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On some ichnotaxa in hard substrates, with a redefinition of *Trypanites* MÄGDEFRAU

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With Plate 18 and 1 Text-figure

S u m m a r y : Some groups of borings faithfully reflect the nature of the originating organism. This is particularly the case with the borings of bryozoans. Nevertheless, it is recommended that the name applied to the work of the animal be held distinct from that of the animal itself. Other groups of borings provide less diagnostic evidence of the nature of the borer. This is the case in one-entrance, pouch-shaped borings (excluding acrothoracic borings). There is a need for a general ichnogenus to cover these single-entrance borings and *Trypanites* MÄGDEFRAU 1932 is redefined to fill this role.

Z u s a m m e n f a s s u n g : Bohr-Spuren, bei denen aus ihrer Form mit Sicherheit auf den Erzeuger wie z. B. Pelecypoden oder Bryozoen zu schließen ist, sollten nicht mit dem Namen des Bohr-Organismus selbst, sondern mit einem Ichnotaxon bezeichnet werden. Für einfache schacht- oder taschenförmige Bohr-Spuren, die eine einzige Öffnung haben und deren Urheber meist nicht einwandfrei zu ermitteln sind, wird (mit Ausnahme der sicher erkennbaren Cirripedier-Bohrlöcher) als dafür geeignetes Ichnotaxon *Trypanites* MÄGDEFRAU empfohlen. Es kann auf Grund der hier revidierten Diagnose nunmehr in einem erweiterten Sinn für derartige Bohrlöcher gebraucht werden.

1. Introduction

Trace fossils include both biogenic sedimentary structures and borings in sediments and other hard substrates. As such, their taxonomy should not be confused in any way with that of the organism which produced the trace.

Trace fossils are most suitably classified on a basis of ethology and morphology. The higher ranks of taxonomy (e.g. Fodinichnia SEILACHER 1953) are based on the ethological characteristics while most ichnogenera are defined on the morphology of the trace. In those forms which lend themselves to further natural subdivisions, ichnospecies may be introduced, based on finer morphological characteristics which may allow an attribution to the originating organism.

In the case of some groups of trace fossils, particularly borings, there is a danger of confusion with biological taxonomy. This is especially the case in the bryozoan borings which represent an extreme end-member of the trace fossil series in this respect.

2. Naming bryozoan borings

This group represents ground on which the zoologist and ichnologist meet with opposing taxonomic viewpoints, and there has consequently been much dis-

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cussion and contradiction in naming these forms. In the boring bryozoans, several of the characteristics used by the zoologist to diagnose species and genera, i. e., the shape of zooecia, their position relative to the stolons, and their pattern of branching, are faithfully reflected in the form of the boring. There is therefore the danger of considering the trace as a mould of the body and, as in the case of moulds and casts of body fossils, of naming the trace with the body's name. This procedure is indeed most convenient to the bryozoologist, as also to the entomologist in the case of insects and their galls. It is much less convenient in fossil traces of bryozoans where the body is unknown.

In principle, however, this procedure is unacceptable. It can only be used in a small minority of marginal groups in the ichnological field. On the contrary, all traces should be named according to the same principles. The borings of bryozoans cannot be confused with the mould of a body; they are conceptually »the work of an animal« and must be named as such.

This group should not represent a problem area. On the contrary, the two sets of names should compliment each other here better than elsewhere in the zoological-ichnological field.

For example, it appears likely that in recent seas the boring *Iramena* BOEKSCHOTEN 1970 is the sole work of the bryozoan *Penetrantia* SILÉN 1946.

3. The pouch-boring series

A large series of borings and embedment structures is represented by single-entrance cavities with a variety of shapes. One group of these, the borings of acrothoracican cirripeds, has highly individual morphological features which clearly separate this group from the remainder.

The remainder of the pouch-borings has, as a series, several characteristic end-members: e. g., flask-shaped borings of bivalves and U-shaped borings of polychaetes. But these merge into the »grey area« of poorly differentiated pouch-borings, the work of many different groups of animals (BROMLEY 1970, p. 82, fig. 4) but most of obscure origin. The morphology of these forms is such that they can all be grouped together in one ichnogenus. A trivial name can be added in those cases which possess special morphological features.

