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RECOMMENDATIONS FOR DRILLING PARTS OF THE COAL CREEK ANTICLINE

RIO BLANCO COUNTY, COLORADO

by

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(Grand Junction, Colorado)

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RECOMMENDATIONS FOR DRILLING PARTS OF THE COAL CREEK ANTICLINE,
RIO BLANCO COUNTY, COLORADO

ABSTRACT

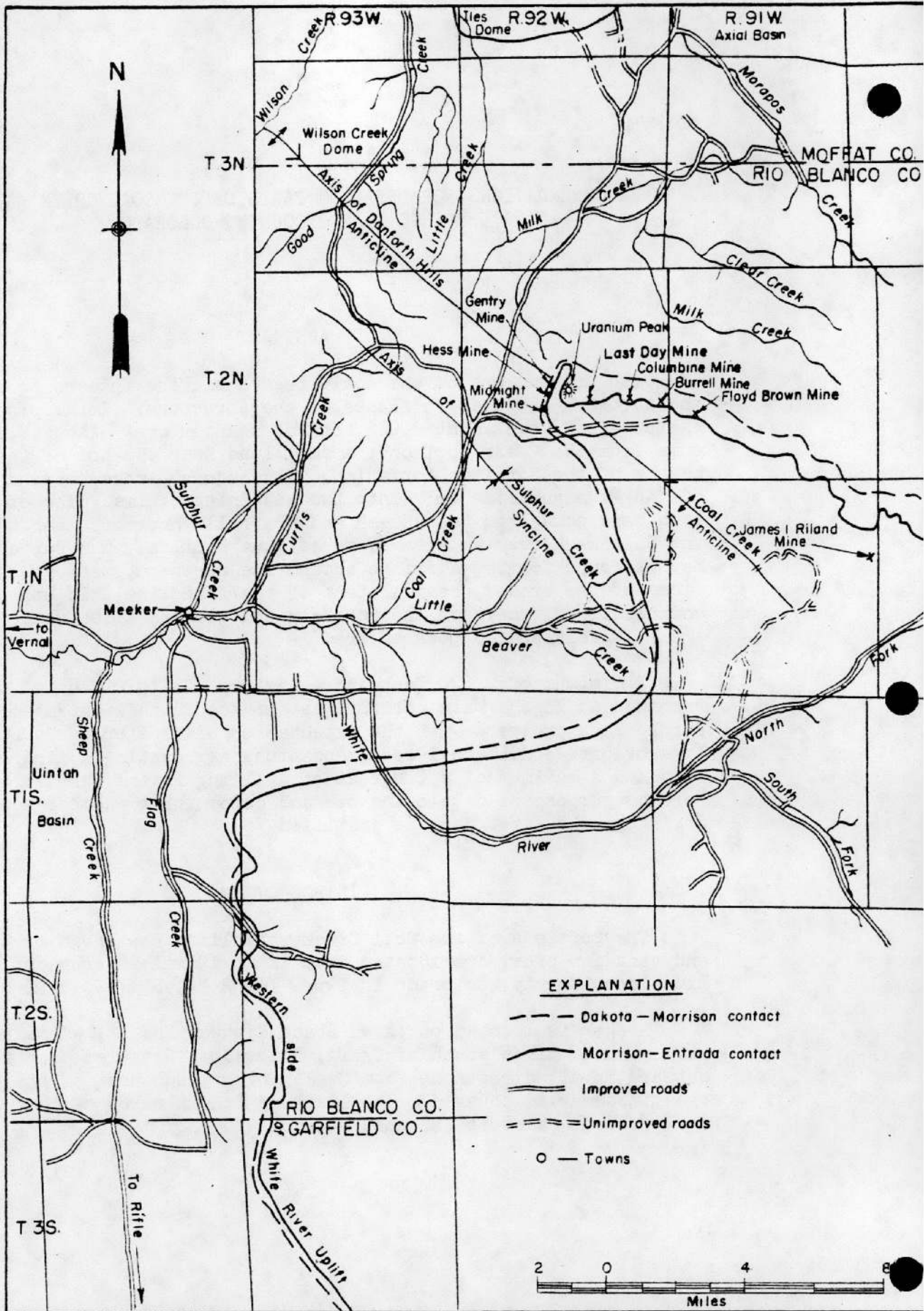
The uranium ore on the Coal Creek anticline appears to be confined to the northern and western flanks of the structure. Total production from the area has been about 8,000 tons of uranium ore. About 7,000 tons have come from the "Main horizon", a sand lens near the top of the Salt Wash member of the Morrison formation, which can be traced beyond the limits of the Midnight mine only onto two adjoining claims. The other 1,000 tons have come from the "Hess" and "Burrell" horizons near the base of the Salt Wash over an area of three square miles. The Burrell horizon may be found forming a fringe around the northern, western and southern sides of the eroded, central part of the anticline. It appears to be unmineralized except on the northern and western sides where it contains small, widely spaced pods of ore.

A minimum of 2,620 feet and a maximum of 7,020 feet of drilling are recommended in the Main horizon west of the South Midnight mine and on the Purple Sage prospect with the expectation of developing 7,000 to 14,000 tons of ore. Additional recommendations aggregating a minimum of 5,260 feet and a maximum of 8,000 feet of drilling in the Burrell horizon are for the purpose of developing ore and determining whether additional drilling at a later date is justified.

INTRODUCTION

The portions of the Coal Creek anticline, now known to contain uranium and vanadium ores, are located from 12 to 19 miles northeast of Meeker, Rio Blanco County, Colorado in Twps. 1 & 2 N., Rgs. 91 & 92 W.

Meeker is located on paved State Highway No. 13, 41 miles north of Rifle and 47 miles south of Craig, Colorado. Graveled county roads extend outward in all directions from Meeker over which most of the distance to the mines may be covered. The last one to six miles of road to every mine and prospect is steep and unsurfaced.



Regional geology of Meeker area — Rio Blanco County, Colorado

Figure 1

Most of the area where the favorable formations crop out has been claimed precluding the necessity of withdrawing the land from public entry. Owners on record are:

1. P. F. Allen, Glenwood Springs, Colorado, who holds by location the Midnight, the Midnight Nos. 2, 3 and 4 and the No Name and No Name Nos. 2, 3 and 5.
2. Arthur Nordeen, c/o P. F. Allen, Glenwood Springs, Colorado, who holds by location the Purple Sage and Purple Sage Nos. 3 and 4.
3. Quinn Burrell, Meeker, Colorado, who holds by location the Last Day and Last Day Nos. 1, 2, 3, 4 and 5; the Windy Point Nos. 3, 4, 5 and 7; the Marvine View Nos. 4 and 5; the Blue Bird Nos. 1 and 2; the Columbine and Columbine Nos. 1, 2, 3, 4, 5, 6, 7 and 8; the Butterfly and Butterfly Nos. 1, 2, 3, 4, 5 and 6; the Little Draw and Little Draw No. 1.
4. Dick Needy, Meeker, Colorado, who holds by location the Needy group of claims.
5. William Gentry, Meeker, Colorado, who holds by location the Gentry group of claims.
6. Guy Steeley, Buford, Colorado, who holds by location the James I. Riland group of claims.
7. Floyd Brown, Meeker, Colorado, who holds by location the Floyd Brown group of claims.

