PETROGRAPHY OF SOME SOUTH VICTORIA LAND ROCKS

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ABSTRACT

A petrographic quantitative study has been made of the mineral composition of certain igneous intrusive rocks of South Victoria Land, Antarctica, and comparisons made between these rocks and those examined from other Antarctic lands.

INTRODUCTION

Forty-five specimens of Antarctic rocks and minerals have been added recently to the collections of the University of Michigan through the courtesy of Dr. W. Campbell Smith of the British Museum. These samples were collected by Mr. Frank Debenham and Mr. R. E. Priestley, of the British Antarctic Terra Nova Expedition, 1910-13, in the vicinity of Granite Harbour, approximately Latitude 77° South, Longitude 162° East, and Terra Nova Bay, approximately Latitude 75° South, Longitude 164° East, South Victoria Land (Fig. 1).

Fourteen specimens are referred to, or have been reported on briefly, by Smith. Of these, quantitative mineralogical data for five (D11G, D56G, D85G, D104G and 1966) are recorded in this paper. Three other reports of the Terra Nova Expedition were helpful in the compilation of the results of this research. Still other references on the petrography of South Victoria Land rocks are those of Benson, Prior, Rastall and Priestley, Schetelig, and Stewart.

3 Debenham, F., The sandstone, etc., of the McMurdo Sound, Terra Nova Bay, and Beardmore Glacier regions. The sedimentary rocks of South Victoria Land: Ibid., No. 4a, 101-119 (1921).
4 Smith, W. Campbell, and Debenham, F., The metamorphic rocks of the McMurdo Sound region. The metamorphic rocks of South Victoria Land: Ibid., No. 5a, 131-144 (1921).
Fig. 1. Sketch map of Antarctica showing the distribution of collection localities.

1. Granite Harbour and Terra Nova Bay, South Victoria Land.
2. Rockefeller Mountains, King Edward VII Land.
3. Ross Island, South Victoria Land.
4. Edsel Ford Range, Marie Byrd Land.
5. Hope Bay, Louis Philippe Land, West Antarctica.
8. Queen Maud Mountains, South Victoria Land.

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| Mineral                  | 1383a | 1600a | 1422 | 1648 | D11G | 1568 | 1573 | 1966 | 1592 | D71G | 1424 | D104G | D56G | D21G | 1328 | 1346 | 1722 | 1740 | D85G |
|-------------------------|-------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Quartz                  | 36.62 | 32.46 | 30.90 | 30.48 | 29.18 | 28.73 | 27.10 | 18.59 | 18.26 | 16.04 | 12.75 | 5.91  | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 |
| K-feldspar              | 47.53 | 29.06 | 37.55 | 30.44 | 30.01 | 0.42  | 32.69 | 16.60 | 31.36 | 36.01 | 36.66 | 38.73 | 46.31 | 12.01 | 26.57 | 18.69 | 25.67 | 19.00 |
| Orthoclase              | —     | 33.38 | 24.73 | 65.16 | 34.33 | 51.08 | 36.01 | 36.66 | 38.73 | 46.31 | 12.01 | 26.57 | 18.69 | 25.67 | 19.00 |
| Albite                  | 3.68  |       |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Andesite                | —     | 42.12 | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Plagioclase             | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Biotite, chlorite       | p     | 4.63  | 4.48  | 3.97  | 6.05  | 3.54  | 20.64 | 12.49 | 20.84 | 2.87  | 17.55 | 39.70 | 21.42 | 15.86 | 12.25 | 18.58 | 23.76 | 49.84 |
| Green hornblende         | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Diopside                | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Wollastonite            | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Vesuvianite             | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Muscovite               | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Prehnite (7)            | 10.40 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Zircon                  | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Spinel                  | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Zoisite                 | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Cassiterite             | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Tourmaline              | 1.76  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Topaz                   | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Rutile (6) needles      | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Apatite (7) needles     | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Artinite (7)            | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Calite                  | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Leucocxene              | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Kaolinite               | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Sericite                | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Accessory               | —     | —     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |


* Average of two sections.

1383. Kalalalitite, Terra Nova Bay.
1600. Leucoadamellite with angular fragments of microcline. Vegetation Island, Terra Nova Bay.
1592. Mammamite, Vegetation Island, Terra Nova Bay.

D56G. Sphenolithic. Talus slope of Discovery Muff, Granite Harbour.
1722. Pubescentumite, Granite Harbour.
Twenty-seven of the specimens represent igneous rocks, eight are sedimentary, eight metamorphic, and two are minerals. Twenty-two of these specimens are labeled erratics. Forty-four thin sections have been examined and twenty-three quantitative mineralogical analyses have been made with the improved Wentworth recording micrometer. An aggregate distance of some 51,000 units was measured in traversing each section, an average of seventeen times. Quantitative results from thin sections of fifteen igneous and four metamorphic rocks are recorded in Table 1.

Acknowledgments

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Characteristics of the Rocks

The fifteen intrusive rocks vary in composition from kalialaskite to meladiorite. The metamorphic rocks include three gneisses and one contact rock. The presence of cassiterite in small quantities in sections of specimen 1383, a kalialaskite, is of interest because of the scarcity of references to metallic minerals in Antarctic rocks. Cassiterite (?) has been previously noted by the author in acid intrusives from the Rockefeller Mountains, King Edward VII Land.

