BOB CREEK ZINC ORE

An Essay submitted during the
Third Year Course in Applied
Science at the University of
British Columbia

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November 15 1952

Acadia Camp,
Vancouver 8, British Columbia
November 15, 1952.

The Dean,
The Faculty of Applied Science,
The University of British Columbia,
Vancouver 8,
British Columbia.

Dear Sir:

In accordance with the regulations governing the course for the Third Year of Applied Science, I submit herewith an essay entitled Bob Creek Zinc Ore based on my work of the past summer.

Yours truly,

N. A. Strom

NORMAN ALEXANDER STROM

Matter – 16

Presentation – 18

English –

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ILLUSTRATIONS

PREFACE

The following essay is based on the personal experience gained during the summer of 1952. Transcontinental Resources Limited, for whom I worked, were engaged in preliminary geological investigations of the Bob Creek mineral showings near Houston, British Columbia.

Most of the information submitted here resulted from the informal discussion of observations made during the actual progression of work at Bob Creek. I am deeply indebted to Clive D. McCord (B.A. Sc. U.B.C., 1950), the geological engineer in charge of the investigations, without whose generous assistance I would have been unable to make this report.

N. A. STROM.

November 15, 1952.

"mineralization" can be either a process or a product - but please not both in the same sentence

ie The ore is a volcanic breccia?
or is in ...

BOB CREEK ZINC ORE

Purpose and Scope of this Essay

This essay is devoted to a geological study of a zinc-gold property situated in the Smithers area of north-central British Columbia. The problems involved in exploration and development of the property will also be outlined.

A low-grade zinc ore is exposed for 1500 feet along the steep-walled canyon of Bob Creek. The disseminated mineralization (which is believed to have ~~proceeded~~ been developed by ~~an~~ epithermal, metasomatic replacement), consists largely of sphalerite stringers and veinlets combined with a generous supply of pyrite. The ore occurs in the form of a volcanic breccia thought to be a planar body representing the ~~last~~ highest of a series of strata of the Hazelton ~~Age~~ group of Jurassic age.

Geological information and obtainable from surface rock exposures is limited insofar as economic development of the property is concerned. Furthermore, owing to the nature of the rock, subsurface investigation cannot be done by core

Suggests 2 miles thick!

Description

Topography
Course of Bob Creek
Importance of the creek
Overburden, geology etc away from creek
Water supply
Floods
Climate and access.

drilling, but must be carried out by tunnelling and drifting. For these reasons, it is unlikely that Bob Creek will be developed as a mining operation in the immediate future. Nevertheless, should an accelerated demand for zinc occur - and this seems possible in view of the present strained international situation -, an initial capital investment with the purpose of a proper investigation of Bob Creek canyon might produce gratifying results.

Description

Bob Creek is a ten-foot wide stream which tumbles down through a narrow "V"-shaped canyon. Before emptying into the less turbulent Buck River, the creek fans out over a wide flat. Its spring-fed waters traverse some two miles of vesicular basalt strata, and eventually make a unique "horseshoe" turn to knife down through a half mile of soft volcanic breccia. The creek then flows out onto a wide alluvial fan, called "Buck Flats", which consists mainly of water-worn gravel.

Particular attention should be paid to the extraordinary course which Bob Creek follows. This course may be of great stratigraphical importance in the determination of possible bedding attitudes, and the estimate of ore limits of Bob Creek canyon.

The heavy overburden limits the geological study of

land areas immediately adjoining the mineralized exposures of the canyon. A fairly dense growth of spruce and jackpine covers the deep-mantled hillsides which were probably terraces of an ancient river bed. A basalt overflow fringing the south-east boundary of the mineralized agglomerate, forms the core of a nearby rugged mountain range. It is, of course, all but barren of any vegetation.

Although water on the hillsides is none too apparent, a constant supply of artesian water feeds Bob Creek the year around. Because the creek flows directly through the mineralized zone and has a constant water supply assured, hydraulic mining of the low-grade zinc ores seems favourable.

