from the Muskox intrusion that is essentially identical with those has been published by Chamberlain (1967, Figure 38). However, in it, the silicate is completely fresh olivine, and the sulphide "bleb" consists of almost pure pyrrhotite and minor chalcopyrite. Had that sulphide "bleb" had a certain amount of nickel rather than copper, the Muskox assemblage and texture could have been an exact precursor to the Dumont material.

According to this interpretation the observed sulphur content of the serpentinite may have been derived entirely from pre-existing magmatic sulphides. Consequently there is no need to seek a source of sulphur outside the ultramafic body.

Further analytical and textural investigation of Dumont samples, presently in progress, will help to substantiate or modify these interpretations.

Exploration guide lines

One of the first factors to consider in an exploration program for this type of deposit is the known distribution of ultramafic rocks. It is not clear which of these intrusive bodies might be the most favourable. Judging by the Texmont Archean volcanics would seem the most of these intrusive bodies might be the most favourable. Judging by the Texmont and Dumont occurrences, the undifferentiated ultramafic lenses enclosed in Archean volcanics would seem the most encouraging. Serpentinization would be a common, though perhaps not essential, characteristic.

Another possible aid in selecting favourable ultramafic bodies may be the geochemical method recently proposed by Cameron, Siddeley and Durham. In this method, one determines the amount of Ni, Co and Cu that can be leached out of bedrock samples of ultramafic rocks, using a hydrogen peroxide and ascorbic acid solution technique. The total of these metals, each multiplied by an appropriate factor can be used as a favourability index, such that a total greater than a certain threshold value would be considered indicative of favourable potential. This threshold value was determined in their study using traditional nickel deposits of the massive or heavily disseminated sulphide types. Consequently the same threshold value will probably not be directly applicable to the low grade type of deposit under consideration here. However, there is some indication that the method could be useful in a slightly different way.

In a few preliminary determinations, Dumont material grading about 0.2% total nickel gave 50 to 100 ppm of ascorbic acid leachable nickel, while material grading about 0.3% gave 200 to 400 ppm, or about 4 times as great an amount of leachable nickel. This more than proportionate increase suggests that the ascorbic acid leachable nickel might be more closely correlative with recoverable nickel, than with total sulphide. Obviously more work is needed to evaluate applicability of the method to these deposits.

It has been suggested for certain nickel deposits that sulphurization of the ultramafic body's silicate nickel is the process which gave rise to the orebodies, and that sulphide-rich wallrocks were the source of sulphur. If primary sulphides in the ultramafic body are the source of sulphur, as suggested here by textures in the Dumont serpentinite, then perhaps exploration programs need not consider sulphide-rich wallrocks as a necessary characteristic.

In conclusion, I submit that low grade nickeliferous serpentinites of the type described herein, constitute a potential source of nickel worthy of serious exploration efforts.

References


Till studies and their application to regional drift prospecting

By W. W. SHILTS*

Till as a sediment

- Glacial till is an unsorted, heterogeneous sediment composed of material eroded from sources a few inches to hundreds of miles from its point of deposition. There is no general agreement as to which textural parts of till are indicative of long-distance transport and which parts reflect only short transport, if, indeed, any such generalization may be made.

Two principal modes of deposition of till can be demonstrated. The first mode is lodgment or plastering of till onto bedrock at the sole of a moving body of ice. The second mode is the release of debris onto the lodgment facies by slumping at the edge of a glacier. The latter process contributes to end moraine formation where the ice edge is static for a period of time or forms blankets of varying thicknesses of sandy till released from the glacier as it melts away. This till facies has been referred to as ablation till and is usually sandy with irregularly distributed pockets of water-laid sediments.

Till is the most poorly sorted of sediment. It contains particles ranging from colluvial size to fragments whose volume may be measured conveniently in cubic miles. Usually, analyses of till composition are made on limited portions of the textural continuum. Since the late nineteenth century, when till was finally universally recognized as a glacial deposit, frequencies of rock types in the boulder and pebble fraction of till have been extensively used in drift prospecting and in tracing directions of glacial transport. From the 1930's, to the present, mineral composition of the finer sand fractions of till has been used for similar purposes.

