Geological Survey of Canada Open File 7339

Appendix A: Geology and Hydrothermal Alteration of the Fab Lake Region, Northwest Territories

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Scale 1:7,500

kilometres

0 0.5 1 2

Abstract

Detailed mapping of the Fab Lake magnetite-group iron oxide-copper-gold (IOCG) system has defined an alteration footprint extending almost 10 by 5 km, with the long axis trending in a southeast-northwest direction. Within this area, field mapping identified seven alteration assemblages: 1) high temperature albite and albite+amphibole±magnetite [HT Na and HT Na-Ca-Fe]; 2) amphibole +magnetite±apatite and amphibole+magnetite+K-feldspar [HT Ca-Fe and HT Ca-Fe-K]; 3) high temperature K-feldspar+magnetite±hematite [HT K-Fe]; 4) K-feldspar; 5) chlorite; 6) hematite; and 7) low temperature epidote+K-feldspar+quartz [LT Ca-Fe]. These alteration assemblages are expressed as incipient to pervasive alteration in the form of veins, hydrothermal breccias and replacement fronts in the host rocks exhibiting multiple crosscutting and overprinting relationships. All of the historic Fab U-Cu-Fe mineral showings occur within zones characterized by intense, texture-destructive alteration comprising multiple episodes of high temperature albite/albite+amphibole+magnetite (Na and Na-Ca-Fe) and amphibole+magnetite±apatite/amphibole+magnetite-K-feldspar (Ca-Fe and Ca-Fe-K) overprinted by K-feldspar+magnetite±biotite (K-Fe) assemblages.

The conceptual alteration to brecciation and mineralization model is key to understanding the alteration assemblages documented in the Fab IOCG system. These assemblages record the build-up of a magnetite-group IOCG system: early high-temperature Na/Na-Ca-Fe and Ca-Fe/Ca-Fe-K alteration, overprinted by high temperature K-Fe alterations and incipient to well-developed hydrothermal breccias. The alteration assemblages themselves and the zoning observed in outcrop provide true vectors towards mineralization, which based on the nature of the hydrothermal system, can be applied elsewhere in the GBmz and other prospective terranes. As field observations indicate that lower-temperature K-Fe alteration associated with hematite-group IOCG systems is only weakly developed, the Fab Lake region is most prospective for magnetite-group types of IOCG mineralization.

Alteration nomenclature

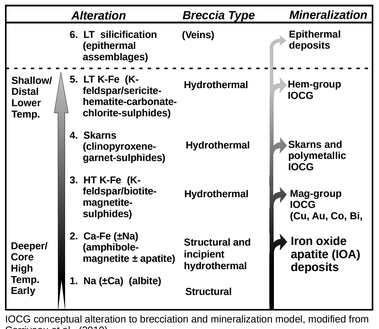
Na (HT) and Na-Ca-Fe (HT)
Na alteration occurs as: 1) incipient to pervasive albitization of the host rocks; 2) albite selvages on amphibole±magnetite veins; 3) albite veins with and without amphibole±magnetite selvages; and 4) texture-destructive amphibole+albite+magnetite replacements.

Ca-Fe (HT)
Observed as: 1) amphibole and magnetite±amphibole alteration types (herein referred to as Ca-Fe alteration), 2) amphibole+apatite and amphibole+magnetite+apatite alteration types (herein referred to as Ca-Fe-P alteration) and 3) amphibole±magnetite veins with K-feldspar±magnetite selvages (herein referred to as Ca-Fe-K alteration). Ca-Fe-K is a prominent hydrothermal alteration within the Fab hydrothermal system, expressed as veins, composite veins, replacement veining, hydrothermal crackle breccias and stockworks

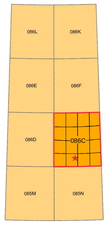
K-Fe (HT)
K-Fe alteration is divided into three assemblages: 1) pervasive K-feldspar+magnetite/hematite impregnation; 2) K-feldspar+magnetite/hematite+biotite alteration fronts and replacement zones; and 3) K-feldspar veins with magnetite selvages.

K-Fe (LT)
Specular hematite veinlets with K-feldspar± quartz selvages overprinted by epidote alteration and are crosscut by the quartz veins with the specular hematite selvages.

