Colorado: [specimens] 42578-42589. No. 350 1901

Van Hise, Charles Richard, 1857-1918
[s.l.]: [s.n.], 1901

U. S. GEOLOGICAL SURVEY

FIELD SECTION BOOK

9-891

LAKE SUPERIOR DIVISION.

INSTRUCTIONS.

1. Ordinarily at least two pages of this book will be devoted to one section. On the left-hand page, place a map of as much of the section as has *actually been seen*. Denote rivers, lakes, marshes, etc., by the usual topographical signs. Denote the ledges of rock, when no structure is made out, by cross-hatching, making the cross-hatching cover as nearly as possible the areas occupied by the exposures. If the rock is a massive one, but still more or less plainly bedded, use the same sign with a dip arrow and number attached, showing the direction and amount of the dip. Denote a shaly or other very plainly bedded ledge by right parallel lines, and a ledge having a secondary structure by wavy parallel lines running in the direction of the strike, with dip arrow and number attached as before. The greatest care must be taken to avoid confusing slaty or schistose structure with bedding, and in all cases where there is the least doubt about the true bedding direction, indicate it by a query. To each exposure on the face of the map attach the number of the specimen representing it. In mapping the section count each of the spaces between the blue lines as 100 paces, and twenty of these spaces to one mile, or 2,000 paces. Usually the southeast corner will be placed at the bottom of the page, or at the first black line above the bottom of the page, and at the right-hand side. If, however, for any reason, it is desirable to show portions of an adjoining section, the southeast corner may be shifted up, or the map may be turned around and the north placed at the left-hand side of the page. The ruling of the left-hand pages is also arranged so that, if desirable, a larger or a smaller scale can be used, eight inches, two inches, one inch, or one-half inch to the mile. With the two-inch scale, the squares outlined in black represent sections, and those in red, quarter sections and "forties," while the space between the blue lines is 200 paces.

2. On the right-hand page place the notes descriptive of the exposures. Begin in each case with the number of the specimen, placing the number on the left-hand side of the red line, after which give in order on the right of the same red line the position of the ledges as reckoned in paces from the southeast corner of the section and the dip and strike when observable, the latter always being expressed from the north; for instance 4025, 250 *N.*, 300 *W.*, *Strike*, *N.* 78° *E.*, *Dip* 50° *S.* Then follow with a full description of the ledge. When topographical maps are used for locations this paragraph applies only in part.

3. Collect a specimen from every ledge, or wherever there is a change of rock on any one ledge, taking care to get fresh material, unless for a special purpose the weathered surface is desired. In case of trips made on foot or in canoes, for long distances, neighboring ledges, unquestionably of one kind of rock, need not be specimened. The position and extent of the ledges not specimened should be marked on the map, with notes that each is of a rock identical with specimen so-and-so. Under the same conditions small-sized specimens, trimmed to a uniform size of 2 x 2½ x ¾ inches will be allowed, but in all other cases *large-sized specimens*, trimmed to a size of 3 x 4 x 1 inches, must be selected, in accordance with section 3, chapter IV, p. 44, Regulations of the U. S. Geological Survey. Specimens should not be placed together without protection in the collecting bag, as the fresh surfaces, important in determining the character of rocks, are thus destroyed. They should be damaged by no temporary mark, but the numbers should be at once marked in at least two places upon the inclosing paper or cloth bags. Specimens may be permanently marked in camp by painting the numbers upon them in white upon a black background, using Silver White and Ivory Black oil tubes for color, with turpentine as a diluent.

4. On the last twenty-five pages of the book give, as may seem desirable, a general account of the examination of the region mapped in the previous pages, correlation of observations, sketches, cross sections, etc.

5. Forward this note book as soon as filled as registered mail matter to C. R. Van Hise, U. S. Geologist, Madison, Wis.

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C R Van Hise,

Colorado, 1901

August 22,1901.
Smuggler Union and Tomboy mines.
Telluride, Colo.

