SEM/EDS analyses
LP3-P-018b sample

Main objective: identify the minerals associated with the bitumen so called Thucholite

Preliminary observations

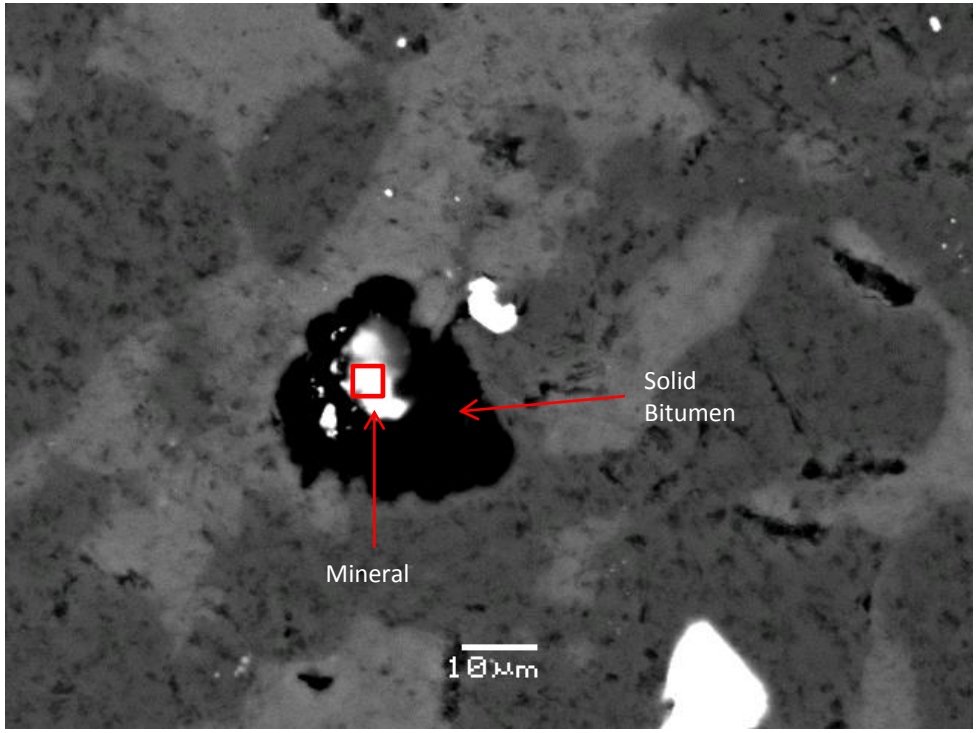
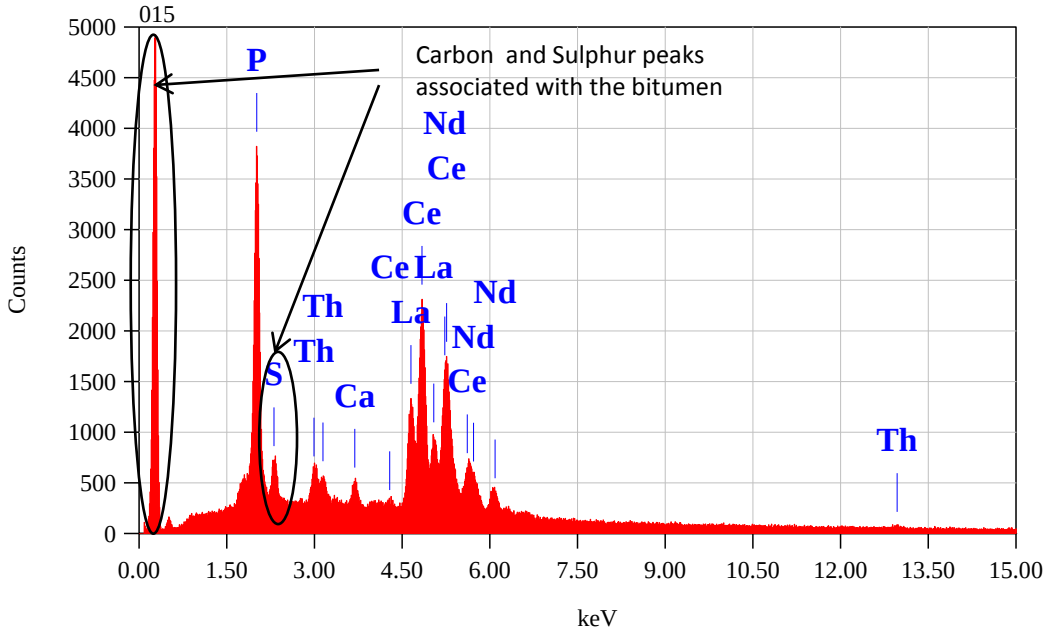


Figure 1 – SEM image BSE mode, high vacuum - **Thucholite**
Instrument: JEOL JSM 6460LA
Volt: 25.00 kV
Mag.: x 1000
Date: 2014/06/27



The chemical composition seems to indicate Monazite ((Ce, La, Nd, Th)PO_4, general formula).

