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ALTERATION STUDY OF DRILLING AT THE AJAX MOLYBDENUM PROPERTY, ALICE ARM, B.C.

File No. 790050680   February 18, 1981

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NEWMONT EXPLORATION LTD.

DANBURY, CONNECTICUT

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ALTERATION STUDY OF DRILLING AT THE AJAX MOLYBDENUM PROPERTY, ALICE ARM, B.C.

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INTRODUCTION

At the request[1] of C. Leitch, Research Geologist for the Newmont Vancouver office, analytical pulps from 19 drill holes on the Ajax molybdenum property near Alice Arm, B.C. have been analyzed by XRD-XRF methods, and the data forwarded to the Vancouver office for early evaluation.[2,3]

According to Mr. Leitch,[1] x-ray diffraction data on alteration minerals were needed to expedite a decision by CANICO on Newmont's proposed work program.[4] This proposal has been under joint consideration by both Newmont and CANICO (Canadian Nickel Company, a wholly owned domestic Canadian subsidiary of INCO, Inc.), and included a program for deep exploration drilling during the May-October 1981 period.

This report contains a description of the alteration-geochemical data generated for Newmont Exploration of Canada Limited, based on alteration and geochemical contouring of select cross sections of the Ajax deposit.

SUMMARY

The Ajax prospect represents a highly anomalous area of widespread MoS_2 mineralization that surfaces in the vicinity of Holes DDH-19, 20 and 30. The mineralization is spacially associated with porphyry intrusives and faulting, and shows coincident alteration anomalies of K-feldspathization and silicification, both in plan and vertical sections.

Alteration and geochemical contouring outline a north-trending mineralized zone that is open to the south in plan, and open at depth in section. Increase in thickness of MoS_2 mineralization and alteration intensity at depth in two of the sections (67-3 and 4+00S) favors improved MoS_2 mineralization below the limits of current drilling. However, MoS_2 values are more widely pervasively disseminated at Ajax than at Trout Lake, showing less tendency to concentrate within a smaller "ore grade" volume.

Additional surface wholework geochemistry, along with limited deeper drilling to the east and south of the drilled area is recommended on the basis of available alteration data.

GENERAL BACKGROUND

The Ajax property is located in the Skeena Mining District near the coastal town of Alice Arm, B.C., and roughly 100 miles northeast of Prince Rupert. The molybdenum mineralization was discovered in 1965 by a Newmont prospector, followed by mapping, aeromagnetic surveys and drilling from 1965 to 1967. Results of mapping and drilling indicate widespread low-grade molybdenum mineralization in the form of a stockwork associated with fracturing and small porphyry intrusives.[5] Alteration assemblages are reported[4,5,6,7] to include quartz-albite-epidote; amphibole, pyroxene and chlorite; minor garnet; and quartz-sericite-K-feldspar veins.

MoS_2 values for most of the drilling are relatively low (0.0X%), locally averaging between 0.1-0.2%, with no significant increase in grade to the limit of drilling, mostly between 1000 and 2000 feet in depth. However, the widespread and pervasive nature of highly anomalous molybdenum, and the similar stockwork features to those at Trout Lake, indicate a need for additional deep drilling.

The location of Ajax within an apparent molybdenum metallogenic province is further exemplified by Amax's Kitsault mine, located 12 miles south of Ajax.

DESCRIPTION AND ANALYSIS OF SAMPLES

A suite of 365 analytical pulps were received from 19 drill holes on the Ajax property. The drill holes include Nos. 8, 12, 14, 15, 19, 20, 23, 26, 27, 28, 29, 30, 31, 33, 35, 67-1, 67-2, 67-3 and 67-4, most of which were angle holes drilled to the west across a steeply dipping structure to the east. (See location map, Figure 1.)

Analytical pulps, as received, had been composited into approximately 50-foot intervals of drilling, but required careful mixing prior to XRD-XRF analysis. X-ray fluorescent analyses were obtained in a semiquantitative manner by scanning of heavy elements, utilizing a G.E. XRD-5 unit equipped with a scintillation detector and tungsten white radiation. Intensities of characteristic spectra for barium, zirconium, strontium, rubidium, arsenic, zinc, copper, nickel, iron and manganese were converted into semiquantitative weight percentages with the aid of computer programming (Appendix 1).

These elements [illegible] done much more accurate, in ppm range.

X-ray diffraction analyses were also obtained in a semiquantitative manner by scanning, utilizing CuKα radiation from a Norelco transisterized x-ray diffractometer with a wide-range goniometer, a curved crystal monochrometer, and a transisterized Honeywell recorder. Sample surfaces were impressed with a "Peters grid" and rotated during analysis in a Philips rotating flat specimen holder to ensure random orientation and optimum precision. Intensities of characteric reflections for various minerals were measured from scans and converted into semiquantitative weight percentages with the aid of computer programming (Appendix 2).

Molybdenum assays were provided for each sample interval by the Newmont Vancouver office, and are included in the Appendices.

50 composites calculated from drill log assays

GEOCHEMICAL DISTRIBUTION OF MoS_2 MINERALIZATION

The geochemical distribution of MoS_2 values was evaluated both in plan and along select cross sections at Ajax. In plan (Fig. 2), the average MoS_2 values for the upper 100' of available samples from each hole were plotted and contoured manually to delineate a wholerock distribution of molybdenum mineralization. Contouring was guided by both data points and by structures, as indicated on cross sections.

In section, molybdenum values from 50' intercepts for each hole were plotted and contoured along four sections (Figs. 3, 4, 5 and 6), including section No. 67-2, 67-3, 4+00S and 9+00S. The locations of these sections are shown in plan in Figure 1.

Distribution of MoS_2 in Plan

The distribution of MoS_2 in the plan map (Fig. 2) does not truly represent a plan plot, since no attempt was made to correct for variations in topography, nor the inclined distribution of molybdenum values through the upper hundred feet of angle holes. However, this is the closest approximation to surface wholerock sampling available at this time, and permits some preliminary interpretation of geochemical molybdenum distribution at surface.

(actually an inclined section)

The apparent center of the molybdenum anomaly at surface lies in the vicinity of Holes 19, 20 and 30 near the southwest corner of the drilled area (Fig. 2). The anomaly defined by the 0.1 and 0.2% MoS_2 contours appears to be somewhat elongate, striking northerly and essentially open to the south. Values drop off sharply to the north, but tend to swing around to the northeast, as indicated by the 0.05 and 0.03 MoS_2 contours. A relatively large highly anomalous area is indicated by the 0.03% MoS_2 contour, which encompasses roughly one-half square mile or more. A much larger area of moderately anomalous molybdenum would be delineated by the 0.01% MoS_2 contour, which could not be outlined on this map due to insufficient sample points.

(correlates with trend [illegible] porphyry intrusions)

A surface wholerock sampling grid is highly recommended for this highly favorable prospect to permit more detailed geochemical-alteration contouring, analogous to the early program conducted at Trout Lake.[8]

(this is not going to facilitate a drill program decision.)

Distribution of MoS_2 in Section

All four sections (Figs. 3, 4, 5 and 6) show similar steeply dipping zones of MoS_2 mineralization, paralleling intrusive bodies and fault structures facing to the east. The highly anomalous zone, delineated by the 0.03% MoS_2 contour, exceeds 2000' in thickness in all four sections, and shows a tendency to increase in thickness at depth in each section.

Likewise, the zone of potential ore grade, delineated by the 0.1%

contour, was noted especially to increase in apparent thickness at depth. This becomes most apparent in Section 67-3 (Fig. 4) where an apparent thickness of about 500' in the upper section between DDH-15 and 19, approaches 2000' at depth in DDH-3. In this section, MoS_2 mineralization continues for significant distances into footwall argillaceous sediments below the intrusive, analogous to the Trout Lake deposit.[9]

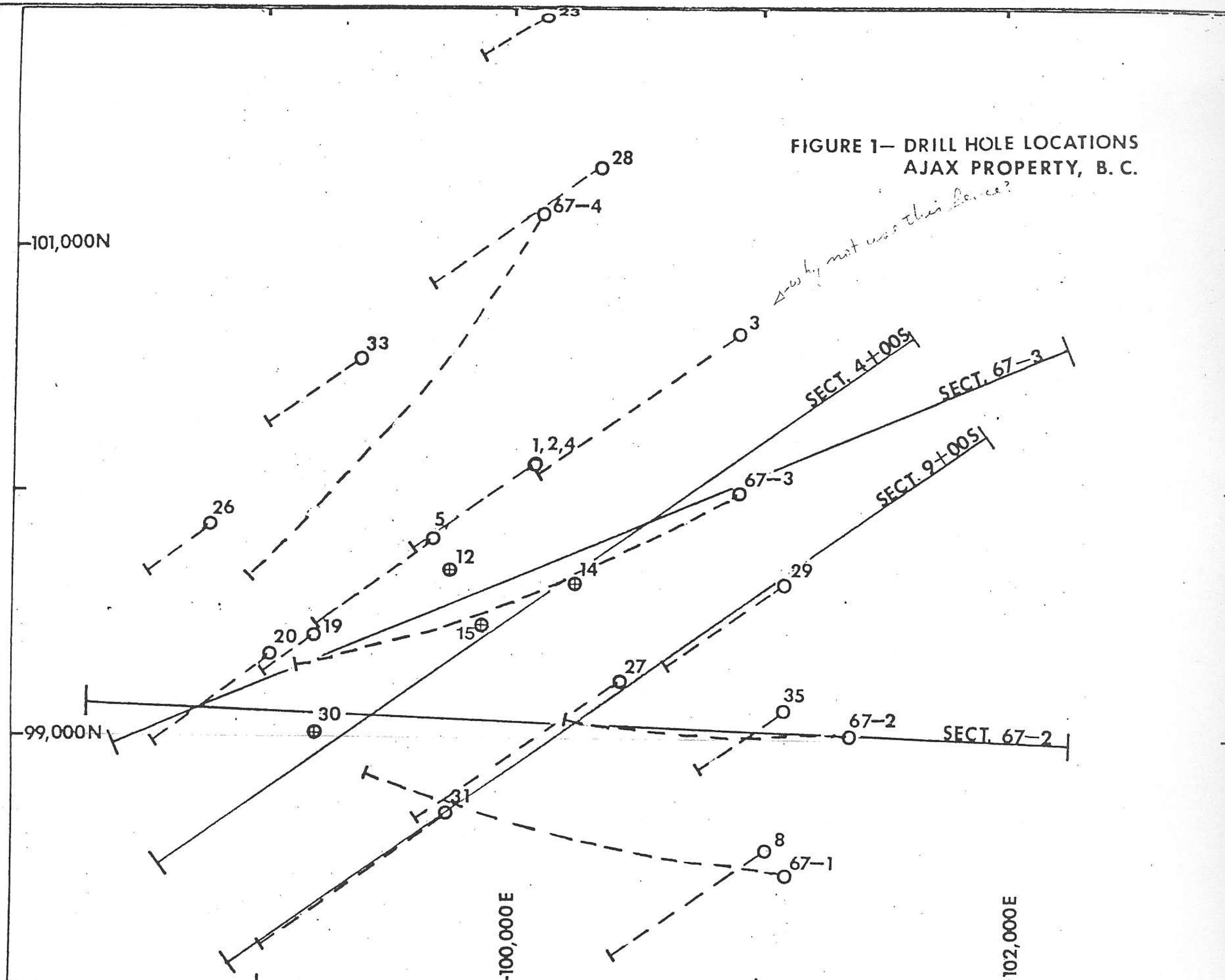

FIGURE 1— DRILL HOLE LOCATIONS
AJAX PROPERTY, B. C.

