Hydrothermal Sediment Fluxes on the Mid-Atlantic Ridge (at TAG and Broken Spur Vent Fields)

FESD Workshop December 2014

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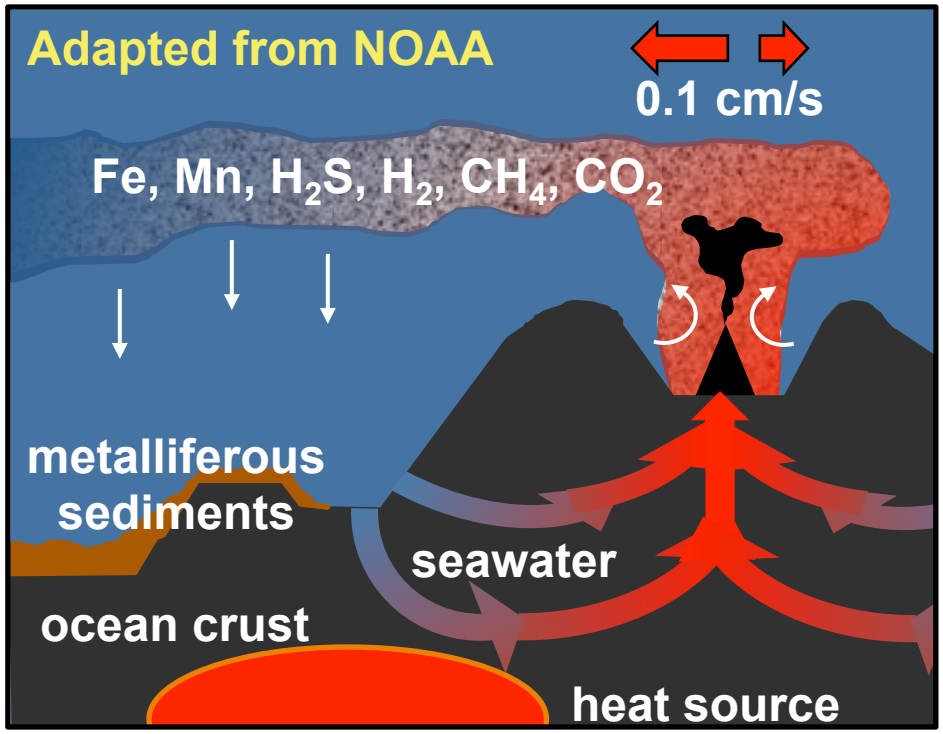
Charlie Langmuir (Harvard) Zhongxing Chen (Harvard)
Jerry McManus (Columbia/LDEO)

