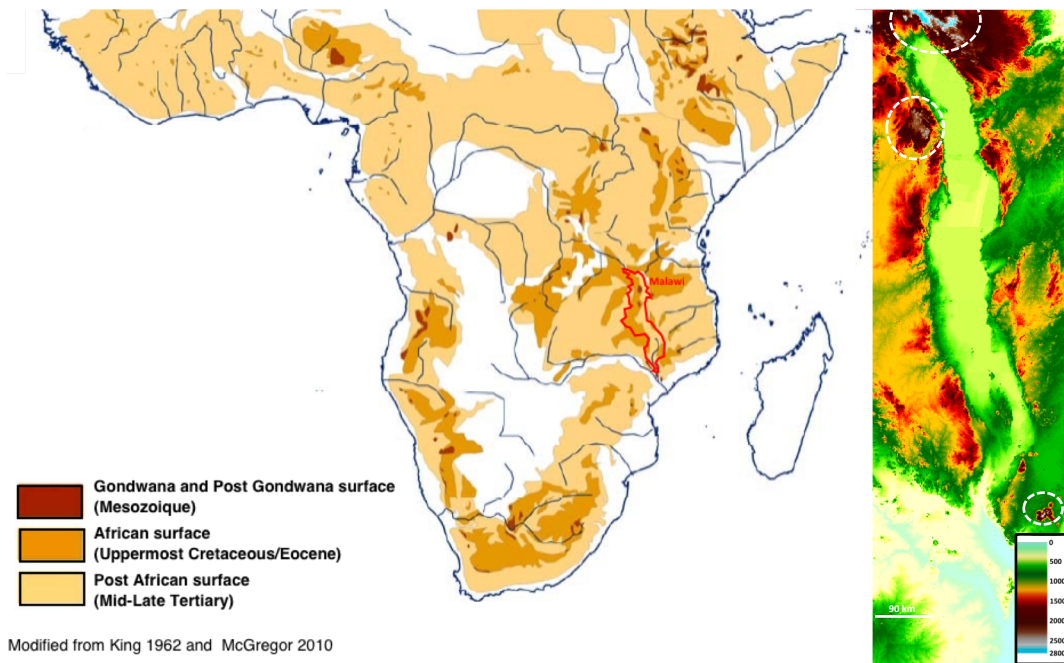


First proofs of preservation of Mesozoic paleosurface in Southeast Africa: Insights from the (U-Th)/He dating of iron oxides from Malawian duricrusts

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Paleoreliefs and Southeast Africa



- Several authors associated near flat surfaces of high elevation to relics of old paleoreliefs preserved from total erosion (King, 1962; Guillocheau et al., 2018; Vasconcelos et al., 2019).
- The preservation of such exposed reliefs during dozens of million years is however highly debated, particularly in tropical area (Summerfield, 1991).

- Malawi (southeast Africa) hosts numerous potential remnants of these surfaces with a large etched plateau (sup. 1000 m) and several surfaces with higher elevations (sup. 2000m).



Nyika plateau surface

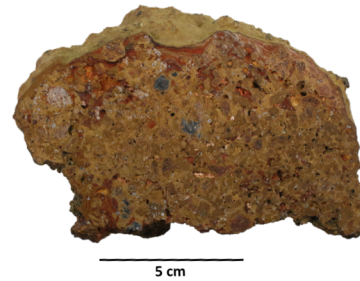


Mulanje plateau view

The duricrusts form Nyika

- Geology dominated by the Nyika granite, with scarce zones of psammite, gneiss or micaschistes.

