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ANTIMONY ORE in the Fairbanks District, Alaska

Cap.

by

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~~(Antimony, Fairbanks)~~

Abstract

Antimony-bearing ores in the Fairbanks district, Alaska, are found principally in two areas, the extremities of which are at points 10 miles west and 23 miles northeast of Fairbanks; and one of two minor areas lies along this same trend 30 miles farther to the northeast. These areas are probably only local manifestations of mineralization ~~which~~ that affected a much broader area and formed antimony-bearing deposits in neighboring districts, the closest of which is 50 miles away. The ores were exposed largely as a result of lode gold mining, but at two periods in the past, high prices for antimony ore warranted an independent production and about 2500 tons of stibnite ore was shipped.

¶ The sulfide deposits occupy the same fractures along which a gold-quartz mineralization of greater economic importance occurred; and both are probably genetically related to igneous rocks which intrude the schistose country rock. The sulfide is in part contemporaneous with some late-stage quartz ~~formation~~ in which it occurs as disseminated crystals; and in part the latest filling in the mineralized zones where it forms kidney-shaped masses of essentially solid sulfide. One extremely long mass must have contained nearly 100 tons of ore, but the average of the larger kidneys is closer to several tons. Much of the ore is stibnite, with quartz as a minor impurity, and assays show the tenor to vary from 40 to 65 percent antimony. Sulphantimonites are less abundant but likewise occur as disseminated crystals and as kidney-shaped bodies. Antimony oxides appear on the weathered surface and along fractures within the sulfide ore.

Deposits containing either stibnite or sulphantimonite are known at more than 50 localities, but only eighteen have produced ore and the bulk of this came from five mines. The geology of the deposit, and the nature, extent, and period of the workings are covered in the detailed descriptions of individual occurrences.

Several geologic and economic factors, which greatly affect prospecting and mining for stibnite ore in the area, are outlined. The principal available ore and reserves are considered to be ores earlier mined but never shipped, ore minable from near-surface deposits, and ores recoverable as a by-product of future gold mining. The outlook for stibnite production in the district is very uncertain. Apparently the greater portion of stibnite ore has already been recovered and present operations will strip the two principal areas of the district. This conclusion is based on the scanty discoveries since the last war and the fact that the areas are so pock-marked with prospects that there is little likelihood that any other large near-surface bodies remain to be discovered. Future prospecting would essentially be limited to attempts to seek the continuation of lodes previously having high yields of stibnite.

Antimony ore in the Fairbanks district, Alaska

by

Pemberton L. Killeen and John B. Mertie, Jr.

Introduction

Deposits of stibnite and other antimony-bearing sulfides in the Fairbanks district, Alaska, are principally coincident in distribution with two well-known areas of gold mineralization. The Ester Dome area, the smaller and more equidimensional of these, lies 10 miles west of Fairbanks; whereas the Pedro Dome belt begins about 10 miles north of Fairbanks and, with a width varying from 1 to 4 miles, extends east-northeast for 20 miles. A minor occurrence of stibnite is known in the valley of Rose Creek, three miles south of the central part of the Pedro Dome belt, and within the parallel Gilmore mineralized zone. Another isolated deposit has been found on Sourdough Creek, a tributary of the Chatanika River, nearly 30 miles beyond the Pedro Dome belt to the northeast. The locations of these areas of stibnite deposits are shown on figure 1.

Figure 1. Areas of antimony deposits in the Fairbanks district, Alaska.

Lode prospecting during the past 35 years has tended to emphasize this restriction of stibnite deposits to a relatively small portion of the area of the Fairbanks district; but, at the same time, has increased the number of similar deposits known in neighboring districts. As these discoveries become closer geographically, there is more certainty that each is only part of a much larger area in which mineralization resulted in ~~stibnite formation~~ the formation of stibnite. These outlying deposits are distinctly concerned in any evaluation of the future of the Fairbanks district as a source of antimony ore.

Too little is yet known of the distribution of these deposits for the recognition of the geologic interrelations of the group or of the factors which have been responsible for the localization of each but as these relations become clearer they will furnish a guide for further prospecting. From the economic viewpoint, the Fairbanks district has been preeminent among these eastern interior Alaskan localities as a potential source for the production of stibnite ore, until within recent years when the Kantishna district, 110 miles to the southwest, became a producer. The disadvantageous location of the others, owing to their remoteness from centers of commercial activity, has so far kept them in a position of minor importance. As these outlying deposits become more accessible, and if they prove to have workable ore, Fairbanks should again become important, not as a producer, a center for the beneficiation of the ores and for shipment. The inset on figure 1 shows the locations of antimony ores in the districts adjacent to the Fairbanks district.

The information available on stibnite in this district is largely a result of the prospecting and mining of lode gold. Stibnite was first recognized during the early stages of placer mining on Cleary and Ester Creeks both in the placers and as a lode beneath the gravels on Chatham Creek. (1) Subsequently, as gold-quartz veins were discovered and prospected, deposits of stibnite were found at 50 to 60 localities, but only a few of these have produced commercial ore.

(1) Prindle, L. M., Auriferous quartz veins in the Fairbanks district: U. S. Geol. Survey Bull. 442, p. 241, 1910

(1) Prindle, L. M., Yukon placer fields: U. S. Geol. Survey B 284, p. 114, 1906

Recovery of such ores was encouraged during the last war by the high price of antimony and from 1915 to 1918, inclusive, about 2300 tons of stibnite ~~was~~ were mined and shipped. This ~~area~~ district furnished the larger part of Alaskan production during that period. A later rise in the price of antimony resulted in additional ~~production~~ output in 1926 and 1927, so that the total past production is probably close to 2500 tons.

Previous publications include both specific discussion of these antimony deposits(2)

(2) Brooks, A. H., Antimony deposits of Alaska: U. S. Geol. Survey Bull. 649, pp. 17-41, 1916.
Mertie, J. B., Jr., Lode mining in the Fairbanks district: U. S. Geol. Survey Bull. 662, pp. 414-417, 1918.
Hill, J. M., Lode deposits of the Fairbanks district, Alaska; Investigations in Alaska Railroad Belt in 1931: U. S. Geol. Survey Bull. 849, pp. 156-157, 1931.
Joesting, H. R., Strategic Mineral occurrences in interior Alaska: Territory of Alaska, Department of Mines, Pamphlet No. 1 (mimeographed), College, Alaska, May 1942, pp. 3-11.

and statements of information obtained incidental to investigations of gold-mining properties (3), and a Geological Survey party examined the stibnite deposits during the months of August and September 1942.

(3) Prindle, L. M., Yukon placer fields: U. S. Geol. Survey Bull. 284, pp. 114-115, 1906.
Prindle, L. M., and Katz, F. J., The Fairbanks gold-placer region: U. S. Geol. Survey Bull. 379, pp. 187-189, 1909.
Prindle, L. M., Auriferous quartz veins in the Fairbanks district: U. S. Geol. Survey Bull. 442, p. 221, 1909.
Brooks, A. H., The mining industry in 1910: U. S. Geol. Survey Bull. 480, pp. 34, 35, 1911.
Smith, P. S., Lode mining near Fairbanks: U. S. Geol. Survey Bull. 525, pp. 153-216, 1913; or Bull. 542, pp. 137-202, 1913.
Chapin, T., Lode Mining near Fairbanks: U. S. Geol. Survey Bull. 592, pp. 321-355, 1914.
Brooks, A. H., Alaskan mining industry in 1915: U. S. Geol. Survey Bull. 642, p. 59, 1916.
Chapin, T., Mining in the Fairbanks district: U. S. Geol. Survey Bull. 692, pp. 321-324, 1919.
Martin, G. C., Alaskan mining industry in 1918: U. S. Geol. Survey Bull. 712, pp. 39, 40, 1920.

Economic Geology

General Features

The country rock consists of ancient sedimentary schists, quartzites, and a small proportion of gneiss and crystalline limestone. These metamorphic rocks have been intruded by several kinds of igneous rocks, the largest exposure of which is the granodiorite of Pedro Dome, formerly described as a quartz diorite; and the various types of ore deposits are considered to be genetically related to these. The most important ore deposits are the gold-bearing quartz veins, ranging in thickness from one inch to 2 feet, which transect the cleavage of the schist; whereas the minor ore deposits, comprising sulfides or scheelite, ~~have been deposited~~ occur both in veins and more irregular bodies. In the Ester Dome area, the average strike of the veins is north-south and the dip both eastward and westward; but in the Pedro Dome belt the average strike of these veins is east-west and the dip is commonly southward. This change of direction may be related to the difference in trend of the schistosity in the two regions: in the Ester region the schistosity trends north or northeast, but in the Pedro Dome area it trends east or northeast. The dip of the schistosity is very low, ranging from nearly horizontal to dips of 45° in either direction.

