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GEOLOGY OF THE FRANKLIN MINING CAMP, B.C

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INTRODUCTION

The Franklin mining camp is situated 70km north of Grand Forks, B.C. The map area is accesssible by road and lies 79 km north of Grand Forks.This paper summarizes the results of the 1987 field season. The fieldwork produced a geological map of the Averill plutonic complex.Preliminary research addresses the petrographic analysis of the rocks that comprise the Averill intrusions. A comprehensive understanding of the petrology of the the Averill suite has two main attributes:

i) it will further the tectonic and petrologic knowledge of the area, and

ii) it will add to the knowledge of alkaline intrusive rocks in general, and consequently elucidate the controls of subsequent platinum mineralization.

REGIONAL GEOLOGY

The Averill plutonic complex is situated at the southern end of the Omineca Crystalline Belt, which includes rocks of the Shushwap (Monashee Group) terrain,and associated gneiss domes and metamorphic rocks (Jones 1959).At its southern end the belt comprises Jurassic, Cretaceous and Tertiary plutonic rocks,with Jurassic granite batholiths being the most common.

Structurally the area appears to have been affected by a period of tectonism which has resulted in fracture, joint and dyke orientations being aligned subparallel to each other. The orientations vary between 360 and 020. This tectonism is inferred to have also produced the Republic Graben to the south.

The detailed mapping of the Franklin mining camp area has delineated the various plutonic units in the area, and has determined the nature of their contacts and hence relationships (see map insert). follow up work will concentrate on the detailed petrology of the rocks, to try and determine their detailed histories and genetic relationships.The age determination of the rocks will also go a long way to help unravel the geological history of this part of the interior of B.C.

GENERAL GEOLOGY

The mapping area essentially comprises a large NW-SE oriented alkalic pluton which has been intruded through Permo-Carboniferous sediments (Franklin Group),and Mesozoic granites.There are two smaller, intrusive outliers to the east in addition to the main body.The edge of the pluton is well delimited by a band of hornfelsed rocks.The alkalic pluton is itself concentrically zoned, with a central core of coarsely crystalline alkalic syenite, surrounded by an envelope of much finer grained syenite. Within the syenite body, lenses of ultramafic syenite occur. These pyroxenite bodies all have a general NW-SE orientation, and some are enveloped by mafic or intermediate lenses of monzogabbro or monzodiorite.The main syenite body is partially enveloped by intermediate monzodiorites,which to the SW form the edge of the pluton, and which to the NE are transitional with a less mafic alkalic unit, the monzonites.The relationships between the monzonites, monzodiorites, monzogabbros and pyroxenites is gradational and is based on an increase in mafic content. This alkalic complex has been cut by two later sets of dykes, an alkali syenite and a feldspar porphyry.

PETROLOGY,

1) Trachytic syenites

The trachytic syenites form the central part of the complex, and can be crudely divided in terms of grain size. For field descriptions, the following criteria were used;

fine trachytic syenite- feldspar laths 1cm
medium trachytic syenite-feldspar laths 1-2cm
coarse trachytic syenite-feldspar laths 2-4cm
v.coarse trachytric syenite-feldspar laths 4cm.

The mineralogy of these syenites as seen in the field is uniform, and the series seems to represent an inward grading from fine, to a core of of coarse slowly cooled trachytic syenite.The rocks consist mainly of alkali feldspar, which occurs as euhedral laths with a welll developed foliation. The proportion of alkali feldspars can be as high as 80%.

Clinopyroxene and hornblende occur as interstitial grains,and minor biotite or magnetite can also be seen in some specimens,as interstitial grains..

Very brief examination of thin sections taken from the Averill claim shows that the rocks are rich in sphene and also contain epidote, sericite, plagioclase feldspar, and other, as yet unidentified minerals.Chalcopyrite is the most common sulphide.These are preliminary results and further detailed thin section and X-ray diffraction work is continuing.

