Sr-Nd-Pb-Hf isotopes reveal the nature and evolution of mantle upwelling at Ross Island, Antarctica

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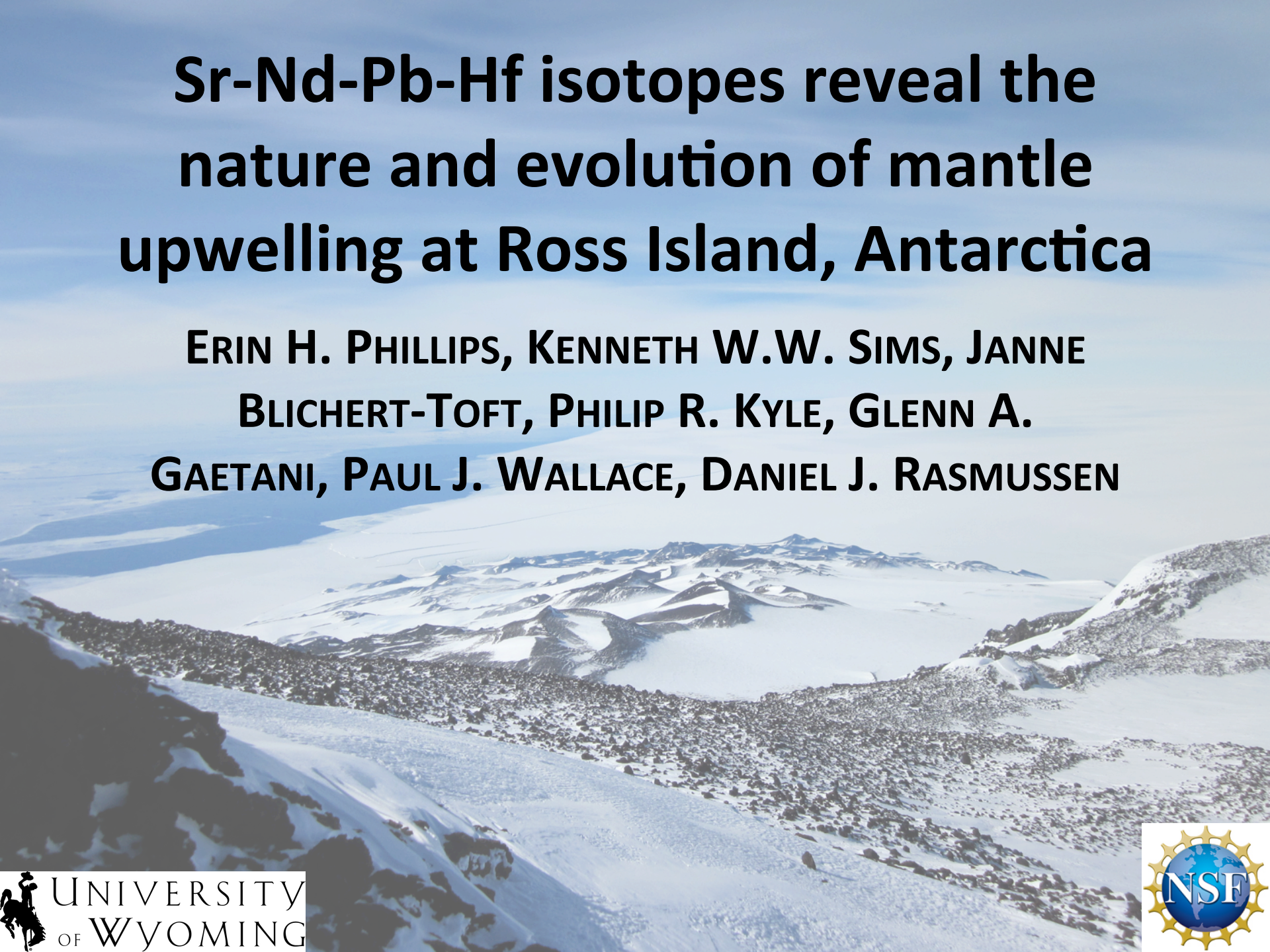

