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A NEW TRACE FOSSIL FROM NON-MARINE UPPER PALAEOZOIC RED BEDS IN COUNTY WEXFORD AND COUNTY KERRY, IRELAND

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ABSTRACT

Previously unrecorded radially symmetrical, apparently cylindrical or downward tapering structures in red, non-marine siltstones and sandstones of Devonian to early Carboniferous age are described from south-west County Wexford and the Dingle Peninsula, County Kerry, Ireland. These structures are interpreted as biogenic trace fossils rather than inorganic features. They are most probably dwelling burrows, possibly of a fresh-water coelenterate. The most comparable known forms are *Laevicyclus* Quenstedt, 1879, *Kulindrichnus* Hallam, 1960 and *Bergaueria* Prantl, 1946.

INTRODUCTION

Isolate, apparently tubular or downward tapering radially symmetrical structures 6 cm to 12 cm in diameter occur in dark red to red-brown micaceous siltstones at several levels in the West Cork Sandstone Formation of south west County Wexford (fig. 1). The local lithological details of this Formation, a non-marine mixed clastic assemblage of late Devonian – early Carboniferous age, are given in G a r d i n e r and H o r n e (in press). Similar structures have also been observed at two differing stratigraphical levels in the Dingle Peninsula, County Kerry (fig. 1), namely the West Cork Sandstone Formation and the underlying Dingle Group of G a r d i n e r and H o r n e (1972) In the former they are developed in red siltstones, while their occurrence near the base of the Dingle Group (? Downtonian – early Devonian) (G a r d i n e r and H o r n e 1972) is in non-marine, medium-grained red sandstones. These structures are apparently previously unrecorded.

GENERAL DESCRIPTION

Where seen the structures appear to be randomly scattered on bedding planes, although usually as groups rather than as individual occurrences (plates 1, 4 and 5). The host lithologies are widespread throughout the Formation from which the structures have been recorded, but the latter have only been noted at 12 horizons. They occur either on internal bedding planes, or on the upper surface of the host siltstone or sandstone unit; in the latter case they never extend into lithologically different overlying beds. In south-west County Wexford, where tectonic deformation is minor, the surface expressions of the structures are approximately circular, but examples from the Dingle Peninsula are distinctly elliptical as a result of tectonic flattening.

The original diameters range from 6 cm to 12 cm (e.g. plate 1). The structures are commonly seen as relief features on the upper surfaces of bedding planes (plate 3). On these surfaces individuals typically show a raised elliptical rounded lip that encloses a smooth concave central depression. All undeformed examples are radially symmetrical.

On bedding planes the rim zone of the great majority of these structures, and to a lesser extent their internal fill, appears darker than the enclosing sediment (plates 1, 2 and 5). This colour variation is merely a weathering feature, internal sections revealing no uniform colour contrast between structures and matrix. In some cases this surface colour difference is insignificant (plate 3) and the structures are revealed only by the superior hardness of the rim zone, which is therefore preserved in relief on bedding planes. In thin section there is no grain size variation either internally or between the structures and matrix, but at one locality (grid reference S. 774/018) in south-west County Wexford the rim zone is calcareous (plate 4).

Transverse sections show no internal sedimentary features within the structures. At the majority of localities the matrix is also microscopically homogeneous, but where internal lamination is revealed the structures cross-cut with no apparent distortion (fig. 2). Because of the lack of internal colour variation, the shape of the structures in three dimensions can only be assessed from these examples, although in the field they are seen on upper bedding planes at some localities and lower bedding planes at others. A representative vertical section through one individual from the West Cork Sandstone Formation is illustrated in figure 2. This reveals the cylindrical or slightly downward tapering form. The structures appear to have vertical dimensions of the order of 8 cm to 10 cm, although the limits are not well defined in section.

1) Geological survey of Ireland.

