Middle Hope

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Highlights

Middle Hope GCR site is significant because it contains a highly fossiliferous raised beach deposit of interglacial age overlying a complex of cold-stage slope deposits, some of which are affected by pedogenesis and some of which contain terrestrial mollusc fossils. Slope deposits and mollusc faunas of this antiquity are extremely rare in South-West England and provide important evidence for the nature of Pleistocene cold-stage environments in the region. The site is the type-locality for the Middle Hope Formation.

Introduction

Middle Hope is a Carboniferous Limestone horst, bounded by alluvial lowlands to the south and east, and by the Bristol Channel to the north and west. Much of the Middle Hope massif is mantled by Quaternary deposits. These are mostly slope deposits, but at two localities they are interbedded with marine sediments. At Swallow Cliff, Middle Hope, a shore platform is overlain by the Middle Hope Palaeosol (pedogenically altered slope deposits), the Woodspring Member (silty slope deposits with fossil land snails), the Swallow Cliff Member (a raised beach deposit) and then by further slope deposits attributed to the Brean Member (Campbell *et al.,* in prep.).

The raised beach deposits here were first described by Sanders (1841) and Ravis (1869). They were briefly re-described by Woodward (1876) who, with Prestwich (1892), provided faunal lists. These early authors recognized a fossil fauna of *Tellina* (*Macoma*)*, Littorina, Nassa, Cerastoderma, Murex* (*?Ocenebra*)*, Purpurea* and *Ostrea.* They also recognized the presence of land molluscs.

Palmer (1931) assigned the raised beach to his '10 foot level'. Donovan (1962) recognised a series of erosion features around the Bristol Channel and correlated them with the Main Terrace of the Severn and the Swallow Cliff raised beach. He attributed them to an episode of sea level not far below OD during the Upton Warren Interstadial. Wood (*in* Callow and Hassan, 1969) obtained radiocarbon dates of 33 240 + 760/– 700 BP (NPL-126a) and 38 990 + 1690/–1390 BP (NPL-126b) which seemed to support this hypothesis, but Kidson (1970, 1977) rejected them as 'almost valueless' since similar dates had been obtained from a number of sites of known interglacial status.

The site was definitively re-studied by Gilbertson (1974), Gilbertson and Hawkins (1977) and Briggs *et al.* (1991). The interglacial nature of the marine fauna was demonstrated, and the raised beach deposits were assigned to the Ipswichian by Gilbertson (1974) and Gilbertson and Hawkins (1977). These authors described in detail the stratigraphy, lithology, palaeontology, micropalaeontology and mineralogy of the sequence of shore platform, cold-climate slope deposits with land molluscs, wind-blown foraminifers and occasional recycled marine shells, 7. raised (storm) beach and upper cold-climate slope deposits.

Andrews *et al.* (1979) provided an amino-acid ratio which was taken to support an Ipswichian (Oxygen Isotope Stage 5e) age for the raised beach deposit (Andrews *et al.,* 1979, 1984). Davies (1983) later provided a higher ratio which she interpreted as indicating a Stage 7 age (*c.* 210 ka BP). More recent reassessment (Campbell *et al.,* in prep.) suggests that attribution of the raised beach deposits to Oxygen Isotope Stage 5e (Ipswichian) is most appropriate.

Description

The deposits at Swallow Cliff, Middle Hope [ST 325 661], lie on a shore platform and against a fossil cliff cut in Carboniferous Limestone, ashes and spilites. The shore platform lies between 12.5 and 5. 11 m OD (Gilbertson, 1974; Gilbertson and Hawkins, 1977). It is overlain by *c.* 2.6 m of Quaternary deposits, in the following sequence (Gilbertson and Hawkins, 1977; Briggs *et al.,* 1991; Gilbertson, pers. comm., 1993; (Figure 9.15)) (maximum bed thicknesses in

parentheses):

10. Modern topsoil. (0.25 m)

9. Brown, sandy very stony loam, with angular clasts of Carboniferous Limestone and vol- 4. canic rocks. The material has a weak, angular blocky structure and firm consistency, and exhibits abundant fine to medium pores. It has a sharp boundary with bed 8. (0.33 m)

8. Coarse, matrix- and clast-supported cobbly gravel of rounded Carboniferous Limestone clasts in a matrix of fragmented marine shell, porous and cemented at point contact. The fossil assemblage is dominated by *M. balthica,* 3. with some *Littorina littoralis* (Linné) and *Cerastoderma* sp., a few *P. vulgata* and *Littorina littorea* Linné*. Littorina saxatalis* (*Olivi*)*, Buccinum undatum* Uncle, *Nucella lapillus* (Linné),*Nassarius reticulatus* Linné, *Lora* sp., *Trophonopsis truncatus* (Strom), *Ocenebra erinacea* (Linné) and *Ostrea* sp. are rare. Aminostratigraphical assays on *Patella* gave a combined D-*alloisoleucine :* L-*isoleucine* ratio of 0.101 ± 0.005 (AAL-771) (Andrews *et al.,* 1979) and a mean ratio of 0.203 ± 0.016 (Group 3 of Davies, 1983). The deposits have a sharp uneven boundary with bed 7. (1.0 m)

