GEOLOGY OF EASTERN CENTRAL MINERAL BELT (13J/10-15; 13O/2,3) LABRADOR

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INTRODUCTION

Geological mapping of the Aphebian Aillik Group was begun in 1977 in the Walker Lake - Maclean Lake area (13J/9, 13K/12) (Bailey, 1978). During 1978, mapping was continued eastwards and northeastwards at a scale of 1:50,000, and the northeastern part of the Central Mineral Belt and the northwestern part of the Benedict Mountains were covered. Over much of this area outcrop distribution is good; however, south of Big River, outcrop is very sparse and mapping was possible at a reconnaissance level only.

Previous work in the eastern part of the Central Mineral Belt has been summarized by Bailey (1978) and Kontak (1978). The Benedict Mountains area has been described by Stevenson (1970), but mapping by the present authors has indicated that a new geological interpretation is necessary.

GEOLOGY

The supracrustal rocks of the eastern part of the Central Mineral Belt are of Aphebian age and comprise volcanic and sedimentary rocks of the Aillik Group. These rocks are bounded and intruded by felsic and mafic plutonic rocks, except in the north where Archean rocks of the Hopedale metamorphic complex mark the northern boundary of the Central Mineral Belt.

STRATIGRAPHY

The Aillik Group comprises mafic and felsic volcanic rocks and their epiclastic derivatives. A complete stratigraphic section through the Aillik Group has not been measured owing to complicated structural relations. However, the following stratigraphic succession has been determined at a gross scale, although it is emphasized that rapid lateral facies changes, typical of volcanic environments, exist in the area. Refinement of the stratigraphic succession described below would require much more detailed mapping than has been possible during the present programme.

Archean

Unit 1. Hopedale metamorphic complex. These rocks comprise banded gneiss and migmatite of amphibolite metamorphic grade which were deformed during the Kenoran Orogeny (Sutton, 1970). In the map area, during the Hudsonian Orogeny, these rocks were reworked (Marten, 1977). Contacts with overlying rocks are commonly tectonic and no unconformity is preserved.

Aphebian (Aillik Group)

Unit 2. Pelitic and psammitic schists and semischists. This unit outcrops in the northwestern part of the map area and comprises pyritic biotite schist, graphitic siltstone, gray psammite and quartz-muscovite schists.

Unit 3. Mafic pillow lavas, mafic tuffaceous sedimentary rocks, quartzite, and silica-magnetite and pyritic iron formations.

Unit 4. Conglomerate, polylithologic and monolithologic felsic breccias. Rocks of this unit commonly contain clasts of granite and rhyolite in a felsic, sandy matrix. However, clasts of mafic volcanic and metamorphic rocks of the underlying units to the north are lacking, suggesting that Units 1, 2 and 3 were negative topographic features during the deposition of Unit 4, or that

LEGEND

HELIKIAN

18	*Coarse grained pyroxenite, gabbro and diabase (Michael Gabbro).*
17	*Gray graphic leucogranite and pegmatite.*
16	*Pink and gray, medium to coarse grained granite, quartz monzonite (includes Monkey Hill and Strawberry granites).*
15	*Complex migmatite.*
14	*Gray, coarse grained, equigranular to porphyritic granite and granodiorite (Benedict Granite).*

Adlavik Igneous Complex

13	*Gray medium to coarse grained syenite.*
12	*Fine to coarse grained pyroxenite and gabbro.*

APHEBIAN - HELIKIAN

11	*Coarse grained, in places porphyritic, well foliated granodiorite.*
10	*Fine to medium grained, well foliated granite and granodiorite.*

