

NEW OBSERVATIONS ON THE SANDSTONE 'DYKES', HEAD DEPOSITS AND RAISED BEACH OF BERRY HEAD



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Berry Head forms the southern boundary of Tor Bay and is an important Site of Special Scientific Interest and a National Nature Reserve. Almost all the northern face of the headland has been quarried and exposes a number of important features including the so-called 'Neptunian Dykes'. These follow both N–S and ENE–WSW trends and can be seen in the quarried faces of the headland, and also on the foreshore at Shoalstone Beach and between Broadsands and Elberry Cove. Some of these fractures are mineralized while others include sandstones (presumed Permian) and fragmented calcite vein material. Also in the old quarry and along the coastline behind Shoalstone Beach are a series of head deposits, overlying the irregular surface of the underlying limestones and, in one location, a fragment of a raised beach. The head deposits contain layers of fine-grained, brecciated limestone, un-lithified sands and occasional layers with large angular blocks. Also incorporated within the head deposits are large blocks of 'dyke' material, some of which contain the mineralized margins of the 'dykes'.

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INTRODUCTION

Berry Head forms the southern boundary of Tor Bay and is an important Site of Special Scientific Interest (SSSI) and a National Nature Reserve (Figs 1, 2). The SSSI was designated on the 28th November 1986 and includes the Shoalstone foreshore, Shoalstone Point, Berry Head, Durl Head and Sharkham Point: hence known as the Berry Head to Sharkham Point SSSI. The site was notified for the non-marine Permian (red bed) sediments, the caves and a range of biological/botanical features of interest (<https://designatedsites.naturalengland.org.uk>). From the work of Leveridge & Shail (2011) and Leveridge (2011) it is known that the Devonian and Carboniferous rocks of the Variscan Orogenic Belt were initially deposited in six separate basins with the Torquay area located within the South Devon Basin. This was formed of two sub-basins (Southern and Northern) separated by the Torquay High. This positive area, together with the Brixham High to the south and the Ashburton High to the north were the shallow-water areas in which were developed the limestones that characterize the Torbay area. For many years it has been known that the limestones formed in shallow-water 'carbonate factories' and that the mudrocks, and sandstones represented slightly deeper water environments (Scrutton, 1965, 1977a, b, 1978; Braithwaite, 1967; Goldring, 1978; Goodger *et al.*, 1984). With the Devonian plankton only represented by organic-walled microfossils and radiolaria (siliceous), there was almost no carbonate sediment supplied to the deeper water environments. With the high atmospheric CO₂ levels, oceanic pH was probably low and so only the shallow-water, 'reefal' areas with high carbonate saturation levels generated carbonate sediments.

The limestones of Berry Head display some complex structures that have been described by Smythe (1973), Coward and McClay (1983), Leveridge (2011) and Leveridge and Shail (2011). The headland has been extensively quarried and is home to a range of calcareous-loving plants (Smith *et al.*, 2016), colonies of seabirds and also provides a viewpoint from which to observe dolphins or porpoises. The site is also an important archaeological location, with impressive views of the surrounding area. The limestones also host an important series of caves that have been described by Proctor (1988) and Proctor and Smart (1991).

Within the Brixham Limestone Formation, in the quarry on the northern side of the headland, are some famous fissures that are filled with reportedly Permian sediments (see Benton *et al.*, 2002, and Warrington, *this volume*). These can also be seen, though less well-developed, between Broadsands and Elberry Cove and on the rocky foreshore at Shoalstone Beach (Fig. 2, locality b). In Breakwater Quarry (Fig. 2, locality a), which now contains the Brixham multi-storey car park (SX 933 566) they can also be observed in what is a Devon County Geological Site (Page, 2004). In the Mendips, south of Bristol, comparable fissures in the Carboniferous Limestone contain well-known vertebrate assemblages and can be accurately dated as late Triassic or early Jurassic in age (Riley and Stutchbury, 1836, 1840; Moore, 1859, 1863; Robinson, 1956; Simms, 1990; Savage, 1993; Walkden and Fraser, 1993; Wall and Jenkyns, 2004; Whiteside *et al.*, 2016). There are no records of vertebrate fossils in the Torbay area and the assumption, therefore, is that they are probably in-filled with Permian sediments.