In the 1940's, with the rapid improvement of analytical tools, such as the X-ray diffractometer and various "rapid" chemical analyzers, the finest fractions of till, silt and clay, began to be analyzed to determine their mineralogic and chemical composition in order to define source areas and directions of glacial flow.

Problems in studying dispersal of till components

The most serious constraints on using glacial till as drift prospecting medium are: (1) the lack of understanding of modes of till deposition; and (2) the analytical problems created by the extreme compositional variation from coarse to fine particle size in till.

The first constraint usually manifests itself in the difficulty of distinguishing ablation facies from lodgment facies. Particles which ultimately form ablation till are carried in the higher parts of a glacier, and not at its sole. With respect to lodgment till, they tend to be less abraded and to reflect the complex flow patterns of the late stages of glaciation, when ice is thin and easily diverted by topographic obstructions.

Textural control of till composition is probably the most serious problem facing the individual who wishes to use till as a prospecting medium. A till sample can generally be broken down into four major texture/composition, particle-size classes (Fig. 1):
also contains aggregates of clay-size iron and other oxides and varying amounts of non-crystalline colloidal material.

The mineralogical and chemical composition of each class is radically different from the other three, and the relative proportions of the classes may vary significantly over a study region (see Fig. 1). Therefore, it is imperative that the relative contributions of minerals and elements from each class be known when several classes are combined for analysis. Alternatively, a single class or portion of a single class should be used exclusively in analyses.

The clay fraction is the most critical fraction in interpreting chemical analyses of tills. It is the active portion of till in that it has a high exchange capacity for ions present in groundwater and is most susceptible to weathering and leaching during the process of soil formation. For these reasons, the clay fraction, of all the fractions in till, is most likely to reflect post-depositional processes (either ion concentration or leaching) which are entirely unrelated to its original composition. It will be shown later that when the silt and clay fractions are analyzed together, as is commonly done in geochemical studies, apparent cation concentration is strongly dependent on the amount of clay in the sample analyzed.

Study regions

Dispersal patterns for several components of till have been studied in two regions that differ radically in topography, bedrock type, climate and age of till (Fig. 2). In both regions, long distance transport for at least part of all textural grades studied has been demonstrated, and many phenomena that have hitherto hindered the use of till as a prospecting medium have been defined.

Lac-Mégantic, Quebec

The Lac-Mégantic study area is located in the folded Appalachian region of southeastern Quebec. Most of the area is underlain by slightly metamorphosed, Ordovician- to Devonian-age slates and impure sandstones which are cut by acid igneous or plutonic and gabbroic, basic volcanic, and ultrabasic bodies of the Thetford Mines-Asbestos complex. The area lies southeast of the main spine of the Green-Sutton-Notre Dame mountains and is bounded on its southeastern side by the Boundary Mountains. The terrain is gently rolling but is broken by several high, isolated peaks formed on the igneous intrusions. During the early and late stages of the last glaciation, these peaks caused radical divergence of glacier lobes from the east-southeast direction of flow that predominated at the height of glaciation (McDonald and Shilts, 1971).

Till in the Lac-Mégantic area is generally compact, grey, weathering-brown, calcareous sediment containing subequal amounts of clay, silt, and sand and has a diameter larger than one foot in diameter. The till surface is mantled by large boulders thought to represent the ablation mode of deposition. In unweathered samples the clay fraction is composed largely of well-crystallized chlorite and white mica with no detectable expansible clays and little colloidal material; in weathered samples, chlorite is broken down to varying degrees to expansible minerals and iron oxide is abundant in colloidal form. As the expansible minerals and iron oxides were thought to increase the potential of weathered till to concentrate cations, only unweathered samples were analyzed for trace elements.

Dispersal patterns

Of the several till components studied in the Lac-Mégantic area, the dispersal patterns of those derived primarily from the Thetford Mines-Black Lake ultrabasic-gabbroic complex will be discussed. Figure 3 depicts the dispersal pattern of ultrabasic and gabbroic boulders in the Lac-Mégantic area. The boulders were collected from the surface ablation mantle and not from within the till matrix. The highest concentrations form narrow fingers extending southeast from the ultrabasic terrane and not fans as are often depicted on glacial dispersal maps. There is also an area of low ultrabasic-gabbroic concentration in the lee of the Little Mégantic Mountains. This gap is partially caused by blocking of ultrabasic debris by those mountains.

