GEOCHEMICAL EXPLORATION FOR GILSONITE

by

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ABSTRACT

The gilsonite and ozokerite deposits of the Unita Basin, Utah, were investigated geochemically. Soil samples were collected along traverses across productive veins in several areas. These soil samples were analysed for gilsonite and ozokerite. The gilsonite and ozokerite content of the soil samples was related to vein proximity.

The veins investigated were the Cowboy vein, the Chepetta lode, the Carbon lode, the Rainbow vein, the Pariette vein, and the Soldier Summit ozokerite deposit.

Three laboratory procedures were developed to separate gilsonite from the soil samples. All were based on the difference in specific gravity between gilsonite, which has a specific gravity of 1.04, and soil fraction, whioh has a specific gravity of about 2.0 - 2.6. In one procedure tetrabromoethane in benzene was the heavy liquid medium. In the other procedure carbon tetrachloride was the heavy liquid medium. In each of these procedures, the gilsonite was floated. In the third procedure, the gilsonite was separated from the soil by panning. In each procedure, the gilsonite fraction was weighed, and the gilsonite

content of each sample was expressed as parts gilsonite per million parts of sample by weight.

The precision of the procedures was determined by replicate analyses. The standard deviation of the derived result in the calculation for PPM gilsonite is ±16.6%.

Geochemical anomalies were recognized in each instance. Background values ranged from 200 PPM to 1,000 PPM. Anomalies ranged from 2,910 PPM to 264,000 PPM, and the contrast ranged from 16 to 545.

In addition to geochemical anomalies disclosed over each vein, several anomalies at a distance from known veins were observed. These anomalies may reflect covered veins.

Gilsonite content and dispersion halos surrounding the veins are due to weathering and erosion of gilsonite veins.

INTRODUCTION

Nature and Uses of Gilsonite: Gilsonite is a solid hydrocarbon that resembles coal. It melts easily in the flame of a match. The specific gravity of gilsonite is 1.04. Powdered gilsonite has a rich brown color.

Gilsonite has many varied uses. In the automotive industry, gilsonite is used for undercoating and soundproofing. Some of the uses in the construction industry include roofing materials, asphalt floor tile, and coated building papers. Chemical industries employ gilsonite in the manufacture of fingerprint powders, pipe coatings, canvas and burlap saturants, and many other items. At the present time, the American Gilsonite Company manufactures gasoline from gilsonite. The distillation residue is used for metallurgical coke.

Brief History of Gilsonite (Remington, 1959): Gilsonite has been known to the Indians of the Uinta Basin for hundreds of years. The first commercial exploitation commenced in 1886 with the formation of the Gilsonite manufacturing Company. At the present time, the American Gilsonite Company is the world's largest producer of gilsonite.

In 1865, Professor John S. Newberry of Columbia College School of Mines had in his collection an unusual variety of asphaltum. Part of the sample was given to Dr. Henry Wurtz, who was an outstanding authority on asphaltite hydrocarbons (Crawford, 1949). Dr. Wurtz associated the sample with Grahamite from Ritchie County, West Virginia. The sample was supposed to have come from some part of central Colorado. However, it probably came from the Uinta Basin.

In 1885, Professor William C. Blake from New Haven, Connecticut and later from Provo, Utah, wrote a paper naming this new variety of asphaltum from the Uinta Mountains as "Uintahite".

In the early 1870's, some prospectors brought samples of gilsonite and elaterite to Salt Lake City, Provo, and even San Francisco.

Sam Gilson experimented with Uintahite and developed a chewing gum, insulation for wires, and paint for the piles of Saltair. The mineral was named "Gilsonite" after Sam Gilson.

In 1886, an effort was made by the Gilsonite Manufacturing Company to commercially exploit the gilsonite in the Uinta Basin. Several companies have operated gilsonite mines in the area since the original company. At the present time, the three companies producing gilsonite are the American Gilsonite Company, the Standard Gilsonite Company, and the G. S. Ziegler Company.

Purpose: The purposes of this investigation were first; to discover the presence of a geochemical anomaly of gilsonite in the soil above a gilsonite vein, and second; to develop techniques to aid in the prospecting for gilsonite, ozokerite, and other oil bitumens.

Scope: A total of 198 soil samples were collected from several areas. The areas sampled are located in the Uinta Basin, Utah. Five traverses were conducted in the Bonanza area. One traverse was conducted in each of the following areas: Castle Peak, Rainbow, Fort Duchesne, Soldier Summit.

The samples were analysed chemically to determine differences if any in their solid hydrocarbon content.

GEOCHEMICAL EXPLORATION FOR OIL BITUMENS

With respect to petroleum geochemistry, gilsonite falls under the general classification of "Oil bitumens".

No previous work has been done on the geochemical exploration for gilsonite. Several geochemical exploration techniques have been utilized in the search for other oil bitumens.

Some exploration for oil bitumens utilizes geochemical indices in the form of ratios. The most important geochemical indices that must be obtained in order to indicate the presence or absence of oil bitumens are: (1) bitumen/organic carbon; (2) bitumen carbon/organic carbon; (3) petroleum-ether extract/alcohol-benzene extract; (4) organic carbon/nitrogen (Kartsev,1959).

The basic method for determining organic carbon in soils and rocks is that of Knop (Kartsev,1959). It consists of the oxidation of organic carbon to carbon dioxide gas which is removed by adsorbtion.

Bitumen has been determined colorimetrically (Kartsev,1959). This method consists of making a cold solvent extraction, and comparing the color of the extract to standards of known concentration.

Nitrogen in soils and rocks is analysed by the Kjeldahl method (Kartsev,1959). In this method, the nitrogenous organic compounds are decomposed by sulphuric acid, and the nitrogen is converted to ammonium sulfate.

The standard analytical methods for geochemical exploration for oil bitumens are either very elaborate, or require the dissolution of the hydrocarbon. Exploration for gilsonite requires a close sample spacing. Therefore, the necessity of collecting many samples prohibits the use of elaborate time consuming techniques. The gilsonite in the soil is oxidized, and will not readily dissolve. This characteristic prohibits the use of techniques which require dissolving the gilsonite.

LOCATION AND GEOGRAPHIC SETTING

The investigated areas are located in the Uinta Basin, northeast Utah. The Uinta Basin, principal drainage, main highways, larger communities and sample localities are platted on Plate 1, page 8. The Uinta Basin covers an area of approximately 12,000 square miles (Childs, 1950). The northern boundary of the basin is defined by the Uinta Mountains. The western and northwestern boundaries are the High Plateaus and Wasatch Mountains of Utah. On the east and northeast, the White River Uplift is the boundary. The southern boundary is defined by a sedimentary escarpment which separates the Uinta Basin from the Colorado Plateau.

In the northern half of the basin, the topography is composed of gentle hills and erosional ridges. The relief is less than 500 feet. In the southern half of the basin, the topography is composed of gentle hills and erosional ridges, but the relief is almost 1,000 feet because of deeply incised canyons.

Five areas were sampled in the Uinta Basin. The following is a brief description of their location and

