Magnesite Deposit

Magnesite occurs in the vicinity of Horse Springs, 14 miles by road southeast of St. Thomas, Nev., and 9 miles north of Gold Butte. The deposit was located originally by Fay Perkins of Overton, Nev., in 1922. The present owner is Albert Bauer. No production has ever been made. Development comprises several short tunnels and a shaft about 60 feet deep. Fine-grained dolomite and magnesite beds overlain by shale and underlain by limestone and dipping about 30° outcrop for several thousand feet.

GOODSPRINGS (YELLOW PINE) DISTRICT

(Zinc, Lead, Copper, Gold, Silver,
Molybdenum, Vanadium, Cobalt, Platinum)

The Goodsprings, also known as the Yellow Pine, district covers an area of several hundred square miles in the southern part of the Spring Mountain Range in southwestern Clark County. The town of Goodsprings, the center of mining activities of this area, is 8 miles northwest of Jean, Nev., a station on the Union Pacific R.R.

Potosi mine in the northern part of the district was discovered by a party of Mormons in 1855. Shortly after, a small amount of lead ore was mined from this property and was treated locally in crude smelters in order to obtain lead for bullets. This venture proved unsuccessful and work stopped until 1868, when a group of prospectors found lead ore in the southern part of the area. They located a number of claims and organized the New England mining district, but when they found that the lead carried low silver values the district was abandoned. A member of this party, named Good, camped at the springs in the vicinity after the others had left, and Goodsprings was named for him. After the collapse of the New England district, the only work done for many years was by prospectors from Ivanpah, Calif., and Eldorado, Nev.

The permanent settlement of Goodsprings dates from 1886, when A. G. Campbell, John Denslow, A. E. Thomas, William Smith (all from Utah), and others began a systematic search for lead ore. They located over 40 claims and did considerable development work. In 1892 a miner by the name of Jonas Taylor, from Ivanpah, Calif., located a cropping of iron oxides and named it the Keystone mine. Samuel Godby of Pioche, Nev., secured from Taylor a short-time option on one-half interest in the Keystone mine for $20,000. Godby hastened to San Francisco, where he sold one-half of the option to a banker for $20,000, thereby securing a one-quarter interest for virtually nothing. The three partners started to work the property and several carloads of ore were shipped to Colorado smelters, one netting them $9,000 and another nearly $16,000. At that time the nearest railroad connection was at Fenner, Calif., on the main line of the Santa Fe, approximately 100 miles to the south. The high-grade ore shipped from the Keystone caused considerable excitement, and at the end of 1892 the camp had a

population of 200. In December 1893 a 10-stamp mill was erected to treat Keystone ore at a place in Mesquite Valley then known as Taylors Well but now known as Sandy. The Keystone mine was worked with varying success until 1906, production being about $600,000.

In 1893 a branch railroad was built from the Santa Fe line to a point 45 miles from Goodsprings, and the northern terminus, Manville, became the shipping point. This branch was extended 16 miles nearer Goodsprings in 1901. When the San Pedro, Los Angeles, & Salt Lake R.R. (now part of the Union Pacific System) was completed in the spring of 1905, Jean, 8 miles from Goodsprings, became the shipping point. Prior to the completion of this railroad some shipments of lead and copper ore were made over the Santa Fe branch, but the long wagon haul was too expensive for any but the highest-grade ores.

In 1905 the mineral reserves were increased vastly by the recognition of zinc in the ores by C. T. Brown, a mining engineer from Socorro, N. Mex. Prior to Brown's discovery, the earthy material associated with the lead ore (that proved to be hydrozincite) was thrown over the dumps. Following the discovery of zinc in the lead ore, a number of deposits were discovered and shipments of crude ore were made from the Potosi, Hoosier, and other mines in 1905.

In 1906 a large body of lead-zinc ore was opened by Frank Kent on the Rover claim 5 miles west of Goodsprings. This claim had been located and relocated a number of times, and it was believed to be of little value. Following Kent's discovery, this claim became the nucleus of the Yellow Pine mine, the largest producer in the district. The Yellow Pine Mining Co. erected a 75-ton daily capacity zinc-lead concentrator at Goodsprings in 1911 and in the following year built a narrow-gage railroad from Goodsprings to Jean. The period of greatest activity in the district occurred during the World War, when the prices of base metals rose considerably. In 1915 the population of the camp exceeded 1,000, and, in addition to the two major producers, the Yellow Pine and Potosi mines, at least 50 smaller properties were productive.

In 1914 considerable excitement was created by the discovery of platinum in the Boss mine by Harold C. Riddall, a Goodsprings assayer. This discovery caused far more excitement than the facts justified, and a townsite in Mesquite Valley called Platina was laid out by unscrupulous promoters and a number of people were swindled.

In 1930, because of the low prices of the base metals, mining stopped, and the population dwindled to about 15 people. In recent years mining has been confined to the gold and molybdenum deposits. When the writer visited the district in February 1937 the population of the camp was about 150 people.

