CHAPTER III - GILSONITE

Gilsonite is a black, pitch-like substance which occurs in pure form in large veins in the Tertiary sediments of the Uinta Basin. It is a homogenous petroleum substance (technically it is a predominantly aromatic asphaltite) which fuses relatively easily and burns like tar. Gilsonite is brittle and has a distinctive conchoidal to hackly fracture. Fresh gilsonite has a brilliant black luster, but weathered gilsonite and some of the more refractory varieties have a dull, soot-black appearance. Gilsonite has a specific gravity of 1.07, just slightly denser than water, and a hardness of 2 to 2.5 on Moh's Scale. Gilsonite is soluble in asphalt-based petroleum, and is frequently employed to change the consistency of lighter petroleum products. Finely pulverized gilsonite is chocolate brown in color and exceedingly penetrating to the skin and lungs.

Gilsonite is a bitumen and approximates the composition of an asphalt-based petroleum, with most of the volatile constituents missing. It should not be confused with the other natural solid hydrocarbons which are found in veinlets in the eastern Uinta Basin, which are pyro-bitumens for the most part. A typical analysis of gilsonite is given by Eldridge (1896):

<table>
<thead>
<tr>
<th>Element</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td>38.30%</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>9.96%</td>
</tr>
<tr>
<td>Sulphur</td>
<td>1.32%</td>
</tr>
<tr>
<td>Ash</td>
<td>.4%</td>
</tr>
<tr>
<td>Oxygen</td>
<td>16.8%</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>.32%</td>
</tr>
</tbody>
</table>

On the other hand, a chromatographic analysis of liquid gilsonite (Hunt, et al., 1954) shows:

- Paraffins and naphthenes 13% (by weight)
- Aromatics US. %
- Oxygen, sulphur, and oxygen compounds

When gilsonite is heated to 250° F. or higher (up to 500° F. for the more refractory varieties), it melts and liberates some volatile constituents. It can be heat refined to produce high octane gasoline, motor oil and other petroleum products, leaving a residue of pure carbon coke.

In mining and marketing gilsonite two grades of ore are distinguished. “Selects,” or massic conchoidal gilsonite, usually contain more volatile substances and have a lower melting point. “Seconds” or fractured gilsonite contain considerably less volatiles, and have a higher melting point. The origin of the two types is discussed below.

Gilsonite Veins

Gilsonite occurs in long, thin, nearly vertical veins, most of which trend N 35-65° W in essentially horizontal beds of Tertiary age. These unusual veins are found in an area 60 miles east-west by 22 miles north-south in the Uinta Basin, and apparently originate from the underlying oil shale beds of the Green River formation (Hunt,
Gilsonite is soft and brittle, and melts at 250-450 degrees Fahrenheit. When exposed to light and atmospheric conditions, gilsonite will become dull and develop minute cracks, gradually breaking down to become "seconds," or more hackly, refractory gilsonite. (specimen courtesy of G. E. and J. Untermann.)

![Figure 6. Specimen of "select" gilsonite showing the distinctive conchoidal fractures and vitreous luster. Gilsonite is soft and brittle, and melts at 250-450 degrees Fahrenheit. When exposed to light and atmospheric conditions, gilsonite will become dull and develop minute cracks, gradually breaking down to become "seconds," or more hackly, refractory gilsonite. (specimen courtesy of G. E. and J. Untermann.)](image)

Where early miners have exposed the gilsonite veins by pits or shafts, the conspicuous black spoil is easily traced from point to point along a vein. In virgin areas a vein may be indicated by pieces of gilsonite float in the soil and in anthills, or in heavy vegetation areas by the characteristic strips of sparse vegetation that mark veins of gilsonite. Until a pit is dug on a vein, little can be learned about its width, and even then little is learned about the quality of the ore, since characteristically gilsonite "slacks" loses volatile constituents when exposed to air, sunlight, or water near the surface. Many veins were discovered at points where streams and ravines cut the veins, and this is still a useful method of tracing a vein in the area.

Gilsonite Ore

Early mining methods consisted of trenching along in the soft Gilsonite Ore

mm
Gilsonite float is very light and may wash far down hill from an outcropping vein.

Weathered gilsonite vein near the surface has a typical "pencilled" fracture structure. This ore generally has a higher melt point and is called "seconds".

Most veins thin gradually upward until they thin to extinction in the upper Uinta or Duchesne River formations.

The unweathered massive gilsonite generally has a lower melt point and is called "select".

Sandstone walls of a vein are very firm; and in clean contact; with the gilsonite, with very little penetration.

Uinta formation
Green River formation

Debris tends to collect at the bottom of a vein where it begins to split upon entering the shale beds, making clean mining at this level difficult.

Typical gilsonite vein reaches its maximum width in the vicinity of the Uinta-Green River formational contact.

Most veins have their "roots" in the oil-shale beds of the Green River formation. A few veins extend downward into the underlying Wasatch formation.

Gilsonite dust created an explosion hazard in the mines, and many disastrous explosions and fires occurred in the early mines. Until recently mining was carried on by primitive, high cost methods, but in 1954, experiments were begun with mechanized water jet mining on the Cowboy vein, and mechanized cutters have been employed in some of the other large veins. Much of the "select" ore is still bagged for shipment to buyers, bringing roughly $47 per ton in 100 pound bags F.O.B. mines.

