

Tectonics and Climate of the Tibetan Plateau

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Introduction

- The Himalayas are a young mountain range, which began forming around 70 million years ago and shortening began around 50-40 million years ago
- The Tibetan plateau is separated by various terrane and sutures
- These are the Lhasa Terrane, the Qiangtang Terrane, Kunlun-Qaidam Terrane and the Eastern Kunlun-Qaidam terrane, along with the Bangong Nujiang suture, the jinsha suture and the Anyimaqen-Kunlun Muztagh suture.
- The Lhasa Terrane lies between the Indus-Yalu and the Bangong-Nujiang sutures. Qiangtang lies between the Jinsha suture to the north and the Bangong-Nujiang suture to the south. The Songpan-Ganzi-Hoh Xil terrane is a triangular tectonic element between the East Kunlun-Qaidam terrane in the north and the Qiangtang terrane in the south. The Eastern Kunlun-Qaidam Terrane is bounded by the Anyimaqen-Kunlun Muztagh suture to the south and the southern Qilian suture to the north.

Objectives

- To find the relationship between tectonics and climate change
- Finding the reasoning behind tectonic events that influenced the changes in climate
- Connecting timelines between tectonic events and climate changes within our area of study
- To prove that the uplift of the tibetan plateau played a major role in the climate change of the region, via the himalayan growth; or whether or not there other factors involved

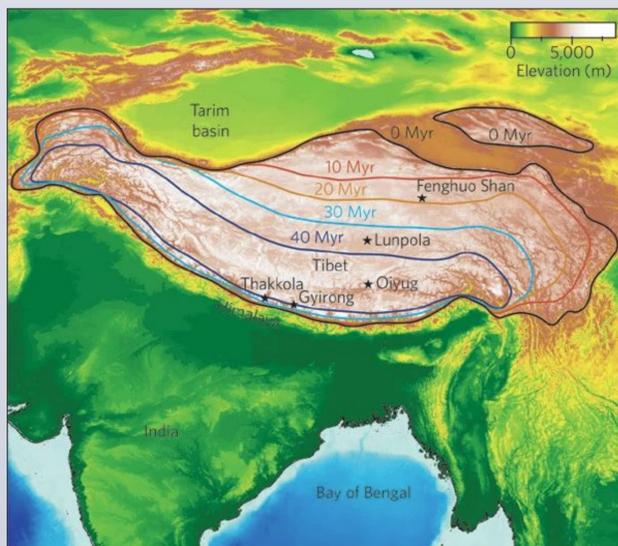


Figure 1. Progression of the size of the tibetan plateau over time.

Methods

- Researching the cause and effect behind the change in elevation and the climate of the tibetan plateau.
- Using stable isotope ratios the concentrations of each can be connected to a difference in elevation.
- Multiple sources agreeing that the uplift of the plateau changes the climate confirmed the idea.
- Utilizing images from the very same sources in order to provide a proper guide on where and when certain events took place