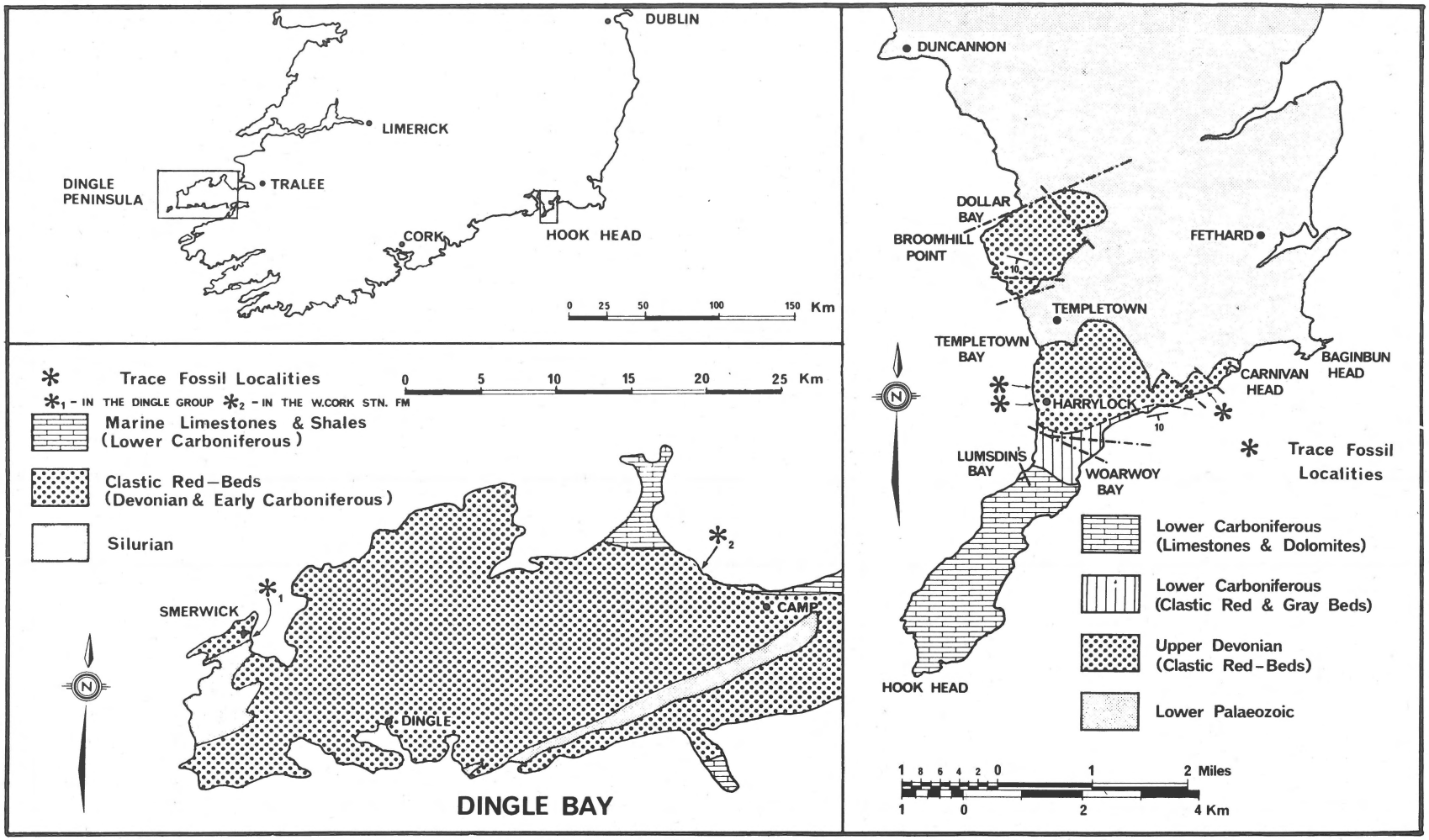

Fig. 1
Geological sketch maps of the Dingle Peninsula, County Kerry, and south-west Co. Wexford. The approximate locations of the trace fossils described in this paper are indicated.

