Mrs. Fowler
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UNITED STATES
DEPARTMENT OF THE INTERIOR
Geological Survey
Washington
1944

FLUORSPAR INVESTIGATIONS

FLUORSPAR DEPOSITS OF THE JAMESTOWN DISTRICT, BOULDER COUNTY, COLORADO*/

By E. N. Goddard
June 1944 1944

U. S. GEOLOGICAL SURVEY
WASHINGTON
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The Jamestown district, in the central part of Boulder County, Colo., 33 miles northwest of Denver, has been chiefly a gold-producing area in the past, but during the last 2 years the mining of fluorspar has been strongly revived. Fluorspar was apparently known in the district as early as 1873, but not until 1903 was an appreciable quantity of ore produced. During the period 1903-43 inclusive, about 60,000 tons of metallurgical-grade fluorspar and 20,000 tons of acid grade fluorspar were shipped from the district. In the last 2 years, 1942-43, the operators report that 64,236 tons of crude ore were mined in the district and treated in local or nearby mills.

The Jamestown district is in the foothills of the Front Range at the extreme northeast end of the Colorado mineral belt. Pre-Cambrian schists and gneisses of the Idaho Springs formation have been intruded by the Silver Plume granite of middle pre-Cambrian age. These rocks in turn have been intruded by early Tertiary stocks and dikes that range from diabase to alaskite in composition. A rather large stock of granodiorite crops out in the immediate vicinity of Jamestown and extends about 2 miles southward (see fig. 1). On the north

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*/ Accompanied by nine illustrations:

Plate 1. Geologic map of the principal fluorspar-producing area, Jamestown district.
2. Geologic map of the Blue Jay mine and vicinity.
3. Geologic maps and sections of the Argo mine.
4. Geologic maps and sections of the Brown Spar mine.
5. Geologic maps and sections of the Burlington mine.
6. Geologic maps and sections of the Chancellor mine.
7. Geologic maps and sections of the Emmett mine and Afterthought tunnel.
8. Geologic map and sections of the Yellow Girl mine.

Figure 1. Geologic map of the central part of the Jamestown district.

side of the granodiorite stock is a small porphyry stock of slightly later age, whose composition ranges from sodic quartz monzonite to sodic granite. This stock appears to be composite and to have resulted from two or more magmatic surges that took place during cooling. Many dikes of sodic granite and quartz monzonite porphyry are scattered around the stocks.

The fluorspar deposits are in altered granite and granodiorite and are grouped around the west and south sides of the sodic granite-quartz monzonite porphyry stock in a northwestward trending belt about 2 miles long. Most of the productive mines are within an area about 2,500 feet square on the west side of the stocks (see pl. 1); but one, the Blue Jay, is about 4,000 feet south of the border of the stock (see fig. 1 and pl. 2).

The fluorspar occurs in veins and breccia zones (see pls. 3-8), and in some places the two types of deposit more or less grade into one another. The breccia zones range from 10 to 70 feet in width and from 50 to 400 feet in length. Most of the productive veins are from a few feet to 20 feet wide and from 150 to a few hundred feet long. The Blue Jay vein, however, is about 1,000 feet long. Some deposits are surrounded by nearly barren zones of brecciated partly silicified granite containing disseminated pyrite. In all deposits of both types the fluorspar is strongly brecciated and cemented by a fine-grained mixture of fluorspar, clay minerals, quartz, and some carbonate material. In the fluorspar breccia deposits, granite fragments are abundant, whereas in the vein deposits, only occasional wall rock fragments are found. The fluorspar in both types of deposits ranges in color from nearly white through purple to a deep violet that is almost black; but after exposure to sunlight for a short period, the color disappears, and the fluorspar in old dumps and outcrops is nearly white.

Fragments of lead-silver ore, mainly galena, as well as pyrite, sphalerite, chalcopyrite, gray copper, and enargite, are locally abundant in some of the breccia zones, and small amounts of these sulfides are found in most of the veins. Pyrite is disseminated throughout the deposits and minute grains of pitchblende are sparingly scattered in some places.

Available evidence indicates that the fluorspar was deposited from solutions closely related to the sodic granite-quartz monzonite porphyry stock and that the breccia zones and vein fissures were produced by forces resulting from the intrusion of the stock.1/ In several of the deposits there is evidence that some of

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1/ Goddard, E. N., The influence of Tertiary intrusive structural features on mineral deposits at Jamestown, Colorado: Econ. Geology, vol. 30, no. 4, pp. 370-386, 1935.

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the fluorspar was dissolved along fractures and grain boundaries by later solutions. The evidence also suggests that the fluorspar was brecciated and mixed

with some wall rock material by collapse and gradual settling of the porous bodies developed by this solution—a process called "mineralization stoping" by Locke.2/

2/ Locke, Augustus, The formation of certain ore bodies by mineralization stoping: Econ. Geology, vol. 21, no. 5, pp. 431-453.

The grade of the fluorspar deposits varies widely. Most of the veins contain between 60 and 85 percent of CaF_2, but a few pockets are of higher grade. The breccia zones contain between 5 and 60 percent of CaF_2. The grade of the crude ore shipped from the district in the past has ranged from 73 percent to about 85 percent of CaF_2. In 1943 crude ore containing from 45 to 73 percent of CaF_2 was being mined and milled. The silica content of most of the ore is high, ranging from 5 to 21 percent in shipping ore and from 12 to 28 percent in milling ore. Other impurities are lime, alumina and the sulfide minerals. In some of the deposits, the sulfides contain enough lead, silver, and gold to make the recovery of a sulfide concentrate profitable.

The fluorspar deposits give promise of extending to considerable depth below the surface, in fact several have already been developed to depths greater than their lengths. The productive deposits have been developed to depths ranging from 50 to 480 feet below the surface and in none of these, with the possible exception of one where the workings are shallow, is there any indication that the ore is playing out with depth. In two of the deposits, breccia zones appear to be consolidating into veins of higher grade with depth. It therefore seems likely that the district has a fairly large reserve of ore, comparable to the tonnage that has been produced, and exploration of many of the known deposits at greater depth is warranted. Some of the large nearly barren breccia zones should also be considered favorable locations for future exploration. Such breccia zones contain only small amounts of fluorspar at the surface but many have been found to develop into minable bodies of fluorspar at depth.

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Figure 1

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STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY MAP

