

UNITED STATES
DEPARTMENT OF THE INTERIOR
~~GENERAL LAND OFFICE~~

Bureau of Land Management

Original

FIELD NOTES

BOOK 4386

Of the Survey of

Subdivisional Line and Sectional Subdivisional Lines,

Meanders of the High Water Line of Lake Mead.

Traverse of Bat Cave Containing Guano Deposits and

Establishment of Triangulation Station

All within Sections 28 and 29,

Township 31 North, Range 14 West.

Of the Gila and Salt River Meridian,

In the State of _____

EXECUTED BY

Clark Gumm, Cadastral Engineer

Under special instructions dated January 20, 1949, which provided

for the surveys included under Group No. 264, bearing the approval of the

Director, Bureau of Land Management

~~Commissioner of the General Land Office~~ under date of February 15, 1949

and assignment instructions dated March 28, 1949.

Survey commenced April 5, 1949

Survey completed April 13, 1949

1A

BOOK 4866

INDEX DIAGRAM.

Township 31 North, Range 14 West

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

6-151

Establishment of Triangulation station in Section 29
 Sectional Subdivision, Section 28
 Sectional Subdivision and Meanders in Section 29
 Traverse in Bat Cave

Page
 1
 5
 5
 7

Subdivision within T. 31 N., R. 14 W.

The purpose of this survey is to provide a basis for the legal description of a tract of land containing phosphate deposits, located in what is known as Bat Cave, near the upper end of Lake Mead. On account of the rugged character of the country, the volume of the survey is kept to a minimum. All of the corner points are inaccessible except those along the edge of the lake. It was found generally impossible to establish witness corners within the limits set out in the special instructions; therefore advantage was taken of the provisions which provide for the establishment of a triangulation station for ground control of the positions of subdivisional corners. It was also found necessary to execute the survey along the lines of legal subdivisions in accordance with the provisions contained in sections 489 to 497 of the Manual of Surveying Instructions.

The survey was executed with a W. and L. E. Gurley transit, serial number 38899, constructed in accordance with the standard specifications of the General Land Office. The instrument was in good condition and was tested and found free from appreciable error prior to beginning the survey.

The directions of the lines were determined by an azimuth given at U. S. C. and G. Survey triangulation station TEA. Measurements were made with narrow steel tapes, five and eight chains in length, both graduated every link for the first 100 links, and the balance at intervals of ten links. The tapes were tested before use by comparison with a one chain standard tape and found correct. The measurements were made on the slope and the vertical angle of each interval was ascertained by the transit; only the horizontal equivalents are entered in the field note record.

