

URANIUM DEPOSITS IN THE WHITE CANYON AREA, SAN JUAN COUNTY, UTAH

By ALBERT F. TRITES, JR., TOMMY L. FINNELL, and ROBERT E. THADEN, U. S. Geological Survey

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ABSTRACT

The geology of approximately 560 square miles has been mapped in the White Canyon area, San Juan County, Utah. The area consists of sedimentary rocks, more than 4,000 feet thick, which range in age from Pennsylvanian to Jurassic and have a regional dip of 2°-3° SW. Normal faults are present in the northwestern and southwestern parts of the area.

The uranium deposits occur where the Shinarump conglomerate fills channels cut into beds of the Moenkopi formation. Most of these channels are within a broad band of Shinarump conglomerate ranging from 8 to 15 miles wide. All of the known high-grade deposits are in channels that are within 3,000 to 15,000 feet of the edge of the band of Shinarump conglomerate.

The major control of the uranium deposition appears to have been lithologic; the most favorable bed is a clayey sandstone immediately overlying a bed of siltstone or mudstone and containing carbonized vegetal material. Branches and bends in channels, and scours in the floor of channels, may have provided the conditions for the deposition of favorable rocks.

In addition to uraninite, the uranium minerals include hydrous oxides, silicates, phosphates, and arsenates.

INTRODUCTION

The White Canyon area, near the center of the Colorado Plateau, is between the Colorado and San Juan Rivers in southeastern Utah (lat 37°40' N., long 110°15' W.). The area is in the west-central part of San Juan County, about 60 miles by road west of Blanding, Utah. The White Canyon project is a part of a regional mapping program on the Colorado Plateau. Approximately 560 square miles have been mapped in the White Canyon area at a scale of 1:48,000.

GENERAL GEOLOGY

Rocks in the White Canyon area range in age from Pennsylvanian to Jurassic and comprise a sedimentary section more than 4,000 feet thick. The nearest exposed igneous rocks are in the Henry Mountains about 12 miles west and in the Abajo Mountains about 25 miles northeast of the boundaries of the area. A generalized stratigraphic section of the rock formations is presented in the table below.

The area is on the west flank of the Monument up-warp, and beds have a regional dip of 2°-3° southwest and strike northwestward. Small local flexures occur in parts of the area.

Many normal faults cut the Moenkopi and Cutler formations in the northwestern part of the White Canyon area and cut rocks of the Glen Canyon group in the southwestern part. Most of the faults in the northwestern part strike N. 65°-75° W., and their maximum vertical stratigraphic displacement is about 100 feet. Many of the surfaces of the faults in the northwestern part of the area have been coated by limonite or calcite. The red sandstones and siltstones have been bleached as much as 3 feet on either side of the faults. The faults in the southwestern part of the area strike N. 30° E. to N. 30° W., and the displacement along these faults is as much as 250 feet. Joints are abundant throughout the White Canyon area, and the major trends are N. 65°-80° W., N. 70° E. to due E., N. 30°-40° E., and N. 10° W. to N. 10° E.

