



Erosion of cratons by plumes: A seismological perspective

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How cratons, the ancient cores of continents, evolved since their formation over 2.5 Ga ago is debated. Seismic tomography can map the thick lithosphere of cratons and, with its resolution now reaching regional scales in most continents, it reveals a more complex, fragmented cratonic lithosphere than seen previously. Joint analysis of the information on the present state of the lithosphere from tomography and its past state from diamondiferous kimberlites reveals surprisingly common lithospheric erosion over the last few hundred million years. Large igneous provinces or hotspot tracks, attributed to deep-mantle plumes, tend to occur near the lithosphere-loss locations. This suggests that the cratonic roots foundered once modified by mantle plumes. Our results imply that the total volume of cratonic lithosphere has decreased substantially since its Archean formation, with the fate of each craton depending on its plate-tectonic movements relative to mantle plumes.

References

- Steinberger, B., Bredow, E., Lebedev, S., Schaeffer, A. and Torsvik, T.H., 2019. Widespread volcanism in the Greenland–North Atlantic region explained by the Iceland plume. *Nature Geoscience*, 12(1), p.61.
- Lebedev, S., Schaeffer, A.J., Fulla, J. and Pease, V., 2018. Seismic tomography of the Arctic region: inferences for the thermal structure and evolution of the lithosphere. Geological Society, London, Special Publications, 460(1), pp.419-440.
- Ravenna, M., Lebedev, S., Fulla, J. and Adam, J.M.C., 2018. Shear-Wave Velocity Structure of Southern Africa's Lithosphere: Variations in the Thickness and Composition of Cratons and Their Effect on Topography. *Geochemistry, Geophysics, Geosystems*.