Pinskey Gill, Cumbria

[NY 699 038]–[NY 699 043]

Introduction

The Pinskey Gill GCR site is a stream section [NY 6995 0382]–[NY 6993 0432] 2.5 km west of Ravenstonedale. It provides the finest section of the Pinskey Gill Beds (marine) in the Ravenstonedale district, and the oldest exposed sequence of Lower Carboniferous (Courceyan) age in the Stainmore Basin. It also includes, higher in the sequence, important exposures of the fluvial Shap Conglomerate. Early site descriptions of significance were by Dakyns *et al.* (1891) who provided the first measured section of the sequence, and by Garwood (1913, 1916) who gave details of the distribution of macrofossils. Later work at the site by Capewell (1955) and Ashton (1970) focused attention on sedimentological aspects, and subsequent micropalaeontological investigations by Johnson and Marshall (1971), Holliday *et al.* (1979) and Varker and Higgins (1979) revealed important biostratigraphical information.

Description

Originally referred to as the 'Lower Limestone Shales' by Dakyns *et al.* (1891) and later renamed the 'Pinskey Gill Beds' by Garwood (1913), this unit occupies a critical position at the base of the Dinantian succession in a region designated as the type area for the Lower Carboniferous sequence in north-west England (Garwood, 1913). It rests with angular unconformity on Lower Palaeozoic (Silurian) Bannisdale Slates (Turner, 1950, 1959a) and is overlain by the Shap Conglomerate (Garwood, 1913), a unit later referred to by Capewell (1955) as the 'Pinskey Gill Conglomerate' (Capewell, 1955), as the 'Feldspathic Conglomerate' (Johnson and Marshall, 1971; Mitchell, 1978) and as the 'Tebay Conglomerate' by Barraclough (1983).

Although parts of the sequence (including critical unit contacts) are obscured by drift, the discontinuous outcrops of the Pinskey Gill Beds at this site provide the best exposed and most complete section of this interval in the Ravenstonedale area. Borehole evidence indicates that the formation has a thickness of around 45–50 in (Holliday *et al.,* 1979). Details of the exposed section (*c.* 5–20 m above its base) described by Holliday *et al.* (1979) and Varker and Higgins (1979) are illustrated in (Figure 5.7). The formation comprises an alternating sequence of thinly bedded, impure, fine-grained, dolomitic and sometimes vuggy limestones interbedded with grey, calcareous mudstones, siltstones and fine-grained, calcareous sandstones. From this sequence, Garwood (1913, 1916) recorded a sparse marine fauna dominated by bivalves (*Aviculopecten, Posidoniella* and *Myalina?*)and brachiopods (*Athyris* cf. *concentrica, Spirifer pinskeyensis, Lingula* and *Orbiculoidea*), with subordinate gastropods (*Naticopsis*), bryozoans (*Fenestella*) and fish remains (*Psephodus*) as well as 'plant shales' containing *Pteridorhacis.* The formation has also yielded abundant miospores, derived mainly from the mudstones (Johnson and Marshall, 1971; Holliday *et al.,* 1979) and conodonts from the carbonate rocks (Varker and Higgins, 1979). Rare bioturbation features, algal nodules, quartz pebbles, seatearths and stromatolite bands are also reported from the sequence (Garwood, 1913; Holliday *et al.*, 1979; Varker and Higgins, 1979). Bed thicknesses are typically less than 2 m and the sequence dips gently to the NNE.

Overlying this unit the Shap Conglomerate comprises vari-coloured (red and green) sandstones, mudstones and a few conglomerate bands (Turner, 1950, 1959a; Holliday *et al.,* 1979). Despite suggested thicknesses of around 36–42 m (Johnson and Marshall, 1971; Holliday *et al.,* 1979), exposure of this unit is limited to a few metres of conglomerate just north of the Newbiggin-Weasdale road [NY 6982 0418]. The conglomerates contain a remarkable suite of pebbles characterized by clasts of greywacke, quartz, volcanic rock, and a distinctive pink, perthitic, orthoclase feldspar similar to that which occurs in the Shap Granite. Provenance studies led Capewell (1955) to conclude that the unit may have been derived from the erosion of a granitic and Borrowdale Volcanic source located a few kilometres to the north (In an area now blanketed by a younger Carboniferous cover) rather than from the present outcrops of the Shap Granite and Borrowdale Volcanic Group exposed 15 km or more to the west.

