

A new specimen of *Cimolichthys* (Aulopiformes, lizardfishes) from the Keld Member, Favel Formation (Upper Cenomanian), Manitoba, Canada



M.P.B. Nicolas¹, M.G. Newbrey^{2,3}, and V.L. Markstrom²

¹ Manitoba Geological Survey, Winnipeg, Manitoba, Canada

² Canadian Fossil Discovery Centre, Morden, Manitoba, Canada

³ Department of Biology, Columbus State University, Columbus, Georgia, U.S.A.



Introduction

Aulopiforms (lizardfishes) are an iconic group of fishes containing the popular Cretaceous forms of *Enchodus* and *Cimolichthys*. Yet we know little about lizardfishes from the Cenomanian and older stages because of a poor fossil record. And the evolution of this group remains poorly known despite many important studies in the last 50 years (Newbrey and Konishi 2015). A recent discovery has revealed a new aulopiform from the Keld Member of the Favel Formation (upper Cenomanian) of Manitoba, Canada.

Location and Stratigraphy

During the summer 2015, a well preserved fossil fish, nicknamed "Wilson" (Figure 1), was discovered along the bank of the Wilson River, east of Dauphin, Manitoba (Figure 2). Vertical exposures of the Keld Member of the Favel Formation line the Wilson River, and weathered blocks of silty shale and siltstone litter the banks (Figure 3a and b). Vertical joints accelerate the mass wasting, resulting in large blocks of Keld to fall off the walls and into the river (Figure 3c). The most common fossil seen in this area are large and numerous *Inoceramus* shells (Figure 4a and b). Scattered fish bones (Figure 4c) and teeth can be found occasionally, but rare crocodile and plesiosaur skeletons have been discovered along this river. The plesiosaur was on temporary display at The Manitoba Museum during the winter of 2014-2015 (Figure 4d).

The Cretaceous Favel Formation is a calcareous, white-speckled, grey silty shale, with limestone interbeds and abundant thin bentonite beds. It consists of two members, the Keld Member at the base and the Assiniboine Member at the top, each capped by prominent limestone beds. The Laurier Limestone beds cap the Keld Member and the Marco Calcarenites cap the Assiniboine. Both the upper and lower contacts of the Favel are conformable with the Carlile and Ashville formations, respectively. (Figure 5)

The Favel Formation represents the maximum flooding surface of the Late Cretaceous transgression, with sea-level rise being dominantly eustatic in nature (Caldwell, 1984). The lowest Keld beds where "Wilson" was found represent the near-peak transgressive stage of this sea-level rise (Caldwell, 1984). This places "Wilson" in the upper Cenomanian stage (Figure 5).



Figure 1: Fossil of a new specimen of *Cimolichthys* (Aulopiform, lizardfishes), nicknamed "Wilson", found along the Wilson River, in the Keld Member of the Favel Formation, southwestern Manitoba.

Systematic Paleontology

Class ACTINOPTERYGII Cope, 1887

TELEOSTEI Müller, 1845

Order AULOPIFORMES Rosen, 1973

Family indet.

Genus *Cimolichthys* Leidy, 1857

The partial skeleton (MGS sample number 106-15-15-1; Figure 1) is attributed to a small specimen of *Cimolichthys* and consists of an exquisitely preserved skull with aspects of the delicate branchial apparatus still preserved. The outer skull bones and most of the jaw elements are missing from the left side.

The pectoral girdle and impressions of the pectoral and pelvic fins are preserved. Impressions of the vertebrae show a prominent lateral bar extending the length of the centrum, which is consistent with centra of *Cimolichthys*. The skeleton is incomplete posterior to the pelvic fins. Large cycloid scales are partially preserved and even show the lateral line.

This specimen has been considerably weathered, but indicates the great potential for other exquisitely preserved fishes. We know little about Aulopiforms in the Cenomanian, but lizardfishes seem to go through a major radiation at about the Cenomanian/Turonian Boundary. Lizardfishes deposited in the Cenomanian stand to tell us a lot about the evolutionary radiation of this iconic group. The specimen of *Cimolichthys* from the Favel Formation is the earliest known report of the genus.

Future work

Articulated fish skeletons are rarely preserved. The locality has the great potential to provide skeletal specimens of other taxa that are even more poorly understood. Any skeletal material from the locality will likely reveal taxa and characteristics unknown to ichthyologists. The late Cenomanian represents a time of radiation of another important group of fishes; the acanthomorphs, spiny-ray fishes (Newbrey et al. 2013). The acanthomorphs represent about half of all living fishes today (Nelson 2006).

Furthermore, there is potential for preservation of skeletal material of other kinds organisms; for example, birds, marine reptiles, and crocodiles. We are planning an excavation at the locality in 2016 with the help of a team of volunteers.

