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THE QUARTZ MOUNTAIN SILICA DEPOSIT, OREGON

By  
Len Ramp\*

A large deposit of fairly high-purity silica occurs on Quartz Mountain, about 35 air miles east of Roseburg, Douglas County, Oregon (see accompanying map). Quartz Mountain is a prominent craggy peak 5,530 feet in elevation, on the divide between Little River and South Umpqua River in sec. 2, T. 28 S., R. 1 E. It is reached by a forest access road connecting the South Umpqua River road and the Little River road. There is an abandoned Forest Service lookout station on top of the mountain.

The Quartz Mountain silica deposit is owned by Roy Rannells of Riddle, Oregon, and Gerald Rannells of Aurora, Oregon. About 30 claims were located in 1957 shortly after the Forest Service road into the area was completed. Development work at present consists of access roads, discovery cuts, and a pit in the talus on the northwest slope of the mountain where about 400 tons of silica have been taken out for smelter test at the Hanna Nickel Smelting Company at Riddle, Oregon.

Walter A. Foster, geologist for The Hanna Mining Company, has conducted a sampling and mapping program to determine the quality and quantity of the deposit.

GEOLOGY

Geologic Background:

The Quartz Mountain area lies in the belt of Western Cascades volcanic rocks composed of continental flows and pyroclastics which have been deformed and partially altered.

Most of the upper portion of Quartz Mountain is made up of a tough and massive grayish white cryptocrystalline silica rock which stands in bold relief. Vertical cliffs from 50 to more than 200 feet in height are prominent features on the north and east sides of the mountain. The main body of silica is about 3,000 feet long by 1,200 feet wide and crops out mainly between 4,800 feet and the top of the mountain at 5,530 feet. Silicified rock is also exposed at various places in Quartz Creek, a short distance to the northeast. The area between Quartz Creek and Quartz Mountain is covered by extensive slide debris, much of which is relatively pure silica rock.

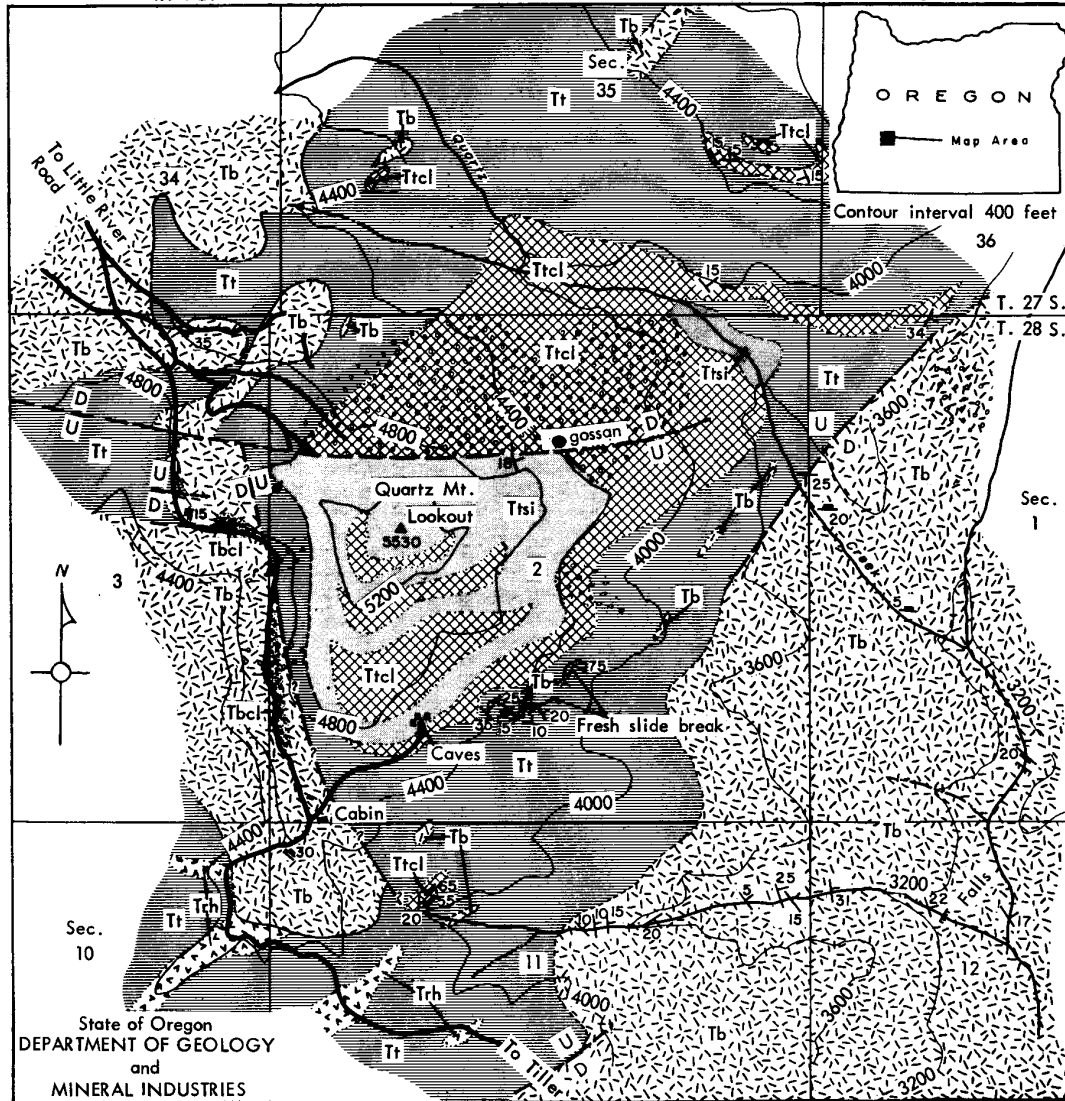
Tuff Series:

The oldest formation is composed of a great thickness of pyroclastic rocks ranging from tuffaceous siltstones to agglomerates and including tuff breccias, lapilli tuffs, fine-grained crystal tuffs, and minor welded tuffs. Near Quartz Mountain the tuffs are mostly light colored and in large part altered to clay minerals and replaced in varying amounts by silica. The relict textures

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R. 1 E.

GEOLOGIC MAP OF QUARTZ MOUNTAIN, DOUGLAS COUNTY, OREGON



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DEPARTMENT OF GEOLOGY  
and  
MINERAL INDUSTRIES



EXPLANATION

**TERTIARY**

Upper Miocene (?)

- Tb (stippled pattern): Basalt flows and dikes, including some agglomerate and andesite
- Tbcl (cross-hatched pattern): Basalt altered to clay

unconformity

Oligocene-Miocene

- Ttcl (diagonal line pattern): Partly silicified tuff in large part altered to clay; cavernous weathering
- Ttsi (white box): Silica rock and silicified tuff, in part with cavernous weathering
- Tt, Trh (horizontal line pattern): Tuff series including fine to coarse sediments, tuff breccia, lapilli tuff, fine-grained crystal tuff, and minor welded tuff, Tt; and rhyolite intrusives, Trh

Silicification and alteration - post Miocene (?)

- Vertical joint symbol: Vertical joint
- Joint showing dip symbol (with 20): Joint showing dip
- Parallel joints symbol (with 30): Parallel joints
- Attitude of bedding or platy flow planes symbol (with 15): Attitude of bedding or platy flow planes
- Small fault showing dip symbol (with 75): Small fault showing dip
- Fault dashed where approximate, showing displacement; question mark where fault probable but uncertain symbol: Fault dashed where approximate, showing displacement; question mark where fault probable but uncertain
- Landslide debris symbol: Landslide debris
- Contact; dashed where approximate, dotted where inferred symbol: Contact; dashed where approximate, dotted where inferred

Scale 0 1/4 1/2 1 Miles

of the silica rock appear to be those of fine-grained crystal tuffs and lapilli tuffs.

