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DUNCAN FLUORSPAR MILL

GREENLEE

See: "Geology of the Summit Mountains and Vicinity, Grant County, New Mexico, and Greenlee County, Arizona" IN GEOLOGY FILE
(Daniels #1 and #2, Luckie #1, 2, & 3; Polly Ann Group; Commerce;)

Trace 1947 USGS Strategic Minerals inv. preliminary Report 3-207
p. 1-6, 2 maps

Elevatorski 1971 Fluorspar ADMR Publication

ABM Bul 180, p. 349-352

ABM Bul. 114, p. 6

ABM Circulary 15, p. 229

MAPS - upstairs in flat storage area - Drawer 7 (Luckie # 1 and #2,
Daniel Camp #1)

MAPS - upstairs in the rolled alphabetical file - most properties are
represented

Priority List of Fluorspar Deposits
(not necessarily in the order of examination)

First Priority

<u>examined</u>	<u>not examined</u>
Capt.	Neptune
Gunsight	Unnamed
Black Dike	Annie Laurie
Big Spar - examination in progress	Packard
Princess Ann - examination in progress	Black Mtn. group
Lone Star	Red Chief
Polly Ann	Sonora - Castle Dome area has several
Luckies 1 & 2	Contact
4th of July	Jumbo
Fluorine Hill	West end
Rhodes	Harris
Snowball	

Second Priority

Buckeye Canyon	Grand Reef
Dragoon Mtns.	Landsman
Little Fannie	Marcotte group
Peabody	Adventure
Stout	Amethyst
West side of Swisshelm Mtns.	Davis
Osborn	Mammoth Spar
Quartz Ledge	Muskhog
Barium King	Rowley
Coronado Group	Texas Queen
Edith	White Quartz
Graham	White Rock

Second Priority (contd.)

Blue Daisy	Burro Barite
Black Mtns.	Happy Day
Dricoll Mtn.	Kofa area
Mammoth	Mammoth & Chicago properties
New York	Nottbusch
Sure Fire	Osborne Wash
White Prince	Pay Day
Gonzalez Pass	Planet Peak
Vekol Mtns.	White Christmas
Near Oracle	Yellow Breast
Alta	McFaddin Peak
Annie Lauri	Conway
Abe Lincoln	Independence
Bagdad area	Ross
Congress Jct. area	No name
Leviathan	Mystery Hill
Lucky Jack	Red Hills
May	Sombrero Butte
Springfield	

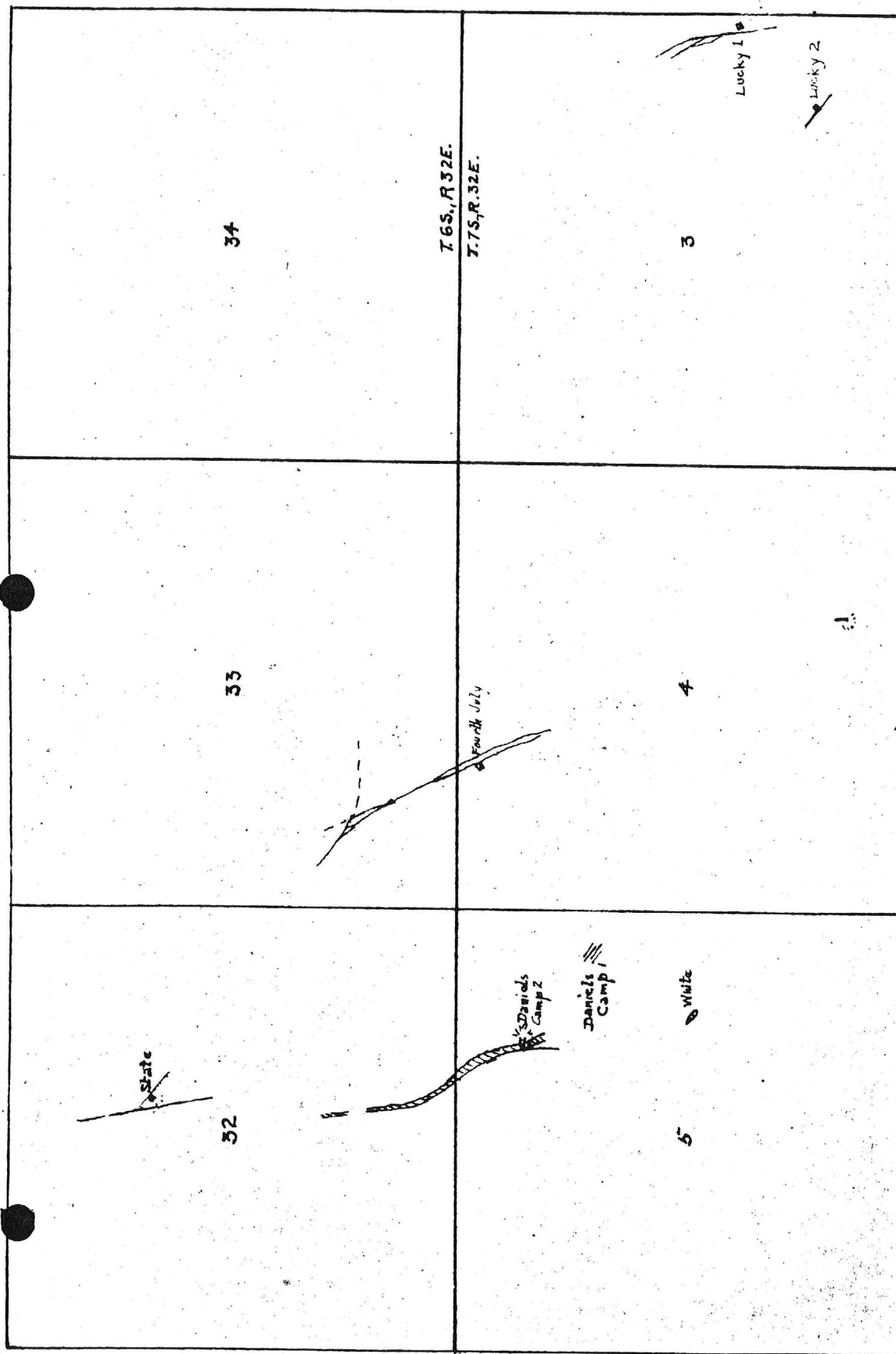
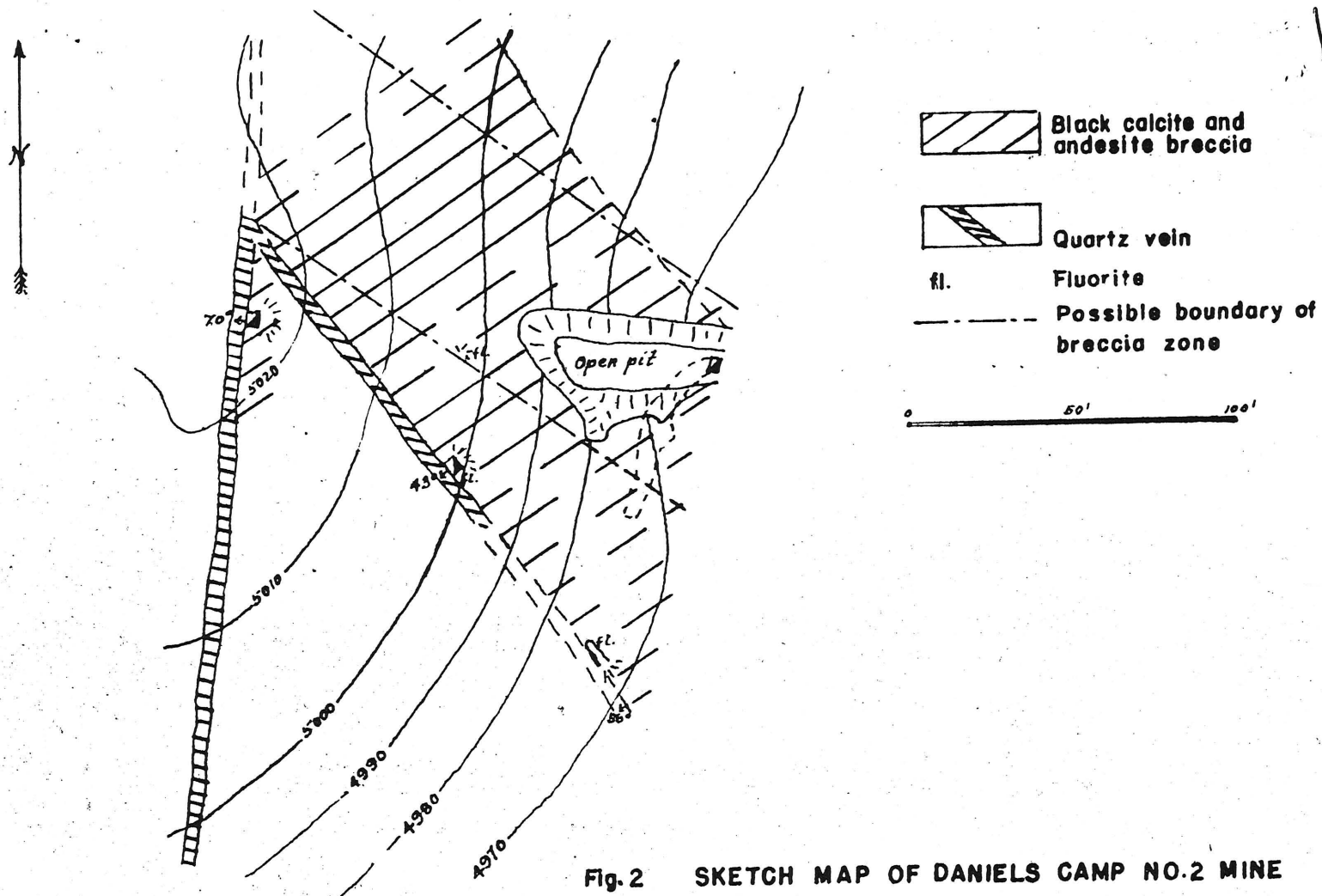


FIG. 1 - SKETCH MAP OF DUNCAN/FLUORSPAR DISTRICT.



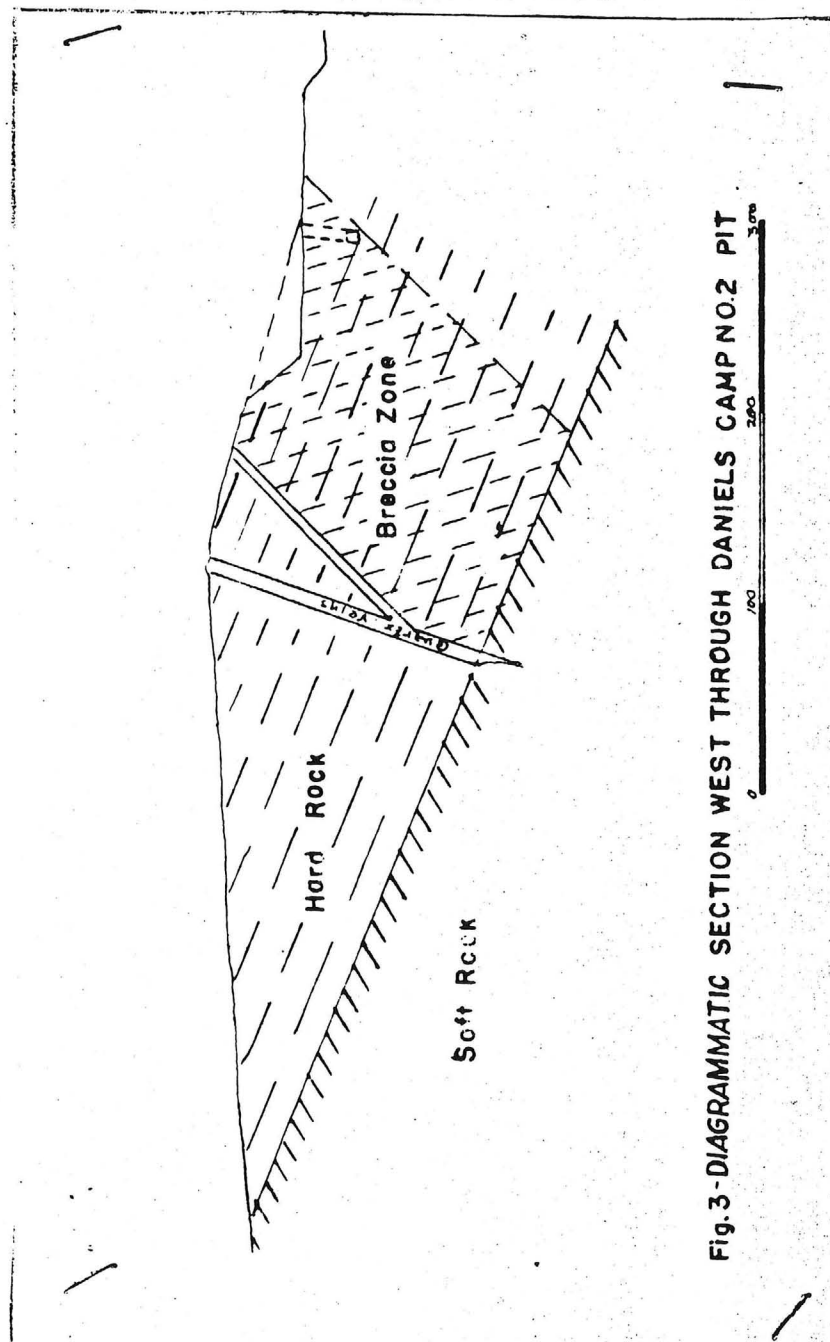


Fig. 3-DIAGRAMMATIC SECTION WEST THROUGH DANIELS CAMP NO. 2 PIT

1 12/1/72 15008 (Sale with Ellis Thompson)
(Duncan)
Joe Knighton - New Mexico Engineering Co.
Box 48, Silver City, N.M.

Telephoned from Silver City for information
regarding Ellis Thompson mines.

Has run out of arrangements and is
looking for place to set mining equipment.
Has four or five compressors, hole drill
steel tracks.

He goes to visit Ellis properties with
the idea of leasing one or more & installing
float-and-sink plant if tests prove it to be
feasible.

Source reports Knighton to be an enthusiast
without mining experience but apparently with
financial backing.

1937 - 610 T

History.

1938 - 1093

Polly Ann & Daniels camp.

Polly Ann - work to down steel plants and to Japan.
Same to flak. nickel. All Ann camp to nickel.

633.45	@ 65	41,164.25
43	69.82	3002.26
48.86	77.90	3806.194
41.34	64.80	2678.832
123.8	70.97	8786.086
48.71	71.73	3493.968

939.26 939.26 62,931.590 (67)

305.71
2926
334.97 @ 71.2
25% SD

633.45	69.82
65	43
316725	20946
380070	27928
41164.25	3002.26
48.86	41.34
77.9	64.8
43974	33072
34202	16536
34202	24804
3806.194	2678.832
123.8	48.71
70.97	71.73
8666	14613
11142	34097
8666	4871
8706.086	34097
	3493.9683

Duncan Fluor space.

1 Fourth of July mine -
Mapping & drilling \$1000 (area)
8 trenches - average length 60', average depth 5'
1/2 bulldozer work, 1/2 shooting.
500 linear feet - \$2,500

200' drifting from shaft - \$5000
3000

South white claim -

200 linear feet trenching - 4' deep.

Bulldozer work & shovel - \$500

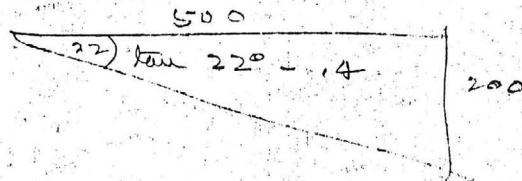
5 pits - 10' deep.

Picking ground & shooting - \$2,500

Additional trenching at points
indicated by mapping to be
favorable

1000 feet trenching - \$5000

1/2 project



• ~~A brass pipe~~

180,000
40,000

Possible mill feed.

7/4 dumps - 250 T - 35%

Forbes dumps - 500 T

Lucky dump - 500 T

Daniel's Camp No. 2 - 20,000 T - 35%

Present dumps

Low grade from other mines 5,000 -

25-30 M.

Cost mill - \$40,000 to \$60,000

Amortization - \$1.35 to \$2.00

Mining & Trucking - 3.00

Grinding - 1.50

per Ton - \$6.50

Recovery 75% - 0.27 tons = \$5.26

/ 3485

1913

1916 - 20

1937 on

1937 - 610 tons from

Polly Ann -

Started low, May, 37

1936 - 40 tons shipped from
Huskey to a steel mill for
steel

Note - Pima Co. production from
Rayore claims by H.A. Gonzales,
shipped to steel plants & iron foundries
on West coast. Quit in Apr. 1942,

REPORT OF MILLS - SOUTHERN DISTRICT (file)

By Axel L. Johnson, Field Engineer

July 24, 1957

✓ ARIZONA EASTERN FLUORSPAR CORP. MILL ✓
(DUNCAN MILL)

GREENLEE COUNTY

✓ FLUORSPAR

NEAR DUNCAN

Arizona Eastern Fluorspar Corp. (company reported to have gone bankrupt, and present ownership of mill not known).

Mill has been idle since June 1, 1954.

MEMO

5/9/58

Not for Publication

Duncan Fluorspar Mill

Inf. Mr. McClaskey

Loc. Near Duncan, Ariz.

Owners Gila Mining & Milling Co., Box 178, Duncan, Ariz. Harold H. R. McClaskey is sole owner of the company.

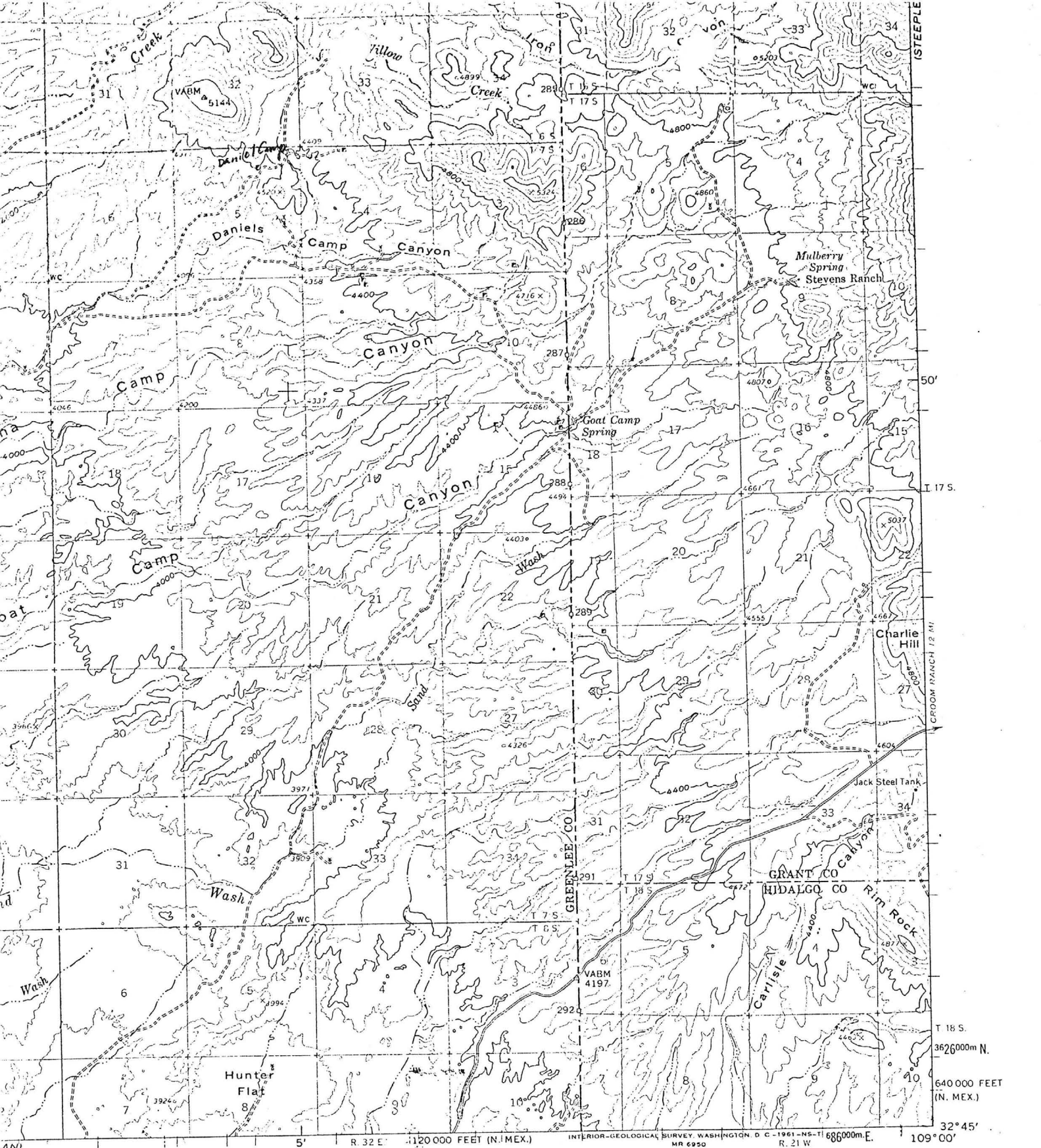
Mr. McClaskey is purchasing the mill from the former owners, Mr. Thirkoff, Los Angeles (major owner), Ben Billingsley, Duncan, Guy Anderson, Safford, and one other. Work to start as soon as the legal paper work is finished.

Owners Ben Billingsley, Duncan, the Mines owner of a number of fluorspar mines and claims in the area 15 miles north of Duncan.

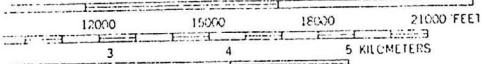
~~Lease~~ Gila Mining & Milling Co. is leasing the Billingsley mines. Among the mines mentioned by Mr. McClaskey, as having been leased from Billingsley are Polly Ann, Daniels Camp, Lucky No. 1, and Lucky No. 2. Mr. McClaskey said however, that the lease included 5 or 6, which means that probably the Fourth of July, Sydney, and Stotts #s 1 and 2 were also included. Company expects to mill acid grade fluorspar.

Custom Milling No custom milling, but will purchase fluorspar from other operators at so much per ton. (No. price schedule established yet.) Prospective sellers are L.H. Foster and C.R. Rhode.
Remarks Visit will be made later with report of same.

AXEL L. JOHNSON



\$2,500





VAL 80 FEET
SEA LEVEL

IAL MAP ACCURACY STANDARDS
TER 25, COLORADO OR WASHINGTON 25, D. C.
AND SYMBOLS IS AVAILABLE ON REQUEST



ROAD CLASSIFICATION

Heavy-duty Light-duty
Medium-duty  Unimproved dirt 

 U.S. Route State Route

YORK VALLEY ARIZ. - N. MEX.
N3245-W10900/15

1959

DUNCAN FLUORSPAR MILL

GREENLEE

Field interview with Ben Billingsley, Duncan, regarding activity at his fluorspar claims on the Arizona-New Mexico border. Also the result of his trying to acquire the Copper Plate Mine in the southern Whetstone Mts.

GW WR 12/20/72

Went to the Greenlee County Courthouse and looked up the recordations of the following claims:

Daniels #1, located 7/14/69, Book 28, Page 630, owned by Mrs. Elizabeth Tea

Daniels #2 " " " " " 631 " " " " "

Fourth of July #1, located 4/22/65, Book 16, Page 569, owned by Ben Billingsley

" " " #2 " " " " " 570 " " " "

Spent 3 hours in the field with the geologists; learned at the recorder's office that Producers Minerals Co. had lease and option to buy the above claims, signed 10/73. Since then they have been paying the claim owners \$600 per month.

