

EGU22-402, updated on 12 Aug 2022

<https://doi.org/10.5194/egusphere-egu22-402>

EGU General Assembly 2022

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Sedimentary facies analysis and palaeoenvironmental reconstruction of the Kalkkop palaeolake, Eastern Cape, South Africa

Loyce Elesia Mpangala^{1,2}, Kelly Kirsten^{1,2}, Torsten Haberzettl³, May Murungi^{1,2}, Silindokuhle Mavuso⁴, and Robyn Pickering^{1,2}

¹Department of Geological Sciences, University of Cape Town, Rondebosch 7701, South Africa

²Human Evolution Research Institute (HERI), University of Cape Town, Rondebosch 7701, South Africa

³Physical Geography, Institute for Geography and Geology, University of Greifswald, Germany

⁴Department of Geology, Rhodes University, Grahamstown, South Africa

Drilling undertaken in the 1990s at the Kalkkop impact crater, situated in the semi-arid, Nama-Karoo biome of South Africa, revealed lacustrine sedimentary deposits. This is an invaluable archive for a region synonymous with a paucity of terrestrial-based, continuous, and high-resolution records. In 2019, a new 90 m core was retrieved from the palaeolake and subjected to a detailed sedimentological log. Sedimentary facies analysis was applied to investigate the changes in past depositional environments, themselves reflecting local changes in hydroclimate. Sedimentological evidence indicated deposition in an overall low-energy environment, intermittently interrupted by brief high energy events. Employment of grey scale image analysis on the top 20 m revealed dry conditions persisted for longer and became more frequent towards the present surface. This was inferred by the darker layers referring to more minerogenic input which is associated with wetter conditions and lighter layers suggesting more pure carbonates and linked to dry conditions. This prolonged aridity impacted the longevity and alkalinity of the Kalkkop lake, resulting in carbonate precipitation, silica dissolution, and complete desiccation. Limited biological remains (diatoms, n=5) support this hypothesis. The body of evidence, namely carbonate precipitation and long persistence of arid spells, as well as the extremely low abundance of silica-based biological remains (pollen, diatoms, phytoliths), supports a transition toward a semi-arid environment by ~250 ka. This remarkable new record of past environmental and climatic changes recorded by the Kalkkop palaeolake core is the subject of ongoing research at the University of Cape Town, South Africa.