Alice Arm

880080

GEOLOGICAL RELATIONSHIPS AND GEOCHRONOLOGY OF PORPHYRY COPPER AND MOLYBDENUM DEPOSITS

The majority of known porphyry copper and molybdenum deposits in west central British Columbia are spatially and genetically associated with Upper Cretaceous and Tertiary intrusions. From west to east, these include the Alice Arm intrusions, the Bulkley intrusions, the Nanika intrusions, and the Babine intrusions. Each group is discussed as a unit.

Each section includes a description of the geological setting of the porphyry deposits, detailed geology and style of mineralization, K-Ar results, and a discussion of the results. A brief section dealing with graphical interpretation of all K-Ar results is included at the end of the Chapter.

4.1 PORPHYRY MOLYBDENUM DEPOSITS ASSOCIATED WITH THE ALICE ARM INTRUSIONS:

A number of molybdenum deposits are related to the Alice Arm intrusions in the area between Stewart and Terrace (Figure 17). These deposits exhibit features typical of porphyry deposits although they have been referred to by some writers as stockwork molybdenum deposits (Clark, 1972) because of the bulk of molybdenum mineralization is contained in a stockwork of quartz veinlets.

4.1.1 GEOLOGIC SETTING:

Most of the known molybdenum-bearing stocks occur near the western edge of the Bowser successor basin, marginal to the Coast Plutonic Complex (Figure 18). The intrusions occur in the form of small stocks, generally not exceeding one-half mile in diameter. Porphyritic quartz monzonite is the dominant rock type, and this distinguishes the molybdenum-bearing stocks from the equigranular, satellitic stocks related to the Coast Plutonic Complex. Molybdenum-bearing stocks generally intrude argillaceous siltstones, greywackes, and shales of Late Jurassic and Early Cretaceous age, although some occur within the Coast Plutonic Complex.

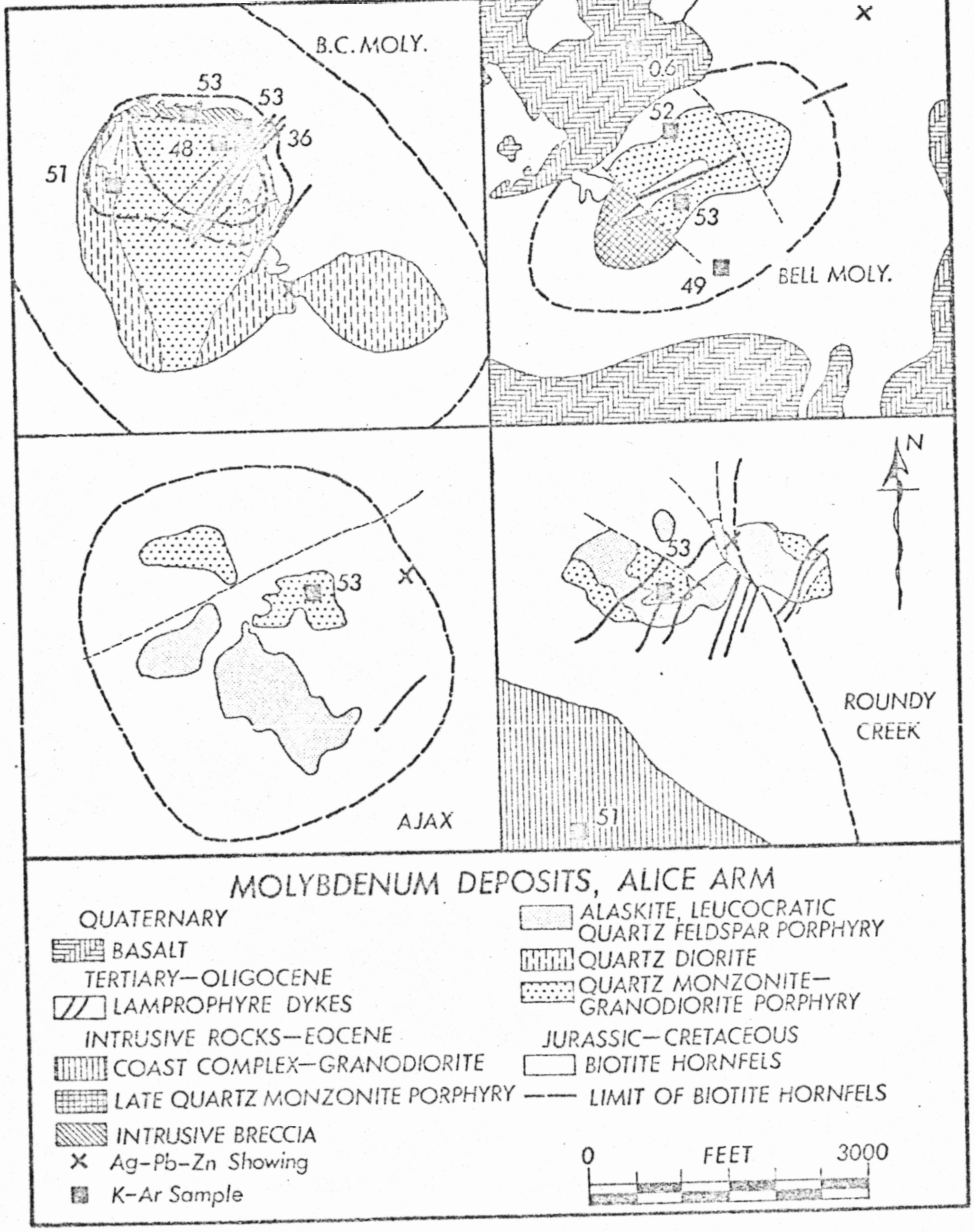
Evidence for both forceful and passive emplacement of the intrusions is well documented. In the Alice Arm area, sedimentary rocks have been arched and domed around the stocks. Elsewhere, little disturbance of the country rock is seen and the elongate nature of some of the intrusions indicates that they probably were emplaced along major fault zones.

