MINERAL POTENTIAL OF CLASTIC SEDIMENTARY BASINS IN NEWFOUNDLAND

by

P.L. Dean and J.R. Meyer
Mineral Deposits Section

Introduction

A continued evaluation of the mineral potential of clastic sedimentary basins in Newfoundland was conducted during the summer of 1983 (Figure 1). Four open file reports on the work carried out in the previous two summers were released in July, 1983. The first three were "Stream Sediment Geochemistry of Three Sedimentary Sequences in Insular Newfoundland", Open Files 1K (19), 1N (440) and NFLD. (1316). The fourth was "Lithogeochemistry of Middle Ordovician Chert and Shale of Central Newfoundland", Open File Nfld. (1317). During the 1983 field season, follow-up work was carried out in the Avalon South (1K (19)) and Humber Arm North (Nfld. (1316)) areas. Mineralization coincident with the indicated anomalies was discovered in the former. Follow-up of the Middle Ordovician chert and shale study discovered visible base metal sulfides coincident with several base metal/barium anomalies, and fluorapatite nodules coincident with a phosphate anomaly. More detailed work on rock samples collected may identify the mineral phase containing the barium, which is present in amounts up to 2%. The shale lithogeochemistry program was expanded to cover the potassium-rich Cambrian "Forteau Shales" on the Great Northern Peninsula, and the Cambro-Ordovician shales of Random Island and adjacent areas. Follow up of lake sediment base metal anomalies on the western side of the Baie Verte Peninsula yielded several new mineral showings all of which coincided extremely well with the geochemical anomalies.

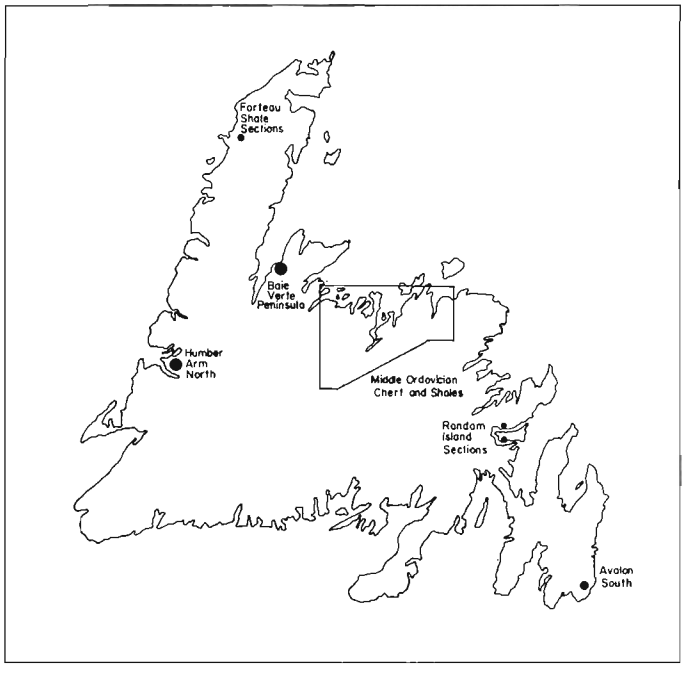

Fig.1 Mineral Potential of Clastic Sedimentary Basins in Insular Newfoundland - 1983 Field Areas

Open File Reports

Four open file reports were released in July, 1983. Results from the 1982 stream sediment geochemistry program (Dean and Meyer, 1983) constituted three releases, two from the Avalon Peninsula (Avalon South - 1K (19) and Avalon North - 1N (440)) and one from western Newfoundland (Humber Arm North - Nfld. (1316)), east of the Bay of Islands. Analyses released for each area include either 8 or 9 single element maps (Zn, Pb, Ni, Cu, Co, Cd, Fe, Mn, ± Ag and F), a loss-on-ignition map, either 4 or 5 residual maps (single element regressions with Fe, Mn, and/or L.O.I.), and sample location maps. Brief reports outlining the geology of the areas and the methods of analysis accompany each report. The Avalon North area was actively explored during the 1983 field season by private industry.