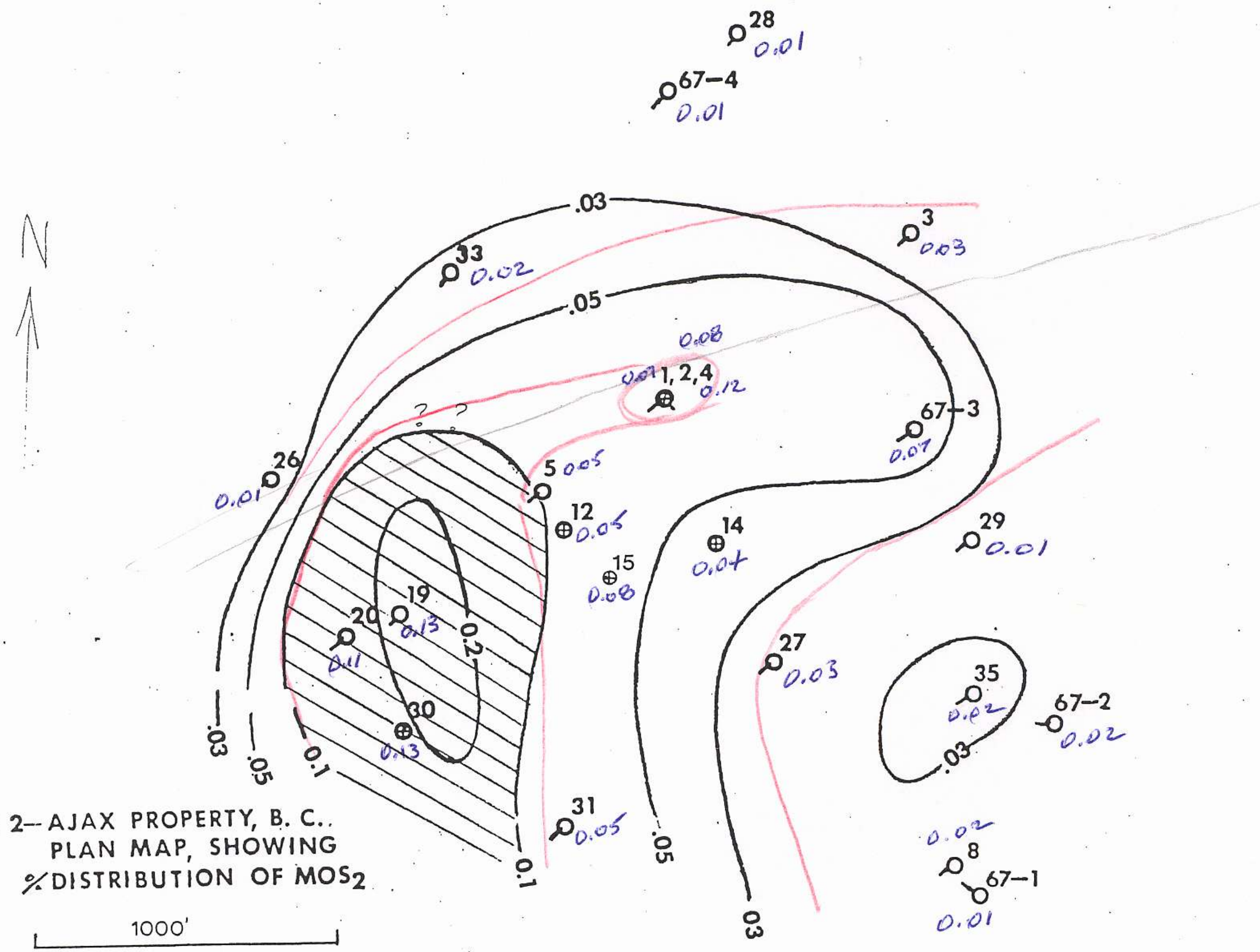

FIGURE 2—AJAX PROPERTY, B. C.. PLAN MAP, SHOWING % DISTRIBUTION OF MOS_2

1000'

