

THE GEOLOGY OF THE AMCO GROUP
SHEEP CREEK, BRITISH COLUMBIA

82

by

W. W. MOORHOUSE

Toronto, Ontario

November 11, 1952

LATITUDE 49° LONGITUDE 117°

SOUTHEAST QUADRANT

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DATES OF WORK

- C. P. Jenney - Amco Claims 1, 2 Fr., 3 Fr., 4,
5, 6, 16 Fr.
July 1st - July 20th, 1952.
- Amco Claims 7, 8, 9, 10, 11, 12,
13, 15 Fr.
July 20th - August 6th, 1952.
- D. P. Wheeler - Amco Claims 32, 34
August 6th - August 12th, 1952.
- S. S. Alderman - Amco Claims 35, 36, 37 Fr., 38 Fr.,
39 Fr., 40 Fr., 41 Fr., 42 Fr.
August 26th - September 13th, 1952.
- Amco Claim 18 Fr.
September 13th - September 16th, 1952.
- Amco Claim 23 Fr.
September 16th - September 19th, 1952.

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Geological map, 1" = 300'

SHEEP CREEK, BRITISH COLUMBIAINTRODUCTION

The Amco Group comprises twenty-seven claims lying on the south side of Sheep Creek, about six miles east of the Nelway-Nelson Highway. These claims are bounded on the east by the property of Sheep Creek Gold Mines, Ltd.; on the southeast by the Summit and adjoining claims; on the south by the Schorl Group; and on the west by the Cat and Dog Group and Victory Tungsten claims.

METHOD OF SURVEY

The information on which this report and the accompanying map are based was obtained during the summer of 1952. The claims were mapped by means of tape and compass surveys spaced at intervals of approximately 150 feet. These traverses were tied into the surveyed boundaries of the claims. Elevations along the claims lines were supplied by the surveyor, and approximate elevations along the traverse lines were determined using the Brunton as a level. The traverses were supplemented by plane-table surveys of the Ore Hill road and limited plane-table surveys where the bush had been burned off.

GENERAL GEOLOGY AND STRATIGRAPHY

The rocks exposed on the claims comprise sediments classified by Walker (GSC Memoir 148) as the Pend Oreille series and by Little (GSC Paper 50-19) as the Laib Group (equivalent to the Maitlen phyllite of Park and Cannon). These sediments have been cut by granite of the Sheep Creek stock and by a few lamprophyre dikes. The sediments are a very complex series of metamorphosed argillites, minor fine grained quartzites or cherts, limestones, dolomites, schists, and various intermediate types. These formations are entirely without recognizable

fossils. They are completely lacking in primary structures usable for top determinations. Consequently structural interpretation must be based entirely on the evidence of dragfolds and bedding-cleavage relations. In view of the obviously complex tectonic history of the rocks, such criteria are unreliable. This uncertainty, together with the wide variations of thickness of individual units, due to complex folding and flow, renders the stratigraphy as outlined below strictly tentative. Since operating mines in the area, with underground and drilling information to draw on, as well as surface mapping extending over several years, find themselves in a similar state of uncertainty, the above observations should occasion little surprise.

<u>Unit</u>	<u>Lithology</u>	<u>Thickness</u>
"J"	Black argillite	?
"I"	Sheared grey dolomite	? - 600'
"H"	Grey to black argillaceous limestone	80 - 350'
"G"	Dark grey dolomite	? - 130'
"F"	Black argillite	? - 800'
"E"	Dolomite, hornfels, argillite, limestone	300'
"D"	Limestone, coarse grained, massive to thin bedded	600 - 800'
"C"	Argillite, schistose argillite, recrystallized chert, limestone, hornfels	600'
"B"	* Limestone, argillaceous	0 - 150'
	Biotite schist	350 - 650'
	Impure limestone	? - 40'
	Biotite schist	? - 130'
	Limestone-dolomite breccia	? - 140'
	Schistose purple argillite	? - 110'
"A"	Crystalline limestone	? - 100'
	Schist and quartzite	(Not exposed on
	Reno quartzite	(Amco group

* Probably repetition of lower bed by folding

LITHOLOGYUNIT "A"

Unit "A", up to 350' thick, is primarily calcareous. It comprises two distinct limestone horizons. The basal limestone directly overlies quartzites which are included with the Rene formation. It is a medium to coarse grained limestone, rather sheared and streaky in appearance, due to layers or films of argillaceous material. White or creamy white, with purplish argillaceous streaks, it tends to weather to a yellowish, slightly rusty colour. It is well exposed on the Standard and Summit claims, but is not known to outcrop on the Amco claims. The same is true of the other members of this unit.

