# MOUNT MELBOURNE QUADRANGLE, VICTORIA LAND, ANTARTICA 1:250,000

(Antarctic Geomorphological and Glaciological Map Series)

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The geomorphological and glaciological map of the Mt. Melbourne quadrangle (74°–75° S, 162°–166° 30' E) is the first product of a cartographic project in Victoria Land undertaken by the Italian National Antarctic Research Program (PNRA). The project involves the survey of six maps between the David Glacier (to the south) and Tucker Glacier (to the north) basins.

Victoria Land is divided into two distinct regions, one to the north and the other to the south of Terra Nova Bay (located within the Mt. Melbourne quadrangle). Outlet glaciers cross the Transantactic Mountains and drain the East Antarctic Ice Sheet (EAIS) in southern Victoria Land, while an arborescent network of glacial valleys is fed by ice fields and local névées in northern Victoria Land. In the Mt. Melbourne quadrangle, the Priestley and Revees outlet glaciers drain the EAIS (southern portion of the Talos Dome area) and part of the Victoria Land névé (southern part of the Deep Freeze and Eisenhower ranges). Small ice caps and snow fields on the Transantarctic Mountains feed the Campbell, Tinker and Aviator glaciers.

The Terra Nova Bay area lies in a very interesting geographic position for characterising the dynamics of present-day glaciers, and periglacial processes acting in deglaciated areas, and for reconstructing the Cenozoic history of the EAIS. Reported geomorphological and glaciological data derives from the analysis of satellite images and aerial photographs, and from field surveys. The main landscapes of the region were surveyed and geometric relationships between different morphologies were analyzed. Besides detailed studies conducted in key sites for depicting the geological and geomorphological evolution of the two sectors of Victoria Land, we applied a method of geomorphological mapping that permits the collection of data in a wide regional context ("regional landscape analysis").

The principal cartographic objectives were: 1) to describe the most relevant components of the landscape, with particular emphasis on modern glaciers and ancient glacial landforms and

deposits, 2) to characterise the environment of this sector of the Antarctic, 3) to describe the analytic pattern of landforms and deposits that originated from different morphogenetic processes, 4) to differentiate and map the main relict landforms with particular attention to those features most useful for reconstructing the geological and palaeoenvironmental history of the Transantarctic Mountains, 5) to provide a useful tool for other research projects, 6) to provide informative layers for an Antarctic GIS.

Map outline – The main trigonometric, geodetic, and GPS (Global Position System) points, and selected contour lines (from U.S.G.S. topographic map) are mapped on a satellite image mosaic (Landsat TM, 1990). Bathymetric contour lines are also reported (Istituto Idrografico Marina Italiana, 1989 and 1991).

Glacier and sea-ice features – The main features related to present-day glacier morphology and dynamics are depicted. Glacier surficial velocities, ice front fluctuations, iceberg calving fluxes and ice discharge were estimated through the analysis of aerial photographs and satellite images (Frezzotti 1993, 1997a, Frezzotti and others 1998, 2000). The boundaries of fast ice are also indicated. Detailed studies were conducted on the dynamics of local glaciers (Meneghel and Smiraglia 1989, Baroni and others 1997) and on the Hell's Gate ice shelf; the latter is fed at the base by accretion of marine ice that is transferred to the surface due to strong ablation induced by katabatic winds (Baroni 1990, Souchez and others 1991, Salvatore and others 1997, Tison and others 1998). A mean annual snow accumulation rate of 170 kg $m^2$ $a^{-1}$ was observed in the area, with and inverse correlation between accumulation rate and altitude (Stenni and others 2000). Terra Nova Bay is the region of Victoria Land where the EAIS is nearest to the sea. The proximity of the ice sheet to the sea and the presence of outlet glacier valleys (Priestley and Reeves) are responsible for the confluence of katabatic winds in Terra Nova Bay (Bromwich and Kurtz 1984, Frezzotti 1997b). The intensity and persistence of katabatic winds which blow mainly in the winter create a permanent polynya in the bay. Along the coastal area, aeolian morphologies are aligned with SW–NE barrier winds (Frezzotti 1997b).

Morphogenetic data – Landforms and deposits of glacial, periglacial, and marine environments, and morphologies related to mass wasting, running waters, wind action, weathering, and geological structure, are distinguished (Baroni 1989, Baroni and Orombelli 1991, Orombelli and others 1991, Biasini and others 1992, Guglielmin and others 1997, Meneghel and others 1997, Salvatore 1997, Gragnani and others 1998). The legend includes 90 items of different colour and/or tonality. Each colour refers to a specific morphogenetic agent.

Morphodynamic and morphochronologic data – Active and relict landforms are differentiated. Chronological information is indicated when available. The stratigraphic sequence, soil chronosequence, and development of landform were reconstructed through radiometric, isotopic, and geochemical data. Several $^{14}C$-ages were obtained from organic features related to marine and glacial deposits and landforms (Baroni and others 1991, Orombelli and others 1991, Baroni 1994, Baroni and Orombelli 1991, 1994a, 1994b). New data on the deglaciation and Holocene environmental history of the coastal area were obtained from relict penguin (Pygoscelis adeliae) rookeries (Baroni and Orombelli 1991, 1994a and b).

Relict alpine topographic features and the elevation of the main trimlines of the area were surveyed and mapped. Several former longitudinal profiles of glaciated valleys were recon-

structed on the basis of trimlines and glacial drift limits. The relationships between relict erosional landforms, old glacial deposits, and volcanic activity were of particular interest for obtaining new chronological information on the paleogeographical evolution of this sector of the Transantarctic Mountains (Armienti and Baroni 1999).

Additional information concerning human activity, such as cultural features, historic sites, and over-snow routes, are also indicated along with Antarctic Special Protected Areas (ASPA).

Inserts – Selected themes, such as lithology, are shown at a small scale (after Carmignani and others 1989). Also depicted on the same insert are areally extensive geomorphologic features, such as the main glacial troughs, relict alpine ridges and spurs, areally scoured terrain and the Mt. Melbourne stratovolcano. Additional inserts report meteorological data from Automatic Weather Stations (AWS) operating since 1987 (Grigioni and others 1992).