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ORE DEPOSITS

Uranium ore deposits at the Orphan Lode occur in two distinct geologic environments - 1) within the pipe fill, and 2) associated with the peripheral shear zone surrounding the pipe. The latter has been termed the annular ring by company geologists and engineers.

Core Ore

Principal orebodies within the pipe include the A, B, and G zones (fig. EE). The A orebody, or zone, occurs in the northeast part of the pipe at the adit level and extends downward to about the 190 level. Since the mine closed the upper portion of the A stope has collapsed to the surface at the adit level. It reached a maximum width of 40 ft (12 m) on the 175 level. This was a very high grade orebody (portions were greater than 1.50 percent U_3O_8) that consisted of uraninite disseminated throughout a poorly consolidated sand, derived from the Coconino Sandstone. The high grade ore from the A stope was the principal source of the Orphan uranium production in the early years (table XX). The shape of the orebody was controlled by the distribution of the Coconino sand fill within the pipe. The northeastern limit of the fill was marked by the peripheral shear zone (annular ring) of the pipe within the Hermit Shale.

The B orebody, or zone, extended from about 30 ft (9 m) above the adit level downward to the 245 level (fig. EE). The principal area of mining was from the 140 level to the 245 level where the orebody was mined to a diameter of about 200 ft (61 m). This large orebody consisted of some very high grade (greater than 1.00 percent U_3O_8) pods surrounded by lower grade and barren material. Host rocks for the B zone included Coconino sand fill as well as a claystone breccia derived from the Hermit Shale. Calcified blocks of argillic breccia, resembling limestone, were mined on the 175 level in 1957, causing the lime content of some shipments to Tuba City to reach 14 percent $CaCO_3$. An increased permeability due

to fracturing and the good porosity in the sand fill appear to have been important in localizing the B orebody. Pyrite was very common in the B orebody, especially in the lower part.

The G orebody, or zone, is essentially a downward continuation of the B orebody. Below the 245 level the ore in the center of the pipe rakes to the northeast and continues downward to the 265 level (fig. EE). The orebody is similar to the B, but not as high grade (table V). It was mined between the 265 and 365 levels and the G stope reached a maximum mean diameter of 160 ft (49 m) on the 320 level. Breccia derived from the Hermit Shale and the Esplanade Sandstone, as well as some sand fill from the Coconino were the host rocks for the G orebody.

Ore stringers from the B and G zones coalesce with the annular ring orebodies below the 175 level, in the northern portion of the pipe. Small pods of such ore stringers have been mined on the 245, 265, 290, 320, and 365 levels. The host rocks for these small pods were largely calcified sandstone-pipe-fill derived from the Coconino Sandstone.

Annular Ring Ore

Orebodies in the annular ring can occur - 1) within the peripheral shear zone, 2) within collapsed pipe-fill materials adjacent to, but inside the shear zone, and 3) in undisturbed sediments outside the shear zone. The most of the ore produced from the annular ring came from deposits in the Esplanade Sandstone outside the shear zone (fig. EE). Here, ore occurs in sandy beds in relatively undisturbed sediments outside of the pipe. Vertical, ring fractures appears to control the radial extent of the ore beyond the pipe; the width of the orebodies varies from 6 to 60 ft (2 to 18 m). Clay and mudstone lenses or beds in the annular ring are barren and some sandy units are also barren. No megascopic differences have been noted between the mineralized and nonmineralized sandy

sections. The ore is continuous horizontally in the favorable sandy sections around the entire periphery of the pipe, but the vertical continuity is interrupted by unfavorable beds. Kofford (1969) compared the annular ring to a stack of washers, with the alternate ones being ore bearing.

The annular ring on the claim has been mined on the 190, 225, 245, 285, 310, 350, 375, and 420 levels. The orebodies are generally about 15 ft (5 m) wide, but reached a maximum width of 60 ft (18 m) on the 350 level. The mineralization was so intense on the northwestern segment of the annular ring that the entire section of rock (referred to as the 350 stope--table UU) between the 310 and 350 levels was entirely mined out. However, an intervening 7 to 10 ft (2-3m) thick mudstone was barren on the south and southeast segment, separating this section of rock into the 310 amd 350 levels. The bottom of the 350 level ore zone in the claim is marked by a second barren mudstone bed.

On the northern perimeter of the pipe, off of the originat patented claim and within the National park, the rock was so intensely mineralized that the separation between the different ore levels is not distinct resulting in the large No. 1 stope (table UU and fig. EE). The intense shearing on the pipe boundary here has resulted in good vertical continuity of the orebodies throughout the mudstone as well as sandstone. The early drilling detected this continuity and hence, this part of the annular ring was termed "the feeder zone" (Kofford, 1969). The massive orebody in the Park was mined out through the No. 1 stope (fig EE) that extended from the 225 level to the 365 level. This stope had an average width of about 50 ft (15 m), with a maximum width of 200 ft (61 m) on the 320 level.

Bleached Supai sandstones outside the pipe are very common. Normally dark reddish-brown sandstones are bleached white, light gray or pinkish gray near ore. Both increased porosity and fracturing have localized ore within the Supai

sandstones.

Remains of land plants in the Esplanade Sandstone are uncommon (McKee, 1992, p. 98). However, on the 245 level, near the C raise, Chenoweth (1986) observed a small accumulation of plant fragments that were mineralized with uranium (fig. HH).

Ore in the annular ring on the 375 level, and below, is localized in sandstone beds of the Wescogame Formation of the Supai Group. Orebodies have been mined on the 375, 400, 420-430, 525, and 585 levels, but these orebodies do not have the horizontal continuity of those in the Esplanade Sandstone. The P series of drill holes (table XX) was unsuccessful in locating additional ring zones below the 585 level.

Mineralogy

The Orphan mine mineral assemblage can be thought of as a fine-grained version of the Mississippi Valley type deposits found in the Viburnam trend, with a later uranium and copper sulfide overprint. Specific examples are the Buick and Sweetwater mines. Although there is considerable controversy over whether the Viburnam trend deposits should be considered true Mississippi Valley type deposits, the purpose here is not to argue deposit classification, but rather to convey an image of the Orphan mine mineral assemblage to the reader.

Unfortunately, in contrast to the large showey display crystals of such minerals as barite, calcite, chalcopyrite, galena, and siegenite collected from Mississippi Valley type deposits most minerals discussed below were present in crystals smaller than 1 mm. Most minerals were identified by reflected light petrography using a 100x objective lens and(or) with the electron microprobe.