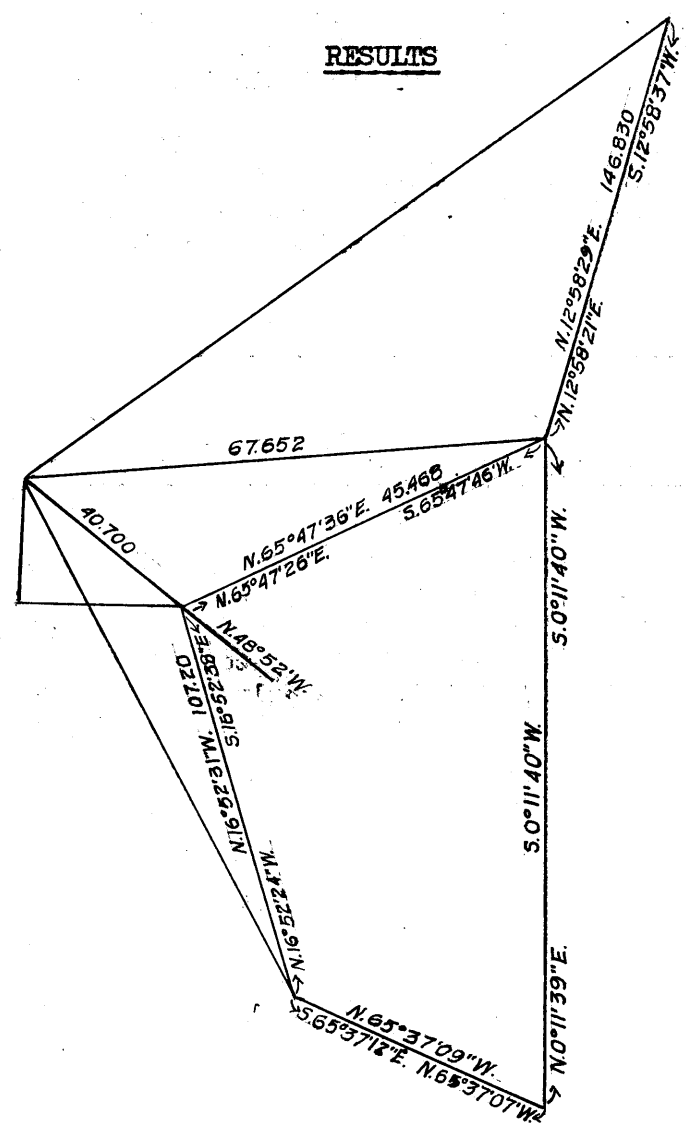
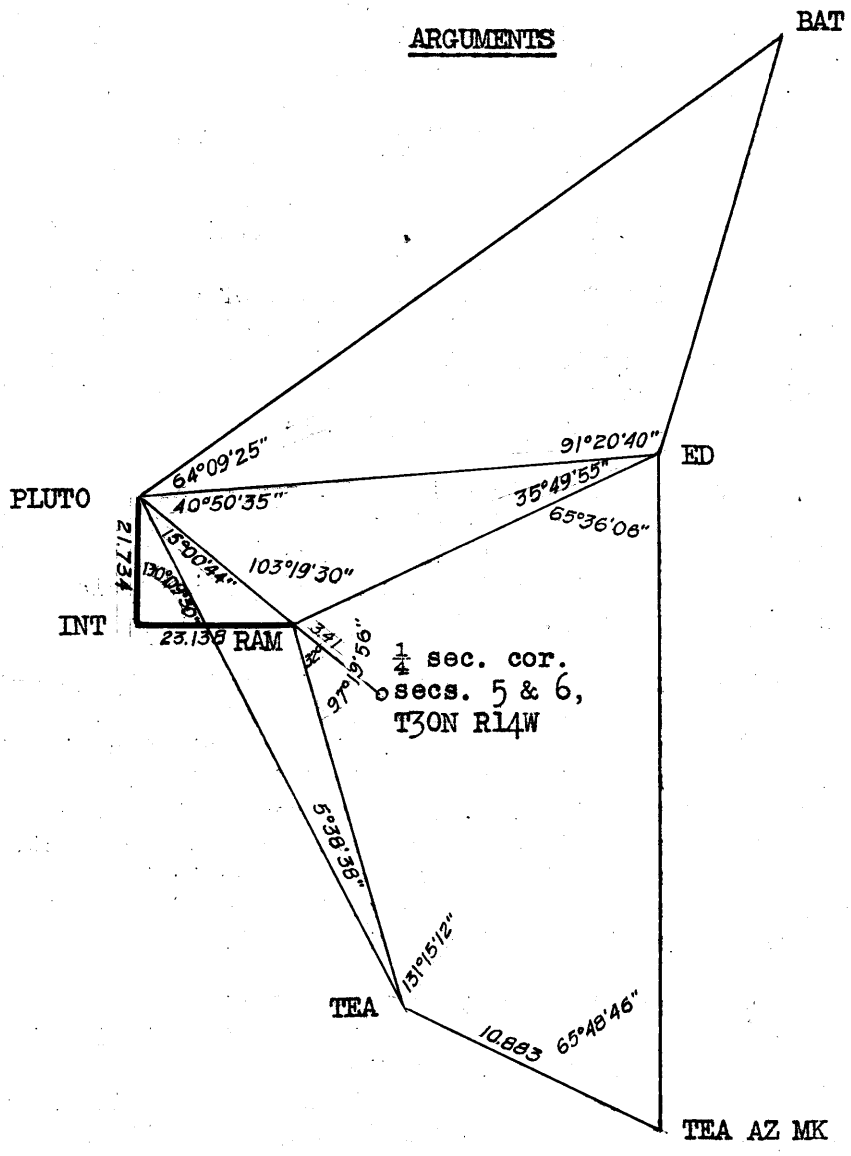
As a considerable amount of triangulation was necessary in order to ascertain the position of the triangulation station in section 29, diagrams are shown in pairs, the first shows the measured distances and angles and the second the results of the solution of same. The actual computations are not shown as they are quite lengthy. All triangulation angles were measured by repetition and were closed on the horizon. The individual triangles were also adjusted if needed to insure a perfect angular closure. Names have been assigned to each station in order to facilitate their identification.

