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MINERALOGY – PETROLOGY · SECTION PREPARATION

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MINERALOGICAL REPORT No. 9772

by Alan C. Purvis, PhD

September 28th, 2010

TO : Nigel Doyle
Exploration Manager
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YOUR REFERENCE : Your email 12/8/10

MATERIAL : Eleven copper-gold Prospect Samples,
Tommy's Gap, East of Alice Springs

IDENTIFICATION : 7268 to 4669P (not consecutive)

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

SAMPLES & SECTIONS : Returned to you with hard copy of this report.

DIGITAL COPY : Emailed 28/9/10 to:
<ndoyle@rumjungleuranium.com.au>

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SUMMARY COMMENTS

The thirteen rock samples described in this report are from Tommy's Gap copper prospect about 100km east of Alice Springs in the Northern Territory. These samples are numbered 7268 to 4669P (not consecutive) and were examined in polished thin sections to allow investigation of opaque oxides and any residual sulphides. Assay data were provided by Rum Jungle Uranium for Au, Pt, Pd, Ag, As, Bi, Co, Cu, Ni, Pb, Zn and Mo. Two offcuts were stained for K-feldspar with HF and sodium cobaltinitrite, which confirmed K-spar due to the distinctive yellow colouration.

The regional geology of this location is in an overthrust mass of metamorphic units from the Arunta Inlier, surrounded by Heavitree Quartzite and Bitter Springs Formation of the Arunta Basin. The petrography and assay data indicates that the suite may be divided into four lithological groups, as follows.

Metamorphosed igneous rocks: 7268, 4264P and 4265P

The three samples in this group include an unusual mafic or ultramafic sample (4264B), an amphibolite derived from diorite (7268) and a recrystallised possible rhyolite or rhyodacite (4265P).

The most mafic sample 4264B, with 400ppm Ni, is unusual in having abundant biotite, scattered K-feldspar and abundant accessory apatite, together with actinolite, carbonate and chlorite. This assemblage suggests alkali-rich mafic lithology, possibly lamprophyric or related to the Mordor Complex.

The metadiorite 7268 has unoriented green hornblende and abundant sericite-clouded plagioclase as well as titanite and apatite. Quartz is partly in recrystallised veins with sparse disseminated quartz.

The recrystallised felsic volcanic has plagioclase phenocrysts locally composite with microcline also recrystallised quartz and biotite phenocrysts in a groundmass of quartz, plagioclase, K-feldspar and biotite.

Metasediments 4632P, 4635P (quartz-rich ± hematite), 4641P, 4667P (possibly albite-rich):

Two samples in this group are possible metacherts ± ironstone, represented by 4632P, which is a quartzite with pyrite, limonite-filled fractures and a limonite-lined leached vein and by 4635P which is heterogeneous with quartzose areas containing limonite ex-amphibole, and hematite-rich patches with interstitial earthy hematite and clay, cut by hematite and limonite-filled fractures and veins locally with voids. These samples have coarse-grained quartz due to exaggerated grain growth during metamorphism.

Two other samples in this group are dominated by microcrystalline material that seems to contain or consist of albite and may represent pervasively albitised fine-grained metasediment. These are 4641P as a fine-grained albitite or albite-rich quartzite, with disseminated pyrite partly leached or replaced by jarosite, and 4667P which is a weakly micaceous pyrite-rich albitite or albite-quartz aggregate, with mica disseminated also in laminae and micro-fractures followed by opaline silica/clay and limonite or earthy hematite in fractures. Some pyrite has been leached or replaced by jarosite).

Samples of largely hydrothermal origin, with abundant fresh/oxidised pyrite, anomalous gold, but relatively poor in copper: 7269, 4621P and 4644P

These samples have variable composition and texture. Sample 7269 has areas of granular quartz with limonite in fractures and colloform quartz with concentric shells of limonite, with abundant limonite-rimmed cavities ex-pyrite. Sample 4621P (3.9g/t Au) is hematite-rich with hematite ± quartz partly representing boxworks ex-pyrite ± carbonate, also irregular areas of crystalline and earthy hematite and interstitial quartz ± chalcedony. Sample 4644P (0.53g/t Au) contains abundant limonitised pyrite in a matrix of quartz, chalcedony and micaceous hematite. Gold was not visible in the polished thin sections of these samples.