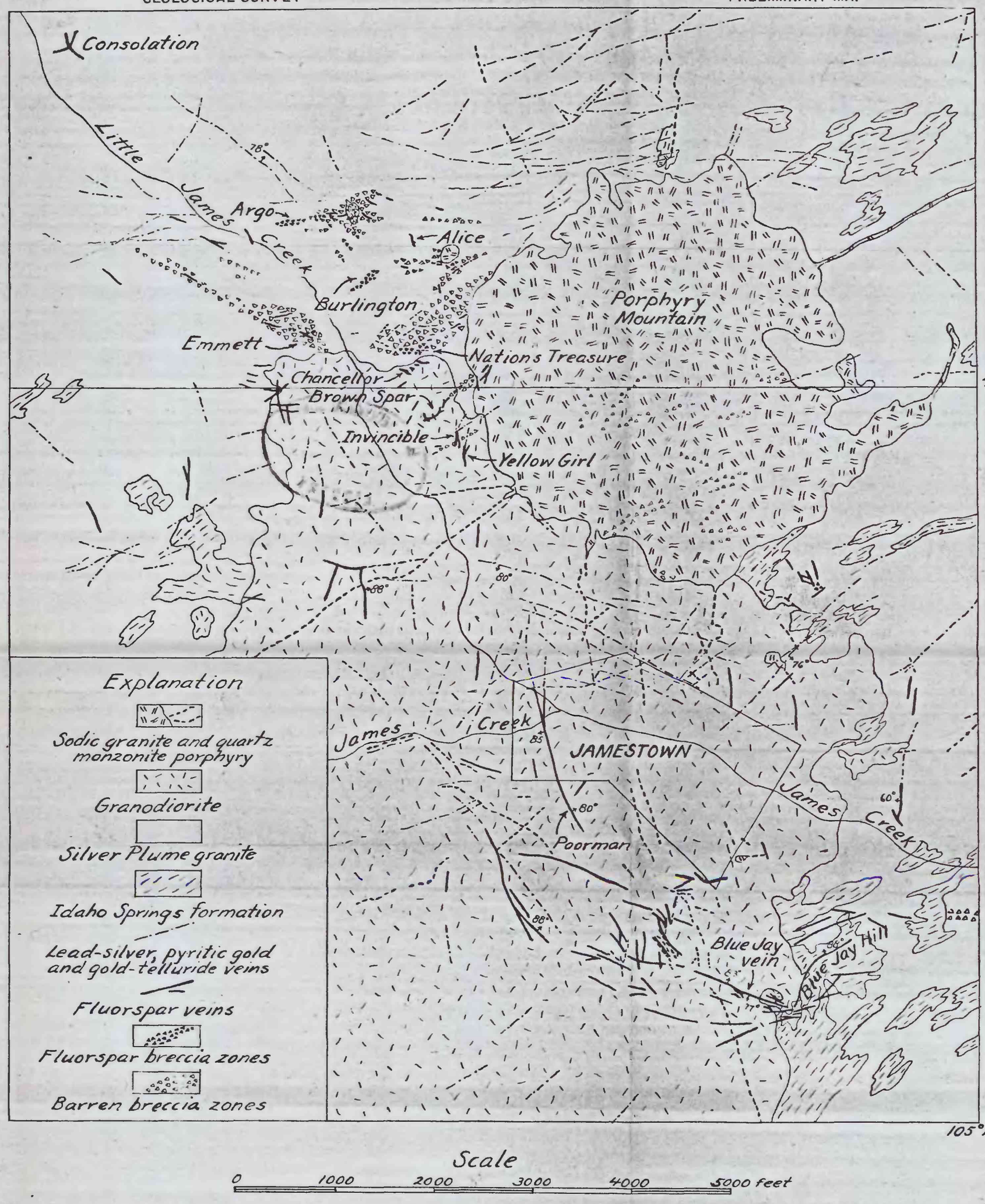
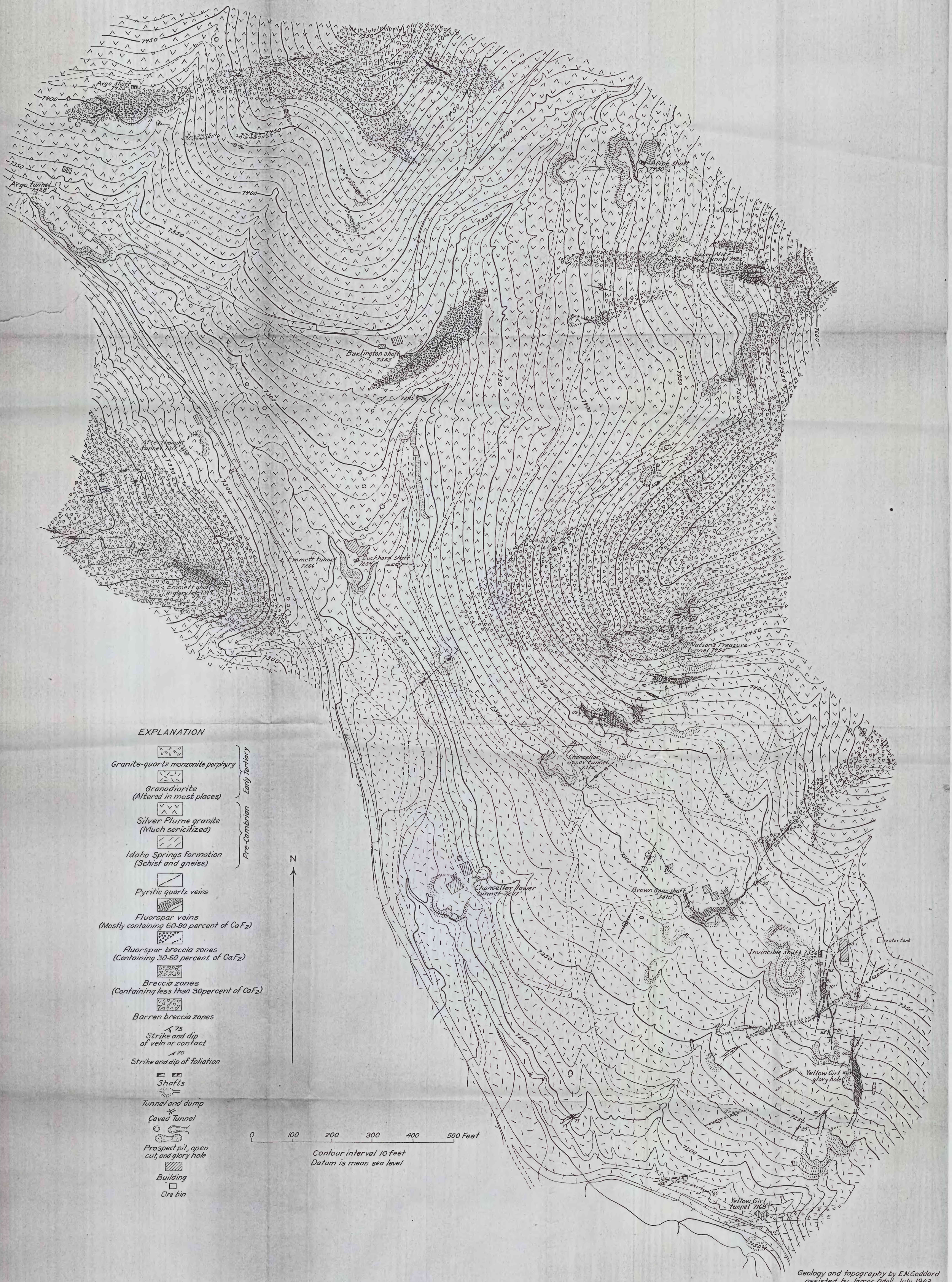


FIG. 1.– GEOLOGIC MAP OF THE CENTRAL PART OF JAMESTOWN DISTRICT, BOULDER COUNTY, COLORADO SHOWING DISTRIBUTION OF THE PRINCIPAL FLUORSPAR DEPOSITS

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY MAP



EXPLANATION

- Granite-quartz monzonite porphyry — Early Tertiary
- Granodiorite (Altered in most places) — Early Tertiary
- Silver Plume granite (Much sericitized) — Pre-Cambrian
- Idaho Springs formation (Schist and gneiss) — Pre-Cambrian
- Pyritic quartz veins
- Fluorspar veins (Mostly containing 60-90 percent of CaF_2)
- Fluorspar breccia zones (Containing 30-60 percent of CaF_2)
- Breccia zones (Containing less than 30 percent of CaF_2)
- Barren breccia zones
- 75 Strike and dip of vein or contact
- 70 Strike and dip of foliation
- Shafts
- Tunnel and dump
- Caved Tunnel
- Prospect pit, open cut, and glory hole
- Building
- Ore bin

N

0 100 200 300 400 500 Feet

Contour interval 10 feet
Datum is mean sea level

Geology and topography by E.N.Goddard
assisted by James Odell, July 1943

PLATE I.-GEOLOGIC MAP OF THE PRINCIPAL FLUORSPAR-PRODUCING AREA, JAMESTOWN DISTRICT,
BOULDER COUNTY, COLORADO

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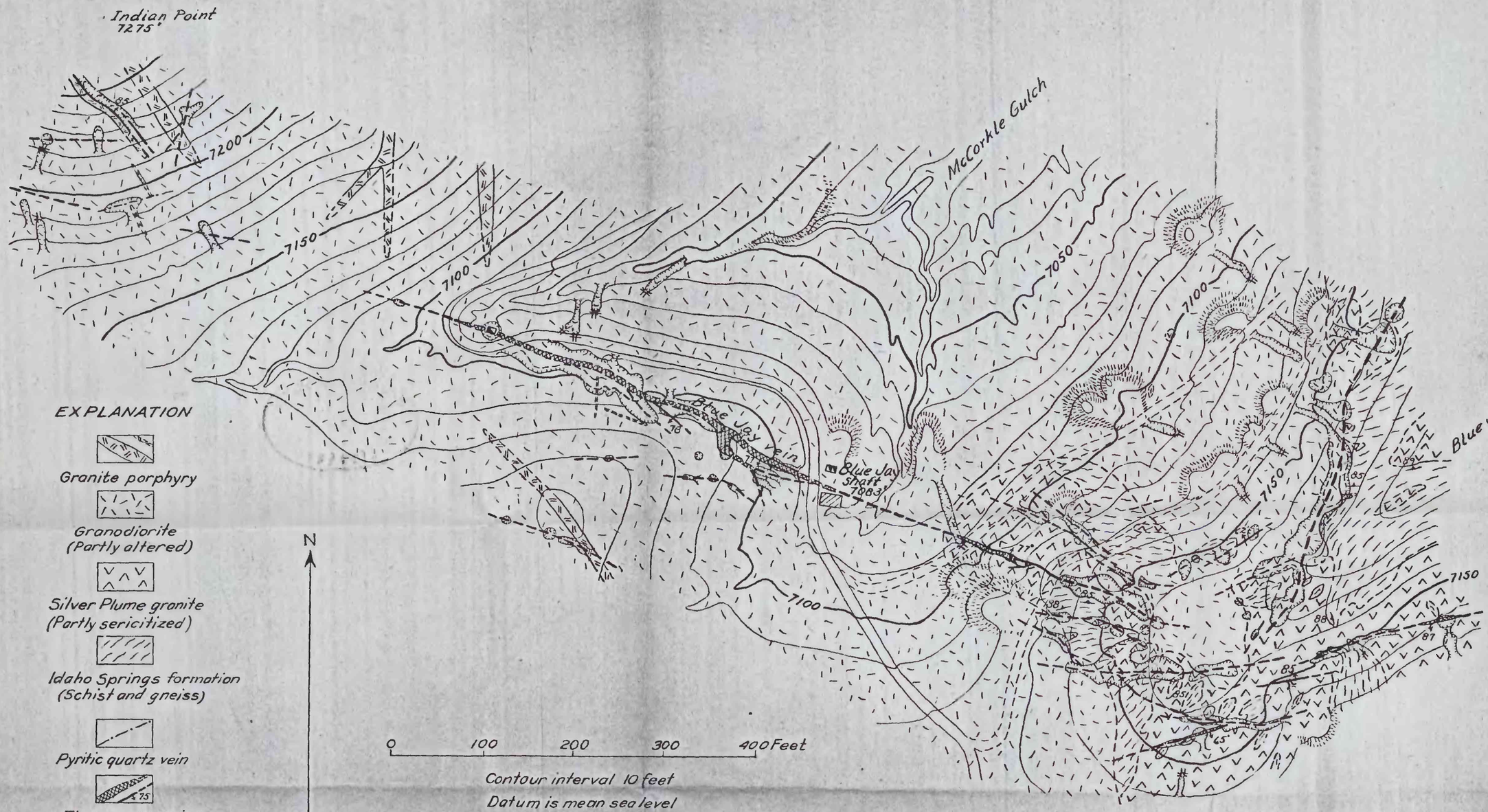
Plate 2

