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Highland Valley Copper

MINE GEOLOGY INFORMATION

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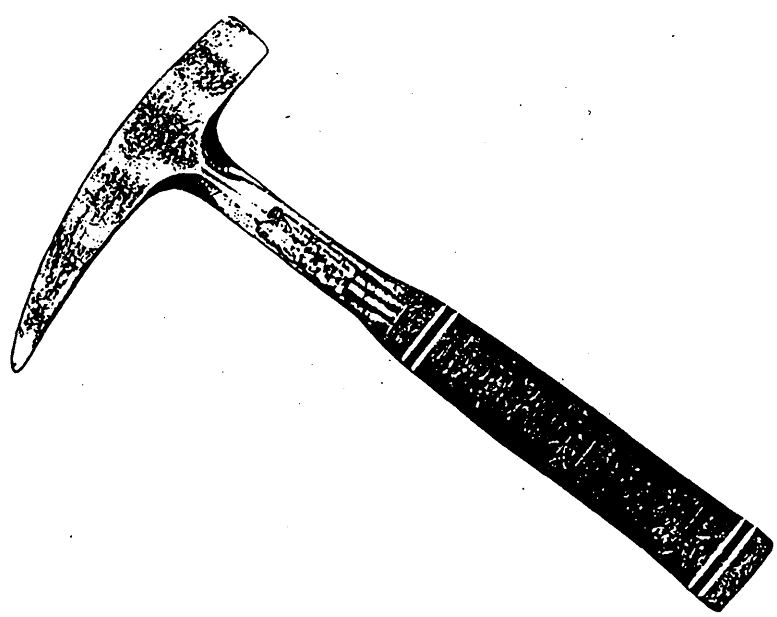
- Geology of the Valley Deposit



GEOLOGY AND ORE DEPOSITS OF THE HIGHLAND VALLEY AREA

(W.J. McMillan)

1 INTRODUCTION

The Highland Valley district, known for its large low-grade open pit porphyry copper-molybdenum mines, is situated in south-central British Columbia about 350 kilometres northeast of Vancouver (Fig. 1).

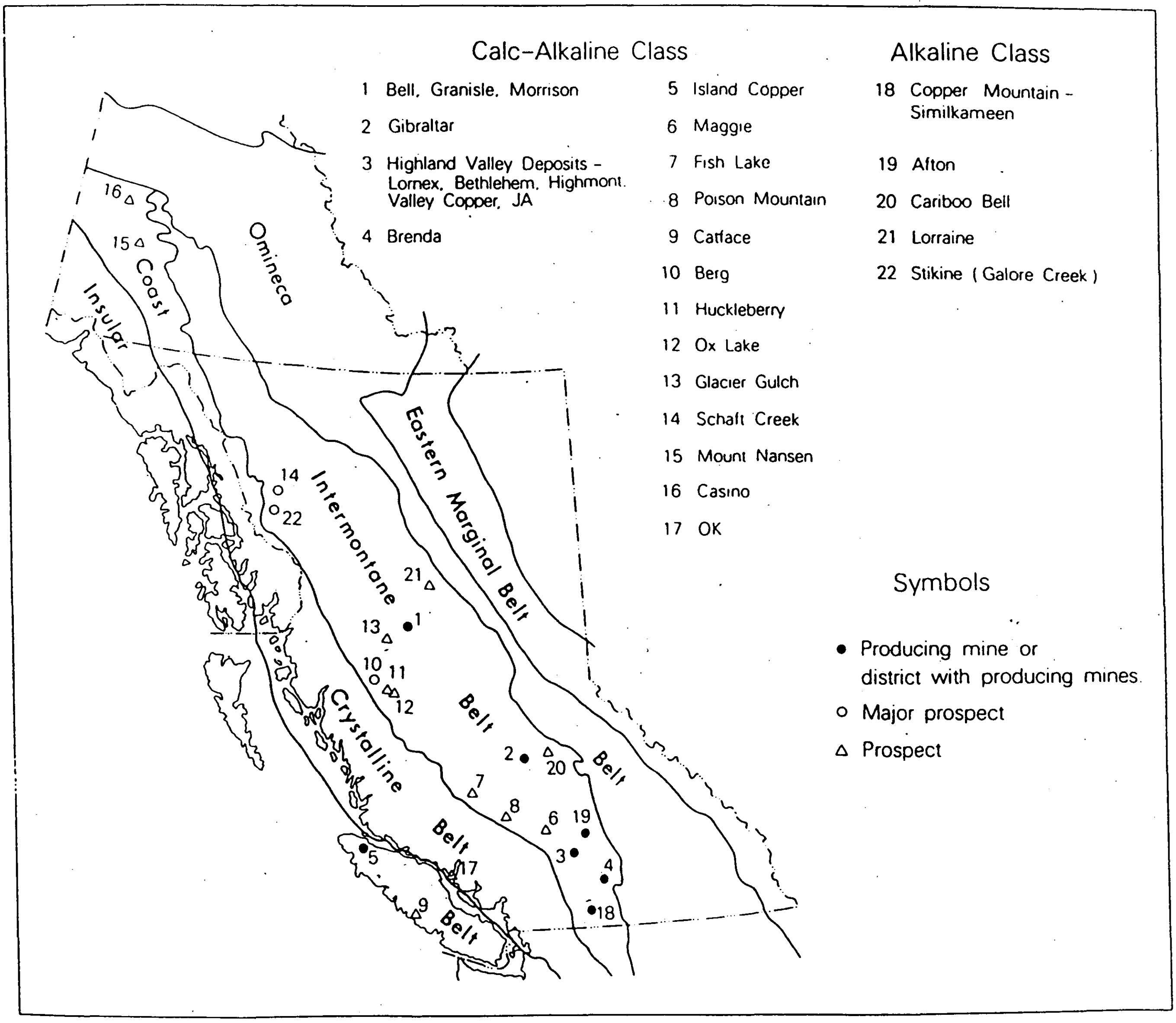


Figure 1. Distribution of porphyry copper deposits of the calc-alkaline and alkaline classes in the Canadian Cordillera relative to tectonic belts. Most are in the Intermontane Belt.

