

Six Crown-granted claims, Aspen, Emma, Mohawk, International, Caroline and Silverton Fraction, comprise the ground on which the Aspen Mine workings are situated. These claims, according to current record, are held in the name of the Salmo-Malartic Mines Limited, Executive Office, 159 Bay Street, Toronto, Ontario.

The claims lie on the eastern side of Aspen (Deer) Creek except for the western tip of the Silverton Fraction. They are reached by a road up Aspen Creek, about 4.5 miles in length. This branch-road leaves the Sheep Creek road at a point about 3 miles easterly from the junction of the latter road with the Nelson-Nelway highway, some 4 miles southerly from the town of Salmo. The road up Aspen Creek climbs 1800 feet in its length of 4.5 miles.

The camp buildings are located on a flat not far from the creek, at approximately 4500 feet elevation. The ground rises gently to the east for 200 yards, then more steeply approaching prominent outcrops of limestone intruded by granite which rise steeply to the east. The "H" workings are about 100 feet above camp-level, while "B" tunnel is about 220 feet above camp. The elevation given on the mine plan would appear to be about 100 feet lower than the elevation shown on Geological Survey Map 299A.

This report is concerned principally with the "A" and "B" workings where most of the recent work on the property has been done. Recently the writer, with an assistant, spent three days examining and sampling these workings. Six weeks earlier a brief visit was paid to all the workings. In preparing this report previous reports of the Minister of Mines and Memoir 172 of the Geological Survey of Canada have been drawn upon. Recent surface-cuts south of "B" shaft were snow-covered when the examination of the "A" and "B" workings was made. The reader is referred to the accompanying plan of part of the workings, on which the elevations given, and the nomenclature, follow those in current use at the mine. Some workings will be referred to by an approximate elevation shown on the plan. In quoting former reports, where there is a difference in nomenclature, that now in use is inserted in brackets.

The general geology is shown on Map 299A accompanying Memoir 172 of the Geological Survey of Canada, in which is included a written description. The underlying rocks consist of limestones, of varying purity grading to limy argillites, intruded by small bodies of granite. The sedimentary rocks belong to the Pend d'Oreille series. A large mass of granite lies to the west of Aspen Creek, a considerable mass outcrops east of the creek, chiefly on the Mohawk claim; other granite outcrops, east of the creek, are small. According to Walker:-(1)

(1) WALKER, John F. - Geological Survey of Canada Memoir 172, "Geology and Mineral Deposits of Salmo Map-area, British Columbia".

"The limestone forms part of a large syncline, striking northerly, between argillaceous rocks of the Pend d'Oreille series on the east and granite on the west. The granite contact is irregular and many dykes and sills extend out from the main mass. The purer limestone in contact with the granite is ordinarily coarsely crystalline, but where the limestone contains argillaceous impurities it is altered to a hard, rusty rock".

The alteration of the limestone varies greatly. Some pure limestone has become coarsely crystalline white calcite. Other beds are highly siliceous and are now close-grained and very hard. Locally wollastonite is developed as fibres through the hard white rock, and as small masses of radiating fibres. In the argillaceous limestone, thin seams of white recrystallized calcite occur, while sulphide minerals principally pyrrhotite and pyrite have been developed, usually along bedding-planes. A sample of typical well-mineralized material assayed:

Gold, trace; silver, 0.8 oz. per ton.

Usually close to a fracture in the hard, white siliceous limestone, lenses of sulphide mineral occur, consisting of pyrrhotite, pyrite, sphalerite, galena and, very occasionally, a little fine-grained chalcopyrite. These lenses are narrow and localized. They appear to follow the bedding or to be developed in a fracture. Irregular lenticular alterations of the limestone which may cut the bedding are found in the same type of rock. These too, are of small extent though they may reach a thickness of 3 to 4 feet and may extend in narrow widths for perhaps 60 feet along the strike. The rock has a brownish-grey, translucent appearance and contains fine grains of sulphide disseminated through it. With the sulphides noted occur varying amounts of gold and silver. The average quantity of sulphide present over any appreciable width is small. From the data available it is apparent that the zinc sulphide is a poor carrier of silver. The quantity of gold present is very small. The silver content is variable, and while not large over any considerable width, it appears to average better in the fine-grained, disseminated mineralization than with the coarser-grained, more massive sulphides. Surface work to the north, west of the creek, shows some similar mineralization in which copper carbonate appears to be secondary after grey-copper. It may also be mentioned that some specimens showing ruby silver are to be seen at the mine.

