

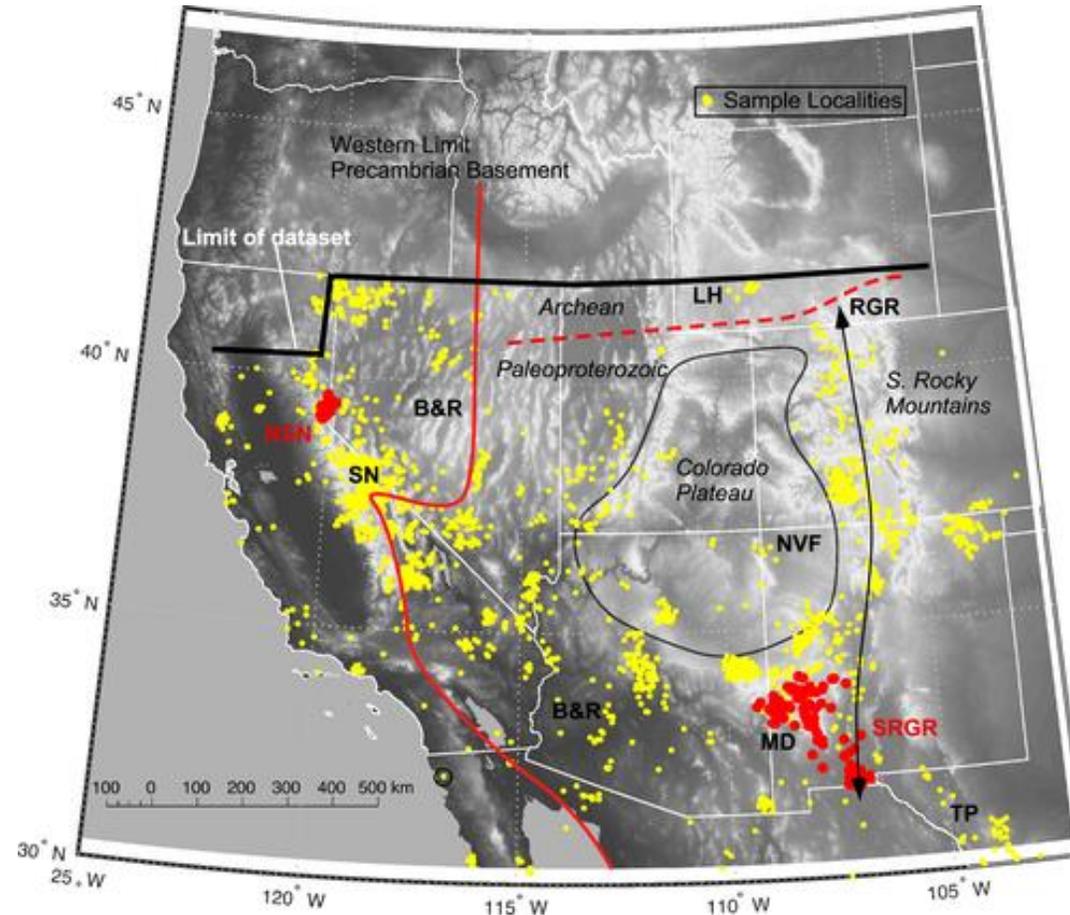
# Big Data in Geochemistry

Using Ta/Th to investigate the evolution  
of the deep continental lithosphere

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# Rock Sample Distribution

~2000 volcanic rock samples across SW North America with geochemical data retrieved from NAVDAT (The Western North American Volcanic and Intrusive Rock Database) and literature sources

