

INTERNAL FEATURES OF *LOLIGOSEPIA BUCKLANDI* (VOLTZ, 1840) FROM THE LIAS OF DEVON



MALCOLM B. HART^{1*}, CHRISTIAN KLUG², CHRISTOPHER MOORE³ AND GREGORY D. PRICE¹

Hart, M.B., Klug, C., Moore, C. and Price, G.D. 2025. Internal features of *Loligosepia bucklandi* (Voltz, 1840) from the Lias of Devon. *Proceedings of the Ussher Society*, 15(4), 167-170.

A new specimen (2025) of Neocoleoidea (*sensu* Hoffmann *et al.*, 2022) from the Charmouth Mudstone Formation of the Devon/Dorset Coast can be identified as *Loligosepia bucklandi* (Voltz, 1840). The specimen includes the gladius and some jaw fragments, while possible eye sockets and arms are slightly unclear. Some internal structures, including the ink sac, are visible. The new specimen is compared to other *L. bucklandi* fossils in the Natural History Museum (London) and the J.F. Jackson Collection in the National Museum Wales (Cardiff).

¹School of Geography, Earth & Environmental Sciences, University of Plymouth, Drake Circus, Plymouth PL4 8AA

²Paläontologisches Institut und Museum, Universität Zürich, Karl-Schmid-Strasse 4, CH 8006 Zürich, Switzerland

³The Forge Fossils, The Street, Charmouth, Dorset DT6 6NX

*Corresponding author E-mail: M.Hart@plymouth.ac.uk

Keywords: *Loligosepia*, Mollusca, Lias, Sinemurian, Devon

INTRODUCTION

The original specimen of *Loligosepia bucklandi* was reportedly collected by Mary Anning from the Lias of Lyme Regis (Dorset) and was recorded as 'fossil *Loligo*' by William Buckland (1836, p. 306, pls 28, 29, 30). The 'Mary Anning specimen' which, by this time, was in the Oxford University Museum (OUM J3530), was named by Voltz (1840) **only** on the basis of Buckland's illustration (Voltz, 1840, pl. 30). Voltz (*op. cit.*) lists line drawings in Buckland's (1836, pls 28, 29, 30) monograph but does not specifically identify which of the illustrations was used as the holotype, although plate 30 shows only one specimen. The monograph in which plates 28, 29 and 30 appear is a part of the '*Bridgewater Treatises*' (occasionally dated as 1837 in some literature). The specimen illustrated by Hart *et al.* (2024, fig. 1) is, therefore, regarded as the holotype, presumably on the basis of monotypy (ICZN article 73.1.2), there being only one illustrated specimen (see Donovan and von Boletzky, 2014). The single view of this unique specimen, in Buckland's plate 30 (reproduced in Figure 1), is the most characteristic and many of the features shown in that drawing are present in our new material. It is quite confusing that plate 30 is supposed to represent 'a large fossil pen of *Loligo* from the Lias of Lyme Regis'. The illustrations were provided by Mrs Mary Buckland (*née* Morland), who illustrated much of her husband's work, though she was a well-known naturalist in her own right (Kölbl-Ebert, 1997). It is listed [https://en.wikisource.org/wiki/Geology_and_Mineralogy_considered_with_reference_to_Natural_Theology/Plate_30] as being in the collection of Miss Philpot though not specifying which of the three sisters had collected the specimen.

Elizabeth Philpot (1779–1857), and her sisters Mary (1777–1838) and Margaret (1786–1845), moved to Lyme Regis from London in 1805. John Philpot, a London solicitor, took possession of Morley Cottage in Silver Street (now the Mariner's Hotel) for the three sisters. The Philpot sisters became well known locally for their fossil collecting and Elizabeth Philpot befriended Mary Anning while she was still a child. The Lyme Regis Philpot Museum was built (1900–1901) in Lyme Regis in honour of the sisters by their nephew, Thomas Embray Davenport Philpot (1859–1918), and commissioned as a museum in 1902.

