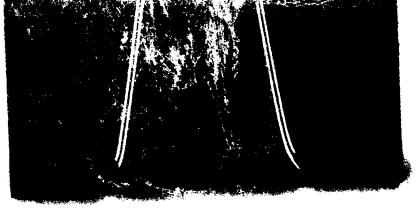

The Aylwin Creek Gold-Copper-Silver Deposit, Southeastern British Columbia

by

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ABSTRACT

The purpose of this thesis is to document the geology of the Aylwin Creek gold-copper-silver deposit and to aid in bringing this prospect to the mining stage. The Aylwin Creek gold-copper-silver deposit is located near Silverton, B.C., in a roof pendant of Lower Jurassic Rossland Group mafic, island-arc volcanics within the Middle Jurassic to Cretaceous Nelson Batholith. They are intruded by an epizonal quartz latite porphyry ring- and radial-dyke complex and a central feldspar porphyry stock which are interpreted as being comagmatic and in part coeval with the Rossland volcanics. A minor quartz +/- MoS_2 stockwork with albitization is associated with the quartz latite porphyry. A strong potassic alteration consisting of pervasive secondary biotite and minor K-feldspar is centered on the feldspar porphyry stock and grades outward to propylitically altered country rock.

Penetrating the porphyry, and likely related to it, is a subvertical heterolithic breccia pipe which hosts the gold-copper-silver mineralization in several structurally controlled zones. The Main Mineralized Zone is comprised of two near-vertical, en-echelon tabular bodies that strike north-south across the core of the breccia pipe. The West and East Mineralized Zones occur in marginal crackle breccia, and may form one continuous arcuate zone around the southern portion of the breccia pipe. Known mineralized zones are characterized on surface by zones of high fracture density (i.e., >5-6 per meter) with associated calc-silicate alteration and sulphide(-oxide) mineralization. Mineralization consists of pyrite, pyrrhotite, chalcopyrite, native gold, magnetite, minor sphalerite, and traces of native silver, all associated with a suite of calcium-rich minerals including salite-ferrosalite, actinolite, andradite, epidote, anhydrite, scapolite and calcic-plagioclase. These calc-silicate alteration minerals occur as massive to vuggy replacements of rock-flour breccia matrix in the central part of the breccia pipe and as veins and veinlets in the marginal crackle breccia. The calc-silicate alteration can be subdivided into four facies which represent increasing degrees of Ca-metasomatism: amphibole facies, pyroxene facies, epidote facies and garnet(-anhydrite) facies. An extensive petrographic study supplemented by Electron Microprobe analyses and bulk chemical analyses of rocks indicates that the potassic alteration facies are overprinted by the calc-silicate alteration facies and that the more calcic facies overprint the less calcic. There is a strong spatial relationship between the mineralized zones (i.e., high gold grades) and the development of high-Ca mineral assemblages, with andradite being particularly localized in the upper portions of the mineralized zones and anhydrite in the lower portions. The andradite-magnetite assemblage overprints the pyroxene-pyrite-pyrrhotite assemblage, with the gold mineralization being deposited during this transition as a result of an increase in either fO_2/fS_2 or pH, or a decrease in temperature. Retrograde alteration of the calc-silicate mineral facies to epidote, amphibole, zeolite and other minerals is followed by emplacement of the Nelson Batholith and mafic dykes. Late-stage alteration associated with the development of the Willa Shear Zone

(and other similar structures) and erosion complete the geological history.

The Aylwin Creek deposit has characteristics of the alkalic clan of porphyry copper(-gold) deposits found within the Intermontane Belt of B.C., the iron--skarn deposits of Vancouver Island, B.C., and the Rossland gold camp, B.C. The study has resulted in the identification of geological criteria for exploration-area selection on the regional scale (Western North American Cordillera and other similar areas of the world), the local scale (Aylwin Creek roof pendant) and the deposit scale (in the area of the Heterolithic Breccia pipe).

