Geology, Ore Deposits, and Mines of the Mineral Point, Poughkeepsie, and Upper Uncompahgre Districts, Ouray, San Juan, Hinsdale Counties, Colorado

by

V. C. Kelley

COLORADO SCIENTIFIC SOCIETY

PROCEEDINGS

VOLUME 14

No. 7

Denver, Colorado

1946

COLORADO SCIENTIFIC SOCIETY

W. P. HULEATT, President
C. E. DOBBIN, Secretary
PERRY N. MOORE, Treasurer

Mail exchanges to Colorado Scientific Society,
Denver Public Library, Denver, Colorado

Address communications to:
COLORADO SCIENTIFIC SOCIETY
906 U. S. NATIONAL BANK BLDG.
DENVER 2, COLORADO

Additional copies of this paper cost $3.50
Subscription price per volume, $5.00

GEOLOGY, ORE DEPOSITS, AND MINES OF THE MINERAL POINT, POUGHKEEPSIE, AND UPPER UNCOMPAHGRE DISTRICTS, OURAY, SAN JUAN, AND HINSDALE COUNTIES, COLORADO.[1]

by

V. C. KELLEY[2]

CONTENTS

[1]Published by permission of the Director of the Geological Survey, United States Department of the Interior, in cooperation with the State of Colorado through the Colorado State Geological Survey Board and the Colorado Metal Mining Fund.

[2]Geologist, U. S. Geological Survey, and Professor of Geology, University of New Mexico.

CONTENTS—(Continued)

ILLUSTRATIONS

Abstract

The adjoining Mineral Point, Poughkeepsie, and Upper Uncompahgre districts lie in a high and rugged part of the San Juan Mountains, covering an irregular area of about 25 square miles. Altitudes range from 8,300 to 13,450 feet.

In the deeper canyons of the northwest part, a folded pre-Cambrian basement of quartzite and slate is exposed. The smooth westward-sloping surface of these rocks is overlain by a relatively thin, westward dipping wedge of sandstones, shales, conglomerates, and limestones which range in age from Devonian to Jurassic. Overlying these and forming most of the mountain ridges are the crudely bedded, essentially horizontal strata of the San Juan tuff. The San Juan tuff and breccias, which are Miocene (?), are 1,500 to 2,500 feet thick. About 1,000 feet of andesite and latite overlie the San Juan tuff in Hayden Mountain. The southeast area comprising Poughkeepsie Gulch and Mineral Point is composed of the Silverton volcanic series which is Miocene. The rocks of this series consist of a thick, slightly tilted, complex accumulation of rhyolite, latite, and andesite flows, tuffs, and breccias. Interfingering and some contemporaneity exist between the flows and breccias of the Silverton volcanic series and the San Juan tuff.

Pre-volcanic intrusive rocks consist of a quartz monzonite laccolith of early Tertiary age and diabase dikes of uncertain age. Most of the intrusive bodies, however, are either contemporaneous with or younger than the volcanic rocks. They consist of plugs and domes of latite, plugs and dikes of rhyolite, dikes of andesite, and dikes and sills of quartz latite porphyry.

The principal mineral deposits are fissure fillings, but the deposits in general may be divided into three classes: (1) fissure and cavity fillings, (2) breccia chimney and breccia dikes, and (3) replacement deposits.

In the northwest area several pre-volcanic fissures have served as the ore channels for much more numerous fissures

that are confined to the overlying volcanic rocks. In the Mineral Point and Poughkeepsie districts the principal fissure sets have a northeasterly course, but an interrupted and less prominent easterly set is also present. The northeasterly fissures usually dip steeply to the southeast and have normal displacements which increase generally on successive fissures to the southeast. The fissures and veins developed thereon, are very much split, branched, and interconnected. Multiple or complex lodes are over 100 feet wide for stretches of several hundred feet. Several of the more persistent vein zones are over five miles long.

The veins average between 2½ and 3 feet in width, and many are strongly marked with gouge walls. The deposits have a high quartz content and contain chiefly argentiferous base-metal ores accompanied by pyrite. The gold content is generally low. Some ore shoots contain tungsten or bismuth. Besides quartz the gangue may also include kaolin, sericite, barite, rhodochrosite, rhodonite, and locally hematite or fluorite. The high-grade ore shoots generally are composed of argentite, ruby silver, brittle silver, or gray copper. They have not been appreciably enriched by supergene processes.