Detrital accumulation zone
(NYI 2)



Pisolithic duricrust

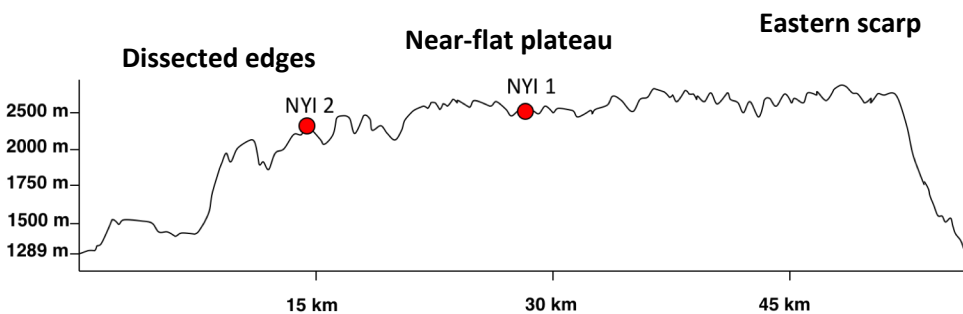
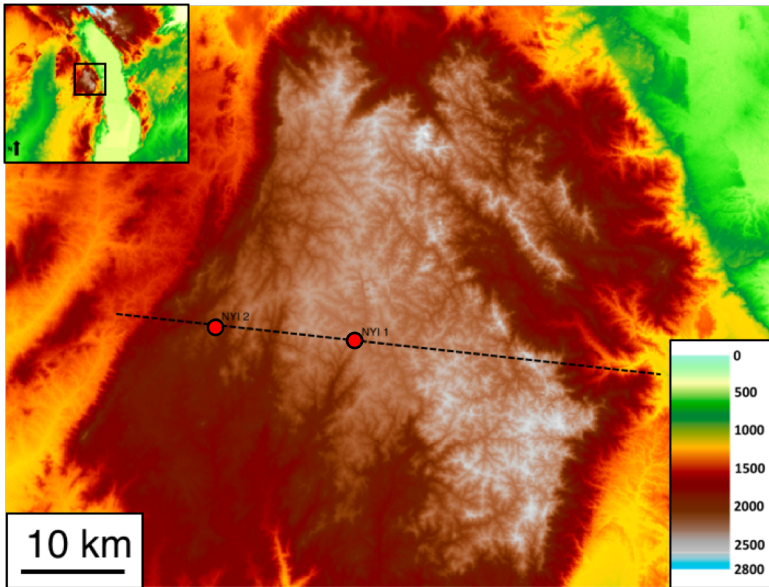


Similar to NYI 1

Duricrust level (NYI 1) lying on the
local bedrock (micaschiste)

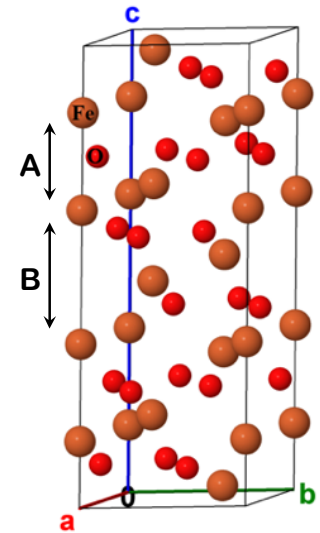


Quartz clast embedded by
iron oxides



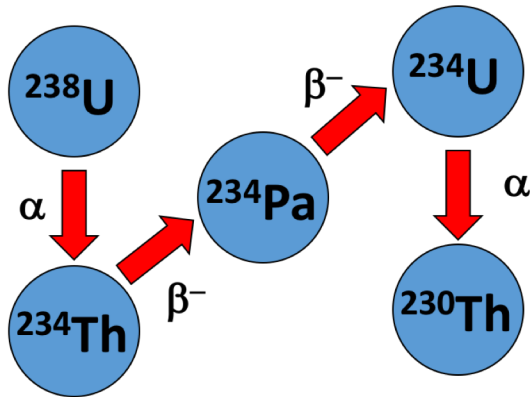
Can the dating of these complex duricrusts provide information about these paleorelief stability ?