4. Naming pouch-borings

Several forms of this series have already received ichnogenus names, but in most cases these are based on characteristics more suitable for ichnospecific subdivision, with the result that each ichnogenus has but one ichnospecies. Some of these names refer directly to a particular originating organism even where good evidence for this is lacking.

Teredolites LEYMERIE 1842, p. 2, pl. 2, fig. 4—5. Borings in wood of Cretaceous age. Sack-like, expanding from a subcircular mouth, they are probably the work of bivalves, but bear little resemblance to borings of teredinids.

Gastrochaenolites LEYMERIE 1842, p. 3, pl. 3, fig. 1. Cretaceous borings in wood with regular flask shape and containing shells of bivalves referred to *Gastrochaena*.

Martesites VITÁLIS 1961, p. 124, pl. 1—2. Borings in Miocene wood, similar in form to *Teredolites*, but with heavy »foreign sculpture« (VOIGT 1971) from the grain of the wood (mistaken for drilling sculpture by VITÁLIS). Name reflects

attribution to *Martesia* by ABEL (1935, p. 484, fig. 408) but no shells are preserved.

These names are unsuitable for embracing all one-entrance borings. Each is applied to a highly characteristic end-member of the series and the names themselves connote a particular borer, which is misleading. The earliest available name without such connotation is *Trypanites* MÄGDEFRAU 1932. The original definition of this ichnogenus needs little adjustment in order to satisfy the requirements of a much broader usage. This has previously been suggested by GLAZEK, MARCINOWSKI & WIERZBOWSKI (1971, p. 439).

Two ichnospecies which also should be transferred to *Trypanites* cannot be included in the following synonymy list since they have received no ichnogeneric name. These are: *Polydora biforans* GRIPP 1967 and *Dodecaceria cretacea* VOIGT 1971.

5. Redefinition of *Trypanites*

Ichnogenus *Trypanites* MÄGDEFRAU 1932, p. 151

Teredolites LEYMERIE 1842, p. 2, pl. 2, fig. 4—5.

Gastrochaenolites LEYMERIE 1842, p. 3, pl. 3, fig. 1.

Trypanites MÄGDEFRAU 1932, p. 151.

Nygmites MÄGDEFRAU 1937, p. 56.

Specus STEPHENSON 1952, p. 51, pl. 8, fig. 4—6.

Martesites VITÁLIS 1961, p. 124, pl. 1—2.

Vermiforichnus CAMERON 1967, p. 190, fig. 1—2.

Conchifora G. MÜLLER 1968, p. 68, fig. 3—7 (pars).

Type ichnospecies: *T. weisei* MÄGDEFRAU 1932.

Diagnosis: Simple, unbranched borings in hard substrate with a single opening to the surface.

Discussion: Pouch-borings excluding those of acrothoracican cirripeds. From the single entrance the boring may extend as a subspherical crypt, a flask-shaped or conical cavity, as a long cylindrical tube or a flattened U-shaped chamber with figure-of-eight entrance, etc. Borings in all substrates are included (rock, shell, wood) (text-fig. 1). No age restriction.

Trypanites weisei MÄGDEFRAU 1932, p. 152

Diagnosis: More or less straight and vertical *Trypanites* penetrating hardened sediments and echinoderm and mollusc skeletons. Diameter ca. 1 mm and reaching over 4 cm in length.

Discussion: MÄGDEFRAU (1932) describes this form clearly and his original definition of the ichnogenus is now restricted to the ichnospecies. Any doubt that it is a true boring was removed by A. H. MÜLLER (1956, p. 409, fig. 2) who described it penetrating echinoderm and mollusc skeletons on and in the hardened sediment. Originally described from hardgrounds in the German Muschelkalk (Middle Triassic).

6. Redescription of *Talpina solitaria* HAGENOW 1840

It is considered worthwhile also to redescribe here another boring close to *Trypanites weisei* and common in Cretaceous shell substrates.

Trypanites solitarius (HAGENOW)

Talpina solitaria HAGENOW 1840, p. 671.

Talpina solitaria QUENSTEDT 1849, p. 470, pl. 30, fig. 37.