Orphan Mine Gangue Minerals

Orphan Mine Metallic Minerals and their Stoichiometry

The 40 minerals identified to date at the Orphan mine are listed in Table K1 as gange or by their major cation metal. Few minerals found at the Orphan mine are pure end members, with the exception of galena and chalcopyrite. Most contain either other metals substituting for their major metal cation or arsentic substituting for sulfur.

Pyrite Group and Marcasite

Pyrite is the most pervasive metallic mineral in the Orphan pipe. It impregnated the sand fill matrix within the orebodies, filled fractures, formed small cubes or massive radially-bladded nodules, and locally corroded and replaced detrital quartz grains. In places the sand fill is totally cemented by pyrite. Much of the bladded pyrite may have been marcasite, as small marcasite blades are intergrown with the pyrite.

The cubes of pyrite are rarely pure $FeS^{?}$, but more commonly are intergrowths of pyrite with bravoite, vaesite, cattierite, and villimaninite; each of these minerals forms discrete mineral boundaries within the cube, yet none represents the pure mineral end member. Although bravoite is no longer

recognized by the International Mineralogical Association's Commission on New Minerals and Minerals Names as a discrete mineral it is used in this report as in the past literature to designate a member of the pyrite group with roughly equal amounts of Ni and Fe. The cores of these pyrite group cubes most commonly are occupied by bravoite with the lowest Ni-bearing pyrite forming the rims. Most of the pyrite group minerals and the marcasite contain arsenic, commonly 1-3%. Marcasite associated with pyrite appears to have little, if any, compositional distinction from the pyrite.

Pyrite formed at several stages during pipe mineralization; many grains are fractured by a later fracturing event and are clearly pre-fracturing, while some are not. Some of the pyrite fractures resemble dessication cracks. The cubes of pyrite group minerals appear to be some of the earliest pyrite. Later instabiity of the Ni-bearing pyrite is suggested by occasional corroded bravoite remnants or cubic molds occupying the pyrite cores.

C G Bowles field work time at the Orphan Lode mine, Grand Canyon, AZ.

Bell

Mapping and sampling at the Orphan Lode mine was undertaken in 1964 and 1965. Addition field work on pipes in the Grand Canyon area and on related geology was undertaken in 1966.

Gil

Eric Brauer

calcite pyrite 365-350 level

Left Western late in 67
Came to Cotter in 1970

B Stope on 245 level highly timbered

500,432 Dry tons @ .428% U_3O_8

April 56 — April 59
averaged over 1.% Cu
.40 oz/ton Ag

10-24-85

Annular Ring

190 - 350 Chalcopyrite
225 - 190 Chalcocite

Henry H. Leigh - Phoenix

Elling Halvorson
2703 152nd Ave NE
Redmond Washington 98052
306 885 - 3433

Purchased claim and computer land
Received all Orphan data from Cotter

Cotter mill began operating Oct 1, 1985

Bruner 1-2-86

Cu zone in Park, observed on 225

Cu scarce below 350

Pyrite in AR below 400 leached oxidized on 585.

Chalcocite upper AR
Chalcopyrite lower AR

Lower B called "G"

Never saw organic in Supai

Sheave wheel for Service Raise was on 225

New adit drilling disappointing + 150' ?
raise from old to new

Pyrite abundant in B zone

MINE INSPECTION REPORTS
ORPHAN MINE

YEAR	Avg. Men Underground	Avg. Men Surface	Avg Total
1954			
55			
56	10	8	18
57			
58	15	7	22
58*	9	7	16
59	37	16	53
59*	10	6	16
60	75	11	86
61	61	24	85
62	24	7	31
63	56	11	67
64	45	9	54
65	32	7	39
66	21	7	28
67	16	8	24
68			
69	42	6	48

* Shaft contractor

Table I
Minerals of the Orphan Mine

MINERALS	COMPOSITION	IDENTIFICATION PRIMARY	SECONDARY	HOST ROCK	LAB	MEGASCOPIC	REMARKS	*AUTHORITY
Arsenopyrite	FeAsS	x		Coconino ss	x	x		Granger, McLeod
Azurite	$2CuCO_3 \cdot Cu(OH)_2$		x	Ss, argillite		x		Ashwill
Barite	$BaSO_4$	x		Ss, ls	x	x	Xls in vugs	Corey, Evans, others
Bornite	Cu_5FeS_4	x		Ss	x			Evans
Calcite	$CaCO_3$	x	x(?)	Ss, arg	x	x	Large xls in vugs	Corey, others
Carbon	C	(?)	(?)	Ss	x			Corey
Carphosiderite	$K_2Fe_6(OH)_{12}(SO_4)_4$	x		Ss	x			Corey
Chalcanthite	$CuSO_4 \cdot 5H_2O$		x	Ss		x		Miller
Chalcocite (?)	Cu_2S	x(?)	x	Ss	x			Corey
Chalcopyrite	$CuFeS_2$	x		Ss	x			Evans, McLeod
Chrysocolla	$CuSiO_2 \cdot 2H_2O$		x	Ss		x		Miller
Copper (native)	Cu		x	Ss		x	In drill core	Kofford, Ashwill
Covellite	CuS	x(?)	x	Ss	x			Corey, Evans, McLeod
Erythrite	$Co_2As_2O_8 \cdot 8H_2O$		x	Ss, arg, ls		x	On mine walls	Ashwill
Galena	PbS	x		Ss, ls	x	x	Fine gr. dissem.	McLeod, others
Gypsum	$CaSO_4$		x	Ss, ls, arg		x	Selenite in vugs	Kofford, Ashwill
Hematite	Fe_2O_3	x	x	Ss, ls, arg		x	(Red paint on faults, botryoidal	Ashwill
Limonite	$2Fe_2O_3 \cdot 3H_2O$		x	Ss, ls, arg		x	Noted to adit - 965 ft.	Ashwill, others
Malachite	$CuCO_3 \cdot Cu(OH)_2$		x	Ss, ls, arg		x		Ashwill
Melanterite (?)	$FeSO_4 \cdot 7H_2O$		x	?		x		Kofford
Marcasite (?)	FeS_2	x		Ss		x		Granger
Metazeunerite	$Cu(UO_2)_2(AsO_4)_2 \cdot 8H_2O$		x	Ss	x		(Frequent megascopic ident. as Torbernite	Corey
Molybdenite (?)	MoS_2	x		?		x	? ident.	Kofford
Nickel-skutterudite (tentative)	$(Ni,Co)As_3$	x		Ss	x		May be Siegenite	Evans
Proustite	$3Ag_2S \cdot As_2S_3$	x		Ss	x			Evans
Pyrite	FeS_2	x		Ss, ls, arg	x	x	Xline and massive	Several
Pyrolusite (?)	$MnO_2 \cdot (H_2O)_x$		x	Ss (?)		x	Dendrites, (?)	Kofford
Rhodochrosite	$MnCO_3$	x		Ss		x	Small xls	Ashwill
Siegenite	$(Ni,Co)_3S_4$	x		Ss (?)	x			McLeod
Sphalerite	ZnS	x		Ss, (?)	x	x		McLeod, Evans, Ashwill
Tennantite	$3Cu_2S \cdot As_2S_3$	x		Ss, (?)	x			McLeod
Unknown				Ss		x	White chalky, non-calcareous, structureless,	Kofford, Ashwill

