

A comparison between the fossil fish faunas from the Talbragar Fossil Fish Bed near Gulgong, NSW and the Koonwarra Fossil Bed, Gippsland, Victoria, Australia: Upper Jurassic vs Lower Cretaceous times

Lynne Bean*

Research School of Earth Sciences, Australian National University, Acton, A.C.T. 2601

(Received 9 May 2017; accepted 19 May 2017)

Abstract - The Talbragar Fish Bed, located in central New South Wales (NSW) is one of the best fossil sites for studying Jurassic fishes in Australia. It contains well-preserved external moulds of at least eight fish genera, many plant fragments and, due to recent discoveries, an increasing number of insects. The site was discovered in 1889 and its importance was recognised immediately. Fossils have been known since the 1960s from the Koonwarra fossil fish site. Both Australian Mesozoic localities have a wide diversity of fishes and plants. They represent well preserved Gondwanan sites which add to our knowledge of the southern continent.

Keywords: Talbragar, Koonwarra, *Cavenderichthys*, *Waldmanichthys*, Archaeomenidae.

1. Introduction

The Talbragar Fish Bed, located in central New South Wales (NSW), 125 km east of the regional city of Dubbo and 26 km northeast of the village of Gulgong, is one of the best fossil sites for studying Jurassic fishes in Australia (Fig. 1). It contains well-preserved external moulds of at least eight fish genera, many plant fragments and, due to recent discoveries, an increasing number of insects. The site was discovered in 1889 and its importance

was recognised immediately, to the extent that several bullock-dray loads of rock were removed and taken to Mudgee railway station (about 57 km away), then to Sydney, where the best specimens were selected and shipped to London for identification by Woodward (1895) at the British Museum. The most common fish was named *Leptolepis talbragarensis* and specimens became widely distributed among research institutions in Australia and beyond.