7. Dark brown, sandy, slightly stony loam, with rare clasts of weathered subangular ?Triassic sandstone and Carboniferous Limestone and pockets, 3 mm deep, of silty clay loam with platy structure, medium pores and clay skins on ped faces. The bed contains numerous foraminifers, abundant marine shell fragments and some terrestrial molluscs — *Vallonia* cf. *pulchella, Trichia hispida* (Linné), *Agrolimax* cf. *agrestis* and Helicids. The material has a moderate, medium, subangular to blocky platy structure, is friable and exhibits abundant fine to medium pores in upper 50 mm; common fine pores are present below this level. Bed 7 has a sharp boundary with bed 6. (0.08 m)

6. Brownish-black silty clay loam with a fine, subangular blocky structure. The deposit is friable and exhibits abundant fine pores. It has a sharp uneven boundary with bed 5. (0.02 m)

5. Brown, extremely stony clay loam, with medium to coarse angular clasts of Carboniferous Limestone and flint, sub-rounded to subangular clasts of weathered Triassic sandstone and marl. The material has a subangular blocky structure, is friable and exhibits occasional clay skins on ped faces. It shows abundant fine pores and frequent medium to coarse pores and has a clear but uneven boundary with bed 4. (0.15 m)

4. Brown, silty, slightly stony clay loam, with angular to subangular clasts of ?Triassic marl. Abundant foraminifers are present. The deposits demonstrate a moderate, medium, angular, blocky platy structure and exhibit occasional clay skins on peds. They contain abundant fine and medium pores, and have a clear but uneven boundary with bed 3. (0.15 m)

3. Brown, extremely stony silty clay, with coarse subangular clasts of Carboniferous Limestone, weathered ?Triassic marl and sandstone and very infrequent clasts of Carboniferous volcanic rocks. It contains occasional pockets and individual specimens of land snails — *Vallonia* cf. *pulchella, T. hispida* and Helicids — and lenses (50–100 mm across) of fragmentary marine molluscs — *N. lapillus* and *L. littoralis.* It is slightly calcareous, cemented at point contact and demonstrates moderate, angular blocky structure and firm consistency. The material exhibits abundant fine and common medium pores and has a clear but uneven boundary with bed 2. (0.15 m)

2. Moderately mottled, red-brown, silty, slightly sandy stony clay, with common small to medium subrounded clasts of ?Triassic marl. Some foraminifers are present. The deposit has a moderate, medium, angular structure and firm consistency, and exhibits clay skins on peds. Abundant fine and common medium pores are present and the material merges down into bed 1. (0.10 m)

1. Red, silty, very stony clay, with subangular to subrounded coarse clasts of Carboniferous volcanic rocks and subrounded to rounded clasts of Carboniferous Limestone and ?Triassic sandstone. The bed demonstrates a moderate, medium, angular blocky structure, shows clay skins on peds and has abundant fine to medium pores. It occurs in hollows on the shore platform. (0.35 m)

Interpretation

The basal shore platform and buried cliff most probably reflect one or more episodes of marine erosion of unknown age. The lowest deposits (bed 1) rest on the platform, contain rounded clasts and have a heavy mineral assemblage derived from the platform rocks. They are thus likely to represent a mixture of local weathering products and the remains of a former beach deposit (Briggs *et al., 1991;* Gilbertson, pers. comm., 1993). The clay coats on peds in beds 1 and 2 are consistent with pedogenic activity (Gilbertson, pers. comm., 1993). Clay content can be used to differentiate the deposits of the Middle Hope Palaeosol (beds 1–3), from the overlying Woodspring Member (beds 4–7): clay enrichment in the former thus reflects a phase of weathering, of at least interstadial status, affecting older slope deposits.

Beds 2–7 contain predominantly angular to sub-rounded clasts and appear to reflect an alternation of hillwash and aeolian processes (Briggs *et al.,* 1991). The presence of marine molluscs and foraminifera in these deposits is suggestive of the former presence of marine deposits upslope, while the foraminifera could have been emplaced by wind following the deflation of nearby marine deposits (Gilbertson and Hawkins, 1977). The fossil land mollusc assemblages are consistent with open wet grassland.

