

KNOWN MINERAL RESOURCES OF
ALBANY COUNTY
WYOMING

PART I
THE METALLIC MINERALS

Prepared for
THE ALBANY COUNTY COUNCIL
OF DEFENSE

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INTRODUCTION

This report treats with the known metallic minerals, the non-metallic minerals and the energy producing fuels of Albany County, Wyoming. The information has been compiled from published reports of the U. S. Geological Surveys, The United States Bureau of Mines, The Geological Survey of Wyoming, The State Geologist's Office, The University of Wyoming, and other reliable sources. The descriptions of the occurrence, character, and extent of the deposits and mine workings are factual as far as available data permits.

THE METALLIC MINERALS

There are no active metal mines in Albany County at the present. The discovery in various localities of metallic minerals, especially gold and copper, in the pre-Cambrian rocks of the Medicine Bow Mountains and the Laramie Mountains has led to serious efforts during the past 50 years to develop commercial metal mines. Some gold and copper and a small amount of manganese have been produced. A brief history of the more important mines and prospects follows:

COPPER

Medicine Bow Mountain Area

The Douglas Creek District

The Rambler Mine: - The Rambler Mine was the most important copper mine in Albany County. It is located in the SW 1/4 sec. 33, T. 15 N., R. 79 W. at an elevation of 9500 feet. It is 40 miles southwest of Laramie. The date of discovery is not known. The mine came into prominence as a producer of copper in 1900. The last reported shipment

of ore was in 1923. Beeler (1904) reports in 1904, that this mine had shipped 1,928 tons of copper ore averaging 19 per cent copper. He also reports that a matte smelter operating at the mine produced 613,881 pounds of matte carrying 30 to 60 per cent copper or 249,196 pounds of copper. Henderson (1913) reports on the total production of copper from Albany County, most of which came from the Rambler Mine from 1901 to 1912, as follows:

1901 - 1903	----	900,532 pounds
1907	----	24,350 pounds
1909 - 1912	----	<u>700,567 pounds</u>

Total production		
1901 - 1912	----	1,625,449 pounds

Several cars of ore are reported to have been shipped from this mine during the years from 1915 to 1918. Four carloads of ore were shipped to refineries during the years, 1921-1923. It is concluded on the basis of the above that the Rambler Mine produced approximately 1,750,000 pounds of copper from 1900 to 1923.

The main shaft penetrated to a depth of 180 feet below the surface. Some 5000 feet of drifts and cross-cuts were driven. The ore body, consisted of irregular lenses 30 or more feet in width, which occurred in a fractured and altered diorite dike. The country rock of the region consists of granite gneiss, quartzites and intrusive granite. The lower 25 feet of the shaft were all in fresh unaltered diorite. The copper ore was chiefly covellite. (Cupric sulphide). Platinum in the form of sperrylite (platinum arsenide) was contained in the ore. Kemp (1904) makes the following statement as to the probable origin of the ore:

"This ore body, therefore, presents some interesting and exceptional features. The usual vein minerals of the gangue, such as quartz, calcite, etc., are lacking. Instead we have over an area of nearly a hundred feet east and west and the same distance north and south, and we do not know to what extent beyond, the decomposition products of an eruptive dike in place. Whether a belt of shattering dips away to the west, along which alteration may be followed to still greater depths, is a question. This surmise would occur to an observer, but the proof is not at hand. Although it can not be denied that uprising waters may have served to decompose the rock and impregnate it with ore, it would seem more likely that a great dike of diorite originally charged with sulphides of copper and iron and with minerals involving the platinum group of metals has suffered from atmospheric weathering. The presence of the sulphides has facilitated its extensive alteration, and the secondary minerals thus formed have descended and become precipitated so as to impregnate and enrich the residual kaolins. A line of shattering and consequent alteration may have facilitated the process."