The Stibnite Deposits

The sulfide ores occur mainly as lenses and kidneys along the borders of, and less commonly within, the quartz veins; or as bodies of similar form along fissures and in shear zones where little or no veins quartz is present. Sulfides also occur within the quartz veins as disseminated crystals.

The lens-shaped masses of stibnite vary greatly in size, ranging from one that had a maximum length of 100 feet down to small pockets of ore less than a foot in length; the widths or mean diameters bear no definite ratio to the long dimensions but none exceeds 12 feet; and the thickness ranges from 6 feet to a few inches. Much variation exists in the orientation of the ore-shoots, the major axes lying in all positions in the planes of the quartz veins or shear zones, from horizontal to a direction parallel with the dip. The lenses are erratically distributed along the course of the vein, both horizontally and vertically, and stibnite is not confined to veins of any particular strike or dip. The stibnite deposits wherever examined appear to be the latest filling in the fissure and even fill reopened spaces in earlier quartz veins, but the period of deposition was contemporaneous in part with some of the quartz as the stibnite crystals are disseminated through it.

All ~~the~~ veins which have been opened to any depth show that their continuity is frequently interrupted by complex faulting. Stibnite also occurs in placer deposits in various creeks in the area but these deposits are in general of little economic importance for stibnite probably was never concentrated in any great amount, both because of its inability to resist disintegration and the lack of large source bodies; and dredging operations have ~~broken up~~ disrupted most of the placer concentrations which have been known to exist.

The sulfide in most of the lenses appears to be pure stibnite, but sufficient quartz adheres to it or is included in the ore that the content of antimony ranged from 40 to 65 and averaged nearly 55 percent for ore shipped during the last war. Samples of high-grade ore collected in 1942, and assayed by the Geological Survey, range from 39.48 to 65.48 percent antimony.

No selenium was found in any of the samples from the district. The assays of these ores from the individual mines are given in table 1. As all of the ore so far mined has been found within a few hundred feet of the surface, in the zone of weathering, the stibnite is more or less oxidized: commonly along the borders of the ore shoots, but locally along planes of fracture throughout the ore. These oxidized ores include the yellowish stibiconite and cervantite, minor amounts of the white senarmontite or valentinite, and some red kermesite. Such oxidation, however, has not materially reduced the tenor in antimony. Sulphantimonites containing lead, copper and other metals also occur in environments similar to that of the stibnite at a number of places well distributed throughout both of the main mineralized areas, and are shown on the maps by a distinctive symbol. The most common are boulangerite and jamesonite although tetrahedrite has also been found. Such ores, where they occur in shoots of mineable size, must also be regarded as commercial deposits, because their content of antimony ranges from 20 to 30 percent, which is within the commercial range specified by the Metals Reserve Co. In addition to the minerals mentioned previously, the other sulfides which occur in these mineralized fracture planes include pyrite, arsenopyrite, galena, sphalerite, chalcopyrite, chalcocite, covellite, and bismuthenite.

Table 1. Antimony content of stibnite ores, Fairbanks district, Alaska.

Stibnite is known to occur in the district at some 50 to 60 localities, i.e. at nearly all of the lode prospects or mines. The exact number varies with the manner of grouping adjacent deposits. Only at eighteen however, has stibnite been mined, and the bulk of the ore came from five mines.

1. Antimony content of stibnite ores, Fairbanks district, Alaska assayed by the Geological Survey, 1942

Source of Ore	Percent of Sb.
Hi-Yu mine, (Crites and Feldman), open cut uphill from 4th tunnel, west side of Moose Creek in Pedro Dome area.	65.84
Reliance Mining Co. property, 900 feet S 20° W. of the Soo mine and about 1.5 miles N. 77° W. of Pedro Dome.	63.90
Alluvial cobbles near mouth of Moose Creek, a tributary of Ester Creek.	62.11
Markovich Mine at the head of Spruce Creek.	57.76
Pennsylvania claim, on divide at head of Wolf Creek.	57.01
Clipper mine, on east fork at head of Eva Creek.	56.58
Hi-Yu mine, on W. side of Moose Creek, a tributary of Fairbanks Creek; ore from 4th tunnel @ 2050 feet.	56.12
Henderson (Mohawk) mine, on south side of St. Patrick's Creek, about 2 1/3 miles S. 78°E from Ester Dome.	54.02
McCarty mine (American Eagle Vein) on north side of headwaters of Fairbanks Creek.	52.82
Soo Claim (Spaulding) on north side of headwaters of Dome Creek, about 1.5 miles N 77 W of Pedro Dome.	47.88
Gilmer property, on east slope of Vault Creek.	46.53
Stibnite property, at head of Eva Creek.	45.65
Homestake mine, at head of Wolf Creek.	45.64
Chatham mine, east fork of Chatham Creek.	39.48
Goodwin prospect, Eagle Creek, from mine dump.	32.95
Scrafford mine, Eagle Creek, from mine dump.	28.64
McQueen property, Ester Dome, from mine dump.	28.12

Sourdough Creek Valley, tributary of Chatanika River	27.38
Pioneer claim, on divide between Wolf and Fairbanks Creeks	26.41

Two of these lodes, the Scrafford and the Stibnite, were worked primarily for their content of stibnite; the others were gold lodes which yielded some stibnite ore as a by-product. Sixty percent of past production came from the few large lenses in the Scrafford mine at the western end of the Pedro Dome belt. Significant quantities were mined at the Stibnite, and perhaps ~~also~~ at the McQueen in the Ester Dome area, and from the Chatham, Gilmer, and Markovich in the Pedro Dome belt. Minor amounts have also been produced at the Henderson and Clipper in the Ester area, and from the Frederick, Soo-Heliance, Cleary, Homestake, Pennsylvania, Pioneer, McCarty, Mizpah, McNeil, and Hi-Yu of the Pedro Dome belt. The other stibnite deposits have not been mined for one or both of two reasons: either small size, or inaccessibility at periods when antimony ore had sufficient value to justify mining. Some of these were in mines which had extensive workings where the small and relatively valueless stibnite masses were ignored during gold mining, and were inaccessible at times when antimony ore was in demand, owing to caving of the workings. Others were in shallow workings, which had been abandoned almost at the time of their discovery because of ~~their~~ a low tenor in gold, and while probably not thoroughly tested for the amount of stibnite, were not considered impressive enough to warrant reopening at later periods when stibnite was worth working. ~~The~~ Most of these deposits occur in the Pedro Dome belt where some 40 occurrences are known as compared to less than half that number in the Ester Dome area.

The Ester Dome Area

The Ester Dome area is roughly circular with a diameter of about six miles, but the stibnite and nearly all of the gold lodes occur in the southeastern quadrant. The majority of the prospects and mines are on

the spur forming the east side of the Eva Creek valley which, at higher altitudes, becomes the divide between the heads of Eva and St. Patrick's Creeks. The others are principally near the top of Ester dome and along the spur between Moose and Ready Bullion Creeks.

The Stibnite Lode, near the head of Eva Creek at an altitude of 1300 feet, has been the principal source of stibnite ore in the Ester Dome area, with a total production of 300 tons for 1915 and 1926. An open cut and shallow pits exposed a shear zone having a trend of N. 17° W. E., a dip of 70° to 89° S., and a width of 12 to 30 inches. Adjacent to the footwall of an iron-stained quartz vein which filled part of this shear zone, lens-shaped masses of stibnite were mingled with the schist. These stibnite lenses had a pitch to the north. The largest was said to be 100 feet long, 7 feet wide, and 4 feet thick, and must have contained nearly 100 tons of ore. Two dimensions of another were reported as 40 feet and 3 feet. A few pieces of ore which remained from the last operation of this property, probably in 1926, were assayed by the Geological Survey and contained 45.65 percent antimony; but returns from ~~earlier~~ shipments in 1915, gave a content of 51.5 percent antimony (4). Available information

(4) Brooks, A. H., (Op. cit.) Bull 649, pp. 38-39, 1916

indicates that lenses have been mined out.

The St. Paul mine (5), between the forks at the head of Eva Creek,

(5) Mertie, J. B., Jr., (Op. cit.) Bull 662, pp. 409-10, 1918.
Hill, J. M., (Op. cit.) Bull. 849, pp. 128-129, 1931

comprised a lower tunnel and mill at an altitude of 1150 feet and an upper tunnel at an altiutde of 1475 feet. Irregular bodies of stibnite were found in 1916 in the schist adjacent to the footwall of a quartz vein which is 6 to 8 inches thick, trends N. 30°-40° E., and dips 38°-45° NW.

