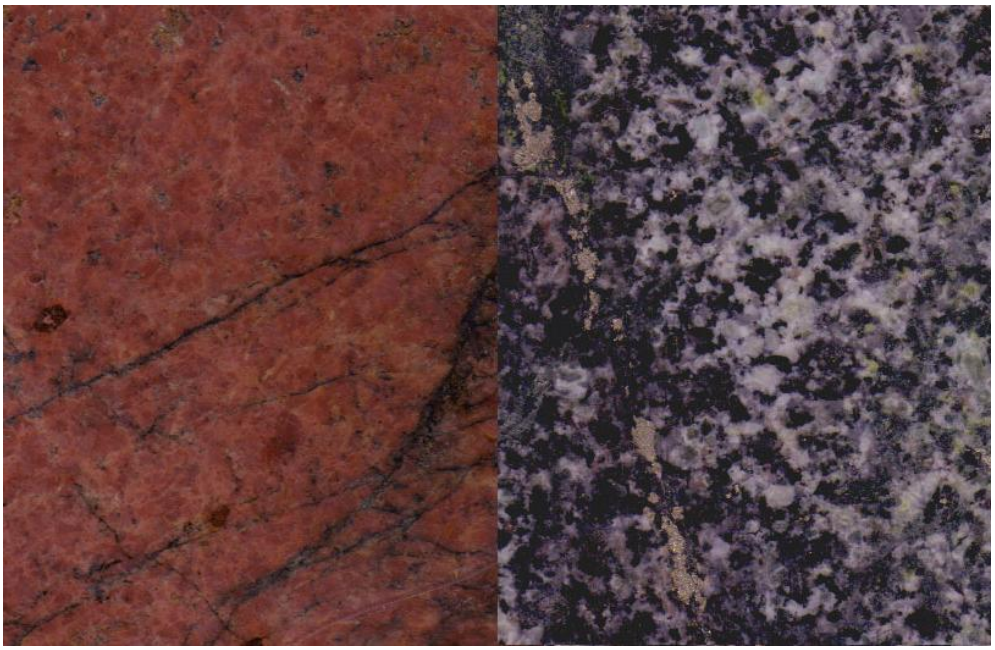
Pallawah Hill Annual Report 2009 – EL 45/2006



Altered and mineralised examples of Dove Granite.

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Pluton Resources

March 2009

Summary

The Pallawah Hill exploration licence (EL45/2006) was granted on April 16th 2007. This report is the second annual report for Pallawah Hill and is submitted in a Mineral Resources Development Act (1995) compliant format by Pluton Resources Ltd. (Australian Stock Exchange Code: PLV, hereafter Pluton). Pluton holds a 100% interest in the lence by way of it's subsidiary Dove River Pty. Ltd.

The Pallawah Hill exploration licence has a number of mineral occurrences, an unexplored gold prospect (Little Bell) and a number of sites with altered Cambrian rocks. The licence has not previously been systematically explored for copper and gold, only regional assessments have been made.

Pluton Resources has focussed on the region because it is believed that there are many characteristics of the copper-gold porphyry districts in New South Wales, which includes the Cadia and Goonumbla deposits. The similar characteristics identified include the setting and chemistry of the host rocks, as well as the styles of alteration.

Recent reconnaissance scale mapping and interpretation of modern geophysics (previous to the application) by Pluton shows the Pallawah Hill area contains areas of alteration within and adjacent to the Dove Granite 'intrusive complex'. Rock chip sampling from the eastern part of the licence has identified better than expected alteration within the previously 'less prospective' parts of the Dove Granite. A more systematic hand sampling program is still planned for the region. No reduction in the current licence area is planned before this assessment is complete.

Work performed by Pluton to date has identified four areas of interest within the licence: the Campbell River copper occurrence (a potential extension of the Devon Mine structural corridor); the strongly altered Mersey River 'pluton' and granite margins; the Olivia Creek base metal occurrence; and the strongly altered intrusives on Gads Hill. These areas are likely to be the main focus of the ongoing work program.

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Tenure

A tenement application (ELA 45/2006) was made for an area of 60km^2 immediately adjacent to the 100% Pluton owned Dove River exploration licence. The tenement was granted by the Minister for Resources on 16th April 2007. The exploration licence is located within the Mt Read Strategic Prospectivity Zone. This provides for security of exploration tenure by way of compensation of reasonable cost of work conducted (or resource defined) if a change in the tenement's land status results in the licence being revoked. The licence is held by Dove River Pty. Ltd. a subsidiary wholly owned by Pluton Resources Ltd.

Location and land classification

The licence is located south-west of the township of Sheffield (pop approximately 1000) and about 60km from port facilities at Devonport (figure 1). The licence land classification consists of State Forest, MDC Informal Reserves, Forest Reserve, Private Land, Regional Reserve, lakeside HEC controlled land.

