51

GEOLOGY OF THE RUSSIAN CREEK-REEVES MCDONALD AREA
KOOTENAY DISTRICT, BRITISH COLUMBIA

by

P. J. Shenon and R. P. Full

February, 1951

Larch Group - 7 Claims

Caviar Group - 8 Claims

Val Group - 8 Claims

Salmo Topographic Sheet

Latitude SE Corner - 49°00'00"N

Longitude of SE Corner - 117°20'30"W

Field Work June 22 - September 10, 1950

82F/3W

CONTENTS

ILLUSTRATIONS

GEOLOGY OF THE RUSSIAN CREEK-REEVES MCDONALD AREA
KOOTENAY DISTRICT, BRITISH COLUMBIA

by

P. J. Shenon and R. P. Full

February, 1951

INTRODUCTION

This report is based upon a study made by the writers assisted by W. O. McKenzie and T. T. Gin in the period between June 22 and September 10, 1950. John J. Holland in conjunction with the writers had made a study of the Metaline district for Day Mines, Ltd. in 1947 but his investigation was concerned largely with the ownerships of properties. McKenzie made a reconnaissance of the area north of the International Boundary in 1949 and 23 claims were staked largely on the basis of his work. The area covered by the map accompanying this report in part overlaps that studied by McKenzie but extends farther to the north and south. Considerable time was spent reviewing stratigraphic sections in June and early July in order to compose in so far as possible the radically different views held by the Canadian and American geologists whose maps join at the International Boundary. Much still remains to be learned about the stratigraphy although it is believed our present knowledge fulfills the requirements of this report.

GENERAL GEOLOGY

The most complete published data on the general geology of the Russian Creek-Reeves McDonald area is contained in a report by J. F. Walker which was published in 1934. C. F. Park, Jr. and R. S. Cannon, Jr. have described the geology of the Metaline district, which lies immediately south of the Russian Creek-Reeves McDonald area in U. S. Geological Survey Professional Paper 202. Both reports contain much valuable data but neither adequately describes the rock formations nor the effects of the alteration processes that have in many places drastically modified the original character and appearance of the rocks. A complete stratigraphic section is nowhere exposed because of structural complications and because gravel and sand deposits in large part overlie the consolidated rocks. In addition dense timber and brush coupled with the steep topography make mapping very difficult. Most of the known ore bodies are in the Maitlen and Metaline formations of middle and upper Cambrian age and unfortunately these units are the poorest exposed of all formations as they occur for the most part in the structurally complex and gravel covered valley areas. Generally speaking the rocks are better exposed on the Canadian than on the American side but questions that have arisen between Canadian and American geologists cast doubts on some of the correlations. Part of the uncertainty is unquestionably due to the complicated structure, which is only partly unraveled, but the Canadians also believe there is a marked and rather sudden change in the stratigraphy

on the two sides of the line. Good sections of the Monk and Gypsy formations occur on the Canadian side in the high country near the head of Sheep Creek and the South Fork of the Salmo River. Good sections of the Gypsy formation are also exposed in the steep slopes west of Metaline Falls. Poor exposures of the lower part of the Maitlen formation occur along the west side of Sullivan Lake and on the ridges east of Abercombie mountain although it should be pointed out that part of the section is cut out by faulting in the latter area. Many thousands of feet of what are believed by the writers to be Maitlen beds are exposed along the Pend Oreille River for several miles west of the mouth of Russian Creek. Whether or not a nearly complete section of these rocks is exposed along the Pend Oreille River is not known but certainly a much greater thickness is here exposed than Park and Cannon assign to the Maitlen. Park has mapped a large area of rocks as Ordovician Ledbetter slate near the head of Russian Creek. Generally speaking this formation is well exposed at this place although access to much of it is difficult because of the steep topography and undergrowth. The section here is not complete as the formation has been truncated by faulting and erosion yet over 1500 feet are indicated.

Only three formations of consolidated sedimentary rocks are exposed in the area mapped near the Reeves McDonald mine; namely, a formation believed to correlate with the Maitlen formation of Park and Cannon, the Metaline Limestone and the Ledbetter Slate. These rocks were intruded by coarse grained, light colored granitic rocks and basic dikes. All have been overlaid by alluvial deposits. For sake of completeness several formations not exposed near the Reeves McDonald mine are briefly described

below.

The Priest River group of rocks occupies a large area in the eastern part of the Metaline quadrangle. The group includes a thick series of phyllites and schists with limestones, dolomites, quartzites and volcanics of unknown thickness. Where seen and as described these rocks have common characteristics with those of the Maitlen formation. No one has studied these rocks in detail and as a matter of fact study of them is made difficult because of the thick soil, brush and timber that covers the area underlain by them.

The Shedroof Conglomerate is described by Park as a coarse, very poorly sorted rock with dingy gray-brown coloration interlayered with phyllite, quartzites and greenstones. All have undergone intense metamorphism; even the pebbles and fragments have been flattened or stretched and the rocks have a schistose appearance. Very little information is available on the thickness of the formation for even the more general structural features are uncertain because of the scarcity of visible bedding planes in the rocks. Park computed the maximum thickness at 11,000 feet and the minimum at 3,000 feet, which all adds up to the fact that very little reliable data is available on this formation. No formation similar to the Shedroof formation occurs in the mapped Russian Creek-Reeves McDonald area.

The greenstones and green schist that lie at the base of the Monk formation have been called the Leola Volcanics by Park and Cannon and the Irene Volcanic series by the Canadians. It is typically homogeneous greenstone mostly with a distinct schistone structure. The thickness is estimated by Park and Cannon as between 4,500 and 9,000 feet.

