Sedimentary environment lithogeochemistry in the southern part of the Gaspé Peninsula

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Abstract

A "metallogeny and lithogeochemistry" project was initiated in the summer of 2002 in the southern part of the Gaspé Peninsula. Preliminary results from lithogeochemistry performed on sedimentary rocks are now available. The aim of this project was to identify and outline environments favourable for the genesis of sedimentary mineralizations or mineralizations controlled by sedimentary environments. Regarding data processing, the report firstly addresses the definition of lithogeochemical background and threshold concentrations associated with potentially mineralized sedimentary units; secondly, it considers the location of exploration targets.

During the summer of 2002, work focused on the Garin Formation. Four areas were visited and sampled: Reboul-Arsenault, Mount Saint-Joseph, Listuguj and Mid-Patapédia. The Reboul-Arsenault area is where the Garin Formation was defined and where its stratigraphic relationships with the underlying Arsenault and the overlying Pabos formations were also best established.

The lithologies included in the Garin Formation range from mudrocks to conglomerates. The mudrocks (claystones, mudstones and siltstones of medium grey, dark grey and greenish grey colours) constitute the major part of the formation. They commonly contain millimetric laminae of silty-sandy and limy compositions. Their fresh colour which is pale grey becomes brown on weathered surfaces. Black shale is mostly limited to thin beds or laminae at the tops of graded bedding cycles of siltstone and mudstone. Coarse to very coarse-grained wackes and meter-thick beds of polygenetic conglomerates are interstratified with the laminated mudrocks.

In order to better understand the sedimentary and metallogenic processes controlling the lithogeochemistry of the Garin Formation, sampling was designed to evaluate the geochemical variations and to link them with:

1. weathering, by comparing analytical results from "fresh" and "altered" samples
2. vertical variability, by sampling different stratigraphic levels on the same outcrop
3. lateral variability, by sampling the Garin Formation in four areas located in the southern part of the Gaspé Peninsula.

Results presented in this preliminary report are related to the above points 1 and 3.

The main mechanisms of geochemical alteration associated with the weathering of mudrocks and sandstones from the Garin Formation are decarbonatation and desulphurization. These processes have touched few elements: Ca, Sr, C, S, and, to a lesser degree, Mn. The impact is minimal for most elements used in source material identification of the fine-grained terrigenous component of the sedimentary rocks. It is more pronounced and random (in enrichment and depletion) for base metals and other elements related to the genesis of metal concentrations such as Ba, Cs, U, Th and As. However, these results still have to be evaluated with respect to the vertical lithogeochemical variations (item 2 above).

Basic statistics associated with the different lithology types sampled during the summer of 2002 are presented within the report by sampling area. Generally, analytical results from good quality samples have been retained. However, a few analytical results associated with spot samples of poorly-represented lithologies are also included.

Cr, Ni and Co, three elements whose grades depend on the composition of the source of the terrigenous sediments (mafic and ultramafic environments), vary significantly in their abundance with respect to the mudstone groups in the various study areas. The highest Cr and Ni concentrations occur in the Reboul-Arsenault area whereas the lowest are in the Mid-Patapédia area. This "lateral" variation, from east to west, suggests a similar east-west decrease in the addition

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of mafic or ultramafic material. Internal variations have also been observed within a same area. In the Reboul-Arsenault area, the medium, greenish grey mudstones of the Garin and underlying Arsenault formations have a lower Cr, Ni and Co content than the other mudrock facies.

No “high” concentration of base or precious metals has been detected. However, three samples containing more than 1000 ppm Ba suggest a possible relationship with a hydrothermal environment (primary mineralizations or secondary alteration halos).

Clay minerals and organic matter in little or unmetamorphosed sedimentary rock environments are variables sensitive to physico-chemical parameter variations, producing low temperature metamorphic halos. The use of these variables could then contribute to identify anomalous areas of larger extent than the lithogeochemical approach. Therefore, this approach would increase the probability of identifying potential metalliferous zones that could then be further refined by lithogeochemistry. Considering the complexity of these various steps, a priority targeting of geochemical anomalies in the secondary environment would constitute a more rational approach.