APHEBIAN

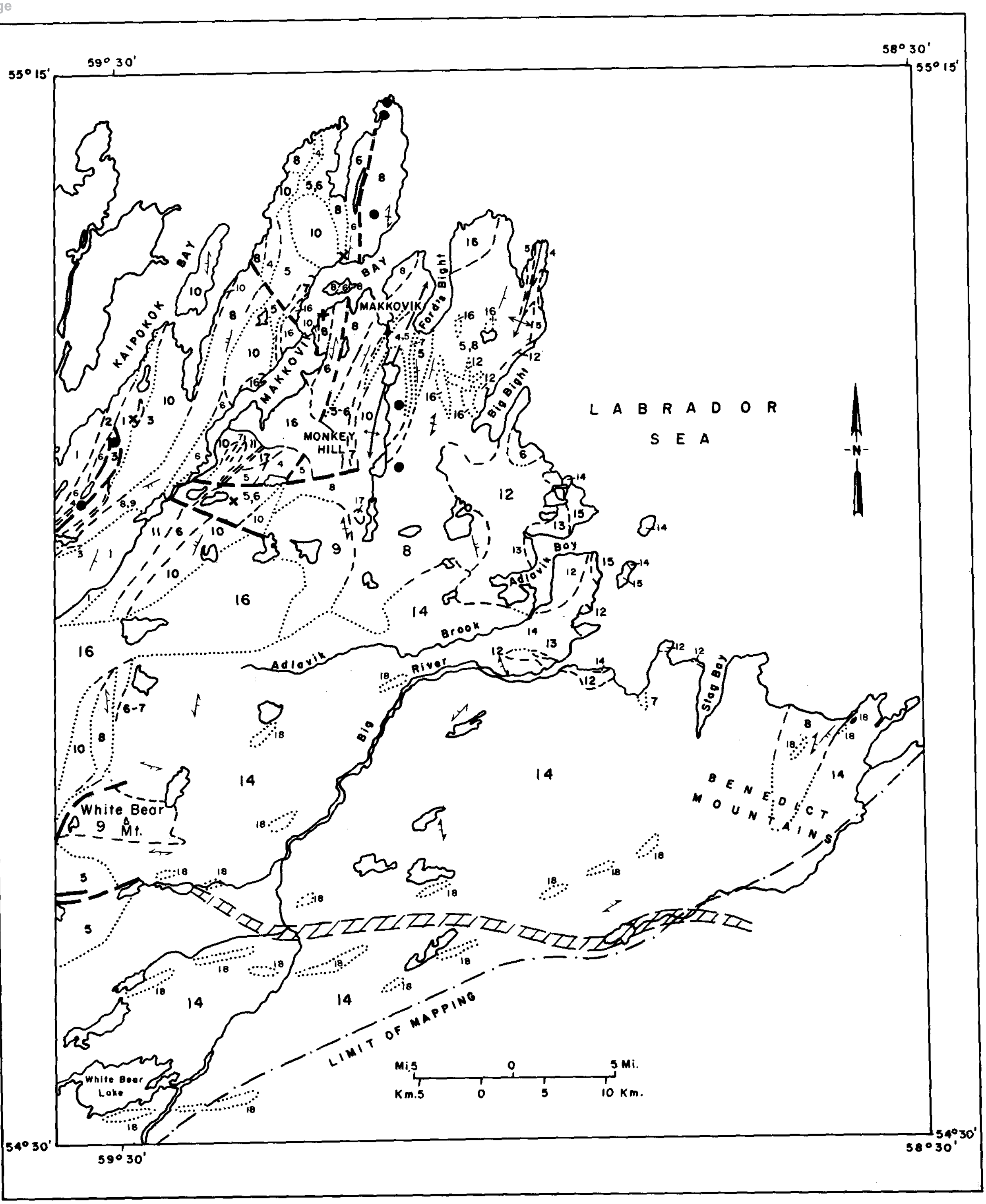
Aillik Group

9	*Massive to well foliated rhyolite.*
8	*Rhyolitic ash-flow and ash-fall tuff, volcanic breccia, sandstone.*
7	*Mafic tuff, pillow lava and pillow breccia.*
6	*Well bedded and laminated pink, gray and green tuffaceous sandstone, and siltstone.*
5	*Massive to poorly bedded arkosic sandstone, conglomerate, and bedded rhyolitic tuff.*
4	*Felsic conglomerate, poly- and monolitholigic felsic volcanic breccia.*
3	*Pillow lava, mafic tuffaceous sandstone and siltstone, quartzite, iron formation.*
2	*Pelitic and psammitic schist and semischist.*

ARCHEAN

Hopedale Gneiss

1	*Well banded orthogneiss, migmatite.*



EASTERN CENTRAL MINERAL BELT, LABRADOR

Mineral occurrences:

Pyrite and pyrite-pyrrhotite .... ✖

Chalcopyrite, pyrite .... ✚

Uraninite .... ●

the provenance of Unit 4 conglomerates was from the south and east.

Unit 5. Massive to poorly bedded arkosic sandstone, bedded rhyolite tuff, conglomerate and volcanic breccia. This unit mainly comprises the reworked products of rhyolitic volcanism.

Unit 6. Well bedded and laminated pink, green and gray tuffaceous sandstone and siltstone. Unit 6 overlies Unit 5 conformably but also grades laterally into it. Thus, in places, Unit 6 overlies Unit 4 rather than Unit 5.

Unit 7. Mafic tuff, pillow lava and pillow breccia. In appearance Unit 7 resembles the basaltic rocks of Unit 3, but its apparent stratigraphic position suggests that it is younger than Unit 3. Extensive zones of undeformed pillow lavas on the west side of Makkovik Bay reflect its submarine origin. South of Makkovik, the unit is entirely tuffaceous and contains interbedded rhyolitic tuff.

