4754 92L/12E, 12W 102I/9E

GEOLOGICAL AND GEOPHYSICAL REPORT

ON THE

EXPO GROUPS 1, 10, 11, 12, 13, 14 and 15, AND
HEP-EXPO GROUPS 2, 3, 4, 5, 6 AND 7

1973

LOCATED
FIFTEEN TO TWENTY ONE MILES, WEST AND SOUTHWEST,
OF PORT HARDY, B.C.
50°, 127°, NW

BY

A. ASCENCIOS, P. ENG.

UTAH MINES LTD.

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ILLUSTRATIONS (MAP POCKET)

Scale: 1 inch - 30 Miles

INDEX MAP

HEP-EXPO GROUPS
Nanaimo Mining Division

SUMMARY

Utah Mines Ltd. examined the Expo claims from 4th May to 15th September, 1973, with a crew of twenty-two men. Geological mapping as well as magnetic, induced polarization, seismic and VLF-EM surveys were carried out over part of the Expo claim block which is located along the north side of Holberg Inlet, Northern Vancouver Island.

The Expo claims studied are underlain by volcanic and sedimentary rocks of Triassic age (the Karmutsen volcanics and Quatsino Limestone) and of Upper-Lower Jurassic ages (the Parson Bay Sediments and the Bonanza pyroclastic rocks). These rocks in this area are believed to form a west to northwest trending synclinal structure. The above rocks are intruded by several plutons of different sizes, and probably of Jurassic age. In addition, there appear to be several breccia bodies, possibly related to volcanic centers, poking (?) into the Bonanza sequence.

Pyrite is the most widespread and abundant sulphide over the whole area of study. Chalcopyrite, though very minor, is also present, but in scattered areas.

Geophysical surveys appear to be useful in outlining intrusive masses as well as some conductor axes related to strong fracture zones.

GEOLOGICAL AND GEOPHYSICAL REPORT ON EXPO GROUPS 1, 10, 11, 12, 13, 14, AND 15, AND HEP-EXPO GROUPS 2, 3, 4, 5, 6 AND 7.

INTRODUCTION

From 4th of May to 15th of September, 1973, geological and geophysical work was done on the Expo Groups 1, 10, 11, 12, 13, 14, and 15, and the Hep-Expo Groups 2, 3, 4, 5, 6 and 7. The claims specifically covered in this work include Expo No's. 2, 11 to 13, 15, 16, 21 to 30, 38, 41, 42, 44 to 49, 51, 60, 71 to 73, 75 to 78, 83 to 85, 89, 93, 95, 97, 98, 101, 103, 105, 107, 379, 381, 400 to 402, 424, 425, 621 to 627, 631 to 638, 645 to 653, 809, 862 to 864, 876 to 879, 896, 898, Expo 10 Fraction, T #1 Fraction, Hep 1, 10, 11, 13, 19, 40 to 43, 49 to 51, 60, 61, 70, 71, 86, 88 to 93 and 100. The work also included portions of Expos No's: 31, 32,36, 50, 52, 60, 61, 63, 69, 237,238, 377, 383, 398, 399, 403, 404, 422, 423, 426, 444, 445, 466, 547, 551, 559, 628, 639, 640, 645, 654, 660, 666, 698, 853, 855, 878, 897, 899, Don 4 Fraction Hep No's: 12, 14, 15, 46 to 48, 60, 69, 95, 97. The field work was undertaken by A. Ascencios, R. Anderson, G. Cargill, U. Malachowski, G. Raynier, geologists, K. Witherly, geophysicist, and G. Annable, G. Brydle, G. Didier, F. Dispirito, J. Hutton, W. Frost, B. Issac, J. Murphy, G. Soroka, N. Connolly, P. Darling, B. Field and T. LaRose as field assistants.

The above claims are part of a larger block of 840 claims located by Utah Mines Ltd. between 1963 and 1972, along the North side of Holberg Inlet ab out fifteen to twenty one miles west and southwest of Port Hardy, near the North end of Vancouver Island.

The Expo and Hep-Expo Groups affected by this report cover an area roughly seven miles long by five miles wide trending west to northwest. The claims lie withing the timber licences of the Rayonier Logging Company. Logging has been active across Hep #41, #60, #67 and #69 claims and Don 7 Fraction. Also, across the Expo #31 to #34, #52, #54 and #25 claims. The studied area, which lies about fifteen miles southwest of Port Hardy, has not been logged, and it is covered with mature stands of hemlock, spruce, cedar and balsam. Areas located over an elevation of 1,600 feet above sea level are covered with sparse vegetation. In general, the shole area of study is rather rugged, with swamps and a few lakes. The elevation ranges from 50 feet to 2.100 feet above sea level.

These claims are partly accessible by the Port Hardy - Holberg road which is used by both the O'Connor and Rayonier Logging Companies. This gravel road leaves the paved Port Hardy - Port McNeill highway about two miles south of Port Hardy and passes along the south side of Kains and Nahwitti Lakes.

Servicing of the two camps employed during the field season was by helicopter and road from Port Hardy. One camp was set up on Expo #876 and the other on Hep #92.