The Monk formation of presumed Cambrian age lies at the base of the Gypsy quartzite. It is correlated with the Horsethief Creek series on the Canadian side. The formation consists of conglomeratic beds at the base, phyllite, and, near the top, quartzitic limestones. The formation is estimated by Park to be 3,800 feet thick and by Walker as 4,000 feet thick. In the vicinity of the Oriole mine, about two miles west of Metaline Falls, the limestones of this group contain irregular ore bodies. The Monk formation is not known in the Russian Creek-Reeves McDonald area.

The Gypsy quartzite is the most uniform and easily recognized formation. The Canadians have divided it into three units - the Three Sisters, the Quartzite Range and the Reno formation. Essentially the same units occur south of the International Boundary although Park and Cannon did not make these subdivisions. The units of the Gypsy quartzite are well exposed in the high country near the headwaters of Waldie and Lost Creeks on the Canadian side and similar units can be seen on the American side on Gypsy Ridge and in the steep bluffs immediately west of Metaline Falls. The lower unit consists of grits with some beds of quartzite and conglomerate. Above it is a thick series of white to gray massive and medium bedded quartzites and above this are interbedded quartzites and argillites with some beds of limestone. On the Canadian side the Gypsy quartzite formation is about 11,000 feet thick. On the American side it apparently ranges from 5,300 to more than 8,500 feet. Walker and Little of the Canadian Survey have classified the beds exposed below the Reeves McDonald mine along the Pend Oreille River as the upper unit (Reno) of the Gypsy quartzite. The writers do not agree with this classification as they could see no

lithologic resemblance between the Reno formation as exposed along the headwaters of Sheep Creek and the rocks exposed below the Reeves McDonald mine.

Information on the stratigraphy of the Maitlen phyllite of middle Cambrian age is very inadequate. Little and Associates of the Canadian Geological Survey mapped a band of rocks lying between the International Iron and Lead Mine and the Reeves McDonald as corresponding with the Maitlen formation of Park and Cannon but he does not include lithologically similar rocks that lie immediately west of the Reeves McDonald with this unit. Little also includes rocks classed by Park and Cannon as Ledbetter slates of Ordovician age with the Maitlen group. The latter inconsistancy is discussed farther along in this report. According to Park and Cannon the Maitlen phyllite on the American side is about 5,000 feet thick. If the similar appearing schists and phyllites west of the Reeves McDonald mine are part of the Maitlen formation it is much thicker than 5,000 feet. The Maitlen grades into the underlying Gypsy quartzite through a series of alternating beds of quartzite and greenish, fine-grained phyllites. However, the most common rock type in the unit is grayish green, fine-grained and conspicuously banded phyllite. Limestone layers are common and quartzite is very abundant at several horizons. Much of the phyllite could be more correctly classed as sericite schist. Below the Reeves McDonald mine remnants of black argillite in green sericite schist give a clue to the original nature of the more argillaceous members. The limestone member that occurs at the Reeves McDonald mine is one of the most important ore bearing members in the district. It not only contains the ore at the

Reeves McDonald mine but also is the ore bearing formation at the Emerald and Red Bird mines and at several prospects. This limestone varies considerably in thickness from 1,000 feet to less than 400 feet. It characteristically is coarse grained and has a banded "gneissic" appearance. Except near ore bodies it is relatively free of magnesium but near ore in most places it has been altered to dolomite. Only part of the limestone members of the Maitlen formation are known to contain ore bodies although most of these members are similar in appearance. As an example the so-called "footwall limestone" that occurs about 2,000 feet stratigraphically below the Reeves McDonald horizon does not reveal mineralization in spite of the fact that it is almost identical in appearance with the Reeves McDonald limestone. On the other hand a similar appearing thin, lens-like limestone layer that occurs at the Michaely prospect contains bodies of high grade ore and the Prospect limestone, stratigraphically about 450 feet above the Reeves limestone, is reported to contain irregular bodies of mineralization in a tunnel lying about 4,000 feet east of the Reeves Adit.

The Metaline limestone is the most important formation from an ore bearing standpoint on the American side of the line although to date no important ore occurrences are known in it on the Canadian side. Also on the American side where the formation is relatively free from alteration it is utilized for manufacturing cement. Only partial sections of the Metaline formation are exposed at any one place and alteration makes identification of the units very uncertain from place to place. In fact some alteration facies in the formation have been interpreted as stratigraphic horizons. The Metaline limestone where it has not been affected

by faulting appears to grade into the overlaying Ledbetter slates through a zone of black limy shales and limestones and according to Park and Cannon it grades into the Maitlen formation below through a series of limy phyllites. Park and Cannon have assigned thicknesses to the Metaline limestone that range from 3,000 to 5,000 or 6,000 feet although they point out that the larger figures may be the result of repetition of strata by faulting. They have divided the formation into four units of 150, 450, 1,200 and 1,200 feet thickness but as indicated earlier these units cannot be distinguished with certainty where alteration was intense. Most of the ore near Metaline Falls occurs in the upper (Josephine) unit not far below the Ledbetter slate but the so-called Yellowhead ore is at a considerably lower horizon. According to the recently published map by H. Little, V. J. Okulitch and A. L. McAllister the Metaline formation lenses out on the Canadian side between Lost Creek and the International Boundary.

