FACULTY OF SCIENCES

[1] DEPARTMENT OF GEOLOGY, GHENT UNIVERSITY , KRIJGSLAAN 281 S8, B-9000 GENT, BELGIUM, [2] CENTRE FOR X-RAY TOMOGRAPHY (UGCT), GHENT UNIVERSITY, PROEFTUINSTRAAT 86, 9000 GHENT, BELGIUM [3] DEPARTMENT OF ANALYTICS, HELMHOLTZ-ZENTRUM DRESDEN-ROSSENDORF, FREIBERG, GERMANY, [4]DEPARTMENT OF EARTH SCIENCES, UTRECHT UNIVERSITY, UTRECHT, THE NETHERLANDS

Arjen Mascini[1,2], Florian Buyse[1,2], Maxim Deprez[1,2], Jonathan Sittner[1,2,3], Matthieu Boone[2], Stijn DeWaele[1], Veerle Cnudde[1,2,4]

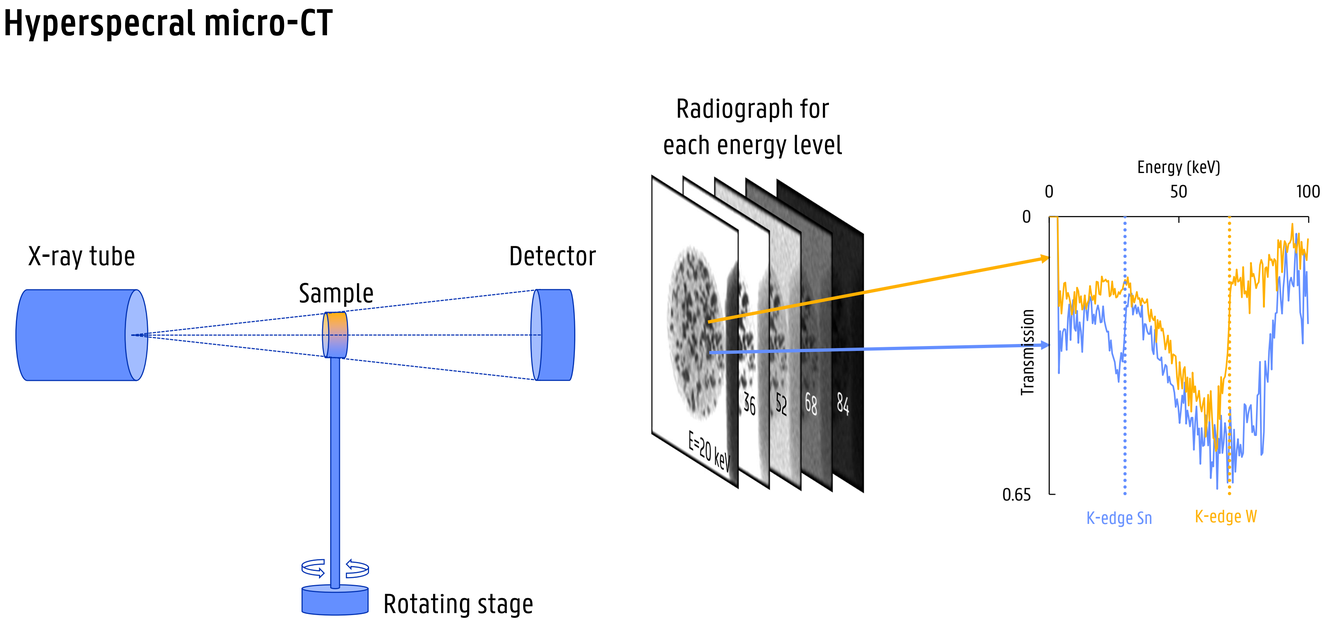
ADVANCED X-RAY-BASED 3D STRUCTURAL AND CHEMICAL CHARACTERISATION OF ORES

Summary

Understanding the 3D distribution of elements within rocks is crucial for understanding the formation of mineral deposits and developing efficient extraction methods. X-ray microtomography (micro-CT) has established itself as an important tool to non-destructively characterize a wide-range of geomaterials in 3D but only provides indirect insight into the chemistry of a material. Here, we show how lab-based hyperspectral micro-CT, a technique based on the difference in X-ray absorption energy of elements present within minerals, can be used to differentiate between ore mineral grains. The association between specific elements and mineral phases can then be studied in 3D, giving important insight into the formation of the different minerals and possible extraction of the metals.

