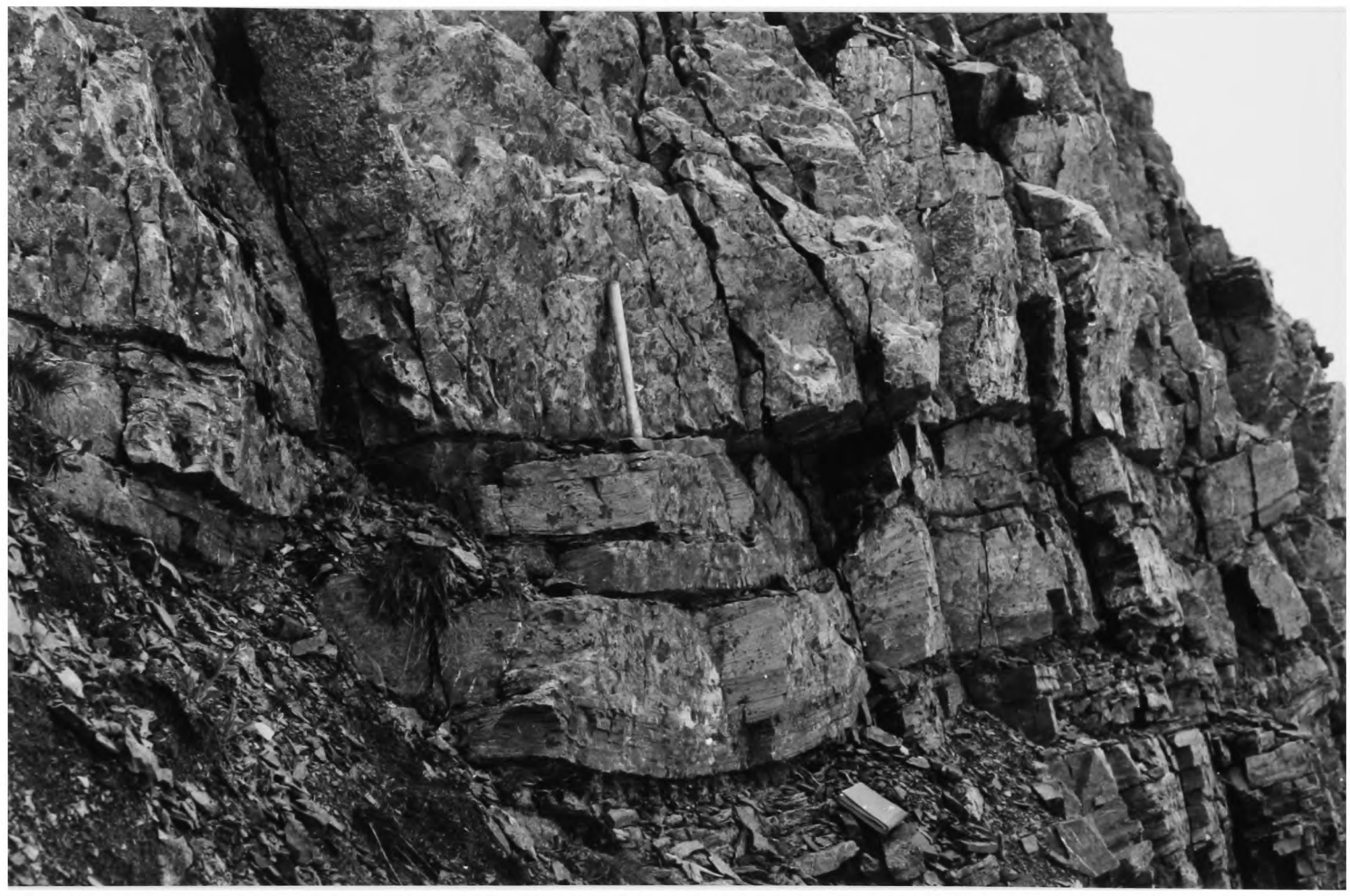


Plate 83 The Upper Duolbasgaissa Member above the middle branch of the Manndraperelv, southwest of Section 6 of Figure 62.

