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A revolution in quantitative 3D imaging for petrology

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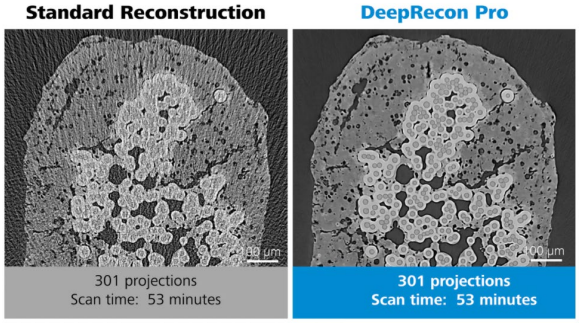

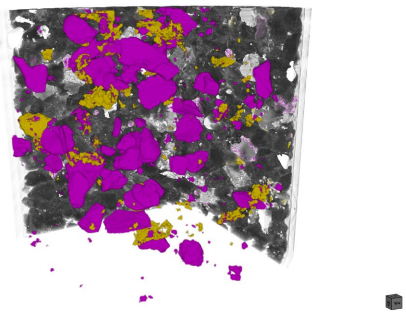

Non-destructive 3D imaging through X-ray absorption contrast tomography provides a fertile ground for incorporating “Everyday AI” into geoscience workflows. The rock samples we study are inherently 3-dimensional, and yet the vast majority of our quantitative analytical solutions are 2-dimensional. ZEISS X-ray platforms (µCT and XRM) have recently undergone a revolution, pushing them into the realms of other quantitative analytical tools with fully calibrated and standardised measurements and datasets. This enables the robust and repeatable measurement of not just 3D textural information, but the consistent identification of the materials themselves.

Now, ZEISS Mineralogic 3D applies non-destructive X-ray microscopy techniques and deep learning algorithms to execute automated mineralogy in 3D. Mineral classification and particle identification are performed alongside customisable data outputs including true grain size/shape and mineral association measurements with none of the stereological restrictions of SEM-based analysis. Mineralogic 3D is capable of analysing whole rock samples, loose particle fractions, or intricate structures in full with no sample damage and minimal preparation.

The phrase 'automated mineralogy' has been synonymous with the use of Scanning Electron Microscopes (SEM) for decades. The classification of minerals using SEM-based Energy Dispersive Spectroscopy (EDS) chemical measurements has been the only method for rapid, automated phase ID in microscopy. ZEISS Mineralogic EM provides a more robust version of this technique, quantifying each EDS measurement to output real geochemical measurements from particle analysis to full mapping of thin sections.

As a result the ZEISS Mineralogic suite now provides the most complete automated package for rock characterisation ever devised. Mineral classification can be achieved through both quantitative geochemical measurements and quantitative X-ray attenuation, allowing for seamless petrology workflows where mineral and textural information can be derived across varying length scales and dimensions, and correlated for the most complete understanding of the sample.

Maximising the quantitative outputs from non-destructive X-ray techniques is ideal for precious samples such as meteorites & sample-return missions, museum specimens, and fossil samples – particularly those still embedded in host rock. However, the automated mineral classification and smart segmentation routines are suitable for wide variety of geoscience applications in academia and industry.