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View Looking East Across Ice Lake Basin Towards Silverton

GEOLOGIC REPORT
and
EXPLORATION PROPOSAL
on the
ICE LAKE PROJECT AREA
San Juan and San Miguel Cos., Colorado

by
the geologic staff
Vitro Minerals & Chemical Company
a division of Vitro Corporation of America

January, 1968

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I. SUMMARY

The Ice Lake project area is located in Ice Lake Basin, San Juan County, Colorado, about seven miles west of Silverton. Elevations range from 12,200 to 13,800 feet. The area lies above timberline and is characterized by long, harsh winters, and short, cool summers.

The project area lies in the western San Juan Mountains, a district which has produced over $330,000,000 mostly gold and silver ore since its discovery about 1870. Most of the ore produced has come from veins in fissures related to the Silverton Caldera or outlying intrusive centers. The richest and most continuous veins are found in the Tertiary San Juan Formation with lesser values being found in the veins where they cut the overlying Silverton and Potosi Volcanic Groups. Throughout the district there is a close spatial relationship between Tertiary intrusives and mineralization.

Vitro Corporation of America owns, or has options on, 14 patented and 19 unpatented claims in Ice Lake Basin. These claims cover a series of veins, the major ones being the Lucy-Last Hope, Diamond, and Columbus-Grand View. These steeply dipping veins are seen cutting the upper Silverton and lower Potosi Volcanic Groups, where they range up to 15 feet in width, and are mineralized along the entire known outcrop length of 5,000 feet. Surface channel samples assay as high as 2.530 ounces of gold and 13.00 ounces of silver per ton.

The presence of this high grade mineralization in the veins where they cut the upper Silverton Volcanic Group, plus the existence of ore grade mineralization in pre-Tertiary rocks at the Bandora Mine just south of the project area, logically suggests that mineralization will be present in the untested San Juan Formation beneath the project area. Experience in the Silverton Caldera Region strongly suggests that ore shoots in the San Juan Formation will be richer, wider, and more continuous than in the Silverton Volcanic Group.

The veins exposed on the Ice Lake project are similar or identical to other veins in the Silverton Caldera Region which have been outstanding producers of gold and silver ores. The points of similarity or identity are:

1. Length and strength of the fissure.
2. Mineralogy.
3. Age and stages of mineralization.
4. Proximity to late Tertiary intrusives.
5. Intensity of mineralization in the less favorable Silverton Volcanic Group.

6. Presence of favorable host rock (at depth).

7. Location within the Silverton Caldera Region.

It is concluded that the Lucy-Last Hope, Diamond, and Columbus-Grand View veins may contain "bonanza" types of gold-silver ores where the veins cut the San Juan Formation.

An exploration project consisting of eight diamond drill holes totalling 7,100 feet is recommended. These holes are oriented to cut the veins or their intersections within the highly favorable upper 300 feet of the San Juan Formation. Drills will be moved and serviced by helicopter. Camp facilities will be provided at Ice Lake Basin. All core will be logged by a Vitro geologist, split for assay, and stored for future use. Total project cost is estimated to be $167,666.10.

II. INTRODUCTION

Location and Accessibility

The patented and unpatented mining claims of concern in the "Ice Lake project" lie in the upper portion of Ice Lake Basin in Sections 13, 14, 23, and 24, T. 41 N., R. 9 W. and also Sec. 18, T. 41 N., R. 8 W., San Juan and San Miguel Counties, Colorado (See Figure 1). The center of the project area is 9 miles due south of Telluride, 3 miles southeast of Ophir, and 7 miles west of Silverton. The area lies within the San Juan and Uncompahgre National Forests, the Ice Lake Mining District, and the Ophir, Colorado 7½ minute topographic quadrangle (See Plate I).

The project area is accessible only by a pack trail leading west from the South Mineral Campground (U. S. Forest Service) at an elevation of 9,820 feet above sea level, and running into Ice Lake Basin at elevations of 12,200 to 12,800 feet. While access to the surface is difficult and has delayed exploration in the past, underground access for future exploration, development, and production will be relatively easy. Low-level tunnel sites with south or southwest exposures and /east room for mill sites and tailings disposal are available near South Mineral Creek to the southeast and Lake Fork Creek to the west. These sites would require about 7,000 feet of drifting to give access to the several veins in the project area.

Ice Lake Basin is a compound cirque enclosed on its north, west, and south sides by aretes and horns typical of areas of alpine glaciation. Ice Lake, Fuller Lake, and several smaller lakes within the basin are tarns. The area is extremely rugged with elevations rising abruptly from 12,585 feet at the surface of Fuller Lake to Golden Horn (13,761 feet), this being a horn on the western arete. Cliffs and steep talus slopes are common on the sides of the basin.

These altitudes place the entire basin above timberline at this latitude and the level areas of the basin are typical, flower-filled, alpine meadows.

No weather records are available for this area, but summers will be rather short (late-June to late-September), cool, and sparklingly clear with frequent afternoon showers. Winters are long and harsh with low temperatures and heavy snowfalls common. Even so, our information indicates that, while undoubtedly difficult, work in the basin is not always impossible in the winter because the Webster, Last Hope, Columbus, and Grand View claims were surveyed for patent in January, 1897, and according to the Silverton Standard, May 16, 1903, mining at the Emma Mine on the divide between Ice Lake Basin and Lower Ice Lake Basin was carried on throughout the winter of 1902-03. The weather station at Savage Basin, altitude 11,522 feet, about 14 miles northeast of this area, reports average annual snowfall of 400 inches (Bromfield, 1967).

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RAND McNALLY STATE COUNTY-CITY MAP

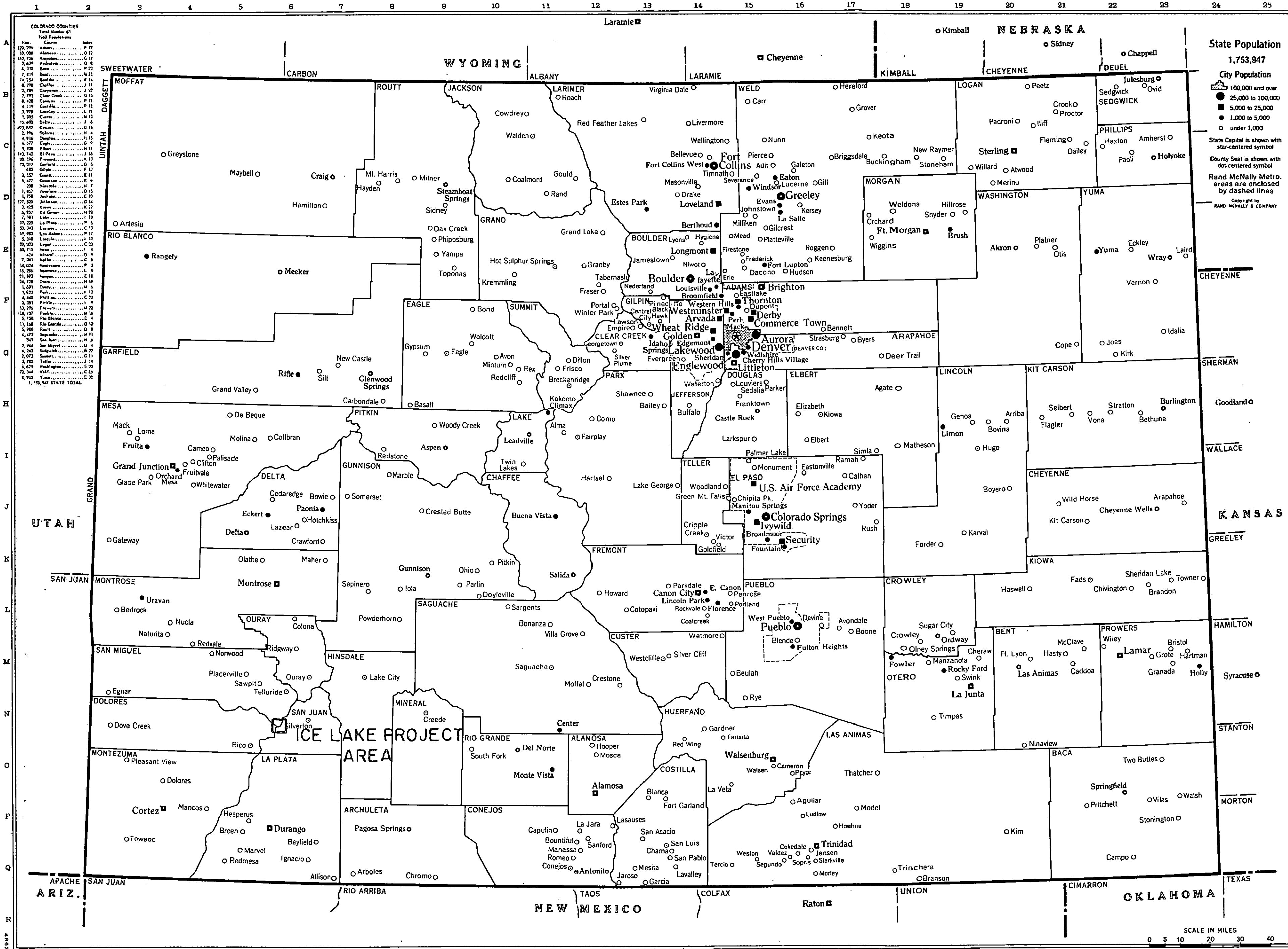

FIGURE I

This Map is also available with County Outlines only.

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COLORADO
SIZE 8½ x 11
4

COLORADO INDEX

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While the rigorous climate will restrict surface exploration work to the summer months, no problems are anticipated to hinder year-around production from the contemplated, low-altitude production adits.

Transportation, Labor, and Other Facilities

As mentioned above, Ice Lake Basin is accessible only by trail from South Mineral Campground. While an access road suitable for four-wheel drive vehicles could undoubtedly be built into Ice Lake Basin, it is felt that the cost would be extremely high and the road would be subject to rock and snowslides and, thus, of only limited usefulness. Furthermore, we understand that the U. S. Forest Service recently refused permission for another prospector to build a road into Lower Ice Lake Basin presumably in order to preserve the wilderness aspect of the area. A well-graded gravel road leads 4 miles from South Mineral Campground to a junction with U. S. Highway 550 about two miles northwest of Silverton, which connects with Ouray to the north (23 miles) and Durango to the south (51 miles). This road is paved and maintained throughout the year.

Silverton is the terminus of the narrow-gauge Denver & Rio Grande Western Railroad from Durango. This line is primarily a tourist attraction, and is operated only between June 1 and October 1. No freight is carried. Freight service is available at Durango on the standard gauge Denver & Rio Grande Western Railroad.

No, narrow gauge being discontinued

Silverton, the seat of San Juan County, with a population of 822, 1960 census, is the nearest community to the Ice Lake project area and can provide a small number of experienced miners. Small supplies, mainly foodstuffs, are also available here, but Durango, Denver, and Grand Junction are the closest centers for major equipment purchases.

A 44,000-volt power line owned by the Western Colorado Power Company runs from Durango to Silverton. In addition, two 17,000-volt power lines run to Silverton from Telluride (Vanderwilt, 1947).

Out of order and do believe down

Adequate and suitable water is available from the several tarns and streams within Ice Lake Basin for the subject exploration program. Sufficient water for future milling operations is available at either of the afore-mentioned mill sites.

History of the District

The Ice Lake Mining District was undoubtedly prospected during the period of discovery in the San Juan Mountains between 1870 and 1880. However, the first record we have of activity in the Basin area is from the early 1880's. From 1880 to 1895, production from the district was quite small and was mainly restricted to high-grade

gold and silver ores found on or close to the surface. In 1896, the Ice Lake (Callow) Mill was constructed about one-half mile above South Mineral Campground, initiating a period of greater mining activity in the area. This activity continued until 1916 when the Ice Lake Mill was closed. Although prospecting and minor production undoubtedly continued after that date, our only record is of $78,500 production in the years 1938-45 (Vanderwilt, 1947) when up to three mines produced ore. There has been no mining during the last 20 years.

No diamond drilling has ever been done in the Ice Lake Basin area. All exploration on the several veins has been done by means of shallow pits and shafts, and short adits. The longest of the adits is believed to be the upper tunnel on the Lucy claim which is said to be 600 feet in length, but all adits on the project property are now caved or filled with ice and not subject to detailed examination.

Ownership of the Project Claims

The Ice Lake project area is covered by a group of 14 patented and 19 unpatented claims with various owners, all of which are owned or optioned to Vitro Corporation of America (See Plate II). The details of ownership and lease conditions will be found in copies of the several leases attached in Appendix I. The titles of the patented claims have been searched and a legal opinion indicates that the title to the several patented claims appears to be established in the lessors.

Previous Investigations

No up-to-date small-scale geologic map has been published covering the Ice Lake Basin. However, Mr. Robert ~~S.~~ Luedke, U. S. Geological Survey, is presently engaged in mapping the Ophir Quadrangle for eventual publication at a scale of 1:24,000. Geologic maps at that scale have been recently issued for the Telluride Quadrangle (Burbank and Luedke, 1966) to the north, the Mount Wilson Quadrangle (Bromfield, 1967) to the west, and the Ironton (Burbank and Luedke, 1964) and Ouray (Luedke and Burbank, 1962) Quadrangles to the northeast. /G.

The literature on the geology and mineralogy of the San Juan Mountains is extremely voluminous, and while a complete bibliography of the literature is beyond the scope of this report, a number of publications were most helpful in the development of this project and have been credited throughout the report.

Several consulting engineers have written reports on the Ice Lake project, and those by J. M. Callow (Oct. 1, 1899), Julian Lee Hayes (Sept. 4, 1935), Mason W. Rankin (Nov. 8, 1949), and Oscar Reynolds (Jan. 20, 1959) have been studied.

Hayes, Rankin, and Reynolds all postulate the likelihood of bonanza-type precious metal occurrences in the upper portion of the San Juan Formation which was the most favorable host rock found in the highly productive mines of the Silverton area, and urge an exploration program similar to that proposed in this report. The Callow report recommends a test of the overlying Silverton Volcanic Group. All these references suggest an increase of grade and tonnage with depth. These reports have already been submitted to the U. S. Geological Survey for their review.

Vitro Corporation of America conducted a geologic mapping and geochemical sampling program in the Ice Lake area throughout the summer of 1967. Much of the geologic data presented herein, particularly the detailed geologic map (Plate III) is a direct result of that program. Geologic mapping was done by the conventional telescopic alidade-plane table method. Color air photos were used as an aid in determining structure and zones of alteration. Magnetic methods of geophysical exploration were used in tracing formational contacts. Assay data derived from samples taken along the veins were used in determining proposed drill hole locations.

III. GEOLOGY

Stratigraphy

All rocks exposed within the immediate Ice Lake project area are of Tertiary age, but from geologic work in surrounding areas, and our examination of pre-Tertiary exposures in the valley of South Mineral Creek, it is known that there is a thick, underlying section of pre-Tertiary sedimentary rocks.

Section partly wrong

Pre-Tertiary Section

The exposures of pre-Tertiary rocks closest to the Ice Lake project area are in the valley of South Mineral Creek and in the amphitheater above the Ice Lake Mill but below the level of Lower Ice Lake Basin. A thick sequence of red siltstones and sandstones can be seen above the Ice Lake Mill which are believed to be a part of the Upper Triassic Dolores Formation (Figure 2). Lying stratigraphically above the Dolores is the Upper Jurassic Entrada Sandstone. This formation was not recognized near the Ice Lake Mill, but was recognized in the valley of South Mineral Creek between the Bandora Mine and the South Mineral Campground where it has a thickness of about 20 feet.

Above the Ice Lake Mill, there are outcrops of a dark gray limestone, believed to be the Pony Express Limestone Member (Figure 3) of the Upper Jurassic Wanakah Formation. The Dakota Sandstone (Upper Cretaceous) is reported to occur at the Bandora Mine (Luedke, personal communication; King and Allsman, 1950).

Formations lying below the Dolores Formation and above the pre-Cambrian form a section about 5,000 feet thick (Bromfield, 1967) and are known to outcrop northeast of the Ophir Quadrangle in the Ironton Quadrangle (Burbank and Luedke, 1964) and Ouray Quadrangle (Luedke and Burbank, 1962). Vhay (1962) mapped and described an area which includes the northern edge of the Ophir Quadrangle and tabulated data on the pre-Tertiary formations in that area. From this published data, and our examinations, it is possible to construct a probable pre-Tertiary stratigraphic column for the Ice Lake Basin area, which is shown in Figure 4.

Tertiary Section (See Figure 5)

Telluride Conglomerate. -- Lying above the pre-Tertiary formations, and on a profound angular unconformity in this area, is the Oligocene (?) Telluride Conglomerate. The Telluride does not outcrop in Ice Lake Basin, but is known to form the base of the Tertiary section in all adjoining areas, and can be seen in a prominent outcrop in the amphitheater above the Ice Lake Mill. Here the flat-lying Telluride lies on an apparently flat surface cut on the Dolores Formation which

Cutler

San Juan Fm.

Telluride Cgl.

Cutler Fm (Permian & Penn.)

FIGURE 2 -- Red beds of Upper Triassic Dolores Formation unconformably overlain by Tertiary Telluride Conglomerate (above Ice Lake Mill).

Bleached sandstone & siltstone in Cutler

FIGURE 3 -- Pony Express Limestone Member (?) of Upper Jurassic Wanakah Formation unconformably overlain by Tertiary Telluride Conglomerate (above Ice Lake Mill).

PRE-TERTIARY SEDIMENTARY FORMATIONS

	Age	Formations	Thickness (feet)
MESOZOIC	Upper Cretaceous	Mancos shale	380+
		Dakota formation	193
	Upper Jurassic	Morrison formation: Brushy Basin member	278+
		Morrison formation: Salt Wash member	(?) Present
		Wanakah formation: Undivided upper section	110
		Wanakah formation: Pony Express limestone member	18-28
		Entrada sandstone	32-40
	Triassic	Dolores formation	300-320
PALEOZOIC	Permian	Cutler formation	500-2000 < Rico Fm.
	Pennsylvanian	Hermosa formation	1450
		Molas formation	40-60
	Mississippian	Leadville limestone	180-235
	Devonian	Ouray limestone	70
		Elbert formation	30-50
	Cambrian	Ignacio Quartzite	90
	Precambrian		

FIGURE 4

Tertiary sedimentary and volcanic formations

Age	Series and (or) formation	Members	Thickness (feet)	Character	
Upper or middle Tertiary	Potosi volcanic series	Andesite flow	40	Massive dark-gray flow; found only on Lookout Peak.	?
		Rhyolite flows	175–250	Massive light-gray flows.	Gilpin Peak Tuff
		Quartz latite flow and breccia	75–100	Red flows and breccia.	
		Rhyolite flows	250–300	Thick flows of glassy banded rhyolite.	
		Quartz latite flows	50–100	Gray quartz-latite flow with dark bands or hard balls of similar rock.	
		Quartz latite flows	300–350	Pinkish-gray massive flows with brown biotite phenocrysts.	
Miocene (Silverton volcanic series)	Burns latite	Pyroxene andesite flow and breccia	40	A few lens-shaped flows associated with breccia.	Henson Fm
		Latite flows	70–200	Dark-greenish and reddish-gray flows; massive flows in upper part, fissile-weathering flows in lower part of unit; typical Burns latite.	Burns Fm
		Latite breccia	0–150	Breccia and tuff, with volcanic conglomerate at base in places.	
	Eureka rhyolite	Breccia and tuff	250–400	Contains many rock types, but very little like underlying flows.	
		Latite flows	10–100	Reddish and greenish-gray flows, characterized by numerous flattened vesicles; typical Eureka rhyolite.	Eureka Tuff
		Andesite flows and breccia	0–25	Dark-gray vesicular flow overlain by a little breccia; may be equivalent to part of Picayune volcanic group farther east.	Picayune Fm
Miocene(?)	San Juan breccia	Breccia and tuff	1,200–2,100	200 ft of well-bedded tuff at base overlain by fairly massive beds of breccia and local lenses of tuff.	
		Andesite flow	0–20	Dark-green flow 450 ft above base of formation.	
Oligocene(?)	Telluride formation		300–400	Massive conglomerate composed mostly of Precambrian and Paleozoic rocks; bottom few feet characterized by immediately underlying rocks; top 15 ft is a pinkish-gray, coarse arkose.	

Oligocene(?) & Miocene

Oligocene

FIGURE 5 -- (Taken from Vhay, 1962).

dips 52° to the southwest. The Telluride is a gray to slightly reddish-gray, cobble conglomerate about 40 feet thick with the cobbles derived from all older formations, being mostly sandstone, granite, metamorphics, and limestone.

The thickness of the Telluride Conglomerate varies widely throughout the western San Juan Mountains, being up to 1,000 feet thick in the Mount Wilson Quadrangle to the west (Bromfield, 1967). Most of the variation in thickness is attributed to the origin of the formation which "is interpreted as a fanglomerate deposited as an apron of gravel and sand in an area marginal to a broad domelike uplift that formed in the San Juan region in Laramide time" (Bromfield, 1967). The dome apparently lay to the north and east of the Ice Lake area with the basin of deposition to the west.

Part of the variation in the thickness of the Telluride is due to a period of erosion which followed its deposition (Luedke and Burbank, 1962).

San Juan Formation. -- Overlying the Telluride Conglomerate is the San Juan Formation, the oldest volcanic unit in the western San Juan Mountains. The age of the San Juan Formation is somewhat uncertain because only fragmental plant fossils have been found in it and therefore its age is presently given only as middle and late Tertiary (Luedke and Burbank, 1963).

Excellent exposures of the San Juan Formation are found on the headwall of Lower Ice Lake Basin, where the total thickness of the formation is 1,100 to 1,200 feet. This thickness compares with 600 to 750 feet in the Mount Wilson Quadrangle (Bromfield, 1967) and more than 3,000 feet in the Ouray Quadrangle (Luedke and Burbank, 1962). Vhay (1962) states that the thickness of the San Juan Formation is about 1,250 feet at the north edge of the Ophir Quadrangle.

The San Juan Formation in the Ice Lake Basin area is rather uniformly composed of angular to sub-rounded volcanic fragments set in a tuffaceous matrix. Bedding is difficult to see except from a distance where indistinct bedding planes are apparent. The formation is purplish-gray in overall appearance, except where hydrothermally altered, but the breccia or agglomerate fragments display a great variety in color and composition. During our mapping, we referred to the San Juan Formation as a quartz latite tuff breccia. This is the designation given by Larsen and Cross (1956). Luedke and Burbank (1963) describe the formation as consisting predominantly of rhyodacitic tuff breccia. The San Juan Formation is separated from the overlying Silverton Volcanic Group by a period of erosion which has contributed to the variation in its thickness.

Silverton Volcanic Group. -- The Silverton Volcanic Group outcrops widely on the floor of Ice Lake Basin and the lower slopes of the bounding arete. In this area, the Silverton is about 700 feet thick. Larsen and Cross (1956) state that it reaches a thickness of

about 3,000 feet in the Silverton Quadrangle and thins to the west (toward Ice Lake Basin). Bromfield (1967) reports that exposures of the Silverton Volcanic Group on Lizard Head are 450 to 700 feet thick, but the upper part of the Group has been eroded in that area.

Geologists of the U. S. Geological Survey, in their published data on areas around Ice Lake Basin, have separated the Silverton Volcanic Group into a number of component formations ranging in composition from andesite to rhyolite. These divisions could not be determined during our mapping, and we describe the Group as a series of tuff breccias and agglomerates, varying in color from dark gray to reddish- or greenish-gray, and with considerable variation in composition, being generally a quartz latite.

The Silverton Volcanic Group is assigned an age of middle and late Tertiary (Luedke and Burbank, 1963).

Potosi Volcanic Group. -- Disconformably overlying the Silverton Volcanic Group (Figure 6) and outcropping only on the horns and arete around Ice Lake Basin, is the lower portion of the middle and late Tertiary Potosi Volcanic Group. The Potosi is about 1,100 feet thick in the South Telluride area (Vhay, 1962), but only the lowest 400 to 500 feet is found on the Ice Lake Basin arete. Here the Group consists of crudely banded, white to light gray, welded ash-flow tuff of rhyolitic or quartz latitic composition. The formation has been extensively altered and much pyrite has been introduced which gives the weathered outcrops a brilliant red coloration.

It is probable that all of the Potosi seen in the Ice Lake Basin area is a part of what has been called the Treasure Mountain rhyolite (See Larsen and Cross, 1956, page 71). Gilpin Peak by us.

Quaternary Formations

Pleistocene alpine glaciation formed the present land surface in Ice Lake Basin with its cirques, tarns, aretes, and horns, but no moraines were seen in the area. Were several

Recent talus is widespread in the Basin forming thick accumulations at the base of the arete. Rock glaciers which are present in many of the cirques in this part of the San Juan Mountains are not present in Ice Lake Basin. There is one.

Intrusive Rocks

Only one intrusive rock unit occurs within the Ice Lake project area. This is a dike which trends about N. 40° E. from the small tarn on the Diamond claim (referred to herein as "Diamond Lake") to the south edge of Ice Lake and from there over the ridge towards Island Lake. The dike averages about 50 feet thick, appears to be vertical,

FIGURE 6 -- Contact between Potosi Volcanic Group (above) and Silverton Volcanic Group (below) as seen in "notch" above Diamond Lake, Ice Lake Basin.

and consists of a rather dark greenish-gray rock containing corroded and altered inclusions of older rocks. Luedke (personal communication) identified this dike as dellenite. It is post-Silverton Volcanic Group in age.

Immediately south of Ice Lake Basin near the Big Three and Bandora Mines, is the large Grizzly Peak-Rolling Mountain stock. The stock was not investigated in detail and only its northern contact is shown on the regional geologic map (Plate I). Larsen and Cross (1956) describe the stock as being 5 miles long with a medium width of 3 miles and composed of a pinkish-gray, rather fine-grained quartz monzonite. It is known to intrude the Treasure Mountain rhyolite and thus must post-date the early Potosi Volcanic Group.

North of the Ice Lake project area, in the vicinity of Ophir, there are a number of intrusive masses, plugs, and dikes (Vhay, 1962). The largest mass, the Ophir Needles intrusive is dioritic in composition but contains several phases ranging to monzonite. There are several other smaller masses of diorite-monzonite, and a number of small plugs of quartz-feldspar porphyry. Cross and Purington (1899) show that the Ophir Needles intrusive occupies a rather large area south and southwest of the town of Ophir. This intrusive was not examined during our survey and is not shown on Plate I.

Structure

Silverton Caldera Area

Burbank (1941) presents an excellent summary of the complex structure of the Silverton Caldera Region and the following paragraphs are quoted directly from that report (pages 151-4):

> "The Silverton volcanic basin comprises two major structural provinces - (1) an interior down-faulted block, which may be further subdivided into a hub of tilted and moderately disturbed formations, and an enclosing ring of highly faulted rocks, and (2) an exterior province of relatively undisturbed but fissured rocks. Although structural studies of the interior block have only begun, the rocks of the hub or down-faulted core of the caldera are irregularly tilted and locally fissured and faulted; in contrast, the rocks of the marginal zone of ring faults are highly faulted, fractured, and more steeply tilted. The rocks exposed in the hub are mainly the Burns latite and pyroxene andesite of the Silverton volcanic series; those exposed in the ring-fault zone comprise a greater proportion of older formations, owing partly to their high structural position, and partly to erosion along the valleys that outline the caldera. This zone is characterized also by numerous small intrusive bodies, breccia pipes, and volcanic necks, which afford evidence of relatively intense

volcanic activity. Over a width ranging from several thousand feet to several miles the rocks have been highly altered by chemical action of fumarolic emanations and hot mineralizing waters. Both the rock alteration and the concentration of intrusive bodies suggest that at moderate depths below the surface the margin of the caldera is underlain by a more or less continuous ring of intrusive rock, the protuberances of which have forced their way up through the highly faulted and shattered volcanic formations. Another local but characteristic feature of this zone is the tendency for the rock formations on the inner part of the ring-fault zone to tilt outward whereas those along the outer part tilt inward, forming a circumferential sag or depression. This kind of structure appears to be more highly developed in wide marginal zones of particularly intense rock alteration.

"The exterior province of the Silverton basin surrounding the down-faulted block comprises relatively undisturbed formations, which are cut by numerous dikes and fissures of radial trend, and by a lesser number that are diagonal to the principal radial and concentric structure lines. In this province the basement rocks beneath the volcanic accumulations are exposed locally along some of the deeper valleys draining the mountains and continuously farther west at the border of the Colorado Plateau. Some of the volcanic formations thicken toward the center of the Silverton basin; others present in the interior are absent or unrecognizable in parts of the exterior province. These relations suggest that sinking of the basin through faulting was in part concurrent with eruptions of the lava flows, an inference that is strengthened by structural evidence along the faulted border between the two provinces.

