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GEOLOGY AND HISTORY OF THE HIGHLAND BELL MINE

Beaverdell, B. C.

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ABSTRACT

The Beaverdell mine area, 60 miles southeast of Kelowna, B. C. has been continuously producing silver ore since 1913 and intermittently since 1900. The present mine is situated in a 1½ mile long mineralized structural zone within which a number of quartz-calcite vein systems occur. Intense block faulting following ore deposition imposed an overall change on the structural pattern of the veins resulting in complexities that have constituted the main hindrance to systematic exploration and mining. A brief account of mining and production is given.

Tom Aastan Hasske

Introduction

The Beaverdell mine of Teck Corporation Limited, formerly known as the Highland Bell mine, is on Wallace mountain just east of the town of Beaverdell, B. C. (Figure 1). The mine is accessible by 60 miles of road from Kelowna, B. C. through highway 33.

The mine area comprises a number of crown-granted claims within which are located five separate vein systems all containing silver. Of these five systems the Lass is the richest and has been the most important producer in the area. In fact it has provided almost three fourths of total production to-date.

The veins are complexly faulted necessitating the use of extensive diamond drilling as the standard exploration tool.

At present only the Lass vein system is being mined using open stoping. Ore is trucked from two haulage levels to a 120-ton concentrator over an average distance of 2 miles. } *

History

Available records indicate that prospecting and exploration in the Beaverdell area was in progress in the year 1898. Various companies were involved each exploring the individual vein or vein system, most of which the former Highland Bell mine finally acquired. In the year 1900 the first carload of ore from the Sally vein was transported over 50 miles of wagon road to Midway for rail transhipment to the Hall Mines smelter at Nelson, B. C. Intermittent shipment of ore from the area continued to the year 1913 when the construction of the Kettle Valley railway reached the town of Beaverdell. The arrival of the railway created renewed interest in mining and several companies commenced production. In 1936, the two most productive companies, the Bell and the Highland Lass mines amalgamated and formed a new organization named Highland Bell Limited. The new company continued production and soon added the Beaver mine to its holdings. In 1946 Leitch Gold Mines Limited acquired a controlling interest in Highland Bell Limited and during the same year acquired the adjoining Sally mine property. The company continued shipping hand-sorted ore to the Trail smelter. A more aggressive exploration and development program under the new management led to further ore discoveries and to a decision to build a mill. During 1950 a 50-ton per day mill was inaugurated and the first shipment of concentrates was made. Production was mostly from the Lass vein.

Meanwhile, the late Dr. D. F. Kidd and associates conducted intensive structural studies of the area and with the help of diamond drilling they verified the existence of a down-faulted extension of the Lass vein with a vertical displacement of 700 feet. Consequently in 1954 a new 5,600-foot long adit was started at the 2900 level with the objective of exploiting the lower section of the Lass. Subsequent mining from this level proved profitable, the quality of the ore being similar to that of the upper section of the vein. As more ore was uncovered in the lower Lass the mill capacity was progressively increased to its present rate of 120 tons per day.

In 1970 the mine became a member of the group of mines controlled by Teck Corporation Limited.

Geological Setting

Five distinctly separate vein systems arranged roughly en echelon occupy a northeasterly structural zone in a large body of quartz diorite (Westkettle Batholith) of probably Cretaceous age (Figure 2). Immediately east of the mine area the quartz diorite is roofed by country rocks consisting of tightly folded and metamorphosed sedimentary and volcanic rocks of the Wallace formation of probably Permian age. The mineralized zone persists for short distances into the Wallace formation east of the mine and there rapidly dies out. West of the mine is a 1-mile-wide body of very coarse grained quartz monzonite (Beaverdell Stock). This stock-like body is emplaced in the quartz diorite and is most likely related to the structure and mineralization of the area. Several aplite dykes probably related to the quartz monzonite occur in the quartz diorite. Two prominent basic dykes of different ages were intruded closely before and after the mineralizing period. (The first is an andesitic dyke called the Wellington dyke which parallels the Wellington vein and is in places invaded and mineralized by the vein.) The second is a lamprophyric dyke called the Idaho which is up to 50 feet wide and cuts the Lass vein at an acute angle midway down the mine.