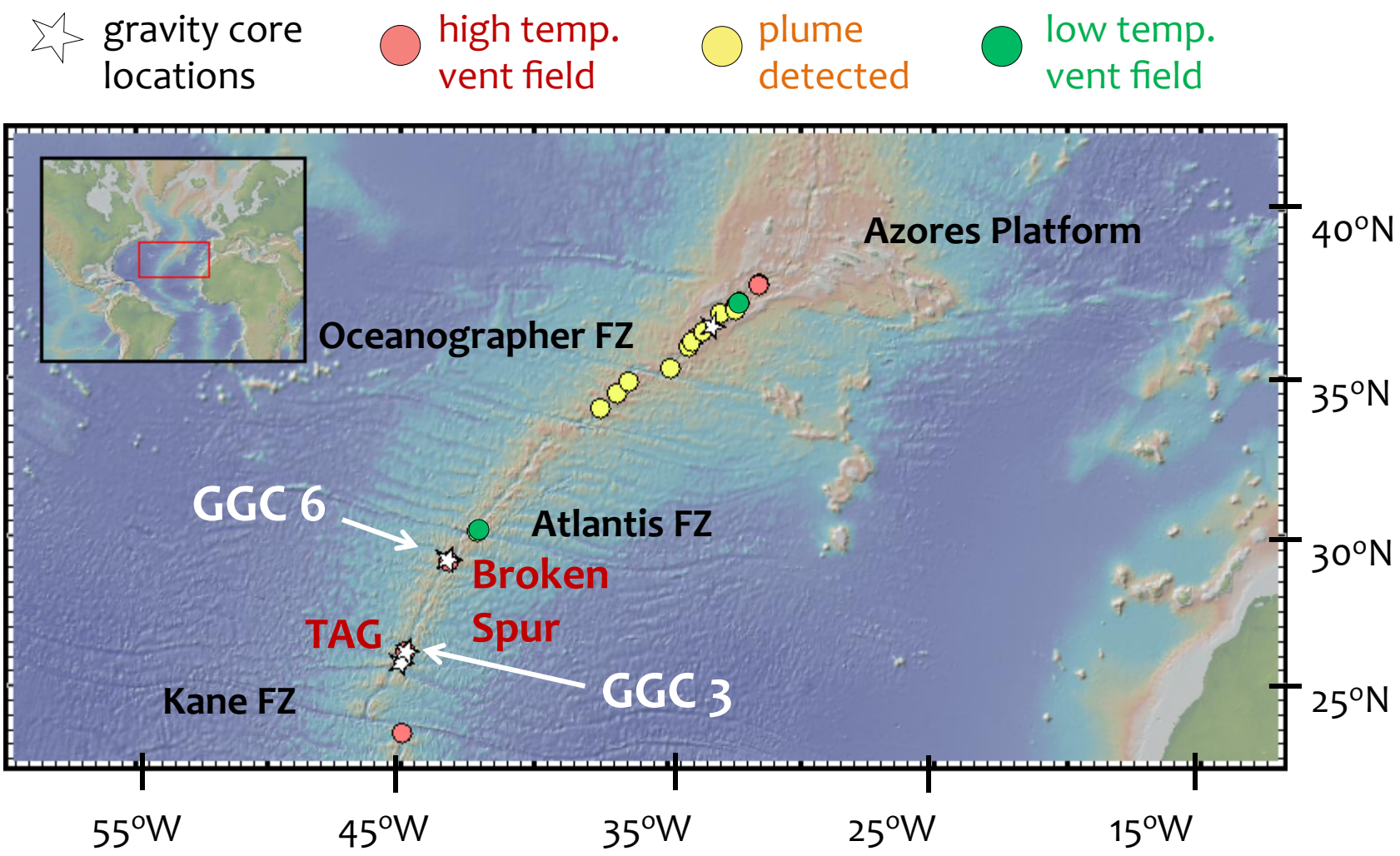
Hydrothermal Sediments: A record of hydrothermal activity?