Quinn Burrell has located many claims not listed above in remote areas where drilling is not contemplated in the near future. The list includes all claims located on ground which is considered of immediate interest.

One part of the Allen ground is under lease to Ray Hasselbush and Henry Ziesiness, Rifle, Colorado and the remainder to Steve Barnett and Andy Barnett, also of Rifle.

All the Burrell claims are leased to Tungsten and Uranium, Inc., 1101 S.W. Fifth Avenue, Portland 4, Oregon, M. L. Wilson, President and General Manager.

Angelo Theos, a sheep rancher, owns portions of T. 2 N., R. 92 W. which are not in conflict with uranium claims on record at this time.

HISTORY AND PRODUCTION

The earliest discovery of uranium ore in the area was made in 1905 and was described by Hoyt S. Gale in 1906 in Economic Geology, U. S. Geological Survey Bulletin 315, pp. 110-117. Gale's description of the Caywood mine seems to apply to the present Midnight mine and a description of a prospect pit situated northeast of the Caywood probably concerns the present Gentry claims. The mines were worked to a slight extent until 1921 for their radium content when all work was discontinued for several years. During the 1930's, James I. Riland, editor and owner of the Meeker newspaper, relocated the old Caywood mine and it became known as the Riland mine. From 1940 to 1943, Riland leased the mine to the U. S. Vanadium Corporation. The ore was mined only for its vanadium content and after removing all the readily available ore aggregating about 6,000 tons, the corporation abandoned the property. Riland died soon after the mine was closed and assessment work was not done.

The area was examined for Union Mines by E. H. Wisser and party in 1943 and a report recommending some exploratory drilling was written by Benjamin Webber in 1944.

In 1948, the old Riland mine was restaked by P. F. Allen and was renamed the Midnight mine. Operations were resumed by lessees Hasselbush and Ziesiness in 1950 who have produced about 1,300 tons of ore. Recently, another portion of the mine was leased to Mr. Barnett and son who have produced about 100 tons of ore.

Production from the remainder of the area aggregates about 1,000 tons.

The Union Mines report states that production prior to 1944 averaged 1.5 percent V_2O_5 and 0.17 percent U_3O_8 . Production since 1948 has averaged 1.92 percent V_2O_5 and 0.36 percent U_3O_8 .

GENERAL GEOLOGY

Stratigraphy

The formations exposed in the area are:

- Eocene Green River - Gray to white shale; 1,000⁺ feet thick
Wasatch - Red to gray sandstones and shales; 4,180 feet thick
- Cretaceous Mesa Verde - Sandstone, shale and coal; 5,000 feet thick
Mancos - Gray to black shale; 5,000 feet thick
Dakota - Sandstone and conglomerate; 200 feet thick
- Jurassic Morrison - Brushy Basin - Red to gray green shales, 230 feet thick
Salt Wash - Buff Ss with red shale partings; 210-220 feet thick
Entrada - Pink to buff Ss; 40-150 feet thick
- Triassic Chinle - Red shale; 1,000 feet thick
Shinarump - Red to gray Ss containing lenses of conglomerate; 75 feet thick
- Permian Undifferentiated red beds

Structural Geology

An anticlinal nose (fig. 1), 80 miles long by 40 miles wide with a northwesterly trend, branches from the main range of the Colorado Rocky Mountains in the vicinity of Aspen. The nose is known as the White River uplift. On the northern, western and southern fringes of the uplift, the sharply upturned Dakota and Morrison formations may be traced continuously except locally where their outcrops are covered by late Tertiary or recent lava flows. To the southeast, Paleozoic strata are exposed at surface overlapping the pre-Cambrian complex which forms the core of the continental divide in this area.

Toward the west from the White River uplift, the Morrison formation dips beneath a deep cover of Cretaceous and Eocene sediments into the Uinta Basin and toward the north into the Axial Basin.

The northwestern corner of the White River uplift is deeply indented by the Sulphur Creek syncline, the axis of which strikes easterly and is

situated about six miles north of Meeker. Two miles north of the Sulphur Creek syncline lies the sinuous easterly to southeasterly striking axis of the Danforth Hills anticline. On the northwestern end of the anticline, the Morrison formation lies beneath a cover of more than 6,000 feet of younger sedimentary rocks and contains petroleum in a closed portion of the anticline known as the Wilson Creek dome. Toward the southeast, the Morrison formation forms a fringe at surface around the northern, western and southern sides of another closed portion of the Danforth anticline known as the Coal Creek anticline. On the southeastern end, the anticline merges with the White River uplift and all Jurassic rocks have been removed by erosion. The closure of the Coal Creek anticline may be observed, however, in the Triassic and Permian strata. Dry wells on the Coal Creek anticline indicate that no petroleum exists in the structure.

Radiometric logs furnished by the Texas Company from oil wells in the Wilson Creek dome indicate radioactivity to a maximum of about five times background at intervals throughout a zone 500 feet thick, including basal Mancos, Dakota and Morrison formations at depths from 6,200 to 6,700 feet below the surface.

Northward from the Danforth Hills anticline are located the Elkhorn syncline and the Iles dome. The Iles dome is also oil-bearing and radiometric logs of oil wells furnished by the Stanolind Company show unusual radioactivity at depths varying from 2,300 to 2,800 feet below the surface.

The Eocene Wasatch and Green River formations are steeply folded on the western and northwestern flanks of the White River uplift indicating a Post-Eocene and probably Miocene age of the uplift.

The uranium ore in the Morrison formation on the Coal Creek anticline has been broken by numerous post-ore faults. The largest of these strikes N. 58° W., dips 75° NE., crosses the axis of the anticline at a low angle and has moved the northeastern segment 170 feet in a northwesterly direction relative to the southwestern portion. Bending of the strata adjacent to the fault indicates that the greatest component of movement was horizontal but there was also a small component of reverse movement, the northeast, or hanging wall segment, having moved upward relative to the footwall segment. Excepting this fault, all others observed were normal faults with displacements of a few feet.

Erosion

The center of the Coal Creek anticline has been eroded so deeply that the Permian strata are exposed and the Triassic exposures cover several square miles. From this central eroded core, the Morrison formation dips away in all directions except to the southeast at the junction of the anticline with the White River uplift. The outcrop of the Morrison is, therefore, U shaped, a few hundred feet wide on the southern and western steeply dipping limbs and maintains a width of 1,500 to 2,000 feet on the gently dipping northern limb. Exposures of the Morrison formation occur only on the edges of the eroded central part of the anticline with no further exposures for a distance of 8 miles to the south and 50 miles to the north. Ore trends cannot be projected across mesas as may be done frequently in the plateau country farther south and west and it must be recommended that drilling start behind the outcrops and proceed cautiously, seeking out the ore trends as drilling advances.