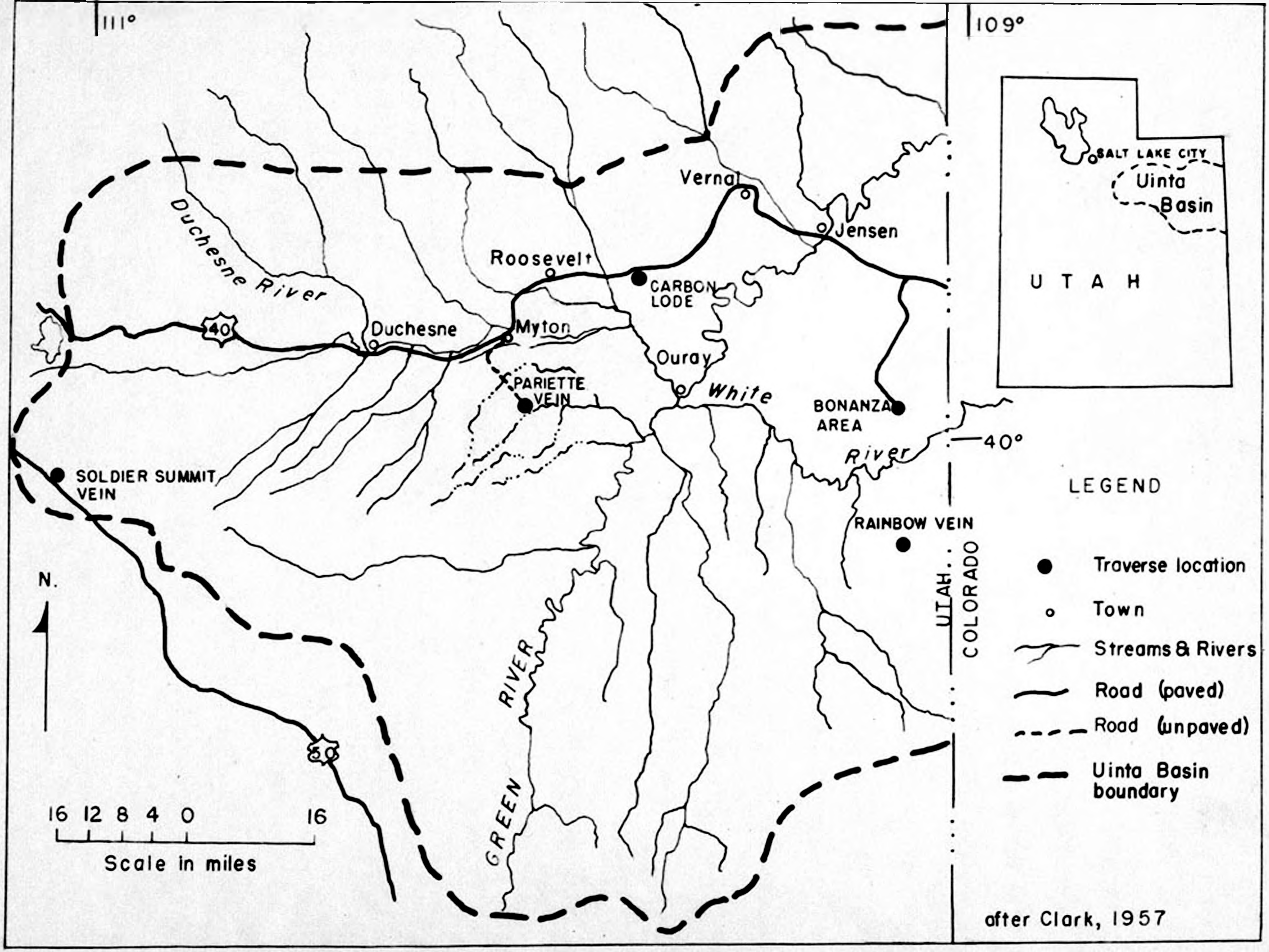

PLATE I. INDEX MAP OF THE UINTA BASIN SHOWING TRAVERSE LOCATIONS topographic features. The names of the veins,and the number of traverses across each vein are also included.

Bonanza area: The Bonanza area is situated 46 miles southeast of Vernal, Utah. The Cowboy vein and the Chepetta lode, two of the several veins in the area, were sampled. Samples were collected from 4 lines across the Cowboy vein, and from one line across the Chepetta lode. The topography near the traverse lines is generally flat to gently rolling.

Castle Peak area: The Castle Peak area is located 9 miles south of Myton. One traverse was conducted across the Pariette vein. The area is broad, open, and gently sloping. The surface in the traverse area is desert pavement.

Rainbow area: The Rainbow area is located 13 miles south of Bonanza. One traverse was conducted across the Rainbow vein. The northern end of the traverse line was located at the southern corner of the abandoned town of Rainbow. In the vicinity of the vein the terrain is hilly. The hills are gentle, and are about 50 to 100 feet high.

Soldier Summit area: The Soldier Summit area is located ½ mile east of the town of Soldier Summit. One traverse was conducted across the ozokerite deposit. The traverse was about 50 yards north of the abandoned shaft in the mine area. The terrain includes a broad hill which is cut by small, steep walled, V-shaped gullies.

Fort Duchesne area: The Fort Duchesne area is located 3 miles east of Fort Duchesne (between Roosevelt and Vernal). A single traverse was conducted across the Carbon lode. This traverse was located ½ mile south of U.S. Highway 40. The terrain in the vicinity of the traverse was generally flat with widely spaced gentle hills. None of the hills were higher than 30 feet.

GEOLOGIC SETTING

Gilsonite deposits of the Uinta Basin, Utah, occur in sediments of Eocene to Oligocene age. The three formations in which gilsonite deposits have been found are: the Green River formation (Eocene); the Uinta formation (Eocene); the Duchesne River formation (Oligocene). Gilsonite veins occupy northwest trending vertical fractures. Some of these veins are 9 miles long, and up to 20 feet wide. One vein extends to a depth of 2,000 feet (Henderson, 1957).

One probable source of gilsonite and other related solid hydrocarbons in the Uinta Basin is the carbonaceous beds of the Green River formation (Hunt, 1954; Crawford, 1949). Organic material in the Mancos and Mesaverde groups, and/or the lignitic beds of the Wasatch formation, all of which underlie the Green River formation, are other possible source beds of gilsonite (Murray, 1950).

EXPERIMENTAL PROCEDURES

Sample Collection: Soil samples were collected at 5 to 50 foot intervals along the traverses. The soil samples were auger and grab samples.

A 15" x 5/8" ship's auger was used to obtain samples from locations 1 and 2 on the Cowboy vein. The samples were obtained from 6" to 12" below the surface. About one ounce of soil was collected and placed in a 6" x 12" cloth bag.

Other samples were obtained by grab sampling using an army trenching shovel. Each grab sample was taken from the bottom of a small pit which was 2 feet in diameter, and 8" deep. About ½ pound of sample was collected. Each sample was placed in a 6" x 12" cloth sample bag.

Scattered over the surface of the sampled areas were small flakes of windblown gilsonite. Care was taken to prevent surface contamination during the sampling.

Sample Preparation: Each sample was dried at room temperature and then transferred from the sample bag to a rubberized canvas rolling cloth. The sample was rolled and a cone was formed in the center of the cloth. Using a spatula, two portions of the sample were scooped from the cone so that two troughs remained which intersected at right angles. The sample scooped from the cone was placed in a porcelain mortar. The remainder was rejected.

The retained sample then was ground in the mortar until it was disaggregated. Mineral grains larger than ¼" in diameter were discarded by hand. Fine grinding of the gilsonite grains exposed unoxidized gilsonite which dissolved in the heavy liquids.

The disaggregated samples were transferred to small manila envelopes and stored for future analysis.

Mineral Separation: Gilsonite was separated from soil samples by one of three procedures. Two of the procedures were heavy liquid medium separations, and the third procedure was a panning separation.

Tetrabromoethane (acetylene tetrabromide) in benzene at a specific gravity of 1.5 was one of the heavy liquids used to separate gilsonite from soil samples. The heavy liquid was added to centrifuge tubes containing the crushed and weighed sample. The tubes were centrifuged until the solution was clear. The tubes were decanted immediately into filter paper, and the solid portion of the decantate was retained. This decantate which consisted of wood and gilsonite was washed with benzene to remove the heavy liquid and collect the decanted solids.

Carbon tetrachloride was a second heavy liquid used to separate gilsonite from soil samples. The specific

