

Introduction:

- Quality control data can be obtained via Standard Reference Materials (SRMs)
 - Can be cost prohibitive for large projects
- USGS has developed project specific Quality Control Materials (QCMs)
 - Have same or highly similar matrix as project samples
 - May reveal analytical problems missed by traditional SRMs due to limited element data available
- Sediments, soils, rocks
 - Mineralogy an important consideration

QCM Production:

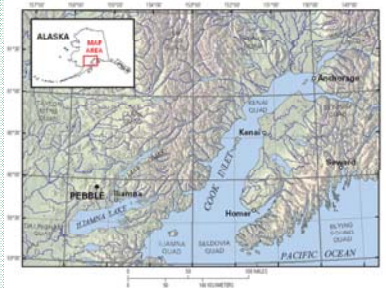
- Identify necessary element and concentration coverage needed
 - Typical USGS studies cover up to 86 elements via ICP-OES and ICP-MS
- Possible to use multiple QCMs
- Can composite multiple samples of source material
 - Subsamples of analytical samples collected
- Blend source material with other materials to achieve target element concentrations and mineralogical content
 - All elements at measurable concentration

Example: Contract Lab QC Materials

- 60 Elements, Base material: Sediments Animas River, Chatfield Reservoir, DGPM-1 (Au ore), and Kesterson Sediments (As, Se)
 - SAR-L – 2-3X ICP-OES DL
 - SAR-M – 10X ICP-OES DL
 - Includes Te, Tl, Pt, Pd, and W
- Used to track laboratory performance
 - 12-Year Performance History

Regional QCM for Pebble Mine Deposit

- Regional study for baseline data of concealed Cu, Au, Mo deposit area
- QCM required for laboratory performance evaluation
 - Existing USGS geochemical reference materials poor matrix match
- Developed by compositing subsamples of all samples collected
 - ~100 pounds of material required for study duration



USGS Reference Materials



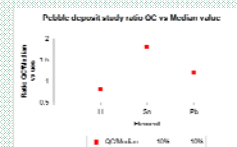
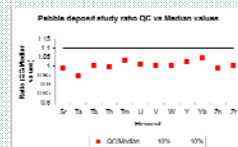
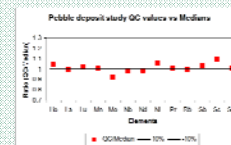
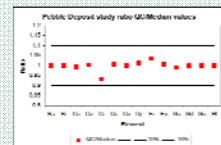
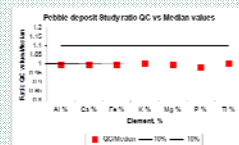
V-blender for sample homogenization



Riffle splitter for bottling

QCM suitability testing:

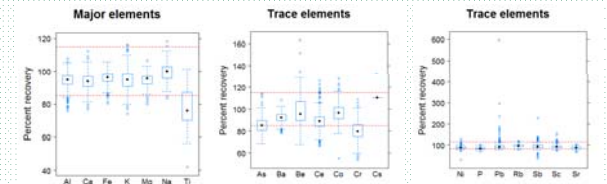
- Compare median element concentration to QCM element concentration
 - QCM values determined internally using multiple methods
 - INAA, XRF, ICP-OES, ICP-MS, etc.
 - Perfect match when $[QCM]/[Median] = 1$
 - $\pm 10\%$ window for analytical precision



- Most elements show good agreement
- Li, Pb, and Sn show poor agreement
 - Li issues related to significant figures
 - Pb related to a single outlier skewing median
 - Results within $\pm 10\%$ with outlier removed
 - Sn related to mineralogy – incomplete sample decomposition

QCM for Continental Geochemical Study

- ~14,000 samples submitted for analysis
 - Approximately 600 sample batches over 4 years
- Large quantity (600 pounds) of single QCM material needed
 - Monitor contract laboratory performance
 - 42 Elements by ICP-MS and ICP-OES
 - As, Se, and Hg by HG-AAS
- SoNE-1 Soil Developed**
 - Sharpsburg Soil Series, Lancaster County, NE
 - Used to assess laboratory precision and accuracy
 - Example performance results



- See Thursday afternoon session for more info on the Continental Baseline Geochemical study

USGS Reference Materials Project

- Can provide consultative services for custom QCM development
- Will collect, grind, homogenize base material plus specific augmentations to meet requirements, and bottle QCMs
 - Can also provide base concentration information from USGS in-house and contract laboratory analysis.

Websites

- http://minerals.cr.usgs.gov/geo_chem_stand/index.html
- http://minerals.cr.usgs.gov/icpms/reference_materials.html
- <http://pubs.usgs.gov/fs/2007/3056/>

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