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DUCHHOLTZ REPORT
Panta Mountain

Lands Involved

The J. O. Group mining claims are located in Inyo County, California in Sections 15, 16, 21, and 22, Township 15 south and Range 41 east. The twenty-four claims lie just within the unsurveyed southern boundary of the northwest portion of Death Valley National Monument. Since the land has not been formally surveyed, the sections given are an approximation.

Summary of Recommendations

It is strongly felt that Wollastonite is on the threshhold of becoming one of the more useful of the non-metallic minerals. Its potential as an industrial mineral hasn't been fully realized as yet. However, before a company invests time and research necessary to fully develop the mineral, a large deposit of white, high-grade Wollastonite should be put at the company's disposal. The J. O. Group's claims cover just such a deposit.

In view of the large size of the deposit, as well as the whiteness and high grade of the Wollastonite, it is recommended that the Cartel Chemical Corporation continue mining and milling plans for the J. O. Group and the sale of the mineral in existing West Coast Wollastonite markets. It is also recommended that the Cartel Chemical Corporation embark on a much needed research program to develop Wollastonite to its full potential.

Introduction

The J. O. Group's claims were examined during the week of November 11, 1963 at the request of the Cartel Chemical Corporation. The examination was for the purpose of advising Mr. M. Hawley

President of the corporation, as to the feasibility of using the deposit as a source of Wollastonite from which a West Coast Wollastonite Industry could emerge.

A portion of the examination was made during Mr. Hawley's presence.

Status of Record Data

The J. O. Group's claims are recorded in the Inyo County Courthouse at Independence, California. The assessment work is up-to-date effective September 25, 1963, at which time an affidavit claiming amount of assessment work totaling $2,400.00 minimum was filed in Volume 18 on Page 650 at the County Recorder's Office.

The claims were originally recorded as follows:

Claim No.	Date	Volume	Page
1	4/21/57	88	301 627
			302 628
2	5/12/57	88	303 629
			304 630
3	5/12/57	88	305-306 631-632
4	5/12/57	88	307-308 633-634
5	5/12/57	88	635 636
6	5/12/57	88	309-637 310-638
7	5/12/57	88	311-639 312-640
8	5/12/57	88	313-641 314-642
9	5/12/57	88	315-643 316-644

Claim No.	Date	Volume	Page
10	10/17/57	88	645 646
11	10/17/57	88	527 528
12	10/17/57	88	525 526
13	10/17/57	88	647 648
14	8/21/57	88	649 650
15	5/19/59	91	659 660
16	6/1/59	91	663 664
17	6/1/59	91	661 662
18	12/18/59	92	593
19	12/18/59	92	594
20	12/18/59	92	595
21	3/18/60	93	79
22	3/18/60	93	80
23	3/18/60	93	81
24	3/18/60	93	82

Physical Features

Location - The J. O. Group consists of twenty-four lode mining claims situated approximately in Sections 15, 16, 21, and 22, Township 15 north, Range 41 east. They are in the order of the Ubehebe Peak quadrangles of the U.S.G.S. 15-minute topographical map series. The claims can be located on the Death Valley sheet of the Geologic map of California, scale 1:250,000 published by the California Division of Mines.

The field claims are in the Panamint range at the southern end of Ulida Flat. To reach the deposit from Olancha, California it is necessary to travel on the Death Valley black-top road for a distance of twenty-seven miles until the Saline Valley road is reached. This road runs north and is considered a good dirt road. After traveling sixteen miles turn left onto the Race Track Road and proceed another 6.7 miles and make a right

turn onto a rough access road. The main deposit is located 5.6 miles further down the road. The total distance traveled from Olancha is 55.3 miles, or if preferred, a total of 65.3 miles from the larger town of Lone Pine.

Terrain - The terrain is typical of the Death Valley area: high steep rocky mountain ranges trending in general north-southernly direction with flat desert valleys between ranges. The valleys are sandy with some sand dunes and scant vegetation. The mountains also lack vegetation with the exception of some scattered pines and sage.

Activity in Area - The main activity of the area is mining. There are some mines in the immediate vicinity which yield lead, talc, and some gold. None of the mines are producing any substantial tonnages.

In addition to mining there are a few cattle loose in the area but not enough to evoke consideration.

Water Facilities - The Ubehebe Peak 15-minute quadrangle lies in the southwestern part of the Great Basin in the Basin and Range province. Drainage flows into five closed basins. The Hidden Valley-Ulida Flat receives only 4-percent of this drainage.

The preciptitation of the drainage area isn't plentiful and, in most of the area, it is slight and sporadic. Cloudbursts occasionally wash out some parts of the roads. Noticeable local differences in the total precipitation are controlled by the altitude of the land .

There are no perennial springs or seeps except at a few places on Hunter Mountain which is located five miles south of the J. O. Group. However, it is felt that a limited supply of water, sufficient for mining necessities, could be obtained by sinking a well at Ulida Flat. This water probably would be potable. In this case, drinking water could be obtained from the Hunter Mountain area.

Power - Electricity is not available economically. The only solution would be to install a diesel electric generator at the mine site should the size of the mine warrant such an installation.

Natural gas is unavailable. Should gas be required at the mine it will be necessary to build a bottled gas installation. These are available at Lone Pine and are used by the various mines in the area.

Transportation - The nearest railroad is at the town of Keeler which has a narrow gauge branch of the Southern Pacific Railroad situated forty-five miles from the deposit. The nearest standard gauge portion of the Southern Pacific track is at Olancha situated fifty-five miles from the deposit. Fifty miles of the total distance is over good roads which are composed of 27 miles of California Highway 190 (black-top), 23 miles of good dirt haulage road and a remaining 5 miles of very poor undeveloped roadway.

It will be necessary to rebuild this road or to reroute the stream of traffic into Ulida Flat. This would add an additional

eight miles to the haul. However, all but one mile of the new route is in current usage by the county. The additional mile would be over relatively flat terrain. The new route would make the base of the deposit accessible and, therefore, permit a more economical method of mine development.

Climate - The claims are in a desert region which is hot during the summer months and cold during the winter months. The altitude of the specific location determines the extent to which the climate affects mining operations. Summer temperatures are disagreeably hot below 3,000 feet with temperatures soaring above 120°F. The winter temperatures are unpleasantly cold above 6,000 feet reaching below the freezing point. Strong sand-laden winds during all seasons accent the extremes in temperature. The precipitation is very slight, as mentioned above, but are sporadic. The few rains are heavy and descend in flash floods. These floods generate problems in maintaining the roads.

General Geology of the Area

The general area of interest contains the old Ubehebe mining district which was first known for the scattered copper deposits. Later, recognition came about after silver, lead, gold, and zinc deposits were mined. Non-metallic deposits have never really been exploited. Bulky materials such as limestone, dolomite, and aggregate are commercially unattractive in their isolated condition. Salines, talc, and asbestos have been explored but none are present in sufficient quantity or quality to be developed. The Wollastonite and garnet of the J.O. group appear to be present in both quality and quantity which would allow their commercial exploitation.

The deposits are situated in Paleozoic rocks near intrusive contacts with mesozoic plutonic rocks. The exposed Paleozoic rocks of the area were originally marine sedimentary deposits. They consist of limestones and dolomite and include quartzite, silt stone, shale, chert, and some conglomerate.

The sequence, which extends from Middle Cambrian to Permian in a composite section more than 1,500 feet in thickness, has been regionally mapped.

A great gap in the sedimentary sequence separates the Permian rocks from Late Pliocene and younger continental deposits. The Cenozoic rocks contain some olivine basalt.

The Plutonic rocks, which have been correlated with the complex of late Jurassic or early Cretaceous, are in the Inyo Range and the Sierra Nevadas. They consist of quartz monzonite and include a wide range of variation along some contacts of the

larger masses and the smaller satellites. These include granite, granodiorite, syenite, minette, monzonite, syenodiorite, diorite, syenogabbro, and gabbro.

The calc-silicate rocks, including Wollastonite, are the product of contact metamorphism of Paleozoic limestones and dolomites by the Plutonic rocks. They occur irregularly in marble along intrusive contacts and, predominately in carbonate formations that are normally silty, shaly or cherty. The calc-silicate rocks consist principally of varied combinations of garnet, diopside, idocrase, epidote, albite, orthoclase, wollastonite, tremolite, calcite, and quartz. The only one of these which have any commercial possibility is the Wollastonite and, possibly, the garnet.

The regional-structure consists of north-trending folds and some contemporaneous thrust faults in the Paleozoic rocks. A batholith and its satellites of late Mesozoic age transected and deformed some parts of the earlier folds and thrust faults. Cutting across the Paleozoic and Mesozoic rocks is a large angular unconformity. Volcanic rocks and other continental deposits of late Cenezoic age were depsited over this unconformity. There are later faults disecting the above, some of which have displaced the present topography.

Geology of the J. O. Group

The deposit of Wollastonite in this group consists of a massive body of mainly altered Devonian calcareous rocks near the contact with the Mesozoic quartz monzonite. Silica bearing

gases which were escaping from the intruding quartz monzonite were deseminated throughout the Devonian calcareous rocks in the J. O. Group area. The structural control of these gases was the two minor faults that form the east and west boundary of the deposit. The southern limit of the deposit is not well defined where it enters the Mississippian calcareous rocks gradually. There it diminishes in intensity and ultimately grades into a non-Wollastonite bearing limestone.

