

Multi-scale rock characterisation and data integration: a case study from the BGS Core Scanning Facility

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Physical and chemical characterisation of sedimentary successions from core underpin a number of areas of geoscience, including source rock and reservoir evaluation, correlation, and, palaeoenvironmental analyses. Recent technical advances in the capabilities and analytical precision of X-ray fluorescence (XRF), computed tomography (CT), and multi-sensor (MSCLS) core scanners mean that they are increasingly applicable to such studies. In contrast to traditional semi-destructive sampling techniques, they offer the ability to rapidly acquire non-destructive and nearcontinuous records. These measurements can be integrated with other datasets at different scale, thereby increasing analytical resolution and the value of core material at the same time as reducing costs.

The new Core-Scanning Facility (CSF) at the headquarters of the British Geological Survey (BGS) in Keyworth houses four high-resolution core scanners – two XRF's, a CT, and a MSCLS – enabling geophysical, mineralogical, and geochemical characterisation of core and allowing high-definition optical, near-infrared (NIR), ultraviolet (UV), and Xradiographic images to be collected. The facility was commissioned to provide fundamental support to the NERC/UKRI funded UK Geo-Energy Observatories (UKGEOS; <https://www.ukgeos.ac.uk/>), an initiative to characterise the subsurface environment at 2 localities (Glasgow and Cheshire) in order to better understand the impact of subterranean infrastructure and the role rocks may play in decarbonising energy supplies.

Here, we use the preliminary results from the Glasgow Observatory as a case study to demonstrate how core scanner datasets are generated, evaluated, and visualised. This involves integrating core scanner outputs with other data generated at widely different scales (e.g. wireline logs, core plug analysis). We highlight the value of core scanning as a mechanism for correctly reconstructing the vertical position of core, for identifying specific intervals of interest, and for resolving new relationships between physical and chemical properties. The core scanner data can also highlight changes in the rock properties that would not be easily identified by conventional downhole geophysical logging and point geochemical sampling. Our ultimate goal is to generate a multi-scale “digital twin” for each core, freely available online, that will allow a more complete understanding of the variability of rock properties.