South of Alice Arm, several molybdenum-bearing stocks are clustered near remnants of flat-lying Quarternary basalt which probably overlie their feeders. In the Nass River area, small stocks occur south and west of the Recent lava flow (Figure 18). These features suggest that the extrusion of lava was related, in part, to deep-seated structures that previously controlled the intrusion of the granitic stocks.

Many of the stocks apparently have been localized at or near intersections of east-northeast and north-northwest faults. The east-northeast trend is reflected by the elongation of several of the stocks (Bell Molybdenum, Roundy Creek, Kay) in the Alice Arm-Nass River areas which may also represent some control of the attitude of the sedimentary rocks. Also a crude east-northeast distribution of the stocks is evident in the cluster south of Alice Arm and south of the Nass River (Figure 20). Some stock contacts are rectilinear in plan, again reflecting the dominant fault and fracture patterns. A good example of this is seen at the Ajax molybdenum deposit northeast of Alice Arm (Figure 19).

4.1.2 GEOLOGY AND STYLE OF MINERALIZATION:

Molybdenum deposits are associated with the Alice Arm intrusions, which occur as small oval or elongate stocks. Some intrusions, most notably the Roundy Creek intrusion south of Alice Arm, are sheet- or sill-like in form and are related to small feeder pipes. Intrusions at Alder Creek, near Lava Lake (Figure 18), and Molybdenum



MOLYBDENUM DEPOSITS, ALICE ARM

Creek, north of Terrace, are northwest-striking dyke swarms intruding sedimentary rocks.

Quartz monzonite porphyry is the most common host rock at most deposits. Phenocrysts range in size from 2 millimetres to 1 centimetre and include, in decreasing order of abundance: euhedral plagioclase, K-feldspar, and both euhedral and anhedral quartz eyes. Quartz monzonite porphyry is characteristically mesocratic with both biotite and hornblende as primary mafic minerals. Leucocratic quartz feldspar porphyry phases of quartz monzonite to granite composition also are prominent at most of the deposits and at some they constitute the bulk of the intrusive rocks. Muscovite is the mica mineral of this phase.

