Albion Sands and Gateholm Island

[SM 771 074]

Introduction

This section in the cliffs, the foreshore, and on Gateholm Island, which is some 24 km southwest of Haverfordwest (Figure 6.20), (Figure 6.21), exposes the top part of the Red Cliff Formation (Ludlow to P■ídolí), the Albion Sands Formation (P■ídolí), and the lower part of the Sandy Haven Formation (of P■ídolí to Lower Devonian age; (Figure 6.22)); an interbedded wedge of the P■ídolí age Lindsway Bay Formation may also be seen. In total, about 250 m are continuously exposed. The Red Cliff Formation and Albion Sands Formation are exposed in the cliffs and foreshore on the east side of Albion Sands and are visible in any tidal conditions. The Sandy Haven and 1.indsway Bay formations, which may be seen in the cliffs and foreshore of Gateholm Island [SM 772 075], are largely covered or cut off at high tide.

General descriptions of the strata involved were given by Strahan *et al.* (1914) and by Cantrill *et al.* (1916). In these publications the Old Red Sandstone facies was divided only into the Red Marls below and the Cosheston Group above; these lithostratigraphical units occupy a stratigraphical interval of Ludlow to what is possibly the Emsian. A revised stratigraphical scheme was presented by Allen *et al.* (1982; see also Williams, 1971; Allen and Williams, 1978; Williams *et al.,* 1982; (Figure 6.22)). The locality is also described in a field guide to Dyfed (Bassett, 1982).

Description

The Albion Sands Formation, here at its type section, is conformable with the Red Cliff Formation below; it is about 110 m thick ((Figure 6.23); Williams in Friend and Williams, 1978; Allen *et al.,* 1982). With the exception of the top part of the formation, lithologies are dominated by coarse-grained deposits of sandstones with included pebble to cobble size clasts. Individual sand beds reach 2 m+ in thickness, and multistorey beds, which are common, reach about 5 m in thickness. These beds are predominantly pale yellow to buff in colour, and contain a great deal of igneous material; they have sharp tops and bases, and above the latter, intraformational mud flake cobble-size conglomerates overlie the erosional surface. The pebble beds and conglomerates have clasts of fine-grained lavas, and vein quartz.

Both towards the base, and particularly at the top of the Albion Sands Formation, dark red sandstones of medium- to coarse-grain size alternate with laminated mudstones, which show synaeresis cracks. In these laminated mudstones, calcretes are absent, except in the *c.* 11 m unit, which is by far the thickest in the section, and which forms almost the top of the Albion Sands Formation. Lithologically, this unit seems to have much more in common with the Sandy Haven Formation, which lies conformably above.

In the Albion Sands Formation sequence, both the pale yellow to buff and the red sandstones show planar and trough cross-bedding to an equal degree. Air-fall and crystal tuffs occur throughout the Albion Sands Formation; these generally occur as thin (on the scale of 0.1 m) individual beds, although two more substantial ones on the scale of 0.5–1 m were recorded by Allen *et al.* (1982, p. 132).

The contact between the Albion Sands and Sandy Haven formations is lithologically transitional. The lower part of the Sandy Haven Formation is largely exposed on Gateholm Island; about 85 m have been recorded. Its base is drawn at the top of a 0.88 m thick unit of alternating coarse sandstones and mudstones that can be seen at the base of Gateholm Stack; this unit overlies the calcrete unit mentioned above.

Between about 69 m and 76 m above the base of the Albion Sands Formation, near Horse Neck (SM 7718 0751; (Figure 6.20)), there are four pebble conglomerate beds interbedded with ill-sorted granule-rich mudstones. The pebbles in the conglomerates are of igneous origin from some unknown source, and the clasts in the mudstones are predominantly vein quartz. This part of the sequence was named the Lindsway Bay Formation by Allen *et al.* (1982). This formation at its type locality in Lindsway Bay, 8 km to the east, attains a thickness of about 70 m.

