

Zircon U-Pb dating of mylonitization, Macaloge Shear Zone, Mozambique

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We document neocrystallization of zircon in a greenschist- to lower-amphibolite-facies ultramylonite in the Unango Complex, Mozambique belt, NE Mozambique. The Macaloge Shear Zone is a prominent NE-trending shear array, 20 km wide and at least 150 km long. It forms a left-lateral duplex clearly visible from the airborne geophysics. A sample of felsic microlayered ultramylonite from a shear zone, at least 60 m wide, shows macroscopic and microscopic evidence for left lateral sense of shear. The rock shows feldspar porphyroclasts in a granulated muscovite-biotite-quartz-ilmenite-bearing matrix (10-100 μm) suggesting deformation in the 300-600°C range. CL and EBSD data from zircon porphyroclasts indicate common to abundant fractures and evidence for partial lattice re-crystallization, which is associated with a change from typical oscillatory zoning to patchy zoning. Zircon, xenotime and thorite neoblasts are observed. Zircon neoblasts, characterized by patchy CL zoning, occur as trails of angular to rounded fragments visibly derived from brittle crushing of a porphyroclast. Xenotime microcrystals are reported within aggregates of zircon neoblasts and inside fractures in zircon porphyroclasts. These features suggests re-crystallization of zircon during mylonitization with loss of HREE. Prismatic, oscillatory-zoned, poorly-fractured zircon porphyroclasts yield a date of 1004 \pm 24 Ma (LA-ICPMS data), recording magmatic intrusion of the granite protolith, in accordance with regional data [1]. Small (<100 μm), generally flat, rounded zircon neoblasts with patchy to concentric zoning, provide an age of 444 \pm 5 Ma (SIMS data), interpreted as recording the timing of mylonitization. These crystals are characterized by Th/U ratio <0.02, consistent with co-precipitation with thorite and xenotime. The Macaloge Shear Zone attests to post-Pan-African and pre-Karoo strike-slip shearing between the Congo-Tanzania Craton and the Pan-African orogenic belts.

[1] Bingen *et al.* (2009) *Precambrian Research*, doi: 10.1016/j.precamres.2009.01.005

The stanol : Δ^5 -sterol ratio as a proxy for palaeoredox conditions in mires

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The reduction of Δ^5 -sterols to their corresponding stanols has long been argued to be an anaerobic microbial transformation which reflects redox conditions in lacustrine [1] and marine settings [2], but it has not been examined in peats. Here, we determined the stanol : Δ^5 -sterol ratio (total stanols : total sterols) in an ombrotrophic peat core from Bissendorfer Moor, Germany, and compared this with water table variations, inferred from testate amoebae, and other lipid-based environmental proxies. The stanol : Δ^5 -sterol ratios were generally constant and near zero in the shallow part of the oxic acrotelm and then, in the catotelm, increased down core, likely reflecting progressive diagenetic alteration via microbial hydrogenation of sterols under anoxic conditions. However, variations deeper in the core were also observed and these apparently record past changes in water table depths. A shift towards higher stanol : Δ^5 -sterol ratios between (i) 96-150 cm and (ii) 392-402 cm coincided with shallower water table depths. In one instance, the stanol : Δ^5 -sterol ratio dramatically increased to 0.9 in a horizon characterised by a shoaling of the water table to the surface, and a peak in archaeol, a biomarker for methanogens in peat [3]. The variations in the proxies in the deeper core indicate anoxic conditions during the earliest stages of diagenesis (e.g. a shallow water table) favour a more rapid and complete reduction of the Δ^5 double-bond. Continued transformations of sterols may be restricted by their incorporation into the macromolecular matter. Thus, the stanol : Δ^5 -sterol ratio could have considerable utility in identifying changes in redox conditions associated with water table variations inferred from other proxies and contribute to our understanding of related aerobic v. anaerobic carbon cycling.

[1] Gaskell & Eglinton (1975) *Nature* **254**, 209-211.

[2] Wakeham (1989) *Nature* **342**, 787-790. [3] Pancost *et al.* (2000) *Geology* **28**, 663-666.