GENERAL GEOLOGY: BELL COPPER MINE, NEWMAN PENINSULA, BABINE LAKE, B.C.

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The intrusive body central to the Bell Copper Mine is related to Eocene epizonal stocks, plugs, dykes and sills known as the Babine Intrusions (Carter,). Two types of intrusions are present: biotite-hornblende-feldspar porphyries of granodioritic affinity and acidic dacite-rhyolites. Their emplacement into Mesozoic strata of the eugeosynclinal Intermontane Belt of central British Columbia coincides with a major period of block faulting during the Eocene that in part defined the dominant NNW structural grain of the region. Extrusive pyroclastics and associated volcanic sediments are coeval with the intrusive activity. Eocene, and post-Eocene molasse-type sediments post-date the igneous activity.

include also the Babine Lake Group

The regional geological setting has been outlined by Carter (1965,), Tipper (1970, 1971), and Richards (1972[2], 1974[3]). Pre-intrusive rocks belong to three major groups, all of which are being re-defined: The Upper Triassic Takla; the Lower Jurassic to Early Upper Jurassic Hazelton; and the Lower to mid. Cretaceous Skeena Groups (figure A). The Takla Group is poorly exposed and consists of black shale, siltstone, augite porphyry and limestone. Fundamentally, the Hazelton Group is subdivided into two assemblages of which only the lower one is exposed on Newman Peninsula. The lower assemblage comprises Lower Jurassic marine and non-marine andesite-dacite volcanic rocks 3,000 to 10,000 feet thick (900 to 3,000 metres) overlain by a late Lower to early Middle Jurassic fossiliferous wacke and greywacke rocks up to 3,000 feet (900 metres) thick. The upper assemblage, separated from the lower by a mid- Middle Jurassic (Bathonian) hiatus, comprises 2,000 to 4,000 feet (600 to 1,200 metres) of deep water,

distal greywacke and argillite overlain by 1,000 to 2,000 feet (300 to 600 metres) of shallow-water and non-marine sandstone, siltstone, conglomerate, and intermediate volcanics of variable thickness. The Skeena Group comprises both marine and non-marine volcanics and sediments of varied lithology, but along Babine Lake comprises mainly shallow water silty argillite, alluvial clastics and intercalated basic and intermediate volcanics. The post-intrusive clastics, in part assigned to the Sustut Group (Lord, 1948~~; Eisbacher, ———~~), are exposed 15 miles (24 km) north of the Bell Copper. They are mainly fine- to medium-grained sandstones, polymictic conglomerate and mudstone. Conglomerate clasts were derived from two sources: rounded pebbles of chert, vein quartz and volcanics from the east, and angular to subrounded pebbles of felsite and altered volcanics of local derivation, probably from the Babine intrusive suite.

The Babine Intrusions and their extrusive equivalents form numerous small bodies and isolated, down-faulted volcanic outliers. Dacitic to rhyolitic bodies predominate and porphyry bodies are of the most economic significance. Many K/Ar determinations on these bodies by various workers of the British Columbia Department of Mines, the Geological Survey of Canada, and the University of British Columbia Department of Geological Sciences (Carter, 1974; Tipper and Richards, pers. comm.) range from 44 to 49 million years for the acidic bodies and 49 to 52 million years for the porphyry bodies (Bell Copper is dated at 51 million years).

The intrusive bodies are block-fault controlled. Episodic block faulting was the main style of deformation during Jurassic, Cretaceous and Tertiary times in the Intermontane Belt of central British Columbia. However, the period commencing in Eocene time and continuing into Late Tertiary probably represents the most intense stage of faulting in the Babine Lake region. The Babine Intrusions were emplaced along

numerous Eocene faults with the mineralized porphyries confined mainly to faults with the greatest amount of vertical throw, and in association with graben-like structures. The period of intrusive activity was generally confined to the initial stages of Eocene faulting, and faulting continued after the cessation of igneous activity, as the coeval extrusives of the Babine Intrusions and the post-intrusive Sustut Group clastics are both down-faulted in grabens that contain mineralized porphyries. The generalized relationships between major faults and the more important mineral prospects of the Babine Lake area are shown in figure B.