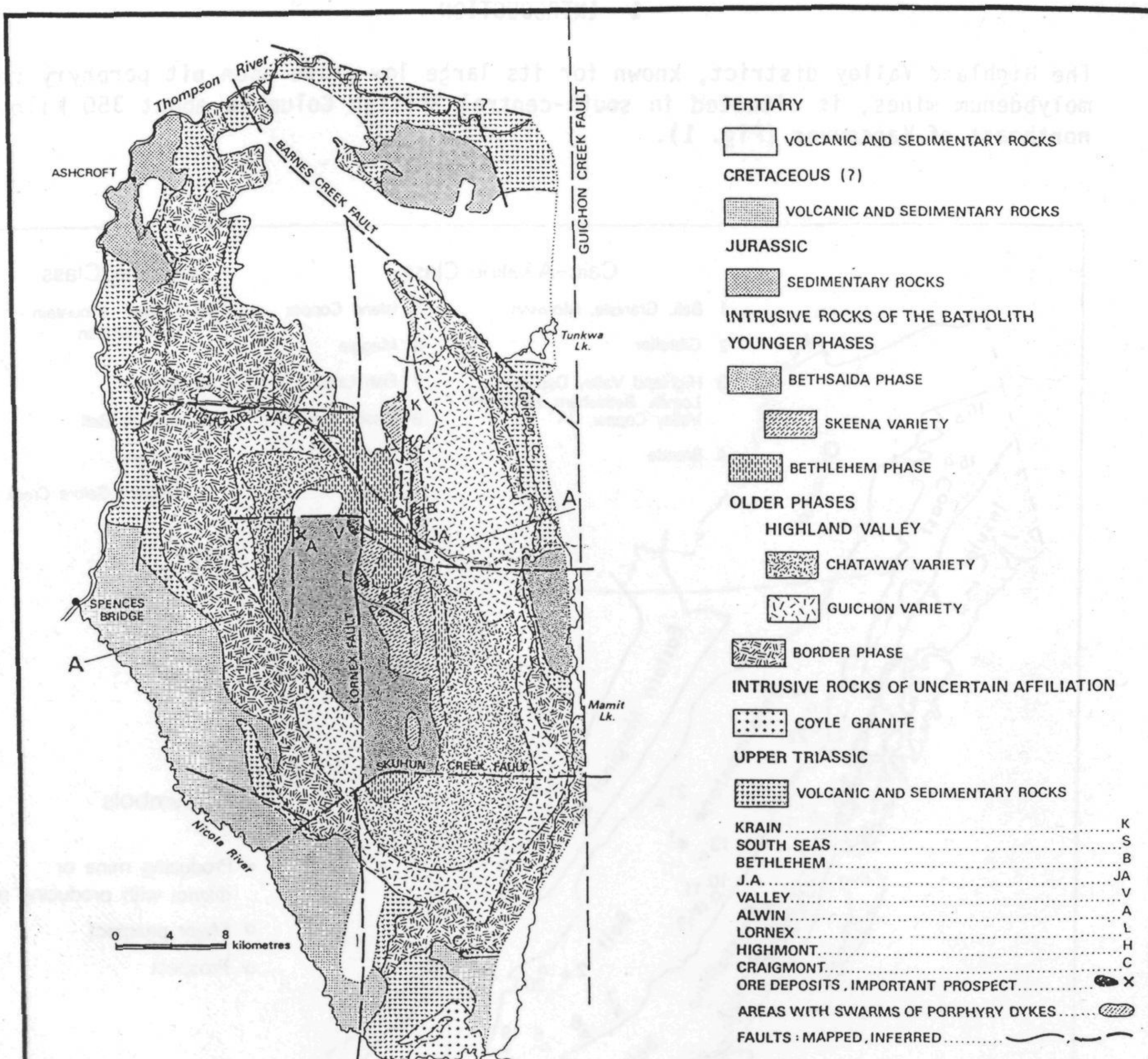


Figure 2 . Geology and major mineral deposits of the Guichon Creek batholith (modified after McMillan, 1976).

