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Arizona Bureau of Mines - University of Arizona, 1950, Fluorspar in Arizona: Paper presented at meeting of Industrial Minerals Division, AIME in El Paso, TX, Oct. 14, 1950, AZ Bur. Mines Circular 15 (mimeograph), 13 p.

P. 9-10

WHETSTONE DISTRICT

The Lone Star mine is at the eastern base of the Whetstone Mountains, 11 miles by road from Curtiss siding. This deposit remained undiscovered until 1946. It was mined by Cooper Shapley, Jr. until early 1950 and later by Pepperdine Foundation (reported to be held by Arizona Eastern Fluorspar Co. in Nov. 1952). Shipments have amounted to approximately 5,400 tons, valued at more than $100,000; thus the mine already ranks as the largest single producer of fluorspar in Arizona. The mine-run spar averaged 85 per cent in effective calcium fluoride content, with only 0.02 per cent silica in the coarse and 2.7 per cent silica in the fines. It has been shipped, after screening, to Pittsburgh, Chicago and Fontana.

The vein occurs in pre-Cambrian schist, overlain on the west by Paleozoic sedimentary beds and intruded 1/4 mile north of the mine by a stock of muscovite granite. One-half mile east of the mine, a northward-trending fault with vertical displacement of more than 3,000 ft brings limestone against the schist.

The fissure containing the vein appears to be of shear type. It has an average strike of approximately noth 30 degrees west, but with numerous sharp bends, and shows evidence of horizontal as well as vertical displacement.

Spar shoots in the vein average 2 1/2 ft wide and range up to 25 ft long by 30 ft high. Exceptionally they attain widths of 10 or 12 ft. The spar is mainly coarse grained, banded and greenis Dense vuggy quartz occurs chiefly along the walls. On the south the spar terminates at a complex fault, beyond which the veins is largely quartz.

In 1949, an inclined shaft 154 ft deep, connected with the workings. Water, encountered at 125 ft, amounted to 2,500 gallons per day.

The shaft was being deepened in 1949 and a washing plant to turn out ceramic spar has been contemplated.

Cochise

WHETSTONE ROADLESS AREA, ARIZONA

By CHESTER T. WRUCKE,[1] U.S. GEOLOGICAL SURVEY, and

ROBERT A. MCCOLLY, U.S. BUREAU OF MINES

SUMMARY

A mineral survey conducted by the USGS and the USBM in 1981 has shown that areas in and adjacent to the Whetstone Roadless Area have a substantiated resource potential for copper, lead, gold, silver, and quartz, and a probable mineral-resource potential for copper, silver, lead, gold, molybdenum, tungsten, uranium, and gypsum. Copper and silver occur in a small vein deposit in the southwestern part of the roadless area. Copper, lead, silver, gold, and molybdenum are known in veins associated with a porphyry copper deposit in a reentrant near the southern border of the roadless area. Vein deposits of tungsten and uranium are possible in the northeast part of the roadless area near areas of known production of these commodities. Demonstrated resources of quartz for smelter flux extend into the roadless area from the Ricketts mine. Areas of probable potential for gypsum resources also occur within the roadless area. No potential for fossil fuel resources was identified in the study.

CHARACTER AND SETTING

The Whetstone Roadless Area comprises about 57 sq mi in the Basin and Range province of southeastern Arizona, about 40 mi southeast of Tucson and 25 mi north of the border with Mexico. The principal physiographic feature of the roadless area is a prominent north-northeast-trending ridge about 9 mi long that forms the crest of the Whetstone Mountains and culminates in several peaks about 7100 to 7700 ft in altitude, no one of which stands out significantly compared to the others. Some lower slopes and many of the higher areas in the mountains expose well-defined layered rock sequences, a few of which, especially near the ridge crest, form bold exposures many hundreds of feet in length, giving an impression of bedrock structure of marked simplicity and continuity. This is the general appearance of the range from the vicinity of Benson, the nearest town, which is situated about 6 mi northeast of the roadless area.

Bedrock in the roadless area and surrounding parts of the Whetstone Mountains consists of Proterozoic igneous and metamorphic rocks and an overlying stratigraphic succession of Paleozoic and Mesozoic strata. The Paleozoic and Mesozoic rocks have been intruded by Mesozoic granitic masses. Published geologic maps of the area are by Creasey (1967) and Hayes and Raup (1968).

