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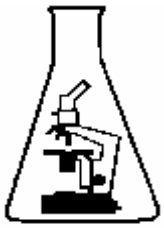

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PETROGRAPHIC REPORTS ON FOUR DRILL CHIP SAMPLES FROM WONARAH BASEMENT ROCKS

prepared for

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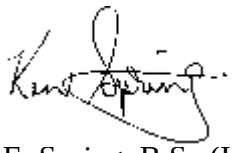

K. E. Spring B.Sc.(Hons), MAppSc
28 October 2009

Sample Number : WNWE052 **Depth** : 114 – 115 m

Sample Type : RC drill chips **Date Supplied** : 28/09/09

Source : Basement rocks at Wonarah Phosphate Project

Work Requested Petrographic report

Identification Granophyric granite

Description

The supplied sample consisted of a small amount of drill chips consisting of hard, robust, unweathered, mainly medium-grained granitic rock displaying speckled, pale red feldspars, light grey quartz, and dark chloritized mafic silicates.

A thin section was prepared to permit detailed microscopic examination in transmitted, polarised light of the drill chips. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the thin section, is:

Primary Minerals

38%	quartz
1%	remnant plagioclase feldspar
41%	K-feldspar (orthoclase)
2%	biotite
trace	opaque oxide and zircon

Secondary Minerals

15%	sericite/illite
2%	hematite
1%	chlorite

Microscopically, the rock displays allotriomorphic, holocrystalline, porphyritic, mainly medium-grained granite with distinctive granophyric quartz-feldspar intergrowths surrounding the phenocrysts. Primary grains are mainly 0.5 to 5 mm in size.

The phenocrysts are thoroughly sericitized and up to about 5 mm long, with hematite-staining well developed along the cleavages and fractures. The granophyric intergrowths consist of K-feldspar and quartz intergrowths, with highly variable grainsize and texture over small distances. Occasional small (0.5 - 1 mm long) prisms of sericite-altered plagioclase are set within the granophyric intergrowths. Well formed crystals of green to bronze biotite are present but not common (~2-3 modal%) and are partly chloritized, and some grains have developed dark brown iron-staining. Well formed zircons are present in some biotite grains, and occasional altered former opaque oxides are present in one or two chips, but rather rare. The larger quartz grains show weak to moderate strain features.

Comments and Interpretations

The supplied drill chip sample (labelled WNWE052 at 114 – 115 m depth) from Wonarah Phosphate Project, NT is interpreted to be granophyric, alkali feldspar, porphyritic granite (using broad IUGS nomenclature or common Australian/British nomenclature), an acid igneous intrusive rock. The minerals in the granite display mild to moderate strain attributed to mild deformation.

For engineering purposes, the rock within the supplied sample may be summarised as:

- **granite** (an intrusive acid igneous rock)
- holocrystalline
- porphyritic
- mainly medium-grained
- unweathered
- moderately altered (the secondary mineral content is about 18% including 16% of weak, soft or non-durable minerals, specifically 15% sericite/illite and 1% chlorite along with 2% hematite, a robust benign mineral)
- **hard**
- **strong**

The rock is predicted to be **durable.**

Free Silica Content

The free silica content is about 38% (as quartz grains mainly about 0.5 to 2 mm in size and locked in crystalline rock).

Sample Number : WNWE052 **Depth** : 150 – 151 m

Sample Type : RC drill chips **Date Supplied** : 28/09/09

Source : Basement rocks at Wonarah Phosphate Project

Work Requested Petrographic report

Identification Granophyric granite

Description

The supplied sample consisted of drill chips consisting of hard, robust, unweathered, mainly medium-grained granitic rock displaying speckled, pale red feldspars, light grey quartz, and dark chloritized mafic silicates.

