

MINERALOGICAL REPORT No. 7240/7411

by Alan C. Purvis, PhD.

TO : Mr Andrew Mackie
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YOUR REFERENCE :

MATERIAL : 4 rock samples

IDENTIFICATION : 4924, 4928, 4929 & 5923

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

SAMPLES & SECTIONS : Returned to you with this report.

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SUMMARY COMMENTS

Four samples from western Arnhem Land in the Northern Territory are described in this report using normal thin sections. Some of the offcuts were stained with HF and sodium cobaltinitrite to reveal alkali (potassium) feldspar (stained yellow). This staining also allows plagioclase (white to cream) to be distinguished from quartz (unstained). In the covering letter from Andrew Mackie, it is stated that these samples are largely from the Nimbuwah Complex (intrusive rocks) and Myra Falls Metamorphics (metasediments).

These rocks are predominantly of igneous or meta-igneous origin, from ultramafic to acid, but no unweathered and unaltered metasediments were seen.

LITHOLOGICAL GROUPS

Mafic

Most of the mafic rocks are foliated amphibolites and are of amphibolite facies in terms of metamorphism. Sample 4929 has some residual igneous clinopyroxene and may be of a lower metamorphic grade than the other mafic rocks other than sample 4924. Sample 4924 is an unmetamorphosed dolerite with plagioclase phenocrysts and very minor largely fresh olivine.

All of the mafic rocks seen to be dolerites to metadolerites.

Granitoids

The most common granitoid type is a foliated biotite \pm hornblende-bearing tonalite to monzogranite/adamellite with accessory allanite, apatite, minor zircon and alteration, as indicated above, to chlorite, epidote, prehnite and pumpellyite in different proportions. These granitoids include 4928 (tonalite).

Quartz monzonite

Samples **5923** is a quartz monzonite, mostly with deep green to olive-green hornblende and biotite in various proportions. Sample 5923 is heterogeneous with alkali feldspar megacrysts. Sample 5923 has some pumpellyite, but the normal alteration pattern, as indicated for the other granitoid groups, is seen in this group.

The samples are listed on Table 1, attached to this report.

TABLE 1: LIST OF SAMPLES DESCRIBED IN REPORT NO. 7240

No.	Lithology	Mineralogy	Metamorphism
4924	Dolerite	Fresh, plagioclase porphyritic with clinopyroxene and olivine	Unmetamorphosed
4928	Tonalite	Biotite-hornblende bearing with allanite.	Unmetamorphosed, some prehnite.
4929	Metadolerite	Actinolite-rich, some residual clinopyroxene	?Greenschist
5923	Quartz monzonite	Hornblende-biotite-bearing with orthoclase megacrysts.	Unmetamorphosed, some pumpellyite.

INDIVIDUAL DESCRIPTIONS

4924 Fresh unmetamorphosed plagioclase porphyritic dolerite with minor olivine and opaque oxide.

Mineral	Vol%	This is a fresh unmetamorphosed dolerite with some plagioclase as phenocrysts to 7 mm long as well as some coarse prismatic to ophitic clinopyroxene grains to 15 mm long, and minor fresh to clay-limonite-altered olivine. The olivine is granular and occurs as grains to 2 mm in size, with some smaller grains enclosed in one of the plagioclase phenocrysts.
Plagioclase	65%	
Clinopyroxene	25-30%	
Olivine	3%	
Oxide	3-4%	
Biotite	<1%	
Apatite	tr	

There is an abundant groundmass dominated by plagioclase laths 0.2 to 1 mm long, intergrown with the coarse ophitic clinopyroxene and with only rare fine grained clinopyroxene. Large patches of opaque oxide also occur, rarely to 4 mm long, and minor biotite. Apatite is relatively rare, however.