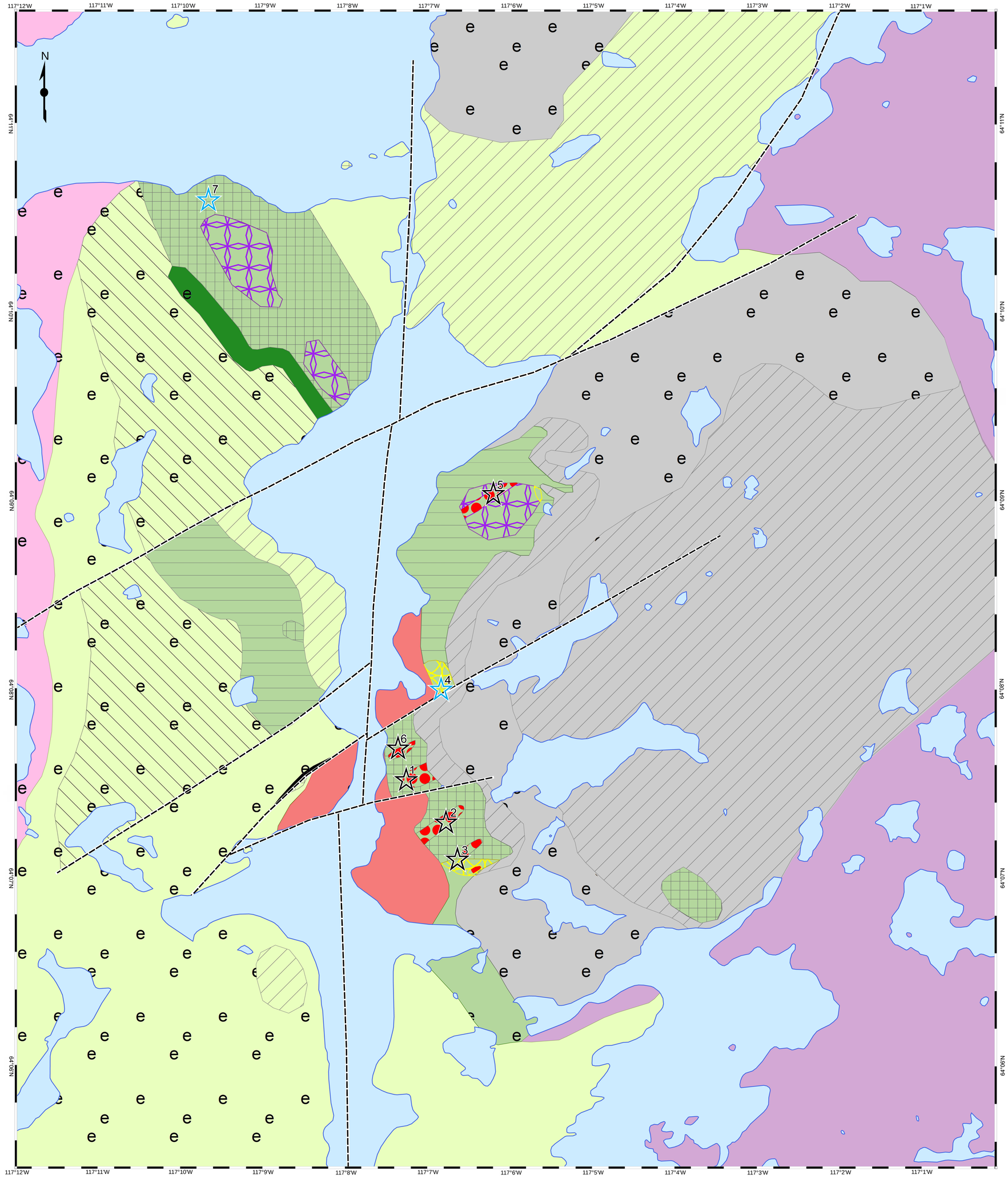
Ca-Fe (LT): epidote±K-feldpsar+quartz+chlorite
Epidote-bearing alteration types form the regional alteration aureole of the Fab hydrothermal system. The intensity and variety of these alteration types decrease southward. They occur as pervasive replacements and vein networks in varying proportions of epidote, microcrystalline K-feldspar, quartz and pervasive oxidation fronts.



IOCG conceptual alteration to brecciation and mineralization model, modified from Corriveau et al., (2010).