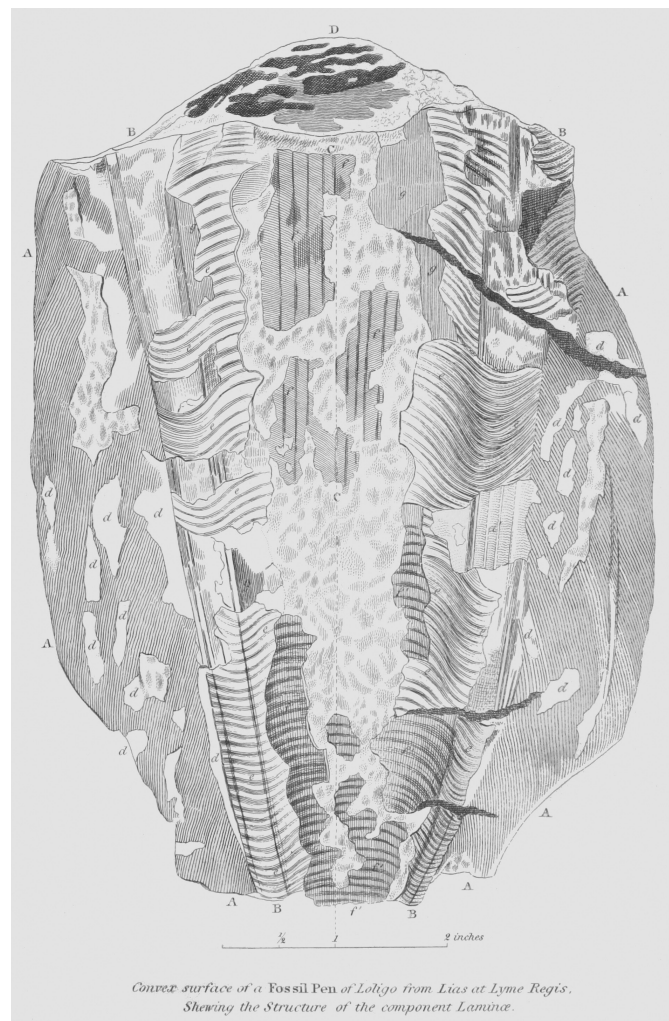


Figure 1. Fossil *Loligo* illustrated by William Buckland (1836, pl. 30) and reproduced from Wikisource (Creative Commons CC BY-SA 4.0).

