URANIUM POTENTIAL OF THE BASAL UNCONFORMITY OF THE SEAL LAKE GROUP, LABRADOR*

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The Seal Lake Group (Brummer and Mann, 1961) is an upper Proterozoic (Neohelikian) sequence of quartzites, basalt flows, shales and diabase sills, in the order of 20,000 feet total thickness. The group is host to significant copper mineralization, and compares in terms of lithology, age and mineralization, with the Keweenawan rocks of the Michigan native-copper district (Evans, 1952).

It has generally been assumed that the Seal Lake Group is younger than the Croteau Group, though the relationship has not been firmly established. Mapping with this objective in view was undertaken by the Department of Mines and Energy, and it was found that the Seal Lake Group unconformably rests on the Upper Croteau Group (now the Bruce River Group; see Smyth, Marten and Ryan, this volume). In the course of this work, it was noted that a significant uranium occurrence, the Stormy Lake showing, is located at the unconformity between the two groups. This relationship prompts assessment of the basal contact of the Seal Lake Group as a potential zone of uranium mineralization. The purpose of this note is to place the new observations in a regional perspective and to briefly outline our present knowledge of the potentially significant zone.

The Seal Lake Group occurs in two structurally distinct subareas:

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the arcuate Seal Lake synclinorium bounded on the northwest by an undeformed foreland, the Shipiskan Plateau (Fig. 1).

The outcrop of the unconformity at the base of the Seal Lake Group is approximately 220 miles long, with an additional 60 miles of thrust-modified unconformity along the south margin of the Seal Lake syncline. Its total extent can be conveniently divided on the basis of tectonic setting into four sectors: (1) Pocket Knife fault sector; (2) Shipiskan Lake - Snegamook Lake sector; (3) Shipiskan Plateau; (4) South margin of the Seal Lake syncline.

(1) Pocket Knife Fault Sector

The Pocket Knife fault is a major lineament that coincides approximately with the eastern limit of the Seal Lake Group; it appears to represent a rejuvenated crustal break, possibly a continuation of the Nain - Churchill province boundary (Greene, 1974). Portions of the Seal Lake Group occur on the east side of the fault, and at two localities were observed to rest unconformably on the Bruce River Group (Fig. 2). A major phase of granitic to monzonitic plutonism followed by uplift and erosion occurred in the Bruce River Group - Seal Lake Group interval, and a major time break is implied.

A north-east trending synclinal outlier of the Bessie Lake Formation (the lowest in the Seal Lake Group) was mapped about 2 miles southwest of Otter Lake (Figs 1 and 2). It consists of quartz-pebble conglomerate and cross-laminated quartz sandstone and quartzite capped by a mafic flow.

