

Cenozoic Glacial Deposits in the Southern Prince Charles Mountains of East Antarctica

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The Southern Prince Charles Mountains extend up to 650 kms inland from the head of Prydz Bay, on either side of the Lambert Glacier which occupies the Lambert Graben. The mountains are widely scattered nunataks that consist largely of Precambrian metasediments and gneisses (Tingey, 1991), blanketed in places by little-known

Cenozoic glaciogene sediments (Trail 1964). Nearer the coast, in the Northern Prince Charles Mountains, recent field work has identified thick glaciomarine sequences in the Amery Oasis and on Fisher Massif (Hambrey & McKelvey, 2000a). These strata were deposited in fjordal settings in the Lambert Graben during the Cenozoic, and

are now uplifted and exposed in scree-mantled cliff sections. Collectively these Miocene (Laiba & Pushina 1997) to Pleistocene strata are > 800 m thick, and have been termed the Pagodroma Group (McKelvey et al., 1999; Hambrey & McKelvey, 2000a). The Pagodroma Group records past intervals of a much reduced East Antarctic Ice Sheet (Bardin and Belevich 1985; McKelvey and Stephenson 1990; Hambrey & McKelvey, 2000b). During the summer of 1997/98 field work was carried out to locate Cenozoic strata in the Southern Prince Charles Mountains, and to determine whether they also include fjordal deposits similar to the Pagodroma Group.

The field work concentrated about the Mount Menzies region, and to a lesser extent Mounts Stinear, Mather and Bayliss. Brief aerial observations were also made of Mounts Rymill, Scherger and McCauley (Fig 1). Previously Trail (1964) had observed a 50 metre thick glacial deposit on Mount Menzies. From air photos of Mount Menzies, Derbyshire and Peterson (1978) identified moraine ridges, glacial trim lines, ice cored moraines, and patterned ground development on the older Cenozoic surfaces. During the 1997/98 field work the lithostratigraphy of the terrestrial Mount Menzies deposits was described, sections more than 150 metres thick were measured, and samples collected for micropalaeontological, sedimentological and geochemical analyses. Similar investigations were carried out on the Cenozoic strata newly located at Mount Stinear. In the Mount Menzies region Cenozoic glacial

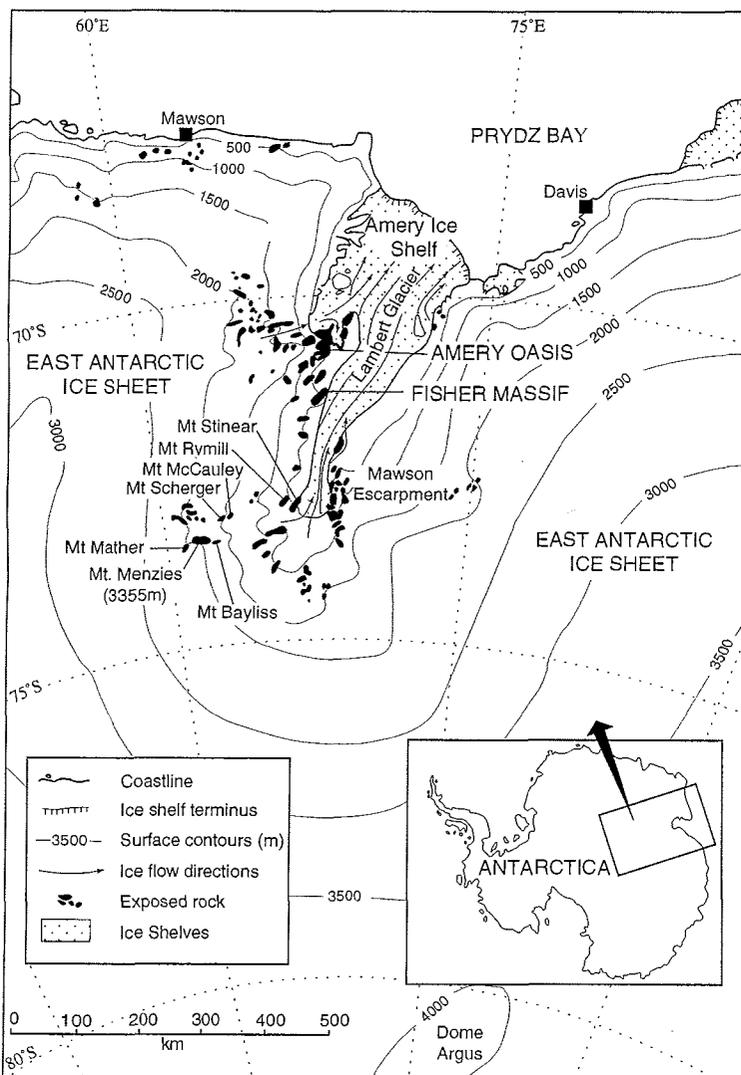


Fig. 1 - The distribution of the Prince Charles Mountains on either side of the Lambert Glacier.

deposit surfaces have also been sampled for ^{10}Be exposure dating.

