

# NEW CRETACEOUS SCOLECIFORM ANNELID FROM COLORADO

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**ABSTRACT**—*Polyupsilon coloradoense*, new genus, new species, a worm of the family Rhizocorallidae which formed U-in-U shaped burrows, is described from the Upper Cretaceous Dakota sandstone of Colorado. *Polyupsilon habichi* (Lisson), from the Upper Jurassic or Cretaceous Salto de Fraile formation of Peru, is a closely related species. Other genera of worms which formed U-shaped burrows are also discussed.

**E**VER since Proterozoic times various kinds of marine worms of the phylum Annelida have lived in burrows which they



made in the muds and sands of the sea-floor. Some of these worms lived in perpendicular burrows, others occupied burrows which they dug diagonally into the mud or sand, and a few made U-shaped homes for themselves which opened to the surface at both ends.

A few of the worms which made U-shaped burrows had the habit of digging one burrow after another as they, themselves grew longer, or as sediment accumulated above them, so that by the time that they were fully grown, or had lived for some time where sediment was accumulating, they had dug a series of curved burrows, one below the other, but all opening to the surface through the two apertures of the original burrow so that the U's were all of the same width, so that these burrows, all together, formed a U-in-U structure that is easily recognized when preserved in consolidated sandstones or shales if the rocks are broken perpendicular to the bedding so that the burrows can be seen from the side. Such burrows are usually found only in sandstones or sandy shales.

The oldest of these U-in-U burrows with the U's all of the same width and reaching

the surface via the same two apertures that have been found by paleontologists occur in Lower Cambrian rocks in Sweden and Maryland (Westergard, 1931, and Howell, 1945). Others have been described from Devonian, Triassic, and Upper Cretaceous formations of Europe (Richter, 1924; Richter, 1926) and from a Mesozoic (either Upper Jurassic or Cretaceous) formation in Peru (Lisson, 1904; pp. 40, 41, text-fig. 21).

Of these burrows the Lower Cambrian species have been placed in the genus *Diplocraterion*, the two Devonian species have been assigned to the genus *Rhizocorallium*, the two Triassic species have been placed in two genera, *Rhizocorallium* and *Arenicoloides* (one of the species, *uniformis*, the species used by Blanckenhorn as the genotype of this genus, was later placed by Richter in *Corophioides*), and the Jurassic or Cretaceous species from Peru was referred to the genus *Tigillites*. The Upper Cretaceous species from Europe, *cretaceum*, was referred by its describer, Andrée (1926, p. 125), to *Diplocraterion*.

The reference of all the Lower Cambrian species to *Diplocraterion* is probably correct (the genus was originally proposed by Torell for two Lower Cambrian species, *parallelum* and *lyelli*), and the Triassic species of *Rhizocorallium*, *R. jenense* Zenker, is the genotype of that genus. But it is probable that the Devonian species *balticum* and *devonicum* (Andrée, 1926; and Kraus, 1930), that have been referred to *Rhizocorallium* were wrongly assigned to that genus, for it is not likely that a Triassic genus ranged back in time as far as the Devonian, and the Devonian species probably should have a new genus for



their reception. Some of these Triassic and Devonian species were figured and discussed by Abel in 1935 (Abel, 1935; pp. 448-456, text-figs. 373-381). The Peruvian Jurassic or Cretaceous species, *habichi*, was certainly wrongly assigned by its describer, Lisson, to *Tigillites*, which is a genus that was originally described from the Ordovician of France (Rouault, 1805, pp. 740, 741) and whose burrows were straight or gently curved, and not U-shaped. This Peruvian genus is discussed on a later page of the present paper. The Upper Cretaceous species, *cretaceum* is also believed to have been wrongly referred by Andrée to *Diplocraterion*, for it seems hardly possible that a genus could have lived from Early Cambrian times until Late Cretaceous days; but Andrée's description of *cretaceum* is very brief, and is not accompanied by a figure, so the writer can say no more about the affinities of that species than that it may be referable to the same genus as the Peruvian burrows, since Andrée placed it in *Diplocraterion*, which formed U-in-U burrows, although the U's were wider than in the Peruvian form.