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY MAP



Geology and topography by E.N. Goddard
assisted by James Odell, July 1943

PLATE 2.- GEOLOGIC MAP OF THE BLUE JAY MINE AND VICINITY, JAMESTOWN DISTRICT,
BOULDER COUNTY, COLORADO

44-56
Plate 3

UNITED STATES DEPARTMENT OF THE INTERIOR
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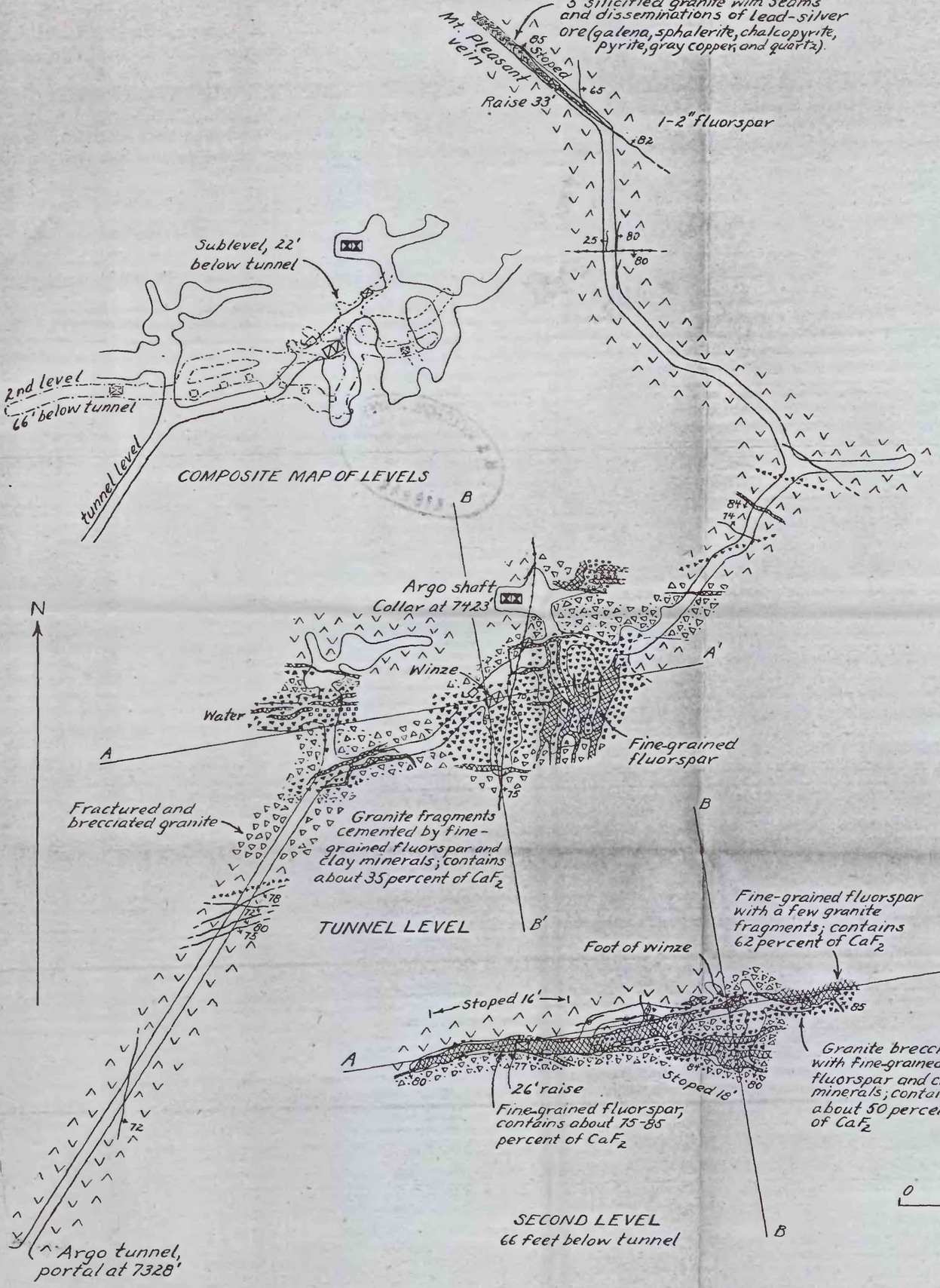
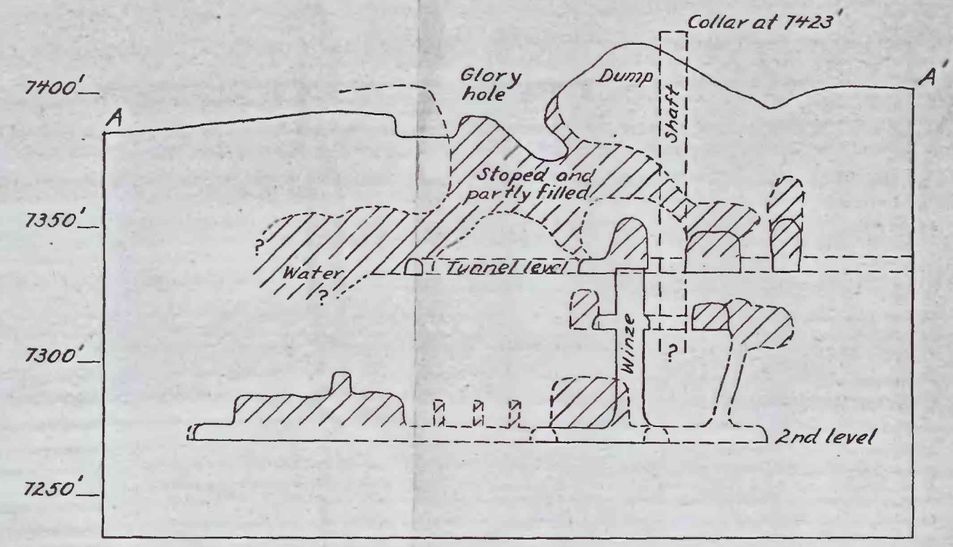
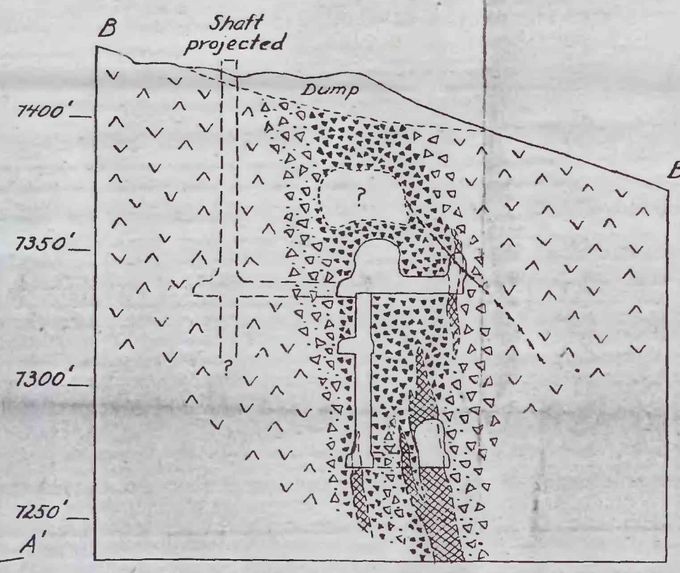
STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY MAP





LONGITUDINAL PROJECTION ON SECTION A-A', SHOWING STOPES



SECTION B-B'

0 50 100 150 200 feet

EXPLANATION

- Silver Plume granite (much sericitized)
- Fault
- Fluorspar veins containing 60-90 percent of CaF_2
- Lead-silver vein
- Fluorspar breccia containing 30-60 percent of CaF_2
- Granite breccia containing less than 30 percent of CaF_2
- Barren granite breccia
- Abundant galena fragments
- Abundant pyrite, chalcopyrite and galena
- Strike and dip of vein, fault or contact
- Vertical vein fault or contact
- Shaft
- Winze
- Raise
- Chute

Geology of tunnel by E. N. Goddard, June, 1934. Mine map furnished by J. E. Byron
Geology of second level by E. N. Goddard assisted by James Odell, July 1943

PLATE 3.- GEOLOGIC MAPS AND SECTIONS OF THE ARGO MINE, JAMESTOWN DISTRICT, BOULDER COUNTY, COLORADO.

