BRUCITE-MAGNESITE DEVELOPMENTS AT GABBS, NEVADA

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The brucite magnesite deposits at Gabbs, Nevada are located in the Mammoth Mining District of Northern Nye County, Nevada, 31 miles north of Luning, Nevada, a station on the Mina branch of the Southern Pacific Railroad, and at the base of the west side of the Paradise Range.

The Mammoth Mining District dates back to 1863[1] when gold was mined at Ellsworth, and in 1908 a small smelter was erected at the Illinois Mine to reduce lead, but this venture did not meet with success. In 1921 a gold strike caused some activity and in December, 1927, brucite was discovered by H. E. Springer. He developed his claims and sold them in 1930[2] to the United States Brucite Corporation who in turn optioned them to the Standard Slag Company and they did some diamond drilling on the property. Later, analysis of diamond drill cores revealed the presence of vast tonnages of magnesite.

At that time no one could see a commercial use of the deposits, primarily because of transportation problems.

The U. S. Geological Survey in cooperation with the Nevada Bureau of Mines mapped most of the deposits during 1931-33. The principal ore bodies are roughly 1 mile long by ½ mile wide with smaller occurrences being found in a belt 4 miles long by about 2 miles wide.

The following are typical analyses of magnesia rocks in this area:

Brucite - Magnesium Hydroxide

$Mg(OH)_2$

Loss	32.4%
MgO	60.1
SiO_2	3.2
Fe_2O_3	.07
Al_2O_3	0.6
CaO	3.0
	100.0%
Specific Gravity	2.34

Magnesite - Magnesium Carbonate

$MgCO_3$

Loss	50.5%
MgO	46.1
SiO_2	1.6
Fe_2O_3	0.4
Al_2O_3	0.1
CaO	1.3
	100.0%
Specific Gravity	2.99

Dolomite

$CaMg(CO_3)_2$

CO_2	45.42%
MgO	21.61
SiO_2	1.54
Fe_2O_3	0.49
Al_2O_3	0.30
CaO	30.55
	99.91%
Specific Gravity	2.89

The reserves of magnesite containing less than 5% lime are estimated to be over 27,000,000 tons. [3]About 6,000,000 tons of ore have been mined to date. Most of this has gone into granular refractory material. Some 1,000,000 tons went to Henderson, Nevada during World War II and was turned into magnesium metal.

Briefly, the geology of the Brucite Magnesite deposits is as follows:

The deposits occur in the upper member of the upper Triassic Luning formation which is divided into three parts consisting of a limestone member, shale member and an upper dolomite member, all of which have been altered in places. The upper dolomite member is further divided into three parts. The magnesite occurs in the light to dark gray portion which weathers to a reddish brown due to iron compounds and is recrystallized and it appears that the magnesite mineralization was accomplished by hydro thermal solutions.

The brucite occurs near the contact of magnesite and altered granodiorite. The brucite as well as the magnesite is cut by many intrusive igneous dikes.

In 1936 Basic Ores, Inc., a subsidiary of Basic Refractories, Inc. of Cleveland, Ohio, H. P. Eells, Jr., President, obtained a long term lease on the U. S. Brucite Corporation holdings at Gabbs, Nevada, and began development of the property under management of N. E. Hanson. Shipments of hand sorted brucite began in 1937 to their plant at Maple Grove, Ohio and continued on a regular basis until 1950.

In early 1941, H. P. Eells, Jr., President of Basic Refractories, Inc., and Major C. J. P. Ball, Managing Director of Magnesium Elektron, Ltd., a British concern, established Basic Magnesium, Inc. (B.M.I.). By November of that year, with 100% government financing by Defense Plant Corporation, erection started of a processing plant at Henderson, Nevada, to produce metallic magnesium from MgO for the war effort. At the same time, a plant was built at Gabbs, Nevada, to produce MgO (Magnesium Oxide) from magnesite.

Power for the Gabbs operation is purchased from the California Electric Power Company. A 65 mile transmission line was built from a substation at Millers, near Tonopah, to Gabbs.

Water for the plant and townsite comes from wells drilled in the valley and range from 215 feet to 625 feet in depth; average depth is 395 feet. The water level is about 57 feet below surface and average drawdown is 60 feet when pumping 325 g.p.m. The water is heavy in minerals, principally calcium, sodium and megnesium sulphates, with some sodium chloride and fluoride; also it is hot. Most of the wells average about 138° F.

As no living facilities were available, the Government agency built a townsite consisting of two apartment houses, sixty 2 and 3 bedroom houses, low cost housing, dormitories and mess hall, complete with all necessary services.