Other reported Copper mines in the Medicine Bow Mountains: -

<u>Property</u>	<u>Extent of development</u>	<u>Year reported</u>
Topeka	75' shaft -- 3 drifts 700', 360' and 29' in length	1907
Blanche	160' shaft	1906
Albany	360' shaft	1906
Medicine Bow	954' of tunnel	1906

The Jelm District

The Jelm district is located at the south end of Jelm Mountain. Nothing is known of the early efforts to develop metal mines in the Jelm district. Knight(1893) reports, "The Cummins Camp is located on Jelm Mountain and was one day celebrated for its rich gold quartz". Copper was reported to occur in a large vein of pyrite. The camp had been idle for several years prior to 1893. Beeler (1906) reports that the Wyoming Queen Mining Company was pushing development work and that their main shaft had been sunk to a depth of 250 feet. The Annie Mining

Company's shaft was 140 feet deep. Reported yields from this mine are: }
A 500 pound ore sample from 100-foot depth, broken for mill run, yielded }
6.3% copper. Assays of ore broken from the two-foot high-grade streak }
at a depth of 135 feet gave copper values of 29% and gold values of }
\$2.30.

The rocks of the Jelm Mountain district are granite gneiss, intrusive granite, and diorite dikes characteristic of the pre-Cambrian complex of the region. The mineral veins trend east and west and are reported to conform in dip and strike with the diorite dikes. It is now known that this area is thrust faulted. There has been no activity in this district for some 30 years.

Laramie Mountain Area

Considerable development work has been done on copper prospects in the Laramie Mountains. A number of shafts have been sunk from a few feet to more than 300 feet at various localities. The total ore shipment from these mines is unknown. The amount is small. Regions which have been extensively prospected are, (1) Tie Siding, (2) Strong Creek, (3) Sybille, and (4) The North Laramie Peak District. Descriptions of developments in each of these regions follows:

Tie Siding District

Serious efforts were made to produce copper from an area lying 1 1/2 miles south of Tie Siding between 1917 and 1934. In 1931 the underground development of this mine consisted of a 168-foot shaft and 1500 feet of drifts. A 150-ton gravity concentrating mill

was built in 1927. Some native copper and copper ore were shipped in each of the years 1917, 1918, 1930, and 1934. Total shipments amounted to a few carloads. There has been little or no activity in this district for the past several years.

The Strong District

The Strong Mine is located in the Laramie Mountains in sec. 4, T. 16 N., R. 71 W., some 12 miles northeast of Laramie. The date of discovery is not known. In 1905 the shaft was reported to be 300 feet deep. In 1906 the shaft (inclined) was reported to have been 335 feet. Drifts and cross-outs aggregated 1000 feet. At the 150-foot level the ore vein was from 2 to 7 feet wide. Lenses of ore are also reported. The surface equipment of the mine was destroyed by fire in July, 1907. There was no work done at the mine in 1908 nor is there any record of any later work. There is no record of any ore having been shipped from this mine. The mine was owned by the Strong Copper Mining Co. The ore is reported to occur in a fractured diorite and gabbro dikes which cut granite (anorthosite). There is no record as to the character or value of the ore.

The Sybille District

Considerable prospecting has been done in the Sybille district. Numerous shafts from a few feet to 50 feet or more have been sunk on siliceous veins or aggregates in the pre-Cambrian metasediments. Some of these veins show evidence of small amounts of copper, chiefly as carbonates. There is no record of any shipment of ores from any of these prospects.

The North Laramie Peak district

This district lies north of Laramie Peak in the northeast corner of Albany County and extends northward some five miles into Converse County. The portion of the district in Albany County is located in T. 28 N., R. 71 W., the northeast township of the County. The district is also referred to as the Esterbrook District. It lies 80 miles north of Laramie.

Since 1875 more or less prospecting has been going on in this region. The following information in regard to the district is taken from Spencer's report ^{of} in 1916. (6)

Maggie Murphy Belt: - This group of claims lies about 3 miles south of Esterbrook. A shaft was driven to a depth of 107 feet and many minor openings were made. The shaft revealed the presence of a heavy body of the magnetic iron sulphide pyrrhotite. In one of the southwestern openings a layer of graphite-pyrrhotite schist from 1 to 2 feet thick was found to carry some chalcopyrite. According to Spencer "the material seen on the dump does not suggest the presence of any valuable body of copper minerals".