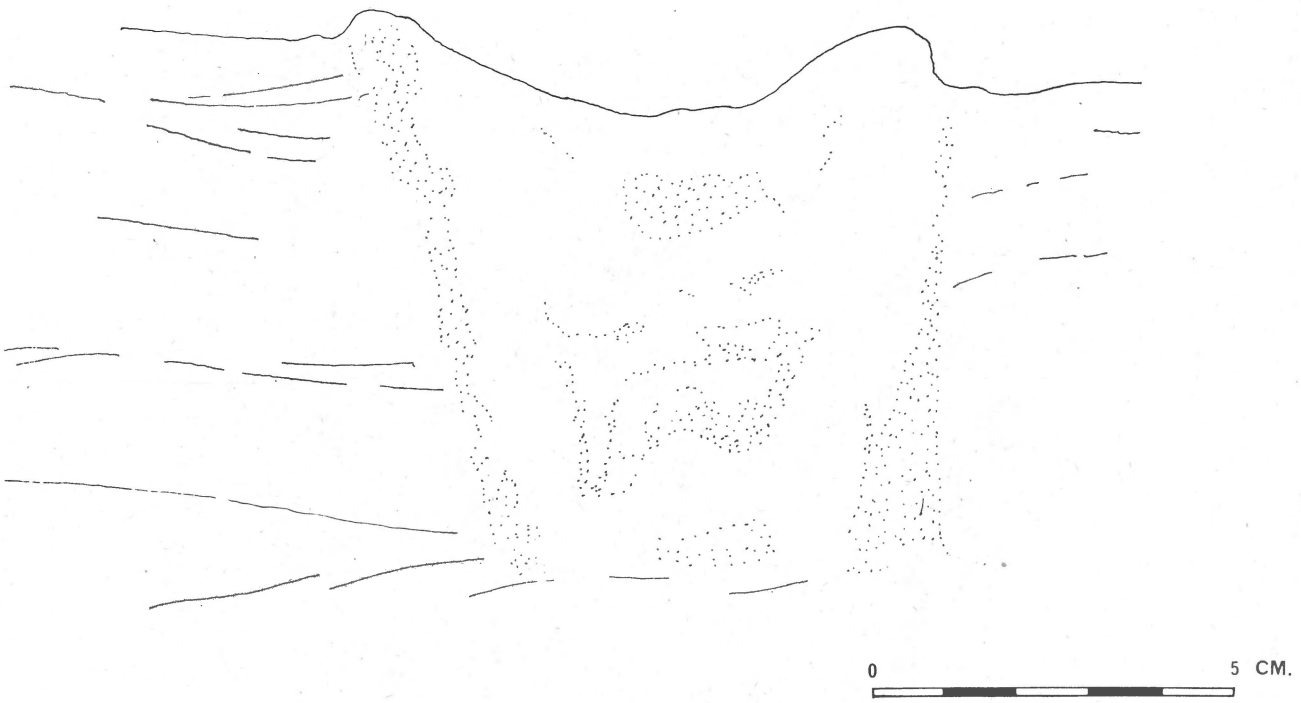

Fig. 2
Longitudinal section (traced) through one of the trace fossils. The dotted areas represent zones of sediment mottling.

Associated structures are rare. The host beds show no signs of secondary sedimentary deformation, but in two upper surfaces of bedding planes in south-west County Wexford features interpreted as sub-horizontal burrows or trails are found in association (plate 2). There is no evidence of any other bioturbation, nor of any scour structures either within the host beds, or directly overlying.

INTERPRETATION

Concretion development, differential compaction around load and scour features, secondary sedimentary movement, or a biogenic origin, are all causal possibilities (cf. G o l d r i n g, 1969). The first two can be discounted on the basis of the three dimensional morphology of the structures described above, and the features shown by the matrix sediments. It would seem therefore that these structures are either secondary sedimentary features, or have an organic cause.

The available evidence does not favour a non-organic origin. The radial and vertical symmetry indicates that any causal soft sediment deformation would have been local and vertically directed. Such a mechanism apparently gives rise to "streamers" or "cusp" structures (S e l l e y et al., 1963), or to sand volcanoes. The "streamers" and "cusp" structures described by Shelley et al. are commonly gregarious, much larger, and often not vertically symmetrical. Plan views range from oval to linear, and in section all "point upwards" with a much larger base than apex indicated by the orientation of the disrupted laminae. The morphology of the structures described here is quite different, in that they are vertically symmetrical, are parallel sided or downward tapering, cross-cut laminae where seen in the matrix and are internally homogenous. These features are also in marked contrast to those of sand volcanoes as described by G i l l and K u e n e n (1958), which again have a conical form and also have a cone of ejected sediment which is absent in the structures described here. Nor do the enclosing sediments in south-west Co. Wexford and the Dingle Peninsula show any evidence of soft sediment deformation.

