

GEOLOGICAL REPORT

82K/6E

SNOWBALL GROUPS OF MINERAL CLAIMS

LARDEAU AREA, B. C.

4½ miles north of Poplar,  
50°N - 117°E (S.E. quadrant)

by W. H. Mathews, P. Eng.

July 27 to Sept. 15, 1953.

82K/6E

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## SNOWBALL PROPERTY - LARDEAU DISTRICT

### INTRODUCTION:

Investigations on the Snowball Group of Mineral claims were conducted with the prime object of determining the geological structure and the relationship of such structure to the known mineral occurrences. The results of these investigations are to a large extent incorporated in the accompanying maps and sections. The text that follows is intended only to call attention to the principal features of stratigraphy and structure and to add to the discussion of the mineralization given in an earlier report by R. C. Macdonald. (1952).

### SUMMARY AND CONCLUSIONS

The rocks outcropping within the limits of the Snowball group consist of sediments and pyroclastics (?) which have been intensely folded and metamorphosed to black and green schists, and more or less recrystallized limestones and arenaceous rocks. Notwithstanding the deformation and metamorphism it is apparent that marked lateral changes existed in the character of the original sediments, the proportion and coarseness of the clastic constituents increasing rapidly to the west or northwest. These facies changes together with the complex structure and, locally, scarcity in exposures makes it impossible to correlate beds and structures across the full width of the Snowball group.

The western part of the area, the east and west slopes of "Lardeau Ridge", is underlain by a succession of limestones, schists, and arenaceous rocks in the southwestern, overturned, limb of an anticline. Drag folds plunging northwestward, and two minor transverse faults, are the only known complications to the structure in this part. Mineral occurrences are sporadic and very limited in extent here, most of them (showings 1, 2, 3, 5, and 6) consisting of disseminated sphalerite and galena in certain favorable beds. One of the occurrences lies close to a sandstone-limestone contact (Showing 1S-1N), another close to a limy schist-green schist contact (Showing 5), but the others are not known to be situated near any such boundaries. Silicification of the limestones occurs locally in the most important showing (No. 1S and 1N) and here the distribution of the silicified lenses suggest a control by gently plunging drag folds. No significant tonnage of mineralized limestone has been seen in the western part of the area mapped.

In the eastern part of the area, on the east slope of "Middle Ridge", is exposed a thick succession of distinctly bedded green schist possibly of pyroclastic origin, overlying limestone or, farther west, a mixture of impure limestone and black schist. The continuity of the contact between the green schist above and the limestone and/or black schist below indicates that it marks a single stratigraphic horizon which has been markedly deformed into a series of tight northwesterly plunging folds. No faults have been detected

in this part. Mineralization here is almost entirely restricted to within a few feet of the green schist-limestone contact in lenses of (1) rusty weathering dolomite or (2) silicified limestone and/or schist. Some control of mineralization by folds is apparent in both types for many, though not all, of the lenses are localized along the crests of folds or the axes of drags. The size of the exposed mineralized lenses is small, and it is doubtful if any of them make up more than a few hundred tons. Additional exploration of the claims if planned, should be concentrated in the cluster of silicified and dolomitic lenses referred to as Showing No. 95. Dolomite lenses, a few containing siliceous zones, in the PhD and MS claims might also be examined with the object of determining grade and extent of sulfide mineralization. No other occurrences worthy of investigation are known in the eastern part of the area.

The central part of the area is marked by a structural discontinuity presumably a strike fault, extending southeasterly from the south summit of Mount Johnson. To the east of this break beds of the green schist-limestone-black schist succession mentioned above have an easterly dip; to the west beds of schist, limestone, and arenaceous rocks dip westerly. The known mineral deposits consist of a series of thick but short lenses of vein quartz in schist, localized close to the presumed strike fault. Galena is known in these quartz lenses, but neither

their grade nor extent justifies any further work. One showing of sphalerite and galena (No. 8) similar to those farther east (No. 98) lies on the contact of some small green schist lenses or infolds in limestone. Grade of mineralization is locally good but, because of the limited extent of the limestone-green schist contact here, no further work is justified unless the showings farther east prove to be potentially commercial.

### FIELD WORK

Field investigations were conducted during a 5 week period (July 29th - Sept. 2nd, 1953), with a party consisting of myself, Mr. E. Legg of Vancouver who served as the instrument man, and Mr. L. Greenlaw of Howser who served as rod man. By means of a stadia-plane table survey on the scale of 200 feet to the inch some 600 points were located, and marked by stakes, in an area of about 800 acres on the upper slopes of Johnson Mtn. These stakes were then used as control for the detailed mapping of geology and topography. The survey was carried down to the upper limit of timber, and locally into the forested slopes, but the delays and difficulties in conducting stadia surveys and in finding outcrops in dense timber precluded the mapping of any large areas below the 6,000 foot level. In a few critical areas chain and compass traverses provided control where stadia plane table surveys would be unduly difficult.

The south summit of Johnson Mountain was located, relative to triangulation stations adjacent to Lardeau Valley (as shown on the Lardeau sheet, B. C. Dept. of Lands, map 4F, 1947), by means of the three point method. Vertical angles on 3 nearby surveyed points were used to ascertain the elevation of the south summit, and the observations (on Meadow Mtn., the 7072 foot summit of Howser Ridge, and an unnamed peak, el. 7900 ft., north of Hope Creek) yielded figures of 7601, 7596 and 7604 feet for the ground elevation. Datum was therefore established

at this point using a weighted mean of 7602 feet above sea level. Orientation of the plane table was established at the same place by means of a sight on Meadow Mountain, using the Lardeau map to determine the direction of astronomic north. Magnetic declination was found to approximate  $25\frac{1}{2}^{\circ}$ .