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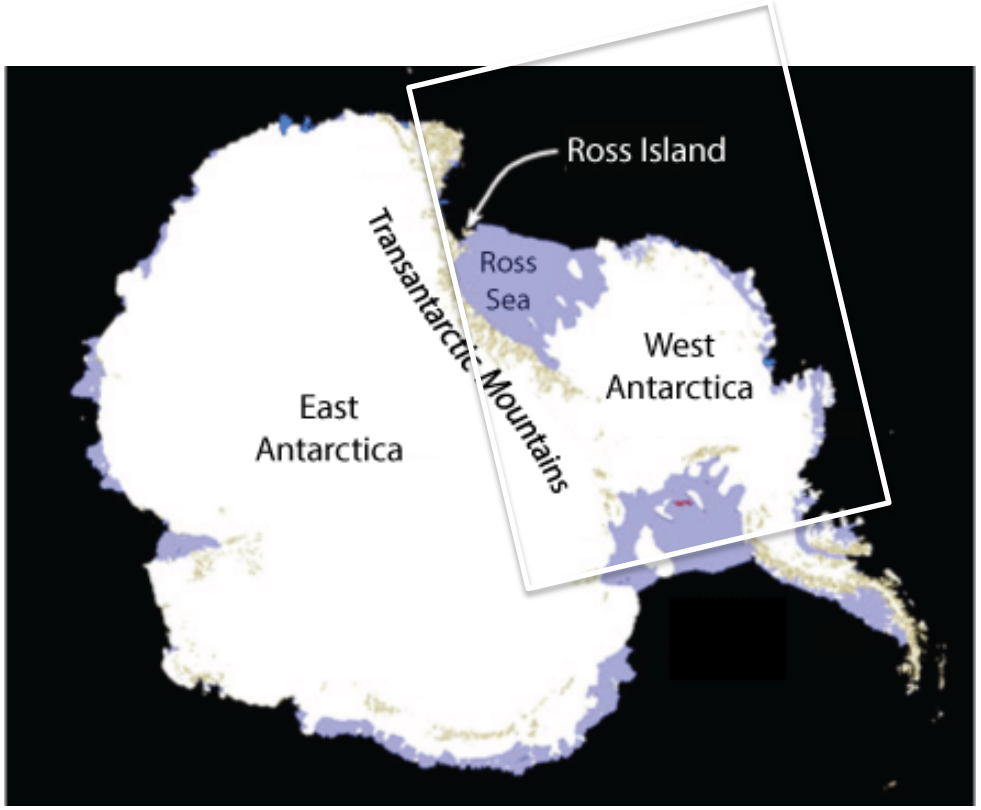
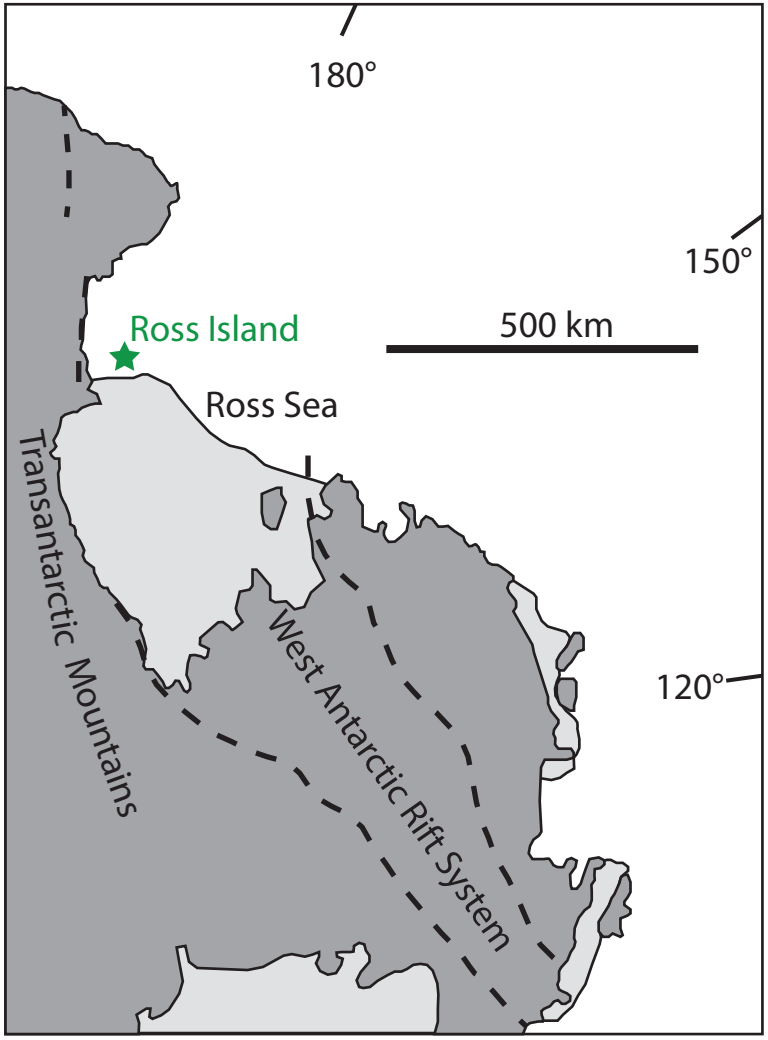
Introduction

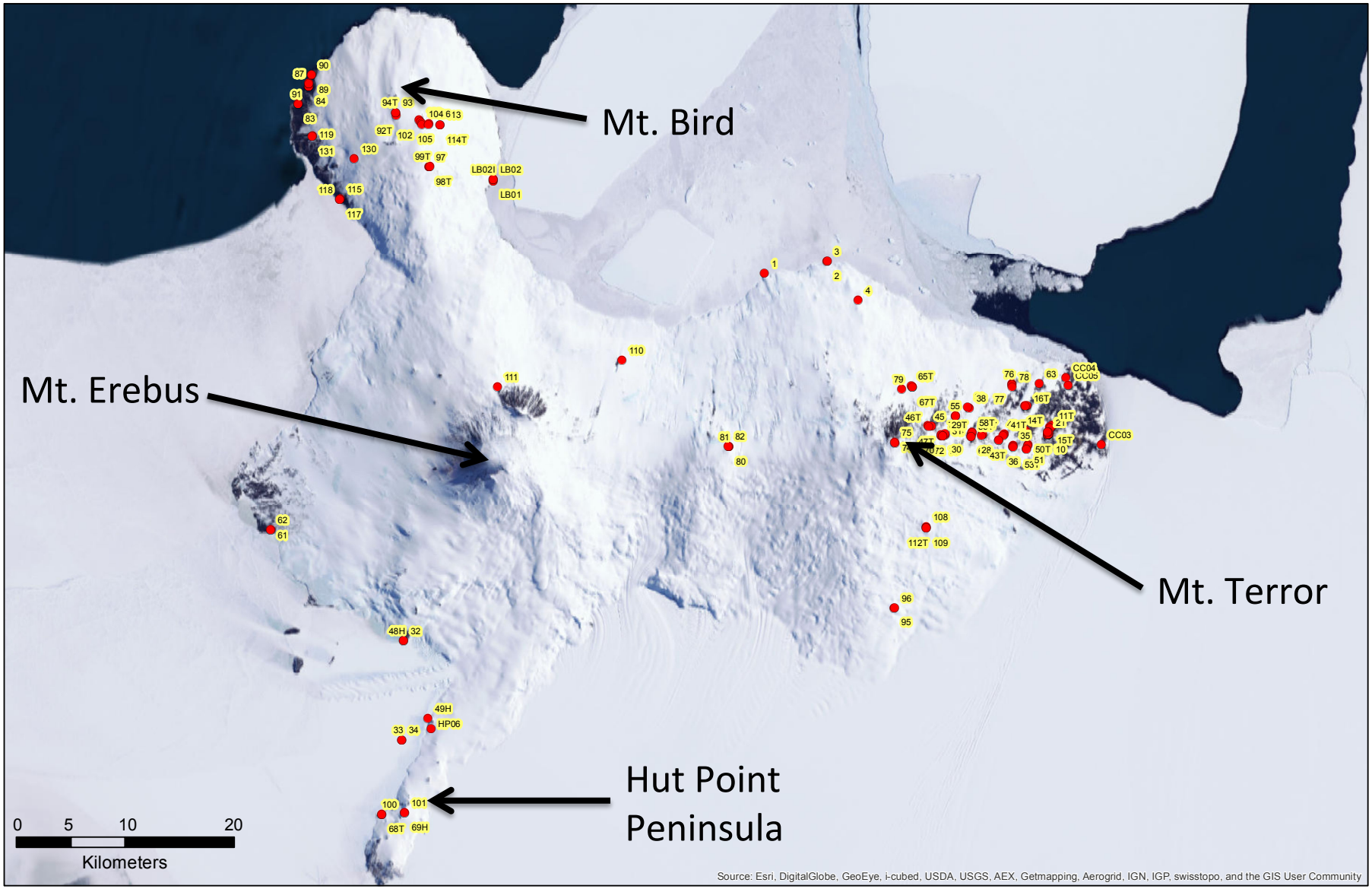


Map modified from www.otago.ac.nz



Map modified from Handler et al. (2003)