(p.115)

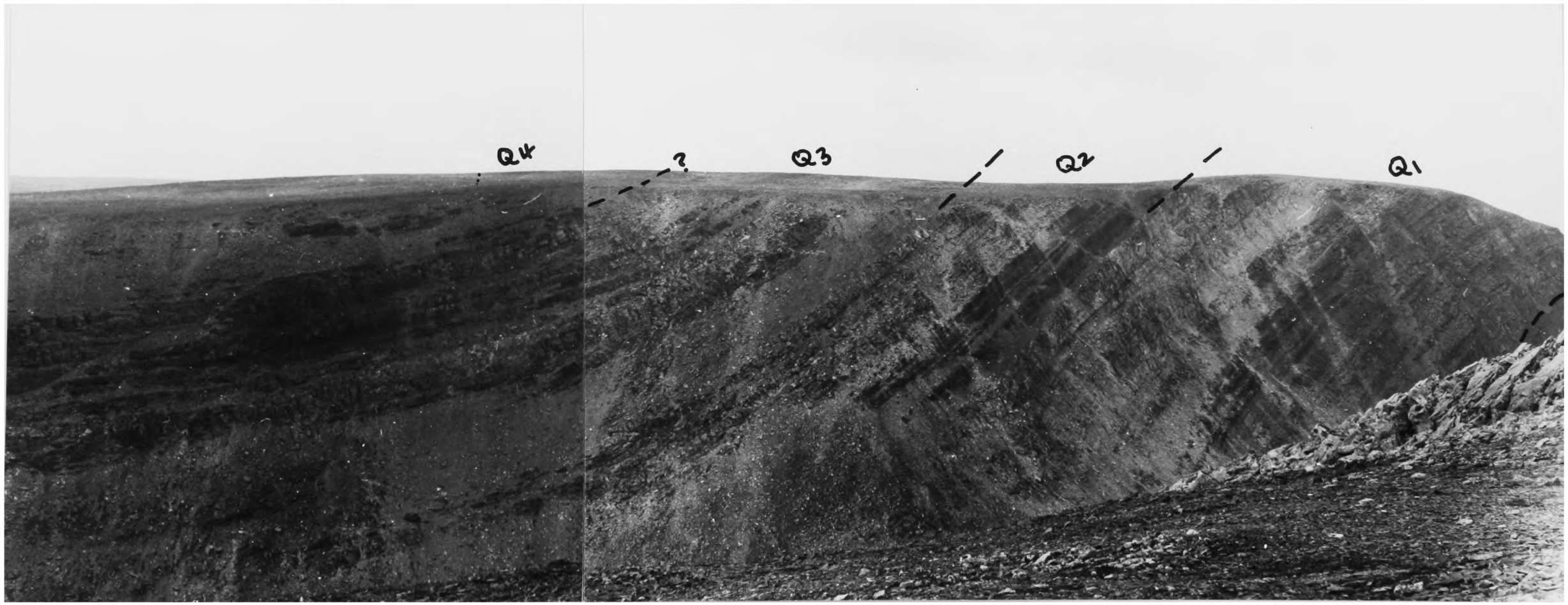

Q4
?
Q3
Q2
Q1

Plate 84 The Upper Duolbasgaissa Member viewed in a valley between Varnes and Breivik (Section 1 of Fig. 62).