The (U-Th)/He dating



Fe substituted by
U (1-10 ppm) and
Th (10-30 ppm)

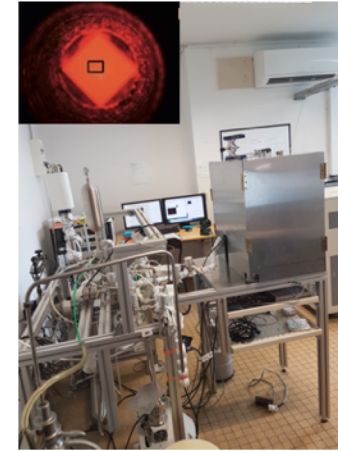
Hematite structure
(Balou et al., 2017)



Radioactive
decay

He trapped
within the iron
oxide structure

*Laser/QUAD-Mass
spectrometer*



$$\text{Apparent Age (Ma)} = \frac{[He]}{\text{Produced He}}$$

Incertitude: 10%

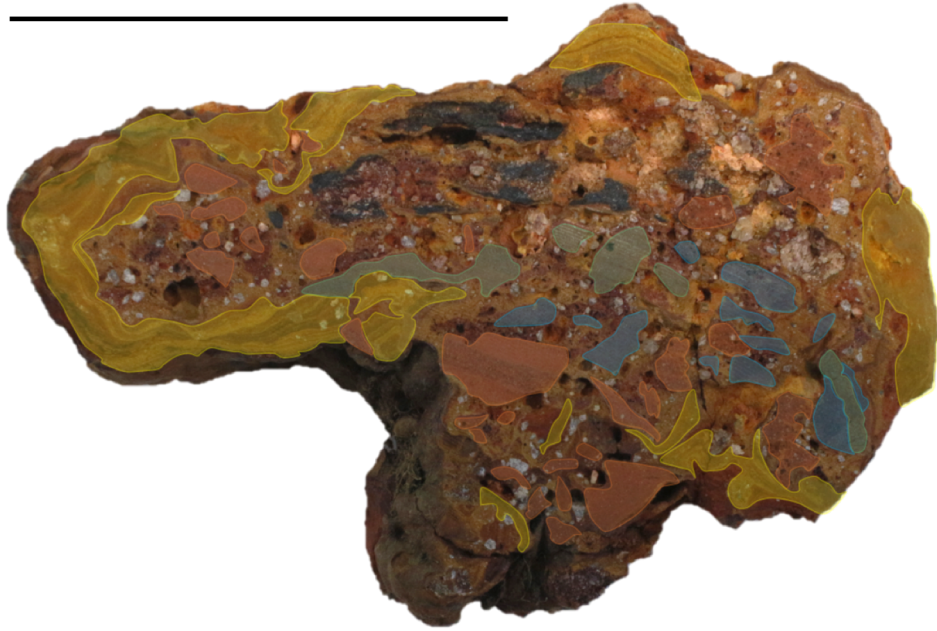
Function of [U], [Th] and [Sm]