FIELD WORK

The 1973 field work by Utah Mines Ltd. on the Expo claims consisted of geological mapping, and magnetic, induced polarization, seismic and E M-16 surveys. For control, two Baselines were used; the first one (cut, surveyed and reported to you last year) is 4.2 miles, and it extends from Expo #835 to #877 with an E-W bearing, from Expo #877 to #654 with a N-S bearing, and from Expo #654 to #665 with an E-W bearing. The second Baseline is 6.3 miles long, and was also surveyed with a Wild Model C-16 Theodolite. This Baseline trends northwesterly through the northwest part of the entire Expo claim block, and the breakdown of its location is as follows:

LENGTH	LOCATION		
(in miles)	FROM	TO	BEARING
1.4	HEP # 10 M.C	Expo #104 M.C	E-W
0.6	EXPO # 104 M.C	Hep # 89 M.C	N-S
1.3	HEP # 89 M.C	EXPO# 24 M.C	E-W
1.1	EXPO # 51 M.C	EXPO # 12 M.C	E-W
0.4	EXPO # 12 M.C	EXPO # 1 M.C	N-S
1.5	EXPO # 1 M.C	EXPO # 77 M.C	E-W

From the first baseline, a grid comprising 25 picket lines, running north and south, with a total length of 38.2 miles, was surveyed using a compass and chain. Likewise, from the second baseline, another grid comprising 50 picket lines, running north and south, was also surveyed with a compass and chain. Picket line spacing was designed to be 500 feet. All pickets have been marked with stations every 200 feet, and all lines were tied at each end with a Brunton compass and chain survey.

Altimeter readings were taken at all stations and corrected to baseline readings by straight-line extrapolation. The elevation of many transit hubs, surveyed along the baselines, were used as datum for the areas herein submitted.

The surveyed grids, as described above, were employed as a base for the geological mapping which was done on a scale of one inch to 200 feet. Magnetometer readings were taken at 200 feet stations along each picket line, and at about 500 feet intervals along the baselines. An induced polarization survey was run along logging roads for a total length of about five miles, and it was concentrated on the following claims: Expo #1, #2, #21, #32, #31, #42, #52, #71, #72, #851, #853 and #855.

The magnetics survey conducted over the surveyed grids was run using the McPhar Gp-70 Proton Precession magnetometer. This instrument measures the total earth magnetic field to an accuracy of 1 gamma and expresses the value on a digital display panel. The unit consists of two components: a sensor head and an instrument package. The sensor head can be mounted on a collapsable staff or worn on a backpack harness by the operator. The instrument console is worn on the chest of the operator. The total system weighs approximately eleven pounds with rechargeable lead cells as the power supply. Magnetic baselines were established using two instruments, one operating in the field, and the other left in a fixed spot where readings were then taken every 15 minutes or so. Loops were then run between magnetic baseline stations and corrected for observed diurnal variation. From the total field value, which is in the region of 56,600 gammas on the north end of Vancouver Island, a constant was subtracted to bring the new data down to a range of numbers comparable to previous ground magnetics work.

The constants were arrived at by surveying in with the GP-70 stations previously surveyed with a Jalander vertical field fluxgate. Although total field and vertical field values cannot be said to be equivalent, at this northern magnetic latitude, there is not much difference.

The topography survey on the picket lines was carried out at the same time as the magnetics survey by the same operator. The instrument used was a Thommens Model 3B5 Barometic altimiter. Readings were taken at 200 foot stations and read to an accuracy of five feet, which is about twice the unit's inherit capability. Control for the survey was the known elevations of transit hubs every 100 feet or so along the control baseline for the picket grid. These transit hub stations were known to an elevation of 0.1 feet.

A limited amount of IP work was carried out on several branches of the Rayonier logging road system running through the Expo claim block. Sections of NE 62, NE 62 J, and NE 62 B were surveyed using a dipole-dipole array with a n=1, a-500 feet configuration. IP readings were taken in the time domain using a Scintrex IPR-7 receiver and an Elliot 1.5 KW transmitter. The Elliot transmitter is powered by a Briggs and Straton 400 HZ generator. The transmitter puts out a square pulse wavetrain alternating two seconds positive, two seconds off, two seconds negative. Both the transmitter and its power supply were carried and operated out of the back of a panel truck while the IPR-7 was carried along the road by the operator. The electrode wire length of 500 feet was used to chain off station distances along the road. IP readings were taken using the convention that one reading is the sum of one integrated positive and one integrated negative or even multiples thereof. The IP response is termed apparent chargeability, and is measured in units of millivolts. The apparent resistivity of the earth is also obtained in the course of the survey and is measured in ohm-feet.

In order to gain more information in certain areas about overburden depths, a seismic refraction survey was conducted over selected targets on the Expo claim group. The equipment used was a Geospace GT-2B Portable Refraction System. This is a twelve channel man-carried system which can record seismic events down to 0.5 milliseconds. The system is composed of four different parts; the recorder, the power supply, the geophones and the geophone cable. Generalized field procedure is to lay out the geophone cable with the geophones attached at fixed intervals. The basic cable length is 330 feet with geophone takeouts every 30 feet. However, any geophone separation might be used, the only restriction being that only 12 geophones can be recorded at one time. Once the geophones are set out, a source of seismic energy is needed to send a signal into the earth. In our case, small charges of dynamite were used. A charge is placed at a known distrance from the geophone spread and then detonated. The seismic energy then travels through the earth governed by the laws of refection and refraction. Different earth materials conduct seismic energy at different velocities. By knowing the position of the shot in relation to the geophones, the time of the shot and the time the shot energy reaches the geophones, it is often possible to estimate the thicknesses of near surface materials of different seismic velocities. The recorder produces a record of the shot time and geophone arrivals on Polaroid Type 57 high speed film. The significant times are the first arrivals, that is, the time from when the recorder fires the blasting cap until the first energy arrives at each of the various geophones. With these times, a travel-time graph can be plotted for the shot. There are various ways in which the data can be treated depending on the requirements of the job.

A VLF-EM survey was also carried out over two areas on the Expo claims in 1973. The instrument used was a Geonics EM-16. The VLF radio transmitter used was Jim Creek Washington. This instrument measures the emergent dip angle of the secondary field and the primary-secondary field strength ratio (quadrature). Readings were taken every 100 feet and the operator recorded the average ground slope between stations in order to aid in the interpretation.

