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GEOLOGY OF THE JERSEY LEAD-ZINC MINE SALMO B. C.

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ABSTRACT

The Jersey Lead Zinc Mine is located in the Nelson Mining Division of southeastern British Columbia. It lies eight miles south of Salmo and twenty-two miles east of the City of Trail.

The deposit forms part of the Kootenay Arc, a north trending lime belt of Lower Cambrian Age. The Kootenay Arc is favourable to lead-zinc mineralization and includes the Reeves MacDonald, Jersey, H.B., Bluebell and Duncan Lake Mines.

The ore bodies are contained within the Reeves dolomite, part of a member of the Laib formation. Ore mineralization consists of fine grained sphalerite and galena with pyrite, pyrrhotite and minor arsenopyrite present as gangue sulphides.

The mine has a trend of north fifteen degrees east and a plunge of ten degrees southerly over a distance of six thousand feet. Maximum east-west width is two thousand feet. The dominant structure in the mine area is the Jersey Anticline, an isoclinal fold, whose axial plane dips approximately forty-five degrees east. The ore bodies lie on the normal limb of this anticline.

A series of secondary folds (normal anticlines and synclines) occur on the upper limb of the Jersey Anticline. These folds, with amplitudes rarely in excess of fifty feet, have been used to delineate ore zones from "A zone" on the west side to "J Zone" on the east side.

The Black argillite fault (a reverse fault) bounds the mine area on the east side and downthrows the Reeves member to the east. The Dodger and Emerald granite stocks underlie the mine area.

Several post ore transverse faults, mostly normal in movement, cut the ore bodies. Net slip on these faults decreases to the north. Movement is in the order of fifteen to forty feet.

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Five ore bands, ranging in thickness from one to thirty feet, are recoghized in the mine. These ore bands listed in stratigraphic sequence are:

1. Upper Lead band
2. Upper Zinc band
3. Middle Zinc band
4. Lower Zinc band
5. Lower Lead band.

In the "A Zone", the ore bands are very close together and frequently have been mined as a unit up to eighty feet thick. Throughout the remainder of the mine these bands have been mined separately or in combinations.

The Upper Lead band is from one to four feet thick and occurs in the "A Zone" and at the north end of the mine. The Lower Lead band, also occurring throughout the "A Zone", is very similar but extends somewhat further south in the mine. Both the Upper and the Lower Lead bands are sinuous in plan view and, except in the "A Zone", are rarely more than one hundred feet wide in east-west dimension. The Upper, Middle and Lower Zinc bands occur either singly or in combinations throughout the entire mine. Lead zinc ratios are in the order of one to four. Bands of mineralization are parallel to sedimentary banding in the host rock.

Cross cutting features exhibited by dykes associated with the Dodger Stock suggest emplacement of ore before granitic intrusion.

I. LOCATION

The Jersey Lead Zinc Mine is located on Iron Mountain, in the Nelson Mining Division of south-eastern British Columbia. It lies eight miles south of the Village of Salmo and twenty-two miles east of the City of Trail.

Elevations of the ore zones range from four thousand to forty nine hundred feet.

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II. HISTORY

First records of ore shipped from the Jersey area date back to 1908 when a John Waldbeser produced 426 tons of lead ore, then valued at $7,000.00. In 1910, Iron Mountain Limited, a subsidiary of Pacific Coast Steel of San Francisco, was formed to operate the property. Waldbeser was retained as manager. The property was worked intermittently between 1910 and 1941 by Iron Mountain Limited. In 1941 detailed surface mapping, to extend reserves, led to the discovery of tungsten mineralization within well defined beds of skarn. This skarn lay conformably below the lead zinc bearing dolomite. The Canadian government purchased the tungsten claims through Wartime Metals Corporation and operated the property for a short period as the Emerald Tungsten Project. In 1947 the original forty-one mineral claims and fractions were bought by Canadian Exploration Limited. Diamond drilling, under the direction of Harold Lakes, primarily for tungsten exploration, indicated approximately 60,000 tons of good grade lead zinc ore. The tungsten mill was converted to a lead zinc mill and production from the Jersey Mine began in March of 1949 at a rate of 8,000 tons per month. From March 1949 to the present time the Jersey Mine has operated continuously and produced almost seven million tons at an average

Continued

grade of 1.8 percent lead and 4.1 percent zinc. Current production rate is 45,000 tons per month.

At December 31, 1967, the published reserves of the mine were:

523,453	tons	Probable Ore at	1.2,	3.7
379,600	tons	Possible Ore at	0.9,	3.1
296,350	tons	Marginal Ore at	0.5,	2.4

III. REGIONAL GEOLOGY

The Jersey ore bodies form part of the Kootenay Arc, a north trending lime belt favourable to Lead-Zinc mineralization. The Kootenay Arc includes the Reeves MacDonald, Jersey, H.B., Bluebell and Duncan Lake Mines. Mineralization associated with this belt is contained in the tightly folded Reeves-Badshot limestone of Lower Cambrian age (refer to fig. (1)).