Introduction



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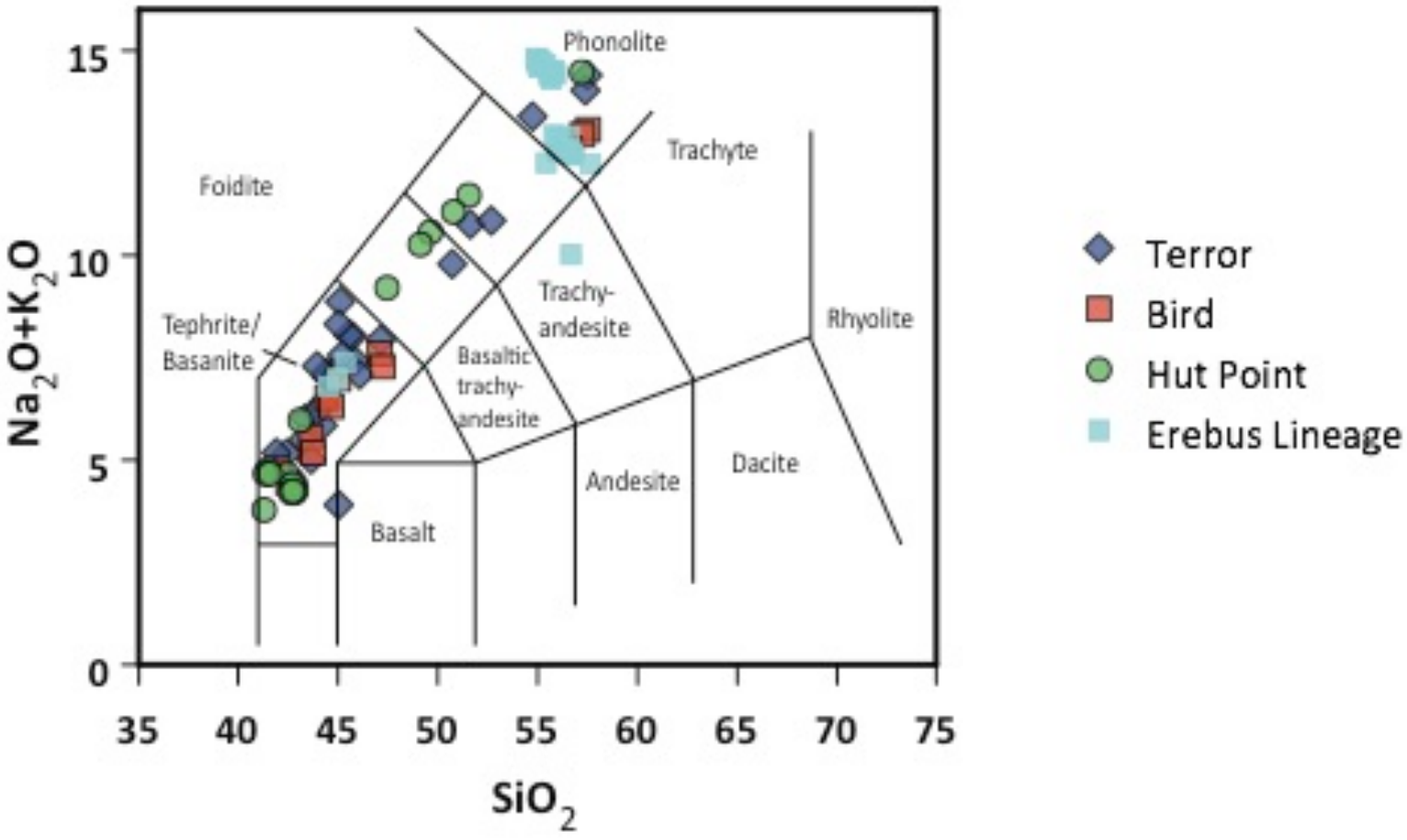
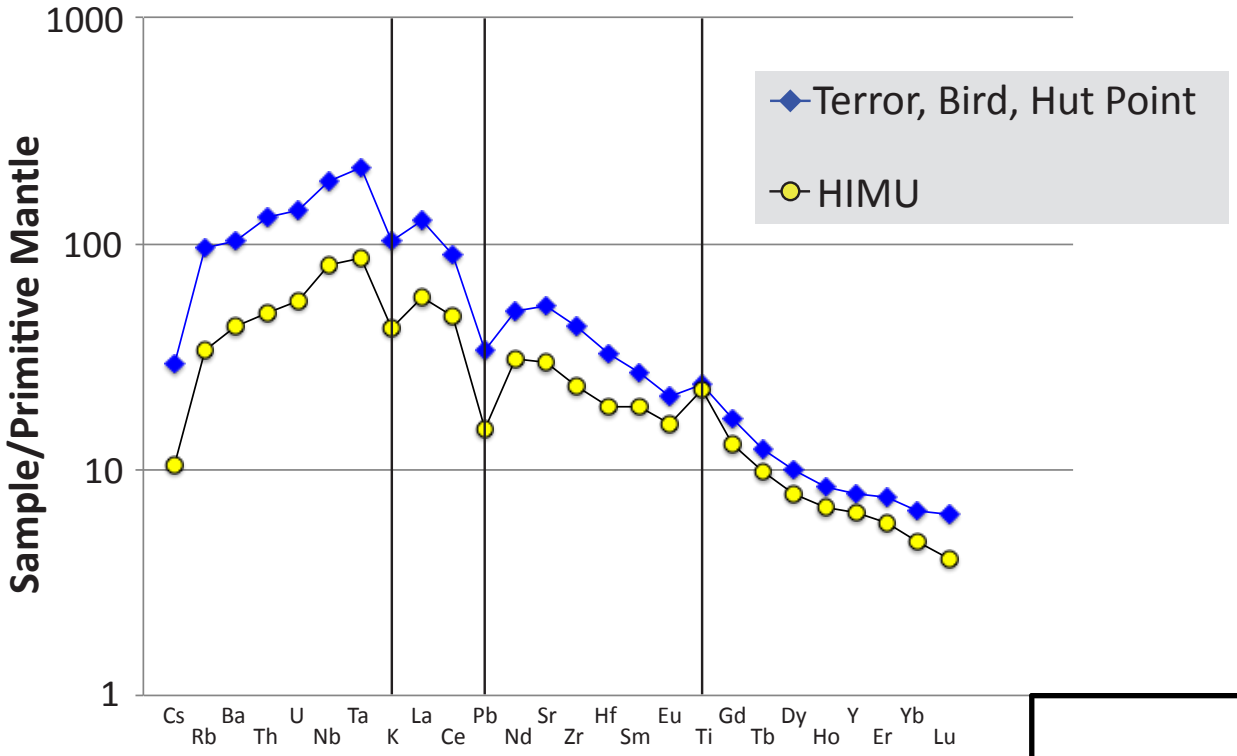
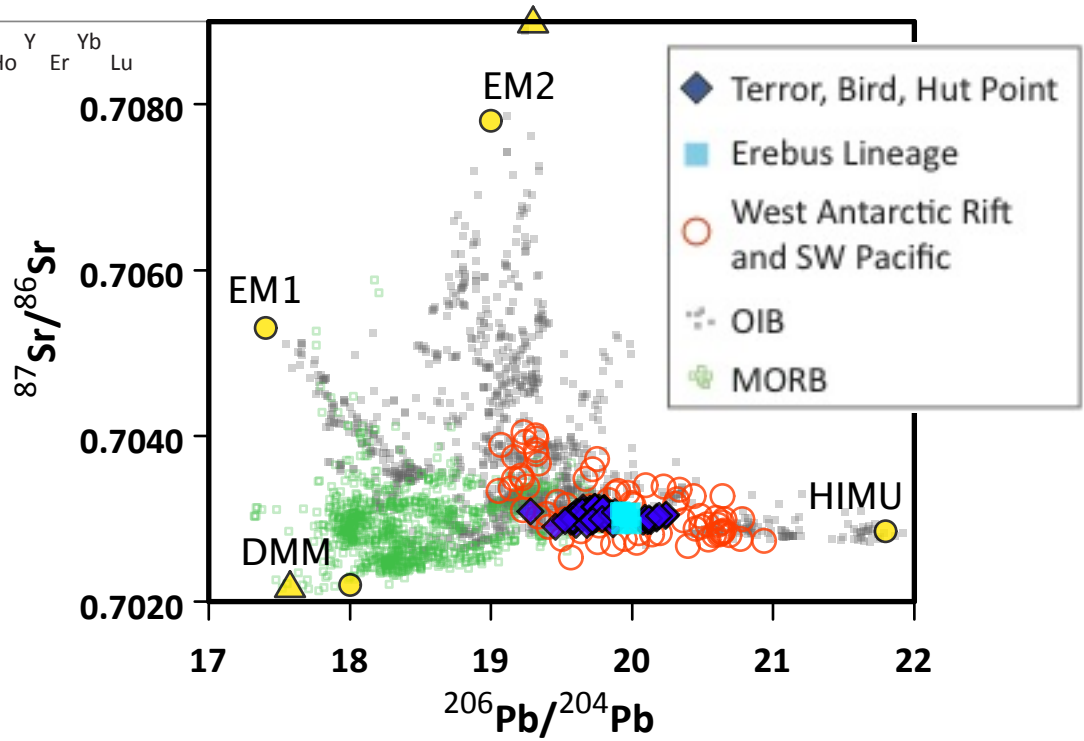


