

## Identifying chemical elements using laboratory-based spectral X-ray imaging

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### 1. Introduction

Methods have been developed to improve the quantitative assessment of density and chemical composition of materials using either dual-energy  $\mu$ CT or projection-based simulations. Despite the measures to untangle these dependencies, it is difficult to overcome this using a polychromatic X-ray source within laboratory-based  $\mu$ CT systems. Recent developments in the spectroscopic capabilities of detectors [1] allow us to measure the energy of each photon using the so-called spectral detectors. Direct 3D chemical information can be derived from the identification of element-specific K-edges in the attenuation profile. However, this technique still requires improved data processing and analysis. We compare the results from two different spectral laboratory-based  $\mu$ CT setups.

### 2. Materials and Methods

Polished rock labs were first scanned using a scanning electron microscope with an energy-dispersive X-ray spectrometer to acquire mineral distribution maps. Points of interest were selected to cover a whole range of chemical elements within the practical energy margins of current spectral detectors (i.e., elements with an atomic number higher than molybdenum,  $Z = 42$ ). At these points of interest, cylindrical 5 mm long cores with a diameter of 2 mm were prepared using an upright drilling machine. Spectral scans were taken with a spectral line detector incorporated in the Tescan UniTOM XL at DMEX-UPPA (France) and were compared with results acquired with a CdTE sensor coupled to a HEXITEC ASIC detector mounted in a WiggleCam configuration at UGCT-UGent (Belgium).

### 3. Results and Discussion

Sudden changes are observed in the attenuation profile related to the presence of specific elements (Fig. 1). The spectral line detector outperforms reconstructed scans taken with a spectral panel

detector due to the higher number of lateral pixels in the detector. However, a spectral panel detector already allows the live visualization of K-edges at a selected energy range over a larger area [2].

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### 5. References

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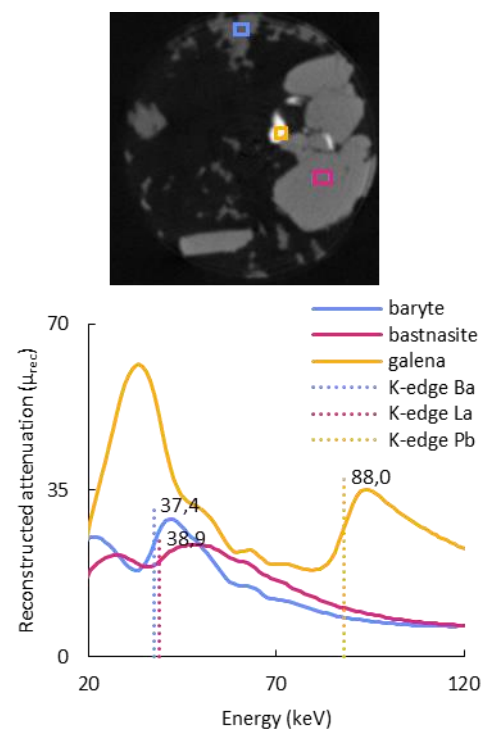


Figure 1. Qualitative detection of K-edges in the attenuation profile of minerals.