R. W. HUTCHINSON, PH.D.
CONSULTING GEOLOGIST

230 HUNT CLUB DRIVE
LONDON, ONTARIO

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November 27, 1978

Mr. D. Arscott
Chevron Exploration Co., Minerals Staff
Marine Building, Suite 901
355 Burrard Street
Vancouver, B. C.

Dear Dave:

I enclose my report on the Seneca deposit and related aspects of exploration in the Harrison volcanic rocks. The report sets out a summary of what I believe are the critical geological relationships and factors to be considered, as well as some main conclusions and suggestions or recommendations. Its substance is much as we discussed during my visit except for two slight revisions or additions.

Firstly, as I again went over all the data in preparing the report, I became less convinced that additional drilling at Seneca offers significant hopes of expanding the tonnage. I still feel (and have recommended) that the possibility of a northeasterly faulted extension in the area north of the "38 showing" should be drill tested. This possibility, however would require northeasterly, or at least easterly clast transport, rather than southwesterly as your study suggested, hence is not in accord with what little observational data we have. I realize however that your study is preliminary, not complete for all holes and perhaps not as comprehensive as would be desirable in regard to its applicability to the fragmental ore, as well as to the full thickness of their footwall fragmental rocks. For this reason I am still willing to recommend the drilling to the northeast. Drilling for "down dip" and "down transport direction" extensions of the known mineralization to the southeast, also still offers some hope, but prior holes have already tested the main areas where this might occur. There remain one or two open directions where narrow extensions might continue to the southeast, and I have suggested these for consideration as possible drill locations. In summary however, I cannot see really attractive possibilities for additional tonnage at Seneca itself.

Secondly, exploration for <u>other</u> transported ore bodies will be difficult, expensive and essentially "blind". The best hope would be to clearly establish transport direction for the sulphide clasts, then follow the indicated trend (southeastward?) with grid drilling. If this is to be attempted it would be desirable to re-drill a few holes in thick, well mineralized parts of the known body, to obtain new "complete-as-possible" cores for clast count, size and lithology studies. I have mentioned this as a possibility for consideration if exploration for other transported sulphide bodies is to be attempted.

In this regard I have included in my report a plan map showing the disposition of primary and transported ore bodies at Buchans, with an accompanying table that lists their tonnage, grade and depth. This is simply for comparative purposes if exploration for other transported ore bodies at Seneca is contemplated. The map and table are not properly drafted as I have no facilities (or skill) here: perhaps you could have the map finished there for inclusion in the report. The tabulated data might be included on the map itself. Please let me have a copy of whatever results from this.

I think that is all for now. Thanks for all your help during my visit, and please also thank Bill Howell. I am sending this directly to you as I don't know whether Earl will be back at work yet - also because you are directly involved in any case. Please give my regards to Earl. I hope the operation was successful and that he will be back to work shortly.

Best regards,

Dick

R. W. Hutchinson

Summary Reprt

on

Regional Exploration and Seneca Deposit,
in Harrison Volcanic Rocks
British Columbia

(with a map of relationships
at Buchans Newfoundland
pertinent to Seneca)

R. W. Hutchinson

November 26, 1978

I. <u>Conclusions and Recommendations</u>

1. Regional exploration for massive sulphides throughout the entire area of the Harrison volcanics offers attractive possibilities and is recommended. It probably merits higher priority than additional drilling at the Seneca occurrence. Present work on the north and north extension grids should be continued, targets should be tested, and coverage should be expanded farther to the north.

2. Limited additional drilling for extensions of known mineralization at Seneca is warranted, but does not offer attractive possibilities for greatly enlarged tonnage. Drilling should test for a possible faulted extension of the known mineralization to the northeast, in the area north of the 38 showing. Two, at most, three short holes are recommended to evaluate this as yet untested possibility.

   Two additional holes should be <u>considered</u> to test for southeastward extension of known good mineralized sections in holes 15 and 31. If drilled, these would require deep holes and should be located somewhere between holes 46 and 33, and between holes 33 and 35. Southeastward extensions are the most probable because of the indicated southeastward transport direction of fragmental clasts.

3. The Seneca deposit consists primarily of secondary fragmental type sulphides. Due to tilting that produced the present easterly dips, its primary sulphide source to the northwest was uplifted and has probably been removed by erosion. Exploration for this source therefore appears unattractive and is not recommended.

