



## *Uranium mining adjacent to Petrified Forest National Monument, Arizona*

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# URANIUM MINING ADJACENT TO THE PETRIFIED FOREST NATIONAL MONUMENT, ARIZONA

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**ABSTRACT**—During the uranium boom of the 1950s, prospectors located uranium-bearing outcrops, staked claims, and leased state and private lands adjacent to the Petrified Forest National Monument. Eight properties made ore shipments. The uranium was mined from sandstone beds in the Sonsela Member of the Chinle Formation of Upper Triassic age. Total ore production was 1178 tons that averaged 0.20% uranium oxide and 0.25% vanadium oxide. All of the mines are now within the administrative boundary of the Petrified Forest National Park.

## INTRODUCTION

On June 26, 1952, a Navajo prospector, Charlie Huskon, employed by the U.S. Atomic Energy Commission (AEC), made a uranium discovery near Cameron, AZ. The host rock of the new discovery was a sandstone bed in the Petrified Forest Member of the Upper Triassic Chinle Formation (Chenoweth, 1993). Since most of the known uranium deposits in the Chinle Formation were in the Shinarump Member, this was a new geologic unit for prospectors to explore.

Prospectors became interested in similar rocks south of the Navajo Reservation in the Winslow-Hollbrook area. Several uranium occurrences were found north of Winslow, north of Joseph City, and in the area of the Petrified Forest National Monument. The latter area became the most productive in the area, as eight properties (Fig. 1) produced ore grade material and are the subject of this paper.

The information presented in this paper is the result of the author's employment in the AEC's Flagstaff field office. Unpublished AEC reports, including my field notes, are now in the National Archives, Rocky Mountain Region, Denver, CO (USAEC, 1960).

## LAND STATUS

The Petrified Forest National Monument, 108 miles east of Flagstaff, AZ, was established on December 8, 1906 by President Theodore Roosevelt to protect and preserve the petrified wood resources of the area. The Navajo-Apache county line bisects the Monument. It is at 109° 50' W longitude on Figure 1. In the area of the Monument, the odd-numbered sections are owned by the New Mexico Arizona Land Company, Albuquerque, NM. Sections 2, 16, 32 and 36 are usually controlled by the state of Arizona. The remaining sections are either federal or private.

The National Monument was designated a National Park on December 9, 1962. With legislative action, land transfers and purchases the Park has expanded both to the east and west (see Day 2 Road log, this guidebook).

## GEOLOGIC SETTING

The geology of the National Park has been mapped by Martz et al. (2012). Within the Park the Chinle Formation consists of five members. In ascending order they are: Mesa Redondo, Blue

Mesa, Sonsela, Petrified Forest and Owl Rock. The Sonsela has been elevated to a member from a sandstone bed in the Petrified Forest Member. The rocks below the Sonsela are now named the Blue Mesa Member (Martz et al., 2012, p. 5). The Sonsela has been divided into five units. In ascending order they are: Camp Butte beds, Lot's Wife beds, Rainbow Forest beds, Jim Camp Wash beds and Martha's Butte beds (Martz et al., 2012, p. 3).

The uranium ore deposits at the Ruth claims and adjacent properties are in sandstones of the Martha's Butte beds (Table 1) (W.G. Parker, written commun., 2013). These beds consist of three sandstones separated by thinner mudstones and siltstones. Petrified wood is common in these beds. The ore-bearing sandstone at the Ruth claims is about 91 m above the base of the Chinle Formation (W.G. Parker, written commun., 2013).

