Late Jurassic (Kimmeridgian–Tithonian) macrofossil assemblage from Jason Peninsula, Graham Land: evidence for a significant northward extension of the Latady Formation

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Abstract: New exposures of fossiliferous sedimentary rocks at Cape Framnes, Jason Peninsula (65°57′S, 60°33′W) are assigned to the Middle–Late Jurassic Latady Formation of the south-eastern Antarctic Peninsula region. A sequence of fine to coarse-grained sandstones of unknown thickness has yielded a molluscan and plant macrofossil assemblage rich in the following elements: perisphinctid ammonites, belemnopseid belemnites, oxytomid, trigoniid and astartid bivalves, and bennettitalean fronds and fructifications. The overwhelming age affinities are with the Kimmeridgian-early Tithonian part of the Latady Formation, as exposed on the Orville and Lassiter coasts. The Cape Framnes sedimentary rocks help to constrain the age of a major sequence of acid volcanic rocks on Jason Peninsula, and show that the Latady Basin was geographically much more extensive than recognized previously. It was the principal depositional centre of Middle–Late Jurassic sedimentation in the Antarctic Peninsula back-arc region and in areal extent may have rivalled the essentially Cretaceous Larsen Basin.

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Introduction
Throughout much of the Mesozoic and early Tertiary the Antarctic Peninsula was the site of an active ensialic magmatic arc (Pankhurst 1982). Extensive volcanism and plutonism along the arc were accompanied by back-arc sedimentation, which was concentrated within two major basins (or basin-complexes). On the south-eastern margins of the arc a thick sequence of Middle–Late Jurassic clastic sedimentary rocks accumulated in the Latady Basin (e.g. Laudon 1992, fig. 3), and to the east and north-east lay the regionally extensive Late Jurassic–early Cenozoic Larsen Basin (e.g. del Valle et al. 1992, fig. 1). The precise area of overlap between these two depositional centres has remained largely unknown (Fig. 1).

During the 1995–96 summer, field observations by one of us (TRR) identified the presence of small exposures of fossiliferous sedimentary rocks at Cape Framnes (65°57′S, 60°33′W), on the eastern extremity of Jason Peninsula (Fig. 2). Subsequent laboratory examinations showed both the lithologies and faunas from this locality to be closely comparable to those known from the Latady Formation. The latter unit was restricted previously to approximately the region of eastern Ellsworth Land and the Orville and Lassiter coasts (i.e. between approximately 75°W and 60°W, and 73°S and 76°S, Fig. 1). The new occurrence at Cape Framnes indicates that the Latady Formation extends at least 500 km farther north than was recognised previously, and that there was a substantial area of overlap between the Latady and Larsen basins.

It is the intention of this study to describe the macrofossil assemblage from the new locality at Cape Framnes and then to use it to effect as precise a stratigraphical correlation as possible with Latady Formation localities on the Orville and Lassiter coasts. A brief reassessment of the chronology of sedimentation within the Antarctic Peninsula back-arc region will also be made.

Geological setting
Jason Peninsula forms the eastern extremity of Oscar II Coast, Graham Land; bounded to the north and south by the Larsen Ice Shelf, it only has a true coastline along its eastern margin (Fig. 2). Topographically, the peninsula consists of several fairly low-lying (<450 m) snow domes, which extend along its main axis. Most of the geological exposures occur around the margins of the domes and take the form of intensely frost-shattered banks of scree. They are most in evidence in areas where the ice sheet has recently retreated.

Smellie (1991) reported that Jason Peninsula is formed entirely of volcanic rocks, being dominated by rhyolitic lavas and ignimbrites, together with rare occurrences of interbedded basic lavas and sills. Collectively, these rock types comprise a bimodal magmatic association formed in a continental back-arc region, possibly undergoing extension. Rex (1976) dated basic volcanic rocks from the north coast of Jason Peninsula, and obtained K–Ar whole rock ages of 156 ± 6 and 186 ± 8 Ma, recalculated to 160 ± 6 and 190 ± 8 Ma by Pankhurst (1982). Acid volcanic rocks from Oscar II Coast...
have also yielded Middle to Late Jurassic ages (174±2 Ma, Pankhurst 1982), and as such are coincident with the initiation of Gondwana fragmentation.

