Pamphlet 62 March, 1943

STATE OF IDAHO
C. A. Bottolfsen, Governor

IDAHO BUREAU OF MINES AND GEOLOGY
A. W. Fahrenwald, Director

THE ANTIMONY AND FLUROSPAR DEPOSITS NEAR MEYERS COVE, LEMHI COUNTY, IDAHO

By

Alfred L. Anderson

University of Idaho

Moscow, Idaho

TABLE OF CONTENTS

ILLUSTRATIONS

THE ANTIMONY AND FLUORSPAR DEPOSITS NEAR MEYERS COVE,

LEMHI COUNTY, IDAHO

by
Alfred L. Anderson

ABSTRACT

This report describes an antimony and a number of recently discovered fluorspar deposits in the Salmon River Mountains near Meyers Cove in western Lemhi County, Idaho. These deposits are fillings and replacements along complicated fissure and fracture zones in tuffaceous beds of the Casto (Permian?) and Challis (Tertiary) volcanics. Because of considerable silicification, the deposits are somewhat more resistant to erosion than the enclosing tuffaceous strata and consequently form low ledges on steepened slopes.

The antimony deposit is composed largely of barite with considerably lesser amounts of stibnite, fluorite, and chalcedony. The presence of stibnite in commercial quantities has not yet been demonstrated. The fluorspar deposits are composed largely of fluorite with variable but generally lesser amounts of barite and chalcedony. Some of the fluorspar ledges are 15 to 20 feet wide and at least several hundred feet long. They commonly contain seams of massive fluorite several inches to several feet wide parallel to the long direction of the ledge with stringers, seams, and embedded masses through much of the remainder.

The ledges are numerous, are grouped rather closely together, and are distributed over a vertical topographic range of about 1,500 feet. The total reserves of fluorite are apparently large; but, because of the lack of any development, estimates of tonnages available are not practical. Should the deposits be developed, the outlook for a considerable production appears bright. Some of the deposits may yield a high grade product by careful sorting, but milling is probably necessary to assure a product acceptable for industrial uses in all except a few deposits.

INTRODUCTION

Purpose and Scope

This report on the antimony and fluorspar deposits near Meyers Cove in Lemhi County, Idaho, makes available data obtained during a reconnaissance examination on July 28 and 29, 1942. This examination was made shortly after word was received of the discovery of a number of fluorspar-bearing ledges where previously only a single deposit of stibnite was known to exist. Although the presence of antimony had been known for some years, the deposit had attracted little attention, in part because of the general lack of interest in domestic deposits, and in part because of rather unsatisfactory surface showings. With the spread of the present world conflict, intense search for domestic supplies of the strategically important antimony has been carried on and every known deposit in the country has been cited for examination with view to possible development and utilization. The search for critical minerals has also spread to fluorspar, the supply of which may fail the big demand made by the greatly expanded iron and steel industries, unless additional new deposits are brought into production. Because of the urgent need of both antimony and fluorspar, the deposits near Meyers Cove were given immediate attention. As yet the fluorspar deposits have not received much publicity and, consequently, have attracted little except local interest. As news of these deposits spreads, the interest in them and the requests for information on them are likely to increase. This report, therefore, has been prepared for the Idaho Bureau of Mines and Geology in anticipation of the inquiries to come and to provide a record of the available data for public use.

Since little work had been done on the antimony deposit and none whatsoever on the fluorspar, the examination had to consist largely of a study of the outcrops, which, fortunately, because of somewhat superior resistance to erosion, tend to form low ledges on the steeper slopes. As the deposits are grouped within a comparatively small area, scarcely more than a day was necessary for traversing the outcrops. Many of the deposits were within an area that had already been mapped geologically; consequently, there was no immediate need of detailed mapping.

The development at the antimony deposit has not demonstrated that ore exists in commercial quantities, but it does reveal that the deposit has more than usual scientific interest. Although the fluorspar deposits had as yet received no work, the surface showings were such as to justify considerable optimism despite the long distance from railroads and markets.

Previous Geologic Work

The antimony deposit received a paragraph in a report by Ross in 1927 1/ and was redescribed at somewhat greater length in a report dealing with the geology and ore deposits of the Casto quadrangle, published in 1934 2/. In both reports Ross raises doubt that the deposit will prove of much economic value, but points out that its unique association with barite makes it of considerable scientific interest. The geologic map that accompanies the report on the Casto quadrange covers considerable of the area that contains the recently discovered fluorspar deposits; but, although the different rock formations and the gologic structure are shown in detail, the fluorspar-bearing ledges evidently escaped attention.

Acknowledgments

The writer wishes to acknowledge his indebtedness to Reese Miles and

1/ Ross, C. P., Ore dèposits in Tertiary lava in the Salmon River Mountains, Idaho: Idaho Bur. Mines and Geol. Pamphlet 25, p. 17 (1927).

2/ Ross, C. P., Geology and ore deposits of the Casto quadrangle, Idaho: U. S. Geol. Survey Bull. 854, pp. 131-2 (1934)

Roy Johnson of Salmon, Idaho, who provided transportation from Salmon to Meyers Cove and return and also furnished saddle horses and served as guides while the examination was in progress. An expression of appreciation is also due H. V. St. Clair of Shoup, Idaho, who was first to call the writer's attention to the fluorspar deposits at Meyers Cove and who contributed some fine specimens of ore from the antimony deposit.

GEOGRAPHY

Location

The stibnite and fluorspar deposits are in the Gravel Range (Singiser) mining district in the far western part of Lemhi County about 38 miles by air or 66 miles by road southwest of Salmon, the county seat, or 27 miles by air or 56 miles by road northwest of Challis, the county seat of Custer County (Fig. 1). They are along Camas Creek, a tributary of the Middle Fork of the Salmon River, far back in the Salmon River Mountains. Inasmuch as Camas Creek serves as a forest boundary, the antimony deposit, which is on the southwest side of the creek, is in the Challis National Forest; whereas the fluorspar deposits, which are on the northeast side of the creek, are all in the Salmon National Forest. Most of the fluorspar deposits fall just outside the east border of the Casto quadrangle at about 114°30' west longitude and 44°50' north latitude.

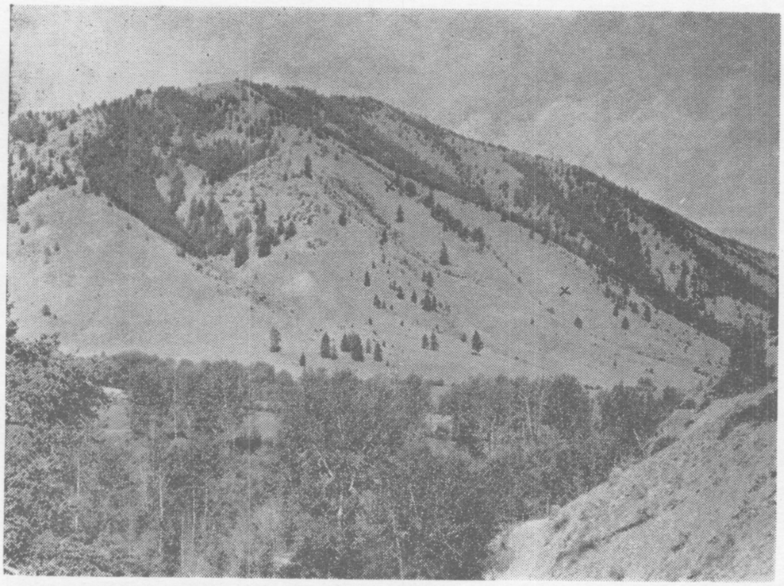
The deposits are from 1 to 2 miles west and north of Meyers Cove, a flat of several hundred acres of arable land at the junction of Silver Creek and the West Fork of Camas Creek with the main Camas Creek. Meyers Cove is in Sec. 5 and 6, T. 17N., R. 17E., but the deposits are in unsurveyed Sec. 1, T. 17N., R. 16E. and Secs. 29, 30, 31, and 32, T. 19N., R. 17E. (Refer to Figure 2).

