ARCHEAN-PROTEROZOIC GEOLOGY OF THE KANAIRIKTOK-KAIPOKOK RIVER VALLEYS (NTS 13K/10), LABRADOR

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INTRODUCTION

Field work in the interior portion of the Central Mineral Belt of Labrador during the summer of 1974 (Smyth et al., 1975) resulted in the recognition of a regional unconformity (cf. Roy and Fahrig, 1973) within the Croteau Group (Fahrig, 1959; Williams, 1970) and its redefinition as two new groups. The name Moran Group was proposed for the lower marine series and Bruce River Group for the overlying dominantly continental succession.

The work carried out in the 1976 field season extended the previous mapping to the north, east and south. This report deals with relationships in the northern part of the belt covered by NTS 1:50,000 scale map-sheet 13K/10 (Fig. 1). Results of mapping to the south and east are given by Smyth (this volume).

ARCHEAN

Lithology

The Archean terrane of the Kanairiktok and Kaipokok River areas is dominated by foliated rocks varying from weakly deformed granite to regularly banded quartzofeldspathic gneisses.

The rocks west of the Moran Group are chiefly granitic rocks exhibiting a single penetrative fabric. Banded gneisses are also present locally (e.g., north of Green Pond); their composite fabrics and structural complexity compared to the granites suggest that they are part of an older terrane into which the granites were intruded.

Banded gneisses predominate over granites in the area east of the Moran Group, but along the southeastern margin of the map area adjacent to the Bruce River, foliated granites similar to those of the Kanairiktok region are the main rock type. Banded garnet and hornblende bearing quartzofeldspathic gneisses and thin bands of garnetiferous amphibolite constitute the major lithology east of Copper Pond. A weakly foliated granite containing rafts of the gneisses is also present east of Copper Pond. The schistosity in the granite overprints the dominant fabric in the inclusions. Locally the banded gneisses are overprinted by a later foliation or fracture cleavage.

Foliated amphibolite units occur south of Copper Pond and west of Green and Embee Ponds. Blastosubophitic textures indicating gabbro as the protolith are locally preserved.

In a narrow strip occurring in the central part of the map area, the Archean amphibolite facies gneisses have been reconstituted along a major shear zone, and retrogressed to quartz-feldspar-chlorite-sericite schists. Small enclaves within this zone escaped complete reworking, and a partially transposed, retrogressed, gneissic banding may still be recognized. The deformation of this zone is believed to be Hudsonian although no absolute age has yet been established. Crustal movements along this zone may have been responsible for the formation of the graben structure which controlled early sedimentation of the Helikian Bruce River Group (Smyth et al., 1975).

Two Archean supracrustal metavolcanic belts and one metasedimentary belt occur in the area. The most extensive is an arcuate belt of schistose metavolcanic and metagabbroic rocks which was partially outlined in 1974 (Smyth et al., 1975). A similar fault bounded linear greenstone belt has been defined south of Boiteau Lake. The latter was considered by Williams (1970) to be part of the Lower Croteau Group (Moran Group), but its obviously more complex structural history renders this interpretation unlikely. Both greenstone sequences of the Kaipokok area are similar to the southern extension of the Ugjoktok greenstone belt north of Bear Track Lake in the northeast corner of the map area.

A succession of tightly folded, green, siliceous schists has been delineated south of Island Pond. A thin unit of grey marble occurs in the southern part of this belt. These metasediments were intruded by thick sheets of foliated gabbro which crosscut the S_1 fabric but predate the F_2 folds identified in the belt. The lithologies are different from all others in the map area, and it is tentatively concluded that they are of the same age (Archean) as the Ugjoktok and other greenstone belts in this part of Labrador. Taylor (1972) has described a similar Archean metasedimentary series in a fault bounded block between Adlatok and Ugjoktok Bays.

Mineralization

Mineralization in the basement rocks is comprised primarily of veinlets and disseminated grains of chalcopyrite and pyrite in the banded amphibolites and greenstone belts. A large pyritic gossan zone is present in an amphibolite just east of Copper Pond. Cross-fiber asbestos occurs in narrow veinlets in an ultramafic body in the Ugjoktok belt, and specular hematite is present in narrow quartz carbonate veins in greenstone northeast of Moran Lake.

