CASTELL COCH TO TRWYNCASTELL

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Introduction

Volcanic rocks are exposed extensively in the north Pembrokeshire region. The major activity, for example around Fishguard, appears to have occurred during Llanvirn times, chiefly during *Didymograptus bifidus* Biozone times. In the Abereiddi area, volcanic rocks of the Llanrian Volcanic Formation (of Hughes *et al*., 1982) are exposed on the north and south sides of the bay, on opposing limbs of the Llanrian Syncline. On the south side of the bay, between Castell Coch in the west and Melin Abereiddi in the east, basaltic tuffs of the Didymograptus Murchisoni Ash of Cox (1915), or the Abereiddi Tuff Member of Hughes *et al*. (1982), are of *Didymograptus murchisoni* Biozone age. On the north side of Abereiddi Bay, silicic tuffs of *Didymograptus bifidus* Biozone age, are exposed; these are the Llanrian Volcanic Group of Cox (1915), or the Lower Crystal Tuff Member of the Llanrian Volcanic Formation of Hughes *et al*. (1982).

The first important description of these tuffs was by Cox (1915). Bevins and Roach (1979b) provided an initial interpretation of the environment and the depositional processes responsible for the genesis of the various tuffs. This was expanded upon by Kokelaar *et al*. (1984a). The geochemistry of tuffs belonging to the Abereiddi Tuff Member was described by Bevins *et al*. (1992).

Tuffs belonging to the Abereiddi Tuff Member represent the youngest Ordovician volcanic rocks exposed in the southern part of the Welsh Basin.

Description

The Ordovician sequence in the area around Abereiddi contains significant volcanic and volcaniclastic rocks, exposed in two E–W coastal sections. These rocks are interbedded with strongly cleaved mudstones that reflect the character of the background sedimentation which was punctuated periodically by short-lived volcanic events.

At the western end of the cliffs forming the south side of Abereiddi Bay (Figure 6.17), the Abereiddi Tuff Member is well exposed to the NE of Aber Creigwyr. The tuffs dip to the north at around 45°, and are represented by two fining-upwards sequences, 95 m thick in total. The upper tuff unit lies conformably on the lower, and the base of each unit is sharp and planar.