Samples with abundant or anomalous copper: 4628P, 4668P and 4669P

Samples 4628P and 4668P in this group contain abundant copper as malachite, together with goethite, limonite and quartz. Sample 4669P has less abundant copper within hydrothermal quartz.

Sample 4628P has areas of highly modified apparent host rock, formerly sulphide-rich but now oxidised with rare residual pyrite. It contains abundant heterogeneous chlorite-quartz-clay-goethite, and local patches of biotite. Abundant goethite-limonite-altered masses, rarely contain residual pyrite, and partly lenticular quartz veins. Malachite occurs in fractures cutting across all of the other material. The assay shows 10.28% Cu, corresponding to 18% malachite.

Sample 4668P has large aggregates of malachite and limonite, including some probably ex-sulphide, with interstitial quartz, quartz-limonite veins (\pm malachite), quartz-malachite veins and vuggy carbonate-malachite veins. The assay has 28.48% Cu corresponding to about 50% malachite. Quartz in this sample is apparently hydrothermal, hosting abundant former sulphide.

In sample 4669P, minor copper (0.31%) occurs in hydrothermally brecciated and apparently altered metasediment, including metasiltstone to fine-grained sandstone, with quartz, chlorite and oxidised opaque oxide, with internal veins of quartz \pm chlorite and cemented by extensive sparry quartz with interstitial limonite and/or malachite and rare chalcopyrite.

The petrographic evidence suggests that copper in these samples was originally of low temperature hydrothermal origin with advanced supergene enrichment manifest as malachite in fractures or in aggregates with limonite. Trace residual chalcopyrite was seen in only one sample 4669P. The two most copper-rich samples have high Bi assays (20 and 45ppm). Sample 4621P has 3.9ppm Au, accompanied by 0.25ppm Pd and 25ppm Bi, but no visible gold.

INDIVIDUAL PETROGRAPHIC DESCRIPTIONS

7264	Massive plagioclase-rich amphibolite with an annealed quartz-rich vein. Possibly metamorphosed diorite
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Field Note: *Diorite*

In hand specimen this sample is dominated by scattered, intricately intergrown amphibole and plagioclase. The visually estimated gross mineralogy is 35% pale green hornblende, 55-60% weakly sericite clouded plagioclase and 1-2% disseminated fine-grained quartz. Lenses of probable vein-quartz occur at one end of the thin section (5%). Accessories include titanite and apatite.

The hornblende is unoriented and occurs singly or in aggregates to 5mm long. The plagioclase seems to have been largely recrystallised to a micromosaic about 5mm in grain size but some areas contain larger grains to 2mm in diameter. Minor quartz is part of the micromosaic, but the lenses of vein-quartz are as much as 3mm wide and extend intermittently across one end of the thin section. Later hairline fractures contain albite ± quartz.

Interpretation:

This sample is classified as massive plagioclase-rich amphibolite, possibly representing a metamorphosed diorite. It includes an annealed quartz-rich vein and later albite-filled microfissures.

7269	Areas of granular hydrothermal quartz with limonite in microfractures, also colloform quartz with concentric shells of limonite and abundant limonite-rimmed cavities ex-pyrite
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Field Note: *Boxwork gossan*

Abundant limonite-rimmed cavities in this sample represent largely oxidised and leached probable ex-pyrite, mostly enclosed in partly limonite-stained quartz. One side of the hand specimen has more than 50% limonite-rimmed voids but elsewhere there are 5-15% voids in elongate arrays.

The thin section has large areas of granular quartz from 0,2mm to 2mm in grainsize with limonite on grain boundaries and in fractures. Less abundant areas have microcrystalline partly colloform quartz with limonite commonly in concentric shells or with a fingerprint-like pattern. Limonite-rimmed cavities are abundant and range from 0.4mm long to about 10mm, with internal ribs of limonite in a boxwork pattern in some of the larger voids.

Interpretation:

The limonite-rimmed cavities in this sample are interpreted to represent limonitised and leached pyrite and are enclosed in quartz of two generations, early hydrothermal and later fine colloform.