Other prospects in the North Laramie Peak district: - For detailed descriptions of the following prospects, see Spencer (1916).

<u>Name</u>	<u>Depth of Shaft</u>	<u>Character of rock and mineralization</u>
Three Cripples	96	Massive pyrrhotite rock
Big Five	50	Pyrrhotite rock
McGhee	?	Gray schist charged with pyrite

<u>Name</u>	<u>Depth of Shaft</u>	<u>Character of rock and mineralization</u>
Esterbrook		
Principal shaft	350', 400' of drifts	Black schist and altered diabase, quartz and calcite carrying lead carbonate at outcrop and galena below the surface, small amounts of chalcoprite in some of the lode stuff.
Newell	?	
3rd	60'	
Tenderfoot	150'	Lode-pyrrhotite (?)
Kreisly	?	Pyrrhotite mixed with hornblende and quartz.
"	60'	Oxidized schist with minor bunches of secondary copper minerals.
Maverick	50'	Schists cut by pegmatite, quartz and pyrite.
Hoosier Boy	80'	quartz veins in schist; small amounts of chalcoprite.
Kentucky Belle	40'	quartz vein, chalcoprite, and some chalcocite.

War Bonnet District

The Pyramid		
Main shaft	100' ?	Quartz veins cutting schist and granite
2nd "	30'	
The Mammoth vein		
Shaft	?	Dense quartz

Summary of development work in the portion of the North Laramie Peak District in Albany County.

No. of shafts from 50 to 350' deep--9 or more.

" " " " 0 to 50' deep----several.

Drifts and cross-cuts----several hundred feet.

There are no reported shipments of copper from this district. Deeler () reports a shipment of 35,588 pounds of lead carbonate ore from the Esterbrook vein prior to 1904. There has been little or no activity in the district for many years.

Summary of Copper Mines and Prospects in
Albany County

Interest in the development of copper in Albany County appears to have begun in 1900 and continued intermittently for thirty years. The Rambler Mine is the only one from which important amounts of copper have been produced. The mine is believed to have produced 1,750,000 pounds of copper from 1900 to 1923. There is no record of the total number of prospects which have been opened by shafts from a few feet to fifty or more feet deep in search for copper. They probably aggregate several score in number. There are records of 18 shafts which were sunk from depths of 50 feet to 350 feet deep. There are probably others. The extent of the underground workings, including tunnels, drifts, adits, and cross-outs are now known. Workings of this nature probably aggregate not less than 10,000 feet.

Most of the copper prospects appear to have been opened on:

- (1) Weathered dikes, chiefly dioritic in character which cut the granite gneisses, schists, and granites of the pre-Cambrian complex.
- (2) Siliceous

intrusive masses associated with the complex. The mineral-bearing veins do not appear to be of hydrothermal origin. There has been some secondary enrichment near the surface of the primary sulphides due to weathering. Extensive thrust and tear faulting is known to occur throughout the Medicine Bow Mountains and to a less extent in the Laramie Mountains. In areas where these faults occur they present serious difficulties in following dikes or mineralized veins in depth.

GOLD

History of Gold Mining

Hayden (1871) states, "during the summer of 1868 an excitement was created in Laramie City by supposed discovery of rich placer mines far up in the mountains, near the Snowy ranges, to the southwest of the Plains". It appears that Laramie had its first gold excitement before it was more than a few months old. Hayden further states, "Gold is sought after in gulches, formed by the little streams that flow from the Medicine Bow and other snowy mountains, most of which empty into the North Platte". He reports that he spent two days in company with a large party including Professor James Hall in search of the quartz seams which he "supposed to be the source of the stray lumps of gold."

Raymond, (1870, 1873) makes no mention of gold mining in Albany County.

Ricketts (1888) describes the Keystone and Florence Mines, in the Douglas Mining District. He states, "The Keystone was worked several years ago, and over 3000 tons of ore were milled, which returned 1,700 ounces of pure gold from the plates". At the time of Ricketts' visit, July 1887, "all the ground developed above the first level was sloped out along the line of the ore chute". Ricketts (1890) states, "The Keystone Mine, on Douglas Creek, Albany County, has recently been sold, and a stamp mill is being built and the mine opened by a new company....". "The 20-stamp mill is nearly completed and there is a large quantity of ore upon the surface ready to be milled. It is estimated that the ore will yield a total of \$20 per ton in gold".

