ITEM 2

YORKE-HARDY GEOLOGY

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INTRODUCTION

The Yorke-Hardy porphyry molybdenum-tungsten deposit is located at depth on the east flank of Hudson Bay Mountain approximately six miles northwest of Smithers, British Columbia. Hudson Bay Mountain lies on the eastern margin of the Hazelton Mountains. Mineralization on surface is partly overlain by the retreating Kathlyn glacier, melt water from which forms twin waterfalls that plunge almost 200 feet to the Bulkley River Valley below.

To date, the property has been extensively tested by 164 diamond drill holes that include 76,934 feet of drilling from surface and 114,525 feet of drilling from underground, access for which is provided by the 3,500 foot (elevation) adit and two cross-cuts, the 15000E and 16100E, containing almost two miles of workings.

Since 1964 when the Yorke-Hardy project was transferred to Climax Molybdenum Corporation of British Columbia Limited, the following major geologic reports have been compiled: a paper by D.C. Jonson, D.A. Davidson and K.L. Daughtry (1968) presented at the 1968 CIM Annual Meeting in Vancouver, a section by D.C. Jonson (1969) in Preliminary Economic Appraisal #2, a paper by D.C. Jonson and M.J. Bright (1976) published in CIM special volume 15 and a recent company report by D. Atkinson (1981).

REGIONAL GEOLOGY

The Yorke-Hardy deposit is situated within the Hazelton Belt, a sub-division of the Intermontane Tectonic Belt (Figure 1). The Hazelton Belt includes Lower and Middle Jurassic basaltic to rhyolitic volcanics and sediments of the Hazelton Group, which are cut by granitic intrusions. A few scattered outcrops suggest that Triassic and Late Paleozoic rocks underlie the Jurassic. The belt is bisected by the Skeena Arch which separates Jurassic marine sedimentary basins, the Bowser to the north and the Nechako to the south (Figure 1). The Yorke-Hardy deposit lies on the boundary between the Skeena Arch and the Bowser Basin. Hazelton Group rocks are locally unconformably overlain by younger rocks, including in the Smithers area the mainly marine sedimentary Lower Cretaceous Skeena Group (Figure 2).

Early Jurassic and Late Cretaceous to Tertiary plutons are scattered throughout the Hazelton Belt and include a group called the Bulkley intrusions which are calc-alkaline and range in composition from granodiorite to quartz monzonite. Some of these are associated with porphyry deposits that include Yorke-Hardy (Mo), Ox Lake (Cu, Mo), Huckleberry (Cu, Mo) and Bergette (Cu, Mo) (Figure 1).

The dominant structural style in the Hazelton Belt is broad open folding and block faulting of Cretaceous and Tertiary age having a dominant northwest trend. Rare thrust faults and related folds include one exposed on Hudson Bay Mountain.

LOCAL GEOLOGY

Rock Types

At surface, Hudson Bay Mountain consists of the Early Cretaceous Skeena Group and the underlying Early to Middle Jurassic Hazelton Group which are both crosscut by a subradial Late Cretaceous to Tertiary quartz-felspar porphyry dyke swarm (Figure 2). At depth, a series of intrusive rocks (Figure 3) have been located and are listed in order of intrusion: 1) the granodiorite sheet, 2) lamprophyre sills and dykes, 3) a Late Cretaceous to Tertiary (?) rhyolite plug and 4) the Late Cretaceous to Tertiary Hudson Bay Mountain stock and associated quartz-felspar porphyry dykes which include those exposed on surface.

The Skeena Group has a minimum thickness of 1,000 feet and consists of well-bedded interlayered conglomerate, greywacke, sandstone, siltstone and shale and includes lenticular Albian coal horizons. The Hazelton Group has a minimum thickness of 7,000 feet and comprises a sequence of poorly layered intermediate flows and pyroclastics with felsic hypabyssal intrusions and minor sedimentary rocks including limestone, mudstone and chert. Both groups have been affected by low grade regional metamorphism and on surface a biotite-hornblende hornfels aureole can be traced over a 2½ by 4½ mile area (Figure 2).

