Building 20 - Federal Center
Denver 25, Colorado
80225

OCT 23 1963

Memorandum

To: George C. Selfridge, Chief
Division of Field Operations, OME
Washington 25, D. C.

From: Acting Field Officer, OME, Region III

Subject: Application OME-6325 (Beryllium)
Ranchero Exploration and Development Corporation
(Marilyn, Barbara, Billie, Rancher Claim Groups)
Juab County, Utah
REPORT OF INVESTIGATION

Attached are the original and two copies of the Report of Investigation on the subject property by T. M. Rumsle, Mining Engineer.

Mr. Rumsle recommends that the application for OME aid be approved at an estimated total cost of $127,754.00. I concur in this recommendation with some misgivings concerning the land to be subordinated.

My past experience in royalty matters has been bad where the Applicant did not subordinate his entire holdings to the Government and it appears in this case that the Applicant has not found so much ore-bearing tuff on his own account on this property that he would complain too much if we asked him to subordinate his entire holdings in this block. I believe it would be worth a try from the Washington level.

Extra copies of a property map for possible use in a contract are being forwarded under separate cover.

Original signed by

Hugh M. Conmore

Attachments

cc S. R. Wilson, Salt Lake City
Mineral Resource DFC
OME-6325
Chron
HMC/lm

mp

ROBERT FORD & ASSOCIATES, INC.
Consulting Geologists
P. O. Box 428
206 S. BROADWAY
RIVERTON, WYOMING
OFFICE 856-3468

October 25, 1963

OME
DEPARTMENT OF THE INTERIOR
REGION III
DENVER, COLORADO

Mr. Hugh M. Connors
Acting Field Officer, Region III
U. S. Department of the Interior
Building 20, Federal Center
Denver 25, Colorado

Re: OME Application, Beryllium, #6325
Ranchers Exploration & Development Corp.
Topaz Mountain
Delta, Utah

Dear Mr. Connors:

Sorry for the delay in answering your letter of October 10 regarding information for the OME application. Both Ford and I have been out of the office for the past two weeks and were unable to take care of it until now.

I have enclosed an ore estimate for Area I and included the assay information for each hole used in the estimate. (The ore body indicates approximately 2¼ million tons of 0.60%+ grade.) As you realize, it is not practical to make a detailed estimate with the drilling information we have available at this time. However, realizing your need for the appraisal, I have attempted to come up with an honest estimate of the potential.

The standard technique of assigning each mineralized hole an area of influence and computing tonnage and grade for this area from the assay information was used. Within the mineralized area (Area I) I have delineated two ore bodies. One includes Holes 1-1 and 1-6 and the other 12-3, 12-5, and 12-9. Enclosed is a summary of computations.

Sincerely,

John D Ortman

John D. Ortman

cc: Ranchers Expl. and Develop.

Encl. - Ore Estimate

JO/jn

Copy to Selfridge

ORE ESTIMATE, AREA I

OME APPLICATION 6325

Ore Body 1

		Depth	Thickness		Grade
Includes Holes	12-3	385-398	13'	@	0.50%
	12-5	250-259	9'	@	0.51%
	12-9	352-361	9'	@	0.63%
		Average:	10.3'		0.54%

Total area Ore Body 1 = 2,031,000 sq. ft.
Average thickness = X 10.3 ft.
Total Volume = 20,919,300 cu. ft. = 1,394,620 tons
Factor of 15 cu.ft./ton

Sub-Total Tonnage = 1,394,620 tons @ 0.54% ore grade (Average)

Ore Body 2

		Depth	Thickness		Grade
Includes Holes	1-1	622-635	13'	@	0.77%
	1-6	316-318	2'	@	0.39%

Area Hole 1-1 = 876,000 sq. ft.
Average thickness = X 13 ft.
Total Volume = 11,388,000 cu. ft. = 759,200 tons
Factor of 15 cu.ft./ton
@ av. grade = 0.77%

Area Hole 1-6 = 510,000 sq. ft.
Average thickness = X 2 ft.
Total Volume = 1,020,000 cu. ft. = 68,000 tons
Factor of 15 cu.ft./ton
@ av. grade = 0.39%

Sub-Total Tonnage, Ore Body 2
(Includes both blocks) = 827,200 tons @ 0.74% average grade

	Tonnage		Grade
Ore Body 1	1,394,620	@	0.54%
Ore Body 2	827,200	@	0.74%
Total Area I =	2,221,820	@	0.61% Average Grade

Building 20 - Federal Center
Denver 25, Colorado

OCT 23 1963

Memorandum

To: Hugh M. Connors, Acting Field Officer, OME, Region III

From: T. M. Romslo, Mining Engineer

Subject: Application OME-6325 (Beryllium)
Ranchers Exploration and Development Corporation
(Marilyn, Barbara, Billie, Rancher Claim Groups)
Juab County, Utah
REPORT OF INVESTIGATION

Approval of the subject application is recommended. In event a contract is granted, it is recommended that the Government's interest in land that might be benefited, be protected for a period of 25 years by a Performance Bond and a Special Agreement.

