Topics

A fossil whodunnit

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Shopping can be a tedious chore, but every now and again something comes to lighten the business. This happened to the first of us, an amateur geologist, when visiting the shopping centre at Brent Cross in North London recently. The eye was caught by polished slabs facing the entrance of Fenwicks store. A pale grey–brown stone was heavily patterned by curving strap-like strips outlined in black – stone which 'boils' with turbulence. The discovery was taken to the third of us, at Reading University, who brought in a background in the study of trace fossils into focus upon the Fenwicks panels. An electronic message to the second of us, at Barcelona University, led to the following results.

The Echinodermata is perhaps the most bizarre of the animal phyla. Its diversity and evolutionary course are scarcely, if at all, predictable, and it is the only major phylum that has not adapted to life out of water. Indeed, it is scarcely ever likely to do so! In north-western Europe, we are most familiar with starfish and their ilk, sea potatoes (heart urchins) and sand dollars. If holidaying by warmer waters, we may delight in the edible delicacies (Fruites de mer), for which the sea cucumbers are best known, but do try to avoid the needle-sharp, barbed spines of some types of sea urchin.

The burrowing behaviour of the infaunal sea potatoes and sand dollars has long fascinated biologists. In recent years, aquaria experiments have been carried out in an attempt to understand the fossilized burrow traces left in sediments (Fig. 1). Parallel studies on the shape of the test, and on morphology of the spines and their attachment areas, in modern and ancient representatives, showed how an infaunal mode of life may be inferred from the test alone. Sea-urchin burrows are distinctive because of their relatively large size and laminated backfill. Often, there is also a single or double tubular burrow running more or less centrally within the backfill – the anal canal(s). Occasionally, there is the trace of a ventilating shaft, connecting the animal to the substrate surface. Yet although the overall morphology of many echinoids in the later Mesozoic and Cenozoic points to a burrowing mode of life, their burrows are relatively rare. It is striking that no burrows that, with certainty, can be attributed to the activity of the common Chalk echinoid *Micraster* have been recognized, possibly because of the shallow depth at which *Micraster* and other spatangoids would have burrowed and also because burrowing took place in an environment where arthropods burrowed to greater depths. As sediment accumulated, so the burrows of the echinoids were systematically churned up and more or less eliminated from the fossil record.

In spite of this unpromising prospect, echinoid burrowing is strikingly demonstrated in the cladding-stone used for facings and columns at Fenwicks store at Brent Cross Shopping Centre in North London (Figs 2 & 3). It has been identified as Bateig Fantasia, is of middle to late Miocene age, and is quarried at Bateig Hill, Alicante, Spain. It has been used architecturally in Spain since the 13th century. The stone is imported already slabbed and polished and then installed by Tiles International of Cumbernauld. It is a fine- to medium-grained, fossiliferous, glauconitic sandstone with a carbonate cement, deposited in a shallow marine shelf, and has been sawn parallel to the bedding.

The columns at Fenwicks store are formed from blocks 25 cm thick, and show beds of about 15 cm thickness, with an erosional base followed by churn-

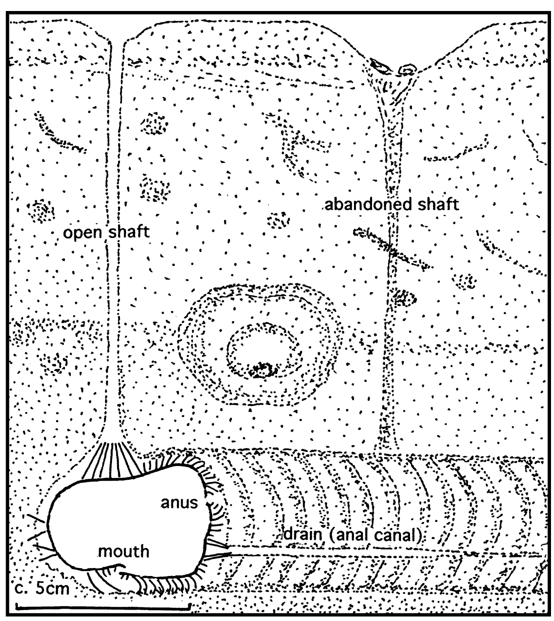

Fig. 1. Diagram to show the formation of a meniscate backfill by the modern echinoid *Echinocardium cordatum* in longitudinal and transverse (centre) section. Spines are shown diagrammatically. An active shaft and an abandoned shaft indicate advance of the animal. (Modified from Bromley & Asgaard, 1975.)

Fig. 2. Cladding on the groundfloor level of Fenwicks store, Brent Cross Shopping Centre. The slabs are 60 cm square.

ing up, which extends almost to the sole, and dominated by echinoid burrows. The better polished slabs used for the walls display backfilled burrows up to 9 cm in diameter, but mostly 6–7 cm, winding, with occasional sharp turns. Burrow margins are sharp and darker in colour, as a result of a concentration of glauconite. There is extensive cross-cutting, and no positive indication of the primary lamination seems to have survived. The burrows may be cut by a variety of other types of burrow, some of which change in character as traced laterally. Thus one type with a dark lining passes into a burrow with a dark core. Narrow burrows which might be attributed to *Planolites* have a light or dark fill. No echinoid tests have been observed. Attribution of the large burrows to echinoid activity is thus based on their size and the nature of the backfill.

The style of bioturbation closely matches that described and figured from the Pleistocene Rhodes Formation of the island of Rhodes. Here, echinoid burrows are present in the Cape Arkhangelos calcarenite facies of the Rhodes Formation. These have been claimed as *Scolicia* isp. and attributed to the activity of *Echinocardium*, several specimens of which were found at the end of burrows in life position.

Fig. 3. Close-up of the cladding slabs of echinoid-burrowed sediment (*Bateig Fantasia*) on the upper floor of Fenwicks.

Echinoid burrow preservation

It is pertinent to consider the situations favouring the preservation of echinoid burrows. While deep burrowing by arthropods became prominent in the Mesozoic, burrowing by echinoids evolved rapidly in the Cenozoic, although many late Mesozoic echinoids were able to plough through the sediment. Nevertheless, although arthropods may burrow to depths greater than 1 m, spatangoid echinoids burrow only to depths no greater than 20 cm, and mostly shallower. The greatest depths appear to be reached in coarser sediment in near-to-shore locations.

Although we have been able to identify the source of the cladding used at Brent Cross, we have yet to establish the depositional environment and facies in detail that has preserved this spectacular stone.

Suggestions for further reading

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