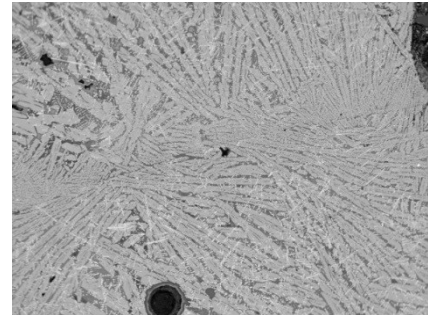


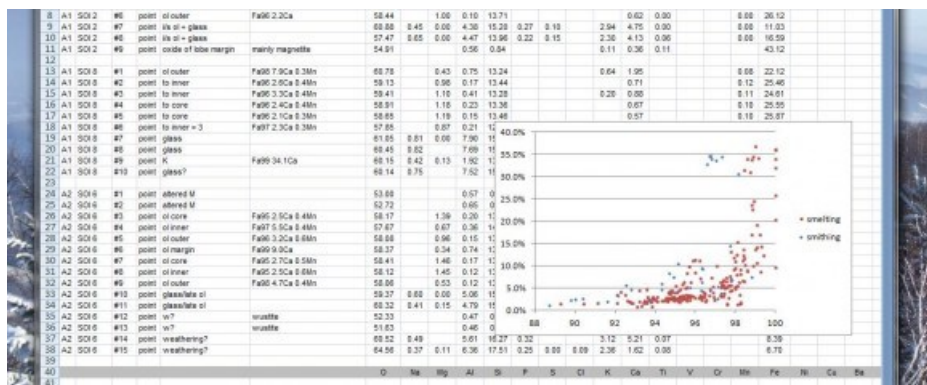
June 29, 2012 Tim Young Day of Archaeology 2012, Science Archaeometallurgy - slag analysis - ferrous metallurgy, Building materials, chemical composition, chemical formulae, chemical microanalysis, Dean, Economic geology, Forest of Dean, Iron, Iron mining, Iron ore, Metallurgy, overall chemical composition, Slag, Smelting, Steelmaking

Following the morning's excitement of a **delivery of new material**, it is back to the interpretation of a large dataset collected on the SEM last week. Some of the collections of archaeometallurgical residues that get examined require detailed analysis to reveal their secrets. Various techniques are used to analyse for chemical composition, mineralogy and microstructure. One of the most commonly used tools is the analytical scanning electron microscope. The analytical SEM allows chemical microanalysis from precise locations in a sample.



Roman tapped iron-smelting slag. The field of view is approximately 2.5mm. The horizontal line across the centre is the chilled margin of an individual flow lobe.

From this information the analyses can be converted into chemical formulae, allowing the detailed mineralogy can be established. Analysis of regions of slag also allows the overall chemical composition of the slag determined. Processing of the microanalyses is time-consuming



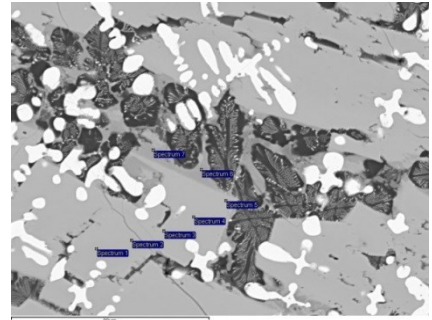
In this example, the chemistry of the slag clearly indicates that the smelters were using iron ore from the Forest of Dean. This ore is generally very pure and produces a slag with a rather simple mineralogy.

Processing microanalytical data, to convert the microanalyses into mineral formulae.

Here, however, the slag has reacted with the ash of the charcoal fuel, levels of calcium and potassium have been increased, and additional phases formed.

So, analysis has, in this instance, clarified not only where the ore was mined, but also provided some subtle indicators that may help with understanding the details of the smelting technique employed.

There are, however, lots more numbers to crunch before the full significance of the material can be understood...



Detail of Roman tapped iron-smelting slag. Field of view is approximately 0.17mm. The image shows the minerals wustite (FeO , white), fayalite (Fe_2SiO_4 , pale grey), kirchsteinite (FeCaSiO_4 , mid grey) and leucite (KAlSi_2O_6 , dark grey).