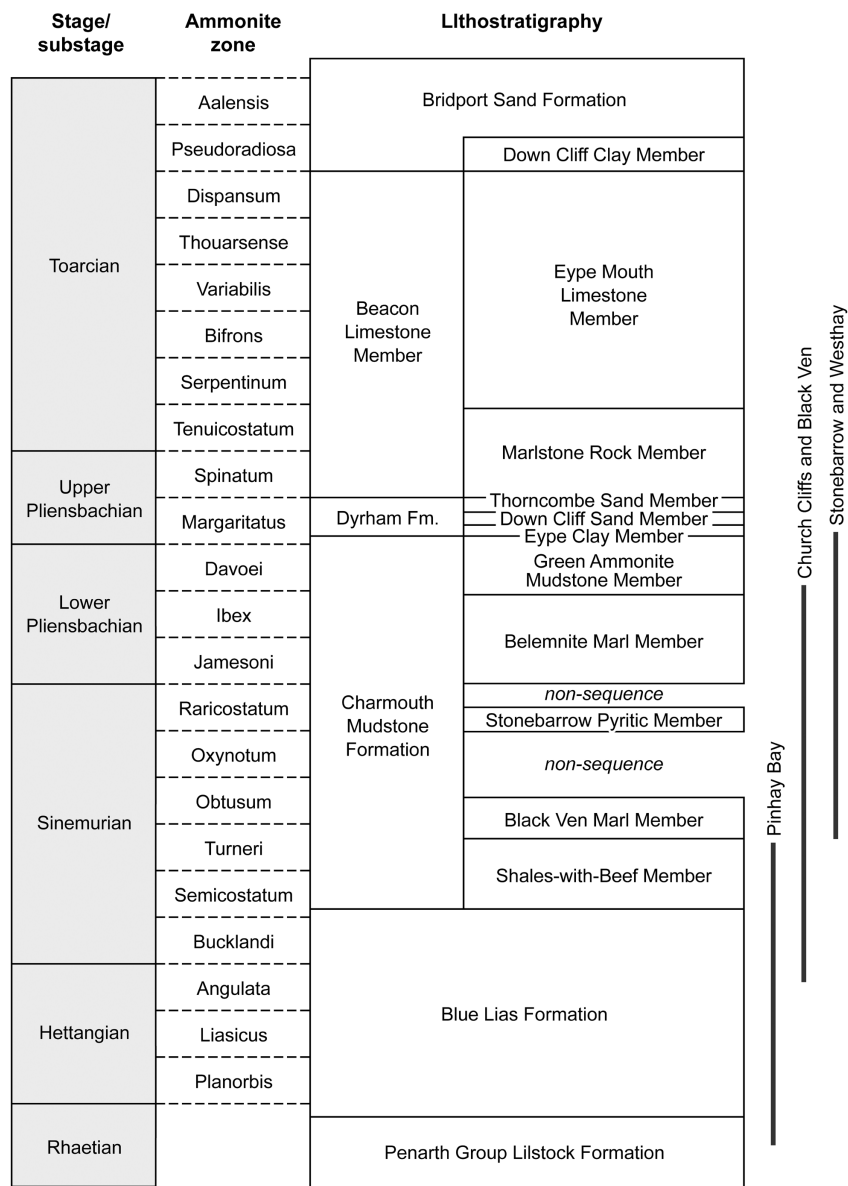


Figure 2. Stratigraphical succession of the Jurassic strata exposed on the Dorset Coast, West Dorset (based on Lang and Spath (1926), Palmer (1984), Simms (2004), Cope (2012, 2016) and Hart et al. (2024)).

Since the determination of the holotype in the OUM collections, further specimens have been collected from the same area (and stratigraphical level) and are housed in the collections of The Natural History Museum (London) and the National Museum Wales (Cardiff). In recent years there have been further descriptions of *Loligosepia* by Fuchs and Weis (2008), Donovan and von Boletzky (2014), and Hart *et al.* (2024) as well as a brief mention (with a small figure) in Klug *et al.* (2020).

STRATIGRAPHY

With respect to the holotype (Buckland, 1836, p. 51), there was limited locality or other geological information attached to the specimen other than being found in – or near – Lyme Regis. Many of the other specimens listed by Donovan and von Boletzky (2014, appendix 1) also lack detailed stratigraphical information, although they appear to come from the Shales-with-Beef and Black Ven Marls members of the Charmouth Mudstone Formation (Figure 2); see Lang and Spath (1926), Palmer (1984), Simms (2004) and Cope (2012, 2016) for further stratigraphical information. As reported by Hart *et al.*

(2024), the best located specimens are those in the J.F. Jackson Collection (National Museum Wales), which are recorded as coming from the Flatstones and the Stellare Nodules of the Sinemurian succession of Lyme Regis (Devon/Dorset, UK); see Cope (2016). This new specimen, described here, is recorded as being from the strata close to the Stellare Nodules and, therefore, within the stratigraphical window described by Hart *et al.* (2024, fig. 3); *i.e.*, lower Sinemurian.

PALAEONTOLOGICAL FEATURES

This new specimen (Fig. 3), which was found *ex-situ* in 2025 close to the Dorset/Devon boundary, shows the gladius, eye sockets, some jaw fragments and an area surrounding the jaw fragments that were part of the head and the arms. The gladius was originally a chitinous structure in the dorsal mantle of the living Vampyromorpha (Decabanchia) that provides support during the contractions of the mantle musculature involved in swimming by ‘jet propulsion’ (Fuchs *et al.*, 2016). Jurassic specimens appear to have had a gladius preserved in apatite (Fuchs and Weis, 2008), although this chemistry has not been confirmed in the new specimen. The form of the

