Brittlestars from the Bathonian of Lincolnshire and Northamptonshire

A. Dawn

Abstract: Rock samples bearing numerous *Ophiohybris griesbachii* (Wright, 1854) from two separate localities in the Great Oolite Group (Bathonian: Middle Jurassic) are reported. Both samples derive from the base of the Blisworth Limestone, close to its junction with the Rutland Formation. The occurrence of *O. griesbachii* in clusters compares closely with the behaviour of living *Ophiothrix fragilis*.

The Middle Jurassic formations of the East Midlands consist of a repeated sequence of limestones and clays (Arkell, 1933; Sylvester-Bradley and Ford, 1968). The Lincolnshire Limestone ('Inferior Oolite') is overlain by the clays of the Rutland Formation ('Upper Estuarine Clay'). These in turn are covered by the Blisworth Limestone ('Great Oolite Limestone'). Many quarries exploit both the limestones and clays for industrial purposes, and there are numerous exposures of these three formations. The samples described here bearing *Ophiohybris* are of a fairly hard limestone from the base of the Blisworth Limestone. They are lodged in Peterborough City Museum, Priestgate, Peterborough.

Localities and accession numbers

Specimen no. 3448/G was found at Gregory's Quarry, Ancaster (SK 985 414), by Mr Robin Hix. Gregory's Quarry (Fig. 1) is a working quarry and permission to enter must be sought by applying to the manager on site during working hours. The specimen comprises

