

POWDER RIVER BASIN: ITS URANIUM HISTORY & PRODUCTION

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Paper presented to AAPG in Casper, Wyoming, on June 5, 1979

Recently, it has been difficult for a person to read a newspaper or to watch a news broadcast without hearing some of the latest controversies concerning the use of nuclear energy. With all of the controversy on nuclear power plants, I thought it might be appropriate to begin this paper with a quote from Dr. Edward Teller, one of the famous pioneers of nuclear energy. According to Dr. Teller: "In sleeping with a woman, one gets just slightly less radioactivity than from a nuclear reactor: but to sleep with two women is very, very, dangerous."

Before the uranium history of the Powder River Basin can be properly assessed, it is important to first examine earlier uranium discoveries and events that led up to the Powder River Basin discovery.

SILVER CLIFF MINE

SLIDE The first recorded discovery of uranium in Wyoming was that at the Silver Cliff Mine near Lusk (SLIDE). This mine was initially operated from 1880 to 1886 for copper and silver, and during the periods of 1919 to 1922 and 1951 to 1953, it produced a total of 800 tons averaging 1.0% U_3O_8 . It is reported that some of the uranium from the Silver Cliff Mine was used in radium experiments in France by the famous Madame Curie.

SLIDE (SLIDE) Uranium mineralization on the Silver Cliff property is found occurring in quartzites, reported as Cambrian by C. P. Bromley in 1953, and as a sandstone unit of the Mississippian Guernsey Formation by F. W. Osterwald in 1950.

The uraniferous sandstones are restricted to the immediate vicinity of the foot wall of the Silver Cliff fault, suggesting that the fault provided a permeable passage for the mineralizing solutions.

The restricted nature of the Silver Cliff ore would probably preclude the reopening of this deposit

LOST CREEK

SLIDE The second discovery of uranium in Wyoming occurred in 1936, when schroekingerite mineralization was found along Lost Creek (SLIDE) in Tertiary strata within the Great Divide Basin. The discovery was made by Mrs. Minnie McCormick, a weekend prospector and sheep camp cook. After her discovery, Mrs. McCormick leased the property from the State of Wyoming and attempted to promote her discovery. Twelve years later, the property was leased to Uranium Incorporated who explored the property for possible development. Grab samples were reported to range between 0.05 to 0.33% U_3O_8 averaging 0.13%. However, the schroekingerite was confined to clay and sands of limited extent above the water table, and only low tonnages could be produced. The significance of the Lost Creek deposit was not that it had low tonnage, but rather, that it was the first discovery of uranium occurring in the Tertiary sedimentary basins of Wyoming.

POST WAR DISCOVERIES

Following World War II, the uranium market was established by the development of the atomic bomb and an incentive program launched by the A.E.C. to develop domestic uranium resources.

During the early post war uranium exploration, geologists from industry and the government were exploring regions of volcanic origin for uranium

mineralization. Very few geologists expected to find uranium ore in Tertiary strata because the predominant train of thought was that uranium mineralization originated only from hydrothermal solutions. However, in 1950-51, Denson, Bachman, and Zeller of the U.S. Geological Survey noted an important relationship of uraniumiferous coals in South Dakota to the overlying tuffaceous sediments. It was proposed that the uranium mineralization in these coals was derived from the leaching of overlying Oligocene tuffs.

This 1950-51 observed relationship led to the recommendation in 1950 by Dr. J. D. Love of the U.S.G.S. to fly airborne radiometric surveys over the Pumpkin Buttes region of the Powder River Basin. It was believed that the Pumpkin Buttes region had similar characteristics to the South Dakota uraniumiferous coals; that is, it had similar favorable host rocks, and at one time in the geologic past was covered by a tuffaceous blanket as evident by the Oligocene White River Formation (SLIDE) forming the Cap Rock of Pumpkin Buttes.

SLIDE

SLIDE

Several anomalies were identified on the airborne survey (SLIDE). During the following year in October, Dr. Love and a small field party located high grade uranium deposits (SLIDE) at eleven different localities in Pumpkin Buttes. Six grab samples taken at the initial discovery site were reported by Dr. Love to average 15.14% U_3O_8 .

SLIDE

This discovery in Pumpkin Buttes prompted the A.E.C. to withdraw 102 square miles (SLIDE) of land from public entry until the region could be properly assessed and studied.

SLIDE

TYPES OF URANIUM DEPOSITS

In the initial studies, it was recognized that two types of uranium deposits occurred in fluvial sandstones: (SLIDE) (1) small irregular-shaped concretionary masses containing manganese and iron and having high uranium

SLIDE

content, and (2) disseminated uranium mineralization with little or no manganese and iron.

