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(16) Item 6 (143)

GEOLOGY OF
ST. ANTHONY MINES.

By: Oscar H. Hershey.

San Francisco. Cal. Dec. 20th/'15.

Atolia Mining Company, San Francisco, Cal.

Gentlemen:

In accordance with your instructions I have made a geological examination of the St. Anthony mines near Toy, Nevada, occupying two days of field-work. The only map available as a base for my geologic mapping of the surface was an imperfect sketch of the claims dated Oct. 17, 1910. The tunnels, shafts and cuts indicated thereon appeared to me to be to a considerable extent somewhat wrongly located and I largely ignored them. I made a rough compass and pacing survey of the main group of underground workings as per accompanying sketch.

FORMATIONS.

The hard rock formations consist of a sedimentary series and an intruded granite series. The sediments strike west and dip south an average of 55°. The highest member recognized is prevailingly a black siliceous shale, though certain layers are thin-bedded black and gray impure limestones. This member has a width of outcrop of at least 600 feet.

The next belt going north consists of black and light gray, thin-bedded, impure limestone. The width of outcrop is about 400 feet.

The third and lowest division was largely a blue-gray.

rather massive, fairly pure limestone, but it has been largely metamorphosed to white and blue-gray marble. The width of outcrop is
about 600 feet. Without a more extended study I cannot be certain of
the age of this limestone-shale series, but it bears a strong resemblance
to a Triassic series extensively developed in western Nevada.

The granites that have intruded the sediments occupy an extensive area north of the mines. The main body is a medium to rather coarse grained rock consisting chiefly of white feldspar, colorless quartz and brown biotite. It is probably granodiorite. This is traversed by irregular dikes and bunches of a finer grained, more acid granite which varies to a true aplite and is doubtless the aplitic phase of the granodiorite intrusion. This finer grained granite is especially abundant near the border of the granite area from the main mine westward and frequently comes into contact with the ore.

A considerable portion of the company's claims is covered by the silts, sands and coarse gravels of the Lake Lahontan sediments; in some places the bed-rock formations are obscured by debris; and along the principal gulches they are buried under alluvium. These three, I have mapped under one designation as their only importance lies in their covering the bed-rock.

CONTACT METAMORPHISM.

The metamorphic effect of the granite intrusion is extensive. It is most apparent in the limestones which, within hundreds of feet of the contact, have been largely altered to marble. At the contact this marble (and possibly to a certain extent the granite) has been further altered to an aggregate of contact metamorphic minerals including quartz, garnet, calcite and scheelite. I have not seen this rock in an unoxidized condition - other contact minerals may be present but are difficult to see. A characteristic is the presence of a yellow mineral that is in places hard but usually soft and seems to be largely in the form of a stain from which I infer that it is secondary. Doubtless some pyrite and possibly other sulphides were present in the unoxidized rock. Their oxides stain the rock and ob-

scure the scheelite. I have not seen the latter except on the tables in the mill and in the pan at the assaying office. I was, therefore, dependant entirely upon the statements of the superintendent, Mr. E. L. Beck, for information about the distribution of the scheelite. Invariably when we saw some of the typical siliceous contact material he said it was ore, meaning that it contained from .5 to 3% WOz, averaging between 1 and 1.5%. He was backing up this opinion by proceeding to develop all such material that occurs in bodies of fair size, hence it hardly seems in order for me to express skepticism. I will, therefore, refer to this material as the contact ore-bodies.

POSITION OF ORE-BODIES.

I will now call attention to the fact that the contact has a general westward course to the east line of the Fairmount claim and thence its course is about N. 70° W., acutely traversing the sediments. The broad marble band or lowest division of the sediments has been more favorable to the formation of contact metamorphic bodies, than have the more siliceous bands, hence the most favorable territory for ore lies westward from the east line of Tip Top No. 2 claim. Because of arms extending from the main granite body into the sediments. the contact is very irregular, but losing sight for a moment of the minor irregularities, there may be said to be two main linesof contact, which for convenience we will call, following Mr. Beck, the North contact and the South contact. The North contact in a discontinuous form may be recognized from near the mouth of the Hazeltine tunnel to the vicinity of the discovery point on the Tip Top No. 3 claim, a distance of about 1100 feet. It is discontinuous because it is but by arms of granite and aplite. In fact, it consists largely of the north side of large inclusions of sediments in the granite, though at the surface at the main mine it is the main contact itself. On the southern side of the granite bands that run back

of the inclusions is the South contact. Nearly all the commercial ore occurs along the North contact. Where the inclusions are small they are largely ore; where they are large, a narrow band of ore runs along the north side. This swells and makes important orebodies at the ends of the inclusions. Scarcely any ore runs around the south side of the inclusions. Very little ore has so far been found at the South contact, either at the surface or underground. At the main mine, instead of an inclusion, we have a blunt projection of marble into the granite and important orebodies occur at both ends of the North contact on this point.