Fossil leaves and wood fragments are found in some of the fine-grained tuffaceous lacustrine sediments in the tuff series. A collection of leaves was made from an outcrop of these sediments 4 miles south of the map area in the SW $\frac{1}{4}$  sec. 26, T. 28 S., R. 1 E. This collection, which contains Engelhardtia (fruits), Platanus, and possibly Salix, Alnus, and Alangium, has been tentatively identified as an Oligocene-Miocene flora. Other Oligocene-Miocene floras in the Western Cascades include the Rujada flora from Layng Creek in T. 21 S., R. 1 E. (Lakhanpal, 1958) and the Scio flora and other fossil leaf collections from the Mehama volcanics in the Lebanon quadrangle (Allison and Felts, 1956). Various collections of Oligocene-Miocene plants, identified by R. E. Brown of the U. S. Geological Survey occur in similar tuffaceous rocks mapped as Little Butte volcanic series in the Medford quadrangle (Wells and others, 1956) and in the Western Cascades in general (Peck, 1960).

#### Rhyolite Intrusives:

Rhyolite and dacite porphyry dikes intruding the tuff series are fairly common in the area. A few fairly large siliceous intrusive bodies were observed during reconnaissance mapping along the South Umpqua River. Included in these are a dacite porphyry dike at Deer Lick Falls about five miles southeast of Quartz Mountain and banded rhyolite dikes exposed in the South Umpqua River at Camp Coffee Pot, sec. 17, T. 29 S., R. 1 E., and about 3/4 mile above the South Umpqua Falls. Several rhyolite dikes were observed along the Quartz Mountain road between the South Umpqua River and the map area. Clay alteration and pyrite impregnation in the tuff series appear to be closely related to the rhyolite intrusives.

#### Basalt Flows and Dikes:

Lavas of andesitic to basaltic composition overlie the tuffs unconformably and a few small dikes and sills of similar composition intrude the tuffs. These basic lavas are generally fresh and have textures varying from glassy to porphyritic, occasionally with feldspar phenocrysts so abundant as to appear coarse grained. In places, the lava is bleached and almost completely altered to clay. This is especially evident along the road west of Quartz Mountain. Peck (1960) maps the lavas as part of the Sardine formation of upper Miocene age.

#### Structure:

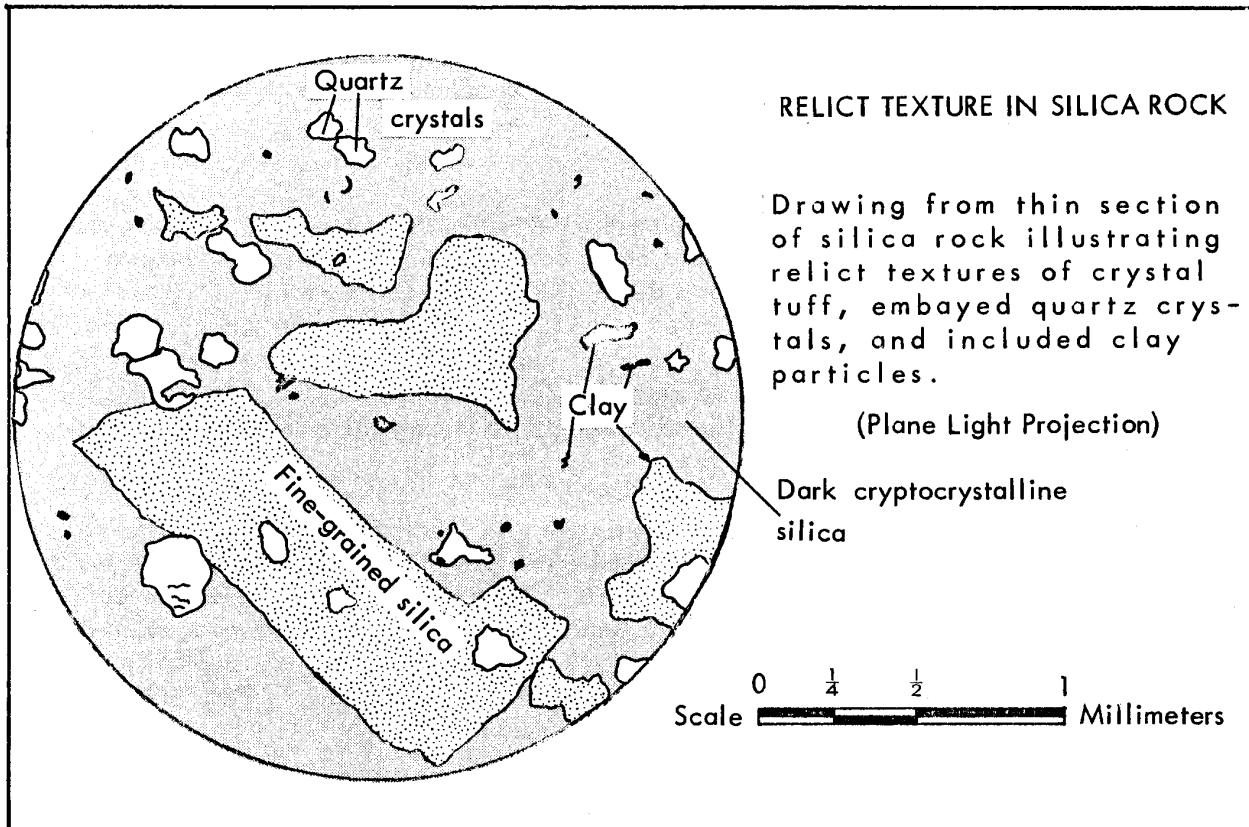
The tuffs and lavas generally strike in a northwesterly direction and dip gently northeast. Wherever attitudes can be seen in the deposit of silica rocks the northwest strike and low dip to the northeast is also apparent. Where the tuff series is better exposed outside the map area along the South Umpqua River, it has a similar strike and dip.

