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Coniacian ammonites from James Ross Island, Antarctica

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Abstract

The Cenomanian–Santonian biostratigraphy of the James Ross Basin, north-eastern Antarctic Peninsula is in need of comprehensive revision. This is being achieved by the systematic re-investigation of a series of key reference sections on the north-west coast of James Ross Island, with the first of these being located in the vicinity of Brandy Bay. A new suite of 10 ammonite taxa from the uppermost Whisky Bay and Hidden Lake Formations at this locality has overwhelming Coniacian age affinities. It comprises representatives from the Tetragonitidae and Gaudryceratidae, together with the stratigraphically earliest representative of the Kossmaticeratidae and the three earliest Pachydiscidae species from the James Ross Basin. Some fragmentary specimens are assigned to the Collignoniceratidae, and various heteromorphs to the Nostoceratidae, Diplomoceratidae and Baculitidae. The one new taxon described herein is *Gaudryceras* (*Gaudryceras*) *strictum* sp. nov. This ammonite fauna represents an important precursor to the much more prolific assemblages that occur in the overlying Santa Marta and López de Bertodano formations (latest Coniacian–Maastrichtian). It shows some affinities to the Madagascan Coniacian ammonite fauna, and offers an opportunity for strengthening Late Cretaceous biostratigraphic correlations between the northern and southern hemispheres.

Keywords: Cretaceous; Coniacian; Ammonites; Antarctic Peninsula

1. Introduction

The Cretaceous ammonite faunas of the James Ross Basin, north-eastern Antarctic Peninsula (Fig. 1) are assuming steadily greater biostratigraphical and biogeographical significance (e.g. Olivero and Medina, 2000, and references therein). Although Aptian–Albian faunas at the base of the succession and Campanian–Maastrichtian ones at the top are now reasonably well known (Thomson, 1984a,b; Macellari, 1986; Olivero, 1992; Olivero and Medina, 2000), the nature of intervening Cenomanian–Santonian assemblages has proved enigmatic. Diagnostic Cenomanian taxa have been described from the Tumbledown Cliffs-Rum Cove region of north-western James Ross Island (Fig. 1) (Thomson, 1984a,b; Olivero and Palamarczuk, 1987) but they do not occur a short distance to the north-east in approximately equivalent strata exposed in Whisky Bay and Brandy Bay (Figs. 1, 2). There would appear to have been a significant stratigraphical hiatus in this region prior to the deposition of late Turonian, Coniacian and Santonian strata (McArthur et al., 2000; Crame et al., 2006).

A biostratigraphical reassessment of the lower part of the Antarctic Upper Cretaceous succession has now become an urgent priority. Key localities on the north-western coast of James Ross Island need to be re-mapped and further collections made from a series of measured sections. In this study we report on the ammonite faunas collected from a major reference section along the south-western shore of Brandy Bay (Figs. 2, 3) in both the 1981–1982 and 2001–2002 field

