BRACHIOPOD "NESTS" FROM THE MARLSTONE ROCK-BED (JURASSIC) OF WARWICKSHIRE

by

R. W. Blake

Summary

Clusters or 'nests' of brachiopods, now situated in the Marlstone Rock-Bed, Warwickshire, originated on stable areas of the sea floor. Mobile sediment was instrumental in preventing uniform spat cover. Terebratulids (*Lobothyris punctata*) and rhynchonellids (*Tetrarhynchia tetrahedra* and *Gibbirhynchia northamptonensis*) avoided direct competition by means of separate nests, which once established grew at each larval settlement period. Nest size was primarily determined by recruitment rate per breeding season. Due to the death of old, centrally situated individuals a nest could break up and be scattered by current action. Most of them were preserved by sudden sediment influx and rapid burial. Peripheral shells were choked and infilled by sediment, but centrally situated ones, having had time to effect valve closure, were infilled after burial by coarsely crystalline calcite.

Introduction

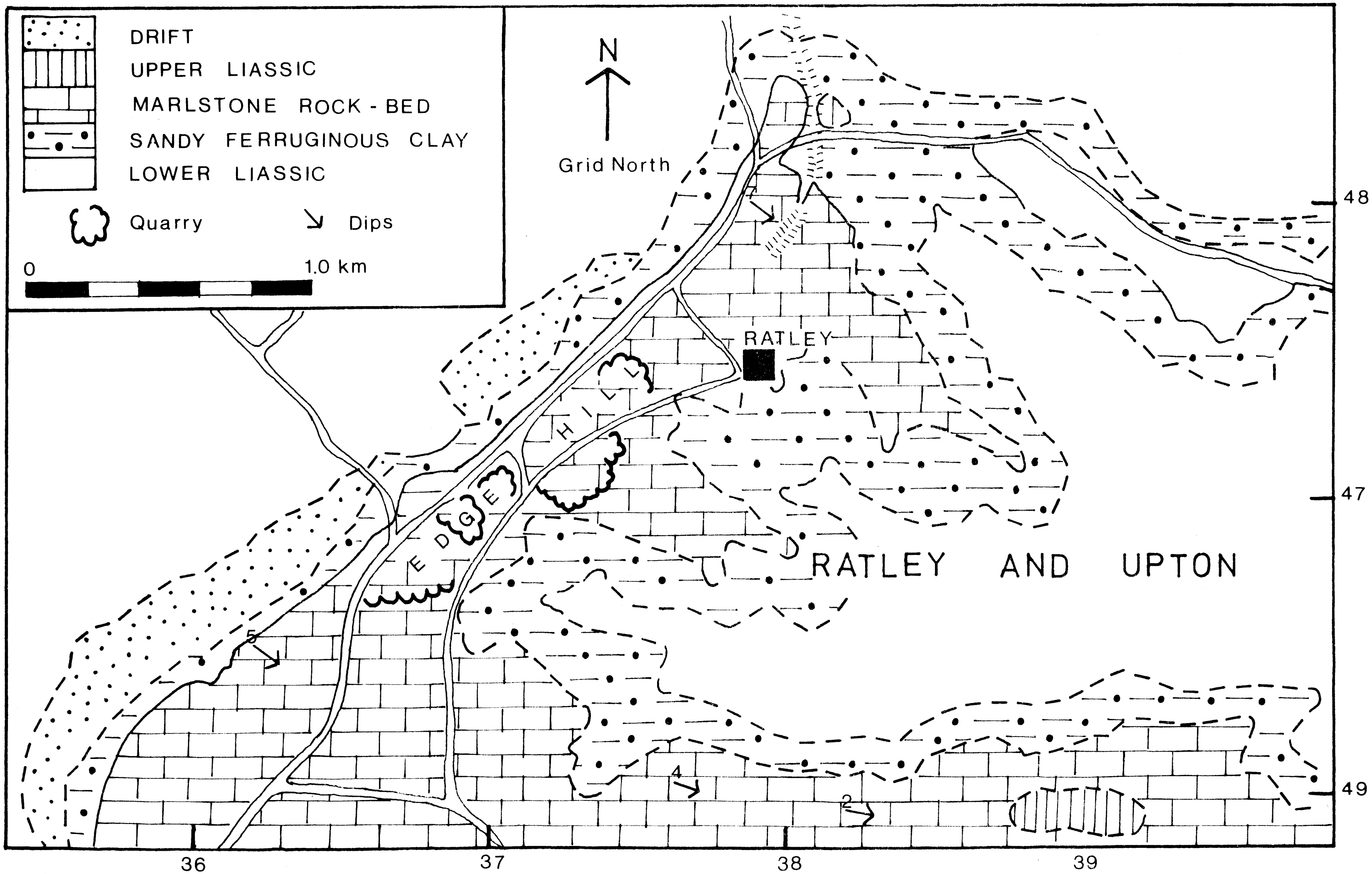
The Marlstone Rock-Bed of the Middle Lias (*Pleuroceras spinatum* zone) of Central England is characterised by the presence of discrete clusters of brachiopods which are often referred to as nests (Ager 1954, 1956). Hallam (1961) interpreted those of Leicestershire as life assemblages and attributed peaks in the size-frequency distributions of dissected nests to distinct brood categories.