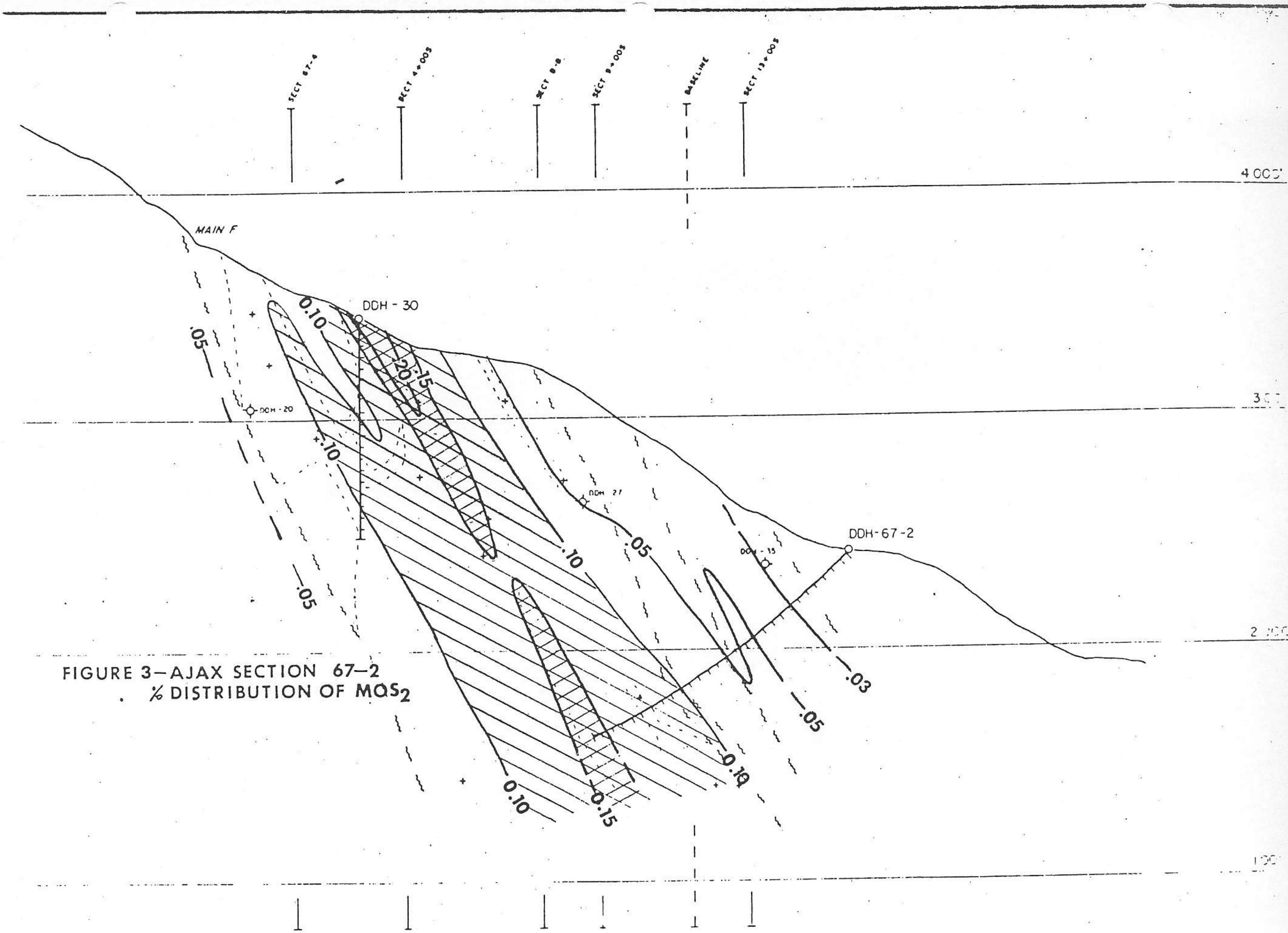

FIGURE 3—AJAX SECTION 67—2
% DISTRIBUTION OF MoS_2

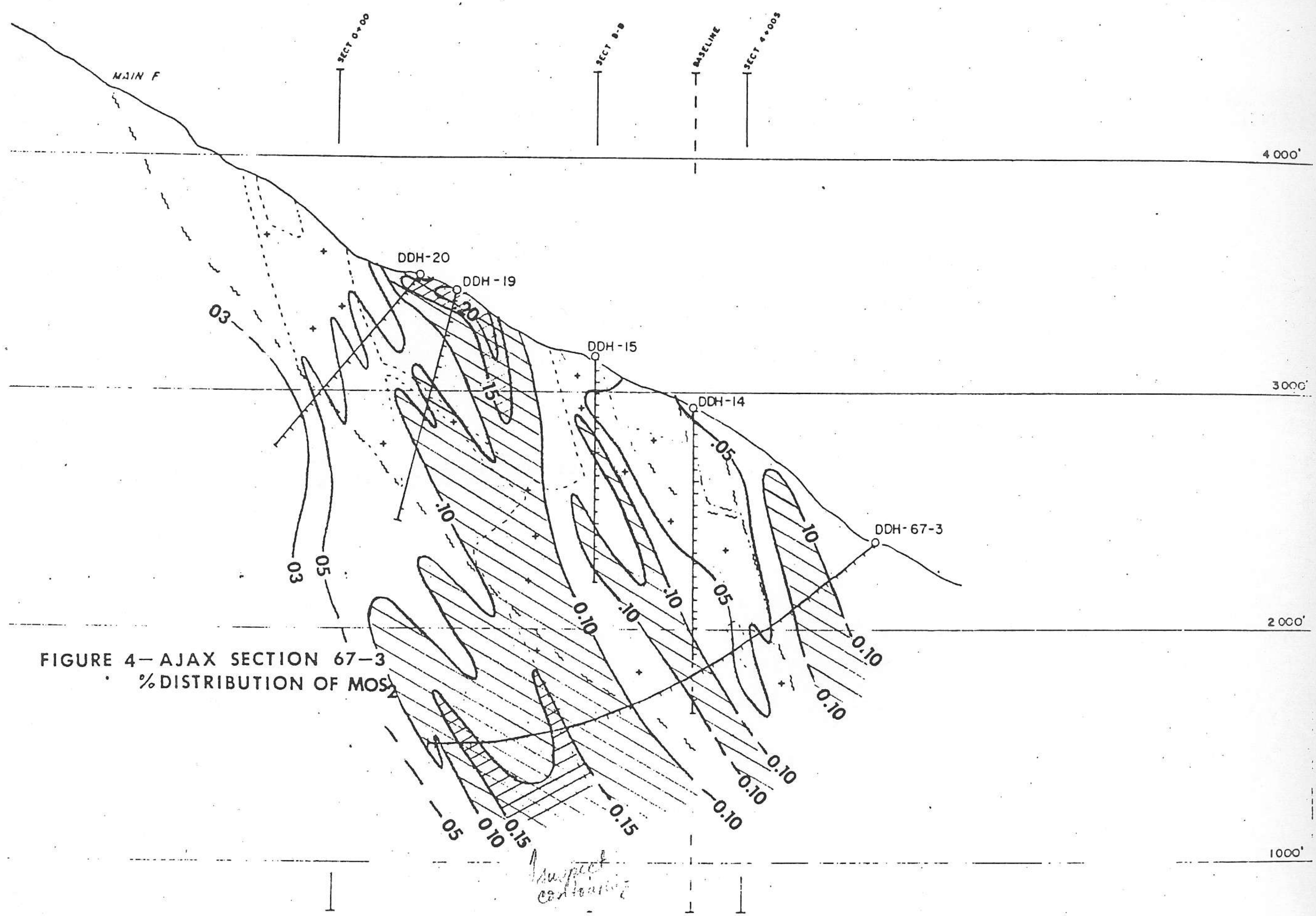

FIGURE 4— AJAX SECTION 67-3
% DISTRIBUTION OF MoS_2

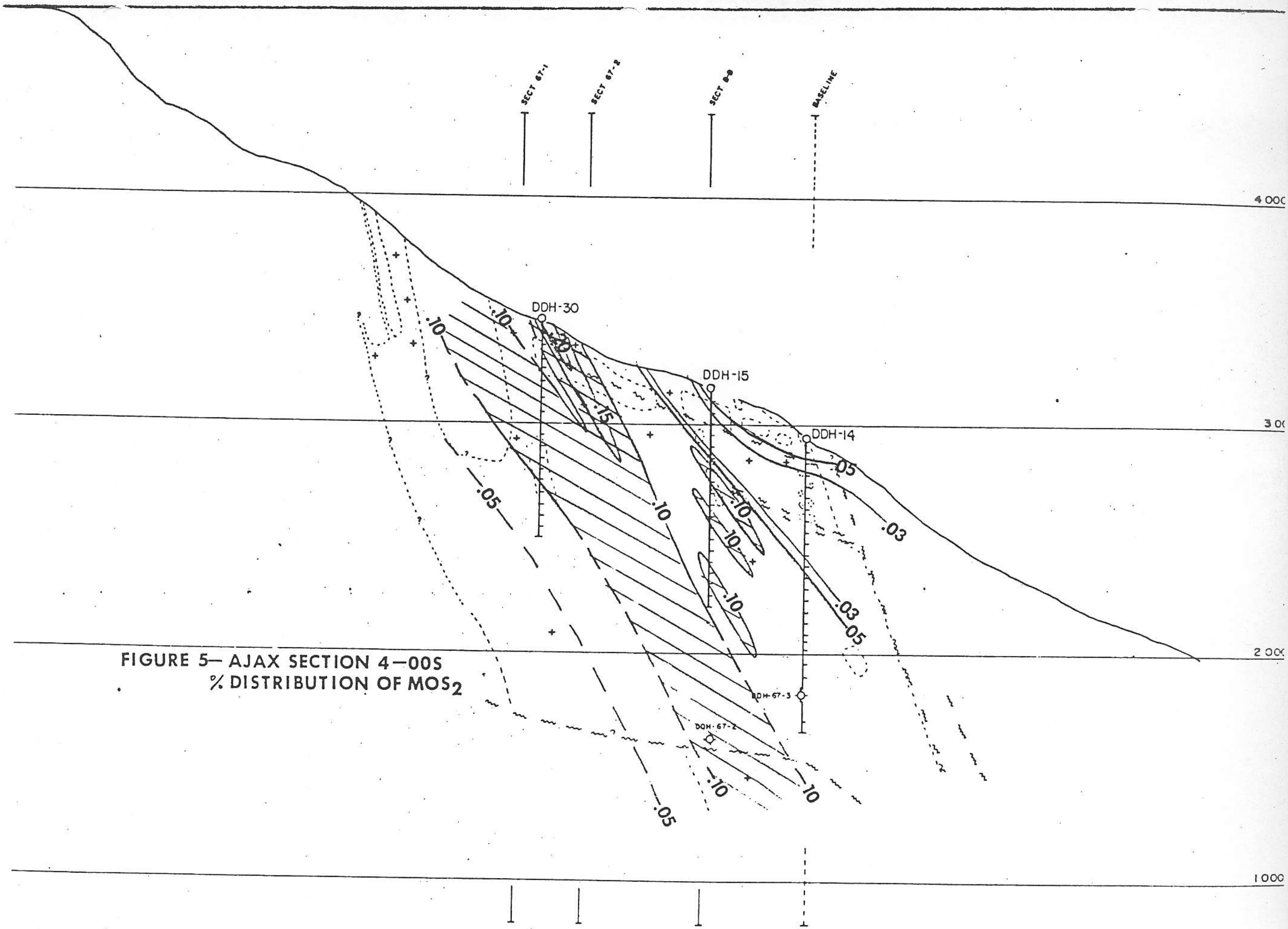

FIGURE 5— AJAX SECTION 4—00S
% DISTRIBUTION OF MOS_2

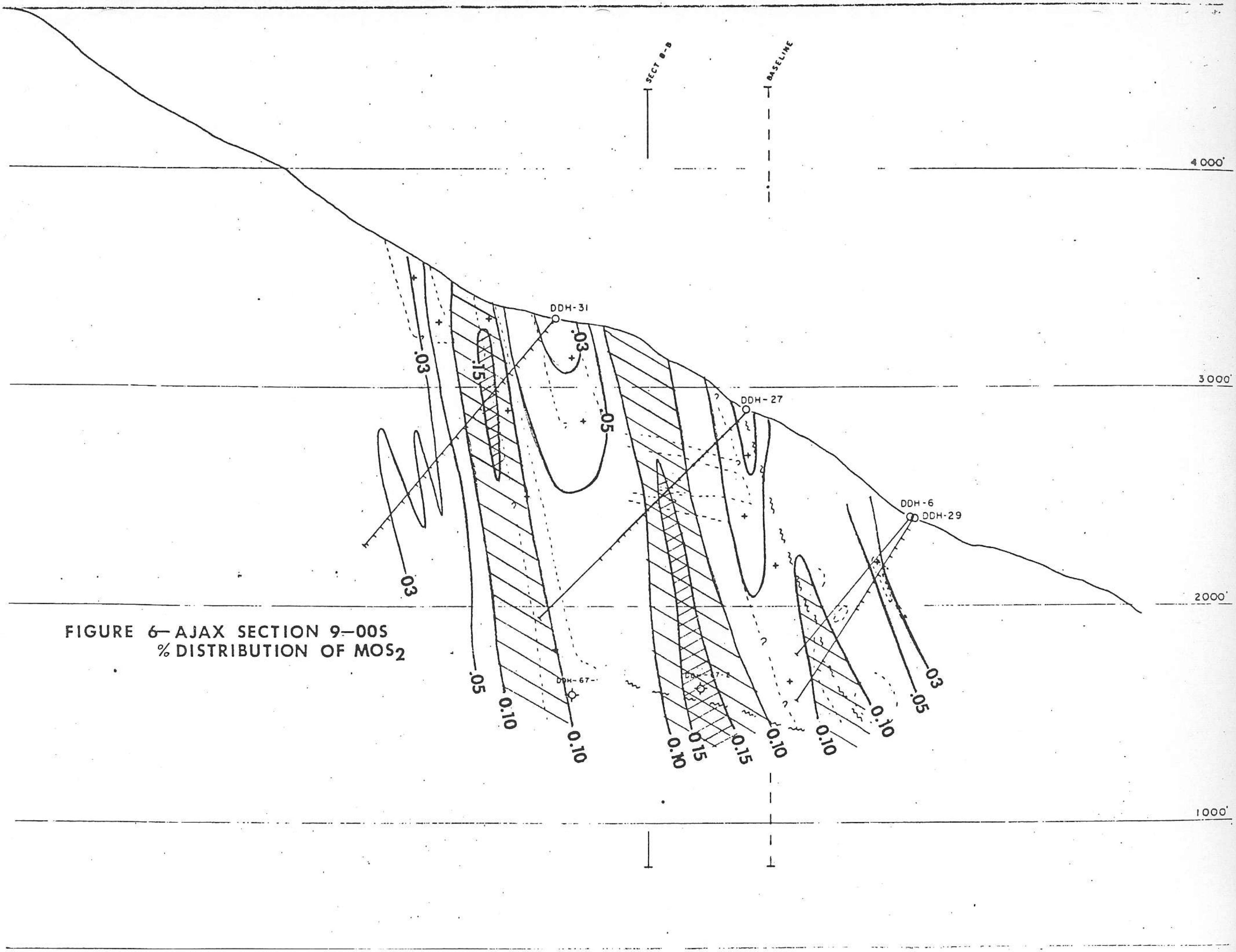

FIGURE 6—AJAX SECTION 9—00S
% DISTRIBUTION OF MOS_2

ALTERATION FEATURES

Features of alteration, including K-feldspathization, silicification, sericitization, feldspar replacement and in select cases ankeritization, have been investigated in surface plan and cross sections across the Ajax prospect, and compared with MoS_2 mineralization. Surface plan distributions of various alteration assemblages were interpreted from XRD analyses of the upper 100' of pulps available from each hole. Sectional distributions were likewise investigated by the plotting and contouring of mineralogic values along Sections Nos. 67-2, 67-3, 4+00S and 9+00S, analogous to the MoS_2 plots described above (Figs. 2 through 6).

Distribution of Alteration Assemblages in Plan

K-Feldspathization

The distribution of K-feldspar/plagioclase ratios have been plotted and contoured in plan in Figure 7. Ratio values were contoured at intervals of 0.5, 1.0, 1.5, 2.0 and 2.5 to outline a northerly striking zone that terminates sharply on the north between DDH-19 and -33, but is apparently open to the south. Additional drilling or surface sampling is required to close both the 2.0 and 2.5 contours on the south.

The K-feldspar "high" occurs in the vicinity of Holes 19, 20 and 30, essentially coincident with the MoS_2 "high" shown in Figure 2. No attempt was made to distinguish between primary K-feldspars from intrusive porphyries and secondary K-feldspathic replacements. XRD data simply provide total estimates of various minerals which are plotted and (contoured with minimum bias or subjective considerations.)? Interpretation of the contoured plots, however, requires geologic disciplines that can best be provided by field personnel.

On the basis of preliminary contouring, K-feldspars correlate closely with MoS_2 mineralization, and are believed to be derived in part from K-feldspathic alteration, associated with the porphyry intrusives. ?

from above paragraph he admits he does not know this.

Feldspar Replacements

Feldspars, notably plagioclase, are often replaced by various alteration assemblages associated with hydrothermal activity, and their absence or "lows" may be used in some instances to delineate hydrothermal ore zones. A weak feldspar "low" was delineated by the contouring of total feldspars in Figure 8, as defined by the 40 and 30% contours in the vicinity of Holes 19, 20 and 30. This weak anomaly is essentially coincident with the MoS_2 and K-feldspar anomalies described above, and serves to confirm the application of alteration contouring to delineate apparent centers of mineralization.