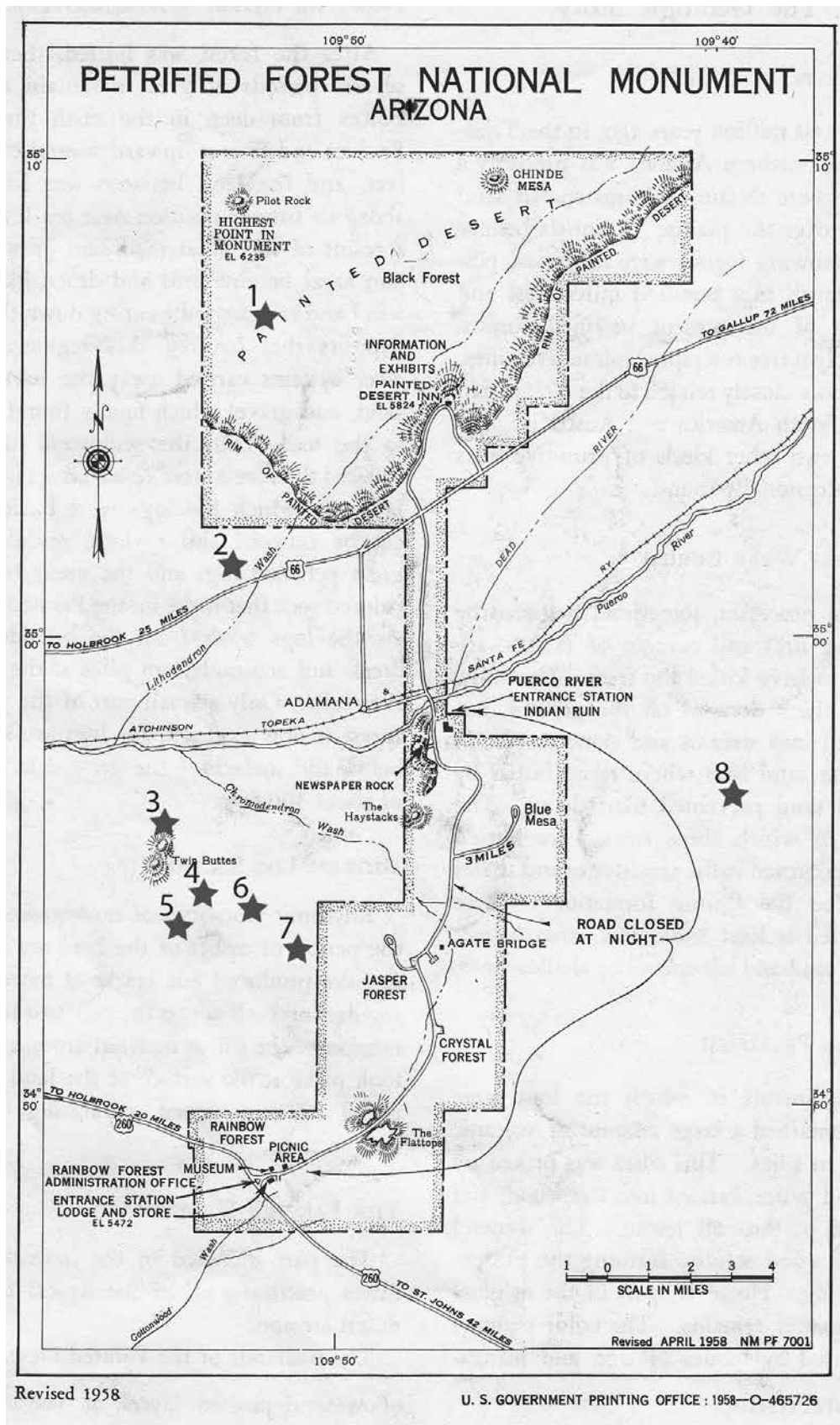
The uranium deposits that were mined adjacent to the National Monument were similar to those at Cameron but smaller (Chenoweth, 1993). Of the eight properties that were mined only one, the Ruth, exceeded 150 tons of ore (Table 1). Uranium minerals were generally associated with carbonaceous plant material in the sandstones, including fossil logs. The maximum ore thickness the author observed in the mine workings was 1 m.

The deposits are largely oxidized. The AEC petrographic lab identified the minerals schroëckerite, zippeite and autunite from the Ruth deposit (Gregg and Moore, 1955). Gruner et al. (1954) identified metatorbernite, metozeunerite, uraninite and coffinite from the Ruth claims. The primary minerals, uraninite and coffinite, probably came from the center portion of fossil logs. The vanadium content of the ores (Table 1) suggests that the minerals carnotite or tyuyamunite may be present. A yellowish-gray alteration associated with the deposits was used as a prospecting guide. Studies of the Cameron deposits found this was due to the oxidation products of sulfides (Chenoweth, 1993). AEC drilling on the Ruth claims indicated that the uranium deposits occurred in scours within channels in the sandstone (Gregg and Moore, 1956).

## PRODUCTION HISTORY

A summary of the location, ore production, operators and years of operation of the mines adjacent to the National Monument are given in Table 1.

On November 15, 1952, Preston Coston of Holbrook, AZ showed Clair Gregg, an AEC geologist, a small rim cut in the NW¼ NW¼ section 2, T17N R23E exposing yellow uranium minerals.



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FIGURE 1. Mine locations, Petrified Forest Monument. Mine names: (1) Navajo, (2) Rock Garden No. 25, (3) Kay Group, (4) Section 33, (5) Mac No. 3, (6) Ruth Group, (7) Little John No. 3, (8) Juanita No. 3. Base map courtesy of the National Park Service.

The host rock was a sandstone bed which was later included in the Sonsela Member of the Chinle Formation. Coston mentioned to Gregg (1952) that three loads of ore had been shipped to Monticello, UT in 1949 (?) by Richard Barrett.

