2012 Back River Core Logging Guide - Lithological Descriptions

Sabina Gold & Silver Corp.

Revised February 29, 2012

A. Greywacke (1a and 1c)

Light to dark grey, fine to medium grained, massive to poorly bedded dirty sandstone (greywacke). In some cases this rock is weakly foliated, defined by the alignment of biotite in the groundmass. Based on the various characteristics and occurrences observed in this rock, it can be divided into two sub units.

Unit **1a (Fig. 1)** consists of thickly bedded to semi-massive, medium grained greywacke with only minor mudstone interbeds and rip-up clasts. This is by far the most common rock type observed at Back River. These rocks contain very little alteration, less than 3 volume percent of quartz veining, and only trace amounts of pyrite.

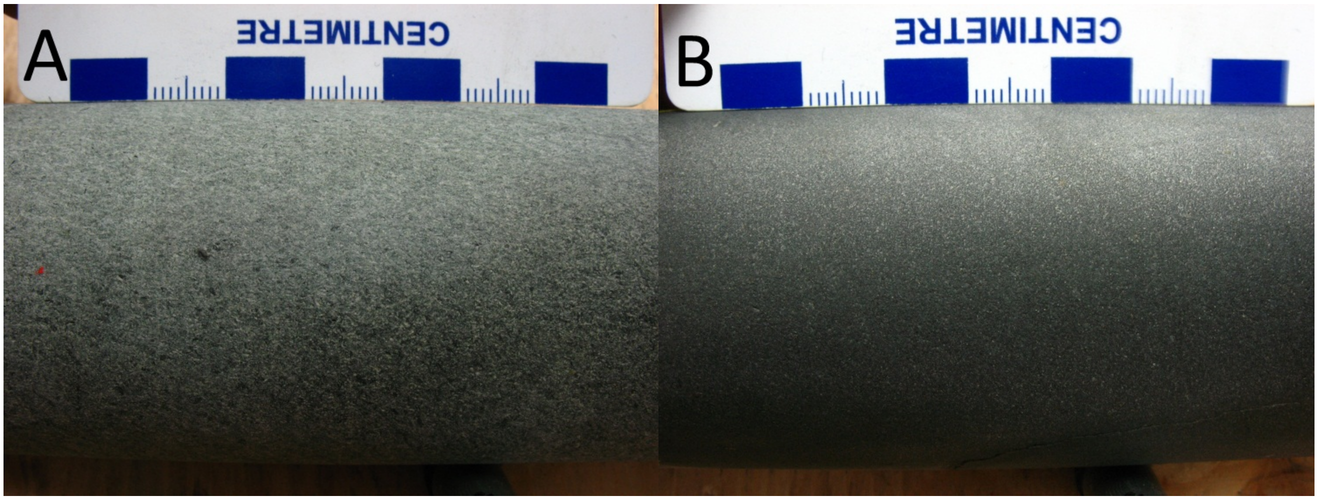

Figure 1 – A) Medium to coarse grained massive greywacke, and B) Fine to medium grained massive greywacke.

Unit **1c (Fig. 2)** consists of thinly bedded to laminated greywacke, siltstone, and mudstone. Individual beds range from several mm's to 50 cm. Grain sizes display a range between medium grained in the greywacke, to aphanitc in the mudstone. The interbedded nature gives this unit a "striped" appearance. Contacts between the three rock types are often gradational, providing an excellent means of gaining younging direction.

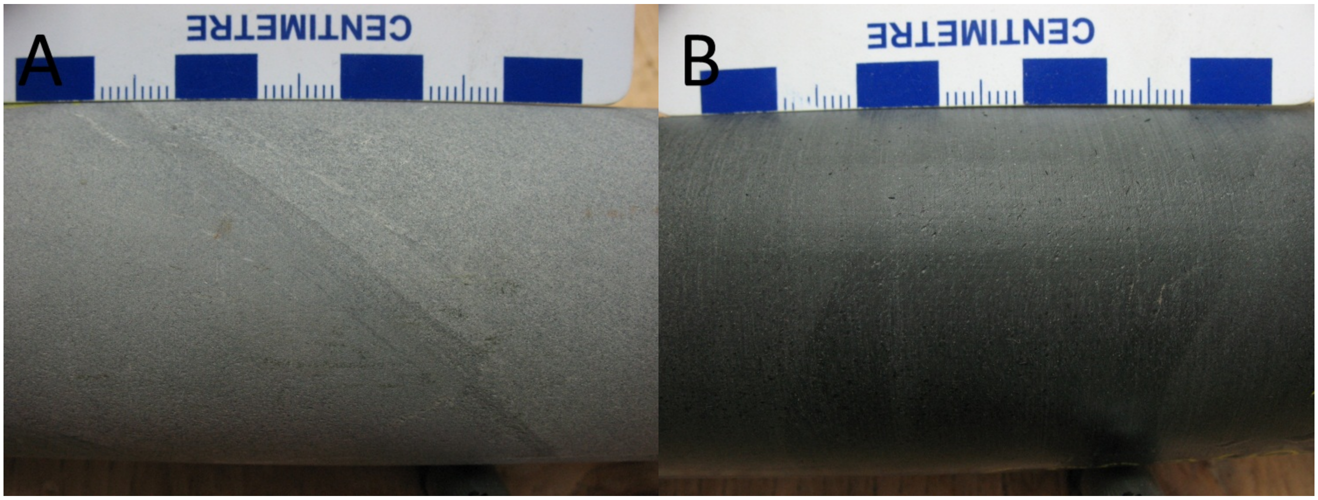

Figure 2 – A) Unit of 1c, showing layer of dark siltstone in a greywacke (dry), and B) 3cm wide dark siltstone bed in a greywacke (wet).