If sedimentary and diagnetic causes are discounted, then a biogenic origin is likely. In this context the spatial association with apparent elongate burrows and trials (plate 2) is significant. These are of a similar scale to the vertical circular structures, and their proximity and similar mode of preservation implies that they may be biogenically related.

The original radial and vertical symmetry of the structures suggests that they were dwelling burrows (rather than feeding or escape burrows) of organisms with a regular form. Burrowing coelenterates seem most likely in this context. (A. S e i l a c h e r, personal communication). The elongate burrows found in association may represent burrows of the same organism. Such organisms apparently existed where there was net accumulation of fine grained sediment under relatively quiet water (? spasmodic) conditions.

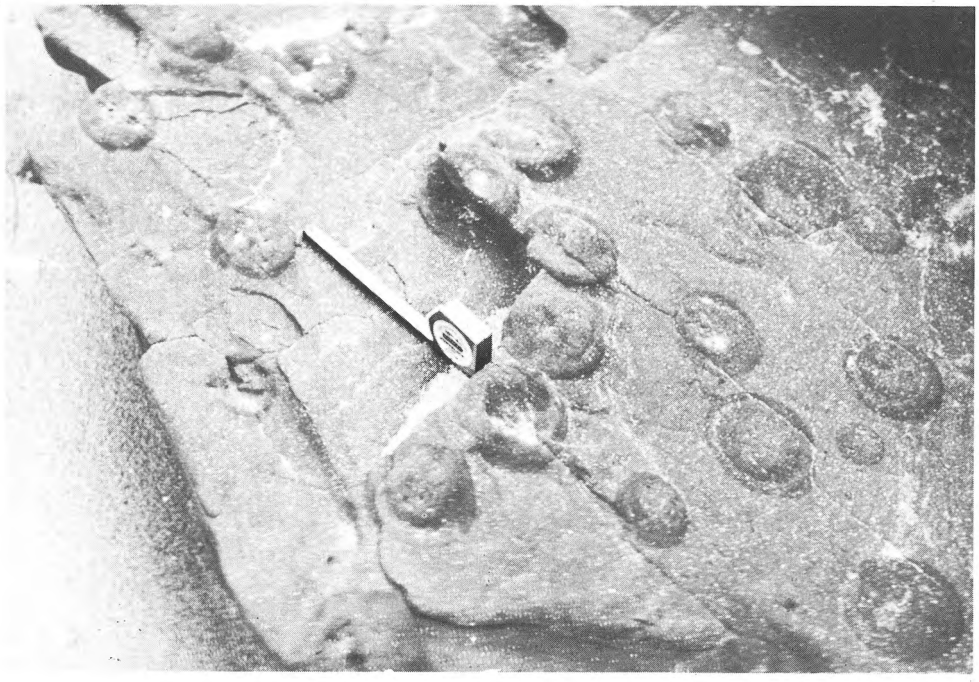

Plate 1
Gregarious development of structures on the upper surface of an internal bedding plane of a siltstone unit. In several cases the depressed perimeter of the rim zone is clearly visible. The exposed scale is 16 cm long. Location: coastal section west of Harrylock, Co. Wexford (grid reference S. 752/015).

