CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
1520 West Adams St.
Phoenix, AZ 85007
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

The following file is part of the

Arizona Department of Mines and Mineral Resources Mining Collection

ACCESS STATEMENT

These digitized collections are accessible for purposes of education and research. We have indicated what we know about copyright and rights of privacy, publicity, or trademark. Due to the nature of archival collections, we are not always able to identify this information. We are eager to hear from any rights owners, so that we may obtain accurate information. Upon request, we will remove material from public view while we address a rights issue.

CONSTRAINTS STATEMENT

The Arizona Geological Survey does not claim to control all rights for all materials in its collection. These rights include, but are not limited to: copyright, privacy rights, and cultural protection rights. The User hereby assumes all responsibility for obtaining any rights to use the material in excess of "fair use."

The Survey makes no intellectual property claims to the products created by individual authors in the manuscript collections, except when the author deeded those rights to the Survey or when those authors were employed by the State of Arizona and created intellectual products as a function of their official duties. The Survey does maintain property rights to the physical and digital representations of the works.

QUALITY STATEMENT

The Arizona Geological Survey is not responsible for the accuracy of the records, information, or opinions that may be contained in the files. The Survey collects, catalogs, and archives data on mineral properties regardless of its views of the veracity or accuracy of those data.

PRINTED: 06/20/2002

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: RIVERVIEW

ALTERNATE NAMES:

COCONINO COUNTY MILS NUMBER: 454

LOCATION: TOWNSHIP 26 N RANGE 10 E SECTION 8 QUARTER NE
LATITUDE: N 35DEG 39MIN 08SEC LONGITUDE: W 111DEG 20MIN 57SEC
TOPO MAP NAME: WUPATKI NE - 7.5 MIN

CURRENT STATUS: PAST PRODUCER

COMMODITY:
URANIUM
VANADIUM
COPPER OXIDE

BIBLIOGRAPHY:
ADMMR RIVERVIEW MINE FILE
BUTLER, A., & BYERS, V., AZBM BULL. 180,P 288
ECONOMIC GEO, VOL 80, 1985, P 1722-1735
CHENOWETH,W.L.,ET AL,1973, URANIUM DEPOSITS
OF NE ARIZONA, (DOE)AEC TM-191, P. 8
CHENOWETH,W.L.1988,PRODUCTION HISTORY & GEOL
OF HACKS, RIDENOUR, RIVERVIEW AND CHAPEL
BRECCIA PIPES, USGS OPEN FILE RPT 88-0648

obtained through underground room-and-pillar techniques with adits or surface declines driven from mesa rims developed on cliffs of the Salt Wash Member of the Morrison Formation.

The Salt Wash Member of the Morrison Formation is interpreted as continental fluvial-floodplain deposits (Chenoweth and Malan, 1973); the uranium-vanadium ores are stratigraphically confined to certain mudstone and sandstone layers which contain abundant fossil woody-plant trash and carbonized log fragments. Ore grade is closely associated with organic content, which, in turn may be related to the position of point bar deposits with respect to paleo-meander bends in the stream courses.

Most workers interpret the ore deposition as quickly following sediment deposition, before later diagenesis solidified the mudstones. In the Carrizo Mountains at the Zona Mine, Chenoweth and Malan (1973) interpreted the ore deposition to have taken place before the Salt Wash sediments were intruded and baked by the Laramide-age Carrizo Mountain laccoliths. Hence the ore deposition is pre-Laramide (~ 70 m.y.) in age.

An unexplained attribute of the Salt Wash ores is a ratio of vanadium to uranium of approximately 4:1 up to 8:1. This ratio is a high for Arizona uranium deposits and accounts for 17.9 million pounds of V_2O_5 production from mines in the Salt Wash Member alone. The uranium and vanadium apparently migrated together under appropriate geochemical conditions, presumably from the source area of the Salt Wash sediments, somewhere to the west of what is today Lee's Ferry on the Colorado River (Craig and others, 1955).

Chinle Formation

The basal part of the Triassic Chinle Formation in the Cameron area and in the Monument Valley region of Arizona and Utah had sustained production of uranium between 1948 and 1969. In the Cameron area, the lower part of the Chinle Formation (termed the sandstone and siltstone member by Repenning and others, 1969, p. 5) and various horizons in the Petrified Forest Member contain ore zones that consist of interbedded sands and mudstones with abundant silicified logs. These strata are exposed along both sides of the Little Colorado River for 40 miles. A total of 102 mines, most of which were open pits averaging between 20 and 60 feet deep, produced 1.24 million pounds of U_3O_8 and 212,000 pounds of V_2O_5 between 1954 and 1963 (see Bollin and Kerr, 1958). These mined areas represent only the most accessible ore bodies. Certainly, some potential for slightly deeper ore bodies remains in the area, as suggested by some recent drilling results. In the eastern part of the Cameron area, minor production is recorded from the basal Kayenta Formation.