Interpretation

Stratigraphical interest at this site stems largely from the fact that the Pinskey Gill Beds pre-date the Shap Conglomerate, which is regarded as basal to the Carboniferous succession in adjacent areas (Garwood, 1913; Capewell, 1955). The dating of this sequence has therefore been of critical importance in defining an accurate time framework for understanding the early evolution of the Stainmore Basin.

Early attempts to define an age for the Pinskey Gill Beds proved difficult for Garwood (1913), who admitted that his invertebrate faunas were diagnostic of neither the Devonian nor the Carboniferous periods, although the discovery of the fish tooth *Psephodus* was taken to indicate a Lower Carboniferous (Tournaisian) age and the formation was tentatively assigned to the *Zaphrentis* Zone (Garwood, 1913; Turner, 1959b). Miospores recovered from exposed beds here (Johnson and Marshall, 1971) and from borehole material (Holliday *et al.,* 1979) subsequently endorsed this view. Johnson and Marshall (1971) also noted striking similarities between the Pinskey Gill miospore assemblages and those described by Sullivan (1964a, 1968) from Tournaisian beds in the Forest of Dean (Lower Limestone Shales) and in Ayrshire (Cementstone Group). Among the more significant miospores identified were *Baculatisporites fusticulus, Pustulatisporites gibberosus, Dictyotriletes* (*Reticulatisporites*) *planus, Auroraspora macra* and *Discernisporites crenulatus.* A somewhat similar miospore assemblage from the Shap Conglomerate led Holliday *et al.* (1979)to assign both the Pinskey Gill Beds and the Shap Conglomerate to the CM miospore assemblage zone (Neves *et al.,* 1972, 1973) and to the Courceyan Stage (George *et al.,* 1976). The discovery of an impoverished conodont fauna in the Pinskey Gill Beds, dominated by *Bispathodus aculeatus aculeatus* and *Clydagnathus unicornis,* verified this view (Varker and Higgins, 1979; Higgins and Varker, 1982). Varker and Higgins (1979) attributed this fauna to the late K or early Z zones of the South-West Province and equated it with the *costatus costatus/Gnathodus delicatus* conodont zone of Rhodes *et al.* (1969). In a subsequent work, Higgins and Varker (1982) used this assemblage to define a new 'Fauna A' conodont zone at the base of the Carboniferous succession in the Ravenstonedale area.

However, regardless of these stratigraphical assertions, difficulties in determining the position of the Pinskey Gill sequence within the accepted chronostratigraphical framework of George *et al.* (1976) still remain. Reports of late Chadian foraminifera (N. Riley, pers. comm., 2002) from the Stone Gill Limestone above the Shap Conglomerate indicate that the position of the Courceyan–Chadian stage boundary, as originally defined by George *et al.* (1976) at the top of the 'Coldbeck Beds' (= Coldbeck Limestone of British Geological Survey, 1997b; and this account), may have been drawn at too high a level (Ramsbottom, 1977a). However, despite there being insufficient palaeontological evidence for the accurate placement of this boundary in the Ravenstonedale succession, Holliday *et al.* (1979) tentatively suggested a placement near the top of the Shap Conglomerate in the Ravenstonedale succession.