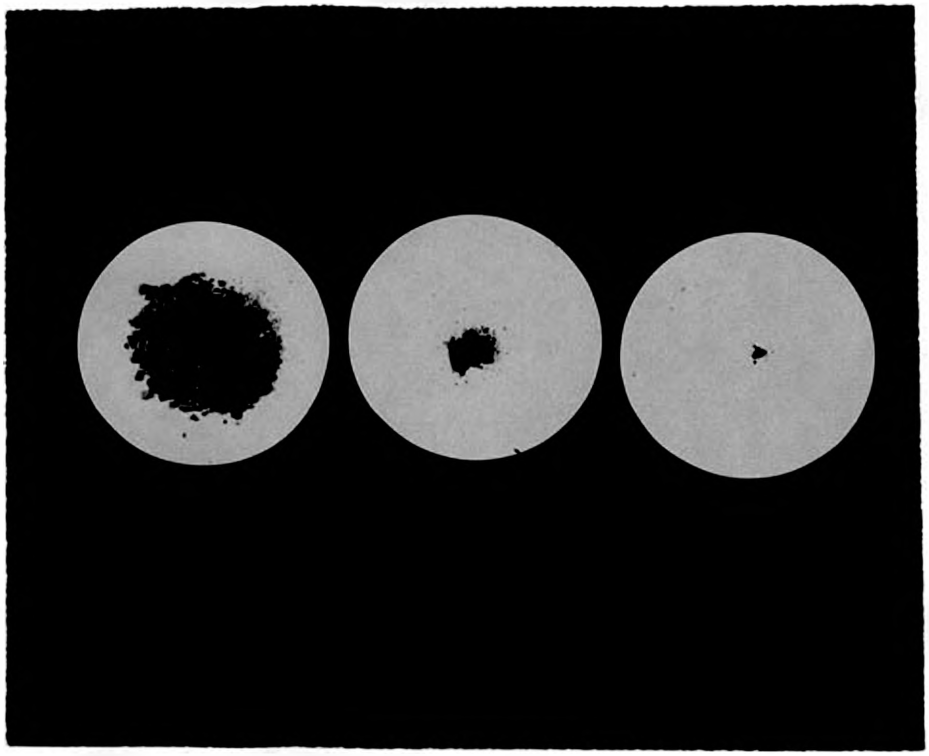

PLATE 3. - Gilsonite That Has Been Separated by Panning

The sample on the left was taken immediately above the Cowboy vein at location 4. The other two samples were taken at 10 foot intervals proceeding southwest away from the vein. The gilsonite content in PPM (from left to right) is 264,000, 22,800, 350, respectively. Each filter paper is 15 cm. in diameter.

gravity of carbon tetrachloride is 1.59. Carbon tetrachloride was poured directly into the centrifuge tubes containing the soil sample. The mixture was centrifuged until the liquid was clear. The tubes were decanted immediately into filter paper, and the solid portion of the decantate was retained. The sample was washed with carbon tetrachloride. The washed sample was thoroughly air dried.

Samples containing large amounts of gilsonite were panned. Also samples containing fresh unweathered gilsonite that would dissolve partially in the heavy liquids were panned. The ground and weighed samples were placed in the gold pan with about 250 ml. of water. A drop or two of household detergent was added to the water in order to reduce the surface tension and more completely wet the gilsonite and wood particles. With the surface tension reduced, the very fine gilsonite flakes and wood particles sank. The samples were panned until all the gilsonite was on one side of the pan. The pan was tilted slowly in the opposite direction from the concentrated gilsonite. At this point, the gilsonite was scooped from the pan, thoroughly air dried, and weighed.

<u>Determination of Gilsonite Content in Separated Fraction</u>: The retained samples contained gilsonite and impurities principally in the form of stems and roots. These pieces of wood floated with the gilsonite. In many cases, over 70% of the separate was wood.

A point counting technique modified after Chayes (1949) was used to determine the amount of gilsonite in each separate. The separate was transferred to a glass slide which was placed on the stage of a petrographic microscope equipped with a mechanical stage. Eight point counting traverses were used to determine the amount of gilsonite present in the separate. A point counting traverse was accomplished by manipulating the slide, using the mechanical stage, so that the separate passed in a straight line across the field of the microscope. Each traverse was divided into a number of fixed intervals. At each interval, the material that was under the cross hairs was recorded. Five of the traverses were conducted across the long axis of the slide, and three of the traverses were conducted across the short axis of the slide.

Following counting, the separate was transferred from the slide to the filter paper and weighed. The percent by weight of gilsonite in the separated fraction of the sample was assumed equal to the following:

$$(100)\,\frac{(\text{number of recorded gilsonite grains})}{(\text{total number of recorded points})} = \text{Percent by weight of gilsonite in separate.}$$

This calculation relates surface area to weight, and requires the wood to have the same surface area as the gilsonite. Although the grain size of both the gilsonite and the wood varied, it was assumed that the average surface areas of the wood and gilsonite were equal. The specific gravities of the wood impregnated with heavy liquid and the gilsonite were about the same.

Parts of gilsonite per million parts of sample were calculated as follows:

$$\frac{(\text{weight of separate})\ (\%\ \text{gilsonite})\ (1 \times 10^4)}{(\text{weight of sample})} = \text{PPM Gilsonite}$$

<u>Equipment and Supplies</u>: The following is a list of the equipment and supplies used during experimental procedures.

Sample Collection

1. Trenching shovel
2. 15" X 5/8" ship's auger
3. 6" X 12" cloth sample bags

Sample Preparation

1. Porcelain mortar and pestle
2. Spatula
3. Rubberized canvas rolling cloth
4. 2¼" X 3½" manila envelopes

Mineral Separation

1. Carbon tetrachloride (CCl_4), benzene, tetrabromoethane (acetylene tetrabromide), household liquid detergent.
2. Hooded or well ventilated area.
3. Centrifuge equipped to hold 50 ml. tubes.
4. Reeve Angel #711 filter paper (15 cm.).

5. Microscope equipped with mechanical stage and glass slides.

6. 1 ringstand and funnel holder.

7. Analytical balance that will weigh to 1/10 mg.

8. A gold pan.

9. Laboratory glassware (minimum amount necessary)

   a) Two 250 ml. beakers.

   b) Two 500 ml. flasks (with stoppers).

   c) One funnel.

   d) Twelve 50 ml. centrifuge tubes.

   e) One wash bottle

   f) One stirring rod.

   g) One 500 ml. graduate.

PRECISION OF EXPERIMENTAL PROCEDURES

The precision of experimental procedures was determined for heavy liquid mineral separations, and for the modified Chayes method for estimating gilsonite content of mineral separate. The precision is stated as standard deviation. From this data, the precision of the derived result was calculated.

The standard deviation was calculated as follows:

$$\text{Standard deviation} = \pm \sqrt{\frac{\Sigma (d^2)}{n - 1}}$$

n = number of samples analysed
d = deviation of each value from the arithmetic average

Sample number 8 from the Cowboy vein, location 3, was analysed 10 times to determine the precision of heavy liquid mineral separation and the modified Chayes method for estimating gilsonite content.

The standard deviation for the heavy liquid laboratory procedures is ± 16.3%.

The standard deviation for the modified Chayes point counting technique is ± 5.4%.

From these standard deviations, the standard deviation of the derived result was calculated as follows:

$$\text{Standard deviation of derived result} = \pm\sqrt{a^2 + b^2}$$

(after Daniels, 1949)

a = standard deviation of heavy liquid separation
b = standard deviation of modified Chayes point counting technique

This formula is for the error of the sum or difference of two quantities. In the formula for calculation of PPM of gilsonite, the weight of the separate is multiplied by the percent gilsonite in the separate. This product is equal to the difference between the weight of the separate, and weight of the wood in the separate. The standard deviation of the derived result is ± 16.6%.

PRESENTATION OF THE DATA

The gilsonite content of soil samples collected from 9 traverses in 5 areas is presented in tables and figures. Geologic cross sections along traverses are also presented in the figures.

Bonanza Area: Tables I through IV on pages 20, 21, 22 and Table VIII on page 33 present gilsonite content of soil samples collected across the Cowboy vein and the Chepetta lode. The gilsonite content ranges from 21 PPM to 264,000 PPM.

The geochemical profiles and geologic cross sections of traverses across the Cowboy vein and the Chepetta lode are presented on figures 1 through 4 on pages 23 to 26, and on figure 8, on page 34.

Castle Peak Area: Table VI on page 29 presents the gilsonite content of soil samples collected across the Pariette vein. The gilsonite content ranges from 17 PPM to 4,800 PPM.

Figure 6 on page 30 is a geochemical profile and geologic cross section across the Pariette vein.

Rainbow Area: Table VII on page 31 presents the gilsonite content of soil samples collected across the Rainbow vein. The gilsonite content ranges from 27 to 164,000 PPM.

Figure 7 on page 32 shows the geochemical profile and geologic cross section across the Rainbow vein.

Soldier Summit Area: Table V on page 27 presents the ozokerite content of soil samples taken across the Soldier Summit ozokerite deposit. The ozokerite content ranges from 1 PPM to 7,040 PPM.

Figure 5 on page 28 shows the geochemical profile and geologic cross section across the ozokerite deposit.

Fort Duchesne Area: Table IX on page 35 presents the gilsonite content of samples taken across the Carbon lode. The gilsonite content ranges from 6 PPM to 19,480 PPM.

Figure 9 on page 36 shows the geochemical profile and geologic cross section across the Carbon lode.

TABLE I

Gilsonite content of samples taken from the Cowboy vein, location 1.

Sample number	PPM gilsonite (±16.6%)
1	244
2	295
3	182
4	410
5	692
6	234
7	373
8	5,540
9	81,800

TABLE II

Gilsonite content of samples taken from the Cowboy vein, location 2.