Began work on the 3 Luckie claims owned by Circuit Judge Forrest Sanders, Las Cruces, New Mexico. The mineralization at #1 shaft can't be traced more than 50 feet although near the shaft a stope has holed through to the surface. There may be 2 veins about 10 feet apart. No identifiable corners were found. This shaft is 12½ miles NE of Duncan.

Started work on the Luckie #2 shaft which is about ½ mile N50E of #1. Here a large open-cut and stope in places are 8 feet wide. No old corners could be found.

Went back to the Greenlee Recorder's office for information on the Luckie claims:

Luckie #1, Location in Book 4, Page 60

Luckie #1 amended " " 5, " 354

Luckie #2 " " 4, " 60

Luckie #2 amended " " 5, " 355

Luckie #3 " " 4, " 60

Luckie #3 amended " " 5, " 356

above information from GW WR 2/21-25/75

Went on the the 4th of July where 2 roughly parallel veins extend about 200 feet each way from the shaft. Finished the mapping. GW WR 2/28/75

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
FIELD ENGINEERS REPORT

Mine Duncan Fluorspar Mill

Date April 2, 1963

District near Duncan, Greenlee County

Engineer Axel L. Johnson

Subject: Field Engineers Report. Information from Ben Billingsley

References: Report of May 4, 1960 and previous.

Location: Near Duncan, Ariz.

Owners: See report of May 4, 1960.

Lessees: Pacific Fluoride Co., Inc., P.O. Box 208, Duncan, Ariz. - Phone 359-2346
Howard Birchfield, General Manager - address above
Home address: - Amarillo, Texas

Lease is with option to buy the mill at a specified amount. No lease on any of the fluorspar mines has been reported.

Present Activity: Making test runs, milling the ore from an old tailings dump of about 300 tons, reported to run about 30% in CaF_2 . This was started today. For the past 2 weeks, the company has been engaged in making repairs to the milling equipment.

Proposed Plans: According to Mr. Billingsley, the company has, as yet, made no definite commitments to purchase fluorspar ore from any mine operators. They have considered buying it from a party in Deming, N. Mex. and have also considered obtaining it from the Daniels Camp Mine, owned or controlled by Ben Billingsley. Company has also relocated the Lone Star and Eureka mines, formerly owned by L.H. Foster, Duncan.

Duncan Fluorspar Mill closed down.

ALJ Weekly Report 6/10/63

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
FIELD ENGINEERS REPORT

Mine Duncan Fluorspar Mill

Date May 4, 1960

District near Duncan, Greenlee Co.

Engineer Axel L. Johnson

Subject: Present Status. Information from Ben Billingsley.

References: Memo of 5-9-58 - Reports of 10-6-54 & previous.

Location: near Duncan

Owners: (1) C.E. Thiercof
851 South Mansfield,
Los Angeles 36, Calif.

Major owner

(2) Ben F. Billingsley
Box 105
Duncan, Arizona

Lesser interest

(3) Guy Anderson
Safford, Arizona

Small interest

Mill Equipment: Reported to consist principally of:

- (1) 8" x 15" jaw crusher
- (2) Ball Mill
- (3) 2 banks of flotation cells (1 bank of 6 cells and 1 bank of 7 cells)

Terms of Sale: Mill is for sale at \$12,000 cash with more on terms, according to Ben F. Billingsley.

Additional: C. E. Thiercof also owns the Lone Star Fluorspar Mine, near Benson.

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
FIELD ENGINEERS REPORT

Mine Arizona Eastern Fluorspar Corp. Mill

Date May 5, 1954

District Near Duncan -----Greenlee Co.

Engineer Axel L. Johnson

Subject: Report of Milling Operations.

For Location, Owners, Officers, Capitalization, and Number of Men Employed see my report on this property under date of March 3, 1954.

Personnell Changes Mr. Carlton Spalding of Safford, Arizona now employed in the capacity of Mill Superintendent. He started work in this capacity on March 15, 1954.

Mill Capacity Rated capacity is 50 tons per 24 hr. Actual capacity, according to the mill superintendent, Mr. Spalding, is only 38 to 40 tons per 24 hr.

Source of Ore Supply About 200 tons per month or 50 tons per week ---all custom ore, viz:

(1) Spar Mining Co., Ft. Thomas, Ariz. ----- 20 tons per week.

(2) Frank Miranda, Gila, N. Mex. ----- 20 tons per week.

(3) Hazen and Tucker, Silver City, N. Mex.-- 10 tons per week.

(Note: L. H. Foster, who formerly operated 2 fluorspar mines north of Duncan, and who shipped his ores to this mill, temporarily ceased mining operations, and at present is making no ore shipments to the mill)

Present Operations Milling now about 50 tons per week of custom ore, which is only about 25 % of actual mill capacity. The mill is operated intermittently---working for a couple of days, and then being closed down for about a week. Efforts will be made to obtain more custom ores for milling, according to statement by mill superintendent. Company, also, as soon as adequate finances are available, plans on reopening the Lone Star Mine south of Benson, and truck the fluorspar production from this mine to the Duncan mill for milling.

Mill superintendent reports that he has been able to improve the mill recovery to some extent by adjustments of reagents, etc. and that their recovery is now about 70 %.

Difficulties Encountered

(1) The mill, on account of insufficient amount of ore, has to be operated intermittently. This makes for more costly and inefficient operation.

(2) Mill superintendent reports that the water used is too hard and too cold. He states that the water, for best results in fluorspar milling, should be soft, and at a temperature of about 140 deg. F.

(3) Ore bins at the mill are of too small capacity, and not sufficiently sloped. Consequently, this requires a lot of hand shoveling, and extra labor cost.

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
FIELD ENGINEERS REPORT

Mine Arizona Eastern Fluorspar Corp.

Date March 3, 1954

District Twin Peaks District ---Greenlee Co.

Engineer Axel L. Johnson

Subject: Report of Mining and Milling Operations

Location Company operates a fluorspar mill near Duncan. They are currently purchasing custom fluorspar ores and milling them at their Duncan mill. None of the company's fluorspar mines are at present operating.

Owners Arizona Eastern Fluorspar Corporation

Officers Leo A. Deatrick, President,
2425 Florence, Arcadia, California.
(Office Address-- 3850 Santa Fe, Los Angeles, 58, Calif.
Fred H. Haselhorst, Secretary-Treasurer and General Manager
P. O. Box 146, Duncan, Arizona.

Note: Lawrence K. Biffenderfer, who was formerly General Manager of the company was replaced by Fred H. Haselhorst ----effective March 4, 1954.

Capitalization The Arizona Eastern Fluorspar Corp. is capitalized for \$300,000 (300,000 shares at a par value of \$1.00 per share) It is incorporated under the laws of the State of Nevada. Most of the outstanding stock is held by 6 or 7 persons living in Los Angeles, Calif. and immediate vicinity. Most of these men are professional and small business executives of rather moderate means. Their big problem so far, seems to have been to raise enough capital to conduct mining and milling operations. The mining and milling operations, which have been conducted thus far have resulted in a loss rather than a profit to the company. Reports are to the effect that the officers of the company have intentions of making every effort to make their operations a success.

Number of Men Employed 8 men have been employed at the mill. None of their mines are working. The mill has been operating intermittently on account of not getting enough ore to keep it going on a full time basis. One of the reasons that the company has not been able to get enough custom ore is because they have been somewhat tardy in their payments to the custom ore producers.

Source of Ore Supply The company has been purchasing custom ore from L. H. Foster, who operates the Lone Star and Eureka Fluorspar Mines north of Duncan, and from the Spar Mining Co. who operates the Spar Mine north of Ft. Thomas. The maximum capacity of the Lone Star and the Eureka mines is about 7 tons per day^{each} and the maximum capacity of the Spar Mine is about 8 tons per day---total 22 tons per day, but ore receipts have been much less than that recently. The capacity of the mill is reported as being from 50 to 75 tons per 24 hours.

General Remarks Mr. Fred H. Haselhorst will take charge of operations as General Manager, effective March 4, 1954. He is bringing an experienced mill man along with him, who will act in the capacity of Mill Superintendent.

Reports received are to the effect that the recovery at the mill has been very poor ----sometimes as low as 40 %.

It is hoped by everyone interested that the necessary adjustments can be made to the company's mill operations and to their financing -----so that the operations of the company will turn out to be successful in the future.

DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
FIELD ENGINEERS REPORT

Mine Arizona Eastern Fluorspar Corp.

Date July 9, 1953

District Twin Peaks & Whetstone Districts

Engineer Axel L. Johnson

Subject: Report of Mining Operations

Location Company operates mines north of Duncan and south of Benson, and operates a mill near Duncan.

Owners Arizona Eastern Fluorspar Corp.

Officers Lawrence K. Diffenderfer, General Manager, Box 146, Duncan, Ariz.
(Note change of management from last report)

Present status of operations are as follows:

✓ Lone Star Mine (south of Benson)

Mine is just starting up again, after having been closed since Jan. 1st. 4 men will be employed on day shift. Work will consist of driving drift on the 107 ft. level, and also stoping.

✓ Polly Ann Mine (north of Duncan) Owned in Fee by company

Company has a \$13,850 D. M. E. A. exploration loan on this property, but very little work has been done on this exploration loan thus far. Only 12 ft. of shaft sinking has been completed. For some reason, the mine was closed temporarily, and the company asked for and was granted an extension of time to perform the work. The manager, Mr. Diffenderfer reports that they plan on resuming work on this project some time this month. The D. M. E. A. loan calls for 110 ft. of shaft sinking, 200 ft. of drifting, and 90 ft. of raising.

✓ Sydney Mine (north of Duncan)

Not operating at the present time. Repair work on the shaft was suspended late last fall. Company expects to resume work on this mine at some future date not yet determined.

✓ Daniels Mine (north of Duncan) Leased by company

Ore has a high lime content. Company ~~xxx~~ is now conducting metallurgical tests in an endeavor to find a process for removal of the lime. Manager reports that the ore averages 29 % Ca F₂, and this can be raised to 42 % CaF₂ by crushing and screening. It is expected that this can be increased considerably by a chemical process to remove most of the lime in the ore.

✓ Mill at Duncan

This mill has recently been operating intermittently due to trouble with ~~their~~ their dryer. Continuous operation is scheduled to commence in 2 or 3 days. Expect to mill 50 tons of ore per day (3 shifts). 7 men will be employed. The manager reports that they will mill custom ores also, and will buy ore at the following prices:-
(40 % ore --- \$6.00 per ton) --- (50 % ore -- \$8.00 per ton) --- (60 % ore -- \$12.60 per ton)
(70 % ore at \$16.80 per ton) --- (80 % ore at \$20.80 per ton)

1
DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
FIELD ENGINEERS REPORT

Mine Arizona Eastern Fluorspar Corporation Mill Date Oct. 6, 1954.

District Near Duncan ---- Greenlee Co.

Engineer Axel L. Johnson

Subject: Present Status. Information from Carlton Spalding, former mill superintendent.

For Location, Owners, Officers, & Capitalization see my report of March 3, 1954.

Present Status Mill is reported to have closed down about June 1, 1954.

Reasons for closing are reported to be lack of finances, insufficient markets for their product, and milling difficulties, with poor recovery.

At a visit to the mill on Oct. 6, 1954, the field engineer found the mine closed, and on the door of the office building was a Writ of Attachment posted, a demand of \$ 4505.30 for Lawrence K. Diffenderfer, former mill superintendent vs. Arizona Eastern Fluorspar Corp., with all their milling equipment listed with the Writ of Attachment.



DEPARTMENT OF THE INTERIOR

INFORMATION SERVICE

GEOLOGICAL SURVEY

For release MARCH 19, 1947

FLUORSPAR DEPOSITS NEAR DUNCAN, ARIZONA, STUDIED

Director W. E. Wrather of the Geological Survey reported today that a preliminary report on the Fourth of July and Luckie No. 1 and No. 2 fluorspar properties, near Duncan, Greenlee County, Ariz., has been released by the Geological Survey.

The fluorspar is found in basaltic lavas at the Fourth of July property, and in andesite porphyry at the Luckie No. 1 and No. 2 properties. The fluorspar forms lenticular veins and pockets along fault breccia zones and fissures. Quartz, calcite, and colorless or green fluorite are the chief minerals. Secondary coatings and thin stringers of psilomelane are associated with the fluorspar. Large-scale geologic and topographic maps and geologic cross sections of the deposits accompany the report.

The report and accompanying maps on the Fourth of July and Luckie No. 1 and No. 2 fluorspar veins near Duncan, Greenlee County, Ariz., by Robert D. Trace, have been released to the public as Preliminary Maps 3-207, Strategic Minerals Investigations series. Only a limited edition of this report is available. Copies may be obtained from the Director, Geological Survey, Washington 25, D. C., by those who are directly interested.

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20004

U. S. BUREAU OF MINES

MAR 27 1947

DUNCAN DIV., MINING BR

UNITED STATES
DEPARTMENT OF THE INTERIOR
Geological Survey
1947

STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY REPORT
(3-207)

THE FOURTH OF JULY AND LUCKIE NO. 1
AND NO. 2 FLUORSPAR VEINS
GREENLEE COUNTY, ARIZONA.

by
R. D. Trace

*

FOURTH OF JULY VEIN

Introduction

The Fourth of July fluorspar vein is about 20 miles by road north-northeast of Duncan, the nearest railroad station, in the SW $\frac{1}{4}$ sec. 33, T. 6 S., R. 32 E., and the NW $\frac{1}{4}$ sec. 4, T. 7 S., R. 32 E., Greenlee County, Ariz. The property is controlled by the R. T. Ellis Mining Co. of Duncan. The mine is reached from Duncan by following Arizona State Highway No. 75 north for 10.1 miles and a dirt road eastward for about 10 miles (see pl. 1).

Mining on the Fourth of July vein started in January 1937, and continued intermittently until August 1942. Between 1937 and 1941 the mine is reported to have produced approximately 2,600 tons of fluorspar containing 65 percent of CaF_2 and 25 to 30 percent of SiO_2 . The only available mill records indicate that between January 1 and August 18, 1942, a total of 573 tons of fluorspar containing 64 percent of CaF_2 was shipped from claim No. 2.

The nearest fluorspar mill is at Lordsburg, N. Mex., 35 miles by road south-east of Duncan, and about 55 miles from the mine. A mill using the heavy-media separation (sink-float) process is located at Gila, N. Mex., 97 miles east of Duncan, via the Tyrone road.

The Fourth of July claims are in the southern foothills of what are locally called the Mule Creek Mountains. The nearby relief varies from 300 to 400 feet. The drainage system is typical of that of a semiarid climate.

This report summarizes the results of field examinations made by the writer and D. A. Warner in January 1944.

U. S. BUREAU OF MINES
MAR 27 1947
TUCSON DIV., MINING BR.

20008

Geology

The predominant igneous rock of the area is a reddish-brown or greenish-gray olivine basalt of Tertiary or Quaternary age, which is generally porphyritic and in places vesicular (see pl. 2). The vesicles are in many places lined with dusty quartz or calcite. Small veinlets of quartz and calcite as much as one-eighth inch thick are scattered without recognizable pattern through the basalt. A thin section 1/ shows that the ferromagnesian minerals are altered to iron oxide and a carbonate of dolomitic composition. The structure and conspicuous images of olivine crystals indicate that the rock was olivine basalt.

Near the north end of claim No. 1, an undulating contact between two basalt flows is exposed. The upper flow is dark red, and the lower is dark greenish gray. Both flows are slightly vesicular, and the vesicles parallel the curve of the flow contact. Some of the basalt is well jointed in at least two directions, approximately north and east.

A bed of very light gray, fine-grained, rhyolitic tuff dipping about 24° N. crops out in the southwest corner of claim No. 2. A thin section of the rhyolitic tuff shows that it has been devitrified 2/. The presence of chessboard albite suggests that the tuff has been hydrothermally altered.

On the surface, evidence of movement along the faults occupied by the fluor-spar veins is slight. A boulder of slickensided basalt was found near the north end of claim No. 1. Underground, however, the basalt and the veins are considerably brecciated, although positive information about the direction of movement or the amount of displacement is lacking.

Fluorspar deposits

The fluorspar veins contain dense milky and reddish-brown quartz, medium-gray, coarsely crystalline calcite, and colorless and green fluorite, named in order of decreasing abundance. Secondary coatings and thin stringers of psilomelane containing 44.9 percent of manganese and 0.89 percent of tungstic oxide 3/ are also associated with the fluorspar veins.

The fluorspar is chiefly an intimate mixture of dense milky quartz and green, fine- to coarse-grained fluorite. After long exposure to light, the fluorite loses its color. Most of the fluorspar is interlaced with a network of reddish-brown, iron-stained quartz veinlets. Calcite commonly is concentrated near the hanging-wall edge of the vein.

1/ Thin-section study by Glass, J. J., U. S. Geol. Survey, May 1944.

2/ Idem.

3/ Analysis by Fleischer, Michael, U. S. Geol. Survey, June 1944.

The fluorspar is found as lenticular veins and pockets along fault-breccia zones and fissures in basalt. The dips of the veins range between 60° and 80° . Much of the fluorspar is brecciated, indicating post-mineralization movement along the faults. The basalt between the East and West veins is slightly brecciated in places and contains many stringers of quartz.

The distribution of fluorite, quartz, and calcite within the veins is not uniform. Calcite, however, commonly occurs near the hanging wall; this relation is shown in the mine by a rather continuous cavity near the hanging wall, where calcite apparently has been leached from the vein. Commonly the fluorspar-rich part of the vein is a mixture of brecciated quartz and fluorite. Locally, however, definite sequences were noted. A small pit on the surface, for example, contains from west to east: fluorite, calcite, quartz, and calcite. On the 102-foot level, a local sequence from west to east is: quartz, calcite, fluorite, and quartz.

The vein system has a length of at least 2,500 feet, but only small sections are known to contain fluorspar. The width of the fluorspar ranges from less than an inch to approximately 5 feet, and averages 3 to 4 feet in the mine. The surface and underground exposures of fluorspar are shown on plates 2 and 3. At the south end of claim No. 1, a section of the vein about 400 feet along the strike may contain commercial deposits. On the surface, the other veins on claim No. 1 are composed mostly of calcite and quartz. On claim No. 2, a section of the vein about 400 feet along the strike has economic widths of fluorspar, and the underground work has been done in this part of the vein.

The west vein in the Ellis shaft, between the surface and the 57-foot level, dips about 60° W, and this part of the shaft was sunk in fluorspar. Below the 57-foot level, the shaft steepens to 80° or 85° and is mostly in quartz.

The East vein has been mined more than the West vein. A comparison of the fluorspar widths on the 102- and 148-foot levels of the East vein indicates that the fluorspar body possibly is pinching downward. Much fluorspar, however, remains in the mine, particularly between the 57- and 102-foot levels. In the south end of the 102-foot level, the fluorspar vein splits, the wider vein turning gently eastward into the wall. In the north end of this level the vein also splits, one part bearing almost directly north and the other west-northwest. On the 148-foot level in the northwest end of the drift, the vein divides as it did on the level above. The west branch apparently contains more fluorspar.

LUCKIE NO. 1 AND NO. 2 FLUORSPAR VEINS

Introduction

The Luckie No. 1 and No. 2 fluorspar veins of Greenlee County, Ariz., are about $14\frac{1}{2}$ miles by road north-northeast of Duncan and are in secs. 3 and 10, T. 7 S., R. 32 E., about half a mile west of the Arizona-New Mexico State line (see pl. 1). The shortest route to the claims from Duncan, the nearest railhead, is north by way of Arizona State Highway 75 for $2\frac{1}{2}$ miles to a dirt road; then northeast about 12 miles, past the Goat Camp Spring and ranchhouse to the mines.

The claims are held under lease by the Quien Sabe Mining Co. of Lordsburg, N. Mex. According to the present lessee, fluorspar production from the mines started during World War I and has been intermittent ever since. Work was resumed at the No. 2 mine early in 1943 and at the No. 1 mine in September of the same year.

The known shipments from both mines total approximately 2,000 tons of fluorspar containing an average of 65 to 70 percent of CaF_2 . This grade is higher than the actual run-of-mine product and is attained by crushing and screening at the mine. The production records prior to 1942 were lost when the mill of the Indian Metals Co. at Lordsburg, N. Mex., was destroyed by fire. The mill was rebuilt in 1943, and since then 1,160 tons of fluorspar containing 67 percent of CaF_2 has been shipped from the No. 1 mine, and 800 tons of fluorspar containing 68 percent of CaF_2 from the No. 2 mine. This fluorspar mill is of the flotation type and is 35 miles by road southeast of Duncan, Ariz., and $49\frac{1}{2}$ miles from the claims. A fluorspar mill designed for the heavy-media separation (sink-float) process is located at Gila, N. Mex., 97 miles east of Duncan by way of the Tyrone road.

The mines are in the southern foothills of what are locally called the Mule Creek Mountains and are about 2 miles west of Vanderbilt Peak. The surrounding relief varies from 400 to 500 feet.

This report summarizes the result of field examinations made during March 1944 by the writer, J. K. Grunig, and D. A. Warner of the Geological Survey.

Geology

Bed rock is well exposed on the Luckie No. 1 claim, but partly covered on the No. 2 claim. Dark-gray, fine-grained andesite porphyry, with lathlike feldspar phenocrysts 0.1 to 0.2 inch long, is most common. A light-gray to reddish-gray, fine-grained, silicified rhyolite occurs as dike-like masses (see pls. 5 and 6). A thin section of the rhyolite shows quartz grains and ghosts of feldspar phenocrysts in a silicified and sericitized groundmass; the light-colored zones are more highly sericitized.^{4/} These igneous rocks are of Tertiary or possibly Quaternary age.

The complex system of quartz and fluorspar veins is associated with presumably normal faults. Sheeting structure, breccia, and fault gouge are well exposed, particularly underground. Slickensides raking across the dip and pitching about 40° are conspicuous underground in the No. 1 mine, but the amount of displacement along the faults is unknown. The faults range in dip from 35° to 68° , but in most places dip about 60° . In the Luckie No. 1 mine the fault zone has many rolls in the raise between the 71-foot level and the surface. The occurrence of brecciated fluorspar indicates postmineral movement along some of the faults.

^{4/} Thin-section study by Glass, J. J., U. S. Geol. Survey, September 1944.

Fluorspar deposits

The fluorspar deposits are the result of fissure filling, perhaps accompanied by some replacement of andesite porphyry along fault zones. Banded milky quartz is the predominant vein mineral, in places constituting almost the entire vein. Veinlets of drusy quartz are believed to be secondary. Even where the vein has been mined for its fluorite content, 35 to 40 percent of SiO_2 is commonly present. No calcite was found, although vein samples contained an average of 5 percent of CaCO_3 .

Both medium and coarse fluorite occur in veins, either brecciated or as a series of closely spaced veinlets interspersed through the brecciated andesite porphyry and gouge. Most of the fluorite is deep green, although some is blue green; fluorite cropping out at the surface is colorless. Fissure veinlets of fluorite as much as one inch thick are scattered irregularly through the quartz-rich part of the vein. The fluorite in these veinlets commonly occurs as well-developed cubes. The thickness of the veins containing fluorite ranges from less than an inch to 5 feet and averages between 3 and 4 feet.

Limonite in places coats fluorite and quartz. Psilomelane containing tungsten is also common in parts of the veins. Chemical analyses of two samples of psilomelane from the Luckie No. 1 vein showed the following:^{2/}

WO_3	V_2O_5	Mn	BaO^*	SiO_2
1.97	none	47.7	14.74	1.59
1.96	none	47.1	15.75	1.79

* BaO soluble in dilute HCl

The sequence of the vein minerals probably was milky quartz closely followed by fluorite or in part simultaneous with it. The veinlets of well-developed fluorite cubes cutting the milky quartz indicate that at least some of the fluorite was later than most of the quartz. The psilomelane and iron oxides are supergene minerals.