"Within the outer province of the basin there are many larger outlying or exterior intrusive centers that perhaps lie along certain main structural trends or rifts of the region. These exterior centers of intrusion lie mostly to the northwest, west, and southwest of the basin. Some of them are connected with the main center by swarms of curved and straight fissures and dikes, along which many of the principal vein deposits of the region are found."

Burbank described at length the "Sneffels axis of sagging" which is a zone of strong northwesterly-trending fractures extending from the northwest margin of the caldera to the Stony Mountain intrusive (See Figure 7, this report). He refers to this feature as an "incipient graben" and classified the fractures of this axis as members of the radial fracture system. Similarly, Varnes (1963) described northwesterly-trending fractures in the South Silverton area as being radial.

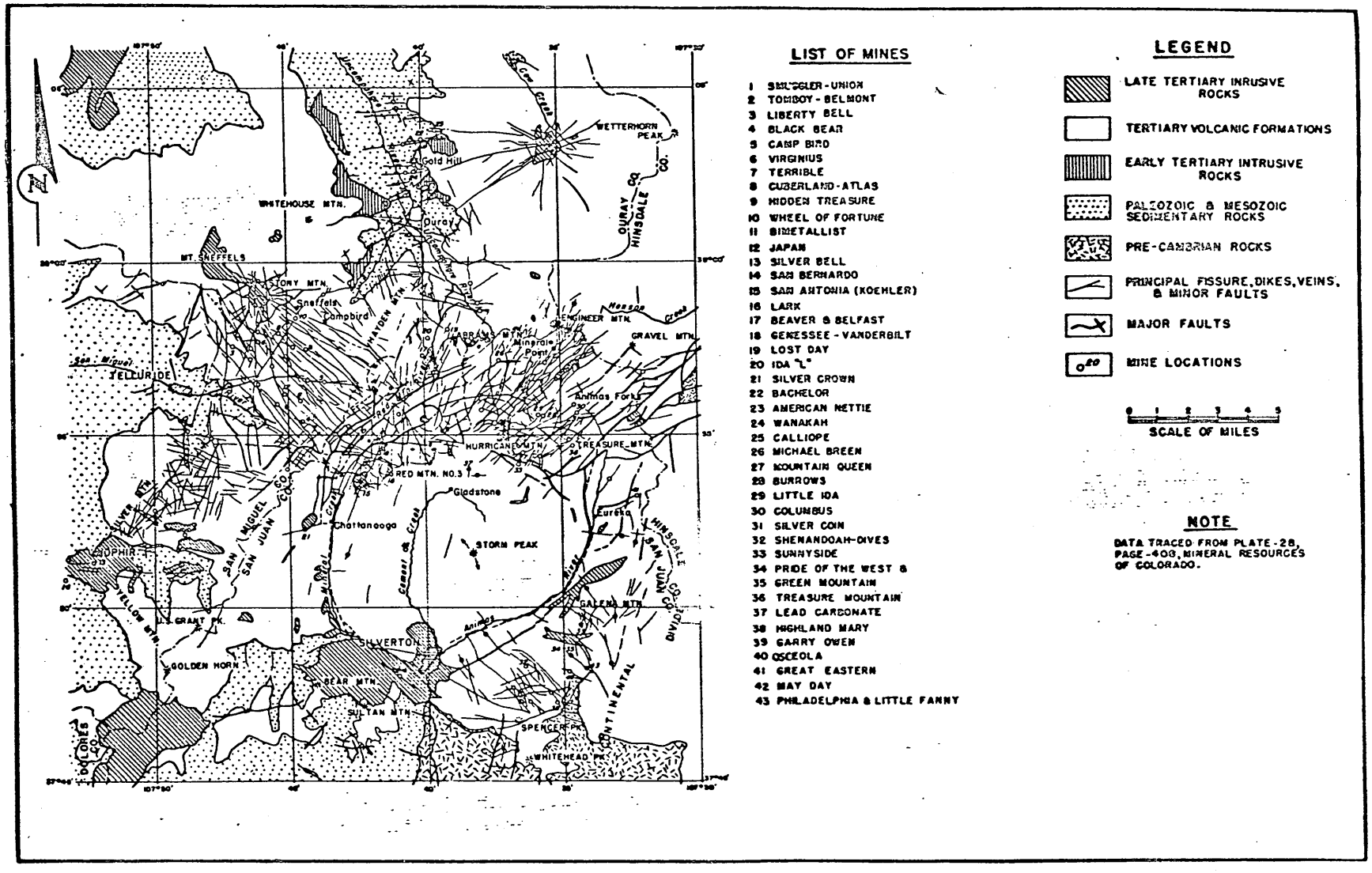


FIGURE 7 -- General geologic map showing location of mines in San Juan Region, Colorado (From King and Allsman, 1950).

Ice Lake Basin

The most important structural feature of Ice Lake Basin is the Lucy-Last Hope vein which is almost straight, striking N. 48° W. and dipping steeply to the southwest. No offset is apparent where the vein cuts the Silverton-Potosi contact, but slickensides on vein material suggest some movement.

The strike of the vein and its position relative to the caldera and the Grizzly Peak-Rolling Mountain intrusive lead to several possible interpretations of the structural relations.

1. It may be a member of the concentric or spiral fractures related to the Silverton Caldera; or,

2. It may be a fracture related to the Grizzly Peak-Rolling Mountain or Ophir Needles intrusives.

Regional studies, now in progress by the U. S. Geological Survey may give an answer to this problem.

The Lucy-Last Hope vein is known to extend from north of Pilot Knob to Fuller Lake, a distance of 5,000 feet (See Plate I). The vein has not been located southeast of Fuller Lake. The northwest extension of the vein beyond the Last Hope claim has not yet been explored, but an examination of the aerial photographs suggests that the vein joins another major northwesterly-trending structure which runs along the west base of Yellow Mountain. (Luedke, in a personal communication, has stated that the "major northwesterly-trending structure" along the base of Yellow Mountain may be the scarp at the head of a major landslide block reported by Cross and Purington (1899).)

Northwest-trending fractures do not appear to be common in the Ice Lake Basin area, judging from field and aerial photograph examination, but most of those observed (notably the Columbus-Grand View, Emma, and Golden Gate) are mineralized.

Northeast-trending fractures, however, are quite common and one of them is occupied by the dellenite dike, but only a few appear to be continuous for any great distance. Northeast-trending fractures appear to cause minor offsets in the Lucy-Last Hope vein and may therefore be younger than the northwest-trending set.

A north-trending fracture set is quite prominent throughout the area, but the fractures do not appear to be through-going or of major economic interest.

The relative spacing and intensity of fracturing suggests that the north- and northeast-trending fracture sets are related to the Grizzly Peak-Rolling Mountain intrusive. The northwest-trending set may be related to the Silverton Caldera or outlying intrusive centers.

The Tertiary rock formations in the Ice Lake Basin area appear horizontal, but geologic sections indicate a possible 1-2° dip to the south or southeast. This apparent dip may be due to changes in formation thickness or an accumulation of minor offsets on fractures, rather than a true dip.

As mentioned previously, the pre-Tertiary formations exposed around Ice Lake Basin dip to the southwest presumably as a result of Paleozoic uplift in the ancestral San Juan Mountains.

IV. MINERAL DEPOSITS

Silverton Caldera Region

History

Although precious metals were apparently discovered in the San Juan Mountains near the site of Lake City as early as 1848 (Irving and Bancroft, 1911), prospecting and mining in the San Juan Mountains did not begin until the early 1870's. From a modest beginning, the annual value of ore produced in the San Juan region increased rapidly to $11,000,000 in 1893 and a peak of $12,500,000 in 1907 (Henderson, 1926). Since that time there has been a decline and between 1938 and 1945, yearly output ranged between 4 and 6 million dollars (Burbank, in Vanderwilt, 1947, page 407). Later production figures are not available.

Total production of gold, silver, copper, lead and zinc from the western San Juan region (Silverton and Lake City volcanic centers) through 1945 is given by Burbank (in Vanderwilt, 1947, pages 404-5) as $332,762,832. Total ore production has been estimated (through 1945) to be about 24,500,000 tons containing 6,700,000 ounces of gold; 135,000,000 ounces of silver; 122,500,000 pounds of copper; 999,500,000 pounds of lead; and 262,000,000 pounds of zinc.

Major Mines

A major portion of the recorded production has come from a small number of very rich mines, some of which are listed below:

Mine	Approximate Gross Value of Production	Years	Source
Shenandoah-Dives	$29,330,000	1901-1957	Varnes, 1963
Silver Lake Mines	7,790,000	"	"
Pride of the West-Green Mountain	6,310,000	"	"
Iowa-Royal Tiger	5,010,000	"	"
Butterfly	±1,000,000	1877-1953	Bromfield, 1967
Yankee Girl-Guston	6,000,000	-1896	Burbank, 1932
Camp Bird	27,269,768 (Chiefly gold)	1896-1916	Henderson, 1926

Mine	Approximate Gross Value of Production	Years	Source
Virginius	$ 4,000,000	?	Burbank, 1932
Smuggler Union	26,000,000	1882-1923	Henderson, 1926
Tomboy	22,235,883	1899-1923	Henderson, 1926
Liberty Bell	16,171,089	1898-1921	King and Allsman, 1950
Montana	26,000,000	1912-1927	King and Allsman, 1950
Alta-St. Louis	4,000,000	1901-1957	Computed from Vhay, 1962
Sunnyside	50,000,000	1917-1938	King and Allsman, 1950

Ore Habits

Types of Ore Deposits. -- Ore minerals occur in several different geologic situations (pipes, disseminated, fissure veins, replacements) in the Silverton Caldera region, but, as far as we know, we are only concerned with fissure veins on the Ice Lake project and therefore only the ore habits of the Silverton Caldera region fissure veins will be stated for comparative purposes.

Mineralization occurred in the region in several stages during the latest Tertiary. The mineralization seems to be associated with centers of late Tertiary intrusion (Stony Mountain, Ophir, Rico, LaPlata) and occurs in fissures related to either the intrusive centers or the Silverton Caldera. Ore minerals were emplaced in all fissures which were open at the time of mineralization and therefore tension fractures are most likely to contain ore. Most ore deposits display the effects of several stages of mineralization.

Mineralogy. -- Burbank (in Vanderwilt, 1947, page 423) says: "The mineralogy of the ores is comparatively simple, a few of the common sulfides, pyrite, sphalerite, galena, and chalcopyrite forming the bulk of the veins in a gangue of quartz with some rhodonite, rhodochrosite, and calcite. Repetition of the common sulfides in several stages of vein formation is common. In general, base metal sulfides decrease in quantity in later vein stages, the final stages being nearly barren quartz or calcite. The gold-bearing quartz of the Camp Bird contains adularia and minor amounts of the common sulfides. It fills fissures alongside or breaking through the earlier more massive sulfide vein."

"In veins far to the northwest such as the Liberty Bell, very little sulphide was present in the ore. The silver was contained chiefly in argentiferous tetrahedrite, stephanite and argentite. Gold was a late mineral associated with quartz and carbonate."

Ore Controls. --

Host rock or wall rock appears to have had a great influence on mineralization. The San Juan is by far the most favorable of the Tertiary formations. The Silverton Volcanic Group is of lesser interest, and the Potosi Volcanic Group is best described as unfavorable for ore deposition. Several quotations will illustrate the opinion on this subject.

> "(The) San Juan tuff. . . is the host rock of a large number of the more highly productive vein deposits. . . The uniformity of fissuring in this formation is an important factor in the productivity of many veins. . . (The Silverton Volcanic Group) likewise have been highly productive, but with the exception of the stronger fissures and faults there is less continuity and regularity to the fissuring than in the San Juan Tuff. . . The Potosi rocks have not been very productive in the western part of the San Juan Mountains, and many of the vein fissures feather out or become unproductive in this series." (Burbank in Vanderwilt, 1947, page 420.)

> "Where the veins cross ridges capped by the Potosi rocks their position may be marked only by vague sheeting and alteration." (Burbank in Vanderwilt, 1947, pages 422-23.)

> "The most favorable places for deposition of vein minerals were at sites where strong, persistent fault zones cut massive, fairly resistant rock units. The important known hosts for ore deposits are the San Juan breccia, the Telluride formation, and the Cutler formation." (Vhay, 1962, page 293.)

> "The San Juan tuff is by far the most productive formation, the Potosi volcanic series essentially unproductive..." (Burbank, 1941, page 232.)

> "In the Telluride and Sneffels districts. . . the evidence is conclusive that the ores do not at any place extend far above the base of the Potosi volcanic series, and in some areas fail even to reach it." (Burbank, 1941, page 249.)

> "The upper terminations of the Camp Bird ore shoots are especially instructive in regard to possible factors controlling ore deposition below the base of the Potosi volcanic series. . . Along the vein for a total stretch

of 5,000 feet the shoots all terminate upward in remarkably accordant flat tops. . . just at the base of the (Silverton) volcanic group." (Burbank, 1941, pages 250-51.)

So it can be seen that while all authors agree that ore grade mineralization occasionally extends upward along the veins through the Silverton Volcanic Group, more often, low-grade mineralization in the Silverton is connected with higher-grade mineralization in the San Juan.

Burbank suggests that the Camp Bird ore shoots are found just below the Silverton-San Juan contact because a sudden release in pressure on the vein system at that point caused the rising metalliferous solutions to "boil" and precipitate the metal content.

Fracturing, either as fissures or breccia pipes, is the most obvious of the several ore controls in the Silverton Caldera Region, as ore minerals were emplaced in all fractures regardless of origin which had access to the ore solutions and which were open at the time of mineralization.

Mineralization occurred after the deposition of the Potosi Volcanic Group and following the intrusion of the numerous stocks and plugs which occur mostly to the northwest, west, and southwest of the Silverton Caldera, or within the ring-fault zone of the Caldera. Ore occurs in fractures related to the intrusions and in fractures generated by the sag of the crust into the emptying magma chamber, a theory recognized by numerous geologists.

Proximity to Late Tertiary intrusives, mentioned earlier, is considered by most authors, at least by inference, to be of importance, because the ore solutions are believed to be the last stage of differentiation of the magmas represented by the intrusives. Thus, ore deposits are clustered around the Stony Mountain and Ophir stocks, and veins are found in those intrusives plus the Grizzly Peak-Rolling Mountain intrusive (Big Three Mine) and the Wilson Peak stock (Silver Pick Mine).

Larsen and Cross (1956) in a discussion of the various intrusive bodies state (page 221), "Most of the mining camps of the western San Juan Mountains are situated near some of these bodies." In a number of other statements (pages 103, 109, 112, 181, 182, 210, etc.), they emphasize similar spatial relationships between mineralization and intrusive masses throughout the San Juan Mountains.

Ore Shoots. -- Many of the veins and ore shoots in the Silverton Caldera Region are remarkably continuous in length and depth. For example, the Smuggler-Union vein system in the Telluride district has been stoped nearly continuously (in the San Juan Formation) for about 9,000 feet along the strike and through a vertical range of about 2,500 feet.

King and Allsman (1950) describe the Sunnyside Mine: "Ore shoots within the veins are nearly vertical and average about 20 feet in width." "At its greatest developed length, the Washington ore shoot is slightly less than 1,000 feet long, and the longest ore shoot, No Name, is 1,500 feet. The vertical range of the Washington ore shoot was about 1,400 feet. . ."

"The Montana vein has been developed on the Pennsylvania level for a distance exceeding 4,000 feet, and on some of the upper levels it has been stoped for a length greater than 6,000 feet." (King and Allsman, 1950, page 15).

Value of Ore. -- The total production figures for the western San Juan region given earlier in this report indicate that the average grade of ore mined (through 1945) was: 0.27 oz. gold, 5.5 oz. silver, 0.25% copper, 2.04% lead, and 0.53% zinc for a gross value per ton at today's prices (American Metal Market, Dec. 1, 1967) of $29.92. This figure takes into account a great deal of relatively low-grade ore produced during later years of operation and from lower mine levels, and of course "bonanza" ore was produced from many mines in the early years of production. For example, from 1885 to 1890, the Union claim (part of the Smuggler-Union) produced 1,927 tons of ore containing 15,724 ounces of gold and 334,334 ounces of silver (Henderson, 1926) for an average value (today's prices) of $632.59 per ton. In 1887, the Sheridan claim produced 1,026 tons of ore with a present value of $640.00 per ton.

The grade of ore taken from the upper 500 feet of stopes in the Camp Bird Mine is given (King and Allsman, 1950, page 26) as 1.4 ounces gold and about 2 ounces silver per ton with a present value of $53.00 per ton. The grade of ore in the lower levels (6th to 14th) of the Camp Bird Mine was about 0.13 ounces gold, 4.5 ounces silver, 2.2% lead, and 2.4% zinc (present gross value: $26.43/ton). Ransome (1901, page 202) reported that the material removed in running the main drift at the Camp Bird, waste included, ran in places about $1,600 per linear foot.

Ice Lake Basin

Major Veins

The Lucy-Last Hope, Diamond, and Columbus-Grand View are the major veins exposed on the property included in the Ice Lake project and are the objects of this exploration proposal. In addition, a number of small mineralized fractures have been found on the property, particularly in the area south and southeast of Fuller Lake, but they are considered to be of minor importance in the first stages of exploration.

Lucy-Last Hope Vein. -- The Lucy-Last Hope vein is known to extend 5,000 feet from Fuller Lake to the center of the Last Hope claim (Figure 8) and is reported (Mason W. Rankin, private report) to continue northwestward onto the Utopia claim for a total length of about 7,000 feet. The northwestward extension of the vein has not yet been explored; and though its extension to the southeast of Fuller Lake has not been identified, a number of small, mineralized fractures have been found south and southeast of Fuller Lake, suggesting that the vein splits or "horsetails" underneath the lake.

Where observed, the vein has a uniform N. 48° W. strike. The dip on the vein varies somewhat, being about 70° to the southwest in its highest exposures, and nearly vertical in its lowest exposures. The vein is seen cutting only the upper and middle portions of the Silverton Volcanic Group except where it cuts across the ridge extending northeast from Pilot Knob. At this point, the vein (best described as a sheeted zone) cuts the lower-most portion of the Potosi Volcanic Group for a length of several hundred feet.

The vein has been prospected (1880-1920) along its entire exposed length, but the mine workings consist only of several adits on the Last Hope and Lucy claims. One of the adits on the Lucy claim is reported to have been 600 feet in length (all in the upper Silverton Volcanic Group). Most of these workings are completely caved, but it was possible to sample the vein in two places. A five-foot channel sample cut across the back of a partially-caved adit on the Last Hope claim (Figure 9) assayed 1.215 ounces of gold and 9.45 ounces of silver per ton. A six-foot channel cut across the exposure of the vein in the notch northwest of Diamond Lake (Figure 10) assayed 2.530 ounces of gold and 13.00 ounces of silver per ton. At this latter point the vein has split into three segments and the total width across the vein segments is 15 feet. The assay sample reported above was cut in a shallow pit sunk in the central vein segment. Other samples were taken from prospect and adit dumps along the vein. Complete sample location and assay information is given on Plate IV. Assay certificates are contained in Appendix II.

Diamond Vein. -- No exposures of the Diamond vein were available for sampling. However, a grab sample of vein material was taken from ore which had been mined, sacked, and left on the dump of the Diamond adit. This sample assayed 0.093 ounces of gold, and 52.54 ounces of silver per ton, and while it obviously is selected material, it does establish the occurrence of ore minerals in the Diamond vein.

The Diamond vein strikes N. 40° E. and appears to be nearly vertical. The vein has been rather extensively prospected between its intersections with the Columbus-Grand View and Lucy-Last Hope veins. but its extensions beyond these intersections to the southwest and northeast have been prospected by only a few shallow pits. Assays of samples collected along the northeast extension of the Diamond vein during our mapping program do not indicate any appreciable metal content. The northeast extension of the vein is occupied by the dellenite dike

vein

FIGURE 8 -- Looking southeast down the Lucy-Last Hope vein from a point on the Last Hope claim.

FIGURE 9 -- Lucy-Last Hope vein (5') as seen in partially-caved Last Hope adit. Snow fills bottom of adit.

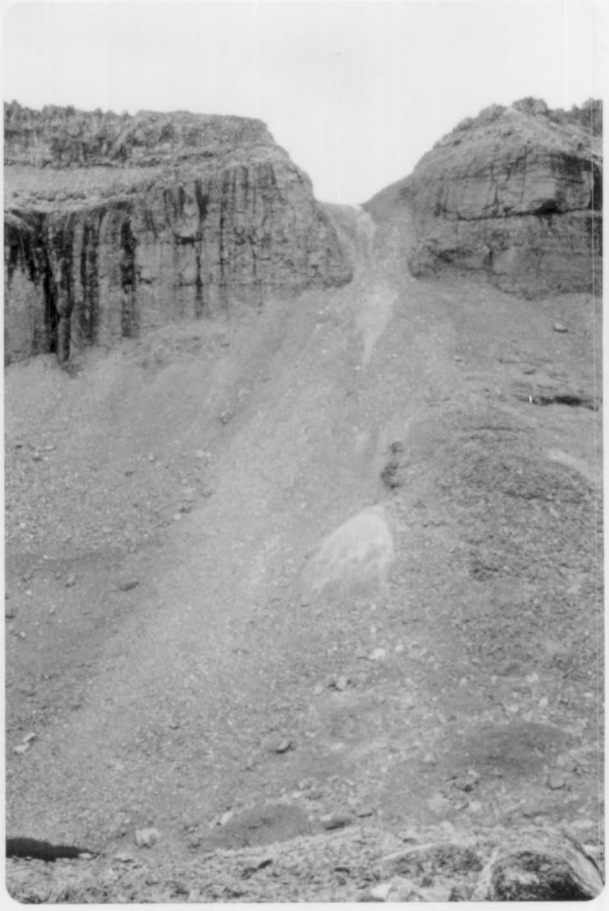


FIGURE 10 -- Notch above Diamond Lake (lower left corner of photo) along the Lucy-Last Hope vein. Major dump in center is from the caved upper Lucy level.

which is mostly fresh, unaltered, and unmineralized, indicating that mineralization in the vein alongside the dike was very weak.

The presence of good mineralization in the segment of the Diamond vein between the Lucy-Last Hope and Columbus-Grand View veins, and not in other segments, may indicate that mineralizing solutions came up the Lucy-Last Hope and Columbus-Grand View and were afforded easy passage only through the interconnecting portion of the Diamond vein.

Columbus-Grand View Vein. -- The Columbus-Grand View vein strikes N. 15° W. and is vertical. The average width of the vein, which cuts the upper Silverton Volcanic Group, is unknown, but a five-foot channel sample was cut across the vein in the Grand View adit near the portal. This sample assayed 0.245 ounces of gold and 1.88 ounces of silver per ton.

Through the courtesy of Federal Resources Corporation, we were allowed to examine and sample the Camp Bird vein in its outcrop above mined-out stopes. Three chip samples were taken from the Camp Bird vein where it cuts the middle portion of the Silverton Volcanic Group. The vein at this point is 4 to 5 feet in width and consists of vuggy vein quartz. The three samples assayed as follows:

Ag. oz/ton	Au. oz/ton
0.15	0.013
0.10	none detected
0.65	none detected

While we admit that no firm conclusions can be drawn, these low assays from the Camp Bird vein compared to assays of samples taken from the Lucy-Last Hope and Columbus-Grand View veins in a similar stratigraphic position, strongly suggest that mineralization in the latter veins within the favorable San Juan Formation should be as good as or better than that found in the Camp Bird mine.

Mineralogy

Samples of vein material from six locations (See Plate IV) on the Ice Lake project were sent to Mr. J. Kent Perry of Hazen Research, Inc., Golden, Colorado, for identification of the ore minerals and a study of the paragenesis of the ore. This study has shown the presence in the several veins of quartz, carbonates, pyrite, chalcopyrite, galena, sphalerite, native gold, tetrahedrite (var. freiburgite), native silver, and covellite in that age sequence from early to late. There are some local reversals in this sequence. (Mr. Perry's complete report, including photographs of polished sections, is in Appendix III).

Only minor free gold was seen in the ore study of Mr. Perry, but it is reported that early production from the veins in the area contained much free gold.

Rhodochrosite stained with manganese oxide was seen on the dumps of both the Lucy and Last Hope adits. It appears to be later than the chalcopyrite and sphalerite, brecciated fragments of which lie within the rhodochrosite. Most of the veins contain a late stage of barren quartz filling voids.

The mineral content, and evidence of several stages of mineralization, in the Ice Lake project area, are therefore similar in all respects to mineralization found elsewhere in the Silverton Caldera region.

Alteration

A number of rock samples were collected throughout Ice Lake Basin during the field study for geochemical assay and thin-section analysis. This work was designed to show trace element distribution and rock alteration characteristics and thus point to possible centers or "hot spots" of mineralization. The thin-section analysis, not yet complete, is being done by Dr. James Whelan, petrology professor at the University of Utah.

The available data show that the Potosi Volcanic Group has undergone rather uniform, widespread, sericitization and pyritization. This is obvious from the bleached and iron-stained Potosi outcrops on the western arete. Similar alteration and pyritization of the Potosi with weak or no ore mineralization is widespread throughout the Silverton Caldera region and appears to be related to the unfavorable nature of the Potosi as a host rock. It is believed that since the Potosi is a less competent formation than the San Juan or Silverton, fractures tend to split or horsetail as they pass upward into it. Also, since the Potosi is more permeable, the mineralizing solutions tend to pass out into the bulk of the formation rather than be confined only to the fractures. Thus, alteration is more widespread, and the sulphide minerals were widely disseminated in uneconomic quantities.

Pyrite is also widely distributed in the Silverton Volcanic Group close to known veins. This is most obvious in the area to the south of Fuller Lake where the main Lucy-Last Hope vein loses its identity by horsetailing (Figure 11).

Geochemical Survey

Samples of mineralized material collected during our field study of the Ice Lake project were analyzed for gold, silver, copper, lead, zinc, manganese, mercury, arsenic, and tellurium. A complete tabulation of these assays and the sample locations are given on Plate IV.

All rock samples submitted for petrographic study were analyzed for mercury, arsenic, copper, silver, and gold. These assays are also tabulated on Plate IV.

The assay data show that gold and silver occur along the entire explored length of the Lucy-Last Hope, Diamond, and Columbus-Grand View

FIGURE 11 -- View looking southeast along Lucy-Last Hope vein from notch above Diamond Lake. Fuller Lake in background. Vein appears to "horsetail" on slope beyond Fuller Lake. Intersection of Lucy-Last Hope and Diamond veins near center of picture beneath Diamond Lake.

veins. Copper content of vein material is generally low. Lead and zinc occur in variable amounts, probably reflecting the fact that samples were taken from different portions of the vein and therefore represent different stages of mineralization. In the Silverton Caldera region, lead, zinc, and copper occur in quantity in lower mine levels, below the bonanza-type gold-silver ores.

Among the trace elements which were determined, mercury appears to be the best indicator of mineralization. Mercury in above-background amounts occurs in all samples of vein material. There appears to be little or no dispersion of mercury away from the veins.

Geophysical Investigations

An induced polarization survey of the Lucy-Last Hope vein was considered during our geologic program in order to locate concentrations of metallic sulphides along the vein. However, while the vein can be traced with almost complete certainty through the project area, there are certain zones covered by blocky talus making it impossible to establish the electrode contact with bedrock necessary for the IP survey. This idea was therefore abandoned.

An attempt was made using an Askania GFZ magnetometer to trace the several veins where covered. This work was based on the assumption that alteration of the volcanic rocks along the veins would have destroyed the magnetic minerals originally in the rocks and thus show the veins as elongate, magnetic "lows." A number of traverses were run across known or buried portions of the veins without success. No consistent, recognizable pattern was detected in the magnetometer readings.

The magnetometer was used to accurately locate covered portions of the dellenite dike near Ice Lake (a sharp magnetic "high") and one traverse was run across the Silverton-San Juan contact. (While this single traverse is inadequate to support a firm statement, it indicates the San Juan Formation may have a slightly lower magnetic background than the basal Silverton).

Relationships Between the Silverton Caldera Region and Ice Lake Basin

With the preceding discussion in mind, it is possible to compare and relate the veins in the Ice Lake project area, with the vein deposits in the rest of the Silverton Caldera region.