(cont)

Table I (cont)
Minerals of the Orphan Mine

MINERALS	COMPOSITION	PRIMARY	SECONDARY	HOST ROCK	IDENTIFICATION LAB	IDENTIFICATION MEGASCOPIC	REMARKS	*AUTHORITY
Uraninite (	$(UO_2) \cdot (UO_3)$	x(?)	x	(Ss, ls, arg.	x		Sooty variety common. Evans, Corey	
Wulfenite	$PbMoO_4$		x	Ss		x		Ashwill, Koffard, Miller
Zeunerite	$Cu(UO_2)_2As_2O_8 \cdot 8H_2O$		x	Ss	x		May be metazeunerite. Evans	

* Authority for identification -
Corey, A. S., AEC
Evans, LeMar, USBM, Tuscon
McLeod, H. B., Stanford Conn.
Miller, R. D., AEC
Ashwill, W. R., AEC
Granger, H. C., USGS

MINING COST STUDY

Company statement — April 1963

mine development	$2.17
direct mining	5.98
other mining	2.39
indirect (est)	.40
Total	10.94
marketing	5.65

Western Equities Production Rate

Nov 21, 1962 - Oct 1, 1963 =

47,042 tons ÷ 10.77 mos = 4368 tons/mo.

4368 tons/mo ÷ 21 days/mo = 208 tons/day

With 57 men on total payroll tons/m.s. = 3.65

Using Delicate rule:

$$\text{Total cost} = \frac{\$60/\text{m.s.}}{3.65 \text{ tons/m.s.}} = \$16.44/\text{ton}$$

D.C. Wills 6/12/62 memo list:

Total mining cost incl haulage @ 210 tpd = $21.26/ton

Ray Holmquist 6/61 PD-5 list:

direct mining	$1.67/ton
haulage	.52
sales tax & employ. ins	1.17
Total	$ 18.66

ROYALTY CALCULATION

Royalty on .18 % U_3O_8

.18 % U = 3.6 #/ton

3.6 x 4.32 = 15.55 value of U_3O_8

+ 1.64 value of Cu

17.19 Total value

less haulage = 5.65

11.54 Net value

x .055

.63

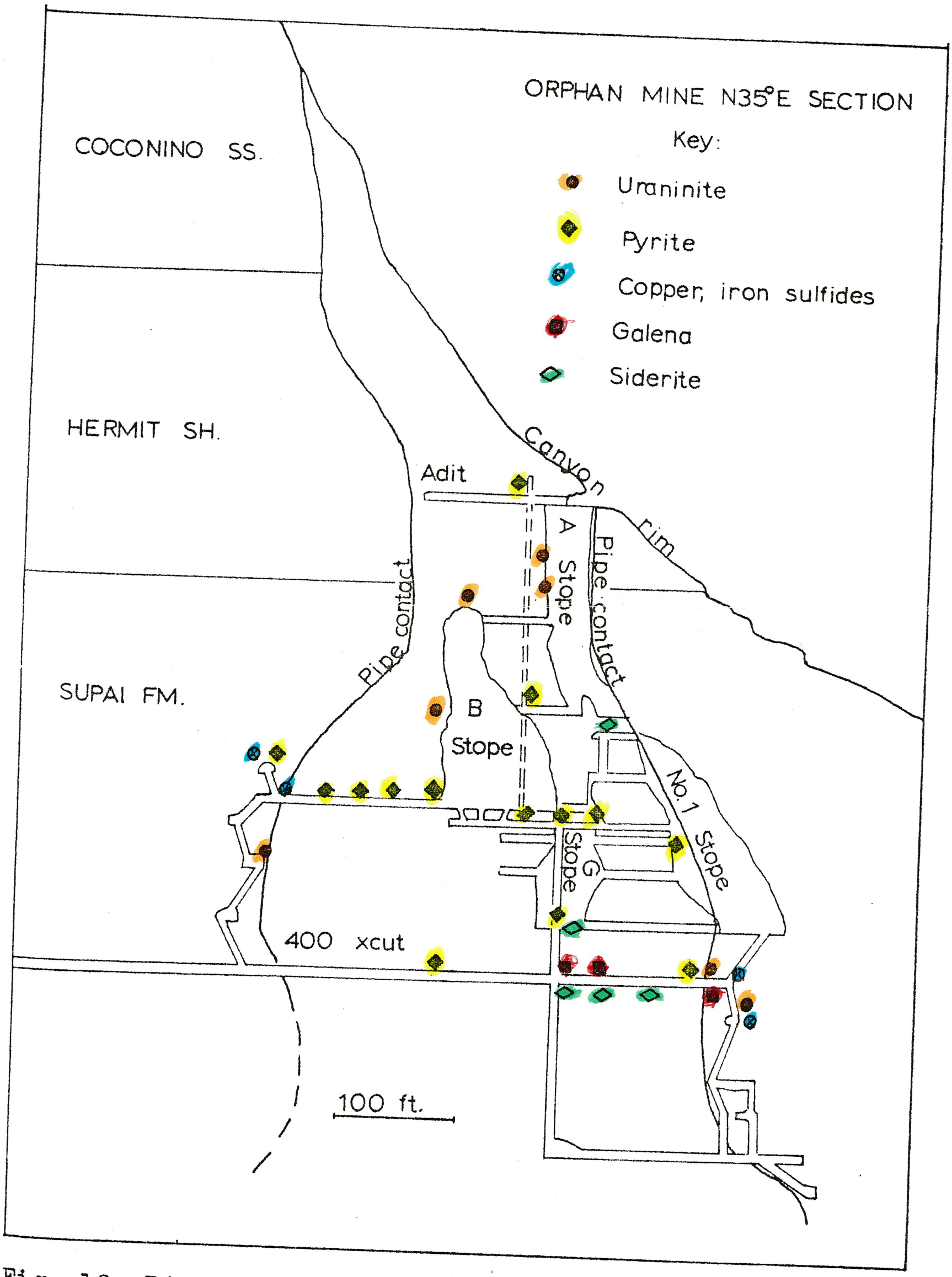


Fig. 10 Distribution of metallic and related minerals.

