Oddicombe Beach, Devon

[SX 927 660]

Introduction

The sea cliffs behind Oddicombe Beach expose sections through the Lower Permian Oddicombe Breccia, for which this is the type locality. The breccias are faulted against the Devonian limestones of Petit Tor. The breccias are poorly sorted sediments arranged in crude sheet-like units that fine upwards, and were deposited from ephemeral floods. Imbrication of clasts in some of the finer-grained breccia units indicates fluvial transport towards the east. Permian sandstones and siltstones also infill a cavity and fissure system cut into the underlying Devonian limestone.

The Oddicombe Breccia has been described by Ussher (1913), Ussher and Lloyd (1933), Laming (1966, 1982), Perkins (1971), and Selwood *et al.* (1984).

Description

The cliffs behind Oddicombe Beach expose the Oddicombe Breccia and Devonian rocks, including the dolerites, shales, and limestones best seen on Babbacombe Downs (Figure 2.37). Potential foreshore exposures are obscured by thick deposits of white limestone and quartz debris that has been introduced by longshore drift (Perkins, 1971). The sea cliffs surrounding Oddicombe Bay form part of the Babbacombe Cliffs Site of Special Scientific Interest (SSSI).

The Permian sediments at Oddicombe occupy a downfaulted block, surrounded on all sides by Devonian rocks. At the northern end of the beach, a substantial normal fault runs from sea level up through the cliffs, roughly following the route of the cliff path. This fault brings the Devonian Petit Tor Limestone against the Oddicombe Breccia (Laming, 1969, 1982). At the opposite end of the beach a second fault, marked by the route of the cliff railway, brings the Permian sediments into contact with dolerite, shales, and limestones of Devonian age.

The Oddicombe Breccia, termed the 'breccio-conglomerates' by Ussher (1913), has a maximum exposed thickness here of approximately 350 in. The unit comprises a series of breccia beds, which range in thickness from 0.15 to 0.5 m, interbedded with thinner units of coarse, pebbly cross- and planar-bedded sandstone ((Figure 2.38); Laming, 1966). The breccio-conglomerate clasts are rounded, and have an average diameter of 0.15 m, although some are as much as 1.5 m across. The clasts consist mainly of Devonian limestones (possibly the Chercombe Bridge and East Ogwell limestones from south-west of Newton Abbot), with smaller amounts of sandstone and quartz-feldspar-porphyries (Selwood *et al.,* 1984). Finer-grained breccias composed of arkosic sandstone clasts enclosing clay clasts are similar to the Devonian Ugbrooke Sandstone, and therefore reflect a local origin for this material (Selwood *et al.,* 1984). The matrix is reddish-brown, haematitic, silty sand composed of quartz, lithic fragments, and mudstone. The Oddicombe Breccia is very well cemented.

Sedimentary structures are commonly preserved within the Oddicombe Breccia, and include pebble imbrication, planar bedding associated with graded bedding, and low-angle cross-bedding. Rarer sedimentary structures include channels and trough cross-bedding (Laming, 1966, 1982; Selwood *et al.,* 1984). At Maidencombe Cove [SX 928 685], large blocks and joint surfaces of the Oddicombe Breccia display individual and interfering trough cross-bedded units and less common subordinate planar bedding. The cross-bedding grades between isolated cut-and-fill trough cross-bedding and grouped cut-and-fill scoops (Laming, 1966).

Towards the northern end of Oddicombe Beach, cavities and open fissures are seen in the top metre or so of the massive Devonian Petit Tor Limestone. The cavities are partly or completely filled with stratified reddish-coloured siltstone and sandstone, forming sandstone dykes. The infilling sediments are well cemented by calcite, which occurs locally as small nodules and crystals lining the cavities (Laming, 1969, 1982).

Interpretation

The Permian sediments exposed at Oddicombe Beach represent deposition under terrestrial environments in a semi-arid climatic regime. The coarse, angular, poorly sorted breccias, with planar and low-angle cross-bedding, suggest accumulation on alluvial fans, with deposition from sheet floods and from floods channelled through canyons incised in the upper surface of the fans (Laming, 1982). The rounded nature of the clasts in the Oddicombe Breccia indicates that they had been transported some distance from the uplands to the west and north-west (Figure 2.39).

The isolated cut-and-fill troughs and the grouped cut-and-fill scoops exposed at Maidencombe Cove (Figure 2.39) have been interpreted as evidence for current eddies migrating downstream, causing erosional bed-forms. The scour-and-scoop bedforms have been infilled with sediments transported by less active currents from upstream of the eddy. These features are characteristic of converging streams in braided channels (Laming, 1966).