The fourth open file report (Nfld. (1317)) contains results from a lithogeochemical study of Middle Ordovician chert and shale from central Newfoundland (Dean and Meyer, 1982). Twenty-four sections were mapped and sampled in detail and 995 samples were analyzed for 24 major and minor elements. The analytical results, accompanied by statistical analyses and field data, are contained in a computer printout. Detailed stratigraphic sections and location maps are included for each sampled area.

Contribution to the Canada-Newfoundland co-operative minerals program 1982-84. Project funded by the Newfoundland Department of Mines and Energy and the Geological Survey of Canada.

Avalon South

The results of the 1982 stream sampling (Dean and Meyer, 1983) confirmed the presence of Zn-Pb-Co lake sediment anomalies (Davenport et al., 1975; Butler and Davenport, 1979) in the Chance Cove and Portugal Cove Brook areas. Coincident Cu, Cd and Ni anomalies are also present. Concentrated prospecting of the bedrock and *in situ* float discovered visible sulfide mineralization near several of the anomalies. The style of mineralization is similar to that in the northern Avalon Peninsula, west of Carbonear (Dean and Meyer, 1983). Chalcopyrite, sphalerite and galena were found as isolated blebs in medium to coarse grained sandstone of the Hadrynian Drook Formation, often associated with 1 to 5 mm black weathered pyrrhotite blebs. Oval pyrrhotite-magnetite "eyes" (2 to 5 mm in length) were observed in fine grained siltstone, and may contain minor base metals. New lithologic observations within the Drook Formation include boulders of volcano-sedimentary breccias and tuffaceous rocks which form a rough northeast trend 2 km northwest of Route 10. A Ag-Pb-Ni-Cu anomaly occurs in the vicinity of the tuffaceous rocks.

Humber Arm North

The stream sediment analyses from this area (Open File Nfld. (1316)) show localized base metal anomalies with few real trends and no noticeable groupings or combinations of elements. However, in the vicinity of Pynn's Pond, stream sediment Pb anomalies corresponds to lake sediment Pb anomalies reported by Butler and Davenport (1980). A slight correspondence of Cu anomalies and red slates and shales of the Upper Summerside Formation was noted. Mineralization found during follow-up work in 1983 included thin laminations of pyrite hosted by black shales of the Irishtown Formation, and minor malachite in sandstone of the Summerside Formation.

Middle Ordovician Chert and Shale of Central Newfoundland

Geochemical analyses of Middle Ordovician chert and shale sections sampled in 1981 indicate base metal and other anomalies (i.e. Ba, P, Mn, etc.) (Dean and Meyer, 1981). As a result, a short follow-up program was carried out in 1983. Galena was observed in 1 to 2 cm thick Mn-carbonate bands and along fracture planes in the lower intervals of the Luscombe Point section at Loon Bay. Isolated blebs of chalcopyrite were observed in the Loon Bay road section, site of the most impressive Ba, Pb, Zn, Cu, Ni and Ag anomalies. Barium is present in amounts up to 2%; however, the mineral(s) containing the barium have not yet been identified. The Loon Bay road section has total iron concentrations of up to 20% in several intervals which display massive, well banded pyrrhotite and pyrite mineralization.

Dense black nodules sampled from the black chert and shale at Lawrence Harbour South contain 26% P_2O_5, 34% CaO, 25% SiO_2, and 22,110 g/t fluorine. These are thought to be fluorapatite nodules. They contain very thin (<1 mm) quartz veins, and vary in shape and size from small rounded nodules 3 cm by 5 cm to large elongate lenses 15 cm by 40 cm. (The latter have not yet been analyzed.) The nodules occur in six intervals at the Lawrence Harbour South section, and three intervals at the Red Cliff section.