The oldest rocks in the area are muscovite-biotite-quartz schist of Early Proterozoic age and quartz monzonite and alaskite of Middle Proterozoic age. The metamorphic rocks formed from shales and silty shales that were regionally metamorphosed near the end of the Early Proterozoic Era and intruded by quartz monzonite about 1400–1450 million years ago. Alaskite that also intruded the schist may be genetically related to the quartz monzonite.

Resting unconformably on the Proterozoic rocks are sedimentary deposits that range in age from Cambrian to Permian. Middle Cambrian sandstone and quartzite recorded the beginning of Paleozoic sedimentation in southeastern Arizona, and represent deposition by advancing seas that beveled the Proterozoic basement. The overlying limestones and dolomites were deposited from the Late Cambrian into the Late Pennsylvanian in an open marine environment, whereas carbonate strata of Late Pennsylvanian to Late Permian age originated under tidal, supratidal, and marine conditions. Gypsum beds of Late Permian age record a supratidal environment. The Paleozoic rocks aggregate about 8000 ft in thickness.

[1]With contributions from David C. Scott, USBM, and R. Scott Werschky, Viki Bankey, M. Dean Kleinkopf, Mortimer H. Staatz, and Augustus K. Armstrong, USGS.

Sandstone, shale, limestone, and conglomerate of Late Cretaceous age were deposited on an unconformity of great local relief that had been carved into the Paleozoic rocks. Deposition of the Mesozoic strata was marine and nonmarine in a prograding delta near the margin of a shallow sea that advanced northwestward into southeastern Arizona from Mexico. The Cretaceous stratified succession is about 8800 ft thick.

The youngest Mesozoic rocks in the roadless area are granodiorite in sills and a small stock, and intrusive rhyodacite in irregular sill-like masses. These bodies were emplaced into the Paleozoic and Mesozoic strata about 74 million years ago. They are the youngest rocks in the Whetstone Mountains, other than a Tertiary(?) dike near the south end of the range, and Cenozoic gravels that crop out mainly around the base of the mountains.

The principal structural feature of the Whetstone Mountains is a southwest-dipping homocline of Paleozoic and Mesozoic strata. Steep faults and thrust faults in these rocks generally have displacements of a few hundred feet or less and do not significantly disturb the homoclinal pattern of the strata. The homocline and faults probably represent deformation mainly during the Laramide orogeny of Late Cretaceous and Early Tertiary age. Additional deformation probably occurred during Basin and Range faulting in the Neogene.

MINERAL RESOURCES

The Whetstone Roadless Area has a substantiated resource potential for copper, gold, silver, and quartz and a probable resource potential for lead, copper, silver, gold, molybdenum, tungsten, uranium, and gypsum. Fluorite and mercury occur in or near the area but no resource potential was identified (Wrucke and others, 1983; McColly and Scott, 1982). Mining activity in the Whetstone Mountains dates from the 1870s, but no mines have yielded ore since the 1960's.

Copper ore containing minor amounts of silver was mined from a vein deposit in quartz-rich sandstone at the Copper Plate mine in the 1950's, and the mine contains demonstrated resources of 2000–4000 tons of low-grade copper and occurs in an area of substantiated mineral-resource potential.

Copper also is known in Mine Canyon just outside the roadless area. The copper occurs in a porphyry-type deposit in granodiorite and in vein and replacement sulfide deposits in granodiorite and skarn at nearby mines. The area of the porphyry deposit as well as the vein deposits has substantiated mineral-resource potential, based on demonstrated resources of 32 million tons of 0.28 percent copper and 0.01 percent molybdenum (DeRuyter, 1957). Records dating from 1918 show that mines in the vein deposits have produced at 136,048 lbs of copper, 900,000 lbs of lead, and amounts of silver and gold. A probable mineral-res potential for copper, lead, silver, gold, and molybd exists around the area of substantiated resource p tial. This determination is based on the assumption copper mineralization extends beyond the area exp by drilling and mining, and on geophysical evid that the granodiorite widens at depth.

Quartz was produced for smelter flux during 1950's from the Ricketts mine, located outside roadless area, north of Middle Canyon. Demonstr resources of 5000–6000 tons for each vertical fo quartz exist in that part of the quartz body that ext for a distance of 800 ft westward into the roadless and is shown on the map as an area of substanti quartz resource potential.

