Current Research (1994) Newfoundland Department of Mines and Energy,
Geological Survey Branch, Report 94-1, pages 253-261

SULPHIDE OCCURRENCES IN CLASTIC SEDIMENTARY ROCKS IN THE HOWSE ZONE, WESTERN LABRADOR

H.S. Swinden and F. Santaguida[1]
Mineral Deposits Section

ABSTRACT

During the third year of a project to evaluate the metallogeny of sulphide mineralization in the Howse Zone of the Labrador Trough, field work was concentrated in the Howse Lake area. In the study area, clastic sediment-hosted sulphide occurrences are of two types: Type I are massive to heavily disseminated pyrrhotite and pyrite having minor chalcopyrite in black argillites; Type II are disseminated pyrite and chalcopyrite in quartzose sandstones. Type I showings are similar to shale-hosted massive sulphide occurrences elsewhere in the Howse Zone and are interpreted as Besshi-type mineralization in a rift-related setting. Type II occurrences are typically sulphide-poor and unlikely to be of any economic significance.

Petrographic observations of samples collected during 1992 in the Martin Lake area confirm field observations that base-metal sulphides are typically later, paragenetically, than the iron sulphides. Original sulphide textures are mainly preserved because of the low metamorphic grade, and indicate that most of the sulphides crystallized on the seafloor or during early diagenesis.

INTRODUCTION

Sulphide occurrences with and without associated base metals are widespread in the northeastern part of the Labrador Trough (Figure 1). An initial reconnaissance survey of a number of these occurrences was carried out in 1991 (Swinden, 1991) and detailed follow-up of showings in the area, immediately north of Martin Lake, was carried out in 1992 (Swinden and Santaguida, 1993).

The 1993 field work was focussed in the area of Howse Lake (Figures 2 and 3) and carried out in late June from a camp on Howse Lake. The objectives of this year's work were to document the nature of the mineral occurrences and to develop and test deposit models for the mineralization by: 1) observation of the field relationships of all mineral occurrences in the area; 2) systematic sampling for assay and geochemical studies to document the base metal and/or anomalies in tracer-element concentrations that could shed further light on the economic potential of the mineralization; and 3) collection of samples for petrographic and stable isotope studies, which could further contribute to deposit models for this part of the Labrador Trough.

The results of the Howse Lake area field work, sample assays, and petrographic observations on some samples collected in previous years from elsewhere in the Howse Zone, comprise this report.

REGIONAL GEOLOGY

The Howse Lake area lies in the Howse Zone of the Labrador Trough (Wardle *et al.*, 1991) adjacent to the Quebec border. The regional stratigraphy of the Labrador Trough in western Labrador, the geological setting of mineralization in the Howse Zone, and the history of mineral exploration in the region were outlined by Swinden and Santaguida (1993). The stratigraphic succession in the Howse Zone consists of a basal continental arkose overlain by a thick deep-marine clastic succession comprising turbidites and carbonaceous argillite. The sedimentary succession is extensively intruded by diabase and gabbro sills that are believed to be approximately coeval with the sediments. In many areas, the sedimentary rocks are only locally preserved as screens between gabbro bodies. During deposition, the tectonic environment of the sedimentary and magmatic rocks is interpreted to have been one of active oceanic rifting, recording breakup of the Superior Craton.

MINERALIZATION IN THE HOWSE LAKE AREA

The Newfoundland Mineral Occurrence Data System (MODS) documents more than 30 sulphide occurrences in the area immediately south and southeast of Howse Lake (Figure 3), most of which were first reported by Bloomer (1955) and most of these occurrences were successfully

This project is funded by the Canada–Newfoundland Cooperation Agreement on Mineral Development (1990-1994); project carried by Geological Survey Branch, Department of Mines and Energy, Government of Newfoundland and Labrador.

[1] Department of Earth Sciences, University of Waterloo, Waterloo, Ontario, N2L 3G1

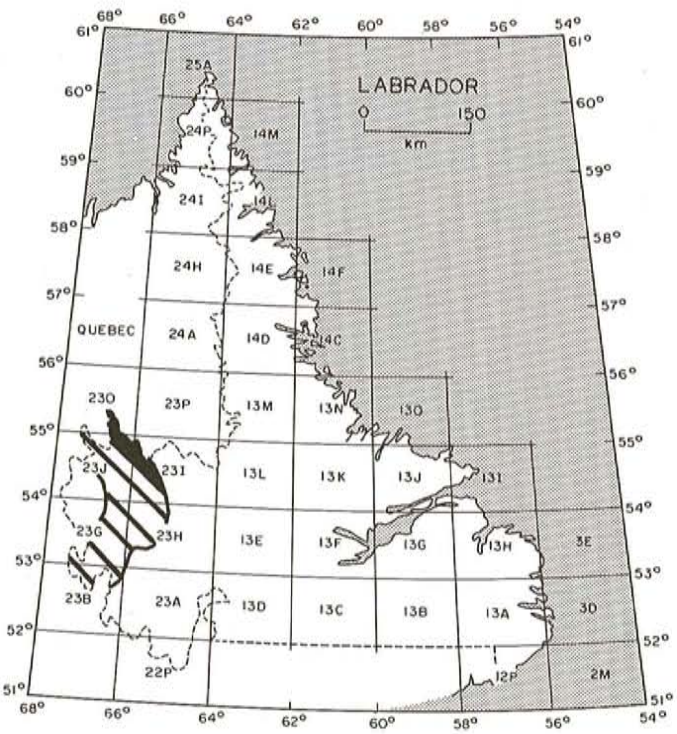

Figure 1. *Location of the Labrador Trough (cross-hatch) and area underlain by the Howse Zone (black) as illustrated on Figure 2.*

relocated. In the following descriptions, showings are referred to by their MODS identifying number, for ease of correlation with mineral occurrence maps for the area (Smith, 1987).