Oldest rocks exposed around the Bell Copper Mine belong to the lower part of the Hazelton Group (figure C) exposed east of the Newman Fault. Oldest facies represented are light green, aquagene tuff, lapilli tuff and breccia that contain chilled, microporphyritic and amygdaloidal basalt and minor pink and buff acid (rhyolite) clasts. They have a fine dense green aphanitic matrix composed of fine chlorite and a mixture of epidote, calcite and prehnite. Few flows are amygdaloidal and bedding is massive except in the finer tuffaceous units. Green tuffaceous argillite and siltstone most likely mid-Lower Jurassic overlie the volcanics. The rocks are metamorphosed to subgreenschist facies with epidote, chlorite, prehnite, albite, calcite and minor actinolite. Subareal, red, maroon and purple, andesitic to dacitic lapilli tuffs near the north end of the peninsula are thought to overlie the green volcanics and volcanic sediments. Although no evidence of age relations was found in the area covered by figure C, to the north they appear to be late Lower Jurassic (Toarcian) in age (Richards, 1973). Overlying the red tuffs are fossiliferous feldspathic-lithic greywackes and wackes, some of which contain a green matrix of glauconite. The age of this sedimentary unit is early Middle Jurassic (Bajocian). Sheared and shattered

feldspathic greywacke and fine tuff along the west shore of the peninsula are tentatively correlated with the Middle Jurassic sediments, but may be younger. Small Pb-Zn occurrences in these sediments aided in the initial discovery of the porphyry copper body.

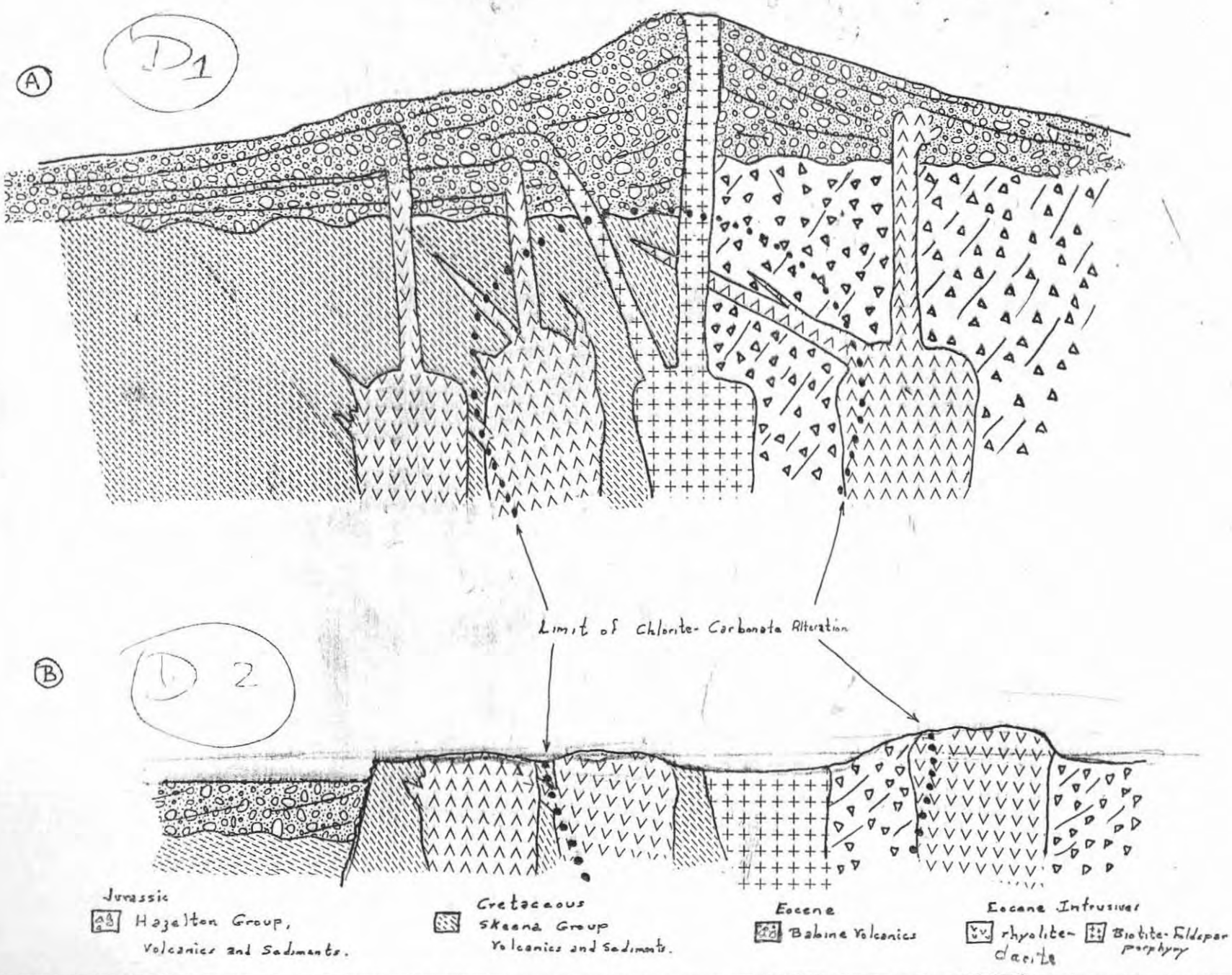
In fault contact with, and lying to the west of the Hazelton Group, is a sequence of interbedded, fine-grained sediments and pyroclastic volcanics of the Skeena Group. An ammonite fragment found in the sediments was tentatively identified by H.W. Tipper of the Geological Survey as Cleoniceras, indicating a mid-Cretaceous (Albian) age. The sediments comprise fine-grained gritty shale with common 1/16 to 1 inch (0.16 to 2.5 cm) thin lenses and laminations of fine sand. The sediments contain minor scour marks, bioturbation features and minor small scale cross-bedding suggesting a tidal or pro-delta depositional environment. The Cretaceous sediments in the northern part of the property are coarser-grained sandstone and pebble sandstone of alluvial facies. Beds of green and purple lapilli tuff and fine breccia of intermediate composition 5 to 20 feet (1.5 to 6 metres) thick are intercalated with the sediments.