Erebus Lineage lavas from Sims et al. (2008) and this study



Similarity to HIMU Mantle End-member



The HIMU signature

- Ross Island lavas represent **simple mixing between DMM and HIMU** (Sims et al., 2008). Occurrence of upwelling asthenospheric mantle in the form of **Cenozoic mantle plumes** (Kyle et al., 1992; Storey et al., 1999).

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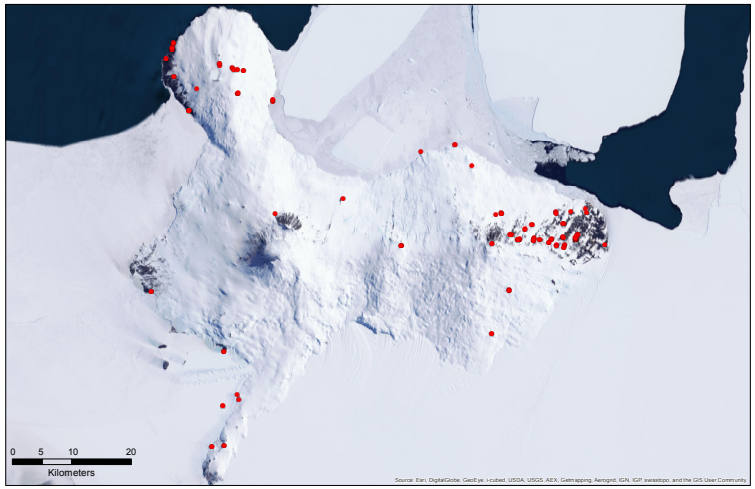
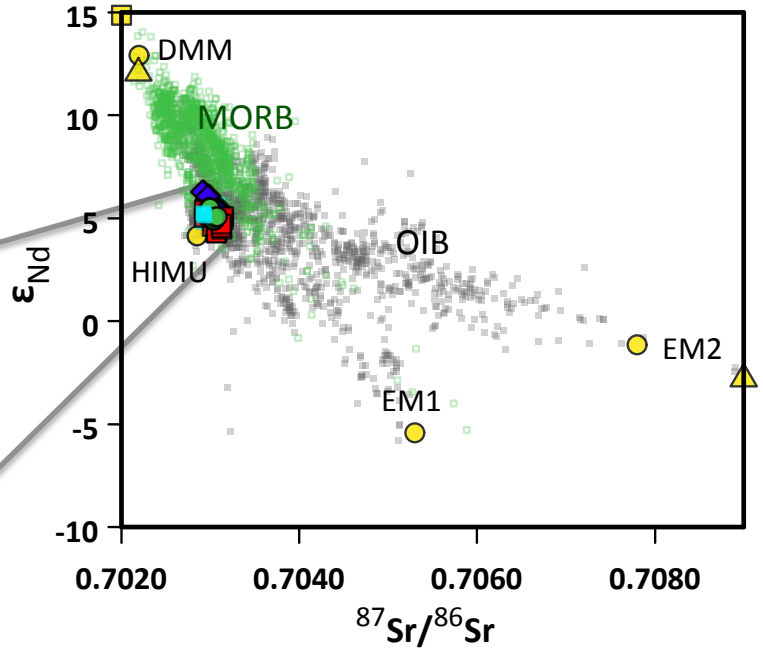
- **Large pre-Cenozoic fossil plume** metasomatized the mantle lithosphere, imparting a HIMU signature (Hart et al., 1997; Rocholl et al., 1995, Panter et al., 2000)
- **Subduction-related** (~100-500 Ma) **metasomatism of continental lithosphere** as the source for regional HIMU signature (Finn et al., 2005)