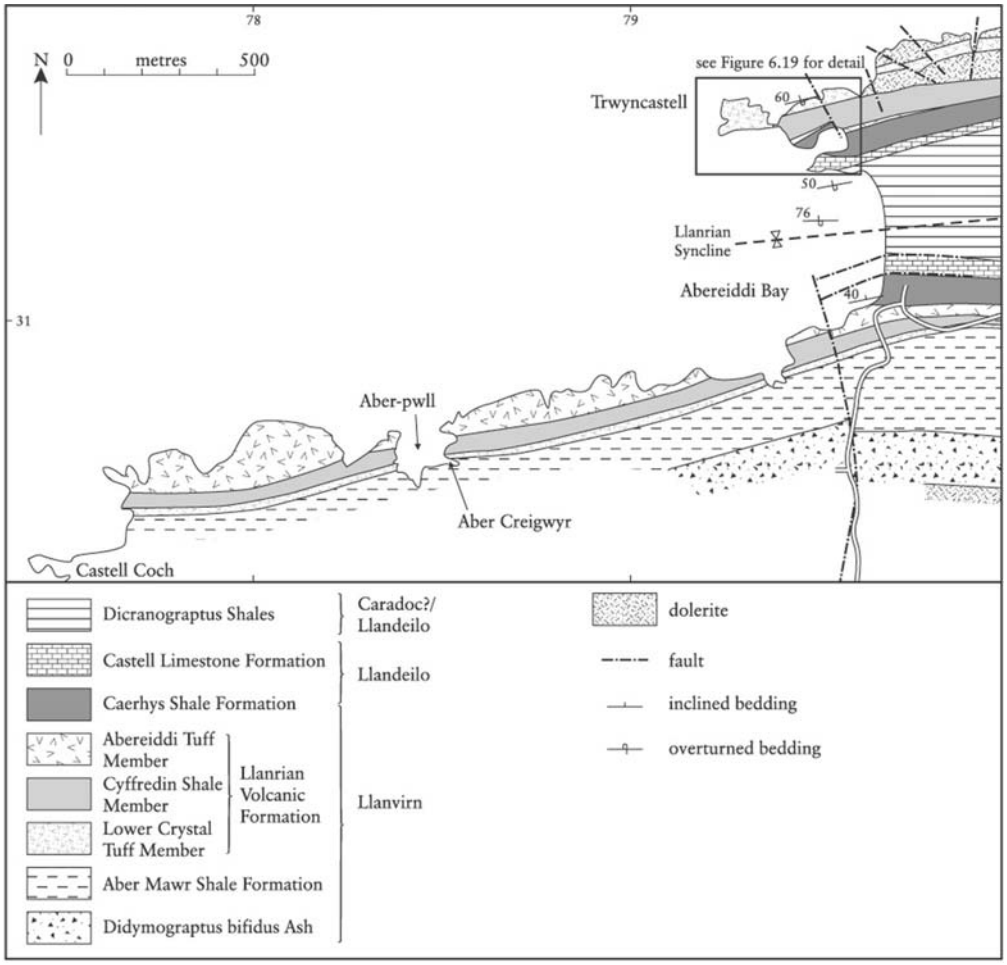

Figure 6.17: Map of the south side of Abereiddi Bay (after Kokelaar et al., 1984a).

The lower tuff unit is poorly to moderately bedded, with successively higher beds becoming overall of finer grade and showing more clearly defined coarse-grained bases (coarse-tail grading). The upper unit, in contrast, is not obviously bedded, although it does show evidence of grading. The tuffs are composed of angular, scoriaceous basalt lapilli and sparsely vesicular blocks and bombs, up to 40 cm in diameter, set in a fine-grained tuffaceous matrix (Figure 6.18).

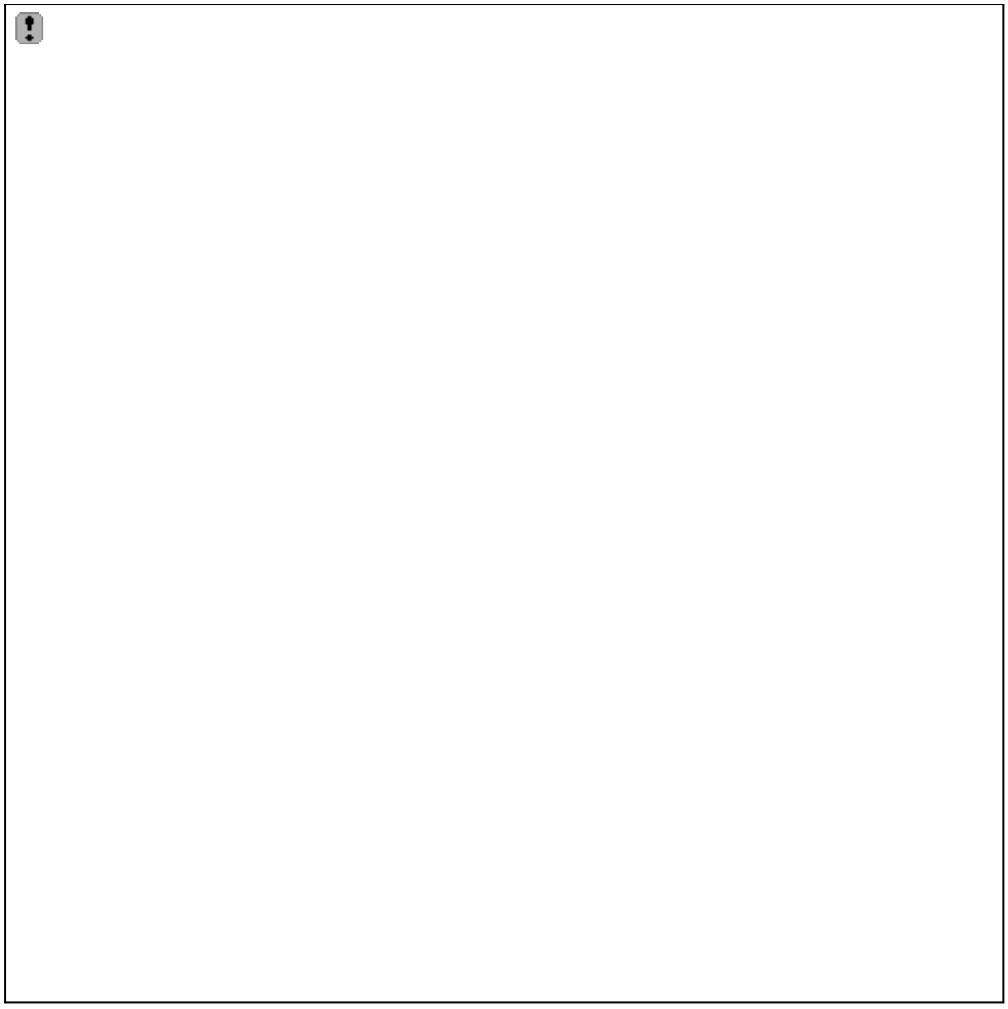

Figure 6.18: Coarse lapilli-tuff of the Abereiddi Tuff Member, south side of Abereiddi Bay. (Photo: R.E. Bevins.)