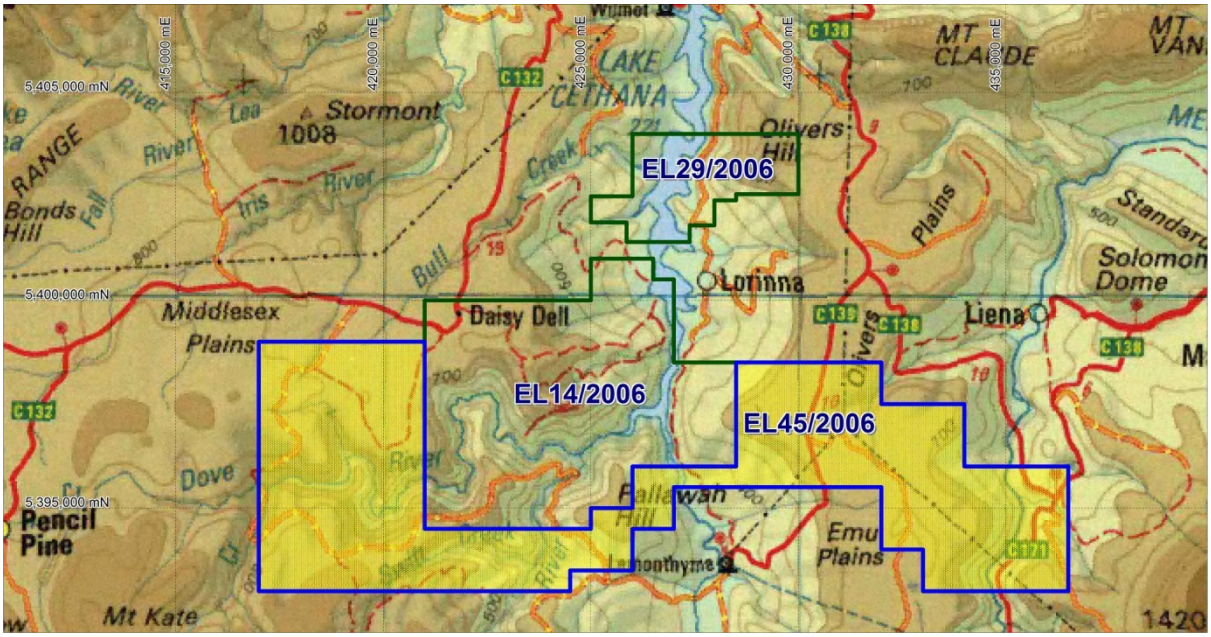

Figure 1: EL45/2006 location, licences with green boundaries representing Pluton's other granted licences.

Topography

The licence traverses Gads Hill and the Mersey and Forth Valleys either side. The western part of the licence is dissected by the Campbell and Dove Rivers. The topography of the licence is variable with relatively flat areas on Gads Hill and adjacent to Middlesex Plains (defined by basalt plateaus) and deeply incised valleys below them. Contours vary from 230m at the edge of Lakes Cethana to >700m on Olivers Plains. The slopes above the Dove River and Mersey River are steep with areas west of Pallawah Hill particularly rugged. Despite the variable topography the access is quite good (see below).

Access

The level of access to the broad (east – west) licence is good with only the major rivers having incised valleys that are not easily traversed.

Access to the Western Part of the Pallawah Hill licence is via the Cradle Mountain Link Road (C132) by way of gravelled forestry track that runs southerly from the Middlesex Plains area. Access to the central part of the licence south of the Dove River is via Lemothyme Road (C139) then a bridge over the Forth River above the Lemonthyme Power Station. This forestry access has a locked gate and the tracks contour westward around Pallawah Hill. Access to Gads Hill is via the Lemonthyme Road and Gads Hill Road (an easterly turn off). The eastern most access is via the Mersey Forest Road, this is connected to Gads Hill by way of Olivers Road via Liena.

Vegetation and Soil

Vegetation comprises wet and dry eucalypt forest typically dominated by Eucalyptus Viminalis, Obliqua and Amygdalina spp. On wetter south facing slopes and near river banks there is dogwood scrub and Acacia Dealbata forest. Rainforest is occasionally present adjacent to creeks and on elevated basalt plateaus. Undergrowth is dependent on how dry the site is, but typically consists of spiky heath or ferns.

The soil profile is extremely variable with deep soils over both granite and basalt. In areas of deep incision the soil profile is almost non-existent with exposed weathered bedrock and significant talus slopes.

Geology

EL 45/2006 is contained within the northern portion of the arcuate Mt Read Volcanic belt which wraps around the Precambrian Tyennan basement. This belt comprises Cambrian c500Ma Mt Read Volcanics and associated intrusive rocks, unconformably overlain by Cambro-Ordovician siliciclastics and limestones. The Mt Read Volcanic belt is highly mineralised, containing numerous polymetallic VHMS-style deposits (e.g. Hellyer, Que River, Rosebery) and volcanogenic copper-gold deposits (eg. Mt Lyell, Henty). Parts of the Palaeozoic sequence are covered by Tertiary basalt.

Very little detailed work has been undertaken in the current licence area. A description of the known lithologies and observed variations within the licence are summarised below.

Precambrian Schist

The oldest rocks in the area are Proterozoic schists. The schists are strongly deformed and have a well developed foliation, they are typically light grey with a dark grey spotting or banding with mica rich and quartz rich alternating bands. Reid (1967) describes these rocks as quartz-sericite schists and quartzites. The schists occupy the southern margin of the lease and are intruded by the Dove Granite and are probably unconformably overlain by the Cambrian Volcanics

Cambrian Volcanics

The Cambrian volcanics within the licence area have not been assigned a formal correlation with the Mt Read Volcanic stratigraphy, however the volcanics appear to be scarce within the licence. The Cambrian sequence is dominated by the intrusive Dove Granite.

Dove Granite
The Dove Granite is regionally mapped as three occurrences, one in each of the Mersey, Forth and Dove valleys with exposures known on Gads Hill and as dykes within the Precambrian Schist. The Dove Granite is of variable composition with many workers attributing the associated porphyritic units to marginal phases of the main 'stocks' (eg: Herrman in Fleming and Castro, 1989). The granitic rocks are tentatively subdivided into three phases: felsic biotite granite (Monzogranite), felsic biotite-hornblende granite/granodiorite and intermediate hornblende granodiorite/quartz-diorite. These descriptions are from recent petrological work and initial hand specimens and drill core descriptions including some from the adjacent Dove River licence and are not definitive petrogenetic terms.

