Mega-raptorids in Victoria

By Stephen Poropat

Long-time readers of the Dinosaur Dreaming Field Report will we be aware that several beautifully-preserved theropod bones have been found at Eric the Red West (ETRW). Two of the bones in question have even been the poster children for the Field Report: "The Claw" made the cover of the 2014 edition, whereas The Claw and friend (a manual phalanx or finger bone) decorated that of the 2016 issue. Since its discovery, The Claw has been aligned with a group of theropods known as megaraptorids. Although these theropods are abundant in Argentina, they are seemingly far rarer in Australia. Outside Victoria, Australian megaraptorids are known from Lightning Ridge in New South Wales (the "Lightning Ridge Ripper") and from near Winton, Queensland ("Banjo", the exceptional type specimen of *Australovenator wintonensis*). Within Victoria, they are known from Flat Rocks (many teeth) Eagle's Nest (the astragalus formerly known as Australia's dwarf "*Allosaurus*"), Dinosaur Cove (an ulna) and ETRW.

In December 2017, while putting the finishing touches on the Victorian Cretaceous review paper, I started writing a paper describing The Claw. In the process, I also studied several other theropod remains from ETRW, including the manual phalanx that accompanied it on the 2016 Field Report cover. My aim was to work out which, if any, of the other theropod bones from ETRW were referable to Megaraptoridae, and whether or not they could all conceivably belong to a single megaraptorid individual. In addition to The Claw and the phalanx, the specimens I worked on were:

1. Two teeth;
2. A cervical (neck) rib;
3. A caudal (tail) vertebra;
4. The small manual ungual (hand claw) preserved on "The Block" found in 2017; and
5. An astragalus (anklebone).

In order to work out what type of theropod each bone represented, I compared each with published descriptions and images of comparable theropod bones from around the world. I quickly worked out that the teeth, both claws and the astragalus were compatible with Megaraptoridae, and that the astragalus was far too small to be from the same animal as the other bones. However, I also found that I could not place the cervical rib or caudal vertebra any more precisely on the theropod family tree than Tetanurae: few megaraptorids preserve cervical ribs, and few important features are found on tail vertebrae that are closer to the tip than the base. I was also unsure of what to make of the manual phalanx — it seemed to articulate perfectly with The Claw, which would make it the only other bone in the first finger, but it did not match the shape of that bone in megaraptorids well at all.

In order to improve the quality of my comparisons, Tim Ziegler and I arranged to get all of the specimens CT scanned at St Vincent's Hospital. I then sent the CT scan data to Dr Matt White (University of New England, Armidale NSW), who used it to generate 3D digital models of each specimen, which he then 3D printed life-size. Matt brought these 3D prints to Winton in May 2018 to enable us to make direct comparisons with *Australovenator*, and this validated my interpretation of the teeth, claws and astragalus. However, it cast further doubt on the affinities of the manual phalanx — it did not seem to match any of *Australovenator*'s phalanges, on either the hand or foot!

In October 2018, I felt confident enough to submit a manuscript on these theropod remains to the Journal of Vertebrate Paleontology (JVP). A few weeks later, I embarked on a Winston Churchill Memorial Trust-funded trip to South America, during which I was able to observe several Argentinian megaraptorid specimens firsthand. While in Argentina, I received a notification from JVP that my manuscript had been reviewed by two other palaeontologists, and that they wanted me to make substantial changes to it before it would be acceptable for publication. I utilised their comments and the observations I had made of several Argentinian megaraptorids to further improve my interpretations.

Image: S Poropat

Tooth NMV P252264. Scale in mm

Image: S Poropat

The Claw NMV P239464

I resubmitted in May 2019, and after further reviews, my paper was accepted in July, and published on 10 October.

As mentioned above, the cervical rib and caudal vertebra were unable to be identified beyond Tetanurae. The same was true of the manual phalanx — we worked out that it was actually from the second finger, closest to the base, but that it was completely different from the same bone in the hand of *Australovenator*, or any other megaraptorid for which that bone was known. All of the undoubted megaraptorid bones from ETRW were found to be almost indistinguishable from the same bones in *Australovenator*, and they were consequently designated as "Megaraptoridae cf. *Australovenator wintonensis*". This means that they were clearly referable to the group Megaraptoridae, and that within that group it was nigh on impossible to differentiate them from *Australovenator wintonensis* (cf. or confer means "compare with").

However, there was one bone from ETRW, identified by us as a megaraptorid, that we could not compare with *Australovenator*…

During the course of the reviews and revisions of my manuscript, I decided that it might be a good idea to take a fresh look at the only other theropod bone that had been reported from ETRW: the cervical (neck) vertebra, found by George Caspar in November 2005, which in 2011 was interpreted as a spinosaurid by Paul Barrett and others. As I had done with all of the other ETRW theropod specimens, I looked at the vertebra under the microscope… and was stunned to see a feature that no-one had ever reported before! On each side of the vertebra, a feature known as a pneumatic foramen is present. In many theropods, only one foramen is present on each side; however, in some megaraptorids — notably a juvenile specimen of *Megaraptor*, from which an almost complete neck is known — two were reportedly present. When I looked at the "spinosaurid" cervical, I realised that the right side hosted one foramen, but the left side hosted two. I went through my notes and photos from Argentina, and soon realised that the juvenile *Megaraptor* showed the same condition: some neck vertebrae hosted one foramen on one side, but two on the other. This observation, a few other anatomical features, and the realisation that many of the features of the ETRW cervical vertebra that were used to support its referral to Spinosauridae were not exclusive to that theropod group, led me to assign it to Megaraptoridae as well. However, unlike all the other undoubted ETRW megaraptorid bones, it could not be directly compared with *Australovenator*; consequently, I had to designate it as "Megaraptoridae genus and species indeterminate", even though it is probably from the same species as the other megaraptorid bones from ETRW.

The long and the short of this research is that megaraptorid theropods, almost identical in shape to but slightly smaller than *Australovenator*, were probably running riot in Victoria during the late Early Cretaceous (~107 million years ago), as they did in the early Late Cretaceous of New South Wales, Queensland, and southern Argentina. Almost all of the theropod bones from ETRW could conceivably belong to megaraptorids — even those that at present cannot be unequivocally shown to be so. Critically, however, our research has shown that there is at least one other theropod bone from ETRW that is definitively not from a megaraptorid — future research with my PhD student Adele Pentland should reveal its identity in due course. In addition, Matt White and I were able to determine that the large claw from west of the Punchbowl, originally identified as a neovenatorid, is also a megaraptorid — and that it is from a megaraptorid larger than *Australovenator*! Could more, possibly larger, megaraptorid remains be awaiting discovery at ETRW? Perhaps! Hopefully, we'll be able to dig there again soon to work this out…

References

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