The greater part of the Red Cliff Formation is thought to be of Ludlow age, although its lowest part might be Wenlock ((Figure 6.22); see Marloes GCR site report in the Wenlock chapter). The Albion Sands Formation, which overlies the Red Cliff Formation conformably, is of P■ídolí age. There is no biostratigraphical evidence to demonstrate the age of the lithological boundary between the two formations, although Cocks *et al.* (1992) indicated that in Pembrokeshire the uppermost part of the Red Cliff Formation is of earliest P■ídolí age. The Sandy Haven Formation is largely of P■ídolí age, although in this area its uppermost part is considered to be Devonian (Cocks *et al.,* 1992).

Within the middle part of the Sandy Haven Formation the Townsend Tuff Member occurs but is not well exposed. This distinctive and widespread unit occurs at localities from Pembrokeshire to Shropshire (Allen and Williams, 1978; 1981). It generally has a thickness of 3–4 m and comprises a complex of three ash fall tuffs (see GCR site report for Little Castle Head in this chapter).

Fossils have been recorded only from two quartz pebble conglomerates from the basal part of the Sandy Haven Formation (Allen *et al.,* 1982). The lower conglomerate has yielded the plant *Pachytheca,* fish scales and spines referable to '*Onchus' wheathillensis,* and a specimen of *Lingula* sp.; the upper conglomerate has yielded only similarly determined fish spines.