New exposures of sedimentary rocks on Jason Peninsula

At localities R.6647 & R.6648 (Fig. 2), the ice cover has receded to expose acid pyroclastic rocks and porphyritic lavas which weather orange/red, following the oxidation of finely disseminated pyrite. Adjacent to the volcanic rocks, at the limits of the ice cover, a high concentration of silstone and sandstone scree crops out. Although the sedimentary rocks are not seen in situ, they almost certainly overlie the acid volcanic rocks. Sandstones are the predominant rock type (see below) and it is apparent, from the high content of fragmental quartz, feldspar and mica grains in the coarser-grained varieties, that they are volcaniclastic in origin. Apart from some traces of planar lamination in some of the finer-grained sandstones, no primary sedimentary structures were observed in these rocks.

An abundant macrofossil assemblage is characterized by ammonites, belemnites, bivalves and plant fragments.

Palaeontology

The macrofossils are preserved in a series of grey, grey-green and grey-brown sandstones that are predominantly fine to medium-grained in texture, but occasionally grade into coarse-grained. These sandstones are for the most part extremely well sorted and indurated; many bear rusty-brown weathering tinges. Molluscan fossils are preserved as either internal or external moulds, and are largely decalcified. A few ammonites and belemnites do show traces of original shell material, but in all instances this has been recrystallised into a coarse spar. Some of the plant impressions are carbonaceous, and specimen R.6648.10 contains a large (15 cm long) low-grade coaly clast of compressed wood material.

Many of the molluscan fossils are obviously broken and in
Fig. 3. Bivalves and ammonites from the Latady Formation, Cape Framnes: a. Vaugonia sp., latex peel from left valve (LV) external mould, R.6647.18, x 1; b. Oxytoma sp., latex peel from LV external mould, R.6647.24, x 1.5; c. Myophorella (Scaphogonia) cf. purseri Fleming, RV internal mould, R.6648.1, x 1.5; d. pectinid bivalve close to Camptonectes (Camptonectes) robusta Quilty, latex peel from RV external mould, R.6647.37, x 2; e. Malayomaorica malayomaorica (Krumbeck), RV internal mould, R.6647.23, x 1;
places there are thin, discontinuous seams of comminuted shell material. Some belemnites are aggregated into small, irregular clumps (e.g. R.6648.7a) and others are currently-"aligned (e.g. R.6648.7b). One rock specimen, R.6647.39, is intensely packed with bioclastic fragments and could be identified as a calcarenaceous sandstone (i.e. 10–50% carbonate grains). Indeed, in places there are thin seams of bivalve fragments (at least some of which are attributable to gryphaeid oysters), and the rock verges on a sandy limestone. The lithologies present, nature of preservation of the macrofossil assemblage, and taxonomic composition of the bivalve fauna (to be described below) all suggest a comparatively shallow-water, high-energy environment of deposition (i.e. inner shelf with significant bottom currents). Such features are consistent with previous descriptions of the Latady Formation (Laudon et al. 1983, Laudon 1992).

So as not to pre-empt a forthcoming major taxonomic revision of Latady Formation faunas and floras, only informal descriptions of certain key elements from the Cape Framnes assemblage will be given here. These are such as to provide a stratigraphical age for the source rocks and enable correlations to be made within the Antarctic Peninsula region. Full descriptions, diagnoses and synonymy lists will be presented in later monographs.

The following descriptions are split into four key groups: bivalves, ammonites, belemnites and plants. All specimens are housed in the collections of the Geoscience Division, British Antarctic Survey, Cambridge.

