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AN EVALUATION OF GEOCHEMICAL EXPLORATION METHODS FOR GOLD PROSPECTING

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ABSTRACT

During 1986, field work was conducted in the vicinity of nine gold occurrences found in a range of surficial and geological environments. The purpose was to develop and document effective geochemical methods for gold exploration in Newfoundland. Sample media were rock, soil, stream sediment and water, and lake sediment. Various size fractions, heavy-mineral separates of soil and stream sediment, and site and analytical duplicates are being used to study the response and analytical reproducibility of the different media.

INTRODUCTION

With the recognition that Newfoundland has significant gold potential, the Newfoundland Department of Mines and Energy has undertaken a project to evaluate the effectiveness of a variety of approaches to geochemical prospecting. Techniques used in the search for base metals do not necessarily lend themselves to an identical application in exploration for precious metals. The extremely low absolute gold abundance and the 'nugget effect' are two factors that may impede the prospector in obtaining a representative sample and analysis of the chosen sample medium. Other related factors influencing the quantity and particle size of gold in transported media include the grain size of gold in primary bedrock mineralization, transport history, and possibly the processes of soil formation.

SAMPLING AND ANALYTICAL APPROACHES

To determine the effects of these factors in the Newfoundland surficial environment, nine gold occurrences in four areas were selected for study during 1986 (Figure 1). Various sampling approaches were taken in the different areas; these are summarized in Table 1.

Table 1. Quantity of samples by area and medium

	Hickey's Pond–Monkstown Rd.	White Bay	Ming's Bight	Betts Cove
Soil	420	280	280	44
Stream sediment		19		
Stream water		20		
Lake sediment		64		
Rock	38	11	4	1

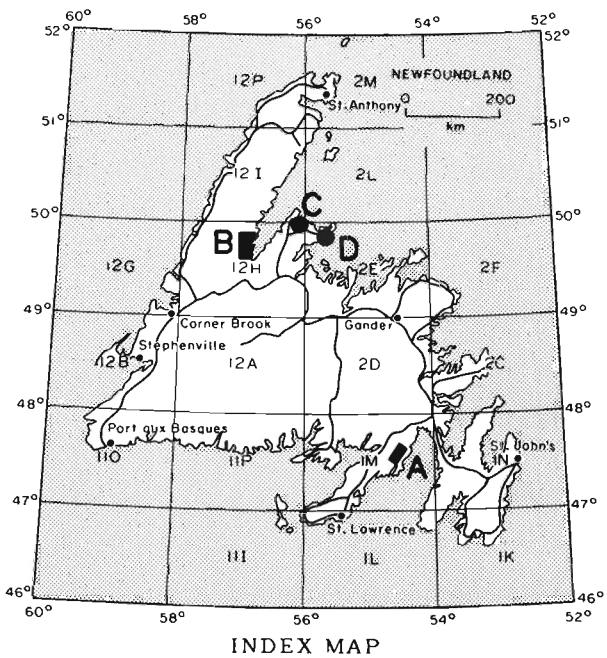

Figure 1: *Location of study areas: A. Hickey's Pond–Monkstown Road; B. Western White Bay; C. Ming's Bight; D. Betts Cove.*

Soil sampling was conducted along lines up to 2 km long, both parallel and perpendicular to ice movement. Conventional-size kraft-paper envelopes of soil, as well as oversize soil samples (five times larger than the conventional), were collected. Geochemical analyses will be done on various size fractions and on heavy-mineral concentrates. Concentrates were prepared in the field from sieved (-0.28 mm) material using a mechanized gold pan (Goldhound).

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Pebble counts from sampled material will be used as an aid in determining provenance and transport distance.

Large stream sediment samples, collected in duplicate, were taken in some areas. The method consisted of obtaining 20 L of -10 mm material, which was further reduced by wet seiving to -0.28 mm. One bulk sample is being used to provide orientation data on the analytical reproducibility and geochemical response of various size fractions of both conventional and heavy-mineral separates.

One-litre samples of filtered and acidified stream water were collected in duplicate from ten sites, both downstream and remote from mineralized areas. Samples were reduced to a 25 mL concentrate in camp on the day of collection, using a method of methylisobutyl ketone (MIBK) extraction modified from Brooks *et al.*, (1981).

Duplicate lake sediment samples were collected in the western White Bay area to further evaluate the usefulness of this method in gold exploration. Previous work around gold occurrences in southwest Newfoundland (McConnell, 1985) suggest the approach is promising.