## GEOLOGY

### Stratigraphy

Complex structure, poor exposures in a critical locality, and rapid facies changes made it impossible to establish a single stratigraphic succession for the rocks of the entire area mapped. Instead it was found possible only to recognize local successions, notably one for 'Lardeau Ridge' on the west, a second for the crest and east slope of 'Middle Ridge', on the east, and a third for the west slope of 'Middle Ridge' in the center.

The rocks of Lardeau ridge are apparently all part of the northeastern limb of major syncline, the axis of which lies entirely to the west of the area mapped. The presence of numerous small scale drag folds makes it impossible to ascertain the stratigraphic thicknesses of the members involved, and marked changes in the outcrop widths of some of the members, apparently because of lensing of the original sediments, makes it questionable whether any precise measurements



of thickness would be of value. Lateral changes in the character, as well as the thicknesses, of some of the beds, moreover, complicates the succession, which can, therefore, be outlined only in a general way as follows:

Top (western limit of area mapped)

Member 1. Brown limestone, becoming more argillaceous downward and grading, thereby, into black schist which predominates at the base - width 200'. †

Member 2. Limy sandstone, arenaceous limestone, and orthoquartzite (quartz sandstone firmly cemented by silica) - width west of the summit of Lardeau Ridge 200', but narrowing southeastward to zero in a half mile. This narrowing appears to be a result of the lenticular character of the member for the underlying beds to the east, and apparently the overlying beds to the west, continue on southeastward without interruption.

Member 3. Limestone locally consisting of well defined subdivisions of olive grey to brown (magnesian) limestones on the one hand and relatively pure blue limestones on the other - total width 400-500 feet. The subdivisions, though almost certainly syngenetic are, however, found to be discontinuous along strike, and in at least one place (100-200 feet SE of the No. 1 post, S.B. No.6 and 7 claims) a well defined bed of blue limestone is found to grade laterally into brown limestone.

Although the distribution of the different types of limestone are somewhat irregular, the blue or purer varieties tend to become more common toward the southeastern end of the belt, and the brown limestones, locally with argillaceous beds, dominate at the summit and northern end of Lardeau Ridge.

Member 4. Limy sandstone, arenaceous limestone, and orthoquartzite - width 100 - 150 ft. Though the rock types present in this member are lithologically similar to those of Member 2, the two belts are stratigraphically distinct, the former (member 4) clearly underlying the limestones which in turn apparently underly the latter (member 2). Member 4, unlike member 2, has been traced to the southeastern edge of the area mapped, and over its entire length it displays relatively little change in thickness.

Member 5. Mainly blue limestone, width 75 - 100 ft.

Member 6. Black, green, and sericitic schists - width 200 - 200 ft. The sericitic schists, which are commonly spotted with pyrite, are probably derived by alteration from either the black (carbonaceous) or green (tuffaceous?) schists.

Member 7. Grey limestone - width 50 - 100 ft.

Member 8. Green and black schist, local masses of pale sericitic schist and schistose quartzite. - width 150 - 200 ft.

Member 9. Blue to black limestone, minor schist width 200 ft. - eastern (lower) limit poorly exposed.

The eastern part of the area exposes a large body of well bedded green schist which overlies, apparently conformably, blue to grey limestone on the east, brown limestone on the south, and interbedded brown limestone and black schist on the west. The change in character in the underlying rocks appears to reflect again the rapid westward or northwestward increase in the clastic ratio (proportion of sand and mud to carbonates) of the sediments that was noted on Lardeau Ridge. The origin of the green schist is uncertain. Their relatively high content of ferromagnesian minerals, principally actinolite but locally including chlorite, which are responsible for the green color, clearly distinguish them from the argillaceous schists which occur in the same locality. Microscopic examination also reveals a high content of plagioclase in some of the specimens of green schist. The continuity and fine grained character of the individual beds indicates that they have been water laid as do the occasional thin beds of impure limestone found associated with them. Their association in the succession with orthoquartzites, and without any coarse greywackes, plus the absence of graded bedding within the green schists themselves does not favor the view that they represent the fine grained equivalent of greywackes. The most probable alternative is an origin by the accumulation of plagioclase-rich debris of dacitic composition. Microscopic

examination however, reveal neither shard shaped particles or devitrified glass which would demonstrate a pyroclastic origin although it remains possible that recrystallization has progressed to the stage where neither of these characteristics could be preserved. Thus a pyroclastic origin, though suggested by field evidence, cannot be confirmed.

West of a structural discontinuity extending southeast from the south summit of Mt. Johnson are two westerly-dipping belts of arenaceous limestones, limy sandstones and quartzites, separated by a belt of black schist and overlain on the west by brown limestone. The relationship of this succession to those to the east of the discontinuity and on Lardeau Ridge is not known. A lens of green schist several hundred feet west and south of the south summit of Johnson Mtn. cannot be placed in a stratigraphic succession with the other rocks. It underlies the brown lime schists which bound it on the west; its age relationship with the black schists on its eastern margin is not clear; its abrupt southern termination is wholly unexplained.

### Structure

The structure, as is noted above, is only partly understood. The rocks of Lardeau Ridge are evidently within the northeastern limb of a major syncline, the eastern limit of which may lie at the discontinuity of the west slope of

Middle Ridge. To the northeast of this break, which may mark the faulted crest of an anticline, the beds, though complexly and tightly folded, have a general dip to the east. The schist-limestone contact reaching its lower elevation at the eastern edge of the area. (see sections) The drag folds display a consistent northwesterly plunge as, apparently, do the major flexures. On Lardeau Ridge the northwesterly plunge of fold axes averages  $13^{\circ}$ ; on Middle Ridge west of the crest of the faulted anticline the plunge averages  $18^{\circ}$ , and in the black east of the crest the plunge, which ranges from  $5^{\circ}$  to  $40^{\circ}$  and in one place reaches  $60^{\circ}$ , averages  $25^{\circ}$ .

