Fritz Neuweiler, Dipl.-Geol., Dr.rer.nat.
Professeur
Fritz.Neuweiler@ggl.ulaval.ca
Faculté des sciences et de génie
Département de géologie et de génie géologique

SÉMINAIRE D'AVANCEMENT DES TRAVAUX DE MAÎTRISE

Maîtrise interuniversitaire en sciences de la Terre (M.Sc.), Université Laval et INRS-ÉTÉ
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Assessing the role of cryoturbation on indicator minerals in till

Par Juan David Bello Rodríguez

Indicator minerals (IMs) provide vital information for mineral exploration in glaciated terrains. In permafrost regions, mudboils (non-sorted circles or frost boils) are one of the most common cryoturbation features in glacial sediments and are therefore critical for IMs studies. Here we investigate if the inner motion dynamics in mudboils could generate a vertical sorting of IMs in the active layer of till profiles.

In this study located at the Amaruq orogenic gold deposit in Nunavut, northern Canada, we sampled several vertical profiles down to ~1 m depth in two trenches ~1 km down-ice of the deposit, including two profiles in the central part of well-identified mudboils (one reaching the permafrost level). The heavy mineral concentrate fraction (<2 mm) of all profile samples contains gold and scheelite. The abundance of these IMs shows vertical variations (up to 90%) that are not uniform between all profiles. Likewise, the size and morphology of gold grains do not exhibit a constant trend. Till in permafrost exhibits the highest abundance of gold, scheelite and sulfides compared to that in the overlying active layer. The lateral variation in IMs abundance was examined in one mudboil, and shows that the highest grain count of gold and scheelite is in the central part of the mudboil. The chemical composition of gold (<400 µm), as well as that of scheelite and chalcopyrite (0.25-2 mm), was determined by EPMA and LA-ICP-MS. Most of the gold, scheelite and chalcopyrite crystals are interpreted to be derived from the Amaruq gold deposit. None of them present systematic vertical trends in chemical composition. In summary, mudboils show variations in the IM properties (mineral abundance, morphology, size and mineral chemistry) at different depths without clear patterns. Fractionation of particles inside mudboils is influenced by multiple variables of the freeze-thawing process (moisture, ice content, maximum thaw depth, activity time, and freezing front and rate), and particle characteristics (weight, size and shape). All these variables and processes indicate that cryoturbation processes do not generate a systematic vertical fractionation of indicator minerals in mudboils.

Directeur de recherche : Georges Beaudoin, Département de Géologie et de Génie géologique, Université Laval
Co-directrice de recherche : Isabelle McMartin, Commission géologique du Canada (CGC), Ottawa