DETAILED DISCUSSION.

Apparently the largest orebody in the entire property occurs at the mouth of the Hazeltine tunnel. It is unusually thick because it surrounds and partly overlies a boss of granite. Its length on the surface appears to have been about 80 feet, and its true length as measured on the Hazeltine tunnel level is about as great. The average width, exclusing the granite boss and a marble horse, may be 15 feet. This body is producing most of the present tonnage and before many weeks will have been mined down to the Hazeltine tunnel level.

A narrow streak of ore, 2 to 6 feet wide at the surface, runs for 100 feet west from the main body and then a pinch extends for about 40 feet, after which the ore again opens up and widens to 20 feet, then abruptly ends against an arm of the granite. This body has been developed at a shallow depth by a tunnel, but has not been much mined.

Now the long narrow orebody that is being stoped near the surface, decreases in average width down to the Hazeltine tunnel and appears not to be of much value on that level. The tunnel is being driven ahead along the North contact and I recommend that it be continued to get the west bunch of ore mentioned in the pre-

A sketch of the east wall of the winze from the Hazeltine level down is appended. A good body of ore runs down 40 feet to a little fault which throws it up into the roof. Hazeltine's sampling of the west wall shows from 2 to 5 feet thickness of fairgrade ore. A short distance below the fault an intermediate is being driven eastward in the granite and now curving toward the North contact. I recommend that this drift be continued eastward along the contact to develop the large orebody at the mouth of the Hazeltine tunnel.

A short distance farther down the winze, a drift is being driven westward along the North contact. Several feet thickness of ore had appeared in the face. I recommend that this drift be continued along the North contact until it runs into granite.

over the North contact ore streak. This granite is an arm that does not reach the surface on the dip, though it may toward the west. The winze was at first steepened along the North contact ore, but as that ore became weak, the winze was flattened and went through the granite (with a local inclusion of ore) to the South contact. This contact was apparently followed, on the so-called 100-foot level, about 150 feet westward, but the drift is obstructed about 30 feet from the winze by waste from a stope on an unusually small shoot of unusually good-grade ore. Eastward the drift was driven along the South contact for about 80 feet without yielding any ore. At the face a winze was put down 15 or 20 feet and it exposed 3 feet of ore of the North contact streak with granite on both sides.

I may say here that I have a rather strong impression that structural features on the Tip Top No. 2 claim, in addition to having a southward dip, have an eastward pitch. My opinion is that the stub of the main winze that goes down on the narrow ore streak of the North contact, if continued down to the level of the ore in the winze from the 100 east drift would probably follow a seam in the

granite. A drift could then be driven eastward along this seam to the ore in the little winze and on eastward to the presumed downward extension of the main orebody.

One might be disposed to criticize the driving of levels at such short intervals, but in view of the character of the deposits, I believe it is good policy not to attempt development by driving drifts at long intervals.

About 140 feet west of the westermost orebody just discussed, an inclusion begins and extends about 100 feet westward at the surface. At its east end there is a bunch of commercial ore that would pay to develop deeper, for which purpose the Hazeltine tunnel might be driven through the granite arm. Some irregular ore extends along the north side of the inclusion beyond the goodbunch. A tunnel, No. 3 West, has been driven from the good ore along the north side and around the west end of the inclusion. This indicates a decided eastward pitch of the inclusion. So far as I can see, the only ore worth while developed by this tunnel is that at and near its mouth.

No. 2 West tunnel runs on the South contact about 40 feet to a fault. There was a bunch of 1 to 1½% ore near the mouth per Beck. Beyond the fault the tunnel is largely in marble but reaches the granite contact near the face. A little ore occurs along the contact. The developments in this tunnel corroborate the 100-foot level and the surface in the matter of the unfavorableness of the South contact for ore. I recommend that work be concentrated on the North contact orebodies and the South contact abandoned for the present.