Overlying the limestone is a variable thickness of sheared, purplish argillite, up to 110' in thickness.

This in turn is overlain by a band of limestone of variable character. Most characteristic is a breccia of dolomite fragments enclosed in a matrix of nearly clear calcite. Coarsely crystalline pure limestones and finer grained argillaceous limestones also appear to occur in this band.

UNIT "B"

Unit "B" is a distinctive biotite schist, intensely contorted and sheared. Its most characteristic feature is the presence of abundant oval-shaped white crystals, probably altered andalusite or cordierite. It is evidently a rather strongly metamorphosed argillaceous rock. In fact, its boundary with Unit "C" is an indefinite one, the argillaceous members of "C" being altered to the same type of rock locally. Infolded (or possibly interbedded with "B") are two narrow bands of argillaceous limestone.

Unit "B" is not known to outcrop on the Amco group, although very similar rocks of Unit "C" are exposed a short distance above the Ore Hill road, on 16 Fraction.

UNIT "C"

Unit "C" is a rather complex and heterogeneous series of rocks, which appear to have been intensely deformed and somewhat metamorphosed. As noted above they include outcrops of biotite schist resembling unit "B" and other spotted schists of somewhat less highly altered nature. Also included are lustrous mica and mica-chlorite schists, purplish argillites, and thin lenses of sooty, black, limestone, generally not more than 3-5 feet thick. A most characteristic member of this unit is a quartzitic rock, probably a recrystallized chert, with which are interbedded $\frac{1}{2}$ -2" streaks and lenses of limestone. In many outcrops, the carbonate-rich and argillaceous interbeds of the chert or quartzite have been altered to hornfels, yielding a unique purple-green banded hornfels. The rocks of this unit are well exposed in the southeast corner of Amco 35 and in Amco 38 Fraction. Cleavage-bedding relationships are well shown by many outcrops, and indicate a syncline to the west, and a uniform plunge to the north.

UNIT "D"

Unit "D" is composed entirely of limestone, which is variable in grain, medium-coarse, and is exposed over a horizontal width of 600-800'. It seems fairly certain that this is not the true width of the limestone, as there is good evidence in the distribution of dips, etc., that a number of minor fold axes are located in this belt. Exact estimates of the true thickness cannot be made, but it is probably between 100 and 200 feet.

At the base of this unit there is a well-developed facies consisting of interbedded limestone and argillaceous or cherty layers, in which the limestone weathers out, giving the outcrop a ridged or corrugated appearance. This facies may be up to 100' thick. The remainder of this unit is a remarkably pure limestone, with only local development of very thin streaks of argillaceous material. The lithology of this unit seems sufficiently distinctive that there seems little possibility that it represents a structural repetition of the limestones of Unit "A". This unit outcrops in abundance in Amco 35, 38 Fraction, 37 Fraction and 16 Fraction.

UNIT "E"

Unit "E" is strongly reminiscent of Unit "C", but differs from it in two respects, first, in the small amount of argillite present, and second, in the characteristic presence of dark grey, fine grained dolomite, and various tactites derived from the dolomite. Also, the purple-green hornfels, resulting from the metamorphism of dolomitic argillites, is represented. Members of this unit have been mapped in Amco 35, but they are especially well exposed along the Ore Hill road in Amco 4 and 16 Fraction. Dolomite, limestone and cherty or quartzitic rocks exposed at the boundary between 37 Fraction and 15 Fraction are also probably members of this unit.

UNIT "F"

Although not recognized in the eastern claims of the group, along Billings Creek, a series of black argillites outcropping on the eastern slope of Bennett Creek appears to occupy about the same stratigraphic position as Unit "E". These argillites differ from any so far described in being black and carbonaceous. Some of them are very

siliceous and cherty. Carbonate layers are present, but are only a few feet thick and are relatively rare. In some outcrops, the argillite appears to have been highly granitized. It loses its black colour, becoming grey to almost white. It also appears to have been porphyritized along one horizon, for a porphyry sill 5-10 feet thick has indefinite gradational borders with silicified argillite. Throughout the argillite is intensely contorted and deformed. Many minor fold axes may be recognized in any traverse across the strike. The relations of this unit to the others which presumably underly it or are equivalent to it, are unknown, due to the persistent belt of drift which separates Units "G" and "E".