Rock samples were also collected from the various gold occurrences to provide background data on gold and associated trace-element chemistry.

STUDY AREAS - SURFICIAL ENVIRONMENT, GEOLOGY AND MINERALIZATION

Hickey's Pond–Monkstown Road

Dispersion in soil around four gold occurrences was studied. The Monkstown Road, Bullwinkle and Strange showings are accessible by foot from the Monkstown Road. The Hickey's Pond showing, 9 km southeast of the Burin Highway, is best reached by helicopter.

Bedrock exposure is less than five percent; most occurs on knobs and ridges or in river beds. The area is covered extensively with poorly drained till. Glacial landforms indicate that ice movement was southeasterly. The mineral occurrences are hosted by volcanic rocks of the Late Precambrian Love Cove Group. Textural, mineralogical and field observations indicate that the mineralization formed either as very high level epithermal deposits or as siliceous sinters at the surface (Huard and O'Driscoll, 1985 and 1986). Grains of native gold up to 0.03 mm in diameter were reported. The highest gold values described were from grab samples from the Hickey's Pond (5 g/t) and Strange (1 g/t) occurrences.

Western White Bay

Field work this summer focused on three of the numerous gold occurrences in the western White Bay area. One of these, the Browning deposit, produced 103 ounces of gold in 1903 (Snelgrove, 1935).

The area has a rugged topography and extensive till cover. Local marine clays and beaches near the coast are found as high as 30 m a.s.l. (Vanderveer and Taylor, *this volume);* sampling was not done in areas of marine overlap. Till thickness in valleys reaches several metres and thins out on the uplands. The presence of rounded pebbles of diverse rock types within the soil at several localities may make it difficult to interpret till provenance and the relationship of soil chemistry to local bedrock. Quaternary mapping suggests that the western White Bay area experienced two directions of glacial flow—an earlier easterly flow off the Long Range Mountains and a later north to northeasterly one *(ibid).*

The most recent regional bedrock mapping is that of Smyth and Schillereff (1981, 1982) and Erdmer (1986). Most of the reported gold occurrences are in Silurian volcanic and sedimentary rocks of the Sops Arm Group to the west of the Doucers Valley fault complex. Pyrophyllite, sericite, chlorite, carbonate, and silica alteration are all related to gold mineralization in quartz veins. Tuach (1986) suggested an epithermal–fumarolic environment for this type of mineralization.

Exploration attention is also focused on the Grenvillian granitoid rocks immediately to the west of the Doucers Valley fault complex, where significant gold mineralization was discovered recently. The gold is associated with pyrite and arsenopyrite in post-Grenvillian fractures, shear zones and quartz veins in a K-feldspar and locally carbonate-altered, granitic host rock (Tuach and French, 1986).

Field work concentrated on soil sampling over the Browning deposit and the Wizard showing in Silurian rocks, and over the Jackson's Arm showing in Grenvillian granitoids. In addition, lake sediment, stream sediment, stream water and rock samples were taken throughout the western White Bay area.

Ming's Bight

Field work focused on soil sampling in the vicinity of the old Goldenville Mine, one kilometre north of the town of Ming's Bight. Outcrop is scarce, except along the coast, and the surface is covered by a thin veneer of locally derived till. Glacial striae and boulder compositions indicate a history of northeasterly glacial flow. Mineralization is associated with ferruginous chert and iron formation, which is intercalated with mafic volcanic and volcaniclastic rocks and graywacke of the Point Rouse ophiolite (Hibbard, 1983). The rocks are thought to be Cambrian or Early Ordovician. Between 1904 and 1906, approximately 158 ounces of gold were recovered from underground workings (Snelgrove, 1935), and the area is again receiving exploration attention.

Betts Cove Mine

Two days were spent doing field work in the Betts Cove area. Outcrop is abundant and till cover is thin and patchy. Glacial boulders are composed of rock types of both distant and local occurrence. The orebody consisted of massive pyrite and subordinate chalcopyrite, sphalerite, gold and silver, and was mined for copper from 1875 to 1883 (Hibbard, 1983). It is hosted by the Betts Cove Complex, a Cambrian or Early Ordovician ophiolite sequence. It is considered by Upadhyay and Strong (1973) to be volcanic exhalative in origin, forming at the contact between sheeted dikes and overlying pillow lavas.

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