The Devonian Lost Burro formation hosting the Wollastonite consists mostly of interbedded limestone and dolomite. Light gray layers alternate with dark gray layers, conspicuously depicting striped mountainsides. Some of the dark layers contain characteristic white stringy shapped mottling and dark concentric cellular masses of Stromatoporas which help identify the formation.

The Mississippian limestone forming the "assay" boundary of the Wollastonite is the Tin Mountain limestone. It is from 400 to 500 feet thick. The lower portion is composed of thin limestone beds which are interstratified with light to brownish-gray to pale red calcareous shale. This calcareous shale could be the agent that formed the deterrent of further formation of Wollastonite in the southern portion of the deposit.

The deposit, itself, is easily distinguishable from the host. The Lost Burro formation is nearly pure white and is, therefore, in direct contrast with the typical Lost Burro coloring. The Wollastonite occurs in approximately 80-percent relationship

with a white altered limestone. Chemical analysis of the deposit are included at the end of this report. Samples were taken in the following order:

9791 - along western border
9790 - down center running north and south
9792 - cross southern end of deposit running east-west
9793 - along eastern border of deposit running north-south

A composite sample of the deposit taken by Gladding McBean Company coordinates favorably with the theoretical assay of Wollastonite ($CaSiO_3$). Such a close comparison is unusual although the overall high Wollastonite content is also without precedent.

J. O. Group	Sample	Wollastonite Present	Other Material Present	Theoretical Wollastonite
SiO_2	39.62%	48.27%	82.08%	48.28%
CaO	42.46	51.73		51.72
Al_2O_3	2.99			
Fe_2O_3	0.79			
TiO_2	0.10			
MgO	3.13		17.92	
Na_2O	Trace			
K_2O	0.03			
Loss	10.88			
Total	100.00	100.00	100.00	100.00

The main body of Wollastonite contains material that is very white and has the typical assidular structure of Wollastonite. The particles are quite small in size in comparison with

other samples of Wollastonite from different areas. This small size will be an advantage when the material is being milled.

There are two other occurances of Wollastonite in the J. O. Group. These deposits are very small and, although very white in color, have a larger assidular structure. These occurances would tend to give some degree of diversity to the deposit as a whole. However, these occurances really are too small to consider on their individual merit. There is no indication that these occurances are connected in any way with each other, or with the main deposit. They are isolated results of metamorphism, probably due to the channalization of gases along small fault intersections.

The presence of garnet is indicative of additional commercial value. This deposit was formed by gases escaping from the mineralizing fault which forms the eastern boundary of the main Wollastonite deposit. The garnets are in a dark colored calc-silicate rock - or tactite. The tactite is characterized by the iron bearing garnet and minor amounts of idocrase and epidote. There is another occurance of garnet in J. O. 17 but it is not known at this time whether this deposit has any commercial value as its size and potential have not been disclosed.

H. C. Burchett

Description and Location

The property consists of 24 unsurveyed lode mining claims (known as the J.O. Group), located near Hunter Mountain, Inyo County, California. Within these claims a massive deposit of Wollastonite occurs as a valley-side outcropping with little or no overburden, and the property can be mined by open-cut, bench, or quarry methods. There is little or no precipitation in this area, and the claims can be reached by California State Highways, Inyo County maintained macadam and gravel roads, and a mine access road, all regularly travelled by automobile and truck. The distance to the nearest railroad from the mine is approximately 55 miles.

A basic geological-engineering study of the claims was conducted by Herbert F. Buchholtz, Professional Engineer – Nevada License 1732. Mr. Buchholtz calculated that the property has probable Wollastonite ore reserves in the range of 25,000,000 tons and could extend to possible reserves of 189,000,000 tons. Proven reserves of 750,000 tons of Wollastonite are present on a portion of the massive deposit. Dr. Yvor H. Smitter, Geologist with the Division of Mines and Geology, Department of Conservation, State of California Resources Agency, Los Angeles, California, inspected the property and confirmed the General Wollastonite calculations of a minimal 750,000 tons of proven Wollastonite reserves (see "Proven Wollastonite Reserves"). In addition, Dr. Smitter examined showings of a potential copper oxide-zone halo which may overlay a copper body. He recommends drilling and attendant assay to map and assess the value of the copper within the property.

The claims and the annual assessment work thereto have been duly recorded in the County Record Ledgers, Inyo County Courthouse, Independence, California. The property is approximately six miles southeast of Ubehebe Peak, some twenty miles from the Nevada-California boundary. It lies within the Panamint Range near the southern end of Ulida Flat. The Wollastonite deposit outcrops on a valleyside between 5000 and 6200 feet above sea level.

Proven Wollastonite Reserves

Sampling, drilling, and assay work performed to date on approximately 12 - 14% of the main Wollastonite ore body reveals proven tonnage of consistent quality of 750,000 tons. This tonnage and quality standard for the deposit was determined after (1) broad, surface sampling and assays thereon, across the centerline, easterly, westerly and southerly lines of a portion of the deposit, (2) sampling and resultant assays from discovery, blast, and drill holes, and (3) drilling and attendant assays taken from 12 drill holes of average 36 ft. depth across the main lines of a portion of the Wollastonite ore body. Assays of this material were also performed, from the surface material to the bottom of the drill-holes, and found to be consistent in quality.

General Market

Several hundreds of thousands of tons of filler-extender materials are sold in the Western Region of the U.S. Exact amounts of Wollastonite sales in the Western U.S. region are difficult to identify; however, in talks with various users and the sole-source jobber, it is estimated that 1972 sales will approximate 15,000 tons. The main reason for the slight Wollastonite penetration of the filler-extender market in the Western U.S. is the cost of freight from the east coast. Several major filler-extender users in the Western Region have evinced high interest in replacing current filler-extenders with Wollastonite if a West Coast source were in production.

The Wollastonite to be mined, processed and sold is exceptionally white, is free of iron, has no carbonate content, can be easily extracted and processed, and should be able to penetrate the Western U.S., Pacific, Central and South American extender-filler market.

Access to the Property

The property lies east-northeast of Keeler, California and may be reached by California Route 190, from Keeler to the Saline Valley Road, then north to the Race Track Road, then West onto the mine haulage road. The total distance from Keeler is 43 miles of which 38 miles is over macadam and gravel roads, maintained by Inyo County, and approximately 5 miles is mine-haulage road. The latter is regularly travelled by automobiles. Keeler, California is designated by the California Public Utilities Commission as a railhead. Trucks of the Southern Pacific Railroad regularly pick up products of a talc mill located at Keeler which they haul to the loading area at Lone Pine, a distance of approximately 20 miles, over paved road. The total distance from Olancha, California is approximately 55 miles. Olancha lies on the Southern Pacific Railroad. There is a talc mill and siding at Olancha.

Constituents of the Property

The total surface area of the massive Wollastonite deposit lying within the claims encompasses approximately 6,000,000 sq. ft. During pilot tonnage extraction, hand-cobbing or beneficiation was accomplished by hand-tossing all ore that was not white to a tailing pile. The balance was crushed, pulverized, bagged, and sold.

Adjacent, but separate from the Wollastonite ore body is a line-series of almandite garnet outcroppings. This garnet is used in the abrasives industry.

Within the bounds of the claims, a high grade of crystalline calcite is easily accessible. Also within the bounds of the claims there are multiple showings of oxides of copper.

During discovery and assessment work on two of the southerly claims, cobalt and silver showings were found.

On the main ore body of Wollastonite there is no overburden which would prevent open-cut mining through the creation of surface benches. The Wollastonite deposit has sufficient slope over contour to enable gravitational flow of crude ore from primary to secondary crushers, thus reducing the demand on mechanical power.

Previous Extraction and Processing

The property was originally stake-claimed by Mr. Joseph Ostringer during 1957 - 1960. Between 1963 and 1966 considerable mine road improvement, drilling, and assay work was conducted on the claims. In addition, 250 tons of Wollastonite was extracted, custom milled, and sold to the ceramics and paint industry in Southern California in a pilot program. However, at that time U.S. Western Region demand for Wollastonite was not sufficient to justify mining operations.

Competition

The only active Wollastonite producer in the Unites States is International Pipe and Ceramics Corp. (INTERPACE), operating a shaft mine and mill at Willsboro, N.Y. They mined, processed, and sold approximately 50,000 tons in 1971 and should sell approximately 60,000 tons in 1972. Prices range from $32 to $100 per ton (F.O.B. New York), dependent on particle size. INTERPACE Wollastonite is sold in Los Angeles, California for $100 to $140 per ton. All of INTERPACE's Wollastonite product is jobbed through the Harwich Corp., Akron, Ohio, except for several large house accounts handled directly by INTERPACE. A small amount of the INTERPACE Wollastonite is exported to Europe and Japan. Freight costs for their New York State produced Wollastonite to the Western U.S. Region are approximately $38.00 per ton.

Demand

Metallic and non-metallic minerals, including Wollasonite, are used as filler-extender additives in the ceramics, paint, plastic, rubber, cement, glass, wallboard, abrasives, mineral wool insulation and paper industries. Several million tons are used annually in the U.S. alone.[1]

Physical and Chemical Properties of Wollastonite

Wollastonite is a naturally occurring calcium metasilicate ($CaSiO_3$) which serves as a beneficial extender-filler. It is an acicular mineral with the following general properties: high uniformity, resin compatibility, low oil and moisture absorption, chemical resistance, mechanical reinforcement and outstanding electrical and thermal insulation characteristics. Wollastonite has the following physical properties:

Hardness – 4½ – 5 on the Mohs' scale

Specific gravity – 2.87 – 3.09

Melting point – about 1540°C.