In general terms, there are two types of clastic sediment-hosted sulphide mineralization in the Howse Lake area. Type I showings are massive to semi-massive pyrrhotite, lesser pyrite and chalcopyrite in black argillite, and are found throughout the area. Type II showings consist of sparse disseminated and nodular sulphides (py> >cpy) in quartzose-laminated sandstones and mudstones. They occur mainly in a northwesterly trending belt that can be traced from the northwest end of Two Island Lake (23O/1[Cu015] and 23O/1[Cu016], Figure 3) to the eastern shores of Howse Lake (23O/1[Cu001], Figure 3).

TYPE I SHOWINGS

Type I showings are found throughout the Howse Lake area. For ease of description, they are here considered in terms of three areas: i) Howse Lake East; ii) Two Island Lake East; and iii) Howse Lake Southwest.

Howse Lake East

This area includes a number of sulphide occurrences that appear to occupy several northwest–southeast-striking bands in the area between the east side of Howse Lake and the Quebec border (Figure 3).

The most northerly of these, 23O/1[Pyr001] and 23O/1 [Pyr002], occupy small valleys that probably mark the trace of argillite bands within the dominantly gabbro outcrop immediately east of Howse Lake; they consist of variably sulphidic black argillite. Showing 23O/1[Pyr001] comprises a few outcrops of moderately rusty, black argillite interbedded with siltstone and contains local concentrations of pyrrhotite. Showing 23O/1 [Pyr002] consists mainly of rubble crop of sulphidic black argillite, which can be traced along strike for about 200 m along the western shore of a small pond. Although not uniformly sulphidic, there are small local beds of massive pyrite, beds rich in fine-grained pyrrhotite, and some crosscutting pyrite veinlets. No base-metal sulphides were seen.

The argillite band that hosts 23O/1[Pyr002] can be traced for more than 3 km, to the south of this showing, where it is reported to contain several showings southwest of Griff Lake (Figure 3). No bedrock mineralization was located in the area of the showings 23O/1[Pyr003,004; Cu010] (Figure 3), although a number of frost-heaved sulphidic argillite boulders were noted in the area of 23O/1[Pyr003], indicating that the mineralized argillite is probably present in the subsurface. However, approximately 1 km to the northwest of this boulder patch, near the end of a small pond in an area where no showings had previously been reported, there are patches of rubble crop and some small outcrops of mainly sandy rocks with black argillite beds containing 5 to 6 cm beds of massive pyrrhotite. The pyrrhotitic beds are commonly cut by small veinlets of chalcopyrite.

Farther to the east, almost on the Quebec border, another mineralized argillite band southeast of Griff Lake also contains sulphides. Showing 23O/1[Cu009] consists of a few thin argillite bands in a predominantly sandy sequence that outcrops in the bed of a small stream. Similar outcrops were observed on the sides of the valley approximately 100 m from the stream. The shaly bands tend to be sheared and locally carry anastamosing lenses of fairly coarse pyrite. This sedimentary band was traced along strike to the southeast for approximately 1.5 km, and in sparse outcrops, is seen to be locally pyritic.

Two Island Lake Area

This area encompasses three reported showings northeast of Two Island Lake (23O/1[Pyr012, 013, 014]), all consisting of variably sulphidic argillite intersected in drill core by Labrador Mining and Exploration (Grant, 1977).

No outcrop was found in the vicinity of 23O/1[Pyr012 and 014]. However, in the area of 23O/1[Pyr013], a band of sulphidic argillite was traced, mainly in float, along a northwesterly strike length of more than 500 m on the northeast side of a small linear pond. Mineralization comprises massive and densely disseminated pyrrhotite and lesser pyrite, which commonly forms conformable bands in the argillite. Chalcopyrite is locally present as veinlets in the massive sulphide.