The triangulation station TEA and its azimuth mark are stations of the U. S. C. and G. Survey and the geographic position of TEA, 1936 is latitude $35^{\circ} 59' 58.394''$ N. and longitude $113^{\circ} 48' 43.340''$ W. The azimuth from TEA to its azimuth mark is $294^{\circ} 22' 48.5''$.

Establishment of Triangulation Station in Section 29

All the stations except BAT in the two diagrams immediately following are on the south edge of the canyon of the Colorado River. BAT is a station near the head A-frame at the Bat Cave. It was found when the cave was reached that BAT could not be occupied and in fact not positively identified. The only function of BAT is to serve as a check on the three-point-problem subsequently shown.

Establishment of Triangulation Station in Section 29

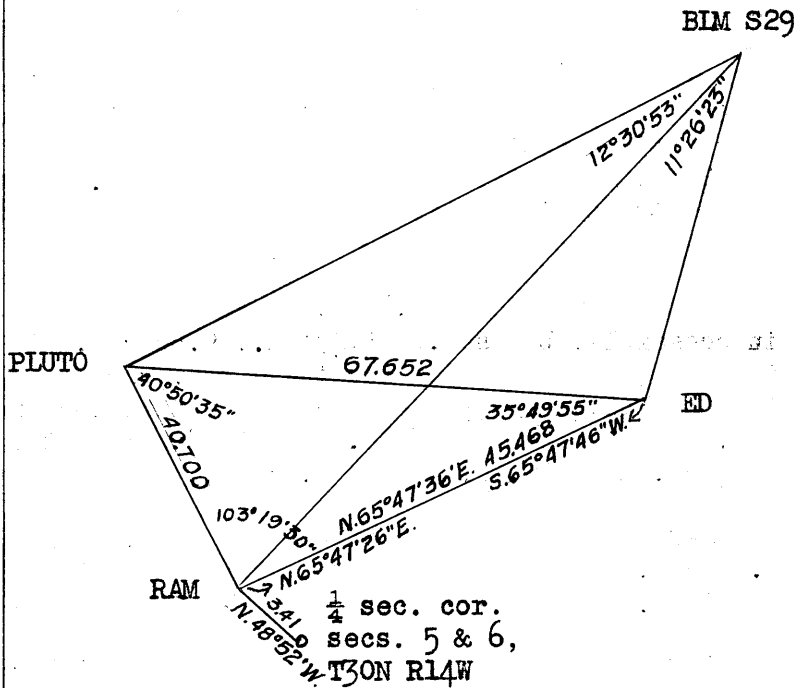


Establishment of Triangulation Station in Section 29.

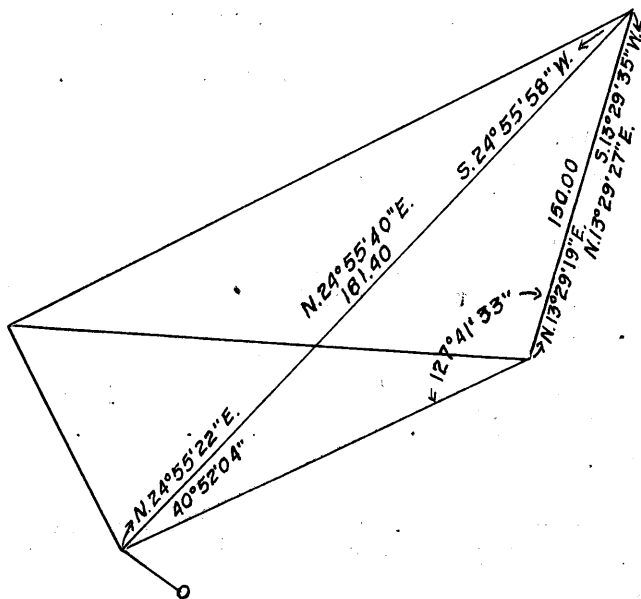
After the triangulation was completed on the south edge of the Colorado River, boat transportation was secured and the Bat Cave reached three days later by way of Pierce Ferry, 14 miles below the cave.