Brightness rating – 92-96% (on the General Electric reflectance rating).

Uses of Wollastonite[2]

Wollastonite has a very short history as an industrial mineral. There was virtually no exploitation of the mineral until 1945 and it was not marketed in any real quantity until 1953. Rapid progress in research, chiefly by the Cabot Corp., Boston, Mass., but in part by consumers in plant trials, has shown many uses for the mineral and many advantages for substituting Wollastonite for broad use extender-fillers such as clay and talc. The Tax Reform Act of 1969 established a mineral depletion rate of 10% for Wollastonite.

THE FILLER-EXTENDER INDUSTRY

Plastics

The general properties, which are of benefit to almost all plastic systems utilizing Wollastonite, include uniformity, brightness, resin compatibility, low oil and moisture absorption, chemical resistance, mechanical reinforcement, and outstanding electrical and

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[1] *Minerals Yearbook*, U.S. Bureau of Mines, Annual Editions

[2] *Wollastonite*, Institute of Geological Sciences, R.W. Andrews, 1970

thermal insulation characterists. In epoxies, Wollastonite gives dielectric constants of 2.2 — 2.8, stable viscosities, and increased pot life. In polyolefins, it imparts higher impact strength than other filler-extenders. In cross-linked polyethylene, it does not affect or impair the efficiency of the curing agents. In PVC it has particular value in floor tile, sheeting, and plastisols. In nylon, low moisture absorption makes it a highly desirable filler. It has wide use in phenolics, polyesters, silicone rubbers, and flourplastics. Because of its stain resistance it is used in melamine tableware and other urethanes.

Ceramics

The addition of Wollastonite to a ceramic mix introduces both silica and lime combined in the form of a single compound. It can be used in part or whole to replace traditional filler-extenders such as clay, talc, flint, quartz sand and feldspar. Wollastonite has greater potential for the ceramics industry than merely as a replacement for other raw materials. First, there are the advantages it confers on the production process such as stopping lamination, providing good die fill, and ease of drying and pressing with improved bonding. Ceramics made with Wollastonite in both green and fired stages have high strength. The low moisture property obviates crazing; fired ware shows little size variation, minimal warpage, better than average modules of rupture, good compression strength and high impact strength. One of the most important results of incorporation of 20% or more of Wollastonite in ceramic bodies is that firing times can be progressively reduced as the content of Wollastonite is increased. If 50% or more is used fast firing is possible, the firing cycle lasting from less than one hour to a maximum of two hours, whereas conventional firing lasts from 20 - 70 hours. Fast firing results in a high production rate with consequent economy of fuel. This is a major factor for the ceramics industry when competing with low prices of ceramics entering the U.S. from Japan and Mexico.

Wall-tile manufacturers make generous use of Wollastonite since its addition allows glazing in a short single firing at a fairly low temperature. Further the bodies dry rapidly with no cracking or shrinkage and they can be sawn, nailed, and drilled with ordinary tools. This is partly because the constituent acicular crystals of Wollastonite, having good cleavage, break down easily, and partly because the bond is uniform.

Wollastonite is also used as a constituent of glaze frits, fluxes, and color stains. It is essential that a glaze has an expansion coefficient near, but never higher than, that of the body. This eliminates crazing. Wollastonite produces a high compression glaze, reduces viscosity, and has more uniform texture and minimal run-off.

In low-loss ceramic electrical insulating materials, Wollastonite behaves like steatite. An ultra low-loss body has been developed in which the bulk of the body is Wollastonite and the flux is lead silicate. Wollastonite ware matures at lower temperatures than alumina, forsterite, or steatite ware.

Some experimentation has been conducted wherein Wollastonite is used to make ceramic moulds vice the normal plaster of paris or gypsum cement moulds.

Paint

Wollastonite is widely used as an extender in paint for house coatings; namely primers, undercoatings, flat and emulsion paints — oil and water based. It can be used in latex

paints, road marking (traffic) paints, caulking compounds, and as a partial or complete replacement for asbestos in asphalt-based coating where aluminum flake is normally incorporated to add body.

It is a good flatting agent and its low oil absorption – 20 - 26 ml. per 100g – reduces amount of binder required. It is easily wetted and less viscous than other extenders.

Wollastonite in suspension is alkaline with a pH as high as 10 or a little over. This is especially useful in steel paints because the steel is less likely to corrode when coated with a Wollastonite improved paint. Further it assists in deterring paint-can corrosion.

Wollastonite incorporated in paints shows many beneficial characteristics such as ease of application, good levelling, and resistance to mildew. Of paints used in the U.S., Wollastonite is known to be incorporated in approximately 9% (by weight) in white semi-gloss enamels and polyvinyl acetate emulsion paints, and 13% in primers and sealers.

Rubber

Wollastonite is used as a semi-reinforcing filler in resin-rubber shoe soling and other non-black rubber goods such as wringer rolls. Additional research and development for the rubber industry will undoubtedly indicate many usages for Wollastonite because of its superior chemical and physical properties described above.

Abrasives

Wollastonite is used in the production of ceramic bonded abrasives and abrasive wheels. This is because it imparts a greater fluxing rate and its combined silica "wets" the abrasive particles thoroughly, increasing the bond strength without increasing the density. In vitrified grinding wheel bonds, Wollastonite acts as a natural frit.

Mineral Wools

Wollastonite has a bulk density when ground to about 15 lbs/cubic ft., or, vibrated to about 29 lbs/cubic ft. Blocks of insulation have been produced with a density of 27 lbs/cubic ft.; they have negligible shrinkage at high temperatures. (.32% at 2090°F.).

Paper

Some use of Wollastonite has been made as both a filler and a coater in the paper industry. It appears that micronic or angstrum-size particle grindings would enable broader use. This could be especially valuable for the paper trade wherein rises in postal rates are demanding superfine calendared paper or thinner and lighter papers to offset the rising transportation costs.

Soil Conditioner/Fertilizer

Some use has been made of synthetic calcium silicate in place of limestone as a soil conditioner and plant fertilizer. From the chemistry of Wollastonite it appears that it could assist plants in assimilating phosphates and other foods.

Glass

In glass making, the maximum possible iron content of limestone and sand cannot exceed .05%. Wollastonite ore with less than this amount of iron can be used to make flat, fibre, and pyrex-type glass.

Cold Setting Foams

Cold setting foams can be produced by treating finer grades of Wollastonite (−325 mesh to 1 micron) with acid. Such foams have broad uses in insulation because the foam is fireproof, has good thermal insulation qualities, and it will not sag like styrofoam. Further, such foams can be produced at building sites in the "house in a barrel" type of operation. Such foams should prove very useful as insulating materials in pre-fabricated homes and trailers as well as for coating structural steels. These foams are weather and salt resistant, will neither crack nor flake, and will withstand thawing and freezing.

Cement

In the asbestor-portland cement industry, Wollastonite can double or treble cross-rupture strength when added to cement mixes. Such usage would improve the roofing shingle and drainpipe subindustry.

PROBABLE & POSSIBLE TONNAGE CALCULATIONS - WOLLASTONITE ($CaSiO_3$) DEPOSIT*
(J.O. Group of lode mining claims, Inyo County, California)

PROBABLE ORE

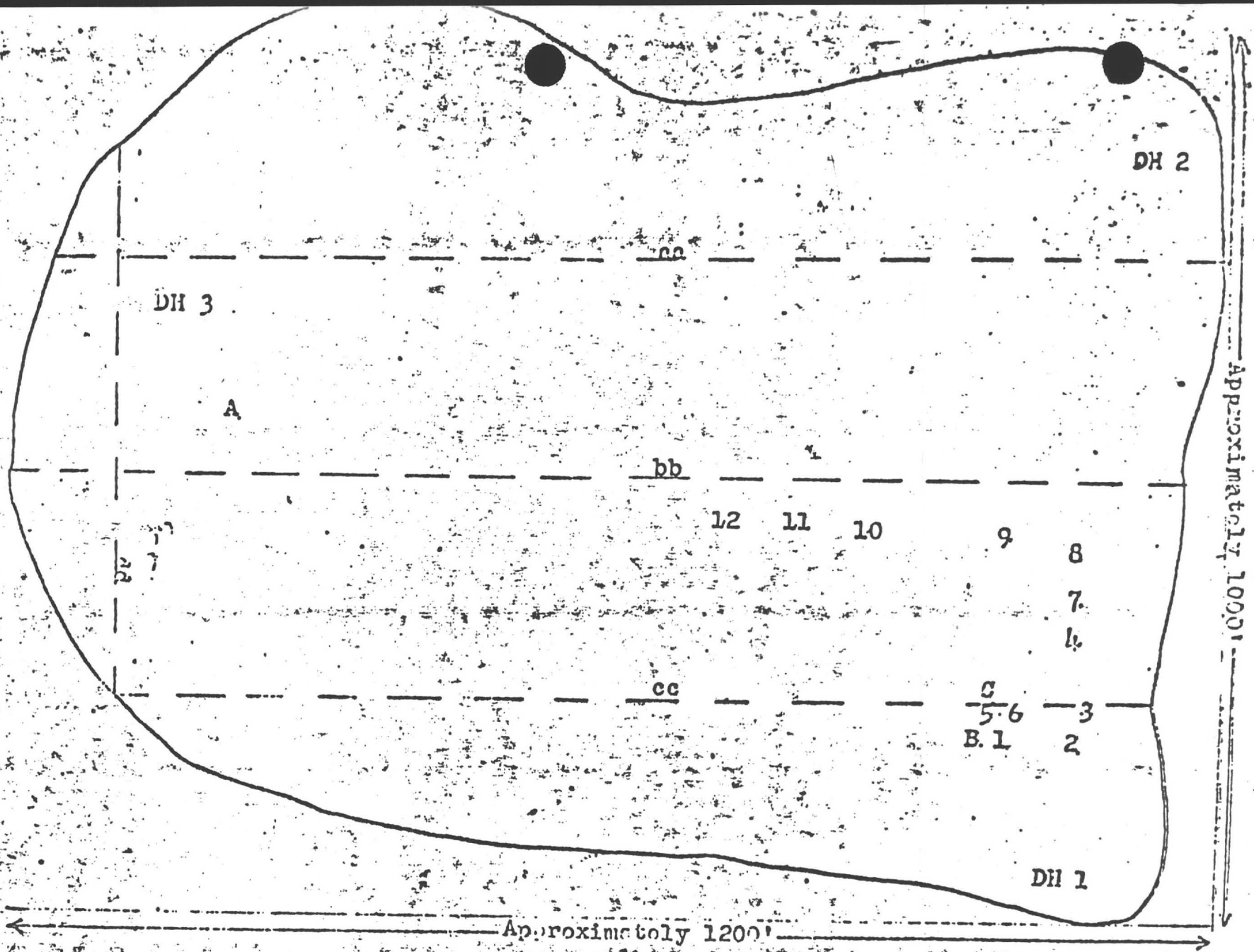
Surface area of deposit	6,000,000 sq. ft.
Probable depth of North End	1 ft.
Probable depth of South End	100 ft.
Average depth of deposit	50 ft.
Volume of deposit	300,000,000 Cu. Ft. (6KK X 50 ft.)
Tonnage factor = 12 cu. ft. per/ ton	12 / 300,000,000

