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Report for: S. McAllister,
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Minerals Staff,
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Invoice 7540

August 29th, 1988

Samples:

4 drill core samples, numbered 88-9 168.2m., 88-11 134.5m., 88-14 209.35m. and 88-16 48.65m., for thin sectioning and petrographic examination.

Summary:

The samples from 88-9, 11 and 16 are all more or less strongly altered, plagioclase-rich intrusives. 88-9 is a quartz diorite and 88-11 and 16 are diorites.

88-9 and 88-16 show variable pervasive sericitization and carbonatization of plagioclase, and complete alteration of mafics to carbonate and chlorite. They are also affected by a veining and intergranular permeation style of carbonate alteration.

88-11 is more intensely altered, with complete pervasive replacement of plagioclase as well as mafics. As with the other rocks, a superimposed veinlet phase of carbonate and minor quartz alteration is present. The carbonate is weakly reactive to dilute acid and is probably a mixture of calcite and dolomite.

The rocks appear largely undeformed. No evidence of albitization was seen.

The sample from 88-14 is of different type and unknown origin. It is a granular aggregate of diopside, veined and permeated by tremolite and minor chlorite.

Individual petrographic descriptions are attached.

J.F. Harris Ph.D. (phone: 929-5867)

Sample 88-9 168.2m.

ALTERED QUARTZ DIORITE

Estimated mode

Plagioclase	50
Quartz	22
Sericite	3
Carbonate	20
Chlorite	2
Rutile)	3
Leucoxene)	
Pyrite	trace
Arsenopyrite(?)	trace

This rock is a medium-grained quartz diorite showing localized strong alteration.

It consists essentially of a rather equigranular, blocky, anhedral intergrowth, of grain size 0.5 - 2.0mm, made up of plagioclase with abundant accessory quartz. The latter occurs as evenly intergrown, individual grains as well as some coarse, pockety segregations.

The plagioclase typically shows weak pervasive alteration in the form of light dustings of sericite and an overall brownish (argillic?) turbidity.

Original mafics, occurring as small grains and networks interstitial to the quartz/plagioclase aggregate, are now totally altered to intergrowths of fine-grained, brown carbonate, chlorite, sericite and sub-opaque rutile/leucoxene (rims and skeletal clumps) in various proportions. Their original character is totally obscured, but they were probably mainly biotite.

The rock is affected by alate-stage alteration consisting of irregular, cross-cutting zones of veining and replacement by carbonate, with minor associated quartz. Some of these appear to be in the nature of localized zones of granulation. The carbonate alteration also penetrates extensively along grain boundaries and incipient microbreccia networks throughout the quartz/plagioclase aggregate.

The rock contains scattered individual grains of pyrite (and arsenopyrite?), 0.1 - 0.3mm in size. These show no apparent relationship to the zones of carbonate permeation.

Sample 88-11 134.5m.

ALTERED DIORITE

Estimated mode

Quartz	10
Sericite	15
Carbonate	57
Chlorite	18
Apatite	trace
Rutile)	trace
Opagues)	

This is an intensely altered rock whose origin can only be inferred from relict textural features and comparison with other samples of the suite.

It is interpreted as an altered diorite.

A relict, blocky, sub-prismatic fabric, on the scale 0.5 - 2.0mm, is recognizable. This apparently consisted principally of an intergrowth of plagioclase and one or more mafic silicates (probably hornblende). The plagioclase is totally altered to minutely fine-grained, compact sericite and carbonate, and the mafics to a feathery/lamellar intergrowth of brown carbonate and chlorite.

Quartz is seen as scattered pockets in the altered matrix. It shows angular/irregular, sub-graphic outlines clearly indicative of its origin as an intergrown accessory in a feldspathic igneous aggregate.

Rare tiny apatite euhedra also survive as remnant primary constituents.

The intense alteration of this rock appears to be largely of a pervasive, non-structural character. However, the slide also includes some sub-parallel veinlets (0.05 - 1.0mm thick) of carbonate and quartz which locally merge with the areas of strong pervasive carbonation.

Sample 88-14 209.35m.

Estimated mode

Clinopyroxene	65
Tremolite(?)	25
Chlorite	5
Sub-opaque alteration	5

This sample is composed essentially of an anhedral aggregate of clinopyroxene, of grain size 0.5 - 2.0mm. This is strongly pervaded by a brownish, turbid/sub-opaque alteration (leucoxene?) which tends to obscure any textural details. Judging from its colour in hand specimen, the pyroxene is probably diopside.

The diopside aggregate is traversed by irregular veinlets and replacement zones of a colourless, fibrous to felted mineral of similar birefringence to the pyroxene. This generally shows a somewhat inclined extinction, and is tentatively identified as tremolite. This mineral is also seen as sporadic areas of granular intergrowth in the pyroxene.

The only other component is chlorite, as scattered, intergrown flakes, and as diffuse streaks and pockets showing fine-grained, felted aggregate texture.

The origin of this rock is indeterminate from the petrographic evidence. It is of totally different type to the other three rocks of the suite. It could be an altered ultramafic (pyroxenite) or a contact metamorphic zone of skarnic affinities. The total lack of opaques or carbonate is a notable feature.

Sample 88-16 48.65m.