The main ore chute of the Smuggler Union to which Mr. Collins took us was at the place where the Simeron and Smuggler Union veins run together for about 2000 feet. Also for a part of this distance parallel with the vein an andesite runs which at one place where crossed is 30 feet thick and at the surface is much thicker. This andesite dike as usual overhangs the ore. The stopes of this vein which here is wide again show the parallel sheeted and brecciated structure. As compared with the Camp Bird mine there is more of the parallel sheeted structure and less of the brecciated structure. Along each crack and between the parallel sheets and around each fragment there are the usual gangue minerals and the ores. The main body of the minerals of the Smuggler Union vein are lead and zinc carrying values chiefly in silver. 42578 (also shows the sheeted structure of the veins). And these sulphides are more prevalent on the foot than the hanging wall in this respect being similar to the Camp Bird and other veins. The Smuggler Union vein is peculiar in that so much of the gangue is rhodonite. 42579-80 also show

association of metals and ore. Rhodonite and rhodochrosite have been rather common gangue minerals i in the other mines of the district, but here the quantity of rhodonite is much greater than has been seen elsewhere.

Mr Collins inclined to the view that the rhodonite could not have been derived from the volcanic rocks, but this was merely an impression. It seemed to me, however, that the breccias are an adequate source of the manganese. Perhaps one set of the solutions furnished the manganese and the other the silica.

Near the hanging wall of the vein is a rather persistent streak of quartz which looks somewhat different from the other quartz of the vein; is very narrow but locally carries high values and free gold, sometimes interlaced with the quartz and calcite, sometimes in crystals and cavities. Mr. Collins showed us many beautiful specimens of this material. In general the crystals of gold seemed not to be included in the quartz but were intergrown with the calcite. Mr. Collins said Emmons thought this gold quartz vein is later than the main vein, I suppose by this meaning that after the Smuggler Union silver vein was formed that subsequent fractures occurred and the gangue of gold

then filled in. All the facts which I saw accorded with this view.

The Smuggler Union started out as a high grade silver galena mine bearing at the surface as high as 300 ounces of silver per ton. The amount of silver has steadily diminished with depth so that now at the Bullion level it is low grade ore, but just how low grade Mr. Collins did not say, but I inferred that it was near the limit of practicable working under present economic conditions, and with this view Mr. Lawrence's statement to me in Denver corresponded.

While the silver values have thus run down in the main vein, the gold along the narrow vein where found is as rich as it has been anywhere although of course it is very pockety and irregular. Thus the Smuggler Union corresponds with the other mines that I have seen in the district in respect that the silver values run down very rapidly but that the gold values hold up very well with depth. This fact may explain why the Camp Bird, although at very considerable depth is still very rich ore. Doubtless the partial explanation is that as the secondary concentration goes on the silver is very quickly precipitated by the base metals galena, sphalerite and pyrite, whereas the

gold as it is taken in solution and carried downward is more slowly precipitated and therefore descends deeper before being thrown down. Indeed we know that silver forms sulphides and naturally with the abundance of sulphur in the adjacent compounds would be precipitated, but gold is not known in the form of a sulphide, and it can probably only be thrown down by the union of the other associates against which it is posed, uniting with some other metal.

We did not go far enough in the Bullion tunnell to get to the deepest workings of the mine, probably not more than 700 or 800 feet below the surface.

The Smuggler Union vein has been traced for five miles and across valleys at places throughout this distance. Mr. Collins said the ore chute which we were in is 3000 feet long, although as he remarked it was of course of variable value both as to richness and to width. The Smuggler Union like the Pennsylvania vein, is likely to become small where the dip is flat, and widen out where the dip is high. At the particular place where we saw the vein it was wide, varying from 2 to 6 feet and here the dip is about 80°.

Mr. Collins made a general remark

which I had no means of verifying. It was to the effect that a great many prospectors had taken up claims along the continuations of the famous veins like those of the Smuggler Union and Camp Bird, but he said that these were the worst possible prospects for it is the rule of the district that the continuations of the veins which were found to be great lodes in one area were usually barren. If this is a general truth, it is to be broadely interpreted for the Camp Bird vein is is said to be run though the Revenue company, being known there as the ..... vein, and of the Smuggler Union property known as the Pandora vein.

42581 42581 pyrite impregnating quartz.
42582 42582 shows precciation of vein and
42583 association of metals. 42583 shows association of metals, gray copper?

Pennsylvania Vein.

The continuation of the original Revenue vein. It is low grade silver displaced by Pandora which is a continuation of one of the properties of the Revenue company name . . . . . which has been almost connected with the Camp Bird. Pandora always displaces the veins with which it comes in contact carries tits free gold in the gouge of the overhang. At intersection with the ~~Pandora~~ is broken country:

Pennsylvania

both veins lost. Pennsylvania displaced 30 feet horizontally Pandora continuing along the strike with the displacement. Vertical displacement unknown.