Some intrusions are zoned, most notably the intrusion that is host to the British Columbia Molybdenum deposit. Here, a core of quartz monzonite porphyry is bordered by more basic granodiorite and quartz diorite which possibly formed by contamination from the argillaceous siltstones and greywackes.

Most molybdenum-bearing stocks exhibit several stages of intrusion. The first stage is represented by quartz monzonite and/or quartz feldspar porphyry and constitutes the bulk of the stock. This main phase may be intruded by fine-grained, equigranular alaskite that consists essentially of quartz, K-feldspar, and myrmekite. Alaskites, which are very common at the British Columbia Molybdenum and Roundy Creek properties (Figure 19), occur as dykes and irregular masses and are host to better grades of disseminated and replacement molybdenite mineralization. Other inter-mineral intrusions include dykes and irregular lenses of intrusive breccia, best developed along the northern stock contact at the British Columbia Molybdenum deposit (Figure 19). Angular fragments 1 to 2 centimetres in size, of both intrusive and country rock, are contained in a granulated matrix of quartz, plagioclase, and K-feldspar. Several deposits feature intrusive phases that are very late in the intrusive mineralization sequence. These also are quartz monzonite in composition and examples include an unexposed plug at the British Columbia Molybdenum deposit, the southwest portion of the Bell Molybdenum stock (Figure 19), and post-mineral dykes at some of the Nass River deposits (Figure 20).

Post-mineral lamprophyre and basalt dykes cut virtually all of the molybdenum-bearing stocks. These usually strike northeasterly, dip vertically, and truncate all pre-existing rocks and structures, including mineralized fractures. Northwest-striking, post-intrusive, and post-lamprophyre dyke faults are found at the Bell Molybdenum, Roundy Creek, and Nass River deposits (Figures 19 and 20).

Sedimentary rocks adjacent to the Alice Arm intrusions have been thermally metamorphosed to biotite hornfels in an aureole which may extend outward from the stock contact for several hundred feet (see property descriptions, Appendix C). Biotite hornfels is a brown-coloured, indurated, fine-grained rock with a granoblastic texture that consists of quartz, minor feldspar, and abundant felted, brown biotite. Some cordierite and andalusite are developed in the hornfels adjacent to intrusive contacts.

Alteration patterns within and marginal to the molybdenum-bearing stocks are typical of porphyry deposits. At many of the deposits, a central zone of potassic alteration is coincident with molybdenite mineralization. At the British Columbia Molybdenum deposit, the most intense potassic alteration is contained within an annular ore zone (Figure 19). Rock within this core of intense alteration is laced with barren quartz veinlets rimmed by secondary K-feldspar, such that the original quartz monzonite porphyry has been converted to a rock consisting mainly of quartz and K-feldspar. Within the annular zone of mineralization, secondary K-feldspar is restricted to the margins of quartz-molybdenite veinlets. Other deposits also feature secondary K-feldspar but not to the same degree as at British

Columbia Molybdenum. Secondary biotite, an alteration of primary hornblende, is present to a limited degree in several of the deposits. At Roundy Creek, quartz-muscovite veins constitute the potassic alteration zone.

The potassic zone at most deposits is gradational outward to a phyllic (quartz-sericite-pyrite) zone which is marginal to the plutons and involves an overprinting on the effects of thermal metamorphism. The phyllic zone is represented at many deposits by a bleaching of the biotite hornfels to a cream or light green colour marginal to fractures and quartz veinlets and is due to the development of very fine-grained quartz, sericite, albite, and epidote. This type of alteration may be weakly developed, as at many of the deposits, or so intense that the original biotite hornfels has been largely transformed to a buff or light-green coloured rock within a zone a few hundred feet outward from the stock contact as at the British Columbia Molybdenum and Ajax deposits. Pyrite is a common constituent in this alteration zone, occurring both in quartz veinlets and as disseminations. The intensity of pyritization may be related in part to thermal metamorphism, which involves a concentration of syngenetic pyrite and pyrrhotite in the sedimentary country rocks.