Sample number	PPM gilsonite (±16.6%)
1	5,180
2	1,910
3	1,673
4	2,480
5	1,720
6	205,000

TABLE III

Gilsonite content of samples taken from the Cowboy vein, location 3.

Sample number	PPM gilsonite (±16.6%)
1	14,710
2	10,350
3	21,750
4	16,150
5	1,232
6	127
7	653
8	57
9	45
10	229
11	21

TABLE IV

Gilsonite content of samples taken from the Cowboy vein, location 4.

Sample number	PPM gilsonite (±16.6%)
1	218
2	672
3	911
4	1,585
5	987
6	366
7	567
8	458
9	498
10	761
11	3,680
12	1,685
13	3,350
14	1,720
15	300
16	350
17	22,800
18	264,000
19	1,645
20	761
21	72
22	74

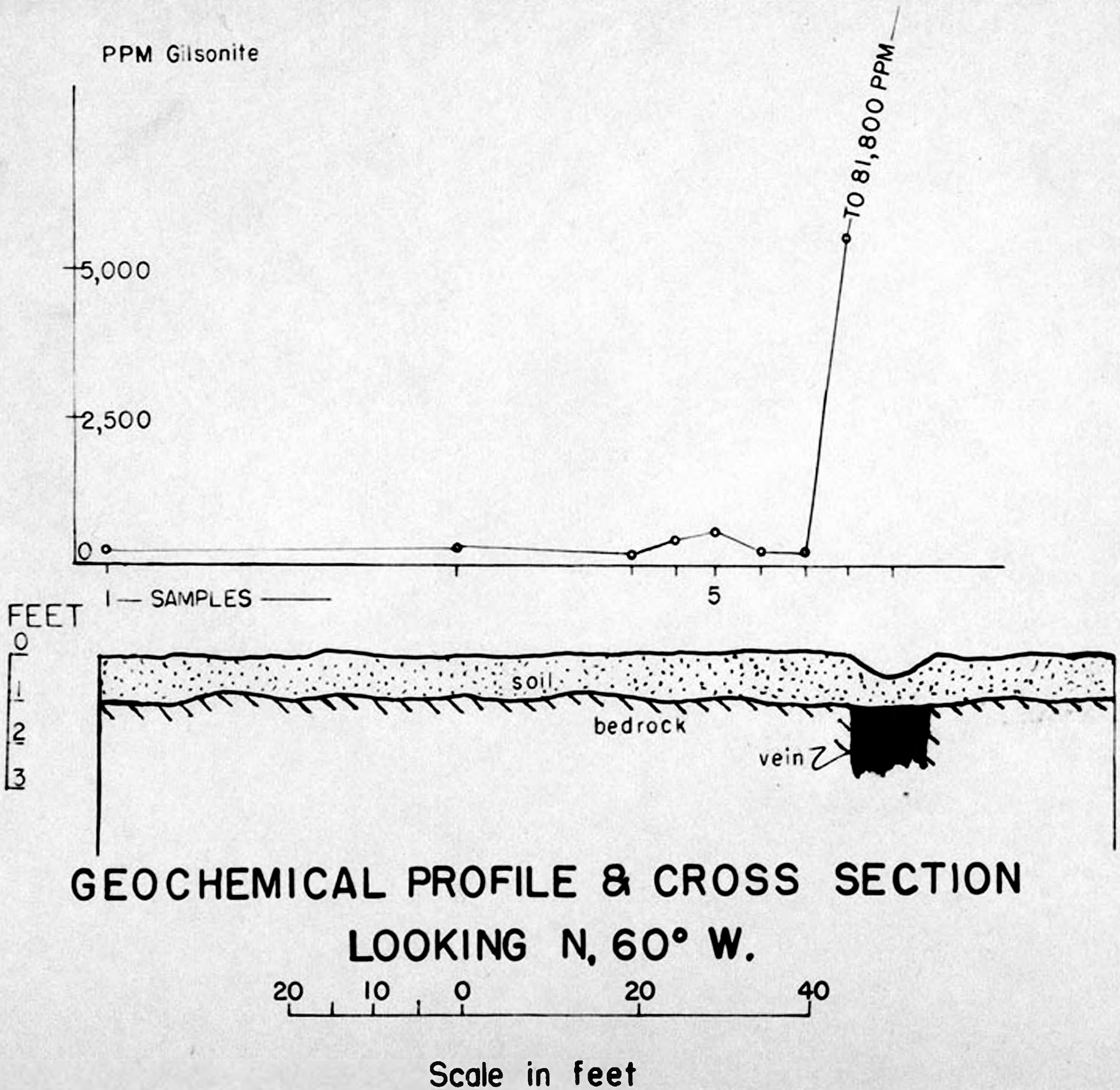

Fig. 1. COWBOY VEIN, LOCATION 1

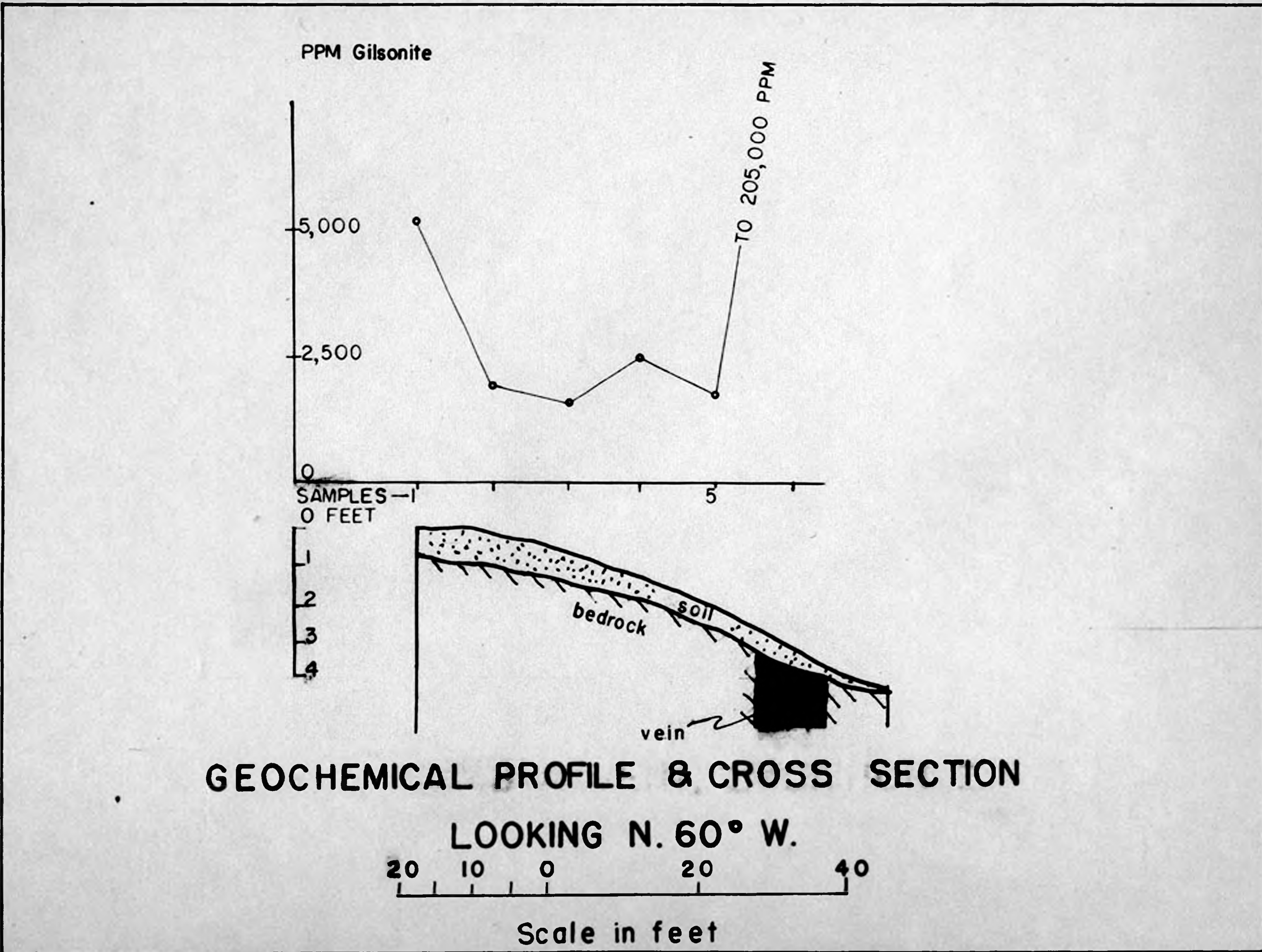

Fig.2. COWBOY VEIN, LOCATION 2

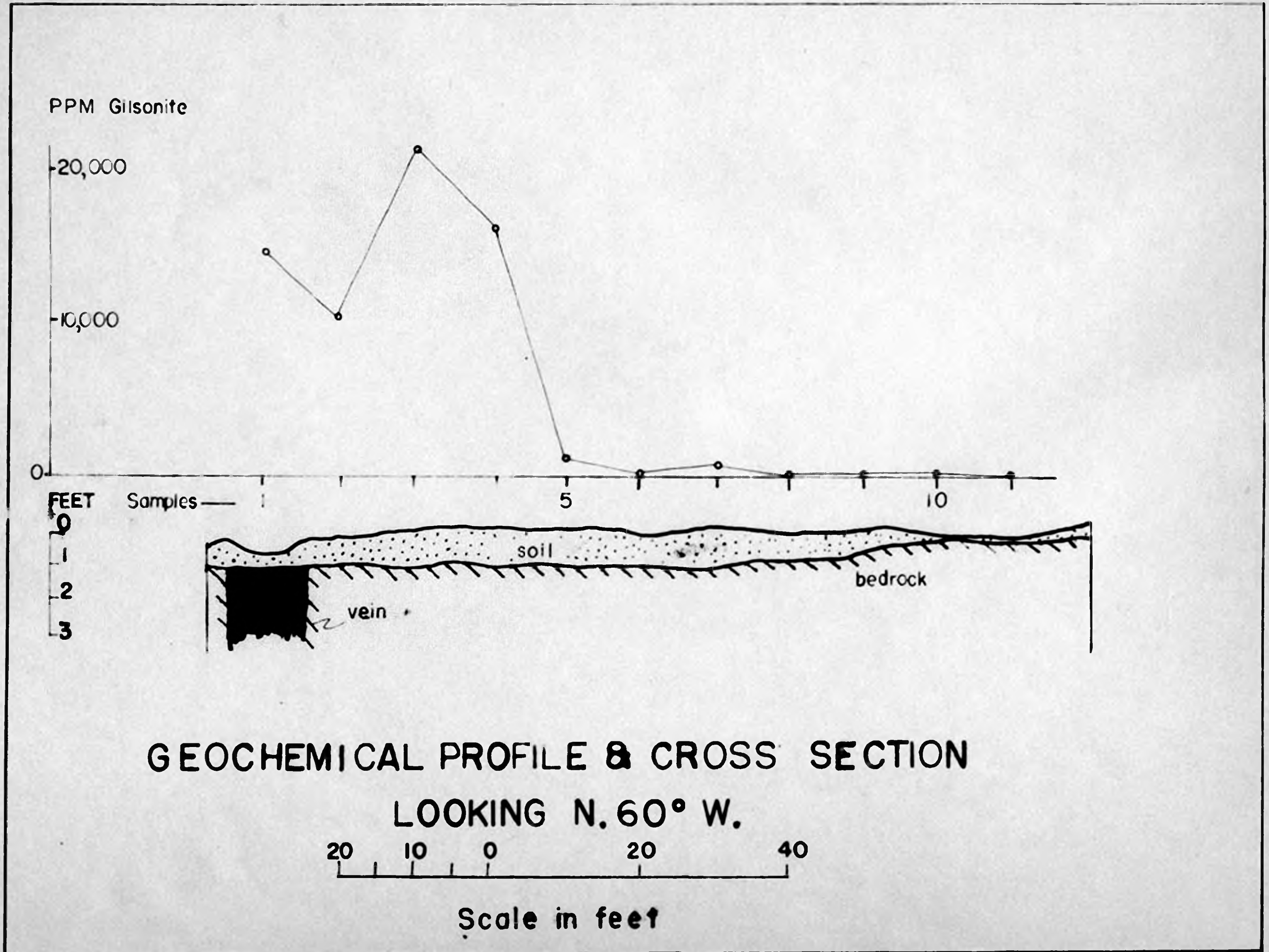

Fig.3. COWBOY VEIN, LOCATION 3

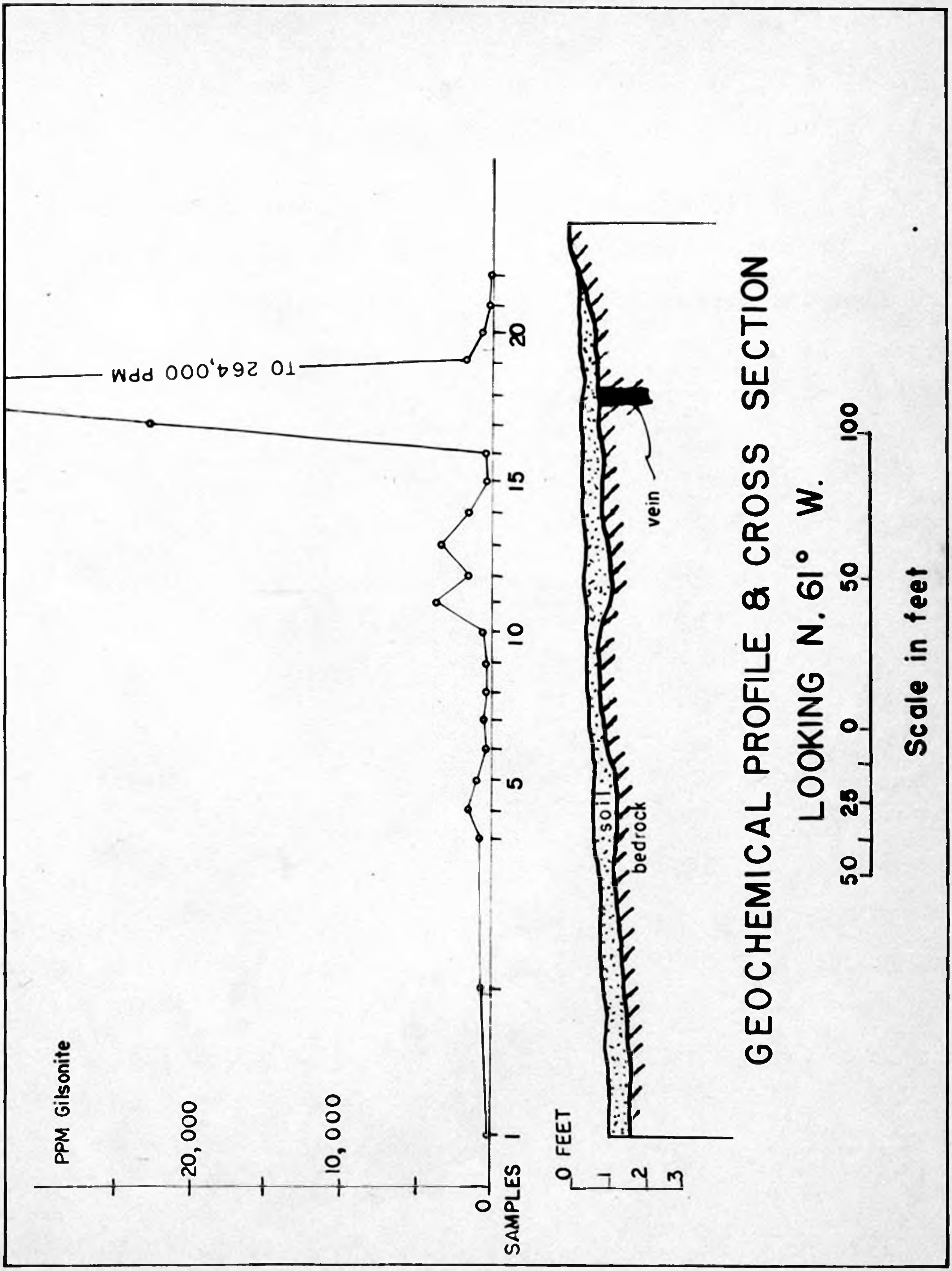

Fig. 4 COWBOY VEIN, LOCATION 4

TABLE V

Ozokerite content of samples taken from the ozokerite deposit at Soldier Summit, Utah.

