Cost effective alternative of landfill disposal

a) **Stabilization/Solidification**: The use of cement-like material, clay, lime, can help stabilize granular arsenic bearing residuals.

b) **Regeneration of the residuals**: Technologies needs to be implemented on developing methods for regenerating the residuals. Advantages are

Reuse of sorbent material, cost effective
Concentrating the arsenic released in specific wetlands.

c) **Use of Ion exchange membranes**: The methods of using ionic membranes in landfills can prevent arsenic mobility to nearby wetlands.

d) **Reduction Techniques**: This technology is used for catalyst preparation. If ABSRs such as ferrous hydroxides are reduced under high pressure and temperature and addition of nitrogen, the solids is expected to re-crystallize into minerals. The binding strength of the arsenic-sorbent bonds is expected to increase with temperature.

Alternative Technologies for Arsenic treatment

a) Nanoscale Metallic Particles

The use of nanoscale metallic particles such as zerovalent iron is expected to affect assessment of residuals.

As particle size of the residuals decrease, high surface areas and surface energies will facilitate in enhanced leaching rates.

Removal mechanism of zerovalent iron occurs via adsorption on iron corrosion products. So desorption is bound to occur at high pH.

The reduction of As (V) to As (III) by these zerovalent and bimetallic particles is even more hazardous as As (III) is more toxic than As (V).

b) Membrane Processes

The use of ion exchange membranes would require the development of additional assessment test as most inorganic and organic ions and acids react adversely with the ion exchange.

Other membrane separations (micellar-enhanced ultrafiltration, reverse osmosis)

c) Electrochemical Treatment Techniques

The disposal of the electrode material, iron and graphite needs to be assessed. However, the advantage of the electrochemical processes is the efficient regeneration of the electrode material via reductive techniques.

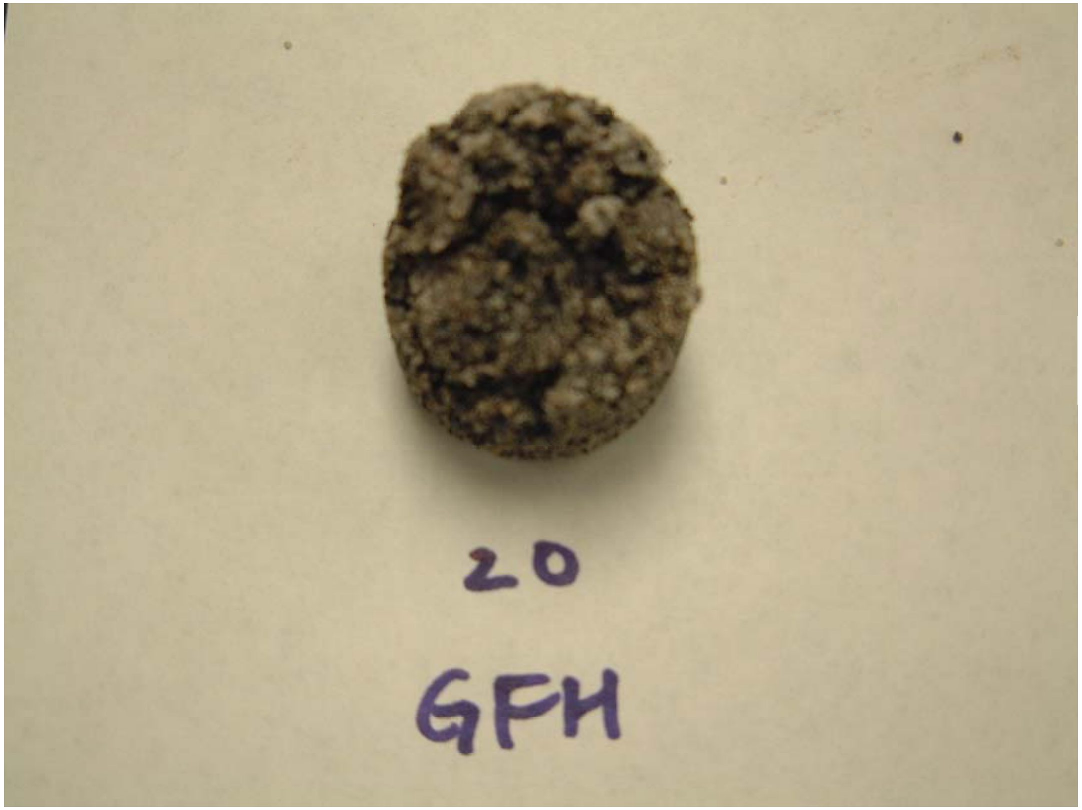
Alternate Stabilization Procedures

a) **Short Run time:** The use of shorter run times of adsorbents would help in the leaching characteristics of the waste and would help pass state regulations that impose a maximum arsenic loading on solid wastes.