Surface Features

Except for the small valley flat at Meyers Cove, the region is entirely mountainous, the slopes rising steeply from Camas Creek to ridge crests 2,000 to 3,500 feet above. (Plate 1). A bench mark at Meyers Cove records an altitude of 5,185 feet above sea level and another about 3 miles down Camas Creek, an altitude of 5,040 feet. The ridges within the map area rise to 7,500 feet; they rise very steeply to 7,000 feet and then more gradually to altitudes of 8,000 to 10,000 feet in more distant peaks and ridges. The flat at Meyers Cove is from 1/4 to 1/2 mile wide and a mile or more in length. Much restricted in width, the valley flat extends several miles above and below Meyers Cove. The expansion of the valley floor at Meyers Cove has resulted from the combined erosion of Silver Creek, Camas Creek, and the West Fork of Camas Creek, the two tributaries joining Camas Creek at about right angles and from diammetrically opposite sides. Slopes rise steeply from the edge of the aggraded valley flat. (Plate 1)

Pertinent topographic features other than the flat along Camas Creek include the deep, narrow, and rugged canyon of Duck Creek, which joins Camas Creek valley about 2 miles below Meyers Cove; and a steep-sided gulch between Meyers Cove and Duck Creek, which, since it contains most of the fluorspar deposits, is herein designated as Fluorspar Gulch. Sides of Fluorspar

PLATE 1



Illustrating the topography at the lower end of Meyers Cove and showing the outcrops (x) of the antimony lode on the steep slope southwest of Camas Creek.

Gulch slope upward at angles of about 30 degrees and reach the ridge crest separating it from the Duck Creek drainage at altitudes of 7,000 to 7,500 feet.

Climate and Vegetation

Although some distance within the Salmon River Mountains, the precipitation is not heavy and comes mostly during the spring and winter months. No records are available, but the presence of sagebrush on most of the lower slopes suggests essentially semi-arid conditions with perhaps little more than 20 inches of precipitation annually along the valley bottoms. The first six months of the year are generally the wettest; and August the driest. From late June to late August or early September much of the precipitation falls during heavy showers of short duration, storms of several days length being rare, but during much of the remainder of the year storms are likely to be prolonged into several days. Snow depth during the winter months was not learned, but apparently is not enough to interfere seriously with travel in and out of Meyers Cove.

The climate is only moderately severe. The winters are long and from November until March the temperature probably rarely exceeds 25° F., and may for short periods of time, drop below zero. Summers are comparatively short, but pleasant. Frost may occur at any time, but is rare in June, July, and August. Fluctuations in temperature are fairly marked and in both winter and summer shifts of 40 degrees in a single day are not uncommon.

Except on north slopes, the ridges are almost barren of timber. The only trees in Fluorspar Gulch are small aspen along the gulch bottom and a belt of evergreens, mostly fir, well up the slope on the southeast side. Considerable timber, however, clothes the surrounding countryside where slopes are not too steep.

Routes of Approach

Meyers Cove, which may be reached from either Salmon or Challis, is at the end of a graded and partly surfaced forest road. Formerly, Salmon was the terminus of the 100-mile long Gilmore and Pittsburg Railroad which connected with the Union Pacific at Armstead, Montana, but in 1939 the line was abandoned and the tracks were removed. Since then, Salmon has been served by auto stage and freight. From Salmon, stages run daily over U. S. Highway 93 to Missoula, Montana (Intermountain Transportation Company), and over U. S. Highways 93, 93-A, 20, and 91 to Pocatello, Idaho (Salmon River Stages). Another stage runs triweekly during the summer months between Salmon and Twin Falls, Idaho (Sun Valley Stages), via Stanley and Sun Valley. Mail is brought to Salmon daily, except Sunday, by mail trucks from Armstead, Montana (also carry passengers), and Pocatello, distances of 95 and 230 miles, respectively.

From Salmon, the shortest route to Meyers Cove is across the 8,000-foot divide separating the Salmon River from Panther Creek (Fig. 1). This route follows U. S. Highway 93 to a point 5 miles south of Salmon and then crosses Salmon River and extends up Williams Creek to its head. From there, it follows Moccasin and Napias creeks to Panther Creek and continues up Panther Creek to a point about 5 miles above Forney. It there crosses a low divide to Silver Creek and extends down Silver Creek to Meyers Cove.

During the winter months when the Williams Creek road is blocked by snow, the route follows the Salmon River downstream through North Fork and Shoup to the mouth of Panther Creek and then continues up Panther Creek as before. The winter road is 40 miles longer, thus increasing the distance from Salmon to Meyers Cove to 106 miles.

The road from Challis is 10 miles shorter than the one from Salmon and cuts the distance to the nearest railhead at Mackay, Idaho by many miles. Challis, which is about 60 miles southwest of Salmon, is 52 miles by road northwest of Mackay, the terminus of a branch line of the Union Pacific which connects with the main line at Blackfoot, Idaho, 25 miles north of Pocatello. Since Meyers Cove is 56 miles from Challis by road, the distance to Mackay, the nearest shipping point by rail is 108 miles. This is about 15 miles less than to Darby, Montana, the terminus of a branch line of the Northern Pacific Railroad extending south from Missoula, Montana. Challis is at the junction of U. S. Highway 93 and 93-A. The alternate route, 93-A extends southeast through Mackay. Challis is served by the Salmon River Stages, which ply between Salmon and Pocatello, and also by the Sun Valley Stages.

The route from Challis to Meyers Cove is along U. S. Highway 93 as far down the Salmon River as the mouth of Morgan Creek. From there, it extends across the 7,578-foot divide separating the head of Morgan Creek from the head of Panther Creek. The route then continues down Panther Creek to the point 5 miles above Forney where it connects with the road that crosses over to Silver Creek. This road, as the one from Salmon, is graded and drained and in part covered by crushed rock or gravel. Grades are gentle, except over the divide between Morgan and Panther creeks.

Mail is delivered triweekly to Forney post office from Challis, and biweekly from Forney to Meyers Cove.

GEOLOGY

Foreword

Ross shows that the part of the district included within the borders of the Casto quadrangle is underlain for the most part by the Casto and the Challis volcanics, the former of Permian (?), the latter of Tertiary 1/ age Formations of more restricted distribution include two small masses of Hoodoo quartzite (Algonkian) 2/, and small masses of intrusive rock of Miocene age. The Casto and Challis volcanics are known to extend eastward and underlie most, if not all, the remainder of the district, but no opportunity was afforded for mapping contacts or ascertaining whether other rocks also are present.