Locally, the greywacke can be comprised of a significant portion of volcaniclastic material (*see unit 4va*).

B. Mudstone (3a, and 3c)

Dark grey to black, fine-grained to aphanitic, moderately to strongly foliated mudstone. Appearance is variable depending on the amount of deformation it has undergone. Much of the mudstone observed has undergone a significant amount of strain **(Fig. 3A)**, resulting in its phyllitic nature and a strong foliation (**3a)**. Non-phyllitic massive mudstones **(Fig. 3B)** usally with higher silicification **(3c)**.

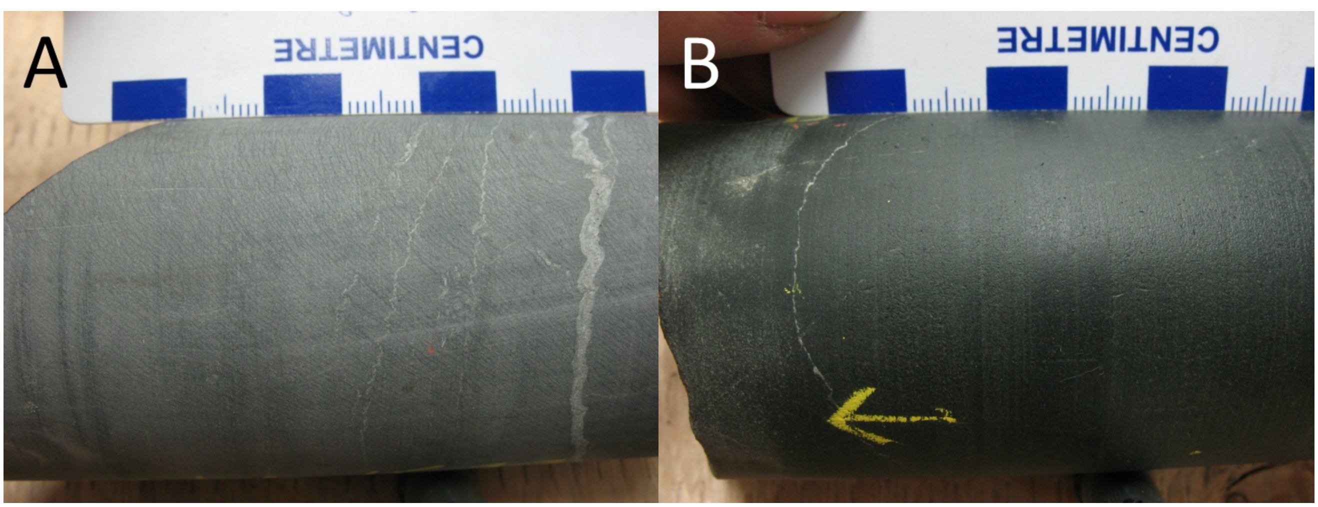

Figure 3 – A) Unit 3a, a foliated mudstone (dry), and B) Unit 3c, a massive mudstone (wet)

C. Iron Formation (2d, 2c, 2dc):

Two types of iron occur at Back River, Silicate Iron Formation (SIF) (**2d**) and Oxide Iron Formation (OIF) (**2c**). In general, the difference between the two is that SIF is dominated by iron silicates (i.e. amphiboles), whereas OIF is dominated by magnetite. Descriptions of each are provided below.

Silicate Iron Formation (2d)

These rocks are also banded rocks that consist of bands of chert and iron silicates **(Fig. 4)**. Bands range between a few mm's to 50 cm's in width. Chert bands are white to light grey colour and often have a cloudy appearance. Where it is difficult to distinguish between chert and quartz veining, a good rule of thumb is that chert will always conform to the banding in the iron formation, whereas veins will not. The iron silicate bands are composed of amphiboles, grunerite (alteration product), garnet, and sporadic euhedral magnetite grains, rarely thin bands, all set on a very fine-grained chlorite rich groundmass. By definition, this unit contains < 2% magnetite.

Figure 4 – A) Thick band of amphiboles in a SIF (wet), and B) Alternating bands of chert and amphibole in a SIF (dry).

Oxide Iron Formation (2c)

OIF typically consists of alternating bands of magnetite and chert with lesser amounts of iron silicates **(Fig. 5)**. Bands range between a few mm's to 50 cm's in width. The magnetite bands are dark grey to brown, often displaying a metallic luster. In some cases these bands are replaced by sulfides dominated by pyrrhotite. By definition, OIF contains more than 10% magnetite.

