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# Rhiwlas

[SH 921 367] and [SH 923 369]

## Introduction

The site at Rhiwlas is the type locality for the Rhiwlas Limestone, which locally marks the base of the upper Bala Group. It played an important part in the understanding of the classic Bala district, particularly in the recognition and interpretation of the major hiatus at the base of the upper Bala Group (column W5 in Williams *et al.*, 1972, fig. 5). The trilobite fauna of the Rhiwlas Limestone is the most diverse in the district and is of significance both taxonomically and palaeoecologically.

Exposures south of Rhiwlas form the type locality for the Rhiwlas Limestone of Ashgill (Rawtheyan) age. The limestone was named by Sedgwick (1843) and formed the middle of his three limestone units in the Bala succession. He considered it to lie well below the 'Bala Limestone' (now termed the Cymerig Limestone), being unaware that the succession was duplicated on either side of the Bala Fault, and hence that the Rhiwlas Limestone was the younger unit. Jukes (in Ramsay, 1866) and Ruddy (1879) considered the Rhiwlas and Cymerig limestones to be the same unit, although Salter (in Ramsay, 1866) expressed a contrary view on the basis of lithological and faunal differences. Marr and Roberts (1885) considered the two limestones to be separate, a view confirmed by Elles (1922a). Elles used the term 'Ithiwas Beds' or 'ithiwas Mudstone and Limestone' to include the overlying succession, part of which she termed the 'Moelfryn Sandstone'. Bassett *et al.* (1966) recognized that these coarser beds are simply interbedded with the mudstones and used the term 'Moelfryn Mudstones' to encompass the whole formation, of which the Rhiwlas Limestone forms a local basal member.

Bancroft (1928a) first recognized that there is a major unconformity below the Moelfryn Formation, and Bassett *et al.* (1966, p. 242) showed that the Moelfryn Formation overlies the Gelli-grŷn Formation and older deposits and that there is thus a substantial gap at the base of the upper Bala Group, representing the upper Caradoc and lower Ashgill.

The Rhiwlas Limestone is richly fossiliferous and includes brachiopods, echinoderms (Paul, 1973–1997; Donovan, 1986–1995) (Figure 9.22)c,d, ostracods, nautiloids and gastropods and the most diverse trilobite fauna in the Bala district, Whittington's monograph (1962–1968) being a standard reference for upper Ordovician trilobite studies. Price and Magor (1984) regarded the Rhiwlas fauna as the shallow end of a spectrum of trilobite associations that reflect a bathymetric deepening south-west from Bala to Corris.

## Description

The type locality for the Rhiwlas Limestone comprises two exposures on the banks of the Afon Tryweryn, 1 km north of Bala (Figure 9.23), as described by Bassett *et al.* (1966). That on the north bank probably provided the early shelly fossil collections labelled 'Rhiwlas'. That on the south bank shows the S-dipping limestone resting on siltstones of the Allt Ddu Formation; about 2 m of unfossiliferous crystalline limestone are followed by 25 cm of black shale with pyrite nodules, then 30 cm of grey mudstones containing black pebbles of the underlying bed, and finally a little over 3.5 m of pale-grey, well-bedded fossiliferous limestone. The Rhiwlas locality has been sampled unsuccessfully for conodonts, but elsewhere the member has yielded sparse assemblages of the *Amcaphognathus ordovicicus* Zone (Bergström and Orchard, 1985; Savage and Bassett, 1985).

The Rhiwlas Limestone is only sporadically developed at the base of the Moelfryn Mudstone Formation, which achieves a maximum thickness of about 760 m (Bassett *et al.*, 1966). Price and Magor (1984, p. 192) and Lockley (1980a, figs 1 and 6) noted that the Rhiwlas Limestone can be traced southwards to Llechwedd-du, 6.6 km south of Bala, beyond which it passes into distinctive calcareous silty mudstones. Bassett *et al.* (1966) demonstrated that south of the Bala Fault the Moelfryn Formation generally rests on various levels within the Gelli-grŷn Formation, the top of which is Woolstonian in age (see Gelli-grŷn site report). To the north of the Bala Fault the Gelli-grŷn Formation is cut out (except at the extreme

eastern end of the exposure), as is an increasing amount of the underlying Allt Ddu Formation, as the unconformity is traced westwards. On both sides of the Bala Fault the depth of erosion below the top of the Gelli-grŷn Formation increases westwards, particularly to the north of the fault, where it may exceed 100 m. Bassett *et al.* (1966) attributed this to the effects of both the NE–SW Bala Fault and local N–S faults prior to deposition of the Moelfryn Formation.

