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 1903-13 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, 1942-13, 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

* 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. In several of the deposits there is evidence that some of 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/

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

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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.
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

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

EXPLANATION

Granite porphyry
Granodiorite (Partly altered)
Silver Plume granite (Partly sericitized)
Idaho Springs formation (Schist and gneiss)
Pyritic quartz vein
Fluorspar veins
A.S. Strike and dip of vertical foliation
Shaft, Tunnel, Caved Tunnel
Prospect pits and open cuts
Building

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

Contour interval 10 feet
Datum is mean sea level

Plate 2.
PLATE 4.-GEOLOGIC MAPS AND SECTIONS OF THE BROWN SPAR MINE, JAMESTOWN DISTRICT, BOULDER COUNTY, COLORADO.
PLATE 5.- GEOLOGIC MAPS AND SECTIONS OF THE BURLINGTON MINE, JAMESTOWN DISTRICT, BOULDER COUNTY, COLORADO.
Vein consists of coarse-grained fluorite fragments (max. 2") in matrix of fine-grained fluorite and clay minerals.

Upper tunnel portal at 7172'.

Chancellor upper tunnel portal at 7112'.

Fluorite veins containing 30-50 percent of CaF₂.

Longtitudinal projection on section A-A' showing stope.

Section B-B' showing approximate shape of vein.

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

- **Granite porphyry dike**
- **Silver Plume granite**
- **Fault**
- **Fluorspar veins containing 0% to 2% of CaF₂**
- **Quartz veins containing 50% to 60% of CaF₂**
- **Brecia containing less than 20% of CaF₂**
- **Brecia containing less than 20% of CaF₂**
- **Conversion breccia**
- **Magnetic breccia**
- **Vein**
- **Fissure**
- **Strike and dip**
- **Vertical contact or fault**
- **Shaft**
- **Incline**
- **Chute**
- **Timbered drift**

**EMMETT AND AFTERTHOUGHT TUNNELS**

- Afterthought tunnel attitude 75° 7'
- Emmett tunnel attitude 75° 3'
- 2nd level
- 3rd level
- 4th level
- Old inaccessible stopes
- Aft Engel, 1st level
- Tunnel or 1st level
- 2nd level
- 3rd level
- 4th level
- E A. Goddard

**SECTION B-B' SHOWING GENERAL SHAPE OF VEIN**

(Outline of stopes omitted because of lack of sufficient data)

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