Proceedings of the Geologists' Association 127 (2016) 391–394

Contents lists available at ScienceDirect

Proceedings of the Geologists' Association

journal homepage: www.elsevier.com/locate/pgeola

Palaeoecology of a reworked, Late Cretaceous inoceramid bivalve: Crimplesham, East Anglia, UK

Nigel R. Larkin [a], Stephen K. Donovan [b,*]

[a] Cambridge University Museum of Zoology, Downing Street, Cambridge CB2 3EJ, UK
[b] Taxonomy and Systematics Group, Naturalis Biodiversity Center, Darwinweg 2, 2333 CR Leiden, The Netherlands

ARTICLE INFO

Article history:
Received 8 January 2016
Received in revised form 22 February 2016
Accepted 24 February 2016
Available online 19 March 2016

Keywords:
Taphonomy
Norfolk
Coniacian
Volviceramus
Pycnodonte
Foraripora

ABSTRACT

A flint erratic slab bearing a shell of the large inoceramid bivalve *Volviceramus involutus* (J. de C. Sowerby), with the valves oriented in a post-mortem 'butterfly' association, was collected from glacial float in an area of superficial deposits at Crimplesham, west Norfolk. This mollusc is typical of the Chalk and may be confined to the Coniacian. The shell is infested by encrusting oysters, *Pycnodonte* (*Phygraea*) *vesiculare* (Lamarck), and bryozoan borings, *Foraripora pesavis* Voigt and Soule. Infestation was most probably post-mortem.

1. Introduction

Reworked fossils are part of the palaeontological record that may provide unexpected, even quirky data. For example, the Cretaceous rudistid bivalve *Bournonia sanctmariae* Chubb, 1967 (see Chubb, 1971, p. 195, pl. 40, fig. 13), was described from a single specimen reworked into and collected from the Eocene Richmond Formation of Jamaica; it remains unknown from any in situ occurrence. Glacial and fluvial erratics give the Netherlands a Palaeozoic palaeontology that it otherwise lacks in surface outcrop (such as Rhebergen, 2014; Donovan et al., 2016). Collecting Chalk erratics on Norfolk beaches can provide new insights into modern and ancient trace fossils or be a way to introduce children to palaeontology (Donovan and Lewis, 2010; Gee, 2013, p. 97). The most famous erratics in the British geological record were a forgery made to look like Pliocene relicts in Pleistocene gravels; we refer, of course, to Piltdown Man and its associated Crag fauna (Millar, 1972, p. 203; Donovan, 2015).

Herein, we describe a Late Cretaceous fossil erratic of unusual size and completeness from which certain palaeoecological and taphonomic inferences are possible. Flints and cherts are among the most robust of clasts. In areas of chalk and adjacent regions, fossils in flint may be found in the overlying drift deposits (Donovan and Fearnhead, 2015), and cherts and flints may be transported by fluvial action for hundreds of kilometres (Donovan, 2010; Donovan et al., 2016). The glacial erratic described herein may not have been transported a great distance; its preservation is unusually fine, despite transport.

2. Locality and horizon

Crimplesham Quarry (Frimstone Ltd. [The Dickerson Group], Main Road, Crimplesham, Downham Market, Norfolk, PE33 9ED) is located to the east of the village of Crimplesham in west Norfolk (Fig. 1; NGR TF 66267 03782). This is a large pit where aggregates are extracted; it is also used for landfill. The quarry contains a wide mixture of geological materials from a variety of ages from Holocene deposits, chalky till and large glacial erratics (including Cretaceous specimens) to Jurassic sedimentary rocks, comprising the Oxford Clay and Kimmeridgian Clay formations with ammonites and septarian nodules (www.crimplesham.ukfossils.co.uk; accessed 21 December 2015), examples of which can be found in the geology collection of Norwich Castle Museum. Other than the Holocene deposits, no well-defined strata are apparent in this pit due mainly to intensive glacial scouring and erosion. Cretaceous fossils are common, including belemnites, brachiopods, bivalves

* Corresponding author. Tel.: +31 71 568 7642.
E-mail address: Steve.Donovan@naturalis.nl (S.K. Donovan).

http://dx.doi.org/10.1016/j.pgeola.2016.02.011
0016-7878/

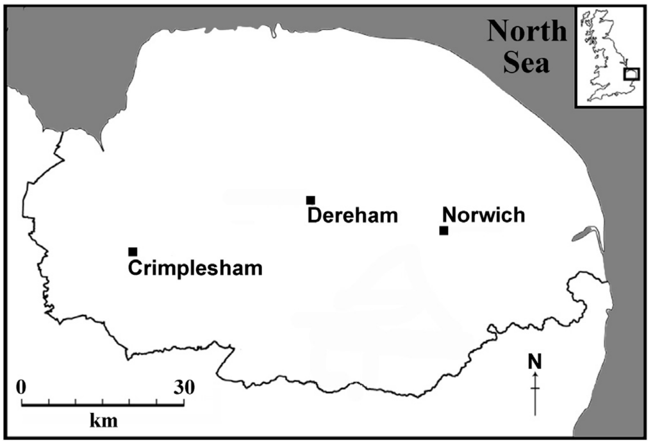

Fig. 1. Outline map of northern East Anglia, UK, showing the boundary of the county of Norfolk and the location of Crimplesham in relation to some of the major settlements. Inset map shows the position of the main map (=box) in the British Isles.

and sponges, but they are all glacially transported; no in situ Cretaceous stratum is exposed at Crimplesham Quarry.