The production of the district is shown in table 3. In addition to the metals shown in the table, small amounts of platinum, molybdenum, cobalt, and

TABLE 3. - Gold, silver, copper, lead and zinc production from Yellow Pine (Goodsprings) District, Clark County, Nevada, 1902-1935

(Compiled by Charles White Merrill, supervising engineer, San Francisco office, Mineral Production and Economics Division, U. S. Bureau of Mines)

Year	Lode									
	No. of mines	Ore, short tons	Gold		Silver		Copper		Lead	
			Fine ounces	Value	Fine ounces	Value	Pounds	Value	Pounds	Value
1902	1	2,078	2,136.97	$ 44,175	342	$ 181	----------	----------	----------	----------
1903	4	2,092	2,583.04	53,396	695	375	21,800	$ 2,987	28,000	$ 1,176
1904	1	1,929	2,316.10	47,878	146	85	----------	----------	----------	----------
1905	2	2,394	725.62	15,000	3,707	2,261	----------	----------	290,063	13,633
1906	5	9,481	442.63	9,150	1,573	1,070	67,341	12,996	625,175	35,635
1907	5	4,400	364.46	7,534	2,976	1,964	92,690	18,538	172,800	9,158
1908	11	4,627	376.92	7,792	10,247	5,431	42,144	5,563	720,285	30,252
1909	10	8,664	277.67	5,740	18,461	9,600	392	51	406,353	17,473
1910	16	5,878	58.97	1,219	16,826	9,086	122,925	15,611	1,263,837	55,609
1911	17	8,677	117.27	2,424	47,072	24,948	173,719	21,715	1,617,228	72,775
1912	22	28,386	1.63	34	223,013	137,153	103,398	17,061	6,544,917	294,521
1913	25	29,060	61.32	1,268	192,339	116,173	283,592	43,957	6,204,065	272,979
1914	19	24,537	388.60	8,033	122,703	67,855	156,389	20,800	4,185,208	163,223
1915	35	38,391	40.29	833	100,146	50,774	262,600	45,955	4,620,243	217,151
1916	54	71,155	693.36	14,333	156,492	102,972	494,604	121,673	8,349,850	576,140
1917	79	64,260	515.50	10,656	219,789	181,106	764,733	208,772	9,298,706	799,689
1918	38	40,614	235.52	4,869	140,211	140,211	400,792	98,996	6,459,836	458,648
1919	26	19,273	563.55	11,650	139,656	156,415	130,395	24,253	4,217,739	223,540
1920	24	18,611	158.33	3,273	96,557	105,247	76,567	14,088	3,927,280	314,182
1921	5	287	1.09	23	2,195	2,195	119	15	186,169	8,378
1922	10	1,861	.95	20	6,618	6,618	52	7	316,125	17,388
1923	13	14,758	5.26	109	31,678	25,976	1,855	273	1,472,113	103,048
1924	13	21,383	7.00	145	123,650	82,845	16,267	2,131	7,710,851	616,868
1925	23	20,435	14.39	298	72,045	49,999	6,900	980	5,287,587	460,020
1926	25	8,931	15.75	326	19,549	12,199	10,994	1,539	1,904,766	152,381
1927	16	10,192	6.44	133	12,619	7,155	7,523	986	1,652,186	104,088
1928	12	10,745	6.77	140	25,793	15,089	43,955	6,329	2,209,087	128,127
1929	14	4,618	22.68	469	11,067	5,899	33,382	5,875	1,070,718	67,455
1930	11	6,984	72.31	1,495	1,031	397	18,065	2,348	965,226	48,261
1931	9	3,759	136.27	2,817	341	99	2,865	261	518,086	19,169
1932	7	721	98.27	2,031	16	5	----------	----------	94,795	2,844
1933	2	309	141.76	3,623	535	187	----------	----------	57,927	2,143
1934	7	5,261	989.28	34,575	1,437	928	4,982	399	138,405	5,121
1935	10	9,852	2,011.82	70,414	3,072	2,208	8,435	700	156,013	6,241
Total	-------	504,603	15,587.79	365,875	1,804,597	1,324,706	3,349,475	694,859	82,671,639	5,297,316

TABLE 3. - Gold, silver, copper, lead and zinc production from Yellow Pine (Goodsprings) District, Clark County, Nevada, 1902-1935 (Continued)

(Compiled by Charles White Merrill, supervising engineer, San Francisco office, Mineral Production and Economics Division, U. S. Bureau of Mines)