Problems:
Cost Ineffective
Large volume of sorbent material required
Inefficient remediation (adsorption is a slow process)
The total amount of arsenic to dispose will not change but merely be diluted. The dilution might not yield a net gain in preventing leaching from landfills.

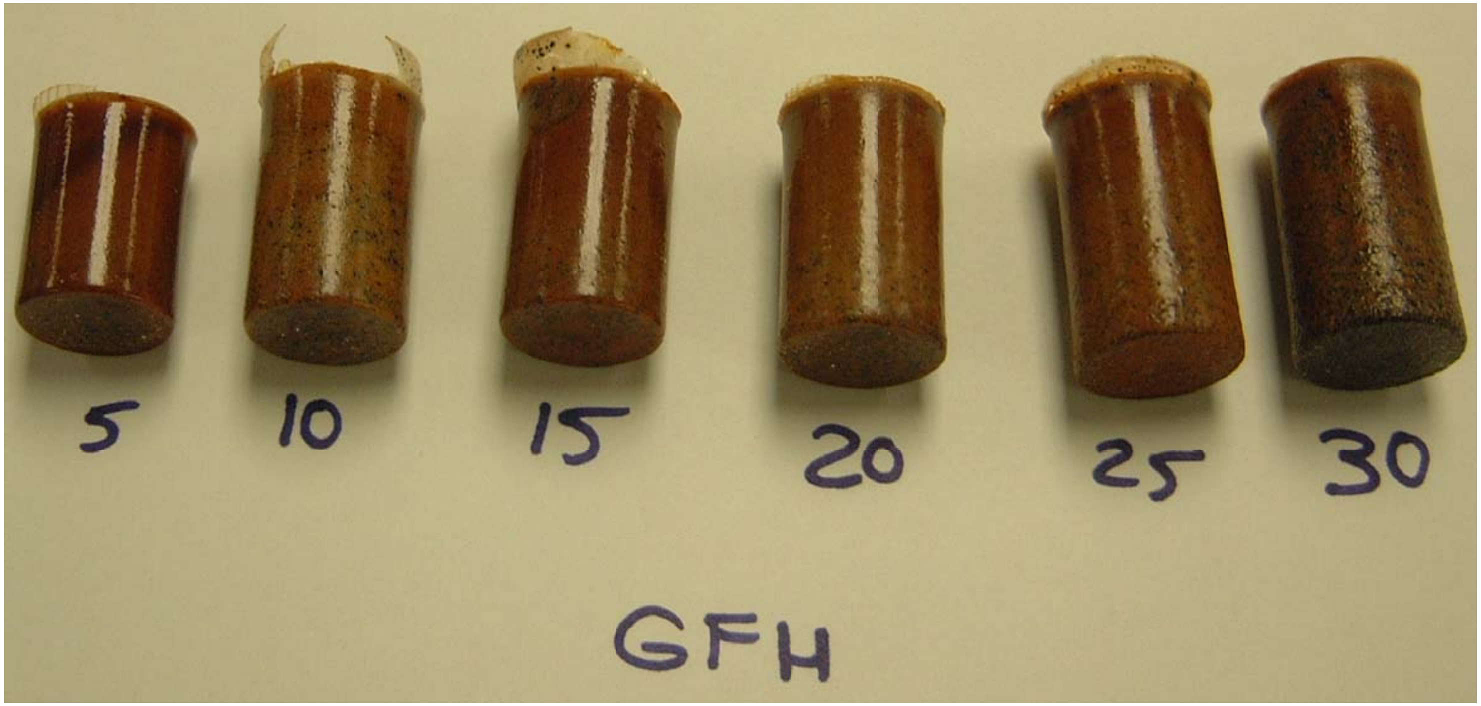
b) **Stabilization of waste**: clay material, ore minerals can help reduce the leachability of arsenic. Use of alternate materials for sorbent encapsulation: polymeric matrices.