About 200 feet farther west there is a point of marble projecting into the granite. Along its north side for about 60 feet the surface shows a little ore along the North contact. Tunnel No. 4 West has been driven under this marble point. It shows a tendency of the granite to underlie the marble with a rather flat contact. The tunnel which is about 100 feet long, with two cross cuts runs largely in marble

and granite south of the North contact and has very little ore.

Beck is now cross-cutting north and getting good ore. This is a

very short distance below the surface. The North contact may now

be followed, though the showing at the surface is not very promising.

The next inclusion northwestward, is about 200 feet long at the surface and terminates against a big fault breccia. At the surface there are some ore lenses along the northeast side. No. 5 West, a very crooked tunnel about 100 feet long (including cut) begins at the southeast end and follows the North contact part of the distance to the face, with bunches of very low grade ore the last test indicating .5% WOz. Nothing commercial has been found so fart. This (and the other tunnels) ought to be surveyed, the places sampled should be marked on the map and the contents recorded, for a permanent record.

claim cuts expose three shallow ore inclusions. Granite may be seen under them and they are too small to be worth consideration. Beyond this point the horizon of the North contact has been entirely engulfed by the granite and nothing of an encouraging nature was seen along the South contact. The fault near the west end line of the Tip Top No. 2 claim is the west limit of the country having possibilities. However, I doubt that there is anything worthy of deep development west of the ore at the mouth of No. 3 West tunnel. My recommendation is that in this section what ore may be found be found by the present shallow work be mined out and no hope entertained of finding anything better with depth.

trends southeast and passes under deep debris and alluvium. It cuts into the middle division of the sediments, where conditions were less favorable for the formation of ore. Where the contact is exposed near the ore bin, there is practically no mineralization. The same is true for the first 100-feet after the contact has re-

appeared on the Fairmount claim. However, near the discovery point of that claim and extending east on to the East Fairmount claim, there is in the marble a contact metamorphic band about 200 feet long and from 2 to 4 feet thick, dipping southward 50° to 60°. This is being developed by shallow tunnels. Much of the band is described as ore, at one place 18 inches carrying 1.5% per Beck. The trouble with these workings is that granite seems to cut the ore off at shallow depths; hence, I recommend that you mine the known ore here and then quit as no deep work is advisable.

The same locality has an antimony vein about 300 feet long and dipping southward 45°. It is marked by a strong fault gouge, and breccia partly in the granite and partly in the sediments, under which is from 1 to 10 inches of stibnite, quartz and some opaque white mineral. It may contain 5 to 30% antimony and some ore has been shipped, but it is clearly too small to be of much value as an antimony vein. Beck gives Mr. Atkins as authority for the statement that it contains some scheelite.

About 200 feet farther east there is in an inclusion a 1-foot band that Beck says pans better than 2% WOz. He says it pinches out in the bottom of the cut. It is too limited.