Year	Lode		Total value	Average recoverable value of ore per ton1/
	Zinc			
	Pounds	Value		
1902	----------	----------	$ 44,356	$ 21.35
1903	----------	----------	57,934	27.69
1904	----------	----------	47,963	24.86
1905	685,659	$ 40,454	71,348	29.80
1906	2,885,246	176,000	234,851	24.77
1907	1,878,732	110,845	148,039	33.65
1908	1,115,851	52,445	101,483	21.93
1909	3,013,352	162,721	195,585	22.57
1910	2,707,071	146,182	227,707	38.74
1911	3,548,032	202,238	324,100	37.35
1912	13,254,860	914,585	1,363,354	48.03
1913	14,369,709	804,704	1,239,081	42.64
1914	11,862,149	604,970	864,881	35.25
1915	21,061,182	2,611,587	2,926,300	76.22
1916	28,889,282	3,871,164	4,686,282	65.86
1917	20,535,768	2,094,648	3,294,871	51.27
1918	15,444,731	1,405,471	2,108,195	51.91
1919	5,974,219	436,118	851,976	44.21
1920	9,381,503	759,902	1,196,692	64.30
1921	69,397	3,470	14,081	49.06
1922	891,174	50,797	74,830	40.21
1923	8,755,427	595,369	724,775	49.11
1924	7,909,042	514,088	1,216,077	56.87
1925	6,230,664	473,530	984,827	48.19
1926	2,181,686	163,626	330,071	36.96
1927	3,546,078	226,949	339,311	33.29
1928	1,425,285	86,942	236,627	22.02
1929	1,236,702	81,622	161,320	34.93
1930	2,474,323	118,768	171,269	24.52
1931	1,899,328	72,174	94,520	25.14
1932	254,795	7,644	12,524	17.37
1933	23,346	981	6,934	22.44
1934	28,635	1,231	42,254	8.03
1935	15,380	677	80,240	8.14
Total	193,548,608	16,791,902	24,474,658	48.50

1/ Not to be confused with average assay value.

vanadium also have been produced. A feature of the mining development in the district worthy of comment is that virtually all the properties that operated in former years either paid their own way from the start or were financed locally without benefit of outside capital.

No attempt has been made in this report to cover the district in detail. A number of reports have been written on the Goodsprings district and the interested reader is referred to the report by Hewett[12], which is the latest and most detailed.

Zinc-Lead-Silver and Copper

In former years the principal production from the Goodsprings district has been zinc-lead ores derived from a large number of properties. The principal producers have been the Yellow Pine and the Potosi mines. Mining has been confined almost entirely to the shipping of oxidized ores obtained chiefly by selective mining and hand sorting. During the war period, dry concentrating, plants generally employing Stebbins tables, were erected at the Singer, Milford, Fredrickson, Bullion, Anchor, Sultan, Hoosier, and Christmas mines. These dry concentrating plants were fairly satisfactory, but in general the process was less efficient than wet concentration. In 1914 a roasting plant was installed at the Potosi mine to treat the zinc ores to effect a saving on freight charges. The zine-lead deposits are of the replacement type in carbonate rocks. The ratio of lead to zinc is extremely variable, ranging from nearly all zinc to nearly all lead. The zinc is in the form of mixed smithsonite, calamine, and hydrozincite, while the lead occurs as cerussite, galena, and anglesite. Some silver is associated with the zinc-lead minerals. The consensus of opinion among the miners in the district is that the combined price of lead and zinc must be above 14 cents before it is profitable to produce shipping ores. No doubt this camp will become active again if this price is maintained for any appreciable length of time.

The copper ores likewise are replacement deposits in carbonate rocks generally separated from the zinc-lead ores. Production of copper has been restricted to the shipment of higher grade material obtained by selective mining and hand sorting. When the writer visited the district in February 1937 virtually no zinc-lead or copper ores were being mined.

Yellow Pine Mining Co.

The Yellow Pine Mining Co., controlled by S. E. Yount of Los Angeles, Calif., owns 16 patented claims in Porphyry Gulch 4 miles west of Goodsprings. This company has been the largest producer of zinc-lead ores in the Goodsprings district. It was originally organized in 1901 by J. F. Kent, and was reorganized in 1906. From 1907 to 1930 it has been a consistent producer. According to the records of the company, production from 1907 to 1925 was

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12/ Hewett, D. F., Geology and Ore Deposits of the Goodsprings Quadrangle, Nevada; U. S. Geol. Survey Prof. Paper 162, 1931, 172 pp.

224,245 tons of ore averaging 28 percent zinc, 14 percent lead, and 12 ounces of silver per ton. The net value of this ore, F.O.B. Jean, Nev., was $27.87 per ton and the total net value was $6,253,583 out of which dividends totaling $3,030,000 were paid. The average cost of mining by the square-set method was $12.11. In 1931 the company suspended operations because of the low price of metals. When the writer visited the property in February 1937, it was under bond and lease to a Las Vegas group and several men were employed in rehabilitating the mine.

Several mills have been built at Goodsprings to treat the ores from the Yellow Pine mine. The first mill was remodeled in 1911 from a mill originally built in 1900 for the leaching of copper ores. This plant separated the lead and zinc products in the coarser sizes by Hartz jigs; the finer materials were classified in a 5-compartment Richards hydraulic classifier, and these products were treated on Overstrom tables. The capacity of the mill was 75 tons per day. This mill was more of a separator than a concentrator, since all the products were marketed except a small amount of waste rock taken off the picking belt. The mill was again remodeled in 1919, and in 1929 it was destroyed by fire. In 1930 a 125-ton flotation mill was erected, but after operating only a short time the mine and mill closed.