Stabilization of As residuals in cement matrices



Maximum GFH loading (20 wt%)

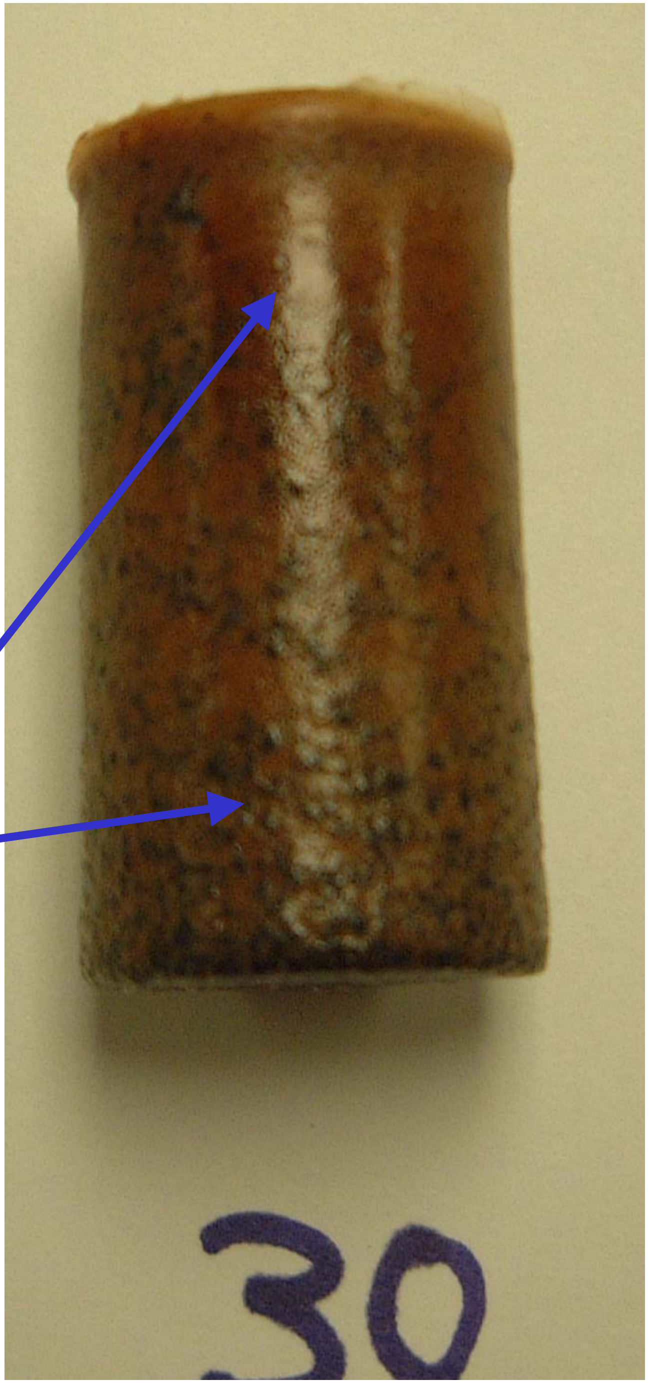
Stabilization of As residuals in polymeric matrices



Maximum GFH loading: ?