During the Neogene, marine sedimentation (*i.e.* the Pagodroma Group) penetrated the Lambert Graben to at least Fisher Massif, some 230 km further south than the present coast at the head of Prydz Bay (McKelvey et al., 1999). However the Cenozoic strata in the Southern Prince Charles Mountains are up to some 270 km further south again, and located in or close to the Lambert Graben. These latter Cenozoic strata constitute, at least in part, the proximal or basin-edge facies of a Lambert Graben basin sequence, the distal facies of which has just been investigated in Prydz Bay by ODP Leg 188. (The Pagodroma Group of the Northern Prince Charles Mountains occupy an intermediate position in the basin). The significance of the Mount Menzies strata, and those newly located at Mount Stinear, are thus considerable with respect to the palaeogeography of the East Antarctic Ice Sheet, and they hold important implications for the Cenozoic tectonics of the region.

Approximately 150 km to the northeast of Mount Menzies, the flat-topped and elongate Mount Stinear (1725 m) rises 1000 metres above the surface of the adjacent Lambert Glacier. Two shoulders of Cenozoic strata, poorly exposed in scree-mantled cliffs, abut the Precambrian basement along both sides of Mount Stinear's flat-topped crest. Beneath each shoulder the disconformity surface's profile appears to be that of a valley or fjord floor and adjacent wall. The Cenozoic strata consist largely of matrix-rich diamicts. However, *ca.* 4 metres of interbedded sands and thin diamicts occur near the base of one section. The most northerly sequence is at least 110 metres thick. To the south the sequence appears to thin. The similarity of both the geological setting and sediment facies of the strata at Mount Stinear to those of the fjordal Pagodroma Group on Fisher Massif strongly suggests the Mount Stinear deposits to also be uplifted fjordal strata.

Finally, widespread diamicts up to several tens of metres thick, were observed from the air, capping the gently rounded crests of Mounts Rymill, Scherger and McCauley. These were not visited and it remains unclear whether they too are fjordal deposits similar to the Pagodroma Group, or else are terrestrial sediments similar to those investigated at Mount Menzies.

Currently work is well under way interpreting both the lithostratigraphy of the Mount Menzies Cenozoic strata and the evolution of the glacial landforms in the region, in order to reconstruct the glacial history of this part of the Southern Prince Charles Mountains. We anticipate this

information will reveal much about the evolution of the East Antarctic Ice Sheet. A 1 : 50 000 geological map of Mount Menzies is in preparation.

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REFERENCES

- Bardin V.I. & Belevich A.M., 1985. On the study of early glacial deposits in the Prince Charles Mountains. *Antarktika: Doklady Komissii*, **24**, 76-81.
- Derbyshire E. & Peterson J.A., 1978. A photo-geomorphic map of the Mt Menzies nunatak, Prince Charles Mountains, Australian Antarctic Territory. *Zeitschrift für Gletscherkunde und Glazialgeologie*, **14**(1), 17-26.
- Hambrey M.J. & McKelvey B.C., 2000a. Neogene fjordal sedimentation on the western margin of the Lambert Graben, East Antarctica. *Sedimentology*, **47**, 577-607.
- Hambrey M.J. & McKelvey B.C., 2000b. Major Neogene fluctuations of the East Antarctic ice sheet: Stratigraphic evidence from the Lambert Glacier region. *Geology*, **28**(10), 887-890.
- Laiba, A.A. & Pushina, Z.V., 1997. Cenozoic Glacial-Marine Sediments from the Fisher Massif (Prince Charles Mountains). In: Ricci C.A. (Ed.), *The Antarctic Region: Geological Evolution and processes*, Terra Antartica Publication, Siena, 977-984.
- McKelvey B.C., Hambrey M.J., Harwood D.M., Mabin M.C.G., Webb P.-N. & Whitehead, J.M., 1999. The Neogene record in the Northern Prince Charles Mountains of a dynamic Lambert Glacier and East Antarctic Ice Sheet. *VIII International Symposium on Antarctic Earth Science*, Wellington (New Zealand), abstract, 204.
- McKelvey B.C. & Stephenson N.C.N., 1990. A geological reconnaissance of the Radok Lake area, Amery Oasis, Prince Charles Mountains. *Antarctic Science*, **2** (1), 53-66.
- Tingey R.J., 1991. Regional geology of Archaean and Proterozoic rocks in Antarctica. In: Tingey R.J. (Ed.), *Geology of Antarctica*, Clarendon Press, Oxford, 1-73.
- Trail D.S., 1964. The glacial geology of the Prince Charles Mountains. In: Adie R. J. (Ed.), *Antarctic Geology*, North Holland, Amsterdam, 143-151.