The volcanic rocks, which locally are largely tuffaceous, and the

---

1/ Ross, C. P., Op. cit., Plate 1.

2/ Ross maps the quartzite as Algonkian (Plate 1), but in the text (p. 28) states that the quartzite is thought to be Paleozoic.

elder Algonkian strata have been folded and rather complexly faulted but little can be added to the structural details already supplied by Ross. The only new data are those on the faulting that has controlled the localization of the fluorspar deposits.

Stratigraphy

Hoodoo quartzite (Algonkian) -

The two small masses of Hoodoo quartzite (?) are on opposite sides of a gulch which drains to Duck Creek. One is almost enclosed by Tertiary intrusive rock; the other is surrounded on all sides by the Casto volcanics (Fig. 2).

Neither exposure was visited; but Ross describes the Hoodoo quartzite as a nearly white quartzite on freshly fractured surfaces, stained light-brownish on joint planes 1/. Representative rock is reported composed of 70 to 80 per cent quartz; up to 10 per cent feldspar; and the remainder of white mica and chlorite, mostly in tiny matted flakes. In most places, the rock is said to be so intricately jointed that it appears shattered. For that reason, the ground is commonly littered with angular fragments of the quartzite.

Casto Volcanics (Permian ?) -

The Casto volcanics underlie more than half of the district (Fig. 2) and are a part of the large mass that stretches diagonally northeast across the middle of the Casto quadrangle from the vicinity of Casto past Meyers Cove. The southeast boundary crosses Camas Creek about a mile below Meyers Cove and extends northeast along the bottom of Fluorspar Gulch and southwest across the slope toward the southwest corner of the district (Fig. 2). Except for small bodies of Tertiary intrusive rock and small masses of Algonkian (?) and Tertiary volcanics, all the bedrock northwest of this line is composed of the Casto volcanic strata.

The Casto volcanics include both flows and tuffaceous strata which locally seem to have an andesitic composition. The flows are fairly well exposed along the southwest side of Camas Creek and along the northwest side of Duck Creek where they have abundant rough outcrops, in part of clifflike character. Tuffaceous material appears to be intercalated with the flows and to compose much of the rock of the ridge between Fluorspar Gulch and Duck Creek. All the rocks are distinctly altered and for the most part have a dull mottled-green appearance. Some of the flows, however, are colored in dull pulplish shades and a few in red, yellow, and blue. Much of the tuff has a greenish mottling and shows numerous fragments of broken dull-white or gray feldspar crystals embedded in a greenish matrix. Since the flows commonly also contain numerous broken feldspar phenocrysts, their rock also has a more or less clastic appearance; consequently, it is not always easy to distinguish between flows and tuffaceous beds, especially since the tuffs have the same mineralogical composition as the flows. According to Ross, 2/,

---

1/ Ross, C. P., Bull. 854, Op. cit., pp. 18-19.
2/ Ross, C. P., Op. cit., p. 30.

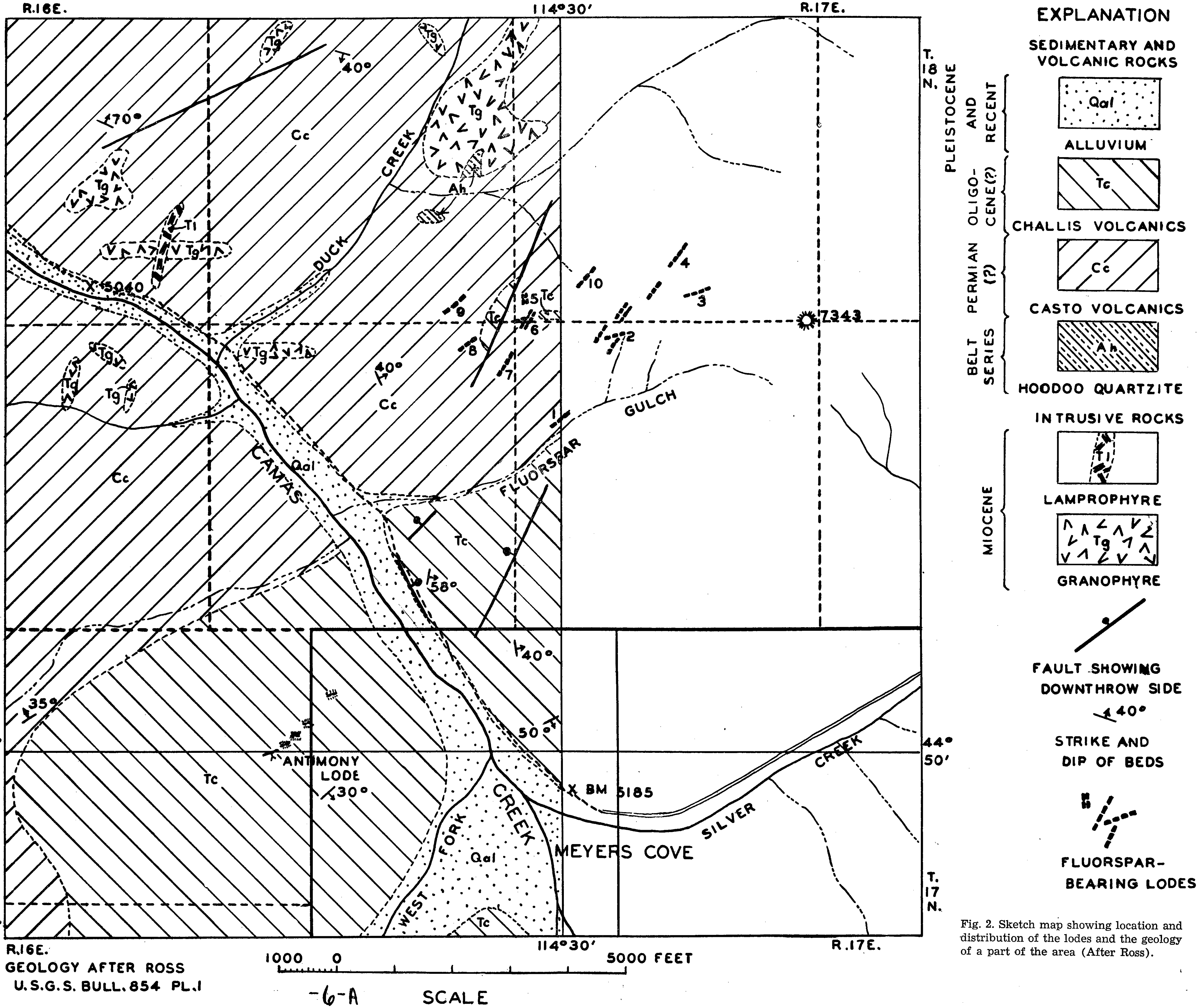


Fig. 2. Sketch map showing location and distribution of the lodes and the geology of a part of the area (After Ross).

-6-A

the rocks are composed of sodic plagioclase, quartz(in part secondary), chlorite, biotite, epidote, black iron oxide, apatite, and various fine micaceous decomposition products. Many of the flows originally had a glassy groundmass, now completely divitrified.

