INTRODUCTION

Central Uintah County, located in northeastern Utah, lies in the Uinta Basin and is underlain by relatively undisturbed Tertiary lacustrine and fluviatile sediments. The area (shown in Figure 63) discussed in this chapter contains all of the known gilsonite veins in the western United States and is the site of large bituminous deposits including oil shale, tar sands, gas, and oil. Nearby portions of the same basin contain smaller deposits of other unusual bituminous substances, such as wurtzilite, tabbyite, ingramite, albertite, and ozocerite, the last of which is a native paraffin (Crawford, 1949; Hunt, 1954).

Because of the detailed treatment given the oil shale, bituminous sandstones (tar sands), gas and oil deposits of the area by authors elsewhere in this volume, the major emphasis of this paper will be directed toward the gilsonite deposits, with only such reference to the other deposits as are needed to understand the interrelationships which exist among them.

Much of the material which comprises this paper is taken from the unpublished (Crawford, 1959) and published (Crawford, 1949; Pruitt, 1961) works of the authors, brought up to date and in places expanded.

GILSONITE

The mineral gilsonite is a solid amorphous asphaltic bitumen which occurs in distinct veins and veinlets in the Tertiary nonmarine sediments of the gently downwarped Uinta Basin. These veins are considered classic, continuing unbroken for miles and maintaining a relatively constant width for great distances both horizontally and vertically. Most of the veins are vertical and filled with pure, massive gilsonite, showing clean contact with the massive sandstone walls of the veins and little or no impregnation or saturation of the vein walls.

Fresh gilsonite has a brilliant black luster, concoidal fracture and a specific gravity of 1.07 (slightly denser than water). It is brittle and has a hardness of 2 on Moh's scale. Gilsonite oxidizes to a dull, soot-black appearance and takes on an uneven hackly fracture. Fresh gilsonite melts at temperatures as low as 230° F and dissolves in petroleum, giving it the valuable properties for which it is mined and used. Gilsonite has been used to saturate roofing and construction paper, as a base for paints and varnish, in mastics and asphalt tile, as a stiffener in petroleum products, as insulation and weatherproofing, and as a filler in rubber battery boxes and plastics. It is also used in mixtures for control of lost circulation in oil wells, in paving materials, light weight aggregates under special circumstances, and upon distillation gilsonite yields high octane gasoline, lubricating oils and leaves a residue of pure carbon "coke."

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Figure 63. Map of the gilsonite vein systems in central Uintah County. Contours from an unpublished report by Kunke1, et. al., (1959) are plotted on the depth to the oil shale source beds to indicate the probable depth of veins in any given area. The veins are roughly parallel, but several of the veins branch or bend gently. The remarkable straightness of the strike of the veins across the rolling terrain and canyons is due to the vertical dip of the veins.
Gilsonite veins occur as a filling in vertical tensional cracks in the competent sedimentary beds. These veins trend northwestward for miles across the rolling terrain and extend vertically downward until they reach the incompetent mudstones of the Uinta and the oil shales of the Green River formations. In the latter the veins "break up" into smaller branching veins and ultimately veinlets. At least two large veins (the Weaver-Colorado vein and the Black Dragon vein, Pruitt, 1961) are known to extend beneath the oil shale horizon into the underlying members. Hunt (1954) shows that the gilsonite of the region is derived from the upper Green River formation oil shales, flowing upward into open tensional cracks. These veins frequently reach widths of 3 to 4 feet and the Cowboy vein is over 17 feet wide at one point. The depth of any given segment of a vein appears to be related to the depth to the oil shale source beds (Figures 63 and 64). In the eastern part of the area the veins are relatively shallow, 600 to 800 feet in depth. In the western part of the area the veins have been mined to depths of 1,500 feet and many extend downward to 3,000 feet or more. Figure 63 shows the depth to the oil shale beds throughout the area and gives a general idea of relationship between gilsonite veins and the oil shale beds.

Unfortunately much of the gilsonite region is still unexplored due to a federal withdrawal of the deposits in 1910 which was only lifted in 1960. The sudden release of these deposits should do much to contribute to knowledge of the veins and the expansion of markets for gilsonite.

