SHORT NOTES

THE OCCURRENCE OF THE BIVALVE *Inoceramus concentricus* ON DUNDEE ISLAND, JOINVILLE ISLAND GROUP

By J. A. CRAME

ABSTRACT. The occurrence of *Inoceramus concentricus* Parkinson in moraines on Dundee Island points to the existence of sediments ranging in age from Middle to Upper Albian or even Cenomanian on the island.

DURING a re-examination of a small collection of fossil bivalves from Dundee Island, Joinville Island group (Fig. 1), a number of specimens was found that can be referred to *Inoceramus concentricus* Parkinson 1819, a well-known species in Europe and around parts of the Pacific margin. This discovery is a fortuitous one for hitherto only two species of *Inoceramus* from the Antarctic Peninsula have been positively identified with previously described species (Thomson and Willey, 1972, p. 16). The presence of *Inoceramus concentricus* on Dundee Island thus has important implications for both Antarctic biostratigraphy and palaeogeography. The specimens described here were collected from Welchness, Dundee Island (Fig. 1), during a reconnaissance survey in the Joinville Island group in 1960–61 (Aitkenhead and Nelson, 1962). They came from moraines that contain both igneous rocks (notably granites) and metamorphic argillites (Trinity Peninsula Series), as well as sedimentary rocks.

SYSTEMATIC DESCRIPTION

FAMILY INOCERAMIDAE GIEBEL 1852

Genus *Inoceramus* J. Sowerby 1814

Inoceramus concentricus Parkinson 1819

Fig. 2a and b

Material

Two more or less complete internal moulds plus a number of broken internal moulds of left valves from Welchness, north-western Dundee Island (Fig. 1).
Age: Middle–Upper Albian, (?) Cenomanian.

Description and remarks

The best-preserved specimen (D.3862.6; Fig. 2a and b) shows all the typical features of *Inoceramus concentricus* Parkinson. Ovate in outline, it is much higher than long, markedly inequivalve and has the characteristic gryphaeoid appearance. The oval right valve is most strongly inflated along the axis of maximum growth; it has a flattened anterior margin that lies almost perpendicular to a plane passing between the valves, and an extended posterior-dorsal area that forms a small wing. The extremely convex left valve has the tall, narrow and sharply incurved umbo that is so typical of this species. The ventral portion of the left valve is unfortunately missing. The ornament consists of simple concentric undulations that are most prominent in the umbonal region of the left valve and the central area of the right valve.

The other complete specimen (D.3863.1) is less well preserved but in general shows most of the typical *concentricus* features. A number of small fragments (internal moulds) of single valves (D.3862.4, 6 and 3863.2) are also present in the collection. Prominent among these fragments are those from the umbonal regions of left valves (Fig. 2c). These are consistently tall, narrow, sharply incurved and regularly ribbed, and bear a close resemblance to similar fragments associated with a large collection of *Inoceramus concentricus* from the English Gault in the British Museum (Nat. Hist.).