GENERAL GEOLOGY

The Holberg Inlet-Nahwitti Lake area is underlain generally by the Vancouver Group, which consists of Karmutsen basic volcanic rocks of Triassic age overlain by Upper Triassic-Lower Jurassic Bonanza pyroclastic rocks. Periods of intrusive activity accompanied the later stages of the Karmutsen and Bonanza volcanic rocks. Around the Holberg Inlet-Nahwitti Lake area, the Triassic Karmutsen Formation is at least 10,000 feet in thickness. It consists of pillow lavas, pillow breccias, amygdaloidal and massive flows, and some interbedded tuffaceous sediments. The Karmutsen volcanic rocks fall almost entirely within the basalt compositional range based on refractive indices and silica analyses of representative rock types. Dykes and sills of similar composition, but of coarser testure, stand for the plutonic activity accompanying the Karmutsen volcanic rocks. Structurally, the Karmutsen volcanics are generally marked by gently folding and intense faulting, a consequence of the relative rigidity of thick basaltic flows.

The Quatsino Formation overlying the Karmutsen consists almost entirely of limestone with a few thin andesite and basalt flows. Its thickness ranges from 200 to 3,500 feet. A thick section of the formation is exposed along the south side of Holberg Inlet.

The Parson Bay sediments, lying between the Quatsino and Bonanza, consist of argillite, some limestone, agglomeratic and tuffaceous limestone, tuff, quartzite and minor conglomerate. This sedimentary division grades upward into the Bonanza volcanic rocks. The Quatsino-Parson Bay contact is gradational in a sequence of interbedded gray, rather pure limestone and black to dark calcareous siltstone, shale and shaley limestone.

The Bonanza rocks represent the resurgence of volcanism after the period of Quatsino and Parson Bay deposition. This volcanism was of an explosive nature and resulted in the deposition of viscous Bonanza flows and pyroclastics. The Bonanza sequence attained a thickness of 6,000 to 8,000 feet. Most Bonanza volcanic rocks near the bottom of the sequence are of a basaltic andesite composition. Rhyolite and rhyodacitic rocks are interbedded with basaltic andesite and andesite higher in the sequence. Several large silicified breccia bodies and some pyrophyllite breccias have been noted apparently cutting the Bonanza rocks. They will be further described under Detailed Geology.

Plutonic activity during the last stages of Bonanza volcanism is mnifested by a large multiple phase intrusive body exposed at the southwest end of Nahwitti Lake and extending toward the south of both sides of the Hepler Creek. This intrusive mass is also present around the head waters of the Hushamu Creek, very likely related to the same intrusive mass found along the Wanokana Creek. The mineral composition of these plutonic rocks is largely granodioritic, but in several places, it varies to granite, quartz monzonite, monzonite and diorite. In addition, several bodies of syenite porphyry and of a quartz feldspar porphyry, have also been found intruding the Bonanza volcanic rocks. The syenite masses appear to follow roughly the regional WNW structural trend, and are exposed at various places along Rayonier's NE 92 branch logging road as well as around the head waters of the Hushamu Creek.

Regionally, the area of study lies in a block faulted structural environment with post-Lower Cretaceous northwesterly trending faults apparently being the major system. This system causes both repetition and loss of parts of the stratigraphic section. Because the strike of these faults is approximately parallel to that of the bedding, lateral displacements on these faults are difficult to detect. In order to cause repetition and loss of large parts of the section, aggregate movement in a vertical sense must be in the order of hundreds to thousands of feet. The most significant of these fault systems follows Holberg Inlet, with one branch passing through the west side of Stranby Valley and another branch continuing westerly toward San Jose Bay. Another northwesterly to westerly system passes through Williams

Lake and Fisherman River and still another smaller system passes through Nahwitti Lake.

Northeasterly trending faults seem to be the next most important system. In some cases, apparent lateral displacement, in the order of a few hundred feet, can be measured on certain horizons. Movement, however, could be entirely vertical with the apparent offset resulting from regional dip of the beds.

Generally, the gentle to moderate regional dip of bedding is southwesterly. Locally, in the area west of Holberg, dips are much steeper, but these are in close proximity to major faults. There is little folding or flexuring of bedding visible except along loci of major faults where it is particularly conspicuous in thin-bedded sediments of Lower Bonanza. Bedding is generally inconspicuous in massive beds of Karmutsen, Quatsino and Bonanza rocks, particularly inland where outcrops are widely scattered and covered by vegatation. Some lineaments observed in airphotographs and trending northwest-southeast and northeast-southwest are known to be fault traces.

DETAILED GEOLOGY

The area of detailed study is underlain by pyroclastics and flows of the Bonanza sequence, which have been intruded by several masses of diorite, monzonite, quartz monzonite and quartz feldspar porphyry.

The Bonanza section includes essentially andesite tuffs, andesite lapilli tuffs, porphyritic andesites, rhyolites and rhyolitic lapilli tuffs, basalts, andesitic flow breccias and agglomerates. Some rock identifications are only approximate because most exposures are strongly affected by weathering. Correlation between rock units is almost impossible because of the structural complexity of the area as well as because of the relative scarcity of outcrops. Nevertheless, attempts were made, and some correlations of units lying mainly on the outer sides of the zone of study have been tentatively suggested such as in and around Expo #51, #53 and #21 claims. Flow bedding attitudes mapped at several locations in rhyolitic rocks (on and around Expo #650 and #651) were N 40° - 60° W, dipping 35° - 50° southwest. An amygdaloidal andesite bed (in Expo #116) had an attitude of N 25° W, dipping 40° to 55° southwest, and laminated tuffs (on Expo #51 and #53) had a strike of N 60° W dipping 20° - 35° southwest.

