

MINERALOGICAL REPORT No. 7942

by Alan C. Purvis, PhD

28th January, 2000

TO : Mr Paul Melville
PNC Exploration (Aust) Pty Ltd
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NIGHTCLIFF NT 0814

YOUR REFERENCE : Facsimile letter from P. Melville, dated 6/12/99

MATERIAL : 4 samples, variably of rock and RAB chips

IDENTIFICATION : 109766, 109791 to 109793

WORK REQUESTED : Thin section preparation, description and report
with comments as specified.

SAMPLES & SECTIONS : Returned to you with this report.

DIGITAL COPY : Enclosed with hard copy of this report.

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SUMMARY COMMENTS

The Four rock, core and chip samples discussed in this report are described using normal thin sections including chips of many samples which required initial mounting in epoxy. Selected section offcuts were stained for k-spar using sodium-cobalti-nitrite. The samples are listed below indicating the rock-type as identified by the petrography, also alteration and veins as appropriate, followed by summary comments.

No	Lithology	Alteration	Veins
109766	Metagabbro (amphibolite)		
109791	Tonalite gneiss	Chlorite-clay altered	Quartz veins
109792	Tonalite gneiss	Sericite-clay altered	Quartz-sericite veins in two sets along a fine fracture network.
109793	Coarse massive granitoid (?), possibly a granodiorite.	Sericite-clay-chlorite and secondary K-spar	Clay-sericite-quartz-K-spar veins, internally laminated/zoned

LITHOLOGICAL GROUPS

The several lithological groups identified in this batch, include a single weakly altered sandstone to fine conglomerate, also numerous quartz-free to quartz-rich metasediments, mafic to felsic and massive to gneissic igneous rock types, most of which show extensive alteration variably to clay-sericite-limonite-leucoxene, minor more localised chlorite and secondary k-spar. The lithological groups are:

1. Mafic igneous lithologies [109766]

Sample 109766 is a massive plagioclase-rich metagabbro with hornblende after pyroxene.

2. Felsic igneous lithologies [109791, 109792 and 109793]

Tonalite gneisses occur in 109791 and 109792. 109793 has abundant secondary K-spar, some of which seems to have replaced plagioclase, some of which may represent inverted primary K-spar (now microcline to adularia?). This sample (109793) is the only clear example of potassic alteration, the bulk of altered samples showing phyllic alteration.

ALTERATION AND VEINING

Alteration is commonly strong, variably involving :

- (1) mostly sericite after feldspar (mostly as complete replacement of plagioclase, partly after K-spar) including sericite replacing the feldspar in myrmekite;
- (2) subordinate sericite, chlorite, clays, limonite and leucoxene after biotite;
- (3) minor chlorite after hornblende and/or pyroxene;
- (4) rarer uraltic amphibole after pyroxene.

Most of these samples, from 109791-109793 have sericite partly to completely replacing plagioclase, with K-spar after plagioclase in 109793. In most cases, any biotite has been replaced by various combinations of chlorite, sericite or clay, together with leucoxene and/or limonite. Dominantly phyllic alteration is indicated, with rare potassic alteration

Veins with sericite and cherty to microsparry or columnar quartz are common (in sample 109892, healing a microfracture network). These seem to be of low-temperature hydrothermal or even epithermal origin. They suggest low pH values (~3-4?). More normal quartz veins occur in 109791. Potassic alteration forms veins in 109793. A 6mm wide vein in the massive, coarse, altered granitoid 109793 is internally zoned-laminated with clay-sericite microsparry quartz and secondary k-spar, also of probable low temperature hydrothermal alteration.

CONCLUDING REMARKS

This suite includes metasediments and a wide variety of deformed to massive, mafic to felsic igneous lithologies, two breccias and a relatively unmetamorphosed sediment. There is relatively common quite intense phyllic alteration; also veinlets and veins of quartz-sericite including cherty, microsparry and columnar quartz are widespread. Pyrite is rare. Some few samples show potassic alteration.

INDIVIDUAL DESCRIPTIONS

109766 **Metamorphosed leucocratic gabbro with minor opaque oxide.**

Field Note: *Amphibolite (of igneous origin?).*

Hand-specimen

Coarse plagioclase seems to dominate this sample, which has interstitial or anastomosing dark zones, probably hornblende, comprising possibly 20-25% of the rock. This suggests a former leucocratic gabbro or diorite.

Thin section

Primary zoned plagioclase is abundant as grains from 2 to 10mm long, and is accompanied by apparently recrystallised plagioclase from 0.2 to 1mm in grainsize, usually marginal to the coarser primary plagioclase or in a mosaic with green hornblende. The total plagioclase content is about 70-75%. Small inclusions of hornblende occur in the plagioclase and there are apparent veinlets now composed of hornblende. Interstitial hornblende seems to be more abundant in this thin section than in the hand-specimen, comprising close to 25% of the rock. It is mostly granular or prismatic and 0.5 to 4mm in grainsize. Small rounded inclusions of quartz occur to 0.25mm in diameter (~1%) and there are areas within which disseminated rounded opaque oxide grains, probably ilmenite, are abundant. The plagioclase seems to be calcic, suggesting a metamorphosed leucocratic gabbro.

