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REPORT CMS 85/10/15

YOUR REFERENCE: Letter dated 10.10.1985
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SAMPLE NOS.: T 865 - T 871

SUBMITTED BY: P.A. Roberts

WORK REQUESTED: Petrology

H.W. Fander, M. Sc.

REPORT CMS 85/10/15

Seven rock chip and drill core samples from the North Lyell area were received for petrological examination, with emphasis on the contained copper mineralisation. Representative thin-sections, supplemented by four polished sections, were prepared and examined together with their respective offcuts. Attached descriptions summarise the microscopic data.

Summary

With the exception of sample T 866, which is best classified as an altered and mineralised breccia, this suite comprises sedimentary or, strictly, low-grade regional metasedimentary rocks.

The T 867 - T 871 (inclusive) group, representing a narrow interval from DDH-NL 1102, comprises variably but generally high-angle discordantly sheared quartzose psammopelites and gritty lithic sediments with accessory to conspicuous detrital chromite, typical of that associated with the (late) Cambrian ultramafics of N.W. Tasmania. These rocks are variably Cu-mineralised, with an extensively supergene-altered disseminated chalcopyrite assemblage forming two apparently distinct modes in terms of distribution:

1. Clast-hosted disseminations, typically complexed by matrix-hosted disseminations, at least in part reflecting the low-grade regional metamorphic overprint (remobilisation); exemplified by sample T 867.
2. Matrix-hosted disseminations, typically with associated chlorite (contrasting with the strictly sericitic T 867) and apparently hydrothermally introduced; exemplified by samples T 868, T 869 and T 871. These rocks exhibit partial remobilisation of sulphides contemporaneous with the ?Devonian tectonic overprint.

The supergene assemblage, comprising mainly bornite (63 % Cu) and chalcocite (80 % Cu), clearly accounts for the low S/Cu ratios in available assay data, and further the rather mesoscopically inconspicuous nature of the mineralisation. Apart from the generally fine grain sizing, these ores exhibit no specific metallurgically deleterious characteristics, at least in comparison with the normal North Lyell assemblage.

The T 866 breccia is broadly analogous to chloritic variants of the T 867 - T 871 group. This rock (T 866) exhibits a late phase of microfracturing which obscures the textural detail, and interpretation will be partly dependent on field evidence. General features are consistent with an altered (chloritised), mineralised (with pyrite, sphalerite, chalcopyrite, galena) and subsequently deformed tectonic breccia but, due to constraints imposed by late fracturing, a sedimentary breccia mode of origin cannot be entirely ruled out.

Samples T 865 and T 866 may be contrasted with the T 867 - T 871 group in being devoid of clastic chromite.

Overall, the mineralised samples reflect a phase of chloritic alteration and sulphide mineralisation, subsequent stress effects, and late supergene alteration of the primarily chalcopyritic sulphide assemblage.

D. Cowan, B. Sc.

Petrological Descriptions

T 865

(T.S. 54682)

This rock may be classified as a hematitic protoquartzite, following Pettijohn's classification.

The sediment is poorly to moderately sorted in the fine to medium sand range and is bedded on a millimetric scale with minor displacive microfractures. The framework is dominated by subangular quartz grains with subordinate composites and a variety of lithic clasts, including chert, ferruginous chert, sericitic chert, sericitic hematitic pelite, felsitic silicified acid volcanic and vein-type quartz aggregates. Accessories include quartzose sandstone clasts, tourmaline grains, zircons, and partly martitised detrital magnetite.

The cement consists of variably hematite-pigmented, fine to micro-crystalline quartz with accessory semi-sericitic white mica, overgrowth quartz, and thinly disseminated clots of chlorite. Rare poikilitic pyrite euhedra are of late metablastic character, but may represent a recrystallized syngenetic component. Hematitic pigmentations in this rock are of authigenic character and apparently locally derived from the clastic hematitic chert and pelite components. The sericite and chlorite appear to reflect mild hydrothermal alteration.

T 866

(T.S., P.S. 54683)

This rock may be broadly classified as an altered and mineralised breccia.