The Applicant proposes to explore for potential beryllium ore on contiguous groups of claims that adjoin on the west and north an area in which significant beryllium reserves have been discovered in recent years. Companies that have explored the area with favorable results include; Anaconda Mining Co., Beryllium Resources, Vitro Minerals Corp., which recently sold its property to Brush Beryllium Co., and the Ranchers Exploration and Development Corp. Much geological information about the area was obtained by the OME as the result of investigations made under dockets OME-6094 (Vitro Minerals Corp.) and OME-6159 (General Beryllium Corp.).

The potential beryllium ore consists of coatings and small particles of bertrandite. It occurs in significant amounts only in a Tertiary rhyolite tuff that rests unconformably on Paleozoic sediments. A Tertiary rhyolite lava that overlies the tuff is in turn overlain by Lake Bonneville sediments and recent alluvium. The tuff and lava beds strike approximately 40° northeast and dip northwest about 15°. Among the fault systems that cut the tuff, lava, and probably the underlying sediments, is a series of northerly-trending, post-ore faults. The western blocks of these post-ore faults are upthrown.

There are three beryllium deposits near the area of the proposed exploration (fig. 1). Deposits No. 1 and 2, which are owned by the Applicant and Anaconda Mining Co., respectively, appear to be cut off to the west by post-ore faults. The Applicant's partially explored deposit could contain a few million tons of material assaying about 0.5 percent BeO. A vertical section extending through deposits 1 and 2, and deposit 3, that also is owned by the Anaconda Mining Co., is shown on attached figure 2.

Approval of the Application is based on the geological probability that the proposed exploration could result in a significant discovery of potential beryllium ore. The potential ore could be present not only in faulted sections of known deposits, but also in new deposits.

PROPOSED PROJECT

Property

The property of the proposed project, (see revised pages of Application) consists of 119 contiguous lode mining in secs. 34 and 35, T.12S., R.13W., and secs. 2, 3, 10, 11, 14, and 15, T.13S., R.12W., Juab County, Utah (fig. 1). The Applicant holds 111 of the claims by a mining lease with the owners, Phill C. Nielson, et al., and owns, as the original locator, the remaining 8 claims. The leased claims are the Marilyn 1 to 6 and 8 to 33, the Barbara 1 to 27, and the Billie 1 to 52. The claims owned by the Applicant are the Rancher 1 to 5, the Rancher Filler 1 and 2, and the Billie 8A.

Mr. John Ortman, a geologist with the Robert Ford and Associates, the Applicant's representative, furnished the following information regarding the Applicant's property. The Applicant's rights to the property of the proposed project, are presently clear, and no conflict in the rights are anticipated. Court action is pending regarding the Applicant's right to claims that were located by the Anaconda Mining Co. and which were "jumped" and partially explored with favorable results by the Applicant. The concerned claims are located in secs. 6 and 7, T.13S., R.12W., and sec. 31, T.12S., R.12W. The Applicant, as plaintiff, contends that it is entitled to the claims because the defendant, the Anaconda Mining Co., was not actively engaged in exploration of the claims in question. Precedent for the Applicant's contention is the court's decision in an identical case concerning uranium claims in New Mexico. In the New Mexico case the court awarded to the Anaconda Mining Co., claims which the Ranchers Exploration and Development Corp. had located but had not explored.

Mr. Ortman also furnished information concerning the property adjoining the proposed project area that is held by the Applicant. As shown on

figure 1, area "A" is held by a lease that will be dropped shortly, and "Area B" that also is held by a lease with owners who will not subordinate the property under the subject application.

Proposed Work

The Applicant proposes to explore the property by drilling an estimated total 30,000 feet in holes that could range in depth from a few hundred feet to 1,500 feet, and average 1,000 feet deep. The drilling would be done in two stages. Stage I would consist of an estimated 15,000 feet of drilling in the 10 holes shown on figure 1. Stage II drilling, that would be done only if warranted by the results of Stage I drilling, would consist of an additional 15,000 feet of drilling. Stage II holes would be drilled at sites not less than 300 feet from Stage I and II holes.

Applicant's Revised Estimated Costs

Independent contracts will be let on all drilling and access road work

Three independent drill bids are submitted as justification of the unit cost of drilling. The low bid was used to calculate costs.

Expenditures of $25.00 per hour for either "cat" tractor work or alternative grader work is based on past contracts in the Topaz area. In addition, one bid for "Cat" work is submitted as justification of the cost figure.

Stage I

a. Independent contracts:

15,000 feet of drilling		
5,000 feet 0-500 feet depth at $2.00/ft.	$10,000.00	
5,000 feet 500-1000 feet depth at $6.50/ft.	32,500.00	
2,000 feet diamond coring at $20.00/ft.	40,000.00	
30 hours of access road construction $25.00 per hour x 30 hours =	$ 750.00	
		$83,250.00

b. Labor, supervision, and consultants:

1 supervising geologist 6 months at $1000.00 per mo.	$ 6,000.00	
1 geologists' helper and sampler 6 months at $450.00 per mo.	2,700.00	
Other labor - none.		
		$ 8,700.00

c. Operating materials and supplies:

1000 sample storage boxes at $36.52 per 500	$ 65.12	
3000 sample paper bags at $18.00 per M.	54.00	
		$ 119.12

d. Operating equipment:

Lease 1 field vehicle at $75.00 month, 6 x $75.00	450.00	
Mileage Field vehicle 3000 mi. per month at 10¢ x 6 mo.	1,800.00	
1 Baryllometer - Rental at $450.00 per month, 6 mo. x $450.00	2,700.00	
		$ 4,950.00

e. Rehabilitation and Repairs:

None

f. New building fixtures and installations:

None

g. Miscellaneous:

1. Field office trailer cost Actual cost: $2400.00 5 yr. depreciation schedule $480 per year at 6 mos. = $240.00	$ 240.00	
2. Payroll taxes and insurance		
Social Security	174.00	
Utah Unemployment Comp.	81.00	
Workmens Comp.	130.50	
Federal Unemployment Comp.	24.00	
		$ 649.50
Stage I Total		$97,668.62

Stage II

Stage II drilling will be entered into upon the successful completion of Stage I and with the express permission of the O.M.E. Regional Director.

No Stage II drilling shall be closer than 300 feet to any Stage I or any other Stage II drilling.

Stage II drilling is estimated to be the same total footage and cost as Stage I.

Stage II Total $97,668.62

INFORMATION FOR POSSIBLE CONTRACT

Amount of drilling - The drilling under Stage I should be started by putting down two holes, one near the site of proposed hole no. 1, and one near the site of proposed hole no. 2. Subsequent drilling under Stage I would be determined from the results obtained from prior holes, and would be subject to prior Governmental approval. The absence of tuff in holes 11-1, 11-2, 11-3, and 12-12 suggests that some of the proposed holes may not find tuff. Prior Governmental approval also would be needed for any Stage II drilling.

Government's interest - Land that could be benefited by the proposed exploration includes portions of areas "A" and "B", sec. 2, T.13S., R.13W., and sec. 35, T.12S., R.13W. Therefore, a Performance Bond would be required to cover the suggested portion of areas "A" and "B" shown on figure 1. And, any land in sec. 2 and 35 acquired during a recommended subordination period of 25 years could be covered by a Special Agreement like that incorporated in proposed contract 2174 (Gas Hills Uranium Co.). The Special Agreement also could provide for deletion of claims found worthless.

Drilling specifications - The holes shall be non-core drilled to minimum diameter of about 4 3/4 inches from the surface to any beryllium bearing tuff. The beryllium bearing tuff shall be core drilled to obtain core not less than 2 inches in diameter. Cored sections of tuff may be reamed, and any underlying sections of beryllium-barren tuff may be non-core drilled to hole diameters of about 4 3/4 inches.

The beryllium-bearing core shall be sampled in sections not more than two feet in length. The core shall be split. One half of the core shall be ground to proper size and assayed with a Beryllometer, and the other half shall be boxed and made available to the Government. When drilling in tuff, all cuttings also shall be sampled at hole intervals not exceeding two feet, and the samples shall be tested with a Beryllometer. Samples containing beryllium shall be assayed with a Beryllometer, and shall be stored in paper sacks and made available to Government.

Estimated cost - The estimated cost of a contract could be as follows:

Stage I

Actual Costs		
Independent Contracts		
Drilling (Low bid by Reid Drilling Co.) Rotary non-core drilling and core drilling 15,000 feet at an average cost not to exceed $5.50/ft.	$82,500.00	
Road Construction (Floyd Talbert's bid) Model D7 Caterpillar (or equivalent) with dozer and ripper, 30 hours at $25.00/hr.	750.00	
Total Independent Contracts		$ 83,250.00
Operating Materials and Supplies 1,000 paper sample-storage boxes at $0.073/box	73.00	
3,000 paper sample sacks at $0.018/each	54.00	
Total Materials and Supplies		$ 127.00
Fixed Costs		
Incidental allowance per foot of drilling, 15,000 ft. at $0.70/ft. 1/		$ 10,500.00
Estimated total cost of Stage I		$ 93,877.00
Estimated total cost of Stage II		93,877.00 2/
Estimated total cost of project		$187,754.00
Government's share at 50 percent		$ 93,877.00

1/ Two rigs, each working one 10-hour shift daily, 5 days weekly, and 22 days monthly, are expected to complete a total 3,000 feet of hole per month. Allowable monthly costs would total $2,115.00, as follows: supervisor - $800.00, helper - $450.00, trailer - $40.00, Beryllometer, Model 300 to be rented from Robert Ford & Associates at same rate charged by Boulder Scientific Co. -- $450.00, and 1963 Jeep station wagon or similar vehicle rented from Hertz Rent a Car at $75.00/mo., plus $300.00/mo. for 3,000 miles at $0.10/mi.

2/ Funds left over from Stage I should be made available for Stage II.

Copy

UNITED STATES

DEPARTMENT OF THE INTERIOR

Bureau of Mines

Region III

Salt Lake City Metallurgy Research Center

1600 East 1st South Street
Salt Lake City 12, Utah

June 24, 1960

Memorandum

To: Marling J. Ankeny, Director, Bureau of Mines

From: Research Director, Salt Lake City Metallurgy Research Center, Region III

Subject: Preliminary report on mineralization, mining, and concentration potentialities of the beryllium occurrence in the Spor Mountain area, west central Utah

You will recall asking for a report on the subject occurrence after you visited the area about two weeks ago.

