Development of Geochemical Reference Materials

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USGS

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

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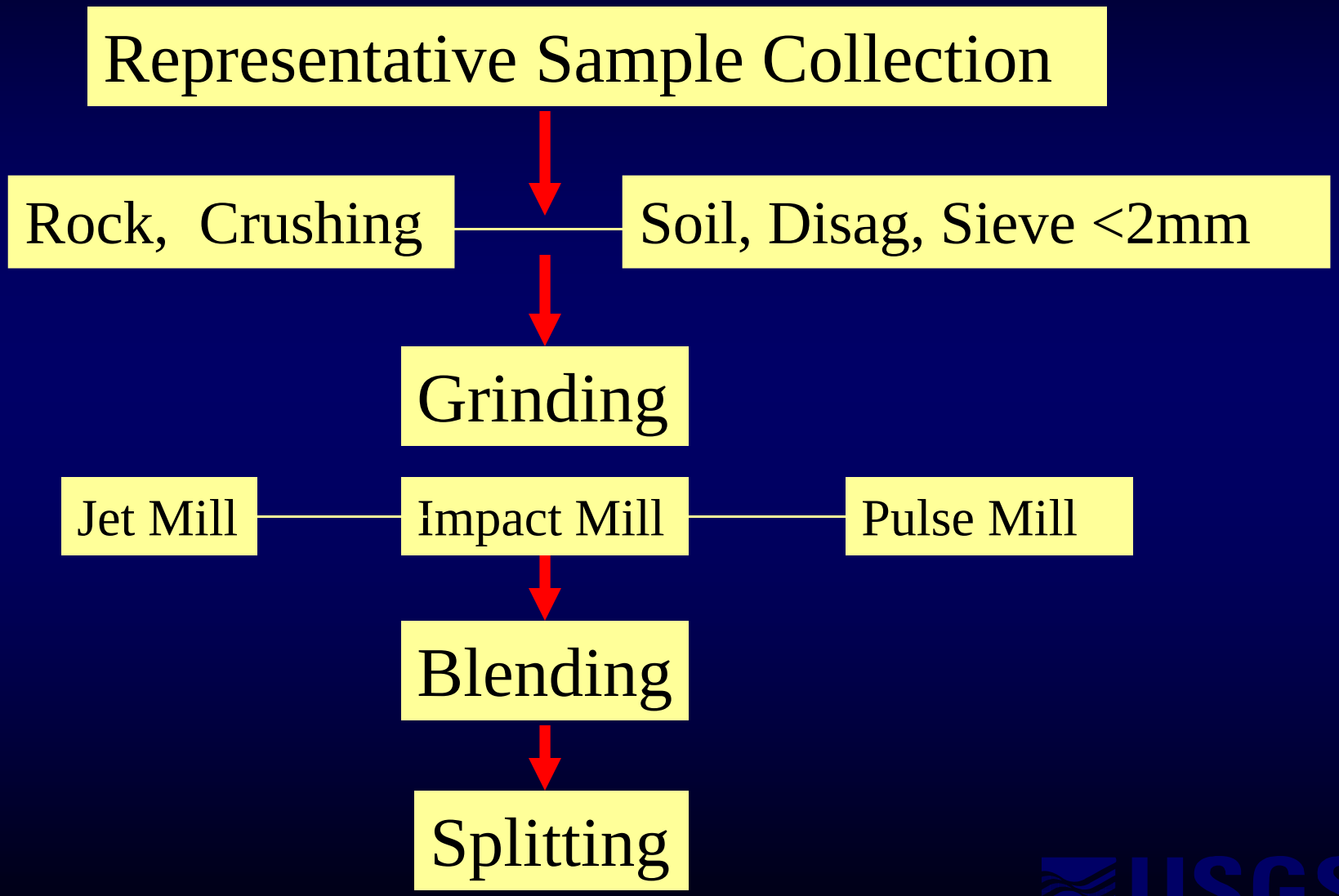
Material preparation



