REPORT ON ANTARCTIC FIELD WORK

PRELIMINARY AMMONITE ZONATION OF THE MID-CRETACEOUS ROCKS OF JAMES ROSS ISLAND

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The Cretaceous rocks of James Ross Island (Fig. 1) are well known for their content of superbly preserved late Cretaceous (Campanian) ammonites (Kilian and Reboul, 1909; Spath, 1953; Howarth, 1958, 1966), and the whole sequence has been reported as being late Cretaceous in age. However, virtually all the described ammonites came from the upper part of the sequence (so-called Snow Hill Island Series: SHIS), whereas Bibby (1966) showed that there was a substantial thickness (over 1000 m) of apparently poorly fossiliferous strata beneath this and whose stratigraphical age was imprecisely known.

From considerations of the thickness of pre-SHIS strata, a few imprecisely identified ammonites, and the discovery of *Inoceramus (?) concentricus* on Dundee Island (Crame, 1980), Thomson (1981) argued that mid-Cretaceous rocks were likely to be present on James Ross Island. More precisely, Crame (1981) was able to show that inoceramid bivalves, collected from these rocks during early reconnaissance surveys of James Ross Island, belong to a number of species indicative of Albian/Cenomanian–Turonian/Coniacian ages, and has confirmed these findings by further field work (Crame, 1983*a*, *b*). Furthermore, lithologically correlated successions on the east coast of Graham Land are known to date from the early Cretaceous (Farquharson, 1982; Thomson and Farquharson, 1984).

Detailed stratigraphical investigations by J. A. Crame, J. R. Ineson and the author during the 1981/82 and 1982/83 Antarctic summers, have confirmed that on the western side of James Ross Island the poorly consolidated siltstones and mudstones of the SHIS are underlain by 2300 m of siltstones, sandstones and conglomerates with no exposed base. Provisional facies analysis of the pre-SHIS rocks suggests that they were deposited in submarine fan and slope apron settings (J. R. Ineson, pers. comm.). They contain a variety of mainly molluscan faunas; those exposed between Kotick Point and the southern end of Tumbledown Cliffs (Figs. 1 and 2), in particular, contain a succession of ammonite faunas indicative of the Albian and Cenomanian stages. An earlier (Aptian ?) fauna is present at Stoneley Point, whereas poorly preserved ammonites on Persson Island are likely to be of late Turonian–early Coniacian age, in view of their association with *Inoceramus madagascariensis* Heinz (cf. Crame, 1981). Fragments of probable Coniacian ammonites have also been obtained from south-east Brandy Bay area.

The early to mid-Cretaceous rocks exhibit complex facies variations along the west coast of James Ross Island, parallel to the depositional strike, and lithological correlations between measured sections more than about 1 km apart is proving difficult. The recent work makes it clear that Bibby's (1966) simple lithostratigraphical scheme will require modification, and significant changes will have to be made to the geological map in a number of areas. Much work needs to be done before the localities studied can be precisely correlated, but a general faunal succession has been established and the main pre-SHIS ammonite faunas are noted below. All identifications and age assignments are provisional. Identifications of associated inoceramid bivalves are by J. A. Crame.

