Pen-y-ghent Gill, North Yorkshire

[SD 852 737]–[SD 857 734]

Introduction

Pen-y-ghent Gill is a tributary of Littondale. The site lies in the upper part of the gill ([SD 852 737] to [SD 857 734]), on the east side of Pen-y-ghent hill, and is 10 km NNE of Settle. The locality displays an outstanding section of the lower part of the Wensleydale Group (Brigantian) on the southern part of the Askrigg Block and includes the Hawes Limestone, Gayle Limestone and Hardraw Scar Limestone. The geology of the area in general is described by Garwood and Goodyear (1924) and Dunham and Wilson (1985); however, the most detailed site-specific information is in an unpublished field guide (Rose *et al.,* 1973). Records of foraminifera from this section are reported by Longerstaey (1975).

Description

This locality is particularly well known for its exposure of the Girvanella Nodular Bed which occurs within the Hawes Limestone. It can be seen in the stream section just below the bridge carrying the minor road across Pen-y-ghent Gill [SD 857 734] (Figure 5.27). The main part of the bed consists of 1.2 m of dark-grey limestone containing crinoid debris and abundant oncoids (the algal nodules or *Osagia* nodules of previous workers) (Rose *et al.,* 1973). The oncoids, which are up to a few centimetres across, mostly comprise a bioclastic nucleus coated with crudely concentric layers of micritic carbonate within which the microscopic calcified tubes of *Girvanella* can sometimes be found. Approximately 8 m of Hawes Limestone occurs above the Girvanella Nodular Bed. This part of the succession comprises dark-grey crinoidal limestones with shaly partings. In the lower part there are scattered oncoids, and higher up, there are a number of units rich in the problematic organism *Saccaminopsis.*

A 10 cm-thick shale marks the boundary with the overlying Gayle Limestone, the basal bed of which is a 0.35 m-thick unit containing *Gigantoproductus* (Rose *et al.,* 1973). Overall, the lithology of the Gayle Limestone is similar to that of the Hawes Limestone, with dark-coloured crinoidal limestones separated by muddy partings. Corals, *Saccaminopsis* and shells with oncoidal coatings occur at a number of levels.

There follows a less well-exposed section comprising interbedded limestones and shales. In the absence of distinctive intervening silici-clastic deposits, the contact between the Gayle Limestone and Hardraw Scar Limestone is difficult to define. However, the uppermost part of the succession, exposed near the confluence of two streams [SD 853 737] and comprising massive beds of cherry limestone with silicified corals and *Gigantoproductus* is attributed to the upper part of the Hardraw Scar Limestone and probably correlates with the Orionastraea Beds of Garwood and Goodyear (1924) (Rose *et al*., 1973). This part of the succession is rich in colonial corals, particularly *Siphonodendron junceum* (Dunham and Wilson, 1985).

Interpretation

The Girvanella Nodular Bed has been taken as an important marker band throughout northern England and was originally used to define the position of the D_1-D_2 biozone boundary (e.g. Garwood, 1913; Garwood and Goodyear, 1924). However, since Arthurton *et al.* (1988) recorded Brigantian foraminifera in the lower part of the Hawes Limestone beneath the Girvanella Nodular Bed in the Settle district, a few kilometres to the south of this site, the Asbian–Brigantian (D_i-D_2) boundary has been taken at the base of the Hawes Limestone, several metres below the occurrence of oncoids at Pen-y-ghent Gill. The revised position of this boundary occurs at the base of Yoredale facies and the Wensleydale Group in this area.

The environmental significance of the widespread development of oncoids at this time is unclear. Garwood and Goodyear (1924) interpreted it as recording a shallowing of the sea permitting growth of calcareous algae. Overall the

abundance of fine matrix suggests low-energy environments, but with the growing oncoids turned over occasionally to allow more-or-less symmetrical growth. A further requirement for their development would be a slow sedimentation rate. The environmental significance of bands with abundant *Saccaminopsis* is also unclear, although they are common in Brigantian shelf deposits of northern England and North Wales.

Compared with the lower part of the Yoredale sequence in its type area of Wensleydale, the succession in Pen-y-ghent Gill lacks the well-defined siliciclastic intervals between the named limestones, which makes the boundaries of the limestones difficult to define. Although the growth of deltas in the north is reflected in the argillaceous content of the succession, which becomes significant in the Hawes Limestone, the more typical deltaic facies of northern England did not spread as far south as this locality during early Brigantian times and the environment was entirely shallow marine.

Conclusions

Overall, the succession of the lower part of the Wensleydale Group at this locality contrasts with that in Wensleydale itself in being wholly marine. The site is also important for its fine exposure of the Girvanella Nodular Bed. Further work is needed to establish the environmental significance of this and other fossil bands, including those with abundant *Saccaminopsis.*

References

(Figure 5.27) Outcrop of the Girvanella Nodular Bed (below hammer, left of centre) in the Hawes Limestone (basal Brigantian) at the Pen-y-ghent Gill GCR site. (Photo: P.J. Cossey.)