UNITED STATES DEPARTMENT OF THE INTERIOR
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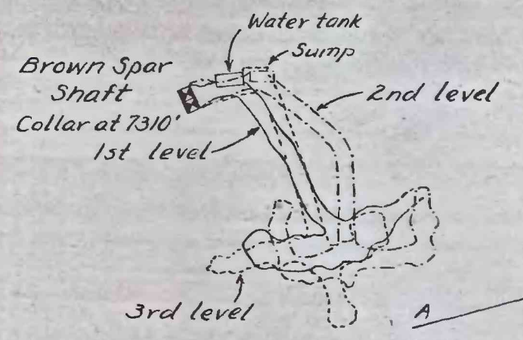
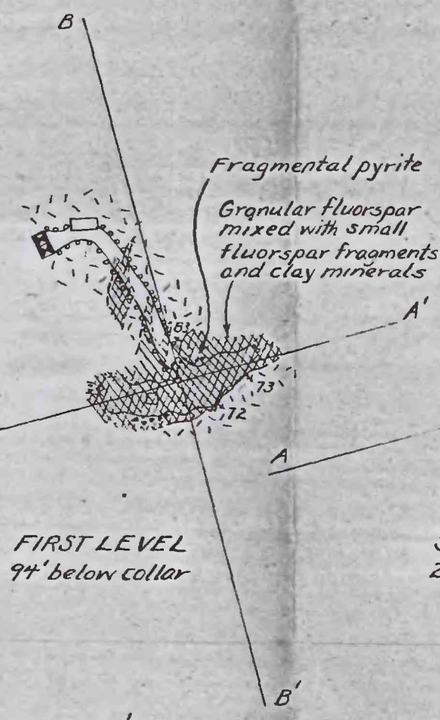
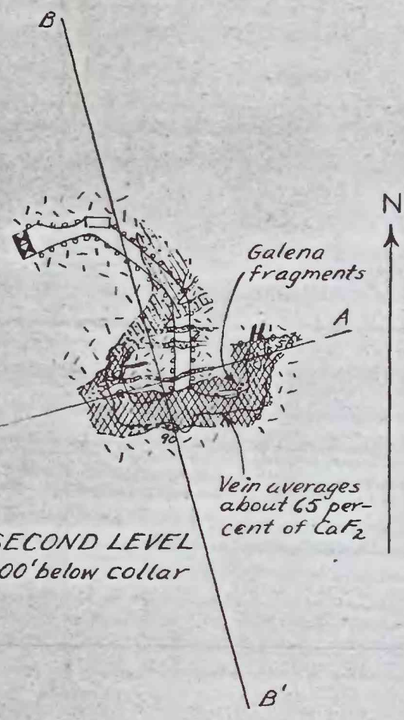
STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY MAP