Another Cretaceous worm burrow has been described by Hosius (1893, p. 53) from Germany as *Rhizocorallium hohendahl*; but this species does not belong in the genus *Rhizocorallium*. And the Polish Miocene fossil, *Glossofungites saxicava* (Lomnicki, 1886, p. 99), which Prell (1926, p. 389) and Andrée (1926, p. 126) considered to be a related species of worm, has been referred by Abel (1935, p. 450) to *Rhizocorallium*. It and the related species that was called *Rhizocorallium saportai* (Dewalque) by Abel (1935, p. 450), belong in the genus *Lissonites* Douvillé (1907, p. 367).

A British Jurassic worm burrow, described by Bather (1925, pp. 14-16) as *Arenicolites stratheri*, is U-shaped and at first sight appears to have a U-in-U structure; but Bather has

pointed out the fact that this appearance is not due to its being made up of a series of U-shaped burrows, one below the other, but results from the fact that the worm which made the burrow, when it died or migrated, left a cavity at the base of the burrow so that the laminated layers of the overlying sand within the upright branches of the burrow sagged and the laminae took on a U-shape which gave the whole fossil a U-in-U appearance. Bather (1924) also discussed U-shaped burrow, *Tisoo siphonalis* Marcel de Serres, from the Jurassic of France; but this was not a U-in-U-shaped burrow.

The Scottish fossil that was originally described (Smith, 1893) as *Corophioides polyupsilon* has sometimes been considered to be congeneric with *Diplocraterion* and to be therefore, of the same nature as the U-in-U burrows here discussed. It is, however, different from them in that, while it consists of a series of U-shaped burrows, one below the other, these burrows do not all unite at their upper ends and have only two common apertures, but each burrow forms a wider U than the burrow overlying it and each burrow therefore has its own apertures, the apertures of the lower, wider, burrows being distant from each other than are the apertures of the upper, narrower, burrows.

Thus, whatever the genera to which they should be referred, there have been formed in rocks ranging in age from Early Cambrian to Late Jurassic or Cretaceous, worm burrows having the U-in-U structure which resulted from the worm's having, during its growth, repeatedly lengthened (or perhaps shifted upward) its U-shaped burrow without widening its curve or changing the location of its two apertures. The writer has now to describe a new Late Cretaceous species of this kind from the Dakota sandstone of Colorado.

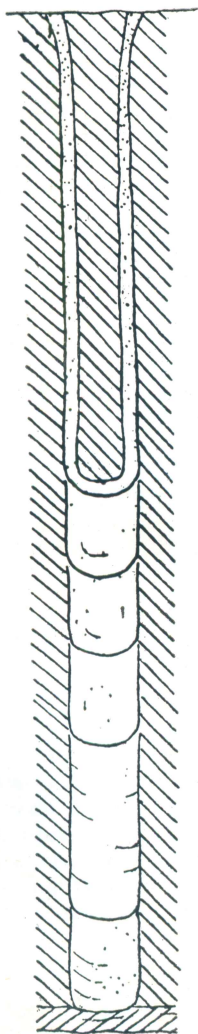
#### EXPLANATION OF PLATE 16

All figures are natural size

FIG. 1.—*Polyupsilon habichi* (Lisson). Lisson's figure of the burrow of this species, from Lisson, 1904, p. 41, text-figure 21.

2.—*Polyupsilon coloradoense*, new species. Holotype burrow (at left) and paratype burrows. Princeton Univ. no. 59556.

3.—*Polyupsilon coloradoense*, new species. Paratype burrows. Princeton Univ. no. 59556,



*Tigillites Habichi* n. s.

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Phylum ANNELIDA  
 Subclass POLYCHAETA  
 Order SCOLECIFORMIA  
 Family RHIZOCORALLIDAE  
 Genus POLYUPSILON, new genus

Marine worms which made U-shaped burrows of small diameter, but great depth, that were lengthened during the lifetime of the worm so that, while the two apertures of the burrow remained unchanged, the burrow was repeatedly lengthened and is preserved as a series of U's, arranged, one above another, with their lower, curved, portions distinct from and parallel with, each other and their upright arms forming two continuous, long, parallel, burrows which stand vertical to the bedding of the sediments in which they were dug. The genotype is *Tigillites habichi* Lisson'. The genus differs from the Triassic genus, *Corphioides*, in having much smaller burrows, which are longer in proportion to their width, and in lacking a membrane between their upright arms.

