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Preliminary Report on the Occurrence of *Angustidontus* in Nevada and Utah

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Preliminary Report on the Occurrence of Angustidontus in Nevada and Utah

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Introduction

From time to time over the past 20 years, jaw-like fossils from the Great Basin have been sent to U.S. Geological Survey paleontologists for identification and possible age determination. In early reports, they were generally considered to belong to the eurypterid genus Pterygotus Agassiz, 1839, but as more collections accumulated, it became apparent that they were more properly assigned to Angustidontus Cooper, 1936, a genus of uncertain affinities. Briggs (1979, p. 658-659), citing in part information provided by Berdan, noted that Angustidontus was apparently attached at the proximal end by a "ball and socket" joint; the specimens on which this observation was based are here illustrated by tracings. Although these specimens do not provide definitive data as to the type of animal to which Angustidontus was attached, they do suggest that certain groups are unlikely. As these fossils are relatively common in certain lithologies and at certain horizons, it seems desirable to review what is known about them to date. The following notes are based on six collections from Nevada and one from Utah, which have been dated as Late Silurian to Late Devonian on the basis of other associated fossils.

List of Localities

USGS 4981-SD. Woodruff Formation. SW 1/4, SW 1/4, NW 1/4 sec. 30, T.32N., R.53E, Carlin quadrangle, Elko Co., Nevada. About 10 specimens, associated with goniatites cf. Platyclymenia (Pleuroclymenia) americana (Raymond) and ostracodes Richterina (Richterina) sp. J. F. Smith, Jr. and K. B. Ketner colln. 58-RJ-38.

USGS 4982-SD. Woodruff Formation. Middle W. edge of sec. 30, T.32N, R.53E., Carlin quadrangle, Elko Co., Nevada. 6 specimens, associated with goniatites cf. Platyclymenia (Pleuroclymenia) polypleura (Raymond). All goniatites identified by Mackenzie Gordon, Jr. K. B. Ketner colln. 506.

USGS 4983-SD. Woodruff Formation. NE 1/4 sec. 33, T.32 N., R.52E., Carlin quadrangle, Elko Co., Nevada. More than 12 specimens, associated with arthropod fragments. K. B. Ketner colln. 510.

USGS D187-SD. Formation undetermined. Alt. 5920 ft., unsurveyed land 1400 ft. S., 800 ft. W. of SE corner, sec. 6, T.25N., R.50E., Horse Creek Valley quadrangle, Eureka Co., Nevada. One specimen, associated with 2 fragmentary monograptids identified by W. B. N. Berry and considered by him to be Upper Silurian. H. Masursky colln. HF-179, 1961.

USGS 7249-SD. Pilot Shale (?). N 1/2 sec. 8(?), T.10N., R.51E. exactly 18,800 ft. N.2 3/4°W. from Morey Mine, Hot Creek Range, Tonopah 1:250,000 sheet, Nye County, Nevada. 3 specimens. F. J. Kleinhampl colln. 15310-F17. 1961.

USGS 8398-SD. Pilot Shale. 3.3 mi. N of southern boundary of T.10N., R.51E., and 1.0 mi. E. of the western boundary of T.10N., R.51E., Hot Creek Range, Morey Peak quadrangle, Nye Co., Nevada. 18 specimens, associated with arthropod fragments. H. W. Dodge, Jr. colln. MP-69-HWD-156., 1969.

USGS 10667-SD. Pilot Shale. Bishop Spring anticline, Confusion Range, sec. 8, T.16S., R.17W., Gandy NE 7 1/2 minute quadrangle, Millard Co., Utah. 8 specimens. R. K. Hose colln., 1978.

Description of material

In most instances the fossils are preserved as impressions in organic black shale or fine-grained siliceous siltstone that weathers to a light tan or buff color. The specimens here identified as Angustidontus (Fig. 1) are long bars (rami) terminating at one end (distal) in a large, curved tooth, and at the other end (proximal) in rounded knobs that appear to represent an articulating surface. Teeth of at least three sizes are arranged along one side of the bar, and are more numerous and larger distally. There are indications that the teeth were hollow, although usually found compressed. Some of the smaller teeth on some specimens appear to be attached to the ramus by a joint, but the first order teeth seem to be an integral part of the ramus. One specimen in USGS colln. 4982-SD is twisted on itself in such a way as to suggest that the rami either were not originally composed of a very hard material, or that they were decalcified before burial. In one collection (USGS colln. 4981-SD) some traces of a black, shiny organic material are present.