The select contains more volatiles and historically had a higher value, being utilized in paint and varnish bases and other high cost uses. Seconds were originally literally rejects, being used only for low cost purposes, such as paving, certain insulations, etc. Most fines, regardless of melting point, used to be marketed as seconds because buyers refused to pay premium prices for mineral that was not obviously "select" and unmixed. High-melt-point ore from the Utah vein is marketed as "jet" in defiance of the tradition, and these premium prices despite its high melting point. Instances are recorded where miners remelted "seconds" to obtain bright, fresh looking lumps of gilsonite which resembled "select" ore, but buyers soon discovered that the ore still had a high melt point, and was unsuitable for their uses.

Seconds are apparently select ore which has lost many of the volatiles found in the fresh gilsonite. Often this is due to exposure to atmosphere and heat from the sun at surface outcrops and at shallow depths, and the veins were stope-mined to either side of the vein. The smooth, unbroken sandstone walls of the veins required only occasional support and wooden stulls were used. Mining was by hand methods using a pick and sacking the broken gilsonite in 200 pound bags for shipment. The highly combustable gilsonite dust created an explosion hazard in the mines, and many disastrous explosions and fires occurred in the early mines. Until recently mining was carried on by primitive, high cost methods, but in 1954, experiments were begun with mechanized water jet mining on the Cowboy vein, and mechanized cutters have been employed in some of the other large veins. Much of the "select" ore is still bagged for shipment to buyers, bringing roughly $47 per ton in 100 pound bags F.O.B. mines.

The June 1961 quotation for gilsonite from American Gilsonite was:

Select ore, 1/4-3/4 inch lumps, $47/ton in 100 lb.-multi-wall paper bags,
Select ore, 1/4-3/4 inch lumps, $43/ton in bulk loads,
Seconds ore, $43/ton in 100 lb.-multi-wall paper bags,
Pulverized ore (all -40 mesh, 50% -200 mesh) $57/ton in special 100 lb. bags.

Volatiles at some time subsequent to emplacement and became "founds."

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Historical Background of Gilsonite

As early as 1865 specimens of "an unusual variety of asphaltum" from "central Colorado" found their way into mineral collections in the Eastern colleges (Remington, 1959), but the first recorded discovery of gilsonite from the Uinta Basin came in 1869. A blacksmith at the White rock Indian Agency near Ft. Duchesne tried to burn some gilsonite from a nearby vein in his forge, mistaking it for coal. When the gilsonite was thrown into the forge it burned hot, giving off a heavy black smoke and a strong petroleum odor, and ran flaming from the forge, nearly burning down the blacksmith shop (Remington, 1959: P. 32).

In 1885 the substance was classified and named "Uintaite" by Professor Wm. P. Blake. However, in 1886 Samuel H. Gilson began to prospect the area and was successful in promoting a market for the new mineral, and a new name, "Gilsonite", was adopted in his honor: by the people who later came to mine and market the mineral. At first gilsonite was merely a local name, later a trade name for the marketed substance, and finally it became the accepted technical name for this unusual mineral.

The first gilsonite veins to be discovered were the Raven and Carbon veins, near Ft. Duchesne in 1869-1888. The Parriette, Baxter, and Castle Peak veins in Duchesne County were discovered soon after. In 1887 the Cowboy-Bonanza vein system was discovered by cowboys near the Uinta Indian Reserve. The Pariette, Baxter, and Rainbow system of veins became known, although the Black Dragon vein was known earlier. At an even later date the Willow Creek and lower White River gilsonite fields were discovered, and these last veins are still relatively unexplored today.

As the many early discoveries of gilsonite became known, it was recognized that practically every vein of gilsonite in the basin lay within one of two Indian reservations, and hence the deposits were not open to acquisition and mining under the Federal Mining Laws. Nevertheless, excited prospectors poured onto the Indian reservations in wholesale trespass, locating "claims" as though no prohibition existed. From 1886 until 1903 a running war was waged between the trespassing prospectors and the patrolling Indian agents. Claim markers were destroyed and discovery pits filled, only to be secretly restored at a later time by the resourceful miners. Indeed, some of the more active prospectors did double duty, serving at times as patrollers for the Indian tribes, keeping out their competitors (Remington, 1959).

Following a long period of no publications on gilsonite, Crawford (1949) wrote a comprehensive discussion of the gilsonite deposits as part of a publication on the Oil and Gas Possibilities of Utah. Much of the article is devoted to a discussion of the origin of gilsonite based on earlier works and Crawford's own original observations as a gilsonite mine operator.

The most recent important publication on the geology of gilsonite is by Hunt and others (Hunt, et al., 1954). Based on rapidly evolving theories in support of the non-marine origins of oil in the Uinta Basin, the hypotheses stated by exhaustive field and laboratory studies, this article authoritatively demonstrates that the gilsonite is throughout the Uinta Basin, as well as other solid hydrocarbons, "ignited from the rich oil shale beds of the Tertiary Green River formation."

One recent work on gilsonite is not a geological treatise, but Vertheless deserves prominent mention in this section. Remington (1959), in an unpublished Master's thesis for the History Department, University of Utah, has compiled an up-to-date factual account of
Isonite mining and historical background that is without equal. 
lag the old records of the Gilson Asphaltum Company, and assisted 
personnel from the American Gilsonite Company. Remington col-
jected a great many facts, figures, names, and dates that have been 
great aid to this writer in compiling the chapter on gilsonite.

Other short articles on gilsonite and reference to hydrocarbon 
sposit s in the Uinta Basin are listed in the bibliography.

DESCRIPTION OF THE DEPOSITS

The gilsonite vein systems in the Uinta Basin can be classi-
cied into six distinct geographical units. Veins within a given unit 
also closely relate in geological environment and stage of dev-
lopment. Interrelationships between the six units discussed below 
are largely inferential due to early legal restrictions which have 
souraged new exploration in areas where gilsonite was not known 
ior to 1903. (See Plate V, beginning on page 4.0.)