The entire mineralized zone is 3 to 4 feet wide. Pieces of ore consisting of stibnite, arsenopyrite, and quartz could be found on the dump of the upper tunnel in 1931.

At the junction of the old Prometheus and Jolly Roger claims, near the head of Eva Creek at an altitude of 1550 feet, a 60-foot shaft exposed a vein having a strike N. 40° E. and a width of 8 feet. This shaft had caved before 1914. White quartz, the principal mineral, was cut by grey quartz carrying jamesonite, arsenopyrite, and covellite; and the sulfide-bearing grey quartz was cut in turn by veinlets of stibnite (7).

(7) Smith, P. S., Lode mining near Fairbanks: U. S. Geol. Survey Bull. 525, pp. 208, 1913
Chapin, T., Lode mining near Fairbanks: U. S. Geol. Survey Bull. 592, p. 355, 1914.
Hill, J. M., Lode deposits of the Fairbanks district, Alaska: U. S. Geol. Survey Bull. 849, p. 148, 1931

The Clipper mine, on the east fork of Eva Creek at an altitude of 1050 feet, is a winding tunnel about 500 feet long, which follows a small faulted quartz vein. The trend is nearly due north and the vein is vertical. Sulphantimonites are present in the vein quartz. Midway along the tunnel, a lens of stibnite which has been partly exposed has a thickness varying from 2 to 12 inches, a width of 3 feet, and may be 10 and 15 feet long. The property is worked by Lloyd Lounsbury. A sample of the ore assayed by the Survey shows a content of 56.58 percent antimony.

On the lower part of the spur east of Eva Creek in the two prospects for which there is a record, the ore consists of quartz, arsenopyrite and stibnite. Abandoned shallow shafts on the McDonald claims exposed such ore in veins which trend N. 40° E. with nearly vertical dip, and N. 35° W. with a dip of 65° NE. On the Combination claim where the vein strikes N. 20° W., dips 45° E. and is 3 feet wide, pieces of arsenopyrite and stibnite were visible on the dump of the 100-foot inclined shaft in 1931 (8).

(8) Chapin, T., Mining in the Fairbanks district: U. S. Geol. Survey Bull. 692, p. 323, 1919
Hill, J. M., Lode deposits of the Fairbanks district, Alaska: U. S. Geol. Survey Bull. 849, pp. 133-134, 1931

The Ryan lode claims, the main workings of which are on the shoulder of the spur between Eva and St. Patrick's Creeks at an altitude of 1300 feet, cover 5000 feet along the trend of a lode which strikes N. 15°-44° E. and has a dip of 50°-64° E. An early report mentions "considerable stibnite and oxides" and "stibnite kidneys in a 35-foot shaft", apparently referring to the 60-foot shaft at the center of the Ryan No. 1 claim near the extreme north end of the lode at an altitude of 1000 feet. Fragments of quartz and stibnite ore were found on the dump of this shaft in 1931 (9).

(9) Chapin, T., Mining in the Fairbanks district: U. S. Geol. Survey Bull. 692, p. 323, 1919
Hill, J. M., Lode deposits of the Fairbanks district, Alaska: U. S. Geol. Survey Bull. 849, P. 136, 1931

The mine was idle in 1942 and the manager states that no amount of stibnite is present anywhere on the lode now.

The Smith and McGlone workings on the Billy Sunday or Lean Fraction claim, in the saddle northwest of the Ryan at an altitude of 1600 feet, have been reported as showing considerable stibnite and cervantite with a little sphalerite (10).

(10) Mertie, J. B., Jr., Lode Mining in the Fairbanks district: U. S. Geol. Survey Bull. 662, p. 413, 1918
Chapin, T., Lode mining near Fairbanks district: U. S. Geol. Survey Bull. 692, p. 323.

Stibnite occurred as a late filling in the broken and shattered portions of a 3-foot quartz vein which strikes N. 25-45 E., dips 55-70 SE, and forms part of a mineralized zone 3 to 11 feet wide. The workings consisted of two shafts, one of which was 200-feet deep in 1922; but the mine is no longer active.

The Mohawk or Henderson mine, known earlier as part of the Tyndall-Finn-McLoughlin workings, is on the spur between the two headwater branches of St. Patrick's Creek at altitudes of 950 and 1250 feet. The vein strikes N. 30° E., dips 40-70° SE., and is 1 to 8 feet wide. It has been developed by tunnels at three levels on the hillslope, between the upper two of which there are two intermediate levels underground. Stibnite, galena, and sphalerite were fairly abundant, and some arsenopyrite was present throughout the quartz of the vein. Scarce and erratically distributed lenses of stibnite were found in the south drift ~~of~~ on the upper intermediate tunnel level, some 600 feet from the portal of the upper tunnel. This mine was active as late as 1940, but idle in 1948 (11). Several tons of

(11) Mertie, J. B., Jr., Op. cit. Bull 662, p. 414, ~~1918~~
Hill, J. M., Op. cit. Bull. 849, p. 145, ~~1931~~

stibnite ore, ~~which was~~ sacked and piled near the mouth of the lower tunnel ~~near road level~~, was sampled and assayed by the Geological Survey and contains 54.02 percent antimony. Stibnite and arsenopyrite are reported in the less oxidized parts of the Bondholder vein on the north side of St. Patrick's Creek. This vein trends N. 20° E., dips 45° NW., and is 6 feet wide. The extensive workings comprise 4 shafts and a 600-foot crosscut tunnel, but there is no information as to the amount or position of the antimony bearing minerals (12).

(12) Hill, J. M., Op. cit., p. 146, ~~1931~~.

On the point of the spur between St. Patrick's and Happy Creeks, O. M. Grant was reported to have sacked quartz-sulfide ore in 1930 from a shaft which opened a 5 to 6-foot vein striking N. 40° E. and dipping 65° E. (13) A mile to the west, on the south side of Happy

(13) Smith, P. S., Mineral Resources of Alaska: U. S. Geol. Survey Bull. 836, p. 19, 1933

Creek at an altitude of about 1200 feet, Cosgrove and Krutsch discovered float stibnite in 1940. Subsequent opening of a large trench with a bulldozer failed to show ore in place, although some pieces of stibnite float were 2 feet in diameter (14). By 1942 most of this loose stibnite had been removed, but a few pieces were seen, the largest being 6 inches

(14) Joesting, H., Op. cit., p. 11

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in diameter. This ore is reported to contain about 62 percent antimony.

Near the top of Ester Dome, on the divide between Sheep and Nugget Creeks at an altitude of 1875 feet, the 60-foot shaft on Grant's Blue Bonanza property exposed a vein which strikes N. 10° W., dips 65° E., and consists of quartz with arsenopyrite, stibnite, galena, pyrite, and tetrahedrite (15). To the southwest where this same ridge

(15) Smith, P. S., Op. cit. Bull. 525, p 197, 1913
Hill, J. M., Op. cit. Bull 849, p. 125, 1931

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forms the divide between Nugget and Ready Bullion Creeks, the Jennie C claim of Roy McQueen, at an altitude of 2325 feet, produced a small amount of stibnite ore during the last war, although statements vary as to whether the amount was 3 tons or 100 tons. Surface trenching, two shafts, and a tunnel, had exposed a vein striking N. 40° W., with a dip of 75° NE., a width of 18 to 24 inches, and carrying lenses of stibnite.

(16) An assay of loose pieces of ore found here in 1942 shows a content of 28.12 percent antimony. In 1912, the 70-foot shaft of the Cottonblossom

(16) Chapin, T., Op cit. Bull. 692, p. 323, 1919.
Hill, J. M., Op. cit. p. 157, 1931. Note difference in trend.

claim, on the spur between Ready Bullion and Moose Creeks at an altitude of 1750 feet, showed stibnite both scattered sparingly through the quartz stringers and as kidneys near the surface (17).

(17) Smith, P. S., Op cit. Bull. 525, p. 208, 1913.

At the Maloney prospect on the east side of Willow Creek at an altitude of 1300 feet, an ore pile in 1931 showed stibnite and arsenopyrite in quartz (18); this originally came from a 90-foot shaft, now caved, which had been

(18) Hill, J. M., Op. cit. p. 123.

sunk on a vein trending east-northeast, with a dip to the southeast, and a width of 12-14 inches. Alluvial stibnite was found in the old placer workings for a mile above the mouth of Moose Creek; some of these cobbles were 6 inches in diameter, and an assay made by the Geological Survey in 1942 shows a content of 62.11 percent antimony.

