CHROMITE IN WYOMING

by

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INTRODUCTION

During the summers of 1934 and 1935 the Geological Survey of Wyoming carried on an investigation of the asbestos and chromite deposits of the state. The writer spent 7 weeks in the field. Most of this time was spent in an investigation of asbestos, the results of which are given elsewhere. The writer wishes to express his thanks to Mr. H. F. Eppson of the Research Chemistry Department of the Agricultural Experiment Station, University of Wyoming, for the chemical analyses of chromite samples given below.

PROPERTIES

Chromite is a black to brown mineral which commonly occurs in octahedrons, has a metallic to submetallic luster and specific gravity around 4.5. The theoretical composition is $FeCr_2O_4$ equivalent to 32% FeO and 68% Cr_2O_3. Chromite containing as high as 68% Cr_2O_3 is seldom found, since chromite is isomorphous with magnetite ($FeO.Fe_2O_3$), picotite ($MgO.Al_2O_3$), and other members of the spinel group.

MODE OF OCCURRENCE

Primary deposits of chromite are invariably found in ultrabasic igneous rocks such as peridotite, picrite, and dunite or in their altered and metamorphosed equivalents. Chromite bodies are commonly in the form of dikes, irregular bodies near the contact of the enclosing mass, or streaks (schlieren) in an ultrabasic intrusive mass. Chromite also occurs in disseminated granular form in ultrabasic igneous rocks, serpentine, and their metamorphosed equivalents.

USES

The largest part of the chromite produced at present is used for preparation of the alloy ferrochrome and for making of chromite fire brick. A smaller amount is used in the paint and chemical industries. Chromite acceptable for preparation of ferrochrome should contain more than 45% of Cr_2O_3 and less than 5% of SiO_2. The phosphorus content must be less than 0.2% and sulfur less than 0.5%. For fire brick use the Cr_2O_3 content can be lower than 45%, but a high iron content is undesirable because of the tendency of iron compounds to fuse at a low temperature. Ore for the paint and chemical trade must be of much the same quality as that for the manufacture of ferrochrome.

DESCRIPTION OF DEPOSITS

Natrona County

Casper Mountain.--The general geology of Casper Mountain is described elsewhere in connection with the description of the asbestos deposits of the area. Enclosed in granite gneisses and metadiabases in the SW¼ sec. 16, SE¼ sec. 17, and NE¼ sec. 21, T. 32 N., R. 79 W., is a lens of chromite-bearing talc schist. The longer axis of the lens extends in the general direction N 60° E and is 2,500 feet long. The maximum width is 350 feet. The foliation of the schist strikes generally parallel to the long axis of the lens and stands vertically or dips

at high angles to the northwest and southeast. The chromite occurs in lenses or beds up to several feet across, with their shortest axes lying normal to foliation, and as fine granular material disseminated through the schist. The writer believes that the chromite deposit was formed as follows:

The talc schist was originally an ultrabasic igneous rock intruded during the period of igneous activity represented by the serpentine masses of the area and was probably a part of the larger mass to the northwest. The chromite was formed by crystallization from the ultrabasic magma in the early stages of consolidation and was concentrated in its present position by sinking of the heavier chromite crystals to the bottom of the magma basin or by diffusion to a cooler lateral margin. During a later pre-Cambrian orogeny the ultrabasic igneous rock was locally metamorphosed to a talc schist and the lens was separated from the larger parent mass by invading granites.

Character of the ore.--The writer did not carry on systematic sampling of the ore. Most of the area is covered by soil and more extensive prospecting would have to be done before any conclusions would be drawn as to tonnage of ore present. A few typical samples were collected and submitted to H. F. Eppson, whose analytical results are given below.

No.	Cr_2O_3%	FeO*%	MgO%	Al_2O_3%	SiO_2%
585	13.7				
585A	26.6	63.0			
588	26.7				
588A	26.6	36.0	4.9	11.0	nil
587	3.6				

585 and 588 are crude ore of the best grade. 585A and 588A were prepared respectively from 585 and 588 by crushing through a 115-mesh screen and treating the fraction caught on a 250-mesh screen with Thoulet solution of specific gravity 3.3. Microscopic examination of the resulting concentrates showed that there was less than 5% of the lighter minerals left. 587 is talc schist containing disseminated chromite.

The following conclusions can be drawn from the analyses:

1. The ore which the writer considered, on the basis of field examination, as the best available contains nearly 50% of gangue minerals. Removal of gangue minerals from 585 and 588 approximately doubled the Cr_2O_3 content.

2. Some of the chromite concentrates contain sufficient Cr_2O_3 for use in the manufacture of ferrochrome. 585A, however, is too low in Cr_2O_3 for this purpose and is extraordinarily high in iron. A large part of this iron is probably in individual grains of the mineral magnetite, since 585A is much more strongly magnetic than 588A. The fact that chromite and magnetite have nearly the same specific gravities would present serious difficulties in a commercial separation of these two minerals by a process depending on specific gravity.

3. The chromite content of some of the talc schist in which disseminated chromite is easily visible with the naked eye is low.

*Ferrous and ferric iron were not determined separately. The total iron was calculated as FeO.

CHROMITE

The occurrence of chromite in the Casper Mountain and Deer Creek areas has been known for some years. The Geological Survey made a detailed field study of the Casper Mountain occurrence in 1934 and 1935. A brief summary of the survey's findings is included herewith. A more detailed report together with maps is in preparation. Available exposures of this occurrence are such that it is impossible to make adequate estimates of the tonnage of various grades of ore. The Geological Survey of Wyoming has recently accepted an offer from the U. S. Geological Survey to assist in further investigations to determine the possible economic value of this deposit. It is anticipated that this work will be carried on next spring and will consist chiefly of trenching operations.

The following description of an occurrence of chromite in the Deer Creek area is taken from the U. S. Geological Mineral Resources for 1918:

"Chromite was discovered on Deer Creek 16 miles southwest of Glenrock, Wyoming, about 1908, and a small quantity of the ore, possibly as much as 700 long tons, has since been mined and shipped. Operations ceased years ago until 1918, when the Ferro Alloy Co., of Denver, obtained control of the property. The chromite occurs in a belt of serpentine about 25 feet wide between granite and hornblende schist. It crops out about midway on the steep slope of Deer Creek canyon, which is nearly 1,000 feet deep. The body of chromite exposed in 1917 showed an irregular thickness of 2 to 5 feet and a more or less continuous length for 150 feet.

"Chrome chlorites occur abundantly, forming veins and lining cavities in the chromite. In composition the chromite ranges from 35 to 44 per cent of chromic oxide with 16 to 20 per cent of iron oxide. Tests of the ore for furnace lining are reported to have shown it too easily fusible for that purpose. The Ferro Alloy Co. uses it in the manufacture of ferrochrome."

Due to the greatly augmented demands of war conditions the mine was operated in 1918, 1919 and 1920, during which time 1,594 tons of ore containing from 35% to 45% chromic oxide having a value of $44,428 were shipped. There has been no production since 1920.

Only 315 tons of a total of 2,321 tons of chromite shipped from mines in the United States in 1937 was ore containing from 35% to 45% chromic oxide. The remainder was ore containing 45% or more of chromic oxide. The chromite imported into the United States in 1937 (553,916 long tons) contained 44.6 chromic oxide. The highest contained 55% and the lowest 32% chromic oxide.

Further information as to the nature and character of the ore and its occurrence in this area will be necessary before any statements can be made as to the possible ore reserves. Information at hand indicates that they are not large. The acquiring of additional information would necessitate trenching or core drilling.