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# Office Memorandum • UNITED STATES GOVERNMENT

TO : Files

DATE: MAR 29 1956

FROM : Richard A. Teichman, Jr., Ivan T. Fisk, and  
Jack I. McLelland, Geologists, Geologic Branch, ED, GJSUBJECT: TECHNICAL MEMORANDUM #80 - PRELIMINARY DRILLING REPORT, BIG INDIAN  
WASH DISTRICT, SAN JUAN COUNTY, UTAH, CONTRACT NO. AT(05-1)-225

SYMBOL: ED:RAT:ITF:JIM

## ABSTRACT

An exploration drilling program was conducted by the Atomic Energy Commission in the Big Indian Wash district from the latter part of June, 1953, to the early part of September, 1953. Nineteen thousand, seven hundred and eighty-five feet of diamond drilling was done in 93 holes in the course of the program, and a considerable tonnage of uranium ore was discovered in the Chinle formation. Additional and larger reserves were developed by private organizations as a result of AEC drilling activities.

A previous discovery of a large ore body in the lower portions of the Chinle formation by the Utex Exploration Company of Moab, Utah, and the discovery of a large ore deposit by the Commission in July, 1953, greatly stimulated private activity in the district.

## INTRODUCTION

Drilling was undertaken in the Big Indian Wash area to determine the possibilities of uranium production from the Permian Cutler formation and from the lower portion of the Triassic Chinle formation. Originally, it was planned to investigate extensively the Permian Cutler formation in the vicinity of the Small Fry, Calico Dyke and Big Buck claims (Dix, 1953), but during the course of the investigation it became apparent that the most favorable horizon was the lower portion of the Chinle (Moss Back member). Accordingly, emphasis was placed on determining the reserves of this member.

The present report was prepared to serve mainly as a resume of the AEC 1953 drilling project at Big Indian Wash, and a record of related activities up to early 1954.

## LOCATION AND ACCESSIBILITY

Big Indian Wash begins 9 miles south of the town of La Sal, Utah (fig. 1), and flows south from that point for 5 miles. An escarpment parallels the wash for approximately  $4\frac{1}{2}$  miles to the point where the wash turns

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west to drain into Hatch Wash and thence into the Colorado River. This escarpment contains several mineralized outcrops in the Cutler and Chinle formations.

The Big Indian Wash area is within Tps. 29, 29½, and 30 S., Rs. 24 and 25 E., Salt Lake Meridian (fig. 2). From Moab, Utah, it is reached by following U. S. Highway 160 south to La Sal Junction, thence east over state road 46 for 7 miles, and south for 7 miles on a gravel road to the first outcrop of Wingate sandstone (fig. 1). The gravel road continues through the wash for approximately 10 miles and joins U. S. Highway 160, 20 miles north of Monticello, Utah. The road is passable throughout the year.

Ore from the area was being shipped either 38 miles to the mill at Monticello, or 60 miles to the buying station at Thompson, Utah.

#### MINING HISTORY

Approximately 20 square miles of land had been claimed in the Big Indian Wash area, and all school sections had been leased. The approximate outlines of various blocks of claims within the area are shown in figure 3.

Production of uranium and vanadium ores from this district was confined to the Cutler and Chinle formations. The lower portion of the Chinle formation Moss Back member was by far the larger producer. The Permian Cutler formation had produced sporadically since 1948, but the ore grade was low, and the mines had been inoperative for many months.

During the first World War, the Ohio Copper Company mined a large amount of copper carbonate ore of unknown grade from a deposit located along the Lisbon Valley fault near the northern part of the wash.

The Utex Exploration Company began producing from the Mi Vida mine (fig. 2) in November, 1952, using a modified room and pillar method of mining. Very little timber was used in the workings, but a large number of roof bolts had been used to advantage (Steen, Dix, Hazen and McLellan, 1953).

The Cal Uranium Company of Moab, Utah, had sunk a two-compartment cribbed shaft into the ore body located by AEC investigative drilling. The shaft (fig. 2) was 278 feet deep and was completed in mid-February 1954.

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Twenty-three privately owned and operated drilling rigs were active in the area. The organizations engaged in the most extensive drilling programs were:

1. The Moab Drilling Company, Moab, Utah.
2. The Garwood and Gerlach Mining Co., Cortez, Colorado.
3. The La Sal Mining and Development Company, Moab, Utah.
4. The Moss Copper Company, Price, Utah.
5. The Cal Uranium Company, Moab, Utah.
6. The Western Mines Development Company, Grand Junction, Colorado.

Much information has been made available to the Commission at low cost by these organizations.

#### GEOMORPHOLOGY AND CLIMATE

The Big Indian Wash district has an elevation ranging from 6,400 feet to 7,100 feet. Two prominent east-facing cuervas (fig. 2) are the major land forms. The westernmost cuesta is capped by the Triassic Wingate sandstone which is the most important land form. One mile to the north-east, across an alluvium-filled valley, is a second prominent cuesta formed by the Pennsylvanian Hermosa limestone (fig. 4).

In the Big Indian Wash area streams are subsequent, intermittent and in a stage of early maturity. Several obsequent canyons have developed in areas where cross jointing is prominently developed. A trellis pattern is formed by the cuervas. Drainage for the area as a whole displays a dendritic pattern. The streams in the area are at present in a stage of downcutting due to rejuvenation.

The climate is semiarid with sparse amounts of rain and snow. Precipitation amounts to less than 12 inches a year. Vegetation consists of sage, cactus and small pinon and juniper trees. Working conditions are good throughout the year, although seasonal rains and snows make some roads temporarily impassable.

