Online ISSN 2435-0931 Print ISSN 0385-0900
DOI: 10.50897/bmfm48.0_27

Bulletin of the Mizunami Fossil Museum, no. 48, 27–31, 3 figs.

Manuscript accepted on April 19, 2021; online published on June 30, 2021
http://zoobank.org/urn:lsid:zoobank.org:pub:1438EB7A-1F39-4E1C-AA77-CFF504125E8D

Taphonomic implications of a mussel-barnacle interaction from Southport, Merseyside, United Kingdom

Stephen K. Donovan*

*Apartment 5 Worsley Point, 251 Worsley Road, Swinton, Greater Manchester M27 0YE, UK
< SKennethDono@gmail.com >

Abstract

The study of the *Aktuo-Paläontologie* of modern shell accumulations may provide important insights of relevance to, particularly, palaeoecology, taphonomy and ichnology. The broad, flat beach at Southport, north-west England, UK, where the sea retreats over 2 km at low tide, is a notable collecting site for shells of allochthonous benthic molluscs. Selected for discussion here is a specimen of the mussel, *Mytilus edulis* (Linnaeus), which is densely encrusted in two layers on its well-preserved left valve by the barnacle *Balanus crenatus* Bruguière; the broken right valve has a sparse infestation of this balanid. The valves remain conjoined because the ligament was overgrown by balanids from the left valve, an unusual preservation. The shell was presumably buried, smothering the initial balanid infestation of the left valve; on reexposure, the surface of dead balanids was covered by a new, conspecific layer. For much of its pre- and post-mortem existence, the right valve was probably buried. The superior preservation of the left valve was favoured by the thick, balanulith-like coating of cemented barnacles. The inner surfaces of both valves remained clean and lack any encrustation.

Key words: *Mytilus edulis*, *Balanus crenatus*, palaeoecology, transported shells

1. Introduction

The Irish Sea coast of north-west England includes many splendid sites for collection of allochthonous dead shells and valves of benthic molluscs. Careful examination of these specimens may reveal many features that are of relevance to the palaeontologist, particularly with regard to palaeoecology, taphonomy and ichnology; in short, *Aktuo-Paläontologie* in the sense of Schäfer (1972). Such studies are truly Lyellian, using the present as the key to the past.

Southport is a splendid site for such investigations (Donovan, 2021a, b, in press). At low tide the sea recedes over 2 km, leaving a broad expanse of beach (Fig. 1) on which allochthonous molluscan valves and shells are common and moderately varied, having been carried onshore by the incoming tide twice per day. Among this wealth of material are rare specimens that provide insights into the taphonomy of benthic molluscs. One such specimen, a mussel, is described herein.

2. Locality, material and methods

The mussel was collected from the beach at Southport, Merseyside, on the Irish Sea coast of north-west England, between low and high tide (Fig. 1). Southport has a particularly broad, sandy beach with no rock exposures, natural or otherwise, but some salt marsh. At

Fig. 1. The view from the land-end of the pier at Southport, Merseyside (England, UK), looking south of west. The beach is near low tide and the sea has retreated over 2 km, presenting an exceptional site for shell collecting. This is an excellent collecting ground for dead marine gastropods and bivalves, present in many hundreds, which lived offshore and have been transported eastwards after death.

low tide the sea retreats over 2 km. My shell collecting is commonly to the north and south of the pier, which is oriented north-west to south-east [NGR SD 328 180 and surrounding area], and more seaward. Dead, allochthonous valves of diverse bivalves and gastropods are common and varied, both along the strand line and on the wave-rippled sand flats. The largest and most prominent gastropods are shells of *Buccinum undatum* (Linnaeus), many of which provide hard substrates for attachment of balanid barnacles and serpulids, both externally and within the shell. The commonest bivalves are razor shells, *Ensis* spp., many specimens of which are still articulated by the ligament.

The mussel, *Mytilus edulis* (Linnaeus) (Figs. 2, 3), was identified using a range of texts, including Tebble (1966), Beedham (1972), McMillan (1977) and Street (2019). In life, shell beds of this species are associated with a great diversity of taxa (Tsuchiya & Nishihira, 1986, table 3). Further, this specimen is of relevance

Fig. 2. *Mytilus edulis* (Linnaeus), Recent, NHMM 2020 020, exterior view. Umbo towards top of page. *Balanus crenatus* Bruguière densely encrusts the left valve. The right valve is incomplete and apparent towards the right. Scale in mm and cm.

to palaeontology, as mytilids have a rich fossil record (e.g., Ando and Itoigawa, 2018). The specimen discussed herein is donated to the Natuurhistorisch Museum Maastricht, the Netherlands (NHMM), and is numbered NHMM 2020 020. The photographic images were taken with a Canon G11 digital camera in natural light.

3. Description

This articulated mussel, NHMM 2020 020, is preserved with the left valve nearly complete and part of the right valve still conjoined in the region of the ligament (Figs. 2, 3). The left valve is c. 70 mm in anterior-posterior direction and c. 31 mm dorso-ventrally. The inner surfaces of both valves are clean with no encrusting organisms or borings. The ligament is dried, but intact. Externally, the left valve is densely infested by balanid barnacles, likely *Balanus crenatus* Bruguière, and extending over the ligament area (Fig. 2). The balanids on the complete valve are present in two distinct layers of mature shells. The broken right valve is only sparsely encrusted by small balanids, that may represent a later(?) spatfall.