Since station BAT could not be positively identified, a station was selected at the position of the original location monument. This station is designated as BIM S29 and is hereinafter described. Using the known stations ED, RAM, and PLUTO, the interior angles to same are measured and the arguments and results shown in the diagrams of the three-point-problem shown below.

ARGUMENT



RESULTS



Establishment of Triangulation Station in Section 29.

Therefore the bearing from the $\frac{1}{4}$ sec. cor. of secs. 5 and 6, T. 30 N., R. 14 W., which is monumented as described in the official record, to triangulation station BLM S29 is N. $23^{\circ} 53' 51''$ E., 182.37 chains distant, or 166.74 chains north in latitude and 73.88 chains east in departure. The course and distance shown by V. O. Eastland, private surveyor, in his 1941 survey is N. $23^{\circ} 48' 10''$ E., 186.72 chains distant. As a check the bearing and distance from point presumed to be BAT to BLM S29 was measured as N. $36^{\circ} 24'$ E., 3.40 chs. dist.; therefore the distance from the $\frac{1}{4}$ sec. cor. of secs. 5 and 6, T. 30 N., R. 14 W. to BLM S29 by the way of RAM, ED, and BAT is 166.72 chains north in latitude and 73.89 chains east in departure.

The geographic position of BLM S29 as computed from triangulation station TEA is latitude $36^{\circ} 02' 52.7''$ N. and longitude $113^{\circ} 48' 06.9''$ W.

From the triangulation station BLM S29, which is monumented by the marks BLM Δ S29, chiseled on a flat ledge of rock, and witnessed by a mound of stone, 3 ft. base, 2 ft. high, NW. of station. This station occupies the position of the original location monument, which contained the location notice of a placer claim, dated July 20, 1940, signed by Harold A. Carpenter, locator, and Harold M. Morse, witness. The balance of the location notice was illegible due to action of the elements.

The point for the $\frac{1}{4}$ sec. cor. of secs. 28 and 29, which is inaccessible, bears S. $39^{\circ} 47'$ E., 9.56 chs. dist. This is the designated position for the $\frac{1}{4}$ sec. cor. as set-out in the Special Instructions which state this corner shall be 159.39 chains north and 80.00 chains east of the $\frac{1}{4}$ sec. cor. of secs. 5 and 6, T. 30 N., R. 14 W.

The A-frame in the mouth of the Bat Cave, bears N. $50^{\circ} 00'$ E., 1.80 chs. dist. and is 100 ft. above the triangulation station.

The A-frame at the "head" or top of the aerial cable is 2.58 chains south and 1.90 chains west.

The A-frame at the bottom of the aerial cable is 12.91 chains south and 10.52 chains west.

Subdivision of T. 31 N., R. 14 W.

From the point for the $\frac{1}{4}$ sec. cor. of secs. 28 and 29.

North, bet secs. 28 and 29.

Over inaccessible cliffs.

- | | |
|-------|--|
| 10.00 | Point for the S-N-1/64 sec. cor. of secs. 28 and 29, which point is inaccessible. The triangulation station BLM S29 is 2.65 chs. S. and 6.12 chs. W. |
| 15.95 | Theoretical intersection with traverse line in cave, hundreds of feet underground, at a point N. $28^{\circ} 38'$ E., 1.00 chs. dist., from traverse point number 4. |
| 30.00 | Point for the N-N-1/64 sec. cor. of secs. 28 and 29, which point is inaccessible. The triangulation station BLM S29 is 22.65 chs. S. and 6.12 chs. W. |
| 40.00 | Point for the cor. of secs. 20, 21, 28, and 29, which point is inaccessible. The triangulation station BLM S29 is 32.65 chs. S. and 6.12 chs. W. |

Land, series of inaccessible cliffs.
Soil, none, solid rock.

Subdivision in T. 31 N., R. 14 W.