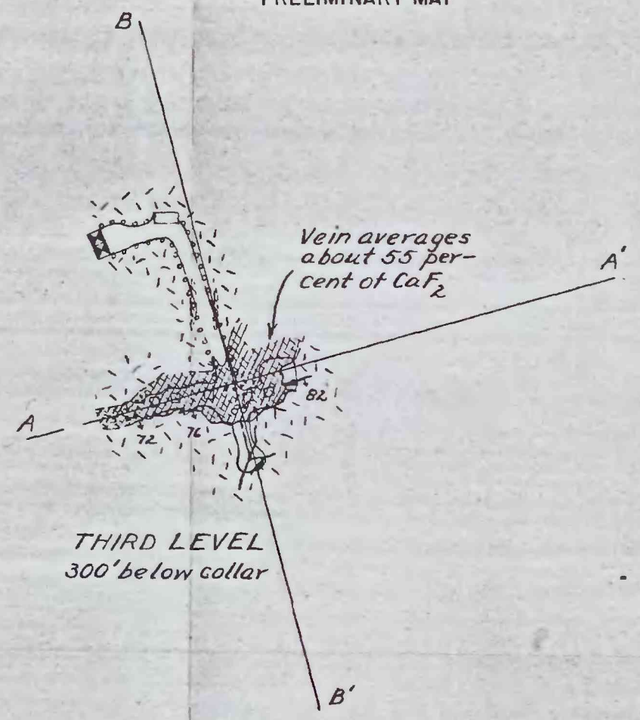
COMPOSITE MAP OF LEVELS



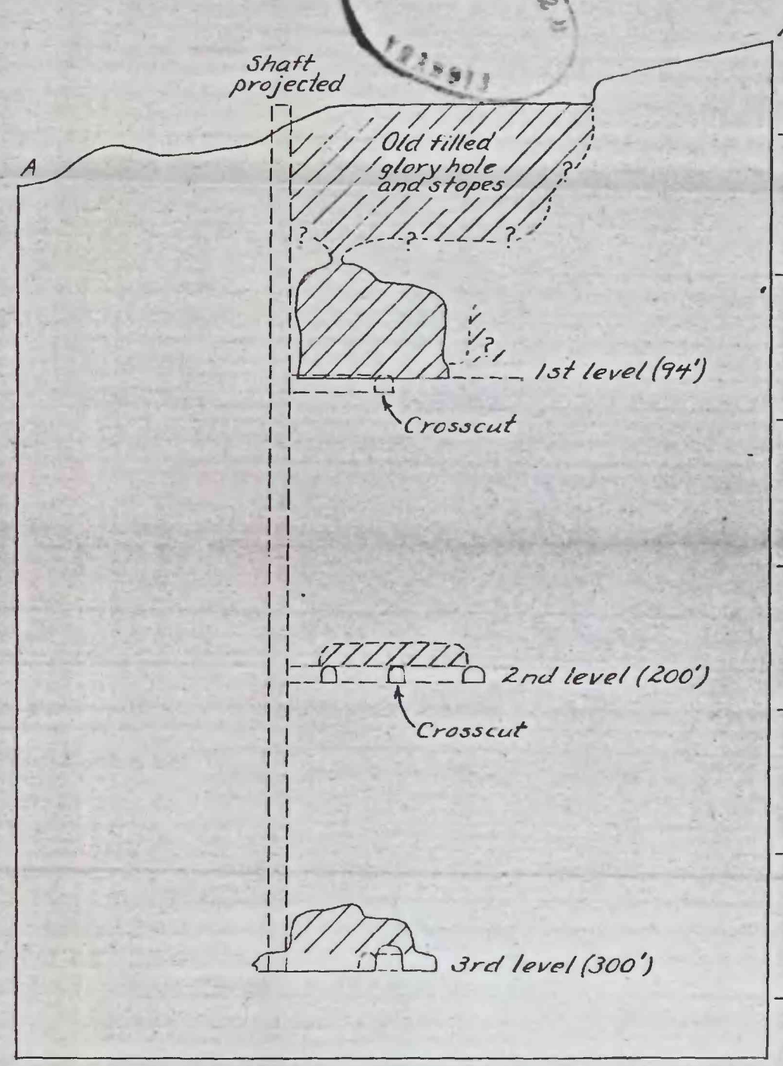
FIRST LEVEL
94' below collar



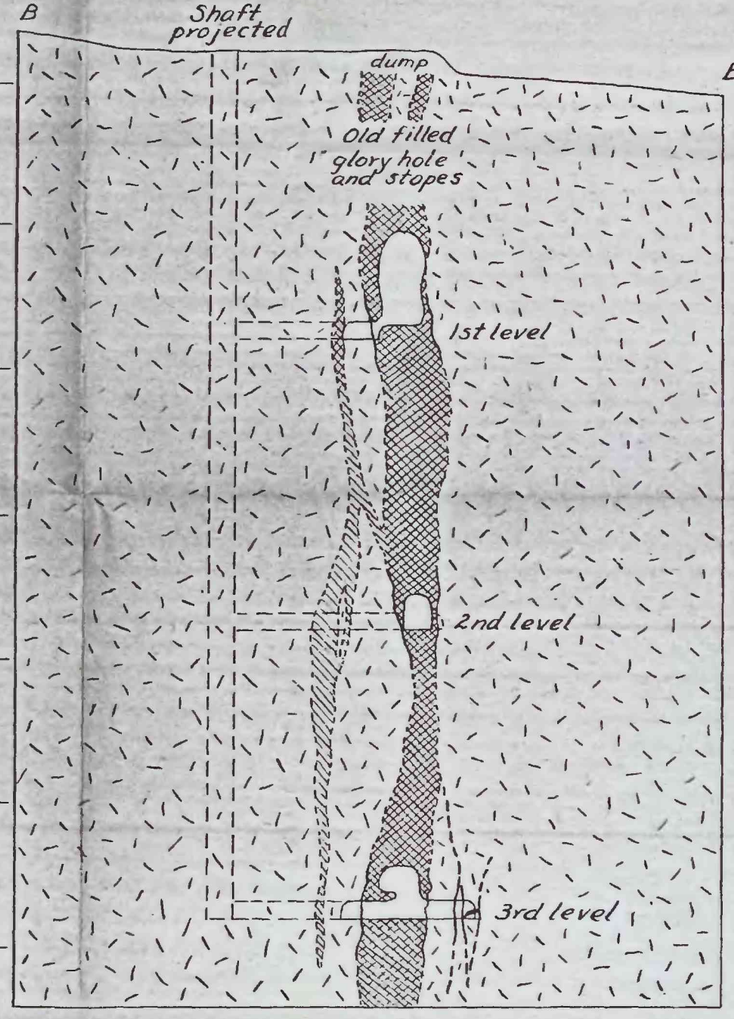
SECOND LEVEL
200' below collar



THIRD LEVEL
300' below collar



LONGITUDINAL PROJECTION ON SECTION A-A', SHOWING STOPES



SECTION B-B'

EXPLANATION

Altered granodiorite

Fluorspar veins containing 60-90 percent of CaF_2

Fluorspar vein containing 50-60 percent of CaF_2

Low-grade fluorspar veins (dots indicate abundant quartz)

Fluorspar breccia containing 30-60 percent of CaF_2

Abundant pyrite or galena

∠75 Strike and dip of vein or contact

∅ Vertical vein or contact

Shaft

Chute

drift timbered

0 50 100 150 feet

Geology by E.N. Goddard assisted by James Odell
July, 1943
Mine maps furnished by H.B. Williamson

PLATE 4.-GEOLOGIC MAPS AND SECTIONS OF THE BROWN SPAR MINE, JAMESTOWN DISTRICT, BOULDER COUNTY, COLORADO.

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY MAP

Plate 5
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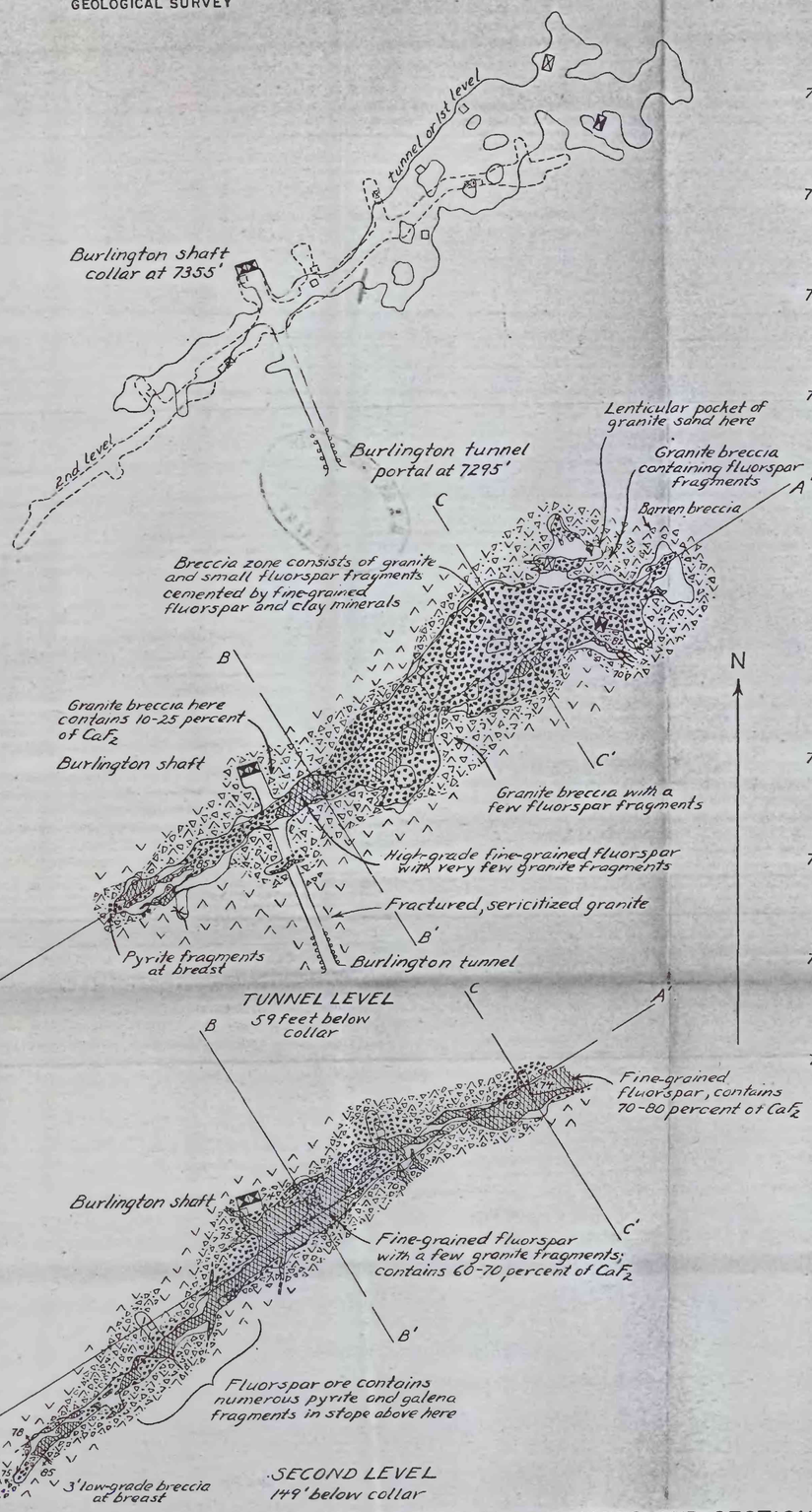
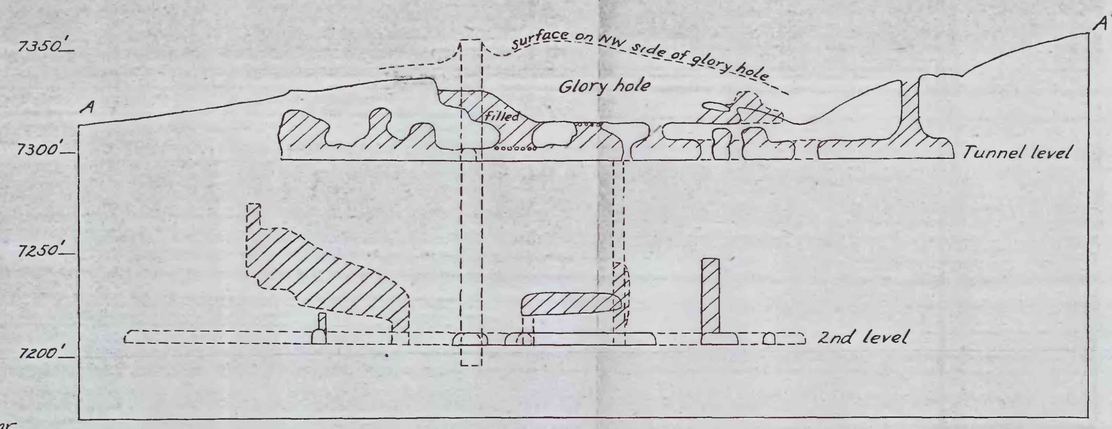
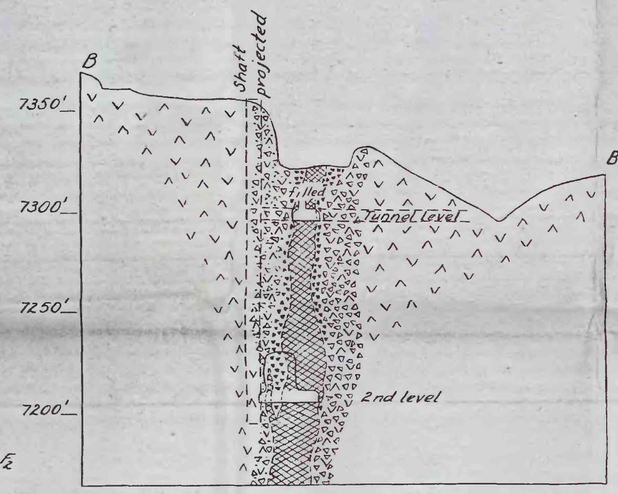
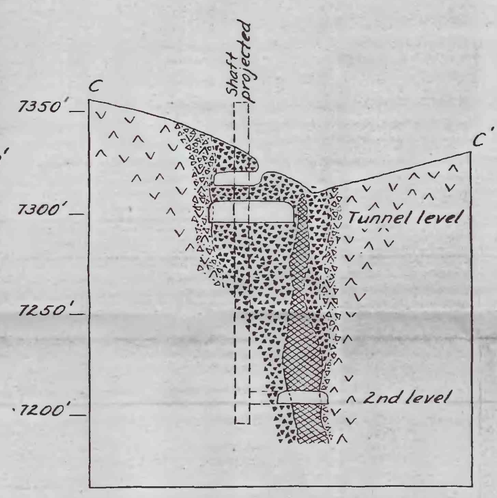




LONGITUDINAL PROJECTION ON SECTION A-A', SHOWING STOPES



SECTION B-B'



SECTION C-C'

0 50 100 150 200'

EXPLANATION

- Silver Plume granite
- Fluorspar veins containing 60-90 percent of CaF_2
- Fluorspar breccia containing 30-60 percent of CaF_2
- Breccia containing less than 30 percent of CaF_2
- Barren breccia
- Abundant pyrite fragments
- 70 Strike and dip of vein or contact
- Vertical vein or contact
- Shaft
- Raise
- Chute
- Timbered drift

Geology by E. N. Goddard
assisted by James Odell
July 1943
Mine maps furnished by
General Chemical Co.

