BELEMNITE FRAGMENTS FROM ANNENKOV ISLAND

By T. H. PETTIGREW *and* L. E. WILLEY

ABSTRACT. A sequence of volcaniclastic sediments from the south-east coast of Annenkov Island contains a poorly preserved fauna including belemnite fragments. These rocks overlie Cumberland Bay type sediments and probably represent the youngest known part of the South Georgia sedimentary sequence. The belemnite fragments are probably a species of *Dimitobelus* and are thought to indicate an Upper Aptian or more likely an Albian (or younger) age.

DURING a detailed geological survey of Annenkov Island, off the south coast of South Georgia, a poorly preserved fauna including belemnite fragments was collected from a sequence of volcaniclastic sandstones and breccias exposed on the south-east coast (Fig. 1). Whereas the volcaniclastic rocks are faulted against sedimentary rocks of Cumberland Bay type in the south, in the rest of the island they overlie them conformably (Fig. 2). Along the north-east coast of South Georgia the Cumberland Bay type sedimentary rocks are strongly overfolded towards the north-east, the intensity of this deformation decreasing towards the south-west. Along the south-west coast the sequence appears to be younging to the south-west (Trendall,

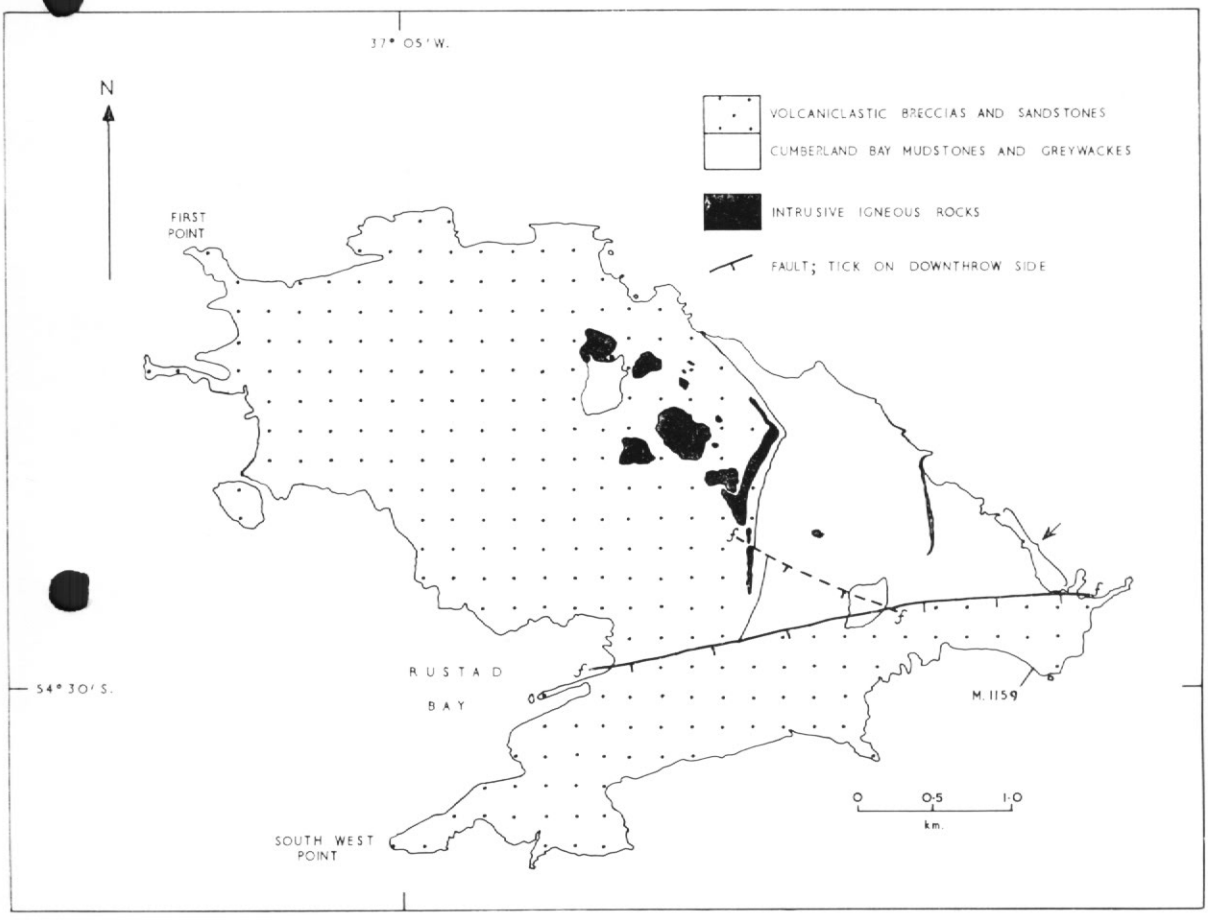


Fig. 1. Simplified geological sketch map of Annenkov Island, indicating the distribution of the main rock types and the fossiliferous localities (arrowed).

