

## A NEWLY DESCRIBED JURASSIC 'SQUID-LIKE CEPHALOPOD' FROM THE LIAS GROUP OF DORSET

M.B. HART<sup>1</sup> AND D. HUTCHINSON<sup>2</sup>



Hart, M.B. and Hutchinson, D. 2016. A newly described Jurassic 'squid-like cephalopod' from the Lias Group of Dorset. *Geoscience in South-West England*, **14** 35–38.

A newly described 'clarkeiteuthid' (squid-like cephalopod) from the Lias Group (Jurassic) of the Dorset Coast provides a significant insight into the development of arm hooks (onychites) in the early Jurassic. This specimen shows the trace of four arms that are picked out by only the lines of hooks. The hooks are paired, with two distinctive elements that are described for the first time. With no soft-bodied preservation of the animal, or signs of a phragmocone, the specimen can only be tentatively identified as *Clarkeiteuthis* sp. cf. *C. montefiorei*.

<sup>1</sup> School of Geography, Earth & Environmental Sciences, Plymouth University,  
Drake Circus, Plymouth PL4 8AA  
(E-mail: mhart@plymouth.ac.uk)

<sup>2</sup> Bristol Museum & Art Gallery, Queen's Road, Clifton, Bristol BS8 1RL

**Keywords:** Lias Group, Dorset, onychites, *Clarkeiteuthis*

### INTRODUCTION

In the palaeontological collections of the Bristol Museum & Art Gallery is specimen number BRSMG Ce12385 that was collected by Stuart Bagnoli, and gifted to the museum on the 26th September 1989. It is recorded as coming from "the (?) Jamesoni Subzone (Pliensbachian), 15 ft (4.5 m) below the *Lytoceras* Stone Band at a location 300 yards (275 m) east of Golden Cap at Stanton St Gabriel". The *Lytoceras* Stone Band is better known as the Belemnite Stone (Cope, 2012, p. 56) and is Lang's Bed 121 which is located at the top of the Belemnite Marls (Beds 106–120): see Lang and Spath (1926) and Lang *et al.* (1928) for the bed notation within the Lias Group. This would place the specimen at the top of the Jamesoni Subzone (*vide*, Donovan, 2017). This is within the Charmouth Mudstone Formation (Cox *et al.*, 1999). The specimen is interesting in that it occurs in highly bioturbated (Figure 1A), calcareous mudstone and it is quite striking that the lines of arm hooks remain virtually undisturbed in such a sedimentary environment.

