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GEOCHEMISTRY OF TILL, FLOWERS RIVER AREA, LABRADOR

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Introduction

Geochemical analyses of till in the Flowers River area of eastern Labrador are presented on accompanying maps at a scale of 1:100 000. The till samples were collected during the summer of 1984 by Terrain Sciences Division, Geological Survey of Canada, to establish drift composition and patterns of glacial dispersal in the area, and to develop techniques of drift prospecting. The area was chosen for study because of its potential for rare earth element mineralization and for Sn, Zn, Pb, U and W mineralization (Hill, 1982), and the work has been funded by the Canada-Newfoundland Mineral Development agreement.

Methods

Sampling

Till was collected throughout the area at sample densities that varied from 1 per 5 to 1 per 100 km^2; sample densities were greatest in areas underlain by the Flowers River Igneous Suite. In highland areas, where soil zonation is weakly developed, till samples were commonly collected from mudboils at depths of 30-50 cm. In areas where soil profiles are evident, samples were collected from below the zone of obvious iron stain (B horizon) at depths of 50 to 80 cm to avoid as much as possible the influence of secondary weathering on the geochemical character of the till.

Analysis

The clay-sized (<0.002 mm) fraction of the till samples was analyzed for Cu, Pb, Zn, Ni, Cr, Mo, Mn, and Fe by atomic absorption methods and for U by delayed neutron activation (Table 1). The silt plus clay-sized (<0.063 mm) fraction of selected samples was analyzed for Ce, Th, Nb, Sr, Y and Zr by X-ray fluorescence. All geochemical analyses were done by Bondar-Clegg and Co. Ltd., Ottawa. About 325 clay-sized samples and 275 silt plus clay-sized samples were analyzed.

Geology

The geology of the Flowers River area has been mapped by Taylor (1978, 1979) as part of a regional mapping program at a scale of 1:250 000, and in greater detail by Hill (1982) at 1:100 000. The area is underlain by Paleohelikian plutons of gabbroic to granitic composition of the Nain Igneous Complex, and is bounded, to the east, by Archean banded gneisses, metagranite and metagranidiorite of the Nain Structural Province and to the southwest by Aphebian-Archean (?) gneisses and plutonic rocks of the Churchill Structural Province. The Paleohelikian plutons are intruded by Neohelikian rocks of the Flowers River Igneous Suite that is composed of peralkaline granite and felsic volcanic rocks. The peralkaline intrusive rocks are generally enriched in Ce, F, Nb, Pb, Y, Zn and Zr (Hill, 1982) and are considered to have the greatest potential for economic mineralization in the area.

Physiography

The area forms part of the Nain-George River physiographic subdivision of Greene (1970). It is topographically rugged, with local relief of hundreds of

metres, and is crossed by large valleys. Trees are largely confined to valley floors and sheltered areas of hills, and upland areas are above tree line. Surficial sediment cover is generally thin (<2 m thick), but can be thick (> 10 m) across valley floors, where extensive deposits of outwash and marine sediments occur.

Glacial Flow Directions

Regional ice flow trends were estimated by measuring striae orientations; sense of flow has been estimated by the shape of streamlined landforms and small-scale features on outcrop surfaces. Across hilltops in the east, the most prominent flow directions, which are related to the last phase of regional glaciation, vary from N55°E, in the south, to N75°E in the north. In the west, the most prominent flow directions are nearly eastward, and vary from N90°E to N110°E. The alignment of flow trends along main valleys in the southwest, such as Adlatok River and Hunt River, suggests the last phase of ice flow in that area was topographically controlled. Evidence of an earlier, more northward-trending phase of flow (N50°E to N20°E) has been recorded throughout the area and that phase does not appear to have been influenced by topography.