High temp fluids enriched in:
H_2, CO_2, H_2S, Mn, Fe, Cu, Zn, Pb, etc…

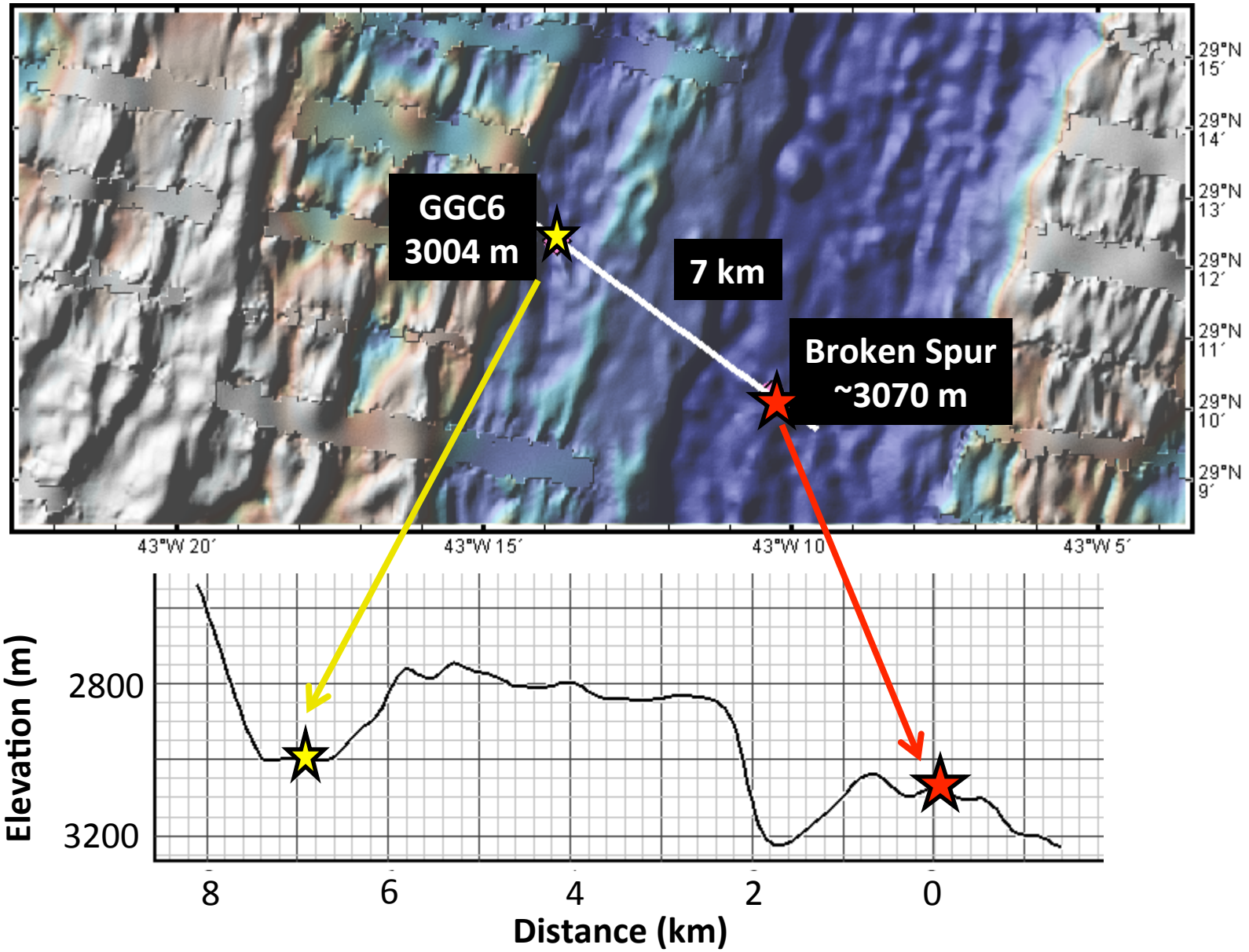
Plumes scavenge V, As, P, and REEs from seawater