(p.115)

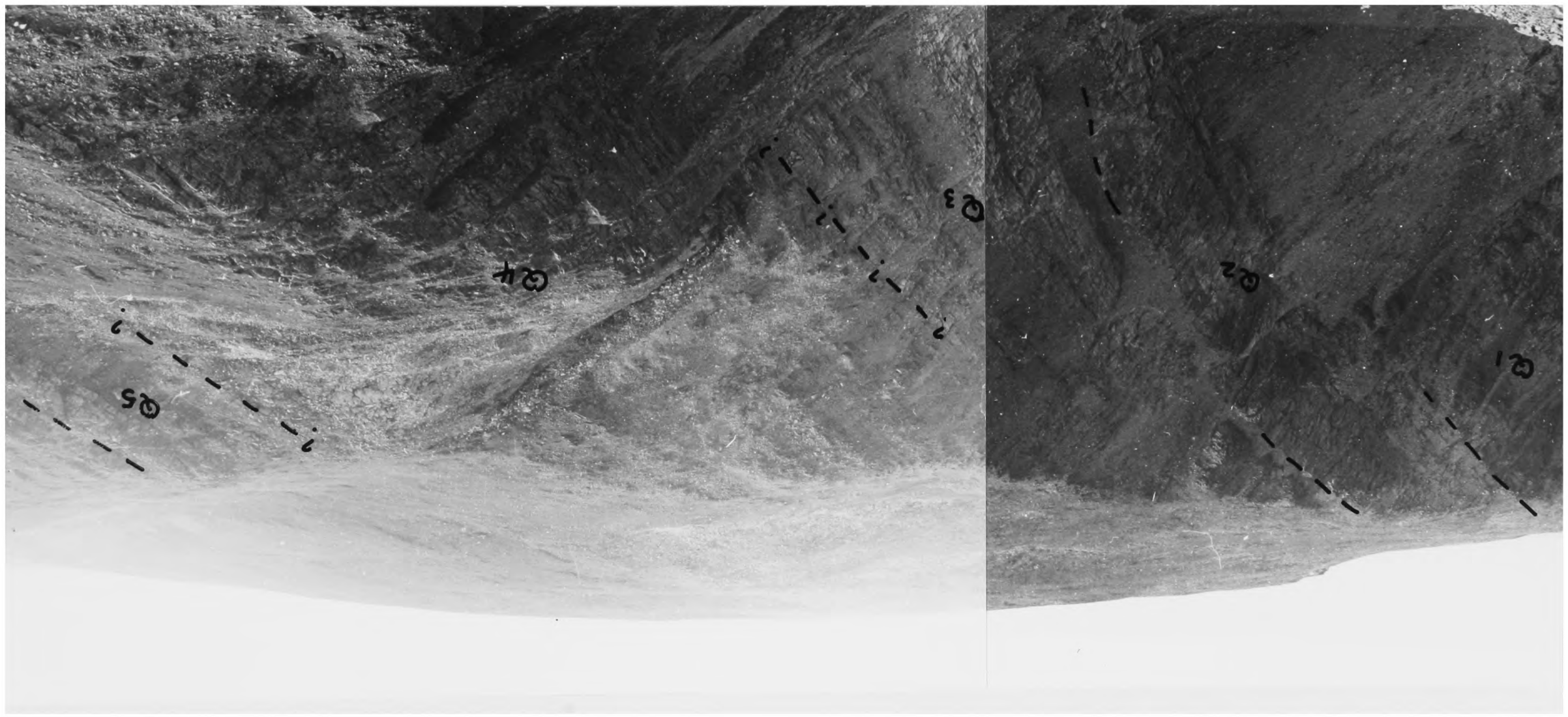

Q1
Q2
Q3
Q4
Q5

Plate 85 View of the N. face of Breivik Valley. The lowest 150m and the uppermost 84m of the Upper Duolbasgaissa Section were measured in the areas shown by the lines. A thrust repeats part of the succession near the top of the cliffs.

(p.116)

Plate 86 View of the south face of Breivik Valley. The middle part of the Upper Duolbasgaissa section (= Section 3) was measured here.