Faults are evident at various places and are probably more numerous than shown on the map. The west-trending fault mapped along the north edge of the main silica deposit is visible where it offsets a basalt flow exposed in the road on the northwest flank of Quartz Mountain. Along this same fault on the northeast flank there is an associated gossan indicating alteration and mineralization. Rocks north of this fault appear to have been downthrown. It is possible that another body of silica lies to the north under the slide debris.

#### Mineralization:

In addition to the widespread silicification, the tuffs and to a lesser extent the basic lavas, are in places completely altered to clay. Areas of intense rock alteration are impregnated throughout with small crystals of pyrite. Surface alteration of these clayey rocks containing abundant disseminated pyrite have in places produced typical gossans. Secondary iron-aluminum sulfate minerals have also formed in caverns and overhanging bluffs in the clayey pyrite-impregnated tuffs.

As shown on the map, the silicified tuffs are interbedded with less silicified layers of altered clayey tuffs. Some of the silicified horizons contain many caverns. Those at Caves Camp site are so large that they were used for living quarters by the mine owners during the exploration period. The cavernous weathering is the result of differential porosity of the silicified tuffs. Porous clayey areas, not completely replaced by silica, absorb water and are thus subjected to more rapid weathering and deterioration by frost action.



#### Origin of the Silica:

Relict textures of tuff in the silica rock are visible both megascopically and in thin section (see accompanying figure). It is apparent that the silica of Quartz Mountain is due to silicification (replacement of the tuffs by silica). The process by which this took place is not completely understood. One of the more feasible explanations is that the action of hot springs, with highly reactive siliceous thermal waters ascending through and migrating laterally in the more porous layers of tuff, caused wholesale replacement by silica. The possibility of the mountain having been a major vent or a concentration of hot springs emerging along faults or fractures may also be considered. It is also possible that the deposit was formerly opalite and that it later altered by diagenesis to chalcedony. Opalites are commonly formed by the action of thermal waters in areas of volcanic activity.

The presence of secondary iron-aluminum sulfate minerals formed by the leaching action of sulfate solutions (derived by alteration of pyrite) on the clays may explain the formation of the silica deposit. The fact that some of the zones of clay alteration containing disseminated pyrite are partly silicified would lend support to such a theory.