Geology of the Ore Deposits

All exposures of uranium ore on the Coal Creek anticline are in the Salt Wash member of the Morrison formation. The Union Mines report states that there are three ore horizons in the member known as the Burrell horizon near the bottom, the Hess horizon 70 feet above the bottom and the Main horizon 160 feet above the bottom. The Hess horizon fluctuates so markedly within the sandstone strata that it is considered probable that the Hess and Burrell horizons are the same.

The Burrell Horizon

This horizon contains most of the known ore exposures, all of which are lenses varying in longest dimensions from a few feet to a maximum of 230 feet. The thickness of the ore varies from a fraction of an inch to 2.5 feet. The grade of shipments from this horizon which, since 1948, have aggregated 172,38 tons, has averaged 0.48 percent U_3O_8 and 1.42 percent V_2O_5 . Mineralized material has been exposed in this horizon on the northeastern flank of the Coal Creek anticline in numerous dozer cuts. Ore, however, has been produced in only four localities known as the Happy Day mine (formerly the Univ), the Columbine mine, the Burrell mine and the Floyd Brown mine (operated by the Devereaux Brothers). Because of the small dimensions and wide spacing of the ore bodies in the Burrell horizon there is little expectation of any large production.

The Hess Horizon

If it should be proved that the Hess horizon is separate from the Burrell horizon, it contains ore in only one locality, on the steeply dipping western flank of the anticline. The ore is thin and occurs in small pods associated with carbonaceous trash. Prior to 1948, all production was from pods exposed on surface by dozer cuts. Recently, ore was found in the Hess horizon about 1,000 feet southeast of the old Hess working. About 20 tons of 1 percent ore were shipped from surface before the ore body was depleted.

The old Hess mine is now known as the Naomi Anne.

The Main Horizon

This horizon is known in only two localities in a sandstone lens 1,000 feet long which cannot be traced outside those limits. The ore is in two seams about six feet apart associated with, but not confined to, carbonaceous trash. The sandstone between the two seams is impregnated with uranium and vanadium minerals to such an extent that at times it is ore grade. Nearly 90 percent of the total production of the area has come from the Main horizon in spite of the limitations in its areal extent. The lens is completely covered by the Midnight, Purple Sage, and Gentry mines.

The Shinarump Horizon

A fourth horizon is in the Shinarump conglomerate. There are many large exposures of Shinarump near the eroded central portion of the dome. It is known to be mineralized only on the southeastern extremity of the dome where it merges with the White River uplift. Here, Guy Steeley, Buford, Colorado, discovered mineralized material about 1910 and named the property for his friend, James I. Riland. Radioactivity may be discerned with a scintillometer for 1,100 feet along the outcrop. The horizon has been opened by a single cut about 40 feet long. In the 40 feet there are two lenses containing visible uranium minerals, each about 8 feet long and attaining a maximum thickness of 2.5 feet.

The Shinarump at this point is a conglomerate of discs of sedimentary rocks, rounded at the edges. The content of CaCO_3 averages about 16 percent and the entire outcrop is colored deep red with hematite. No

chert pebbles were observed and the rock is considered Shinarump only because it is found at the base of the Chinle formation.

Ore Controls

There are three evident controls of ore deposits and a fourth which exists but is not evident. All of them are described below:

1. Association with the Coal Creek anticline. The Morrison and Entrada formations are exposed on about two-thirds of the periphery of the White River uplift. Ore, however, has been discovered only on the Coal Creek anticline or on other similar structures which create irregularities in the outline of the uplift. In the vicinity of Meeker, therefore, the first and most obvious control is the association of the ore deposits with the Coal Creek anticline.

2. Association with thick sand lenses. The Main horizon is a sand lens about 1,000 feet long which attains a thickness of 40 feet near its center. The ore is best at the center and diminishes to the vanishing point at its extremities. The thickening of sandstone lenses as a control is most evident in the Surrell horizon as exposed in numerous dozer cuts. Most of the horizon is six or eight feet of sandstone containing many mudstone partings. At numerous places, the stratum loses its shale partings and thickens to 15 or 20 feet, sometimes at the base, like channel fills, but more frequently at the top. Almost invariably these thicker lenses contain mineralized material and, occasionally, small lenses of ore.

3. Association with carbonaceous trash. In the Hess horizon, most of the ore is in carbon and where no carbon is present, there is no ore.

In the Main horizon, however, ore has been formed regardless of the presence of carbon, although the richest parts of the ore shoot are found where carbon is abundant. At the extremities of the sandstone lens and outside the limits of the ore body, abundant unmineralized carbon may be found.

In the Surrell horizon, some rich ore has been found in silicified trees, but carbon has not been a prominent factor in the precipitation of the uranium compounds.

4. All known ore bodies are confined to the western and northern sides of the Coal Creek anticline. This is not due to the absence of sandstone elsewhere, the Hess horizon being as prominent on the southern

SAMPLE DATA

Sample No.	Thickness	Hanging	Middle	Foot	%E-U ₃ O ₈	%U ₃ O ₈	%V ₂ O ₅
25726	4.6'	x			0.02	0.02	0.02
25727	4.0			x	0.04	0.02	0.40
25728	2.6	x			0.05	0.04	0.92
25729	3.4		x		0.03	0.02	0.22
25730	2.2			x	0.03	0.04	0.80
25731	5.2			x	0.79	0.91	3.20
25732	4.0			x	0.17	0.20	1.23
25733	4.0			x	0.02	0.03	0.32
25734	3.7			x	0.22	0.28	1.82
25735	1.5			x	0.17	0.15	0.96
25736	2.6			x	0.23	0.24	3.17
25737	3.6			x	0.37	0.37	1.82
25738	2.6	x			0.17	0.18	0.48
25739	2.8	x			0.15	0.16	0.53
25740	4.0		x		0.02	0.03	0.84
25741	2.5			x	0.13	0.14	1.02
25742	2.0			x	0.18	0.29	0.27
25743	4.0		x		0.05	0.04	0.10
25744	2.7			x	0.05	0.05	0.18
25745	1.8	x			0.84	0.84	2.52
25746	1.4	Entire	vein		0.03	0.03	0.02
25747	2.0	"	"		0.05	0.03	0.02
25748	1.5	"	"		0.11	0.05	0.59

