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: 04-11-2011

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: ORPHAN LODE

ALTERNATE NAMES:
GOLDEN CROWN MINING CO.
WESTERN GOLD AND URANIUM

COCONINO COUNTY MILS NUMBER: 55

LOCATION: TOWNSHIP 31 N RANGE 2 E SECTION 14 QUARTER N2
LATITUDE: N 36DEG 04MIN 20SEC LONGITUDE: W 112DEG 09MIN 00SEC
TOPO MAP NAME: BRIGHT ANGEL - 15 MIN

CURRENT STATUS: PAST PRODUCER

COMMODITY:
URANIUM
COPPER OXIDE
MOLYBDENUM
ANTIMONY
COBALT
GOLD
BARIUM WITHERITE
IRON
LEAD
MANGANESE
SILVER
ZINC
CALCIUM CALCITE
FELDSPAR

BIBLIOGRAPHY:
ADMMR ORPHAN MINE FILE
US-AEC 172-479, P. 2, 8 & 9
BLM MINING DISTRICT SHEET 62
ADLER, H2, ECON GEO, VOL 58, #6, P 849-850
GRANGER, H. ET AL, USGS BULL 1147-A, P A7-A12
AZBM BULL 180, P 235, 287
ADMMR "U" FILE
USBM CRIB PRINTOUT M001823

CONTINUED ON NEXT PAGE

CONTINUATION OF ORPHAN LODE

HICKS, C., ADMMR MOLY OCCUR, MIN RPT 3, P 15
CHENOWETH, W.L. "ORPHAN LODE MINE, GRND CYN AZ, HSTRY MINLZED COLLAPSE-BRECCIA PIPE" OPEN FILE RPT 86-510 (ADMMR GEOLOGY FILE)
ADMMR 7 U/G MAP (ABM MAP BOX)
USGS OFR 86-510 ORPHAN LODE MINE A CASE HISTORY . . . BY W.L. CHENOWITH, 1986

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
FIELD ENGINEERS REPORT

Mine Orphan Mine Date Sept. 4, 1959

District Grand View (Grand Canyon) Engineer Travis P. Lane

Subject: Visit of Aug. 20, 1959

The operating company is Western Gold & Uranium, Inc. Company officers and key personnel at the mine are as follows:

President	Russell Richards	Supt.	Maurice Castagne
Treasurer	Joe Fakler	Asst. Supt.	Bob Hartman
Mining Director	C. E. Pryor	Geologist	Max Kofford

Mr. Richards was present at the time of this visit. Mr. Castagne was absent on vacation. Mr. Hartman conducted a tour of the workings. Mr. Kofford supplied much helpful information re the operation.

The deposit is a brecciated volcanic pipe, technically described as a cryptovolcanic diatreme. The pipe workings in depth penetrate the beds of the Hermit shale formation and enter the underlying beds of the Supai formation. However, the breccia filling of the pipe is Coconino sandstone, its presence being attributed to a slumping into the pipe vent of material from the Coconino sandstone formation lying directly over the Hermit shale. A number of similar breccia filled diatremes have been recognized in the Canyon area and the company has investigated several of them. However, none occur in close proximity to the Orphan deposit and none indicated a content of U_3O_8.

The long axis of the pipe is apparently vertical. The horizontal section is roughly circular with many lateral bulges. At the horizon of the adit workings the diameter is about 180' and in the lowest workings the diameter is estimated at about 400'. Most of the production to date has been derived from an annular ring on the periphery of the pipe. Recently however some excellent ore has been developed in the lower part of the workings in a secondary breccia pipe in the interior of the main pipe, and this is considered to hold good promise for the future. The pipe material contains a fair amount of pyrite throughout and in places the pyrite occurrence is abundant. Some silver is present, and some tetrahedrite and other non-ferrous sulphides have been noted but only in very minor amounts.

The operators during the past year have conducted an intensive development program and are continuing with this program. The aim is to fully explore the ore potential of the deposit and to put the workings in shape to economically handle a greatly expanded rate of production.

The vertical shaft which was collared last spring (1958) a short distance back from the rim of the canyon near the head of the aerial tram was completed at 1600' and a level at 1500' driven southwesterly some 900' connects by a raise with the northeastern workings of the 245' adit winze level (referred to the adit level as 0). The 1500' shaft level corresponds to a depth of 400' below the adit level which is driven northeasterly into the canyon wall. A winze at about 100' in from the portal of the adit opens levels at 100', 175' and 245' below the adit. The 1500' shaft level is being continued under the adit workings and two connecting raises are being run and third is planned.

Stoping is presently in progress between the 175' and 245' levels and between the

100' and 175' levels.

Animportant feature of the mining operation is the systematic drilling of long holes into the walls of the mine openings to determine (by probes) the economic ore limits beyond those openings. At present only development material is being hoisted thru the vertical shaft. Ore and men and most supplies are still handled by the aerial tram. The operators anticipate that within two to three months it will be possible to serve all mining needs thru the shaft and thus obviate the costly multiple handling incident to the tram operation. Also, the limited capacity of the tram has been a bottle neck to expanding the mine output.

The work crew varies from 80 to 90 men of whom about 20 are surface plant and office employees. Of the rest more than half are on development.

Current production is averaging about 2000 TPM, all going to the Tuba City plant of Rare Metals Corp. The Company hopes to double or triple this production rate when the necessary underground connections with the shaft are completed.

DEPARTMENT OF MINERAL RESOURCES

STATE OF ARIZONA

FIELD ENGINEERS REPORT

Mine Orphan Mine Date 7-15-58

District Engineer Frank P. Knight, Director

Subject:

Mr. R.V. Wyman, general manager western operations of Western Gold & Uranium, Inc., and P.E. Sayre, Supt. of the Orphan Mine, were present at time of visit.

Went down the 1800 ft. incline (1100 ft. vertically) to the lower terminal about 25 ft. above the tunnel portal and offset from it. This incline must have been very difficult to install.

The tunnel goes in about 100 ft. to a 175 ft. winze, so that ore must come up the winze, out of the tunnel, up the short incline and out on the 2-bucket long incline. A 1600 ft. shaft is being sunk to overcome this expensive system. This shaft is 3 compartment with steel sets and treated lagging, and is down about 200 ft. It is expected to be finished early in 1959.

The ore occurs as pitchblende and metatorbernite in and around a breccia pipe at the north side of a downfaulted block of Coconino sandstone. In a stope which floors at the 145 level of the winze, and is about 40 x 50 ft. in area, this ore is running about 2%. Due to the fact that they are not allowed by the Canyon Park Service to dump any material outside of their one claim, they include much low grade ore with the high.

A winze is being sunk from the 175 ft. level and now is down 79 ft. Stope gob comes from this and other development.

The shaft program will afford better opportunity to diamond drill. They have been confined to downward drilling in the pipe itself without ability to cross-cut it, so that they do not have desired information as to size and vertical extent of the pipe and surrounding ore.

The mine has unusual difficulties besides the inefficient extraction and total lack of dump space. Water costs 1½ cents per gallon, there being none in the mine. The Park Service charges 67 cents per ton toll for use of the Park road. A.E.C. now is cutting down and the mine is limited to 1600 lbs. per month of U_3O_8 to Tuba City. The balance is going to Vitro in Colorado. Incline maintenance is heavy, particularly in rainy season and winter when rock falls are bad.

There are a total of 25 men working, with about 17 underground. The shaft is being sunk by a Eureka, Nevada contractor. Mine output is 40 tons per day.

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

Date Feb. 6, 1958

1. Mine: ORPHAN MINE

2. Location: Sec. 14 Twp. 31N Range 2E Nearest Town Grand Canyon Distance 2½ miles
   Direction West Nearest R.R. (Grand Canyon) Santa Fe Distance 2 miles
   Road Conditions Good

3. Mining District and County: Grand Canyon Mining District, Coconino County

4. Former Name of Mine:

5. Owner: Western Gold & Uranium, Inc.
   Address: Box 95, Grand Canyon, Arizona

6. Operator: Same
   Address:

7. Principal Minerals: U3O8, V2O5

8. Number of Claims: Lode 1 Patented yes Unpatented
   Placer Patented Unpatented

9. Type of Surrounding Terrain:

10. Geology and Mineralization:

11. Dimension and Value of Ore Body:

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" quite a bit

Ore Probable: More

13. Mine Workings—Amount and Condition: Good

No.	Feet	Condition
Shafts		
Raises		
Tunnels		
Crosscuts		
Stopes		

14. Water Supply: Hauled

15. Brief History:

16. Remarks: Currently employ about 35 men.

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

18. Signature: WESTERN GOLD & URANIUM, INC.
P. O. BOX 95
GRAND CANYON, ARIZONA

B. E. Lupe, Supt.

File Orphan Mine

TABLE # 1

Elements and Minerals Found in the Orphan Pipe

I. Metallic Minerals & Elements:

Metal	Mineral (s)	Primary	Secondary
Uranium	Urananite-Pitchblende	X	X
	Tobernite, Meta-tobernite		X
	Zeunerite, Meta-zeunerite		X
	Gummite		X
	Hydrous Uranium Sulphate (?)		X
	Uranospinite		X
Antimony	Tetrahedrite	X	
	Stibnite	X	
	Bindheimite (?)		X
Arsenic	Tennantite	X	
	Arsenopyrite	X	
	Uranospinite		X
	Orpiment (?)	X	X
Copper	Tannantite, Tetrahedrite	X	
	Bornite, Chalcopyrite	X	
	Chalcocite	X (?)	X
	Covellite	X (?)	X
	Azurite Brochantite		X
Gold	Native (?)		
Iron	Pyrite	X	
	Hematite, Siderite	X	
	Ankerite, Jarosite		X
	Melanterite, Goethite (?)		X
	Limonite, Marcasite		X
Lead	Galena	X	
	Wulfenite		X
	Anglesite (?)		X
	Bindheimite (?)		X
Magnesium	Dolomite	X	
Manganese	Rhodocrosite	X	
	Pyrolusite (?)		X
Molybdenum	Molybdenite	X	
	Ilsemannite		X
	Wulfenite		X
Nickel, Cobalt	Siegenite	X	
	Nickel-Skutterudite (?)	X	
	Bravoite (?)	X	
Mercury	Cinnabar	X	
	Meta-cinnabar (?)		
Silver	Proustite	X	
Selenium	(Unknown)		
Zinc	Sphalerite	X	
	Marmatite	X	
	Smithsonite		X

II. Elements Indicated by Spectrographic Analysis. Minerals Unknown:

Metal	Mineral (s)	Primary	Secondary
Cadmium			
Columbium (?)			
Gallium			
Germanium			
Tantalum			
Tin			
Titanium			
Yitrium			

III. Non-metallic Hydrothermal Minerals:

Barite, bartyocalcite
Calcite
Dolomite
Andesine, Labradorite
Quartz (?)
Illite
Alunite

IV. Secondary Non-metallics and Non-classified:

Kaolin
Gypsum
Carbon

NOTE:

(?) indicates a tentative identification.