The tightness of folding in the smaller flexures at least is clearly influenced by the character of the rocks in their vicinity. Thus in the thick green schist succession the limbs of the drag folds diverge from the axial region at angles generally in excess of  $30^{\circ}$  and commonly 40 to  $50^{\circ}$ . Relatively open drag folds are also noted in the limy sandstones. On the other hand the black schists folds may be so tightly compressed that limbs diverge by only a few degrees. Though bedding is rarely apparent in the upper limestones, it would seem that their behaviour in folding is intermediate between that of the black schist and that of the thick succession of green schist. The green-schist-limestone contacts in the folds on the PhD claim commonly diverge from the axes of the anticlines at an angle of 15 to 30 degrees.

In several places on the east slope of Middle Ridge isolated lenses of limestone are apparently wholly enclosed within green schist. Both in their outline and their lithologic characters these bodies of limestone closely resemble the tongues of limestone infolded into the green schist along the tight northwesterly plunging anticlines. In the absence of any clearly defined faults limiting the isolated lenses of limestone, it is presumed that they represent other anticlines which during folding become so tightly compressed that the green schists on either flank were brought into contact and the intervening limestone squeezed up into the axial region of the fold and cut off from the corresponding bed in the lower portion of the fold. A few isolated masses of green schist near the crest of Middle Ridge may have originated in a similar fashion in the troughs of synclines.

Schistosity is present in all the rocks except the purer limestones and the arenaceous rocks and wherever it has been observed in conjunction with drag folds it is found to parallel their axial planes. A northwesterly strike to the schistosity parallel to the bedding and folds is universal; the dip is almost invariably steep to the east. The angle of dip varies from about  $90^{\circ}$  in the east to  $65^{\circ}$  on Lardeau Ridge, and on a few westerly facing cliffs low dips prevail, almost certainly as a result of large scale creep or slump.

Few signs of faulting have been observed. Two minor transverse faults have been found high on the east face of Lardeau Ridge, 2000 and 2200 feet southeast of the summit, where they each offset a contact between blue and brown limestone approximately 20 feet to the right. Elsewhere the continuity of many of the contacts indicate no significant transverse faulting. The discontinuity southeast of the south summit of Johnson Mtn. appears to mark the major fault following closely the crest of an anticline, but the fault itself is not exposed. Some bleaching or sericitization of the schists and an abundance of quartz lenses may be an expression of fault movements in the vicinity of this inferred fault. Strike faults, other than the one just mentioned may be present but have not been detected. Some sheeted jointing along the limestone-green schist contact in a few of the tight anticlines in the southeast part of the PhD mineral claim suggests the possibility of faulting along one or other limb of the folds but in most no such faulting is indicated.

Minor oblique flexures are common in the green schists on the east slope of Middle Ridge. Within these flexures bedding, preexisting schistosity, and in one case a fold axis, have been deflected, a fraction of an inch, but nowhere disrupted. In most cases the flexure is restricted to a zone generally less than an inch wide striking about northeast and its deflection is to the left in plan. However,

in a few examples the zone of flexuring strikes almost easterly and the deflection of the schistosity and bedding is to the right. (see sketch).

Assuming they represent congruent strains, they reflect a crustal shortening in a northwest-southeast direction and are hence unrelated to the folding which has resulted in a crustal shortening at right angles to this trend. No such flexures have been observed in other than the green schist.

#### Mineralization

Mineralization is of four types:

- (1) Disseminations of galena and sphalerite in limestone without any marked alteration.
- (2) Lenses in schist of vein quartz containing minor quantities of galena and, on weathered surfaces, casts of pyrite.
- (3) brown weathering dolomite ( $n_D = 1.705$ , i.e. ferroan dolomite) containing minor amounts of finely disseminated calcite, veinlets of quartz, and local pockety or banded disseminations of galena and sphalerite.
- (4) Silicified limestone and/or schist containing disseminated sulfides, notably galena and sphalerite but including also in places tetrahedrite.



The first type is known only in the western part of the area (Showings 1S and 1N, 2, 3, 5, and 6). Only locally is the sulfide content of the limestone sufficiently great to constitute mineable grade, and only rarely is the width of such mineralization greater than 1 foot. (viz. in showings 1S, 1N, and in one of the cuts on showing 3). In all examples the greatest extent of the mineralized zone is parallel to the bedding of the limestones, and either the composition of the host rock or the structural characteristics of the bed and adjacent rocks seem to have been the principal control localizing mineralization. Folding may have provided an additional structural control, for better-than-average mineralization is found along the axis of such a fold in showing 6 and the relatively high grade mineralized zone of showing 1S is repeatedly offset, apparently by drag folds. No other controls localizing mineralization are known.

The second type, that of the quartz lenses in schist, occurs in a zone extending from a point 500 feet northwest of the south summit of Mount Johnson to a point 2500 feet southeast of this summit. The quartz is known to attain a width of 3 feet, and still greater thickness may have occurred in the disintegrated quartz mass at the northwestern limit of exposures of this type. The greatest length of any lens is but a few tens of feet and it contains probably less than several hundred tons. Coarse particles of galena have been observed in some of the quartz lenses, and cubic cavities

lined with iron stain testify to the former presence of pyrite in others, but many of the masses seem to be essentially devoid of sulfides and probably not one has an average lead content in excess of 1 per cent. From the standpoint of both grade and tonnage, none of the deposits of this type, including these known as the No. 7 showings deserves additional work.