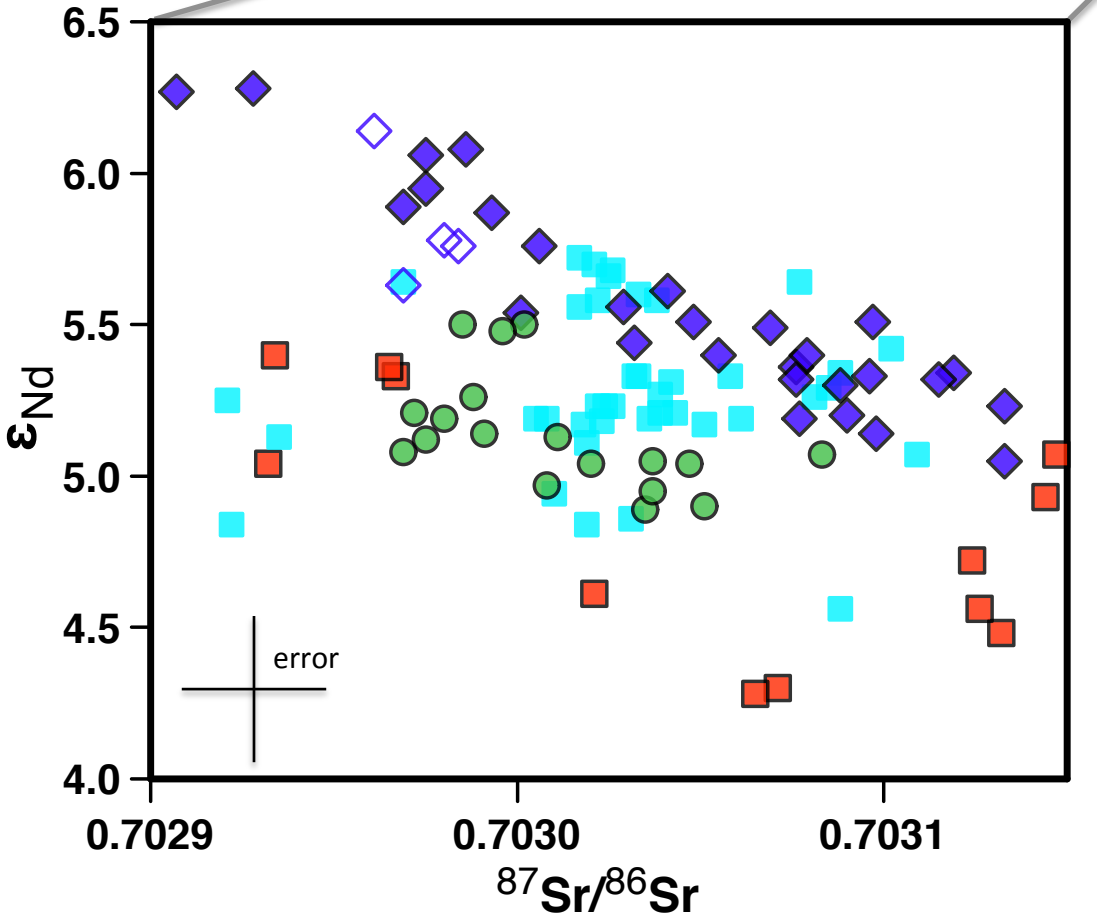
A Ross Island Mantle Plume?

- Radial symmetry
- High eruptive volume at Erebus (melting of >82,000 km^3 of mantle peridotite; Kyle et al., 1992)
- Kaersutite in peripheral centers: a cooler, wetter periphery?
- Seismic data (e.g., Watson et al., 2006; Hanson et al., 2014)