*Generalized stratigraphic section, White Canyon area, San Juan County, Utah*¹

System or series	Group	Formation	Member or tongue	Thickness (feet)	Description
Middle and Upper Jurassic.	San Rafael group undifferentiated.			200+	Shale and sandstone, red, calcareous.
— Unconformity — Jurassic and Jurassic (?)	Glen Canyon	Navajo sandstone.		600+	Sandstone, cream-yellow, massive, cross-bedded.
Jurassic(?).		Kayenta.		200±	Sandstone, dark-red, thin-bedded.
		Wingate sandstone.		300±	Sandstone, reddish-brown, massive, cross-bedded.
Upper Triassic.	-----	Chinle.	Upper member.	100±	Sandstone, siltstone, and mudstone, reddish-brown, thin-bedded, calcareous.
			Middle member.	250-425	Mudstone and siltstone, calcareous and bentonitic, variegated.
			Sandstone member.	0-100	Sandstone, gray and brown conglomerate.
			Lower member.	150-245	Clays, gray to variegated, and gray to brown lenticular sandstone and conglomerate.
— Unconformity —		Shinarump conglomerate.		0-75	Sandstone, yellow to gray, and siltstone, claystone, and conglomerate.
Lower and Middle (?) Triassic.		Moenkopi.		175-350	Siltstone, dark-brown to grayish-red, thin-bedded, fissile, and very fine-grained ripple-marked sandstone, brown to yellow shale, and white to pink fine-grained sandstones containing clay balls locally; mica abundant.
— Unconformity —					
Permian.	-----	Cutler.	White Rim sandstone member.	0-20	Sandstone, cream-yellow, fine-grained.
			Hoskinnini tongue.	80-100	Siltstone, reddish-brown, massive-bedded, to fine-grained sandstone. Contains interbedded cream-yellow limestone-pebble conglomerate in western part of area.
			Organ Rock tongue.	100-300	Siltstone, reddish-brown, micaceous, and very fine-grained sandstone.
			Cedar Mesa sandstone member.	1,000±	Sandstone, cream-yellow, crossbedded, with red shale locally near the top.
Pennsylvanian and Permian(?).	-----	Rico.		575±	Sandstone, siltstone, shale, and limestone, interbedded, gray, red, and purple.
Pennsylvanian.	-----	Hermosa.		400-1,000	Limestone, gray, cherty, with gray, buff, and red calcareous sandstone and shale.

¹ In part from Gregory (1938) and Benson and others (1952).

URANIUM DEPOSITS

The uranium deposits in the White Canyon area occur in channels that have been cut into beds of the Moenkopi formation and filled by sandstone, siltstone, claystone, and conglomerate of the Shinarump conglomerate. Most of these channels are within a broad outcrop belt of Shinarump conglomerate ranging from 8 to 15 miles in width. This belt extends across the area, from beyond Deer Flat on the east to beyond the Colorado River on the west, a distance of more than 20 miles. The northern edge, or pinchout, of the belt of Shinarump is, in general, irregular with many lenses of Shinarump extending outward from the main mass.

A few isolated patches of Shinarump conglomerate occur in the area north of the main belt. The southeast edge of the belt of Shinarump conglomerate (near head of Red Canyon, fig. 85) is more regular and has a general trend of N. 80° E. The extent of the Shinarump conglomerate is not known southwest of Red Canyon, because it is deeply buried beneath younger rocks. Most of the Shinarump conglomerate within the belt ranges from 8 to 80 feet in thickness, although locally it is absent.

Of the 64 channels that have been mapped in the White Canyon area (fig. 85), 16 are known to contain at least 1 uranium deposit with a minimum grade of