Compared to the nearby Silverton, Red Mountain, and Ouray districts, the output from these veins has been small. In part this contrast is because the deposits are fewer and the ore of lower grade, but for many of the deposits of the Mineral Point and Poughkeepsie Gulch districts the low output record is attributable to inaccessibility. The future of the Mineral Point and Poughkeepsie Gulch districts depends on development and mining through long low-level tunnels. About 125 miles of veins have been mapped and more than 100 mines and prospects are described.

INTRODUCTION

This report is to accompany and supplement the preliminary geologic map and cross sections of the Mineral Point, Poughkeepsie, and Upper Uncompahgre Districts, Ouray, San Juan, and Hinsdale Counties, issued in 1943 by the Geological Survey, U. S. Department of the Interior, in cooperation with the Colorado State Geological Survey Board and the Colorado Metal Mining Fund.

Geography

The Mineral Point, Poughkeepsie, and Upper Uncompahgre districts, which adjoin one another, are in the San Juan Mountains of southwestern Colorado at about latitude 37°58′N. and longitude 107°38′W. The map represents an area of about 25 square miles extending from Bear Creek Falls about a mile south of Ouray, southeastward nearly to Animas Forks, a distance of seven miles. It covers the headwaters of the Uncompahgre River at Mineral Point and in Poughkeepsie Gulch, the headwaters of the Animas River in the North Fork of Animas River and in California Gulch, and a small part of the headwaters of Henson Creek north of Engineer Mountain. It also includes Red Mountain Creek between Ironton Park and the Uncompahgre River, and a short stretch of Canyon Creek, as well as parts of Hayden, Abrams, Brown, Hurricane, Tuttle, Houghton, and Engineer mountains. Altitudes in the area range from 8,300 to 13,450 feet. The entire area lies within the Uncompahgre National Forest.

The region is one of heavy winter snows which considerably hamper mining activity in the higher parts from late fall to late spring. The summers are typified by afternoon thunder-storms and much rainfall. The region is exceedingly rugged with steep slopes and many sheer cliffs. The lower parts of the Uncompahgre River and Canyon Creek are in gorges, and the numerous small glacial lakes and cirque basins in the high areas are rimmed by sharp ridges and hornlike peaks. The cirque basins are commonly filled deeply with talus and rock glaciers which hide some veins for long distances. Water is abundant and the rocks are so saturated as to make much very heavy ground where lodes are wide and soft or where the wall rock is much altered and permeable. Thin glacial moraine, residual soil, and snowslide mud, all more or less grown over by grass and bush, cover other areas. In many places these masses are steadily creeping, and where tunnels to deposits have been driven in such ground the portals are soon caved unless often repaired.

Although the lower Canyon Creek and Upper Uncompahgre areas are among the most accessible parts, Mineral Point and especially Poughkeepsie Gulch are perhaps the least accessible parts of the Silverton quadrangle. The Mineral Point district is accessible by road either from Silverton or Ouray. The Silverton road is generally less difficult to travel but somewhat longer. During the summer of 1942 the road over Engineer Pass connecting the Mineral Point and Henson Creek districts was repaired. The rest of the districts are accessible only by good trails.

Geologic Map and Cross Sections

In connection with various uses of the geologic map, (pl. 1) and the cross sections (pl. 2) certain guiding remarks should be made especially for those who lack experience in interpreting geologic maps.

On the geologic map about one-half of the area is covered by an alluvium pattern. This includes many kinds of mantle or rock debris and soil generally moved some distance from its bed-rock source. The boundaries of this material are well-defined in some places, thereby permitting accurate mapping; in other places, however, the boundaries are not clearly defined and the interpretation on the map is correspondingly uncertain. In some places, because of its thinness or its occurrence in scattered patches, the alluvial cover has not been shown. In a few areas, as on the east side of Hayden ridge or the south base of Engineer Mountain, landslide blocks are mapped as part of the alluvium. Where such blocks are not too much broken, veins may still be intact within them and may even contain ore bodies which could be mined more or less continuously to the base of the slide block. In most places, however, much shattering, discontinuity of veins, and heavy ground should be expected in landslide material. Along the south slope of Engineer Mountain several veins are shown by dotted lines extended through the alluvial pattern. In some places where uncertainty exists more than one possibility of vein connections or extensions are indicated by dotted lines; these features remain to be proved or disproved by further development.