Better grades of molybdenite mineralization in the Alice Arm intrusions are dependent on structural and lithologic controls. Fracturing and attendant quartz-molybdenite veining is best developed near stock contacts. Later alaskite intrusive phases contain disseminated to near-massive molybdenite. An example is the ore zone at British Columbia Molybdenum which is annular or ring-shaped in plan, occurring near the contacts of the northern half of the stock (Figure 18). Molybdenite occurs as selvages in a network of east-northeast and west-northwest quartz veinlets. A similar style of mineralization occurs at most of the other deposits. Disseminated rosettes of molybdenite occur in leucocratic quartz-feldspar porphyry phases at the Tidewater and Kay properties.

Disseminated molybdenite is contained in the alaskite intrusive phase at the British Columbia Molybdenum deposit. At Roundy Creek, the alaskite contains near-massive lenses, pods, and parallel bands of molybdenite.

At least three stages of quartz-molybdenite veining are present in the British Columbia Molybdenum deposit. Virtually all of the Alice Arm molybdenite deposits feature late-stage quartz-carbonate veins which contain pyrite, galena, sphalerite, tetrahedrite, chalcopyrite, minor molybdenite, and at British Columbia Molybdenum, a silver-lead-bismuth sulphosalt, neyite (Drummond, et al., 1969). These silver-lead-zinc veins which are best developed perpheral to the stocks were exposed many years before the molybdenite mineralization attained economic significance.

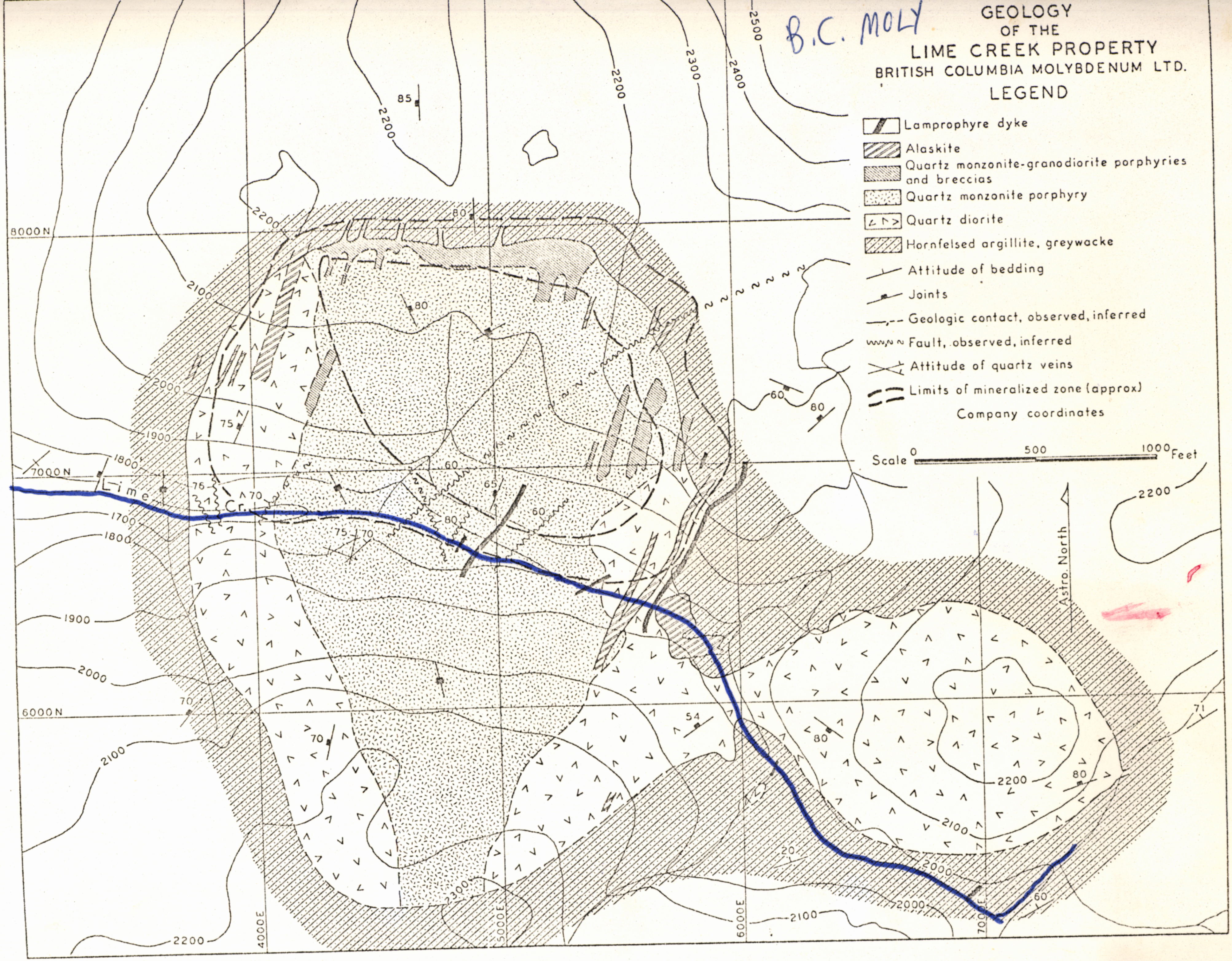
A pyrite halo may extend outward from the molybdenite zone for several hundred to a thousand feet. Where exposed, the pyrite zone is weathered to a prominent gossan, particularly at the Ajax and Snafu properties.