In this case is a (Ce)-Monazite since higher mass percentage was found for the REE Ce.

Sm and Gd may be also in the structure; however, higher resolution technique is needed to confirm that. Furthermore, the error associated with the insertion of these two elements in the mineral spectrum was higher than their mass%, so I made a decision and removed them from the spectral analysis.

Carbon and sulphur peaks belong the bitumen (see Figure 3).

Calcium can be a interaction volume effect with the rock matrix (background).

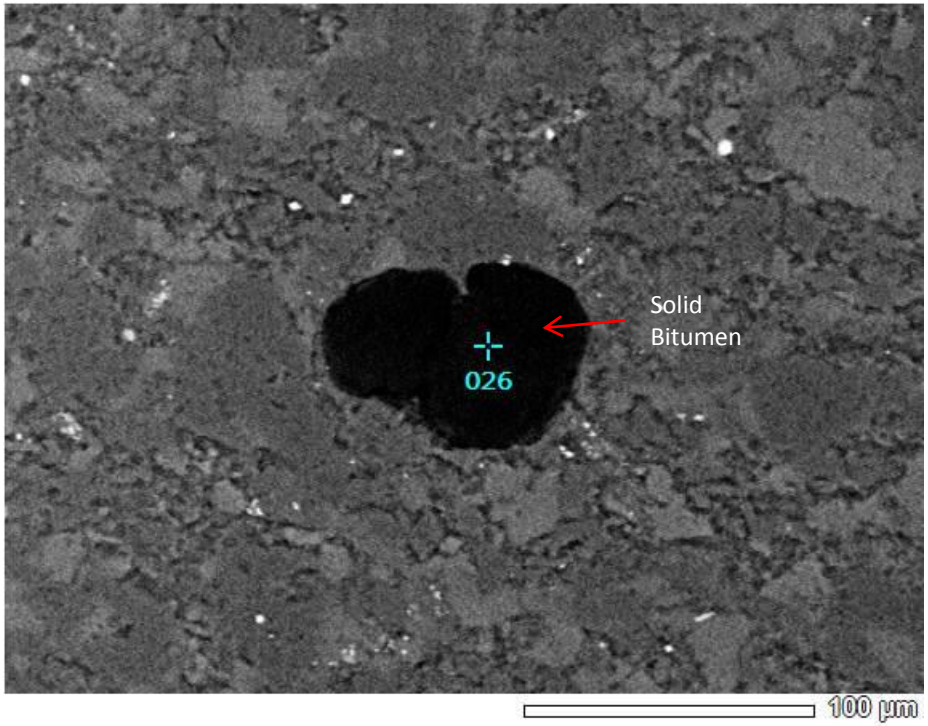
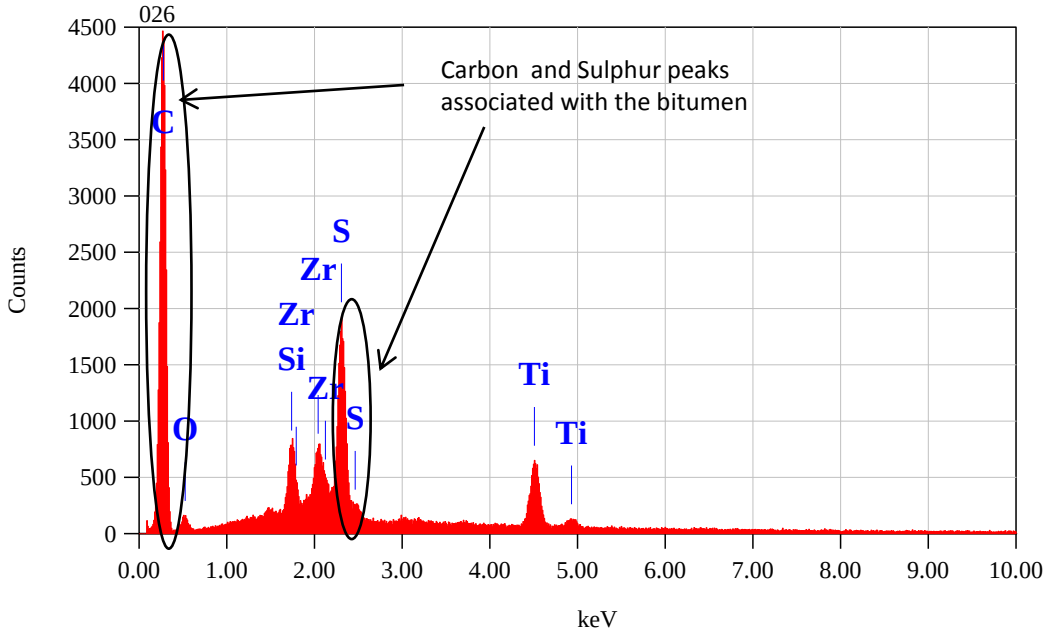


Figure 2 – SEM image BSE mode, High vacuum – **Thucholite (?)**
Instrument: JEOL JSM 6460LA
Volt: 25.00 kV
Mag.: x 400
Date: 2014/06/27



This case is not that clear. Once again assuming that C and S is associated with the solid bitumen structure (see Figure 3), what Zr and Ti stand for? And the Si may or may not belong to the background.