Major features comprise angular submillimetric to centimetric clasts of chert, thoroughly silicified felsic volcanic (tuff in part), and chloritic quartzose sandstone, supplemented by quartz grains in a chloritic matrix. Clasts exhibit chloritic alteration, with minor interspersed films and fine-scale vugs of quartz and barite, and random sulphide disseminations (dominantly pyrite). The matrix, in detail, reflects secondary brecciation with sub- to fine millimetric-scale clasts of vein and matrix Mg-chlorite aggregates, carrying varying proportions of sulphide (pyrite, pale sphalerite + galena, chalcopyrite), cemented with irregular films and clots of chlorite-stained micro-crystalline quartz, grading locally into sericitic quartz aggregates.

This rock includes minor clasts of chloritic, pyrite-sphalerite-mineralised vein-type quartz. General features are consistent with a veined, altered and mineralised sedimentary breccia, although finer detail is obscured by stress and microfracturing effects. An alternate interpretation comprises a sedimentary breccia composite of altered sediment, volcanic, and associated mineralised chlorite(-quartz) vein components.

Polished section examination confirms a disseminated fine-grained pyrite/subordinate sphalerite/accessory chalcopyrite/minor galena assemblage. Pyrite is relatively concentrated in the clasts and base metal sulphides in the chloritic matrix components. Matrix chlorite-hosted pyrite is mildly granulated. Sphalerite exhibits ultrafine exsolution chalcopyrite.

T 867

(T.S., P.S. 54684)

This sample represents a sandy pelite-matrixed sedimentary breccia. Texturally, the rock approximates to a poorly sorted (sandy, pebbly) angular grit with mild shearing (phyllitic) overprint effects concentrated in the matrix.

The framework comprises clasts of chert, impure chert and silicified felsic volcanic supplemented by clasts of quartzose sandstone, vein-type quartz, and sericitic pelite. Conspicuous fine to medium sand-sized quartz grains include abraded volcanic types. Accessories include frequent detrital grains of dark red chromite (Cambrian ultramafic-derived), partly concentrated into thin bands or "placers", to which the phyllitic cleavage is high-angle discordant, and rare detrital tourmaline.

Thinly disseminated sulphides are fine- to ultrafine-grained and largely restricted to the siliceous (chert, silicified volcanic) clasts. Polished section examination reveals an assemblage of Cu-Fe and Cu-sulphides. Chalcopyrite is present as fine-grained (typically < 50 μ , max. 250 μ) disseminations and discontinuous films (within the matrix). This phase is extensively replaced by bornite with varying proportions of associated chalcocite. This assemblage grades into chalcocite-rich pseudomorphs with associated traces of digenite and covellite. Rare microscopic matrix-hosted blebs of galena and tetrahedrite are trace accessory constituents.

T 868

(T.S. 54685)

This rock may be classified as a sericitic orthoquartzite or, strictly, a metaquartzite in that it exhibits low-grade regional metamorphic effects analogous to those in T 867.

The rock consists largely of weakly overgrown, well-sorted, fine sand-sized subangular quartz grains with an intergranular sericite/microcrystalline quartz/minor chlorite matrix which is phyllite-microtextured and grades into sporadic discontinuous sericitic foliae. These features are variously concordant to discordant to the tectonic fabric but, in the absence of tangible bedding traces, it is uncertain whether the rock as a whole represents a slumped pelite-parted sandstone or, alternately, reflects sericite veining and subsequent shearing effects.

Accessories include minor chert clasts, conspicuous fine quartz, intergranular Cu-sulphide disseminations, semi-conspicuous detrital chromite with associated traces of magnetite and ilmenite, and traces of detrital tourmaline.

T 869

(T.S., P.S. 54686)

This sample represents an impure quartzite, broadly similar to T 868. In comparison, this rock is modally coarser-grained with a medium sand-sized relict framework, carries accessory clasts of silicified felsic volcanic, supplementing relatively conspicuous clasts of chert. The matrix consists of (stressed) overgrowth quartz with intergranular clots and films of chlorite in contrast to the sericitic matrix of T 868.

The silicified volcanic component is partly represented by coarse sand-sized "megaclasts". Detrital chromite is present and partly concentrated into "placers" defining bedding, intersected at a high angle by the weak recrystallization/re-orientation effects.

