Meal Bank Quarry, North Yorkshire

[SD 697 736]

Introduction

The Meal Bank Quarry GCR site is situated on the right bank of the River Greta just north of Ingleton. This site [SD 697 736] covers most of the ground between the North and South Craven faults which are here only about 500 m apart. The disused quarry shows one of the finest sections of Dinantian strata close to the Craven Faults between Ribblesdale in the east and the Dent Fault in the west. Highlights of the site include the best-exposed coal seam within a Dinantian shelf limestone succession in England and Wales. There is no modern account of the site, the most detailed description being that of Garwood and Goodyear (1924). The site was also described by Dunham *et al.* (1953), but these authors added little to the original description.

Description

Limestones exposed in the quarry were attributed to the S_2 and D_i zones by Garwood and Goodyear (1924). A modern stratigraphical nomenclature has not been applied to this area, but using the scheme of Arthurton *et al.* (1988) for the Dinantian succession of the Askrigg Block and the transition zone between the Craven Faults in the Settle area a few kilometres to the south-east, the succession at Meal Bank would fall entirely within the Malham Formation (Holkerian–Asbian).

The oldest beds are found at the north end of the quarry. Adjacent to the North Craven Fault the beds dip to the north, but southwards along the quarry face they turn over to dip to the south. This part of the succession (*c.* 18 m thick) was attributed to the Nematophyllum minus Beds (Holkerian, S_2) by Garwood and Goodyear (1924), with the index fossil *N. minus* (= *Lithostrotion aranea* of Mitchell, 1989; = *L. vorticale*, J. Nudds, pers. comm., 2000) found in the lowest exposed strata. Roughly 50 m of strata attributed to the D_1 Zone (Asbian) are also exposed and the succession is apparently complicated by thrusting. The limestones are medium grey, massive, sparsely fossiliferous at the base and with several developments of burrow mottled 'spotted beds' or 'pseudo-breccias' where darker limestone patches are enclosed by paler areas.

Midway through the Asbian succession a major palaeokarstic surface is overlain by a prominent palaeosol clay and capped by an impure coal seam (Figure 5.26) first recorded by Ricketts (1869) and later analysed by Shelley (1967). These features have attracted interest because they are particularly well developed and accessible just above the quarry floor. Marr (1899) regarded the coal as a slice of Coal Measures from the Ingleton Coalfield to the south of the South Craven Fault that had been thrusted into its present position. Kendall (1918), however, considered it to be contemporaneous with the limestones. Garwood and Goodyear (1924) initially preferred the Marr suggestion, but reported on a discussion with E.E.L. Dixon who had pointed out the presence of an underclay with rootlets immediately beneath the coal, sitting on an eroded, potholed limestone surface. The existence of an 'unconformity' at this level was noted by Moore *et al.* (1974). As the coal is traced up the quarry face it is cut out by the succeeding limestone.

Other features of interest include a highly fossiliferous nodular bed about 13 m above the coal. A rich coral–brachiopod fauna with especially large productoids from this horizon was recorded by Garwood and Goodyear (1924). A further 9 m above this is the Davidsonina septosa Band. At the south end of the quarry, adjacent to the South Craven Fault, the limestones have been extensively dolomitized (Garwood and Goodyear, 1924).

Interpretation

Although they lie in the transition zone between the North and South Craven faults, the limestones of Meal Bank Quarry are entirely of shelf aspect. In the Settle area, to the east, the Malham Formation is thicker in the transition zone than on

the Askrigg Block proper (Arthurton *et al.,* 1988). Around Ingleton and at Meal Bank this relationship is difficult to prove since the base and top of the formation are not seen. No reef structures are known from the transition zone in this area.

