Flotation of REE-Minerals from Fluorite by PH-Shift

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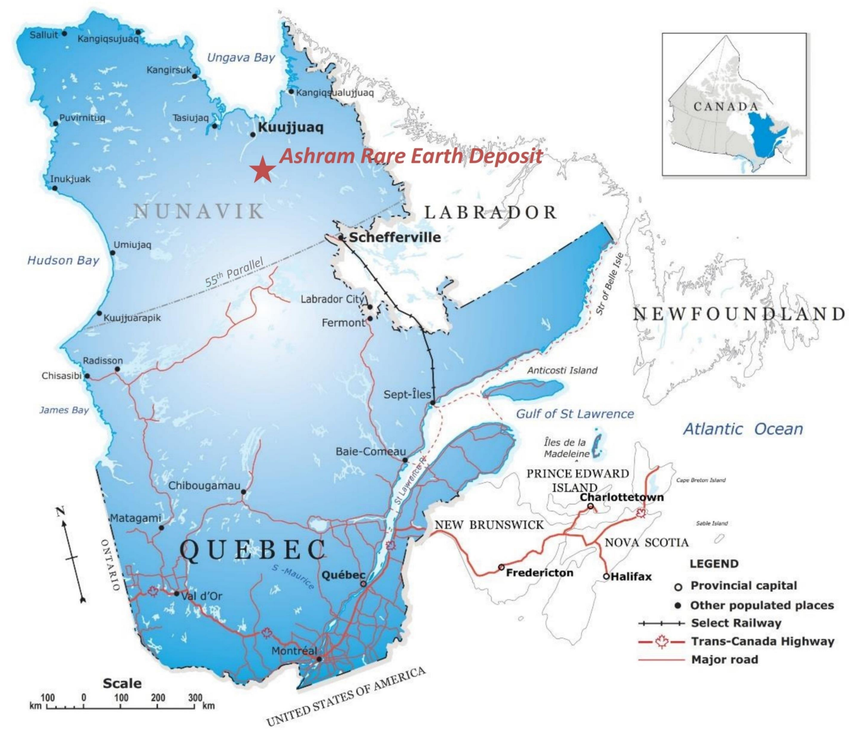


INTRODUCTION

The Ashram carbonatite deposit in Canada is a promising potential source of rare earth (REE) minerals such as monazite, and to a lesser extent bastnaesite, and xenotime.

It is characterized by a comparatively simple mineralogy (REE and gangue), good grade, high-tonnage, top jurisdictional location, and a well-balanced REE distribution enriched in the MF-REEs,

In 2011, Commerce Resource Corporation, based in Vancouver/Canada and sole owner of the Ashram Deposit, engaged MMP and UVR to support the development of a beneficiation technique for producing a rare earth mineral concentrate in excess of 20% TREO with a total REO recovery of more than 65 % from Ashram Deposit material.

Owing to similar flotation properties, the separation of the aforementioned REE-minerals from gangue minerals such as apatite, iron bearing carbonates, and fluorite by flotation was a challenging task. Hence, an essential aspect of this work was the development of an REE-mineral-fluorite-separation method by flotation.

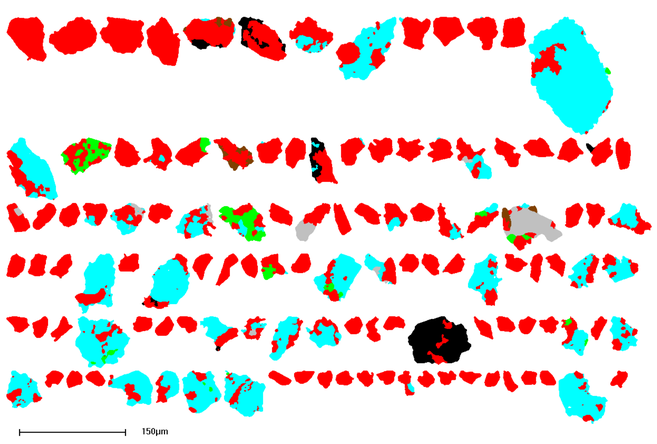
Over the course of the test programs, Commerce Resource Corp. was able to successfully develop various beneficiation processes to produce high grade REE mineral concentrates of up to + 50% TREO at modest recovery without any optimization of the process being undertaken.

As a result of this work, the basis of an applied REE bulk and cleaner flotation procedure is presented in this poster.