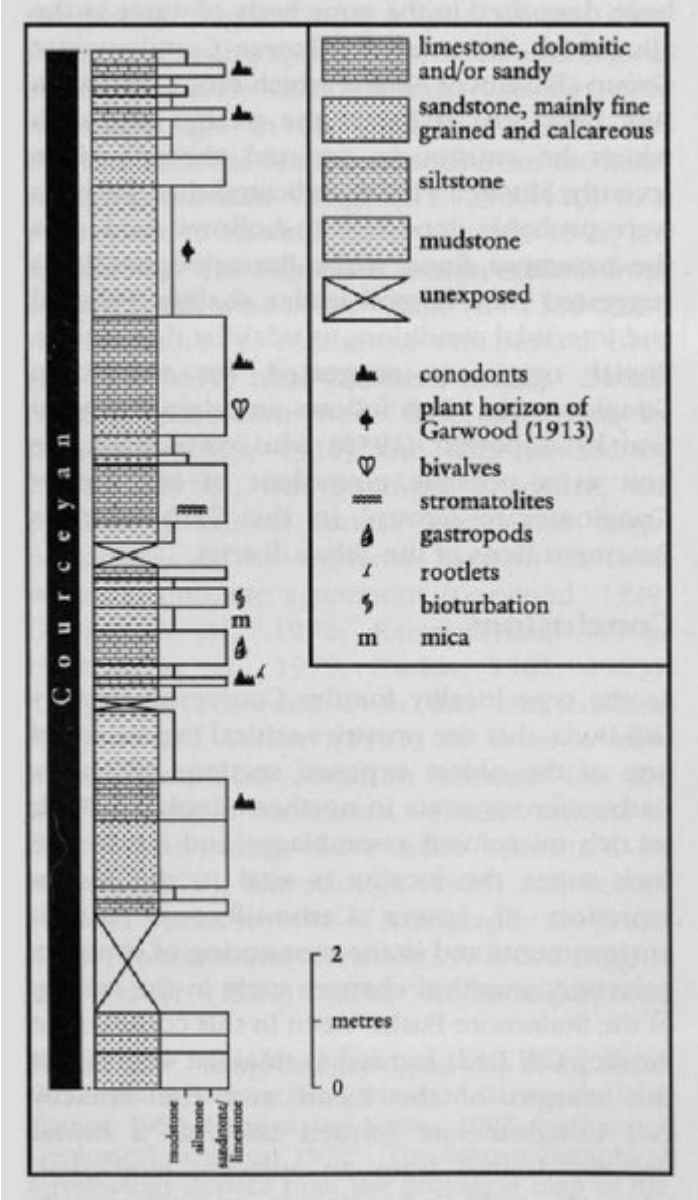
The association of interbedded dolomitic limestones and siliciclastic deposits containing rich microfloras, a low-diversity molluscan fauna, plant remains and rare seatearth and stromatolite bands suggests the Pinskey Gill Beds were deposited in a shallow, restricted and marginal marine environment close to the shoreline. Garwood (1913) regarded these beds as lagoonal in origin, a view later supported by Capewell (1955) who suggested they may have been deposited in the same body of water as the alluvial-fan facies of the Lower Conglomerate Group (Basement Series) which crops out in the Birk Beck area 10 km to the west, a unit with which he cautiously equated them. More recently, Mitchell (1978) indicated that the beds were probably deposited in hollows eroded in the basement floor, while Barraclough (1983) suggested they formed under shallow subtidal and intertidal conditions as tidal-flat deposits. A fluvial origin is suggested for the Shap Conglomerate. This follows an original suggestion by Capewell (1955) who considered the unit as a possible equivalent of his 'Upper Conglomerate Group' in the Carboniferous Basement Beds of the Tebay district.

Conclusions

As the type locality for the Courceyan Pinskey Gill Beds, this site provides critical exposures of one of the oldest exposed sections of Lower Carboniferous strata in northern England. With its rich microfossil assemblages and its diverse rock suites the locality is vital in the reconstruction of Lower Carboniferous palaeo-environments and in the monitoring of complex palaeogeographical changes early in the history of the Stainmore Basin. Seen in this context, the Pinskey Gill

Beds formed as tidal-flat deposits at the margin of the basin and the Pinskey Gill Conglomerate formed later, as a fluvial deposit derived from an adjacent land area, when the early Carboniferous seas temporarily retreated.

References



(Figure 5.7) Sedimentary log of the exposed section of the Pinskey Gill Beds (Courceyan) at the Pinskey Gill GCR site. After Varker and Higgins (1979).