Nygmites solitarius MÄGDEFRAU 1937, p. 56.

Diagnosis: Simple, more or less cylindrical *Trypanites* with straight or gently curving course generally following close beneath the substrate surface. Diameter ca. 1 mm, length up to ca. 3 cm.

Discussion: The name has so far only been used for borings in Cretaceous shells. The original description restricted its substrate to belemnites but KENNEDY (1970, pl. 5) illustrated an example in echinoid calcite. In belemnites, the tendency to run just beneath the substrate surface in a somewhat spiral fashion was noted by QUENSTEDT (1849, p. 470).

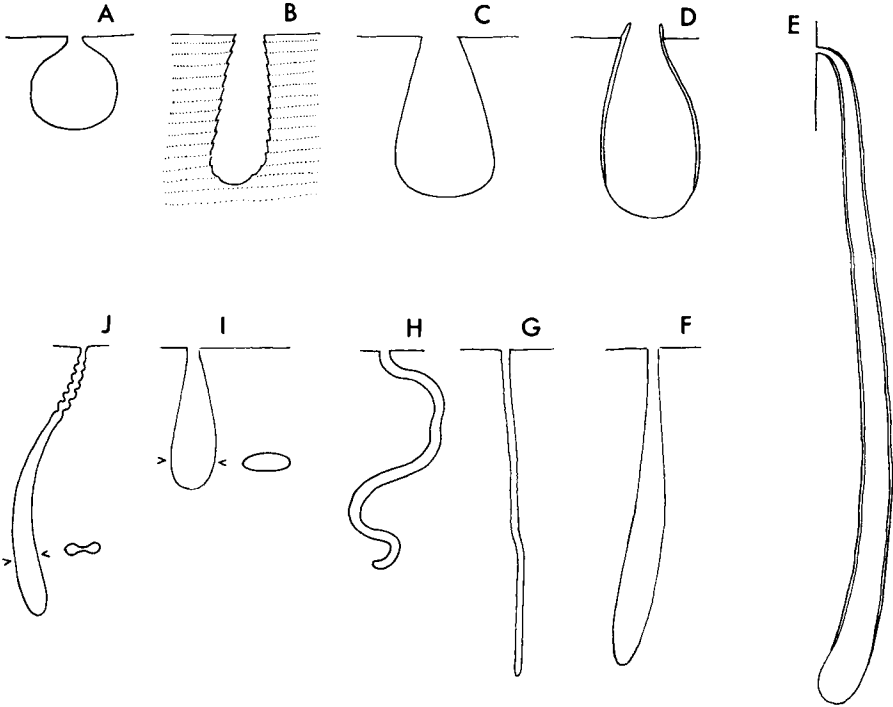


Fig. 1. Schematic longitudinal sections of a range of forms of *Trypanites*. A: Sub-spherical boring of bivalve. B: *T. vadaszi* (VITÁLIS). Boring of bivalve in wood with »foreign sculpture« from the grain of the substrate. C, D: *T. clavatus* (LEYMERIE). Flask shaped borings of bivalves with and without calcareous lining. E: Boring of teredinid bivalve (in wood) with calcareous lining. F: Common form, generally the work of sipunculids or annelids. G: *T. weisei* MÄGDEFRAU and H: *T. solitarius* (HAGENOW). Borings of sipunculids, phoronids or annelids. I: *T. cretacea* (VOIGT) and J: *T. biforans* (GRIPP). Borings of polychaete annelids.