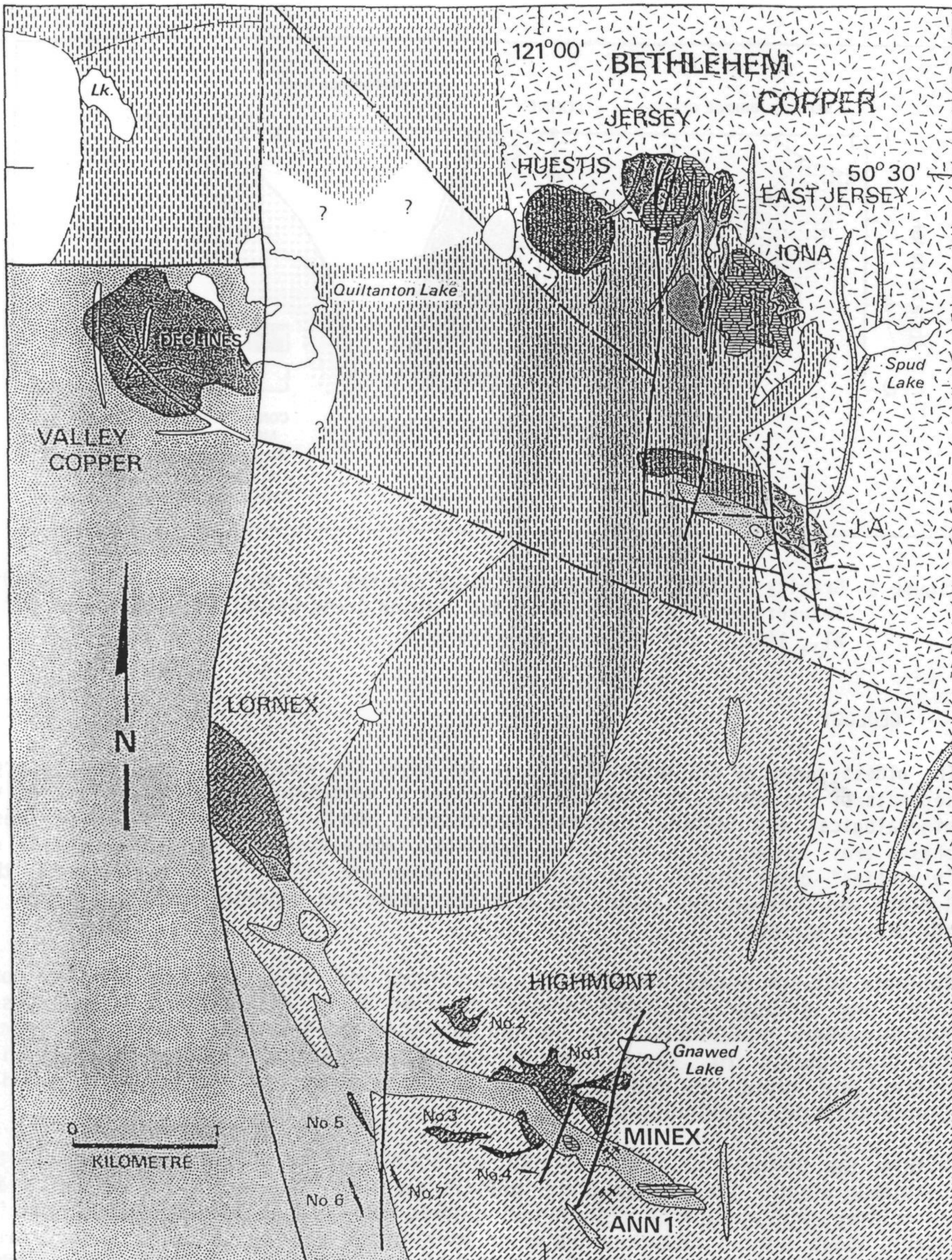


Figure 2a Geology, ore deposits and major prospects of the Highland Valley area (for legend see Fig. 2).

