AINSWORTH CAMP, B. C.

R. H. Seraphim, P. Eng.

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SUMMARY.

The Ainsworth Camp, including the Bluebell mine, has produced 1,500,000 tons of ore with recovery grading 4.5 oz. Ag; 5% Pb; 3% plus (5%) Zn; and 1/4 to 1/2 lb. Cd. per ton. The properties lie in a northerly trending belt of schists, quartzites, and limestone on the western flank of a large anticline, bordered by granite of the Nelson batholith on the west. The major ore bodies are found where fractures intersect limestone beds. A westerly to north-westerly trending fracture system is productive in both the Bluebell and Florence mines. A possible western extension of these systems would intersect large limestone beds of Slocan series between the Florence ground and the granite. An exploration program employing self-potential and conductivity geophysical methods is recommended for this area.

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INTRODUCTION

The Ainsworth camp, including the Bluebell mine, has produced 1,520,025 tons of ores from which 6,832.601 oz. Ag; 154,858.638 lbs. Pb: 94,938.761 lbs. Zn; and 206,599 lbs. Cd. was recovered. The average tenor of ore is thus - 4.502 Ag; 5% Pb; 5% Zn; and 1/4 to 1/2 lb. Cd. per ton. (Much zinc and cadmium was discarded in the early production period).

The productive history of the camp dates from 1892. Five mines: the Bluebell, Highlander (Yale), Florence (Ainsmore-Western) Highland, and Number 1 have contributed the bulk of the production. At present only the Bluebell and Yale are producing. C. M. & S. operate the Bluebell and recently optioned the Florence ground from Western Mines. H. W. Knight interests have a large interest in the Yale.

PRODUCTION

Production of the camp is shown in the following tables:-

Florence-Ainsmore-Western	Tons	Ozs/Ag:	Lbs/Pb:	Lbs/Zn:	Cd:
pre 1942	74,789	129,205	9,762,426	Not known	
43	6,762	8,000	630,000	371,000	
44	10,431	12,346	967,202	571,618	
45	9,900	12,590	738,107	250,873	
46	8,873	9,600	676,105	181,467	
47	19,398	15,219	871,393	422,938	
48	13,661	15,432	627,882	408,337	
49	11,907	16,526	778,554	622,225	2,891
50	13,339	22,295	1,290,099	725,184	3,331
51	17,984	23,473	1,311,010	645,401	2,784
52	21,484	27,505	1,950,806	1,004,743	8,234
53	2,084	3,393	259,490	197,761	1,270
Totals:	210,612	295,584	19,863,074	5,401,547	18,510
Yale					
51	36,355	56,946	3,113,685	490,778	
52	56,095	131,107	5,799,951	1,712,987	
53	52,375	123,574	5,062,156	2,225,954	
Totals:	144,825	311,627	13,975,792	4,429,719	
Bluebell					
pre 1952	40,164	669,713	49,309,420	6,260,671[x]	69,580
52	36,212	225,995	15,672,897	15,838,897	118,509
53	16,401	340,722	25,010,407	26,059,973	
Totals:	892,787	1,236,430	89,992,724	48,159,541	188,089
Totals - including Shippers	1,520,025	6,832,601	154,858,638	94,938,761 ≠	
	=	4.5 oz/ Ag.	5.07% Pb.	3.1% Zn.	¼ to ½ lb. Cd.

≠ Much of the zinc was discarded prior to 1952.

GEOLOGY.

The following account of the geology of the Ainsworth camp, west of Kootenay Lake, is quoted from G.S.C. Paper 44-13 by M. M. Rice:

"General Geology

The area is underlain by a succession of metamorphosed sedimentary and volcanic formations cut by minor intrusions. These dip to the west and lie roughly parallel to Kootenay Lake and between it and the main mass of the Nelson batholith which outcrops just beyond the western border of the area. The assemblage is believed to include members of the Lardeau, Milford, Kaslo, and Slocan groups of Windermere, Carboniferous, and Triassic ages, but metamorphism has so changed the rocks that it is difficult, and in many places impossible, to distinguish one group from another and for purposes of this study the attempt has not been made. It is known, however, that the formations are successively younger across the area from east to west, except where folding has locally reversed the order.