Ft. Duchesne Area

This is the locality where the first reports of gilsonite or-
lated in 1869. Only two gilsonite veins, the Carbon and the 
, are found in this area. Both veins are presently idle after 
long history of production.

The Carbon vein, discovered in 1869, was also the first to be 
3led, in about 1888, by Sam Gilson. The old St. Louis mine, north 
of Gusher, Utah, is in SE-4 section 18, T. 2 S., R. 2 E., Uintah 
Ijipial Meridian. The vein passes under U. S. Highway 40 a short 
mlue southeast of the mine workings. Eldridge (1896) described 
vein in detail (mistakenly calling it the Duchesne vein). The 
also known as the St. Louis vein.

The Carbon vein trends N 40° W over a distance of 3 miles or 
. Its maximum width of 3-4 feet occurs near the middle of the 
and is maintained for a length of about 1-2 miles, diminishing 
ithin the extremity of the vein. Transverse faults with a throw 
.5 less than 8 inches cut the vein at places, and fragments of wall 
ave been found in the vein, completely enclosed and suspended 
ilesonite. The walls of the vein are well defined, showing little 
impregnation of gilsonite into the sandstone wallrock (Eldridge, 
). The gilsonite ore in this vein is of the highest quality except 
the surface. Workings reach a depth of 660 feet (Douglass, 1928) 
de. Ore from the Carbon vein sold for $120 per ton in 1889, and 
the vein produced 68,407 tons at $20.47 per ton (Murray, 1950).

Isonite crops out in the Duchesne River formation (Oligocene), and 
ng a deep narrow cut in the earth traceable for hundreds of 

the Raven vein, known also as the Duchesne vein, was apparently 
to Eldridge in 1896, although it occurs partially within the 
d Duchesne Military Reservation. It may have been gilsonite 
this vein that caused the legendary fire in the blacksmith shop 
9. This vein trends N37° W, averaging 18 to 24 inches wide. 
 worked mainly by the Raven Mining Company from 1904 to 1939, 
now idle. This vein contains a total of 14 shafts ranging
rom 100 to 700 feet deep. Indicated reserves are 1,231,000 tons to depth of 1,500 feet with inferred reserves of double that amount to a depth of 3,000 feet (Remington, 1959). The vein terminates under alluvial deposits in the bed of Uintah River near the NE\(\_\)E, section 15, T. 2 S., R. 1 E., Uintah Special Meridian. It is traceable upon the surface for approximately 3 miles. Gilsonite ore from this vein was of good quality, classified mainly as "selects".

**Pariette Area**

The Pariette area has a long history of gilsonite production, and is often looked upon as a maverick among gilsonite deposits in the Uinta Basin. In many respects the Pariette and Castle Peak veins defy the orderly pattern of the gilsonite veins to the east.

The Pariette vein, located 8 miles south of Myton, Duchesne County, Utah, is an historical landmark in this region. Discovered in rocks of the Uinta formation (upper Eocene), this vein was first mined in 1890. Federal authorities surveying the boundary of the Uncompahgre Indian Reservation were persuaded to shift the boundary line a mile or more to the east to permit part of this vein to be legally owned by white men. In 1896, Eldridge (p. 932) stated that the Pariette vein was the only workable vein in the area, and this with difficulty.

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The Pariette vein is broken at intervals by short transverse veins, with horizontal offsets of 1 to 6 feet, moving each gauge toward the west, en echelon. The vein does not appear to be piously affected by these faults. Lateral veins up to 16 inches wide occur within a fractured zone 250 feet wide, mostly east of the Pariette vein (Eldridge, 1901). The Pariette vein is owned by the Standard Gilsonite Company of Salt Lake City, Utah, and had produced an estimated 110,580 tons of gilsonite by the end of 1952 (Remington, 1959).

The Castle Peak vein, also called the Seaboldt or Baxter vein, a southeast extension, is a small, offset somewhat, of the Pariette vein. It is discovered in about 1887 on the Uncompahgre Indian Reservation (Remington, 1956, p. 74). The Castle Peak vein lies about 100 feet to the southeast of the Pariette vein, striking S35°E for a distance of 7 miles to the southeast. The Castle Peak vein is about 12 to 16 feet wide at the northern end, and splits into two veins 12 to 16 feet apart at the southern end (Eldridge, 1896, p. 933). The ore is similar in many respects to ore from the Pariette mine.
In 1949 the vein had been mined to a depth of 1200 feet. The ore on the 1200 foot level is considered to be a better grade than ore found at higher levels. Some ore was so soft it could be wound on a stick like soft tar (Carey and Roberts, 1949). The mine is owned by G. S. Ziegler of Great Neck, New York, and is still in operation.

The Baxter vein, or "Dalton area," also called the January vein, is actually a broken area of gilsonite veins and veinlets in the region where the Pariette and Castle Peak veins meet. It is owned by the American Gilsonite Company and held in reserve (Remington, 1959).

The April vein, located 2 miles northeast of the Pariette mine, runs parallel to the strike of the Pariette vein for about 3000 feet. At the 240' level it is 42 inches wide (Lawrence Wall and James R. Hall, personal communication).

Cowboy-Bonanza Area

The discovery of gilsonite veins in eastern Uintah County in 1887 by cowboys on the Uncompahgre Indian Reservation quickly led to the exploration of the 9 or 10 large veins in this area. The Cowboy vein, the largest of the gilsonite deposits, and the other large veins in the area have supported large scale mining operations continuously since the turn of the century.