The Ledbetter slate formation of Ordovician age occurs as a number of irregular large and small outcrops south of the International line where it is used as a guide for locating the upper ore-bearing portion of the Metaline limestone. The Ledbetter slate formation is for the most part a black, fine-grained, non-limy, generally homogeneous rock in which the individual grains can rarely be distinguished. At least one conspicuous bed of nearly black quartzite, 15 or 20 feet thick, crops out on Slate Creek and near Three Mile Creek. Some nearly black limestones occur in what appears to be a transition zone between the Ledbetter and Metaline formations and Park and Cannon report that the uppermost known beds are black limestones. Park and Cannon have assigned a thickness of 2,500 feet

to the Ledbetter formation.

The largest outcrop shown by Park and Cannon occurs in the area immediately south of the International line north and west of Russian Creek. The map by Little, Okulitch and McAllister which adjoins on the Canadian side assigns these same rocks to a Lower Cambrian group which is correlated as approximately equivalent to the Maitlen rocks of Park and Cannon. A glaring inconsistancy of this sort is hard to explain, particularly where two such widely different formations are involved. It means that either Park and Cannon or Little and his associates have improperly classified the rocks at the International Boundary. To our knowledge no fossils have been found in the questioned formation at the head of Russian Creek but index fossils have been found in similar nearby outcrops and no formation in the area other than the Ledbetter is known to contain a comparable thickness of black non-limy argillite.

Park found Devonian fossils in two relatively small outcrops of breccia-like limestones; the first near the headwaters of Harrington Creek about 1 mile southwest of the Frisco Standard mine and the other about 1 mile west of Z- canyon. No limestones of Devonian Age are known in the vicinity of the Reeves McDonald mine.

South of the International Boundary along the valley of the Pend Oreille river; Park and Cannon have mapped clastic rocks of Tertiary age that they have named the Tiger formation. Park and Cannon assign a maximum thickness of 1,000 feet to it. The material consisting of conglomerates, sandstones and clays, is fairly well consolidated and stands in steep banks where exposed in road cuts. Tertiary rocks corresponding with the Tiger

formation are not known in the area mapped by us on the Canadian side although it is possible that some Tertiary sediments were included with the Quaternary and Recent alluvium.

Quaternary and Recent alluvium consisting largely of poorly consolidated conglomerate and sand overlies a large area in the vicinity of the Reeves McDonald mine. The Quaternary beds are found at elevations 1,200 feet above the present streams and in part at least represent material deposited in ponded water, quite likely formed behind ice dams during one or more periods of continental glaciation. The highest Quaternary deposits reach to an altitude of about 3,000 feet. These deposits have a negative value so far as the ore deposits are concerned as they make prospecting difficult; some favorable areas of limestone are overlain by 500 or more feet of sand and gravel.

Coarse grained intrusive rocks occupy large areas both north and south of the International line. Park and Cannon have termed the large granitic mass south of Metaline Falls as the Kanisksu batholith and Canadian geologists call the very large intrusive north of our mapped area the Nelson batholith. Associated with the granitic rocks are numerous light and dark colored dikes and sills. The darker colored ones are very numerous throughout the Russian Creek-Reeves McDonald area. Generally speaking the granitic rocks are intermediate in composition and like the rocks of the Idaho batholith have been termed granodiorites. Some important ore deposits near Ymir and Nelson are in the granitic rocks or in sedimentary rocks close to granitic intrusions.

The rock structures in the Russian Creek-Reeves McDonald area

and in the Metaline district to the immediate south are complicated and are known only in a general way. Park and Cannon in addition to the folding have recognized three periods of faulting. According to their interpretation compressive stresses were dominant during folding and some of the folds broke into thrust faults. The folds and thrust faults strike generally northeast. After thrust faulting nearly vertical normal faults developed - one set with a northeast strike and the other with a north to northwest strike. The information based on our recent mapping agrees fairly well with the concepts of Park and Cannon. For example the large normal fault that runs down Russian Creek and offsets the thrust faulting belongs to the early normal faulting of Park and Cannon and the faults immediately west of the Reeves McDonald mine represent the later normal faulting.

The largest fault in the Reeves McDonald area is a thrust of large displacement. It accounts for the apparent disconformity of the Ledbetter rocks with those classed as Maitlen. For example near the head of Red Bird Creek the Reeves McDonald limestone member passes beneath the Ledbetter slates on strike and several other higher units of the Maitlen formation can also be followed and projected under the Ledbetter rocks. Direct evidence of the fault can be seen in the intensely folded and broken condition of the rocks exposed near the headwaters of Russian Creek, along the Pend Oreille River in the vicinity of the International Lead and Iron property, and near the head of Red Bird Creek. On the basis of cross sections, the fault plane should be close to the surface near the head of Russian Creek and this belief is supported by the intense crumpling and brecciation of the Ledbetter rocks along the floor of the valley. Near

the International Lead and Iron property where the rocks are well exposed along the Pend Oreille River the limestones are completely brecciated for over a thousand feet immediately north of the International line. Here the fault must necessarily have two branches for a shattered, wedge-shaped block of nearly black, shaly limestone that probably belongs to the Maitlen formation both underlies and overlies Metaline limestone. On the flat ridge, about a mile west of the Red Bird Mine, the Ledbetter slates near the contact with Maitlen rocks are also intensely broken and folded and the disturbed condition supports the likelihood of a fault contact.

The best example of the older northeast trending normal faults is exposed on both river banks about 1500 feet upstream from the mouth of Russian Creek and along the Reeves McDonald mine road. Where this fault is exposed it is nearly vertical and is marked by several feet of gouge and by shearing across more than 200 feet where the fault can be seen in the road cut. Several normal faults of the north to northwest trending system occur near the Reeves McDonald mine where the strikes are more nearly north-south than in the Metaline district. Two of these faults can be seen in the river bank during low water periods. The more westerly one trends a little east of north and is nearly vertical. It offsets the so-called "foot-wall" limestone about 300 feet. The more easterly branch strikes west of north and offsets the same limestone 800 feet. Several faults of this system are also known in the Reeves McDonald mine. One of them is said to dip 60° E.