The commonest rock type in the area is some variety of quartz-mica schist, such as sericite schist, biotite schist, or granetiferous mica schist. Massive quartzite is not uncommon and all gradations between it and schists can be seen. Some of these rocks are calcareous or dolomitic and grade into almost pure limestone or dolomite.

The dolomite is cream-coloured, weathers buff, and occurs near Kootenay Lake as thick beds in formations of the Lardeau group. The limestone is fine-grained to coarsely crystalline, is blue-grey and weathers light-grey. It occurs in some of the same formations as the dolomite but is also interbedded wuth volcanic rocks farther from the Lake, and forms particularly thick beds above the zone of the volcanic rocks in what is believed to be the Slocan Group.

Thick belts of hornblende schist and, to a lesser extent chlorite schist, occur in a north-south zone that lies roughly up the centre of the area. These are believed to be metamorphosed andesitic lavas and volcanic breccias belonging, in part at least, to the Kaslo Group. The number and distribution of these belts cannot be determined with certainty, for, like all volcanic formations, they are in part lenticular rather than continuous, are probably repeated in places by folding, and are undoubtedly accompanied by related intrusions that have suffered similar metamorphism and cannot now be distinguished from the extrusive rocks.

Dark grey argillite is common in the formations west of the hornblende schist and is believed to be confined to the Slocan Group. Near the base of this group is a thick bed of dark-grey schist in which knots of secondary minerals resemble pebbles in a conglomerate.

Bodies of granitic rock occur. Some of these may be truly intrusive bodies but many are in whole or in part the results of granitization of schists or quartzite.

Many dark-coloured dykes and sills can be seen. They are definitely younger than the granitic bodies and vary in composition from diorite to syenite. Some occupy the same fissures as the mineral deposits although they are definitely older. In 1938 the writer collected some evidence to indicate that the dark dykes are probably of Tertiary age and in that case the ore deposits cannot have formed before Tertiary time. The evidence, however, is not considered conclusive.

Structural Geology

The strata in Ainsworth district have a general north-south strike and dip west into the hill at angles from 30 to 50 degrees They are involved, however, in so many structural complications that a satisfactory interpretation of the nature and history of the structures and their relationship to mineralization could not be made even after careful mapping on scale of 200 and 400 feet to the inch.

The formations have been deflected from their regular trend by a series of complex drag folds that range from an inch to a thousand feet across. In parts of these folds, beds of limestone and hornblende schist have been greatly thickened; in other parts they have been thinned out and, localy, may be missing. The difficulty of mapping these folds is further increased by lack of outcrops at critical localities, and by the fact that some of the hornblende schist involved has formed from crosscutting intrusive bodies that serve but to confuse the bedding structures.

No faults of large displacement were observed. There are, however, many small faults or fractures zones that, although they have little structural significance, contain the mineral deposits of the area and are consequently of great economic importance. These will be referred to more fully in the following section of this report.

ECONOMIC GEOLOGY.

Types of Mineral Deposits

Silver, lead, and zinc are the principal metals recovered in the district. The two most abundant ore minerals are galena and sphalerite; of these sphalerite is the more common, but until recent years had been regarded as a detriment rather than an asset in the ores, and as a result only a small amount of it has been produced. Silver is of secondary importance, except in a few mines like the Krao and Silver Hoard, where the native metal and high-grade silver-bearing minerals have afforded rich silver ore. Traces of tin were detected in a number of ores from this camp. Fluorite is reported by Schofield to be a common gangue mineral in some of the deposits, but was not seen by the writer.

