Ticknall Quarries, Derbyshire

[SK 360 238]

Introduction

The Ticknall Quarries GCR site is located 12 km south of the centre of the Derby, just east of the village of Ticknall [SK 360 238]. A series of somewhat overgrown and partially flooded abandoned lime quarries expose 10–11 m of flat-lying Brigantian limestones, shales and dolo-stones of the Ticknall Limestone (type locality). This section offers the best sequence of latest Dinantian strata in the region, providing important evidence for the development of nearshore shallow marine environments on the Hathern Shelf, north of the Wales–Brabant Massif. The site is also significant because of its historically important and diverse shelly faunas. Hull (1860) and Fox-Strangways (1905, 1907) mentioned the Ticknall quarries, and Parsons (1918a), Mitchell and Stubblefield (1941), and Monteleone (1973) provided more detailed accounts, including extensive faunal lists.

Recent publications of significance arising from the British Geological Survey re-survey of the area are by Ambrose and Carney (1999) and Ambrose (1999).

Description

Parsons (1918a) and Mitchell and Stubblefield (1941) discussed the nature and stratigraphical subdivision of the succession, but the stratigraphical terminology and thicknesses given here follow the work of Monteleone (1973) as modified by Ambrose and Carney (1999). Within the Ticknall Limestone, two informal units are recognized. The lower unit, equivalent to the 'limestone and shale member' of Monteleone (1973), comprises up to 6 m of interbedded limestone and fissile mudstone (Figure 7.35). The limestones are grey, muddy and finely crystalline; bedding planes are undulatory and thin beds appear nodular — a feature probably enhanced by pressure-solution during diagenesis. The mudstone interbeds are between 10 cm and 30 cm thick and are highly fossiliferous. Fossils, including brachiopods, solitary and colonial corals, and crinoids are common throughout the lower unit. Lithologically, most of this unit corresponds to 'facies 2' of Ambrose and Carney (1999), characterized by fine-grained muddy limestones and coarser skeletal wackestones and packstones. The lowest parts of the Ticknall Limestone, previously observed in caves associated with the quarrying (e.g. Parsons, 1918a), are no longer exposed.

The upper unit, equivalent to Monteleone's (1973) 'thinly-bedded limestone and dolomite member', is dominated by dolostones. These are buff-grey in colour but are commonly stained red, yellow or purple. They are finely crystalline and massively bedded, with a few clay partings. The siliciclastic content of the beds varies, some being fine- to very fine-grained dolomitic sandstones. The dolostones are locally fossiliferous, with some beds dominated by brachiopods, especially in the lower 3 m (Monteleone, 1973). Lithologically most of this unit can be assigned to 'facies 1' of Ambrose and Carney (1999).

The macrofauna of the Ticknall Limestone is well known, and extensive lists of taxa are given by Parsons (1918a), Mitchell and Stubblefield (1941) and Monteleone (1973). In addition, micropalaeontological preparations of the limestones have revealed foraminifera, ostracodes and conodonts, while shale beds are rich in foraminifera, ostracodes, conodonts, fish teeth, sponge spicules, crinoid calices, echinoid plates and scolecodonts (Monteleone, 1973). Wilson (1880) listed a diverse fish fauna from mudstones in the formation.

The base of the formation is not exposed at this site but the Ticknall Borehole reveals that the lower boundary is unconformable with, or possibly faulted against, the underlying Cloud Hill Dolostone (Ambrose and Carney, 1999). Most reports indicate that the Ticknall Limestone is unconformably overlain by red and green marls of probable Triassic age, and strata exhibiting this stratigraphical relationship are exposed in the north-eastern part of the quarry complex, beyond the northern limit of the Ticknall Quarries GCR site (e.g. Monteleone, 1973). However, a section in the south-west part of the site reveals the top of the Ticknall Limestone overlain by Millstone Grit (Ambrose and Carney, 1999).

Interpretation

Historically, few age-diagnostic macrofossils have been recovered from the Ticknall Limestone at this site, but all workers have agreed on a D_2 (Brigantian) age for these beds (e.g. Fox-Strangways 1905, 1907; Parsons, 1918a; Mitchell and Stubblefield, 1941; Monteleone, 1973). This age is based on the occurrence of taxa such as *Gigantoproductus, Productus productus, Pugilis pugilis, Dibunophyllum bipartum, Siphonophyllia junceum* and *Nemistium edmondi,* but, except for the last named, all these taxa are now known to have an Asbian to Brigantian range (Riley, 1993). The conodonts listed in Monteleone (1973), especially *Gnathodus girtyi collinsoni,* indicate a Brigantian age, and more recently this has been confirmed by foraminiferal evidence (Riley 1997).

As noted above, the contact between the Ticknall Limestone and the underlying Cloud Hill Dolostone is not conformable. Foraminifera indicate that the top of the Cloud Hill Dolostone at this locality is of early Asbian age (Riley, 1997), indicating that strata of late Asbian age are missing from the sequence (Ambrose and Carney, 1999).

In terms of depositional environments, Ambrose and Carney (1999) interpreted rocks of their facies 2 as being deposited in shallow-marine, high-energy, wave- or current-dominated environments, with periods during which lower-energy shallow-shelf conditions prevailed. The skeletal grainstones of facies 1 were thought also to have been deposited in high-energy, nearshore, shallow marine settings, although most lithological details were destroyed during dolomitization.

The rocks exposed at this site are crucial in understanding the late Dinantian depositional history and evolution of palaeoenvironments close to the northern shoreline of the Wales–Brabant Massif, and the spatial and temporal relationships of these deposits to Brigantian sequences elsewhere. The site is also significant as the type locality for the Ticknall Limestone, preserving the finest section of shallow marine Brigantian strata in the Midlands. Although recent British Geological Survey work (Riley, 1997; Ambrose and Carney, 1999) has gone a long way towards bringing interpretations of the sequence exposed at this site into a modern geological framework, there is still considerable scope for significantly improving the understanding these deposits through the application of modern palaeontological and sedimentological methods.

Conclusions

The sequence exposed at Ticknall Quarries represents the best evidence for late Dinantian nearshore marine environments in the Midlands, and provides evidence that is central to understanding the geological history and evolution of the Hathern Shelf and Widmerpool Gulf during this time period. The site is also significant as the type section for the Ticknall Limestone, and because of the diverse shelly faunas collected from here over the last 100 years. Furthermore, the site has great potential for studies using modern palaeontological and sedimentological techniques.

References

(Figure 7.35) Interbedded limestones and fissile mudstones in the lower unit of the Ticknall Limestone (Brigantian) at the Ticknall Quarries GCR site. The hammer towards the centre of the photograph indicates scale. (Photo: M.A. Purnell.)