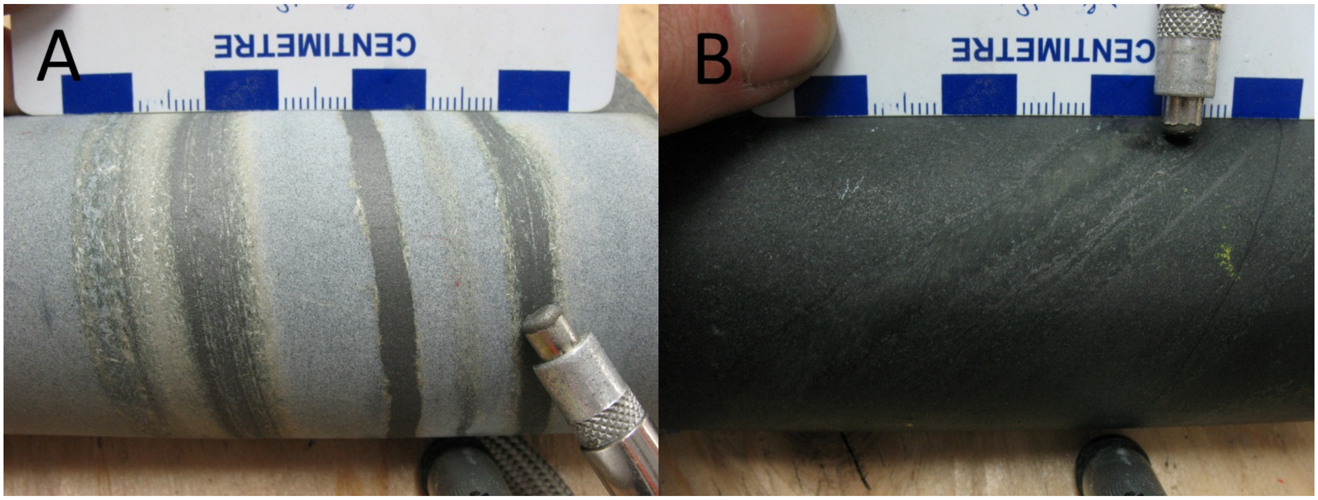

Figure 5 – A) Typical "zebra rock" with alternating bands of chert and iron oxides (dry), and B) More subtle version of 2c, but magnetite and chert bands are still distinct (wet).

Magnetite Bearing Silicate Iron Formation (2dc)

These rocks are very similar to 2d, but they contain between 2-10% magnetite.

Sulphide-bearing Iron Formation (2ca, 2da, 2dca)

Where the iron formation contains more than 2% sulphide minerals (i.e. Pyrite, Pyrrhotite, Aresnopyrite), the suffix "a" is added to the back of the name to denote their presence.

D. Dykes, Sills, and Volcanic Rocks (4)

While not common, a variety of dykes, sills, and volcanic rocks occur in the Back River area. These are outlined below.

Felsic Dykes (4a)

White to light grey to green, fine to medium grained intrusive rocks **(Fig. 6)**. Highly siliceous, locally containing euhedral feldspars and rounded quartz phenocrysts. Display cross cutting relationships with the surrounding units.

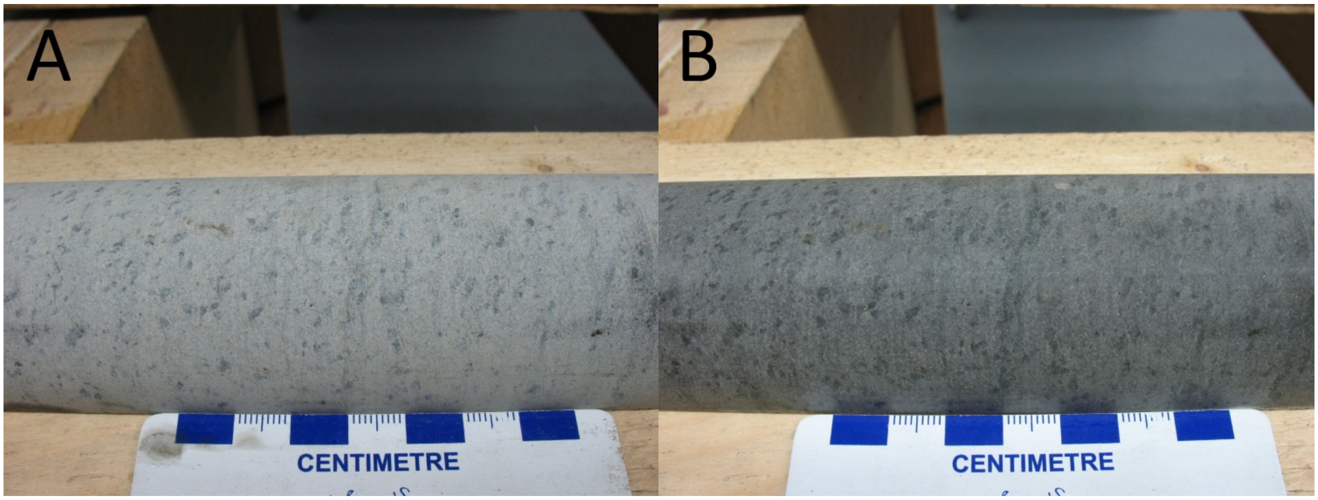

Figure 6 – A) Felsic dyke with quartz phenocrysts (dry), and B) Same as A), but wet.

Intermediate Dykes (4b)

Medium grained rocks containing variable amounts of quartz, feldspar, biotite, amphibole, chlorite, sericite, and carbonate. Commonly contain medium grained, equigranular, light to medium grey groundmass +/- feldspar and biotite phenocrysts.

Volcanic/Volcaniclastic Rocks (4v)

Extrusive equivalents of all of the above units occur to varying degrees throughout the Back River region. Naming of volcanic rocks follows that of the intrusives with the addition of a "v" (i.e. **4va, 4vb, 4vc**).

Most commonly, felsic volcanic (**4va; Fig. 7**) and volcaniclastic rocks occur at Boulder Pond. They can be distinguished by their fragmental textures and flow banding. In addition, well rounded blue quartz eyes of volcanic origin are common in many areas. While not conclusive evidence of volcanic rocks, blue quartz eyes are a good indication of a volcanic source close by and should be noted.