Mineralization occurs as fissures and replacement bodies, and both types are closely related. The replacement deposits are in limestone and, to a lesser extent, in hornblende schist. Ore-bearing solutions rising along fissures or small faults deposited much of their load by replacing the wall rocks adjacent to the fractures. Ore so formed is usually high grade but the deposits are irregular in shape and limited to the favourable bed. Fractures may parallel the bedding, but more commonly cross it at a fairly sharp angle. In the latter case the length of the orebody is limited by the width of the favourable bed. It is not always possible to see the parent fissure; within the orebody the replacement of the wall rock by ore commonly destroys the evidence by which it could have been recognized, and in the adjacent schists most faults and fissures pinch out within short distances. Little displacement was observed along any of the faults and efforts to trace them from one limestone bed to another have not been successful. It seems probable that a fissure may develop in schist close to a body of limestone and nearly parallel to it, swing rather abruptly to cross the limestone at a high angle and, on passing into the schist on the other side, swing back into line with the plane of schistosity and die out.

Fissure-vein deposits occur mostly in mica and hornblende schist and quartzite. They occupy the fissure, cementing fault breccia fragments within it, and forming veinlets in the wall-rocks. Replacement is of secondary importance. The normal sequence of events seems to have been as follows: the fissures were first occupied by veins of barren quartz with sometimes a little calcite. This vein-matter was shattered by later movements along the original fissure, and either during or just after this interval of deformation some of the fissures were intruded by the young, dark-coloured dykes referred to earlier in this report. The breccia thus formed, whether it be of earlier quartz, wall-rock or shattered dyke, was cemented and to some extent replaced by ore to form the present deposits.

It is evident that replacement and fissure-vein deposits are closely related. They probably originated from the same solutions and they follow the same fissure systems. Their differences lie apparently in the nature of the wall-rocks which, if they are limestone, allowed almost complete replacement by ore-bearing solutions.

The key to the location of the ore deposits is clearly related to the occurrence of faults and fissures. Although these form a definite pattern, neither the origin of this pattern nor of the fissures themselves is known. Most of the mineralized fissures at the south end of the area follow the bedding, whereas those at the north end cut across it, this in spite of the fact that rock structures at both ends are, in general, similar. There is little difference in deposits occupying the parallel and the transverse fissures. Most of the parallel fissures can, however, be traced much farther than any of the cross fissures.

Principal Fissure Systems

The principal mineralized fissure systems will now be described briefly commencing with the most southerly.

The Eden-Crescent-Krao system can be traced at intervals for some 7,000 feet. On it are the Eden-Crescent, Last Chance, Firebrand, Crow Fledgling, and Krao mines. In general it is parallel to the bedding although in place it splits into two or more components. These components may join again farther along the fissure or swing off to form a related cross fissure. On the Crow Fledgling, for instance, the system is 100 feet or more wide, with well-defined fissures along both walls in which ore-shoots are irregularly distributed. The more easterly fissure continues north to include the Krao deposit, beyond which it dies out. The westerly fissure swings up Krao Creek and also disappears, although the cross fissure at the United mine is probably a part of the same system.

The next important fissure system to the northeast is that of the Maestro-Spokane mines. This can be traced with reasonable certainty for not less than 6,000 or 7,000 ft. and along it lie some half-dozen deposits, among them those of the Little Donald, Little Phil, Maestro, Spokane and Trinket mines. It consists essentially of bedded veins and is as regular as any of the systems in the area, but also splits and throws off cross fractures. South of the Spokane mine, for instance, it consists of not less than three parallel veins and at least one small cross vein.

Farther east is the Banker-Townsite system of bedded veins which can be traced with reasonable certainty for 3,000 or 4,000 ft. and, perhaps, for over 7,000 ft. The principal deposits in it are those of the Albion, Banker, and Townsite mines but may also include the Danero to the north.

The above-mentioned, as well as other fissure systems such as those of Number 1 and Silver Hoard mines, form the vein pattern in the southern half of the area. Deposits in them, with the exception of the last two mentioned which are replacement deposits in limestone are principally of the fissure-vein type. Bedded veins are far more abundant, more continuous, and economically more important than those that occur in cross fissures.