The granodiorite sheet has been defined by drilling over a strike length of almost 4,000 feet, along dip for 4,500 feet and through a maximum vertical extent of 1,800 feet (Figure 3). The sheet is divided texturally, from upper to lower, into aplitic granodiorite, porphyritic granodiorite and granodiorite and contains stoped blocks of Hazelton volcanic rocks that form zones traceable for hundreds of feet (Figure 3).

The aplitic granodiorite, which forms the upper northeast edge of the sheet, is light coloured with saccharoidal texture containing local areas of granophyric texture. An average composition for the aplitic granodiorite is 36 percent quartz, 17 percent K-felspar, 48 percent plagioclase (An 10-18) and no mafic minerals. The porphyritic granodiorite forms the northeastern upper and central portion of the sheet. It is pale green or grey and characterized by 20 percent ragged plagioclase phenocrysts and five percent quartz "eyes" in an aphanitic groundmass. An average composition for the porphyritic granodiorite is 35 percent quartz, 13 percent K-felspar, 50 percent plagioclase (An 28-33) and two percent mafic minerals. The granodiorite is the most common textural type and occupies the lower part of the sheet. It is mottled green or grey with granitic texture oonsisting of 30 peroent quartz, 10 percent K-felspar, 55 percent plagioclase (An 32-34) and five percent mafic minerals.

Lamprophyre sills and dykes are common and crosscut the Hazelton Group and the granodiorite sheet. They vary in thickness from one centimetre up to 12 metres and where exposed in underground workings dip gently east and are mineralized. They are composed of 40 percent plagioclase and 60 percent hornblende altered in part to chlorite. They range in texture from equigranular to ophitic.

The rhyolite plug has been intersected by 12 drill holes. It intrudes the granodiorite sheet and Hazelton Group rocks and astride its upper contact are quartz stockworks and a high silica zone (Figure 3). The plug is oval in plan, 1,000 by 1,500 feet, with steep walls and a relatively flat top near 3,000 feet elevation. It has well defined chill and crenulated quartz band zones and is characteristically a porphyry with 20 percent quartz and felspar phenocrysts set in an aphanitic to fine grained groundmass. It consists of 25 percent quartz, 37 percent K-felspar, 37 percent plagioclase (An 2-5) and one percent biotite.

The Hudson Bay Mountain Stock truncates the rhyolite plug and intrudes the Hazelton Group. K-Ar age dates on the stock range from 67 to 73 my. Although the stock has been intersected by only four drill holes, it is interpreted to be a large pluton, to have produced both the hornfels aureole and the concentric, radial and domal fractures and to be the parent magma of the quartz-felspar porphyry dyke swarm. The Hudson Bay Mountain Stock is composite varying from a pink and grey porphyritic quartz monzonite to an equigranular granodiorite. Phenocrysts include quartz, strongly zoned plagioclase with albitic rims, perthitic K-felspar, biotite and hornblende. An average composition is 33 percent quartz, 22 percent K-felspar, 39 percent plagioclase (An 12-32) and six percent mafic minerals.

Structure

Hudson Bay Mountain is intersected by three major faults (Figure 2). These include the following: 1) the northwest trending, steeply east dipping normal Glacier Gulch Fault which crops out beneath the 3,500 foot adit portal and locally forms the contact between Skeena and Hazelton rocks, 2) the north trending, gently east dipping Hudson Bay Mountain thrust fault on the west slope of the mountain where a Lower Jurassic sequence is thrust over Middle Jurassic rocks and 3) an east trending, steeply south dipping shear zone that crosscuts the south cirque.

Within the area of drilling major fault dislocations do not occur. Surface and underground mapping indicate fractures, joints and veins have three dominant trends - concentric, radial and domal - and are attributed to doming by Tertiary intrusion and uplift.

Rocks of the Hazelton and Skeena Groups on Hudson Bay Mountain have been moderately tilted and domed. Hazelton Group rocks strike east and dip north with progressively steeper dips northwards. Skeena Group rocks have a concentric strike and dip away from the mountain. Folding is locally associated with the major faults.

