GEOLOGICAL MAPPING IN THE RED WINE LAKE-LETITIA LAKE AREA (13L/1, 13L/2, 13L/8), CENTRAL LABRADOR

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INTRODUCTION

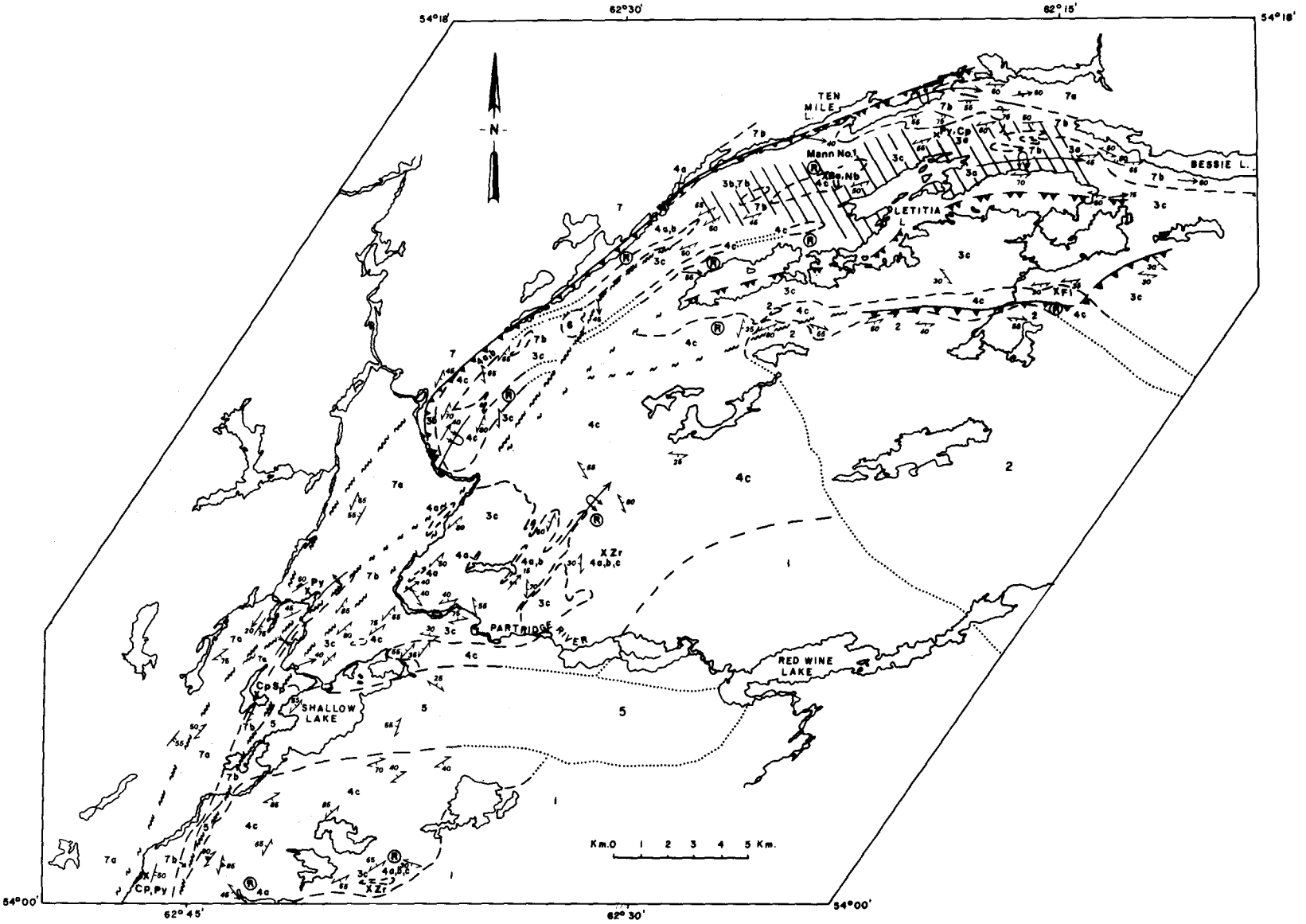
This report summarizes geological mapping carried out in the Red Wine Lake - Letitia Lake area of central Labrador. The purpose of the project is threefold: **(i)** to investigate the geological relationships between low grade sedimentary-volcanic rocks of the lower Seal Lake Group and rocks belonging to the high grade plutonic-gneiss complex to the south; **(ii)** to evaluate the economic mineral potential of the rocks along the boundary between these two terrains; and **(iii)** to evaluate the economic mineral potential of the plutonic-gneiss complex.

