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# Trwyn Carreg-y-tir

[SH 2876 2402]

## Introduction

Trwyn Carreg-y-tir and the adjacent cliffs form the best accessible section through any part of the Harlech Grits Group. Excellent exposure of the Hell's Mouth Formation allows study of their sedimentology. The higher beds yield the only Lower Cambrian (late Comley Series) trilobites known from the Harlech Grits Group, making this a key section for regional correlation.

Nicholas (1915) described the geology of St Tudwal's Peninsula (Figure 3.3). He termed the oldest strata, exposed in the cliffs on the west of the peninsula, the 'Hell's Mouth Grits'. Bassett and Walton (1960) described the sedimentology and provenance, and Young *et al.* (1994) redescribed the rocks and formalized the formational names. The Hell's Mouth Formation is correlated lithologically with the upper part of the Rhinog Formation of the Harlech Dome, in particular because each is overlain by a formation with dark manganiferous siltstones. However, whereas the Rhinog Formation is unfossiliferous and poorly constrained as to age, the occurrence of fossils in the Hell's Mouth Formation indicates a level near the top of the Comley Series and provides an important biostratigraphical datum for the Cambrian of North Wales.

## Description

The cliffs around Trwyn Carreg-y-tir, including the coast to Trwyn y Ffosle 800 m to the north [SH 2868 2482], expose about 190 m of Hell's Mouth Formation dipping eastwards at 30–40° (Figure 3.5). The formation is composed mainly of coarse- to medium-grained sandstone, commonly in beds 0.3–1 m thick but occasionally approaching 4 m in thickness, interbedded with thinner siltstone units usually not more than 0.5 m thick. Bassett and Walton (1960) described sedimentary structures typical of Bouma cycles and showed that the sandstones are turbidites. The orientation of bottom structures such as groove and flute casts shows that depositional currents flowed from the north-east (Bassett and Walton, 1960, p. 98).

Young *et al.* (1994) took the exposures at Trwyn y Ffosle as the type-section of the Hell's Mouth Formation, but the upper part is best seen at Trwyn Carreg-y-tir [SH 2876 2402], where units I to K of Bassett and Walton (1960, p. 88) are exposed. The base of the overlying Trwyn y Fulfran Formation of Young *et al.* (1994), broadly equivalent to the base of Nicholas' Mulfran Beds, is marked by the disappearance of thick sandstone beds and the appearance of manganiferous siltstone (Young *et al.*, 1994).

Bassett and Walton (1960, p. 103) collected a fauna of trilobites and sponge spicules from three levels in the upper 23 m of the Hell's Mouth Formation. These were described by Bassett *et al.* (1976), who considered that the trilobites *Hamatolenus (Myopsolenus) douglasi* Bassett, Owens and Rushton, *Kerberodiscus succinctus* Bassett, Owens and Rushton and possibly *Serrodiscus ctenoa* Rushton indicate a late Comley Series age (late Lower Cambrian in traditional terms). Martin (in Young *et al.*, 1994) recorded acritarch floras from several levels in the Hell's Mouth Formation. Most of the taxa she recorded have long stratigraphical ranges, but a few, including *Skiagia scottica* Downie, are restricted to strata that elsewhere are assigned to the Lower Cambrian.

## Interpretation

Bassett and Walton (1960) showed that the Hell's Mouth Formation is composed of turbidites deposited from currents flowing from the north-east, much like the Rhinog Formation (see the Barmouth Hillside site report). The fossils that they discovered in the top of the formation are significant because biostratigraphical control of the Harlech Grits Group is so scanty. The next younger faunal horizon lies well up in the Middle Cambrian at Porth Ceiriad (see site report below), and the only older fossils are a *Platysolenites* from the Dolwen Formation (Rushton, in Allen and Jackson, 1978) and an

indeterminate brachiopod from the Llanbedr Formation (Lockley and Wilcox, 1979), both from the centre of the Harlech Dome.