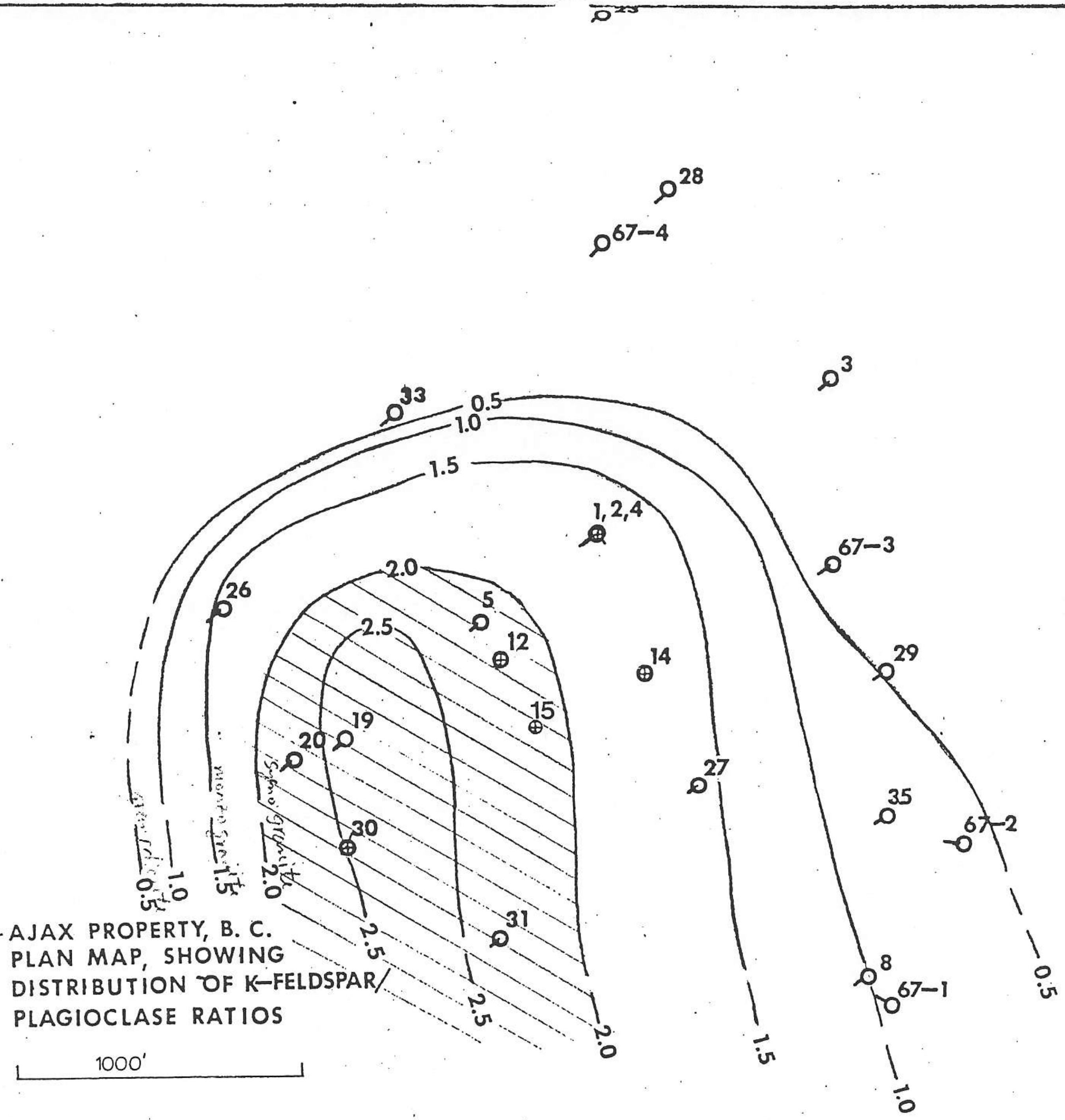

FIGURE 7— AJAX PROPERTY, B. C.
PLAN MAP, SHOWING
DISTRIBUTION OF K—FELDSPAR/
PLAGIOCLASE RATIOS

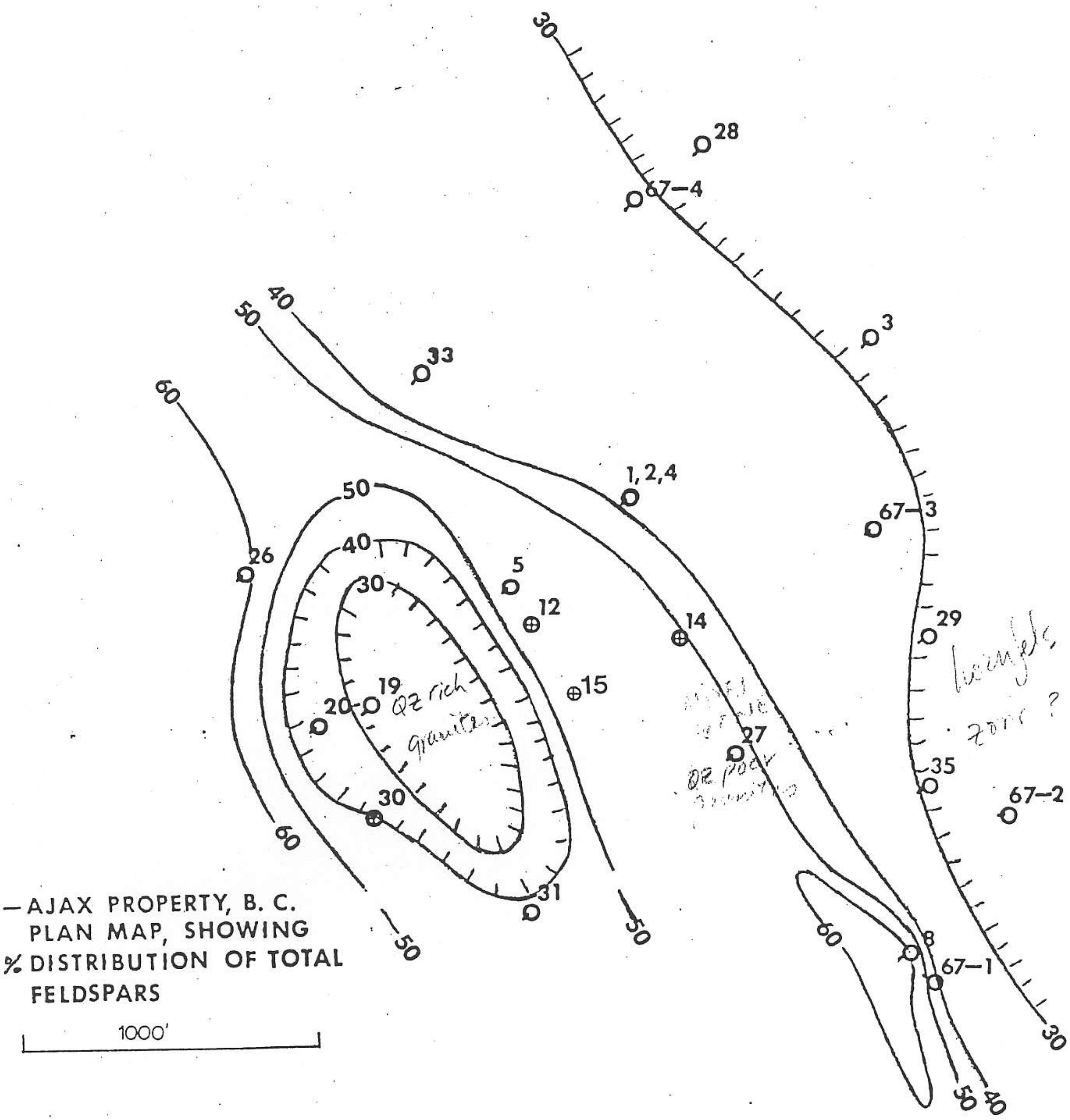

FIGURE 8—AJAX PROPERTY, B. C.
PLAN MAP, SHOWING
% DISTRIBUTION OF TOTAL
FELDSPARS

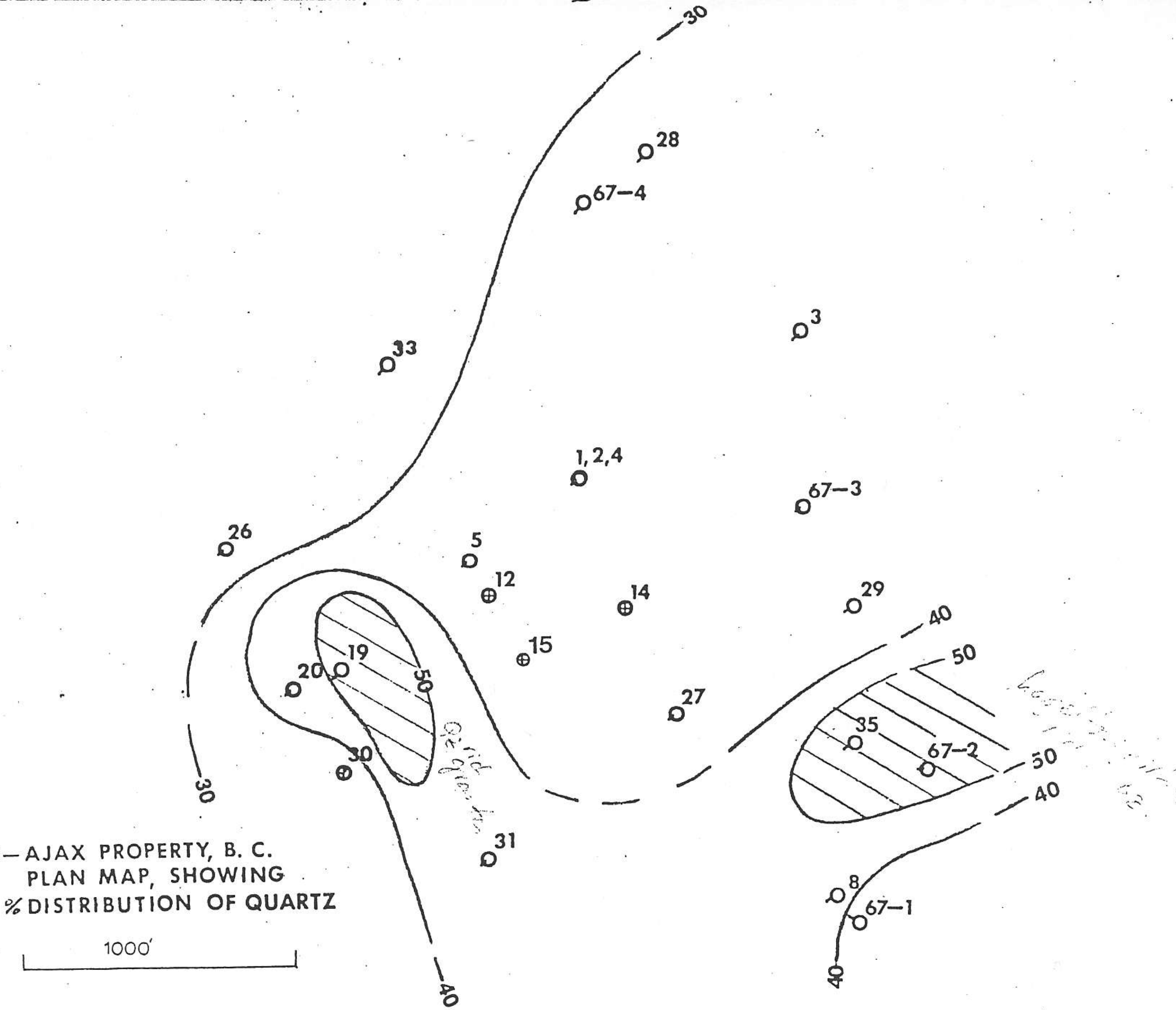

FIGURE 9—AJAX PROPERTY, B. C.
PLAN MAP, SHOWING
% DISTRIBUTION OF QUARTZ

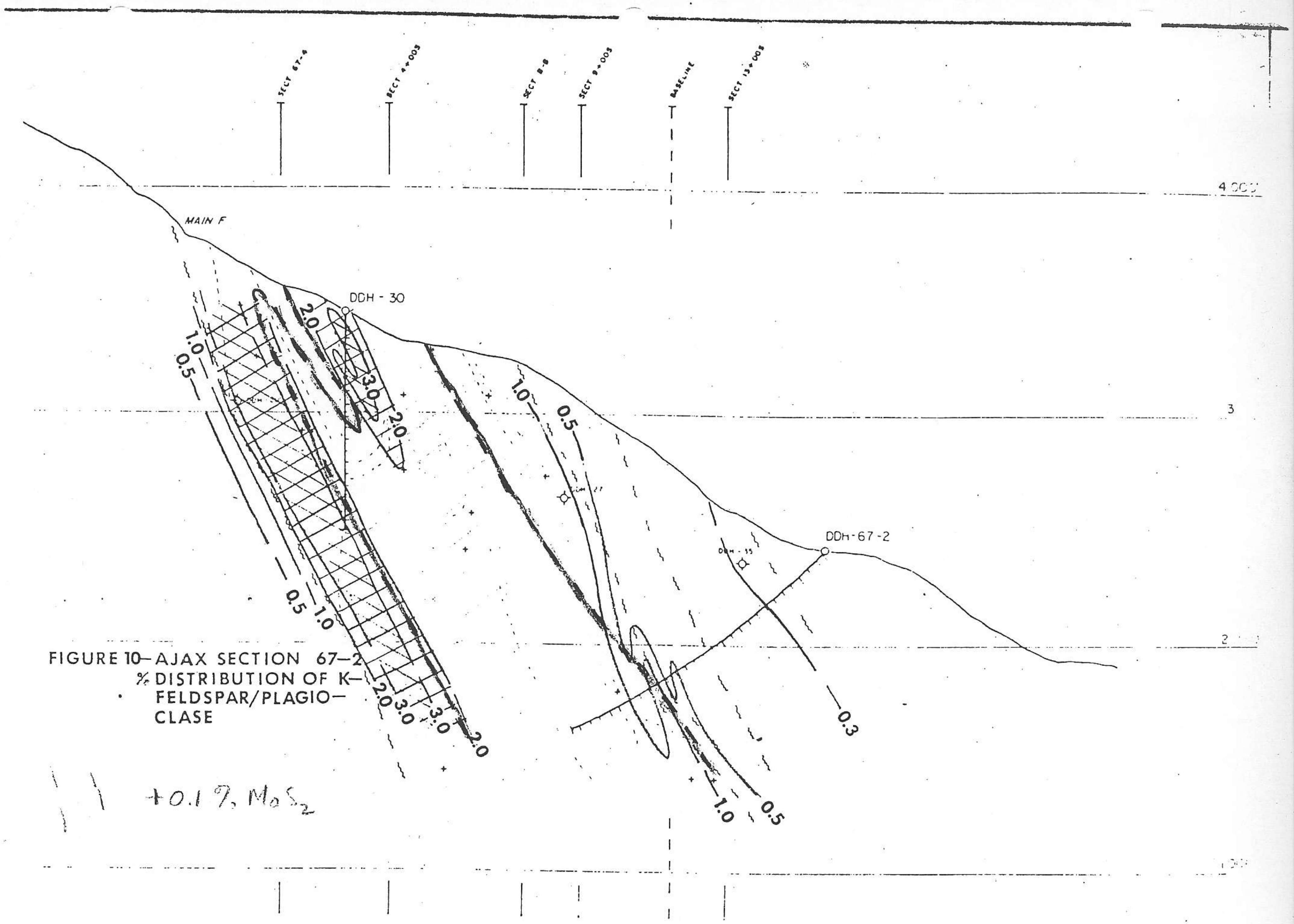

FIGURE 10—AJAX SECTION 67–2
% DISTRIBUTION OF K–FELDSPAR/PLAGIOCLASE

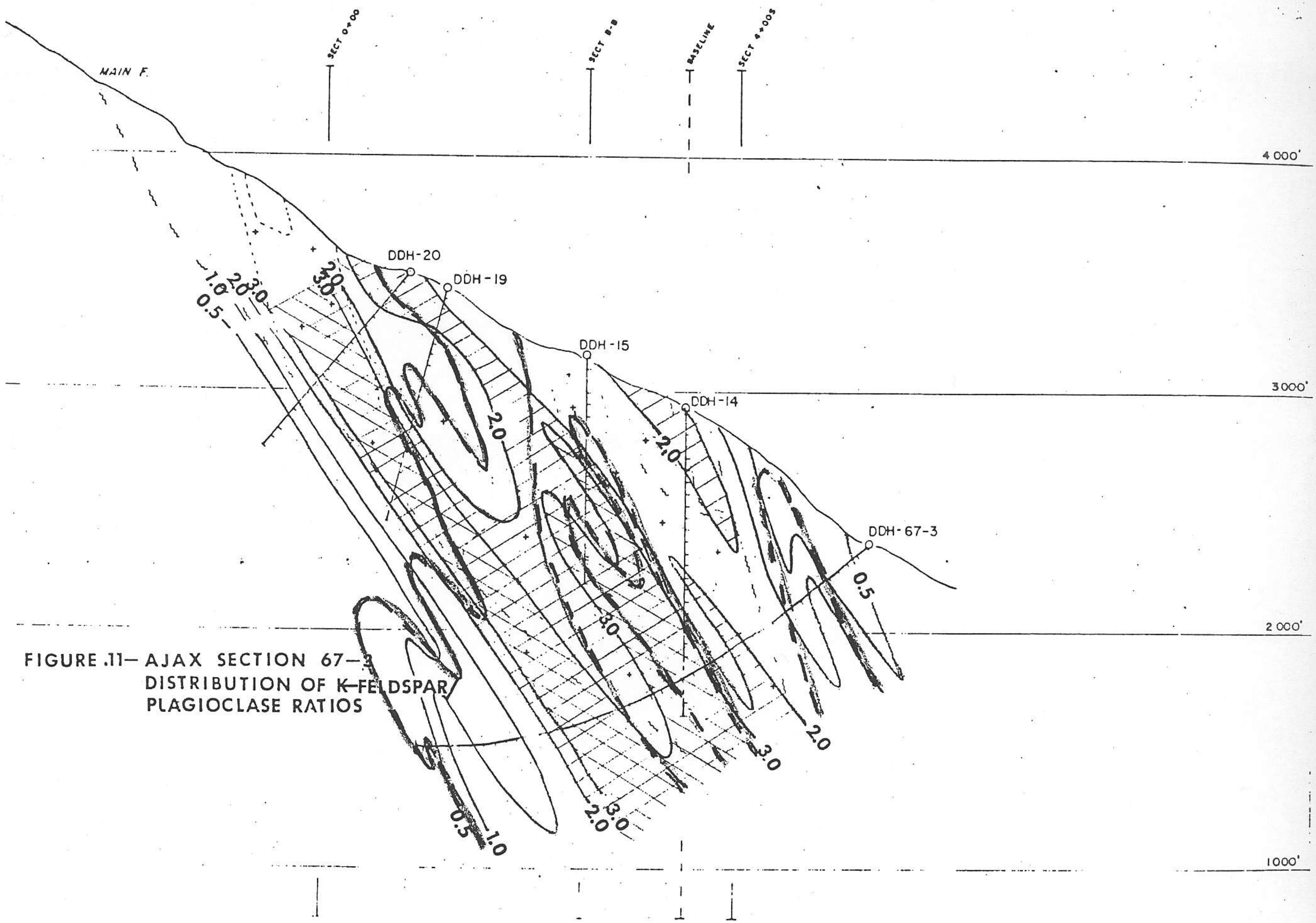

FIGURE 11— AJAX SECTION 67—3
DISTRIBUTION OF K-FELDSPAR/
PLAGIOCLASE RATIOS

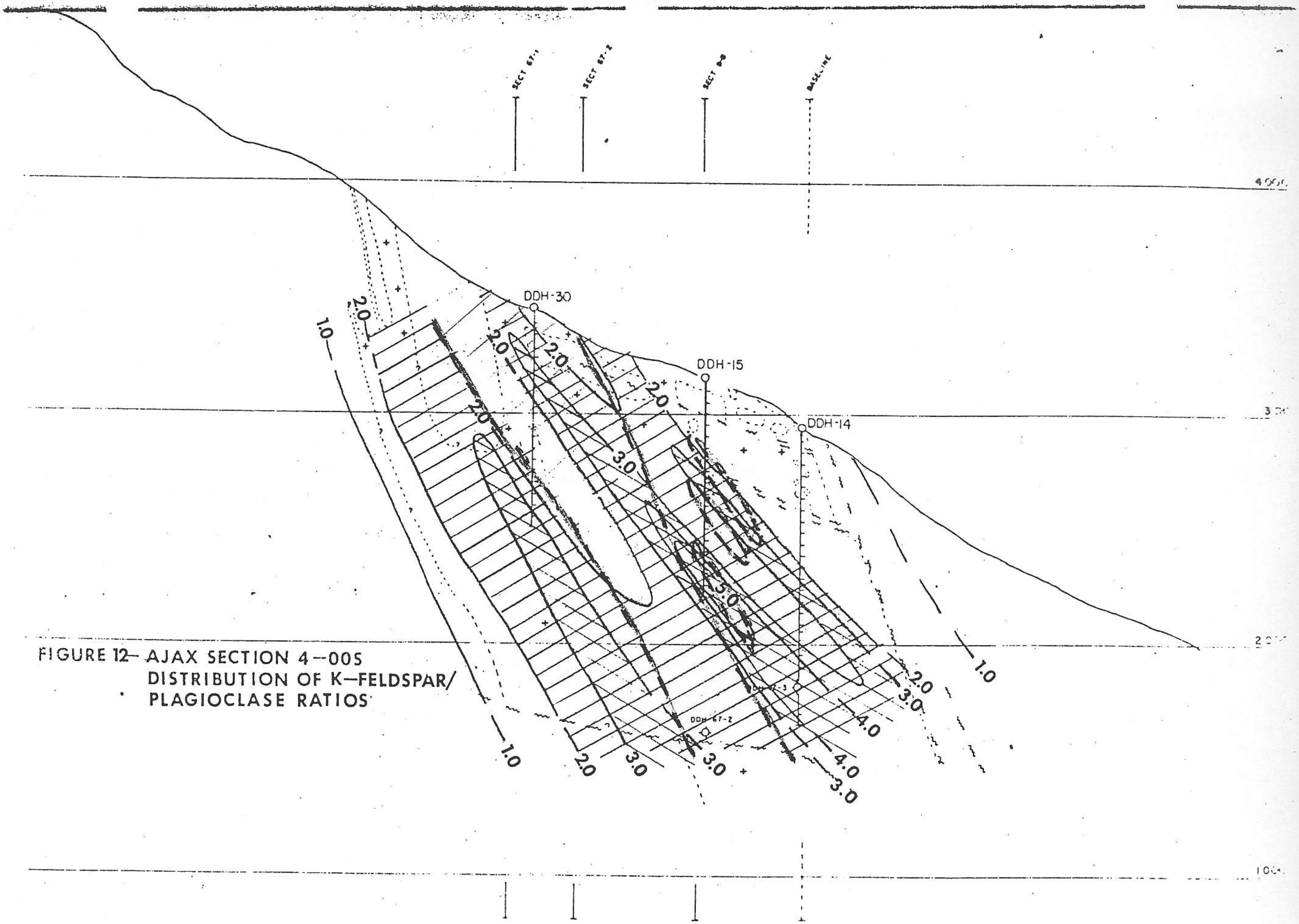

FIGURE 12— AJAX SECTION 4—005
DISTRIBUTION OF K—FELDSPAR/
PLAGIOCLASE RATIOS

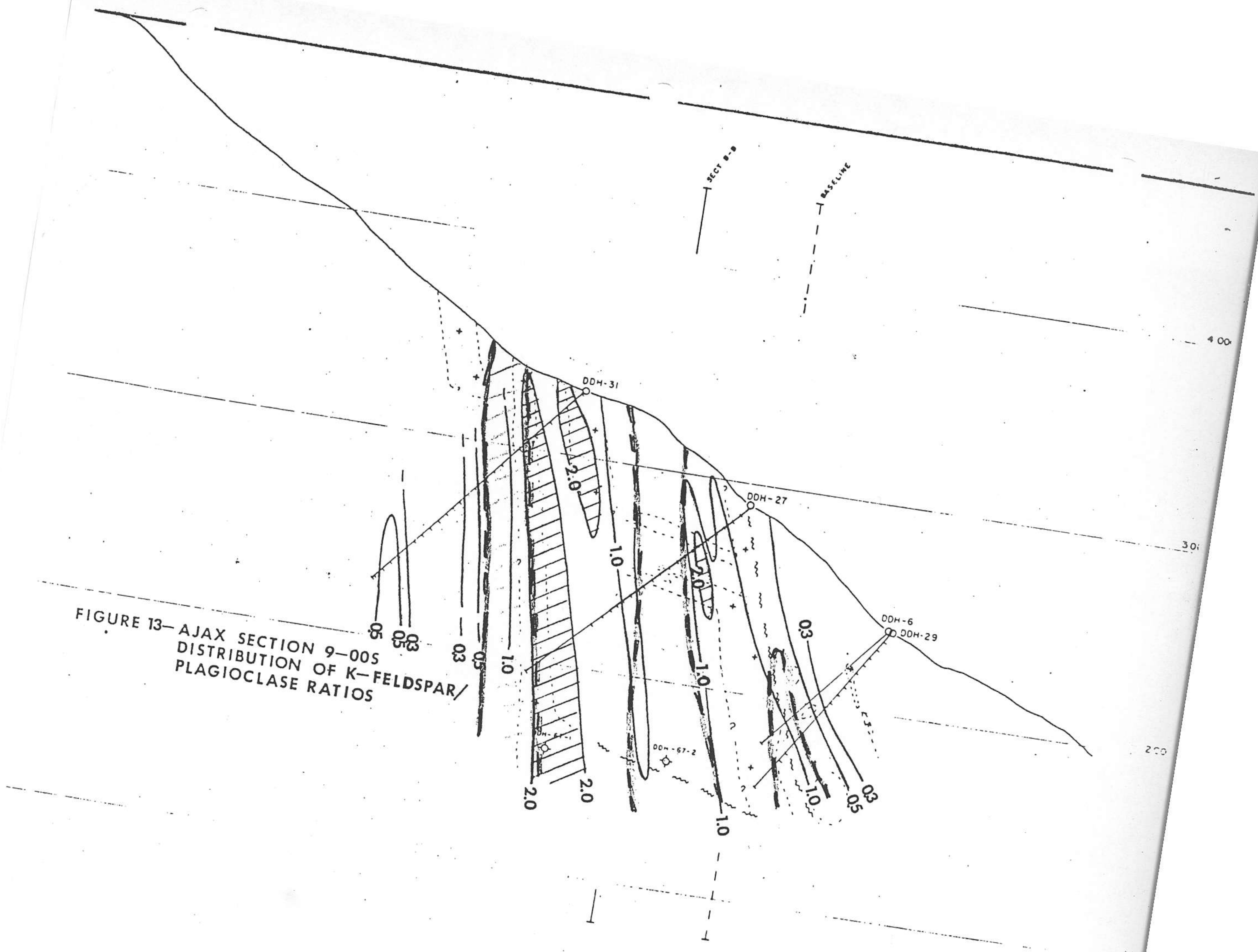

FIGURE 13— AJAX SECTION 9—00S
DISTRIBUTION OF K—FELDSPAR/
PLAGIOCLASE RATIOS

Contouring of total feldspars shows a regional NNW trend, with decreasing values to the east, reflected by changes in primary lithology. The weak "low" in the vicinity of MoS_2 mineralization is terminated by closed contours on the north, but may be open to the south, requiring more data points to outline its shape and continuity in this direction.

Silicification

Silicification may be interpreted from the plotting and contouring of total quartz values, as shown in Figure 9, but required a knowledge of primary lithology, since some of the intrusive rock types at Ajax are inherently high in quartz and feldspars.

Nevertheless, XRD data outline two quartz-rich zones, respectively, near DDH-19 and 20 on the west and near DDH-35 and 67-2 on the east, as defined by the 40 and 50% contours. The former is coincident with the major MoS_2 anomaly, whereas the latter overlies a weak MoS_2 anomaly defined by the 0.03% MoS_2 contour (Fig. 2). The significance of quartz "highs" from whole-rock samples requires more study of additional surface samples before trends of silicification can be correlated with molybdenum mineralization.

Distribution of Alteration Assemblages in Section

K-Feldspathization

K-feldspar/plagioclase ratios have been contoured at intervals of 0.3, 0.5, 1.0, 2.0 and 3.0 in Sections 67-2, 67-3, 4+00S and 9+00S (Figs. 10, 11, 12 and 13), and correlated with MoS_2 mineralization as shown by the red dashed lines outlining the 0.1% MoS_2 contour (inferred ore zone).