Monument Valley has been the single most productive area for uranium in Arizona. In this region, well-defined channels of the basal Chinle conglomerate (the Shinarump) were cut into the underlying Triassic Moenkopi Formation and were subsequently mineralized locally. The channel fill consists of pebbley conglomerates with sandstone and mudstone lenses and locally abundant carbonized and silicified logs. Total Monument Valley production from 34 mines between 1948 and 1969 amounts to 8.7 million pounds of U_3O_8 and 24.4 million pounds of V_2O_5. Arizona's largest single mine group is the Monument No. 2 mine, operated by the Vanadium Corporation of America. This Monument mine is in an erosional remnant of a low scour in a single Shinarump channel, with both upstream and downstream portions removed by later erosion. The preserved channel remnant is cut through the Moenkopi Formation into the underlying De Chelly Sandstone, and is about 700 feet wide and up to 60 feet deep. Monument No. 2 production alone accounts for 5.2 million pounds of U_3O_8 and 21.8 million pounds of V_2O_5 from 1952 to 1967. Earlier underground workings were eventually replaced by an open pit which followed the course of the Shinarump channel. Production was enhanced from 1955 to 1964 by a mechanical upgrader situated near the mine that separated higher grade clay-silt ore averaging 0.24% U_3O_8 and 2.6% V_2O_5 from more sandy materials (0.02% U_3O_8 and 0.18% V_2O_5) which were discarded. During 1964–1967, heap leaching of the sand residue and some low grade ore resulted in additional production. Ore minerals at Monument No. 2 are tyuyamunite, carnotite, becquerelite, hervettite and uraninite; they impregnate sandstone lenses, fill fractures, and replace clay and fossil plant fragments. Most workers hypothesize ore deposition in Shinarump channels to have occurred through the trapping of uranium-vanadium minerals by organic debris in the channels from groundwater solutions which were moving through the permeable channelways in the post-Shinarump time. However, Finnell (1957) suggests a Laramide age of low-temperature hydrothermal ore deposition.

Mining at the Charlie Huskon No. 3 open pit in the Cameron area, April 1966. Uranium here is in sands and shales of the Triassic-age Chinle Formation. Petrified wood in the sediments is especially uranium rich. Photo by W. Chenoweth, Dept. of Energy.

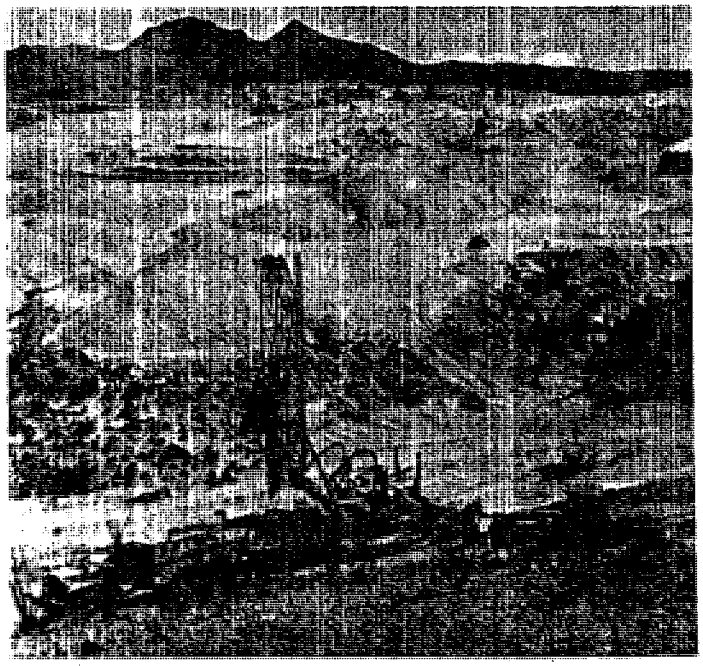
Breccia Pipe Sources

Breccia pipes are found in large areas of the Colorado Plateau country. More than 100 have been postulated by DOE subcontract studies to exist in the region surrounding the Grand Canyon. The pipes take the form of vertically elongate, cylindrical masses filled with heterogeneous assemblages of sedimentary rock fragments that have been displaced downward, presumably by collapse into a solution cavity formed in Mississipian-age Redwall Limestone. Radial and concentric faults and fractures mark the lateral pipe boundaries. Where explored, the pipes never contain sedimentary material that can be proven to have moved upward, nor do they contain any volcanic debris. Many, but by no means all, of the Arizona Plateau pipes contain varying degrees of copper and/or uranium mineralization. Past uranium production in Arizona is recorded from five pipes. The first four (Chapel, Hack Canyon, Ridenour and Riverview) supplied a cumulative total of 1852 tons of uraninite-type ore that contained about 0.5% U_3O_8 between 1950 and 1964. The fifth, the Orphan Lode, is the second largest individual Arizona uranium mine. It is credited with 509,000 tons of ore that contained 0.43% U_3O_8, and with considerable values of copper and silver. Vanadium content was quite low.