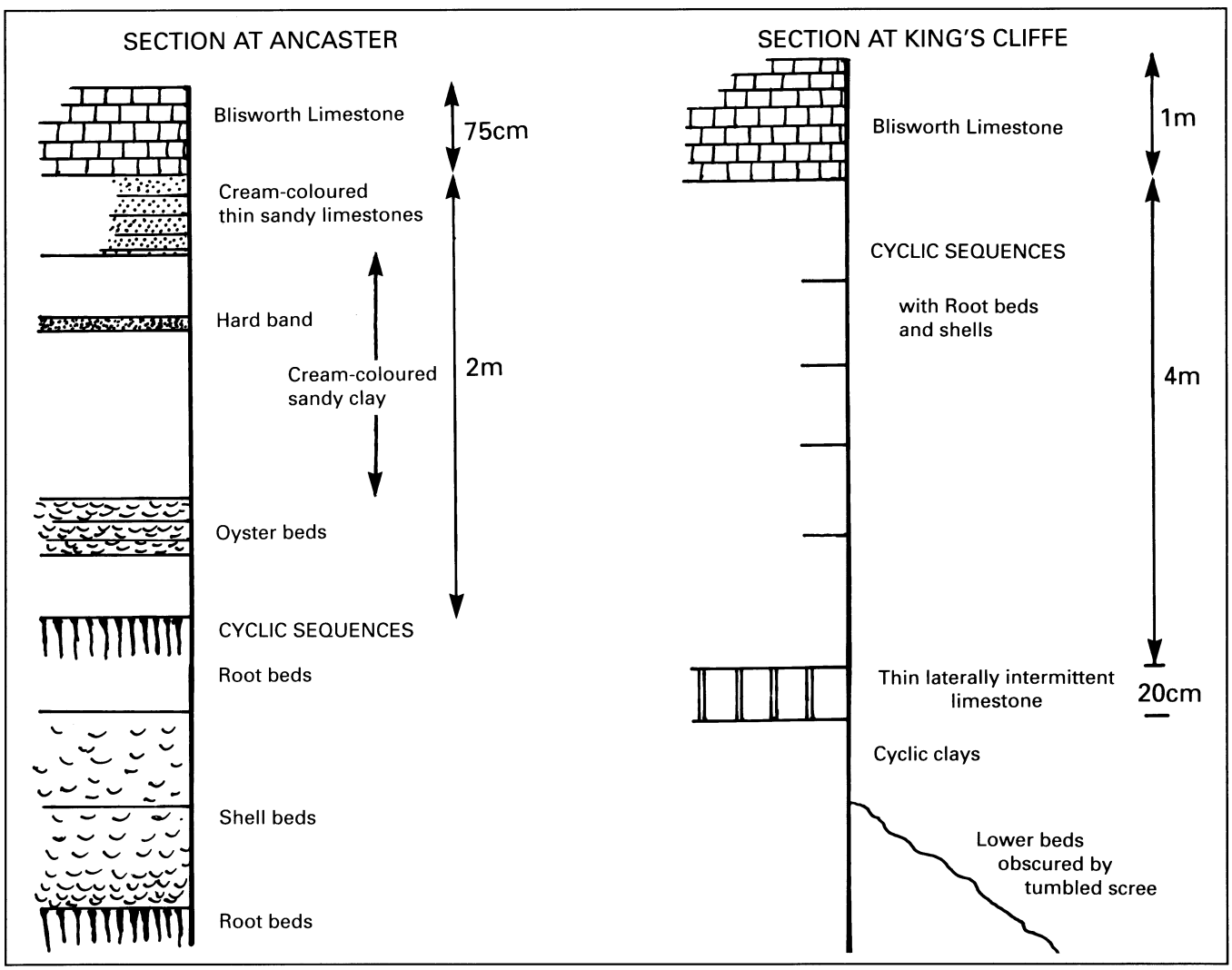

Fig. 1. Diagrammatic sections at Gregory's Quarry, Ancaster and at King's Cliffe Quarry.

about eight animals and disassociated fragments (Fig. 2). It was found in loose scree composed of thin sandy limestones. Many of these limestone slabs contain burrows of worms and other organisms. Further searching has failed to reveal the exact source horizon or further specimens. These light-coloured thin sandy layers occur high in the clay sequence and seem to be transitional from the clay to the limestone proper. There is no sharp and distinct contact in this quarry at the top of the Rutland formation.

Specimen nos. 5062/G (Fig. 3), *5063/G, 5064/G* (Fig. 4) and associated fragments were found in a quarry about 1km south-east of King's Cliffe, Northants (TL 012 966), by Dr J. A. D. Dickson. The King's Cliffe Quarry (Figs 1, 5) is no longer worked. Permission to enter the site should be sought at the farm near the quarry entrance, between Kingscliffe and Apethorpe villages.

These three blocks bear tangled masses of animals, and there are also numerous disassociated fragments. The appearance of the limestone is similar to that of the base of the Blisworth Limestone which caps the clays in this quarry. The junction between the Rutland Formation and the Blisworth Limestone is here quite sharply defined, unlike at Ancaster.

Classification, Morphology and Life Habits of Brittlestars

Brittlestars fall into the phylum Echinodermata, sub-phylum Asterozoa, class Stelleroidea and sub-class Ophiuroidea. The geological range of brittlestars is Ordovician to Recent. The ophiuroids possess five arms radiating in a horizontal plane from a central pentagonal disc which forms the main body, which contains the viscera and the mouth (Fig. 6). The mouth is surrounded by five centrally facing tooth-like projections (Fig. 7). The arms are moved by a complex water-vascular system and some forms can move their arms in all planes, enabling the creatures to walk and climb over the sea-floor.

Brittlestars are abundant in the seas today. Some forms live at abyssal depths, and others on hard-grounds on rocky shores where there are moderate currents. They disintegrate rapidly after death and become scattered, so they are rarely preserved in the fossil record. When a group of specimens is found articulated it would seem to indicate the burial of a life assemblage beneath a cloud of sediment. Clarkson (1979) stated that modern ophiuroids are unable to escape from sediment more than 5 cm thick.

Observations on living ophiuroids have been published by Broom (1975) and Warner (1971), based on a series of S.C.U.B.A. dives in Torbay, Devon, between Berry Head and Hope's Nose. Ophiuroid beds of *Ophiothrix fragilis* (Abildgaard) at a depth of 15 m extended for some 1000 m by 200 m. The animals occurred in patches or clusters, rarely less than 100, and often in concentrations of 1000-2000 per m^2. Individuals separated from a cluster walked until they found another cluster to join. They are suspension feeders and collect food by raising some of their arms vertically so that the adoral surface, which is underneath, is exposed to the suspended matter in the current.

Warner (1971) suggested several advantages in the aggregation behaviour of *Ophiothrix:*
1. There is stability when large numbers hold the sea floor together against currents.
2. The interlocking mass of animals allows them to extend more arms into the current and so increase the suspension feeding potential of each individual.