On the spur between Moose and Ready Bullion Creeks at an altitude of 1500 feet, stibnite was sparse in the old Hudson mine in a vein which trends nearly due north, has a width of 4 inches, and was found in a 200-foot drift to the south on the 100-foot level of the vertical shaft (19). The 600 and 1200-foot tunnels of the Ready Bullion mine, on this same spur at

(19) Chapin, T., Op. cit. Bull. 592, p. 352.

altitudes of 1000 and 1100 feet, cut several veins and wide mineralized zones, and were reported to show stibnite and arsenopyrite as the result of the latest mineralization in reopened quartz veins.

Bournonite or boulangerite was said to be common in the quartz (20).

(20) Hill, J. M., Op. cit. Bull. 849, p. 127.

The Vuyovich prospect tunnel, on the east side of the mouth of Ready Bullion Creek at an altitude of 875 feet, opened a shear zone four feet wide which strikes N. 20° E., dips 85° E., and consists of crushed schist, quartz veinlets, and lenses of stibnite and arsenopyrite (21).

(21) Hill, J. M., Op. cit. Bull. 849, p. 128.

The Pedro Dome Belt

The deposits of the Pedro Dome belt extend from the Scrafford mine in the basin of Treasure Creek, about ten miles north of Fairbanks, east-northeast for 20 miles to the Hi-Yu mine on Moose Creek. This is essentially along the ridge which forms the divide between the drainage to the Chatanika River on the north, and that to Goldstream and Fish Creeks on the south. As far east as the Pennsylvania, the deposits lie on the north side of the divide, except for the three small deposits in creeks south of Pedro Dome; but eastward from the Pennsylvania the deposits lie on the south side of the divide. This alignment reflects in part the easier prospecting along the upper portion of the divide where the mantle of disintegrated rock is thinner; but it may also have a more fundamental basis, for this trend closely parallels both the strike of the schistosity of the country rock and the linear exposure of the granodiorite of Pedro Dome.

The Scrafford (22), known also as the Black Eagle or Wood's mine, on

(22) Smith, P. S., Op. cit. Bull. 525, p. 196.
Brooks, A. H., Op. cit. B 649, p. 28-29
Mertie, J. B., Jr., Op. cit. Bull. 662, p. 415
Hill, J. M., Op. cit. p. 156

one of the branches of Eagle Creek at an altitude of 1300 feet, is the most westerly of the Pedro Dome belt and has been the largest producer of stibnite in the entire Fairbanks area. Approximately 1600 tons of ore has been recovered from this property, principally in 1916, by the successive operaters: Quinn, Scrafford, Wood, and Vernetti. A shear zone 3 to 15 feet wide, with a strike of N. 80° E., and dip of 50° to 70° S., cuts the schistose country rock and is partly filled with iron-stained quartz and kidneys of stibnite. One of the large kidneys was reported as 40 feet by 11 feet by 6 feet, and several kidneys contained a ton of ore. An open cut, and 75 feet of the upper tunnel were completed by Quinn in 1914 and 1915; others have extended this tunnel to a reported length of 300 feet, and raises at 100-foot intervals. ~~were used to mine the individual kidneys of ore.~~ The property has been idle for a long time, and the only stibnite ore accessbile in 1942 was that on the dump. This dump covers 27,000 square feet ~~(in area)~~ on the hillside; and much of its surface is deep yellow in color due to the abundance of fragments of antimony oxide enclosing unoxidized stibnite ore. Conservative estimates indicate that 500 tons of 10-20 percent antimony ore, largely oxidized, might be recovered ~~from this dump~~. An assay of the better grade of material from the surface of the dump, made by the Geological survey in 1942, shows a content of 28.64 percent antimony.

The Goodwin prospect is nearly due east of the Scrafford on the opposite slope of the valley and over 300 feet higher in altitude. During the last war a shaft was sunk vertically for 40 feet and then continued on an incline of 30° for another 30 feet; at the bottom, four lenses of stibnite were found, each about 2 cubic feet in size and weighing about 500 pounds.

With the drop in price in 1916, Goodwin abandoned work before producing any ore; [illegible] only a few hundred pounds of ore remain on the dump.

(25) Compare with Hill, J. M., op. cit. p. 157.

Still farther east on [the opposite side of the spur, or on] the west side of Independence Creek, Goodwin has also driven a tunnel in which stibnite is said to have been found, but none was seen on any of the dumps in 1942.

The old Gilmer lode, also known under the name of Muchamo and even more recently as the Helen W. claim of Howard Wilcox, is on the east slope of Vault Creek at an altitude of 1200 feet; this is 1/2 mile west-northwest of the top of the hill which lies between Vault and Moose Creeks, and is along the roadbed of the abandoned Tanana Valley Railroad. A fracture zone in schist trends N. 80° E. and dips 40° N., as indicated by a line of pits, an open cut, caved tunnel, and an inclined shaft. Quartz, mineralized schist, and irregularly distributed kidneys of stibnite, occupy this [fracture] zone which varied from 1 to 5 feet in width[23]. [The largest kidney of stibnite was 4 feet thick; and some specimens]

(24) Brooks, A. H., Op. cit. Bull. 649, p. 29-30.

showed quartz fractured and recemented by stibnite veinlets. All workings were inaccessible in 1942, but about 6 tons of sacked ore remains from previous operations, and a sample assayed by the geological survey contains 46.53 percent antimony. Samples taken from this same locality in 1941 by the Territorial Department of mines showed a quite similar content of 38-42 percent antimony.

At the old Fredericks mine, on the east slope of Vault Creek at altitudes of 1225 and 1250 feet and about 1/2 mile north of the Gilmer lode, early reports mention the amount of stibnite as "considerable" and some[24].

(25) It was present in gold ore on the 100-foot level of the west shaft in 1912, but none could be found around the workings or dumps in 1942. The mine has been inactive for many years.

The Soo and Reliance mines, also variously known in the past as Spaulding, Hawkins, and Heath and Kearns, are on the hillside north of the headwaters of Dome Creek at altitudes of 1350 and 1500 feet. Three east-west veins, known as the Soo, Wild Rose, and H. & K., have been the principal ones worked; these vary from 15 inches to 7 feet in width and one of them dips 68° N. Two other veins, which trend N. 45-50° E., and show opposite dips of northwest and southeast, have been worked to some extent. Sulfides were scarce throughout the major portion of the veins, but small amounts of tetrahedrite, and a few large masses of stibnite occurred locally in the old workings on the Soo and Wild Rose veins; and a late stibnite and arsenopyrite mineralization is also recognized in the more recent workings from 1926 to 1936. Older workings on the Soo and Wild Rose veins consist of a 200-foot shaft, several shallow shafts, and surface pits; and more recent workings on the H. & K. vein, the most southerly, involved 225 feet of shafts, 400 feet of drifts, and 500 feet of crosscut tunnels. (26) In 1942 piles of high grade ore which had

(26) Smith, P. S., Op. cit. Bull.525, p. 191.
Brooks, A. H., Op. cit. Bull.649, p.31.
Hill, J. M., Op. cit. Bull. 849, p.78-79.

been saved from these previous operations, but not shipped, comprised 2 tons at the Soo, and 3 to 4 tons at the Reliance. Assays of these ores, made by the Geological Survey, show that ore at the Soo contains 47.88 percent antimony, whereas that at the Reliance contains 63.90 percent antimony.

The Markovich mine, on the west side of the spur between Spruce and Louis Creeks at an altitude of 1550 feet, has been described at different times as the Hindenburg claim, the Poz and Contardi workings, and the Ohio claim of John Regash (26). Two veins have been worked on this property: one trends N. 40° E., dips 68° SE, and was worked in 1916 in six shallow shafts over a distance of several hundred feet; the other, farther east, trends N. 65° E., dips 74° W., and was intersected underground at 448 feet along the more recently constructed crosscut tunnel. The mouth of this tunnel is 240 feet west and downhill from shaft No. 1 the most southwesterly of the older workings. Poz and Contardi shipped 200 tons of stibnite ore, in 1916, from three of the shafts: the thickness of the stibnite found in shaft No. 2 is unknown to the writer, but shaft No. 5 is said to have exposed 24 inches of stibnite, and shaft No. 6 showed three or four bands which were six inches thick. In 1942, Mintti held a lease on the stibnite in the quartz vein opened by the crosscut tunnel. The largest body, 15 feet long, 5 feet wide, and 1 foot thick, was found in a stope above the drift which follows the vein northeast from the tunnel. Three stibnite lenses above the tunnel level have been mined and yielded about 6 tons of ore which is ready for shipment. An assay of a sample of this ore, made by the Geological Survey, shows a tenor of 57.76 percent antimony. A fourth lens which has not yet been mined is known in the 35 foot winze has been driven at the intersection of the tunnel and vein. In addition to this high grade stibnite ore, the dump at shaft No. 2 of the old workings is estimated to contain about 150 tons of partially oxidized ore, and is said to run about 30 percent antimony.