A large intrusive mass, centered at about 230,000 N and 262,000 E, consists essentially of a medium grained diorite which is apparently intruded by an E-W narrow elongated monzonite porphyry at about 231,150 N and 263,230 E. This large diorite mass is very likely related to the intrusive mass also found along Wanokana Creek.

Diorite outcrops have also been mapped at and around 260,250 N and 209,750 E, where it is intruded by a quartz feldspar porphyry. Also, diorite outcrops are found on road cuts on Expo #21, #51 and #54 claims; at about 256,000 N and 217,000 E map co-ordinates and on Hep #13 and #14 claims. Monzonite porphyry outcrops have also been mapped in some areas such as at about 258,400 N and

214, 150 E; at 257,200 N and 216,100 N; at 257,000 N and 219,000 N and at around 262,000 N and 200,300 E map co-ordinates. In addition, some small outcrops of a quartz porphyry were mapped at about 263,500 N and 197,500 E map co-ordinates.

Contact metamorphism of the volcanics has, in some places, resulted in hornfels-like rocks and the development of zeolite facies, and possibly, pyrophyllitized volcanics found at 263,100 N and 197,250 E.

On and around the Expo #548 to #550, #621 to #625, #632, #876, #878, #879 claims, several outcrops of a silicified breccia were mapped. Fragments are generally angular, though sub-angular and rounded ones are also visible, they are set in a fine broken matrix. The color of the fragments varies from dark grey to milky white.

The silicified breccia masses appear to follow an approximate N 75° W trending zone in which they appear to be truncated by either diorite masses or pyroclastics and flows of the Bonanza sequence. So far, it is suggested that these breccia masses have originated through some magmatic upward pressure, such as volcanic centers. Related to these breccia masses, there also appears to be an intrusive andesite porphyry which cuts into the breccia as mapped, at 232,100 N and 258,400 E, and at around 231,200 N and 255,700 E. Some outcrops of pyrophyllitized lapilli tuff, and pyrophyllite breccia associated with a quartz porphyry were also found at and around 263,100 N and 197,250 E.

Several basaltic dykes trending approximately N 60° W and cutting the Bonanza volcanics were also found on and around Hep #43 claim and at about 253,000 E and 228,900 N.

The Bonanza sequence is generally cut by northeast, northwest, and east-west trending faults and shear zones whose dips vary from low angle to vertical. Shearing is almost always associated with jointing, which is fairly well developed in most outcrops.

Fractures developed in the intrusive rocks mentioned before have an attitude similar to those in the Bonanza volcanics, though they appear to be less numerous.

The silicified breccia masses are strongly faulted, sheared and jointed. Jointing is well developed at about 229,500 N and 255,500 E. Fracture trends are commonly northeast, northwest, north-south, and east-west with dips varying from 40° to vertical. The character of some breccia outcrops indicates at least two stages of brecciation. Narrow breccia dykes cutting into the silicified breccia area also present at about 228,450 N and 256,180 E. Generally, the southern flanks of these silicified breccia masses are bounded by interbedded rhyolitic tuffs and rhyolitic lapilli tuffs.

The Bonanza pyroclastics and flows on the Expo claims have undergone prophylitic alteration, and some restricted argillic alteration. A chlorite-epidote-zeolite assemblage is well developed in the propylitized volcanics. Chloritization is generally pervasive, epidote is present as specks and in veinlets. Zeolites are almost always present, are fracture controlled and appear to form the transition zone into unaltered volcanic rocks at several places. Sericitic alteration is also present in the volcanics, mainly in the outcrops surrounding the silicified breccia masses where it appears to have been partly enhanced by supergene processes.

Silicification in the Bonanza volcanic rocks appear to be almost entirely related to intrusive contacts such as those at 232,835 N and 259,500 E, and 255,600 N and 220,250 E.

In addition to silicification in the breccia masses described above, some argillic and pyrophyllitic alteration, such as that mapped at 231,220 N and 255,210 E, is present.

The intrusive masses generally show some propylitic alteration.

The quartz porphyry found at about 263,500 N and 197,500 E has apparently gone through strong silicification.

Over the entire area of study, pyrite is the most widespread and abundant sulphide. It essentially occurs in disseminations and in veinlets in the altered Bonanza volcanic rocks, generally not associated with copper sulphides, although at about 249,950 N and 218,530 E a ten foot section of silicified andesite carrying some specks of chalcopyrite, malachite and covellite,(?) was found. Also, at 259,690 N and 210,440 E and 231,260 N and 263,215 E, some tiny specks of chalcopyrite were observed.

At 260,380 N and 209,685 E, some specks of native copper were found in a chloritized fine grained diorite.

In general, copper mineralization is scarce and erratically distributed. Pyrite content definitely increases at and close to the silicified breccia - volcanic contact. In the silicified breccia masses, pyrite has been almost completely leached out leaving specks, smears and masses of limonite after pyrite.

Magnetite is widespread in the Bonanza sequence, but not abundant. Its content appears to increase at and near volcanic-intrusive contact zones as well as in rocks approaching basaltic composition. Hematite is also present generally associated with some fresh breccia flows and lapilli tuffs.

GEOPHYSICAL RESULTS

MAGNETICS

The magnetics results on sheets E-8, F-8, F-9, G-8, G-9 show an overall grain NW-SE trending with two major zones of magnetic highs and a band of lows across the southern ends of the grid lines. The values ranged from 900 gammas to over 3,700 gammas with an average value between 1,500 to 1,600 gammas. Highs are considered over 2,000 gammas with an anomalous high over 2,500 gammas, while lows are less than 1,200 gammas.