Occasionally flash flood waters race through the steep-walled canyon dragging down trees and rock debris. At various times, the creek is known to have risen ten feet above its normal level. At such times Bob Creek threatens the prospector's dwelling, located at the canyon mouth, and washes out road approaches to the property. Heavy snows blanket the area during the winters, which last from mid-October to mid-April.

Although its climatic conditions are severe and erratic, the Bob Creek area is seldom cut off from the nearest railroad point and local distribution centre of Houston. This town, which lies on the Canadian National Railway's northern British Columbia branch line, is a logging and mixed farming

centre located about 300 miles east of the port of Prince Rupert. A ten-mile unsurfaced road is Bob Creek's only link with Houston. At the present time, however, a road extension of 1500 feet is required to make the prospector's camp accessible by car or truck. In comparison with many metal-mining operations, Bob Creek (considered here as a prospective zinc ore producer) is a relatively easily accessible property.

History

Although at the present time sphalerite constitutes the mineral of key interest at Bob Creek, the property has been worked for gold-placer a number of times in the past. The potentialities of the creek were apparently discovered during the gold rush of the late nineteenth century. Intermittent placer operations which resulted in considerable gold recoveries are related to have taken place previous to 1914. First authentic reports of placer working are recorded in the British Columbia Department of Mines' annual report for 1914; the gold is described as eminating from a "porphyry dyke". This "porphyry dyke" and what is presently known as the mineralized agglomerate of Bob Creek Canyon are understood to be synonymous. Downstream alluvial gravel beds are very deep, and consequently bed rock or gold pay-streaks were not likely to be continuous. It is assumed that placer operations ran spasmodically, chiefly on speculation, when these particular pay-streaks were encountered.

In 1928, Douglas Lay, prospector and miner, reported development of a forty-three-foot adit into the west canyon wall and a fifteen-foot adit into the east wall. Since both adits are now caved, no geological information can be obtained from them concerning subsurface structures. However, with respect to mineralization, assay reports are quoted which are noticeably erratic and probably not well representative of general mineralization of the total ore. Grab samples showed traces of gold and silver with 3% zinc, while three-inch stringers gave up 1.4 oz. gold, 41 oz. silver and 18% zinc.

Free gold was discovered in 1932 to occur discontinuously in the oxidized zone of mineralized agglomerate. The property was worked for a brief duration at that time under the name of "Gold Brick". The following year, 1933, George Smith staked two mineral claims which include most of the mineralized exposures, and he has held them to the present time. After spending three years on prospecting and analysing the Bob Creek showings, Mr. Smith organized the "Houston Gold Mines Company" for the purpose of underground exploration of the mineralized zone, and with a view to a possible small mine-mill operation. Seven men were employed throughout the summer of 1936, during which time eighty tons of ore were extracted from the "T"-shaped adit located on the eastern wall of the canyon about 500 feet upstream from the mill. Twelve tons of concentrate were realized from the ore by means of a simple milling process. Further operations were suspended

since the owners were unable to interest any proper mining concern in the property.

Only of late has renewed interest been shown in Bob Creek. This is a result of increasing demands for base metals. Transcontinental Resources Limited took an option on the property in October, 1951. They did so on the basis of recommendations of G. M. Radisies, who cited the possibility of the existence of a large-tonnage, low-grade zinc ore deposit. With this possibility in mind, during the summer of 1952 a geological investigation was undertaken.

Exploration

Procedure

Exploration work was carried out during the months of June and July by Transcontinental Resources. Duties consisted mainly of plane-table mapping and underground excavation with the purpose of furthering qualitative geological observations. A group of four men, comprised of a cook, two mapping geologists and a geological engineer in charge, completed the required investigation.

Initial work consisted of a three-day reconnaissance of the property and the surrounding vicinity, at which time a systematic mapping procedure was outlined. The nature of the

mineralized body was studied briefly. Particular attention was given those stratigraphical features which might influence the extent of mapping necessary for accurate interpretations.