UNIT "G"

Unit "G" is a fairly persistent layer of rather massive, dark grey, argillaceous dolomite. This dolomite is up to 130 feet thick. It is silicated to a varying degree. A similar massive dark grey dolomite outcrops along the Ore Hill road in Amco #4.

UNIT "H"

Unit "H" appears to overly unit "F" conformably. It is a strongly sheared, argillaceous, dark grey limestone, whose exposed thickness varies from 80-350'. There are some layers of black argillite in this unit. This unit outcrops on Amco 18 Fraction and on the west side of Billings Creek on Amco #4.

UNIT "I"

Overlying Unit "H" is unit "I". This is perhaps the most distinctive stratigraphic unit in the group of claims. It is not known to occur anywhere else in the Salmo area outside the Sheep Creek-Reno belt. The unit is composed almost entirely of dolomite, generally grey

in colour and in most cases more or less sheared. It is locally interbedded with thin beds of calcareous dolomite and limestone, argillite, etc., and on claims Amco 5 & 8, interbedded argillaceous and quartzitic material make up a section apparently only a few feet thick which has been displaced by a minor fault.

The most characteristic feature of this dolomite unit is the widespread occurrence of a breccia, consisting of angular fragments of light coloured dolomite in a dark coloured dolomite matrix. The fragments are often obviously slab-like segments of thin dolomite beds, which in some cases have been but little removed from their original attitude. It is clear from the mode of occurrence, the interbedding with thin bedded unbrecciated dolomites, and the widespread distribution that these breccias are sedimentary and not structural in origin. As noted above, this intraformational breccia is, as far as is known, entirely unique. No other dolomites were encountered by the writer, or have been reported by others working in the area (Little, Fyles, and mine geologists from both south and north of the international border) which are comparable in detail with these unusual rocks.

The dolomites are silicated and silicified to varying degrees. Some beds, only a few feet thick, have been metamorphosed to tactites or hornfelses over considerable distances. It is a peculiar fact that even where silicates such as tremolite are fairly abundant, there has been very little of the dedolomitization, which one is accustomed to find in highly silicated rocks from other areas, e.g. the Grenville carbonate rocks of Ontario and Quebec. In Amco 6, the highest point of the ridge between Bennett and Billings Creek,

there is an extensive body of coarse, pegmatitic-looking quartz, with abundant white lime-magnesia silicates (tremolite and diopside predominating). This body is approximately 50-60' wide and about 160' long. Its thickness is unknown, but must be at least 30'. North of this body, glassy quartz and silicified zones extend for some distance.

The principal outcrops of the dolomite occur on Amco claims #2, 3, 5, 6, and 8. Similar outcrops are also exposed on Amco #1, #4, and 16 Fraction, near the Ore Hill road. Here, however, they are intimately associated with argillites, banded hornfelses and limestones, and it is therefore doubtful if they represent the same unit as "I". They are provisionally correlated with unit "E". Traces of the intraformational breccia are visible in some outcrops, but in general these dolomites are more massive and somewhat darker in colour than those of unit "I".

UNIT "J"

There are two small exposures of argillite, one on the boundary between Amco #5 and Amco #2, and the other just north of the quartz knob described above, in Amco #6. They are intensely sheared, brown-black in colour, and rusty due to the presence of iron sulphides. As a result of the latter characteristic, a shaft, of unknown depth, was sunk by early prospectors in this area. The shaft is located about 100' north of the north boundary of Amco #5. These argillites are provisionally assigned to unit "J", and are considered to overly unit "I", the dolomite, although relations are obscured by shearing and possible faulting.

INTRUSIVE ROCKS

The sediments described in the preceding pages are cut by granitic rocks of the Sheep Creek stock. In Amco #2 Fraction, #3, and #5 the granite is in contact with dolomite of unit "I" and argillite of unit "J". In Amco #32 it is in contact with argillite of unit "F". Although there is local silicification of the dolomite, and local development of skarn along the contact, in general the lack of metamorphism of the sediments near the contact is quite surprising. Fragments of dolomite have been observed completely enclosed within the granite, apparently unaffected by silicification. The argillites in Amco #32 have been brecciated and invaded by quartz, but otherwise do not appear to have been significantly altered. The granite contact in the northern part of the group is extremely irregular. Near the contact the granite is quite fine grained and very leucocratic. It becomes much coarser grained and considerably darker, due to the appearance of biotite, as one proceeds into the granite. On the north boundary of Amco #5 and near the east boundary of the same claim, the argillite and dolomite respectively are cut by dikes of fine-grained, aplitic, leucocratic granite from 5 to 30 feet wide. No particular metamorphism was apparent along the contact of these dikes. Pegmatitic dikes were observed cutting the granite in the northwest corner of Amco #5.