(p.116, 128)


K.Fm.
Q4-5
Q5
K.Fm.
Q4
Q3
Q2
Q1

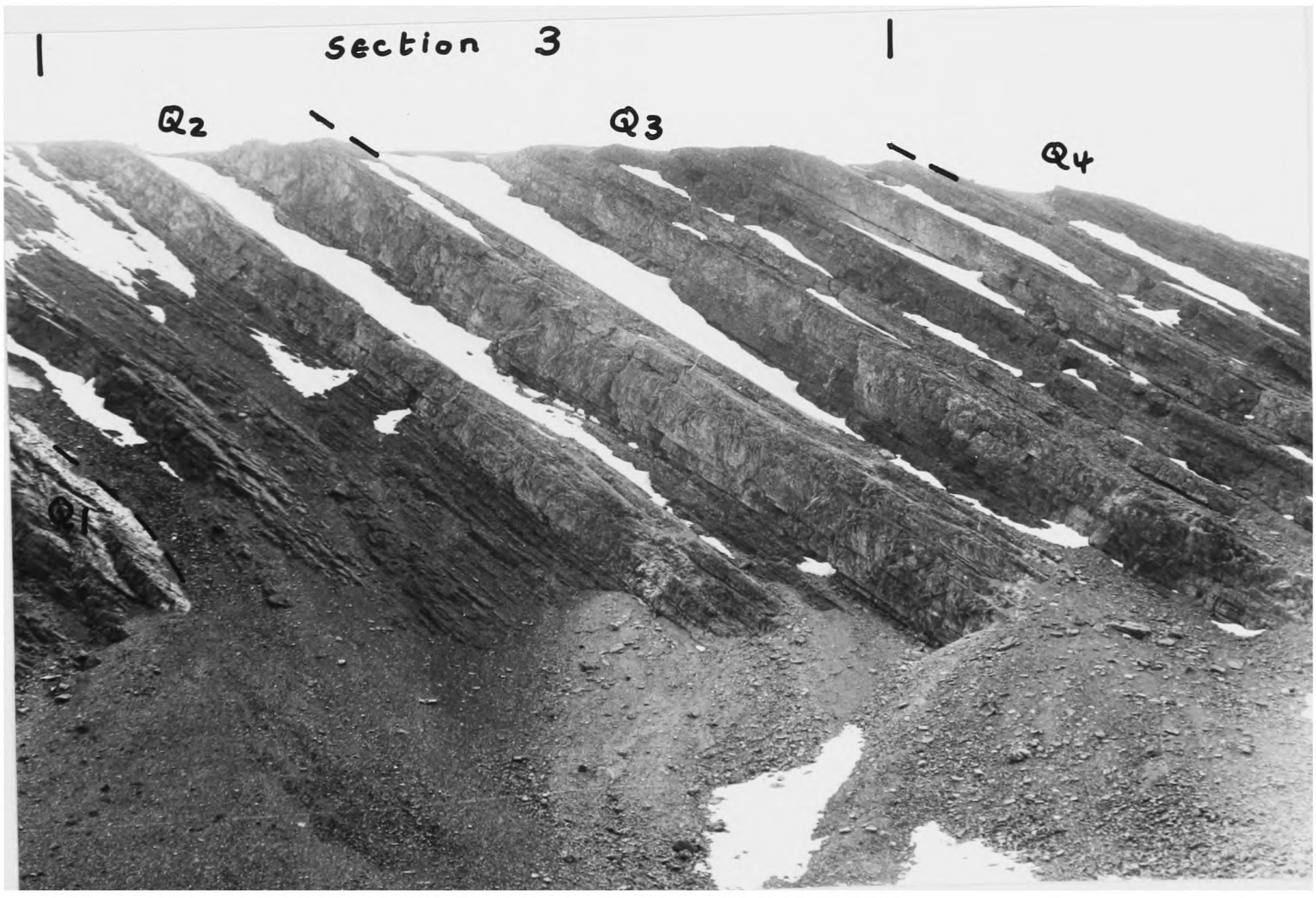

Section 3
Q2
Q3
Q4
Q1

Plate 87 Flat-bedded and low angle cross-bedded fine sandstones with primary current lineation. Some thin beds with fine-grained partings are present. Sharply overlying these beds come white cross-bedded sandstones (arrowed contact) 56-61m, Breivik Valley Section, Upper Duolbasgaissa Member.