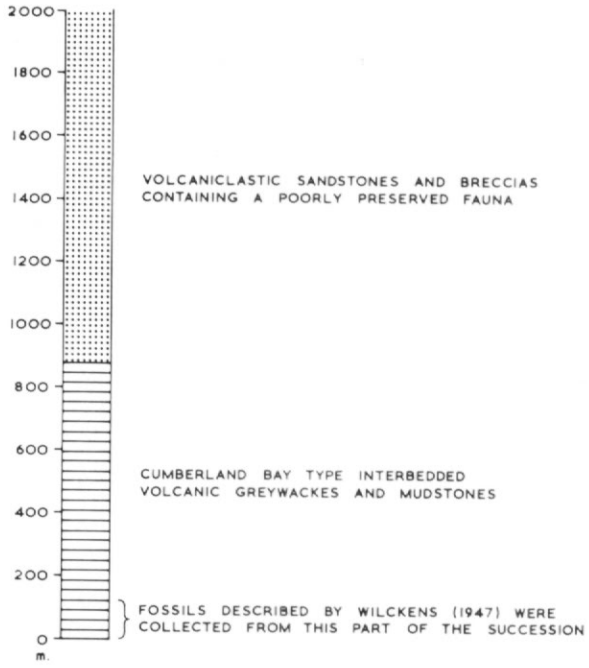


Fig. 2. Generalized succession of the sedimentary rocks exposed on Annenkov Island. The exact stratigraphical position of the fossils in the volcaniclastic sequence is not known because of faulting.

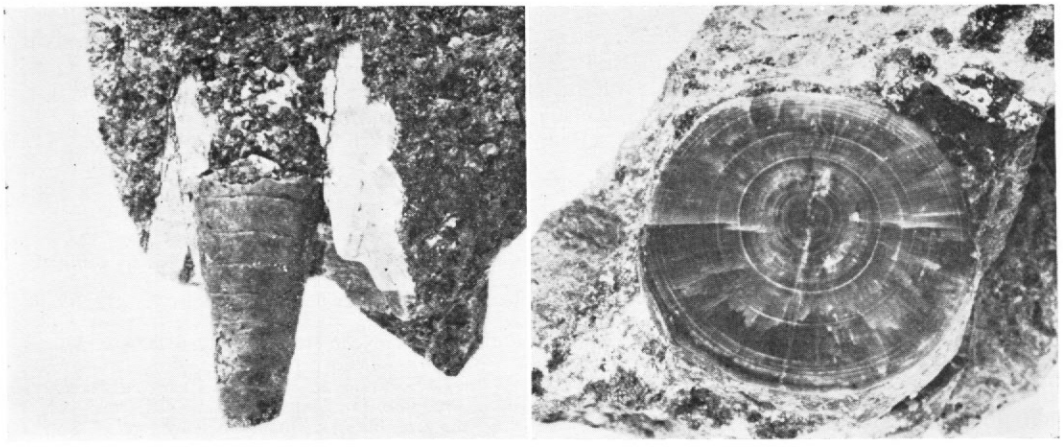
1953, p. 25). It is therefore probable that the Annenkov Island volcaniclastic rocks represent the youngest known part of the South Georgia sedimentary sequence.

The composition of the volcaniclastic rocks is uniform and consists of porphyritic, fine-grained igneous rocks, crystals and crystal fragments. A striking paucity of recognizable primary pyroclastic constituents such as glass shards, volcanic bombs, ashy material and the occurrence of sub-rounded lava fragments emphasizes the epiclastic nature of the deposits as defined by Fisher (1961). The abundance of large andesitic blocks in the breccias indicates the close proximity of a volcanic source (probably an island arc). In composition and texture both the breccias and sandstones show similarities to the coarser volcanic greywacke units of the underlying Cumberland Bay type sedimentary sequence.

The lithology of the volcaniclastic succession is predominantly one of massive coarse breccias which are sometimes tens of metres thick. Impersistent stratified sequences of interbedded breccias and sandstones occur locally, and they merge laterally with the adjacent unstratified deposits. Typically, the stratification in such sequences is poorly defined by the change in size and amount of the larger clastic material, the proportion of fragments less than 2 mm. remaining constant in both lithologies. No fossils were found in any of the massive breccias but one of the stratified sequences exposed on the foreshore at station M.1159 (Figs. 2 and 3) contained belemnites associated with an indeterminate ammonite, shell fragments and carbonized wood. Although this stratified sequence is at least 15 m. thick, the fossils are restricted to the middle 5 m.

Specimen M.1159.6c (Fig. 4a) is a fragment from the alveolar region of a moderately robust guard. Nine septa, about 4 mm. above the position of the protoconch, are preserved and show an internal, ventrally positioned siphuncle. The alveolar angle is acute (about 12°) and the phragmocone is central. Two narrow ventro-lateral grooves, set about 120° apart, and accompanied by splitting surfaces, are developed in the attached guard fragment. In the alveolar region the guard is almost circular in cross-section and the transverse diameter

Fig. 3. Part of the poorly fossiliferous stratified sequence exposed at station M.1159 on Annenkov Island. The collecting site is arrowed.



a **b**

Fig. 4. Belemnite fragments from the volcaniclastic sedimentary sequence at station M.1159.
a. *Dimitobelus* sp.; right lateral view of a fragment split longitudinally and displaying part of the phragmocone, ×3 (M.1159.6c).
b. (*?*) *Dimitobelus* sp.; slightly oblique cross-section from the stem region of a depressed guard, ×3, under oil (M.1159.6b).

is 12 mm. The ventro-lateral grooves and the relatively short phragmocone indicate that this fragment is probably from a species of *Dimitobelus*.

