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Glacial and Periglacial History of the Southern Prince Charles Mountains, East Antarctica

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Abstract - Field investigations into glacial sediments and landforms in the southern Prince Charles Mountains reveal at least four major phases of deposition. The oldest, which is a thick succession of mud-rich sediments on the summit surfaces, is a potential correlative of the mid-late Cenozoic Pagodroma Group. The next three are a series of thin, sandy diamict drapes across the massifs. The first phase of thin diamicts records a glacial expansion that inundated all of the 2000 m high nunataks, with weathering characteristics suggesting an early-mid Pleistocene age. The second phase records an ice height increase of ~800 m near the modern grounding line. Sediments from this phase are relatively unweathered, and depositional landforms indicate deposition probably terminated during the short warm phase that occurred between 11 and 9.5 ka BP. The third and final phase indicates minor readvance since this time.

INTRODUCTION

The southern Prince Charles Mountains (sPCMs) is a group of nunataks within the Lambert Glacier-Amery Ice Shelf system (LG-AIS). They lie approximately 550 km from the modern ice shelf edge, and contain the modern Lambert Glacier grounding line (Fig. 1). This system presently drains ~16% of the grounded East Antarctic Ice Sheet (Drewry et al., 1982), and has probably been an important fluvial and glacial drainage system since the initiation of the Lambert Graben in the late Mesozoic (Federov et al., 1982; Stagg, 1985). Thus, this area has excellent potential for recording past changes in ice volume and ice flow regimes of the Lambert Glacier-Amery Ice Shelf system.

The mountains contain a regionally extensive paleosurface, which has been interpreted to represent a fluvial erosion system (Bardin, 1975). A subaerially erupted mafic lava on Manning Massif in the Northern Prince Charles Mountains, dated at 50.4 ± 2 Ma BP (Wellman and Tingey, 1981) indicates that this surface predates the transition to a glacial regime during the Late Eocene to Early Oligocene (Hambrey et al., 1991). Glacial incision into this paleosurface began at or before the Miocene, when thick sequences of glacial and fjordal deposits of the Pagodroma Group were laid down on the margins of many of the modern massifs, including Mount Menzies (Hambrey and McKelvey 2000a, 2000b; McKelvey et al., 2001; Whitehead and McKelvey, 2001; Whitehead et al., 2003).

Thin moraine drapes and ridges that overlie and postdate the Pagodroma Group are present on almost every massif and nunatak in the region (Crohn, 1959; Trail, 1964). Photo-geomorphic assessment of the weathering, morphology, cross cutting relationships and elevations of these moraines indicates that they were deposited during at least two distinct periods (Derbyshire and Peterson, 1978; Wellman, 1982). However, apart from reconnaissance field surveys at Mount Ruker and Mount Menzies (Kolobov, 1980; Whitehead et. al. 2000), these sediments have received little field study.

This study investigates the glacial deposits in the little explored region along the centre of the graben, and determines the number and character of glacial highstands preserved in this area.

METHODS

Field investigations were undertaken during December 2002 and January 2003, and focused on four main localities. The deposits and landforms along the middle and lower portions of Mount Stinear were examined in detail over 21 days, and the thick deposits on the summit were investigated at a reconnaissance level over three days. Mount Rymill was examined at reconnaissance level over two days. Mount Ruker was examined in detail over ten days, with the exception of the heavily glaciated southern margin. The Rimmington Cirque, Tingey Glacier, and Accidental Valley areas of the southern Mawson Escarpment (Fig. 1) were also investigated over ten days.

The relative chronology of glacial deposits was established in the field using weathering characteristics, deposit morphology and field relationships. Weathering characteristics were