The variability in granite samples collected from the Mersey Forest Road show a range of alteration styles, particularly evident is the strong sodic (albite) alteration which produces an apparent leucogranite by way of ferromagnesian mineral replacement. Similarly on Gads Hill specimens with strong potassic alteration appear to be almost pure orthoclase in hand specimen. Further study of the geochemistry and review of the petrology as it becomes available should determine the true composition and classification of the phases of the Dove Granite.

Tertiary Basalt
The Tertiary Basalt is a fine-medium grained vesicular dark rock with occasional zeolites and calcite veins. It is commonly underlain by Tertiary sediments. Herrmann in Fleming and Castro (1989) estimated Tertiary Basalt flows south of the Post Office Tree are likely to be only a few tens of metres thick. No attempt has been made to assess the thickness of basalt as yet.

Quaternary Glacial and Fluvial Deposits
Although not prominent in the main part of the licence there are surficial deposits of known glacial origin on the flanks of the Mersey River valley.

Exploration History

James 'Philosopher' Smith discovered alluvial gold in the Forth River in 1859 near Golden Point approximately three kilometres north of Lorinna (Jennings 1963). The Campbell brothers opened the first hard rock mine in the early 1880's on the east side of the Forth River. In 1887 a gold discovery at Five Mile Rise was made by J Aylett at the "Great Caledonian" Mine (Reid, 1919). The proximity of these deposits to the Dove Granite has prompted minor interest and no significant hard rock workings have been reported in the tenement, however regionally workings have been confined to the adjacent tenement to the North. No systematic exploration has been recorded for disseminated copper-gold mineralisation within the tenement area, however several regional stream sediment surveys have covered the area RGC (1989-1990), MT LYELL (1965-1971) and FREEPORT (1973).

For a summary of these activities see McDougall and Reed (2007).

Work to date

The licence was applied for cover extensions of mineralisation and alteration mapped on the adjacent Dove River Licence (EL14/2006) and to cover historical stream sediment anomalism mapped in the Olivia Creek area (west of the Dove River EL14/2006). Also the

idea was cover eastern extensions of the Dove Granite. Exploration in the Mt Read Volcanics and younger rocks south of Sheffield will continue to focus on rock and possibly soil sampling, utilising existing access tracks and roads. Activities to date are summarised below.

Geophysical and Geological assessment

A regional assessment of the Western Tasmanian Regional Minerals Program data was made and this identified areas of high radiometric response associated within and adjacent to known Dove Granite occurrences.

Particular prospects include the southern extension of the Devon structure in the Campbell River. There are also potentially parallel structures containing base metals in Olivia Creek, west of the Devon Mine.

Rock Chip Sampling

Rock samples were collected on a sub-regional basis during reconnaissance mapping traverses for geochemical analysis and lithological comparison. Rock chip sampling from the eastern part of the licence has identified better than expected alteration within the previously 'less prospective' parts of the Dove Granite. Initial results for gold and copper have not revealed any strong anomalism, however an assessment of whole rock and REE data is underway to identify if alteration or rock types are prospective indicators of porphyry mineralisation.

The rock chip traverse done on the Mersey Forest Road will be used to provide baseline data for anomalous element concentrations in relatively un-mineralised granite. Prospective features identified during this traverse included indications of potassic, sodic and phyllic alteration. The copper and gold values from preliminary assay are not anomalous, however the propylitically altered volcanics adjacent to the intrusive body are very high in iron (>15%) suggesting a high fluid flow.

Rocks collected from Gads Hill are also strongly altered with orthoclase dominated potassic alteration, photographs of this strong type of alteration can be found in Appendix 2 of the previous annual report and on the left hand side of the cover page of this report. The raw geochemical data and locations are presented in Appendix 1 of the previous annual report.

Mapping

The area has been mapped at a reconnaissance scale only, with the focus being on Gads Hill where a reference to azurite and known outcrops of Dove Granite have been investigated. The area contains boulder size outcrops of diatreme breccia which contains quartz veining. The surrounding Granite is strongly potassically altered and contacts with the diatreme breccia preserved in boulders are sharp. Pluton believes this area which includes the Little Bell gold prospect should be the focus of a soil survey and more detailed mapping. Data from the multi-element analyses done on mineralised drill holes at both Devon and Cethana will be used to determine indicator elements to be included in the geochemical survey.

Petrography

Seven samples from previously collected rock chips (152802, 152804, 152805, 152807, 152808, 152810, 152812) were sent for petrographic determination to better identify their composition. The Dove Granite samples are described as a suite of granodiorite, monzonite (syenite?), monzogranite and quartz diorites with incipient to strong alteration. Propylitic alteration is the most common with best development in the adjacent (intruded) volcanics. Albitic alteration is limited to quartz poor intrusives. Full descriptions by contract petrologist Paul Ashley are presented in Appendix 1.

FUTURE WORK (,discussion and conclusions)

Petrographic work and ongoing lithogeochemical assessment have not precluded the target style of mineralisation from the area. Priority work includes a geochemical survey on Gads Hill which includes the Little Bell gold prospect which will likely be the focus of a soil survey. Pluton also intends to undertake mapping traverses on Forestry Roads, Campbell's River, Mersey River and Olivia Creek. Rock chip sampling will be ongoing with possible soil surveys, IP follow up and drilling likely in years 3 and 4 if a suitable target is found that matches patterns of known mineralised occurrences at the Cethana and Devon Prospects.

Pluton is looking for a bulk tonnage copper-gold-molybdenum-REE target on the licence and the focus of work will be to collect more baseline data, particularly multi-element geochemical data for comparison with our database of regional rock chips. More intense exploration will be planned where appropriate targets are defined.