To the east, in the area around Melin Abereiddi, the tuffs are thinner (around 60 m). The tuffs of the lower unit rest conformably on tuffaceous mudstones, and are poorly sorted, with crude coarse-tail grading and ill-defined bedding. Upwards the tuffs of the lower unit become more thinly bedded and finer grained. The upper unit, which has a distinctive lapilli-tuff at its base, shows a coarser grain-size. These tuffs are well bedded, with bed thickness ranging from 3–25 cm; some beds showing normal grading, although most show little to no evidence of grading. Parallel and ripple drift lamination are present. Bed bases tend to be planar, although locally erosive, down-cutting bases are also seen. Upwards, these tuffs pass conformably into tuffaceous mudstones and mudstones.

On the north side of Abereiddi Bay (Figure 6.19) the Abereiddi Tuff Member is represented by a thin sequence of tuffs exposed in the disused quarry. Structurally above but stratigraphically below this unit, the Lower Crystal Tuff Member, up to 100 m thick, is chiefly represented by crystal-rich volcaniclastic sandstones that show clear evidence of normal grading. On the promontory of Trwyncastell the group comprises a sequence of fine-grained silicic tuffs, considered by Cox (1915) to be rhyolitic lavas. Subsequent studies (Bevins and Roach, 1979a), however, have shown that they contain shards and are fine-grained, silicic tuffs.

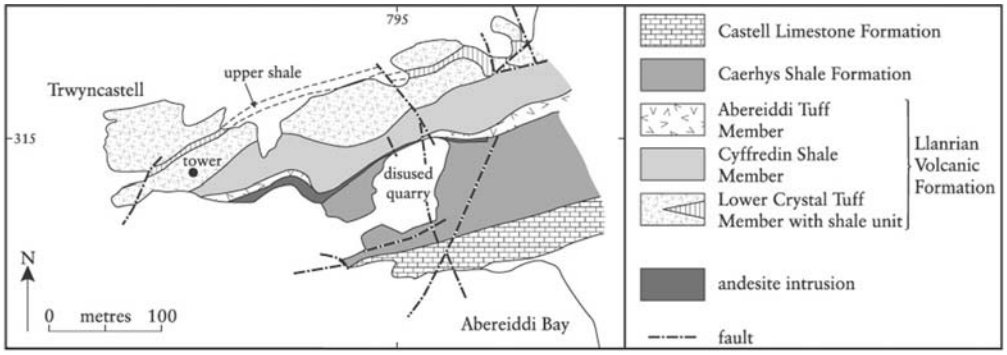

Figure 6.19: Map of the north side of Abereiddi Bay (adapted from Hughes et al., 1982).

Interpretation

The silicic rocks of the Llanrian Volcanic Formation were interpreted byCox (1915) as being rhyolitic lavas. However, they contain shardic fragments, along with crystals and are interpreted as ash-flow tuffs, emplaced subaqueously and later extensively recrystallized.

The tuffs of the Abereiddi Tuff Member were deposited entirely in a submarine environment and are interpreted as deposits chiefly from low- and high-density turbidity currents and from debris flows. They become thicker towards the west, as well as becoming coarser grained and less well bedded. The sequence is thought to have been generated by the periodic slumping of unstable basaltic debris down the flanks of a submarine volcano. The increase in bedding features and the fining of grain-size upwards through the sequence possibly reflects a decrease in the rate of activity with time, such that the input of slumped material and coarse-grained debris decreased progressively. Periodic increases in activity are reflected, for example, by the lapilli-tuffs at the base of the upper unit of the sequence.

Conclusions

Ordovician tuffs exposed to the north and south of Abereiddi Bay reflect subaqueous silicic and basaltic volcanism. The silicic tuffs were probably generated as ash-flow tuffs from primary explosive eruptions and developed broadly contemporaneous with similar tuffs to the east around Fishguard (at the Pen Caer GCR site) and to the west in the vicinity of Ramsey Island (at the Aber Mawr to Porth Lleuog GCR site). Direct correlations are not possible due to lack of outcrop continuity, but they clearly form part of the major bimodal basic–silicic volcanism which characterized this part of the Welsh Basin in early Ordovician times.

Basaltic tuffs appear to have been generated on the flanks of a submarine volcano; loose ash and lapilli were reworked due to slumping, leading to the accumulation of a sequence of turbidity deposits. These tuffs are the youngest Ordovician volcanic deposits in the southern part of the Welsh Basin.

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