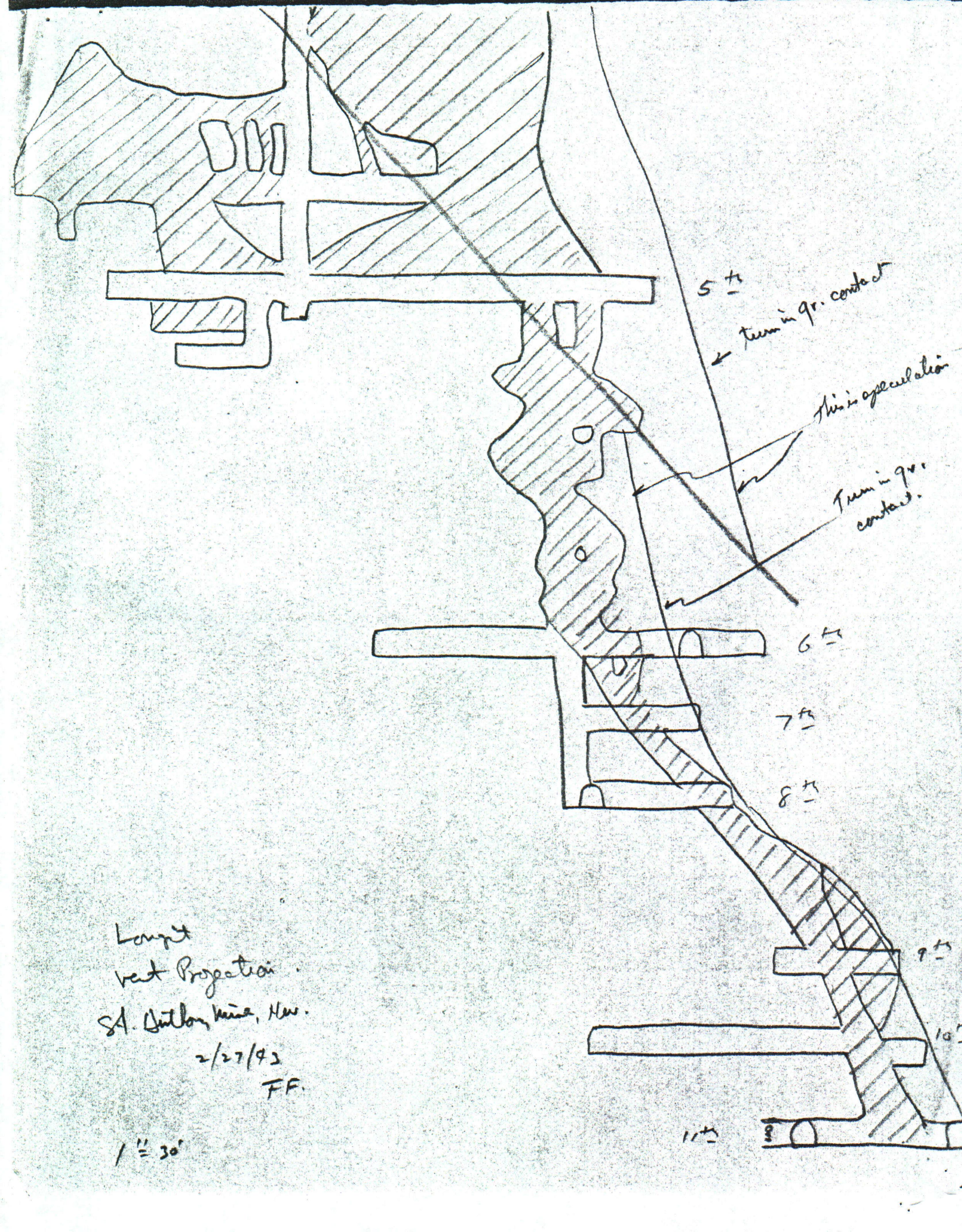
under lake sediments and where it reappears no encouraging deposits of contact minerals may be found. In short, there is not anything in sight on the property east of the main mine that impresses me as being worthy of serious consideration except to dig out the small amount of shallow ore that is in sight. It is, of course, true that other small deposits may occur along the contact at greater depth, and they will probably be isolated and not be found except at prohibitive expense.

Taking a broad view of the entire proposition it is evident that the only portion that is really of an encouraging nature is the North contact for about 400 feet (even this interfupted by over