The known gilsonite veins occur in clusters or systems which are described briefly. A more detailed description is given by Pruitt (1961). It is likely that some of these systems will be found to interconnect and that veins will be discovered which do not reach the surface in areas where the oil shale source beds are deeply buried.

The Cowboy Bonanza system contains twelve named veins. Except for the Weaver-Colorado, the veins of this system are located north of the White River and west of the Colorado-Utah state line. This area is the location of the largest active gilsonite mines of the region, operated by the American Gilsonite Company and the G. S. Ziegler Company. The Cowboy vein is the largest of all known gilsonite veins, reaching a maximum width of 17.5 feet and a length of over 13 miles. The Bonanza vein is a branch of a larger vein complex whose total length is over 15 miles and whose maximum width is 13 feet. There are nine other named veins south of the Bonanza vein, several of which are currently being mined. The total length of gilsonite veins in this system having a width of 1 foot or more is 52 miles. Many of the veins on the eastern end of both systems are shallow since erosion near the White River has cut down to the oil shale source beds. Figure 64 shows a cut away view of the Cowboy-Bonanza vein system and their assumed relationship to the underlying beds.

Rainbow System

The large Rainbow system south of the White River and near the Colorado-Utah state line is presently idle, but once supported large scale mining operations.

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1. Gilsonite and asphalt deposits were made available by the Act of September 2, 1960 (30 U.S.C. 181, 182, 184) and regulations published July 4, 1962 permit competitive leasing of deposits (43 C.F.R. 203).
Figure 64. Block diagram of the gilsonite veins and oil shale beds in the Bonanza area, down White River to the northwest. The gilsonite veins bifurcate upon entering the oil shale source beds and are not minable in the oil shale zone. South (left) of the Cowboy vein is the Tabor vein, which branches to the west to form the Bonanza and Little Bonanza veins. Next (immediately to the left) are the Little Chapita vein, an unnamed vein, and the Chapita vein. Note that the Wagonhound vein is shown continuing below the oil shale into the upper Wasatch formation, based on the existence of the Weaver-Colorado vein along the strike of the Wagonhound vein, in the Wasatch formation farther to the east. It is possible that other gilsonite veins extend beneath the oil shale source beds.
The major vein of the system has three segments: from northwest to southeast the Pride-of-the-West, Rainbow, and Black Dragon. These segments together form the longest gilsonite vein known, totaling over 24 miles, with a maximum sustained width of 8 feet. The Black Dragon segment, the southeastern 4 1/2 miles, is beneath the oil shale zone and not known to be vertically connected to the rest of the vein, although it is precisely on the same strike and undoubtedly an extension of the same vein downward. This observation raises the possibility that other gilsonite veins may have a counterpart beneath the oil shales and if this is so it would multiply many fold the known gilsonite reserves.

There are at least 16 distinct veins in the Rainbow system and veins having a width of 1 foot or over total 72 miles in length. Depths of the veins vary from only 400 feet on the eastern end of the system to much deeper toward the west. The veins near the western end of the Rainbow system are largely unexplored and may extend westward to join with the relatively unexplored Ouray system of veins near the confluence of the Green and White Rivers.

**Willow Creek and Ouray Systems**

The area south of Ouray is relatively unexplored for gilsonite, but contains at least five moderately-sized gilsonite veins and a host of other veins whose dimensions are not yet fully known. Two systems may be involved (Figure 63), but it is difficult to recognize a distinct boundary between them. West of Ouray and northwest of the Green River, the old Florence Mining Company, before it promoted the old Uteland copper mill, patented under special act of Congress, a copper claim on which occur gilsonite veinlets. The adjacent Original Owner and O.K. patented claims, and isolated state-owned tracts southeast of the river, have been worked near the surface, intermittently; but information on the quantity and quality of gilsonite in this area is scarce. The largest three veins, the Pride-of-Utah, the Cottonwood, and the Willow Creek, about 10, 8, and 7 miles long, respectively, are southeast of the Green River. Their location and interrelationships are shown in Figure 63. It is very likely that some of the gilsonite veins on either side of the Green River in the vicinity of Ouray are interconnected. It is also possible that the veins immediately south of Ouray connect with the long veins of the Rainbow system to the southeast.