Chains	<u>Sectional Subdivision in Section 28.</u>
	From the N-N-1/64 sec. cor. of secs. 28 and 29. East, along the N. bdy. SW $\frac{1}{2}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 28. Over inaccessible cliffs.
10.00	Point for the NW-NW-1/64 sec. cor. of sec. 28, which point is inaccessible. The triangulation station BLM S29 is 22.65 chs. S. and 16.12 chs. W. Thence South, along the E. bdy. SW $\frac{1}{2}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 28, beginning new measurement. Over inaccessible cliffs.
10.00	Point for the C-W-NW-1/64 sec. cor. of sec. 28, which point is inaccessible. The triangulation station BLM S29 is 12.65 chs. S. and 16.12 chs. W. Thence South, along the E. bdy. NW $\frac{1}{2}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 28, beginning new measurement. Over inaccessible cliffs.
10.00	Point for the SW-NW-1/64 sec. cor. of sec. 28, which point is inaccessible. The triangulation station BLM S29 is 2.65 chs. S. and 16.12 chs. W. Thence West, along the S. bdy. NW $\frac{1}{2}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 28, beginning new measurement. Over inaccessible cliffs.
10.00	The S-N-1/64 sec. cor. of secs. 28 and 29. Land, inaccessible cliffs. Soil, none, solid rock.
	<hr/>
	<u>Sectional Subdivision and Meanders in Section 29.</u>
	From the point for the $\frac{1}{4}$ sec. cor. of secs. 28 and 29. West, on the E. and W. centerline of sec. 29, and S. bdy. SE $\frac{1}{2}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$. Over inaccessible cliffs.
5.00	Leave cliffs and enter accessible land with steep S. slope.
10.00	Point for the C-E-E-1/64 sec. cor. of sec. 29. Set a sandstone, 14x12x4 ins., 8 ins. in ground, with marks C-E-E-1/64 S29, chiseled on S. face, and witnessed by a mound of stone, 3 ft. base, 2 ft. high, NW. of cor. The triangulation station BLM S29 is 7.35 chs. N. and 3.88 chs. E. Thence South, along E. bdy. fractional NW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 29, beginning new measurement. This fractional subdivision is now designated Lot 1, Sec. 29. Descend S. slope 210 ft.
5.00	Point for the C-N-NE-SE-1/256 sec. cor. of sec. 29. Set a limestone, 24x14x5 ins., 10 ins. in ground, with marks 1/256 chiseled on S. face and S29 on N. face.
8.42	Intersect the high water line of Lake Mead, which point falls on flat topped boulder, 8 ft. long, 4 ft. wide, and 5 ft. high.

Subdivision in T. 31 N., R. 14 W.

Chains

At the point of intersection, chisel the marks

S29

AMC 1

Thence, meandering the high water line of Lake Mead, in fractional subdivision NW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 29

From AMC 1.

N. 81° 00' W., 3.97 chs. dist. to AMC 2 (not monumented.)

N. 60° 00' W., 2.60 chs. dist. to AMC 3 (not monumented.)

N. 39° 45' W., 5.99 chs. dist. to AMC 4, on the E 1/16 sec. line of sec. 29 and the W. bdy. of fractional subdivision NW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$.

At point for AMC 4, set a red sandstone, 24x12x4 ins., 10 ins. in the ground, and in a mound of stone, marked AMC 4 on S. face and S29 on N. face.

Continuing Sectional Subdivision in Section 29.

From AMC 4.

North, on E-1/16 sec. line sec. 29, along W. bdy. fractional subdivision NW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$.

Ascend S. slope 65 ft.

1.89 Point for the C-E-1/16 sec. cor. of sec. 29.

Set a limestone, 18x12x10 ins., over X chiseled on solid rock, in a mound of stone, and marked C-E-1/16 S29 on S. face.

Thence North, beginning new measurement, on the C-E-1/16 sec. line of sec. 29, and along the W. bdy. SW $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$.

Ascend S. slope

5.00 Ascend over inaccessible cliff.

10.00 Point for the C-S-NE-1/64 sec. cor. of sec. 29, which point is inaccessible. The triangulation station BLM S29 is 2.65 chs. S. and 13.88 chs. E.

Thence East, along the N. bdy. SW $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 29, beginning new measurement.

Over inaccessible cliffs.

10.00 Point for the SE-NE-1/64 sec. cor. of sec. 29, which point is inaccessible. The triangulation station BLM S29 is 2.65 chs. S. and 3.88 chs. E.