The third type, characterized by brown weathering dolomite is widespread in the tightly folded belts of limestone of the eastern part of the area, between the 9S showings on the south and the showings of the western part of the PhD mineral claim on the north. The same type of mineralization occurs under similar circumstances in the No. 8 showings on the southwest slope of Middle Ridge. More or less irregular exposures of this dolomite are a few feet to a few tens of feet in length, and up to about 10 feet in width. The true thickness may not reach this amount and the sample (no 7) taken across a reported 10 feet on a dip slope may give an erroneous impression of the minimum dimensions of such masses. All the lenses are within limestone close to the green schist contact. A few are separated from the green schist by a few feet of unaltered limestone, but most are in contact with the schist. A few (e.g. one represented by sample 5, MS mineral claim) are uniformly dipping beds, but most appear to lie at or close to the axes of folds. The main showings of the eastern part of the

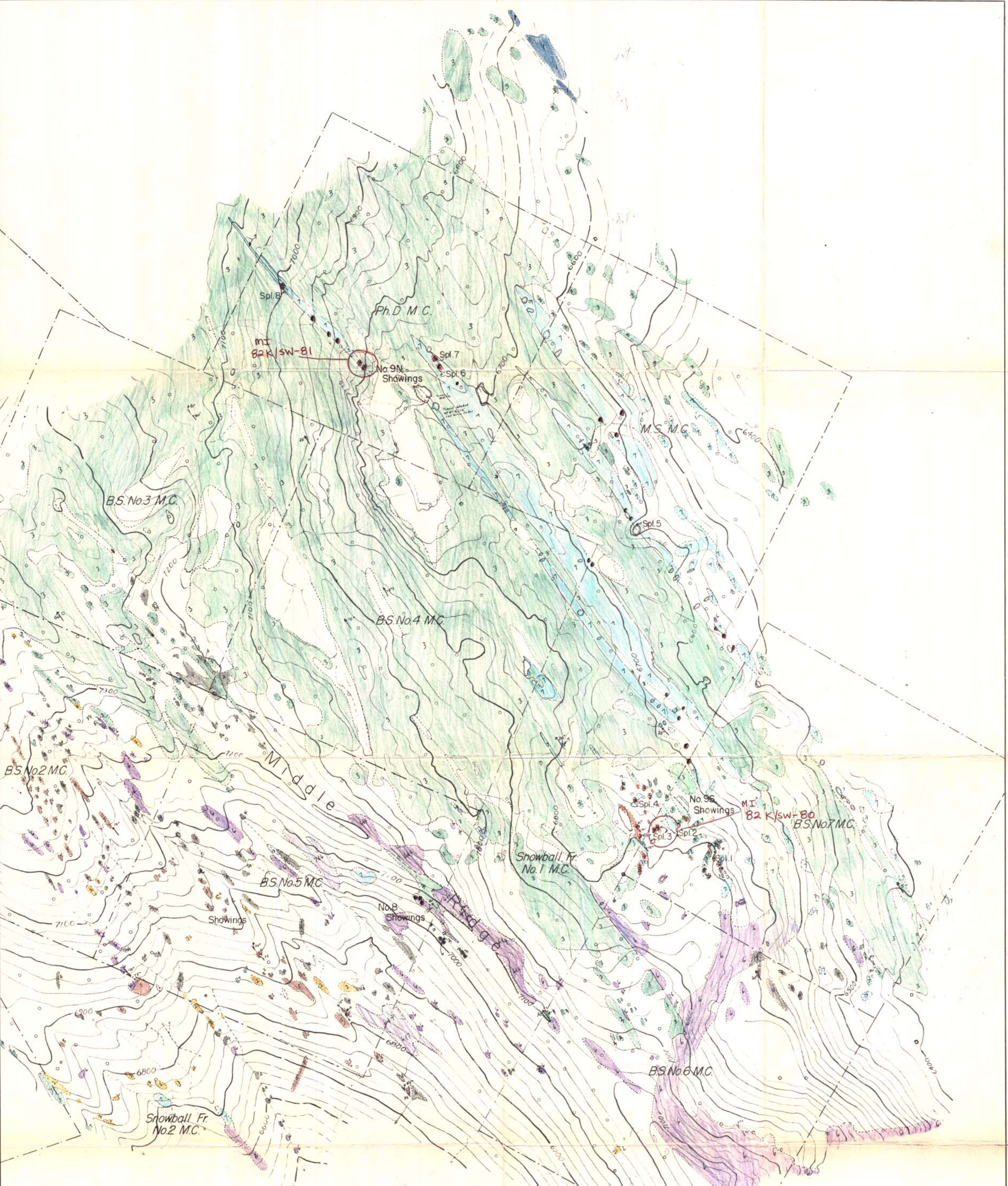
PHD mineral claim (including those represented by samples 6 and 7) lie, for example, close to the crests of the main anticlines, but others in the 9S group of showings lie close to the troughs of the synclines or on drag folds. No other structural control is known. It may be presumed, therefore, that many, if not all of the dolomite lenses are somewhat elongated parallel to the northeasterly plunge of the folds. If this be the case, then the depth of a deposit is in general less than its exposed length on horizontal exposures, and its total tonnage is measurable in tens or at best hundreds of tons. None of the lenses is considered by itself worthy of additional study, though should a party be sent to the claims to continue investigation then some time might be spent in examining these showings to provide more precise data on the area and grade of the exposures.