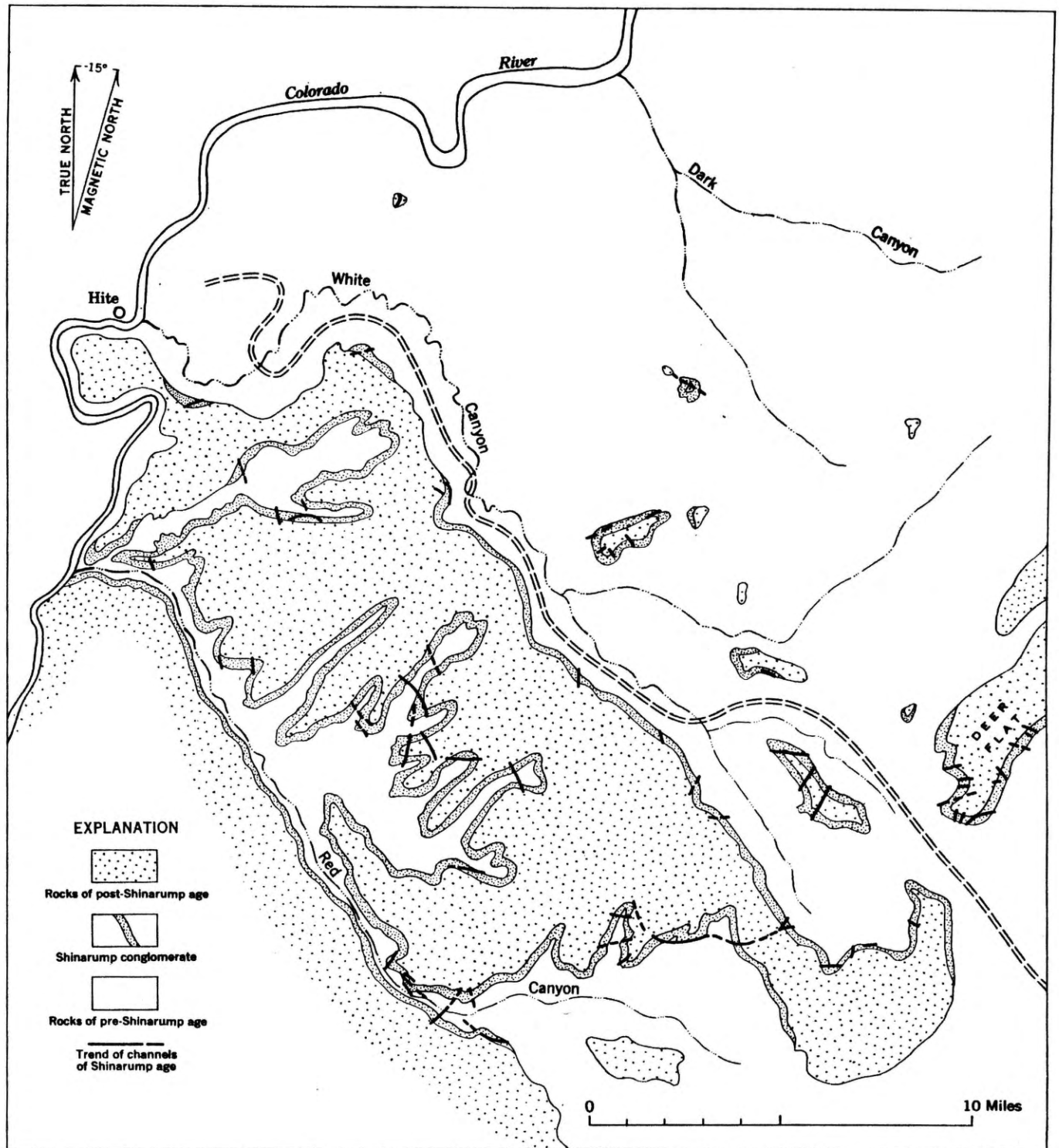


FIGURE 85.—Geologic map of White Canyon area, San Juan County, Utah.

0.10 percent U_2O_3 . In addition, 8 channels—possibly more—contain low-grade uraniferous material. The trend of channels in the area is shown in figure 85. Channels range from 30 to 650 feet in width and from 4 to 50 feet in depth. Uranium deposits do not show

a preference for channels of a particular size or shape, but seem to have selected a lithologic setting. All the known high-grade deposits occur where Shinarump conglomerate fills channels that are within 3,000 to 15,000 feet of the pinchouts of the Shinarump.

The emplacement of the uranium deposits is believed to have been controlled principally by the lithology of the sediments filling the channels. Channel segments filled with a high percentage of sandstone and containing few, if any, mudstone or siltstone beds appear to be unfavorable for deposits; channel segments with too high a percentage of mudstone or siltstone beds are equally unfavorable. Within favorable channels a sandstone lens immediately overlying a bed of mudstone or siltstone, and containing a high percentage of clay cement and pebbles, appears to be the most highly

mineralized bed in many of the mines in the area. Trashy carbonaceous material is present in most of the ore-bearing beds and may have been important in depositing the uranium minerals. Trash and finer grained material appear to be concentrated at branches and bends along the channels.

Uraninite occurs in most of the deposits that have been mined behind the oxidized rim outcrops. Secondary uranium minerals are abundant in many of the deposits and are listed in the following table.