A 2,000 ton per day flotation plant consisting of four ball mills of 525 tons per day capacity each, float cells, conditioners, thickeners, etc. to produce the 800 tons per day of concentrates needed to feed the four Herreshoff furnaces. These furnaces were 22 ft. diameter and had 14 hearths. Each furnace was rated at 100 tons per day of oxide (MgO). The calcine (oxide) was discharged to the cooler at 800° F.

The MgO (oxide) was trucked to Luning, Nevada and shipped by rail to Las Vegas, Nevada via Salt Lake City, Utah at the start of operation. As this method of transportation was cumbersome and slow, it was soon switched to truck all the way from Gabbs to Henderson. In all, six quarries were opened up to produce the magnesite ore by open pit methods. Management of the project was turned over to Anaconda Copper Mining Co. in early 1942 and stopped in November, 1944, as an excess supply of metallic magnesium for the war effort was realized.

Standard Slag Company of Youngstown, Ohio, obtained an option on the U. S. Brucite claims in 1932 and did some diamond drilling but dropped the option during the depression, and in 1942 purchased the Albert Brown claims, part of which were leased to B.M.I. during the war. R. O. Jones became Manager of Standard Slag Company's Western operation during 1946. Through his efforts the Standard Slag Company bought control of the U. S. Brucite Corporation properties from Dr. Haig. In 1947, a crushing plant was installed and by open pit mining 11,000 tons of high grade magnesite was shipped to Japan. During 1948 and 1949 a small calcine plant was built and production of caustic magnesia began.

In 1952 an 8'x10'x200' rotary kiln was erected with a yearly capacity of 35,000 tons of granular refractories. This plant is still in operation.

Sierra Magnesite Company, a joint venture of the Permanente Company and the Westvaco Chlorine Products Company was organized in 1941 and produced high grade magnesite from claims leased from the Standard Slag Company and Frederick Thornton, by selective open pit mining.

All ore was shipped to California, and most of this went to Permanente for the Hansgirg magnesium metal process. In October, 1943, this was stopped and the MgO was obtained from a sea water plant.

In 1946 Sierra Magnesite Company started production underground by shrink stope methods on the Betty O'Neal (leased) claims of Frederick S. Thornton. A crushing plant was erected and production of 50 tons per day began, which was sent to Westvaco, California plants until the fall of 1951. In the Spring of 1952, Basic Refractories, Inc. obtained the lease on the Frederick S. Thornton claims and Sierra Magnesite Company was dissolved. Basic Refractories, Inc. began open pit mining on the Betty O'Neal claims that year and the Sierra Magnesite Company crushing plant was dismantled in 1954 and no further underground mining has been done since.

After the war was over the government declared the B.M.I. plants as surplus and in 1949 Basic Refractories, Inc. purchased the Gabbs oxide plant and mineral land that the government held. All leased properties had been returned to former owners. Plans were drawn to convert the plant so that dead burned granular magnesia refractories could be produced, primarily for the steel industry.

A heavy media separation plant was built in 1950 to upgrade brucitic material and do away with hand sorting.

A 9½'x395' rotary kiln of 80,000 ton yearly capacity was erected in 1950 to be fired either with coal or oil. At first a wet slurry kiln feed was used. This feed was prepared in the wet grinding circuit of the old flotation plant. Dead burned magnesite clinker was produced early in 1951 and production has continued to date.

It was thought that a better product could be made by briquetting the kiln feed. In 1953, under the management of H. P. Willard, dry grinding was introduced and briquettes were made. In the meantime, two of the Herreshoff furnaces had been sold. The two remaining Herreshoff Furnaces were rehabilitated and are now in operation producing MgO (oxides).

To make use of the low grade magnesite mined by necessity to get the better ore, a 500 ton per day flotation plant was put into operation in June, 1959.

In 1960 a second rotary kiln 8½'x220' of 40,000 tons a year capacity was built as well as a special products plant and oxide grinding and bagging facilities.

All mining is by selective open pit methods using air trac drills, Euclid 15 ton trucks, 2½ yard diesel shovel and using prilled ammonium nitrate as a blasting agent. Since the deposits are very erratic, the pit benches are on 10' intervals and all cuttings from the drill holes are analyzed and a chemical contour[4] map is made. Only in this way can the grade of ore be controlled.

Basic Incorporated (formerly Basic Refractories Incorporated) produces a wide range of furnace maintenance refractories, varying from pea size to powder. These ramming, gunning, patching and hearth maintenance materials protect the furnace structure from the extremely high temperature and corrosive action of the metal bath. Also produced at Gabbs from mined or beneficiated magnesite ores is Magox, a chemical magnesium oxide available in varying grades of purity from 91 to 97% MgO. This product has extensive application in industrial and chemical processing.

In March, 1961 these companies and individuals owned claims in the magnesite area:

Basic Incorporated
The Standard Slag Company
United States Brucite Company
Frederick S. Thornton

The two principal operating companies are Basic Incorporated and the Standard Slag Company.

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