Preserved along the west side of the peninsula are coarse pyroclastics of lahar or mud-flow origin that are most plausibly extrusive equivalents of the intrusive rhyolite-dacite and porphyry bodies. Two types of pyroclasts are common; one is dominated by angular clasts of light coloured, flow-banded, dense-massive and quartz-albite porphyry acid volcanics that range from 1/4 inch to 4 feet (0.6 cm to 1.2 m) in diameter, the other contains a chaotic mixture of mauve, purple and light green, unaltered, fine-grained biotite-feldspar and biotite-hornblende-feldspar porphyry clasts to 2 feet (0.6 m) in diameter. In places, both acid and porphyry clasts along with rare sandstone, argillite, green volcanic and charred wood fragments are present. Massive acid and porphyry dykes and, on the small island immediately west of the peninsula, small plugs are intrusive into the volcanic pile.

Of the two types of intrusives, only the porphyry bodies have economic significance, although the acidic phases may be in places highly pyritic. Age relations of the two types are inconclusive, with Carter (1966) suggesting the porphyry pre-dates rhyolite-dacite and O'Grislo (pers. comm.) suggesting the reverse. Both are probably true. Generally, the mineralized porphyry is central to the acid bodies. The acid phases vary texturally and range in colour from white, light brown, pale grey-green to buff. They may be coarsely to finely porphyritic with phenocrysts of quartz and plagioclase, or are dense, massive or flow banded. Some are in part breccia bodies. The porphyry bodies peripheral to the alteration zone are unaltered, usually fine-grained with scattered phenocrysts of biotite, plagioclase, and minor hornblende. Within the alteration zone, the porphyry has been largely transformed to quartz, carbonate, chlorite, sericite and secondary biotite assemblages described below.