7. The boring *Lapispecus cuniculus* VOIGT 1970

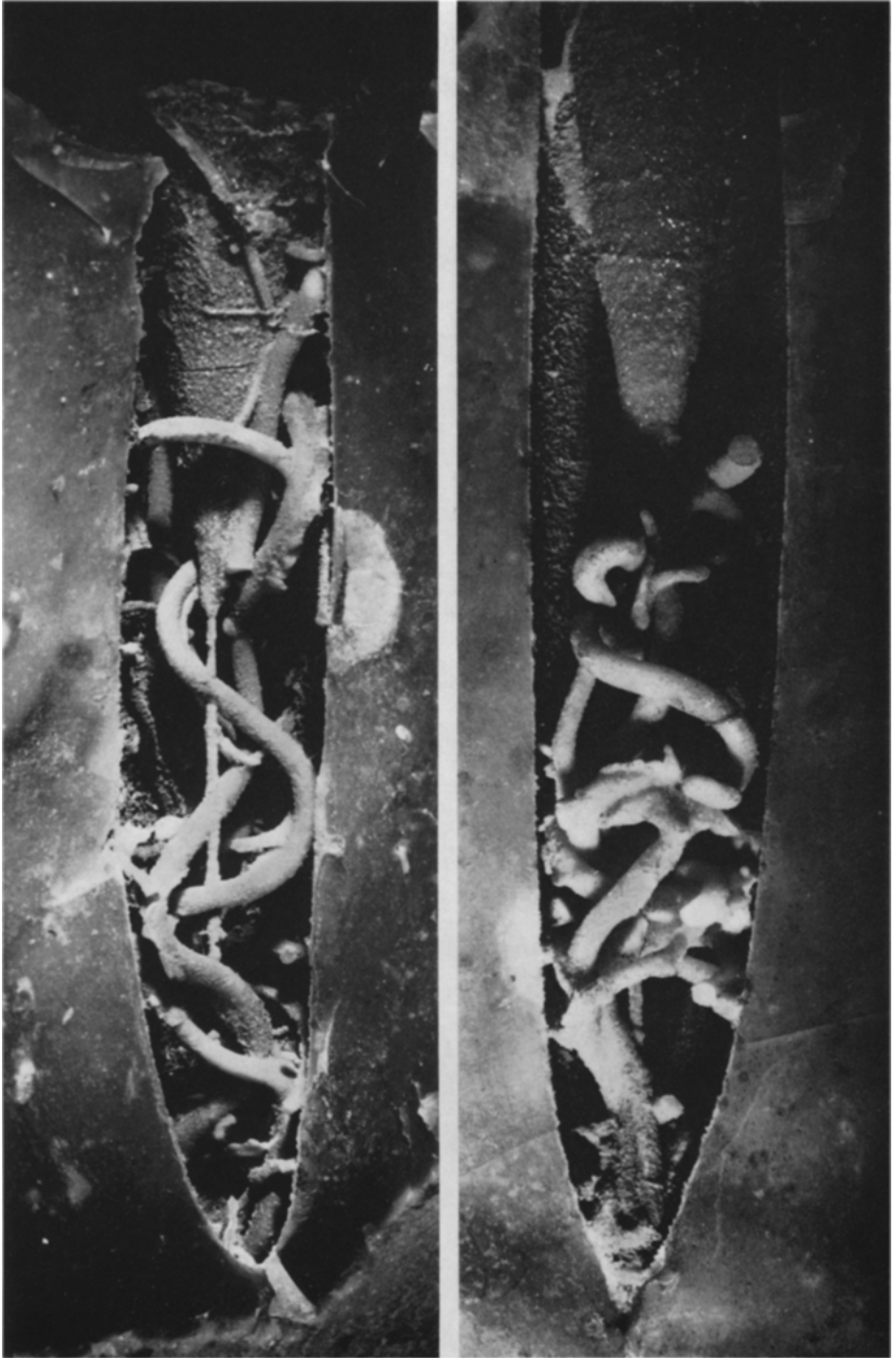
The ichnogenus *Lapispecus* is not included as a synonym of *Trypanites* on account of doubt expressed over the number of openings in this form (VOIGT 1970, p. 374). The chief diagnostic feature of its only ichnospecies *L. cuniculus* is a discontinuous fin-like extension which runs as a slit along the side, especially the concave side in bends, of the long, slender boring (Pl. 18). VOIGT (1970, p. 365) considered this structure to be organic and an integral part of the boring.

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Plate explanation**Plate 18**

Two belemnites preserved as natural casts in flint. In each the silicified fills of several *Lapispecus cuniculus* show a somewhat spiral arrangement within the substrate and have a diameter of 1.5 mm. The belemnite calcite has been silicified only along the axial line. At upper left a keel runs along the fill of each boring. Campanian, Norwich, England. Norwich Castle Museum collection, nos. 475.970 (2) and (3).



R. G. Bromley: Ichnotaxa in hard substrates