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RUBIDIUM-BEARING DYKES, GODS RIVER AREA, MANITOBA

(Report and 3 figures)

J.L. Jambor and R.R. Potter

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ABSTRACT

Dykes at Red Cross Lake in the Gods River area of Manitoba contain purple mica which contains 3.08 per cent Li_2O, 4.53 per cent Rb_2O, and 1.00 per cent Cs_2O. Whole rock chemical analyses of 5 grab samples from a dyke swarm average over 1.2 per cent Li_2O and 1.0 per cent Rb_2O. Most of the lithium and rubidium are bound in muscovite, lepidolite, and amblygonite.

RUBIDIUM-BEARING DYKES, GODS RIVER AREA, MANITOBA

INTRODUCTION

Although rubidium is one of the more abundant metals of the earth's crust, it is geochemically classed as a dispersed element and has not been found as the principal constituent of any known mineral. The maximum rubidium contents previously known in minerals were 3.30 per cent Rb_2O in pegmatitic microcline feldspar (Adamson, 1942), and 3.80 per cent Rb_2O in pegmatitic lepidolite mica (Pehrman, 1945). Recently, however, Melent'yev (1965) reported that zoned granitic pegmatites of the Sayan region, U. S. S. R., contain lepidolite mica having 4.93 per cent Rb_2O, and Nickel (1961) reported an analysis of lithian muscovite from Bernic Lake, Manitoba, having 5.10 per cent Rb_2O, the highest rubidium content so far found in a mineral.

The occurrence of pegmatites unusually rich in rubidium was noted by Potter (1962) in his preliminary report on the Gods River area in Manitoba. The purpose of this paper is to briefly describe the mineralogical and chemical characteristics of the occurrence. R. R. Potter is at present with the New Brunswick Department of National Resources, Fredericton, New Brunswick and J. L. Jambor is a member of the staff of the Geological Survey of Canada.

GODS RIVER RUBIDIUM-RICH DYKES

The Gods River map-area is in northeastern Manitoba near the Ontario-Manitoba boundary and due south of York Factory on Hudson Bay (Fig. 1). Dykes of pegmatite were observed at several places in the map-area. Their age relationships are not known, and a spatial or genetic tie to any specific intrusion has not been established.

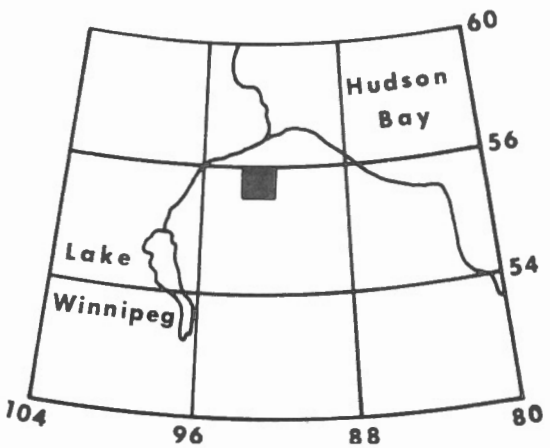

Figure 1. Index map.

A swarm of 17 or more rubidium-rich dykes occurs at the northeastern end of Red Cross Lake, approximately 1 3/4 miles northwest of the Red Sucker River (see GSC map 17-1962). The dykes intrude dark grey, fine-grained, porphyritic basic volcanic rocks. The distribution and widths of the individual dykes are shown in Figure 2. A few

of the dykes have been traced for approximately 50 feet from the shore where they disappear under glacial drift.

Hand specimens from the dykes show considerable variation in texture. In some cases plagioclase grains several centimetres in length and pink tourmaline crystals up to 6 mm long are present. Typically, however, the dykes have been extensively sheared and are fine grained and, as shown in Figure 3, a banded or finely laminated structure is characteristic. The principal mineral constituents of the dykes are quartz, albite, K-feldspar, and mica. The darker bands in the dykes are due to abundant purple rubidium-rich mica. In thin sections, amblygonite in bands up to several millimetres in width is also common, and anhedral beryl is an accessory mineral.

Whole rock chemical analyses of five grab samples from the dykes are given in Table 1. Analyses given in columns 1, 2, and 3 are from separate dykes; those in columns 4 and 5 are from opposite margins of a 12-foot dyke (Fig. 2). The analyses show an average of more than one per cent Rb_2O in the five samples. Although pollucite was not observed in thin sections, the high cesium content of one analysis indicates that the mineral may be present. Cesium in the remaining samples of the swarm is undoubtedly bound in the mica lattice, where it substitutes for potassium.

A chemical analysis of mica from the purple bands in the dykes is given in Table 2. Concentration was carried out with heavy liquids and magnetic separation of crushed and screened material. The sample selected for analysis was free from foreign materials to the extent that the strongest X-ray lines of quartz and feldspar were not detected in either powder photographs or diffractometer scans. Microscopic examination nevertheless showed that the mica was not completely free from fine-grained quartz which occurs in granular intergrowths with the mica. Further purification was, however, not possible.

