Development of Geochemical Reference Materials

Stephen A. Wilson
QCM development options

- Single source material
  - Representative
  - Specific element profile
  - One site collection
  - Sample contamination
  - 1000’s samples

- Multi-source material
  - Detect conc. all elements
  - Natural mineralogy
  - Matrix match
  - Soils, sediments
  - Blending program
  - 1000’s samples
Material preparation

Representative Sample Collection

- Rock, Crushing
- Soil, Disag, Sieve <2mm

Grinding

- Jet Mill
- Impact Mill
- Pulse Mill

Blending

Splitting
Spinning Riffler
GRM development with spike addition

Option #1 bulk analysis
Option #2 analyte analysis
Material preparation option #1

Sample matrix

Grinding

Blending

Splitting

Analyte addition

Analyte addition
Material preparation option #2

Sample matrix

Grinding

Analyte addition

Blending

Disaggregate

Splitting

Wet

Dry

USGS
Homogeneity testing

• Stratified random sampling (every 100\textsuperscript{th} sample)
• Bulk chemical analysis
• Between and within bottle assessment
• Intra-laboratory testing
• Statistical analysis compile data
• Certificate of analysis
USGS methods of analysis

- Major element analysis  WDXRF
- Minor & Trace element analysis
  
  ICP-AES, ICP-MS, INAA, HY-AAS, GF-AAS
- Isotope analysis  MC-ICP-MS, ID
- Microanalysis  SEM, EPMA, TEM, LA-ICP-MS
- Extractive analysis
  
  EPA 3050/3051, Lung/Gastric fluid,
Collaborative studies

- NIST
  Soils, Mine waste, Sediments, Coal
- EPA
  Soils, potable water/pipe scale
- NASA
  Lunar regolith, nano phase iron/glass
- Industrial
  Titanium ores, Gold ores,
Items to consider

- Matrix matching important
- Analyte homogeneity
- Analyte preservation (physical characteristics)
- Representative sample size
- Develop prototype material(s) improve fidelity
- Develop sufficient supplies
- Intra-laboratory, multi-method testing