W. C. Knight (1893) gives the following summary of gold mining in Albany County from 1868 to 1893:

"Since the discovery of gold in Moore's Gulch in the Medicine Bow Mountains in 1858 the following mining camps have been located in Albany county, the order given being the order of discovery: Last Chance, Douglas Creek, Centennial, La Plata, Keystone and Cuzmins. There are many other local camps which have not been named.

The Last Chance camp was the first discover, but prior to 1868 gulch mining had been carried on, by whom no man will ever know, along the lower tributaries to Douglas Creek. Moore's Gulch, which was the richest digging at Last Chance, was exhausted in 1870, since which time no work has been done with the exception of prospecting for quartz. This camp yielded about \$10,000.

The Centennial camp was discovered in 1875 but not opened until 1876. The most valuable vein of quartz discovered was called the Centennial. This mine operated a ton-stamp mill and extracted \$50,000 in gold. On the account of faulting the vein was lost and the mine abandoned. There are many other quartz claims in the district, but none of them are developed.

The Douglas Creek district embraces Douglas Creek and its tributaries. Prior to 1878 this was a placer camp. In 1878 the Keystone mine was discovered and immediately afterward the Florence. These two mines have produced the bulk of the gold from the Douglas Creek and Keystone camps. At Keystone there is one ten and one twenty-stamp mill. The latter closed down in November, 1892. The product of gold from the Keystone and Florence mines has been \$135,000. The gulches have produced approximately \$40,000.

THE LA PLATA MINING DISTRICT

The La Plata district is located under the brow of Medicine Peak. It is lead and silver camp, the formation being limestone. Owing to the slight development no one knows what the future may bring forth. The ore is galena carrying from 12 to 30 ounces of silver to the ton. Owing to water in large quantities near the surface a pumping plant will be the first requisite in prospecting.

THE CUZMINS CAMP

The Cuzmins camp is located on Jehu Mountain and was one day celebrated for its rich gold quartz. Stamp mills were erected and operated for some time but were not made to pay. In and near this camp are valuable prospects of copper, lead and bismuth. The lead is in the form of a large vein of low-grade galena, which must be concentrated before it will be fit for market. The copper is a large vein of pyrites fairly rich in copper but low grade in gold and silver. This camp has been almost idle for several years.

The Gold Output from Albany County

<u>Name of Mine</u>	<u>Output</u>
Centennial.....	\$ 50,000
Keystone.....	100,000
Florence.....	35,000
Other quartz mines.....	4,000
Placer mines.....	<u>40,000</u>
TOTAL.....	\$229,000 "

Lode Mines

Gold mining on lodes has been carried on intermittently since the early days, chiefly in the Douglas Creek and Centennial Districts. During the eight years from 1932 to 1939 inclusive \$8.64 ounces of gold were produced from lode deposits. Although the estimates of the amount of gold produced in the early days of mining operations are not too reliable, it is believed that the total production of gold from lode mines had a value of approximately \$200,000 at the time it was produced.

The Douglas Creek and Centennial Districts

The most important lode gold mines of Albany County were the Keystone, Florence and Centennial.

The Keystone Mine: The Keystone mine was discovered in 1878 and was operated for some years, during which time more than \$30,000 in gold was recovered. It appears to have been idle for some years prior to 1889 when it was again opened and operated until November 1892. The shaft was sunk to a depth of 365 feet and approximately 5000 feet of drifts were run (Seeler, 1906). The vein is reported to have been from 2 feet to 6 feet in width. The average value of the ore was \$23.50 a ton. There were one ten-stamp and one twenty-stamp mill at this mine. Total production was \$96,000. It is the deepest mine in Albany County.

The Florence Mine: The Florence Mine was discovered immediately after the Keystone. It was closed sometime prior to 1889, when the machinery was moved to the Keystone. The shaft was 160 feet deep and there was a 120 foot drift at the 50 foot level and a short drift at the 100 foot level. A large amount of ore was stoped from the upper level. The ore is reported to consist of very irregular kidneys and bunches of white iron sulphide included in the granite.