Northern Peninsula

Reconnaissance sampling of the Cambrian "Forteau shales" on the Northern Peninsula indicate a high K_2O content (R. Stevens, personal communications, 1977 and 1983). These shales are readily exposed in quarries along the western portion of the Roddickton road (Route 432) and immediately to the south at Three Mile Pond. Four relatively undeformed sections were sampled in 3 m intervals. The shales are dark gray, weather rusty brown; and are medium to thickly laminated and very friable. They are generally very calcareous, rarely manganiferous and contain trilobite imprints, pyrite nodules and beds rich in limestone nodules. A fine to coarse grained clastic limestone unit usually overlies these shales.

Random Island

Two representative sections of Cambro-Ordovician shale (and slate), sandstone and limestone were sampled in the Random Island area on the west side of Trinity Bay. A 2.5 km coastal exposure at Smith Point contains an excellent section of the Lower to Middle Cambrian Adeytown Group, which disconformably overlies the Random Formation near White Rock (Jenness, 1963). It consists of dominantly green to brownish red slaty shale with limestone concretions, and interbedded thin to thick, pink, green and gray limestone beds, some of which exhibit very resistant algal structures. There are several thin silty horizons, a 6 m thickly bedded sandstone interval, and a single 1 m thick, extremely dense manganiferous zone. Dark gray and black shale at the base of the conformably overlying Harcourt Group was sampled at the top of this section in Broad Cove.

A more complete section of the Harcourt Group was sampled on the south side of Random Island, between Fosters Point and Elliotts Cove. The change from red and green to gray and black shales approximately 0.75 km north of Fosters Point marks the base of the Harcourt Group. The southern half of the section consists of steeply dipping, undeformed, gray to black shale and slaty shale with minor siltstone, sandstone and limestone. The shale typically weathers rusty brown, appears sulfur-rich, is very friable and contains calcareous concretions 5 to 30 cm in diameter. Two porphyritic dikes 10 and 50 cm thick were observed and contain minor pyrite. The northern half of the section consists of strongly deformed black and gray graphitic shale with thin sandstone interbeds and calcareous concretions. Each of the lithologies mentioned above was sampled in at least one location. Additional samples of the Harcourt Group were collected from the shale quarries operated by Trinity Brick Ltd. at the northwest end of Random Island.

Baie Verte Peninsula

Base metal anomalies are indicated by lake sediment geochemistry (Butler and Davenport, 1980) on the western side of the Baie Verte Peninsula (Figure 2). A northern trending series of copper anomalies which parallel represent lithologic trends are present in the Westport area, and localized Zn-Cu and Zn-Pb anomalies occur between Baie Verte and Seal Cove. The region is underlain by highly metamorphosed rocks of the Eocambrian to Middle Ordovician White Bay and Old House Cove Groups. These rocks consist mainly of northeasterly striking psammite and pelite with lesser marble, mafic and graphitic schist and amphibolite. The psammite in the Westport area contains very minor pyrite; however, 12 km to the northeast, on the west side of East Pond, quartzose bands in a garnetiferous psammite contain chalcopyrite and pyrite mineralization. A coincident Cu-Ag high in the lake sediment geochemistry was noted. Graphitic schists exposed in roadcuts halfway between Westport and Western Arm contain up to 4% pyrite-pyrrhotite mineralization. The 'amphibolite' units, interpreted as dikes, sills and flows, intrude and are part of the Old House Cove Group and older rocks in the area. They are dark green, usually porphyroblastic, and frequently host chalcopyrite mineralization (2% in grab samples). These units occur adjacent to ponds with anomalously high copper values in their lake sediments. Vuggy boulders of 'amphibolite' contain veinlets of ruby red, glassy to resinous sphalerite(?) and disseminated chalcopyrite in the Osbournes Pond area. The veinlets are 1 to 10 mm thick, up to 10 cm long, and often intimately associated with calcite and quartz veins. Other 'amphibolite' boulders found on the shores of this pond contain up to 1 to 2% combined chalcopyrite-pyrrhotite. A road quarry 2 km west of Osbournes Pond contains quartz-carbonate veins which host galena, sphalerite(?), molybdenite and pyrite mineralization. Rusty weathering pelites 1.5 km east of the same pond contain up to 5% chalcopyrite-pyrrhotite-pyrite mineralization. All the mineralization found in this area coincides remarkably well with the lake sediment geochemistry.