Table VV Distribution of ore production by level and stope, Orphan Lode mine

Level	Tons of ore	% U_3O_8	Pounds U_3O_8
140	2,200	0.27	10,800
175	2,000	0.31	12,400
190	6,100	0.20	24,400
225	8,300	0.26	43,200
245	12,400	0.36	89,300
265	4,500	0.33	29,700
285	3,000	0.55	33,000
310 - 320	30,000	0.42	255,000
350 - 365	65,500	0.45	596,100
375 - 400	12,200	0.37	90,300
420	6,500	0.38	49,400
430	1,100	0.57	12,600
525	2,800	0.32	17,900
585	1,500	0.60	18,000
			1,282,100
Stope			
A	43,100	0.85	737,000
B	72,000	0.18	259,200
G	38,500	0.14	107,800
No. 1	88,500	0.52	929,300
335	5,300	0.17	18,000
350	89,600	0.48	887,100
TOTAL	495,100	0.43	4,220,500

1962 - 1969

222,910 tons

6,680,000 lbs Cu = 1.50%

107,000 oz Ag = .48 oz/ton

Ore averaged

1.10 – 1.50% Cu 22# – 30#/ton

.35 - .45 ozs/ton

TABLE 6

Comparison of production statistics from the Orphan Lode Mine, Coconino County, Arizona.

Source	Tons of Ore	Pounds U_3O_8	Average Grade
Chenoweth, this report	495,106.63	4,257,571.47	0.43%U_3O_8
Cotter Corp.[1]	500,432	4,286,254	0.428%U_3O_8
Scarborough, 1981	509,025	4,360,000	0.43%U_3O_8

[1] Personal communication from Erik W. Bruner, 1985.

(1)

Thru 1961

POR: COLE: 11/15/63

SUMMARY OF COMPANY STOPE PRODUCTION DATA
ORPHAN LODE CLAIM INCEPTION TO DECEMBER 1961
THRU

Area	Wet Tons	(assume 5% H_2O) Dry Tons	%U308
101 Dr.	280	266	.40
140 Shaft Pillar	864	821	.270
175 Shaft Pillar	827	786	.315
179 Stope	3,250	3,088	1.14
A Zone	3,523	3,347	.707
B Zone	53,865	51,172	.182
190 Level	216	205	.15
225 Level	8,304	7,889	.263
245 Level	12,987	12,338	.355
245 B Stope	3,060	2,907	1.331
290 Level	1,574	1,495	.273
310-320 Level	25,598	24,318	.402
350-365 Level	56,926	54,080	.355
400 Level Rises	12,852	12,209	.327
F Rse (225-400)	1,177	1,118	.706
	185,303	176,039	.343

9,239 T .37

For some period IBM shows 195,627 DT @ .412 for total. It appears that 19,588 tons was omitted from Company records. Most of it was probably early production, although it is apparent that some of it came from later years. However, assuming that the missing tonnage is entirely the early production the following calculation is made:

Total to date (IBM)	195,627	@ .412
minus first 19,588 tons -	19,588	1.020
Remainder	176,039	.344

This grade checks very well with the average of the company records, although it may be a coincidence.

(2)

8/62 - 9/63

SUMMARY OF COMPANY STOPE PRODUCTION DATA

ORPHAN LODE CLAIM

August 1962 thru September 1963

Area	Wet Tons	Assume 5% Water Dry Tons	%U308
245 level	62	59	0.080
265 level	982	933	0.159
285 level	129	123	0.439
350 - 365 level	3,552	3,374	0.255
	4,725	4,489	0.238

For the same period IHM shows 4,434 DT @ 0.239 which is a good check.

From inception thru December 1961 this same area (245-365) produced 92,231 DT @ 0.366. The total production of this area from inception thru September 1963 is 96,720 DT@ 0.360.

Park
8/62 - 9/63

SUMMARY OF COMPANY STOPE PRODUCTION DATA

U.S. Park Service

Inception (August 1962) thru September 1963

Area	Wet Tons	Assume 5% Water Dry Tons	%U308
225 level	1,606	1,526	0.401
245 level	492	467	0.301
260 - 265 level	8,520	8,094	0.746
285 - 290 level	1,277	1,213	0.449
310 - 320 level	7,501	7,126	0.441
350 - 365 level	21,012	19,961	0.581
400 level	1,852	1,759	0.553
525 level	1,317	1,251	0.367
	43,577	41,397	0.568

For the same period IBM shows 42,608 DT @ 0.553 which is a reasonably close check.

8/62 - 9/63

POR:PITMAN:11/19/63

From Monthly Reports Castagne to Prior

Recent Production			Tons	%U308	Waste
Aug. 1962	Devel. (Park)	260 — X cut	358	.41	
		260 — J Drift	544	1.08	
		260 — F Drift	141	.09	
		320 — X cut	198	.26	
Sept. 1962	Devel. (Park)	225 — Level	172	1.26	
		260 — Level	264	.85	
		245 — F Drift	81	.39	
		260 — J Drift	225	1.05	
		320 — Level	90	1.19	
		290 — Level	81	.14	
		400 — Xcut	152	.28	
		400 G Box Hole	17	.20	
Oct. 1962	Devel. (Park)	225 — Level	176	.10	
		245 — F drift	335	.33	
		265 — Level	54	.57	
		290 — Level	493	.39	
		320 — Level	504	.12	
		365 — Level	240	.10	
		400 Rse	92	.06	
Nov. 1962	Devel. (Park)	225 — Level	161	.20	
		245 — F drift	76	.08	
		260 — Level	102	1.51	
		290 — Level	150	.87	
		320 — Level	113	.17	
		365 — Level	157	.22	
		400 - 30 drift	13	.24	79
		400 E drift	340	.32	242
	Devel (Co.)	400 J Mng	70	.17	
		245 F No. 2 Dr.	62	.08	
Dec. 1962	Devel (Park)	400 drift	20	.11	397
		400 - 30 drift	205	.76	207
		365 — #2 Rse	45	.17	
		320 — Level	476	.13	
		290 — Level	112	.33	
		265 — X cut	203	.11	
		260 — J drift	409	1.08	
		225 — Level	492	.43	
		350 — J level	233	.15	
		400 - 30 Rse			148
		400 #2 Rse			70
Jan 1963	Devel	400 E drift	128	.48	85
		400 - 30 drift	91	.38	314
		400 B chute			45
		400 - 30 #2 Rse			16
		400 #2 Rse	12	.13	
		400 J Mng Rse			39

Jan. 1963 (cont'd)