4. Discussion

This specimen preserves a not unexpected association between an epifaunal bivalve mollusc and encrusting barnacles. However, careful consideration shows that this is an unusual juxtaposition. The left valve of *Mytilus* is densely encrusted whereas the right valve bears only a few balanids. The most important observation is that the shell, although incomplete, is still articulated, but gaping – the so-called 'butterfly' preservation (Ager, 1963, p. 84; Schäfer, 1972, p. 164; Allmon, 1985; amongst others) – because the ligament linking

Fig. 3. *Mytilus edulis* (Linnaeus), Recent, NHMM 2020 020, interior view. Umbo towards top of page; left valve to the right. The interior surfaces of both valves lack encrusting shells and borings. Scale in mm and cm.

the valves has been stabilised by overgrowing balanids. This is unusual; under normal conditions the ligament would have rotted over time, although more slowly than the internal soft tissues of the shell, and the two valves would have become separated (Schäfer, 1972, p. 164).

This Southport mussel is analogous to, yet very different from, a specimen of the infaunal cockle *Cerastoderma edule* (Linnaeus) from the Netherlands in which valves were preserved in close association by an encrusting oyster, *Ostrea edulis* Linnaeus (Donovan et al., 2020, fig. 4). In the same paper, a butterfly mussel (Donovan et al., 2020, fig. 2) starkly contrasts with the Southport specimen in having a cemented shell of *O. edulis* on the inner surfaces of the valves, stabilizing the gaping orientation, yet it is similar in that the other surfaces (in this case outer) of the valve are free from encrustation. The Dutch specimen is encrusted on the inner surface; this must have occurred after the death of the mussel. The Southport specimen is a similar conundrum, being encrusted externally only; why are some surfaces pristine and others densely infested, all on the same specimen? As *M. edulis* is epifaunal, it may have been encrusted, at least in part, while the mussel was alive, perhaps only extending onto the ligament soon after death and once the shell had taken on a butterfly alignment. Why the balanids did not similarly encrust the right valve may merely indicate that it was the lower surface in life in the mussel bed. The clean inner surfaces are perhaps evidence for the dead shell resting with the inner surfaces down on the sea floor.

What is more difficult to explain is why the right valve has only a sparse fauna of barnacles, yet the left valve has two layers of balanids, one overgrowing the other? The lower layer of balanids, directly encrusting the left valve, must have died off, but after stabilization of the ligament. A plausible cause of death would be burial and smothering by sediment. Once re-excavated by bottom currents or waves, balanids preferentially infested the substrate of balanids, possibly attracted by the biochemical signature of the dead conspecific layer (Walker et al., 1987). All this time the right valve was buried; only later (or perhaps earlier) was it exposed and lightly infested. The dense, balanulith-like (Cadée, 2006, 2007) layer on the left valve favoured its preservation, in contrast to the weakly armoured right valve.

5. Acknowledgements

The journal reviewer, Dr. J. W. M. Jagt (Natuurhistorisch Museum Maastricht, the Netherlands), is thanked for their pertinent comments on an earlier version of this paper and accepting the present specimen for his museum's collections.

6. References

Ager, D. V. 1963. Principles of Palaeoecology. McGraw-Hill, New York.

Allmon, R. A. 1985. "Butterflied" bivalves as palaeoenvironmental indicators. Geological Society of America, Abstracts with Programs 17(7): 512.

Ando, Y., and J. Itoigawa. 2018. Molluscan fossils from *Crenomytilus*-bearing lens of the Akeyo Formation at the construction site of Mizunami-Kita Junior High School in Mizunami City, Gifu, Japan. Special Volume, Bulletin of the Mizunami Fossil Museum 44: 13–24.

Beedham, G. C. 1972. Identification of the British Mollusca. Hulton Educational Publications, Amersham, UK.

Cadée, G. C. 2006. Balanulieten, rollende *Balanus crenatus* clusters. Het Zeepaard 66: 83–87.

Cadée, G. C. 2007. Balanuliths: free-living clusters of the barnacle *Balanus crenatus*. Palaios 22: 680–681. DOI: 10.2110/palo.2006.p06-090r

Donovan, S. K. 2021a (in press). Chapter 53. Field trip: *Aktuo-Paläontologie* of Southport Beach, Merseyside. In Hands-On Palaeontology, A Practical Manual. Dunedin Academic Press, Edinburgh. p. 228–234.

Donovan, S. K. 2021b (in press). Fossils explained: An exciting, but bored whelk. Geology Today 37.

Donovan, S. K. (in press). Fast post-mortem encrustation of razor shells: examples from the Irish Sea and palaeontological implications. Proceedings of the Yorkshire Geological Society.

Donovan, S. K., B. W. Hoeksema, C. H. J. M. Fransen, R. Vonk, and J. P. H. M. Adema. 2020. Unusual preservation of North Sea shells: Scheveningen,

North Sea coast, the Netherlands. Bulletin of the Geological Society of Norfolk 70: 55–65.

McMillan, N. F. 1977. The Observer's Book of Seashells of the British Isles. Frederick Warne, London.

Schäfer, W. 1972. Ecology and Palaeoecology of Marine Environments (translated by I. Oertel). University of Chicago Press, Chicago.

Street, P. 2019. Shell Life on the Seashore. New edition. Faber and Faber, London.

Tebble, N. 1966. British Bivalve Seashells: A Handbook for Identification. Trustees of the British Museum (Natural History), London.

Tsuchiya, M., and M. Nishihira. 1986. Islands of *Mytilus edulis* as a habitat for small intertidal animals: effect of *Mytilus* age structure on the species composition of the associated fauna and community organization. Marine Ecology – Progress Series 31: 171–178. DOI: 10.3354/MEPS031171

Walker, G., A. B. Yule, and J. A. Nott. 1987. Structure and function in balanomorphs larvae. In A. J. Southward, ed., Barnacle Biology. Balkema, Rotterdam: 307–328.