

## **Antarctic Specially Protected Area No. 159 (Site of Special Scientific Interest No 24)**

### **Summit of Mt Melbourne, North Victoria Land**

#### *i. Description of Site*

*Physical Features.* Mt Melbourne, North Victoria Land (lat 74°21'S, long 164°42'E) is situated between Wood Bay and Terra Nova Bay, on the west side of Ross Sea, and Campbell Glacier, about 10 km to the west. The site comprises all terrain above the 2200 m contour surrounding the main crater of Mt Melbourne. The location of the site and its main features are shown in the attached maps.

*Topography.* In profile, Mt Melbourne is an almost perfect low-angle volcanic cone rising to 2732 m a.s.l., showing only slight dissection and little or no glacial erosion. Many smaller basaltic cones and mounds occur near the base and on the flanks of the mountain. The summit caldera is about 1 km in diameter and forms a neve for a glacier flowing westward. The two areas of ice-free steaming ground (at A, 'Cryptogam Ridge' and B on the accompanying map) are on the edge of the caldera, with a third area (C) 250 m lower on the northern slopes. 'Cryptogam Ridge', on the southern side of the main crater, is an area of geothermal activity. About 300-400 m of this ridge is ice-free with the remainder covered by numerous ice hummocks. These hummocks are hollow, contain fumaroles and are 1-6 m in diameter and up to 4 m high.

*Geology and soils.* Mt Melbourne is part of the McMurdo Volcanics which are a line of dormant and extinct volcanoes running along the coast of Victoria Land. The Mt Melbourne area is more likely to be late Quaternary than late Tertiary in age, and the most recent eruption may have been only about 150 years ago. The mountain is a large low-angle strato-volcano containing basalt, trachyandesite and trachyte flows and including pyroclastics. Small basalt scoria cones are scattered around the base, some of which appear to be very recent as they are undissected. Several older slightly dissected cones occur on the summit caldera. Surface ground temperatures vary markedly over distances of centimetres on ice-free warm ground, up to a recorded maximum of 47°C. Random probing to depths of 1 m and detailed temperature transects to depths of 15 cm indicate substrate temperatures of up to 60°C. Within the ice pinnacles soil surface temperatures range from 10°C to over 40°C. Frost heave occurs at some warm areas. Although the substratum is classified as azonal, there are two distinct soil zones within some areas of hot ground probably caused by heat, moisture and gases from below. A typical profile comprises an upper 0-5 cm layer of dark sandy soil with a lower 6-30 cm horizon consisting of large lighter coloured scoria gravels. The upper layer contains organic matter in which there is microbiological activity, including cyanophaecan nitrogen fixation. No clay minerals have been detected.

*Meteorology.* No detailed data are available for the site. Field party records, during one week in late November 1984, indicate summer air temperatures in the caldera area of -6°C to -20°C, with an absolute minimum of -32°C.

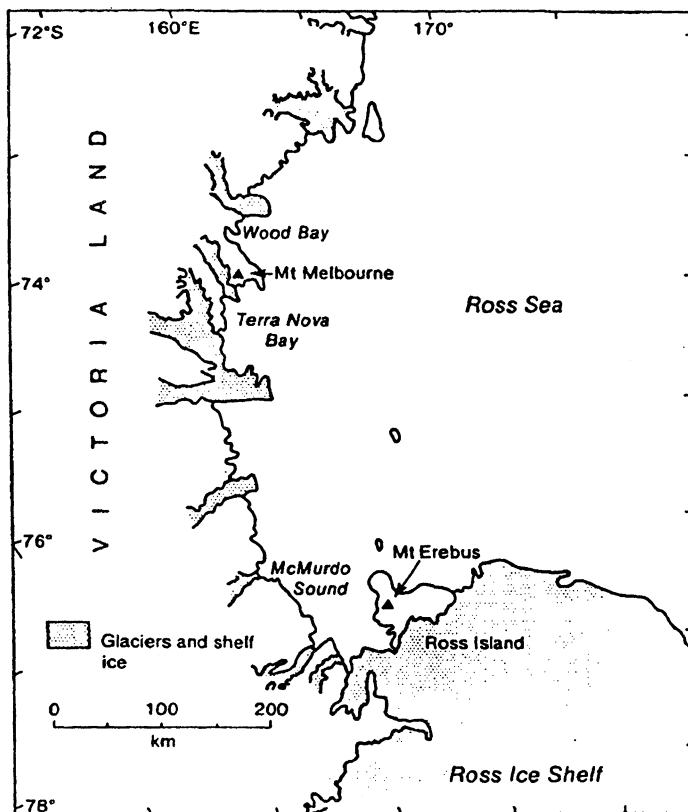
*Biological Features. Terrestrial.* The warmest areas of ground support patches of yellow-green moss, liverwort and brownish crusts of algae. The site contains an unique bryophyte community comprising the moss *Campylopus pyriformis* and the liverwort *Cephaloziella exiliflora*. *C. pyriformis* is not known elsewhere in the Antarctic biome, and *C. exiliflora* is known from only three other (low altitude) areas of continental Antarctica. Other than at a similar geothermal site at the summit of Mt Erebus

(protonemata only) this is the highest altitude at which bryophytes have been found in Antarctica. A single unidentified lichen has been observed as a component of black crusts over small areas of warm soil. The unusual occurrence of shallow peat is evidence of bryophyte growth having taken place over at least several decades.