Within the range of the "A" and "B" workings the sedimentary rocks strike from 10 degrees to 50 degrees west of the north and the dip varies from 10 degrees to 70 degrees in an easterly direction. The general strike is about north 30 degrees west and the dip about 35 degrees to the north-east. Altered argillaceous limestone, impregnated with pyrite and pyrrhotite, appears to overlie light-coloured siliceous limestone in the underground workings. In the inner end of the Upper "A" adit-crosscut the limy argillites have been sheared. The shearing strikes about north 10 degrees west and has an average dip of about 30 degrees to the east. Projected on average dip and strike this shearing would be above all the other "A" and "B" workings with the exception of the inner end of the lower "A" adit-crosscut. The sedimentary rocks have been folded and squeezed, with resulting local variations in dip and strike. One anticlinal roll is well-marked on the 95 foot level; the axis of the roll plunges to the east. It would appear also that there have been material disturbances along the dip of the bedded rocks.

Near the contact of the pyrrhotite-impregnated, argillaceous limestone with the white, siliceous limestone, fracturing has developed. The fracturing follows the general trend of the bedding, but also cuts the beds usually at small angles. Occasionally the beds are crumpled or closely folded close to a fracture. Some fractures depart materially from the general dip and strike.

Along the fractures there may be up to 3 inches of gouge and there may be some slickensiding of the wall-rock. Such fracturing is to be noted at numerous points in surface-cuts and also underground. As before mentioned, the most promising mineralization appears to occur in, or close to, a fracture in the underlying siliceous limestone. Apparently it has been considered that there is one continuous fracture; recent work has been in part guided by this theory. The workings do not follow any one fracture continuously and the writer doubts that there is a continuous fracture which could be followed. It seems probable that the fracturing is local and that there are numerous small fractures or slips, representing relief from the shearing and folding before mentioned. It seems rather improbable that a fracture of the type noted would extend for 1000 feet in length in such a rock formation and follow all the convolutions which it would be necessary for a single fracture to follow. The workings are quite irregular and certainly do not establish the continuity of a principal fracture.

The property has been prospected or developed over a period of 24 years, as shown by reference to the "Aspen" in various reports of the Minister of Mines since 1912. Early work appears to have been done near the northern end of the property and was extended southerly in numerous open-cuts, shafts and tunnels. A shipment of approximately $7\frac{1}{2}$ tons of sorted ore was made to the smelter at Trail in 1918. The settlement sheet gives the following assays:

Gold, 0.18 oz. per ton; silver, 61.7 oz per ton;
lead, trace; zinc 2.3 per cent; copper 0.2 per cent.

In 1926 the sleigh-road from the property was widened and made passable for trucks. That year the "H" workings on the Mohawk claim were commenced.

In 1927, Salmo-Malartic Mines Limited of Toronto acquired the property. Work was continued under the management of P. F. Horton, one of the former owners.

By the end of 1929, exploration had been carried out on the Upper and Lower "A" levels, "B" shaft had been sunk some distance from the surface, "B" tunnel had been driven as a crosscut some 550 feet into the hill going through a considerable thickness of siliceous limestone but not finding mineralization of promise. A campaign of diamond-drilling is said to have indicated zinc mineralization carrying no appreciable values in silver, in the vicinity of, and northerly from, the Lower "A" workings. A radiore survey had also been made.