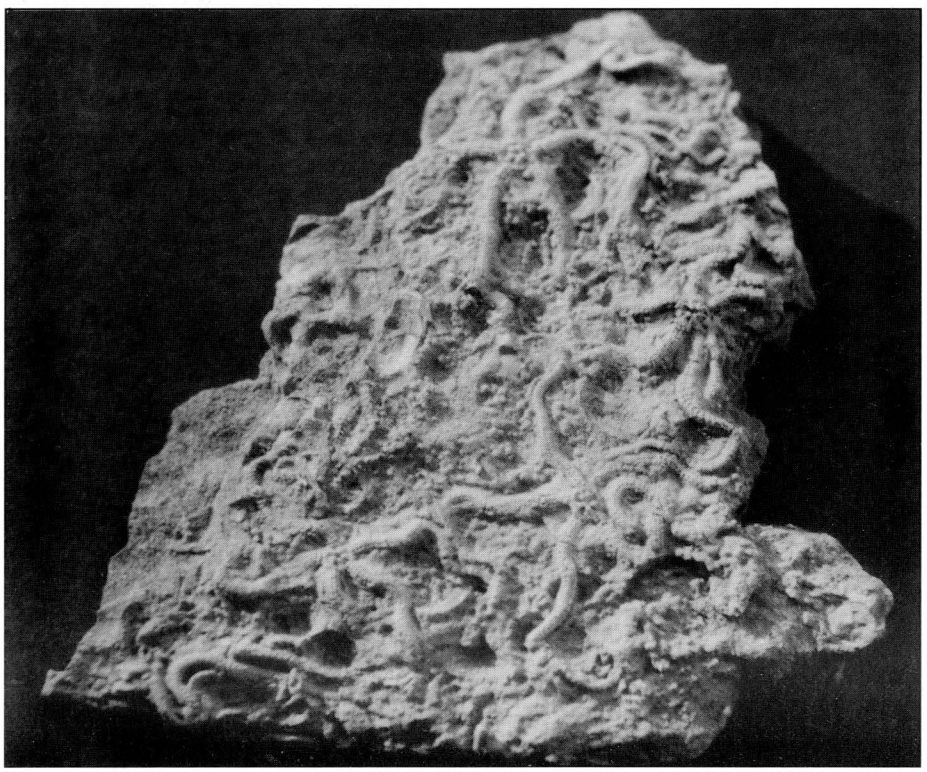

Fig. 2. *Ophiohybris griesbachii* (Wright), Blisworth Limestone, Gregory's Quarry, Ancaster. Peterborough Museum no. 3448/G. Scale ×1.

Fig. 3. *Ophiohybris griesbachii* (Wright), Blisworth Limestone, King's Cliffe. Peterborough Museum no. 5062/G. Scale ×3.