(26) Martie, J. B., Jr., Op. cit. Bull. 662, p. 415
Martin, G. C., Op. cit. Bull. 712, p. 40.
Hill, J. M., Op. cit. Bull. 849, p. 83.

South of Pedro Dome, a lode opened by John Nightingale on Steamboat Creek, previous to 1912, was reported to have considerable stibnite and galena. (28) At the old Birch-Anderson property on Granite Creek, re-

(28) Smith, P. S., Op. cit. Bull. 525, p.198

located in 1931 as the Hoover claim of Robinson and Lieman, 50 tons of ore piled near the mouth of the 390-foot tunnel in 1931, consisted of quartz, pyrite, arsenopyrite and stibnite. (29) Jamesonite is reported

(29) Hill, J.m., Op. cit. Bull. 849, p 119-120

from the old Burnet galena workings at 1725 feet on the west side of Twin Creek, northwest of milepost 18 on the Steese Highway. (30) Boulders of

(30) Hill, J. M., op. cit. Bull. 849, p 118

arsenopyrite and stibnite have been found on the dump from shallow pits between the new and old roads at the east end of the North Star Claim, which straddles Skoogy Gulch. (31)

(30) Hill, J.M. p. 117. Bull. 849.

In the Mohawk lode, at the head of Little Eldorado Creek drainage at an altitude of 2150 feet on the northwestern slope of the hill which forms the divide between Twin Creek and Willow Creek, minor amounts of pyrite, arsenopyrite and stibnite are reported. This prospect in 1916 had exposed two parallel quartz veins at the faces of east and west drifts from the bottom of a 50-foot shaft. These veins strike N. 20° E., dip 60° W, and the east and west veins were respectively 16 to 18 inches and 30 to 42 inches thick. A second shaft, 75 feet to the northwest, was driven 30 feet deep on a vein striking N. 80° W. with a dip of 35° SW. but showed only arsenopyrite and quartz (32).

(31) Mertie, J. B., Jr., Op. cit., Bull. 662, p. 407
Hill, J. M., Op. cit. Bull 849 p. 82

On the same high divide east of the Mohawk lode, the Mother Lode Claim about 1 mile northwest of the Summit roadhouse was staked as a result of the discovery of stibnite during the construction of the Cleary wagon road in the early mining period (33). On the east side of

(33) Brooks, A. H., Op. cit. Bull. 649, p 32.

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the ridge between Willow and Bedrock Creeks at an altitude of 2025 feet, quartz with stibnite could be found on the dump of the Hess and Burnet shaft in 1913. This is apparently the same ground covered by the Vergil and Wolverine claims of the Jackson group in 1916, where a 14-foot shaft exposed schist impregnated with quartz and stibnite, forming a mineralized zone 8 inches wide which strikes N. 55° E. and dips 15° SE. (34). Other

(34) Chapin, T., Op. cit. Bull. 592, p. 339.
Mertie, J. B., Jr., Op. cit. Bull. 662, p. 417.

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claims of the Jackson group were centered about the top of the spur between Bedrock and Tamarack Creeks, where near the rock pinnacle at an altitude of 2300 feet, a small ore-body consisting of quartz, galena, iron pyrite, arsenopyrite, and stibnite was known in 1913. (35) On the Siver King, or

(35) Smith, P. S., Op. cit. Bull. 525, p 182.

Little Jim, claim of this group, an open cut exposed a lode trending N. 45° E. with a gentle dip to the south, and about 12 inches in thickness; the center was sulphantimonite of lead, and the borders were quartz with pyrite, arsenopyrite, and perhaps stibnite. A second open cut on the Little Jim claim, 250 feet southwest of the first, showed a vein trending east-west with a dip of 25° S and a thickness of 2 inches; this was largely galena with minor stibnite.

On the Big Jim claim, a flat-lying stibnite vein was also reported to have been found in a shaft which had caved by 1916. (35)

(35) Smith, P. S., Op. cit. Bull. 525, p. 182.
Chapin, T., Op. cit. Bull. 592, p. 338.
Mertie, J. B., Jr., Op. cit. Bull. 662, p. 417

At the Newsboy mine, in the saddle on the divide between Eldorado and Cleary Creeks at an altitude of 1875 feet, sulfides disseminated through the quartz consisted principally of pyrite and stibnite, although arsenopyrite, chalcopyrite and sphalerite were also present. The vein strikes N. 40°-48° E. and the dip averages 73° NW. Extensive workings comprised an inclined shaft driven to the 315-foot level and considerable drifts, but no large bodies of sulfide were located during the gold mining operations. (36)

(36) Smith, P. S., Op. cit. Bull. 525, pp. 187-188.
Chapin, T., Op. cit. Bull. 592, pp. 340-341.

Between the extreme headwater branches of Cleary Creek at an altitude of 1475 feet, the Steil tunnel, which had caved by 1912, exposed stringers of quartz carrying stibnite and less pyrite. Below this in the fork at an altitude of 1375 feet, the property variously known as the Eldorado Mining and Milling Co., the Westenvik mine, and Old Anchor claim, has recently been relocated as the Checkako No. 1 by Duane Franklin. Workings which are now caved, comprising 2 tunnels and 3 shafts, furnished the material for three dumps on which the sulfide ore is largely pyrite, sphalerite, galena, arsenopyrite and stibnite. (37)

(37) Smith, P. S., Op. cit. Bull. 525, pp. 186-187.
Mertie, J. B., Jr., Op. cit. Bull. 662, p. 416.
Chapin, T., Op. cit. Bull. 692, p. 324.
Hill, J. M., Op. cit. Bull. 849, pp. 89-90.

Although indium and cadmium were said to have been found in the ore, samples analysed in 1942 by the Survey contained ~~not even a~~ trace of indium. At the mouth of Willow Creek near its junction with Cleary Creek, a placer cut has been opened by Elmer Johnson through 12 feet of gravel. The exposed bedrock in which a vein of stibnite with occassional quartz and other sulfides, 6 to 18 inches wide, is traced for 75 feet N. 40° E. and has a vertical dip. Nearby on the west side of Willow Creek at an altitude of 1300 feet, a 16-foot shaft was sunk in 1912 on a narrow quartz stringer carrying a large amount of stibnite. On the east side of Willow Creek at the same altitude, the Tolovana mine showed only an abundance of stibnite crystals disseminated in the quartz of parallel lodes which strike N. 75° E., dip 60° S. and were exposed by a 100-foot shaft and 475-foot tunnel. At an altitude of 1325 feet on this same slope, the Tolovana-Stibnite prospect had considerable stibnite and its oxidation products in a quartz vein which strikes eastward and was exposed in a 100-foot shaft sunk in 1913. (38)

(38) Smith, P. S., Op. cit. Bull. 525, pp. 183-185.
Chapin, T., Op. cit. Bull. 592, p. 339

On the east side of Bedrock Creek near its junction with Cleary Creek, the Cleary Hill mine, formerly the Rhoads-Hall mine on the Free Gold claim, shows crystals of jamesonite disseminated in the vein and an occassional kidney of stibnite. This is one of the active mines of the area and the relatively few stibnite bodies which have been found in the extensive workings is a good indication of the scant distribution which would be found along many other veins in the district.

Indefinite records suggest that some large masses of stibnite were found during early mining on this property (39), and two more recently found kidneys of ore were visible in 1942. The larger which yielded about 6 tons ore, was stoped from the intersection of two veins above the third or main tunnel level and was probably about 8 feet long, 4 feet wide, and 2 feet thick. A small lens occurs on the Goessmann fault at the fifth level; and a trace of stibnite is found at many places along this fault plane, which strikes N. 70-80° W. and dips steeply north whereas the main vein has the same strike but dips 43° to 60° S.