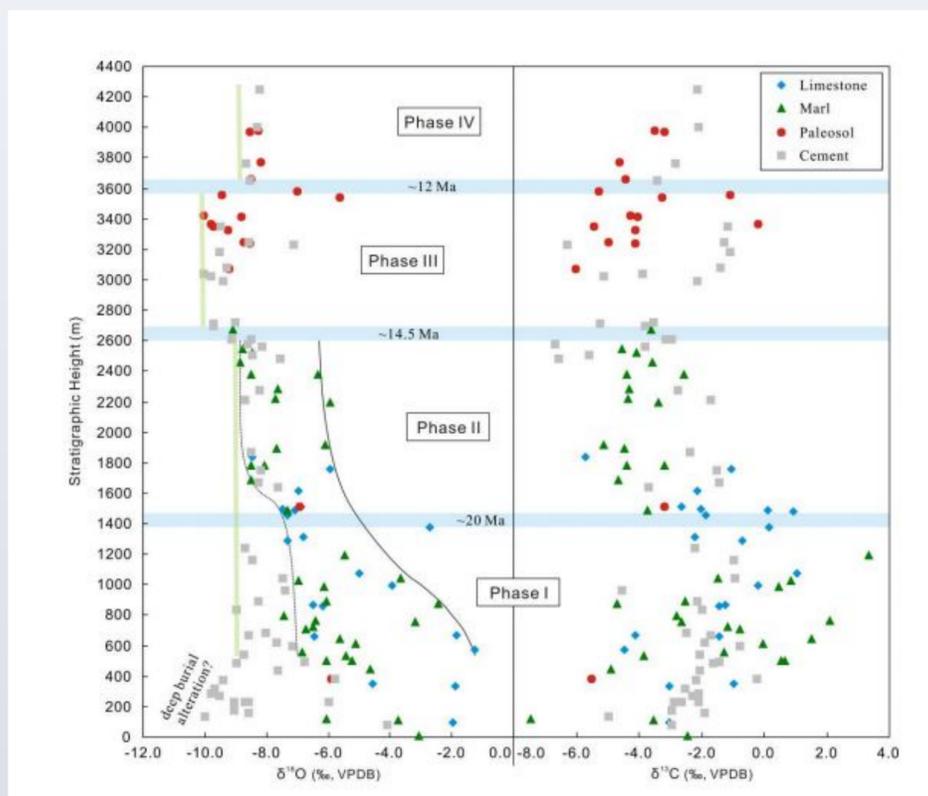


Figure 2. Stable isotope variations O18 and C13 of carbonate compared with elevation. Trends can be seen in the ratios and the elevation of the rock types. Phases were recognized.

Results

- A change in oxygen isotope compositing in lake sediments occurred at the same time that uplift began.
- The climate is much more arid not because of the change in air currents
- Ages of evolution in the size of the tibetan plateau
- Air currents changed after uplift
- The monsoon in southern asian is caused by cool air from the mountains coming across the land area to the ocean.
- Evolution of the plateau was rapid geologically speaking.
- stable isotope-based paleoaltimetry is most reliable in the southern margins of the Plateau, and increasingly unreliable toward the northern Plateau.
- Meteoric waters in the interior of the plateau are heavily influenced by the combined effects of mixing of different moisture sources, contribution of recycled moisture from local surface water evaporation, and sub-cloud evaporation
- As elevation increases the percent O18 increases.

Conclusions

- The change in climate was not recent; happened almost 40 million years ago.
- change in oxygen isotopic composition in lake sediments correlates directly to uplift of the region due to collision.
- the change in air currents due to the uplift created new cold and warm air changes during seasons to create the south asian monsoon
- With higher areas of elevation, Oxygen isotopes show a much higher negative value, giving proper acknowledgement of changing weather patterns allowing for assumptions of uplift of the plateau causing the much more arid climate we see today

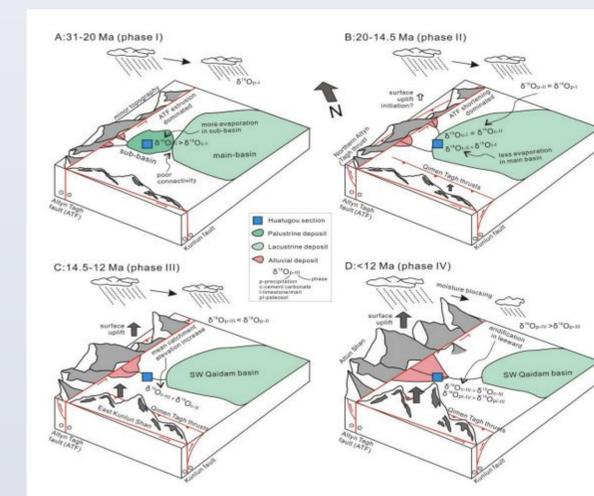


Figure 3. Topographic growth of northern plateau and the change in oxygen isotope concentration.

Sources and Acknowledgements

Su, T., et al., 2019, Uplift, climate and biotic changes at the Eocene-Oligocene transition in south-eastern Tibet, National Science Review;pg 1-8, 8p

Li, et al. 2016, Tectonic and climatic evolution of the central-northern Tibetan Plateau: evidence from sedimentation and stable isotopes, University of Rochester thesis.

Mulch, A., C. Page Chamberlain, 2006, The Rise and Growth of Tibet, Nature: London Vol. 439

Rowley, D., Currie, B., 2006, Palaeo-altimetry of the late Eocene to Miocene Lunpola basin, central Tibet, Nature, Vol 439

Yin, A, 2000, GEOLOGIC EVOLUTION OF THE HIMALAYAN TIBETAN OROGEN, Annu. Rev. Earth Planet. Sci. 2000. 28:211-80