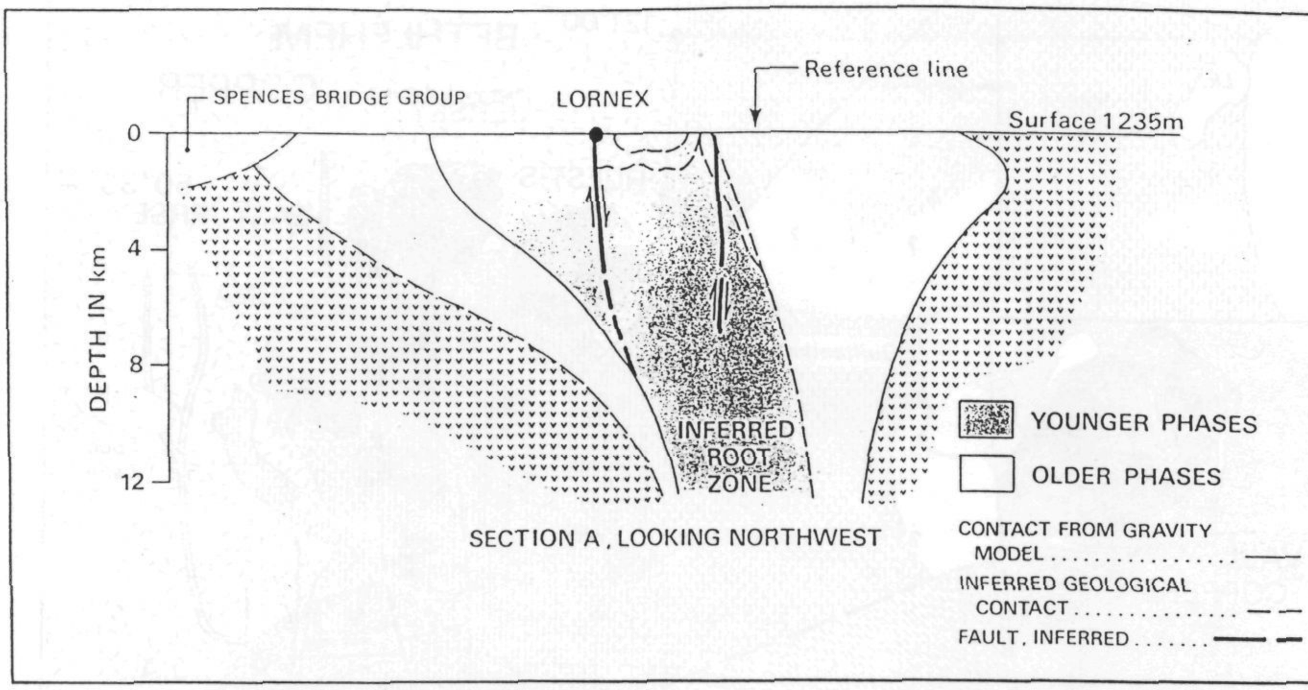


Figure 3 Gravity profile and geological model showing rock type distribution and the interpreted shape at depth of the Guichon Creek batholith (after Ager, et al., 1972). For location see Figure 2a.

GEOLOGY

The oldest rocks in the batholith lie at its edge; the youngest in its core. Large segments of the batholith (Figs. 2, 2a) consist of mappable 'phases' with distinctive mineralogical and textural features (Northcote, 1969). From edge to core these phases are: Border, Highland Valley, Bethlehem, and Bethsaida. Mappable subunits or 'varieties' occur within some phases: the Highland Valley phase consists of the Guichon and Chataway varieties; the Bethlehem phase has subareas that are mapped as the Skeena variety.

Contacts between phases are generally gradational and rarely chilled; locally, however, they crosscut. Contacts between the older Border and Highland Valley phases are everywhere gradational. The younger Bethlehem and Bethsaida phases seem to cut the older phases but, again, contacts can be gradational. Evidently, successive phases were often injected before the preceding phase was completely solidified (Northcote, 1969; McMillan, 1976).

Within the batholith, episodic dyke emplacement began after intrusion of the Bethlehem phase. The Bethlehem ore deposits and South Seas and Krain prospects are associated with a swarm of north-trending dykes that have related explosion breccias (Carr, 1960) and cut Bethlehem and older rocks north of Highland Valley. Texturally and chemically (this study; Briskey and Bellamy, 1976; Briskey, 1981) these dykes have affinities to the Bethlehem phase. They represent late-stage intrusions tapped from Bethlehem phase magma and are related in time to the first major period of ore formation in the batholith. In a younger event dykes and plugs were emplaced that trend not only northward parallel to the older dyke swarm but also northwesterly; most are in or south of Highland Valley. They represent offshoots of Bethsaida phase magma and later, more evolved magmas. The largest ore deposits in the batholith were deposited during and after this younger event.

PETROLOGY

Rocks of the batholith are composed of varying proportions of plagioclase, amphibole, biotite, quartz, and potassic feldspar with the ubiquitous accessories magnetite, apatite, and sphene (Table 3). In the oldest rocks, amphibole locally contains cores of pyroxene; in the youngest rocks biotite may be the only ferromagnesian mineral. The rocks are oversaturated with respect to quartz, hypersthene normative, and equivalent to an andesitic rock series (Johan, et al., 1980). From border to core, normative compositions range from diorite or quartz diorite through quartz monzodiorite to granodiorite. Late-stage porphyry dyke compositions extend into the granite field (Fig. 4). Older phases are medium grained and relatively equigranular, younger phases are coarser and more porphyritic.