Claim No. 1.—The vein system in claim No. 1 (see pl. 5) is well exposed as low quartz ridges containing pockets of fluorspar. Because fluorspar is less resistant to erosion than quartz, the quartz content of the veins may be over-estimated in the outcrop.

On the surface fluorspar widths in all exposed veins range from less than an inch to 2.3 feet, although they may be greater in the debris-covered bottom of the long trench just west of the Sanders Shaft. Widths of fluorspar underground are as much as 4.5 feet. The entire fault zone is not mineralized, for barren sheeted zones in the andesite porphyry commonly are parallel to margins of the veins.

^{2/} Analyses by Fleischer, Michael, U. S. Geol. Survey, June 1944.

The easternmost vein is the best and perhaps the only commercial deposit of fluorspar in Claim No. 1, but a branch vein about 125 feet northwest of the Sanders shaft may also be of economic value. At the surface, the easternmost vein dips about 50° ; about 20 feet down the raise from the surface the dip flattens to about 35° or 40° and then gradually steepens again, until on the 71-foot level it is about 60° . The widest section of fluorspar is found where the dip of the vein is about 35° or 40° . Neither the north nor south face of the drift on the 71-foot level contains as much fluorspar as the part of the vein near the three stopes. From surface indications, however, it is reasonable to believe that the fluorspar might widen to between 2 and 3 feet farther north along the strike of the vein.

Claim No. 2.—The vein system in the Luckie No. 2 claim is largely covered on the surface, in contrast to that in the No. 1 claim. The location of the vein is obtained only from the glory hole and shaft and by projection from underground workings.

The fault pattern and fluorspar widths are shown on plate 7. The veins, composed of fluorite and quartz, dip generally about 70° N. and have a more uniform dip than those in the Luckie No. 1 claim. The average fluorspar width that had been mined was probably between 3 and 5 feet, but no fluorspar width greater than 3 feet is exposed now. Underground, several veins of varying widths, diverging from the vein system, probably represent local irregularities in a complex fracture system. The vein shown in the underground workings, which strikes northwest from the shaft, however, may be related to another fracture system.

Much of the fluorspar in the mine is obviously later than the faults, since both the fluorspar and quartz surround and cement breccia fragments of andesite porphyry. Slickensides are common but give no evidence of the general direction of movement or amount of displacement along the faults.

DEPARTMENT OF MINERAL RESOURCES

STATE OF ARIZONA
FIELD ENGINEERS REPORT

Mine Duncan Fluorspar Mill

Date June 5, 1963

District near Duncan, Greenlee County

Engineer Axel L. Johnson

Subject: Field Engineers Report. Information from Ben Billingsley

Present Activity: Closed down operations about 2 weeks ago. Owners expect the lease will be terminated soon.

Lessees: Pacific Fluoride Co., Inc., P.O. Box 208, Duncan, Ariz.
Home address - Amarillo, Texas
'Howard Birchfield, Gen. Mgr.
'Donald Wakefield, Asst. Gen. Mgr.

Company reported to be composed of about 20 or more stockholders in Amarillo, Texas.

Review of Recent Operations: An old tailings dump was first run. Later some fluorspar ore from one of the mines recently relocated was run through the mill. An examination of the ore in the crude ore bin and a nearby stockpile reveals the fact that this is very poor ore, mixed with dirt and rock, and should not have been milled without prior screening or upgrading.

About 400 sacks (each 100#) of fluorspar concentrates are stored at the plant. Mr. Billingsley states that this is below grade.

Proposed Plans: Mr. Billingsley reports that the mill is for sale and that the mill consists of the following equipment:

8" x 15" jaw crusher
15 HP electric motor
4 $\frac{1}{2}$ ' x 4 $\frac{1}{2}$ ' ball mill
Double Rake Classifier (Denver)
Agitator - Square 36" x 36"
13 flot. cells - 2 banks - of 6 cells & 7 cells
Thickener tanks
Filter
Dryers - 20 ft. long x 2 $\frac{1}{2}$ ' wide
Sacking equipment
Dust Collectors

The price asked is ~~\$~~\$ 15,000.00 with \$2,000.00 down and the balance at \$600.00 per month at 6% interest.

Duncan Fluorspar Mill - Closed down & entrance barricaded.

ALJ-WR Oct. 9, 1963

Some interest has been shown in the fluorspar deposits north east of Duncan, but no active work to the present time. Ben Billingsley and the company he represent continues some work just across the line in New Mexico, with Duncan serving as headquarters for operations. GWI Quarterly Report 10-1-70

ARIZONA DEPARTMENT OF MINERAL RESOURCES
Mineral Building, Fairgrounds
Phoenix, Arizona

1. Information from: Ben Billinsley
Address: Box 105 Duncan
2. Mine: Polly Ann 3. No. of Claims - Patented 0
Unpatented 3
4. Location: Daniels Camp Canyon Greenlee County
5. Sec 6&7S Range 32E 6. Mining District Twin Peaks (Mayflower)
7. Owner: Ben Billingsley as above.
8. Address: _____
9. Operating Co.: _____
10. Address: _____
11. President: _____ 12. Gen. Mgr.: _____
13. Principal Metals: Fluorite 14. No. Employed: 0
15. Mill, Type & Capacity: _____
16. Present Operations: (a) Down ☐ (b) Assessment work ☒ (c) Exploration ☐
(d) Production ☐ (e) Rate _____ tpd.
17. New Work Planned: _____
18. Misl. Notes: In Sept. ~~1966~~ 1969 the shaft was dewatered so that the mine
could be examined and sampled. (Jack Gillispie and Jim Brooks of CF&I Steel
Corp. did have a look at the mine probably in October or November)
3 claims Polly Ann, Daniels Camp & White.
(Human Resources)

Date: 12-15-69

[Signature]
(Signature)

(Field Engineer)

PACIFIC FLUORIDE COMPANY, INC.

GEN. OFFICE: 14022 HEMPSTEAD RD. • HOUSTON 55, TEXAS • PHONE: HO-2-4553
PLANT: P. O. BOX 208 DUNCAN ARIZONA • PHONE: 366-2846

HOWARD BIRCHFIELD
PRESIDENT

208
August 26, 1963

LONNIE SIMPSON
ORE SALES CONTRACT MANAGER

Mr. Axel Johnson
Arizona State Mining Engineer
School of Mines
Tucson, Arizona

Dear Mr. Johnson:

One of my employees informed me that you were in Duncan to see me a month ago. I am sorry that I did not have the pleasure of meeting you on your trip to Duncan. I have the mill shut down at the present time. I plan to start the mill at its full capacity in the next couple of weeks.

I have made the trade, with Mr. Marcil in California, on the Lone Star Mine located near Benson, in the Whetstone Mining District. Mr. Marcil stated you should have a report in your files as to the blocked out tonnage, and the geology of the deposit. Would you please send me any information that might be valuable on the deposit, or any other information that might be valuable to me on any other deposit in the State of Arizona; as I plan to operate this mill as a custom mill.

In the near future I will forward a buying schedule, that I have published, to buy from the small miners. At the present time, our main source of ore is south of Lordsburg, and the Huckleberry Mine located near Glenwood.

It is my plan to apply for an OME Government Loan in the near future. I will base my application relative to the application which Arizona Eastern filed in behalf of the Lone Star and Polly Ann Mines. I would appreciate any assistance which you could give me along these lines.

Yours very truly,

Howard Birchfield

Howard Birchfield

HB/j

Important veins occur within andesitic to basaltic lavas
 Occur many miles from outcrops of large intrusive bodies,
 but are more or less closely assoc. w/ abund.
 dikes which indicate the presence of stocklike
 bodies beneath

Rhyolite dike

Contain a little tungsten; are 4 mi. from Au veins
 of Steeple Rock district.

Psilomelane containing tungsten, generally under 2% WO_3 ,
 occurs in parts of the Duncan veins.

Limonite is locally present?

3 mi. long x 1 mi. wide in Steeple Rock dist.

16 mi. NE of Duncan

Production 1936-1944 mostly = 6500 T \$124,000
 mostly from 4th of July, Luckie, Polly Ann +
 Daniels Camp mines.

largely went to flotation mills at Lordsburg + Deming
 but some was shipped directly to steel
 plants + for hydrofluoric acid manufacture

Spar ave. 65% CaF_2 + 25-30% Si.

although some ranged up to 93% CaF_2

Western foothill portion of Mule Creek Mtns = porphyritic andesite,
 basalt, + rhyolite tuff, intruded by dikes of
 rhyolite porphyry.

Veins occupy 2 systems of fissures

1. $N10^{\circ}W - N25^{\circ}W$ subparallel to principal rhyolite
 dikes; irregular + branching shear faults.
 - yielded more than half of total district product.
 - 4th of July + Luckie Mtns
2. -

Juc

402.20,008

UNITED STATES BUREAU OF MINES
SUMMARY REPORT OF WAR MINERALS EXAMINATION

State Arizona County Greenlee Mineral Products Fluorspar

Name of property or deposit Duncan Fluorspar District - Akers, White, Fourth of July, Forbis and Curry, Lucky mines

Date examined Nov. 20 - 25 Engineer P. S. Haury Date of this report Nov. 30, 1943

Engineer accompanied/by to some mines Robert T. Ellis Address Duncan, Arizona

Extent of district property approximately 1/2 by 2 miles

Owner See attached sheet Address _____

Leased or optioned to See attached sheet Address _____

Location of property (be specific) secs. 32, 33, T.6 S., R.32 E., and secs. 4, 5, 9 and 10, T.7 S., R.32 E. See attached sketch.

Type of deposit and mineralogy (brief description) Veins containing quartz and chalcedony, black calcite, and crystalline fluorspar and wall rock breccia in tilted andesitic flow rocks intruded by similar rocks.

Known dimensions of the deposit
Length _____ Width _____ Depth _____

Attitude of the deposit (strike, dip, etc.) See attached descriptions of individual mines.

Possible extensions; correlation of known showings _____

Mine workings (brief description or attach map or sketch) (indicate whether accessible) See attached sheets

Mining and milling equipment on property none

(over)

Past production (if any) 5,000 to 6,000 tons

Present rate of production (if any) 25 tons per day from 2 mines

Sampling (describe briefly, or attach sketch) 2 cut samples; 3 samples picked ore; 1 sample of shipping ore.

Bulk sample of fines from waste dump sent to Salt Lake laboratory for rough concentration tests.

Tentative Estimate of Reserves

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

Measurable on dumps	tons	<u>5,000 - 6,000</u>	Grade	<u>25% to 50% CaF₂</u>
Indicated Shipping ore,	tons	<u>23,500</u>	Grade	<u>65% average</u>
Possible milling ore		<u>33,000</u>		<u>30%</u>
Inferred from 2 mines	tons	<u>57,500 - 67,500</u>	Grade	<u>65%</u>
Possible milling ore	tons	<u>50,000 - 91,000</u>	"	<u>30%</u>
Mining method (actual or suggested)		<u>Open cut, and underground</u>		

Milling or processing method (actual or suggested) selected ore now shipped to a flotation mill at Lordsburg, N.M. Erection of 50-ton gravity concentration mill in field suggested.

Processing tests suggested Bulk sample was shipped to laboratory at Salt Lake City for rough concentration tests.

Tentative Class of Report to be submitted (check one)

Class A ; Class B X; Class C ; Memo .

Tentative conclusion and reasons for it Much of the fluorspar in this district is in clear crystals that separate easily from the gangue. The specific gravity differential between the fluorspar and the gangue is 0.4 to 0.5 so coarse gravity concentration probably is feasible. Many of the ore lenses are small and present markets are distant. A small mill in the field and a stock pile at Duncan would permit 100% to 200% increase in production.

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. May be executed in pencil. Should be mailed within 24 hours after examination is completed.

Send copies to: District Engineer; Regional Engineer; Asst. Director, Washington 25, D.C.

Some trenching by the Bureau of Mines of outcrops on the Fourth of July ground is recommended.

Mines and ownership, Duncan Fluorspar District.

<u>Mines</u>	<u>Owner</u>	<u>Address</u>	<u>No. of Claims</u>
Fourth of July	Robert T. Ellis	Duncan, Arizona	4
Akers	J. W. Akers	-	2 or more
White (State)	Wes White	Duncan, Arizona	2
White	do	do	1
Forbis & Curry	Forbis & Curry	-	1 or more
Lucky	Forrest Sanders	Duncan, Arizona	?

<u>Lessees</u>	<u>Mines</u>	<u>Operation</u>
Robert T. Ellis	Akers and 2 White properties	Opencut mine on Akers
D. F. McCabe & Forrest Sanders	Lucky Mine	Mining in Lucky No. 2

General Geology: The area is underlain by andesitic flow rocks with variable physical characteristics. They dip eastward and have apparently been intruded by the same magma that was extruded so that details of structure are hard to unravel. Step faulting with downthrow to the west seems to have occurred through a belt, 10 or more miles long, that strikes north-northwest diagonally across the Arizona-New Mexico boundary. The principal fluorspar deposits, in secs. 32 and 33, T.6 S., R.32 E., and secs. 4, 5, 9 and 10, T.7 S., R.32 E., occur along two nearly north-south faults and a system of fractures that strike N.55°W. Evidence of a major fault farther west, where it is largely covered by terrace deposits, was noted but the time was not available to walk out the exposures in the canyons. The most prevalent fractures are those of the N.55°W. system but the individual faults in this system are generally rather short. The general development of this fracture system suggests that it was induced by nearly horizontal shear

along major faults of the north-northwest system.

Ore Deposition: Most of the ore lenses in the faults of the N.55°W. system are small but good ore bodies were developed along one of these faults in the Forbis and Curry mine. The best showings are along the N.10°W. fault on the Akers ground and along the N.25°W. fault on the Fourth of July ground. Much shearing and brecciation took place along all the fractures in which ore was deposited. Parallel lenses of ore and horses of wall rock were noted at nearly all the mines.

The first vein mineral deposited was quartz, grading into chalcedony. This was followed by black calcite, which frequently includes fragments of the original quartz vein. Fluorspar then was deposited in fissures in the quartz and calcite veins and in the wall rock and probably also replaced some of the gangue rocks. Veins and lenses of clear crystalline fluorspar were deposited at the Ellis workings on the Akers claims, at the two White properties, at the Forbis and Curry mine, and were noted at some of the outcrops on the Fourth of July vein. In many places the gangue was altered in some of the fluorspar lenses to earthy material containing iron and manganese oxides. The manganese oxides were doubtless derived from the black calcite.

Mr. Ellis reported that the fluorspar mined from the Fourth of July contained 8 to 12 percent silica. The ore from the old Akers workings and from the Lucky No. 2 mine is even more siliceous.

The individual ore lenses usually are rather short. However, there appears to be continuous stoping for a length of 450 feet or more at the Forbis and Curry workings but this may have been from 2 or 3 lenses that lay en echelon since there is an offset in the stope. One surface stope at the Fourth of July mine is about 150 feet long.

Changes in the physical character of the host rock caused discontinuity of

ore deposition. Soft, somewhat crumbly rock, that was probably derived from volcanic mud, outcrops in several areas that lie across the courses of some of the veins. This rock was too weak to fracture and the veins fail where the fractures cross these areas.

Evidence of considerable intrusion by the same magma into the flow rocks, both into breccias and into fractures parallel to the later fractures, were noted. No opinion could be formed as to the extent of this intrusion. Geologic mapping is needed to determine, if possible, whether extensive dikes were intruded into some of the fractures in which the veins occur since this will govern at some places the extent of the fracturing in which ore could be deposited.

Description of the Mines:

Akers mine (old workings): On the Akers claims, in the northwest 1/4 of Section 4, fluorspar was mined by several operators at different times from four different lenses that strike N.55°W. and lie somewhat en echelon. The deepest working is 70 feet deep. The width of ore mined varied from 6 inches to a maximum of 6 feet and probably did not average more than 2 feet. The wall rock is hard andesite and the veins were hard. The fluorspar was highly siliceous. Perhaps 500 to 1,000 tons of ore was produced. This mining probably did not pay and it is doubtful if more ore will be mined here.

Ellis workings on Akers claims: Robert T. Ellis is mining from an opencut on the Akers ground, near the line between Sections 4 and 5 and about 1,000 feet northwest of these old workings.

This is along the strong N.10°W. fracture. Some vein disposition occurred across a width of more than 170 feet. An opencut was being advanced westward across the ore zone. This averaged about 12 feet wide at the bottom and 24 feet wide at the top. It was in ore for a length of 50 feet. The depth of ore was 6 feet at the east, or footwall, side and about 16 feet at the face. This ore zone is a

coarse breccia with clear crystalized fluorspar occurring in irregular veins and fillings between blocks of country rock, and in fractured quartz and black calcite and also loose in decomposed gangue. These irregular fluorspar bands very from 2 or 3 inches thick up to a width of 1 foot or more. Much of the fluorspar breaks into lumps from about 2 to 4 inches in diameter down to gravel size and free from gangue. Ellis stated he had shipped 300 tons from this pit that averaged 63 percent CaF_2 . This is about 36 percent of the ground that was excavated. The face was in an irregular vein, 1 to 2 feet wide and some clean fluorspar was being sorted, while the fines contained about 70 percent CaF_2 in gravel sizes. The reject on the waste dump, contains perhaps 30-percent CaF_2 , after sorting out coarse lumps of waste.

The soil had been partly stripped with a bulldozer for a width of 50 feet ahead of the pit, exposing much fluorspar at the outcrop. This part of the ore zone appears richer than the first 50 feet in the opencut, and there is some indication of fluorspar veins parallel to the overlying quartz and calcite vein. Black calcite outcrops for the next 12 feet west and then a vein of quartz, which strikes about $\text{N.}30^\circ\text{W.}$ Two shallow pits in the calcite, under the quartz vein show dips of 40° and 56° west. The calcite carries a little fluorspar. There is a second quartz vein on the hanging wall of the main fissure 60 feet farther west. A 25-foot shaft, under the quartz vein, shows black calcite with very little fluorite. The vein dips 75° west and strikes $\text{N.}10^\circ\text{W.}$ The two quartz veins join farther north.

Good fluorspar was found in shallow pits 75 feet south of the opencut and a pit 50 feet north of the opencut also shows fluorspar.

Figure 2 is a section across the ore zone and veins. The two quartz veins join farther north. A heavy chalcedonic quartz vein, with $\text{N.}10^\circ\text{W.}$ strike, outcrops for 800 to 900 feet farther north. This is underlain by a thick calcite vein. Very little fluorspar was found along this outcrop.

The extreme brecciation in this deposit is probably due to movement on both the north-south fracture and on northwest fractures, which are prominent in a hill about 1,000 feet southeast of this deposit. The outcrops at this deposit are largely masked by overburden so the limits of the fluorspar-bearing breccia cannot be traced. Drawing the end limits along N.55°^{lines}W./defines a near rhombic area of 22,800 square feet at the opencut level, which is believed to be occupied by this breccia (see fig. 3). The floor of the opencut is in good ore and a depth of 25 feet below the opencut, a total average depth of 40 feet, was used for calculating the indicated ore. This block contains 57,000 tons. Assuming that 25 percent of this tonnage instead of the 36 percent obtained from the opencut will be shipping ore, the block will yield 19,000 tons of 65-percent CaF_2 ore. Probably one-half the remaining material, or 28,500 tons, would be 30-percent mill ore. This block could be easily and cheaply mined by opencut methods.

Estimates of inferred ore depend entirely on geologic interpretation. The block of ground may be underlain by soft incompetent rock that outcrops about 500 feet south of the cut. Dip readings of the flow layers in this vicinity vary from 19° east to 26° east. Most were 23° to 26°. If this soft rock underlies the ore zone, then the fractures terminate at an average depth of about 125 feet below the level of the opencut (fig. 4). Assuming that a minimum of 20 feet width of minable veins extends to that depth, then the minable ore below the block of indicated ore would have a volume of $225' \times 20' \times 100' = 450,000$ cubic feet or 37,500 tons of 65-percent ore. Probably 30,000 tons of 30-percent mill ore would be extracted in recovering this shipping ore. This is the minimum estimate for inferred ore. If the block of ore-bearing breccia is underlain by the soft volcanic rock, then it is probable that the entire block of hard rocks overlying the soft volcanics was brecciated and a tonnage on the order of 2.5 times the indicated ore or 47,500 tons of 65-percent ore and 71,000 tons of

30-percent ore can be inferred.

Some evidence was found that the ore-bearing breccia was formed in a block of intrusive rock or in rock that was down-faulted against the footwall andesite. This rock is finer-grained than the latter and has no phenocrysts. Detailed geologic mapping will be necessary to unravel the structure in this area. This was discussed with geologists of the Federal Geological Survey, who are working in the area a few miles east of this district.

The operator should complete crosscutting the ore zone with the large cut that he is driving in the course of 2 or 3 weeks. He proposes then to cut through at this level along the strike and install equipment for mechanized handling. This work will add much to our knowledge of the areal extent of the minable ore-bearing breccia.

Fourth of July mine: This mine is situated near the northeast corner of the northwest quarter of sec. 4, T.7 S., R.32 E., on the N.25°W. ore-bearing fracture that forms the northeast limit of this main fluorspar district. A considerable amount of mining was done. A shaft, with average inclination of about 80° southwest was sunk to a depth of 165 feet, the water level. The shaft is on a small ore lense, 40 feet in the hanging wall. A small amount of ore was stoped from this. Crosscuts were driven at depths of 65, 120, and 165 feet to the main footwall vein.

There is 100 feet of drifting in this vein on the 65-foot level, 100 feet of drifting on the 120-foot level, and 50 feet of drifting on the 165-foot level.

Stoping amounts to 50 feet width and 25 feet height above the 65-foot level, 40 feet width from the 120-foot level to the 65-foot level, and 25 feet width by 25 feet height above the 165-foot level. The width of vein stoped varied from 1 foot to 6 feet where branching veins join. Mr. Ellis reported that 2,000 tons of ore was mined and shipped that averaged 70 percent to 75 percent CaF_2 . The

stope volumes indicate that the amount shipped was nearer 1,000 tons. The 165-foot level was not seen. Ellis reports 6 feet width of ore in the bottom with 9 feet of 50-percent ore at the end of the 50-foot south drift.

Probably 1,000 tons of shipping ore was mined by lessees from surface stopes. One such stope is 150 feet long and 35 feet deep. Stope widths varied from about 1 foot to 5 feet. There is about 2,000 tons of dump material that contains 25 to 50 percent CaF_2 .

Some of the ore was sold to the General Chemical Company mill at Deming, New Mexico, and some to the Indian Metals Company mill at Lordsburg, New Mexico. Ellis reported that the fluorspar from this mine contains 8 to 12 percent silica.

Outcrops: Intermittent outcrops of ore extend for a mile or more along this fracture. The Fourth of July holdings are four claims long, extending 2,250 feet northerly into sec. 33, T.6 S., and nearly 4,000 feet southerly in sec. 4, T.7 S. The outcrop was followed northerly to the intersection with a marked N.55°W. fracture. From about 250 feet north of the shaft to about 750 feet north there are no notable outcrops. The fault line here crosses an outcrop of weak rocks. Good outcrops occur in the next 500 feet. Evidence of several ore lenses in a fault zone 50 to 60 feet wide was noted there and at several outcrops farther north to the junction with the cross fracture. Showings of fluorspar, associated with quartz and black calcite, outcrop. These outcrops can be prospected by surface trenching.

Indicated Ore Reserves: The vein on the 165-foot level is wide. Sinking 100 feet farther and driving 100 feet should develop at least 2,000 tons of 60-percent ore. The drifts on the 65- and 120-foot levels would need to be extended over 100 feet north to prospect the ground under the long surface stope. There is no drifting north of the shaft on the 165-foot level. Extending these drifts north should develop perhaps 2,000 tons of 65-percent ore.