ICPMS



A complex set of ages

NYI 1 5 cm

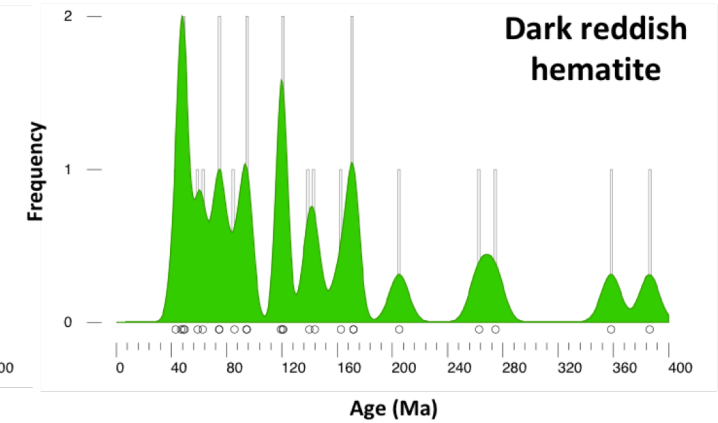
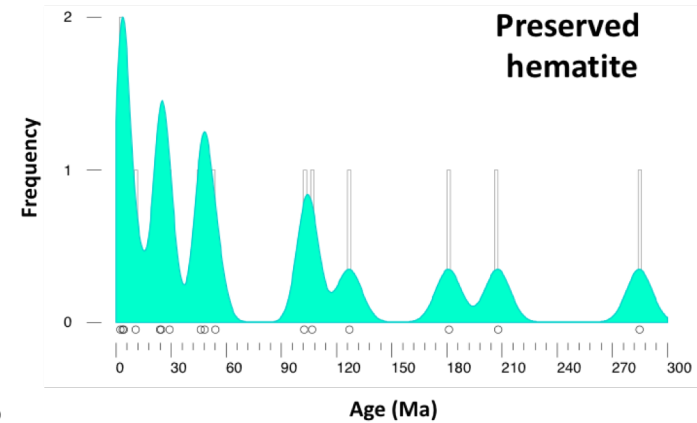
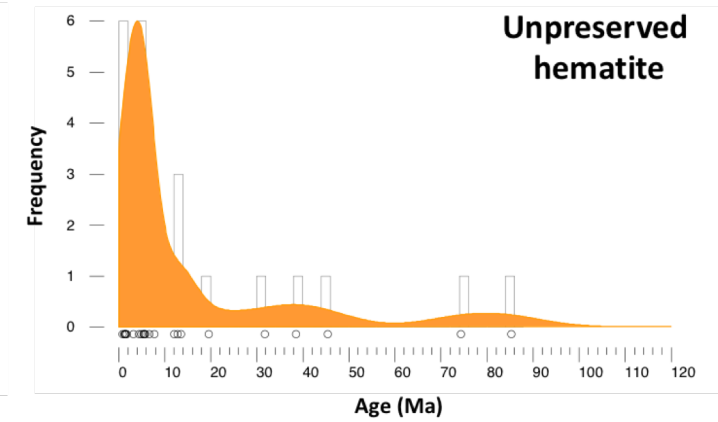
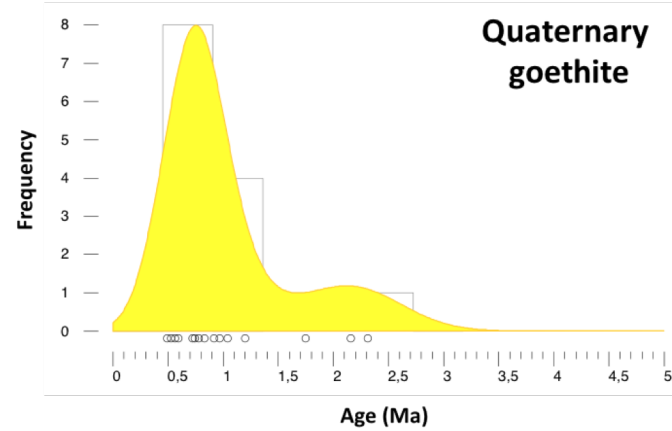


Recent goethite-rich datable area
(brownish matrix and duricrust bloc brownish growth bands)

Hematite-rich datable area potentially impacted by
iron oxides recrystallisation (reddish area, low porosity)

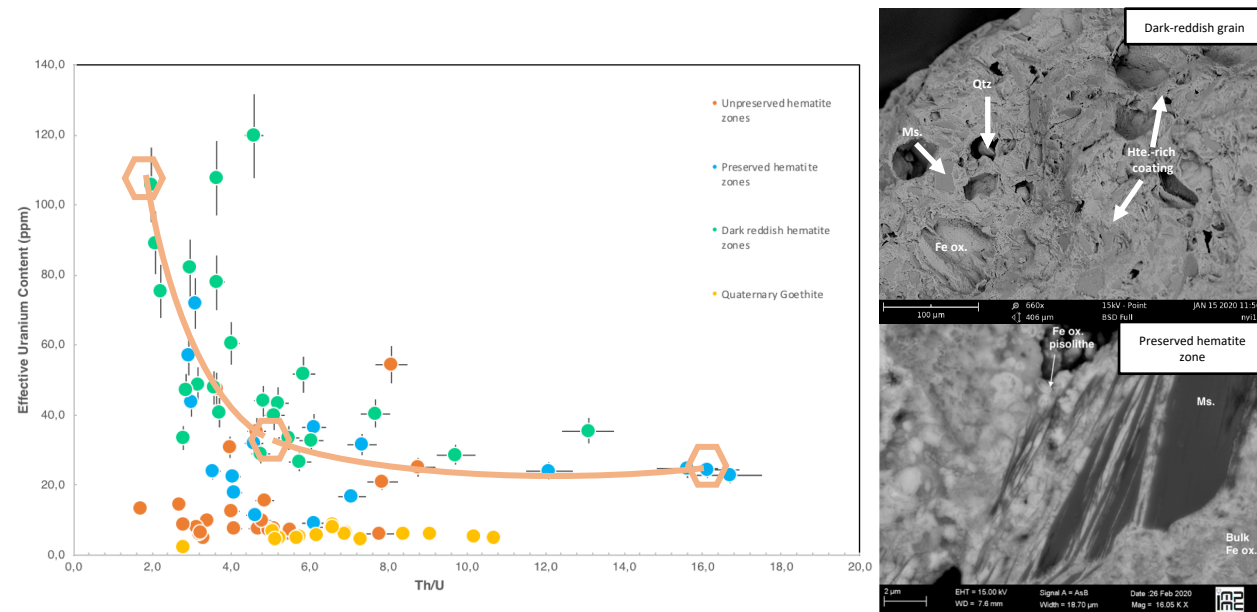
Unpreserved hematite-rich datable area
(High quartz density and or high porosity reddish area)

