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PRELIMINARY RANGE CHART OF CONODONTS FROM THE CHESTER SERIES (MISSISSIPPIAN) IN THE ILLINOIS BASIN

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ABSTRACT

Detailed regional studies of conodont faunas from the Renault, Glen Dean, and Kinkaid Formations, plus geographically limited studies of other formations, have defined stratigraphic limits of occurrence for many conodont genera and species in the Illinois Basin. These ranges have been compiled and are presented in chart form.

Several genera are shown to be reliable index fossils. *Synprioniodina* serves as an index to the lower part of the Chester Series, *Cladognathodus* is limited to the middle and upper part of the series, and *Streptognathodus* is an index to the uppermost part of the Kinkaid Formation. The genus *Lambdagnathus* is found throughout the Chester and has not been reported from non-Chester rocks. *Elsonella?* and *Falcodus?* likewise may be useful indices for the entire series but must be evaluated further.

Ranges of species are useful for detailed correlation of geologic strata. Where, however, limits of the ranges fall between the units that have been studied in detail, the ranges cannot be used with complete confidence until more data are accumulated.

Several taxonomic problems are discussed, and *Cladognathodus*, n. name, is proposed for *Kladognathus* Rexroad 1958, which is preoccupied by *Cladognathus* Burmeister 1847.

INTRODUCTION

In biostratigraphy a great fund of information must be accumulated before any group of fossils can be considered reliable indices for detailed stratigraphic correlation. Nevertheless, a preliminary report on a fossil group that shows promise of reliability is useful in that other workers may use, criticize, and supplement original information before it is published in final form. This is especially true for projects of long duration such as that discussed here.

In the Mississippian Chester Series of the Illinois Basin, conodonts appear to be particularly valuable for biostratigraphic zonation. They are not only widespread both geographically and stratigraphically, but 33 of 43 species appear to be restricted to a particular part of the series. Furthermore, five of the 15 genera occur in only one part of the Chester, and a sixth genus has not been recorded from rocks of any other age. Such findings seem important enough to warrant this preliminary report on conodont ranges in the Chester Series, even though more work remains to be done before a final report can be published.

In the Illinois Basin, detailed studies have been made of the Renault and related formations (Liebe, 1959) near the base of the standard Chester sequence, of the Glen Dean Formation (Rexroad, 1958) near the middle, and of the Kinkaid Formation (Burton, 1959) at the top of the series. These studies placed definite limits on the ranges of many species. The remaining formations of the standard Chester Series have been studied mainly in the area near Chester in southwestern Illinois (Rexroad, 1957), but they provided much information about occurrences between the more thoroughly studied formations. Studies of conodonts from the Ridenhower, Downeys Bluff, Golconda, and Menard Formations are in progress. Basin-wide studies of the Vienna and Clore remain to be started, but future studies probably will not produce major modifications in the chart.

INTERPRETATION OF RANGE CHART

The range chart (pl. 1) is compiled from more than a thousand samples taken at more than sixty localities. The chart shows ranges rather than occurrences. *Hindeodella* and the "genus indeterminate" of Rexroad (1957, 1958) are not shown. The ranges are based mainly on occurrences in limestone and gray shale because sandstone and red shale, the other important rock types of the Chester, only rarely yielded specimens. Samples from the Cypress, Tar Springs, Palestine, and Degonia Formations contained no specimens, and the Hardinsburg and Waltersburg contained only a few from near their boundaries, which are probably gradational. The Yankeetown Formation produced a few conodonts from limestone nodules at a single locality.

The outline drawings representing species on the chart were drawn by Marie E. Litterer from characteristic representatives of the species. All are drawn to the same approximate scale (X30) and represent the average size of each species. D. H. Swann provided the stratigraphic control for most of the studies and supplied the stratigraphic column.

On the chart, square ends of range bars coincide with the upper or lower limits of stratigraphic occurrence. Where the range continues beyond the limits of the Chester Series, the range bar is terminated by an arrow and the approximate limit of the range is given; for example, "M. Miss." indicates the middle part of the Mississippian.

In evaluating the usefulness of genera with seemingly limited ranges, three complicating factors should be recognized:

1) Ranges based on data developed within a single basin may be complicated by faunal migrations. There is evidence that some of the Chester conodont faunas in the Illinois Basin differ somewhat from contemporaneous faunas elsewhere. It seems probable that the apparent limitation of several species to the middle of the Chester may reflect migration.

2) Classification of conodonts is based primarily on form, so that in many cases the range of a form genus may be greatly extended by the inclusion of homeomorphs. More phylogenetic data are needed before this problem can be eliminated.