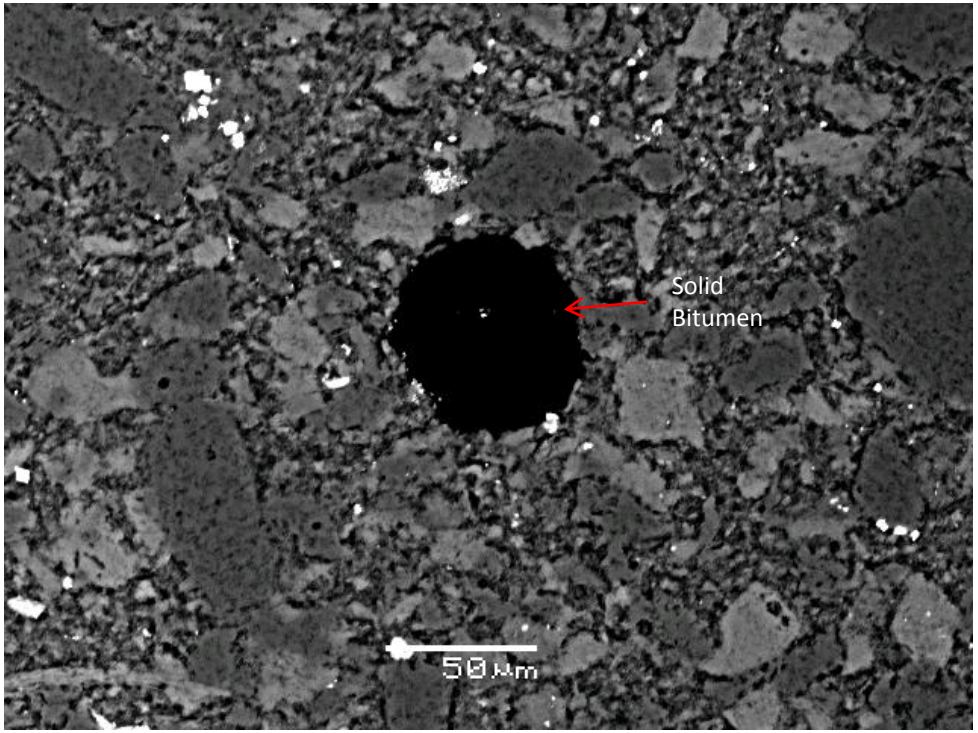
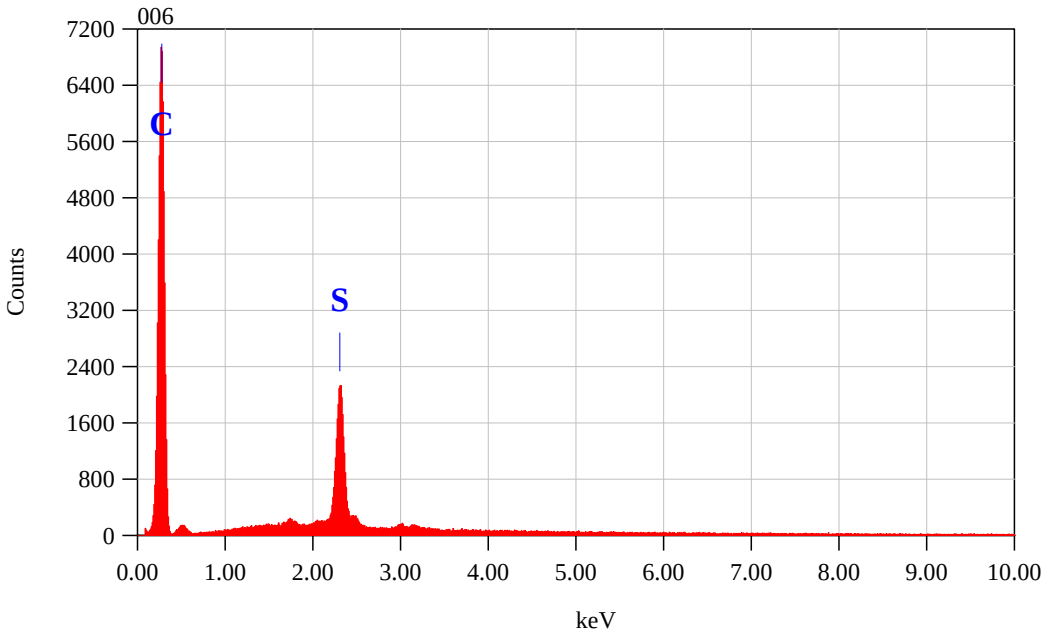


Figure 3 – SEM image BSE mode, High vacuum – **Rounded bitumen (?)**
Instrument: JEOL JSM 6460LA
Volt: 25.00 kV
Mag.: x 400
Date: 2014/06/27



Organic component with no mineral inclusion. The spectrum indicate C and S in its composition. It may be equivalent to the rounded bitumens.
I am assuming this particle is not a detrital particle/high reflectance bitumen because, from optical microscopy observations, these particles are smaller than 15 µm and have a irregular shape.