In a pile of disturbed material in the middle of this quarry, a well-preserved internal mould of the shell of the unusually-shaped inoceramid bivalve *Volviceramus involutus* (J. de C. Sowerby, 1828) (Fig. 2) was found by the senior author in October 2004. Examples of this species preserved in flint with such fine detail are rare (but compare Fig. 2 with Cleevely and Morris, 2002, pl. 19, fig. 2). Further, this specimen preserved both valves in a 'butterfly' association (compare with, for example, Selover et al., 2005, fig. 3; Komatsu et al., 2007, p. 136; Skawina, 2013, fig. 2A) as well as an epifauna including boring bryozoans and a cementing bivalve mollusc. Although the specimen was not found in situ, the site manager confirmed that no material has ever been imported to the site. Therefore, until recently, it must have formed part of the glacially derived deposits within the quarry.

The specimen was donated to Norwich Castle Museum and has the Accession Number NWHCM: 2006.627. A cast of the specimen

Fig. 2. Late Cretaceous inoceramid bivalve *Volviceramus involutus* (J. de C. Sowerby, 1828) from Crimplesham Quarry, west Norfolk (NWHCM 2006.627) with both valves clearly visible, left (upper, strongly curved) and right (lower right, more gently convex). The museum label towards the bottom of the specimen is about 30 mm in length. Specimen uncoated.

is now in the Natuurhistorisch Museum Maastricht, the Netherlands, registration number NHMM 2016 001.

3. Description

The two valves of *V. involutus* have very different shapes. The morphology of the coiled (left) valve (Fig. 2) in fact very much resembles a nautilid shell rather than a traditional inoceramid. Cobban (1983, p. 7) described this taxon thus: "*V. involutus* is a moderate-sized species that is inequilateral and extremely inequivalve. The left valve is much larger than the right valve, very inflated, spirally coiled, and nearly smooth. The right valve has a nearly oval outline and a very low convexity; it is ornamented with conspicuous concentric rugae" (Fig. 2; see also Cleevely and Morris, 2002, pp. 115, 117). The Crimplesham specimen, NWHCM 2006.627, corresponds to this description in all details and a new assessment of this species, based on a solitary shell, is considered unwarranted.

The preservation of the shell is considered good because both valves are still in close association. Silicification has replaced both valves which are embedded in a flint nodule which weighs about 18 kg. However, the shell is crossed by cracks and pits (Fig. 3B) on the surface. These were the result of early biostratinomic mechanical damage, the products of the silicification process or both. On the right valve (lower in Fig. 2) cracks are essentially radial, whereas on the left valve they are radial but, because of the nautiloid-like shape of the shell, are sub-parallel and curve around the venter, away from the observer.

The shell bears a fauna of episkeletozoans (sensu Taylor and Wilson, 2002) and borings which are worthy of further comment. The larger bivalve attached to the coiled left valve of the inoceramid (towards the right of this valve in Fig. 2) is possibly a juvenile of the pycnodonteine oyster, *Pycnodonte* (*Phygraea*) *vesiculare* (Larmarck) (pers. comm. to N.R.L. by Ireneusz Walaszczyk; see Cleevely and Morris, 2002, pp. 147–148, pl. 24, figs 8–10) (Fig. 3A). This has maximum dimensions of about 20 mm × 20 mm and represents one valve, depressed on the surface of the inoceramid, presumably exposing the internal surface of the attached valve, although no muscle scar is apparent. At least one other specimen is present on the left valve, also showing the internal surface of the attached valve, but much smaller, about 4 mm × 5 mm. The right valve appears to preserve a small free valve (presumably originally the whole episkeletozoan shell) with concentric growth lines, but preservation is poor (Fig. 3D). Other concentric surface markings may either be conspecific or are sports of the preservation or silicification process.

The inoceramid also bears flint casts of ctenostome bryozoan borings, probably *Foraripora pesavis* Voigt and Soule, 1973 (Fig. 3C), previously described from the upper Campanian (Upper Cretaceous) of northern Germany (Paul D. Taylor, pers. comm. to N.R.L., 16 January 2008). This is the only species within this genus. These borings are infilled with silica, darker in colour than the inoceramid left valve except where both are obscured by strong staining and preserved flush with the shell surface. Borings are slender, cross-cutting and twig-like, and are only apparent on the left valve, although the right valve has a uniform dark stain that would conceal any such trace. John W.M. Jagt (written comm. to S.K.D., 22 January 2016) has also identified a colony of cheilostome bryozoans, close to where both valves meet, on the cast NHMM 2016 001.

4. Discussion

4.1. Provenance

Volviceramus Stoliczka, most commonly *V. involutus*, is widely distributed. It is reported to occur in the Coniacian to Santonian of southern England and East Anglia (Cleevely and Morris, 2002,