
Cwm Hirnant

[SH 951 296]

Introduction

Cwm Hirnant gives its name to the latest Ordovician stage, the Hirnantian, and is the type locality for two of the core elements of the latest Ordovician *Hirnantia* brachiopod fauna, *Hirnantia sagittifera* and *Eostropheodonta hirnantensis*. The site thus has global importance because these taxa, the *Hirnantia* brachiopod fauna generally and the Hirnantian Stage figure prominently in the understanding of one of the major mass extinction events, namely that at the end of the Ordovician.

The mudstones and oolitic limestone known as the 'Hirnant Limestone Member' of the Foel-y-Ddinas Mudstone Formation at Cwm Hirnant were the first beds from which the so-called *Hirnantia* brachiopod fauna was recognized. The unique character of this fauna, which contrasts with the less remarkable compositions of the faunas that preceded and followed it, gave rise to considerable controversy as to the age of the 'Hirnant Beds'. Sedgwick (1845) considered the Hirnant Limestone to be the third and highest limestone in his 'Bala Group'. Ruddy (1879) referred the beds to the lower Silurian, as did Elles (1922b, 1923), who first drew attention to their unusual brachiopod fauna, whereas Jones (1923) argued for an Ordovician age. The term 'Hirnantian', introduced by Bancroft (1933, 1945) for the highest part of the Ordovician, was put on a more formal footing by Ingham and Wright (1970); it has since developed considerable international currency, although a stratotype section and basal boundary definition have yet to be designated. Bassett *et al.* (1966) described the rocks of Cwm Hirnant and placed them in stratigraphical and historical context.

Temple (1965) recognized the fact that the brachiopod association of Cwm Hirnant (Figure 9.22)e–g had a wider than local distribution and introduced the term '*Hirnantia* fauna'. He was followed by various workers, who extended the geographical range of the fauna and interpreted its development. The *Hirnantia* fauna is now understood to have an almost world-wide distribution (Rong and Harper, 1988) and is the means by which the uppermost stage of the Ordovician, the Hirnantian, is recognized in shelly facies. Its origin and fairly swift demise are an important facet of the latest Ordovician mass extinction event (Owen *et al.*, 1991, Harper and Rong, 1995), one of the largest extinctions in Earth history. The faunas from Cwm Hirnant provided the starting point for the recognition and understanding of that event.

Description

The site is a small abandoned quarry on the western side of Cwm Hirnant. The rocks dip at about 75° to the ESE; Bassett *et al.* (1966, p. 254) gave a measured section through the Foel-y-Ddinas Mudstone Formation there. The section is about 22.5 m thick and comprises cleaved blue mudstones and silty mudstones, with the 1.8 m thick Hirnant Limestone Member 3 m from the top. The dark-coloured limestone is pisolitic (possibly originally oolitic), with ellipsoidal grains up to 3 mm in diameter, flattened in the plane of cleavage and set in a black matrix that owes its colour to the presence of carbon. Brenchley and Cullen (1984, p. 117) interpreted the limestone as a channel-fill sediment, into which shells were washed from the adjacent muds during the deposition of the limestone.

Bassett *et al.* (1966) estimated the whole of the Foel-y-Ddinas Mudstone Formation to be about 120 m thick, the section at Cwm Hirnant lying in the upper half. They equated the thin Calettwr Quartzite some 6 km to the NNE with the Hirnant Limestone and recorded shelly fossils from both of these members, as well as from mudstones at Cwm Hirnant and elsewhere.