Environment

No environmental impact has occurred with the office/lab based continuation of the program

Expenditure

Approximately $2000 has been expended on Petrology although invoices are still not received. Another undisclosed amount (approximately $3000) has been expended investigating the geochemical characteristics of the field specimens, this work is ongoing.

References

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Reid, A.M, 1919. The Mining Fields of Moina, Mt Claude and Lorinna, Geological Survey Bulletin 29, Geological Survey of Tasmania.

Twelvetrees, W.H, 1907 Report on the Bell Mount and Middlesex Tinfields, Secretary of Mines Report, Geological Survey of Tasmania

Waller, G.A, 1901, Report on the mineral Districts of Bell Mount, Dove River, Five Mile Rise, Mount Pelion and Barn Bluff. Secretary for Mines Report 1900-01, Geological Survey of Tasmania

Appendix 1 – Petrological Descriptions

PETROGRAPHIC REPORT ON SEVEN OUTCROP ROCK SAMPLES FROM NORTH-CENTRAL TASMANIA

For

Pluton Resources Limited

Reference: Email from John McDougall 12-12-08 and subsequent emails. Sample receipt 15-12-08

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Interpretation and Comment

Three rock types were identified within the suite of samples taken from the Pallawah Hill licence:

- Sample 152808 represents a felsic volcaniclastic rock, possibly an epiclastic.
- Three other samples represent medium to coarse grained, locally porphyritic, I-type granitic rocks (Dove Granite and relatives), mostly ranging from granodiorite to monzogranite. These include the samples 152802, 152805 and 152810.
- Three samples represent strongly feldspathic altered granitoids, including sodic types (152804, 152807) and potassic type (152812)

Preserved primary mineralogy, or inferences on primary mineralogy, indicate that the granitic rocks range from monzogranite to granodiorite, with a few being somewhat more leucocratic, but most being mesocratic and having 10-25 volume % of ferromagnesian minerals. Textures range from porphyritic to more even-grained and inequigranular, with grainsize being medium to coarse grained. Primary igneous minerals include abundant plagioclase and commonly subhedral grains of biotite and hornblende, with abundant interstitial quartz and minor to moderate amounts of K-feldspar. FeTi oxide (titanomagnetite), apatite and zircon are characteristic accessory minerals, commonly being in association with the ferromagnesian phases, but with larger apatite grains being isolated in feldspars. It is possible that a little pyroxene might have originally been present, enclosed in hornblende, but if so, all pyroxene was subsequently altered. Micro-enclaves of more mafic composition that the host occur locally (e.g. in 152810) comprised of hornblende ± plagioclase, biotite, FeTi oxide, apatite. The less altered granitic rocks are all moderately magnetic, and what with the presence of hornblende in most, indicate that they are of I-type character.

The three samples dominated by either sodic or potassic feldspars (152804, 152807, 152812) could superficially be viewed as feldspar-rich igneous rocks (e.g. syenitic). However, the fact that their textures differ from "normal" igneous rocks and that they have a suite of other (minor) alteration minerals, implies that they are products of strong replacement of originally granitic protoliths. There is a possibility that the protoliths were of similar character to the Dove Granite, but that there has been strong mineralogical and textural transformation.

All samples in the suite show the effects of alteration. Alteration effects range from mild (e.g. only slight replacement of igneous minerals in a few of the granodiorites/monzogranites) to intense.

Feldspathic alteration of various types is restricted to the granitoids (152804, 152807, 152812), although vestiges of potassic alteration, manifest by local replacement of igneous minerals by K-feldspar and (hydrothermal) biotite could have occurred in granitic rock 152802 (prior to retrograde alteration). In samples 152804 and 152807, it is interpreted that albitic feldspar replaced initial igneous feldspars (and possibly quartz), with associated or later replacement by minor sericite/muscovite, epidote, chlorite, prehnite and tourmaline. Sample 152807 is unusual in that it contains several volume % of rather coarse titanite, texturally in late magmatic habit. In sample 152812 replacement of igneous feldspars ± quartz by K-feldspar (hematite-pigmented) has occurred, with accompanying or later replacement by one or more of sericite, chlorite, hematite, magnetite and rutile. Volcaniclastic rock sample 152808 displays unusual alteration (for the suite) in having replacement by quartz-epidote-magnetite (-pyrite-chlorite). There is evidence of local Fe-enrichment during alteration, manifest in replacements by Fe-rich minerals including magnetite, Fe-bearing sulphides, epidote.

In the granitic rocks, only minor veining has been observed. Possible early veining occurs in 152802, where thin veins of K-feldspar-magnetite-pyrite-biotite were emplaced. Minor veining by chlorite-magnetite (-quartz-sericite) in 152812 and sericite/muscovite in 152804.

DETAILED DESCRIPTIONS

152802 TS

Summary: Medium to coarse grained, inequigranular biotite-hornblende granodiorite, with moderate alteration effects. The rock contained abundant plagioclase, with less common hornblende and biotite, enclosed by abundant interstitial quartz and minor K-feldspar. Accessory apatite and FeTi oxide grains are locally present. There may have been initial localised potassic alteration, manifest by patchy replacement of igneous ferromagnesian grains by finer grained secondary biotite, and by the occurrence of a couple of thin veins of K-feldspar-magnetite-pyrite-biotite. Later alteration is of propylitic type, with development of sericite, chlorite, epidote and trace pyrite, mainly from ferromagnesian minerals and plagioclase.

Handspecimen: The handspecimen is composed of a massive, medium to coarse grained speckled pale and dark grey granitic rock. It contains abundant pale coloured quartz and feldspar, with dark ferromagnesian minerals (including hornblende, biotite). It is likely that some chlorite alteration of the ferromagnesian minerals has occurred. Staining of the section offcut with sodium cobaltinitrite showed that there is minor interstitial K-feldspar. The rock must contain minor disseminated magnetite, as it is relatively strongly magnetic, with susceptibility up to 1310 x 10^{-5} SI units.