3) Although very long ranges for many conodont genera have been widely accepted, few long-range species have been recognized. The present study shows that although some species are limited to a single formation, or even a part of a formation, many have much more extensive ranges and some occur in more than one geologic system. Thus, the over-all nature of the fauna, rather than the presence of one or two species common to the units, must be the basis for correlation.

Our studies indicate that several conodont genera are reliable index fossils. Foremost among these are the genera *Synprioniodina*, *Cladognathodus*, and *Streptognathodus*. The Chester representatives of *Synprioniodina* are found only in the lower part of the series; they probably developed during late Valmeyer time from an apatognathid. *Cladognathodus* is indicative of middle and upper parts of Chester. *Streptognathodus*, which is common in Pennsylvanian rocks, developed from *Cavusgnathus* near the close of Chester time and is found only in the upper part of the Kinkaid Formation.

The form genus *Lonchodina* is in general long ranging but in the Illinois Basin has been reported from only the Golconda and Glen Dean Formations. The apparent limitation may be the result of geographic migration, but more detailed work may show *Lonchodina* in other formations between the Renault and Kinkaid Formations.

Rexroad's 1958 regional study of the Glen Dean conodont fauna presented strong evidence of two closely similar but distinct faunal provinces in the Illinois Basin during middle Chester time. The smaller province covers the southern part of the basin and is characterized by species suggestive of faunas from the Barnett and Caney Formations of Texas and Oklahoma. The other province is much more widespread and covers the remainder of the basin. That such geographic differentiation did not exist throughout Chester time is shown by collections from the Renault which reveal a single widely uniform fauna. A southern province centered south of the Illinois Basin may have expanded northward during middle Chester time, which may explain the restriction of *Lonchodina* to the middle part of the Chester Series even though the genus is known to occur both above and below the Chester elsewhere.

The genus *Lambdagnathus* ranges from the Renault through the Kinkaid and may be a pure Chester index for it has not as yet been reported from rocks of any other age. *Elsonella?*, which may well be a homeomorph of its upper Devonian likeness, also may be a purely Chester index, as may *Falcodus?*, which in the Chester may be an aberrant form of *Hindeodella* unrelated to previously described falcodids.

Insufficient data preclude a detailed discussion of the ranges of the species known from the Chester Series in the Illinois Basin. Termini of ranges of species not common to the three formations for which detailed work has been done will almost certainly fall in the intervening units for which there has been only a reconnaissance. It seems likely that several different zones will be recognizable when faunas from the entire series become better known.

SOME TAXONOMIC PROBLEMS

In developing accurate information on the stratigraphic ranges of fossils and on their geographic distribution, sound taxonomics are required. To help clarify some of the nomenclatural problems of Chester conodonts, a number of ideas relating to questions of taxonomy are presented.

Cavusgnathus unicornis Youngquist & Miller and Related Forms

Youngquist & Miller (November 1949) named *Cavusgnathus unicornis* and *C. regularis* from the Pella beds of Iowa. These, along with *C. convexa* Rexroad (1957), are present in the Chester Series of the Illinois Basin. Because there are transitions between *C. unicornis* and *C. regularis* and between the latter and *C. convexa*, there is some doubt that the three species are sufficiently distinct to merit separation. Furthermore, *C. convexa* may be a junior synonym of *C. alta* Harris & Hollingsworth (1933).

The status of *Cavusgnathus unicornis* also is not clear because of problems concerning *C. giganta* (Gunnell), 1933, and *C. arca* Sturgeon & Youngquist, July 1949. Type specimens of all three have been compared, but it must be emphasized that a holotype alone, or even a group of several type and figured specimens, is not adequate to establish fully the concept of a species. Youngquist & Miller differentiated *C. unicornis* from *C. arca* on the basis of less arching, but the difference does not seem to us to be sufficient for distinction of the two species. The types of *C. unicornis* and *C. arca* differ from the holotype of *C. giganta* in configuration of the oral margin of the blade, but other workers have included in *C. giganta* forms with oral margins nearly identical to the other two. McLaughlin (1952) included (?) in *C. giganta* specimens that show considerable differences in arching, and the specimen figured by Ellison & Graves (1941, pl. 3, fig. 3) as *C. giganta* could not be distinguished by Rexroad from *C. unicornis*. Thus, most authors have used a broad interpretation of *C. giganta*, and, if such is correct, both *C. unicornis* and *C. arca* should be considered as synonyms of *C. giganta* Only study of large numbers of specimens from a broad geographic and stratigraphic range can offer a final solution.