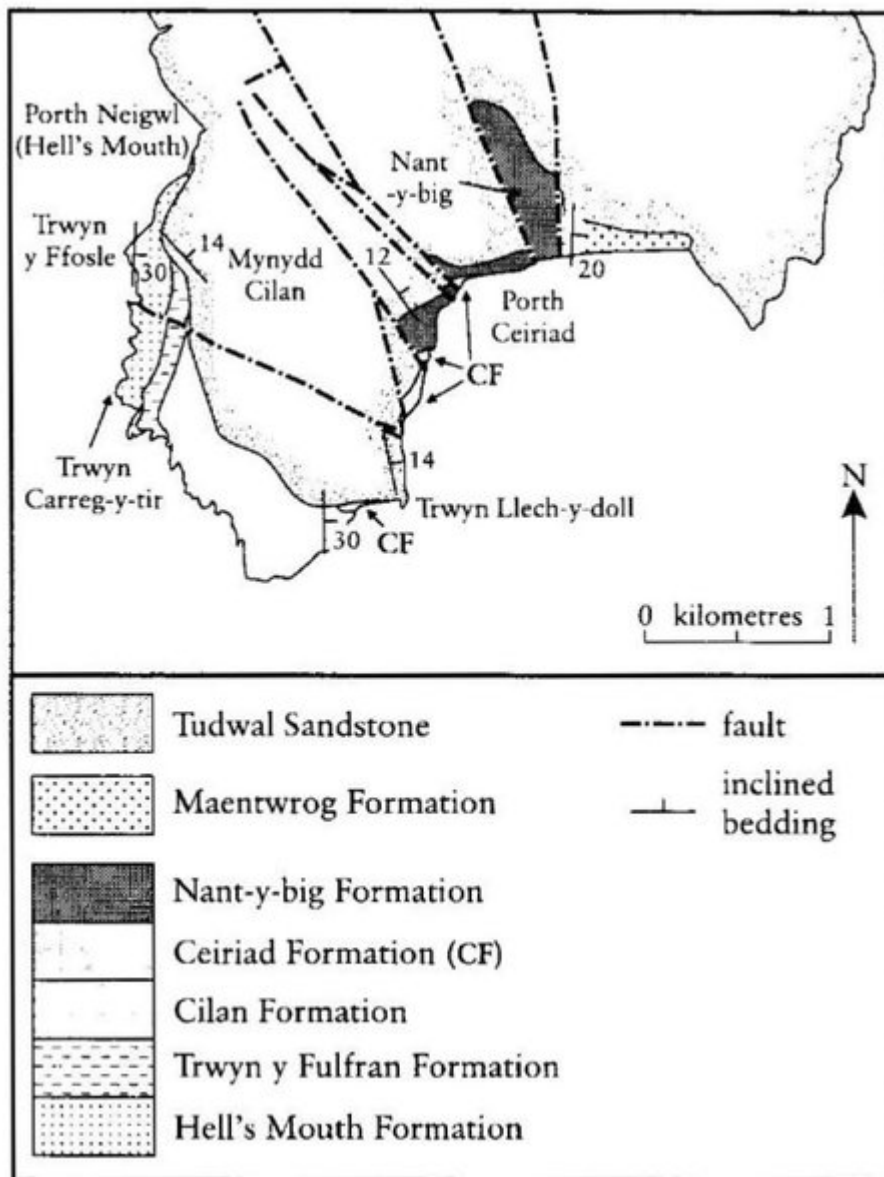
Assessment of the trilobites from Trwyn Carreg-y-tir gives conflicting ages. *Kerberodiscus*, though endemic, is related to *Leptochilodiscus*, which is associated with *Olenellus* in eastern North America, implying an early Cambrian age, as recognized in North America (Bassett *et al.*, 1976). The species of *Hamatolenus* (*Myopsolenus*) is related to species associated with early Paradoxididae in Morocco, implying a mid-Cambrian age (Geyer, 1990). It is clear that the level taken as the Lower–Middle Cambrian boundary in North America is not the same as in Morocco, but evidently the Hell's Mouth fauna lies near the Lower-Middle Cambrian boundary. Here it is assigned to the Lower Cambrian, following Young *et al.* (1994). Reference to a high level in the Comley Series of Cowie *et al.* (1972) is independent of the ambiguities of 'Lower' and 'Middle' Cambrian.

The fauna from Trwyn Carreg-y-tir is also of value in showing the relative ages of the Harlech Dome sequence and the Llanberis Slates belt of Arfon; this question troubled discussants of Bassett and Walton's paper (1960, pp. 106,109). Rushton (1974, p. 80) and Bassett *et al.* (1976, p. 641) showed that the level in the Llanberis Slates that yielded *Pseudatops viola* (Woodward) is lower than the Hell's Mouth fauna and indicates that the Llanberis Slates as a whole can be regarded as older than the Hell's Mouth and Rhinog formations.

## Conclusions

Trwyn Carreg-y-tir and the adjoining cliffs form a key site, important in understanding the geological history of the whole region. It shows better than elsewhere the conditions of deep-water sedimentation in the Welsh Basin during the latest Lower Cambrian period, when the Hell's Mouth Formation was deposited. Their age is inferred from fossil-bearing layers that are the only such beds of this age known in North Wales.

## [References](#)



(Figure 3.3) Geological map of St Tudwal's Peninsula, after Nicholas (1915) and Young et al. (1994).



*(Figure 3.5) Cliffs on the west side of St Tudwal's Peninsula, looking north-east, showing the type development of the Hell's Mouth Formation. The headland on the right is Trwyn Carreg-y-tir, and the beds with trilobites lie near the top of the cliff. The Trwyn y Fulfran Formation underlies the smoother ground beyond and the trial-pits for manganese ore show dark. The cultivated ground behind is underlain by the Tudwal Sandstone Formation of Arenig age. (Photo: Cambridge University Collection of Air Photographs, 70K EH5: copyright reserved.)*