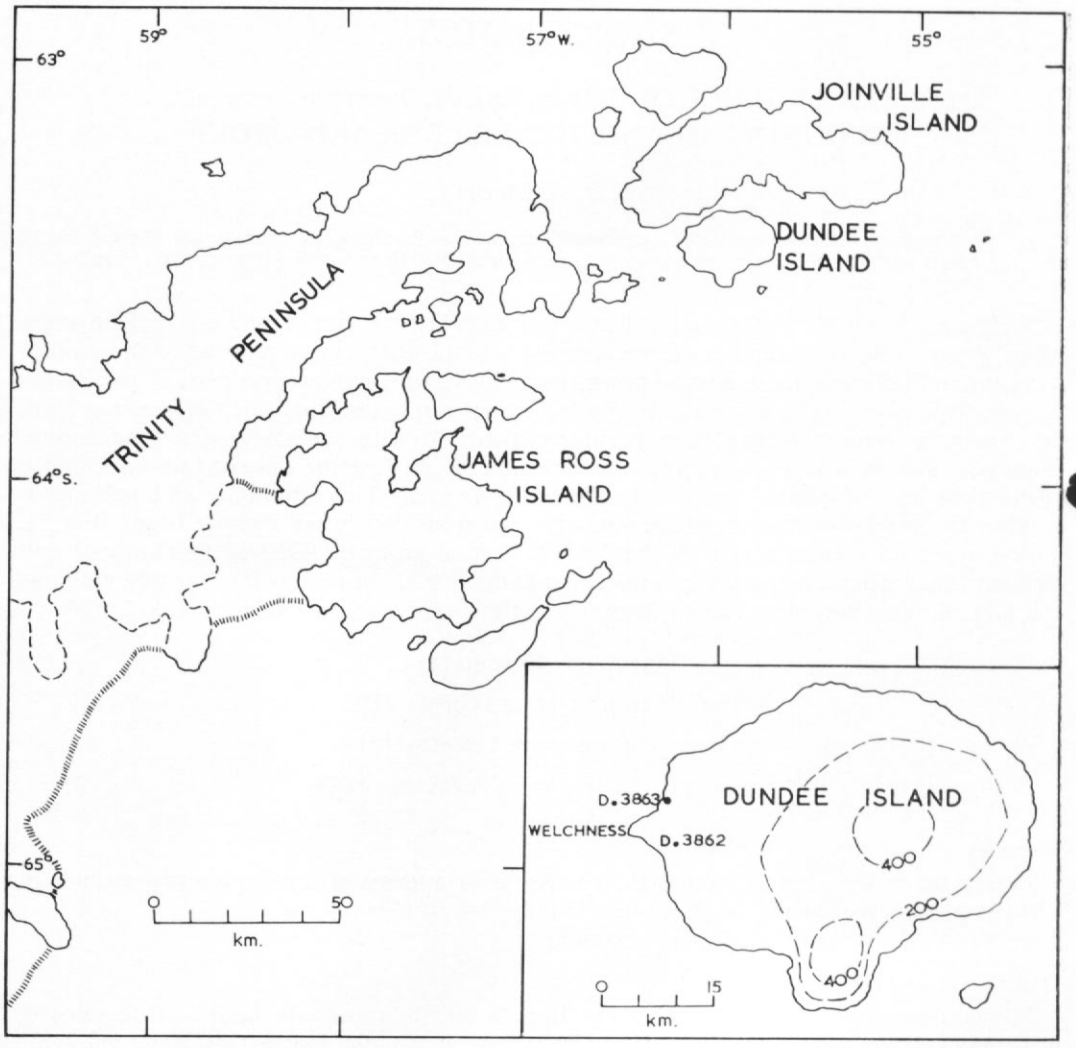

Fig. 1. Sketch map of north-eastern Graham Land, the Joinville and James Ross Island groups showing the location of Dundee Island. The inset of Dundee Island shows the two localities from which specimens of *Inoceramus concentricus* were collected.

Under certain circumstances, *Inoceramus concentricus* can be confused with both *I. salomoni* d'Orbigny and *I. tenuis* Mantell (Woods, 1911, p. 264 and 272, 1912, p. 2–4). However, *I. salomoni* generally has a prominent radial sulcus on the left valve and *I. tenuis* is both longer and has a less obvious umbo on the left valve.

Thomson and Willey (1972) described five rather poorly preserved single valves from south-eastern Alexander Island as *I.* aff. *concentricus* Parkinson. These specimens are all appreciably larger than typical *Inoceramus concentricus* (e.g. Woods, 1911, pl. XLVI). The left valves (e.g. Thomson and Willey, 1972, fig. 10) do bear some resemblance to large European specimens but the right valve illustrated in their fig. 9a would seem to be both too broad and too flat. It may well be that more than one species is represented in this material.

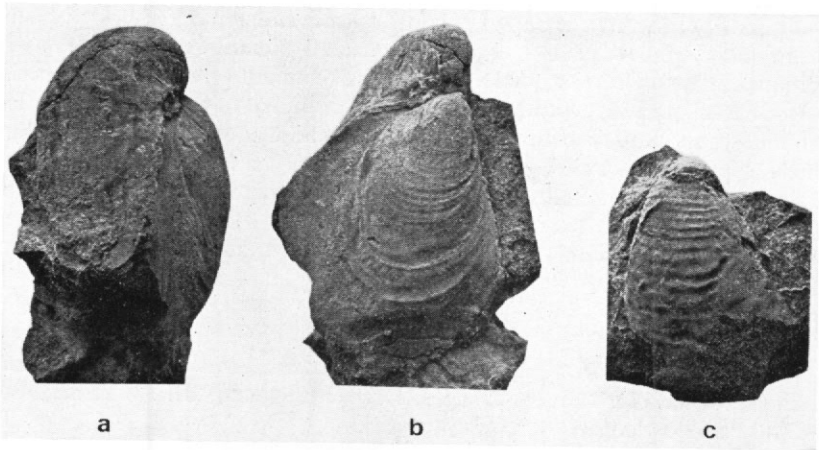

Fig. 2. a. *Inoceramus concentricus* Parkinson; lateral view of an internal mould of an almost complete specimen; × 1 (D.3862.6).
b. The same specimen, showing the right valve and strongly projecting umbonal region of the left valve; × 1 (D.3862.6).
c. *Inoceramus concentricus* Parkinson; a fragment from the umbonal region of a left valve; × 1 (D.3863.2).