Tungsten has been mined sporadically since a 1900 from an area 1 mi north of Middle Canyon. Mo the production was from veins at the Chadwick r outside the roadless area, although the James r within the roadless area has recorded production. A the ore-grade deposits were exhausted prior to 1 and there is little promise of additional deposits near surface. A probable resource potential for tungste this area is based on the possibility that tungsten v occur at depth.

High-grade fluorspar has been produced at the L Star mine, on the north side of Middle Cany Although the mine is about 1000 ft outside the road area the fluorite vein system might extend into roadless area at depth. The mine is believed to h been the largest single producer of fluorspar in Arizo Although the workings are now inaccessible, a proba mineral-resource potential for fluorite is assigned to t area.

Uranium deposits occur in veins in Proterozoic qua monzonite and alaskite on the northeastern flank of t Whetstone Mountains. High scintillometer readin chemical values for uranium, and the production uranium at the Old Windmill No. 1 mine in Cottonwo Canyon indicate that additional resources exist at t mine. Demonstrated resources of 47 tons of uraniu bearing rock containing as much as 0.094 perce uranium occur at the Star No. 1 (Bluestone) prosp north of Middle Canyon. However, the concentration uranium in the mine areas and elsewhere is spotty. T northern part of the Whetstone Mountains has a pro able resource potential for uranium.

Gypsum occurs in Permian sedimentary rocks ne the south end of the Whetstone Mountains, outside t roadless area, and these same Permian rocks occ within the roadless area, indicating a probable resour potential for gypsum.

A gold deposit at the Gold Crystal prospect in Midd

Canyon outside, but within a few hundred feet of the roadless area has about 3000 tons of demonstrated low-grade gold resources to a depth of 100 ft, and a small area of substantiated resource potential extends into the roadless area.

Mercury (as cinnabar) was found in heavy-mineral concentrates during sampling in the vicinity of Middle Canyon and Montosa Canyon. The mercury shows no clear relationship to any of the known mineral resources in the area. No mercury resource potential was identified.

Most of the known mineral deposits in the Whetstone Mountains were formed by hydrothermal processes that can be related to igneous events. The copper deposits in the southern and western parts of the mountains are best developed in and adjacent to Cretaceous granodiorite, leaving little doubt of a genetic tie between these deposits and the Cretaceous intrusive rocks. A genetic relationship between the uranium, tungsten, and fluorite veins and the Proterozoic quartz monzonite and alaskite is suggested by the close spatial association of the mineral deposits to these igneous rocks. Moreover, the trace-element suite uranium, fluorine, tungsten, beryllium, niobium, and yttrium is in both the host igneous rocks and the vein deposits. This relationship is consistent with a model for mineralization in which the uranium, tungsten, and beryllium were carried in solution as fluoride complexes during a late phase of the igneous event. The quartz body located between the quartz monzonite and alaskite probably is of Proterozoic age, whereas the mercury mineralization most likely was Cretaceous or younger.

SUGGESTIONS FOR FURTHER STUDY

The geology of the Whetstone Mountains is known in some detail, but the mineral deposits are understood only in a general way as a result of this investigation. Detailed study of the Proterozoic rocks would lead to a better understanding of the fluorite, tungsten, and uranium mineralization and enhance the possibility for finding additional occurrences of these commodities. Study of the Cretaceous igneous rocks would aid in understanding the copper mineralization. Detailed geochemical sampling and geologic mapping could provide information on the source and setting of the mercury occurrences.

REFERENCES

Creasey, S. C., 1967, Geologic map of the Benson quadrangle, Cochise and Pima Counties, Arizona: U.S. Geological Survey Miscellaneous Investigations Map I-470, scale 1:48,000.

DeRuyter, V. D., 1979, Geology of the Granitic Peak stock area, Whetstone Mountains, Cochise County, Arizona: Tucson, University of Arizona, M.S. thesis, 121 p.

Hayes, P. T., and Raup, R. B., 1968, Geologic map of the Huachuca and Mustang Mountains, southeastern Arizona: U.S. Geological Survey Miscellaneous Investigations Map I-509, scale 1:48,000.

McColly, R. A., and Scott, D. C., 1982, Mineral investigations of the Whetstone Roadless Area, Cochise and Pima Counties, Arizona: U.S. Bureau of Mines Open-File Report MLA 129-82, 22 p.