Here answers to basic questions concerning the nature of the nests are suggested. The questions are:

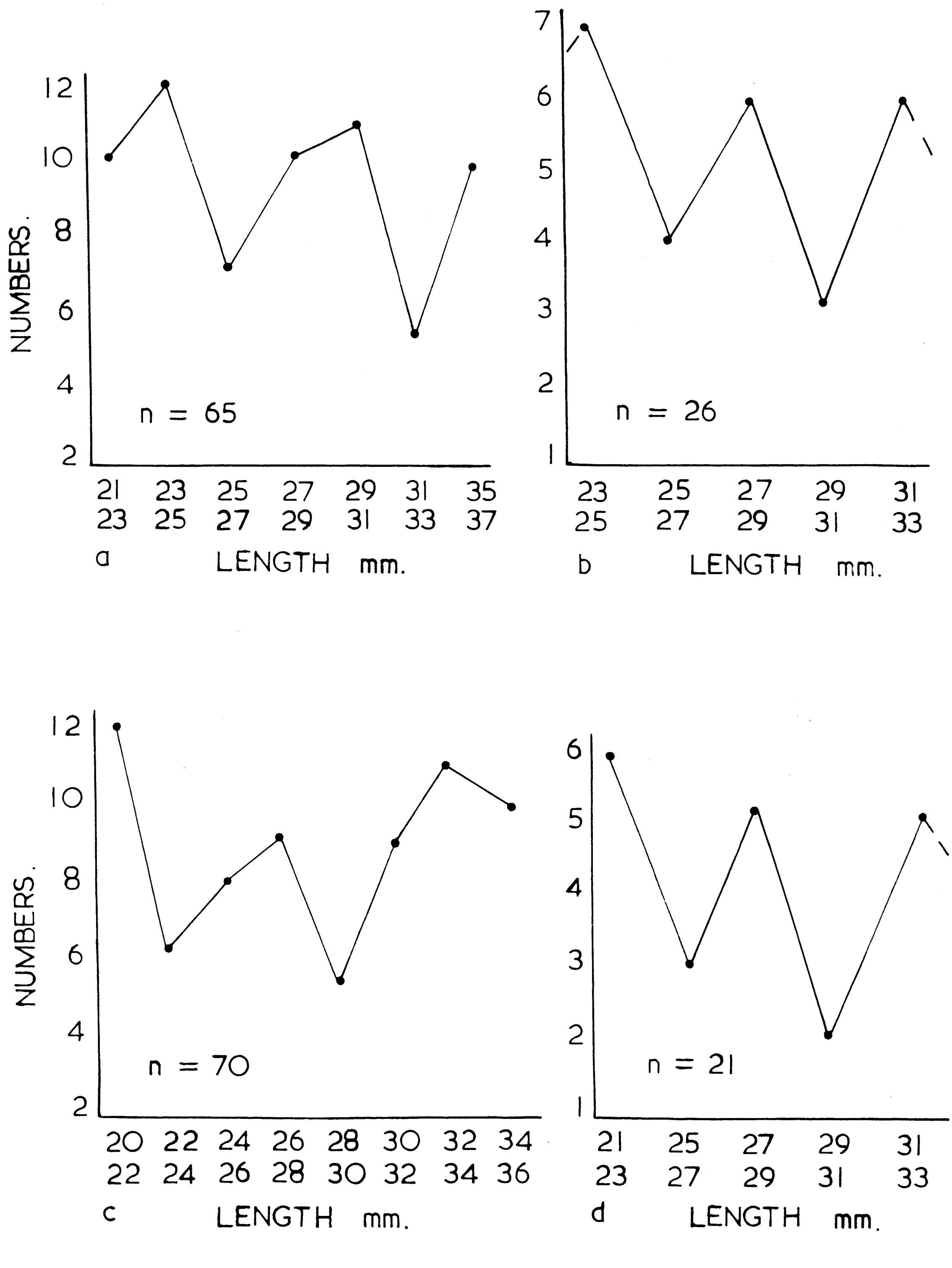
1. Why and how did a nest form?
2. What determined nest size?
3. What mechanisms were responsible for nest preservation?

