

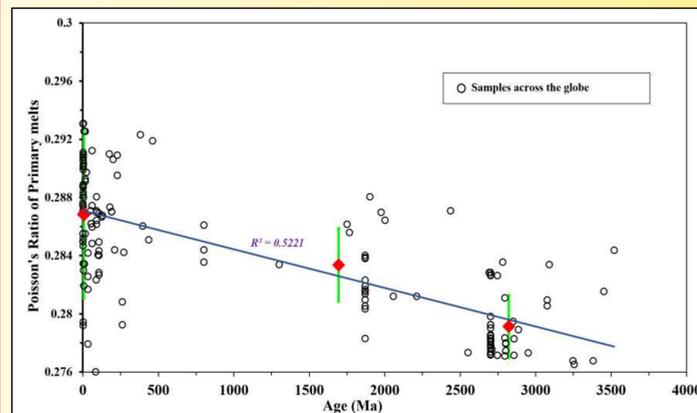
Early Earth Plate Tectonics; A Universal or Craton Specific Feature? Implication from Poisson's Ratio Calculation of the Primary Melts

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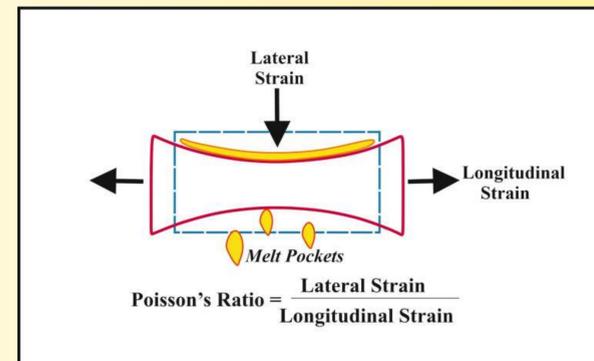
Materials and Methodology

1. Primary melt compositions and mantle potential temperatures (T_p) for mafic dikes, basalts across the globe ranging from Archean to present were calculated using PRIMELT3 of Herzberg and Asimow, (2015) considering a constant redox condition at the source ($Fe_{+2}/Fe_{Total}=0.9$). The final results of these calculations were checked geochemically and statistically to meet the program requirements.
2. Volume normative mineral% were calculated for these calculated primary melts.
3. Physical properties of the primary melts were calculated using the volume normative mineral% utilizing the program by Abers&Hacker, (2016).
4. A comparison between Poisson's ratio of the primary melts with their ages is shown in the following figure.

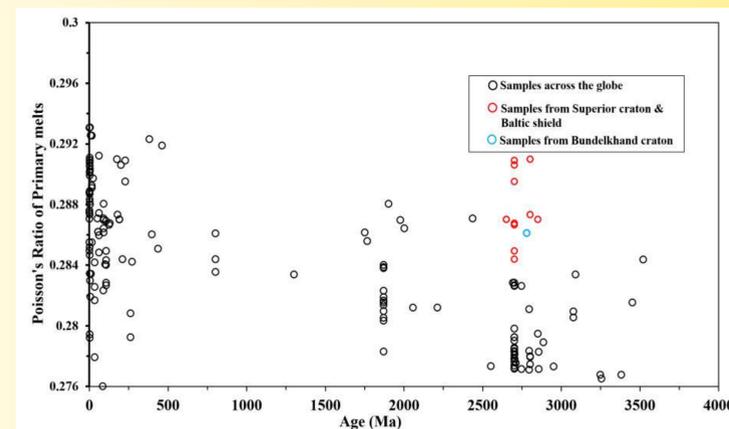


Rigid plate motion during Archean

1. Following is a figure illustrating Poisson's ratio

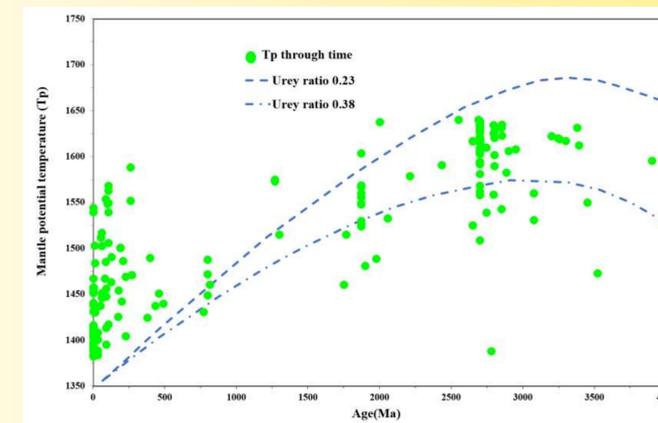


2. The Archean was characterized by high T_p values (>1500 degrees celsius) and low Poisson's ratio value. The minimum drop in T_p value was calculated to be 200 degrees celsius since the last 2.5 Ga.
3. However, Archean samples from Superior craton and Baltic shield show high Poisson's ratio and high T_p values (1530-1638 degrees celsius).



High T_p and Mantle Overturn?

1. Sample from Bundelkhand Craton however shows low T_p and higher Poisson's ratio value during Archean.
2. Bédard, (2020, 2013); Stern, (2008) suggested intermittent mantle overturn periods during the Archean and showed the birth of subduction dominated plate motion at least during paleoproterozoic.



3. The multiple peaks in T_p (data from this study and from Ganne and Feng, (2016))values around the globe, however, indicate a similar scenario for many of the cratons

Summary

- Archean was characterized by high T_p and low Poisson's ratio value for primary melts.
- Unlikely some cratons around the globe show a present-day-like Poisson's ratio value during Archean.
- Nevertheless, their high T_p is unlikely to represent a rigid present-day type tectonic activity.
- However, low T_p producing samples with a high Poisson's ratio during Archean seems to be a possible crustal composition that could have manifested subduction-related tectonic activity.

References

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