The mineralized porphyry has been localized along a major structural break (The Newman Fault), separating Lower Jurassic volcanics from middle Cretaceous sediments (Figure D.1). This fault represents the eastern margin of a north-northwest trending graben whose west edge is somewhere in Babine Lake. The amount of vertical throw on the fault at the time of explacement is unknown, but must have been in the order of 2,000 to 4,000 feet (600 to 1,200 metres) throughout the lifetime of its activity. Movement ceased after intrusion as its trace is not recognizable in the pit. The Newman Fault represents the fault with the greatest known vertical displacement on hypothesized faults of this immediate region. Continued block movement of the fault system is evident by the preservation of the Eocene volcanics (Figure D.2) along the west side of the peninsula.

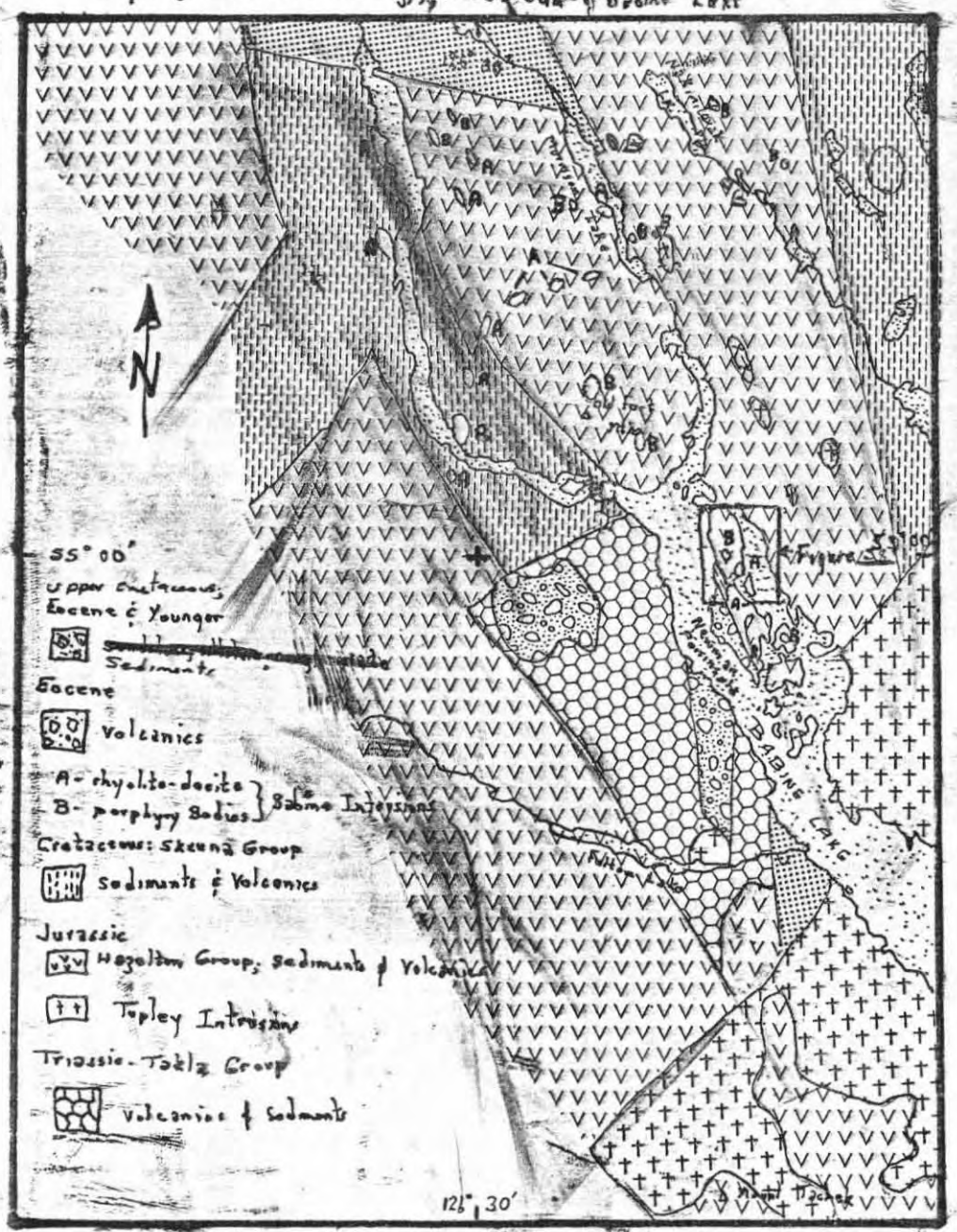
Schematic Cross-sections Intrusive-Extrusive relations at Bell Copper, Newman Peninsula during (A), Eocene time (50 M.Y), and (B), Post-~~Eocene~~ 50 M.Y time



(A)

what is this? Same SW of portion
SW of LAKE.
in Babine L.