1. The Lucy-Last Hope, and subsidiary Diamond and Columbus-Grand View veins, represent a long, continuous, major fracture system. This is the type of fracture most favorable for major ore bodies as found in other parts of the Silverton Caldera region.

2. Vein mineralization in the Ice Lake project area is paragenetically analagous to other major ore deposits in the region.

3. The Ice Lake project veins are in close proximity to both the Grizzly Peak-Rolling Mountain and Ophir Needles intrusives. This is important since the late Tertiary intrusives in the region are considered to be sources of the mineralizing solutions.

4. The Ice Lake project veins were obviously open at the time of mineralization, a fundamental prerequisite, as demonstrated in the productive veins in other parts of this region.

5. The Ice Lake project veins are moderately strong in the Silverton Volcanic Group, but deteriorate into sheeted zones in the overlying Potosi Volcanic Group. This description matches those given in the literature for most of the veins in the region which had major ore production.

6. Mineralization in the Ice Lake project veins in the Silverton Volcanic Group is better than that found in other veins in the region which had major production from the San Juan Formation.

7. The exact structural relationships between the Ice Lake project veins and the Silverton Caldera or its outlying intrusive centers is uncertain, but our study indicates that ore formed in fractures of diverse origins if they were open and had access to the ore solutions at the time or times of mineralization.

8. The highly favorable San Juan Formation is known to underlie the Ice Lake project area.

9. The occurrence of ore in pre-Tertiary rocks at the Bandora Mine lends support to the postulation that mineralization can be expected in the San Juan Formation below the Ice Lake project area.

The richest and most continuous ore bodies in the region are almost invariably found within the San Juan Formation. Weak mineralization in higher formations has generally been indicative of stronger mineralization in the San Juan.

It is our belief that the strong, continuous well-mineralized veins that are seen cutting the relatively unfavorable upper Silverton Volcanic Group in the Ice Lake project area, reflect strong, continuous, intensely-mineralized veins at depth where they are bounded by the highly-favorable San Juan Formation.

The history of the region has shown that ore mineralization is likely to be most intense where the vein cuts the upper 300 feet of the

San Juan Formation directly below the Silverton Volcanic Group. An exploration program is proposed to test the several veins, and their intersections within this 300-foot zone of high favorability.

(It should be noted that Vhay (1962, page 294) proposes a very similar exploration program in the upper end of Bridal Veil Basin on the basis of data and postulations almost identical to those presented herein).

V. CONCLUSIONS

A study of the geologic literature on the ore deposits of the western San Juan Mountains leads to several conclusions on ore habits of this area which can be stated briefly.

1. Ore mineralization is related to centers of late Tertiary intrusion.

2. Ore minerals are found in fissures related to these intrusives or to the Silverton Caldera.

3. Long, continuous fractures are favored.

4. Ore shoots are generally richer and larger in all dimensions where the vein is bounded by the San Juan Formation.

5. Mineralization generally decreases in grade in higher formations.

Field study of the Lucy-Last Hope vein system in Ice Lake Basin shows:

1. The area lies close to the large Ophir Needles and Grizzly Peak-Rolling Mountain intrusives.

2. While the exact origin of the fissures is not known, ore mineralization of the western San Juan type does occur within them.

3. One fracture is known to extend for at least 5,000 feet.

4. The highly favorable San Juan Formation is known to underlie the area.

5. Mineralization of excellent grade is found in many places along the vein system in the higher formations (Silverton and Potosi Volcanic Groups).

Therefore, we conclude that the Lucy-Last Hope vein system has an excellent chance of containing rich ore shoots where the vein is bounded by the San Juan Formation.

VI. RECOMMENDATIONS

We recommend a drill hole program designed to intersect the Lucy-Last Hope, Diamond, and Columbus-Grand View veins within the upper part of the San Juan Formation.

The program would consist of eight diamond drill holes to be drilled at intervals along these veins, or into the intersections of these veins. These eight holes should adequately test the veins in the San Juan Formation, and if successful in locating ore, could lead to the establishment of a profitable mining operation.

The details and costs of this recommended drilling program are set forth in following sections of this report. The recommended program is estimated to cost $167,666.10.

VII. PROPOSED EXPLORATION

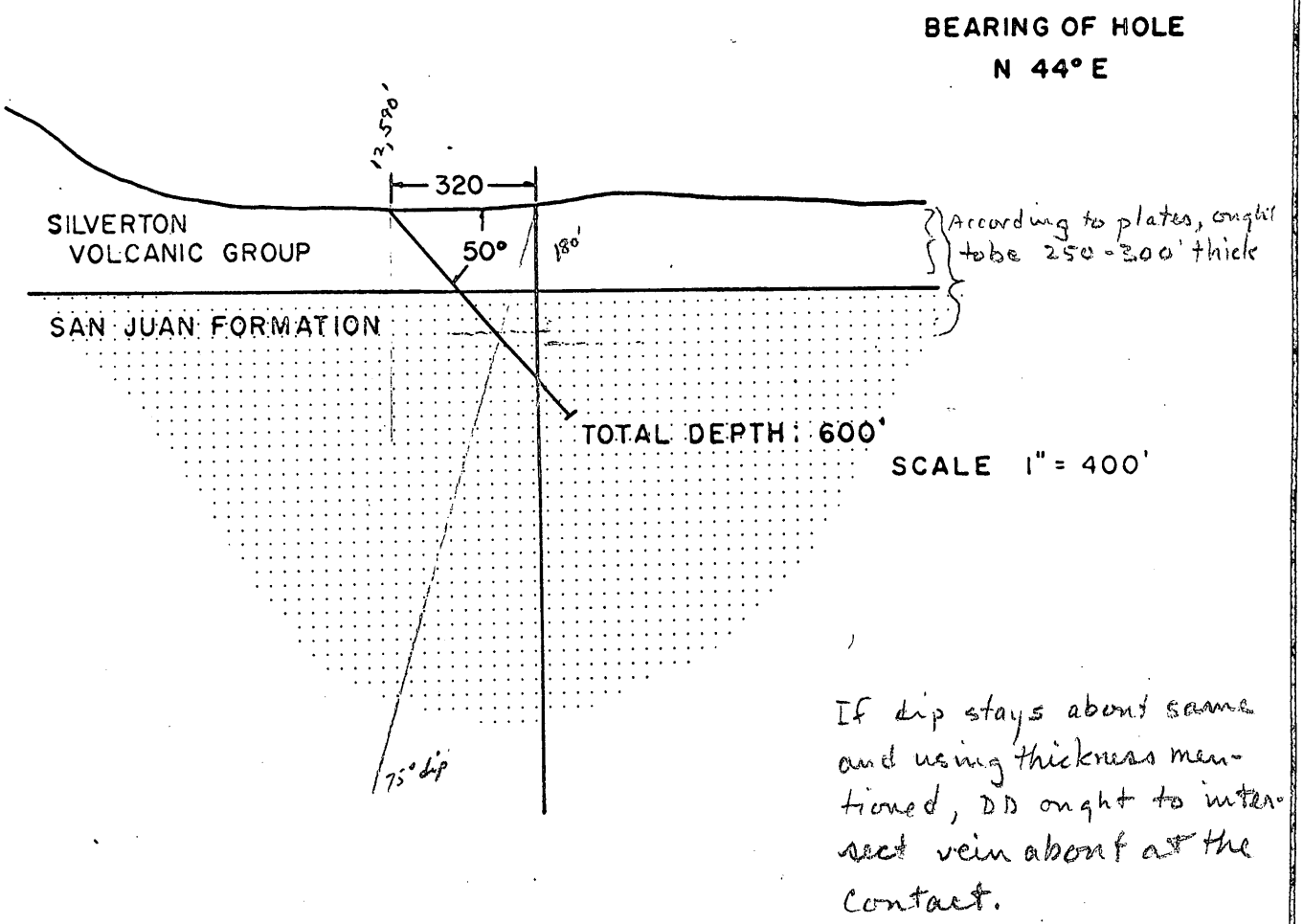
General

During this first stage of exploration, we propose to drill eight diamond drill holes designed to intersect the Lucy-Last Hope, Diamond, and Columbus-Grand View veins where they cut the upper 300 feet of the favorable San Juan Formation. The collar locations of these proposed holes are shown on Plate V and cross-sections of the holes showing approximate inclination and bearing and estimated total depth are given in Figures 12 through 19. In summary, the holes are as follows:

Hole No.	Approximate Bearing	Approximate Inclination	Estimated Total Depth
1	N 44° E	50°	600'
2	S 74° W	50°	1,100
3	N 75° E	55°	1,000
4	S 48° E	50°	800
5	S 82° E	50°	900
6	N 45° E	50°	700
7	N 46° E	60°	900
8	S 53° W	60°	1,100
		TOTAL FOOTAGE	7,100'

Method of Exploration

All holes will be drilled with wireline diamond core drilling equipment provided by a competent, independent contractor. To this end, bids for the drilling were solicited from three drilling companies (See Appendix IV). All holes will be drilled so as to set casing in bedrock, from which point BX wireline core will be recovered to the end of the hole. It is recognized that difficulties encountered in the drilling may require that at some point the core size be reduced. It is proposed that the completed drill holes be left in such condition that they can be easily recovered, and therefore some casing may be left in the holes. Casing from the surface to bedrock will be left in all holes.



If dip stays about same and using thickness mentioned, DD ought to intersect vein about at the contact.

FIG. 12

DIAMOND DRILL HOLE NO. 1

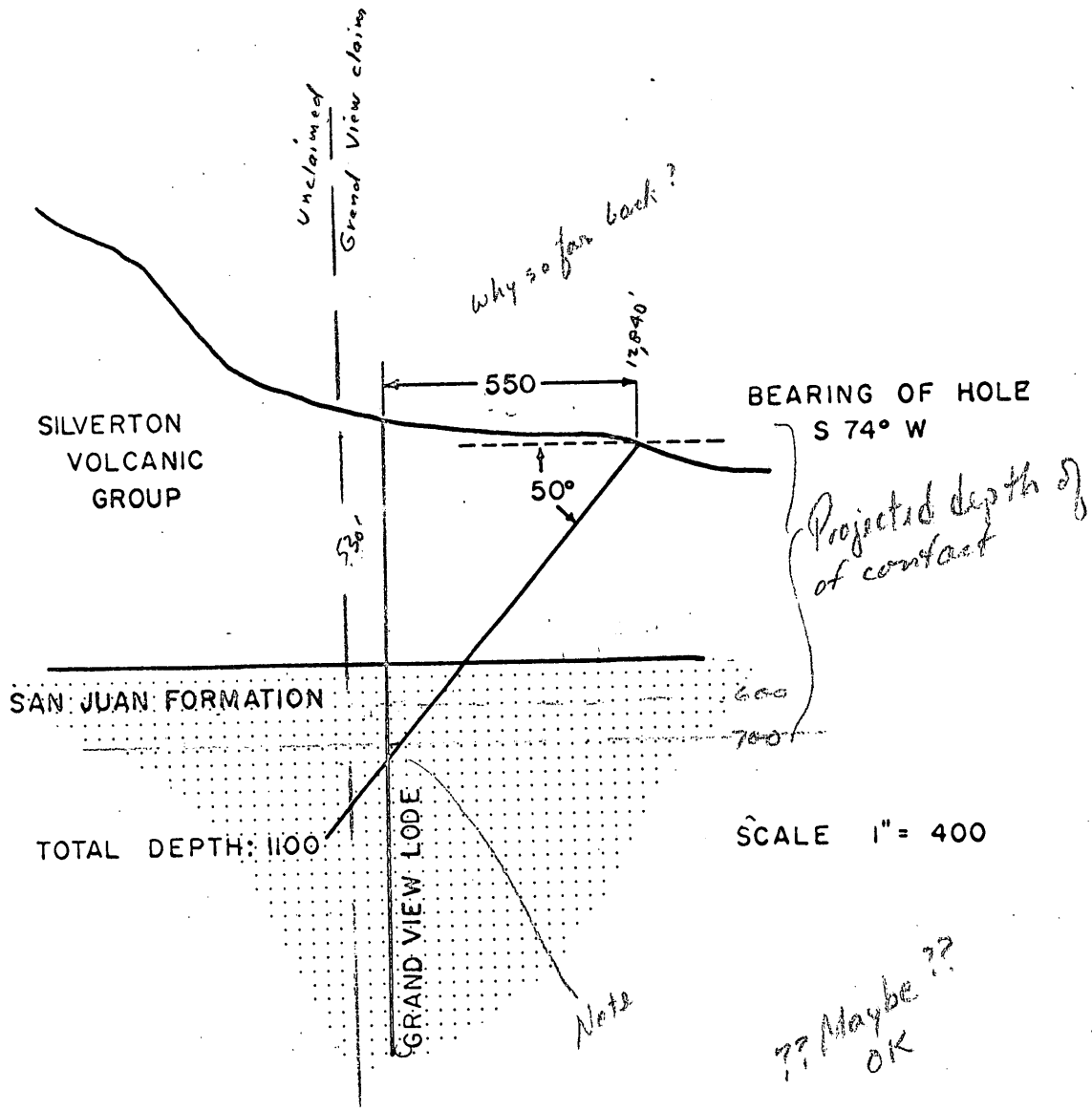


FIG. 13

DIAMOND DRILL HOLE NO. 2

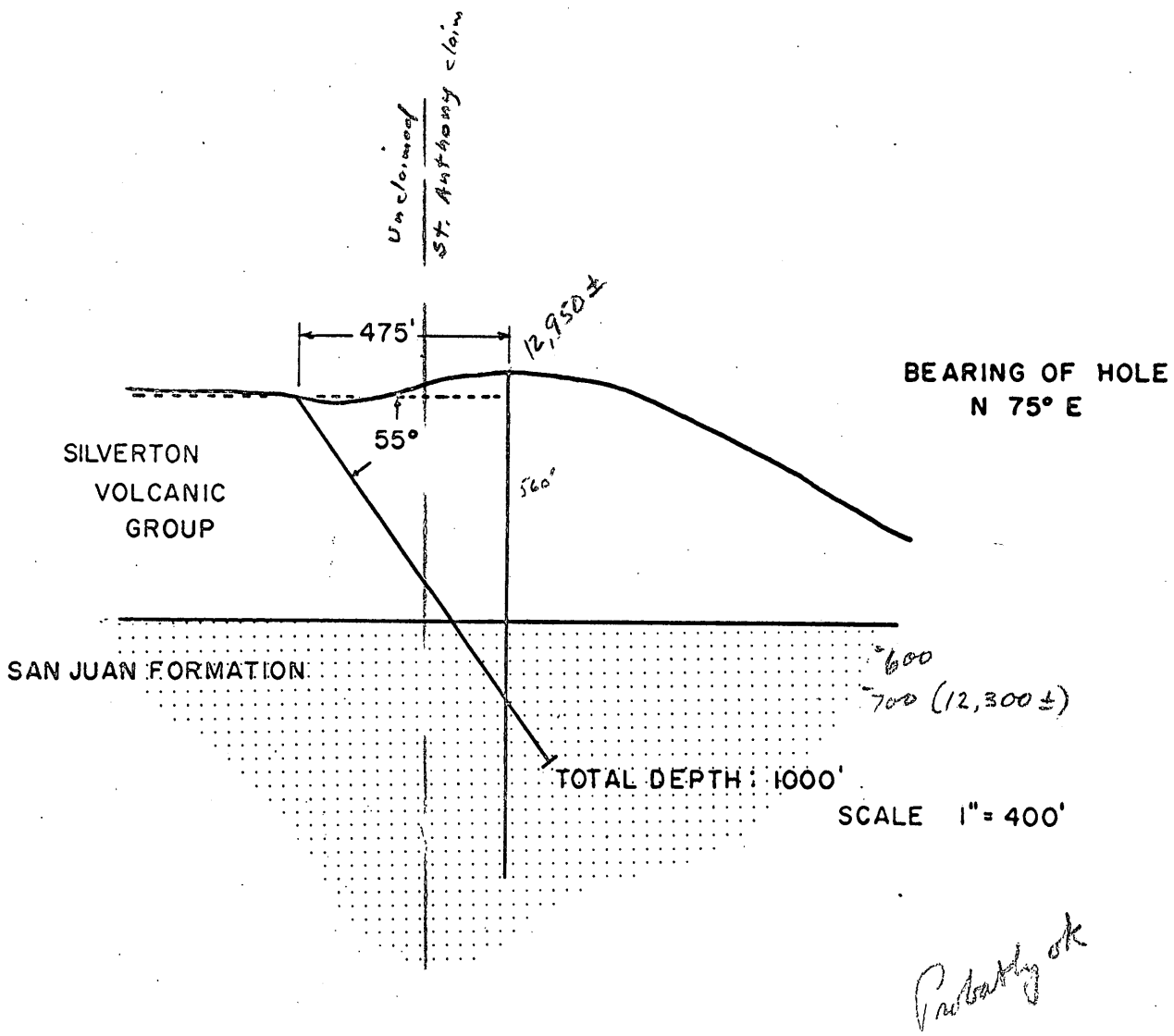


FIG. 14

DIAMOND DRILL HOLE NO. 3

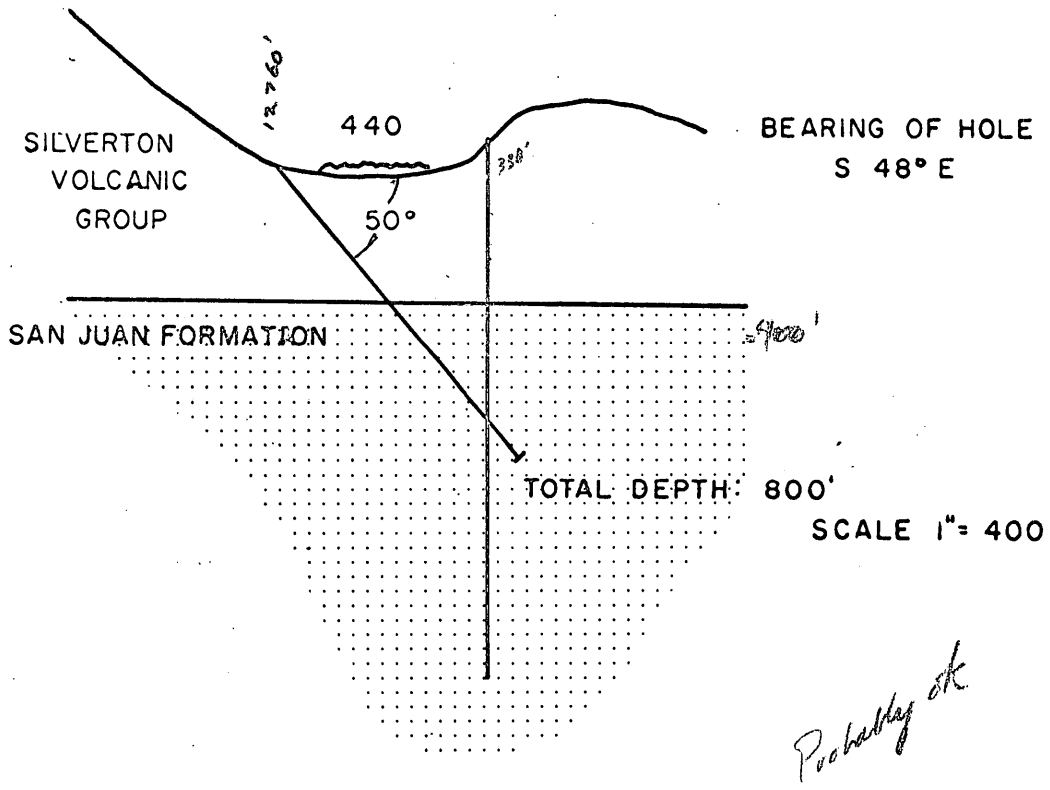


FIG. 15

DIAMOND DRILL HOLE NO. 4

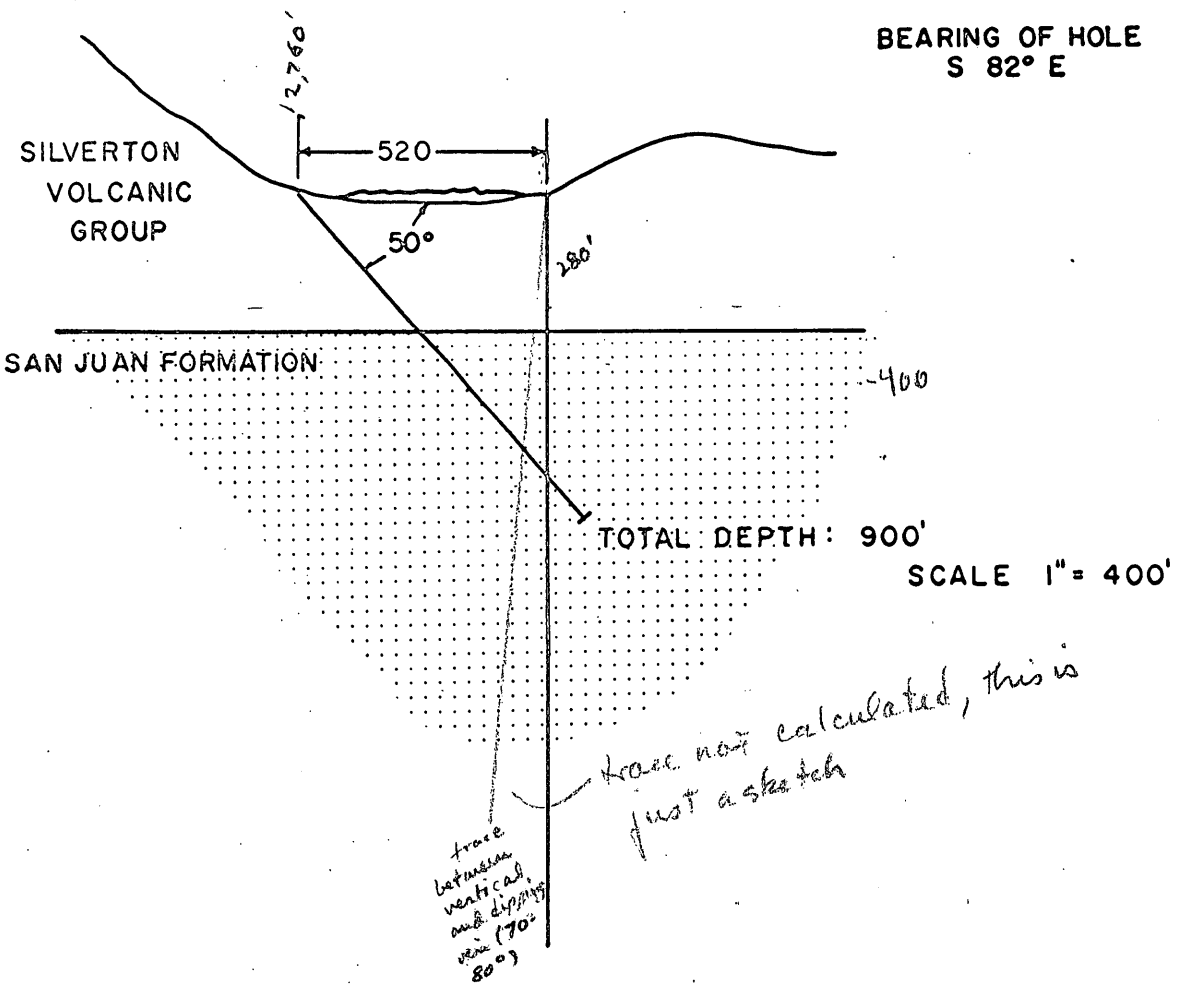
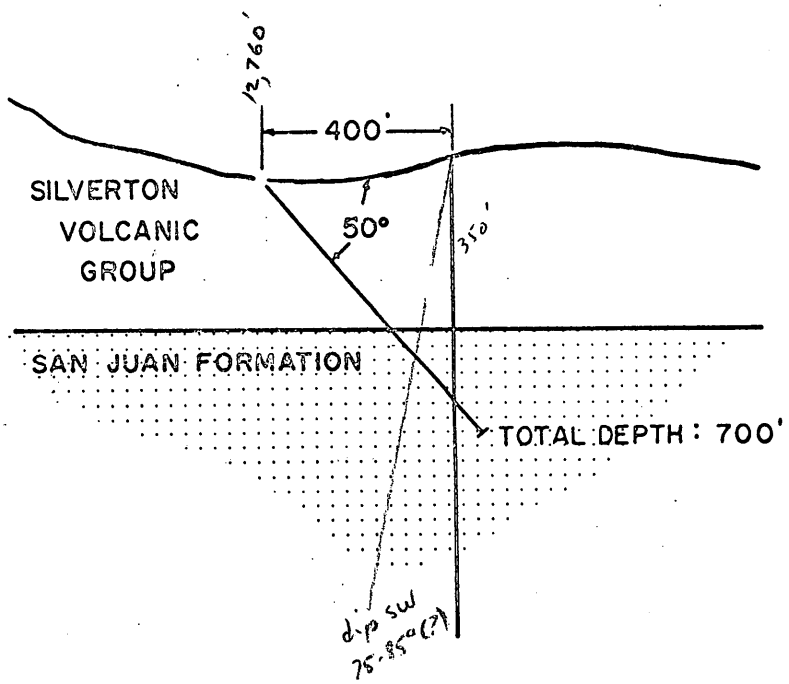


FIG. 16

DIAMOND DRILL HOLE NO. 5



BEARING OF HOLE
N 45° E

SCALE 1" = 400

Probably ok, but not intersection with dip and the extra length of hole.