Discussion

In North America, similar fossils have been described from Upper Devonian and Lower Mississippian rocks in the western United States and Canada and from as far east as Ohio. Ruedemann (1935, p. 72) described a form which he named Pterygotus (Curviramus) montanensis from the Upper Devonian Three forks Shale at Three Forks, Montana. The subgenus Curviramus has since been put in synonymy with Pterygotus by Størmer (1955, p. P30) but P. (Curviramus) montanensis is almost certainly an Angustidontus. A year later Cooper (1936, p. 92-94) described the new family Angustidontidae and the genus Angustidontus for fossils which he considered to be the jaws of actinopterygian fish from the Woodford Formation in Oklahoma, the Cleveland and Sunbury Shales in Ohio, and the Ohio Shale and Linietta Clay in Kentucky. His specimens were found associated with conodonts, paleoniscid fish scales, and phyllocarid crustaceans. According to Copeland and Bolton (1960), Raasch (1956, p. 113) "was the first to point out the supposed eurypterid affinity of the Angustidontidae". He suggested that Angustidontus might belong in the synonymy of Pterygotus. Subsequently, Harker and Raasch (1958) used "Angustidontus" seriatus Cooper as a zone marker for the base of their Banffian series. The associated fossils were listed as "Sporangites" huronensis Dawson, Asmussia sp., Spathiocaris sp., eurypterid and ganoid remains. Copeland and Bolton (1960, p. 35-38) have reviewed the literature on the Angustidontidae, and expressed doubt that "specimens of this genus can be assigned as Eurypterida without more definite proof than is presently available." They suggested that Angustidontus may represent "denticulate structures of otherwise non-preserved organisms (i.e. gill rakers of fishes, or raptorial claws similar to those on the second maxilliped of the stomatopod Squilla". They also proposed a dental formula for distinguishing species by indicating the number and rank of smaller teeth between the larger teeth, and described a new species, Angustidontus weihmannae Copeland and Bolton, 1960, from the Upper Devonian Ireton Formation of Alberta. In addition to the North American occurrences of Angustidontus, Chlupáč (1978) has described a species of the genus, A. moravicus Chlupáč, 1978, from the Upper Devonian (Famennian) Ponikev Formation of Czechoslovakia, and has noted that Jux and Krath (1974) reported angustidontids from the Famennian Nehden-Stufe of the Rheinisches Schiefergebirge.

Affinities

In late 1955, Walter Youngquist of the University of Kansas sent D. H. Dunkle of the U.S. National Museum of Natural History some specimens from the Upper Devonian to Lower Mississippian Pilot shale of eastern Nevada which were supposed to be actinopterygian jaws. Dr. Dunkel has kindly allowed me to see the correspondence which ensued. Dr. Dunkle compared the material from the Pilot with specimens collected by Wilbert Hass from the Woodford Chert, from which the type species of _Angustidontus_, _A. seriatus_ Cooper, 1936, was described. Dunkle sectioned the latter, but was unable to find any indication of typical vertebrate bone histiology, and x-ray diffracton tests failed to show the diffraction pattern of apatite, which is characteristic for vertebrate remains. Although negative evidence, this work suggests that _Angustidontus_ is not a vertebrate but an arthropod.

The occurrence of specimens of _Angustidontus_ which show the proximal end of the ramus articulated with a straight, non-spinose segment (Briggs, 1979, p. 658-659) also argue against a vertebrate relationship for these structures. It appears most likely that they are the remains of arthropods; however, it is by no means certain that they can be assigned unequivocally to the Eurypterida. Kjellesvig-Waering (1964, p. 333-334) considered that the resemblance of _Angustidontus_ to eurypterid structures was only superficial, and the late Dr. Leif Størmer (oral commun, 5/12/66), after examining these specimens concluded that they were not eurypterids but were of uncertain affinity, possibly decapod crustaceans. Most authors who have considered these fossils as eurypterid have assigned them to the family Pterygotidae, because that is the only one with conspicuous chelae. However, the Pterygotidae are also characterized by distinct, semilunar scales on the integument, and although impressions of integument have been found associated with _Angustidontus_ and may have came off the same animal, none of the pieces shows the characteristic scales. Furthermore, the chelicerae of eurypterids are composed of three segments, the third of which forms an opposing movable finger and the second forms the other side of the pincers. The specimens (fig. 2) from USGS colln. 4982-SD show that the ramus of _Angustidontus_ was articulated with a simple straight segment rather than a claw. Chlupáč (1978, p. 240) noted that raptorial clasping organs were developed in other arthropods, including eurypterids--such as the Mixopteridae and Megalograptidae, but in these families the denticles are born on several segments rather than on one long segment.