The rocks exposed in the Big Indian Wash area range in age from the Pennsylvanian Hermosa limestone to the Jurassic Navajo sandstone (fig. 5). The principal uranium-bearing horizon is a sandstone in the Moss Back member in the lower part of the Triassic Chinle formation.

#### REGIONAL STRUCTURES

The Big Indian Wash area is located midway between two major laccolithic intrusives, the La Sal Mountains and the Abajo Mountains, and approximately one mile west of the Lisbon Valley anticline which trends north-westward (figs. 2 and 4).

A pronounced joint system is present in the Big Indian Wash district, and aerial photographs indicate that most of the joints strike northwest in the northern part of the district, where private development was centered. In two places, as seen from aerial photographs, closely spaced conjugate sets exist. These two areas are in the vicinity of Steen Canyon and North Canyon (fig. 2). These well-developed conjugate joints doubtless influenced the canyon development.

#### ECONOMIC GEOLOGY

In the Big Indian Wash area, uranium mineralization was known to have occurred in the lower part of the Chinle formation (Moss Back member) and in the upper part of the Cutler formation. The mineralized zone within the Chinle is exposed in the Utex Exploration Company's Mi Vida mine and crops out directly southeast of the mine shaft. Uranium deposits known within the Cutler formation were confined to 5 arkosic sandstone lenses. Four of these lenses are within a hundred feet of the Cutler-Chinle contact and the other is within 150 feet of the contact.

#### Chinle Deposits

A continuous outcrop of the Chinle ore horizon, composed of sandstone, siltstone and conglomerate, extends for 8 miles across the Big Indian Wash area, and southeast into Lisbon Valley (fig. 2). Mineralization was apparent on the rim in the northern part of the Big Indian Wash near the Mi Vida mine, and in the extreme southern part of the area at the Continental Uranium No. 1 mine (fig. 2). Four large ore deposits had been discovered in the area. The Mi Vida mine ore body was located in July, 1952, by Charles Steen, the Cal Uranium Company ore body (San Juan shaft, fig. 2) was located by Commission drilling, and the La Sal Mining and Development ore body was located by T. C. Hudson 700 feet southwest of Commission ore hole BS-85 as an indirect result of Commission drilling. The deposit located by the Commission is approximately 2 miles north of the ore deposit located by Steen. The Continental Uranium No. 1 mine is located in the southern part of Big Indian Wash. All drilling by the Commission has been confined to the northern portion of the wash, except for five barren holes drilled south of Big Indian Rock (fig. 2).

Study of the core samples from the ore body located by Commission drilling in the northern part of the wash indicated that the ore, mainly disseminated uraninite, was confined to three closely spaced horizons within the lower Chinle. The host rock ranges from a gray, medium-grained, poorly cemented, micaceous sandstone, to a gray-green siltstone. The ore horizons are separated by one to two feet of barren green mudstone and siltstone. These barren mudstones are composed of the illite and

montmorillonite type clays. The sandstone contains pyrite and marcasite. Muscovite is found along bedding planes. Calcite is the most common cementing material, and is accompanied by iron oxides and vanadium minerals.

Thin sections were cut and autoradiographs made of selected ore-bearing samples from the lower part of the Chinle formation. The autoradiographs showed a few alpha tracks from the cementing material. Other alpha track clusters originated from black opaque specks in altered feldspar grains or on their borders.

The following ore and gangue minerals had been identified from the lower Chinle (Moss Back) deposits in Big Indian Wash:

Carnotite	Pyrite	Rutile
Tyuyamunite	Muscovite	Zircon
Montroseite		Jasper
Doloresite		Epidote
Corvusite	Orthoclase	Garnet
Uraninite	Chert	Magnetite
Quartz		Pyrolusite
Calcite		

Examination of the Utex Exploration Company Mi Vida mine indicated that the ore there was also confined to three horizons within the lower Chinle. In some parts of the mine the prevailing black color of the sandstone appeared to have been altered to light gray. Where the sandstone is light gray, it is impregnated with carnotite and tyuyamunite. In other places in the mine, solutions appeared to have dissolved part of the sandstone and created vugs. Later solutions had, in some cases, deposited stalactitic tyuyamunite on the walls of the vug and upon remnants of the sandstone within the vug. Seams of carnotite, uraninite and tyuyamunite have been observed in the mine. Tyuyamunite coatings on joint surfaces are not uncommon. Uraninite is present in irregular pods and lenses within the host rock and as interstitial material between grains. Polished sections show the uraninite occurring as minute spheroidal blebs, veinlets and irregular pods replacing carbonate gangue. The deposit is elongated in a northwest direction.

The Mi Vida deposit and environs were undergoing a large drilling program conducted by the Moab Drilling Company, a subsidiary of Utex Exploration Company. Exclusive of the main ore body, 37 holes had penetrated ore on the north and south Utex projects (fig. 3). The average thickness was approximately 4 feet and the average grade approximately 0.40 percent  $U_3O_8$ .

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The La Sal Mining Company discovery in the northern part of the Big Indian Wash district (fig. 2) was temporarily tied up in litigation, causing development work to stop. However, 6 holes had been drilled on one of their claims, and all but one penetrated ore at about 500 feet below the surface. Average thickness of ore was 6 to 12 feet, although mineralization had extended vertically for a distance of 30 feet in some holes. The average grade of the ore was approximately 0.70 percent  $U_3O_8$ .

Approximately 1,500 feet south of the La Sal discovery is the Commission discovery which was being developed by Cal Uranium Company (San Juan Shaft, fig. 2). Approximately 52 Commission and private drill holes penetrated the ore-bearing horizon in this area. The average grade of ore was approximately 0.22 percent  $U_3O_8$ , and the average thickness approximately 8 feet. This deposit and the La Sal deposit together form a rough ellipse with the axis trending northwest.