Figure 4 shows the dispersal pattern for chromium determined spectrophotographically on the <230 mesh (<0.062mm) fraction of till. Chromium has a dispersal pattern remarkably similar to the ultrabasic-boulder pattern and can be traced at least 40 miles down-ice from the presumed source. Sand-size magnetite concentrations and nickel in silt and clay (no figures) have dispersal patterns essentially identical to chromium.

Because of certain consistent variations in concentrations of copper and zirconium, it was suspected that the amount of clay in the <230 mesh fraction had a partial influence on trace element distribution. Figure 5 shows the relationship of six trace elements studied to the amount of silt in the sample. Copper clearly decreases with increasing silt, and zirconium increases. Vanadium, titanium, chromium, and nickel all seem to decrease with increasing silt but have secondary, nearly vertical (textural intermittent) variations.
Donald and Kieffer (1962) noted that the region is weathering-containing, and sand is present in and around by-presenting features. In ultrabasic and metagabbro outcrop.

In the Lac-Mégantic region, dispersal patterns are ribbon or finger-shaped with some indication of narrowing in the down-ice direction. Dispersal bands can be detected up to 40 miles away from source areas. Trace elements, minerals, and boulders have comparable dispersal patterns and any of these components could have been used to locate an ultrabasic body similar to that at Thetford Mines. Trace element concentrations are influenced to varying degrees by clay content except in anomalous areas where trace element concentration seems to be independent of texture. With the sample split and analytical techniques used, anomalous values are 2 to 5 times higher than background values for chromium and 4 to 9 times higher than background values for nickel, but are low with respect to the average trace element contents of soils formed on ultra-basic rocks (Ni = 1000 ppm; Cr = 3000 ppm; Mitchell, 1964).

**Kamrak Lake Area, District of Keewatin**

In the summer of 1970, the Geological Survey undertook a pilot regional drift-prospecting project 240 miles north-northeast of Churchill, Manitoba, in the Kamrak Lake region of Keewatin (Fig. 2). The purpose of the first summer's work was to sample till over a large area with the objective of outlining transported anomalies which could serve as target areas for follow-up work in the summer of 1971.

The Kamrak area was chosen for several reasons, foremost among which were the apparently simple pattern of ice flow (southeast) (Lee, 1959) and the existence of semi-detailed maps of Archean-age volcanic and sedimentary strata which were known to contain several areas of sulphide mineralization (Davidson, 1970a, 1970b).

The Kamrak area is a region with very low relief and extensive till cover. The entire area covered by the sample grids was submerged in the post-glacial Tyrrell sea, but marine sediments are thin and discontinuous over glacial deposits. Terraces and beaches, cut into glacial deposits as the sea receded, are common features of the landscape.

The Kaminak area is underlain by deep, continuous permafrost which thaws to depths of 3 to 4 feet in the summer. Surfaces underlain by marine sediments and till, both of which contain appreciable amounts of clay and silt, are characterized by numerous frost boils and solifluction lobes. Frost cracks and polygonal ground are confined to well-sorted, gravelly or sandy sediments with little or no silt and clay or to alluvial plains covered by organic mats. Because frost boils are usually restricted to the more poorly sorted sediments, of which till is the most common member, sample pits were dug in frost boils.

Sample traverses were laid out to take advantage of the known direction of ice flow. Samples were located at 0.8-mile intervals along lines oriented at right angles to the direction of ice movement. Spacing between lines was 4 miles, or 5 times the sample spacing along lines. At each sample site a 50cm- to 100cm-deep pit was dug and samples were collected from the walls of the pit. Each sample was air-dried, sieved to <230 mesh (silt and clay), and analyzed for trace element content. Zn, Pb, Ag, and Mo were extracted by a hot, HCl-HNO₃ leach and analyzed by atomic absorption. Cu, Ni, and several other minor elements were analyzed by emission spectroscopy. Heavy minerals were separated in bromoform from the fine-sand grade of some samples. The heavies were crushed in a ball mill, leached in hot, mixed HCl and HNO₃, and analyzed by atomic absorption for Cu, Ni, Zn, Pb, and Ag.

