Analysis of Sediments Cores from Lake Basin of Olduvai Gorge using X-ray Diffraction

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1. Introduction

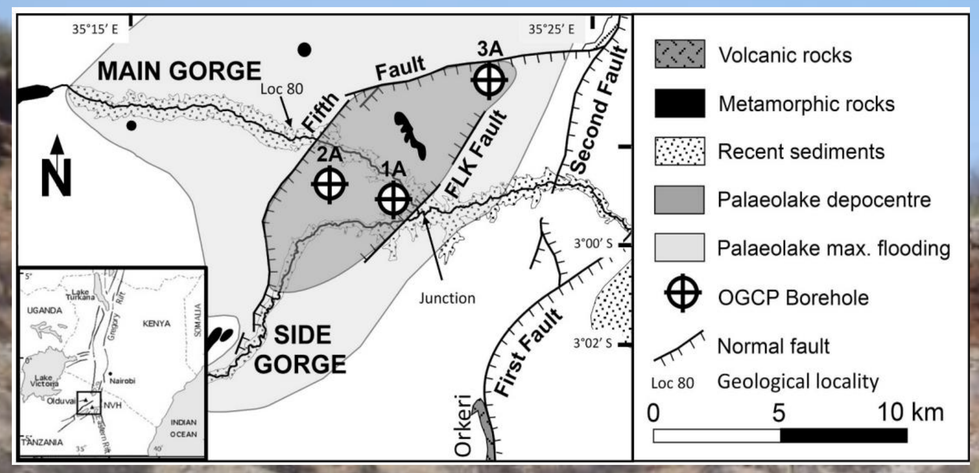
- In July 2014 OGCP recovered four cores from three locations at Olduvai looking to link the paleoclimatic records of the lake to events in hominin evolution as previously shown in earlier studies (McHenry et al., 2020)
  - These cores provide a complete Pleistocene record of the paleolake.

2. Background

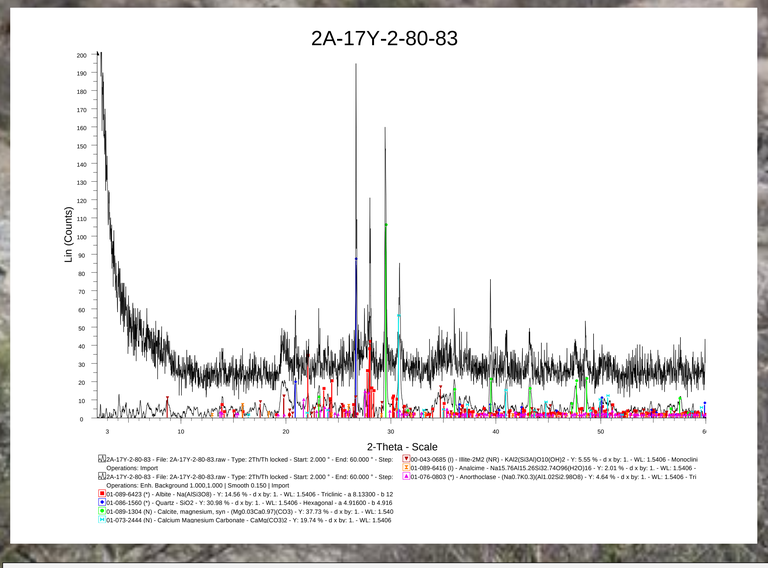
- Olduvai Gorge in Tanzania, East Africa is important anthropologically and has provided information on key phases on early human evolution and vertebrate fauna during the Pleistocene epoch from 2 Ma and 11,700 Ka.
- Strata of the lake basin in Olduvai Gorge are subdivided into Beds named I-IV (This study focuses on Bed II)

3. Methods

The minerology of a paleolake sediment core (2A) sampled between 31 and 44 meters below the surface was powdered using mortar and pestle then analyzed using X-ray Diffraction (XRD) and interpreted to determine changes in sediment sources and lake water chemistry.