A somewhat variable relationship is indicated between K-feldspars and MoS_2 values from plot to plot. In Section 67-2 (Fig. 10), the zone of high K-feldspar is limited mostly above the main fault and underlies most of the ore zone. However, in Sections 67-3 and 4+00S (Figs. 11 and 12), the zone of high K-feldspar is much thicker, and is largely coincident with the ore zone. The ore zone actually extends into the footwall below the zone of high K-feldspar in Section 67-3. Likewise, in Section 9+00S (Fig. 13), the ore zone extends into the footwall below the intrusive and zones of high K-feldspar. The ore zones in 9+00S are split into multiple zones that are not necessarily coincident with high K-feldspar.

In general, the distribution of K-feldspar/plagioclase ratios is highly variable, suggestive of varying degrees of K-feldspathic alteration. There is apparent continuity of high K-feldspar at depth along select zones or horizons in the deposit, notably just above the Main fault. There also appears to be a trend of increasing intensity and thickness of K-feldspathization at depth in select sections, notably in 67-3 and 4+00S, where mineralization is most prevalent.

Silicification

Quartz values have been contoured at values of 20, 30, 40, 50 and 60% in Sections 67-2, 67-3, 4+00S and 9+00S (Figs. 14, 15, 16 and 17). Zones of high quartz, outlined by the 50% contour, are correlated with MoS_2 mineralization, shown as red dashed lines to delineate the 0.1% MoS_2 contour (inferred ore zone).

A variable relationship between zones of high quartz and molybdenum mineralization is analogous to that described previously for K-feldspathization. Irregular thin lenses of high quartz are distributed within the ore zone in Section 67-2 (Fig. 14), but also occur in the hanging wall above the ore zone. However, in Sections 67-3 and 4+00S (Figs. 15 and 16), the zones of silicification are much thicker and correlate more closely in distribution with higher MoS_2 values. In Section 9+00S (Fig. 17), the main high quartz horizon near the base of the section is contained within the lower ore horizon, but the upper zones of MoS_2 mineralization contain low quartz.

The variable distribution of lenticular high quartz zones through the deposit is suggestive of spotty silicification, locally associated with MoS_2 mineralization. There is no apparent trend of increasing silicification at depth, comparable to K-feldspathization, and its continuity and distribution requires more study for definition.

Feldspar Replacements

The distribution of total feldspars in section were studied only in the most highly mineralized Section 67-3 (Fig. 18). A weak feldspar "low" was defined by the 30 and 40% contours, paralleling the upper side of the orebody. This "low" appears to weaken at depth, and was virtually undetected in Hole 67-3. On the basis of weakly defined outlines and lack of continuity at depth, feldspar "lows" do <u>not</u> appear to be a favorable ore guide in the Ajax environment.

Ankeritization

Ankerite, a ferroan dolomite, is a common late alteration product in porphyry-type deposits, occurring as sizable pockets of replacement at Trout Lake. Small amounts of this late hydrothermal carbonate were also detected in Ajax samples by XRD, values of which were contoured at intervals of 5 and 10% in Sections 67-3 (Fig. 19), as a preliminary guide for evaluation.

As indicated in Figure 19, thin lenticular zones containing 5 to 10 percent ankerite occur along multiple parallel horizons through the deposit, but show no apparent relationship to MoS_2 mineralization.