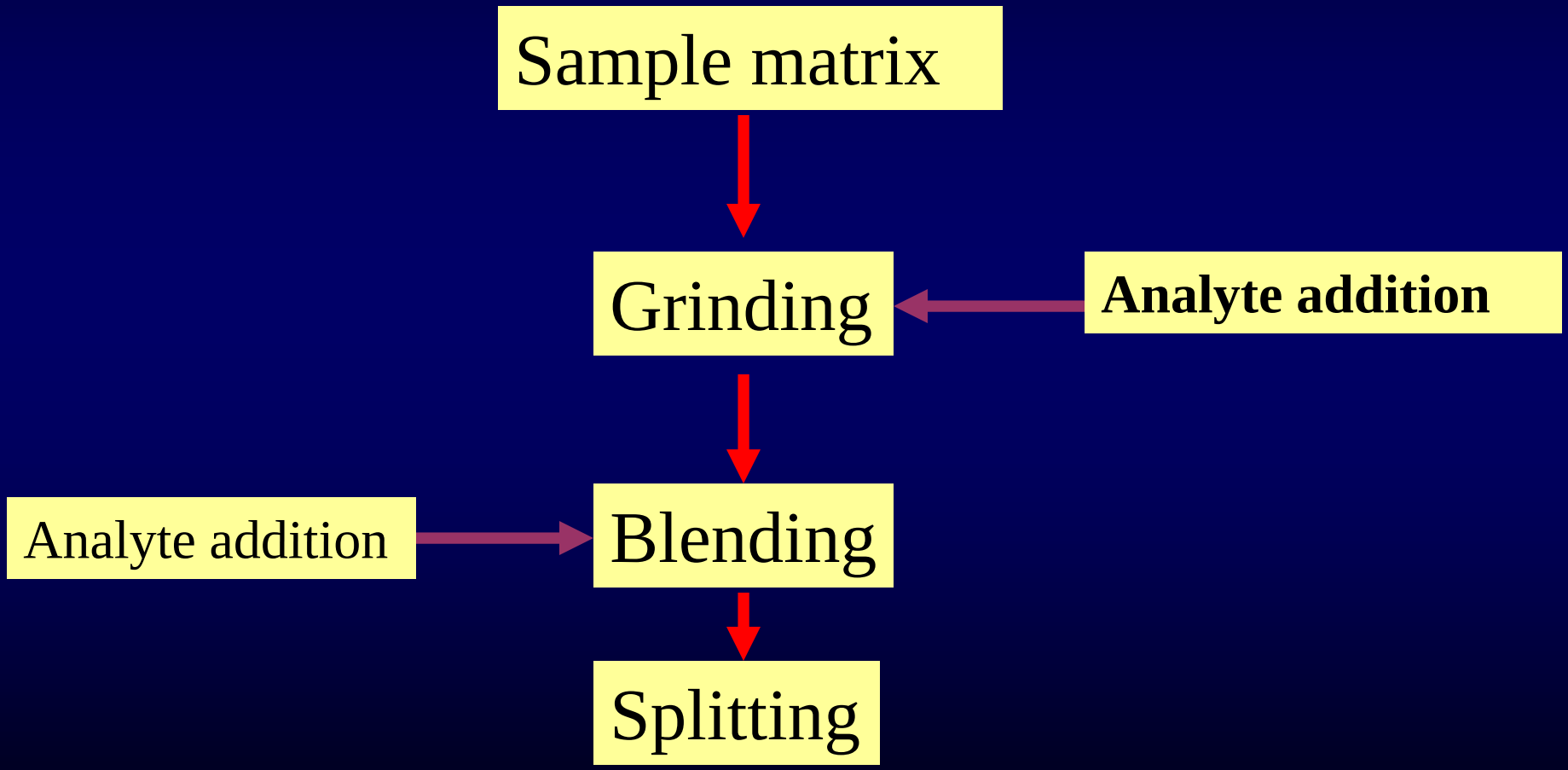
Spinning Riffler

GRM development with spike addition

Option #1 bulk analysis

Option #2 analyte analysis

Material preparation option #1



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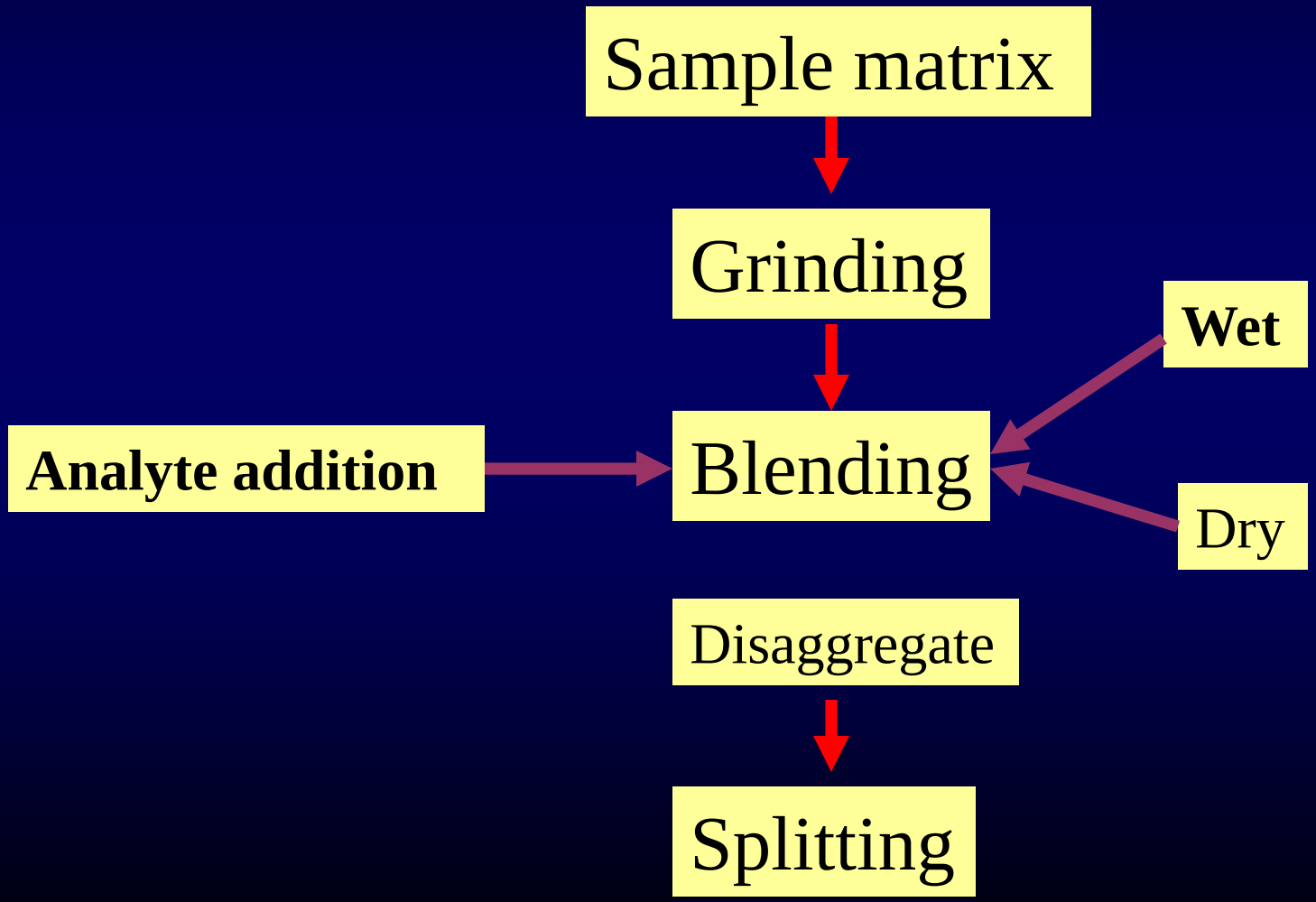
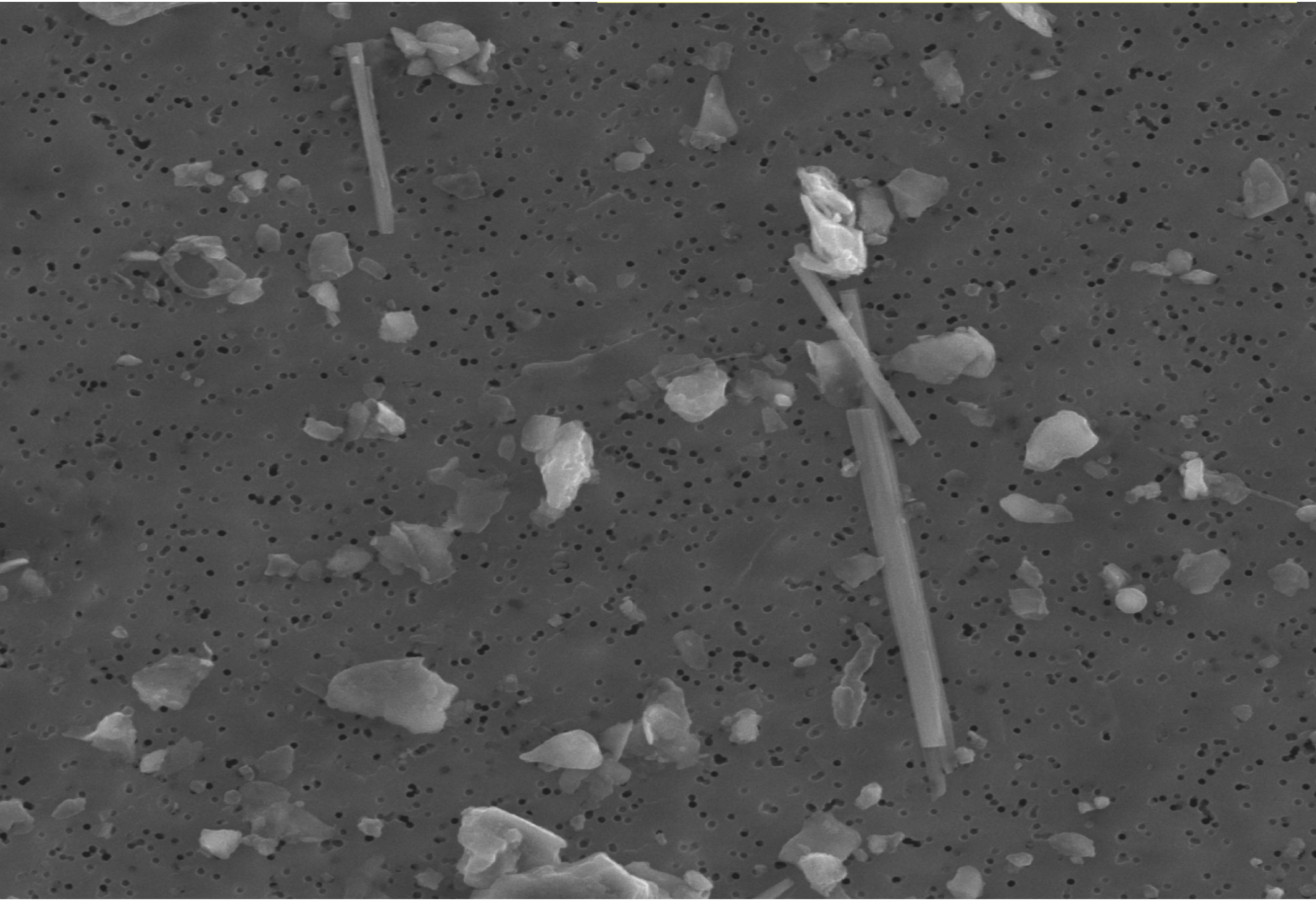
Material preparation option #2





Homogeneity testing

- Stratified random sampling (every 100th sample)
- Bulk chemical analysis
- Between and within bottle assessment
- Intra-laboratory testing
- Statistical analysis compile data
- Certificate of analysis

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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,

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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,

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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

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