CURIG HILL

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Introduction

Following the cessation of volcanic activity related to the 1st Eruptive Cycle, northern and central Snowdonia underwent large-scale extension in later Caradoc times to form an elongate NW-trending trough or graben structure. The sediments and lesser volumes of acidic and basic tuffs that infilled this trough provide valuable information on the environment of deposition and volcanic activity prior to the initiation of the 2nd Eruptive Cycle of acid ash-flow tuff volcanism in North Wales.

The GCR site in the vicinity of Curig Hill records an impressive heterogeneous sequence of marine sedimentary rocks, interlayered with tuffaceous sedimentary rocks and distal acid and basic tuffs. This distinctive association, which occurs immediately above the Capel Curig Volcanic Formation, passes conformably up into a distal outflow tuff derived from the Snowdon Centre (the Lower Rhyolitic Tuff Formation or LRTF). This tuff is in turn overlain by tuffs and tuffaceous sedimentary rocks derived from the Crafnant Centre (the Lower Crafnant Volcanic Formation or LCVF). The site is also important in being one of the few examples of a well-exposed section through a basic vent or tuff cone.

Originally, the area was mapped in 1848, with the first geological maps and sections published between 1851 and 1854, and described by Ramsay (1881). It was mapped at the 1:10 560 scale by Williams (1922) and later by the Geological Survey in 1968–70. Detailed descriptions are presented in Howells *et al*. (1978) with later revisions and re-interpretation of the stratigraphy in Howells *et al*. (1991). Published geochemical data for the LCVF indicate predominantly rhyolitic compositions with individual tuffs distinguished by their Zr/TiO_2 ratios (Howells *et al*., 1991).

Description

The Curig Hill GCR site lies on the limb of a paired fold structure with moderate dips predominantly to the NE (Figure 6.52). The western (and lowest) parts of the succession are exposed immediately north of the A5 at Plas Curig and comprise greyish-green, well-bedded sandstones of the Cwm Eigiau Formation, interbedded with acid tuff, tuffaceous sedimentary rocks and basic tuffs. Pre-tectonic deformation of the strata is common and prominent in a 2 m-thick sandstone containing slump structures including overfolds and oversteepened foresets. Fossiliferous beds dominated by shelly faunas occurring in layers up to 10 cm thick are also common locally; north of Curig Hill these include the brachiopod *Plaesiomys multifida,* indicating a Soudleyan age. Elsewhere along strike, the presence of Longvillian faunas near the top of the section suggests that the Soudleyan–Longvillian boundary probably lies within the sequence.