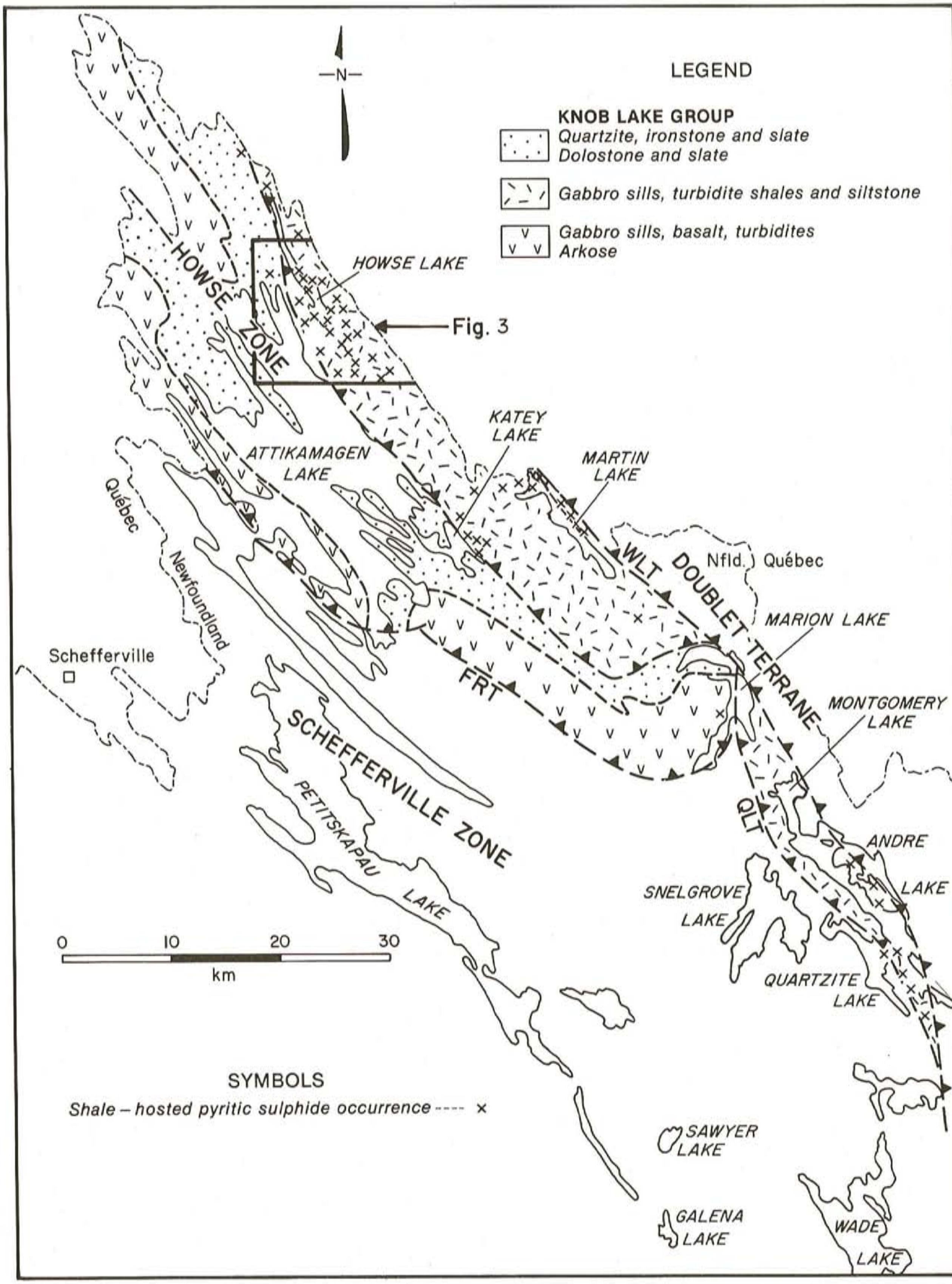

Figure 2. *General geology (after Wardle* et al., *1991) and base-metal sulphide occurrences of the Howse Zone, Labrador Trough. FRT–Ferrum River thrust; QLT–Quartzite Lake thrust; WLT–Walsh Lake thrust. Shale-hosted pyritic occurrences shown by 'x'. Area of Figure 3 and Martin Lake area where petrographic samples were taken are indicated by heavy boxes.*