   Exploration for other similar concentrations of fragmental ore along the southeastward, transport direction should be considered, but will be difficult and expensive! If this approach is to be pursued three holes should probably be re-drilled in the known deposit to provide core for sulphide clast studies. This would provide better definition of clast transport direction as a guide to grid drilling that should then test the areas in the "down flow" direction. The disposition and relationships of primary and secondary fragmental massive sulphide orebodies at Buchans and in Japan are pertinent and should be applied if this approach is to be adopted at Seneca.

II. Summary

1. Introduction

At the request of Mr. Earl Dodson of Chevron Minerals Staff in Vancouver, the writer made a two day visit to British Columbia from November 15 to 18, 1978. On November 16, the Seneca and IAM sulphide occurrences and surrounding areas were examined in the field with D. Arscott and W. Howell of Chevron staff. On November 17, all data pertaining to Chevron's work in the area, including results of prior work by former owners were reviewed at Chevron's Vancouver offices. Geology of the area and of the Seneca deposit was discussed at length with Arscott and Howell. It is difficult and undesirable to base final conclusions about the complex Seneca deposit on such a brief review, but this report summarizes the writer's main conclusions and recommendations arising from it.

2. Seneca

The Seneca sulphide body is a typical polymetallic or Kuroko-type deposit in essentially undeformed and unmetamorphosed Jurassic volcanic-sedimentary rocks of the Harrison Group. It has many features characteristic of such deposits including highly altered, veined and weakly mineralized footwall felsic fragmental-pyroclastic rocks, variably siliceous-tuffaceous-sedimentary strata, relatively unaltered hanging wall andesitic volcanics, and a massive sulphide body that consists partly of secondary, fragmental-conglomerate type mineralization. This body strikes northerly and dips gently easterly into a steeply rising mountain slope. The body has been extensively drilled by previous owners prior to Chevron's tenure and although no tonnage estimate is warranted based on this work, results suggest that some 800,000 tons grading about 7% Zn and 1% Cu are present. The body ranges up to about 30 feet thick but is extremely variable in both thickness and grade from hole to hole. Core recovery during drilling was poor, particularly in mineralized sections, and the core has been split for assay, extensively scavenged, taken for mineralogical study etc. Little remains, which inhibits direct study of the important and distinctive fragmental type mineralization.

A partial study of clast size distribution in footwall fragmental rocks by D. Arscott however, suggests that fragments have been transported from a primary source that lay to the north-northwest. Distance of transport is unknown, but very coarse yellow ore (oko) clasts in the exposed body suggest very short distances, although this is an intuitive judgement and is not well founded. A topographically low area lies northwest of the exposure and a primary sulphide source here would have been erosionally removed. Moreover, small trenches on the fringe of this area expose strongly altered and veined footwall rock (4W between 10 and 11S), and similar float has been located farther downslope below the area. This suggests a footwall vent in this location and provides additional support for the possibility of a former primary massive sulphide source above this vent, now erosionally removed.

The exposed body has been complexly faulted, and details of fault movement are unknown. It is possible however, that a northerly extension of the main exposure may have been faulted upward and offset relatively to the east. This might explain the location of a second weakly mineralized exposure near drill hole 38, north of which is an extensive covered area that has not been drill tested. This interpretation would imply easterly to north-easterly clast transport of the fragmental sulphides however, hence is not fully in accord with results of the clast size study. Nevertheless this possibility merits drill testing.

Prior drilling in the down-transport and down-dip direction has not completely closed off mineralization, but has limited the possibilities. Additional holes somewhere between #S46 and 33, and between #S33 and 35 would test for southeasterly extensions of interesting mineralization in earlier holes. Three very deep holes about a half mile to the east were all discouraging, but may have been drilled too far north of the down-transport trend.

Fragmental ore bodies of this type in Japan and at Buchans Newfoundland, consist of isolated pods, rich in transported sulphide clasts that occur along the down-transport trend for distances of as much as 6,000 feet. They were formed by dense debris flows derived from primary ore bodies on the flanks of rhyodacite domes. The flows were presumably set in motion by continuing volcanism in the domes and carried previously-deposited sulphide, barite and rhyolite clasts down paleoslope, depositing them in paleotopographic depressions.