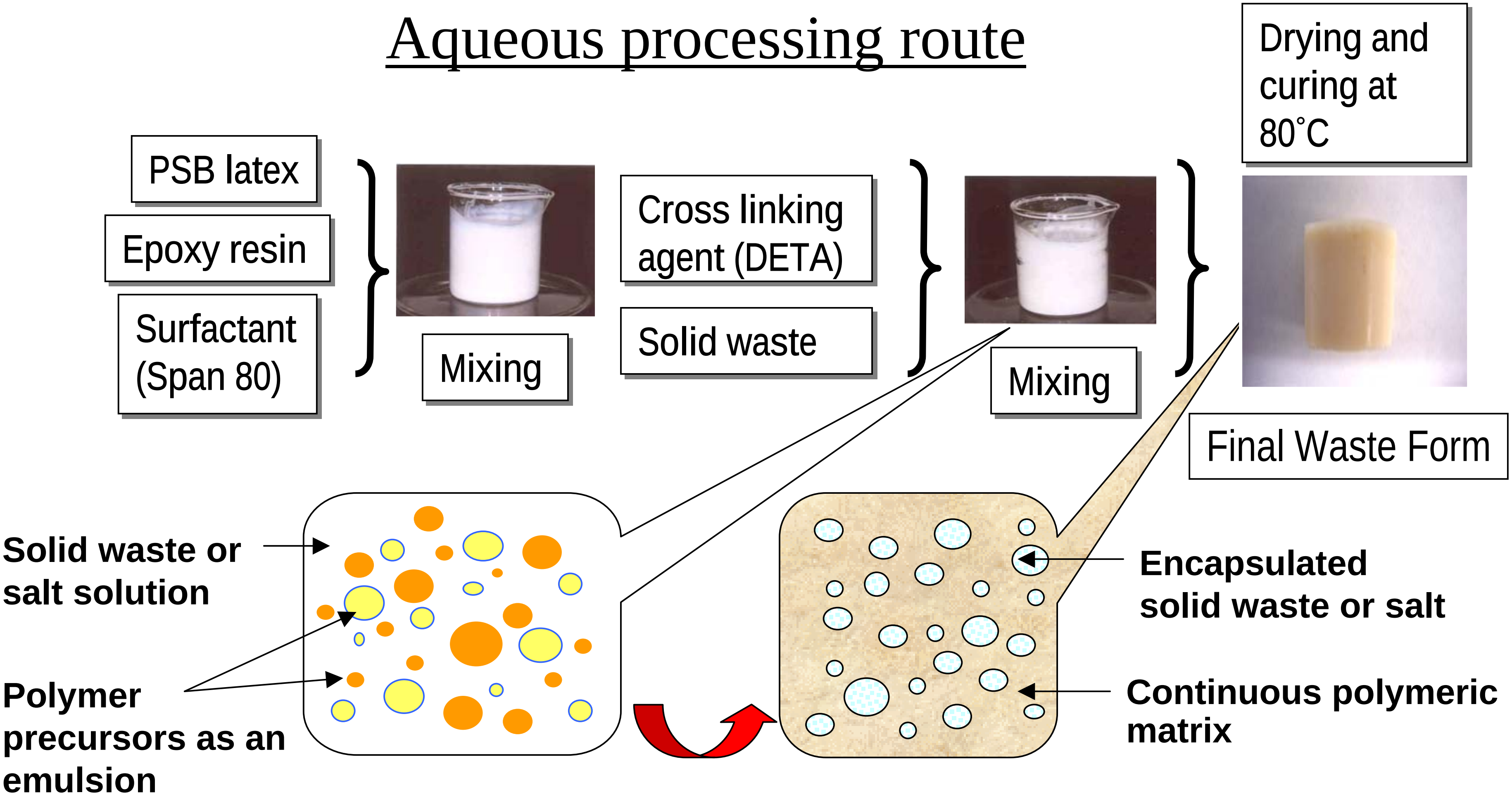
Stratification of stabilized GFH

However, mechanical properties of sample seem acceptable



Waste form synthesis

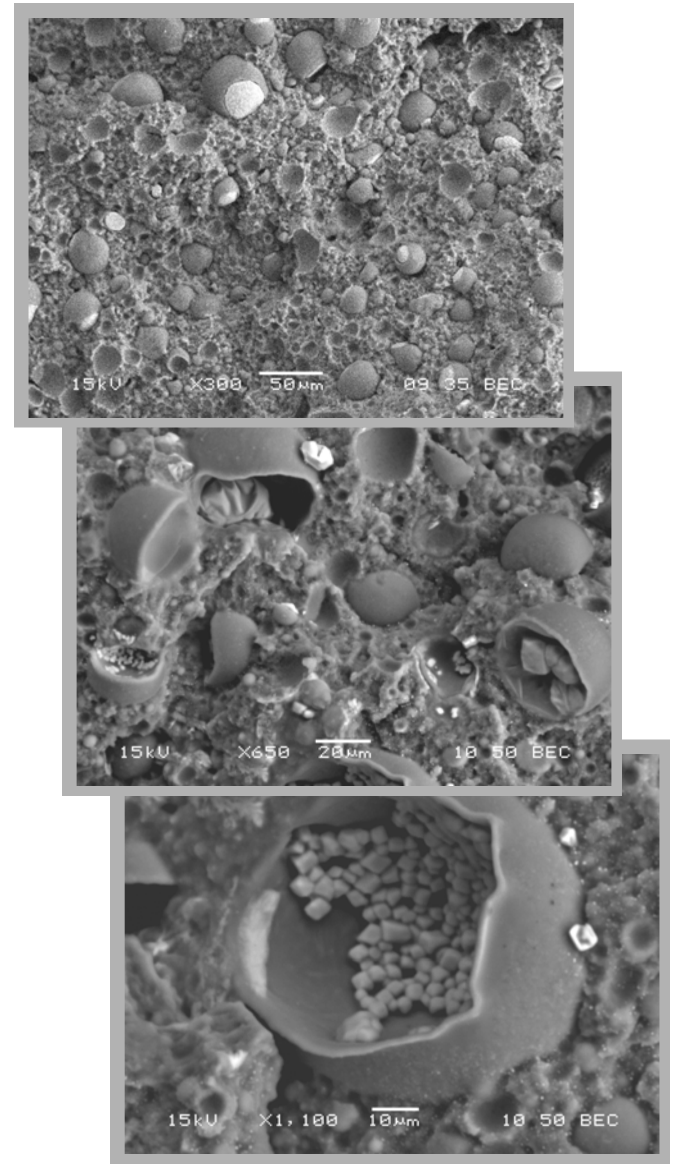
Aqueous processing route



Phase inversion: polymers go from being the discontinuous phase to