The portion of the Kootenay Arc extending from the U. S. border, near Nelway, north to a point east of Ymir is known as the Mine Belt. The Mine Belt includes the Reeves MacDonald, Jersey, H.B., Jackpot and Oxide properties. The dominant structure of the Mine Belt is the north trending "Jersey Anticline", an isoclinal fold whose axial plane dips 45 degrees east.

The Jersey ore bodies lie on the normal limb of the Jersey anticline parallel to the banding in the sediments (refer to fig. (2)). The Jersey Mine has a trend of north 15 degrees east and a plunge of ten degrees southerly over a horizontal distance of 6,000 feet. Maximum east-west width is 2,000 feet.

Reeves limestone is 400 to 500 feet thick in the mine area. Lead zinc mineralization occurs mainly in dolomite near the base of the Reeves, varying between 25 and 100 feet thick within the mine. Reeves limestone and dolomite range from a blue-grey banded type to a white massive variety. The chief visual distinction between the two is grain size; the dolomites are generally finer grained than the limestones.

The Truman member of the Laib Formation conformably underlies the Reeves, and forms the mine footwall rocks. This member consists of a hard, dense, reddish green skarn and a brown greasy textured argillite.

Contact relationships in the mine suggest the origin of skarn to be an alteration of the argillite. The skarn is characterized by tungsten and minor molybdenum mineralization. The previously mined Dodger, Emerald, and Feeney Tungsten mines underlie stratigraphically,and in some cases,geographically, the lead zinc ore bodies.

Continued -----

The mine is bounded on the east by the Argillite (Iron Mountain) Fault which down faults younger beds on the east side. The Dodger and Emerald stocks, offshoots of the Nelson Batholith underlie the mine area.

IV. MINE GEOLOGY

Secondary fold structures along the normal limb of the Jersey Anticline have been used to delineate zones. These folds are most commonly symmetrical anticlines and synclines, having amplitudes rarely in excess of fifty feet. The axes of these folds trend slightly east of north. Zones have been designated A to J from west to east. (Refer to fig. (3)).

The mine is cut by several transverse faults, mostly of normal movement. Movement appears to be principally dip slip and is in the order of fifteen to forty feet. These faults are mainly rotational types, hinged on the west side of the mine. Transverse faults appear to have a common zone of origin as longitudinal faults in the south-east section of the mine and gradually swing westerly in a horsetail type of structure. Movement on faults decreases to the north. These faults are all post ore. Faults have been numbered 4 to 21, increasing numbers to the north.

Continued -------

F-4, a near vertical transverse fault, separates the track and trackless mines.

Lamprophyre dykes occur throughout the mine, especially along faults and the crests of folds. These dykes are post ore, post faults and do not influence the position of ore horizons. They are occasionally useful to delineate fault zones, but can seriously dilute ore when they form the hanging wall, as they are very incompetent. The dykes range in size from less than one inch to twenty feet thick.

Ore mineralization consists of fine grained sphalerite and galena, with pyrite, pyrrhotite and minor arsenopyrite as gangue sulphides. Cadmium is present in the sphalerite and silver accompanies the galena. Iron content of the sphalerite is approximately 6%. The grade of the probable reserve of the mine is 1.2% lead and 3.7% zinc.

Five ore bands, ranging in thickness from one to thirty feet are recognized in the mine. These ore bands listed in stratigraphic sequences are:

1. Upper Lead Band
2. Upper Zinc Band
3. Middle Zinc Band
4. Lower Zinc Band
5. Lower Lead Band

Continued -----

Any ore band containing more lead than zinc has been designated as a lead band.

A ZONE

The A Zone is the westermost ore body in the mine, the north end of which was originally mined as the Emerald track mine. This zone outcrops on the west slope of Iron Mountain. The A Zone is divided into three distinct areas, the West, Central and East zones.

The West A Zone is a steep, east dipping two band structure. A thin lead band (one to four feet thick) underlies a zinc band of similar thickness. These bands are separated by five to ten feet of grey white dolomite. The Main West Fault, shown on Fig. (4) is a north trending structure dipping 20 to 35 degrees east, and has a normal movement of 125 feet. Approximately 70,000 tons of ore has been mined on the west or up faulted block of this fault.

Further west, the Granite fault shown on Fig. (5) has brought intrusive rocks up on the west side but does not interfere with any known ore horizons.

Continued -----

The central part of the A Zone has a combined ore thickness approaching 80 feet. A unique feature of the central A Zone is the A Zone skarn roll, a recumbent isoclinal fold open to the west. This fold contains high grade ore, particulary lead. Footwall rocks of the Truman member form an envelope around the lead and zinc bearing Reeves Dolomite. The west limit on the 100 scale plan shown on Fig. (4) is the trace of the nose of the fold, while the east limit shown represents the core of the fold. The axis of the fold trends north paralleling the A Zone. In the south part of the mine the ore contained in the skarn roll is thick, but has limited east-west dimension. Proceeding north the situation reverses.