At the time of this report, the most notable characteristic of the lower Chinle (Moss Back) ore-bearing horizon appeared to be the presence of feldspars in sandstones and conglomerates of favorable areas. No feldspars had been found in the corresponding horizons in unfavorable areas.

#### Cutler Deposits

The Cutler deposits have been described in some detail elsewhere (Dix, 1953) and receive only brief consideration here.

Uranium deposits within the Cutler formation were known in 5 small lenses. The first, in the vicinity of the Small Fry claim (fig. 2) in the northern part of the wash, is a variegated purple-white quartzitic sandstone lens, 150 feet wide and 25 feet thick, which is 10 feet below the Chinle-Cutler contact. Concentrations of carnotite and becquerelite are found in this lens. Some active mining was being done, but only 10 tons had been shipped and the ore was pinching out.

The second lens is called the "Calico Dyke" (fig. 2), formerly named the "Purple Paint." This is a white to purple quartzitic sandstone 300 feet wide and 35 feet thick. Concentrations of carnotite and becquerelite are disseminated throughout the outcrop. Some rim stripping had been done, but with little success. The lens is approximately 100 feet below the Chinle-Cutler contact.

The third and fourth lenses are known jointly as the Big Buck horizon (fig. 2). These are arkosic lenses 450 feet wide and 11 feet thick. The lenses overlap 30 feet and are separated vertically by 20 feet of red mudstone. They are approximately 120 feet below the Chinle-Cutler contact. Uranium ore at the Big Buck group was partly carnotite and becquerelite disseminated in the sandstone, and most of the ore shipped had been of this

type. The second type consisted of concretions of uranium, vanadium and lime with some malachite, one-half to 4 inches in diameter. No ore was being produced from the Big Buck mines at the time of this report. Total production to date had been 1,209 tons, beginning in August, 1948 (Rasor, 1949).

The fifth lens, an arkose, crops out at the base of the escarpment, immediately north of the Big Buck deposit and 150 feet below the Chinle-Cutler contact. It was intersected in one diamond drill hole, and was found to be weakly mineralized. Excessive drilling depths prevented further exploratory work.

Mapping of several mines within the Cutler formation indicated that mineralization was concentrated in sandstone adjacent to certain joints striking northwest.

The following ore and gangue minerals had been identified from the Cutler deposits of Big Indian Wash: 1/

carnotite	quartz	hematite
becquerelite	calcite	apatite
uranophane (?)	orthoclase	chlorite
uraninite (?)	chert	
copper sulfate	muscovite	
malachite	magnetite	

Diamond drilling of the Cutler deposits by the Commission was unfruitful. Lenses could not be traced in a westerly direction for any distance, and no significant mineralization was noted.

#### EXPLORATION TECHNIQUES

Evaluation of data on the Big Indian Wash area, prior to the drilling program recommendation (G. P. Dix, 1953) indicated that a more effective drilling program could be carried out by extending the area to be drilled to the west and widening the spacing between drill holes.

After the cessation of drilling activities in Big Indian Wash, radiation studies were made in the southern part of the wash by Research Inc. of Dallas, Texas, under an Atomic Energy Commission contract. Results of this work indicated an anomalous area east of Big Indian Wash, probably in the Hermosa limestone. This was investigated but no surface anomaly

1/ Rosenzweig, A. and Gross, E. B., 1953, U. S. Atomic Energy Comm. unpublished laboratory report.



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was found. Additional surface radiation, geochemical and seismic studies were made by Research Inc. in the northern part of Big Indian Wash, over the ore deposit located by the Commission. This study showed the presence of significant anomalies over the La Sal Mining and Development Company discovery, over the Commission discovery (San Juan Shaft of Cal Uranium) and over an area near the triangulation station "Anvil." This latter anomaly was tested with three holes drilled through the Chinle formation, but all were barren. Complete cores were collected from these holes for laboratory study by Research, Inc.

Nine different types of subsurface maps were made and kept up to date as drilling progressed. Four of these, including a maximum amplitude isorad map, suggested a west-northwest trend.

Consideration was given to recommending rotary drilling in the western part of Big Indian Wash, in those areas deemed favorable, but a large number of private organizations were already considering drilling in those areas, and accordingly, no Commission drilling was recommended.

Aerial photographs of the Big Indian Wash area at a scale of 1:1,000 were taken in September, 1953, by the Commission. These were being used to evaluate fracture patterns of the area as possible ore controls.

Drilling in the area was done with four diamond drilling rigs designed and produced by Minerals Engineering Company of Grand Junction, Colorado. The core taken was "BX" size. Minerals Engineering Company was the contractor.

Drilling operations proceeded satisfactorily. Little water loss was encountered and caving was not a problem. Should further exploration activities be conducted in the area in the future it is recommended that a larger coring rig of the Mayhew-type be used due to the increased depth of drilling which would be required west of the known ore bodies.

Ninety-three holes were drilled in the area for a total of 19,785 feet. The average depth of the holes was 212 feet, with the range in depth from 50 feet to 425 feet. The average core recovery was 97.6 percent.

#### SUMMARY AND CONCLUSIONS

AEC drilling commenced in the Big Indian Wash district on June 22, 1953. At that time 3 privately owned and operated drilling rigs were active in the area. Twenty-three private drilling rigs were in operation in and about the Big Indian Wash district at the time of preparation of this report. Private drilling was being done at the rate of 20,000 feet per month.

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In addition to the Mi Vida mine which had been in operation since November 23, 1952, three other companies, the La Sal Mining and Development Company, the Cal Uranium Company, and Western Mines Development Corporation were carrying on development work.

