UPPER JURASSIC AND LOWEST CRETACEOUS TRIGONIIDAE (BIVALVIA) FROM SOUTH-EASTERN ALEXANDER ISLAND

By L. E. WILLEY

ABSTRACT. Two species of *Myophorella* are described from marine sediments of Upper Jurassic–lowest Cretaceous age from south-eastern Alexander Island. Both species are considered to be new and one is sufficiently well preserved to be formally named. The stratigraphical position of the Trigoniidae in Alexander Island is discussed.

TRIGONIIDAE first appear in the Upper Trias and are both abundant and greatly diverse in the Jurassic and Cretaceous (Cox, 1952, p. 45). Living Trigoniacea are now restricted to a few closely related species and subspecies of the genus *Neotrigonia*. This genus is restricted to Australia in seas ranging from tropical to cool temperate and in depths ranging down to 200 fathoms [380 m.] (Fleming, 1964, p. 196). *Neotrigonia* is known to have a foot capable of violent motions (Fleming, 1964, p. 198) and observations on living specimens in an aquarium show that it is a "nonsiphonate, infaunal suspension feeder which lives with the posterior shell margin slightly above the sediment surface" (McAlester, 1966). In Alexander Island *Myophorella* have been obtained from sediments indicative of shallow-water marine environments (Taylor and others, 1974).

SYSTEMATIC DESCRIPTIONS

SUPERFAMILY TRIGONIACEA LAMARCK 1819

FAMILY TRIGONIIDAE LAMARCK 1819

Genus *Myophorella* Bayle 1878
Myophorella alexandra sp. nov.

Fig. 2a–c

Material

Seventeen internal and external moulds and three external casts. Six specimens from the Ablation Point area and the remainder from locality Z (Fig. 1). Specimen KG.719.10, an external mould of an incomplete, partially articulated example, collected from the southern side of Ablation Valley, is designated as the holotype.

Diagnosis

Shell medium-sized for the genus; outline trigonally ovate to oblong and strongly inequilateral. Umbones placed far forward and are orthogyrate. Valves weakly inflated, greatest inflation occurring in the area of the umbones and along a curve, paralleling the line of the antero-ventral margin. Both marginal and escutcheon carinas are curved, obtuse and delicately tuberculate except towards the posterior where lamella protuberances are developed. Between these carinas is a bipartite area ornamented by a series of closely spaced, slightly curved, transverse raised lines or ridges which increase in strength posteriorly. The flank of both valves is ornamented by a series of broadly spaced oblique to sub-concentric costae; tuberculate towards the marginal carina and pustulate approaching the antero-ventral margin.

Description

The holotype (KG.719.10) is an external mould of an incomplete articulated specimen (Fig. 2a). It is medium-sized for the genus, strongly inequilateral and trigonally ovate in outline. Several of the larger specimens are more elongate posteriorly becoming almost oblong in outline (Fig. 2b). The umbones are placed far forward and the beaks appear to be ortho-