(May 1952)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

SUMMARY REPORT OF MINERALS EXAMINATION

State Arizona County Coconino Mineral Products U_3O_8

Name of property or deposit Orphan Claim

Date examined 5-17-61 Engineer W. E. Young Date of this report 5-24-61

Reason for examination Request for report on type of geological occurrence

Engineer accompanied by Eldred D. Wilson Address Tucson, Arizona

Extent of property 1 claim

Owner Western Gold & Uranium, Inc. Address St. George, Utah

Leased or optioned to None Address

Location of property (be specific) Sec. 14, T. 31 N., R. 2 E., Gila and Salt River B. & M. Coconino County, Arizona

Type of deposit and mineralogy (brief description) Diatreme or breccia pipe. Nearly vertical pipe with constricted neck. Ore occurs in annular rings on the periphery of the breccia pipe and in ore shoots within the main structure.

Known dimensions of the deposit Length 400' Width 400' Depth 800' +

Attitude of the deposit (strike, dip, etc.) The breccia pipe plunges steeply in a northeast direction.

Possible extensions; correlation of known showings Mine workings have been carried to a depth of 400 feet below the outcrop. Diamond drilling indicates mineralization extends plus 800 feet below outcrop.

Mine workings (brief description or attach map or sketch) (indicate whether accessable) 1,585 foot vertical shaft. 900 foot crosscut from shaft to breccia pipe. Mine workings on several levels.

(over)

Mining and milling equipment on property Hoist, headframe and modern underground mining equipment.

Past production (if any) Approximately 2,000 tons per mo. 1955-1959; 7,000 tons per month 1959-1960

Present rate of production (if any) 7,000 tons per month

Sampling (describe briefly, or attach sketch) None

Tentative Estimate of Reserves

(Subject to revision when assays are received or after engineering calculations)

Measurable ____ tons ____ Grade ____

Indicated ____ tons ____ Grade ____

Inferred 500,000 tons Uranium ore Grade 0.25

Mining method (actual or suggested) Long hole open stoping.

Milling or processing method (actual or suggested) Ore is shipped to Rare Metals Uranium mill at Tuba City, Arizona.

Processing tests suggested ____

Tentative conclusion and decision Operation likely to continue at present rate until 1966.

To be accompanied by brief letter giving examining engineer's general impression of the deposit, his impression of the owner, and any other confidential information he may care to submit. Refer to any known prior examinations and reports. May be executed in pencil. Shall be mailed within 24 hours after examination is completed.

Original and one copy to Washington Office.

Section, Washington, D. C.

76412

GEOLOGY AND MINE WORKINGS OF ORPHAN CLAIM, COCONINO COUNTY, ARIZONA

By

W. E. Young and Eldred D. Wilson

ILLUSTRATIONS

Figure 1. - Index map showing location.

2. - Patent survey plat of Orphan claim.

3. - Longitudinal section along center line of Orphan claim, looking northwest.

4. - Cross section N. 32° E. showing general relations of ore bodies and breccia pipe.

5. - Cross section N. 32° E. showing detailed relations supplemental to Figure 4.

6. - Cross section C - C' (N. 50° W.)

7. - Cross section E - E' (N. 45° E.)

8. - Map of workings on Adit level.

9. - Map of workings on 140 level.

10. - Map of workings on 175 level.

11. - Map of workings on 245 level.

12. - Map of workings 290 level.

13. - Map of workings on 310 - 320 levels.

14. - Map of workings on 330 level.

15. - Map of workings on 350 - 365 levels.

16. - Map of workings on 400 level.

17. - Outcrop at northeast edge of diatreme.

18. - Lower tremaine terminal.

GEOLOGY AND MINE WORKINGS OF ORPHAN CLAIM, COCONINO COUNTY, ARIZONA

by W. E. Young[1/] and Elfred D. Wilson[2/]

1/ Mining Engineer, Bureau of Mines

2/ Geologist, W.A.E., Bureau of Mines

PURPOSE AND SCOPE OF REPORT

As outlined by Mr. Robert W. Geehan, Regional Director, Region III, Bureau of Mines, on May 15, 1961, the purpose of the investigation was to ascertain and report upon the following items:

1. The relation of the original Orphan mineral discovery to the end lines and side lines of the Orphan patented claim
2. The physical location of the old pre-1955 workings that remain accessible or identifiable on the Orphan claim
3. The general geology and geometry of the Orphan ore body, with special reference to the boundaries of the Orphan claim

FIELD WORK

On May 17, 18, and 19, 1961, we examined the surface locations and the underground workings of the claim. The company officials made us welcome, conducted us through the mine, and gave us access to all the mine records. Patent plats of the Orphan claim were acquired from the General Land Office in Phoenix, Ariz. An attempt was made to locate claim corners or reference points on the ground. We were unable to find any claim corners although the pre-patent discovery and improvement work on the outcrop were virtually as shown on the patent plats. Company officials reported that they had found only one corner, namely Corner No. 2, but that it had been knocked out in the course of mining work and was no longer in existence.

All mine maps had been tied to this corner. We next contacted Mr. McLaughlin, Park Superintendent, and found that a survey by the Park Service had been made, beginning at the section corner between secs. 14, 15, 22, and 23, T. 31 N., R. 2 E., Gila and Salt River base and meridian, and extending to the southwest end line of the Orphan claim. No permanent points were established, but a fence was constructed along this southwest end line of the claim from Corner No. 1 to Corner No. 2. A map of this survey was furnished to us by the Grand Canyon National Park Service. Survey records are incomplete but indicate possible disagreement between the Park survey and the patent survey.

In light of the above information a check was made of the mining company survey notes and ledger. These records were found to be fragmentary, incomplete, and inadequate. It is our considered opinion that these records would not stand up under a check for accuracy and reliability. Survey procedures and methods used are not accepted as standard practice. Because time would not permit our making a check survey from the section corner, having the degree of accuracy necessary for this type of work, it was decided to make a rough Brunton-tape survey from the southwest end line of the claim, as indicated by the Park fence, to the northeast end line. We assumed the one shaft and two raises involved are vertical. The check survey revealed a difference of some 30 feet in the location of the mine workings as compared to the company's survey. The Brunton work is not precise, but indicates there is no existing survey which is reliable except the patent survey.

The corner monuments of the patent survey are gone and must be re-established.

We recommended to mining-company engineers that the northeast end line be re-established by a precise survey. It is our understanding that company engineers were to start this work on May 20, 1961.

As prescribed, the time available for the field investigation, preparation and transmittal of this report was not to exceed 10 days. Fortunately, Western Gold and Uranium, Inc., supplied us with its mine maps, geologic maps, geologic cross sections, and other information pertaining to the Orphan property. We had opportunity to check these data at many places underground as well as on the surface during May 17 to 19, inclusive, and it is our belief that the information, insofar as used and qualified in this report, is for the most part correct, and our major criticism is not that an error was made in the survey of the mine workings, but in their relation to the boundary lines of the Orphan claim.

Required Survey Work

No corner monuments of the original patent survey could be found. There is no reference in mining company survey records of any tie to any of these claim corners. There is no reference of any tie to claim corners in Park Service surveys. The only known point remaining in reference to the original patent survey is the section corner common to secs. 14, 15, 22, and 23, T. 31 N., R. 2 E. It is estimated that at least one month will be required to complete a survey from this section corner to re-establish the corners of the Orphan claim.

The position of the northeast end line of the Orphan claim as now shown on maps is only approximate. The discovery and improvement work of the original locator as shown on the patent plat are still intact. From the positi of this work a rough approximation of the location of the northeast end line can be made. It appears the mineralized outcrop of breccia pipe is within

the boundaries of the claim, and that the pipe plunges in a northeasterly direction and extends beyond the northeast end line at depth.

SITUATION

The Orphan patented claim (Figure 2) is in sec. 14, T. 31 N., R. 2 E., Gila and Salt River base and meridian, within the Grand Canyon National Park and approximately 1-1/4 miles northwest of Grand Canyon Station.

HISTORICAL SUMMARY

The Orphan claim was located in 1893 by Daniel Hogan who had found copper showings 1,100 feet below the south rim of the Grand Canyon. Hogan served in the Spanish-American War and, in 1906, returned to the area to file for patent on his claim. Patent was granted March 23, 1906, many years before the surrounding area acquired National Park status.

To complete the necessary labor and improvements for patent on his claim, Hogan had to make his way, by a series of ropes and ladders, over the nearly vertical canyon wall to the mineralized outcrop 1,100 feet below the rim. The patent plat and notes show two adits aggregating 105 feet in length and one discovery shaft 10 feet in depth. These workings are still accessible, and with the exception of the discovery shaft are virtually as Hogan left them. The discovery shaft was obliterated by the recent mining operation in the course of transferring waste material from the surface for use as stope fill in the mine.

Hogan finally gave up in his search for copper, not realizing he had encountered high-grade uranium. When the Grand Canyon National Park was created the claim became valuable for surface rights. It was the only parcel of privately owned property in the area and completely surrounded by the National Park. The claim was sold by Hogan, passed through several other

hands, and was finally acquired by Western Gold and Uranium, Inc., in 1957. This company installed an aerial tram from the rim to the outcrop and started mining. The low capacity of the tram limited the monthly ore production to 2,000 tons and made mining the ore an expensive, high-cost operation. In 1959 a vertical, 3-compartment shaft was sunk to the 1,587-foot level, and a 900-foot crosscut was driven to the mine area on the 1,500-foot level. Raises were driven from the level to the mine workings. The operation is now conducted through this level, 1,500 feet below the shaft collar.

TOPOGRAPHY

Approximately the southern one-third of the Orphan claim lies at an altitude of 7,000 feet upon a plateau of moderately low relief immediately south of the Canyon rim. Northward from the rim, the surface of the property descends over precipitous slopes and sheer cliffs to an altitude of almost 5,900 feet (Figure 3).