109791 **Tonalite gneiss with strong chlorite-clay-sericite alteration of the abundant plagioclase and the minor biotite.**

Field Note: *Altered chloritised gneiss.*

Hand-specimen

This is a grey and white granular gneiss with some grey-green grains that may be amphibole or chlorite.

Thin section

The thin section is dominated by clay-sericite-altered plagioclase grains (50-55%) apparently as much as 5mm in grain size, which form a composite coarse gneissic-textured aggregate with abundant (~40%) quartz in lenses aligned roughly parallel to a foliation defined by altered biotite. The quartz occurs in lenses to 5mm long, composed of ragged grains to 3mm in length. Former biotite (~5%), to 3mm long in discontinuous wavy foliations, has chlorite-clay-leucoxene alteration and accessory inclusions of apatite. There are also patches of chlorite with little or no leucoxene (~2%), some of which may have replaced an amphibole, but the origin of these patches is unclear. Narrow quartz veins are present.

This seems to be a tonalite gneiss with strong sericite-chlorite-clay alteration.

109792 **Fine-grained tonalite gneiss with extensive sericite-clay alteration. Numerous irregular quartz-sericite veinlets, some later than, and off setting, earlier veins, along a sporadic microfracture network.**

Field Note: *As above, brecciated.*

Hand-specimen

There seems to be a foliation in this sample, which is finer-grained than the previous sample but otherwise similar in overall texture and colour.

Thin section

As in 9792, this sample is dominated by plagioclase (~60%), completely altered to clay-sericite but with grain boundaries more clearly defined than in the previous sample, and has possibly some albite as well as abundant sericite replacing the plagioclase. The plagioclase is seen to have been inequigranular, from 0.2 to 2mm in grain size, and is accompanied by less abundant (~30%) quartz than in the previous sample. The quartz is mostly fine-grained and seems to have been recrystallised, but there are rare grains to 2mm long. Clay-chlorite-altered biotite is again abundant (~5%) and defines a foliation, with flakes to 1mm long.

There are complex veins to 2mm wide, typically at a low angle to the foliation and along a somewhat sporadic fine fracture network of cherty to fine prismatic quartz set in massive sericite. Some of these veins have been offset by 2 to 6mm along later layer veinlets with a similar mineralogy, generally at a high angle to the earlier veins and to the foliation. Veins make up about 5% of this thin section, which has been net-veined rather than brecciated as suggested in your notes.

109793 **Massive coarse granitoid (tonalite or granodiorite?) extensive alteration involving sericite, clays, chlorite. Also secondary K-spar, mostly clouded by clays and limonite, locally fresh (microcline to adularia?).**

Field Note: Coarse-grained granitoid from within a breccia zone.

Hand-specimen

This core-segment seems to represent a massive granitoid with abundant pinkish K-spar (as indicated on the stained offcut), quartz and altered biotite. Some of the K-spar seems to be secondary, with apparently residual areas of plagioclase. A composite internally microzoned vein to 6mm wide along a margin of this rock, has fine k-spar (seen on the stained offcut) within apparent fine quartz and clay-sericite.

Thin section

There is abundant (~60%) feldspar in this sample, from 0.5 to 8mm in grainsize. Some grains, and areas within other grains, have multiple twinning and sericite clouding and are clearly plagioclase, but other grains, and areas within grains, are untwinned, with sericite-clay-limonite staining and seem to correspond with areas of K-spar as shown on the stained offcut. There is more abundant apparent K-spar in the larger grains, and some of the smaller grains are entirely albite to sericite-altered plagioclase. Grains of clear K-spar are also present. Some have areas of microcline twinning, but one has a low 2V and may be adularia. It seems that this was originally a plagioclase-rich grainitoid (granodiorite or a tonalite?), and most of the K-spar is apparently of secondary origin.

The quartz in this sample (~30%) is present as aggregates of ragged interstitial grains to 4mm in grainsize. Clay-chlorite-sericite-leucoxene-altered biotite is common (7-8%) as unoriented flakes to 4mm long, commonly with lenses of clay parallel to the cleavage. A single altered biotite flake, 8 x 2mm, is also present. Inclusions of apatite and of leucoxene after fine-grained opaque oxide are common. There are also chlorite patches, 1-3mm in diameter (2-3%), with a low leucoxene content, apparently after amphibole.

There are narrow sericite veins and a distinctive wide vein system, about 6mm wide, with internal composite laminations along one side of the hand-specimen. The several laminated zones within this wide vein mostly consist of trains of fine sparry quartz prisms along margins and pointing inwards into a clay-sericite infill. Areas of sericite and clouded clays, locally with rare K-spar, also occur between these zoned veins, (with the K-spar again visible on the stained offcut). This vein probably has a low temperature hydrothermal genesis.