4621P	Hematite-rich mass with hematite-quartz aggregates probably representing boxworks ex-pyrite ± carbonate. Also irregular areas of microcrystalline and earthy hematite and interstitial quartz ± chalcedony
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Field Note: *Massive purple hematite ironstone or hematite-quartz breccia: 3.9g/t Au, 253ppb Pd and 48ppm Cu*

This sample has abundant fine crystalline and earthy hematite and less abundant quartz. In thin section there are widespread minor to common possible boxworks of earthy hematite ± quartz ± crystalline hematite, which have probably derived from pyrite and/or carbonate. These are enclosed in large masses of microcrystalline hematite passing into zones and rims of earthy hematite. Most aggregates are dominated by microcrystalline hematite, with earthy hematite abundant in some quartz-rich areas.

Interstitial quartz is mostly rimmed by earthy hematite, but some areas have interstitial microcrystalline quartz and chalcedony and there are zones with colloform chalcedony as well as or instead of microsparry granular quartz. There is also a vein from 0.5mm to 2mm wide with lamellae of cryptocrystalline and microcrystalline quartz as well and lenses of earthy and microcrystalline hematite.

Interpretation:

This sample consists largely of apparent low temperature hydrothermal hematite/quartz ex-pyrite with later ?supergene earthy hematite and chalcedony.

4624P	Massive fine grained aggregate of biotite-actinolite-carbonate-chlorite-K-feldspar-hematite-apatite. May be interpreted as a lamprophyric alkali mafic, or ultramafic rock.
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Field Note: *Fine-grained ultramafic intrusive – dark: 400ppm Ni*

This is a fine-grained dark-coloured rock in hand specimen, with K-feldspar, partly disseminated and partly in a vein, visible on the offcut stained with sodium-cobalti-nitrite. The thin section has lenses and aggregates of decussate biotite, partly interlaminated with earthy hematite, and large areas that contain or consist variously of fine-grained actinolite, carbonate and minor chlorite. Small lenses of recrystallised K-feldspar are scattered locally with possible quartz and accessory apatite as prisms to 0.5mm long. There is also accessory probable rutile possibly ex-titanite. A narrow vein is filled with fine-grained granular K-feldspar, possibly orthoclase.

The mineralogy may indicate relatively alkaline mafic or ultramafic material as also seen in the 1100Ma Mordor Complex and may be lamprophyric. Further geochemistry may be useful to more specifically interpret this rock.

4625P	Quartz-plagioclase-biotite porphyritic rhyolite (albeit possibly intrusive). Has phenocrysts of recrystallised quartz and biotite, partly sericitised plagioclase phenocrysts and limonite after pyrite, all in a fine quartzofeldspathic groundmass. Biotite is disseminated and in fractures and sericite-chlorite alteration is evident.
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Field Note: *Light grey intrusive rock with black clasts and disseminated sulphide.*

This sample is pale grey in hand specimen with dark lenses in a roughly parallel arrangement. The thin section has poorly aligned plagioclase phenocrysts to 4mm long enclosing biotite and/or muscovite and locally composite with or rimmed by minor K-feldspar, recrystallised quartz phenocrysts to 2mm in diameter and lenses, to 4mm long, composed of recrystallised biotite. The biotite lenses are roughly aligned but not schistose.

The groundmass is microcrystalline and quartzofeldspathic with minor biotite and fine-grained recrystallised biotite also occurs in annealed veinlets. K-feldspar is disseminated somewhat irregularly but there may be albite as well as quartz. Some of the biotite has been altered to chlorite and the plagioclase phenocrysts contain minor sericite. Minor pyrite in biotite-filled fractures has been altered to limonite, as has rare disseminated pyrite.

This sample is petrographically identified as a rhyolite but is possibly intrusive. The black material referred to as clasts in the field description supplied consists of recrystallised biotite phenocrysts.

4628P	Heterogeneous chlorite-quartz-clay-goethite-altered, locally biotite-bearing material. Includes abundant goethite-limonite-altered masses, rarely with residual pyrite, and partly lenticular quartz veins. Malachite occurs in fractures cutting across all other components.
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Field Note: *Malachite sample from Midway Creek in bleached mafic: 10.28% Cu, 210ppm Ni, 0.23g/t Au, 20ppm Bi*

This sample has abundant malachite-filled fractures and areas rich in earthy hematite and/or goethite. In thin section the host rock has large irregular masses of limonite and goethite as well as variously chlorite-rich and quartz-rich areas, some of which contain leucoxene/limonite spots and clays, possibly sericite/illite or smectite. Rare kernels of pyrite occur within limonite.