On the fourth day, the two-man plane table crew commenced mapping at a scale of one inch on the map equivalent to one hundred feet in nature (i.e. 1" = 100'). The mineralized canyon area was surveyed in detail for obvious reasons (see Appendix A). After completion of the map the entire four-man party spent the final two weeks fulfilling required assessment work on the mineral claims. Detailed analyses were made of structural and mineral features exhibited in critical areas.

Geology of Bob Creek

Stratigraphy

Mineralized rock consisting of volcanic breccia or a brecciated tuffaceous agglomerate is exposed for some 1500 feet along both sides of Bob Creek canyon. Tertiary vesicular basalts are believed to overlie a main body of volcanic breccia which includes the mineralized zone. (See fig. 1). Lying between the basalt and the breccia is a contact zone made up of vesicular basalt containing inclusions of volcanic breccia. This indicates that the basalt overlies the breccia, and also, that the volcanic debris was deposited in its present form rather than being brecciated by later movements.

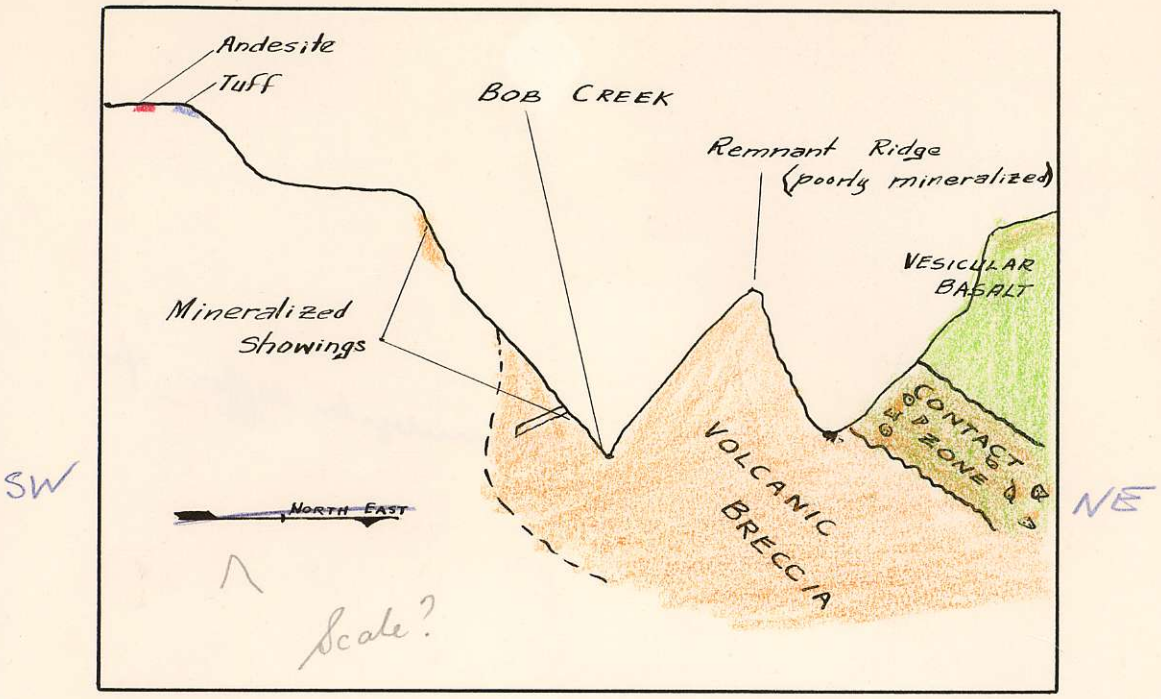


Fig. 1. Cross-section across Bob Creek showing Basalt-Breccia contact zone.