Interpretation

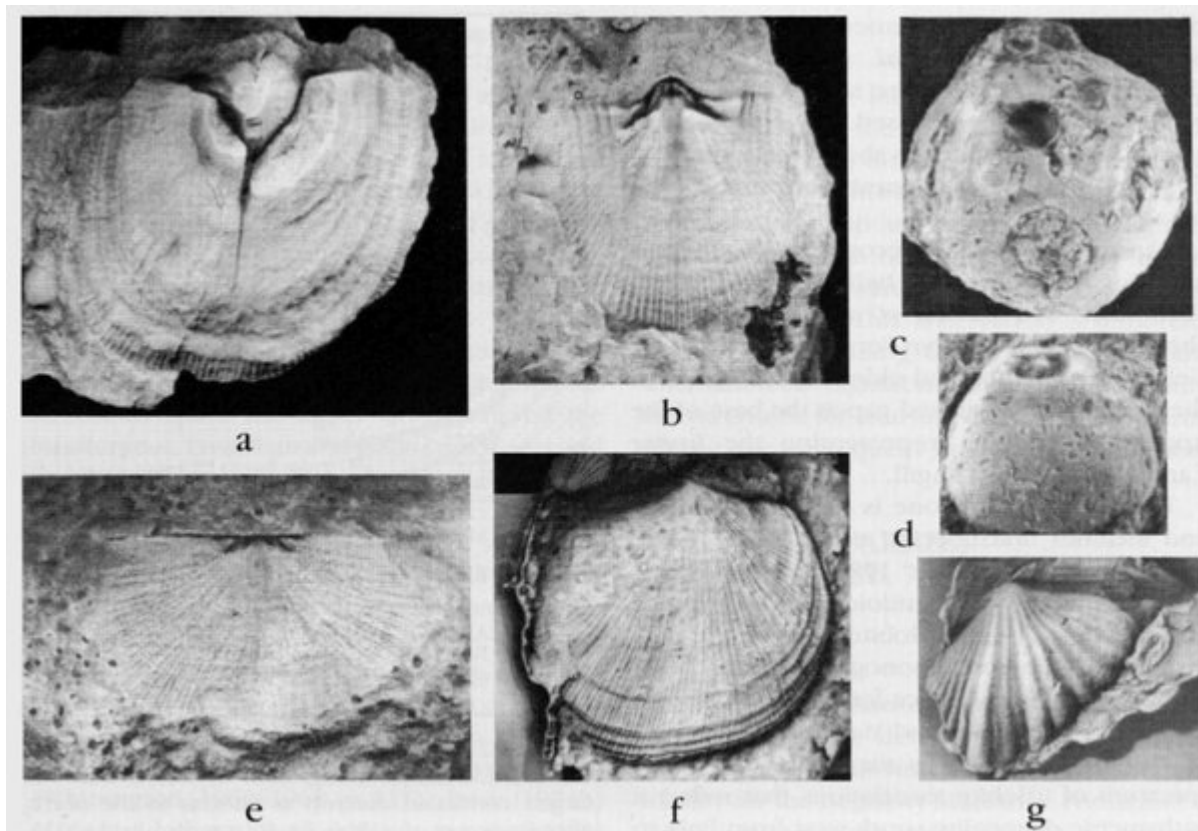
Sedimentologically, the occurrence of oolitic/pisolitic limestone in a channel-fill at Cwm Hirnant reflects the glacially induced Hirnantian sea-level fall, even in what was a fairly distal shelf setting (Brenchley and Cullen, 1984, figs 2 and 3). The brachiopod-dominated shelly fauna is the same in both the mudstones and the limestone and was listed and partly described by Temple (1965), in conjunction with similar faunas from the north of England and from Poland (see also Brenchley and Cullen, 1984, table 1). [It is dominated by the brachiopods *Hirnantia sagittifera* (M'Coy) and *Eostropheodonta birnantensis* (M'Coy) (Figure 9.22)d, e, both of which have their type locality here, and *Horderleyella* sp. nov. of Havlieek (1977) (= *Bancroftina?* cf. *bouceki* of Temple, 1965), with rarer specimens of *Dalmanella*, *Kinnella* and *Plectothyrella* (Figure 9.22)f. Most of these genera are core members of the globally widespread *Hirnantia* fauna (Rong and Harper, 1988). Bryozoans, conulariids and the almost cosmopolitan trilobite *Mucronaspis mucronata* (Brongniart) also occur.

In its widest sense, the *Hirnantia* fauna comprises several different communities that lived at a variety of water depths and show a latitudinal provincialism (Rong and Harper, 1988; Owen *et al.*, 1991). At high latitudes, the Bani province comprised low-diversity *Hirnantia* faunas, whereas the subtropical and temperate Kosov province (which included the Anglo-Welsh area) had more diverse *Hirnantia* faunas. The equatorial belt was typified by the Edgewood province, which contained several endemic elements. The *Hirnantia* fauna developed from a mixture of existing genera and newly evolved forms during a time of global mass extinction. It reflects a short-lived reorganization of the brachiopod communities and disappeared as a recognizable suite of ecological units before the end of the Hirnantian (Harper and Rong, 1995; Owen and Robertson, 1995).

Conclusions

This site was the first at which the distinctive and short-lived but widely distributed *Hirnantia* association of brachiopods was recognized; the association represents an episode of fundamental change in benthic community structure during one of the most profound mass-extinction episodes in Earth history. The site gives its name to the latest stage of the Ordovician, the to this association and is the type locality for two Hirnantian, which is typified by the *Hirnantia* of its brachiopod species. It also gives its name fauna in many parts of the world.

References



(Figure 9.22) Ashgill fossils from sites in North Wales. (a, b) Ventral and dorsal valves of *Vellamo* sp., x1.5, Cynwyd. (c, d) *Tetraeucystis munita* (Forbes), x4, Rhiwlas. (e-g) Brachiopods of the Hirnantia Fauna, Hirnant Limestone of Aber Hirnant: (e) Dorsal valve of *Eostropheodonta hirnantensis* (M'Coy), x1.5; (f) Dorsal valve of *Hirnantia sagittifera* (M'Coy), x1.5; (g) Ventral valve of *Plectothyrella crasscostis* (Dalman), x2.