# A novel 4D-view on lake sediments

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Sedimentary archives contribute greatly to our understanding of past environments and climates. Yet, conventional analyses of lake sediments are limited to a 2D-view on the sediment core surface or volumetric analysis, for which the original structure needs to be destroyed. To overcome these limitations, we combined high-resolution 3D-microCT-scanning ($\mu$m-scale) of fresh lake sediment with XRF-scanning (200 $\mu$m spacing), micro-XRF mapping (40 $\mu$m spacing), and traditional thin section analysis.

We studied sediments from ferruginous Lake Towuti (2.75°S, 121.5°E; Indonesia). MicroCT scans reveal $\mu$m-thick vertical voids filled with high density mineral precipitates, related to post-depositional fluid circulation, as well as coatings of high-density material (mainly siderite), around low-density centres. We also observe bands of high-density minerals, which appear continuous in 2D, but prove to be separated structures in 3D space. A crack showing vertical displacement in the sediment is, in 3-D space, visualised as a plane of higher density material, which points towards a rupture, perhaps seismically induced, that promoted precipitation of high-density minerals on the newly-formed surface. The combination of high-resolution imaging with XRF element scans allows a novel, very detailed 4D-view of sedimentary structures that helps towards identifying processes involved in authigenic mineral formation.