

A humerus tale: physically investigating and recording a new species of *Ichthyosaurus* from Pliensbachian deposits at Charmouth, England.

Nigel R. Larkin¹ & Dean R. Lomax^{2, 3}

¹ Cambridge University Museum of Zoology, Downing St, Cambridge, CB2 3EJ & freelance conservator and curator at Natural-History-Conservation.com

² School of Earth, Atmospheric and Environmental Sciences, The University of Manchester, Manchester, UK.

³ Doncaster Museum & Art Gallery, Chequer Road, Doncaster, South Yorkshire, DN1 2AE.

Abstract

In the palaeontology collection of Doncaster Museum and Art Gallery an almost complete ichthyosaur skeleton (DONMG:1983.98 (Fig1)), collected from Upper Jurassic Pliensbachian deposits near Charmouth in Dorset¹, was recently identified as a new species (Lomax and Massare, in press²). However, it was clear that at some point in the past some of the forefin bones had been deliberately set within a filler. The skeleton was purchased by the museum in 1983 and no details about the discovery, excavation, conservation or mounting of the specimen were available. As the morphology of the visible humerus appeared to be unusual (a potentially diagnostic feature), the authors had to be clear exactly which bones were *in situ* and which - if any - had been introduced (i.e. from other specimens). Therefore the current positions of the forefin bones (including the humerus) had to be recorded, the paint had to be removed, the exact outline of the filler recorded and the filler removed along with any 'introduced' bones - which included one of the humeri. This meant also that the *in situ* and much less visible humerus had to be completely prepared and removed, to check if it was a perfect symmetrical match or not (it was). Because the morphology of the humerus would be the prime defining feature of the new species, the opportunity was taken to photograph, video, illustrate, CT scan and mould the humeri before re-setting them in the matrix. A set of good quality casts are now stored with the specimen for future study.



Fig 1: The conserved ichthyosaur skeleton DONMG:1983.98

Investigation of the forefin

Firstly, the positions of all the bones in the forefin were photographed (Fig 2) and also traced on to paper as a record of their exact arrangement (their orientation as well as position), and the bones were numbered. An airabrasive unit using compressed air lightly laced with sodium bicarbonate was used to remove the varnish on the bones and to remove the paint on the matrix and filler so that the bone, the matrix and the filler could all be distinguished from one another more easily and the exact extent of the filler assessed and recorded (Fig 3). The filler was then gently removed with scalpels and vibrating preparation pens and the numbered bones embedded within the filler were removed and stored, leaving only those *in situ* (Figs 4 & 5). The bones removed included most of the proximal phalanges and one humerus. Some filler was kept for analysis as the collector and the preparator of the specimen are still unknown but it would be useful to track them down to find out more about the specimen's discovery. The type of filler used could help with this as people often stick to materials they know. XRD analysis (Fig 6) revealed that the filler is a mixture of quartz, calcite and cristobalite - it has yet to be determined what product has these constituent parts (it did not have the texture of plaster or of resins such as epoxy or polyester etc).



Far left: Fig 2, showing the forefin before work commenced.

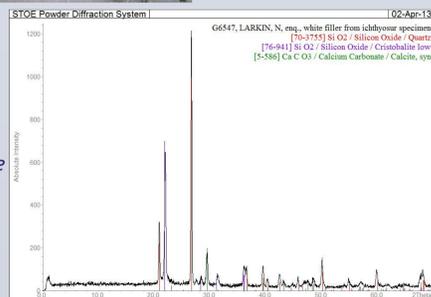
Middle left: Fig 3, showing the extent of the filler once the paint was removed.

Left: Fig 4, the forefin after all the bones embedded in the filler had been removed, including one humerus.



Left: Fig 5, the filler being removed from the forefin.

Right: Fig 6, the results of the XRD analysis of the filler material.