The largest of the two magnetic highs covers most of sheet F-9 and 2/3 of the uppermost part of G-9. This anomalous zone is enclosed by the 2,000 gamma contour with peak highs being over 2,500 gammas. There are seven of these +2,500 gamma zones inside the 2,00 gamma contour with the two major ones being about 300 feet from each other. The more northwesterly and larger of these two areas is roughly 1,800 feet long (E-W) by 950 feet wide (N-S). The second body is just to the SW and is a bit smaller; 1,600 feet (E-W) by 500 feet (N-S). The other bodies above 2,500 gammas are of a variety of shapes but average about 1,000 feet by 250 feet with a variety of inclinations.

The other anomalous zone is on the upper central part of sheet F-8. This zone is about 3,000 feet in an E-W direction and 1,400 feet in a N-S direction. There is as well a small tail sticking down from the SE corner of the main body. The highest value observed on the five sheets is on the NW corner of this anomaly, but is localized to a single station.

The band of lows which runs across the bottoms of G-9, G-8 and F-8 is about 800 feet to 1,100 feet wide. The zone is fairly continuous on G-9, but becomes spotty as on G-8 and F-8.

The following discussion covers the magnetics survey run on sheets A-1 and 2, B-1, 2, 3 and 4 and C-2, 3 and 4. Total intensity values ranged from 500 to over 4,000 gammas, with the average around 1,600 gammas. Highs were considered areas greater than 2,500 gammas and lows were taken as less than 1,200 gammas. The general grain of the survey was a NW-SE trend through an area with prominent features being a large band of lows across the southern map sheets and a few scattered highs in the north.

The extent of the lows is much greater over this area than was observed at the area first described on page 14 . Large parts of sheets B-1, C-2 and 4 and to a lesser extent B-2 are covered by irregular shaped or NW-SE trending lows.

There are three areas of anomalous magnetic relief which show up in the map area. Moving from east to west, the first anomaly is in the NE corner of sheet C-4. The anomaly shape is roughly circular with a diameter of about 500 feet. There is a single high reading about half a mile west of the above mentioned anomaly, but is probably due to some localized feature and is not part of the larger anomaly. The second area of magnetic relief is located on the lower portion of sheet B-3. This zone is a rather complex series of small intense magnetic highs and lows. The zone is elliptically shaped with the dimensions 2,600 feet by 1,300 feet. The major axis is on a N 70° W strike. The third area of magnetic high shows up on the three lines running through the upper portion of B-3 and into A-3. This zone is the largest and most continuous of the three highs and probably has dimensions considerably greater than observed. The zone itself is composed of three anomalous areas running in a northwesterly direction from 2,616 N to 2,660 N. The lowermost anomaly is about 500 feet and runs in an elbow shape across the three lines. The next zone is about 400 feet north of the first and is approximately 1,000 feet wide and appears to line on a NE-SW strike. The uppermost anomaly in the zone sits at the very top of the three lines. The anomaly is about 300 feet wide on 2,097 E and about 1,300 feet on 2,107 E; the effect is a funnel shape outline with the small end pointing west.

INDUCED POLARIZATION

CHARGEABILITY

The range in apparent chargeabilities observed was from 7.5 Milliseconds to 40 Milliseconds. Results on Plates 35 (C-2) and 33 (A-2) show no significant response. On plate 34 (B-2) there appears an anomalous zone on Expo claims #1, 2, 3 and 5. Following the 20 Millisecond contour, the zone is roughly 2,000 feet long, in a N-S direction, and 1,200 feet wide in an E-W direction.

RESISTIVITY

The apparent resistivity values ranged from 570 ohm-feet to 4,600 ohm-feet. No distinctive trends are found with the resistivity data above. However, it is noted that the measuring within the chargeability anomaly all have corresponding resistivity values of less than 1,000 ohm-feet.

VLF-EM RESULTS

This survey was carried out in two areas on the Expo grid in order to see if VLF-EM might be able to help in outlining geological contacts or faults buried under overburden. Results in the first area are shown on Plates 40, 41, 42 and 43. As the lines here ran roughly perpendcular to the strike of a valley, some topographic influence was expected and observed. However, bonafide anomalous zones were detected as well. On Expo claim #219, a conductor axis runs roughly E-W across lines 2298 E, 2302 E and 2308 E, and just to the north of this axis, a magnetic low trends in roughly with the same direction and length. Both observations appear to be correlated with a highly fractured zone intercepted at 60 feet beneath surface by a nearby diamond drill hole. Several other apparent conductors also can be correlated with surface magnetic lineations. Through Hep claim # 57 and #59, and Expo # 189 and #190, a conductor axis, about 2,000 feet long and striking roughly N 70° W, can be traced. This trend is based on slightly more noisy data, and may possibly be a form of topographic distortion. Generally, however, the effect of topography in this area was that dip angles were negative going north and then made a crossover roughly over the valley bottom, and then went positive going uphill to the south. The interesting anomalies are the smaller and higher frequency crossovers setting on the broad topographic pattern. Quadrature response varied considerably, but tended generally to mirror image the dip angle response.

Over the second area surveyed, shown on plate #39, the VLF-EM results were rather different than the first area. The topographic affect was much more prominent, and significant response, other than topography, was much less. Possibly two significant crossovers were observed, one on line 2137 E, 256 N and another on line 2142 E, 2576 N. There was, however, poor correlation between lines and little apparent correlation with surface magnetic results. As in the first area, the quadrature generally mirror imaged the dip angle response.

SEISMIC SURVEY - RESULTS

The location and orientation of the seismic lines are given in plates 36, 37 and 38. Each line has beside it the numbers of the photographs which were to be on that particular line. On the following page, an example of a typical GT-2B record is shown. The various points of record identification are illustrated and these apply to all the enclosed records. Appendix I gives two of the most commonly used formulae in seismic refraction interpretation and illustrates how the formula parameters are arrived at.