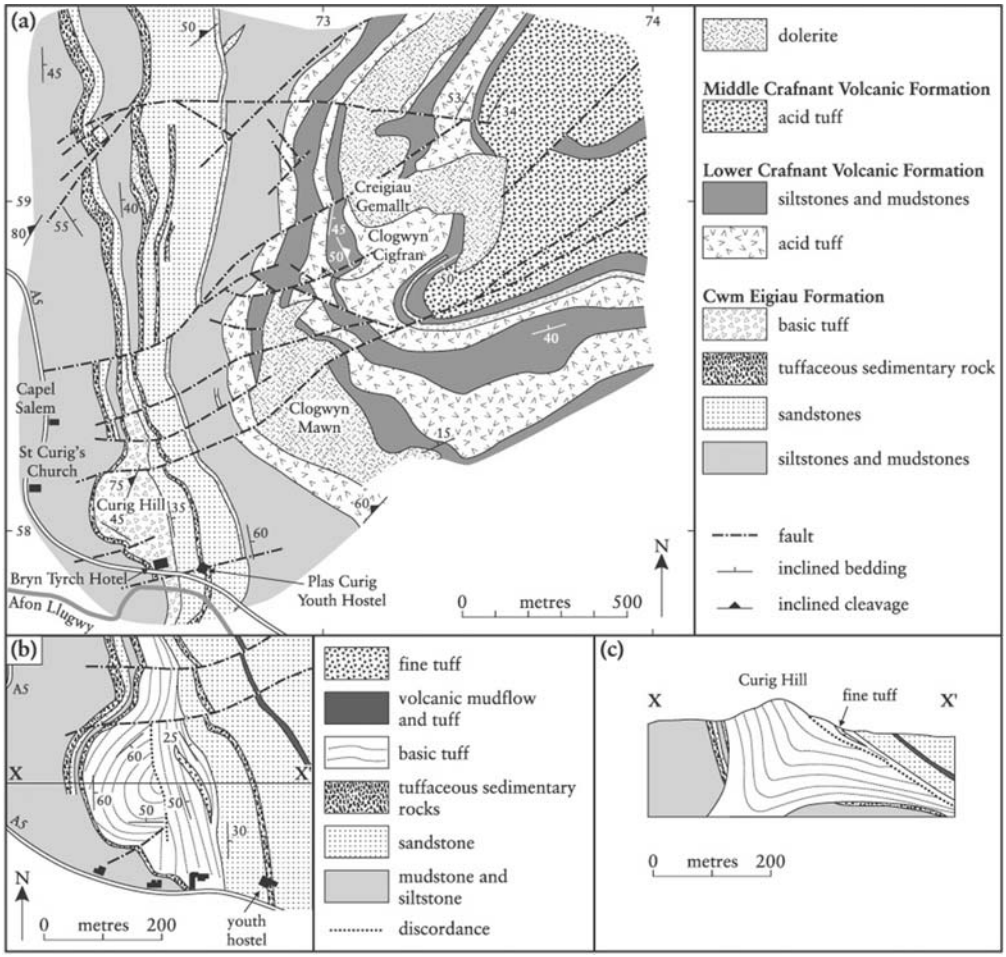

Figure 6.52: (a) Map of the Capel Curig area (after BGS 1:10 000 Sheet SH75NE). Insets (b), (c) show sketch map and section of the basaltic vent at Curig Hill (after Howells et al., 1991).

The interbedded acid tuffs are fine grained and composed of devitrified, recrystallized fragmentary shards and dust, with or without a mudstone matrix. Locally, with increasing additions of sedimentary debris, the tuffs grade into tuffaceous sandstones and siltstones. Generally up to 5 m thick, the tuffaceous sandstones commonly show cross-bedding in the tops of units and washouts. In places they are disturbed by soft-sediment deformation, for example north of the Capel Curig Youth Hostel (at 7258 5811).

Basic tuffs form two distinctive layers within the succession. The lower crops out as a wedge-shaped intrusive mass some 200 m wide, forming the mass of Curig Hill immediately to the north of the Bryn Tyrch Hotel (724 581) (Figures 6.52 and 6.53). Well-cleaved, poorly sorted and rarely graded, the basic tuffs contain abundant volcanic blocks and lapilli, with bedding defined by grain-size variations and clast or block concentrations. Petrographically the tuffs are composed mainly of aggregates of chlorite, carbonate and iron oxide.