The centre of the map area is located 174 km northwest of Goose Bay, Labrador and 55 km east of the Smallwood reservoir about a geographic centre of 62°30′W longitude and 54°14′N latitude. Access to the area is by float equipped aircraft from Goose Bay or by canoe from Northwest River via the Naskaupi River system. Rocks of the Seal Lake Group have been mapped at reconnaissance scale (Fahrig, 1958; Brummer and Mann, 1961; Roscoe and Emslie, 1971) and at a more detailed scale by Frobisher Ltd., Brinex and Cominco. The boundary zone between Seal Lake Group rocks and the gneisses to the south has been partly mapped by Marten (1975) and the gneisses have in part been mapped on a regional scale by Geiger (1961) and Stephenson (1969). Rocks of the Red Wine alkaline complex have been studied in detail by Singh (1972), Currie (1973), Curtis (1975), Currie *et al.* (1975) and Curtis and Currie (in press).

GENERAL GEOLOGY

The map area is underlain in part by rocks of the Grenville province and in part by supracrustal rocks of the Seal Lake and Letitia Lake Groups. Four major rock types occur in the area: **(i)** a basement complex of deformed and undeformed leucocratic plutonic rocks and high grade mesocratic to leucocratic gneisses (Wapustan gneiss complex); **(ii)** a mafic-intermediate quartz-feldspar porphyry which grades upward into felsic quartz-feldspar porphyry, banded porphyritic rhyolite and ash-flow tuffs (Letitia Lake Group); **(iii)** the Red Wine alkaline complex, consisting of aegirine-arfvedsonite-quartz syenites, eudialyte nepheline syenites, aegirine-aenigmatite gneisses and omphacitic gneisses (Currie, 1973; Currie *et al.*, 1975); and **(iv)** quartzite, siltstone, argillite and basal conglomerate interbedded with mafic flows and gabbro sills (Seal Lake Group).

The Wapustan gneiss complex is overlain by the Letitia Lake Group. However, the contact was not observed. The Letitia Lake porphyry is a separate lithology from the granitic rocks to the south. This finding refutes Marten's (1975) argument against use of the term Letitia Lake Group and reinstates the group to its former standing as described by Brummmer and Mann (1961). The Red Wine alkaline complex intrudes the Letitia Lake porphyry and mapping during this study substantiated Marten's (1975) conclusion that the alkaline complex predates the Seal Lake Group. Rocks in the upper part of the Letitia Lake Group exhibit effects of oxidation and paleoweathering and this, together with the presence of cobbles of Letitia Lake porphyry in basal conglomerate of the Seal Lake Group, indicates that Seal Lake Group rocks unconformably overlie Letitia Lake Group rocks.



RED WINE LAKE – LETITIA LAKE AREA, LABRADOR

LEGEND

NEOHELIKIAN

Seal Lake Group

7 — **Wuchusk Formation: 7a,** *Gabbro sills, diabase dikes and sills intruding siltstone, shale, argillite and interbedded chert;* **Bessie Lake Formation: 7b,** *Amygdaloidal to massive green basalt flows interbedded with feldspathic to clean, gritty coarse white quartzite. Locally at bottom of unit is oligomictic, porphyry cobble conglomerate and hematitic shales derived from rocks beneath uncomformity.*

PALEOHELIKIAN

6 — *Gabbro-anorthosite.*

5 — *Biotite-chlorite granite (may be retrograde equivalent of unit 2)*

Red Wine Alkaline Complex-Arc Lake Group

4 — **4a,** *Green pyroxenic and aenigmatitic gneiss;* **4b,** *blue-black omphacitic and nephelinic gneiss;* **4c,** *Alkali quartz-feldspar porphyry, includes plutonic syenitic phases, hybrid syenitic phases and gneissic porphyry phases.*

Letitia Lake Group

3 — **3a,** *Oxidized, hematized, paleoweathered quartz-feldspar porphyry with blue quartz eyes;* **3b,** *porphyritic rhyolite, banded rhyolite, tuffaceous equivalents with ignimbrite;* **3c,** *massive, intermediate to felsic quartz-feldspar porphyry.*

2 — *Hornblende-biotite granite.*

APHEBIAN-ARCHEAN (?)

