Map 900

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

CNR CONSTITUTION AVENUE AND ANZAC PARADE, CANBERRA
Postal address: G.P.O. Box 378, Canberra, A.C.T. 2601
Please address all communications to the Director

Telephone: 49 9111
Telegrams: BUROMIN
Telex: 62 109

Department of Resources and Energy

In reply please quote:

1:500 000 GEOLOGICAL MAP SOUTHERN PRINCE CHARLES MOUNTAINS, ANTARCTICA

The 1:500 000 geological map of the Southern Prince Charles Mountains has been prepared by the Bureau of Mineral Resources, Geology and Geophysics and portrays the results of geological research in the Prince Charles Mountains by geologists of the Australian National Antarctic Research Expeditions. The map is printed on mosaics of Landsat Band 7 Multi Spectral Scanner imagery prepared in standard map sheets by the Australian Division of National Mapping. The Landsat background effectively shows the ice bound landscape from which the bedrock outcrops known as the Prince Charles Mountains protrude.

Outcrop geology is portrayed on the map in standard colours, this approach being more practicable than printing colours over the dark grey imagery tones of the various mountains and nunataks. The map incorporates comments on various geological features and is designed to be largely self-explanatory and thus useable without the aid of an explanatory text. However such a text will eventually be prepared.

A description of the geology of the Prince Charles Mountains was presented at the 3rd International Symposium on Antarctic Earth Science in Madison, Wisconsin, USA in 1977, and was published in 1982 as 'The geologic evolution of the Prince Charles Mountains - an Antarctic Archean cratonic block' by R.J. Tingey, in ANTARCTIC GEOSCIENCE (editor C. Craddock), University of Wisconsin Press, Madison, Wisconsin, pages 455-464. A copy of the abstract of this paper is attached. Other views on the geology of the Prince Charles Mountains are also presented in 'ANTARCTIC GEOSCIENCE'.

The Southern Prince Charles Mountains is the first of a number of 1:500 000-scale maps which will be produced by the Bureau of Mineral Resources to portray the results of ANARE earth science research in the Australian Antarctic Territory. The next map will be of Enderby Land and western Kemp Land and will be accompanied by a descriptive bulletin. A map of the northern Prince Charles Mountains is also being compiled.

This map is sent to you in recognition of your participation and interest in Antarctic earth science; your comments would be most welcome and should be addressed to R.J. Tingey (C/- Department of Geology, University of Tasmania, GPO Box 252C, Hobart, Tas, 7001, Australia). Further copies of the map can be obtained from the map sales section of the Bureau of Mineral Resources cost $A7.88 plus postage*. We would be grateful if you would display this map and draw it to the attention of your colleagues.

The Prince Charles Mountains constitute the largest cross-sectional exposure of the East Antarctic metamorphic shield, and the southern parts of them have proved to be of considerable geological interest both in the Antarctic context

and in the wider context of global Precambrian geology. However the research so far completed can only be described as a systematic reconnaissance examination which has revealed numerous, but as yet unaddressed, geological problems. It is expected that future field operations of the Australian National Antarctic Research Expeditions will bring about the required follow-up studies, although it is not known when this will be possible.

* Current postage rates are $1.55 (surface mail to Australian addresses), $A1.60 (surface mail to overseas addresses), $A5.50 (surface-air-lifted), $A7.50 (airmail to overseas addresses).

55

The Geologic Evolution of the Prince Charles Mountains—An Antarctic Archean Cratonic Block

R. J. TINGEY
Bureau of Mineral Resources, P.O. Box 378, Canberra, A.C.T. 2601, Australia

Abstract. The Prince Charles Mountains consist mainly of a complex of Archean to upper Proterozoic metamorphic rocks, locally intruded by Cambrian granites and unconformably overlain by a small enclave of upper Permian sedimentary strata. Metamorphic grade ranges from greenschist to granulite facies, and at least two major metamorphisms—one Archean, the other late Proterozoic—have been distinguished despite geologic, metamorphic, and isotopic complexities caused by the overprinting of the later metamorphism. The wide range of $^{87}Sr/^{86}Sr$ initial ratios obtained in geochronologic studies is interpreted as evidence that both major metamorphisms involved crustal formation and reworking processes.

Archean rocks are exposed in the southern Prince Charles Mountains and comprise a 2800 m.y. old granitic basement complex unconformably overlain by metasedimentary beds characterized by prominent white fuchsite-bearing quartzites that are cut at one locality by a 2580 m.y. old muscovite pegmatite. Banded-iron formations in the area may also be Archean. These Archean rocks are intruded by now-amphibolitized tholeiitic basic dikes of probably middle Proterozoic age and are overlain by locally contorted upper Proterozoic greenschist facies metasedimentary beds. The greenschist facies metamorphism in the southern Prince Charles Mountains is thought to be a marginal manifestation of the major metamorphic episode that produced amphibolite and granulite facies metamorphic rocks in the northern Prince Charles Mountains between 800 and 1100 m.y. ago. Granitic stocks and pegmatites were intruded into the Precambrian rocks about 500 m.y. ago and were associated with a widespread thermal effect that reset mineral isotope systems. A few Phanerozoic alkaline basic intrusive rocks that intersect the basement are thought to be related to activity along the major rift structure now occupied by the Lambert Glacier-Amery Ice Shelf system.

The Prince Charles Mountains provide probably the best cross section of the East Antarctic metamorphic shield and contain the only Archean cratonic block as yet identified in Antarctica. Comparisons with other parts of Gondwanaland reveal important similarities with Africa and southwestern Australia but few correlations with peninsular India and Sri Lanka, the areas most commonly juxtaposed against the Prince Charles Mountains area in Gondwanaland reassemblies. The research described in this paper demonstrates yet again that the highest grade metamorphic rocks in an area are not necessarily the oldest, and it highlights the importance of geochronology in studies of the East Antarctic shield.