Wellington

Idaho.

IDAHO POSTORE

Vein Systems

The northeasterly structural zone containing the vein systems is four miles in length. Its west half contains the Wellington, Sally and Rob Roy systems which all strike easterly and dip anywhere from 70 degrees south to vertical. The Wellington and Sally each comprise two separate veins and the Rob Roy three.

In the central part of the zone, the Bell system comprises two veins. This system undergoes a change in strike from easterly to northeasterly and it dips moderately to the south and southeast. The eastern part of the zone contains the upper and lower sections of the Lass vein which strikes northeasterly and dips some 50 degrees southeast. Associated with the Lass lode are easterly striking and steeply dipping veins that appear to branch off its hangingwall. These easterly structures, although erratic in occurrence commonly include good grade sections.

All veins in the mine area are essentially the same in appearance and mineralogy. Each shows typical fissure fillings of galena and sphalerite with quartz and calcite as dominant gangue. Towards the east the veins generally exhibit progressive increases in width, intensity and extent of wallrock alteration, and amount of silver-bearing minerals. Native silver is invariably present, being especially abundant close to intersection with faults. The average width of the Wellington, Sally and Rob Roy veins is in the order of 2.5 feet and the Bell and Lass veins average 3 and 5 feet wide respectively. Wallrock alteration in the form of chlorite, sericite and epidote increases eastward and in the Lass system it becomes pervasive, extending outward from each wall as much as 20 feet. Chalcopyrite and pyrrhotite are restricted to the Wellington and eastern part of the Lower Lass, suggesting these vein systems were formed at the same structural level. Gold accompanies these minerals in the Lower Lass. Generally, the veins exhibit interbanded quartz, galena and sphalerite, and they may contain pyrargyrite, which is especially common in the Bell and Lass. Drusy cavities and cockscomb structures are sometimes encountered. As a general rule the walls of the veins are clearly defined although undulating.

Faults

Five sets of faults in the Beaverdell area was reported in detail by White (1949) and Kidd and Perry, (1954). Of the five sets , two are most important in their effect on the vein systems. The so-called East and West Terminal faults belong to a set of northerly striking and steeply east-dipping normal faults. The East Terminal fault was found by Kidd and associates to have displaced downwards the eastern half of the Lass vein by 700 feet (Figure 3). The amount of displacement on the West Terminal fault is not known although its vertical movement must have been sufficient to allow complete erosion of the up-dip extension of the Lass vein. The other important fault-set consists of several north-easterly-striking, moderately west-dipping normal faults that are closely spaced and chop the Bell and Lass veins into innumerable sections with dip and strike lengths ranging from a few inches to several tenths of feet.

If it were not for all these individual displacements, the Lass vein would have remained a single, 50-degree-dipping vein instead of being a more or less segmented, gently dipping ore zone.

Production

Irregular shipments of high grade ore were made between 1896 and 1950 by the various operators. Production records indicate that about 17 million ozs Ag had been extracted before the K. J. Springer interests decided in 1950 that the operation would be more economical if a 50 ton mill was erected. The tonnage of the concentra was increased to 85 in 1964 and to 110 in 1967, which represents the maximum capacity that can be handled with the existing structure.

Monthly production averages about 3200 dry tons. Mill heads have fallen off from 40-50 in the early days to about 18 ozs per ton. This will likely decrease further depending on availability or ore and metal prices. Total annual production in ozs has averaged 672,000 since 1945, and was 638,000 last year.

In total, Wallace Mountain has produced over 30 million ozs of Ag plus appreciable quantities in Pb, Zn, Au and Cd.

Mining

The mine is developed through numerous adits, two of which are presently in active use. A lot of the older ones might eventually be rehabilitated. The reason for using two adits is the 700 ft fault gap.

The 2900 level portal services the 2800 to 3100 levels, which supply approx. one third of the ore, with the other two thirds coming from the east and west ends of the old 7 level which is now accessible from surface through the 3800 level adit.