The relationships of the faults to the ore bodies are not fully known. Some of the last described faults are known to offset the Reeves McDonald ore body but it seems likely that the thrust faulting antedated the zinc-lead ore bodies for zinc and lead sulphides are found in brecciated and silicified limestones near some thrust faults, presumably those thrusts that caused the brecciation.

The sedimentary rocks of the Reeves McDonald-Russian Creek area and of the Metaline area to the south have undergone alteration of several kinds and at different times. Differences in alteration are due in part to variations in rock types but also no doubt due in part to the different alteration processes that have affected the rocks. Induration and re-crystallization and the formation of some of the platy minerals quite likely resulted from regional metamorphism. For example sandstones were converted to quartzites, shales to slates and argillites, volcanics to greenstones, and limestones to marbles. Other mineral assemblages, for example, feldspars, dark micas, tremolite, diopside, etc. were formed close to intrusive masses as a result of the intrusive processes. In addition there is strong evidence of later hydrothermal alteration and some of the later effects were closely associated with processes of ore formation.

Some of the older rocks, particularly the more argillaceous ones have been greatly affected by alteration. As we see them today these rocks are largely mica schists or phyllites but in places there are remnants of fairly fresh material that gives a clue to the nature of the original rock. For example the green micaceous schists below the Reeves McDonald

mine contain remnants of nearly black shaly argillite. In other places dense, nearly black limestone remnants are included in white or gray marble, some of it dolomitic. In some places rocks as young as Ledbetter slate show fairly widespread alteration of a type that is believed to have resulted from hydrothermal processes. Some of the partly altered black Ledbetter slate is criss-crossed by grayish-green vein-like areas that give the rock a brecciated appearance. It is believed that this pattern has resulted from alteration working out along bedding surfaces and cleavage planes. Where the alteration was incomplete a breccia-like pattern resulted. The affects of dolomitization and silicification processes and the relationship of these types of alteration to ore deposition in the Metaline and Reeves McDonald areas are known only in a general way. Studies made during the past summer indicate that dolomitization processes were nearly everywhere closely related to ore formation and that generally speaking where mineralization is absent the rocks are low in magnesium. In the Metaline district widespread silicification preceded the deposition of the sulphide ore minerals but in the mines visited on the Canadian side of the line silicification was a minor process. Enough work has not been done to date to make positive statements but it does appear that studies of alteration affects, particularly dolomitization, could lead to the discovery of new ore bodies.

ORE DEPOSITS

Two deposits were being worked within the mapped area in 1950

and another had been worked at an earlier date. A fourth property was producing a short distance north of the map limit. In 1950 the Reeves McDonald and International Lead and Iron properties were producing from within the map boundaries and a large production was coming from the Emerald located a few miles to the northeast. In past years the Michaely mine, which is located about 2 miles northwest of the Reeves McDonald, produced a small tonnage. The International Lead and Iron property has been producing limonite for the cement plant at Metaline Falls. The Reeves McDonald and Michaely are zinc-lead deposits whereas the Emerald has produced both zinc-lead and tungsten ore.

All of the deposits occur as limestone replacements. The Reeves McDonald and Emerald appear to be in the same limestone bed. The Michaely is in a footwall bed 5,000 or 6,000 feet stratigraphically below the Reeves horizon. The International Lead and Zinc mineralization is in a much higher horizon, the Metaline limestone.

Reeves McDonald Mine

The Reeves McDonald is the largest mine in the area immediately north of the Metaline district. It is located 3 miles northwest of Nelway, the Canadian customs port, and about 1 mile east of the mouth of the Salmo River. Concentrates are trucked to the smelter at Trail via Salmo. Pend Oreille Mines and Metals Company with 1,389,000 of the issued 2,338,000 shares controls the company. The property consists of 64 crown-granted claims and fractions, a well constructed camp, and a new 1,000

ton mill which we have been informed is at present handling about 1,200 tons per day.

The general geology of the Reeves McDonald mine was described in Canadian Geological Survey Memoir 172 and the Pend Oreille geologists have mapped the mine in considerable detail. The mine geology is not available to us although we were taken through the mine and were most cordially received.

The Reeves McDonald is a consolidation of two properties, the Reeves (International group) and the McDonald (Rio Tinto group). The original McDonald group is situated just above the Pend Oreille River whereas the Reeves or International is located to the northeast on the ridge between the Salmo and Pend Oreille rivers.

The property is developed through several long tunnels. Principal access is through what is known as the River Level. It is located about 200 feet above the Pend Oreille River and totals about 5,000 feet of drifts and crosscuts. Ore is hauled from this level to the mill. Another tunnel known as the McDonald Adit lies about 400 feet west of the portal to the River Level and is not far vertically above the Pend Oreille River. The workings consist of a crosscut and a drift that total about 1,000 feet. The Reeves tunnel is about 4,000 feet northeast of the River Adit portal and vertically about 920 feet higher. The portal is on the west side of the saddle shown on the accompanying geologic map. The workings of the Reeves tunnel, which consists of a main westward trending Adit with numerous north and south crosscuts across the ore body, total about 3,000 feet. In 1950 ore was being mined from a glory hole

above the level. In 1949 a two-compartment raise was completed between the Reeves Level and the River Level and 5 sublevels were opened from the raise in the upper part of the mine.