Examination of the results of Commission drilling indicated that further exploration of the mineralized arkosic sandstone horizons within the Cutler formation unjustified, inasmuch as the deposits were small and the grade low.

## REFERENCES

1. Dix, G. P., Jr., The uranium deposits of Big Indian Wash, San Juan County, Utah: U. S. Atomic Energy Comm., RME-10, (unpublished report), 1953.
2. Hazen, S. W., Jr., McLellan, R. R., Dix, G. P., Jr., and C. A. Steen, Uranium-mining operations of the Utex Exploration Company in the Big Indian district, San Juan County, Utah: U. S. Bur. Mines Inf. Circ. 7669, 1953.
3. Rasor, C. A., Interim report on examination of Big Indian Wash uranium properties, San Juan County, Utah: U. S. Atomic Energy Comm., unpublished report, 1949.

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District (1)

UNITED STATES ATOMIC ENERGY COMMISSION  
GRAND JUNCTION OPERATIONS OFFICE, EXPLORATION DIVISION  
ORE RESERVE BRANCH  
ORE RESERVE STATEMENTS, BIG INDIAN WASH PROJECT, SAN JUAN COUNTY, UTAH

Ore Reserve Calculations

A minimum thickness cut-off of 1.0 foot and a minimum grade cut-off of 0.10 percent  $U_3O_8$  or 1.00 percent  $V_2O_5$  are used for Grade A ore except that thickness less than 1.0 foot is used provided the thickness-grade product is equivalent to 1.0 foot at 0.10 percent  $U_3O_8$  or 1.00 percent  $V_2O_5$ . Grade B mineralization, same as above with grade cut-off of 0.05 percent  $U_3O_8$ , is included with Grade A ore only in instances where Grade B material intervenes between Grade A intervals and the entire series averages Grade A.

Various mineral-bearing horizons are correlated from drill hole data. The boundaries of lenses of Grade A ore are projected laterally up to 100 feet from the outer holes. Hole spacing up to 200 feet within orebodies is normally accepted for large orebodies. A radius of 50 feet was used to delimit single-hole orebodies. A factor of 14 cu. ft. per ton is used for ore in sandstone.

Ore-grade mineralization in a given lens penetrated by a single drill hole is classified as "Inferred"; with more than one drill hole the classification is "Indicated." Mineral lenses of inferred class are not reported as ore if the  $U_3O_8$  content of the drill hole fails to meet the above listed requirements. Likewise in mineral lenses of indicated class drill holes with subgrade  $U_3O_8$  content are not included if the average  $U_3O_8$  content of the lens fails to meet the same requirements.

Ore Reserve Statements

A summary of Grade A reserves for the drilling project is submitted. An ore reserve statement for each block of ore is also submitted.

Horizons of mineralization are denoted from the top downward by Roman numerals. Radiometric values for  $U_3O_8$  are used for samples assaying less than 0.05 percent  $U_3O_8$ . All other samples have chemical assays for  $U_3O_8$ . In some diamond drill holes, where core recovery in ore is nil, the thickness of the ore and  $U_3O_8$  content are estimated from gamma-ray logs. Thickness is measured in tenths of feet.

UNITED STATES ATOMIC ENERGY COMMISSION  
 GRAND JUNCTION OPERATIONS OFFICE  
 EXPLORATION DIVISION  
 ORE RESERVES BRANCH

ORE RESERVE STATEMENT

Project: Big Indian Wash

Ore Block No.: I, III & IV

Date: February 14, 1955

District: Monticello

Claim: Small Fry Nos. 2, 4, 5,  
6, 7, 12

Locality: Big Indian

Township: Secs. 27 & 34, T.29S., R.24E.

Owner: Cal Uranium Co.

Mining Availability: All of Block I could be mined from one set of workings. Blocks III and IV are inferred bodies and since they are completely isolated, it is doubtful if they could be mined at this time.

Metallurgy: Uraninite, low vanadium, high lime

Access: Seventeen miles via gravel road to U. S. Highway 160; thence 21 miles to the Monticello mill.

Discussion: Ninety-two holes totaling 19,350.5 feet were drilled by the Commission. Of the 92 holes, 18 were in ore, 20 were mineralized, 5 were weakly mineralized and 48 were barren. The average drilling depth is 210.3 feet.

The Commission drilling developed 92,390 tons of the 167,170 tons reported herein.

Summary of Reserves: 5.01 tons ore and 31.92 lbs.  $U_3O_8$  developed per foot of drilling for ore block by Commission drilling.

	Tons Ore	Percent		Pounds	
		$U_3O_8$	$V_2O_5$	$U_3O_8$	$V_2O_5$
Indicated Ore	162,340	0.28	--	909,104	--
Inferred Ore	4,830	0.38	--	36,708	--
<b>Total</b>	<b>167,170</b>	<b>0.28</b>	<b>--</b>	<b>954,812</b>	<b>--</b>

UNITED STATES ATOMIC ENERGY COMMISSION  
 GRAND JUNCTION OPERATIONS OFFICE  
 EXPLORATION DIVISION  
 ORE RESERVES BRANCH

ORE RESERVE STATEMENT

Project: Big Indian Wash

Ore Block No.: II

Date: February 14, 1955

District: Monticello

Claim: Columbia

Locality: Big Indian Wash

Owner: R. Barrett

Township: T. 29 S., R. 24 E.

Mining Availability: This is a single-hole orebody approximately 350 feet from the nearest ore hole. The overburden is 390 feet thick. The ore appears in two horizons, both of which are very thin.

Metallurgy: Uraninite, low vanadium, high lime.

Access: Seventeen miles via gravel road to U. S. Highway 160; thence 21 miles to the Monticello mill.

Discussion: One hole totaling 435 feet was drilled by the Commission in this area and it was in ore.