PLATE 5.- GEOLOGIC MAPS AND SECTIONS OF THE BURLINGTON MINE, JAMESTOWN DISTRICT, BOULDER COUNTY, COLORADO.

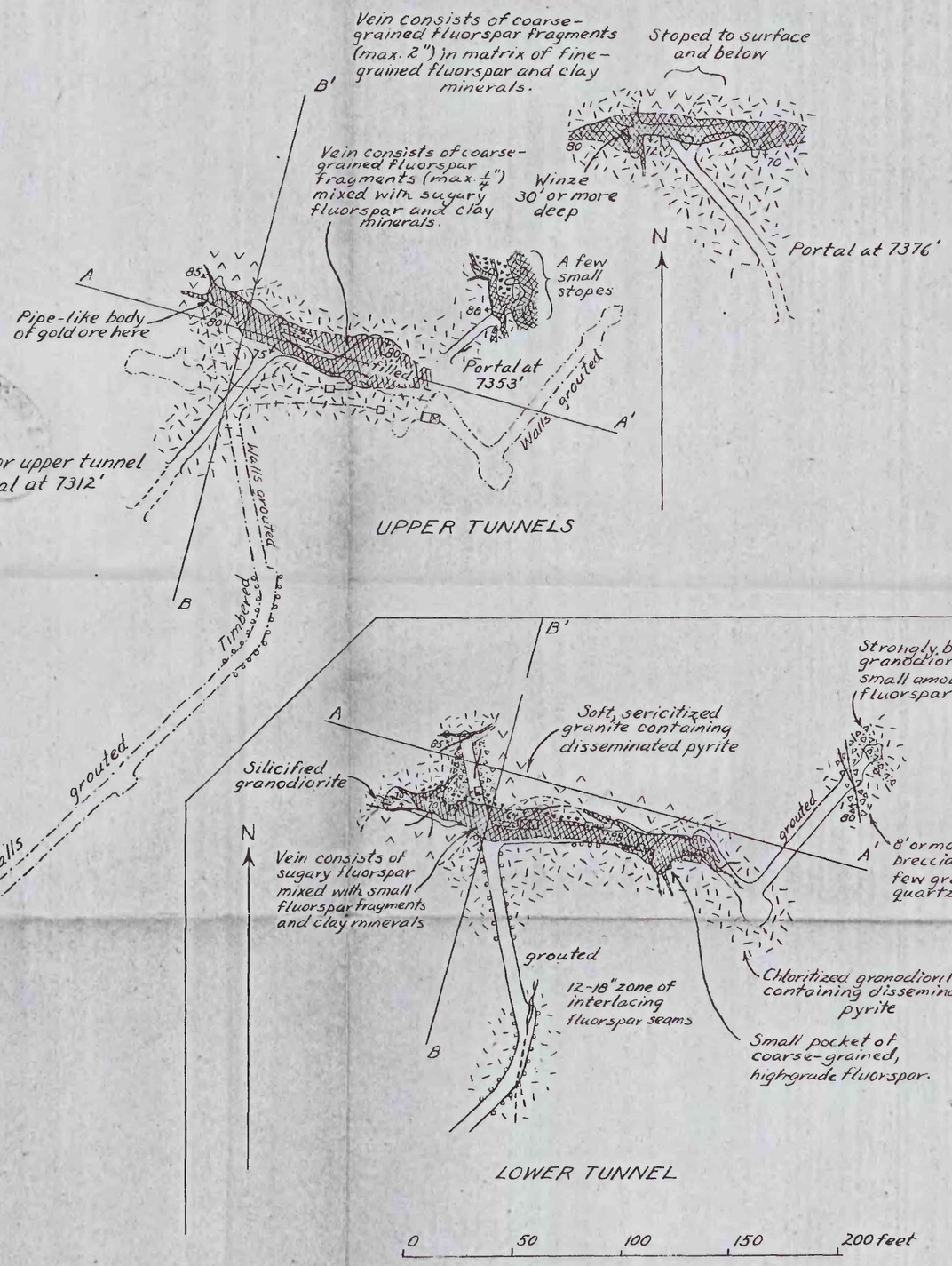
44-56
Plate 6

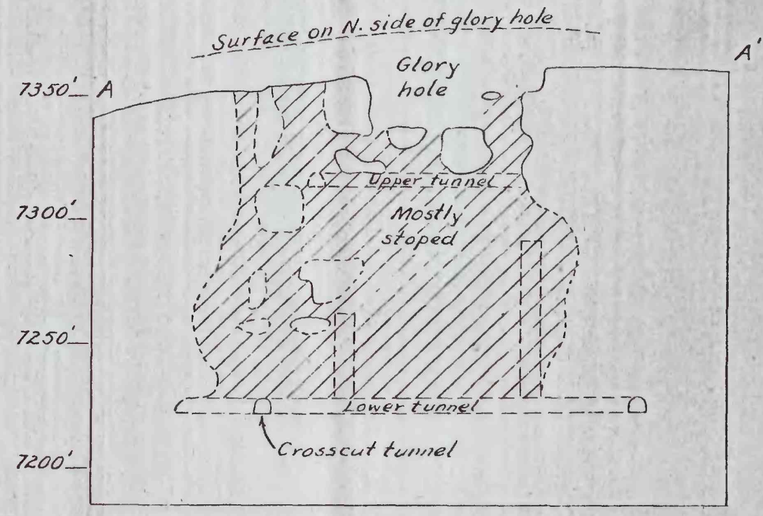
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY MAP

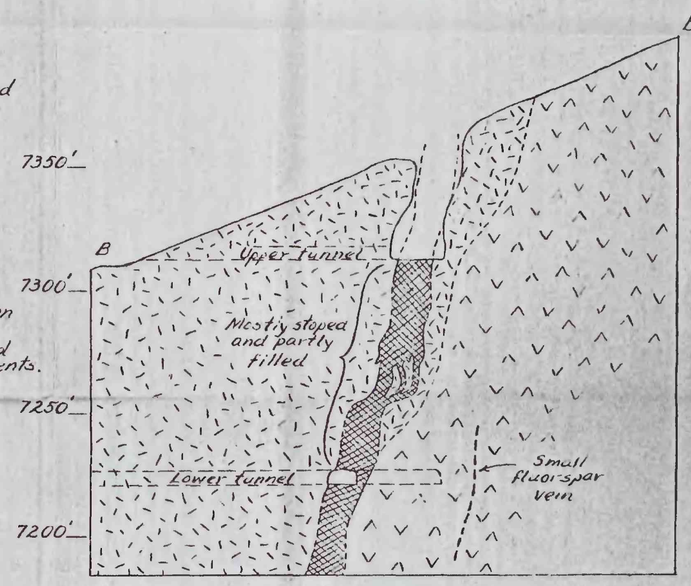
EXPLANATION

- Granodiorite (mostly altered)
- Silver Plume granite (largely sericitized)
- Fault
- Pyritic quartz vein
- Fluorspar veins containing 60-90 percent of CaF_2
- Low-grade fluorspar vein (dots indicate abundant quartz)
- Fluorspar breccia containing 30-60 percent of CaF_2
- Breccia containing less than 30 percent of CaF_2
- Barren breccia
- Strike and dip of vein, fault or contact
- Vertical vein fault or contact
- Raise
- Winze
- Chute





LONGITUDINAL PROJECTION ON SECTION A-A'
SHOWING STOPES



SECTION B-B'
SHOWING APPROXIMATE SHAPE OF VEIN

Geology of upper tunnels by E. N. Goddard, Aug. 1933;
Lower tunnel by E. N. Goddard assisted by James Odell, July, 1943
Lower tunnel map furnished by General Chemical Co.

PLATE 6.- GEOLOGIC MAPS AND SECTIONS OF THE CHANCELLOR MINE, JAMESTOWN DISTRICT, BOULDER COUNTY, COLORADO.