The mineralized body has an apparent strike of N 15° W and a dip of about 30° easterly. (See Appendix A.). This theory is supported by the fact that no vesicular basalt occurs in bed rock west of the canyon and that, in that area, the mineralized zone grades into entirely different types of rocks consisting of andesite, tuff, diabase, diorite, etc. Furthermore, a remnant ridge consisting of a fairly resistant, poorly mineralized agglomerate trends northwesterly starting from the "horseshoe". This would suggest that the ridge represented a certain more resistant layer of a main planar body having a northwest strike. Although fractures and joints were observed in the canyon, they were found to be random and,

therefore, they represent no conclusive indication of the general dip and strike of the volcanic breccia stratum.

Extent of Ore Zone

Thickness of the mineralized zone is estimated to be 800 feet on the basis of a 1600 foot horizontal exposure and a 30° dip. On either side of the Bob Creek canyon exposures, the mineralization deviates distinctly from that exhibited by the volcanic breccia. To the south, quartz and arsenopyrite characterize the mineralization. To the north and west, the tuffs and purple breccias are practically barren of any mineralization which could be correlated with the disseminated pyrite and sphalerite featured in the canyon. It can be concluded then that Bob Creek canyon is a limited mineralized zone contained in an extensive planar body of volcanic breccia. The unusual "horse shoe" deviation of the creek supports this conclusion. If the soft mineralized zone were distributed uniformly throughout the bedding plane, there would be no apparent reason why the creek would not have cut headward in normal fashion (see fig. 2). Instead, the creek has practically reversed its direction and developed an immature, steep-walled canyon extending through the mineralized zone.

Type of Mineralization

Prominent minerals occurring in Bob Creek canyon are, in order of their abundance: pyrite, sphalerite, galena, chalcopyrite and free gold. Pyrite and chalcopyrite particles are disseminated throughout the breccia mass, while spharite-galena veinlets, carrying free gold, occur as thin coatings on

breccia globules and fill fractures and fissures. Although the larger stringers of sphalerite are as wide as six inches, their value alone is negligible, since they run in lenticular, sharply terminated veins. However, combining the larger stringers with the disseminated sphalerite veinlets creates an economically more interesting condition.

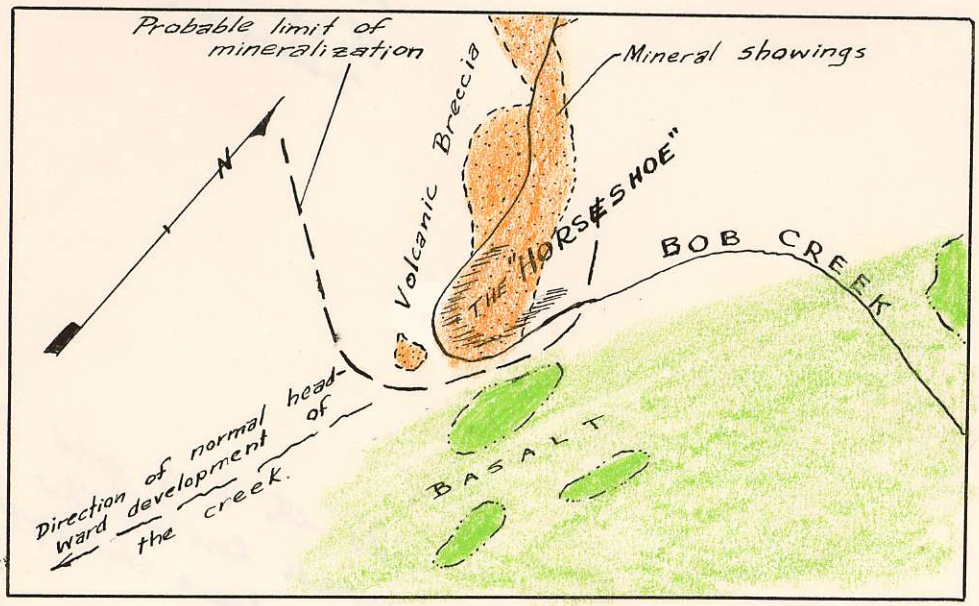


Fig. 2. The Bob Creek "Horseshoe"
with reference to stratigraphic control features