Cavusgnathus unicornis previously has been recorded only from rocks of Mississippian age and *C. giganta* from rocks of Pennsylvanian age. *C. arca* originally was named from Pennsylvanian beds, but a single specimen from the cuIII zone in Europe has been referred to it (Bischoff, 1957).

Genus *Cladognathodus* Rexroad & Collinson, n. name

Dr. Willi Ziegler (personal communication) has called attention to the fact that the change of an initial *C* to a *K* does not constitute a name change under the rules of the International Code of Zoological Nomenclature. Therefore, *Kladognathus* Rexroad, 1958, like *Cladognathus* Rexroad, 1957, is preoccupied by *Cladognathus*, Burmeister, a genus of the Coleoptera (Burmeister, 1847, p. 364). Accordingly, we propose the new name, *Cladognathodus*, to replace both *Cladognathus* Rexroad, 1957, and *Kladognathus* Rexroad, 1958.

Elsonella? imperfecta (Rexroad)

Rexroad's (1958) identification of specimens with a symmetrical arch and no posterior bar as *Trichonodella imperfecta* is now considered to have been incorrect because the pit in such specimens is small. The only other genus possessing such features is *Elsonella* Youngquist (1945), a Devonian genus to which we are provisionally assigning the species. We consider the symmetry of the arch a fundamental characteristic that serves to distinguish *Elsonella* from *Palmatodella* or *Synprioniodina*. A species distinct but closely similar to *E.? imperfecta* is recorded from the Dimple Limestone of Texas as *Synprioniodina? compressa* Ellison & Graves (1941).

Gnathodus Versus *Spathognathodus*

The assignment of *Spathognathodus commutatus* Branson & Mehl (1949) to the genus *Gnathodus* by Hass (1953), Bischoff (1957), and others is here accepted, as is the placement of *Gnathodus inornatus* Hass (1953) in synonymy with *G. commutatus* (Branson & Mehl) by Bischoff (1957), Flügel & Ziegler (1957), and Bischoff & Ziegler (1956). Apparently, Stanley (1958) places the two in synonymy, but he uses the junior synonym, *G. inornatus* Hass. *G. commutatus* differs from typical

gnathodids in lack of ornamentation on the upper surface of the lips of the navel, although the presence or absence of such ornamentation on Pander's types of the genus is not known.

Hass based separation of *Gnathodus inornatus* on its rounded navel, which contrasts with the posteriorly pointed navel of *G. commutatus*. However, in Rexroad's collection of material from the Barnett Formation, as well as in collections from the Caney Shale and the series of the Chester Illinois Basin, the difference is not consistent. Sufficient numbers of specimens have now been collected from the Illinois Basin to dispel any doubt that forms previously called *Spathognathodus* cf. *S. commutatus* truly belong to *G. commutatus*.

Perhaps *Spathognathodus campbelli* Rexroad also should be placed with *Gnathodus*, although there is no evidence of transition to ornamented forms. Also assigned to *Spathognathodus* is an additional group of species that differ from typical spathognathodids in having a relatively large navel that extends to the posterior tip. This group is distinguished from typical gnathodids by lack of ornamentation of the oral surface of the navel, the relatively short length of the free blade, and the general form. Because these forms apparently do not represent a lineage distinct from *Spathognathodus* and do have the form of *Pandorinella* (Stauffer) which Müller & Müller (1957) consider a subgenus of *Spathognathodus*, we believe the group should be retained in *Spathognathodus*.

Gnathodus bilineatus (Roundy 1926) and Closely Related Forms

A group of closely similar gnathodids from essentially time-equivalent units in different areas of the United States has been recognized – *Gnathodus bilineatus* (Roundy 1926) from the Barnett Formation, Llano region, Texas; *G. pustulosus* Branson & Mehl (1941a) from the Delaware Creek Member of the Caney Shale, Arbuckle Mountains, Oklahoma; *G. liratus* Youngquist & Miller (1949) from the Pella Beds, Iowa, which may be based on an atypical specimen; *G. modocensis* Rexroad (1957) from the Chester Series, Illinois, Kentucky, and Indiana; and *G. multilineatus* Elias (1959) from the upper Sand Branch Member of the Caney Shale, Arbuckle Mountains, Oklahoma. *G. bransoni* Elias (1959), also from the Sand Branch Member, is not considered a valid species.

In Europe, *Gnathodus bilineatus* has been recognized in the *Goniatites* Stufe of southwestern Germany (Bischoff, 1957), in the Lower Carboniferous of Steinberg, Germany (Flügel & Ziegler, 1957) and in the Upper Visean of northwestern Spain (Lys & Serre, 1958). The specimens figured by Bischoff & Ziegler (1956, pl. II, figs. 21-23) as *G. bilineatus* from the German Westhang Kalkberg, cuII, seem to present a different species, as do specimens of *G. bilineatus semiglaber* Bischoff (Bischoff, 1957; Flügel & Ziegler, 1957).