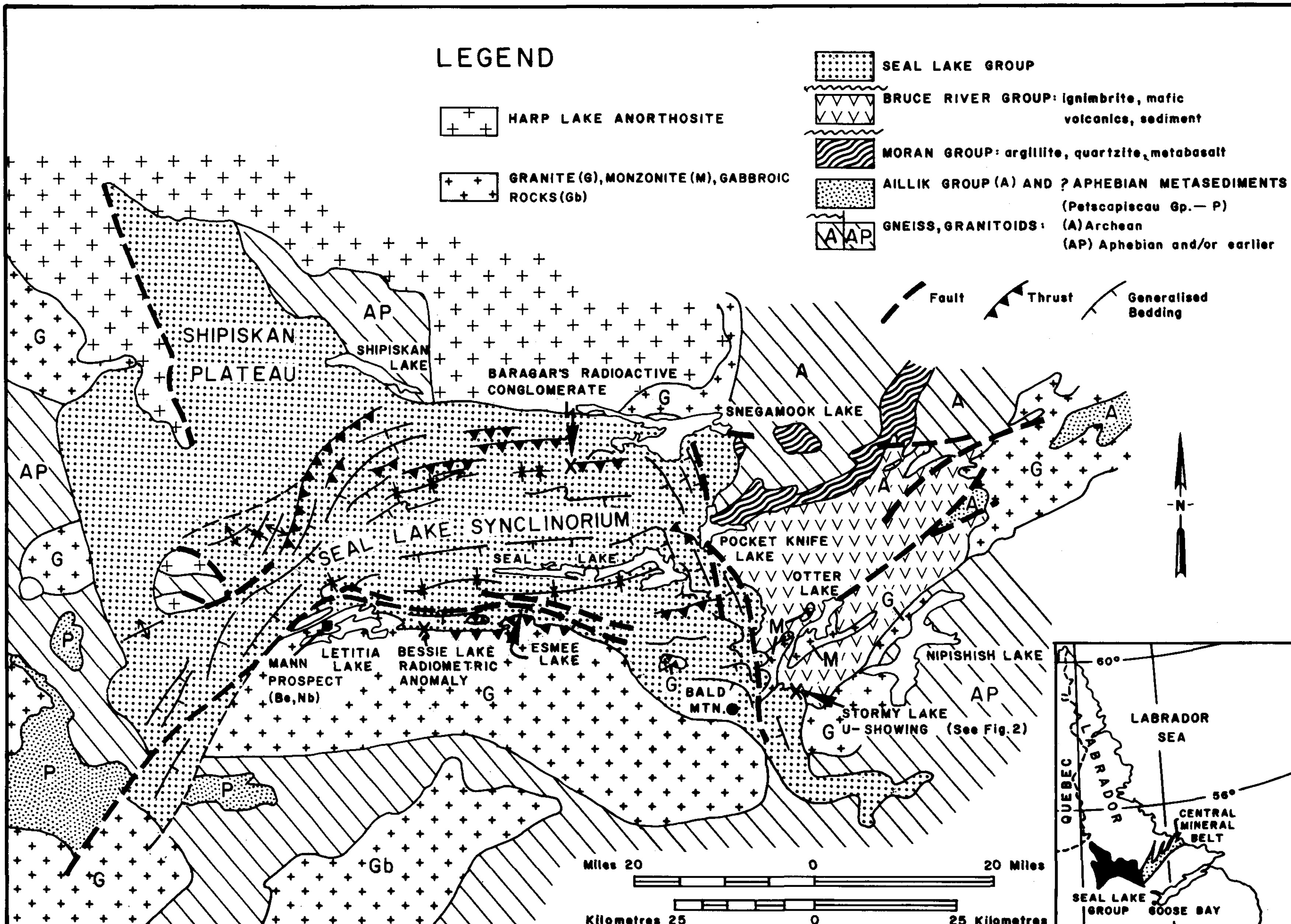

Fig. 1 Sketch map showing geological setting and contact relationships of the Seal Lake Group. Revised after Greene (1972).