This mine is reported to have produced \$50,000 in gold. The Little

Wall property was an extension of the Florence. Its shaft was 60 feet deep. Knight (1893) values the total amount of gold produced from the Keystone and Florence mines at \$135,000.

The Centennial Mine: The Centennial Mine was opened in 1876 and produced \$50,000 in gold. It is reported that the mine was abandoned because of the loss of the vein at a fault. No reports descriptive of this mine are known to the writer.

Other Mines of the Centennial District: Detailed reports descriptive of a number of gold properties which have been mined from time to time are not available. In the Centennial District the properties of the Cliff Gold Mining Company and the Utopia Mining and Milling Company are the most extensively developed. Total development work on the Cliff property in 1930 consisted of a 90-foot vertical shaft, an 800-foot adit, and 500 feet of drifts. A 50-ton amalgamation-concentration mill was erected on the property in 1926. Seven hundred and fifty feet of underground working were driven on the Utopia property in 1930 and 1931. A 35-ton concentrating mill was completed during 1932 for the treating of gold ores. Several tons of gold concentrates from the mill were shipped in 1933, 1934, and 1935.

Development work has been done during the past ten years on several lode claims in the Douglas Creek District and Centennial Districts.

Placer Mining

Gold placer mining has been carried on in the Medicine Bow Mountains with varying degrees of success since before 1866. Moore's Gulch is reported to have yielded \$10,000 in placer gold before it was exhausted in 1870. W. C. Knight (1889, Original notes) reports that \$10,000 was spent in the construction of a flume in the Douglas Creek area. The flume was never finished. He also reports that a hundred miles of placer ground had been located and twelve

companies were to work the ground during the 1889 season.

Beeler (1906) gives an extensive account of the Douglas Creek, Home, Albany and Spring Creek placers. He states;

"Douglas Creek proper is about thirty miles in length, and the greater portion of its length has been located for placer, together with its most important tributaries which are Lake Creek, Muddy, Spring, Keystone, Beaver Gulch, Horse, Gold Run, Joe's Creek, Moore's Gulch, Cave's Creek, Ruth's, Elk, Bear, and Willow creeks. The district may be stated to embrace an area of fifteen miles long and ten miles wide, and lies forty-five miles due west of Laramie".

In the Douglas Creek area the gold-bearing gravels are reported to be from 3 to 15 feet in thickness. Beeler states, "The average tests made on Douglas Creek by M. W. Grant show 83 1/2 cents to the cubic yard and it is believed that all of the ground will average not less than 35 cents to the cubic yard".

Extensive placer operations have been carried on in the area from time to time since 1868. The total reported yield of placer gold from the Douglas Creek and other placer areas in the Medicine Bow Mountains is not large. The number of placer mines operating in Albany County from 1932 to 1939 inclusive varied from none to eleven. The yield varied in the same period from a minimum of 4.02 ounces to a maximum of 398.57 ounces (1935). The total yield for the eight years was 478.79 ounces, having an approximate value of \$16,500.

Available figures indicate that approximately \$60,000 worth of placer gold was recovered from Albany County in the 72 years from 1868 to 1940.

It is estimated that \$250,000 worth of gold has been produced in Albany County since the first reported gold mining activity in 1868.

MANGANESE

The only known occurrence of manganese in Albany County is located in sec. 10, T. 26 N., R. 75 E., 3 miles southeast of Marshall P. O. and 38 miles northeast of Medicine Bow.

An attempt was made to recover manganese from this occurrence by the Fovey Mining Company during the years 1917 to 1920. When visited by Jones (1921) in October 1917 the workings consisted of a drift 150 feet long and a shaft 25 feet deep. Shipments of ore containing 35 per cent or more of manganese were as follows: 1917, 30 tons; 1918, 42 tons; 1919, no shipment; 1920, 40 tons. The 1920 shipment was valued at \$2,800. There is no reported shipment of ore since 1920. The ore was contained in two chert beds separated by an interval of a few feet. The chert beds ranged in thickness from 1 to 8 feet and had an average thickness of 6 feet. The ore consisted of the manganese oxides manganite and pyrolusite and occurred as mammillary crusts and nodular aggregates which had wholly or partly replaced the chert, and to a lesser extent the beds which enclose it. The highest grade ore was obtained from the upper parts of the beds. Jones estimated that two feet of ore could be sorted from each bed. However, the greater part of the manganeseiferous chert was too siliceous to be of marketable value without concentration by the removal of the siliceous gangue.