As yet the biologic affinities of the rami known as _Angustidontus_ are poorly understood, and will probably remain so until more of the animal is found. The consensus of recent students of the family Angustidontidae is that the rami represent raptorial appendages of arthropods rather than vertebrate jaws, and that the arthropod was probably not a eurypterid. It should be noted that the types of Cooper's species _Angustidontus seriatus_, the type species, have not yet been restudied.

Age

Although in most reports of _Angustidontus_ the beds from which it has been obtained are dated by other fossils as Upper Devonian or lower Mississippian, one collection (USGS colln. D187-SD) yielded one specimen reported to be associated with fragmentary monograptids considered by W. B. N. Berry to be Upper Silurian. The presumed Silurian specimen is shown in figure 1, USGS colln. D187-SD, for comparison with known uppper Devonian specimens from USGS colln. 4981-SD, and, as may be seen, there are more obvious differences between the Devonian specimens from the same collection than there are between one from the Devonian and the Silurian individual. Should the Silurian age of this specimen be confirmed by additional collecting, it would appear that Angustidontus alone is of little value for age determination. However, in view of the complicated and tectonically shingled structure of the Western Assemblage rocks in which Angustidontus is found, it seems highly probable that the presumed Silurian specimens from the Horse Creek Valley quadrangle did not actually occur with the monograptid identified by Berry. Unless unequivocal evidence of fossils of an older age occurring with Angustidontus is found, it is probably safe to assume that the range of this taxon is Late Devonian to early Mississippian.

Paleoecology

Upper Devonian specimens of Augustidontus from the Woodruff Formation occur with goniatites cf. Platyclymenia (Pleuroclymenia), poorly preserved pelecypods, rare tentaculitids and sponges, and entomozooid ostracodes identified as Richterina (Richterina) sp. Chlupáč (1978, p. 235) reported that his specimens of Angustidontus occurred with abundant conodonts, scarce inarticulate brachiopods, isolated fish scales, poorly preserved nautiloid remains and sporadic cyrtosymbolid trilobites in light brown to yellowish, bleached and leached shales, the angustidontids being in somewhat darker beds than the rest of the fauna. Chlupáč (1978, p. 240) concluded that the beds containing Angustodontus were deposited off-shore in a quiet, oxygen-deficient bottom environment not suitable for the development of a true benthic fauna. As described by Smith and Ketner (1975), the Woodruff Formation includes many lithologies, but the parts containing Angustidontus are grey shale and mudstone, tan weathering dolomitic siltstone, and black pencil shale, somewhat like the lithology of the Ponikev Formation discussed by Chlupac. The preservation of the other fossils in the angustidontid-bearing beds suggests that they may have been decalcified before or shortly after burial, as many of the pelecypods appear wrinkled and somewhat distorted. Although Smith and Kettner (1975, p. A31, fig. 7) figured two specimens of Angustidontus from the Woodruff, they did not discuss the possible environment of deposition. However, the general aspect of the fauna associated with Angustidontus in the Woodruff, and in particular the occurrence of the entomozooid ostracodes, suggests that the environment of deposition was anoxic, quiet, and possibly fairly deep water. In Europe, entomozooids are considered indicative of deeper water and are thought to be pelagic (Becker, 1977; Gooday and Becker, 1979).

Summary

The presence of two specimens of Angustidontus from the Upper Devonian Woodruff Formation of Nevada which show the proximal end of the ramus articulated with a non-denticulate segment suggests that these widely distributed but ambiguous fossils are not parts of fish, and are probably not chelae of eurypterids. They are most likely parts of an as yet undetermined arthropod. Although one collection with Angustidontus was reported to contain a Silurian graptolite, there is some doubt that the graptolite was actually associated with the specimen of Angustidontus, as other reported occurrence of this taxon from less tectonically disturbed areas are all from formations dated by other fossils as Late Devonian (Famennian) or early Carboniferous. The preservation of Angustidontus and the associated fossils suggests that the environment of deposition was anoxic, quiet water, and possibly quite deep.