Conclusion

The evaluation of clastic sedimentary basins in Newfoundland has been largely based on a geochemical approach. Lake sediment geochemistry has identified base metal anomalies in at least four areas which are underlain by sedimentary rocks. One of the areas was explored by private industry in 1983, while our prospecting and stream sampling in two of the other areas confirmed the original anomalies and found many new mineral showings in bedrock.

The lithogeochemical study of central Newfoundland chert and shale has confirmed the existence of metal-rich, fine grained sedimentary rocks. Variations in the concentration of elements, such as Ba, by amounts of 200 to 20,000 g/t suggest introduction, migration and/or concentration by

LEGEND (Figure 2)

MIDDLE ORDOVICIAN TO HADRYNIAN

RATTLING BROOK GROUP (Unit 9)

9 *Unseparated semipelitic, pelitic and psammitic schist; minor greenschist, marble and graphitic schist.*

WHITE BAY GROUP (Units 5-8)

8 *Unseparated semipelitic, pelitic, and graphitic schist with subordinate psammitic, garnet porphyroblastic, and mafic schist; minor marble and quartz pebble metaconglomerate.*

7 PIGEON ISLAND FORMATION: *Mainly garnet porphyroblastic quartz-muscovite semipelitic schist, feldspathic psammitic schist, locally magnetite-rich, and graphitic schist.*

6 GARDEN COVE FORMATION: *Medium to dark green amphibolite and mafic schist, locally fragmental.*

5 *Mainly marble and carbonate schist, local marble breccia and conglomerate; minor quartzite.*

OLD HOUSE COVE GROUP (Units 3 and 4)

4 *Buff to gray weathering, medium to coarse grained psammitic and semipelitic schist , minor pebbly psammitic schist and graphitic schist.*

3 *Medium to coarse grained feldspar porphyroblastic mica schist, tectonically derived from Units 1 and 4.*

HADRYNIAN AND EARLIER (?)

EAST POND METAMORPHIC SUITE (Units 1 and 2)

2 MIDDLE ARM METACONGLOMERATE: *Mainly polymictic metaconglomerate with interlayered buff to gray psammitic schist.*

1 *Dominantly fine to medium grained gray psammitic and semipelitic schist and gneiss, may include rocks equivalent to Unit 4; 1a, migmatite gneiss and gray banded quartzofeldspathic gneiss, minor pink granitic gneiss.*

Mainly massive, blackish green amphibolite dikes, sills, and pods; locally eclogitic in Units 1 and 2.