Unpublished AEC ore production records for Navajo County, AZ show that in 1949 Richard Barrett delivered 12 tons of ore averaging 0.35% U<sub>3</sub>O<sub>8</sub> and 0.01% V<sub>2</sub>O<sub>5</sub> to the AEC's Monticello ore-buying station. The source of the ore was listed as the Carnotite Canyon mine. No doubt the ore came from section 2.

Preston Coston and partner Hugh Barton staked the Ruth 1-3 claims on December 5, 1952 and the Ruth 4-6 claims on February 1, 1953 in the NW<sup>1</sup>/<sub>4</sub> section 2, T17N, R23E. The claims were named for Barton's wife Ruth. Since section 2 was a state section, the men applied for, and were issued, Arizona Mineral Leases for the two sets of claims.

Using the Moab Uranium Company as a mining contractor, Coston and Barton began shipping ore to the AEC ore-buying station at the Anaconda Company's mill near Bluewater, NM. Shipments during 1953 totaled 642 tons of ore averaging 0.24% U<sub>3</sub>O<sub>8</sub> and 0.15% V<sub>2</sub>O<sub>5</sub>, all from the Ruth No. 4 claim. Gregg and Moore (1955, p.10) show four short adits on this claim.

On March 3, 1953, J. R. McEvoy and W. Preston Nutting leased the N<sup>1</sup>/<sub>2</sub> N<sup>1</sup>/<sub>2</sub> section 3, T17N, R23E from the New Mexico Arizona Land Company. They had a contractor strip 37 m along the rim, and drove two short adits on mineralized outcrops. After not locating anyone to further develop the property, the lease was cancelled on March 3, 1954.

Also in 1953, Merrill Young shipped 4 tons that averaged 0.12% U<sub>3</sub>O<sub>8</sub> and 0.16% V<sub>2</sub>O<sub>5</sub> from the Little John No. 3 claim in the NW<sup>1</sup>/<sub>4</sub> NW<sup>1</sup>/<sub>4</sub> section 12, T17N, R23W. He also shipped 7 tons that averaged 0.09% U<sub>3</sub>O<sub>8</sub> and 0.17% V<sub>2</sub>O<sub>5</sub>. Since the grade was below the AEC's minimum of 0.10% U<sub>3</sub>O<sub>8</sub>, he was not paid for

the shipment and it is not included in Table 1. The workings on Claim No. 3 consisted of a 10 m long adit.

Between January 23, 1954 and April 17, 1954, the AEC rotary drilled 125 holes totaling 7326 m in sections 2 and 12, T17N, R23E. The drilling on section 2 was on the Ruth claims and on section 12 was largely on the Brigham claims, located west and southwest of the Little John claims. Drilling began on 183 m centers and was reduced to 41 m when favorable ground was found. Drill hole spacing was further reduced to 30 m when uranium was located. Four small ore bodies were discovered behind the mine workings on the Ruth No. 4 claim (Gregg and Moore, 1956).

Mining continued on the Ruth claims in 1954 with 364 tons of ore averaging 0.14% U<sub>3</sub>O<sub>8</sub> and 0.20% V<sub>2</sub>O<sub>5</sub> shipped from the Ruth No. 1 claim. Also shipped were 44 tons averaging 0.19% U<sub>3</sub>O<sub>8</sub> and 0.45% V<sub>2</sub>O<sub>5</sub> from the No. 4 claim. Late in 1954, Coston and Barton ceased mining and cancelled their state leases. Also in 1954, a small shipment was made from the Juanita No. 3 claim, east of the Monument in Apache County, AZ (Fig. 1).

Raymond C. Henderson and A. J. LaSoto staked the Kay claims in the W<sup>1</sup>/<sub>2</sub> W<sup>1</sup>/<sub>2</sub> section 28, T18N, R23E on October 26, 1955. This was an area Henderson had selected from an aerial survey. He formed Flyers Mining Company, which shipped 134 tons of ore between March and July 1956.

Bay Shore Mining Company leased the Ruth claims from the State of Arizona in 1956 and mined 69 tons later that year from the Ruth No. 1 claim. In May 1956, Bay Shore leased section 33, T18N, R23E from the New Mexico Arizona Land Company, and during the year mined 28 tons of ore from a small pit in the southeast corner of the section. When section 33 was examined by the author on May 18, 1960, the workings consisted of 610 m of rim stripping and the 4.6 m deep pit, which had been filled in. Also on the section was a 50-ton stockpile of marginal ore. Also

TABLE 1. Summary of uranium ore production, Petrified Forest area, Navajo and Apache Counties, Arizona. Unpublished U.S. Atomic Energy Commission and U. S. Department of Energy data in Chenoweth's files.