GENERAL GEOLOGY

In this portion of the Grand Canyon area, the Older Precambrian basement rocks are overlain by 3,600 feet of Paleozoic (Cambrian through Permian) strata. The general character and thickness of the individual formations comprising this series are shown in Figure 3.

The Paleozoic beds here dip southwestward at about 100 feet per mile. Fractures of northeast, northwest, north-south, and other trends are fairly common, but no large fault displacements are evident in the immediate area of the mine. The Bright Angel fault of northeastward trend, approximately 3/4 mile southeast of the Orphan claim, effected displacements in both Precambrian and Post-Paleozoic times. Other zones of fracturing in the ancient crust presumably occur, concealed by the Paleozoic series, and they are significant factors regarding potential mineralization.

THE MINERAL DEPOSITS

The known mineral deposits on the Orphan claim, of present economic interest chiefly because of their uranium content, occur as replacements within a breccia pipe.

This pipe, or diatreme, is believed to have been localized where a plexus of intersecting fractures in the basement rocks was invaded with explosive violence by gaseous hydrothermal solutions ascending from a deep-seated source.

Where exposed on the surface and in the mine workings, the filling of the pipe consists of rounded to subangular fragments of Coconino sandstone, Hermit shale, Supai sandstone and shale, and limestone (Figure 5). The breccia mass was subjected to minor faulting and fracturing at intervals before, during, and after its mineralization.

The mineralizing process resulted in irregular replacements by dolomite and other gangue minerals, together with various ore minerals, sulphides and oxides. As described by Max E. Kofford, chief geologist of Western Gold & Uranium, Inc.,3/ "Most of the mineralization occurs as a complex very fine-grained aggregate that besides uranium includes minerals of antimony, cobalt, copper, gold, iron, lead, magnesium, manganese, molybdenum, nickel, silver, titanium, and zinc, in addition to silica, clay minerals, calcite, feldspars, and barite. A number of other elements are indicated by spectrographic analysis.

3/ Mining World, vol. 21, No. 1, p. 35, Jan. 1959

"The mineralization occurs for the greater part in the primary form. The primary minerals were apparently deposited under a wide temperature range. Secondary minerals occur in the leached upper part of the pipe, above the adit level, and in numerous post-mineral shear zones. There is some secondary enrichment. Alteration is extensive."

The breccia pipe as a whole is reported to contain from 0.01 - 0.02 percent U_3O_8, but the ore (presumably rock containing 0.27 percent or more U_3O_8) occurs in bodies of irregular size and shape. Thus Figures 4 - 16 show, by areas of stoping, the principal ore bodies designated as "A", "B", and "Annular Ring." Perhaps more ore remains in the annular ring structure than in the other known areas.

Ore in "A" and "B" ore bodies has been mined from the zero or adit level to the place where the structure passes beyond the northeast end line of the claim. With the exception of a few pillars and some oreabove the adit level, the mining operation has removed all of the ore in the "A" and "B" orebodies within the claim boundaries. In a short time mining will be confined to the annular ring structure.

The locations of the various known ore bodies with reference to the approximate boundaries of the Orphan claim are shown in Figures 3-5 and 7-16. Figures 3 - 5, particularly, show the ore bodies plunging or dipping outward beyond the approximate position of the northeast end line. How far the ore may continue below the depth of present exploration, or at what depth the dip might change so that the ore might plunge outward beyond either of the claim's side lines, is unpredictable.

Figure 2 shows that the original Orphan discovery and other old workings are within the boundaries of the Orphan patented claim. At this time the position of the northeast end line is not definitely known; however, rough measurements from workings and locations shown on the Patent Survey Plat (Figure 2) indicate the northeast end line to be northeast of the outcrop of the ore body. These relations are illustrated also, with reference to the approximate position of the northeast end line of the claim in Figures 3 and 5.

It is noteworthy that the highest grade uranium ore in the mine is found in the "A" ore body. Drill hole records show this ore body dips or plunges in a northeast direction, passes outside the end line of the Orphan claim, and merges with ore in the annular ring structure of the diatreme. Therefore, it is presumed this is the feeder source or passageway for ore solutions from depth.

Figure 18 is a photograph of lower trueline terminal.

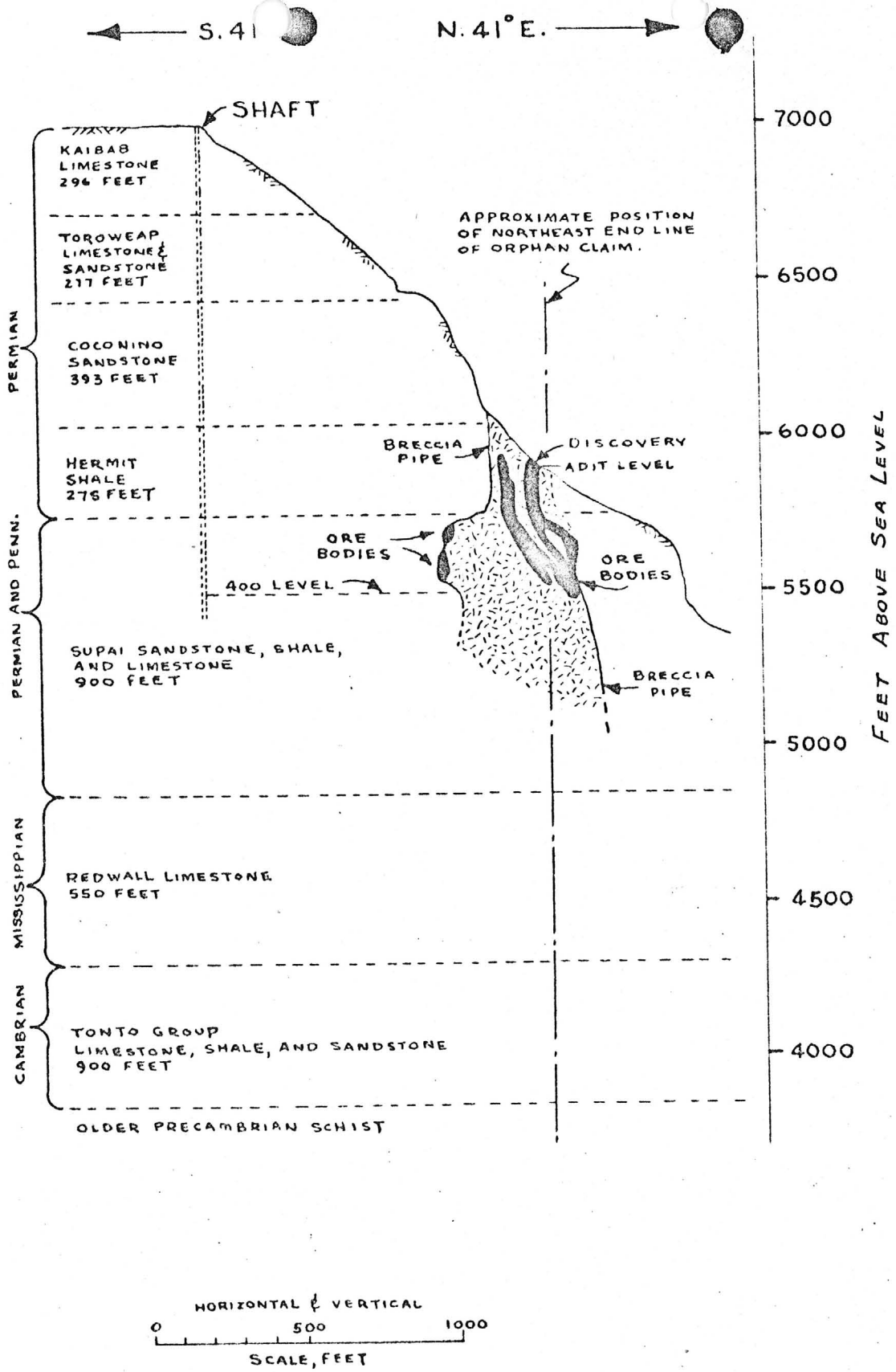

Figure 3.- Longitudinal Section along Center Line of Orphan Claim, looking Northwest

04

75.8

Inspection Symbol 0003
DMS Code 4033-02-307-10740

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
HEALTH AND SAFETY ACTIVITY

Kerr-McGee
Grand Canyon
Project
Arizona

P. L. 87-300

HEALTH AND SAFETY INSPECTION REPORT
ORPHAN MINE (URANIUM)
WESTERN EQUITIES, INC.
GRAND CANYON, COCONINO COUNTY, ARIZONA

August 28-29, 1962

By

L. G. Anderson and Paul P. Schapiro
Mining Health and Safety Engineers

Originating Office - Bureau of Mines
[illegible] Federal Building, Phoenix 25, Arizona
F. A. Morgan, Subdistrict Supervisor

(Revised)
April 1955)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

REFERENCE SLIP

Route to:	Name	Room
1.	J. Howard Bird, District Supervisor	
2.	Health and Safety, District H	
3.		
4.		
5.		

For:

..... Action	..... Record of .....
..... Approval	..... Referring to .....
..... Comment	..... Reply for signature of .....
..... Conference	..... Rewriting
..... Consideration	..... See or call me
..... Filing	..... Signature
..... Initials	..... Suggestions
..... Instructions	..... Surname
..... Investigation	..... Your information
..... Mailing	
..... Note and return	
..... Previous correspondence	
..... Recommendation	

Remarks:

Re: Health and Safety Inspection Report on the Orphan Mine, Grand Canyon, Coconino County, Ariz. dated August 28-29, 1962 the IMR Code is listed as 40933-02-009-10946. It should be 40933-02-003-10946.

Carl L. Bieniewski, Acting Project Coordinator
From (Name)

Division of Mineral Resources Date 10-18-62
Division—Office—Address

Ext: Room:

U. S. GOVERNMENT PRINTING OFFICE : 1957—O-416832

This report is
suant to provi
1961, authoriz
covering the c
and other heal
mines. The Se
Bureau of Mine

The inspection
tion of all co
recommend meas

The Orphan mine
on patented lan
Park, 2-1/2 mil
County, Arizona

The mine was ow
ated under an a
Service, U.S. D
office address
officials at th
and Jack Marzo,
part of the inspection.

There were 26 men on the pay roll, 20 underground and 6 on the surface. The mine was operated 2 shifts a day, 6 days a week.

The ore body contained uranium and copper values and occurred as a diatreme-pipe cutting through the Grand Canyon sediments.