Two tunnels in addition to those described above are located 3,000 to 4,000 feet east of the Reeves tunnel on the south slope of the Salmo River. They are known as the O'Donnel and Prospect tunnels. Both are accessible although water was backed up in the O'Donnel tunnel at the time of our visit. The O'Donnel tunnel has a total of about 1,000 feet of crosscut and drift workings. The Prospect tunnel is between 500 and 600 feet above the O'Donnel tunnel and east of it about 1,700 feet. It explores a higher limestone horizon, known as the Prospect limestone, than do the other workings described above.

The Reeves McDonald ore exposed in the Reeves McDonald and O'Donnel workings consists of zinc, lead and iron sulphides in streaks and disseminated through a limestone bed known as the Reeves limestone. The more common minerals are resin colored sphalerite, galena and pyrite. The limestone, except near ore has a very low magnesium content. In and close to ore it has been altered to dolomite. Both limestone and dolomite in most places have a banded, gneissic appearance and this banding closely parallels the attitude of the bedding planes. The strike and dip of the mineralization also closely follows the bedding although the rake of the ore appears to follow the plunge of the minor folding. Generally speaking the ore shoots strike east and west and dip 50°-70°S. The rake appears to be about 60°W. Several ore shoots have been exposed. The principal

one is about 350 feet long and is said to average 10 to 40 feet in thickness; the average is about 30 feet. According to present plans widths less than 12 feet will not be mined. This shoot has a length down dip of about 700 feet. Several other smaller shoots have also been partly explored by trenching, underground work and diamond drilling. One occurs almost at river level about 1,100 feet west of the McDonald Adit close to the more easterly branch of the fault shown on the accompanying geologic map. Where exposed in cuts the mineralization is almost all oxidized but some residual galena can be seen. It is reported that diamond drilling intersected oxidized material 150 feet below the Pend Oreille River near the fault. Some pyrrhotite, sphalerite and galena were found in the O'Donnel tunnel. The mineralization is reported to be low grade and irregular. Some mineralization is also reported in the Prospect tunnel but the widths are narrow.

The ore is cut by basic dikes and offset by several post-mineral faults. They strike west of north and dip generally 55°-60°E.

The grade of the principal ore body is reported to be 6% zinc, 1% lead and 0.4 oz. of silver per ton. The ore is also reported to have an appreciable cadmium content. A reserve of 3 million tons is claimed. According to the management an output of 18 tons per man was expected and a mining cost of about $1.50 per ton anticipated.

Red Bird Mine

The Red Bird mine is located south of the Pend Oreille River,

about one mile airline from the Reeves McDonald mine. The property consists of 16 claims and fractions. It is owned by the Hecla Mining Company of Wallace, Idaho. The property was formerly reached by 2 miles of trail from the suspension bridge which crossed the Pend Oreille River about a mile below the junction with the Salmo River. This bridge is no longer safe and access now is devious and long. From the Reeves McDonald mine it is necessary to drive 18 miles over a narrow winding road to the Waneta bridge and an additional 14 miles over very poor and in places dangerous road to a junction with a trail. The trail distance to the mine from the end of the useable road is about 3 miles and the difference in elevation is about 800 feet. The suspension bridge could be repaired for foot travel but the cost would be considerable.

The Redbird is developed by two tunnels a short shaft and several diamond drill holes. The mine openings are no longer accessible but old reports state that the lower Adit is about 1,200 feet long and the upper one is said to have been short. The shaft is reported to have been 31 feet deep. The mineralization at the Red Bird is in the offset segment of the Reeves limestone. About 200 feet south of the lower portal the limestone passes beneath black slate believed to be an overthrust block of Ledbetter. In the vicinity of the Red Bird mine the Reeves limestone appears to be abnormally thick but this is quite certainly due to some local folding as shown by the variations in strike and dip. The limestone is identical in appearance with that at the Reeves McDonald mine.

Very little information is available to us on the nature of the mineralization at the Red Bird although a report by J. F. Walker indicates

that the mineralization was in the form of a disseminated replacement of the limestone by iron sulphides, sphalerite and galena. Oxidation near the surface was complete yielding brown iron oxides and secondary zinc and lead minerals. Mr. Walker reports the silver content as being low.

International Lead and Iron

The International Lead and Iron property consisting of 18 claims and fractions is located east of the Pend Oreille River immediately south of the Reeves McDonald ground. Henry H. Shallenberger is said to be the owner.

The principal workings are located not far north of the International Boundary and close to the east bank of the Pend Oreille River. The rocks in the vicinity are greatly shattered due to extensive faulting as shown on the plan map. We did not visit the underground workings hence the following description is taken from a report by J. F. Walker.

". . .The workings are in three localities, namely, on the east side of Pend-d'Oreille River close to the International Boundary, on Lomond Creek three-quarters of a mile to the east, and half a mile north of those on Lomond Creek. All the workings are close to the Pend-d'Oreille road. There is a difference of 1,200 feet in elevation between the workings on the river bank and those on the hill-side north of the road, but the relief is quite gentle and outcrops are not abundant.

"Mineralization consists chiefly of irregular replacements

of limestone by brown iron oxides, some of which is hard, brown limonite and some is earthy material. The presence in the oxidized material of fragments of galena strongly suggests that the iron oxides were produced by the oxidation of iron sulphides. Probably some enrichment of the iron has taken place.