The Cowboy vein, the northernmost large vein in the Cowboy-Bonanza system, reaches a maximum width of 22 feet and runs for over 13 miles. The vein begins on the north wall of the White River canyon, near the Utah-Colorado state line, and trends N60°-65°W with a dip ranging from vertical to 87° N. At the Bandanna Mine, section 17, T. 9 S., R. 25 E., the vein is 17' wide in the lower Uinta formation. The vein seems to have roots below the Mahogany oil shales, deeper than the other veins in the area and widens rapidly in the upper Green River sandstones (Eocene), narrowing again in the overlying Uinta formation, until it pinches out in the upper Uinta beds (Douglass, 1928, p. 16).

Ore from this vein is classed as "seconds," with a melt point of 350° F. (Hendricks, 1943). The ore is pencilled and fractures easily. Since 1936 the Eureka mine has utilized the highly successful ful hydraulic jetting method. The gilsonite is reduced to minus 1/8 inch chips for transportation as a slurry mixture with water via a 72-mile long, 6-inch diameter pipeline to the gasoline and carbon coke producing refinery at Gilsonite, Colorado, at a rate of 325-35 gallons per minute. The Cowboy ore is uniquely suited to this type of mining and transportation, and since it is too refractory for higher uses, such as varnish or paint base, the operation is considered highly successful (Remington, 1959). Douglass (1928) estimate ore reserves of 8,763,750 tons. Since 1928 the vein has been traceable nearly 4 miles southwest, the lower 500 to 600 feet of the vein is broken and irregular, in places filled with sandstone debris making recovery impossible.

The "E. B." vein is a 5 to 6 foot wide vein which parallels the western part of the Cowboy vein approximately 100 feet to the north. Its width is nearly 1 foot. Craig (1943) and the ore is of a very high quality, being presently used as a rubber substitute in industry. Total length of this vein is about 4 miles.

The Tabor vein, which branches to the west to form the Bonanza and Little Bonanza veins, strikes N 56° W for a length of 3 miles and is 10 to 14 feet wide. The vein has its roots in the upper oil shales of the Green River formation and extends upward to within 100 feet of the top of the Uinta formation. Like the other veins in the area, it is widest in the lower Uintah formation (Douglass, 1928). The gilsonite exposed on the surface of the vein is deeply weathered, and is of a very high quality.

The Bonanza vein, also known as the Independent vein, is the southern branch of the Tabor vein west of the point where the Tabor vein splits. Striking N 61° W, this vein runs nearly 7 miles and is at its maximum width of 14 feet near where State Highway 45 crosses the vein. The Bonanza vein had not been fully explored in 1928 when Douglass made his report, but was estimated to be 993 feet deep. Near the northwest end of the vein (in section 16) the ore is very soft, forming tarry balls when heated by the sun. It is thought that the Bonanza and Little Bonanza veins join at depth (Douglass, 1928). The "E. B." vein is 6 feet wide near the junction of the Little Bonanza vein, is 6 feet wide some 2 miles to the northwest, and decreases to 7 or 8 feet wide 3 miles from the junction.

The Little Bonanza vein is the southern branch of the Tabor vein. Until recently it was the most important vein in the area. The vein averages 9 feet or more wide for a distance of nearly 6 miles. At its western end the vein measures 4' wide and begins to branch. The eastern end of the vein measures 7 feet wide and varies little with depth. The ore is mixed, with "seconds" occurring as lenses in the pencilled "seconds" ore even to great depth. The temperature of ore from the Little Bonanza vein, to the northwest, produced large amounts of ore from 398° to 408° F. (Hendricks, 1943). The ore is of a very high quality, being presently used as a rubber substitute in industry. Total length of this vein is about 4 miles.

The Chapita and Little Chapita veins occur parallel to, and about 1 mile south of, the Tabor vein. The Little Chapita is "ly a few hundred feet southwest of the Tabor, while the Chapita vein is about 1 mile southwest of the Tabor. Approximately midway between the Chapita and Little Chapita veins is a third unnamed vein, about 1/8 mile long is known as the Bonanza Mine. Both open-pit and underground mining are carried on at this mine. The Little Chapita vein, to the northeast, produced large amounts of ore from 398° to 408° F. (Hendricks, 1943).

The Chapita vein is 34 feet wide at its western end and varies little with depth. The width of the vein increases slightly to about 4 miles. At its western end the vein measures 4' wide and begins to branch. The eastern end of the vein measures 7 feet wide and varies little with depth. The ore is mixed, with "seconds" occurring as lenses in the pencilled "seconds" ore even to great depth. The temperature of ore from the Little Chapita vein, to the northwest, produced large amounts of ore from 398° to 408° F. (Hendricks, 1943). The melt point of ore from the Little Chapita vein is 290° to 300° F. (Hendricks, 1943).
The Wagon Hound, Weaver and Colorado veins are, in all probability, the same vein with different names in different areas. The Wagon Hound vein is located about 1/2 miles south of the Little Bonanza vein. It strikes N65°W and can be traced northward from the flanks on the White River for a distance of about 5 miles. The latest width is over 3 feet, near the western end. The vein has a root 63 feet into the Green River oil shales, where it splits into smaller veinlets (Douglass, 1928).

The Weaver vein strikes N61°-65°W, on line with the Wagon Hound vein, and runs southeast from a point near the White River. Near it crosses the state boundary and enters Colorado where the vein is called the Colorado and Black Diamond vein. Because it lay in Colorado outside the Uncompahgre Indian Reservation, this vein was one of the earliest to be mined in the Basin, in about 1890. The vein is reported by Douglass to be over 1000 feet deep, extending 300 feet to the Wasatch formation. It measures 3 feet wide near the Colorado state line and runs 6 miles to the southeast, eventually thinning to 6 inches wide. The vein has been worked to depths of 100 to 300 feet contains pencilled, or "seconds" ore. The vein was abandoned in 1909 (Douglass, 1928; Cashion, 1956). No measurements on the Weaver vein are available, but the ore is reported to be "select".