The courses of the veins are mapped on plate 1. The names along the veins are those of patented claims, each name being placed nearly midway between the end lines of the claim. With veins that are inclined the course of the outcrop may be considerably different from the direction of a drift along the vein and the difference becomes increasingly great as the dip of the vein decreases and the slope of the terrain becomes steeper. The difference between the course or trend of a vein (to which the side lines of a claim should be parallel) and the strike of the vein (the direction of drifting) is one that is naturally confusing to inexperienced observers. On a steep slope, two nearby veins of opposite dip may actually course or trend toward each other as if to intersect, and drifts on the two veins at the same level may diverge. This is true of the Sutton and Denver veins which are described under the Sutton mine. The situation is accentuated by steep slopes and gentle vein dips. Although slopes are unusually steep in these districts the veins also are mostly steep to vertical. An example of the relationship between the course and the strike of a vein is given in figure 1.

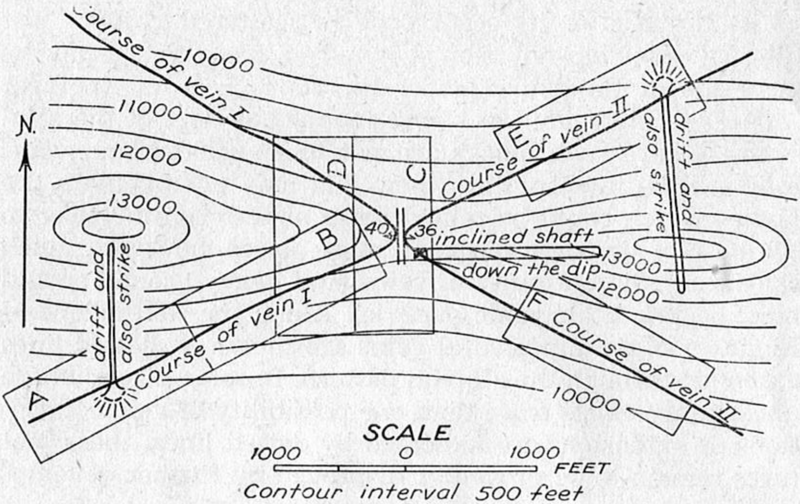

Figure 1. Relationship of the course and the strike of inclined veins.

Both veins I and II strike nearly N, as shown by dip and strike symbols in the saddle at their apices and by the drifts on claims A and E. Note that the courses diverge from the strikes by about 45 degrees and that the course of vein I on claims A and B is the same as and in line with that of vein II along claim E. Claims C and D suggest other methods of holding parts of the veins; however, C includes the apex of each vein, and its owner would have apex rights to the part of the vein underlain by B. Of course, the outcrops on claims E and F belong to the same vein.

These remarks apply strictly only to veins uncurved in either the strike or the dip directions. Generally the veins are considerably curved locally, but large or abrupt changes in direction or dip are uncommon and the principles explained above usually apply. On the geologic map many dips but only few strikes of veins are shown; however, the direction of a drift along a vein shows its strike rather accurately. The direction of dip is also shown by the position of the drift (black) to the outcrop (red). Veins on which there are no dip arrows are vertical or nearly so.

On the geologic cross sections (pl. 2) the attitudes of the veins are only apparent; that is, they are the traces of the veins as they intersect the plane of the cross section. If this plane is perpendicular, or very nearly perpendicular, to the strike of the vein, then the attitude in which the vein is shown is its true attitude. Veins that are rather oblique to the plane of the cross section are plotted with attitudes or apparent dips that are somewhat less than their true dips. The apparent dip departs farther from the true dip and becomes more gentle as the vein departs from an attitude perpendicular to the cross section. The true dip of an inclined vein shown in cross section can usually be determined by reference to the geologic map, but the relationship of true dip to apparent dip is as follows:

$$\tan D = \frac{\tan A}{\sin B}, \text{ where}$$

D = true dip, A = apparent dip (shown in cross section), and B = angle between planes of vein and cross section.