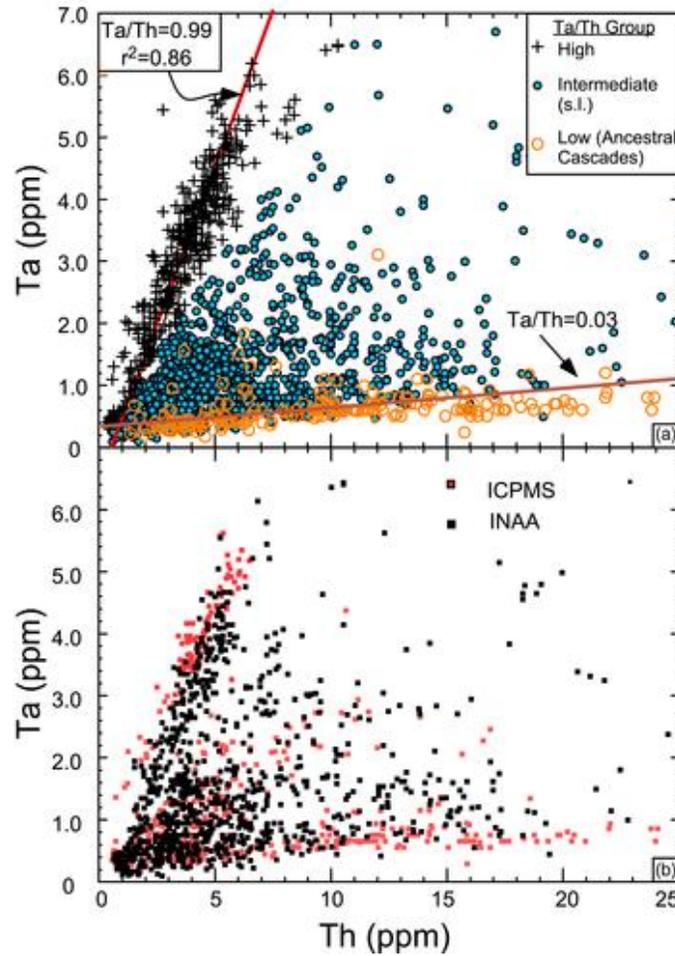


Map of SWNA with locations of volcanic rock samples included in data set. Samples from northern Sierra Nevada (NSN) and southern Rio Grande rift (SRGR) shown in red. LH = Leucite Hills, SN = Sierra Nevada, NVF = Navajo Volcanic Field, TP = Trans-Pecos, RGR = Rio Grande rift (arrowed line), B&R = Basin and Range province, MD = Mogollon-Datil Volcanic Field

Volcanism occurred throughout southwestern North America (SWNA) over the past 40 million years, but exactly what melted to produce the resulting volcanic rocks is unclear. By investigating the relative amounts of the elements tantalum (Ta) and thorium (Th) in these volcanic rocks, we can assess the potential presence of metasomatized continental lithospheric mantle (CLM).

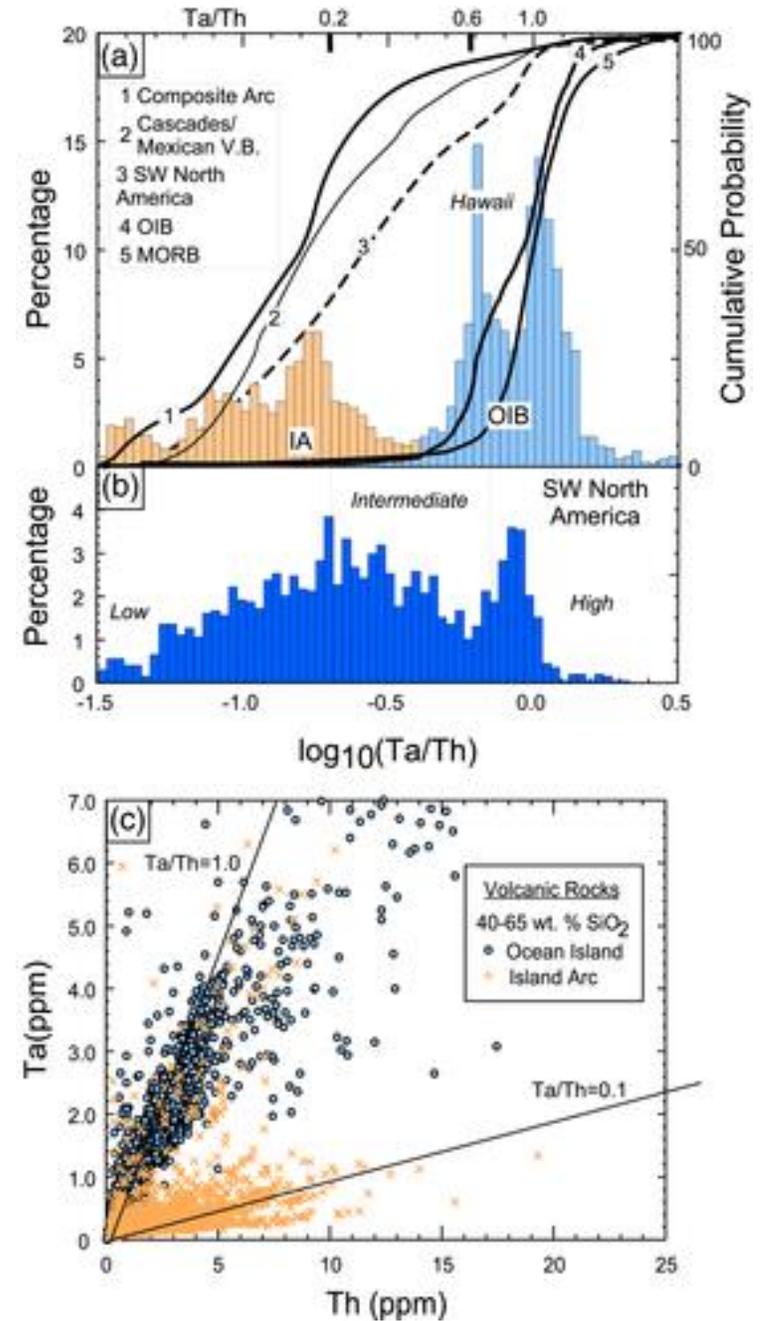
# Ta/Th value patterns:

Rutile (a carrier for Ta) and apatite (a carrier for Th) are minerals that can precipitate from water-rich fluids that cool when infiltrating and altering the continental mantle but readily melt upon subsequent heating.