South and east of the Cleary mine on the spur between Bedrock and Chatham creeks, stibnite has been reported at five points. The Wackwitz mine, on the Wyoming claim, at an altitude of 1300 feet just east of Bedrock Creek, was said to show kidneys of stibnite in 1925 (40), but none was accessible in 1942 although the mine is still actively worked. On the

(39) Brooks, A. H., Op. cit. Bull. 649, p 34

(40) Moffit, F. H. and others, Mineral Resources of Alaska...in 1925: U. S. Geol. Survey Bull. 792, p. 12, 1927.

ridge of this spur at an altitude of 1300 feet, a short tunnel on a narrow vein showed a large amount of arsenopyrite and some stibnite in 1912; and this may be a northern continuation of the vein which strikes north and dips west, and was known to cross the Texas, California, and Pauper's Dream claims (41). The Butler and Petree tunnel in 1909, at an altitude of 1225 feet on the west side of Chatham Creek one-half a mile

(41) Smith, P. S., Op. cit. Bull. 525, pp. 181-182.
Brooks, A. H., Op. cit. Bull. 649, pp. 34-35.

above the junction with Cleary Creek, intersected a 6 foot shear zone striking northwest and dipping 45 to 70° S.; along this shear, mica schist and quartz veins were impregnated chiefly with pyrite, arsenopyrite, and minor stibnite, galena, and sphalerite (42). On the west side of Chatham

(42) Prindle, L. M., Op. cit. Bull. 442, p. 226

Creek about opposite the forks at an altitude of 1650 feet, the pits and tunnel of the Bobbie claim were caved in 1912 but specimens of the ore showed galena and stibnite enclosing quartz crystals (43). Near the junction of Cleary and Chatham Creeks, either on the nose of this spur at an altitude of 1100 feet or on the opposite side of Chatham Creek, the dump of the Sunrise claim in 1913 showed quartz impregnated with stibnite, and fracture coatings or veinlets of antimony oxides. The vein from which this dump material was derived is said to strike east and dip 25° S. (44).

(43) [illegible]

(44) Chapin, T., Op. cit. Bull. 592, p 337

On the North Star claim of the Pioneer Mining Company, one mile up the east side of Chatham Creek from Cleary Creek at an altitude of 1300 feet, an 85-foot shaft, sunk in 1911, opened the intersection of two veins. The smaller vein, which varied from 4 to 30 inches in width, was reported to carry considerable stibnite, arsenopyrite, and minor amounts of sphalerite and pyrite (45).

(45) Prindle, L. M., Op. cit. Bull. 442, p. 226

The Chatham mine or Burns mine (46), on the north side of the extreme

(46) Chapin, T., Op. cit. Bull. 592, p. 335-336.
Brooks, A. H., Op. cit. Bull. 649, p. 35-36.
Mertie, J. B., Jr., Op. cit. Bull. 668, p. 415.

eastern headwater tributary of Chatham Creek at an altitude of 1825 feet, was one of the principal producers of the 1915-17 period. Although primarily a gold mine in which the vein had a low sulfide content, stibnite was found at several places in the workings. The main vein trends N. 60° W., dips 65-80° S, is 6 to 18 inches wide, and has been opened by a crosscut tunnel, which was driven for 1300 feet to the northeast by 1916. Kidneys of stibnite ranging from a few inches to 12 feet in length were reported by the manager in 1915; but the only occurrence for which an accurate mine location has been published, is narrow vein which had a strike of east, dip to the south, and occurred 150 feet along the southeast drift that turned from the crosscut 200 feet from the portal. In 1916, stibnite was found in a raise 60 feet above tunnel level and 850 feet from the portal, where it formed a vein striking N. 70° E., nearly vertical in dip, and 18 inches thick. In the tunnel, 20 feet beyond the raise, a 32-foot winze struck stibnite below tunnel level. In 1942 the tunnel was inaccessible, although this mine was operated as recently as 1936, and the only stibnite available was that forming three piles on the dump near the tunnel mouth, a total of about one ton of ore. A sample assayed by the Geological Survey shows a tenor of 38.48 percent antimony.

The Harris and Brown 50-foot shaft, between the two northern pinnacles of the spur separating Chatham and Wolf Creeks at an altitude of 2050 feet, exposed a vein striking N. 70° E. in which a small portion consisted of brecciated quartz cemented by stibnite (47). The 60-foot shaft of the Quemboe Brothers, at an altitude of 2125 feet on this same spur, exposed a vein striking N. 70° W. in which the sulfides cementing the broken quartz fragments comprised stibnite, pyrite and arsenopyrite (48).

(47) Smith, P. S., Op. cit. Bull. 525, pp. 175-176.

(48) Smith, P. S., Op. cit. Bull. 525, pp. 171-172.
Brooks, A. H., Op. cit. Bull. 649, p. 36.

The Homestake or Nordale mine (49), between the extreme headwater forks of the west branch of Wolf Creek, exposed several veins, which strike east and dip to the south. The workings comprised 4 crosscut tunnels at levels between 1500 and 1600 feet in altitude on the hillslope. The third, in order uphill, with a large dump, is probably the 800-foot tunnel in which stibnite has been reported. At 320 feet from the portal, a vein, which strikes N. 70° E., dips 40° S. and averages 9 inches in width, was said to show stibnite along with copper and iron sulfides in the quartz. At 600 feet from the portal, a second vein with a strike of N. 60° W. and dip of 45° NE. showed isolated "bunches" of stibnite. In 1942 the workings were inaccessible; but one piece of stibnite was found at the second tunnel uphill and 50 pounds of ore was scattered about the mouth of the main tunnel mouth. An assay of this material, made by the Geological Survey, shows a content of 45.64 percent antimony. ~~One-half~~ Half a mile downstream from the Homestake, on the west side of Wolf Creek at an altitude of 1400 feet, the caved pit mapped as the Solomon in 1913, is reported to have exposed a northeasterly trending vein consisting of 3 to 4 inches of quartz carrying a large amount of stibnite (50).

(50) Smith, P. S., Op. cit. Bull. 525, p. 171.
Chapin, T., Bull. 592, p. 332.

The 146-foot shaft on the Pennsylvania claim, on the Wolf Creek side of the divide between Wolf and Fairbanks Creeks at an altitude of 2100 feet, opened a vein which was 12 inches wide, had a strike of N. 8° W. and a dip of 55° S. Yellowish oxidation products of stibnite were common in the quartz. (51)

(51) Smith, P. S., Bull. 525, p. 166.

This property has been idle for a long time, but a pile of oxidized stibnite ore near the dump contains about 300 cubic feet of material and would probably yield a half ton of lump ore if screened. An assay of a sample of this lump ore shows a content of 57.01 percent antimony. At the Hinton cut on the old Willie or Marigold claim, southwest of the Pennsylvania at an altitude of 1900 feet, small lenses of both jamesonite and stibnite were visible in 1942. (52)

(52) Hill, J. M., Op. cit. Bull. 849, map pl. 6.

The Pioneer and adjacent claims of the McCarty group (53), on the Fairbanks slope of the divide between Wolf and Fairbanks Creeks at an altitude of 2200 feet, have furnished some stibnite ore in the past. A vein 8 inches in width, portions of which were nearly pure stibnite, had a strike of east and dip to the south, and extended from the Pioneer eastward into the adjacent Henry Clay or Iron Mask claim. Immediately to the west, pieces of stibnite ore could be found in 1942 on the dump of the Pioneer vein which strikes N. 70° W., dips 60° S, and was developed by three shafts one of which was 110 feet deep. Halfway between the Pioneer and the road along Fairbanks Creek at an altitude of 2150 feet, the "Antimony" vein is said to have been the source of some ore. This vein strikes N. 70° E. and was exposed by shallow pits. The dump around these pits contains about 2000 cubic feet of chiefly oxidized ore from which several tons of lump ore could be screened. An assay of this lump ore shows a content of 28.12 percent antimony.

(53) Chapin, T., Op. cit. Bull. 692, p. 328.
Hill, J. M., Op. cit. Bull. 649, p 103 and map plate 6

The McCarty mine of the Fairbanks Exploration Co., on the north side of the extreme headwater part of Fairbanks Creek at an altitude of 2000 feet, is an active gold mine and one of the few which were accessible in 1942. The principal workings are on the American Eagle vein which strikes N. 80° W., dips 60°-70° S., and varies from a mere stringer to 3 feet in width. The vein has been developed by a 235-foot inclined shaft below which a 65-foot winze has been driven from the east drift on the 235-foot level to the 300-foot level. East of the fault, which displaces the vein in the vicinity of the winze, four lenses of stibnite are known; and west of the same fault eight others occur. None of these is over a foot thick and the average is near 4 to 5 inches. One stibnite body, in a stope east of the main shaft and 20 feet above the 235-foot level, was 15 feet long, ten feet wide, and 6 inches thick; another, 50 feet west of the winze and 15 feet above the 300-foot tunnel was 15 feet long, 5 feet wide, and one foot thick. A second vein, the Henry Ford, which is displaced by the fissure along which the American Eagle vein occurs, is 4 feet wide, strikes N. 30° E., dips 70° NW., and is said to have more sulfide than is usual for veins of this district. Stibnite saved from 6 months operation of the gold mine in 1942 amounted to 4 tons; and an assay, by the Geological Survey, of a sample of this ore gave a tenor of 52.82 percent antimony. An assay, made by the Territorial Bureau of Mines in 1941, on ore from a lens on the 235 foot-level contained 60.66 percent antimony. (54)

(54) Joesting, H., Op. cit. p 10.