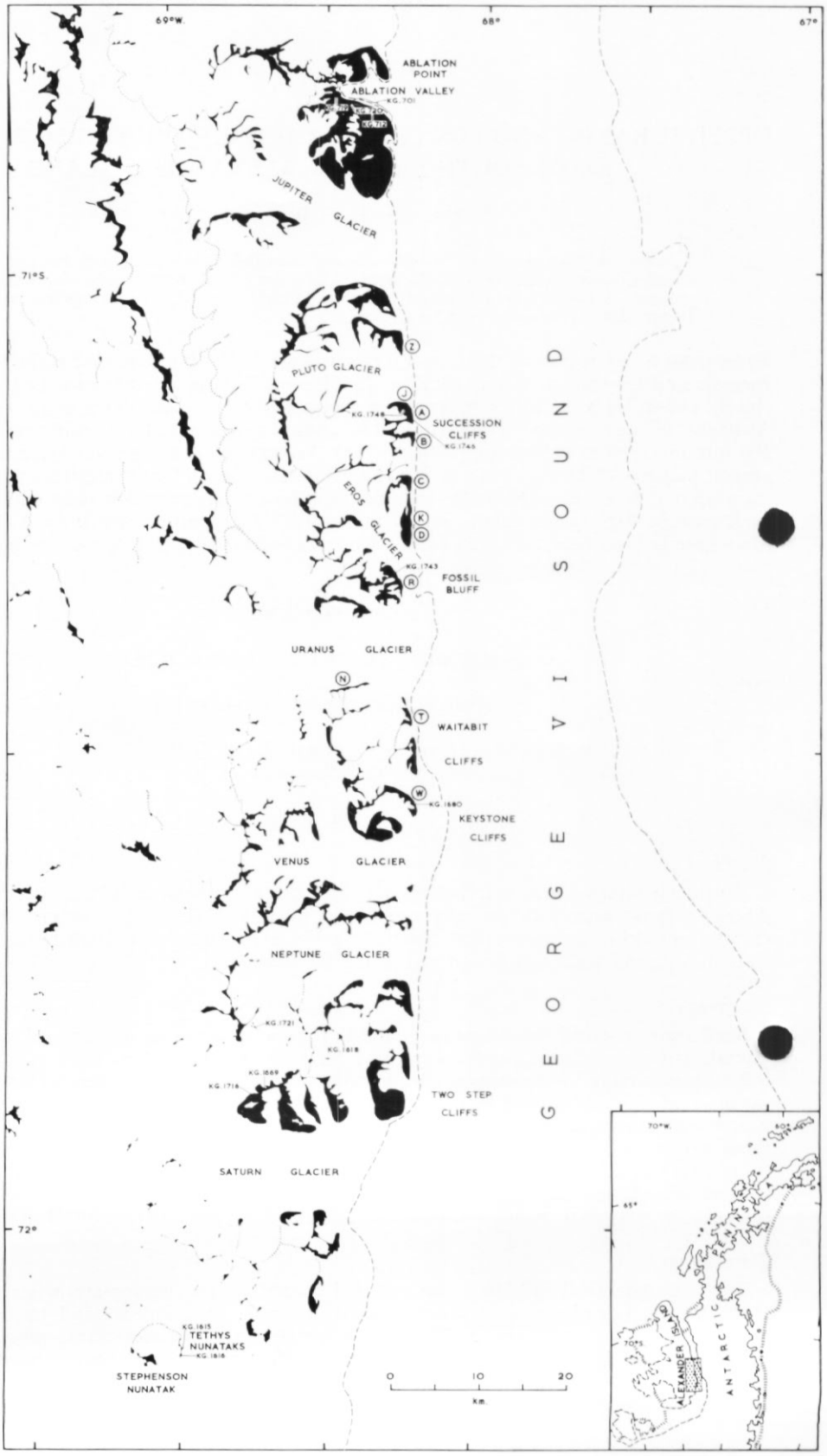

Fig. 1. Sketch map of part of Alexander Island showing the area discussed and the locations from which the specimens of Trigoniidae were collected.