## Interpretation

The age of the Rhiwlas Limestone has been debated (Bassett *et al.*, 1966), being variously assigned to the Actonian–Onnian (Bancroft, 1933), Pusgillian (Bancroft, 1945) and lower Ashgill (Dean, 1959a). A middle Ashgill (i.e. Rawtheyan) age was favoured by Bassett *et al.* (1966) and was confirmed by Whittington (1962–1968, p. 117), who recognized an equivalence to Zones 5–7 of Ingham's (1966) subdivision of the Ashgill of the Cautley area, which subsequently formed the basis for the Rawtheyan Stage (Ingham and Wright, 1970). Thus the minimum hiatus below the Rhiwlas Limestone spans the upper Cheneyan and the Streffordian, Pusgillian and Cautleyan stages and locally extends well down into the Burrellian. The unconformity can be traced over much of North Wales and was termed the 'sub-Powys unconformity' by Woodcock (1990), who considered it to be tectonically rather than eustatically controlled.

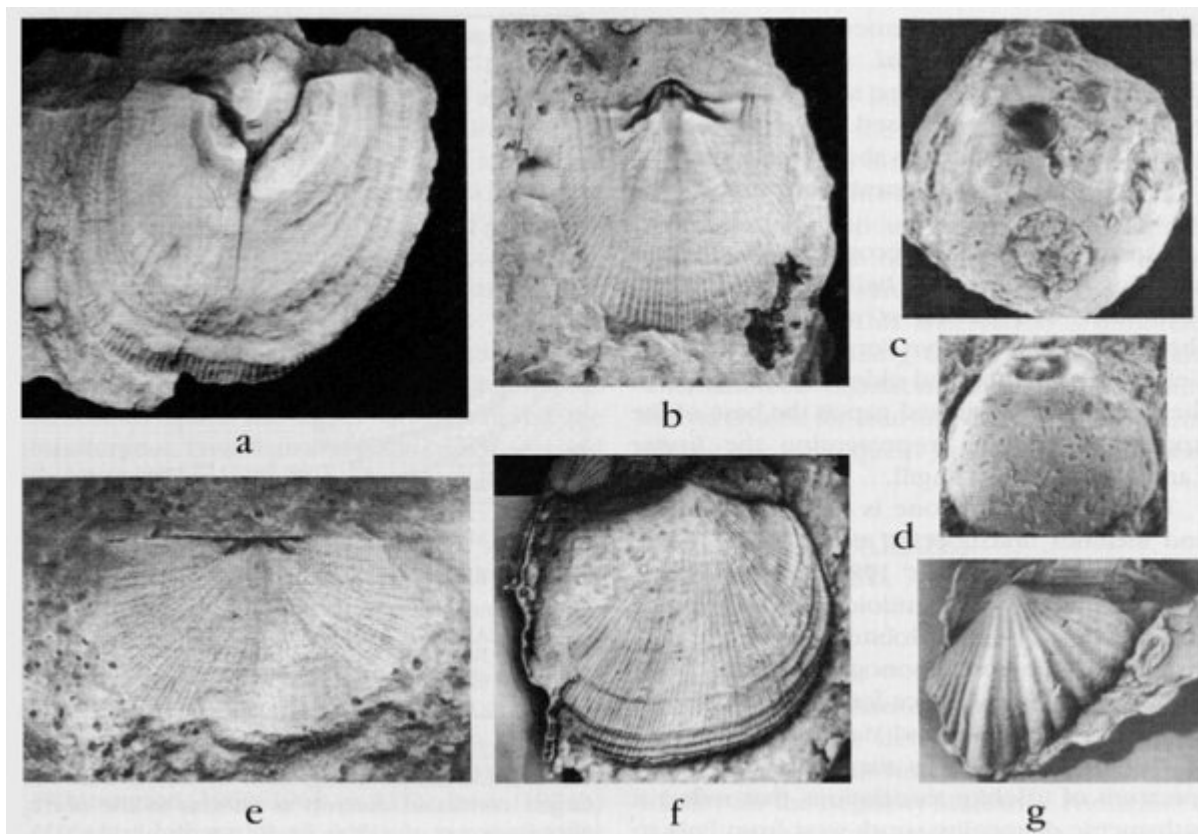
Some of the problems in assigning an age to the limestone hinge on the ascription of its trilobite fauna to either the *Phillipsinella parabola* 'Zone' or the *Staurocephalus clavifrons* 'Zone' (Whittington, 1962–1968, p. 117). Price (1973b) recognized that these concepts are essentially ecologically based and have little biostratigraphical significance. At species level there is strong evidence for correlation with the Rawtheyan Stage. Given the great thickness of the Moelfryn Formation above it and the Hirnantian age of the Foel-y-Ddinas Mudstone above that (see Cwm Hirnant site report), an early Rawtheyan age seems most probable (see also Price and Magor, 1984).

Price and Magor (1984) quantitatively documented a spectrum of trilobite faunas, ranging from their *Ceraurinella–Encrinuroides* Association in the Rhiwlas Limestone of Bala, through the *Nankinolithus–Opsimasaphus* Association, to the *Novaspis–cyclopygid* Association in equivalent strata about 30 km to the south-west at Cords. This represents a bathymetric deepening from fairly shallow-shelf to upper-slope depths during one time interval and is the most complete such spectrum of trilobite biofacies in the Ordovician of the British Isles. It provides not only information on basin geometry but also a database on trilobite depth distributions. The latter was used by Owen *et al.* (1991) and Owen and Robertson (1995) in analyses of the fate of Rawtheyan trilobite genera from different ecological settings during the end-Ordovician extinction event.