Inspection Symbol O
DMR Code 4093-02-009-10946

HEALTH AND SAFETY INSPECTION REPORT
ORPHAN MINE (URANIUM)
WESTERN EQUITIES, INC.
GRAND CANYON, COCONINO COUNTY, ARIZONA

August 28-29, 1962

By

L. C. Anderson and Paul P. Schapiro
Mining Health and Safety Engineers

INTRODUCTION

This report is based on a health and safety inspection made pursuant to provisions of Public Law 87-300, effective September 26, 1961, authorizing the Secretary of the Interior to conduct a study covering the causes and prevention of injuries, health hazards, and other health and safety conditions in metal and nonmetallic mines. The Secretary of the Interior assigned this study to the Bureau of Mines.

The inspection and this report also are intended to call the attention of all concerned to the hazards observed at the mine and to recommend means of correcting those hazards.

GENERAL INFORMATION

The Orphan mine is located on the south rim of the Grand Canyon, on patented land within the boundaries of Grand Canyon National Park, 2-1/2 miles west of the village of Grand Canyon, Coconino County, Arizona.

The mine was owned by Western Equities, Inc., and was being operated under an agreement between that company and the National Park Service, U.S. Department of the Interior. The company's post-office address was P.O. Box 95, Grand Canyon, Arizona. Operating officials at the mine were Maurice Castagne, general superintendent, and Jack Marzo, mine foreman, both of whom participated in all or part of the inspection.

There were 26 men on the pay roll, 20 underground and 6 on the surface. The mine was operated 2 shifts a day, 6 days a week.

The ore body contained uranium and copper values and occurred as a diatreme-pipe cutting through the Grand Canyon sediments.

The mine was opened by a vertical shaft, 1,500 feet deep, on the rim of the canyon and by an adit into the canyon wall. Access to the portal of the adit from the canyon rim was by means of an 1,800-foot aerial tramway. Two distinct mining methods were employed. Depending on the location, either a room-and-pillar method, or open stoping was used. The uranium-copper ore was transported 95 miles by autotruck to a mill at Tuba City, Arizona. Waste was hauled by autotrucks to a designated area outside the boundaries of the park.

The mine was in the process of reopening after a shutdown of several months for major repairs to the headframe and ore bins.

SURFACE

The major surface facilities were housed in several closely grouped insulated sheet-metal covered wood-frame buildings located within 60 feet of the shaft.

Equipment in the shops was maintained in good working condition, but spare oxygen and acetylene cylinders were standing unsecured. The bench mounted grinding wheels were properly guarded. An employee, observed sharpening bits on the 1,500 level, was not using any eye-protective equipment. All saws in the timber-framing shed were equipped with guards, except two table saws. Timber was neatly stacked about 150 feet from the shaft. Moving machine parts were adequately guarded, except the flex coupling on the small circulating pump in the compressor house, the V-belt drives on the crusher, and the pulverizer in the bucking room.

The compressor plant consisted of three semiportable electrically operated compressors, with a combined capacity of 3,000 cubic feet of air a minute. All compressors were equipped with safety valves, gages, and drain valves, and the air intakes were located outside the building. Good housekeeping was practiced in and around the surface plant.

FIRE HAZARDS AND FIRE-FIGHTING EQUIPMENT

Most of the principal buildings were of fire-resistive construction; however, their proximity to each other and the presence of flammable materials, presented a fire hazard.

Oil was stored 200 feet south of the shaft in a wooden dirt floored open-front shed, located between two frame buildings, in one of which were stored the electric detonators. Fire extinguishers were not provided, the area was not posted against open flame and smoking, and drip pans were not provided in the oil shed. Gasoline was stored in an underground 1,100-gallon tank equipped with a metered

pump. The pump was kept locked, but was not posted against smoking. Smoking was permitted underground, except on the shaft stations and the cage. "No Smoking" signs were not posted on the shaft stations. Smoking was prohibited in the timber-framing shed, and the area was posted.

A trailer mounted 300-gallon-capacity pumper-tank equipped with a nozzle and 100 feet of fire hose was kept on the property. The National Park Service fire-fighting facilities were stationed 2-1/2 miles away.

Dry-chemical type and carbon dioxide fire extinguishers were installed at locations underground and on the surface; a carbon tetrachloride fire extinguisher was installed on the 1,500 shaft station. Fire extinguishers were not regularly inspected.

Surface employees were instructed in the procedures to follow in the event of a fire on the surface. None of the underground employees had received training in the use and care of mine-rescue apparatus, or procedures to follow in the event of an underground fire. A system to warn men and clear the mine in the event of an underground fire was not provided. The nearest available mine-rescue equipment was located at the U.S. Bureau of Mines safety station in Phoenix, Arizona, a distance of 313 miles from the mine. Self-rescuers were not provided for men working underground. Practice fire drills were not conducted for underground employees, nor were fire doors or refuge chambers provided.

Oxyacetylene cutting and welding equipment was being used on the 1,500 shaft level station in construction work on a new ore-train-dumping ramp and skip pocket. The floor in this area was constructed of dry planks. The underground transformer station, properly posted, was located across the drift from the 1,500 shaft station. Two haulage-locomotive-battery-charging stations were located at the untimbered end of the drift, about 50 feet from the transformer station. The entire area was dry. It was stated that the transformer station and the locomotive-battery-charging stations were to be relocated. Suitable type fire extinguishers were not provided.

STORAGE AND USE OF EXPLOSIVES

Blasting was done with 40 percent special gelatin, fired electrically.

The surface explosives-storage magazine, located 9 miles from the mine, was properly constructed and posted. No explosives were being stored at the time of this inspection.

The surface detonator-storage magazine, a wood-frame building covered with asphalt roofing material, was located close to the oil-storage building. The building was not posted. At the time of this inspection, the magazine contained 2,750 electric detonators stored on wooden racks and a number of automobile tires. Some empty detonator boxes were left on the floor.

All blasting was done electrically, using 220 volts, alternating current. The blasting box was located on the 1,500 haulage level at the pump station, more than 250 feet from the nearest working area. Well-installed, separate blasting lines for each working area were marked and were disconnected from the blasting box when not in use. There were no provisions for shunting the lines at the blasting box when the lines were disconnected. The only key to the blasting box was kept by the shift boss, who fired all blasts, after checking the men out of the area.

Detonators were stored on shelves in a posted wooden box-type magazine, located on the 1,500 haulage drift and 6 feet from the haulage track.

The underground explosives-storage magazine was located on the 1,500 level in a dead-end drift a safe distance from the haulage tracks. The magazine was clean, dry, and posted, and it contained 40 boxes of 40-percent-special-gelatin type explosives.

Explosives and detonators were delivered separately to the working places by the nipper. Primers were prepared at the working faces immediately before use. Wooden tamping sticks were used. Unused explosives and detonators were returned to their respective storage magazines. Blasting was done at the end of the shift. Misfired holes were either washed out with a water hose or reblasted under the direction of the foreman. A 30-minute waiting period was required before returning to a missed hole.

SHAFTS AND HOISTING, OTHER TRAVELWAYS

The mine was originally opened by an adit at the 1,250 level on the south wall of the Grand Canyon of the Colorado, and ore, men, and supplies were transported to and from the mine by means of an aerial two-bucket tram from the rim of the canyon to the adit portal ore bins. The buckets had an 800-pound capacity for ore, and the tramway was 1,800 feet long. At the time of this inspection, the tramway was used only for inspection of the ventilation fan in the adit and as an emergency escape way. The tramway equipment was inspected twice a week. Brakes were operated by solenoid, and handrails were installed on landing platforms.

The main shaft was equipped with an electrically operated gear-driven double-drum hoist operated in balance and equipped with

/erspeed and overwind devices. Each drum was separately equipped with hand brake, clutch, and indicator. Drums were 5 feet in diameter, and 31 wraps of the 1-inch cable remained on each drum when the cables were fully extended. Hoisting equipment was inspected at the beginning of each shift by the hoisting engineer. Safety dogs were inspected once a month. Critical parts on the hoist were inspected weekly and serviced by an experienced mechanic, and a record of these inspections was kept. All hoistmen received annual physical examinations. The hoisting cables were new and were inspected weekly. The sheave diameters were 60 inches, and weekly inspections were made of the sheave wheels, records of inspections being kept.

The headframe was of steel construction, 70 feet high, and was equipped with a steel ladderway, on one leg of the angle braces from the base to the sheave-wheel platform. Neither the ladder nor the sheave-wheel platform was equipped with handrails. The ore bins were in the process of being constructed, and ore from the 40-cubic-foot-capacity skips was to be automatically dumped into the bins.

The service cages were properly secured under the ore skips and were provided with steel bonnets and steel doors that were closed before the cage was moved. The hoisting cables were properly attached to the skips and service cages with thimbles of adequate size and cable clamps, and there was a second connection on each. Only eight men were allowed to ride the cage at one time. Hoisting speed was 827 feet a minute.

There were audible- and visual-signal systems between the shaft stations and the hoist house, and the signal system was operated on 110 volts, alternating current. Telephones provided at shaft stations were used to call cages. The official state signal code was posted in the hoist house and at shaft stations. Men were not allowed to ride on the cage while hoisting or lowering material.

The hoisting shaft was 1,590 feet deep, and the main haulage level and skip-loading facilities were on the 1,500-foot level. The three-compartment shaft was supported with a concrete collar and with steel sets with wooden lagging, which had been treated with a fire-resistive material. The shaft and the areas around the shaft, were dry. The two hoisting compartments were each 5 feet square, and the manway-and-service-line compartment was 2-1/2 by 5 feet in cross section. The ladders and landing platforms were of steel construction. Ladders were installed at an angle with steel-grate landings at 18-foot intervals.

Steel gates provided at the shaft stations were kept closed while not in use. The backside of the shaft, toward the cliff, was not fenced, and it presented a hazard.

n emergency escape way was provided through the 1,250-foot-level adit, which was connected to the 1,500 haulage level and other sublevels above the 1,500 level by ladderways through connecting stopes and raises. Signs designating the emergency escape ways were posted, and, reportedly, all underground employees were instructed as regards their locations.