A thin section was prepared to permit detailed microscopic examination in transmitted, polarised light of a random sub-sample of the drill chips. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the thin section, is:

Primary Minerals

33%	quartz
1%	remnant plagioclase feldspar
42%	K-feldspar (orthoclase)
2%	biotite
trace	opaque oxide and zircon

Secondary Minerals

15%	sericite/illite
4%	hematite
2%	chlorite
1%	sphene

Microscopically, the rock displays allotriomorphic, holocrystalline, porphyritic, mainly medium-grained granite with distinctive granophyric quartz-feldspar intergrowths surrounding the phenocrysts. Primary grains are mainly 0.5 to 5 mm in size.

The phenocrysts are thoroughly sericitized and up to about 5 mm long, with hematite-staining well developed along the cleavages and fractures. The granophyric intergrowths consist of K-feldspar and quartz intergrowths, with highly variable grainsize and texture over small distances. Occasional small (0.5 - 1 mm long) prisms of sericite-altered plagioclase are set within the granophyric intergrowths. Well formed crystals of green to bronze biotite are present but not common (~2-3 modal%) and are partly chloritized, and some grains have developed dark brown iron-staining. Well formed zircons are present in some biotite grains, and occasional altered former opaque oxides (now altered to sphene) are present in one or two chips. The larger quartz grains show weak to moderate strain features.

Comments and Interpretations

The supplied drill chip sample (labelled WNWE052 at 150 – 151 m depth) from Wonarah Phosphate Project, NT is interpreted to be granophyric, alkali feldspar, porphyritic granite (using broad IUGS nomenclature or common Australian/British nomenclature), an acid igneous intrusive rock. The minerals in the granite display mild to moderate strain attributed to mild deformation.

For engineering purposes, the rock within the supplied sample may be summarised as:

- **granite** (an intrusive acid igneous rock)
- holocrystalline
- porphyritic
- mainly medium-grained
- unweathered
- moderately altered (the secondary mineral content is about 22% including 17% of weak, soft or non-durable minerals, specifically 15% sericite/illite and 2% chlorite along with 4% hematite and 1% sphene, which are robust benign minerals)
- **hard**
- **strong**

The rock is predicted to be **durable.**

Free Silica Content

The free silica content is about 33% (as quartz grains mainly about 0.5 to 2 mm in size and locked in crystalline rock).

Sample Number : WNWE017 **Depth** : 105 – 106 m

Sample Type : RC drill chips **Date Supplied** : 28/09/09

Source : Basement rocks at Wonarah Phosphate Project

Work Requested Petrographic report

Identification Coarsely porphyritic granite

Description

The supplied sample consisted of drill chips consisting of hard, robust, unweathered, coarse-grained granitic rock displaying speckled, pale to moderate red feldspars, light grey quartz and dark altered mafic silicates.

A thin section was prepared to permit detailed microscopic examination in transmitted, polarised light of a random sub-sample of the drill chips. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the thin section, is:

Primary Minerals

43%	quartz
1%	remnant plagioclase feldspar
42%	K-feldspar (orthoclase)
trace	apatite and zircon

Secondary Minerals

12%	sericite
2%	hematite

Microscopically, the rock displays allotriomorphic, holocrystalline, porphyritic, relatively coarse-grained felsic intrusive rock of granitic composition. Primary grains are mainly 0.5 to at least 10 mm in size.

The rock is dominated by 1 - 4 mm-sized moderately to heavily-strained and fractured quartz grains with frilly grain boundaries and occasional zones of sub-grain recrystallization, and large, slightly hematite stained K-feldspar crystals. Several chips are single K-feldspar crystals that almost certainly represent megacrysts in the granitic rock represented by most other chips. These K-feldspar grains are mottled by dark hematite-stained alteration and cut by narrow, sub-parallel seams of quartz, but also contain small spots and blebs of quartz. Small, slightly sericite-altered plagioclase prisms are present, but uncommon, in the K-feldspar grains, and a 2 mm-wide veinlet of polycrystalline quartz cuts one K-feldspar megacryst. Only one or two former mafic crystals are present and these are completely altered to coarse sericite and are heavily iron-stained, but have shapes that suggest they were probably biotite. A few blocky small apatite grains and a single large zircon crystal are also present.