(p.116)

Plate 88 Large scale cross-bedding at the top of Quartzite 1. In the background can be seen the whole of Quartzite 2. South side of Breivik valley, Upper Duolbasgaissa Member.

(p.117.)

Plate 89 1-10cm bedded, rippled, fine sandstones with mudstone partings and a thicker, erosively based sandstone above. Quartzite 1, Upper Duolbasgaissa Member, Section 7.

(p.117)

Plate 90 View of the sandstones with interbedded siltstones and mudstones of Quartzite 2 in the Breivik valley section of the Upper Duolbasgaissa Member. About 12m of beds are shown.

(p.120)

Plate 91 Sharp based and sharp topped sandstones in Quartzite 2. Interbedded siltstones die out upwards. The base of the cross-bedded sandstones is at the level of the man's head. Upper Duolbasgaissa Member, Breivik Valley.

(p.120)

Plate 92 Irregular primary bedding surface consisting of small basins surrounded by sharp-crested ridges. Many of the small black circles are lichen-filled tops of U-shaped burrows. South side of Breivik Valley, Upper Duolbasgaissa Member, Quartzite 2 (165m in section).

(p.120)

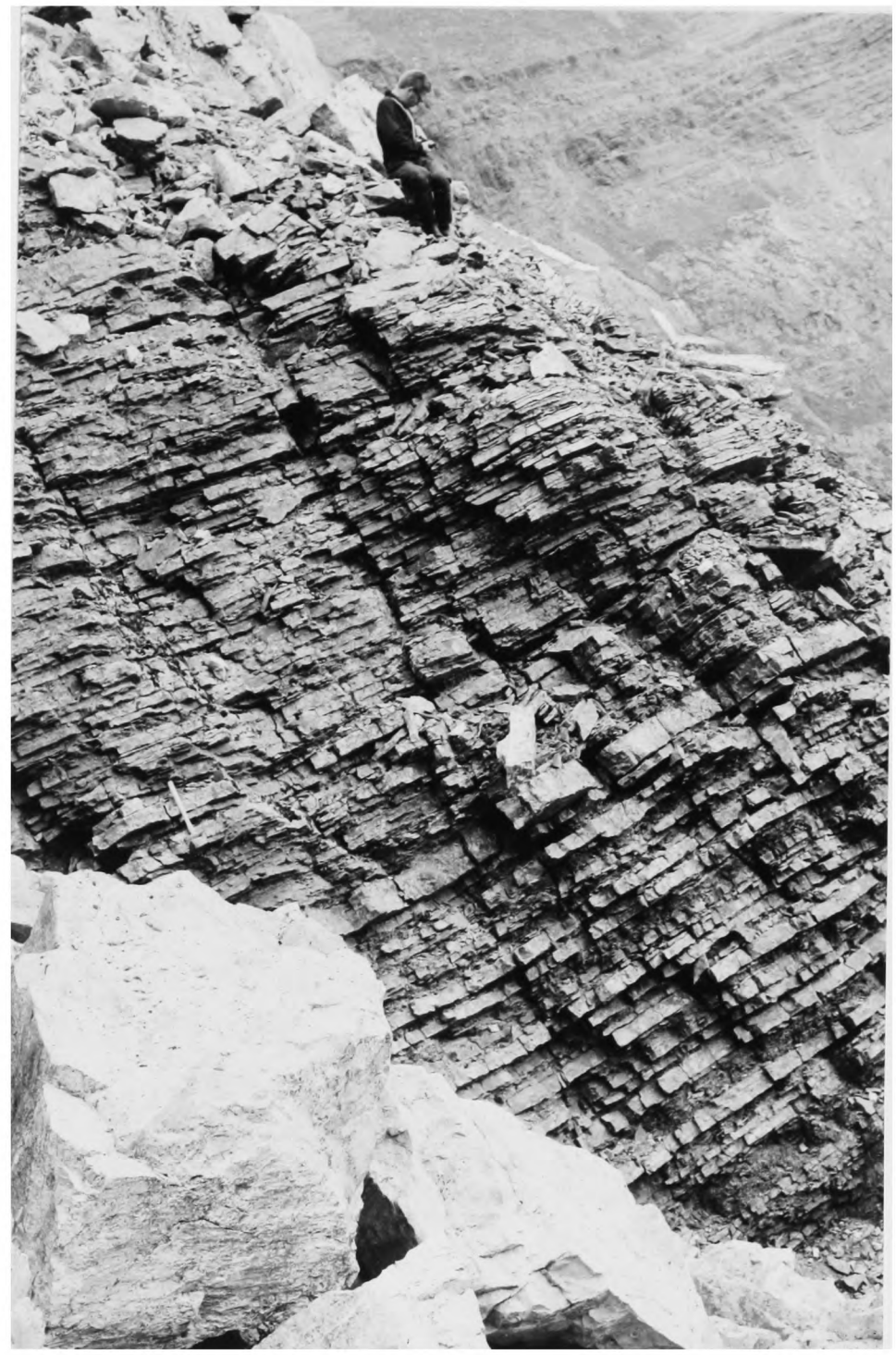