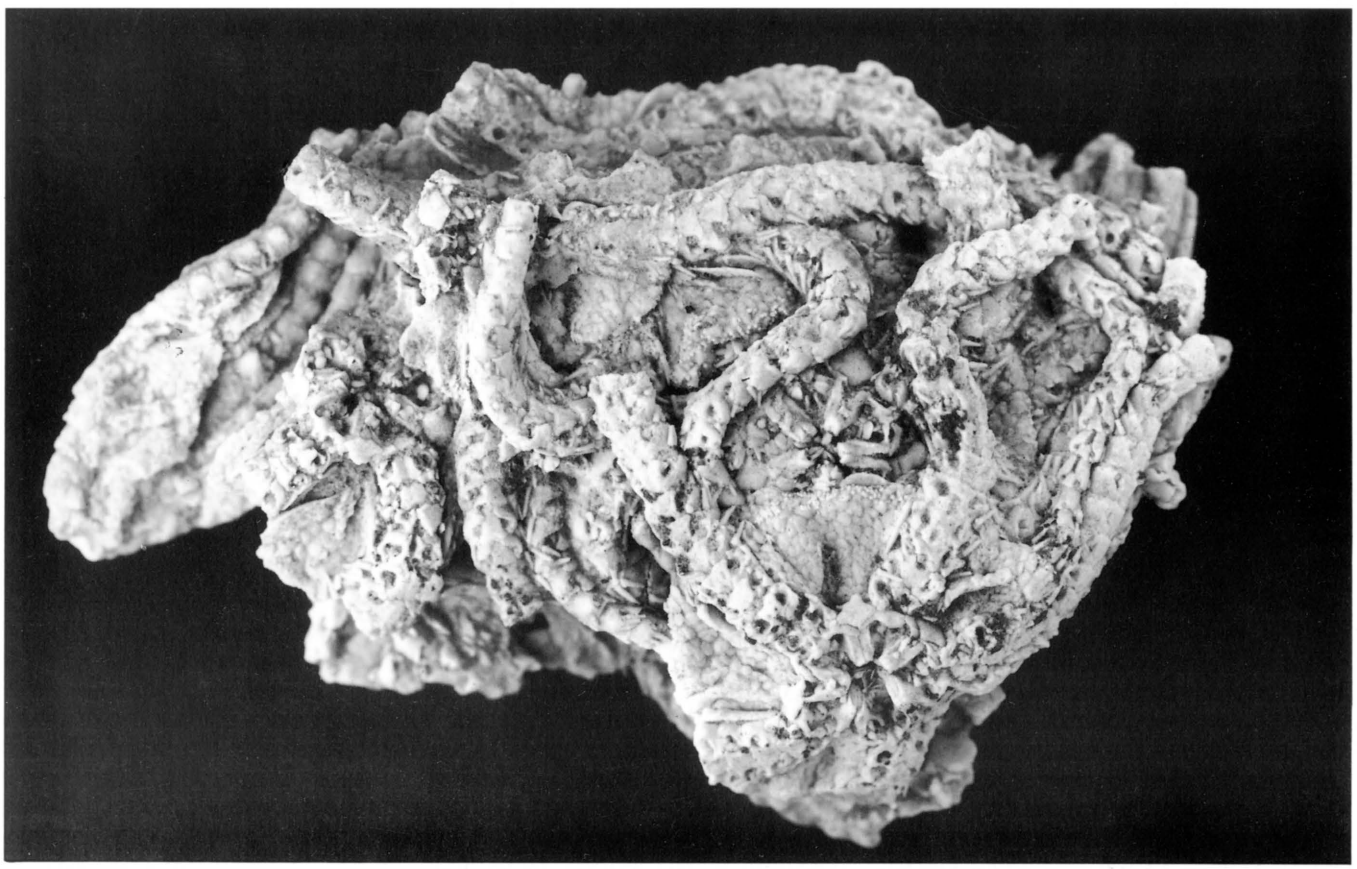

Fig. 4. *Ophiohybris griesbachii* (Wright), Blisworth Limestone, King's Cliffe. Peterborough Museum no. 5064/G. Scale ×3.

3. The current will slow somewhat within the mass of extended arms, thus allowing suspended material to be deposited.
4. The presence of many adults creates a greater certainty of fertilisation during the breeding season.

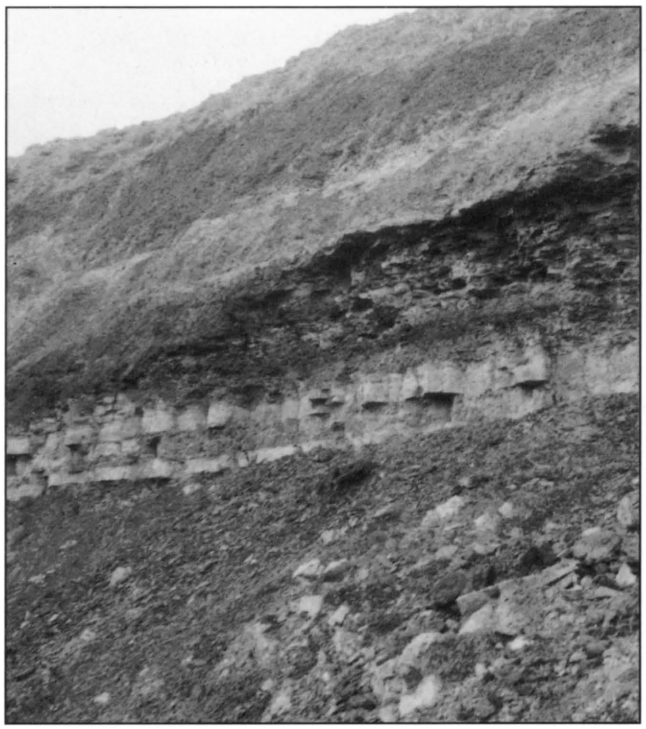

Fig. 5. The exposed face at King's Cliffe Quarry.