Figure 7 – Felsic volcaniclastic unit with abundant rounded quartz-eyes.

NOTE: *Caution should be taken when determining the amount of volcanic components that comprise a lithological unit. Keep in mind that greywackes are sedimentary in origin, and by definition can contain abundant components of multiple lithologies. Therefore, if you see evidence of a volcanic component (i.e. blue quartz eyes) in a greywacke without conclusive evidence of volcanic origin to the overall unit, it is best to log the major lithology as a 1a and include 4va as the minor lithology.*

E. Gabbros/Diorites (8)

Gabbroic dykes are fine- to coarse-grained, light- to dark-green to greenish-grey, and commonly display aphanitic chilled margins. In some cases away from the margins, the texture of the dyke becomes porphyritic (locally) in which feldspar crystals that vary in size from 1mm to 1 cm are set on a very fine-grained chloritic groundmass. The feldspar in the gabbros is commonly altered to carbonate. Commonly gabbros are composed of various amounts of amphiboles, biotite, and plagioclase and rarely, and locally the presence of K-Feldspar has been observed **(Fig. 8)**.

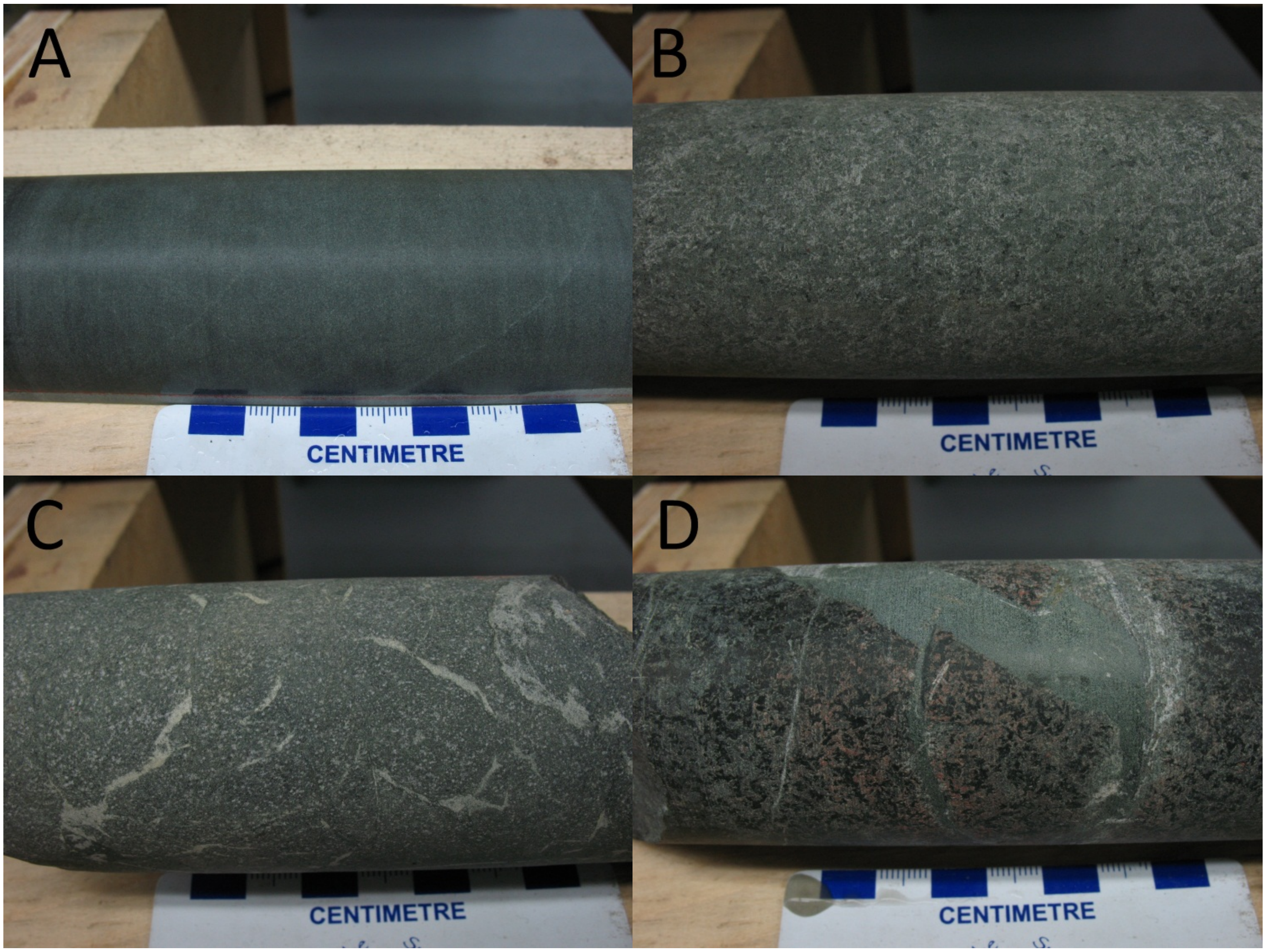

Figure 8 – A) Fine grained gabbro (wet), B) Coarse grained gabbro (dry), C) Carbonate veinlets in a gabbro (dry), and D) Potassic alteration in a heavily veined, coarse grained gabbro.

F. Veins (5)

Quartz veins (5)

Quartz veins are white, clear, or smoky massive crystalline veins that have sharp or irregular contacts with the other units. These veins may or may not cross-cut banding and bedding.