Inferred Ore: Trenching on the northerly outcrops would probably reveal several parallel ore lenses over a considerable strike length. It is believed that an aggregate width of 5 feet of 65-percent ore over an aggregate length of 500 feet could be found. This would yield 20,000 tons down to 100 feet depth.

White Claims on State Land: A small lense of fluorspar was mined near the east quarter corner on Sec. 32, T.6 S. by McCray. Not more than 50 tons of ore was produced. A vein of clear fluorspar, about 6 inches thick was noted in the shallow inclined shaft from which the ore was stoped. This is on the N.55°W fracture, near its intersection with the main N.10°W. fracture. It is doubtful if any important ore bodies will be found on this fracture with the possible exception of its intersection with the Fourth of July fracture where fluorspar outcrops.

South White Claim: Some clear crystalline fluorspar was mined from several shallow shafts on this claim. This is mainly in soft ground which weathers to red clay. Small veins were noted in several shafts but they tend to pinch out downward. These strike N.55°W. and the deposit is in alignment with the strong N.10°W fracture.

Gravel fluorspar seems to have accumulated in the first few feet beneath the surface. This shallow ground could be treated in a log-washer. It is possible that an area 50 to 100 feet wide and 100 to 200 feet long could be mined to a depth of 8 or 10 feet with a bulldozer and log washed.

Forbes and Curry Mine: This mine is situated in sec. 9, T.7 S., near the north quarter corner. It is the only important mine on a N.55°W. fault. The South White claim and the No. 1 Lucky shaft appear to be on the same fault. Three shafts were sunk on the vein, spaced at 180 feet and 150 feet going southeastward.

The ground was stoped for a length of 400 feet or more. The stopes were carried to the surface for fully two hundred feet. The stoping probably followed several lenses en echelon. Fifty feet southeast of the middle shaft the open stope deflects from N.55°W. to N.30°W. and returns to the N.55°W. strike beyond that shaft. A short open stope was mined about 12 feet in the footwall just west of the northwest shaft. The dip of all the stopes is steeply southwest.

The underground work is in poor condition. The timbering was poor and no shaft pillars were left. The walls slab off. Therefore, the shafts were not entered. Ellis, who worked in the mine reported that the lowest level is 185 feet below the surface and that about 2,500 tons of 70-75-percent ore was shipped. He stated that water was encountered at a depth of 140 feet and that 50 gallons per minute was pumped to keep the mine unwatered.

Much clear fluorspar remains on the dumps where the ore was sorted and parts of the dumps contain a considerable amount of fluorspar. The mine dumps aggregate about 15,000 cubic feet. Probably 500 tons of this dump material could be milled if there were a rough concentrating mill in the district.

While it is reported that there is good ore at the bottom level, it is doubtful if the mine will justify the cost of rehabilitating one of the shafts to re-open it.

Lucky Mine: The Lucky mine, situated in the northwest quarter of sec. 10, T.7 S., is owned by Forrest Sanders of Duncan. It is operated by D. F. McCabe and Forrest Sanders. McCabe also operates the Great Eagle Fluorspar mine at Red Rock, New Mexico.

Information was obtained from Mr. Mosely, the mine foreman.

A small stope was mined at the abandoned No. 1 Lucky shaft. This strikes N.55°W. and is roughly in alignment with the Forbis and Curry mine and the South White claim. Also with the Fourth of July vein, Mr. Mosely reported that the shaft is 90 feet deep and that a drift was driven 75 feet southeast at the

65-foot level. A lense of ore above this drift was stoped nearly to the surface. He reported good ore in the shaft down to the 90-foot level where a drift was driven 90 feet southeast and that the ore is 3 to 5 feet wide on this level and averaged 45 to 50 percent CaF_2 between the two levels. Water was encountered at 70 feet depth and now stands at 85 feet. It amounted to 50 gallons per minute while the shaft was being sunk. Later, 3 hours pumping per day, at the rate of 60 to 70 gallons per minute, was sufficient to handle the water.

The present operations are at the No. 2 Lucky shaft, about $1/4$ mile northeast of the No. 1 shaft. The vein there is highly siliceous. It strikes $\text{N. } 10^\circ \text{W.}$ and dips steeply west. Some ore had been stoped from the surface for a length of about 125 feet. The vein was wide there due to branches in the hanging wall, with northwest strike and flatter dip, that join the main vein. In one pillar where a thick branch vein joins the main vein there is 12 feet width of highly siliceous ore. Quartz lenses, with some fluorspar were noted at the outcrop for a width of 60 feet into the hanging wall of the main vein.

The present operations were started in June 1943. An inclined shaft was sunk in the footwall to a depth of 80 feet. The vein is barren where it was crosscut at the bottom of the shaft and the crosscut was continued 50 feet into the hanging wall without encountering more vein matter. A drift was driven 100 feet north and a thin lense of ore was encountered at 60 feet from the shaft. Upward this widened to 5 feet. The stope was inaccessible. Mr. Mosely reported that the ground got so heavy that he had to abandon the stope. A raise farther north was advanced 50 feet above the level. The vein is 5 feet wide in the face of the raise. A sample was cut from 2.5 feet of fluorspar containing granules of quartz to determine the grade of the fluorspar. The remaining 2.5 of breccia with fluorspar was not sampled.

Mr. Mosely reported that seven cars of ore that averaged 67-percent CaF_2 have been shipped to the Indian Metals Company mill at Lordsburg, New Mexico, and one car of 80-percent high grade was shipped.

The indicated ore reserve does not exceed 600 tons. No inferred ore is credited to this mine since a new ore lens must be found to add to the ore reserves and it is doubtful if sufficient profit will be realized from mining the present ore shoot to justify further exploration. The hanging wall is considerably brecciated and ore recovery will probably be poor unless more timber is used than the grade of the ore will justify.

There is a fairly good road to Duncan, 11 miles distant. Trucking to Duncan costs \$1.25 and freight from Duncan to the mill at Lordsburg is \$0.70.

A little ore was being sorted from the dump at the old surface stope. Perhaps 1,000 tons of the dumps could be milled if a local mill were erected. The logical site for such a mill would be about 3 miles by road from this mine.

Marketing: The nearest Metals Reserve Company stockpile is at Gila, New Mexico, where a sink-float mill for treating fluorspar ores is being built. This is 75 miles, by road, from the district with a high mountain pass to cross. The nearest available market is the Indian Metals Company flotation mill, at Lordsburg, New Mexico. The ores from the two producing mines are sold there.

Ellis reported that he receives 14 cents per unit of contained CaF_2 and pays \$2.15 net per ton for trucking to the mill. The distance is 43 miles. Truck and railroad freight charges from the Lucky mine to the mill amount to \$1.95.

Two flotation mills at Deming, New Mexico, 60 miles east of Lordsburg, are treating fluorspar ore. One of these is operated by the General Chemical Company and the other by P. L. Grattan.

The Southwestern Minerals Company flotation mill, at Duncan, treated about 1,500 tons of fluorspar ore from the Great Eagle mine at Red Rock, New Mexico.

The fluorspar from this mine contains a considerable amount of finely divided silica. Mr. Roy E. McKown, the company's agent, reported that the ore was ground to 300-mesh and that acid grade concentrate assaying 98.3 percent CaF_2 and less than 1 percent silica was made. It is reported that the recovery was low. The fine grinding unit is a 5' x 5' Marcy ball mill so the tonnage per day ground to this extreme fineness probably was not great.

The mill has been operating for about a year on lead-zinc ore from the Carlisle mine in New Mexico. Plans are under way to erect a mill at the Carlisle mine and it is expected that the Southwestern mill at Duncan will again be available for treating fluorspar ore about next April.

Stock Pile: Efforts are being made to persuade the Metals Reserve Company to stockpile fluorspar at Duncan. This is on the Lordsburg-Clifton branch of the Southern Pacific railroad, 38 miles from the Southern Pacific main line at Lordsburg.

Road distances from the mines to Duncan vary from 11 miles from the Lucky mine to 17 miles from the Fourth of July mine. The greater part of the ore reserve is 16 to 17 miles by road from Duncan. Ten miles of this distance is on the Duncan-Clifton paved highway. The roads back from the highway go over terrace deposits and washes to the mines. They are maintained by the county. The washes are gravelly but not bouldery and the roads do not require much repair after heavy rains. Truck rates from the mines to Duncan would be about \$1.25. With some improvement of the roads they should be reduced to \$1.00 per ton.

Recommendations

Building of a stockpile at Duncan or in the field would certainly stimulate exploration and mining in this district. It is estimated that daily deliveries would rise to 50 tons of ore, averaging 65-percent CaF_2 , soon after the stockpile was started and would attain 100 tons in the course of 6 months. At 17 cents

per unit, the price paid for fluorspar ore at the Gila, New Mexico stockpile, this ore would be worth \$11.05 at the stockpile. Mining costs would range from \$2.00 to \$8.00. Trucking costs to Duncan would be \$1.25. This leaves a sufficient margin of profit to encourage vigorous development. It is believed that a rough concentrate can be made by gravity concentration methods. If this belief is verified by the concentration tests at the Salt Lake City laboratory, then it is recommended that such a mill be built in the field. This would permit recovery of much fluorspar from lower grade material that is rejected in mining and sorting the 65-percent product. Much of the gravity concentrate would be high-grade metallurgical spar in gravel sizes. The remainder could be treated in flotation mills at Duncan, Lordsburg, and Deming to produce acid grade spar.

Sufficient water is available in three shafts to supply a 50- to 100-ton gravity mill. The cost of erecting a 100-ton mill and supplying water should not exceed \$50,000. A few days' work with a bulldozer would make roads from the mines to the mill. Trucking of the ore to the mill would cost 25 cents per ton. This low-grade ore is a by-product of producing the shipping ore so the mining costs have been charged to the latter. A small profit per ton would probably be realized on 30-percent ore with a \$2.00 to \$2.50 charge for coarse concentration. A very considerable tonnage of fluorspar that now is wasted would be recovered by such a mill.

of
Estimates/available reserves of ore for stockpiling and for milling are set out in the following table:

<u>Mine</u>	<u>Indicated Ore</u>		<u>Mill</u>	
	<u>Tons</u>	<u>Grade</u>	<u>Tons</u>	<u>Grade</u>
Ellis on Akers	19,000	65%	28,500	30%
Fourth of July	4,000	65%	4,000	30%
Lucky	500	65%	500	30%
	23,500		33,000	

Inferred Ore

<u>Mine</u>	<u>Stockpile</u>		<u>Mill</u>	
	<u>Tons</u>	<u>Grade</u>	<u>Tons</u>	<u>Grade</u>
Ellis on Akers	37,500 to 47,500	65%	30,000 to 71,000	30%
Fourth of July	<u>20,000</u>	65%	<u>20,000</u>	30%
	57,500 to 67,500		50,000 to 91,000	

Mill ore on present dumps amounts to 5,000 or 6,000 tons.

Bureau of Mines Exploration:

Surface trenching of outcrops of the Fourth of July claims by the Bureau of Mines is recommended. Four hundred to 500 feet of trenches, 3 to 8 feet deep, will be sufficient. The trenching would require bulldozer work and shooting.

No other outcrops were seen where trenching would be practical.

(Note): This summary report was delayed for office study in order to correlate field notes which was necessary to make intelligent ore estimates. The report was written in unusual detail because ore estimates are based largely on geologic interpretation and the War Minerals Report will be delayed until gravity concentration tests at the Salt Lake City laboratory have been completed.

UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Mines
Technical Service, Reno, Nevada

Reno, December 9, 1943

Sample supplied by: Peter S. Haury
U. S. Bureau of Mines
Box 4097 Univ. Station
Address: Tucson, Arizona

PROJECT: Haury
4th of July Mine, Duncan Fluorspar
District, Arizona

Nature of Ore: Fluorspar

Sample No.	%CaCO ₃	%SiO ₂	%R ₂ O ₃	%CaF ₂
247	0.89	12.88	1.78	84.23
Ackers Claim, Duncan Fluorspar District, Arizona				
248	17.06	12.96	3.72	64.92
249	15.71	2.72	1.60	75.36
250	1.61	0.36	0.70	98.24
Lucky Mine, Duncan Fluorspar District, Arizona				
258	1.46	36.90	1.58	58.39
Single determinations.				
Forbes & Curry Mine, Duncan Fluorspar District, Arizona				
256	1.64	1.42	1.24	93.48

Single determination

A. C. Rice
A. C. Rice

Acting Supervising Engineer

cc Dist. Engr. - J H Hedges
Salt Lake
Files

Date reported 12-21-43

U. S. GOVERNMENT PRINTING OFFICE 16-33553-1

Signed A. E. F.

MAR 28 1944

UNITED STATES
DEPARTMENT OF THE INTERIOR

WESTERN REGION

BUREAU OF MINES

OFFICE OF THE REGIONAL ENGINEER
SALT LAKE CITY, UTAH

March 24, 1944

Mr. J. H. Hedges,
P.O. Box 4097,
University Station,
Tucson, Arizona.

Re: Fluorite Ore from Ellis Mine on
Akers Claim, Duncan, Arizona.

20,008

Dear Mr. Hedges:

The following information and attached data sheets cover testing requested by P. S. Haury on a sample of fluorite ore from waste dump of Ellis Mine, Duncan, Arizona. Object of testing was to determine if a plus 60 percent CaF_2 shipping grade product could be made by a simple plant operation at the mine. Testing, therefore, included screening, jigging of coarse material, tabling, table agglomeration, and flotation of fines.

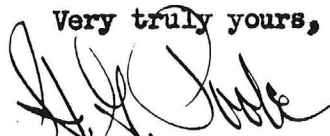
A representative head sample assayed 33.6 percent CaF_2 , 23.2 percent SiO_2 , 20.7 percent CaCO_3 , and 2.7 percent Fe. A large part of the fluorite is present as free particles distributed throughout all sizes. However, an indeterminate amount of iron oxide-calcite middling having a specific gravity approaching that of the pure fluorite particles makes gravity separation difficult in the finer table sizes. Liberation of fluorite was sufficient to obtain good recoveries in the plus 60 percent CaF_2 product desired and, therefore, a crushing or grinding step was unnecessary.

The ore proved amenable to screening, jigging, and tabling for recovery of 79 percent of the fluorite in an 82.9 percent CaF_2 product that probably could be marketed directly as metallurgical grade spar, or 86 percent recovery was obtained in a 73 percent CaF_2 product.

Substitution of table agglomeration and flotation for tabling of minus 10-mesh material gave comparable results. However, the straight gravity flow sheet would be simpler, would not involve a reagent cost, and gives better control of calcite rejection.

No further testing is planned and if additional information is desired, please advise.

Very truly yours,


H. G. Poole.

Enclosure.



U. S. Bureau of Mines

Western Region

Ore Dressing Report

Date Jan. 11, 1944

Ore Ar-23.1. Ellis Class Fluorite Source Ellis Mine, Duncan, Arizona.

State Engineer's Remarks Sample of fines from waste dump. Determine if 60 percent CaF_2 concentrate can be made by washing or gravity concentration methods.

Physical Character Fluorspar in a gangue of quartz, black calcite, andesite, and earthy decomposition products containing iron and manganese oxide.

Chemical Character

Assay, Percent					
<u>CaF_2</u>	<u>SiO_2</u>	<u>CaCO_3</u>	<u>MgO</u>	<u>Al_2O_3</u>	<u>Fe</u>
33.6	23.2	20.7	1.0	6.5	2.70 (Resample - Assay No. 25722)

Treatment Procedures (1) Wet screening, jigging, and gravity table concentration.

(2) Wet screening, jigging, table agglomeration and flotation.

U. S. Bureau of Mines
Western Region
Ore Dressing Report

Date Dec. 23, 1943

Test Number Z-8398

Ore Ar-23.1. Ellis

Class Fluorite

Treatment Ore as received was screened on 3/4-inch and 10-mesh. The plus 10-mesh fractions were jigged and the minus 10-mesh portion was hydraulically sized and tabled. No crushing, grinding, or middling re-treatment employed.

Metallurgical Data

Product	Assay	Grams	%	Assay, Percent			Distribution, %
	No.	Wt.	Wt.	CaF ₂	SiO ₂	CaCO ₃	CaF ₂
<u>Plus 3/4-inch</u>							
Jig Concentrate	28185	227	3.00	96.6	0.8	1.95	8.0
Jig Tailing	28186	886	11.78	7.5	43.6	15.35	2.4
<u>Minus 3/4-Inch+10-Mesh</u>							
Jig Concentrate	28187	1,659	21.92	86.13	1.73	8.26	51.9
	28189						
	28191						
Jig Tailing	28188	2,036	26.89	7.88	36.52	26.07	5.8
	28190						
	28192						
<u>Minus 10-Mesh</u>							
Table Concentrate	25184	748	9.88	71.55	4.0	16.05	19.4
	25193						
Table Middling	25194	622	8.22	30.8	15.5	35.2	7.0
Table Tailing	25195	900	11.89	11.0	28.0	33.4	3.6
Table Slimes	25196	492	6.50	10.85	33.6	22.1	1.9
Calculated Heads		7,570	100.00	36.42	22.5	20.58	100.0
Comb. Concts.	Comp.	2,634	34.80	82.9	2.30	9.9	79.3
Comb. Concts. + Table Middling	Comp.	3,256	43.02	73.0	4.80	14.8	86.3

Remarks Combined concentrates probably would meet both grade and size specifications for metallurgical grade spar. All assays were checked. Discrepancy in calculated head probably due to difficulties in sampling coarse material.

Test Engineer Donald T. Holmes

U. S. Bureau of Mines
Western Region
Ore Dressing Report

Date Dec. 23, 1944

Test Number Z-8398

Ore Ar-23.1. Ellis Class Fluorite

Treatment Wet screen analysis of ore as received.

Metallurgical Data

<u>Product</u>	<u>Assay</u>	<u>Wt.</u>	<u>%</u> <u>Wt.</u>	<u>Assay, Percent</u>			<u>Distribution, Percent</u>		
	<u>No.</u>			<u>CaF₂</u>	<u>SiO₂</u>	<u>CaCO₃</u>	<u>CaF₂</u>	<u>SiO₂</u>	<u>CaCO₃</u>
+3/4-inch	Comp.	1,113.0	14.70	25.7	34.8	12.7	10.6	22.1	9.0
-3/4-inch+ 10-mesh	Comp.	3,695.0	48.83	43.0	20.9	18.1	58.6	44.1	42.7
-10+65-mesh	Comp.	950.0	12.54	18.8	30.9	23.0	6.6	16.7	13.9
-65-mesh	Comp.	<u>1,182.0</u>	<u>23.93</u>	<u>36.4</u>	<u>16.5</u>	<u>30.0</u>	<u>24.2</u>	<u>17.1</u>	<u>34.4</u>
Calculated Head		7,570.0	100.00	35.8	23.1	20.7	100.0	100.0	100.0

Remarks Concentration to 60 percent CaF₂ grade not possible by simple screening methods.

Test Engineer Donald T. Holmes

U. S. Bureau of Mines

Western Region

Ore Dressing Report

Date Dec. 27, 1943

Test Number Z-8401

Ore Ar-23.1. Ellis

Class Fluorite

Treatment Ore as received was wet screened on 3/4-inch, 10- and 65-mesh screens. The plus 10-mesh fractions were treated by jigging; minus 10- plus 65-mesh portion was treated by table agglomeration; minus 65-mesh by flotation.

Reagents, Pounds Per Ton Ore (Table Agglomeration & Flotation)

Na ₂ CO ₃	=	0.30
Oleic acid	=	0.35
Sodium		
silicate	=	0.10

Metallurgical Data

<u>Product</u>	<u>Assay No.</u>	<u>Grams Wt.</u>	<u>% Wt.</u>	<u>Assay, Percent</u>			<u>Distribution, %</u>
				<u>CaF₂</u>	<u>SiO₂</u>	<u>CaCO₃</u>	<u>CaF₂</u>
<u>Plus 3/4-inch</u>							
Jig Concentrate	25185	227.0	3.00	96.6	0.8	1.9	8.1
Jig Tailing	25186	886.0	11.70	7.5	43.6	15.4	2.5
<u>Minus 3/4-inch Plus 10-Mesh</u>							
Jig Concentrate	Comp.	1,659.0	21.93	86.13	1.7	8.3	52.7
Jig Tailing	Comp.	2,036.0	26.90	7.88	36.5	26.1	5.9
<u>Minus 10- plus 65-Mesh</u>							
Table Agglomeration Conct.	25242	296.0	3.91	46.9	1.2	47.7	5.1
Table Agglomeration Midds.	25243	45.0	0.59	20.3	15.2	44.6	0.3
Table Agglomeration Tails.	25244	609.0	8.04	5.15	46.4	9.5	1.2
<u>Minus 65-Mesh</u>							
Flotation Concentrate	25245	1,157.0	15.28	50.0	2.0	40.5	21.3
Flotation Middlings	25246	124.0	1.64	35.4	14.8	28.8	1.6
Flotation Tailings	25247	<u>531.0</u>	<u>7.01</u>	<u>6.85</u>	<u>48.4</u>	<u>6.2</u>	<u>1.3</u>
Calculated Heads	Comp.	7,570.0	100.00	35.84	23.1	20.7	100.0
Combined Concentrates	Comp.	—	44.12	70.9	1.7	22.5	87.2
Combined Concentrates and Middlings	Comp.	3,508.0	46.35	68.9	2.3	23.0	89.1

Remarks All assays were checked. Presence of coarse fluorite makes accurate sampling difficult.

Test Engineer Donald T. Holmes

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

OCT 20 1943

CENTRAL REGION
OFFICE OF THE DISTRICT ENGINEER
FOR NEW MEXICO

SILVER CITY, NEW MEXICO
P. O. BOX 852

October 16, 1943

20,008

Mr. J. H. Hedges, District Engineer
U. S. Bureau of Mines
Box 4097
University Station
Tucson, Arizona

Dear Mr. Hedges:

Enclosed is a letter-report by D. H. Mullen of this office on some fluorspar deposits north of Duncan. We were asked to make an examination of the district and did so under the impression that more of the mines were in New Mexico than now appears to be the case. A small production is being made from two of the properties in Greenlee County, and you may wish to have these examined. Mr. Roy E. McKown, Duncan, will be glad to direct your engineer and assist him in any way possible. Mr. McKown's interest in the matter is based on the possibility that the flotation plant at Duncan, which is now treating ore from the Carlisle mine in the Steeple Rock District, Grant County, may become available next year for treating fluorspar ores. We are interested in this district because at the present time it is tributary to the fluorspar mills at Lordsburg and Deming. I should be very glad to have copies of any reports you may get on the mines in Greenlee County if that is permissible.

Very truly yours,

C. H. Johnson

C. H. JOHNSON,
District Engineer

20008

Silver City, New Mexico
October 13, 1943

Memorandum to C. H. Johnson, District Engineer
From D. H. Mullen, Mining Engineer
Re: Fluorspar area in vicinity of Duncan, Arizona

Accompanied by Roy McKown of Southwestern Minerals Company, I visited several fluorspar occurrences near the New Mexico-Arizona state line on October 9, 1943. These will be referred to as the Ellis operation, the Lucky mine and the Powell prospect.

The Ellis operation and Lucky mine are reached by traveling north from Duncan, Arizona on state highway 75 for 10 miles thence east toward the New Mexico state line. This turnoff can be recognized by a recently constructed cattle guard. The road crosses semi-arid desert land, rolling hills and along sandy washes. At a point 4.5 miles from highway 75 a branch to the southeast goes past the White and Forebush properties to the Lucky mine 4.5 miles from the forks. The Ellis operation is 4.6 miles east of these forks in Sec. 5, T. 7 S., R. 32 E. and Sec. 32, T. 6 S., R. 32 E., all in Greenlee County, Arizona.

