Fissure deposits or 'neptunian dykes'

Some of the most interesting Lower Jurassic sediments in Britain occur within 'fissures' in older rocks. These fissure deposits are almost all confined to areas where the Carboniferous Limestone was exposed during early Jurassic times. Examples have been reported from south Wales (Robinson, 1957; Simms, 1990b; Benton and Spencer, 1995) and the Mendip Hills (Moore, 1867a; Savage, 1977, 1993; Benton and Spencer, 1995), and they are of exceptional importance for the terrestrial vertebrate faunas, including early mammals, that they have yielded (Moore, 1867a; Kermack *et al.,* 1968; Savage, 1993). Their faunas show that some fissure fills were terrestrial in origin while others were marine. The south Wales fissures, and some of those in the Mendips, contain terrestrial fills that have proved difficult to date precisely. In others, the associated flora indicates an early Jurassic age (Harris, 1957; Lewarne and Pallot, 1957). A significant proportion of the fossiliferous Mendip fissures have yielded both vertebrate and invertebrate marine fossils that indicate a late Triassic to at least mid Jurassic age range (Copp in Duff *et al.,* 1985).

A diverse range of lithologies in the Mendip fissure-fills, includes breccias, red pebbly mudstones and grey mudstones similar to typical bedded Liassic sequences, and limestones. The limestones are the most characteristic facies and comprise a very fine-grained micritic limestone, often yellowish or pinkish in colour. Bedding within these sediments may be sub-horizontal, and may exhibit post-depositional sagging, but most commonly appear to have been deposited sub-parallel to the fissure walls. A minority of examples appear to represent karstic conduits or caves, and appear to be mostly of Triassic age (Simms, 1990b). The dominant fissure-type in the Mendip Hills is elongate, sometimes extending for hundreds of metres, straight and parallel-sided, with most orientated WSW–ENE. Commonly they are associated with lead and zinc mineralization (Stanton, 1991; Simms, 1997). Most of these fissures extend below the quarry floors and hence their depth is unknown. Moore (1862, 1867a) recorded a rich Lias fauna from sediments intercepted at a depth of 270 ft (83 m) in a lead mine at Charterhouse, as did Stanton (1991) more recently.

The origin of the fissures has been controversial. Simms (1990b) suggested that they represent solutional 'giant grikes' but it is now clear that they are 'pull-apart' structures developed on major joint sets during brief periods of extension during late Triassic to mid-Jurassic times. This basic mechanism was suggested by Moore (1867a) and expanded upon by Copp (in Duff *et al.,* 1985) and Smart *et al.* (1988). Jenkyns and Senior (1991) attributed the presence of Hettangian to Bajocian sediments in these fissures to a period of extensional faulting in this region, correlating with the early rifting phase of the Central Atlantic area. The frequency and widths of these fissures should provide an indication of the scale of this extension across the Mendip Hills, on the northern margin of the Wessex Basin. Moore (1867a) estimated that as much as a quarter of the face of the Holwell Quarries GCR site comprised Lower Jurassic sediments, indicating a crustal extension of up to 25%. This is probably an over-estimate (Jenkyns and Senior, 1991) but it broadly corresponds to the figure of 13–17% cited by Chadwick (1986) for basinwide crustal extension in the Wessex Basin.

Three GCR sites exemplify the fissures and their unusual associated facies in the Mendip Hills. The Cloford Quarry GCR site exposes numerous fissures, which have yielded a significant marine invertebrate fauna, and shows more clearly than elsewhere the relationship of the fissures to the surrounding country rock. The Holwell Quarries GCR site is of considerable historical importance as well as yielding a diverse fauna with both marine and terrestrial elements. Finally, the Leighton Road Cutting GCR site exposes the interface between the fissures and normal-bedded marine sediments.

References