Bivalves

At least ten separate bivalve taxa are represented in this collection (Figs 3a–g, i). Shallow-burrowing astarids and trigoniids comprise the commonest elements, and they are accompanied by deeper-burrowing anomalodesmatans, which are assigned, provisionally to the genera Pleuromya Agassiz (Fig. 3g) and Thracia Leach. Epifaunal taxa include a probable pectinid close to Camptonectes (Camptonectes) robusta Quilty (1983) (Fig. 3d), the oystomids Oxytoma Meek (Fig. 3b) and Malayomaorica Jeletzky, plus an indeterminate gryphaeid oyster. The assemblage is a characteristically shallow-water, inner shelf-depth one.

Malayomaorica malayomaorica (Krumbeck)

Fig. 3e

A single internal mould of a right valve (R.6647.23) is assigned to this highly variable species. It has a rounded-rectangular to sub-obliquely elongated outline, axial length (AL) of 40 mm, and secondary axial length (SAL) of 37 mm. The gently inflated surface is covered by irregular concentric growth pauses and depressions. A prominent, blade-like, antero-dorsal notch is positioned directly above a conspicuous byssal notch (Fig. 3e). Close inspection of the ear reveals it to be inclined steeply inwards, with respect to the plane of commissure, and to possess a transverse ridge on its dorsal surface. These are both key diagnostic features of the genus Malayomaorica, and with reference to the comprehensive review of this genus by Crame (1983, 1985), an assignment can be made to M. malayomaorica. This species has a Heterian–Ohuan (i.e. Lower Kimmeridgian–Middle Tithonian; Stevens 1992) age-range in New Zealand and is prolific in strata of Kimmeridgian–early Tithonian age in Hauberg Mountains–Wilkins Mountains region of the Orville Coast (Crame 1983). The closely related Malayomaorica sp.nov.? from Ablation Point, Alexander Island (Crame 1985, figs 9b & 10b) emanates from either the Kimmeridgian (i.e. undifferentiated) Ablation Point Formation or the lowest levels of the Himaia Ridge Formation (early Tithonian).

Myophorella (Scaphogonia) cf. purseri Fleming

Fig. 3c

At least two specimens, R.6647.39 and R.6648.1, can be referred to this taxon. The larger and more complete one (R.6648.1, Fig. 3c) is an internal mould of a right valve with a length of approximately 39 mm and a height of 34 mm. The valve is trirgonally ovate in outline, weakly inflated, and divided by a prominent posterior carina into an antero-ventral flank and a postero-dorsal area. The flank bears up to ten oblique to arcuate costae with fine tuberculation, and the area is marked by fine, sub-parallel lamellae. The relatively squat nature of this valve, its broad posterior area, and general form of the flank tubercles all suggest greatest allegiance to Myophorella (Scaphogonia) purseri Fleming from the Puaroan (Middle–Upper Tithonian) stage of New Zealand (Fleming 1987, Kelly 1995). However, this species is closely allied to both M.(S.) macnaughti Fleming from the Heterian–Ohuan of New Zealand and M.(S.) alexandra Willey from the Tithonian–Berriasian Himalia Ridge Formation of Alexander Island, and the material in hand is insufficient for a positive identification to be made. In his comprehensive review of late Jurassic Antarctic trigoniids, Kelly (1995) identified specimens of both M.(S.) purseri and M. (S.) alexandra from the Latady Formation of the Orville Coast.
The external mould of an incomplete left valve (R.6647.20) can probably be linked to this distinctive species. *Pterotrigonia (Pterotrigonia) thomsoni*, which occurs commonly in the Latady Formation of the Orville Coast, is a comparatively small and well inflated pterotrigoniid with a recurved, pyriform outline (Kelly 1995, figs 3 & 10). Specimen R6647.20 (Fig. 3f) shows the characteristic strongly tuberculate costae of the antero-ventral region.