Challis Volcanics (Oligocene) -

The Challis volcanics underlie much of the area not underlain by the Casto volcanics (Fig. 2), and, consequently, comprise the bedrock of only a little less than half of the district. From the main contact with the Casto volcanics, which extends northeast through almost the center of the district, the Challis volcanics spread south and east as a part of a broad mass that covers more than a thousand square miles with exposures appearing continuously to and beyond the town of Challis from which the series of volcanic rocks receives its name. The Challis volcanics formerly were much more extensive and probably blanketed the entire region; but, except for the two small infaulted masses, they have been stripped from the older Casto rocks as shown on the geologic map of the Casto quadrangle (Bull. 854, Plate 1).

The Challis volcanics also include flows and tuffs, which, however, lack the considerably altered appearance of the rocks that compose the Casto volcanics. These younger rocks are in general of silicic to intermediate composition and show much undivitrified glass. The lower part is built up of a succession of generally rather bright-colored flows with distinctly subordinate amounts of tuff. The middle part is dominantly tuffaceous but includes some flows of light-colored lava similar in appearance and composition to the associated tuff. The rocks at Meyers Cove appear to be those belonging to the lower and middle part of the section and include much cream-colored tuff with a few flows of intercalated light-colored rhyolite or quartz latite. The local succession appears to be more than 1,000 feet thick.

Miocene Intrusive Rocks -

The intrusives mapped as Miocene (Fig. 2) include small bodies of pink granophyre and a single body of lamprophyre, all in the Casto volcanics in the northern part of the district. The granophyre and lamprophyre are two of a number of different kinds of Miocene intrusives known to occur in the Casto quadrangle, all related genetically to a magma that has undergone extensive differentiation.

According to Ross 1/, most of the granophyre is pale pinkish cinnamon-brown and weathers to buff. The phenocrysts, which make up 10 to 25 per cent of the rock, include quartz, feldspar, and biotite enclosed in and corroded by an aphanitic groundmass of micropegmatite. The quartz and feldspar phenocrysts are reported to be about equally abundant, and to measure as much as 5 millimeters in length. The biotite, partly chloritized, is scarce. Much of the micropegmatite is reported to be a typical graphic intergrowth but in some parts of the Casto quadrangle, it consists of radial aggregates or well-defined spherulites.

1/ Ross, C. P., Op. cit., P. 64.

The lamprophyric rock, according to Ross 1/, is black, fine-grained, but has biotite phenocrysts. Most of the bodies are reported to have the composition of kersantite. The biotite phenocrysts are embedded in a matrix of oligoclase-andesine laths and in partly to completely altered biotite grains with varying amounts of apatite, black iron oxide, epidote, chlorite, and calcite.

Quaternary Rocks -

Rocks mapped as Quaternary include terrace and present stream alluvium. The deposits are most widespread at Meyers Cove and flank Camas Creek for some miles both above and below. They also extend some distance up Silver Creek and the West Fork of Camas Creek, and for a short distance up Duck Creek. The deposits are mostly a coarse sand and gravel with admixed boulders. Alluvial terraces are apparently the remains of alluvium that accumulated in the main stream valleys during Pleistocene time when the streams received more debris from glaciers than they were able to carry away. Subsequently, the present streams have intrenched in the older valley fill and have developed narrow flood plain deposits of their own.

Structure

Although the Casto volcanics have been subjected to earlier periods of diastrophism, the structural relations and particularly the faulting are so like those expressed in the Tertiary volcanics,that separate treatment seems unnecessary. Both groups of volcanic rocks have been folded and faulted to practically the same degree, apparently largely in response to mid-Tertiary deformation.

Folding -

As pointed out by Ross 2/, the major structural feature of the region is a broad dome or arch apparently related to intrusion of a large mass of Miocene granite exposed by erosion of the volcanic rocks immediately above. The longer axis of this major flexure strikes N. 40° E., passing some miles northwest of Meyers Cove. The Casto volcanics of the southeast flank of this major fold have been bent into smaller flexures striking N. 55° - 75° E., but dips rarely exceed 30°, except near faults. The Challis volcanics, which in turn, flank the Casto, have an average dip not much over 5° to and beyond Challis. In places, the broad arch is modified by subordinate flexures, in part transverse, and in places has partly collapsed with formation of numerous normal faults. One of the largest of the subordinate transverse flexures is at Meyers Cove, the volcanic strata locally having northwest strikes and dips of 45° or more with the steepest dips near faults (Fig. 2). It is possible that the subordinate transverse flexure on the flank of the major arch and the presence of numerous normal faults, which were probably formed concommitantly with the folding, may have had much to do with localizing the mineral deposits near Meyers Cove.

1/ Op. cit., p. 65
2/ Op. cit., pp. 75-77.

Faulting -

The Tertiary normal faults are also reported by Ross as one of the striking structural features of the region 1/. Most of these faults fall into two groups, both of which are present near Meyers Cove. Those of the larger and better developed group have an average trend of about N. 37° E., those of the smaller group, a trend of about N. 27° W. The members of the northeast group have the largest average throw and are the more easily recognized. They have high dips to the northwest and southeast. One of the less numerous northwest faults at Meyers Cove dips steeply northeast.

There is also a system of minor faults or fracture zones near Meyers Cove revealed through discovery of the fluorspar lodes (Fig. 2). Most of these zones of fractured rock trend about N. 30° E., conforming closely with the trend of the major northeast group, but some trend N. 70° E., and a few due north. All of them appear to dip to the west or northwest at comparatively low angles, perhaps at angles as low as 25° to 45°. Those that trend about N. 30° E. appear to be the most prominent and to possess the greatest length. As these fracture zones have been recognized only in the fluorspar outcrops, they have not been traced for more than a few hundred feet; but the alignment of some of them suggests continuity and possible lengths of several thousand feet. Those that trend N. 70° E. are probably no more than a few hundred feet long. Those that trend about due north are even shorter.

The fracture zones appear to range from a few feet to 20 feet wide. The more prominent fractures parallel the long direction of the zone. Other fractures extend obliquely across, the prevailing directions being N. 70° E., N. 30° E., and about due north. The rock in these fracture zones is considerably broken but there is no evidence of any considerable movement. Neither is there any evident clue as to the direction of movement.

These minor faults or fracture zones no doubt were formed at the same time as the larger normal faults in the vicinity, but until more is known of the nature of these minor ones, little can be said of their relation to the major structural features.

ANTIMONY AND FLUORSPAR DEPOSITS

General Character

The antimony and fluorspar deposits form well defined lodes along the minor complex zones of fracturing in the tuffaceous rock and occur in part as fillings of fractures and in part as replacements of the bordering rock. Their structural and textural characteristics indicate that they were formed at comparatively shallow depth and at relatively low temperature under conditions that Lindgren would define as epithermal 2/.

1/ Op. cit., pp. 77-81.
2/ Lindgren, Waldemar, Mineral Deposits: McGraw-Hill Book Company, 4th edition, Chap. 24, (1933), pp. 444-513.

Although their substance makes it convenient to class them as antimony and fluorspar deposits, their only essential difference is the presence of stibnite in one and its absence in all others. The one with antimony also contains a larger proportion of barite than the others. Because of the abundant barite, it might be more aptly designated as a stibnite-barite rather than as a simple stibnite or antimony deposit.