Mid-Atlantic Ridge Study Area

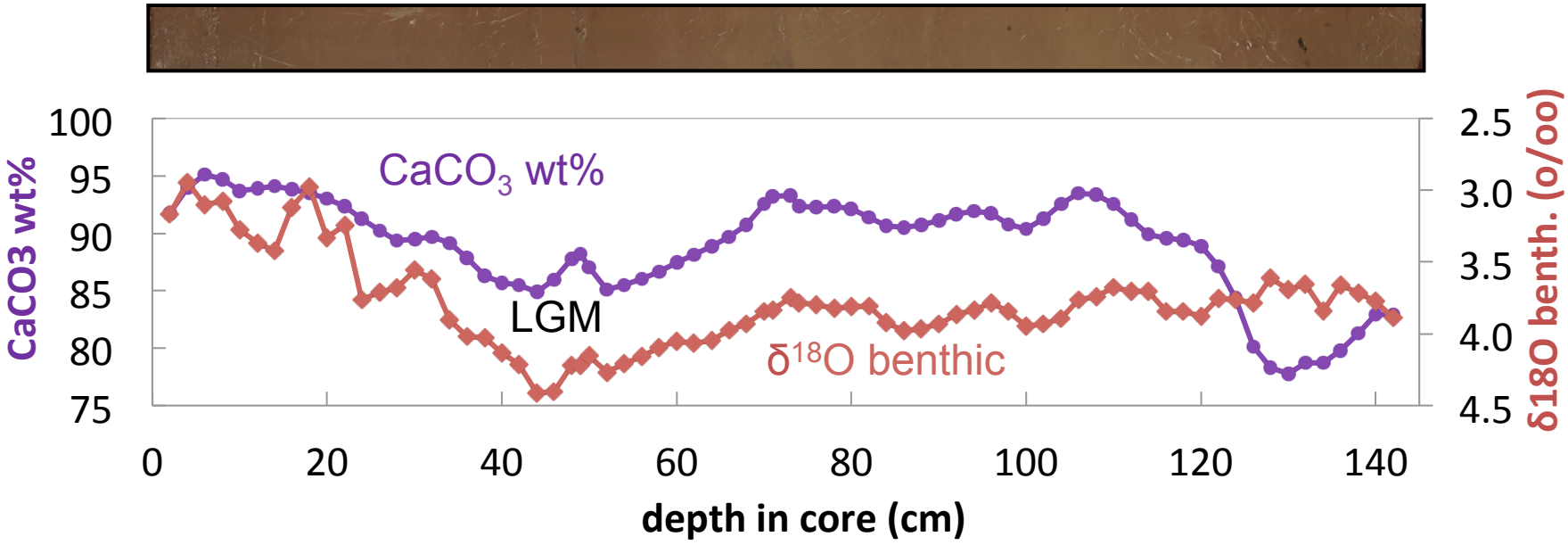


[Hydrothermal vent and plume locations from InterRidge Vents Database]

Broken Spur and GGC6: 7 km apart



Broken Spur Core (GGC6): Context



lat. 29.207 °N long. 43.230 °W depth 3004 m

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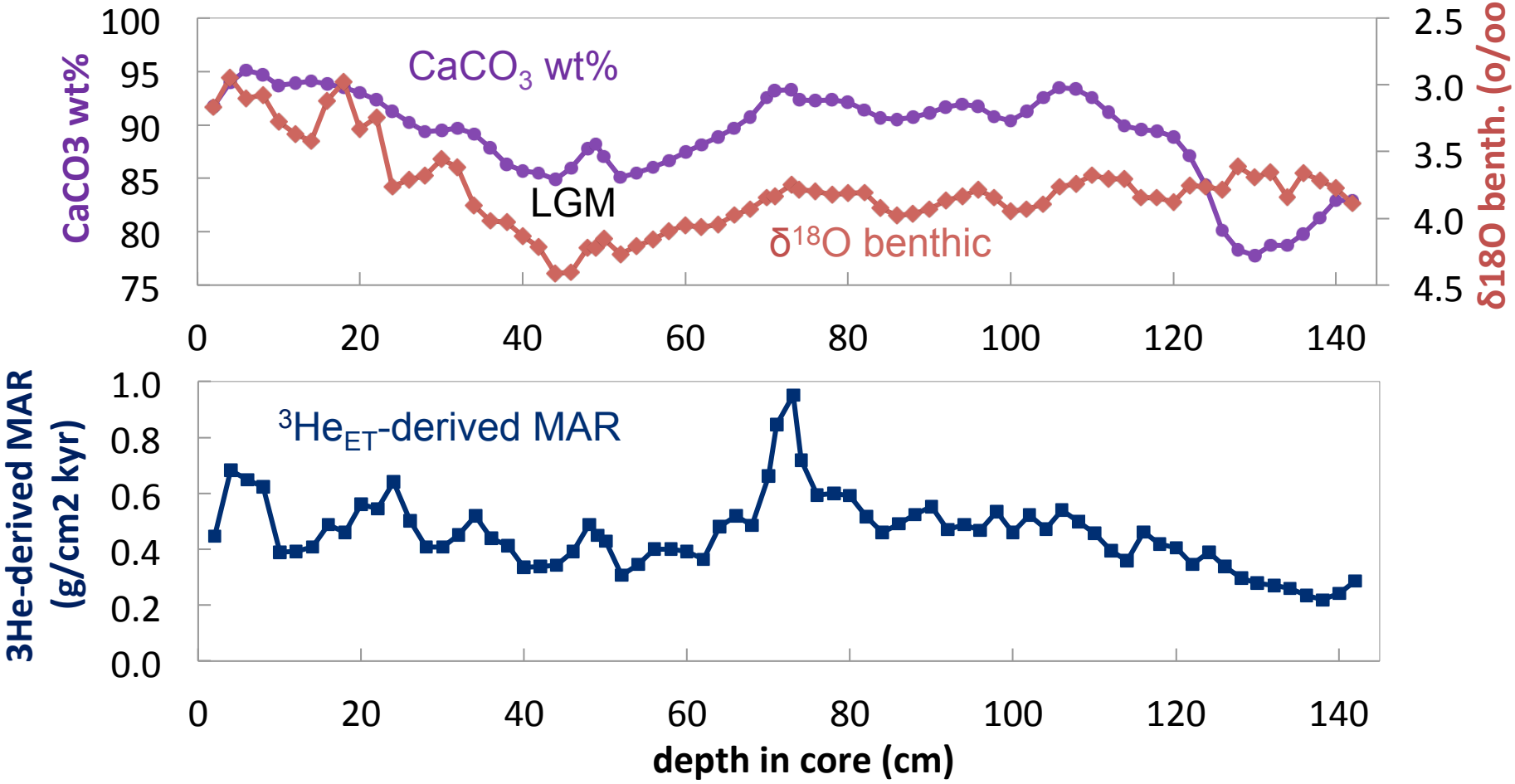