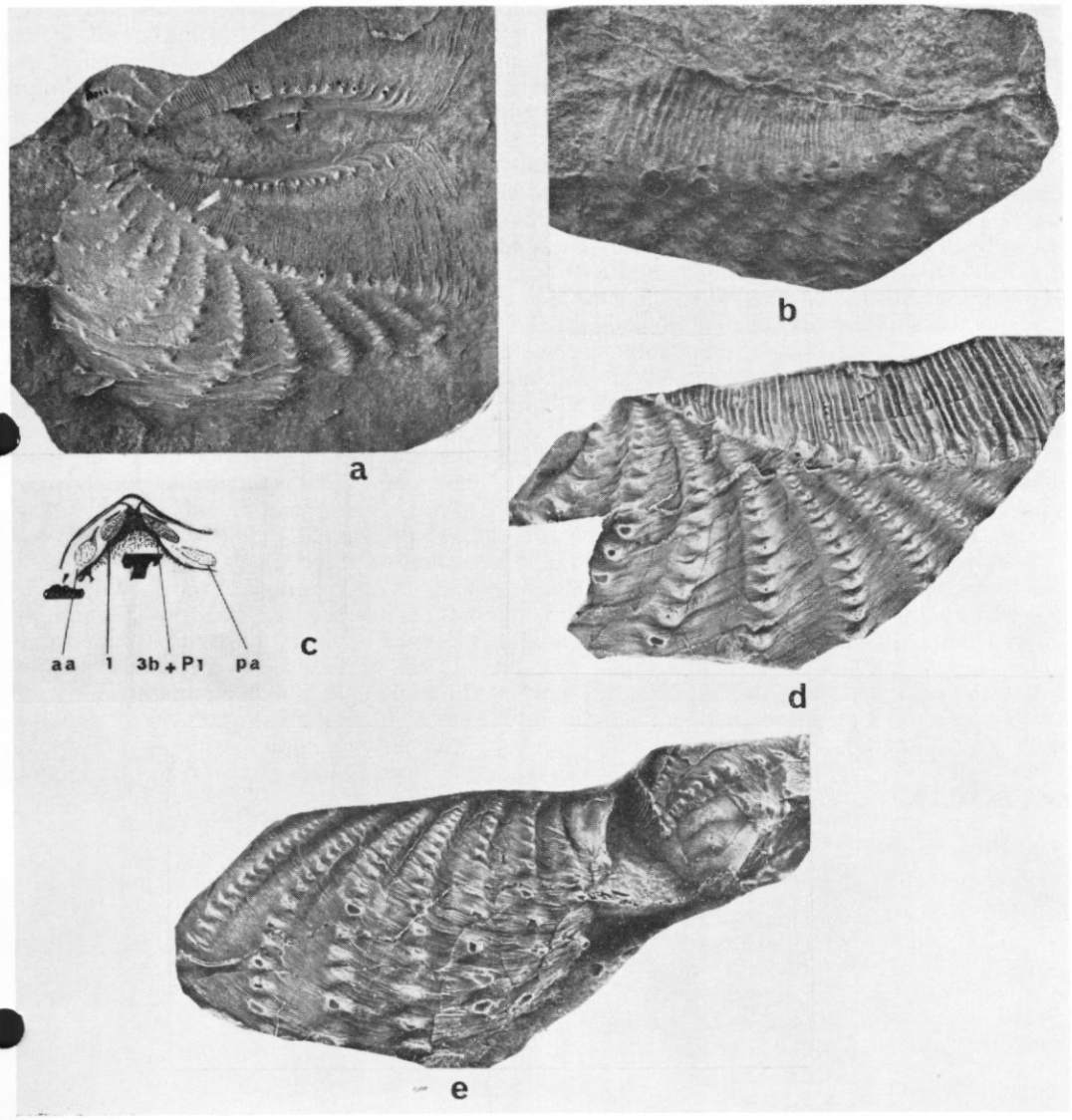

Fig. 2. a. *Myophorella alexandra* sp. nov.; latex cast of a mould of the holotype, an incomplete partially articulated example, collected from the southern side of Ablation Valley; ×2, coated (KG.719.10).
b. *Myophorella alexandra* sp. nov.; latex cast of a mould of a posteriorly elongate specimen, collected from locality Z; ×1·5, coated (KG.401.601).
c. *Myophorella alexandra* sp. nov.; composite diagrammatic illustration of the dentition of a right valve; ×3.
d. *Myophorella* sp. nov. (*?*); latex cast of a mould of a left valve showing external ornamentation, collected from the southern side of Ablation Valley; ×1·5, coated (KG.712.78).
e. *Myophorella* sp. nov. (*?*); latex cast of a mould of a right valve showing external ornamentation, collected from the southern side of Ablation Valley; ×1·5, coated (KG.712.81).

gyrate. The valves are only weakly inflated, greatest inflation occurring in the area of the umbo and across the flank along a curve extending from the umbo paralleling the antero-ventral margin. The line of the anterior and ventral margin is moderately convex and meets the line of the marginal carina (terminology of Cox, 1969*b*, p. *N*471) at an angle of about 40°. The line of the posterior margin is also convex and meets the escutcheon carina at an angle of about 100°. The curved, obtuse marginal carina separates the flank from the bipartite area; along most of its length it is ornamented by delicate tubercles and is separated from the dorsal termination of the flank costae by a narrow groove. A more angulate, delicately tuberculate escutcheon carina borders the area dorsally. The area broadens rapidly away from the umbo and is ornamented by a series of fine, slightly curved, transverse raised lines or ridges which increase in strength posteriorly. Towards the posterior margin these ridges encroach on to both carinas, so that the tubercles are replaced by lamella protuberances. The area is divided by a shallow radial groove into broad ventral and narrow dorsal parts. The escutcheon is not preserved in any of these specimens.

Ornamentation on the flanks of both valves consists of a series of broadly spaced oblique to sub-concentric costae. Close to the umbo the costae are nearly at right-angles to the marginal carina; they then curve strongly towards the anterior margin, maximum curvature occurring over the inflated region of the flanks. Towards the postero-ventral margin the costae are only slightly curved. Posteriorly, the angle between the costae and the marginal carina becomes increasingly acute; in the holotype the angle is approximately 30°. The costae are tuberculate close to the carina and approaching the antero-ventral margin they become increasingly pustulate. The flank is also ornamented by radial growth lines, feint in the region of the umbo and becoming increasingly coarse towards the ventral margin.

A composite diagrammatic illustration of the dentition of the right valve of this species has been drawn from the fragmentary information preserved on two internal moulds (KG.401. 500 and 522) (Fig. 2c). A single, moderately prominent, horizontally ridged tooth (1) (terminology of Cox, 1969*a*, p. *N*52, fig. 47) radiates from below the beak and lies sub-parallel to the antero-dorsal margin. A second, elongate, transversely ridged tooth (3b+P1) radiates from below the beak and lies sub-parallel to the postero-dorsal margin. A poorly discernible sub-circular scar of the anterior adductor, and a slightly elongate scar of the posterior adductor were also observed.