Sulfide Bearing Quartz Veins (5a)

Quartz veins that contain 2% or greater sulfides such as pyrite, pyrrhotite, and arsenopyrite belong to this category **(Fig. 9)**.

Carbonate Bearing Quartz Veins (5b)

Quartz veins that contain 2% or more carbonates such as dolomite, calcite, or siderite are considered carbonate bearing

Sulfide and Carbonate Bearing Quartz Veins (5ba)

These are carbonate bearing quartz veins that contain 2% or more sulfides.

Figure 9 – Large sulfide bearing quartz vein with pyrrhotite and chlorite in quartz.

NOTE: *Only use this unit if the vein is >1m.*

G. Proterozoic Sedimentary Rocks (7)

Proterozoic rocks of the Gouldburn Group overlie Archean rocks at parts of George Lake and Boulder Pond properties. They are dominated by flat-lying clastic sedimentary rocks that have undergone only minor alteration and deformation. A description the major units in the Gouldburn Group is provided below.

NOTE: *GemsLogger will only except 7 for proterozoic rocks so don't pay attention to these rocks they are **not** important to finding **GOLD**!!!!!!! They are only **GOOD FOR BLANKS**!!!!!!*

Siltstone with interbedded Sandstone (7a)

Laminated to thinly bedded maroon siltstone with minor interbeds of grey to light brown siltstone and medium grained sandstone. The maroon colour, interpreted to be a result of hematite oxidation, is concentrated in the siltstone and exhibits a light pink colour in the sandstone. The unit may exhibit soft sediment structures such as cross bedding, scour, flame, and load casts. The unit takes on a more bleached appearance towards the base and the unconformity.

Micaceous Quartz Sandstone (7b)

Medium to locally coarse grained, light grey to light brown, strongly micaceous quartz sandstone. The sandstone forms thick beds, and may locally contain minor thin layers of grey and brown siltstone. This unit locally contains abundant orange blotches, likely the result iron carbonate alteration of the fine grained matrix.

Laminated sandstone/siltstone (7c)

Medium grained, light grey sandstone interbedded with light brown to dark grey laminated siltstone. The sandstone is strongly micaceous and typically forms beds a few cm's thick. Individual beds contain localized hematite alteration. The siltstone occurs as thinly laminated concentrations in between the sandstone beds. Primary sedimentary features, such as scours and cross bedding are also commonly preserved in the unit.

Regolith (7f)

Regolith between Proterozoic and Archean consisting of clay, mud suspended fragments of Proterozoic and Archean lithologies. The unit also displays prominent quartz and carbonate veining. Regolith thickness typically ranges between 0 and 80 cm.

Lithic quartz sandstone (7g)

Quartz sandstone containing greater proportion lithic clasts than feldspar clasts. Quartz grains display variable grain sizes and rounding. Matrix is composed of either allocthonous sediment, quartz or carbonate minerals. This unit is differentiated from greywacke by the lack of mud and clay in the matrix.

Carbonate rocks (7h)

White to maroon to beige carbonate rocks. These includes crystalline limestones and dolostones and any variant of clastic carbonates such as wackestones, grainstones, packstones, etc. Crystalline carbonates may exhibit a stylolitic texture. Dolostone may occur as sub-rounded, very coarse grained, composite particle grainstone with a medium grained sandy matrix or as a crystalline dolomite which may exhibit a stylolite texture. Remnant bedding is notable as wavy dark bands in the dolostone.

Arkosic quartz sandstone (7i)

Sandstone containing greater proportion feldspar clasts than lithic clasts. Quartz grain may be of variable grainsize and rounding. Matrix is composed of either allocthonous sediment, quartz or carbonate minerals. Light grey, medium to coarse grained, moderate to well sorted, rounded to subrounded, carbonate cemented, subarkosic sandstone with lithic clasts of sulphide minerals and graphite. Clasts of the subarkosic sandstone contains up to 14 % feldspar and lithics combined, the rest consists of well rounded to sub-rounded quartz. The sandstone may be locally zeolite and hematite altered. Hematite alteration is primarily noted in the feldspar grains. Zeolite alteration occurs as anhedral, chalky mineralization within fractures and vugs in the sandstone. Coarser grained varieties of this sub-arkosic sandstone have the appearance of tapioca pudding.

H. Overburden (9)

2013 Back River Core Logging Guide - Alteration Descriptions

Sabina Gold & Silver Corp.
Revised Feb 18, 2013

A. Grunerite

Grunerite alteration is characterized by pale yellow-green amphibole that often replaces iron-rich bands in iron formation, or forms along fractures/veinlets that cross-cut bedding **(Fig. 1A)**. Grunerite can be fine to coarse grained, where coarser grained examples often exhibit radiating fibrous aggregates that give the rock a "spotted" texture **(Fig. 1B)**.

