EUROPEAN SYNCHROTRON RADIATION FACILITY
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# Experiment Report Form

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| | **Experiment title:**<br>XRF nano-analysis/nano-tomography of microkrystites from the Cretaceous-Paleogene (K-Pg) boundary | **Experiment number**:<br>ES 420 |
| **Beamline**: | **Date of experiment**:<br>from: 20/04/2016 to: 25/04/2016 | **Date of report**: |
| **Shifts:** | **Local contact(s)**:<br>Remi Tucoulou | *Received at ESRF:* |

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One of the major Phanerozoic mass extinctions happened 66 million years ago, when a major crisis famously caused the passing of most dinosaurs and marked the rise of the mammals. The discovery of high abundances of siderophile iridium and other PGEs in the Cretaceous-Paleogene boundary clay at Gubbio (Italy) and Caravaca (Spain) led to the hypothesis that an asteroid ~10 km in diameter struck Earth's crust, ejected significant volumes of target and Ir-rich projectile material, and lead to severe environmental stress inflicting a worldwide mass extinction (Alvarez et al., 1980; Smit and Hertogen, 1980).

Impact ejecta found more than ~10 crater diameters away from large impact craters consist primarily of glassy spherules that are droplets solidified from melt or condensed from vapour. Most impact spherules are smaller than 1 mm in diameter and are either microtektites, consisting of pure glass (e.g., Belza et al., 2015), or microkrystites, containing primary crystallites in addition to glass. Microkrystites are generally more mafic in composition, can be highly contaminated by the impactor (i.e., the impacted and ejected meteorite) as indicated by elevated siderophile element contents (Goderis et al., 2013a,b), and may contain unusual Ni-rich spinels. Although these primary spinel crystals are thought to be one of the carriers of the siderophile element enrichment, the distribution of the platinum group elements (PGEs: Re, Os, Ir, Ru, Pt, Rh, Pd) in the spherule groundmass remains unclear.

The main focus of beamtime ES 420 was the elemental analysis of several microkrystite particles, focussing on the PGEs (mainly Pt and Ir).Next to the distribution of these elements thoughout the spherules, the overal elemental distribution and possible trends and interactions of PGEs with other elements were also investigated on the sub-micron scale at the ESRF ID16B beamline.

Due to their very low concentration (around or below the limits of detection), Pt and Ir would prove difficult to find, one of the scans with a good Pt signal is shown in Figure1. The experiment yielded nontheless valuable information on the general elemental composition and sub-micron structure of these impact ejecta. A manuscript is currently being prepared summarizing the new insights distilled from the beamtime data.

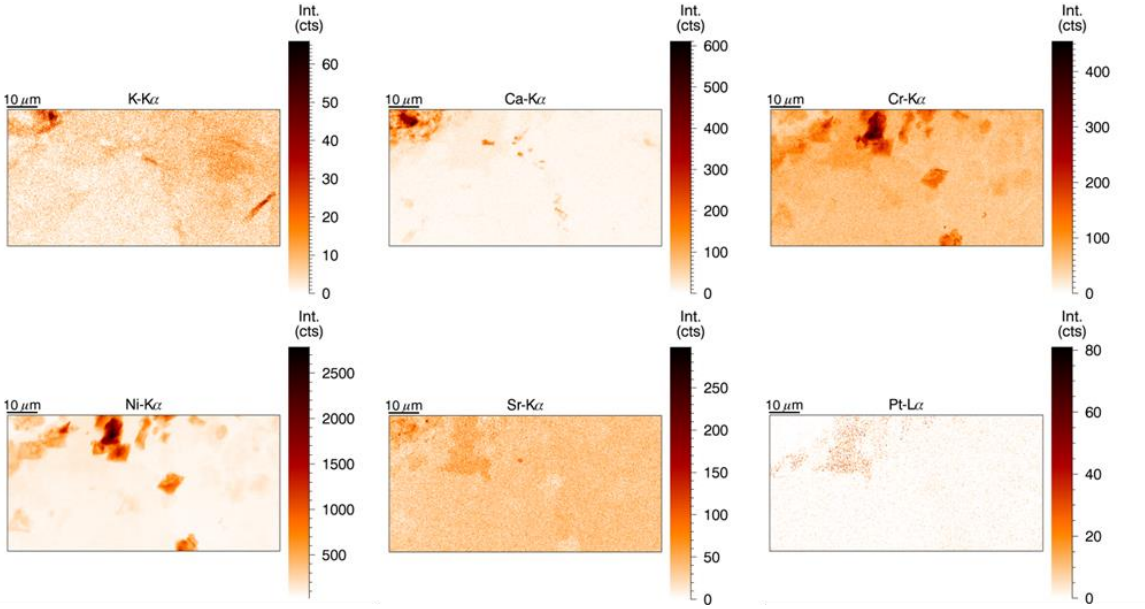


Figure 1 XRF imaging for some of the elemnts composing the inclusions in the mycrokrystites. A vague Pt-rich region can be discerned.

The second type of sample which was analysed during this beamtime, a feruous micro-meteorite, was imaged with high resolution in a semi-3D fashion. This sample is used as reference for coupling of different state-of-the-art sub-micron analysis techniques and as such will be of huge importance for our future experiments on small geological samples. The writing of a second manuscript is being considered based on the data from this micro-meteorite.

**References**

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