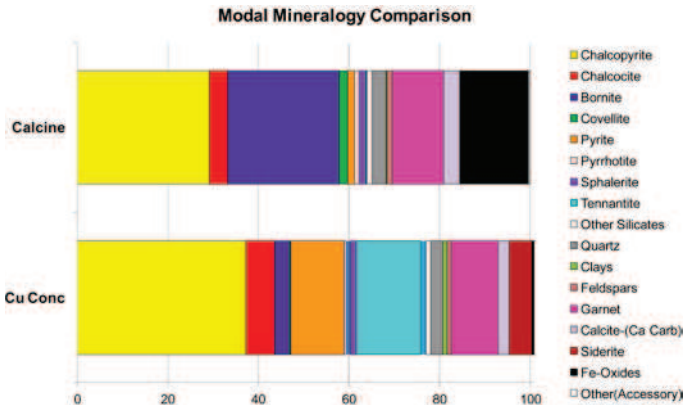
When Extractive Metallurgy meets Quantitative Mineralogy … Sparks Fly!!

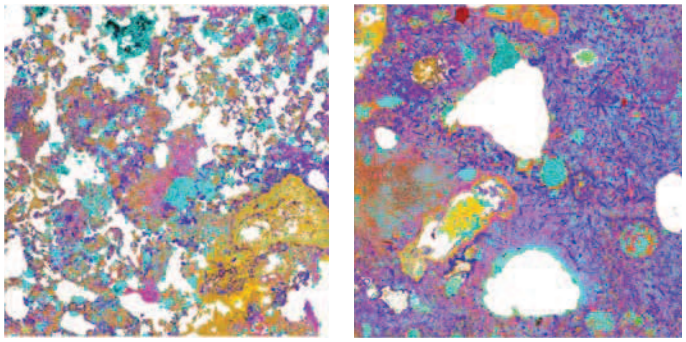
The capabilities of the world class mineralogical facilities at XPS are well known in the international mineral processing community, but are more of a closely guarded secret amongst extractive metallurgy practitioners. Perhaps it is time to change that...

While extractive metallurgists have been using microscopic examination as a diagnostic tool for many years, and Scanning Electron Microscopes equipped with EDX capabilities are routinely used, to date relatively little use has been made of the power of the QEMSCAN coupled with a Microprobe (EPMA) to solve intricate metallurgical problems. At XPS this has been slowly changing in recent years and after some notable initial successes, the Extractive Metallurgy group has made increasing use of the mineralogical power of the QEMSCAN-Microprobe power to provide a level of diagnostic and analytical detail.



Roaster Feed Modal Mineralogy

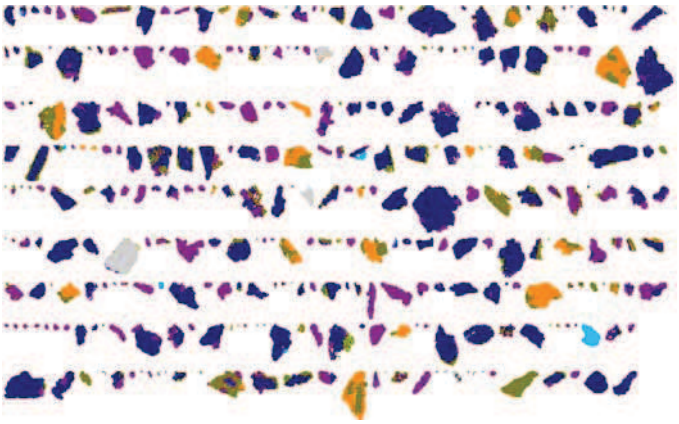
Initial work to characterise some rather tricky arsenic –bearing roaster feeds, reported at COM 2014 were followed by a solution to a particularly sticky (literally) sinter problem also reported at last year's Conference of Metallurgists in Vancouver.



QEMSCAN Images

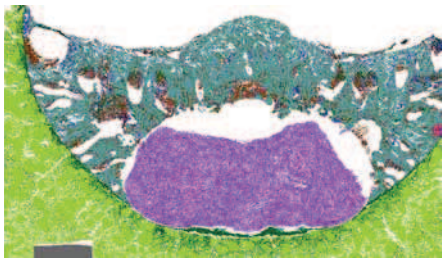
Good Sinter *Bad Sinter*

Ground-breaking work in an innovative direct reduction process developed for chromite ores from the Ring of Fire was readily interpreted by QEMSCAN analysis of the reaction products, helping to unravel the novel underlying reaction mechanism.



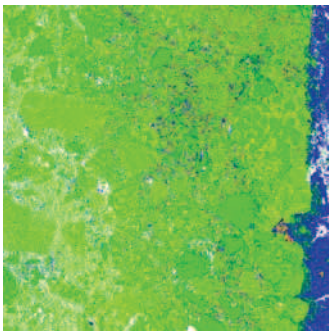
QEMSCAN Images - Chrome particles from the novel direct reduction process

Recent work for Taseko revolved around aluminothermic reduction of a niobium-rich concentrate to produce a limited quantity of high grade ferro-niobium. The small scale of the experiments proved challenging for conventional chemical analyses, but QEMSCAN and probe analyses allowed metal accounting balances to close within 1% as well as providing vital detail on the temperatures achieved by providing very detailed slag phase analyses, and refractory slag reactions impossible to resolve by other means.



QEMSCAN Image – FerroNiobium Product

Most recently, the technique has found a new niche application-analysis of refractory brick compatibility with process slags: The sensitivity of the analysis has revealed microstructural changes taking place in the refractory along with detailed chemistry of the alteration material. This is a significant advance over the traditional element mapping via SEM EDX, as not only is the special association of elements obtained but the precise stoichiometry of the reaction products is revealed as well. This provides the refractory engineer and the process metallurgist with key information to improve refractory brick formulations to meet demanding process conditions.



QEMSCAN Image – Gopher Refractory Brick

For further information on the use of quantitative mineralogy to support extractive metallurgy, contact Mika Muinonen at mika.muinonen@xps.ca or Lori Kormos at lori.kormos@xps.ca.