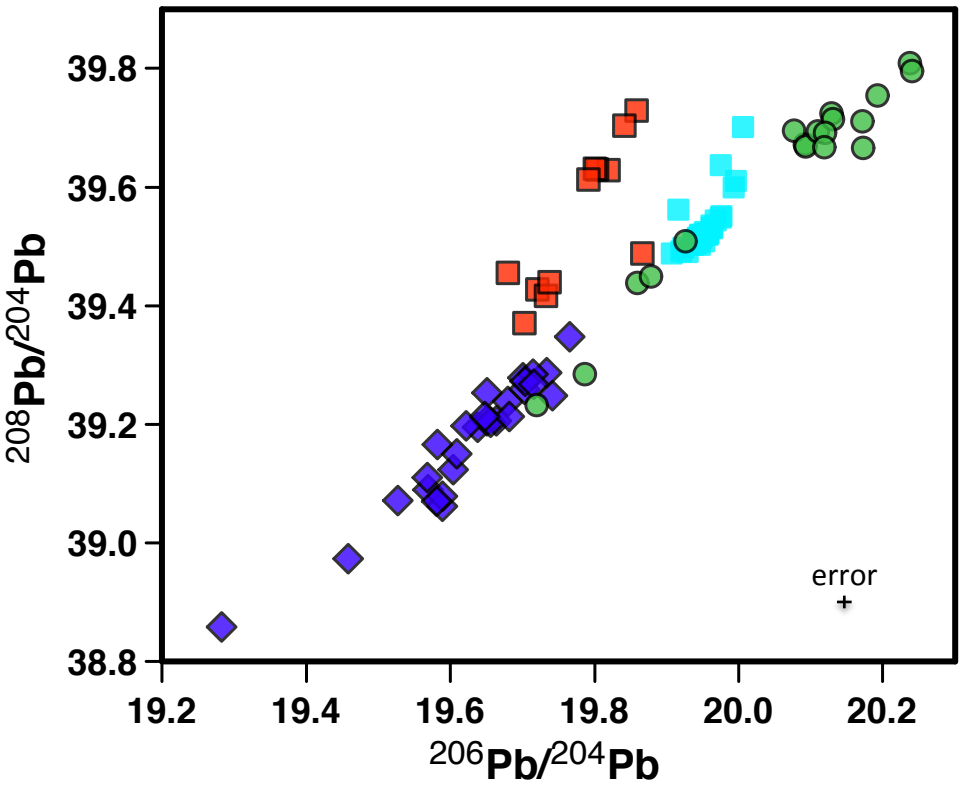
Ross Island Isotopes

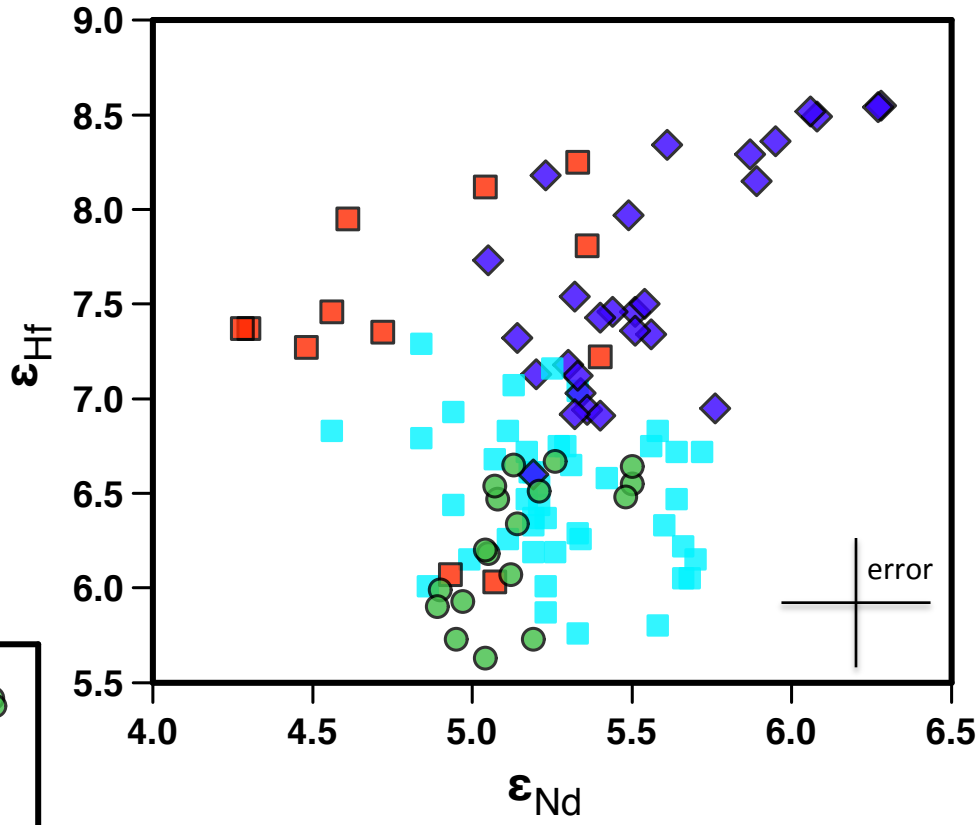




- Terror
- Terror mineral separate
- Bird
- Hut Point
- Erebus Lineage

Departure of Bird samples from overall trend