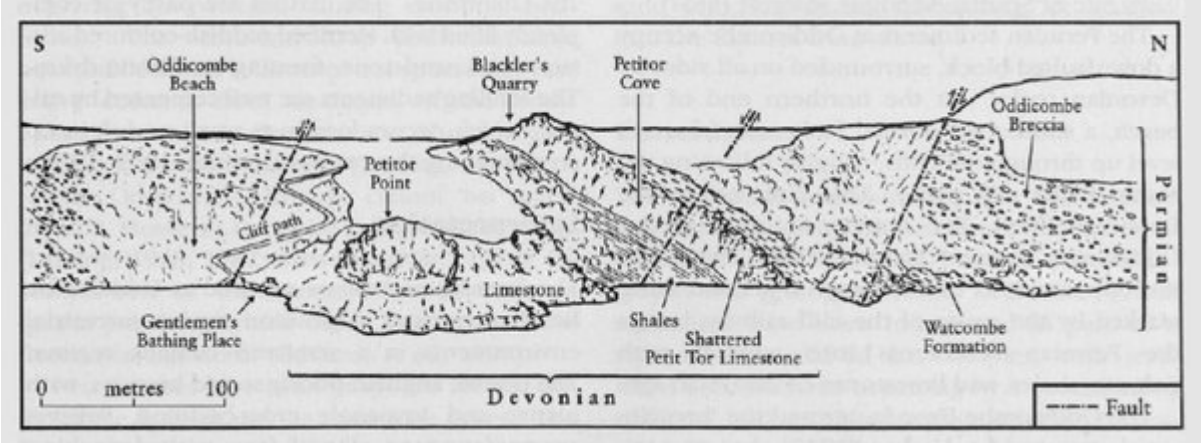
The Oddicombe Breccia cannot be dated directly. However, it may be Early Permian in age (Laming, 1968, 1982; Selwood *et al.,* 1984), by comparison of the included clasts, such as quartz porphyry, which occur also in the Bow Breccia farther north (Edwards *et al.,* 1997).

Two theories have been proposed for the origin of the fissures and the sandstone dykes. The first is that fissures and cavities within the Petit Tor Limestone are solution features produced by exposure and karstification of the limestones during the Permian Period (Laming, 1982). The fissures were then filled with a mixture of red sandstone and silt, grey limy silt, and small fragments of limestone, presumably washed into the cracks. The alternative view is that the fissures were formed through a combination of desiccation and loading associated with flooding events (Selwood *et al.,* 1984). The red sediment may then have been emplaced from below by quicksand injection during dewatering, or washed into the fissures from above.

Conclusions

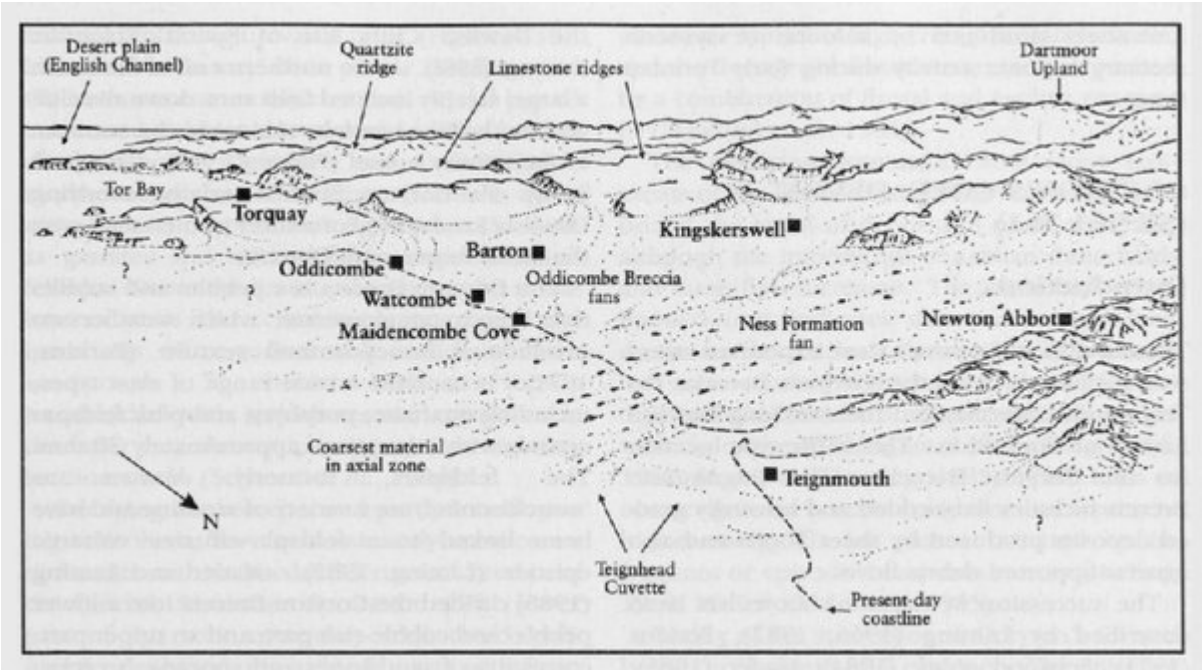
The excellent exposures of the Oddicombe Breccia at Oddicombe Beach provide valuable information on the early Permian palaeogeography and geological history of Devon. These sediments have been interpreted as part of a regional-scale alluvial fan complex, with sediment accumulation occurring by a combination of fluvial, and, to a lesser extent, aeolian processes. The site is the type location for the Oddicombe Breccia. Notable also are the cracks and fissure infills in the underlying Devonian limestones produced by solution or synsedimentary tectonic activity during Early Permian times.

References



(Figure 2.37) The cliff section at Petitor and Oddicombe, showing the three faults that bring the Devonian and the Permian sediments into direct contact. (From Laming, 1982.)

(Figure 2.38) The Oddicombe Breccia at Oddicombe Beach, showing intercalated coarse sands and breccias, with imbrication of the pebbles. (Photo: P Turner.)



(Figure 2.39) Palaeogeography of South Devon during the Early-Mid Permian epochs, showing the mountainous hinterland of uplifted Devonian and Carboniferous sediments, the main depositional basins, and the present-day coastline. (After Laming, 1982.)