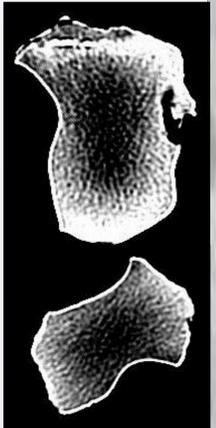


Whilst the visible humerus upon which the determination of the new species partly relied was found to be embedded entirely within filler and therefore remained suspect, the other humerus was fortunately deeply embedded within the matrix. However, this meant that it was difficult to determine if the humeri matched one another to make a perfect symmetrical pair. Therefore, although the second humerus was positioned tightly against some of the surrounding bones, it had to be mechanically prepared enough to enable its morphology to be assessed. So, pneumatic preparation pens with long and strong reciprocating needles were deployed and the bone was eventually completely removed and prepared.

Recording the humeri

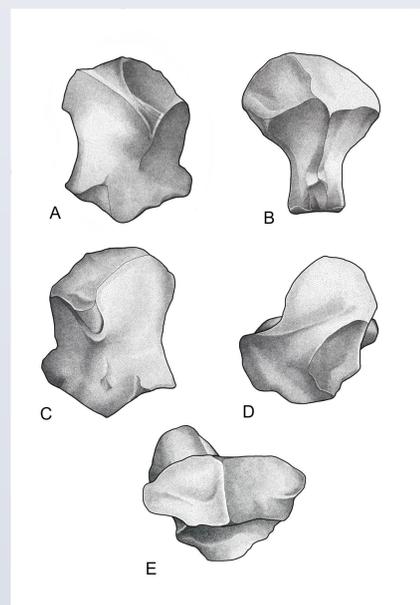


The two humeri (Fig 7) were found to be a perfect match in size and morphology. Therefore although one was found within the artificial filler, there is no doubt that both are from the same skeleton. As the humeri were to be a very important feature of the soon to be described new species, before replacing them the opportunity was taken not only to photograph them but to video them slowly rotating on a turntable and to CT-scan them (Fig 8). All this data was immediately sent via Dropbox by the preparator (NRL) to the authors describing the specimen, one of whom was on the other side of the world, so that they could advise on what other preparation may be required. In addition, the bones were also illustrated (Fig 9) and moulded to make high quality casts (Fig 10) to assist future research.



Above Left: Fig 7, the two humeri prepared and ready for photography, videoing, CT scanning, illustration and moulding. Above right: Fig 8, just two of the many dozens of slices of CT scans now available for study.

Such a variety of ways of recording the two humeri for the benefit of current and future researchers were used because the two bones are not only important diagnostically, but they would have to be carefully replaced in their original positions along with all the other forefin bones that had been removed. Before this was done, further exploratory preparation work was undertaken in this area to determine if any other forefin bones had been preserved unseen *in situ* in the matrix but only one other small phalange was found. Photos were taken of this prepared area as a record. After this, both the humeri and all the other *ex-situ* forefin bones were set in plaster of paris in their original locations and orientations. The plaster was painted out with artists acrylic paints to match the surrounding matrix.



Left: Fig 9, the illustrations made of the right humerus. A. Dorsal, B. Anterior, C. Ventral, D. Proximal, E. Distal views - Courtesy of Elizabeth Hall.

Above right: Fig 10, the casts of the humeri.

Conclusions

The amount of time spent working on this single specimen (eleven days including some conservation work not described here) was easily justified as this ichthyosaur is the single most important specimen in the palaeontology collection of Doncaster Museum and Art Gallery and it was in the process of being described as a new species. The specimen was enhanced by this work because a much greater knowledge was gained of the exact arrangement of the *in situ* bones of the forefin and in particular how the *ex-situ* humerus related to the *in-situ* humerus, leading to a greater confidence in the identification of the specimen within its wider taxonomy. Preparing and removing these bones was the only way of achieving this because the bones concerned were too small and too close together to resolve the issue by X-raying and/or CT scanning the bones *in situ*, especially considering the density of the matrix, the plaster and the wooden frame they were all surrounded by. If the preparation work described here had not been undertaken, determining the specimen as a new species would have been exceedingly difficult, if not impossible.

References

- Lomax, D. R. (2010). An *Ichthyosaurus* (Reptilia, Ichthyosauria) with gastric contents from Charmouth, England: First report of the genus from the Pliensbachian. *Paludicola*, 8: 22-36.
- Lomax, D. R. and Massare, J. A. (In press). A new species of *Ichthyosaurus* from the Lower Jurassic of West Dorset, England. *Journal of Vertebrate Paleontology*.

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