Before investigation of the till composition of any region, it is necessary to have a fair understanding of regional stratigraphy so that sediment types encountered during sampling may be anticipated and recognized in sample pits. We were fortunate, in Keewatin, to have an easily accessible stratigraphic section which not only revealed at one place the sediments that were eventually encountered in sample pits, but also exposed the sediments in their frozen state so that their original characteristics could be studied without the disturbance, mixing, and weathering common to the active zone.

The Kaminak section (Fig. 6) consists of 4.5 m of till overlain by fine-grained, fossiliferous marine clay which grades upward into massive sandy silt...
and sandy forest and gravelly topset beds of a marine delta. The till consists of a lower, massive, sandy, grey unit which is covered by a zone of shear or thrust plates of alternating grey and brick-red till. The intersheared zone is overlain by massive red till.

The principal difference between the two types of till is that the red till has more clay than the grey. The clay of both tills is maroon because of adsorption and inclusion of colloidal iron oxides; the greater amount of this material in the red till accounts for the colour discrepancy. It was found, as in the Megantic area, that certain trace elements were concentrated in the clay-size fraction so that at this one site, trace element concentrations (particularly zinc) varied significantly. In sample pits, either one or the other type of till or, rarely, marine sediment, was encountered. Often, mixtures of the types occurred with discrete blocks of red till included in a grey, sandy matrix or vice-versa. Trace element concentrations showed even stronger disparities among sediment types in sample pits than in section (Table 1). Therefore, for elements, such as zinc, that are preferentially adsorbed by clay minerals or colloidal oxides, the regional anomaly map is largely a sophisticated (and expensive) map of textural variation.

Figure 7 shows the texture-dependent relation of zinc for samples collected in the Kaminak area. No secondary spikes are evident such as were noted for Cr and Ni in the Megantic area. Although Cu, Ni, Pb, and Ag have not yet been plotted against clay, qualitatively similar texture dependence is evident for these cations, although not to the degree of Zn.

To avoid the textural problem where searching for small, transported anomalies, the chemically active clay portion of till and other quaternary sediments must be removed or its influence rationalized. To rationalize the influence of clay on Zn concentration, sample values may be adjusted by relating them to the slope of a best-fit line drawn through figure 7. This procedure is time-consuming but makes the requirement for textural data; a better method of rationalization might be to normalize the data by relating cation concentrations to measured exchange capacities which are directly related to both the clay content and mineralogy of the clay fraction.

The author feels that an alternative method of collecting cation data is to eliminate clay by elutriation or by analyzing a portion of the sand or coarse-silt fractions which can be segregated by simple dry sieving. A drawback of analyzing these fractions, as sieved, is that trace element values will be very low and near the detection limits of the analytical tools (note the projected Zn concentration at 0% clay on Fig. 7). However, by separating, crushing, and analyzing heavy minerals from the sieved fraction, trace element values are elevated above those of the silt-clay fraction and chances of post-depositional chemical changes are minimized.

Figures 8 and 9 show the relationship of Zn in silt-clay to the per cent of clay in the samples from a portion of the 1970 grid. Glacial movement was determined to be southeast from strong drumlin development and from striation orientation. Some striae were noted that cross the southeast striae and trend nearly due south.

Zn is strongly influenced by textural variations. A lead-zinc orebody that has been extensively drilled, but not developed, appears to serve as a focus for a
south-transported anomaly. Other anomalies appear to be related to unknown occurrences, but, again, most anomalies can be related to textural differences.

Figure 10 depicts Zn concentrations in crushed heavy mineral separates from the same samples as in figures 8 and 9. Zinc still shows the southerly trend but also shows the southeast trend expected from drumlin and striation orientations. Several clay-induced anomalies disappear and other anomalies appear. It is interesting to note that the convergence of south and southeast-trending zinc anomalies indicate a zinc enrichment at a point southeast of the drilled occurrence. The point of convergence is under a large lake.

An observation that may be made, after comparing silt-clay and heavy-mineral dispersal patterns of Cu, Ni, and Pb (no figures) to those of Zn, is that heavy-mineral anomalies for Cu do not follow the Zn-Pb-Ni anomalies as they do in the silt-clay analyses. That Cu follows the Zn-Pb-Ni anomalies in the silt-clay diagrams is a function of preferential adsorption of copper onto clay or colloids and not necessarily the affinity of copper for areas of Pb-Zn-Ni mineralization.