*Author for correspondence: lynnebean@anu.edu.au

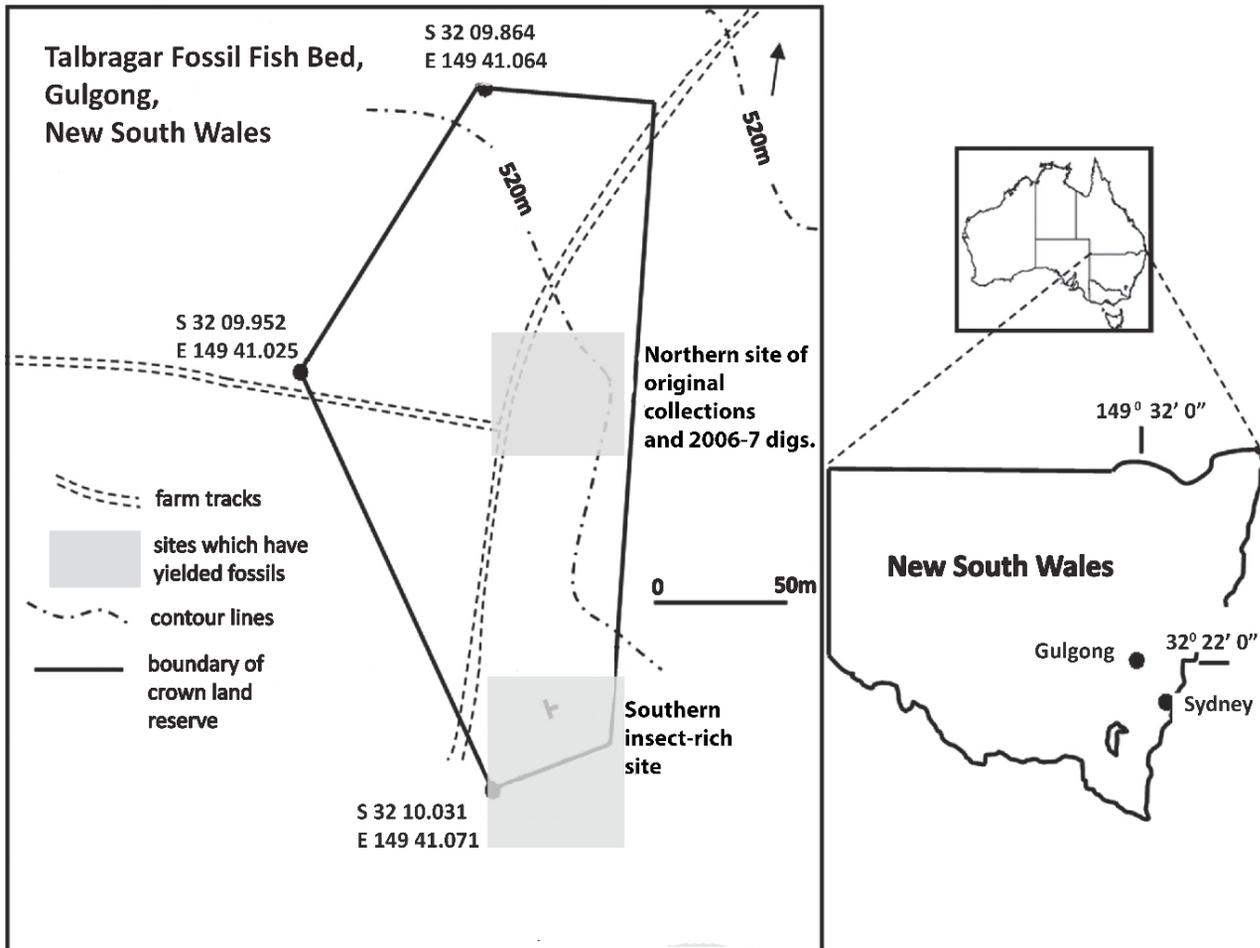


Figure 1. Location map of the Talbragar Fossil Fish Bed. Modified from Beattie and Avery (2012). The northern site is the original site which has produced the most fish and plants. The southern site has produced the most insects (Bean, in press).

Fossils have been known since the 1960s from the Koonwarra fossil fish site, which is located about 145 km southeast of Melbourne (Fig. 2). According to Waldman (1971), fossils were discovered by workmen straightening out a bend in the South Gippsland Highway in 1962. The University of Melbourne, National Museum of Victoria (now Museums Victoria), and the Victorian Mines Department then made collections primarily from the north side

of the highway. Excavations on the south side of the highway were commenced by Monash University staff and students early in 1966, and extended by staff from Melbourne University and the National Museum of Victoria in February 1981. Waldman concentrated on describing the five fish he could identify, and his results were published in 1971.