PROBABLE TONNAGE = 25,000,000 TONS

POSSIBLE ORE

Level	AREA Surface area average (square ft.)	Depth (Feet)	Volume Mil. Cu. Ft.	Tons in Millions
6200	0 - 300,000	200	60	5.0
6000	600,000 - 875,000	200	175	14.5
5800	1,150,000 - 1,700,000	200	340	28.3
5600	2,250,000 - 2,400,000	200	480	40.0
5400	2,550,000 - 2,550,000	200	500	41.7
5200	2,550,000 - 2,150,000	200	430	35.8
5000	1,750,000 - 1,075,000	200	215	17.9
4800	400,000 - 360,000	200	72	6.0
4600	320,000 -			
				189.2

*Tonnage calculations were performed by Herbert F. Buchholtz, Professional Engineer - Nevada License #1732



Legend:
DH - Discovery Holes
A-B-C Blast Holes
1-12 Drill Holes
- - - Surface Samplings

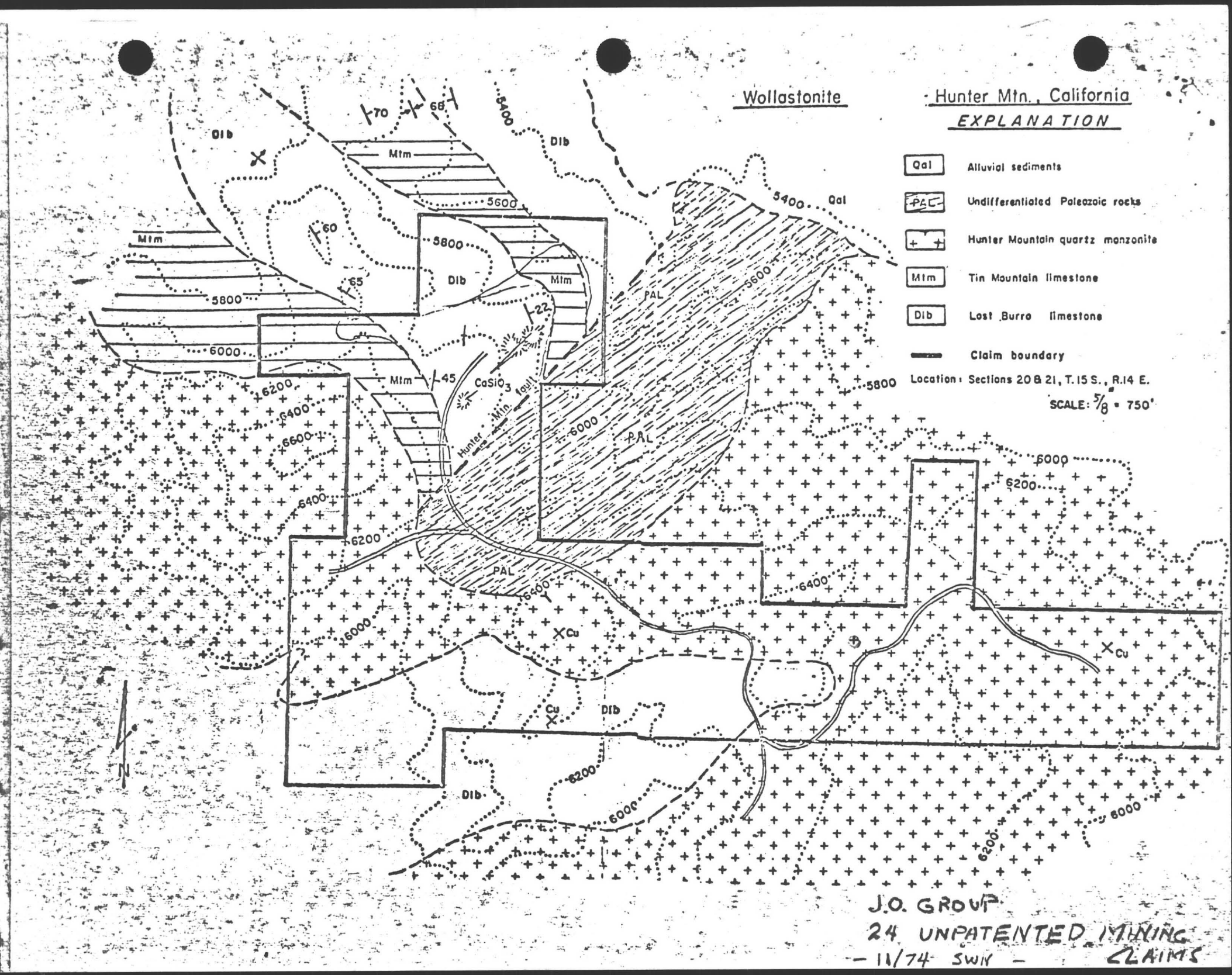
Ore Sampling and Exploration
J.O. Group of Lode Claims
Main Portion of Wollastonite Deposit
Approximately 36° 40' N at DH 3
117° 31' W

ASSAYS ON J.O. GROUP OF LODE CLAIMS - WOLLASTONITE DEPOSIT

Surface Sampling		SiO_2	CaO	Fe_2O_3	Assayer
aa (Westerly)		52.98	41.27	.71	Gladding-McBean
bb (Center)		46.29	37.39	.96	"
cc (Easterly)		63.30	33.28	1.25	"
dd (Southerly)		48.40	42.45	1.25	"
Discovery Holes	**Depth**				
DH 1	0-10'	47.21	48.44	---	Eisenhauer
DH 2	0-10'	54.44	43.44	---	"
DH 3	0-65'	56.00	42.00	.04	"
Blast Holes					
A	0-6'	56.60	41.50	.04	Eisenhauer
A	0-6'	44.92	45.66	.13	C. K. Williams
A	0-6'	39.62	42.46	.79	Interpace Corp.
B & C	0-4'	51.70	46.40	.10	Osborne Lab
B & C	0-4'	56.00	41.00	.80	Bishop Lab
Drill Holes					
1	0-44'	56.00	41.00	---	Bishop Lab
2	0-44'	37.90	39.15	---	"
3	0-25'	38.50	44.60	.90	"
4	0-36'	40.09	41.50	.71	"
5	0-44'	55.00	43.07	.30	Osborne Lab
6	0-44'	46.90	47.60	.33	"
7	0-30'	39.80	31.30	.62	Bishop Lab
8	0-50'	40.80	53.50	.30	"
9	29-40'	41.00	40.00	.42	"
10	0-30'	45.74	42.60	.52	"
11	0-30'	45.74	42.60	.52	"
12	0-30'	44.80	41.00	.26	"

1 A49

6


Wollastonite
Hunter Mtn., California
EXPLANATION
Qal Alluvial sediments
PAL Undifferentiated Paleozoic rocks
Hunter Mountain quartz monzonite
Mtm Tin Mountain limestone
Dlb Lost Burro limestone
Claim boundary
Location: Sections 20 & 21, T. 15 S., R. 14 E.
SCALE: 5/8" = 750'
Dlb
Mtm
Qal
PAL
CaSiO3
Hunter Mtn. fault
Cu
N
J.O. GROUP
24 UNPATENTED MINING CLAIMS
- 11/74 SWN -

EXECUTIVE OFFICES
P.O. Box 362
Monterey Park, Calif.
Tel: 283-9712

PRODUCTS
CHEMICALS
METALS
MINERALS
MICROBRASIVES
PIGMENTS

CARTEL CHEMICAL CORPORATION

CONSUMER SALES
7141 N. Figueroa Street
Los Angeles 42, Calif.
Tel: 255-1533

CONSUMER ITEMS
CL-7
CEPTOX
POLY BRITE

June 18, 1964

Mr. Joseph Ostringer
12266 Spring Canyon
Kagel Canyon,
San Fernando, Cal..