Measurements

Specimen number	*Height* (mm.)	*Length* (mm.)
KG.401.467	14·2	20·5
KG.401.478	15·1	22·1
KG.401.484	15·0	18·0
KG.401.485	12·0*	18·5
KG.401.495	11·9	17·5*
KG.401.575	15·5*	20·2
KG.401.601	30·0*	42·5*
KG.719.10†	19·0	29·2
KG.719.48	13·7	18·2
KG.719.49	10·0	13·5
KG.721.35	9·1	12·9

* Estimated. † Holotype.

Remarks

The smaller Alexander Island specimens closely resemble examples of *Trigonia* [*Myophorella*] *exotica* Möricke from the *Humphriesianus* beds of Chile (Möricke, 1895, p. 94, pl. I, fig. 9, pl. VI, fig. 9). However, the South American species is generally more quadrate in outline, poorly inflated and the costae appear to lose their tuberculation towards the ventral margin of the shell. The largest specimens of *Myophorella alexandra* have certain characteristics of

ornament and shell form similar to those shown in several of the "*Quadratrigonia*" of South America (Caminios, 1969), e.g. *Trigonia neuquensis* (Burckhardt, 1903, p. 74, pl. XIV, figs. 4–6; Lambert, 1944, p. 383, pl. IX, fig. 5).

The general appearance of the Indian species, *Trigonia kutchensis* Kitchin from the Jurassic fauna of Cutch (Kitchin, 1903, p. 84, pl. VII, figs. 7–9), is similar to that of *M. alexandra* but the ornamentation on the flanks of *kutchensis* is irregular, the costae bifurcate near the ventral margin and lack the strong anterior swing developed in the Alexander Island specimens.

An example of *Trigonia elegans* Baily, from Cretaceous sediments in South Africa (Baily, 1855, p. 461, pl. XIII, fig. 3a and b), is of a similar size and outline to the smaller examples of *M. alexandra* but the area is ornamented by strong transverse ridges, the marginal carina is non-tuberculate and the costae are only slightly arched across the flanks of the valves.

Similarities have also been observed with several European forms. A small example of *Trigonia costata* var. *monilifera* Agassiz, from the Upper Jurassic of Russia (d'Eichwald, 1865–68, p. 598, pl. XXIII, fig. 13a and b), can be distinguished from the Alexander Island specimens by the poorly arched costae and the lack of tuberculation on the marginal carina. Immature specimens of *Trigonia perlata* Agassiz, from the British Corallian (Arkell, 1927–35, p. 17, pl. VI, figs. 5 and 6), have an additional tuberculate, longitudinal ridge within the area, and the moderately convex postero-ventral margin intersects the marginal carina at a more acute angle than that developed in *M. alexandra*.

Apart from the costae close to the umbo, the tuberculation in *Trigonia signata* Lycett *non* Agassiz, from the Inferior Oolite of Great Britain (Lycett, 1872–79, p. 29–31, pl. II, figs. 1–3) and the Bajocian of the Cordillera region of South America (Burckhardt, 1903, p. 23, pl. II, fig. 8), differs from that of *M. alexandra* in that those on the flank are replaced by strong pustules and those along the marginal carina give way, at an early stage of growth, to lamella protuberances extending from the area.

Trigonia (*Myophorella*) *norberti* Chavan, from Cordebugle (Normandy) (Chavan, 1952, p. 51–52, pl. 3, fig. 6), differs from the Alexander Island specimens in having a proportionally narrower area ornamented by strong transverse ridges and, although the costae appear to be regular in Chavan's illustration, he included specimens with an irregular flank ornament within his species.

The Australian species *Myophorella* (*Myophorella*) *australiana* Skwarko, from Aptian sediments of Queensland (Skwarko, 1963, p. 38, pl. 5, figs. 8–11), differs from the Alexander Island specimens in that the costae pass almost without any curve across the flank of the valves, the transverse ribbing in the proximal part of the area is replaced distally by an irregular tubercular ornament and the outline of the Australian species is sub-crescentic.

From amongst the varied Trigoniidae described from Japan, examples of the Upper Jurassic species *Myophorella* (*Promyophorella*) *orientalis* Kobayashi and Tamura (Kobayashi and Tamura, 1955, p. 98, pl. V, fig. 6a and b; Kobayashi, 1957, p. 46, pl. 1, figs. 16–18) are similar to the Alexander Island specimens. However, the beaks of the Japanese examples are opisthogyrate, across the flanks the costae are more acutely arcuate and the tuberculation of the costae is less prominent.