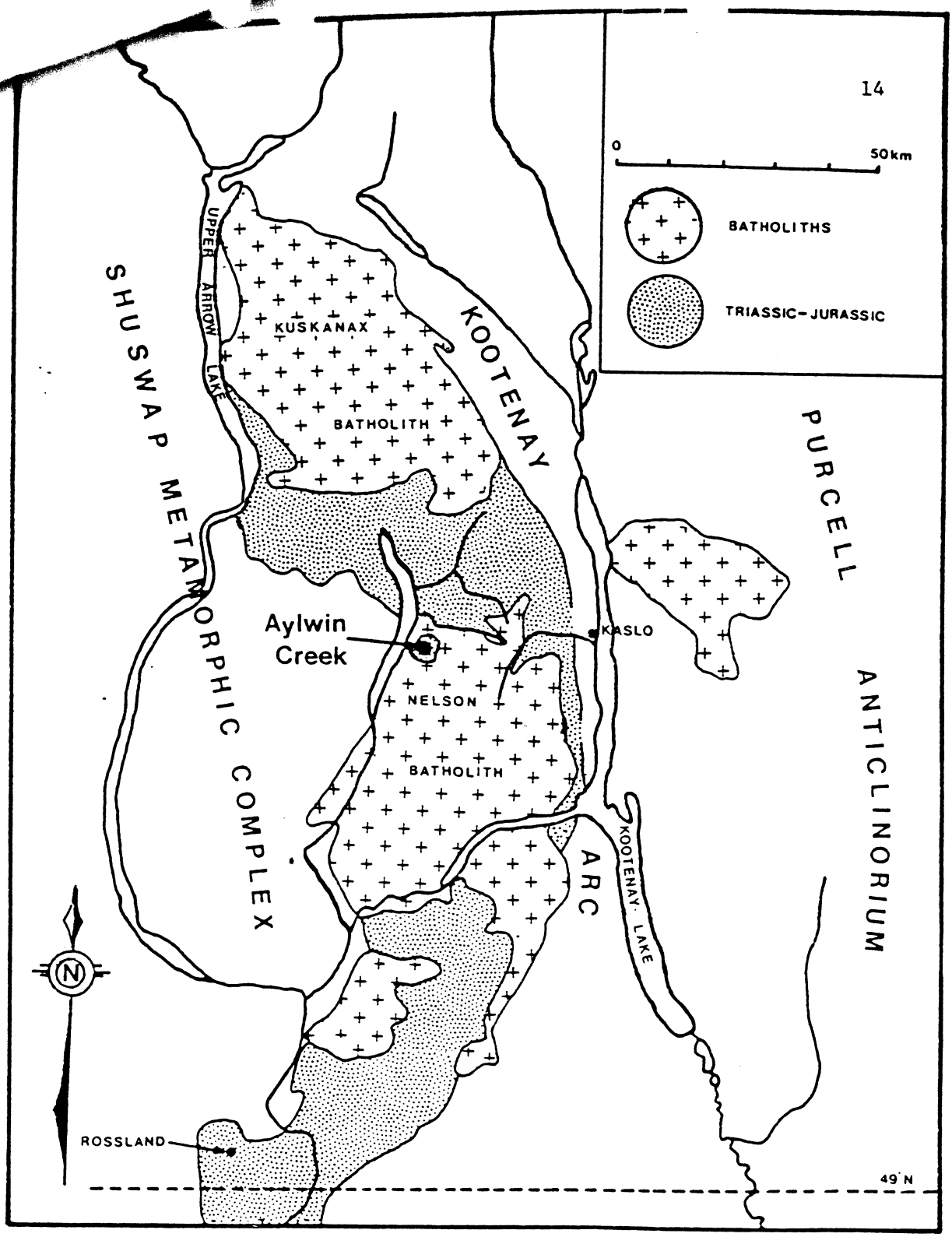

FIGURE 6 Regional geology of the Slocan Lake region of British Columbia.

The western element consists of a highly metamorphosed Precambrian terrain of granites and gneisses including metasediments of the Horsethief Creek Group which collectively are known as the Valhalla Complex. The western element is separated from the central element by a persistent narrow fault-breccia zone.

Stratigraphic relationships of the central element are illustrated in table 3. The Kaslo, Slocan and Rossland Groups of rocks occur generally to the north and south of the Nelson Batholilth and as roof pendants within it (figure 6). The Rossland Group, which hosts the Aylwin Creek deposit, forms an arcuate belt extending from Rossland, B.C., in the south, to Upper Arrow Lake in the north (figure 6). The deposit occurs in a 5 kilometer by 5 kilometer roof pendant within the Nelson Batholith.

1H REGIONAL METAMORPHISM

The grade of regional metamorphism within the sedimentary and volcanic rocks bordering the northwest corner of the Nelson Batholith (figure 6) has been shown to be low (Cairnes, 1935; Little, 1960; and Cox, 1979). A higher grade contact aureole on the batholith, which typically ranges in width from 300 to 800 meters, is defined by the occurrence of a wide variety of metamorphic minerals reflecting the bulk composition of the original rock and the conditions of metamorphism (for complete documentation see Cairnes, 1935 and Cox, 1979). However, outside this aureole the sedimentary and volcanic rocks show little or no effects of thermal metamorphism.