Alteration

Alteration at Yorke-Hardy includes thermal metamorphism which has resulted in the development of an extensive hornfels aureole together with veins and clots of andradite garnet and epidote affecting the Skeena and Hazelton Groups and the granodiorite sheet. The hornfels aureole extends from the contact with the Hudson Bay Mountain Stock (Figure 3) upward to surface where it is recognized over a 2½ by 4½ mile area (Figure 2). Within the aplitic granodiorite, garnet clot development is locally impressive and is called appaloosa texture. Hydrothermal alteration is fracture and vein controlled and overprints metamorphic assemblages. It includes the following:

a) Bleaching, particularly of Hazelton Group rocks, has leached up to 90 percent of the iron, magnesium and manganese content above and peripheral to the main area of molybdenite mineralization.

b) A chlorite-magnetite-amphibole-biotite assemblage developed in stockwork fractures and in clots is notable within the Hazelton Group rocks and the granodiorite sheet and also appears to be above and peripheral to the main area of molybdenite mineralization.

c) Phyllic alteration associated with molybdenite veins is best developed within the granodiorite sheet and is observed in and above the 16100E and 15000E crosscuts.

d) Potassic alteration associated with molybdenite veins is observed in the granodiorite sheet in and above the 15000E crosscut.

e) Formation of both crosscutting quartz stockworks and a high silica zone occurs within and above the rhyolite plug (Figure 3).

Mineralization

The property is characterized by mineralogical zoning recognized both on and below surface. A molybdenite and scheelite vein zone crops out over two miles horizontally and has been located in drilling to a depth of 7,000 feet below surface. This is interior to a quartz vein zone which in turn is enveloped by a pyrite and base metal vein zone that extends out to over a five mile radius (Figure 2).

The lower portion of the granodiorite sheet is host for a high grade molybdenite zone defined to date above the 15000E crosscut and extensively tested in the 1979/80 drill program. Thus, the granodiorite may be an important lithologic control on mineralization. Molybdenite occurs in three modes, as follows:

1) as early fine-grained hairline stockwork veins,

2) as cross-cutting fine-grained banded quartz-molybenite veins which occur throughout the deposit but were confirmed in the 1979/80 program to form shallowly arching sets above the 15000E cross-cut and,

3) as cross-cutting coarse-grained quartz-molybdenite veins that contain spectacular molybdenite crystals up to two inches in diameter and provide extremely high assays.

Vein types 1) and 3) are associated with potassic alteration and vein type 2) is associated with phyllic alteration. Banded fine-grained quartz-molybdenite veins and coarse-grained quartz-molybdenite veins equally contribute to the high grade zone above the 15000E crosscut while stockwork veins provide relatively uniform background values up to 0.1 percent MoS_2.

Scheelite occurs in quartz ± magnetite ± K-felspar veins formed prior to coarse-grained quartz-molybdenite veins. Late stage vein minerals include pyrite, chalcopyrite, sphalerite and carbonate. The source of mineralizing fluids is presumed to be the Hudson Bay Mountain Stock due to its proximity to mineralization.

Ore Reserve Estimate

Yorke-Hardy ore reserves were manually compiled for all drill hole assay data through DDH 164 using standard Climax ore zoning techniques (Steininger 1981). Reserves were calculated from sets of north and east cross sections at 100 foot spacings through the deposit. Tonnage calculations were made for various cutoff grades on each section using: 1) the Climax digitizer and computer programs to determine the area within a cutoff grade boundary, 2) a sphere of influence of 50 feet on either side of the plane of the section and, 3) a tonnage factor of 12.12 $feet^3$/ton. Average tonnage was calculated separately for north sections and for east sections, and by averaging all drill hole assays contained within a cutoff grade average grade was calculated for north sections. At a 0.1 percent MoS_2 cutoff (Figure 3) there are estimated to be 138.3 million tons of 0.252 percent MoS_2, at a 0.2 percent MoS_2 cutoff there are estimated to be 22.7 million tons of 0.401 percent MoS_2 and at a 0.3 MoS_2 cutoff there are estimated to be 4.0 million tons of 0.636 percent MoS_2. Within these cutoffs, tungsten values range from 0.039 to 0.043 percent WO_3.