I have summarized our joint view of the situation in this memorandum. As a first attachment for considering the geology and mining potentialities of the area there is a section prepared by Steve Wilson of the Mineral Resources group. A second section, prepared by Carl Schack, presents such metallurgical information as we have been able to gather in the intervening short period of time.

The beryllium occurrences on the western slope of Spor Mountain, Thomas Range of west central Utah, comprise a completely new type of beryllium mineralization. Preliminary data indicate that the alumina content of a magnesium montmorillonite-type clay, formed by the decomposition of a volcanic tuff, has been partially and irregularly replaced by beryllia. There is some evidence, not as yet authenticated, that the deposits could be extensive. Whether or not the material would be economically mineable in large tonnage quantities remains to be determined as outcrops thus far examined appear to vary widely and rapidly in beryllium content. The developers believe they can outline appreciable tonnage of ore containing 0.5 to 0.6 percent BeO.

Current evidence indicates that the maximum grade product that could be obtained--montmorillonite in which all alumina had been replaced by beryllia--would contain about 7 percent BeO. However, due to the apparent variability, it seems likely that the average grade product that can be attained will be appreciably less than theoretical.

It seems likely that physical beneficiation can be used only to reject hard gangue from the beryllliferous clay fraction. It probably will be impractical to separate berylliferous clay from unaltered clay.

Preliminary data indicate that the beryllia can be recovered from the clay by extractive metallurgical methods. Again we cannot anticipate the economic feasibility of this approach on the basis of present limited data on average grade.

In summary, too little is currently known about the extent, mineability, and grade of the deposits to enable dependable assessment of their potentiality. There is a possibility that in the ultimate analysis they might constitute an appreciable domestic reserve of beryllia, albeit of relatively low grade.

Exploration is indicated, at least until such time as a conclusion can be reached as to whether or not the deposits will be economically mineable. Concurrently, metallurgical work will be needed to determine whether or not the material can be economically treated for beryllia recovery.

B. H. Clemmons

Enclosures
cc: C. W. Merrill
P. W. Geehan
S. R. Wilson

SPOR MOUNTAIN, UTAH

MINING

General Geology

The Thomas Range area was mapped by the Geological Survey during 1951-52 as a result of discovery of several fluorspar deposits on Spor Mountain, the western segment of the Thomas Range. The information appears in Bulletin 1069, "Geology of the Thomas Range Fluorspar District, Juab County, Utah," by M. H. Staatz and F. W. Osterwald.

Commercial fluorspar deposits occur in Ordovician and Silurian dolomite beds, principally at the higher elevations of Spor Mountain. A wide variety of tertiary volcanic rocks is present on Spor Mountain. They virtually surround the mountain on the flanks, and in general parallel the sedimentary rocks, with northeast strike and dip to the northwest.

Investigations to date indicate that beryllium mineralization is found chiefly in rhyolite tuff, which in some areas is exposed at the surface and in other areas is covered by variable thicknesses of rhyolite and recent Lake Bonneville sediments. In the areas drilled, the tuff lies on an erosional surface of Devonian dolomite.

The beryllium-bearing tuff deposits controlled by Vitro Minerals Corp. lie on the westerly slope of Spor Mountain, a short distance west and southwest of the commercial fluorspar occurrences. Investigations in three general areas over a total strike length in excess of 10,000 feet indicate that the rhyolite and tuff beds increase in thickness downdip to the northwest.

The beryllium-bearing tuff is a highly altered and brecciated rock containing considerable clay. In most occurrences the rock is soft and friable, in sharp contrast to the overlying rhyolite, which is extremely hard and abrasive. The tuff contains many irregular patches and nodules of light to dark purple fluorite.

Insofar as is known, beryllium mineralization is not present in the sediments that underlie the tuff. A minor amount has been noted in the rhyolite.

Extent of Exploration

Exploration by Vitro Minerals Corp. has been confined principally to three areas--Taurus, Roadside, and Blue Chalk. The claims covering the three areas were originally located for fluorite, which occurs in association with the beryllium mineralization. Bulldozer trenching was performed by the lessor in searching for commercial fluorite deposits in the Taurus and Roadside areas.

Vitro Minerals Corp. obtained a lease on the claims in the three areas, as of April 1, 1960. Since the effective date of the lease a plane-table geologic map has been completed and surface sampling accomplished with a Berylometer. Surface trenching with a bulldozer, and rotary drilling were started in May 1960, and both are in progress at present. Approximately 5,000 feet of drilling has been completed in 35 holes, to date.

Exploration has been confined to areas of outcropping beryllium-bearing tuff or to areas a short distance downdip where the tuff has

only moderate cover of Lake Bonneville sediments and rhyolite. The Taurus, Roadside, and Blue Chalk areas and the intervening areas not yet explored cover a zone along the tuff outcrop greater than 2 miles.

Potential of the District

Exploration accomplished by Vitro Minerals Corp. in the Thomas Range, Juab County, Utah, in searching for workable deposits of beryllium ores, consists of surface trenching and rotary drill holes. The work has been concentrated near the outcrops of northwesterly dipping tuff beds, in areas most easily accessible to exploration.

Investigation has been conducted principally in three general areas, the Taurus, Roadside, and Blue Chalk, extending from north to south a distance in excess of 2 miles. Bulldozer trenching has revealed zones containing beryllium near the surface, and shallow drill holes have penetrated rhyolite overlying the tuff, the full thickness of the tuff bed, and a few feet into the underlying Devonian dolomite.