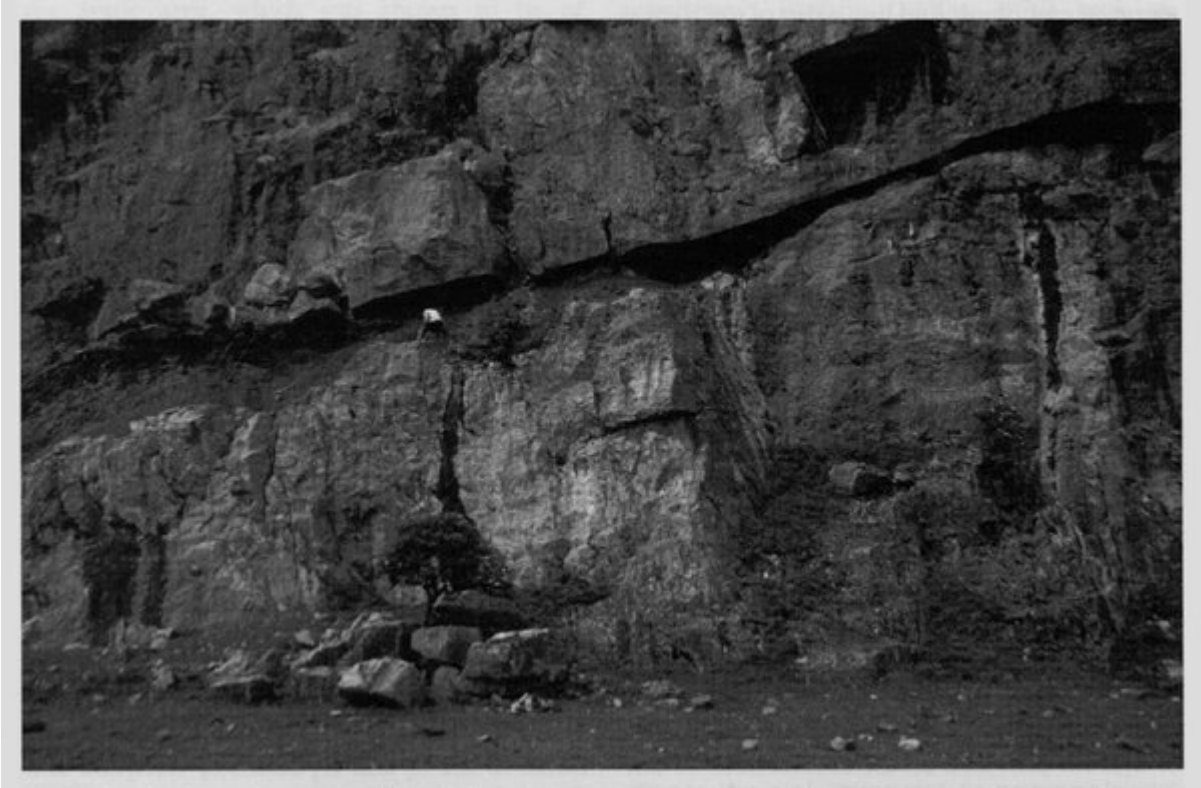
The palaeokarstic surface and its associated coal and seatearth indicate that a prolonged period of emergence Interrupted marine limestone deposition. Rootlets and thin carbonaceous horizons are not unusual in late Dinantian palaeosols, but rarely are coals well developed. The presence of the coal suggests that either the climate was particularly humid during this episode of subaerial exposure, or that the thick underclay inhibited the drainage of groundwater allowing the coal to form. The nature of the upper contact of the coal has long been debated, it being interpreted as either a thrust or an erosion surface (Garwood and Goodyear, 1924; Dunham *et al.,* 1953).

The distinctive nodular bed higher in the limestone succession was correlated with a similar bed at Trowbarrow by Garwood and Goodyear (1924). Such nodular beds in late Dinantian successions often result from calcretization as a result of subaerial exposure in semi-arid conditions (Vanstone, 1996).

Conclusions

Meal Bank Quarry provides the best exposure of the Malham Formation in the transition zone on the south-western margin of the Askrigg Block. The site is particularly notable for the best developed coal seam associated with a palaeo-karstic surface in the Lower Carboniferous shelf limestone successions of England and Wales.

References



(Figure 5.26) Massive limestones of the Malham Formation (Asbian) at Meal Bank Quarry, Ingleton. A thick clay palaeosol capped by a coal seam occurs above the prominent palaeokarst at the centre of the quarry face. (Photo: A.E. Adams.)