Patches of fine-grained pale green chlorite are common, as are areas richer in quartz, with interstitial chlorite and other clays. Some lenses contain schistose or decussate fresh or altered biotite, locally with malachite parallel to the cleavage. Lenses and veins of granular and columnar quartz occur widely, with the most continuous vein from 0.5mm to 1mm wide. These veins postdate the material that was later altered to goethite but locally contain small grains altered to goethite ± malachite.

Most of the malachite in this thin section is in anastomosing and intersecting fractures with some larger lenses rimmed by microcrystalline malachite and infilled with malachite to 0.3mm in grain size. The assay indicates 18% by weight malachite but the thin section seems to have less than 10% by volume malachite. The Ni content may be consistent with former mafic material.

4632P	Coarse crystalline metaquartzite (metachert?) with minor pyrite, limonite-filled fractures and a limonite-lined leached vein
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Field Note: *Iron-rich quartz with disseminated pyrite: 0.11% Cu, 55ppm Zn, 55ppm Mo*

This sample is dominated by interlocking anhedral quartz grains to 5mm long with weak sub-parallel elongation and many grains with their c-axes at a low angle to the elongation direction. Pyrite is disseminated as small cubes and there are fractures and stylolite-like veins filled with limonite. A leached lenticular vein, mostly about 1mm wide, is lined with limonite and may have contained carbonate.

This sample may represent metamorphosed pyritic chert with exaggerated grain growth due to metamorphism, with a strong quartz fabric and late limonite-filled or limonitised and leached fractures and veins.

4635P	Heterogeneous rock with quartz-rich areas containing limonite ex-amphibole, and hematite-rich patches with interstitial earthy hematite and clay. Cut by hematite and limonite-filled fractures and veins locally with voids.
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Field Note: *Hematite-rich iron quartz: 100ppm Cu*

Large areas of weakly deformed inequigranular quartz occur in this sample, with grains to 3mm long showing undulose extinction, but there are also large masses of granular hematite to 0.5mm in grainsize enclosing patches of clouded possible clay and/or earthy hematite. Rare limonitised possible amphibole occurs in the quartz. Hematite also occupies irregular fractures, but vuggy fractures to 1mm wide are partly filled by limonite as well as having lenticular voids to 5mm long. Narrow limonite-filled fractures are abundant.

4641P	Fine-grained possible albitite or albite-rich quartzite, with disseminated pyrite, partly leached or replaced by jarosite
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Field Note: *Altered light grey quartzite with disseminated sulphides: 100ppmCu*

This sample represents fine-grained quartzite or microcrystalline albite rock with disseminated pyrite and small open cavities or aggregates of yellow grains. Yellow material also partly coats a fracture bounding the hand specimen.

The thin section consists of extensive microcrystalline and fine-grained albite ± quartz (from 20µm to 0.2mm in grainsize) with interstitial possible clays and abundant (10-15%) disseminated inequigranular pyrite to 1mm in grainsize. At least some of the micromosaic is twinned possible albite and clearly defined quartz is rare. The pyrite is mostly in laminae in several directions possibly related to shearing and deformation and some of these contain voids to 1mm long, with patches of fine-grained jarosite from 0.2mm to 1.5mm long.

This sample may represent albitised metasediment but has abundant pyrite and minor jarosite.

4644P	Extensive limonitised pyrite, in a matrix of quartz, chalcedony and micaceous hematite, predominantly of low temperature hydrothermal origin.
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Field Note: *Coarse crystal massive hematite with white matrix: 0.53g/t Au; 80ppm Cu*

There is abundant brown limonite or goethite in this sample with minor hematite in interstitial areas with possible quartz. The thin section is dominated by goethite-limonite masses derived from pyrite crystals from 0.5mm to 2mm in grain size. Interstitial material contains chalcedony and sparry granular to prismatic quartz as well as minor micaceous hematite, rimmed by very fine-grained quartz, and interstitial patches of fibrous possible chalcedony with a very low apparent birefringence. The quartz and chalcedony may be of low temperature hydrothermal origin cementing hematite and abundant oxidised pyrite.