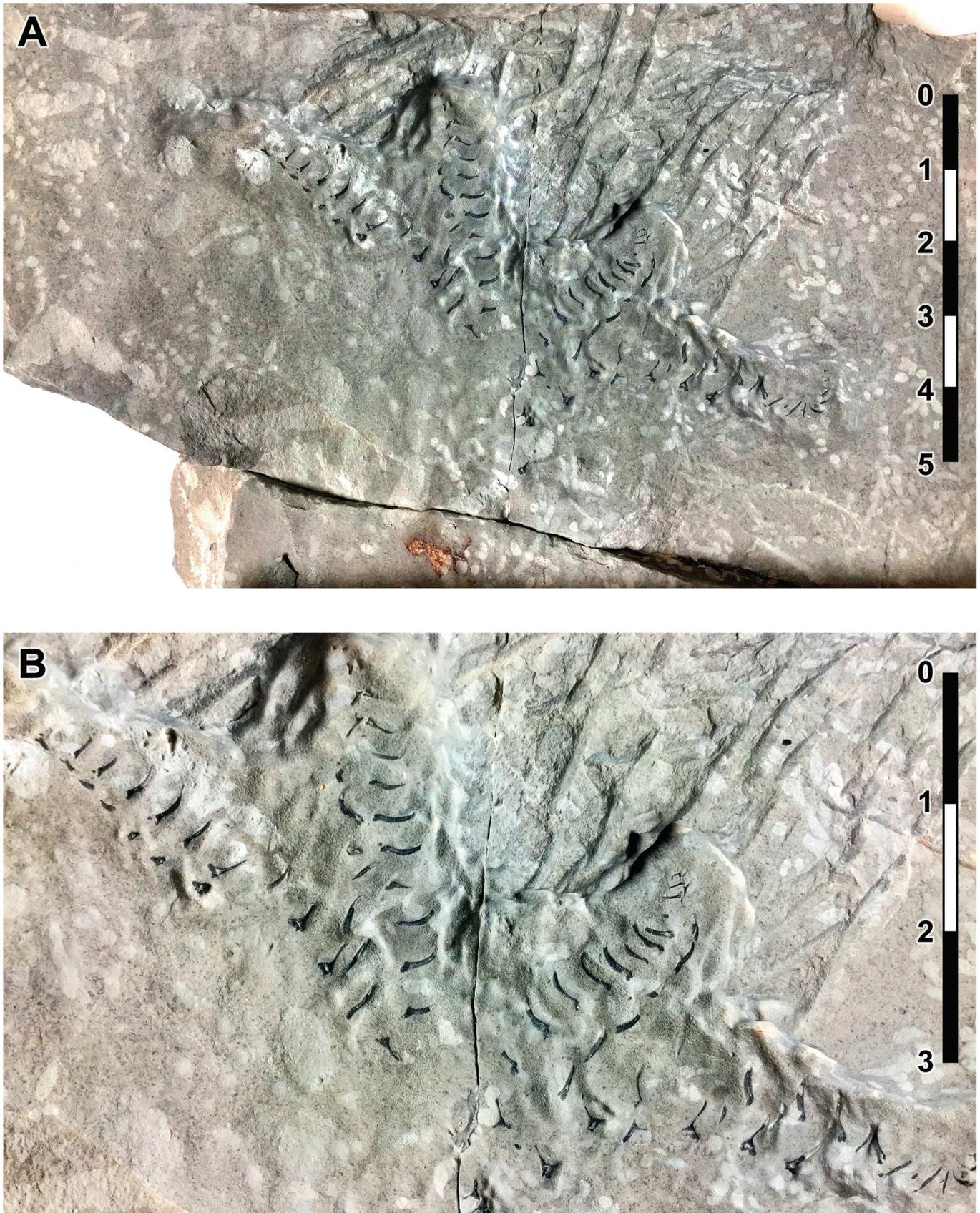
### ONYCHITES

Modern squid have few easily preserved components. These include the crystalline lens of the eye (Clarke, 1993), the gladius or chitinous backbone (La Roe, 1971), mandibles or chitinous jaws (Clarke, 1965), onychites (squid arm and tentacle hooks) and statoliths (Clarke, 1966, 2003).

Modern coleoid (squid-like) cephalopods have arms that carry arrays of both suckers and hardened, organic hooks. Fossil arm hooks have been known since their 'accidental' description by Kašpar Maria Sternberg in 1822, although he identified them as plant remains: see Naef (1922) and Cleal *et al.* (2005). During the twentieth century there were a number of brief descriptions of hooks but it was Kulicki and Szaniawski

(1972) who described 22 morphotypes from the Jurassic of Poland. These authors gave these 'forms' names using a binomial classification though, with many lacking defined (and figured) holotypes and, in some cases, only one recorded specimen, some of their designations should probably be regarded as invalid. Some of their morphotypes from Poland have, however, been reported from Germany (Engeser, 1987; Fuchs *et al.*, 2013), Spitzbergen (Hammer *et al.*, 2012) and the United Kingdom (Pollard, 1968, 1990; Hart *et al.*, 2016). An account of earlier records of hooks was provided by Engeser and Clarke (1988, and references therein), who also attempted to use some of the Kulicki and Szaniawski (1972) terminology. It is important to record that Engeser (1987, pp. 8, 9) described the processing methods appropriate for the recovery of separate hooks from sediment samples, though few authors appear to have adopted this approach to their study.

The material described by Kulicki and Szaniawski (1972) came from the Middle and Upper Jurassic of Poland and, therefore, did not record the typical Lower Jurassic hooks described by Engeser and Clarke (1988, fig. 2d, fig. 3) that had a bi-lobed, inflated base. Engeser and Clarke (1988) attributed these forms to "*Phragmoteuthis montefiorei*" (Buckman, 1880), illustrating a specimen from the Lower Jurassic of Southern England. Fuchs *et al.* (2013) have recently revised the generic position of *Clarkeiteuthis montefiorei* (Buckman, 1880) and illustrated (Fuchs *et al.*, 2013, fig. 5b, c) a specimen from the Charmouth Mudstone Formation (Upper Sinemurian) of Dorset that clearly shows the bi-lobed bases to the lines of arm hooks. These are quite different from the more prominently 'hooked' forms associated with *Phragmoteuthis bisinuata* (Bronn, 1859) and illustrated by Doguzhaeva *et al.* (2007, fig. 2C) and Fuchs *et al.* (2013, fig. 4E). One issue with the illustration of Doguzhaeva *et al.* (2007, fig. 2C) is that it shows, without comment, two types of hook:



**Figure 1.** *Clarkeiteuthis* sp. cf. *C. montefiorei* (BRSMG Ce12385): **A.** View of the complete specimen showing the arm books within the bioturbated, calcareous, mudstone of the Belemnite Marls (Scale in cm); **B.** Close-up of the arm books of BRSMG Ce12385 showing their bi-lobed base, gently curved uncinus and central core of grey 'matter'. The pairs of books are different to those figured by Fuchs et al. (2013) for *Clarkeiteuthis conocauda* – which shows that both elements of the pair are almost identical – being rather closer to that figured by Hyde (2012) where the pairs are composed of different looking elements (Scale in cm).

- One hook has a straight shaft, a distinct spur around the mid-point and a near 90° curvature of the uncinus; and
- More massive hooks with a less straight shaft and a massive, rather robust spur.

It is always difficult in prepared material (as distinct from hooks separated by processing) to know if the shape is being influenced by the relationship between the hook and the matrix. This is certainly true of the Bristol specimen that is the subject of this paper as the marks left by the preparatory work are clearly visible.

In their discussion of *Clarkeiteuthis*, Fuchs *et al.* (2013, fig. 4E) show the more massive hook as representing *P. bisinuata*. This is very different to the hook shown by Fuchs *et al.* (2013, fig. 3F, 3G) as being typical of *Clarkeiteuthis conocauda* from Holzmaden (Germany) and also different to the hooks of *C. montefiorei* from the Charmouth Mudstone Formation (Upper Sinemurian) of Dorset.

The un-named specimen (BRSMG Ce12385) from the Belemnite Marls of Dorset (Fig. 1B) shows arm hooks with bi-lobed, inflated bases, which places the animal in the new genus *Clarkeiteuthis* following the descriptions of Fuchs *et al.* (2013). As the presently known range of the genus is Sinemurian to Toarcian this is not problematic: the question is the species to which it can be attributed? As there are no soft parts preserved, or a phragmacone, the arm hooks are the only elements that can be used in the identification.

In Manchester University Museum there are two specimens of Lower Jurassic squid-like cephalopods, both of which have been described by Hyde (2012). The specimens are attributed to the Lower Lias and given a location of Lyme Regis. Unfortunately many collectors in the nineteenth century sold specimens and gave the location as Lyme Regis knowing that the place was famous for its fossils or it was where they were based. One of these specimens (L.6810) was, apparently, found near the top of the *A. bucklandi* Zone (within the Sinemurian). Specimen L.6809 (not L.6089 as stated by Hyde, 2012) was bought in 1905 along with specimen L.6810 (Kate Sherburn, *pers. comm.*, November 2016). Hyde (2012, fig. 2B, 2C) shows hooks from specimen L.6809, including long forms with a relatively straight shaft and an 'inflated' base and smaller, more triangular, forms that he interprets as part of a dissimilar pair (Hyde, 2012, fig. 2C). Hyde (2012, pp. 443, 444) also notes that in both specimens (L.6923 and L.6809) hooks appear to have a white to buff-coloured core, surrounded by a dark black outer layer.

In the Bristol Museum & Art Gallery specimen (Ce12385) there is a clear sign that some of the hooks appear to be in pairs and that while one of the pair has a long, slightly curved, shaft the other part of the pair is smaller and does not have an elongated shaft (Fig. 1B). Hyde (2012, p. 443) attributes L. 6809 to *Phragmoteuthis*, though Fuchs *et al.* (2013) would now place it in their new genus *Clarkeiteuthis*. The paired hooks are, however, not the same as those figured by Fuchs *et al.* (2013, fig. 3F, 3G) for *C. conocauda*. The figure of Fuchs *et al.* (2013, fig. 5B, 5C) showing the hooks of *C. montefiorei* are also different, though there may be scattered small hooks in the photograph that are comparable to those shown by Hyde (2012, fig. 2B, 2C) and present in BRSMG Ce12385. *C. montefiorei* was originally described from the 'Lower Lias Shales' between Charmouth and Lyme Regis: now known as the Black Ven Marls Member of the Charmouth Mudstone Formation. Donovan (2006, p. 675) suggests that this would place it within the Upper Sinemurian. The top of the Bucklandi Zone, which *may* be the horizon from which L.6809 was collected, is relatively close to that of *C. montefiorei* and only slightly older than BRSMG Ce12385 from the Belemnite Marls. The newly described specimen (BRSMG Ce12385) should probably be recorded as *Clarkeiteuthis* sp. cf. *C. montefiorei* pending a more detailed assessment of the hooks of the specimen of *C. montefiorei* in the Natural History Museum (BNHM C5026) which was described by Donovan (2006). The