Other molybdenite deposits studied in the Alice Arm area include the Molly Mack prospect near Anyox and the Penny Creek showing south of Alice Arm (Figure 17). At the Molly Mack property, coarse-grained molybdenite is abundantly disseminated in a small zone of biotite granite contained within a stock-like body of leucocratic quartz-monzonite porphyry which is similar in appearance to some phases of the Alice Arm intrusions. The Penny Creek occurrence consists of rosettes of molybdenite in a biotite quartz monzonite, a late phase of the Coast Plutonic Complex.

Numerous showings of molybdenite occur near the eastern margin of the Coast Plutonic Complex and in the satellite stocks related to the complex.

4.1.3 POTASSIUM-ARGON DATING OF THE ALICE ARM PORPHYRY MOLYBDENUM DEPOSITS:

K-Ar ages obtained from samples collected in the Alice Arm-Nass River



B.C. MOLY
GEOLOGY
OF THE
LIME CREEK PROPERTY
BRITISH COLUMBIA MOLYBDENUM LTD.
LEGEND
Lamprophyre dyke
Alaskite
Quartz monzonite-granodiorite porphyries and breccias
Quartz monzonite porphyry
Quartz diorite
Hornfelsed argillite, greywacke
Attitude of bedding
Joints
Geologic contact, observed, inferred
Fault, observed, inferred
Attitude of quartz veins
Limits of mineralized zone (approx)
Company coordinates
Scale 0 500 1000 Feet
Astro. North
Lime Cr.
8000N
7000N
6000N
4000E
5000E
6000E
7000E