To investigate mineralization beyond the zone of oxidization, five collars were developed along the canyon wall at equally spaced intervals. They were each about eight feet in width and six feet in depth. Development accessories (which included a gasoline powered pneumatic drill, mining picks, shovels and forcite explosives (60% TNT)) limited the

depth below surface to which the men could work safely. Results were poor and the only conclusive factors brought to light were: that oxidation is likely to be very deep; and, many larger mineral stringers along cracks and fissures are very badly leached. No vein attitude could be discerned, as those stringers which were found seemed haphazard in length and direction. It is well to point out here that a detailed mineral investigation beyond the zone of oxidation is the only answer to an accurate assessment of values. Core drilling is understandably hopeless in this type of rock which is composed of irregular hard and soft particles in a poorly cemented mass.

In summary, the mineralization of Bob Creek canyon consists of pyrite, sphalerite and free gold, with galena and chalcopyrite in traces. Economically the bulk rock mass must be considered as the ore if there is to be any hope of worthwhile mineral recovery.

Ore tonnages

Assuming a uniform sphalerite pyrite mineralization of the canyon zone, appropriate tonnage calculations were made. To facilitate these calculations, cross-sections 1000 feet long across were taken at intervals of 180 feet perpendicular to a line representing the lengthwise axis of the canyon exposure (see fig. 3). From these cross-sections, the tonnages were calculated by choosing for the ore limits, the creek as the bottom, the actual surface profile as the top, and straight vertical lines as the sides projected down from points on the

profile slope where the outline of mineralization was observed (see fig. 4).