MORAN GROUP

Lithology

The Aphebian (Williams, 1970) Moran Group within the map area consists of a thin basal unit of black and grey laminated mudstone with minor grey chert and yellow-brown dolostone overlain by a succession of pillow lava, massive flows and pillow breccia.

The lower sedimentary unit is, for the most part, rather thin (30-50 m) but reaches a maximum outcrop width of 1500 m in the Green Pond-Embee Pond area. The thickening is due to a combination of faulting, tight overturned chevron folding, and original irregularities in the pre-Moran erosion surface. The most abundant rock types are grey or black laminated mudstones and slates. Interbedded with these are thin discontinuous lenses of grey to black chert and quartzite and brown-weathering siliceous dolostone. The unconformity between the slates and the Archean granitoid rocks to the west is exposed at the northern end of the area and just a few meters of cover separates the two rock types at several other localities, e.g., Green Pond, Embee Pond, and north of Moran Lake.

A thick unit of light to dark green pillow lava containing local pillow breccia and massive lava units overlies the slates and faces to the southeast. Preliminary petrography has shown that the least altered pillows display quench textures identical to those described by Pearce and Donaldson (1974) from pillow lavas of the Doublet and Knob Lake Groups of the Labrador Trough. Within the pillow lava succession there are local lenses of grey limestone, chert and red jasper. Although the pillow lavas are usually undeformed, they are cut by a number of narrow shear zones. In the north, where the Moran Group pinches out, the shearing has led to the development of a fine grained, schistose rock in which pillow structures are preserved only on surfaces normal to the stretching direction. The age of this shearing is not known at present but it is probably due to the Hudsonian orogeny, which reconstituted the basement rocks to the east.

Linear belts of the Moran slates have been recognized within the quartz-feldspar-chlorite-sericite schists of the Hudsonian shear zone in the vicinity of Island Pond and Copper Pond. These are interpreted as slivers of the cover rocks which were infolded during the reconstitution of the underlying Archean gneisses, the original unconformable relationship being largely destroyed. Mafic volcanic rocks have not been recognized in these linear belts.

Mineralization

The sediment-pillow lava sequence is locally transected by quartz-carbonate veins up to 0.5 m wide which contain galena, sphalerite and chalcopyrite, e.g., on the north side of Moran Lake (Ellingwood, 1958), at Green Pond (Macpherson, 1954), and at the northern end of the map area. At the latter locality the veins also occur in the fossil regolith beneath the slates. Chip samples from the veins at Green Pond were assayed by AMCO Exploration and gave combined maximum values of 10.3% zinc and 3.5% lead, the high zinc being due to an 8 cm vein of sphalerite (Moore, 1954). Cumming et al. (1955) reported an age of 1685 $\pm$ 160 m.y. for this galena mineralization. Other mineralization observed in the area included pyrite and chalcopyrite disseminated throughout the mafic volcanics and pyrite and magnetite in some chert horizons in the slates.

JUNIOR LAKE GRANITE

An elongate body of pink hornblende granite is present in the southern part of the area. It is intrusive into the Archean complex and is considered to predate the Moran Group, although the exact relationship has not been established (Smyth et al., 1975). It is, however, unconformably overlain by the Bruce River Group. Isotopic dating of the Junior Lake Granite is planned for the near future.

LEUCOGRANITE

A massive, weakly foliated leucogranite is in fault contact with the Moran Group slates on the Stipec River in the southeast corner of the map area. A small lens of leucogranite intrudes the Moran Group just north of this fault. A similar nonfoliated granite intrudes Moran Group slates along the Gravelly River (Smyth, this volume) and occurs as a fault wedge in the Bruce River sandstones. Although a nonconformable relationship between foliated granite and tuffaceous sandstones is exposed north of Del Rizzo Lake (Smyth, this volume), the primary relationship between the Bruce River Group and the undeformed leucogranite has not been established with certainty. However, small wedges of leucogranite previously considered to be sills within the sediments (Smyth et al., 1975) are now interpreted as thrust wedges which predate the folding of the Bruce River Group; this may indicate that intrusion of the leucogranite was pre-Bruce River Group.

