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## Saltern Cove, Devon

[SX 894 591]–[SX 896 586]

### Introduction

The sea cliffs and foreshore exposures at Saltern Cove and the adjacent headland to the north expose the unconformity between Devonian slates and the Lower Permian Tor Bay Breccia. The breccia contains much locally derived material and comprises poorly organized, fining-upwards sequences. The coarsest Permian beds occur immediately above the unconformity. The site is notable also for the occurrence of large fossil burrows, possibly excavated by tetrapods.

The Saltern Cove section has been described by Ussher and Lloyd (1933), Laming (1966, 1982), and Perkins (1971), and the trace fossils by Ridgeway (1974) and Pollard (1975).

### Description

The coastal section between the southern end of Crystal Cove [SX 985 579] and the northern margin of Waterside Cove [SX 896 587] exposes sandstones and breccias of the Tor Bay Breccia.

This GCR site is part of the more extensive Saltern Cove Site of Special Scientific Interest (SSSI) comprising two GCR sites — the area was selected for the GCR both for Permian red beds and, independently, for marine Devonian stratigraphy and sedimentology.

### Sedimentology

At Waterside Cove, also known as 'Oyster Cove', the unconformable boundary between the Lower Devonian Meadfoot Beds and Permian Tor Bay Breccia is clearly exposed. Here, the purple Devonian slates have a reddened zone that extends below the contact for approximately 3 m. The surface of the Devonian rocks is an eroded landscape, but there is no evidence of soil formation.

The Tor Bay Breccia consists of interbedded sandstones, sandy breccias, and coarser breccias (Figure 2.33). The breccias are poorly sorted and contain clasts, at most 0.2 m across, primarily of locally derived Devonian limestones and shales; smaller clasts include shale and slate. The breccia contains a high proportion of medium-grained sand matrix that is well cemented by calcite. The sediments preserve a variety of sedimentary structures, including bedding (indicated by alignment of clasts), low-angle trough cross-bedding, planar bedding, rare channels, and pebble imbrication (Perkins, 1971; Laming, 1982). Larger pebbles are imbricated and smaller clasts are aligned parallel to the bedding.

The sediments in Saltern Cove are cut by at least three faults. The headland that separates Saltern Cove and Waterside Cove is fault-bounded. Other faults cut the cliffline, and affect the Devonian limestones and volcanic rocks (Perkins, 1971). At Crystal Cove, outside the GCR site boundary, the Permian sediments have been affected by extensive calcite mineralization, associated with the Crystal Cove Fault Zone. The calcite crystals are found scattered across the cliff faces, and are especially common in the shatter zone (Laming, 1982).

### Palaeontology

At Waterside Cove [SX 895 588] large burrows (Figure 2.34) have been recorded from interbedded sandstones and sandy breccias in the Tor Bay Breccia. Individual burrows are up to 0.15 m wide and up to 1.7 m long and are infilled with sediment, which is tightly packed, forming nests of curved meniscus structures (Ridgeway, 1974). Early reports of these burrows claimed that they were made by worms (Scrivenor, 1948; Laming, 1969), but they may have been produced by burrowing reptiles or amphibians as nesting or aestivation structures (Ridgeway, 1974; Pollard, 1975).

## Interpretation

The red-bed succession at Saltern Cove was deposited under predominantly terrestrial conditions in a semi-arid climate (Laming, 1966). The eroded basal surface and absence of soil shows that the currents that carried the clasts scoured the underlying Devonian sediments and discharged their load directly on the eroded surface.

The interbedded sandstones and breccias of the Tor Bay Breccia were deposited in one of the many alluvial fans that characterize Permian deposition in South Devon. The sediments accumulated through a combination of sheet and channel flows associated with periodic torrential rainfall. The sediment-rich flood waters flowed through channels and wadis until they reached the open areas of the fans. Here, the flood waters were able to expand and cover a larger area, resulting in a decrease in current velocity and the deposition of the sediment load. At Saltern Cove, the beds of imbricated pebbles indicate that the dominant direction of flow was from the south and west ((Figure 2.31); Laming, 1982). The coarser-grained materials are more characteristic of the proximal areas of the fans, and the sandstones were deposited in the distal areas.