In addition to the granite, which is by far the most abundant intrusive rock, a quartz porphyry sill was observed within the argillites, and grading into them, on the east slope of Bennet Creek. One or two porphyry dikes were also observed in the same area. Lamprophyres are not abundant, but one was noted cutting argillaceous dolomites and limestones along the Ore Hill road, in Amco #4.

STRUCTURAL GEOLOGY

The Amco group is located just west of the "Gold Lode Anticline" as mapped by Matthews and others. This structure, located on the west side of the major Sheep Creek anticline, brings to the surface the Reno quartzites. Since this structure is overturned to the west, the lower units in the succession on Amco ground dip to the east at angles ranging from 35° to vertical. The strike is uniformly a few degrees east of north. This attitude is shared rather generally by all outcrops in the eastern half of the Amco group. The strike is locally modified by dragfolds and subsidiary folds, such as those indicated by the distribution of outcrops and strikes in Amco Fraction 16 and #1 and #4. Apart from minor structures of this type, there seems no compelling reason for considering the structure as other than an overturned conformable sequence of units, facing uniformly to the west.

West of Billings Creek there is a profound change in the structure. The dolomite of unit "H", together with units "F" and "G", strike generally in an east-west direction, and in general have a gentle dip to the north of $0 - 35^{\circ}$. Near the contact with the granite, in the north part of Amco #5, however, the dip steepens progressively, to $60 - 70^{\circ}$, although the strike remains roughly east west. The argillite outcropping below and west of the dolomite mass in general shares the same attitude, but the strike and dip become so irregular due to minor folds that generalization is difficult. The reason for this change in structure is not obvious. It would be natural to assume the existence of a major fault between these two types of structure. While faults have been assumed in such situations with much less reason than in this case, no clear-cut evidence was found in the field to justify such a theory.

Neither heavy shear-zones in this direction, nor zones of structural breccia (roughly parallel the strike) were observed. The Queen Fault, mentioned later in this section, strikes in approximately the right direction, but the movement on this fault is not in the sense which would give the downthrow side to the west of the fault, as would appear to be required here. A further argument which seems to militate against the presence of a fault is the observation that along the Ore Hill road, in Amco #4, the dips in argillaceous dolomites and limestones are much flatter than further east, suggesting a transition to the nearly horizontal attitude of the dolomite of unit "H". A more likely explanation than faulting is that the main dolomite area may represent a structurally highly competent formation of relatively small east-west extent, i.e. a relatively restricted facies of the argillite unit. Of course these two possibilities are not mutually exclusive, but the dominating factor in the development of this structural contrast appears to be the presence of this thick and massive dolomite unit, which probably pinches out to the east.

DRAGFOLDS, MINOR FOLDS AND CLEAVAGE

The larger-scale dragfolds, bedding-cleavage intersections, and most linear structures appear to plunge at relatively low angles (0-30°) to the north. This generalization does not hold for the argillites on the west side of the property. Here complex cross-folding locally gives very erratic values. Also crenulations in the biotite schist of unit "B" appear to plunge south at angles of 30-65°. In some outcrops of the biotite schist, however, the linear structure pitches north at low angles.

The above generalizations do not apply to the dragfolding of the main dolomite mass. Here the few dragfolds which are exposed have axes which strike roughly east-west and are within a few degrees of horizontal. These dragfolds appear to have been produced by a vigorous thrust from the north. Local occurrences of fracture cleavage in thin incompetent beds in this unit demand the same interpretation. This conclusion again emphasizes the structural singularity of this dolomite unit, when considered in the light of the very general north-northeast strike and westerly overturn of the Sheep Creek area as a whole.

Flow cleavage is very extensively developed in limestones, argillites, schists and some dolomites. Fracture cleavage is found in some hornfelsed argillites, interbedded limestones and cherty quartzites. East of Billings Creek and in claims 35, 38 fraction and adjoining claims, bedding-cleavage relations and dragfolding all indicate that tops face west. In other words, as noted on an earlier page, going west from the Gold Lode anticline (just east of the Amco group), the beds exposed are in simple stratigraphic sequence, with the exception of minor folds in unit B, C and D.

The main outcrop area of unit "H" is characterized by fairly general shearing, which appears to be generally parallel to the bedding. One or two cases of fracture cleavage at oblique angles to the bedding were noted in thin-bedded, argillaceous dolomite, as noted on P. 12.