Wapustan Gneiss Complex

1 — *Quartz-feldspar-biotite gneiss, locally migmatitic; marginal parts contain epidote and muscovite, central parts rich in sillimanite (may contain metamorphosed tectonized equivalents of units 2 to 5).*

Wapustan gneiss complex (Unit 1)

In the map area the Wapustan gneiss is undivided and extends from Red Wine Lake as far south as the Red Wine mountains and east to the Naskaupi River. It consists of mesocratic to leucocratic gneisses, which may include granitic and sedimentary rocks. The gneisses are strongly foliated, locally exhibit cataclastic textures and include rotated blocks of gabbro up to 2 m across, some of which are aligned and appear to be boudinaged dikes that have been involved in at least one period of deformation. The mineralogy of the gneisses is quartz, plagioclase (An_{25-45}), biotite, magnetite, muscovite, cordierite, sillimanite, garnet and K-feldspar (Curtis and Currie, in press). They have undergone polyphase deformation; minor fold patterns are erratic, with no consistent orientation. Rocks of the complex have been metamorphosed to amphibolite grade but locally contain disequilibrium lower grade assemblages (Curtis and Currie, in press).

A 2700 Ma lead component has been isolated from eudialyte in hybrid syenite of the alkaline complex (Curtis and Currie, in press). They believe the lead originated within rocks of the Wapustan complex. This fact and the polydeformed, polymetamorphosed nature of the complex suggests that the gneisses may be of Aphebian age and possibly in part Archean (Curtis and Currie in press).

Letitia Lake Group (Unit 3)

This group occurs in a narrow arcuate band trending northeast from Shallow lake, increasing to a maximum width of 6.5 km in the vicinity of Letitia Lake.The group is divided into three subunits. Massive, intermediate to felsic quartz-feldspar porphyry (Unit 3c) lies at the base. It is an intrusive igneous rock consisting of buff to green euhedral to subhedral K-feldspar phenocrysts up to 3 cm and deep blue, oval quartz eyes up to 4 mm in a green biotitic groundmass. This grades upward into a more felsic equivalent consisting of buff to white K-feldspar phenocrysts and oval quartz eyes in a white fine grained siliceous groundmass. Feldspar phenocrysts are generally more sparse and smaller in size and the proportion of quartz eyes tends to increase towards the top of the subunit. The contact of the lower part of the subunit with the Wapustan basement complex is obscured.

Porphyritic rhyolite, banded rhyolite and tuffaceous equivalents, including ignimbrite (Unit 3b), lies on the flanks and over felsic porphyry of unit 3c. These rocks consist of euhedral and broken feldspar phenocrysts averaging 4 mm but up to 1.5 cm in a salmon pink siliceous aphanitic groundmass Flow banding and eutaxitic structures are developed, suggesting that the rocks of unit 3b represent extrusive equivalents of the intrusive rocks of unit 3c. Rocks of unit 3b, therefore, may be coeval and comagmatic equivalents of unit 3c.

Unit 3a includes parts of units 3b and 3c that underwent subaerial paleoweathering during late Paleohelikian or early Neohelikian time. Oxidation of porphyry, and, locally, rhyolite resulted in the development of hematite and magnetite in discrete patches of various sizes which penetrate along paleo fracture surfaces. This unit is in unconformable contact with the basal Bessie Lake Formation of the Seal Lake Group.

Letitia Lake Group rocks exhibit a moderate to strong foliation which trends northeastwards near Shallow Lake and eastwards around Letitia Lake. These rocks also exhibit various degrees of recrystallization and cataclasis, being most intensely sheared and mylonitized adjacent to thrust faults. Quartz-feldspar-muscovite-chlorite-epidote assemblages indicate a metamorphic grade of middle to upper greenschist facies. The Letitia Lake Group is thought to be early Paleohelikian in age since it has tentatively been correlated with the Bruce River Group to the east (Brummer and Mann, 1961), dated by Wanless and Loveridge (1972) at 1474±42 Ma.

Red Wine alkaline complex - Arc Lake group (Unit 4)

Rocks of the alkaline complex and the Arc Lake group are chemically and spatially closely related and, therefore, have been grouped together. These rocks occur south of Shallow Lake and west and southwest of Letitia Lake. The Arc Lake group (Unit 4c) consists of porphyritic alkali gneisses and their relatively unmetamorphosed equivalents. The gneisses consist of quartz and K-feldspar phenocrysts, aegirine, biotite, astrophyllite and possibly riebeckite (Curtis and Currie, in press). Their unmetamorphosed equivalents are alkali quartz-feldspar porphyry, alkali quartz syenite and hybrid syenite consisting of quartz, K-feldspar, aegirine, arfvedsonite and aenigmatite.