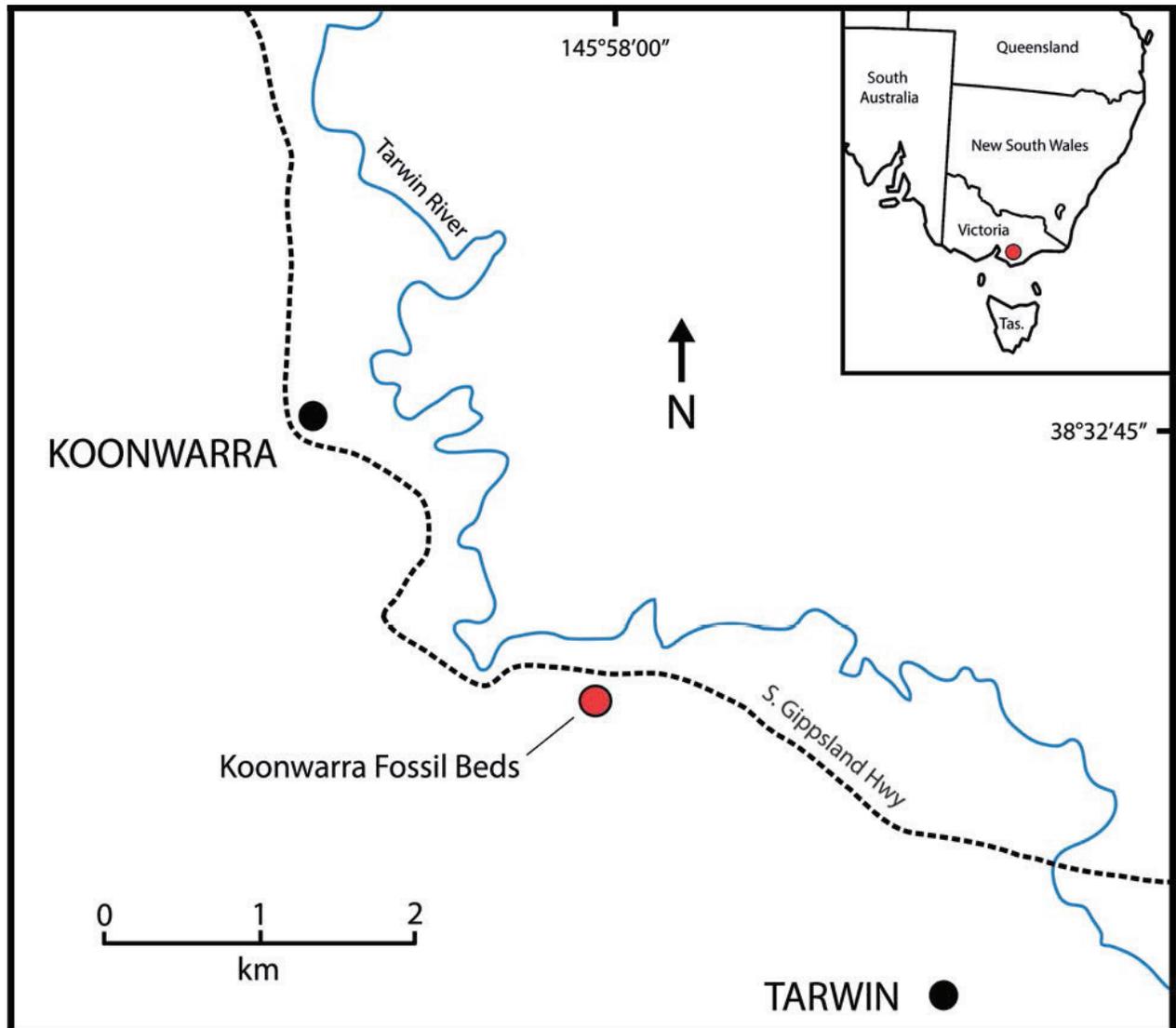


Figure 2. Locality map for the Koonwarra Fossil Bed, indicated by red circle. From Tuite *et al.* (2016) with permission. These two sites make a significant contribution to our knowledge of Gondwanan freshwater fauna during the Mesozoic era. Early work on fossils from the NSW site continued into the 1940s (Wade, 1941) but then there was a quiet time when the only published work was on the stratigraphy. The Koonwarra site was discovered later, but after Waldman (1971) no significant work has been published updating the fish. Publications on the flora (Drinnan and Chambers, 1986) and invertebrates (Jell and Duncan, 1986) included updates on the stratigraphy.

2. Fossil fishes

Originally the best-known fishes from both Talbragar and Koonwarra were assigned to *Leptolepis*. This changed in 1997 when Arratia renamed Upper Jurassic *Leptolepis talbragarensis* Woodward (1895), as *Cavenderichthys talbragarensis* (Woodward, 1895) (see Arratia, 1997).

Leptolepis koonwarri Waldman, 1971, from the Lower Cretaceous of Koonwarra was renamed *Waldman-*

ichthys koonwarri by Sferco *et al.* (2015) when they also erected a new freshwater, Gondwanan family, Luisiellidae, also containing *Cavenderichthys talbragarensis* and the Patagonian species *Luisiella feruglioi*.

Comparisons between specimens of *Cavenderichthys talbragarensis*, *Waldmanichthys koonwarri* and *Luisiella feruglioi* demonstrate the similarities between these taxa (see Fig. 3).