The east A Zone or B zone is principally a zinc horizon, varying in thickness from one to ten feet and dipping 0 to 20 degrees east. This zone is very pyritic and occasionally the lead zinc ore is masked by massive pyrite. Samples of this pyrite show a grade of 1.4% Pb., 3.8% Zn. However the quantity of iron (20 to 30%) associated with ore mineralization significantly lowers the recoverable grade. The East A Zone dips below the C Zone, and has been traced north and east to a point 70 feet below the west side of the D Zone at 7000N.

Continued ------

Total production from the A Zone from 1949 to 1968 was approximately 2,000,000 tons of 2.9% Pb., 2.8% Zn.

C ZONE

The C Zone lies immediately east of the A Zone and is delimited by a north trending anticline. The crest of this anticline is occupied and paralleled by a large lamprophyre dyke. Ore in the C Zone is generally thin on the crest of the fold and thickens on the flanks. This zone does not persist to the north.

D AND E ZONES

The D and E Zones occupy the central part of the Jersey Mine. Two shallow anticlines east of the C Zone trend north and delimit these zones. Ore mineralization tends to parallel the folds and is seldom in excess of 20 feet thick. Faults F-5, 6, and 7 displace ore, mainly vertically, in the order of 20 to 30 feet. Oxide associated with F-5 directly overlies the D Zone and varies between 5 and 20 feet thick. Both zones are predominantly zinc bearing. In most areas the ore has been mined as a single unit but occasionally three distinct bands of mineralization have been recognized and mined as such where sill thicknesses have permitted. North of 4470

Continued ------

crosscut, D Zone ore ceases to parallel the west anticline and trends northeasterly across the structure at a low angle. Mineralization fades out in a coarsely crystalline limestone on the west flank of the D Zone anticline.

Ore in the D Zone is underlain by Truman skarn and argillite. The argillite is dark brown and occasionally exhibits a boudinage structure.

In a few isolated areas the argillite forms what has been termed a "dessication breccia", (rectangular fragments of brown argillite in a black limey matrix).

F ZONE

The F zone lies on the east, moderately steeply dipping, flank of the trackless mine. All five ore bands are represented in this zone. Usually two or more zinc bands have been mined as a unit in this area. A monoclinal roll of footwall rocks trends north as shown in Fig. (4) abruptly cutting off the lower zinc band. An upper lead and lower lead band shown on Fig. (6) occur above and below the zinc horizons. The trend of these bands are closely parallel. Combined grades from the upper and lower lead bands are similar, but the lead zinc ratios differ, i.e.:

Continued -----

Upper 3.3% Pb, 3.0% Zn

Lower 4.0% Pb, 2.3% Zn.

A unique feature of the F Zone is the skarn which encloses the lower lead band, roughly resembling the A Zone skarn roll, but open to the east. Zinc ore on the east flank of the F Zone is occasionally overlain by massive arsenopyrite.

G ZONE

The G Zone in the mine is a misnomer and actually is the north extension of the E Zone. Mineralization in the G Zone has a greater vertical extent than that encountered in the E Zone and, as in the F Zone, all five ore bands are present. Typical G Zone lead ore is associated with boudins of pyrite. A large low grade section of zinc ore occurs at the north end of this zone, overlain by oxidized remnants of the upper zinc and lead horizons.

EAST MARGIN OF THE MINE

H ZONE AND J ZONE

Along the steeply dipping east margin of the mine it is not uncommon to have a flattening of ore banding and, in some instances, a dip reversal.

Continued --------

The H Zone, a two band zinc structure, lies within this flattened area, referred to as the Dodger trough.

H Zone ore is complicated by sills and dykes from the Dodger Stock.

The J Zone, a recent addition to the mine, is a double band tilted anticlinal structure occuring above the top of the Dodger Stock. (Refer to Fig. (5)). Diamond drilling has indicated a narrow (east-west) zone of mineralization extending over 1600 feet (north-south) which closely parallels the trend and plunge of the mine proper. Ore grade is approximately the same as the mine probable reserve. J Zone mineralization is probably directly related to the east F Zone and has been pushed up some 300 feet by the emplacement of the Dodger Stock. Steep dips and occasional lead zinc mineralization encountered between the F and J Zones in diamond drilling tentatively confirms this theory. Mineralization in the J Zone is underlain by Truman footwall rocks.

Current development in this area may increase the low tonnage presently carried on reserves.

MINERALIZATION CONTROL:

Dr. J. T. Fyles of the B. C. Department of Mines suggests that the dolomitization of the Reeves Limestone

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is structurally controlled by secondary folding. Mineralization occurs more strongly in the troughs of these folds rather than the crests. Open textures developed in the dolomite may have been favourable to lead zinc mineralization. Granitic intrusion followed dolomitization and mineralization as evidenced by post ore dykes in the north and west areas of the mine. The range of possible ages of mineralization is wide. It may be said that it approximates or post-dates secondary folding and pre-dates granitic intrusions.

