

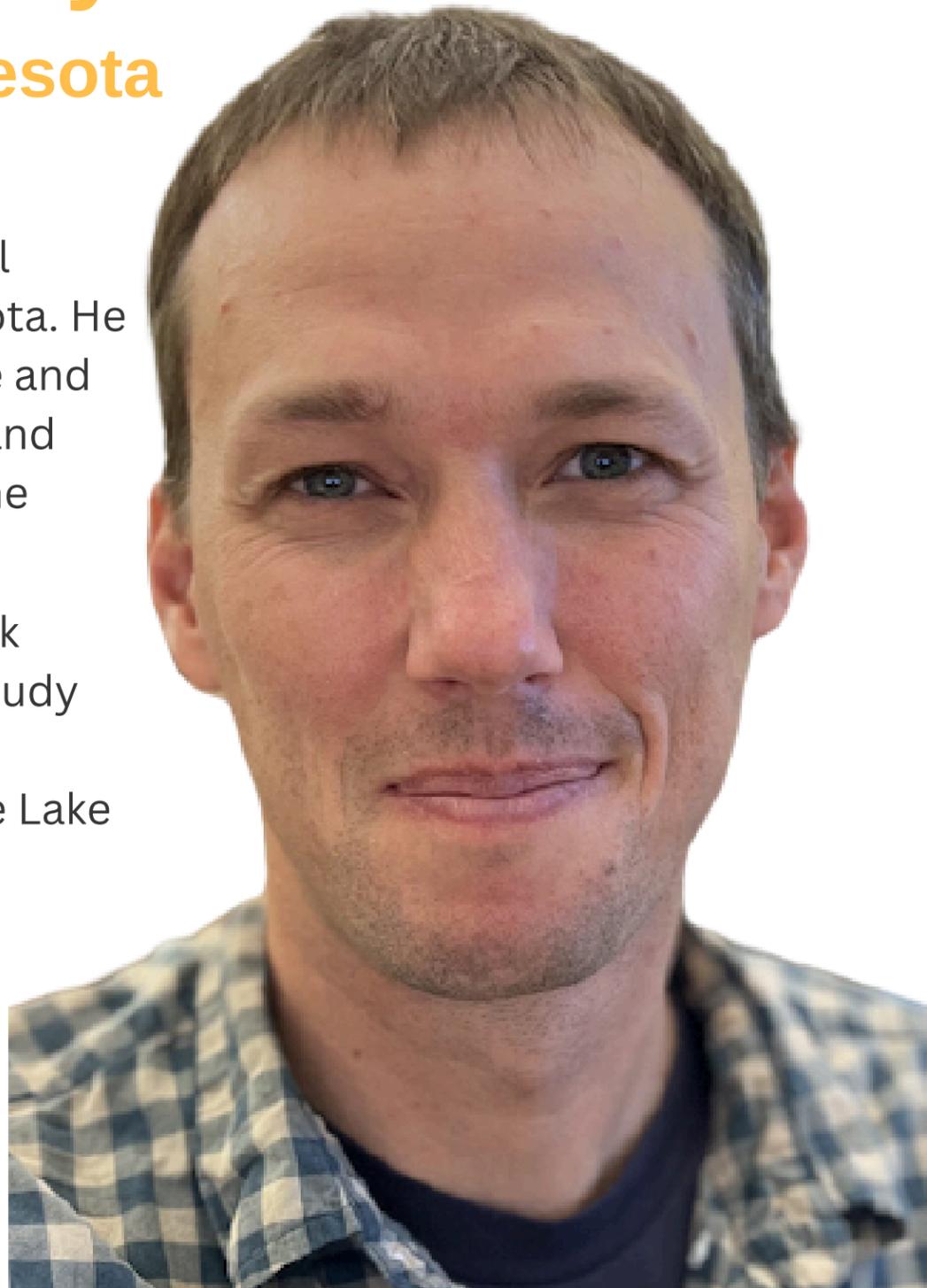
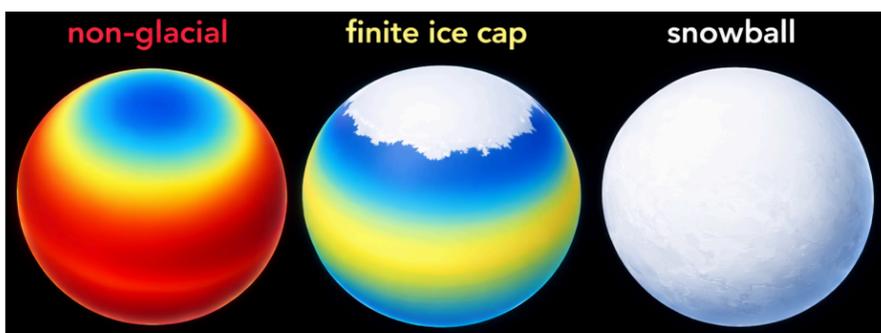
Tectonic Forcing of Earth's Climate Evolution over the Past Billion Years

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His research uses paleomagnetic, rock magnetic, and geochemical data to study Earth's long-term evolution, with a particular focus on the geology of the Lake Superior region.



MARCH 4 | 3:00 PM | RNS 210

Earth's climate has alternated between ice-free warmth, glacial states with polar ice caps, and extreme "Snowball Earth" events over the past billion years. What drives these transitions? On million-year timescales, climate is regulated by the balance between volcanic CO₂ emissions and CO₂ consumption through chemical weathering of rocks – a balance maintained by stabilizing feedbacks but one that can be shifted by tectonic processes. New temperature records reveal that major cooling events unfold gradually over tens of millions of years, pointing to slowly evolving tectonic boundary conditions rather than sudden catastrophic triggers. A key insight comes from the modern Southeast Asian Islands, where mountains of highly weatherable rock in the tropical rain belt act as a powerful CO₂ sink. Reconstructing the paleogeography of analogous arc-continent collisions over the past billion years reveals a striking correlation with glacial intervals. This relationship suggests that plate tectonics, by building and destroying tropical mountain belts, has played a central role in driving Earth's long-term climate evolution.