2)Co magmatic monzonite, monzodiorite and monzogabbro

The monzonites, monzodiorites and monzogabbros form a gradational sequence which was subdivided in the field on the proportion of mafic minerals. The classification used was (Strecheisen,1976).

10-30% mafics = monzonite
30-60% mafics = monzodiorite
60-90% mafics = monzogabbros

The monzonite is generally a fine grained rock containing two feldspars and mafic phenocrysts. The mafic grains fill interstices but also form part of the groundmass of the rock.

Very brief thin section examination shows that the rock contains clinopyroxene (augite) and biotite, and possibly some hornblende, which together form less than 30% of the rock. The clinopyroxene is being replaced by biotite. Other phases on the rock include the opaque minerals which occur as mainly chalcopyrite,and other replacement or accessory minerals such as sericite or sphene.

The monzodiorite unit has essentially the same mineralogy, but displays a weak foliation and has an increased amount of pyroxene/biotite/hornblende. As yet it is unclear as to whether this foliation is igneous or tectonic.

The monzogabbro unit is generally coarse grained and has pyroxene-rich schlieren running through it. There are also many small veins and veinlets of alkali feldspar which cut the schlieren with visible offset. The hand specimen mineralogy is similar, but it is not yet clear if there are two feldspars in the rock, as a thin section is not yet available.

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3) Pyroxenites

The pyroxenite unit varies in character throughout the area. It is seen as both very fine grained pyroxenite, with minor biotite, and as a very coarse grained crumbly biotite rich rock. The biotite rich variety (up to 90%) is almost certainly the product of hydrothermal alteration of the original pyroxenits,ae pyroxene would be most lihely to break down to biotite as a result of hydrothermal alteration.It is also possible that some biotite rich forms may represent vertical zonation of the original magma chamber, as in some areas such as the Buffalo claim (see map insert) the biotite appeared to be primary.This will be determined from thin section work.

Other minerals identified in hand specimen were very large euhedral grains of sphene,and possibly olivine.Thin sections are being cut for more detailed analysis.

4) Dyke rocks

i) Pulaskite

This rock is recognises by its buff weathering colour. It consists of an aphanitic grounmass with up to 30% phenocrysts of alkali feldspar and biotite. Based on the phenocryst assemblage, the rock is an alkali syenite. The dykes are vertical with their trend varying from NE to SW in the NE part of the complex, to N-S in the SW part of the complex.

ii) Porphyry

This rock has a distinctive spotted apppearance and consists of plagioclase feldspar phenocrysts and biotite in a grey aphanitic groundmass. Accessory minerals are quartz, disseminated pyrite and chalcopyrite.

These rocks together make up the alkali plutonic suite. At the borders of this complex, where the suite has intruded earlier rocks, a band of hornfels occurs.

The plutonic suite cuts both sediments of the Franklin Group and granite batholiths of varying ages. Many of these granites have previously been regarded as Mesozoic, but none have been radiometrically dated.

MINERALIZATION

From field observations it appears as if there have been at least two phases of mineralization in the area. These are:

i) A pegmatite association, as seen at the Maple Leaf claim (see map insert), and

ii) a late hydrothermal phase of mineralization.

The remnants of a large copper mineralized syenite pegmatite can be seen at the Maple Leaf mine workings. The The copper minerals remaining are malachite and chalcopyrite. This type of mineralization is almost unique in the complex.The only other evidence of pegmatites occurs at the north end of the property, where very coarse grained syenites occur, with feldspar laths up to 8cm.The outcrop pattern suggests that it might be part of a large vein/pegmatite.

This mineralization is interpreted as being related to the last atages of crystallisation of an igneous melt, and predates the hydrothermal phase of mineralization.

Evidence of hydrothermal mineralization can be seen throughout the complex, but is especially obvious at the Averill claim, where copper and sulphide mineralization is clearly seen along fracture surfaces.

In all areas where hydrothermal mineralization is seen, the host rocks (syenites, pyroxenites)are exceptionally hard and/or altered, and mineralizaation is commenly seen along the edges of alkali feldspar veins which have intruded the syenite.

