EXCURSION

The East Devon and Dorset coast

Leaders: Chris Pamplin, Richard Hamblin (BGS)

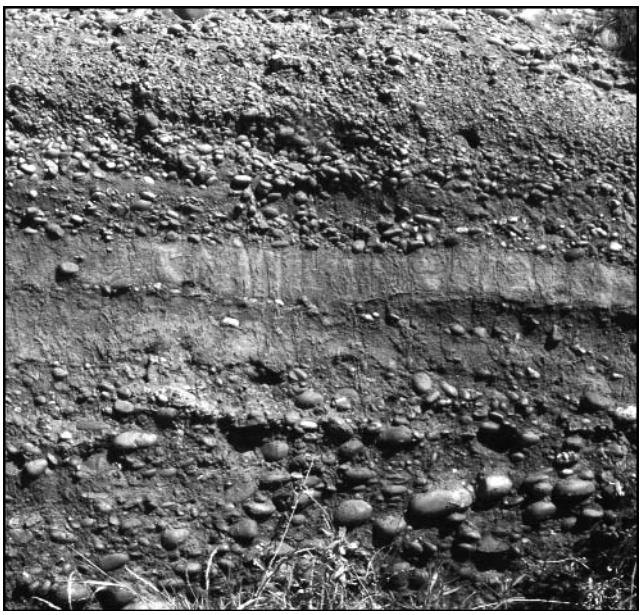
Weekend 7th-8th September 2002

This weekend trip was organised to celebrate the granting of World Heritage status to the coast of East Devon and Dorset, in recognition of the outstanding sections of Triassic, Jurassic and Cretaceous rocks exposed in a series of sea cliffs. For the Saturday we were lucky to have the services of local professional tour leader Chris Pamplin, and for the Sunday we were led by Richard Hamblin, who had recently been working in this area for the BGS Sidmouth mapping project (Edwards *et al*, in press). Unfortunately only eight further members of the Society were able to attend, staying in accommodation around Sidmouth.

Both the Saturday and Sunday were blessed with warm sunny weather. The plan was to start low in the Trias and work our way up the succession, so the EMGS members met up with the leader on the sea-front road at Budleigh Salterton, left our cars and walked westward along the beach to the cliffs of Budleigh Salterton Pebble Beds Formation. Here we discovered that Chris is the type of leader who asks awkward questions rather than dishing out dull facts, and although we probably all knew already that the formation was of fluvial origin, we were obliged to search diligently for actual evidence! Fortunately the thick beds of conglomerate yielded ample evidence of imbrication, with trough cross bedding in the intercalated sand beds, while dreikanter, desert-varnished and wind-faceted pebbles at the top of a conglomerate bed, demonstrated a desert climate. The conglomerates contain very well rounded pebbles and cobbles largely of metaquartzite, with a little porphyry, vein quartz and tourmalinite. No fossils were found in the quartzites on this occasion, but brachiopods eg *Orthis budleighensis* and *Lingula leseuri*, bivalves and trilobites indicate derivation from Ordovician and Devonian rocks in Brittany, Normandy and Cornwall. Detailed sedimentary analysis indicates a large, fast, south to north flowing braided river.

From Budleigh Salterton we drove to Ladram Bay and parked in the car park of the caravan site, then walked westward along the cliff top. From here there are splendid views of the impressive sea stacks in the bay. These are formed from the Otter Sandstone Formation, a softer unit than the Budleigh Salterton Pebble Beds, comprising reddish orange-brown cross-bedded fine- to medium-grained sandstones, with subordinate conglomerates and mudstones. Like the Pebble Beds, the Otter Sandstone was deposited in braided and meandering stream channels in arid to semi-arid environments, in a south to north flowing river system. From Ladram Bay we drove to Beer, although on the way most people stopped, illegally, on the road descending from Peak Hill towards Sidmouth, from which the view eastward is spectacular, with the full succession of the Mercia Mudstone Group cropping out in the sea cliffs beyond Sidmouth and overlain by Upper Greensand on the hilltops. The Mercia Mudstone Group constitutes the bulk of the Triassic succession in the district, whilst the Upper Greensand Formation, of Albian (late Early Cretaceous) age, overlies it unconformably. The Albian sea transgressed from the east, with the unconformity resting on Jurassic rocks in the east, cutting down almost to the base of the Mercia Mudstone at Peak Hill, then re-appearing west of the River Exe where it rests upon Permian and Devonian strata.

In Beer, the leaders ate their sandwiches on the beach while the Society members investigated the delights of the town, then we walked westward along the beach to the first cliff exposure, where the Chalk Group is seen resting on the Upper Greensand. The Upper Greensand Formation comprises a series of calcareous sandstones, calcarenites and chert beds, and the topmost member hereabouts, now termed the Bindon Sandstone Member, is a coarse, calcareous sandstone with calcarenite, slumped beds, contortions and festoon-bedding structures in its upper part. The lowest formation in the Chalk Group in East Devon is the Beer Head Limestone, a near-shore shallow-water condensed sequence equivalent to the Zig Zag Chalk Formation farther east in the Wessex Basin. At Beer this comprises 0.6 m of highly bioturbated porcellanous limestone including three prominent mineralised hardgrounds associated with glauconitic (green-coated) pebbles. It sits on a hardened surface of Upper Greensand calcarenite, indicating a marked sedimentary break, but with no detectable unconformity.