### Vaugonia sp.?

**Fig. 3a**

The external mould of a single left valve (R.6647.18) has a characteristic trigonoid outline, with a prominent umbo situated well towards the anterior. There is the trace of a strong posterior carina and indications of a large area covered with tightly grouped, gently convex lineations. Adult ornament on the flank comprises at least six gently sinuous and tuberculate costae, and there is a good resemblance to taxa such as *Vaugonia (Vaugonia) orvillensis* Kelly (1995, figs 8.5–8.7) from the Latady Formation of the Orville Coast. Unfortunately, the anterior region of the valve is not well enough preserved to confirm that this is in fact a *Vaugonia* Crickmay.

#### “Astarte” marwicki Quilty

**Fig. 3i**

Two internal moulds of left valves (R.6647.18b & 36) are provisionally assigned to this species. The larger of the two, R.6647.18b, has an axial length of 47 mm and a secondary axial length of 45 mm. They are both subcircular in outline, with prosogyrous umbones which overlie well-developed lunules. Ornament consists of fine, regular and closely spaced commarginal ribs (Fig. 3i); details of the hinge region are unknown. Of the three new Heterian species of “Astarte” described from eastern Ellsworth Land, the closest similarities are to “A.” *marwicki* Quilty (1977, figs 72–75). A further specimen, R.6647.25, is somewhat broader in outline, and as such may be closer to “A.” *behrendtensis* Quilty (1977, figs 76–80). It should be pointed out that Southern Hemisphere Late Jurassic astartids are currently in need of detailed taxonomic revision. Kelly (1995) has suggested that the medium–large Antarctic taxa may be better assigned to the boreal genus *Lyapinella* Zakharov, rather than *Astarte* J. Sowerby.

### Ammonites

The ammonite assemblage (18 in total) is dominated by small fragments that are most readily attributable to simple and strongly ribbed perisphinctid genera such as *Torquatisphinctes* Spath and *Subdichotomoceras* Spath. It bears at least a strong superficial resemblance to those known from both the Latady Formation of the Orville Coast (Thomson 1983) and the Longing Member of the Nordenskjöld Formation (the putative basal stratigraphical unit within the Larsen Basin) (Whitham & Doyle 1989, Doyle & Whitham 1991). Three of the more complete specimens are described below.

#### Virgatosphinctes cf. andesensis (Douvillé)

**Fig. 3j**

Specimen R.6647.13 is an incomplete composite mould with a maximum diameter of 50 mm. Although not particularly well preserved, it can be determined that it is evolute, with a suboval whorl section in at least the later stages of the shell. There is also a strongly inclined umbilical slope and well-defined umbilical border. Simple, evenly spaced primary ribs display virgatome ribbing at approximately the mid-point of the flank; there are either three or four thinner secondaries (Fig. 3j). The general form of the specimen and style of ornament is very close to that seen in specimens of *V. andesensis* from the lower Vaca Muerta Formation, Neuquen (west-central Argentina) (e.g. Leanza 1980, pl. 2, fig. 5a), and *V. cf. andesensis* from the Himalia Ridge Formation, Alexander Island (Antarctic Peninsula) (e.g. Howlett 1989, text fig. 2c). Thomson (1979, p. 19) noted the wide variation in specimens currently attributed to this species and indicated that it was in need of a detailed revision. The foregoing authorities have consistently interpreted *V. andesensis* as Early Tithonian in age.

#### Virgatosphinctes cf. denseplicatus (Waagen)

**Fig. 3k**

Specimen R.6647.30a is a small external mould measuring 28 mm in diameter. It would appear to have been moderately involute and inflated, with a comparatively deep umbilicus. In cross-section the outer whorl has a subelliptical profile and gently convex flanks. There is a dense ornament of fine, sharp, simple ribs which seem to emanate from approximately the middle of the umbilical slope (Fig. 3k). There are some traces of rib branching low on the flank, but in general these are not easy to see. This specimen resembles small specimens of *V. denseplicatus (sensu stricto)* from the Himalia Ridge Formation of Alexander Island (e.g. Howlett 1989, pl. 2, fig. 3), and *V. denseplicatus rotundus* Spath from the lower Vaca Muerta Formation, Neuquen (e.g. Leanza 1980, pl. 2, figs. 2 & 3). It is also close to a series of small specimens from the Orville Coast attributed to the *V. denseplicatus* group by Thomson (1983, p. 318). This species too, has strong Early Tithonian age affinities.
**Subdichotomoceras** sp.