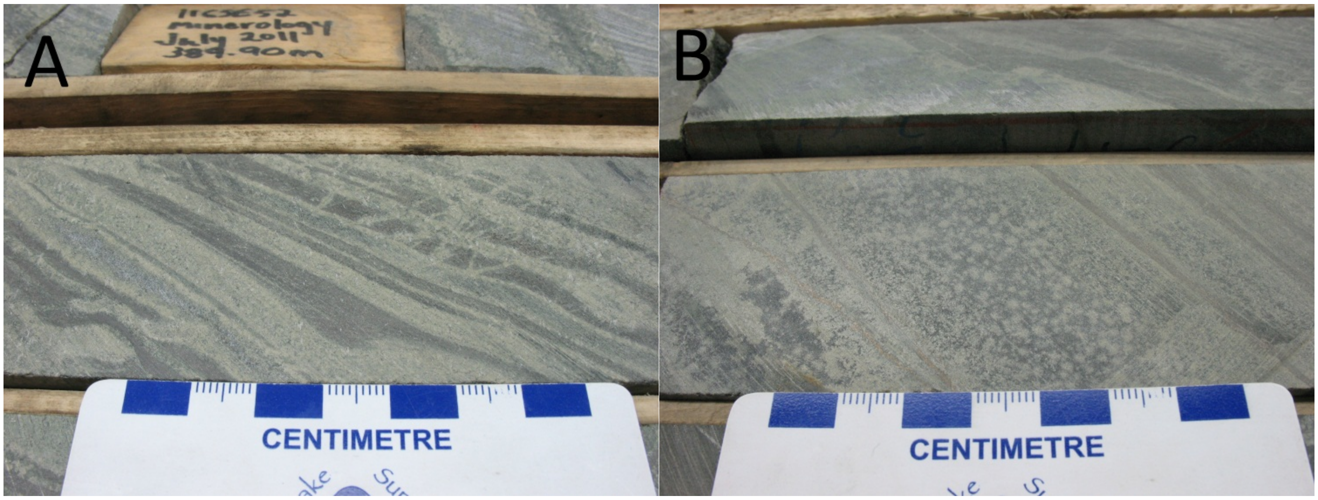

Figure 1 – A) Grunerite replacing magnetite bands in an iron formation, and cross-cutting beds along fractures, and B) Spotted grunerite alteration.

B. Amphibole

Amphibole alteration is a somewhat general description of the more arbitrary amphibole species including ferroactinolite and ferrohornblende (excluding grunerite and tremolite, which have more reliable traits for identification; see sections **A.** and **I.**). Amphibole alteration can vary from pale blue-green to dark-green or black. It often replaces iron-rich beds **(Fig. 2B)**, or concentrates in veins or fractures **(Fig. 2A)**. Individual crystals of amphibole are usually tabular or acicular and can range in size from less than 1 mm to greater than 1 cm.

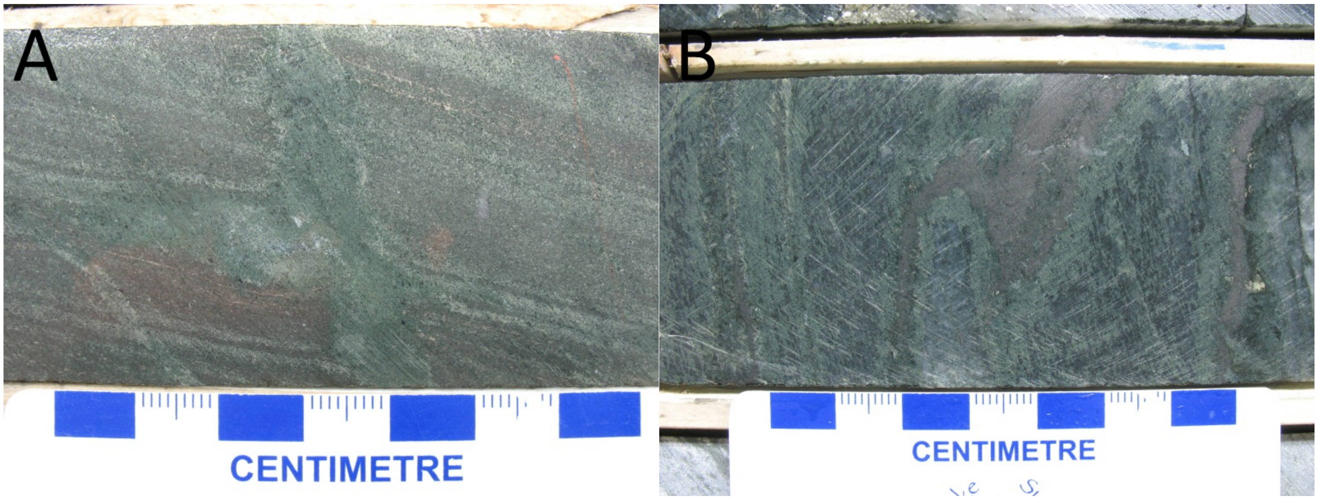

Figure 2 *(previous page)* – A) Vein of quartz-amphibole cross-cutting bedding in an iron formation and causing amphibole alteration of the iron rich beds, and B) Amphibole alteration around a folded magnetite bed in an iron formation.

C. Chlorite

Chlorite appears as a blue-green to dark green mineral that can form patchy aggregates in veins **(Fig. 3A)**, or replace amphiboles in iron formation. Chlorite alteration is often difficult to distinguish from amphibole alteration **(Fig. 3B)**, especially when the two are intergrown. In this case, chlorite can be distinguished by its relative softness, since it is easily scratched by a tungsten carbide scribe, while amphibole is more resistant to scratching.