Property	Location			Tons of Ore	Pounds	%	Pounds V <sub>2</sub> O <sub>5</sub>	% V <sub>2</sub> O <sub>5</sub>	Operator(s)	Years
	Section	T(N)	R(E)							
Navajo (a)	SW NW 26	20	23	66.81	162.34	0.12	205.00	0.15	Joe Hall	1956
Rock Garden 25	SW NE 22	19	23	53.35	295.28	0.28	779.37	0.73	Bay Shore Mng.	1956-57
Kay Group	SW NW 28	18	23	145.93	729.19	0.25	1183.02	0.40	Raymond Henderson Flyers Mng. Terry Engineering	1956 1956 1957
Section 33	SE SE 33	18	23	28.05	74.95	0.13	266.03	0.47	Bay Shore Mng.	1956
Goof 6 (b)	SE SE 33	18	23	8.86	17.73	0.10	23.00	0.13	Berry and Hatfield	1956
Sunrise (c)	SE SE 33	18	23	13.77	27.55	0.10	57.85	0.21	Bonner and Pettit	1957
Juanita 3	NW SE 14	18	25	4.72	13.20	0.14	44.32	0.47	Pat Paulsell	1954
Ruth 1, 4	NW NW 2	17	23	1386.64	5355.85	0.19	5454.06	0.21	Richard Barnett Coston & Barton Bay Shore Mng. Hugh Barton Silver Creek Ind.	1949 1953-54 1956 1959-60 1976,1978
Mac 3	SW SW 4	17	23	6.38	61.24	0.48	91.00	0.71	John MacMahon	1956
Little John 3	NW NE 12	17	23	3.91	9.38	0.12	12.50	0.16	Merrill Young	1953
TOTALS				1718.42	6746.71	0.20	8093.38	0.25		

(a)Mined in trespass from the National Monument. Location may be in error.  
 (b)Stolen from the open pit on Section 33.  
 (c)Stolen from the abandoned stockpile on Section 33.

in 1956, Bay Shore mined 34 tons of ore from the Rock Garden No. 25 claim north of U.S. Highway 66 (Fig. 1). The host rock was sandstone in the Sonsela Member.

During 1956, 6 tons were mined from the Mac No. 3 claim in section 4, T17N, R23E. AEC ore production records show that in 1956 Joe Hall shipped 67 tons from section 26, T20N, R23E. The shipment was labeled the Navajo mine and the location puts it in the northeast part of the National Monument (Fig. 1). Research by the National Park Service has determined that the Navajo mine is not at the location shown at Figure 1 (W. G. Parker, written commun., 2013). Today, the source of this shipment is not known.

Some former employees of Flyers Mining Company stole 9 tons from Bay Shore's pit on section 33. They also over-staked some of the Kay claims with Goof claims. The stolen ore was shipped to the AEC ore-buying station near Globe, AZ, and described as coming from the Goof No. 6 claim.

With the exception of some small shipments to the Globe ore-buying station, most of the ore mined in 1956 was shipped to the mill at Shiprock, NM, operated by Kerr-McGee Oil Industries, Inc.

During 1957, Bay Shore shipped 34 tons from the Rock Garden No. 25 claim. Terry Engineering shipped 12 tons from the Kay claims. When the author examined the abandoned Kay claims in May 18, 1960, the abandoned working consisted of 305 m of rim stripping and a pit 18 m by 9 m and 6 m deep. The only other activity in 1957 was a 14-ton shipment of low grade ore reportedly stolen from the abandoned stockpile on section 33, and labeled as the Sunrise mine.

After the Ruth property had been idle since 1956, Hugh Barton again leased the property in 1959. In September and December, he shipped a total of 66 tons of ore averaging 0.19%  $U_3O_8$  to the Homestake-Sapin Partners mill near Grants, NM. Mr. Barton told the author the shipment came from stockpiles. In February 1960, another 13 tons of ore averaging 0.17%  $U_3O_8$  were shipped. When contacted by the author on March 24, 1960, Mr. Barton stated he had stopped mining and had sold his dump truck due to high haulage costs. At that time, the workings consisted of 457 m of rim stripping and a 3 m long adit, and a stockpile of low grade material. An exposure of good ore was observed on Claim No. 4.

Unpublished U. S. Department of Energy (DOE) records show that in 1976, Silver Creek Industries shipped 67 tons of ore averaging 0.22%  $U_3O_8$  and 0.66%  $V_2O_5$  from the Ruth Group. In 1978, 108 tons averaging 0.06%  $U_3O_8$  and 0.29%  $V_2O_5$  were

also shipped from the Ruth property. The extreme low grade of the 1978 shipments could have been clean-up material from the previous mining.

## OUTLOOK

There will be no further exploration or mining on the properties mentioned in this paper as they are now within the administrative boundary of the Petrified Forest National Park. However, the Ruth and Juanita mines are on Arizona State sections and the Section 33 and 3 are on private lands within the Park (W.G. Parker, written commun., 2013).

## ACKNOWLEDGMENTS

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