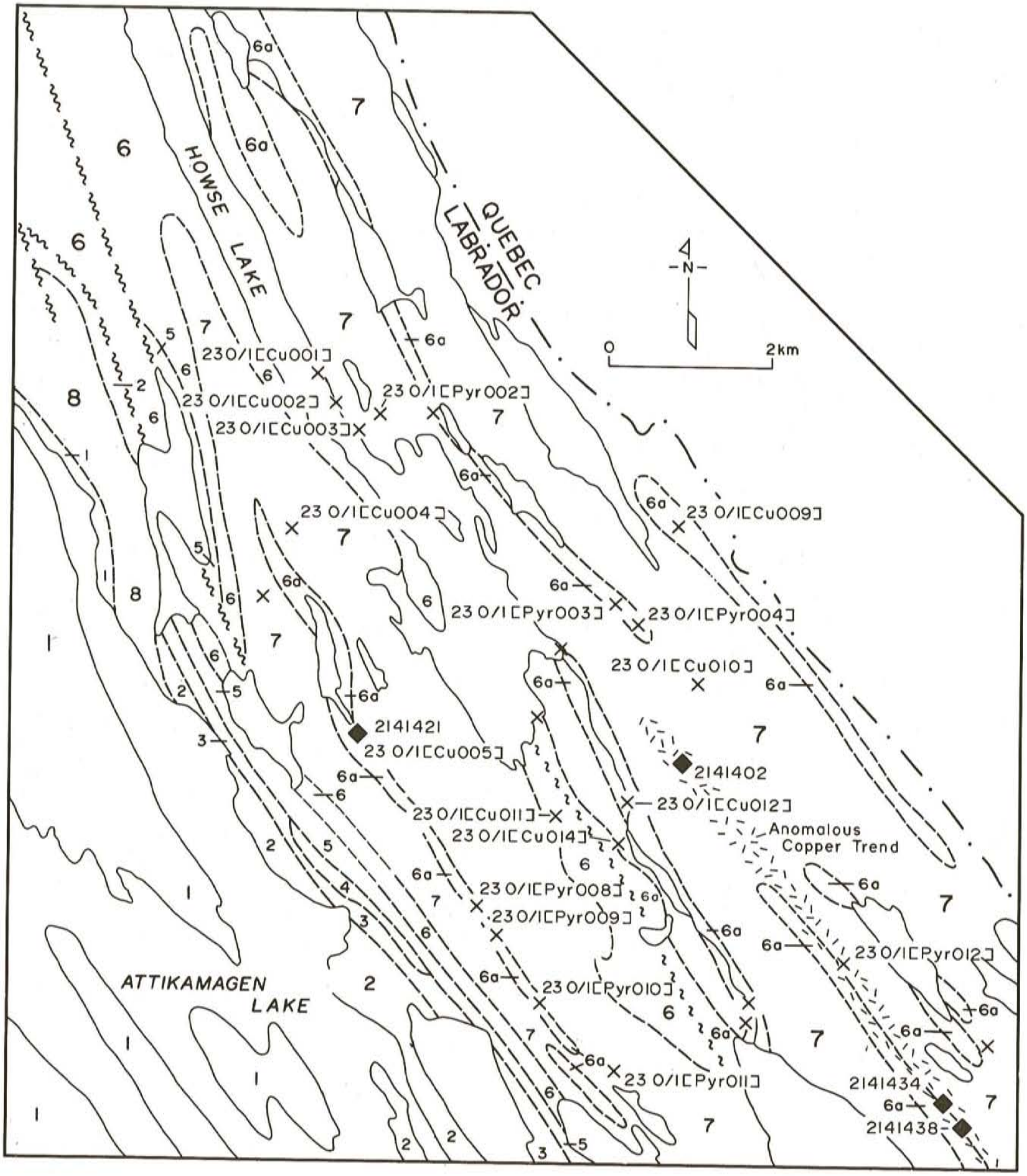

Figure 3. *General geology and location of sulphide showings in the Howse Lake area. See text for description of 'anomalous Cu trend' northeast of Two Island Lake. 1—Le Fer Formation, dominantly fine-grained clastic sedimentary rocks; 2—Dennault Formation, dolomite; 3—Wishart Formation, quartzite; 4—Nimish Formation; basalt; 5—Sokoman Formation, iron formation; 6—dominantly fine-grained clastic sedimentary rocks, includes rocks assigned to the Menihek Formation; 6b—pyritic argillite; 7—dominantly gabbro with screens of fine-grained clastic sedimentary rocks.*

Howse Lake Southwest Area

This area encompasses at least six reported sulphide occurrences disposed along a strike length of more than 5 km in a northwest linear trend (Figure 3). These outcrops were visited during the reconnaissance phase of the project in 1991 and were previously described by Swinden and Santaguida (1993). The sulphides are hosted by a black carbonaceous argillite unit, which is at least 20 m wide in some areas, although its complete width is seldom exposed and may be variable. Sulphides include beds of massive pyrrhotite as well as argillite and cherty argillite with heavily disseminated pyrrhotite and pyrite. Chalcopyrite is present in many areas, where it typically seems to crosscut the massive pyrrhotite in small fracture fills and veinlets.

Mineralization in the Howse Lake Southwest area seems to be continuous along its traced strike length although the mineralized rocks are not continuously exposed over this distance. The best sulphide mineralization is found in the vicinity of showings 23O/1[Pyr008 and Pyr009], where the mineralized band is well exposed for more than 400 m along strike. It commonly includes a thick (up to 10 m) interval of laminated massive pyrrhotite–argillite, which contains beds and veinlets of pyrite and chalcopyrite. This unit also includes a prominent cherty band that is well mineralized with coarse pyrite, and is locally brecciated.

TYPE II SHOWINGS

Type 2 showings outcrop along a northwest-trending belt, over a strike length of more than 8 km, from the northwest end of Two Island Lake to the eastern shore of Howse Lake.

The three sulphide occurrences on the Howse Lake shore (23O/1 [Cu001, 002, 003]) are along strike from each other and hosted by a belt of laminated quartzitic sandstone and mudstone. The quartzose sandstones are locally sulphidic, although sulphides are seldom a major constituent of the rock. In areas where showings have been identified (Figure 3), the rocks contain from 0.2 to 0.5 percent disseminated sulphide, consisting mainly of pyrite grains, locally with crosscutting pyritic (± quartz) veinlets up to 15 mm wide. Locally, there are small (1 to 2 cm) concretions of pyrite and/or pyrrhotite. Although all of these showings are categorized as Cu showings in the MODS files, chalcopyrite is present only in very minor amounts. The sulphides impart a rusty aspect to the outcrops but the amount of sulphide present is generally insignificant. These occurrences are not considered to be of economic significance.

There are five reported sulphide occurrences along the flowage connecting Howse and Two Island lakes. Most of these seem to be similar in nature to the showings on Howse Lake to the north. They comprise minor amounts of disseminated and veinlet pyrite in laminated and fine-bedded mudstones and sandstones. None of these showings contains appreciable amounts of sulphide and the host rocks are generally not carbonaceous.

GEOCHEMISTRY

Fifty three sulphide-bearing samples from the Howse Lake area were assayed for base and precious metals and a number of tracer elements as well. Results are summarized in Table 1. In addition, assays of 7 grab samples taken from the Howse Lake Southwest area, during the 1991 reconnaissance, were reported by Swinden and Santaguida (1993).

No metal anomalies of economic interest were found in Type II (quartzose–sandstone-hosted) showings. Likewise, most assays from Type I (argillite-hosted) showings returned background values in all metals. However, four samples are distinctly anomalous in Cu and/or Zn (Figure 4). A single sample from showing 23O/1 [Cu005] in the northern part of the Howse Lake Southwest trend returned 0.9 percent Zn and 0.13 percent Cu. This is the only sample in this trend that returned anomalous base metals and confirms the Zn anomaly at this showing reported by Swinden and Santaguida (1993).