Currie *et al.* (1975) have subdivided the Red Wine alkaline complex into six lithological groups. In this regional report only the two groups of Currie *et al.* which are most easily distinguished in the field are delineated, and are compiled from Curtis and Currie (in press). Blue-black gneiss (Unit 4b) consists of albite, omphacite, nepheline and pectolite. Unit 4a is green gneiss consisting of aegirine-jadeite, aenigmatite and albite. Arc Lake gneiss and plutons of the alkaline complex have been extensively tectonized and metamorphosed to middle to upper amphibolite grade (Curtis and Currie, in press) so that original textures of, and geological relationships between, units have been for the most part destroyed. A

Rb-Sr age of 1345Ma has been determined (Curtis and Currie, in press) for the Red Wine complex.

Seal Lake Group (Unit 7)

Only the lowermost two formations of this group were examined and these form the terrain north of Letitia Lake. The basal Bessie Lake Formation consists of conglomerate, hematite-magnetite rich psammitic sediments, feldspathic quartzite and interbedded vesicular and massive green basalt flows. In the conglomerate, cobbles and pebbles of quartz-feldspar porphyry derived from the upper part of the underlying Letitia Lake Group and rounded pebbles of siltstone and shale are volumetrically most abundant. A small number of pebbles of mafic volcanic and plutonic rocks of unknown origin also occur. The matrix of the conglomerate consists of various proportions of hematite and magnetite rich psammite which also locally interfinger with, and conformably overlie, the conglomerate. This psammitic sediment has also been derived from the Letitia Lake Group. Feldspathic, white to pink-white, coarse to medium grained quartzite conformably overlies the conglomerate and associated sediments.

The Wuchusk Formation conformably overlies the Bessie Lake Formation and consists of green and pink siltstone, shale, argillite and chert extensively intruded by thick sills of gabbro and diabase. The albite-muscovite-epidote-chlorite-quartz mineral assemblage, together with extensive preservation of primary structures and textures, implies that these rocks have undergone only greenschist facies metamorphism. Curtis and Currie (in press) report a preliminary Rb-Sr age of 1350 Ma whereas Wanless and Loveridge (1977) have determined a Rb-Sr age of 1278Ma for the Seal Lake Group.

Intrusive rocks

Equigranular, coarse grained hornblende-biotite granite (Unit 2) occurs south of Letitia Lake. Although generally massive, the body is foliated towards its margins. It is in contact with quartz-feldspar porphyry of the Arc Lake group which forms a chilled margin with the granite. Its age relationship to the Letitia Lake Group is unknown. A foliated biotite-chlorite granite (Unit 5) occurs beneath and to the east of Shallow Lake. Primary quartz and feldspar grains have been completely recrystallized, giving the rock a sucrose texture. Chlorite appears to be secondary and its presence plus the recrystallization suggests that this granite has undergone extensive alteration. The body also contains numerous xenoliths up to 2 m in size of Letitia Lake quartz-feldspar porphyry. The chlorite-biotite granite is similar in texture and composition to unit 2 and may be a retrograde equivalent. A small body of gabbro-anorthosite (Unit 6) consisting of feldspar and green amphibole with minor biotite has intruded rocks of the Letitia Lake Group south of the west end of Ten Mile Lake.

STRUCTURE

Evidence is present for at least two periods of deformation. Sedimentary and volcanic rocks of the Seal Lake Group have been folded whereas relatively homogeneous porphyries and granitic rocks to the southeast have yielded primarily by cataclasis and shearing.

Seal Lake Group rocks have been deformed by D_1 into tight, isoclinal F_1 folds whose axes trend northeastwards and undulate from a shallow southwest plunge through horizontal to a shallow northeast plunge. D_1 is marked by a strong penetrative S_1 axial planar mica foliation in the siltstone and quartzite beds and, locally, along the unconformity surface by shearing and chevron folding. In Letitia and Arc Lake Group rocks, D_1 is marked by the same strong penetrative S_1 foliation and by zones of cataclasis. Rocks of the Red Wine alkaline complex occur as stretched lenticular masses within the core zones of gentle, open F_1 folds within the Arc Lake group.

F_1 folds within Seal Lake rocks have been overturned to the north and northwest by D_2 so that the S_1 foliation now dips to the southeast. D_2 has also resulted in the formation of imbricate thrust faults along limbs of F_1 folds and along the unconformity surface between Seal and Letitia Lake Groups. These faults dip gently to the southeast and pass gradually along strike into vertical to subvertical strike-slip faults and shear zones. D_2 is marked in quartzite beds by a weak to moderate penetrative S_2 mica foliation which has crenulated S_1, is subparallel to it, and dips to the southeast. The S_2 foliation is weak and intermittent within Letitia Lake Group rocks but, where observed, crenulates the stronger S_1. F_1 folds in which the alkaline rocks occur are also overturned to the northwest. In the Wapustan gneiss complex, it becomes impossible to differentiate S_2 from S_1 and the orientation of the foliation is chaotic.