Interpretation

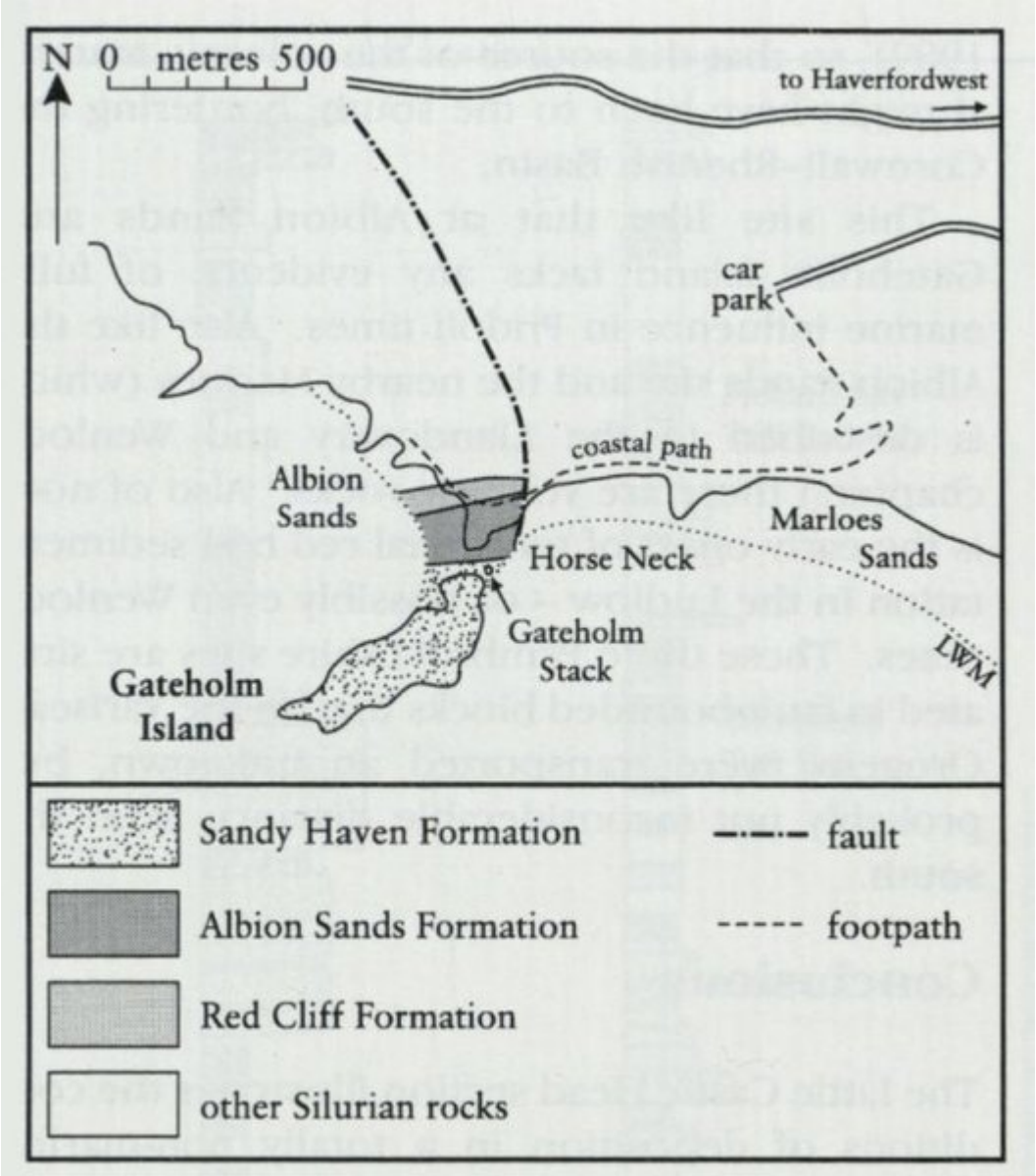
The P■ídolí age rocks of this section demonstrate developing continental conditions. The sedimentary sequence of the Albion Sands Formation is interpreted as having been deposited by braided streams; the sediments were sourced first and mainly from the south. Unlike in the Red Cliff Formation below, and the Sandy Haven Formation above, in both of which calcrete horizons are common, there is no evidence of prolonged subaerial exposure. The Lindsway Bay Formation comprises a wedge of alluvial fan sediments, of relatively local derivation, which were derived from the south or south-east. The Sandy Haven Formation is suggestive of a coastal mud flat horizon environment that was at times subject to periodic marine incursions, but at other times scoured by rivers or owing to more prolonged subaerial exposure shows more stable surfaces. The air-fall tuffs of the Townsend Tuff Member accumulated on the coastal mud flats, as indicated by the sedimentary features of the Sandy Haven Formation; the Townsend Tuff Member originated from powerful Plinian eruptions from an unknown, but distant, source.