An underground hoistroom, located in a crosscut on the 1,500-foot level close to the underground machine shop, was provided with an electrically operated 4-foot diameter single drum hoist. The hoisting cable was seven-eighths of an inch in diameter and was properly fastened to the hoist drum and supply skip. The hoist was provided with an indicator and a substantial hand brake, and audible- and visual-signal systems operated on 110 volts, alternating current. The official state signal code was posted in the hoist house. The hoist was used to hoist men and supplies through an angle chute to the sublevels and the adit level, above the 1,500 level. This section of the mine was not being worked, and the hoist was not in operation at the time of this inspection.

A small tugger hoist operated by air and located near the end of the 1,500 level haulage drift, by the lunchroom, was used to hoist men and supplies to three sublevels being developed above the 1,500 haulage level. The three sublevels were designated as the 245 level, the 260-J drift, and the 320 crosscut. This was the only section of the mine being operated at the time of this inspection, and these levels were connected to the worked-out areas of the mine by stopes, raises, and other travelways. The hoist was provided with a two-man-capacity cage operated in a vertical raise. The official state signal code was posted at the hoist, and a signal bell, activated by pulling a cord, was used to direct all movements of the cage. The cage and level landings were provided with steel gate bars, which were kept closed when the cage and level landings were not in use.

LOADING, HAULING, AND DRILLING

Ore and waste were loaded into mine cars on the haulage level through ore chutes or with pneumatic mucking machines. Muck in two stopes and sublevels was loaded into chutes with electrically operated slushers; and, on one sublevel, into 1-ton hand-trammed cars with a pneumatic mucking machine. Battery-powered locomotives were used for main-line tramming. Muck piles were wet down with water before mucking operations were started. The haulage tracks were well-maintained, and shelter holes were provided. Headlights and brakes were provided on the haulage locomotives, and trip lights were used. Regular tramming operations had been suspended since the collapse of the headframe and ore bin and, at the time of this inspection, were not in operation.

Jackleg drills were used for drilling blastholes. The number of holes and drill pattern were governed by local conditions and left to the individual driller's judgment.

GROUND CONTROL

The host rock consisted of a diatreme-pipe intrusion in the Grand Canyon sedimentary formations, which was quite dry and stood well when exposed to the air.

Timbers and expansion shell rock bolts were used for artificial support where needed, and some stopes were backfilled with waste. Loose rock was scaled down as soon as detected, and loose, unsupported rock was not observed during this inspection. Scaling bars were available in all working areas.

VENTILATION

The electrically operated ventilation fan located in the portal of the adit on the 1,250 level was operated exhausting and, at the time of this inspection, was causing 33,000 cubic feet of fresh air a minute to enter the mine through the main hoisting shaft. The fresh air was coursed from the shaft through the 1,500 haulage level and through raises and stopes to the working areas. The hoisting shaft and 1,500 level were in barren material, and the air in this area was not contaminated.

Compressed air and blower fans with 12-inch metal tubing were used to augment ventilation in the three sublevels being developed at the time of this inspection. The discharge ends of the vent tubing in each of the sublevels was more than 60 feet from the face areas, and air movements could not be detected. It was stated that development of the aforementioned three sublevels was being expedited to completion at this time. The three levels, when completed, will be interconnected to the 1,500 level through a common raise, to augment ventilation.

DUST

The mine was dry in some, and wet in other areas. Water lines on the 1,500 haulage level were equipped with valves and hose connections, and the haulageway was wet down with a water hose. Water was used during all drilling operations, and muck piles were wet down before mucking operations were started. It was stated that the dust engineer from the state department of mines made periodic tests for air-borne dust.

RADIATION

Of the types of radiation found in uranium mines, only alpha radiation from air-borne radon-daughter products and gamma radiation,

are presently of concern as potential health hazards. Measurements to indicate personnel exposure to these were made in various parts of the mine.

Gamma radiation was measured using a specially calibrated Geiger counter. Results are given in Table 1. National Bureau of Standards Handbook 59 lists five roentgens a year of whole-body gamma radiation as the maximum average cumulative dose. To exceed this the dose rate during a 48-hour week must exceed 2.0 milliroentgens an hour. The highest of eight dose rates measured was 3.0 milliroentgens an hour. It was stated that men working in areas containing high-grade ore were rotated each week to low-grade or barren areas; therefore, the dose rate of 2.0 milliroentgens an hour was not exceeded.

The concentration of radon-daughter products in the mine atmosphere is reported as a multiple of a working level (W.L.). One working level, 1.3×10^5 million electron-volts of potential alpha energy per liter of air, is considered to be the maximum concentration to which a man can be safely exposed throughout his working lifetime. U.S. Public Health Service Publication No. 494 describes the sampling method, which consists of filtering the daughters from a known volume of air and measuring the alpha activity on the filter.

Excessive concentrations of radon daughters indicate a need for more ventilation or more control of the radon entering the ventilating air, or both. Radon frequently can be controlled by sealing off abandoned stopes through or by which intake air is coursed.

Increasing the flow of air to the working place is the most effective means of reducing high radon-daughter concentrations to a safe level. The volume of air required to reduce a specific concentration to a safe level can be calculated from the equation

$$V_2 = V_1 (W.L.)^{0.56},$$

where V_2 is the required volume of air in c.f.m.,

V_1 is the existing ventilation, c.f.m., at time of sampling, and

W.L. is the measured multiple of a working level.

The required volume of air, V_2, will be higher if the incoming air is contaminated.

Radon-daughter concentrations measured and other data are listed in Table 2. Table 3 lists the projected average daily exposure levels experienced by the miners at the time of inspection.

Table 1.--Gamma readings

Location	Milliroentgens/hour
260-J Drift, at face	3.0
260-J Drift, bottom raise	---
245 Station	0.3
260 Crosscut, face	1.9
260 Crosscut, slusher	0.3
320 Crosscut, slusher	0.6
320 Crosscut, face	0.6
Lunchroom	0.3
1,250 Adit, hoist	1.0

Table 2.--Radon-daughter concentration and ventilation data

Location, Time, Number of Men, Operation	Radon-daughter Concentration[1]	V_1 c.f.m.[2]	V_2 c.f.m.[3]
260-J Drift, at face, 8:30 a.m., two men	14.3 X W.L.	Convection Currents	---
260-J Drift, at slusher, 8:42 a.m., one man	17.7 X W.L.	Convection Currents	---
245 Level station, 8:55 a.m.	19.5 X W.L.	Convection Currents	---
260 Crosscut, face, 9:13 a.m., two men	21.0 X W.L.	700 c.f.m.	---
260 Crosscut, slusher, 9:20 a.m., one man	17.0 X W.L.	2,000 c.f.m.	---
320 Crosscut, slusher, 9:26 a.m., one man	25.5 X W.L.	Convection Currents	---
320 Crosscut, face, 9:34 a.m., two men	12.0 X W.L.	Air-line Ventilation	---
1,500 Level, lunchroom[4] 9:45 a.m., one man	1.9 X W.L.	No Air Movement	---
1,250 Mine-air exhaust adit, 11:09 a.m., no men	13.0 X W.L.	33,000	---

[1] An arithmetical average of these samples can not be used to determine an average exposure for the men.

[2] V_1 could not be measured at any of the locations. At times compressed air was used to augment air flow forced through 12-inch vent tubing to face areas by means of auxiliary fans located in old stope areas.

[3] V_2 could not be calculated by formula, as the air in the auxiliary-fan areas was contaminated with radon daughters while being coursed through old workings. It was stated that the sublevel crosscuts and working areas would be ventilated with fresh, uncontaminated air from the 1,500 level, as soon as the crosscuts were holed through to a raise from the 1,500 level, in the hanging wall at the extremities of the ore body.

4/ Ventilation in the lunchroom on the 1,500 level was not sufficient to reduce the radon-daughter concentration to one working level or less.

Table 3.--Estimated average full-shift exposure to radon daughters

No. Men	Location Operation	Estimated average full-shift exposure to radon daughters 1/
2	260-J Drift, at face	10.5 X W.L.
1	260-J Drift, at slusher	13.0 X W.L.
2	260 Crosscut, face	15.0 X W.L.
1	260 Crosscut, slusher	16.0 X W.L.
1	320 Crosscut, slusher	15.0 X W.L.
2	320 Crosscut, face	9.0 X W.L.
5	Haulage level	0.0 X W.L.
6	Supervision and maintenance	3.0 X W.L.

1/ These average levels are estimated from information gained in questioning the miners as to where their time is spent and by weighting the radon-daughter concentrations in these various places in proportion to the time spent in them. Main areas of exposure are, generally, included; such as, working place, lunch, travel to and from stope, securing supplies, etc.

QUALITY OF AIR

Direct reading field test instruments were used to measure CO (carbon monoxide) and NO_2 (nitrogen dioxide) concentrations in the mine air during this inspection.

In addition, a mine-air sample collected in a vacuum bottle during the inspection was analyzed in the Bureau of Mines laboratory, Denver, Colorado.

Field-test results are shown in Table 4. Laboratory analytical results are shown in Table 5.

Table 4.--Direct field tests

Place, Time	Percent CO	PPM* NO_2	Temperature °F W.B.†	Temperature °F D.B.#	Relative Humidity	Velocity Air
260-J Drift, 8:30 a.m.	Trace	0.0	55	57	89%	Convection Current
245 level station, 8:55 a.m.	Trace	0.0	53	54	88%	Convection Current
260 Crosscut, 9:15 a.m.	.002	0.0	58	60	90%	Convection Current
320 Crosscut, 9:30 a.m.	Trace	0.0	52	53	94%	Convection Current
Lunchroom, 9:50 a.m.	Trace	0.0	60	67	68%	0
1,250 Adit, 11:49 a.m.	Trace	0.0	52	53	94%	33,000

*Parts per million
†Degrees Fahrenheit Wet Bulb
#Degrees Fahrenheit Dry Bulb

Table 5.--Laboratory analytical results

Sample Number	Place, Time	PERCENT O_2	PERCENT CO_2	PERCENT CO	PERCENT CH_4	PERCENT N_2	PPM* NO
Y-3800	1,250 level main exhaust, 11:10 a.m.	20.82	0.05	0.000	0.00	79.13	----

*Parts per million

Air for ventilation is considered to be of satisfactory quality when it contains at least 19.5 percent O_2 (oxygen), not more than 0.5 percent CO_2 (carbon dioxide), and no harmful quantities of dust or noxious gases. The threshold limit value for CO is 0.01 percent and for NO_2 is 5 parts per million.

The results listed in Table 5 indicate that the air was of satisfactory quality at the time and place shown.