Dear Joe:

This letter will confirm our agreement to pay you $42.00 per ton for all garnet tonnage hauled from the J. O. Claims on Hunter mountain and processed according to direction. At such time as we are able to complete a 3% to 5% grade haulage road, there will be a reduction in price amounting to $5.00 and/or $37.00.

Length of contract and/or agreement and the amount of tonnage per month, will parallel the agreement between Mr. O. C. Callery and Cartel, in which he implies he will not order less than 200 tons per month, by reason of the fact that he expects to sell in excess of 200 tons per month. At such time as Mr. Callery reduces his volume of orders, or through any unforseen circumstance ceases to require garnet, this agreement will also end, unless renewed in writing by ourselves.

The present market indicates however, with the gradually increasing usage of garnet as an abrasive, that we may look forward to a long-term continuing operation, with an increase in the per-month tonnage.

It is further understood that you are mining and hauling the said garnet as a separate contractor and the Cartel Chemical Corporation assumes no direct supervision over your activities. All orders of course, are subject to Mr. Callery's acceptance of commercial grade material, in sizes as directed by him, in the matter of production.

This agreement will also serve to give you ingress and egress to the J.O. Claims on Hunter mountain for the purpose of mining and hauling garnet and in the event other mining activities are in progress on the property, you will agree to coordinate your schedules so as not to interfere with any other operation.

Your signature at the bottom hereof, will constitute acceptance of the terms herein. Please sign both copies, returning one to me for our files.

Sincerely yours,

Mark H. Hawley, President

ACCEPTED: Joseph Ostringer

DATE: June 22-1964

EXECUTIVE OFFICES
P.O. BOX 362
MONTEREY PARK, CALIF
TEL: 283-9712

PRODUCTS
CHEMICALS
METALS
MINERALS
MICROBRASIVES
PIGMENTS

CARTEL CHEMICAL CORPORATION

CONSUMER SALES
7141 N. FIGUEROA STREET
LOS ANGELES 42, CALIF.
TEL: 255-1533

CONSUMER ITEMS
CL-7
CEPTOX
POLY BRITE

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12266 Spring Canyon
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Sincerely yours,

Mark H. Hawley, President

ACCEPTED: Joseph Ostringer

DATE: 6-22-1964

STATE OF CALIFORNIA—THE RESOURCES AGENCY

RONALD REAGAN, Governor

DEPARTMENT OF CONSERVATION

DIVISION OF MINES AND GEOLOGY

DIVISION HEADQUARTERS
RESOURCES BUILDING, ROOM 1341
1416 NINTH STREET
SACRAMENTO, CA 95814

District Offices: LOS ANGELES
Junipero Serra Bldg., Rm. 1065
107 South Broadway
90012

SACRAMENTO
Resources Bldg., Rm. 118
1416 Ninth Street
95814

SAN FRANCISCO
Ferry Building
94111

June 19, 1974

Mr. Joe Ostrenger.
12266 Spring Trail
San Fernando, Calif. 91342

Dear Mr. Ostrenger:

Summary Statement - J. O. and Calmet wollastonite claims, Inyo County.

The writer has examined these claims on a number of occasions in 1973-74 and over this period a great deal of mapping, evaluation work, sampling, testing and studies of markets were carried out by myself and several others. Most of the reports relating to the wollastonite claims are, I believe, in your possession at this time. Nonetheless, a brief review of the findings of the various studies may perhaps be helpful to you.

Location and Geologic Setting: The 47 J. O. and Calmet claims lie about 50 miles east-northeast of the small town of Keeler. All claims adjoin one another and the claim area may be reached by California Route 190 in conjunction with county and short mine haulage roads. The claims are located in the Hunter Mountains and elevations of wollastonite exposures range from approximately 4200 to 5500 feet.

The geology of the locality is complex with some folding of Paleozoic sediments, high-angle faulting and the intrusion of quartz monzonite "plugs" in the Hunter Mountain core. Wollastonite occurs as an altered skarn material along zones of contact between the Lost Burro-Tin Mountain limestones and the Hunter Mountain quartz monzonite. Presumably, the carbonate faction in contact limestones was lost and replaced by silicates during phases of emplacement of the quartz monzonite intrusive. The result was the genesis of a variety of metamorphic minerals, the most prominent of which is a calcium metasilicate complex or wollastonite. Quite obviously there is much more that could be detailed in connection with the geology of the locality, but it is not the purpose of this summary to deal comprehensively with the geologic complexities of the Hunter Mountain area.

In a specific sense, the wollastonite occurs as a contact band of material 300 to perhaps 800 feet in width, extending over a distance of three to four miles. At several points, faulting has offset

exposures by as much as 300 to 400 feet. Apparent dip of bedding ranges from 60 to 80 degrees north and this is an important factor in determining estimates of probable reserves.

A number of estimates have been made by several professional geologists in order to delimit tonnages within the claim area. These estimates range upward to 200,000,000 tons and more. In this regard, the writer feels that it is virtually impossible to provide a sensible or realistic reserve figure although certainly the deposit is extremely large by any worldwide standard. Drilled and blocked-out tonnages, currently covering a small fraction of the claims, amount to approximately 1,000,000 tons.

Materials Testing: Many points within the claim area have been sampled and the samples tested for chemical composition, whiteness, mineral texture, milling characteristics, etc. Basic assay work has been carried out by firms in Los Angeles, Riverside and Denver. Colorimetric testing was completed in Los Angeles. Mill test runs have been done at the Hardinge plant at York, Pennsylvania. For the most part, the results of tests have been good: mineral compositions often approach theoretical standards; garnet, epidote and diopside are generally absent; iron content tends to run less than ½ of one percent; much of the rock is short-fibered and as a consequence crushes, mills and air-classifies with little difficulty. Test results and names of firms having completed various aspects of testing are presently on file with the Division and are available for review.

Operating Considerations: There are many factors involved here which would bear on the successful exploitation of wollastonite from the claims and included are circumstances of accessability, transportation, mining procedure, rock quality, labor, mill siting, the availability of water, etc. In brief, the writer will comment on what are probably the more important of these operating factors.

In extracting rock from the deposit, open pit procedures would be entirely feasible and at no point would any underground work be required. This would, as contrasted to the few wollastonite mining activities in other parts of the world, substantially reduce extraction costs. This is an important consideration. Further, overburden is shallow or nonexistent over most of the outcrop area and would not pose much of a removal problem in commencing operations.

Wollastonite within the J. O. and Calmet claims appears to be almost entirely free of contaminating accessory minerals. Garnet and iron related minerals tend, in most wollastonite occurrences, to create milling and separation problems in the mill flow. This would not be the case in this instance and again could result in substantial savings in final product costs.

Access to the claims does not constitute much of a problem and dirt mine roads cut through most of the claim area. At present, the roads are fairly rough and would require some grading and dressing to bring them into good working shape. Circumstances of transportation - mine to market - involve problems needing close evaluation in terms of trucking and rail costs, road condition, labor, mill siting, and

a variety of other related factors. In the Hunter Mountain area, roads in general tend to be fairly rough, although once out of hilly parts of the region, roads are well maintained and in good condition. The nearest railhead (Southern Pacific) is located at Olancha about 70 miles southwest of the claims.

Although the claim area lies in an arid part of California, there are nonetheless several supplies of year-around water in the immediate vicinity - Spanish Springs, Coyote Springs. Available water would certainly be sufficient to support mining needs, labor and domestic requirements.

Marketing: The pricing and marketing of wollastonite in the western U.S. is by no means a simple proposition as contrasted to the rather straightforward marketing of metal mineral commodities. At present, milled wollastonite is only available in volume shipments in the U.S. from the Cabot mine at Wilsboro, New York. Charles Pfizer and Co. produce small quantities of wollastonite from deposits located near Blythe, California, but the deposits are extremely small and production limited and erratic. Materials coming from the Cabot mine, now owned by Interpace, primarily go to Interpace owned ceramic manufacturing facilities throughout the U.S. Almost no product is available for general sales to other buyers. Pfizer and Co., as an alternate producer, have been totally unable to produce sufficient quantities of wollastonite to serve even a small fraction of the western U.S. market demands. In brief, circumstances of supply in California and the western U.S. are poor and potential users have, as a result, been reluctant to adapt their manufacturing facilities to the use of wollastonite despite many significant advantages in the manufacturing stream.

Pricing, too, has been much affected by the irregularity of supply. New York to western U.S. shipping costs are also a major factor in local user demand circumstances. Rather than treat the complexities of marketing and pricing in this summary, however, the reader should refer to previous reports which are far more comprehensive in dealing with this problem. These reports are on file with the Division and again are freely available for review.

Final Comments: The writer believes that a significant mining potential exists in connection with the extraction of J.O.-Calmet wollastonite in Inyo County. The deposits are certainly large and the quality of the material exceptionally good. There are problems - largely those of transportation and marketing - but these are surmountable with intelligent engineering and planning.

Finally, it should be noted that this summary statement in no way constitutes an endorsement by the California Division of Mines and Geology. Evaluations and interpretations are strictly those of the writer.

Should further information or consultation be desired in connection with this statement, I would be happy to provide what assistance I am able.

Sincerely yours,

Yvor H. Smitter

Yvor H. Smitter

Dear Joe:

The compressed-air test of our Almandite Garnet was conducted by a reliable laboratory belonging to one of our customers.