Following a shut-down, work was resumed in 1933 under the direction of P. F. Horton. In the recent work "B" shaft was deepened and, by various rather irregular workings, connections have now been established between "B" tunnel and the Upper "A" Tunnel. The policy has been to follow mineralization or whatever was regarded as the most favorable indication. Due to the nature of the occurrence, the workings are irregular, inclines and winzes may have low dips, and, as reversals of dips occur, it has been found necessary to cut down through humps in order to continue the working. Some idea of the nature of the workings can be obtained by referring to the plan.

At present the total underground work amounts to about 4000 feet; diamond-drilling is reported to amount to a total of about 1600 feet, while there has also been a great deal of stripping and trenching done on the surface.

The accompanying plan, showing the "A" and "B" workings, is copied from the Company mine plan, with working faces brought to date, November 11th, 1936. On it the locations of recent samples taken by the writer, are indicated, and a number within a circle for reference is shown close to each sample or group of samples. In the following description, reference is made to the various points sampled, while the assays and other data are given in the accompanying table.

The quotations below are from Memoir 172 of the Geological Survey of Canada.

"The most northerly working examined is a prospect adit 57 feet long, driven across the contact of granite with limestone. The limestone is brecciated and holds a little brown iron oxide above the contact, and traces of pyrite and sphalerite near it. An open-cut 250 feet south-easterly from the adit exposes a little galena, sphalerite, and pyrite, in small fractures and disseminated in a bed of limestone. One hundred and sixty feet south-easterly from this cut is an inclined working, the lower part of which is flooded. At the mouth of this incline is a small slip that strikes 88 degrees, dips 60 degrees south, and cuts across limestone striking approximately 335 degrees and dipping north-east. A little fine-grained sphalerite and galena is in the limestone immediately below the slip. A small pile of ore indicates that a pocket occurred somewhere in the working. Two hundred feet south-easterly from this working is the portal of No. 1 (Upper "A") Adit. An open-cut beside the portal shows a slip that strikes north-west, dips 57 degrees and more to the north-east, and cuts limestone. Mineralization consisting of sphalerite and a little galena has a width of 2 feet in the limestone above the slip, but does not extend far into or along the rock face. No. 1 (Upper "A") adit is 97 feet long and extends easterly into the hill-side. At 43 feet from the portal a little pyrite, sphalerite, and galena are disseminated through the limestone. A raise from this point to the surface could not be examined."

At about 12 feet from the portal, a drift goes south 30 degrees east for 80 feet then swings to a more easterly course for 35 feet to the top of a raise from the 4800-foot sub-level. To 60 feet from the collar, the roof is timbered; at the inner end of the timbering there is a chute and some stoping has been done. The silicified limestone here strikes north 30 degrees west and dips 65 degrees north-easterly. There has been some movement along a fracture of the same strike, the dip of which at the northern end is steeper than the dip of the bedding. Near the bend in the drift the beds are somewhat twisted and at the bend, a fracture of the same strike but dipping 30 degrees goes off into the wall. No significant mineralization is to be seen.

"An adit (Lower "A") 61½ feet below No. 1 (Upper "A") is 325 feet long with, at 195 feet from the portal, a crosscut 110 feet long to the north, and another 90 feet long to the south. A raise, 135 feet from the portal, connects with No. 1 (Upper "A") adit at the point where mineralization is displayed. In the lower adit, a little pyrite, pyrrotite, and galena occur as specks in limestone about 200 feet from the portal and a little pyrite is present at a point 50 feet along the north crosscut. A little mineralization was also seen in the raise near the bottom, and about 50 feet up."

The crosscuts mentioned essentially follow the trend of the bedding. That to the north has been extended to a total length of 380 feet, and from the end, a raise goes to the surface. Some zincy mineralization is indicated in these workings.

"Eleven open-cuts occurring at intervals for 600 feet south of No. 1 (Upper "A") adit were examined. No mineral could be seen in seven of them. One cut exposed a few inches of quartz with pyrite and specks of sphalerite. A long adit ("B" Tunnel) 200 feet below No. 1 (Upper "A") and about 500 feet south of it, has been driven easterly into the hill-side. It is 550 feet long and has a crosscut 130 feet north-westerly at a point 50 feet from the face. This adit extends into the hill 300 feet beyond a point vertically below the line of open-cuts. A few specks of sphalerite were seen 285 feet from the portal. A little mineralization, chiefly pyrrhotite and pyrite, was seen in the first part of the crosscut."