Budleigh Salterton Pebble Beds at their type locality.

Cliffs of the Mercia Mudstone Group east of Sidmouth overlain by the Upper Greensand at Golden Cap.

Finally for the Saturday we drove to Lyme Regis and parked at Monmouth Beach, and for the fourth time that day walked westwards, this time to look at the lower part of the Early Jurassic Lias Group. The foreshore here is a wave-cut platform in the Blue Lias Formation, with the lowest member of the overlying Charmouth Mudstone Formation, the Shales-with-Beef, cropping out in the cliffs. The Blue Lias comprises interbedded grey shales and hard, fine-grained, blue-hearted limestones. The thickest mudstone is 1.8 m thick, and the thickest limestone about 0.6 m (Edwards *et al*, in press). The Shales-with-Beef Member comprises thinly bedded grey mudstones with numerous beds up to 0.2 m thick of fibrous calcite colloquially referred to as 'beef', and a few discontinuous beds of limestone as in the Blue Lias. Because of the high risk of cliff-falls we restricted our activities to examining the rich fauna exposed in the foreshore limestone pavements in the Blue Lias, finding a surprising number of specimens of *Nautilus*, and a variety of ammonites, some of prodigious size.

Sunday again dawned fine and sunny and we met at Charmouth, but as the tide was high, a decision was made to leave the beach walk until after lunch, so we headed inland. After a hiatus when the leader realised he had left his camera in the car park at Charmouth and discovered just how fast a BGS Ford Escort will go, we met up again at Pilsdon Pen, an iron-age fort surmounting the highest point in Dorset. The view was clear as far as the Mendip Hills to the north, and to the west appeared to be an unbroken flat plateau of Upper Greensand, but the leader explained that we were looking at a series of fault-blocks, each of which had rotated to dip eastwards (towards us) as they were down-faulted to the west by listric faults flattening out westwards at depth.

A stop was made at Broadwindsor at a rock and fossil shop which turned out to possess the largest amethyst geode in captivity in Europe, imported from Brazil and not for sale. We then stopped at a development site nearby in Inferior Oolite Formation limestone, known to Ian Sutton, who had obtained permission for our visit from the Nature Conservancy. The fresh exposure revealed a very rich fauna of bivalves, ammonites and gastropods but no collecting was allowed. We then drove down to the coast at Burton Bradstock, where the valley descending to the sea follows a fault which at the beach throws the Middle Jurassic Fuller's Earth Clay against the Lower Jurassic Bridport Sands (Wilson *et al*, 1958). We walked westward along the beach to examine the impressive sea-cliffs of Bridport Sands, orange-yellow micaceous sands with prominent bands of blue-hearted calcareous sandstone. The shingle beach piled against these cliffs forms a part of Chesil Beach, which extends for 15 km to the Isle of Portland, clearly visible to the east. During the rest for lunch, at least one member of the party walked to the headland east of the fault, from which the more characteristic topography of Chesil Beach could be seen, with hollows and meres, some of them water-filled, between the great shingle bank and the low slope of the clay cliffs.

Having thus proved it was possible to walk eastwards along a beach, we returned to Charmouth, parked in the car park by the River Char, and walked eastwards beneath cliffs of the Charmouth Mudstone Formation of the Lias Group. The dip is about 2° to the east, dropping successive members to beach level. Immediately east of the river, the Shales-with-Beef Member is overlain by the Black Ven Marl Member, fissile dark grey mudstone with individually named beds of tabular and concretionary limestone including the 'Birchi Tabular' at the base and the 'Hummocky' at the top. This is succeeded by the Belemnite Marl Member, pale to medium grey massive calcareous mudstone with abundant belemnites in the upper part and the 'Belemnite Stone' limestone at the top. This is overlain by the Green Ammonite Member, black fissile mudstone with a few limestone beds, so-called because of the greenish calcite infilling the septa of some of the ammonites. Large numbers of small exquisitely pyritised ammonites were found on the wave-cut platform in the Green Ammonite Beds. The leader explained that inland in the Sidmouth district it had proved possible to distinguish the Belemnite Marl Member from the over- and underlying dark shale members, by its paler colour and its relative hardness, but that there was insufficient exposure to separate the Shales-with-Beef from the Black Ven Marl: in the Bridport district, where the Lower Lias is less affected by a soliflucted cover derived from the Upper Greensand, all four members have been mapped.

By this time it was late afternoon and most of the party set off for the East Midlands, although some not going straight home stopped to visit the excellent free museum on the quay in Charmouth.

References

Edwards, R.A., Gallois, R.W., & Hamblin, R.J.O., *In press*. Geology of the Sidmouth district - a brief explanation of the geological map. *Sheet Explanation of British Geological Survey*. 1:50 000, Sheets 326 and 340 Sidmouth (England and Wales).

Wilson, V., Welch, F.B.A, Robbie, J.A. & Green, G.W., 1958. Geology of the country around Bridport and Yeovil. *Mem. Geol. Surv. G.B.*, Sheets 312 and 327.