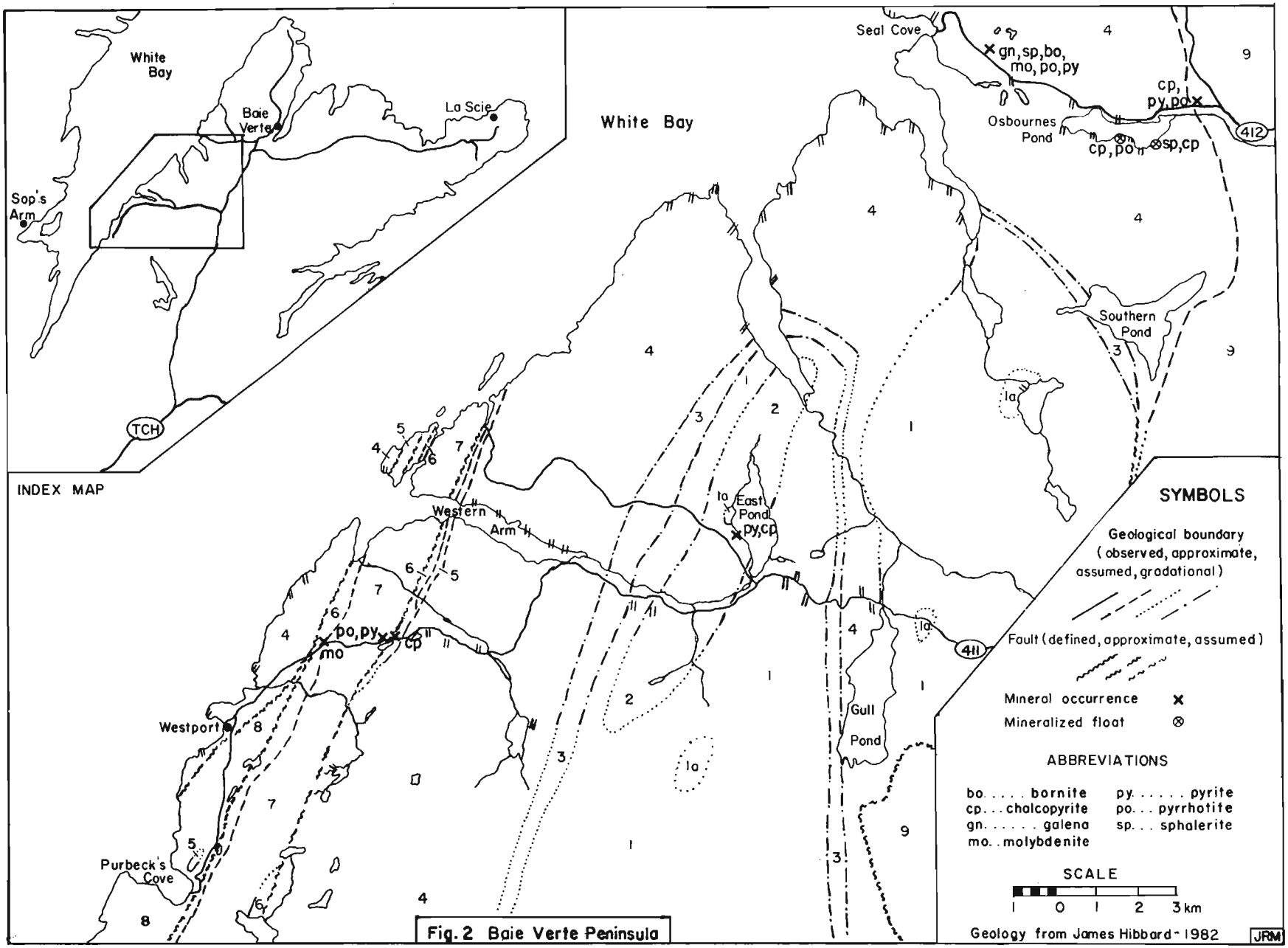

Fig. 2 Baie Verte Peninsula

fluids favorable to ore deposition. Clearly, the results indicate a favorable potential for the discovery of clastic-hosted base metal sulfide deposits in Newfoundland.

Acknowledgements

We thank Terry Brace, a hard working senior assistant; Angela Best, for inspiration and energy on the way to work each morning; and Nanny Muggeridge for volunteering her summer and very keen eyes.

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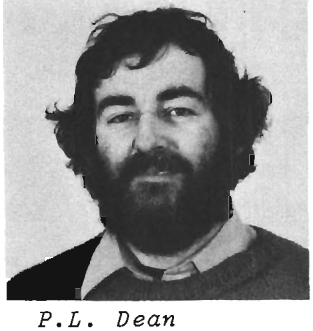
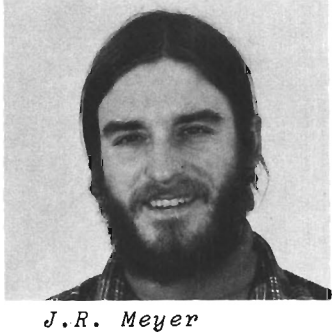


P.L. Dean



J.R. Meyer