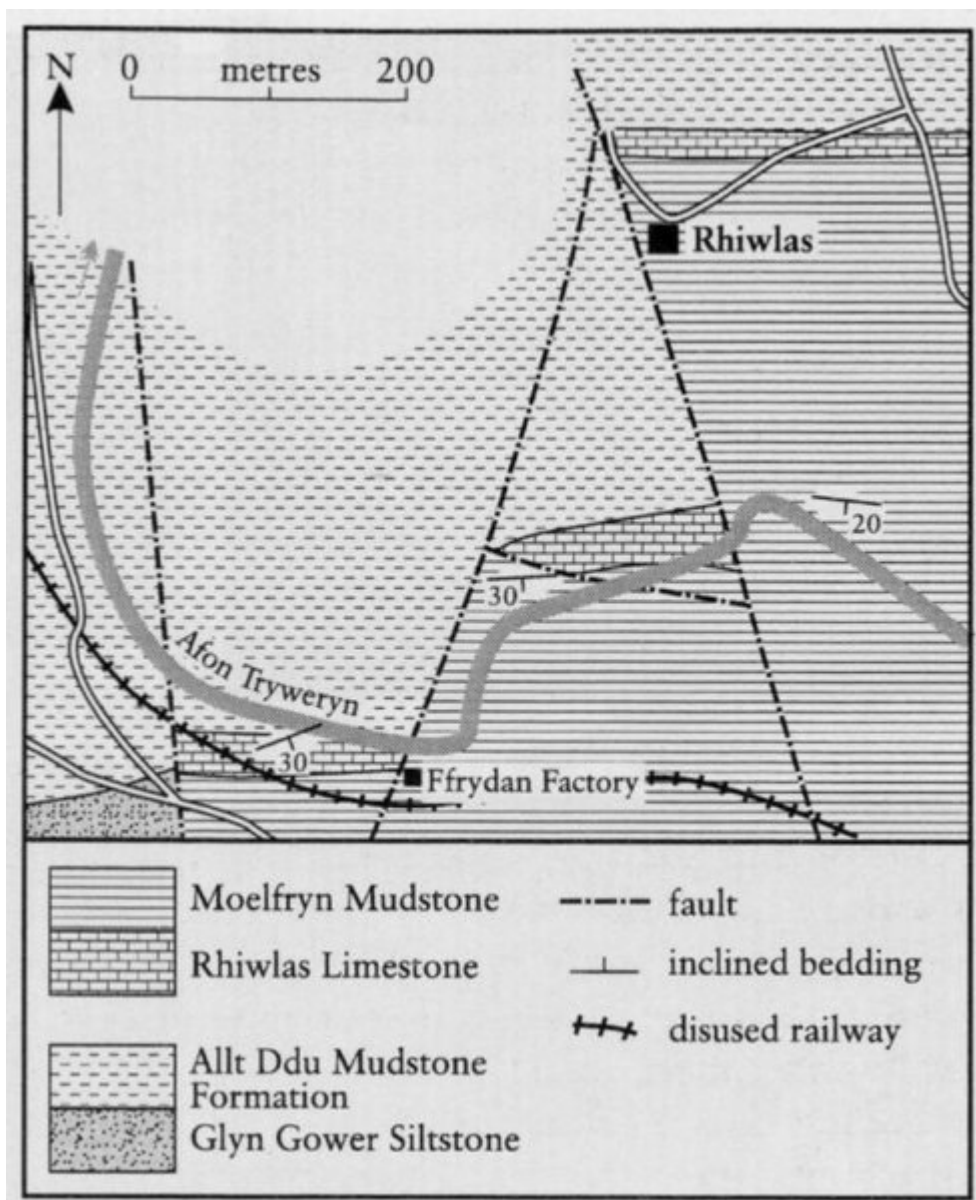
## Conclusions

Rhiwlas is a key locality for recognizing the unconformity at the base of the upper Bala Group in the Bala district. The diverse trilobite faunas of the Rhiwlas Limestone indicate a Rawtheyan age and are viewed as the shallower end of a spectrum of faunas that lived in progressively deeper waters when traced south-west towards Cords. This observation is important for the understanding of the Welsh Basin and internationally significant in providing bathymetric criteria for studying the fate of organisms during the subsequent end-Ordovician extinction event.

## [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 crassicostis* (Dalman), x2.



(Figure 9.23) Geological map of the type locality of the Rhiwlas Limestone along Afon Tryweryn and the largely concealed outcrop at Rhiwlas to the north, after Bassett et al. (1966, fig. 9); see also Paul (1973, fig. 7).