A long-range development program got under way a few weeks ago. This involved about 3,000 feet of cross cutting and several hundred feet of raising. It will be used to develop the recently-located down-dip extension of the 3800 shear zone and to get below the old 7 to 10 level Lass workings so that the remaining ore on these levels will not have to be hoisted.

Tramming distances are 1-1½ miles in the lower mine, and up to ½ a mile in the upper mine.

Compressed air is supplied by two Holman portable Rotair compressors to the upper workings and two Holman stationary electric compressors below with a standby available for each portal. Mining is carried out on a one shift basis, 5 days per week, sometimes with a tramming crew on weekends. Total underground crew is 17, including two trammers and a mechanic. Three or four men are usually available for driving development headings. Stopes, drifts, raises, are all one man headings, with development work and production being on a bonus system.

Natural ventilation normally supplies enough fresh air to all headings. This is assisted by fan ventilation when diesel locomotives are in operation. Several Mancha Little Trammers are used to service the 2800 and 3000 levels. Side dump cars are being used, $2\frac{1}{2}$ + in the upper, $1\frac{1}{2}$ + in the lower mine. There are no shafts, all levels are interconnected with 32^{o} inclines.

The concentrator is located at the C. P. R. track and close to the West Kettle River about $\frac{1}{2}$ mile by road from the lower, and $3\frac{1}{2}$ miles from the Upper mine.

Trucking of the ore is done under contract. The Mill is operated on a 24 hour, 7 days per week basis, with a total crew of nine.

The milling process is relatively uncomplicated with jaw crusher, cone crusher, 6 x 6 ball mill, flotation and filtering section.

Three products are being shipped by rail to the Cominco smelter in Trail, Jig, lead, and Zinc concentrates, on the average about 140 tons per month.

Power

The powerhouse is located within the mill building, and equippped with one D 375 and D 397s, one of them being on standby. The, supply mill, lower portal and camp with steady reliable power.

Personnel

37 men are employed at the mine site, 17 underground, 9 in the mill, 5 on surface, and 6 on the staff.

Personnel Cont'd.

The camp owns 16 houses which are available at nominal rent for those wishing to reside in Beaverdell. Quite a few of the employees have taken up residence in the Okanagan valley and commute daily or on weekends.

General Remarks

The complex and intricate faulting combined with the erratic distribution of the veins renders calculation of ore reserves difficult. The veins are offset nearly every 10 ft on the average, the movements on the faults varying from a few inches to as much as 700 ft in the case of the East Terminal Fault. Often enough testholing will pick up the faulted extensions but in many cases the problem can only be solved through extensive diamond drilling, which involves waste work, loss of time, dilution etc. Further adding to the difficulties are varying widths and grades of the veins, frequently changing within a short distance. Many low grade D.D. values have resulted in high grade stopes when they were opened up and vice versa. So, D.D. intersections can only be used as an indication of the presence of a vein, regardless of width and assays.

The main thing is that we are still mining the same deposit after more than 70 years. It is not likely that the ore body will last another 70 years, even though we have not reached the end of the zone. The mine is changing at depth in the east end of the lower mine; silver values disappear nearly completely, making it uneconomical to continue mining. Even a higher Ag price would not change this situation much and we are left with: previously overlooked faulted sections; mineralized areas that were unprofitable at lower Ag prices; narrow hanging wall and footwall stringers; pillars; remnants. Dumps and backfill from old stopes have added considerably to the life expectancy of the operation. Over 30,000 tons of this material was milled during the last 4 years. It is difficult to estimate the quantity or grade of fill that might be still available due to the inaccessibility and incomplete mapping of old workings.

To sum up: Future mining appears to be confined to leftovers, remnants, and extensions overlooked by previous operators.