Myophorella sp. nov. (*?*)

Fig. 2d and e

Material

Six fragmentary external moulds and one internal mould, all from the Ablation Point area (stations KG.712 and 717).

Description and remarks

None of these fragments is complete (Fig. 2d and e) and therefore only an impression based on these specimens can be given. The fragments are all derived from valves of medium size for the genus. They differ from *Myophorella alexandra* in the following respects:

i. The costae are more prominent, sub-triangular in cross-section, closely spaced and with the sloping sides of the costae meeting to form deep angular interspaces.

ii. Curvature of the costae over the flank is not as well developed.
iii. Tuberculation of the marginal carina is more prominent.
iv. Ornamentation of the area is coarser and more widely spaced.

Although these fragments clearly represent a species distinct from *M. alexandra*, none of the material is sufficiently well preserved for a formal diagnosis to be prepared.

Stratigraphical Discussion

Trigoniidae have been reported from several areas in the Antarctic Pensinsula. In the geological reports of the Swedish South-Polar Expedition, 1901–03, Wilckens (1910) described four new species (*Trigonia antarctica*, *pygoscelium*, *regina* and *hydriiformis*) from Cretaceous sediments on Snow Hill and Seymour Islands, north-eastern Graham Land. Bibby (1966, p. 24–25) also reported the presence of *Trigonia* sp. in Upper Cretaceous sediments at Cape Lamb (Vega Island) and Dagger Peak (James Ross Island), north-eastern Graham Land.

Fragmentary bivalves, including several identified as *Trigonia* (*?*) sp., have been obtained from calcareous grit boulders of probable Upper Jurassic–lowest Cretaceous age in the Spence Harbour Conglomerate, Coronation Island (Thomson and Willey, 1975).

Myophorella has been reported from several localities in eastern Elsworth Land associated with a varied (?) Upper Jurassic marine fauna (Laudon and others, 1969). These specimens were reported to be "very similar to an un-named form from New Zealand" (Fleming, 1964). Fleming's (1964, fig. 9, middle figure, second column) sketch of *Myophorella* from the Upper Jurassic of New Zealand is also similar to the Alexander Island species, the prominent tuberculate costae suggesting a closer comparison with *Myophorella* sp. nov. (*?*) than with *M. alexandra*.

The first report of Trigoniidae from Alexander Island was of "a fragment of an indeterminate ribbed bivalve (*Trigonia ?*)" by Cox (1953, p. 3) from station E.711 (Stephenson Nunatak). However, this specimen has subsequently been identified as a fragment of *Grammatodon* (*Indogrammatodon*) cf. *robusta* (Etheridge) (Willey, 1975). Taylor (1971, p. 151) reported the occurrence of *Trigonia* [= *Myophorella*] from localities D and K, and suggested that it may form a stratigraphical zone marker in Alexander Island. Unfortunately no specimens were collected from these localities to enable precise descriptions and identifications to be made.

Neither of the Alexander Island species has been identified with previously described species, although considerable similarities have been noted with species from mainly Upper Jurassic sediments in South America, India, Europe, Australia, Japan and (?) New Zealand, and eastern Ellsworth Land, Antarctica (Fig. 3). The ages given to these specimens have largely been determined by those indicated by the associated ammonites (Thomson, 1971, 1974), belemnites (Willey, 1973) and *Inoceramus* (Thomson and Willey, 1972) in stratigraphically equivalent or near-equivalent horizons (Table I).

In the Ablation Point area, *Myophorella alexandra* has been collected from stations KG.719 and 721 on the southern side of Ablation Valley (Fig. 1). These specimens occur in sediments of a Berriasian age associated with ammonite faunas rich in *Haplophylloceras strigile* (*?*) Blanford and *Bochianites* aff. *versteeghi* (Boehm), and the belemnites *Belemnopsis alexandri* Willey, *B.* aff. *uhligi* Stevens, *Hibolithes subfusiformis* (Raspail) and *H.* cf. *compressus* Stolley (Willey, 1973; Elliott, 1974; Taylor and others, 1974).