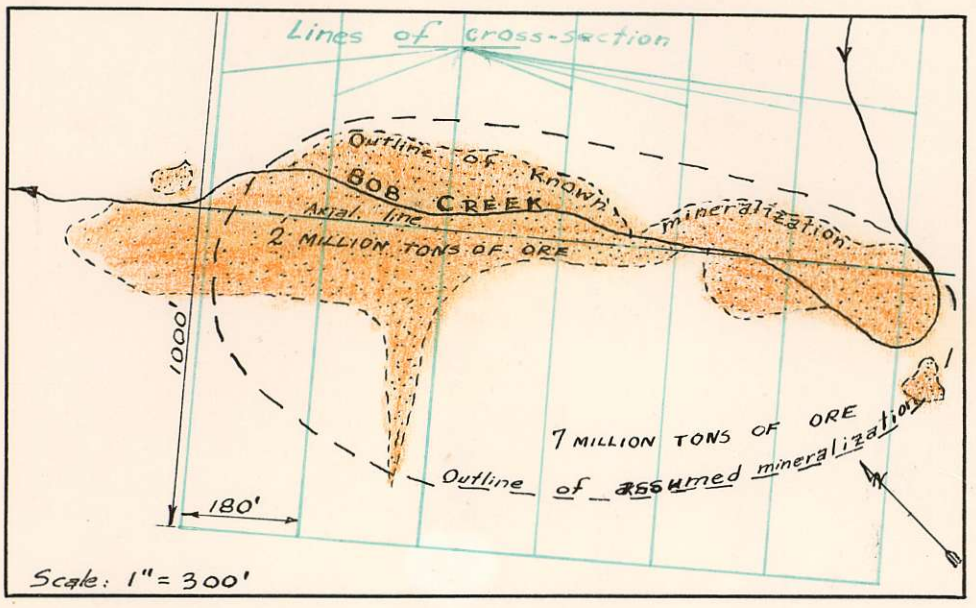


Fig. 3. Cross Sections along Bob Creek in connection with Tonnage Estimates

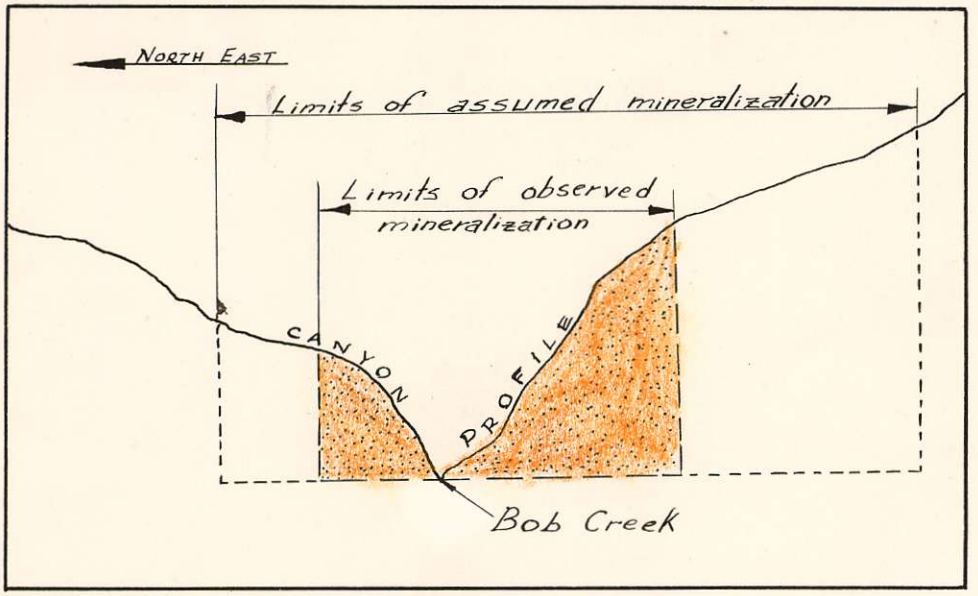


Fig. 4. Typical Cross-section illustrating the choice of limits of possible ore in Bob Creek Canyon.

A total of 1,888,000 tons of ore was estimated to lie within the limits restricted to actual mineral exposures. A second, more crude estimate, was derived by choosing an elliptical map area (where mineralization is assumed to be continuous) as the horizontal limit, and the surface profile and creek bottom as the upper and lower limits, respectively. Seven million tons of ore reserves were calculated on this basis. Providing a brisk demand for base metals prevails, these large tonnages could prove worthwhile to a company interested in a high-tonnage, low-grade operation.

Value of Material

Before the Bob Creek showings can actually be mined, a proper investigation determining more accurate tonnage estimates and prospective mineral recovery would have to be executed. It has been found that sampling by underground excavation beyond the zone of oxidation is the only reasonable solution to achieve a true assay of the average available sphalerite, pyrite, gold, etc. throughout the projected ore body.

Assay figures, as reported by Mr. Smith (the property holder), are not necessarily representative, but are the only ones available. During its brief mining operation of 1936, 80 tons of ore were mined. A 12-ton concentrate was realized by a simple milling process utilizing a jaw-crusher, ball mill

and Wilfey table. Assay values are quoted as follows:

	Values of Concentrate	give	Values of ore
Gold	0.45 oz./ton		0.064 oz./ton
Silver	7.0 oz./ton		0.99 oz./ton
Zinc	8%		1.13%
Lead	trace		trace

Judging from these returns, the ore is definitely of a low grade. Normally the value of zinc should be above 4% of the ore for an economically sound operation. One consideration, that of the value of the sulphur in the pyrite, has been ignored, simply because the pyrite percentages were not given in this 1936 report. In recent years the recovery of sulphur from pyrite has received increased attention

Summary

Bob Creek canyon is a low-grade zinc property possessing a very high potential tonnage of ore. It is this large tonnage with its adaptability to low-cost, open-pit mining methods that makes the property economically interesting. Furthermore, the property has a favourable geographical location, being an easily traversable ten miles from a transcontinental railroad. Timber and water resources are plentiful enough to meet with the fuel and construction, and power and hydraulic

mining requirements.