Plate 93 View of the upper part of Section 7 of Fig. 62 looking northward from the sloped of Duolbasgaissa showing a tight fold in the beds of Quartzite 2. Upper Duolbasgaissa Formation.

(p.121)

Plate 94 Steeply climbing ripples in a bed of slightly micaceous, very fine sandstone. Lower part of Quartzite 2, Upper Duolbasgaissa Member, Section 7.

(p.121)


Foyn's conglomerate
Q4
Q3
Q2
WHITE SANDSTONES
Q2
Q1
Q2
Q1

Plate 95 Rippled surface within a set of steeply climbing ripples similar to those of Pl. 94. Slight asymmetry towards the right. Lower part of Quartzite 2, Upper Duolbasgaissa Member, Section 7.

(p.121)

Plate 96 Burrow tubes weathering out to leave voids at the top of a sandstone bed. Other burrows occur at partings lower in the bed. Lowest part of main sandstone unit, Quartzite 2, Upper Duolbasgaissa Member, Section 7.

(p.122, 125)


PENTAX

Plate 97 Horizontal view of burrow tubes shown in Pl. 96.

(p. 122, 125)

Plate 98 Symmetrical dunes in Section 7 of Fig. 62. The horizon is near the top of the "White Sandstones" of Quartzite 2 shown in Pl. 93. Upper Duolbasgaissa Member.

(p. 122)