Mine development comprises an inclined shaft 900 feet deep and a 300-foot winze from the bottom level. The vertical depth attained in the mine is 465 feet. Total underground workings comprise 52,000 feet. Equipment at the mine includes a 310-cubic-foot-capacity, Chicago, pneumatic, single-stage compressor; a 400-cubic-foot-capacity Ingersoll-Rand Duplex compressor driven by 75-horsepower Fairbanks-Morse Diesel engine; a 50-horsepower Fairbanks-Morse geared hoist; a Sullivan drill sharpener; and all tools necessary for mining. Mill equipment included a Symons cone crusher, Hardinge ball mill, Aiken classifier, 2 Diester double-deck concentrating tables, 6 Fagergren flotation machines, Oliver filter, 2 Dorr agitators, and 2 Dorr thickening tanks. Power for milling is furnished by a 360-horsepower, 4-cylinder, Fairbanks-Morse, Diesel engine.

The ores are all oxidized and occur as irregular replacement deposits in limestone. The deposits have been disturbed considerably by faulting.

Gold and Platinum

The gold deposits in the Goodsprings district are confined mainly to a small area in the vicinity of the Keystone mine. The principal bodies have been found in fractures in limestone or dolomite at or near the contact of granite porphyry. The Keystone mine has been the principal property, with a production of about $600,000, most of which was made in the early days. Small amounts of platinum and palladium associated with copper-gold ore are found in the Boss mine. In recent years most of the mining activity in this district has been confined to the gold deposits.

Keystone-Barefoot Mine

The Keystone-Barefoot mine, comprising six patented claims owned by B. H. Kinney, of Albuquerque, New Mex., lies on the west slope of the Spring Mountain Range, 12 miles by road west of Goodsprings via Wilson Summit. The mine was rehabilitated in 1934 after it had lain idle for many years, and in 1935 a 40-ton flotation mill was erected at Sandy 6.7 miles west of the mine. This mill operated only a short time on ore from the Keystone-Barefoot property. In 1936 the mine was taken over under a 5-year lease by O. F. Schwartz and five partners, all from Goodsprings. In 1936 the lessees shipped 8 carloads of ore from the Barefoot claim, totaling 286.95 tons and having a gross smelter value of $12,856.90, an average of $44.81 per ton. In addition, several small sack shipments of high-grade ore having a value of about $500 per ton were made. In the early days, principally from 1892 to 1906, the Keystone is reported to have produced $600,000 and the Barefoot $50,000.

Development comprises the Keystone inclined shaft 820 feet deep, the Barefoot inclined shaft 300 feet deep, four adits, and other workings, totaling about 1 mile. Equipment includes a 22-horsepower, Fairbanks-Morse, geared hoist, a 220-foot-capacity, Ingersoll-Rand, portable compressor, a blacksmith shop, and mining tools.

The ore occurs in irregular deposits in limestone at or near a contact of granite porphyry. The values are chiefly in gold in a gangue of iron oxides, calcite, a little quartz, and in places small amounts of oxidized copper minerals.

A representative carload shipment of ore made from the Barefoot claim to the American Smelting & Refining Co. on December 19, 1936, yielded the following data:

Metal quotation:	Au 34.9125 per oz.		
Settlement assay:	Au 1.46 oz.		
	Percent		
	Cu .52		
	Insol 44.6		
	Iron 28.3		
Metal payment:	1.46 oz. Au at 31.81825		$46.45
Treatment charge:	Base rate	$3.00	
	5 percent excess over $20 gr.	1.32	
		4.32	
	Labor increase	.28	
		4.60	4.60
	Net value per ton		41.85
	Lb.		
Wet weight	93,330		
Less 9.2 percent moisture	8,584		
Dry weight	84,716 equals 42.358 tons at $41.85 per ton		
	42.358 tons at $41.85 per ton		$1,772.68
	Less freight advanced $5 per ton		233.25
	Net proceeds		1,539.43

The royalty payments are 20 percent of the net smelter returns.

The hauling cost to Jean 20 miles from the mine is $3 per ton on contract.

Boss Mine

The Boss mine, comprising a group of five patented claims owned by S. E. Yount, of Los Angeles, Calif., and associates, lies on the west side of the Spring Mountain Range, 14 miles by road west from Goodsprings. Originally located as a copper prospect in 1886, it has been worked intermittently as a source of copper, gold, and platinum. In 1900, a company erected a leaching plant at Goodsprings for the treatment of copper ores from the Boss and Columbia mines, but it was unsuccessful. In 1914, platinum and palladium were discovered in the Boss mine by H. C. Riddall. Considerable publicity was given to this discovery, and the high assays of selected platinum ore gave the impression that it was an unusually high-grade mine, which was not the case. In 1914 the Boss Gold Mining Co. was organized, and in the same year the property was sold to a syndicate headed by W. C. Price, of Los Angeles, which organized the Platinum Gold Mining Co. In 1915 the property reverted to the Boss Gold Mining Co. In 1936, after lying idle for many years, the mine was leased to Roy Myers, and in 1937 the lease was transferred to E. E. Kinney.