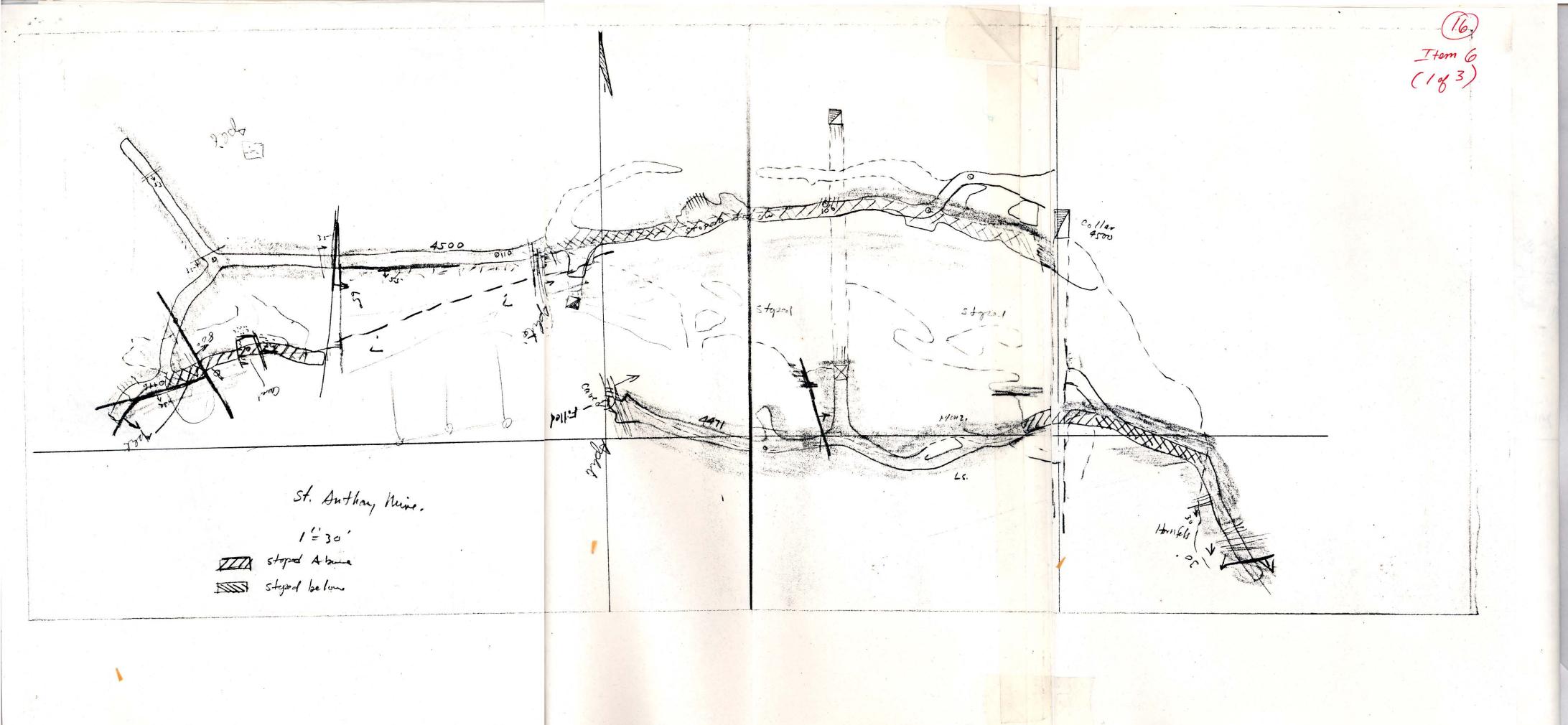
100 feet of granite) including three main ore-shoots that may be known from a sketch accompanying the superintendent's report for Nov. 6, 1915, as the No. 1 East, the No. 1 West and the No. 3 West. These should be worked energetically while war prices remain in effect. This mine cannot be successfully operated without constant surveying. By keeping the new work surveyed, making sketches, recording on them where samples were taken and what they contained, data will be available at the end of the war to estimate how much of the property can be worked at a profit at normal prices.

Respectfully submitted,

Oscar H. Hershey.



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SECOND REPORT

on

ST. ANTHONY MINE.

Atolia Mining Company. 1404 Humboldt Bank Building. San Francisco, Cal.

Gentlemen:

In December of last year I visited the St. Anthony tungsten mine near Fanning, Nevada and prepared a report on the geology of the group of claims belonging to your company. Today I accompanied Mr. J. H. Mackenzie on a visit to the property. The trip being somewhat unexpected I do not have with me a copy of my first report, but, if I remember rightly, I divided the prospects having possibilities into two groups, one centering near the line between the Fairmount and East Fairmount claims and the other extending from the cut at the mouth of the Hazeltine tunnel westward to a fault near the west line of the Tip Top No. 2 claim. However, there were but three orebodies that seemed to me to promise to centinue to a considerable depth, the one near the mouth of the Hazeltine tunnel, the No. 1 West and the No. 3 West orebodies.

Development work has fully borne out my opinion that the first group, that near the east line of the rairmount claim, would prove very shallow because of the granite spreading out under the marble and shales, thus cutting off the ore. In the No. 2 East workings very little ore is left. In the most easterly tunnel on the antimony vein, Mr. Beck has discovered 15 inches of good ore. This should be driven upon toward the eastward. The No. 1 East drift develops ere nearly through the hill, but the base of much of the orebody is exposed in the tunnel and a lower cross-cut tunnel shows granite where the orebody would be due by projection. It is clear that the proper thing to do in this group of workings is to mine out the ore that is in sight and then quit.