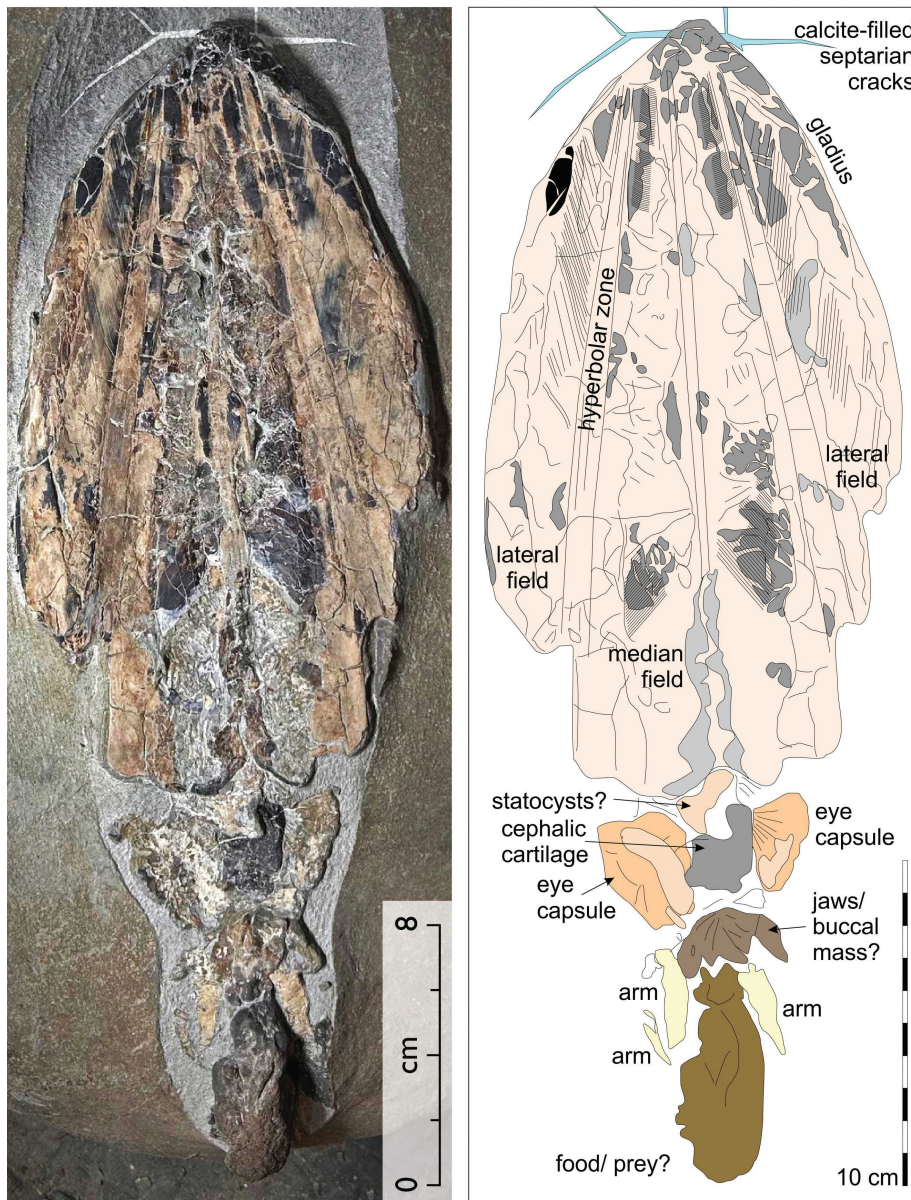


Figure 3. New specimen of *Loligosepia bucklandi* and interpretation of the various features. The specimen comes from a loose nodule (ex-situ) that may have come from the Shales-with-Beef, Charmouth Mudstone Formation (Sinemurian) of Monmouth Beach, Lyme Regis. This specimen shows the various segments of the gladius, jaw fragments (black in colour) and an area which may represent the disturbed remains of the head and arms. Internally there is evidence of the ink sac and there is a 'lump' of phosphate that may represent an item of prey that was being consumed when the animal perished.

gladius has been described in detail by both Fuchs and Weis (2008) as well as Donovan and von Boletzky (2014, fig. 4). In dorsal view Figures 4 and 5 show the central field, median field and wing (*sensu* Jeletzky, 1966); i.e., the lateral field of

(Fuchs *et al.*, 2016). The boundary between these two regions is known as the lateral asymptote (Naef, 1922). The slightly sinusoidal character of the growth lines in the hyperbolar zone are quite indistinct though probably discernible. The general



Figure 4. Close-up view of the gladius showing the fine details of the central, median field and wing (*sensu* Jeletzky, 1966), with the boundary between these two regions known as the lateral asymptote.

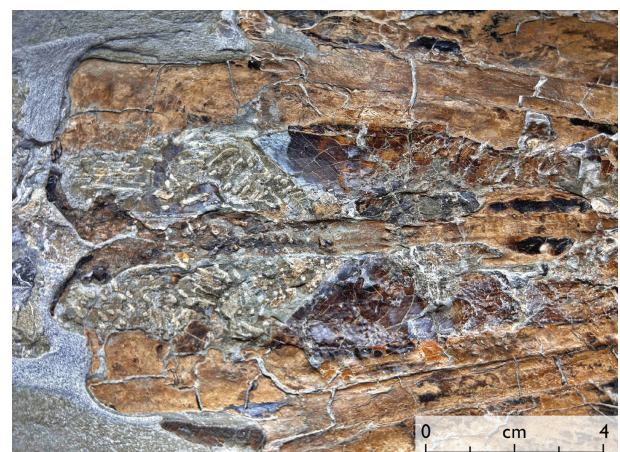


Figure 5. Anterior part of the gladius.

appearance of this specimen matches that illustrated by Fuchs and Weis (2008, fig. 3) and the specimens figured by both Fuchs and Weis (*op. cit.*, fig. 4A), Donovan and von Boletzky, 2014, figs 1, 2, 5, 7) and Hart *et al.* (2024, figs 4, 5).