Other than the record of a single specimen of *Lingula,* this site like that at Little Castle Head shows no marine influence in P■ídolí times. Like the nearby Marloes site (see the Llandovery and Wenlock chapters, this volume) there are volcanics, and red-bed sedimentation of Ludlow age indicate the early onset of terrestrial deposition. These Pembrokeshire GCR sites lie in fault-bounded blocks that were transported an unknown distance from the south, during the Variscan Orogeny.

Conclusions

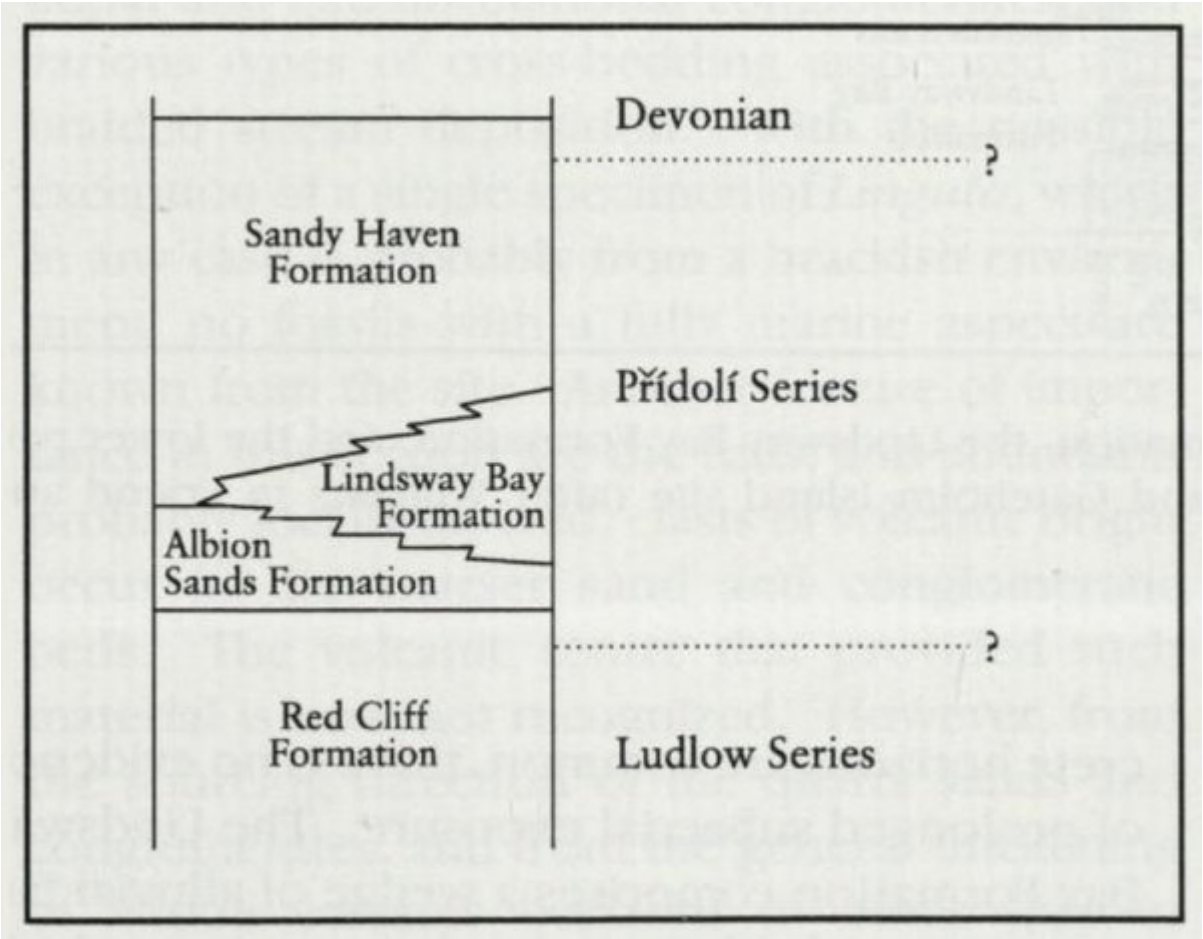
The site has been selected for the GCR because it shows a complete, conformable, and almost uninterrupted succession through Old Red Sandstone facies of the Ludlow, P■ídolí, and earliest Devonian. The P■ídolí strata at this site provide an excellent example of a fully terrestrial environment of deposition that is in sequence with the marine Wenlock and the Ludlow rocks below. The strata exhibit classic sedimentary features of such terrestrial environments, including impressively developed calcretes, intraformational and extraformational conglomerates, and various types of cross-bedding associated with braided stream deposition. With the possible exception of a single specimen of *Lingula,* which in any case is probably from a brackish environment, no fossils with a fully marine aspect are known from the site. Another feature of importance in this section are the tuffs, and abundant, probably locally-derived, clasts of volcanic origin occur in the coarser sand and conglomeratic beds. The volcanic centre that provided such material is now not recognized. However, from the sourcing direction of the quartz sands and conglomerates, and from the general thickening of P■ídolí volcanic horizons in other sites in Pembrokeshire (e.g. Little Castle Head), the provenance is thought to be from the south or south-west.