Map of the locations where sediment cores were collected.



XRD analysis of sample 2A-17Y-2-80-83 that contains carbonates & analcime

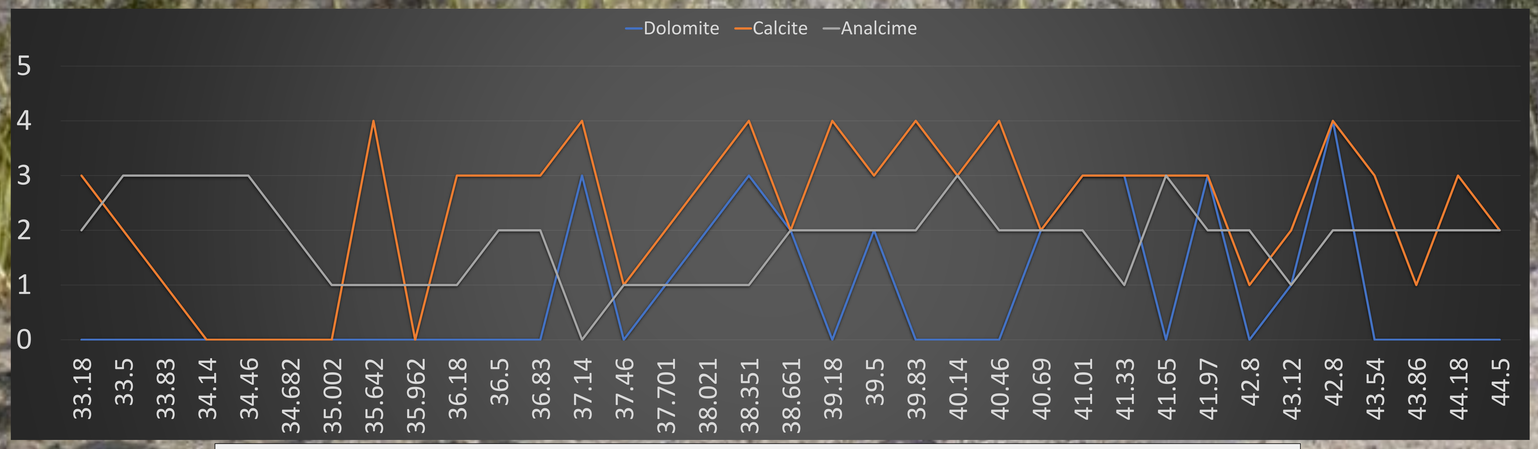


Fig. 1: Chart depicting the relationships between the fluctuating presence of dolomite and its relationship with analcime and carbonate materials. X = Depth (Meters below surface (MBS)) Y= Relative abundance (0-4).

Works cited:

- McHenry, Lindsay et al., *Lake conditions and detrital sources of Paleolake Olduvai, Tanzania, reconstructed using X-ray Diffraction analysis of cores,* 2020
- McHenry, Lindsay et al., *Tuff fingerprinting and correlations between OGCP cores and outcrops for Pre-Bed I and Beds I/II at Olduvai Gorge, Tanzania,* 2020

4. Conclusions

- Changes in water composition are indicated by fluctuating amounts of carbonate and zeolite minerals.
- All samples but one contain the zeolite mineral analcime
  - Analcime forms only at high pH, indicating saline-alkaline conditions.
- From 33.18 to 34.46 meters of core 2A analcime is abundant but for the next 3m below it is less detectable.
- Finer claystone intervals have a higher abundance of analcime, while zeolite is less abundant in clay-sand layers.
- In core 2A at 37.14 m and ending at 39.5 m in depth dolomite is abundant where analcime and other zeolites are less detectable.
  - This indicates a possible influx of Mg and more neutral pH.
- These findings are consistent with an arid environment with a saline-alkaline lake that is not suitable for human or animal consumption.

Sediment core 2A (a 15 cm interval)