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Geochemical evidence of a developing plate boundary and a SW rift extension of the East African Rift

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The Central African Plateau of Zambia and the Democratic Republic of Congo has been suggested as a broad zone of NW/SE extension based on low gravity, high heat flow and sparse and irregular seismicity. Recent multi-disciplinary tectonic analysis argued that there is a young, through going, active rift system that breaks the Nubian plate, extending from the East African Rift System (EARS), and forming a southwestern rift extension (Daly et al., 2020). The isotopic composition of helium from hot springs in the centre of this rift system adds new and compelling data to this hypothesis. Gas samples from surface vents along the faulted margin of the Kafue Rift Basin are N_2-dominated, with up to 2.3% ^{4}He and ^{3}He/^{4}He ratios of 0.15 R/R_A. The geochemical profile indicates presence of mantle fluids and enhanced release of crustal N_2 and ^{4}He, in line with observations of early rift stages in Rukwa basin, Tanzania [2]. $CO_2/^3$He ratios in the Kafue Rift samples are lower than MORB values by up to a factor of 200, indicating mantle CO_2 loss from the system. Mantle CO_2 is sequestered within the crust during hydrothermal fluids ascent, in contrast to CO_2-dominated fluids proximal to mature EARS spreading centres. The Kafue Rift basin records geochemical signatures of the very early stage processes of lithospheric heating and weakening associated with the propagation of continental rifting.

[1] Daly et et al. (2020), *Geochemistry, Geophysics, Geosystems,* https://doi.org/10.1029/2019GC008746

[2] Danabalan et al. (2022), *Petroleum Geoscience,* https://doi.org/10.1144/petgeo2021-029