being the continuous phase, encapsulating solid waste

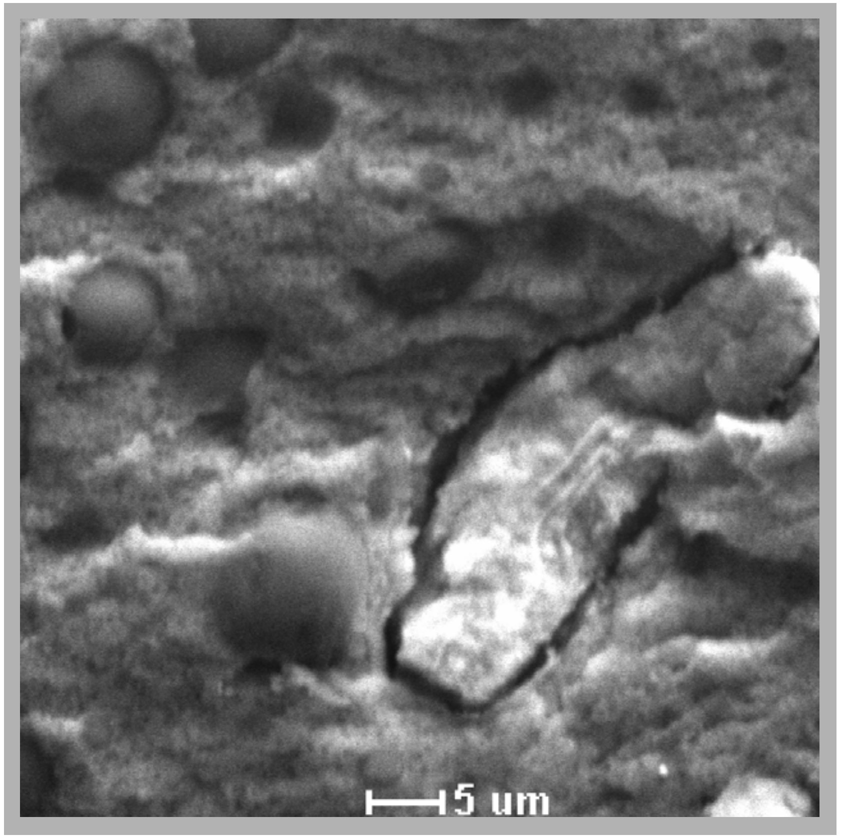
SEM/EDS analysis

- Salt is encapsulated in the polymeric matrix
- Characteristic feature: salt “sacs”
- Salt crystals form inside sacs and salt present also throughout bulk of polymeric matrix