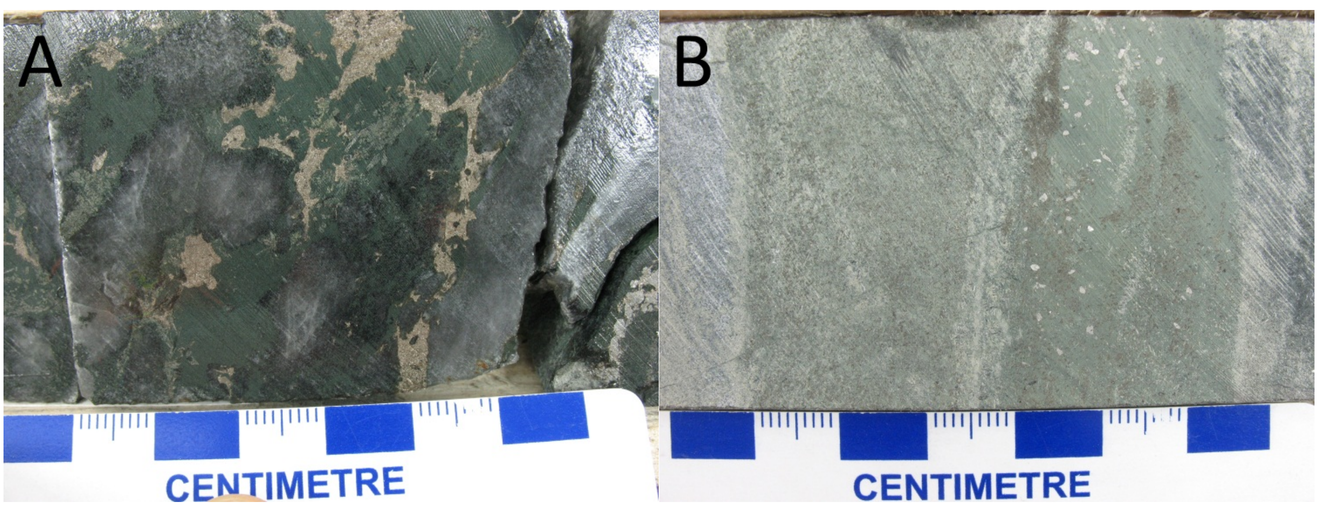

Figure 3 – A) Chlorite-pyrhottite forming an aggregate in a quartz vein, and B) Chlorite alteration (right side) with amphibole alteration (left side) replacing iron beds in an iron formation.

D. Silica

Silica alteration is usually pervasive **(Fig. 4A)** and difficult to identify visually. Identification of silicification is best achieved through periodic scratch tests, since silicified rocks are generally much harder than they would be if silicification were absent. Caution should be exercised, however, since other minerals (e.g. magnetite and amphibole) can contribute to a rock's hardness. On a broken surface, silicification will often appear recrystallized **(Fig. 4B)**.

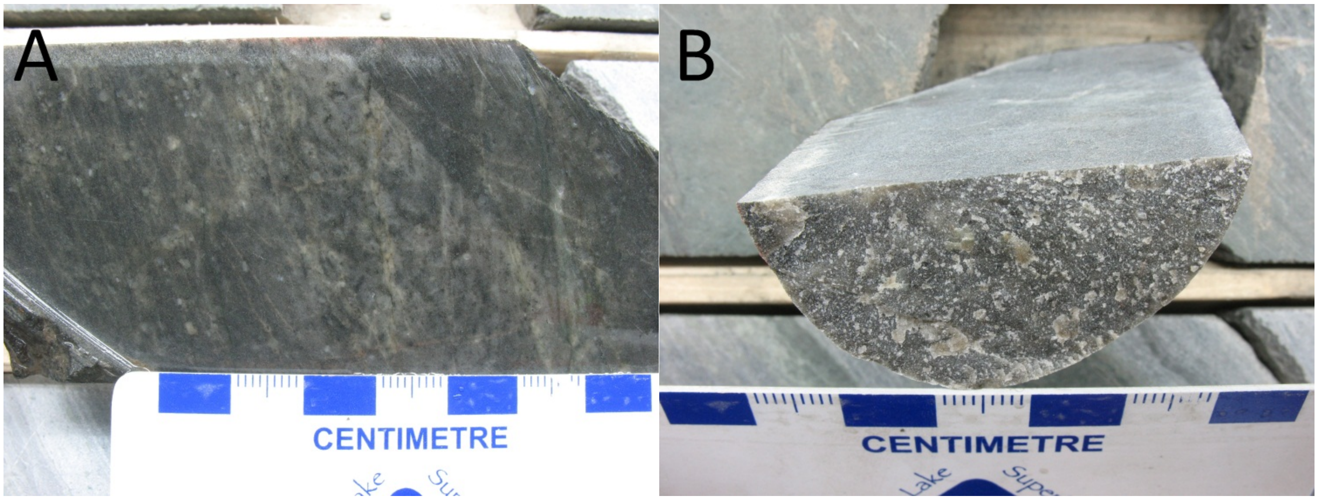

Figure 4 – A) Pervasive silicification of iron formation, and B) Recrystallized quartz texture on broken surface.

E. Graphite

Graphite alteration is common in units of mudstone **(Fig. 5A)**. Graphite is easily identified by its extreme softness (it will leave a streak on paper) and by its dark grey metallic lustre. Rocks will often be broken along seams of graphitic alteration and display a characteristic sheen **(Fig. 5B)**.