The Orphan ores are mostly primary uraninite-pyrite-chalcocite-tennantite, with some secondary ores found near the present surface of the mine, 1,000 feet below the top of the Grand Canyon. The ores have been subdivided into basically two types. A central "B" orebody occupies a "pipe within a pipe" structure, where the ore has impregnated the highly brecciated pipe-fill derived largely from the Coconino Sandstone. The annular ring orebody is found mostly outside the pipe perimeter, 200–400 feet below the surface. Outside of the pipe perimeter, rich ore selectively replaced certain mudstone layers in the Supai Formation. For details of Orphan geology, see Gornitz and Kerr (1970) and Kofford (1969).

Ore mined in 1956 to 1959 was hoisted to the canyon rim by an aerial bucket tramway with a 1,000 ton-per-month capacity. From

Adits in the Little Joe-Workman mine areas of the Sierra Anchas of Gila County. Uranium is contained in the late Precambrian Dripping Spring Quartzite. This area is continuing as an exploration target in the 1980s. Photo by R. Scarborough.



Mining and drilling in 1958 at the Anderson mine of Yavapai County. Renewed drilling in the 1970s outlined a large low-grade uranium orebody nearby which now awaits favorable economic conditions for further development. Photo by W. Chenoweth, Dept. of Energy.

1959 on, ore was hoisted through a crosscut and 1,600 foot shaft directly to the canyon rim. Most ore was trucked to the Rare Metals Mill in Tuba City.

More than 60 exotic minerals have been identified at the Orphan mine. Detailed analyses indicate primary ore deposition at temperatures of 60° to 110° C, with uranium-lead age dates suggesting a Jurassic age of ore deposition. Interestingly, this very nearly coincides with the age of the Morrison Formation sedimentation in the Four Corners region to the east.

Other Arizona Production

Between 10,000 and 20,000 tons of uranium ore have been shipped from each of three other sources in Arizona: The Cretaceous Toreva Formation on the eastern extent of Black Mesa; the Precambrian Dripping Spring Quartzite of the Sierra Ancha of Gila County; and scattered shipments from 11 different sources in the Basin and Range portion of the state. The Toreva Formation and Dripping Spring Quartzite ores are both interpreted as stratabound deposits (Chenoweth and Malan, 1973; Williams, 1957). The two largest southern Basin and Range sources (both in the 1950s) have been the Anderson mine of Yavapai County (consisting of Miocene carbonaceous and siliceous sediments) and the Duranium mine of Santa Cruz County (a shear zone in Cretaceous quartzites).

RECENT TRENDS IN URANIUM INDUSTRY

The 1970s has been a decade of increased exploration and mining of uranium on a national scale. During this ten-year period, average production figures (DOE open file report 100(80)) for New Mexico were 6,200 tons of U_3O_8 concentrate *per year*, 4,400 tons *per year* for Wyoming, and 4,300 tons *per year* for all other states combined (Colorado, Utah, Washington and Texas). Viewed in comparison with these figures, the total *cumulative* Arizona uranium output to date is 9,164 tons of U_3O_8, or 2.82% of the U.S. cumulative total production for 324,900 tons of U_3O_8 as of January 1, 1980. Nationally, 1979 drilling footage for uranium was distributed geographically as follows: 35% in Wyoming basins, 33% on the Colorado Plateau, 20% in west Gulf Coast plains, about 2.5% in the Basin and Range Province, and about 10% in all other areas.

RECENT ACTIVITY IN ARIZONA

Although Arizona has only produced moderate amounts of uranium in the past, considerable exploration efforts have been expended in the state during the last decade, particularly in reference to breccia pipe and Cenozoic sedimentary targets. Recent trends of exploration drilling in Arizona are illustrated in Table 2. Land held for exploration and development by companies and individuals in Arizona was at an all-time high at about 1.7 million acres, as of January 1, 1980, up 30% over the January 1979 holdings. Drilling in the first half of 1980 was down about 50% from the same time in 1979, probably related at least in part to nuclear reactor cancellations following the Three Mile Island incident. The drilling peak in 1976 was centered around renewed interest in the Miocene sediments of the Date Creek basin of Yavapai and Yuma Counties. During this surge, Minerals Exploration and Urangesheldshaft drilled out low-grade ore reserves in excess of 30 million pounds of U_3O_8 in the shallow subsurface near the Old Anderson mine (*Fieldnotes*, v. 9, n. 3, p. 15). Announcements in 1977 of new mining and milling plans were temporarily canceled in mid-1980 because of financial considerations. However, considerable interest remains in the Date Creek basin area and many other Cenozoic sedimentary deposits (see Otton, 1977; Scarborough and Wilt, 1979).