BRUCE RIVER GROUP

Lithology

The unconformable relationship between the Moran Group and the Bruce River Group is particularly well exposed in the southeast corner of the map area, where a syncline of Heggart Lake conglomerate and tuffaceous sandstones and quartzite overlies Moran slates. The slates strike

LEGEND

PROTEROZOIC

INTRUSIVE ROCKS (POST-BRUCE RIVER GROUP)

12	Gabbro, diorite
11	Quartz-feldspar porphyry

BRUCE RIVER GROUP

10	Tuffaceous sandstone, quartzite
9	Heggart Lake conglomerate: conglomerate, grit, sandstone

U/C

8	Leucogranite
7	Junior Lake Granite

MORAN GROUP

6	Mafic volcanic flows, pillow lava dominant
5	Laminated siltstone and mudstone, slate, argillite, phyllite, minor dolostone and chert

U/C

ARCHEAN

4	Siliceous schists, minor marble. Intruded by gabbro sheets
3	Metavolcanic rocks (greenstone belts), minor metagabbro
2	Quartz-feldspar-chlorite-sericite schists, derived by Hudsonian reconstitution of 1
1	Foliated granite, quartzofeldspathic gneiss, minor amphibolite. 1a, granoblastic and banded amphibolite (metagabbro). Diabase and gabbro sheets locally abundant

Geology by A.B. Ryan and W.R. Smyth, 1976, and B.E. Marten, 1974.

SYMBOLS

Bedding: tops known . . . .

Bedding: inclined, vertical; tops unknown . . . .

Syncline . . . .

Pillows: inclined; tops known . . . .

Cleavage, schistosity: inclined, vertical; age undifferentiated . . . .

Strain slip cleavage: inclined, vertical. . . . .

Gneissic banding: inclined, vertical . . . .

Axis of minor fold; S, M, Z - sense of vergence looking along the arrow . . . .

Geological contact: defined, approximate, assumed . . . .