## ECONOMICS

### Analysis:

The average grade of the silica rocks has not been established for the overall deposit but the better grade contains from 96 to 99 percent silica. The principal impurities are iron, alumina, and titania. A typical analysis shows: 98 percent  $\text{SiO}_2$ , 1 percent  $\text{Fe}_2\text{O}_3$ , .2 percent  $\text{Al}_2\text{O}_3$ , .3 percent  $\text{TiO}_2$ , .05 percent  $\text{CaO}$ , .005 percent  $\text{P}_2\text{O}_5$ , and a small loss on ignition. The loss on ignition (water) appears to be directly proportional with the alumina content. This is reasonable in light of the small inclusions of clay (kaolinite) seen in thin sections of the silicified rock.

### Uses of Silica:

High purity silica has been applied to many industries. Some of the more important uses are listed below:

#### Metallurgical

Silicon metal, ferrosilicon, and other silicon alloys.  
Flux in smelting basic ores, foundry mold wash and foundry parting sand.

#### Abrasives

Scouring and polishing powders and soaps.  
Sandpaper, whetstones, and sandblast.  
Production of silicon carbide (carborundum).  
Pebbles for ore-grinding mills.

#### Refractory

Silica firebrick and other refractories.

#### Miscellaneous

Road-surfacing aggregate.  
Chicken grit.

#### Chemical

Lining for acid towers.  
Filtering medium.  
Catalytic agent in petroleum refining.  
Cement.  
Manufacture of sodium silicate (water-glass), silicones, and other chemicals.

#### Mineral Fillers

Inert extender in paint, wood filler, fertilizer, insecticides, rubber, phonograph records, linoleum, etc.

#### Ceramics

Pottery, glazes, and enamels.  
Manufacture of glass and fused quartz chemical apparatus.

#### Building

Roofing granules.  
Rubble stone for exterior walls.  
Aggregate for stucco and plaster.

Most users of silica demand a uniform high-purity raw material containing 97 percent or more  $\text{SiO}_2$ . The production of high-purity silicon metal, such as that produced by the National Metallurgical plant in Springfield, Oregon, requires an ultra-pure variety of quartz, 99.7 plus percent  $\text{SiO}_2$ . Most of their quartz is obtained from the Crystal Peak deposit in California, a short distance west of Reno, Nevada.

Objectionable impurities in the production of ferrosilicon metal include calcium, arsenic, phosphorous, and refractory elements such as aluminum, titanium, and magnesium. Physical properties such as toughness and whiteness are also important in certain uses.

### Silica Production in Oregon:

The only producer of high-purity silica in Oregon is the Bristol Silica Company. This

company has operated a quarry and plant near Rogue River, Oregon, since 1938. The Quartz Mountain property, although not in production at the present, represents a vast supply of relatively high-purity silica for use in the future.

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#### AMERICAN MINING CONGRESS RESOLUTIONS

The following resolutions on gold, silver, and monetary policies were adopted at the meeting of the American Mining Congress at Las Vegas, Nevada, in October, 1960:

1. The restrictions on the purchase, ownership and sale of gold by United States citizens be abolished.
2. The Administration recognize the historical and traditional confidence in gold and silver as monetary metals throughout the world, and as part of its foreign policy aid other governments in restoring gold and silver coinage -- and currencies convertible into gold -- as a standard of value and as a circulating medium.
3. Congress fix the ratio at which the dollar and gold are to be made fully convertible and take all steps necessary to provide for the orderly restoration of the gold standard.
4. The Treasury, prior to restoration of full convertibility, cease sales of gold for industrial uses.
5. The Secretary of the Treasury, under the discretionary powers granted him by the Act of July 31, 1946, cease sales of silver at less than the monetary value and retain the Treasury's dwindling supply of free silver for future subsidiary coinage requirements.
6. The Congress act to prevent the wasteful reduction of our silver stocks by immediately monetizing the presently held free silver and declaring inviolate the present monetary stocks, as well as insuring the supply of silver to our country by amending the Act of July 31, 1946, to eliminate the 30 percent seigniorage charge.
7. The tax on silver transactions be repealed and the buying and selling of silver for future delivery be allowed.
8. The Government give immediate recognition to the increased costs of producing gold within the United States by means of an increase in the price paid to domestic producers for newly mined gold.