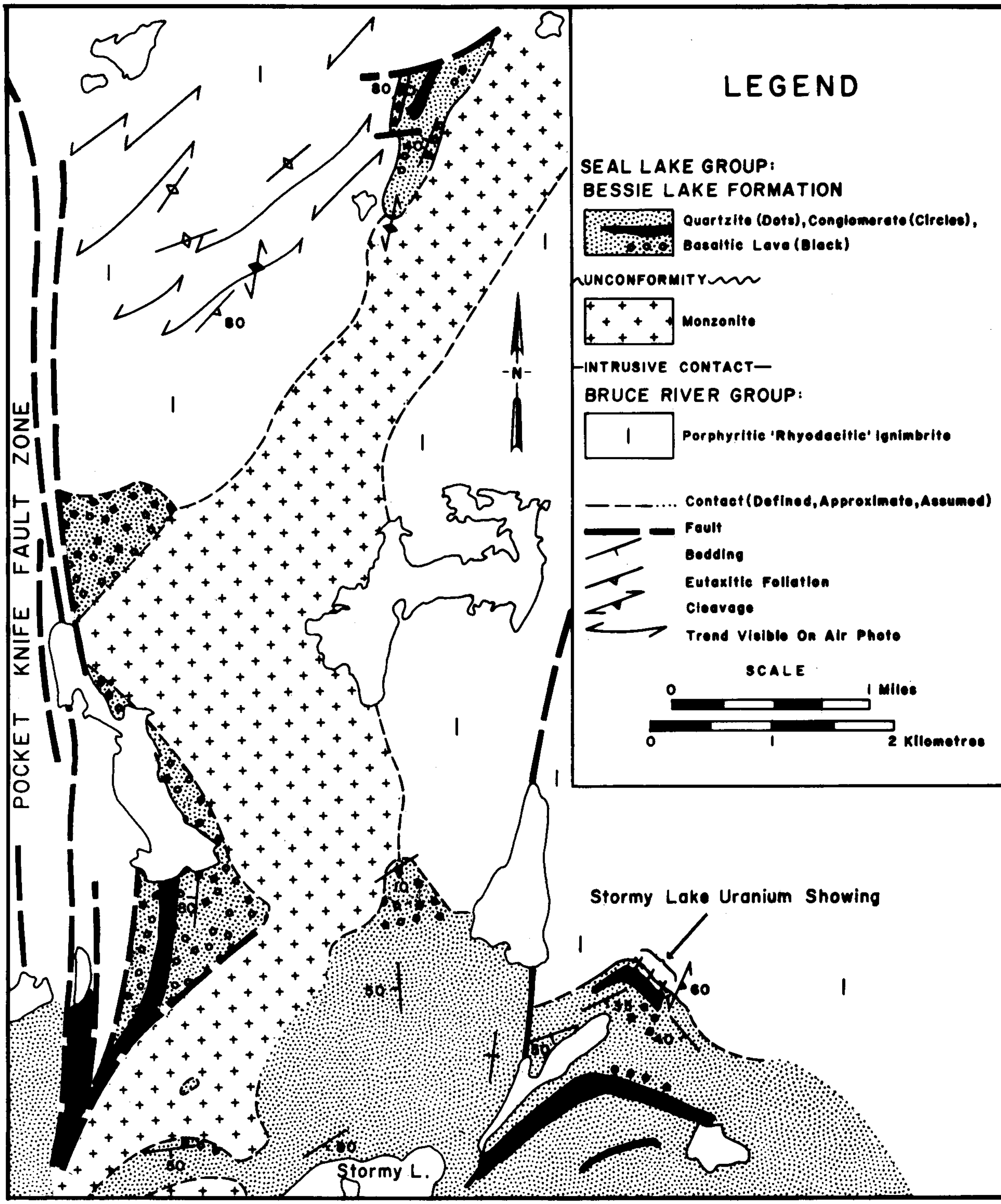

Fig. 2 Sketch map showing unconformable relationship of the Seal Lake Group and location of the Stormy Lake uranium showing.

The outlier rests on and obscures an intrusive contact between monzonite and "rhyodacitic" ignimbrite of the Bruce River Group. On the west side of the syncline pebble conglomerate containing clasts of porphyry rests on mauve, fairly massive, porphyritic ignimbrite; on a large scale, the contact appears to truncate (in plan) primary eutaxitic fabric in the ignimbrite, at approximately 20^{0}. On the east side, quartz pebble conglomerate rests directly on pinkish monzonite, a boulder of which was seen in the conglomerate. The monzonite locally shows spheroidal weathering for up to 100 feet below the unconformity; specularite is common in joints in the weathered portions. Unfortunately, a scintillometer was not available during this part of the mapping.

The Stormy Lake uranium showing, discovered by Piche in 1955 (Robinson, 1956a) was subsequently visited, and it was found that the showing occurs at a similar unconformity (Fig. 2). Quartz pebble conglomerate and quartzite, 20-80 feet thick, hosting the mineralization overlies massive porphyritic 'rhyodacite' of the Bruce River Group (previously mapped as arkose). Pitchblende seams occur at eight places along the unconformity for a distance of 1800 feet; one trench has exposed the unconformity for approximately 100 feet. Chip samples that excluded all visible pitchblende gave assays from 0.0023% to 0.225% U_3O_8 (Robinson, 1956a). Specularite is common at the unconformity, and fluorite, chalcopyrite, galena and chalcocite also occur. The host rock is overlain by thin mafic flows, white quartzite and pebble to cobble conglomerate. A second radioactive zone parallel to bedding occurs in the quartzite about 800 feet stratigraphically above the unconformity; it was traced along strike for 600 feet, and the highest assay from five chip samples was 0.004% U_3O_8(Robinson, 1956a).

(2) Shipiskan Lake - Snegamook Lake Sector

The presumed unconformity along the north margin of the Seal Lake syncline is obscured by drift. Robinson (1956b) suggested that this contact is in fact a thrust and that the Seal Lake Group overrides the anorthosite and the Shipiskan Plateau sediments. His interpretation has not received much attention, but recently Knight (1972) has mapped major northward directed folds and thrust faults in the Arkose Lake area, and their intensity can be related to the shape of the nearby anorthosite massif. It is probable, therefore, that at least local modification of the unconformity by thrusting has taken place, and the zone of maximum uranium potential may be partly obsured.