**Pariette System**

The Pariette and Castle Peak veins are the major features of this system, located south of Myton, Utah, in Duchesne County. The total length of these veins is 9 miles. Surface exposures of the veins are only 18 inches wide, but increase to over 40 inches at depths of 1,500 feet. The Pariette is the deepest gilsonite mine with the longest period of operation. It was closed from 1906 to 1932. This system represents the western extremity of the gilsonite deposits in Utah.

**Fort Duchesne**

Two prominent veins, the Carbon and the Raven, comprise this system, which is the northern extent of gilsonite deposits in the basin. One or the other of these veins have been in continuous operation from the late 1880's until about 1946. These veins measure up to 4 feet wide. Each vein is about 3 miles long. The Carbon vein crosses beneath U.S. highway 40 just east of the town of Gusher Utah.

Aside from the six named systems of gilsonite veins, other areas of small gilsonite veins are reported on Wild Horse Bench in T-10-S, R-19-E, near Red Wash in T-8-S, R-23-E, and near the head of Asphalt Canyon in T-12-S, R-24-E. Some
Figure 65. Map of the relationship of gilsonite to the gas- and oil-producing areas in the vicinity. Bearing in mind that oil shale underlies the whole area and that large bituminous sand deposits are found on the fringe of the area to the north and southwest, it is obvious that the Uinta Basin is an unusual locality of abundant bituminous resources. The shaded areas indicate gas (dots) and oil (lines) producing areas. Individual fields or wells cannot be shown accurately at this scale.
of these areas may become important as the region is opened to exploration and mining.

**GILSONITE MINING AND MARKETS**

Gilsonite is mined by various hand and mechanical methods, depending upon market specifications and characteristics of the individual veins. The fresh, unoxidized gilsonite is mined by hand or machine as lumps for use in insulation and coating products where its low melting point or high solubility in petroleum are important factors. Fresh gilsonite is massive and hard to break or cut mechanically, and so relatively high-cost hand methods are commonly employed to mine it. Most fresh gilsonite ore is sized and shipped in bags or in bulk directly to users with little additional preparation, bringing $43-$47 per ton, F.O.B. mine.

Oxidized gilsonite is more fractured and has a higher melt point. Its uses are different from those of the fresh, massive gilsonite, and it can be mined more easily by mechanical methods. The gilsonite ore of the Cowboy vein is of this class and is mined by hydraulic jet methods. This gilsonite ore breaks easily under the force of high pressure water jets and almost floats. It is conveyed to the surface, crushed, mixed in a slurry, and piped 72 miles to a refinery at Gilsonite, Colorado, and converted into gasoline, oil, and a high purity carbon char or coke. By far the largest quantity of gilsonite mined today is mined and treated in this manner by the American Gilsonite Company.

**OTHER BITUMINOUS RESOURCES**

**Oil Shale**

As discussed by Quigley and Price (Paper 21), the Uinta Basin is underlain by large deposits of rich oil shale in the Green River formation of Tertiary age. These oil shale beds crop out along the eastern edge of the area discussed in this chapter and dip gradually beneath central Uintah County, ultimately reaching depths in excess of 5,000 feet (Figures 63 and 65). The richest and thickest oil shales are found in what is assumed to have been the depositional trough of the Uinta Basin syncline which lies roughly along the course of the White River. Relatively rich deposits at or near the surface are located in T-9 and 10-S, R-25-E, near the old settlement of Watson, Utah, and in T-13-S, R-25-E on McCook Ridge. Some of these surface deposits are privately owned, whereas the deeper rich deposits are on federal or state-owned lands. All federal lands are closed to oil shale mining.