The fourth type of mineralization, the silicified limestone and/or schist, occurs only in the 9S and 1S showings. In the latter occurrence it forms a few limited and discontinuous lenses, possibly related to drag folds, in the otherwise mineralized but unaltered limestone. The 9S showings (see Map AXL-BC-14-5) include rather poorly exposed bands of rock, closely resembling quartzite, restricted to the immediate vicinity of the limestone-green schist contact and commonly associated with brown weathering dolomite. Individual exposures may be in excess of 150 feet long and they generally range from

to 15 feet in width. Trenching may indicate still greater widths although judging from the relatively resistant character of the silicified rock most occurrences probably stand above the general level of the bedrock and are hence likely to be already exposed. Most of the silicified rock is sparsely mineralized or barren and in only a few places is galena, sphalerite, and tetrahedrite present in anything approaching mine grade. A few higher grade lenses have been noted, particularly those represented by samples 2 and 3 which consist essentially of silicified rock, and by samples 1 and 4 which include both silicified rock and brown weathering dolomite. The showings represented by samples 1 and 2 are evidently localized along drag folds; the control in the other two showings is not apparent. The tonnage present in the known higher grade lenses is small. The greatest known width, 8 feet at sample 1, is the maximum width of a lens, which rapidly narrows northwestward up slope and is not represented at all along strike in the next exposure to the southeast, less than 40 feet away. It is highly unlikely that any substantial tonnage of mineable grade material exists in the vicinity of the 98 showings. It is clear, however, that these showings constitute the most promising in the entire group of claims, and it is here that any future work, if contemplated, should be concentrated.

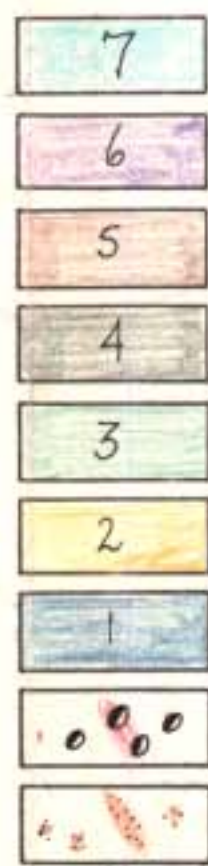
Showing No. 4, not hitherto mentioned, consists of a few boulders of mineralized limestone in part of a crescentic ridge making up the lower limit of a rockslide from the steep hillside a few hundred feet to the southeast. There is no doubt that the boulders are not in place.

*W. H. Malheur*  
*Sept. 15<sup>th</sup> 1953*

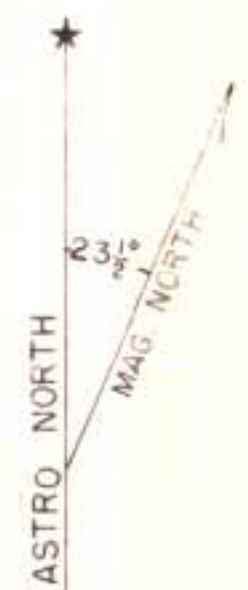


**LEGEND**

- Blue, grey, and white limestone
- Olive grey to brown (magnesian) limestone, associated black schist
- Brown to grey sandstone, quartzite, and arenaceous limestone
- Black schist, minor associated brown to black limestone
- Green schist
- Rusty weathering sericitic schist
- White to blue quartzite, black schist
- Rusty weathering carbonate rock with or without quartz, galena, and sphalerite
- Silicified limestone and schist
- Sulfide mineralization
- Attitude of axial plane and plunge of axis of drag fold
- Sink
- Open cut
- Plane table station
- Chain and compass str.
- Claim post



Note: Outcrop areas are bounded by dotted lines

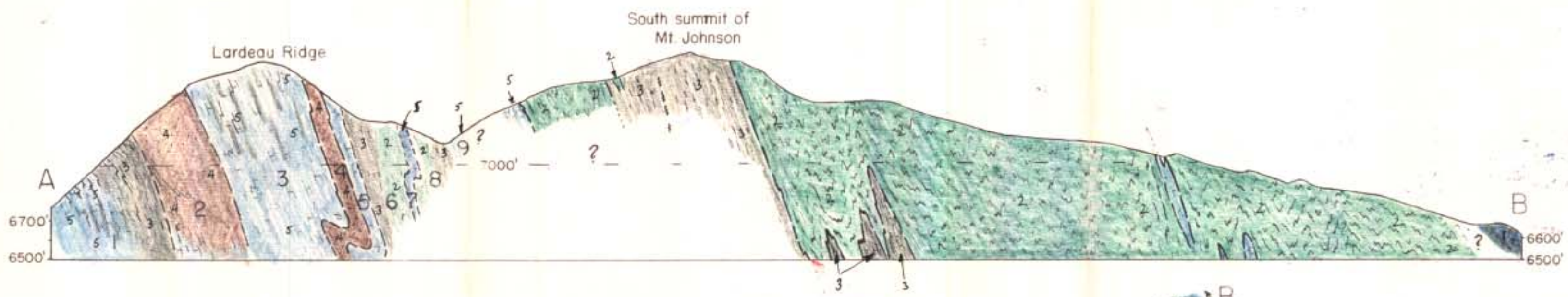


Spl.	Width	Ag. oz.	Pb. %	Zn. %
1	96"	0.35	420	8.20
2	26"	0.70	7.70	9.70
3	36"	Tr.	11.4	8.5
4	48"	Tr.	1.10	1.90
5	36"	Tr.	0.15	Tr.
6	30"	Tr.	0.30	2.10
7	120"	N.D.	3.6	5.3
8	66"	Tr.	Tr.	0.3