CONCLUSION

Although the grade of the Probable Reserve of the Jersey Trackless Mine is close to 5% combined, the mining grade is less. This is due to the wide distribution of low tonnage probable ore blocks which require the addition of much of the Marginal Reserve in order to maintain an economic production tonnage.

The gentle plunge and low dips of the ore are particularly amenable to trackless mining.

REFERENCES - STRATIGRAPHY AND STRUCTURE OF THE SALMO LEAD ZINC AREA, B. C. Department of Mines Bulletin No. 41 by James T. Fyles and C. G. Hewlett, 1959.

- THE LEAD ZINC AND TUNGSTEN PROPERTIES OF CANADIAN EXPLORATION LIMITED, SALMO, B.C. C.I.M.M. Transactions, Volume LVI 1953

(1) History of the Properties, pp. 228-231 by J. D. Little

(2) Geology of the Orebodies, pp. 231 - 236 by C.W. Ball, Q.G. Wishaw, and F.H. Mylrea

- NELSON MAP-AREA, WEST HALF, BRITISH COLUMBIA G.S.C. Memoir 308 by H. W. Little, 1960

ACKNOWLEDGEMENT

- The west half of Fig. (2) Idealized Cross-Section of the Jersey Mine, was reproduced from Bulletin No. 41 with the permission of Dr. J. T. Fyles of the B.C. Department of Mines

- I wish to acknowledge the most welcome assistance of Mr. Lyle Andrews of Canex Aerial Exploration in the preparation of the accompanying illustrations.

LIST OF ILLUSTRATIONS

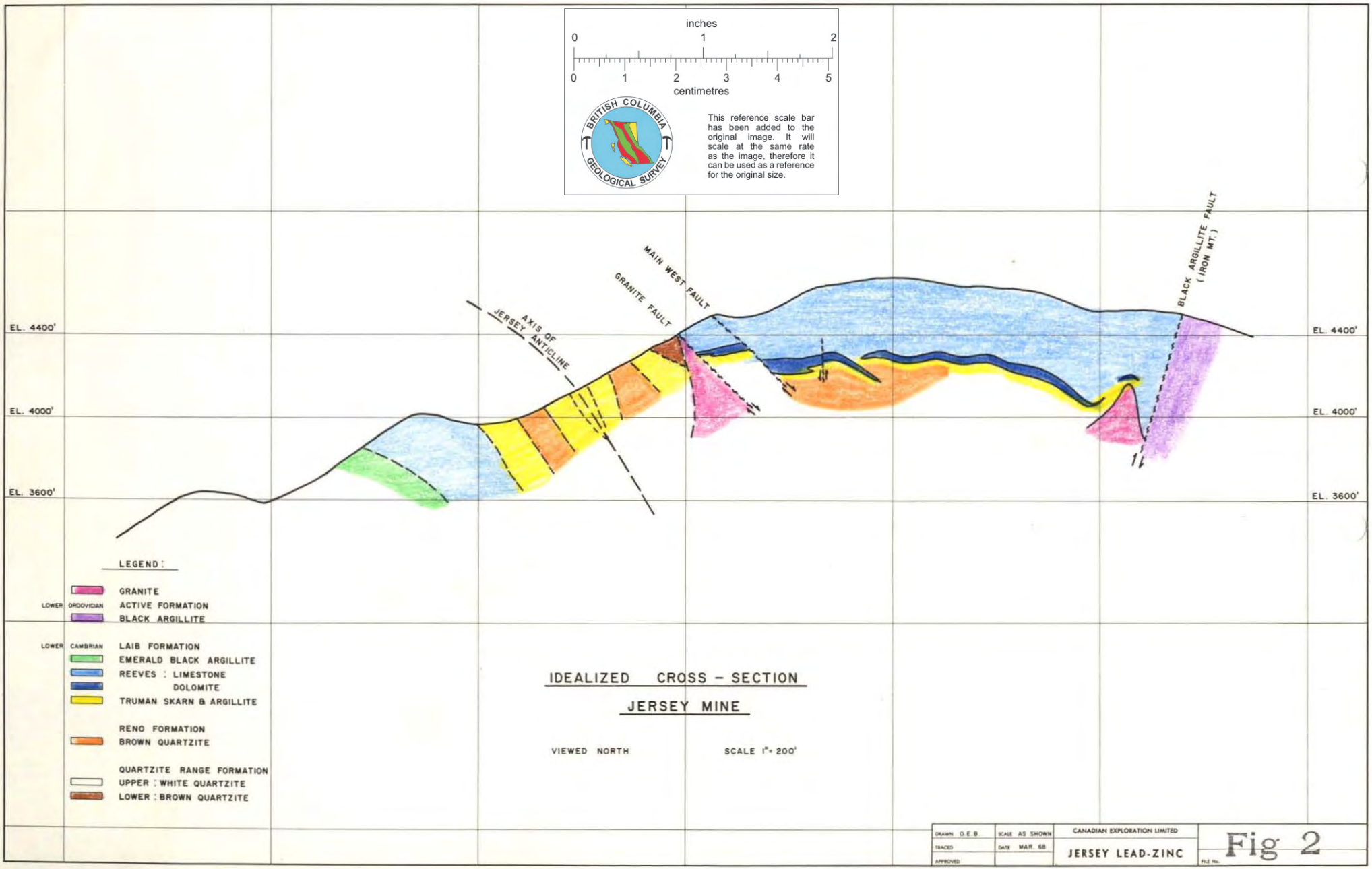
NOTE:

The scale of the illustrations has been changed during reduction of the original prints. The scale may be read using the lettered coordinates.

Lead-Zinc in Yukon

Prolongation NW of Tintina Trend

Show proposed fieldwork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BRITISH COLUMBIA GEOLOGICAL SURVEY
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EL. 4400'
EL. 4000'
EL. 3600'
AXIS OF JERSEY ANTICLINE
GRANITE FAULT
MAIN WEST FAULT
BLACK ARGILLITE FAULT (IRON MT.)
LEGEND:
GRANITE
LOWER ORDOVICIAN ACTIVE FORMATION
BLACK ARGILLITE
LOWER CAMBRIAN LAIB FORMATION
EMERALD BLACK ARGILLITE
REEVES : LIMESTONE
DOLOMITE
TRUMAN SKARN & ARGILLITE
RENO FORMATION
BROWN QUARTZITE
QUARTZITE RANGE FORMATION
UPPER : WHITE QUARTZITE
LOWER : BROWN QUARTZITE
IDEALIZED CROSS - SECTION
JERSEY MINE
VIEWED NORTH
SCALE 1"= 200'
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CANADIAN EXPLORATION LIMITED
JERSEY LEAD-ZINC
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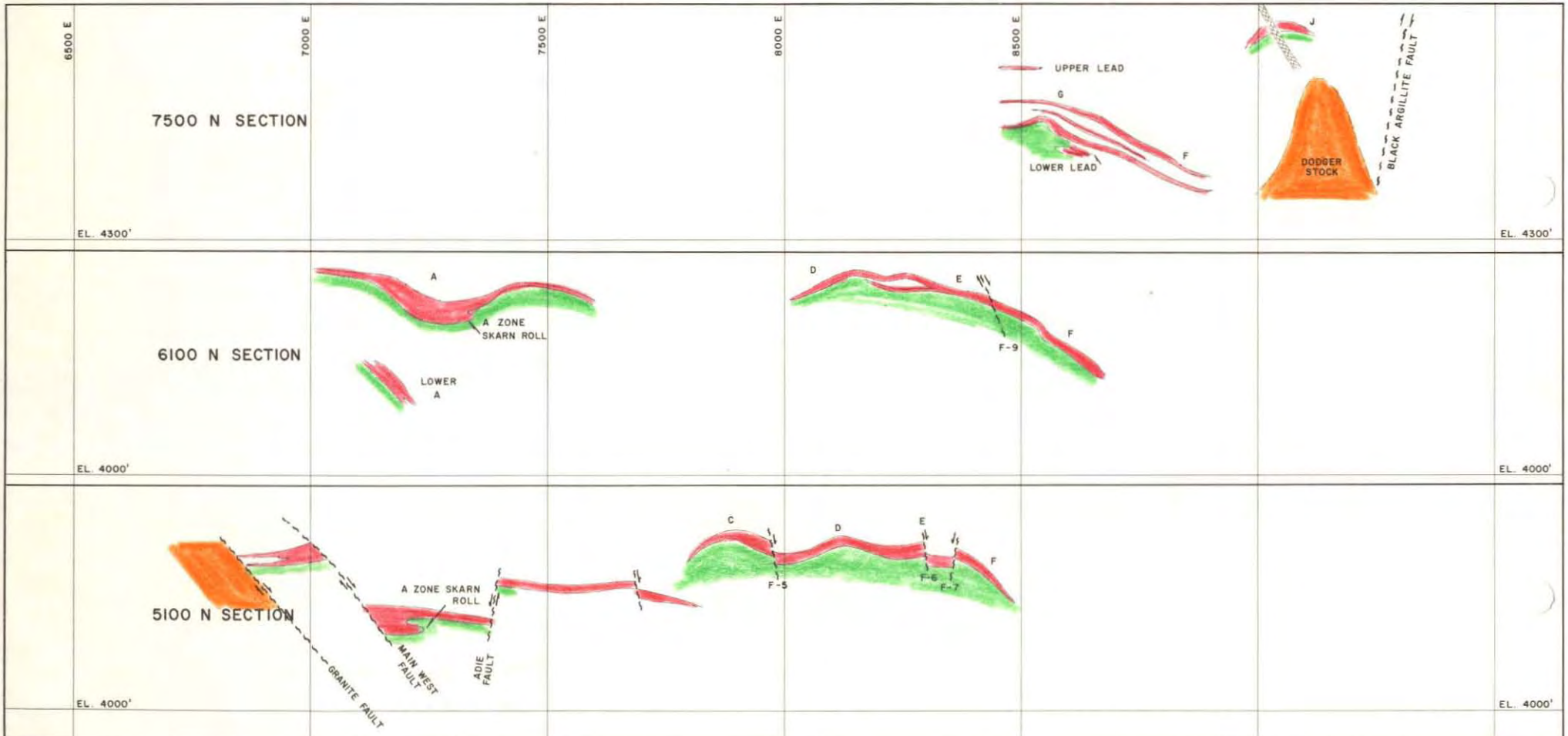
Fig 2