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## STATE OF THE MINING INDUSTRY - STRATEGIC METALS \*

By  
S. H. Williston\*\*

The strategic metal industry in the United States has reached, or will reach in the next few months, the production levels of 1939. We are again the "have not" nation in strategic metals that we were before World War II.

At one time or another during the last 20 years we have produced up to 100 percent of our annual mercury requirements, up to 50 percent of our antimony requirements, roughly 15 percent of our chrome and manganese requirements, 200 percent of our tungsten requirements, and 50 percent of our cobalt requirements. It cannot be said, in the light of these facts, that we do not have the deposits to mine.

As it so happens, deposits of these strategic metals are relatively abundant in some of the lower labor cost countries in the world. Thus chrome, cobalt, antimony, beryl, columbium, manganese and tungsten come from countries such as Africa, Turkey, Brazil, Bolivia, Red China, and India, where the total wages per day are far less than the cost of the American miner per hour, and the types of deposits are such that the efficiency of labor in these countries is fully equal to the efficiency of the American miner. Thus, in the United States labor costs in strategics range from 500 percent to 5000 percent of foreign labor costs. Further, when, as, and if technical experts or American technical equipment are necessary our own government has been quite willing to assist the foreigner in acquiring that knowledge and machinery.

While many of the manufacturers of finished goods in the United States enjoy tariff rates ranging as high in some cases as 50 percent ad valorem, or even higher, tariffs on the strategic metals are either non-existent, as in the cases of chrome, cobalt and columbium, or extremely low (less than 10 percent) such as the case in respect to antimony, manganese and mercury. Of all of the strategics only tungsten has a tariff in excess of 10 percent, and it is interesting to note that only tungsten is showing a slightly improved production figure at the present time.

These two reasons clearly explain the almost complete elimination of the strategic mining industry. There is, however, a contributing cause which is most difficult to understand, and that is the apparent policy of our government in Washington to permit the complete elimination of this industry so long as the cold war continues. You may recall that at the end of World War II a strategic mineral policy was proposed that we leave our minerals in the ground and procure them from unfriendly foreign nations. That proposal was never officially adopted and the man who made it came to an ignominious and tragic end, yet, at the present time, that policy has been apparently firmly established as the underlying strategic mineral policy of the United States.

Where, except in the strategics, are metals repeatedly taken from the military stockpile without Congressional approval and without published Presidential permission?

Where, except in the strategics, do government agencies use barter for the procurement of their current requirements?

Where, except in strategics, are government agencies' requirements acquired 90 percent from abroad at prices no lower than domestic, and without giving domestic producers an opportunity to bid?

Where, except in the strategics, are government import figures falsified?

Where, except in the strategics, are barter contracts entered into after announcement that our stockpiles are full to overflowing?

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\* Presented at the 1960 Metal Mining and Industrial Minerals Convention and Exposition, American Mining Congress, Las Vegas, Nev., October 10-13, 1960.

\*\*Executive Vice President, Cordero Mining Co., Palo Alto, Calif.

It might be wise for producers of other metals to examine the precedents set by government action in the strategics. They could prove disastrous to other industries beside our own.

The present situation as to the individual strategics is as follows:

#### Antimony:

Domestic production of antimony is limited to by-product metal from Idaho which accounts for about 5 percent of domestic antimony requirements. Antimony in the ore is worth about 13 cents a pound, as the metal, about 26 cents a pound, and the ad valorem tariff is less than 5 percent. Our present supply of antimony comes from Mexico, Red China, South Africa and Bolivia.

#### Cobalt:

The only primary cobalt producer in the United States has closed down. The refining equipment and mining plant machinery has been sold. World cobalt prices have declined materially and even the Canadian cobalt producers announced that they will be unable to continue operations. Although there is some by-product production in the United States, the principal source of cobalt for consumption in the United States is now the Congo and Castro's Cuba. Cobalt is on the free list.