TABLE 2

EXPLORATION DRILLING FOR URANIUM IN ARIZONA, 1970-1980

Calendar Year	Number of Holes	Footage
1970	14	3,500
1971	24	2,200
1972	37	6,000
1973	50	8,700
1974	127	52,000
1975	1,165	176,200
1976	1,465	544,700
1977	1,035	500,400
1978	1,372	688,300
1979	663	378,400
1980*	98	64,300

*First six (6) months only. Source: W. Chenoweth, DOE, Grand Junction

STATE OF ARIZONA
DEPARTMENT OF MINERAL RESOURCES
MINERAL BUILDING, FAIRGROUNDS
PHOENIX, ARIZONA 85007

Reviewed

March 20, 1968

ORPHAN MINE

COPY

Walter Ashwheel, AEC, Grants, New Mexico, Box 2038, Milan, New Mexico 87020 in the office 3-20-68.

According to Mr. Ashwheel, the Orphan mine has 40 men working and the Cotter company wishes to double production.

Maurice Castagne still is manager and Eric Bruner geologist. Have recently employed a young geologist and plan to increase exploration. The Riverview property in the Cameron area is said to be one of interest.

Interest in the breccia pipes of the Cameron area is attracted by the presence of minerals other than uranium. Cotter can recover copper, etc. in its process.

Uranium exploration also is active in the Globe area and elsewhere in the State.

F. P. Knight, Director.

AEC 172-479, p. 55 AEC files

DEPARTMENT OF MINERAL RESOURCES
State of Arizona
MINE OWNER'S REPORT

Date 2-18-58

1. Mine: Huskm 4, Huskie 3, Huskm 9, 18, 19, 20, 34
2. Location: Sec..... Twp..... Range..... Nearest Town Cameron Distance 2-20 miles
   Direction..... Nearest R.R. Flagstaff Distance.....
   Road Conditions fair to poor
3. Mining District and County: Little Colorado, Dist. 3 Navajo Res.
4. Former Name of Mine: None
5. Owner: Navajo Tribe
   Address: Window Rock, Ariz.
6. Operator: Utco Uranium Corp.
   Address: P.O. Box 1196, Flagstaff, Ariz.
7. Principal Minerals: Uranium
8. Number of Claims: Lode All Navajo Permits Patented..... Unpatented.....
   Placer..... Patented..... Unpatented.....
9. Type of Surrounding Terrain:.....

10. Geology and Mineralization: Uranium mineralization in sandstone members within the lower half of the Chinle formation

11. Dimension and Value of Ore Body: ~~Prob~~ Small bodies usually from a few hundred to a few thousand tons of 0.20 U_3O_8 ore

Please give as complete information as possible and attach copies of engineer's reports, shipment returns, maps, etc. if you wish to have them available in this Department's files for inspection by prospective leasors or buyers.

(over)

12. Ore "Blocked Out" or "In Sight":

Ore Probable:

13. Mine Workings—Amount and Condition: All open pit

	No.	Feet	Condition
Shafts			
Raises			
Tunnels			
Crosscuts			
Stopes			

14. Water Supply:

15. Brief History: Production of app. 40,000 tons last 2 years principally from Huskon 4 and Huskie 3 claims. Average grade app. 0.185 U_3O_8

16. Remarks: App. 10 men employed at present

17. If Property for Sale, List Approximate Price and Terms:

18. Signature: Utco Uranium Corp.
by Mason W. Rankin
Gen. Mgr.

DEPARTMENT OF MINERAL RESOURCES

STATE OF ARIZONA

FIELD ENGINEERS REPORT

(UTCO - NAVAJO RESERVATION LEASE)

Mine HUSKIN # 4- JULIUS CHEE # 2 and RIVERVIEW

Date June 5, 1957

District CAMERON

Engineer B. J. Squire

Subject: Activity Report

LOCATION: Mines are located approximately 4 miles SE of Cameron Airport on NE side of the Little Colorado River.

ORE: Uranium of + 0.22% U_3O_8 grade is being shipped from open pit operation in the Chinle formation. Considerable ore of 0.1 % to 0.2 % is being stockpiled.

OPERATOR: UTCO URANIUM CORP.
Mason W. Rankin, Mgr.
227 Guarantee Bank Bldg.,
Denver 2, Colorado
P. O. Box 1196
Flagstaff, Ariz.