FIG. 17

DIAMOND DRILL HOLE NO. 6

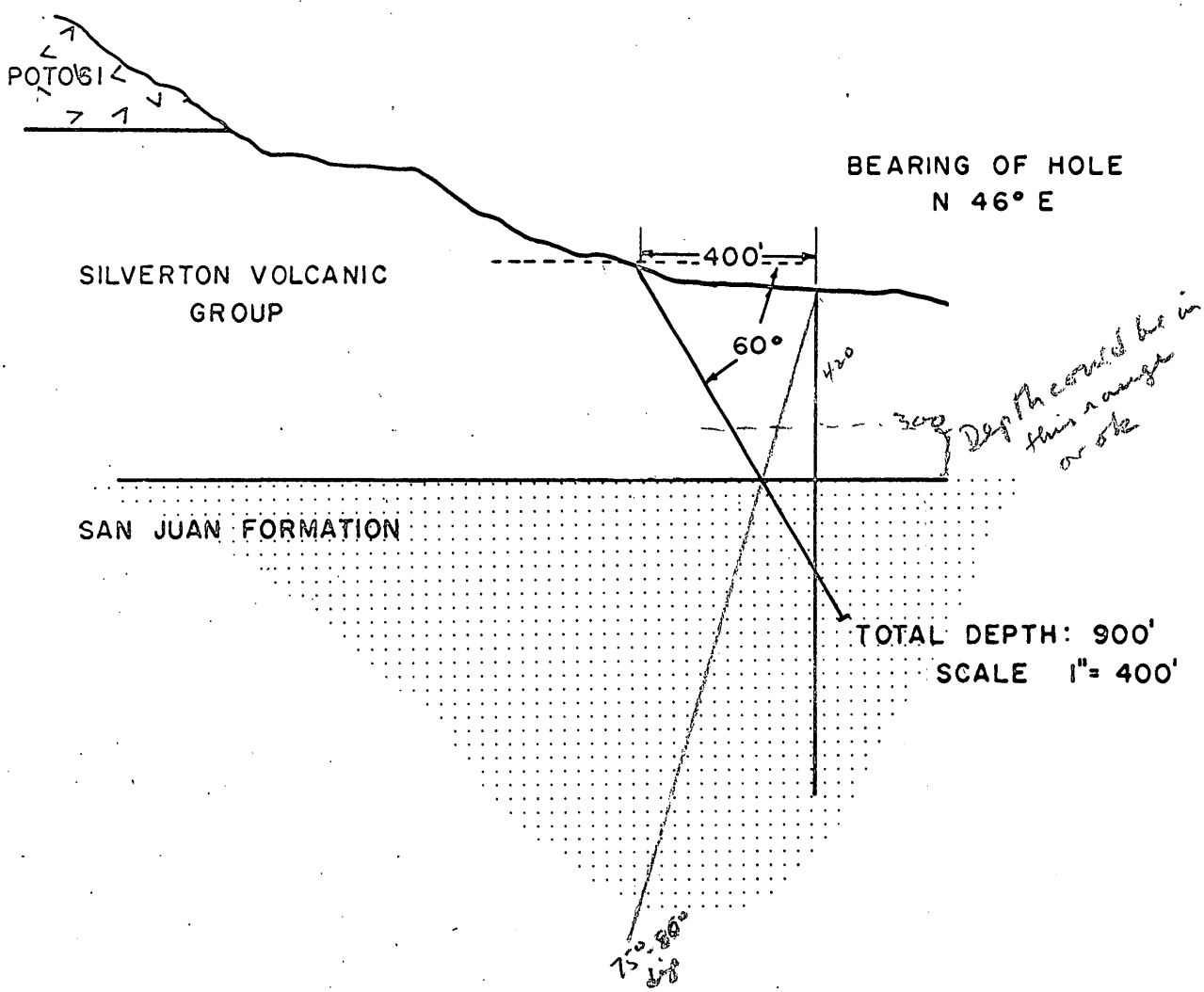


FIG. 18

DIAMOND DRILL HOLE NO. 7

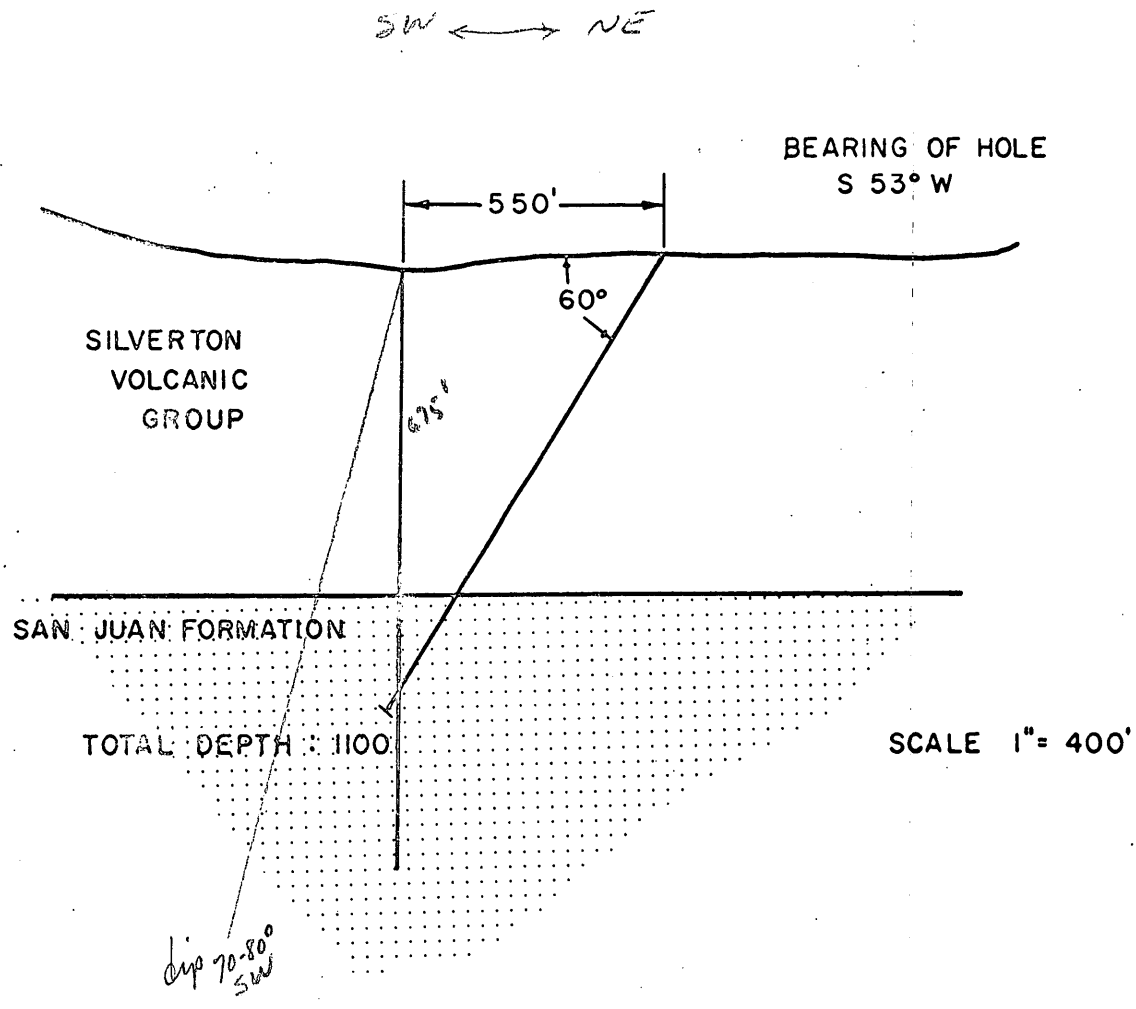


FIG. 19

DIAMOND DRILL HOLE NO. 8

Because of the short working season, we plan to save time by moving the drilling equipment to the several drill sites from Silverton by helicopter, rather than break the drilling equipment into the small-sized pieces which could be packed by a mule.

Camp facilities for the drilling personnel, geologic staff, and helicopter pilot will be furnished in Ice Lake Basin by a separate contractor. He will provide tents, cots, and meals, and horses which will be used when necessary to move the crews from camp to drill rig and return. Camp will be established and maintained in accordance with U. S. Forest Service regulations.

All holes will be cored from bedrock to the bottom of the hole. Core will be placed in cardboard core boxes and accurately logged by a member of Vitro's geologic staff. All mineralized core will be split and assayed for gold, silver, lead, zinc, and copper. Occasional rock samples will be taken for thin section study. Facilities for core storage will be rented in Silverton.

The Vitro geologic staff will prepare periodic reports on the project as required by conventional Company practice and OME regulations.

Drilling Program

We estimate that drilling will progress at an average rate of 15 feet per rig per shift. This estimate is based upon our experience in other drilling programs and takes into consideration the high altitude, drilling time lost during reaming, cementing, casing, setting up, etc. Since the work period available in Ice Lake Basin is about 12 weeks long (late June to late September), three rigs will be needed to complete the proposed program in one season.

Since each rig will require two men per shift, a total of 12 drillers and helpers, plus two supervisors, will be needed to man the 3 rigs.

Helicopter Services

It is planned to use a helicopter to move all drilling equipment from Silverton to the several drill sites, move the drilling equipment when drill sites are changed, and to return the equipment to Silverton at the end of the project. The helicopter would also be used for other supporting activities such as taking gasoline and other necessary supplies to the drilling rigs during the project, taking core from the project area to Silverton for storage, and transporting drillers to and from the camp and drill sites, weather permitting. In the interest of safety at this remote location, it is planned to base the helicopter at the camp and thus have it available in case of emergency.

Five helicopter companies (Sky Choppers, Inc. of Durango, Aerial Applicators, Inc. of Salt Lake City, Mountain West Helicopters of Provo, Pease-Hamilton, Inc. of Denver, and Page Aircraft Maintenance, Inc. of Holloman Air Force Base, New Mexico) were asked to quote on providing helicopter service for this project. The requirements as set forth in the requests to bid (See Appendix IV) called for helicopters capable of transporting 500 pounds at an elevation of 13,200 feet. All four companies submitted bids, claimed that their helicopters were capable of fulfilling the requirements, and proposed to supply a helicopter of the Bell 47G3B-1 type for this project. Information provided by the Bell Helicopter Company indicates that the Bell 47G3B-1 type of helicopter can safely transport such loads at these altitudes.

In order to estimate the amount of flying time required for this project, we have listed the necessary drilling equipment, approximate weights, and helicopter trips required.

Equipment	Approximate Total Weight in Pounds	Trips Required
Move in:		
3 hydraulic drill rigs	7,170	15
3 drilling pumps and engines	3,075	6
3 water pumps and engines	2,400	5
3,000 feet BX drill rods	12,000	24
300 feet NX rods	1,470	3
800 feet NX casing	6,240	13
300 feet BX casing	1,900	4
Cement	2,000	4
Mud	700	2
3,000 feet plastic water hose	700	2
3 mud tanks		3
9 tripod poles		3
1 week supply of gasoline @ 50 gal/day/rig	6,300	18
1 week supply of core boxes and oil		1
Miscellaneous items (filters, tools, etc.)	2,000	4
Personnel (16 men)		8
Total Move in:		115 trips
Move out:		
(Same as "move in" less cement, mud, gasoline, core boxes, oil, casing, tripod poles)		
Total Move out:		70 trips

The time for a round-trip flight from Silverton to Ice Lake Basin is estimated to be 20 minutes. Therefore, the 185 round trips required for move-in and move-out will take 61 2/3 hours of flight time.

The three interim moves of the drill rigs within Ice Lake Basin are estimated to require 27 hours of flight time.

Transport of drilling crews from camp to drill rig will require one-half hour per shift or 1 hour of flight time per day.

Supply of gasoline, core boxes, transport of core, etc. will require a minimum of 1 hour flight time per day.

Total flight time estimates are:

Move in	61-2/3	hours
Move out		
Interim moves	27	hours
Transport (1 hr/day for 79 drilling days)	79	hours
Support (1 hr/day for 79 drilling days)	79	hours
Total Estimated Flight Time:	246-2/3	hours

VIII. EXPLORATION COSTS AND BUDGET

Diamond Drilling Costs

Boyles Bros. Drilling Company of Denver, Colorado; Sprague & Henwood, Inc. of Salt Lake City; and E. J. Longyear Company of Salt Lake City, were asked to bid on the diamond drilling phase of this project (See Appendix IV). A comparison of the bids indicates that the Sprague & Henwood, Inc. bid is the lowest and their figures are used in preparing these costs for eight drill holes totalling 7,100 feet drilled by 3 rigs manned by 6 crews.

1.	Mobilization and demobilization of men and equipment to and from the Silverton, Colorado area	$ 2,450.00
2.	Drilling of overburden - estimated to average 75 feet per hole or 600 feet @ $10.50	6,300.00
3.	BX Core Drilling 1,400 feet @ $8.35	11,690.00
	2,000 feet @ $8.65	17,300.00
	1,800 feet @ $8.95	16,110.00
	1,100 feet @ $9.25	10,175.00
	200 feet @ $9.55	1,910.00
	7,100 feet	
4.	Reaming - estimated 800 feet @ $5.50	4,400.00
5.	Cementing - estimated 240 hours @ $26.00	6,240.00
6.	Cement and mud	3,000.00
7.	Moving and setting up, moving from site to site estimated at 290 hours @ $18.00/hr.	5,220.00
8.	Standby time, hole surveys - estimated at 160 hours @ $22.00/hr.	3,520.00
9.	Cardboard core boxes to hold 10 feet of core each @ $0.90	639.00
10.	Casing lost or left in holes by request estimated 800 feet @ $3.00/foot	2,400.00
	Sub-total	$ 91,354.00
11.	Contingency - 15% of costs	$ 13,703.10
	TOTAL	$105,057.10
	Cost of drilling per foot	$ 14.80

Helicopter Costs

As stated, bids for the helicopter service were requested from five companies (See copies of the bids in Appendix IV).

Our estimates of flight time requirements indicate that the helicopter will be used for 100 2/3 hours the first month, 70 hours the second month, and 76 hours the third month. Based on these estimates, and assuming a 90-hour minimum contract the first month, and 60-hour minimum contracts the second and third months, Aerial Applicators, Inc. of Salt Lake City, has submitted the lowest bid and their figures are used below.

First Month:	100 2/3 flight hours @ $110.00/hr. for first 90 hours and $90.00/hr. for all time over 90 hours	$10,860.00
Second Month:	70 flight hours @ $125.00/hr. for first 60 hours and $115.00/hr. for all time over 60 hours	8,650.00
Third Month:	76 flight hours @ $125.00/hr. for first 60 hours and $115.00/hr. for all time over 60 hours	9,340.00
	TOTAL	$28,850.00

Camp Costs

We have considered the possibility of maintaining the drilling crews and geologic staff in Silverton, but have rejected this because of room and board costs (estimated at $12.00/man/day), the impossibility of walking or riding from South Mineral Campground to the drill sites and return each day, and the fact that helicopter transport from Silverton to the drill sites and return cannot be guaranteed for each drilling day. The need to maintain a certain degree of secrecy during the project also recommends that a drilling camp be established in Ice Lake Basin.

Three camp contractors were asked to bid (See Appendix IV) on the establishment of a camp plus provision of board: George Lancaster, Silverton; Cap Atwood, Grand Junction; and Sid Simpson, Paonia. The lowest bid was that of George Lancaster and his bid prices are used in the camp cost estimate below.

Camp costs are figured on a $10.50 per man per day basis. Considering that the camp will be operated for 93 days and the attendance will be 17 men (12 drilling crewmen, 2 supervisors, 2 geologists, and 1 helicopter pilot), the costs will be:

Camp and Board: 93 x 17 x $10.50	$16,600.50

A minimum of 4 saddle horses will be required during the project for use in transporting the drillers to the drill sites when the helicopter cannot fly, and for emergencies. The cost of these horses will be $6.50 each per day. Therefore:

Horses: 93 x 4 x $6.50	2,418.00
Mobilization:	100.00
TOTAL	$19,118.50

Assaying and Petrographic Costs

8 50-foot sections, 1 foot/sample = 400 samples

400 samples assayed for: Au, Ag, Pb, Zn, Cu ?
($3.50 + $2.00 + $2.00 + $1.50 = $9.00)

400 samples @ $9.00/sample	$ 3,600.00
15 thin sections/hole for 8 holes @ $2/thin section	240.00
Examination of sections @ $5/section	600.00
	$ 4,440.00
Core storage space rental in Silverton: $50/month for 3 months	150.00
TOTAL	$ 4,590.00

Technical Costs*

This category includes the immediate costs of technical supervision of the Ice Lake project, report writing, secretarial services, drafting, and map reproduction.

1 Exploration Geologist (full time): 3 months @ $1,100/month	$ 3,300.00
1 Geologic Field Assistant (full time): 3 months @ $600/month	1,800.00
Chief Geologist (one-third time): 3 months @ $1,200/month	1,200.00

*/ This portion of the contract costs will be provided by Vitro through its normal payroll and accounting procedures.

Exploration Manager (one-quarter time): 3 months @ $1,500/month	$ 1,125.00
Secretarial Services: 60 hours @ $2.75/hour	165.00
Draftsman: 60 hours @ $2.50/hour	150.00
Total Wages	$ 7,740.00
FICA, unemployment, etc. figured @ 7.5% of total wages	580.50
	$ 8,320.50
Travel expense: $150/man/month	1,200.00
Vehicle expense: 2 vehicles for 3 months @ $30/month	180.00
Telephone and telegraph	300.00
Reproduction (maps and reports) 500 sq. ft. @ 10¢/sq. ft.	50.00
TOTAL	*$10,050.50

Total Cost of Ice Lake Project

Diamond Drilling Costs	$105,057.10
Helicopter Costs	28,850.00
Camp Costs	19,118.50
Assaying and Petrographic Costs	4,590.00
Technical Costs	10,050.50
TOTAL	$167,666.10

*/This portion of the contract costs will be provided by Vitro through its normal payroll and accounting procedures.

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APPENDIX I

LEASE AND OPTION AGREEMENTS

and

RECORDING DATA

(bound separately)

APPENDIX II

ASSAY CERTIFICATES

Rocky Mountain Geochemical Corporation

P. O. BOX 2217
SALT LAKE CITY, UTAH 84110

Phone 322-2396
Area Code: 801

CERTIFICATE OF ANALYSES

Date October 26, 1967

Client Mr. L. Rove
Vitro Minerals & Chemical Company
600 West 33rd South
Salt Lake City, Utah 84115

Report on: 88 samples

Submitted by: Mr. Rove

Date Received: September 22, 1967

Analysis: Arsenic & Mercury

Remarks: Arsenic analyses determined colorimetrically. Mercury done by mercury vapor detector and reported in parts per billion.

cc: Enc.
file

JJJ:ktg

All values are reported in parts per million unless specified otherwise. A minus sign (−) is to be read "less than" and a plus sign (+) "greater than." Values in parenthesis are estimates. This analytical report is the confidential property of the above mentioned client and for the protection of this client and ourselves we reserve the right to forbid publication or reproduction of this report or any part thereof without written permission.

ND = None Detected 1 ppm = 0.0001% 1 Troy oz./ton = 34.28 ppm % Mo x 1.6683 = %MoS_2

Sample No.	ppm Arsenic	ppb Mercury
4654	10	160
4655	-5	390
4656	-5	30
4657	105	190
4658	-5	190
4659	-5	70
4660	-5	290
4661	50	400
4662	5	370
4663	5	220
4664	-5	100
4665	20	260
4666	10	320
4667	-5	80
4668	-5	80
4669	5	190
4670	-5	230
4671	-5	160
4672	-5	60
4673	-5	150
4674	-5	300
4675	15	140
4676	5	210
4677	15	110
4678	-5	100

Sample No.	ppm Arsenic	ppb Mercury
4679	20	220
4680	10	60
4681	45	230
4682	170	180
4683	5	130
4684	20	110
4685	-5	50
4686	5	60
4687	5	360
4688	25	130
4689	25	370
4690	25	170
4691	-5	280
4692	30	370
4693	25	210
4694	30	280
4695	-5	100
4696	-5	30
4697	-5	110
4698	5	290
4699	80	240
4700	40	100
4701	5	150
4702	15	390
4703	-5	150

Sample No.	ppm Arsenic	ppb Mercury
4704	30	270
4705	-5	80
4706	-5	80
4707	-5	70
4708	20	90
4709	25	110
4710	5	180
4711	20	120
4712	40	170
4713	95	140
4714	5	160
4715	5	190
4716	5	270
4717	90	250
4718	-5	120
4719	45	140
4720	-5	170
4721	1100	170
4722	450	250
4723	640	240
4724	150	420
4725	5	240
4726	125	330
4727	25	50
4728	-5	170

Sample No.	ppm Arsenic	ppb Mercury
4729	110	170
4730	-5	230
4731	-5	200
4732	55	100
4733	+1000	200
4734	700	350
4735	45	260
4736	25	280
4737	-5	90
4738	-5	140
4739	-5	60
4740	25	110
4741	10	120

Rocky Mountain Geochemical Corporation
Salt Lake City, Utah October 26, 1967

By James J. Johnson

Vitro MINERALS & CHEMICAL COMPANY
DIVISION OF VITRO CORPORATION OF AMERICA
600 WEST 33rd SOUTH STREET • SALT LAKE CITY, UTAH 84115 • P. O. BOX 15437 • 262-2491

January 2, 1968

Attention: Tom Sharps, Exploration Dept. - 805.72/100

ASSAY ANALYSIS

I.D. No.	Vitro Minerals	Ppm Cu	Ag. Oz/Ton	Au. Oz/Ton
3	Ice Lake	40	0.06	ND
4		60	0.03	ND
5		ND	0.06	ND
6		120	0.10	ND
7		40	0.03	ND
8		40	0.74	0.03
9		ND	0.03	ND
10		ND	0.05	ND
11		ND	0.03	ND
12		40	0.03	ND
19		ND	0.02	ND
20		ND	0.04	ND
21		ND	ND	ND
27		ND	0.05	ND
31		ND	0.03	ND
37		ND	ND	ND
38		ND	ND	ND
39		40	0.03	ND
40		60	0.10	ND
42		ND	0.04	ND
43		ND	0.06	ND
44		ND	0.05	ND
45		20	0.09	ND
46		ND	ND	ND
49		20	0.05	0.001
50		ND	0.01	ND
54		ND	0.03	ND
55		40	0.07	ND
56		40	0.08	ND
57		40	0.05	ND
58		40	0.01	ND
59		ND	ND	ND
60		ND	ND	ND
61		ND	0.06	ND
62		40	0.06	ND
63		ND	ND	ND
64		100	0.05	ND
65		ND	ND	ND

ASSAY ANALYSIS

I.D. No.	Vitro Minerals	Ppm Cu	Ag Oz/Ton	Au Oz/Ton
66	Ice Lake	ND	0.04	ND
67		ND	0.03	ND
68		12	ND	ND
69		14	0.01	ND
71		44	ND	ND
73		20	0.04	ND
74		22	0.03	ND
75		16	ND	ND
76		20	ND	ND
77		20	ND	ND
91		18	0.04	ND
92		32	ND	ND
95		16	ND	ND
96		24	0.03	ND
97		22	ND	ND
98		22	ND	ND
99		20	0.04	ND
102		18	ND	ND
103		24	ND	ND
104		18	ND	ND
105		16	ND	ND
106		20	ND	ND
107		10	0.04	ND
108		9	0.04	ND
109		8	ND	ND
110		22	ND	ND
111		8	0.04	ND
112		12	0.05	ND
115		13	ND	ND
118		9	ND	ND
119		8	ND	ND
120		10	ND	ND
121		6	ND	ND
122		10	0.09	ND
123		13	0.03	ND
127		14	ND	ND
128		9	0.04	ND
130		9	0.06	ND
132		8	ND	ND
133		12	ND	ND

E. H. Phillips

jr

Rocky Mountain Geochemical Corporation

P. O. BOX 2217
SALT LAKE CITY, UTAH 84110

Phone 322-2396
Area Code: 801

CERTIFICATE OF ANALYSES

Date November 27, 1967

Client Mr. L. C. Rove
Vitro Minerals & Chemical Company
P.O. Box 15437
Salt Lake City, Utah 84115

Report on: 78 Rock Samples

Submitted by: Mr. Rove

Date Received: October 31, 1967

Analysis: Arsenic & Mercury

Remarks: Arsenic determined colorimetrically. Mercury analyzed by mercury vapor detector.

cc: Enc.
file

JJJ:ab

All values are reported in parts per million unless specified otherwise. A minus sign (−) is to be read "less than" and a plus sign (+) "greater than." Values in parenthesis are estimates. This analytical report is the confidential property of the above mentioned client and for the protection of this client and ourselves we reserve the right to forbid publication or reproduction of this report or any part thereof without written permission.

ND = None Detected 1 ppm = 0.0001% 1 Troy oz./ton = 34.28 ppm % Mo x 1.6683 = %MoS_2

Sample No.	ppm Arsenic	ppb Mercury
3	10	30
4	10	170
5	5	120
6	10	290
7	-5	50
8	255	220
9	5	10
10	-5	20
11	5	30
12	-5	50
19	5	20
20	5	30
21	5	30
27	5	30
31	25	30
37	30	50
38	5	30
39	15	270
40	5	160
42	5	50
43	-5	20
44	-5	20
45	5	40
46	-5	40
49	10	20

Sample No.	ppm Arsenic	ppb Mercury
50	25	40
54	5	30
55	5	80
56	-5	20
57	5	20
58	-5	50
59	-5	20
60	5	80
61	5	50
62	5	20
63	5	30
64	-5	20
65	5	30
66	5	200
67	-5	60
68	-5	50
69	-5	30
71	-5	30
73	280	70
74	20	240
75	5	20
76	20	50
77	-5	180
91	-5	320
92	5	20

Sample No.	ppm Arsenic	ppb Mercury
95	-5	40
96	-5	30
97	-5	50
98	-5	30
99	5	20
102	5	30
103	5	20
104	5	20
105	5	40
106	-5	-10
107	-5	20
108	-5	20
109	-5	30
110	-5	100
111	10	390
112	-5	80
115	-5	30
118	-5	50
119	-5	20
120	5	30
121	-5	30
122	10	50
123	-5	20
127	10	50
128	-5	30

Sample No.	ppm Arsenic	ppb Mercury
130	20	80
132	5	20
133	5	270

Rocky Mountain Geochemical Corporation
Salt Lake City, Utah November 27, 1967

By _____
James J. Johnson

Vitro MINERALS & CHEMICAL COMPANY
DIVISION OF VITRO CORPORATION OF AMERICA
600 WEST 33rd SOUTH STREET • SALT LAKE CITY, UTAH 84115 • P. O. BOX 15437 • 262-2491

November 6, 1967

Attn: Tom Sharps, Exploration Dept. - 805.72/100

ORE ASSAYS

Vitro Lot No.	Shipper	Oz. Ton Ag	Oz. Ton Au	Ppm Mn	Ppm Cu	Ppm Pb	Ppm Zn
4654	Ice Lake-Vitro Minerals	0.43	0.004	6,280	150	750	374
4655		0.12	0.002	1,162	52	362	388
4656		0.11	0.002	1,046	52	426	282
4657		0.10	0.001	1,420	74	506	330
4658		0.06	ND	840	46	368	244
4659		0.09	0.004	1,146	94	536	172
4660		0.08	0.002	992	44	474	644
4661		0.07	0.005	766	94	500	84
4662		0.06	ND	1,012	48	404	190
4663		0.05	ND	1,464	52	372	152
4664		0.06	ND	874	48	336	128
4665		0.08	ND	1,028	40	450	290
4666		0.54	0.006	506	48	346	170
4667		0.06	0.005	1,490	42	346	512
4668		0.06	0.003	1,112	52	424	164
4669		0.41	0.011	32,240	538	5,966	2,072
4670		0.08	0.003	162	42	362	144
4671		0.08	0.005	216	66	530	118
4672		0.06	0.005	552	58	460	226
4673		0.05	0.003	516	60	480	156
4675	Repeat Ice Lake	0.10	0.009				
4680	" " "	3.43	0.293				

E. H. Phillips

EHP:jr

Vitro MINERALS & CHEMICAL COMPANY
DIVISION OF VITRO CORPORATION OF AMERICA
600 WEST 33rd SOUTH STREET • SALT LAKE CITY, UTAH 84115 • P. O. BOX 15437 • 262-2491

October 19, 1967

Attention: Tom Sharps, Exploration Dept. - 805.72/100

CERTIFICATE OF ANALYSIS

Vitro Lot No.	Shipper	Ag Ozs/ton	Au Ozs/ton	Mn PPM	Cu PPM	Pb PPM	Zn PPM
4674	Vitro Minerals-Ice Lake	0.09	0.006	368	56	332	116
4675		0.13	0.006	680	48	344	124
4676		0.24	0.007	796	46	394	96
4677		0.15	0.006	14,100	86	472	130
4678		0.09	0.005	334	58	496	142
4679		0.31	0.102	3,392	74	484	372
4680		3.39	0.93	14,680	160	934	262
4681		1.88	0.245	440	142	886	164
4682		0.49	0.012	1,820	88	526	236
4683		0.37	0.103	11,720	80	448	96
4684		0.82	0.015	44,700	76	1,598	1,706
4685		0.09	0.006	2,800	274	808	1,606
4686		0.07	0.005	386	54	422	36
4687		0.07	0.006	930	50	484	112
4688		1.03	0.014	10,400	72	386	114
4689		0.11	0.006	13,760	94	516	114
4690		1.30	0.026	3,476	104	730	256
4691		0.14	0.005	1,366	58	368	122
4692		0.22	0.007	2,924	88	520	318
4693		0.78	0.013	22,500	222	1,528	516
4694		1.84	0.11	2,880	2,800	1,860	19,560
4695		0.12	0.006	1,174	38	260	168
4696		0.13	0.005	942	42	200	108
4697		0.13	0.005	1,172	82	280	174
4698		0.15	0.008	1,138	78	260	96
4699		0.24	0.005	146	56	400	752
4700		0.18	0.004	1,250	116	340	182
4701		0.14	0.004	1,490	40	240	198
4702		0.15	0.005	1,758	44	440	174
4703		0.14	0.003	1,392	102	380	112
4704		0.14	0.002	6,500	66	440	288
4705		0.15	0.003	862	102	320	64
4706		0.17	0.011	1,372	62	220	20
4707		0.50	0.004	7,160	86	300	84
4708		0.13	0.004	1,384	38	180	116
4709		0.70	0.006	40,050	580	404	13,340
4710		0.14	0.004	1,342	38	240	154
4711		0.64	0.006	16,600	130	720	826
4712		4.51	0.067	5,830	166	116	532

CERTIFICATE OF ANALYSIS (Cont.)