The mineralized tuff bed dips to the northwest at angles ranging from 15° to 25°. Assuming continuity of the tuff to the northwest, toward Fish Springs Valley, a large area of possible beryllium-bearing tuff is present. However, because the dip of the flow rocks is greater than the slope of the surface, and because the thickness of the beds appears to increase downdip, the distance from the surface to the tuff bed can be expected to be much greater to the northwest, downdip.

Exploration completed to date indicates that the tuff is erratically mineralized in different zones relative to the top and bottom of the tuff bed. In the Taurus area the tuff cut in the drill holes averages approximately 110 feet thick. Mineralization is present principally in zones near the top of the bed and a few feet from the bottom, at the lower contact with the Devonian dolomite. Holes drilled in the Roadside area have cut the tuff bed in thicknesses from 100 to 150 feet. Most of the beryllium mineralization in this area appears to be near the middle and top of the bed. The tuff bed in the Blue chalk area is much thinner than in the other areas. Here the bed, as shown in the drill holes, ranges from 25 to 50 feet in thickness. Beryllium mineralization is found principally near the middle of the bed, but also occurs near the top and bottom.

The beryllium content of samples taken by Vitro field men from surface trenches and drill holes has been determined by use of the Berylometer. Work accomplished to date near the outcrops of mineralized tuff in the most accessible areas has indicated that a moderate tonnage of tuff averaging approximately 0.5 percent BeO could be mined by open-pit methods. However, investigation of the tuff outcrops between the Taurus, Roadside, and Blue Chalk areas is necessary before a more reasonable estimate of the potential of the outcrop areas can be made. If this investigation is favorable, holes should be drilled downdip

to determine the extent of the mineralized tuff. If the tuff is present downdip, and is mineralized, a large tonnage is possible. However, undarground mining will undoubtedly be necessary a short distance below the outcrop because of the increased cover of Lake Bonneville sediments and rhyolite to the northwest. An acceptable grade of ore will be difficult to maintain in mining both at the surface and underground because of the apparent erratic distribution of the beryllium mineralization.

Stephen R. Wilson

SPOR MOUNTAIN, UTAH

METALLURGY

The Samples Studied

Eight samples from beryllium occurrences on the west side of Spor Mountain have been examined. Three of the samples were channel cuts taken from trenches on the Roadside, Blue Chalk (Vitro), and Miller (independent) claims. The latter is located approximately one-half mile south of the Roadside prospect. As these represented different types and grades of beryllium-bearing tuff, each was studied in considerable detail. The other five samples were hand specimens, selected as representing unusual mineral facies of the beryllifereus tuff. These were given only cursory examination.

The beryllium contents of the five specimens, as determined by a berylometer, are given in table 1. and incomplete chemical analyses of the three channel samples are given in table 2. Our berylometer assays, in the range above 0.1 percent BeO, check closely with normal analytical results.

TABLE 1. - Beryllium content of selected mineral specimens (hard materials)

Specimen	Analysis, percent BeO
Fluorite nodule	0.1
Siliceous nodule	.6
Black stained tuff	.1
Tan colored tuff	.8
Pink colored tuff	3.0

TABLE 2. - Chemical analyses of channel samples

Sample	Assay, percent				
	BeO	Al_2O_3	MgO	CaO	SiO_2
Roadside (Vitro)	0.18	7.9	6.9	6.8	55.1
Blue Chalk (Vitro)	.88	10.5	2.7	4.9	66.8
Miller (independent)	2.36	9.2	5.5	5.2	61.2

A detailed mineralogic study has been partly completed on the Roadside, Blue Chalk, and Miller claim samples. The pertinent facts developed by this study are as follows: The three samples are mineralogically similar as all three are altered volcanic tuffs. The principal minerals present are montmorillonite clay, volcanic glass, quartz, chalcedony, sanidine, feldspars, and minor amounts of fluorite, gypsum, calcite, mica, iron, and manganese oxides.

On the basis of preliminary chemical, X-ray, and differential thermal analyses of carefully prepared mineral products, it was concluded that the beryllium occurs in the magnesium montmorillonite clay. The element seems to have replaced aluminum in the crystal lattice of the clay mineral, as little or no beryllium was extracted by water leach or ion exchange leaching with ammonium acetate or chloride.

Analyses for beryllium in enriched clay fractions from each of the three samples revealed that the beryllium content of the clay is quite irregular. A clean clay fraction from the Miller ore contained 5 percent BeO, whereas clay fractions isolated from the Blue Chalk and Roadside claim samples assayed from as little as 0.1 to over 6 percent BeO.

The information obtained in the as yet incomplete studies suggests the following origin for the beryllium. The volcanic tuff, after

being emplaced, was subjected to weathering, whereby part of the volcanic glass in the tuff was altered to a magnesium montmorillonite. Subsequently, the tuff was invaded by beryllium-bearing hydrothermal solutions that irregularly replaced some to nearly all of the aluminum in the lattice of the montmorillonite clay. Limited information precludes establishment at this time of any relationship between the beryllium content of the tuff and the amount of fluorite, secondary quartz, or other possible minerals emplaced by the postulated hydrothermal process.