ELECTRICITY AND ILLUMINATION

Electric power was received at 2,300 volts and stepped down to 440, 220, and 110 volts, alternating current, for general mine use. Transformers were cooled with nonflammable oil and placed within a fenced enclosure. The transformer area was not posted.

Electric wiring was well-installed. Electric power, at 2,300 volts, was taken underground through a separate shaft compartment by means of a well-supported armored cable. All electrical equipment was properly grounded, except for the bench mounted and hand-held tools in the shops. Fixed illumination was provided at shaft stations, shops, lunchroom, along the 1,500 track haulage, and at slusher installations. Electric cap lamps were used for portable illumination.

GENERAL HEALTH AND SAFETY

The union safety committee was the functioning safety organization at the mine and handled all routine safety work, inspections, and monthly safety meetings. Cooperation between this committee and management was very good. Copies of safety rules were posted on the bulletin boards.

In the past 2 years, 28 men had been trained in first-aid methods, and the plans were for another class in the immediate future. First-aid supplies, including basket-type stretchers, were maintained both on the surface and underground. An ambulance was kept on the property, and doctors and a hospital were available at Grand Canyon village, 2-1/2 miles away. Physical examinations of employees were not required, except for the previously mentioned annual physical examinations for hoistmen.

Safety-toed shoes and hard hats were required of all personnel, and miners were required to wear safety glasses while operating slushers.

The changeroom was kept clean and was equipped with hot and cold showers, wash basins, and toilets. Baskets and hangers were provided for clothing storage. Water for drinking and sanitary use was hauled by tank truck a distance of 65 miles from Williams, Arizona, at a cost of 1.5 cents per gallon. Mine water was reclaimed for mining purposes.

Records of the details of individual accidents were kept by the company, but severity and frequency rates were not calculated.

A brass-tag-check-out system was in use.

RECOMMENDATIONS

Surface

Oxygen and acetylene cylinders should always be secured against accidental upset.

Eye protection, either safety glasses or face shields, should be supplied for all mechanical grinding operations and their use required at all times.

Adequate guards should be installed on the blades of the two table saws in the timber-framing shed.

Adequate guards should be installed on the flex coupling on the circulating pump in the compressor room and on the V-belt drives on the crusher and the pulverizer in the bucking room.

Fire Hazards and Fire-Fighting Equipment

Lubricating oil should be stored in a fire-resistive structure, located as far from other structures as possible.

A fire extinguisher appropriate for oil fires should be installed on the outside of the lube-oil-storage shed.

Drip pans should be provided in the lube-oil-storage shed.

"No Smoking" signs should be posted at each the lube-oil-storage shed, the gasoline pump, and the shaft collar.

The carbon tetrachloride fire extinguisher should be removed from the 1,500 shaft station, and carbon tetrachloride extinguishers should not be used underground or in confined places.

Fire extinguishers should be inspected periodically (at least annually), and records of these inspections should be kept.

A suitable number of qualified men should be trained in mine-rescue operational procedures.

A stench method of fire warning should be provided where compressed air is used.

Fire Hazards and Fire-Fighting Equipment (Cont'd)

A well-planned mine rescue and fire-fighting procedure should be adopted and all employees made thoroughly familiar with it.

Practice fire drills should be given once or twice a year and should include a requirement that all underground employees meet at designated places. The stench used as a warning agent should be blown out of the working places as quickly as possible after each practice use.

Self-rescuers should be provided for all underground employees, and employees should be instructed in their proper use and limitations.

Refuge chambers and fire doors should be constructed at strategic locations in the mine.

Before and after using welding and cutting equipment, all adjacent dry timber should be thoroughly wet down.

If cutting or welding equipment has been used on any work in or around the shaft or landings, all adjacent timber should be inspected thoroughly for fire.

"No Smoking" signs should be posted in the entire timbered area at the 1,500 level ore pocket dumping facilities and at the locomotive-battery-charging stations.

Fire extinguishers safe for use on electrical fires, should be provided at all electrical installations.

Storage and Use of Explosives

The detonator-storage magazine should be provided with suitable danger signs nearby, posted in such a manner that a bullet, passing through the face of any sign, will not strike the magazine.

The interior of the detonator magazine should be kept clean and dry at all times, and materials other than detonators should not be stored in the magazine (this does not prevent the storage of safety fuse or detonating fuse in any detonator or explosives magazine).

The ends of electric blasting lines should be kept shunted at all times while not in use.

Storage and Use of Explosives (Cont'd)

The underground detonator-storage magazine should be relocated, to a point which is at least 25 feet from the main haulageway.

Shafts and Hoisting, Other Travelways

Handrails should be provided on the headframe ladderway, and the sheave-wheel platform should be equipped with handrail, middle rail, and toeboard.

The backside of the shaft, toward the cliff, should be fenced to prevent unauthorized persons from entering that area.

Ventilation

Vent tubing should be carried to within 30 feet of the face area at all times while men are working.

Radiation

All workings should be sealed off, to prevent contamination of air circulated to working areas.

The volume of fresh, uncontaminated air entering all working areas, should be sufficient to reduce the radon-daughter concentration to one working level, or less.

Ventilation in the lunchroom, on the 1,900 level, should be increased, to dilute the radon-daughter concentration to one working level, or lower.

Electricity and Illumination

"DANGER-HIGH VOLTAGE" signs should be placed on all transformer enclosures.

All electrically powered hand and bench tools should be properly grounded.

ACKNOWLEDGMENT

The cooperation of mine officials and employees during this inspection is gratefully acknowledged.

L. F. Anderson

L. G. Anderson
Mining Engineer and Safety Engineer

Paul P. Schapiro

Paul P. Schapiro
Mining Health and Safety Engineer

Approved:

[illegible]

463.2/19033

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
REGION III

3928

DIVISION OF MINERAL RESOURCES
TUCSON FIELD OFFICE

BOX ~~4097, UNIVERSITY STATION~~
TUCSON, ARIZONA

June 14, 1963

Memorandum

To: M. H. Salsbury, Project Coordinator, Tucson

From: F. E. Williams, Project Leader, Tucson

Subject: Orphan Uranium Mine, Sec. 14, T. 31 N., R. 2 E., Grand Canyon, Coconino County, Arizona

During the recent field trip to accompany Mr. Hira Sthapit, Nepal Bureau of Mines, the Orphan mine, Western Equities, Inc., on the rim of the Grand Canyon was visited. Data herein brings up to date the information on file.

Main ore minerals include uranophane, uraninite, pitchblende, and tourbanite. Copper minerals present are chalcocite and slight chalcopyrite.

The past 30,000 tons of ore sold to the Tuba City mill contained 0.53 percent U_3O_8, 1.25 percent Cu, and 2 oz. of Ag per ton.

Current work is being done on the 400 foot level, using shrinkage stopes to extract the ore. The deposit occurs in a pipe-like body of known dimensions within the Grand Canyon geologic column. Mr. Maurice Castagne, Mine Manager, quoted present blocked out ore reserves at 180,000 tons.

Some cost figures and other data given by Mr. Castagne follow:

Employment	25 underground men per shift
Shaft cost (total)	$242/foot
Main drift cost (total	56/foot
Present production	200 TPD
Gross ore value	50/ton
Direct Mining costs	5.98/ton
Total mining costs	11.77/ton
Royalty and Haulage	8.00/ton
Net Profit for April 1963	$165,746

Frank E. Williams
Frank E. Williams

cc - D.O.Kennedy
Ariz. Bureau of Mines
File 463.2/19033
H. R. Sthapit
DF

September 28, 1961

Mr. Eldred Wilson
Arizona Bureau of Mines
University of Arizona
Tucson, Ariz.

Dear Eldred:

Very sorry to hear of your long siege of illness and hope you are back on your feet again. Mr. Geehan was interested in the Kodachromes and asked me to convey his thanks to you for them.

Apparently our report was O.K. and was accepted. I had to return and check their survey about one month later. It turned out that the mineral surveyor had made an error in location of the claim. However, this had little or no effect on location of the outcrop within claim boundaries. Also the mine surveys were in error in most places and corrections were made of this work.

I promised to return the negatives you furnished for the report. I'm not able to do this because all negatives for Bureau reports are indexed and put on file.

I hope to be seeing you in the near future.

Sincerely yours,

W. E. Young

July 26, 1961

Memorandum

To: Frank Barry, Solicitor, U. S. Department of the Interior

Through: Marling J. Ankeny, Director
Bureau of Mines

From: Acting Regional Director, Region III

Subject: Orphan Mine, Coconino County, Arizona

We enclose original and four copies of report on final survey of the Orphan claim, Coconino County, Ariz. The report was made by Mining Engineer W. E. Young who checked the survey and testified to its propriety and accuracy.

It appears that the original survey made in 1905 by the U. S. Deputy Mineral Surveyor was incorrect both as to distance and direction from the section corner from which the survey was started. According to the mineral-survey notes, the patent corner No. 1 would have been some 140 feet southeast of its actual position on the ground as indicated by its witness tree, which was found. None of the corner stones was found, but well-preserved witness trees for corners 1, 2, and 3 still exist and from these a nearly accurate picture of the mine workings in relation to on-the-ground claim boundaries was made.

Mr. Young states that mine workings as mapped through former surveys made by the company are about 1° 15' off their true bearing as determined by the new survey and tells how an adjustment can be made on the maps with the minimum amount of additional surveying.

This would have to be done if the precise relationship of mine workings and ore structure to boundary lines must be established.

T. A. Christensen

Attachments

REPORT OF REVIEW OF ORPHAN CLAIM SURVEY
COCONINO COUNTY, ARIZ.

Questions concerning the reliability of the initial surveys of the Orphan Claim and Mine, Coconino County, Arizona, called for a new survey to be made by engineers of Western Gold and Uranium, Inc. Before this review, an earlier examination made in May 1961 disclosed that the mine surveys were unreliable, incomplete, and fragmentary. Further, this examination also suggested what appeared to be a disagreement between the patent claim survey and recent work. These disclosures resulted in two recommendations: (1) That a closed balanced traverse be made from the known section corner to the corners of the Orphan Claim; and (2) that a closed balanced traverse be made from the surface through the mine and back to the surface at the northeast endline. The purpose of this resurvey was to locate properly the mine workings and geologic features with respect to the claim boundaries.

Company engineers, following these recommendations, confirmed the error in the patent surveyor's location of the claim and in the location of mine workings within the claim boundaries -- errors resulting from the initial patent survey and previous company surveys.