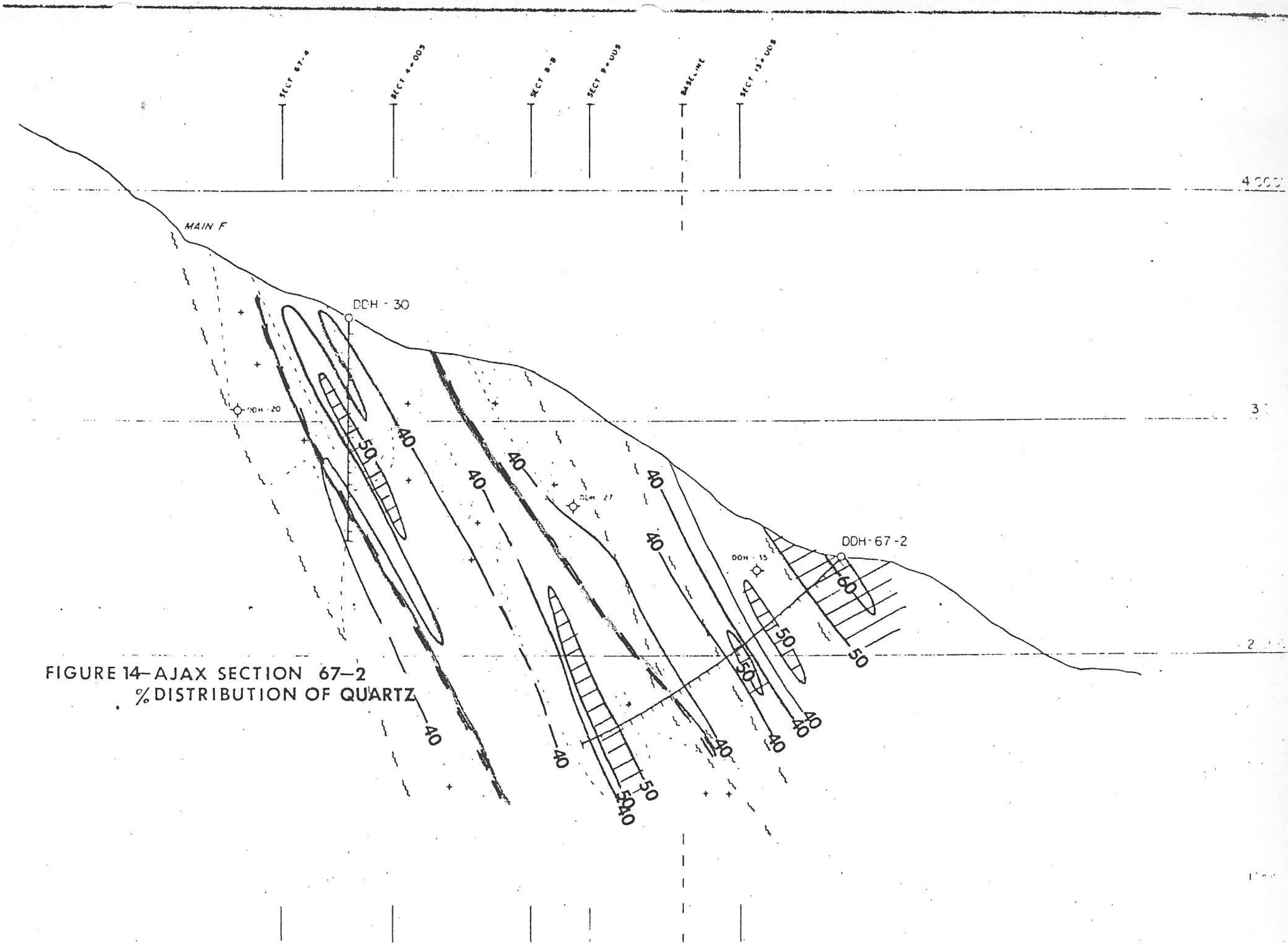

FIGURE 14—AJAX SECTION 67—2
% DISTRIBUTION OF QUARTZ

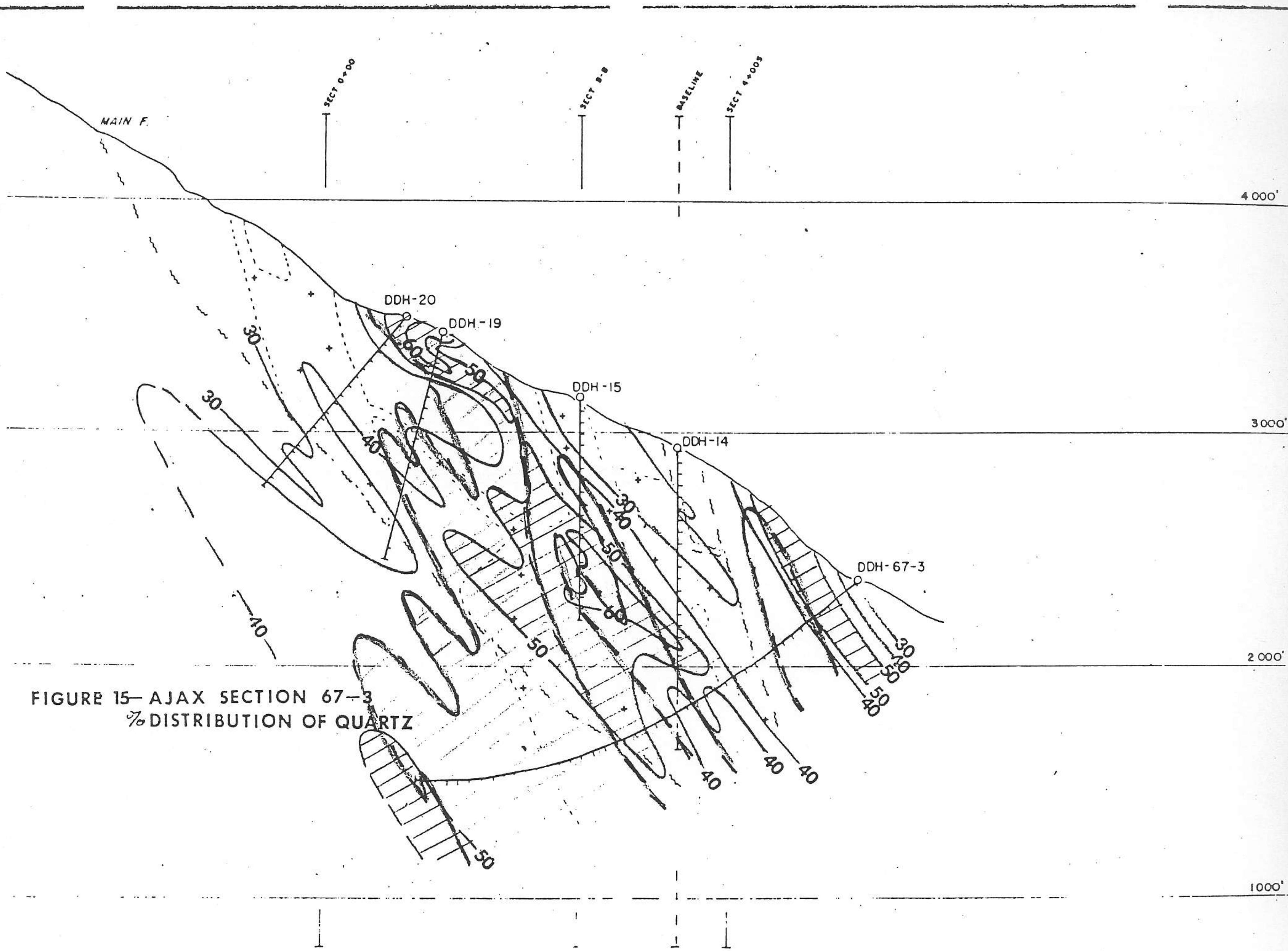

FIGURE 15— AJAX SECTION 67—3
% DISTRIBUTION OF QUARTZ

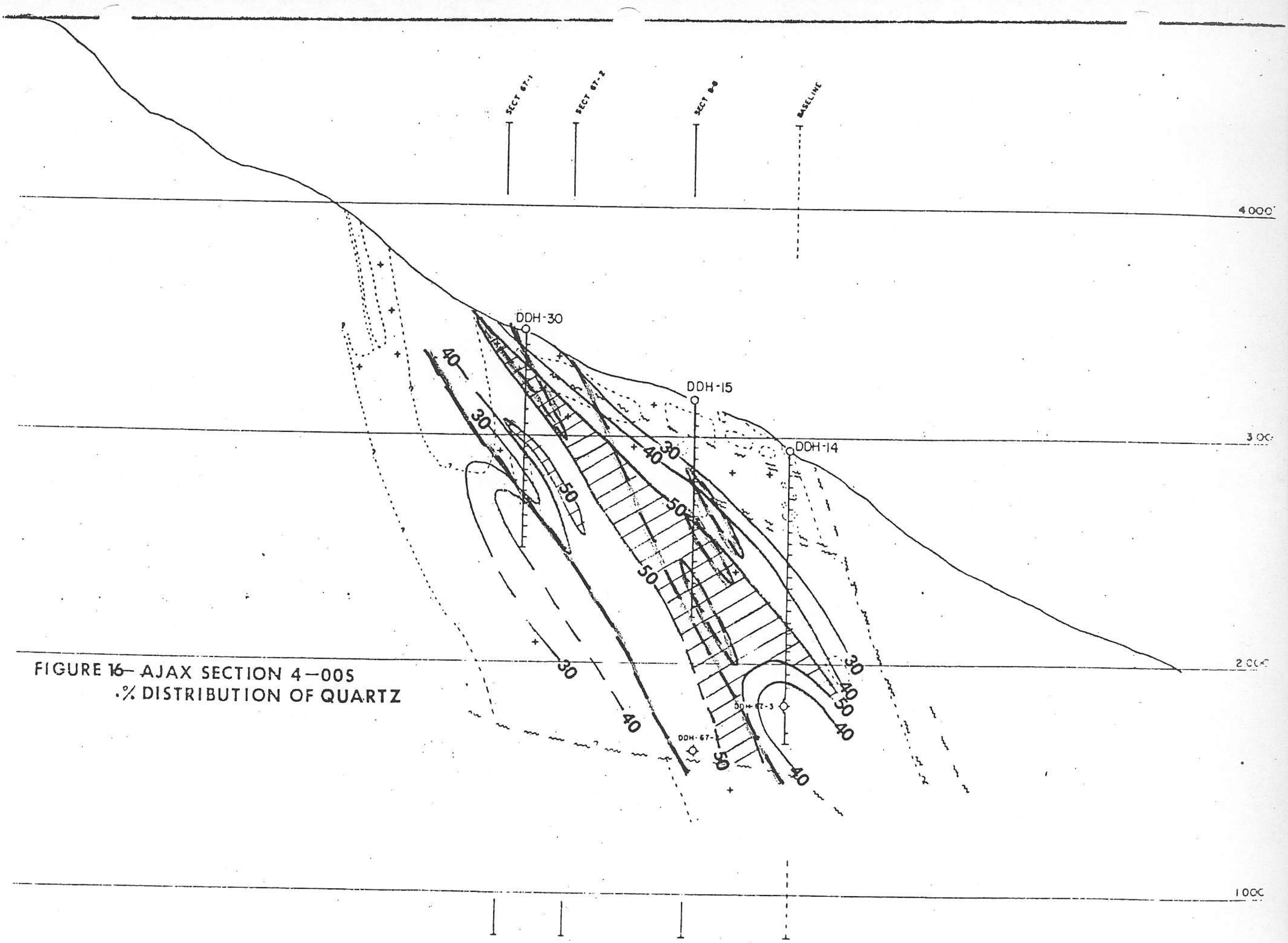

FIGURE 16— AJAX SECTION 4—00S
·% DISTRIBUTION OF QUARTZ

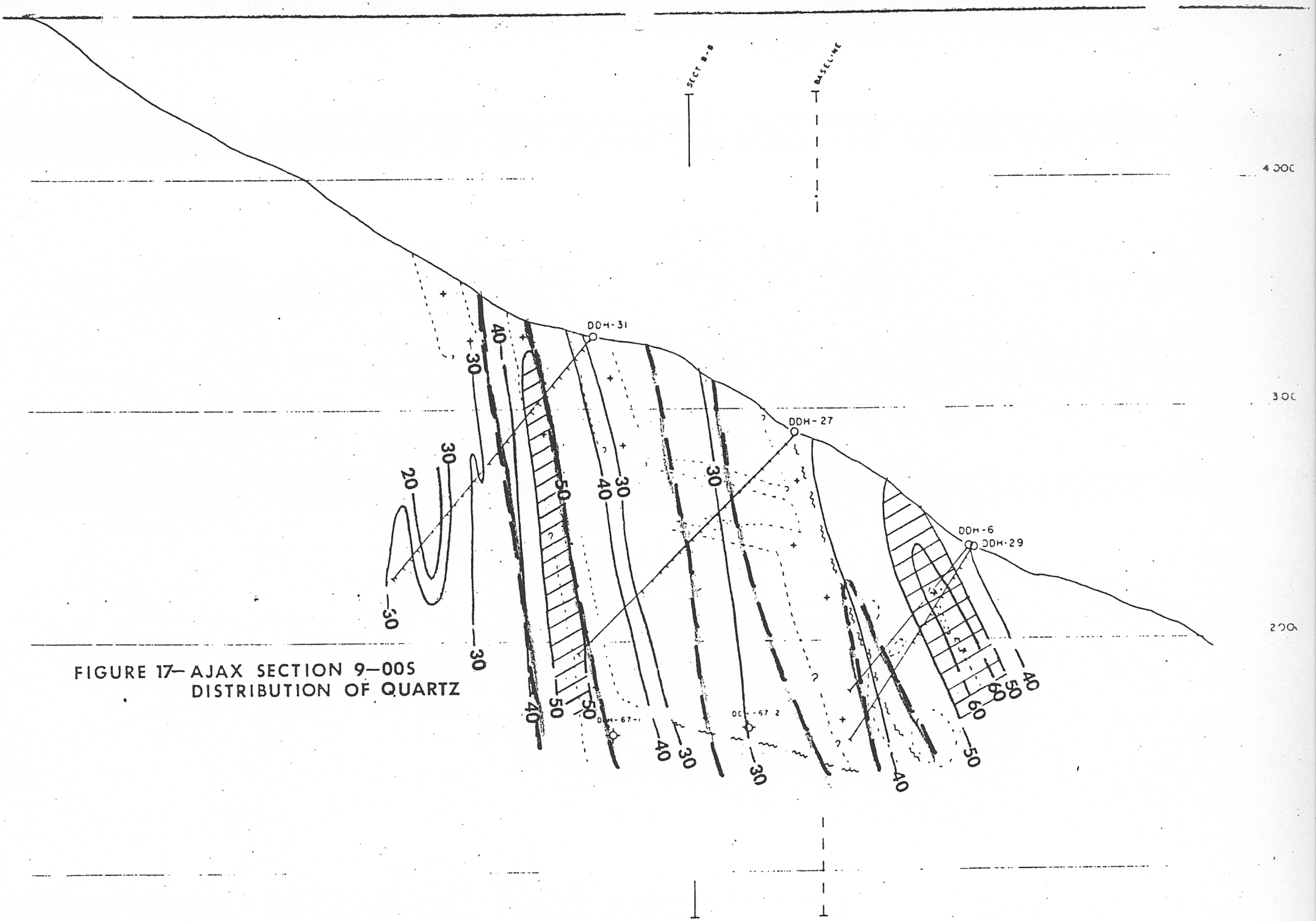

FIGURE 17— AJAX SECTION 9—00S
DISTRIBUTION OF QUARTZ

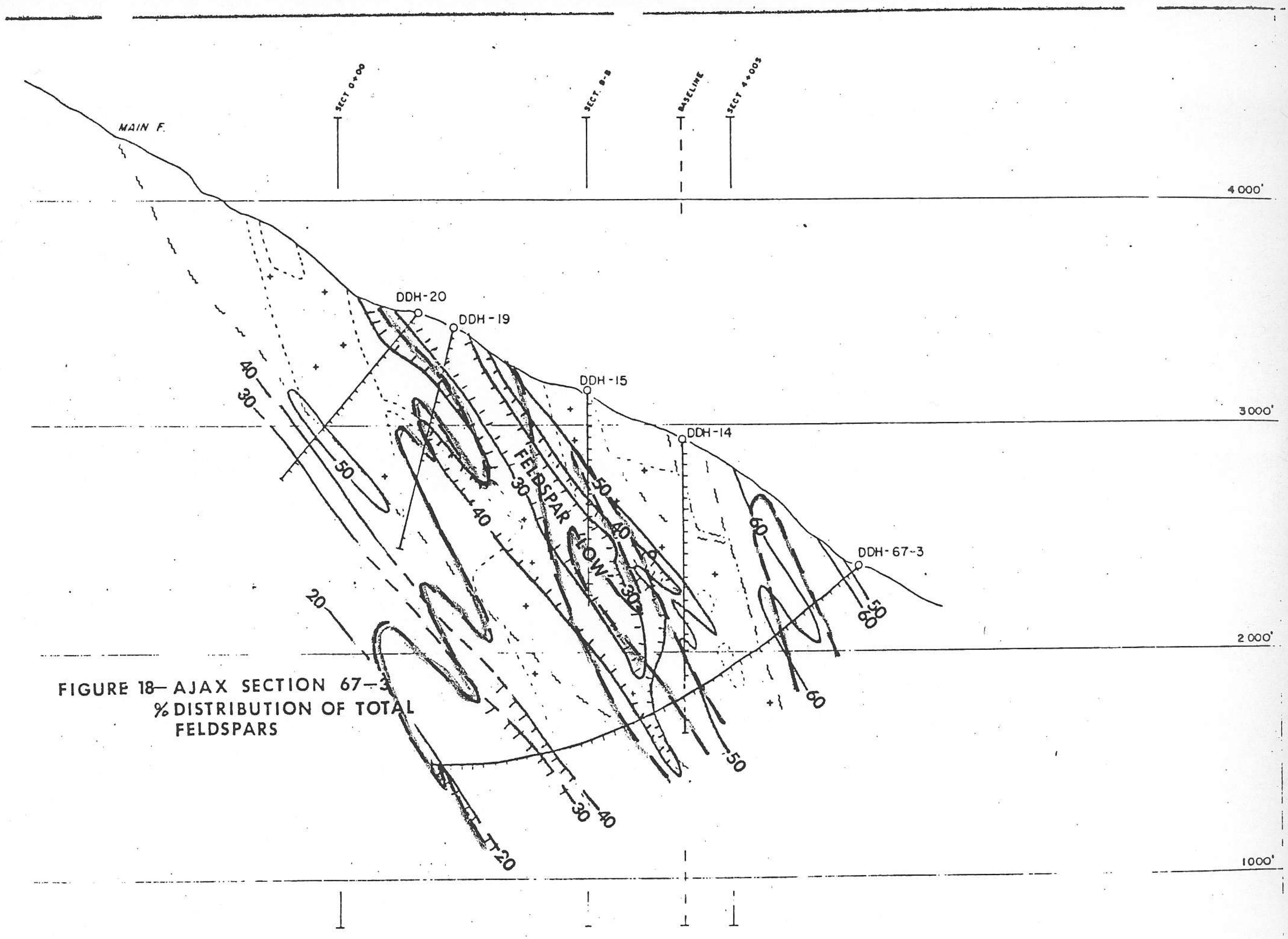

FIGURE 18— AJAX SECTION 67-3
% DISTRIBUTION OF TOTAL
FELDSPARS

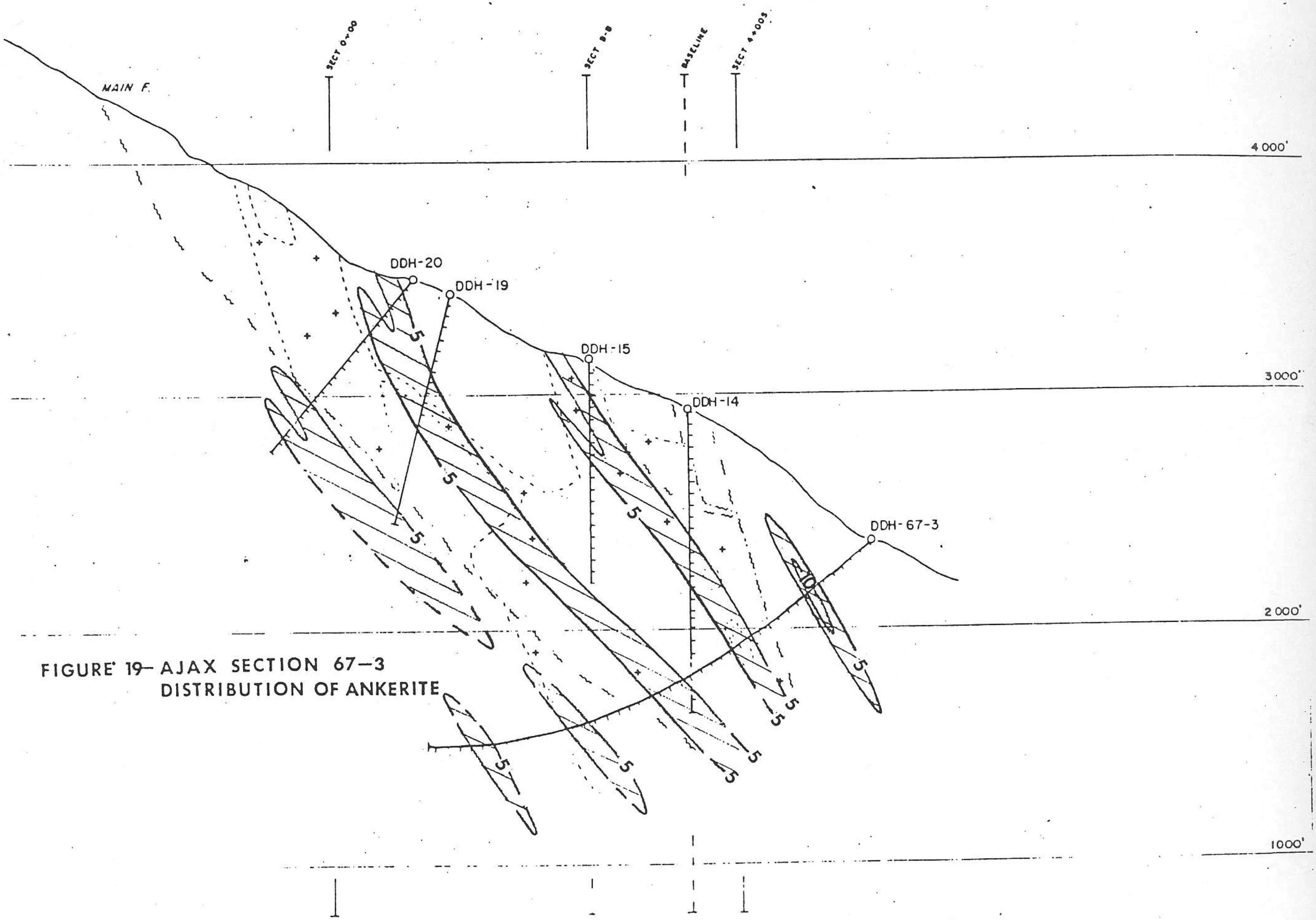

FIGURE 19– AJAX SECTION 67–3
DISTRIBUTION OF ANKERITE

Sericitization

Sericitization was evaluated by XRD analysis to be very weak (2-5% sericite) throughout the deposit, in comparison to other forms of alteration, i.e., K-feldspathization and silicification. No correlation could be established between sericitization and MoS_2 mineralization from available samples (Fig. 20). However, there is some indication that low-grade sericitization becomes more continuous at intermediate depths in Hole 67-3 (Section 67-3).

GEOCHEMICAL DISTRIBUTION OF COPPER

Anomalous copper was noted in XRF scans of several holes, varying locally up to about 0.07% Cu. Values were plotted and contoured at intervals of 0.03, 0.05 and 0.07% for only one section (67-3) in Figure 21, because of the XRF detection limit near 0.02%. In this section, an apparent zoning distribution of copper is apparent at lower elevations and to the east, notably in Drill Hole DDH 67-3, where an anomalous copper "blanket" appears to be developing through much of this hole.

On the basis of preliminary geochemical evidence, wholerock sampling and drilling east of 67-3 would be justified to delineate an apparent copper anomaly and to determine its relationship to the deeper molybdenum mineralization.

an interesting possibility suggesting peripheral Cu mineration in hornfels.

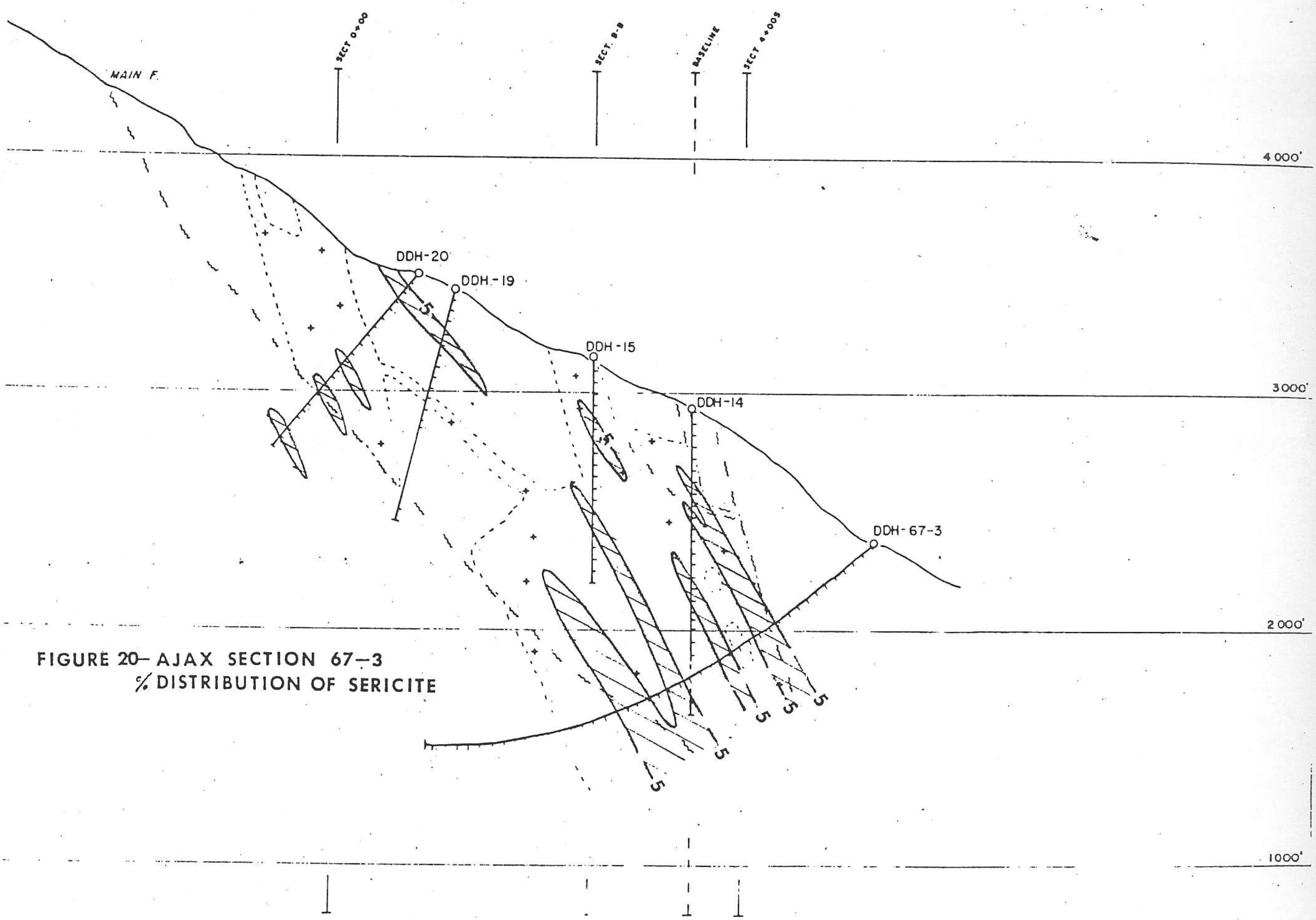

FIGURE 20– AJAX SECTION 67–3
% DISTRIBUTION OF SERICITE

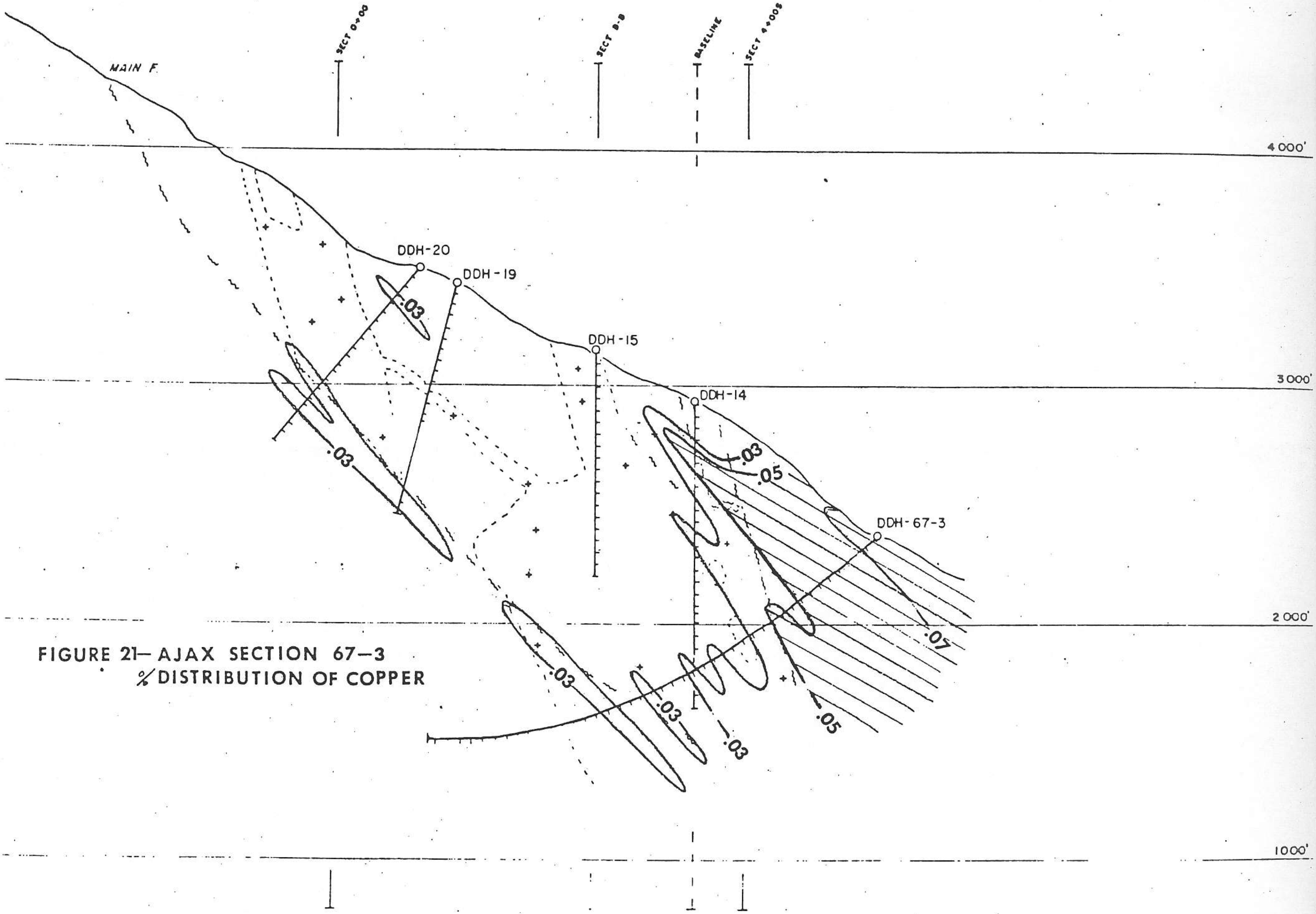

FIGURE 21— AJAX SECTION 67—3
% DISTRIBUTION OF COPPER