ALTERED DIORITE

Estimated mode

Plagioclase	55
Quartz	8
Sericite	5
Carbonate	26
Chlorite	6

This sample is clearly recognizable, in thin section, as a strongly altered intrusive rock of dioritic character.

The intensity of alteration is patchy, and there are substantial areas consisting of relatively unaltered (mildly turbid) plagioclase, as a coarse, blocky, anhedral aggregate of grain size 0.5 - 4.0mm. The plagioclase has the composition of andesine.

Quartz, as anhedral aggregates of grain size 0.2 - 2.0mm, occurs as an intergrown accessory. Its distribution is notably sporadic, as scattered, pockety segregations.

Much of the plagioclase shows strong (locally almost complete) pervasive alteration to fine-grained carbonate, sometimes with more or less intimately intergrown sericite. Carbonate also occurs filling a system of close-spaced, sub-parallel hairline veinlets.

The primary mafic constituent appears to have been hornblende. This is now totally replaced - occasionally with pseudomorphic preservation of the characteristic cleavage - by compact, brown carbonate and intergrown chlorite. A few streaky areas in which chlorite is the dominant constituent probably represent original accessory biotite.

The typical trace accessories of diorites, such as sphene, apatite and opaques, are notably absent.

Apart from the tracery of microfractures, the strong alteration of this rock appears to have taken place without associated brecciation or deformation.



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PHONE (604) 888-1323

Invoice 7564
August 1988

Sample: NN-1 88-18 30.50 m

Summary:

The rock is a cryptocrystalline chert which was cut by several sets of veins, in part with conflicting age relations. These include the following in order of increasing age (oldest to youngest):

- 1) quartz
- 2) quartz-chlorite-(chalcopyrite)
- 3) K-feldspar-(chlorite-Ti-oxide) (may be earlier than 2)
- 4) quartz-chlorite-Ti-oxide
- 5) quartz-albite-(chlorite)
- 6) calcite


John G. Payne

**NN-1 88-18 30.50 m Chert cut by Veinlets of several ages
containing one or more of Quartz, Chlorite, Albite, Ti-oxide,
K-feldspar and Calcite, and a trace of Chalcopyrite and Pyrite**

The rock is a cryptocrystalline to extremely fine grained chert containing minor chlorite. It is cut by early veins of quartz, quartz-(chlorite), and K-feldspar, by later irregular seams of quartz-chlorite-Ti-oxide, and late veins of quartz-albite-(chlorite) and of calcite.

chert	35-40%	
chlorite	0.3	
apatite(?) - opaque	trace	
veins		
early quartz-(chlorite)	8-10	
quartz-chlorite	25-30	
K-feldspar-(chlorite-Ti-oxide)	1	
quartz-chlorite- Ti-oxide	15-17	(brown veins)
quartz-albite-(chlorite)	4- 5	
calcite	1- 2	

The host rock consists of cryptocrystalline chert (grain size 0.002-0.003 mm, with minor disseminated chlorite. An early inclusion(?) 0.8 mm long may be an apatite grain containing very abundant dusty opaque. It was strongly segmented by early quartz veinlets.

The rock was cut by a network of early quartz veinlets, ranging from wispy seams less than 0.01 mm wide to veinlets averaging 0.03-0.1 mm in width. In these, quartz commonly is oriented perpendicular to vein walls. Some of these veinlets contain minor to moderately abundant chlorite.

These grade texturally into somewhat later veins and patches up to a few mm wide. These are dominated by very fine to fine grained quartz with minor to abundant irregular patches of very fine to fine grained chlorite. Locally quartz is medium grained. Textures commonly indicate that these veins were recrystallized under strain. A few contain subparallel, elongate quartz grains up to 1.5 mm long, with strongly strained extinction and very irregular grain borders (produced by recrystallization in response to shearing). Associated with these, and possibly of the same age or later are lenses and veinlets of very fine grained chlorite. These are from 0.05-0.3 mm in width.

The host rock is cut by veinlets up to 0.1 mm wide of very fine grained K-feldspar with minor chlorite and dusty semiopaque to opaque; these are later than the early quartz veinlets.

Late veins (brown in hand sample) up to 3 mm wide (average 0.5-1 mm) consist of extremely fine grained quartz (0.01-0.03 mm) with moderately abundant disseminated chlorite (0.005-0.01 mm) and Ti-oxide (0.005-0.015 mm). Ti-oxide also forms a few lenses up to 0.05 mm wide and 0.3 mm long within these veins, commonly near and parallel to their borders. These veins have moderately irregular, wavy outlines, and commonly are somewhat braided. They may be cut by veinlets of quartz-albite-(chlorite).

Quartz-albite-chlorite forms very fine to fine grained veins up to 0.2 mm wide. These grade texturally into the earlier quartz-(chlorite) veins; however, deformation is much less intense and vein outlines sharper than those of the earlier veins.

(continued)

Late veinlets up to 0.2 mm wide consist of fine to medium grained calcite, locally possibly with patches of quartz and chlorite. These are fracture filling veinlets, which are well developed in chert, but commonly are weak or discontinuous where they crosscut earlier quartz veins.

Chalcopyrite and lesser pyrite form scattered anhedral grains averaging 0.0-2-0.05 mm in size. These occur mainly in the quartz-(chlorite) veins, but a few grains also are present in the host rock and in the quartz-chlorite- Fe -oxide veins.