D. Atkinson

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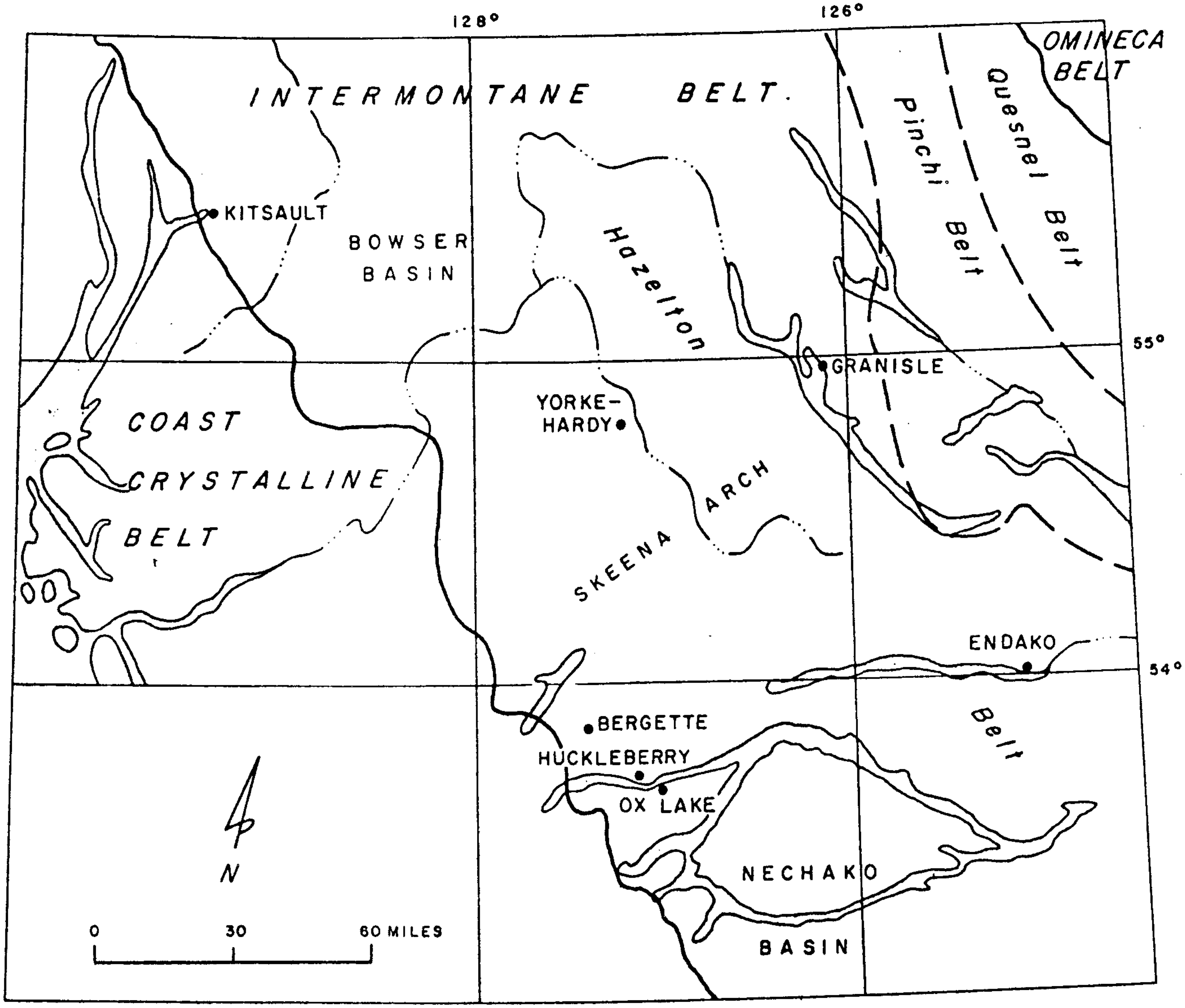