Oil shale is presumed to be the source of practically all of the abundant bituminous and petroleum deposits in Uintah County (Hunt, 1954, and Paper 24) and the recoverable shale oil reserves locked up in the deposits of eastern Uintah County are estimated to exceed 14.5 billion barrels (Cashion, 1956). Shales yielding over 45 gallons of oil per ton of rock are not uncommon in certain parts of the area. Some of the oil-shale zones are hundreds of feet thick near the center of the basin and undoubtedly will be exploited sometime in the future. The total estimated oil reserves for the oil shale deposits of Utah, Colorado, and Wyoming are truly staggering (Figure 67).
Figure 66. Sectional view of the oil shale zone in the Green River formation (Tertiary). The trace of this section (A-A') is shown on Figure 65 beginning in the region of the Pariette gilsonite system and extending east-south-east through the Willow Creek and Rainbow systems to the oil shale outcrops. The axis of deposition was north of the section, so that the abrupt thinning westward (left) is not representative of the best oil shale conditions. The depth of gilsonite veins is thought to be related to the depth of the oil shale source beds, indicating an increase in depth of the veins westward. If the number or width of gilsonite veins is related to the richness of the oil shales it would appear the best gilsonite localities are east (right) of the Green River.
Oil shales appear quite prominently in resistivity electrical logs of the numerous oil and gas wells in the basin. Individual beds appear to be quite discontinuous over any area, although the general oil shale can be plotted (Figure 66).

![Map of oil shale deposits in Idaho, Utah, and Colorado.](image)

**Bituminous Sandstone**

Rich deposits of asphalt-impregnated sandstone occur in and around the area known as central Uintah County. Asphalt Ridge is the richest nearby deposit and is located just west and southwest of Vernal. Covington (Paper 23) discusses this and another important deposit near Sunnyside, Carbon County, Utah, which are believed derived from the oil shale beds of the Green River formation. Smaller deposits are known on Raven Ridge and at Dragon, Utah, in Three Mile Canyon.

These asphalt deposits are possible sources of liquid petroleum providing pilot studies by the U.S. Bureau of Mines prove workable on a large scale (Shea, et al., 1952). Reserves in Asphalt Ridge alone exceed 2 billion barrels of crude asphaltic oil along an 11 1/2 mile front (Spieker, 1930). Near Vernal the rich asphalt beds are mined and used to pave city and county roads in the region. Wells drilled on the dip slope of the asphalt beds indicate a tarry liquid oil permeates the horizon to a considerable depth down dip.
Oil and Gas

High pour-point oils are produced from both the Green River (Tertiary) and the Mesaverde (Cretaceous) formations within the Uinta Basin. Low pour-point oil is produced from the Weber–Park City formation (Pennsylvanian–Permian) on the northern edge of the basin. The oil of Tertiary age is thought to be derived from the oil shale beds of the Green River formation.

The Red Wash oil field is the largest producer in northeastern Utah (Figure 65) and contains over 160 oil wells. The small Roosevelt oil field is another Tertiary deposit on the edge of the area under discussion.

The big recent development in Uintah County, and undoubtedly the most valuable resource from an immediate production standpoint, is the discovery of enormous deposits of gas in the Wasatch formation (Tertiary) near the center of the Uinta Basin (Figure 65 and Paper 20).

One puzzling feature of the relationship of the various bitumen and petroleum substances of the Uinta Basin is the high paraffin content of the Tertiary oil and the shale oil, contrasted to the asphaltic character of the bituminous sandstones and the gilsonite deposits. Crawford (1952, 1959) suggests that artificial ozokerite can be produced from the waxes contained in the crude Tertiary oils of the Uinta Basin.

Recent deep wells in the area near the White River indicate commercial gas and condensate in the Mesaverde and Dakota formations (Cretaceous). These deeper discoveries, coupled with the enormous proven gas reserves in the Wasatch formation (Tertiary), certainly make this area an important factor in the national mineral economy.

CITED REFERENCES


______, 1959, Mineral Potentials on approximately 30 townships for which Utah State Land Board selections are recommended (in Uintah County): Unpublished report for the Committee on Oil Shale and Solid Hydrocarbons of the Utah State Land Boards, p. 22.


Oil and Gas Possibilities of Utah, Re-Evaluated

Compiled and Edited by Arthur L. Crawford

Pure Oil Company Big Flat Wildcat Well. Return cuttings and water from well pile up at end of blooey line. (Photograph courtesy of "Oil and Gas Journal", Dec. 4, 1961, p. 125.)

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