At locality Z, *M. alexandra* occurs in association with a varied fauna of Berriasian age (Thomson, 1971, 1974; Thomson and Willey, 1972; Willey, 1973, 1975; Taylor and others, 1974) including:

Phyllopachyceras (*?*) sp.
Himalayites (*?*) sp.
Neocosmoceras aff. *sayi* (Simionescu)
Belemnopsis alexandri Willey
Belemnopsis gladiatoris Willey
Belemnopsis aff. *uhligi* Stevens
Hibolithes subfusiformis (Raspail)
Hibolithes antarctica Willey
Hibolithes aff. *marwicki mangaoraensis* Stevens
Hibolithes sp. nov. (*?*)
Grammatodon subrectangulus Willey
Grammatodon (*Indogrammatodon*) aff. *fyfei* Marwick

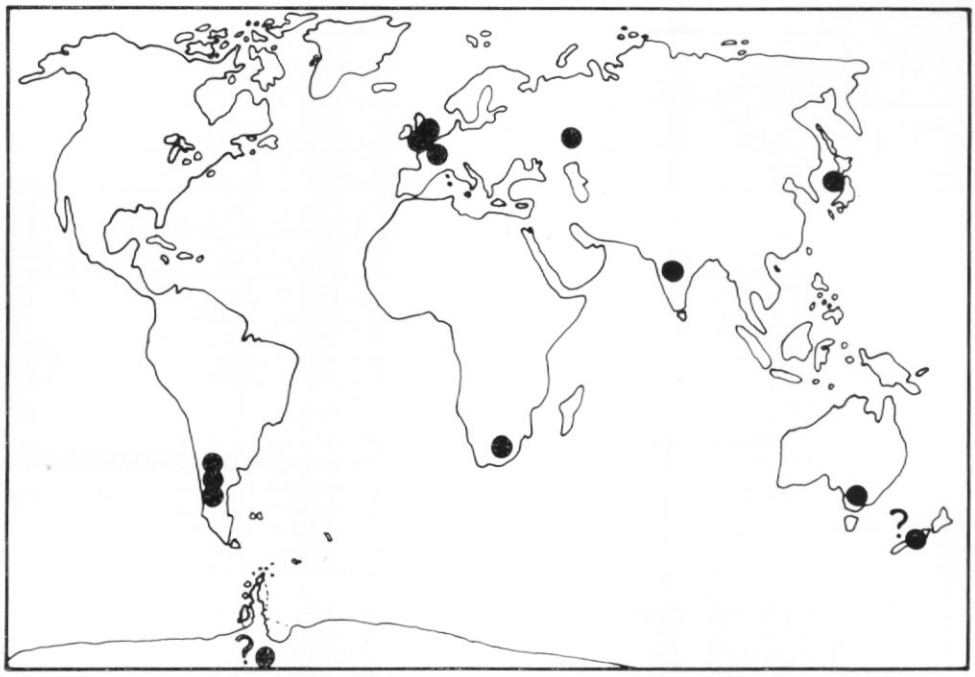

Fig. 3. Sketch map illustrating the distribution of species of Trigoniidae similar to those collected from Alexander Island.

Grammatodon (*Indogrammatodon*) *antarctica* Willey
Grammatodon (*Indogrammatodon*) *elongatus* Willey
Inoceramus pseudosteinmanni Thomson and Willey

and below beds containing *Bochianites gracilis* Thomson.

At localities D and K, *Trigonia* [= *Myophorella*] has been reported from a mainly arenaceous facies together with a varied bivalve fauna including *Ancellina*, *Inoceramus trapezoidalis* Thomson and Willey, *Pinna* and *Pholadomya* (Taylor, 1971; Taylor and others, 1974). No ammonites have been collected from these beds but belemnites (*Belemnites gladiatoris* Willey and *Hibolithes* sp. nov. (*?*) (Willey, 1973)), derived from beds laterally equivalent to those at locality D, suggest that these sediments are of approximately equivalent age to the Berriasian sediments at locality Z.

Specimens of *Myophorella* sp. nov. (*?*) have been collected from stations KG.712 and 717 in the Ablation Point area (Fig. 1). At station KG.712 they occur in sediments associated with a Tithonian ammonite fauna dominated by species of *Virgatosphinctes* and *Aulacosphinctoides* (Elliott, 1974; Taylor and others, 1974). Those from station KG.717 were obtained from sediments characterized by the absence of *Virgatosphinctes* and *Aulacosphinctoides* and by the appearance of an Upper Tithonian ammonite fauna including *Berriasella* and *Blanfordiceras* (Elliott, 1974; Taylor and others, 1974).