Comments and Interpretations

The supplied drill chip sample (labelled WNWE017 at 105 – 106 m depth) from Wonarah Phosphate Project, NT is interpreted to be coarsely porphyritic alkali feldspar, granite (using broad IUGS nomenclature or common Australian/British nomenclature), an acid igneous intrusive rock. The minerals in the granite display straining and partial recrystallization attributed to deformation.

For engineering purposes, the rock within the supplied sample may be summarised as:

- **granite** (an intrusive acid igneous rock)
- holocrystalline
- coarsely porphyritic
- mainly coarse-grained
- unweathered
- lightly altered (the secondary mineral content is about 14% including 12% of weak, soft or non-durable minerals, specifically sericite along with 2% hematite, a robust benign minerals)
- **hard**
- **strong**

The rock is predicted to be **durable.**

Free Silica Content

The free silica content is about 43% (as quartz grains mainly about 0.5 to 2 mm in size and locked in crystalline rock).

Sample Number : WNWE029 **Depth** : 125 – 126 m

Sample Type : RC drill chips **Date Supplied** : 28/09/09

Source : Basement rocks at Wonarah Phosphate Project

Work Requested Petrographic report

Identification Coarsely porphyritic granite

Description

The supplied sample consisted of drill chips consisting of hard, robust, unweathered, coarse-grained granitic rock displaying speckled, pale to moderate red feldspars, light grey quartz and dark altered mafic silicates.

A thin section was prepared to permit detailed microscopic examination in transmitted, polarised light of a random sub-sample of the drill chips. An approximate mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the thin section, is:

Primary Minerals

37%	quartz
2%	remnant plagioclase feldspar
42%	K-feldspar (orthoclase)
trace	apatite

Secondary Minerals

18%	sericite/illite
1%	hematite

Microscopically, the rock displays allotriomorphic, holocrystalline, porphyritic, relatively coarse-grained felsic intrusive rock of granitic composition. Primary grains are mainly 0.5 to at least 10 mm in size, but quartz has recrystallized to a much finer grainsize.

The large K-feldspar crystals are up to almost 1 cm long and slightly iron-altered along cleavages. Suggestions of a microperthitic intergrowth texture (of albite and orthoclase) are preserved in places. Unlike the previous sample (WNWE017), the quartz in this sample is highly strained, elongate ribbon quartz, and shows an almost local mylonitic texture, with abundant sub-grain crystallisation along grain boundaries. Totally altered former biotite crystals now consist of brown, iron-staining and commonly show bending of cleavages. Also present are some narrow seams of altered mica intergrowths now replaced by brown secondary iron oxide. A few small apatite prisms are the only notable accessory phase.

Comments and Interpretations

The supplied drill chip sample (labelled WNWE017 at 105 – 106 m depth) from Wonarah Phosphate Project, NT is interpreted to be coarsely porphyritic alkali feldspar, granite (using broad IUGS nomenclature or common Australian/British nomenclature), an acid igneous intrusive rock. This sample has almost certainly developed from the preceding K-feldspar megacrystic granite ((WNWE017) in or adjacent to a high-strain zone, in which the quartz has been strongly flattened and strained to ribbon quartz textures, whereas cleavages in the feldspar picked up the strain, resulting in less obviously deformed grains.

For engineering purposes, the rock within the supplied sample may be summarised as:

- **granite** (an intrusive acid igneous rock)
- holocrystalline
- coarsely porphyritic
- mainly coarse-grained
- unweathered
- moderately altered (the secondary mineral content is about 19% including 18% of weak, soft or non-durable mineral, sericite along with 1% hematite, a robust benign minerals)
- **hard**
- **strong**

The rock is predicted to be **durable**.

Free Silica Content

The free silica content is about 37% (as quartz grains mainly about 0.01 to 2 mm in size and locked in crystalline rock).