Secondary uranium minerals from deposits in the White Canyon area, San Juan County, Utah

Type	Mineral	Composition	Major occurrences (mines)
Hydrous oxide	Becquerelite	$2\text{UO}_3 \cdot 3\text{H}_2\text{O}$	Posey.
Silicates	Cuprosklodowskite	$\text{Cu}(\text{UO}_2)_2\text{Si}_2\text{O}_7 \cdot 6\text{H}_2\text{O}$	Posey.
	Uranophane	$\text{Ca}(\text{UO}_2)_2\text{Si}_2\text{O}_7 \cdot 6\text{H}_2\text{O}$	North Point.
Sulfates	Zippeite	$(\text{UO}_2)_2(\text{SO}_4)(\text{OH})_2 \cdot 4\text{H}_2\text{O}$	Happy Jack.
	Johannite	$\text{Cu}(\text{UO}_2)(\text{SO}_4)(\text{OH})_2 \cdot 6\text{H}_2\text{O}$	
	Uranopilite	$(\text{UO}_2)_6(\text{SO}_4)(\text{OH})_{10} \cdot 12\text{H}_2\text{O}$	
Phosphates	Phosphuranylite	$\text{Ca}_3(\text{UO}_2)_5(\text{PO}_4)_4(\text{OH})_4 \cdot 2\text{H}_2\text{O} (?)$	North Point, Posey.
	Torbernite	$\text{Cu}(\text{UO}_2)_2(\text{PO}_4)_2 \cdot 12\text{H}_2\text{O}$	North Point.
Arsenate	Metazeunerite	$\text{Cu}(\text{UO}_2)_2(\text{AsO}_4)_2 \cdot 8\text{H}_2\text{O}$	Markey, Jomac.
Carbonates	Bayleyite	$\text{Mg}_2(\text{UO}_2)(\text{CO}_3)_3 \cdot 18\text{H}_2\text{O}$	Hideout.
	Schroekingerite	$\text{Na Ca}_3(\text{UO}_2)(\text{CO}_3)_3(\text{SO}_4)\text{F} \cdot 10\text{H}_2\text{O}$	

Sulfide minerals, including chalcopyrite, pyrite, bornite, and sphalerite, are disseminated with the uranium minerals in many of the deposits, and galena and marcasite occur in the Happy Jack mine. In deposits exposed at the surface, crude supergene and oxide zones have been formed. Supergene sulfide minerals are chalcocite and covellite. Many of the secondary uranium minerals, copper carbonates and sulfates, and abundant iron oxides have been formed in the zones of oxidation.

GUIDES TO FAVORABLE AREAS

The guides to favorable areas in the White Canyon area are divided into three groups: primary guides, secondary guides, and tertiary guides. Primary guides are closely associated with the ore deposits and extend only a few feet from the deposits. They are covellite pods, secondary uranium minerals, abnormal radioactivity, and carbonized wood (coal). The presence of jarosite in some of the deposits suggests its usefulness as a primary guide.

Secondary guides may extend from tens of feet to hundreds of feet beyond the limits of the deposits. These secondary guides may prove useful in indicating sites for core drilling. The secondary guides are branches, bends, and basins in channels; clayey sandstone overlying siltstone or mudstone in the channel;

disseminated sulfide minerals, especially chalcopyrite, covellite, and bornite; secondary uranium minerals; secondary copper minerals; carbonized wood and trash; and abnormal radioactivity.

Tertiary ore guides are large-scale features that may be useful in determining large areas favorable for deposits. Pinchouts of the Shinarump conglomerate may have restricted and concentrated uranium deposits in some parts of the area. Channels may also be considered as tertiary ore guides.

The large number of channels filled with Shinarump that have been mapped in the White Canyon area, and the frequency of uranium deposits within these channels, suggests that the area is favorable for the discovery of additional deposits. Any channel with a scour deeper than 5 feet may contain significant quantities of uraniumiferous rock somewhere along its length. The best guides for favorable areas for uranium deposits along the channels seem to be the secondary guides.

REFERENCES CITED

- Benson, W. E., Trites, A. F., Jr., Beroni, E. P., and Feeger, J. A., 1952, Preliminary report on the White Canyon area, San Juan County, Utah: U. S. Geol. Survey Circ. 217, 10 p.
- Gregory H. E., 1938, The San Juan country, a geographic and geologic reconnaissance of southeastern Utah: U. S. Geol. Survey Prof. Paper 188, 123 p.