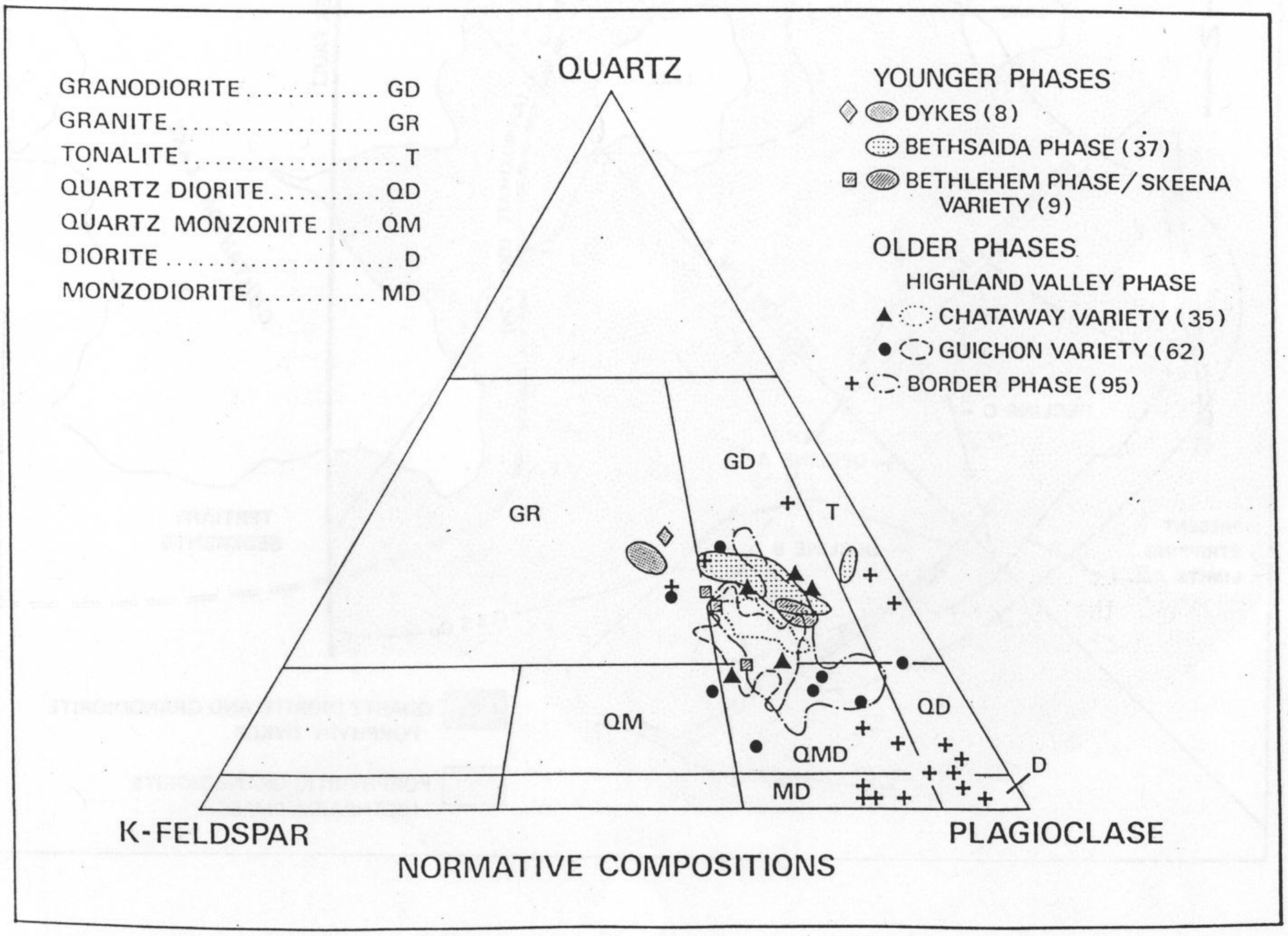


Figure 4. Ternary plot of normative compositions of rocks of the Guichon Creek batholith (numbers in brackets indicate number of analyses of each phase or variety).

VALLEY COPPER DEPOSIT
(W.J. McMillan)

GEOLOGY

The rocks that contain the Valley Copper deposit are mainly porphyritic quartz monzonites and granodiorites of the Bethsaida phase of the Guichon Creek batholith (Fig. 31). These rocks are medium to coarse grained with coarse phenocrysts of quartz and biotite. Accessory minerals are hornblende, magnetite, hematite, sphene, apatite, and zircon.