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BRITISH COLUMBIA GEOLOGICAL SURVEY

CROSS SECTIONS VIEWED NORTH

JERSEY MINE

LEGEND

ORE BAND
FOOTWALL (SKARN & ARGILLITE) (TRUMAN MEMBER)
GRANITE

DRAWN O.E.B.	SCALE 1" = 100'	CANADIAN EXPLORATION LIMITED	
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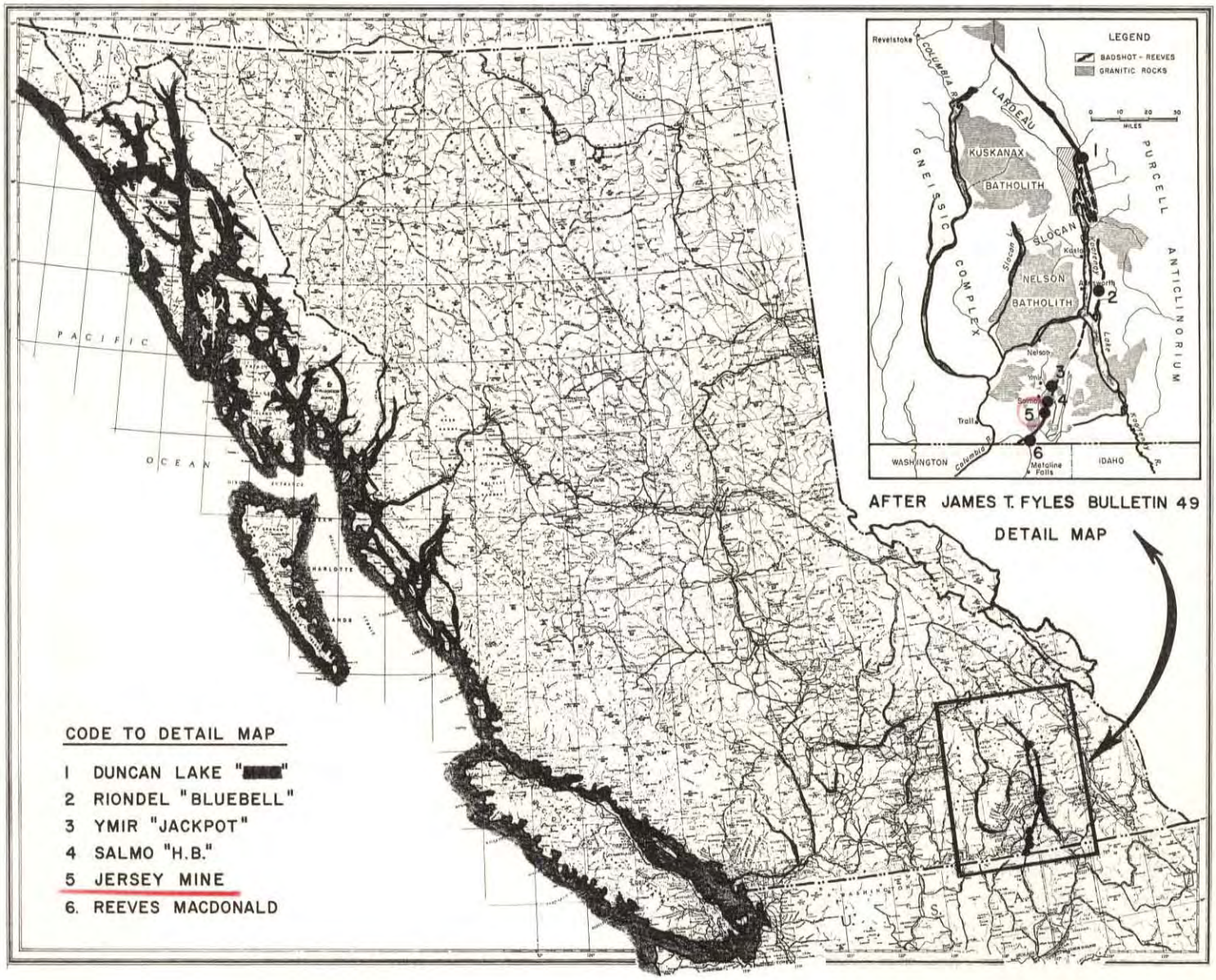
Fig 5