FIGURE 1. GENERALIZED TECTONIC MAP OF WEST-CENTRAL BRITISH COLUMBIA

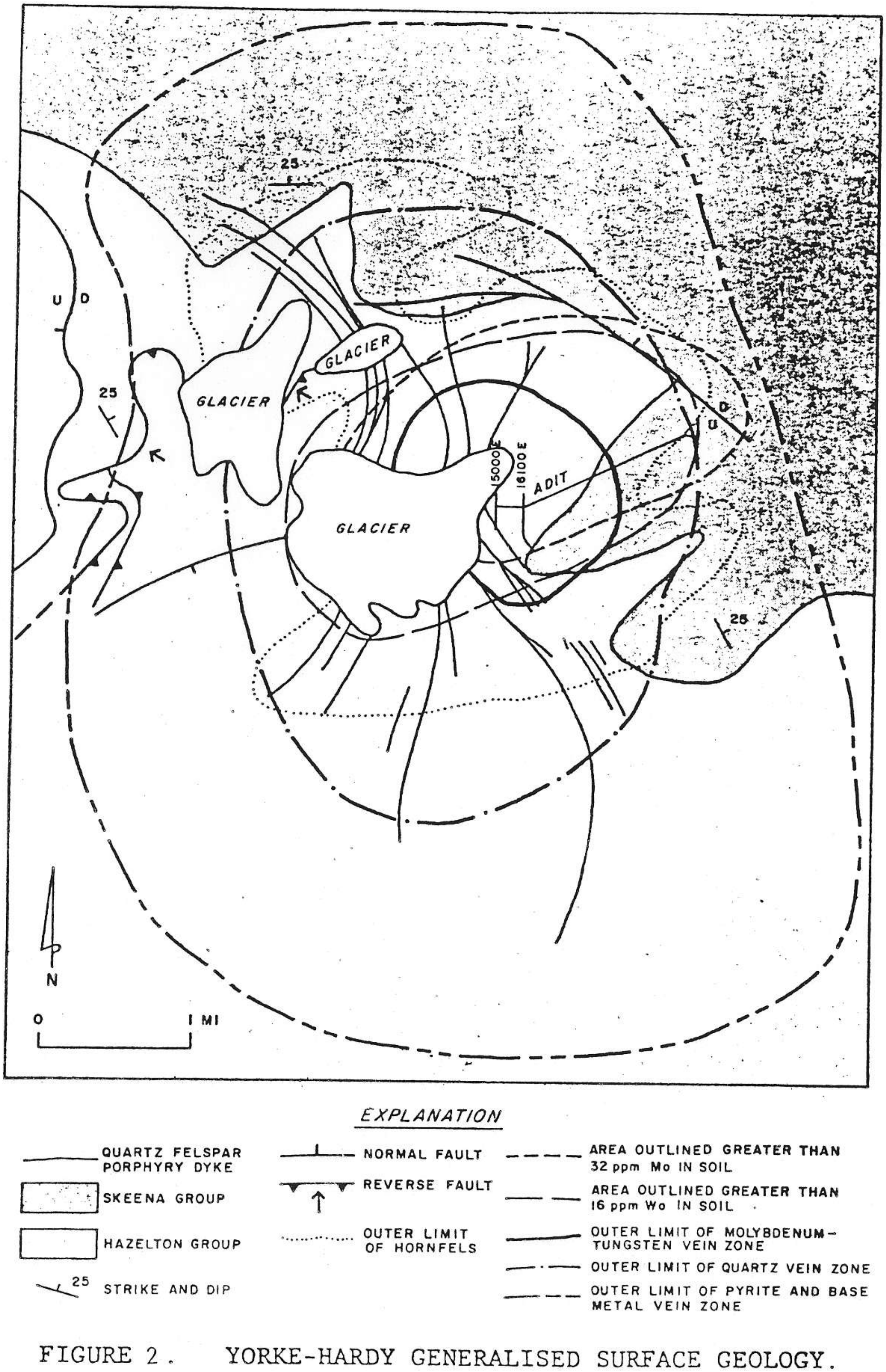

FIGURE 2. YORKE-HARDY GENERALISED SURFACE GEOLOGY.