Three samples from the area east of Howse and Two Island lakes returned anomalous Cu values. These samples appear to be along strike from each other over a strike length of more than 4 km. One of these samples also contains slightly anomalous gold.

SULPHIDE PETROGRAPHY

Polished sections of sulphide-rich samples collected in 1992 from the Martin Lake area were examined to determine the sulphide mineralogy and to identify any primary depositional textures. The geological features of the showings and representative assays can be found in Swinden and Santaguida (1993). Petrographic studies are still in progress and will include samples from the Howse Lake area. The observations and interpretations presented below must, therefore, be considered as preliminary.

Mineralization in the Martin Lake area consists of conformable accumulations commonly dominated by either pyrite and/or pyrrhotite, and containing minor chalcopyrite and locally anomalous concentrations of Zn and/or Pb. Swinden and Santaguida (1993) described three types of mineralization in the area: i) pyritic argillite; ii) fine-grained pyrrhotitic argillite; iii) very coarse-grained pyritic mineralization in calcareous rocks.

Pyritic mineralization in argillite consists of fine grained, thin layers that are conformable with bedding. The pyrite layers are composed of small, framboidal grains and contain abundant gangue mineral inclusions (Plate 1a). No other sulphide minerals are found within the pyritic layers. The individual framboids appear as atoll structures, which contain a gangue mineral core, suggesting sulphide mineralization utilized the sediment particles as nucleation sites.

Fine-grained pyrrhotite mineralization varies from disseminations to massive sulphide beds commonly

Table 1. Assay data for samples collected in the Howse Lake area during 1993. See text for descriptions of Type I and Type II showings. Easting and northing give sample locations in the NTS map area 23 O/1. Au, Pt, Pd in ppb, all other elements in ppm

Sample No.	Type	Easting	Northing	Cu ppm	Pb ppm	Zn ppm	Co ppm	Ni ppm	Ag ppm	Au ppb	Pt ppb	Pd ppb	As ppm	Sb ppm	Ba ppm
2141384	I	661130	6112780	190	nd	80	30	200	0.4	6	5	10			
2141385	I	661130	6112780	50	nd	50	30	50	0.1	<2	5	2	6.6	3	130
2141386	I	661130	6112780	40	20	610	30	70	0.5	32	<5	4	26	2.7	280
2141387	I	662450	6111300	510	nd	30	150	180	0.2	<2	<5	6	33	1.1	25
2141388	I	662450	6111300	60	nd	20	20	30	nd	0.2	<5	<2	4.6	1.3	640
2141389	I	663800	6111350	790	nd	30	130	220	0.1	2	10	<2	4.3	0.02	25
2141391	I	664050	6111470	240	nd	150	40	30	0.4	8	5	6	13	3.2	25
2141392	I	664050	6111470	130	110	50	80	60	0.7	4	5	2	208	3.5	25
2141393	I	663500	6110250	250	nd	70	10	190	0.4	6	10	4	4.6	0.5	51
2141394	II	662740	6110020	150	nd	70	30	70	nd	<2	<5	2	0.2	0.02	25
2141395	I	662740	6110020	120	nd	40	10	70	0.3	12	<5	6	10	0.54	77
2141396	I	662740	6110020	270	nd	60	30	170	0.6	8	5	10	80.3	1.2	25
2141397	II	663000	6109550	170	nd	20	20	70	0.1	<2	5	10	13	0.46	430
2141398	II	663000	6109550	70	nd	20	10	50	0.1	<2	<5	2	1.5	0.2	640
2141399	I	663550	6108550	30	nd	50	20	50	0.1	<2	<5	<2	2.4	0.5	2700
2141401	I	663450	6107700	280	nd	50	40	60	0.3	<2	<5	<2	0.9	0.12	440
2141402	I	664100	6108400	4500	20	80	10	20	2.7	140	<5	<2	121	1.8	25
2141403	I	664200	6108300	120	nd	130	20	120	0.5	<2	<5	4	14	0.11	150
2141404	I	662950	6109960	130	nd	70	30	140	0.3	<2	5	10	46	0.44	440
2141405	I	662460	6109190	70	nd	40	30	60	nd	2	<5	<2	6.2	1	870
2141406	I	663300	6105650	130	nd	30	10	20	0.2	2	5	6	21	5.3	25
2141407	I	663300	6105650	70	nd	10	nd	20	0.1	<2	<5	<2	12	0.94	25
2141408	I	663300	6105650	30	nd	20	nd	nd	nd	<2	<5	<2	16	0.41	25
2141409	I	663300	6104750	550	30	40	50	100	0.5	14	<5	8	64	2.8	170
2141411	I	663300	6104750	70	nd	30	20	100	0.2	<2	<5	4	10	1	400
2141412	I	663300	6104750	150	30	30	10	40	1.2	51	<5	6	87.2	25.1	25
2141413	I	663300	6104750	50	nd	-10	nd	nd	0.1	6	<5	<2	18	1.2	25
2141414	I	663200	6105050	50	nd	100	nd	20	nd	<2	<5	2	27	0.4	67
2141415	I	663100	6105150	310	nd	450	50	320	0.4	14	10	12	15	0.24	71
2141416	I	663100	6105150	70	nd	60	20	120	0.2	6	<5	6	1.1	0.11	340
2141417	I	663100	6105150	60	nd	20	nd	nd	0.2	14	<5	2	39	1.9	25
2141418	I	662500	6105800	130	nd	90	30	170	0.3	10	5	14	20	0.23	220
2141419	I	659050	6117250	-10	nd	20	nd	20	nd	<2	5	4	1.9	0.37	790
2141421	I	660350	6108750	1330	20	8900	70	110	1.2	ns	ns	ns	10	0.24	220
2141422	I	660650	6108350	40	40	170	10	20	0.1	12	<5	4	4.3	0.5	260
2141423	I	661100	6107900	270	20	30	20	310	0.5	16	5	14	21	1.1	0.76
2141424	I	661100	6107900	20	nd	20	nd	nd	0.1	4	<5	4	7.2	3.7	25
2141425	I	661100	6107900	160	nd	170	60	190	0.2	6	5	18	20	0.29	200
2141426	I	661100	6107900	290	nd	40	40	300	0.2	8	5	26	79.5	0.49	210
2141427	I	661100	6107900	130	nd	30	20	120	0.3	<2	<5	<2	0.9	0.44	430
2141428	I	661100	6107900	230	nd	430	50	250	0.4	12	5	16	12	1.6	65
2141429	I	661100	6107900	30	nd	80	nd	nd	0.2	8	<5	2	12	1.5	25
2141431	I	661100	6107900	210	nd	210	40	230	0.3	12	5	16	55.9	0.8	83
2141432	I	661100	6107900	100	30	80	30	90	0.5	26	5	6	20	10.1	110
2141433	I	667900	6104700	200	nd	420	nd	260	0.7	14	10	6	146	1.7	25
2141434	I	667550	6104300	1270	nd	90	70	nd	0.1	10	<5	4	52.9	1.3	25
2141435	I	667550	6104300	110	nd	30	20	140	0.2	26	10	6	13	1.1	350
2141436	I	667800	6103800	150	nd	30	20	110	0.2	4	<5	4	1.7	0.77	350
2141437	I	667800	6103800	100	nd	180	30	140	0.2	8	5	12	29	0.34	310
2141438	I	667800	6103800	1400	nd	30	80	100	0.3	<2	<5	4	0.2	0.02	310
2141449	II	660200	6112510	730	nd	150	40	50	0.4	<2	<5	2	5.1	0.1	130
2141451	II	660200	6112510	400	nd	20	20	40	0.3	<2	<5	2	1.1	0.12	180
2141452	II	659600	6113200	40	nd	20	nd	40	0.1	<2	<5	2	2.8	0.4	510
2141453	II	660100	6112950	320	nd	40	160	360	0.6	14	10	12	19	0.17	53
2141454	II	660460	6112700	620	30	60	30	70	0.6	8	<5	2	16	1.3	580
2141455	qz vein	660460	6112700	400	nd	60	40	nd	0.6	12	<5	2	15	2	25