hooks present in the type specimen (Donovan, 2006, text-fig. 1) were not described in detail but the hooks illustrated clearly show pairs that have a long hook with a bi-lobed base alongside smaller, almost triangular hooks. As noted by Donovan (*op. cit.*, p. 674), this specimen has been 're-arranged' and subsequently figured by Crick (1902, fig. 1).

## STRATIGRAPHY AND EVOLUTION OF THE EARLY JURASSIC CLARKEITEUTHIDS

The known ranges of *Phragmoteuthis* and *Clarkeiteuthis* are very much related to lagerstätte in which soft bodied remains are known (Donovan and Fuchs, 2016). *P. bisinuata* has been described from the Carnian (Upper Triassic) of Austria (Doguzhaeva *et al.*, 2007) and Prof. M. Benton (*pers. comm.*, October 2016) has found an arm hook attributable to *P. bisinuata* in the Rhaetian of the West Country).

*C. montefiorei* is known from the Sinemurian and may, if the specimen described by Hyde (2012, p. 445) is correctly attributable to the Hettangian, have a known range of Hettangian to Upper Sinemurian. If specimen BRSMG Ce12385 is correctly identified as *Clarkeiteuthis* sp. cf. *C. montefiorei* then the range may be extended into the Lower Pliensbachian. The distinctive species, *C. conocauda* is known from the Upper Pliensbachian and Toarcian.

None of the hooks attributable to *Phragmoteuthis* and *Clarkeiteuthis* were described in the Middle and Upper Jurassic acid reductions of Kulicki and Szaniawski (1972) or in the washed residues of Hart *et al.* (2016). This would suggest that arm hooks with inflated, often bi-lobed, bases are limited to the lower Jurassic. This was the conclusion of Engeser and Clarke (1988, fig. 3) in their analysis of Jurassic arm hooks and research post-1988 has confirmed this as being a correct assessment of the situation.

## SUMMARY

Specimen BRSMG Ce12385 has been determined as representing a Lower Pliensbachian clarkeiteuthid, attributable to *C. montefiorei*. Despite having no phragmocone or soft body preservation the arm hooks have been used to make the determination. This demonstrates that discrete arm hooks from processed micropalaeontological residues may, with care, be used to extend the ranges of taxa in the absence of body fossils.

## ACKNOWLEDGEMENTS

The authors wish to acknowledge the advice of Dirk Fuchs, Rene Hoffman, Ben Hyde, Kate Sherburn (Manchester Museum) and the late Malcolm Clarke. Prof. Desmond Donovan is thanked for his helpful comments on an earlier version of this paper, all of which allowed the authors to make significant improvements to the final version. Mr James Quinn (Plymouth University Geomapping Unit) is thanked for producing the final versions of the figures.

## REFERENCES

- BUCKMAN, J. 1880. On the *Belemniteuthis montefiorei*. *Proceedings of the Dorset Natural History and Antiquarian Field Club*, **3**, 141–143.
- CLARKE, M.R. 1965. "Growth rings" in the beaks of the squid *Moroteuthis ingens* (Oegopsina, Onychoteuthidae). *Malacologia*, **3**, 297–307.
- CLARKE, M.R. 1966. A review of the systematic and ecology of oceanic squids. *Advances in Marine Biology*, **4**, 91–300.
- CLARKE, M.R. 1993. Age determination and common sense – a free discussion on difficulties encountered by the author. In: OKUTUNI, T., O'DOR, R.K. and KUBODERA, T. (eds), *Recent advances in cephalopod fisheries biology*, Tokai University Press, Tokyo, 670–678.
- CLARKE, M.R. 2003. Potential of statoliths for interpreting coleoid evolution: A brief review. *Berliner Paläobiologische Abhandlungen*, **3**, 37–47.