According to Hewett[13/], production of the mine up to 1920 was 3,500 tons of ore having a gross value of $210,000. The most productive period was from 1914 to 1920, when 3,051 tons of crude ore were mined containing 1,771.81 ounces of gold, 7,014 ounces of silver, 396 ounces of platinum, 594 ounces of palladium, 568,099 pounds of copper, and 753 pounds of lead.

From March to November 1936, Myers shipped 261.87 tons of ore having a gross value of $5,086.81, an average of $19.42 per ton. This ore was obtained by screening the dumps. From December 1, 1936, to March 1937 Kinney treated 1,200 tons of dump material in the Keystone mill.

Mine is developed by five adits and other workings, totaling about 1 mile. There is no mining equipment on the property. An aerial, 2-bucket, gravity-type tram 1,000 feet long connects the upper workings with a loading bin.

The ore occurs in dolomitic limestone along a fault zone striking about northeast and southwest. Most of the ore was derived from a stope about 150 feet long, 25 feet wide, and 25 feet high above the upper tunnel level. This ore body was an irregular mass of quartz and iron oxides containing copper minerals, gold, silver, and a small amount of platinum and palladium.

A carload of screened dump ore shipped by Roy Myers on November 28, 1936, to the International Smelting and Refining Co. yielded the following data:

13/ Hewett, D. F., Work cited, p. 114.

Metal quotations:	Au	$34.9125 per oz.	
	Ag	.77 per oz.	
	Cu	10.15 less 2.525 cents per pound	
		Oz.	
Settlement assay:	Au	.67	
	Ag	1.8	
		Percent	
	Cu	2.02	
	Insol	30.0	
	Fe	6.3	
	CaO	15.4	
Metal value	Au at $31.81825		$21.32
	Ag at $.77		1.32
	Cu less .5 at 1.525		2.32
	Total		24.96
Treatment charge:	Base charge	$3.50	
	10 percent excess over $20 gr.	.50	
		3.50	
	Labor increase	.34	
		3.84	3.84
	Net value per ton		21.12
		Lb.	
Wet weight		75,100	
Moisture, 4.0 percent		3,004	
Dry weight		72,096 or 36.045 tons	
	36.045 tons at $21.12		$761.33
Deductions:	Freight $4.50 per ton		168.98
	Net proceeds		592.35

The hauling cost to Jean, 22 miles from the mine, is $3 per ton on contract.

Royalty payment is 10 percent of the net smelter or mill return.

The flow sheet of the Kinney custom mill is shown in figure 6. It is at Sandy 3 miles southwest of the Boss mine. At the time of the writer's visit the mill was operating entirely on dump material from the Boss mine. Capacity of the mill is 40 tons per day. Power is furnished by a 55-horsepower Ingersoll-Rand Diesel engine and a 20-horsepower Fairbanks-Morse Diesel engine, the latter connected to a 25-kv-a generator. Water for milling is obtained from a well near the millsite.

Chiquita Mine

The Chiquita property, comprising 18 claims (1 patented) owned by the Chiquita Mining Co., Ltd., James Maxfield, general manager, lies 12 miles

by road west of Goodsprings via Wilson Summit. In the early days considerable work was done on the Chiquita and Hillside claims, but there is no record of any production. In April 1931 O. F. Schwartz and six associates, all from Goodsprings, obtained a lease and bond for $10,000 on the Chiquita and Hillside claims from the owner, A. J. Robbins of Goodsprings. The lessees discovered a body of milling ore and, after working it 1 1/2 years, sold their bond and lease to James Maxfield of Los Angeles for $80,000. The purchase price included a group of claims the lessees had located after the ore was discovered. Development work was continued by the Chiquita Gold Mining Co. Ltd., and in July 1936 a 100-ton all-slime cyanide plant was completed. When the writer visited the property 70 men were employed in the production of about 80 tons of ore per day averaging about $12 per ton.

The mine is developed by an inclined shaft 750 feet deep and other workings totaling about 2 1/2 miles. Property is completely equipped, and recently a 350-horsepower Fairbanks-Morse Diesel generating set has been installed. Water for milling is obtained from a well in Mesquite Valley and is pumped to the mill through a 4-inch-diameter pipeline 6 miles long. Total lift is 2,000 feet.

Values are chiefly gold, which occurs in irregular bodies in limestone near granite porphyry.

Red Cloud Group

The Red Cloud group of two unpatented claims owned by John D. Loop, of Goodsprings, lies about 4 1/2 miles northwest of Goodsprings. This property was originally located in 1902, and in 1906 a small cyanide leaching plant was erected at the mine to treat the ore. According to Loop, about 2,000 tons of ore were cyanided and $10,000 in gold recovered. In 1934 the property was leased to P. S. McClanahan, who shipped 36.66 tons having a gross value of $1,726.32, an average of $47.09 per ton. In 1936 Loop shipped 26,193 tons having a gross value of $679.18, an average of $25.93 per ton. The foregoing constitute the total production.

The main shaft on the property is vertical to a depth of 116 feet, from which point it is inclined 68 degrees to a depth of 300 feet. Underground workings total 2,000 feet. The only equipment on the property is a gasoline hoist and a blacksmith shop.