Review of the corrected survey -- detailed below -- consisted of a recalculation of the mine survey from company field notes and a field spotcheck of the transit work. The field spotcheck, performed with a transit and steel tape, was made at five separate locations along the course of the traverse. As a result of these standard checking procedures, the recent survey work of Western Gold and Uranium, Inc., may be accepted as free from error and correct within the limits of accuracy required for this type of work.

By observing Polaris at eastern elongation on May 23, 1961, company engineers determined the azimuth of a line for starting their traverse from the known section corner to the Orphan Claim. Because of the close agreement of this

azimuth with that obtained by the Park Service engineers in their survey (fig. 1), no check was made of this work. Thus, agreement between these two independent surveys definitely proves the patent surveyor wrong in his location of the Orphan Claim. This disagreement is significantly underscored for it establishes two possible locations for the Orphan Claim. According to the field notes of John F. Hesse, U. S. Deputy Surveyor on Orphan Claim No. 2004, the claim would be moved approximately 140 feet S. 60° E. in direction from the position it actually occupies on the ground and the Grand Canyon Inn Lodge would fall outside the claim boundaries. The uncontrovertible existing physical features designating the location of the claim on the ground are three blazed witness trees for three claim corners conforming to locations specified in Hesse's field notes, (witness tree for corner No. 4 cannot be found) the outcrop of the Orphan lode, and the location of adits and the discovery pit as shown on Hesse's plat of the Orphan claim (fig. 2). If the location on the ground as designated by the above-named physical features holds, the claim corners have the following coordinate positions:

Calculated from Witness Tree Locations	Cor. No. 1	2316.69N	658.58E
	Cor. No. 2	2019.41E	1179.17E
	Cor. No. 3	3144.63N	2156.51E
Calculated from other 3 corners	Cor. No. 4	3441.87N	1633.75E

Note: There are no corner monuments remaining on the ground.

From the above, Corner No. 1 of the Orphan Claim is N. 13° 57' E., 2400.6 feet from the section corner common to sections 15, 14, 22, and 23, T. 31 N., R. 2 E., Gila and Salt River meridian.

If the location as designated in the notes of patent survey No. 2004 holds, the claim corners have the following coordinate positions:

Cor. No. 1	2244.72N	777.22E
Cor. No. 2	1668.69N	945.11E
Cor. No. 3	2799.90N	1930.19E
Cor. No. 4	3375.93N	1762.29E

If the latter location is accepted, Corner No. 1 of the Orphan Claim is N. 17° 10' E., 2363.3 feet from the section corner common to sections 15, 14, 22, and 23, T. 31 N., R. 2 E., Gila and Salt River meridian.

Company engineers made a closed traverse relating the mine workings to claim boundaries as designated by witness trees. This traverse originated on the surface, carried an azimuth into the mine by plumbing the 1500-foot shaft to the 400-foot level, surveyed the main haulage level, plumbed the service raise to the 245-foot level, traversed to the Adit shaft, plumbed the Adit shaft to the Adit level, traversed the Adit level to the surface, and located claim corners on the northeast sideline of the claim.

A second Polaris shot was taken at eastern elongation to check the bearing at this position. This work revealed a departure of two minutes from true bearing, a departure well within the limits of accuracy for this type of work. A correction was made in bearing, and the traverse was continued back through the mine to the surface to close on its original starting points. The traverse closed within two minutes of bearing and within 0.12 feet in a north direction and 0.32 feet in an east direction. The work is within the required limits of accuracy, and was checked by recalculation of the traverse.

On figure 3, the positions of the claim corners are shown as located from witness trees over which is superimposed a full-sized claim located from Corner No. 1. The extended location presupposes a full-sized claim as granted by patent. Obviously this presupposition must be ruled out because if a corner location is run in from a witness tree in one instance, all corners should be located in a like manner. This inconsistency notably limits the claim length to 1490.4 feet, and changes the bearing of the side lines from N. 41° 03' E. to N. 43° 58.5' E. Also, witness-tree locations for claim corners on the south-

west endline slightly change the bearing and length of this line.

On figure 4 is shown the claim as located from witness trees. Superimposed is the position of the northeast endline of the claim as used in old mine surveys. Because none of the points for the old endline were in existence at the time of the survey, no check could be made of their location. However, two points in the mine on the old survey were included in the new traverse. The line formed by these two points shows essentially the same counterclockwise change in bearing and the same relative distance of shift. This is shown approximately on figure 5 with new coordinates superimposed on map of Adit Level with old coordinates. The error in bearing, approximately 01° 18', was made by company engineers in early mine surveys. Reorientation of mine workings to the correct survey will require remapping a section of each level. Each remapped section will need to be large enough to include a definite pattern of mine workings. The old level sheet can then be fitted over the similar newly mapped pattern. All workings can then be traced from the old sheet to their true location on maps with proper coordinates. Mine officials do not consider the shift sufficiently large to justify the necessary work.

The notes and records of the claim patent survey work and the record of section corner, common to sections 15, 14, 22 and 23 land survey location were obtained from the General Land Office, 1305 North Central Ave., Phoenix, Ariz.

The survey notes and calculations pertaining to the recently re-run survey of the Orphan Claim and Mine are in the office of the Western Gold and Uranium, Inc., Grand Canyon, Ariz. From these records, made available to the Government, a separate calculation of the surveys was made. These calculations are in our office, Building 20, Denver Federal Center, Denver 25, Colorado.

As a result of the examination, the accuracy and propriety of the last company surveys are confirmed and may be accepted.

The location of the outcrop of the Orphan lode is still within the boundary lines of the claim irrespective of which claim location is found to be correct.

May 26, 1961

Memorandum

To: A. S. Konselman, Acting Chief, Division of Mineral Resources

From: W. E. Young, Mining Engineer

Subject: Summary Report, Orphan Mine

The Orphan mining claim is a patented claim situated in sec. 14, T. 31 N., R. 2 E., Gila and Salt River base and meridian , in Grand Canyon National Park, Coconino County, Ariz. It is owned by Western Gold and Uranium, Inc.

Production from the claim was about 2,000 tons of uranium ore a month during 1955-1959 and about 7,000 tons a month in 1960, all of which was shipped to Rare Metals mill at Tuba City, Ariz. About 500,000 tons of ore containing 0.25 percent U_3O_8 remain in the mine as an inferred reserve.

The ore occurs at the periphery of a diatreme, or breccia pipe, which is roughly 400 feet in diameter and is known to extend for at least 800 feet below its outcrop. The structure plunges steeply to the northeast. A number of similar structures occur in the area, one known as the Copper Mountain deposit being on the opposite, or north, rim of the Grand Canyon.

The mine is worked through a vertical 3-compartment shaft 1,585 feet deep that has a 900 feet crosscut on the 1,500-foot level. Two raises connect the crosscut with working levels.

W. E. Young

W. E. Young

6-803
(January 1952)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

SUMMARY REPORT OF MINERALS EXAMINATION

State Arizona County Coconino Mineral Products U_3O_8

Name of property or deposit Orphan Claim

Date examined 5-17-61 Engineer W. E. Young Date of this report 5-24-61

Reason for examination Request for report on type of geological occurrence

Engineer accompanied by Eldred D. Wilson Address Tucson, Arizona

Extent of property 1 claim

Owner Western Gold & Uranium, Inc. Address St. George, Utah

Leased or optioned to None Address

Location of property (be specific) Sec. 14, T. 31 N., R. 2 E., Gila and Salt River B. & M. Coconino County, Arizona

Type of deposit and mineralogy (brief description) Diatreme or breccia pipe. Nearly vertical pipe with constricted neck. Ore occurs in annular rings on the periphery of the breccia pipe and in ore shoots within the main structure.

Known dimensions of the deposit Length 400' Width 400' Depth 800' +

Attitude of the deposit (strike, dip, etc.) The breccia pipe plunges steeply in a northeast direction.

Possible extensions; correlation of known showings Mine workings have been carried to a depth of 400 feet below the outcrop. Diamond drilling indicates mineralization extends plus 800 feet below outcrop.

Mine workings (brief description or attach map or sketch) (indicate whether accessable) 1,585 foot vertical shaft. 900 foot crosscut from shaft to breccia pipe. Mine workings on several levels.

(over)

Mining and milling equipment on property Hoist, headframe and modern underground mining equipment.

Past production (if any) Approximately 2,000 tons per mo. 1955-1959; 7,000 tons per month 1959-1960

Present rate of production (if any) 7,000 tons per month

Sampling (describe briefly, or attach sketch) None

Tentative Estimate of Reserves

(Subject to revision when assays are received or after engineering calculations)

Measurable tons Grade

Indicated tons Grade

Inferred 500,000 tons Uranium ore Grade 0.25

Mining method (actual or suggested) Long hole open stoping.

Milling or processing method (actual or suggested) Ore is shipped to Rare Metals Uranium mill at Tuba City, Arizona.

Processing tests suggested

Tentative conclusion and decision Operation likely to continue at present rate until 1966.

To be accompanied by brief letter giving examining engineer's general impression of the deposit, his impression of the owner, and any other confidential information he may care to submit. Refer to any known prior examinations and reports. May be executed in pencil. Should be mailed within 24 hours after examination is completed.

Send original and one copy to Washington Office.