The Alexander Island occurrences of *Myophorella*, so far, appear to be restricted to sediments of Tithonian–Berriasian age. The absence of Trigoniacea from the relatively fossiliferous Aptian sediments of the Fossil Bluff area and from marine beds interbedded with the predominantly deltaic sediments of Albian (or younger) age in southern Alexander Island may indicate either an unsuitable environment or that the genus did not survive in this area above the lowest Cretaceous. Their absence from collections made from the Upper Oxfordian–

TABLE I

Age		*Myophorella species*	*Remarks and associated stratigraphically significant faunas*
Albian			
Aptian			
Neocomian	Barremian Hauterivian Valanginian		Not yet proven in Alexander Island
	Berriasian	*Trigonia* [= *Myophorella*]	? At localities D and K with a varied bivalve fauna including *Aucellina*, *Inoceramus trapezoidalis*, *Pinna* and *Pholadomya*, and in beds laterally equivalent to those containing *Belemnopsis gladiatoris* and *Hibolithes* sp. nov. (*?*)
		Myophorella alexandra sp. nov.	In sediments at locality Z below those containing *Bochianites gracilis* and in beds associated with *Phyllopachyceras* (*?*) sp., *Himalayites* (*?*) sp., *Neocosmoceras* aff. *sayi*, a varied *Belemnopsis*/*Hibolithes* fauna and bivalves including *Inoceramus pseudosteinmanni* and *Grammatodon* (*Indogrammatodon*) aff. *fyfei*
		Myophorella alexandra sp. nov.	In association with *Haplophylloceras strigile* (*?*), *Bochianites* aff. *versteeghi*, *Belemnopsis alexandri*, *B.* aff. *uhligi*, *Hibolithes subfusiformis* and *H.* cf. *compressus* from the southern side of Ablation Valley
Tithonian		*Myophorella* sp. nov. (*?*)	At station KG.717 in Ablation Valley, in beds containing an ammonite fauna characterized by the occurrence of *Berriasella* and *Blanfordiceras*
		Myophorella sp. nov. (*?*)	In association with an ammonite fauna dominated by species of *Virgatosphinctes* and *Aulacosphinctoides* from station KG.712 on the southern side of Ablation Valley
Kimmeridgian to **Upper Oxfordian**			

Kimmeridgian sediments of Ablation Point may only reflect the cursory nature of the palaeontological collections which have been made from this succession. However, considerable areas of Mesozoic sediments in Alexander Island remain to be examined before a more definite distribution of this family can be given.

ACKNOWLEDGEMENTS

The author wishes to thank Professor F. W. Shotton for facilities in the Department of Geology, University of Birmingham, and Dr. R. J. Adie for his guidance and helpful criticism in the preparation of this manuscript. The assistance of Dr. N. J. Morris (British Museum (Nat. Hist.)) is gratefully acknowledged. I am particularly indebted to my colleagues Drs. C. M. Bell, B. J. Taylor and M. R. A. Thomson for their co-operation and assistance throughout the preparation of this paper. The co-operation of M. H. Elliott, who also collected several of the specimens from the Ablation Point area, is also acknowledged.

MS. received 4 October 1974

REFERENCES

ARKELL, J. W. 1927–35. A monograph of the British Corallian Lamellibranchia. *Palaeontogr. Soc.* [*Monogr.*], xxxviii+392 pp.

BAILY, W. H. 1855. Description of some Cretaceous fossils from South Africa; collected by Capt. Gardon of the 45th Regiment. *Q. Jl geol. Soc. Lond.*, **11,** Pt. 1, 454–65.

BIBBY, J. S. 1966. The stratigraphy of part of north-east Graham Land and the James Ross Island group. *British Antarctic Survey Scientific Reports*, No. 53, 37 pp.

BURCKHARDT, C. 1903. Beiträge zur Kenntnis der Jura- und Kreide-Formation der Cordillera. *Palaeontographica*, **50,** Lief. 1–3, 1–144.

CAMINIOS, L. DE. 1969. Revision de las Trigonias de la Argentina. V. El grupo de las Pseudoquadratae. *Ameghiniana*, **6,** No. 1, 65–68.

CHAVAN, A. 1952. Les Pélécypodes de sables astartiens de Cordebugle (Calvados). *Schweiz. palaeont. Abh.*, **69,** Ht. 3, 132 pp.

COX, L. R. 1952. Notes on the Trigoniidae, with outlines of a classification of the family. *Proc. malac. Soc. Lond.*, **29,** 45–70.

———. 1953. Lower Cretaceous Gastropoda, Lamellibranchia and Annelida from Alexander I Land (Falkland Islands Dependencies). *Falkland Islands Dependencies Survey Scientific Reports*, No. 4, 14 pp.

———. 1969*a*. General features of Bivalvia. (*In* MOORE, R. C. *and others, ed. Treatise on invertebrate paleontology. Pt. N. Vol. 1. Mollusca 6. Bivalvia.* Lawrence, Kansas, University of Kansas and the Geological Society of America, Inc., *N*3–129.)