Br. Antarct. Surv. Bull. No. 64, 1984, pp. 85–91

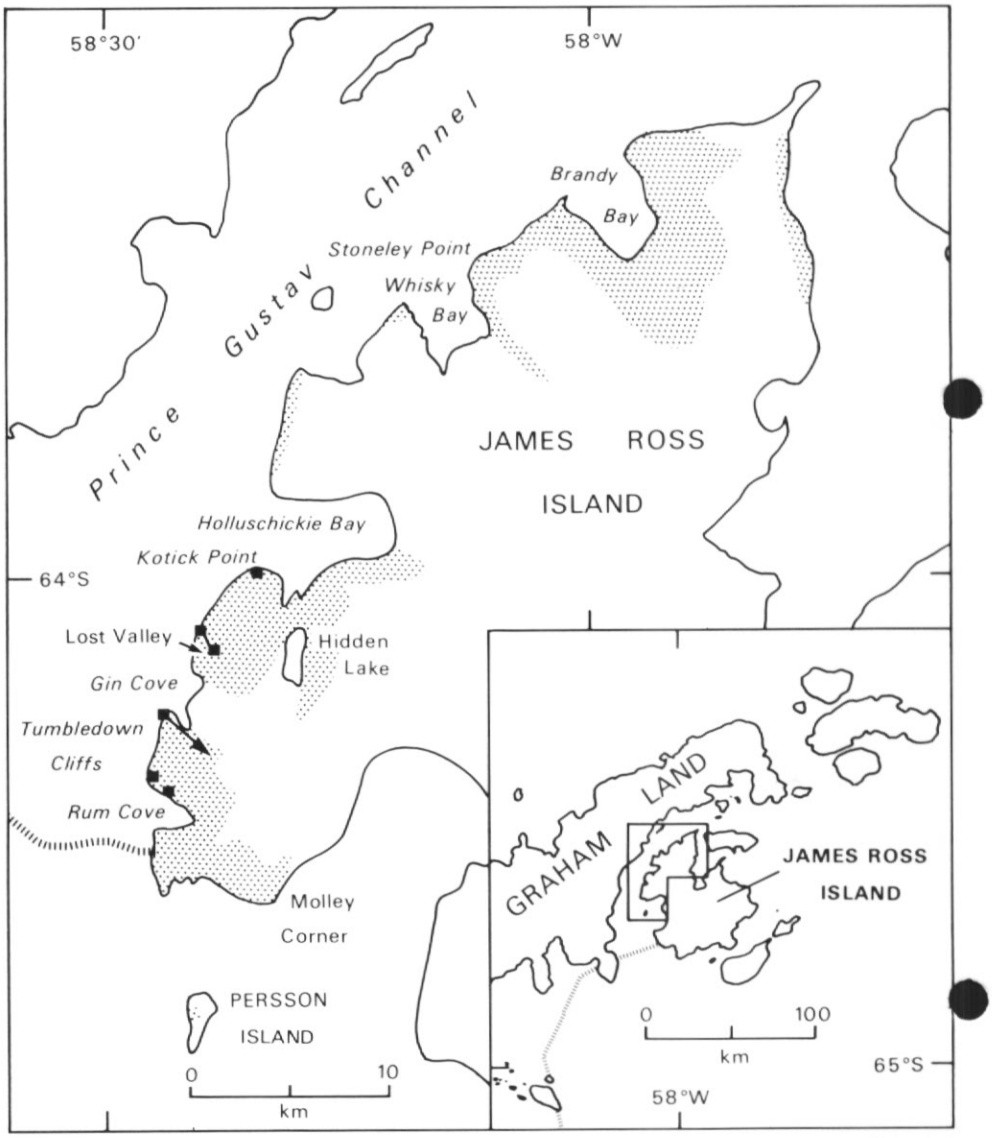

Fig. 1. Sketch maps to show the location of James Ross Island and extent of Cretaceous strata (Stippled) on the western side of the island. Solid squares indicate the locations of the measured sections in Fig. 2.

Fauna

Aptian (?)

The oldest faunas occur in the Stoneley Point area. In the lowest 600 m of exposed succession fossils are rare and only one ammonite, a small gaudryceratid, has been found. About 700 m above the base of the section there are fragments of *Phyllopachyceras*, small aconeceratids and heteromorph fragments, several of the latter being almost identical with some of the so-called *'Ancyloceras' patagonicum*