Petrographic Section:

a) Primary mineralogy and textures: In the section, there is considerable preservation of primary igneous minerals and the rock has a medium to coarse grained, inequigranular texture. There are abundant, partly altered blocky plagioclase grains up to 3 mm across and less abundant ferromagnesian grains, mostly <4 mm across, but with some larger. Interstitial to these phases are coarse grained quartz and lesser amounts of K-feldspar (grains up to 5 mm across). Ferromagnesian phases include brown-green hornblende and biotite, but there may have been a couple of pyroxene grains although they are now entirely altered. Small amounts of accessory apatite, FeTi oxide (e.g. titanomagnetite) and zircon are associated with the ferromagnesian phases, but there are also a few larger discrete subhedral grains of apatite up to 1.5 mm across hosted in quartz and K-feldspar. The primary mineralogy and texture of the rock indicate that it is a hornblende-biotite granodiorite, evidently of I-type affinity.

b) Alteration and structure: There has been moderate to locally strong alteration imposed. It is possible that there was initial minor potassic alteration, manifest by local patchy replacement of hornblende and igneous biotite by fine grained hydrothermal biotite. This alteration phase might also be indicated by the occurrence of a couple of sub-planar veins up to 0.4 mm wide containing K-feldspar, magnetite, biotite and pyrite. Later imposed alteration is of propylitic type, with the common partial replacement of plagioclase (especially zoned cores) by epidote and fine grained sericite. The ferromagnesian phases have been partly altered to chlorite and epidote, with a trace of pyrite.

c) Mineragraphy and paragenesis: A little relict igneous FeTi oxide (e.g. titanomagnetite) is preserved. A little vein-hosted magnetite and pyrite could have formed at the interpreted early potassic alteration stage and there is a trace of pyrite that probably accompanies the propylitic alteration.

Mineral Mode: Approximate modal proportions are: plagioclase 35%, quartz 30%, hornblende 9%, biotite (includes hydrothermal biotite) 8%, K-feldspar 6%, chlorite, sericite and epidote each 3%, FeTi oxide (includes magnetite) 2%, apatite 1% and a trace of pyrite and zircon.

Interpretation and Comments: It is interpreted that the sample represents a moderately altered, medium to coarse grained, inequigranular biotite-hornblende granodiorite of I-type affinity. The rock contained abundant plagioclase, with less common hornblende and biotite, enclosed by abundant interstitial quartz and minor K-feldspar. Accessory apatite and FeTi oxide grains are locally present. There may have been initial localised potassic alteration, manifest by patchy replacement of igneous ferromagnesian grains by finer grained secondary biotite, and by the occurrence of a couple of thin veins of K-feldspar-magnetite-pyrite-biotite. Later alteration is of propylitic type, with development of sericite, chlorite, epidote and trace pyrite, mainly from ferromagnesian minerals and plagioclase.

152804 TS

Summary: Medium to coarse grained biotite syenite or monzonite, with strong albitisation and development of muscovite/sericite, plus minor chlorite, epidote and leucoxene/rutile. The original rock was feldspar-rich, with plagioclase apparently enclosed by alkali feldspar, with minor biotite and only a little quartz. Feldspars were albitised and also locally strongly flecked by muscovite/sericite, with local epidote patches. Most biotite was replaced by chlorite and minor epidote.

Handspecimen: The handspecimen is composed of a pale grey to whitish altered, medium to coarse grained felsic igneous rock. It appears to be dominated by feldspar, with a small amount of altered (chloritised) ferromagnesian mineral. Feldspar grains are clouded and probably partly sericitised. Testing of the section offcut with sodium cobaltinitrite did not reveal the presence of K-feldspar. The sample is essentially non-magnetic, with susceptibility of $<10 \times 10^{-5}$ SI units.

Petrographic Section:

a) Primary mineralogy and textures: In the section, it is apparent that the original igneous rock is very strongly altered, although relict texture is moderately preserved. It was formerly medium to coarse grained and inequigranular in texture, with abundant blocky to tabular plagioclase grains up to 4 mm long. These were enclosed by abundant interstitial alkali feldspar, with minor amounts of biotite (grains up to 2.5 mm across), a little disseminated FeTi oxide (grains up to 1 mm across), interstitial quartz (uncommon grains up to 2 mm across) and traces of zircon in grains up to 0.2 mm across hosted in feldspar. The rock is of granitoid aspect, but as quartz is very minor, it is concluded that the rock represents a rather leucocratic biotite syenite or monzonite.

b) Alteration and structure: There has been strong alteration imposed. All feldspar was probably albitised, with original plagioclase grains being the sites for strong replacement by fine to medium grained muscovite, a little epidote and a trace of dark blue tourmaline. Alkali feldspar (also albitised) was also strongly flecked by fine grained sericite/muscovite and a little epidote. Much of the original igneous biotite was replaced by chlorite and minor epidote and most FeTi oxide was replaced by fine grained leucoxene/rutile. A couple of thin sub-planar veins of muscovite/sericite cut the altered rock. The mineralogy of the alteration assemblage is consistent with propylitic type.

c) Mineragraphy and paragenesis: No sulphide minerals have been observed.

Mineral Mode: Approximate modal proportions are: albite 70%, muscovite/sericite 20%, chlorite 4%, epidote 3%, biotite, quartz and leucoxene/rutile each 1% and traces of tourmaline, zircon and FeTi oxide.