Inoceramus concentricus is particularly common in the Gault and Upper Greensand of western Europe (e.g. Woods, 1911; Sornay, 1965). Specimens closely resembling the European form have also been recorded from British Colombia (Whiteaves, 1876), South Africa (Heinz, 1930), New Zealand (Woods, 1917), Japan (Nagao and Matsumoto, 1939) and the Pacific coast of the U.S.S.R. (Pergament, 1966). Of less certain affinity are the specimens assigned to *I. concentricus* from Colombia (Burgl, 1958), Peru (Schlagintweit, 1912), Tierra del Fuego (Camacho, 1949), Patagonia (Bonarelli and Nágera, 1921) and southern India (Spengler, 1914).

Discussion

The stratigraphical range of *Inoceramus concentricus* in western Europe is Middle to Upper Albian (Woods, 1912, p. 2). However, there is some evidence to suggest that outside Europe this range should be extended upwards. In New Zealand, *Inoceramus concentricus* occurs at the base of the Cenomanian Ngaterian stage (Hall, 1962) and in Japan both *I. concentricus* var. *costatus* and *I. concentricus* var. *nipponicus* occur in beds ranging from Cenomanian to Turonian (Nago and Matsumoto, 1939). Pergament (1966) also assigned a Cenomanian age to specimens of *I.* cf. *concentricus* from the Pacific coast of the U.S.S.R.

The sediments yielding the Dundee Island specimens can thus be dated as ranging from Middle to Upper Albian and possibly into the Cenomanian. Unfortunately, it would appear that all the specimens were collected from moraines rather than solid rock outcrops (Aitkenhead and Nelson, 1962, p. 3), figs. 1 and 2). The provenance of this morainic material is not known at present but it most likely came from the interior of Dundee Island.

The fossils all occur in fine- to medium-grained sandstones that are lithologically similar to parts of the Upper Cretaceous succession exposed in the James Ross Island group. However, no fossils older than Lower Campanian have yet been described from this sequence (Bibby, 1966). Conglomeratic beds exposed at the eastern end of Joinville Island may perhaps be Upper Cretaceous in age (Elliot, 1967, p. 31) but there are no further records of any other Cretaceous sediments at the northern end of the Trinity Peninsula.

That a European Cretaceous bivalve species should also occur at localities as far apart as

British Colombia, South Africa, Japan, New Zealand and Antarctica is not altogether unreasonable. In mid-Cretaceous times, broad, gradational climatic zones would have encouraged the widespread migration of adaptable taxa such as the Inoceramidae. Kauffman (1968, p. 204) has in fact estimated that an unusually high percentage of inoceramid species had intercontinental or cosmopolitan distributions (probably as high as 50–70 per cent in the Cretaceous western interior province, U.S.A.). It would seem too that the problems associated with migration across the tropical Tethyan ocean were not insurmountable, and Kauffman (1973, p. 358) has suggested at least two plausible mechanisms by which north-temperate Cretaceous bivalves could have crossed into the south-temperate realm and vice versa.

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RADIOCARBON DATING OF A RAISED BEACH AT 10 m IN THE SOUTH SHETLAND ISLANDS

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ABSTRACT. Recently dated organic remains from the South Shetland Islands extend the absolute chronology for this area after deglaciation.

MATERIALS taken from beach shingle at a height of *c.* 10 m above sea-level, in the South Shetland Islands, have yielded radiocarbon dates which help date the area's glacial chronology.

Collagen isolated from fragments taken from whale vertebrae found embedded in raised shingle at two separate sites on the south coast of Byers Peninsula, Livingston Island, gave the following dates:

Site A. 10.3 m raised beach shingle; sample embedded *in situ* to a depth of 0.3 m.
SRR-1086. 2 823 ± 40 years B.P.

Site B. 10.13 m raised beach shingle; sample embedded *in situ* to a depth of 0.4 m.
SRR-1087. 3 121 ± 35 years B.P.

Using a correction factor of 650 to 850 years to adjust for ^{14}C deficiency in Antarctic waters (Olsen and Broecker, 1961), the proposed age of the "10 m" beach is *c.* 2 100–2 400 years B.P.

The beach at 10 m is one of a series of raised beaches which occur up to an altitude of 54 m and accompanied the last major phase of deglaciation in the South Shetland Islands (John and Sugden, 1971; Sugden and John, 1973). So far, few absolute dates exist which can be used to date the raised beaches. One radiocarbon date on marine molluscs suggests that deglaciation was well advanced, approximating to present conditions, by 9 700 years B.P. So far, no datable deposits have been found associated with beaches higher than 5–7.5 m a.s.l. However, the prominent beach at the latter altitude has been dated at 500–700 years B.P., while lower beaches at 3 m are dated at 300 years B.P.

The significance of the two dates of 2 100 and 2 400 years B.P. is that:

i. They are the highest organic remains yet found in raised beaches and they represent the highest dated raised beach in the South Shetland Islands.

ii. They agree well with and extend the tentative absolute chronology so far established for this area.

iii. They relate to the collagen fraction of the bones and thus are both reliable (Broecker, 1965) and comparable with previous dates from this area.

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