Both deformation periods are Grenville in age (circa 1000 Ma) since they both affect Seal Lake Group rocks (1278 Ma).

MINERALIZATION

In psammitic sediments of the Bessie Lake Formation, disseminated pyrite mineralization is ubiquitous (locally constituting up to 20 percent of the rock) along with hematite and magnetite. Pyrite also occurs sporadically as interstitial grains and, along with minor

chalcopyrite and sphalerite, as dusting on fracture surfaces in Wuchusk diabase and gabbro sills or in rusty zones along the contacts between these sills and the country rocks. Brummer (1960) has reported sphalerite and galena bearing quartz veins in Letitia Lake porphyry and Marten (1975) reported sphalerite and galena in sediments derived from weathered porphyry.

Beryllium, niobium, thorium, zirconium and rare earth elements are associated with rocks of the Red Wine alkaline complex. The Mann No. 1 showing is a beryllium-niobium occurrence in mafic syenite of the alkaline complex. The low concentration of these elements in the host minerals and the fine grain size of these minerals precludes the alkaline bodies from being mined at the present time. The high radioactivity of these rocks is due to high contents of thorium; the occurrence of uranium mineralization is relatively minor.

Radioactivity throughout rocks of the Letitia Lake Group is approximately 2.5 times that of Seal Lake Group rocks; Marten (1975) found background radioactivity in the paleoweathered upper part to be at least 1.5 times greater than background in the rest of the Letitia Lake Group. High radioactivity and the paleoweathered nature of the upper Letitia Lake Group suggest that possibly uranium mineralization may be associated with the basal unconformity of the Seal Lake Group. Discrete shear and fracture zones up to 10 cm wide within the granite around Shallow Lake were found to be anomalously radioactive. Mylonites along D_2 thrust faults were also found to display higher than normal radioactivity. The gneiss zone of the Mann no. 1 prospect, which is now reinterpreted to be mylonite associated with D_2 thrusting, contains minor uranium mineralization. Minor fluorite mineralization was found in veinlets and along fracture surfaces in mylonitized Arc Lake group rocks associated with a thrust fault south of Letitia Lake.

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REFERENCES

Brummer, J.J.
1960: A reconnaissance geochemical survey in the Seal Lake area, Labrador. Canadian Institute of Mining and Metallurgy Transactions, **53**, pages 172-179.

Brummer, J.J. and Mann, E.L.
1961: Geology of the Seal Lake area, Labrador. Geological Society of America Bulletin, **72**, pages 1361-1382.

Currie, K.L.
1973: The Red Wine-Letitia alkaline province of Labrador. *In* Report of Activities, Part A, 1972. Geological Survey of Canada, Paper 73-1, Part A.

Currie, K.L., Curtis, L.W. and Gittens, J.
1975: Petrology of the Red Wine alkaline complexes, central Labrador and a comparison with the Ilimaussaq complex, southwest Greenland. *In* Report of Activities 1974. Geological Survey of Canada, Paper 75-1, Part A.

Curtis, L.W.
1975: Petrology of the Red Wine complex. Ph.D. thesis, University of Toronto, Ontario.

Curtis, L.W. and Currie, K.L.
(in press): Geology and petrology of the Red Wine alkaline complex, central Labrador. Geological Survey of Canada Bulletin.

Fahrig, W.F.
1958: Snegamook Lake, Newfoundland. Geological Survey of Canada, Map 1079A.

Geiger, K.W.
1961: Reconnaissance geology and mineral deposits of the Wilson Lake-Winokapau Lake area, Labrador. Ph.D. thesis, Cornell University.

Marten, B.E.
1975: Geology of the Letitia Lake area, Labrador. *In* Report of Activities for 1974. *Edited by* J.M. Fleming. Newfoundland Department of Mines and Energy, Mineral Development Division, Report 75-1, pages 75-86.

Roscoe, S.M. and Emslie, R.F.
1973: Kasheshibaw Lake (east half), Newfoundland-Quebec. Geological Survey of Canada, Map 1342A.

Singh, S.K.
1972: Petrology, mineralogy of the Joan Lake agpaitic complex. Ph.D. thesis, University of Ottawa, Ontario.

Stephenson, I.M
1969: Lac Brûlé and Winokapau Lake map area, Newfoundland and Quebec. Geological Survey of Canada, Paper 67-69.

Wanless, R.K. and Loveridge, W.D.
1972: Rubidium-strontium isochron age studies (Report 1). Geological Survey of Canada, Paper 72-23.
1977: Rubidium-stronium isotopic age studies, Report 2 (Canadian Shield). Geological Survey of Canada, Paper 77-14.