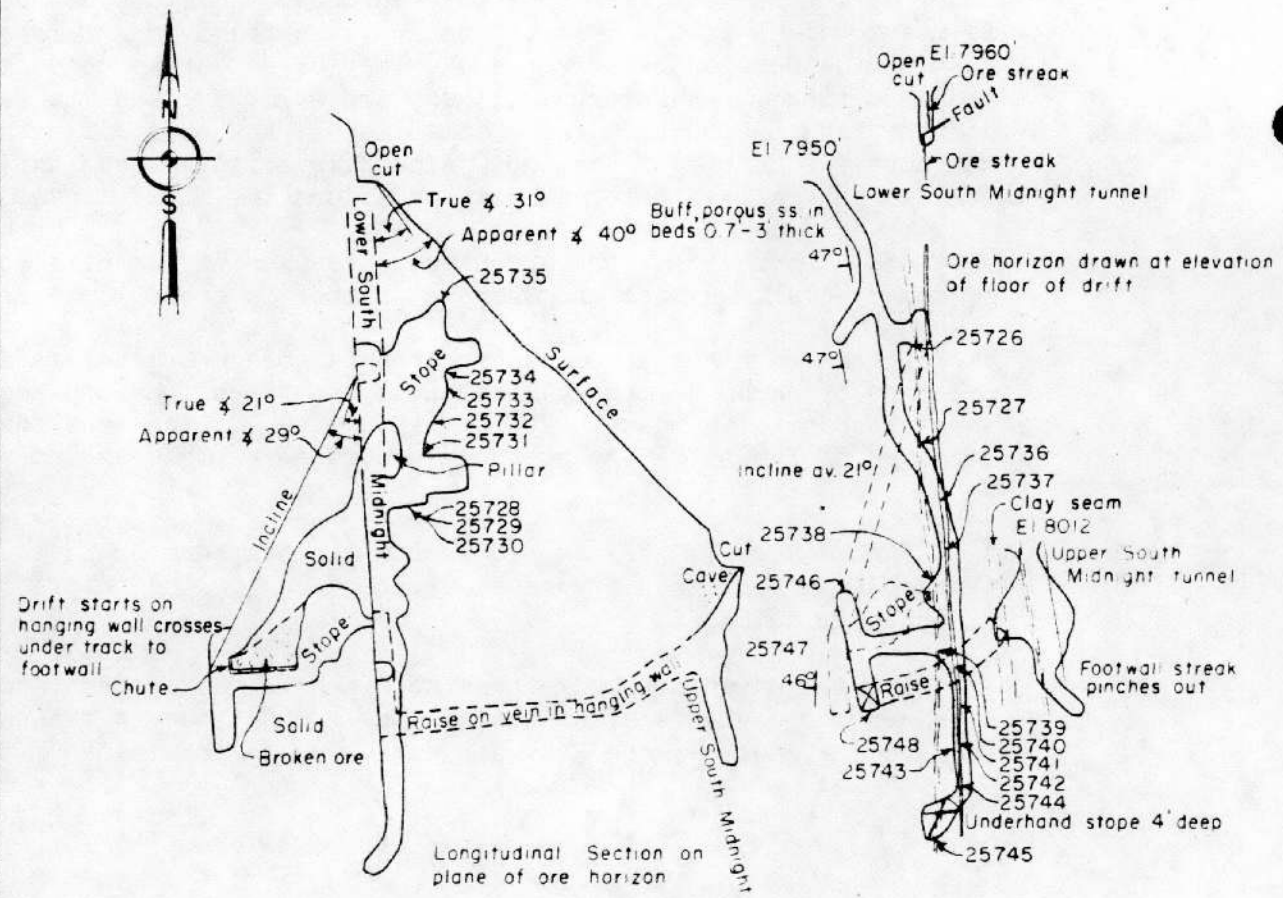
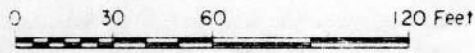
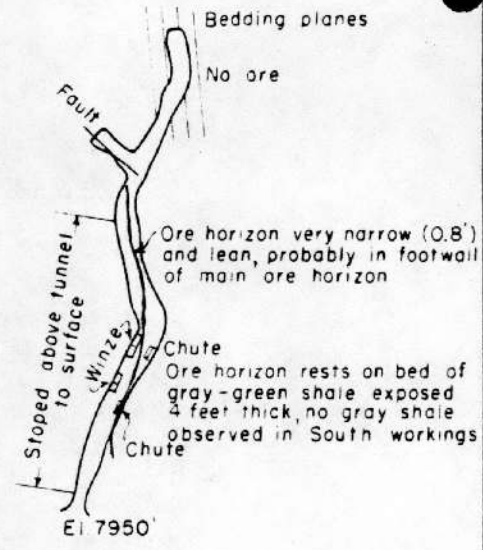


Figure 2 - Underground workings of the South Midnight Mine
Rio Blanco County, Colorado

side of the anticline as on the northern and western sides. The reason for this phenomenon is not known. At this time, it may be stated only that there is some unknown factor which permitted deposition only on the northern and western sides of the dome.

Descriptions of Individual Mines

The South Midnight Mine (fig. 2)

The owner is P. F. Allen and it is operated by Ray Hasselbush and Henry Ziesiness.

This mine is in the Main horizon and was discovered in 1905. It was slightly developed in 1943 by The United States Vanadium Corporation and was abandoned in 1944. Work was resumed by the present lessees in 1950. About 100 tons were shipped during that year; 700 tons in 1951 and from May 15 to July 31, 1952, 300 tons. Subsequent shipments went out at about 20 tons per week and continued at this rate until the operation was closed by snowfall toward the end of November, 1952. A production of 10,000 pounds U₃O₈ was attained and the operation continued without the bonus.

The South Midnight mine is developed by three tunnels and an inclined winze. The portal of the upper tunnel is only 40 feet from the southern limit of the ore shoot and the backs are stoped out to surface.

The portal of the lower tunnel is 200 feet from the southern limit of the ore body and is 62 feet vertically below the upper tunnel. On the average 46° dip of the strata, the stope height is 85 feet. Near the portal, a stope has been carried almost to surface; near the face, on the other hand, there remain about 75 feet of backs inadequately explored by raises which reach 12 to 15 feet above the floor of the tunnel. A winze inclined on the vein about half way between the strike and the dip at an angle of 21° has been sunk to the southern limit of the ore shoot. It reaches a depth of 40 feet vertically below the tunnel level and 56 feet on the dip. Stopes have been mined from the incline to the tunnel level and at present a drift is being driven from the bottom of the incline, northward under the track in the incline. All production in 1951 and 1952 from the South Midnight mine has come from the incline. The footwall and hanging wall veins have seldom been extracted in the same portions of the mine. In some places, the hanging wall streak appeared richer and the