FAULTING

Very little evidence of faulting was observed on the Amco group. Near the south boundary of Amco 5 and just south of the north boundary of Amco 8, a fault of small displacement has cut a thin zone of interbedded argillite and tactite, within the dolomite. The east side appears to have been dropped down compared with the west side. The Queen fault, described by McGuire (CMM Bull. 1942, P. 183) should

appear in the northeast corner of the group, but has not been recognized on surface. It is known from underground workings of the Queen mine. It is an east-dipping normal fault with a horizontal as well as vertical displacement, and hence does not harmonize with the general westerly overthrusting. A zone of brecciation and possible faulting occurs along the contact between granite and argillite in Amco 32. The sheared zone in the argillite strikes N 10° E and dips 60° E. A number of faults, of east to northeast strike, and small horizontal displacement, are exposed in workings on the Standard and Summit claims, but they have not been observed on Amco ground.

In conclusion, it is apparent from the preceding discussion that the structure of the Amco group is exceedingly complex and that it is not possible to construct a clear picture of the stratigraphy or fold pattern on the basis of information from the surface outcrops. The dominant features of the succession are the fairly definite demonstration of the presence of at least four bands of limestone, and two major dolomite zones, one of which is of great thickness. The position of the argillites on the west side of the Amco group is not clear.

The general structural pattern is one of steeply east-dipping beds in the eastern part of the group, changing to nearly horizontal in the center and west, a structure probably representing the flat west limb of a synclinal structure. The structure is much complicated by minor folding, dragfolding and shearing, but appears to have been subjected to only minor modification by faulting.

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DEPARTMENT OF GEOLOGICAL SCIENCES

TO WHOM IT MAY CONCERN:

This is to certify that I, the undersigned, am a practicing geologist, with the following qualifications:

Training:

Undergraduate: B.A., 1935, in Geology and Mineralogy, University of Toronto.

Graduate: M.A., 1936, University of Toronto, major in Economic Geology.

Ph.D., 1941, Columbia University, New York, major in Economic Geology and Petrology.

Experience:

From September 1940 to June 1943 and from September 1945 to the present time I have been engaged in active teaching at the University of Toronto. At present my work is principally in Petrology, Metamorphism, Sedimentary Petrology and Precambrian Geology. I have in the past taught courses in Economic Geology and General Geology.

As of now, I have spent 16 summers in field work, during 13 of which I have been in a position of responsibility. During 8½ summers I have been in charge of a field party for the Ontario Department of Mines, one summer has been spent in the service of the Quebec