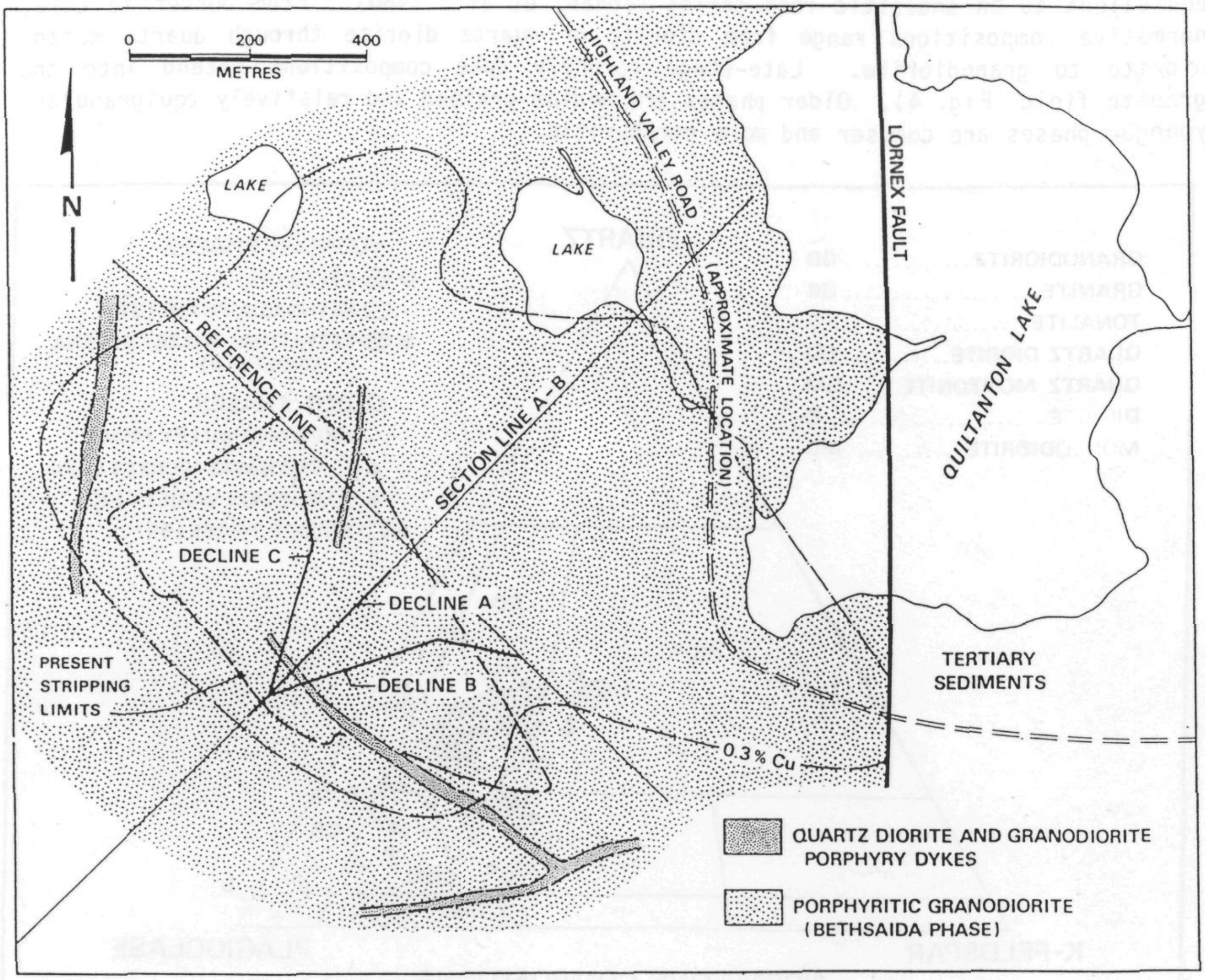


Figure 31. Plan view showing the geology and the ore outline in the Valley Copper deposit (after Osatenko and Jones, 1976).

ALTERATION

Alteration types recognized at Valley Copper are: silicic, potassic, phyllic, argillic, and propylitic. In general, alteration types are associated intimately, even at hand specimen scale. A generalized diagram of the distribution of dominant alteration types is depicted on Figure 32. A major zone of potassic feldspar alteration in the west-central part of the deposit is associated with and enveloped by an extensive zone of moderate to strong phyllic and pervasive argillic alteration. These grade outward into a zone dominated by weak to moderate pervasive argillic alteration fringed by a peripheral zone of weak to moderate propylitic alteration. Locally this peripheral zone contains minor amounts of phyllic and pervasive alteration as well as quartz veining. An area of well developed barren quartz veinlets occurs in the southeastern part of the deposit.

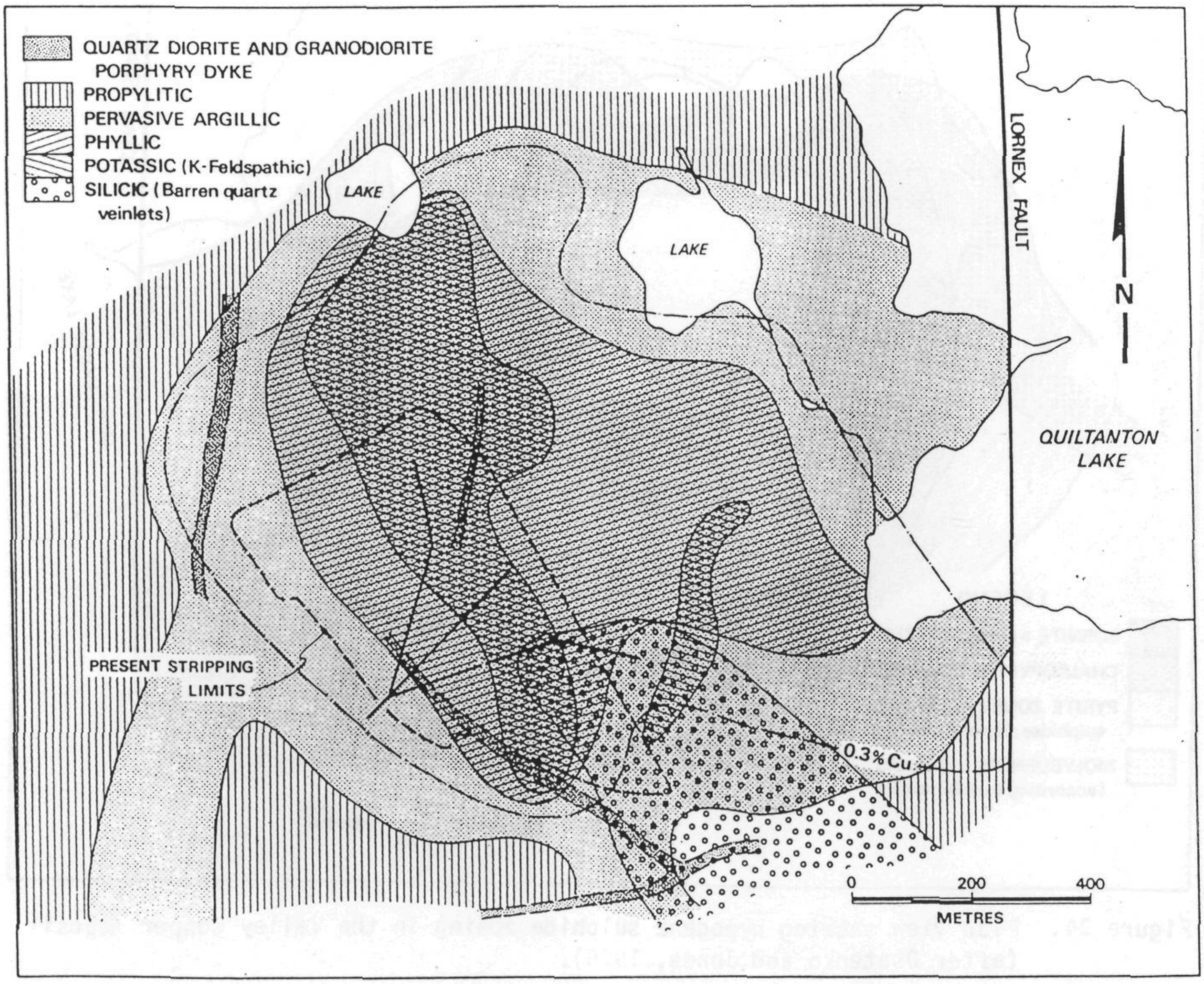


Figure 32. Plan view showing the distribution of major alteration types in the Valley Copper deposit (after Osatenko and Jones, 1976).