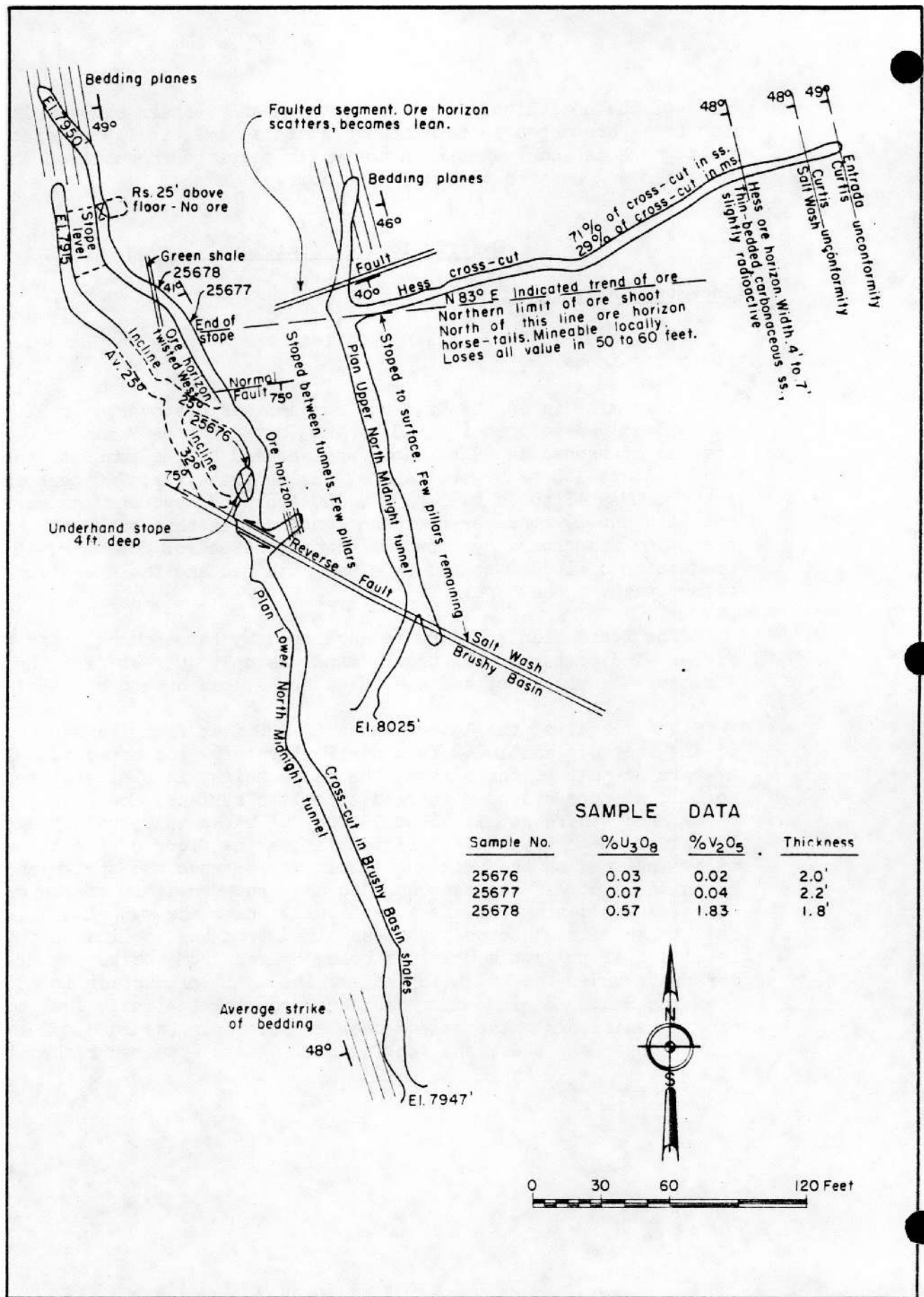


Figure 3 - Underground workings of the North Midnight Mine
Rio Blanco County, Colorado

footwall was left unbroken; elsewhere the footwall streak was mined and the hanging wall was left unbroken. The result is that nearly one-half the ore remains in those portions of the mine which are considered worked-out.

A third tunnel enters the hill on the vein in a northerly direction across a gulch from the main, lower tunnel and at approximately the same elevation. It penetrates the hill 105 feet to the big reverse fault. A 45-foot drift on the northeast side of the fault disclosed no ore. From the portal of the tunnel to the fault, the back of the drift has been stoped. The stope cannot be entered at this time and it is unknown how high it was driven above the level.

The North Midnight Mine (fig. 3)

The owner is P. F. Allen and it is operated by Steve Barnett and Andy Barnett.

The North Midnight mine is on the continuation of the South Midnight vein offset 170 feet in a westerly direction by the reverse fault.

It has been developed by an upper and lower tunnel. The portal of the upper tunnel is near the fault and follows the vein for 180 feet to the northern limit of the ore body. The drift continues for an additional 50 feet cross-cutting the strata at a low angle without disclosing additional ore.

A 230-foot cross-cut to the east was driven to prospect the Hess horizon. It was found to be a streak 0.3 to 0.5 of a foot wide containing abundant carbon, a little vanadium and a small amount of uranium. The cross-cut also cuts a black, calcareous shale which was identified as the Curtis formation by Wisser and penetrates five feet into the Entrada sandstone.

From the portal of the upper North Midnight tunnel to the northern limit of the ore, the ore body has been stoped to surface except for a few pillars.

The lower North Midnight tunnel cuts through 250 feet of Brushy Basin shales to the reverse fault. On the north side of the fault, the vein was found and the drift on it continues for 80 feet in ore to the northern limit of the ore body. From the end of the ore shoot, the drift continues

for 130 feet, cross-cutting the strata at a low angle. One small body of ore was found in a stratum fifty feet north of the main ore body and 18 feet higher stratigraphically. This horizon probably corresponds to the horizon discovered in the South Midnight in the west cross-cut (shown on the map in fig. 2). In neither location has it produced ore of any note either in quantity or quality. It should be watched for and examined, however, in drill cores.

An inclined winze extending to a depth of 40 feet below the tunnel follows the contact between the ore horizon and the fault. The fault cuts the ore off in the northern segment and the North Midnight mine is considered worked out except for a few pillars which are now being removed by the Barnetts.

This mine was the principal producer during the period of activity under the U. S. Vanadium Corporation. Total production aggregated in excess of 6,000 tons of ore. Although there is no possibility of a downward extension of ore in the North Midnight mine, the entire mine is not condemned because every linear foot of ore which is lost in the North Midnight will be gained by the South Midnight. It is, therefore, the South Midnight which has a promising future at greater depth.