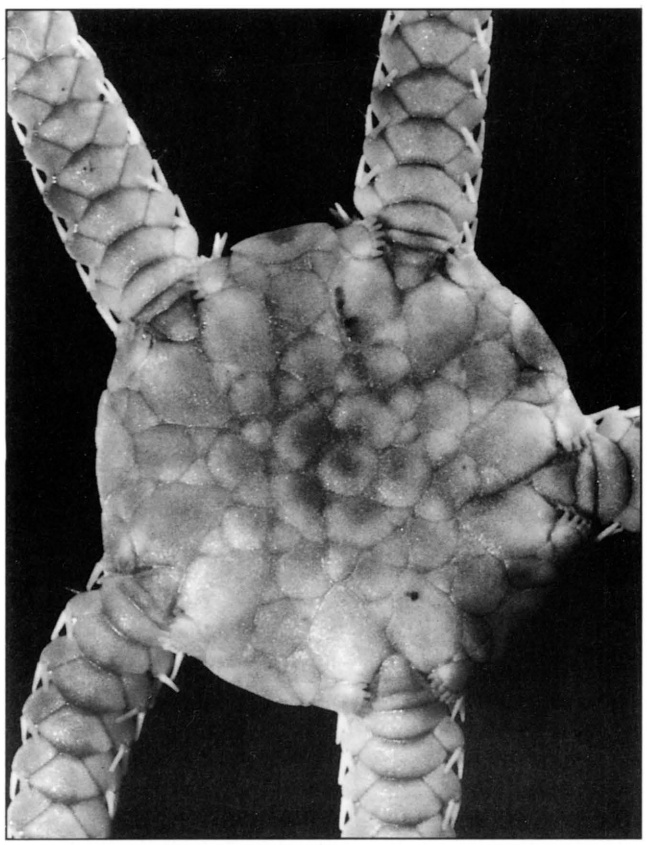

Fig. 6. *Ophiothrix fragilis* (Abildgaard), a modern brittlestar. Upper (aboral) surface of disc with radiating arms. Scale ×6.

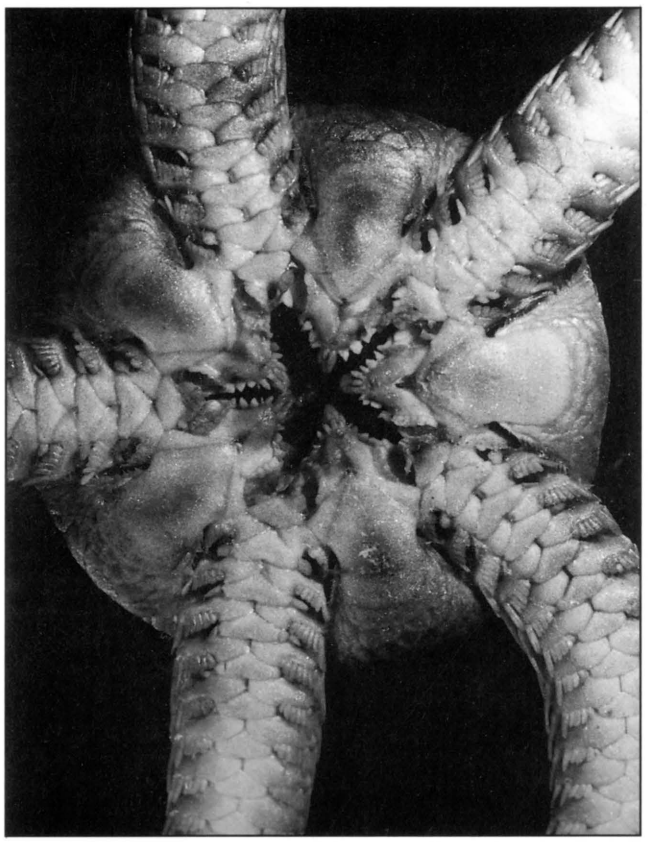

Fig. 7. *Ophiothrix fragilis* (Abildgaard). Lower (adoral) surface showing tooth-like projections around the mouth. Scale ×6.

It seems probable that the life-style of the ophiuroids has changed little through geological time, and that the specimens of *Ophiohybris* reported here lived much in the same way as the modern *Ophiothrix*.

Acknowledgements

The author is indebted to the following for their help: Dr J. A. D. Dickson of Cambridge University for providing the King's Cliffe specimens, the photographs in figs 3, 4, 6, 7, the modern material of *Ophiothrix fragilis*, and some of the literature; Dr A. Smith of the Natural History Museum for identifying the Ancaster specimen; Mr Robin Hix for donating the Ancaster specimen; Dr R. G. Clements of Leicester University for suggesting references, and Dr G. R. Chancellor of Peterborough Museum for checking the draft.

References

Arkell, W. J., 1933. *The Jurassic System in Great Britain.* Oxford, 681pp.
Broom, D. M., 1975. Aggregation behaviour of the brittlestar *Ophiothrix fragilis. Journal of the Marine Biological Association UK*, **55**, 191-197.
Clarkson, E. N. K., 1979. *Invertebrate palaeontology and evolution* (first edition). London, Boston and Sydney, 323pp.
Hess, Von Hans, 1964. Die Ophiuren des Englischen Jura. *Eclogea Geologicae Helvetiae*, **57**, 787-789.
Sylvester-Bradley, P. C., and Ford, T. D., (Eds) 1968. *The geology of the East Midlands.* Leicester University Press, 400pp.
Warner, G. F., 1971. On the ecology of a dense bed of the brittlestar *Ophiothrix fragilis. Journal of the Marine Biological Association UK*, **51**, 267-282.

Alan Dawn
26 Sutherland Way
Stamford
Lincs
PE9 2TB.