Long-term climate change recorded in sediments from Lake Tanganyika, Tropical East Africa, over the past 90+ ka

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Despite decades of research the link between high-latitude and tropical climate is still poorly understood, due in large part to a lack of tropical continental records. Our sediment core from Lake Tanganyika sheds light on Tropical East Africa, an area with few climate records and virtually none prior to 30 ka. This record offers new insight into the timing and mechanisms behind East African climatic change over the past 90+ kyr. Our age model provides a high degree of age certainty for the past 45+ kyr, and our suite of proxies, including carbon isotopes, biogenic silica and scanning XRF, allows a thorough examination of Lake Tanganyika's dynamics over this time period.

Our record provides evidence of a severe mega-drought sometime prior to ~94 ka, followed by relatively high lake levels until the Last Glacial Maximum with short term changes interspersed. Two such changes are seen in nearly all parameters under consideration at ~75 ka and ~58 ka, the second of which corresponds to Heinrich 6; we interpret these as short term periods of enhanced precipitation. Zr/Ti provides a reliable record of overall precipitation until ~40 ka, at which time a change in lake dynamics drastically changes Zr/Ti values in concert with biogenic silica. The onset of glacial aridity occurs at 30 ka, with a concordant sedimentation rate drop of over 50%. Similar to other Lake Tanganyika records, we see evidence of much lower lake levels beginning at 17 ka with rising water levels by 15 ka.

The biogenic silica record in our core is in close agreement with a recently published record from the southern basin, providing evidence that our Kavala Island Ridge core is accurately recording changes seen elsewhere in the lake. This slow-sedimentation site can be used as a record of lake wide changes much deeper in time than other Lake Tanganyika sites are capable of recording.

[1] Tierney J.E. & Russell J.M. (2007) *Geophys. Res. Let.* **34**.

Unraveling the formation and oxidation of iron-monosulfides in acid-sulfate soil landscapes

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Iron-monosulfide minerals form as products of bacterially-mediated Fe(III) and SO_4 reduction in drain sediments and re-flooded wetland soils associated with coastal lowland acid sulfate soils (CLASS). The acid volatile sulfide (AVS) content in these soils and sediments is often in the range of several percent (on a dry weight basis), indicating iron-monosulfide contents of up to 18%. The behaviour of iron-monosulfides is of great important to Fe and S cycling and water quality in CLASS landscapes. Here we describe recent research aiming to unravel the formation and oxidation of iron-monosulfides in CLASS landscapes.

The *in situ* iron-monosulfide mineralogy is dominated by nanoparticulate mackinawite (tetragonal FeS), but may also include greigite (Fe_3S_4). In well-aerated water, natural mackinawite oxidises with a half-life of ~30 min. The initial products are orthorhombic elemental S (S_8) and Fe-oxyhydroxides (Figure 1), including ferrihydrite ($Fe(OH)_3$), lepidocrocite ($\gamma FeOOH$) and goethite ($\alpha FeOOH$). If the supply of oxygen is constrained, the initial oxidation process proceeds via a solid-state transformation of mackinawite to greigite (Fe_3S_4). Greigite may then partially oxidise to magnetite (Fe_3O_4) or pyrite (FeS_2), in addition to elemental S and Fe-oxyhydroxides. If oxidising conditions persist, severe acidification (pH~3) may develop, with the subsequent precipitation of schwertmannite ($Fe_8O_8(OH)_6SO_4$).
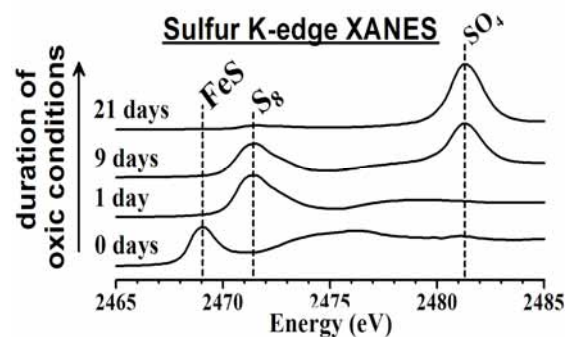
Figure 1: X-ray absorption near-edge structure (XANES) spectra following oxidation of natural mackinawite (FeS).