There is much red kermesite in the ore from this property. In 1912, stibnite had been reported from this same general vicinity at the El Toro No. 3, where quartz was said to contain a small amount of stibnite; and the Kellen tunnel, nearly a mile farther downstream on the north side of

Fairbanks Creek, showed stibnite and senermontite (55).

(55) Smith, P. S., Op. cit. Bull. 525, p. 163-164
Chapin T., Op. cit Bull. 592, p. 329.

On the spur between upper Fairbanks and Too-Much-Gold Creeks, stibnite has been found in six workings. Near the crest of the spur at an altitude of 1980 feet, pits sunk in 1913 on The Minnie and Aroostook claims of George Perrault, exposed several parallel quartz veins which strike N. 80° W. and dip 60° S; narrow reticulating veinlets of stibnite occurred in both the quartz and the intervening schist. (56) The Mizpah shaft, about 3/4 mile west of the mouth of Too-Much-Gold Creek at an altitude of 1775 feet, opened a vein which strikes N. 78° W., dips 75° S., and varies in width from 3 inches to 3 feet. In this mine, which was worked during the last war, stibnite was found locally in the vein, as in the west drift on the 80-foot level of the 160-foot shaft; and silver-lead ore with sulphatimonites was found in the east drift at the same level. (57) On Fairbanks Creek at an

(56) Chapin, T., Op. cit. Bull. 592, p. 329

(57) Chapin, T., Op. cit. Bull. 592, p. 329
Mertie, J. B., Jr., Op. cit. Bull. 662, p 406)

altitude of 1650 feet, the Gilmore tunnel was driven 800 feet in 1917 as a prospect adit to intersect the Mizpah and other veins; and at the mouth of this tunnel in 1942 there were 30 sacks of lead-copper antimony ore. East of the Mizpah, the Connors (or Gilmore) and Stevens property included the Ohio, Mayflower, and Early Bird claims; stibnite and pyrite in a 4 to 6 inch vein in the east drift from a 70-foot shaft on the Ohio claim; and stibnite as 12 to 15 inch lenses in a 25-foot shaft on the Early Bird claim (58). On the east side of the mouth of Too-Much-Gold Creek at

(Stibnite with galena was found in the upper shaft at an altitude of 1900 feet.)

(58) Smith, P. S., Op. cit. Bull. 525, p 163
Mertie, J. B., Jr., Op. cit. Bull. 662, p. 409.

an altitude of 1450 feet, shallow pits of the Whitehorse mine exposed a lode in which stibnite, pyrite, and galena formed a matrix for the brecciated rock of the footwall (60). One mile up the west side of Too-Much-Gold

(60) Smith, P. S., Op. cit. Bull. 525, p. 160.

Creek at an altitude of 1625 feet, the Excelsior claim showed stibnite, galena, and arsenopyrite, in a vein which trends N. 30° E. and dips steeply to the southeast (61). At the head of Too-Much-Gold Creek at an altitude of 2250

(61) Smith, P. S., Op. cit. Bull. 525, p. 161-2

feet, the McNeil shaft, which was known in 1916 as the Leindecker property and has been recently staked as the Bramholm-Jenkins property, developed a vein which trends N. 60° W., and dips 70° S. The workings were filled with ice when examined in 1942, but sacked ore which was found on the property in 1931 consisted of quartz, arsenopyrite, jamesonite and galena. (62)

(62) Hill, J.M., Op. cit. Bull. 849, p. 104.

On the west side of Moose Creek, the Hi-Yu mine, formerly the Crites and Feldman property, is the most easterly of the stibnite deposits of the Pedro Dome area. (63) Four tunnels along a line N. 65° W., between creek

(63) Smith, P. S., Op. cit. Bull. 525, p. 157-158
Mertie, J. B., Jr., Op. cit. Bull. 662, p. 405.
Hill, J. M., Op. cit., Bull. 849, p. 108-113

level at 1550 feet and 2150 feet altitude on the hillslope, open the Helen S. and Hi-Yu veins. The Helen S. vein trends N. 60°-70° W., dips 80°-85° S., and varies from 4 to 30 inches but averages 10 inches in width. The Hi-Yu vein lies north of the upper part of the Helen S vein and is not quite parallel for it strikes N. 75° W. but has the same steep dip to the south, and at an altitude of 2100 feet this vein splits, with a spur trending N. 80° W which has a dip to the north.

A few hundred feet above the uppermost tunnel a third vein strikes east and probably dips to the north, but is poorly exposed in two shallow pits about 20 feet apart. Concentrates from the mill apparently indicate that sulfides form 1 to 2 percent of the vein material and that this is principally stibnite although other sulfides present include argentiferous galena, arsenopyrite, pyrite and sphalerite. Early workings showed senarmontite coloring the quartz in the surficial oxidized portions of the veins. Kidneys of stibnite constitute a very small proportion of the bulk of the mineralized zones as indicated by the small number which have been found despite the thousands of feet of development on these veins. In 1912 a lens of stibnite was reported at the intersection of two veins, which may correspond with the split in the Hi-Yu veins that was exposed in the uppermost tunnel. Kidneys of ore were also reported in 1916 in the vein which strikes east and ~~high above~~ crops out higher on the hillside than the Hi-Yu vein. The mine was idle in 1942, but there was a small pile of stibnite ore at the mouth of the upper or fourth tunnel which is now caved and inaccessible; and stibnite was seen in place several hundred feet above this tunnel, in the two small pits which had been reopened in 1941. These pits were sunk through five feet of hillside float and expose a vein which strikes east and has a steep but irregular dip, ~~which is~~ probably due to the lenticular shape of the stibnite bodies and of the fine-grained quartz which makes up the north side of the mineralized zone. The entire width of the zone is about two feet and the stibnite forms half of this. An assay of a sample of this ore shows a content of 65.84 percent antimony. Assays made by the Territorial Bureau of Mines of ore from the Hi-Yu mine have shown a range from 60-66 percent antimony.

Rose Creek

At an altitude of 1825 feet between the main fork of Rose Creek, a tributary of Gilmore Creek, a small amount of stibnite was found as tiny veinlets in a lode 6 to 8 inches wide, composed principally of quartz and feldspar. As exposed in a 15-foot shaft, the lode strikes N. 30° E. and dips 70° NW. Apparently no work has been done on this property since 1913 (53).

(53) Chapin, T., Op. cit. Bull. 592, p. 346.
Brooks, A. H., Op. cit. Bull. 649, p. 24.

Sourdough Creek

Stibnite has been found in the valley of Sourdough Creek, a northern tributary of the Chatanika River. The mouth of Sourdough Creek is 68 miles from Fairbanks as measured along the Steese Highway; and the deposit occurs on the north wall of a eastern fork about two miles from the highway at an altitude of 2000 feet and just above timberline. A tunnel driven N. 50° W., apparently along a gold-quartz vein in quartzitic schist, is now caved. A few hundred pounds of low-grade ore remain on the dump and an assay of the best of this material shows its tenor to be only 28.38 percent antimony.

Ore Reserves

The number, the widespread distribution, and the occassional large size of individual stibnite lenses, suggest extensive stibnite mineralization in these areas near Fairbanks district, but several geologic and economic factors greatly affect the prospecting and mining of the deposits:

The larger and more accessible of these deposits were exhausted years ago.

The deep mantle of disintegrated rock, its frozen condition, and the surficial covering of moss hinder prospecting.

The small size of the individual kidneys with respect to the bulk of the veins or shear zones, their erratic distribution along ~~the veins or shears~~ these places and the existence of numerous faults, not only make prospecting difficult, but prohibit extensive underground workings for stibnite alone.

Periods of high prices for antimony bring production from this area, whereas the normal market conditions the ore has no value owing to high transportation charges, ~~he~~ but no extensive workings are warranted at any time because of the sudden fluctuations which frequently occur in the price of antimony.

Stibnite deposits become accessible largely through gold mining operations; and as such mining has been greatly curtailed, and may be discontinued entirely, the outlook for future discovery and production of stibnite ore is very uncertain.