It is unclear whether the Tor Bay Breccia should be regarded as entirely latest Carboniferous (Stephanian; Laming, 1965, 1968, 1982), as spanning the Permo–Carboniferous boundary, or as entirely Early Permian in age. By analogy with the basal breccias of the Exeter and Crediton areas (Edwards *et al.*, 1997; Edwards and Scrivener, 1999), they are here regarded as probably spanning the Permo–Carboniferous boundary, on the assumption that the cycle of red-bed deposition began at the same time throughout Devon.

The large burrows indicate that life was present, despite the climate being semi-arid. The presence of reptiles or amphibians implies availability of water bodies and abundant vegetation and insect life, for example. Burrows of vertebrates are unusual in the fossil record, and may have been constructed for nesting purposes, so that the eggs and developing young are sheltered from the sun and potential predators. Alternatively, they may have been constructed by adult animals that themselves merely sought protection, or as aestivation structures (Pollard, 1975), dug as resting chambers in which the inhabitants went into a torpid state during the summer months.

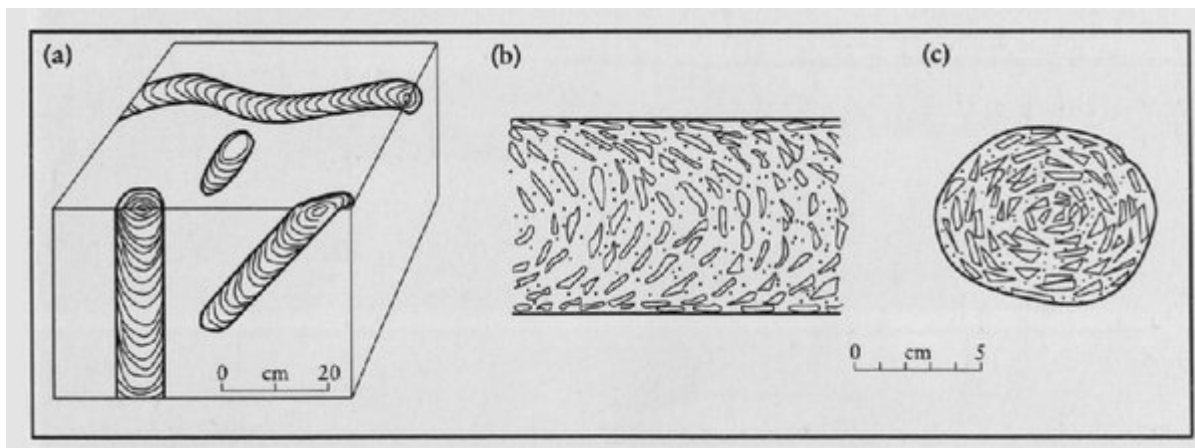
## Conclusions

The Tor Bay Breccia exposed in the cliff and foreshore section in Saltern Cove comprises a sequence of interbedded sandstones, breccias and coarse-grained breccias. These sediments rest unconformably on the Lower Devonian limestones, shales and tuffs of the Meadfoot Beds. The Tor Bay Breccia was deposited in a large alluvial fan complex, from periodic floods in the Permian deserts. Key features in Saltern Cove are the basal unconformity, the breccia composition, and the unusual burrows. This site provides important information for the reconstruction of the palaeogeography of Devon during around the beginning of the Permian Period.