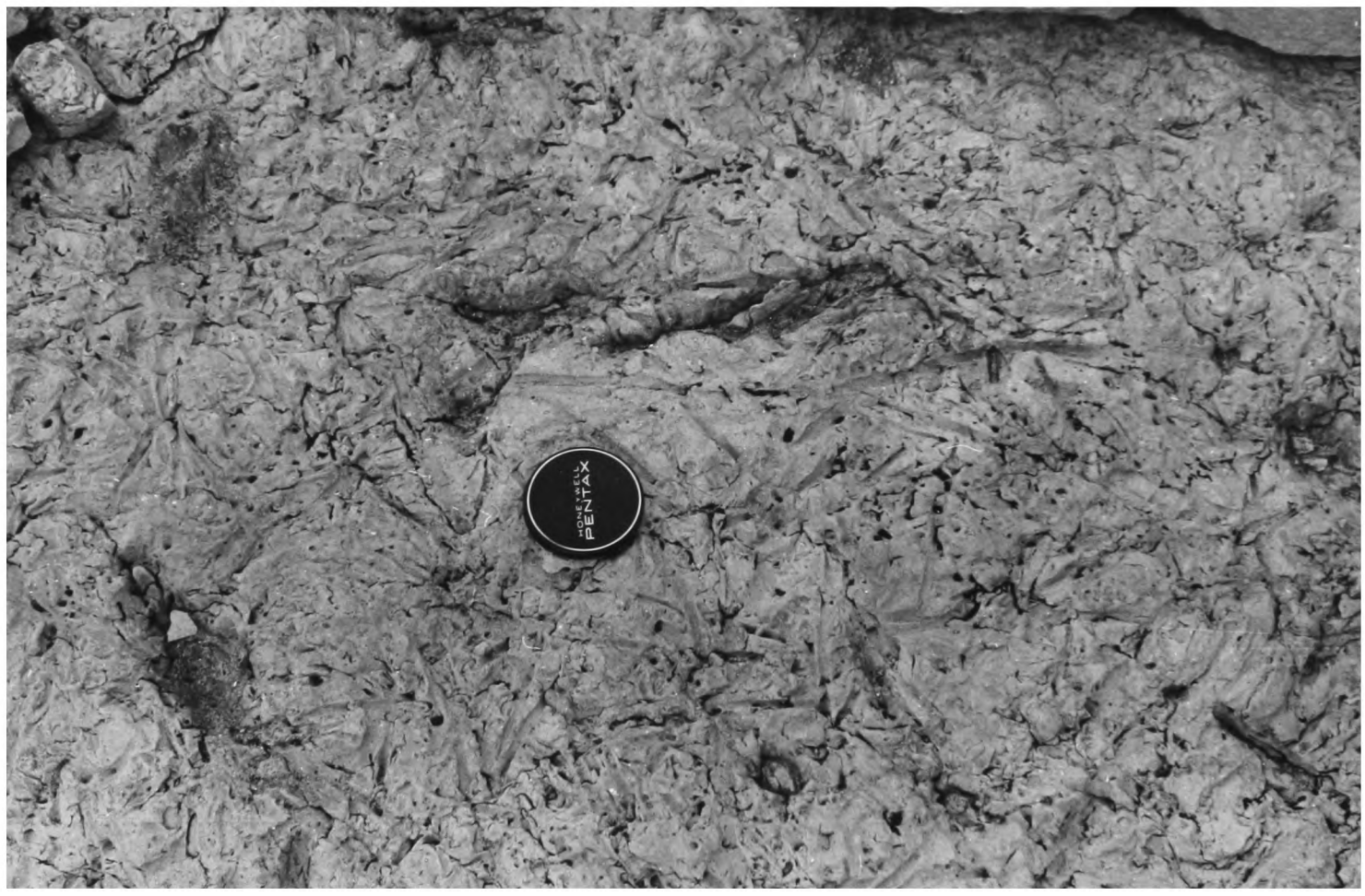

PENTAX

Plate 99 Top of Quartzite 3 showing medium-bedded cross-stratified sandstones passing up into low angle cross-bedded sandstones. Note the finer-grained partings between many sandstone beds. About 7m of beds shown. South side of Breivik Valley. Upper Duolbasgaissa Member.