———. 1969*b*. Family Trigoniidae Lamarck, 1819. (*In* MOORE, R. C. *and others, ed. Treatise on invertebrate paleontology. Pt. N. Vol. 1. Mollusca 6. Bivalvia.* Lawrence, Kansas, University of Kansas and the Geological Society of America, Inc., *N*476–88.)

D'EICHWALD, E. 1865–68. *Lethaea rossica ou paleontologie de la Russie. Vol. 2.* Stuttgart, E. Schweizerbart (E. Koch).

ELLIOTT, M. H. 1974. Stratigraphy and sedimentary petrology of the Ablation Point area, Alexander Island. *British Antarctic Survey Bulletin*, No. 39, 87–113.

FLEMING, C. A. 1964. History of the bivalve family Trigoniidae in the south-west Pacific. The geological background to an Australian 'living fossil'. *Aust. J. Sci.*, **26,** No. 7, 196–204.

KITCHIN, F. L. 1903. The Jurassic fauna of Cutch. The Lamellibranchiata; Genus *Trigonia*. *Mem. geol. Surv. India Palaeont. indica*, Ser. 9, **3,** Pt. 2, No. 1, 1–122.

KOBAYASHI, T. 1957. Some trigonians from the Hida Plateau region, central Japan. Studies on the Jurassic trigonians in Japan, Pt. VII. *Jap. Jl Geol. Geogr.*, **28,** Nos. 1–2, 43–46.

———. *and* M. TAMURA. 1955. The Myophellinae from north Japan. Studies on the Jurassic trigonians from Japan, Part IV. *Jap. Jl Geol. Geogr.*, **26,** Nos. 1–2, 89–103.

LAMBERT, L. R. 1944. Algunas Trigonias del Neuquén. *Revta Mus. La Plata*, N.S., Sección paleontología, **1,** No. 14, 357–97.

LAUDON, T. S., LACKEY, L. L., QUILTY, P. G. *and* P. M. OTWAY. 1969. Geology of eastern Ellsworth Land (Sheet 3, eastern Ellsworth Land). (*In* BUSHNELL, V. C. *and* C. CRADDOCK, *ed.* Geologic maps of Antarctica. *Antarct. Map Folio Ser.*, Folio 12, Pl. III.)

LYCETT, J. 1872–79. A monograph of the British fossil Trigoniae. *Palaeontogr. Soc.* [*Monogr.*], 245 pp.

MCALESTER, A. L. 1966. Life habits of the "living fossil" bivalve *Neotrigonia*. *Spec. Pap. geol. Soc. Am.*, No. 87, 104 pp.

MÖRICKE, W. 1895. Versteinerungen des Lias und Unteröolith von Chile. *Neues Jb. Miner. Geol. Paläont. BeilBd.*, **9,** 1–100.

SKWARKO, S. K. 1963. Australian Mesozoic trigoniids. *Bull. Bur. Miner. Resour. Geol. Geophys. Aust.*, No. 67, 42 pp.

TAYLOR, B. J. 1971. Stratigraphical correlation in south-east Alexander Island. (*In* ADIE, R. J., *ed. Antarctic geology and geophysics*. Oslo, Universitetsforlaget, 149–53.)

———., 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.

THOMSON, M. R. A. 1971. Ammonite faunas of south-eastern Alexander Island and their stratigraphical significance. (*In* ADIE, R. J., *ed. Antarctic geology and geophysics*. Oslo, Universitetsforlaget, 155–60.)

———. 1974. Ammonite faunas of the Lower Cretaceous of south-eastern Alexander Island. *British Antarctic Survey Scientific Reports*, No. 80, 44 pp.

———. *and* L. E. WILLEY. 1972. Upper Jurassic and Lower Cretaceous *Inoceramus* (Bivalvia) from south-east Alexander Island. *British Antarctic Survey Bulletin*, No. 29, 1–19.

———. *and* ———. 1975. Fossils from the South Orkney Islands: I. Coronation Island. *British Antarctic Survey Bulletin*, No. 40, 15–21.

WILCKENS, O. 1910. Die Anneliden, Bivalven und Gastropoden der antarktischen Kreideformation. *Wiss. Ergebn. schwed. Südpolarexped.*, Bd. 3, Lief, 12, 132 pp.

WILLEY, L. E. 1973. Belemnites from south-eastern Alexander Island: II. The occurrence of the family Belemnopseidae in the Upper Jurassic and Lower Cretaceous. *British Antarctic Survey Bulletin*, No. 36, 33–59.

———. 1975. Upper Jurassic and Lower Cretaceous Grammatodontinae (Bivalvia) from southern Alexander Island. *British Antarctic Survey Bulletin*, Nos. 41 and 42, 1–22.