The concretionary nodules were described by W.N. Sharp and others in 1964 to have an outer casing of 1/2 to 2 inches thick of submetallic manganese oxides (SLIDE) with centers commonly enriched in oxidized uranium (SLIDE). The richest uranium concentrations were contained in concretionary nodules with some containing as much as 25% U_3O_8 ; however, the concretions were generally less than 1 foot across and only small tonnages could be gained by mining.

The disseminated deposits contained much smaller concentrations of U_3O_8 per ton, but at the same time they included much greater tonnages than the nodules. The relationship of disseminated deposits associated with a color change in the stream deposited sandstones was recognized early in the U.S.G.S. studies. As early as December, 1953, disseminated ore was reported to occur where pinkish-red

hematite stained sandstone came in contact with buff to white sandstone (SLIDE).

A narrow zone of limonite staining and occasionally an interval of almost white bleached sandstone occurred adjacent to the mineralization. With the advent of

mining in the Powder River Basin (SLIDE) uranium ore guides were well defined (SLIDE).

Important targets in the Powder River Basin were located near the edge of the altered redish-pink sandstone.

MINING DISTRICTS

The first ore in the Powder River Basin was shipped by Jenkins and Hand in July of 1953, from the Triangle Group near Ross. Within a few years of Dr. Love's discovery, uranium mining activity was booming in the Powder River Basin.

In the early 1950's, four mining districts were outlined in the basin (SLIDE):

- (1) The Pumpkin Buttes District (although early mining was limited in Pumpkin Buttes to those mines outside of the A.E.C. withdrawal)
- (2) The Turnercrest District
- (3) Monument Hill and
- (4) Box Creek.

PUMPKIN BUTTES

In 1956, the A.E.C. opened the Pumpkin Buttes area to public entry primarily because of public protests and congressional hearings on the withdrawal. The opening of the Pumpkin Buttes area led to an overnight uranium rush. Some additional SLIDE mines began production in the Pumpkin Buttes District (SLIDE), however, only a few mines in the district produced more than 1,000 tons. These mines were the Blowout 119, the Jeanette, Colorado Christensen, Coldspot, Black Star, Antelope, Pete, SLIDE Alma 8 (Uranium Box), and the Turnercrest mines. The Blowout 119 anomaly operated by Kerr McGee produced 25% of the district's tonnage which amounted to 10,784 tons of 0.28% U_3O_8 . The Colorado Christensen Mine was the second largest producing SLIDE mine (SLIDE) with 4,492 tons of 0.21% ore. The Colorado Christensen Mine shows SLIDES excellent exposure of uranium mineralization (SLIDE) which can be traced on the (SLIDE) surface for ~~several~~^{several} tens of feet out of the pit. The Alma 8 Mine was reported as another major producer (SLIDE), however no reported tonnage is available.

SLIDE Other major producers were the Turnercrest Mine (SLIDE) with 3,804 tons of ore of 0.17%, the Jeannette Mine (SLIDE) with 2,708 tons of 0.39% ore, and the Pete SLIDE Mine with (SLIDE) 1,774 tons of 0.47% ore. All additional mines in the Pumpkin Buttes - Turnercrest districts produced less than 1,500 tons of ore.

BOX CREEK DISTRICT

In the early 1950's, uranium mineralization was discovered in the southern Powder River Basin in the Monument Hill and Box Creek districts. The Box Creek is the southernmost district in the basin. The early production in the Box SLIDE Creek District was insignificant, totaling less than 10,000 tons, in 1958, (SLIDE) containing 35,752 pounds U_3O_8 at an average grade of 0.17%. Nearly all of the pre-1970 production came from the Box Creek Mine near the present location of UNC. ~~the~~ 1704 pit.

MONUMENT HILL DISTRICT

The Monument Hill District, located between Box Creek and Turnercrest, proved to be the most prolific district in the Powder River Basin during the 1950's and 1960's. More than 460,000 tons (SLIDE) were produced from this district containing 1,627,900 pounds of U_3O_8 at an average of 0.18%. More than 92% of the total ore tonnage, and 85% of the total uranium oxide produced in the Powder River Basin during the 1950's-1960's uranium boom came from Monument Hill.

Nearly 1/2 of Monument Hill's ore was produced from a single mine operated by Western Nuclear Incorporated from 1960 to 1966, known as the Spook Pit located between the present Bear Creek and Kerr McGee mining operation (SLIDE). The rest of the production in the Monument Hill District came from a number of mines operated by B & H Mines Incorporated and the Mrak Mining Company.

SECOND URANIUM BOOM - BOX CREEK

When the A.E.C. allocations ran out, uranium mining and production came to a virtual standstill in 1967 and 1968. However by the end of 1968 a resurgence of uranium exploration was inevitable to supply nuclear power plant contracts. At this time uranium explorationists were equipped with advanced exploration tools and modern ore deposition concepts. The discovery of the Highland ore body in the old Box Creek District in 1968 breathed new life into the uranium industry, and by 1972, Exxon began processing ore with 260,000 tons produced in 1972. Ore at Exxon is produced from (SLIDE) open pit and underground mining (SLIDE). Exxon is also presently testing in situ mining. Exxon's ore is processed at their mill (SLIDE) with a rated capacity of 2,000 TPD.