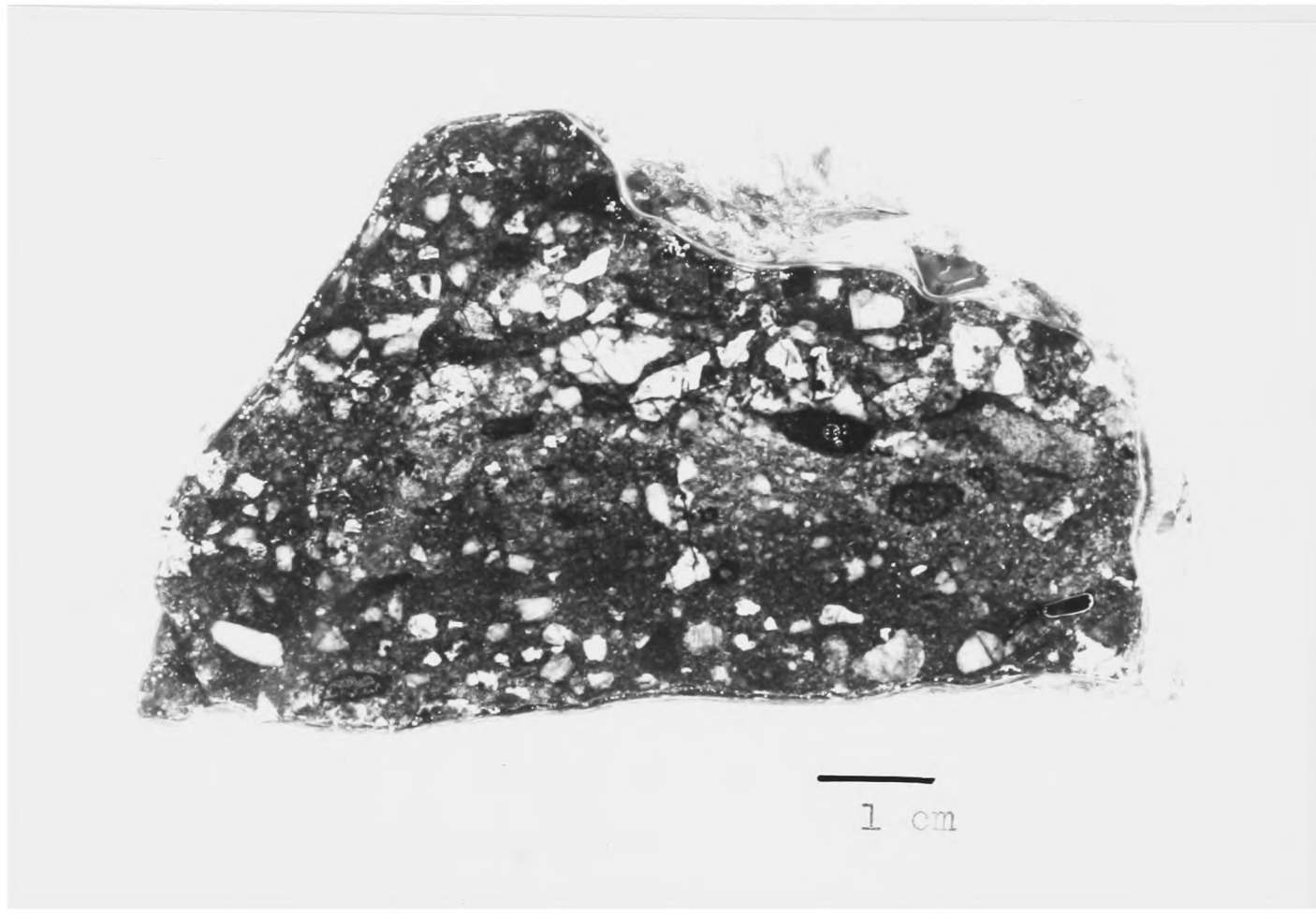
(P. 126, 127)

Plate 100 Unidirectional trough cross-bedding in the lower part of the lower major sandstone of Quartzite 3, Upper Duolbasgaissa Member, Section 7.

(P. 126-7)

Plate 101 Poorly sorted conglomeratic sandstone corresponding to the "conglomerate" of Føyn (1937). Quartzite 4, Upper Duolbasgaissa Member, Section 7.

(p.129.)


1 cm