Conclusions

Although preliminary data have not yet been entirely evaluated, it appears that orebodies or bedrock sources of anomalous metal concentration can be located by outlining and defining transported anomalies. Because Kaminak till anomalies have relatively low values as compared to those developed by geochemical dispersion in the immediate vicinity of orebodies, the adsorptive power of widely varying amounts of clay tends to mask true anomalies and create false anomalies. At this point, some sort of preconcentration of the non-clay fraction of till (and all other unconsolidated sediments from glaciated terrain) seems to give the most realistic picture of glacial dispersal of mineralized fragments. Although abnormal concentration concentrations have been detected as far as 40 miles from their source areas in Quebec, transport of cations over similar distances has yet to be firmly established for the Kaminak area — partially because of the uncertainty regarding the significance of the analyses of the clay-silt fractions obtained for the bulk of the samples. Finally, the author feels that regional analysis of drift transport of trace elements will be a most efficacious technique for prospecting in all glaciated terranes, once the proper combinations of sample split, preconcentration, pro-

TABLE 1 Comparison of trace element contents of till matrix, weathered zones, and inclusions from single sample sites (in ppm)

<table>
<thead>
<tr>
<th>Sample</th>
<th>Facies</th>
<th>Zn</th>
<th>Pb</th>
<th>Zn</th>
<th>Pb</th>
</tr>
</thead>
<tbody>
<tr>
<td>210</td>
<td>Grey till</td>
<td>8</td>
<td>6</td>
<td>37</td>
<td>16</td>
</tr>
<tr>
<td>210A</td>
<td>Red till inclusion</td>
<td>77</td>
<td>18</td>
<td>38</td>
<td>22</td>
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<tr>
<td>132</td>
<td>Grey till</td>
<td>13</td>
<td>9</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>132A</td>
<td>Red till inclusion</td>
<td>73</td>
<td>20</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>134</td>
<td>Leached till</td>
<td>6</td>
<td>8</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>134A</td>
<td>Red till</td>
<td>30</td>
<td>19</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>136</td>
<td>Leached till</td>
<td>11</td>
<td>12</td>
<td>—</td>
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</tr>
<tr>
<td>136A</td>
<td>Red till</td>
<td>40</td>
<td>20</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>119</td>
<td>Red till</td>
<td>36</td>
<td>20</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>119A</td>
<td>Grey till inclusion</td>
<td>7</td>
<td>8</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>211</td>
<td>Clayey red till layer</td>
<td>49</td>
<td>16</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>211A</td>
<td>Red sandy till</td>
<td>14</td>
<td>10</td>
<td>—</td>
<td>—</td>
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<tr>
<td>245</td>
<td>Leached surface layer</td>
<td>9</td>
<td>12</td>
<td>—</td>
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<tr>
<td>245A</td>
<td>Red sand</td>
<td>16</td>
<td>14</td>
<td>—</td>
<td>—</td>
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<tr>
<td>325</td>
<td>Composite till sample</td>
<td>9</td>
<td>10</td>
<td>—</td>
<td>—</td>
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<tr>
<td>325A</td>
<td>Leached horizon</td>
<td>10</td>
<td>8</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>325B</td>
<td>Red till inclusion</td>
<td>55</td>
<td>21</td>
<td>—</td>
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</tbody>
</table>
References

McDonald and Shills, W. W., in press, Quaternary stratigraphy and events in southeastern Quebec; Bull Geol. Soc. America., vol. 82, no. 3.

Relationship of mineralization to stratigraphy in the Archean Rankin Inlet-Ennadai Belt as compared with analogous “Greenstone” belts of the Superior Province

By R. H. RIDLER*

In the summer of 1970 the author, working for the Geological Survey of Canada, initiated a study of the inter-
relation of the metallogeny and strati-
graphy of the Rankin Inlet-Ennadai Belt in the south central District of Keewa-
tin. This paper rests upon the data gathered in the short Arctic summer (Ridler, 1971) plus the excellent recon-
naisance mapping of others, principally A. Davidson (1970 a, b) of the Sur-
vey. In addition the author has drawn upon experience gained from work in the Superior Province (Ridler, 1970 a, b) and the extensive literature available. Accordingly, he believes that the rela-
tions about to be presented are founded upon well documented geologic models (Goodwin and Ridler, 1970; Hutchinson, Ridler and Suffel, 1971), and hence will prove to be more fact than fiction.