nd—not deleted; ns—no sample

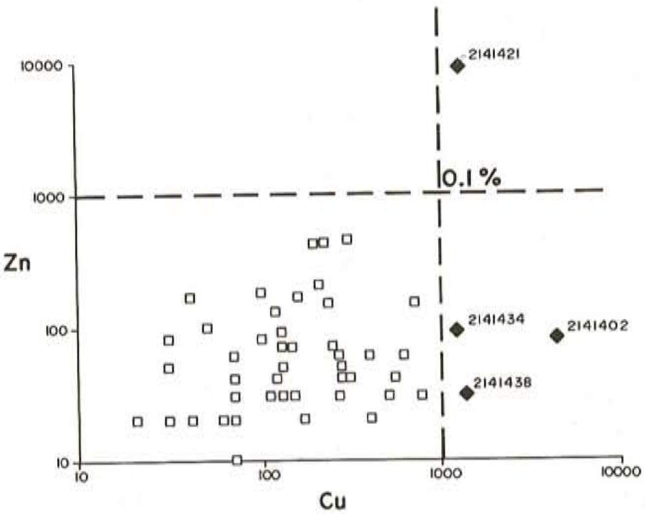

Figure 4. *Plot of Cu versus Zn for samples collected from Howse Lake area Type 2 occurrences during 1993. Heavy lines indicate 0.1 percent base metals. Sample numbers of anomalous samples are indicated.*

interbedded with argillite. Disseminated pyrrhotite locally forms encrustations on coarse-grained gangue minerals (Plate 1b). Where pyrrhotite mineralization is more massive, the sulphides and sediment are finely intergrown (Plate 1c), probably reflecting contemporaneous sedimentation with sulphide precipitation. Chalcopyrite is locally concentrated within massive pyrrhotite beds, typically in fine fractures that cut bedding. At the Jimmick Lake showing, coarse blebs of massive sulphides consisting of pyrrhotite locally replaced by chalcopyrite and isolated grains of galena (1 to 2 cm in length) are present within the pyrrhotitic sediments (Plate 1d). Intergranular galena occurs with pyrrhotite and chalcopyrite and represents a later stage of sulphide mineralization.

The third type of mineralization, coarse-grained pyrite in calcareous rocks, does not show any evidence of primary bedding features. Pyrite forms as coarse subhedral cubes, but does not contain the sedimentary inclusions typical of the pyritic argillite occurrences. Chalcopyrite is locally concentrated within brecciated pyrite fractures (Plate 1e). Replacement of pyrite by chalcopyrite is observed in intergranular spaces and outlines the coarse-grained pyrite. This relationship between the sulphide minerals suggests that pyrite has precipitated as coarse crystals rather than having formed as a result of later recrystallization of originally fine-grained pyrite. Sphalerite is found locally within the fractures and replacing chalcopyrite (Plate 1f).

