EXCURSION

The apron reef above Castleton

Leaders: Gerard and Brenda Slavin

Sunday 11th July, 2004

Twenty three members of the Society met at Speedwell Cavern car park on a blustery but dry day, which was an improvement on weather in the previous week, which had left the hills sodden and slippery. Cars were used to shuttle to Peakshill Farm, from where a largely downhill walk could be enjoyed.

The aim of the excursion was to examine the northern apron reef which formed initially when the Asbian carbonate platform was an area of shallow water deposition and its northern edge was a footwall margin associated with the normal Edale Fault, downthrown to the north (Fig. 1). The abrupt shelf edge was at a high angle with depositional slopes of 20-30° into the Edale Gulf. During the Brigantian, gentler platform margins developed with the growth of extensive bioclastic sand shoals, but high relief was maintained by episodic movements on the fault. These shoals may be seen *in situ* in Pindale, Hope and Bradwell quarries (see a previous excursion, Gutteridge, 1996). Basinal accumulation of such bioclasts in submarine fans is seen in the "Beach Beds" near Speedwell Cavern. Coarser, post-Asbian "Boulder Beds" are seen at several sites around the northern margin, and these can be related to mid-Brigantian footwall uplift and subaerial exposure with karstification (Simpson & Broadhurst, 1968). Carbonate sedimentation ceased during the mid-Brigantian, following siliciclastic input from the north, and the carbonate platform was then on-lapped by the deep-marine Edale shales.

Around the Speedwell Cavern car park (NGR 138827), the Winnats cuts through the platform margin. The hill sides to both north and east are steep slopes of the exhumed Asbian platform margin. The cliffs within the gorge show the transition from shelf to shelf-margin and fore-reef. At the mouth of the gorge, and extending as far as Cow Low Nick, a series of coarse bioclastic beds on-laps the platform margin limestones. The crags behind the car park are now fenced off, but there are good exposures behind the Cavern shop. The bioclasts include rounded and smoothed brachiopods, sometimes with imbricate structure, and crinoidal fragments; graded bedding was debatably recognisable. Originally described as "Beach Beds", theses are now regarded as turbidites that originated from platform-top grainstone complexes, and are found more widely with intercalated shales in boreholes at Castleton and Edale (Sadler, 1964; Gutteridge, 1991, 2002).

Seen from the walk eastwards from the Peakshill Farm car park, the northern edge of the platform from Perryfoot to Windy Knoll is marked by a steep frontal slope with dips of 20-30°. At its base a line of swallow holes lies at the junction of limestone and on-lapping Edale Shales. Peaks Hill (118827) is a knoll of algal limestone bounded by crinoid-rich beds, which lies north of the main reef crest and separated from it by the valley containing Giant`s Hole. The party walked round the hill noting the variable dip directions attributed to differential uplift of apron reef deposits on the Edale Fault (Stevenson & Gaunt, 1971).

Giant`s Hole (119826) swallows a small stream into an open cave. With the help of a couple of ex-cavers in the party, its underground route was described, down a long vadose canyon and then through a deep phreatic loop to rise in Speedwell Cavern, before passing under the Peak Cavern gorge to rise again at Russet Well in Castleton (Ford, 1996).

Windy Knoll cave and quarry (126830) lie in the most northerly outcrop of the Asbian reef belt, which disappears here beneath the shales to reappear again in Treak Cliff. The roof of the cave is formed of a megatalus of pre-Namurian "Boulder Bed" lying on the Asbian limestones. In the main quarry face, tapering palaeokarstic fissures contain large limestone clasts in a dark bituminous matrix. The palaeokarst was sealed by Edale Shales, which also served as the hydrocarbon source. At the top of the face the deposit of limestone breccia with its rubbery elaterite matrix has been attributed to recent weathering following Devensian or later exposure (Gutteridge, 2002), and was examined with caution on slippery ground.

Passing the true top of the Winnats, a view point (135828) was reached. The origin of the Winnats Pass and gorge is debatable. It seems likely that there was no more than a shallow depression during deposition of the "Beach Beds" at the foot of the gorge, with further incision during pre-Namurian uplift associated with formation of the "Boulder Beds"; then after infilling with Edale Shales it remained buried, until exhumation by periglacial meltwater and runoff during the Pleistocene (Ford, 1987).

Above Old Tor mine (135827), good exposures revealed the Boulder Beds, with plentiful and photogenic Blue John crystals on the joint faces.

Treak Cliff (135830) has intermittently exposed algal limestone above a steeply dipping fore-reef slope that drops to the basin. Lunch was taken on spectacular colonies of branching corals originally identified as *Lithostrotion*, but now re-classified as *Siphonodendron*.

Prompted by sunshine, the party left the ridge and descended to a small crag on the fore reef slope (1343 8346) to see geopetal evidence that the observed slope of the fore-reef is original and is not tectonic (Broadhurst & Simpson, 1967). A walk northwards along the cliff top to join a path down the junction of the Edale Shales and the limestone to the Odin mine.

In the Odin fissure (134835) there was discussion on the movements of the fault, which shows not only horizontal slickensides but also vertical offset of the limestone-shale boundary across the fissure, implying some vertical slip (though this could be apparent due to horizontal displacement of the dipping beds).