These deposits possess a uniqueness of character that makes them of considerable scientific interest.

Geographic and Geologic Distribution

The deposits are grouped along a zone about one-half mile wide and 2 miles long that extends northeast from the spur just northwest of the mouth of the West Fork of Camas Creek. This zone crosses Camas Creek about one-half mile below Meyers Cove and extends up Fluorspar Gulch and the ridge separating Fluorspar Gulch from Duck Creek. The antimony deposit is at the southwest end of this zone on the southwest side of Camas Creek. All the known fluorspar deposits are on the northeast side of Camas Creek in and on the north slope of Fluorspar Gulch and on the upper slope on the Duck Creek side. Most of those that were examined are well toward the crest of the ridge on the north side of Fluorspar Gulch, but the presence of float in the soil on the south side of the gulch indicates that the fluorspar deposits are by no means confined to the north slope. One of the lodes is in the bottom of Fluorspar Gulch about 1,000 feet below those on the ridge. Those on the ridge outcrop at altitudes from 6,500 to 7,500 feet and thus, are exposed 1,500 to 2,500 feet above Camas Creek. The antimony lode is 1,000 feet above the creek.

The antimony deposit and the fluorspar lodes on the south side of Fluorspar Gulch are contained in the Challis volcanics. The others are all in the Casto volcanics in fracture zones that have the same structural characteristics as those in the Tertiary volcanics.

Structural Relations

The mineralization is localized along a complex zone of fracturing about half a mile wide and 2 miles long that trends about N. 30° E. This zone includes some of the major northeast and one of the northwest faults that are striking features of the regional geology, but so far as known, these larger faults have escaped mineralization. Those that are mineralized, are apparently minor breaks or fracture zones along which the rock has been considerably shattered or brecciated, but not much displaced. The more prominent and persistent of these minor fracture zones as pointed out before, strike about N. 30° E. or in about the same direction as the prominent northeast faults. Their dip, however, appears to be low as compared with the steep dips of the major faults. Less numerous than the fracture zones of N. 30° E. trend are those that trend about N. 70° E. and others that trend about due north. Those that trend N. 70° E. are not so extensive as those that trend about N. 30° E., but have in part provided larger and more numerous openings for the fluorspar and other minerals. The antimony, as well as several of the broader fluorspar ledges, is along these shorter but thicker fracture zones. The deposits along the fractures of northerly trend are not only short but narrow.

Mineralogy

The deposits have a simple yet unique mineralogy. All of them contain fluorite and variable amounts of chalcedony and barite and one also contains stibnite. Sulphides other than the stibnite appear to be lacking, and the absence of any vugs in the fluorspar outcrops resulting from leaching and the scarcity of iron oxides in the surface material suggest that sulphides will not be encountered at depth. The only impurities in the fluorspar deposits are apparently in chalcedony, fragments of tuff, and the barite. The antimony deposit shows some surficial effects of weathering. Some of the stibnite is represented in part or in whole by white and pale yellow pseudomorphous antimony oxides.

Barite -

Barite ($BaSO_4$) or Heavy Spar is abundant only in the antimony deposit. Otherwise, it is a subordinate mineral comprising but a few per cent to 25 per cent of the lode material. It is not uniformly distributed along a lode, but may be absent in one place and relatively abundant in another. In no deposit is it known to be entirely absent nor in no deposit is it conspicuous, except in the antimony lode.

Much of the barite is in fairly coarse grains and crystals which are easily distinguished from the fluorite by their higher specific gravity (4.5), their well-defined tabular crystal forms, their perfect cleavage parallel to the basal plane, their vitreous to pearly luster, and their lack of any except a white color. Individual crystals are as much as an inch long, exceptionally as much as 4 inches long. They may be scattered as individuals through the fluorite or may be grouped in crystalline aggregates resting on and covered by fluorite.

Except at the antimony deposit, the barite shows but one stage of deposition. Ordinarily, the crystals rest upon an earlier generation of fluorite and are buried beneath a younger generation of fluorite, but in the antimony lode barite also appears on the younger generation of fluorite. There, the deposition of the early barite was accompanied by that of stibnite, largely by replacement of the silicified tuff, chalcedony, and older fluorite. The younger generation of barite then was deposited in part by replacing the stibnite and earlier minerals. The younger barite is considerably coarser than that deposited earlier; its crystals are from one-half to an inch long. This younger barite is also much more abundant.

Chalcedony -

Chalcedony (SiO_2), the cryptocrystalline or very finely crystalline variety of quartz, is present in all the deposits but nowhere in especially large amounts. It has been deposited rather sporadically along the lodes and the quantity not only varies from place to place within the lode, but also from lode to lode.

Much of the chalcedony is white and has a chertlike appearance; but some of it is rhythmically banded in alternate gray and black, white and gray, and locally gray and red colors, each band generally less than a tenth of an inch thick.

Most of the chalcedony has been deposited around fragments of brecciated and partly silicified tuff and forms a base upon which considerable amounts of fluorite have been deposited. In places, however, the chalcedony was partly brecciated before the fluorite was deposited; and fragments of it appear as inclusions within the fluorite or as nuclei for the growth of more or less concentric layers of fluorite. Not all the chalcedony was deposited early; but in places some was deposited contemporaneously with the fluorite as thin, discontinuous layers alternating with considerably thicker layers of fluorite. Some also was deposited even later. At the antimony deposit late seams of chalcedony cut and embed masses of barite, fluorite, and earlier chalcedony. In parts of the lode this late chalcedony is much more abundant than that deposited earlier.

Fluorite -

Fluorite (CaF_2) or fluorspar, is the predominant mineral in all except the antimony lode. It seems to be more resistent to weathering and erosion than the barite and, consequently, forms the principal part of the ledges that project above the surface of the ground. Only the chalcedony and silicified tuff are more resistant to erosion. The fluorite commonly forms abundant float on the slopes below the outcrops.

The fluorite is rather easily distinguished by its brilliant vitreous luster, its cubic crystallization, its octahedral cleavage, its lower specific gravity (3.18), and its variety of colors. Some of the fluorite is white, but most of it is tinted in different shades of gray, green, purple, lavendar, and rose. Much of the fluorite occurs as coarse-grained granular aggregates, but openings in the lodes are invariably lined with crystals showing cubic faces. Most of the crystals are from one to several inches square, but in places the surfaces of these larger crystals are covered with thin crusts of very minute crystals. Grain size may vary within a deposit as well as between deposits. Much of the fluorite is in layers or crusts, but some that fills fractures appears to be massive. Long, thin lenses of massive fluorite are not uncommon.

The fluorite has been deposited in several stages. The earliest is deposited on or cements fragments of generally silicified tuff and chalcedony and locally shows alternate deposition with chalcedony but always in much thicker layers. Crusts of this early fluorite may show crystal faces; but generally the crystals are buried beneath those of barite or, where barite is absent, by younger generations of fluorite. In some deposits, the early fluorite comprises the main lode filling but in others the fluorite deposited later is the more abundant. In general, the early fluorite has gray and pale greenish colors; the younger may be strongly tinted in shades of green, purple and rose. The younger also is generally more coarsely crystalline and contains less admixture of chalcedony or other impurities. In places it forms lenses of high-grade fluorite. Where the late fluorite has not completely filled the available opening, the faces of its crystals are commonly covered by a thin crust of finely drusy fluorite, less commonly by chalcedony. Both of the two main generations of fluorite were recognized in parts of the antimony lode, the younger fluorite deposited on the early barite and then covered by the second generation of barite.