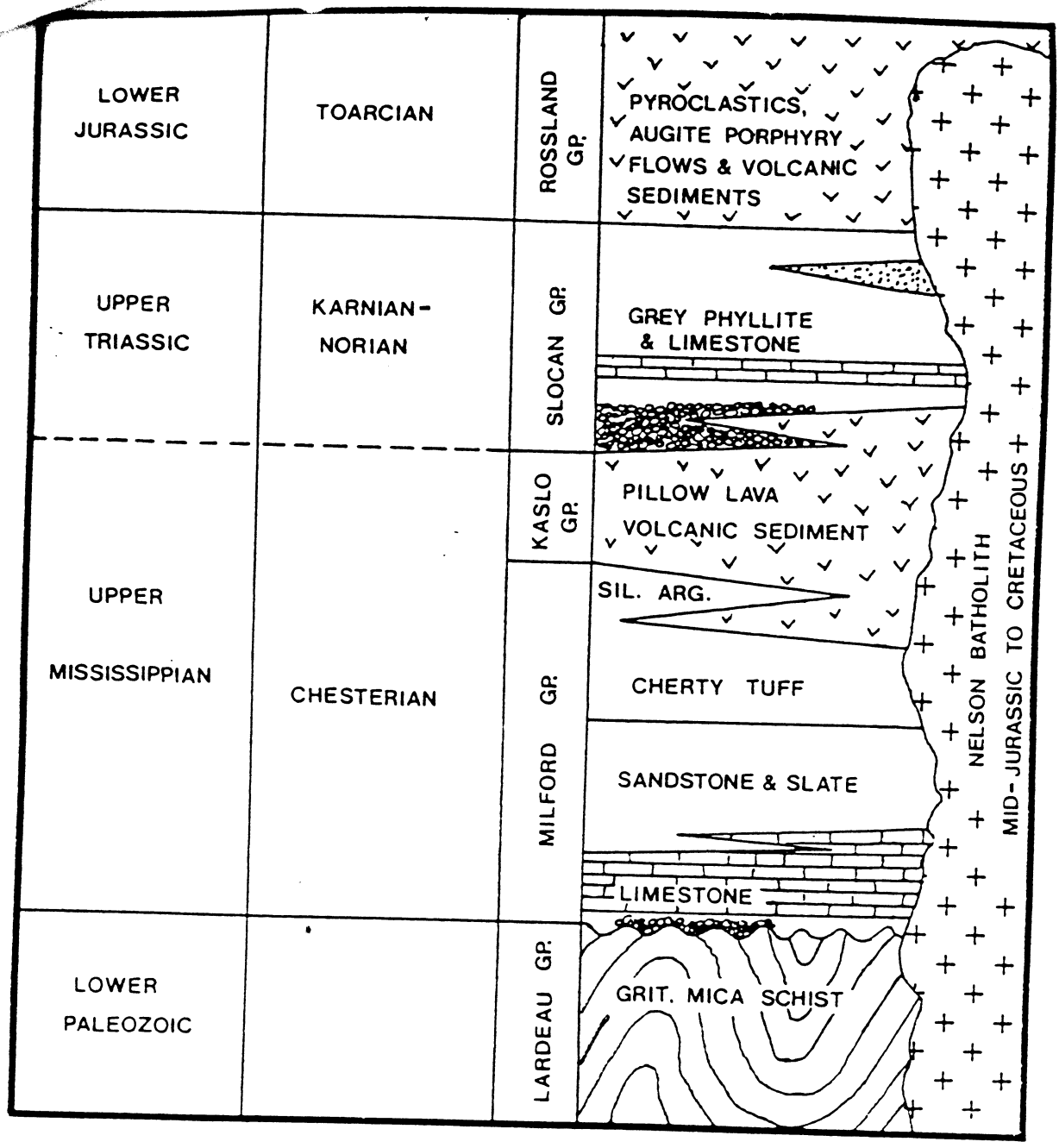

TABLE 3 Stratigraphic column for the Nelson-Slocan Lake-Kootenay Lake region of British Columbia (Modified after Klepacki, 1983).

CHAPTER 2-GEOLOGY OF THE AYLWIN CREEK GOLD-COPPER-SILVER DEPOSIT

2A INTRODUCTION

Intruded into the Rossland Group volcanics in the area of the deposit is a Lower Jurassic epizonal igneous complex with a breccia pipe which hosts the mineralization.

There are numerous types of volcanic rock within the roof pendant including pyroclastics, augite porphyry, volcanic siltstones and biotitic schists. The volcanics are steeply dipping and strike northeast where bedding has been observed. The majority of the unit was mapped as undifferentiated metavolcanics (figure 3).

There are two major igneous intrusive centers on the property (figure 3). One consists of a polyphase quartz latite porphyry ring-dyke complex with a central feldspar porphyry stock and crosscutting breccia pipe. The other consists of two subparallel bodies of white feldspar porphyry and hornblende-feldspar porphyry located northeast of the ring dyke complex (figure 3).

Intruding both the intrusive complexes and volcanics is the polyphase Nelson Batholith (figure 3). Within the mineralized area only dykes and/or sills related to the Nelson Batholith were encountered in drilling. Mafic dykes crosscut all other rocks and appear to be post-mineralization.

In the following discussion, the rocks are described in the order of their age of emplacement.