RECORD IDENTIFICATION

(1) Cross record timing lines (10 milliseconds between timing lines)

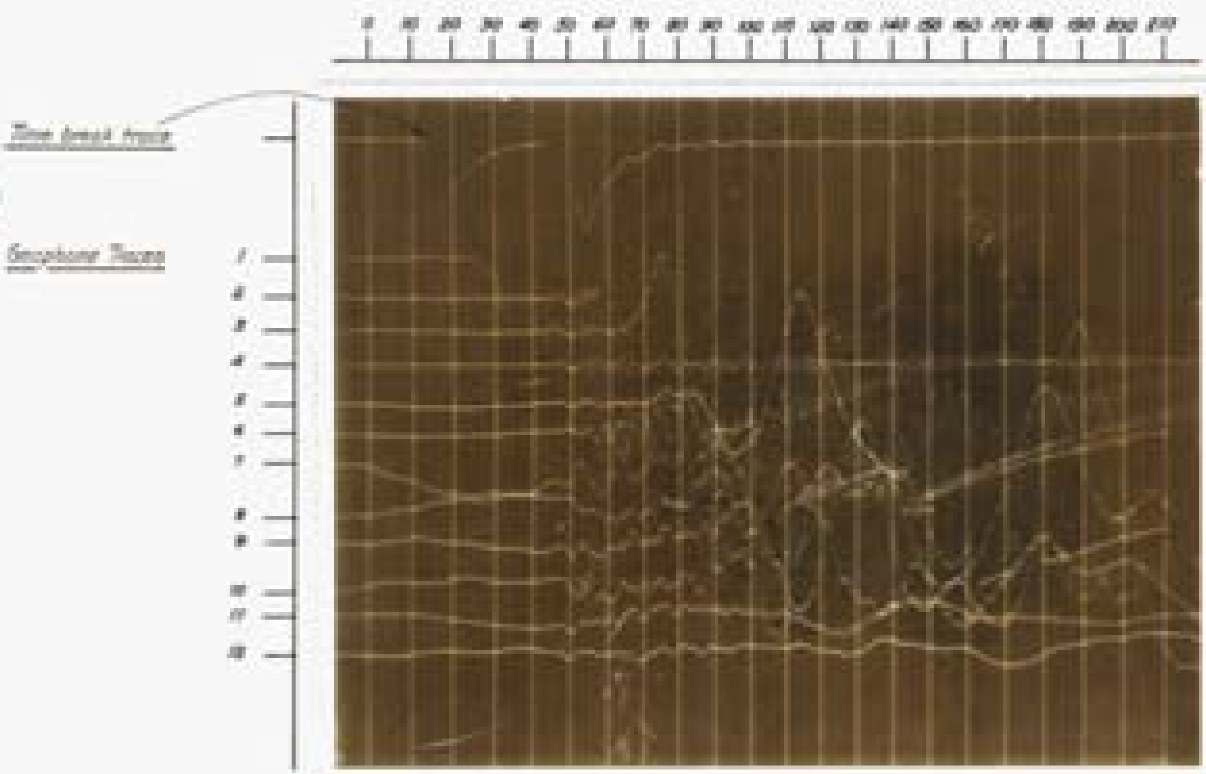
(2) Time break, or zero time, when shot occurs.

(3) Time break trace.

(4) Geophone traces, one through twelve consecutively.

(5) First arrival of shock wave, one through twelve geophone traces.

TIME IN MILLISECONDS



TYPICAL RECORD

Department of

Mines and Petroleum Resources

ASSESSMENT REPORT

NO. 4754 MAP

APPENDIX I

RECORD INTERPRETATION FORMULAE

There are two furmulae used to interpret the information obtained with the GT-2B. These are the Critical Distance Formula and Time Intercept Formula.

(a) Critical Distance Formula

$$D = \frac{Xc}{2} \quad X \quad \frac{V2 - V1}{V2 + V1}$$

D = Depth of first layer

Xc = The distance at which velocity change occurs.