The Possibility of Beneficiating the Ores

Little is known as yet about the nature and grade of ore that ultimately might be mined from the deposits, or in fact, whether the seemingly highly variable berylliferous material can be economically mined. As a consequence, the three available samples, which differ widely in grade and in proportions of the component minerals, probably are not fully representative. Hence, only tentative conclusions can be made as to the possibilities of upgrading the ores by mineral dressing methods.

The beryllium apparently occurs as an integral part of some of the montmorillonite clay in the ores. As tentatively defined by the mineralogic and chemical studies, the degree of beryllium replacement of aluminum in the clay is erratic. The aluminum in some of the clay has been almost completely replaced by beryllium and apparently in some clay in the same sample, hardly at all. When practically all the aluminum has been replaced, the clay contains about 7 percent B_eO. This would, therefore, be the maximum grade of product that could be

anticipated from physical treatment, if such methods can be effectively applied at all.

The three samples that have been studied are all finely crystalline. The clay, an alteration product formed by incomplete weathering of the volcanic glass in the tuff, is disseminated throughout the samples and closely associated with the other minerals. In general, the clay component is soft and friable, but part of the clay has been silicified by secondary quartz and chalcedony to form relative hard and tough fragments.

These varying mineralogic and physical characteristics of the different samples seriously limit the feasibility of effectively beneficiating the ores by mineral dressing methods. There is little hope of finding a method for separating low-beryllium clay from high-beryllium clay. The silicified nature of some of the beryllliferous clay, the close association with the other minerals, and the almost amorphous nature of the clay preclude effective liberation and segregation of the clay as a separate product.

The three samples examined have contained from 30 to 40 percent of magnesium montmorillonite clay. If more thorough exploration of the deposits shows that silicification of the clay is relatively uncommon, then it may be feasible to upgrade the tuff perhaps twofold by wet attrition grinding and sizing methods. Gravity, magnetic, electrostatic, and flotation methods do not appear to be promising.

A preliminary study was made to determine the general conditions required to dissolve the beryllium in the ores. The sample from the

Blue Chalk claim of the Vitro Chemical Co., which contained 0.9 percent B_eO, was selected for testing.

Attempts to water leach or effect a cation exchange between beryllium and ammonium ions were unsuccessful. The results of these tests also suggest that the beryllium has replaced aluminum in the clay lattice rather than the exchangeable cations such as magnesium and calcium.

Direct leaching of the ore with sulfuric acid at 70° C. dissolved only 50 percent of the beryllium. Only 40 percent of the beryllium was extracted by the standard Copeaux fluoride fusion-acid leach procedure used by Brush Beryllium Co. despite use of a large excess of flux.

Extraction of over 95 percent of the beryllium was obtained when the ore was mixed with concentrated sulfuric acid, the mixture cured at 220° C., and then water leached. A total of about 75 pounds of acid per pound of beryllium extracted was used. Only exploratory tests were made with the acid cure procedure. Process details such as optimum amounts of acid, curing temperature and time, and amount of water needed for effective leaching and washing of the residue have not been defined.

Based on the promise that the sample used in the preliminary leaching tests is typical of the ores of the area, the following generalizations probably are valid. (1) High extraction of beryllium is possible by an acid cure procedure. Acid requirements are likely to be in the range of 1,000 to 1,500 pounds per ton of ore processed. (2) The acid cure-water leach procedure dissolves not only beryllium

but many other constituents of the clay and the tuff. The resulting solution is of low-beryllium tenor and contaminated with large amounts of impurities. (3) Solution purification and beryllium recovery methods applicable to such low-grade and complex leach solutions have not been devised and are likely to be complicated and expensive. (4) There is little doubt that a chemical process can be developed for recovery of a high-grade beryllium product. Considerable research will be necessary on samples fully representative of typical grade ore before meaningful estimates can be made on expected recovery and quality of end product and on process details. Owing to the low-grade and complex nature of the ores and the indicated complicated chemical processing that would be required, production costs will be high.