Robert Ellis, the operator, owns the 4th of July group, consisting of 4(?) claims, which has been developed by a 165-foot shaft, drifts on the west vein, crosscuts to the east vein and a raise to surface. According to Ellis these two veins are about 40 feet apart, strike north and south, dip 70° west and range in thickness from 7 to 20 feet. The structure in which they occur has been traced for about 3,000 feet. Shipments of metallurgical grade fluorspar have been made from this property for the past 7 years. The property is idle at present because of water at the 165-foot level. I was informed that considerable ore remains.

Ellis is now engaged in prospecting some claims lying 1200 to 1500 feet west of the 4th of July Group. He has leased two claims from J. W. Acres, one which he is now working, has two claims leased from the state in Sec. 32, north of the Acres claims, and has leased an additional claim from Wes White lying to the south of the Acres claims. Present operations consist of stripping overburden across an area about 200 feet wide and driving a small open cut to the west. The ore is crystalline fluorite and appears to be exceptionally pure and free from waste in pieces as large as 6 to 8 inches. The fluorite occurs in pockets and seams in rhyolite porphyry. The deposit was not sufficiently exposed to determine its shape or attitude. According to Ellis, the structure can be traced for 7,000 feet over the claims on state land, the Acres claims and the White claim. Mineralization to the west seems to stop at a north-south siliceous dike. Considerable float is found in the alluvium east of the dike ranging in size from 1/4 to 1 inch in size. The alluvium ranges in depth from 1 to 2 feet, where the present operation is being carried on, to 30 or 40 feet, farther to the north.

The lease Ellis holds on the White property requires that he begin operations by October 15 and he plans to move his small portable compressor to the claim and start trenching by that time. In his estimation the structure he is now exploring on the Acres claim can be traced through the White claim, hence his lease from White.

The Forebush property consists of a shaft 120 feet deep and an open cut 6 to 8 feet wide. It is apparently an extension of the vein system developed on the 4th of July group about 5000 feet to the north. The property is idle and has been for about a year. The ore is reported to have been of good grade.

The Lucky property lies about 2 miles to the south of the Ellis operations and is being developed by D. F. McCabe of Basic Minerals and a party named Saunders. The original Lucky shaft is 120 feet deep, where considerable water was encountered. J. Mosley, in direct charge of the work, reported that the vein, which had been 6 to 8 feet wide, near the surface had decreased to about 2 feet at the bottom of the shaft. The present Lucky mine is about 1500 feet to the east, and consists of an 85-foot inclined shaft and a crosscut to the vein. Previous work on this deposit had been by open cut and the present operation has developed an additional lense to the north. The ore is crystalline, is mined in large pieces which are sorted and crushed for direct shipment as gravel spar. The grade is reported to be about 70 percent CaF_2 . The fines are shipped to the Gratton mill in Deming.

This property is also in Arizona, the New Mexico line being about one and one-half miles to the east.

These deposits appear to be closely associated with siliceous dikes in rhyolite porphyry. The dikes strike due north and south and dip steeply to the west.

The Fred Powell prospect is in Bitter Creek canyon to the northeast of the Ellis operation. It is reached by traveling 11.5 miles north of Duncan on Highway 75 thence 10.5 miles east and north over a poor desert road and through sandy creek beds. The property consists of 4 claims that lie in Sec. 197, T. 16 S., R. 21 W., Grant County, New Mexico.

Development consists of open cuts on opposite sides of the east-west canyon. The deposit is about 3 feet wide and nearly vertical. The ore is fine grained and appears to be intimately mixed with silica. The occurrence is in rhyolite porphyry associated with a north south siliceous dike. The siliceous dikes in this area are very prominent forming wall-like ridges for many thousands of feet.

The property is idle at present, all the work having been done by the owner Fred Powell, who is now employed elsewhere. It is reported that several car-loads of ore were shipped from the property to the General Chemical Co. at Deming, the hand-sorted product averaging from 60 to 70 percent fluorite.

Roads to these properties consist of bulldozer trails built by the Greenlee County road commission. They follow easy slopes and creed beds and are subject to considerable damage from rains. However the road commission maintains them, and the mines are for the most part easily accessible.

The old Mohawk mine lies about four miles beyond the Powell prospect in Bitter creek. This property was operated by L. E. Wemple during the time Southwestern Minerals operated the mill at Duncan and was one of the main sources of supply. The road to this property is now impassable. The mine was not visited. The ore is reported to have been quite siliceous.

The most promising of these properties lie in Arizona and perhaps are not the concern of the New Mexico office, however, the occurrences are of sufficient strength and size to warrant further investigation. The controlling factor seems to be the siliceous dikes and the persistence and uniformity of these dikes over a large area is outstanding.

Further investigation of the Powell prospect appears to be warranted as a source of supply should the Duncan mill resume the concentration of fluorspar. A metallurgical product should not be difficult to produce with reasonable recoveries. The installation of pelletizing equipment and the proximity of the Southern Pacific railroad at Duncan should provide a readily accessible market for the probable 75 tons per day capacity as well as any direct shipping ore that could be sorted during the operation.

It is reported that D. F. McCabe of Basic Minerals has leased the Great Eagle mine at Red Rock in Grant County and he is preparing for active operation. The property was formerly worked as a source of supply for the Duncan mill. The ore is said to be highly siliceous. The production of acid grade was difficult because of the necessity of 200 mesh grinding and low recovery. Lack of time prevented a visit to the property.

cc: Rolla
Mullen

August
July 1944

WAR MINERALS REPORT *

Report of the Bureau of Mines to Secretary of the Interior, Harold L. Ickes

Basic Report No. 8131

DUNCAN FLUORSPAR DISTRICT
Greenlee County, Arizona

- Fluorspar -

Summary

Fluorspar occurs in a belt along the Arizona-New Mexico border 15 to 20 miles long from north to south and several miles wide. The most important mines are in secs. 3, 4, and 5, T.7 S., R.32 E., 10 miles north of Duncan. A little fluorspar was produced during World War I but most of it has been mined since 1936. Total production amounts to about 7,000 tons, mainly from ^{six} 6 mines. The ore bodies at two of these, the Daniels Camp No. 1 and the Lucky No. 2, are too small and erratic to merit further development. A third mine, the Polly Ann, which yielded about 2,500 tons of high-grade fluorspar ore, was mined out to the 185-foot level. Good ore is reported in the bottom but the mine made considerable water and the workings are in poor condition. The cost of reconditioning and unwatering the mine would be high so reopening of the mine is unlikely.

There is some ore developed at three other mines. One is now producing and the other two may be reopened soon.

* The War Minerals Reports of the Bureau of Mines are issued by the United States Department of the Interior to give official expression to the conclusions reached on various investigations relating to domestic minerals. These reports are based upon field work of the Bureau of Mines and upon data made available to the Department from other sources. The primary purpose of these reports is to provide essential information to the war agencies of the United States Government and to assist owners and operators of mining properties in the production of minerals vital to the prosecution of the war.

The fluorspar occurs mainly in lenses associated with strong veins of quartz and black calcite. The country is underlain by andesitic flow rocks some of which are porphyritic. Irregular dikes of rhyolite were intruded in parts of the area.

The veins containing fluorspar occupy fissures in a fairly regular fracture system (fig. 1). Fissures that strike $N.55^{\circ}W.$ are the most prevalent. This system is well developed between strong quartz-calcite veins that occupy fissures which strike northerly — $N.10^{\circ}W.$ to $N.25^{\circ}W.$ These veins are well developed in the hard rocks but fade out where they enter layers of soft rock that probably was consolidated from volcanic ash or mud. Two or three layers of this soft rock were noted.

Intersections or junctions of fractures of the two systems seem to have been favorable to the deposition of fluorspar. At the Lucky No. 1 mine, which is now in production, the widest ore shoots occur at the junctions of northwest trending branch veins with the main vein, which strikes nearly north. The ore bodies are erratic and mining is difficult because the hanging wall is brecciated.

The Fourth of July mine is on two parallel veins that strike $N.25^{\circ}W.$ This was opened by a shaft with three levels. Ore that can be mined from the present openings is estimated at 2,000 tons. Some extension of the underground workings might develop 3,000 to 5,000 tons additional ore. The system of veins outcrops northward to and beyond the intersection with a northwest fissure, 1,600 feet north of the shaft. Some fluorspar was noted at the intersection and in pits at 300 feet north of the shaft. Trenching by the Bureau of Mines at these two places is recommended.

At the Daniels Camp No. 2, the fluorspar is in a breccia and is associated

with black calcite, some quartz, and fragments of andesite. This breccia is at the junction of a zone of fracturing that strikes N.55°W. with a large black calcite vein that strikes N.25°W. locally. It dips west and has a branching quartz vein on its hanging wall.

A large opening was dug in this breccia. Shipments of selected ore amounted to 485 tons that averaged about 65 percent CaF_2 . The reject dump, about 800 tons, averages about 30 percent CaF_2 . The average of the pit was about 40 percent. The work did not define the limits of the fluorite-bearing breccia but indicates that the brecciated block is extensive. A possible area of about 7,000 feet is indicated and a probable depth of 170 feet, or some 100,000 tons that might be low-grade fluorspar ore. Perhaps 25 to 30 percent of this volume may be 60- to 65-percent fluorspar ore that could be recovered by selective mining. Underground exploration by the Bureau of Mines to determine the extent of the mineralized breccia down to a depth of 100 feet is recommended. This would cost about \$7,500.

The fluorspar is very low in silica. A test made at the Bureau of Mines testing laboratory at Salt Lake City on fines from the reject dump showed that about 80 percent of the fluorspar can be recovered as high-grade metallurgical fluorspar by jigging and tabling without grinding. Metallurgical fluorspar is needed at western steel mills and ^{foundries} ~~foundaries~~. If the Bureau of Mines exploration should show that 50,000 tons of 30- to 40-percent fluorspar ore can be developed, then the feasibility of building a 50-ton gravity concentration mill in this district should be investigated.

A little bulldozer trenching by the Bureau of Mines is recommended at the White prospect where there is high-grade crystalline fluorspar in decomposed rhyolite. This fluorspar could be concentrated by screening and washing.

The fluorspar from the Lucky No. 1 and Fourth of July mines is too high in silica to yield a metallurgical product, ^{and} this is sold to flotation mills.

The cost of recommended exploration by the Bureau of Mines is estimated as follows:

Underground work at Daniels Camp No. 2	\$7,500
Trenching on Fourth of July vein	3,000
Trenching at White Prospect	250
Moving equipment in and out	1,500
Total	\$12,250

Introduction

Fluorspar mines and prospects near the Arizona-New Mexico border were first investigated by an engineer^{1/} of the Bureau of Mines on October 9, 1943. The group of mines in Arizona was examined by another engineer^{2/} of the Bureau of Mines on November 20-25, 1943 and March 28, 29, 1944. Four of the mines were mapped by the Federal Geological Survey early in 1944. These maps were studied before this report was prepared.

Location and Accessibility

The principal mines lie in secs. 3, 4, and 5, T.7 S., R.32 E. (fig. 1) about 10 miles north of Duncan and 1 to 3.5 miles west of the Arizona-New Mexico boundary. The mines are reached by driving 10 miles north from Duncan on the paved highway to Clifton and then turning east on a bulldozer-graded road that goes up washes and over gravel terraces to the mines. Distances to the mines from the highway vary from 7 to 10 miles.

^{1/} Kullen, D. E., mining engineer

^{2/} Maury, P. S., mining engineer

Ownership

The principal mines are owned as follows:

<u>Mine</u>	<u>Ownership</u>	<u>Leasee</u>
Lucky	Forrest Saunders	D. F. McCabe
Polly Ann	Mrs. Ferbis	none
Fourth of July	R. T. Ellis et al	—
Daniels Camp 1 & 2	J. W. Akers	R. T. Ellis
White Claim	Wes White	R. T. Ellis

History

A little fluor spar was mined in this district during World War I. More extensive mining was started at the Daniels Camp No. 1 mine in 1936 and at the Polly Ann in 1937. The greater part of the production from the Polly Ann was shipped to domestic steel plants and to Japan.

The Lucky mine was operated in 1936. A test shipment of one carload was made to a steel mill. Most of the production was treated at flotation mills in New Mexico. Development of the Fourth of July mine was begun in 1938. The ore was shipped to flotation mills at Deming and Lordsburg, New Mexico. Underground development of the Lucky No. 1 mine was begun on June 15, 1943. Several hundred tons of ore had been mined earlier from an open cut.

Total production from the district amounts to about 7,000 tons. Production from the principal mines was about as follows:

<u>Mine</u>	<u>Tons</u>	<u>Grade, percent CaF_2</u>
Polly Ann	2,500	70 - 75
Fourth of July	1,000	70
Lucky No. 1	1,000	67
Lucky No. 2	635	68
Daniels Camp No. 2	<u>485</u>	65
	5,620	

Physical Features

The mines are at altitudes of 4,900 to 5,150 feet on the lower western slope of a range of low mountains that trends south along the Arizona-New Mexico

boundary. The crest of this range is in New Mexico. The terrain is considerably dissected. The drainage is into the Gila River about 7 miles west of this area and about 1,000 feet lower. The river filled the valley with conglomerate and sandy clay beds almost up to the western edge of this area at an earlier period. Later uplift increased the stream gradients and the valley fill was eroded into three terraces which have been somewhat dissected by gulches leaving long terraced ridges between the gulches. Roads are easily built up the washes in the gulches and up the ridges.

Geology and Ore Deposits

The country is underlain by andesitic flow rocks some of which are porphyritic. The flow bands dip to the east at angles of 19° to 26° . Two or three layers of softer rock were noted that was probably derived from volcanic ash or sand. Irregular dikes of rhyolite were intruded in parts of the area.

The fluor spar occurs in lenses associated with veins of quartz and black calcite. Some of these veins are large. They fill fractures that fall into two systems. One system of fractures strikes $N.55^{\circ}W.$ These are the most prevalent. The veins at the Polly Ann, Lucky No. 2, Daniels Camp No. 1, and the State land prospect in sec. 32 strike $N.55^{\circ}W.$ Several large veins of quartz and black calcite strike more northerly. The Lucky No. 1 is a large quartz vein that strikes nearly north and dips west. It splits into several branches that turn off to $N.30^{\circ}-40^{\circ}W.$ strikes. The Fourth of July mine is on parallel veins that strike $N.25^{\circ}W.$ and dip steeply west. This system of veins outcrops for a length of nearly 3,000 feet.

The Daniels Camp No. 2 mine is in a breccia on the footwall side of a large quartz-calcite vein that strikes about $N.25^{\circ}W.$ locally. The mineralized breccia is partly in the footwall andesite and partly in a thick black calcite vein that has a branching quartz vein on its hanging wall. The breccia deposit

is at the junction of a system of fractures that strike $N.55^{\circ}W.$ with the large quartz-calcite vein. Another $N.10^{\circ}W.$ vein outcrops 0.75 mile slightly west of north of the mine. A layer of the soft volcanic rock outcrops between the Daniels Camp No. 2 mine and this north vein. Strong fractures were not developed in this soft rock. The veins die out or pinch down to small discontinuous lenses where they enter the soft rock.

Junctions or intersections of the northwest fissures with the strong nearly north-striking veins seem to have been favorable to the deposition of fluorspar. This is shown at the Daniels Camp No. 2 mine. This breccia deposit is in alignment with the series of veins at the Daniels Camp No. 1 that strike $N.55^{\circ}W.$ (fig. 1). The thickest ore shoots in the Lucky No. 1 mine are at the junctions of the northwest branch veins with the main vein. The White prospect is in a rhyolite dike that strikes about $N.25^{\circ}W.$ The fluorspar occurs in small veins where the rhyolite is intersected by one of the fissure zones that strike $N.55^{\circ}W.$ A fair outcrop of fluorspar was noted at the intersections of the Fourth of July vein with a northwest-striking fracture, 1,600 feet north of the Fourth of July shaft.

Two types of fluorspar are found. At the Polly Ann mine, the Daniels Camp No. 2, the White prospect, and the small prospect on State land in sec. 32, T.6 N., R.32 E., the fluorspar is crystalline and contains little silica. Fluorspar picked from the dumps at the Polly Ann mine and at the White prospect assayed 93.48 percent CaF_2 and 1.42 percent silica. Large selected crystals from the Daniels Camp No. 2 open pit assayed 98.84 percent CaF_2 and 0.36 percent silica.

The fluorspar from the Fourth of July mine contains considerable silica. That from the Daniels Camp No. 1 and the Lucky mines is very siliceous.

The siliceous fluorspar will not yield a metallurgical grade by selective mining and sorting. Fine grinding and flotation are needed to reduce the silica

content. All this ore is sold to the flotation mill at Lordsburg, New Mexico.

Description of the Mines

Lucky No. 1. This mine is near the east quarter corner of sec. 3, T.7 S., R.32 E. It is operated by D. F. McCabe who operates the Mammoth fluor-spar mine in New Mexico also.

The mine is on a large quartz vein that intersects both the andesite and irregular rhyolite dikes. This vein strikes nearly north and dips about 60° west. To the north it splits into several branches that strike $N.30^{\circ}-40^{\circ}W$. The first ore was mined from an opensut 150 feet long and about 12 feet deep. This was mined to widths of 5 to 8 feet. At the junction with a hanging wall branch vein the width was 12 feet. An inclined shaft was sunk in the footwall in 1943; a crosscut was driven through the vein at 70 feet depth and a level driven north on the vein. At 140 feet north this has a vertical depth of about 120 feet.

The vein is much broken on the level. The fluor-spar there is in small bunches and rather low grade. Above the level the ore shoots are wider and of better grade. The ore is difficult to mine. The hanging wall has a casing of gouge that is inclined to slab off in openings 8 to 10 feet high. The hanging wall behind this gouge is brecciated. The first stope was lost through caving about 45 feet above the level. A raise of 100 feet north was up 50 feet in October 1943. The vein was 5 feet wide at the top of the stope. A 30-inch sample of the best part of the vein assayed 58.39 percent CaF_2 and 36.9 percent silica. The remainder was much more siliceous. This raise had been driven through to the opensut and stoped to widths of 10 to 20 feet when the mine was visited in March 1944. The mine foreman reported that toward the surface the ore was more than 12 feet wide. This is near a branch in the vein. A stope had been started at 120 to 160 feet north. The back was in 3 to 5 feet of about 60-percent ore.

Production in 1943 amounted to 633.5 tons, containing 54.61 to 75.40 percent CaF_2 and 42.41 to 19.64 percent silica. The average grade was about 65 percent CaF_2 . Shipments in January 1944 totaled 432 tons that averaged 71.2 percent CaF_2 and about 25 percent silica. The ore is sold to the Indian Metals Company mill at Lordsburg, New Mexico. The price is 14 cents per unit of CaF_2 . It is trucked 20 miles from the mine to Fox on the Morenci branch of the Southern Pacific railroad.

Lucky No. 2. The Lucky No. 2 mine is about 1/4 mile southwest of the Lucky No. 1. This is on a vein that strikes N.55°W. and dips northeast.

An inclined shaft was sunk to a depth of 90 feet. Ore was stoped on the 64-foot level for a maximum length of 90 feet and 40 feet height; also from an openst above this stope. The vein is thin and low grade on the 90-foot level. The production amounted to 635.6 tons, averaging 68.35 percent CaF_2 . This ore is siliceous. All but one carload was sold to flotation mills in New Mexico. A test shipment of 40 tons of selected ore was made to a steel mill. The mine foreman reported that water was encountered at about 70 feet depth. After 30 days pumping this declined to 8 or 10 gallons per minute.

The showings at this mine do not justify work by the Bureau of Mines.

Polly Ann mine. This mine is near the south quarter corner of sec. 4, T.7 S., R.32 E. It is now owned by Mrs. Forbis, the widow of one of the former operators. The mine is on a vein that strikes N.55°W. and dips steeply southwest.

Development was started by Curry and Forbis in May 1937. Production to December 1938, amounted to 1,700 tons. R. T. Ellis reported that the total production was about 2,500 tons. Most of the ore was sold to steel plants and iron foundries. The mine was worked through three shafts spaced 150 feet apart. The vein was stoped to the surface for a length of more than 150 feet. Offsets in the open stope suggest that two or three lenses lying on echelon were mined. No shaft pillars were left and the underground workings are in bad condition.

R. T. Ellis, who worked in the mine, reported that it was mined to a depth of 185 feet and that there is good ore in the bottom. Water was encountered at 140 feet depth. It is reported that the mine made 50 gallons of water per minute. The mine dumps contain about 1,700 tons. There is considerable clear, crystalline fluor spar on the dumps where the ore was screened and sorted. This spar is low in silica. Perhaps one-third or one-half of the dumps contain enough fluor spar to repay treatment in a gravity concentrating mill. It is unlikely that this mine will be reopened, because of the high cost of reconditioning the mine and keeping it unwatered. The outcrops were well prospected and work by the Bureau of Mines is not recommended.

Fourth of July mine. This mine is near the north quarter corner of sec. 4. It is on a system of quartz-calcite veins that strikes N.25° E. and dips steeply west. These veins were mapped by the Federal Geological Survey for a length of 2,500 feet. The mine is owned by R. T. Ellis and associates. Ellis started development in 1938. An inclined shaft was sunk to 148 feet depth where a little water was encountered. This was on a west branch of the vein. The east branch, 40 feet in the footwall of the shaft is the stronger vein. Crosscuts to the east vein and drifts were driven at the 48-, 102-, and 148-foot levels. Some stoping was done on all the levels. A short stope was carried from the 102-foot level to the surface. Some ore was also mined from two open stopes on the east vein, one 60 and the other 70 feet long. The 102-foot level was driven 75 feet north under the south open stope. An advance of 150 feet would take this level well under the north open stope.

About 1,000 tons of ore was shipped from the mine to a flotation mill at Deming, New Mexico. Ellis reported that this ore averaged 70 to 72 percent CaF_2 and 8 to 12 percent silica. A sample, cut across 32 inches from a pillar on the 48-foot level, assayed 84.23 percent CaF_2 and 12.86 percent SiO_2 . Indicated ore in the developed part of the mine is estimated at 1,000 tons, and

inferred ore at 1,000 tons additional. Drifting northward and sinking are justified, also a little crosscutting to prospect the west vein farther. This might develop 3,000 to 5,000 tons additional ore. The owners were negotiating to finance the reopening of the mine in April 1944.

A little fluorspar was seen in small open cuts on the vein 800 feet north of the mine and at outcrops 1,600 feet north. The vein intersects a fracture that strikes N.55°W. at the farther place and several branching veins were formed there. This is about 0.75 mile S.55°E. of a small prospect on State land in sec. 32, T.6 S., R.32 E. (fig. 1).

Some trenching by the Bureau of Mines at the two places noted, 800 and 1,600 feet north of the shaft is recommended. Ten to twelve trenches, ranging in length from 50 to 150 feet are suggested. The total work would be about 1,000 linear feet of trenches at an estimated cost of \$3,000.

State Land Prospect. A small lens of crystalline fluorspar was mined on State land in sec. 32, T.6 S., R.32 E. The recovery probably was not over 25 tons. This was in a fracture that strikes N.55°W. This was mined for a length of about 20 feet and to about 12 feet depth. The vein was only a few inches thick at the ends and in the bottom of the stopes. No work at this place is recommended.

Daniels Camp No. 1. This is in the NE 1/4 of sec. 5, T.7 S., R.32 E. Several thin quartz-fluorspar veins that strike N.55°W. occur. Some ore was mined from open stopes on three veins. The largest is about 70 feet long and 50 feet deep. The country rock is hard andesite porphyry and the veins are narrow and hard. The fluorspar is very siliceous. Work at this place is not recommended.