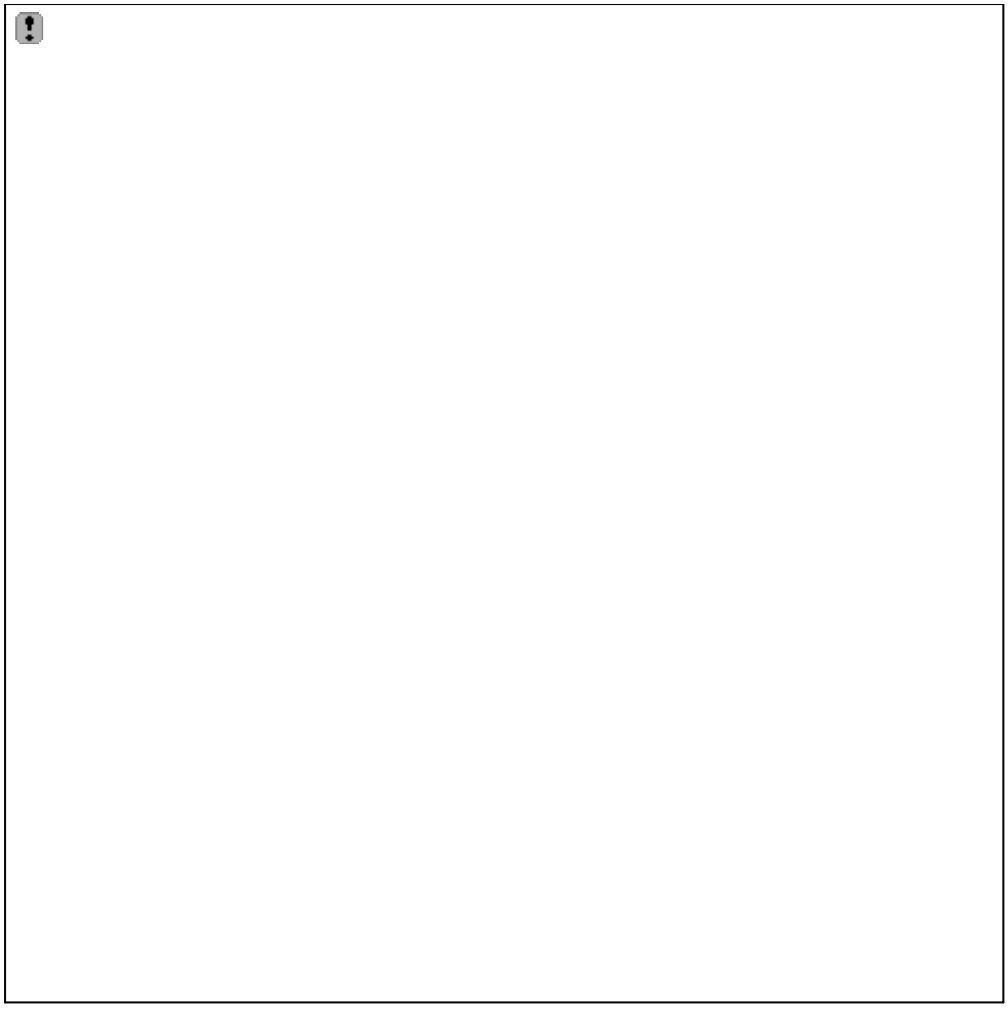

Figure 6.53: Base of bedded basalt agglomerate, Curig Hill 'vent' with acid tuff forming the lower feature near the wall. (Photo: BGS no. L1868.)

Grain-size analysis reveals that towards the summit of the hill there is a gradual increase in the size of the blocks and lapilli. This is associated with the development of a slumped, agglomerate zone characterized by blocks of tuff up to 1 m in diameter and penecontemporaneous minor faults. In addition, there are important variations in the dip patterns around the hill. In the west concentric inward (centroclinal) dips decrease from 80° to 50° towards the zone of slumped agglomerate. In contrast, above a planar discordance, which trends N–S within the eastern part of the tuff pile, dips of between 25° to 30° are more constantly to the east. The tuffs here are finer grained and include lenses of fine-grained reworked tuff and tuffaceous sedimentary rocks and pass conformably up into younger sandstones typical of the Cwm Eigiau Formation.

The upper basic tuff layer lies near the top of the sandstone succession at 7275 5790. It is composed of two distinct horizons: a lower laharic mudflow, less than 2 m thick, includes angular clasts of sedimentary rock and acid tuff showing a crude alignment parallel to the regional bedding; and an upper basic tuff, 2–3 m thick, which marks the contact between sandstones and overlying mudstones and siltstones. Well-exposed around 7275 5793, the tuff contains clasts of chloritized and altered basalt and basic pumice or scoria in a fine-grained matrix.

The higher parts of the GCR site, from Clogwyn Mawr across to Creigiau Gemallt, are dominated by a succession of NE-dipping acidic ash-flow tuffs separated by siltstones and mudstones and intruded by a dolerite sill.