Preservation of the fine-grained textures within pyrite and pyrrhotite is attributed to the relatively low grade of regional metamorphism. Massive sulphide textures in pyrrhotite-rich showings resemble those typically found in volcanogenic massive sulphide (VMS) deposits (e.g., Eldridge *et al.*, 1983; Yui, 1983). Framboidal pyrite and disseminated pyrrhotite textures suggest that some sulphide recrystallization occurred after sediment deposition and may reflect low temperature, diagenetic processes.

The coarse-grained sulphides at the Martin Lake North #1 showing are texturally distinct from other nearby showings, but are paragenetically similar. All showings display evidence of multi-stage base-metal mineralization and the differences between the showings may reflect metallogenic end members within a single depositional environment.

DISCUSSION

Type II showings are probably the main focus of economic potential with respect to sulphides in clastic sedimentary rocks in the Howse Lake area. These showings are similar in most respects to pyritic and pyrrhotitic argillite occurrences previously studied in the Martin Lake area. Swinden and Santaguida (1993) presented several lines of argument to suggest that this mineralization represents sea-floor exhalative activity in a reducing basin or basins, possibly in response to magmatism now represented by the Wakuach gabbros. Observations in the Howse Lake area support this contention. Showings in this area contain almost no nickel, suggesting that they are not related to gabbro intrusion and the most intense mineralization in the sedimentary rocks is not spatially related to gabbro sills. Base-metal anomalies are cupriferous, with no lead or barite, indicating, as at the Martin Lake area, that the appropriate exploration model for this area might be Beshhi-type deposits, which are copper-dominated massive sulphides hosted by reduced fine-grained sediments and formed in a rift basin.

This conclusion is further supported by preliminary petrographic observations that indicate that fine-grained pyrrhotite and pyrite were deposited diagenetically. Petrographic and field observations indicate that chalcopyrite and other base-metal sulphides were formed slightly later than the iron sulphides. This may record influxes of base-metal-bearing hydrothermal fluid into the diagenetic environment. However, concentrations of base metals observed in all areas are generally low, indicating that all sampled locations are distal to any major sites of hydrothermal discharge.

In the Howse Lake area, it may be significant that the three anomalous cupriferous samples northeast of Howse Lake appear to lie upon a strike-parallel trend. It is at least possible that this is a stratigraphic interval at which greater than normal amounts of hydrothermal Cu were being introduced to the environment. This being the case, exploration along strike to the northwest and southeast is warranted. Similarly, the anomalous Zn and Cu at the northwest end of the Howse Lake Southwest trend, may indicate that a site of hydrothermal discharge lies farther to the northwest at this stratigraphic horizon. Both possibilities are worthy of follow-up.

CONCLUSIONS

There are two types of sulphide occurrences hosted by clastic sedimentary rocks in the Howse Lake area. Type I showings consist of heavily disseminated and conformable