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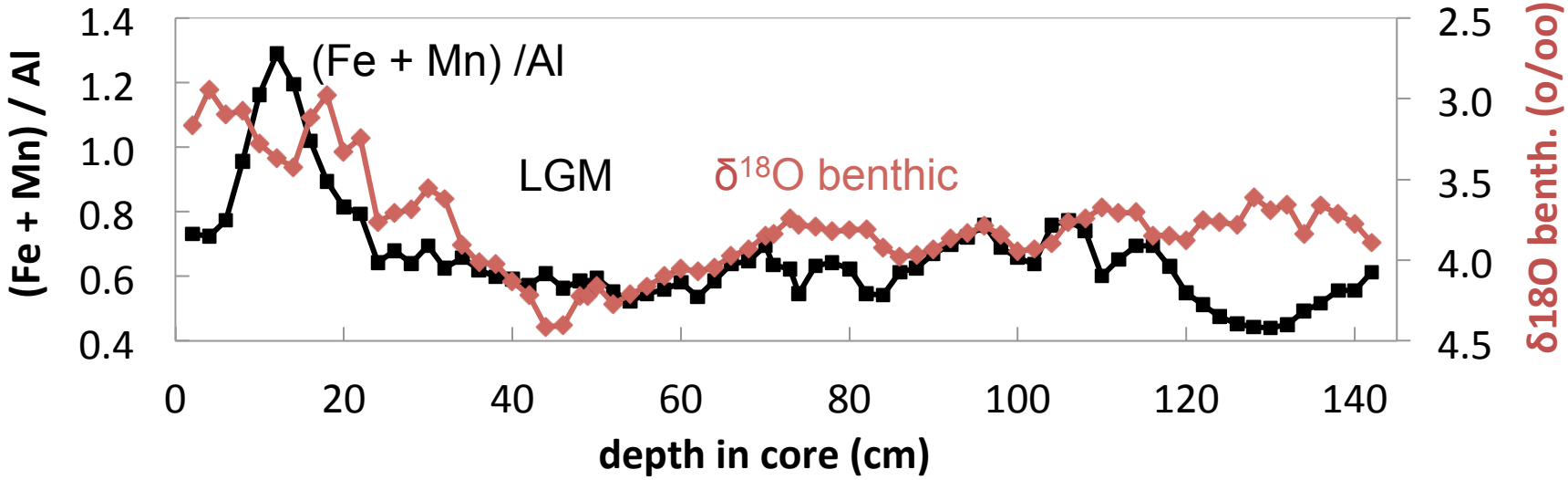
Broken Spur Core (GGC6): Why flux matters