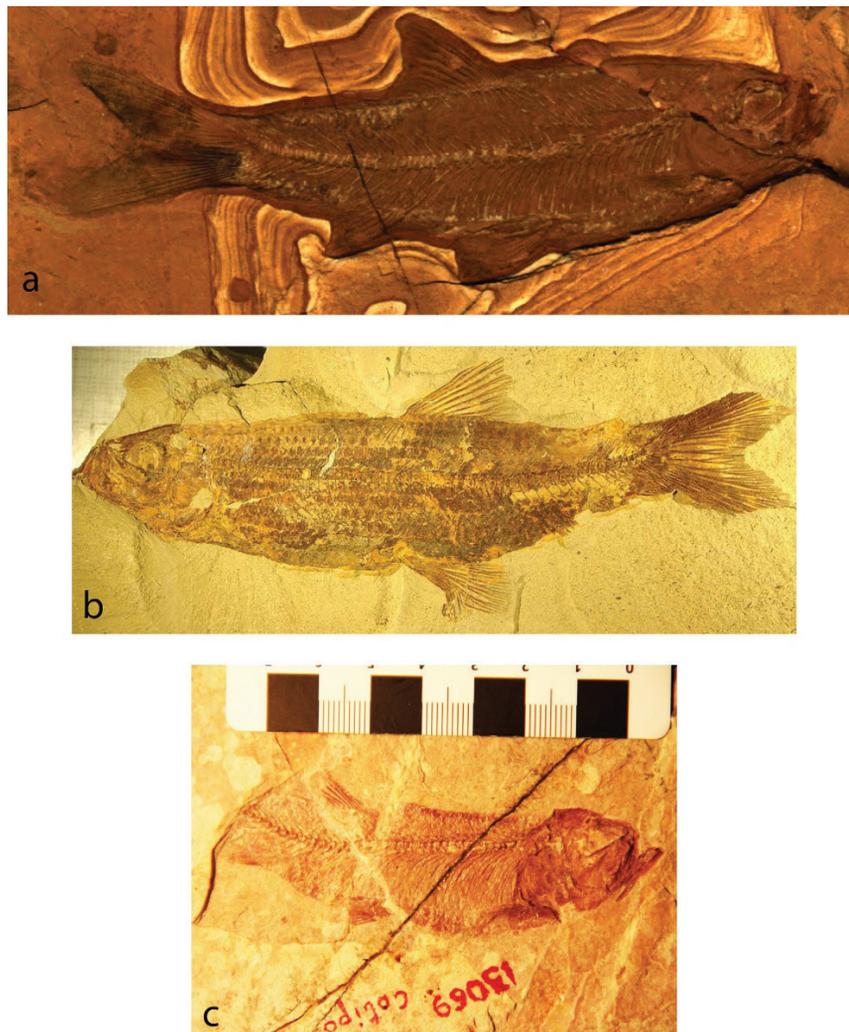


Figure 3. a. *Cavenderichthys talbragarensis* (Bean, 2006); b. *Waldmanichthys koonwarri* (Bean, in press); c. *Luisiella feruglioi* (Bean, in press)

Another family with a representative in each locality is the Archaeomenidae, that was assigned to the Order Pholidophoriformes Berg, 1937. *Archaeomene tenuis* from Talbragar can be compared to *Wadeichthys oxyops* from Koonwarra. This family is currently being re-studied by the author.

Two genera from Talbragar, *Aphnelepis australis* and *Aetheolepis mirabilis*, described by Woodward (1895) and ascribed to the family Semionotidae, have clear similarities in the structure of the cheek, the jaws, and the pattern of squamation, but differ in their general body shape.

Another genus which is represented in both localities is *Coccolepis*. *Coccolepis australis* Woodward, 1895, from Talbragar, and *Coccolepis woodwardi* Waldman, 1971, from Koonwarra have previously been ascribed to the Palaeonisciformes. Among Gondwanan fishes, Lopez-Arbarello *et al.* (2013) redescribed and renamed a coccolepid from Argentinian Patagonia, *Condorlepis groeberi*. They suggested that the Australian examples of *Coccolepis* no longer fit into this genus. Currently the two Australian species previously identified as *Coccolepis* are in revision by the author.

Also from Talbragar with no parallel at Koonwarra

is another fish with a very special morphology, *Uarbryichthys latus* Wade, 1953, which he ascribed to macrosemiiforms. This was doubted by Bartram (1977), but a revision by Murray and Wilson (2009) of a macrosemiid from Morocco placed *Uarbryichthys* as a sister group of the macrosemiids, a position that confirms it as a macrosemiiform. New information from a third specimen in the possession of the author will lead to an up-to-date description. The unidentified specimens from Talbragar consist of three specimens of a relatively large halecomorph which has not yet been described or identified. Turner and Avery (2017) have described a possible shark, but the quality of the specimen does not allow a clear definition. Woodward (1895) also described a fragment of scales as possibly belonging to a coelacanth.

The two fish from Koonwarra with no parallel forms are a possible fragment of *Ceratodus* and a fish described by Waldman as a clupeiform which he named *Koonwarria manifrons*. The latter does not fit the current interpretation of Clupeiformes.

3. Conclusion

Both Australian Mesozoic localities have a wide diversity of fishes and plants. They represent well preserved Gond-

wanan sites which add to our knowledge of the southern continent. Further exploration may lead to the discovery of more forms, and to the solving of some of the current

problems in identification. The following table summarises the taxa that are known, and indicates the affinities of those where this is understood.

Table 1. A comparison between the fossil fishes from Talbragar and Koonwarra, including classification where known.

Locality	Talbragar Fossil Fish Bed	Koonwarra Fossil Bed
Age	Upper Jurassic	Lower Cretaceous
Years	151 +/- 4 Ma	115 +/- 6 Ma
Comparable Taxa Currently under study	<i>Cavenderichthys talbragarensis</i> (Woodward, 1895) Luisiellidae Teleostei	<i>Waldmanichthys koonwarri</i> (Waldman, 1971) Luisiellidae Teleostei
	<i>Archaeomene tenuis</i> Woodward, 1895 Archaeomenidae “Pholidophoriformes” sensu Arratia, 2000.	<i>Wadeichthys oxyops</i> Waldman, 1971 Archaeomenidae “Pholidophoriformes” sensu Arratia, 2000
	<i>Coccolepis australis</i> Woodward, 1895 Actinopterygii	<i>Coccolepis woodwardi</i> Waldman, 1971 Actinopterygii
Differences	<i>Aetheolepis mirabilis</i> Woodward, 1895 Holostei Semionotiform	<i>Koonwarria manifrons</i> Waldman, 1971 (not Clupeiformes)
	<i>Aphnelepis australis</i> Woodward, 1895 Holostei Semionotiform	<i>Ceratodus</i> sp. (Ceratodontiformes)
	<i>Uarbryichthys latus</i> Wade, 1953 Macrosemiiformes, currently under study	
	Unidentified long fish Halecomorph (cf. “Furo”)	
	Chondrichthyan (‘shark’)	
	Coelacanth?	