44-56

Plate 7

UNITED STATES DEPARTMENT OF THE INTERIOR
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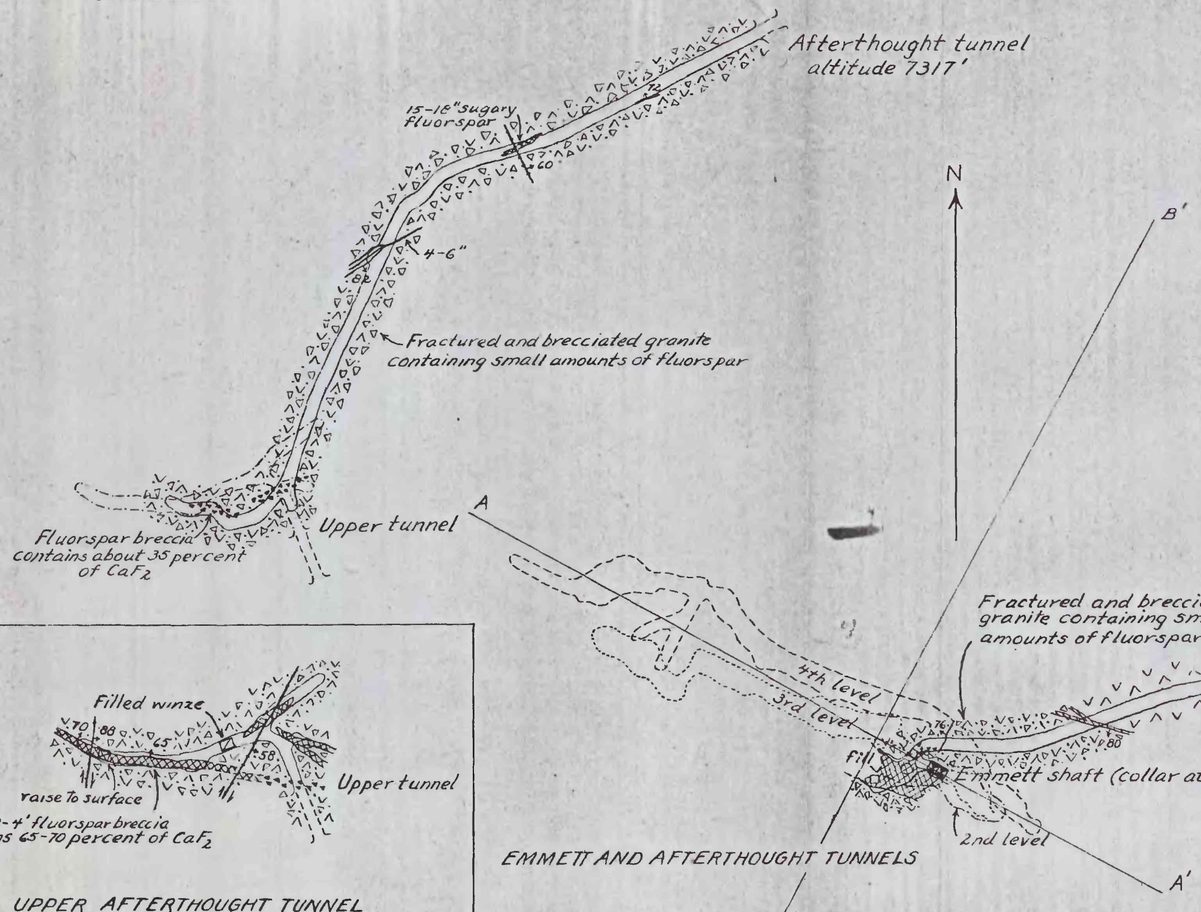
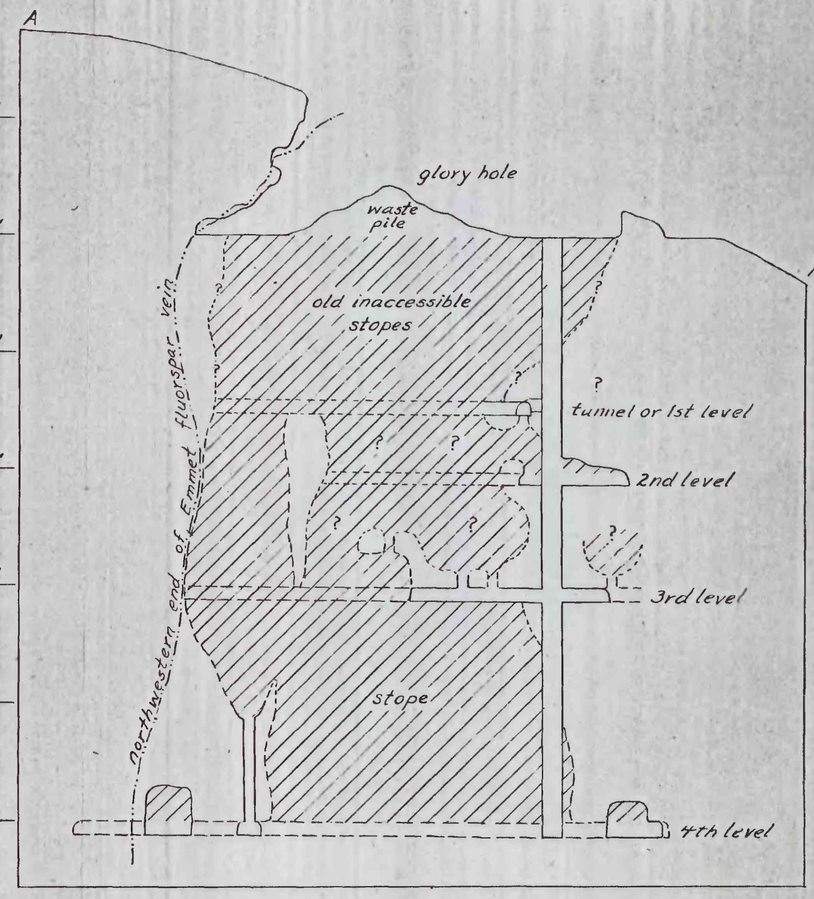
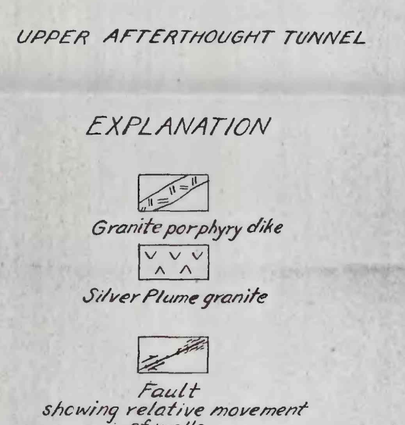
STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY MAP





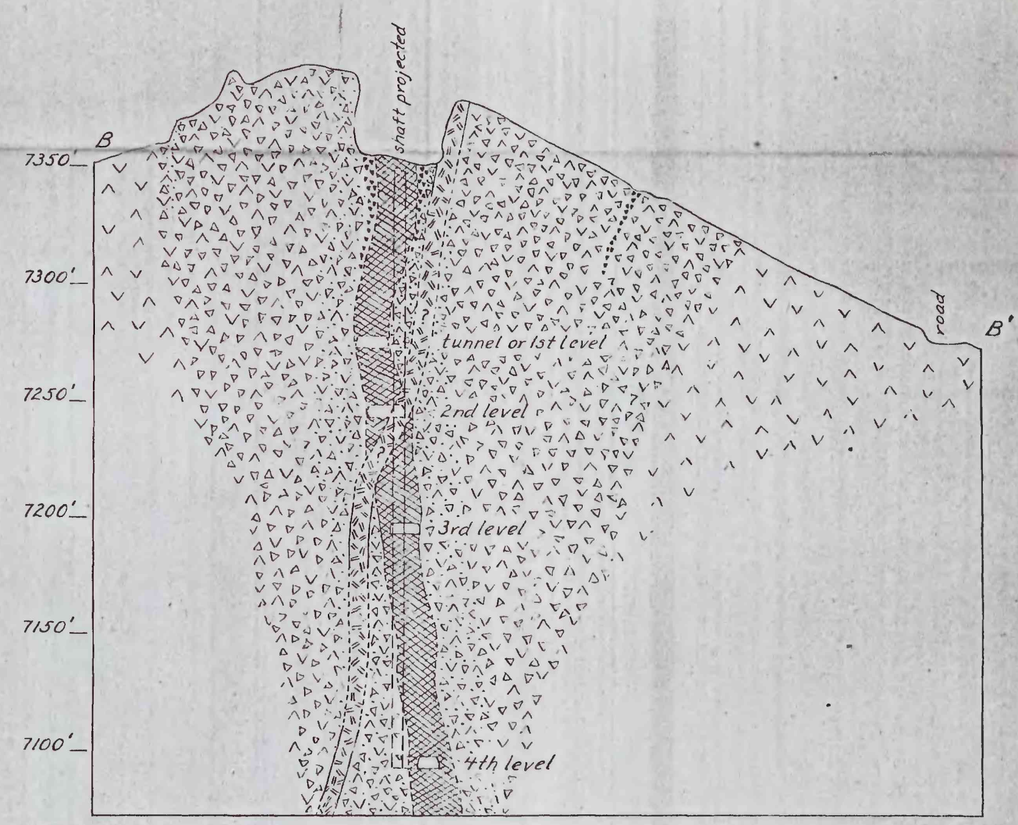
LONGITUDINAL PROJECTION ON SECTION A-A'
SHOWING STOPES



UPPER AFTERTHOUGHT TUNNEL

EXPLANATION

- Granite porphyry dike
- Silver Plume granite
- Fault showing relative movement of walls
- Fluorspar veins containing 60-90 percent of CaF_2
- Low-grade fluorspar veins (dots indicate abundant quartz)
- Fluorspar breccia containing 30-60 percent of CaF_2
- Breccia containing less than 30 percent of CaF_2
- Barren breccia
- 75 Strike and dip
- Vertical contact or fault
- Shaft, Winze, Raise
- Chute, Timbered drift