The main rock type is a calcitic sideritic fragmental limestone with prominent ooliths of chamosite (Taylor 1949; Whitehead 1952). Hallam (1967) thought that the siderite was precipitated at an early stage of diagenesis, as a result of interaction of ferrous and carbonate ions in the interstitial solutions. Several explanations have been suggested for the origin of the chamosite ooliths. Chamosite, containing ferrous iron, is presumed to require reducing conditions for its formation. However an abundant benthonic fauna clearly signifies oxidizing conditions. Cayeaux (1922) suggested that the ooliths formed in agitated waters as aragonite ooliths do today. This is unlikely as modern carbonate banks are not reducing environments. It has been suggested (Pulfrey 1933: Caillere & Kraut 1954) that the chamosite formed in a gel by a concretionary action. Dunham (1960) has pointed out that the chamosite ooliths have little resemblance to the concretionary pisolitic chamosite of certain bauxites. Hallam (1967) has suggested that the reducing environment required for the formation of chamosite could have existed within the sediment. Burrowing organisms could have brought the newly formed chamosite to the surface where it must have been stable in an oxidizing environment. Porrenga (1965) has found chamosite in modern faecal pellets and it is possible that faecal pellets on the Marlstone sea floor were an important source of chamosite.

Mercian Geol. vol. 6, No. 2, 1977, pp. 97-102, 2 text-figs.



Text-fig. 1. Geological map of the Ratley district.



Text-fig. 2. Size-frequency distributions of four of the nests studied. The number of brood categories indicated is three, in both large (a and c) and small (b and d) nests. They are considered to be representative of the fourteen nests studied.

Fourteen nests were studied in detail, all consisting of the terebratulid *Lobothyris punctata*. They were all collected from a single horizon (approximately 50 cm from the base of the Marlstone Rock-Bed) from exposures in the quarries of Hornton Quarries Ltd at Ratley, near Edge Hill. The general geology of the Ratley district and the location of the quarries are shown on text-fig. 1. The nests studied were ovate in shape, ranging in size from 25 cm in length, 10 cm in height to 40 cm in length and 15 cm in height.

Nest formation and composition

Prominent ooliths of chamosite suggest that large areas of the Marlstone sea bed were mobile; these areas would not be suitable for larval settlement. Where stable areas occurred (e.g. around clumps of calcareous worm tubes and coarse shell material) larvae would settle. Intertwined worm tubes were found directly below three of the nests studied. Aggregation at the settlement site would form the basis of a nest. As the nest grew (by individuals settling on each other) it would offer increasing stability and physical protection to the individuals that composed it.