Fig. 3h

Specimen R.6648.6 is an incomplete external mould with a maximum diameter of 49 mm. It is strongly evolute, with the whorl cross-sections varying from subelliptical to subcircular; the umbilical slope is strongly inclined, and the umbilical border, flanks and periphery widely rounded. Ornament consists of prominent, narrow and rather widely spaced ribs that show a tendency to bifurcate in the upper one-third of the flank. There is one prominent constriction, which is bordered by simple and strong ribs. A strong similarity exists between this specimen and those described by Thomson (1980, fig. 3f) as *Subdichotomeras* sp. from the Hauber Mountains region of the Orville Coast. Thomson (1980, p. 316) drew attention to the resemblance between his material and that assigned to *S. araucanense* Leanza (1980, pl. 6, figs 1 & 3) from the Middle Tithonian Vaca Muerta Formation, Neuquen. Perisphinctid fragments from the Longing Member of the Nodenskjold Formation attributed to *Torquatisphinctes* sp. (e.g. Whitham & Doyle 1989, fig. 6d) are also close to this taxon.

**Belemnites**

Small to medium-sized belemnites comprise one of the commonest faunal elements (20 in total) within the fossil assemblage. It can be determined that many of them have elongate, slender, sub-cylindrical to hastate rostra, with acute apices. Ventral alveolar grooves are present to strongly developed and it is likely that all taxa can be assigned to the family Belemnopsidae Naef, suborder Belemnopsina Jeletzky. Representatives of the genera *Belemnopsis* Bayle, *Dicoelites* Boehm and *Hibolites* Montfort are probably all present.

**Belemnopsis** cf. *annae* Challinor

Fig. 4c

The commonest specimens can be referred to a small, elongate form that is best exemplified by specimen R.6648.7a (Fig. 4c). In outline, the guard is symmetrical and slightly hastate, and in profile the ventral surface is almost straight and the dorsal surface gently convex. The specimen has a length of approximately 90 mm and a greatest lateral diameter of 7 mm.

Specimen R.6648.7a is characterized by a comparatively broad and deep ventral groove which extends almost the whole length of the guard into the acute apical region (Fig. 4c). This and similar material bears the closest resemblance to juvenile specimens of *Belemnopsis annae* Challinor from the lower Heterian stage (Lower Kimmeridgian) of New Zealand (e.g. Challinor 1979, figs 3-16), and fragmentary material assigned to "B. aff. keart" from Bean Peaks, Orville Coast by Mutterlose (1986, figs 6c, d) (? = *B. annae*). These specimens are also very close to juveniles of *B. maccrawi* Challinor (e.g. Challinor 1979, figs 28-31), which occurs slightly higher within the Heterian stratotype but still within the Lower Kimmeridgian (*sensu* Stevens 1992). Incomplete material such as that illustrated in Fig. 4e may be attributable to either *B. annae* or *B. maccrawi*.

**Dicoelites** sp.?

Figs 4d

With an apical length of 105 mm and a maximum transverse diameter of 15 mm, specimen R.6648.7c is one of the larger ones within the collection (Fig. 4d). Although incomplete, and therefore difficult to orientate, the view given in Figure 4d would appear to be rather more of a profile than outline (see e.g. Mutterlose 1986, fig. 2). The guard is robust, slightly asymmetrical, and terminates in an acute apex. There is a weakly developed ventral groove, and overall the specimen would seem attributable to either *Hibolites* or *Dicoelites*. Referral to the latter taxon may be preferable as there are some similarities to species such as *D. kowhaiensis* Challinor (1980, figs 2-15) from the Kowhai Point Siltstone (Upper Kimmeridgian) of New Zealand.