The jaw fragments illustrated by Hart *et al.* (2024, fig. 4) and Klug *et al.* (2020, fig. 4a, b) show the 'beak' of the upper jaw and a part of the lower jaw, following Tanabe *et al.* (2017). The new specimen does not show this level of detail. In the new specimen there is a mass of what appears to be phosphatised material at the very extremity of the specimen. This could be the remains of prey that the animal was in the process of consuming when it perished. Recently a number of Jurassic neocoleoids have been described which still hold their last prey in their arms. Amongst those, *Clarkeiteuthis* with a *Leptolepides* each were found in both Germany and England (Jenny *et al.*, 2019; Hart *et al.*, 2020). Further cases of direct evidence for neocoleoid predator-prey interactions have been documented (Klug *et al.*, 2021a, b). It might be that, as in these cited cases, the neocoleoids were so engaged with their prey that they started sinking, eventually suffocating in the oxygen-poor bottom waters (Mapes *et al.*, 2019; Klug *et al.*, 2021a).

SUMMARY

This new specimen of *Loligosepia bucklandi* was collected *ex-situ* from Sinemurian of Chippel Bay, west of The Cobb in Lyme Regis (close to the Dorset/Devon boundary), has been cleaned and prepared. It reveals many of the diagnostic features of both the genus and species, especially in the shape and structure of the gladius. It adds to the growing number of specimens from Devon and Dorset, key to understanding both soft tissue preservation and the place of *Loligosepia* in neocoleoid phylogeny. The *ex-situ* specimen was collected from within the Axmouth – Lyme Regis Undercliffs National Nature Reserve (NNR) and, in accordance with the NNR Fossil Collecting Code has been recorded on the Site website (record No. 33).

ACKNOWLEDGEMENTS

The helpful advice of reviewers, Peter Doyle and Sam Scriven, is acknowledged. Ms Cindy Howells (National Museum Wales) and Ms Zöe Hughes (NHM, London) are thanked for providing information and images of specimens in their respective collections. This assistance has been very helpful in making sense of both this specimen and the stratigraphical distribution of the species within the Sinemurian succession. The authors thank Paul Davies (Lyme Regis Museum) for his assistance in understanding the biographical details of the Philpot sisters. The authors thank Mr James Quinn (University of Plymouth Cartographic Unit) for assistance with some of the figures.

REFERENCES

- BUCKLAND, W. 1836. *The Bridgewater Treatises on the Power, Wisdom and Goodness of God, as Manifested in the Creation. Geology and mineralogy considered with reference to natural theology.* -2 + xvi + 129 pp. (London, William Pickering). [Reprint Verlag (Publisher): Outlook Verlag GmbH, Zeilweg 44, 60439 Frankfurt, Deutschland, 1st Edition 2024, ISBN 978-3-36876-652-8].
- BUCKLAND, W. 1837. *The Bridgewater Treatises or the Power, Wisdom and Goodness of God as manifested in the Creation. Geology and mineralogy considered with reference to natural theology.* Carey, Lea and Blanchard, Philadelphia, USA.
- COPE, J.C.W. 2012. *Geology of the Dorset Coast* [1st Edition]. Geologists' Association Guide No. 22, London, viii + 212 pp.