Feb. 1963 D

March 1963 D (

Stope

Compa

April 1963 D (

Stope

Compar

Recent Production			Tons	%U3O8	Waste
Jan. 1963 (cont'd)	350	No. level	335	.42	
	350	F level	356	.33	
	350	J level	286	.20	
	365	Level	145	.13	
	265	Level	410	.46	
	265	Rse	47	.71	
	290	Level	253	.08	
	260	Level	542	.45	
	260	Rse	54	4.25	
	260	Mng Rse	64	.20	
	225	Level	331	.31	
	225	Rse	124	.19	
Feb. 1963 Devel.	400 - 30	drift	481	1.01	
	400	B chute			45
	400 - 30	#4 Rse	35	.89	60
	400 - 30	#3 Rse			95
	350	No level	842	.77	
	350	J level	601	.96	
	350	F level	842	.47	
	320	Level	2	.14	
	320 & 260	slot	434	.32	
	265	Level	261	.65	
	260	Level	156	.10	
	225	Level	150	.35	
March 1963 Devel.	550	Level	0	0	513
(Park)	400	X cut	29	.67	
	430	drift	0	0	23
	430	#3 Rse	18	.38	
	430	#4 Rse	13	.33	
	350	No. Level	1,961	.62	
	350	F	967	.76	
	320	Level	498	.25	
Stope Preparation (Park)					
	320 & 260	slots	934	.68	
	350	Level	347	1.25	
Company Ore					
	350	J Zone	437	.25	
April 1963 Devel	550 & 525		281	.31	216
(Park)	350 & 320		883	.80	
Stope Preparation (Park)					
	350	F level	95	.24	
	350	Level	1,938	.65	
	320 & 260	level	1,298	.35	
		Stope	485	.83	
Company Ore					
	350	J ore pass	397	.22	

		Recent Production	Tons	%U308	Waste
May 1963	Devel (Park)	550 & 525	248	.48	194
		320 Level	274	.35	
		Stope Preparation			
		350 & 320 1949/1844	3,698	.40	(upper three assembly)
		Stoping - 350	506	.34	
		Company Ore			
		350 So Zone	320	.306	
June 1963	Devel (Park)	550 Rse & Subs	126	.18	204
		320 Drift	690	.68	
		265 Drift	136	.88	
		Stope Preparation			
		350 Level	920	.69	
		Stoping			
		350	1,224	.64	
	Devel				
		Company Ore			
		335 X cut	466	.13	128
		265 Drift	630	.12	
		350 So Level	10	.38	
		285 Drift & Rse	91	.32	
July 1963	Devel (Park)	525 Sub	524	.25	
		430 Sub	12	.96	16
		310 & 320 Drift	124	.95	14
		285 Drift	188	.97	
		265	192	.79	
		Stope Preparation			
		300 Stope	571	.41	
		Stoping			
		350 Stope	1,157	.48	
		265 Slots	946	.83	
		Company Ore			
		350 So Stope	252	.31	
		265 Drift	316	.23	
		285 Drift	16	.40	
August 1963	Devel (Park)	525 Sub	34	2.50	
		Stope Preparation			
		350 Rse	80	.16	
		400 Rse	22	.24	28
		Stoping			
		350 Stopes	1,498	.41	
		265 Slots	1,732	.98	
		Company Ore			
		265 Drift	6	.15	
		350 So Stope	776	.35	

Sept. 1963	Devel (Park)	525	Sub	104	.37	14
		550	Level			22
	Stope Preparation					
		350	Level	315	.34	
		265	Level	90	.38	
		400	#3 Rse	102	.29	
		320	Rse	80	.68	
	Stoping					
		350	Stope	3,631	.69	
	Company Ore					
		350	So Stope	894	.22	
		285	Drift	22	.96	

(3)

10/63- 7/64

Summary of tons hoisted from company records October 1963 through July 1964.

Area	Park Ground		Orphan Lode Claim	
Lower B Zone	0			
225	40	0.13	394	0.22
265	134	0.25	30	0.36
285	0		0	
310-320	480	0.17	740	0.18
390	701	0.64	84	0.10
"390 Stopes"	36,152	0.55	0	
775	0		6,108	0.25
400	243	0.11	98	0.09
525	965	0.26	20	0.16
585	1,442	0.60	438	0.34
			0	
Total wet tons	40,157	0.54	7,912	0.24
Broken ore stored underground 7-1-64	26,599	0.55	397	0.25

Certain areas assigned probable additional ore have been mined since the estimate was made. These are notable as follows:

Park - 585 and 525 levels; Orphan Lode claim - 285 and 525 levels and Lower B stope.

The grade of the ore mined on the 285 and 525 levels has been lower while that mined on the 585 and Lower B Zone has been higher than the estimated grade of the probable additional ore blocks. Also, in comparing the current maps with those of the latest (10-1-63) ore reserve calculation, there has been no mining outside the ore reserve or probable additional blocks.

NEW DEVELOPMENTS

The 585 level has been developed since the previous examination. Previous core splits of this ore zone showed considerable limonite alteration and a disequilibrium in favorable of the chemical assay. The workings confirm that this is the case, as the ore is thin and appears to have been largely leached and the host sand contains abundant limonite alteration. This level will be the lowest level of the mine as no further ore is known below it.

10/1/63
OR

SUMMARY 10/1/63 ORE RESERVES - Orphan Lode Claim

	Tons	%U308
Above 245 level	4,079	0.26
Above 350 level	11,505	0.36
Above and Below 400 level	9,537	0.52
Total:	25,121	0.40

SUMMARY 10/1/63 ORE RESERVES - U. S. Park Service

	Indicated		Inferred	
	Tons	%U308	Tons	%U308
Above 225 level	5,409	0.40	5,408	0.40
Below 225 level	3,689	0.30	-	-
Above 265 level	8,476	0.75	-	-
Below 265 level	3,476	0.45	-	-
Above 290 level	-	-	7,968	0.45
Below 290 level	-	-	9,851	0.44
Above 320 level	9,351	0.44	-	-
Below 320 level	9,257	0.58	-	-
Above 365 level	18,417	0.58	-	-
Below 365 level	-	-	8,964	0.55
Above 400 level	-	-	2,466	0.55
Below 400 level	4,822	0.55	-	-
Above 525 level	-	-	792	0.37
Broken ore stored underground	16,000	0.57	-	-
Total:	78,897	0.55	35,449	0.47
Rounded:	79,000		35,000	

5/59 - 12/61

Production Breakdown, Dec. 61 - May 59

Monthly Reports - Castagne to Prior for Dec. 61 and before

(All Wet Tons)