4928 Biotite-hornblende tonalite with minor alkali feldspar, also altered possible allanite.

Mineral	Vol
Quartz	35-40%
Plagioclase	45%
Biotite	8-10%
Hornblende	7-8%
Alkali feldspar	2-3%
Apatite, zircon	<1%
?Allanite	tr

Quartz is much more abundant in this sample compared with the previous sample, but there is less abundant alkali feldspar, also irregularly disseminated, but no foliation. In thin section, the rock is dominated by irregularly sericitised plagioclase to 8 mm long of quite ragged grains. There is also common brownish green hornblende to 4 mm grainsize and decussate biotite to 3 mm in grainsize, commonly altered to chlorite + leucoxene \pm prehnite. The biotite and to a lesser extent the hornblende, carries apatite inclusions and the hornblende in some areas has inclusion of quartz. As indicated above, alkali feldspar is uncommon, but occurs as grains to 5 mm in size, with minor myrmekite attached to the alkali feldspar in some places.

Rare grains which appear to be altered metamict allanite occur to 2 mm long as well as rare zircons to 0.2 mm in length. There are narrow late fractures containing prehnite.

4929 Metadolerite with minor biotite and some residual clinopyroxene. Partly sericitised, with a prehnite vein.

Mineral	Vol%
Plagioclase	40-45%
Actinolite	50%
Clinopyroxene	3%
Biotite	2%
Oxides	3%

The stained offcut from this sample shows a single plagioclase phenocryst 10 x 5 mm, but only a small part of this is retained on the thin section, where it shows partial alteration to sericite. The host rock is a metadolerite with some areas retaining primary ophitic clinopyroxene to 1.5 mm in grainsize. However in most of the rock the pyroxene has been altered to uralitic to recrystallised actinolite or hornblende. The groundmass plagioclase laths, to 1 mm long, vary from fresh to sericitised and there is minor biotite, some of which may be primary. Some metamorphic biotite may be present, especially within the actinolite pseudomorphs after pyroxene. Disseminated skeletal opaque oxides, possibly with both ilmenite and magnetite, are present as accessories. There is a cross cutting prehnite vein with minor carbonate.

**5923 Megacrystic hornblende-biotite-quartz monzonite with orthoclase
 megacrysts and sericite-prehnite-chlorite-clay-leucoxene
 alteration.**

There is considerable similarity in hand-specimen between this sample and 5919, as both have irregularly disseminated alkali feldspar megacrysts (?phenocrysts or augen) in a matrix with fresh to altered ferromagnesian grains as well as probable plagioclase and quartz. The thin section contains a zone from 2 to 8 mm wide containing large orthoclase grains, as well as abundant weakly sericite to prehnite-altered plagioclase laths, quartz and ferromagnesian aggregates. The plagioclase occurs as grains, laths and more equant, possibly tabular grains from 0.5 to 7 mm in maximum dimension, but seems to be unzoned.

The ferromagnesian aggregates include fresh olive-green hornblende as well as totally altered biotite. The biotite has been altered to chlorite or to clay-prehnite mixtures, all with lamellae leucoxene. Inclusions of apatite and opaque oxide occur in the ferromagnesian aggregates, with some opaque oxide also in the plagioclase. Late magmatic quartz is very irregularly disseminated in lenses from 1 to 8 mm in maximum dimension. Small quartz inclusions also occur in both the ferromagnesian aggregates and the plagioclase, and there is rare myrmekite, with a sericitised plagioclase component. Rare patches of a bright yellow mineral, seen in prehnitised granitoids elsewhere, are also evident.

The irregular distribution of alkali feldspar megacrysts in sample 5919 makes it difficult to give a representative visually estimated mineralogy based on such a small hand-specimen; however the visually estimated mineralogy seems to be approximately as listed below:

1. Orthoclase megacrysts	30-35%
2. Weakly sericite-prehnite-altered plagioclase	45-50%
3. Quartz	10-15%
4. Fresh olive-green primary hornblende	4%
5. Chlorite to clay-pumpellyite-altered biotite (with lammellar leucoxene)	4%
6. Apatite, oxides, bright yellow secondary mineral (?)	<1%

The rock is classified as a megacrystic hornblende-biotite quartz monzonite with sericite-prehnite-chlorite-clay-leucoxene alteration.