Interpretation and Comments: It is interpreted that the sample represents a strongly altered, medium to coarse grained biotite syenite or monzonite. The rock has undergone strong albitisation with associated development of muscovite/sericite, plus minor chlorite, epidote and leucoxene/rutile. The

original rock was feldspar-rich, with plagioclase apparently enclosed by alkali feldspar, with minor biotite and only a little quartz. Feldspars were albitised and also locally strongly flecked by muscovite/sericite, with local epidote patches. Most biotite was replaced by chlorite and minor epidote.

152805 TS

Summary: Medium to coarse grained inequigranular biotite-hornblende granodiorite. The rock contains abundant plagioclase and interstitial quartz, with less abundant interstitial K-feldspar and scattered grains of biotite and green hornblende. Mild low grade alteration has occurred, with development of minor sericite, epidote and chlorite, mainly from plagioclase and biotite. The rock also contains a trace of pyrite, mostly associated with alteration of biotite. There is considerable similarity between this sample and 152802.

Handspecimen: The handspecimen is composed of a massive, medium to coarse grained, pale and dark grey granitic rock. It contains abundant pale quartz and feldspar, with subordinate amounts of dark ferromagnesian minerals, probably biotite and hornblende. Staining of the section offcut with sodium cobaltinitrite showed a minor to moderate amount of interstitial K-feldspar. The sample is moderately magnetic, with susceptibility up to 600 x 10^{-5} SI units.

Petrographic Section:

a) Primary mineralogy and textures: In the section, the rock is relatively fresh and there is considerable preservation of primary igneous minerals. There are abundant tabular to blocky plagioclase grains up to 4 mm long (with some preservation of igneous twinning and zoning), plus scattered subhedral to anhedral grains of biotite up to 4 mm across and green hornblende up to 2 mm across. These phases are enclosed by abundant interstitial medium to coarse grained quartz and by locally coarse grained (up to 5 mm) K-feldspar. A few grains of pyroxene may have originally been present (e.g. as cores in hornblende), but if so, they have been completely altered. There are a few small grains of FeTi oxide (e.g. titanomagnetite), apatite and zircon, generally associated with the ferromagnesian phases. The mineralogical and textural characteristic of the rock indicate that it is a biotite-hornblende granodiorite, clearly of I-type affinity. The sample is considerably similar to sample 152802.

b) Alteration and structure: There has been mild low grade alteration imposed. Plagioclase is commonly flecked by fine grained sericite and epidote (especially in cores) and biotite is locally altered to chlorite, with traces of epidote and leucoxene. A couple of aggregates of pyrite up to 2 mm across occur in association with the alteration of biotite. Former pyroxene grains appear to have been replaced by fine grained pale green actinolite and/or chlorite.

c) Mineragraphy and paragenesis: The rock contains a little relict igneous FeTi oxide (e.g. titanomagnetite) in grains up to 0.3 mm across. There are rare pyrite aggregates up to 2 mm across that have been slightly altered to goethite as a result of supergene oxidation.

Mineral Mode: Approximate modal proportions are: quartz 35%, plagioclase 30%, K-feldspar 15%, biotite 8%, hornblende (+ actinolite) 6%, sericite 2%, chlorite, epidote and FeTi oxide each 1% and traces of apatite, zircon, leucoxene, pyrite and goethite.

Interpretation and Comments: It is interpreted that the sample is a medium to coarse grained inequigranular biotite-hornblende granodiorite, clearly of I-type affinity and showing considerable similarity to sample 152802. The rock contains abundant plagioclase and interstitial quartz, with less abundant interstitial K-feldspar and scattered grains of biotite and green hornblende. Mild low grade alteration has occurred, with development of minor sericite, epidote and chlorite, mainly from plagioclase and biotite. The rock also contains a trace of pyrite, mostly associated with alteration of biotite.

152807 TS

Summary: Unusual leucocratic, quartz-poor granitoid, originally with abundant medium to coarse grained plagioclase, plus minor interstitial quartz, alkali feldspar, titanite and biotite. The rock could represent a plagioclase-rich quartz diorite or granodiorite in which rather coarse poikilitic titanite appears to be of late magmatic crystallisation. The rock has subsequently undergone strong alteration with considerable albitisation of feldspars. Plagioclase is also flecked by fine grained sericite, with formation of traces of epidote and prehnite, with former biotite being altered to chlorite ± prehnite. Alteration could be viewed as of sodic type, maybe a variant of propylitic type.

Handspecimen: The handspecimen is composed of a pale greenish-grey to whitish coloured, strongly altered medium to coarse grained felsic igneous rock. It is dominated by feldspar, probably with some sericitisation, with a little interstitial quartz and a pale yellow-brown phase (e.g. titanite). Testing of the section offcut with sodium cobaltinitrite did not detect the presence of K-feldspar. The sample is essentially non-magnetic, with susceptibility of $<10 \times 10^{-5}$ SI units.

Petrographic Section:

a) Primary mineralogy and textures: In the section, it is evident that the rock is strongly altered, but relict igneous texture is moderately well preserved. There is abundant altered plagioclase, forming blocky grains up to 3.5 mm across. Interstitial to plagioclase are minor amounts of quartz (aggregates up to 2 mm across), prominent poikilitic rather coarse grained titanite (grains up to several millimetres across), altered alkali feldspar and a few altered biotite grains. Several small subhedral grains of zircon are enclosed in feldspar. Textures of titanite suggest that it is a late magmatic product. The relict characteristics of the rock imply that it represents an unusual type of quartz-poor, leucocratic, plagioclase-rich granitoid, perhaps a type of quartz diorite or granodiorite.

b) Alteration and structure: Strong pervasive alteration has been imposed. Most plagioclase and alkali feldspar are replaced by albite, with plagioclase also being flecked by fine grained sericite and a few small aggregates of epidote and prehnite. Former biotite has been replaced by chlorite and trace prehnite. The alteration is evidently of sodic type, maybe representing a variant of propylitic alteration.

c) Mineragraphy and paragenesis: No sulphide minerals have been observed.