The ore occurs in irregular bodies at or near the contact of a granite porphyry dike that cuts the dolomitic limestones. Values are chiefly in gold in a gangue of silicified material stained with iron oxides. An interesting feature of the property is that cinnabar was found on the upper levels associated with gold. The cinnabar, however, has not been commercially important. The smelter returns on the shipment of ore made by Loop on October 14, 1936, to the American Smelting and Refining Co. yielded the following data:

Metal quotation:	Au	34.9125		
		Oz.		
Settlement assay:	Au	.815		
	Ag	.1		
		Percent		
	Insol	86.4		
	Fe	3.6		
	CaO	2.6		
Metal value:	0.815 oz. Au at 31.81825			$25.93
Treatment charge:	Base		$3.25	
	10 percent excess over $20 gr.		.59	
			3.84	
	Labor increase		.28	
			4.12	4.12
	Value per ton			21.81
	Lb.			
Wet weight	53,620			
Less 2.3 percent moisture	1,234			
Dry weight	52,386	26.193 tons at $21.81		$571.27
Deductions:	Freight, $4.50 per ton			120.65
	Net proceeds			450.62

The hauling cost to Jean, 12 1/2 miles from the mine, is $2 per ton on contract.

Other Mines

The Clementina group of four unpatented claims, owned by H. A. Hogle of Salt Lake City, Utah, lies 1/2 mile southeast of the Keystone mine. At the time of the writer's visit this ground was being prospected by two men. Only a few tons of ore have been shipped from the property in former years.

Development work comprises a shaft 60 feet deep and an adit 400 feet long. Equipment includes a Fairbanks-Morse compressor (8 by 8 inches) driven by a 16-horsepower International tractor engine. Gold ore occurs in pockets in a shear zone in dolomite.

The Yellow Horse group of two patented claims and the Honduras group of four patented claims are controlled by the Minerals Exploration Co. At the time of the writer's visit this company was exploring the Yellow Horse property with a crew of three men. There is no record of any production. Development work comprises an inclined shaft 60 feet deep with about 200 feet of lateral workings. Equipment includes a 6-horsepower Fairbanks-Morse geared hoist and a one-drill Fairbanks-Morse air compressor belt-connected to a 26-horsepower Western gasoline engine. The formation is limestone intruded by granite porphyry.

Molybdenum

Molybdenum in the form of wulfenite ($PbMoO_4$) is found in the Shenandoah, Milford, Hoosier, Mobile, Hermosa, and other mines in the district. The wulfenite occurs in small irregular deposits in limestone associated with zinc-lead ores. The only effort made to produce molybdenum concentrates was in 1935-36 when the California Molybdenum Corporation acquired the Shenandoah mine under bond and lease and erected a mill near Sandy, 3 miles from the mine. Judging from the tailings pile at the mill, about 5,000 tons of wulfenite ore were treated, but no information is available on the amount or grade of concentrates produced. The Shenandoah mine and mill reverted to the original owners in November 1936.

Shenandoah Mine

The Shenandoah mine, owned by P. H. Springer of Las Vegas, Nev., and J. A. Fredrickson of Goodsprings, comprises a group of 13 claims (1 patented) on the west side of the Spring Mountains, 16 miles by road west from Goodsprings. This property has been intermittently worked for zinc-lead ores, principally by lessees, for many years. According to Hewett[14/], production from 1908 to 1926 was 1,143 tons of shipping ore containing 2,120 ounces of silver, 208,580 pounds of lead, and 538,557 pounds of zinc.

The mine is developed by several adits, which, with lateral workings, total about 2,500 feet. The mine is near the top of a steep mountain, and an aerial gravity tramway 1,650 feet long connects the mine with the loading bins. Mine equipment has been removed from the property.

Wulfenite is present in lenses in brecciated zones in limestone. According to Fredrickson, the ore mined by the California Molybdenum Corporation was found in a block of ground 130 feet long, 160 feet high, and from 10 to 30 feet wide. The zinc-lead ore minerals are cerussite, galena, smithsonite, and hydrozincite.

The Shenandoah mill has a capacity of 50 tons of wulfenite ore per day. Concentration was effected by tabling followed by flotation. Mill equipment includes an Eimco ball mill (4 by 5 feet), Dorr simplex classifier, 2 Deister tables, trommel (5 by 2 1/2 feet, equipped with 8-mesh screen), 12 M. S. flotation cells, an Eimco filter, and other equipment. Primary crushing was done at the mine. The power plant at the mill consists of a 180-horsepower, 4-cylinder, Diesel engine connected to a 170-kv-a alternator and a 75-horsepower, Fairbanks-Morse, 2-cylinder, Diesel engine connected to a 56-kv-a alternator. A power line connects the mine with the power plant.

Water for milling is available at the millsite from a well 186 feet deep, lined with 6-inch casing, and equipped with a 52-gallon-per-minute-capacity, Pomona, deep-well, turbine pump connected to a 5-horsepower motor. The corrugated iron stand tank near the well has a capacity of 16,000 gallons.

14/ Hewett, D. F., Work cited.