At 457 and 500 feet from the portal of "B" Tunnel drifts extend northerly, the first for about 35 feet, and the second for 140 feet. From midway along the latter a 20-foot crosscut has been driven westerly. Near the commencement of the longer drift there is from 1 inch to 4 inches of pyrrhotite along a bedding-plane for 15 feet. At 250 feet from the portal a vertical raise connects with the 95-foot level, and at 310 feet a raise, inclined to the north, connects about 65 feet up with a drift which, extending 25 feet northerly, connects with the bottom of "The Winzo".

"Eight hundred feet southerly and 100 feet lower in elevation is "H" adit, an irregular working, in the form of a distorted H, with two portals 135 feet apart. This working explores a small limestone area between two masses of granite. A small lens of galena and sphalerite was encountered in this working and completely explored. It is almost flat-lying and fades out rapidly in all directions. About half of this lens, that is between 10 and 15 tons, was mined and shipped. Close to the north portal of this working is a small cut in limestone showing a brittle, metallic, grey mineral occurring in small seams. It is one of the less common lead sulphantimonides."

Returning to the Upper "A" level we shall describe the recent "A" and "B" workings, proceeding toward "B" Tunnel. The 4800-foot sub-level is a drift about 145 feet in length driven northerly from a raise or incline of low inclination put up from the 95-foot level. The raise leading to Upper "A" level is 85 feet north of the incline. Ten feet north of this raise the drift swings west for 30 feet, then turns northerly to the face; the heading was still being advanced. In this section the beds bend to a more westerly strike but appear to be resuming the normal attitude in the face. Apparently some bunchy mineralization had been encountered from time to time in the drift. Results of sampling the poorly-mineralized, silicified limestone are given in the accompanying table, opposite (2) and (3); at (3) the drift is slashed out and direction changed, giving an 11-foot section. At 50 feet northerly from the top of the incline, on the west wall of the drift in a vertical distance of 4.5 feet, is an upper band, 1.5 feet, and a lower band, 0.8 feet, of the fine, disseminated mineralization. Five feet south, both bands have pinched materially and from this point to the incline they may be followed more or less continuously as streaks, not more than 3 inches wide in a vertical range of 3.5 feet. A sample was cut at (4), 25 feet from the incline. The drift bends to the west at 55 feet and should therefore crosscut any northerly continuation of the mineralization but the mineralization was not seen ahead. Near the bottom of the incline and extending northerly to another raise from the 95-foot level is a short sub-level drift. On the west wall of the drift, near the incline, is another occurrence of the fine-grained disseminated mineralization, here 3 feet wide, but 8 feet south the width is

reduced to 1.5 feet; from this point, it is traceable about 1 foot in width as far as the raise. This occurrence cuts the beds at a small angle. A sample was cut at (5), the widest place. The raise goes above the sub-level for a few feet. At (6), a sample was taken of siliceous lime-beds, overlying the beds in which the disseminated mineralization occurs.

On the 95-foot level, near the bottom of the raise just mentioned, a winze or slope known as the "shaft continuation" has been sunk, following a fracture dipping to the east. The fracture dips at 40 degrees near the top but flattens going down, and rises on the walls from the floor to the roof. About 80 feet down there is a horizontal roll, the axis striking considerably west of north. The reversal in dip made it necessary to cut down through the hump. The working is level from about 80 feet to the end, and swings to a southerly course, 120 feet from the 95-foot level. The beds in the roll are much disturbed and several fractures were noted. This winze and drift are for the most part in altered impure limestone, impregnated with pyrrhotite and pyrite.

At (7), on the 95-foot level, about 12 feet northerly from the centre line of "B" shaft, the roof of the drift is better mineralized than average. The roof was sampled in two sections. The drift, extending northerly from this point, shows very little mineralization.