Barager (1969) reported a radioactive conglomerate unit interbedded with basalts near the base of the group in this area (Fig. 1). BRINEX have found that the uranium occurs in detrital form (Dr. P. Beavan, personal communication). This occurrence appears to be similar to the radioactive zone above the Stormy Lake showing.

Roy and Fahrig (1973) have pointed out that the aeromagnetic pattern of the Harp Lake anorthosite can be traced southwards under the Seal Lake Group for approximately 19 km. (see G.S.C. Map 7405G). This suggests that the Seal Lake Group is relatively thin along the north margin of the syncline.

(3) Shipiskan Plateau

The flat-lying sediments and volcanics of the Plateau are poorly known and are largely undifferentiated on existing maps. Exposures are reported to occur in the precipitous sides of incised river valleys. No recorded observation of the unconformity has been made. The basal sediments of the Plateau may be a favourable setting for roll-type and tabular uranium deposits using the model of Fisher (1974). In this case, however, massive mafic flows rather than mudstone would have acted as the impermeable strata.

A comparison can also be made between the ancient exhumed erosion surface bordering the edge of the Shipiskan Plateau sediments, and the environment of the Alligator River uranium deposits in northern Australia. The latter deposits occur close to the edge of a flat lying Proterozoic sedimentary cover in structural zones within the basement directly beneath the exhumed unconformity.

(4) South Margin of the Seal Lake Group

The southern margin of the overturned Seal Lake synclinorium is bordered by a northward bulging arc of granitoid rocks. The unconformity between the Bessie Lake Formation and the granitoid is perserved at the eastern and western margins of the buttress, at Letitia Lake (Marten, this volume) and at Salmon Lake (Brummer and Mann, 1961). However along the central portion of the arc, the unconformity has been obliterated by northward thrusting of the granite during development of the synclinorium.

Mapping at Letitia Lake and Esmee Lake has established that the southern overturned limb of the synclinorium suffered a second major phase of deformation. The second phase refolded earlier structures and produced major east-west trending shear zones that locally truncate the axial planes of early folds in the core of the synclinorium, and in places effect a sinistral deflection (refolding) of major F_1 closures (Fig. 1; seen also maps of Brummer and Mann, 1961; and Roscoe and Emslie, 1973). The axial planes of the F_2 folds dip southwards at 45^0-50^0, and at Letitia Lake the F_2 folds are upward facing. However in the Esmee Lake area, where the early thrusts occur, the F_2 folds are downward facing and an isolated "klippe" of granite occurs in the core of one of these (Fig. 1). The "klippe" rests on a folded early thrust which separates it from underlying downward facing quartzites of the Bessie Lake Formation. These relationships show that the south limb of the synclinorium must have originally been nearly recumbent in the Esmee Lake area prior to the second deformation.

The unconformity at Letitia Lake is represented by a regolith consisting of a deeply weathered zone of bedrock (Letitia Lake Porphyry) overlain by oxidized sediments derived more or less in situ; the regolith is characterised by high background radioactivity (Marten, this volume). In 1967 an airborne scintillometer survey was conducted by BRINEX over a strip of ground extending from Esmee Lake to southwest of Letitia Lake. It revealed a cluster of anomalies covering about one square mile south of Bessie Lake (unpublished private report). This cluster straddles the inferred position of the unconformity, and is associated with a group of more scattered anomalies extending eastwards along the same zone for nearly three miles. These anomalies were considered at the time to represent a similar situation to the Mann showing in the alkaline body at Letitia Lake, and consequently do not appear to have received much attention. This study, however, indicates that they are related to a totally different mineralization environment - the unconformity at the base of the Seal Lake Group.

In 1971, an airborne gamma ray spectrometer traverse detected an increase in radioactivity in the vicinity of the Grenville - Churchill boundary southeast of Michikamau Lakê (Darnley et al., 1972). The increase was tentatively attributed to granitic rocks, but the area (which corresponds to the southwest corner of Fig. 1) is also underlain by sedimentary rocks of the Seal Lake and Petscapiskau Groups. Although the exact route of the traverse is not known to us, our study suggests that the radioactivity could be related to the sedimentary sequences, especially their basal contacts (where preserved).

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