Oil immersion examination of the mica concentrate also revealed that several mica phases are present. Of the two principal groups, one consists of lamellar intergrowths with $N_x = 1.538$, $N_y = 1.566\text{-}1.568$, $N_z = 1.568\text{-}1.572$, and 2V (-) about 30°. A second group, which tends to occur as rims on the above aggregates, has indices of $N_x = 1.534\text{-}1.536$, $N_y = 1.552\text{-}1.556$, $N_z = 1.556\text{-}1.560$, and 2V (-) about 40-45°. The refractive indices of both groups thus fall within the range of lithian muscovite and lepidolite. In addition, a few grains with N_z up to 1.600 were also noted, and this suggests that some normal muscovite may also be present.

X-ray powder photographs of the analyzed mica concentrate show that it consists predominantly of $2M_1$ muscovite. About twenty X-ray powder patterns made on material taken directly from hand specimens also indicated that muscovite is the dominant mica. Usually, however, extra diffraction lines attributable to an additional mica phase are present in the powder patterns, and in one case the pattern consisted wholly of the $2M_2$ polymorph of lepidolite. Rubidium is thus probably present in both muscovite and lepidolite. As the analyzed concentrate contains several micas, one of these undoubtedly contains more rubidium than the average represented in the chemical analysis.

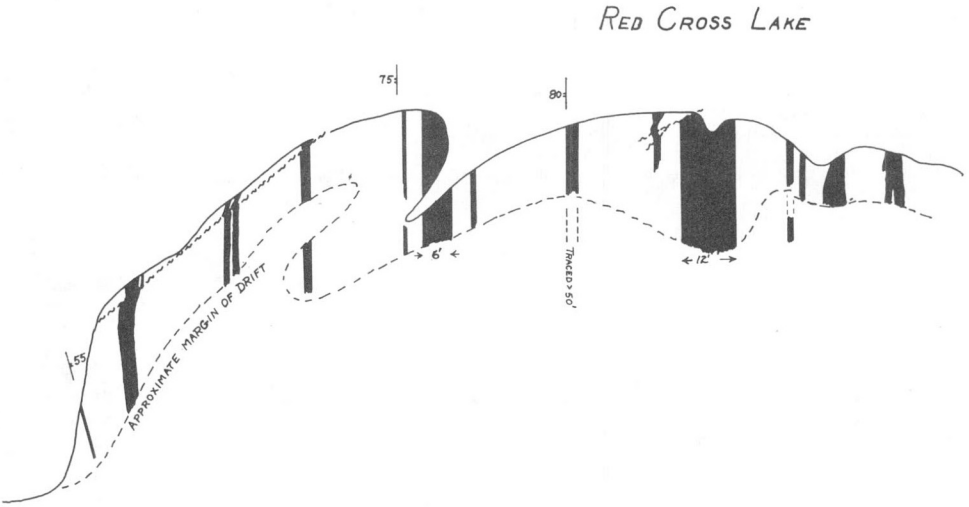

Figure 2. Sketch map of rubidium-rich dykes cutting basic volcanic and tuffaceous rocks at northeastern end of Red Cross Lake. Widths of the individual dykes from left to right are: 1 in.; 3 ft.; 8 ins.; 1 ft.; 6 ins.; 6 ft.; 1 ft.; 12 ft.; 1 ft.; about 6 ins.; about 2 ft.; about 2 ft.

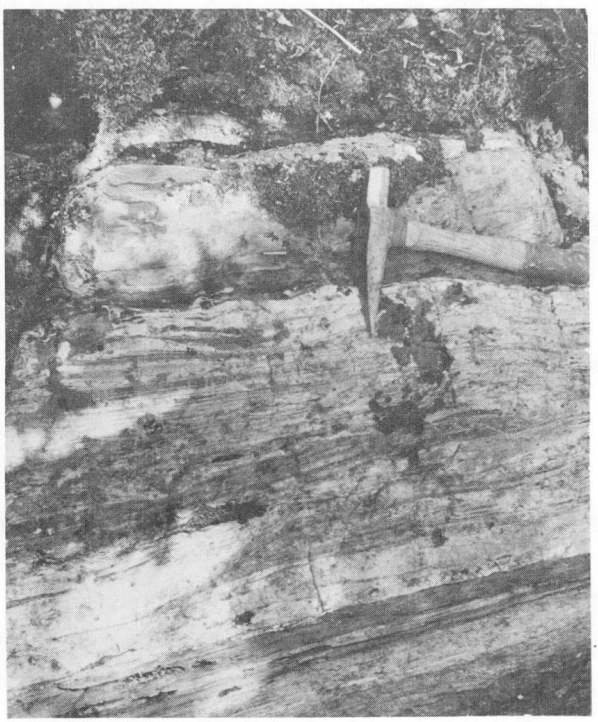

Figure 3. Characteristic banded structure of sheared rubidium-rich dykes, northeastern end of Red Cross Lake