"B" shaft is sunk from the surface chiefly in light-coloured silicified limestone. At the bottom, the shaft is a chamber about 15 feet wide. The silicified limestone here shows a very little sulphide mineralization.

From the bottom of "B" shaft, on the 95-foot level, a drift runs at south 30 degrees east for 120 feet to the top of the vertical raise from "B" Tunnel. Near the commencement of the drift, on the east wall, is a patch, 4 feet by 4 feet, of the fine grained, disseminated mineralization and a band from 0.5 feet to 1 foot wide extends for 50 feet southerly along the drift. A composite sample, averaging 0.7 feet wide, was cut at intervals along its length (9). A wider patch, $4\frac{1}{2}$ feet by 6 feet, shows in the south-west wall of the crosscut near the top of "The Winze". The two wide patches are indicated at (8) and a composite sample of them was made.

"The Winze" is sunk in a south-easterly direction on a slope of about 30 degrees. It flattens toward the bottom and a drift continues along the same course making connection with the inclined raise from "B" tunnel. From near the bottom of the winze a crosscut is driven 25 feet to the south-west and, from this crosscut, a drift, marked "El. 4710" on the plan, is driven for 65 feet to the south-east. This drift ends at a contact of the limestone and granite. Surface evidence indicates that the granite intrusive is small. A short raise follows up along the contact. From the bottom of the winze, a crosscut is driven for 25 feet at north 10 degrees east and from it the new winze goes down 55 feet at north 40 degrees east on a slope of 27 degrees. From the bottom of the new winze a drift was being driven at north 5 degrees east.

At the top of "The Winze" is a fracture striking north 30 degrees west and dipping 55 degrees to the north-east. It does not show in the winze but at the top of the new winze is a fracture of flatter dip which is followed down for some distance. At 60 feet from the bottom of the winze at (11), a sample was taken across the roof, width being 6 feet. On the south-west

wall, a vertical sample was cut for $4\frac{1}{2}$ feet from the roof down. This was silicified limestone containing a little sulphide. Near the bottom of the winze at (12), a sample was cut, consisting of a channel 2.5 feet in length on the roof and, 3.2 feet from the roof down the south-west wall, the width measured normal to the dip, being 4.2 feet. This section consisted of hard, siliceous limestone with some fine-grained sulphide. At (13) on the north-west wall of the crosscut to the south-west, a 4-foot sample was cut, normal to the beds below the beds sampled in (12). At (14) on the opposite side of the crosscut, including the roof of the 4710-foot drift, four samples were cut, widths being measured normal to the dip of the beds which is about 50 degrees to the north-east. The total width of this section was 20.5 feet. The section across the roof of the drift was fairly well-mineralized with sulphides of iron and zinc. At (16) on the east wall of the crosscut to the top of the new winze, three samples were cut normal to the beds, giving a 10.5 foot section of beds lying above those sampled at (14). At (15) across the roof of the 4710-foot drift to the granite, a 5-foot section was sampled.

At (17) on the north-west wall of the new winze near the bottom of the slope, a small lens of sulphide was sampled, while (18) was taken from the face of the drift from the bottom of the winze where there was also a little sulphide.

In the sampling, an effort was made to determine the values carried by visibly-mineralized limestone and the limestone which showed little mineralization. Well-mineralized sections were sampled where seen. The brownish-grey, translucent, altered limestone with disseminated mineralization carries the best values in general; samples of this material varied from 3 to 23.5 oz. silver per ton. The several occurrences of mineralization of this type have been described above. Visible sulphides carry fair values but were found only in small lenses. Siliceous limestone with little visible mineral may also carry as much as 3 or 4 oz. silver per ton.

It is concluded that low-grade silver values extend over considerable widths but the grade appears to be sub-commercial and there is an obvious lack of continuity. Higher grade sections are limited to small widely separated occurrences, too low-grade and too small to be regarded as commercial ore-bodies.