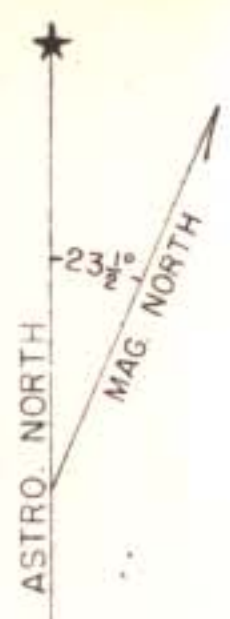
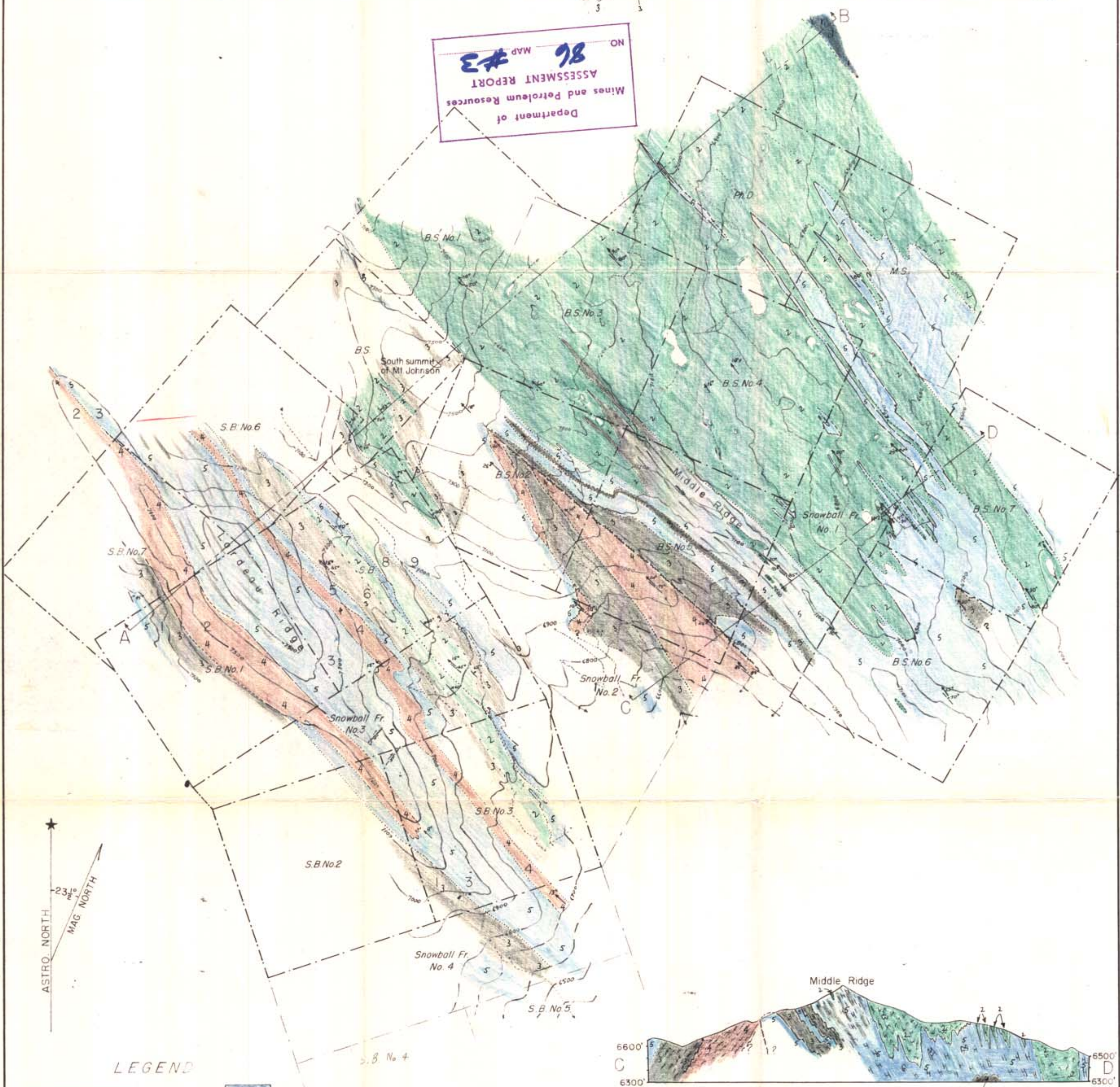
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NO. **86** MAP **#12**

NEW JERSEY ZINC EXPLORATIONS LTD.  
**SNOWBALL GROUP**  
LARDEAU DISTRICT, B.C.  
Geological map, E. half  
SCALE 1" = 200'  
DATE Sept 1953  
BY W. H. Mathews  
**AXL-BC**  
14-3

MT #'s added by J.A.W. 4/76.