At the main workings near the east end of the Tip Top No. 2 claim there is a new inclined shaft about 130 feet deep. The

main orebody seems to go down east of the shaft. The bottom of the shaft is in granite. A level known as No. 1 level from the New Shaft has been begun. The short east drift is in granite. About 10 feet higher vertically, but up the shaft from the level, the ere seems to pass into the east side of the shaft and if it continues down with an eastward rake, the No. 1 level east drift continued should cut it. Probably the ore will go down to the level, but perhaps not much lower.

The Hazeltine tunnel was driven ahead into the No. 1
West crebody and this crebody has been practically stoped out from
the surface to a short distance below the Hazeltine tunnel, now
known as the Ol drift. The first west intermediate (now known
as drift 51) down the old incline is being driven ahead to develop
this crebody. However, the crebody rakes eastward, is probably
represented by the cre in the incline and the bettom is practically
in sight on the No. 1 drift west from the New shaft.

The No. 3 West erebody bettemed about 10 feet below the No. 3 West tunnel. Bunches of ore were stoped from the south contact over No. 2 West tunnel, but did not pay to work.

have proved shallower than I anticipated and this weakens my confidence in the third. Developments farther west have resulted about as I had expected. Driving and raising along the north contact in No. 4 West workings, yielded small bunches of ore, not large enough to be worked profitably. The No. 5 West tunnel developed along the north contact small bunches of ore, but nothing worth working.

There was a notable change in Mr. Beck's attitude in the interval between my visits. In December he was optimistic, but as nearly all the workshe has done since that time has shown the deposits to be mere pockets he has come to the conclusion

that he has practically exhausted the possibilities and that
he will have the property worked out in three months or less. In
this conclusion I fully concur, with the possible exception noted
below, and I believe Mr. Mackenzie is convinced that it is correct
though he doubts that there is more than sufficient ore to supply
the mill for a month or six weeks.

The only chance to give the operation a reasonably long life lies in the possibility of finding more isolated orebodies in depth. My surface mapping brought out the fact that the granite contact in general traverses the strata on the strike at an acute angle and it is now quite clear that it does so also on the dip. In other words, the contact in general is flatter than the stratification of the limestone and shales. On my first visit I had developed the fact that the orebodies occur only at the contact between the granite and a broad limestone belt largely converted to marble. Today it appeared to me that commercial orebodies are confined to the upper portion of the limestone belt. Thus future exploration should consist of a thorough underground development of the granite contact in the upper portion of the limestone. This section will have a rather flat rake toward the west. The proper method would be to sink the new inclined shaft deeper, then drive westward on the main or south contact and at frequent intervals cross-cut toward the north in search of isolated bodies of marble and ore, The probability that such orebodies occur in a fair one. probability of Their banes found sneapt at but the prehibitive expense as doubtful; hence, I do not recommend that you enter upon such a purely speculative compaign of development. Perhaps I can make my meaning clearer by saying that I am in the position of the physician who is pretty certain that the patient will die, but prescribes certain medicines as being the proper remedies in cases of that kind, though not always successful in preventing an early demise.

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BY OSCAR H. HERSHEY

Lovelock, Nevada,

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November 18, 1917.

Hon. E. C. Voorheis, President.

Atolia Mining Company,

1404 Humboldt Bank Bldg.

San Francisco, Cal.

Dear Sir:

I have this day visited the St. Anthony mine, accompanied by the watchman, Mr. T. J. Clavering. It is somewhat difficult to distinguish the ore by sight alone and Mr. Clavering was not acquainted with it. However, I noted the distribution and extent of such material as had been mined, a quartzese contact metamorphic rock occurring usually between marble and granite. My last visit was on March 28th, 1916. Work done since then I will refer to as new work.

I had no map but I made a rough sketch of the lowest level connecting with the main shaft. Along the North contact, in the floor of the level and of a shallow underhand stope, there seems to be a body of ore 25 feet long and probably 2 to 3 feet wide. The former superintendent says that it is 5% ore. It stands very steep. It terminates at the east end against a fault that dips eastward 45°. The ore has been stoped upward to the fault. East of the fault the granite-marble contact bends southeast and is unfavorable. Going northwest the contact bends southewest and becomes unfavorable. The feet of the shaft is in thin-banded blue and gray marble, dipping south 60°. If the main contact reaches this formation, conditions will be unfavorable.

the ore may be found to go much deeper than the present lowest level.