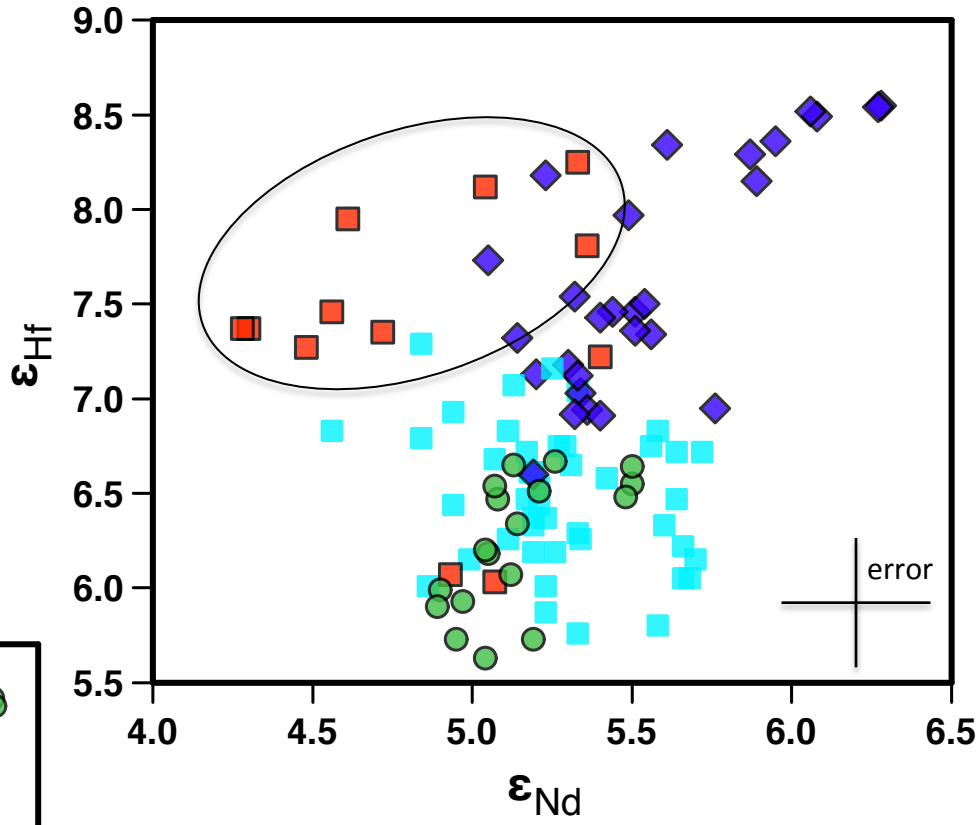


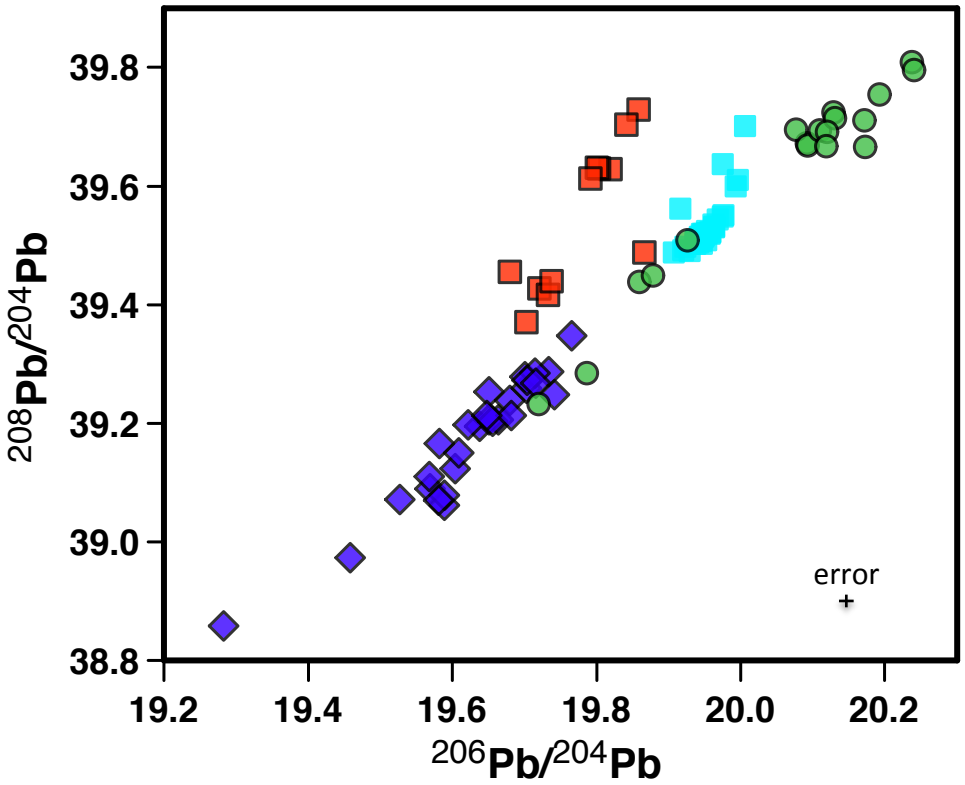


Terror
Bird
Hut Point
Erebus Lineage

Departure of Bird samples from overall trend

Influence of pelagic sediments in the source of Bird lavas?