The Purple Sage Prospect

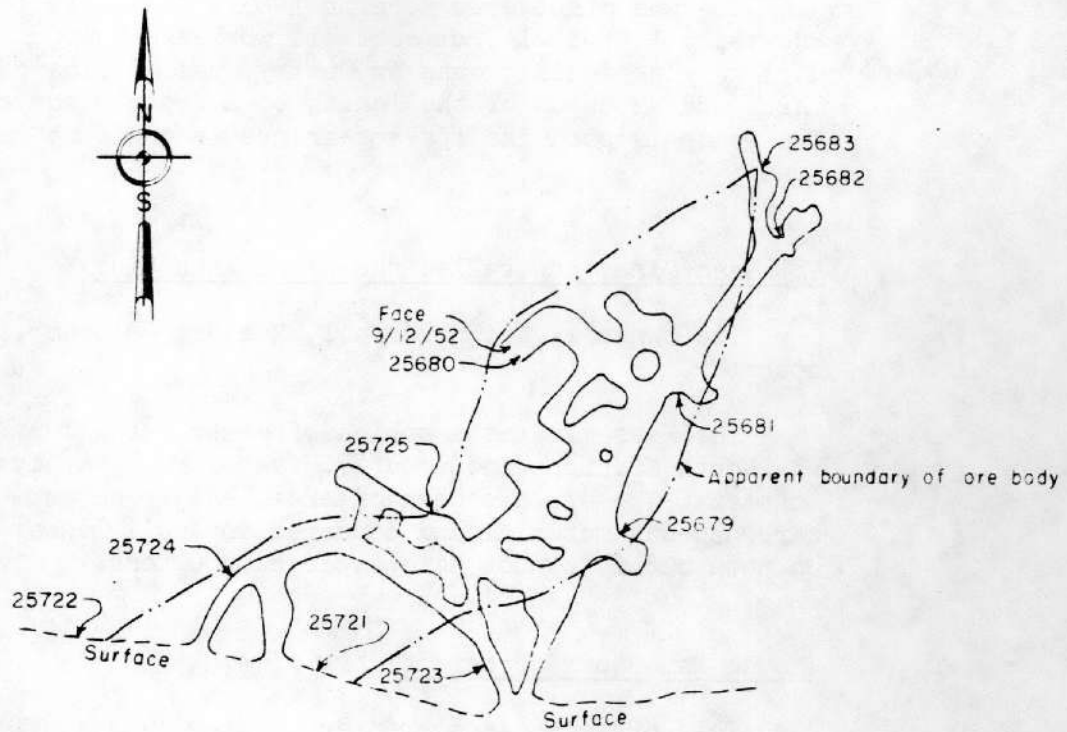
The owner is Arthur Nordeen, c/o P. F. Allen, Glenwood Springs, Colorado and there is no operator.

This is a thickening of the main ore horizon about 800 feet north of the North Midnight. It is about 40 feet long and was recently dozed, disclosing considerable radioactive material. There has been no production.

The Gentry Prospect

The owner is William Gentry of Meeker, Colorado, and there is no operator.

This prospect is the last known occurrence of mineralized rock in the Main horizon. It is near the top of Uranium Peak, 3,800 feet northeast of the Midnight mines and over the crest of the anticline so that the formations are dipping northerly at an angle of 8°.



SAMPLE DATA

Sample No.	% E-U ₃ O ₈	% U ₃ O ₈	% V ₂ O ₅	Thickness
25679	0.50	0.54	1.84	1.9'
25680	0.77	0.81	2.37	1.9
25681	0.15	0.14	0.62	1.0
25682	0.05	0.05	1.15	1.3
25683	0.01	0.01	0.84	2.2
25721	0.16	0.17	1.57	2.0
25722	0.01	0.01	0.74	2.0
25723	0.07	0.07	1.04	1.4
25724	0.46	0.50	1.35	1.5
25725	0.06	0.05	0.62	1.5

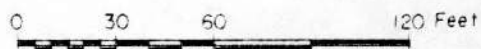


Figure 4 - Underground workings of the Last Day Mine
Rio Blanco County, Colorado

Ore was discovered here in 1905 and a small production was made between the years 1905-1921 from some old workings now obliterated by recent bulldozing. The dozing, done by Gentry, has disclosed an ore bed 1.0 foot thick and exposed for the length of a dozer blade or about 8.0 feet long. The grade is good and its appearance is the same as the ore in the Midnight mine.

The Hess Mine, now called the Naomi Anne Mine

The owner is Quinn Burrell, Meeker, Colorado, and there is no operator.

The Hess mine is a series of dozer cuts about 400 feet northeast of the North Midnight and about 70 feet stratigraphically above the Entrada contact. The ore has been of excellent grade but was confined to carbonaceous material and occurred in small lenses. Total production is unknown but it cannot have exceeded 200 tons.

The No Name No. 5 Prospect

This ore was discovered during the summer of 1952 by Hasselbush in the Hess horizon with a scintillometer immediately east of the South Midnight mine. The ore body proved to contain about 20 tons of ore in a carbon trash pile and appears to be depleted.

The Dick Needy Prospect

The owner is Dick Needy, Meeker, Colorado.

This prospect is located about 2,500 feet northwest of the Gentry property and consists of a dozer cut 300 feet long in the Morrison formation. At the location of the dozer cut, a radioactive, fossilized dinosaur bone was found on surface. The dozing disclosed no ore nor mineralized rock.

The Last Day Mine (fig. 4)

The owner is Quinn Burrell, Meeker, Colorado.