Acknowledgement

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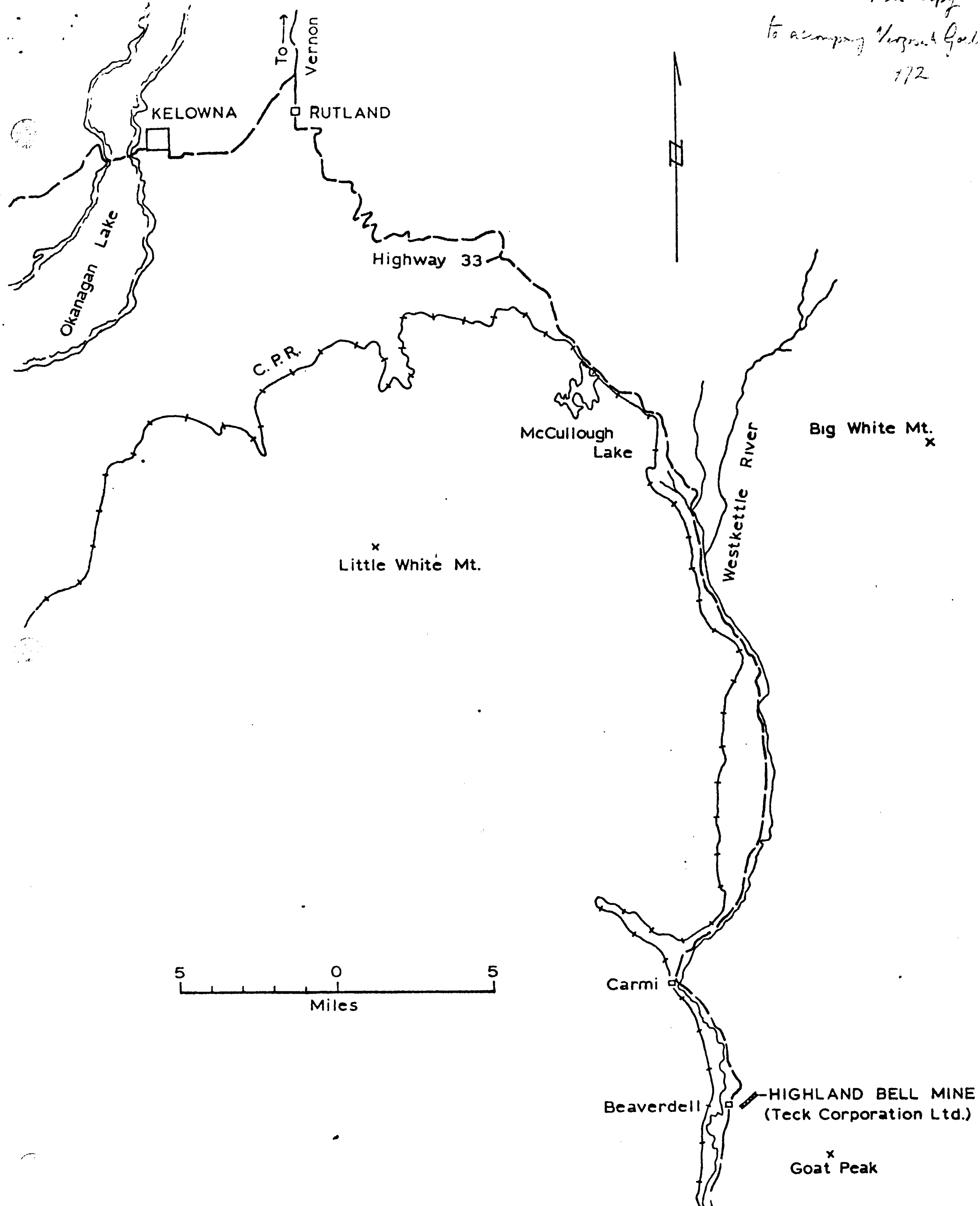


FIGURE 1. Property location map of the Highland Bell mine.