Acknowledgements

Much information was given freely by many of the residents and operators in the Ouray and Silverton regions. The assistance especially of E. W. Creel, Annie and Kenneth MacLennan, William McCullough, Ernest Miller, Walter Wheeler, Belle Hersinger, E. E. Eggleston, J. E. Jarrett, Frank Bell, J. E. Carney, Art Walker, Dan C. McNaughton, E. E. Rathbun, Nick Collins, Gustavus Sessinghaus, and Joseph D. Pender is gratefully acknowledged. Mr. Caswell Silver served as field assistant in 1940 and 1941. For much advice in mapping problems and aid in preparation of the maps and report, the author is greatly indebted to W. S. Burbank. under whose general supervision the work was done. To Mr. G. F. Loughlin, who edited the manuscript, appreciation is extended for many suggestions, especially in connection with the problem of ore in depth. The geologic map in Canyon Creek is from the unpublished works of W. S. Burbank and F. M. Chase. For office space, certain equipment, and minor contributory research funds the writer is grateful to the University of New Mexico.

ROCK FORMATIONS

Pre-Cambrian Rocks

The Uncompahgre formation comprises all the pre-Cambrian rocks of the region. It consists of alternating quartzite and slate units which, in the highly tilted limb exposed in Uncompahgre Canyon between Bear Creek Falls and the north slope of Abrams Mountain, aggregate about 7,000 feet in thickness, as shown in the following table:

Lithologic Units of the Uncompahgre Formation

NO.		FEET
5.	Quartzite, white, sugary-grained, and evenly bedded.	350
4.	Slate, black and greenish-black with common varvelike, dark and light laminations (Bear Creek locality)	750
3.	Quartzite, evenly bedded with common small-scale (one foot) cross-bedded layers; prominent white quartzite at the top becoming red and brownish-red and more argillaceous with inter-bedded slates toward the bottom. (Sutton Mill locality)	2,900
2.	Slate, arenaceous, and intercalated quartzite beds near the top and the bottom; some chlorite, mica, and chiastolite schist; drag-folded zones. (State Bridge locality)	1,700
1.	Quartzite and conglomerate, gray to red-gray; conglomerate near the top and near the exposed lower beds. (Dunmore mine locality)	1,300+

An additional thickness of about 1,700 feet of quartzite and slate lies above and north of this section in the area adjacent to Ouray. The base is not exposed, but it probably grades downward into the Vallecito conglomerate of the Needle Mountains group.

The upper surface of the Uncompahgre formation is regular where it is overlain by the Paleozoic sedimentary rocks, and moderately irregular where it is overlain by the Telluride conglomerate or the San Juan tuff. The unconformity at the base of the Telluride conglomerate or the volcanic rocks slopes irregularly to the northwest. In detail its higher parts follow the hard quartzite units and its lower parts follow the soft slate. The relief of the surface is about 1,100 feet, and rather abrupt changes are common. The position of this surface determines the bottom of many fissure veins.

PALEOZOIC AND MESOZOIC ROCKS

The principal area of Paleozoic and Mesozoic rocks is in Canyon Creek where they occupy the lower part of the canyon and lie beneath the Telluride conglomerate. The Cutler formation (Permian), composed of red sandstone, shale, and conglomerate, forms the bottom of the canyon and is overlain by Mesozoic rocks which crop out as bands in both walls of the canyon. The Mesozoic rocks lie with small angular unconformity over the Paleozoic rocks. The Hermosa formation (Pennsylvanian) is covered by San Juan tuff, and only a small outcrop of sandstone, limestone, and shale of the Molas formation (Pennsylvanian) occurs in the Uncompahgre Canyon on Ralston Creek. As a whole the Paleozoic and Mesozoic formations consist of red, white, and buff thin-bedded sandstones and shales, with lesser units of conglomerate, marl, and limestone. Brief lithologic descriptions of the formations are given under explanation on the geologic map (pl. 1); detailed lithologic descriptions have been published by Burbank.[3]

The Leadville limestone (Mississippian) and possibly the Ouray limestone (Devonian) underlie parts of the alluvial patch along Ralston Creek, but they, like most of the other Paleozoic and Mesozoic formations, are of greater distribution and occurrence in the Uncompahgre district at Ouray. The favorable aspects of the Leadville-Molas con-

---

[3]Burbank, W. S., Revision of geologic structure and stratigraphy in the Ouray district of Colorado, and its bearing on ore deposition; Colorado Sci. Soc. Proc., vol. 12, pp. 157-180, 1930.

tact, and the Ouray limestone for ore channels have been pointed out by Burbank.[4]

Tertiary Bedded Rocks

Telluride Conglomerate

The Tertiary bedded rocks are volcanic except for the small quantity of Telluride conglomerate in the northwestern part of the districts.

