Making a record of early Cretaceous (late Barremian – early Aptian) rebbachisaur (Sauropoda, Rebbachisauridae) remains found on the Isle of Wight, UK, including unpublished material

Stachyrellus rebbachisi (Rebbachisauridae) alreday from the early Cretaceous of Niger. © Scott Hartman From Lomax, 2014;

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Abstract: The Rebbachisauridae is a widespread family of Cretaceous (Hauterivian-Coniacian) basal diplodocoid sauropods known from South America, Africa and Europe, but their remains are rare. In the UK, only three specimens have formally been described, recorded from the Early Cretaceous (late Barremian – early Aptian) Wessex Formation on the Isle of Wight. These include some of the oldest rebbachisaur remains known in the world and the only postcranial material of the clade so far identified in the British Isles (Nasah and Matilli, 2007, p. 36). Associated to the Rebbachisauridae by Sereno and Wilson (2001), Mannion and Lomax (2015), and Lomax and Tamura (2014). However, many additional rebbachisaur specimens have been found by various collectors over the last 40 years including cervical, dorsal, and caudal vertebrae, pelvic or pelvic material, forelimbs and ribs. Some of the bones show signs of tooth damage and some exhibit traces of invertebrate burrowing. The material has been found in at least four distinctly separate sites in the Wessex Formation but these appear to all be of a similar geological age, with similar preservation. Although two described and published bones are in the Dinosaur Isle Museum the rest are scattered throughout several private collections. Recently, the authors have been assessing and recording all of the known Isle of Wight rebbachisaur remains, including 3D scanning all of the bones to create a virtual collection of the material in one place to facilitate research, in order to resolve which bones the material may represent. Here, the additional in-house unpublished bones and the sites where they were found are described for the first time.

Introduction

The Rebbachisauridae is a widespread family of Cretaceous (Hauterivian-Coniacian) basal diplodocoid sauropods known from South America, Africa and Europe, but their remains are rare. In the UK, only three specimens have formally been described, recorded from the Early Cretaceous (late Barremian – early Aptian) Wessex Formation on the Isle of Wight. These include some of the oldest rebbachisaur remains known in the world and the only postcranial material of the clade so far identified in the British Isles (Nasah and Matilli, 2007, p. 36). Associated to the Rebbachisauridae by Sereno and Wilson (2001), Mannion and Lomax (2015), and Lomax and Tamura (2014). However, many additional rebbachisaur specimens have been found by various collectors over the last 40 years including cervical, dorsal, and caudal vertebrae, pelvic or pelvic material, forelimbs and ribs. Some of the bones show signs of tooth damage and some exhibit traces of invertebrate burrowing. The material has been found in at least four distinctly separate sites in the Wessex Formation but these appear to all be of a similar geological age, with similar preservation. Although two described and published bones are in the Dinosaur Isle Museum the rest are scattered throughout several private collections. Recently, the authors have been assessing and recording all of the known Isle of Wight rebbachisaur remains, including 3D scanning all of the bones to create a virtual collection of the material in one place to facilitate research, in order to resolve which bones the material may represent. Here, the additional in-house unpublished bones and the sites where they were found are described for the first time.

Site 3

Nick Chase found a partial left scapula in situ within the foresale at Grange above Chalk at the Isle of Wight (Mannion, 2009). Fig 5A (in Dinosaur Isle Museum, no. MIWG.6544, Scale bar 5cm. Photograph from Lomax & Tamura, 2014). Steve Hunt found a partial anterior caudal vertebra in the conglomerates of the Brighstone Wessex Formation of Brighstone Bay (Mannion et al., 2011). Fig 5B (in Dinosaur Isle Museum, no. MIWG.5384, Scale bar 5cm. Photograph from Lomax & Tamura, 2014).

Keth Simmonds found a caudal vertebra (tentatively attributed to Rebbachisauridae) collected from the black bed (debris bed on the east side of Brighstone Bay) in March 1986. This is possibly the youngest of the IOW rebbachisaur material. Fig 5C (scale bar 5cm).

Specimens from uncertain stratigraphy

All of the material found on the Isle of Wight that has been identified as rebbachisaur has a similar preservation including the texture and colour of the bone and the matrix and the fact that the bones were partially encased in many concretions, some extremely hard. In places the bone could be quite soft and fragile and in other places quite hard. In all cases the bones have been damaged by burrowing invertebrates that have left sub-circular tunnels up to 15 to 20mm in diameter (Fig 6). These burrows are naturally infilled and frequently contain fragments of the damaged bone. It is most likely that the burrowers were coprolitic beetles, perhaps Dermestidae, suggesting a climate including all seasonally extended dry periods (Lockwood et al., 2016). The geology and palaeoenvironment is being investigated by Bill Webb.

Site 4

The conglomeration band at the base of the Brighstone Sandstone in the Wessex Formation in Brighstone Bay. Between 1997 and 2003 Mick Green found a partial femur, a possible ilium fragment and a cervical vertebra, and Andrew Cocks found a dorsal vertebra centre – see Fig 3B below for the dorsal vertebra (scale bar 10cm).

 Preservation

Preparation & Recording

Preparation: Mick Green mostly removed the matrix from his bones using a pneumatic reciprocating air drill, and where needed a Swabmaster abrasive unit utilising sodium bicarbonate. In some places the bone was soft enough to require consolidation (Paraloid B-72) and the handling required for further preparation was limited. Some bones were prepared by the late David Cooper and one cervical vertebra (donated by Sean Smith) was prepared by Gary Blackwell of the Dinosaur Isle Museum.

Recording: Andrew Cocks is creating 3D digital models of all the rebbachisaur bones (Fig 7), using a Shining 3D scanner SP Pro white light structured light scanner. The models can currently be seen on Andrew Cocks Facebook page but will soon be made more widely available.

Fig 7 (left) Images from the digital 3D model of a dorsal vertebra (Mick Green’s collection) from site 2.

Discussion & Conclusion

All of the rebbachisaur bones were found in situ. The material appears to be scattered as the bones are found very infrequently and are usually articulated but some do appear to be associated (particularly the forelimbs). Many of the bones have clearly experienced weathering before burial and one rib fragment has multiple scratches indicating possible scavenging and one vertebra has clear tooth marks (Fig 8). Invertebrate burrows are found in many bones, indicating the pre-burial presence of the invertebrates and sometimes along the surfaces of the bones. The collection of the bones as well as the colour and appearance of the matrix and, importantly, the presence of burrows in the matrix and in bones are identical to rebbachisaur material of a similar age (upper Barremian) found in La Revilla northern Spain, approximately 520 miles south from the Isle of Wight, comprising some of the best rebbachisaur material in Europe. The startling similarity in preservation in both of these instances may indicate rebbachisaurus were conservative in their habits. Rebbachisaur bones in the UK are rare but are amongst the oldest known material of this group. Compared with previously described rebbachisaur species the bones found on the Isle of Wight appear to possess some slight anatomical differences – for instance in the orientation of the neural spines. Previous work on a limited range of the material has suggested that the Isle of Wight rebbachisaur remains are most closely related to the Spanish Demandasaurus and the African Ngaramus. This project aims to further resolve the identification of rebbachisaur material found on the island.

Fig 8 A. Possible tooth marks on a rib (Mick Green’s collection) from site 2. B. Possible tooth marks on the rim and anterior caudal vertebra centrum (Mick Green’s collection) from site 2.

Acknowledgements

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References