Copper mineralization (malachite) and sulphides are commonly seen associated with alkali feldspar veins, but also occur as disseminations in pyroxenite. It is plausible that the passage of hydrothermal fluids is the cause of the large amounts of secondary biotite in the pyroxenites.

Platinum/Palladium soil anomalies

Platinum/palladium soil anomalies occured both within and out of the pyroxenite/syenite areas. Soil anomalies occuring within the boundaries of the complex were either generally on scree slopes or in swamp areas. It may be pertinent that while Pt/Pd anomalies were concentrated in scree slopes of pyroxenite, very few actually occured in the slopes above pyroxenite outcrops.

Anomalies of Pt/Pd also occured within the boundaries of monzodioite, monzonite and granodiorite.In these areas, although the rocks showed haematite staining, there was no visible mineralization.

In summary, Pt/Pd anomalies were located with and without a pyroxenite association, and with or without copper anomalies. Platinum and palladium did also not necessarily occur together.

CONCLUSIONS

The Averill alkali plutonic complex consists of a mineralogically gradational plutonic series that range from pyroxenite to monzonite.The outcrop pattern of the rocks suggests a vertical zonation, with pyroxenite at the base and monzodiorite at the top. The present erosional surface topography has exhumed successively lower strata, hence the pyroxenite is only visible as lenses in the centre.

The syenite clearly cuts through and disrupts the pyroxenites, and so it seems that the early zoned rocks were intruded by the syenites whilst the former were still in a state capable of semi-ductile deformation (deduced from the nature of the contacts).

As well as disrupting the pyroxenites, the intrusion of the syenites also caused the remobilisation of some of the ultramafic rocks, resulting in pyroxene schlieren in the monzogabbros, and concentrations of pyroxenites along the borders of the syenite units.

The syenites did not intrude to a shallow enough depth to affect the monzodiorites or monzonites.

Brief notes on thin sections from DDH# 12
Sited at Maple Leaf

True collar azimuth 245.00
Collar dip -45.00
Collar elevation 950 m
Depth of hole 66 ft.

Slide no. 1. - Depth 6 ft.

Mineralogy: plagioclase feldspar } Carlsbad twinning 70%
alkali feldspar }
hornblende / actinolite 5%
clinopyroxene - augite }
haematite / ilmenite } 10
sphene }
apatite }
pyrite } 15%
chalcopyrite }
? epidote ?

feldspars appear to be altering to clay minerals
Minor quartz veins cutting Kspar - secondary actinolite in close association with qtz veins.
Opaque sulphide mins have inclusions of feldspar - some lock replaced. Rock is coarse grained

Slide no. 2 - Depth 13.5 ft.
Mineralogy:
chlorite ~~- as [illegible]~~
quartz
calcite - as veins
Kspar
minor plagioclase
sericite

opaque minerals - chalcopyrite and pyrite

This rock is very finely crystalline; the main groundmass constituents being small interlocking grains of feldspar and/or quartz. Chlorite is a common constituent recognisable by its anomalous interference colours. Thin calcite veins cross cut the section, and some of the Kspar has broken down to sericite. The lack of pyroxene/amphibole suggests that the rock is not common of the alkali syenite. A tentative suggestion is that the rock is part of a Kspar vein running through the syenites or it may be the product of cooling of a syenite residue.*
Quartz and feldspar together comprise approximately 90% of the rock.
* Still needs more detailed work.

Slide no. 3 - Depth 16.5 ft

Mineralogy: Kspar
calcite veins
calcite as groundmass
clinopyroxene ?
altered feldspar - clay alteration
opaques

Most of the rocks (~70%) is composed of a brownish coloured alteration product, derived from the break down of the Kspar in the rock. Calcite occurs as both a groundmass mineral and as vein infill. The original feldspar grains were coarse, and are now being replaced by clay. Opaque phases form ~15-20% of the rock