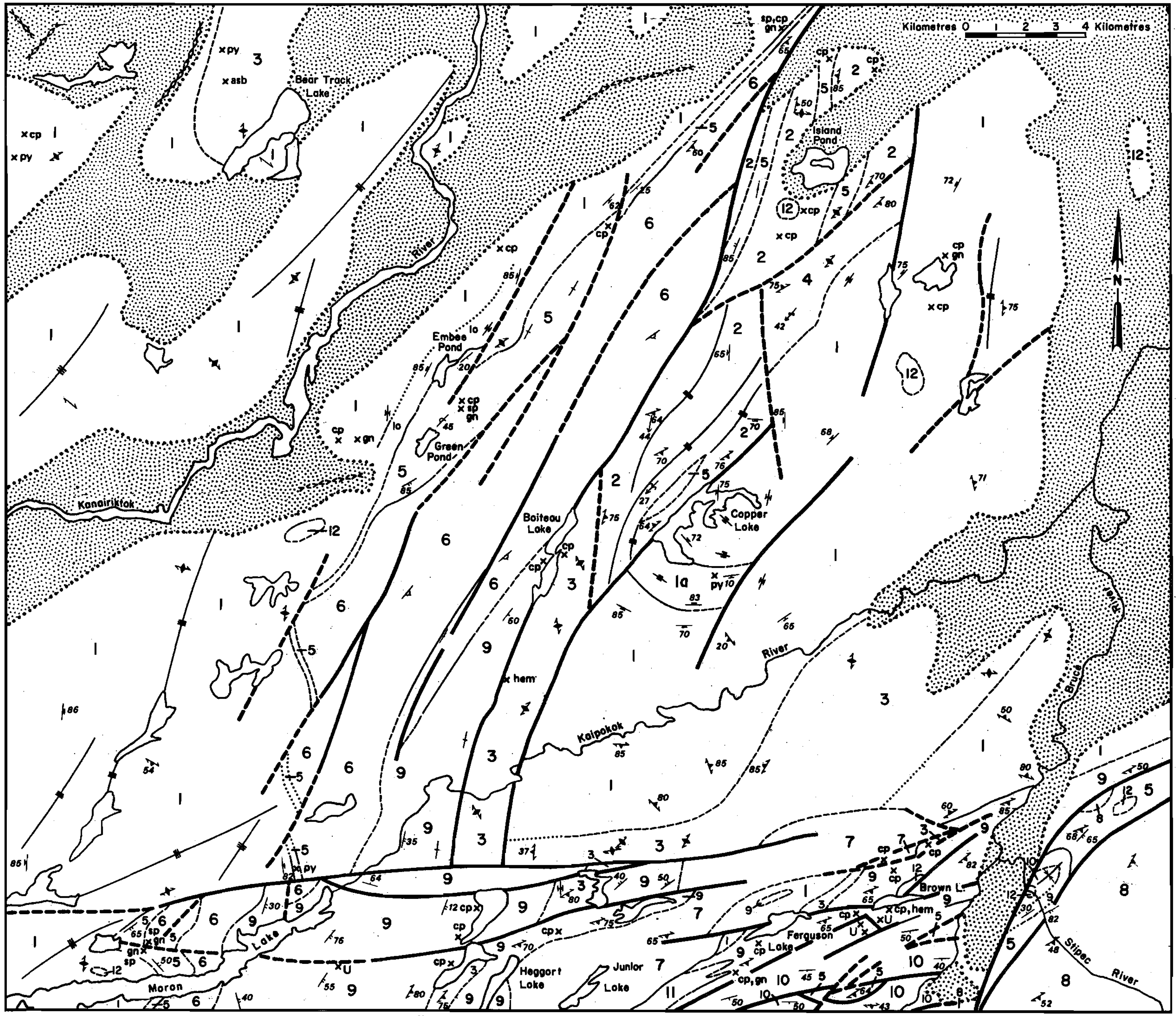
Fault: defined or approximate, assumed . . . .

Topographic lineaments from air photograph . . . .

Mineral occurrence; u = uranium, cp = chalcopyrite, py = pyrite, gn = galena, sp = sphalerite, hem = hematite . . . . ×

Drift-covered area . . . .

Esker; direction of flow unknown. . . . .



Kilometres 0 1 2 3 4 Kilometres
N
Bear Track Lake
Island Pond
Embee Pond
Green Pond
Kanairiktok
River
Baiteau Lake
Copper Lake
Kaipokok
River
Bruce River
Brown L.
Ferguson Lake
Heggart Lake
Junior Lake
Moran
Lake
Stipec
River

Figure 1.

obliquely into the overlying sediments. North of Moran Lake, sandstones of the Heggart Lake formation of the Bruce River Group are in contact with Moran pillow lavas on the west side of a narrow fault wedge. The contact is marked by a thin breccia horizon consisting of weathered clasts of the underlying mafic volcanic rocks.

The Heggart Lake conglomerate is a greyish weathering, massive, polymictic deposit which outcrops in a thick wedge trending northeast from Alvin Lake (Smyth et al., 1975). It unconformably overlies the Archean complex, the Moran Group, and the Junior Lake Granite. Northeast of Moran Lake red and pink sandstones, quartzites and grits occur at the base of the Heggart Lake formation; at Brown Lake a thin greyish siltstone horizon and an amygdaloidal lava flow are also present.

The Heggart Lake conglomerate is overlain by a succession of varicolored well bedded tuffaceous sandstones. The contact is partially fault bounded, but abrupt changes in lithology are also present without any obvious structural break; these appear to represent conformable or perhaps disconformable contacts. The tuffaceous sandstones are commonly cross-bedded and vary in color from buff, mauve, pink, and grey to red. South of Brown Lake pale green and grey, relatively pure orthoquartzites and minor conglomerates with quartzite matrices are interbedded with the sandstones.