Wrucke, C. T., McColly, R. A., Scott, D. C., Werschky, R. S., Bankey, Viki, Kleinkopf, D. M., Staatz, M. H., and Armstrong, A. K., in press, Mineral resource potential map of the Whetstone Roadless Area, Cochise and Pima Counties, Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1614-A.

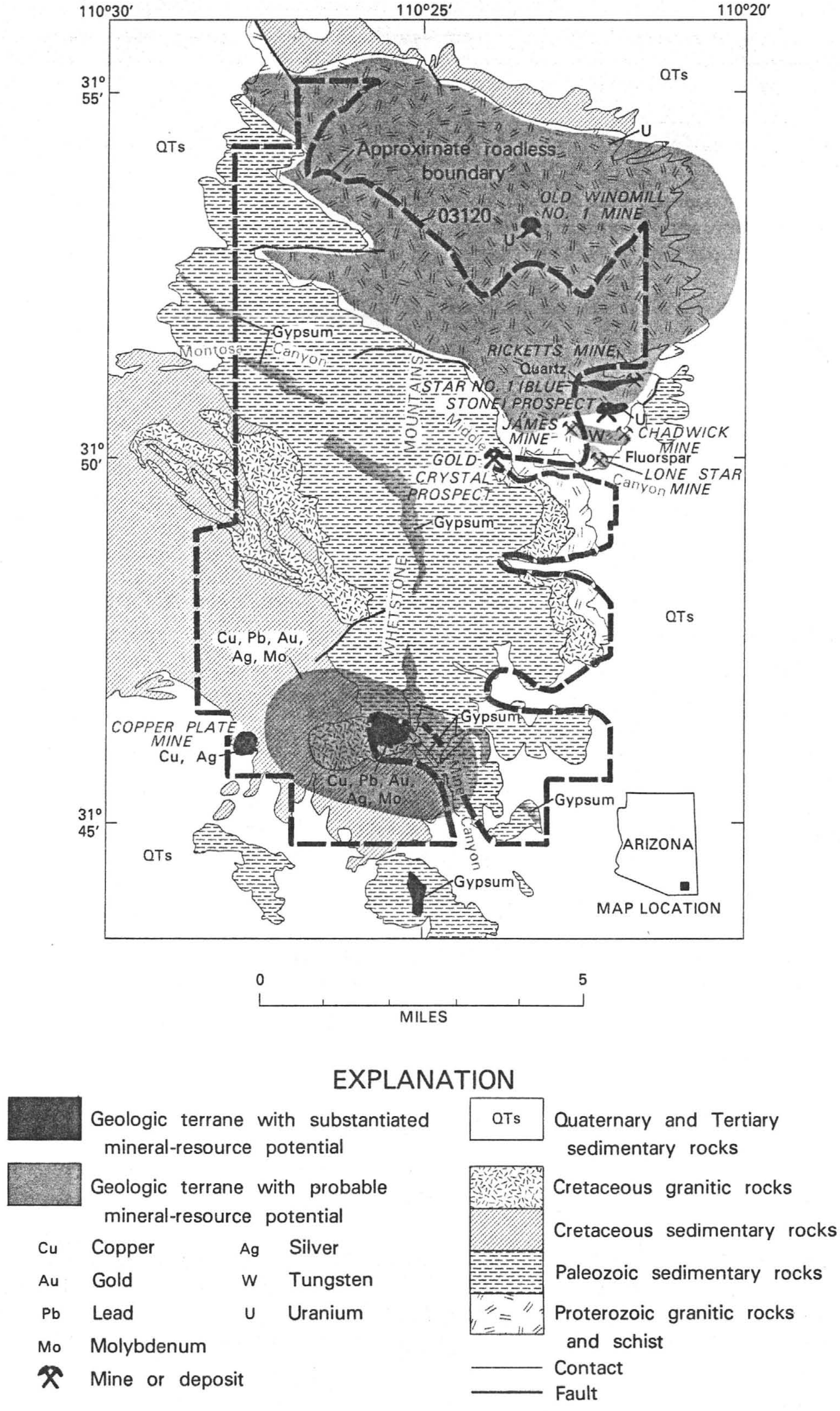

Figure 35.—Whetstone Roadless Area, Arizona.