General geology

The Rankin Inlet-Ennadai Belt is an assemblage of Archean supracrystal and plutonic rocks. It stretches 400 miles from the vicinity of Snowbird Lake in the southeast corner of the District of Mackenzie east-north-east to Hudson Bay at Rankin Inlet and is up to 100 miles wide, making the belt the second largest in Canada.

To the north, south and west the belt is bounded by terrains characterized by pronounced Hudsonian orogenic effects, and to the east by Hudson Bay and Paleozoic cover. Thus it differs by defini-
tion significantly from analogous belts in the Superior Province whose limits are set by a change in predominant rock type from volcanic to sedimentary, the traditional example being the Lake of the Woods or Keewatin belt which is bound on the south by Couteching schists and to the north by English River gneisses. It follows that, unlike the belts in the Superior Province, the margins of the Rankin Inlet-Ennadai Belt can be and in fact are discordant to major su-
pracrystal lithofacies trends or, put more simply, the present outline and trend of the belt (E.N.E.) coincides only roughly with the trend (E.-W., to W.N.W.) of the original Archean basin.

The area of greatest interest for the current project is the north-east-half of the belt as outlined on the original 16 mile reconnaissance map (Fig. 1) (Wright, 1967). For reference, the names of three well known mining camps in their correct spatial orienta-
tion are on the diagram. In addition, the specific area studied last summer in the vicinity of Kaminak Lake, and the traces of the two cross-sections sampled are indicated. For our purposes the most important geological feature re-
vealed by the map is the overall geom-
etry of the belt produced by domical struc-
ture and thus establish the trend of vol-
canics. By tracing the various facies into one another and establishing their areal distribution a model for the original basin can be estab-
lished. In addition, significant Fe, Au, or base metal mineralization may be found. An example is the south margin of the Abitibi Basin where facies change from oxide to sulphide to the south, through carbonate, to sulfide to the north (Rid-
er, 1970 a, b).

Other known mineralization is also studied in order to gain an understanding of its relation to stratigraphy. Ni associated with mafic and ultra-mafic volcanics is perhaps the best example, but Au associated with porphyries has historically been important.

The two approaches are then inte-
grated, and areas exhibiting the greatest coincidence of favourable relations de-
signated. Examples in the Abitibi Belt are the Timmins, Noranda, or Kirkland Lake camps. Each combines great vol-
canic thickness and variety, a high de-
gree of differentiation and diverse iron formation.

Aspects of the geology of the Kaminak Lake area

The Kaminak Lake area was chosen for study because reconnaissance 4 mile mapping by the Survey has estab-
lished many of the above prerequisites, and both access and outcrop are excel-
 lent. Fig. 3 is an integration of David-
The seventies — the prospector's challenge

The future of copper and mining in the seventies

Prospects for oil and gas in the Canadian Arctic Islands

Guidelines to prospecting and mineral exploration

Molybdenum, tungsten and uranium — S. E. Yukon / R. G. Garrett

Nickel potential — serpentinitized ultramafic / O. R. Eckstrand

Till studies and regional drift prospecting / W. W. Shilts

Mineralization/stratigraphy Rankin Inlet-Ennadai / R. H. Ridler

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Alaska's mineral potential / A. E. Weissenborn

Developments — Australia and Indonesia / A. C. A. Howe

COVER STORY

Despite recent improvements and advances in geophysics and geochemistry, diamond drilling is still the ultimate tool in assessing potential mineral deposits. The cover picture for this year's Prospectors issue is a departure from the conventional tripod surface installation and shows instead a typical clean, brilliantly lit electric diamond drilling station underground at an Inco mine. The wire line system used here has been a real breakthrough in eliminating drudgery and increasing output. The driller is operating the wireline hoist to retract the overshot and core tube assembly, obviating the necessity of pulling up the entire string of rods to recover core. Photo courtesy Inco Triangle.