**Plants**

The fossil plants consist largely of comminuted stems and woody material (up to 15 cm long), but small fragments of bennettitalean fronds and fructifications were also recognized. Bennettitalean material is common in much of the marine Jurassic and Cretaceous sedimentary strata of the Antarctic Peninsula, and reflects preservation of the more robust elements of the vegetation.

**Otozamites** sp.

Fig. 4f

Specimen R. 6648.4 is a small frond fragment 60 mm long bearing alternate pinnae up to 7 mm long by 3 mm wide. The pinnae apices are acute and the base asymmetrical, with the basiscopic margin contracted and the acrosopic margin enlarged to form an auricle. Veins are poorly preserved, but appear free. Following Harris (1969) and Watson & Sincock (1992), the material is best assigned to the form genus *Otozamites* Braun. Preservation as an impression precludes more accurate taxonomic determination as cuticular material is important for discriminating between taxa. However, bennettitalean foliage is widespread through Late Jurassic and Early Cretaceous strata of the Southern Hemisphere. Within the Antarctic Peninsula, bennettitalean foliage is abundant in the Jurassic Hope Bay deposits (Halle 1913, Gee 1989) and Cretaceous Fossil Bluff Group (Taylor *et al.* 1979).
Williamsonia sp.

Specimen R.6647.14 comprises a central conical axis up to 17 mm wide basally. The base of the axes is surrounded by numerous scales, up to 50 mm long, 7 mm wide, strap-shaped, and with parallel veins (Figs 4a, c). The margins are hirsute, and the scales strongly recurved to surround the central axis (Figs 4a, c). The central axes and internal sporophyll whorls are not exposed and it is unclear if the structure was unisexual or bisexual. Few Bennettitalean reproductive structures are known from the Southern Hemisphere and all occur in Jurassic or Early Cretaceous strata. Williamsonia Carruthers occurs in the Early Cretaceous of northern Australia (White 1986) and is of similar dimensions to the material described here. In South America Williamsonia bulbiformis Menendez and W. umbonata Menendez occur in Late Jurassic to Early Cretaceous strata (Menendez 1966), but both taxa are larger than the Jason Peninsula specimen. A much smaller (9.5–11 mm diameter) Williamsonia, W. pusilla Halle, has also been described from the Jurassic of Hope Bay (Halle 1913, Gee 1989).

Discussion

The precise limits of the extensive Latady Basin have always been difficult to define, but must at least cover the area of outcrop of the Latady Formation. At its southernmost extremity, it can be traced eastwards from the Lyon Nunataks–Behrendt Mountains region of eastern Ellsworth Land to Sweeney Mountains, and then on to Orville Coast (Fig. 1).
From there it can be extended with certainty northwards onto the Lassiter and southern Black coasts, and possibly farther north still into the central and northern Black Coast area (Laudon et al. 1983, Thomson 1983). Fossiliferous metasedimentary rocks of the Mount Hill Formation, which occur at least as far north as Mount Hill (70°56'S, 61°40'W), are probable lateral equivalents of the Latady Formation (Meneilly et al. 1987).

Strata of Middle Bajocian, Callovian, Oxfordian and Kimmeridgian ages have been proven in eastern Ellsworth Land (Quilty 1977, and references therein). Farther east, on the Orville and Lassiter coasts, there are overwhelming Kimmeridgian–early Tithonian age affinities (Thomson 1980, 1983, Crame 1981, 1983). A composite stratigraphical section of 830 m has been measured in the Hauberg Mountains, but it is estimated that the total thickness of the Latady Formation in this region is in the order of “several kilometres” (Laudon et al. 1983, p. 310). Unfortunately, it is not yet possible to say how much of this succession should be assigned to the Kimmeridgian stage and how much to the Tithonian. Ammonites, belemnites and bivalves show general similarities to both the Heterian and Ohauan (i.e. Kimmeridgian–Middle Tithonian) stages of New Zealand, as well as to the Puaroan (i.e. Middle–Upper Tithonian) stage, and the well-established early Tithonian faunas of the Antarctic Peninsula region (Quilty 1977, Thomson 1980, 1983, Crame 1981, 1983, Mutterlose 1986). The Kimmeridgian–Tithonian boundary has not yet been established with any degree of certainty in Antarctica. The youngest ammonite fauna of the Latady Formation comprises a series of berriasellid taxa from Cape Zumberge (south-eastern Orville Coasts) (Thomson 1983).