"On the east bank of Pend-d'Oreille River, 400 feet north of the International Boundary, an adit has been driven 48 feet easterly in limestone. Twenty-five feet from the portal there is a 7-foot winze and a raise to the surface 15 feet above. The limestone in which this adit is driven is the highest member of the Pend-d'Oreille (Metaline) series known within the area and is of grey and black varieties, the latter being further distinguished by spots of white calcite. The limestone strikes about 65 degrees and dips 80 degrees southeast. A breadth of about one foot of brown iron oxide is exposed in the face of the adit dipping westerly. In the winze the iron oxide is about 7 feet thick, and toward the portal most of the working is in brown oxides. Some of the oxide is hard, layered, pipe-like masses of limonite. It appears to be a replacement of the limestone due to near surface phenomena, the pipe-like masses suggesting deposition along solution channels. The source of the iron is not apparent.

"On the same side of the Pend-d'Oreille, and 1,700 to 1,900 feet north of the International Boundary, are three prospect holes in graphitic phyllites. A little quartz following the bedding is exposed in the two more northerly holes, and in one of these holes there are traces of copper stain. A fourth prospect hole, in similar rock, half a mile north

of the International Boundary, and also in graphitic phyllite, is barren. The objective sought in these prospect holes is not evident unless it was to test the small stringers of quartz which are obviously of no importance.

"The next group of workings are on Lomond Creek half a mile east of those just described. There are two prospect adits on the north side of the creek and four on the south, all in the highest limestone member of the Pend-d'Oreille series. They are spread over a distance of 1,000 feet along the strike, and, with one exception, are accessible. The limestone strikes almost due east and the dip is to the south at angles of 25 degrees and higher. All the workings show irregular replacements of limestone by brown iron oxides that vary from an earthy form to hard, brown limonite. The extent of the replacement varies from limestone with only small amounts of brown iron oxides to completely replaced limestone. The bodies of partly or wholly replaced limestone follow the bedding in a general way. The greatest width, including all degrees of replacement, is about 50 feet. Some galena in oxidized material is lying about the most easterly workings, and has evidently come out of the oxidized mineralization. Surface stripping on the outcrops adjacent to the workings on both sides of the creek exposes conditions like those disclosed by the underground workings.

"The iron oxides are the result of oxidation of iron sulphides that had replaced the limestone. Probably some enrichment in the iron has taken place. To what depth oxidation may extend is unknown, but the presence of some galena suggests that the depth is not great. The oxidized material is reported to be poor in lead and zinc, which suggests that with depth the material will change to an iron sulphide replacement with,

possibly, some sphalerite and less galena.

"The third group of workings, on the hill-side a mile north of those on Lomond Creek, expose conditions similar to those just described. The dip of the limestone conforms in a general way with the slope of the hill-side. It is possible that a greater depth of iron oxides may exist on this hill-side, which is 600 feet higher than the Lomond Creek workings at creek level.

"The deposits are of value only as sources of limonitic iron ore, but as yet no considerable quantity of ore is in sight. The deposits investigated by the lower workings do not afford indications of much depth to the limonitic ore. The hill-side prospect is more favourable in this respect."

Michaely Prospect

The Michaely prospect is located a little over two miles airline northeast of the Reeves McDonald mine. It is reached by a branch road that leaves the main "river road" near the mouth of the Salmo River. This branch road is narrow and crooked and is passable by car only to a sawmill which is located about 2 miles from the river road. From the sawmill to the mine there is an additional mile of steep narrow road which cannot be traversed with an ordinary car although a jeep or truck can travel it.

The workings of the Michaely property are probably on open ground as the Government office at Nelson reported the claims expired in 1950. Furthermore the workings are not far from the northwest boundary of the Gray

Rock group and on dip the Michaely ore would pass into the Gray Rock at a fairly shallow depth. The Michaely workings consist of a number of shallow cuts and short tunnels. Most of the mining was done from two tunnels vertically about 50 feet apart and from a stope that extended from the lower level to the surface. The pitch length of the stope is about 90 feet long and its horizontal length about 25 feet. The width of the stope ranges from 3 to 15 feet but averages less than 10 feet. It is conceivable that the property may have produced 2,000 tons of ore.

The ore at the Michaely prospect occurs in a bed of limestone that is underlain and overlain by dark gray quartzitic schist. The ore has been found in the limestone near its lower contact. Some high grade zinc ore with some lead was left in the hanging wall of the stope at the surface and about 2 feet of mixed zinc-lead ore occurs along the lower tunnel. Both bodies are less than 30 feet long. The principal minerals are high-iron sphalerite and galena. Very little oxidation occurs even at the surface.

The ore-bearing limestone bed can be traced on the surface several hundred feet northeast and southwest of the main workings and several trenches cross it, but to date the only known commercial ore is restricted to the described shoot. A very small tonnage of good grade zinc ore could be mined from the property but a large tonnage does not appear likely.

Caviar Prospect

Two showings of zinc ore have been found on the Caviar No. 1 claim. One is on the west side of and immediately above Russian Creek and about 1,000 feet north of the International boundary, the other is about 1,200 feet N 55° W from boundary monument 186. It is about 600 feet directly north of the boundary line.

The more westerly deposit was found by Wayne O. McKenzie while he was making a reconnaissance of the Russian Creek area in the fall of 1949. The other showing was found by Val Lehto in the same fall while staking claims.

The showing along Russian Creek is most readily reached from the flat divide at the west end of the boundary No. 9 claim by walking down the more easterly branch of the creek. The other showing can be reached by walking northward on the flat ridge top from the Russian Creek road. Neither outcrop is easy to reach because of brush or steep topography.