Daniels Camp No. 2. This is in the NE 1/4 of sec. 5. The claim is owned by J. W. Akers and is leased to R. T. Ellis. Ellis opened the mine in 1923. The fluorspar, associated with quartz and black calcite, occurs in brecciated andesite. This breccia is on the footwall of a thick vein of black calcite,

partly in the calcite vein and partly in the footwall andesite. The calcite vein has a strong branching quartz vein on its hanging wall. It strikes about N.25°E. locally and dips about 50° west. This highly brecciated area appears to be localized at the junction of a system of fractures that strike N.55°W. with the thick quartz-calcite vein. The group of parallel northwest veins at the Daniels Camp No. 1 is about 1/4 mile southeast of this mine (fig. 1). The opencut starts about 110 feet east of the east branch of the quartz vein and was driven 65 feet west. It is 10 to 14 feet wide at the bottom and 15 to 40 feet wide at the top. The face is 25 feet high (fig. 2). About 1,300 tons of rock was excavated. Ellis reported that 485 tons, that averaged 65 percent CaF_2 , was shipped, the most of it to the Indian Metals Company mill at Lordsburg, New Mexico. There is about 800 tons of material, containing about 30 percent CaF_2 on the dump. The average grade of the pit was about 40 percent CaF_2 .

A small shaft was sunk at the east end of the opencut to 28 feet depth. A drift at the bottom was turned to the left and advanced 42 feet S.15°W. This is in about 35-percent ore for the first 30 feet. There it goes through fault gouge into nearly barren country rock. The fault strikes northwest.

Some fluor spar in black calcite was seen in a small pit 50 feet north of the ^{opencut} ~~open cut~~. Good clear fluor spar was dug from shallow cuts south of the pit. Some fluor spar in black calcite shows in small pits at the footwall of the east branch of the quartz vein for a length of 100 feet or more. There may be a good fluor spar vein on the footwall of the quartz vein.

The indicated area of the breccia is about 7,000 feet. This ground may be thoroughly brecciated to a depth of 200 feet. Soft volcanic rock outcrops about 500 feet south of the pit. The dip is 20 to 25° east. The outcrops show that this layer of soft rock is extensive. It probably dips under the pit and should be about 200 feet below the bottom of the pit (fig. 3). Fracturing is

weak in this soft rock and it is unlikely that the breccia extends down into it. However, because this soft rock yields readily, it is probable that strong stress was applied to the hard overlying andesite and that this is brecciated down to the soft rock or about 170 feet depth.

The volume of brecciated rock may be on the order of 1,200,000 cubic feet or perhaps 100,000 tons. If one-fourth of this tonnage is a good grade of fluorspar ore then some 25,000 tons of 60- to 65-percent fluorspar ore could be recovered by selective mining and sorting. The ratio in the open pit was 37 percent of 65-percent ore.

The fluorspar at this mine is very low in silica. A grab sample of sorted ore from the pit assayed 75.36 percent CaF_2 and 2.72 percent SiO_2 . Large selected crystals assayed 98.84 percent CaF_2 and 0.36 percent SiO_2 .

This deposit merits some exploration by the Bureau of Mines. Sufficient work to explore the breccia deposit to a depth of 100 feet is recommended. This would require 100 feet of sinking, about 100 feet of crosscutting to the quartz vein on the hanging wall of the breccia, and about 100 feet of drifting transverse to the crosscut. This would explore a block of ground that may contain some 40,000 tons of low-grade fluorspar ore from which 10,000 to 12,000 tons of 60- to 65-percent ore might be recovered by selective mining and sorting. The cost of the work is estimated as follows:

Sinking, 100 feet at \$50	\$5,000
Crosscutting and drifting at \$12	2,400
Total	\$7,400

White Prospect. This is in the east part of sec. 5, about $3/8$ mile south of the Daniels Camp No. 2 and about $3/4$ mile $N.55^\circ W.$ of the Pelly Ann mine. It is in a rhyolite intrusion that strikes about $N.25^\circ W.$ The surface is weathered to red sandy clay. A small amount of fluorspar was recovered by screening material from several small pits. Two small veins that strike northwest were seen in the

pits. The fluorspar is crystalline and clear. There seems to be some concentration of fluorspar crystals in the first 3 or 4 feet beneath the surface over an area about 50 by 100 feet. This material could be concentrated by screening and washing.

A little bulldozer trenching by the Bureau of Mines to determine if there is sufficient fluorspar at this place to justify mining it is recommended. This work would cost about \$250.00.

Willing Tests. A sample of fines from the Daniels Camp No. 2 reject dump was sent to the Bureau of Mines testing laboratory at Salt Lake City for gravity concentration tests. This assayed as follows:

Percent					
<u>CaF₂</u>	<u>SiO₂</u>	<u>CaCO₃</u>	<u>MgO</u>	<u>Al₂O₃</u>	<u>Fe</u>
33.6	23.2	20.7	1.0	6.5	2.7

The sample was screened on 3/4-inch and 10-mesh. The plus 10-mesh fractions were jigged and the minus 10-mesh portion was hydraulically sized and tailed. No crushing, grinding, or middling retreatment was employed.

A commercial product could not be made by screening alone. The best screen product was the minus 3/4-inch plus 10-mesh size, which was 48.83 percent of the whole sample and assayed 45.0 percent CaF₂ and 20.9 percent silica. It contained 58.6 percent of the total CaF₂.

The concentrates were as follows:

<u>Product</u>	<u>Weight</u>	<u>Percent</u>			<u>Percent of total CaF₂</u>
		<u>CaF₂</u>	<u>SiO₂</u>	<u>CaCO₃</u>	
Plus 3/4" jig conc.	3.00	96.6	0.80	1.95	8.0
Minus 3/4" plus 10m jig conc.	21.92	86.13	1.73	8.26	51.9
Minus 10m table conc.	9.88	71.55	4.0	16.05	19.4
Table middling	8.22	30.8	15.5	35.2	7.0
Combined concentrates	34.80	82.9	2.3	9.9	79.3
Combined conc. and middling	42.02	73.0	4.8	14.8	86.3

Almost 80 percent of the fluor spar was recovered in a high-grade metallurgical product that contained 82.9 percent CaF_2 and 2.3 percent SiO_2 or 77.15 percent effective CaF_2 . The ratio of concentration was 3.19:1. Development of reserves of metallurgical fluor spar for western steel mills and iron foundries is desired. The fluor spar at the Polly Ann and Daniels Camp No. 2 mines is of this grade if it is not diluted with waste. A small amount might be recovered from the White prospect. It is unlikely that the Polly Ann mine will be reopened. The Daniels Camp No. 2 is the only prospective source of any considerable tonnage of low-silica fluor spar. Careful sorting was required to raise the grade of ore from the open pit above 70 percent CaF_2 and the recovery of such material was small. A fair recovery of 60- to 65-percent CaF_2 ore can be made by selective mining and a little sorting. This, like the high-silica fluor spar, is shipped to flotation mills.

A gravity concentrating mill would be needed to produce a considerable tonnage of metallurgical fluor spar. The metallurgical tests indicate that such a mill would recover about 80 percent of the contained fluor spar from ore down to 30-percent CaF_2 in a concentrate containing about 77 percent effective CaF_2 . Such a mill with the necessary water supply would cost about \$50,000. An ore reserve of 40,000 to 50,000 tons would need to be assured before such a mill could be considered.

The cost per ton of mining and milling 50,000 tons of ore would be about as follows:

Mining and transporting to mill	\$2.50
Amortisation of mill	1.00
Milling	1.25
Trucking concentrate to railroad	<u>.50</u>
Total	\$5.25

At 28 cents per unit effective CaF_2 , the concentrate would be worth \$21.56 f.o.b. cars Duncan. The ratio of concentration would be about $82.9/30 \times .80 = 3.45$. The return per ton of ore containing 30 percent CaF_2 would be about $\$21.56/3.45 = \6.25 . On 40-percent ore the ratio of concentration would be about 2.59 and the return per ton of ore \$8.32. A profit of \$1.00 to \$3.07 per ton of ore is indicated. The total indicated recovery from 50,000 tons of 30-percent ore would be nearly 14,500 tons of metallurgical fluorspar containing 77 percent effective CaF_2 and 19,300 tons from 50,000 tons of 40-percent ore.

Conclusion

The Lucky No. 1 mine probably contains a considerable amount of high silica fluorspar ore that is sold to the Indian Metals Company flotation mill at Lordsburg. However, the distribution is erratic and mining is difficult because of a bad hanging wall. Long continued operation of the mine at a profit is doubtful.

Indicated and inferred ore that could be mined from the present openings in the Fourth of July mine are estimated at 2,000 tons. Drifting northward and sinking and a little crosscutting might develop 3,000 to 5,000 tons of additional ore. This mine may be reopened. Trenching by the Bureau of Mines at the outcrops of two sections of the Fourth of July vein, north of the shaft, is recommended. The open-pit mining done at the Daniels Camp No. 2 does not define any of the limits of this breccia deposit but indicates that it may be extensive. Underground exploration by the Bureau of Mines, at an estimated cost of about \$7,500, to define the limits of this fluorite-bearing breccia at a depth of 100 feet seems justified and is recommended. Possible ore-bearing ground may be 40,000 to 50,000 tons.

High-grade metallurgical fluorspar can be recovered from this ore by concentration. If the exploration should indicate a reserve of 40,000 to 50,000

tons of 30- to 40-percent ore, then the feasibility of erecting a 50-ton gravity concentration mill should be investigated. A little bulldozer trenching at the White prospect, where metallurgical fluor spar could be recovered by screening and washing, is recommended.

The estimated cost of the recommended exploration is as follows:

Underground work at Daniels Camp No. 2	\$7,500
Trenching on Fourth of July vein	3,000
Trenching on White prospect	250
Moving equipment in and out	<u>1,500</u>
Total	\$12,250

Duncan Fluorspar District
Greenlee County, Arizona

Sources of Information

Information was obtained by field examinations by P. S. Maury

Minerals Yearbook, 1937-40

Maps of Lucky Nos. 1 and 2, Fourth of July, and Daniels Camp
No. 2 mines by Federal Geological Survey.

MINING DIVISION

REGION IV

Memorandum

October 23, 1953

To : Walter A. Storms, Chief, Mining Methods Br., Mining Div.,
Region IV, Tucson, Ariz.

From : William R. Hardwick, Mining Engineer, Tucson, Ariz.

Subject : Completion Report, Docket DMEA-2528, Contract Idm-L411,
Fluorspar Producers Corp.'s Polly Anne Fluorspar mine,
Greenlee County, Ariz.

The small amount of exploration actually completed on this project has developed no significant facts that will change the conclusions and recommendations as expressed by the original examining engineer and geologist. This memorandum is intended to serve as a final completion report for the project.

Fluorspar Producers Corp., a Nevada corporation (now completely reorganized as Arizona Eastern Fluorspar Corp., Post Office Box 146, Duncan, Ariz.), acquired the Polly Anne Mine near Duncan, Ariz., and applied to the Defense Minerals Exploration Administration for assistance to do exploration work estimated to cost \$36,000.00. The mine was examined on June 10, 1952 by a Bureau of Mines engineer and a geologist from the Geological Survey, who estimated that 3,000 tons of metallurgical grade fluorspar might be discovered. A contract was approved on September 19, 1952 by the Executive Officer, DMEA Field Team, Region IV, and the Fluorspar Producers Corp., which provided that the Government would participate to the extent of 50 percent in the following work:

Sink shaft 100 feet (estimated cost, \$60.00/ft.)	\$6,600.00
Drift 200 feet (estimated cost, \$25.00/ft.)	5,000.00
Raise 90 feet (estimated cost, \$25.00/ft.)	2,250.00
Total estimated cost	\$13,850.00
Government's part at 50 percent	\$6,925.00

Work on the contract was actually started on December 12, 1952, and on February 1, 1953 the shaft had been sunk 8 feet. In February, an additional 4 feet was completed, making a total of 12 feet. At that point all work on the project was suspended and the operator requested a 90 day recess which was granted. At the end of this recess period, work on the project had not been resumed and a second recess was approved with the stipulation that, if work on the contract was not resumed by September 15, 1953, the contract was to be automatically terminated by agreement. No work had been accomplished by September 15, 1953 so the contract was terminated.

CC W. A. King (Orig. & 6)

DMEA-2528

DF

WRStorms:frj

Fluorspar Producers Corp. (or Arizona Eastern Fluorspar Corp., as the company now is called) is operating the Lone Star Fluorspar mine near Benson, Ariz. and has done some development work on another prospect, the Daniels Camp mine, about one mile north of the Polly Anne mine. The company also has another mine, the Fourth of July prospect, under option and is buying custom ore in the district. It also has constructed a small beneficiation plant at Duncan, Ariz. It is the opinion of the undersigned that the production of the Lone Star Mine, together with available custom ore, will be adequate to supply the mill and that the operator is not interested in tying up additional capital in exploration work at this time.

A total of 12 feet of shaft has been completed at a cost of \$720.00. The Government's agreed part of this amount is \$360.00, of which \$240.00 has been paid to the operator and \$120.00 is held pending a final report by the operator. The operator has not presented a final report. The 12 feet of shaft were in the vein and the ore varied from 1.9 feet in width to 0.9 feet. The grade is estimated to be 85 percent CaF_2 . When the mine was visited by the undersigned the water stood at about the 130-foot level in the shaft.

The financial status of the project is summarized as follows:

Total cost approved by contract -----	\$13,850.00
Total amount spent on project -----	720.00
Government's agreed part of amount spent -----	360.00
Government's part of estimated cost unexpended -----	6,565.00
Value of production -----	0.00
Government's royalty received -----	0.00

By the terms of the termination agreement (Amendment No. 2), the Government has agreed to contribute \$360.00. While the program was not completed, the shaft was in ore for the depth that it was actually sunk, and there is reason to believe that the ore that was expected to have been discovered by the program will be discovered when the work is completed. Some ore has been discovered by the work that has been completed. The operator or owner, will be benefited at that time by the work for which the Government has contributed. Therefore, it is indicated that a Certificate of Discovery should be made.

The examining engineers estimated a potential of 30 tons per foot of depth. On this basis the 12 feet additional depth will indicate an additional 360 tons of Spar at plus 85 percent CaF_2 . Arizona Eastern Fluorspar Corp. has been marketing spar of this grade for a price of \$45 per ton. At this price the value of the spar

indicated by work under the DMEA contract is \$16,200.00, and the Government's royalty of 5 percent would be \$810.00, or more than enough to repay the Government's contribution of \$360.00.

The operator has experienced some difficulty in getting his mill set up and operating at Duncan and has pleaded money shortage. However, he has been able to continue operating his Lone Star Mine, construct his mill, and do some exploration work on another property. Therefore it appears that his failure to actively pursue work under the DMEA contract was a matter of choice.

Based on the above facts it is recommended that the project be certified.

William R. Hardwick, Mining Engineer
Mining Methods Branch
Mining Division, Region IV

16816

UNITED STATES
DEPARTMENT OF THE INTERIOR
Geological Survey
1947

STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY REPORT
(3-207)

THE FOURTH OF JULY AND LUCKIE NO. 1
AND NO. 2 FLUORSPAR VEINS
GREENLEE COUNTY, ARIZONA.

by
R. D. Trace

U. S. BUREAU OF MINES
MAR 27 1947
LUCSON DIV. MINING BR.

FOURTH OF JULY VEIN

Introduction

The Fourth of July fluorspar vein is about 20 miles by road north-northeast of Duncan, the nearest railroad station, in the SW $\frac{1}{4}$ sec. 39, T. 6 S., R. 32 E., and the NW $\frac{1}{4}$ sec. 4, T. 7 S., R. 32 E., Greenlee County, Ariz. The property is controlled by the R. T. Ellis Mining Co. of Duncan. The mine is reached from Duncan by following Arizona State Highway No. 75 north for 10.1 miles and a dirt road eastward for about 10 miles (see pl. 1).

Mining on the Fourth of July vein started in January 1937, and continued intermittently until August 1942. Between 1937 and 1942 the mine is reported to have produced approximately 2,600 tons of fluorspar containing 65 percent of CaF_2 and 25 to 30 percent of SiO_2 . The only available mill records indicate that between January 1 and August 18, 1942, a total of 573 tons of fluorspar containing 64 percent of CaF_2 was shipped from claim No. 2.

The nearest fluorspar mill is at Lordsburg, N. Mex., 35 miles by road southeast of Duncan, and about 55 miles from the mine. A mill using the heavy-media separation (sink-float) process is located at Gila, N. Mex., 97 miles east of Duncan, via the Tyrone road.

The Fourth of July claims are in the southern foothills of what are locally called the Mule Creek Mountains. The nearby relief varies from 300 to 400 feet. The drainage system is typical of that of a semiarid climate.

This report summarizes the results of field examinations made by the writer and D. A. Warner in January 1944.

1000

Geology

The predominant igneous rock of the area is a reddish-brown or greenish-gray olivine basalt of Tertiary or Quaternary age, which is generally porphyritic and in places vesicular (see pl. 2). The vesicles are in many places lined with dusty quartz or calcite. Small veinlets of quartz and calcite as much as one-eighth inch thick are scattered without recognizable pattern through the basalt. A thin section 1/ shows that the ferromagnesian minerals are altered to iron oxide and a carbonate of dolomitic composition. The structure and conspicuous images of olivine crystals indicate that the rock was olivine basalt.

Near the north end of claim No. 1, an undulating contact between two basalt flows is exposed. The upper flow is dark red, and the lower is dark greenish gray. Both flows are slightly vesicular, and the vesicles parallel the curve of the flow contact. Some of the basalt is well jointed in at least two directions, approximately north and east.

A bed of very light gray, fine-grained, rhyolitic tuff dipping about 24° N. crops out in the southwest corner of claim No. 2. A thin section of the rhyolitic tuff shows that it has been devitrified 2/. The presence of chessboard albite suggests that the tuff has been hydrothermally altered.

On the surface, evidence of movement along the faults occupied by the fluorspar veins is slight. A boulder of slickensided basalt was found near the north end of claim No. 1. Underground, however, the basalt and the veins are considerably brecciated, although positive information about the direction of movement or the amount of displacement is lacking.

Fluorspar deposits

The fluorspar veins contain dense milky and reddish-brown quartz, medium-gray, coarsely crystalline calcite, and colorless and green fluorite, named in order of decreasing abundance. Secondary coatings and thin stringers of psilomelane containing 44.9 percent of manganese and 0.89 percent of tungstic oxide 3/ are also associated with the fluorspar veins.

The fluorspar is chiefly an intimate mixture of dense milky quartz and green, fine- to coarse-grained fluorite. After long exposure to light, the fluorite loses its color. Most of the fluorspar is interlaced with a network of reddish-brown, iron-stained quartz veinlets. Calcite commonly is concentrated near the hanging-wall edge of the vein.

1/ Thin-section study by Glass, J. J., U. S. Geol. Survey, May 1944.

2/ Idem.

3/ Analysis by Fleischer, Michael, U. S. Geol. Survey, June 1944.

The fluorspar is found as lenticular veins and pockets along fault-breccia zones and fissures in basalt. The dips of the veins range between 60° and 80° . Much of the fluorspar is brecciated, indicating post-mineralization movement along the faults. The basalt between the East and West veins is slightly brecciated in places and contains many stringers of quartz.

The distribution of fluorite, quartz, and calcite within the veins is not uniform. Calcite, however, commonly occurs near the hanging wall; this relation is shown in the mine by a rather continuous cavity near the hanging wall, where calcite apparently has been leached from the vein. Commonly the fluorspar-rich part of the vein is a mixture of brecciated quartz and fluorite. Locally, however, definite sequences were noted. A small pit on the surface, for example, contains from west to east: fluorite, calcite, quartz, and calcite. On the 102-foot level, a local sequence from west to east is: quartz, calcite, fluorite, and quartz.

The vein system has a length of at least 2,500 feet, but only small sections are known to contain fluorspar. The width of the fluorspar ranges from less than an inch to approximately 5 feet, and averages 3 to 4 feet in the mine. The surface and underground exposures of fluorspar are shown on plates 2 and 3. At the south end of claim No. 1, a section of the vein about 400 feet along the strike may contain commercial deposits. On the surface, the other veins on claim No. 1 are composed mostly of calcite and quartz. On claim No. 2, a section of the vein about 400 feet along the strike has economic widths of fluorspar, and the underground work has been done in this part of the vein.

The west vein in the Ellis shaft, between the surface and the 57-foot level, dips about 60° W, and this part of the shaft was sunk in fluorspar. Below the 57-foot level, the shaft steepens to 80° or 85° and is mostly in quartz.

The East vein has been mined more than the West vein. A comparison of the fluorspar widths on the 102- and 148-foot levels of the East vein indicates that the fluorspar body possibly is pinching downward. Much fluorspar, however, remains in the mine, particularly between the 57- and 102-foot levels. In the south end of the 102-foot level, the fluorspar vein splits, the wider vein turning gently eastward into the wall. In the north end of this level the vein also splits, one part bearing almost directly north and the other west-northwest. On the 148-foot level in the northwest end of the drift, the vein divides as it did on the level above. The west branch apparently contains more fluorspar.

LUCKIE NO. 1 AND NO. 2 FLUORSPAR VEINS

Introduction

The Luckie No. 1 and No. 2 fluorspar veins of Greenlee County, Ariz., are about $14\frac{1}{2}$ miles by road north-northeast of Duncan and are in secs. 3 and 10, T. 7 S., R. 32 E., about half a mile west of the Arizona-New Mexico State line (see pl. 1). The shortest route to the claims from Duncan, the nearest railhead, is north by way of Arizona State Highway 75 for $2\frac{1}{2}$ miles to a dirt road; then northeast about 12 miles, past the Goat Camp Spring and ranchhouse to the mines.

The claims are held under lease by the Quien Sabe Mining Co. of Lordsburg, N. Mex. According to the present lessee, fluorspar production from the mines started during World War I and has been intermittent ever since. Work was resumed at the No. 2 mine early in 1943 and at the No. 1 mine in September of the same year.

The known shipments from both mines total approximately 2,000 tons of fluorspar containing an average of 65 to 70 percent of CaF_2 . This grade is higher than the actual run-of-mine product and is attained by crushing and screening at the mine. The production records prior to 1942 were lost when the mill of the Indian Metals Co. at Lordsburg, N. Mex., was destroyed by fire. The mill was rebuilt in 1943, and since then 1,160 tons of fluorspar containing 67 percent of CaF_2 has been shipped from the No. 1 mine, and 800 tons of fluorspar containing 68 percent of CaF_2 , from the No. 2 mine. This fluorspar mill is of the flotation type and is 35 miles by road southeast of Duncan, Ariz., and $49\frac{1}{2}$ miles from the claims. A fluorspar mill designed for the heavy-media separation (sink-float) process is located at Gila, N. Mex., 97 miles east of Duncan by way of the Tyrone road.

The mines are in the southern foothills of what are locally called the Mule Creek Mountains and are about 2 miles west of Vanderbilt Peak. The surrounding relief varies from 400 to 500 feet.

This report summarizes the result of field examinations made during March 1944 by the writer, J. K. Grunig, and D. A. Warner of the Geological Survey.

Geology

Bed rock is well exposed on the Luckie No. 1 claim, but partly covered on the No. 2 claim. Dark-gray, fine-grained andesite porphyry, with lathlike feldspar phenocrysts 0.1 to 0.2 inch long, is most common. A light-gray to reddish-gray, fine-grained, silicified rhyolite occurs as dike-like masses (see pls. 5 and 6). A thin section of the rhyolite shows quartz grains and ghosts of feldspar phenocrysts in a silicified and sericitized groundmass; the light-colored zones are more highly sericitized.^{4/} These igneous rocks are of Tertiary or possibly Quaternary age.