MINERALOGY OF ORE SAMPLES

1 REE-min
2 Fluorite
3 Apatite
4 Carbonates
5 Silcates
6 sulfides+Nb_etc

Mineral	Wt%
REE-Monazite	2,94
REE-FC+Others	1,00
Apatite	1,15
Fluorite	6,70
Calcite	0,26
Dolomite	44,42
Ankerite	32,47
Siderite	7,77
Quartz	1,35
Feldspars	0,04
Phyllosilicates	0,78
Sulfates	0,00
Cu-Fe-Sulfides	0,57
Fe-Ti-Ca-phase	0,25
Nb-Zr-Yb-phase	0,18
Invalid	0,13
Total	100,00

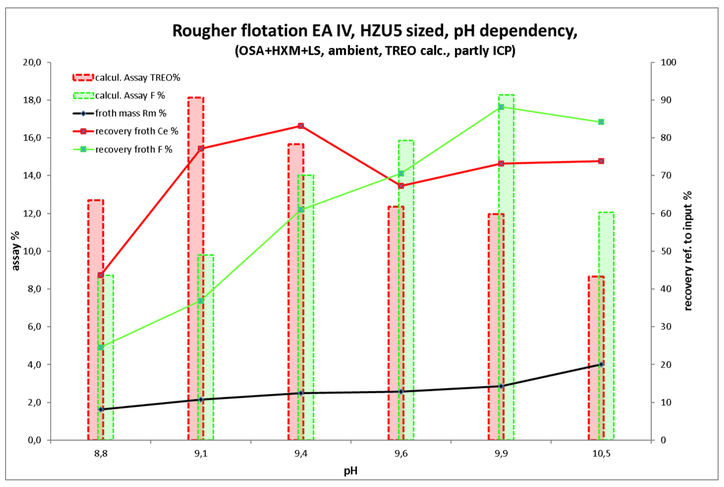


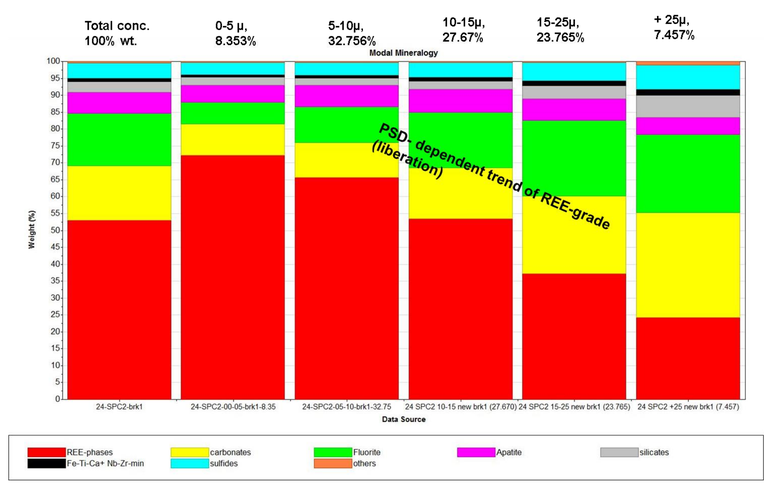
CONCLUSIONS:

- **From all reagents tested, a combined use of an oleyl sarcosine (e. g. MD 20542) and alkyl hydroxamate (e.g. Aero 6494) in collaboration with sophisticated bio polymers (e.g. F 500) brought about the best results with a direct bulk flotation of REE-phases under ambient temperature.**
- **Open cycle tests showed a recovery of about 80 % in the rougher + scavenger stages, with REE-mineral grades of up to 45 % TREO in the final cleaner stages.**
- **The Ashram REE-deposit material can be successfully treated by a multi-stage flotation technique combining known flotation reagent types with a special pH-shift.**
- **The incomplete state of work on the technique developed holds good potential for a remarkable improvement of the process performance by further investigations comprising:**
  - **an optimized comminution process to further improve the liberation,**
  - **Adaptation of flotation hydro dynamics to the fine particle fractions,**
  - **A detailed adaptation of the reagent scheme for the cleaner and scavenger stages,**
  - **Back-cycling of middling products with locked cycle or pilot tests.**