Minor discontinuous chlorite veinlets are present, with variable attitudes to the faint relict bedding, and these are supplemented by frequent microscale films along grain-boundaries. This rock exhibits semi-pervasive microscale laceworks of microscale sulphide films similarly concentrated along grain-boundaries, where they appear temporally late with respect to the chlorite films, but reflect remobilisation into stress-induced microfractures.

Polished section examination reveals a bornite-chalcocite assemblage with subordinate relics of chalcopyrite and rare traces of covellite. Grainsizings are ubiquitously very fine (typically $< 20 \mu$, films generally $< 10 \mu$ in width), with a maximum observed of $50 \times 125 \mu$ for a bornite-chalcopyrite composite aggregate.

T 870

(T.S. 54687)

This rock may be categorised as a chloritic quartzite. Major constituents are partly recrystallized silt- to fine sand-sized subangular clastic quartz and fine-grained chlorite which represents the matrix. Accessories include traces of carbonate, apatite, leucoxenic semi-opaques, zircons, and partly degraded (martitised) magnetite as relict detrital components.

This rock is incipiently banded, with an essentially concordant, rather incipient phyllitic overprint. Close examination revealed no detectable sulphides.

T 871

(T.S., P.S. 54688)

This rock represents a sheared intercalation of fine-grained quartzose sandstone and sericitic pelite.

Relict bedding is planar to lensoid, with a millimetric-scale alternation of well-sorted sandstone and massive to weakly quartzose-silty shale interbeds. Sandstone units are sericite-matrixed, carry minor sericitic lithoclasts (altered volcanic in part), clastic chromite grains, and minor clots of secondary chlorite.

Fine-grained Cu-sulphides are thinly disseminated throughout the sandstone units and are partly concentrated in chloritic zones, although the overall distribution is semi-banded ("bedded") and a substantial proportion of the total sulphide component is of quartz-intergranular habit.

Pelite units include ultrafine-grained Cu-sulphides concentrated in marginal zones of individual interbeds.

This rock exhibits a high-angle discordant phyllitic cleavage with sulphide disseminations substantially dimensionally orientated parallel to the shearing (cleavage), particularly in pelitic units.

Polished section examination confirms a bornite-chalcocite assemblage, with the bornite typically marginally replaced by chalcocite and including extremely rare microscopic corroded relics of chalcopyrite.

Pelite-hosted disseminations (dominantly chalcocite, subordinate bornite, extremely rare covellite) are typically < 20 μ diameter, with an orientated, mica-interstitial flaky habit. Sandstone-hosted disseminations (chalcocite-rimmed bornite) range up to 200 μ diameter, with a mode around 40 μ , and are variably quartz-intergranular or exhibit "mutual" intergrowths with chlorite.

D. Cowan, B. Sc.



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PAR/5516/1

10th October, 1985.

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Dear Wally,

Petrology Samples - Mt. Lyell Area

I am sending you today, under separate cover, six samples for petrographic description. Details of the samples are as follows:

- (1) T865 Hematized Owen Conglomerate with minor pyrite mineralization.
- (2) T866 Strongly pyritized and ?lead-zinc mineralized ?Jukes Conglomerate.
- (3) T867-871 Five samples from NL1102, a diamond drill hole completed in the vicinity of the North Lyell orebodies. These samples are green and altered examples of a clastic sediment, possibly Owen Conglomerate, carrying significant copper values but little obvious copper mineralization. The samples in question came from the following assay intervals:

169.5-171.5m 1.18% Cu, 18 g/t Ag, 0.52% S.
171.5-173.5m 1.66% Cu, 12.3 g/t Ag, 0.52% S.

Depth locations of each sample are:

T867 170.0m
T868 171.6m
T869 172.5m
T870 172.9m
T871 173.5m

All of the above samples are mineralized and altered post-Cambrian rocks. We are now interested in the nature of such mineralization at Mt. Lyell. I would therefore be grateful if you could give us any clues as to the sequence of alteration and mineralization events in these rocks.

In addition, we are also keen to know what the copper mineral is in the last five samples and what its metallurgical characteristics might be.

Regards,

Paul Roberts

P.A. Roberts
Senior Regional Geologist