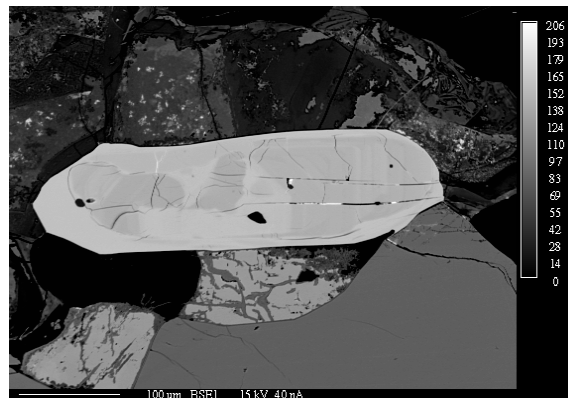
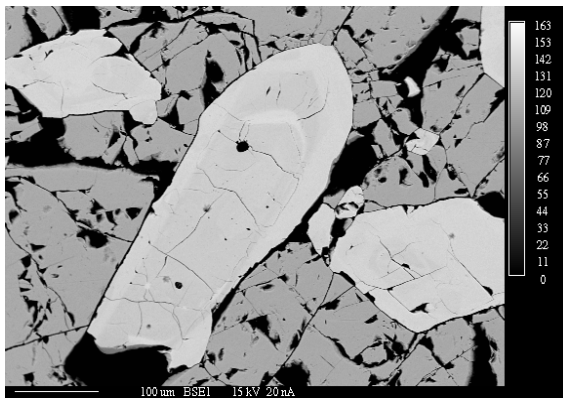


## Project 2004-11: Indicator minerals for metamorphosed metal deposits

Indicator minerals can be very useful in exploration for mineral deposits in high-grade metamorphic terrains. Their composition can reflect conditions related to the mineralising system and therefore serve as guides in terrains where the metamorphic grade obscures or modifies the rock composition preventing us from seeing the effects of fertile hydrothermal or magmatic activity.

A series of tests involving three indicator minerals, zircon, apatite and sphene, were carried out in areas of the Grenville Province in Quebec. Thin sections were studied and microprobe analyses were carried out on samples collected by our members on two sites, one fertile and the other sterile. The same was done regionally to compare the indicator mineral signatures. The Kwyjibo area is a Proterozoic iron oxide deposit. The area has interesting copper-REE grades associated with magnetite enrichments. It shows marked similarities with the Olympic Dam deposits. Metamorphism is medium to upper amphibolites facies. The Marmont area corresponds to layers of banded magnetite associated with granitic gneisses and leucogranites. Mineralisation is poor or absent and metamorphism is granulite facies. The Kwyjibo area is represented by eight (8) samples and the Marmont area by ten (10). Sixteen (16) samples are from the immediate surroundings considered to be part of the regional background noise.

Zircons are strongly zoned in the mineralised area of Kwyjibo. In contrast, zircons from the Marmont area are unzoned and usually rounded. Zircons from Kwyjibo are enriched in rare-earth elements (especially Ce) compared to the Marmont zircons and the zircons from the regional sampling. In addition, Kwyjibo sphenes are also characterised by a marked Na enrichment with respect to the Marmont and regional sphenes. In contrast, the Kwyjibo apatites show depletion in Ce with respect to the Marmont and regional apatites.



*Photographs of zoned zircons, Kwyjibo property, analysed using a microprobe.*

### Summary: Project 2004-11

<b>Objectives</b>	<ul style="list-style-type: none"> <li>• To establish the range and characteristics of indicator minerals to target the most promising ones based on the different mineralisation contexts.</li> <li>• To assess and test certain indicator minerals in high-grade metamorphic settings.</li> </ul>
<b>Results</b>	<ul style="list-style-type: none"> <li>• Tests on the Grenville metamorphic terrain in the Kwyjibo/Marmont areas.</li> <li>• Comparison with the regional environment of the Kwyjibo and Marmont properties:             <ul style="list-style-type: none"> <li>- Kwyjibo: Fe-oxide type Cu-REE-Mo-F-U-Au mineralisation;</li> <li>- Marmont: oxide mineralisation (magnetite).</li> </ul> </li> <li>• Three promising minerals:             <ul style="list-style-type: none"> <li>- Zircon associated with mineralisation (Kwyjibo property) is zoned and shows enrichment in cerium, whereas zircon not associated with mineralisation (Marmont and regional samples) is unzoned or slightly zoned and is cerium-poor;</li> <li>- Apatite from Kwyjibo is depleted in Ce with respect to regional apatite;</li> <li>- Sphene from Kwyjibo is enriched in Ca, but depleted in Na relative to regional sphene.</li> </ul> </li> </ul>
<b>Tools and Innovations</b>	<ul style="list-style-type: none"> <li>• Exploration guides based on the composition of indicator minerals</li> </ul>
<b>Special Collaboration</b>	<ul style="list-style-type: none"> <li>• André Gobeil and Tom Clark, MRNF</li> </ul>