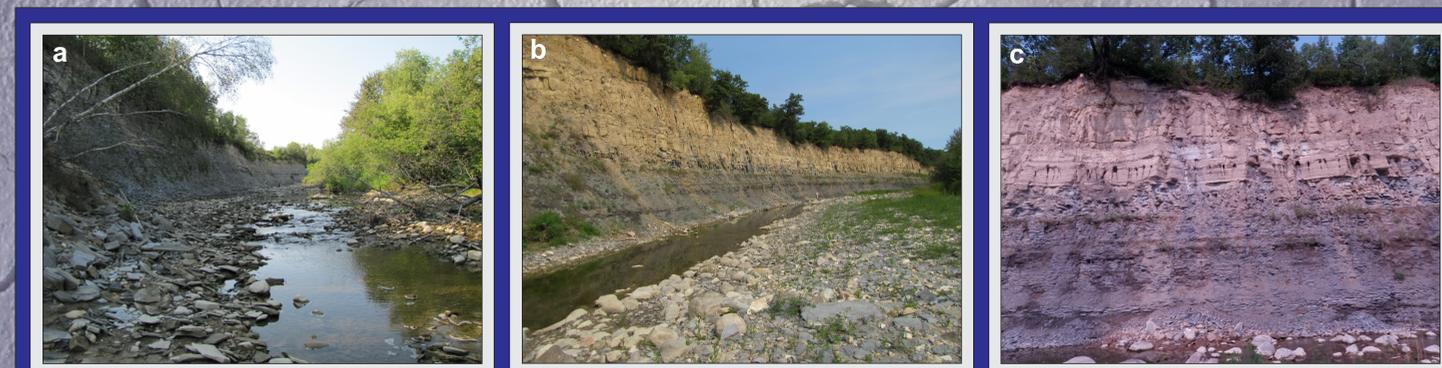


Figure 3: Banks of the Wilson River showing (a) rubble along the shore, (b) vertical cliffs going for long distances, and (c) vertical jointing on the cliff faces.

Period/ Series/ Epoch	Stage age	Southwestern Manitoba
Upper Cretaceous	Santonian	Carlile Formation Boyne Member
	Ceniacian	Morden Member
	Turonian	Favel Formation Assiniboine Member
		Laurier Limestone beds Keld Member
Lower Cretaceous	Cenomanian	upper Belle Fourche Member
		Fish Scales Zone Westgate Member
	Albian	lower Newcastle Member
		Skull Creek Member
Aptian	Swan River Formation	

Figure 5: Stratigraphic and age chart of a portion of the Cretaceous strata in southwestern Manitoba.

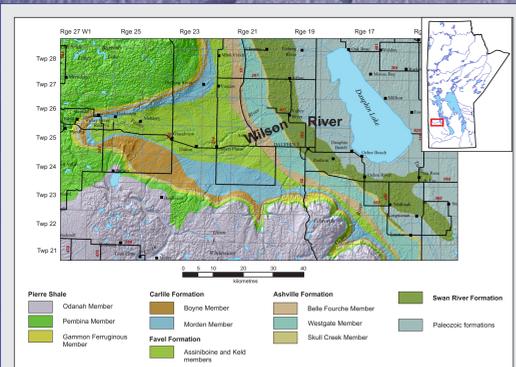


Figure 2: Stratigraphic map of the Dauphin area; the fish specimen "Wilson" was found along the banks of the Wilson River.



Figure 4: Fossils found along the Wilson River include (a) large and (b) small *Inoceramus* shells, (c) fish fragments, and (d) plesiosaur skeleton (image from <https://manitobamuseum.ca/main/flipping-the-skull>). This plesiosaur skeleton was on temporary exhibit at The Manitoba Museum during the winter of 2014-2015.

References

- Caldwell, W. G. E. 1984. Early Cretaceous transgressions and regressions in the southern Interior Plains; in: The Mesozoic of Middle North America. Stott, D. F., and Glass, D. J., (eds.), Canadian Society of Petroleum Geologists Memoir 9, p. 173-203.
- Nelson, J. S. 2006. Fishes of the World, fourth edition. John Wiley and Sons, New York, 601 pp.
- Newbrey, M.G. and T. Konishi. 2015. A new lizardfish (Teleostei, Aulopiformes) from the Late Cretaceous Bearpaw Formation of Alberta, Canada with a revised diagnosis of *Apatodus* (Aulopiformes, Ichthyopterygidae). *Journal of Vertebrate Paleontology* 35(3): e918042.
- Newbrey, M.G., A.M. Murray, M.V.H. Wilson, D.B. Brinkman and A.G. Neuman. 2013. A new species of the paracanthopterygian Xanyllion (Spheroscapthiformes) from the Mowry Formation (Cenomanian) of Utah, USA, pp. 363-384. In *Mesozoic Fishes 5 - Global Diversity and Evolution*; edited by G. Arratia, H.P. Schultz, and M.V.H. Wilson. Verlag Dr. Friedrich Pfeil, Munich, Germany.