In the Upper Uncompahgre and Canyon Creek areas the Telluride conglomerate is an alluvial-fan formation. It accumulated largely on a flat terrain of Mesozoic and Paleozoic rocks which existed to the west of the pre-Cambrian upland in middle Tertiary time. In Canyon Creek the conglomerate forms a nearly continuous bed about 50 feet thick at the base of the San Juan tuff. In Uncompahgre Canyon it is mostly in isolated thinner patches which formed in canyons, on hillsides, and near cliffs. It is largely composed of angular quartzitic cobbles, pebbles, or sand, but occasionally contains some granite, schist, or slate debris. In places it has been mixed with San Juan tuff and locally in Uncompahgre Canyon it is transitional upward into the San Juan tuff.

San Juan Tuff

The San Juan tuff is a coarse angular accumulation of volcanic fragments held in a matrix of sandy or tuffaceous volcanic material. It is largely a fanglomerate derived by subaerial erosion of flows, tuffs, and breccias of the Silverton volcanic series. Some tuffs and pyroclastic breccias are in the formation just as some alluvial beds are in the Silverton volcanic series. The composition of the material ranges from rhyolite to andesite just as do the volcanic rocks of the Silverton volcanic series. The lower part of the San Juan tuff interfingers with the Eureka rhyolite and several flows of the Burns latite. Occasional isolated andesite flows occur in the upper part of the formation on Hayden

[4]Burbank, W. S., Structural control of ore deposition in the Uncompahgre district, Ouray County, Colo.; U.S. Geol. Surv. Bull. 906-E, p. 241, 1940.

Mountain.[5] The thickness and generally horizontal attitude of the formation can be seen in several cross sections of plate 2. A tuff bed 10-20 feet thick can be identified at about 10,000 feet altitude in Hayden and Abrams mountains and in the cliffs between the Silver Link and Michael Breen mines. Burbank[6] made a rough lithologic separation of the formation into the lower Canyon Creek member and the upper Sneffels member. In this region the horizon between the two members is at an altitude of about 10,700 feet.

Silverton Volcanic Series

Considerable change in interpretation of units from that of the Silverton folio has been made at Mineral Point and in Uncompahgre Canyon north of Mount Abrams. Nevertheless, the correlations with units in the adjoining areas and hence designation within formerly established formations is still uncertain. Regrouping of units and establishment of new formation names may be warranted in the future but is not undertaken extensively in this report.

Picayune volcanic group.—The rocks overlying the San Juan tuff on Hayden Mountain have been previously designated as units of the Picayune volcanic group. In general these rocks consist of a lower group of andesite flows, flow breccias, and breccias, and an upper group of latite and rhyolite flows, flow breccias, and tuffs. The lower group consisting of andesites may be roughly compared to the andesites on Mount Abrams near the Guadaloupe mine, and the upper group of rhyolite and latites may be compared to the similar rocks which are present in the upper part of Mount Abrams. The andesites of Hayden Mountain lie with a pronounced erosional unconformity on the San Juan tuff, and the contact drops somewhat abruptly to the south along the west side of Ironton Park toward Full Moon Gulch where, however, some interfingering is suggested between

[5]By mistake these were not labeled on plate 1, but should be marked Tsja as indicated in the explanation. They are correctly labeled on plate 2.

[6]Burbank, W. S., Revision of geologic structure and stratigraphy in the Ouray district of Colorado and its bearing on ore deposition: Colorado Sci. Soc. Proc., vol. 12, pp. 186-190, 1930.

the lower andesite and the San Juan tuff. The lower andesites of Mount Abrams appear to interfinger with the San Juan tuff in a very similar manner in a southward sloping contact north and south of Hendrick Gulch. It also appears quite probable that the lower part of the hornblende latite flows and tuffs of the Picayune, shown just south of Hendrick Gulch on the Red Mountain-Sneffels-Telluride map[7], belong to the Eureka rhyolite.