References

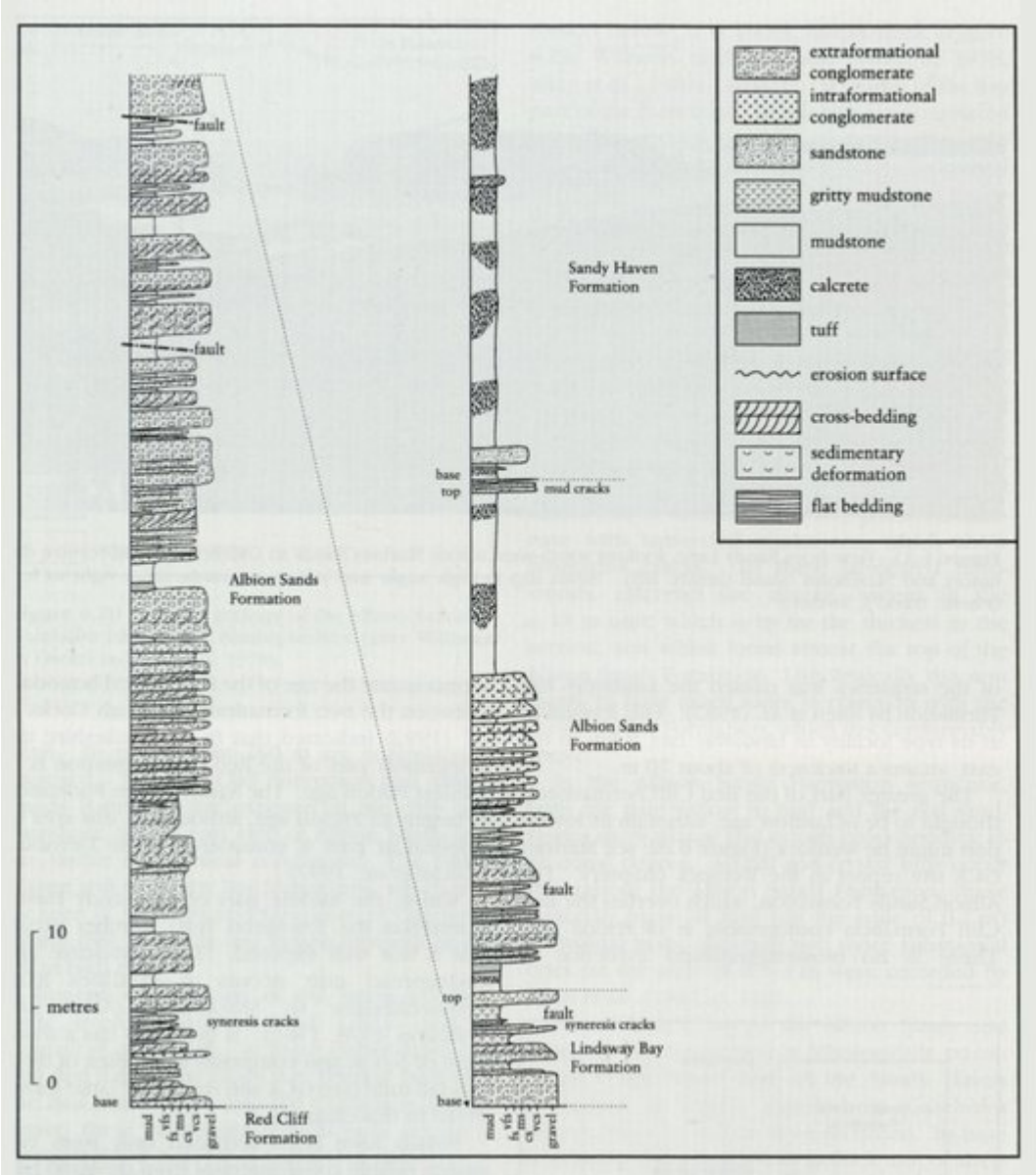


(Figure 6.20) General geology of the Albion Sands to Gateholm Island area, Pembrokeshire (after Williams in Friend and Williams, 1978).

(Figure 6.21) View from Sandy Lane, looking south-west across Marloes Sands to Gateholm Island (centre distance) and Skokholm Island (centre left). Strata dip at high angle and young seawards, from right to left. (Photo: David J. Siveter.)



(Figure 6.22) The lithostratigraphy of the Albion Sands to Gateholm Island area, Pembrokeshire, with possible relationship to chronostratigraphy.



(Figure 6.23) Sedimentary log of the Albion Sands Formation, the Lindsway Bay Formation, and the lower part of the Sandy Haven Formation at the Albion Sands and Gateholm Island site (after Williams in Friend and Williams, 1)78).