To date there has not been any private drilling in the immediate vicinity of this ore hole and, therefore, the reserves cannot be increased as in the instance of Block I.

Summary of Reserves: 1.29 tons ore and 7.60 lbs  $U_3O_8$  developed per foot of drilling for ore block.

	Tons Ore	Percent		Pounds	
		$U_3O_8$	$V_2O_5$	$U_3O_8$	$V_2O_5$
Indicated Ore					
Inferred Ore	560	0.38	--	4,256	--
Total	560	0.38	--	4,256	--

SUMMARY OF ORE RESERVES, BIG INDIAN WASH

Block Lens Horizon	INDICATED			INFERRED			TOTAL		
	Ore Tons	Percent U <sub>3</sub> O <sub>8</sub>	Th. V <sub>2</sub> O <sub>5</sub> Feet	Ore Tons	Percent U <sub>3</sub> O <sub>8</sub>	Th. V <sub>2</sub> O <sub>5</sub> Feet	Ore Tons	Percent U <sub>3</sub> O <sub>8</sub>	Th. V <sub>2</sub> O <sub>5</sub> Feet
1 A I II B C D E F G H I	4,220	0.28	-- 1.8	1,120	0.61	-- 1.2			
	158,120	0.28	-- 4.3						
Total Block I							166,440	0.28	-- 4.1
2 I II				220	0.46	-- 0.4			
				340	0.33	-- 0.6			
Total Block 2							560	0.38	-- 0.5
3				60	1.08	-- 0.1	60	1.08	-- 0.1
4				670	0.22	-- 1.2	670	0.22	-- 1.2
Total BIW	162,340	0.28	-- 4.2	5,390	0.38	-- 0.9	167,730	0.28	-- 4.1

Of the above tonnages, the following were discovered by the Commission:

63,420	0.20	-- 6.0	29,530	0.21	-- 2.9	92,950	0.20	-- 5.0
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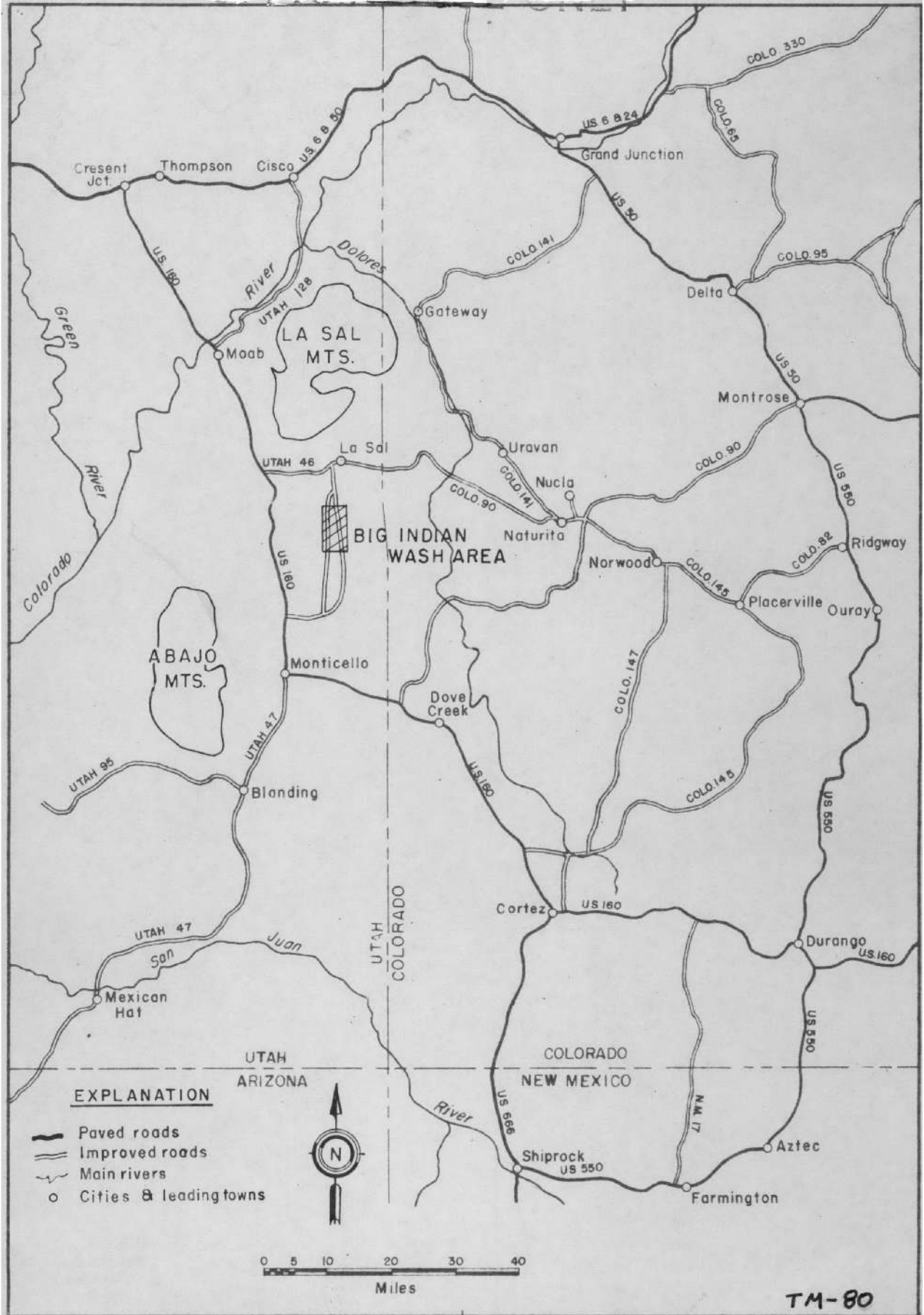
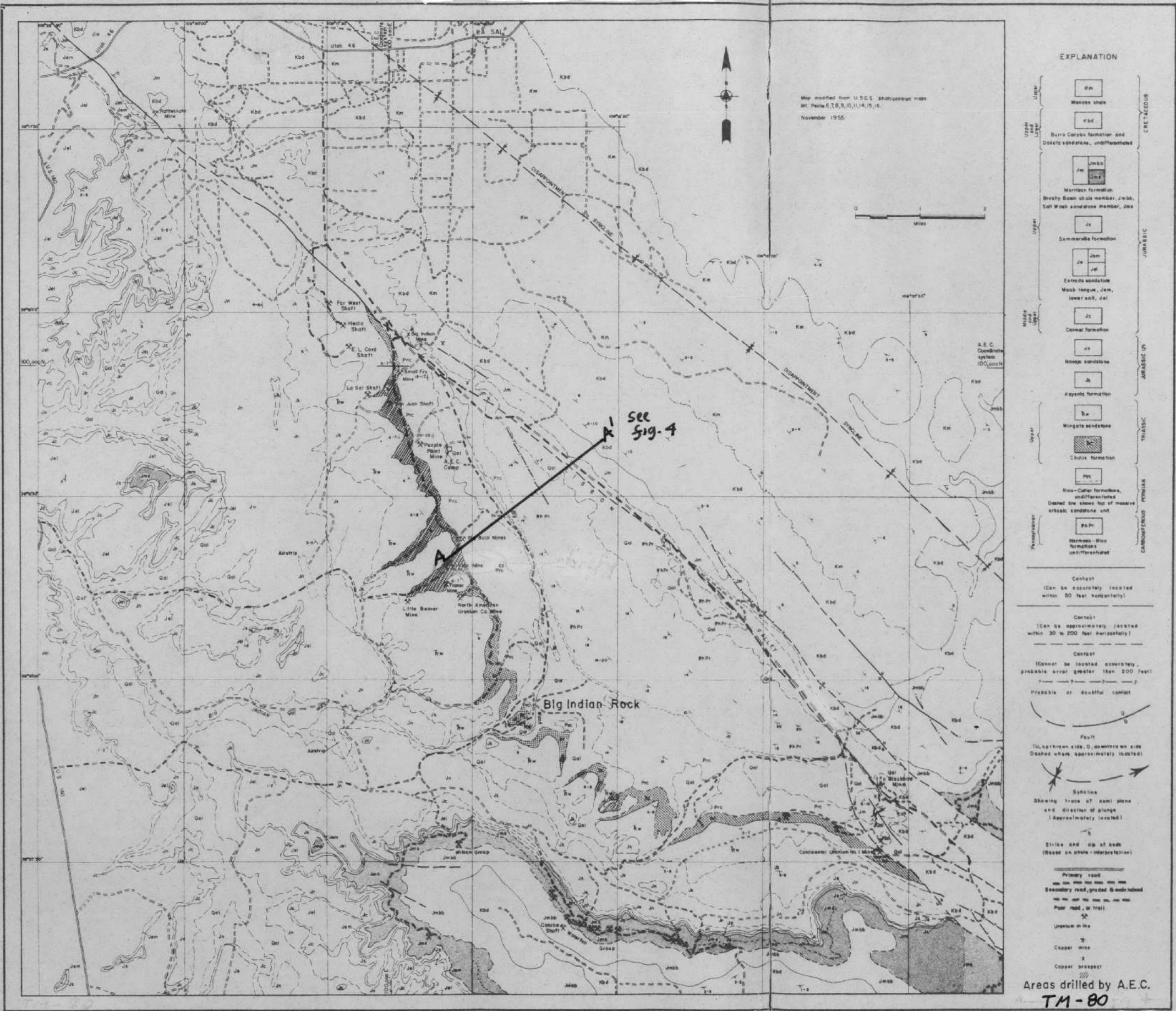


Figure 1. Location map of Big Indian Wash Area, San Juan County, Utah

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**EXPLANATION**

Upper Layer		CRETACEOUS
Upper		JURASSIC
Middle and lower		JURASSIC (P)
Lower		TRIASSIC
Permian		PERMIAN
Carboniferous		CARBONIFEROUS

**Contacts**

- (Can be accurately located within 30 feet horizontally)
- (Can be approximately located within 30 to 200 feet horizontally)
- (Cannot be located accurately, probable error greater than 200 feet)
- Probable or doubtful contact

**Fault**

- (Upthrown side, 0, downthrown side)
- Dashed when approximately located

**Syncline**

- Showing trace of axial plane and direction of plunge
- (Approximately located)

**Strike and dip at base**

- (Based on photo-interpretation)