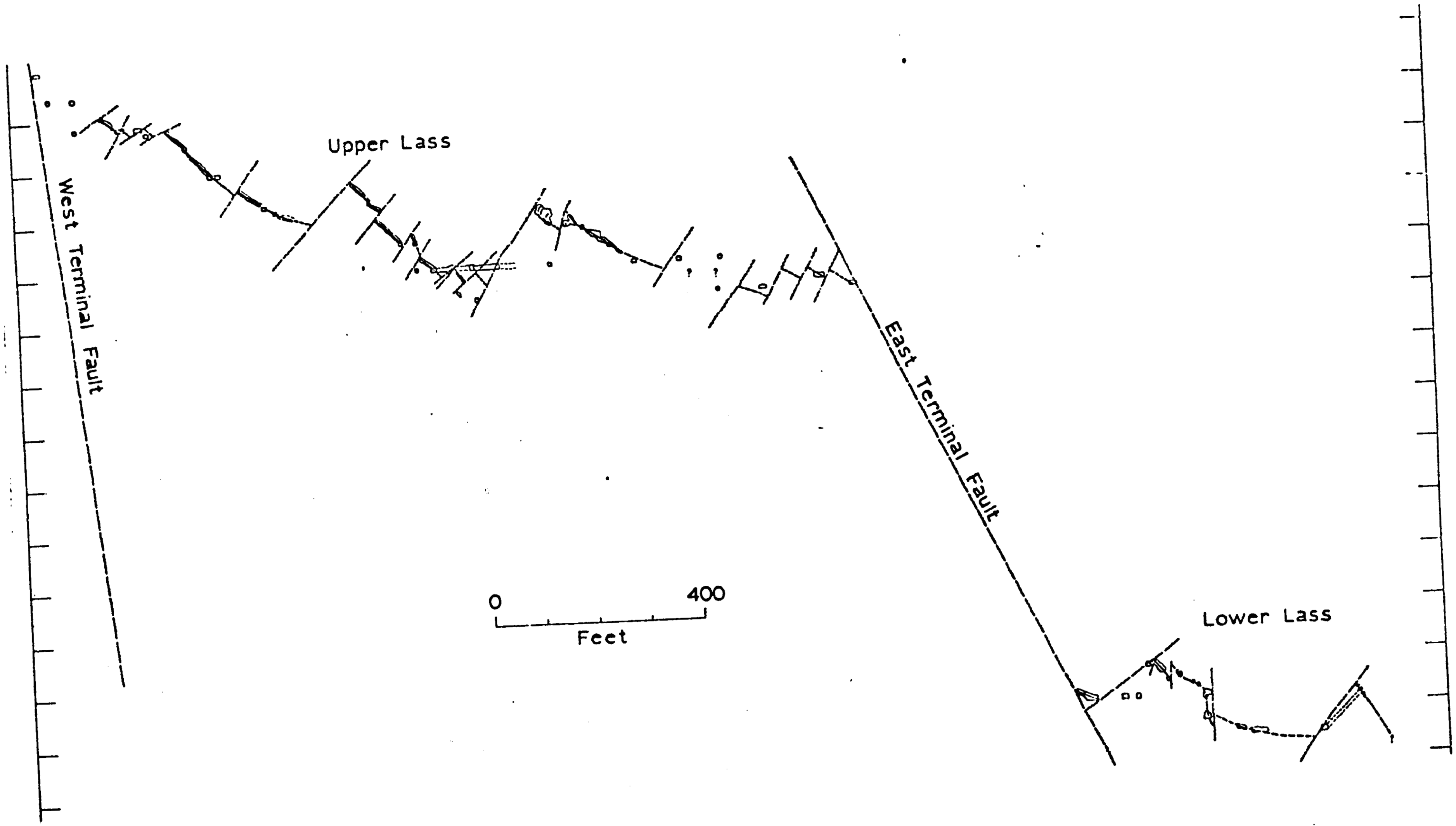
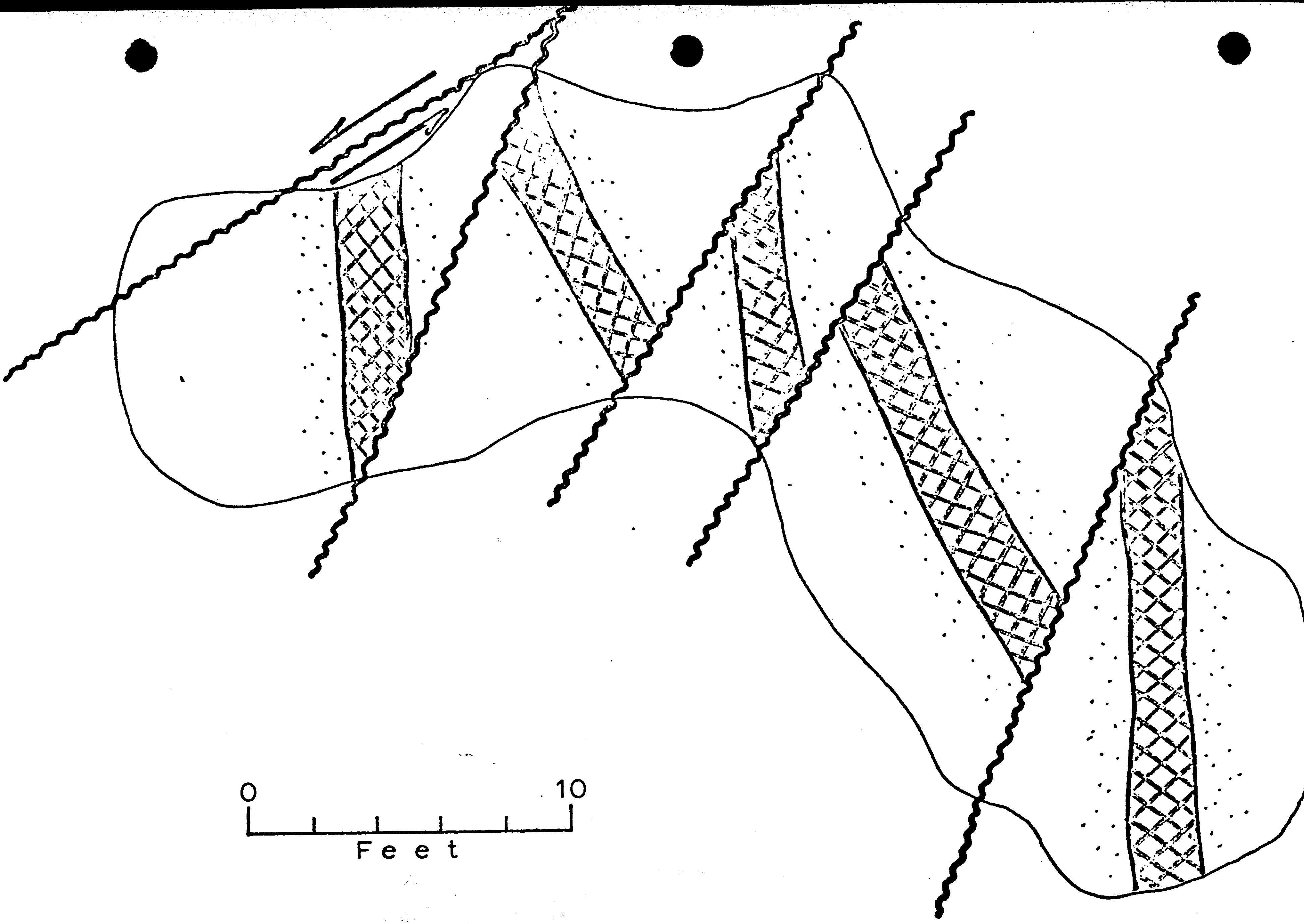
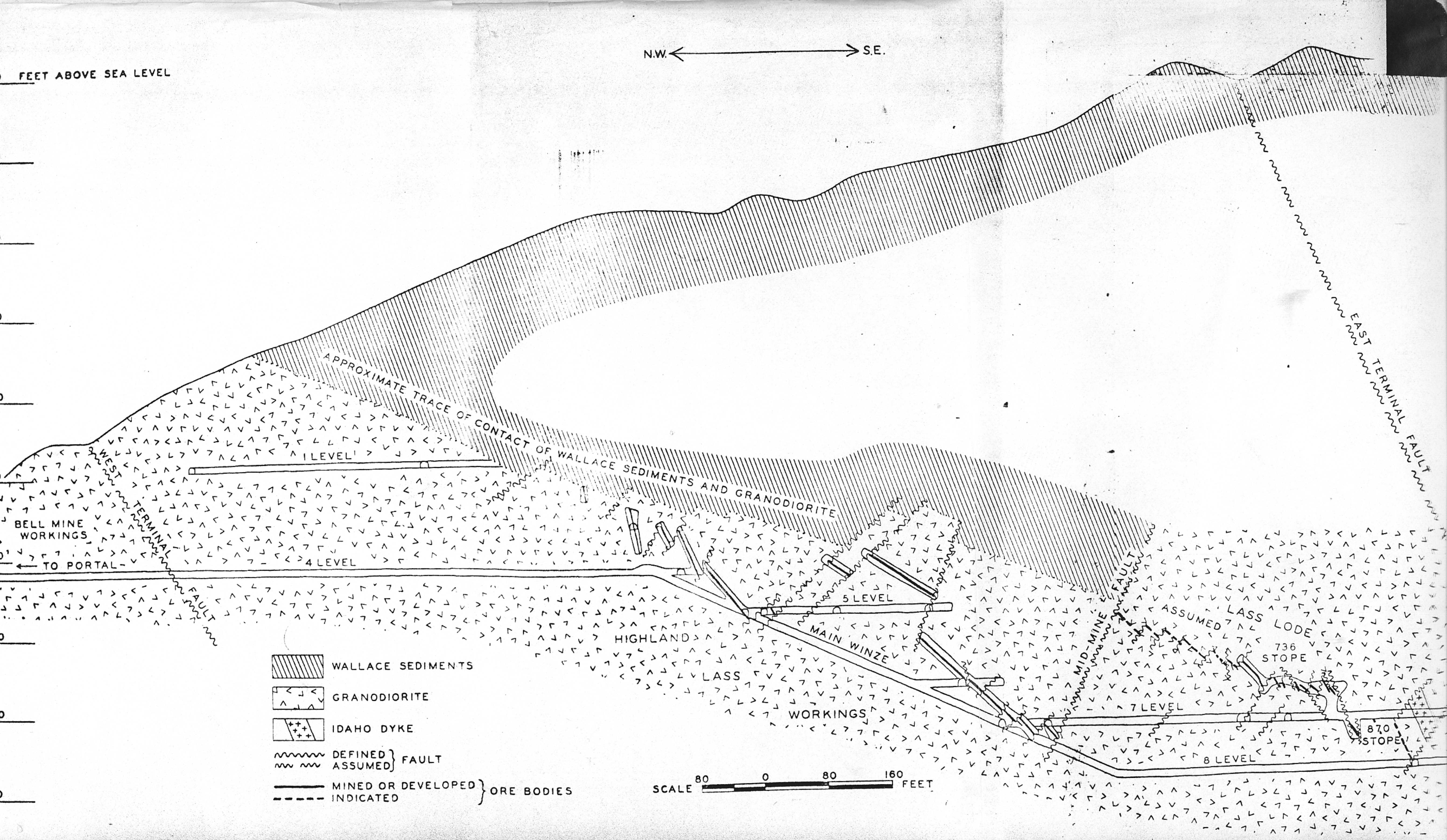


FIGURE 3. Cross section of Lass vein along line 239



CROSS SECTION OF STOPE SHOWING TYPICAL FAULTING



N.W. ⟷ S.E.
FEET ABOVE SEA LEVEL
APPROXIMATE TRACE OF CONTACT OF WALLACE SEDIMENTS AND GRANODIORITE
EAST TERMINAL FAULT
WEST TERMINAL FAULT
BELL MINE WORKINGS
1 LEVEL
4 LEVEL
← TO PORTAL
5 LEVEL
7 LEVEL
8 LEVEL
MAIN WINZE
HIGHLAND LASS WORKINGS
MID-MINE FAULT
ASSUMED LASS LODE
736 STOPE
870 STOPE
WALLACE SEDIMENTS
GRANODIORITE
IDAHO DYKE
DEFINED
ASSUMED
FAULT
MINED OR DEVELOPED
INDICATED
ORE BODIES
SCALE
80
0
80
160
FEET