Stibnite -

Stibnite (Sb_2S_3) shows in several of the cuts made on the antimony lode. It appears to be rather sporadically distributed, but in several places forms small bodies of what might be considered antimony ore.

Much of the stibnite forms radiating clusters of needle-like crystals, some of which are nearly two inches long and less than a tenth of an inch in diameter. Other crystals with more random orientation form blades up to an inch long and one-fourth of an inch wide. The crystals are closely to widely spaced but nowhere are packed so closely as to form well defined massive aggregates.

Some of the blades penetrate and replace the silicified tuff, chalcedony, and fluorite; but much of the stibnite is associated with the early barite and was deposited with it, partly by replacing the chalcedony and the early fluorite. Growth of the stibnite may have continued after the early barite had ceased to be deposited but had stopped before the younger generation of barite was introduced. Coarse aggregates of the younger barite have partly replaced radiating masses of the stibnite and crusts composed of small barite crystals have been found which envelop the individual needles composing some of the large stibnite clusters.

Paragenesis -

Despite the presence of but four minerals, the deposits, because of several stages of mineral deposition, show a fairly complicated development. All, except stibnite, appear in more than one generation; the barite, in two; and the chalcedony and fluorite perhaps in no less than three. The evidence of successive deposition is shown in more or less widespread banding, crustification, and brecciation and cementation of the earlier minerals.

Chalcedony was the first as well as the last mineral to be deposited and was also deposited concurrently, though not abundantly, with the other minerals. Fluorite followed closely after the early chalcedony, but reappeared a second and a third time during the later stages of mineralization. Barite was introduced well toward the mid-part of the period of mineralization and, since it was deposited on fluorite and was, in turn, covered by fluorite, and at the antimony deposit was deposited on the second fluorite, its position in the sequence is well-defined. Stibnite apparently accompanied the early barite in the one antimony-bearing lode.

Thus in the various lodes, the mineralization was begun with silicification of the brecciated tuff and the deposition of chalcedony about the fragments of tuff and in fractures in the tuff. In the fluorspar lodes the deposition of chalcedony was followed by that of fluorite, locally after the chalcedony had been somewhat brecciated, but some chalcedony continued to be deposited more or less contemporaneously with the fluorite. Variable but generally minor amounts of barite were deposited on the fluorite, locally with a little chalcedony; and then fluorite was added, commonly as a generation of coarse crystals, deposited on and around the barite. In places this fluorite was coated by a thin layer of finely crystalline fluorite and less commonly by chalcedony. In the antimony lode the deposition of the early chalcedony, commonly banded, was followed by fluorite, then by stibnite and barite, in places again by fluorite, and then by abundant coarse-grained barite, which enclosed and replaced the stibnite and earlier minerals. The deposition of the younger barite was then followed by more chalcedony, which forms irregular masses and also thin seams or stringers in fractures that cut across all minerals, including the late chalcedony, that forms irregular masses.

Structure of the Deposits

The lodes possess rather complex structural relationships with veins or lenses of fluorite (locally barite) that parallel the zone of fracturing and with stringers and smaller seams and lenses that extend obliquely across. Other stringers are less-definitely oriented. Fluorite and barite also impregnate the silicified tuff as grains and small masses. Few of the seams or lenses are more than a few inches thick; but, where replacement also has taken place, masses some feet across have been formed. The veins and lenses that parallel the zones of fractured rock are the more prominent; the oblique seams are generally less than 2 inches wide. Stringers and impregnated masses may be closely spaced across and along the zone of fractured rock.

Where the tuffaceous rocks were considerably brecciated and especially where openings were most abundant, as along some of the fracture zones that trend N. 70° E., the filling commonly shows banding and crustification and openings lined with drusy crystals. Otherwise, the fillings and replacements tend to be rather massive and show poorly-defined banding by deposition.

Size and Tenor of the Deposits

Some of the mineralized fracture zones are as much as 20 feet wide with outcrops that may be traced for several hundreds of feet, but the fluorite and other minerals are not distributed uniformly and may actually be concentrated along a narrow part of the zone of fractured rock. The largest known body of fluorspar measures about 18 feet wide. Others are 6 to 8 feet wide; and some 1 to 3 feet. Some of the lodes contain veins of pure fluorspar a few inches wide that may be traced for a hundred feet or more. Stringers and impregnations in the fractured rock alongside, however, may increase the width 10 feet. Most of the ledges show more or less fluorspar throughout. The antimony lode is as much as 20 feet wide, composed largely of barite, and locally has 12 inches of almost massive stibnite next to the hanging wall, and a layer 4 inches wide of radiating needles about 4 feet below.

Since the writer was in the district, several of the lodes were sampled by Mr. John Taber of the U. S. Bureau of Mines. The results made available by Mr. Arthur Chambers 1/ show that the widest lode contained across a width of 18 feet, 0.50 per cent $CaCO_3$, 9.59 per cent SiO_2, 1.58 per cent $BaSO_4$, and 85.10 per cent CaF_2. Another lode measuring 2 feet wide contained 0.46 per cent $CaCO_3$, 4.21 per cent SiO_2, 0.14 per cent $BaSO_4$, and 93.77 per cent CaF_2; whereas one measuring 1 foot in width had 0.57 per cent $CaCO_3$, 1.97 per cent SiO_2, 2.22 per cent $BaSO_4$, and 92.59 per cent CaF_2. Two other lodes, one measuring 1.9 feet, the other 2.3 feet, showed rather high barite content. One carried 0.73 per cent $CaCO_3$, 8.93 per cent SiO_2, 19.64 per cent $BaSO_4$, and 67.37 per cent CaF_2; the other 0.65 per cent $CaCO_3$,

---

1/ Written communication.

12.42 per cent SiO_2, 16.11 per cent $BaSO_4$, and 61.62 per cent CaF_2. Other lodes, if sampled, would probably differ little in analytical results from those obtained from the lodes that were sampled. Some would probably show a high fluorite content over widths of 4 to 10 feet, perhaps with no more than one or two per cent of barite.

Genesis of the Deposits

Inasmuch as these deposits are contained along zones of considerably fractured volcanic rock and show considerable banding and crustification indicative of deposition in abundant openings, they were probably formed at comparatively shallow depth and under conditions that may be most aptly defined as epithermal. The presence of chalcedony and stibnite may be taken as evidence that fairly low temperatures existed at the time the deposits were formed. The minerals apparently were deposited from hydrothermal solutions that ascended along the zones of fractures from a fairly deep magmatic source, perhaps the same source that provided the magma for the bodies of pink granophyre and the almprophyre within the district and for the pink granite and various porphyries in other parts of the Casto quadrangle 1/.