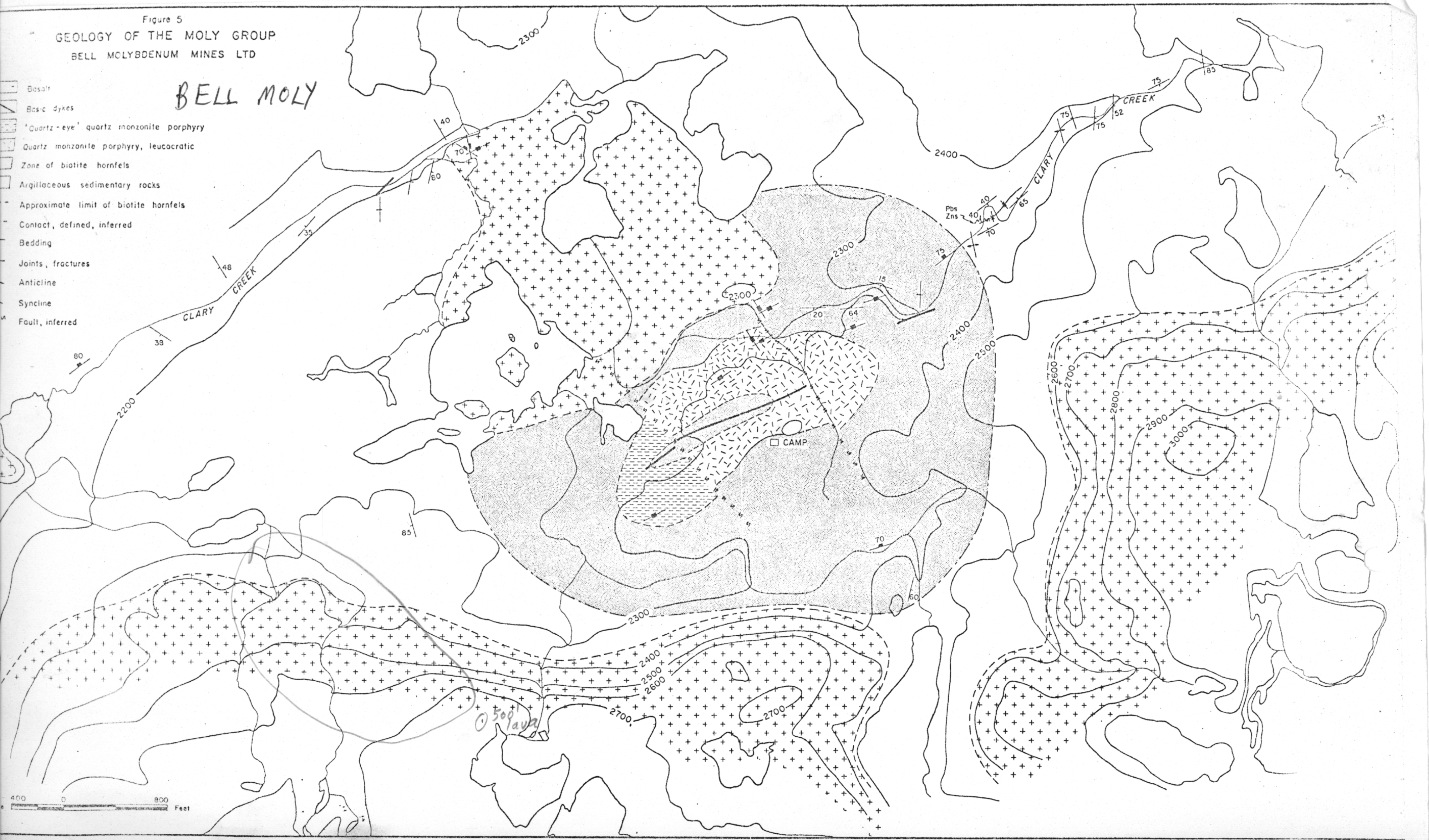


Figure 5
GEOLOGY OF THE MOLY GROUP
BELL MOLYBDENUM MINES LTD

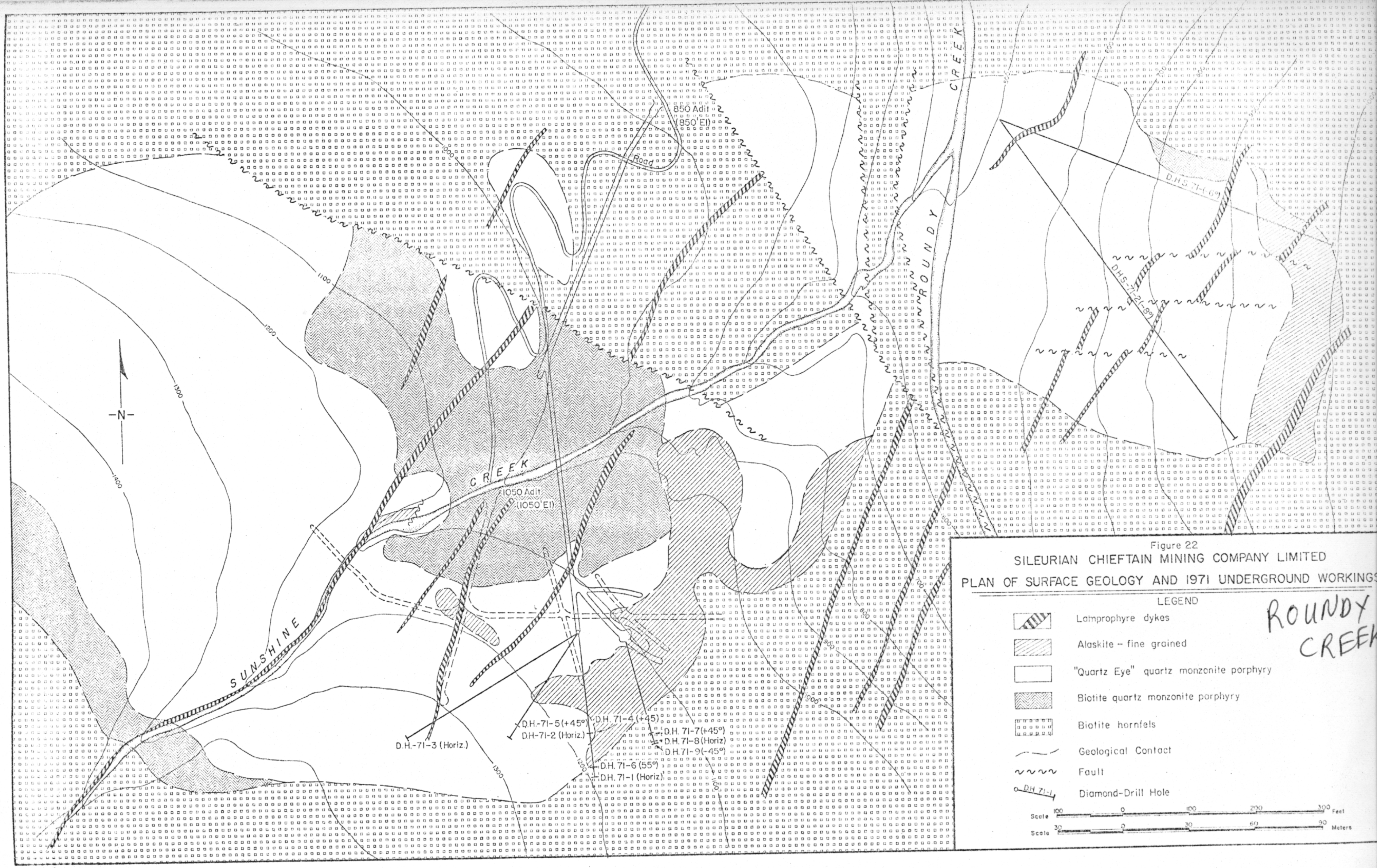


Figure 22
SILEURIAN CHIEFTAIN MINING COMPANY LIMITED
PLAN OF SURFACE GEOLOGY AND 1971 UNDERGROUND WORKINGS
LEGEND
Lamprophyre dykes
Alaskite – fine grained