On the next level up the shaft I found evidence of an orebody 20 feet long and 2 feet thick at the North contact east of the shaft. This is in the floor of a shallow underhand stope and may extend somewhat deeper. It may be the same shoot as on the lowest level, displaced somewhat by the fault mentioned The remainder of the North contact seems to have nothing stopable. At the east end the contact bends southward. The thin-banded marble occurs at a short distance south of the contact. The ore-shoot has been stoped to the surface. It was much longer and wider above the level just disquased. On the third level from the bottom, a drift runs from the stope 55 feet S. 200 E. more or less closely following the contact of granite with the thin-banded marble, showing that the ore is cut off on the southeast by a change in the course of the contact and appearance of the thin-banded marble. The same relation appears at the surface. In other words, the southeast limit of the ore has been reached and goes down steep so far as pitch is cocerned. The ore as a whole in the main mine gives out downward in tongues that extend progressively deeper toward the southeast to the vicinity of the main shaft. That gives us a rather flat southeast rake in general of the northwest limit, and as the southeast limit has scarcely any pitch, the two limits may come together a little deeper than the present lowest level. Thus, so far as the structure is concerned, the future of the mine is not promising. Besides the two bodies described, a little ore is left in small pillars and patches on the walls of the stopes, not worth considering.

In the first group of workings west of the main/nine, little erebodies have been stoped, but there has been little new development work and there is nothing in sight to encourage any?

Thence we visited the old workings west to the end of the group. A little new work was noted, but the results are not worth discussion.

Mr. Clavering told me that new claims have been located for a long distance westward, but he said no discoveries of promise have been made on them and I did not go over them, having seen much of the country on my first visit. Subsequently, I met the former superintendent, Mr. W. H. Sherman, in Levelock, and he mentioned a deposit 2000 feet west of the main mine. This place was mentioned in my original report as three shallow ore inclusions southwest from the discovery point on the Tip Top No. 3 claim. I have not changed my opinion regarding them.

At the group of workings east of the main mine considerable new work has been done. East of the shaft exposing the antimonybearing vein, there is an incline going down on the strong fault gouge that accompanies the antimony vein. In the banded limestone over this gouge a narrow band of ore was stoped and north of it a smaller band of ore of similar character was stoped. In both cases the ore bottomed on the gouge. One might think it possible to pick up ore below the gouge by the proper cross-cutting. but unfortunately the granite contact occurs near the gouge, leaving little chance for much ore below the fault.

The work done since my second visit has yielded more ore than I expected (perhaps partly by working lower grade ore) and has shown the ore to go down deeper near the main shaft than I feared it would, but it has not shown cause for any modification of the principles laid down in my former reports, and I consider the property nearly worked out.

There are three things that can be done as follows:

Resume work on company account and dig out the ore in

- 2. Lease the mine and let the lessee dig out the ore in sight.
- 3. Let the ore in sight remain as a bait for selling the property.

I cannot see any chance of there being enough ore to warrant recommending the company to go to the expense of preparing to resume operations. Hence, I favor the leasing proposition. But lessees will dig the ore out completely and greatly injure the chance of selling the mine.

I am unable to estimate just what chance there may be of selling the mine. In this connection I may mention that some months ago an employee of the Atolia Mining Company tried to sell the St. Anthony property to the Primos Chemical Company and the matter was referred to me. I said it placed me in a very embarrassing position and for a long time refused to express an opinion. I was told, however, that the Primos Chemical Company positively would not buy the property without a favorable report from me. I told them that in that case it was useless to go farther because knowing what oportunities they have had and rejected, they would never buy the St. Anthony on my report. You will realize that I have been trying to play fair with both companies, and any other answer would have led to a useless expenditure of money on the part of the Primos Chemical Company and a useless raising of expectations on the part of the Atelia Company.

But I realize that other tungsten operators may not take as pessimistic a view of the future of the mine as I do and might be willing to give it a twial. Hence, I cannot absolutely reject proposition three. In fact, I am hardly in a position to

advise as between two and three and I can go no farther than to express the opinion that leasing might yield a little money and place the mine in the worked out class.

Respectfully submitted.

Oscar H. Hershey