Review by By Harry Matchette-Downes, University of Cambridge

North Somerset Coastline Field Trip


Fig. 1

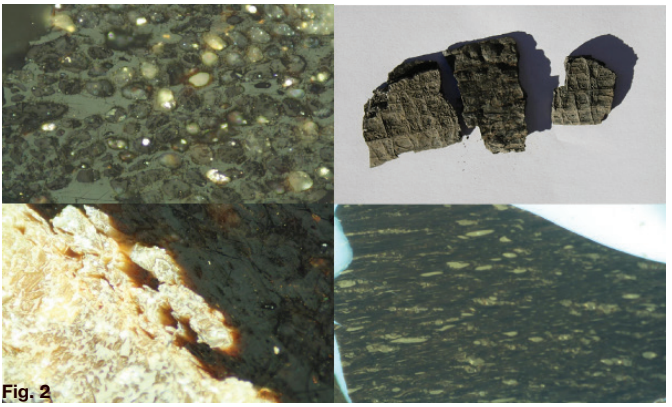
Fig. 2


Fig. 3

25 geologists ventured from the comfort of historic Dunster to observe the geology of the north Somerset coastline. The exposures of Upper Triassic and Lower Jurassic sediments are world-class—officially, as they include one of the handful of GSSPs or 'Golden Spikes' found in the UK. Beautifully exposed at low tide, the rocks display the stratigraphy and structure of the region, and fuelled spirited discussion of their hydrocarbon potential throughout the two-day trip.

The half-graben structure of the Bristol Channel Basin is very well displayed on seismic sections, but is also mirrored by the small-scale analogue structures on the Somerset foreshore. For instance, at our first locality we saw the eponymous Helwell Bay Fault from the cliff top. This south-dipping normal fault downthrows the Jurassic Blue Lias by 210 metres against the Triassic Mercia Mudstone Group.

At beach level, we traced the facies changes associated with the regional transgression from the continental environment of the Rhaetian into the restricted marine environment of the Lias. The Lias locally consists of mudstone-marl-limestone-marl cycles, with some of the mudstones containing almost 20% TOC. Same age rocks are the source rock for the major Wytch Farm oil field in the Wessex Basin, and have famously supplied the fossil shops of Lyme Regis since the days of Mary Anning.

Heading west through Watchet and to Warren Bay, the group passed into the tea-green and grey marls of the sabkha deposited Blue Anchor Formation, and the older red beds with alabaster nodules, thought to represent playa lake deposits. As well as gypsum in the massive habit—alabaster—the beds were cut by abundant fibrous gypsum veins, leading us to a discussion of the reverse reactivation of the normal faults. Horizontal veins with vertical fibres suggested hydraulic fracturing due to over-pressuring, which facilitated the inversion. Other evidence we considered

Fig. 4

Fig. 5

Fig. 1: The Quantocks Head Fault. Dr Mark Anderson is touching the plane of a normal fault which is both reactivated and offset in a reverse sense. The offset can be seen about the level of his midriff.

Fig. 2: Araucaria hand specimen and photomicrographs. The low reflectivity 0.25% Ro is probably suppressed by the hydrogen-rich kerogen, as evidenced by (anticlockwise from top left) lipid-filled lumina, exudates, and fluorescence from humic material. Photo and analysis courtesy of Patrick Barnard.

Fig. 3: The party poses around the largest mud volcano. The three volcanoes sit in a line, thought to be the trace of a fault. Such features are seen today, for example in Azerbaijan, Indonesia and Trinidad, although the Liassic examples are much smaller in scale.

Fig. 4: A relay ramp between two normal faults in a single bedding plane. Note the incipient transfer faults. These structures can allow communication of oil across an otherwise sealing fault.

Fig. 5: Sandstone (pale coloured rock) injectite in fault plane (centre of image to upper right) and injected into red beds (left and right just above beach). The injectite is probably sourced from other Triassic unit, possibly local sheet sands in the Mercia Mudstone or, deeper still, the Otter Sandstone (which is partly equivalent in age to the Sherwood Sandstone of Wytch Farm. Photo courtesy of Dr Pete Webb.

included tightly-folded strata besides the Helwell Bay Fault, overprinted slickenfibres, and continuous successions of vein fibre orientations through vein-orthogonal to vein-parallel.

Further along Warren Bay, we saw another piece of evidence for high fluid pressures: an injectite, where a sandstone from a (presumably) deeper horizon has been injected up a fault plane into the Mercia Mudstone (fig. 1), in the style of a sill. Although this feature was quite local, the presence of a potential reservoir rock poses the question: is there a play in the making?

Exploration programmes in the Bristol Channel and western Wessex Basins have not so far been successful. We learnt that the Lower Lias has reached maturity in places, but some participants took their own samples (fig. 2) to corroborate this! Furthermore, traps, such as hanging wall roll-over anticlines, may have formed, but may also subsequently been destroyed by inversion. Some attempts have been made to exploit the Liassic mudstones: on the second day, moving a few miles to Kilve, we came across a mudstone oil retort built by the Shaline Company in 1924, a venture which never broke even.

East of Kilve we located three unusual features which were suggested to be preserved mud volcanoes puncturing the limestone beds of the Lias (fig. 3). Elsewhere, these beds showcase various deformations, including conjugate fault systems and classic relay ramps (fig. 4). The cross-cutting normal, strike-slip and thrust faults at the Quantocks Head Fault made it an emphatic final locality, encapsulating the history of the regional stresses (fig. 5).

With thanks to Dr Pete Webb and the organisers Dr Danny Clark-Lowes and Dr Mark Anderson