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## Notes on the Occurrence of Conodonts in Iowa

WALTER YOUNGQUIST

**ABSTRACT**—Conodont faunas in Iowa have so far been described from only the Ordovician and Devonian. However, they are known to occur in the Mississippian and Pennsylvanian systems, and are also reported from the Silurian. A summary of the known stratigraphic and geographic occurrences of conodonts in Iowa is given, and the Lime Creek shale and the shales of the Mississippian are cited as having particularly worthwhile possibilities with regard to future conodont investigations.

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Though the study, or at least the collecting, of macro-fossils dates back to ancient man, it seems quite certain that both the collecting and study of the micro-fossils, conodonts, date back only to about 1856, the year when Pander published his monograph on "fossilien Fische" of the Baltic region and coined the term "conodont".

After Pander's work and until 1926, no very significant advances in the study of conodonts were made. However, Newberry (1875) recorded the discovery of conodonts in the United States, and Hinde (1879) and Bryant (1921) considerably enlarged the knowledge of American faunas. Ulrich and Bassler in 1926 brought out their classification of conodonts, illustrated two faunas, and provided the basis for present-day study. Holmes (1928) gives a bibliography of conodonts and conodont literature through 1926 and refigured many of Pander's, Hinde's, Smith's, and Haddings' types, as well as other specimens from literature relatively difficult for the average student to secure. This remains a very useful contribution, but it should be noted that the study is inclusive only through 1926, though the publication date is 1928. Hibbard's studies of 1927 and 1928 are therefore not included.

The chief contemporary students of conodonts are Branson and Mehl. Their University of Missouri Studies, volume 8, (1933 and 1934) contains descriptions and illustrations of Ordovician, Silurian, Devonian and Mississippian faunas as well as a restudy and reillustration of Hinde's types in the British Museum.

Methods of securing and studying conodonts deserve brief consideration. Branson and Mehl (1933, pp. 5-17) discuss at some length the "Geologic Occurrence", "Sedimentary Associations", "Segregation of Conodonts", etc. The use of heavy liquids such as tetrabromethane for a gravity separation of conodonts from calcite and quartz sand residues can be recommended for extensive studies involving large washed samples. From small samples, the conodonts can be most readily and quickly separated by merely picking out the specimens from the dried sample with a fine, wetted camel's hair brush under a binocular microscope.

Conodonts are best known from shales but indications are that shaly limestones which cannot be effectively reduced by washing

alone will also yield good faunas. Accordingly, mention should be made of the glacial acetic acid method of securing specimens. Branson and Mehl (1944, p. 236) describe it briefly, and W. H. Hass has verbally reported to the writer that he has secured excellent faunas by placing shaly limestones in glacial acetic acid and then adding water until solution of the limestone is indicated by effervescence. The carbonate material of the matrix is dissolved but the calcium phosphate of the conodonts remains intact. The writer has not used this technique for securing a whole assemblage, but can recommend it as a method of cleaning individual specimens which are not washed clean in the initial sample reduction.

Branson and Mehl state that "drawings of conodonts are not entirely satisfactory" and the writer concurs with their conclusion that photographs are the best method of illustrating these micro-fossils. Retouched photographs at magnifications of X25 to X40 have proved satisfactory. Finally, in regard to storing conodonts, particularly the types, it should be noted that micro-fossils are easily lost, for most cements (e. g., gum arabic and water) will dry excessively, become very brittle, and crack and crumble with age. The cement developed for foraminifera by J. J. Galloway has proved very useful and the formula is given herewith:

1 oz. gum arabic (powdered)  
2 oz. water (60 c. c.)  
40 drops glycerin  
100 drops carbolic acid

Dissolve the gum in water. Add glue and carbolic acid. Place in wide-mouthed bottle with paraffined cork. This glue is water soluble.

Eicher (1946) has recently reported conodonts from the Triassic of Egypt, and Gunnell (1932) stated that they have been found in the Mesozoic of Texas. However, Branson and Mehl (1946) evidence some doubt as to these occurrences, and at present conodonts are generally regarded as exclusively Paleozoic. They have not yet been reported from the Cambrian but have been recorded from strata which range in age from Lower Ordovician to Lower Permian. Ellison (1946, figs. 1, 2) indicates that conodonts are not known in Permian strata younger than the Wolfcamp. In Iowa, they have been recorded from the Lower Ordovician to the Upper Pennsylvanian.

*Ordovician:* Conodonts from the Prairie du Chien beds were described by Furnish in 1938. Although the great majority of his specimens came from Minnesota and Wisconsin, Furnish had some from the Oneota formation of Allamakee County, Iowa. It should be mentioned that the conodonts which Furnish described from the lower part of the Prairie du Chien constitute possibly the oldest fauna described up to the present time. Note should be made, however, of a recent paper by Irene Crespín (1943) illustrating some primitive conodonts from the Ordovician of Australia, which are strikingly similar to those of the Prairie du Chien and appear to represent a fauna which may rival Furnish's for the distinction of being the old-

est yet recorded. The lower Prairie du Chien assemblage appears to be somewhat older than that described from the Jefferson City formation by Branson and Mehl (1933).