Thence North, along the W. bdy. NE $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 29, beginning new measurement.

Over inaccessible cliffs.

10.00 Point for the C-E-NE-1/64 sec. cor. of sec. 29, which point is inaccessible. The triangulation station BLM S29 is 12.65 chs. S. and 3.88 chs. E.

Thence North, along the W. bdy. SE $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 29, beginning new measurement.

Over inaccessible cliffs.

10.00 Point for the NE-NE-1/64 sec. cor. of sec. 29, which point is

Subdivision in T. 31 N., R. 14 W.

Chains

inaccessible. The triangulation station BLM S29 is 22.65 chs. S. and 3.88 chs. E.

Thence East, along the N. bdy. $SE\frac{1}{2}NE\frac{1}{4}NE\frac{1}{4}$ sec. 29, beginning new measurement.

Over inaccessible cliffs.

10.00 The point for the N-N-1/64 sec. cor. of secs. 28 and 29.

Land, inaccessible cliffs except along lake edge.
Soil, solid rock.

The legal description of the area surveyed with the area of each is as follows and is also the description of the area to be leased.

<u>Section 28</u>		<u>Section 29</u>	
$SW\frac{1}{2}NW\frac{1}{4}NW\frac{1}{4}$.10.00 Acres	$SE\frac{1}{2}NE\frac{1}{4}NE\frac{1}{4}$	10.00 Acres
$NW\frac{1}{4}SW\frac{1}{4}NW\frac{1}{4}$	10.00	$NE\frac{1}{4}SE\frac{1}{4}NE\frac{1}{4}$	10.00
Total	20.00 Acres	$SE\frac{1}{4}SE\frac{1}{4}NE\frac{1}{4}$	10.00
		$SW\frac{1}{4}SE\frac{1}{4}NE\frac{1}{4}$	10.00
		Lot 1 (fract.)	
		$NW\frac{1}{4}NE\frac{1}{4}SE\frac{1}{4}$	6.40
		Total	46.40 Acres

Total Sections 28 and 29 is 66.40 Acres

Traverse in Bat Cave

From the mouth of the Bat Cave which point falls under small A-frame on scaffolds and frames supporting chute and other mining equipment. The opening of the cave is 10 ft. wide and 25 ft. high.

N. 20° 52' E., 1.25 chs. To traverse point 1. Dimensions of cave are 15 ft. to left, 50 ft. to right, and 70 ft. high.

N. 42° 24' E., 1.03 chs. To traverse point 2. Dimensions of cave are 20 ft. to left, 20 ft. to right, and 40 ft. high. A winch is located at this point to operate a dragline deeper into the cave.

N. 32° 08' E., 2.61 chs. To traverse point 3. Dimensions of cave are 5 ft. to left, 20 ft. to right, and 60 ft. high.

N. 35° 35' E., 2.98 chs. To traverse point 4. Dimensions of cave are 10 ft. to left, 25 ft. to right, and 30 ft. high.

N. 28° 38' E., 1.00 chs. Intersect the section line bet. secs. 28 and 29, 15.95 chs. North of the $\frac{1}{4}$ sec. cor. of secs. 28 and 29.

2.00 chs. Enter room and start of large guano deposits which rises 50 ft. above this point in the right branch of cave and 65 ft. in left branch.

2.99 chs. To traverse point 5. Dimensions of cave are 30 ft. to left, 50 ft. to right, and 25 ft. high. This point is the site of mining operations and is the end of dragline. Cave branches at this point.

Traverse in Bat Cave

Chains

Traverse in Right Branch of Cave.

From traverse point 5.

N. 49° 49' E., 1.78 chs. To traverse point 6 R. This point is in room with guano nearly to ceiling and is the end of the known deposits in this branch. An opening 12 ins. high and 10 ft. wide leads out to North.

Traverse in Left Branch of Cave.

From traverse point 5.

N. 26° 29' E., 1.28 chs. To traverse point 6 L.

N. 6° 26' E., 1.62 chs. To traverse point 7 L. Guano extends nearly to ceiling in this room and is the end of the known deposits. There is a small tunnel leading out of this room to the North.