- COPE, J.C.W. 2016. *Geology of the Dorset Coast* [2nd Edition]. Geologists' Association Guide No. 22, London, 222 pp.
- DONOVAN, D.T. and VON BOLETZKY, S. 2014. *Loligosepia* (Cephalopoda: Coleoidea) from the Lower Jurassic of the Dorset coast, England. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, DOI:10.1127/0077-7749/2014/0415.
- FUCHS, D. 2006: Fossil erhaltungsfähige Merkmalskomplexe der Coleoidea (Cephalopoda) und ihre phylogenetische Bedeutung. *Berliner Paläobiologische Abhandlungen*, 8, 1–115.
- FUCHS, D. and WEIS, R. 2008. Taxonomy, morphology and phylogeny of Lower Jurassic loligosepiid coleoids (Cephalopoda). *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, 249, 93–112.
- FUCHS, D., IBA, Y., TISCHLINGER, H., KEUPP, H. and KLUG, C. 2016. On the locomotion system of fossil Coleoidea (Cephalopoda) and its phylogenetic significance. *Lethaia*, 49(4), 433–454. <https://doi.org/10.1111/let.12155109>.
- HART, M.B., ARRATIA, G., MOORE, C. and CIOTTI, B.J. 2020. Life and death in the Jurassic seas of Dorset, Southern England. *Proceedings of the Geologists' Association*, 131, 629–638. <https://doi.org/10.1016/j.pgeola.2020.03.009>
- HART, M.B., MOORE, C. and PRICE, G.D. 2024. First evidence of vampyromorph cephalopod jaw structures from the Sinemurian, Lower Jurassic of Dorset. *Geological Quarterly*, 2024, 68: 14; <http://doi.org/10.7306/gq.1738>
- HOFFMANN, R., HOWARTH, M.K., FUCHS, D., KLUG, C. and KORN, D. 2022. The higher taxonomic nomenclature of Devonian to Cretaceous ammonoids and Jurassic to Cretaceous ammonites including their authorship and publication. *Neues Jahrbuch für Geologie und Paläontologie*, 305(2), 1–11.
- JENNY, D., FUCHS, D., ARKHIPKIN, A.I., HAUFF, R. B. FRITSCHI, B. and KLUG, C. 2019. Predatory behavior and taphonomy of a Jurassic belemnoid coleoid (Diplobelida, Cephalopoda). *Scientific Reports*, 9(7944), 1–11. <https://doi.org/10.1038/s41598-019-44260-w>
- KLUG, C., ETTER, W., HOFFMANN, R., FUCHS, D. and DE BAETS, K. 2020. Large belemnite jaws from the Aalenian (Middle Jurassic) of Switzerland. *Swiss Journal of Palaeontology*, 139(4), 1–11. <https://doi.org/10.1186/s13358-020-00207-7>
- KLUG, C., SCHWEIGERT, G., DE BAETS, K. and FUCHS, D. 2021a. Distraction sinking and fossilized coleoid predatory behaviour from the German Early Jurassic. *Swiss Journal of Palaeontology*, 140(7), 1–12. <https://doi.org/10.1186/s13358-021-00218-y>
- KLUG, C., SCHWEIGERT, G., HOFFMANN, R., WEIS, R. and DE BAETS, K. 2021b. Fossilized leftover falls as sources of palaeoecological data – a 'pabulite' comprising a crustacean, a belemnite and a vertebrate from the Early Jurassic Posidonia Shale. *Swiss Journal of Palaeontology*, 140(10), 1–12; <https://doi.org/10.1186/s13358-021-00225-z>
- KÖBL-EBERT, M. 1997. Mary Buckland (née Morland) 1797–1857. *Earth Sciences History*, 16(1) 33–38. <https://doi.org/10.17704/eshi.16.1.yl20183310h53372>
- 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.
- MAPES, R.H., LANDMAN, N.H., and KLUG, C. 2019: Caught in the act? Distraction sinking in ammonoid cephalopods. *Swiss Journal of Palaeontology*, 138, 141–149.
- NAEF, A. 1922. *Die fossilen Tintenfische - Eine paläozoologische Monographie.* 322 pp. Gustav Fischer, Jena.
- PALMER, C.P. 1984. A note on the Birchi Beds, Lower Jurassic, at Lyme Regis, Dorset. *Geological Magazine*, 121(6), 645–647.
- SIMMS, M.J. 2004. The Wessex Basin (Dorset and central Somerset). In: SIMMS, M.J., CHIDLAW, N., MORTON, N., and PAGE, K.N. (eds), *British Lower Jurassic Stratigraphy*, Geological Conservation Review Series, No. 30, Joint Nature Conservation Committee, Peterborough, 53–109.
- TANABE, K., MISAKI, A., HIKIDA, Y. and NISHIMURA, T. 2017. New records of coleoid cephalopod jaws from the Upper Cretaceous of Hokkaido, Japan, and their paleobiogeographic and evolutionary implications. *Cretaceous Research*, 70: 128–141, <http://dx.org/10.1016/j.cretres.2016.10.009>.
- VOLTZ, P.L. 1840. Observations sur les *Belopeltis* ou lames dorsales des bélemnites. *Mémoires de la Société du Muséum d'Histoire naturelle de Strasbourg*, 3(1), 1–38.

WEBSOURCE

[https://en.wikisource.org/wiki/Geology_and_Mineralogy_considered_with_reference_to_Natural_Theology/Plate_30]*

*Note that Buckland's other plates are also available through the same website as black and white line drawings.