Questions both of synonymy and subspeciation are pertinent here. *Gnathodus pustulosus* has been placed in synonymy with *G. bilineatus* by Hass (1953), Bischoff (1957), Flügel & Ziegler (1957) and Elias (1959), but specimens of *G. pustulosus* seem to differ slightly from other named species in the shape of the outer lip of the navel above its aboral edge, although this is not apparent in published photographs.

Gnathodus modocensis differs from *G. bilineatus* in the shape of the outer parapet, the depth of the trough, the separation of trough and carina, by a smaller average size, and by the fact that virtually no lineation is apparent in the arrangement of the nodes on the platform surface of *G. modocensis*. Even in very young specimens of *G. bilineatus* (and *G. pustulosus*) with nearly smooth surfaces,

alignment is apparent. Only in a limited area of Kentucky and adjacent eastern states is there any evidence of commingling of the two species. It is likely that the differences in *G. modocensis* are a response to geographic isolation of a time-equivalent group, in which case *G. modocensis* might be placed in synonymy with *G. bilineatus* and in a zoological sense considered a subspecies.

Gnathodus multilineatus is distinguished chiefly on the basis that its sharply defined rows of nodes are arranged essentially parallel to the carina. Whether this difference justifies its separation is questionable.

A gnathodid found in the Bluefield Group of West Virginia (Clarke, 1959), although obviously closely related to *G. bilineatus* of the Barnett, is less similar to it than are some species, but is nearly identical in form to a variant of *G. bilineatus* figured by Flügel & Ziegler (1957, pl. IV, fig. 7) in which the outer part of the platform is nearly triangular in oral or aboral view.

Some Ligonodinids

In need of further study are the relationships of *Ligonodina levis* Branson & Mehl (1941b) from the Keokuk Formation, Mississippi Valley, *L. obunca* and *L. hamata* of Rexroad (1957) from the Chester Series in the Illinois Basin, *L. tenuis* Branson & Mehl (1941a) from the Delaware Creek Member of the Caney Shale, and *L. fragilis* Hass (1953) from the Barnett Formation of Texas. *L. obunca* apparently developed directly from *L. levis* and may not be sufficiently different to merit designation as a separate species. Cooper (1947) referred uppermost Kinkaid specimens to *L. levis* . *L. hamata* in turn is a modification of *L. obunca* through completely transitional stages, but we believe the two to be distinct.

The relationship of *Ligonodina hamata* to *L. tenuis* presents additional problems. *L. tenuis* is described as having a short, straight or slightly arched posterior bar with exceptionally small denticles (Branson & Mehl, 1941a), and *L. hamata* has a long, thin posterior bar with an alternation of small and large denticles. The bar thickens anteriorly, and in many adult specimens the thin posterior portion is broken, leaving a part that precisely fits the description of the posterior bar of *L. tenuis* . *L. hamata* also differs markedly from the type specimens of *L. tenuis* in having a rather uniformly recurved cusp. However, as previously stated, there is question as to how adequately type specimens represent a species as a whole. If it should ever be shown that specimens in the median range of variability of the two named are the same, *L. hamata* would be considered a junior synonym of *L. tenuis* .

Neoprioniodids Similar to *Neoprioniodus scitulus* (Branson & Mehl)

It is probable that a continuous evolutionary line is represented by *Neoprioniodus barbatus* (Branson & Mehl) (1941b) in the Kinderhook, *N. cassilaris* (Branson & Mehl) in the Valmeyer, and *N. scitulus* (Branson & Mehl) in the Chester. Of these, *N. scitulus* is the most variable, and some representatives of it closely resemble *N. cassilaris* . Variation among the adults is particularly marked by deviation from a straight anterior margin of cusp and anticusp to a strongly convex margin. In addition, the length of the anticusp in both oral-aboral and anterior-posterior direction is variable, as is the shape of the posteroaboral margin, which may range from nearly straight to sigmoid. Attachment scars may or may not be visible along the face of the anticusp paralleling the margin.

Although it is very easy to distinguish between individual specimens, none

of these variables seem to represent a consistent evolutionary trend or a particular geographic locale. It therefore seems necessary to interpret this group broadly, rather than separate material artificially on the basis of single variations. In this interpretation it may be advantageous to place *N. cassilaris* in synonymy with *N. scitulus* although such is not our intent here.

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