To avoid confusion the rocks on Hayden are designated as Picayune to correspond to the overlapping and adjoining area on the Red Mountain-Sneffels-Telluride map.

Eureka rhyolite.—The Eureka rhyolite crops out in two areas—(1) in the lower part of Poughkeepsie Gulch, and (2) around the base and flanks of Houghton Mountain extending into the north fork of the Animas River and California Gulch. It is a greenish-gray rock that is more or less crudely bedded and jointed parallel to its top and base. The base of the formation is not exposed in this region. The top is clearly distinguished around Houghton Mountain where it contrasts with the somber brown of the overlying Burns latite. The formation is composed of rhyolite-latite flows, breccias, and welded tuffs. Veins and fissures are less branched and split than in the overlying Burns latite.

Burns latite.—Included in the Burns latite are four units of rather contrasting type or character. Each unit mostly occupies separate but adjoining areas. These units are

(4) rhyolite-latite of Mount Abrams.

(3) banded latite of south of Mineral Point.

(2) amygdaloidal gray andesite of Engineer Mountain.

(1) andesite of Mineral Point.

The younger latitic units are separated from the andesites mostly by pronounced erosion surfaces. The latites are not in contact with each other and appear to have been

[7]Burbank, W. S., Structural control of ore deposition in the Red Mountain, Sneffels, and Telluride districts of the San Juan Mountains, Colo.; Colorado Sci. Soc. Proc., vol. 14, plate 1. 1941.

derived from different centers of eruption. Together the latite units constitute what was mapped as the Burns latite in the Silverton folio. However, the two are rather distinct. The Mount Abrams unit is in part rhyolitic and is composed of rhyolite-latite flows, flow breccias, and welded tuffs. It seems to have been derived entirely from the intrusive plugs and vents of Mount Abrams and thus is simply a local facies of the Burns. The latites south of Mineral Point and those at the head of Poughkeepsie and California gulches are almost entirely flows. They have a flow structure which in places is remarkably formed into vertical or nearly vertical narrow bands over large areas; in fact, on the flat glacial surface east of the Old Lout and Maid of the Mist mines this banding is strongly suggestive of an intrusive mass such as a great shallow dome, but because of its continuity with the surrounding horizontally banded latites the mass is included with these clearly extrusive rocks. In the Tuttle Mountain area south of Mineral Point and in Poughkeepsie and California gulches, the Burns latite group rests directly upon the Eureka rhyolite and is overlain by the pyroxene andesite. The group does not appear to have extended as far north as Engineer Mountain except perhaps locally in the area off the base map north of the Benack mine.

The andesite of Mineral Point and the overlying unit in Engineer Mountain were formerly mapped as part of the younger pyroxene andesite unit. However, the detailed mapping around Mineral Point has shown clearly that the banded latites overlie the andesite of Mineral Point. The gray amygdaloidal andesite unit of Engineer Mountain consists partly of breccias and coarse-bedded tuffs.

Veins are much more branched and split in the banded latites than in the andesites. No mineral deposits are developed in the rhyolite-latites of Mount Abrams.

Pyroxene andesite.—The pyroxene andesite is found on the ridges of Engineer Mountain, on the high ridges and peaks around the upper part of Poughkeepsie Gulch, and on Hayden Mountain. At Engineer Mountain it is the boldly outcropping dense andesite of the high cliffs whose base lies about at the lower 4-level Polar Star tunnel. It is locally amygdaloidal at the top where it is in contact with the Henson tuff. The pyroxene andesite unit of the Poughkeepsie area is composed of irregularly intermixed andesite flows and tuffs. In some sections the andesites are predominant, and in others the tuffs are predominant. The tuffs are sandy, well-stratified, green or brown, and very similar to the Henson tuff with which they may in part be correlated. Irregular lobes of andesite occur locally in the tuff. In the Duco area, the lower part of the formation is principally andesite flows, and the upper part is principally sandy tuffs and some breccias.

Henson tuff.—The Henson tuff occupies much of the top of Engineer Mountain ridge. It is a sandy, green to brown, well-stratified tuff which contains thin lapilli beds. The formation on Engineer Mountain dips north-northwest and extends down into the head of Palmetto Creek and onto American Flats where it becomes thicker. On Engineer Mountain it is scarcely thicker or more prominent than the similar if not identical tuffs of the pyroxene andesite in Tuttle and Brown Mountains.