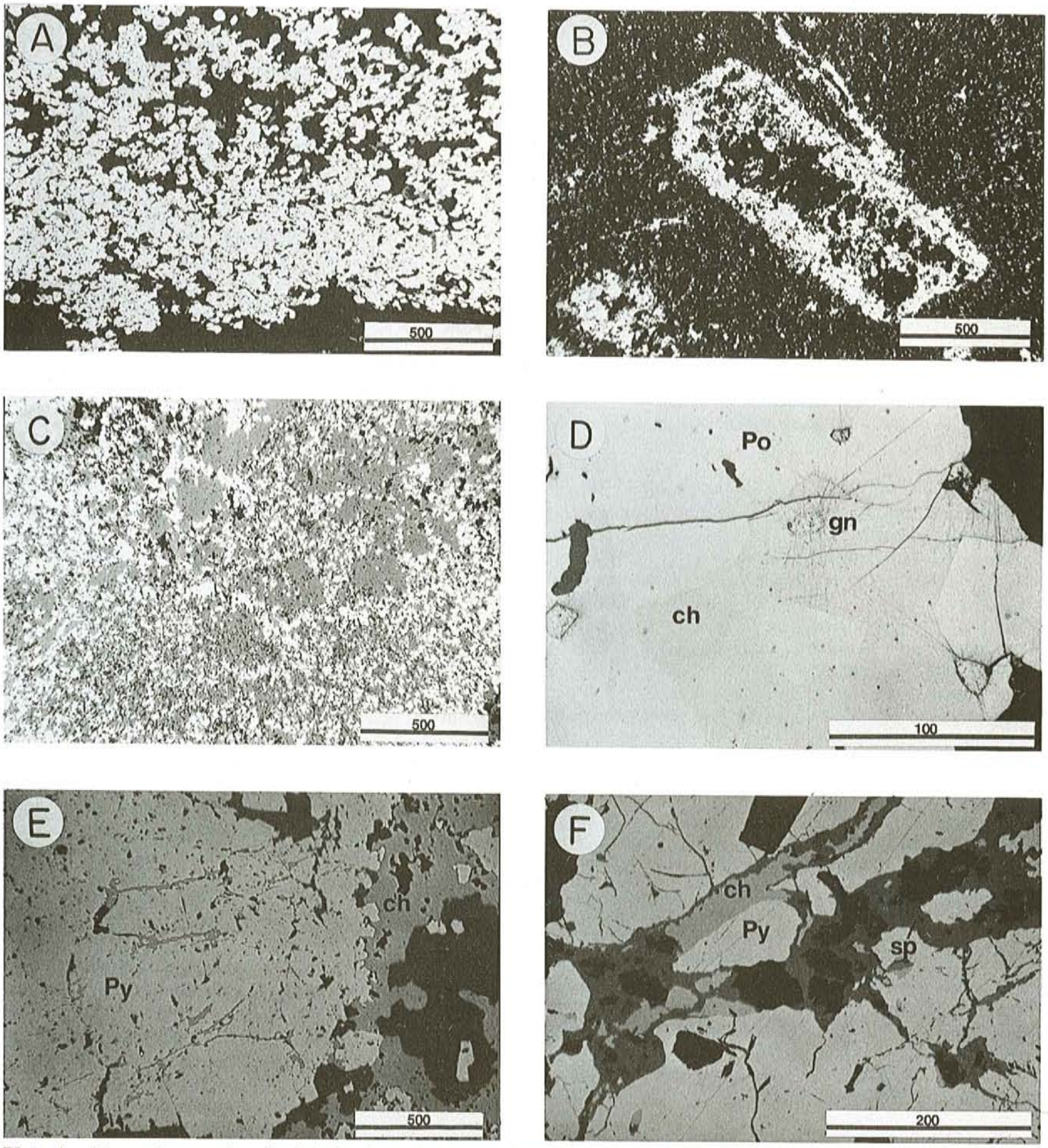

Plate 1. *Photomicrographs of sulphides from the Martin Lake area. Scale bar numbers for each photo in micrometres. Abbreviations: Po = pyrrhotite, ch = chalcopyrite, gn = galena, Py = pyrite, sp = sphalerite. a—fine-grained pyrite layers composed of small framboids contain abundant gangue mineral inclusions; Jimmick Lake showing. b—pyrrhotite encrustations (white) on relatively coarse-grained gangue minerals. Argillite also contains finely disseminated pyrrhotite; Chicago Lake #3 showing. c—finely intergrown pyrrhotite (white) within the argillite in semi-massive sulphide sediments; Chicago Lake #2 showing. d—close-up view of coarse massive sulphide blebs containing pyrrhotite and chalcopyrite as well as isolated grains of galena; Jimmick Lake showing. e—chalcopyrite-filled fractures within coarse-grained massive pyrite; Martin Lake North #1 showing. f—replacement of chalcopyrite by sphalerite within fractured pyrite; Martin Lake North #1 showing.*

massive bands of pyrrhotite similar to occurrences in the Martin Lake area and elsewhere in the Howse Zone. These are believed to belong to the general class of exhalative copper deposits in rift-related, fine-grained clastic sediments referred to as 'Besshi-type' (see Swinden and Santaguida, 1993). Exploration potential for this deposit type is believed to be good. Assay results from the Howse Lake area suggest that anomalous exhalative base metals were delivered to the sedimentary environment in at least two areas. Although the occurrences in which the anomalous base metals were encountered may not provide specific targets for exploration, they do indicate stratigraphic levels at which more detailed exploration might profitably be carried out.

Occurrences immediately east and southeast of Howse Lake comprise minor disseminated pyrite and very minor chalcopyrite in a quartzitic sandstone. These occurrences are sulphide poor, of no lateral extent, and have no apparent economic significance.

Field work for this project is now complete. Future work will include geochemical analysis of samples collected during this summer's field work, petrographic studies of mineralized specimens, and sulphur isotope analysis to help constrain genetic models for the mineralization.

ACKNOWLEDGEMENTS

Partial funding was provided by the Geological Survey of Canada under the Canada-Newfoundland Cooperatioon Agreement on Mineral Development. We would like to express our appreciation to Al Sangster and Mark Hannington for their continued support for this project.

Thanks to Wayne Tuttle for logistical help and advice. The manuscript was critically reviewed by Dick Wardle.

REFERENCES

Bloomer, R.O.
1955: The geology of the Howse Lake area, Ungava; Unpublished report for the Labrador Mining and Exploration Company Limited. Newfoundland Geological Survey open file. [23O (5)]

Eldridge, C.S., Barton, P.B. Jr. and Ohmoto, H.
1983: Mineral textures and their bearing on formation of the Kuroko orebodies. Economic Geology, Monograph 5, pages 241-281.

Grant, J.M.
1977: Report on ground investigation of airborne geophysical anomalies on Block No. 134; Unpublished report for the Labrador Mining and Exploration Company Limited. Newfoundland Geological Survey open file. [23O (18)]

Smith, J.L.
1987: Mineral occurrence map of the south-central Labrador Trough, Map A. Newfoundland Department of Mines and Energy, Mineral Development Division, Map 87-10.

Swinden, H.S.
1991: Metallogeny of base-metal sulphide occurrences in the Labrador Trough east of Schefferville. *In* Report of Activities, 1991. Newfoundland Department of Mines and Energy, Geological Survey Branch, pages 103-106.

Swinden, H.S. and Santaguida, F.
1993: Shale-hosted sulphide occurrences in the eastern part of the Labrador Trough. *In* Current Research. Newfoundland Department of Mines and Energy, Geological Survey Branch, Report 93-1, pages 401-418.

Wardle , R.J., Ryan, A.B., Nunn, G.A.G. and Mengel, F.
1991: Labrador segment of the Trans-Hudson Orogen: crustal development through oblique convergence and collision. *In* The Trans-Husdon Orogen of North America: Lithotectonic Correlations and Evolution. *Edited by* J. Lowry and M. Stauffer. Geological Association of Canada, Special Paper 37, pages 353-369.

Yui, S.
1983: Textures of some Besshi-type ore and their implications for Kuroko deposits. Economic Geology, Monograph 5, pages 231-240.

Note: Geological Survey Branch file numbers are included in square brackets.