This sample seems to be of low temperature hydrothermal origin with former pyrite dominant over quartz, chalcedony and hematite.

4667P	Weakly micaceous pyrite-rich possible albitite or albite-quartz aggregate. Mica is disseminated and in laminae and fractures, followed by possible opaline silica/clay and limonite or earthy hematite. Local ex-pyrite has been leached or replaced by jarosite.
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Field Note: *Light grey quartzite with disseminated sulphide and sericite-hematite alteration:
40ppm Cu*

An abundant micromosaic in this sample is mostly less than 0.1mm in grainsize and is accompanied by possibly 10% pyrite to 0.5mm in diameter and minor disseminated muscovite to 0.3mm in grainsize. At least some of the micromosaic is composed of twinned sodic plagioclase, possibly albite, and it is not clear whether there is any quartz, as all of the grains in the micromosaic have a similar refractive index.

Muscovite also occurs in laminae and in microfractures, where it is accompanied by later clouded possible opaline silica. Apparent opaline silica (and/or clay) also in laminae and poorly defined bands, locally with central fractures filled with limonite or earthy hematite. Some of these areas and fractures contain leached pyrite, with pyrite rarely replaced by jarosite.

4668P	Large aggregates of malachite and limonite, probably ex-sulphide. Interstitial quartz, quartz-limonite veins (\pm malachite), quartz-malachite veins and vuggy carbonate-malachite veins.
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Field Note: *Malachite in purple hematitic ironstone: 28.48% Cu, 140ppm Pb, 45ppm Bi and 44ppm Ag*

This handspecimen is rich in green malachite with associated orange-brown goethite or limonite. Most of the thin section confirms extensive malachite intergrown with limonite and with scattered kernels of relatively opaque material, (goethite or limonite). Relatively minor interstitial granular quartz occurs in irregular lenses, some of which have been cut by malachite-filled fractures. An early vein to 2mm wide contains quartz and lenses of limonite \pm malachite with a vein to 1mm wide, adjacent to the quartz-limonite vein, with quartz and malachite. Later narrow veins with fibrous carbonate have small vugs as well as minor malachite.

The assay indicates approximately 50% by weight malachite which is consistent with the thin section. The malachite-limonite aggregates seem to have replaced coarse-grained sulphide.

4669P	Brecciated and veined weakly metamorphosed and chloritised sediments (siltstone to fine-grained sandstone). These consist of fine quartz, chlorite and oxidised opaque oxide and are cut by internal veins of quartz ± chlorite and cemented by abundant sparry quartz with interstitial limonite and/or malachite and rare chalcopyrite.
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Field Note: *Sulphide and minor malachite in altered brecciated rock: 0.31% Cu.*

This handspecimen is seen to consist of grey sediment or metasediment, with irregular quartz veins and possible sulphide on a broken surface.

The thin section has unsorted fragments of low-grade metasediment enclosed in extensive quartz, comprising possibly $\frac{2}{3}$ of the area, commonly and veined by quartz ± chlorite. The fragments consist of abundant or dominant quartz, lesser abundant pale green chlorite and disseminated fine-grained hematite ex-magnetite. The more quartz-rich fragments and zones seem to represent very fine and fine-grained sandstone, with more abundant chlorite and opaque oxide in siltstones and very fine-grained sandstones.

A large possible fragment to 8mm across of mostly quartz-rich metasediment occupies one end of the thin section. This has crosscutting quartz stringers. A more disrupted parallel fragment has more abundant quartz veins. Another large fragment, 15mm wide and more than 15mm long, is finer-grained and less quartz-rich, but has early internal quartz veins and veins with granular or coarser sparry quartz and pale green chlorite. Smaller fragments are mostly fine-grained (siltstones and very fine-grained sandstones) and more commonly have partial or complete rims of pale green chlorite.

The quartz in these clasts or fragments is mostly coarse-grained and granular to prismatic, to 3mm in grain size. Possible anatase occurs as small grains in and adjacent to quartz and some areas have disseminated chlorite possibly representing totally disaggregated fragments. Minor interstitial patches of limonite and/or malachite are from 0.4mm to 3mm long. The largest patch contains residual chalcopyrite in limonite but only very minor malachite.

This sample seems to represent hydrothermal brecciation of partly chloritised metasediment.