LOCATION MAP



JERSEY MINE & KOOTENAY ARC

FIGURE (I)

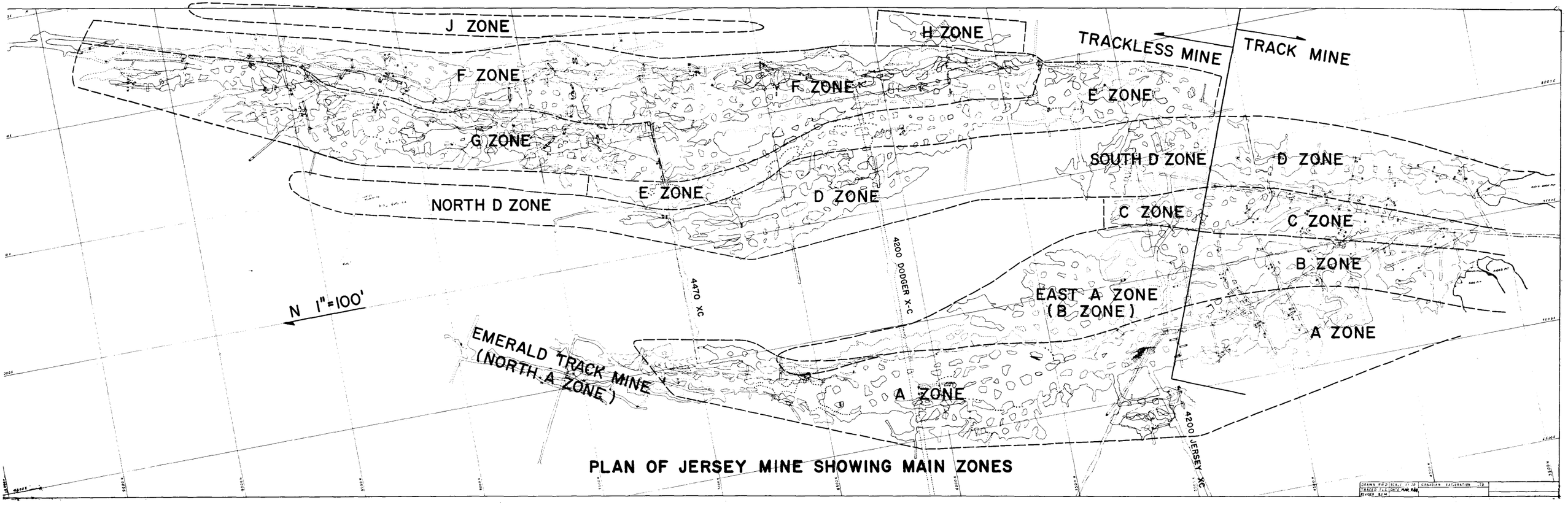


Fig 3