An optional bolt-on to the excursion was a guided tour round Treak Cliff Cavern (136832) with Mr Peter Harrison. The cave gives a remarkable transect through the fore-reef and its overlying deposits. The entrance, dug through Edale Shale, leads into the cave, where initially shale forms the interstices of a post-Asbian "Boulder Bed" derived from the collapse of the carbonate platform margin, following subaerial exposure in the late Brigantian or early Namurian. The "Boulder Bed" is extensively mineralized by Blue John fluorite. The cave extends beyond the "Boulder Bed" into the fore-reef limestones, which dip steeply at 30-40° east but lack the fluorite deposition.

References

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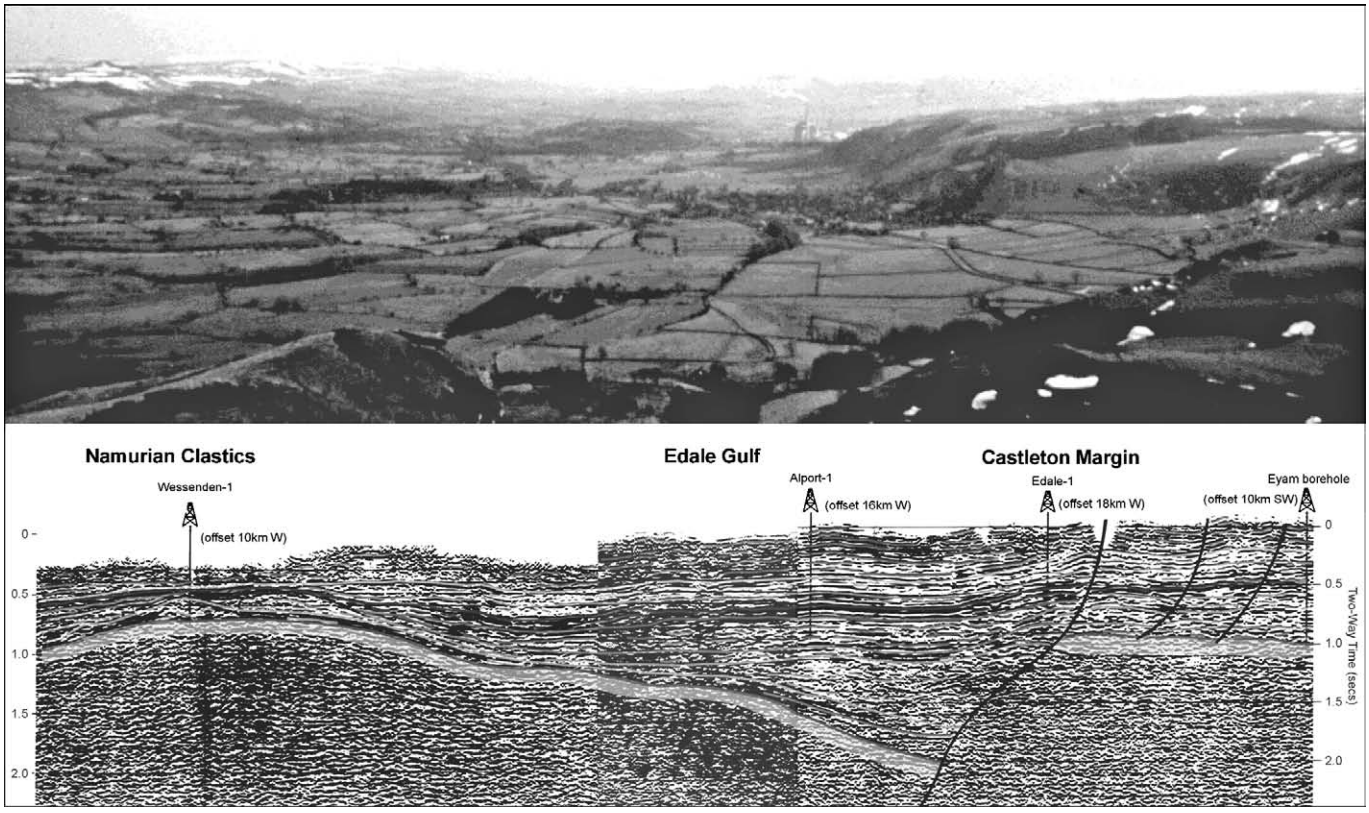

Figure 1. *Edale Fault, showing the Northern Edge of the Derbyshire Dome carbonate platform. Above: view looking east from Mam Tor; early Namurian shales in the valley on-lap the now exhumed late Dinantian carbonate platform forming the valley side on the right. Below: the composite seismic line from the Edale Gulf illustrates the subsurface geology and highlights the half graben and fault-controlled geometry of the Dinantian basin; the top of the pre-Carboniferous basement is on the upper edge of the broad grey band that is 1 second down at each end of the profile. (From Fraser & Gawthorpe, 2003, with permission)*

Footnote: The leaders were somewhat embarrassed by the many pictures they had purloined from other authors` papers to illustrate their excursion handout, and in their defence pleaded the apologia of a Nobel Laureate of Literature:

"When `Omer smote `is bloomin lyre,
`E `eard men sing by land and sea,
And what `e thought `e might require
`E went and took -- the same as we.
Men knew `e stole: `e knew they knowed,
They never made no noise nor fuss,
But winked at `Omer down the road,
And `e winked back -- the same as us"

Rudyard Kipling