The failure to produce a large tonnage of manganese ore from this deposit can be accounted for by (1) the nature of the occurrence, (2) the limited amount of commercial ore per foot of drift, (3) the problem of sorting.

PLATINUM METALS

W. C. Knight, (1901) announced the occurrence of platinum in the copper ore of the Rambler Mine of the Douglas Creek District. Wells and Penfield (1902) reported that the platinum occurred as well-defined crystals of sperrylite (arsenide of platinum) in association with covellite and pyrite. Emmons, (1903) and Kemp, (1904) describe the occurrence of the platinum-bearing ore and point out the fact that the ore body is associated with a hornblende-biotite-diorite. Emmons thought it probable that the sperrylite was an original constituent of the sulphide ore. He states however, that, "More definite knowledge as to its manner of occurrence will probably be obtained when the deposit has been opened at greater depths and beyond the reach of surface alterations". Ores sold from the Rambler Mine carried several ounces per ton of platinum and palladium.

Hess (1926) reported on the occurrence of platinum near Centennial. The following information is taken from Hess' report. A small mass of sulphides or arsenides found about 100 feet from the middle tunnel of the Empire No. 1 claim was assayed in 1923 and reported to carry platinum. Startling claims made as to the value and extent of the ore led to a mild boom during the winter of 1923-24. Three assays of specimens believed to have come from sulphide or arsenide masses encountered in the Empire tunnel showed the presence of the platinum metals in considerable amounts. Samples of the chlorite schist which surrounded the sulphide mass assayed only a small fraction of an ounce per ton in platinum metals. Hess concludes that:

"Platinum metals, in very small quantities, are undoubtedly present on Centennial Ridge. At some places there may be larger masses of rich ore than the small pockets found in the middle Schaitaler tunnel, but the writer believes the chances for such discoveries are too few to warrant the expenditure of money, time and labor."

The Wyoming Platinum and Gold Mining Syndicate carried on extensive operations in the Centennial District. Up to and including 1930 this company had driven 1253 feet of adits and sunk a 160-foot shaft.

There is no record of any commercial production of platinum from the

There is no record of any commercial production of platinum from the Centennial District.

MAGNESIUM

The Rock Creek Lakes

Magnesium in the form of hydrous magnesium sulphate ($MgSO_4 \cdot 7H_2O$) occurs in considerable quantity as a saline lake deposit in the larger of the Rock Creek Lakes (Brooklyn Lake). These lakes are located 13 miles north of Rock River in sections 20, 21, 28, 29, and 33, T. 23 N., R. 76 W. Brooklyn Lake covers an area of 116 acres in the SW 1/4 sec. 28 and the NW 1/4 sec. 33. The Rock Creek Lake deposits have been described by Ricketts (1888), Knight and Slosson (1901), W. C. Knight (1903) and S. H. Knight (1939).

S. H. Knight (1939) reports on the basis of investigations made in 1933 that the character and extent of the Brooklyn Lake deposits were as follows:

Summary of the Brooklyn Lake Salt Deposits

<u>Mirabilite</u>	<u>Approximate tonnage of surface deposit</u>	<u>Approximate tonnage in black mud</u>	<u>Approximate total tonnage of salt</u>
($Na_2SO_4 \cdot 10H_2O$)	1,500	100,000	101,500
<u>Epsomite</u>			
($Mg SO_4 \cdot 7H_2O$)	25,000	150,000	175,000

175,000 tons of Epsomite ($MgSO_4 \cdot 7H_2O$) would yield approximately 17,000 tons of magnesium metal.

Whether or not such a limited tonnage of magnesium would be economically recovered from this deposit is a problem for the industrial or chemical engineer.