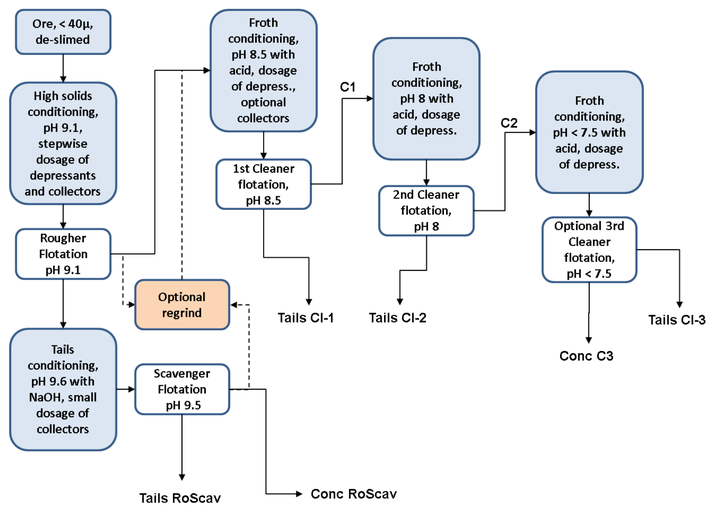
FLOTATION RESULTS

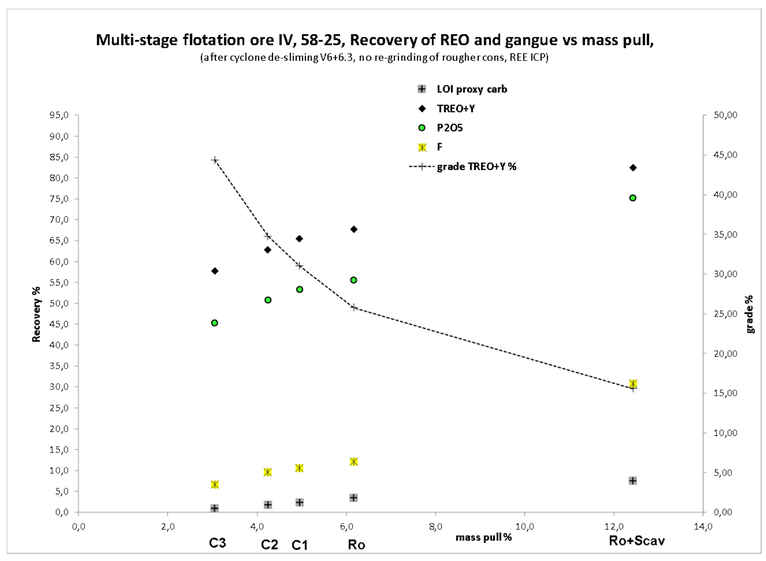
pH-trend of rougher flotation performance (Fluoride + Cerium) and cleaner concentrate grade depending on particle size



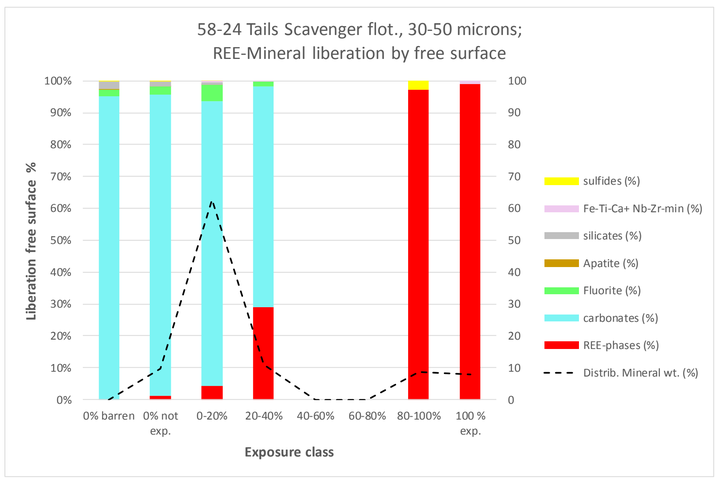


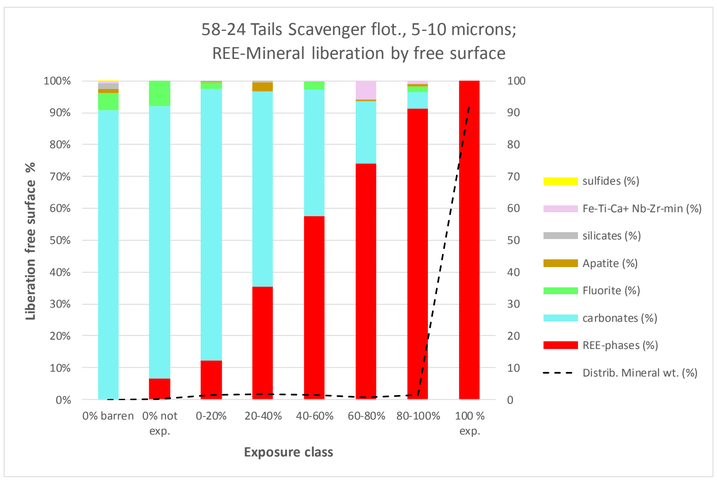
Exemplified flow sheet of open cycle flotation tests and mass pull versus recovery of a test with three cleaners





Loss of REE minerals in the tailing fractions, locked and liberated particles from MLA (minlib free surface)





Exemplified concentrate composition and comparison with other global REE producers concentrate grades