The Uinta vein, also known as the Little Emma, is located less than a mile south of the Wagon Hound vein. It strikes N65°W for a total distance of 5 miles, beginning in the bluffs of the White River near the bridge on State Highway 45. The vein has a maximum of 24 inches (Cashion, 1956) and increases slightly with depth. Little Emma mine was opened in 1920 and by 1928 had reached a depth of 752 feet, where the width of the vein had increased by 6 inches. The estimated maximum depth of this vein is 750 to 800 feet (Douglass, 1928). The ore from this vein is considered as better than "select", and is presently used to undercoat the interiors of automobile bodies (Baker, personal communication).

Rainbow-Watson Area

This great area of gilsonite veins is not as actively mined as it has been in the past. From 1904 to 1936 the eastern part of this area was served by the famed Uintah Railway, and the great bulk of gilsonite production came from veins in this area. Since 1936 the effort has shifted to the Cowboy-Bonanza area, and the mines in the Rainbow-Watson area are idle.

The Pride-of-the-West, Rainbow and Black Dragon veins are all of the same vein system which can be traced without interruption for over 19 miles. It is the longest vein in the Uinta Basin and certainly the most important vein south of the White River. The southeast segment of the vein strikes N65°W and is known as the Pride-of-the-West vein. The northwest segment strikes N63°W and is known as the Rainbow vein. The Pride-of-the-West vein is the name for the eastern end of the Pride-of-the-West vein, in the vicinity of the Rainbow mine. The Pride-of-the-West vein intersect, forming an obtuse angle with short extensions along on for a short distance past the intersection. This intersection is a convenient boundary between the Pride-of-the-West and Rainbow veins.
The Black Dragon vein was known prior to 1896, and had been considerably prospected near its southern (eastern) end when Eldridge (1896) reported on the area. At that time the southern end was reported to measure 4 feet 5 inches wide, with the vein walls impregnated with asphalt 1 to 3 feet from the vein. The vein in this area is very pocketed and splits into two closely spaced parallel veins in the middle Green River oil shales, but does not extend upward through the upper Green River oil shales. In this respect it is the deepest vein in the basin, and would appear to underlie the Rainbow vein without any vertical connection between the veins (Douglass, 1928, p. 94). Eldridge (1896, p. 937) observed two 18-inch wide zones of gilsonite-impregnated sandstone passing upward from the bottom of the Black Dragon vein, and thus afford a possible connection, while the gilsonite was still fluid. Whether these zones pass upward into the Rainbow vein, and thus afford a possible connection, has not been determined. The northwest end of the Black Dragon vein is approximately where it crosses the Township 11-12 South line.

The Black Dragon vein is 1 to 5 feet wide, with an average depth of 677 feet. Pockets near the bottom of the vein measure up to 10 feet wide. There is much debris in the bottom parts of the vein and it is not considered workable in the lower Green River oil shales. Most of the ore is "selects", even as shallow as 75 feet below the surface. Seams of the ore have been spoiled by groundwater which slacked the ore and in places deposited calcite crystals in fracture in the gilsonite. The vein was first worked in 1903, but after 191 operations were limited to small leases (Douglass, 1928).

The Rainbow vein is eroded almost to its roots and bottoms of several hundred feet above the Black Dragon vein, approximately 20 feet from its contact. The Black Dragon vein continues westward beneath the Rainbow vein, as envisioned by Douglass (1928), is not known. The Rainbow vein is uniformly about 8 feet wide although it splits and divides in places. Most of the workable ore is very shallow, occurring in the upper Green River an lower Uinta formations. The maximum depth at the vein on the north west end is only 419 feet. At this depth the vein splits into four veins, then into smaller veins. The ore is mostly "selects", but contains parts with dull surfaces, causing much of it to be shipped as seconds (Douglass, 1928). In 1911 the Uintah Railroad was extended to the Rainbow vein and supplied five mines. In 1938 the Rainbow mine was closed, except for limited lease mining which continued into the 1950's. Watson, the camp that served the mines in this vicinity, is now abandoned (Remington, 1959).

The Pride-of-the-West vein is the western segment of the Black Dragon-Rainbow vein system. The historical boundary between the Pride-of-the-West and Rainbow veins is not certain, but a convenient bound, dating from 1900, where the two veins intersect in section 13, T. 11 S., R. 24 E. West of this point the vein strikes N6E/W for a distance of almost 14 miles. The vein measures 4 feet wide at the easter end, near the intersection, and gradually tapers to 3 feet 6 inches at Asphalt Creek and finally 18 inches wide at its western end near Bitter Creek. The vein is thought to be shallower than the Rainbow vein, having an estimated average depth of only 317 feet east of Asphalt Creek (Douglass, 1928). West of Asphalt Creek the vein is virtually unexplored. This was one of the last major veins to be discovered, around 1900, and has received little attention except near its eastern end, near the Brown Bear mine.

The Alabama and Rustler veins are two separate small veins in the area north of the Pride of the West-Rainbow vein. At least three other veins are known in this area, north of the Pride-of-the-West vein and south of the White River, in T. 10 S., R. 24 E., section 13 and 14, 23 and 24, and in 26 and 27, respectively. The Alabama vein lies parallel to and about 3/4th's of a mile north of the Pride-of-the-West vein. It has a reported length of 4 miles, gaging from less than a foot wide at either end to 18 inches wide at the midpoint of the vein. The Alabama vein crops out in the Jber Uinta formation. The ore looks fresh and rich and breaks into pecks instead of the typical conchoidal fracture (Douglass, 1928). The Rustler vein is only 12 miles long with a maximum surface width of 6 inches. It is located 1 1/2 miles northeast of the eastern end of the Pride-of-the-West vein. Both veins are parallel to the larger veins in the area.