- CLEAL, C.J., LAZARUS, M. and TOWNSEND, A. 2005. Illustrations and illustrators during the 'Golden Age' of palaeobotany: 1800-1840. In: BOWDEN, A.J., BUREK, C.V. and WILDING, R. (eds), *History of Palaeobotany: selected essays*, Geological Society, London, Special Publications, 241, 41–61.
- COPE, J.C.W. 2012. *Dorset*. Geologists' Association Guide, No. 22 [1st Edition], London.
- COX, B.M., SUMBLER, M.G. and IVIMEY-COOK, H.C. 1999. A formational framework for the Lower Jurassic of England and Wales (onshore area). *British Geological Survey, Research Report*, RR/99/01, 30pp.
- CRICK, G.C. 1902. Note on the type-specimen of *Belemnoteuthis montefiorei*, J. Buckman, from the Lower Lias Shales between Charmouth and Lyme Regis, Dorset. *Proceedings of the Malacological Society of London*, **5**, 13–16.
- DOGUZHAeva, L.A., SUMMESBERGER, H., MUTVEI, H. and BRANDSTAETTER, F. 2007. The mantle, ink sac, ink, arm hooks and soft body debris associated with shells in Late Triassic coleoid cephalopod *Phragmoteuthis* from the Austrian Alps. *Palaeoworld*, **16**, 272–284.
- DONOVAN, D.T. 2006. Phragmoteuthida (Cephalopoda: Coleoidea) from the Lower Jurassic of Dorset, England. *Palaeontology*, **49**(3), 673–684.
- DONOVAN, D.T. and FUCHS, D. 2016. Part M, Chapter 13: Fossilized soft tissues in Coleoidea. *Treatise Online*, **73**, 1–30.
- ENGESER, T. 1987. Belemnoid arm hooks ('onychites') from the Swabian Jurassic – a review. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, **176**, 5–14.
- ENGESER, T.S. and CLARKE, M.R. 1988. Cephalopod hooks, both recent and fossil. In: CLARKE, M.R. and TRUMAN, E.R. (eds), *Palaeontology and Neontology of Cephalopods*, vol. 12; WILBUR, K.M. (ed.), *The Mollusca*, Academic Press Inc., London, 133–151.
- FUCHS, D., DONOVAN, D.T. and KEUPP, H. 2013. Taxonomic revision of "Onychoteuthis" *conocauda* Quenstedt, 1849 (Cephalopoda: Coleoidea). *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, **270/3**, 245–255.
- HART, M.B., DE JONGHE, A., PAGE, K.N., PRICE, G.D. and SMART, C.W. 2016. Exceptional accumulations of statoliths in association with the Christian Malford lagerstätte (Callovian, Jurassic) in Wiltshire, United Kingdom. *Palaios*, **31**, 203–220.
- HAMMER, Ø., HRYNIEWICZ, K., HURUM, J.H., HØYBERGET, M., KNUTSEN, E.M. and NAKREM, H.A., 2012. Large onychites (cephalopod hooks) from the Upper Jurassic of the Boreal Realm. *Acta Palaeontologica Polonica*, **58**, 827–835.
- HYDE, B.G. 2012. A description of two Phragmoteuthid coleoid cephalopods from the Lower Jurassic of Lyme Regis, Dorset and the importance of well intended forgeries. *The Geological Curator*, **9** (8), 441–446.
- KULICKI, C. and SZANIAWSKI, H. 1972. Cephalopod arm hooks from the Jurassic of Poland. *Acta Palaeontologica Polonica*, **17**, 379–419.
- LANG, W.D. and SPATH, L.F. 1926. The Black Marl of Black Ven and Stonebarrow, in the Lias of the Dorset coast. *Quarterly Journal of the Geological Society, London*, **82**, 144–187.
- LANG, W.D., SPATH, L.F., COX, L.R. and MUIR-WOOD, H.M. 1928. The Belemnite Marls of Charmouth, a series in the Lias of the Dorset coast. *Quarterly Journal of the Geological Society, London*, **84**, 179–257.
- LA ROE, E.T. 1971. The culture and maintenance of the loliginid squids, *Sepioteuthis sepioidea* and *Doryteuthis plei*. *Marine Biology*, **9**, 9–25.
- NAEF, A. 1922. *Die Fossilen Tintenfische*. Gustav Fischer, Jena, 322pp.
- POLLARD, J.E. 1968. The gastric contents of an ichthyosaur from the Lower Lias of Lyme Regis, Dorset. *Palaeontology*, **11**, 376–388.
- POLLARD, J.E. 1990. Evidence for diet. In: BRIGGS, D.E.G. and CROWTHER, P.R. (eds), *Palaeobiology, a Synthesis*, Blackwell, Oxford, 362–367.