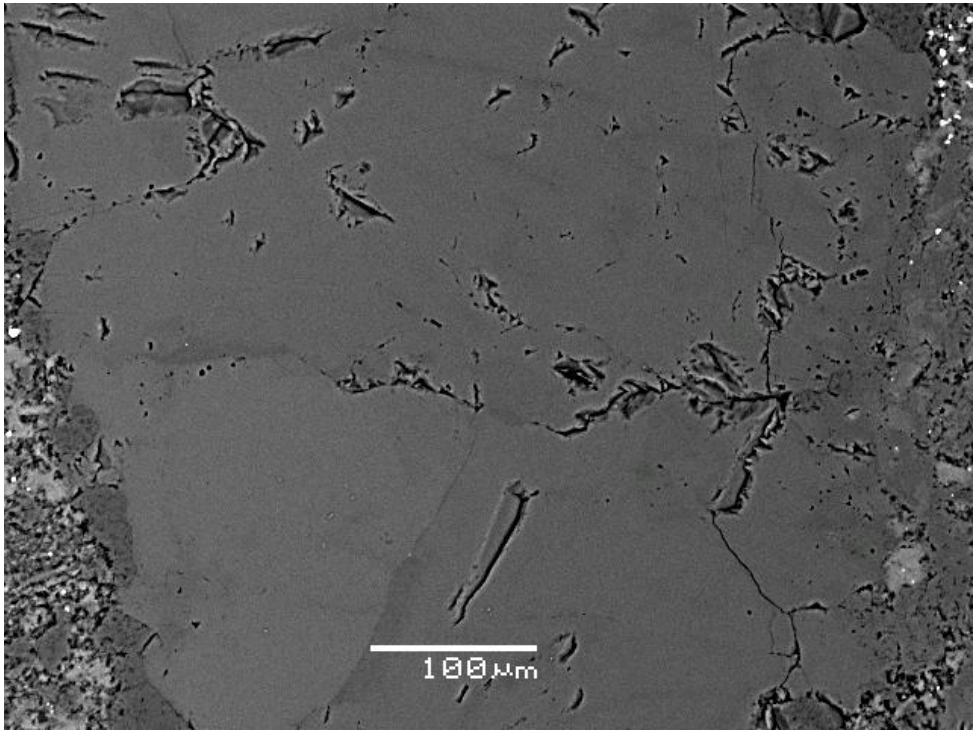
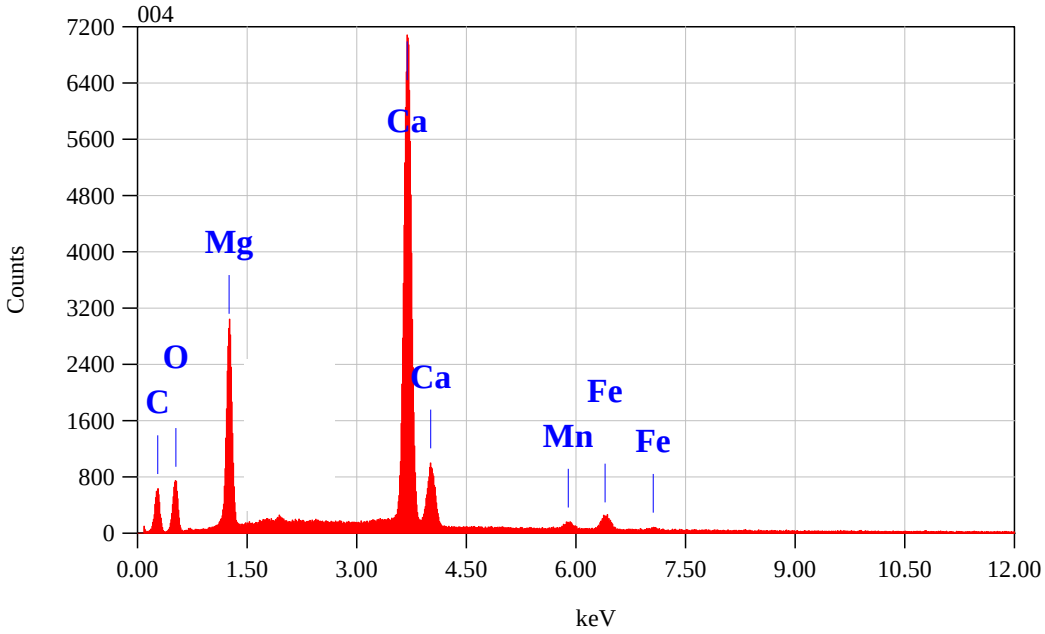


Figure 4 – SEM image BSE mode, High vacuum – **Carbonates inside a fracture - Dolomite**
Instrument: JEOL JSM 6460LA
Volt: 25.00 kV
Mag.: x 220
Date: 2014/06/27



Ca and Mg are the main components. Fe and Mn appear in low mass percentages, 2.7 and 1%, respectively.