CONCLUSIONS AND RECOMMENDATIONS

The Ajax molybdenum prospect represents a highly favorable area of widespread molybdenum mineralization, locally associated with intrusive porphyries and along stockwork fractures and shear zones. K-feldspathization and silicification are indicated by alteration contouring to be closely associated with MoS_2 mineralization, and confirm the steeply dipping mineralized structure facing to the east. Both K-feldspathic and silicic alteration increase down dip with MoS_2 in select sections, notably 67-3 and 4+00S, suggesting the potential for improved grades and thicknesses of molybdenum ore at depth in the deposit.

On the basis of preliminary contouring of alteration XRD data from limited shallow drilling, it is recommended that deeper drilling be conducted, notably to the east below Hole 67-3. Also, additional wholerock sampling of surface outcrops should be analyzed geochemically for copper and molybdenum and by XRD for feldspars and quartz to evaluate surface trends in more detail, especially south of DDH-30 where mineralization and alteration contours are still open.

It should be emphasized that x-ray diffraction has been used to obtain gross semiquantitative mineralogic data for relatively large (composite) intercepts of drilling, but that it cannot be used to distinguish between primary and secondary forms of K-feldspars or silica. Other disciplines, including geologic field mapping, visual logging and microscopic study, are required to distinguish K-feldspathic alteration from primary magmatic orthoclase, or silicification from primary quartz. Plotting and contouring of mineralogic data in this report have been directly implemented in a quantitative sense, with no attempt to distinguish alteration from primary minerals. Nevertheless, anomalous trends in apparent alteration have been revealed by this method that correlate with molybdenum mineralization and that may be used in a pathfinder sense to infer increasing alteration and mineralization below the depths of previous drilling.

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