Stauffer (1935) described and illustrated a large and varied collection of conodonts from the Glenwood shale in Minnesota. Apparently he did not figure any specimens from Iowa, but he stated (p. 157) that conodonts "have been found in nearly every outcrop of the Glenwood sampled, as far south as Spechts' Ferry, Iowa." The same year, Stauffer also recorded the presence of a prolific conodont fauna in the Decorah shale. His specimens came from both Iowa and Minnesota—in Iowa they were secured at Guttenberg, Spechts Ferry, and Decorah, and in the vicinity of Ion.

The Maquoketa formation in Iowa was sampled by the writer in company with Richard F. Peterson in 1946 at the type section along the Little Maquoketa River west of Dubuque. No conodonts were secured but the ostracodes which were described by Spivey (1939) were found to be remarkably abundant. A single conodont fragment, generically undeterminable, was noted by Stanley E. Harris of the Iowa Geological Survey while he was making routine examination of well samples. It came from the sample representing the interval 15 to 20 feet below the top of the Maquoketa in the well "DuPont No. 5" (Iowa Geological Survey well-log number) on the DuPont Company grounds near Clinton, Iowa.

*Silurian*: No conodonts have been described from the Silurian of Iowa. However, Ellis Scobey has orally informed the writer that he recalls seeing both scolecodonts and conodonts in washed residues from some of the shale partings in the dolomites of the Alexandrian series on which he published in 1938. Since very little is known about Silurian conodonts, either from this country or abroad, this report of the presence of conodonts in the Silurian of Iowa should merit special consideration.

*Devonian*: Insofar as the writer has been able to ascertain, the earliest Devonian conodonts known from Iowa are those reported from the Independence shale. In connection with studies of Devonian foraminifera, Cushman and Stainbrook (1943) have incidentally commented on the conodonts and other microfossils in that formation. They state (p. 74) regarding the Independence shale that "microfossils are especially abundant in the shale as nearly all outcrops yield many specimens . . . Ostracodes predominate, are well preserved, and occur in all localities. Conodonts, are less common but are secured from most outcrops. Foraminifera generally are rare. . . The number of foraminifera varies inversely with that of the conodonts. One locality affording conodonts by the hundred has as yet not given up a single foraminifer. Strata yielding many foraminifera have few conodonts."

In 1940 Stauffer described a number of conodonts from the Cedar Valley limestone in southern Minnesota. The writer has sampled shale partings in the Cedar Valley limestone in the quarry just north of Coralville, and also the exposures along both sides of the Iowa

River valley in the environs of Iowa City without success. However, T. R. Beveridge and the writer secured some conodonts from the quarry in Cedar Valley limestone about half a mile west of Solon just south of the road to Lake MacBride, that is, in approximately the NW $\frac{1}{4}$ NE $\frac{1}{4}$  sec. 26. T. 81 N., R. 6 W., Johnson County. The shale partings in the limestone about 5 to 8 feet above the floor of the west end of the quarry carry conodonts sparingly. *Icriodus postiflexus* Branson and Mehl and *Hindeodella* sp. have been identified from this locality.

Conodont faunas have been described from an Upper Devonian shale .4 miles west of Middle Amana, an Upper Devonian shale 1 $\frac{1}{2}$  miles northeast of North Liberty, the Sheffield formation in its type area, and the Sweetland Creek shale (type section, and vicinity) about 4 miles east of Muscatine, Iowa.

In addition, through the courtesy of John Carrier, formerly of the Iowa Geological Survey, the writer has seen a few conodonts from the Hackberry shale (Lime Creek) at Bird Hill, located in section 19 along the line between Floyd and Cerro Gordo Counties some 3 miles west and 1 mile south of Rockford.

Though the conodonts of the Devonian in Iowa are better known than those of any other system in the State, the exact relationships of these Devonian faunas, that is, those of the Sweetland Creek shale, Middle Amana beds, North Liberty beds, and Sheffield formation, remain to be demonstrated. Since the Lime Creek shale forms a rather extensive complex in Iowa both geographically and stratigraphically, it seems likely that a thorough study of that formation, as now recognized, would be more than ordinarily worthwhile. Inasmuch as conodonts are notably facies fossils, a study of the Lime Creek beds, well distributed both stratigraphically and geographically, probably would indicate several related but not identical conodont assemblages.

It should be noted in addition that micro-fossils other than conodonts are common in some parts of the Iowa Devonian. Searight (1924) has reported and illustrated scolecodonts which were found in great abundance in the Cedar Valley limestone in the vicinity of Iowa City. Since scolecodonts are chitinous they were secured from matrix with the aid of hydrochloric acid. Ostracodes are abundant at several horizons in the Devonian. The Lime Creek shale yields ostracodes as well as charophyte oogonia, and the presence of foraminifera (Thomas, 1931; Miller and Carmer, 1933) in that formation is noteworthy. The Sweetland Creek shale carries small structures presumed to be spores, in addition to the prolific conodont fauna and the associated forms that Stauffer (1935, 1940) has termed "egg cases?" and which may possibly be otoliths.