Potosi Volcanic Series

The only outcrop of the rhyolite of the Potosi volcanic series is on Engineer Mountain and the ridge to the north which forms the divide between Bear Creek and Palmetto Creek. On Engineer Mountain the Potosi is a dense fine-grained flow which is quite white owing to much alteration. The top is not exposed on Engineer Mountain, but along the ridge northwest of the Frank Hough mine the white flow is overlain by fluidal latite flows which are probably a part of the Alboroto quartz latite.[8]

[8] Cross, W., and Larsen, E. S., A brief review of the geology of the San Juan region of southwestern Colorado; U.S. Geol. Survey Bull. 843, pl. 10, 1935.

Intrusive Rocks

Pre-Tertiary Intrusives

The principal pre-Tertiary intrusive rocks are dikes of andesite or diabase in the quartzites and slates of the Uncompahgre formation near the Uncompahgre River and Red Mountain Creek. These dikes, which are up to 60 feet in width, are usually much sheared, brecciated, or altered. In the smaller bodies shearing and alteration have converted the original massive rock into a shaly or slaty dark-brown variety. The only other intrusive body of possible pre-Tertiary age is a granitic sill about 15 feet thick which occurs in the slates near the junction of Curran and Red Mountain Creeks, but this intrusive might be of early Tertiary age and related to the Canyon Creek laccoliths.

Laccolith of Canyon Creek

The rock of this laccolith is a light-gray or greenish-gray quartz monzonite porphyry with a maximum thickness of more than 500 feet. The laccolith is of late Mesozoic or early Tertiary age and is related to the similar laccoliths at Ouray. The upper surface of the laccolith was exposed and eroded before the deposition of the Telluride conglomerate, as it is unconformably overlain by Telluride conglomerate and San Juan tuff. Mineral deposits that are directly associated with this body may be of late Mesozoic or early Tertiary age. Their character has been described by Burbank.[9]

Upper Tertiary Intrusives

The intrusives of this group are principally dikes, plugs, and sills. Quartz latite porphyry occurs in only two places. Near Duco a long, narrow dike with occasional small branching sills has invaded the tuff and breccia of the pyroxene andesite unit. On Engineer Peak, quartz latite porphyry forms a thick sill which overlies the white rhyolite of the Potosi.

---

[9]Op. cit. Bull. 906-E, pp. 236-239.

The andesite intrusives are dikes of two varieties. The prominent andesite dike of Hayden Mountain is a dark rock similar to the andesite flows of that area. Flow structures of the dike indicate lateral emplacement from east to west. The other andesite dike is a green fine- to medium-grained tuffaceous-appearing rock with platy structure. It occurs east of the Eurades mine.

The latite intrusives are plugs or plug-dike forms, and a few have cone-sheet offshoots from them. All the latite intrusives are in the general vicinity of Mount Abrams. One small plug near the head of Hendrick Gulch flares upward and feeds into the overlying rhyolite-latite flows. The top and center of Mount Abrams is a large funnel-shaped plug which flares upward as though it may have welled into a crater or formed as a large plugdome. Most of these intrusives have marginal contacts of breccia. It is possible that some parts of the vertically banded latites mapped with the rocks of the Burns latite are intrusive.

East of the Old Lout and Maid of the Mist mines vertically banded latites form a great horseshoe-shaped body which is nearly 4,000 feet in diameter. The vertically banded rock in this body, which may be a great plugdome, flattens in all directions into the Burns latite flows.

Rhyolite is the youngest intrusive in the area; it forms irregular dikes and plugdikes. The rhyolite is white to gray, highly banded, and platy. The dikes usually pinch and swell considerably, and some fissures are discontinuously filled with them. The dikes also turn sharply in their courses and fill en echelon or parallel fissures. They commonly occupy fissures with veins and are then usually much pyritized and sericitized although they contain little or no ore. The dikes on Engineer Mountain commonly have distinct borders of pitchstone. At one time the mistaking of the pitchstone for pitchblende caused considerable excitement and claim staking. On Denver Hill and along the north flank of Houghton Mountain the rhyolite along the Sewell fissure has widened into an elongate plugdike.