The results were as follows:

30 min test

90 lbs. pressure

$\frac{1}{4}$ inch air hose

Complete penetration ($\frac{1}{4}$")

3/8ths. carbon steel 4 sq.inch plate

Remarks: The results were considerably faster in cutting than with Idaho Garnet.

Waste material was high (50%) due to the fact that we ground it as we found it at the deposit. It is important to know what you have to start with - before you start refining it. We have to either bring out two tons for one ton of finished material - at a comensurately higher price, or put a primary crusher and a whizzer on the property and shake it out there - hauling less tonnage out.

We would not have known the percentage of waste had we not tested it with the waste in - right?

Within the next 30 days or so, I expect to have some <u>clean</u> sample material in 36 mesh and 60 mesh sizes.

Regards

Frank

Hunter Mountain

IRA C. BECHTOLD
CONSULTANT
1987 SKYLINE VISTA DRIVE
LA HABRA, CALIFORNIA 90631
OWEN 7-4000
OWEN 1-4275
CODE 213

RECEIVED
JUL 21 1966

July 19, 1966

add KB
Rec'd
7-25

Mr. David C. Honey
Pacific Western Industries
3810 Wilshire Blvd.
Los Angeles, California 90005

COPY

Dear Dave:

In accordance with your request, I am submitting the following very brief report of my investigation of the Hawley Properties, or American Non-Metallics, Inc. properties, in Inyo County, which have been explored for wollastonite and other minerals. This investigation was made in accordance with your request of June 14, 1966.

The following report is intentionally made as brief as possible in accordance with our telephone conversation where it was decided not to encumber the first report with any more detail than would be necessary to understand the fundamentals of the results of the investigation.

My files contain many items of data, maps, information and pertinent background which has been used in the study made in the field as well as that underlying this report.

In addition to this report, I have made a verbal report to you and later to Mr. John Boreta on July 6, at which time we had a personal meeting in Los Angeles.

The field information was obtained on the weekend of June 24-26, at which time I spent two days in the field with Mr. Hawley, most of June 25 being spent on the property.

COPY

DOCUMENTS CONSULTED

Mr. Mark Hawley has supplied the writer with the following documents which have been utilized, among others, for this study:

1. Buchholtz, H. F.; Western White Wollastonite; Cartel Chemical Corporation Engineering Report, January 23, 1964.
2. Proposal of Anomet for joint venture.
3. Title Guarantee to Cartel Chemical Corporation by Title Insurance and Trust Company, Guarantee No. 20982, June 14, 1965.
4. Cartel Garnet; Data and scrapbook on Garnet including samples.
5. Western Wollastonite; Scrapbook of pictures of deposit, comparison with Willsboro, New York, deposits, technical data sets on commercial wollastonite, general articles on wollastonite, etc.
6. Adirondack Development Corp.; Utilization of Wollastonite; An Area Redevelopment Administration Project, No. Cc-5970, January 4, 1964; May 15, 1964.
7. Statistical analyses of calculated mineral assemblies.
8. Sketches and maps made by Mr. Hawley.
9. Anomet minerals map. "The J. O. Group."

In addition to the above, the writer has utilized extensive geologic data, geologic maps and other information which were already in his own files.

LOCATION

This property is located approximately in the center of Inyo County, California, being situated almost 33 miles airline due

east of Lone Pine. It is in an unsurveyed area which, by projection, is obviously located in T15S, R41E. The claims are included in Sections 20, 21, 28, 29 as projected.

It is situated in the uplands south of Ulida Flat and southeast of Racetrack Valley (see East Central Ubehebe Peak Quadrangle, and corresponding West Central Marble Canyon Quadrangle, USGS).

The property is partially situated within the boundaries of Death Valley National Monument. Hence, the boundary line of the monument lies within the property. From the above description, it will be noted that within the area there is an intersection of the East-West line of the monument with a North-South line, the latter terminating in an irregular line following the ridge of the mountains. It is part of this North-South boundary and the western extremity of the irregular boundary which lies within the property. Although the area has not been surveyed, it is believed that the southeast corner of Section 20, T15S, R41E, lies just a few feet south of the southern terminus of the North-South boundary or where the East-West irregular boundary starts. This is slightly to the northeast of Hill, Elevation 6653.

Apparently at the time the Buchholtz report (Item 1) was prepared, the surveyed portions of the Ubehebe Peak and Marble Canyon Quadrangles were projected into the area of the claims. There are twenty-four claims called the "J. O. Croup". It is believed that the locations of the claims shown in the Buchholtz report are in error and possibly these should have been located further south. However, the description of the boundaries of the property has not yet been established by land survey. Those who have dealt with this question have apparently oriented the claims on existing maps by attempting to place the map positions of the corners of the claims as staked in the field in the proper relationship to land marks such as the various peaks in the vicinity. Apparently this has been done with some compass bearings but there has been no land survey which would thoroughly establish the boundaries of the property in question and its location on the map, nor have the boundaries been staked on the ground by land survey of a registered surveyor.

Since the location of this property with respect to highways, towns, railroads, etc., is quite important in the economics, the following information is given and is related to the crude map (Exhibit 1) attached hereto. This map is a portion of the Inyo County Map, compiled and distributed by Harry Freese.

Although the distance from Lone Pine to the property is 33 miles airline, it is necessary to travel approximately 63.5 miles by automobile road to reach the mine at the present time. Apparently

COPY

this distance will not be shortened very much by any practical roads that could be built through the mountains for a project of this magnitude.

The following table of distances between points will be useful in studying the following discussion.

	Miles*
Los Angeles to Lone Pine.	211
Los Angeles to Olancha (Railhead).	188
Lone Pine to Keeler (Cyprus Mill).	13
Olancha (Railhead) to Keeler (Cyprus Mill).	18
Olancha (Railhead) to Interstate 190. . . .	15
Keeler (Cyprus Mill) to Interstate 190. . .	3
Lone Pine to Intersection with Saline Valley Road via Hwy. 136-190	36.2
Keeler to Intersection of Saline Valley Road via 190	22
Intersection of Hwy. 190 to turnoff to mine road	22.9
Hwy. 190 to end of blacktop road.	8.6
Gravel road from end of blacktop road to mine turnoff	14.3
Turnoff to center of claim area	5.5
Mine to Keeler (Cyprus Mill).	50.4
Mine to Lone Pine	63.4
Mine to Olancha (Railhead).	62.4
Keeler to Black Calcite claims.	35.4**
Black Calcite claims to mine.	15 **

*All mileage taken from speedometer on one trip, one way, hence should be checked for future use.

**Estimated.

Besides the "J. O. Group" there are two other claims located about 15 miles south of the mine directly on the Saline Valley Road. That portion of the road which bisects the claims is part of the blacktop road from Highway 190 to Saline Valley. These are known as lode claims No. 1 and No. 2, the road running through No. 2 claim at an approximate distance from Keeler of 35.4 miles. The material in these claims is a black calcite ranging from fine grained to coarsely crystalline but always dark in color ranging to dense black. It is understood that these claims are a part of the property which would be included in the areas of operation of a joint venture.

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GEOLOGY

No extensive discussion of the geology is warranted here except to explain the general geologic background for the existence of the wollastonite deposit and its associated minerals such as limestone, calcite, garnet, and the copper minerals, all of which have some possible use as industrial minerals. In the area of the "J. O. Group" Permian limestone and dolomites have been intruded by much younger quartz monozonite. The contact between the igneous rock and the limestone is very extensive and has produced a considerable thickness of contact rocks among which one finds the wollastonite, garnet and other minerals. The mineralization which deposited the heavy metal bearing minerals such as copper probably occurred on this same contact during the circulation of hydrothermal waters.

Black calcite found on the claims 15 miles south of the mine has not been correlated definitely with that which appears at the mine but it is probably also of considerable age being Permian or older. In the limited investigation which was made in this area, no contacts or mineralization was noted although some additional could be present on or near the claims. This rock consists almost exclusively of black limestone which would perhaps have some usefulness as a commercial product. Possible uses for this rock will be discussed later.

POTENTIAL COMMERCIAL MINERALS

The commercial feasibility of this project must be predicated first upon the production of wollastonite by itself since it is quite probable that this would be the only mineral in the area which would be amenable to a high rate of production to establish a commercial enterprise of sizeable income.

However, another associated mineral, namely garnet, which occurs in considerable amounts ajacent to the wollastonite, might also be the source of a commercial product such as material for abrasives and sand blasting sand.

Among the other known non-metallics are limestone and dolomite which, if the property was being operated for other things, might be utilized to make limestone products. In fact, some of the calcite which is included with the wollastonite, and would of necessity be sorted out, might be utilized for such products.

Quartzite, which would also be sorted from the wollastonite, might lend itself to making a silica product.

Along the contact considerable evidence was seen of rather high-grade copper mineral outcrops which have been sampled from time to time in the past, the results of which will be reported below. Although these copper bearing areas are not included within that portion of the rock which would be mined for wollastonite, they are immediately adjacent and might be opened up at the same time as mining would proceed for wollastonite. If they prove to be sufficiently extensive, copper ore might be a by-product of this mining operation.

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Wollastonite

The wollastonite in this area occurs extensively in the contact zone between the igneous rocks and the limestones. It can clearly be identified in the weathered surfaces of the rocks exposed in the hills where the claims have been located. It is interspersed with white calcite; dark calcite, sometimes almost black; blue calcite occurs which has an amazing resemblance to that found at Crestmore. Quartzite, which is difficult to separate visually from some of the wollastonite, also occurs dissimulated throughout the contact zone. Both the calcite and quartzite cannot be described as being "bedded" since there are no continuous beds of these minerals. However, they do occur in extensive stringers which seem to parallel the strike of the contact.