General Description

The Bat Cave is located near Flour Sack Rapids as shown upon the Geological Survey topographic survey of the Colorado River and fourteen miles above Pierce Ferry and seven miles below Quartermaster Canyon. When the water level of Lake Mead is high, the lake extends up the river a considerable distance above the Cave; however at the time of this survey, the lake level was low and the Colorado River entered the lake approximately twelve miles below the Cave. Due to silting in the river, Flour Sack Rapids have disappeared.

The Canyon of the Colorado River at the Bat Cave is 3,000 ft. deep and there are no known trails or likely points at which the canyon can be climbed from Pierce Ferry to Quartermaster Canyon. Immediately North of the Bat Cave there are cliffs nearly 1,500 ft. high.

The opening to the cave is located in a cleft on the point of a steep spur and under an overhang of 50 ft. on a 150 ft. high cliff. The opening can only be seen from a short stretch of the river.

The cave was apparently discovered and explored in 1937 and 1938 by Harold A. Carpenter who spent four days climbing to the opening.

There are very few bats now living in the cave and their reasons for leaving are not known. No bat carcasses have been found in the guano which is probably accounted for by the presence of ringtail cats. The temperature on the guano heaps in the end rooms is considerably higher than the rest of the cave. Insects were noted in the end rooms.

The cave is a fissure cave and has a uniform strike but an irregular floor. If there are any large openings continuing deeper from the end rooms they could have been very easily covered by guano.

The mine operators have an extensive set-up for mining the guano. The cave is lighted with electricity and the guano is brought from the interior by a dragline operated by a winch. Only one miner is employed at the mining face as the guano is very dry and powdery and when disturbed swirl about in the air. The miner at the head wears a dust respirator when at work. The guano is moved from the entrance of the mine to the area at the head A-frame by means of a canvas tube where it is weighted and sacked in the fifty pound bags in which it is sold. No refining or processing is required. From the head A-frame the sacks are lowered to the bottom A-frame by a skip operated on an aerial cable. The sacked guano is stored on the banks of the river until it can be loaded on barges and towed to Boulder City, Nevada.

Subdivision in T. 31 N., R. 14 W.

General Description (Continued)

Due to the shallowness of the river at certain times, barging is only practical when the river has a depth of 3 ft. or over.

At the bottom A-frame is an engine to operate the skip and west of the frame about 60 ft. is a combination cook and bunk house. A diesel light plant and bath house is also located at the cook house. A bunk house is located about 100 ft. west of cook house.

While the bottom A-frame and its engine is located above the high water line of the lake, the balance of the improvements are within the lake area. The aerial cable supporting the skip is 1070 ft. long and the head is 600 ft. above the bottom. The mine entrance is 255 ft. above the head A-frame.

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BOOK 4366

CERTIFICATE OF CADASTRAL ENGINEER

I, Clark Gumm, Cadastral Engineer, HEREBY CERTIFY upon honor that, in pursuance of special instructions bearing date of the 20th day of January, 1949, I have surveyed a subdivisioal line, sectional subdivisioal lines, meandered the high water line of Lake Mead, traversed Bat Cave containing Guano deposits, and established a triangulation station, within sections 28 and 29, township 31 north, range 14 west.

of the G. and S. R. Meridian, in the State of Arizona, which are represented in the foregoing field notes as having been executed by me and under my direction; and that said survey has been made in strict conformity with said instructions, the Manual of Instructions for the Survey of the Public Lands of the United States, and in the specific manner described in the foregoing field notes.

April 26, 1949

Santa Fe, New Mexico

Clark Gumm
Clark Gumm
Cadastral Engineer

CERTIFICATE OF APPROVAL

BUREAU OF LAND MANAGEMENT,
Washington, D. C., MAY 5 1949, 19

The foregoing field notes of the survey of subdivisioal line, sectional subdivisioal lines, meanders of the high water line of Lake Mead, traverse of a Bat Cave containing guano deposits, and establishment of a triangulation station, all within sections 28 and 29, township 31 north, range 14 west.

executed by Clark Gumm, Cadastral Engineer

having been critically examined and found correct, are hereby approved.

Zaffy K...
Chief, Branch of Engineering and Construction.
Chief, Division of Engineering.

CERTIFICATE OF TRANSCRIPT

I certify that the foregoing transcript of the field notes of the above described surveys in is a true copy of the original field notes.

Chief, Branch of Engineering and Construction.