Table 1
Whole rock analyses of dykes from Gods River area, Manitoba

	1	2	3	4	5	6	7
SiO_2	70.7	66.2	70.5	67.6	68.0	74.8	71.1
Al_2O_3	15.0	16.4	18.4	16.9	16.8	19.1	13.9
Fe_2O_3	0.8	0.5	0.7	0.4	0.6	0.7	0.9
CaO	0.4	0.3	0.3	0.8	0.3	0.3	0.3
MgO	0.6	< 0.5	< 0.5	0.5	0.5	< 0.5	0.5
Na_2O	2.06	5.12	3.67	5.88	3.42	2.18	2.72
K_2O	2.02	1.99	2.20	1.93	2.28	2.11	5.57
TiO_2	< 0.02	< 0.02	0.03	< 0.02	0.04	0.04	< 0.02
MnO	0.08	0.07	0.09	0.13	0.13	0.04	0.04
H_2O	1.1	0.8	1.0	0.8	1.0	0.3	0.3
Li_2O	2.10	1.08	1.56	0.24	1.26	2.97	0.57
Rb_2O	0.86	1.07	1.21	0.68	1.29	0.16	0.46
Cs_2O	0.35	0.31	0.42	0.11	2.86	0.04	0.05

Columns 1 to 5 inclusive: Dyke swarm on northeastern end of Red Cross Lake. Columns 4 and 5 from margins of the 12-foot dyke (Fig. 2), remainder from smaller dykes.

Column 6: Spodumene-bearing pegmatite one mile north of Red Cross Lake.

Column 7: Blue tourmaline-bearing dyke south of Gods River.

Analyses by Staff, Analytical Chemistry Section, Geological Survey of Canada: flame photometric determination of alkali metals by J. G. Sen Gupta, other constituents by Rapid Methods Group, using combined chemical and X-ray fluorescence methods.

Table 2

Analysis of muscovite - lepidolite concentrate from dykes at northeastern end of Red Cross Lake, Gods River area, Manitoba

SiO_2	49.7
TiO_2	0.04
Al_2O_3	26.87
Fe_2O_3	0.52
MnO	0.65
MgO	0.23
Li_2O	3.08
Na_2O	0.18
K_2O	7.37
Rb_2O	4.53
Cs_2O	1.00
F	4.35
H_2O	2.80
	101.32
$O \equiv F$	1.83
Total	99.49
Powder density	2.908/25.09° C

Notes: Analysis by Analytical Chemistry Section, Geological Survey of Canada: analysts, Serge Courville and Sydney Abbey (SiO_2 determined colorimetrically); powder density determination by K. G. Hoops; a semiquantitative spectrographic analysis (in %) by W. F. White gave B 0.33, Be 0.0024, Ca 0.11, Sn 0.026, Cu 0.0069, Ba < 0.002, Sr 0.051; not found: Cr, Zr, V, Ni, Co, Sc, Pb, Nb, Ag, Y, Yb, Ce, La.

OTHER DYKES IN THE AREA

Three closely spaced dark grey pegmatite dykes, each about 2 feet wide, intrude metamorphosed sedimentary rocks on the southeast side of a small lake one mile north of Red Cross Lake. The dykes contain quartz, K-feldspar, sodic plagioclase, and spodumene. The spodumene averages less than 2 mm in size and is generally very fine grained due to deformation within the dykes. A few grains of beryl were also identified, but mica is virtually absent. The chemical analysis of a grab sample is given in Table 1, column 6. The low rubidium and cesium values reflect the lack of mica; the presence of almost three per cent lithium oxide is due to the presence of abundant spodumene.

The remaining group of pegmatites within the Gods River map-area occurs in large isolated outcrops at several localities south of Gods River (see GSC map 17-1962). Individual outcrops commonly exceed 100 feet in diameter. The pegmatites, which occur within or near the margins of granitic and granodioritic gneisses, are pink to grey, fine- to coarse-grained, and consist largely of pink K-feldspar, sodic plagioclase, and quartz. Very dark blue, anhedral to subhedral, zoned tourmaline grains up to 5 mm in diameter are a conspicuous feature. Small amounts of chlorite, garnet, and columbite are present. Chemical analysis of a grab sample (Table 1, column 7) indicates that the lithium and rubidium contents are relatively low.

The dykes in the Gods Lake area thus contain a somewhat varied mineralogy, with muscovite and lepidolite being the principal mineralogical sources of rubidium. Lithium is bound principally in spodumene and amblygonite, as well as in mica. The dyke swarm at the northeastern end of Red Cross Lake is unusually rich in rubidium and constitutes the main concentration of this element in the map-area.

ACKNOWLEDGMENTS

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