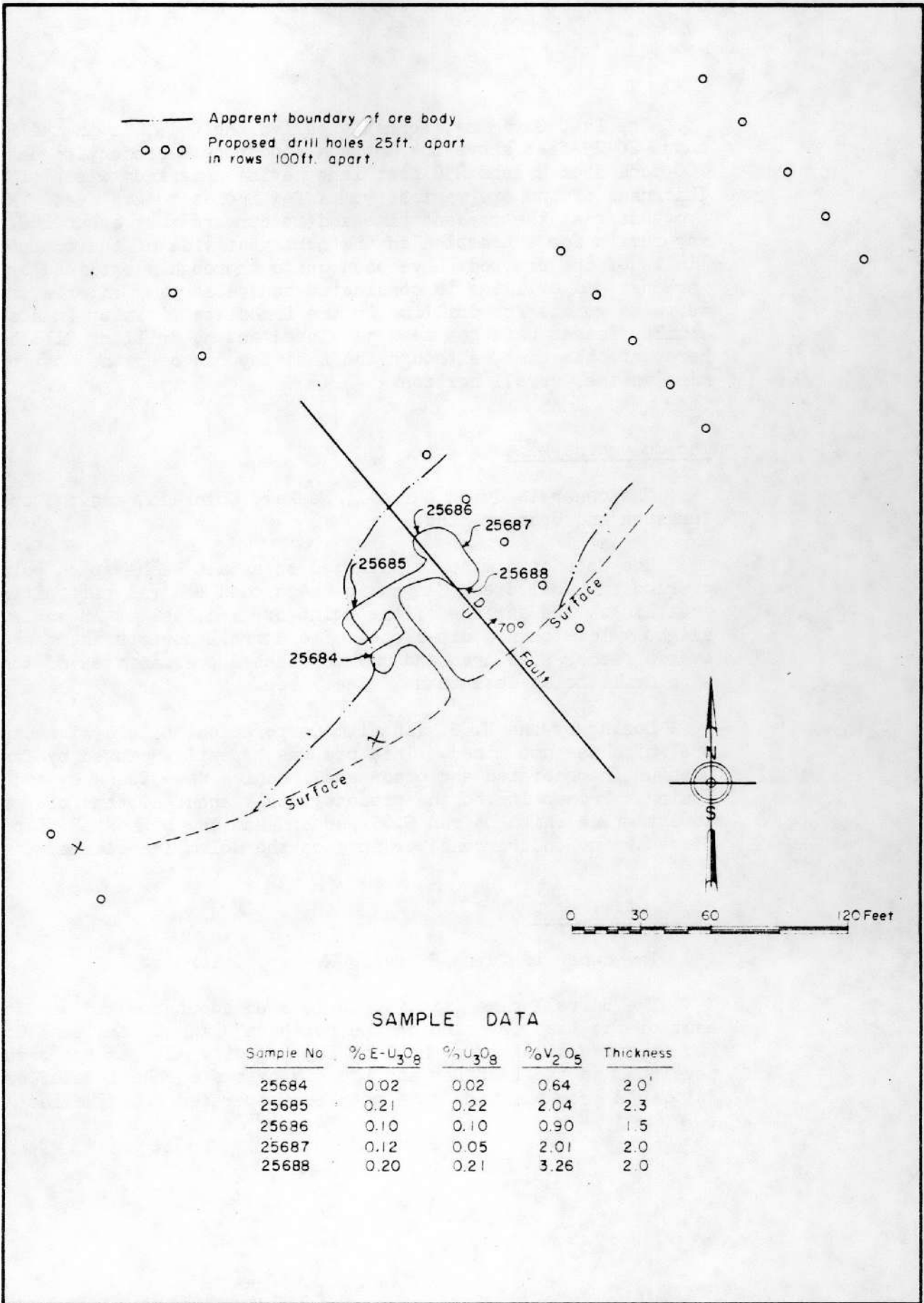


Figure 5 - Underground workings of the Burrell Mine
 Rio Blanco County, Colorado

The Last Day mine, formerly called the Uriv, is in the Burrell horizon about 20-25 feet above the Entrada sandstone. Production has totaled about 700 tons from a lens 230 feet long having a maximum width of 50 feet. Thickness of the ore varies from a few inches to 2.5 feet. Mining is proceeding at the present time and it appears that about 100 tons of ore may remain for extraction on the northwest side of the ore body. The limits of the ore body have been quite thoroughly outlined by underground workings and drilling is considered unnecessary. Criteria which might serve as guides for drilling in the immediate vicinity in a search for similar lenses have not been developed and no drilling will be recommended here, at this time, although the Last Day has been the most productive mine in the Burrell horizon.

The Columbine Mine

The owner is Quinn Burrell, Meeker, Colorado, and the operator is Tungsten and Uranium, Inc.

The Columbine mine is situated on a Salt Wash-capped point of land overlooking Coal Creek Canyon in the eroded central part of the Coal Creek anticline. The surface of the point of land lies at an angle only slightly less than a dip-slope. The Burrell horizon is, therefore, exposed over a rather wide area and may be reached over an area of about 100 acres with drill holes less than 75 feet deep.

Dozing by the U. S. Vanadium Corporation in 1944 disclosed a little ore which was not mined. This ore was recently removed by Tungsten and Uranium, Incorporated and other small bodies were found by additional dozing. Production to the present totals about 60 tons of which the lowest grade shipment ran 0.65 percent and the highest 2.75 percent U_3O_8 . There are no underground workings on the Columbine claims.

The Burrell Mine

The owner is Quinn Burrell, Meeker, Colorado.

The Burrell mine (fig. 5) is located about one and one-fourth miles east of the Last Day mine on the northern flank of the Coal Creek anticline, and is quite similar to the Last Day deposit. It has not been as fully developed as the Last Day and the dimensions of the lens of ore are unknown. Shipments from the mine have not been separated from the Last Day. The

size of the opening indicates, however, that 50-100 tons of ore have been shipped from it. The mine is not being operated at present.

The Floyd Brown Mine

The owner is Floyd Brown, Meeker, Colorado, and it is operated by the Devereaux Brothers.

Bulldozing was started at this location because a fragment of silicified, fossil wood was found. Two hundred to three hundred feet of rim has been dozed in each of two areas situated about one-fourth mile apart and approximately three-fourths of a mile southeast of the Burrell mine.

A few very thin seams of uranium-vanadium bearing material, from which no ore was produced, were found and two exceptionally high-grade fossil trees were mined. Ore with a gross value of \$700.00 was produced from one tree and of \$7,000.00 from the other. Although a substantial production accrued from these two small bodies of ore, dozer operations conducted over intermittent periods of time aggregating five months, failed to disclose additional ore. Because of the wide and irregular spacing of the fossil trees, no drilling on the Floyd Brown claims will be recommended.

The James I. Riland Prospect

The owner is Guy Steeley, Buford, Colorado.

The James I. Riland prospect is situated in an exposure of the Shinarump formation near the head of Fawn Creek about two and one-half miles southeast of the Floyd Brown mine. The mine consists of an open cut about 40 feet long exposing two lenses of mineralized material with a high calcite content, each about eight feet long with maximum thicknesses of 2.5 feet. Several faults have exposed rims of Shinarump formation at a number of elevations over an area of several square miles. Some radioactivity may be observed on these rims at widely separated locations. However, only one cut has been made into the several radioactive rims.

RECOMMENDATIONS FOR DRILLING

General

Exposures of the ore-bearing formations are confined to the central, eroded part of the dome. Therefore, unlike much of the Colorado Plateau to the southwest, ore trends cannot be established by observing ore exposures on opposite sides of the mesas. Because of this unilateral exposure, recommendations for extensive drilling programs cannot be made. Recommendations must confine the drilling to a limited amount behind some of the better outcrops of ore. Should this initial program prove successful, additional drilling in small amounts each year may be warranted over a period of several years. Should it prove, however, that the ore bodies are too small or too widely spaced to justify drilling, the Coal Creek anticline should be dropped as a drilling project at the conclusion of this recommended program.

Recommendation No. 1

The South Midnight Mine

The strikes of the beds average N. 16° W. and their dip average 46° westerly. The average slope of the mountain is about 28° toward the west.

Most of the ore has been extracted from the lower tunnel to surface and drilling above the tunnel is not justified. It is recommended that a row of holes, spaced 50 feet apart, be drilled from the southern end of the thick sandstone lens in a N. 16° W. direction until the thrust fault is encountered. The location of the holes should be chosen to cut the ore horizon 100 feet vertically or about 137 feet down the plane of the vein below the lower Midnight tunnel. This will involve the drilling of approximately 40 holes, each about 55 feet deep and will aggregate about 2,200 feet of drilling.

It was intended to superimpose a structure contour map of the area on a topographic map to aid the engineer in charge in determining the approximate depth of holes at any location by studying the map. A contour map on a scale of one inch equals 600 feet was the biggest scale which could be produced from existing photographs and it is not practical to show either drill holes, or structure contours on it. It is recommended that the drilling areas be flown low about the first of May and new drilling maps be prepared from the resulting photographs.

A diagrammatic sketch of the area showing the 28° slope of the hill and the 46° dip of the beds would demonstrate that vertical holes will be only a few feet deeper than inclined holes and it is recommended that all holes be drilled vertically.

If the first row of holes is successful in disclosing ore in appreciable quantities and of a grade similar to that which has been mined, it is further recommended that a second row of holes be drilled on 50-foot centers designed to cut the ore horizon 200 feet vertically below the present lower tunnel level and 274 feet down the dip. The holes should be so placed that they will be staggered or offset half-way from the first row of holes.