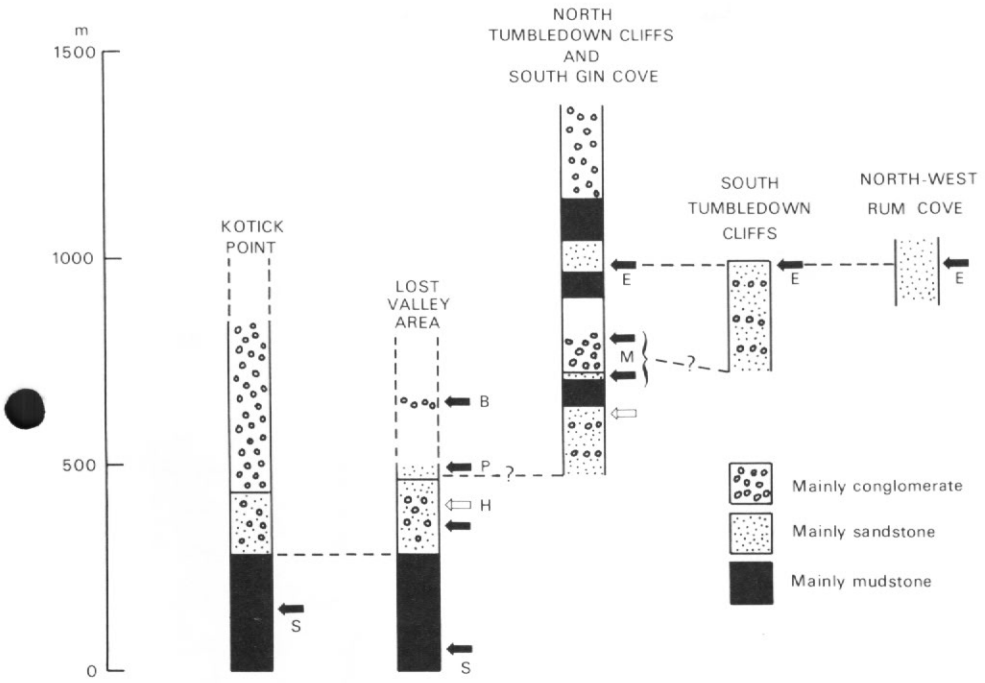

Fig. 2. Simplified stratigraphical scheme for the mid-Cretaceous rocks between Kotick Point and Rum Cove. Arrows indicate the position of the main ammonite faunas noted in this report. (Solid arrows: in-situ faunas; open arrows: derived or loose specimens. B = *Beudanticeras*, E = *Eucalycoceras*, H = *Hysteroceras*, M = *Mariella* (?), P = *Ptychoceras*, S = *Silesites*.)

Stolley from the (?) Aptian of Alexander Island (Howarth, 1958; Thomson, 1974). Associated bivalves include *Aucellina* and a new species of *Inoceramus*.

Albian

Greenish grey siltstones and sandstones of Bibby's (1966) Lower Kotick Point Beds were examined near Kotick Point and about 1 km north of Lost Valley. Fossils are uncommon but the dominant ammonite is a species of *Silesites* that is probably conspecific with *S. antarcticus* Thomson from Alexander Island (Thomson, 1974). Towards the top of its range it is associated with the enigmatic '*Pseudothurmannia* cf. *mortilleti* Pictet', also known from Alexander Island (Thomson, 1974, 1983). It has been argued that this fauna in Alexander Island is probably Albian in age, and support for this age assessment is given by the occurrence of *Anagaudryceras buddha* (Forbes) (Middle Albian–(?) Turonian, cf. Kennedy and Klinger, 1979) in a concretion weathered out of the *Silesites* beds near Kotick Point (Fig. 3a). Medina and others (1982) argued that some poorly preserved bivalves and ammonites from these same beds indicated an Aptian age but, for the reasons stated above, an Albian age is considered more probable. The bivalve, *Aucellina*, is present in much of this sequence. Fragments of *Silesites*, associated with gaudryceratids and *Aucellina* were also collected in the Stoneley Point area, about 175 m above the heteromorph beds.

Succeeding strata are well exposed in Lost Valley where three broad faunal assemblages can be recognized in a sequence of sandstones and conglomerates. The lower one contains *Anagaudryceras* and a large (400 mm diameter) puzosiid, as yet

Fig. 3. Important ammonite discoveries from western James Ross Island: a. *Anagaudryceras buddha* (Forbes), ×1 (D.8403.65); b. *Mariella* (?) sp., ×1 (D.8414.1); c. *Hysteroceras* aff. *orbignyi* (Spath), ×1 (D.8423.15); d. and e. ventral and lateral views of *Eucalycoceras* sp., ×0.5 (D.8417.2).

unidentified. Associated bivalves include *Aucellina* and *Maccoyella*. The succeeding interval of sandstones and conglomerates is poorly exposed and has yielded few fossils, but a specimen of *Hysteroceras* aff. *orbignyi* (Spath) (Fig. 3c) was obtained from the screes. The most productive beds crop out in and above a 10 m sandstone cliff, forming the eastern rim of the valley. Ammonites include *Anagaudryceras buddha*, fragments of small heteromorphs (possibly *Labeceras*), *Ptychoceras* and *Pachydesmoceras (?)*. These are accompanied by the bivalves *Aucellina* and *Inoceramus carsoni* McCoy. A slightly crushed but otherwise excellent example of *Beudanticeras* aff. *revoili* (Pervinquière) was obtained from a concretion in conglomerates, exposed in a stream section on the north side of Gin Cove, at a stratigraphical level about 150 m above that of the last fauna (Fig. 2).