Recommendations for Additional Laboratory Studies

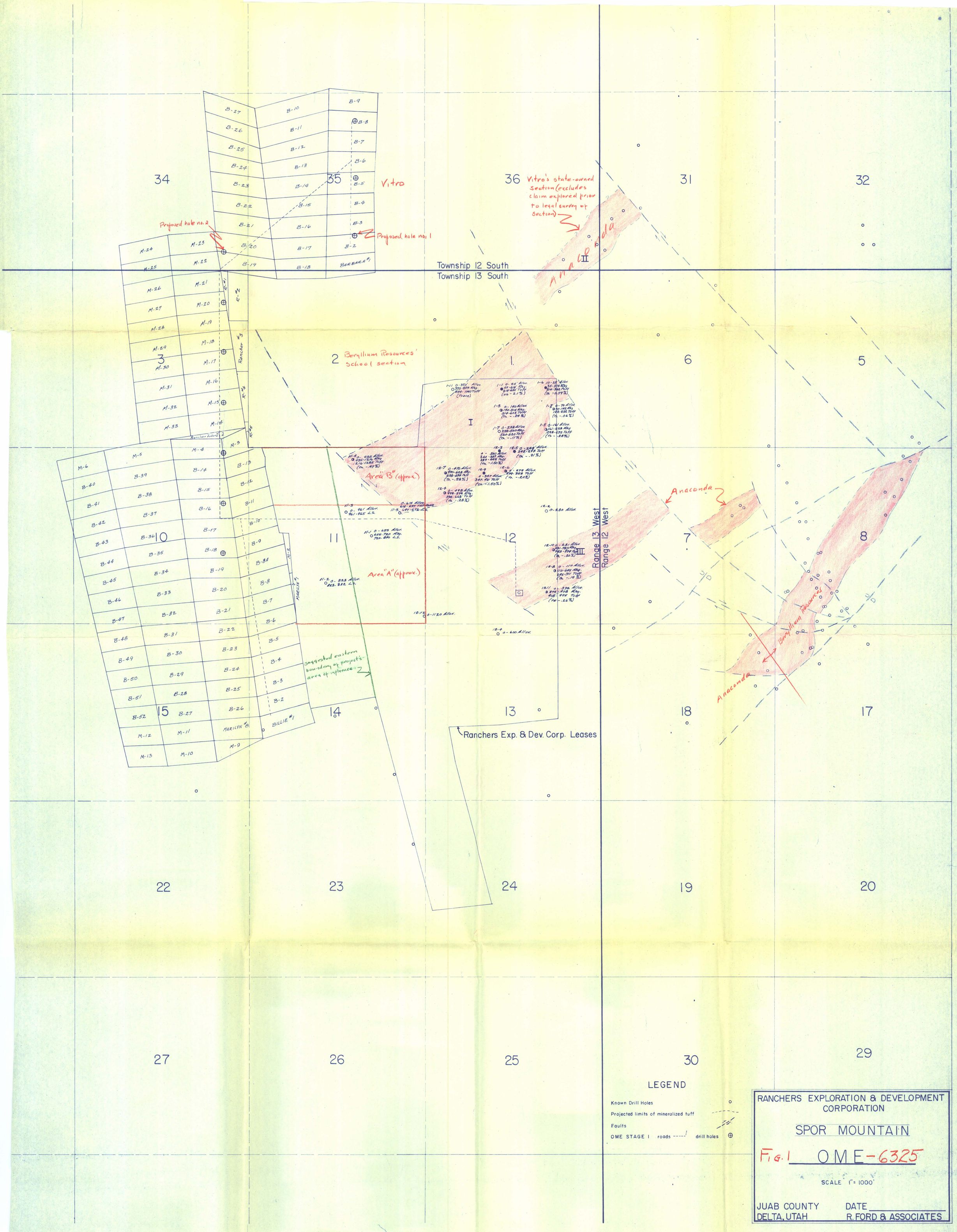
The limited laboratory investigations that have been in progress for only 2 weeks have permitted formulating only tentative conclusions about the nature of the ores and their response to processing. Predicated on current understanding of the problems that need to be investigated, defined, and resolved, a three-step program of laboratory research is suggested. It comprises the following stages:

1. Continuation of the present limited studies on available but not necessarily representative samples. The purpose of these studies will be to arrive at definite conclusions about the mineralogic and physical nature of the ores, and to delineate in a general way the processing problems likely to be encountered in recovering high-purity beryllium products from the ores.

2. When sufficient field work has been completed so that the size, grade, and nature of the ore zones are reasonably well defined, additional representative samples should be obtained for detailed bench-scale research. This phase of the research program will be directed to determination of the precise conditions for effective leaching, solution purification, and product recovery. The possibility of upgrading representative ore by mineral dressing procedures also should be reexamined.

3. The final phase of the program would be directed to evaluation of the technical and economic feasibility of processing typical ore by round-the-clock pilot scale mill tests of the methods devised by the bench-scale research.

