A Precambrian porphyry Mo-Cu ±Au ±Ag occurrence in the Superior Province: the Tilly property, James Bay area, Québec

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Abstract

The exclusive presence of porphyry-type deposits in Phanerozoic belts is becoming questionable, given the recent discoveries of porphyry deposits in Precambrian terrains (e.g., Troilus and Malartic, Québec; Spinifex ridge and Boddington, Western Australia). The Tilly property of Sirios Resources is one of the best examples of Precambrian porphyry systems in the Superior Province.

The Tilly property is located in the Archean La Grande Subprovince, in the James Bay area.The local geology is dominated by a tonalite-granodiorite pluton in contact with a dioritic stock to the north, clastic sediments to the east and volcaniclatic rocks to the southeast (figure 1). Porphyric

intrusions consisting of dykes and irregular bodies have been observed in outcrop and in drill core. Such intrusions are principally located in the centre-north of the property.

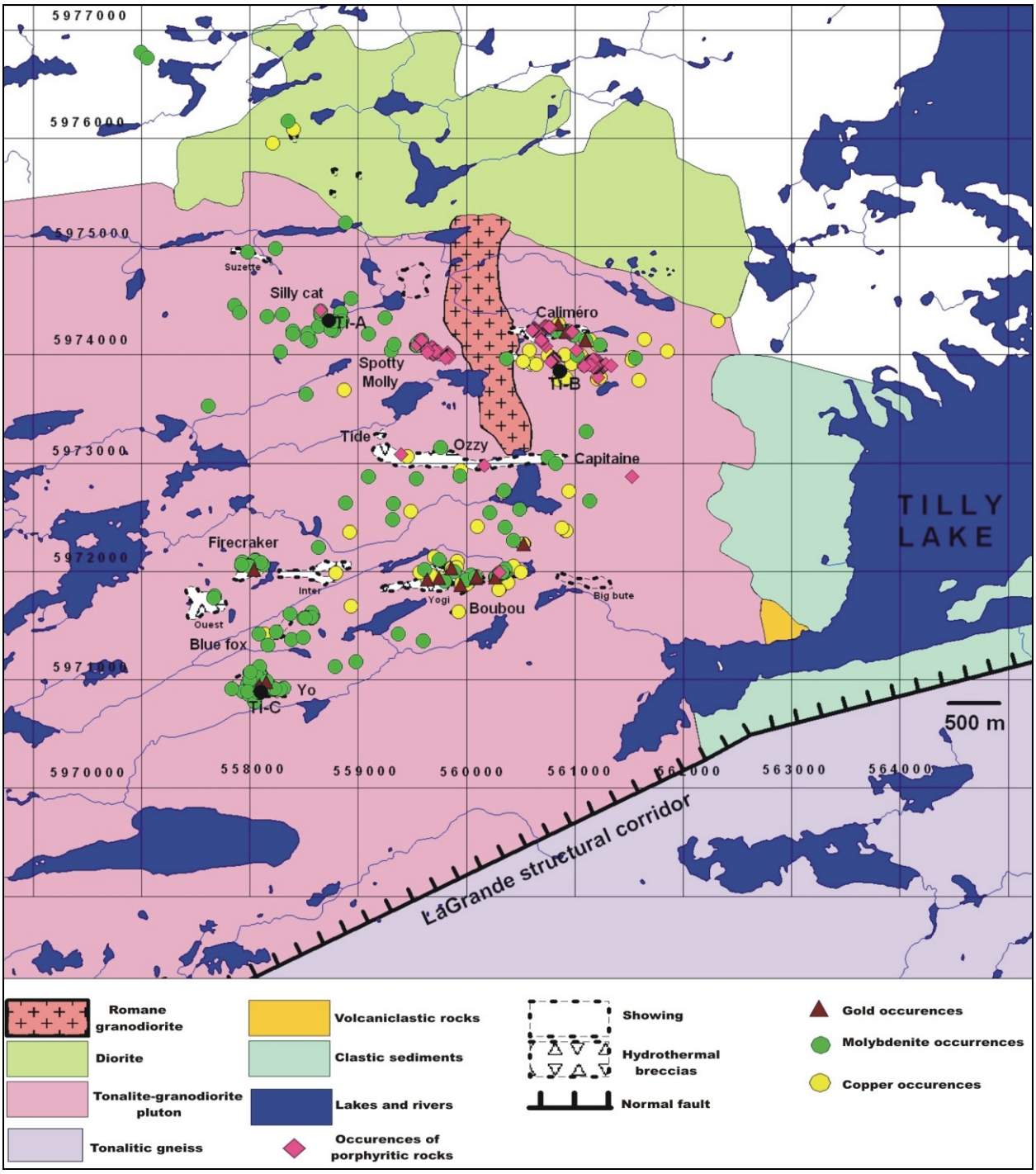

Figure 1: Map of the Tilly porphyry, James Bay area

Mineralization is exclusively hosted by the felsic pluton and porpyritic intrusions. It is composed of pyrite, molybdenite, and chalcopyrite, with minor bornite and chalcocite. Gold and silver values are systematically associated with the highest copper contents, rather then with the Mo

values. Hydrothermal alteration, especially potassic alteration, is difficult to distinguish in the field because of an intense hematite overprint. Potassic alteration consists of secondary biotite and minor K-feldspar. Phylic alteration is observed in thin section but not generally identifiable in the field.

Hectometric to kilometric zones of hydrothermal breccia occur in the pluton. These breccia were analysed using image analysis and quantitative morphological parameters (perimeter, roundness and circularity) plotted on discriminating diagrams (Jébrak 1997). Results indicate that fluid assisted brecciation was the dominant process, marked by angular clasts, hydrothermal cement and local in situ breccias with a limited corrosive wear.

In many cases molybdenite accompanies quartz in the cement of the breccias, forming cm-scale masses. Two additional styles of Mo mineralization were noted: (1) stockworks or sheeted veinlets of quartz-molybdenite ; (2) mm- to cm-scale molybdenite spots disseminated in granitoids but spatially associated with pockets and veinlets of quartz.

The late Archean age of mineralization was confirmed by Re-Os isotopic dating of pure molybdenite separates. Preliminary results on three samples (more in progress) yield an average age of 2624 +/- 77 Ma. Future work will include dating several intrusive phases using the U-Pb method on zircons.

Preliminary data suggests that the geochemistry of the intrusive rocks is characteristic of a magmatic arc environment. Combined with the metallic association of mineralization (Mo-Cu ±Au ±Ag) and the absence of fluorite, this indicates that the Tilly Mo porphyry system belongs to the “arc” type, rather than the “rift” type of deposits. This discovery opens the possibility of low-grade large tonnage porphyry-type mineralization in the James Bay area.

References

Jébrak, M. 1997. Hydrothermal breccias in vein-type ore deposits: a review of mechanisms, morphology and size distribution. Ore Geology Reviews, 12: 111-134.