Vitro Lot No.	Shipper	Ag Ozs/ton	Au Ozs/ton	Mn PPM	Cu PPM	Pb PPM	Zn PPM
4713	Vitro Minerals-Ice Lake	0.91	0.009	28,700	574	8,000	4,500
4714		0.15	ND*	774	70	340	124
4715		0.08	ND	612	46	120	68
4716		0.15	ND	614	36	140	32
4717		0.42	0.010	3,390	122	880	708
4718		0.13	0.009	1,124	66	240	8
4719		0.63	0.028	81,750	414	1,660	734
4720		9.45	1.215	77,500	1,362	8,500	1,350
4721		4.26	0.044	5,600	2,172	12,000	15,800
4722		52.54	0.093	290	7,060	10,500	2,500
4723		83.60	0.027	504	15,040	25,000	11,850
4724		9.20	0.027	302	1,126	2,860	568
4725		0.11	ND	196	36	140	12
4726		13.00	2.53	686	2,248	10,000	424
4727		2.91	0.005	19,250	372	2,880	250
4728		1.20	0.014	106,000	1,692	6,500	1,950
4729		12.4	0.112	40,500	3,936	30,500	23,250
4730		0.10	0.005	406	1,012	32,500	23,450
4731		0.14	ND	702	46	600	302
4732		20.52	0.060	5,850	1,232	235,000	124,250
4733		4.30	0.011	2,650	47,510	78,500	522
4734		0.011	0.17	2,050	1,990	51,000	1,800
4735		6.23	0.005	1,166	108	340	200
4736		27.28	0.053	7,750	614	3,720	2,932
4737		0.11	ND	1,118	136	280	298
4738		0.11	ND	744	48	240	ND
4739		0.15	0.013	424	76	540	160
4740		0.10	ND	778	116	260	116
4741		0.65	ND	790	432	5,800	1,912

* ND - None Detected

E. H. Phillips

EHP:jr

Vitro MINERALS & CHEMICAL COMPANY
DIVISION OF VITRO CORPORATION OF AMERICA
600 WEST 33rd SOUTH STREET • SALT LAKE CITY, UTAH 84115 • P. O. BOX 15437 • 262-2491

November 13, 1967

Attn: Tom Sharp, Exploration Dept. - 805.72/100

CERTIFICATE OF ANALYSIS

Sample Number	Shipper	Ppm Te
4654	Vitro Minerals	ND
4655	Ice Lake	5.5
4656		4.0
4657		4.5
4658		3.5
4659		5.0
4660		7.5
4661		5.0
4662		6.0
4663		6.5
4664		3.0
4665		6.0
4666		3.0
4667		2.5
4668		3.5
4669		6.5
4670		6.0
4671		6.0
4672		5.0
4673		ND
4674		2.5
4675		14.0
4676		8.5
4677		7.5
4678		9.0
4679		9.0
4680		10.0
4681		10.5
4682		10.5
4683		10.5
4684		11.0
4685		8.0
4686		11.5
4687		10.5

CERTIFICATE OF ANALYSIS (Cont.)

Sample Number	Shipper	Ppm Te
4688		6.0
4689		6.5
4690		9.0
4691		8.0
4692		10.0
4693		7.5

E. H. Phillips

jr

APPENDIX III

PARAGENESIS REPORT

HAZEN RESEARCH, INC.
4601 Indiana Street
Golden, Colorado

HRI Project No. 324
Copy No. 2

MINERALOGICAL STUDY OF ORES FROM ICE LAKE DISTRICT

for

Vitro Minerals and Chemical Company
P.O. Box 15437
Salt Lake City, Utah

December 7, 1967

By:

J. Kent Perry
Geological Engineer

Approved by:

James L. Lake
Vice President

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INTRODUCTION AND SUMMARY

Vitro Minerals and Chemical Company submitted six samples to Hazen Research for determination of the mineralogy and paragenesis of the sulfide minerals. The samples consist of small specimens from Vitro's property in the Ice Lake District.

The mineralogy resulting from hydrothermal ore deposition is relatively simple:

Quartz
Carbonates
Pyrite
Chalcopyrite
Galena
Sphalerite
Trace native gold
Argentian tetrahedrite (freibergite)
Trace native silver
Covellite
Oxidation minerals

The above order of listing is the overall general paragenesis (time sequence of deposition) synthesized from examination of all six samples. Individual minerals may be absent in any given sample, and there are occassionally reversals in order. Quartz and carbonate (chiefly rhodochrosite) continued to be deposited intermittently from before pyrite deposition until after native silver deposition.

Native silver occurs as a trace in only one sample. With the exception of this case, we were unable to detect any discrete silver minerals, i.e., minerals in which silver is an essential constituent. Most of the silver in these ores occurs as substitutional solid solution in argentian tetrahedrite, which should thus be considered as the variety freibergite. Because of this association, silver will tend to report in a copper concentrate if selective flotation is used to beneficiate this ore.

A minute trace of gold was found in only one sample. Gold appears to be associated with the freibergite phase of deposition based on this rather scanty evidence.

Secondary covellite forms surface replacement skins or rinds on sphalerite and galena, and to a lesser extent on chalcopyrite and freibergite. This covellite replacement phenomena may cause some problems if selective flotation is used to beneficiate the ore. Some of the lead and zinc will have a tendency to report in the copper concentrate.

EXPERIMENTAL WORK

Six samples from Vitro Minerals and Chemical Company were received at Hazen Research on October 16, 1967 for mineralogical study. The samples were contained in cloth sacks and consisted of specimens ranging from two to six inches in diameter. Several of the samples consisted of two or more specimens. This group of samples was assigned our number HRI-898 for reference.

Individual specimens were given a preliminary examination with a binocular microscope, and at least one polished section was prepared for each sample using a piece of ore selected as having greatest potential interest. A thin section was also prepared in one case.

The sections were examined using a Leitz Panphot microscope, and photomicrographs were taken to illustrate certain ore textures. These photomicrographs are grouped together at the end of the report for convenience.

INDIVIDUAL SAMPLE DESCRIPTIONS

Detailed descriptions of individual samples follow. For those samples consisting of more than one specimen we include brief descriptions based on binocular examination for the pieces which were not prepared as polished sections.

Sample No. 1

Mineralogy of this sample is very simple, and consists of chalcopyrite, galena, and sphalerite in irregular intergrowths scattered through earlier quartz gangue. The sulfides typically occur at grain boundaries and in interstices between anhedral interlocking grains of quartz. In some portions of the polished section the sulfides have been severely corroded by late carbonate gangue, chiefly rhodochrosite, which replaced sulfides along their mutual grain boundaries.

In a few areas the primary sulfides have been partly replaced by secondary covellite, which in turn has been partly oxidized to form traces of cuprite and malachite stain. There is also a trace of cerussite resulting from oxidation of the galena. No silver minerals or gold were noted.

Sample No. 2

This sample consists of several individual specimens, and polished sections were prepared of two specimens.

One specimen consists largely of quartz and clay minerals with euhedral late quartz crystals in vugs. Euhedral argentian tetrahedrite (freibergite) crystals up to 2 mm in size occur along an open fracture transecting the specimen.

Polished section examination shows that the sequence of deposition in a second specimen was quartz, pyrite, galena, and freibergite. Early euhedral quartz crystals frequently contain very fine-grained inclusions of carbonate, and many such quartz crystals were later corroded and replaced by both galena and freibergite. No gold was detected.

Polished section examination of a third specimen shows a depositional sequence of: early quartz, pyrite, galena, sphalerite, trace gold, argentian tetrahedrite (freibergite), silver, and late quartz. Many of the early quartz crystals contain very fine-grained subgraphic intergrowths of carbonate; such early quartz appears to have localized later sulfide deposition in many cases, possibly because of reaction of mineralizing fluids with the intergrown carbonate.

Scanning of this polished section of the third individual specimen with a high power oil immersion objective resulted in detection of traces of gold and silver. A single native gold particle approximately eight microns in diameter was found locked within a freibergite grain. A single electrum particle (gold-silver alloy) approximately five microns in diameter was located at the grain boundary between a grain of sphalerite and a grain of freibergite. We also found several irregular, narrow stringers of native

silver. In section these stringers are typically 5 to 10 microns wide and 50 microns long, and thus represent very thin sheet silver. This silver occurs deposited on top of freibergite grains and beneath late quartz, and also along microscopic fractures in late gangue; the native silver was thus deposited immediately after the last primary sulfide deposition took place.

Sample No. 3

Binocular microscope examination of this sample shows textural suggestions in some areas that this rock was originally a welded tuff. However, this could not be confirmed by petrographic examination of a thin section, in which we were unable to detect any of the textural characteristics of a welded tuff: axiolitic texture, "U" or "Y" shaped shards, or indeed, any shard textures at all.

We believe that the original rock, prior to severe alteration, was a hornblende latite, consisting of 20 to 30% microphenocrysts of plagioclase, 5 to 10% hornblende microphenocrysts, and possible some biotite phenocrysts, in an extremely fine-grained hypocrystalline groundmass composed partially of glass. Although there is insufficient distinguishable quartz (approximately 5%) to classify the rock as a hornblende quartz latite, there may be enough cryptocrystalline quartz in the groundmass to change it to this category.

The rock has been severely altered. The glassy portion of the groundmass has been devitrified and now consists of a mixture of clays, sericite, and cristobalite (?). The plagioclase phenocrysts have also been strongly argillized, and altered to sericite in part. Hornblende and biotite have been almost entirely altered to a pale, weakly pleochroic chlorite. The rock has been strongly pyritized.

The disseminated pyrite has been highly corroded, contains many gangue inclusions, and a trace of sphalerite. The entire polished section was scanned twice with a high power oil immersion objective without detecting any gold.

Sample No. 4

The sequence of deposition in this sample was quartz, minor carbonate, pyrite, chalcopyrite, galena, sphalerite, and finally covellite. Quartz and carbonates continued to be intermittantly deposited throughout the period of sulfide mineralization.

The periods of chalcopyrite and galena deposition partly overlapped, and local reversals in their depositional sequence can be found in a number of areas. Chalcopyrite also formed later in time as minute exsolution blebs in the sphalerite.

Covellite formed surface replacements and guided replacements of galena, and to a minor extent of chalcopyrite and sphalerite.

Discrete silver minerals and gold could not be detected in this sample.

Sample No. 5

This sample consists of three specimens. One piece is chiefly quartz which is stained black by manganese oxides along fracture surfaces. A second piece consists of fine-grained, massive, very pale pink rhodochrosite which has been oxidized along fractures to form psilomelane.

The third specimen in this sample was prepared as a polished section. It consists of coarse grains up to 3 mm in size of a gray sulfide mineral enclosed in coarse vein quartz. Optical properties and microchemical etch reactions indicate that this material is argentian tetrahedrite (freibergite). Hand picked fragments of this mineral were

subjected to qualitative emission spectrographic analysis, which showed the presence of a strong silver spectrum as well as copper and iron, and a minor amount of zinc. The presence of silver proves that the mineral of the tetrahedrite series is silver bearing, i.e., variety freibergite. Published analyses of 44 samples from various localities indicate that silver can substitute for the other cations at least up to 18 percent by weight of the pure mineral, but most freibergites contain less than 5 percent silver.

Oxidation of an originally large grain of freibergite (approximately 0.5 x 1 cm) has left remnant freibergite grains up to 3 mm size in a boxwork of yellowish waxy alteration products. Some of this yellowish material was hand picked, ground, and examined by grain immersion petrography. Only one small particle could be tentatively identified as a silver halide (cerargyrite) on the basis of its optical properties. The bulk of the yellowish material is a jarosite derived from the iron and sulfur of the freibergite during oxidation (the jarosite mineral can, of course, be argentian by virtue of silver substitution in the "A" cation lattice position of the jarosite structure).

Sample No. 6

The sulfide deposition sequence in this sample was: pyrite, chalcopyrite, freibergite(?), galena, sphalerite, freibergite, covellite. It is difficult to determine from the textures whether the freibergite follows chalcopyrite or sphalerite, and there is some textural evidence that both situations may exist in different portions of the section. In other words, there appear to have been local reversals between the pair galena-sphalerite and the freibergite.

The secondary covellite occurs extensively throughout the section as replacement rinds or skins on the surface of sphalerite and galena

grains, and to a lesser extent on freibergite and chalcopyrite. Covellite replacement of galena is quite common in ores, but the surface replacement of sphalerite by this mineral is quite unusual. Such replacement of chalcopyrite and freibergerite is less common than for galena, but not as unusual as the covellite replacement of sphalerite. This covellite replacement association may cause some problems if selective flotation is used for beneficiation of this ore, and is discussed elsewhere.

Discrete silver minerals and native gold were not detected in this sample.

COMMENTS ON GOLD AND SILVER MINERALOGY

Other than the trace of native silver in Sample No. 2 we were unable to detect discrete silver minerals among the hypogene sulfides in this ore, i.e., minerals in which silver is an essential constituent. We did not detect any argentite, "ruby silver" (proustite or pyrargyrite), or other silver sulfosalts. On the basis of our examination of seven polished sections we conclude that a minor amount of silver is present as native metal, and that the bulk of the silver is carried as substitutional solid solution in argentian tetrahedrite (freibergite).

We were able to detect only two small grains of gold, both in one of the specimens of Sample No. 2. However, the failure to detect more gold particles is not too surprising in view of the fact that a total of only seven polished surfaces were examined in this study. If the two gold grains found in Sample No. 2 can be taken as an indication, the gold deposition in this ore appears to be associated with the freibergite phase of deposition. We found no evidence of any auriferous pyrite association.

PARAGENESIS

Figure 1 illustrates the overall paragenesis (time sequence of deposition) synthesized from examination of all six available samples.

Paragenesis of Ice Lake Ore

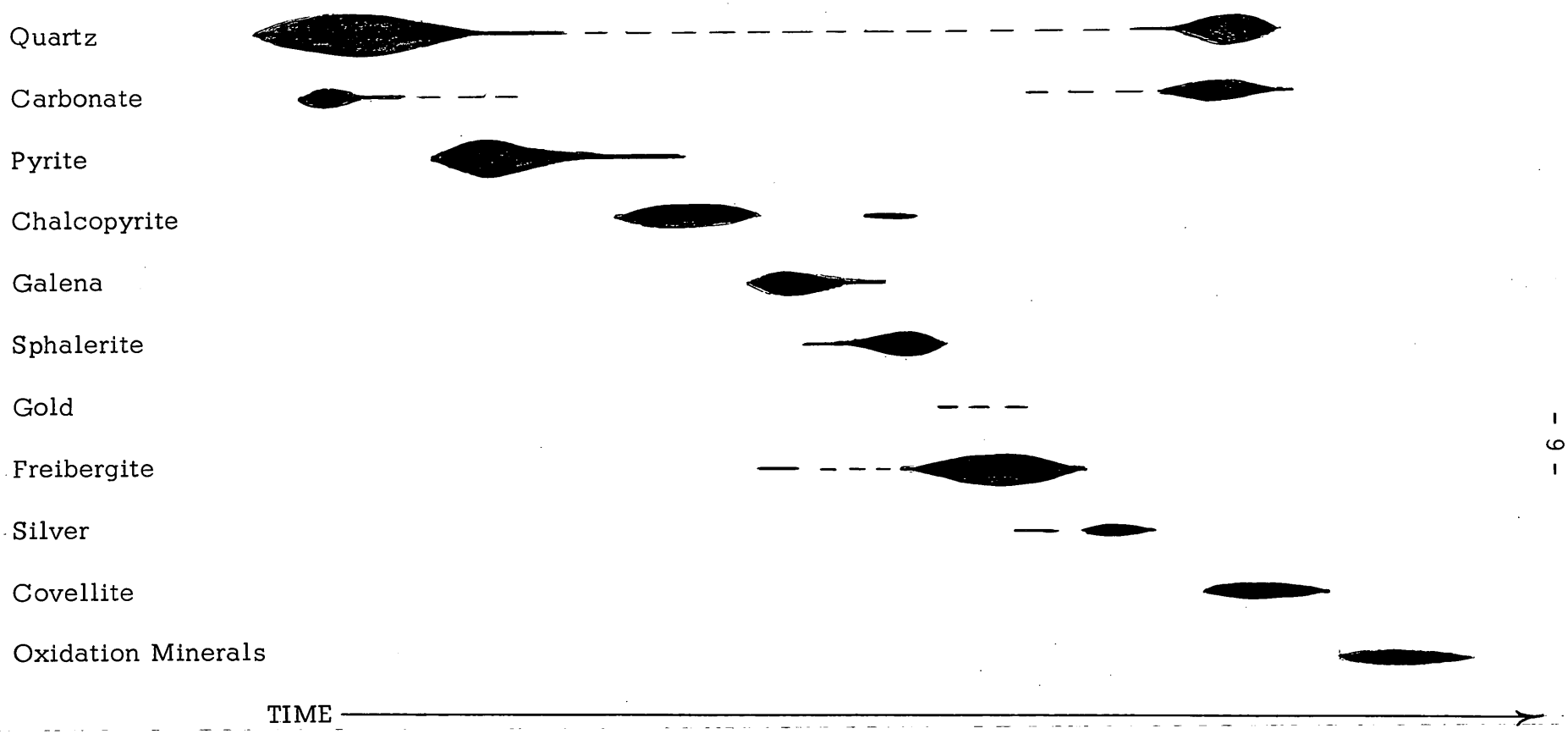


Figure 1

All minerals are not necessarily present in any given sample, and there are local reversals in depositional sequence. For instance, freibergite directly follows chalcopyrite in some cases, and in the case of Sample No. 2 chalcopyrite is absent from the sequence. In some areas of individual samples galena and sphalerite are reversed from the general order, or may overlap in deposition time. There also appears to be some renewed chalcopyrite deposition synchronous with sphalerite, as well as chalcopyrite exsolution from sphalerite.

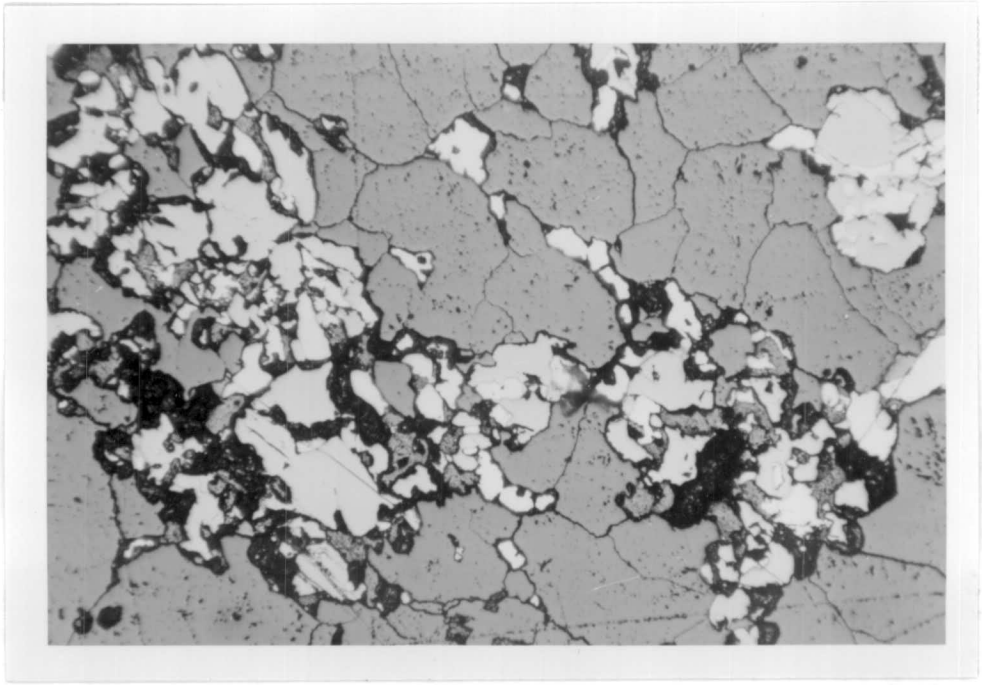
METALLURGICAL IMPLICATIONS

Mineralogy indicates that most of the silver should report in a copper concentrate if selective flotation is used to beneficiate this ore.

Secondary covellite forms surface replacement skins or rinds on sphalerite and galena, and to some extent on chalcopyrite and freibergite. This is a common situation for galena, but it is a rather unusual replacement in the case of the sphalerite host. This covellite replacement may cause some problems if selective flotation is used to beneficiate the ore; lead and zinc will have a tendency to report in the copper concentrate because of the coatings of a copper mineral on the sphalerite and galena.

PHOTOMICROGRAPHS

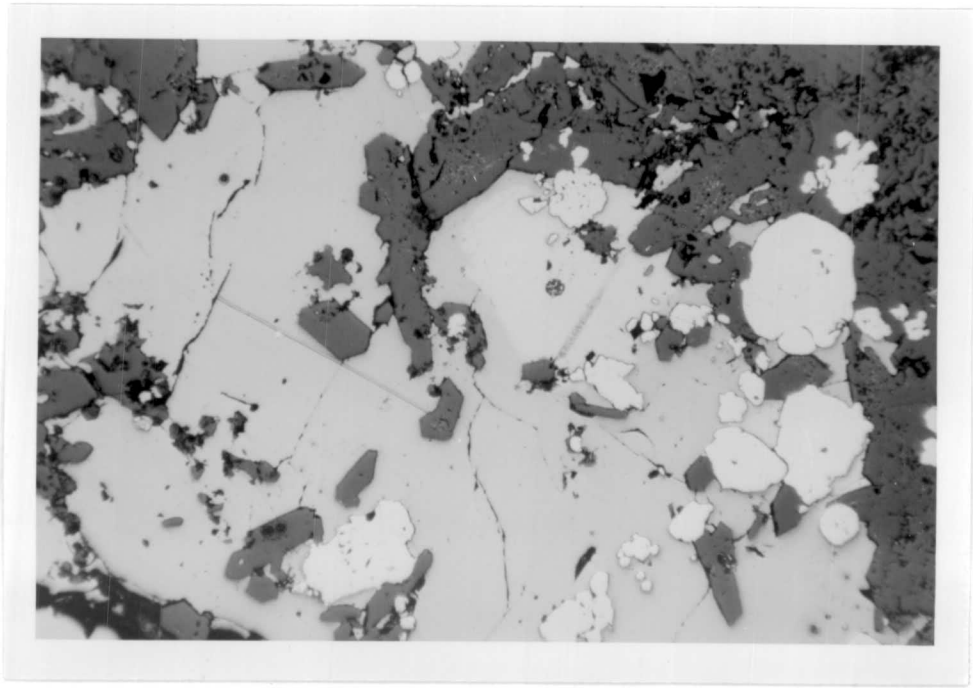
Figures 2 through 7 follow, and illustrate certain textural features of the Ice Lake ores.



Sample No. 1: Photomicrograph of polished surface illustrating textural relationships of galena (white), sphalerite (light gray), and chalcopyrite (yellow) in quartz gangue (dark gray). The small brownish-gray grains intergrown with sulfides in bottom half of photo are late carbonate gangue.

Plain incident light.
Scale of print: 1" = 310 microns (80X).

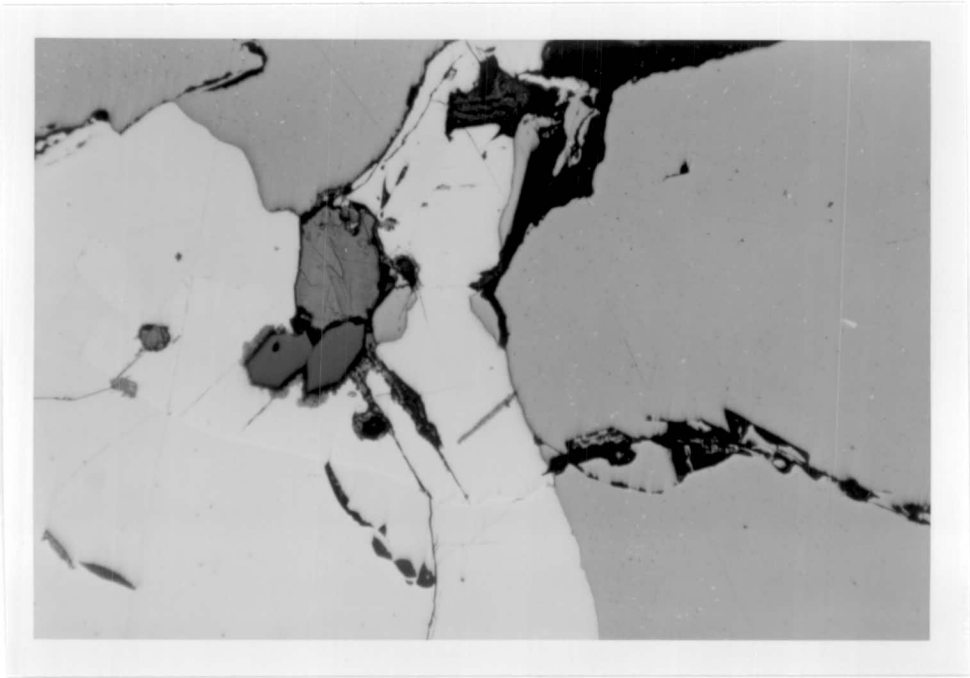
Figure 2



Sample No. 2: Photomicrograph of polished section showing typical intergrowth of sulfides in early quartz gangue (dark gray). The minute speckled inclusions in the cores of quartz crystals at top center and to the right of top center are early carbonate. Pyrite (yellowish-white rounded and corroded grains) was earliest sulfide. The abundant medium gray mineral with a slight greenish tint is argentian tetrahedrite (variety freibergite). A galena grain (light grayish-white) is enclosed within freibergite just above center of photo.

Plain incident light.
Scale of print: 1" = 310 microns (80X).

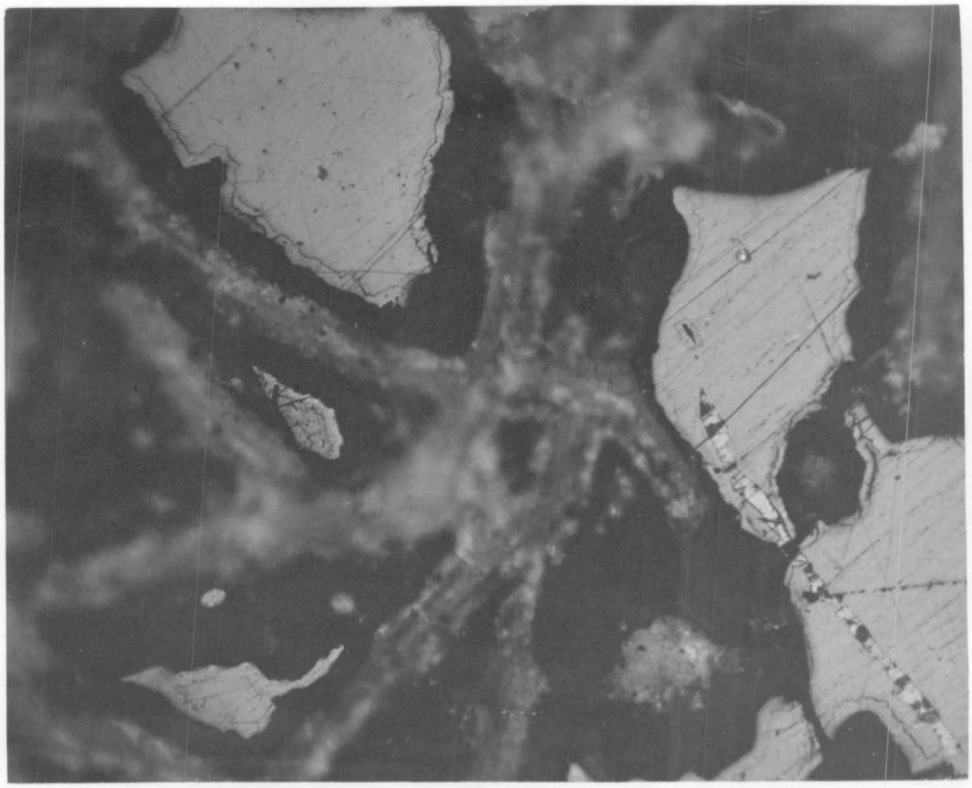
Figure 3



Sample No. 4: This polished section shows intergrowth of chalcopyrite (yellow), galena (light gray to white grain in center), and sphalerite (medium gray mass at right). The minute yellow specks disseminated through the sphalerite are exsolution blebs of chalcopyrite. At left center, enclosed within the galena, are two euhedral quartz crystals which crystallized before sulfide deposition (dark gray). Adjacent to these small crystals is a small mass of carbonate gangue (brownish gray). Covellite (blue) occurs as a replacement of galena at its contact with the quartz crystals and as guided replacements along cleavage fractures.

Plain incident light.
Scale of print: 1" = 310 microns (80X).