The range of sandstone lithologies exposed at the various Cape Frannes localities matches closely those known from the Latady Formation of the Orville and Lassiter coasts (Laudon et al. 1983, Laudon 1992). There are very strong similarities between the respective molluscan faunas of the two regions too, and there can be no doubt that Cape Frannes represents an important new exposure of the Latady Formation. The Cape Frannes fauna has a Late Jurassic affinity with no evidence of extension down into the Middle Jurassic, and therefore the new exposures are stratigraphically high in the known Latady Formation. Unfortunately, we cannot as yet make any more of a precise correlation than with undifferentiated Kimmeridgian–early Tithonian strata of the general Orville Coast area. It should be explained at this point that the term “early Tithonian” is used entirely in a local, Antarctic sense. It refers, in principal, to the perispincitid-dominated ammonite fauna which occurs in the lower levels of the extensive Himalia Ridge Formation, Fossil Bluff Group, Alexander Island. It is coincident with Howlett's (1989) _Virgatosphinctes_ Biozone and can be distinguished from a late Tithonian berriasellid-dominated fauna which is largely coincident with the _Blanfordiceras_ Biozone.

A Kimmeridgian–early Tithonian age for fossiliferous sedimentary rocks at Cape Frannes has two immediate and important implications. Firstly, it provides a minimum Kimmeridgian age for the thick sequence of underlying acid volcanic rocks. A minimum age of 154 Ma (Gradstein et al. 1994) (i.e. the approximate age of the base of the Kimmeridgian stage) fits in well with previous radiometric age determinations (see p. 434). Secondly, it can be concluded that the Latady Basin must have extended some of 500 km farther north than was known previously (Fig. 1). Indeed, it is likely that, during the greater part of Middle–Late Jurassic time, an extensive back-arc basin lay to the east of the Antarctic Peninsula magmatic arc. The form of this basin is intriguing, for it is clear from the nature of both the component sedimentary rocks and faunas that much of it was comparatively shallow-water. It stands in sharp contrast to the comparatively narrow and deep-water Late Jurassic fore-arc basin which lay directly to the west of the Peninsula (e.g. Taylor et al. 1979).

It is also apparent that there must be substantial overlap in the back-arc region between the areas of outcrop of the respective Latady and Larsen basins (Fig. 1). Within the latter, the southernmost limit of the basal Nordenskjöld Formation has hitherto been unknown. However, it is obvious now that the lower Longing Member could not have extended farther south than Jason Peninsula (Fig. 1), for its component anaerobic-dysaerobic black mudstones are laterally equivalent to the sandstone-dominated lithologies of the Kimmeridgian–early Tithonian Latady Formation (Whitham & Doyle 1989). It is likely that the Longing Member sedimentary rocks were restricted to some form of silled basin centred on the James Ross Island group (Fig. 1) (Pirie & Crame 1995). An apparent hiatus in sedimentation within the Larsen Basin from Late Berriasian to Valanginian times corresponds to the principal phase of penetrative deformation of the Latady Formation (Meneilly et al. 1987). By the Hauterivian, coarse clastic marine sedimentary rocks were being deposited on the north-western margin of the Larsen Basin, and by the late Early Cretaceous this feature had become the principal focus of back-arc sedimentation (Farquharson 1983).

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