Upper B Zone		365 Level		350 Level S.		350 Level E.		225 Stope	
Tons	%	Tons	%	Tons	%	Tons	%	Tons	%
1,324	.09	486	.17	754	.41	1,244	.20	44	.26
1,082	.12	148	.10	572	.46	228	.18	514	.21
				(350 Level)		(E. Sub)			
688	.12	580	.15	3,094	.34	68	.08	1,344	.24
				(350 Level)				(North Slope)	
936	.17	1,258	.13	766	.36			326	.19
				(350 Level)				(North Slope)	
1,354	.24	668	.16	4,170	.37			340	.10
1,352	.27	350	.16	910	.25			2,568	.209
2,042	.21	520	.29	11,806	.336				
1,836	.19	46	.12						
2,981	.17	336	.15	11,806	.336				
3,990	.19	4,392	.163						
4,414	.23								
3,184	.11								
1,710	.11								
2,734	.11								
1,880	.13								
2,220	.18								
2,309	.18								
2,566	.22								
1,276	.18								
2,039	.15								
3,198	.23								
1,793	.14								
46,908	.175								

320 Level		285 Stope		400z & Dr.		400 Dr.		235 N. Rse		310 E. Sub.	
Tons	%	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%
314	.16	44	.22	630	.30	732	.86	222	.21	88	.10
				(Wz)							
500	.12	850	.33	1,126	.80	910	.60				
(Sub)				(Wz)							
220	.05	274	.22	334	.61	834	.37				
		(Sub)		(Wz)							
206	.20	308	.19	24	.26	384	.11				
		1,476	.277	(Dr & Rse)							
524	.17			394	.35	268	.07				
				(Dr & Rse)							
82	.12			218 waste		226	.07				
(325 Sub Level)											
720	.09					106	.19				
(320 - 290)				5,968	.506						
1,882	.27										
(320 - 290)						400 - XC					
2,266	.25					32	.21				
						400 - Xc					
2,552	.30					825	.31				
1,422	.46					not 400 level					
254	.18										
264	.18										
11,206	.260										

350 F Rse		320 Shrink		285 Level		350 Zone		400 A Rse		400 30 Rse	
Tons	%	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%
68	.04	1,142	.15	98	.22	1,808	.27	14	.23	926	.12
										(Sub)	
356	.12					820	.19			172	.07
424	.107									(Slot)	
						884	.20			71	.05
										(Drift)	
						3,600	.39			100	.29
						(350, 245 Zone)					
						5,334	.43			(Drift)	
										43	.08
						3,581	.38				
										(Drift)	
						2,662	.30			200	.30
										1,512	.1449
						1,000	.30				
						2,886	.34				
						472	.42				
						23,047	.354				

Lower B		350 F		350 D		400 Box Hole		A Stope		140 Level Shaft Pillar		330 D	
Tons	%	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%
556	.20	902	.48	200	.27	117	.02	931	.35	334	.27	64	10
1,228	.17	908	.66	1,080	.24			50	.60	530	.27		
1,784	.179	594	.77	768	.14			160	.31	864	.270		
				(D North)									
		471	.55	358	.34			177	.75				
		296	.38	906	.23			107	.50				
		818	.94	2,633	.51			158	.81				
				(350 D & E)									
		328	.47	1,974	.42			52	.81				
		4,317	.645					237	1.00				
				1,048	.35			335	1.05				
				8,967	.367			431	.51				
								(100 A Stope)					
								263	1.00				
								(100 A Stope)					
								622	1.06				
								3,523	.707				

350 E Rse		400 L Rse		400 J Rse		400 M Rse		400 W Rse		400 F Rse		400 20 Rse	
Tons	%	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%
8	.12	48	.12	266	.08	14	.60	6	.21	364	.17	62	.15
264	.32	14	.08	76	.23					233	.22	(400-20 Dr.)	
141	.16	62	.111	302	.118					597	.190	16	.10
290	.26											78	.140
451	.31												
784	.53												
414	.66												
(375 E Rse)													
8	.08												
2,360	.429												

335 Level		225 W Level		435 Level		190 Level		310 Level		245 F Rse	
Tons	%	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%
76	.20	484	.30	306	.18	216	.15	76	.18	16	.11
		(W Sub)									
48	.07	418	.36					256	.25		
		(Sub)						(S Dr.)			
22	.16	344	.16					1,204	.34		
858	.15	(Sub) 850	.19					439	.25		
(Sub)		(Sub)									
494	.13	1,448	.32					459	.25		
1,498	.144	(Sub)						1,912	.59		
		1,174	.39					2,172	.64		
		(Sub)									
		558	.24					3,942	.46		
		(Sub)						743	.71		
		198	.15					(Sub)			
		5,514	.291					875	.98		
								(Sub)			
								795	.70		
								203	.91		
								13,078	.548		

400 DD Sta		400 Rse		400 E Rse		400 K Rse		245 Zone		F Zone		175 Pillar	
T	%	T	%	T	%	T	%	T	%	T	%	T	%
52	.06	62	.28	226	.08	124	.19	202	.25	48	.06	711	.30
		402	.19	56	.16			526	.20	(F Rse) 642	.65	43	.40
		464	.202					(NE) 626	.25	(F Rse) 453	.90	(175 Shaft Pillar) 63	.40
				118	.28			(Level) 458	.23	(F Rse) 34	.08	(Shaft Pillar) 10	.50
				400	.150			(Annular Ring) 310	.20	1,177	.706	827	.315
								(Annular Ring) 812	.18				
								(Annual Ring) 570	.15				
								(NE) 40	.08				
								(245 SE Drift) 116	.10				
								(NW Drift) 320	.14				
								(SW Drift) 205	.42				
								(S Dr) 59	.13				
								(N Stope) 233	.21				
								(S Dr.) 209	.34				
								(N Stope) 308	.40				
								(N X-cut) 53	.07				
								(E X-cut) 53	.18				
								(N X-cut) 243	.90				
								(N X-cut Rse) 506	.65				
								(S X-cut) 344	.19				
								(N X-cut Rse) 568	.46				
								6,561	.295				

B Stope (Cont'd)		400 Service Rse		D Rse		245 (Cont'd)		400 B Rse	
T	%	T	%	T	%	T	%	T	%
1,408	.21	422	.18	51	.30	(N Dr Rse)		120	.20
						122	.32		
1,262	.17	86	.12						
						(X-cut S)			
515	.31	756	.12			452	.25		
						(X-cut S)			
376	.37	575	.14			155	.18		
		1,839	.140						
(X cut)									
115	.12	5,173	.249			(N X-cut Rse)			
						206	.50		
635	.30								
						(N Rse)			
862	.32					169	.22		
(245 B Stope)						(AB &C Rses)			
798	.78					163	.38		
(245 B Stope)									
1,250	1.40	3,060	1.33			(N Rse)			
						315	.39		
(245 B Zone)									
1,012	1.68					(Incline)			
						17	.05		
						(N X-cut)			
						29	.09		
						(N Dr. & Rse)			
						113	.79		
						(X-cut & Dr.)			
						200	.16		
						(N Dr. & Rse)			
						344	.43		5/59
						(X-cut & Dr.)			
						481	.22		
						2,766	.319		

A vs B 3rd?