Other fragments are from the stem and apical regions of moderately robust and depressed guards. In specimen M.1159. 6b (Fig. 4b) the transverse diameter is 15·0 mm. and the corresponding saggital diameter is 12·4 mm. The apical line is ventrally positioned in the fragments from the stem region and it is almost central in those from the apical region. Although the lack of diagnostic features makes even generic identification of these fragments hypothetical, it is probable that they are conspecific with specimen M.1159.6c.

A poorly preserved fossil assemblage, collected from the underlying Cumberland Bay type sedimentary sequence on the north-east coast of Annenkov Island (Fig. 1) by Dr. L. Kohl-Larsen, included fish remains, cirripedes, ammonites, bivalves and echinoderm fragments. Part of this material was later described by Wilckens (1947), who suggested that the fauna, particularly the ammonites, indicated an Upper Aptian age. However, doubts concerning the age assigned to the Annenkov Island fauna were expressed by Casey (1961, footnote on p. 56), who suggested that the ammonites *Georgioceras* Wilckens and "*Puzosia matheroni* (d'Orbigny)?" more closely resemble Neocomian forms. *Belemnopsis*-like fragments, indicating an Upper Jurassic–lowest Cretaceous age, have also been described from a lower horizon in the Cumberland Bay type sedimentary sequence on the north-east coast of South Georgia (Stone and Willey, 1973).

Dimitobelus has been described from Australia, New Zealand, India, New Guinea and Alexander Island, Antarctica. During a visit to the La Plata Museum, L. E. Willey identified *Dimitobelus* from amongst fossils collected by Dr. A. C. Riccardi from southern Argentina and Patagonia. The earliest record of *Dimitobelus* is that of *D. (?) youngensis* Skwarko from late Neocomian sediments of the Northern Territory, Australia (Skwarko, 1966). Other records of *Dimitobelus* are mainly from Albian or younger sediments, continuing at least until the Maestrichtian in New Zealand (Stevens, 1965, p. 176). In Alexander Island, *Dimitobelus* has been described from sediments of Upper Aptian and Albian age (Willey, 1972; Taylor and others, 1974). The specimens from Annenkov Island are believed to indicate an Upper Aptian or more probably Albian (or younger) age.

Acknowledgements

We wish to thank Professor F. W. Shotton for the use of facilities in the Department of Geology, University of Birmingham, Dr. R. J. Adie for helpful criticism and Dr. M. R. A. Thomson for his advice during the preparation of the manuscript. The assistance of Dr. A. C. Riccardi, La Plata Museum, Argentina, is gratefully acknowledged.

MS. received 16 April 1974

REFERENCES

Casey, R. 1961. A monograph of the Ammonoidea of the Lower Greensand. Part 2. *Palaeontogr. Soc.* [*Monogr.*] 45–118.

Fisher, R. V. 1961. Proposed classification of volcaniclastic sediments and rocks. *Bull. geol. Soc. Am.*, **72**, No. 9, 1409–14.

Skwarko, S. K. 1966. Cretaceous stratigraphy and palaeontology of the Northern Territory. *Bull. Bur. Miner. Resour. Geol. Geophys. Aust.*, No. 73, 133 pp.

Stevens, G. R. 1965. The Jurassic and Cretaceous belemnites of New Zealand and a review of the Jurassic and Cretaceous belemnites of the Indo-Pacific region. *Palaeont. Bull., Wellington*, No. 36, 283 pp.

Stone, P. *and* L. E. Willey. 1973. Belemnite fragments from the Cumberland Bay type sediments of South Georgia. *British Antarctic Survey Bulletin*, No. 36, 129–31.

Taylor, B. J., Thomson, M. R. A. *and* L. E. Willey. 1974. The geology of the Ablation Point–Keystone Cliffs area, Alexander Island. *British Antarctic Survey Scientific Reports*, No. 82, 65 pp.

Trendall, A. F. 1953. The geology of South Georgia: I. *Falkland Islands Dependencies Survey Scientific Reports*, No. 7, 26 pp.

Wilckens, O. 1947. Paläontologische und geologische Ergebnisse der Reise von Kohl-Larsen (1928–29) nach Süd-Georgien. *Abh. senckenb. naturforsch. Ges.*, No. 474, 66 pp.

Willey, L. E. 1972. Belemnites from south-eastern Alexander Island: I. The occurrence of the family Dimitobelidae in the Lower Cretaceous. *British Antarctic Survey Bulletin*, No. 28, 29–42.