**Roads**

- Primary road
- Secondary road, graded & well maintained
- Poor road, or trail

**Other symbols**

- Uplift in the
- Copper mine
- Copper prospect

Figure 2. Index map of Big Indian Wash Mining District, San Juan County, Utah

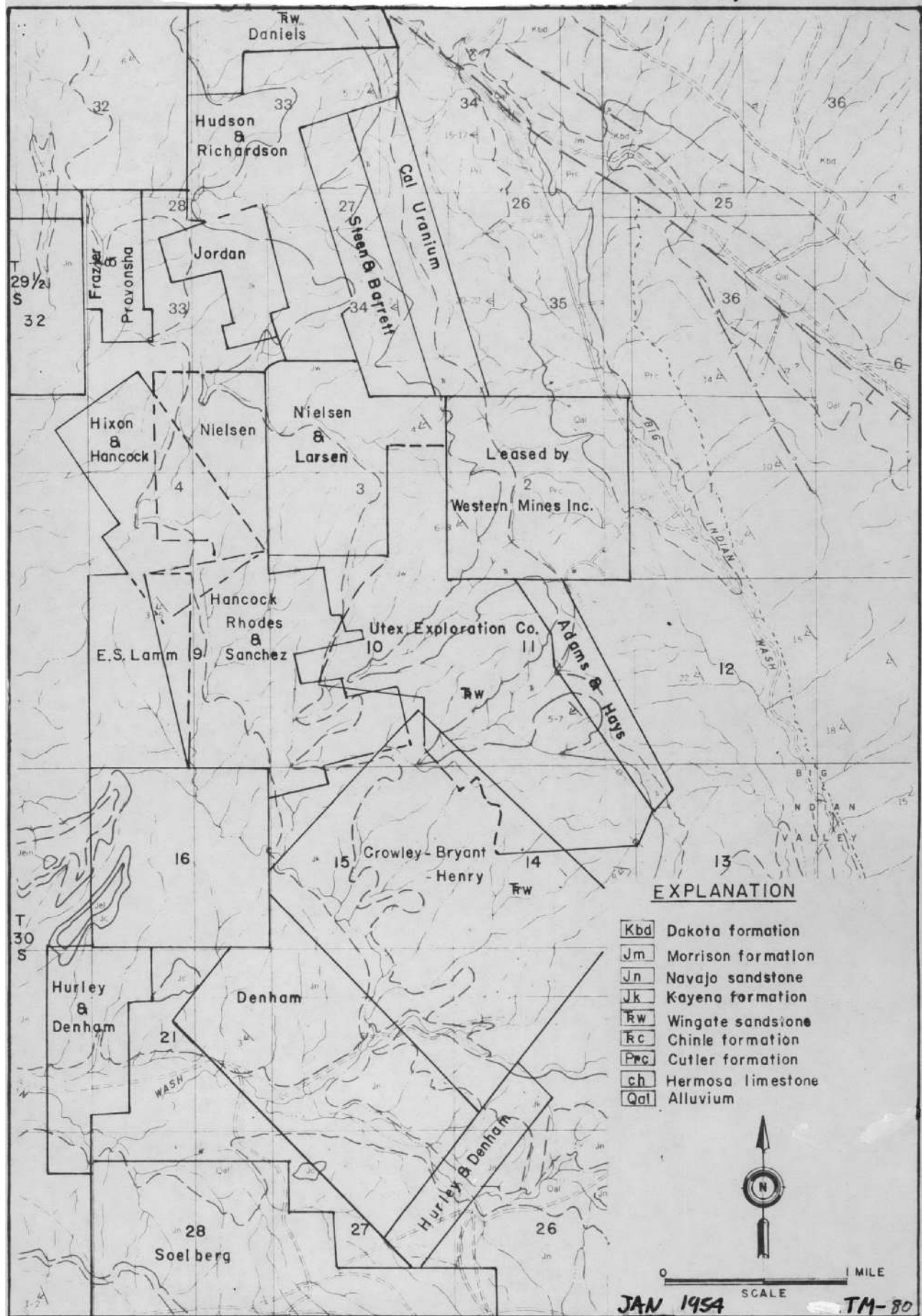


Figure 3. Sketch map of Claims, Big Indian Wash, San Juan County, Utah