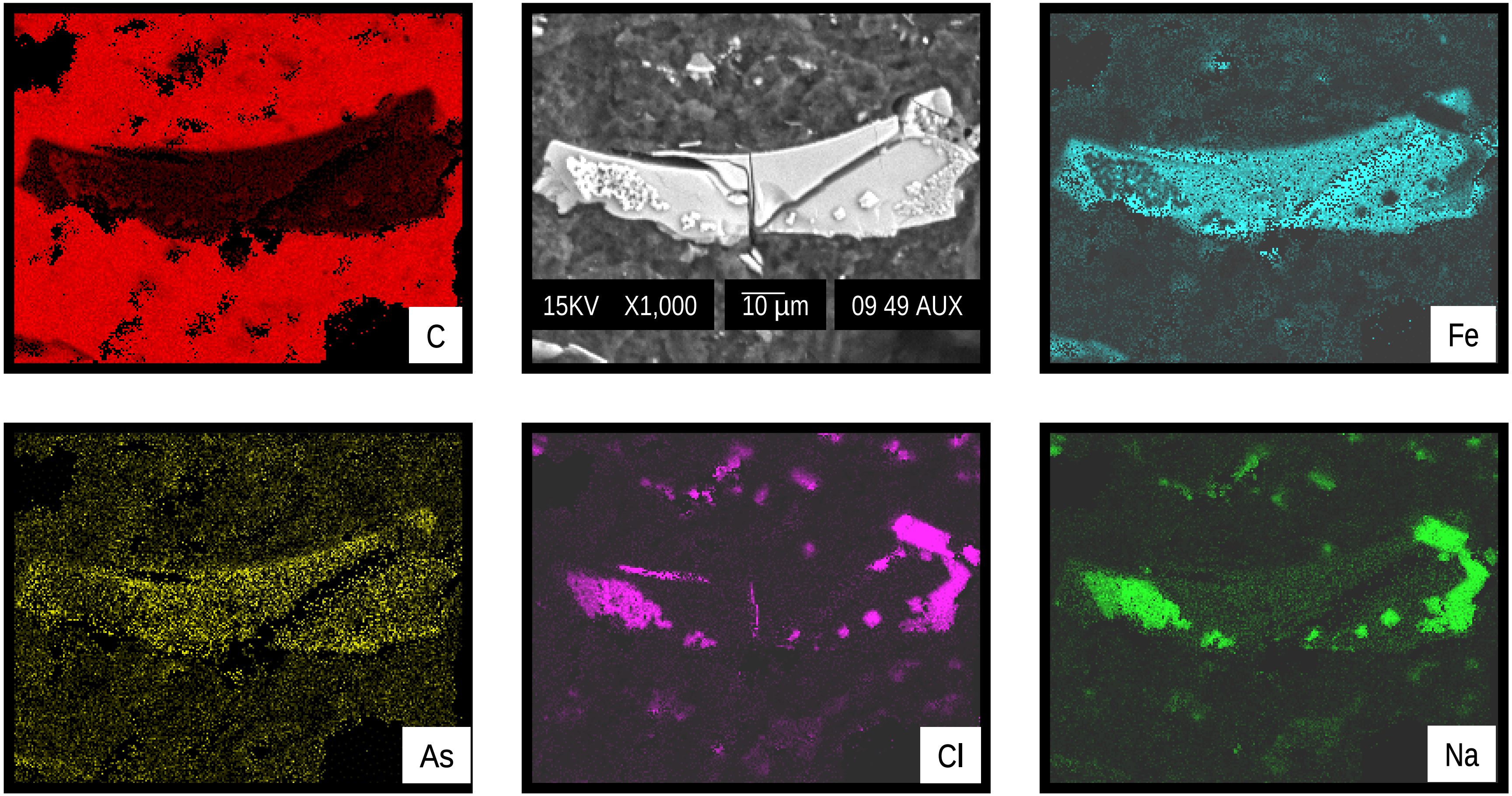


SEM/EDS analysis

- Evidence of iron sludge encapsulation
- Osmium tetroxide staining
- Epoxy/PSB distribution visible
- Sac outer skin composition is epoxy



SEM/EDS elemental mapping



Sample composition: 10% $Fe(OH)_3$, 4.6% NaCl, 0.3% $NaNO_3$