*Mississippian:* No conodont faunas have so far been described from the Mississippian of Iowa. Two studies are under way, however. Richard F. Peterson has secured and is now studying a collection of conodonts from the Maple Mill shale at several localities including the type section. Also, S. H. Patterson has assembled a large

and varied collection from the Prospect Hill formation. E. R. Branson (1934, p. 302) incidentally commented on an assemblage which apparently had been secured from the Mississippian of Iowa and stated that the "conodont fauna of the English River sandstone of Iowa, although lacking in many characteristic species, is distinctly that of the Hannibal." E. B. Branson and M. G. Mehl have reported conodonts from the Keokuk of Iowa and they state (1941, p. 180), regarding this occurrence that the "conodonts in our Keokuk collections that were obtained at and near the type locality in Iowa are too few to permit a satisfactory comparison with the much more abundant collections from several places in Missouri." Probably with reference to this same occurrence, E. B. Branson (1944, p. 240) has stated that conodonts "have been collected from near the type locality of the Keokuk in Iowa." In 1946, the writer, together with Bruce C. Heezen made a brief survey of, and secured shale samples from, the Keokuk, Warsaw, Spergen, St. Louis and Ste. Genevieve (Pella) beds in southeastern Iowa but found no conodonts. The Warsaw formation in Missouri has yielded some specimens, however, for Branson (1944, p. 246) lists the fauna of the Warsaw and adds in a concluding note that "conodonts have been found but the species have not been identified." The highly fossiliferous Pella beds (limestones and interbedded shales) which crop out in the small but well developed synclinal structure just west of Brush Creek and north of the bridge near the center of section 6, T. 70 N., R. 5 W., in Henry County, appeared particularly promising but no conodonts were secured. The occurrence of a few scolecodonts and a rather large ostracode fauna in these beds is worthy of note, however.

There are numerous shale stringers in the Burlington, Keokuk, and St. Louis limestones, and the Warsaw formation is chiefly shale. These can be easily washed and reduced. Almost certainly, good conodont faunas occur in Iowa in some if not all of these formations.

*Pennsylvanian:* In 1928, V. H. Jones (unpublished master's thesis, State Univ. Iowa) in a faunal list, stated that conodonts occur in the Deer Creek limestone member of the Shawnee formation (Missouri series) in southwestern Iowa. To date, no study of Pennsylvanian conodonts from Iowa has appeared. However, Mr. C. B. Campbell of Knoxville, Iowa, has called the writer's attention to the occurrence of specimens in the Pennsylvanian shales of the Des Moines series in Marion County. In the fall of 1946, together with Bruce C. Heezen and C. B. Campbell, the writer visited the Knoxville area and secured conodonts from two localities, both within two miles of Knoxville. At these places, conodonts can be seen with the aid of a hand lens in thin-bedded, black, somewhat slaty shale in association with abundant fish remains including shark spines. Also, an eight-inch bed of gray-green shale a few feet stratigraphically higher than the black shale was sampled, and reduced by washing. A well preserved but sparse conodont fauna was secured from it and these specimens, from two localities, are the subject of a short paper now in preparation. In addition, R. H. Downs has recently undertaken a study of

Pennsylvanian conodonts secured by C. B. Campbell early in the spring of 1947. These specimens come from a slightly higher horizon but are from essentially the same localities as the aforementioned fauna.

*Summary and conclusions:* Conodonts have so far been described from the Ordovician and Devonian of Iowa. Studies are now in progress on lower Mississippian and on Pennsylvanian faunas. In each system, however, only a few formations have been investigated and most of these only cursorily. Conodont faunas are definitely known to occur in, but have not been described from, the Ordovician Maquoketa formation, the Devonian Cedar Valley limestone and the Lime Creek shale, and the Keokuk formation of the Mississippian. Conodonts have also been reported from the Alexandrian series of the Silurian. This last occurrence is of particular interest, for conodonts are but poorly known from that system, and a Silurian fauna would be noteworthy not only for its own uniqueness but for the aid which it would be in bridging the gap between the well-known Ordovician assemblages and the even better known Devonian conodont faunas from Iowa as well as other areas.

Because the conodonts of the Devonian of Iowa are at present relatively better known than those of any other system in the State, it would appear that a thorough study of the conodonts of the Lime Creek shale would be of considerable value. Such a study would necessarily be geographically rather extensive for conodonts are notably facies fossils. However, the information as to relationships of the conodont fauna(s) of the Lime Creek shale to those that have been described from the Middle Amana beds, the shale near North Liberty, the Sweetland Creek shale and the Sheffield formation would indeed be a more than ordinarily useful contribution.

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