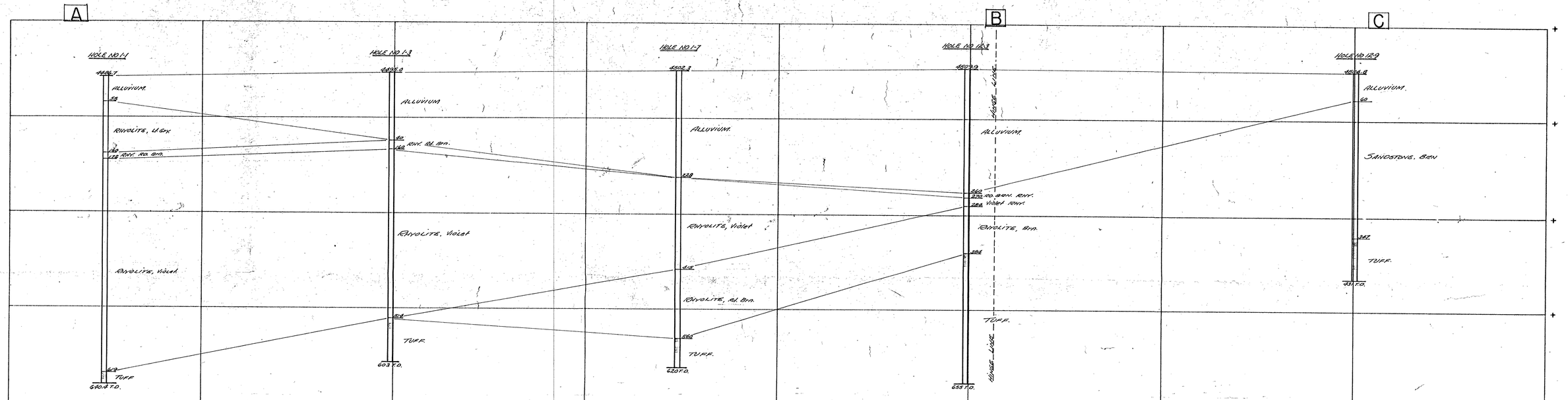
Carl Schack


Vitro
Vitro's state-owned section (excludes claim explored prior to legal survey of section)
Proposed hole no. 2
Proposed hole no. 1
Beryllium Resources' school section
Area "B" (approx.)
Area "A" (approx.)
Suggested eastern boundary of project's area of influence
Anaconda
Beryllium Resources
Ranchers Exp. & Dev. Corp. Leases
Township 12 South
Township 13 South
Range 13 West
Range 12 West
LEGEND
Known Drill Holes
Projected limits of mineralized tuff
Faults
OME STAGE I roads
drill holes
RANCHERS EXPLORATION & DEVELOPMENT CORPORATION
SPOR MOUNTAIN
Fig. 1 OME-6325
SCALE 1" = 1000'
JUAB COUNTY
DELTA, UTAH
DATE
R. FORD & ASSOCIATES

REDCO

SECTION 1-2 T. 13 S., R. 13 W. EXPLORATION CROSS-SECTION A-B-C LOOKING EAST

SCALE 1" = 100 FT.



HOLE NO. 1-1

FOOTAGE	ASSAY BaO4	ASSAY COMP.	BaO4
619-622	TR		
622-623	0.40		
623-624	0.28	.32	
624-625	0.27		
625-626	0.31		
626-627	0.87		
627-628	1.31		
628-629	2.18		
629-630	1.20		
630-631	0.41	.91	
631-632	0.42		
632-633	0.55		
633-634	0.47		
634-635	0.77		
635-640.4	TR.		

HOLE NO. 1-3

FOOTAGE	ASSAY BaO4	ASSAY COMP.	BaO4
414-515½	0.03		
515½-517½	0.06		
517½-518½	0.09		
518½-519½	0.11		
519½-521	0.03		
521-522	0.09		
522-523	0.03	.064	
523-524	0.07		
524-525	0.03		
525-526	0.03		
526-527	0.10		
527-529	0.00		
529-530	0.17		
530-531	0.17	.135	
531-532	0.01		
532-533	0.19		
533-534	0.02		
534-535	0.05		
535-539	0.00		
539-540	0.17		
540-542	0.00		
542-546	0.22		
546-547	0.07		
547-556	TR.		
556-557	0.24		
557-558	0.28		
558-560	0.09		
560-561	0.22		
561-603	TR		

HOLE NO. 1-7

FOOTAGE	ASSAY BaO4	ASSAY COMP.	BaO4
520-562	0.00		
562-562.3"	0.09		
562.3"-564	0.02		
564-565	0.11		
565-566	0.09		
566-572	TR.		
572-580	0.04		
580-582	0.01		
582-584	0.07		
584-586	0.00		
586-587	0.06		
587-588	0.00		
588-589	0.02		
589-598	TR		
598-606	COMP. LOST.		
606-616	TR.		
616-617	0.06		
617-618	0.02		
618-619	0.05		
619-620	0.08		

HOLE NO. 12-3

FOOTAGE	ASSAY BaO4	ASSAY COMP.	BaO4
383-385	0.02		
385-386	0.10		
386-387	0.80		
387-388	0.72		
388-389	0.60		
389-390	0.38	1.00	
390-391	0.70		
391-392	1.60		
392-393	0.96		
393-394	0.20		
394-395	0.14		
395-396	TR.		
396-397	0.50		
397-398	0.20		
398-399	TR		
399-400	0.20		
400-401	0.32		
401-403	TR.		
403-404	0.22		
404-406	0.30		
405-406	0.20		
406-407	0.12		
407-408	0.20		
408-409	0.18		
409-410	TR		
410-414	TR.		
414-414 1/2"	0.07		
414½-598	TR.		

HOLE NO. 12-9

FOOTAGE	ASSAY BaO4	ASSAY COMP.	BaO4
350-351	0.02		
351-352	0.00		
352-353	0.50		
353-354	1.40		
354-355	1.38	1.16	
355-356	.50	.88	
356-357	.80		
357-358	.82	.08	
358-359	0.00	.06	
359-360	0.12	.12	
360-361	0.30		
361-362	0.08		
362-363	0.00		
363-364	0.04		
364-366	0.46		
366-367	0.37		
367-368	0.08		
368-369	0.12		
369-370	0.18		
370-371	0.00		
371-372	0.12		
372-373	0.00		
373-374	0.07		
374-375	0.07		
375-376	0.28		
376-377	0.00		
377-381	0.14		
381-382	0.00		
382-383	0.02		
383-385	0.17		
385-400	TR.		
400-401	0.32		
401-402	0.12		
402-403	0.06		
403-407	0.00		
407-408	0.08		
408-408	0.00		
408-415	0.10		

FIG. 2, OME-6325