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ANNOTATED BIBLIOGRAPHY OF PENNSYLVANIAN AND PERMIAN
XIPHOSURIDS FROM KANSAS

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INTRODUCTION

Xiphosurids, which are known popularly as horseshoe crabs, are chelicerate arthropods that have a stratigraphic range putatively from the Early Cambrian to the present. Because they do not have a mineralized cuticle, fossil remains are rare in most sedimentary strata. About 30 valid genera of these animals are known. Seven genera of putative xiphosurids were described based on specimens from Pennsylvanian or Permian rocks of Kansas (Dunbar, 1923; Tasch, 1961, 1963, 1964), but six of them have been subsequently reassigned (Bergström, 1975). Two species of xiphosurids are currently recognized from Pennsylvanian or Permian rocks of Kansas. They are Paleolimulus avitus Dunbar, 1923, and Prestwichia signata Beecher, 1904. P. signata was transferred to Paleolimulus by Dunbar (1923). A report of Euproops? sp. (Tasch, 1963, p. 1247, pl. 173, fig. 14) seems to be in error. The illustrated specimen is probably an incomplete prosoma of Paleolimulus.

The purpose of this annotated bibliography is to provide a source of information about the Pennsylvanian and Permian xiphosurids of Kansas. This bibliography includes only published sources; no attempt has been made to include the few and scattered reports in unpublished theses, dissertations, or other documents. The bibliography seems to be complete for illustrated or described specimens. Some reports in faunal lists or passing references in texts, however, may have been overlooked.

Taxonomic nomenclature used in this bibliography is exactly that published in the cited papers.

ANNOTATED BIBLIOGRAPHY

Beecher, C. E. 1904. Note on a new Permian xiphosuran from Kansas. *American Journal of Science*, series 4, 18:23-24.

The new species Prestwichia signata is described from the Fort Riley Limestone (Lower Permian), three miles west of Stockdale, Kansas.

Bennett, D. K. 1984. Fossils, p. 96-162. In R. Buchanan (ed.), *Kansas Geology. An Introduction to Landscapes, Rocks, Minerals, and Fossils.* University of Kansas Press, Lawrence.

A reconstruction of a horseshoe crab, Prestwichianella, is illustrated in figure 72. Although not stated, the implication is that this genus is known from Kansas. However, this form has not been reported from the state, nor are any unpublished specimens known.

Bergström, J. 1975. Functional morphology and evolution of xiphosurids. *Fossils and Strata*, 4:291-305.

In a classification of the order Xiphosurida, Paleolimulus, described first from the Permian of Kansas (Dunbar, 1923),

is included in the suborder Limulacea, the superfamily Limulacea, and the family Paleolimulidae. All genera of putative xiphosurids described by Tasch (1961, 1963, 1964) from the Permian of Kansas are rejected from the Xiphosurida. They are Bifarius (an insect), Cyclocephalus (an insect), Elmocephalus (a crustacean?), Hypatocephala (an insect), Permolimulinella (an insect), and Strongylocephalus (an insect).

Dunbar, C. O. 1923. Kansas Permian insects. Part 2.

Paleolimulus, a new genus of Paleozoic Xiphosura, with notes on other genera. American Journal of Science, series 5, 5:443-454.

The new genus Paleolimulus is described. The new species P. avitus from the Elmo Limestone Member of the Wellington Shale (Lower Permian), near Elmo, Kansas, is the type species of the genus. Two figured specimens of P. avitus show impressions of ventral appendages.

The holotype of Prestwichia signata is reillustrated, and the species is transferred to Paleolimulus.

Dunbar, C. O. 1924. Kansas Permian insects. Part 1. The geologic occurrence and the environment of the insects. American Journal of Science, series 5, 7:171-209.

Paleolimulus avitus is listed as occurring at "Insect Hill," "about 3 miles south and 1/2 mile east of the village of Elmo," Dickinson County, Kansas (p. 182). The section is in the Wellington Shale (Permian).

Moore, R. C. 1964. Paleoeological aspects of Kansas Pennsylvanian and Permian cyclothem, p. 287-380. In D. F. Merriam (ed.), Symposium on Cyclic Sedimentation. Kansas Geological Survey, Bulletin 169(1).

Among invertebrates listed from the Elmo-type (Sellardsia) paleoeological assemblage of Kansas are "aquatic chelicerates related distantly to the modern kingcrabs (Limulus)" (p. 301). Paleolimulus is illustrated in the Supplement (fig. 1.9).

Raymond, P. E. 1944. Late Paleozoic xiphosurans. Museum of Comparative Zoology, Bulletin 94:473-508.

The species Paleolimulus avitus is discussed and illustrated. Specimens used in the study are from the Lower Permian Wellington shales at Elmo, Kansas.

Størmer, L. 1952. Phylogeny and taxonomy of fossil horseshoe crabs. Journal of Paleontology, 26:630-639.

Paleolimulus avitus from the Permian of Kansas is referred to in connection with its inferred relationship to other Paleozoic Limulina.

Tasch, P. 1961. Paleolimnology: part 2--Harvey and Sedgwick counties, Kansas: stratigraphy and biota. Journal of Paleontology, 35:836-865.

Four xiphosurid species are described from the Permian of Harvey or Dickinson County, Kansas. The new species Pringlia leonardensis is described from bed 2 of locality Annelly VIII, S line, SW SE sec. 16, T. 22 S., R. 2 E., Harvey County. The new genus and species Bifarius compta is described from bed 6 of locality Annelly I-A, NW NE sec. 21, T. 23 S., R. 2 E., Harvey County. The new genus and species Strongylocephalus charactis is described from bed 4 at locality Annelly I-A. The new genus and species Hypatocephala rugosa is described from locality Elmo V, Dickinson County.

Tasch, P. 1963. Paleolimnology, part 3--Marion and Dickinson counties, Kansas, with additional sections in Harvey and Sedgwick counties: stratigraphy and biota. Journal of Paleontology, 37: 1233-1251.

Four species of xiphosurids are described from the

Wellington Formation in Dickinson or Harvey County, Kansas. The new genus and species Permolimulinella raris is described from bed 3, locality Elmo VIII-A, Dickinson County. Paleolimulus avitus is identified from bed 1?, locality Elmo III, Dickinson County. Euproops? sp. is identified from a broken prosoma from bed 5, locality Annelly I-C, Harvey County. The new genus and species Dickinsonia carltonensis is described from bed 13, locality Elmo IV, Dickinson County.

Tasch, P. 1964. New name for a Permian xiphosuran. Journal of Paleontology, 38:787.

The generic name Elmocephalus is proposed to replace Dickinsonia Tasch, 1963. Dickinsonia is preoccupied by Sprigg, 1947, and refers to a late Precambrian organism of problematic phylogenetic affinities.