The high level of wages that now exists in local defense activities has attracted the prospector, the small-scale miner, and the wage-earner, and has had a deleterious effect on both prospecting and mining. Only three prospectors were active in 1942.

The establishment of an ore-buying depot at Fairbanks by the Metals Reserve Company should encourage the shipment of all available ore because it alleviates in part the high transportation costs of ore shipment direct to the smelters./ The principal reserves of antimony ore that are now available in the Fairbanks district may be divided into three classes, as follows:-

1. Ores earlier mined that were never sold or shipped.

2. Ores minable from masses of stibnite that occur at or near the surface.

3. Ores recoverable as a result of future gold-lode mining.

Reference has already been made to the two periods of stibnite mining that resulted from the high prices which existed during the last world war, and again in 1925. ~~and 1926.~~ During both of these periods, stibnite was mined that was never marketed, owing in part to rapidly falling prices in the later stages of these two periods, and in part to the fact that only high-grade ores were shipped at any time, thus leaving low-grade material that would not yield a profit. An examination of all the old mines ~~dumps~~ in the Fairbanks district, shows the presence of about 30 tons of high-grade stibnite ore that remains from earlier mining operations. Much of this had originally been sacked, but the sacks are now rotted, and the ore will have to be resacked. Such ore is available at the Gilmer, Soo-Heliance, Markovich, Chatham, Henderson, Hi-Yu and Gilmore tunnel. In addition, there are dumps of low-grade ore with a tenor of 10 to 30 percent antimony: about 300 tons of such ores are available at the Scrafford property, about half as much at the Markovich property, and smaller quantities at ~~some of the other mines~~ the Pennsylvania and Pioneer claims.

No masses of stibnite ore lying close to the surface are now known that are comparable in size with some of those that were earlier mined, such as the Stibnite ~~deposit~~ lode. The principal occurrences in this category are the following:-

1. One or more small lenses or stringers of stibnite that occur on the hillside above the Hi-Yu (Crites and Feldman) mine on Moose Creek, a tributary of Fairbanks Creek.
2. Similar small deposits, reported to be present on the hillside above the Tolovana mine, on Cleary Creek.
3. A thin lens of stibnite, about 75 feet long, recently uncovered below the placer gravels, at the junction of Willow and Cleary creeks.
4. One or more masses of sulphantimonite ore at the Hinton prospect, on the ridge near the head of Wolf Creek.
5. Some alluvial stibnite in the gravels of Moose Creek, a tributary of Ester Creek.
6. Miscellaneous small showings of stibnite of unproven significance: Cosgrave's float on Happy Creek, Jackson claims on spur between Bedrock and Tamarack Creeks.

From such deposits, it is possible that 50 tons of high-grade stibnite ore might be recovered.

The ore that may be obtained as a by-product of future gold-lode mining is small, because few such mines are being worked. At the McCarthy property operated by U. S. Smelting, Refining, and Mining Co., about 4 tons of antimony ore has already been marketed and if gold lode mining continues, a total of 25 tons may be produced within the next few years. At the gold-lode mine of the Cleary Hill Mines Co., 6 tons of stibnite has recently been marketed and probably the total production in the near future could not exceed 5 tons of such ore.

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One small lens of stibnite is also known at the Clipper mine on Eva Creek, but the total production in sight at this property cannot exceed one ton. There is one kidney of stibnite in the Markovich mine at the head of Spruce Creek which will be mined.

From the figures above given, it follows that about 115 tons of high-grade ore containing 40 to 65 percent antimony, is now available in the Fairbanks district. In addition it is possible that 500 tons of low grade ore, containing 10 to 30 percent antimony, may also be recovered from the dumps.

The present outlook for stibnite production from the Fairbanks district depends on small-scale mining of near-surface deposits. The largest of these have been mined out and the district appears to have yielded already the greater portion of the stibnite ore which can be expected to be recovered from it.

Probably all of the near-surface deposits have not been located as yet, but very few have been made accessible since the last war, and at only one locality does float indicate that a lode remains to be found. If any large deposits do exist near the present surface, it is peculiar that the distinctive yellow oxides which would be characteristic of the weathered portion have not been found in the disintegrated rock debris covering the hillsides. Prospecting has evidently been intense enough to nullify the possible concealment of any large patches of oxides by the heavy blanket of moss. When the available reserves, as outlined previously, are exhausted, apparently the only course open to prospectors would be to seek masses along the continuation of lodes at such localities as the Stibnite near the head of Eva, the McQueen on Ester Dome, the Scrafford on Eagle Creek, the line of old shafts at the Markovich on Spruce Creek, and the divide between Wolf and Fairbanks Creeks.

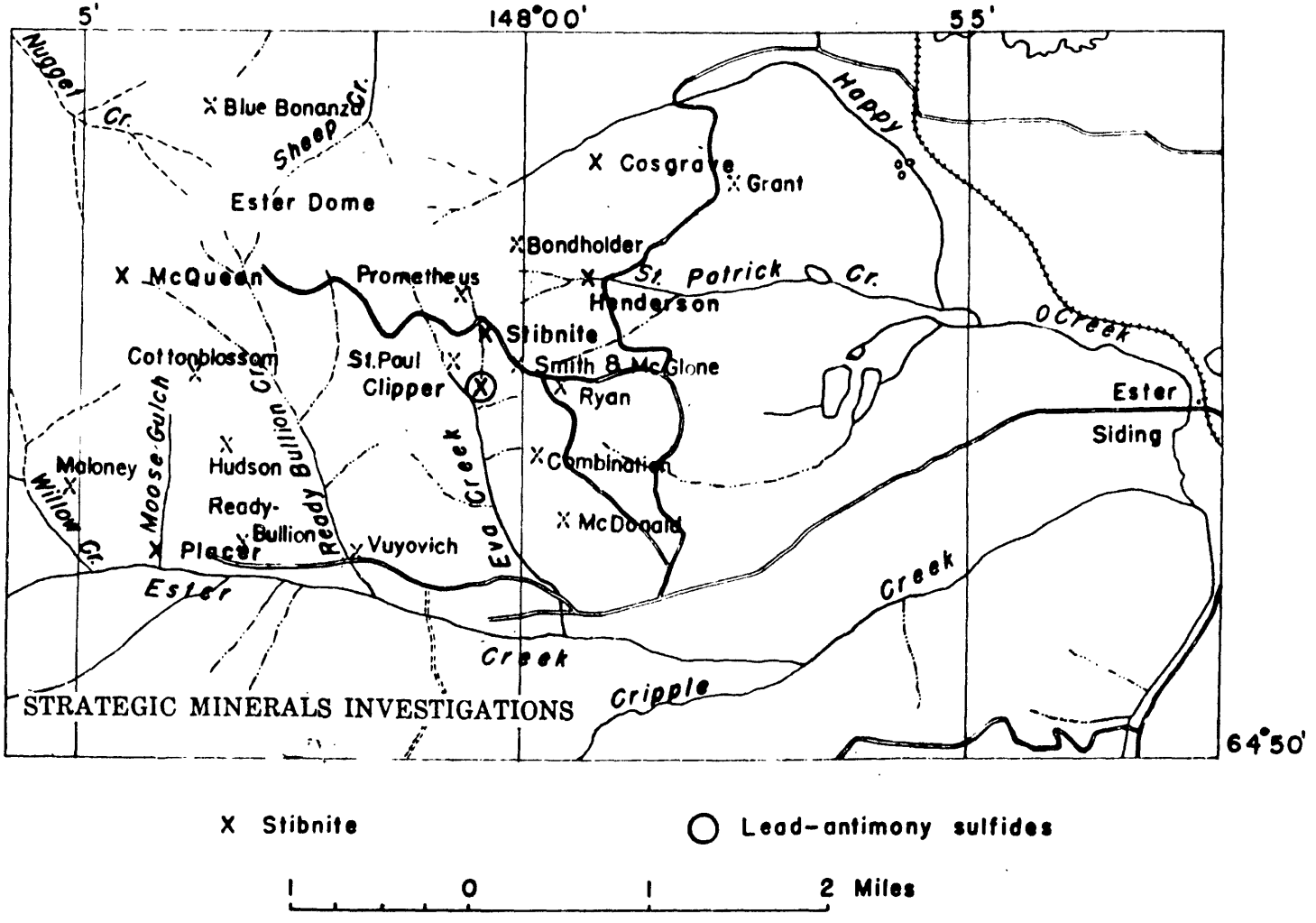

FIGURE 2. Sketch map showing location of antimony deposits in the Ester Dome area.

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