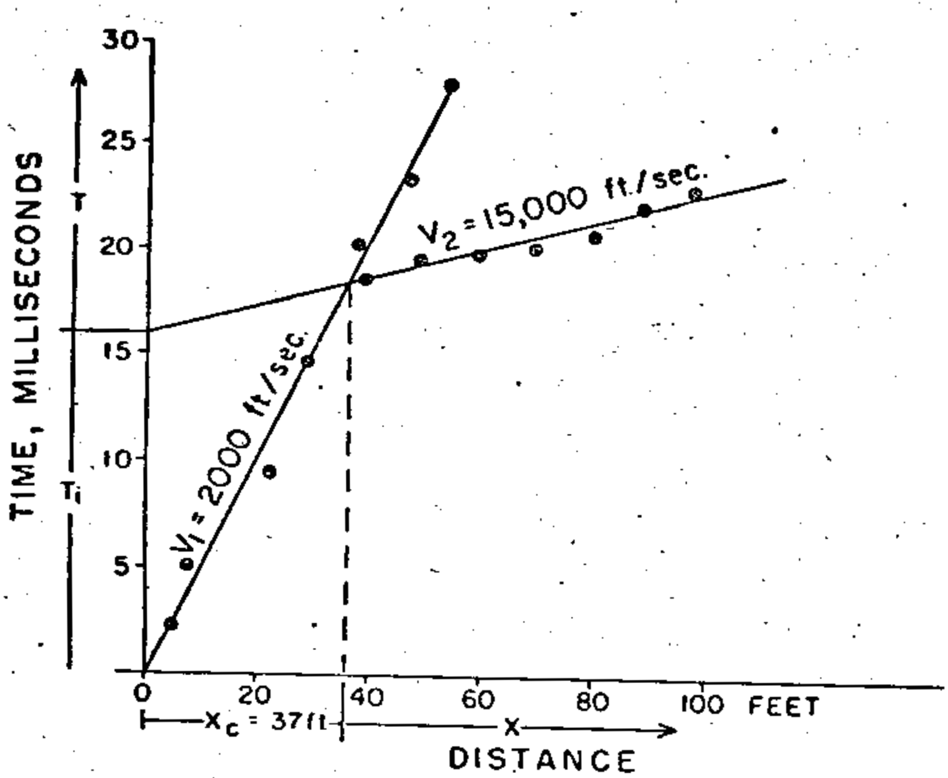
V1 = Velocity in first layer

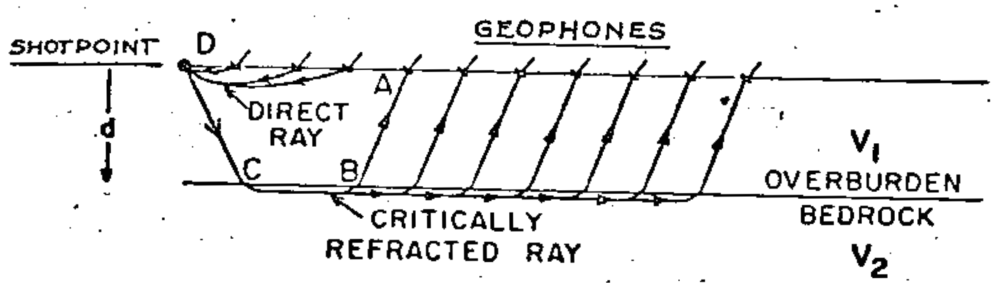
V2 = Velocity in second layer

(b) The Time-Depth Intercept Formula

$$D = \frac{ti}{2} \quad X \quad \frac{V1 \times V2}{V2^2 - V1^2}$$

APPENDIX I CONT.





CONCLUSIONS

A total of four silicified breccia bodies, one complex silicified pyrophyllite breccia body and some other small ones, stand for the main geological feature over the entire Expo claim block. The major ones appear to follow a N75°W trend and to be related to volcanic centers.

Pyrite is the most widespread and abundant sulphide in the area herein submitted. Only some counted specks of chalcopyrite are found either in the volcanic or the intrusive rocks which have undergone weak alteration hydrothermally.

Magnetic anomalies are essentially related to intrusive masses which generally carry more magnetite than the intruded rocks.

Though restricted and affected topographically, the VLF-EM survey appears to disclose some conductors likely related to strong fracture zones.

A. Ascencios, P. Eng.
Senior Geologist

REFERENCES

DAWSON, G.M. 1886 — Geology of Rupert Inlet, Annual Report, Geological Survey of Canada.

NORTHCOTE, K.E. — In Geology, Exploration and Mining, In British Columbia, 1970 p.257-258.

MULLER, J.E. 1971 — Chemistry and Petrology of Some Mezozoic Volcanic Rocks of Vancouver Island, British Columbia, G.S.C. Paper 71-1B, p.5.

NORTHCOTE, K.E.
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J.E. MULLER
K.E. NORTHCOTE
D. CARLISLE 1973 — Geology and Mineral Deposits of Alert Bay-Cape Scott Map Area (92L-1021) Vancouver Island, British Columbia.

APPENDIX A

STATEMENT OF QUALIFICATIONS

STATEMENT OF QUALIFICATIONS

The field work for this report was done by the following persons whose qualifications are outlined below.

1. A. ASCENCIOS, P. Eng., Senior Geologist for Utah Mines Ltd., Vancouver, British Columbia.
   Completed geological engineering at San Marcos National University of Lima, Peru in 1959 and M.Sc. (Geology) at the University of Arizona, Tuscon, U.S.A. in 1966; employed by Cerro de Pasco Corporation, La Oroya, Peru from January, 1956 to March, 1956, and from January, 1957 to March, 1957 as student-trainee; employed by Cerro de Pasco Corporation, La Oroya, Peru from May,1960 to August, 1961 as assistant mine geologist under the supervision of U. Peterson, Chief Geologist; employed by Asarco in Casagrande, Arizona, U.S.A. from June, 1962 to September, 1962 as student-trainee under the supervision of K. Richard, Chief Geologist; employed by Cerro da Pasco Corporation, La Oroya, Peru from February, 1963 to June, 1970, as a pit geologist, division geologist and project geologist at Cerro da Pasco Mine (February, 1963 to November, 1963) at Yauriococha Mine (November, 1963 to March, 1967), and at the Exploration Department, Lima (April, 1967 to June, 1970) under the supervision of G.E. Walker, J.S. Molloy and C.R. Petersen respectively; employed by Utah Mines Ltd. from July, 1970 to date as a Senior Geologist under E.S. Rugg, P. Eng., and M.J. Young, P. Eng.

2. R.B. ANDERSON, Geologist for Utah Mines Ltd., Vancouver, British Columbia.
   Completed B.SC. (Geology) at University of British Columbia in 1970; employed by British Columbia Department of Mines, Texas Gulf Sulfur and Canico during 1967, 1968 and 1969 summer field seasons respectively as geologist assistant; employed by Utah Mines Ltd. from April, 1970 to date as a geologist under the supervision of E.S. Rugg, P. Eng., and M.J. Young, P. Eng.

3. D.G. CARGILL, Geologist for Utah Mines Ltd., Vancouver, British Columbia. Completed B.A.Sc. at the University of Toronto in 1967, M.Sc. at Queen's University, Ontario, in 1970; worked as a student during summer field seasons with the Geological Survey of Canada in 1964, and with the Ontario Department of Mines in 1965 and 1966; employed as a field geologist during the summer field seasons by Lytton Minerals Ltd. in 1967, by Eldorado Nuclear Ltd. in 1968 and 1969, and by Utah Mines Ltd., in 1970, 1971 and 1972, and from June, 1973 to date as a geologist under the supervision of E.S. Rugg, P. Eng., and M.J. Young, P. Eng. Registered as a P. Eng. in Ontario and British Columbia.