Rudwick (1970 p. 161) points out that modern brachiopods are often found attached to each other. He considers this to be the result of intense competition for settling space in environments where oxygen and food are abundant (Rudwick 1962). On the Marlstone sea bed settling space itself was limited due to movement of sediment and this explains why brachiopod larvae might settle on fixed, established, shells.

Mixed nests containing both terebratulids (*L. punctata*) and rhynchonellids (*T. tetrahedra* and *G. northamptonensis*) are rare, only two were found during a three week search. When found together they are often associated with isolated crinoid ossicles, shell debris, fragmented belemnite guards and disarticulated bivalve shells. Such associations indicate that these are not life assemblages in the sense of Hallam (1961). I suggest that terebratulids and rhynchonellids avoided direct competition by means of separate nests.

Few other fossils are associated with the nests. The bivalves *Pseudopecten equivalis* and *Entolium corneolum* are the forms most commonly found adjacent (within 50 cm) to the nests. The above forms were probably active swimmers (like modern pectinids) and would not have competed with the brachiopods for nest sites. Other bivalves such as *Oxytoma inequivalis*, *Oxytoma cynipes*, *Modiolus scalprum* and *Protocardia truncata* occur commonly in horizons above and below those of the brachiopod nests.

Nest Size

Size-frequency distributions (length: anterior - posterior axis against numbers) of both large (over sixty specimens) and small (less than thirty specimens) nests show an average of three peaks, text-fig. 2. Each peak is assumed to represent a single brood category (Hallam 1961). During each period of larval settlement nest size would increase as new individuals settled on established nests. The two main factors which determined nest size were the recruitment rate per breeding season and the number of breeding seasons for which the nest was thriving. As both large and small nests possess an average of three distinct size categories it is concluded that recruitment rate was the more important of the two. However due to retardation of growth with increasing age, coalescence of size categories could occur and may account for the low number of peaks on the size-frequency distributions of some of the larger nests.

After a period of time, due to the death and eventual detachment of old, centrally situated individuals a nest could become unstable and break up. It is not possible to say how long it would be before this occurred. Very little is known about the life span of modern brachiopods. The terebratulid *Pumilus antiquatus* has an estimated life span of three years (Rickwood 1968). Paine (1969) estimated a maximum life span of nine or ten years for *Terebratalia transversa*. It would seem that most of the larger living brachiopods have a life span of at least several years (Vogel 1959).

Mechanisms responsible for nest preservation

After the break up of a nest, shells would be transported by current action and little indication of the nest's existence would be preserved. This mode of destruction was probably not common, as isolated, disarticulated brachiopod valves, showing signs of transportation are rare. However they do occur, sometimes within 50 cm of well preserved nests.

Two types of shell infilling material are noted, coarsely crystalline calcite and sediment. Many of the larger nets show a differentiation of the infilling material, centrally situated specimens being infilled by coarsely crystalline calcite. Small nests were commonly infilled by sediment only. It is possible that such nests were overwhelmed by a sudden influx of sediment (Hallam 1961) which choked only peripherally situated specimens, the more centrally situated ones having had time to effect valve closure. Peripheral shells would offer a degree of physical protection to the central ones. Subsequent to burial calcite would be precipitated in the centrally situated shells.

The existence of two modes of destruction is consistent with the fact that transported shells and single valves would be buried simultaneously with thriving nests, during sudden sediment influx.

Acknowledgements

I am indebted to Mr. C. Stewart for introducing me to the location at which this work was carried out. I am grateful to Prof. J.W. Murray, Dr. A. Hallam and Miss A. P. Wilby for useful criticisms and to the management of Hornton Quarries Ltd for access and specimens collected.

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R.W. Blake,
Department of Zoology and
Dove Marine Laboratory,
University of Newcastle-upon-Tyne,
Newcastle-upon-Tyne,
NE1 7RU.