Antiperthite, small patches of K-feldspar in acid plagioclase, is recorded in sections 1568, 1573, 1722 and 1966. Strain shadows are observed in the quartz of six sections, and bent plagioclase twinning lamellae in eight sections of the intrusives. This apparent characteristic of some South Victoria Land basement intrusive rocks has been referred to by Mawson,11 Prior,12 Smith,13 and Woolnough.14

12 Prior, G. T., op. cit., 126.
13 Smith, W. Campbell, op. cit., 169.
In ten intrusive specimens zoning of the plagioclase feldspars is apparent. In eleven, micrographic intergrowths of quartz and feldspar are recorded, and in seven sections both zoned plagioclase and micrographic intergrowths occur. Reference to such an association is made by Woolnough in a description of a quartz diorite erratic collected at Cape Royds, Ross Island, South Victoria Land. In a publication by Mawson the association of zoned plagioclase and micrographic intergrowths is not mentioned in the study of rocks collected at Cape Irisar and certain other localities on the mainland of South Victoria Land.

**DISCUSSION**

According to Nordenskjöld, the plagioclase feldspars of the intrusives of the Hope Bay area, Louis Philippe Land, West Antarctica, exhibit zoning, and at times micrographic intergrowths of quartz and orthoclase. In a discussion, resulting from a study of 107 rocks collected by Nordenskjöld’s Swedish Antarctic Expedition, 1901–03, this occurrence was noted in certain intrusive rocks, and the occurrence of fragments of micrographic intergrowths in certain sedimentary rocks, most probably derived from the igneous rocks, was recorded. The studies of Gourdon indicate a great similarity between the intrusive rocks collected by the Expédition Antarctique Française, the Swedish Antarctic Expedition and the Expédition Antarctique Belge, all from West Antarctica.

Wade, in referring to the intrusives of the Edsel Ford Range, remarks: “The eruptives of northwest Marie Byrd Land are high in sodium and potassium and are in this respect analogous to those of East Antarctica. However, the presence of zoned plagioclase in many of the intrusives suggests a relationship with rocks of West Antarctica.” A preliminary examination of Wade’s thin sections of thirty-six acid intrusives from northwest Marie Byrd Land indicates that some seventy-five per

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16 Mawson, D., *op. cit.*
cent contain zoned plagioclase feldspars, thirty-five per cent micro-
graphic intergrowths, and approximately thirty-five per cent exhibit
both zoned plagioclase and micrographic intergrowths.

The examination of the Terra Nova rocks shows that there is some
petrographical similarity between certain South Victoria Land, Marie
Byrd Land and West Antarctica specimens, inasmuch as there are zoned
plagioclase feldspars associated with micrographic intergrowths in a
number of the intrusives.

Schetelig, after a comparative study of granite, diorite and granodio-
rite from West Antarctica and Scott's Nunatak, King Edward VII Land,
concluded that the rocks of the two regions are not similar. Bodman
examined rocks from Scott's Nunatak, King Edward VII Land, and
Mount Betty, Queen Maud Mountains, South Victoria Land, and found
that they possessed characteristics different from those of the rocks of
West Antarctica.

After comparative studies of Gould's specimens from King Edward
VII Land with specimens from the Queen Maud Mountains of South
Victoria Land and with rocks collected by the Expédition Antarctique
Française, 1903–05, in West Antarctica, the author concluded that the
rocks of the Rockefeller Mountains have close affinities with the high
sodium- and potassium-bearing rocks of East Antarctica, and show little
affinity with the high calcium-, magnesium-, and iron-bearing rocks of
the Andes of South America and West Antarctica. The rocks of the
Rockefeller Mountains do not exhibit zoned plagioclase feldspars in thin
section, and moreover, the feldspars of the specimens from the Queen
Maud Mountains, described by Stewart, lack zonary banding.

CONCLUSIONS

It is suggested that the intrusives of West Antarctica, high in calcium,
magnesium and iron, and possessing petrographical similarities, as
zoning of the plagioclase feldspars and having affinities with the rocks

23 Schetelig, J., op. cit.
24 Bodman, Gösta, Petrographische Studien über einige antarktische gesteine: Wissen-
schaftliche Ergebnisse der schwedischen Südpolar-Expedition, 1901–1903, Geologie und
Rev., 21, No. 2, 177–200 (1931). Structure of the Queen Maud Mountains, Antarctica:
26 Stewart, Duncan, Jr., A contribution to Antarctic petrography: Journ. Geol., 42,
No. 5, 550 (1934).
27 Stewart, Duncan, Jr., The petrography of some rocks from South Victoria Land:
Proc. Am. Philosophical Soc., 74, No. 4, 307–310 (1934). The petrography of some Ant-
of the Andes of South America, be placed in a petrographic province; that the intrusives of the Edsel Ford Range, northwest Marie Byrd Land, and certain of those of South Victoria Land, high in the alkalis and possessing some petrographical characteristics of West Antarctica rocks, as zoned feldspars, be placed in a second petrographic province; and, that intrusives of the Queen Maud Mountains, South Victoria Land, and those of the Rockefeller Mountains, King Edward VII Land, high in the alkalis, but lacking in the zonary banding of the feldspars, be placed in a third petrographic province.