SECTION B-B' SHOWING GENERAL SHAPE OF VEIN
(Outline of stopes omitted because of lack of sufficient data)

Geology by E.N. Goddard
assisted by James Odell, July 1943
Mine maps furnished in part by H.B. Williamson

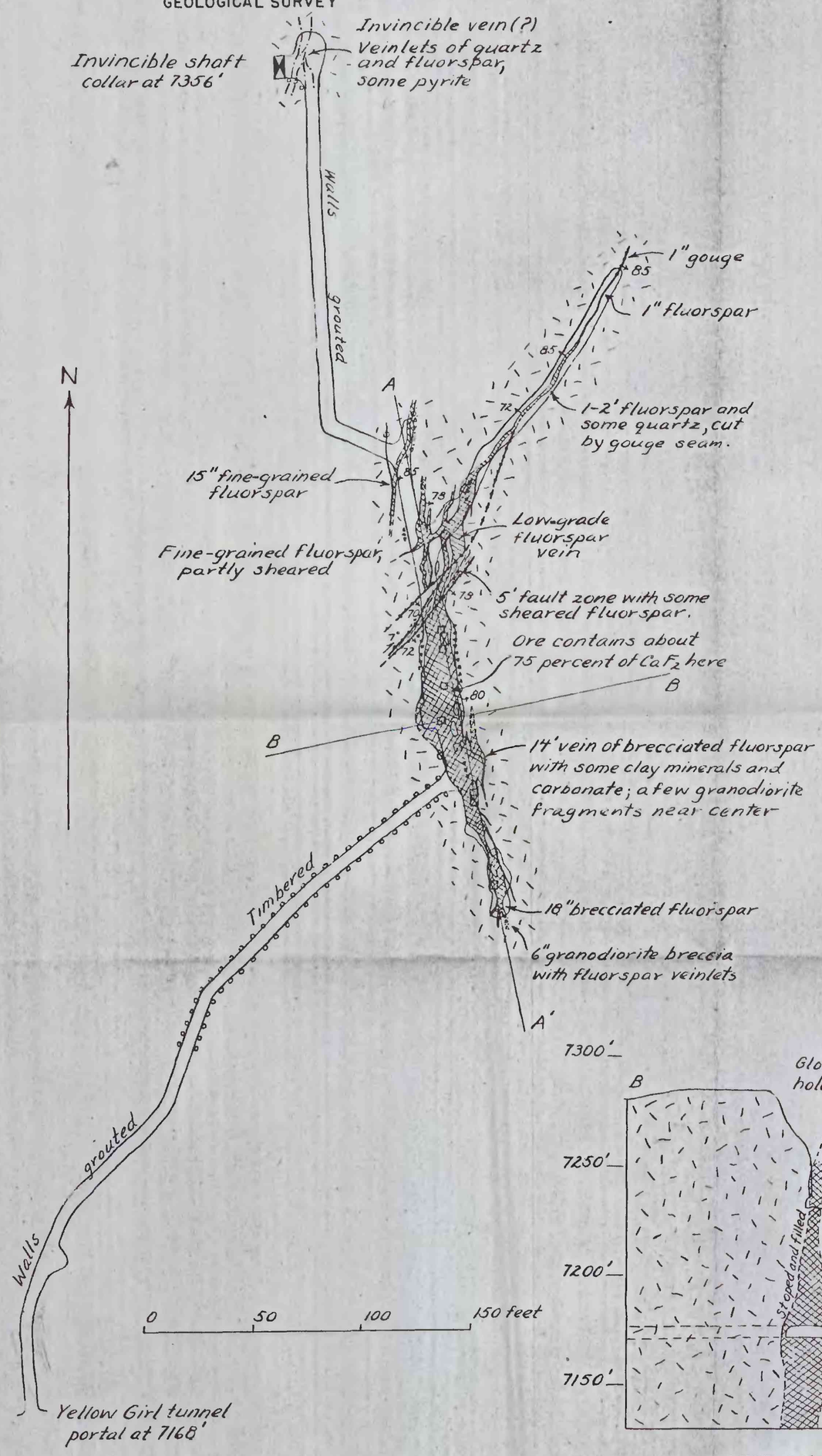
PLATE 7.- GEOLOGIC MAPS AND SECTIONS OF THE EMMETT MINE AND THE AFTERTHOUGHT TUNNEL, JAMESTOWN DISTRICT, BOULDER COUNTY, COLORADO

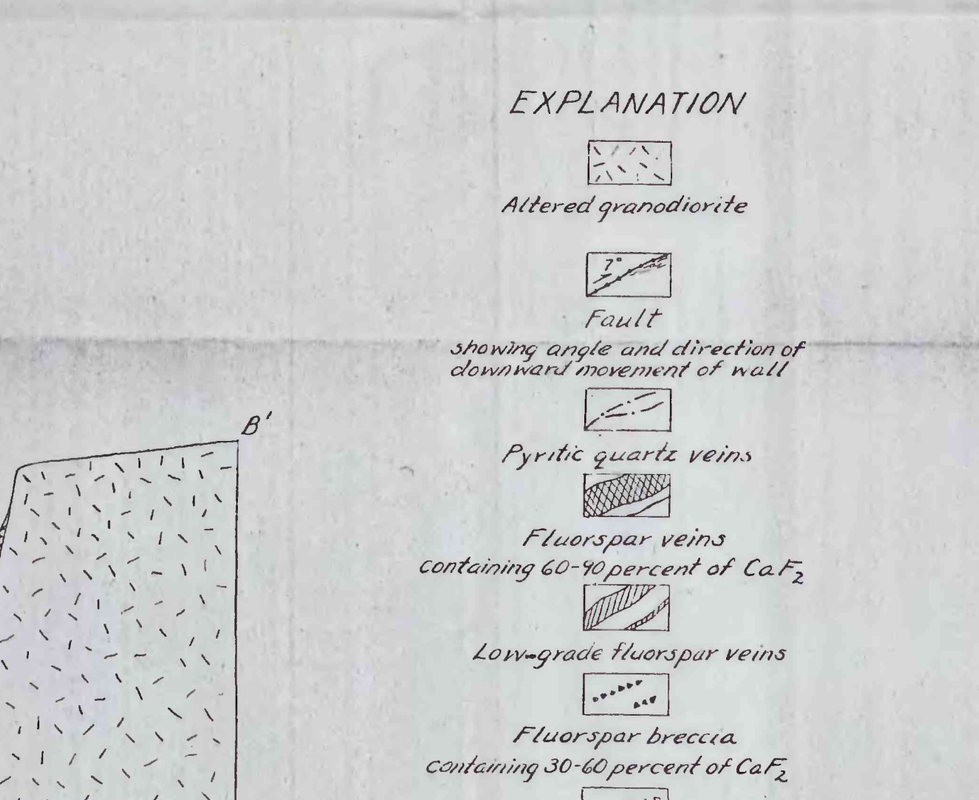
44-56

Plate 8

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STRATEGIC MINERALS INVESTIGATIONS
PRELIMINARY MAP





LONGITUDINAL PROJECTION ON SECTION A-A', SHOWING STOPES

SECTION B-B'
SHOWING APPROXIMATE SHAPE OF VEIN

EXPLANATION

Altered granodiorite

Fault
showing angle and direction of downward movement of wall

Pyritic quartz veins

Fluorspar veins
containing 60-90 percent of CaF_2

Low-grade fluorspar veins

Fluorspar breccia
containing 30-60 percent of CaF_2

Breccia containing
less than 30 percent of CaF_2

∠75 — Strike and dip of vein, fault or contact

ϕ — Vertical vein fault or contact

Shaft Raise Chute

Geology by E.N. Goddard assisted by James Odell, July 1943.
Mine map furnished by General Chemical Co.

PLATE 8.- GEOLOGIC MAP AND SECTIONS OF THE YELLOW GIRL MINE, JAMESTOWN DISTRICT, BOULDER COUNTY, COLORADO