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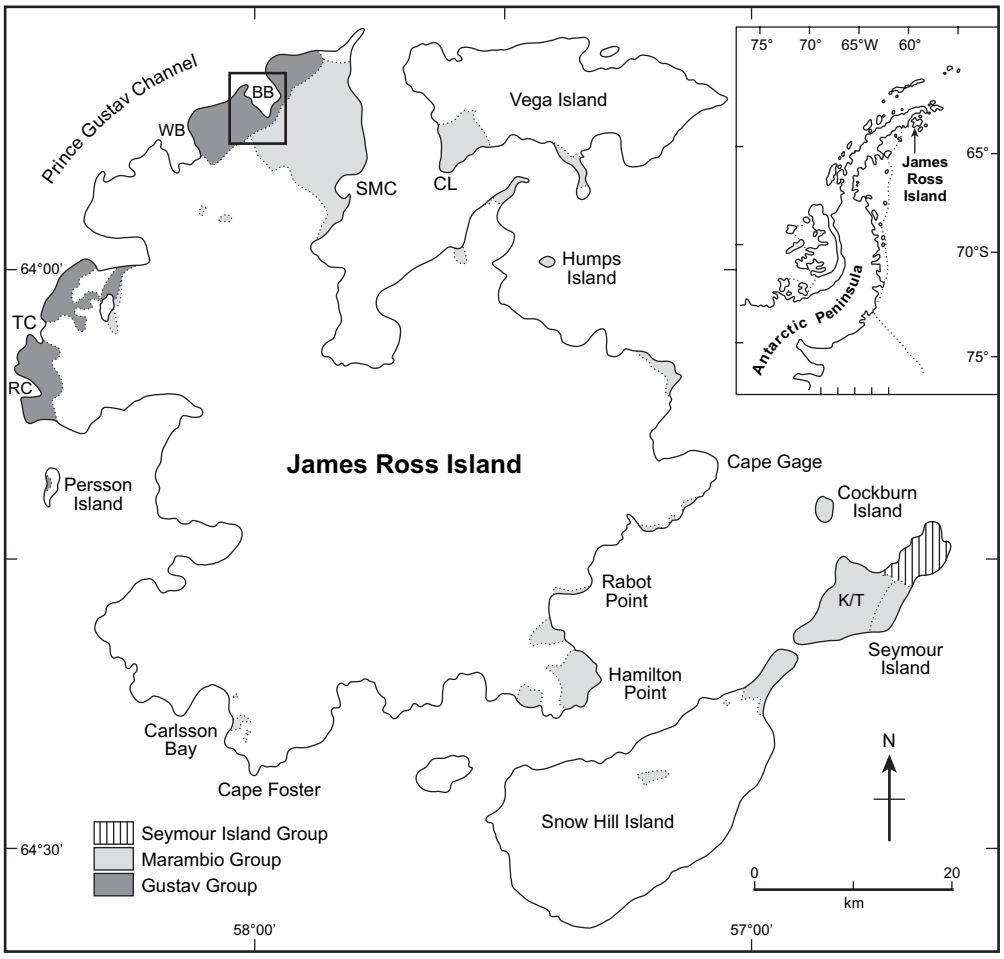

Fig. 1. Locality map for the James Ross Island region, north-eastern Antarctic Peninsula. Inset shows the position of Fig. 2. Key: BB, Brandy Bay; CL, Cape Lamb; RC, Rum Cove; SMC, Santa Marta Cove; TC, Tumbledown Cliffs; WB, Whisky Bay. Based on Crame et al. (2006, fig. 1), with minor modifications.

seasons. As will become apparent from the discussion below, this material was collected from the uppermost Whisky Bay and Hidden Lake formations, and has overwhelming Coniacian age affinities.

2. Geological background and methods

The James Ross Basin, a sub-component of the larger Larsen Basin, was one of a series of back-arc basins to form in the southernmost South America–Antarctic Peninsula region during the mid-Mesozoic–early Cenozoic (Hathway, 2000). The Aptian–Maastrichtian basin fill is in excess of 5 km in total thickness and comprises a variety of clastic and volcaniclastic marine sediments that were deposited in a range of deep- to shallow-water settings (Ineson et al., 1986; Rinaldi, 1992, and references therein). It has been formally subdivided into a lower Gustav Group (2.6 km thick; Aptian–Coniacian) and an upper Marambio Group (2.5 km thick; Coniacian–Danian), each of which is in turn further subdivided into a series of formations (Hathway, 2000; Hathway and Riding, 2001; Riding and Crame, 2002; see below).

The Gustav Group is confined to the north-west coast of James Ross Island and certain isolated outcrops on the adjacent margins of the Antarctic Peninsula (Fig. 1). On James Ross Island it dips consistently east to south-east and passes up into the finer grained Marambio Group. There are five component formations within the Gustav Group, the upper two of which, the Whisky Bay and Hidden Lake Formations, are well exposed in the Brandy Bay section (Figs. 1–4). The Whisky Bay Formation is in turn subdivided into three members, the stratigraphically most important of which are the 552-m-thick Lewis Hill Member and the 357-m-thick Brandy Bay Member. These two units are characterised by pebble and cobble conglomerates with minor intercalated pebbly sandstones and mudstones. They are sparsely to moderately fossiliferous, although preservation is poor and ammonites are generally rare (Ineson et al., 1986; McArthur et al., 2000). It is now apparent that these two members are separated by a prominent unconformity (Crame et al., 2006; see below).

The precise nature of the boundary between the Whisky Bay and Hidden Lake Formations is uncertain; whereas at some localities the contact appears to be conformable, at others it does not (Ineson et al., 1986). The latter unit comprises a distinctive set of sandstone, siltstone and mudstone lithologies that are generally interpreted to mark the onset of basin-wide shallowing to shelf depths (Whitham et al., 2006). The Hidden Lake Formation is reasonably fossiliferous, with inoceramid bivalves and ammonites being common, together with other taxa such as