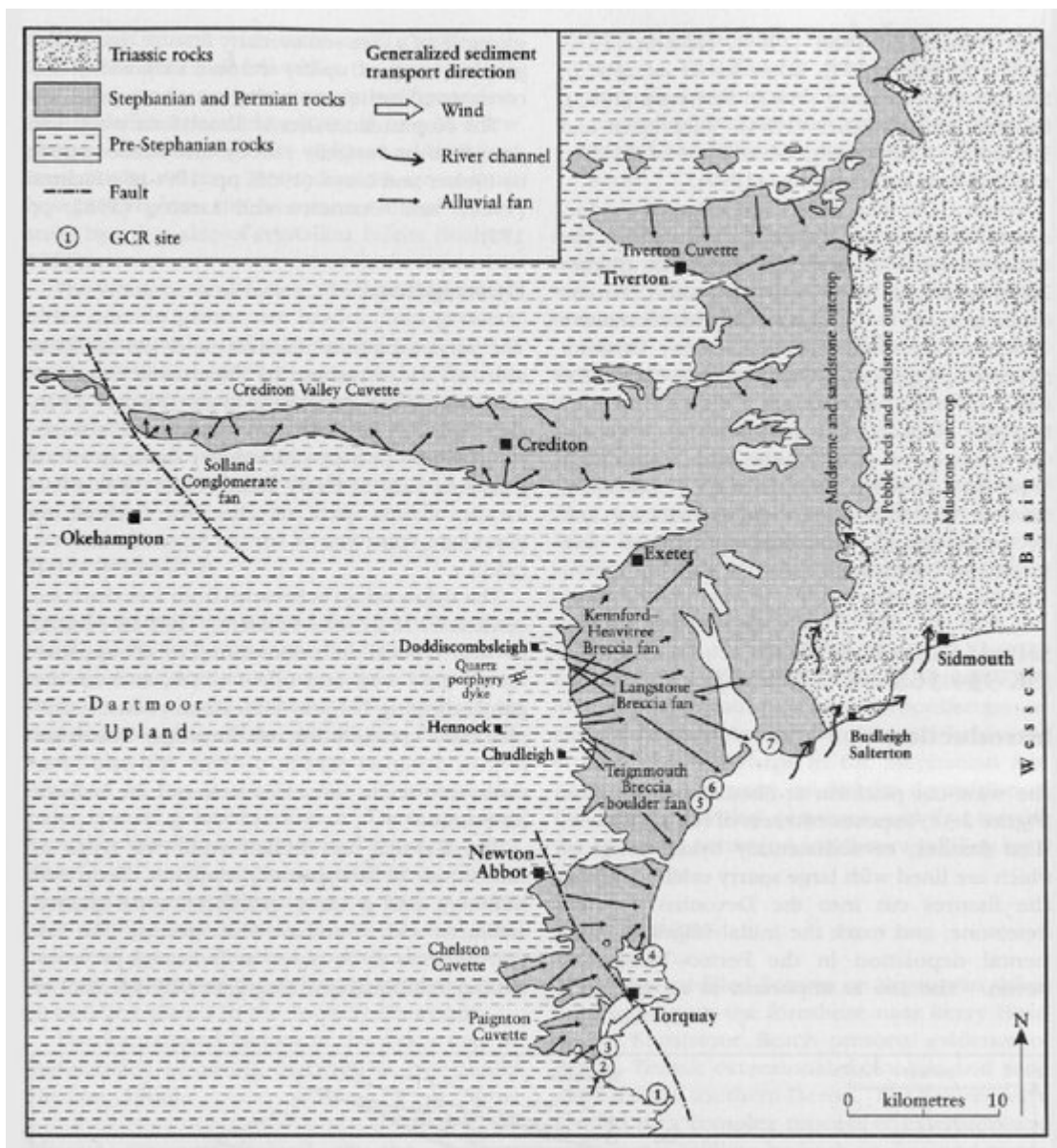
## [References](#)



(Figure 2.33) The Tor Bay Breccia in Saltern Cove. (Photo: D. Evans.)



(Figure 2.34) Burrows from the Tor Bay Breccia of Waterside Cove, shown as a reconstruction (a), in vertical section, with meniscate packing structures (b), and in horizontal section, with oriented clasts (c). (After Ridgeway, 1974.)



(Figure 2.31) Depositional basins and sediment transport trends in the Permian of Devon. GCR sites are: (1) Shoalstone; (2) Saltern Cove; (3) Roundham Head; (4) Oddicombe Beach; (5) Coryton's Cove; (6) Dawlish; (7) Ocombe Rocks. (After Laming, 1982.)