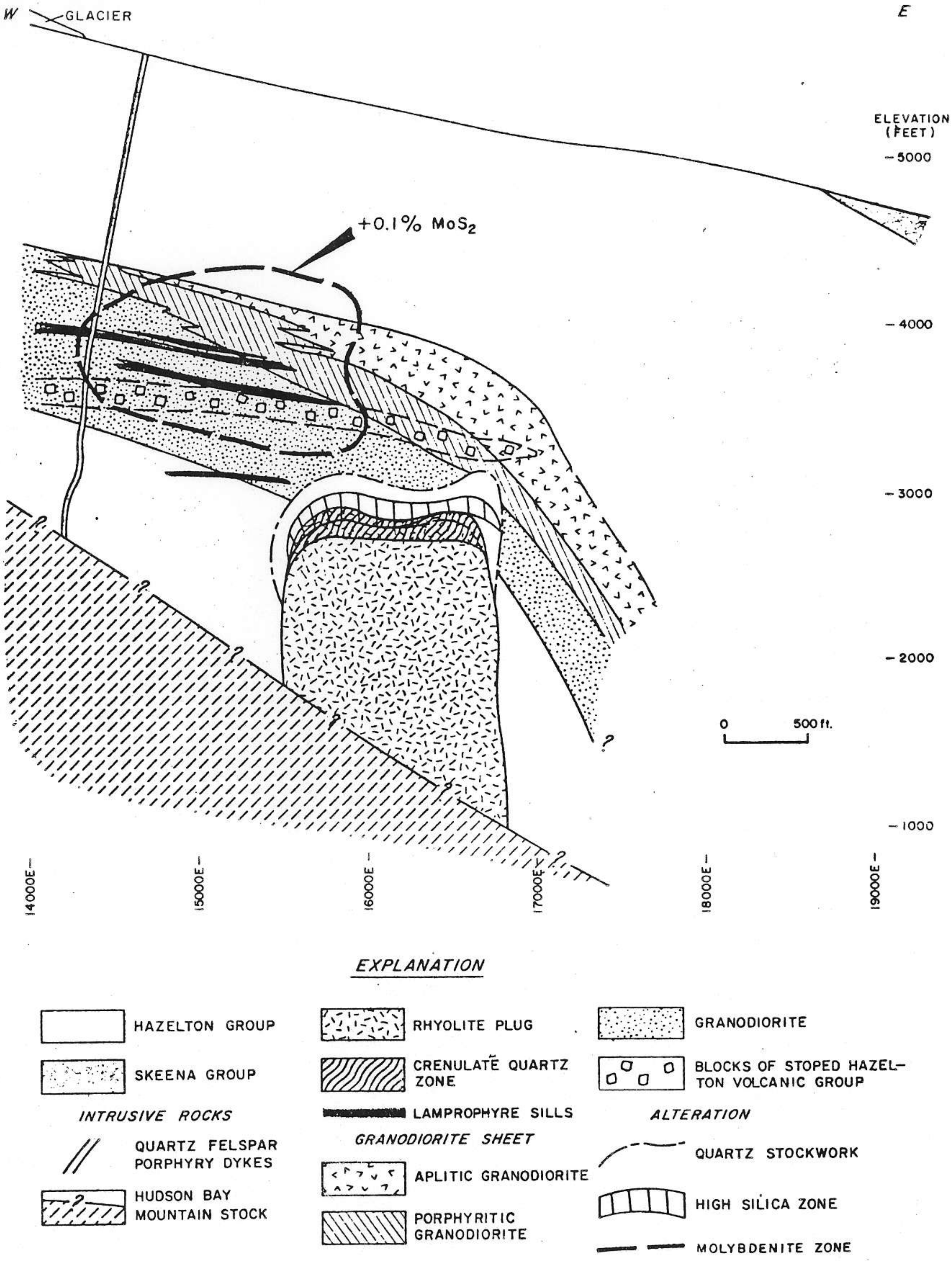

FIGURE 3. YORKE-HARDY GENERALIZED GEOLOGICAL CROSS SECTION (SOUTH OF ADIT)