The rich free gold of the Smuggler Union not in main vein which is silver, but in adjacent fracture which seems later and may be of same date as Pandora. Pennsylvania vein carries values largely in galena with quartz gangue.

Where spring comes in in Gladiator vein about 2000 feet below the surface water feels to the hand warmer than surface water. This is used for milling water because of the constancy of the flow. Not used for boiler water because of the scale which forms in the boilers showing a large amount of material in solution. The Pennsylvanic vein at intersection almost free from water in winter, especially in February, but in late spring especially in May a perfect rain of water from the roof of the Pennsylvania vein at the very place where it intersects the Gladiator.

Tomboy mine. We next went to the Tomboy. This is a high level mine, the main level being at nearly 12000 feet. We went up to the workings nearest the surface and went into a level here which had

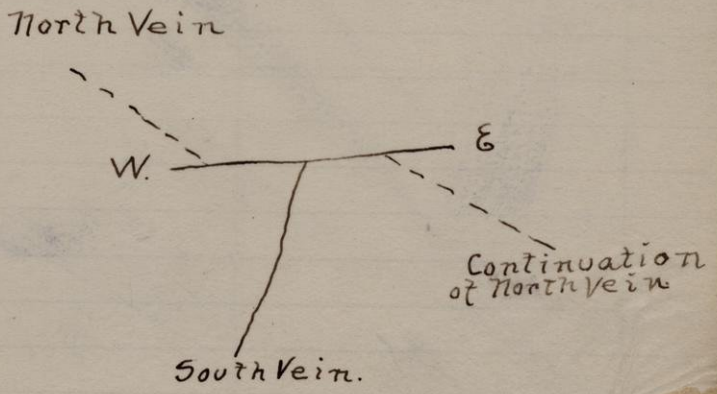
been worked out. At this horizon much ice was seen. The vein material so far as we saw it is very much oxidized as is also the wall rock although an residue of sulphides remains.

We then descended to the tunnel level in three stages looking at the stopes on the way down. The vein is of varying width, but in some places is very wide, being 12 feet or more. It shows very characteristically the sheeted structure of the district, perhaps as well as any of the mines visited. Locally also it is brecciated. Like the other mines it is apt to cary with it belts of galena with some blende upon the foot wall and less of this material along the hanging. At one place here a solid belt of galena 6 inches wide was seen. Also in this mine there is a considerable quantity of chalcopyrite.

The oxidation has extended down very irregularly someparts of the levels visited being well oxidized and other parts of them containing sulphides with very little evidence of oxidation. I asked the foreman of the effect the oxidation had on the values. He said he was glad to see it as the gold values went up. Also both he and the engineer Mr. Wheeler said that the gouge which locally occurred was apt to be very rich in free gold. In some places the gouge is high

in gold, but where this has been true it has been comparatively near the surface. The gouge in the deep mines which we have visited has only come in where the veins are small. Doubtless the explanation is that the secondary concentration has been enabled to make its way into the gouge comparatively near the surface where it is more or less open, but it has acted as an impervious stratum at depth.

At this place there are two east-west veins one north and one south. The south vein is the main Tomboy vein. This is characteristically a quartz vein. The north vein is characteristically a sulphide vein They intersect and run together for several hundred feet in this manner:



42588

Where the two run together the richest ore occurs. 42588 rich ore of Tomboy mine. In fact this is the part of the mine which is considered as the paying part. However Mr. Wheeler said that in numerous places in the north vein after it had branched off again from the Tomboy rich pockets of free gold occur. The gangue minerals of this sulphide vein are galena, blende (enough zinc to be charged in smelting the ore), chalcopyrite, and iron pyrites. The horizontal extension of these two veins is great, so that a large body of ore has been mined.

Mr. Wheeler also said that where the two veins come together the sulphide vein influences the character of the other.

General Points Concerning the San Juan District.

(1) So far as I can make out the richer parts of the lodes are below the middle slopes of the mountains. Nearly all the veins have been opened in the so called basins. Above these basins are the high peaks 13000 to 14000 feet high. Below them are the low-lying gulches The mines are not at Ouray or Telluride, but are 2000 or 3000 feet up the slope. Ouray is 7800 and Telluride 9000 feet high (see map). Most of the levels run in between 10,000 and 12,000 feet, and abv e these levels are 2000 feet more . It is proposed in one or two cases to run the tunnels from one basin to another, but so far as I know this has in no case been done so that it is not known that the values continue. The same vein has been mined in different basins and pretty well connected, but the richer values so far as I know of them are on the middle slopes.