400 C Rse		306 Rse		179 Stope	
T	%	T	%	%	%
20	.09	84	.47	(May 1959)	
				277	.94

12/58 - 4/59

PRODUCTION INFORMATION PRIOR TO MAY 1959

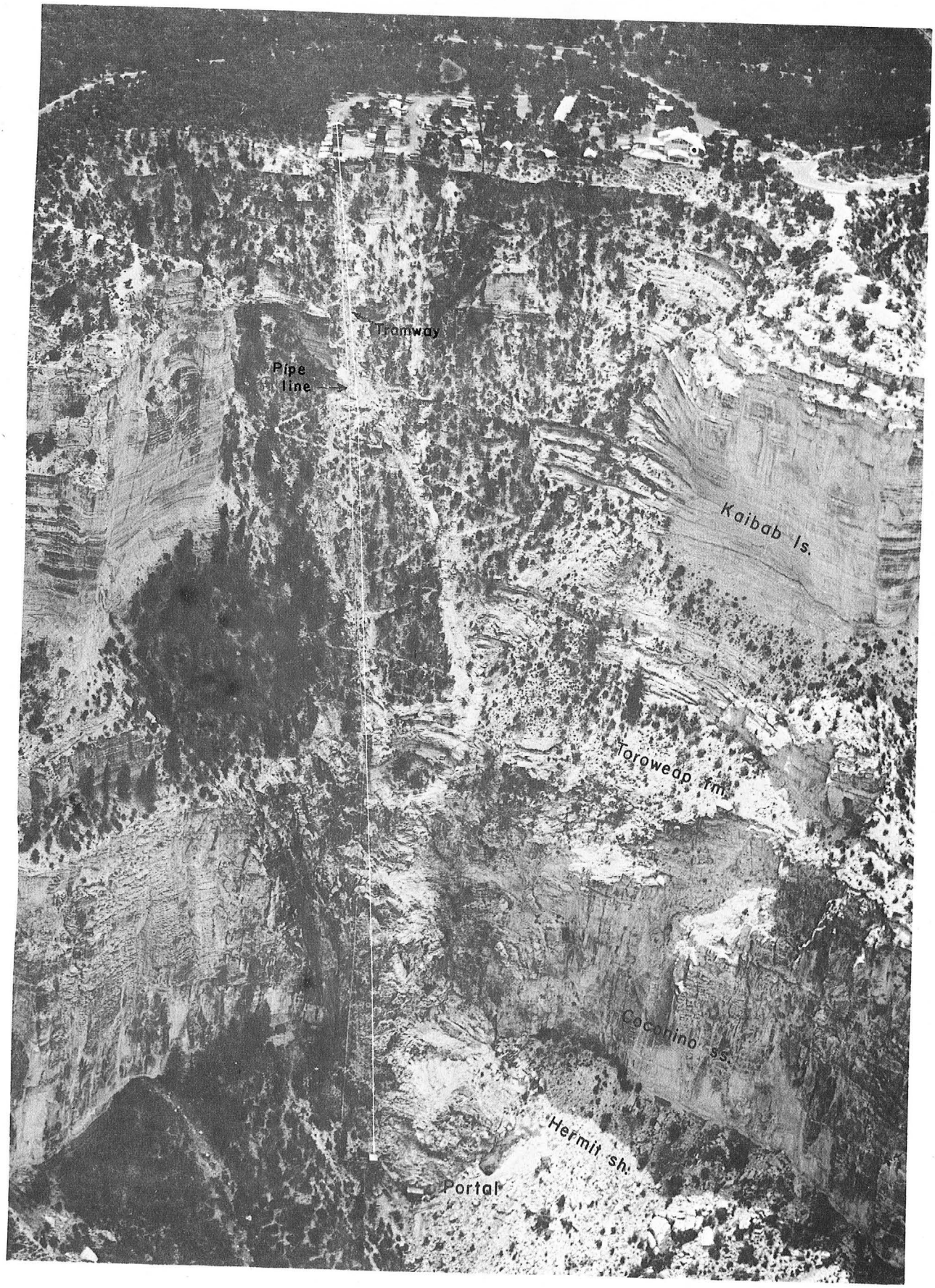
April 1959	Tons	%
179 Stope	224	
245 B Stope	445	
245 Dr.	399	
245 X-cut	317	
	1,318	.48
	(1,385)	

March 1959		
179 Stope	348	
245 X-cut	631	
245 Dr(fm B Zone	485	
101 Dr	172	.48
	1,676	
	(1,636)	