(SLIDE) Additional production to Exxon's Highland operations in the Box Creek District, in the 1970 boom, came from Teton Exploration in 1973. 58,000 tons of ore were produced from the Box Creek Mine in that year. United Nuclear Corporation

produced another 58,000 tons in 1977 on their South Morton Ranch property near the
SLIDES Box Creek Mine (SLIDE). To date, more than 6,500,000 tons (SLIDE) of ore have been
produced in the Box Creek District, nearly all of the production is from the Exxon
Highland operations. The annual production is expected to increase in the near
future with TVA-United Nuclear anticipating the construction of a mill with a
capacity of about 2,000 TPD to handle the ore from the South Morton Ranch open
SLIDE pits and the North Morton Ranch Golden Eagle Shaft (SLIDE).

MONUMENT HILL

SLIDE North of the Box Creek District the old Monument Hill District (SLIDE) became
active again in the late 1970's with Kerr McGee's Bill Smith Shaft and Bear Creek
Uranium's Bear Creek Mine reporting 275,000 mined tons for 1977 and 450,000 tons for
SLIDES 1978. At the end of 1978, the Bill Smith Mine (SLIDE) shut down, and Bear Creek (SLIDE)
increased production at their operations. The Bear Creek Mill has a reported capacity
of 1,000 TPD.

SLIDE In 1978, Kerr McGee's 28-33 Mine (SLIDE) became active producing more than
SLIDE 100,000 tons of ore. To date, a total of more than 1,300,000 tons of ore (SLIDE)
has been produced from the Monument Hill District. Additional production is ex-
pected in the near future from Kerr McGee's 3-10 Mine which is scheduled for pro-
duction this year. Additionally, six underground mines are being considered by
Kerr McGee in and around the Monument Hill District, and Pioneer Nuclear Incorporated
is expected to announce plans for development of an open pit mine south of Bear
SLIDE Creek and north of Kerr McGee (SLIDE).

PUMPKIN BUTTES

The Pumpkin Buttes-Turnercrest District has been dormant of uranium production
since the 1950-1960's boom. The total uranium production amounted to only about
SLIDE 36,700 tons of ore (SLIDE).

URANIUM EXPLORATION

SLIDE The amount of uranium exploration in the Pumpkin Buttes-Turnercrest region has picked up considerably with exploration near Turnercrest, Ross and to the west of the Buttes. Wyoming ^{Minerals} ~~Minerals~~ Corporation (SLIDE) Irigaray In Situ Mine is expected to go commercial this year, producing 250 TPD. Other projects expected are (SLIDE) the J & P ^{Christensen} ~~Christiansen~~ Ranch In Situ Mine expected to produce 100 TPD starting 1983-84 and the Cotter Corporation, Charlie Mine south of the Irigaray project. Near Ross, exploration by Conoco and Kerr McGee on the Moore Ranch property may lead to the development of an open pit mine. Near Turnercrest, Rocky Mountain Energy Company is conducting feasibility studies on the Reno Ranch Property for in situ leaching and possibly open pit mining. American Nuclear Incorporated is exploring and developing property on the Brown's Ranch in Campbell County expected to go into production by 1982 with a capacity of 1,500 TPD. With the recent successes of discovery of ore bodies in the Pumpkin Buttes, we can anticipate additional discoveries in this region in the future.

Outside of the Pumpkin Buttes - SPRB districts, U.S. Energy/Western Standard are developing an underground mine near Kaycee. Rocky Mountain Energy Company is developing the Nine Mile Lake In Situ Mine with an expected capacity of 250 TPD, located north of Casper. Teton Exploration is drilling NE of Glenrock for feasibility studies for an In Situ leach mine in that area.

SLIDE The total ore production (SLIDE) in the Powder River Basin to date is more than 7,800,000 tons. In 1978, 2,163,009 tons of ore were reported to the mine inspectors office from mines operating in the Powder River Basin. This tonnage placed the Powder River Basin uranium producers ^{essentially equivalent to the} ~~as the highest producing~~ ^{Gas Hills District} ~~in the world~~ for the first time during the 1970's uranium boom.

ACKNOWLEDGEMENTS

I sincerely wish to thank the employees and geologists of the Exxon Highland Mine, the United Nuclear Corporation Morton Ranch Operations, Kerr McGee uranium mining operations and the Bear Creek Uranium operations for the welcome mat extended to myself at their mines and for the tours of their mining operations. Carl Applin and Lou Tauber of the Department of Energy provided me with much needed production statistics from many of the abandoned mines operated prior to 1970, and their input was greatly appreciated.