Exploration for deposits of this type involves consideration of two possibilities;

1) locating the primary, in-situ sulphide clast source
2) locating other down-transport secondary, fragmental or conglomerate ore concentrations

At Seneca all available information suggests that the primary, in-situ ore source lay to the northwest, i. e. at lower topographic elevations and down slope from the transported sulphide body. It has therefore probably been eroded and chances for 1) above appear remote. Chances for 2) above merit consideration, but are of questionable merit considering results to date. It must be recognized that exploration for secondary fragmental ores is complex and methods of approach are limited. Geophysical systems are of restricted use at Seneca as prior test results have indicated. Geochemistry is unlikely to reflect the deep , buried, blind sulphide bodies beneath a cover of hanging wall volcanic rocks. Best methods as used in Japan and at Buchans are grid drilling, particularly along the flow or transport direction as determined by detailed studies of the fragmental sulphides (and rock types) themselves. There is no way however, of predicting the size, grade or spacing of the transported ore concentrations. Nor is there any way of predicting the possible spacing or locations of other paleotopographic depressions down the flow direction where fragmental-type sulphides may have accumulated. If this approach is to be applied at Seneca, then it might be desirable to redrill three or four holes into known ore intersections, emphasizing maximum core recovery. Detailed clast size, orientation and lithology studies on the new core should then be used to define transport direction. Grid drilling in the defined, down-flow direction would then be required for follow up.

Simply for comparative purposes a map is attached showing the size and spatial disposition at Buchans, Newfoundland of various secondary fragmental-type orebodies in relation to their known primary source orebody.

3. Regional Considerations

Regional exploration possibilities for other massive sulphide bodies of both primary and secondary type in the Harrison volcanic rocks appear to be very attractive. The following points are pertinent to this assessment:

i) The Harrison volcanic belt is a "roof pendant" of Mesozoic volcanic rocks within the Coast Range Intrusions like the one that contains the important Brittania Mine to the northwest. In other words, volcanic rocks of similar age, type and geologic setting are proven hosts to important massive sulphide deposits.

ii) The Seneca deposit offers "proof positive" of the presence of primary and secondary fragmental sulphide bodies in the Harrison rocks.

iii) There is abundant evidence in the area north and northeast of Seneca (IAM claims etc.) of other extensive, hydrothermally-altered and veined footwall volcanic rocks. These are interpreted to represent other vent areas for hydrothermal brines discharged to the sea floor during "Harrison volcanism". It is probable that this activity formed primary (and secondary fragmental-type) massive sulphide bodies, and these should be preserved in places where uneroded hanging wall rocks remain above the altered footwall volcanics.

iv) Geochemical work and prospecting on the Seneca north grid and north grid extension has revealed interesting anomalous indications, as well as two "float occurrences" of massive sulphides.

v) Despite its relative accessability and proximity to established basic infrastructure facilities, the area of the Harrison volcanics has not previously received thorough exploration coverage.

Considering these favorable aspects, a thorough program of regional exploration for massive sulphides in the Harrison volcanics is warranted. Reconnaisance geochemical, geophysical, and geological coverage apparently works well in defining interesting areas for detailed exploration. This program is probably more attractive and merits higher priority than immediate additional drilling at the Seneca deposit itself.