The overlying volcanic rocks are poorly cleaved, often flinty, vitric, non-welded acid tuffs with variable proportions of crystals and lithic clasts. The lower tuff (No. 1 of the LCVF of Howells *et al*. (1973, 1978)) is equivalent to part of the most easterly outflow tuff of the LRTF (Howells *et*

al., 1991). Up to 56 m thick at 7270 5760, the tuff displays a distinctive upwards-fining sequence from a basal zone rich in crystals and lithic clasts, through a sparsely porphyritic middle part with small pumice clasts, to a fine-grained crystal-depleted top. The basal zone includes clasts of siltstone, brachiopod and trilobite fragments, and rare ooliths. The middle zone, between 7 and 21 m above the base, is regularly bedded with thin (up to 3 cm) well-cleaved silty layers and passes up into massive columnar-jointed tuff with clasts of pumice and rhyolite. Above are interbedded siltstones and mudstones.

The middle tuff (No. 2 of the LCVF) is well exposed on Clogwyn Cigfran at 7295 5873, where it is underlain by a rusty brown-weathering feldspar-phyric dolerite sill. The tuff is uniform and massive with visible pumice clasts, feldspar crystals and rare siliceous nodules. The upper tuff (No. 3 of the LCVF), up to 40 m thick, is a more heterogeneous unit, distinguished by the absence of xenocrysts and a wide range in shard sizes. Forming the eastern slopes of Clogwyn Cigfran (e.g. at 7321 5879), it includes clast-rich vitric tuff interlayered with tuffaceous siltstones. Lithic clasts include andesite, hyaloclastite, basic and acid tuff, pumice and siltstone. Bedding is demonstrated at 21 m above the base by a thin agglomeratic bed with rounded clasts.

Interpretation

The strata in the Curig Hill GCR site area lie within the middle part of the interval between the two major Caradoc eruptive cycles in Snowdonia and have been interpreted as marking a marine transgression, with the progressive development of deeper water environments from shallow marine to offshore down a south-facing palaeoslope. Sedimentological studies in adjacent areas have interpreted the sandstones in the lower part of the succession as having formed within fluctuating inner and outer shelf regimes subject to periodic storm events (Orton, 1988). Within this environment the acid tuffs and tuffaceous sedimentary rocks represent distal ash fall-out, subsequently reworked in the marine environment and disrupted by soft-sediment deformation. The coarser-grade tuffs probably represent secondary emplacement by transport as high-density debris flows and slurries of pyroclastic debris.

The centroclinal dips, lateral wedging and grain-size variation in the lower basic tuffs of Curig Hill were interpreted by Howells *et al*. (1978, 1991) to represent the upper levels of an intrusive funnel-shaped volcanic vent which probably fed a tuff cone on the ancient surface. The cone superstructure was reworked and the sediments were redeposited as the fine-grained bedded volcaniclastic sediments at the top of the section. The limited contamination of the adjacent sediment with basaltic debris suggests that such eruptions were minor and that debris dispersal was limited.

The lowest tuff of the overlying Lower Crafnant Volcanic Formation is the sole distal representative of a rhyolitic ash-flow tuff (Lower Rhyolitic Tuff Formation) derived from the Snowdon Centre. The fine-grained top of vitric dust probably represents the elutriation of devitrified and recrystallized volcanic dust and ash material from the head of the pyroclastic flow. The overlying tuffs and tuffaceous sedimentary rocks are the products of rhyolitic ash-flow eruptions with limited ingestion of substrate sediment and were emplaced in a deep-water marine environment. Later remobilization of these tuffs was periodic and localized.

Conclusions

The Curig Hill GCR site preserves an important section recording the reworking of volcanic deposits and sedimentation between the two major eruptive cycles in Snowdonia. A complex heterogeneous sequence of marine sedimentary and volcaniclastic deposits indicates the progressive subsidence and development of a major trough. The products of initial basaltic eruptions, in shallow shelf settings, were progressively reworked and buried by finer-grained marine sediments from a more distant source as the trough deepened. Distant minor volcanic activity released small volume ash-fall deposits. The start of the 2nd Eruptive Cycle is heralded by the Lower Crafnant Volcanic Formation and its emplacement into quiescent deep marine conditions.

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