The Russian Creek showing, generally referred to as the Caviar, crops out in a bluff-like exposure. Disseminations of resin-colored sphalerite occur in banded limestone. The sphalerite tends also to occur in bands. Some oxidation is present but it is only a few inches or a few feet thick. No development work has been done on the deposit, hence very little is known regarding its dimensions or average grade. Some samples contained enough zinc to be of ore grade providing a large tonnage is available. The mineralized limestone belongs to the Metaline formation

and is thought to represent one of the lower horizons. To the west and just above the limestone outcrop black slates with some interbedded black limy shales occur. The slates which are believed to belong to the Ledbetter formation are thought to be in fault contact with the ore bearing limestones as the large fault exposed along the Pend Oreille River projects to about this position on Russian Creek and on dip the Ledbetter rocks would project into the limestones. The displacement of this fault is unknown but is believed to be large. Bulldozing and some diamond drilling are necessary to accurately locate the position of the fault and the extent of the displacement. The showing in the outcrop warrants some exploration. The exploration should be pointed toward locating the fault as well as investigating the extent of the mineralization.

The extent of the mineralization near the top of the flat hill northwest of boundary monument 186 is unknown. The top of the hill is gravel covered and much gravel has migrated down the hill slope and trenching is necessary to expose bedrock. Oxidized material associated with vuggy quartz can be seen in nearly white crystalline limestone in a small hole about 12 inches deep and 3 feet in diameter. A sample of the oxidized material assayed 23% zinc. The mineralization is spotty but appears to warrant more extensive trenching.

Emerald Mine

A short visit was made to the Emerald mine which is located about 9 miles airline northeast of the Reeves McDonald mine. It lies between

Sheep Creek and Lost Creek on a high terrace at an altitude of about 4,500 feet which is over 2,300 feet above the mill on the Salmo River. The mine is reached by a steep, narrow road that leaves the main highway near the mouth of Sheep Creek. A new road down Lime Creek was under construction at the time of our visit on July 10, 1950. An aerial tram carries the ore from the mine to the mill.

The Emerald mine is now owned by Canadian Exploration Limited, a subsidiary of Placer Development, Ltd. Mr. Charles A. Banks of Vancouver is president and Mr. R. E. Legg was manager at the time of our visit but we have recently heard that Mr. Harold Lakes has been appointed in this capacity.

During World War II the Emerald property was operated as a tungsten mine by Wartime Metals Corporation, a Canadian government agency. It came into production just before the close of the War. A 250-300 ton mill was completed shortly before the war ended and according to Mr. Lakes $90,000 worth of tungsten was sold in one month before the shutdown. In 1947 Canadian Exploration Ltd. purchased the property from Canadian War Assets Corporation for $950,000 of which $50,000 was paid in cash. The remainder was to be paid out of 50% of net profits from operations. Canadian Exploration first worked the property for tungsten but in 1948 decided to operate the lead-zinc deposit known as the Jersey ore body that had been partly explored by diamond drilling. New equipment was installed in the mill and an open pit operation was started. In 1950 we understood the milling capacity was 500 tons. For the year ending November 30, 1949, it is reported that the value of tungsten concentrates as $230,476 and

lead and zinc concentrates was $1,574,815. The net profit for the year is reported at $136,457.

The tungsten ore body was mined in a small open cut and through underground workings. We were not shown the underground workings but where exposed in the open cut the tungsten occurred as scheelite in the usual appearing garnet-diopside type of contact rock. The altered rock was in limestone close to a granitic contact.

The zinc-lead ore body was being mined from an open cut but we were informed that similar ore is developed by underground workings. We were not taken into the underground mine but were shown around the open pit. Where we saw it, the ore occurred as replacements in nearly flat limestone beds and appeared to be in big lenses. The limestone is almost identical in appearance with the banded gneissic appearing limestone at the Reeves McDonald, and is also underlain by quartzites as at the Reeves McDonald. A dark colored basic dike cuts the sulphide ore in the pit. Mr. Lakes said that up to the time of our visit 70,000 tons had been taken from the pit that averaged about 6% Zn, 3% Pb and 2 oz. Ag. He also said that the pit would eventually produce 85,000 tons. As drilled, the ore is about 2% (combined Zn and Pb) higher grade than it mines out in the pit. Mr. Lakes says that about 1,100,000 tons are indicated by diamond drilling and that further drilling in an unprospected section could increase this tonnage to over 4,000,000 tons.

Respectfully submitted,

P. J. Shenon

R. P. Full

STATE OF IDAHO)
) ss.
County of Shoshone)

HENRY L. DAY, being first duly sworn on oath, deposes and says:

That affiant is President of DIEM MINES, LIMITED;

The the following expenditures were made for a geological survey of the CAVIAR, VAL and LARCH group of mining claims and adjoining ground:

ACTUAL EXPENDITURES:

NAME	DAYS WORKED	REMUNERATION	EXPENSES, MATERIALS, or SUPPLIES	TOTAL EXPENDITURES
P. J. Shenon	41)			
R. P. Full	45)	$ 5,000.00	$ 1,519.33	$ 6,519.33
W. O. MacKenzie	56	937.04	60.00	997.04
Thon T. Gin	63	517.20	21.20	538.40
TOTAL	205	$ 6,454.24	$ 1,600.53	$ 8,054.77

EXPENDITURES CLAIMED:

On CAVIAR, VAL, and LARCH mining claims:

NAME	DAYS WORKED	RATE PER DAY	REMUNERATION	ADDITIONAL EXPENSES	TOTAL
P. J. Shenon	11)				
R. P. Full	12)	$35.00	$ 805.00	$ 406.13	$ 1,211.13
W. O. MacKenzie	15	$15.00	225.00	16.05	241.05
Thon T. Gin	15	$ 8.21	123.15	5.05	128.20
			$1,153.15	$ 427.23	$ 1,580.38