The Harrison vein is the second largest vein in the area, striking N0° to 58° W for a total distance of 16 miles, and ranging 1 to 3 feet wide. Douglass (1928) reports that no select ore has been found in this vein. West of Asphalt Creek the vein has been 8 feet wide, but the ore was seconds. The ore splits into plates diagonal to the vein, and appears to be disturbed and broken, rather than polished. The southeastern end of the Harrison arc's to the southward. 41 departure from the general strike pattern of veins in the area Unexplained.

The South Harrison vein is actually two or more separate veins of the main Harrison vein. The northeast segment of the South Harrison vein is 2 miles long and 18 to 24 inches wide. Six miles to the northwest and on the same course are three separate segments of Harrison veins each as much or more long and a foot or two wide. Any one of these segments may be a continuation of the same vein or vein system. The northwest segment or vein is 6 1/2 miles long 1 and 1 to 3 feet wide. Lass (1928) remarks that the filling material in this vein does appear to be gilsonite, as it will float on water and differ greatly in appearance from typical gilsonite.

The Little Chief vein is one of several small veins southwest of the South Harrison veins about which very little is known. The vein is about a mile long and 12 to 18 inches wide. The Fox vein is 2 miles long and 12 inches wide. The Nigger Baby is 3 miles long and 18 inches wide. The Little Chief vein is 1 mile long and 12 inches wide. It is described as "open" by Douglass (1928). The Neal vein is about one mile long and 18 inches wide. The Jim vein, in T. 12 S., R. 23 E., is reported to be 1 mile long and 18 inches wide, but little else is known about it.

Lower White River-Ourai Area

The area west and south of the mouth of the White River, in vicinity of the Green River, is known to contain numerous moderate- to small sized veins of gilsonite. Owing to their late discovery he fact that most of the area has been closed to gilsonite mining deral order, available information is scarce and sometimes con-
Sheets 1 and 2

Map of the Gilsonite Veins
of Uintah County, Utah

Small numbers at intervals on the veins indicate the approximate width of the vein at that point, measured in feet.

Index of sheets to plate V
Small numbers at intervals on the veins indicate the approximate width of the vein at that point, measured in feet.
flicting. The following descriptions were pieced together from unpublished sources considered to be reliable.

The Pride of Utah vein, south of the White River, strikes generally N66°E for a distance of almost 11 miles, ranging in width from 5 feet at the Anthill mine in section 32, T. 9 S., R. 21 E. (Hall and Wall, personal communication) to 3 feet wide at the Black Gnat mine in section 16, T. 9 S., R. 20 E. The ore at the Black Gnat mine comes from six closely spaced veins ranging from 14 to 34 inches wide, and has a melt point of 325° F. Although the mine is shallow, nearby veins are mined to a depth of 1300 feet (Hendricks, 1943b).

The Jumbo vein is located 2 miles northeast of the Pride of Utah vein, and strikes N67°W. The length is reported to be about 5 miles, possibly longer to the southeast, with a width near the west end of 12 to 14 inches. Between the Jumbo and Pride of Utah veins several short veins were observed on aerial photographs, but, their commercial value is unknown.

South and west of the Black Gnat mine are numerous small veins. The Black Diamond mine, in section 36, T. 9 S., R. 19 E., is on three unnamed veins ranging in width from 14 to 22 inches wide, all occurring within a 200 foot wide zone (Hendricks, 1943b). The ore from this area is reported to be of poorer quality than the ore mined in the Bonanza or Rainbow areas (Hall and Wall, personal communication).

On the west side of the Green River, near Ouray, are several, small veins which may well be extensions of the veins observed near the Pride of Utah and Jumbo veins. All of the veins described below, are on patented mining claims within the old Uintah Indian Reservation.

The Little Jack vein, north of Ouray, on the east side of the Duchesne River, is less than 16 miles long and 8 to 10 inches wide. The strike is N70°W. Southwest of the mouth of the Duchesne River, overlooking the west bank of the Green River are eight additional small veins. The Canyon and Little Seam veins, both of which strike N55°W, may be the same vein. The Canyon vein is reported to be 18 inches wide. The Ouray vein, about 3000 feet long and 18 inches wide, strikes N65°W, and may be a branch of the Little Seam-Canyon vein. The Gem vein and the nearby Little Boy vein strike N43°W. The Little Boy vein is reported to measure 6 inches wide. The Green River, Cliff Dweller and Black Butte veins are three roughly parallel small veins located in the bluffs west of the Green River. All three veins strike approximately N56°W. These veins are no being mined, and there is no record of any production from them.

The Florence, O.K., and Original Owner veins are part of a complex vein system north of Parriette Draw and 8 miles west of Ouray. The Florence vein appears to strike N 76° W and intersect the original Owner vein, which strikes almost east-west. The O.K. vein parallels the Original Owner to the north, and is reported to measure 20 inches wide. These veins have been mined, but the total tonnage of gilsonite is reported to have been small. Two small vein are reported to strike N 55° W, apparently occurring as branches of the Florence mine. The Florence mine is based primarily upon the works of Baker (1959), Ingent (1959), and Carey and Roberts (1949).

Willow Creek Area

Three moderate sized veins occur near the junction of Willow Hill Creeks, and in the area to the east. Numerous smaller veins have been found in the area, but since the only permissible mining is by lease on state-owned lands, information is meager.