Mineral Mode: Approximate modal proportions are: plagioclase (includes dominant albite) 85%, quartz and titanite each 5%, sericite 4% and traces of epidote, prehnite, chlorite and zircon.

Interpretation and Comments: It is interpreted that the sample represents an unusual leucocratic, quartz-poor granitoid, originally with abundant medium to coarse grained plagioclase, plus minor interstitial quartz, alkali feldspar, titanite and biotite. The rock could represent a plagioclase-rich quartz diorite or granodiorite in which rather coarse poikilitic titanite appears to be of late magmatic crystallisation. The rock has subsequently undergone strong alteration with considerable albitisation

of feldspars. Plagioclase is also flecked by fine grained sericite, with formation of traces of epidote and prehnite, with former biotite being altered to chlorite ± prehnite. Alteration could be viewed as of sodic type, maybe a variant of propylitic type. There is some similarity of this sample with sample 152804.

152808 TS

Summary: Strongly altered, medium to coarse grained volcaniclastic rock, derived from felsic volcanic material, perhaps representing an epiclastic sandstone or a lithic-crystal felsic tuff. There are abundant altered lithic fragments (some were porphyritic felsic volcanic material), plus quartz, altered feldspar and ferromagnesian grains in a fine to medium grained altered matrix. There has been widespread replacement of the rock by fine to medium grained quartz, epidote and lesser amounts of magnetite and pyrite, plus a little chlorite. Supergene oxidation has led to pyrite being replaced by goethite.

Handspecimen: The handspecimen is composed of a strongly altered volcaniclastic rock, with a grey to yellow-green colour. It has a medium to coarse grained relict clastic texture, with possible fine grained lithic grains up to several millimetres across. The rock is rich in quartz and epidote and must contain significant magnetite, as it is strongly magnetic, with susceptibility up to 8690 x 10^{-5} SI units. Testing of the section offcut with sodium cobaltinitrite did not detect the presence of K-feldspar.

Petrographic Section:

a) Primary mineralogy and textures: In the section, relict medium to coarse grained clastic texture is moderately preserved. There are scattered altered lithic grains up to 4 mm across, along with scattered quartz grains, and altered feldspar and ferromagnesian grains, each up to 2 mm across. The rock also has a trace of relict apatite. Relict shapes of the ferromagnesian grains suggest that some represent altered biotite grains. Relict textures in the lithic grains imply that some were derived from porphyritic felsic volcanic material. Clastic grains occur in a fine to medium grained, altered and recrystallised matrix. From the relict characteristics, the rock is interpreted as being an altered medium to coarse grained volcaniclastic, derived from a felsic volcanic source. It could represent an epiclastic sandstone or a lithic-crystal felsic tuff.

b) Alteration and structure: Strong pervasive hydrothermal alteration has been imposed. Lithic grains and former feldspar grains were replaced by dominant fine to medium grained granular quartz, with local epidote, magnetite and pyrite in some of the lithic grains. Former ferromagnesian grains were mostly replaced by epidote, with a little chlorite. The matrix of the rock was almost totally replaced by fine to medium grained epidote and quartz, with rather abundant fine grained interstitial magnetite, plus disseminated pyrite, a little chlorite (mostly associated with epidote aggregates) and a trace of rutile. In the matrix, aggregates of epidote (-chlorite) are up to 2 mm across. Supergene oxidation has affected the rock, with replacement of all pyrite by goethite. He alteration assemblage in the sample is of FeCa type.

c) Mineragraphy and paragenesis: Disseminated pyrite grains up to 1 mm across formed part of the alteration assemblage, along with relatively abundant fine grained magnetite intergrown with epidote and quartz in the matrix. All pyrite was later replaced by goethite as a result of supergene oxidation.

Mineral Mode: Approximate modal proportions are: quartz 60%, epidote 30%, magnetite 5%, goethite 4%, chlorite 1% and traces of rutile and apatite.

Interpretation and Comments: It is interpreted that the sample represents a medium to coarse grained volcaniclastic rock that has experienced quartz-epidote-magnetite-pyrite alteration. The sample was derived from felsic volcanic material, and may be an epiclastic sandstone or a lithic-crystal felsic tuff. There are abundant altered lithic fragments (some were porphyritic felsic volcanic material), plus quartz, altered feldspar and ferromagnesian grains in a fine to medium grained altered matrix. There has been widespread replacement of the rock by fine to medium grained quartz, epidote and lesser amounts of magnetite and pyrite, plus a little chlorite. Supergene oxidation has led to pyrite being replaced by goethite.

152810 TS

Summary: Rather coarse grained, inequigranular texture biotite-hornblende monzogranite. The rock contains abundant plagioclase, biotite and hornblende enclosed in anhedral interstitial quartz and K-feldspar. A small enclave dominated by medium grained hornblende and biotite is present. Only localised mild alteration has occurred, with minor development of sericite and epidote at plagioclase sites and actinolite and carbonate in hornblende (but where former pyroxene cores might have existed). The rock is clearly of I-type affinity and is similar to samples 152802 and 152805.

Handspecimen: The handspecimen is composed of a massive, medium to coarse grained granitic rock. It contains abundant pink and pale grey feldspar, as well as quartz and black ferromagnesian minerals, including biotite and hornblende. Maximum grainsize (mostly of pink feldspar) is up to 5 mm. Staining of the section offcut with sodium cobaltinitrite showed that the pink feldspar is K-feldspar. The sample is weakly to moderately magnetic, with susceptibility up to 106 x 10^{-5} SI units.