Preserved older hematite-rich datable area
(dark reddish area, low porosity)



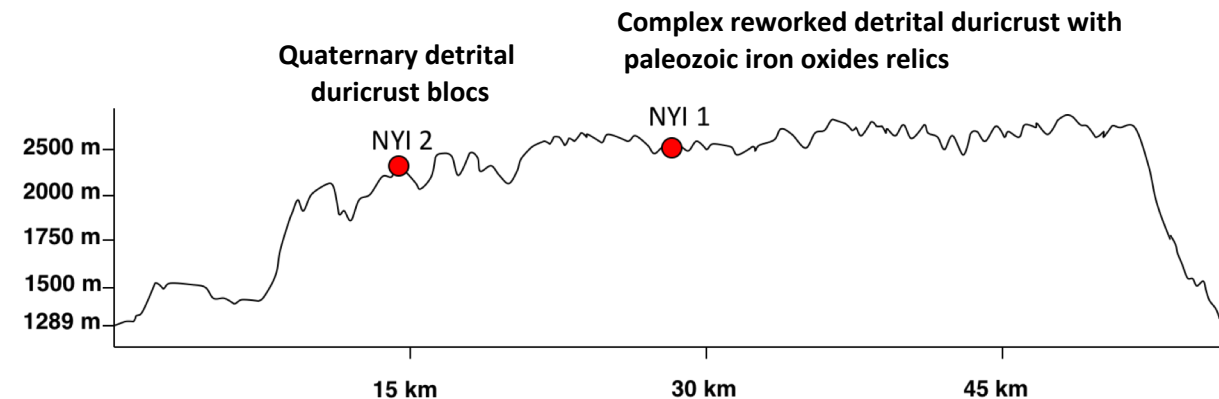
- Duricrust composed by a complex mixing of iron oxides generations.
- Ages ranging from the Paleozoic to the Quaternary.

The oldests paleoreliefs of Africa ?



- The presence of iron oxides of different origins is highlighted by the petrography, even in the preserved zones.
- Their chemical characteristics (eU, Th/U, REE) points to the fact that these areas are composed by a mixing between at least 3 generations of iron oxides formed due to dissolution/recrystallization processes.

- The duricrust level of the near-flat plateau hosts duricrust levels with preserved parts older than the Mesozoic.
- Nyika is a relic of a Paleozoic paleorelief that was preserved from total erosion since its formation.
- The plateau erosion is still active in the Quaternary, preferentially impacting its dissected edges.



A scenic landscape photograph featuring a large, leafy tree on the left side, its branches extending towards the center. The sky is a vibrant blue with wispy white clouds. A bright sun is visible on the right side, partially obscured by a large, white, cloud-like formation. The sun's glow creates a warm, golden light across the horizon. In the foreground, a person wearing a hat is visible, looking out over a valley filled with green trees and vegetation. The overall mood is peaceful and contemplative.

Merci !