The Willow Creek or Wall vein strikes N60°W for a distance approximately 8 miles. It measures 30 inches wide at Willow Creek, where shallow pits expose the vein, to 24 inches wide in NW4 section 2, T. 10 S., R. 21 E. The Wall mine, in section 32, exposes a width of 15 inches.

The Cottonwood vein, sometimes known as the Black Prince vein, is 1£ miles north of the Wall vein and mine, and strikes N64°W for total length of almost 10 miles. Measurements at the “G.K.” mine in section 29, T. 10 S., R. 21 E., show the vein to average about 36 inches wide. It is considered the best vein in the area for mining (Wall and Hall, personal communication). The G. K. mine is now closed since it was a trespass on federal gilsonite lands which were withdrawn in 1910.

Near the eastern end of the Cottonwood vein, according to unconfirmed reports, is another large vein called the Red Rock vein, is reported to strike N48°W for an approximate distance of 5 miles, apparently branching from the Cottonwood vein.

Other small veins are reported in the area, and small scale mining from veins on Wild Horse Bench, west of Willow Creek is reported from several sources (Remington, 1959).

pCONOMIC VALUE OF THE GILSONITE DEPOSITS

The gilsonite deposits of the Uinta Basin, practically all of which lie within Uintah County, represent a major mineral resource of the United States. These deposits have been mined continuously since 1888, a period of 72 years, and yet the deposits have only been tapped. Estimates of gilsonite reserves in Uintah County range as high as 30,000,000 tons, and could go higher in the event of intensified exploration.

Mining and Technology

Early gilsonite mining practices in the Uinta Basin were primitive and hazardous, and transportation to distant railheads and smelters was costly. In those early days a vein was mined by trenching along the vein, with surface exposures to whatever depth was considered safe. When drifts were costly, and bad air dictated, mining switched to underground drifts, sinking shafts to shallow depths and drifting along the vein in convenient intervals, or constructing plank floors at frequent intervals to keep debris out of the mine. Actually the entire vein in the vicinity of a shaft was usually one big stope, the “drift pth this vein is shown on several maps of the gilsonite veins in the United States. For a confirmation of its exact length, width, etc., could be pined from the sources consulted. Whether such a vein actually Uts is doubtful.

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levels" being plank flooring over wooden stulls, leading to the working face of ore. Pillars of ore were left at intervals, for support, but between the pillars the mine depended upon the solid, firm sandstone walls, and a minimum of round-pole stulls were used to brace the walls. The working face of ore was inclined at 4.0°, and the ore fell or rolled by gravity to a lower level where it was collected in bins and trammed in small cars to the shaft for hoisting to the surface. The ore was broken by hand, using a pick and shovel, and cut a small trench along one vein wall. Internal stresses within the ore then caused the gilsonite to break into lumps and fall down the inclined face to the hauling level below. These practices are still followed today in a majority of the smaller mines, despite the primitiveness, because gilsonite mining is not easily mechanized.

The use of explosives in gilsonite mining is highly dangerous. Gilsonite dust is a very combustible substance, and will explode and turn itself to powder if exposed to an open flame. Early miners practiced exploding the dust intentionally before it accumulated in dangerous quantities, but many disastrous fires nevertheless resulted, fed by the gilsonite and wooden mine timbers. Melted gilsonite would solidify after fire, encasing men and machinery, and filling parts of the mine. Some gilsonite fires have been known to smolder for years, only to burst forth again. According to tests, gilsonite dust must contain 90 to 95% rock dust to render it safe from explosion (as compared with coal, which must contain only 60 to 65% rock dust). In detonating with dynamite, the dust tamping lining the mine face, 80% rock dust was used, but the practice was difficult to enforce. As a result, most gilsonite mines prohibit the use of any explosives underground (Carey and Roberts, 19-49).

Attempts to mechanize gilsonite mining, particularly at the mining face, present some unique problems. Gilsonite is somewhat rubbery, and dissolves in lubricating oils. Pneumatic jack hammers have been used to break the gilsonite ore, but they tend to heat up the ore and stick in it. Also, lubricating oils for the machine dissolver the gilsonite dust, fouling the mechanism. Rippers were also used, but the teeth would slide over the rounded conchoidal fracture surfaces, decreasing efficiency. Similarly, chain cutters were unsatisfactory. The ore fell or rolled by gravity to a lower level where it was collected in bins and trammed in small cars to the shaft for hoisting to the surface. The ore was broken by hand, using a pick and shovel, and cut a small trench along one vein wall. Internal stresses within the ore then caused the gilsonite to break into lumps and fall down the inclined face to the hauling level below. These practices are still followed today in a majority of the smaller mines, despite the primitiveness, because gilsonite mining is not easily mechanized.

The most rewarding attempt at mechanizing gilsonite mining is the Eureka mine on the mammoth Cowboy vein. It is called "jet-mining" and is actually a method of underground hydraulique mining. Water is jetted onto the face of gilsonite ore at 2000 to 2000 p.s.i. from a ½ inch nozzle, flowing 82 g.p.m. at a velocity of 500 f.p.s. The jet action breaks the brittle Cowboy ore into chips and lumps which are then ground down a grade to a central crushe and into a sump. The ore is crushed to minus 3/4 inch and pumped 800 feet to the surface, where it is reduced to minus 1/8 inch an where it still contains other impurities are removed. The ore, mixed with water to obtain a 40% by weight solids concentration, as this slurry is pumped at 325-350 g.p.m. via a 6-inch, 72-mile-lon pipeline to a $16,000,000 refinery at Gilsonite, Colorado. Here the ore, classified into "seconds," is treated to produce petroleum products and metallurgical grade coke (Baker, 1959; Remington, 1959).