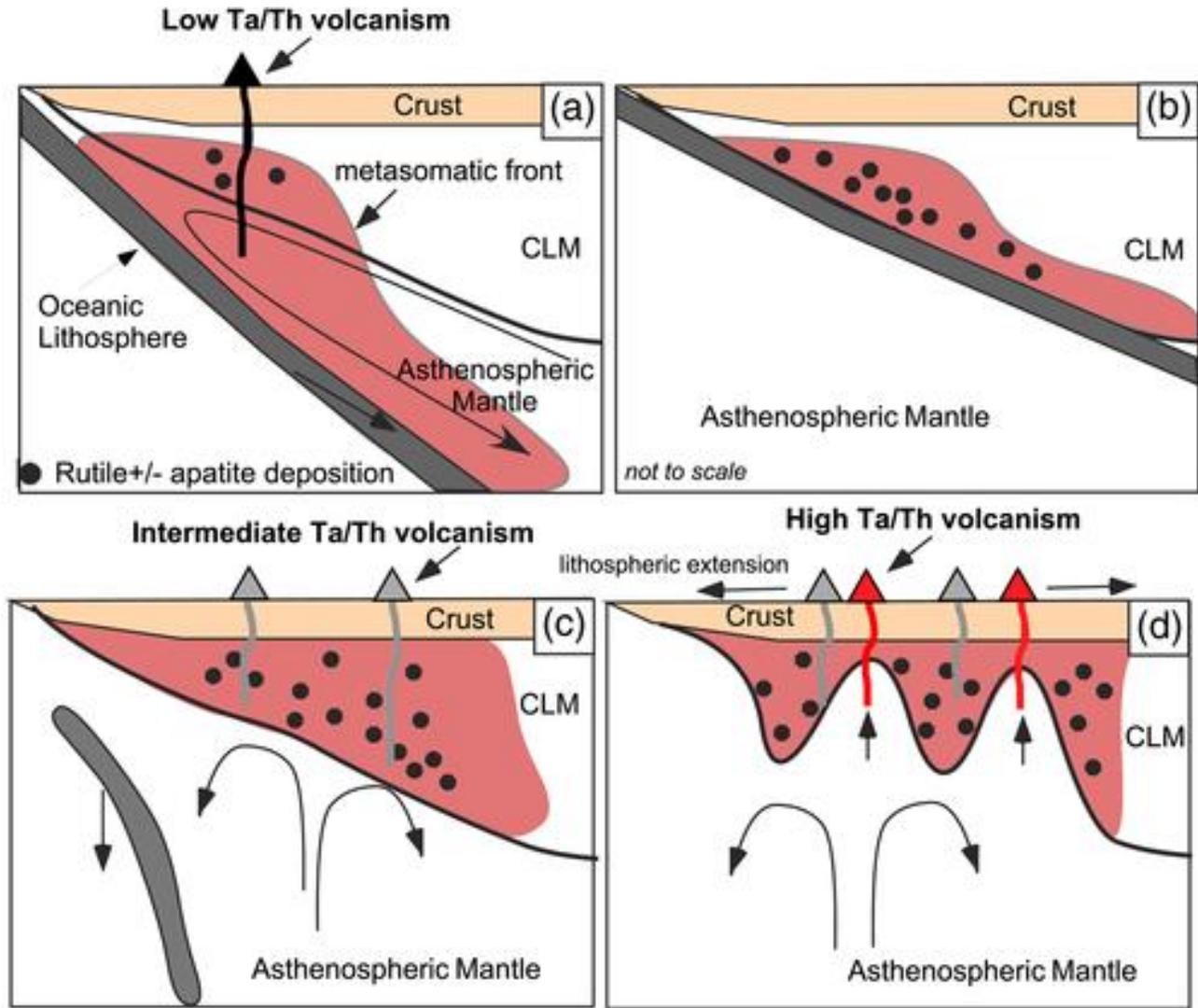
Comparison of island arc basalts (AI), ocean island basalts (OIB) and our sample suite with intermediate Ta/Th values.

The intermediate Ta/Th values reflect melting of mantle directly beneath the continent that contains minerals that concentrate Ta and Th.



# Deep Continental Lithosphere Structures

Based on the patterns of intermediate Ta/Th values, we believe hydrated, rutile- and/or apatite-bearing continental mantle was widespread beneath SWNA



Cartoon showing interplay between infiltrating, subduction-related fluids, and melt generation in continental margin arc (a), lithospheric mantle (c), and upwelling asthenosphere (d). Low-angle subduction can produce widespread metasomatism of mantle lithosphere but does not immediately trigger magmatism due to refrigeration by subducting slab (b).

# Disciplinary & Institutional Repositories

A data source  
and a place to  
share your data!

- <http://portal.earthchem.org/>
  - There are many disciplinary repositories out there. Ask your librarians for help to find them!

- <http://digital.auraria.edu/air> **AURARIA  LIBRARY**

- For the full publication on Ta/Th patterns in SWNA volcanics:

Farmer, G. L., Fritz, D. E., & Glazner, A. F. (2020). Identifying Metasomatized continental lithospheric mantle involvement in Cenozoic Magmatism from Ta/Th values, southwestern North America. *Geochemistry, Geophysics, Geosystems*. 2020;21(5):e2019GC008499.

doi:10.1029/2019gc008499