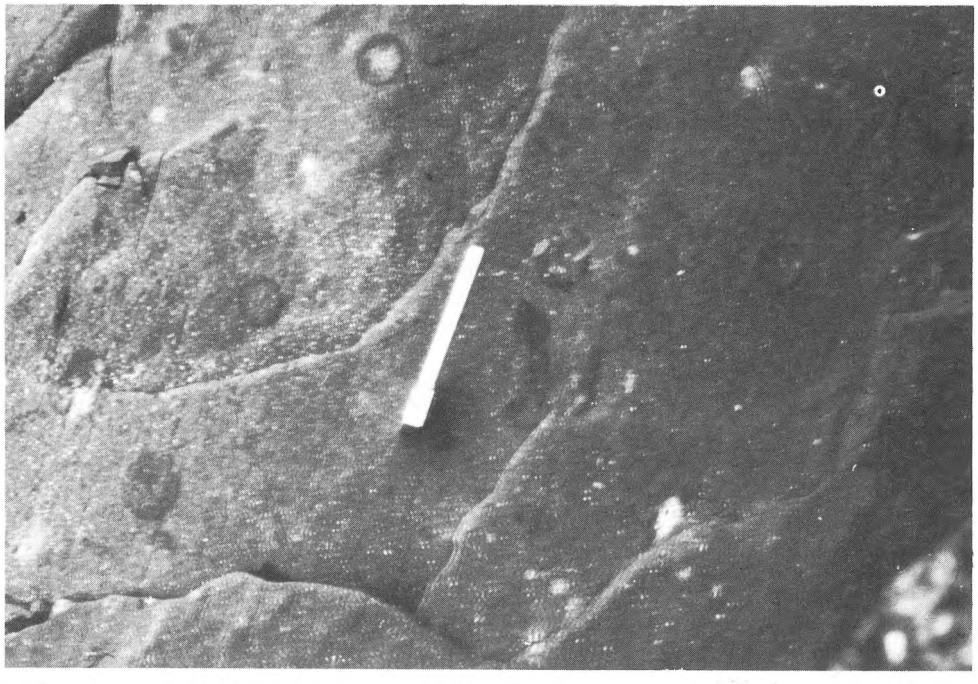

Plate 2
Vertical view of randomly located structures, showing the typical circular cross-section and the darker weathering rim zones. Large surface burrows are visible to the right of the scale. The exposed scale is 22 cm long. Location: coastal section west of Harrylock, Co Wexford. (grid reference S. 752/015).

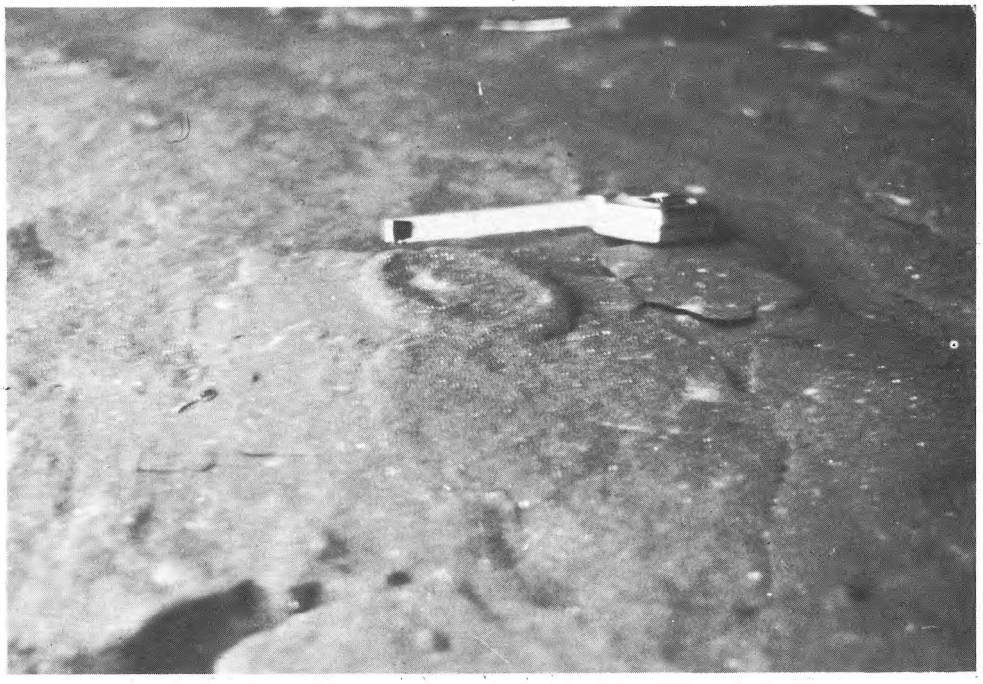

Plate 3
The upper surface of an isolated individual, showing the raised and rounded shape of the rim zone and the central depression. The exposed scale is 12 cm long. Location: coastal section west of Harrylock, Co. Wexford (grid reference S. 752/015).