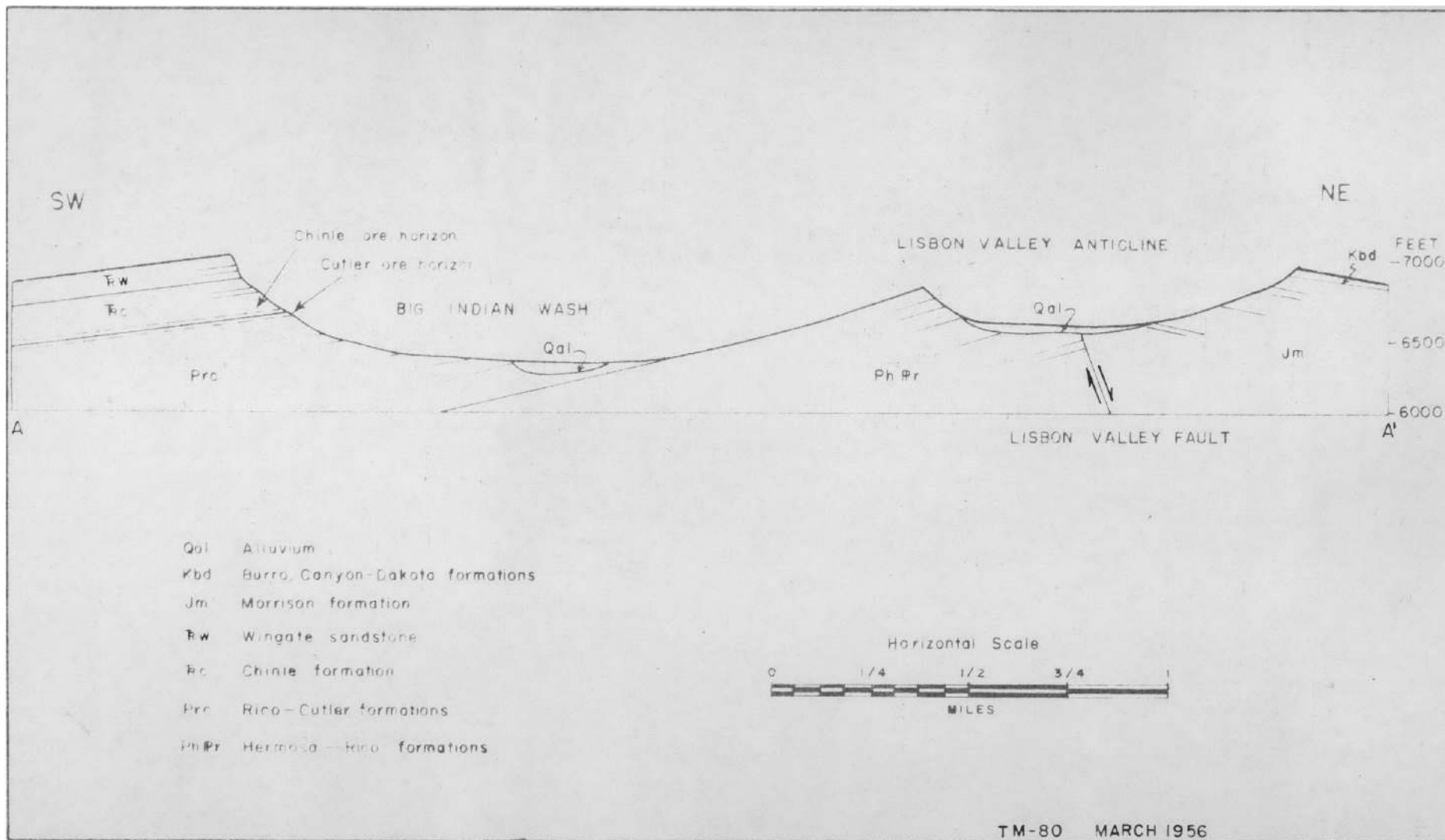
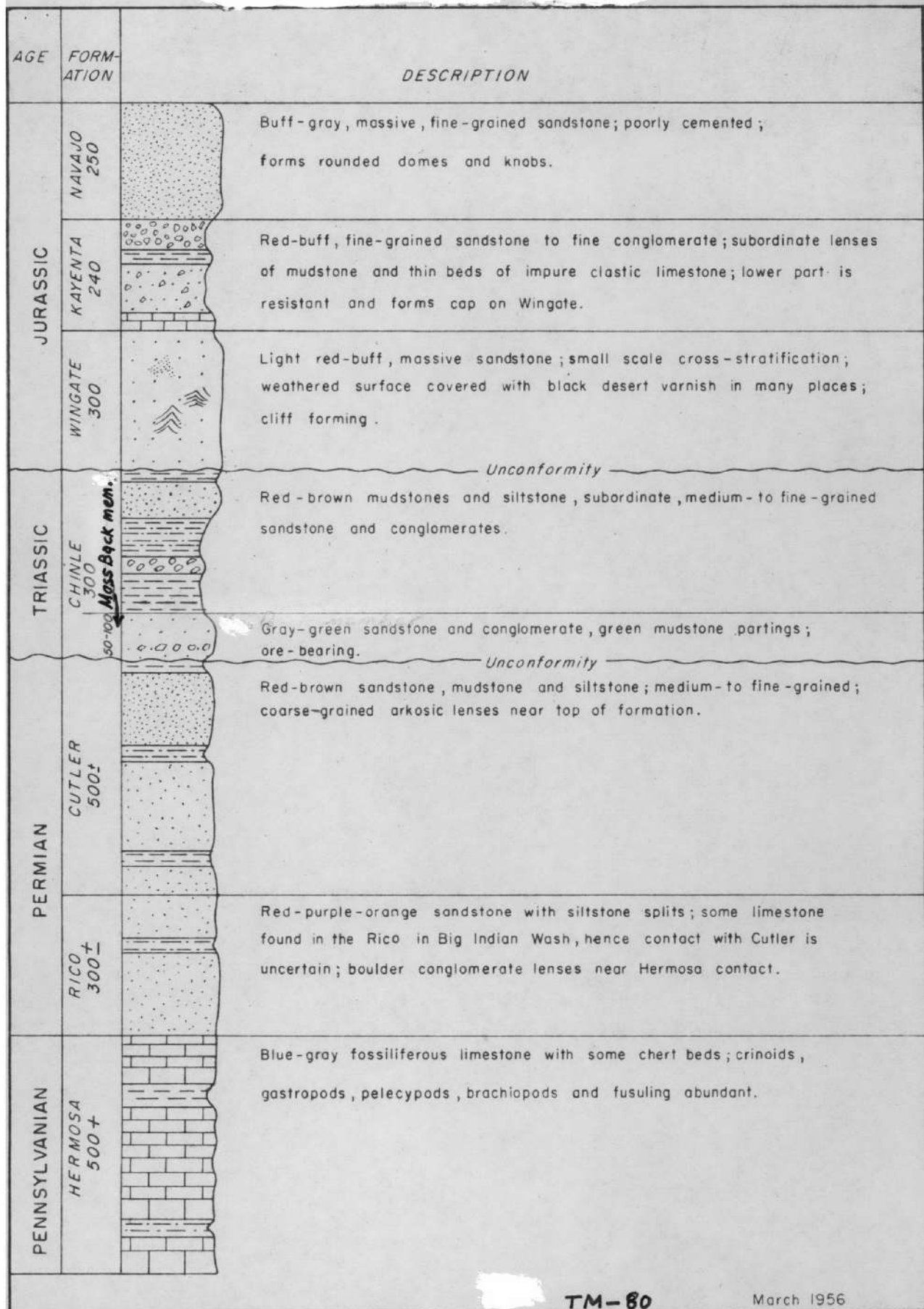


Figure 4. Geologic section across Lisbon Valley Anticline in the vicinity of Ute and Big Buck Mines San Juan County, Utah



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Figure 5. Generalized columnar section, Big Indian Wash, San Juan County, Utah