Sample number	PPM ozokerite (±16.6%)
1	103
2	2,990
3	3,200
4	1,629
5	2,450
6	404
7	542
8	310
9	37
10	130
11	1
12	133
13	3,675
14	170
15	353
16	66
17	3,490
18	1,030
19	1,979
20	7,040
21	1,885
22	3,415

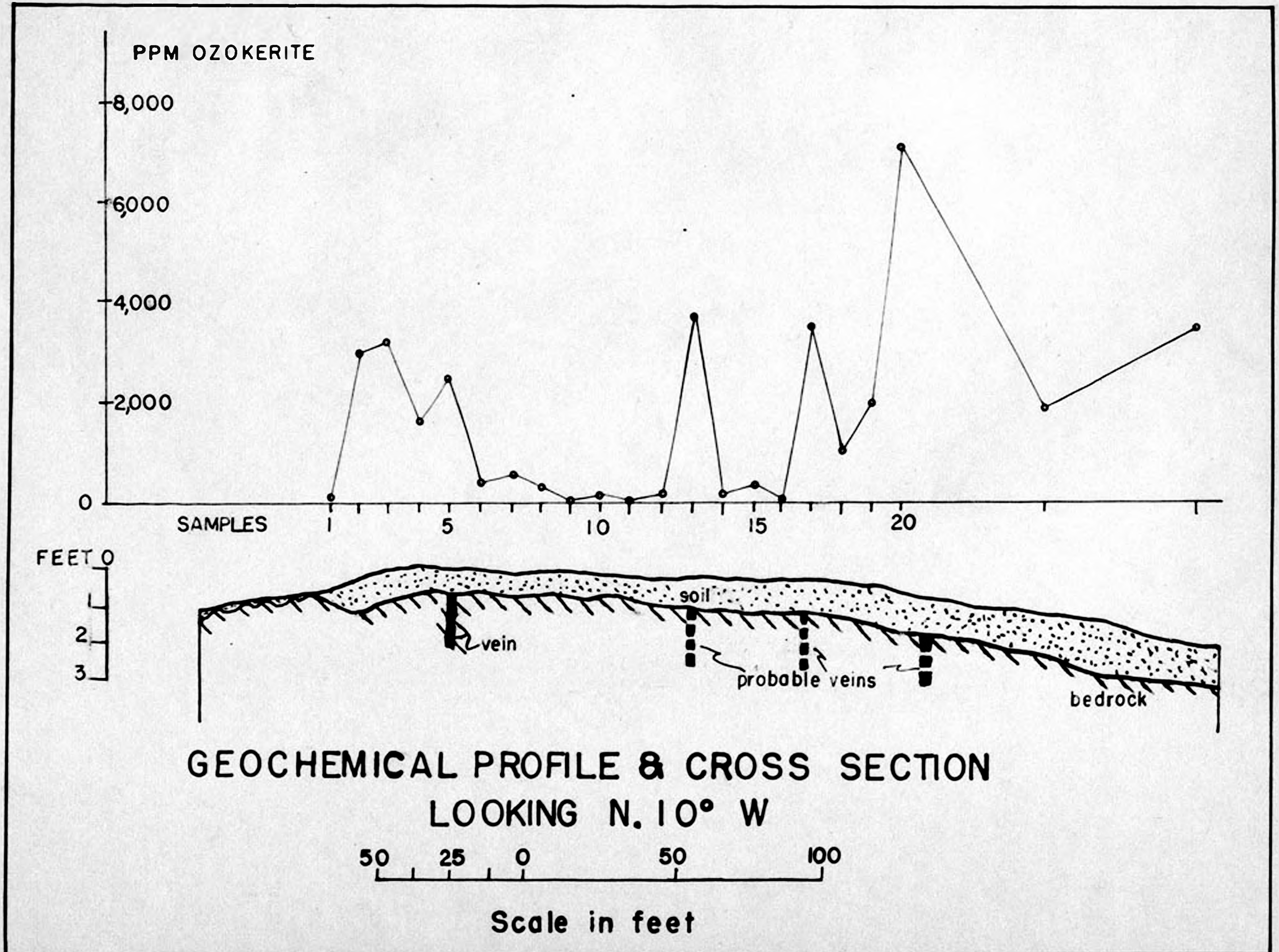

Fig. 5. OZOKERITE DEPOSIT, SOLDIER SUMMIT, UTAH

TABLE VI

Gilsonite content of samples taken from the Pariette vein.

Sample number	PPM gilsonite (±16.6%)
1	64
2	17
3	82
4	319
5	227
6	78
7	103
8	233
9	72
10	242
11	273
12	202
13	33
14	27
15	315
16	111
17	4,800
18	1,000
19	4,620
20	408
21	2,910
22	213
23	177
24	320
25	1,075
26	294
27	384
28	376
29	119
30	394
31	240
32	650
33	257

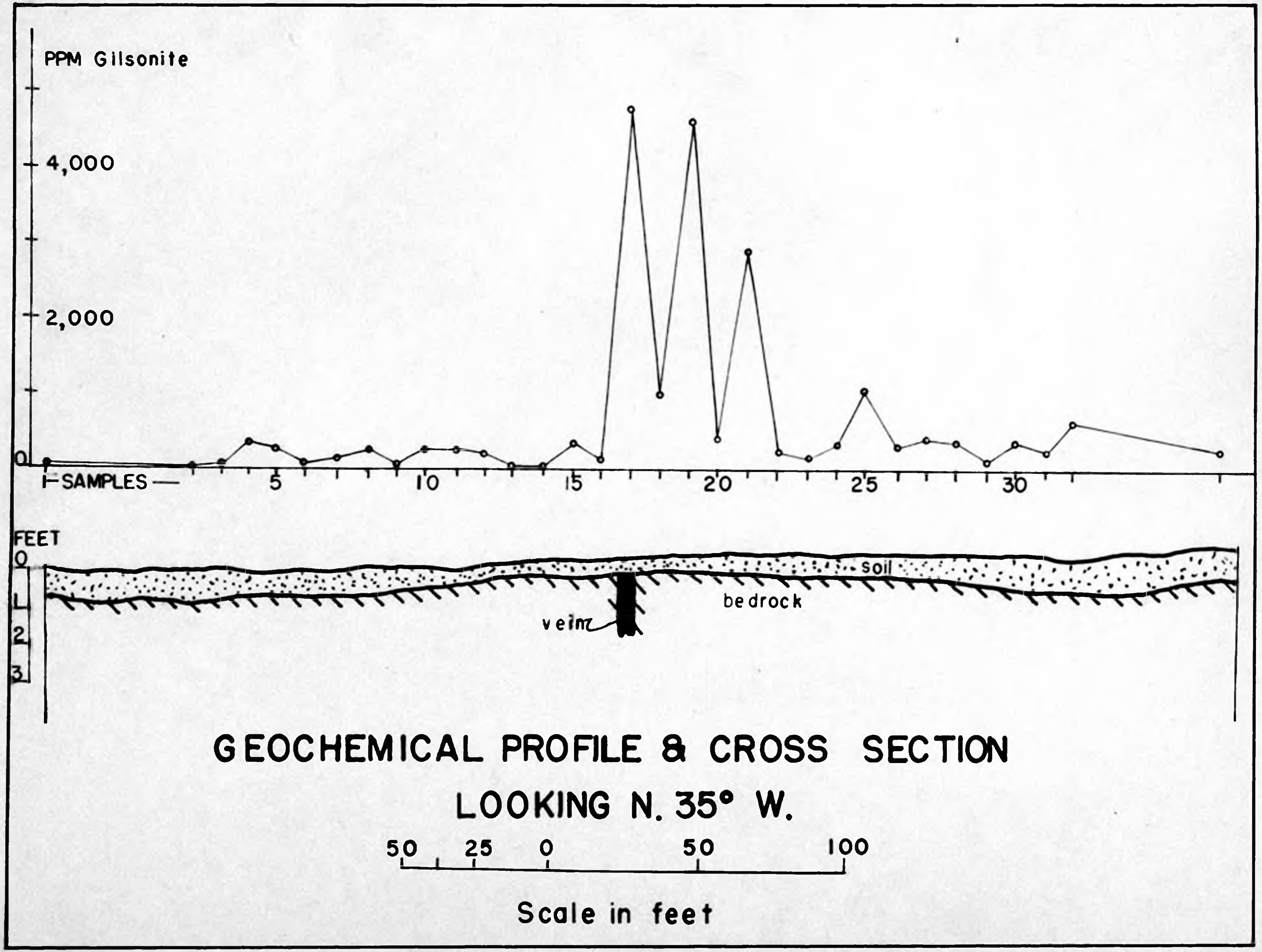

Fig. 6 PARIETTE VEIN

TABLE VII

Gilsonite content of samples taken from the Rainbow vein.