The complex system of quartz and fluorspar veins is associated with presumably normal faults. Sheeting structure, breccia, and fault gouge are well exposed, particularly underground. Slickensides raking across the dip and pitching about 40° are conspicuous underground in the No. 1 mine, but the amount of displacement along the faults is unknown. The faults range in dip from 35° to 68° , but in most places dip about 60° . In the Luckie No. 1 mine the fault zone has many rolls in the raise between the 71-foot level and the surface. The occurrence of brecciated fluorspar indicates postmineral movement along some of the faults.

^{4/} Thin-section study by Glass, J. J., U. S. Geol. Survey, September 1944.

Fluorspar deposits

The fluorspar deposits are the result of fissure filling, perhaps accompanied by some replacement of andesite porphyry along fault zones. Banded milky quartz is the predominant vein mineral, in places constituting almost the entire vein. Veinlets of drusy quartz are believed to be secondary. Even where the vein has been mined for its fluorite content, 35 to 40 percent of SiO_2 is commonly present. No calcite was found, although vein samples contained an average of 5 percent of CaCO_3 .

Both medium and coarse fluorite occur in veins, either brecciated or as a series of closely spaced veinlets interspersed through the brecciated andesite porphyry and gouge. Most of the fluorite is deep green, although some is blue green; fluorite cropping out at the surface is colorless. Fissure veinlets of fluorite as much as one inch thick are scattered irregularly through the quartz-rich part of the vein. The fluorite in these veinlets commonly occurs as well-developed cubes. The thickness of the veins containing fluorite ranges from less than an inch to 5 feet and averages between 3 and 4 feet.

Limonite in places coats fluorite and quartz. Psilomelane containing tungsten is also common in parts of the veins. Chemical analyses of two samples of psilomelane from the Luckie No. 1 vein showed the following:^{5/}

WO_3	V_2O_5	Mn	BaO^*	SiO_2
1.97	none	47.7	14.74	1.59
1.96	none	47.1	15.75	1.79

* BaO soluble in dilute HCl

The sequence of the vein minerals probably was milky quartz closely followed by fluorite or in part simultaneous with it. The veinlets of well-developed fluorite cubes cutting the milky quartz indicate that at least some of the fluorite was later than most of the quartz. The psilomelane and iron oxides are supergene minerals.

Claim No. 1.—The vein system in claim No. 1 (see pl. 5) is well exposed as low quartz ridges containing pockets of fluorspar. Because fluorspar is less resistant to erosion than quartz, the quartz content of the veins may be over-estimated in the outcrop.

On the surface fluorspar widths in all exposed veins range from less than an inch to 2.3 feet, although they may be greater in the debris-covered bottom of the long trench just west of the Sanders Shaft. Widths of fluorspar underground are as much as 4.5 feet. The entire fault zone is not mineralized, for barren sheeted zones in the andesite porphyry commonly are parallel to margins of the veins.

^{5/} Analyses by Fleischer, Michael, U. S. Geol. Survey, June 1944.

The easternmost vein is the best and perhaps the only commercial deposit of fluorspar in Claim No. 1, but a branch vein about 125 feet northwest of the Sanders shaft may also be of economic value. At the surface, the easternmost vein dips about 50° ; about 20 feet down the raise from the surface the dip flattens to about 35° or 40° and then gradually steepens again, until on the 71-foot level it is about 60° . The widest section of fluorspar is found where the dip of the vein is about 35° or 40° . Neither the north nor south face of the drift on the 71-foot level contains as much fluorspar as the part of the vein near the three stopes. From surface indications, however, it is reasonable to believe that the fluorspar might widen to between 2 and 3 feet farther north along the strike of the vein.

Claim No. 2.—The vein system in the Luckie No. 2 claim is largely covered on the surface, in contrast to that in the No. 1 claim. The location of the vein is obtained only from the glory hole and shaft and by projection from underground workings.

The fault pattern and fluorspar widths are shown on plate 7. The veins, composed of fluorite and quartz, dip generally about 70° N. and have a more uniform dip than those in the Luckie No. 1 claim. The average fluorspar width that had been mined was probably between 3 and 5 feet, but no fluorspar width greater than 3 feet is exposed now. Underground, several veins of varying widths, diverging from the vein system, probably represent local irregularities in a complex fracture system. The vein shown in the underground workings, which strikes northwest from the shaft, however, may be related to another fracture system.

Much of the fluorspar in the mine is obviously later than the faults, since both the fluorspar and quartz surround and cement breccia fragments of andesite porphyry. Slickensides are common but give no evidence of the general direction of movement or amount of displacement along the faults.

~~PRODUCTION HISTORY: "Initial production began in 1918, with significant shipments in 1936-44, and the last production recorded in 1953. Total Greenlee production is estimated at 7,500 tons." (Elevatorski, 1971)~~

In a 1921 Arizona Bureau of Mines Bulletin 114, Allen & Butler reported the following information: "Among the largest fluorspar deposits so far known in Arizona are those owned by Joe Hardy and associates. The groups of claims covering these deposits are located about nine, twelve, and sixteen miles, respectively, northeast of Duncan on the Arizona-New Mexico state line.

Most of this company's production has been from the properties that are located about sixteen miles from Duncan. In this group of claims the fluorspar occurs in the gouge that fills veins in andesite porphyry in a fractured zone about fifty feet wide, which can be traced on the surface approximately 4000 feet. These veins have been prospected by numerous shallow shafts, open cuts, and trenches. According to the owners, two carloads of fluorspar have been shipped, which assayed as follows:

CaF ₂	88 to 96 %
Silica	1 to 8 %
Iron Oxide	0.25- 0.6%
Alumina	0.5 to 0.6%
Magnesia	0.1 to 0.4%
color	light green

The deposits on the other groups are made up of fissure veins which vary in width from a few inches to one foot, and cover an area several hundred feet wide by several hundred feet long. Numerous open cuts, shafts, etc. show that the veins extend downward at least to water level. These groups have yielded a small tonnage of high grade fluorspar. The owners estimate that 150 tons per month of selected fluorspar can be produced.

These properties have also yielded some gold-silver ore." (Allen & Butler, 1921, p. 6)

80/ Duncan (Steeple Rock) dist.

Greenlee Co.

Wilson, 1950a, p. 8-9 Circ. 15

Trace, 1947, USGS Strategic Minerals Div. Prelim Rept 3-20;
Fourth of July + Luckie mine areas. 6 p.

manner of occurrence -

md-cse gn; colorless or green

lenses in veins of dense, massive to banded qtz
cutting T rhy, and, + bas.

Outshoots are 3-4' thick, 50' long, 50' high

65% CaF_2 + 25-30% SiO_2

Production

mining began 1918

small output through 1920

ceased 1921-1935

resumed production 1936 - end of 1944 = 6500 tons = \$124,000

1952 some production again

1953 1951 tons from Duncan, Castle Dome, + Spar mine

ore went largely to flotation mills at Lordsburg + Deming, N.M.
for production of acid-grade fluorapatite.

owned by Joe Hardy & associates
9, 12, + 16 mi. NE of Duncan

16 mi. NE Duncan) properties yielded most of the company's production. In this group of claims the fluorospar occurs in the gouge that fills veins in andesite porphyry in a fractured zone about 50' wide, which can be traced on the surface approx. 4000 ft. Veins have been prospected by numerous shallow shafts, open cuts, + trenches. Acc. to owners 2 carloads have been shipped, which assayed

CaF₂ 88-96%.

Si 1-8%

Iron Oxide 0.25-0.6%

Alumina 0.5-0.6%

Magnesia 0.1-0.4%

Color light green

Other groups - fissure veins which vary in width from a few inches to one foot + cover an area several hundred feet wide by several hundred feet ~~long~~.

Numerous open cuts, shafts, etc. show that the veins extend downward at least to water level.

These groups have yielded a small tonnage of high grade fluorospar.

The owners estimate that 150 Tons/month can be produced.

Properties also yield some gold-silver ore.



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DEPARTMENT OF THE INTERIOR

INFORMATION SERVICE

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GEOLOGICAL SURVEY

For release MARCH 19, 1947

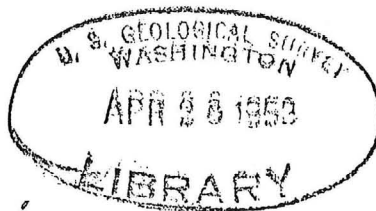
FLUORSPAR DEPOSITS NEAR DUNCAN, ARIZONA, STUDIED

Director W. E. Wrather of the Geological Survey reported today that a preliminary report on the Fourth of July and Luckie No. 1 and No. 2 fluorspar properties, near Duncan, Greenlee County, Ariz., has been released by the Geological Survey.

The fluorspar is found in basaltic lavas at the Fourth of July property, and in andesite porphyry at the Luckie No. 1 and No. 2 properties. The fluorspar forms lenticular veins and pockets along fault breccia zones and fissures. Quartz, calcite, and colorless or green fluorite are the chief minerals. Secondary coatings and thin stringers of psilomelane are associated with the fluorspar. Large-scale geologic and topographic maps and geologic cross sections of the deposits accompany the report.

The report and accompanying maps on the Fourth of July and Luckie No. 1 and No. 2 fluorspar veins near Duncan, Greenlee County, Ariz., by Robert D. Trace, have been released to the public as Preliminary Maps 3-207, Strategic Minerals Investigations series. Only a limited edition of this report is available. Copies may be obtained from the Director, Geological Survey, Washington 25, D. C., by those who are directly interested.

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no. 3-207

UNITED STATES
DEPARTMENT OF THE INTERIOR
U.S. Geological Survey
1947

STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY REPORT
(3-207)

THE FOURTH OF JULY AND LUCKIE NO. 1
AND NO. 2 FLUORSPAR VEINS
GREENLEE COUNTY, ARIZONA.

by
R. D. Trace

*

FOURTH OF JULY VEIN

Introduction

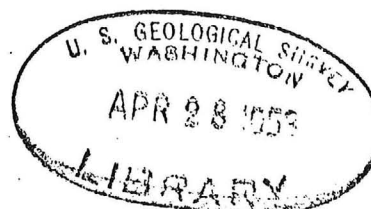
The Fourth of July fluor spar vein is about 20 miles by road north-northeast of Duncan, the nearest railroad station, in the SW $\frac{1}{4}$ sec. 33, T. 6 S., R. 32 E., and the NW $\frac{1}{4}$ sec. 4, T. 7 S., R. 32 E., Greenlee County, Ariz. The property is controlled by the R. T. Ellis Mining Co. of Duncan. The mine is reached from Duncan by following Arizona State Highway No. 75 north for 10.1 miles and a dirt road eastward for about 10 miles (see pl. 1).

Mining on the Fourth of July vein started in January 1937, and continued intermittently until August 1942. Between 1937 and 1941 the mine is reported to have produced approximately 2,600 tons of fluor spar containing 65 percent of CaF_2 and 25 to 30 percent of SiO_2 . The only available mill records indicate that between January 1 and August 18, 1942, a total of 573 tons of fluor spar containing 64 percent of CaF_2 was shipped from claim No. 2.

The nearest fluor spar mill is at Lordsburg, N. Mex., 35 miles by road south-east of Duncan, and about 55 miles from the mine. A mill using the heavy-media separation (sink-float) process is located at Gila, N. Mex., 97 miles east of Duncan, via the Tyrone road.

The Fourth of July claims are in the southern foothills of what are locally called the Mule Creek Mountains. The nearby relief varies from 300 to 400 feet. The drainage system is typical of that of a semiarid climate.

This report summarizes the results of field examinations made by the writer and D. A. Warner in January 1944.



Geology

The predominant igneous rock of the area is a reddish-brown or greenish-gray olivine basalt of Tertiary or Quaternary age, which is generally porphyritic and in places vesicular (see pl. 2). The vesicles are in many places lined with dusty quartz or calcite. Small veinlets of quartz and calcite as much as one-eighth inch thick are scattered without recognizable pattern through the basalt. A thin section 1/ shows that the ferromagnesian minerals are altered to iron oxide and a carbonate of dolomitic composition. The structure and conspicuous images of olivine crystals indicate that the rock was olivine basalt.

Near the north end of claim No. 1, an undulating contact between two basalt flows is exposed. The upper flow is dark red, and the lower is dark greenish gray. Both flows are slightly vesicular, and the vesicles parallel the curve of the flow contact. Some of the basalt is well jointed in at least two directions, approximately north and east.

A bed of very light gray, fine-grained, rhyolitic tuff dipping about 24° N. crops out in the southwest corner of claim No. 2. A thin section of the rhyolitic tuff shows that it has been devitrified 2/. The presence of chessboard albite suggests that the tuff has been hydrothermally altered.

On the surface, evidence of movement along the faults occupied by the fluor-spar veins is slight. A boulder of slickensided basalt was found near the north end of claim No. 1. Underground, however, the basalt and the veins are considerably brecciated, although positive information about the direction of movement or the amount of displacement is lacking.

Fluorspar deposits

The fluorspar veins contain dense milky and reddish-brown quartz, medium-gray, coarsely crystalline calcite, and colorless and green fluorite, named in order of decreasing abundance. Secondary coatings and thin stringers of psilomelane containing 44.9 percent of manganese and 0.89 percent of tungstic oxide 3/ are also associated with the fluorspar veins.

The fluorspar is chiefly an intimate mixture of dense milky quartz and green, fine- to coarse-grained fluorite. After long exposure to light, the fluorite loses its color. Most of the fluorspar is interlaced with a network of reddish-brown, iron-stained quartz veinlets. Calcite commonly is concentrated near the hanging-wall edge of the vein.

1/ Thin-section study by Glass, J. J., U. S. Geol. Survey, May 1944.

2/ Idem.

3/ Analysis by Fleischer, Michael, U. S. Geol. Survey, June 1944.

The fluorspar is found as lenticular veins and pockets along fault-breccia zones and fissures in basalt. The dips of the veins range between 60° and 80° . Much of the fluorspar is brecciated, indicating post-mineralization movement along the faults. The basalt between the East and West veins is slightly brecciated in places and contains many stringers of quartz.

The distribution of fluorite, quartz, and calcite within the veins is not uniform. Calcite, however, commonly occurs near the hanging wall; this relation is shown in the mine by a rather continuous cavity near the hanging wall, where calcite apparently has been leached from the vein. Commonly the fluorspar-rich part of the vein is a mixture of brecciated quartz and fluorite. Locally, however, definite sequences were noted. A small pit on the surface, for example, contains from west to east: fluorite, calcite, quartz, and calcite. On the 102-foot level, a local sequence from west to east is: quartz, calcite, fluorite, and quartz.

The vein system has a length of at least 2,500 feet, but only small sections are known to contain fluorspar. The width of the fluorspar ranges from less than an inch to approximately 5 feet, and averages 3 to 4 feet in the mine. The surface and underground exposures of fluorspar are shown on plates 2 and 3. At the south end of claim No. 1, a section of the vein about 400 feet along the strike may contain commercial deposits. On the surface, the other veins on claim No. 1 are composed mostly of calcite and quartz. On claim No. 2, a section of the vein about 400 feet along the strike has economic widths of fluorspar, and the underground work has been done in this part of the vein.

The west vein in the Ellis shaft, between the surface and the 57-foot level, dips about 60° W, and this part of the shaft was sunk in fluorspar. Below the 57-foot level, the shaft steepens to 80° or 85° and is mostly in quartz.

The East vein has been mined more than the West vein. A comparison of the fluorspar widths on the 102- and 148-foot levels of the East vein indicates that the fluorspar body possibly is pinching downward. Much fluorspar, however, remains in the mine, particularly between the 57- and 102-foot levels. In the south end of the 102-foot level, the fluorspar vein splits, the wider vein turning gently eastward into the wall. In the north end of this level the vein also splits, one part bearing almost directly north and the other west-northwest. On the 148-foot level in the northwest end of the drift, the vein divides as it did on the level above. The west branch apparently contains more fluorspar.

LUCKIE NO. 1 AND NO. 2 FLUORSPAR VEINS

Introduction

The Luckie No. 1 and No. 2 fluorspar veins of Greenlee County, Ariz., are about $14\frac{1}{2}$ miles by road north-northeast of Duncan and are in secs. 3 and 10, T. 7 S., R. 32 E., about half a mile west of the Arizona-New Mexico State line (see pl. 1). The shortest route to the claims from Duncan, the nearest railhead, is north by way of Arizona State Highway 75 for $2\frac{1}{2}$ miles to a dirt road; then northeast about 12 miles, past the Goat Camp Spring and ranchhouse to the mines.

Fluorspar deposits

The fluorspar deposits are the result of fissure filling, perhaps accompanied by some replacement of andesite porphyry along fault zones. Banded milky quartz is the predominant vein mineral, in places constituting almost the entire vein. Veinlets of drusy quartz are believed to be secondary. Even where the vein has been mined for its fluorite content, 35 to 40 percent of SiO_2 is commonly present. No calcite was found, although vein samples contained an average of 5 percent of CaCO_3 .

Both medium and coarse fluorite occur in veins, either brecciated or as a series of closely spaced veinlets interspersed through the brecciated andesite porphyry and gouge. Most of the fluorite is deep green, although some is blue green; fluorite cropping out at the surface is colorless. Fissure veinlets of fluorite as much as one inch thick are scattered irregularly through the quartz-rich part of the vein. The fluorite in these veinlets commonly occurs as well-developed cubes. The thickness of the veins containing fluorite ranges from less than an inch to 5 feet and averages between 3 and 4 feet.

Limonite in places coats fluorite and quartz. Psilomelane containing tungsten is also common in parts of the veins. Chemical analyses of two samples of psilomelane from the Luckie No. 1 vein showed the following:^{5/}

WO_3	V_2O_5	Mn	BaO^*	SiO_2
1.97	none	47.7	14.74	1.59
1.96	none	47.1	15.75	1.79

*BaO soluble in dilute HCl

The sequence of the vein minerals probably was milky quartz closely followed by fluorite or in part simultaneous with it. The veinlets of well-developed fluorite cubes cutting the milky quartz indicate that at least some of the fluorite was later than most of the quartz. The psilomelane and iron oxides are supergene minerals.

Claim No. 1.—The vein system in claim No. 1 (see pl. 5) is well exposed as low quartz ridges containing pockets of fluorspar. Because fluorspar is less resistant to erosion than quartz, the quartz content of the veins may be over-estimated in the outcrop.

On the surface fluorspar widths in all exposed veins range from less than an inch to 2.3 feet, although they may be greater in the debris-covered bottom of the long trench just west of the Sanders Shaft. Widths of fluorspar underground are as much as 4.5 feet. The entire fault zone is not mineralized, for barren sheeted zones in the andesite porphyry commonly are parallel to margins of the veins.

^{5/} Analyses by Fleischer, Michael, U. S. Geol. Survey, June 1944.

The easternmost vein is the best and perhaps the only commercial deposit of fluorspar in Claim No. 1, but a branch vein about 125 feet northwest of the Sanders shaft may also be of economic value. At the surface, the easternmost vein dips about 50° ; about 20 feet down the raise from the surface the dip flattens to about 35° or 40° and then gradually steepens again, until on the 71-foot level it is about 60° . The widest section of fluorspar is found where the dip of the vein is about 35° or 40° . Neither the north nor south face of the drift on the 71-foot level contains as much fluorspar as the part of the vein near the three stopes. From surface indications, however, it is reasonable to believe that the fluorspar might widen to between 2 and 3 feet farther north along the strike of the vein.

Claim No. 2.—The vein system in the Luckie No. 2 claim is largely covered on the surface, in contrast to that in the No. 1 claim. The location of the vein is obtained only from the glory hole and shaft and by projection from underground workings.

The fault pattern and fluorspar widths are shown on plate 7. The veins, composed of fluorite and quartz, dip generally about 70° N. and have a more uniform dip than those in the Luckie No. 1 claim. The average fluorspar width that had been mined was probably between 3 and 5 feet, but no fluorspar width greater than 3 feet is exposed now. Underground, several veins of varying widths, diverging from the vein system, probably represent local irregularities in a complex fracture system. The vein shown in the underground workings, which strikes northwest from the shaft, however, may be related to another fracture system.

Much of the fluorspar in the mine is obviously later than the faults, since both the fluorspar and quartz surround and cement breccia fragments of andesite porphyry. Slickensides are common but give no evidence of the general direction of movement or amount of displacement along the faults.

Duncan district

LOCATION: The Duncan fluorspar district is located in the Steeple Rock mining district in the western foothills of the Mule Creek Mountains, between 11 and 20 miles by road northeast of Duncan, Arizona. The mines are within 2 to 3 miles of the Arizona-New Mexico state line in T7S, R32E, sections 4, 5, 9, 10 and 15. The mines are shown on the York Valley, Arizona-N. Mexico 15 minute topographic quadrangle.

The Duncan fluorspar mines can be reached by driving northwest of Duncan, Arizona, on Arizona Highway 75 for 2 miles from the Ariz. 75-U.S. 70 junction. Turn right through a gate in the highway fence and drive $8\frac{1}{2}$ miles northeast on a well-maintained gravel road to Goat Camp Spring. The Goat Camp Mine is near this; the Luckie No. 1 and 2 mines are about $1\frac{1}{2}$ miles along a road to the northwest and the Polly Ann Mine is about 1 mile further along the road to the west. The Daniels Camp mine and the Fourth of July Mine can be reached from the Polly Ann Mine by continuing west on the same road for about 3 miles until it forks back to the northeast, and then by driving northeast for 2 miles to the Daniels Camp mine and an additional mile to the Fourth of July Mine. According to the topographic map this road fork can also be reached from Duncan by driving northwest on Arizona Highway 75 for 9 miles from the Ariz. 75-U.S. 70 junction and taking a northeast dirt road following along Sanders Wash for 4 miles.

Most of the mines are located near or above elevation 4400 feet (1341 meters) in hilly terrain with local relief about 250 feet within 1 square mile (75 to 100 meters). Duncan, Arizona, has precipitation evenly distributed throughout the year ranging from 12 inches in May to 1.83 inches in August with a mean yearly precipitation of 8.90 inches (Green & Sellers, 1964, p. 163, U. of A. Press). The climate is temperate with the mean daily temperature ranging from 41.0°F in December to 78.6°F in July (Green & Sellers). The area near the mines has desert vegetation and is pri-

marily used for grazing. The area is only 37 miles by road from Clifton, Arizona, a large town with a good labor supply of experienced miners.

PRODUCTION HISTORY: "Initial production began in 1918, with significant shipments in 1936-44, and the last production recorded in 1953. Total Greenlee production is estimated at 7,500 tons." (Elevatorski, 1971)

In 1921 Allen and Butler reported in Arizona Bureau of Mines Bulletin 114 that "according to the owners (Joe Hardy and associates), two carloads of fluorspar have been shipped from the deposits located about sixteen miles from Duncan." "The deposits on their other groups have yielded a small tonnage of high grade fluorspar. The owners estimate that 150 tons per month of selected fluorspar can be produced." (Allen & Butler, 1921)

"Fluorspar mining began in the Duncan district and in the Sierrita Mountains in 1918; however, output was small through 1920 and ceased during 1921-35. Production from the Duncan district was resumed in 1936 and continued until the end of 1944." (Val Alstine & Moore, 1969, Ariz. Bur. Mines Bull. 180, p. 349).

"Shipments, made largely during 1936-44, amounted to possibly 6,500 tons, valued at \$124,000. Most of this output came from the Fourth of July, Luckie, Polly Ann and Daniels Camp mines. It went largely to flotation mills at Lordsburg and Deming, but some was shipped directly to steel plants and for hydrofluoric acid manufacture. The spar averaged about 65 percent calcium fluoride and 25-30 percent silica, although some ranged up to 93 percent calcium fluoride." (Wilson, 1950, p. 8, Az. Bur. Mines Circ. 15).