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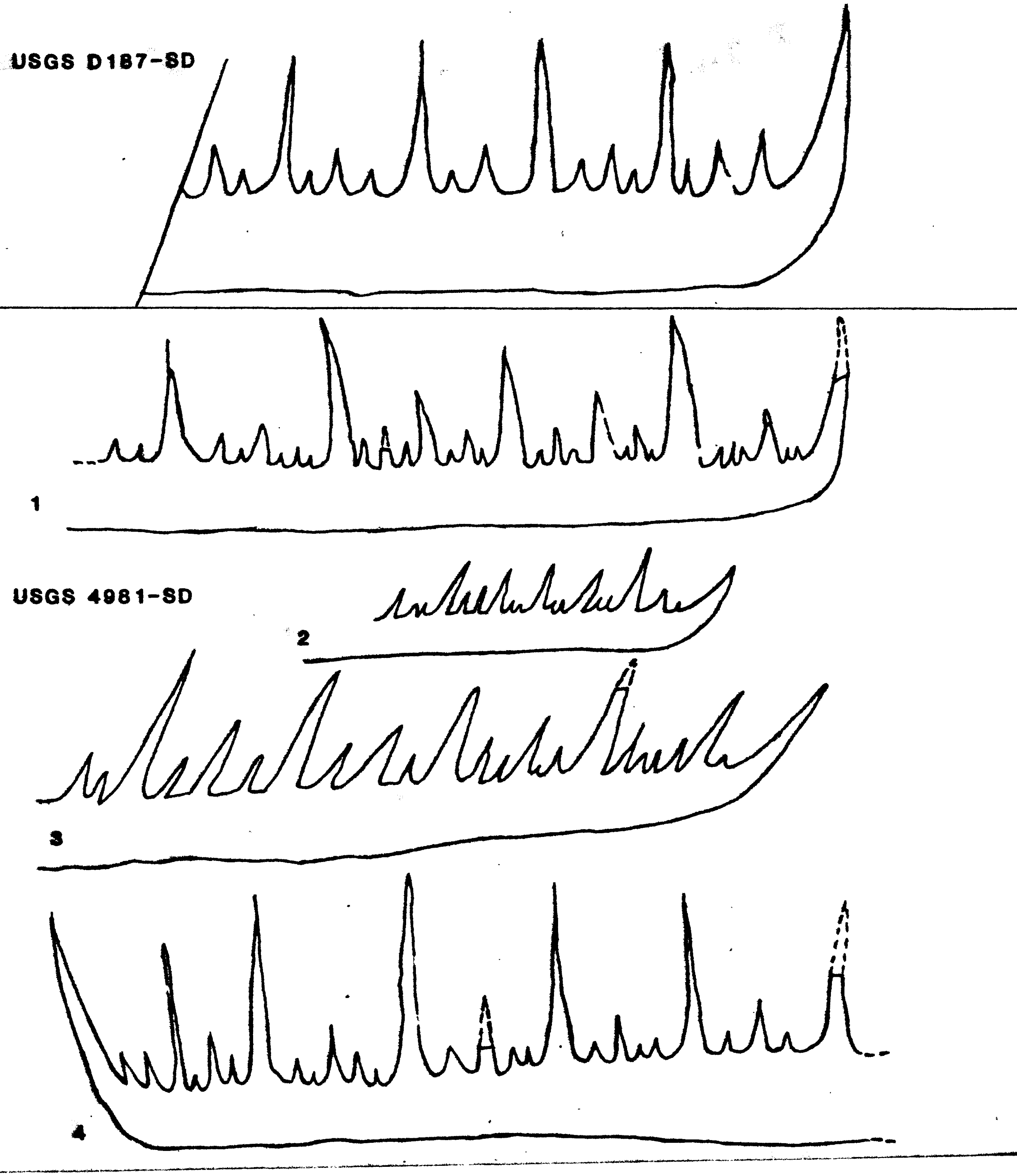

Figure 1. Angustidontus rami from Nevada, x 10, showing similarity between specimen from USGS colln. D187-SD, possibly Silurian, and specimens from USGS colln. 4981-SD, from the Late Devonian Woodruff Formation.