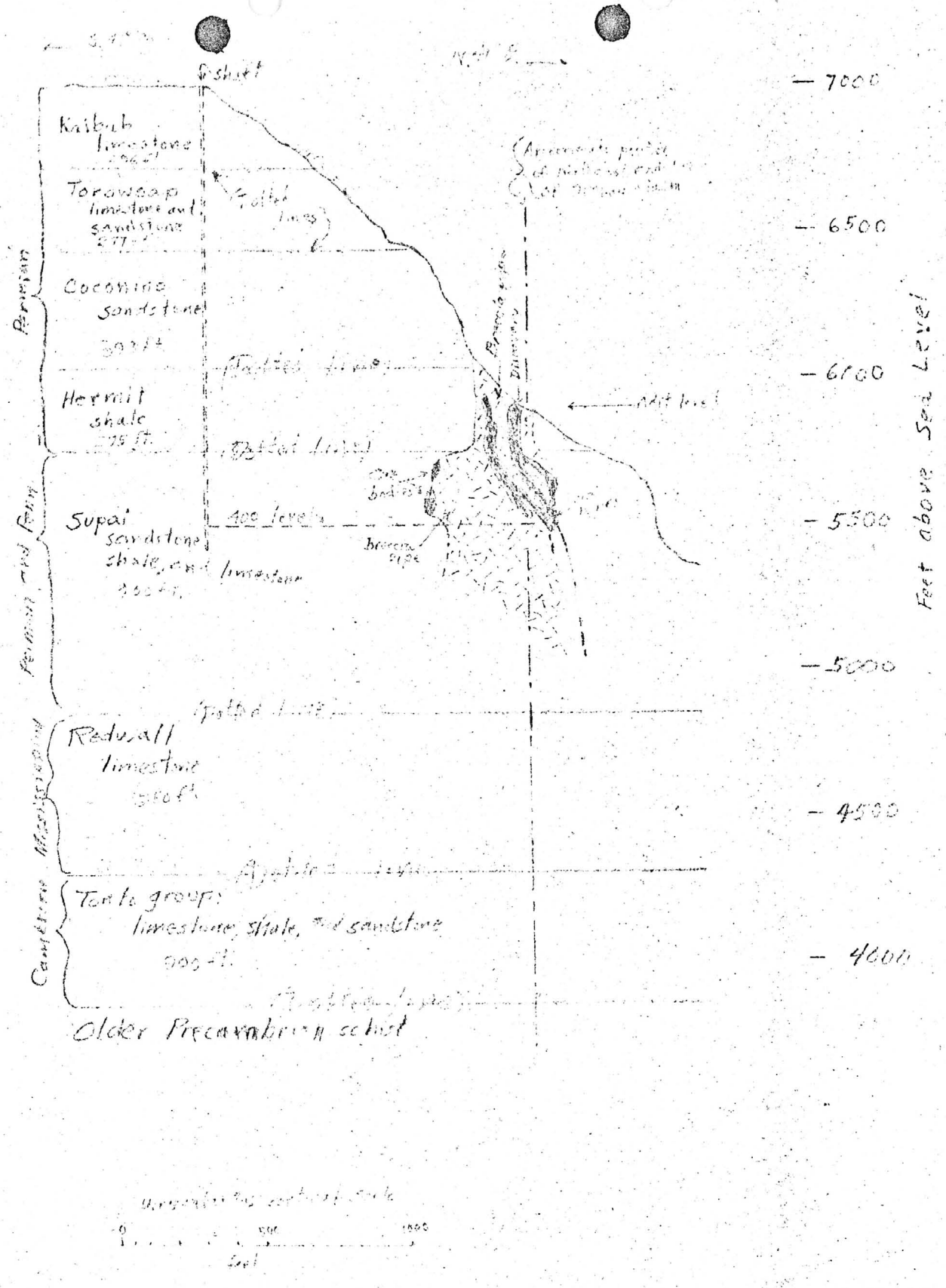

Figure 3. Geologic section along center line of Orphan claim, looking northeast.

EXIST. ROCKS

PROPOSED PIPE
(BELOW DRIFT - GRADE)

June 26, 1961

Mr. Max E. Kofford
Chief Geologist
Western Gold and Uranium, Inc.
Grand Canyon, Arizona

Dear Max:

Probably you have completed the survey of the Orphan claim by this time. In anticipation of the possibility that I may be contacted concerning this matter, I would like to hear of the status of this work. I will look forward with interest to hearing from you.

Very truly yours,

W. E. Young

cc: Bureau Agency
Reading file - W. Young
C. H. Johnson

May 29, 1961

Memorandum

To: Frank J. Barry, Solicitor, Office of the Solicitor, Department of the Interior, Washington

Through: Marling J. Ankeny
Director, Bureau of Mines

From: Regional Director, Region III

Subject: Orphan mine, Coconino County, Arizona

Your letter of May 25 crossed our report to you, dated May 26, in the mail. We believe our report covers nearly all the questions in your letter. Those we feel still need amplification are covered below:

Fact question No. 4 - "Location of the copper and other nonradioactive minerals in or outside the structure."

In the portion of the mineral deposit now exposed, copper and other nonradioactive minerals occur with the uranium minerals. There may have been mineral segregation to some degree at the surface near the discovery pit, but, if so, we are not aware of it. Geological reasoning based on other mineral deposits makes it seem quite likely that there will be zonal arrangement and segregation of minerals with depth.

Discovery question No. 1 - "Was the entire collapse structure or diatreme the 'discovery vein' of the original mine?" and Discovery question No. 2 - "If not, what was the 'discovery vein'?"

Field evidence offers no answer to these two questions. It seems probable that the annular ring structure was the discovery vein; however, it seems certain that at the time of location and at the time of patent not enough work had been done to disclose the circular nature of this zone of mineralization.

cc: Director Ankeny
Resources - W. Young
C. H. Johnson

UNITED STATES
DEPARTMENT OF THE INTERIOR

The work marked Tunnel No. 2 on the survey plat and on our figure 2 constitutes part of the pre-patent improvement. This adit started roughly parallel to the sidelines of the claim, which would seem to indicate that the locator believed this to be the direction of the mineralized structure; however, we have no proof that this was his belief. Actually, the mineralization extends the entire length of the working marked "Tunnel No. 2" and beyond. Incidentally, our draftsman inadvertently left the discovery shaft off figure No. 2. The discovery shaft is situated at the portal of tunnel No. 2.

Discovery question No. 3 - "Is there a discernible strike to the discovery vein?" and Discovery question No. 4 - "If so, what is that strike?"

If the annular ring is considered to be the discovery vein, it has a nearly circular strike and a constantly varying direction and angle of dip. If the diatreme "breccia pipe" is considered to be the discovery vein, the strike can best be defined as follows: By definition the strike is at right angles to the dip. As shown by the maps and sections included in our report, the dip is northeast. Therefore, the strike is northwest-southeast and is nearly at right angles to the sidelines of the Orphan claim.

We believe that the above information, coupled with that already in our May 26th report, provides all the available factual data that you requested. As mentioned in our report, the company has agreed to make an accurate survey of the claim, and we have agreed to return to the mine, check the survey and submit the modified set of maps to you. It seems probable that the modifications will in no way affect a policy decision unless the end line as now mapped is moved so far as to actually cut the diatreme. They will, of course, have a bearing on the ownership of certain ores depending on legal or other interpretation of the extra-lateral rights problem.

If we can be of further assistance, please advise.

/s/ Robert W. Geehan

Robert W. Geehan

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SOLICITOR
WASHINGTON 25, D. C.

IN REPLY REFER TO:

MAY 25 1961

Mr. Robert W. Geehan
Regional Director, Region III
Bureau of Mines
Department of the Interior
224 New Customhouse Building
Denver, Colorado

Dear Mr. Geehan:

I am writing to confirm our telephone conversation of May 12, 1961, concerning Orphan Mine and to state in more detail the type of information we want.

The ultimate fact we need to know is whether or not the discovery vein of the mine had or has a discernable strike, and, if so, the direction of that strike. In order to reach some conclusions concerning these ultimate questions, we need certain facts and would appreciate your opinion based on these facts.

Fact questions:

1. Size, shape and dimensions of the surface outcrop of the collapse structure or diatreme.

2. Exact location of the original adits and of additional tunneling constructed in connection with the present mine operation.

3. Size, shape and dimensions of the structure: a) on a horizontal cross section, and, b) on a cross section perpendicular to its vertical axis.

4. Location of the copper and other nonradioactive minerals in or outside the structure.

5. Location of the radioactive materials in the structure.

From these facts and whatever other facts you may find and deem pertinent, we should like to know your opinion concerning the following:

1. Was the entire collapse structure or diatreme the "discovery vein" of the original mine?

2. If not, what was the "discovery vein"?

3. Is there a discernible strike to the discovery vein?

4. If so, what is that strike?

If further questions arise in the course of your investigation, or if you should want any further clarification of these issues, please call us.

Sincerely yours,

Frank J. Barry

Frank J. Barry
Solicitor

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
REGION III

DIVISION OF MINERAL RESOURCES

BUILDING 20, FEDERAL CENTER
DENVER 25, COLORADO

May 26, 1961

Memorandum

To: A. S. Konselman, Acting Chief, Division of Mineral Resources

From: W. E. Young, Mining Engineer

Subject: Summary Report, Orphan Mine

The Orphan mining claim is a patented claim situated in sec. 14, T. 31 N., R. 2 E., Gila and Salt River base and meridian, in Grand Canyon National Park, Coconino County, Ariz. It is owned by Western Gold and Uranium, Inc.

Production from the claim was about 2,000 tons of uranium ore a month during 1955-1959 and about 7,000 tons a month in 1960, all of which was shipped to Rare Metals mill at Tuba City, Ariz. About 500,000 tons of ore containing 0.25 percent U_3O_8 remain in the mine as an inferred reserve.

The ore occurs at the periphery of a diatreme, or breccia pipe, which is roughly 400 feet in diameter and is known to extend for at least 800 feet below its outcrop. The structure plunges steeply to the northeast. A number of similar structures occur in the area, one known as the Copper Mountain deposit being on the opposite, or north, rim of the Grand Canyon.

The mine is worked through a vertical 3-compartment shaft 1,585 feet deep that has a 900 feet crosscut on the 1,500-foot level. Two raises connect the crosscut with working levels.

W. E. Young

W. E. Young

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

Date September 14, 1968

1. Mine: Orphan Lode
2. Location: Sec. 24 Twp. 30N Range 2E Nearest Town Williams Distance 62
   Direction South Nearest R.R. Santa Fe Distance 2
   Road Conditions Good
3. Mining District and County: Coconino
4. Former Name of Mine: Orphan
5. Owner: Cotter Corporation
   Address: Post Office Box 95 Grand Canyon, Arizona 86023
6. Operator: Maurice Castagne
   Address: Post Office Box 95 Grand Canyon, Arizona 86023
7. Principal Minerals: Uranium, Copper, Silver
8. Number of Claims: Lode 1 Patented yes Unpatented
   Placer Patented Unpatented
9. Type of Surrounding Terrain: South Rim of the Grand Canyon
10. Geology and Mineralization: The mineralized formation lies within a volcanic pipe conisiting of limestone, sandstone and shale beds in the Supai formation.

    Uraninite or pitchblende, Chalcocite and argentite occurs in massive formation in angular rings.
11. Dimension and Value of Ore Body:

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:

	No.	Feet	Condition
Shafts	2	1500 & 375	Good
Raises			
Tunnels			
Crosscuts			
Stopes			

14. Water Supply:

15. Brief History:

16. Remarks:

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

18. Signature: George E. Collins