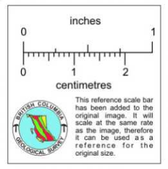
The major prohibitive factor to mining at Bob Creek, to all but the larger mining companies, is the relatively high cost (and the risk involved therein) of determining the true values and tonnages of ore reserves. Bulk sampling from extensive underground exploration work appears to be the only method of attaining a proper evaluation. A continuing steady demand for zinc would have to be anticipated before any large amount of speculative capital expenditure would be warranted.

GEOLOGICAL MAP OF BOB CREEK

SCALE: 1" = 300'

MAPPED: JULY, 1952

BOB CREEK, HOUSTON, B.C.



ANDESITE

TUFF

BUCK RIVER

BUCK FLATS

UNSURFACED ROAD

TUFF

BOB CREEK

AVE. CREEK GRADE = 4.75 %

Pb

TUFF

Old cabins (good condition)

ANDESITE

PURPLE BRECCIA

MAGNETIC DEC. 29° 30'

Prospector's Cabin

OLD MILL

COLLAR (A)

ADIT

MINERALIZED VOLCANIC BRECCIA

COLLAR (B)

COLLAR (C)

(Zn-Au-Pb-Ag) Py

COLLAR (D)

COLLAR (E)

ADIT

ADIT

APPARENT STRIKE OF THE PLANAR BODY OF VOLCANIC BRECCIA

DIORITE

TUFF

Py

TUFF

CONTACT ZONE

VESICULAR BASALT

ANDESITE

From ?

QUARTZ & ARSENOPYRITE predominant mineralization

GLOSSARY OF TERMS

adit:
a horizontal opening into a hillside giving access to a mine.

agglomerate:
tuffaceous agglomerate is composed of rounded or sub-angular volcanic fragments contained in a fine-grained matrix. In this report, it is to be noted that the ore body is believed to occur in either a volcanic breccia or a tuffaceous agglomerate.

alluvial fan:
a fan-like formation resulting from the deltaic deposition of sand and gravel on stream outwash plains.

andesite:
a medium-dark colored (grey or green) lava composed of plagioclase feldspar and hornblende, biotite, etc.

basalt:
a dark-colored, fine-grained igneous rock; usually a lava. Vesicular basalt is formed by expanding gases creating pockets in cooling lava (esp. upper part of flow).

breccia:
a volcanic breccia is composed of coarse, angular fragments of volcanic rocks cemented together by a finer interstitial material. The fragments are formed by pyroclastic blow-off of volcanoes. Tectonic breccia is formed of rock fragments resulting from the crushing action of movements such as faulting.

bulk sampling:
choosing representative large samples for assay, (e.g. one ton samples). Channel sampling is a delicate method of obtaining a small but representative assay sample.

GLOSSARY OF TERMS
(cont.)

core drilling:
a method of rock drilling, usually diamond drilling, by which a cylindrical core of rock is recovered. The core represents substratum features.

diabase:
an igneous rock consisting mainly of feldspar and augite with no quartz.

diorite:
an intrusive igneous rock of granitoid texture consisting of plagioclase feldspar and horneblende.

epithermal (hydrothermal):
many mineral deposits are formed by the movement of magmatic fluids called hydrothermal solutions. An epithermal solution is a relatively low-temperature hydrothermal solution.

fractures and joints:
fractures are formed by shear, tensile and compressive stresses causing the rupture of rocks. Joints are essentially fracture planes which show no effects of movement parallel to the plane.

gold-placer deposit:
an accumulation of loose gold particles laid down in sand and gravel beds by the action of water. Because of its high specific gravity, gold placer is generally found at the bottom of gravel beds near bedrock (hence: "bedrock or pay-streaks").

metasomatic replacement:
the process by which hydrothermal solutions lose their mineral content by molecular replacement of the host rock which is subject to the intrussion.

over-burden:
refers to detrital material composed of rock debris and soil which covers the bed rock.

tuff:
the fine-grained fragmental material thrown out of volcanoes. Coarser material is volcanic breccia.