Factors commonly controlling the location of ore-shoots in the bedded veins are changes in the nature and direction of the parent fissure . For example, ore-shoots have formed in or close to both vertical and horizontal rolls in the veins at both the Banker and Spokane mines. Dykes and construction in the fissures have acted as dams in some instances. A good example was noted at the Banker where an ore-shoot found under a dyke that crossed the fissure from hanging-wall to foot-wall.

The approximate northern boundary of this group of systems of essentially parallel veins is a few hundred feet south of Cedar Creek. Just north of this boundary is the Highland fissure system that includes, in addition to the several fissures of the Highland mine itself, those of the Jewel, New Jerusalem, Ayesha, and Buckeye mines. These together form a widespread system of short fissure veins that cross the bedding in a northwesterly direction. Ore-shoots occur in mica and hornblende schist and quartzite and their position is controlled, at least in part, by the nature of the beds through which the fissures pass. They are consequently limited to certain locally favourable beds. Thus a shoot in hornblende schist may end abruptly when the fissure passed into quartz-mica, elsewhere the reverse may be true. Few fissues persist from one favourable horizon to the next.

Still farther north is the fissure system of the Florence and adjacent properties whose veins cut more or less directly across the bedding. The position of ore-shoots in the fissures of this system is controlled in a manner similar to those in the Highland system, except that the principal shoots of the Florence and Lakeview mines have formed in limestone by replacement.

CONCLUSIONS.

The work done in the area during the season of 1943 failed to establish a relationship between the structure and the fissure system that could be used as a guide in prospecting for mineral deposits. Several general facts may, however, be of interest.

(1) The most complicated structures in the area are between Coffee and Woodbury Creeks and there is evidently a relationship between this complexity and the location of the ore deposits. Prospecting to the north of Woodbury Creek and south of Coffee Creek is, therefore less likely to meet with success than in the area between them.

(2) The most promising veins in the southern half of the area are bedded veins; and, in the northern half, those occupying cross fissures.

(3) Finally, it should be noted that large limestone bodies occur in the drift-covered region west of the area mapped, and between it and the Nelson granite, and that these are more likely to contain large, replacement orebodies, than the thinner limestone formations nearer the lake. Should the fissure system of the Highland and Florence mines persist far enough west to intersect these large limestone bodies or should they be involved in other similar systems, important replacement deposits may be expected to be present."

The Bluebell Mine lies on the east shore of Kootenay Lake, almost directly east of the Florence mine. The ore bodies are formed by pyrrhotite-galena-sphalerite replacement in westerly dipping limestone of the Lardeau Series. The ore is found in manto-like shoots in two limestone beds. The shoots are controlled by steep joints, which strike N55 degrees to N80 degrees West, and dip steeply. The orebodies thus plunge down the dip of the limestone. Two zones, the Bluebell and Kootenay Chief are productive, and a third, the Comfort, is under development.

The joint system in the Bluebell is thus similar in attitude, and on strike of the fissure system in the Florence area. If these systems are part of a major joint or fissure system, interest is added to Rice's third conclusion. The possibility of a continuity of the Florence and Highland fissures into the limestone to the west is enhanced. The area would appear very favourable for replacement bodies, and thus merits an exploration program. The area contains very few outcrops, but overburden is reported to average only one or two tens of feet. One detrimental factor is that C. M. & S. as shown by their recent option of the Florence ground, are interested in the general area. Thus, the ground west of the Florence may be staked by C.M. & S. soon.

EXPLORATION PROGRAM and COSTS.

The type of mineralization expected would be most susceptible to discovery by self-potential and conductivity surveys. A short reconnaissance of the terrain is necessary to determine costs of line cutting and ease of traverse with geophysical instruments. Line cutting and staking is estimated to total $50.00 per claim. Geophysical methods should cost about $125.00 per claim. Supervision and overhead would depend on the size of the exploration program. A block of at least fifty claims should be explored initially. The cost of this program would be from $15,000.00 to $20,000.00.

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