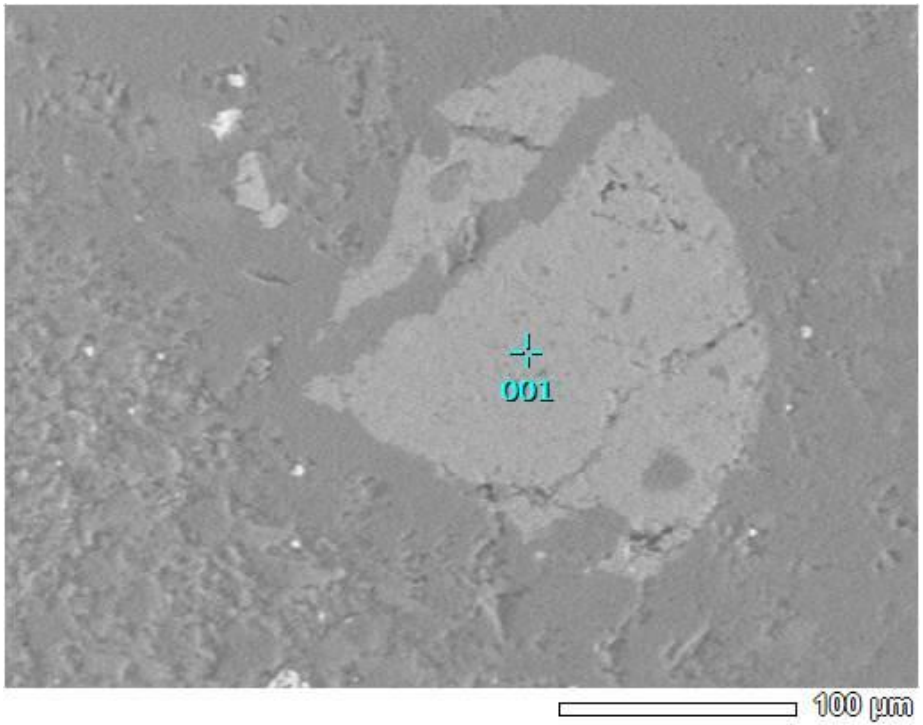
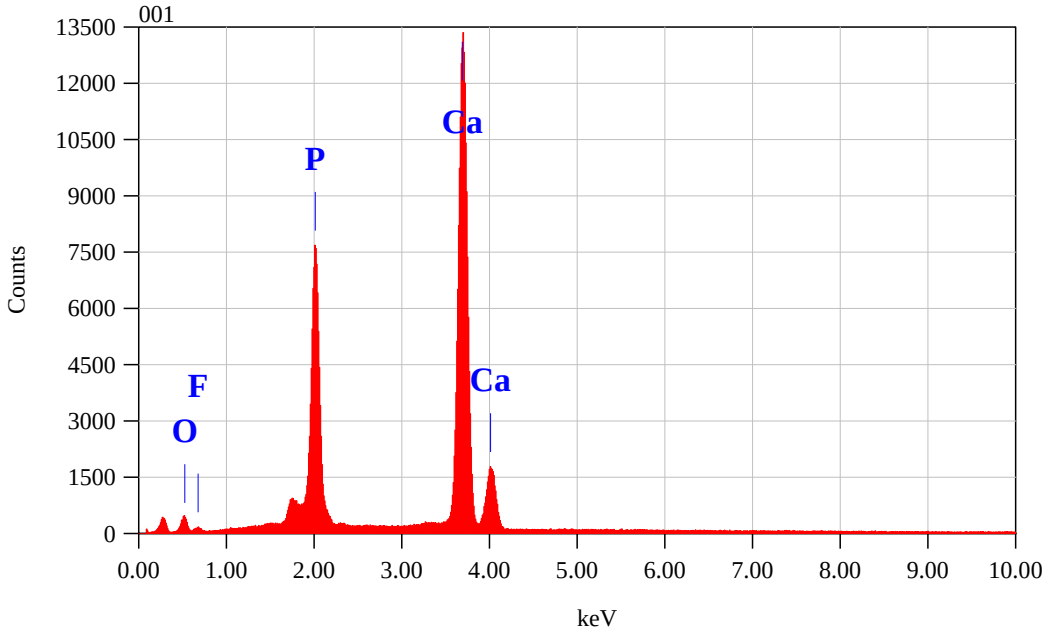