Figure: General Geology, North End of Babine Lake



- Takla
- Hazelton
- Skeena
- "Sustut"
- Tert. Vo
- Topley I.
- Babine
- Cretace

(B)

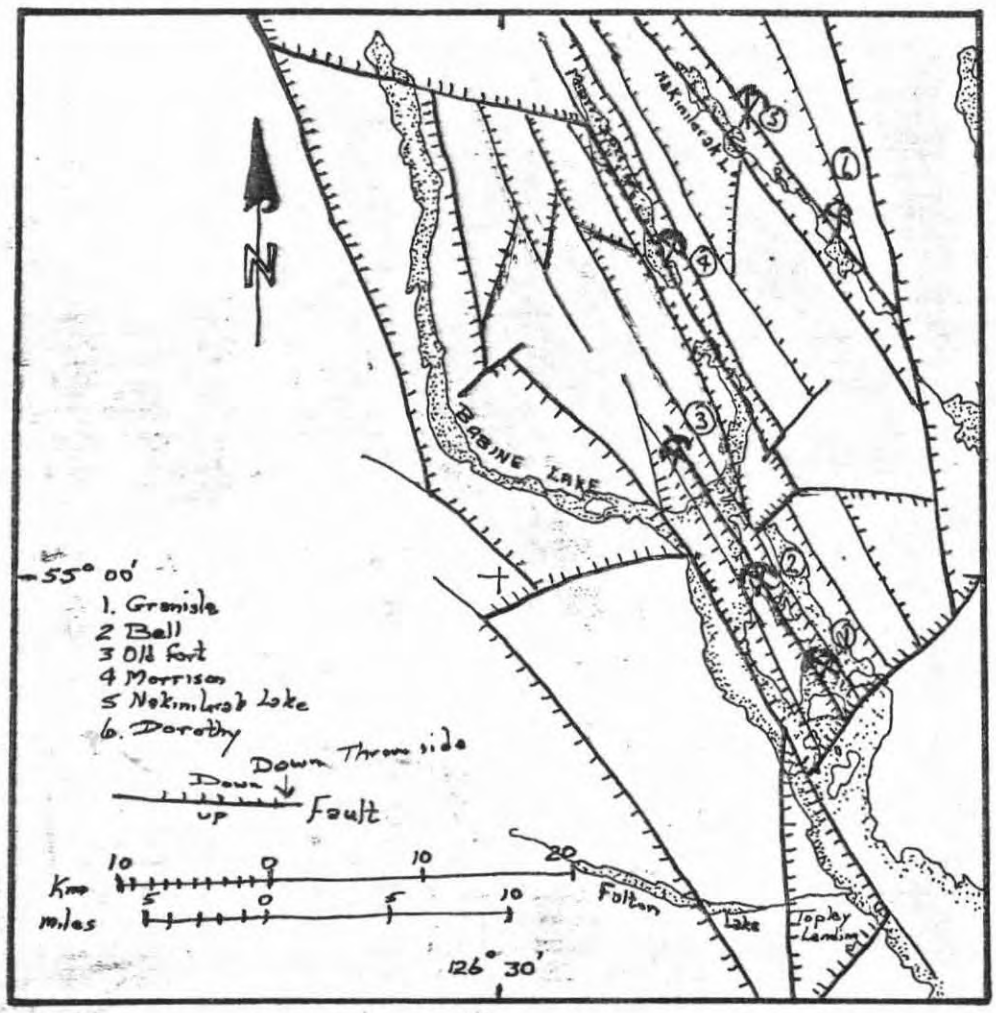
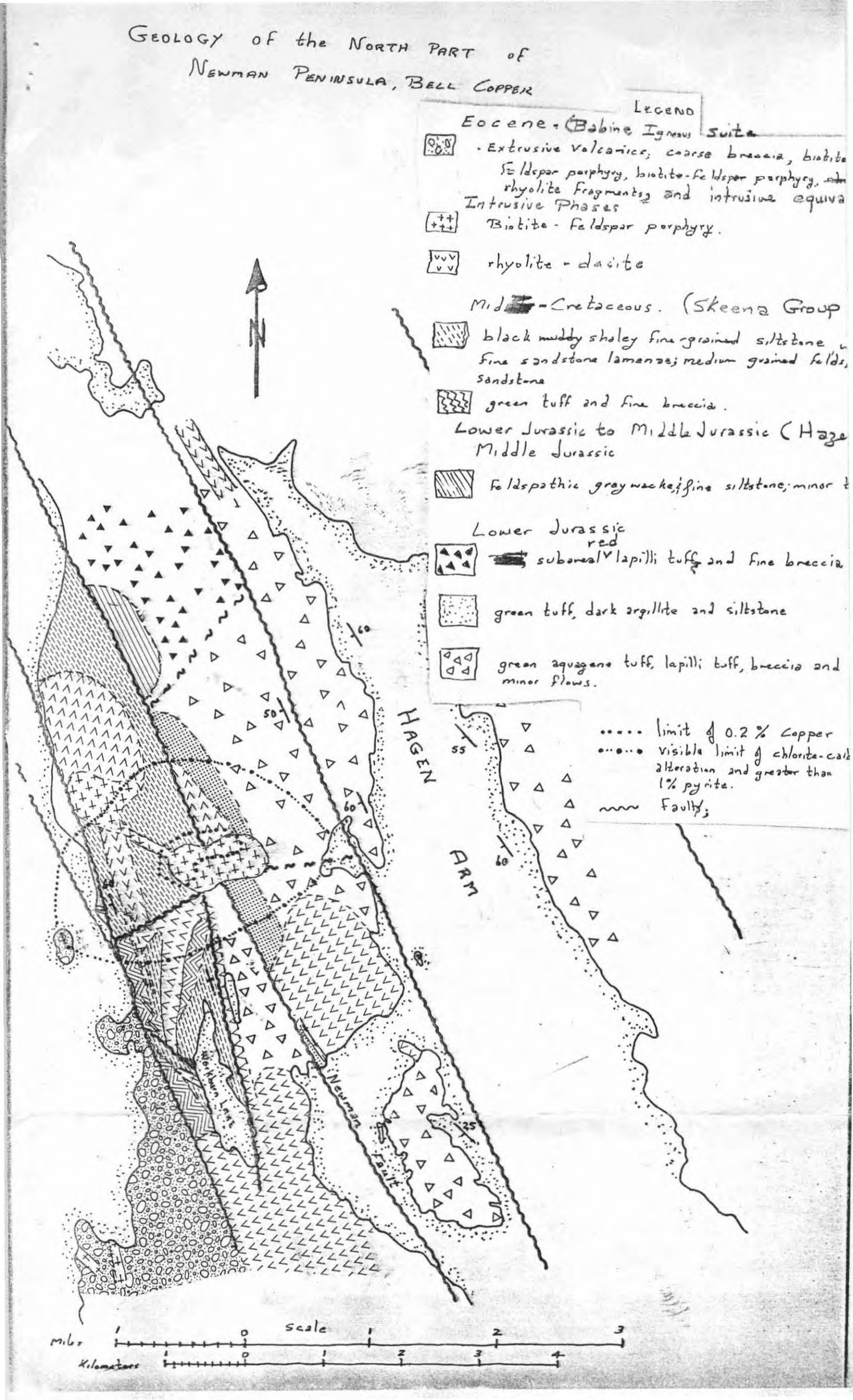