NOTE ON A WOLFRAMITE DEPOSIT IN THE WHETSTONE MOUNTAINS, ARIZONA.

By Frank L. Hess.

About 12 miles south and a little east of Benson, Cochise County, Ariz., an attempt has been made to mine wolframite from deposits which are, so far as known to the writer, unlike anything heretofore described in the literature of ore deposits. Benson is at the west end of the El Paso and Southwestern System, on the main line of the Southern Pacific Railroad, and is the point from which the Southern Pacific's Sonora branch departs. The Whetstone Mountains, in which the deposits are situated, are one of the many short ranges of the region and lie directly south of the town.

The country has an elevation of 3,576 feet at Benson (Southern Pacific station). It is exceedingly dry and supports a poor growth of mesquite. The yucca gives a grateful touch of green to the landscape, and along the base of the mountains there are a few live oaks in the watercourses. The mountains are rugged and rocky. In the broad San Pedro Valley, with the Whetstone Mountains on the west and the Dragoon Mountains on the east, are irrigated patches of alfalfa, with tall bordering cottonwoods which are peculiarly beautiful in contrast with the bare surroundings. Part of the water for irrigation is obtained from small artesian wells said to be 300 to 400 feet deep.

The tungsten deposits lie on the eastern slope of the Whetstone Mountains between McGrew Spring and French Joe Canyon, half a mile from either place, at both of which water may be obtained. The locality is reached by a very fair road, and aneroid readings give it an elevation of 1,130 feet above Benson, or approximately 4,800 feet above sea level. The property was formerly worked by the Euclid Mining Company, but nothing has been done for a couple of years except to ship a few tons of ore (the entire output) which had been mined some time before.

The deposit is at the base of a steep rise, in granite which is intrusive in a series of metamorphic rocks, including siliceous mica schist and limestone. The wolframite occurs near the contact of the granite and schist and in a tongue of granite 60 or 70 feet long and perhaps half as wide which runs out into the schist. The granite is very light colored and, except in segregations to be described, contains no dark constituents.

Half a dozen prospect holes, the deepest of which is down about 25 feet, have been sunk along a line running N. 55° E. (magnetic) within a distance of 200 yards. These holes either cut or are close to a white quartz vein which gradually dwindles at both ends, but in the middle attains a thickness of 2 feet. The vein has a steep dip to the northwest. At the time visited the holes all contained more or less water.

A little wolframite is found in the quartz vein accompanied by small amounts of mica, pyrite, bornite, and probably chalcopyrite. A more noteworthy quantity of wolframite occurs in segregations in the granite. The mineral is designated wolframite without a chemical analysis, as it is too black and opaque to be hübnerite, and fusion with soda gives the green color characteristic of manganese. Though this color is given by very small amounts of manganese, such as might be contained in ferberite (iron tungstate), the crystals are stumpy and the crystal terminations do not have the beautiful chisel shape of the ferberite of Boulder County. Some of the crystal faces are curved. Owing to their being wholly embedded in quartz, it has been impossible to make measurements of faces. The crystals are comparatively small and do not reach over one-half inch in length or three-sixteenths of an inch in thickness. The wolframite does not appear at many places in the vein. It occurs also in segregations in the granite similar to hornblendic and biotitic segregations in many other granites. The richer exposed deposits have been mined out, but there could not have been any very large ones, as the excavations are all small. The deposits still to be seen are lenticular in shape and are not over 2 feet long by a few inches broad. The breadth of the lenses could not be measured. In these segregations the wolframite varies considerably in the percentage it forms of the mass. In places there are small bunches of which much the larger part is wolframite, but it is said that as mined and hand picked the ore averaged 10 per cent WO_3.

The particles of wolframite in the granite are tabular and reach one-fourth inch in length. They are thin, the thickness probably averaging about one-sixth to one-fourth of the length and the breadth reaching two-thirds of the length. No parallel arrangement is noticeable. No scheelite is visible to the unaided eye, but in thin section the microscope shows a narrow band of a mineral which is probably scheelite bordering a portion of the wolframite. This band is so narrow that it is difficult to determine the matter decisively.