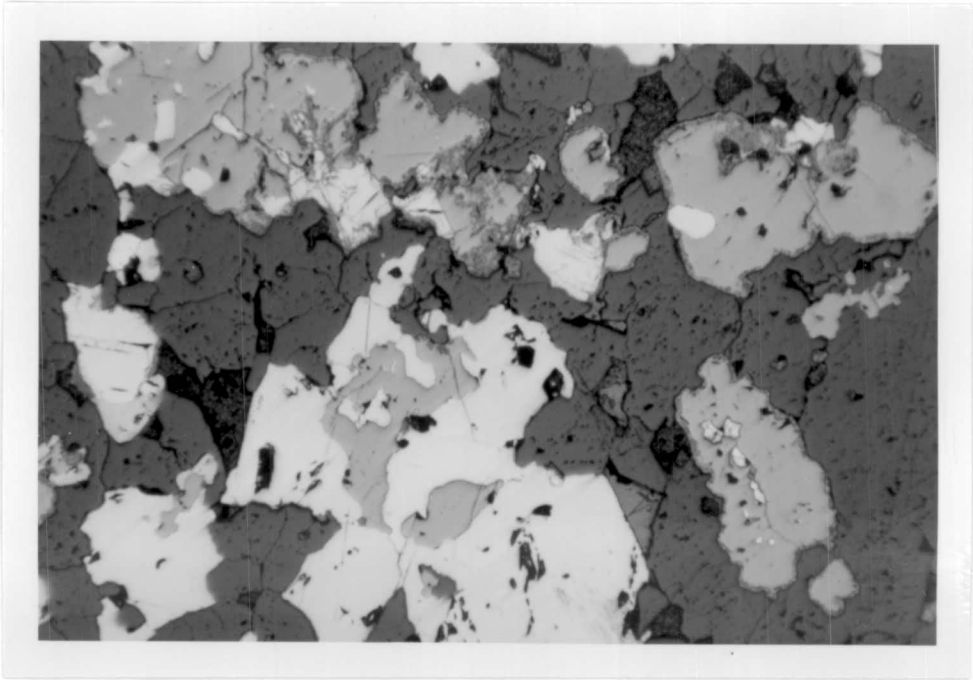
Figure 4



Sample No. 5: Photomicrograph of polished section showing irregular remnant grains of argentian tetrahedrite (freibergite) in a boxwork of oxidized alteration products. The alteration minerals are soft and tended to tear out of the section during polishing; thus, they are below the plane of focus and are blurred. The veinlets consists chiefly of jarosite, but also contain traces of cerargyrite.

Polarized incident light (nicols slightly depolarized).
Scale of print: 1" ≈ 250 microns (100X).

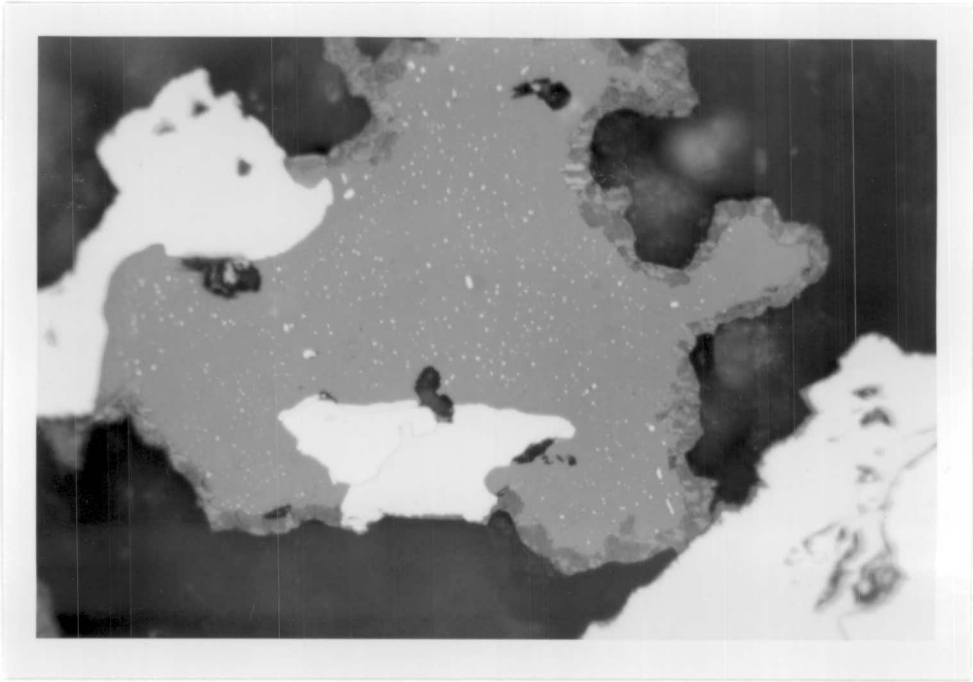
Figure 5



Sample No. 6: This photomicrograph illustrates textural relationships between chalcopyrite (yellow), galena (white), and sphalerite (medium gray) in quartz gangue (dark gray). A small amount of silver bearing tetrahedrite (variety freibergite) occurs as a slightly greenish gray mineral in contact with a galena grain located at the left side of the photomicrograph. Covellite (blue) occurs as secondary replacement skins or rinds around sphalerite and some galena grains.

Plain incident light.
Scale of print: 1" = 310 microns (80X).

Figure 6



Sample No. 6: This photomicrograph shows sphalerite (medium gray) which contains minute exsolution blebs of chalcopyrite (yellow). Secondary covellite has formed a replacement rind on the surface of the sphalerite grain (bireflectant blues and purples); this replacement skin thus occurs at the boundary between the sphalerite and the quartz (black).

Plain reflected light.
Scale of print: 1" = 98 microns (260X).

Figure 7

APPENDIX IV

CONTRACTORS' BIDS

21.00

December 13, 1967

Mr. David F. Crotty, Manager
E. J. LONGYEAR COMPANY
P. O. Box 15218
Salt Lake City, Utah

Dear Mr. Crotty:

Reference is made to your bid submitted on our Ice Lake project dated October 4, 1967. We have recently increased our footage requirements for this project and would greatly appreciate a re-submittal of your bid as per the conditions and requirements herein set forth.

Eight BX size inclined diamond core holes estimated to total 7,100 feet are required. Inclinations and depths of these proposed holes are as follows:

Hole No.	Inclination	Est. Total Depth
1	50°	600
2	50°	1,100
3	55°	800
4	50°	800
5	50°	900
6	50°	700
7	60°	900
8	60°	1,100

The above footages are strictly an estimate and should not be construed to represent a minimum guaranteed footage.

To facilitate comparison of competitive bids, please quote on individual items in the following manner:

(1) Mobilization and demobilization to and from Silverton, Colorado, all crews and equipment Lump sum $_____

(2) Drilling through overburden and placing casing @ $_____per foot

(3) Diamond core drilling (wireline) minimum size EX

0 - 250 feet @ $_____per ft.
250 - 500 feet @ $_____per ft.
500 - 750 feet @ $_____per ft.
750 - 1,000 feet @ $_____per ft.
1,000 - 1,100 feet @ $_____per ft.

(4) Reaming to advance casing

All sizes
0 - 500 feet @ $_____per ft.
500 - 1,000 feet @ $_____per ft.

(5) Cementing and redrilling cement per 2-man crew @ $_____hour

(6) Moving, rigging up, rigging down, laying water lines, etc. @ $_____man hour

(7) Standby, waiting for cement to set, hole surveys, delays caused by Vitro. Per 2-man crew @ $_____hour

(8) Cardboard core boxes to hold 10 feet of core. Each $_____

(9) Casing lost in holes. _____% cost to contractor

Casing left in holes at Vitro's request. _____% cost to contractor

- Conditions, Requirements, and Suggestions -

(1) As you know the project area is in the Upper Ice Lake Basin, San Juan County, Colorado. Elevations of all drill sites are above 12,500 feet.

(2) Drilling contractor will absorb all bit costs, fuel and oil costs at no additional charge to Vitro.

(3) Vitro will satisfy invoices for all cement, drill mud, and mud additive used on the job.

(4) Vitro will provide camp and board to drilling contractors personnel free of charge. This is limited to 14 men.

(5) Vitro will furnish helicopter service for the moving of equipment and supplies from the Silverton area to and from the job sites. To facilitate these moves the drilling contractor must reduce all machine components to 500 pounds or less.

(6) It is suggested that due to the short season that 3 drill rigs operated on a 2-shift per day basis be employed. This would probably necessitate 2 foremen, instead of one as was originally planned when considering 2 rigs.

Your early attention to this request to bid will be greatly appreciated.

If you have any questions pertaining to the requirements of this project, please do not hesitate to contact me.

Very truly yours,

VITRO MINERALS & CHEMICAL COMPANY

THOMAS I. SHARPS
Exploration Geologist

TIS:bas

December 15, 1967

Mr. David F. Crotty, Manager
E. J. LONGYEAR COMPANY
P. O. Box 15218
Salt Lake City, Utah

Dear Mr. Crotty:

Reference is made to our bid request, dated December 13, 1967, for our diamond drilling exploration project in Ice Lake Basin, Colorado.

Please amend that request to include AX wireline drilling costs per the same footage intervals for which you are quoting BX wireline drilling. BX wireline is preferred by us, but if it is unobtainable for any reason, we want to be able to figure the cost of completing the holes by AX wireline.

Also, please amend item 4 under the heading "Conditions and Requirements" to read: Vitro will provide camp and board in the Ice Lake Basin to drilling contractors personnel free of charge.

Also, under item 5 regarding helicopters, we wish to make it clear that Vitro will provide helicopter service for all moves of equipment and supplies to and from the drilling area and from site to site within the area. When possible, helicopter service will be available to move men between the camp and their rigs. We plan on having a helicopter available at all times for emergency use.

Very truly yours,

VITRO MINERALS & CHEMICAL COMPANY

THOMAS I. SHARPS
Exploration Geologist

TIS:bas

21.00

OUR '91 75TH '66 YEAR

Longyear

E. J. LONGYEAR COMPANY
GENERAL OFFICES, 76 SOUTH 8th STREET
MINNEAPOLIS, MINNESOTA 55402, U.S.A.
TELEPHONE (612) 339-7631 • CABLE LONGCO

865 West 2600 South
P. O. Box 15218
Salt Lake City, Utah
December 27, 1967

Vitro Minerals & Chemical Company
600 West 3300 South
Salt Lake City, Utah

Attention: Mr. Tom Sharps

Dear Tom:

This letter will serve to confirm our telephone conversation of today wherein I stated that the bid proposal which we submitted to you on October 4, 1967 for your Ice Lake Basin project in Colorado will remain the same, even though you have added additional footage.

You will notice that my original bid proposal provided for AQWL prices per foot as well as BQWL prices.

Sincerely,

D. F. Crotty

Manager, R. Mt. Zone

DFCrotty:ec

cc: MJGleason

RECEIVED
DEC 29 1967
VITRO MINERALS & CHEMICAL COMPANY

OUR '91 75TH '66 YEAR

Longyear

E. J. LONGYEAR COMPANY
GENERAL OFFICES, 76 SOUTH 8th STREET
MINNEAPOLIS, MINNESOTA 55402, U.S.A.
TELEPHONE (612) 339-7631 • CABLE LONGCO

865 West 2600 South
P. O. Box 15218
Salt Lake City, Utah
October 4, 1967

Vitro Minerals & Chemical Company
600 West 3300 South
Salt Lake City, Utah

Attention: Mr. Tom Sharps

PROPOSED EXPLORATORY DRILLING PROGRAM VICINITY SILVERTON, COLORADO

Gentlemen:

In response to your recent request, and based on field observations made by our Mr. Victor Mayer, we are pleased to submit below for your consideration, our proposal for the subject project.

1. We understand that the project as now planned will consist of a minimum of 4,000 linear feet of drilling in holes not to exceed 1,000 feet in depth; and that the angle will not be less than 45 degrees as measured from the horizontal.

2. The overburden is not expected to exceed 50 feet in depth and will consist of loose angular talus. The formation is to consist of Silverton volcanics, which is a well cemented conglomerate, and San Juan breccia.

3. We also understand that water will be available from a small creek 500 feet from the drilling sites and that the maximum lift will be about 75 feet.

4. We further understand that Vitro Minerals will furnish helicopter service, as required for transportation of equipment and supplies to and from the property from a staging area, and from one drill hole location to another at the jobsite. Vitro Minerals will also provide and supervise the camp with the understanding that camp and board for Contractor's drilling personnel will be free of charge.

5. Based on the conditions as outlined, we are pleased to quote as follows:

a) Mobilization and demobilization of personnel and drilling equipment - $750.00 Lump Sum per drill unit

b) Overburden drilling - $18.50/hr., plus cost of all materials used.

c) Diamond core drilling -

	AQWL	BQWL
0 - 250' in depth	$ 8.75/ft.	$ 9.00/ft.
250 - 500' in depth	9.00/ft.	9.25/ft.
500 - 750' in depth	9.75/ft.	10.00/ft.
750 - 1000' in depth	10.25/ft.	10.50/ft.

NX collaring of hole only - $ 9.50/ft.

d) Reaming for casing, if and when required - $18.50/hr., plus $1.00/ft. reamed, as compensation.

e) Casing, cementing, waiting for cement to set, and any other drill hole stabilizing operations - $18.50/hr.

f) Moving, rigging up, rigging down, and installing and dismantling water lines - 8.00/man hour

g) Casing lost in holes - 80% List Price
Casing left in holes at your request - 100% List Price

h) Drill hole inclination tests and delays for your convenience, or for which you are responsible - $15.50/hr.

i) Cement, drill mud and drill mud additives to be invoiced to you at our cost, f.o.b. job site.

j) Contractor will be re-imbursed by Vitro Minerals for all bit costs in excess of $1.25/ft.

6. For this work we propose to use two skid-mounted Longyear Jr. Model diamond core drills capable of drilling to a depth of 1,000 feet BX size hole. We also propose to operate each drill on two-10 hour shifts per day, five days per week; and employ a driller-foreman to supervise and direct the drilling operations.

7. It is understood that Contractor will take all precautions regarding fire prevention which shall be reasonably required by Vitro Minerals and Chemical Company, or by local or state regulations and practices.

8. Statements covering the work performed will be prepared as promptly as possible after the first of each month, and payment shall be due within twenty days from date of invoice.

9. We will carry public liability insurance covering personal injury and property damage, and Workmen's Compensation insurance and also all-risk insurance on the drilling equipment protecting against loss by theft, fire, flood, landslides, and other similar hazards. Certificates showing the coverage referred to will be furnished upon request.

10. Drill cores will be turned over to your representative at the individual drill hole locations in core boxes furnished by you.

11. We appreciate the opportunity to quote on this project. If we are awarded this work, we would be prepared to commence operations as soon as weather permits in the 1968 field season.

Sincerely,

E. J. LONGYEAR COMPANY

D. F. Crotty

Manager, Rocky Mt. Zone

DFCrotty:ec

ACCEPTED:

VITRO MINERALS & CHEMICAL COMPANY

BY:_____

DATE:_____

21.00

December 13, 1967

Mr. Vincent D. Nourse
Manager, Western Branch
SPRAGUE AND HENWOOD, INC.
2151 North Redwood Road
Salt Lake City, Utah

Dear Mr. Nourse:

Reference is made to your bid submitted on our Ice Lake project dated September 26, 1967. We have recently increased our footage requirements for this project and would greatly appreciate a re-submittal of your bid as per the conditions and requirements herein set forth.

Eight BX size inclined diamond core holes estimated to total 7,100 feet are required. Inclinations and depths of these proposed holes are as follows:

Hole No.	Inclination	Est. Total Depth
1	50°	600
2	50°	1,100
3	55°	800
4	50°	800
5	50°	900
6	50°	700
7	60°	900
8	60°	1,100

The above footages are strictly an estimate and should not be construed to represent a minimum guaranteed footage.

To facilitate comparison of competitive bids, please quote on individual items in the following manner:

(1) Mobilization and demobilization to and from Silverton, Colorado, all crews and equipment Lump sum $_____

(2) Drilling through overburden and placing casing @ $_____per foot

(3) Diamond core drilling (wireline) minimum size BX

0 - 250 feet @ $_____per ft.
250 - 500 feet @ $_____per ft.
500 - 750 feet @ $_____per ft.
750 - 1,000 feet @ $_____per ft.
1,000 - 1,100 feet @ $_____per ft.

(4) Reaming to advance casing

All sizes
0 - 500 feet @ $_____per ft.
500 - 1,000 feet @ $_____per ft.

(5) Cementing and redrilling
Cement per 2-man crew @ $_____hour

(6) Moving, rigging up, rigging down, laying water lines, etc. @ $_____man hour

(7) Standby, waiting for cement to set, hole surveys, delays caused by Vitro. Per 2-man crew @ $_____hour

(8) Cardboard core boxes to hold 10 feet of core. Each $_____

(9) Casing lost in holes. _____% cost to contractor

Casing left in holes at Vitro's request. _____% cost to contractor

- Conditions, Requirements, and Suggestions -

(1) As you know the project area is in the Upper Ice Lake Basin, San Juan County, Colorado. Elevations of all drill sites are above 12,500 feet.

(2) Drilling contractor will absorb all bit costs, fuel and oil costs at no additional charge to Vitro.

(3) Vitro will satisfy invoices for all cement, drill mud, and mud additive used on the job.

(4) Vitro will provide camp and board to drilling contractors personnel free of charge. This is limited to 14 men.

(5) Vitro will furnish helicopter service for the moving of equipment and supplies from the Silverton area to and from the job sites. To facilitate these moves the drilling contractor must reduce all machine components to 500 pounds or less.

(6) It is suggested that due to the short season that 3 drill rigs operated on a 2-shift per day basis be employed. This would probably necessitate 2 foremen, instead of one as was originally planned when considering 2 rigs.

Your early attention to this request to bid will be greatly appreciated.

If you have any questions pertaining to the requirements of this project, please do not hesitate to contact me.

Very truly yours,

VITRO MINERALS & CHEMICAL COMPANY

THOMAS I. SHARPS
Exploration Geologist

TIS:bas

December 15, 1967

Mr. Vincent D. Nourse
Manager, Western Branch
SPRAGUE AND HEINWOOD, INC.
2151 North Redwood Road
Salt Lake City, Utah

Dear Mr. Nourse:

Reference is made to our bid request, dated December 13, 1967, for our diamond drilling exploration project in Ice Lake Basin, Colorado.

Please amend that request to include AX wireline drilling costs per the same footage intervals for which you are quoting BX wireline drilling. BX wireline is preferred by us, but if it is unobtainable for any reason, we want to be able to figure the cost of completing the holes by AX wireline.

Also, please amend item 4 under the heading "Conditions and Requirements" to read: Vitro will provide camp and board in the Ice Lake Basin to drilling contractors personnel free of charge.

Also, under item 5 regarding helicopters, we wish to make it clear that Vitro will provide helicopter service for all moves of equipment and supplies to and from the drilling area and from site to site within the area. When possible, helicopter service will be available to move men between the camp and their rigs. We plan on having a helicopter available at all times for emergency use.

Very truly yours,

VITRO MINERALS & CHEMICAL COMPANY

THOMAS I. SHARPS
Exploration Geologist

TIS:bao

SPRAGUE & HENWOOD, Inc.
Contract Division
REGIONAL OFFICE
2151 North Redwood Road (P.O. Box 2556)
Salt Lake City 10, Utah DAvis 8-4271
DIAMOND DRILLING • MINERAL EXPLORATION • SOIL SAMPLING • PRESSURE GROUTING
SINCE 1883
EXECUTIVE OFFICES & PLANT
SCRANTON, PENNSYLVANIA

December 15, 1967

Vitro Minerals and Chemical Co.
P. O. Box 15437
Salt Lake City, Utah 84115

Attention: Mr. Thomas I. Sharps
Exploration Geologist

Gentlemen:

In accordance with your request for revised proposal on the Ice Lake, Colorado drilling program, we herewith submit our revision based on increased footage amounts and other specification changes recently discussed with Mr. Sharp.

Proposal

1. Mobilization and demobilization to and from Silverton, Colorado all crews and equipment. — Lump sum --- $2,450.00

2. Drilling through overburden and placing casing — @ $10.50 per foot

3. Diamond Core Drilling - Wireline tools -

	BX	AX
0 - 250 '	$8.35	$8.10
250 - 500 '	8.65	8.40
500 - 750 '	8.95	8.70
750 - 1000 '	9.25	9.00
1000 - 1100 '	9.55	9.30

4. Reaming to advance casing, All sizes

0 - 500 '	@ $ 5.50 per foot
500 - 1000 '	@ 5.75 per foot

5. Cementing and redrilling cement rig time, 2-man crew — @ $26.00 per hour

continued page 2

RECEIVED
DEC 13 1967
VITRO MINERALS & CHEMICAL COMPANY

Vitro Minerals and Chemical Co.
Salt Lake City, Utah 84115

Proposal continued

6. Moving, rigging up, rigging down, laying water lines, etc.		@ $ 9.00 per man/hour
	Or	@ 18.00 per 2-man crew per hour
7. Standby, waiting for cement to set, hole surveys, delays caused by Vitro		@ $22.00 per 2-man crew per hour
8. Cardboard core boxes to hold 10' of core		@ $0.90 each
9. Casing lost in holes		@ 50% price list
Casing left at Vitro's request		@ 95% price list

Conditions

1. Sprague and Henwood, Inc. will provide two #40C S & H skid-mounted hydraulic head core drills, operating three 8-hour shifts on each machine, or three core drills operating two 10-hour shifts on each machine. Total crews would consist of 6 two-man drill crews and 2 qualified supervisors, total 14 men. All accessory equipment and diamond bits would be furnished, as well as fuel for machines.

2. Drilling muds, additives, cement and soluble oil will be supplied by Sprague and Henwood, Inc. to staging area. Vitro will be responsible for transportation of such products, as well as fuel, to drill area. These products will be reimbursed to Sprague and Henwood, Inc. at invoice cost f.o.b. staging area. Left over materials will be credited to Vitro, by suppliers credit memo.

3. Camp and board will be furnished by Vitro at no cost to Sprague and Henwood, Inc, and will be limited to 14 contractor's personnel.

4. Hourly rate under Item 6 will apply for all time spent by crews to move equipment into drill area, setting up, laying water line, moving site to site, tearing down and breaking water line at termination of drilling and moving back out to staging area.

5. It is understood that a 500# limitation exists on any piece of equipment or supplies that is handled by helicopter.

continued page 3

Vitro Minerals and Chemical Co.
Salt Lake City, Utah 84115

Proposal continued

6. Helicopter service to be supplied from staging area to camp and drill areas by Vitro.

7. Sprague and Henwood, Inc. will reserve the right to withdraw this proposal any time after May 1, 1968, unless notified of award prior to May 1, 1968.

Thank you for giving us the opportunity to quote on this work.

Very truly yours,

SPRAGUE AND HENWOOD, INC.

Vincent D. Nourse
Manager, Western Branch

VDN:rp

21.0

December 13, 1967

Mr. George E. Lensch
District Manager
BOYLES BROS. DRILLING COMPANY
15865 West 5th Avenue
Golden, Colorado 80401

Dear Mr. Lensch:

Reference is made to your bid submitted on our Ice Lake project dated October 6, 1967. We have recently increased our footage requirements for this project and would greatly appreciate a re-submittal of your bid as per the conditions and requirements herein set forth.

Eight DK size inclined diamond core holes estimated to total 7,100 feet are required. Inclinations and depths of these proposed holes are as follows:

Hole No.	Inclination	Est. Total Depth
1	50°	600
2	50°	1,100
3	55°	800
4	50°	800
5	50°	900
6	50°	700
7	60°	900
8	60°	1,100

The above footages are strictly an estimate and should not be construed to represent a minimum guaranteed footage.

To facilitate comparison of competitive bids, please quote on individual items in the following manner:

(1) Mobilization and demobilization to and from Silverton, Colorado, all crews and equipment — Lump sum $_____

(2) Drilling through overburden and placing casing — @ $_____per foot

(3) Diamond core drilling (wireline) minimum size BX

0 - 250 feet @ $_____per ft.
250 - 500 feet @ $_____per ft.
500 - 750 feet @ $_____per ft.
750 - 1,000 feet @ $_____per ft.
1,000 - 1,100 feet @ $_____per ft.

(4) Reaming to advance casing

All sizes
0 - 500 feet @ $_____per ft.
500 - 1,000 feet @ $_____per ft.

(5) Cementing and redrilling cement per 2-man crew @ $_____hour

(6) Moving, rigging up, rigging down, laying water lines, etc. @ $_____man hour

(7) Standby, waiting for cement to set, hole surveys, delays caused by Vitro. Per 2-man crew @ $_____hour

(8) Cardboard core boxes to hold 10 feet of core. Each $_____

(9) Casing lost in holes. _____% cost to contractor

Casing left in holes at Vitro's request. _____% cost to contractor

- Conditions, Requirements, and Suggestions -

(1) As you know the project area is in the Upper Ice Lake Basin, San Juan County, Colorado. Elevations of all drill sites are above 12,500 feet.

(2) Drilling contractor will absorb all bit costs, fuel and oil costs at no additional charge to Vitro.

(3) Vitro will satisfy invoices for all cement, drill mud, and mud additive used on the job.

(4) Vitro will provide camp and board to drilling contractors personnel free of charge. This is limited to 14 men.

(5) Vitro will furnish helicopter service for the moving of equipment and supplies from the Silverton area to and from the job sites. To facilitate these moves the drilling contractor must reduce all machine components to 500 pounds or less.

(6) It is suggested that due to the short season that 3 drill rigs operated on a 2-shift per day basis be employed. This would probably necessitate 2 foremen, instead of one as was originally planned when considering 2 rigs.

Your early attention to this request to bid will be greatly appreciated.

If you have any questions pertaining to the requirements of this project, please do not hesitate to contact me.

Very truly yours,

VITRO MINERALS & CHEMICAL COMPANY

THOMAS I. SHARPS
Exploration Geologist

TIS:bas

December 15, 1967

Mr. George E. Lensch
District Manager
BOYLES BROS. DRILLING COMPANY
15865 West 5th Avenue
Golden, Colorado

Dear Mr. Lensch:

Reference is made to our bid request, dated December 13, 1967, for our diamond drilling exploration project in Ice Lake Basin, Colorado.

Please amend that request to include AX wireline drilling costs per the same footage intervals for which you are quoting BX wireline drilling. BX wireline is preferred by us, but if it is unobtainable for any reason, we want to be able to figure the cost of completing the holes by AX wireline.

Also, please amend item 4 under the heading "Conditions and Requirements" to read: Vitro will provide camp and board in the Ice Lake Basin to drilling contractors personnel free of charge.

Also, under item 5 regarding helicopters, we wish to make it clear that Vitro will provide helicopter service for all moves of equipment and supplies to and from the drilling area and from site to site within the area. When possible, helicopter service will be available to move men between the camp and their rigs. We plan on having a helicopter available at all times for emergency use.

Very truly yours,

VITRO MINERALS & CHEMICAL COMPANY

THOMAS I. SHARPS
Exploration Geologist

TIS:bas

DIAMOND CORE DRILLING
DIAMOND DRILLING EQUIPMENT
GROUTING
FOUNDATION TESTING
MINING
QUARRYING
SHAFT SINKING
TUNNEL DRIVING
MINE PLANT DESIGN
AND FABRICATION

Boyles Bros.
DRILLING COMPANY
CONTRACTORS-ENGINEERS-GEOLOGISTS
15865 West 5th Avenue
GOLDEN, COLORADO 80401
Phone (303) 279-7913

General Offices and Plant
1624 Pioneer Road P. O. Box 58
SALT LAKE CITY, UTAH 84110
Phone 487-7595

BRANCH OFFICES
ARIZONA (PHOENIX)
CALIFORNIA (AUBURN)
COLORADO (GOLDEN)
NEVADA (SPARKS)
WASHINGTON (SPOKANE)
CHILE (SANTIAGO)
CABLE: BOYLESBROS
MEXICO, D.F.
PERU (LIMA)
CABLE: BOYLESCOP

December 29, 1967

Vitro Minerals & Chemical Company
Division of Vitro Corporation of America
600 West 3rd South Street
Salt Lake City, Utah 84115

Attention: Mr. Thomas I. Sharps - Exploration Geologist

Dear Sir:

As per your request in your letter of December 13, and acknowledgement of your letter of December 15, 1967, we propose the following schedule of charges for core drilling, approximately 6900 feet, at your Ice Lake Project near Silverton, Colorado.