The mineralizing solutions obviously contained appreciable amounts of silica, some antimony, and considerable but variable amounts of calcium, barium, and sulphur, which under appropriate conditions combined and were precipitated as chalcedony, fluorite, barite, and stibnite in a more or less orderly but repeated succession. The association of these different elements and minerals is not an ordinary one.

Since these deposits are contained in the Tertiary Challis volcanics as well as in the older Casto volcanics, they can be no older than Oligocene (?), but since they are probably genetically related to the nearby bodies of pink granophyre (Miocene), they are probably Miocene and, therefore, belong to the mid-Tertiary period of mineralization that is recognized in south central Idaho.

DESCRIPTION OF THE LODES

Antimony Lode

The antimony lode is at the extreme southwest end of the mineralized zone near the west boundary of sec. 6, T.17N., R.17E. It is well up the face of the spur that lies between Camas Creek and the West Fork (Plate 1) a little more than half a mile from the end of the road at Meyers Cove. It extends diagonally up the steep slope to a point more than 1,000 feet above Camas Creek. Except at one point, the lode is not ledge-forming but may be traced by a series of 4 or 5 cuts, some of which are visable from the valley below. The deposit has been known for a long time but has been given surprisingly little attention. It is reported to have been located first by

1/ Ross, C. P., Bull. 854, Op. cit. Pp. 54-67.

Andrew Lee many years ago. In 1942 it was relocated by H. V. St. Clair and Don Shulenberger of Shoup, Idaho, and by Max Oyler of Forney.

The lode is in the light-colored silicic tuff of the Challis volcanics, and is aligned along a fracture zone that strikes about N. 70° E. and dips 40° to 45° NW. Because it is truncated by the steep face of the spur, it appears to bear in a more northerly direction; and the cuts along it are aligned in a direction of about N.30°E., diagonally down the slope.

The first cut is about 400 feet up the slope and exposes several feet of chalcedony and barite, but no fluorite or stibnite. The second cut is southwest and 200 feet above near the bottom of a shallow but steep gulch. This cut has not penetrated the solid ledge matter but has uncovered considerable of the lode material, perhaps directly over the lode, which locally may dip with the slope into the gulch. The broken pieces of lode material strewn in the cut and piled on the banks along side show considerable chalcedony, fluorite, and barite, and some widely scattered crystals of stibnite.

Several other cuts lie above the second, but the only one to show anything of consequence is the last one which is on the crest of a minor ridge about 200 feet from the second cut, measured on the slope. This last cut is about 20 feet long and has been driven into and almost across the lode. It reaches from the foot to the hanging wall, the end of it extending partly beneath the surface of the outcrop. This cut reveals much barite, some stibnite, but apparently no fluorite. A band about 12 inches wide that contains considerable stibnite is exposed in the face of the cut just beneath the hanging wall. Minerals associated with the stibnite include subordinate amounts of barite and chalcedony. This is the widest as well as the richest body of stibnite exposed in the lode. Nearly 4 feet below is a parallel layer of stibnite about 4 inches wide that contains radiating groups of stibnite needles associated with and partly replaced by coarse crystals of barite.

The size of the deposit cannot be adequately determined by the small amount of development that has been done. The presence of stibnite in the cut on the ridge and in the cut near the bottom of the gulch about 100 feet vertically below indicates that the antimony mineralization may persist more or less sporadically for a distance of possibly 200 feet. The amount of stibnite exposed in the cuts between is considerably less than in the ridge exposure. As pointed out by Ross 1/, it is doubtful that the deposit will ever prove of much economic value.

Fluorspar Lodes

The fluorspar deposits are from one-half to one mile from the trail that extends down Camas Creek from the end of the road at Meyers Cove. The route taken to reach them from Meyers Cove is from 1-1/2 to 2-1/2 miles long, of which about a mile is by trail along Camas Creek. Since most of the lodes are near the crest of the ridge between Fluorspar Gulch and Duck Creek, considerable strenuous climbing is necessary to reach them.

1/ Ross, C. P., Op. cit., P. 131.

These deposits had just been located by Reese Miles and Roy Johnson, both of Salmon, Idaho, who at the time the deposits were examined had not yet done the location work. Seventeen claims in all, the Crystal group, had been located. The location work was started several days after the writer left the district. As many lodes as were then known were examined, but several others were located later when the location was underway. The lodes examined and those uncovered later are shown on the map (Fig. 2) and are indicated by number.

Lode No. 1 -

The first lode examined (designated as No. 1 on the map) is near the bottom of Fluorspar Gulch at an altitude of about 5,800 feet, approximately three-fourths of a mile from Camas Creek. The lode is partly exposed in a small cut apparently made many years ago. Overburden on all sides effectively conceals the lode, except for that part uncovered in the cut. The exposed portion is about 2 feet wide and appears to be part of a body that has a general northeasterly trend and moderate northwesterly dip. Much of the exposed part of the lode is composed of fluorite. Considerable fluorite is also strewn over the dump. No barite was observed.

Lode No. 2 -

The second lode is well toward the head of a small tributary in the upper part of Fluorspar Gulch at an altitude close to 7,000 feet. The lode is one of a small cluster, all of which form conspicuous ledges on the steep slope. Several are below and several above and to the west of No. 2, but so far as known, Lode No. 2 is the only one with considerable amounts of fluorite. The others were not examined but are known to be silicified fracture zones in the Casto volcanics more or less impregnated with chalcedony and minor amounts of fluorite and perhaps barite.

All but two of the ledges or silicified zones appear to strike about N. 30° E., but Lode No. 2 and another not shown on the map strike about N. 70° E. The ledges that represent the lodes with N.30°E. trend are fairly long and persistent; the others are relatively short, but appear to be wider. Whether any of these lodes are parts of those exposed on ridge crests to the southwest and northeast can be determined only by trenching the ground between.

Lode No. 2 has a prominent outcrop that forms a ledge about 100 feet long and up to 15 feet wide. It contains more or less fluorite throughout but there is a greater concentration in seams several inches thick and in zones 3 to 4 feet wide that parallel the long direction of the ledge. These seams and zones are many feet long and dip northwest at rather low angles. There are also stringers and impregnated masses throughout the remainder of the zone of fractured tuff, but until the outcrop is trenched and the lode sampled, it is not feasible to estimate the proportion of the lode that is composed of fluorite. This seems to be one of the more promising lodes.

Some chalcedony and barite are associated with the fluorite, particularly in the seams and masses of what appears to be pure fluorite and in some of the more highly mineralized zones. The lode shows more evidence of filling than most of the others and much of the fluorite is banded. In places, it has concentric structures and with the chalcedony, forms shell-like elliptical bodies enclosing small fragments of tuff. Breccia structures are fairly conspicuous and considerable of the last-deposited fluorite shows crystal or drusy surfaces. The barite crystals are not numerous and probably comprise considerably less than 5 per cent of the filling. On cursory examination, the deposit appears to have more fluorite than most of the other lodes, but milling is probably necessary to assure a product acceptable to the industry, particularly since some of the fluorite is intricately banded with small amounts of chalcedony.