STRUCTURE

Folds and Faults in the Pre-Cambrian Rocks

The quartzites and slates of the Uncompahgre formation are folded into a broad anticline which pitches 40°-50° in a N.65°W. direction (see fig. 2). The dips on the limbs range from 40° to 90° but are most commonly between 55° and 70°. Two zones of slate are rather uniformly drag folded, as shown on plate 1. A set of fan-shaped tension fractures is present in the fold; because of the pitch of the fold these fractures diverge in the direction of pitch and dip toward the core of the fold. These fractures are more numerous near the crest of the fold. Some are filled with dikes or veins or both. A few of the fractures are faults; the Dunmore fissure which lies near the crest of the fold has offset the beds on the north side about 4,500 feet west of those on the south side. This displacement appears to have been largely strike slip or horizontal and the white quartzite in contact with slate near the Sutton mill is the same bed as the one in contact with slate on the highway one-quarter mile south of the Dunmore ore bin. In plate 2, section B-B′ the vertical offset is shown to be 2,800 feet. The actual slip on the fault could not have been less than this amount, but may have been more than 4,500 feet.

The divergent fissures are mineralized especially where the walls are quartzite, but a few large veins extend through the slate bands. Numerous bedding-plane displacements have occurred, and the younger beds on either limb have slipped westward and upward toward the axis. Little or no ore deposition occurs on bedding-plane faults. Post-volcanic adjustments on the divergent fractures and bedding planes controlled the formation of many of the fissures and faults in the overlying San Juan tuff.

Paleozoic-Mesozoic Wedge

The Paleozoic and Mesozoic formations are prominent and extensive to the north and west, but in this area they have been bevelled off between the smooth westward-tilted

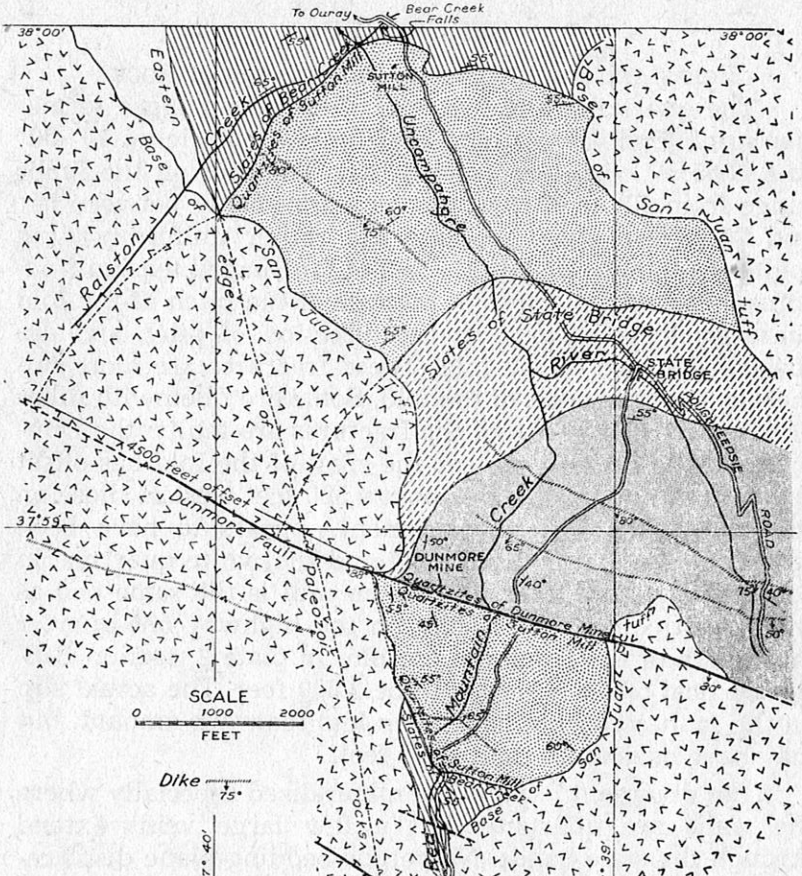

Figure 2. Geologic map of the Upper Uncompahgre area, showing the projected offset of pre-Cambrian and later formations on the Dunmore fault.

surface on the pre-Cambrian rocks and the irregular base of the horizontal overlying Tertiary formations under the north end of Hayden Mountain. They thus form a wedge whose thin edge probably lies along a nearly north line under the east side of Hayden Mountain and extends toward