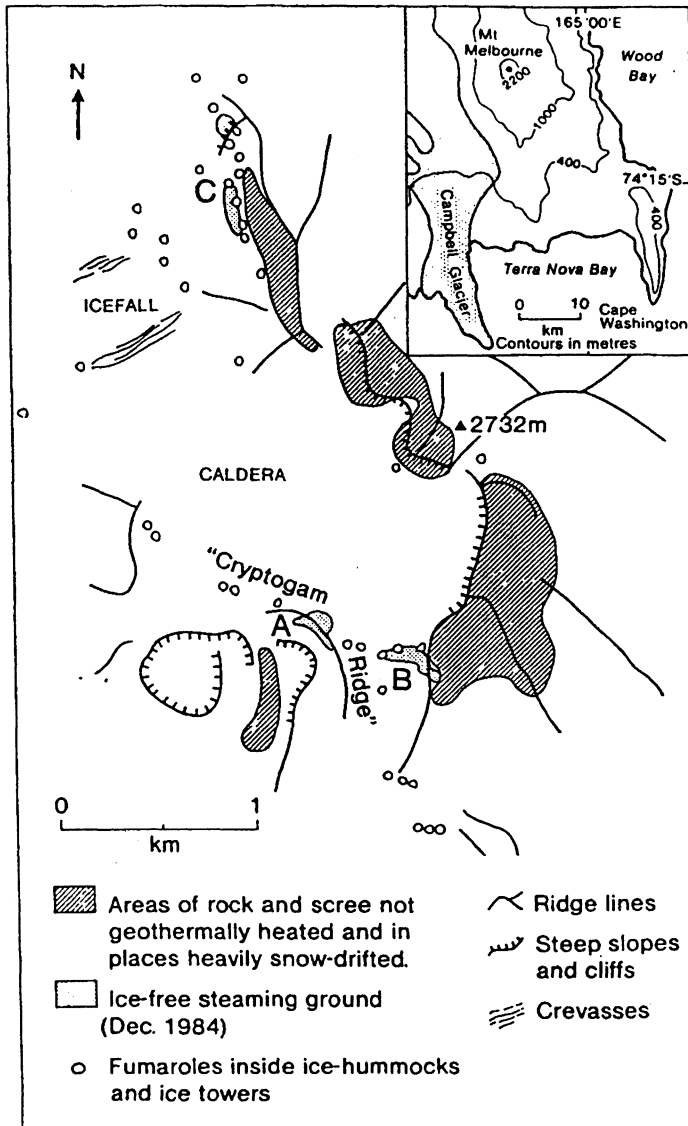
Algae grow over wide areas of the warm ground and on the surface of warm rocks in some fumaroles. The microflora comprises a range of unicellular and filamentous algae, including the green *Chroococcus* sp., *Tolypothrix* sp. and *Stigonema* sp. and the cyanobacteria *Mastigocladus laminosus* and *Pseudococcomyxa simplex*.

Thermotolerant and thermophilic micro-organisms have been isolated from the soil. The only invertebrate reported is a testate amoeba, *Corythion dubium*, amongst the vegetation. The occurrence of plant life is made possible only the water droplets formed by the condensation of steam. Very small 'pools' up to c. 50 cm<sup>2</sup> and about 1 cm deep have been observed on occasions where dripping condensate gathered in small depressions.

*Birds.* No observations of birds have been made near the summit of the volcano.



ASPA 159  
Map A\*



ASPA 159  
Map B\*

ii. *Reason for designation.* The site is of exceptional scientific interest because of its extensive ice-free geothermal areas, at high altitude, supporting a unique cryptogamic flora and microbiota and accumulations of organic matter. The closest documented, high altitude fumarolic ground is 400 km to the south of the summit of Mt Erebus (see SSSI No 11, Tramway Ridge Mt Erebus), but there the organisms differ significantly from those on Mt Melbourne. Elsewhere in Antarctica vegetation on steam-warmed ground is known only in low altitude maritime areas of the Antarctic Peninsula region where, again, the vegetation differs significantly for botanists, microbiologists, volcanologists and geophysicists. Uncontrolled human activity within this area could cause severe damage by trampling of plants, compacting soil and altering soil temperature gradients, changing rates of steam release and possibly causing the introduction of alien micro-organisms and cryptogamic plants.

*iii. Outline of research.* There has been little previous research activity in the site. The studies that have been undertaken have involved investigations of geothermal and volcanic activity and a survey of the plant and microbial communities. Future research is likely to include studies of soil microbiology and microfauna, vegetation, volcanology and the geophysics of the area. Mt Melbourne was first sighted in 1841 by James Ross and first climbed in January 1967 by a New Zealand party. Since then the summit area has been visited by New Zealand parties in December 1972 and November 1984. The 1984 party surveyed the biota on 'Cryptogam Ridge'. Brief visits were also made in January 1983 by a United States party and more recently by West German (1984/85) and Italian (1985/86) parties.

*iv. Date of expiry of designation.* 31 December 1997.

*v. Access points.* Access to the site is normally by helicopter and landings should be made only on the glacier ice in the caldera, thereby avoiding any of the vegetated or other sensitive areas.

*vi. Pedestrian and vehicular routes.* No vehicle should be used within the site. Pedestrians should avoid, whenever possible, walking on any obvious areas of warm ground or disturbing any vegetation. Entry to the 'Cryptogam Ridge' area of the site should be made only from either end of the ridge. Entering the ridge directly up its slopes should be avoided.

*vii. Other kinds of scientific investigations which would not cause harmful interference.* Low impact studies having a minimal effect on the environment of the site.

*viii. Scientific sampling.* Samples should be taken only for compelling scientific reasons.

*ix. Other restraints.* To prevent the introduction of foreign organisms sterile protective overclothing should be worn and footwear should be sterilized before entering the site. Sterilized sampling equipment should also be used. All wastes should be removed from the site.