(2) There is a notable tendency almost universally for the sulphides of lead, zinc, and iron to be more abundant on the foot wall than on the hanging. This, however, does not imply that the gold values are here the highest.

(3) There is an equally marked tendency wherever the veins are in contact with andesite dikes to be under them.

(4) Putting 1, 2, and 3 together it seems to me highly probable that the first concentration has been by ascending solutions along trunk channels. This would be in accordance with their position under the andesite dikes. Second, it seems to me that the abundance of sulphides on the foot wall indicate a second concentration.

(5) So far as the argument of descending richness goes, this argument is also in favor of two concentrations, but it might be possible that the primary concentration by downward lateral moving waters alone would accumulate material enough so as to make this true even if there was no deep ascending circulation in the earlier stages of the process.

(6) The belt of action of descending waters is the deepest in this district of any of which I know, extending to a depth of 3000 feet below the surface at the Revenue tunnell. This is favorable to a great vertical depth of rich deposits, and indeed values to great vertical depth have been shown to exist. In terms of feet the belt oc secondary concentration is here greater than usual, but in terms of

topography it is about the same here as elsewhere. The slopes are exceedingly steep, the elevation is great; the rocks much fractured by joints; and therefore oxidation naturally extends to a great depth. In the terms of topography the oxidation is not known to extend any deeper here than elsewhere, for nowhere has mining extended to depth below the valleys. Nearly all of th the workings in all of the mines are above levels which are driven in horizontally comparatively high up the slopes. At the Revenue a shaft has been extended downward from the main level 700 feet, but as yet this has not been opened up so that one can see the relations.

(7) The primary filling of the veins is regarded as contemporaneous with the cementation of the breccias The breccias are thoroughly cemented wherever oxidation is not apparent, so thoroughly cemented indeed that if any grooves or cracks exist these are not visible to the unaided eye. The veins for the most part are no less thoroughly cemented than the breccia with the exception that at many places open vuggs are seen from those of small size to large water channels several feet in length and in some cases a foot wide. However I have no idea that these are continuous.

During the movements which formed the veins here and there large openings were produced. The process of cementation continued in vein and wall material alike until the smaller openings were closed. Then circulation ceased; the water in the vuggs remained inclosed precisely as have the minute particles of water in a quartz crystal.

(8) If it be admitted that the cementation of the breccia was due to an ordinary water circulation the conclusion cannot be escaped that the vein material was deposited by water since the gangue materials are identical and the essential relations the same.

(9) The subordinate minerals which make the veins of economic value were there deposited because these were trunk channels of water circulation where streams from different sources were mingled.

(10) When the San Juan district was a great volcanic plateau, as it certainly was since the breccias are practically horizontal, before the streams had cut deeply in to this plateau, and before the breccia was cemented, and the veins formed, the water circulation must have corresponded very closely with the ideal circulation worked out. Everywhere the breccias

were permeable, and under these conditions the waters would move freely in all directions an ideal course going down from the crrsts, moving laterally on the slopes, and ascending at the valleys. Wherever there were main fracture zones such as veins, or there were impervious materials like the andesite dikes, the waters would be deflected into trunk channels and there the precipitation of the metallic materials would take place. As erosion extended deeper and deeper, and the topography approached its present form, the ascending factor of the circulation would become relatively less importand and the descending-lateral movements relatively more important , and the main processes at the present time are doubtless these descending lateral moving waters which produce the secondary concentration. Indeed Chamberlin is so impressed with this side of the matter that he said that he thought that most of the veins were thus formed. However I have no idea that this is more than half the history of any of them that are important. Indeed we know that in one case at least of the mines visited that deep circulation would have been vastly more important in the earlier days of the development of the region.

In order to get an idea of the earliest circulation we must think of the volcanic plateaus of the west which are but slightly dissected or are even dissected so far as the Yellowstone Park. Here there is no question but that along the valleys circulation is ascending; that the solutions are hot and that the deposition of material is taking place whether ore material is there deposited or not.