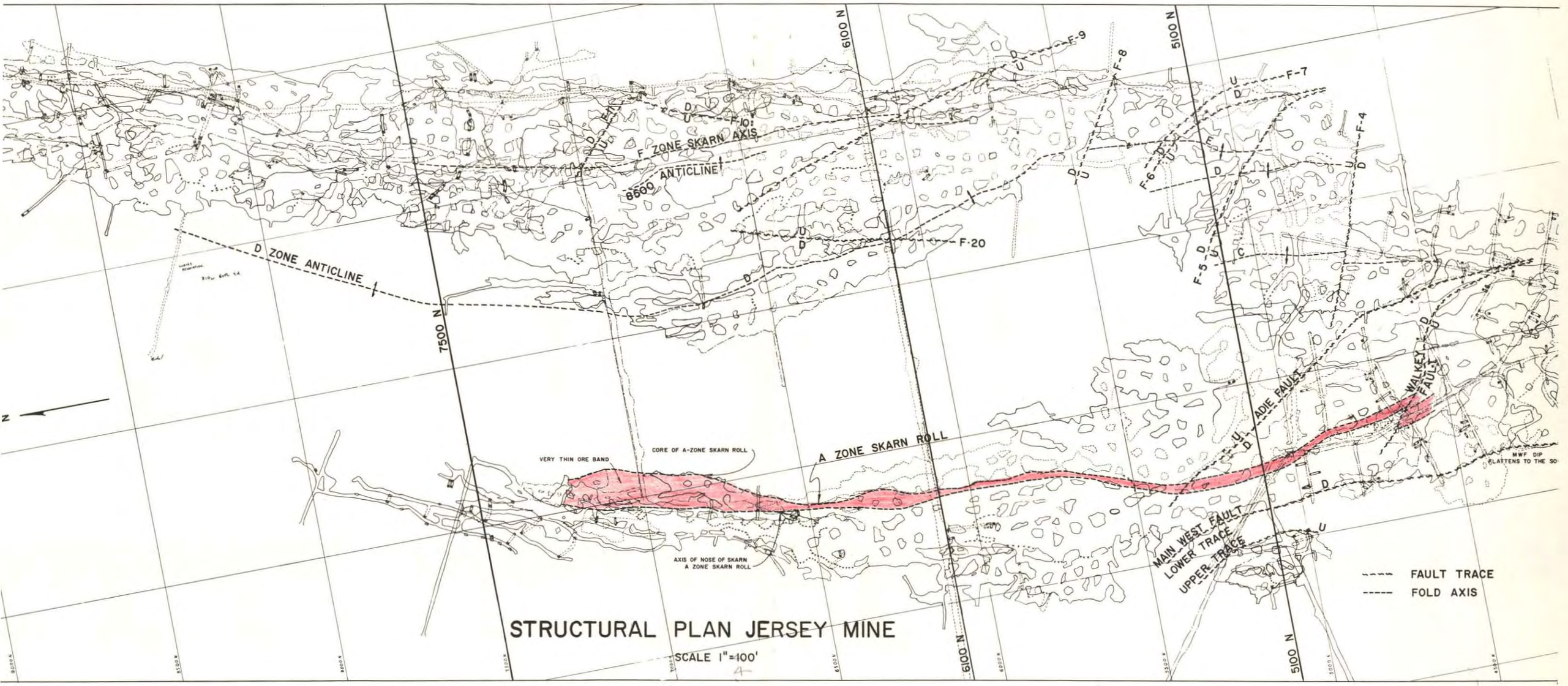
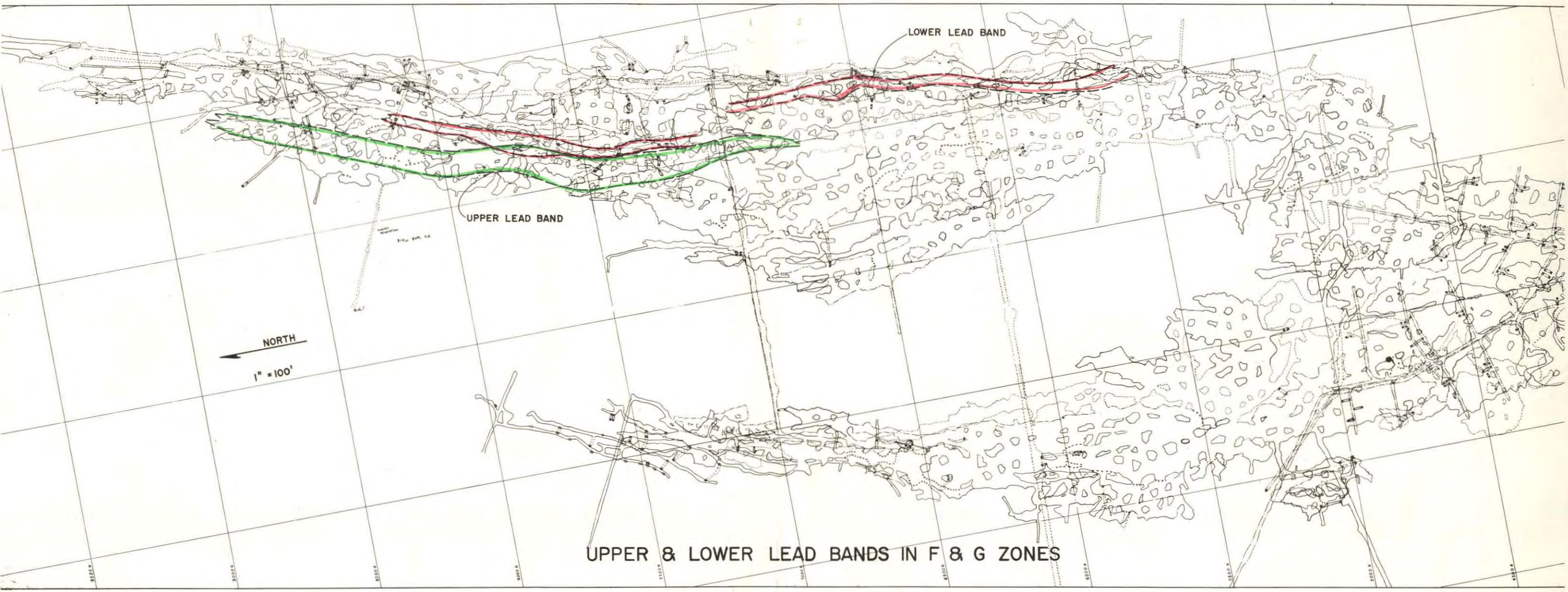


Fig 4



UPPER & LOWER LEAD BANDS IN F & G ZONES

Fig 6