EXPENDITURES CLAIMED:

On adjoining ground (necessary to complete geological picture):

NAME	DAYS WORKED	RATE PER DAY	REMUNERATION	ADDITIONAL EXPENSES	TOTAL
P. J. Shenon R. P. Full	30) 33)	$ 35.00	$ 2,205.00	$ 1,113.20	$ 3,318.20
W. O. MacKenzie	41	15.00	615.00	43.95	658.95
Thon T. Gin	48	8.21	394.05	16.15	410.20
			$ 3,214.05	$ 1,173.30	$ 4,387.35
TOTALS			$ 4,367.20	$ 1,600.53	$ 5,967.73

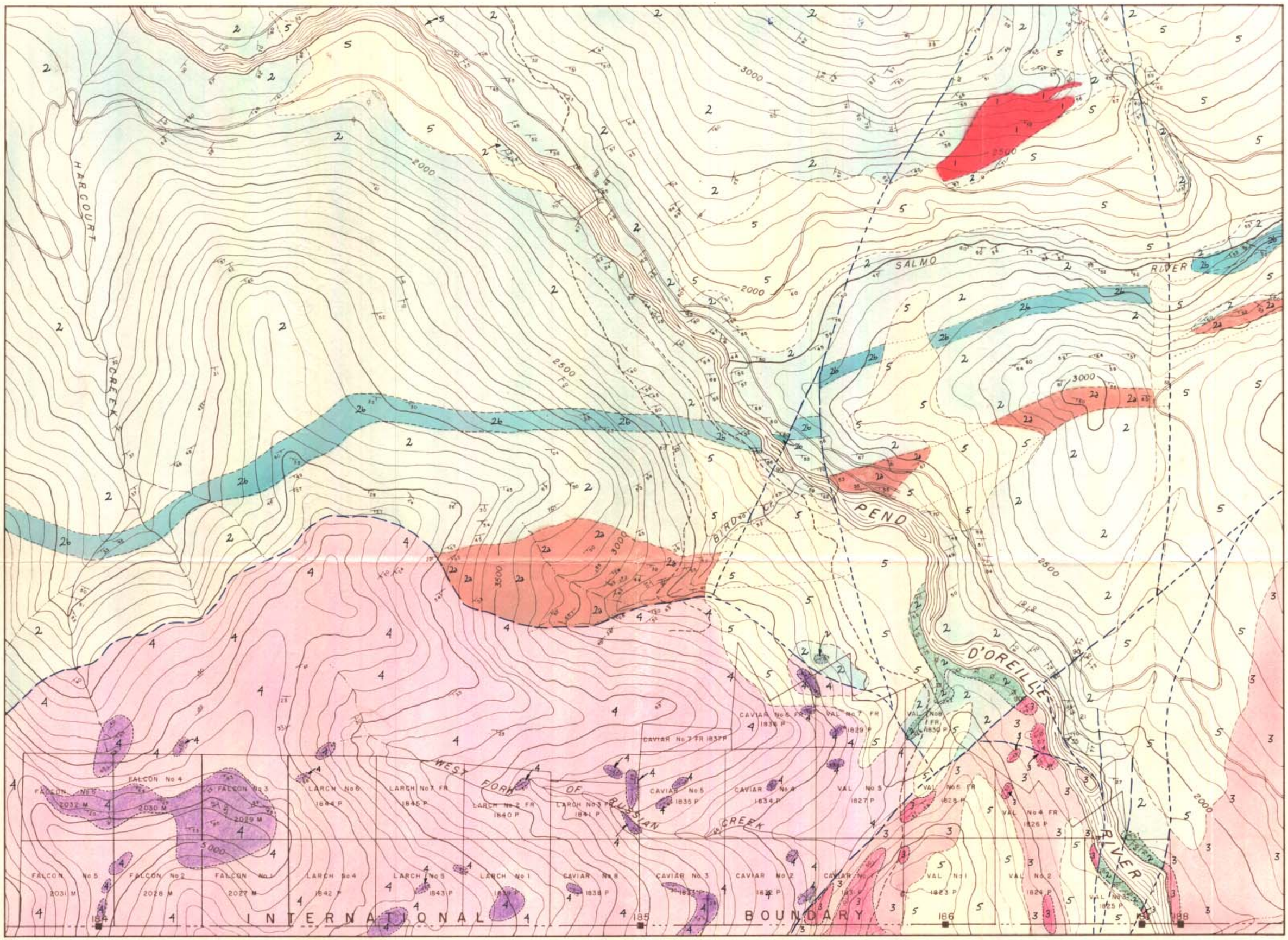
Henry L. Day.

Subscribed and sworn to before me, the undersigned, this 27th day of January, 1951.

Kathryn A. Eichwald

Notary Public in and for the State of Idaho, residing at Wallace.

My Commission expires March 10, 1954.



Topography from enlargement of Salmo Sheet, Kootenay District British Columbia.

Geology by P.J. Shenon, R.P. Fyll, W.O. MacKenzie, T.T. Gin.

GEOLOGIC MAP

RUSSIAN CREEK — REEVES MACDONALD AREA

KOOTENAY DISTRICT, BRITISH COLUMBIA

SCALE 1" = 1000 CONTOUR INTERVAL 100'

NOVEMBER 1950

5 Recent and Quaternary Sediments

4 Ledbetter Slate

3 Metaline Limestone

2 Reeves ls. / Footwall ls. — Maitlen Phyllite (?)

1 Granite

Fault

Concealed Fault

Formational Contact

Concealed Contact

Strike and Dip of Beds

Strike of Vertical Beds

N

REPORT 51
MAP 1