Albion Sands and Gateholm Island, Pembrokeshire

[SM 771 074]

Potential ORS GCR site

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Introduction

This site was described in detail in the companion Silurian stratigraphy GCR volume (by Lane in Aldridge *et al*, 2000) on account of the late Silurian (Ludlow–P■ídolí) age of the lowermost beds of Old Red Sandstone red-bed facies. Only a brief summary is given here, with an updated interpretation based on recent work on the marine Silurian-Old Red Sandstone junction by Hillier (2000) and Hillier and Williams (2004). The site comprises the cliffs and foreshore at Albion Sands and on the adjacent Gateholm Island (Figure 5.49). It provides a magnificent section of almost 250 m of strata dipping steeply on the southern limb of the Marloes Anticline (Figure 5.50). Following early accounts by the [British] Geological Survey (Cantrill *et al.,* 1916), descriptions were given by Williams (1971, 1978), Allen and Williams (1978), Allen *et al.* (1981a), Bassett (1982b) and Williams *et al.* (1982). Hillier (2000) and Hillier and Williams (2004) have carried out a recent sedimentological study of the basal part of the succession. The Old Red Sandstone rests on the Gray Sandstone Group of Wenlock age, the nature of the junction continuing to generate debate (see Interpretation, below). The Old Red Sandstone comprises, in upward succession, the Red Cliff Formation, Albion Sands Formation (with a thin wedge of Lindsway Bay Formation) and the Sandy Haven Formation (Figure 5.51). All of the Old Red Sandstone strata are part of the Milford Haven Group (Allen and Williams, 1978).

Description

The following account summarizes that of Allen and Williams (1978) and Williams (1978). The Red Cliff Formation sharply overlies the Gray Sandstone Group at the northern end of the section. It comprises 51.6 m of interbedded red-brown mudstones and very fine- to fine-grained, bioturbated sandstones. Calcrete nodule horizons are present in a few of the mudstones. A Ludlow (late Ludfordian) spore assemblage has recently been recovered from the formation (Hillier and Williams, 2004). The Albion Sands Formation is named from this locality. It is over 100 m thick and consists mainly of thick, pale yellow to bug multi-storey sandstones. Thin red-brown laminated mudstone interbeds occur throughout, with 11 m of mudstones with calcrete nodules lying at the top of the formation, as defined by Allen and Williams (1978). Calcrete nodules appear to be absent in the mudstone interbeds below, prompting Lane (in Aldridge *et al*., 2000) to note that the topmost 11 m are much more like the calcrete-bearing mudstones in the overlying Sandy Haven Formation. Mudcracks in the laminated mudstones are desiccation cracks, and not synaeresis cracks as stated by Lane (in Aldridge *et al*., 2000). The sandstones comprise individual bodies over 2 m thick and common multi-storey bodies up to 5 m thick. They have sharp tops and bases, the latter resting on erosion surfaces and commonly containing lenses of intraformational conglomerate with mudstone clasts up to cobble size. The sandstones also contain much igneous debris, and extraformational conglomerates also occur locally. The petrography of the sandstones and conglomerates indicates a westerly provenance. Thin airfall dust- and crystal-lithic tuffs occur sporadically, including a distinctive 1 m-thick, lilac, purple, red and yellow mottled dust tuff. A thin (7.42 m) wedge of conglomerates in the upper part of the formation outcrops on Horse Neck [SM 7718 0751] is correlated with the Lindsway Bay Formation. Here, it comprises petromictic conglomerates with exotic igneous pebbles interbedded with ill-sorted, granule-rich mudstones. The conglomerates have the greatest assortment of clasts of any petromict in the Old Red Sandstone of southern Britain.

The base of the Sandy Haven Formation is placed on Gateholm Stack [SM 7725 0746], where there is a conformable transition with the underlying Albion Sands Formation. About 85 m of beds comprise mainly bright red mudstones and thin pebbly sandstones. The mudstones are heavily cakretized, with mature soil carbonates and pseudo-anticlinal structures. The pebbly sandstones have yielded *?Onchus wheathillensis, Pachytheca* and lingulids. Large-scale synsedimentary faults were recorded at Horse Neck by Hillier (2000).