#### Chromite:

Domestic production of chromite is limited to the Mouat Montana operations of American Chrome on a government contract which expires in 1961. Metallurgical investigations, looking toward the production of ferro-chrome, are reported as satisfactory, but the recent decline in imported chrome ore prices must make continued operation considerably less than certain.

Metallurgical grade chrome production on the West Coast and in Alaska ceased in 1958. These chrome mines are no longer on a stand-by basis but are closed and caved. Little of the reserves developed are now available.

Chrome in the ore is worth approximately 3 cents a pound, as ferro-chrome it is worth 30 cents a pound, and as electrolytic chrome metal a little over \$1 a pound. United States' requirements of chrome come from Turkey and the East Coast of Africa. Chrome is on the free list.

#### Columbium:

The only producer of appreciable amounts of columbium, Porter Brothers in Idaho, discontinued mining operations in early 1960. Columbium in the ore is worth less than \$2 a pound but, as the metal, is worth \$50 a pound. United States' requirements of columbium come from Brazil and Africa. Columbium is on the free list.

#### Manganese:

Domestic production of manganese has declined drastically since the termination of the government purchase program. A small amount of battery manganese and special-purpose manganese is being produced in Montana. The Three Kids operation in Nevada is still operating but will not continue beyond the middle of next year. Current United States' requirements of manganese come from Brazil, India and Africa. Manganese in the ore is worth approximately 3 cents a pound and, as electrolytically reduced metal, slightly over 30 cents a pound. Tariff protection is considerably less than 10 percent.

#### Mercury:

As a result of lowered prices mercury production in the United States dropped 20 percent during 1959 and will probably decline another 20 percent in 1960. World-wide production has also declined materially in the last two years for the same reason. Domestic production is able to supply almost half of domestic commercial requirements, the balance coming from Mexico, Italy, and Spain. Tariff protection is less than 10 percent.



Tungsten:

Two primary producers of tungsten, as well as one by-product producer, are in operation, and two additional mines have announced reopening. Since the Bureau of Mines has discontinued production statistics on tungsten, and since the producing picture is subject to change without much notice, accurate estimates are difficult to make. It is, however, rather certain that United States production is in excess of one-fourth our consumption requirements but not as much as one-half our requirements. While the world price of tungsten has improved materially in the last year or so from its extreme low point, domestic costs have continued to rise so that present tungsten prices cannot bring forth much more tungsten production than that now in operation or considering operation. The balance of United States' tungsten requirements comes from Australia, Korea, Brazil, Red China, Bolivia and Africa. Tungsten is the only strategic metal which has an import duty in excess of 10 percent ad valorem.

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MINING NEWS OF SOUTHWESTERN OREGON

Harry Commers of Grants Pass shipped two carloads of copper-bearing vein quartz from the Copper Eagle (Brass Ledge) mine in the Galice district, Josephine County, to the Tacoma Smelter. The shipments were made during October.

The War Eagle Quicksilver mine in Jackson County is being explored by Dave Chase of Medford, Oregon. He has moved his 10-ton Gould type rotary furnace from the Bonita mine to the War Eagle. The lower drift and shaft have been opened and the upper drift extended for about 60 feet to the east. Small amounts of ore are being mill tested.

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SURVEY PUBLISHES RECENT TECHNICAL FINDINGS

A new type of publication has been issued by the U. S. Geological Survey as an experiment to meet public and professional demand for prompt release of important research results. This is Professional Paper 400, "Geological Survey Research 1960", issued in two separately bound chapters, 400-A and 400-B. Chapter 400-A, with 138 pages and four illustrations, presents a synopsis of a wide variety of geologic studies by the Survey's Geologic Division. Chapter 400-B, with 515 pages and 303 illustrations, consists of 232 individually authored papers averaging about 1,000 words in length. Some are scientific notes announcing new discoveries; others are summaries of more comprehensive investigations. Included in Chapter 400-B are the following reports on Oregon geology:

- "Age and correlation of some unnamed volcanic rocks in south-central Oregon,"  
by George W. Walker.
- "Upper Triassic graywackes and associated rocks in the Aldrich Mountains, Oregon,"  
by T. P. Thayer and C. E. Brown.
- "The John Day formation in the Monument quadrangle, Oregon," by Richard V.  
Fisher and Ray E. Wilcox.
- "Cenozoic volcanism in the Oregon Cascades," by Dallas L. Peck.