Vanadium

Vanadates of lead, zinc, and copper have been found on the Spelter, Hoodoo, Whale, Valley Forge, Velvet, Akron, and a number of other properties in the Goodsprings district. All of the vanadium deposits in the district were found while prospecting was being done for zinc-lead ores.

The production of vanadium has been about 50 tons of hand-sorted shipping ore containing about 10 percent V_2O_5, and 200 tons of milling ore averaging about 1.6 percent V_2O_5. The largest shipment was made in 1918 by Charles Kennedy from the Lookout mine on the east side of the Spring Mountain Range. This shipment contained 36 tons and averaged 9.26 percent V_2O_5. In 1923 an unsuccessful attempt was made to concentrate vanadium ore on the Spelter property by gravity methods. In 1936, 182 tons of vanadium ore mined from the Spelter and Hoodoo properties were treated at the Kinney custom mill by flotation. From the 182 tons of ore averaging 1.65 percent V_2O_5, 6.6 tons of concentrates were produced containing 16.7 percent V_2O_5, 43.3 percent lead, 3 percent copper, and some zinc. Since the recovery of vanadium on this test run was only 36.8 percent, the mill would not accept further shipments of vanadium ores.

All the vanadium deposits are in brecciated zones in limestone or dolomite. The principal vanadium minerals are vanadinite ($3Pb_3V_2O_8.PbCl_2$), descloizite ($4RO,V_2O_5.H_2O$;R=Pb,Zn, usually in the approximate ratio 1 to 1), and cuprodescloizite ($(Pb,Zn,Cu)(VO_4)_2(Pb,Zn,Cu)(OH)_2$), associated with limonite, galena, and oxidized lead and zinc minerals.

In general, the vanadium ores are too low-grade to be shipped crude. With the present stage of development, no single property in this area is capable of producing sufficient vanadium ore to keep a 25-ton daily capacity concentrator operating steadily. However, the writer is of the opinion that if the properties were worked by lessees they could, together, supply sufficient ore averaging better than 1 percent V_2O_5 to keep a 25-ton mill busy. The mill would have to be operated on a custom basis. The various economic factors involved in an enterprise of this nature would have to be investigated further.

Laboratory milling tests made on vanadium ores from the Goodsprings district by the U. S. Bureau of Mines Experiment Station at Rolla, Mo., indicate that the ores are amenable to concentration by the flotation process. In continuous, closed-circuit milling a recovery of 80 to 85 percent of the vanadium minerals appears feasible.

Because of the complex nature of the vanadium minerals the concentrates require a special treatment process to reduce them to finished products. The U. S. Bureau of Mines Experiment Station at Reno, Nev., has made some tests on the reduction of the vanadium concentrates along the lines of caustic fusion, direct smelting, and leaching with sulphuric acid. The interested reader is referred to the report on the results of these tests made by Doerner15/.

15/ Doerner, H. A., Metallurgical Possibilities of the Descloizite Ores at Goodsprings, Nev.: Rept. of Investigations 2433, Bureau of Mines, 1923, 19 pp.

Spelter Group

The Spelter group of four unpatented claims, incorporated under the name of Master Alloy Mining and Milling Co., Rex C. Ewing, Goodsprings, Nev., principal owner, lies 9 miles southwest of Goodsprings on the west slope of the Spring Mountain Range. These claims were located originally for lead and zinc, but there is no record that these minerals were produced. In 1923 an attempt was made to concentrate the vanadium ore in a small mill equipped with crusher, rolls, screens, and four Wilfley tables. About 3 1/2 tons of vanadium concentrates averaging 11 percent V_2O_5 were produced and sold to Elmer H. Hester of Kingman, Ariz. In 1936, 72 tons of vanadium ore averaging 1.84 percent V_2O_5 were treated in the Keystone Custom mill at Sandy.

Property is developed by three tunnels which, with lateral workings, total about 1,000 feet. There is no equipment on the property.

The ore occurs in a brecciated zone in limestone striking east and west and having a maximum width of 25 feet. The vanadium occurs as vanadanite and descloizite associated with galena. Lenses of ore up to 6 feet in width are said to contain from 1 to 2 percent V_2O_5. Two cut samples taken by the writer over widths of 20 and 25 feet analyzed .25 and .45 percent V_2O_5, respectively.

Hoodoo Group

The Hoodoo group of four unpatented claims, incorporated under the name of the Kansas Nevada Mining Co., controlled by Frank Williams of Goodsprings, adjoins the Spelter group on the southeast. This property was located originally for zinc-lead, and it has been worked intermittently for a number of years on a small scale. According to Hewett[16], the production of crude zinc-lead ore from 1911 to 1927 was 335 tons containing 523 ounces of silver, 33,831 pounds of lead, and 189,954 pounds of zinc. According to Williams, 16 tons of vanadium ore, averaging 4 percent V_2O_5 were sold to Elmer H. Hester, Kingman, Ariz., in 1928. In 1936 110 tons containing 1.52 percent V_2O_5 were treated in the Keystone custom mill at Sandy.

Development work comprises three adits and other workings totaling about 2,000 feet. There is no equipment on the property.