Sample number	PPM gilsonite (±16.6%)
1	433
2	92
3	683
4	382
5	628
6	421
7	179
8	107
9	37
10	53
11	36
12	27
13	140
14	89
15	164,000
16	1,341
17	1,572
18	5,375
19	4,850
20	6,220
21	12,711

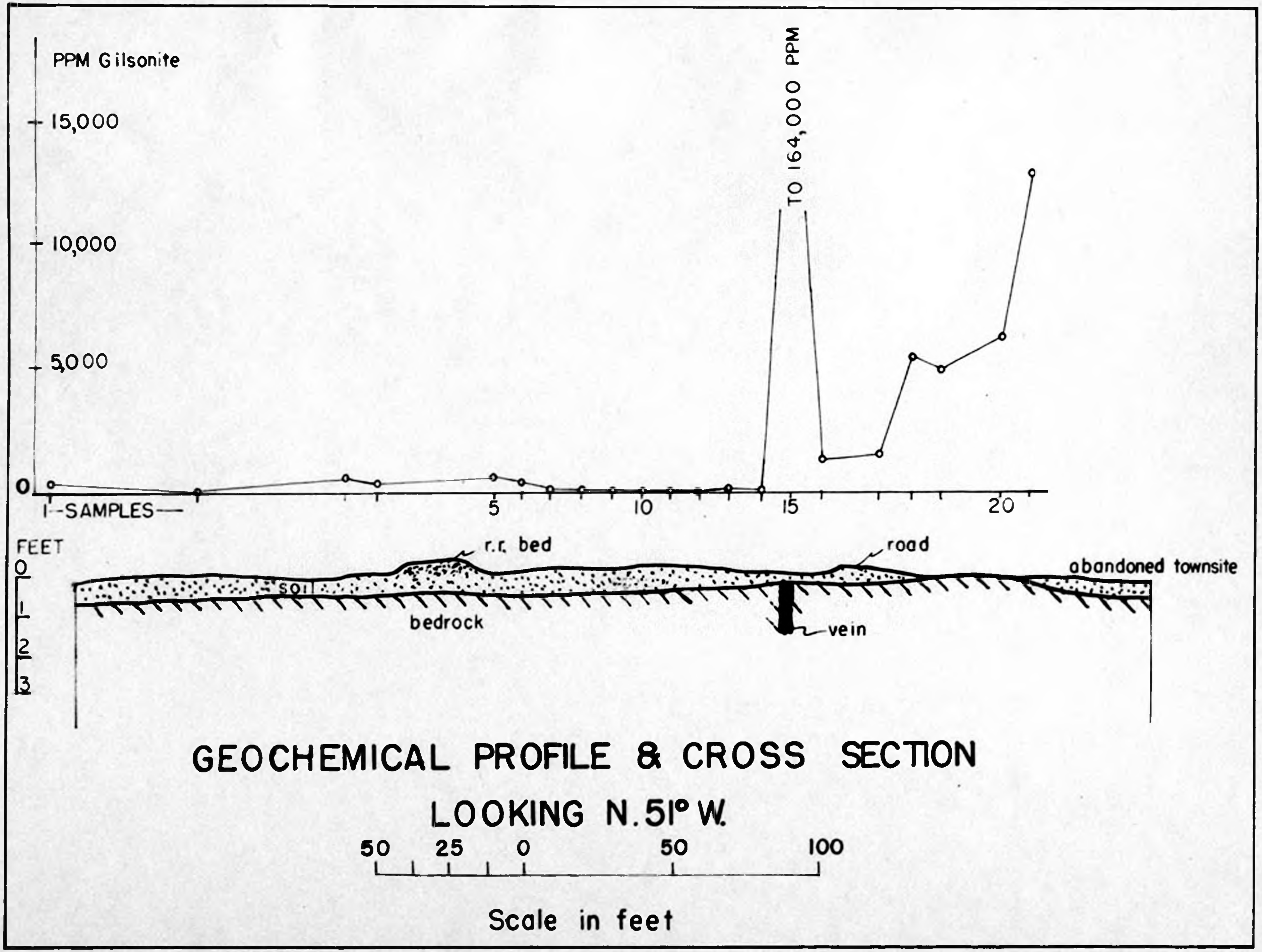

Fig. 7 RAINBOW VEIN

TABLE VIII

Gilsonite content of samples taken from the Chepetta lode.

Sample number	PPM gilsonite (±16.6%)
1	107
2	628
3	117
4	66
5	54
6	39
7	106
8	106
9	12
10	55
11	62
12	343
13	840
14	51
15	53
16	498
17	7,030
18	3,210
19	3,045
20	626
21	3,245
22	1,745
23	1,730
24	1,808
25	2,525
26	8,125
27	1,895
28	963
29	883
30	180
31	1,129
32	1,058
33	3,150

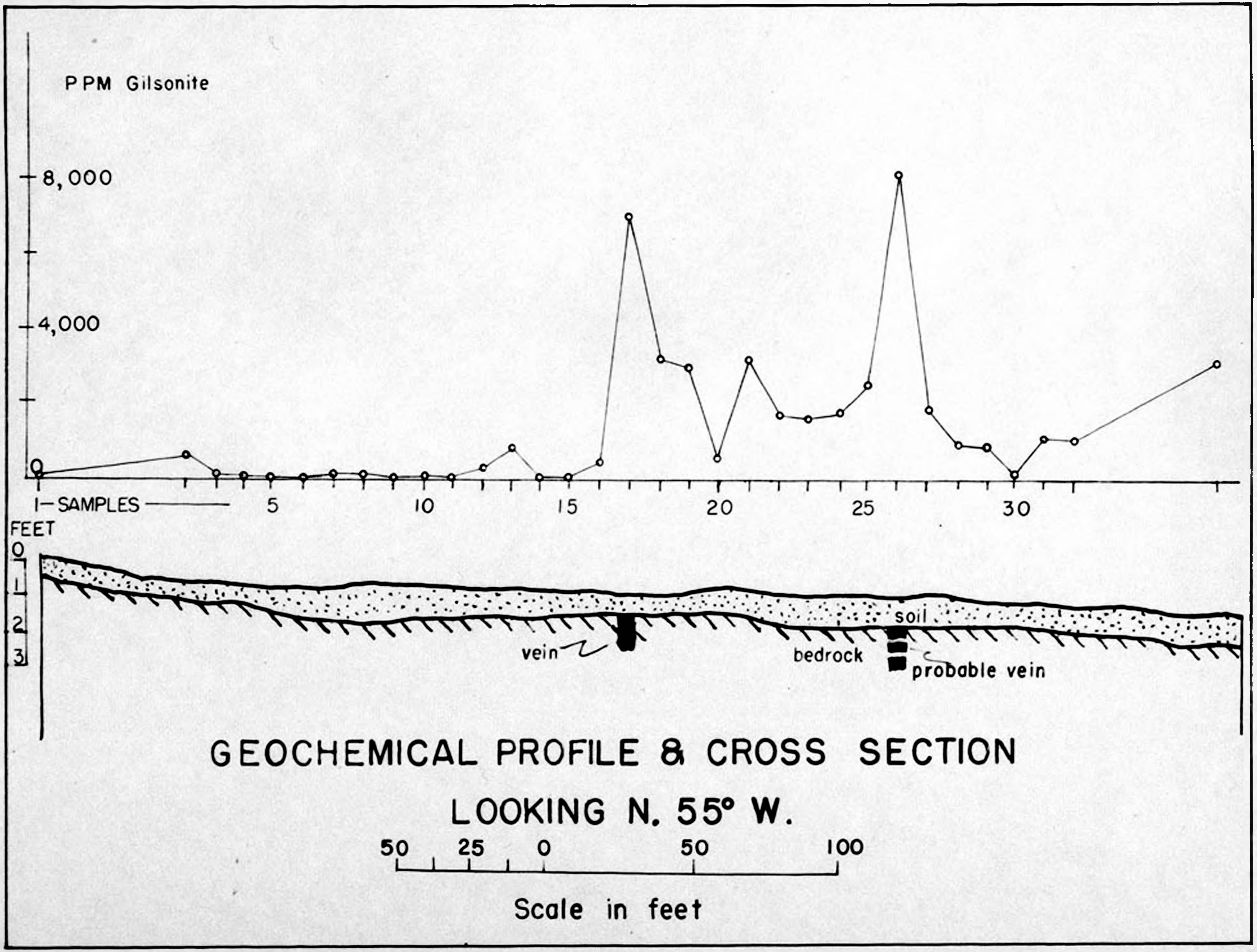

Fig. 8. CHEPETTA LODE

TABLE IX

Gilsonite content of samples taken from the Carbon lode.