Copies of Professional Paper 400-A and 400-B are available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at \$1.00 and \$4.25 respectively.

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## OPTIMISM EXPRESSED FOR GOLD MINING

Las Vegas, Nev., October 13 -- "The outlook for the gold and silver mining industries is good," declared Dr. Elgin Groseclose, financial consultant and internationalist of Washington, D. C., speaking at the 1960 Mining Show of the American Mining Congress.

He based his optimism upon an acute and growing shortage of the precious metals and the necessity to stimulate higher production. "Paradoxically", he said, "although 60 percent of the total gold produced since the discovery of America is still in existence, and over 20 percent of the silver, the demand for both far exceeds the supply." He pointed out that while world industrial production is expanding at the rate of 5 percent a year, carrying with it a monetary expansion of 60 percent in the decade, the gold stock to support this money has increased only 14 percent. In the case of silver, he said, new industrial techniques are creating a voracious demand for the metal, and taking annually more than the world produces. Meantime, he added, demand for silver for coinage is also expanding. Dr. Groseclose emphasized: "In the U. S., some 40 million ounces of silver coins are required annually to meet the appetite of juke boxes, parking meters, laundromats, and other vending machines. Abroad, governments are rediscovering that cheap substitutes like copper, aluminum, and dirty paper do not serve the dignity of sovereignty and are turning again to silver for their small coinage."

The shortage of gold arises from the vast increase in money and claims on money, which only gold can ultimately settle, he declared. Citing International Monetary Fund figures, Dr. Groseclose pointed out that in the years 1950-1959, free world money supply increased by 60 percent, and in Continental Europe, where the claims on U. S. gold are the highest, the money supply doubled.

Dr. Groseclose predicted a further devaluation of the dollar unless steps are taken to curb the balance of payments deficit and the gold outflow, which has been going on now since 1949. The decade of the nineteen fifties is the first decade in American history to register a net decline in U. S. gold holdings. This decline, which has taken 20 percent of the gold stock, he stated, occurs at a time of extraordinary domestic expansion, itself requiring increased supplies of money.

The cause of the gold outflow is the adverse balance of payments, which began coincidental with the foreign aid program, Groseclose said. He pointed out "The cumulative adverse balance for the decade is around \$18 billion. In addition to loss of \$5 billion in gold, foreigners have added to their dollar holdings some \$13 billion, which represents an added potential threat to the gold supply."

Dr. Groseclose urged, as to silver, a cessation of Treasury sales to industry, and the maintenance of substantial stocks of silver as a prime strategic reserve. As to gold, he pointed out that as the world monetary and credit structure depends upon a stable dollar, foreign expenditures of the government should be curtailed until the gold reserves of this country are replenished. He expressed the conviction that a stable dollar is more important to the world than foreign aid, and that a stable dollar can be maintained only through a hundred percent reserve. Meantime, as a measure of protection, he recommended suspension of international convertibility of the dollar and the establishment of a free gold market to determine the proper value at which the dollar should be exchanged. (From American Mining Congress Press Release, October 13, 1960).

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## EARLY CRETACEOUS AMMONITES DESCRIBED

The U. S. Geological Survey has just issued Professional Paper 334-F, "Ammonites of Early Cretaceous Age (Valanginian and Hauterivian) from the Pacific Coast States", by Ralph W. Imlay. The publication is for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. The price is \$1.25, paperbound. The report describes 26 genera and 65 species of ammonites from Washington, Oregon, and California, gives localities, and makes correlations. It supplements the earlier study by Imlay (Prof. Paper 314-G, 1959) on the pelecypod *Buchia* (formerly *Aucella*) in the interpretation of the Jurassic-Cretaceous boundary on the Pacific Coast.

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