National Topographic System reference
Geodetic Reference System 1980
Approximate magnetic declination 2013: 19°52'E



Legend

Geological Units

- **Granite**: Coarse-grained, phaneritic granite composed of quartz, K-feldspar and plagioclase. Hornblende is the main mafic mineral with lesser quantities of biotite.
- **Rapakivi granite**: Very coarse- to coarse-grained K-feldspar phenocrysts with alternating overgrowths of albite and K-feldspar set in a medium- to coarse-grained groundmass composed primarily of quartz, K-feldspar, plagioclase and trace amphibole and biotite.
- **Undivided granite**: Medium- to coarse-grained, leucocratic to mesocratic rocks ranging in composition from granitic to monzonitic with accessory biotite±hornblende±magnetite. Equigranular to seriate textured with weakly developed K-feldspar or plagioclase-phyric zones.
- **Andesite Dyke**: A circa 200 metres wide unit in sharp contact with the dacitic feldspar porphyry. Massive and homogenous to flow-banded unit with fine-grained, sparsely disseminated plagioclase and pyroxene phenocrysts with accessory magnetite, apatite, zircon and quartz.
- **Porphyritic dacite**: Fine- to medium-grained euhedral plagioclase phenocrysts set in a fine-grained to aphanitic groundmass of quartz and altered feldspar. Groundmass phases include chlorite, amphibole, pyroxene, iron-oxides and titanite. Occasional K-feldspar and quartz.
- **Undivided porphyries**: Fine- to medium-grained, feldspar porphyries: one-feldspar porphyritic intrusions with rhyolitic to andesitic compositions, one-feldspar porphyritic intrusions containing trace quartz phenocrysts with rhyolitic compositions and two-feldspar porphyries with dacitic to rhyolitic compositions.
- **Porphyritic monzonite**: Phaneritic porphyritic monzonite to monzodiorite, with localized zones with aphanitic groundmass. Plagioclase and K-feldspar are the main phenocrysts and occur in a proportion of 3:1 to 2:1. Plagioclase phenocrysts are coarser grained than the K-feldspar phenocrysts. This intrusion has a bright pink to orange pink color on weathered surfaces.

Faults (interpreted)

Alteration

- Weak/Not mapped
- Silicification
- Ca-Fe (LT)/epidote
- Incipient K-Fe (LT)/Ca-Fe (HT)
- K-Fe (HT)/Ca-Fe±Na (HT)
- Ca-Fe (HT)/K-Fe (HT)/K-Fe (LT)
- Ca-Fe (HT)/Ca-Fe (LT)
- Ca-Fe±Na (HT)/K-Fe (HT)
- Ca-Fe (HT)/Na (HT)/K-Fe (HT)
- Na (HT)/Ca-Fe (HT)/K-Fe (HT)

Mineral showings/anomalies

- 1 Fab Lake U-Cu-Fe showings (Fab1)
- 2 Fab Lake U-Cu-Fe showings (Fab2)
- 3 Fab Lake U-Cu-Fe showings (Fab3)
- 4 Fab Lake Th-U-Fe Anomaly (Fab4)
- 5 Fab Lake U-Cu-Fe showings (Fab5)
- 6 Fab Lake U-Cu-Fe showings (Fab6)
- 7 Fab Lake Th-U-Fe Anomaly (Fab7)

Geology modified after

Gandhi, S.S., 1988. Volcano-plutonic settings of Cu-bearing magnetite veins of FAB claims, southern Great Bear magmatic zone, Northwest Territories; in Current Research, Part C, Geological Survey of Canada, Paper 88-1C, p. 177-187.

Jackson, V.A. 2008. Preliminary geologic map of part of the southern Wopmay Orogen (parts of NTS 86B and 86C; 2007 updates), Descriptive notes to accompany 1:100 000 scale map; Northwest Territories Geoscience Office, Open Report 2008-007, 51p.

References

Corriveau, L., Williams, P., and Mumin, A.H., 2010. Alteration vectors to IOCG mineralization from unchartered terranes to deposits, In Exploring for Iron Oxide-Copper-Gold (Ag-Bi-Co-U) Deposits: Canada and Global Analogues, (eds.) L. Corriveau and A.H. Mumin; Geological Association of Canada, Short Course Notes 20, p. 89-110.

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