Sample number	PPM gilsonite (±16.6%)
1	78
2	44
3	352
4	338
5	15
6	7
7	26
8	6
9	74
10	399
11	665
12	208
13	143
14	53
15	945
16	19,480
17	368
18	4,440
19	1,750
20	835
21	117
22	3,160
23	442
24	154
25	350
26	99
27	57
28	304
29	10
30	80
31	129

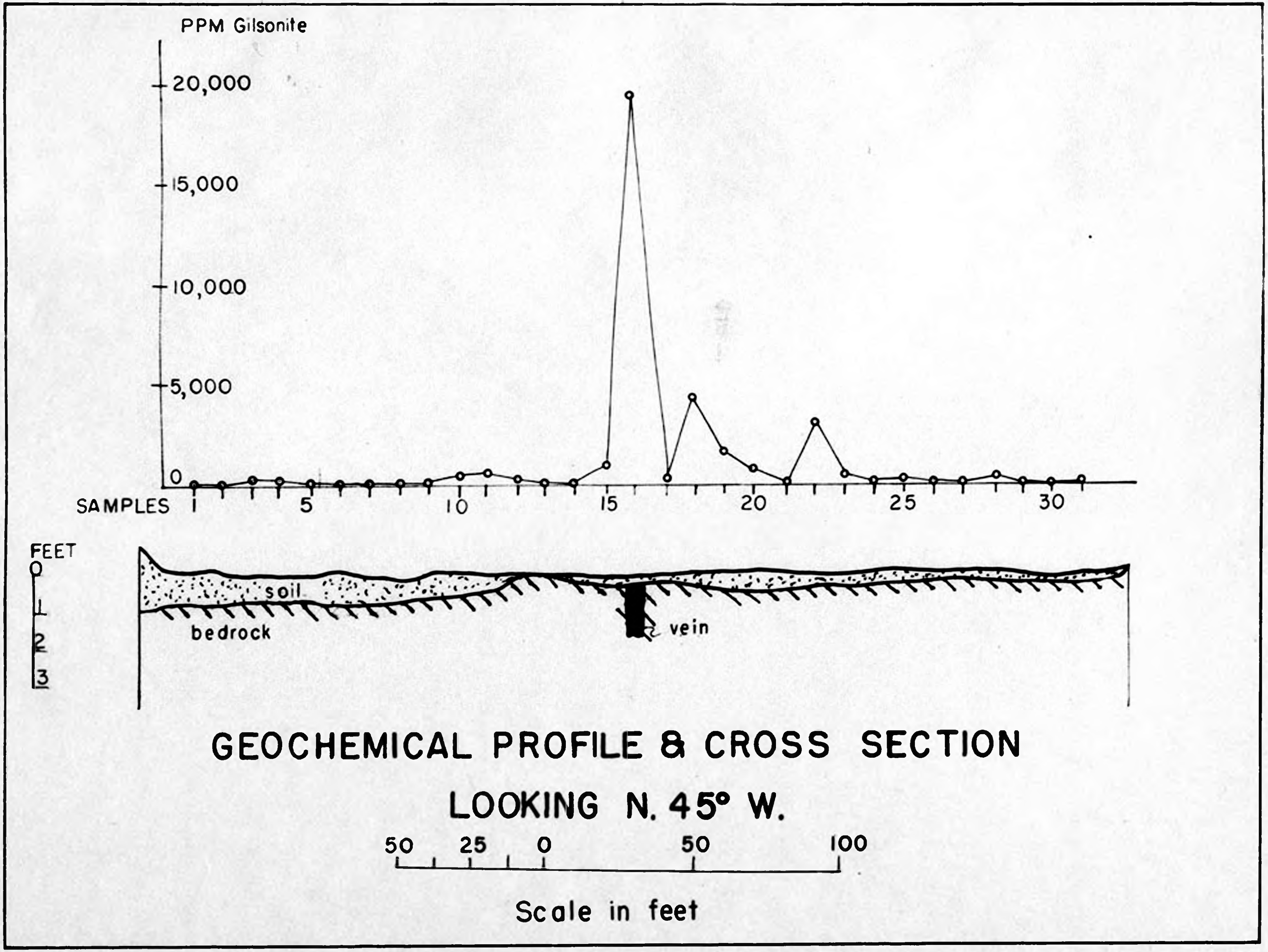

Fig. 9. CARBON LODE

INTERPRETATION OF DATA

Geochemical profiles of preliminary traverses across the Cowboy vein are discussed with respect to reasons for using a 10 foot sample interval.

Geochemical profiles in each area are discussed. Background, which is the average gilsonite content for each vein (excluding anomalies), varied from 200 PPM to 1,000 PPM. Contrast, which is the anomalous value divided by background (Hawkes, 1957), varied from 16 to 545. Causes of anomalies which ranged from 2,910 PPM to 264,000 PPM are discussed.

Interpretation of Preliminary Traverses: An optimum sample spacing was determined by conducting preliminary traverses across the Cowboy vein at locations 1, 2, and 3 (figures 1, 2, 3). On the basis of the information given in figures 1, 2, and 3, it was decided that: (1) both sides of the veins should be sampled; (2) samples should be spaced at 10 foot intervals. See also Tables I, II, III. A 20 foot sample interval was established by taking samples #1, #3, and #5 at location 2. Within 10 feet of the vein, the gilsonite content of sample #5 did not rise. Assuming the other side of the vein to be nearly equal to the side that was sampled, the anomaly would have been missed entirely by using a 20 foot interval.

Interpretation of Geochemical Profiles

Bonanza Area: In figure 4, an anomaly of 264,000 PPM gilsonite with a contrast of 264 was disclosed over the Cowboy vein. Background for the entire vein was about 1,000 PPM. On the downslope side of the vein the values were slightly higher than background. On the upslope side of the vein, values lower than background were reached within 20 feet of the vein. Bedrock prevented further sampling on the northeast end of the traverse line.

An anomaly of 7,030 PPM gilsonite with a contrast of 23 was disclosed over the Chepetta lode. The anomaly is centered about sample #17 on figure 8. Background was about 300 PPM. Sample #26 contained 8,125 PPM gilsonite. This anomaly was possibly due to the presence of an undisclosed vein.

Castle Peak Area: In figure 6, an anomaly of 4,800 PPM gilsonite with a contrast of 19 was disclosed over the Pariette vein. Background was about 250 PPM. Sample #19 was taken at the base of a small gilsonite dump. This sample showed an anomaly of 4,620 PPM gilsonite. Sample #21 was taken about a ½" stringer of gilsonite, and showed a value of 2,910 PPM.

Rainbow Area: Sample #15 on figure 7 shows an anomaly of 164,000 PPM gilsonite over the Rainbow vein. Background was about 300 PPM. The gilsonite content of samples 17 through 21 increased sharply as the abandoned mining town of Rainbow was approached.

Soldier Summit Area: In figure 5, an anomaly of 3,200 PPM ozokerite with a contrast of 16 was disclosed 20 feet to the west of the vein. Background was about 200 PPM. Because of soil creep, this anomaly has shifted downslope. Three anomalies occurred on the east end of the traverse. These ranged between 3,490 PPM and 7,040 PPM, and were due to the possible presence of undisclosed ozokerite veins in the bedrock.

Fort Duchesne Area: In figure 9, an anomaly of 19,480 PPM gilsonite with a contrast of 39 was disclosed over the Carbon lode. The anomaly is indicated at sample #16. Background was about 500 PPM.

CONCLUSIONS

A definite relation exists between the gilsonite content of the soil and vein proximity. All of the investigated locations showed positive geochemical anomalies associated with the veins. The anomalies ranged from sharp "one station" anomalies to diffuse "four station" halos.

The dispersion of gilsonite in the soil is primarily a function of weathering and erosion. Background and contrast varied from area to area.

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