Figure 5 – SEM image BSE mode, High vacuum – **Fluorapatite**
Instrument: JEOL JSM 6460LA
Volt: 25.00 kV
Mag.: x 330
Date: 2014/06/27



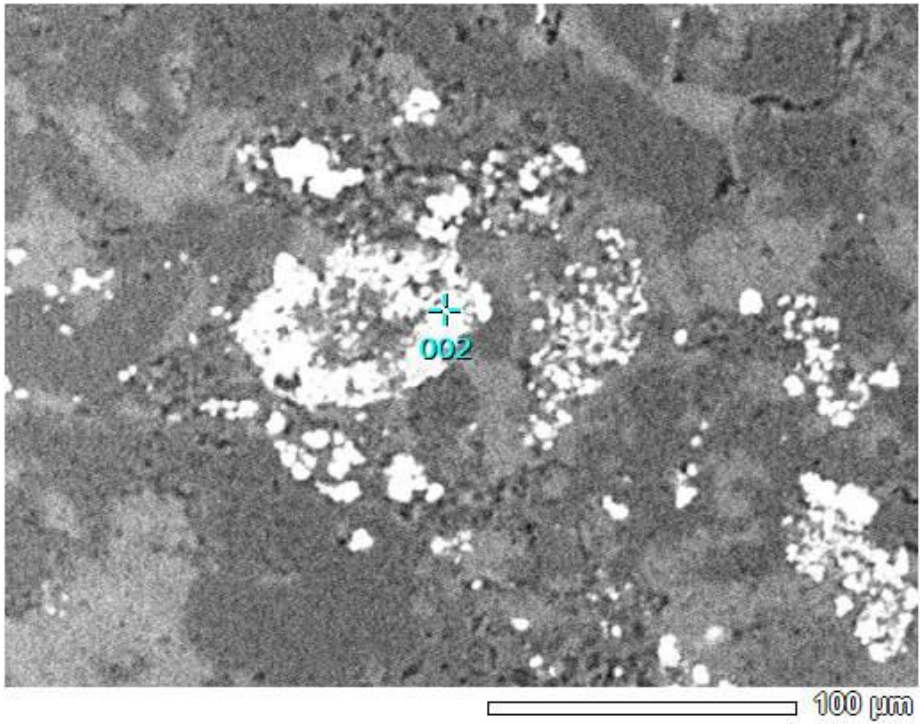
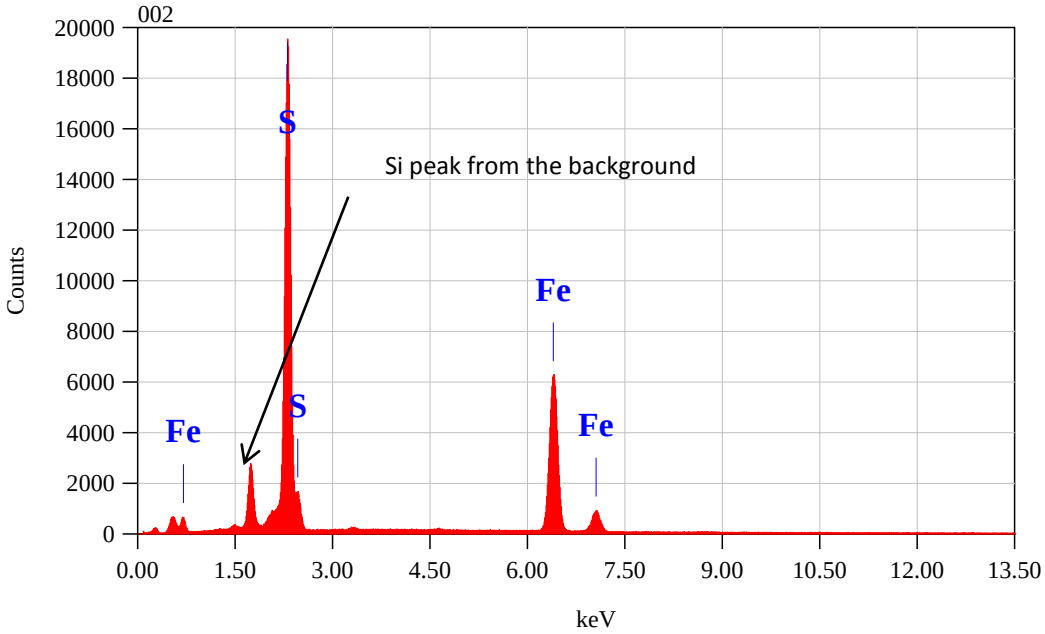


Figure 6 – SEM image BSE mode, High vacuum – **Pyrite**
Instrument: JEOL JSM 6460LA
Volt: 25.00 kV
Mag.: x 430
Date: 2014/06/27