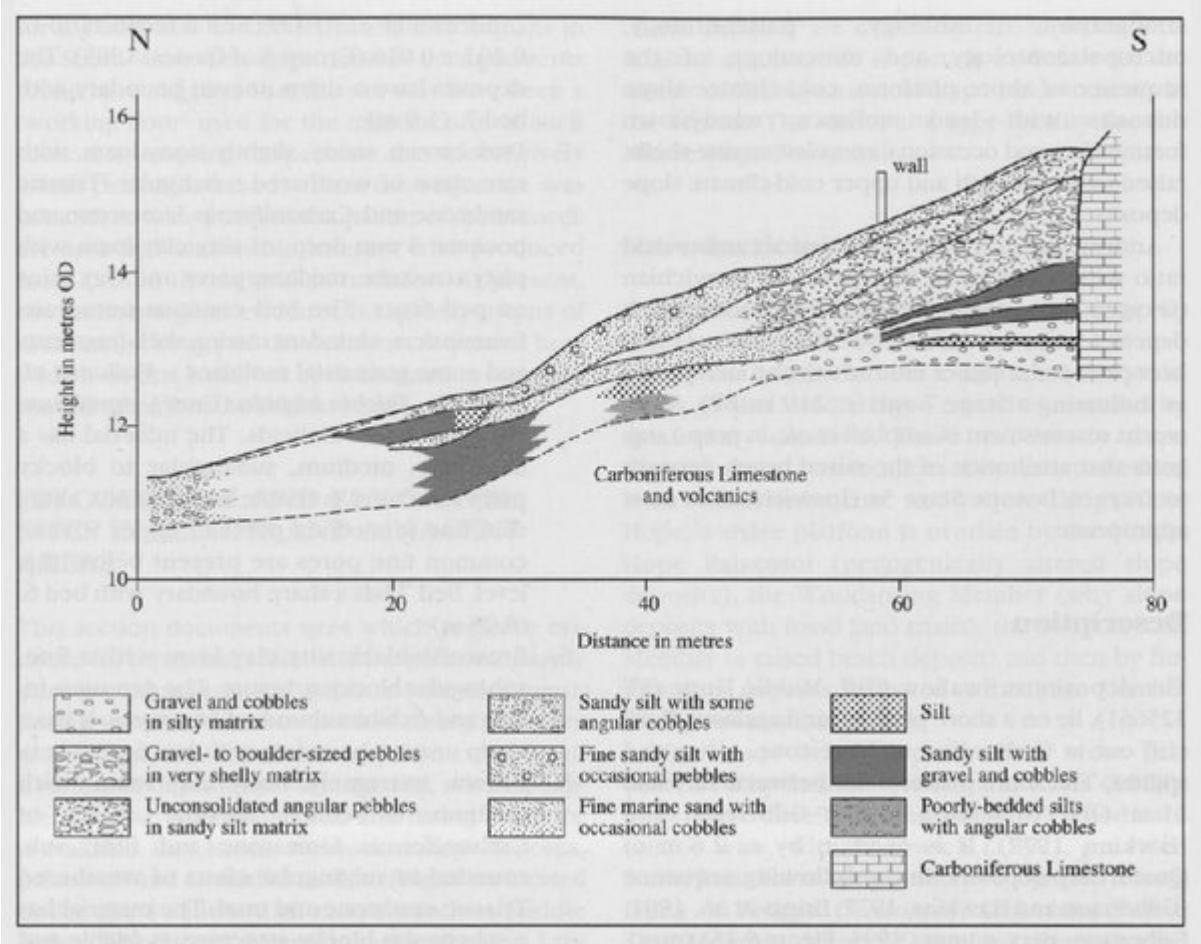
Bed 8, the Swallow Cliff Member, represents a storm beach probably related to a mean sea level perhaps 5 m higher than that of today. The dominant *Macoma* was derived from sand and mud flats in the Bristol Channel. Many of the other taxa are species typical of rocky shores and are thus consistent with the depositional locality. Gilbertson (1974) and Gilbertson and Hawkins (1977) have demonstrated the interglacial nature of the fauna. The major discrepancy beween the amino-acid ratios given by Andrews *et al.* (1979) and Davies (1983) has not yet been accounted for, and both Ipswichian (Oxygen Isotope Stage 5e) and earlier ages for the beach deposit are possible. If Davies' (1983) interpretation is accepted, a correlation with the marine deposits at Kenn Church (Andrews *et al.,* 1984) becomes probable, although this was rejected by Campbell *et al.* (in prep.). Further work is needed to resolve this problem.

Bed 9 reflects the resumption of cold-climate depositional activity after the interglacial phase. This thin unit can be assigned to the Brean Member.

Conclusion

The deposits at Swallow Cliff, Middle Hope, are important because they provide evidence for depositional and pedogenic environments during two later Middle Pleistocene cold stages and an intervening ?temperate episode. Subsequent temperate-stage beach sedimentation, probably correlated with Oxygen Isotope Stage 5e, is also represented. Further work is necessary to resolve problems with the dating of the sequence.

References



(Figure 9.15) Quaternary deposits at Swallow Cliff, Middle Hope, simplified from Gilbertson and Hawkins (1977).