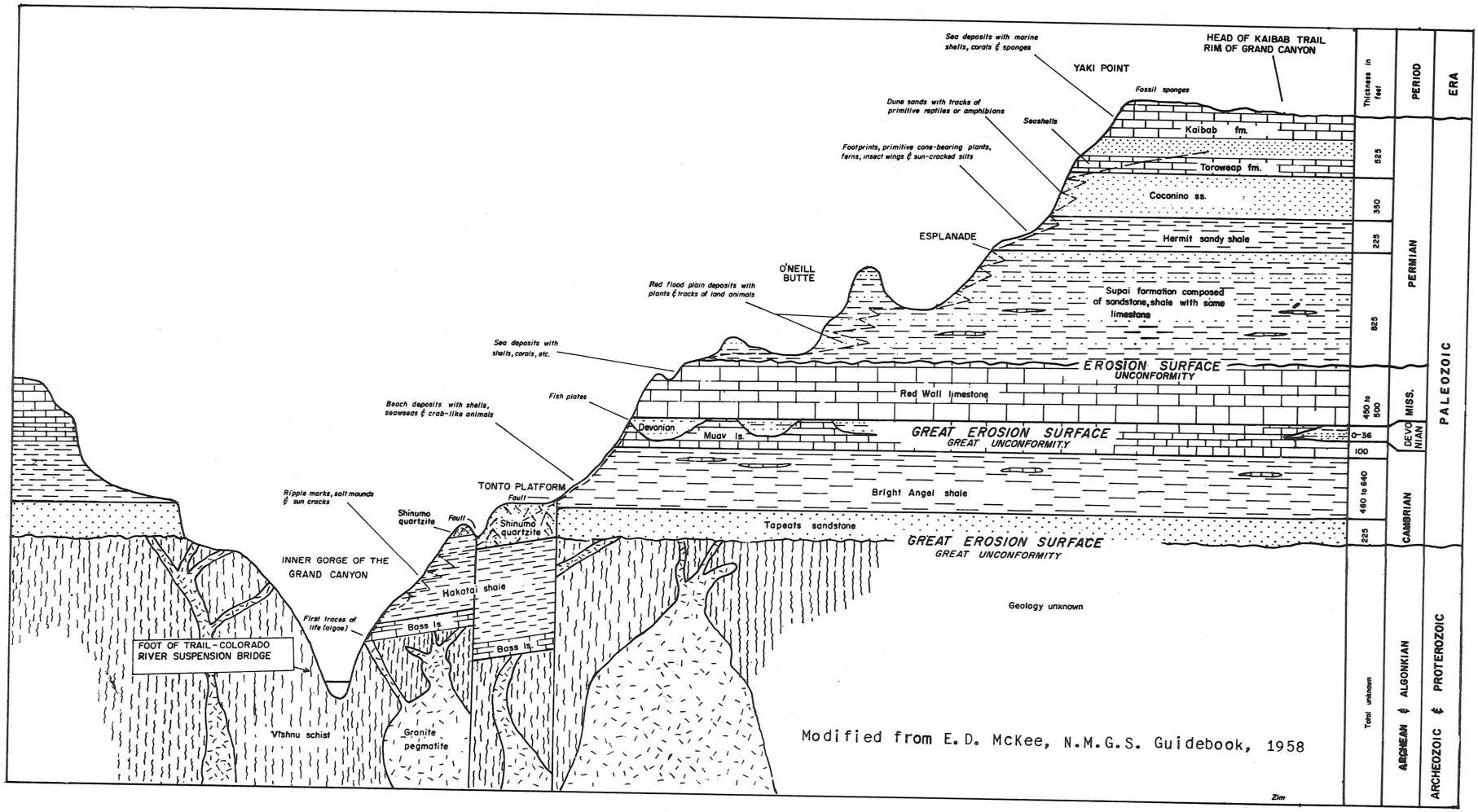
February 1959		
179 Stope	166	1.97
245 Level	876	.70
	1,042	.90

January 1959		
179 Stope	1,080	1.00 /
178 Dr.	20 /	
245 Level	291	low gr. (.20)
	1,372	1.00
	(1,391)	

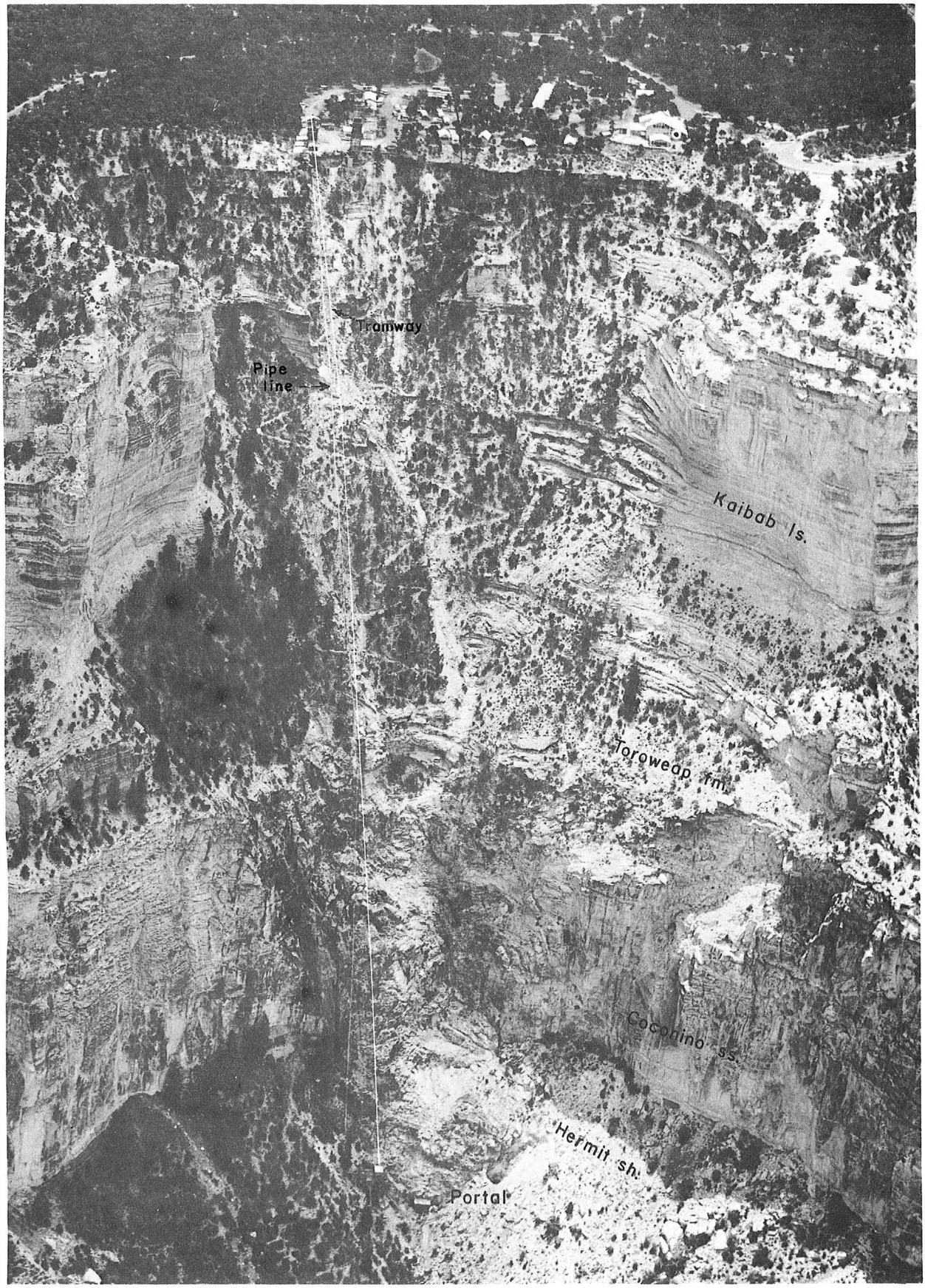
December 1958		
179 Stope	300	1.59/
179 Dr	835	1.50
101 Dr.	108	.28
	1,223	1.59 (?)
	(1,243)	



Orphan Lode Mine, Grand Canyon, Arizona



Geologic section along Kaibab Trail, Grand Canyon, Arizona



Orphan Lode Mine, Grand Canyon, Arizona