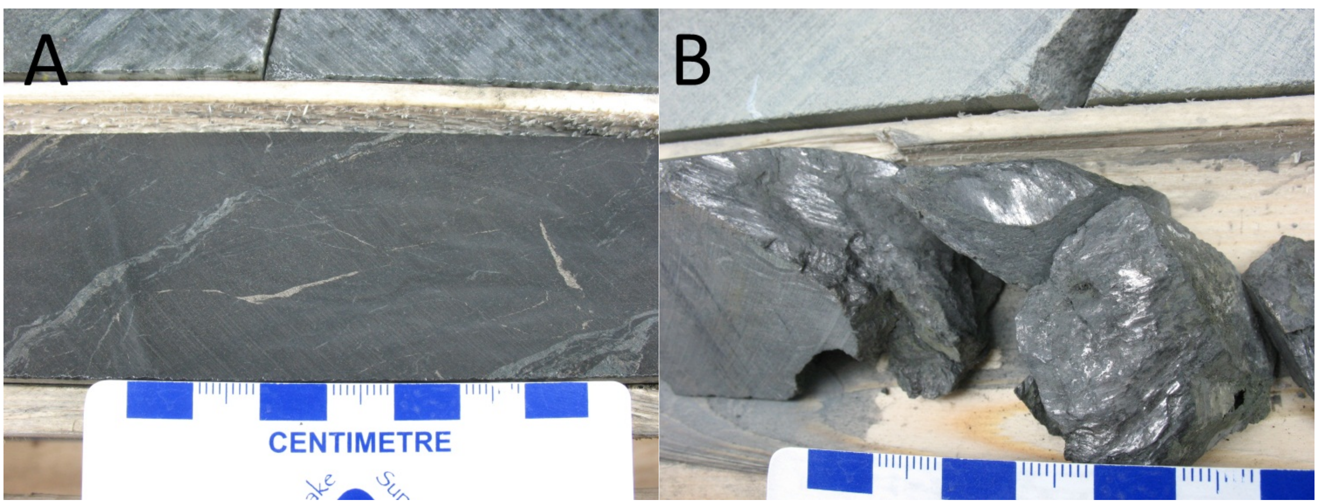

Figure 5 – A) Faint graphitic seams in an altered mudstone, and B) Typical metallic lustre of graphite along a broken seam.

F. Garnet

Garnets are observed in altered mudstone and in silicate iron formation as euhedral to subhedral porphyroblasts. Garnets can range in colour from pinkish to yellow brown. They can range in size from less than 1 mm to greater than 1 cm. Any deformation or pressure shadowing should be noted and measured if present.

G. Carbonate

Carbonate alteration is most commonly observed as fracture filling or in veinlets along with quartz and other impurities (e.g. fine grained chlorite) that often give the veinlets a “dirty” appearance. Two dominant types of carbonate are common in the Back River core: **ankerite** is pale yellowish-orange in colour, while **calcite** is white. Ankerite will not react with cold, dilute HCl, whereas calcite will effervesce. Acid tests must be used with caution, since even a minor amount of calcite with ankerite will cause a reaction.

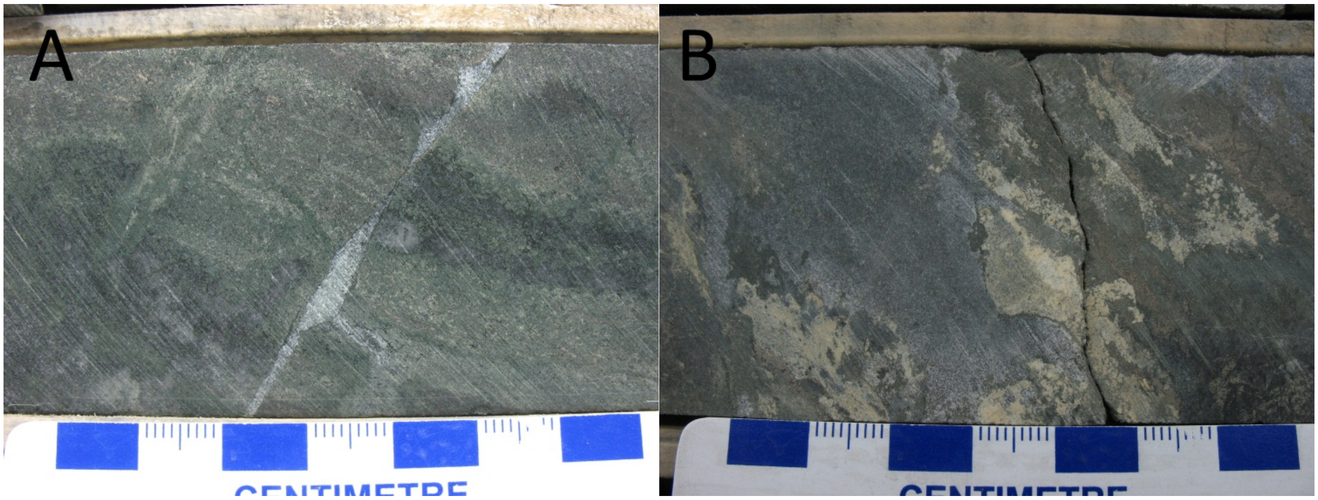

Figure 7 – A) Calcite veinlet cross-cutting beds in iron formation, and B) Patches of ankerite and calcite in iron formation.

H. Albite

Albite is usually observed in mudstones as a fine grained (typically ~0.1mm to 1mm) laths, generally with an aspect ratio of ~3:1. These laths are generally white in colour (**Fig. 8**), however they can have a pinkish hue.

Figure 8 – Albite laths in a mudstone. Field of view is 1cm.

I. Tremolite

Diopside-tremolite aggregates (always logged as tremolite), are pale greenish-grey subhedral cauliflower shaped crystals with a distinct vitreous lustre on cleavage surfaces.

Appendix B Sample Location Figures

B1 Overburden and Quarry Samples Collected by Rescan at the Goose Property

Appendix B1: Sample Location Figures, Overburden and Quarry Samples Collected by Rescan at the Goose Property