USGS 4982-SD

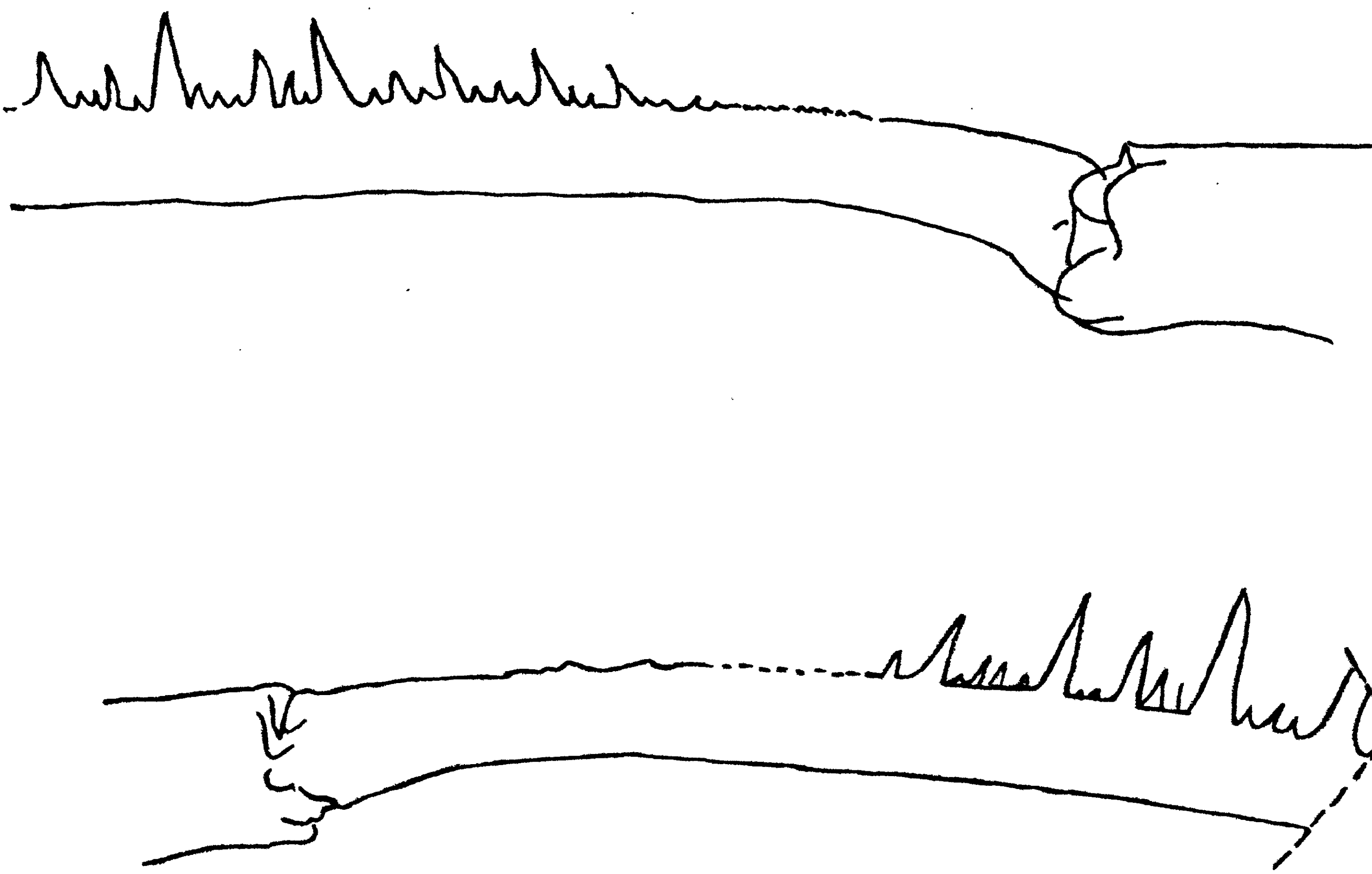

Figure 2. Proximal ends of two <u>Angustidontus</u> rami, x 10, from USGS colln. 4982-SD from the Late Devonian Woodruff Formation, showing apparent "ball and socket" articulation with straight non-denticulate segment.