"Quartz Eye" quartz monzonite porphyry
Biotite quartz monzonite porphyry
Biotite hornfels
Geological Contact
Fault
Diamond-Drill Hole
DH 71-1
Scale 100 0 100 200 300 Feet
Scale 30 0 30 60 90 Meters
ROUNDY
CREE
850 Adit
(850' El)
Road
1050 Adit
(1050' El)
SUNSHINE
CREEK
ROUNDY
CREEK
-N-
D.H.-71-3 (Horiz.)
D.H.-71-5 (+45°)
D.H.-71-2 (Horiz.)
D.H. 71-4 (+45)
D.H. 71-7 (+45°)
D.H. 71-8 (Horiz)
D.H. 71-9 (-45°)
D.H. 71-6 (55°)
D.H. 71-1 (Horiz)
D.H.S. 71-1 (-6°)
D.H.S.-71-2 (-6°)
1100
1200
1300
1400
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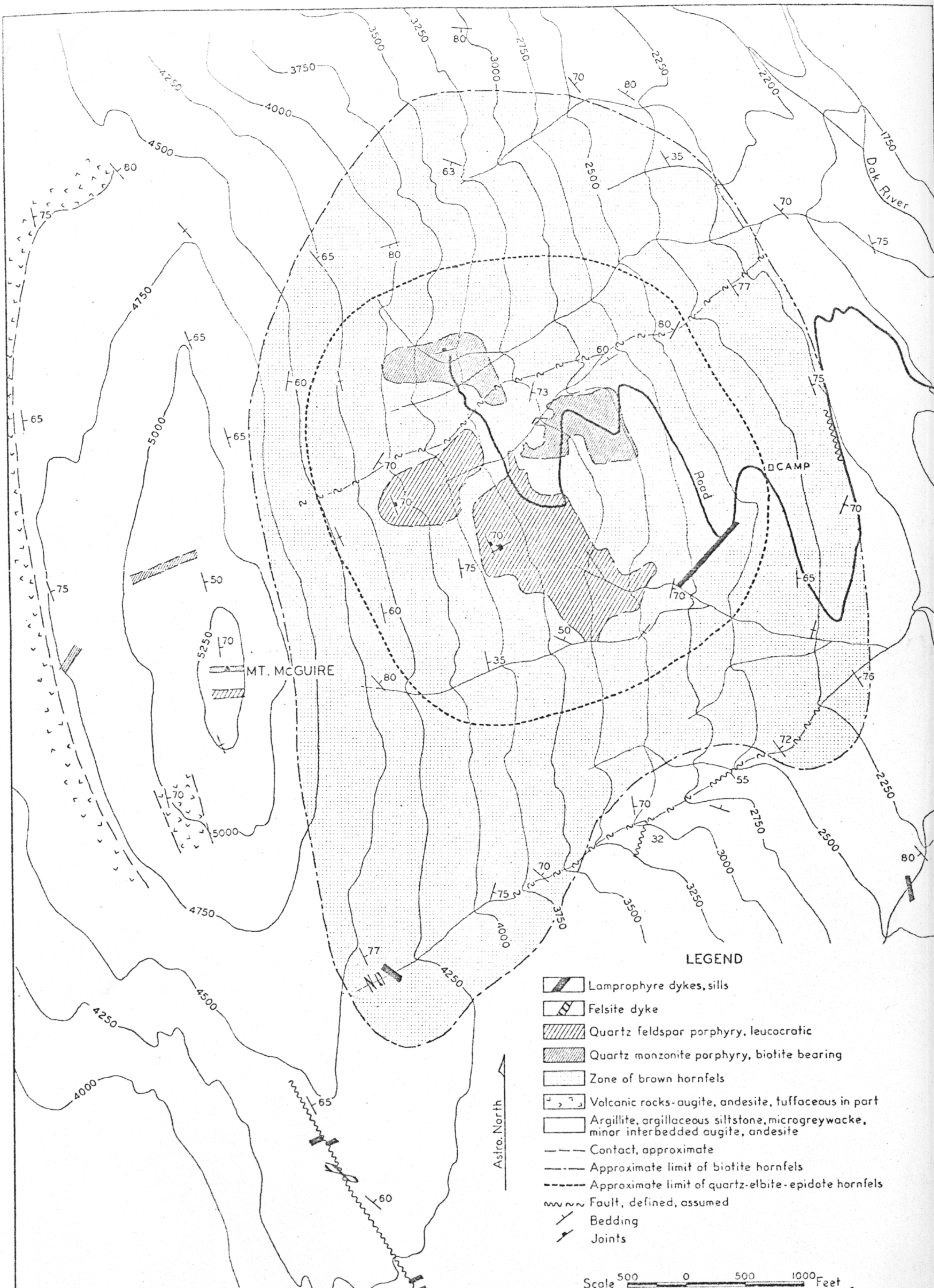

Figure 8. GEOLOGY OF AJAX GROUP, MT. McGUIRE AREA