For additional information on the Rock Creek Lake deposits see S. H. Knight's report of 1939 a copy of which is appended to this report.

Other possible Sources of Magnesium

Recent technological investigations indicate that magnesium may be recovered from dolomite. Whether or not there are any deposits of dolo-

nite in Albany County that are rich enough in magnesium to be a possible source of this metal is not known. Deposits of dolomite and marble occur in a number of localities in the pre-Cambrian rocks of the Laramie and Medicine Bow Mountains. So far as is known no chemical analyses of these occurrences have been made. The deposits will have to be systematically sampled and analyzed before their magnesium content is known.

Limestones of Pennsylvanian and Permian age outcrop extensively along the west flank of the Laramie Mountain. Little is known of chemical composition of these limestones. Some of them are known to be nearly pure limestone.

TITANIFEROUS MAGNETITE DEPOSITS

The titaniferous magnetite deposits of the Laramie Mountain have been described by Hayden (1870), Zirkel (1876), Hague (1878), King (1878), W. C. Knight (1893), Kemp (1905), Lindgren (1902), Ball (1907), Singewald (1913), Diemer (1941) and others.

Diemer (1941) describes 18 occurrences in Tps. 18, 19, 20, and 21 north, Rs. 71 and 72 west. The chief occurrences are (1) Iron Mountain Deposit (2) Shanton Deposit and (3) Taylor Deposit.

The Iron Mountain Deposit

The most detailed description of this deposit is given by Diemer (1941). The following facts have been taken from the Diemer report, a copy of which accompanies this report.

This deposit is a dike-like mass located in secs. 22, 23, 26, and 27, T. 19 N., R. 71 W. It varies in width from 50 to 250 feet and extends in a north-south direction for nearly a mile. The dike is a granular aggregate of magnetite, ilmenite, and intergrown magnetite-ilmenite. Small amounts of spinel, alivine, and limonite are present. The dike is intruded into massive anorthosite. Associated with the main dike are several minor dike-like masses. Diemer estimates that there are 43,936,000 tons of ore in the main Iron Mountain dike from the surface down to the elevation of Chugwater Creek. Fourteen reported analyses show the average iron titanium content of the ore as follows:

Metallic iron (Fe)-----	51.3%
Titanium oxide (TiO ₂)-----	22.7%

Vanadium oxide (V₂O₃) has been determined in five analyses. The average of these five determinations shows V₂O₃ present to the extent of 0.39%.

The Shanton Deposit

This deposit is located in the NE 1/4 SW 1/4 sec. 8, T. 18 R. 71

W. The magnetite-ilmenite is identical with that at Iron Mountain except that no olivine is visible in hand specimens. An analyses of a sample from this occurrence gave the following results:

V_2O_3	TiO_2	Fe	P_2O_5
0.53%	25%	51%	0.0%

According to Diemer's computation this deposit contains approximately 11,890 tons of ore per foot of depth.

Diemer lists and describes briefly some 16 additional occurrences which are less extensive in character than the Iron Mountain and Shanton deposits.

Possible Economic Value of Titaniferous Magnetite

Imports of ilmenite for consumption in the United States in 1939 were 513, 152, 770 pounds. The bulk was imported from British India and consumed in the manufacture of titanium pigments. The pigments are used in paints, paper, soap, linoleum, artificial silk, rubber and ink. Titanium tetrachloride used in making smoke clouds to cover war movements is now made from ilmenite. Ferrotitanium is used to deoxidize steel and to make closer-grained cast iron. Kennametal, a tungsten-titanium carbide, is a new ultra-hard carbide used in cutting tools, valve seats, and other wearing surfaces. According to Hess and Gillson (1937), titanium can be used in making high-speed steel in which titanium replaces vanadium.

If the technique of making pure white titanium oxide from titaniferous magnetite has been or can be solved then these ores may become a valuable source of titanium.

Vanadium is one of the principal alloying elements in the making of steel. Although the extraction of vanadium from ilmenite is technically possible, it has been obtained more cheaply from other sources. Should the demand for vanadium exceed production from other sources then ilmenite may have value as a source of this element.

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