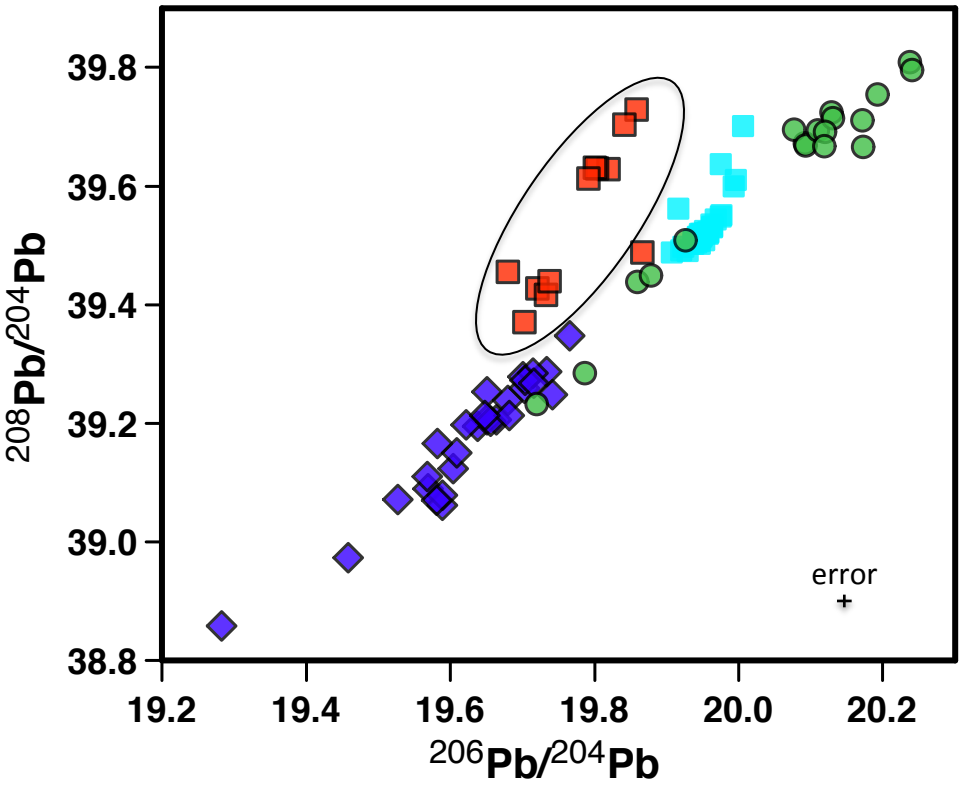


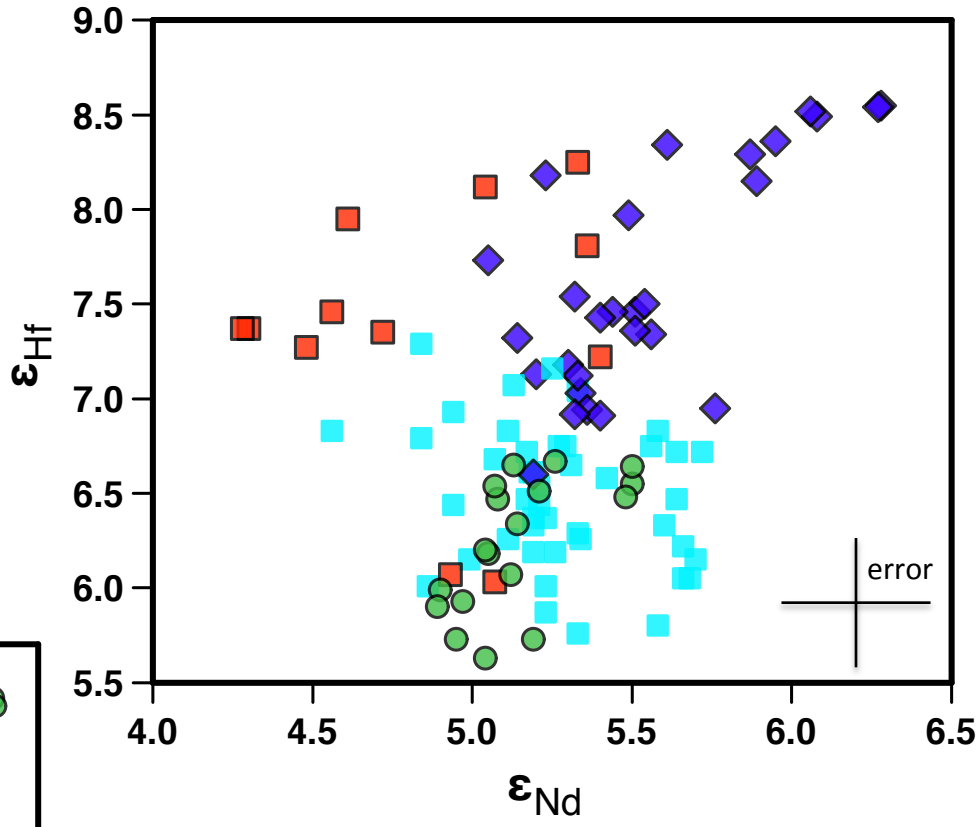


Departure of Bird samples from overall trend

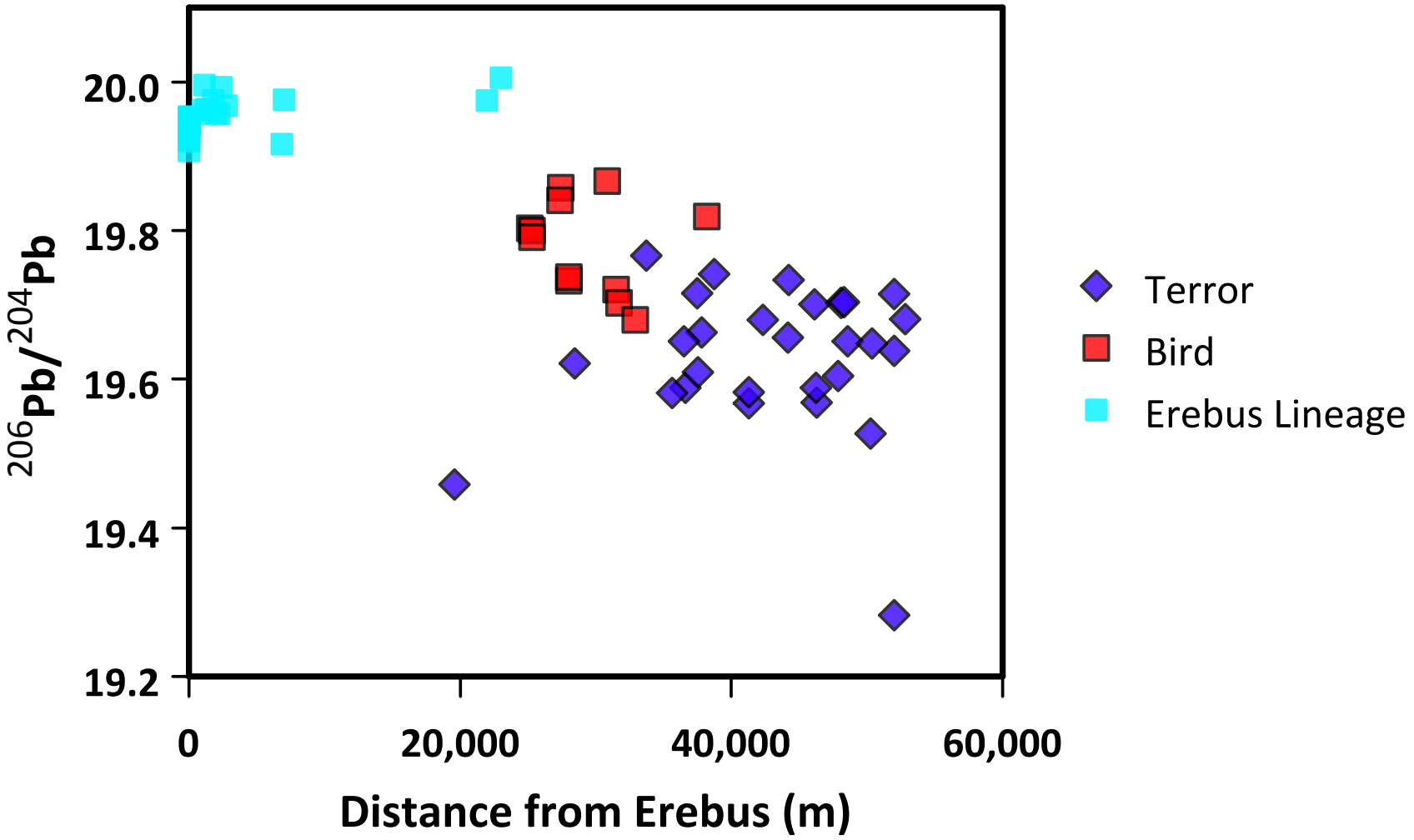
Influence of pelagic sediments in the source of Bird lavas?

Incorporation of source material with a different long-term U/Th ratio?





Distance from Erebus



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- Greater overall variability in peripheral centers than for Erebus, suggesting increased mixing on periphery
- Suggestion of a disparate component (pelagic sediment?) in the source of Bird lavas
- Marked decrease in $^{206}Pb/^{204}Pb$ with distance from Erebus for Terror and Bird lavas

Conclusions

- Evidence exists that suggests the presence of a Ross Island mantle plume
- Ross Island lavas fall on mixing line between DMM and HIMU
- A regional HIMU-like signature is present
- A widespread regional enrichment event does not preclude the presence of young deep mantle plumes