Markets and Uses for Gilsonite

Most gilsonite sold to consumers is still classified according to its melting point of the crude ore, and is sold as lumps or fines. "Select" ore, having the lowest melt point, brings the best prices. It is characteristic.ly sold in lump form, it being too difficult to prevent blending the fines with "seconds" of poorer quality. Remelting the fines makes results in a loss of volatiles and is not practiced by most mine owners. "Seconds" ore has a higher melting point and generally breaks easily into small particles and dust. It cannot be used for as great a variety of purposes as "selects", and brings a lower price.

Gilsonite is used directly in its crude form, as insulation pipe, particularly hot pipes, as waterproofing and underlaying for wood and metals, and as paving, roofing and other uses. Gilsonite is also blended with crude asphalt. Gilsonite is also blended with refined produced asphalt and petroleum products to obtain certain desired characteristics. It is used in saturating felts and building-construction papers. Ore from the Pariette mine is sold as an additive that solidifies fluids to stop loss of circulation and as a light-weight agent to plug back wells and cement production liners in gas wells.

"Select" grade gilsonite will dissolve in all proportions in nitric acids, and makes an excellent base for paints, varnish, and an. It is blended to form acid and alkali resistant coatings, mastics for floor coverings. Gilsonite is used extensively as filler in rubber (up to 30%), asphalt tile, battery boxes, phonograph records and a variety of other products.

By far the greatest quantity of gilsonite is processed through the refinery at Gilsonite, Colorado, where it is heat refined to produce high octane gasoline (25%), gas (15%), metallurgical grade coke (50%) and other products. In this application, however, gilsonite is competing directly with cheap supplies of liquid petroleum from domestic and foreign sources.

Many historic uses and markets for gilsonite have been lost cap by-products of petroleum refineries. These petroleum by-products of petroleum are now considered wastes, produced tactically no additional cost, in localities more convenient to "atrl markets. While many gilsonite applications are still in competition with same cheap petroleum by-products. It is ironic, but not very (Waging, to note that this competition with cheap liquid petroleum gone full cycle with the production of gasoline and oil from d gilsonite.

"this early classification is giving way as modern research finds new markets for gilsonite. American Gilsonite Company markets its ore as pea-sized lumps, and the fines are not separated. "Is only a $3 per ton difference in the prices for "select" and "seconds" ore, and mixtures or blends are valuable, and many u.ized gilsonite brings the highest price per unit, but this diff erial is due to costs incurred in grinding and sacking the gilsonite. Future demand for gilsonite may well shift to the more re-ox grades to meet new market specifications.
Exploration and New Discoveries

Since 1910 very few new deposits of gilsonite have been discovered. Indeed, several known gilsonite veins remain unexplored both on the surface and underground, leading the observer to conclude that something basic is amiss in the gilsonite industry. The lack of exploration is not due to unproductive techniques or even to oversupply of gilsonite reserves.

Douglass (1928) observed that, at least in the Cowboy-Bonanza area, that the larger gilsonite veins characteristically pinch out above the Uinta and Duchesne River formation. The immediate inference is that veins outcropping in or above the up Uinta horizon ought to be explored to determine if they widen at depth to become commercially minable veins. Also, the possibility of buried veins beneath this same horizon would bear examining. That buried veins exist and can be found is evidenced by reports from seismograph crews, who find that the verticle homogenous veins interfere with seismic investigations—including areas where no veins we thought to exist. Other geophysical techniques such as gravity and resistivity surveys hold promise as useful tools in mapping new gilsonite areas in the Basin. Conventional rotary drilling on the sottary gilsonite in vertical veins is not usually rewarding. It difficult to determine widths at greater depths with conventional drills, although large diameter calyx drilling might prove worthwhile.

The principal deterrent to exploring for new gilsonite veins is not physical or technical, it is legal. The Act of March 3, 19 (32 Stat. 998) was an effort by Congress to open gilsonite mining the Federal gilsonite and Indian Reservations. The act mining claims located prior to 1891 would be legally recognized, and mineral driven on even numbered sections not covered by pre-1891 claims could be purchased. The President's Proclamation of June 6, 1906 (34 L. 648) set a deadline for purchasing available mineral tracts and a lands not disposed of by 1910 were thereafter reserved to the Uinta States. The Executive Order of January 21, 1926 (No. 4371) and Secretary of the Interior Decision A-21949 of July 10, 1940, confirmed that veins outcropping in or above the up Uinta horizon might be disregarded.

For several months after the passage of the act, it was not generally considered that "native asphalt, solid and semisolid bitumen, and bituminous rock (including oil-impregnated rock or sands from which oil is recoverable only by special treatment after the deposit is mined or quarried)" might refer to gilsonite. Inquiries to Washington confirmed that gilsonite is covered by the term "native asphalt", and, therefore, is leaseable under the new law. At this writing, there are leasing regulations in effect for gilsonite which would permit immediate mining, but presumably these will be drafted and released due time. It will be interesting to see the effects of this new availability of long dormant deposits.


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...native asphalt, solid and semisolid bitumen, and bituminous rock (including oil-impregnated rock or sands from which oil is recoverable only by special treatment after the deposit is mined or quarried)" Section 7 (a), at 74 Stat. 790.

While the writer was compiling the information for this chapter, Congress passed a new law which at long last reopens the federally-owned lands to gilsonite prospecting and mining. The Act of September 1960, (78 Stat. 781), entitled "An Act to amend the Mineral Leasing Act of February 25, 1920", contains in Section 7 an amendment which permits the leasing of:
THE MINERAL RESOURCES OF UINTAH COUNTY

by

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