MINERALIZATION

Sulphides in the Valley Copper deposit occur chiefly as disseminations in quartz veinlets and in phyllic and potassic alteration zones. The greater part of the copper sulphides are in areas with abundant phyllic alteration and associated quartz veinlets. Bornite is the dominant sulphide in this association, whereas chalcopyrite is the dominant sulphide associated with potassic alteration.

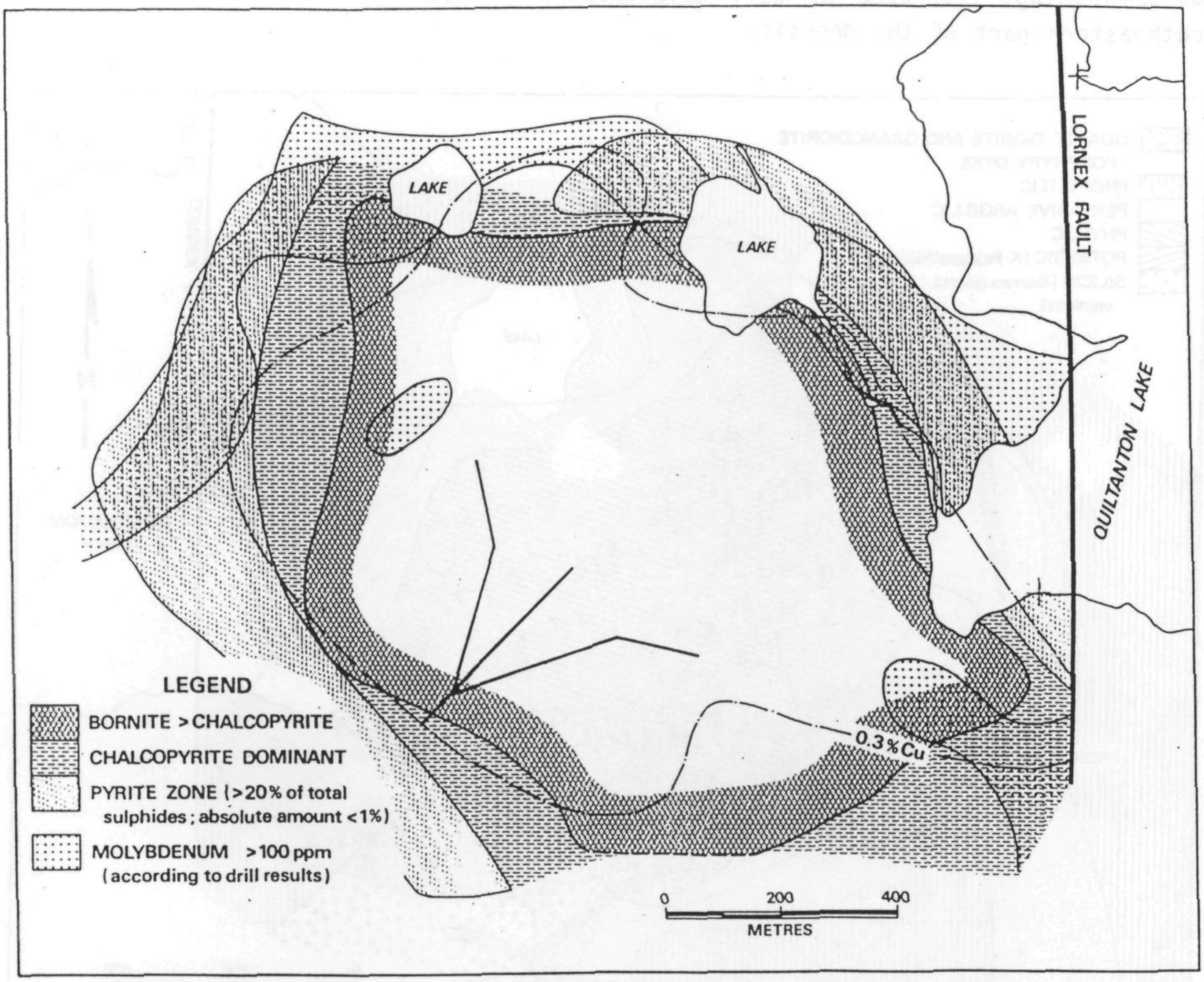
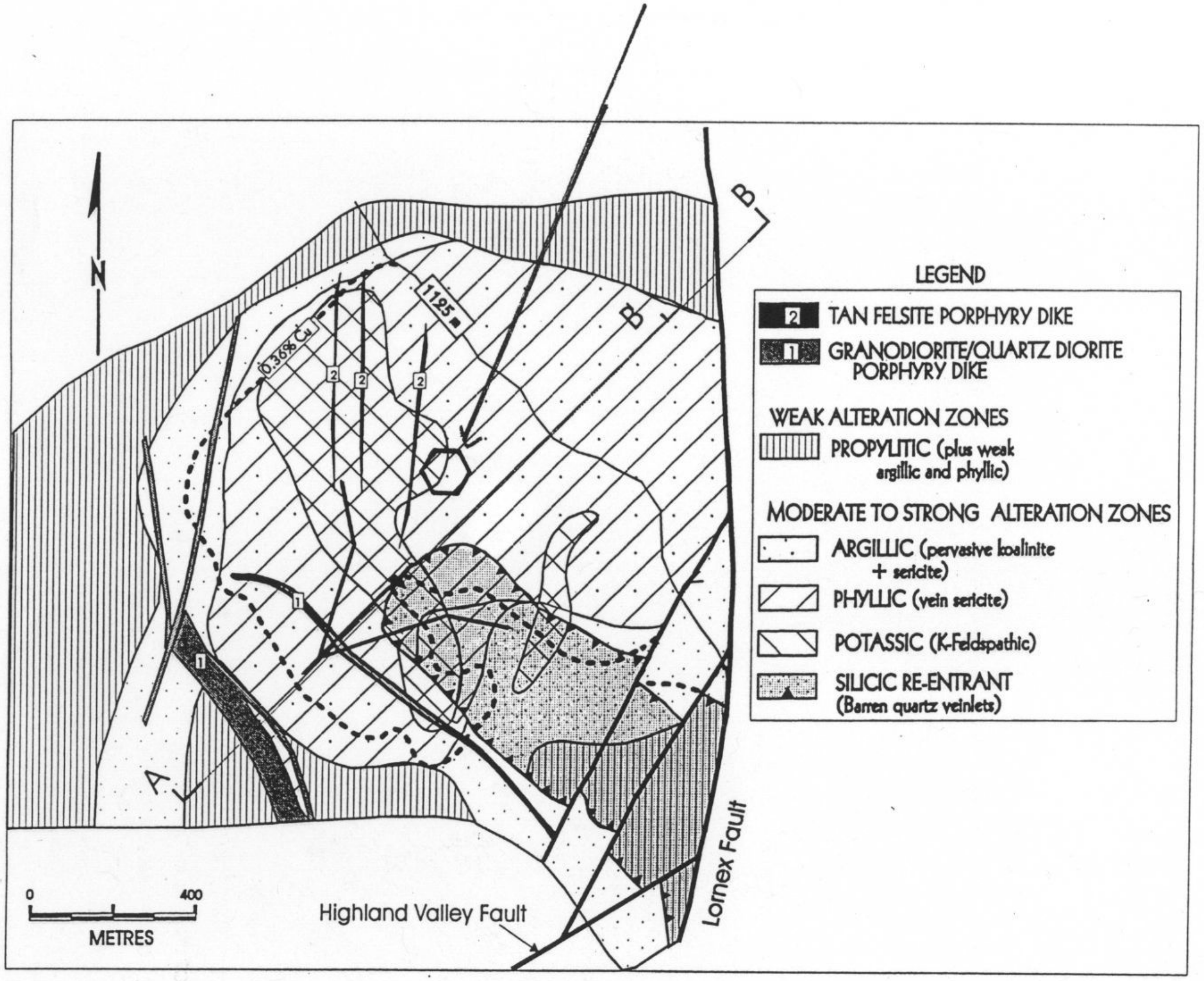
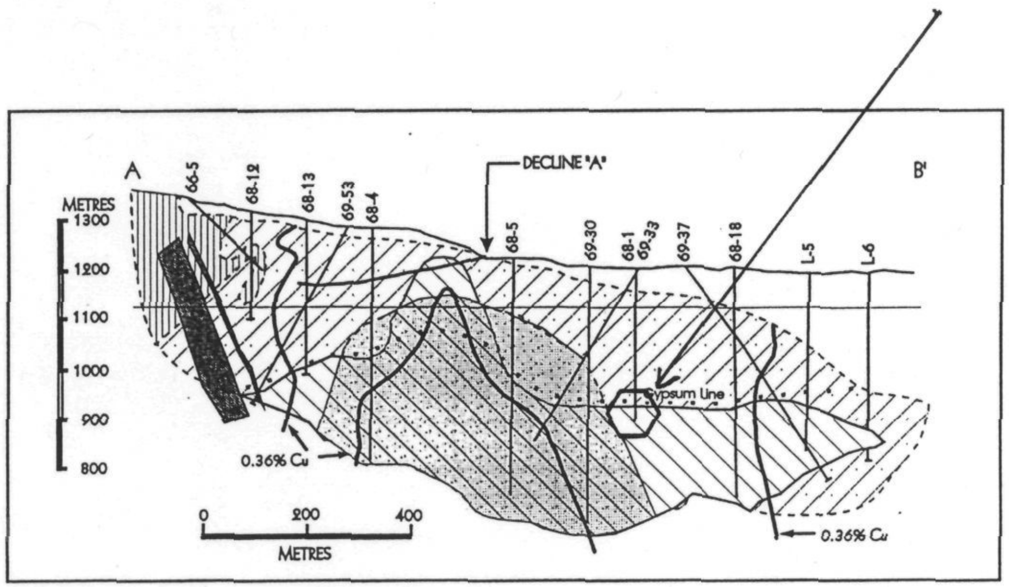


Figure 34. Plan view showing hypogene sulphide zoning in the Valley Copper deposit (after Osatenko and Jones, 1976).



HVALTNV2.CDR



file: HVALTSEC.CDR FIG. 8-10B