Unit 8. Rhyolitic ash-flow and ash-fall tuffs with interbedded volcanic breccias and sandstone. This unit is economically important in that it hosts many uranium showings in the map area. In a few places textures typical of ignimbritic rocks occur, indicating probable subaerial deposition but, generally, deformation has obscured primary fabrics. Southwest of Makkovik Bay, Unit 8 is massive and may be of hypabyssal intrusive rather than extrusive nature. Although the unit has been subdivided by Clark (1974) on the basis of phenocryst type, at the scale of present mapping this has not been possible because of complex interdigitating relations. However, it is recognized that subunits do exist and can be mapped out in places on the basis of quartz and feldspar phenocryst proportions.

INTRUSIVE ROCKS

Unit 9. Massive to well foliated hypabyssal rhyolite. Two large rhyolite intrusions have been recognized; namely, (i) White Bear Mountain and (ii) an intrusion about 18 km south of Makkovik. The intrusion at White Bear Mountain has a central core of quartz porphyritic rhyolite surrounded by feldspar porphyritic rhyolite. A similar relationship exists in the intrusion south of Makkovik. There, however, the feldspar porphyritic rhyolite is not as extensive as at White Bear Mountain, and there is no sharp demarcation between intrusive and extrusive rocks, the boundary being generally marked by a zone of volcanic breccia. Unit 9 is thus probably of the same age as, and comagmatic with, the enclosing rhyolitic extrusive rocks.

Unit 10. Fine to medium grained granodiorite and granite. This unit comprises a number of different intrusions which are considered to be synkinematic and intruded during the Hudsonian Orogeny. A well developed foliation characterizes the unit although it is of variable lithology. Examples include the Long Island Gneiss of Gandhi (1969) and Clark (1974), a name which is not used by the present authors because of the lack of gneissosity in these rocks.

Unit 11. Coarse grained granodiorite. Porphyritic in places with large feldspar phenocrysts, this rock is generally intimately related to Unit 10. Southwest of the head of Makkovik Bay it has intruded and migmatized Aillik Group sedimentary rocks.

Unit 12. Pyroxenite and gabbro. Along with Unit 13, these rocks comprise the Adlavik Igneous Complex. Gabbroic rocks occasionally exhibit well developed rhythmic layering and cumulate textures. Marginal zones of the mafic bodies are commonly coarse hornblende pegmatoids, although Clark (1974) has described chilled margins.

Unit 13. Syenite. Like Unit 12, Unit 13 in places exhibits rhythmic layering. The unit borders Unit 12 on its eastern side and comprises medium to coarse grained gray equigranular syenite to syenodiorite.

Unit 14. Granite and granodiorite. Known as Benedict Granite in the map area and as Walker Lake Granite further to the west (Bailey, 1978), this unit is generally a coarse grained equigranular to porphyritic hornblende-biotite granodiorite. Leucogranite and syenite phases are also present.

Unit 15. Migmatite. An exceedingly complex unit occurs on the eastern coastline north of Big River where granite of Unit 14 intrudes Units 12 and 13. It comprises essentially a mafic paleosome with a felsic neosome. However, several intrusive phases are present which, because of their complex relations, have not been mapped out. Generally, the texture of the unit is agmatitic.

Unit 16. Granite. A number of medium to coarse grained, postkinematic granitic intrusions are present in the map area, such as the Monkey Hill Granite and the Strawberry Granite (at Makkovik Bay and Ford's Bight, respectively).

Unit 17. Leucogranite. This unit, which is spatially associated with Unit 16, characteristically comprises leucogranite with graphic intergrowths of quartz and feldspar, and abundant quartz-feldspar pegmatoid bodies. East of the southern part of Makkovik Bay, the unit has invaded mafic tuffaceous rocks of the Aillik Group to form migmatite. Generally, areas of Unit 17 are too small to be represented on the map at a scale of 1:50,000.

Unit 18. Gabbro. Known as Michael Gabbro, dikes of this unit are abundant in the southern part of the map area where they intrude the Benedict Granite and rocks of the Aillik Group.

STRUCTURE

The map area can be divided into two parts on the basis of degree of deformation. The rocks bordering the southeast side of Kaipokok Bay, and described in detail by Marten (1977), although exhibiting a strong northeasterly S-fabric, have well recognizable fabric elements attributable to earlier polyphase deformation. The area is also characterized by zones of intense deformation a few metres wide which are generally stratabound. Marten (1977) considers such zones to be tectonic slides formed during the Hudsonian Orogeny.

South and east of the Marks Bight - Post Hill belt (Marten, 1977), the felsic volcanic and sedimentary succession has a single penetrative axial planar fabric which is considered to have been the product of a single Hudsonian deformation. Clark (1974) considered this fabric to have been the product of a D_3 event. Folds considered by Clark (1974) as F_4 interference structures, such as the domal structure immediately south of Makkovik, are probably the result of synkinematic intrusion in fold axial zones.