One relatively large area has been blasted to secure samples, 100 tons of which were ground at the Macco Drilling Mud Mill at Rosemond near Mojave. This ground material was used as samples to the trade. It was found that in milling, some of the material was contaminated which spoiled the color, and iron content, but it is claimed that otherwise the samples were acceptable and that favorable reports were received from potential users.

It is obvious that the wollastonite would have to be hand sorted from its associated calcite and quartzite which is considered to be an undesirable but entirely feasible operation. Probably this could be done by having the primary crusher at the mine, discharging the output over a sorting belt where hand sorters would inspect it and cast out calcite and quartzite permitting the high grade wollastonite to go to loading bins for trucks. If the other two products were to be recovered, they could also go to other loading bins.

Most of the wollastonite seen in this blast area, as well as a smaller one and that inspected in the surface outcrops, was of a fine grain texture which is highly desirable in the industry where it is used. There is another type of wollastonite which has a crystal structure which gives it a fibrous texture somewhat like asbestos. For some uses this is undesirable. In any case, wollastonite is a tough, hard grinding mineral. The more granular types seem to grind easier and to give better products.

From the data inspected, the wollastonite when freed from the calcite and quartzite yields a product which closely resembles pure wollastonite as far as chemical analysis is concerned. It is very low in iron.

Eighteen drill holes were located in the area between the two blasts mentioned above. These were run to depths varying anywhere from six feet to fifty feet. Unfortunately only one sample was taken for each hole which was an average of the entire hole. Therefore, it is impossible to ascertain the quality of wollastonite which might have been penetrated. If the samples had been broken down into short sections, one could have at least isolated the wollastonite from the other material and determined its proportion in the vicinity of the hole. The data which are now available will only provide an approximate approach to this answer by estimating the calcite present from the loss on ignition, subtracting this amount of calcium from the total and calculating the excess silica which would then be attributed to quartzite. The balance would be assumed to be wollastonite. This is a very unsatisfactory approach to the answer but would be about the only way the existing data could be used. Actually it is considered that this drill hole data should be regarded as interesting but not very useful. Some of it does indicate a rather large amount of high grade wollastonite, ranging from 60% to 85% in the various holes.

As far as reserves are concerned, the writer did not have time in the field to make much of an estimate of the mineable reserves. Buchholtz had previously estimated probable tonnage of reserves of 25 million tons. He also estimated "possible ore" as 189 million tons. It is believed by the writer that this latter figure is probably too high by quite an amount and that possibly the probable tonnage figure is also high. However, it is thought that there is a good chance that 15-20 million tons of wollastonite could be secured from this property. This would represent many years of reserves for any size of operation which could be contemplated at the present time. For example, it has been stated that the market potential in the United States for a second operator would be about one-half to three-quarters of

COPY

a million tons. This means that reserves for 20 to 40 years of operation for such production can possibly be present in this deposit. However, it is to be borne in mind that this will be a manual selection process and the actual reserves will be dependent upon the proportion of wollastonite in the total mass of the contact zone.

Extensive field work, mapping and further drilling might easily expand this conservative figure to several times the value given above but it would seem that for any operation which can be foreseen at the present time, there would be ample reserves to maintain a plant for a very long period of profitable operation insofar as quantity is concerned.

It is to be noted that this wollastonite, assuming a satisfactory degree of hand selection, produces a highly desirable product which has good texture and is low in iron content without need for any beneficiation other than the hand sorting.

At the present time the only extensive producer of wollastonite in the country is White Pigment Division, Godfrey Carbon, Inc., which has mining operations in Willsboro, New York. (Exhibit 2) This producer furnishes wollastonite for the trade as noted below from a deposit which apparently requires more beneficiation of the product which even then is not as low in iron content as the present material seems to indicate. Also the Willsboro deposit is not anywhere near as large as the Inyo County deposit although the writer has not investigated this comparison extensively.

COPY

Garnet

Another one of the contact minerals which outcrops in quantity in the area is garnet. This very hard material tends to form some of the most prominent cliffs and peaks in the area. No extensive inspection was made to try and determine the extent of the reserves. It is obvious that considerable quantities of this material are available in the same general area as the wollastonite. However, it would probably have to be mined separately which could mean operating two different pits.

This kind of material is highly desirable as a sand blasting agent which commands rather high prices when it can be processed into a high grade product. Usually the product is judged by its ability to be reused without breaking down and specification tests have been devised for measuring this property quantitatively. For some of the better grades of garnet, prices ranging from $60 to $100 per ton are not uncommon. A large

amount of garnet now used in Southern California comes from Idaho so there would be a considerable freight advantage in competing with this material. Very little abrasive grade garnet is produced in California at the present time. In fact, very little testing has been done on the abrasive qualities of this material although it occurs in many places throughout the state.

The present deposit has a garnet which is obviously mixed with some other materials, e.g. diopside, which are not useful as abrasives and which would, of necessity, be removed by beneficiation.

It is believed that the garnet occuring on this property could well be investigated as a potential product to supplement the income from the wollastonite.

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Limestone, Dolomite and Calcite

Associated with the wollastonite is some black, blue and white types of calcite. This would be sorted from the wollastonite before it left the mine. It is conceivable that these materials could be converted into limestone products, e.g. decorative gravel which can be sold at prices which would warrant its production and shipment to the Los Angeles and other areas.

There is also the possibility of deliberately mining limestone and dolomite in the area for limestone products.

The black calcite on the claim south of the mine was once investigated for its possible use as a black marble which would have golden streaks through it. In the areas which were investigated, it appeared that no large blocks of marble could be secured although certainly smaller pieces could be mined which would be quite useful for ornamental uses and decorative building stone. This latter use should definitely be investigated.

In recent times many black calcites have been shown to contain substantial amounts of silver. Two samples of the black calcite were submitted to Dr. A. K. Baird, at Pomona College, who made an X-ray investigation, the results of which indicated that silver is not present in significant amounts. This should not preclude the further investigation of other black calcite samples from the area since it is quite probable that there would be concentration of this mineral in some areas whereas others might be completely barren.

Copper and Other Metals

It was noted that in two prospect pits which were investigated, there were indications of rather heavy mineralization by copper bearing compounds. These had previously been noted by the owners and at various times several assays were made which are shown in Exhibit 3. These assays indicate that in some of the samples interesting quantities of gold and silver were also present. In view of the present copper shortage, the possibilities for developing ores of this metal are intriguing. It is to be noted that a value for silver of $1.29 per ounce and copper at $0.36 per pound was assumed in calculating the value of the ore. The market for these two items may be higher at the present time or in the future.

One reason for this preliminary interest is that in the two pits investigated the copper mineralization seemed to be rather heavy although it could not be noted on the surface other than in the pits. Such a rather concentrated amount of copper minerals would indicate that there had, at one time, been a large source of this mineralization in order to deposit the quantities seen in some of these rocks. This source could have already disappeared through erosion. On the other hand, it may still be present at depth. It would, therefore, be important to prospect further for larger bodies of the copper bearing minerals which could also possibly contain gold and silver.

This general area has in the past produced substantial quantities of these minerals and the history of those mines which were active should be investigated. It is to be noted that there are other potential areas on the same type of contacts with respect to mineralogy to the southwest of the "J. O. Group" of claims. Some of these areas may be open to mining claims or, if already staked, might be purchased or leased.

The sources of the samples shown in Exhibit 3 are not known and no attempt was made to correlate these with the present maps or their locations on the ground. It would be recommended in any case that an entirely new sampling program be conducted and that little reliance be placed on those samples listed in Exhibit 3.

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SURVEYS

As has previously been noted, the land surveys for this property are not in satisfactory condition for absolute assurance of the definition of the boundaries as related to the land survey. Hence, in order to insure the validity of the title in any negotiations which might be conducted, additional work should be done. A brief form of title insurance, designated as Guarantee #20982, was issued by Title Insurance and Trust Company to Cartel Chemical Corp., dated June 14, 1965. However, the guarantee was limited to a sum not to exceed $100. The guarantee pertained only to the facts of the filing of the location notices for the twenty-four claims and the affidavits relating to the assessment work done through August 1964. It did not include any examinations or reports pertaining to easements, water rights, defect of title and did not refer to any description of the property which could be regarded as a land survey.

One of the reasons for making a special point of this issue is that the property is in an unsurveyed area of rugged mountainous country where it is difficult to even approximately locate points on the surface because there are no land survey markers, such as section corners, in the near vicinity.

Those who have attempted to map this area have merely projected lines on the maps from the west into the area and have then located the position of the claims by reference to land marks and compass directions.

Before any negotiations concerning this property were to proceed to any degree of finality, survey work, plots and descriptions of the boundaries should be prepared by a registered surveyor, preferably one from the local area, e.g. Lone Pine. At the present time and for most of the experimentary work there is no necessity for this because the corner monuments, discovery points and other information can readily be seen upon the ground.

The only possible conflict of mining claim which has been noted thus far is one which was mentioned in the literature as "Shamrock," a copper, lead, zinc claim said to be located in the year 1945, in Section 21, T15S, R41E. Possibly this claim is a little further north than any of those included in the "J. O. Group".

