

## Introduction

Tectonic activity has numerous affects on the earth as a whole and these affects can produce long sequences of changes that drastically change species that live on this planet. Specifically, human evolution was drastically propelled because of tectonic activity in northern Africa started by the East African Rift System. This rift is a tectonically active, divergent boundary that started around 40 million years ago.

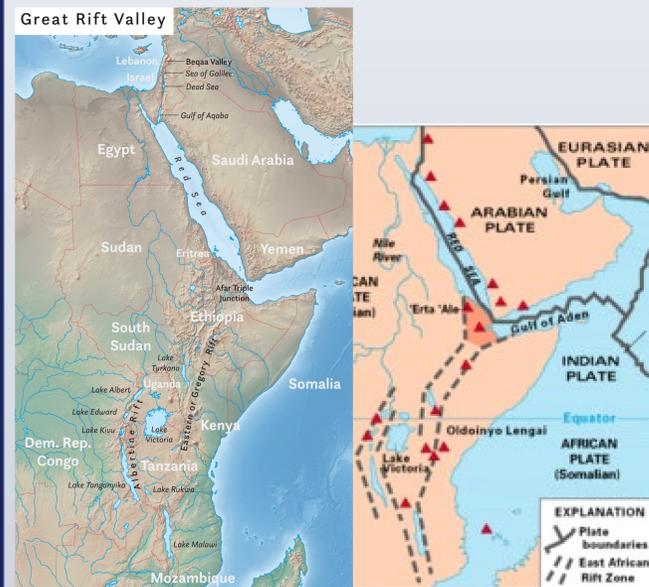


Figure 1: Map of the northeast portion of Africa where the EARS is located. On the left, a topographic map of the region, showing the differences in elevation. On the right, a diagrammatic map of the region depicting the actual EARS.

## Goals

Consolidate information surrounding early African hominid evolution due to the progression of the East African Rift System.

Show the progression of the system and its affects on topography, climate, flora, and eventually fauna.

## Methods

Multiple scientific papers were read through and their information was compiled. How these different theories and processes relate to each other was interpreted.

## Results

- The propagation of the East African Rift System pushed the surrounding region to become very diverse with mountains, plains, swamps, and other environments present in the region.
  - As a result, plants that survived in the homogenous forest region migrated towards the savannah and slowly became dominated by C4 plants.
  - These plants survived due the ephemeral lakes present across the region whose basins were formed as a result of the rifting.
    - The plants were able to survive on less water since they retained it much better, and these lakes were able to satisfy local populations of plants and animals during the dry seasons.
  - Early hominids followed these plants from the jungles and were able to be sustained in the new environments due to the lakes and the plants.
    - Early hominid brain size grew 80% in the times when there were the greatest number of ephemeral lakes present on Africa.
- Speciation of early hominids grew because of their ability to adapt both to become specialized individuals or as generalists.
  - Both forms of species were present in early hominids in this region, and both were able to survive and diversify during the time where there were these ephemeral lakes.
    - Species such as *Paranthropus sp.* were able to survive being specialized hominids due to their acclimation to swamp-like conditions.

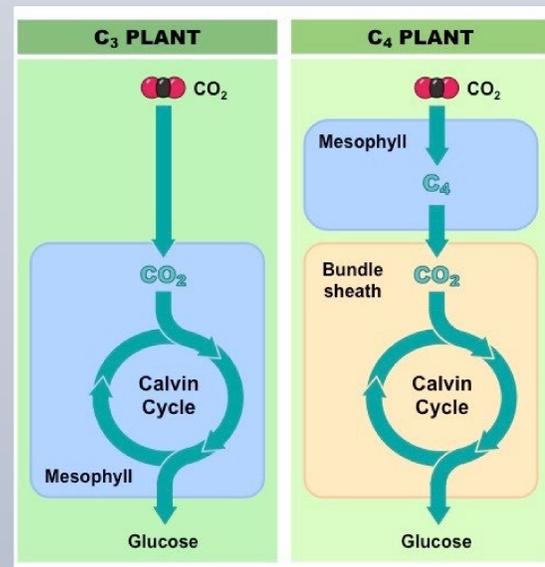


Figure 2: Differences in the photosynthetic process of C3 and C4 plants, highlighting the Bundle sheath in C4 plants.

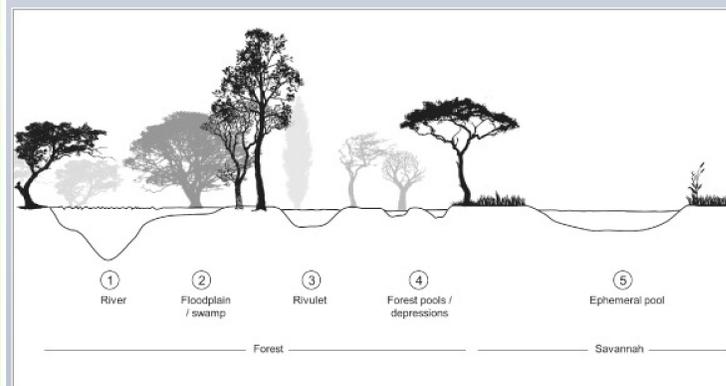


Figure 3: Example of modern water bodies present in Africa. Ancient ephemeral lakes, much like 5 in the image, would have likely been significantly deeper.

## Conclusions

- The start of the East African Rift System moved northern Africa from a homogeneous, environmentally forested region into a diverse, heterogeneous region with numerous different sub environments allowing for the eventual diversification of plant life and early hominids.
- The new diverse terrain allowed C4 plants to become more abundant and allowed for ephemeral lakes to hold water during the dry seasons.
  - These plants held more water in their stems and retained liquid better in arid regions.
- The migration of C4 plants, their ability to retain more water, their ability to grow in these arid regions allowed early hominids to have consistent food in the region.
- Finally, early hominids were able to migrate into these new environments due to the surplus of water and food during dry periods, caused by these ephemeral lakes.

## References

- Shultz S. and Maslin M., 2013, Early Human Speciation, Brain Expansion and Dispersal Influenced by African Climate Pulses, <https://doi.org/10.1371/journal.pone.0076750> (February 12, 2021)
- Gani MR. and Gani N., Tectonic hypotheses of human evolution. *Geotimes*. 2008;53(1):34-39. [http://search.ebscohost.com/login.aspx?direct=true&AuthType=cookie\\_ip\\_cid&custid=ssc&db=geh&AN=2008-040228&site=ehost-live&scope=site](http://search.ebscohost.com/login.aspx?direct=true&AuthType=cookie_ip_cid&custid=ssc&db=geh&AN=2008-040228&site=ehost-live&scope=site) (February 12, 2021)
- deMenocal P.B., 2011, Climate and Human Evolution, *Science* 04 Feb 2011: Vol. 331, Issue 6017, pp. 540-542 DOI: 10.1126/science.1190683
- Scott M, Climate and human evolution, *Climate.gov*, <https://www.climate.gov/news-features/climate-and/climate-and-human-evolution> (March 3, 2021)
- Rafferty J, East African Rift System, <https://www.britannica.com/place/East-African-Rift-System> (March 3, 2021)

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