Vanadates occur in lenses in a shear zone in limestone. Three cut samples taken by the writer over widths from 5 to 9 feet contained 0.67, 0.68, and 1.18 percent V_2O_5.

Whale Group

The Whale group of six unpatented claims owned by Frank Miller of Goodsprings lies on the west slope of the Spring Mountain Range, 8 miles by road west of Goodsprings. This property has been worked intermittently for

16/ Hewett, D. F., Work cited, p. 152.

zinc-lead ore. According to Hewett[17], from 1912 to 1917, 537 tons of crude ore were shipped, containing 265,368 pounds of zinc, 21,238 pounds of lead, and 98 ounces of silver. The first discovery of vanadium ore was made on this property by Frank Miller in 1912 while prospecting for zinc-lead. No vanadium ore has been produced.

A deposit of zinc-lead has been prospected by an adit and subsidiary workings totaling about 500 feet. The vanadium deposits have been prospected by two shallow shafts, several short adits, and numerous open-cuts totaling about 250 feet of workings. The latter work on vanadium deposits was done while prospecting for lead-zinc ore.

The vanadium occurs chiefly as cuprodescloizite in shear zones in limestone. Small amounts of galena, calamine, and wulfenite are present. Vanadium showings have been found in irregular deposits in at least 20 places scattered over an area 60 feet wide and 1,000 feet long. There is no continuity to the deposits. A general sample of dump material taken by the writer from 10 open-cuts analyzed 1.12 percent V_2O_5, and another sample of dump material near a shallow shaft analyzed 0.73 percent V_2O_5. By selective mining the grade of the ore probably could be maintained above 1 percent vanadium pentoxide.

Valley Forge Group

The Valley Forge (formerly known as the Hickory Dick) group of four unpatented claims, owned by Frank Williams of Goodsprings, lies 2 miles west of Columbia Summit and 6 miles southwest of Goodsprings. This property was located originally for copper, and during the World War four carloads of copper ore was mined and shipped. Vanadium ore has not been produced.

Development work on the copper showings comprises 250 feet of adits and other workings. The vanadium deposits have been prospected by five open-cuts totaling not more than 50 feet. There is no equipment on the property.

Vanadates (chiefly cuprodescloizite) occur in brecciated zones in limestone over widths of 12 to 15 feet. Several samples were taken by the writer; one sample of dump material analyzed 0.72 percent V_2O_5 and a cut sample taken over a width of 3 feet on the hanging-wall side of a deposit 15 feet wide analyzed 1.26 percent V_2O_5. With a small amount of work done, the showings are encouraging.

Velvet Group

The Velvet group of three unpatented claims, owned by Charles Kennedy of Goodsprings, lies on the north side of Table Mountain, 8.7 miles by road southwest of Goodsprings. Nothing has been produced from the property.

Development comprises an adit 50 feet long and other scattered workings totaling about 100 feet. Vanadates, principally vanadinite and descloizite,

17/ Hewett, D. F., Work cited, p. 146.

occur in a shear zone in limestone. A channel sample taken by the writer across a width of 3 feet in the face of the adit analyzed 0.79 percent V_2O_5.

Akron Group

The Akron group of three patented claims, owned by Charles Beck of Goodsprings, adjoins the Valley Forge group on the west. The Bill Nye claim, formerly a separate property, constitutes part of the Akron group. These claims originally were located for zinc-lead. According to Hewett[18], production from the Bill Nye claim from 1914 to 1919 was 1,488 tons of crude ore containing 6,860 pounds of copper, 62,564 pounds of lead, 921,931 pounds of zinc, and a little silver and gold. Production from the Akron claim has been four carloads of zinc-lead-silver ore and 7 tons of vanadium ore containing about 7 percent V_2O_5.

Development comprises several shafts, the deepest of which is 220 feet inclined 76°, and other workings totaling about 1,000 feet. Virtually all the development work has been done in the search for zinc-lead ore. There is no equipment on the property.

Vanadates, chiefly cuprodescloizite, occur in brecciated dolomitic limestone on the Akron claim.

Cobalt

Cobalt, in the form of stainierite $(Co,Fe,Al)_2O_3.H_2O$), occurs in a number of mines in the Goodsprings district. The only production was made in 1921-22, when a number of small lots aggregating 21 tons, containing 5.13 to 29.18 percent and averaging 8.73 percent cobalt, were shipped from the Blue Jay, Columbia, Copper Chief, and Highline properties. Although the presence of cobalt is rather widespread in the area, the deposits so far described have been small. In recent years the only prospecting done for cobalt was on the Swansea property.

Swansea Group

The Swansea group of three unpatented claims, owned by Frank Williams of Goodsprings, lies about 1 mile west of Columbia Summit. This property was located originally for copper, and 4 years ago it was relocated for cobalt. None has been produced.

Development consists of several short adits totaling not more than 100 feet of workings. There is no equipment on the property. The stainierite occurs as irregular replacement deposits in limestone. It is associated with considerable calcite. About 4 tons of ore on the dump was reported to contain 3 1/2 percent cobalt.

18/ Hewett, D. F., Work cited, p. 146.