(11) At various places in the district the veins have been carried down from the volcanic breccias into the sediments. In a number of places the sediments near the breccias have borne rich pockets of ore, but up to the present time no large mines have been found in the sediments, and in many cases the veins have become so poor as to be valueless under present conditions. Mr. Collins told me of an interesting case , that of the Lake vein, just below the Smuggler Union. This vein extended far in the breccias. In passing below the breccias into the limestone it changed from a quartz vein into a calcite vein, and then as it went down into the sandstone gradually changed again into a quartz vein. This shows how important an influence the wall rock may have upon a vein deposit.

This is clearly a case of the law of mass action where the solutions moving in the vein mainly coming from the limestone are calcite, but this was a thin stratum and incluenced the deposit only a short distance. Continuing down into the quartzose sandstone quartz was deposited. Above in the breccias quartz was deposited and calcite subordinate. This vein, like so many others, so far as gold and silver is concerned in the sediments is valueless. In the sedimentary series at ..... horizon shales are found one about .... feet thick. These shales are doubtless the practical limit of the deep circulation spoken of above. Of course faults may have occurred within some of them to displace these shales, and it is possible that the circulation may have gone deeper into the sedimentaries and risen through them, but so far as the region as a whole is concerned I suspect that it would be unreasonable to suppose that the circulation was important below this shale, at least so far as ore bodies are concerned. Certainly the general disappearance of values in passing into the sedimentaries strongly points in this direction.

S. T. R.

SMUGGLER MILL FROM INGRAM

(12). The San Juan region appears to me to be the clearest case with which I have become acquainted of the derivation of the values from the volcanic rocks there found. These volcanic rocks are not as is so often the case as for instance at Aspen, a few dikes, but are a great mass of breccias together capped by a great thickness of rhyolite which was overlain by an unknown but great quantity of volcanic material. This material in its abundance is an adequate source for the veins found in the district and the circulation is limited below by impervious sediments. Moreover the veins disappear in these sediments, and the case seems closed in favor of the derivation of the values from the volcanic material.

51 SAVAGE BASIN FROM SMUGGLER MINE

TELLURIDE FROM INGRAM TRAIL

General Geology.
(See photos, pp. 17-25)

The high peaks of the San Juan in the upper cirques break off in vertical cliffs. These are along joints. At many places square buttressed and cathedral forms are seen, due to there being two sets of vertical joints approximately at right angles. Besides these two sets of vertical joints there are various sets of diagonal joints which were not studied. Some of these sets of diagonal joints are nearly in the same direction as the fissure veins, as shown by the outcrops of the latter on the higher slopes.

From the pass from Ouray over to Telluride we look down the San Miguel valley and here we see the same type of topography that I have seen in the Sierras, that is serrated peaks near the divide, some of which rose above the glacial line and on the sloping plateau going toward the valley . . . . . and sloping downward into the valley. In this another deep valley several hundred feet in depth with flat floor upon which the San Miguel meandered and with steep walled sides, the two sloping plateau like areas of the upper valley are cut across by many

S. T. R.

San Miguel Valley

Telluride, Col.

subordinate valleys which run at right angles to the San Miguel Valley and are of the same shape but of smaller size and higher up. In fact the topography is precisely that which I take as evidence of two periods of glaciation in the Sierras. However, so far as my own observations are concerned I did not support this interpreation by observations on the moraines or upon the amount of weathering. Indeed the latter would be difficult since the slopes are all covered with forest. Chamberlin said that the late glacier had not only filled in the valley but had extended far up on the slopes toward the peaks, as shown by the margins of the moraines which he thought was similar to that of the late Wisconsin stage.

S.

St. Sophia Ridge & Mt. Emma

Stony Mt. from Virginia Mine

Aug. 24, 1901.

Silverton, Col.

In riding up to the Silver Lake properties I had a full conversation with C. W. Purington and Senator Campbell, of Durango, in reference to the red mountains of the district, or as they are called by the mining men "the blow-outs." According to these gentlemen there are small pockets containing rich values at various places for a short distance from the surface. A short distance below the surface the materials found are usually widely disseminated sulphides carrying low values. However there have been some good mines in the red mountain areas, as for instance, the Yankee Girl a short distance from Red Mt. village.