POLYUPSILON COLORADOENSE, new species

Plate 16, figures 2-3

The upright arms of the burrows are from 1 to 3 mm. in diameter and from 5 to 10 mm. apart. They are usually a little farther apart at the upper end of the U than they are at the lower end, but they are always straight. The longest burrows seen were about four inches long. No burrows with funnel-shaped apertures were found, nor have any traces of connecting films between the arms of the burrows been seen, such as are sometimes present in other genera of the Rhizocorallidae. The intersections of the arms of the burrows with the weathered bedding surfaces of the sandstone in which the burrows are preserved are in each case a pair of circular apertures without any connection between them at the surface. There are in our fossils no traces of the dumbbell-shaped impressions on the weathered bedding surfaces of the sandstone such as are characteristic of some other genera of the Rhizocorallidae.

The curved portions of the burrows form approximate semi-circles and lie from 5 mm. to 10 mm. apart, one above the other. They have the same diameter as the upright arms of the burrows. There is no evidence

that the sand between them has slumped. The curved portions of the burrows, as well as the upright arms, are filled with sand grains that are darker in color than, but of the same size as, the grains of which the surrounding sandstone matrix is composed. During the lifetime of the worms and for a short time after the burrows had been permanently abandoned and were being filled with sand from above by way of their apertures, there would seem to have been a membrane of some kind that held the well of the burrows in the position until the empty burrows were filled with sand, for the sand filling the burrows still forms a distinct cylindrical unit which breaks away easily from the surrounding matrix.

*Location of types.*—The holotype, and a number of paratype burrows are all in a single block of sandstone, that is, No. 59556 in the paleontological collection of Princeton University.

*Horizon and locality.*—Fine grained brown sandstone of the upper part of the Cretaceous Dakota formation, 20 feet below the base of the Graneros shale, in a bluff on the western side of Turkey Creek Canyon, in the southwestern corner of the northwestern quarter of the southeastern quarter of Section 36, Township 18 South, Range 67 West, Pueblo County, Colorado.

#### DISCUSSION

*Polyupsilon coloradoense* probably lived in the bottom sands of a shallow, near shore (possibly littoral) portion of the sea that covered part of Colorado in late Dakota time. Its burrows are abundant in the bed from which the type specimens were collected. It closely resembles in the shape and size of its burrows the worm which was described from the Upper Jurassic or Cretaceous of Peru by Lisson (1904, pp. 40, 41, text-fig. 21) as *Tigillites habchi* (pl. 16, fig. 1). As noted on an earlier page, this Peruvian worm can not, however, be referable to *Tigillites*, which is an Ordovician worm that made straight, not U-shaped, burrows (Roualt, 1850, p. 740, 741; Douvillé, 1907, p. 362), and it is believed to be rightly considered to be the genotype of a genus of its own.

The age of the sandstone near Chorillos, south of Lima, Peru, in which *Polyupsilon*



*habichi* occurs, has been in doubt. Bather (1910) states that, while Lisson thought these beds to be Cretaceous, but later than Neocomian, in age, Crick and Gabb considered them to be more probably Late Jurassic (Kimmeridgian or Corallian). Steinmann (1929, p. 92) considered them to be Lower Neocomian (Lower Cretaceous). They are thus somewhat older than the beds in which *Polyupsilon coloradoense* occurs. They are now known as the Salto de Fraile formation (Rivera, 1951, p. 10).

Certainly our Colorado burrows are very similar to the burrows of *Polyupsilon habichi*. They differ from the Peruvian burrows only in having usually shifted the lower end of the burrow a shorter distance when a new burrow was made, and in having the apertural ends of the arms of the burrow straight, instead of somewhat curved away from each other. If it were not for the great geographic distance from each other of the localities where they were found and the difference in age of the beds in which they occur we would be tempted to consider the Peruvian and Colorado burrows as all referable to a single species. With the evidence now available, however, it seems best to give the Colorado burrows a distinct specific name.

Since the genus *Polyupsilon* has now been found in rocks of later Mesozoic age in both South America and North America, it may well have lived in other parts of the world in the latter half of the Mesozoic era. As it has always been found up to now in sandstones, a search of marine sandstone of this age may well disclose its presence in regions where it has been overlooked in the past.

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