Mineralization

Several uranium occurrences are known in the Bruce River Group. Three important uranium showings are known at Moran Lake (Smyth and Ryan, this volume), one of which is within the present map area. This occurrence is a zone of radioactivity several hundred meters in length confined to a narrow shear zone in the Heggart Lake conglomerate, adjacent to the extrapolated expression of a major east-west fault.

At Brown Lake a similar shear zone in Heggart Lake conglomerate contains uranium mineralization. Tuffaceous sandstones in fault contact with the Heggart Lake conglomerate south of Brown Lake also contain narrow radioactive shear zones, commonly along mafic dykes. The sandstones are reddened and highly silicified in some of the radioactive zones.

Numerous chalcopyrite showings have also been observed in the Bruce River Group(see Smyth et al., 1975). A narrow quartz vein with specular hematite occurs in an amygdaloidal lava flow on the south side of Brown Lake.

POST-BRUCE RIVER GROUP INTRUSIVE ROCKS

A quartz-feldspar porphyry body southwest of Ferguson Lake, previously described by Smyth et al. (1975), and several exposures of gabbro are the only post-Bruce River rocks in the area. Although the age of the gabbros is not known, the unaltered state of these rocks in comparison to the Bruce River Group rocks suggests a younger age. The gabbros are typically equigranular, subophitic and medium grained; however, the gabbro in the northeast corner of the area is porphyritic and contains pyroxene phenocrysts up to 2 cm in diameter. Another gabbro body south of Island Pond also contains a layered anorthositic portion which has a spotted appearance due to stellate aggregates of biotite.

GENERAL STRUCTURAL GEOLOGY OF THE AREA

Folds

The structure of the Archean rocks has not been studied in detail, but it is obvious from the changing attitude of the gneissic layering in areas of sufficient exposure that macroscopic folds are present. Apart from cross-cutting foliations, mesoscopic structures are rare in the gneisses. By contrast, small folds are locally abundant in the greenstone and metasedimentary belts, and in most cases they fold earlier penetrative fabrics.

The reconstituted gneisses of the shear zone are variably folded. Although crenulations of the schistosity are most abundant, folds with the regional fabric as the axial surface are also present.

The structure of the Moran and Bruce River Groups has been previously outlined by Smyth et al. (1975). The Moran Group and the Archean basement were deformed and metamorphosed during the Hudsonian orogeny, before the Bruce River Group was deposited. Grenville deformation folded the Bruce River Group into a southwest-plunging syncline and offset lithological contacts in the hinge zone of this fold along two major faults, the Bruce River and Gravelly Lake shear zones. Although Bruce River Group rocks have been traced southwards across the Gravelly Lake shear zone, their full extent is unknown at present.

Faults

Before the Bruce River Group was folded, there was a period of north-directed horizontal compression during which slices of pre-Bruce River Group rocks were juxtaposed against the Bruce River Group by a series of reverse faults. This is especially evident from the manner in which wedges of Moran Group slates and phyllites occur within the Bruce River sandstones south of Brown Lake. Bedding and cleavage orientations in these Moran Group slivers are discordant to bedding in the surrounding sediments. The apparent thickness of Bruce River sediments south of Brown Lake is several times the true thickness due to telescoping and fault imbrication. This is not readily apparent, however, due to the monotonous character of the sandstone succession and the strata-bound character of the faulting. Leucogranite wedges which have been thrust into the tuffaceous sediments along the Gravelly River display strongly mylonitized margins. The mylonite foliation has been folded during folding of the Bruce River Group.

High angle faults have two dominant trends; east-west and north-northeast to south-southwest. The east-west faults cut the earlier north-trending structures and displace these earlier faults and lithological contacts both sinistrally and dextrally.

The repetition of the Bruce-Moran unconformity north of Moran Lake along a north-trending reverse fault is considered to be due to Grenville movement initiated along a pre-existing zone of weakness in the Moran Group, namely a shear zone caused by the Hudsonian reactivation of the eastern basement.

In the southeast corner of the map area, curvilinear faults juxtapose Moran Group rocks against Heggart Lake conglomerate, and foliated leucogranite against Moran. These faults are probably the same age as the Bruce River and Gravelly Lake shear zones.

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