1. Mobilization and demobilization of men and equipment to the Silverton area, from which the helicopter will fly, lump sum, each rig. $ 600.00

2. Overburden, plus cost of bits, per hour. $ 20.00

3. Core drilling:

	NC	NX	BX	AX
0 to 250 feet.	$10.50	$ 9.65	$ 8.35	$ 8.10
250 to 500 feet.		11.40	8.95	8.70
500 to 750 feet.			10.45	10.20
750 to 1000 feet.			13.20	12.95
1000 to 1100 feet.			14.70	14.45

4. Reaming, if required.
   0 to 500 feet, per foot. $ 5.85
   500 to 1000 feet, per foot. 8.35

5. Cementing, plus cost of cement or cement substitutes, including mud, per hour. $ 20.00

6. Standby and delays, per hour. $ 17.00

7. Moving in, out and from site to site. Every man to be charged for including supervision, per man hour. $ 6.50

DIAMOND CORE DRILLING
DIAMOND DRILLING EQUIPMENT
GROUTING
FOUNDATION TESTING
MINING
QUARRYING
SHAFT SINKING
TUNNEL DRIVING
MINE PLANT DESIGN
AND FABRICATION

Boyles Bros.
DRILLING COMPANY
CONTRACTORS-ENGINEERS-GEOLOGISTS
15865 West 5th Avenue
GOLDEN, COLORADO 80401
Phone (303) 279-7913

General Offices and Plant
1624 Pioneer Road P. O. Box 58
SALT LAKE CITY, UTAH 84110
Phone 487-7595

BRANCH OFFICES
ARIZONA (PHOENIX)
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WASHINGTON (SPOKANE)
CHILE (SANTIAGO)
CABLE: BOYLESBROS
MEXICO, D.F.
PERU (LIMA)
CABLE: BOYLESCOP

8. Cardboard core boxes to hold 10 feet of core, each. $ 1.00

9. Lost casing will be charged at our cost, at job site.

10. Camp and kitchen will be set up, furnished and maintained free of charge to all Boyles personal by Vitro Minerals & Chemical Company.

11. The moving of equipment and supplies from the Silverton area, to and from the job sites, will be the responsibility of Vitro Minerals & Chemical Company.

12. Travel time, if required, from camp to drill site, for crews, will be charged to Vitro Minerals & Chemical Company at cost of wages, payroll taxes & insurance.

Due to the location of the site, I believe it necessary to consider paying a subsistance to the personal on the project. I suggest the furnishing of the camp and food would compensate for this.

Should our company be favored, we would appreciate as much notice as possible to enable us to schedule crews and equipment.

If you have any questions, please feel free to call me. Thank you for your consideration of our company.

Very truly yours,

BOYLES BROS. DRILLING COMPANY

George E. Lensch

George E. Lensch, District Manager

December 15, 1967

PEASE HAMILTON HELICOPTER, INC.
Denver Club Building
Denver, Colorado

Gentlemen:

Thank you for your recent response to our request for bids on helicopter service for our contemplated exploration project in Ice Lake Basin, San Juan County, Colorado. However, because some changes have been made in the project, we are requesting all contractors to submit new bids based on the conditions and requirements set forth below. Your early attention to this request will be greatly appreciated.

Conditions and Requirements

(1) Operating elevations will be between 9,000 and 13,200 feet above sea level.

(2) Pilots must have had 1,000 hours total flight time and 250 hours flight time above 10,000 feet in helicopters of the type and model you propose to employ on this project.

(3) The helicopter must be capable of transporting a sling load of 500 pounds at an elevation of 13,200 feet under average conditions.

(4) The project will start on or about June 15, 1968, and is tentatively estimated to conclude about September 15, 1968.

(5) The helicopter will be used to transport diamond drilling equipment and supplies from Silverton to Ice Lake Basin at the start of the project; move the drills from site to site during the project; and transport them back to Silverton at the conclusion of the project.

(6) During the project, the helicopter will be used to transport drilling crews to and from the drills (weather permitting), to bring supplies to camp and drills from Silverton, and to transport boxed core from the drills to Silverton.

(7) The helicopter should be available for emergency use at all times during the project and should be equipped to transport injured personnel.

(8) In regard to item 7 above, it is preferable that the helicopter and pilot be based at our camp in Ice Lake Basin. Room and board (excluding sleeping bag) will be provided in camp for the pilot.

(9) Contractor will provide all gasoline, oil, and operating supplies.

(10) Contractor will provide public liability insurance and adequate insurance covering cargo and personnel to be carried during the project.

Quotes Requested

In order to facilitate comparison of the competitive bids, please quote on the following items.

(1) Cost, if any, of ferry time from home base to Silverton, Colorado, and return.

(2) Cost per hour of flight time for a monthly contract calling for a minimum of two hours flight time per day. This contract would be renewable at Vitro's option and would provide that the helicopter would be at Vitro's disposal at all times unless specifically released. Hours of flight time flown for other parties during any month would apply against Vitro's minimum flight time.

(3) Cost per hour of flight time for all hours flown in excess of the two hour per day minimum during any monthly contract.

(4) Cost per hour of flight time for a monthly contract calling for a minimum of three hours flight time per day. All other contract provisions as in item 2 above.

(5) Cost per hour of flight time for all hours flown in excess of the three hour per day minimum during any monthly contract.

(6) Vitro reserves the right to terminate any monthly contract before the end of the contract, in which case charges for the period will be pro-rated on the monthly basis.

(7) Contractor will state make and model number of equipment he proposes to employ in the contract.

Please contact me if you have any questions.

Very truly yours,

VITRO MINERALS & CHEMICAL COMPANY

THOMAS I. SHARPS
Exploration Geologist

TIS:bas

2.00

PEASE-HAMILTON HELICOPTERS, INC.
1517 DENVER CLUB BUILDING
DENVER, COLORADO 80202

December 26, 1967

TELEPHONE
(303) 534-6121

Vitro Minerals & Chemical Company
P. O. Box 15437
Salt Lake City, Utah 84115

Attention: Mr. Thomas I. Sharps
Exploration Geologist

Gentlemen:

We wish to thank you for the opportunity to resubmit a bid under your new conditions and requirements set forth in your letter dated December 15, 1967, on your exploration project in the Ice Lake Basin in San Juan County, Colorado.

The purpose of this letter is to state in writing the rates, charges and conditions applicable to our charter agreement for the Bell G3B1 helicopter which we would propose to employ on your project.

Our rates are $125.00 per flight hour. This hour being computed only when the helicopter rotors are engaged. A minimum charge of $375.00 per day, or 3 flight hours per day will be computed in the following manner: Multiply the number of days the aircraft is chartered by 3 . . .

Example: 30 days x 3 = 90 hours

This 90 hours would be a minimum amount of time that could be flown in 30 days. There is no maximum.

Any additional time above the 3 hours per day will be at a rate of $125.00 per flight hour. All over 100 hours in any one month, the rate will be $100.00 per flight hour.

The ferry time from Denver to Silverton and return to Denver will be provided free of charge by Pease-Hamilton Helicopters, Inc.

The charterer will also be billed for pilot expenses, such as, meals and motel, and he will also provide transportation between the aircraft and living quarters, if necessary.

F.A.A. requires that an inspection be performed by an A & E licensed mechanic every 50 hours on the helicopter. In keeping with our company policy of providing superior maintenance on the helicopter, we go beyond

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DEC 29 1967
VITRO MINERALS & CHEMICAL COMPANY

this maximum time requirement and pull our inspections every 24 hours. This inspection requires approximately 6 hours. The expense of positioning this mechanic and lodging is charged to the customer. Pease-Hamilton will pay his regular wage and other expenses entailed.

We have found in the past that this additional safety feature has benefited the customer in the long run and gives you and our personnel the assurance of knowing the helicopter is in topnotch condition. Also, our pilots have a minimum of over 5,000 hours, with extensive mountain and sling experience.

In regards to Item 7 of conditions and requirements. We feel the nature of your work will require frequent trips into Silverton. If, by proper scheduling, we could spend the majority of nights in Silverton, this would eliminate additional flight time that would be required to position large quantities of aviation fuel at your job site. By departing Sliverton early in the morning with full tanks of fuel, this would possibly eliminate additional refueling during the day. Also, being close to a telephone at Silverton would allow us to keep in touch with our base of operations in Denver, and promote other work in the area that would apply towards your minimum flight time.

Enclosed is a Xerox copy of our insurance coverage, which we hope will be satisfactory in every regard.

We wish to thank you again for the opportunity to submit this revised bid and we sincerely hope that we will be the successful bidder for this job. If there are any further questions regarding this bid or our operations, please feel free to call us anytime.

Very truly yours,

PEASE-HAMILTON HELICOPTERS, INC.

Mackie D. Mott

Mackie D. Mott,
Flight Operations

MDM/ln

Encl.

CERTIFICATE OF INSURANCE

EFFECTED THROUGH

Van Schaack & Co.

624 SEVENTEENTH ST. • DENVER, COLORADO 80202

Contract No. 450400000

PRODUCER VAN SCHAACK & CO.

CERT. NO. 45040-38-67 RENEWAL OF CERTIFICATE NO. New

ASSURED PEASE-HAMILTON HELICOPTERS, INC.
Denver Club Building
Denver, Colorado 80202

	PREMIUM
$1,000,000 Single limit liability	$ 1900.00
$2500.00 medical payments	50.00
STATE TAX 2%	45.00
Cargo legal liability	300.00
POLICY FEE	
	$ 2295.00

In accordance with authorization granted to VAN SCHAACK & COMPANY, by LLOYDS UNDERWRITERS AND ENGLISH COMPANIES whose names and the proportions underwritten by them are or will be on file in the office of the undersigned, and also on file in the office of J. H. MINET & CO. LTD., London, England (hereinafter called the "Underwriters"), the Underwriters do hereby bind themselves, each for his own part and not one for another, for 100 % of the risk and amount and premium expressed herein, in favour of PEASE-HAMILTON HELICOPTERS, INC. (hereinafter called the "Assured"), in consideration of the stipulations herein named during the period commencing with the 31st of August, 1967 and ending with the 31st of August, 1968 both days at 12:01 a.m. Standard Time, at the Assured's address shown above.

COVERAGE: Helicopter Liability Coverage - See Aviation Form 20 attached.
1966 Bell 47GB-1 Helicopter, N1324X
1967 Bell 47GB-1 Helicopter, N7942S

It is agreed that in the event of the failure of Underwriters hereon to pay any amount claimed to be due hereunder, Underwriters hereon, at the request of the insured (or reinsured), will submit to the jurisdiction of any Court of competent jurisdiction within the United States and will comply with all requirements necessary to give such Court jurisdiction and all matters arising hereunder shall be determined in accordance with the law and practice of such Court.

It is further agreed that service of process in such suit may be made upon VAN SCHAACK & COMPANY, and that in any suit instituted against any one of them upon this contract, Underwriters will abide by the final decision of such Court or of any Appellate Court in the event of an appeal.

The above-named are authorized and directed to accept service of process on behalf of Underwriters in any such suit and/or upon the request of the insured (or reinsured) to give a written undertaking to the insured (or reinsured) that they will enter a general appearance upon Underwriters' behalf in the event such a suit shall be instituted.

Further, pursuant to any statute of any state, territory or district of the United States which makes provision therefor, Underwriters hereon hereby designate the Superintendent, Commissioner or Director of Insurance or other officer specified for that purpose in the statute, or his successor or successors lawful process in any action, suit or proceeding instituted by or on behalf of the insured (or in office, as their true and lawful attorney upon whom may be served any reinsured) or any beneficiary hereunder arising out of this contract of insurance (or reinsurance), and hereby designate the above-named as the person to whom the said officer is authorized to mail such process or a true copy thereof.

1. This insurance is made and accepted subject to all the provisions, conditions, and warranties set forth herein and in any forms or endorsements attached hereto, all of which are to be considered as incorporated herein and any provisions, or conditions appearing in any forms or endorsements attached hereto which alter the Certificate provisions stated hereon shall supersede such Certificate provisions in so far as they are inconsistent therewith.

2. This Certificate may be cancelled on the customary short rate basis by the Assured at any time by written notice or by surrender of the Certificate to VAN SCHAACK & COMPANY. This Certificate may also be cancelled with or without the return or tender of the unearned premium, by the Underwriters or by VAN SCHAACK & COMPANY, on their behalf, by delivering to the Assured or by sending to the Assured by mail, registered or unregistered, at the Assured's address as shown herein not less than ten (10) days' written notice stating when the cancellation shall be effective, and in such case the Underwriters shall refund the paid premium less the earned portion thereof on demand, subject always to the retention by Underwriters hereon of any minimum premium stipulated herein (or proportion thereof previously agreed upon) in the event of cancellation either by Underwriters or Assured.

3. It is expressly understood and agreed by the Assured by accepting this instrument that the undersigned is not one of the Underwriters or Assurers hereunder and neither is nor shall be in any way or to any extent liable for any loss or claim whatever as an Assurer, but the Assurers hereunder are only those Underwriters whose names are on file as hereinbefore set forth.

4. If the Assured shall make any claim knowing the same to be false or fraudulent, as regards amount or otherwise, this Certificate shall become void, and all claims hereunder shall be forfeited.

5. THIS CERTIFICATE SHALL BE SUBJECT, HOWEVER, IN ALL RESPECTS TO THE TERMS, CONDITIONS AND PROVISIONS OF UNDERWRITERS' POLICY HERETOFORE OR HEREAFTER ISSUED, IT BEING AGREED THAT THE PROVISIONS OF SAID POLICY, IN CASE OF CONFLICT HEREWITH, BE CONTROLLING.

6. This Certificate of insurance shall not be assigned either in whole or in part, without the written consent of the undersigned endorsed hereon.

7. Notice is hereby given that the Underwriters have agreed to allow for the purpose of paying the Federal Excise Tax, if any, of the premium payable hereon to the extent such premium is subject to Federal Excise Tax.

8. It is understood and agreed that in the event of any return of premium becoming due hereunder the Underwriters will deduct 2% from the amount of the return and the Assured or his agent should take steps to recover the Tax from the U. S. Government.

This Certificate shall not be valid unless signed by VAN SCHAACK & COMPANY.

Dated at Denver, Colorado 80202, this day of October, 1967

VAN SCHAACK & COMPANY

By W. R. Kuster

RECEIVED DEC 8 1967 NITRO MINERALS & CHEMICAL COMPANY

Original

December 18, 1967

TRANS-WEST AIR SERVICE
Division of Aerial Applicators, Inc.
2382 West 580 North
Salt Lake City, Utah

ATTENTION: MR. JOHN STREETER, GENERAL MANAGER

Dear Mr. Streeter:

Thank you for your recent response to our request for bids on helicopter service for our contemplated exploration project in Ice Lake Basin, San Juan County, Colorado. However, because some changes have been made in the project, we are requesting all contractors to submit new bids based on the conditions and requirements set forth below. Your early attention to this request will be greatly appreciated.

Conditions and Requirements

(1) Operating elevations will be between 9,000 and 13,200 feet above sea level.

(2) Pilots must have had 1,000 hours flight time and 250 hours flight time above 10,000 feet in helicopters of the type and model you propose to employ on this project.

(3) The helicopter must be capable of transporting a sling load of 500 pounds at an elevation of 13,200 feet under average conditions.

(4) The project will start on or about June 15, 1968, and is tentatively estimated to conclude about September 15, 1968.

(5) The helicopter will be used to transport diamond drilling equipment and supplies from Silverton to Ice Lake Basin at the start of the project; move the drills from site to site during the project; and transport them back to Silverton at the conclusion of the project.

(6) During the project, the helicopter will be used to transport drilling crews to and from the drills (weather permitting), to bring supplies to camp and drills from Silverton, and to transport boxed core from the drills to Silverton.

(7) The helicopter should be available for emergency use at all times during the project and should be equipped to transport injured personnel.

(8) In regard to item 7 above, it is preferable that the helicopter and pilot be based at our camp in Ice Lake Basin. Room and board (excluding sleeping bag) will be provided in camp for the pilot.

(9) Contractor will provide all gasoline, oil, and operating supplies.

(10) Contractor will provide public liability insurance and adequate insurance covering cargo and personnel to be carried during the project.

Quotes Requested

In order to facilitate comparison of the competitive bids, please quote on the following items.

(1) Cost, if any, of ferry time from home base to Silverton, Colorado, and return.

(2) Cost per hour of flight time for a monthly contract calling for a minimum of two hours flight time per day. This contract would be renewable at Vitro's option and would provide that the helicopter would be at Vitro's disposal at all times unless specifically released. Hours of flight time flown for other parties during any month would apply against Vitro's minimum flight time.

(3) Cost per hour of flight time for all hours flown in excess of the two hour per day minimum during any monthly contract.

(4) Cost per hour of flight time for a monthly contract calling for a minimum of three hours flight time per day. All other contract provisions as in item 2 above.

(5) Cost per hour of flight time for all hours flown in excess of the three hour per day minimum during any monthly contract.

(6) Vitro reserves the right to terminate any monthly contract before the end of the contract, in which case charges for the period will be pro-rated on the monthly basis.

(7) Contractor will state make and model number of equipment he proposes to employ in the contract.

Please contact me if you have any questions.

Very truly yours,

VITRO MINERALS & CHEMICAL COMPANY

THOMAS I. SHARPS
Exploration Geologist

TIS:bas

21.00

INC.
tors

FIXED WING AND HELICOPTER
Specialists in Aerial Spraying, Fire Fighting and Mountain Flying
2382 WEST 580 NORTH ● SALT LAKE CITY, UTAH 84116 ● 322-0527

DECEMBER 27, 1967

VITRO MINERALS & CHEMICAL COMPANY
DIVISION OF VITRO CORPORATION OF AMERICA
600 WEST 33RD SOUTH STREET, P.O.BOX 15437
SALT LAKE CITY, UTAH 84115

ATTENTION: MR. THOMAS I. SHARPS

DEAR MR. SHARPS:

IN ANSWER TO YOUR REQUEST FOR HELICOPTER SERVICE IN THE SILVERTON AREA, WE SUBMIT THE FOLLOWING INFORMATION.

WE WOULD BE MOST AGREEABLE TO KEEPING A HELICOPTER AND PILOT AT YOUR ICE LAKE CAMP.

IN RESPONSE TO YOUR ITEMS:

#1 FERRY TIME—IF THE HELICOPTER IS USED MORE THAN 100 HOURS ON THE TOTAL JOB, (NOT 100 HOURS PER MONTH)-----NO CHARGE. IN THE EVENT THE HELICOPTER IS USED LESS THAN 100 HOURS A FLAT CHARGE OF $250.00.

#2 2 HOURS PER DAY FOR 30 DAYS = 60 HOURS—PER HOUR CHARGE $125.00 PER HOUR.

#3 PER HOUR CHARGE IN EXCESS OF 60 HOURS IN THE 30 DAY PERIOD = $115.00 PER HOUR.

#4 3 HOURS PER DAY FOR 30 DAYS = 90 HOURS—PER HOUR CHARGE $110.00 PER HOUR.

#5 PER HOUR CHARGE IN EXCESS OF 90 HOURS IN THE 30 DAY PERIOD = $90.00 PER HOUR.

#6 THE HELICOPTER THAT WE WILL USE IS A BELL 47 G3B-1. A SUPER-CHARGED SHIP EQUIPPED WITH EXTERNAL CARGO RACKS AND CARGO HOOK FOR SLING LOAD WORK.

INC.
tors

FIXED WING AND HELICOPTER
Specialists in Aerial Spraying, Fire Fighting and Mountain Flying
2382 WEST 580 NORTH • SALT LAKE CITY, UTAH 84116 • 322-0527

I HOPE YOU WILL FIND THIS BID ATTRACTIVE. WE WOULD BE MOST HAPPY TO HAVE YOU CHECK SOME PEOPLE THAT WE HAVE DONE THIS TYPE OF WORK FOR.

BEAR CREEK MINING CO.----------MR. DAN REGAN

PHELPS DODGE CORPORATION----------MR. CHUCK ARNOLD

U. S. FOREST SERVICE----------MR. JIM SOTOR

U. S. GEOLOGICAL SURVEY----------(DENVER OFFICE)

? NAME OF MAN ON JOB

IF YOU WILL CHECK WITH ANY OF THESE PEOPLE, I AM SURE THAT THEY WILL TELL YOU THAT WE ARE DEPENDABLE, CAPABLE, AND SKILLED IN THIS TYPE OF WORK.

YOU WILL FIND THAT WE ARE ALWAYS READY TO DO THE JOB AND WE HAVE YOUR INTERESTS FOREMOST IN OUR MIND, BUT WE NEVER COMPROMISE WITH SAFETY.

SINCERELY YOURS,

AERIAL APPLICATORS, INC.

JOHN D. STREETER
PRESIDENT

JDS:DG

RECEIVED
DEC 23 1967
VITRO MINERALS & CHEMICAL COMPANY

December 18, 1967

Mr. Ron Newbrough
SKYCHOPPERS
P. O. Box 1222
Durango, Colorado

Dear Mr. Newbrough:

Thank you for your recent response to our request for bids on helicopter service for our contemplated exploration project in Ice Lake Basin, San Juan County, Colorado. However, because some changes have been made in the project, we are requesting all contractors to submit new bids based on the conditions and requirements set forth below. Your early attention to this request will be greatly appreciated.

Conditions and Requirements

(1) Operating elevations will be between 9,000 and 13,200 feet above sea level.

(2) Pilots must have had 1,000 hours total flight time and 250 hours flight time above 10,000 feet in helicopters of the type and model you propose to employ on this project.

(3) The helicopter must be capable of transporting a sling load of 500 pounds at an elevation of 13,200 feet under average conditions.

(4) The project will start on or about June 15, 1968, and is tentatively estimated to conclude about September 15, 1968.

(5) The helicopter will be used to transport diamond drilling equipment and supplies from Silverton to Ice Lake Basin at the start of the project; move the drills from site to site during the project; and transport them back to Silverton at the conclusion of the project.

(6) During the project, the helicopter will be used to transport drilling crews to and from the drills (weather permitting), to bring supplies to camp and drills from Silverton, and to transport boxed core from the drills to Silverton.

(7) The helicopter should be available for emergency use at all times during the project and should be equipped to transport injured personnel.

(8) In regard to item 7 above, it is preferable that the helicopter and pilot be based at our camp in Ice Lake Basin. Room and board (excluding sleeping bag) will be provided in camp for the pilot.

(9) Contractor will provide all gasoline, oil, and operating supplies.

(10) Contractor will provide public liability insurance and adequate insurance covering cargo and personnel to be carried during the project.

Quotes Requested

In order to facilitate comparison of the competitive bids, please quote on the following items.

(1) Cost, if any, of ferry time from home base to Silverton, Colorado, and return.

(2) Cost per hour of flight time for a monthly contract calling for a minimum of two hours flight time per day. This contract would be renewable at Vitro's option and would provide that the helicopter would be at Vitro's disposal at all times unless specifically released. Hours of flight time flown for other parties during any month would apply against Vitro's minimum flight time.

(3) Cost per hour of flight time for all hours flown in excess of the two hour per day minimum during any monthly contract.

(4) Cost per hour of flight time for a monthly contract calling for a minimum of three hours flight time per day. All other contract provisions as in item 2 above.

(5) Cost per hour of flight time for all hours flown in excess of the three hour per day minimum during any monthly contract.

(6) Vitro reserves the right to terminate any monthly contract before the end of the contract, in which case charges for the period will be pro-rated on the monthly basis.

(7) Contractor will state make and model number of equipment he proposes to employ in the contract.

Please contact me if you have any questions.

Sincerely,

VITRO MINERALS & CHEMICAL COMPANY

THOMAS I. SHARPS
Exploration Geologist

TIS:bas

21.00

Sky Choppers, Inc.

R. E. NEWBROUGH
PRESIDENT

P.O. Box 1222
Durango, Colorado 81302

PHONE
303-247-0861

December 27, 1967

Vitro Minerals & Chemical Company
Mr. Thomas I. Sharps, Exploration Geologist
P. O. Box 15437
Salt Lake City, Utah 84115

Dear Mr. Sharps:

Sky Choppers, Inc. agrees to all conditions and requirements listed #1 through #10.

Under quotes requested:

#1 No ferry time charges.

#2 $120.00 per hour.

#3 $118.00 per hour above 60 hours.

#4 $115.00 per hour.

#5 $110.00 per hour above 90 hours.

#6 Sky Choppers, Inc. agrees to the termination conditions set forth by Vitro Minerals.

#7 Contractor proposes to use Bell 47G3B1 helicopters that are turbo charged.

Sincerely,

R. E. Newbrough

SKY CHOPPERS, INC.
R. E. Newbrough, President

RECEIVED
DEC 29 1967
VITRO MINERALS & CHEMICAL COMPANY

December 18, 1967

Mr. James B. Burr
MOUNTAIN WEST HELICOPTERS
P. O. Box 691
Provo, Utah

Dear Mr. Burr:

Thank you for your recent response to our request for bids on helicopter service for our contemplated exploration project in Ice Lake Basin, San Juan County, Colorado. However, because some changes have been made in the project, we are requesting all contractors to submit new bids based on the conditions and requirements set forth below. Your early attention to this request will be greatly appreciated.

Conditions and Requirements

(1) Operating elevations will be between 9,000 and 13,200 feet above sea level.

(2) Pilots must have had 1,000 hours total flight time and 250 hours flight time above 10,000 feet in helicopters of the type and model you propose to employ on this project.

(3) The helicopter must be capable of transporting a sling load of 500 pounds at an elevation of 13,200 feet under average conditions.

(4) The project will start on or about June 15, 1968, and is tentatively estimated to conclude about September 15, 1968.

(5) The helicopter will be used to transport diamond drilling equipment and supplies from Silverton to Ice Lake Basin at the start of the project; move the drills from site to site during the project; and transport them back to Silverton at the conclusion of the project.

(6) During the project, the helicopter will be used to transport drilling crews to and from the drills (weather permitting), to bring supplies to camp and drills from Silverton, and to transport boxed core from the drills to Silverton.

(7) The helicopter should be available for emergency use at all times during the project and should be equipped to transport injured personnel.

(8) In regard to item 7 above, it is preferable that the helicopter and pilot be based at our camp in Ice Lake Basin. Room and board (excluding sleeping bag) will be provided in camp for the pilot.

(9) Contractor will provide all gasoline, oil, and operating supplies.

(10) Contractor will provide public liability insurance and adequate insurance covering cargo and personnel to be carried during the project.

Quotes Requested

In order to facilitate comparison of the competitive bids, please quote on the following items.

(1) Cost, if any, of ferry time from home base to Silverton, Colorado, and return.

(2) Cost per hour of flight time for a monthly contract calling for a minimum of two hours flight time per day. This contract would be renewable at Vitro's option and would provide that the helicopter would be at Vitro's disposal at all times unless specifically released. Hours of flight time flown for other parties during any month would apply against Vitro's minimum flight time.

(3) Cost per hour of flight time for all hours flown in excess of the two hour per day minimum during any monthly contract.

(4) Cost per hour of flight time for a monthly contract calling for a minimum of three hours flight time per day. All other contract provisions as in item 2 above.

(5) Cost per hour of flight time for all hours flown in excess of the three hour per day minimum during any monthly contract.

(6) Vitro reserves the right to terminate any monthly contract before the end of the contract, in which case charges for the period will be pro-rated on the monthly basis.

(7) Contractor will state make and model number of equipment he proposes to employ in the contract.

Please contact me if you have any questions.

Sincerely,

VITRO MINERALS & CHEMICAL COMPANY

THOMAS I. SHARPS
Exploration Geologist

TIS:bas

MOUNTAIN WEST HELICOPTERS P.O. BOX 691 PROVO, UTAH 84601 TELEPHONE 801 373-1508

December 27, 1967

Mr. Thomas I. Sharps
Exploration Geologist
Vitro Mineral and Chemical Company
600 West 33 South
Salt Lake City, Utah 84115

Dear Mr. Sharps:

I received your letter of December 18, 1967 revising information previously received from you, and requesting bids accordingly.

Since we have discussed this project at length with your people, we are quite familiar with the operational nature of the flying involved, the terrain and the conditions. Since meeting with you last, we have discussed the project at length with our pilots, and we offer our assurance that our equipment and personnel are capable of performing to your satisfaction.

We will furnish a Bell 47G3B-1 helicopter complete with all operating supplies under the terms and conditions of your letter of December 18. I think we have made our position clear as to the quality of our personnel, the integrity of our operating philosophy with reference to maintenance and project support. Our personnel are dedicated to providing the very best helicopter service possible in the industry today. I know that if we are chosen to perform under a contract which is mutually agreed upon, that you will find our services to be satisfactory and reliable.

Our quotes, as requested by you, are as follows:

1. Cost of ferry time from home base to Silverton, Colorado and return shall be $200.

2. Cost per hour of flight time on a contract calling for a minimum of two hours flight time per day, or 60 hours flight time per month would be $130 per flying hour.

3. Cost per hour for flight time flown in excess of 60 hours per calendar month, would be $120 per flying hour.

4. Cost per hour flight time for a monthly contract calling for a minimum of 3 hours of flight time per day or 90 hours flight time per month, would be $120 per flying hour.

5. Cost per flight hour flown in excess of 90 hours per month, would be at the rate of $110 per flying hour.

6. Any and all flight time flown in excess of 200 hours during the term of this contract would be at the rate of $110 per flight hour.