For the most part, folding is isoclinal and, as in the southwest part of the Aillik Group, antiforms are commonly sheared. It is the intensity of folding and the lack of continuous marker horizons which have prohibited the estimation of stratigraphic thickness. Previous estimates of thickness (Gandhi, 1969; Clark, 1974) cannot be considered to be reliable because of the lack of definition of the structural geology in detail in the map area.

Folds and lineations generally plunge to the southwest at about 45°, similar to the direction and plunge of lineations in the Walker Lake-Maclean Lake area. Apart from a few faults cutting the stratigraphy in the Makkovik Bay area and a possible stratabound tectonic disconformity (the Ranger Bight slide of Clark (1974)), mappable faults at 1:50,000 scale are absent. However, shearing parallel to fold axial planes is very common, although the amount of translation is considered to have been small.

Faults from the Walker Lake-Maclean Lake area (Bailey, 1978) can be recognized as continuing into the present map area. North of White Bear Mountain a mylonite zone strikes eastwards into Benedict Granite, but lack of outcrop in that area has restricted tracing the easterly extension of the zone. However, within the Benedict Granite south of Big River, a well defined shear zone can be traced westwards into faults of the Walker Lake-Maclean Lake area. This shear zone is over one kilometre wide and comprises very well foliated Benedict Granite, in places with feldspar augen. Similar shears in the Walker Lake-Maclean Lake area have been considered by Bailey (1978) to be possibly Hudsonian structures reactivated during the Grenville Orogeny. However, owing to the possible post-Hudsonian age of the Benedict Granite, this may not be the case for the shear south of Big River.

The shear zone south of Big River displays an L-S tectonitic fabric; the northern extent of these tectonites may mark the northern extent of Grenville deformation.

METAMORPHISM

Like deformation, regional metamorphism is zonal in character. The rhyolitic rocks, because of their composition, have not recorded metamorphic changes. This, and the limited extent of mafic rocks throughout most of the map area, does not allow detailed mapping of metamorphic facies.

For the most part, metamorphism is of the greenschist facies, marked by the assemblage epidote-chlorite-actinolite. However, the rocks of Units 1, 2 and 3 along the southeast side of Kaipokok Bay have reached the amphibolite facies of regional metamorphism. Hornblende in some mafic rocks along Makkovik Bay indicates amphibolite grade in this area also. For the most part, however, mafic rocks previously mapped as amphibolite (Clark, 1974; Gandhi, 1969) are generally greenschists.

The change from greenschist to amphibolite facies occurs approximately along the southeastern side of the Marks Bight-Post Hill belt, and coincides with a change from rocks exhibiting only one phase of deformation in the southeast to polydeformed rocks in the northwest.

ECONOMIC GEOLOGY

The map area contains a large number of uranium showings which can be divided into three broad groups:

(1) Deposits associated with volcanic rocks and which are essentially confined to discrete stratigraphic units; *e.g.*, at Aillik Peninsula and in the Marks Bight-Post Hill belt. These deposits, which are probably all of volcanogenic hydrothermal origin, can be subdivided into two types; namely, (i)

those associated with mafic volcanic rocks and tuffaceous sediments (*e.g.* Kitts) and (ii) those associated with felsic volcanic rocks (*e.g.* Sunil showing);

(2) Showings associated with mafic dikes which cut rhyolitic volcanic rocks; *e.g.* Falls Lake and Cape Makkovik; and

(3) Showings in pegmatoid rocks of Unit 17; *e.g.* Makkovik Bay.

Of the three types, the first appears to have most economic significance; *e.g.* Kitts may have mineable grades and tonnage. Type (1) showings in felsic volcanic rocks are commonly associated with a coarsely porphyritic feldspar rhyolite in Unit 8. Showings of type (2) appear to have formed by later remobilization of uranium from felsic volcanic rocks by hydrothermal activity initiated by dike injection. Pegmatitic uranium showings of type (3) have high thorium contents, but are small and sporadically distributed.

Recognition during 1978 of late Aphebian exhalites raises the possibility of volcanogenic massive sulphides of economic size being discovered in the Aillik Group. On the southeast side of Makkovik Bay massive sulphide lenses containing pyrite-chalcopyrite (-sphalerite (?)) occur at the contact between silicified rhyolite and chloritic mafic tuff. Disseminated chalcopyrite also occurs in minor amounts associated with chloritic stringers in the rhyolite.

At Anderson Ridge, about 5 km north of the Kitts deposit, a massive sulphide deposit occurs in mafic volcanic rocks. Here, however, copper is insignificant, and the deposit comprises mainly pyrite and pyrrhotite.

Other areas of exhalitive activity have been recognized. These occur, as does the copper deposit at Makkovik Bay, near the contact of massive rhyolite with tuffaceous sediments, marking, perhaps, the seawater-rhyolite interface.

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