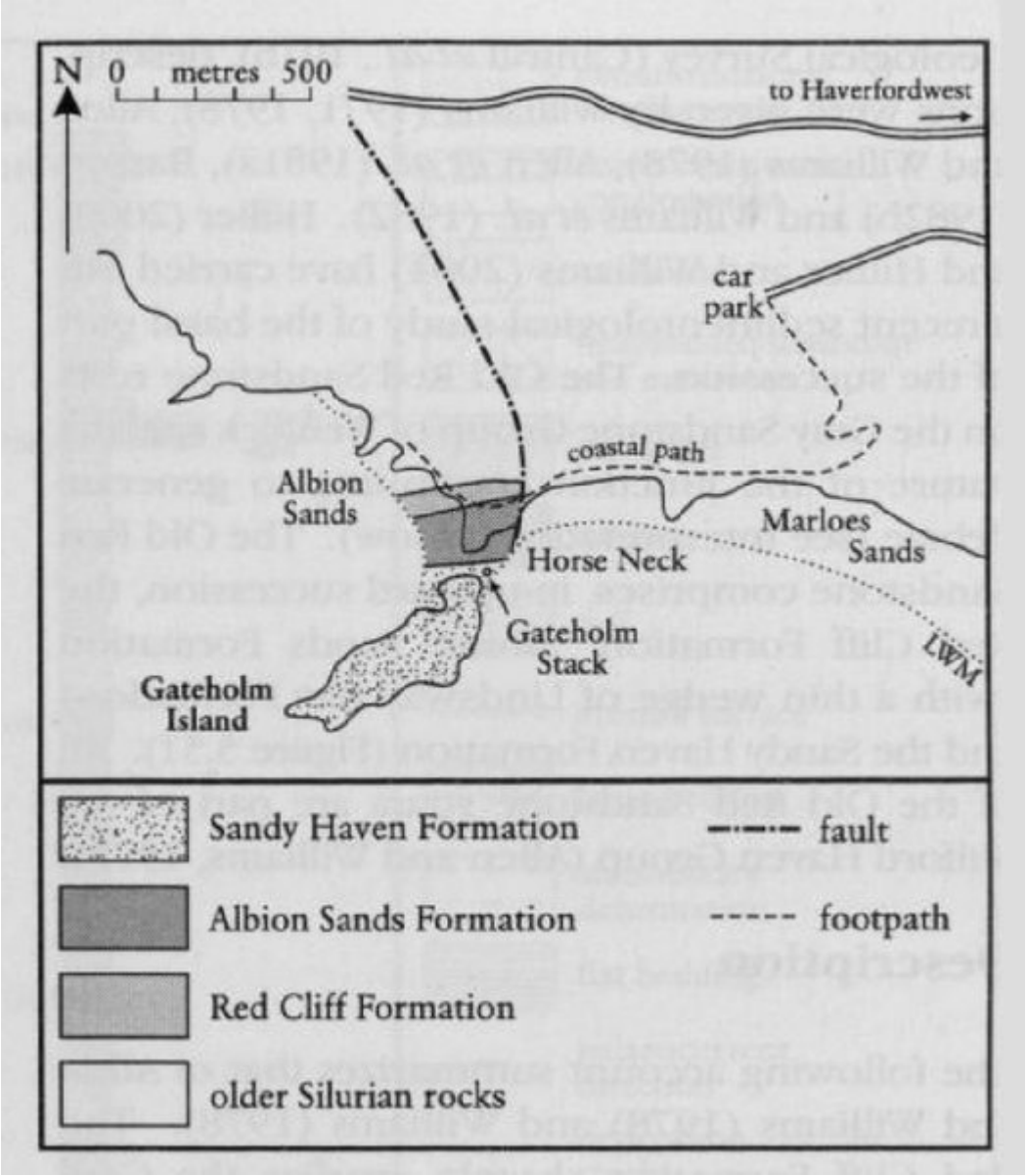
Interpretation

The nature of the base of the Old Red Sandstone has generated much debate. A conformable contact with the underlying Wenlock Gray Sandstone Group was advocated by Cantrill *et al.* (1916), Sanzen-Baker (1972), Walmsley and Bassett (1976) and Hurst *et al.* (1978) and assigned a late Wenlock, or, at the latest, early Ludlow age. Allen and Williams (1978) preferred a disconformable contact, with the basal Old Red Sandstone being Downtonian (P■ídolí) in age. Recent spore analysis has confirmed a late Wenlock (Homerian) age for the Gray Sandstone Group (Hillier and Williams, 2004). Hillier (2000) re-affirmed a conformable junction, with terrestrial red-bed sedimentation commencing here in the Ludlow. This is confirmed by the presence of late Ludfordian spores in the Red Cliff Formation (Hillier and Williams, 2004). Hillier (2000) and Hillier and Williams (2004) attribute the succession to the final of five episodes of incision and valley-fill in a structurally controlled basin. Transtensional movement on a series of NE-trending faults produced rifting on the southern margins of the Lower Palaeozoic Welsh Basin, producing local basins (the Skomer Basin in this case) fed with sediment derived from the Pretannia landmass to the south. Relative sea-level changes led to alternating marine flooding and fluvial incision. The Red Cliff Formation is interpreted by Hillier (2000) as the deposits of mudflats and tidal, flu-vially influenced channels, the fluvial input being derived from the south (Hillier and Williams, 2004). However, a southerly source conflicts with the presence of white micas of northerly Laurentian (Scottish Highland) origin (Sherlock *et al.,* 2002). Renewed transtensional activity produced tilt block topography, with the Albion Sands Formation being the fluvial deposits of a low-sinuosity, east-flowing, axial drainage system and the Lindsway Bay Formation representing gravel fans that prograded northwards from the uplifted fault scarps of the Pretannia landmass.