1½ miles north

ECONOMICS

Due to the brevity of this present investigation, the writer has not made any independent economical study nor has there been any attempt to develop unit costs other than those which were provided by the documents cited above or by Mr. Hawley. As will be suggested below, this is a phase of investigation which should be thoroughly pursued at a later date.

Exhibit 4 is a page from Item 2 which cites prices which presumably pertained to the production of the Willsboro mine of Cabot. Competitive prices are set forth by Mr. Hawley for a "western-mined" production which presumably is the hypothetical one which would be produced from his property.

Assuming the highest value for a fine paint grade of

$40.00 per ton,

which he has set forth, there is a cost differential delivered in Los Angeles of

$35.50 per ton

less than the New York State product. It is not known why the value of

$40.00 per ton

was placed upon the western product. Presumably a higher price could be secured if such a delivered cost differential really exists.

On the cheaper product the differential of

$29.50 per ton

is shown. Here again it would seem that with such a differential, a higher price could be secured especially at the beginning of marketing.

It is believed that the

$4.00 per ton

difference between the values in the column "Comparable Amount Product" and delivered cost are too low. In personal conversation it has been understood that the freight quoted by Southern

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Pacific from the Rosemond Mill of Macco to Los Angeles was

$4.41 per ton,

from Olancha to Rosemond trainload quantities of 10 cars, each 60 tons or a total of 600 tons per train, would be

$2.80 per ton.

This would bring the total freight charge to

$7.21 per ton

which would make the delivered cost of the two grades

$47.21 per ton

and

$41.21 per ton

respectively.

It has been stated that Macco has offered to mill the first 200 tons of product for a charge of

$10.00 per ton

with production runs costing

$8.00 per ton.

At this time it would be difficult to estimate a mining cost and hence no attempt will be made to include such a figure in this report. However, it will be seen that if milling can be done for the cost given above, there will be considerable latitude between the delivered values of

$47.21 per ton

and

$41.21 per ton

respectively, and the milling plus freight of

$15.21 per ton.

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This would indicate an amount equal to

$32.00 per ton

for the paint grade and

$26.00 per ton

for the lower grade to cover mining, transportation from the mine, all other costs and profit.

It would seem reasonable that a profitable operation could be carried out under these conditions. One set of figures, which is of some interest as an approximation of costs, was shown in Item 6 and is presented here as Exhibit 5, where factory costs which presumably include all costs are shown to range between

$22.39 per ton

and

$27.45 per ton.

This would include the milling costs shown above.

However, it is very obvious that this project must be studied thoroughly from the standpoint of economics before any final decision is made concerning its profitability.

Considerable attention has been given by the present owner to the prospect of processing the wollastonite at Keeler, which is a small town near either Olancha or Lone Pine. It is said that there is a grinding mill there owned now by Cyprus Mines which is being used for milling talc. This talc is secured from a mine which is in the same vicinity but several miles further on a road having very much worse grades on it than has the wollastonite location. It is reported that this mill, which contains a four-roll Raymond mill of undetermined size which is said to be capable of producing

4 to 5 tons per hour,

can be purchased at a cost of

$75,000.00.

Another figure which has been given is that it would cost

$25,000.00

to install a second crusher and magnetic separators.

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A very large amount of information is available in addition to that which is given above. I presume that you and others will want to discuss this at a future time. I will be very pleased to meet with you for this purpose whenever you desire.

Sincerely,

Ira C. Bechtold

Ira C. Bechtold

ICB:cel
Attachments

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TABLE 3. - Summary of heats of formation

Heats of formation or transition	Nepheline $Na_{0.7794}K_{0.2206}AlSiO_4$	Wollastonite $CaSiO_3$
$\Delta H_{298.15}$, (from elements), kcal/mole.....	-501.0 ± 0.5	-
$\Delta H_{298.15}$, (from oxides), kcal/mole.....	-34.8 ± 0.6	-
$\Delta H_{298.15}$, (gl to c), kcal/mole.....	-9.0 ± 0.3	-8.1 ± 0.2

Although, as mentioned in the introduction, there are no previous data in the literature corresponding to the data given above, some indirect comparisons can be made. Kelley,[16] in his compilation of data for anhydrous silicates, reported $\Delta H_{298.15}$ = -8.5 kcal/mole as the heat of the glass-crystal transformation of sodium metasilicate. This seems to indicate a rather constant order of magnitude for the heat of this transformation for compounds containing one mole of silica.

In this compilation, Kelley also adjusted the values obtained by Kracek[17] to derive the heat of formation of sodium-nepheline ($NaAlSiO_4$) from the oxides as $\Delta H_{298.15}$ = -30.9 ckal/mole. Converting this value to the more directly comparable heat of formation from the elements, there is obtained $\Delta H_{298.15}$ = -498.6 kcal/mole, which is in fair agreement with the value given above for the potassium-containing nepheline.

[16] Kelley, K. K. Heats and Free Energies of Formation of Anhydrous Silicates. BuMines Rept. of Inv. 5901, 1962, 32 pp.

[17] Kracek, F. C. Contributions of Thermochemical and X-Ray Data to the Problem of Mineral Stability. Ann. Rept. Director of the Geophysical Laboratory, Geophysical Laboratory Paper 1215, 1953, p. 69.

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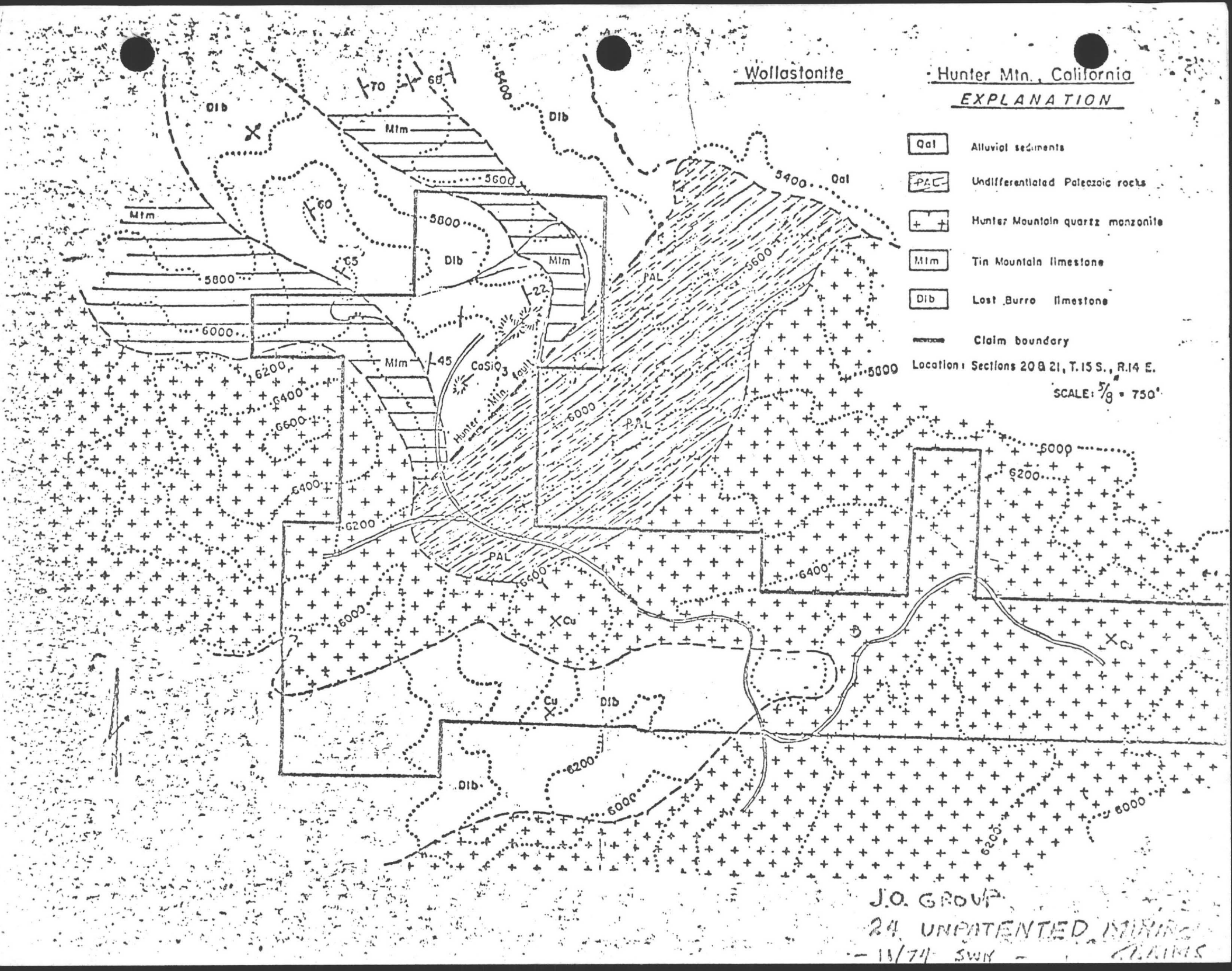
Wollastonite
Hunter Mtn., California
EXPLANATION
Qal Alluvial sediments
PAL Undifferentiated Paleozoic rocks
Hunter Mountain quartz monzonite
Mtm Tin Mountain limestone
Dlb Lost Burro limestone
Claim boundary
Location: Sections 20 & 21, T.15 S., R.14 E.
SCALE: 5/8" = 750'
Hunter Mtn. fault
CaSiO3
Cu
J.O. GROUP
24 UNPATENTED MINING CLAIMS
11/74 SWK