These holes will average about 110 feet deep, will be about 40 in number, and will aggregate about 4,400 feet of drilling. Therefore, on the South Midnight mine, a minimum of 2,200 feet of drilling is recommended with a maximum of 6,600 feet. A third row of holes is not recommended at this time as the slope of the mountain decreases considerably below the second proposed row and a third row would entail drilling to depths of 400-500 feet.

The ore, as exposed, is so consistent in the South Midnight mine that offsetting from ore holes is not required. Ore may be projected with considerable assurance from holes spotted 50 feet apart horizontally and 137 feet apart along the dip.

The present workings of the North and South Midnight mines have produced in excess of 7,000 tons of ore from a stope height which, in few places, exceeds 137 feet and much of the ore horizon has been removed by erosion to the depth of the lower tunnels. It is, therefore, considered probable that the proposed 6,600 feet of drilling may develop in excess of 14,000 tons of ore which should run 0.25-0.30 percent U_3O_8 and 1.00-1.50 percent V_2O_5 .

The upper row of holes will be, for the greater part, in sandstone members of the Salt Wash and drilling should be accomplished with no great difficulty. The lower row will collar in Brushy Basin, soft, green shales. Each hole may be plug-bitted to points within 50 feet of the bottom.

Drill roads will have to be constructed on a steep hillside. There are few ledges of rock exposed at the surface and it is believed that most of the roads can be constructed without drilling and blasting. A compressor and a jackhammer should be on hand, however, to drill and blast

large boulders and buried ledges which the bulldozer cannot move. An engineer and bulldozer operator should be sent into the area about two weeks before the drills arrive in order to have the roads prepared, as two drills should use the drill sites in the upper row of holes at the rate of six sites every two days.

Ample drilling water is available either from a spring one and one-half miles to the southeast at an elevation 600 feet higher than the proposed drilling location, or from Coal Creek one and one-half miles to the southwest and at 600 feet lower elevation. Some water may be available from the pumps at the South Midnight mine. The roads are in better condition below the mine than above it and it will probably be found that Coal Creek will constitute a more suitable source of water than the spring.

Snow usually starts falling in the area in November and remains until May. Preparation for drilling should start about May 15 and drilling should be concluded before November 15.

Recommendation No. 2

The Purple Sage

The reef of sandstone constituting the main ore horizon forms nearly a dip slope on the Purple Sage claims to a height of about 200 feet. Drilling on this dip slope cannot be accomplished without excessive cost in road construction. It is, therefore, recommended that a row of seven holes on 25-foot centers be drilled at the base of the dip slope, designed to cut the bottom of the ore horizon at 60 feet of depth.

The road to this location can be constructed in a few hours from the main mine road and all seven sites should be prepared in a day.

The water haul will be about a mile over a good road from Coal Creek.

Drilling will be through Salt Wash sandstones and should not be difficult.

Both the minimum and maximum footage recommended for this location is about 420 feet.

Recommendation No. 3

A row of holes on 50-foot centers is recommended below the Hess dozer cuts designed to cut the horizon 75 feet vertically below the outcrop. The holes will number seven and will average about 80 feet deep. Minimum footage will, therefore, be about 560 feet. Because of the erratic nature of ore occurrences at the Hess mine, some offset holes may be necessary. It is recommended that 240 feet of drilling be allowed for offset holes in the event that ore is found by the row of holes, thus making a maximum of 800 feet of drilling.

The drilling will all be in Salt Wash and should not be difficult.

A few hours of work with a bulldozer should complete all necessary roads and drill sites.

Drilling water may be obtained from Coal Creek, two miles away and at an elevation about 1,000 feet lower.

Recommendation No. 4

The Burrell Mine

Irregularly spaced holes northeast of the Burrell mine are recommended to start immediately northeast of the present ore face and to be extended as far as the lens of ore continues. The work should be done as if the first hole drilled were an offset of an existing ore hole. When the lens of ore is outlined a few widely spaced holes should be drilled approximately along the line established as the ore-trend to determine whether another ore body exists in the same thick sand lens. As sand thickness is the most obvious control of ore deposition, the geologist in charge of drilling should construct and keep up to date at all times, a sand-thickness map.

It is recommended that 1,500 to 2,000 feet be drilled in this area.

Road construction will be on a steep hillside but few rocks will be encountered to hinder construction.

Water may be obtained from a branch of Coal Creek one-half mile to the east and at about the same elevation or from a spring one-half mile to the west. If the spring should be chosen as the site to obtain water, a 1,500-gallon tank will have to be installed as a reservoir as the spring flows a three-fourths inch pipe full of water and would require an hour or more to fill the tank of a water truck.

Recommendation No. 5

The Columbine Prospect

It is recommended that the 100 acres of nearly horizontal land be drilled with a regular grid pattern. The purpose of the drilling will be two-fold: to disclose ore; and to attempt to establish criteria so that, if the project is successful in finding ore, the same criteria may be applied to deeper drilling at a later date in areas not so readily accessible.

As the ore-bodies which may be found will be small and at an unpredictable spacing, the initial grid pattern must be rather closely spaced. It seems that 200 feet should be suitable with a closer spacing in those trends where thick sand lenses are found. A sand-thickness map should be started after the first few holes are drilled and should be kept up to date as a guide to continued drilling. When the ore horizon has reached a depth of 75 feet, drilling should be discontinued as it is unlikely that any company will sink shafts deeper than 75 feet to recover ore in such small bodies and so widely spaced as these occurrences now appear to be.

There will be about 64 holes which will average 50 feet in depth making a total of about 3,200 feet as a minimum footage and an additional 2,000 feet for offsets making a maximum footage of about 5,200 feet. If the drilling should prove that the ore-bodies are larger or more closely spaced than anticipated, an indefinite, but large footage could be drilled advantageously in the area.

The terrain is level to gently sloping, contains no ledges nor large rocks and has but few trees and bushes growing on it. There will be no problem in road construction.

The nearest supply of water is a spring about one-half mile away. A 1,500-gallon tank should be installed to catch the flow from a three-fourths-inch pipe at all times. The haul from the spring to the drilling sites will be over level or gently inclined roads.

All drilling will be through Salt Wash sandstone and should offer no obstacles.

Although recommendation No. 5 is for wagon-drill depths, it is recommended that all the drilling be done with core drills as information

which can be obtained only from cores will be essential to project the work away from the outcrop toward the deeper portions of the area.

RECAPITULATION

<u>Recommendation</u>	<u>Minimum feet</u>	<u>Maximum feet</u>
South Midnight	2,200	6,600
Purple Sage	420	420
Hess	560	800
Burrell	1,500	2,000
Columbine	<u>3,200</u>	<u>5,200</u>
Totals	7,880	15,020

CONCLUSION

The recommendation for drilling west of the South Midnight mine is well justified and the drilling will probably develop several thousand tons of ore. The remainder of the recommendations are of an investigative nature to determine whether the area, exclusive of the South Midnight, is worthy of further attention in the future.