As a whole the red mountains are regarded as less favorable places for prospecting than the gray mountains. Practically all the prospectors avoid the "blow-outs" and work on the gray unoxidized mountains. As a matter of fact, in the red mountain areas there is now no large mine working, with the exception of the Yankee Girl. All the large mines of the district being in the unoxidized areas of the gray mountains. The products of the Yankee Girl are however, I understand, from the sulphide belt below the belt of oxidation.

S. T. R.

With Mr. Owens, the superintendent, we visited the Silver Lake mine. The main Silver Lake vein is much broken material., in many cases breccias with small openings, the ore-bearing minerals being in small cavities. The Silver Lake lead is not the richest part of the mine; indeed, at the present time upon this lead little is being done.

The Silver Lake is cut by five intersecting veins. One of these, the New York, is now the best payer. This
42585 bears much chalcopyrite (42585); indeed, its main base metal is copper, but it contains some lead and zinc.
42589 shows band of native copper.
The other intersecting veins are mainly lead veins, with some zinc. The average values of gold and silver are not now high,-$10 to$15 per ton. The working visited of the Silver Lake were mostly 700-800 ft. below the surface, not nearly so deep as many of the mines of the other districts. Notwithstanding this fact there is comparatively little oxidation.

We next visited the Royal Tiger mine of the Iowa Co. At this mine we went in at the high level tunnel, only 300-400 ft. below the surface. Here was a wide lode of sheeted ground, which contains upon an average 10 per cent or more of galena, and carries, according to one of the owners, 7 oz. of silver per
42586 ton (42586). Although this mine was

S. T. R.

N. slope of San Miguel Valley

Telluride, Col.

so near the surface there was comparatively little oxidation. In places there were oxidized areas.

All the mines visited in the Silver Lake basin seem to be properties of rather moderate grade so far as silver and gold are concerned, but having veins of considerable width and high quantities of the base metals. galena in the Royal Tiger and chalcopyrite in the New York vein of the Silver Lake Co.

At the Royal Tiger along one wall slipping has occurred, and here the galena is dragged out into fibrous
42587 material (42587), showing that important movement has taken place since the deposition of the metals.

Upon returning to Silverton we rode over the divide where the veins outcrop at the surface. Here were seen the Silver Lake vein, the New York vein, and others. The surface of the veins as seen on the tops of the hills are much oxidized, have a brilliant red color; in short, show the typical "iron hat." However when examined closely the lode is found not to be completely oxidized, there being cores of lead in almost every specimen. In many cases the galena is surrounded by borders of
42588 lead sulphate (42588), and at other places the quartz is porous, the cavities which were once filled with the base sulphides being left.

I was surprised to find lead sulphide at the surface. However this

S. T. R.

Glacial cirge + Erosion peaks

Virginius Pass, Col.

corresponds with the fact that there is not an advanced stage of oxidation at any considerable depth.

These facts, combined with the rather low grade material of the mines, so far as silver and gold are concerned near the surface, suggested to me at Silverton that the glacial erosion had cut deeper than in the other districts, and that a good part of the rich belt of concentration had been swept away. The red hat at the surface might readily be explained by weathering since the glacial period.

The Silver Lake basin differs from other basins in being higher up. The veins go right across the divides; not the highest divides to be sure, but still very high. One of the tunnels already passes across the divide, but the relative values of the vein under the crest and along the slopes were not ascertained. Other tunnels are to cross another one of the divdes. However, these are all minor divides, all belonging on the Silverton slope; not the highest divides the drainage of which goes away from Silverton.

The lodes which are now worked are cut by another set of veins running more nearly north-south. These frequently displace the veins bearing values, and as yet none of them have been shown to bear mineral in profitable quantity. However, Mr. Owen says comparatively little work has been done upon them, and he thinks

S. T. R.

Virginias Pass, San Juan Mts. Col.

some of them sufficiently favorable to warrant exploratory work. These cross veins are certainly narrow as compared with the wide veins of earlier age, such as those of the Silver Lake and a great vein which outcrops on the ravine opposite the main workings of the Silver Lake property. This vein is 30 or 40 ft. wide at its outcrop. The cross veins of the Silver Lake where worked are several feet in width; whereas the late intersecting veins seem to be only a foot or two or three feet in width.

S.


MT. EMMA
GILPIN PEAK
From Virginius Mine
MT. SNEFFELS


46 POTOSI PK. FROM VIRGINIUS TRAIL

S. T. R.

S. T. R.

San Miguel Valley, Telluride, Col.