Drift Composition

Erratics and Glacial Dispersal

Far-travelled (> 50 km) erratics of red quartz sandstone and arkosic sandstone are widespread, and they are most likely derived from Siamarnekh Formation and small, unmapped outliers of it which occur west of Flowers River Area. Although representing typically <1 % of the drift (visual estimate), the erratics of

sedimentary rock are easily found because they are distinct in appearance from the crystalline rocks of local provenance that form the bulk of glacial sediments. Porphyritic, fine-grained rock derived from the volcanic pile of Flowers River Igneous Suite forms a local-scale glacial dispersal train trending northeastward and extending at least 10 km down ice of the bedrock source (Klassen and Bolduc, 1986).

A sand-sized rock fragment containing scheelite-powellite was found in sample 84 KY 71 during a general examination of till samples under ultraviolet light. No additional fragments were found, despite close examination of all samples in the area of 84 KY 71. Due to the small size of the mineralized fragment, there is no information available concerning the lithology of the host rock, and the bedrock source is not known.

Till Geochemistry

Patterns defined by till geochemistry have the following general characteristics:

1. Cu, Ni, Cr are generally elevated in the southwest and may be associated with bedrock of the Nain Igneous Complex, near the Nain and Churchill structural provinces.
2. Pb, Zr, Nb, Y and Mo are generally elevated along the northern and eastern margin of the Flowers River Igneous Suite, and the elements display discrete 'anomalous' areas within that area.
3. U is generally elevated in northwest, over the Nain Igneous Complex, and in the southeast, over the Nain Structural Province. The uranium patterns are not matched by the other elements.

4. Zn is anomalous in the area underlain by the volcanic pile to the southeast, which is an area characterized by known Zn mineralization (Hill, 1982).

Additional geochemical information, based on analysis of lake sediment and water, is given by McConnell (1984).

Implications for Drift Prospecting

Glacial erratics indicate local-scale (10-20 km) transport of debris in directions that are consistant with glacial flow based on striae trends, although the bulk of drift does not appear to have been transported more than a few kilometres. Over the volcanic pile in the southeast, geochemically-defined (Pb, Zn) glacial dispersal from known mineralized sources trends northeastward, along ice flow directions (Klassen and Bolduc, 1986).

Till overlying bedrock of the Flowers River Igneous Suite is not geochemically uniform and some parts of the Suite that are geochemically enriched may have a greater potential for economic mineralization than others. If that is correct, data presented here could be of use in focusing exploration effort within the Flowers River Igneous Suite. The geochemically 'anomalous' areas may be the result of enrichment due to primary magmatic processes or represent parts of broad dispersal trains from mineralized sources, or both. Hill (1982) has described the character of primary differentiation within the Flowers River Igneous Suite. In the area of Strange Lake, patterns of glacial dispersal from mineralization in peralkaline granite extend several kilometres down-ice (Batterson, 1985; R.N.W. Dilabio, personal communication) and they may provide a basis for modelling transport distance and geochemical definition of dispersal trains in the Flowers River area.

References

Batterson, M.J., Taylor, D.M., and Vatcher, S.V.

1985: Quaternary mapping and drift exploration in the Strange Lake area, Labrador; in Current Research, Department of Mines and Energy, Newfoundland, p. 4-10.

Greene, B.A.

1974: An Outline of the Geology of Labrador; Information Circular No 15, Department of Mines and Energy, Newfoundland, 64 p.

Hill, J.D.

1982: Geology of the Flowers River-Notokwanon River area, Labrador; Newfoundland Department of Mines and Energy, Mineral Devleopment Division, Report 82-6, 139 p.

Klassen, R.A. and Bolduc, A.M.

1986: Ice flow trends and drift composition, Flowers River area, Labrador; in Current Research, Part A, Geological Survey of Canada, Paper 86-1A, p. 697-702.

McConnell, John

1984: Reconnaissance and detailed geochemical surveys for base metals in Labrador; Newfoundland Department of Mines and Energy, Mineral Development Division, Report 84-2, 114 p.

Taylor, F.C.

1978: Geology, Hopedale, Newfoundland-Labrador; Geological Survey of Canada, Map 1443A, scale 1:250 000.

1979: Reconnaissance geology of a part of the Precambrian Shield, northeastern Quebec, northern Labrador and Northwest Territories; Geological Survey of Canada, Memoir 393, 99 p.