<u>Lode No. 3</u> -

The third lode examined (Lode No. 3 on the map) is almost on the divide between Fluorspar Gulch and a tributary of Duck Creek, a little more than a quarter of a mile northeast of Lode No. 2 and at a somewhat higher level. This lode also strikes about N. 65° - 70° E. and appears to dip about 35° NW. It may be easily traced on the surface for more than a hundred feet. In places, the exposed part of the lode is more than 10 feet wide and shows more or less fluorite throughout. There are zones along the lode, however, where the minerals are particularly concentrated in bodies or masses several feet wide. Whereas such masses lie parallel to the lode, other masses, particularly stringers up to 2 inches wide, extend diagonally across the lode in a N. 30°E. direction. Such stringers also dip northwest at low angles. Although fluorite predominates, the deposit also contains much barite and in places considerable amounts of chalcedony. The seams, stringers, and some of the more highly mineralized zones may contain from 10 to 20 per cent barite. The barite crystals which are in part enclosed between broad bands of fluorite, commonly are an inch long, but in places measure up to 4 inches. This lode apparently contains more barite than most of the others, but it is presumed that the barite would not be a serious obstacle in the milling of fluorite.

<u>Lode No. 4</u> -

The fourth lode (Lode No. 4 on the map) is several hundred yards north of No. 3 and crosses the highest point on the ridge, perhaps at an altitude above 7,500 feet. This lode has a conspicuous outcrop that may be easily traced for more than a hundred yards. Its strike is about N.30° - 35°E., and its dip, apparently about 35° NW. Much of the ledge is 8 to 10 feet wide, but locally the silicification extends across twice the distance. In the lode are seams of coarsely crystalline greenish and rose-tinted fluorite measuring up to 4 inches thick, some of which may be traced for many feet along the strike of the lode. Stringers of fluorite also extend through the fractured tuff and with the main seams make up a body of mixed lode material about 6 feet wide that may be traced for not less than 200 feet. The main body contains considerable chalcedony but little or no barite, except at the extreme northeast end of the exposure where the ledge terminates in a bluff overlooking the upper Duck Creek drainage. The main seams that persist along the lode appear to be composed entirely of the late coarsely-crystalline fluorite. Some of the stringers, however, show the fluorite deposited on a thin wall of banded reddish chalcedony.

<u>Lode No. 5</u> -

The lode designated as No. 5 actually includes several (two shown on the map) rather closely spaced mineralized fracture zones on the crest of the main ridge between Fluorspar Gulch and Duck Creek, at an altitude of about 7,100 feet about a quarter of a mile northwest of Lode No. 2. These lodes strike about due north and seem shorter and less prominent than those that strike northeast. They show stringers of fluorite through a zone several feet wide and a few tens of feet long.

Lode No. 6 -

Three lodes are included in the group designated as No. 6 on the map, all of which are within a hundred feet of each other. These lodes are on the slope a short distance south of the No. 5 lodes. Two of the lodes strike about N.30°E.; the other strikes about N.70°E. All of them have moderately low dips to the northwest.

The individual fracture zones are several feet wide and contain short stringers and seams of fluorite along fractures that trend N.30°E., N.70°E., and due north. Together, these stringers and seams of fluorite form mineralized bodies 2 to 5 feet wide. These bodies apparently were among those mapped and sampled by John Taber, who reports that the lode that strikes about N. 70°E. was sampled across 2 feet and showed 0.46 per cent $CaCO_3$, 4.21 per cent SiO_2, 0.14 per cent $BaSO_4$, 0.64 per cent combined Al_2O_3 and Fe_2O_3, and 93.77 per cent CaF_2. Samples across the other two lodes, one of them across 1.9 feet, the other, 2.3 feet, show in the first 0.73 per cent $CaCO_3$, 8.93 per cent SiO_2, 19.64 per cent $BaSO_4$, 1.68 per cent combined Al_2O_3 and Fe_2O_3, and 67.37 per cent CaF_2. The other showed 0.64 per cent $CaCO_3$, 12.42 per cent SiO_2, 16.11 per cent $BaSO_4$, 2.40 per cent combined Al_2O_3 and Fe_2O_3, and 61.62 per cent CaF_2.

Lode No. 7 -

The lode designated as No. 7 is near the head of a tributary to Fluorspar Gulch a few hundred yards southwest of the No. 6 lodes. This lode projects 2 to 3 feet above the surface for a distance of about 20 feet on the strike, but otherwise is largely concealed by slope debris. The strike is about N.30°E.; the dip is not apparent. The ledge is only 2 to 3 feet wide but in part is made up of almost massive fluorite. This may be one across which Taber took a foot sample and found it composed of 0.57 per cent $CaCO_3$, 1.97 per cent SiO_2, 2.22 per cent $BaSO_4$, 1.05 per cent combined Al_2O_3 and Fe_2O_3, and 92.59 per cent CaF_2.

Lode No. 8 -

Lode No. 8 was one of those uncovered after the writer left the district. According to Reese Miles, it lies several hundred yards west of the No. 7 lode and may be traced in a northeasterly direction for about 100 yards. It is reported to show 2 feet of fluorite.

Lode No. 9 -

The lode designated as No. 9 is another that was not known when the writer was in the district. It is reported to be the largest and most promising of any that have been uncovered. It lies just over the Duck Creek side of the divide at a point some distance west of Lode No. 5 and north of Lode No. 8 at an altitude close to 7,000 feet.

The lode is another of northeasterly trend and rather low northwesterly dip. It is reported to be about 20 feet wide and, according to Taber, who took samples across 18 feet, contains 0.50 per cent $CaCO_3$, 9.59 per cent SiO_2, 1.58 per cent $BaSO_4$, 0.80 per cent combined Al_2O_3 and Fe_2O_3, and 85.10 per cent CaF_2.

Lode No. 10 -

Lode No. 10 is another of those exposed since the writer was in the district. It is on the Duck Creek side of the divide a short distance below the crest of the ridge, a few hundred yards northeast of Lode No. 5 and west of Lode No. 4. The lode is reported to parallel the others and to be exposed more or less continuously for 300 feet along the strike. It is said to be about 8 feet wide and to be composed largely of fluorite with minor amounts of barite and chalcedony.

Other Lodes -

There are other showings in Fluorspar Gulch, some of which, if prospected, may show as much promise as those that have been described. Ledges of silicified tuff are fairly widespread and extend beyond the limits of the zone that includes the known fluorspar-bearing lodes. A thick mantle of debris masks the surface along the projected extension of the mineralized belt in the upper drainage of Duck Creek and, therefore, may conceal possible lodes. Fluorite float appears on the slope on the southeast side of Fluorspar Gulch in line with the antimony deposit on the southwest side of Camas Creek and the lodes on the north side of Fluorspar Gulch. No ledges appear on the south side of Fluorspar Gulch but the source of the float may easily be revealed by trenching.

OUTLOOK

Because the fluorspar ledges are fairly numerous and have a known vertical range of not less than 1,000 feet and perhaps as much as 1,500 feet, they probably contain a considerable tonnage of marketable mineral. Although some of the lodes contain appreciable amounts of barite, others, including some of the largest, have comparatively little and, therefore, the chalcedony and silicified or silicic tuff, which may readily be separated by milling, are the chief impurities. Reserves of high-grade fluorite together with reserves of milling grade, probably total some tens of thousands of tons. Distances from markets may be the chief factor involved in the utilization of the deposits; otherwise the district appears to have much promise as a potential producer of fluorspar.