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TORONTO 5, CANADA

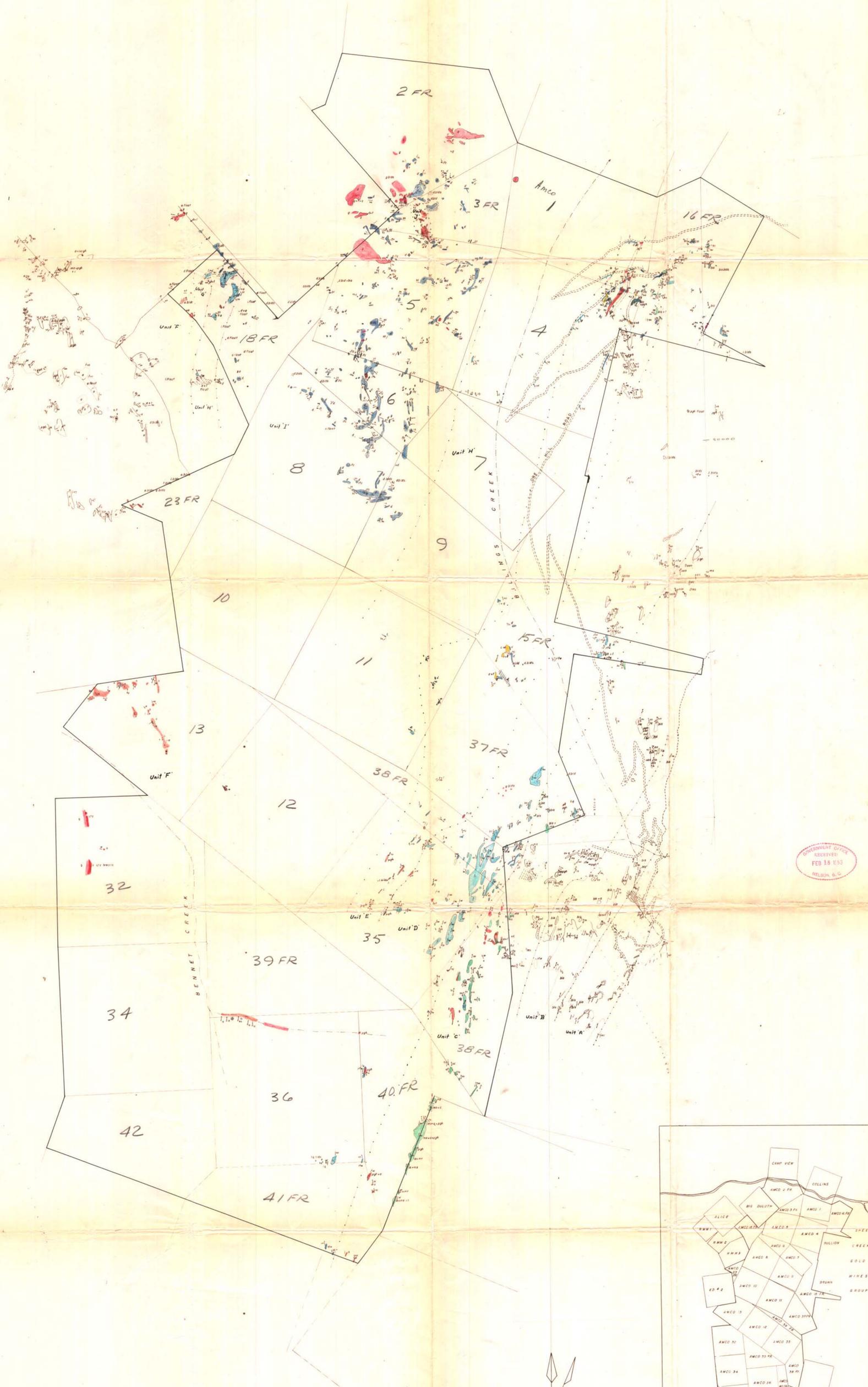
DEPARTMENT OF GEOLOGICAL SCIENCES

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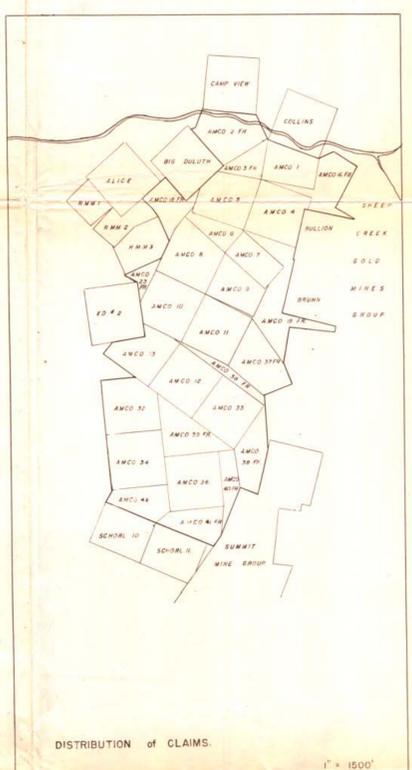
Department of Mines, and 3½ summers with the American Metal Company and its subsidiaries. Most of this time has been spent in mapping Precambrian (Timiskaming and Grenville) rocks, Devonian sediments (Great Slave Lake) and in the Salmo-Pend Oreille area. During this period I have had published 9 papers, of which 5 are government reports, and I have prepared many reports for private companies.

I trust that this supplies you with the information you require.

Signed: *W. W. Mooshouse*



GOVERNMENT OFFICE
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DISTRIBUTION OF CLAIMS.
1" = 1500'

LEGEND	
Structural Symbols	Rock Types
	Limestone
	Lolomite
	Argillite
	Hornfels
	Tactite
	Quartzite
	Chert or fine grained quartzite
	Schist
	Granite
	Aplite
	Lampyrine
	Skaen
	Quartz
	Purple green hornfels
	Limestone-dolomite breccia
	Schistose schist
	Intraformational conglomerate - dolomite only
	Mica schist
	Schistose argillite
	Quartzitic limestone
	Amphibolitic or pyroxenitic argillite
	Radiolar-fine weathering limestone
	Boulders

GEOLOGICAL MAP
AMCO GROUP
SHEEP CREEK, B.C.

Scale: 1" = 300'

Prof. W. W. Woodsworth, B.Sc., Ph.D.,
Geologist

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 42 MAP #1