7. In addition, a discount for prompt payment in the amount of 2 per cent 10 days will be offered.

Since meeting with you last, we have located the films on the Independance Pass sling-load project, if you would be interested in seeing them. I would very much appreciate hearing from you soon, and look forward to the possibilites of working with you next summer.

Sincerely yours,

MOUNTAIN WEST HELICOPTERS

James B. Burr

James B. Burr

JBB:jm

PAGE AIRCRAFT MAINTENANCE INC.

FLIGHT SERVICES DIVISION
P. O. Box 936
Holloman Air Force Base, New Mexico

REX H. MADEIRA
President

A. L. CHARIPAR
Vice-President

6 January 1968

RECEIVED
JAN 10 1968
VITRO MINERALS & CHEMICAL COMPANY

Mr. Thomas I. Sharps
Exploration Geologist
Vitro Minerals and Chemical Co.
600 West 33rd South St.
Salt Lake City, Utah 84115

Dear Mr. Sharps:

Reference our telecon of 5 January 1968, Page Aircraft Maintenance, Inc., Flight Services Division, hereinafter referred to as "the contractor," submits the following bid covering helicopter services for your Ice Lake, Colorado project.

To eliminate complicated accounting procedures and to simplify cost analysis, a "flat rate" system is proposed. The amount of flight time involved in your project enables the contractor to do this to the mutual advantage of both parties.

For morale purposes, it is proposed that the pilots involved be rotated every two weeks. This will insure that you will have a highly qualified pilot available to you at all times.

U. S. Forestry Service flight time limitations of not more than six hours flight time per day will be adhered to except in exceptional circumstances. All flight time will be the time recorded on meters installed in all contractor's aircraft. The rotation of pilots will in no way derogate the mission, as our pilots are among the best in the industry as evidenced by the attached enclosure. Bid is herewith submitted per format in your letter of 22 December 1967 to Mr. Earl Short:

Conditions and Requirements

(1) Operating elevations are well within our experience level and the performance capabilities of the aircraft.

(2) The encloses pilot qualification records are sufficient evidence to more than measure up to this requirement.

(3) The Bell 47G-3B-1 helicopter (brochure enclosed) is capable of performing your mission effectively.

(4) We are prepared to offer the services for the period stipulated.

(5) The terrain surrounding Silverton, Colorado has been researched by the contractor and is well within the range and performance capabilities of our equipment.

(6) See Para (5) above.

(7) The contractor's helicopter and pilot will be available for emergency use at all times and equipped to transport injured personnel. Due to the exposure rate, any flights performed during the period from sunset to sunrise will be computed on a higher rate per hour. See Paras (2), (3), (4), and (5) under Quotes Submitted.

(8) To facilitate the expeditious removal of injured personnel, the helicopter and pilot will be based at your camp in Ice Lake Basin. Room and board (excluding sleeping bag) will be furnished by Vitro.

(9) Contractor will provide all gasoline, oil and operating supplies. However, it is requested that Vitro Minerals and Chemical Company cooperate with the contractor in regard to placement of fuel caches and necessary equipment to be carried to the operating site.

(10) The contractor is insured with Fireman's Fund Insurance Co. (Associated Aviation Underwriters), Pol. Nos. FHL 97-498 and APL 97-326 with the following coverage:

a. Bodily injury liability, each person - $100,000.

b. Bodily injury liability, each accident - $1,000,000.

c. Property damage liability, each accident - $1,000,000.

Quotes Submitted

(1) A flat rate of $600.00 for any and all ferry time between Alamogordo, New Mexico and Silverton, Colorado.

(2), (3), (4), (5)

Contractor proposes a flat rate of $5,000.00 per month plus $60.00 per hour of flight time. A rate of $150.00 per hour or any part of an hour will be charged for any flight during the period between 30 minutes after official sunset and 30 minutes prior to official sunrise.

(6) In the case of contract termination prior to the end of the contract, the flat rate of $5,000.00 per month will be pro-rated at the rate of $166.67 per day, plus $60.00 per hour for the accumulated flight time flown during the stated period.

(7) Aircraft to be employed is the Bell, supercharged 47G-3B-1 utility helicopter. Each aircraft will be equipped with all standard utility equipment, including Stokes litters, cargo carriers, cargo

Vitro ltr/bid 6 Jan 68

nets and all necessary sling load accessories. The enclosed brochure on the Bell 47G-3B-1 and the photograph of one of the contractor's helicopters engaged in operations above 10,000 feet, will bear this out. (Request photo be returned.)

Since the opening of Flight Services Division in September 1966, we've had opportunities to participate in many varied and interesting aspects of mountain flying. If you so desire, you may contact any of the following regarding the qualifications of our pilots and the capabilities of our equipment:

John Hall and/or Dan McIntyre, Lincoln National Forest, Alamogordo, New Mexico

Tom Steven, Room 2625, Bldg. 25, Geological Survey, Federal Center, Denver, Colorado 80225

Myron R. Wilson, Vice President, Recovery Systems Research, Alamogordo, New Mexico

Alex Blomerth, ERDA Project, White Sands Missile Range, New Mexico

We are pleased to present this bid, and if we can provide any further information, please contact us.

Sincerely,

PAGE AIRCRAFT MAINTENANCE, INC.

Russell T. Blair

Russell T. Blair
Manager

RTB/mn
Enclosures

21.00

December 8, 1967

Mr. Karl F. Zeller
District Ranger
Animas District
San Juan National Forest
Durango, Colorado 81301

Dear Mr. Zeller:

Thank you very much for your prompt reply to my request for information on camping in the National Forest.

Vitro Minerals & Chemical Company, a division of Vitro Corporation of America, intends to conduct a diamond drilling exploration program on our patented and unpatented mining claims in the Ice Lake Mining District, San Juan and San Miguel Counties, Colorado. I have identified by name, on the map which you furnished, the patented claims of interest and have circled the general area of interest in which we have unpatented property. Maps of these unpatented claims are on file with the San Juan County Recorder in Silverton, Colorado.

Our activities for the 1968 field season will probably be restricted to diamond drilling and geological reconnaissance. We may do some trenching and pitting but do not plan on any mining at this time. We do not plan on construction of any roads in this area for a number of reasons. For one thing, a road up there would be almost impossible to construct in the time allotted for the completion of exploration phase of this project. Secondly, the limited useful life of the road would not justify the expense of building it. After we have completed the diamond drilling exploratory work on these claims, we will have little need to work at the surface but will (if we find an ore body) mine it through a low-level tunnel. We plan on hauling our drilling equipment into the Ice Lake Basin by helicopter and servicing our camp by horses. We may have 15 men in the area for approximately two months, and although they will probably be camped on our claims, the horses may graze on unclaimed property.

We wish to comply with all Forest Service regulations, and also we fully intend and hope that we may move into, work in, and move out of the Ice Lake Basin without detracting from its pristine beauty. This we feel is another good reason for not building a road into the area.

At the present time we anticipate that Mr. George Lancaster of Silverton, Colorado, will be our camp outfitter, and we will instruct him to secure the proper permits from your office.

We are also considering the reconstruction of the old bridge where the road to the old Callow Mill crosses Clear Creek. A bridge at this point would facilitate our outfitter in bringing his pack train across Clear Creek. We would want this bridge to be constructed in compliance with Forest Service specifications. May we have permission for its construction.

We will try to keep you posted on our activities in the Forest, and if there are any questions which we have left unanswered, please do not hesitate to contact us.

Very truly yours,

VITRO MINERALS & CHEMICAL COMPANY

THOMAS I. SHARPS
Exploration Geologist

TIS:bas

Enclosure - map

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
SAN JUAN NATIONAL FOREST
Animas District
Durango, Colo. 81301

IN REPLY REFER TO

2700 (2800)
December 6, 1967

Vitro Mineral & Chemical Company
600 West 3300 South
Salt Lake City, Utah 84115

Attention: Mr. Tom Sharp

Dear Mr. Sharp:

Forest Supervisor R. K. Blacker has informed me that your company plans to do core drilling in Ice Lake Basin beginning about July 1, 1968.

If you conduct bona fide mining operations entirely on your patented or un-patented valid mining claims, and your campsites and horse use (except for transport in and out) are entirely within the surface area of such claims, a permit would not be required. However, since a claim or group of claims may not provide the area necessary, a permit is generally considered necessary. This permit covers the transportation, grazing use, and campsite use and is usually issued to the outfitter whom you engage. We would expect any prospective outfitter to be in contact with us and to keep us informed of his plans. Fees are based on number of men, number of horses and length of stay.

I would be happy to answer any specific questions you might have on this subject. I would also appreciate some information on the enclosed map as to the location of your claims and the activity that you propose.

Sincerely yours,

Karl F. Zeller

KARL F. ZELLER
District Ranger

Enclosure

VITRO MINERALS & CHEMICAL COMPANY
600 West 33rd South Street
P. O. Box 15437
Salt Lake City, Utah 84115

December 18, 1967

Mr. Sid Simpson
Paonia
Colorado

Dear Mr. Simpson:

We thank you for your recent bid to provide camp and board for our proposed drilling project in Ice Lake Basin, San Juan County, Colorado. Because of several changes in the project, we are asking all prospective contractors to re-examine their bids and submit a new bid, if necessary, on the basis of the conditions and requirements set forth below.

Conditions and Requirements

(1) Camp will be established near Fuller Lake in Ice Lake Basin at an altitude of about 12,600 feet.

(2) The contractor will establish and maintain a camp consisting of a cooking and eating tent (or building), sleeping tents (four cots per tent), a shower tent, and latrine (or latrines if women cooks are used).

(3) All facilities should be designed to accommodate twenty (20) men (plus your own personnel). We anticipate that the crew will consist of seventeen (17) men. However, facilities should be adequate to accommodate up to three visitors.

(4) Contractor will provide cots, air or foam mattresses, tents, cooking facilities, tables, benches, heating stoves for sleeping tents, and facilities for heating shower water.

(5) Camp will be established and maintained according to U. S. Forest Service regulations. Contractor will obtain and pay for all necessary permits.

(6) Camp will be established about June 15, 1968, and it is presently anticipated that the contract will extend to about September 15, 1968. However, no guarantees are made as to the length of the contract.

(7) Drilling will be done in two shifts and hot meals should be provided for the entire crew in the morning and evening with box lunches provided for the noon and midnight meals.

(8) Four good saddle horses should be provided for general use.

(9) Potable water is available at or near the camp site and horses should be corralled so as to maintain the potability of the water supply.

(10) Vitro will have available a helicopter for use in moving heavy or bulky camp equipment from Silverton to Ice Lake Basin. This service, also available for moving in supplies during the contract, will be provided at cost.

Quotes Requested

(1) Contractors will bid to provide camp and board as outlined above on a per man per meal or per man per day basis.

(2) Cost per horse per day should be quoted.

(3) Cost of mobilization of the camp equipment from home base to Ice Lake Basin and return.

A copy of your original bid is attached for reference. Please consider these new conditions and submit a new bid as soon as possible. Please call me "Collect" if you have any questions pertaining to this contract.

Sincerely,

VITRO MINERALS & CHEMICAL COMPANY

THOMAS I. SHARPS
Exploration Geologist

TIS:bas

Enclosure - bid

December 29, 1967

Paonia, Colorado

Thomas I. Sharps, Exploration Geologist
Vitro Minerals Y Chemical Company
600 West 33rd South Street
P.O. Box 15437
Salt Lake City, Utah 84115

Dear Mr. Sharps:

In answer to your letter of December 18, 1967, please enter my bid of $15.00 per man per day for providing camp and board facilities for the drilling crew.

Saddle hourses would be provided for the men on a $7.00 per day per animal use basis. Cost of mobilization of my camp equipment from home base to Ice Lake Basin and return would be $440.00.

If you have any questions about this bid, please feel free to call me at Paonia - 527-3486.

Very truly yours,

Sid Simpson

Sid Simpson

RECEIVED
JAN 2 1968
VITRO MINERALS & CHEMICAL COMPANY

VITRO MINERALS & CHEMICAL COMPANY
600 West 33rd South Street
P. O. Box 15437
Salt Lake City, Utah 84115

December 18, 1967

Mr. Cap Atwood
399 Little Peak Road
Grand Junction, Colorado

Dear Mr. Atwood:

We thank you for your recent bid to provide camp and board for our proposed drilling project in Ice Lake Basin, San Juan County, Colorado. Because of several changes in the project, we are asking all prospective contractors to re-examine their bids and submit a new bid, if necessary, on the basis of the conditions and requirements set forth below.

Conditions and Requirements

(1) Camp will be established near Fuller Lake in Ice Lake Basin at an altitude of about 12,600 feet.

(2) The contractor will establish and maintain a camp consisting of a cooking and eating tent (or building), sleeping tents (four cots per tent), a shower tent, and latrine (or latrines if women cooks are used).

(3) All facilities should be designed to accommodate twenty (20) men (plus your own personnel). We anticipate that the crew will consist of seventeen (17) men. However, facilities should be adequate to accommodate up to three visitors.

(4) Contractor will provide cots, air or foam mattresses, tents, cooking facilities, tables, benches, heating stoves for sleeping tents, and facilities for heating shower water.

(5) Camp will be established and maintained according to U. S. Forest Service regulations. Contractor will obtain and pay for all necessary permits.

(6) Camp will be established about June 15, 1968, and it is presently anticipated that the contract will extend to about September 15, 1968. However, no guarantees are made as to the length of the contract.

(7) Drilling will be done in two shifts and hot meals should be provided for the entire crew in the morning and evening with box lunches provided for the noon and midnight meals.

(8) Four good saddle horses should be provided for general use.

(9) Potable water is available at or near the camp site and horses should be corralled so as to maintain the potability of the water supply.

(10) Vitro will have available a helicopter for use in moving heavy or bulky camp equipment from Silverton to Ice Lake Basin. This service, also available for moving in supplies during the contract, will be provided at cost.

Quotes Requested

(1) Contractors will bid to provide camp and board as outlined above on a per man per meal or per man per day basis.

(2) Cost per horse per day should be quoted.

(3) Cost of mobilization of the camp equipment from home base to Ice Lake Basin and return.

A copy of your original bid is attached for reference. Please consider these new conditions and submit a new bid as soon as possible. Please call me "Collect" if you have any questions pertaining to this contract.

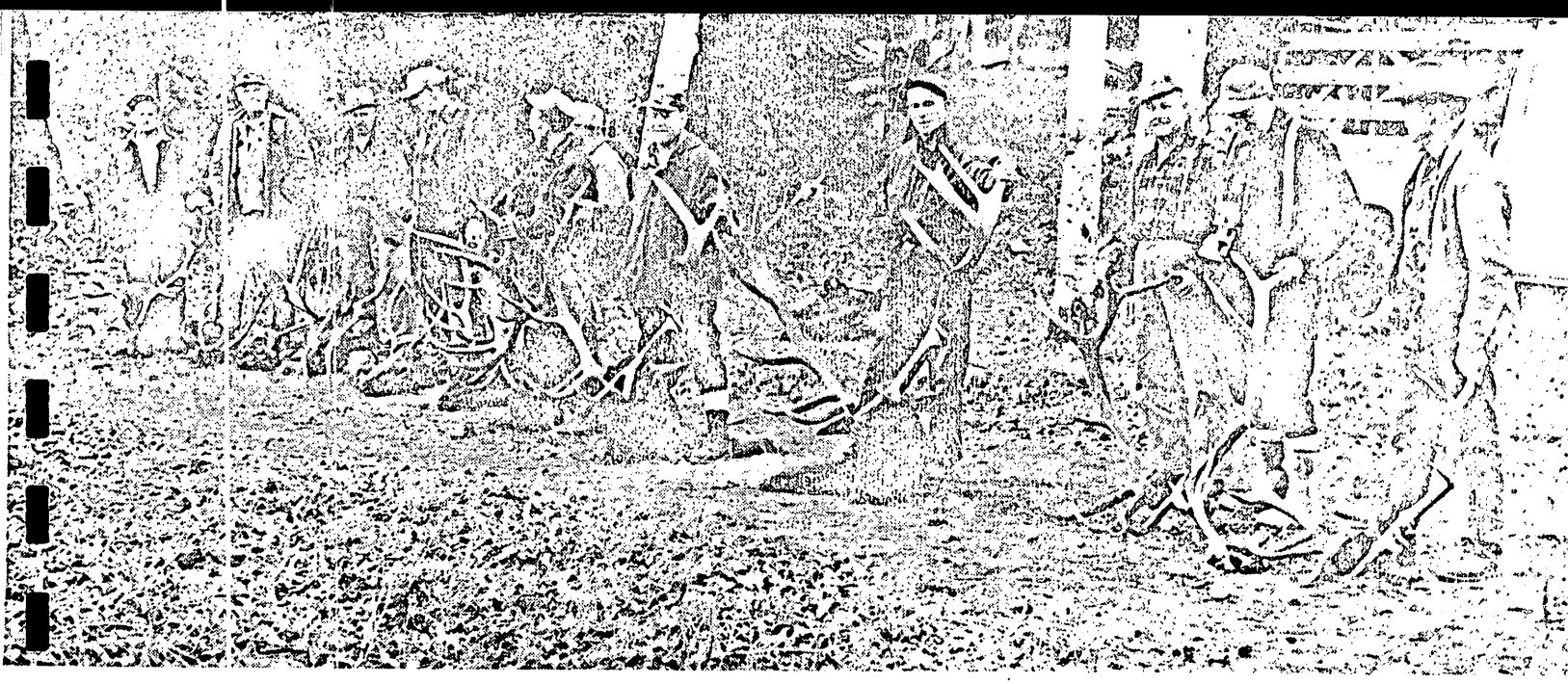
Sincerely,

VITRO MINERALS & CHEMICAL COMPANY

THOMAS I. SHARPS
Exploration Geologist

TIS:bas

Enclosure - bid



CAP ATWOOD Phone ~~XXXXX~~ 242-7228
CRAIG, COLORADO
~~XXXXXXXXX~~ ~~XXXXXXXX~~
399 Little Park Road
Grand Junction, Colo 81501

RECEIVED
DEC 26 1967
VITRO MINERALS & CHEMICAL COMPANY

Vitro Minerals & Chemical Co.
600 West 33rd So. Street
Box 15437
Salt Lake City, Utah

Dear Sirs:

My bid on your Ice Lake Basin drilling project is as follows:

1. Camp, mobilized and maintained adequate for 20 men which includes showers, cooking tent, eating tent, and heated sleeping tents, cots and matresses, latrines $4,000

2. Meals per man per day . . . . . $ 12

3. Per horse per day which would be 2 pack and 4 saddle horses . . . . . $ 6

My crew would consist of 4 which would be 2 cooks and 2 camp hands.

Thank you,

Cap Atwood

VITRO MINERALS & CHEMICAL COMPANY
600 West 33rd South Street
P. O. Box 15437
Salt Lake City, Utah 84115

December 18, 1967

Mr. George Lancaster
2110 North 15th Street
Grand Junction, Colorado

Dear Mr. Lancaster:

We thank you for your recent bid to provide camp and board for our proposed drilling project in Ice Lake Basin, San Juan County, Colorado. Because of several changes in the project, we are asking all prospective contractors to re-examine their bids and submit a new bid, if necessary, on the basis of the conditions and requirements set forth below.

Conditions and Requirements

(1) Camp will be established near Fuller Lake in Ice Lake Basin at an altitude of about 12,600 feet.

(2) The contractor will establish and maintain a camp consisting of a cooking and eating tent (or building), sleeping tents (four cots per tent), a shower tent, and latrine (or latrines if women cooks are used).

(3) All facilities should be designed to accommodate twenty (20) men (plus your own personnel). We anticipate that the crew will consist of seventeen (17) men. However, facilities should be adequate to accommodate up to three visitors.

(4) Contractor will provide cots, air or foam mattresses, tents, cooking facilities, tables, benches, heating stoves for sleeping tents, and facilities for heating shower water.

(5) Camp will be established and maintained according to U. S. Forest Service regulations. Contractor will obtain and pay for all necessary permits.

(6) Camp will be established about June 15, 1968, and it is presently anticipated that the contract will extend to about September 15, 1968. However, no guarantees are made as to the length of the contract.

(7) Drilling will be done in two shifts and hot meals should be provided for the entire crew in the morning and evening with box lunches provided for the noon and midnight meals.

(8) Four good saddle horses should be provided for general use.

(9) Potable water is available at or near the camp site and horses should be corralled so as to maintain the potability of the water supply.

(10) Vitro will have available a helicopter for use in moving heavy or bulky camp equipment from Silverton to Ice Lake Basin. This service, also available for moving in supplies during the contract, will be provided at cost.

Quotes Requested

(1) Contractors will bid to provide camp and board as outlined above on a per man per meal or per man per day basis.

(2) Cost per horse per day should be quoted.

(3) Cost of mobilization of the camp equipment from home base to Ice Lake Basin and return.

A copy of your original bid is attached for reference. Please consider these new conditions and submit a new bid as soon as possible. Please call me "Collect" if you have any questions pertaining to this contract.

Sincerely,

VITRO MINERALS & CHEMICAL COMPANY

THOMAS I. SHARPS
Exploration Geologist

TIS:bas

Enclosure - bid

CHATTANOOGA RANCH

SILVERTON, COLORADO

December 27, 1967

Vitro mineral & Chemical Company
600 West 33rd South St.
P.O. Box 15437
Salt Lake City, Utah

Gentlemen:

This is in reference to your letter of December 18, 1967. We would like to re-submit our bid for camp and board for drilling crews for the summer of 1968.

(1) Our bid would include establishing and maintaining a camp consisting of a cooking and eating tent, sleeping tents (four men per tent) a latrine, a shower tent, and all facilities for 20 men, including cots, foam mattresses for each man, stoves for heating, tables, benches and cooking facilities. We will obtain and pay for necessary Forest Service permits. We will furnish two (2) substantial meals and one (1) box lunch per man per day, consisting of meats, potatoes and etc. for a hardy drillers appetite. We will supply one cook and two helpers if conditions require.
Our bid for these services, per man per day is $10.50.

(2) Supplying the camp with horses, maintaining a corral and supplying grain for horses etc.

Our bid for this would be $6.50 per horse per day.

(3) Mobilization of the camp equipment from home base to Ice Lake Basin and return.

Our bid for this would be $10.00 per horse per day including packer and etc.

Sincerely,
Chattanooga Ranch
George Lancaster
George Lancaster
2110 North 15th St.
Grand Junction, Colorado
81501

RECEIVED
JAN 2 1968
VITRO MINERALS & CHEMICAL COMPANY

CHATTANOOGA
RANCH
SILVERTON, COLORADO

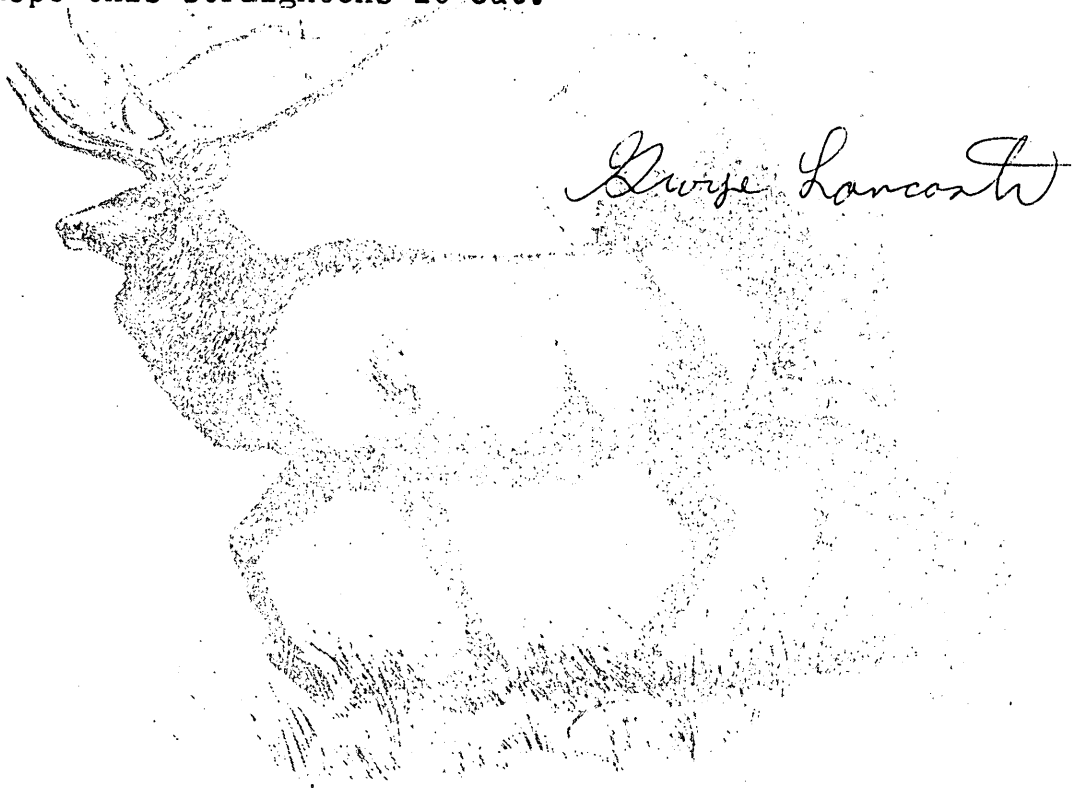
2 January, 1968

Vitro Minerals and Chemical Co
P.O. Box 15437
Salt Lake City, Utah

Dear Sirs:

Inclosed is our supplement to the bid we sent you in the latter part of December, 1967.

Hope this straightens it out.



Louise Lancaster

Elk - Deer - Bear - Fishing - Streams - Alpine Lakes - Pack Trips - Jeep Tours

(3) On cost of mobilization of camp equipment from home-base to Ice Lake Basin and return:

If contract is stopped before (20) twenty days the mobilization charge would be ($500.00) Five hundred dollars.

However if contract goes full length or there about the mobilization charge would be (100.00) One hundred dollars.

Below is a sample menu for one work week, with equal substitutions when necessary:

Breakfast	Box Lunch	Supper
Tomato Juice Ready-to-eat Cereal Fresh Milk Fried Eggs Corn Fritters w/ Syrup Bacon Toast Jam-Butter Coffee	Cold Cuts (Salami, Balony, Cold-Ham etc) Canned Beans, Weaners etc Canned Peaches, Fruit cocktail Bread-Butter Sandwich Spread Fruit (one) Orange Apple, Banana Candy Bar (one) or Cookies	Yankee Pot Roast w/ Brown Gravy Mashed Potatoes Buttered Peas Pineapple & Cottage Cheese w/ Dressing Bread-Butter Ice Cream Coffee
Orange Juice Ready-to-eat Cereal Fresh Milk Individual Omelet Hot Cakes w/ Syrup Toast Jelly-Butter Coffee	Same as above Men will prepair own Box Lunches w/ Choice of above	Grilled Pork Chops w/ Apple-sause Creamed Potatoes Buttered Cabbage Mixed Vegetable Salad w/ Dressing Bread-Butter Pie Coffee or Tea
Blended Juice Hot Oatmeal Fresh Milk Eggs to Order Bacon Hot Cakes w/ Syrup Toast Jam-Butter Coffee or Hot Chocolate	Same as above	Frankfurters or Meat-Loaf w/ Tomato Gravy Hashed Brown Potatoes Creamed Peas Cabbage & Carrot Slaw w/ Cole Slaw Dressing Rolls-Butter Fruit Cocktail Oatmeal Cookies Coffee
Apple-sause Ready-to-eat Cereal Fresh Milk Fried Ham & Eggs Hot Cakes w/ Syrup Toast Jelly-Butter Coffee	Same as above	Grilled Steaks w/ Gravy Mashed Potatoes Buttered Corn Lettuce Wedges w/ Dressing Bread-Butter Apple Pie Coffee or Tea

Breakfast	Box Lunch	Supper
Bananas Ready to eat Cereal Fresh Milk Scrambled Eggs Bacon Hot Cakes w/ Syrup Toast Jelly--Butter Coffee	Same as above	Salisbury Steak w/ Onion Gravy O'Brien Potatoes Stewed Tomatoes Vegetable Salad w/ Dressing Bread-Butter Peaches Coffee
Orange Juice Ready to eat Cereal Fresh Milk Eggs Bacon Hot Cakes w/ Syrup Toast Jelly--Butter Coffee	Same as above	Country Style Steaks w/ Gravy Mashed Potatoes Buttered Beets Pepper and Onion Rings with Lettuce w/Dressin Bread-Butter Ice Cream Coffee

Cooks will have Candy, Canned Pop, Cigarettes etc for sale.

The Menu will be made up for two weeks in advance and can be checked anytime.

Floyd Lancaster