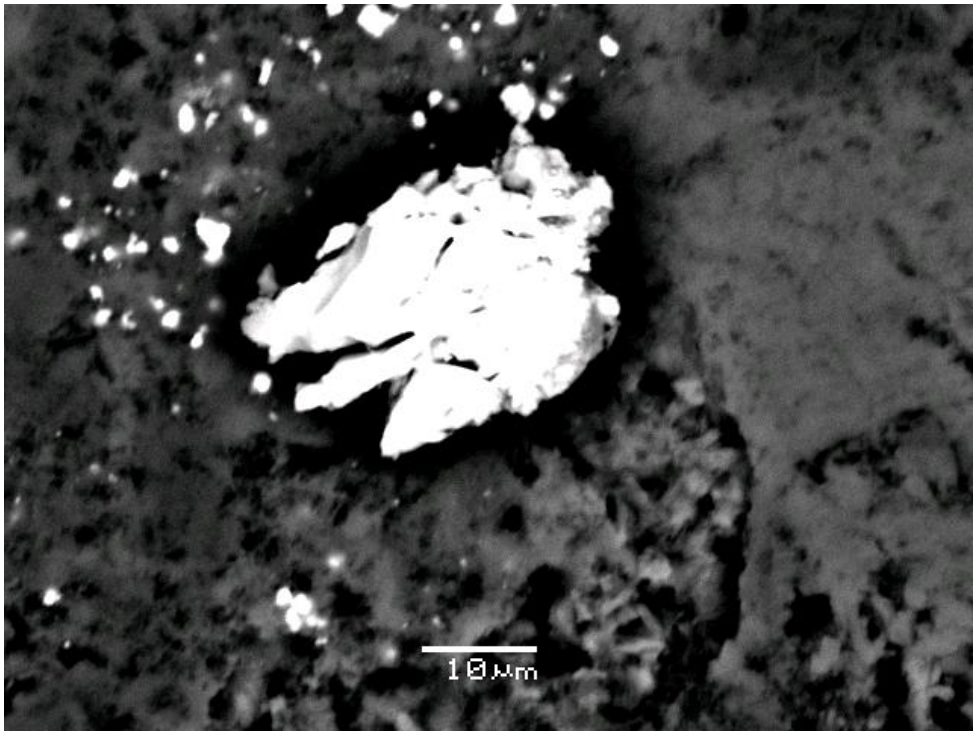
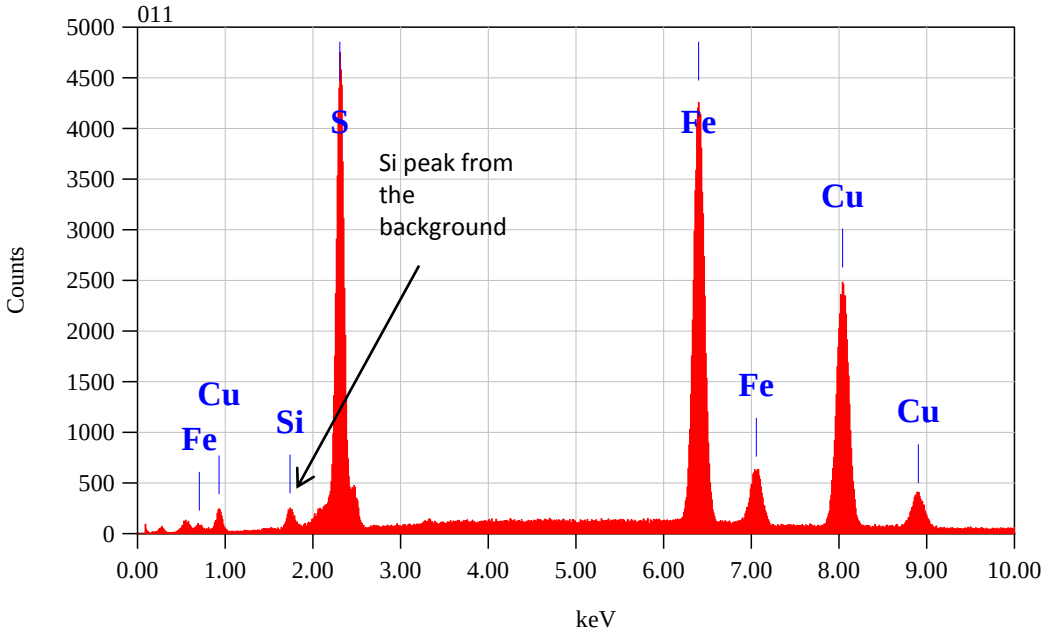


Figure 7 – SEM image BSE mode, High vacuum – **Chalcopyrite**
Instrument: JEOL JSM 6460LA
Volt: 25.00 kV
Mag.: x 1500
Date: 2014/06/27