Conclusions

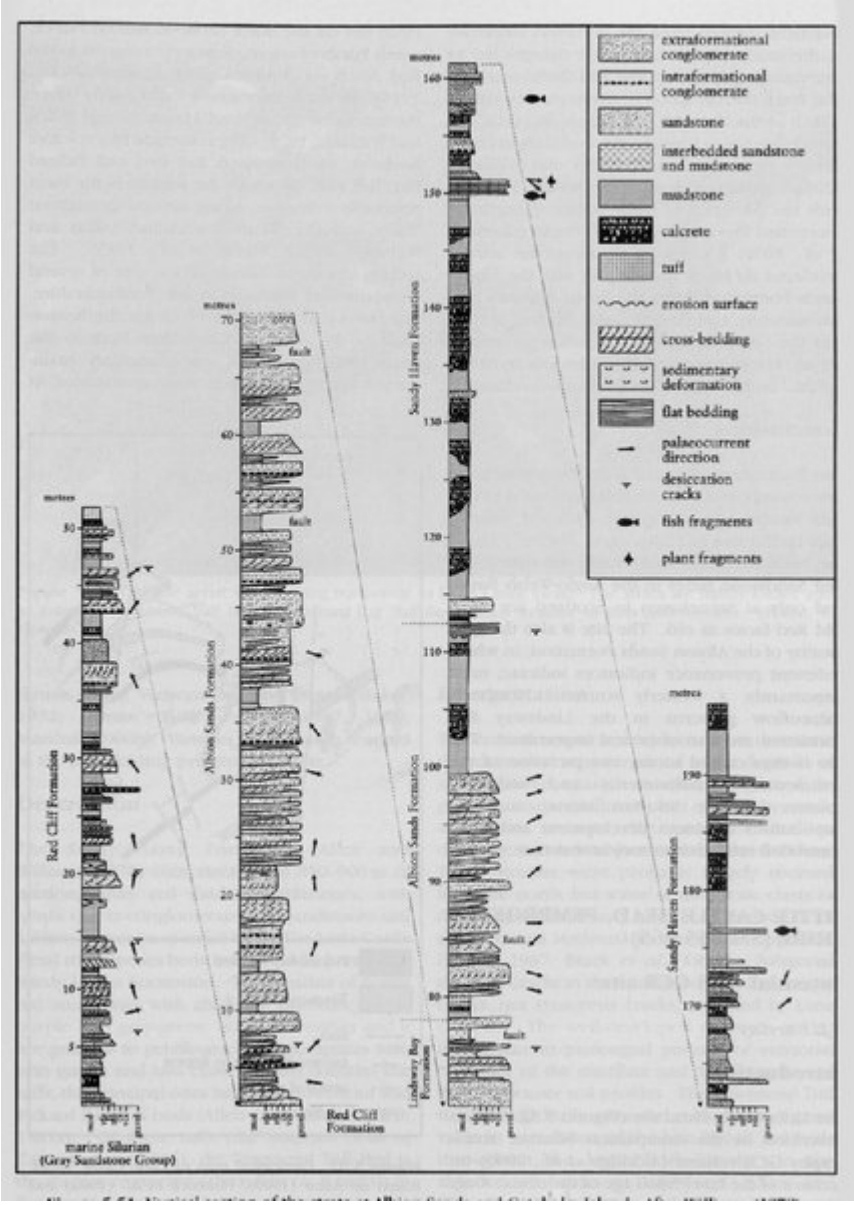
The magnificent cliffs and foreshore outcrops at this site expose a conformable succession of Old Red Sandstone sedimentary rocks of Silurian (late Ludfordian to P■ídolí) age. The early age of the basal red rocks make them the oldest Old Red Sandstone facies in the Anglo-Welsh Basin, and only at Stonehaven in Scotland are there Old Red fades as old. The site is also the type locality of the Albion Sands Formation, in which sediment provenance indicators indicate, most importantly, a westerly source. Northerly palaeoflow patterns in the Lindsway Bay Formation are also of critical importance. The site is thus crucial to the interpretation of the sedimentary environments and sediment sources of late Silurian strata, and the implications for basin development and fault-controlled infill architecture at that time.

References



(Figure 5.49) Location and simplified geology of Albion Sands and Gateholm Island. Based on Williams (1978) and Lane (2000c, fig. 6.20).

(Figure 5.50) Oblique aerial view looking ENE to Albion Sands, the promontory of Horse Neck connecting with Gateholm Island, and Marloes Sands. (Photo: S. Howells.)



(Figure 5.51) Vertical section of the strata at Albion Sands and Gateholm Island. After Williams (1978).