Petrographic Section:

a) Primary mineralogy and textures: In the section, it is evident that the sample is a fresh, medium to coarse grained, inequigranular texture granitic rock. It is composed of abundant, rather coarse grained interstitial quartz and K-feldspar (orthoclase), enclosing blocky plagioclase and less common flaky brown biotite and blocky to prismatic green hornblende. Largest grainsize is exhibited by K-feldspar, plagioclase and biotite, with grains up to 4.5 mm across. There are traces of fine grained FeTi oxide (e.g. titanomagnetite), zircon and apatite associated with the ferromagnesian phases and rare grains of apatite up to 0.4 mm across are enclosed in K-feldspar and quartz. A few hornblende grains display altered cores that might have originally been pyroxene. A single mafic micro-enclave about 5 mm across is present and consists of medium grained hornblende and biotite, with a little plagioclase and FeTi oxide. The mineralogical constitution of the sample indicates that it is a biotite-hornblende monzogranite, with similarities to samples 152802 and 152805.

b) Alteration and structure: The rock has experienced only slight alteration, with plagioclase (mainly the zoned cores) being locally replaced by fine grained sericite and a trace of epidote. Possible former pyroxene cores in hornblende were replaced by fine grained pale green actinolite, with later overprinting traces of carbonate. K-feldspar is faintly dusted by hematite.

c) Mineragraphy and paragenesis: The rock contains a few grains of relict igneous FeTi oxide (e.g. titanomagnetite) in grains up to 0.1 mm across, mainly associated with the ferromagnesian minerals.

Mineral Mode: Approximate modal proportions are: quartz 35%, plagioclase 25%, K-feldspar 20%, hornblende (includes actinolite) 10%, biotite 8%, sericite 1% and traces of FeTi oxide, apatite, zircon, epidote, carbonate and hematite.

Interpretation and Comments: It is interpreted that the sample is an I-type, biotite-hornblende monzogranite. The rock contains abundant medium to coarse grained plagioclase, biotite and hornblende enclosed in anhedral interstitial quartz and K-feldspar. A mafic micro-enclave dominated

by medium grained hornblende and biotite is present. Only localised mild alteration has occurred, with minor development of sericite and epidote at plagioclase sites and actinolite and carbonate in hornblende (but where former pyroxene cores might have existed). The rock is similar to samples 152802 and 152805.

152812 TS

Summary: Medium to coarse grained inequigranular K-feldspar-rich rock, possibly representing a felsic igneous rock (e.g. syenite), or another variant of granitic rock that has undergone strong replacement by K-feldspar. Interstitial to K-feldspar are small amounts of sodic plagioclase and alteration aggregates after former ferromagnesian material. The latter have been replaced by fine to medium grained aggregates of chlorite, rutile and local magnetite. The rock is locally fractured and veined, with K-feldspar slightly replaced by sericite and chlorite, and local veining by chlorite, magnetite and a little sericite and quartz.

Handspecimen: The handspecimen is composed of a massive, medium to coarse grained felsic rock composed largely of brownish-pink feldspar. It is possible that there is minor sericite and the rock is cut by a couple of thin dark veins containing a little magnetite and chlorite. Staining of the section offcut with sodium cobaltinitrite showed that K-feldspar dominates the sample. The sample is moderately magnetic, with susceptibility up to 770 x 10^{-5} SI units.

Petrographic Section:

a) Primary mineralogy and textures: In the section, the rock is dominated by inequigranular, medium to coarse grained K-feldspar (e.g. orthoclase), with anhedral, interlocking grains up to 5 mm across. The texture could be interpreted as being of relict igneous type, with a little sodic plagioclase occurring interstitially to K-feldspar and also enclosed in K-feldspar, along with a minor amount of altered ferromagnesian material. Rare small zircon grains are enclosed by K-feldspar. If the texture and mineralogy of the sample are interpreted as primary igneous, then the rock could be classified as a syenite.

b) Alteration and structure: The rock contains abundant medium to coarse grained K-feldspar, slightly dusted by hematite. Although K-feldspar could be of igneous derivation, some could represent an alteration product of previously more abundant plagioclase and of quartz (i.e. a granitic rock). A former ferromagnesian phase (e.g. biotite) was replaced by aggregates up to 2 mm across of fine to medium grained chlorite ± rutile ± magnetite. Individual rutile aggregates are up to 1 mm across. K-feldspar is locally fractured (cataclastically) and replaced along fractures by chlorite and trace sericite. A few veins up to 1 mm wide cut the rock and are dominated by chlorite, but locally contain thin (<0.2 mm) concentrations of magnetite, along with a little quartz, sericite and titanite.

c) Mineragraphy and paragenesis: No sulphide minerals have been recognised. A little fine grained disseminated magnetite is present, in places at altered ferromagnesian sites and there are also a couple of thin (<0.2 mm) discontinuous veinlets of fine grained magnetite, mostly in association with chlorite.

Mineral Mode: Approximate modal proportions are: K-feldspar 90%, sodic plagioclase 4%, chlorite 3%, magnetite and rutile each 1% and traces of quartz, sericite, hematite, zircon and titanite.

Interpretation and Comments: It is interpreted that the sample is a medium to coarse grained inequigranular K-feldspar-rich rock. Interstitial to K-feldspar are small amounts of sodic plagioclase and alteration aggregates after former ferromagnesian material. The latter have been replaced by fine to medium grained aggregates of chlorite, rutile and local magnetite. The rock is locally fractured and veined, with K-feldspar slightly replaced by sericite and chlorite, and local veining by chlorite, magnetite and a little sericite and quartz. It is possible that the sample represents a felsic igneous rock (e.g. syenite), or another variant of granitic rock that has undergone strong replacement by K-feldspar.