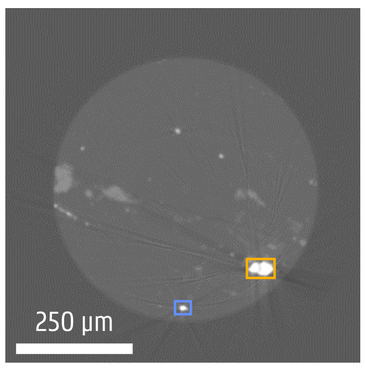
Methodology

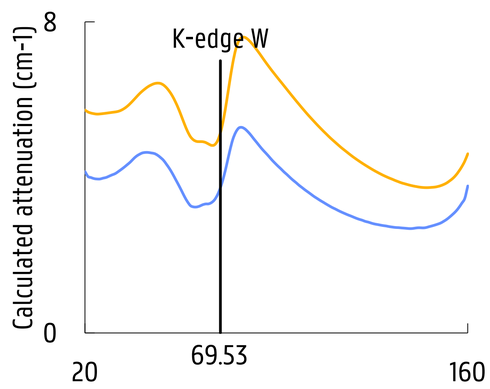
Hyperspecral micro-CT



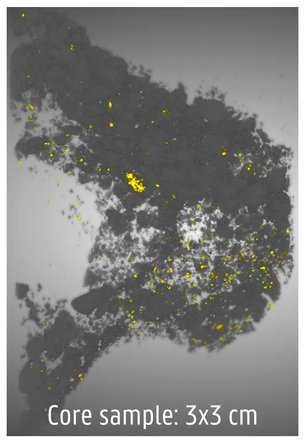
Geological applications

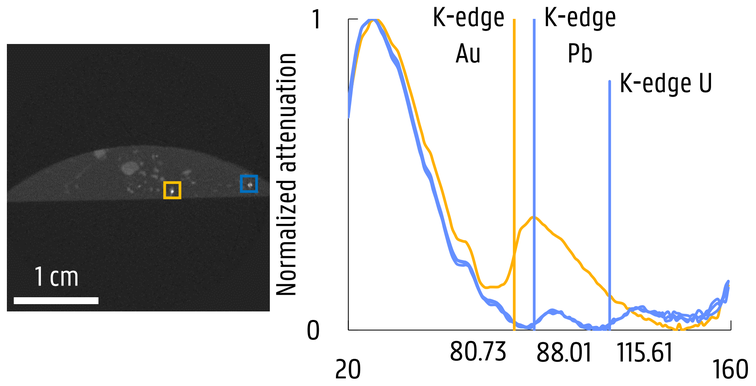
1. Structural linkage of scheelite in samples from the Mittersill mine (Austria)



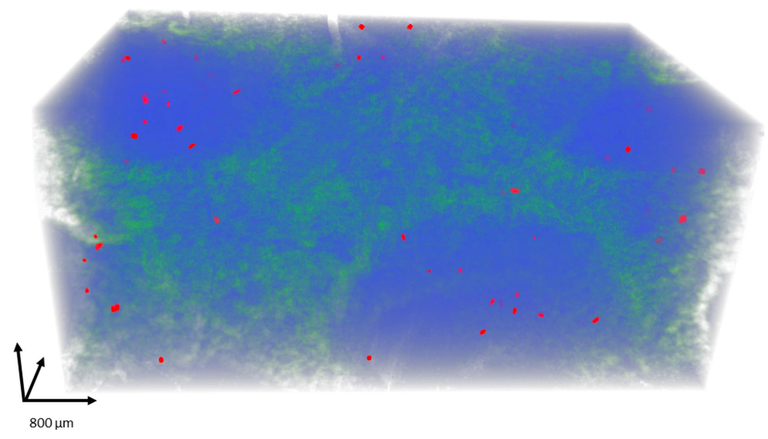


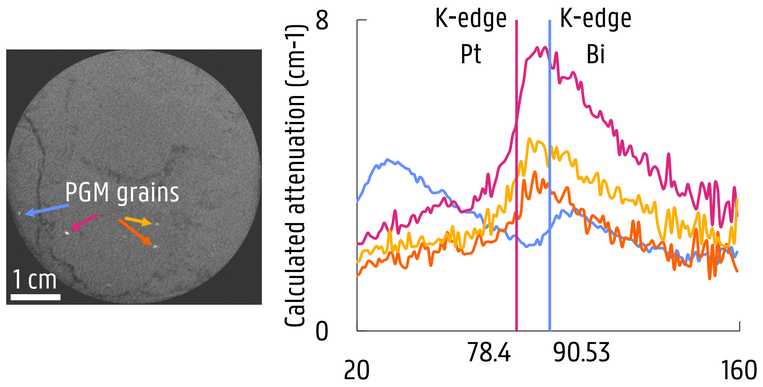
2. Au-bearing and U-bearing minerals from the Witwatersrand Supergroup (South Africa)





3. 3D distribution of Platinum Group Minerals (Norilsk deposit, Russia)





Outlook

By complimenting the capabilities of hyperspectral CT, 3D XRF and 2D scanning electron microscopy-based energy dispersive spectroscopy a multi-scale correlative workflow can be created to characterize materials crucial for the energy transition and a circular economy.

Contact

Arjen.Mascini@ugent.be
www.ugent.be/we/ugct/en

@PprogressU

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Sittner, J.; Godinho, J. R. A.; Renno, A. D.; Cnudde, V.; Boone, M.; De Schryver, T.; Van Loo, D.; Merkulova, M.; Roine, A.; Liipo, J. Spectral X-ray Computed Micro Tomography: 3-dimensional Chemical Imaging. *X-Ray Spectrom.* **2021**, *50* (2), 92–105. https://doi.org/10.1002/xrs.3200.

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