"In 1952 some production again came from the Duncan district and in 1953 the largest amount (1,951 tons) of fluorspar produced in Arizona in a single year was shipped from mines in the Duncan and Castle Dome districts and from the Spar Mine." (Val Alstine & Moore, 1969, as above).

GEOLOGY: "This western foothill portion of the Mule Creek Mountains is made up of porphyritic andesite, basalt and rhyolite tuff, intruded by dikes of rhyolite porphyry.

The veins occupy two systems of fissures. One system, representing irregular and branching shear faults, strikes between north 10 degrees east and north 25 degrees west, subparallel to the principal rhyolite dikes; it has yielded somewhat more than half of the total district production and is exemplified at the Fourth of July and Luckie No. 1 mines.

The veins consist largely of dense massive to banded quartz, locally with coarsely crystalline calcite and colorless or green fluorite of medium to coarse texture.

Individual spar shoots, which are best in the andesite and basalt, average approximately 3 to 4 feet wide and 50 feet long by 50 feet high. In places spar shoots of good quality and size continue below water level, which was encountered at depths of from 90 to 165 feet. The Polly Ann is reported to have been drowned out at 185 feet or 50 feet below water level.

The Duncan area may not yet be considered as exhausted, but costs of mining, pumping, transportation and milling have held back further development of it during recent years." (Wilson, 1950, p. 8-9).

"Duncan (Steeple Rock) district - Medium - to coarse-grained, colorless or green fluorite, as lenses in veins of dense, massive to banded quartz cutting Tertiary rhyolite, andesite and basalt. Ore shoots, averaging 3-4 feet thick, 50 feet long and 50 feet high, contain about 65 percent CaF_2 and 25-30 percent SiO_2 . Arizona's most productive fluorspar district." (Val Alstine & Moore, 1969, p. 352)

Others of the Arizona fluorspar deposits, "exemplified in the Duncan, Castle Dome and Vulture areas, are many miles from outcrops of large intrusive bodies, but they are more or less closely associated with abundant dikes which indicate the presence of stock-like intrusives beneath. The associated dikes are rhyolite in the Duncan area, rhyolite and diorite porphyry in the Castle Dome district and andesite porphyry and pegmatite in the Vulture area." (Wilson, 1950, p. 6)

"The Duncan fluorite veins contain a little tungsten, but are 4 miles from gold veins of the Steeple Rock district and 11 miles from siliceous silver, gold, copper and lead deposits of the Ash Peak district. Psilomelane containing tungsten, generally under 2 percent WO_3 , occurs in parts of the Duncan veins. Limonite is locally present." (Wilson, 1950, p. 7)

In the Duncan district mineralization generally followed faulting, although there was some additional movement as some of the fluorite is brecciated. The orebody type is generally fissure veins (mineral mass filling open spaces along a fracture with or without chemical alteration of adjoining rock), with some shear zones (zone of fissuring or shearing that has been mineralized by impregnating solutions, by replacement or by filling of open spaces), and some breccia filling (zone of shattering in which mineralization has cemented or replaced the shattered mass of angular fragments and comminuted material). The mode of origin

was hydrothermal (mineral deposition by heated, ascending solutions) and the shape of the orebodies are tabular (orebody relatively long in two dimensions and short in one dimension). The ore controls were generally fracturing (jointing) and faulting. The wall rock alteration is slight to moderate and the type of alteration was silification (increase in amount of quartz or opal in country rock). (Definitions within parentheses are from the MAS classification manual). There was no confidential information entered in the record or used in the study. Access to all underground workings in the area was denied by MESA for safety reasons. None of the mines are currently active.

report compiled by Jan Wilt 5/28/75
verbatim from re to by Hint, Walker, Elevatorist & Trace

file

Luckie No. 2 Mine

LOCATION: The Luckie No. 2 Mine is located in the Steeple Rock mining district in the western foothills of the Mule Creek Mountains, about 14 miles northeast of Duncan. The mine shaft is shown on the York Valley, Ariz.-N. Mex. 15 minute quadrangle in T. 7 S., R. 32 E., Sec. 10, NW $\frac{1}{4}$, NE $\frac{1}{4}$, SE $\frac{1}{4}$, NW $\frac{1}{4}$. The shaft is on or slightly above the 4480 foot contour line (1366 meters) and is located at 32.84353° (32° 50' 36.71") North latitude and 109.05738° (109° 3' 26.57") West longitude.

The Luckie No. 2 Mine can be reached from Duncan by driving northwest on Arizona Highway 75 for 2 miles from the Ariz. 75 - U.S 70 junction. Turn right through a gate in the highway fence and drive 8 $\frac{1}{2}$ miles northeast on a well-maintained gravel road to Goat Camp Spring. Turn left (northwest) on the jeep road for 1 $\frac{1}{2}$ miles and the Luckie No. 2 shaft will be within 75 feet north of the road. (Walker)

OWNERSHIP: "The Luckie No. 2 unpatented claim is recorded in Book 4, page 60, and amended in Book 5, p. 355, and the Luckie No. 3 in Book 4, page 60, and amended in Book 5, p. 356, in the Greenlee County Records

Office at Clifton, Arizona, under the ownership of Judge Forrest Sanders, District Court Chambers, Courthouse, ^{L45} Las Cruces, New Mexico." (Walker)

GEOLOGY: ⁶⁶ The Luckie No. 2 Mine is located in an area of fresh andesite porphyry along whose fractures the fluorspar has been emplaced by hydrothermal solutions along with considerable silica. In this area very little alteration is present. The vein which forms the ore body strikes S. 56° E. and is surrounded by andesite porphyry along most of its extent. Rhyolite dikes adjoin the vein southeast and southwest of the vein as shown on Trace's geologic map. The andesite in the 'glory hole' has many quartz veins up to 1 inch wide running through it. The fluorspar outcrops at the surface in the glory hole and is colorless to light green in color. (Hint)

"The fluorspar deposits are the result of fissure filling, perhaps accompanied by some replacement of andesite porphyry along fault zones. Banded milky quartz is the predominant vein mineral, in places constituting almost the entire vein. Veinlets of drusy quartz are believed to be secondary. Even where the vein has been mined for its fluorite content, 35 to 40 percent of SiO_2 is commonly present. No calcite was found, although vein samples contained an average of 5 percent of CaCO_3 . Limonite in places coats fluorite and quartz. Psilomelane containing tungsten is also common in parts of the veins.

Both medium and coarse fluorite occur in veins, either brecciated or as a series of closely spaced veinlets interspersed through the brecciated andesite porphyry and gouge. Most of the fluorite is deep green, although some is blue green; fluorite cropping out at the surface is colorless. Fissure veinlets of fluorite as much as one inch thick are scattered irregularly through the quartz-rich part of the vein. The fluorite in these veinlets commonly occurs as well-developed cubes. The thickness of the veins containing fluorite ranges from less than an inch to 5 feet and averages between 3 and 4 feet.

The sequence of the vein minerals probably was milky quartz closely followed by fluorite or in part simultaneous with it. The veinlets of well-developed fluorite cubes cutting the milky quartz indicate that at least some of the fluorite was later than most of the quartz. The psilomelane and iron oxides are supergene minerals.

Much of the fluorspar in the mine is obviously later than the faults, since both the fluorspar and quartz surround and cement breccia fragments of andesite porphyry. Slickensides are common but give no evidence of the general direction of movement or amount of displacement along the faults.

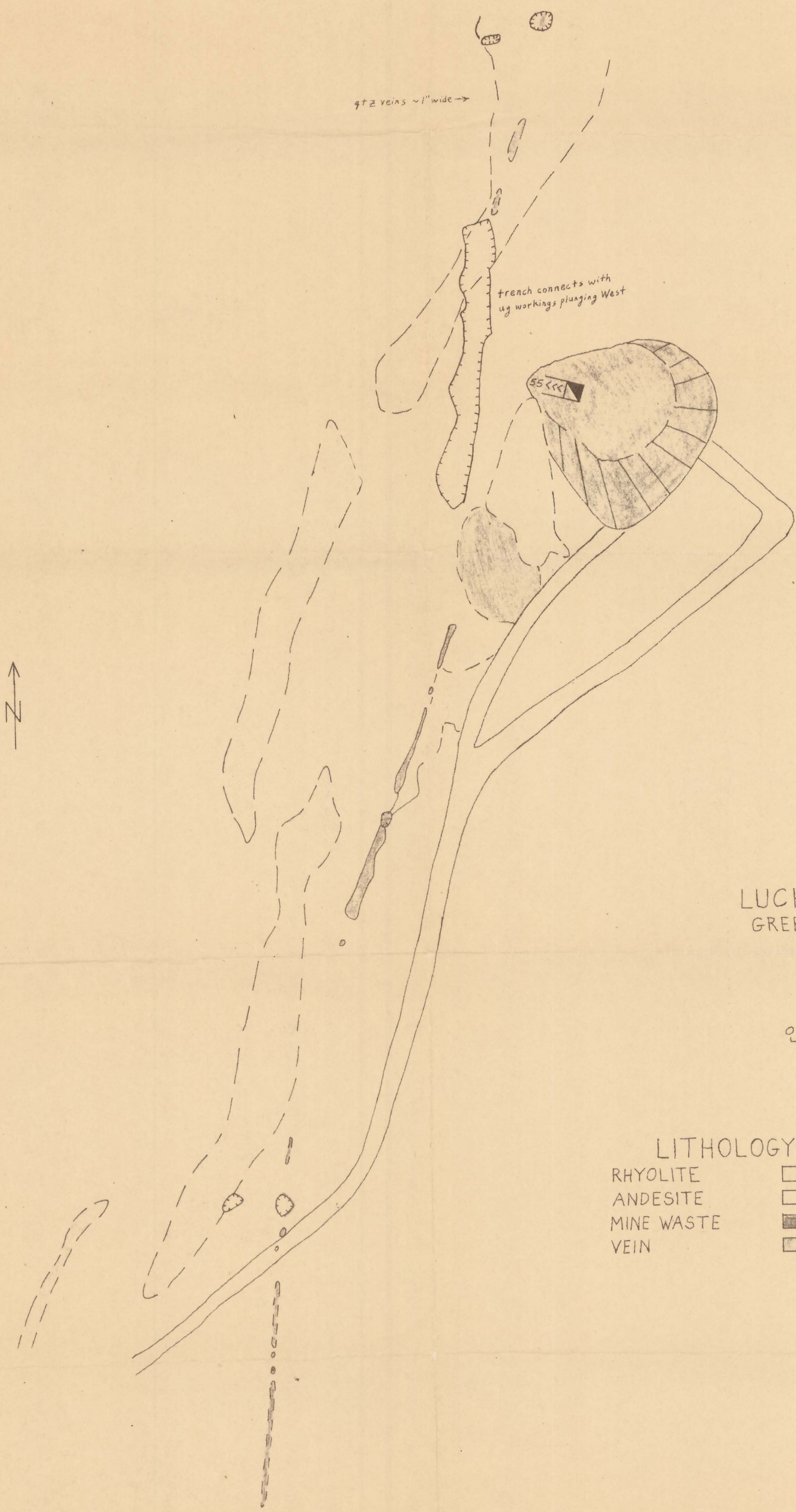
The vein system in the Luckie No. 2 claim is largely covered on the surface, in contrast to that in the No. 1 claim. The location of the vein is obtained only from the glory hole and shaft and by projection from underground workings.

The veins, composed of fluorite and quartz, dip generally about 70° North and have a more uniform dip than those in the Luckie No. 1 claim. The average fluorspar width that had been mined was probably between 3 and 5 feet, but no fluorspar width greater than 3 feet ^{was} exposed in 1947. Underground, several veins of varying widths, diverging from the vein system, probably represent local irregularities in a complex fracture system. The vein shown in the underground workings, which strikes northwest from the shaft, however, may be related to another fracture system. ^(Trace, 1947)

DEVELOPMENT: ["]The mine workings consist of a 6 foot by 4 foot cribbed shaft 59 feet deep, a glory hole approximately 40 feet by 20 feet of unknown depth, and an indeterminate amount of underground workings. The underground workings were not examined in 1975 because they were deemed unsafe and access was denied by MESA. ^(Hint)

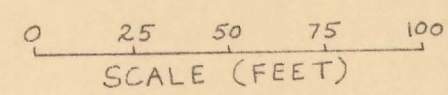
Maps and cross-sections of the underground workings in 1947 are illustrated in the U.S.G.S. report by Trace. They include approximately 100 feet of workings at the 64 foot level and 120 feet of workings at the 90 foot level.

["]The average grade of the ore was about 40 to 50 % CaF_2 , with silica 35 to 40%, and 5% calcite. 65% ore was attained by crushing and screening at the mine. ^(Elevatorski, 1971)



LUCKIE NO. MINE
GREENLEE COUNTY, ARIZ.

4-1-75
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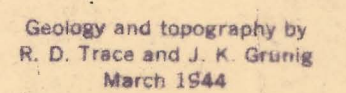
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VEIN	



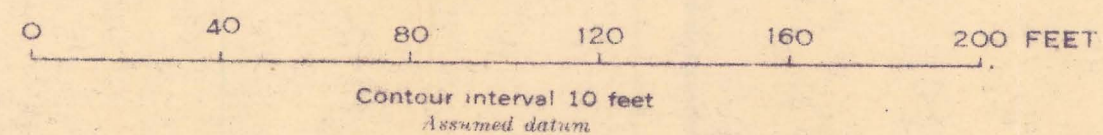
INDEX MAP SHOWING LOCATION OF FLUORSPAR DEPOSITS NEAR DUNCAN, GREENLEE COUNTY, ARIZONA

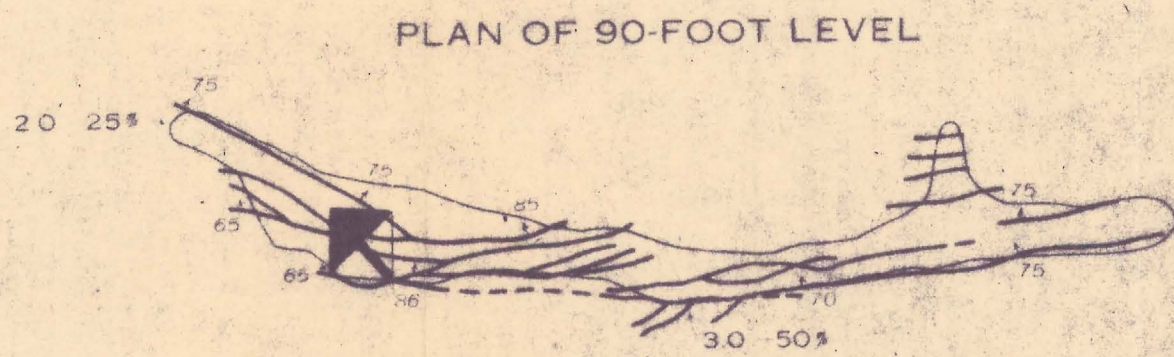
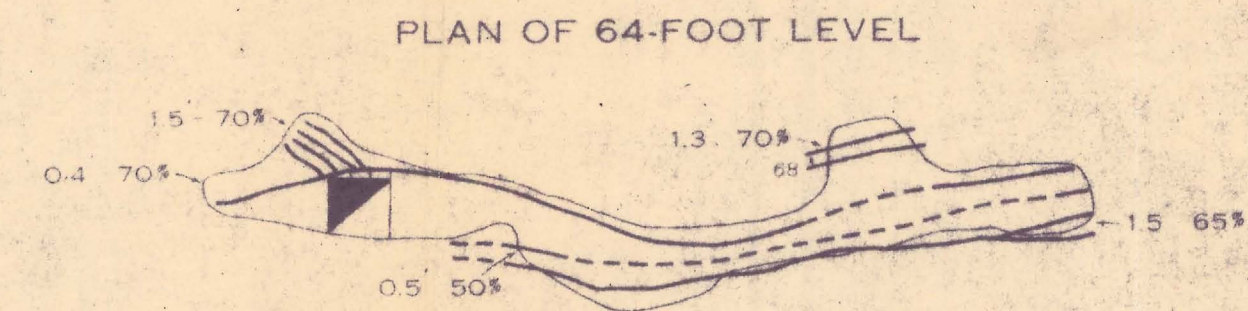
0 1 2 3 4 5 MILES

Base map from Soil Conservation Service

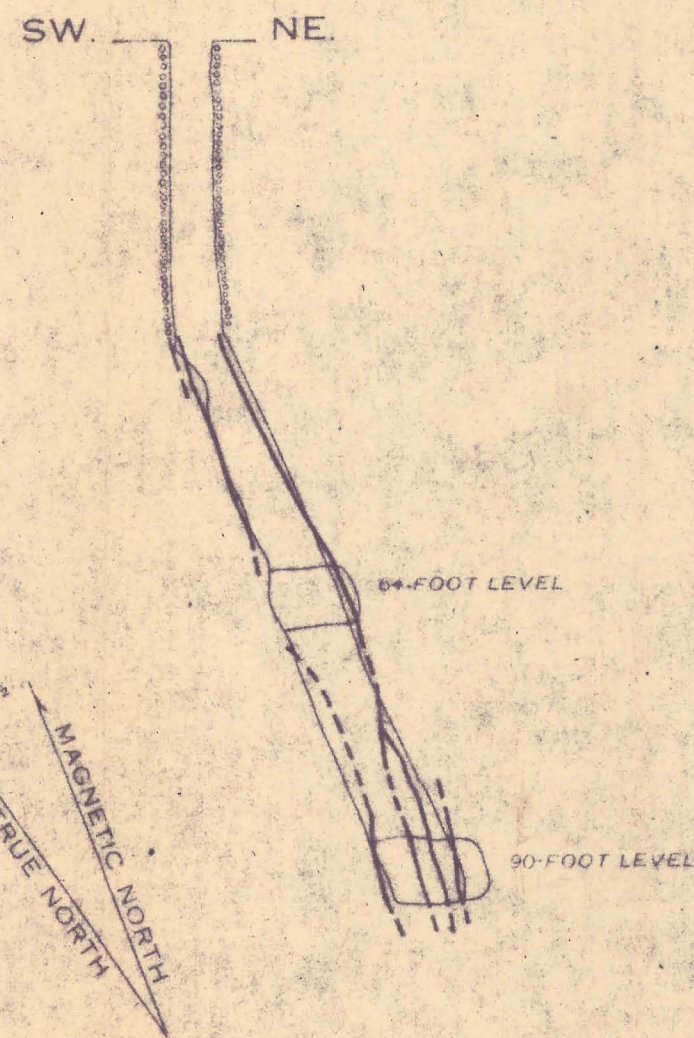


GEOLOGIC AND TOPOGRAPHIC MAP OF THE LUCKIE NO. 2 FLUORSPAR MINE, GREENLEE COUNTY, ARIZONA

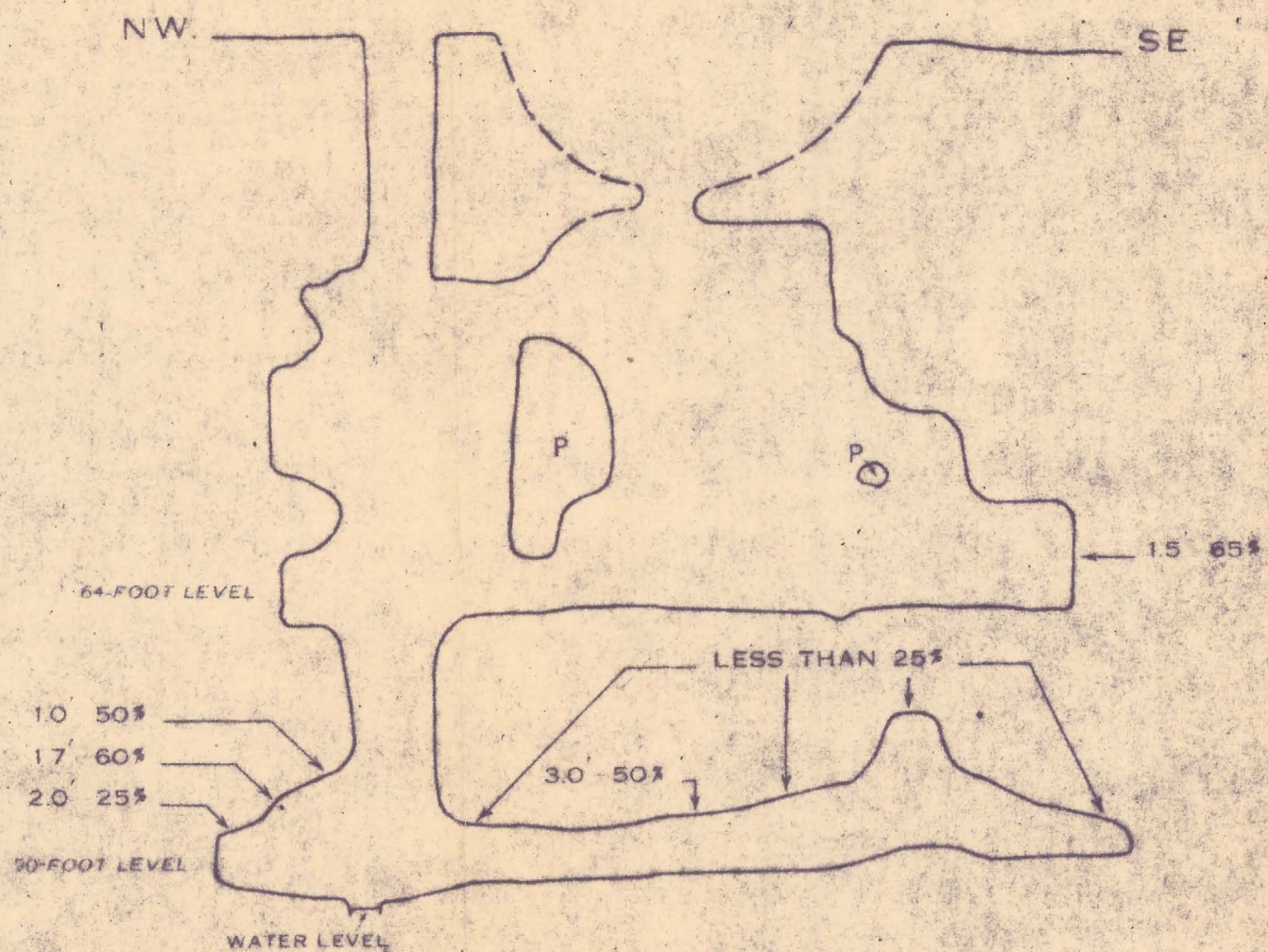




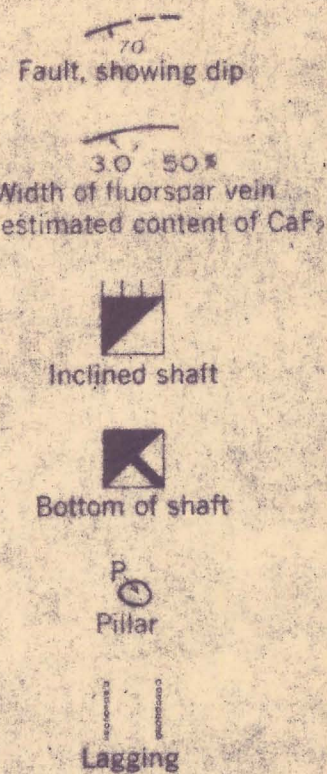
SECTION THROUGH SHAFT



SECTION ALONG VEIN



EXPLANATION



Tape and compass survey
by R. D. Trace and J. K. Gruning
March 1944

LEVEL MAPS AND SECTIONS, LUCKIE NO. 2
FLUORSPAR MINE, GREENLEE COUNTY, ARIZONA