

## MICROPALAEONTOLOGY NOTEBOOK

**Statoliths: neglected microfossils**MALCOLM B. HART<sup>1</sup>\*, ALEX DE JONGHE<sup>2</sup>, ADRIAN J. RUNDLE<sup>3</sup> & CHRISTOPHER W. SMART<sup>1</sup><sup>1</sup>School of Geography, Earth & Environmental Sciences, Plymouth University, Drake Circus, Plymouth PL4 8AA, UK<sup>2</sup>Robertson International Oil and Gas Consultants, Tyn-y-Coed, Pentywyn Road, Llandudno LL30 1SA, UK<sup>3</sup>Department for Learning, Natural History Museum, Cromwell Road, London SW7 5BD, UK\*Corresponding author (e-mail: [mhart@plymouth.ac.uk](mailto:mhart@plymouth.ac.uk))

In the Callovian mudstones associated with the Christian Malford Lagerstätte (Wilby *et al.*, 2008), exceptionally large numbers of statoliths have been found in normally prepared (White Spirit method of Brasier, 1980) micropalaeontology residues. Statoliths, like the otoliths in teleost fishes, are aragonitic ‘stones’ found in the stato-acoustic organs (statocysts) of squid. While statoliths are relatively well known in the biological literature (Lipiński, 1986, 1997; Hanlon & Messenger, 1996) they remain almost undescribed in the field of micropalaeontology.

Otoliths are the stato-acoustic organs of bony (teleost) fish and can be well preserved as fossils (Frost, 1924, 1926; Rundle, 1967; Stinton & Torrens, 1968; Lowenstein, 1971; Patterson *et al.*, 1993; Patterson, 1998, 1999; Hart *et al.*, 2006, 2009). In some of these accounts of Jurassic otoliths there are a number of illustrations of what are, more correctly, regarded as statoliths (e.g. Frost, 1926, figs 13, 14; Martin & Weiler, 1954, pl. 3, fig. 116; Rundle, 1967, text-fig. 4).

**STATOLITHS**

Statoliths are the small, aragonitic ‘stones’ which lie in fluid-filled cavities or statocysts within the cartilaginous skulls of all living and (probably) all fossil members of the Coleoidea (Clarke & Fitch, 1975, 1979; Clarke, 1978, 2003; Clarke & Maddock, 1988*a*, *b*; Clarke *et al.*, 1980*a*, *b*). Often co-occurring with otoliths, and being of similar appearance, size, colour, etc., has caused the confusion in the past, although it is probably the case that the various authors were completely unaware of the existence of statoliths at the time of writing. While a number of authors have noted the occurrence of statoliths in Jurassic sediments (Clarke, 1996, 2003), there is no taxonomic nomenclature available. Indeed, the only specific description and illustration of Jurassic statoliths (Jurassic

sp. A and Jurassic sp. B; Clarke, 2003, figs 14, 15) leaves the two taxa in open nomenclature. Recently Hart *et al.* (2009, fig. 3(F)) have illustrated a statolith from the Wottonensis Beds (Upper Bathonian) of South Dorset and this is very close to the form, or forms, identified as Jurassic sp. A of Clarke (2003, fig. 15).

In the case of the Christian Malford Lagerstätte, Wilby *et al.* (2008) illustrate and describe a number of coleoids that were collected over 170 years ago during construction of the Great Western Railway. During a re-investigation of the site in 2007, the British Geological Survey drilled a number of short boreholes and one of these (Core 10) has been investigated at Plymouth University. Processed samples from this core have yielded exceptionally large numbers of statoliths (*c.* 400 g<sup>-1</sup> of sediment in some cases). Almost all of the individuals found, along with abundant squid hooks, otoliths and foraminifera, appear to be the same species (Fig. 1) and a full description of the assemblage is in preparation. The ‘squid’ represented by the statoliths is not yet identified, although *Belemnoteuthis*, as a hook-bearing belemnite without a solid rostrum – and which is well known from Callovian sediments in the British isles – may be the favoured taxon. Malcolm Clarke (pers. comm., 2010), though retired from the Marine Biological Association in Plymouth, is currently working on the taxonomy of the Jurassic statoliths while our work continues on the assemblages from Christian Malford.

**SUMMARY**

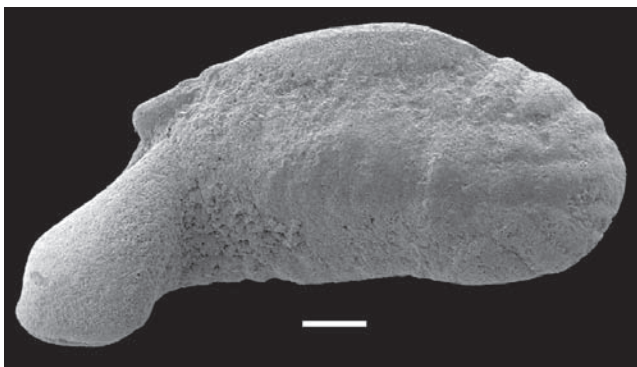
Statoliths are, following the work of Clarke, now known to exist in the fossil record from the Lower Jurassic to Recent, though few micropalaeontologists know of their existence. Despite working on many thousands of Cretaceous residues, MBH has no record of statolith-like microfossils from the Cretaceous, though squid hooks have been recorded. Within the chalk facies this may be a result of dissolution of the aragonitic statoliths as other aragonitic microfossils (e.g. epistominid foraminifera) are also rare or non-existent. It is important that such microfossils are noted (and described) by those working on microfossil residues in order that their full potential as palaeoenvironmental indicators is attained.

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**Fig. 1.** Anterior view of a large left statolith from 70–80 cm in Core 10, Christian Malford. Scale bar is 200 µm. This specimen is almost identical to ‘Jurassic sp. A’ of Clarke (2003).

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