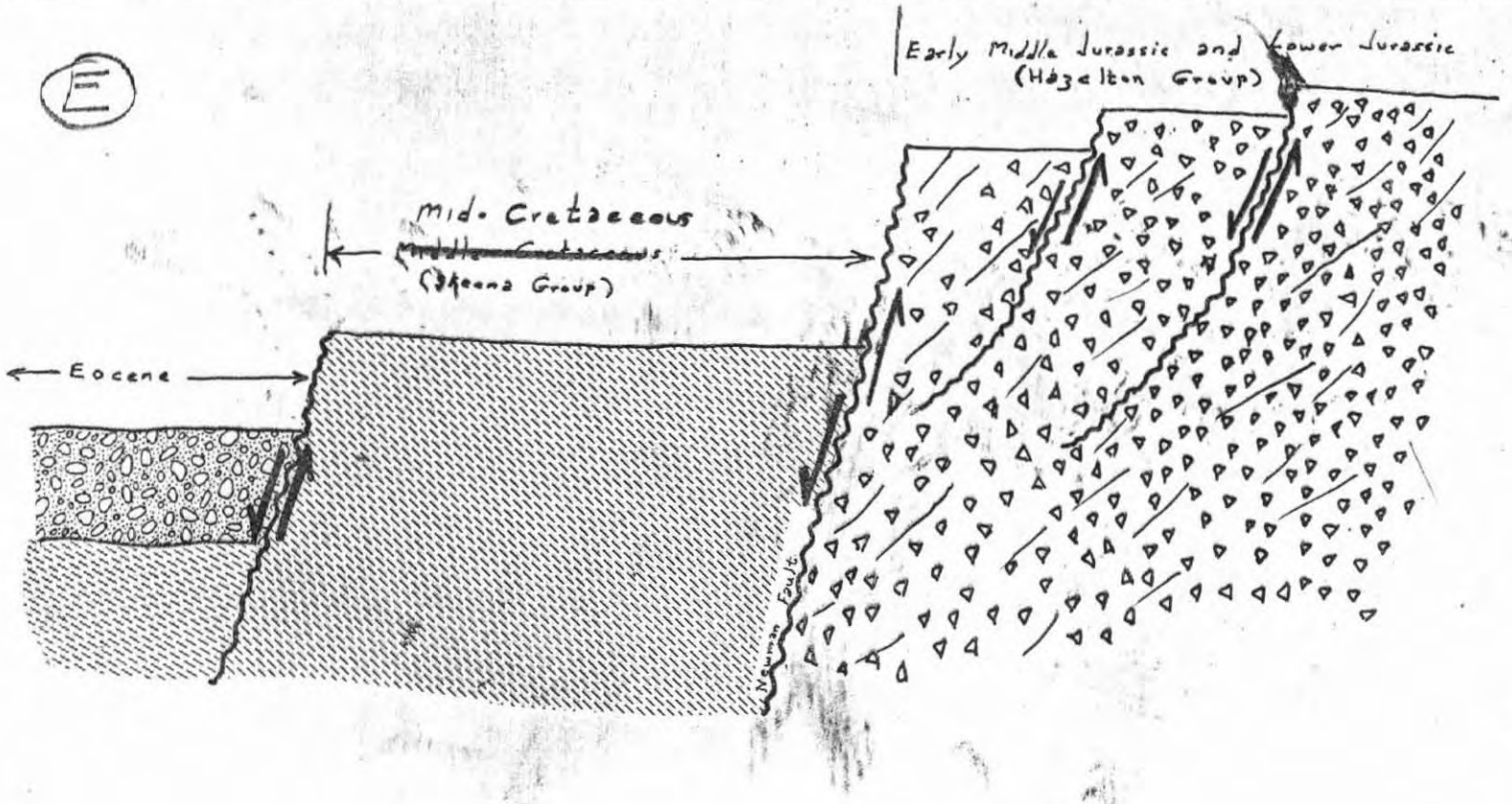
Figure B. Tertiary Block Faults and Babine Lake Porphyry Copper Deposits.

Add - downthrown side of fault is indicated ?

Geology of the North Part of Newman Peninsula, Bell Copper



(E)



Major Block Fault units ~~at~~ near ~~around~~ Ball Copper, Newman Peninsula.

Cretaceous is Lower & Upper. - could use mid - Cretaceous