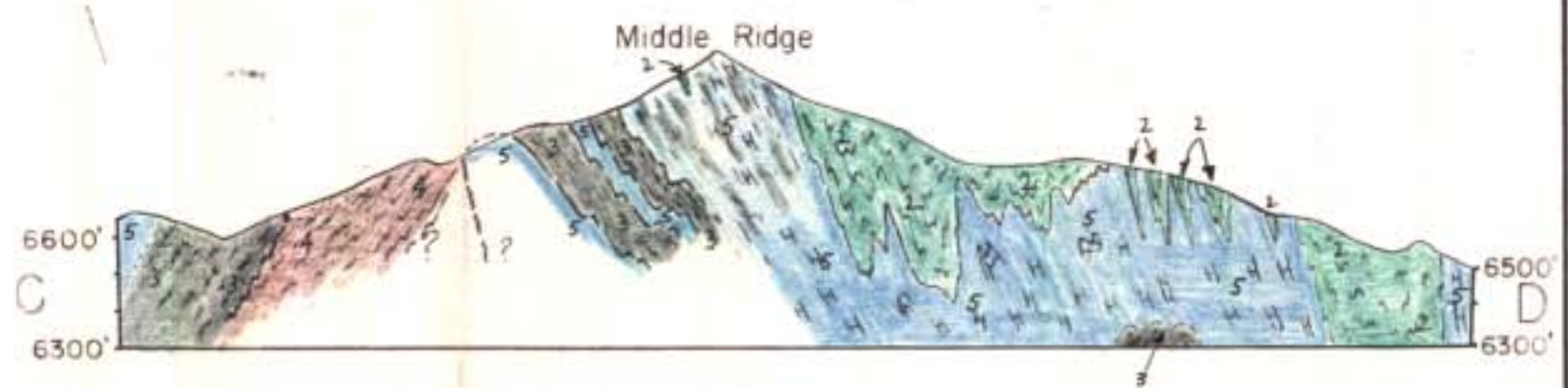


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 MAP # 3  
 NO 86



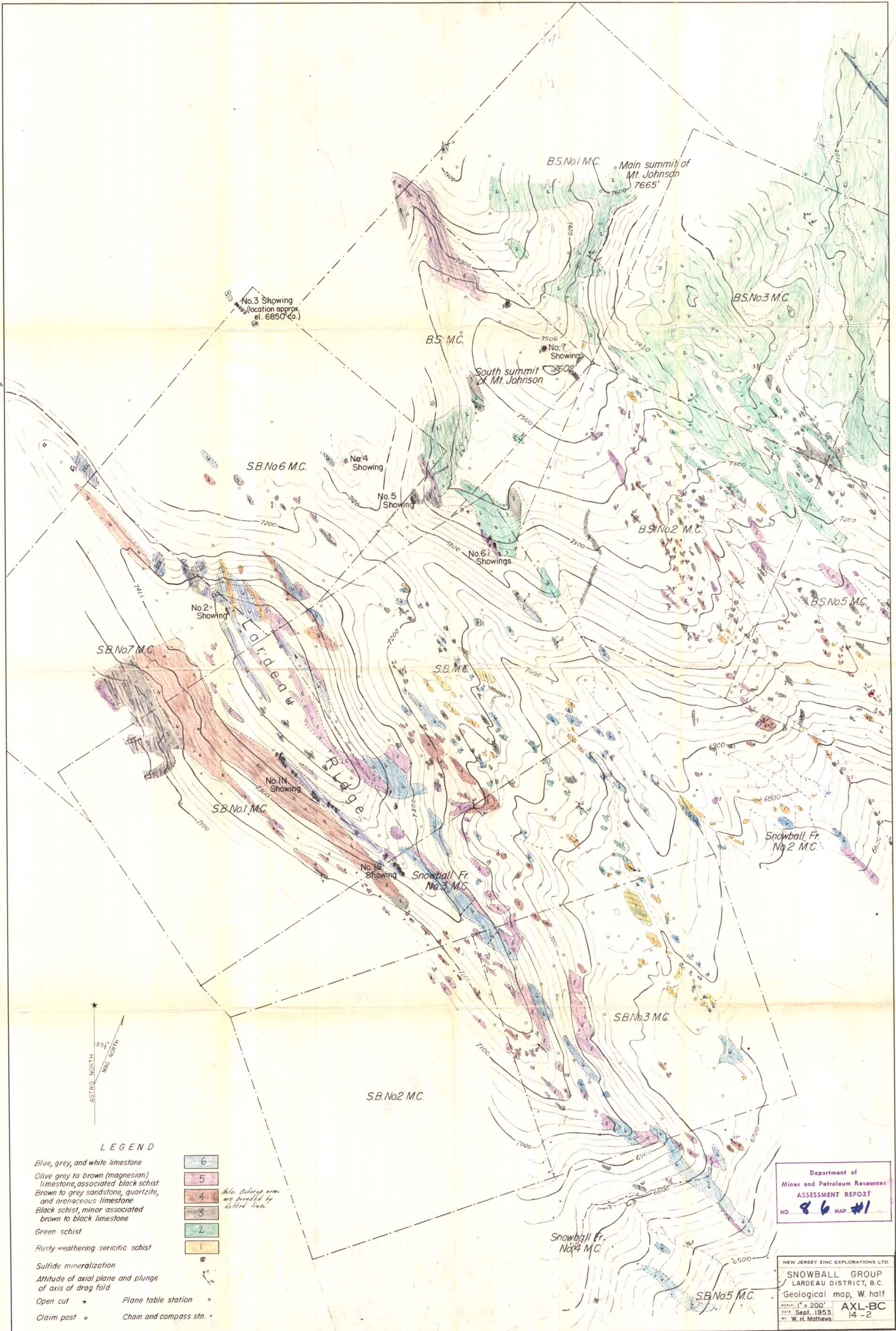
**LEGEND**

Blue to brown limestone	5
Sandstone, quartzite, arenaceous limestone	4
Chiefly black schist	3
Chiefly green schist	2
White to blue quartzite, black schist	1
Plunge of folds	20°
Attitude of axial plane of folds and schistosity	70° 40°
Sulfide mineralization	
Member (see accompanying text)	2



# 86  
Map # 3

NEW JERSEY ZINC EXPLORATIONS LTD.  
 SNOWBALL GROUP  
 LARDEAU DISTRICT, B.C.  
 Geological plan and sections  
 SCALE 1" = 500'  
 DATE Sept. 1953  
 BY W. H. Mathews  
**AXL-BC**  
 14-4



**LEGEND**

- Blue, grey, and white limestone
- Olive grey to brown (magnesian) limestone, associated black schist
- Brown to grey sandstone, quartzite, and arenaceous limestone
- Black schist, minor associated brown to black limestone
- Green schist
- Rusty weathering sericitic schist
- Sulfide mineralization
- Attitude of axial plane and plunge of axis of drag fold
- Open cut → Plane table station
- Claim post ○ Chain and compass stn.