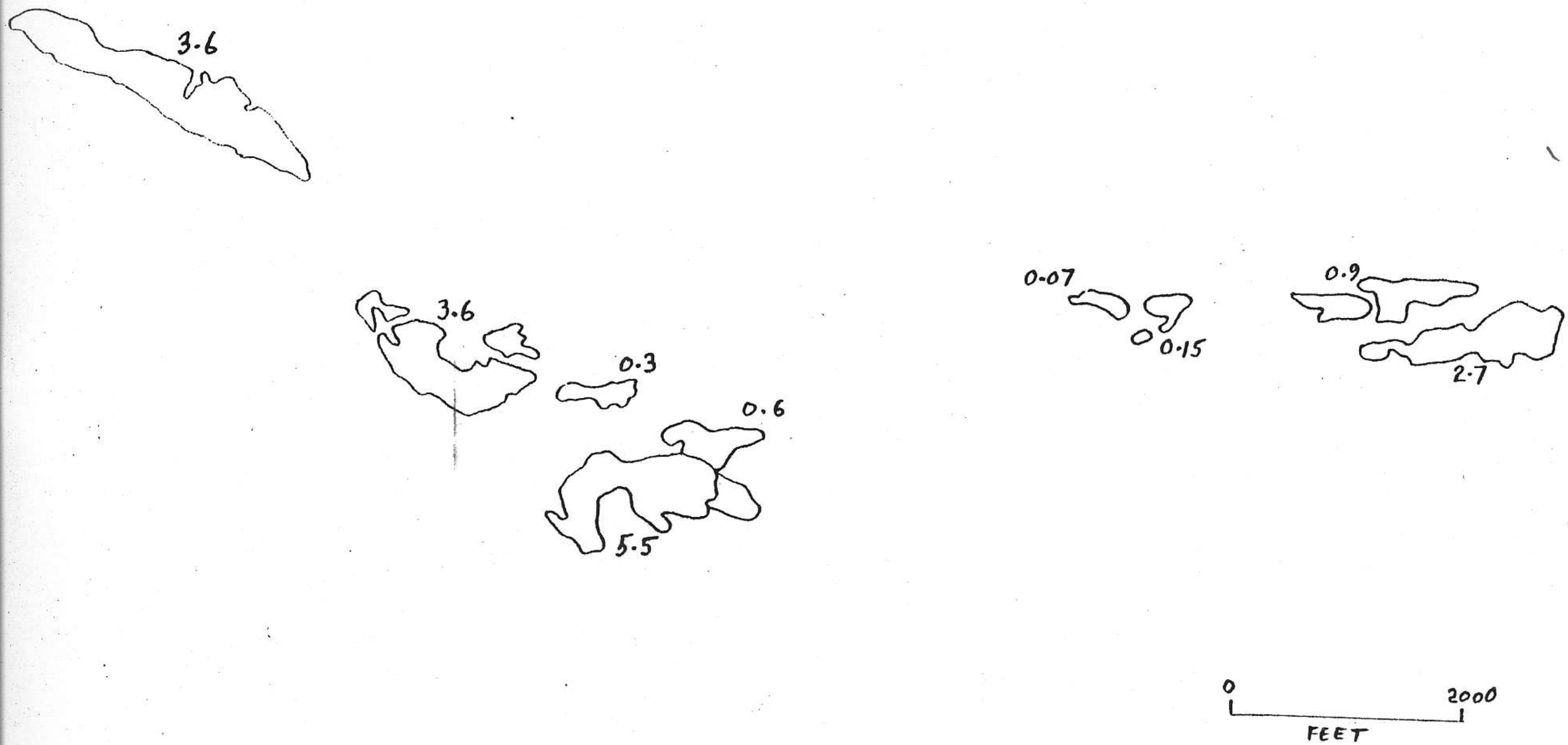
R W Hutchinson

TABLE

Tonnage, grade and depth, Buchans Orebodies

(To accompany plan map)