Correlation between the Lost Valley sequence and that of Tumbledown Cliffs is hampered by the discontinuity of exposure across Gin Cove and a lack of marker beds. However, it is tentatively suggested that the succession at Tumbledown Cliffs more or less follows on from that exposed to the north (Fig. 2). The lower 150 m contain few ammonites; all are poorly preserved, although most appear to be desmoceratids. The bivalves, *Maccoyella, Aucellina* and *Inoceramus carsoni*, are common at some levels.

Derived concretions, in a mass flow conglomerate at the 150 m level in the Tumbledown section, contain well-preserved ammonites: small phylloceratids, desmoceratids and *Tetragonites* aff. *rectangularis* Wiedmann. The Albian aspect of these suggests that the concretions were derived from a sequence not significantly older than the bed in which they now occur. About 90 m higher, just beneath a 100 m thick sequence of coarse conglomerates, are a few metres of coarse sandstones and granule conglomerates with *Phylloceras, Anagaudryceras* and *Mariella (?)* in association with *Inoceramus (?) concentricus* Parkinson. Studies by J. A. Crame have shown that *I. (?) concentricus* is a good stratigraphical marker in the Brandy Bay area. It is a world-wide indicator of the Middle and Upper Albian and its presence at Tumbledown Cliffs is likely to provide a useful correlation between the rocks north and south of Holluschickie Bay.

Mariella (?) (Fig. 3b) also occurs with small gaudryceratids and baculitids in an isolated outcrop in a stream gully on the south side of Gin Cove. The stratigraphical position of this locality is uncertain as yet, but a provisional estimate suggests that it could be 90 m higher in the section than the *Mariella (?)* fauna at north Tumbledown Cliffs (Fig. 2).

Cenomanian

Good Cenomanian ammonite faunas, dominated by one or more species of *Eucalycoceras* (Fig. 3d, e) occur on the south side of Gin Cove, about 3 km east of Tumbledown Cliffs and at least 70 m higher in the section than the *Mariella (?)* beds. Equivalent faunas are present at the southern end of Tumbledown Cliffs (250 m above beds with *I. (?) concentricus*) and in low cliffs on the north-west shore of Rum Cove, where *Eucalycoceras* is also associated with *Sciponoceras*, small desmoceratids (*Desmoceras(?)*), rare *Gaudryceras* cf. *stefanini* Venzo and *Pseudouhligella*. An evolute *Tetragonites* was found a few metres above the *Eucalycoceras* beds in Gin Cove. The fauna is associated with abundant inoceramids of the *I. pictus* Sowerby/*I. neocaledonicus* Jeannet group.

Undistorted examples of *Eucalycoceras* have inflated whorls but many have been laterally compressed during fossilization. Probably because of this a single crushed example from north-west Rum Cove was identified with the Campanian species,

Submortoniceras chicoense Trask (Howarth, 1966). However, the collection of abundant new material suggests that that identification was erroneous.

Turonian and Coniacian

As yet there is little ammonite evidence for the presence of Turonian and Coniacian stages on James Ross Island. However, fragments with the characteristic tricarinate venter and bituberculate ribs of *Peroniceras* (Coniacian) have been found about 3 km south of the south-western corner of Brandy Bay, and a species of *Gaudryceras*, closely resembling *G. denseplicatum* (Jimbo) (mainly Coniacian but also reported from the Campanian, see Kennedy and Klinger, 1979), was collected from an isolated outcrop at Molley Corner.

Conclusions

The presence of pre-Campanian Cretaceous strata on James Ross Island is now firmly established on the basis of both bivalve and ammonite evidence. The lowest part of this sequence can be correlated with the upper part of the early Cretaceous succession of Alexander Island on the basis of ammonites. Independent evidence from James Ross Island strengthens the probability that the *Silesites* fauna of Alexander Island is Albian in age, as was suspected previously. On James Ross Island, ammonite faunas of Albian and Cenomanian age are well represented: those of the Turonian and Coniacian are less so, although the presence of these stages is indicated by fragmentary and isolated ammonite specimens, as well as by inoceramid bivalves.

Acknowledgements

I wish to thank my colleagues Dr J. A. Crame and J. R. Ineson, on whose collections part of this summary is based, for their help in the preparation of this note. I am grateful to M. P. D. Lewis for his cheerful assistance in the field.

Received 27 April 1984

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