4. G. RAYNER, P. Eng., Consultant geologist employed by Utah Mines Ltd. from July to September, 1973.

5. U. MALACHOWSKI, Geologist for Utah Mines Ltd., Vancouver, British Columbia. Completed B.Sc. 1969; employed by Texaco Explorations, Calgary, Alberta, from 1969 to 1970; by Kennco Explorations, Vancouver British Columbia, from 1970 to 1971, and by Utah Mines Ltd., Vancouver, British Columbia from 1971 to date as a geologist under the supervision of E.S. Rugg, P. Eng., and M.J. Young, P. Eng.

6. K. WITHERLY, Geophysicist for Utah Mines Ltd., Vancouver, British Columbia. Completed B.Sc., (Geophysics) at the University of British Columbia in 1971; employed by Utah Mines Ltd. and Tri-Con Exploration Surveys during 1969 and 1970 summer field seasons respectively as a geophysicist's assistant; employed by Utah Mines Ltd. from May, 1971 to date as a geophysicist under the supervision of E.S. Rugg, P. Eng., and M.J. Young, P. Eng.

APPENDIX B

STATEMENT OF COST

STATEMENT OF COST

A. Ascencios	82 days @ $55.00 per day	$ 4,510.00	
R. Anderson	91 days @ $34.00 per day	$ 3,094.00	
D.G. Cargill	42 days @ $44.00 per day	$ 1,848.00	
G. Rayner	57 days @$110.00 per day	$ 6,270.00	
U. Malachowski	28 days @ $31.50 per day	$ 882.00	
K. Witherly	94 days @ $32.00 per day	$ 3,008.00	
G. Annable	24 days @ $20.68 per day	$ 2,564.32	
G. Brydle	110 days @ $25.03 per day	$ 2,753.30	
G. Didier	129 days @ $25.82 per day	$ 3,261.12	
F. Dispirito	58 days @ $26.82 per day	$ 1,663.44	
J. Hutton	36 days @ $29.72 per day	$ 1,069.92	
W. Frost	69 days @ $20.54 per day	$ 1,417.26	
E. Isaac	62 days @ $21.60 per day	$ 1,339.20	
S. Lui	101 days @ $23.44 per day	$ 2,367.44	
C. Marcoux	104 days @ $33.83 per day	$ 3,519.36	
J. Murphy	38 days @ $19.48 per day	$ 740.24	
J. Proven	114 days @ $32.17 per day	$ 3,667.38	
G. Siroka	3 days @ $25.00 per day	$ 75.00	
N. Connolly	8 days @ $20.80 per day	$ 166.40	
P. Darling	8 days @ $20.80 per day	$ 166.40	
B. Field	16 days @ $20.80 per day	$ 332.80	
T. LaRose	8 days @ $31.12 per day	$ 248.96	
	TOTAL SALARIES	$44,964.54	$44,964.54

VEHICLE RENTAL

Two 1973 Crew Cabs, Fords 2 X 4			
	135 days @ $12.95 per day	$ 1,748.25	
One 1970 Suburban, G.M.C., 4 X 4			
	84 days @ $10.00 per day	$ 840.00	
One 1973 Suburban, G.M.C. 4 X 4			
	59 days @ $10.00 prt fsy	$ 590.00	
	TOTAL	$ 3,178.25	$ 3,178.25

LIGHT PLANT RENTAL

Two VM-Markon 5KW & 3.5KW Diesel 110 V-AC

	135 days @ $ 14.00 per day	$ 1,890.00	
	TOTAL	$ 1,890.00	$ 1,890.00

RADIO EQUIPMENT

SSB 60	135 days @ $ 1.87 per day	$ 252.45	
SSB 60	89 days @ $ 1.87 per day	$ 166.43	
	TOTAL	$ 418.88	$ 418.88

I.P. EQUIPMENT

Transmitter, Receiver and radios

	2 days @ $46.00 per day	$ 96.00	
	TOTAL	$ 96.00	$ 96.00

MAGNETIC EQUIPMENT

Two McPhar GP-70 Proton Precession Magnetometer

	65 days @ $13.27 per day	$ 862.55	
	TOTAL	$ 862.55	$ 862.55

SEISMIC EQUIPMENT

Geospace GT-2B Seismic Refraction Recorder

	17 days @ $35.18 per day	$ 598.06	
	TOTAL	$ 598.06	$ 598.06

VLF-EM EQUIPMENT

Ronka EM-16	8 days @ $ 9.00 per day	$ 72.00	
	TOTAL	$ 72.00	$ 72.00

ALTIMETERS

Two Thommens Altimeters

	65 days @ $ 1.43 X 2 per day	$ 195.90	$
	TOTAL	$ 195.90	$ 195.90

GRID PREPARATION

Baseline Cutting Cost (Underhill & Underhill)		$ 6,680.50	
	TOTAL	$ 6,680.50	$ 6,680.50
Picket Lines Cutting Cost (Mannex Mining)		$25,245.69	
	TOTAL	$25,245.69	$25,245.69

HELICOPTER

94.0 hours @ $160.00 per hour		$15,040.00	
	TOTAL	$15,040.00	$15,040.00

CAMP COST

2,243 man days @ $ 5.52 per man day		$12,381.36	
	TOTAL	$12,381.36	$12,381.36

REPORT AND MAP PREPARATION

Total Cost		$ 8,000.00	
	TOTAL	$ 8,000.00	$ 8,000.00
	GRAND TOTAL		$119,613.72

A. ASCENCIOS, P. ENG.