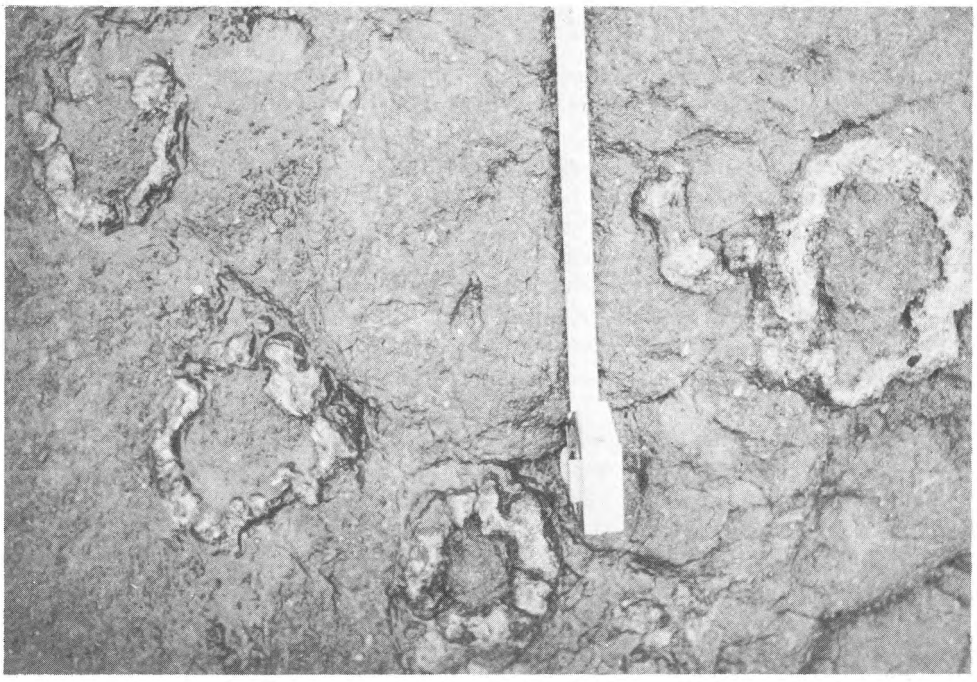

Plate 4
Vertical view of structures with calcareous rims that have weathered out in an irregular manner. The exposed scale is 15 cm long. Location: coastal section south-west of Carnivan Head, south-west Co. Wexford (grid reference S. 774/018).

Plate 5
Gregarious development of structures exposed on the scoured upper surface of a siltstone unit. The rim zones are indicated by darker colours. Compass base is 10 cm long. Location: coastal section north of Aughacasla, Dingle Peninsula, Co. Kerry (grid reference P. 650/120).

SPECIFIC AFFINITY

In attemping to suggest a zoological affinity for the organism involved the main problem is that the sequence in which the trace fossils occur both in County Wexford and County Kerry are considered to have been deposited in a non-marine environment. Dehydration features are abundant and bodies of standing water were obviously impermanent. Data on fresh water softbodied, burrowing organisms is naturally sparse, and comparable trace fossils recorded elsewhere are all interpreted as marine. Thus these Irish examples compare closely in morphology to *Kulindrichnus* Hallam, 1960, and to a lesser extent to *Laevicyclus* Quenstedt, 1879, and *Bergaueria* Prantl, 1946.

The morphological comparison to *Kulindrichnus* is particularly close but shell fragments described from *Kulindrichnus* are not present here. This trace is interpreted as the burrows of a cerianthid sea anemone (H a n t z s c h e l, 1962).

The structures described here lack the distinct axial canal of *Laevicyclus,* although this is not well developed in all examples (T.P. C r i m e s, personal communication). Various origins for *Laevicyclus* are mentioned by H a n t z s c h e l (1962), the most recent being S e i l a c h e r's (1955) suggestion of the dwelling shaft and scraping circles of an annelid worm.

The structures have a certain similarity to some forms of *Bergaueria* but differ in vertical section. *Bergaueria* occurs in forms reminiscent of load casts (H a n t z s c h e l, 1962) and also as circular raised areas on bedding surfaces with a depressed rim in the Arenig of the British Isles (T.P. C r i m e s, personal communication). *Bergaueria* has been interpreted as resting traces of actinians.

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