Each of the Talbragar and Koonwarra sites has a significant diversity of fish taxa. All the fish are actinopterygians, except for the shark and the possible coelacanth. Within the actinopterygians, two are Teleostei, two may belong to the Pholidophoriformes, two are Semionotiformes, one belongs to the Macrosemiiformes and two are non-neopterygian actinopterygians. In addition, there is one Ceratodontiformes and there are two at present not assigned to an order.

Acknowledgements

Thanks to the Research School of Earth Sciences at the Australian National University and the Australian Government Research Training Program Scholarship for supporting my PhD studies. The field trips in 2006 were funded by a grant from the Linnaean Society of New South Wales. I am grateful to Prof Stephen Eggins for chairing my Supervisory panel, and to Prof John Long, Flinders University, for being my Associate Supervisor. My thanks also go to colleagues Mark Wilson (Chicago), John Maisey (New York), Gloria Arratia (Kansas) and Lionel Cavin (Geneva) for their encouragement and help towards my late foray into academic research. Finally, I wish to express my gratitude to Rodger Bean for carrying my bags and all the support he has always given to me.

References

- Arratia, G. 1997. Basal teleosts and teleosteans phylogeny. *Paleo Ichthyologica* 7, 5-168.
- Bartram, A. W. H. 1977. The Macrosemiidae, a Mesozoic family of holostean fishes. *Bulletin of the British Museum (Natural History)* 29(2), 137-234.
- Bean L. B. 2006. The leptolepid fish *Cavenderichthys talbragarensis* (Woodward, 1895) from the Talbragar Fish Bed (Late Jurassic) near Gulgong, New South Wales. *Records of the Western Australian Museum* 23, 43-76.
- Bean L. B. 2017. Reappraisal of Mesozoic fishes and associated invertebrates and flora from Talbragar and Koonwarra, Eastern Australia. *Journal of the Royal Society of Victoria*. (In press).
- López-Arbarello, A. Sferco, E. and Rauhut, O. W. M. 2013. A new genus of coccolepidid fishes (Actinopterygii, Chondrostei) from the continental Jurassic of Patagonia. *Palaeontologia Electronica* 16(1), 1–23.
- Murray, A. M. and Wilson, M. V. H. 2009. A new Late Cretaceous macrosemiid fish (Neopterygii, Halecostomi) from Morocco, with temporal and geographical range extensions for the family. *Palaeontology* 52(2), 429-440. <http://doi.org/10.1111/j.1475-4983.2009.00851.x>

- Sferco, E. López-Arbarello, A. and Báez A. M. 2015. Phylogenetic relationships of †*Luisiella feruglioi* (Bordas) and the recognition of a new clade of freshwater teleosts from the Jurassic of Gondwana. *BMC Evolutionary Biology*, 15(1), 268. <http://doi.org/10.1186/s12862-015-0551-6>
- Turner, S. and Avery, S. 2017. A Jurassic non-marine chondrichthyan in Australia and its palaeogeographic significance. *Palaeoworld*. <http://dx.doi.org/10.1016/j.palwor.2017.01.001>
- Wade, R. T. 1941. The Jurassic Fishes of New South Wales. *Journal and Proceedings of the Royal Society of New South Wales* 75, 71-84.
- Wade, R. T. 1953. Jurassic Fishes of New South Wales (Macrosemiidae) with a note on the Triassic genus *Promecosomina*. *Journal and Proceedings of the Royal Society of New South Wales* 87(2), 63-72.
- Waldman, M. 1971. Fish from the freshwater Lower Cretaceous of Victoria, Australia, with comments on the palaeoenvironment. *Special Papers in Palaeontology* 9. The Palaeontological Association, London.
- Woodward, A. S. 1895. The Fossil Fishes of the Talbragar Beds (Jurassic?). *Geological Survey of New South Wales, Palaeontology. Memoir* 9, 1-27.