The segregations that have been worked have been close to the quartz vein mentioned, but there are other prospect holes 100 or more feet away, and one small lens of wolframite-bearing granite occurs 200 feet from the vein, up a small gulch. It is said that there is another occurrence on top of the hill above the workings, but the writer did not know of this until after his visit. Efforts were made for several years to work the deposits, and an air concentration plant was put up, but the quantity of ore did not prove to be large enough to pay for working.

ite near the surface is partly altered to iron oxide, which shows the form of the original crystal.

Most of the veins are under 10 inches in width, though some up to 2 feet were noted. The latter, however, are largely quartz. The veins occur both in the dikes and in granite near the dikes, and apparently the association between the wolframite and the intrusive rocks is very close.

Wolframite, however, is not found in all the veins nor in all parts of a single vein. It seems to lie in pockets in the larger quartz veins and to be more concentrated where these pinch. In the smaller veins the deposition of wolframite was apparently more general, as bands about one-eighth of an inch thick are fairly continuous along some of these veins. No large pockets were seen, the largest being about 4 by 3 feet along a 6-inch vein.

At the Reagan property, one-fourth of a mile east of the railroad and 2½ miles south-southeast of Calabasas, there are several open cuts and two shafts on a group of three veins. The country rock is granodiorite, very much altered and weathered. This is cut by two dikes of the dark rock described above, striking N. 75° W. The veins are apparently later than the dikes, which they offset a few feet. These veins all strike N. 25° W. and stand almost vertical. The central one is 30 feet west of the east vein and 60 feet east of the west vein.

The two outside veins are small and well banded and contain minor amounts of wolframite. The "tungsten" ore is usually next the wall rock, and the vein has a central band of comby quartz. The central vein varies from 1 to 2 feet in width and consists largely of quartz in which are pockets and stringers of wolframite. The deposition seems to have been repeated, as the banding from the wall inward is quartz (0.2 inch), wolframite (0.3 inch), quartz (0.25 inch), wolframite (0.1 inch), and quartz. The banding is not at all regular, however, wolframite locally filling the entire space inside of the first quartz bands. Scheelite occurs as minute crystals in the quartz near the bands of wolframite.

A 30-foot shaft at the Reagan property could not be entered, so conditions at that depth could not be studied. The veins as seen, however, to depths of 15 feet showed a slight pinching and rather less wolframite at the bottom. From the few prospects visited no generalization can be attempted as to the probabilities of ore at greater depth.

The deposits as a whole do not seem particularly encouraging. There are a large number of veins, but apparently most of them are nearly or quite barren. In the others wolframite is present in such small quantities and the pockets are so widely scattered as to hardly pay for mining.

SOME CHROMITE DEPOSITS IN WESTERN AND CENTRAL CALIFORNIA.

By E. C. Harder

INTRODUCTION.

Chromite is widely distributed through areas of serpentine and associated basic rocks in various parts of the United States. Such rocks are found at a few localities in the old crystalline region east of the Appalachian Mountains from New England to Georgia, at various points in the Rocky Mountains, throughout the extent of the Sierra Nevada and Coast Range in California, and at a few points in the Cascade Mountains. Chromite, being one of the accessory minerals in serpentine rock, probably occurs in a disseminated condition in all these regions, but its concentration is very local. Deposits are found in Massachusetts, Pennsylvania, Maryland, North Carolina, Wyoming, and California.

Chromite is the only commercial ore of chromium. Theoretically its composition is $FeO.Cr_2O_3$, with 32 per cent of ferrous oxide (FeO) and 68 per cent of chromic oxide (Cr_2O_3). Practically, however, the content of chromic oxide varies down to 10 per cent in the ores, though generally ranging between 40 and 60 per cent, and the ferrous oxide content varies from 10 to 50 per cent. Alumina and magnesia are almost invariably present, and in places they form a considerable proportion of the ore, alumina being present in quantities varying up to 30 per cent and magnesia in quantities varying up to 20 per cent. Ferric oxide is commonly present in small quantities. Alumina and ferric oxide replace chromic oxide and magnesia replaces ferrous oxide.

Chromite deposits are of two kinds—(1) pockets or lenses in serpentine or associated basic rocks, formed during the intrusion and cooling of the original magma by the segregation of chromite particles, and (2) chrome sands along watercourses, formed by the mechanical concentration of chromite particles derived from the weathering of serpentine, in which they occurred as disseminated granules or in pockets and lenses. Nearly all the deposits worked commercially have been of the first type.