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# Llynnau Cregennen

[SH 652 148]–[SH 658 144]

## Introduction

The outcrops to the north-west of Llynnau Cregennen display a partial section through the lower part of the Aran Volcanic Group from the local base of the Arenig up to fossiliferous Llanvirn strata which serve to date the lower parts of the Aran Volcanic Group.

Ridgway (1975) proposed the term Aran Volcanic Group for the major complex of volcanic rocks that girdle the south and east of the Harlech Dome, and the area of the Cregennen site shows a representative succession through the lower part of that group. The strata are well exposed and make splendid and most instructive topographical features at the site and in the ridges to the north-east (Figure 9.11).

The general succession in the area was described by Cox and Wells (1921) who named in ascending succession (1) the Basement Series (of Arenig age), (2) the Lower Acid Series (including the fossiliferous Pont Kings Slates, thought to lie at the Arenig–Llanvirn boundary), (3) the lower Llanvirn, consisting of the Moelyn Slates, Bryn Brith Ashes, Croegenen Slates and the Cefn Hir Ashes, overlain by (4) the Lower Basic Series (of uncertain age). The British Geological Survey (1995) re-mapped the area and redescribed the succession (Pratt *et al.*, 1995), and that account is followed here. The 'Basement Series' is assigned to the Allt Iryd Formation, the 'Lower Acid Series' is equivalent to the Offrwm Volcanic Formation, and the lower Llanvirn strata are referred to the Cregennen Formation (with the Bryn Brith and Cefn Hir members) and are overlain by the Llyn y Gafr Volcanic Formation.

## Description

The Allt Iryd Formation rests sharply on the Dol-cyn-afon Formation (Tremadoc) near Pant-y-cae [SH 6535 1482]. It is composed of thickly bedded sandstones showing cross-lamination and bioturbation. Macrofossils are not known, but, from localities to the north-east, Molyneux (in Pratt *et al.*, 1995, p. 20) recorded acritarch floras of Arenig age that indicate the presence of both Moridunian and Fennian strata.

The Offrwm Volcanic Formation consists of 100 m of acid tuffs and intercalated mudstones. Pratt *et al.* (1995, fig. 12) gave a log. The succession is interrupted by a thick, intrusive dolerite sill. No fossils are recorded here, but graptolites of early Llanvirn age (*Amplexograptus confertus* (Lapworth), *Didymograptus* cf. *miserabilis* Bulman) were found about 1 km to the north-east (Pratt *et al.*, 1995, p. 24), in strata that Cox and Wells (1921, pl. 20) mapped as 'Pont Kings Slate'.

The stream that drains Llynnau Cregennen exposes mudstones representative of the type area of the Cregennen Formation, together with a thin development of the Bryn Brith Member, both dipping south-east at about 60°. The Cregennen Formation consists mainly of dark-coloured graptolitic mudstone with numerous thin beds and layers of feldspar crystals and fragments of volcanic rocks. Cleavage is strong, and bedding may (in the absence of tuffaceous layers) be difficult to discern. Pendent didymograptids typical of the lower Llanvirn *artus* Zone have been collected, including *Didymograptus* (*D.*) cf. *spinulosus* Perner west of Llynnau Cregennen [SH 6578 1437] and at other localities to the north-east (Pratt *et al.*, 1995, figs. 14i, j).

The Bryn Brith Member consists of coarse-grained basic tuffs with mudstone interbeds, together forming a steep ridge that stands above the ground occupied by the softer slates. Pratt *et al.* (1995, fig. 13) gave a log and recorded trilobites, including *Stapeleyella murchisonii* (Salter), from a mudstone interbed immediately north of the site [SH 6581 1486] (Pratt *et al.*, 1995, p. 29, pls 9h, 1). The overlying Cefn Hir Member consists of basic and acid tuffs and tuffites that, with a microgranite intrusion, form another striking ridge (Figure 9.12). South of Llynnau Cregennen the formation is overlain in turn by the Llyn y Gafr Volcanic Formation. South of Arthog [SH 6467 1334] mudstones between the Cefn Hir and Llyn y Gafr divisions contain Llanvirn graptolites, but their zone is uncertain (Pratt *et al.*, 1995, p. 30).

## Interpretation

The Allt Llyd Formation represents shallow-water sandstones deposited under the influence of storms. According to Pratt *et al.* (1995, p. 20), deposition of coarse sandstone commenced to the south-west in Tremadoc to early Arenig times and transgressed towards an uplifted area in the north-east, where some of the sandstones yield probable Llanvirn acritarch floras. The present site lies in an intermediate position in this tran-sect. Traynor (1990, fig. 11) showed deposition of deltaic fans forming on the downthrow side of the active fault scarp that marks the southerly margin of his 'Fairbourne Trough' to the south of the Harlech Dome.

After uplift and erosion the tuffs of the Offrwm Volcanic Formation were deposited sub-aqueously. Intercalated mudstones contain early Llanvirn graptolites referred to the *artus* Zone, but Cox and Wells' (1921) record of Arenig graptolites was discounted by Rushton (in Pratt *et al.*, 1995, p. 24), and all the known faunas associated with the Offrwm Volcanic Formation are regarded as basal Llanvirn in age.

The Cregennen Formation represents background deposition of fine-grained detritus in poorly oxygenated conditions and is typical of graptolitic Llanvirn mudstones in much of Wales. It includes periodic influxes of volcanic material by mass-flow from a volcanic centre somewhere nearby; the Bryn Brith and Cefn Hir members show the most substantial of these flows. Although the location of the centre is uncertain, Pratt *et al.* (1995, p. 30) considered it may have lain to the north-east. All the identifiable faunas indicate the *artus* Zone and set a maximum age for the Llyn y Gafr Formation, which underlies strata of the *multidens* (and possibly *gracilis*?) Zone, but is otherwise of uncertain age (Pratt *et al.*, 1995, p. 32).

## Conclusions

Llynau Cregennen provides an admirably featured and instructive transect of the stratigraphy of the lower part of the Aran Volcanic Group. Faunas from the vicinity demonstrate better than those from elsewhere around Cadair Idris the Llanvirn age of the first stages of volcanic activity of the Man Volcanic Group.

## [References](#)



(Figure 9.11) Llynau Cregennen, viewed from Barmouth, looking ESE towards Cadair Idris (the highest ridge). The dark scarp below and to the right of Cadair Idris is Tyrrau Mawr, made up of Aran Volcanic rocks intruded by microgranite. The lakes Llynau Cregennen appear as dark expanses directly below the summit of Cadair Idris; and, below them, steep wooded slopes around the settlement of Arthog are mostly of Dol-cyn-afon Formation (Tremadoc). The ground left of Llynau Cregennen and Arthog is well featured, showing successively higher ridges of the Dol-cyn-afon (quarried for slate), Allt Llyd Formation (Arenig), Offrwm Volcanic Formation (Arenig–Llanvirn), and the Bryn Brith and Cefn Hir members of the Cregennen Formation (Llanvirn). (Photo: Cambridge University Collection of Air Photographs, BMZ 22: copyright reserved.)



(Figure 9.12) Llynau Cregennen, looking north-east towards Pared y Cefn Hir. The lower ground to the left is occupied by fossiliferous Llanvirn slates of the Cregennen Formation, overlain by basic and acid tuffs of the Cefn Hir Member dipping to the right, with debris from a microgranite intrusion littering the dip-slope. (Photo: R.M. Owens.)