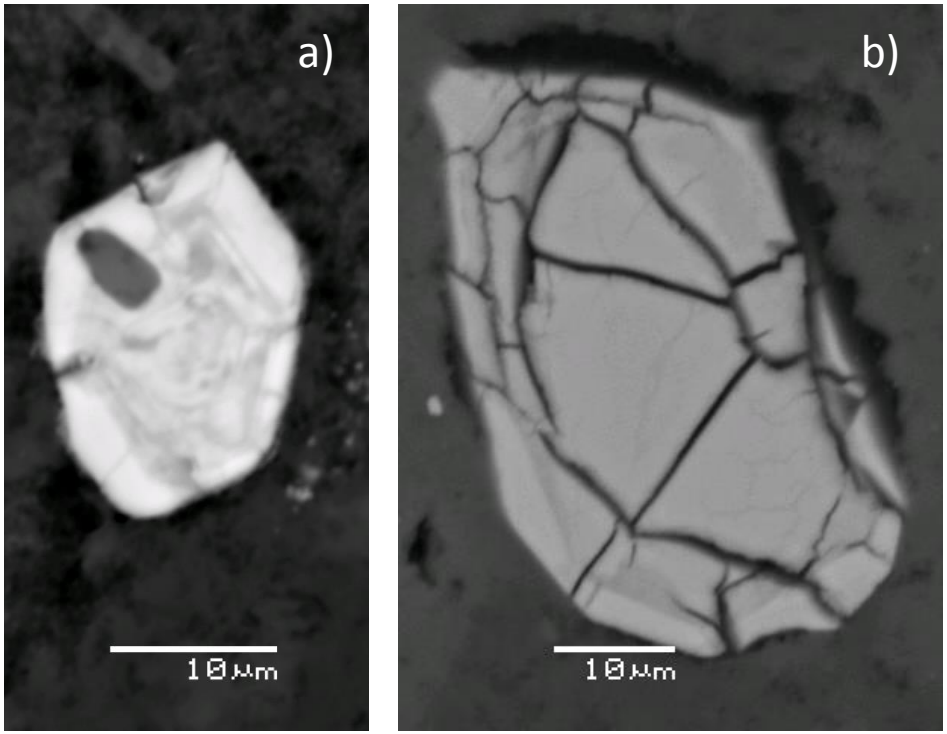
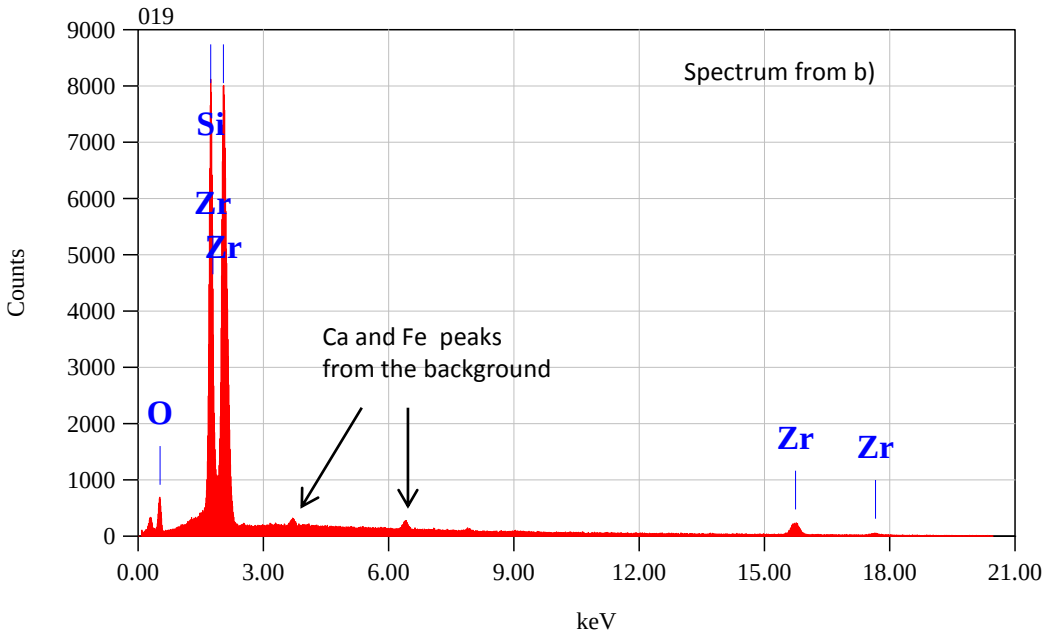


Figure 8 – SEM image BSE mode, High vacuum – **Zircon**
Instrument: JEOL JSM 6460LA
Volt: 25.00 kV
Mag.: x 2200 (a); x 1600 (b)
Date: 2014/06/27



Analyses conditions:

- Instrument: JEOL JSM 6460LA
- Accelerate Voltage: 25 kV
- Signal: Backscatter electron (BSE)
- Working distance: 10mm
- Spot size: 55
- Aperture: 2
- High Vacuum
- Coating: Carbon