Orebody	tons	Au oz/T.	Ag oz/T.	Cu %	Pb %	Zn %	Fe %	$BaSO_4$ %	depth below surface
Oriental #1 (primary)	2,738,000	.061	3.93	1.71	8.47	15.80	6.0	24	cropped out
Oriental #2 (transported)	929,000	.046	6.15	0.76	6.20	9.41	3.2	30	200'
Old Buchans (primary)	152,000	.064	4.35	1.66	7.92	14.60	9.5	24	cropped out
Old Buchans (transported)	73,000	045	370	0.76	5.88	9.47	2.6	31	cropped out
Lucky Strike Main Orebody (primary)	5,555,000	049	3.28	1.63	8.62	18.42	8.7	26	cropped out
Lucky Strike North Orebody (Transported)	621,000	049	3.52	0.46	454	8.20	1.8	31	100'
Two Level Orebody (Transported)	329,000	047	3.64	0.50	4.56	8.02	2.5	31	300'
Rothermere Orebodies (Transported)	3,598,000	034	3.92	1.17	7.72	12.73	4.4	31	625'
MacLean Orebody (Transported)	3,653,000	028	3.84	1.13	7.46	13.50	4.3	24	2000'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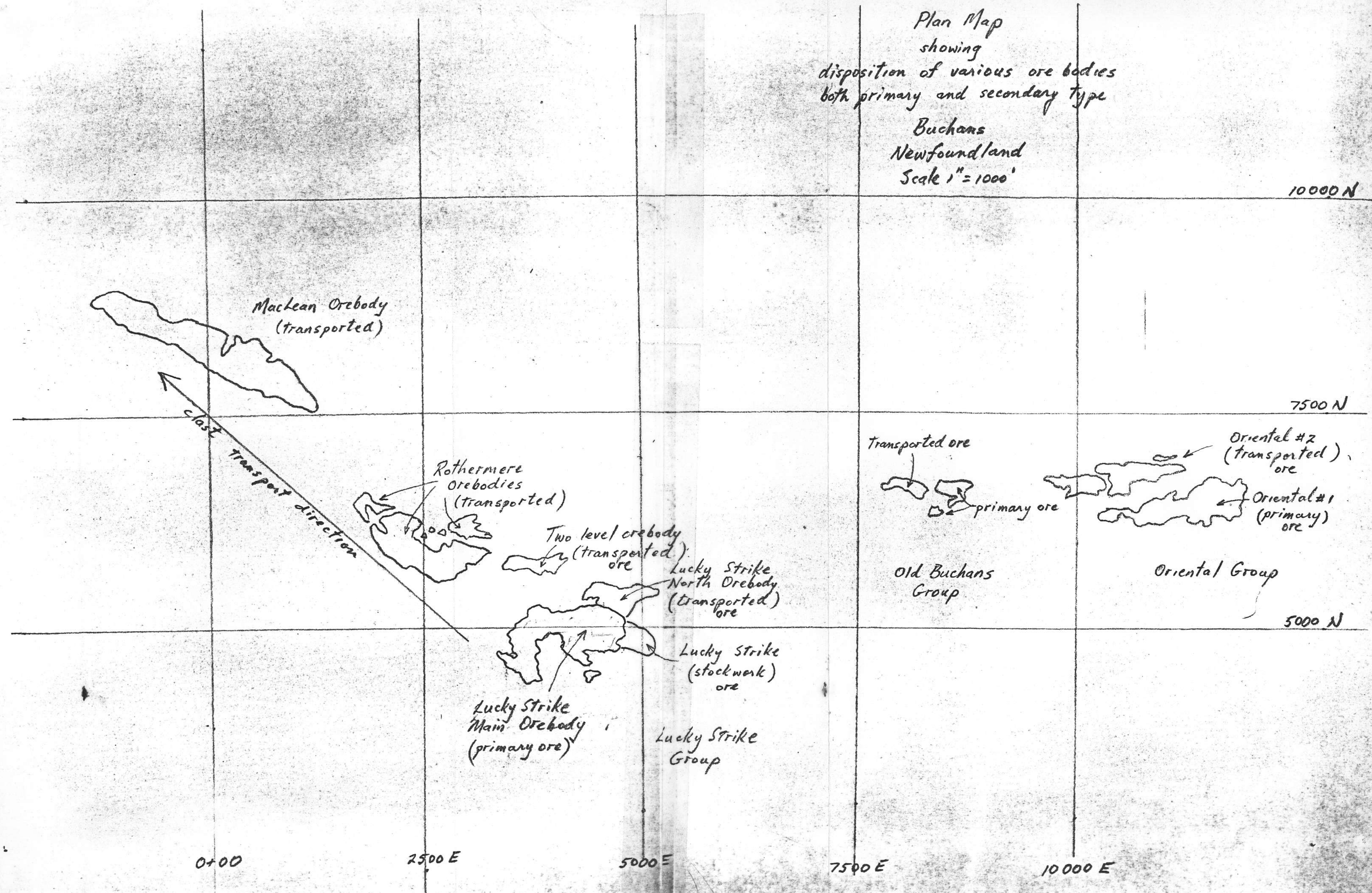
Plan Map
showing
disposition of various ore bodies
both primary and secondary type
Buchans
Newfoundland
Scale 1" = 1000'
10000 N
7500 N
5000 N
MacLean Orebody
(transported)
clast transport direction
Rothermere
Orebodies
(transported)
Two level orebody
(transported)
ore
Lucky Strike
North Orebody
(transported)
ore
Lucky Strike
(stockwork)
ore
Lucky Strike
Main Orebody
(primary ore)
Lucky Strike
Group
Transported ore
primary ore
Old Buchans
Group
Oriental #2
(transported)
ore
Oriental #1
(primary)
ore
Oriental Group
0+00
2500 E
5000 E
7500 E
10000 E