6
5
4
3
2
1

*Note: Overlap areas are bounded by dotted lines.*

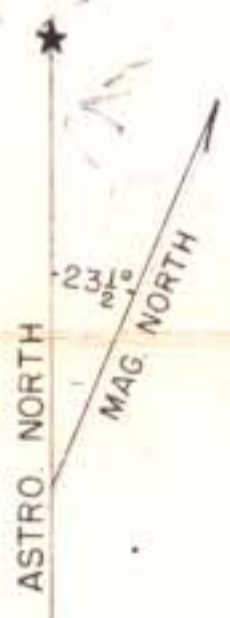
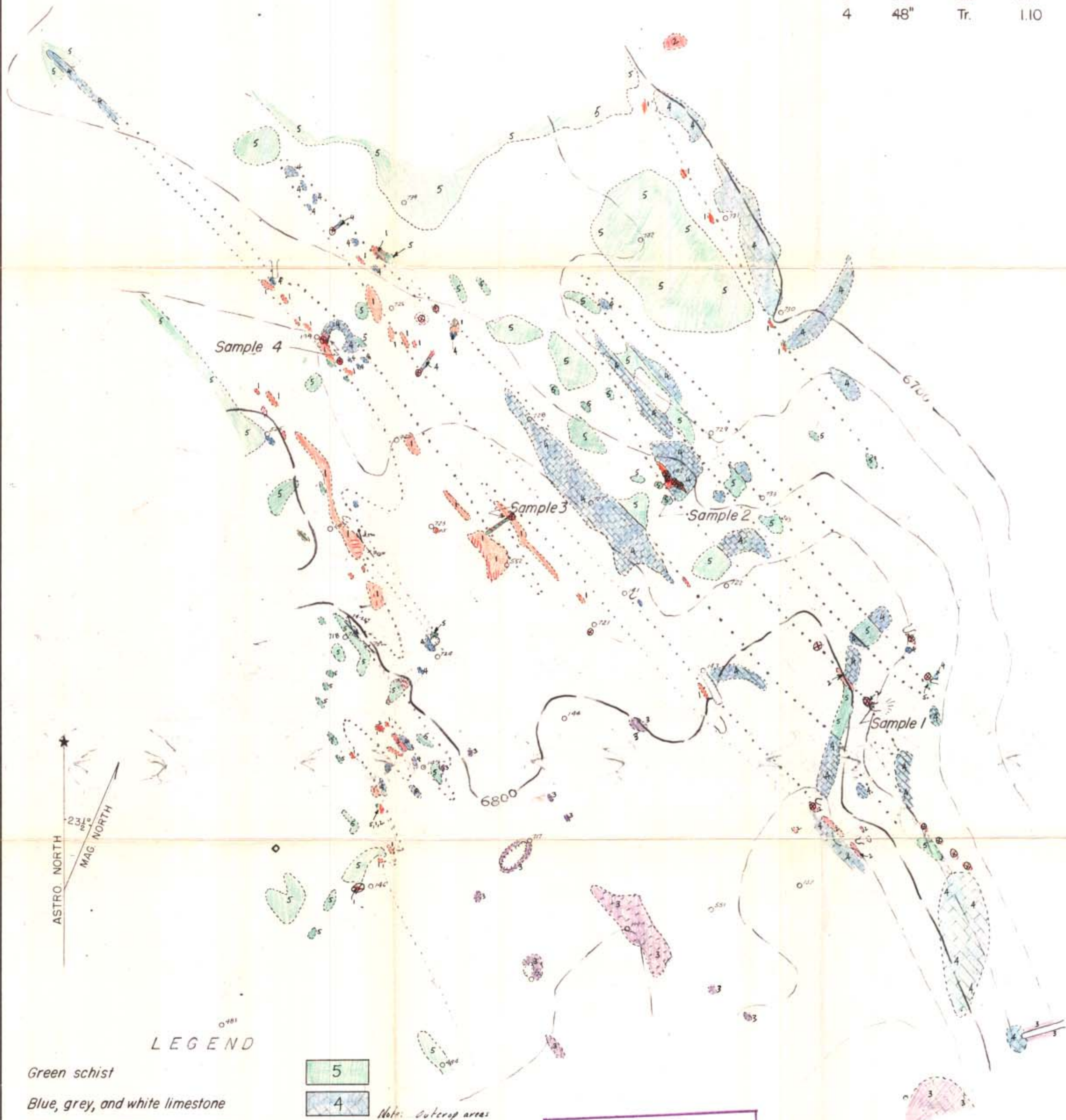
Department of  
Mines and Petroleum Resources  
ASSESSMENT REPORT  
NO. 86 MAP #1

NEW JERSEY ZINC EXPLORATIONS LTD.  
SNOWBALL GROUP  
LARDEAU DISTRICT, B.C.  
Geological map, W. half  
SCALE: 1" = 200'  
DATE: Sept. 1953  
BY: W. H. Mathews  
AXL-BC  
14-2



ASSAYS

Sample	Width	Ag. oz.	Pb. %	Zn. %
1	96"	0.35	420	820
2	26"	0.70	7.70	9.70
3	36"	ND.	11.4	8.5
4	48"	Tr.	1.10	1.90



LEGEND

- Green schist  5
- Blue, grey, and white limestone  4
- Olive grey to brown (magnesian) limestone, associated black schist  3
- Rusty weathering carbonate rock with or without quartz, galena, and sphalerite  2
- Silicified limestone and schist  1
- Sulfide mineralization ⊗
- Attitude of axial plane and plunge of axis of drag fold ↗  
↘
- Limestone-green schist contact, inferred
- Open cut /
- Plane table station o<sup>145</sup>
- Sink ○
- Claim post o

Note: Outcrop areas are bounded by dotted lines.

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NO. **86** MAP # **4**

# 86  
Map 4

NEW JERSEY ZINC EXPLORATIONS LTD.  
SNOWBALL GROUP  
LARDEAU DISTRICT, B.C.  
Geology, No. 9S. showings  
SCALE 1" = 50'  
DATE Sept. 1953  
BY W. H. Mathews  
**AXL-BC**  
14-5