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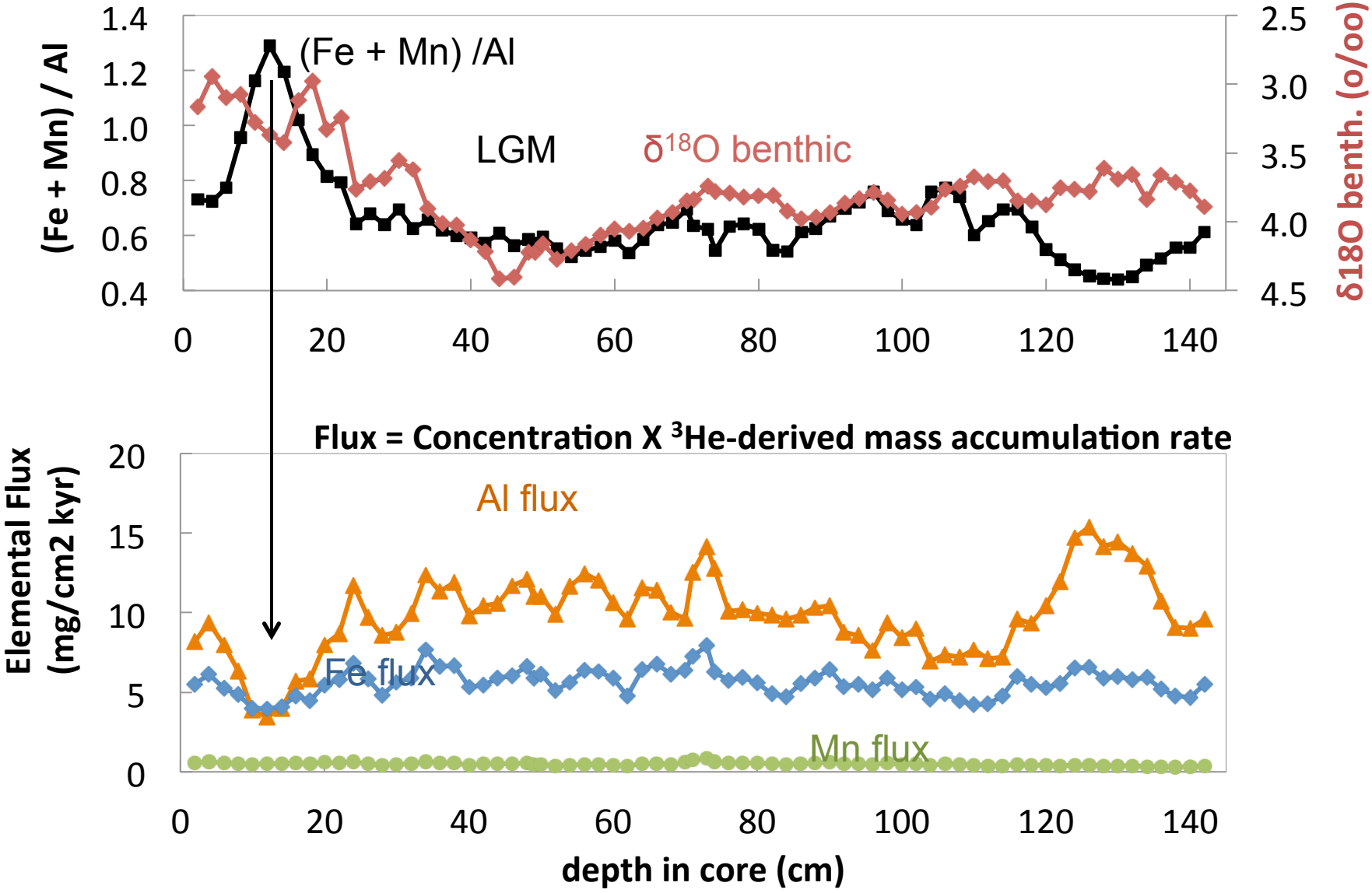
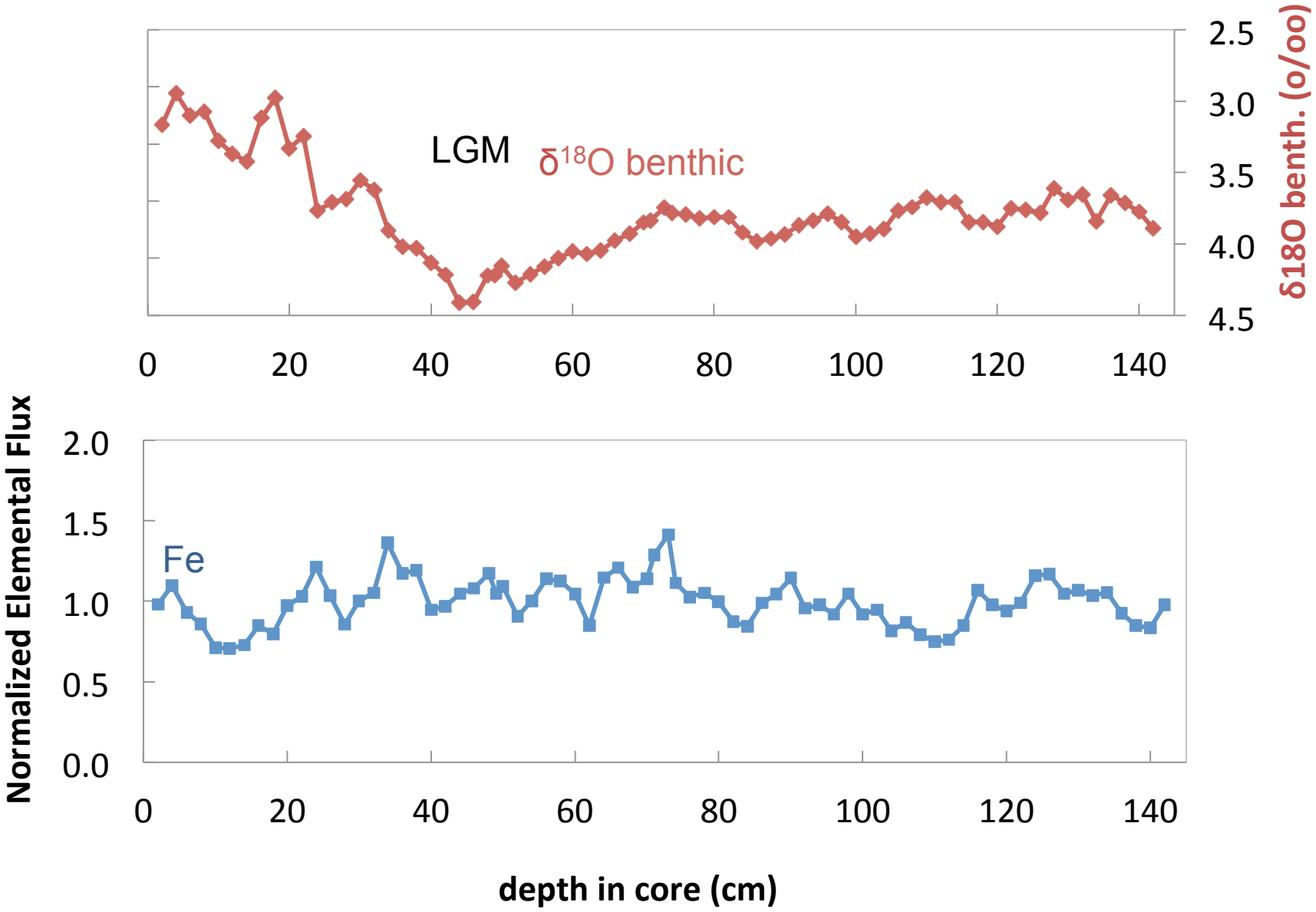


Fluxes calculated from $^{3}He_{ET}$-derived rain rates

Broken Spur Core (GGC6): Normalized elemental fluxes



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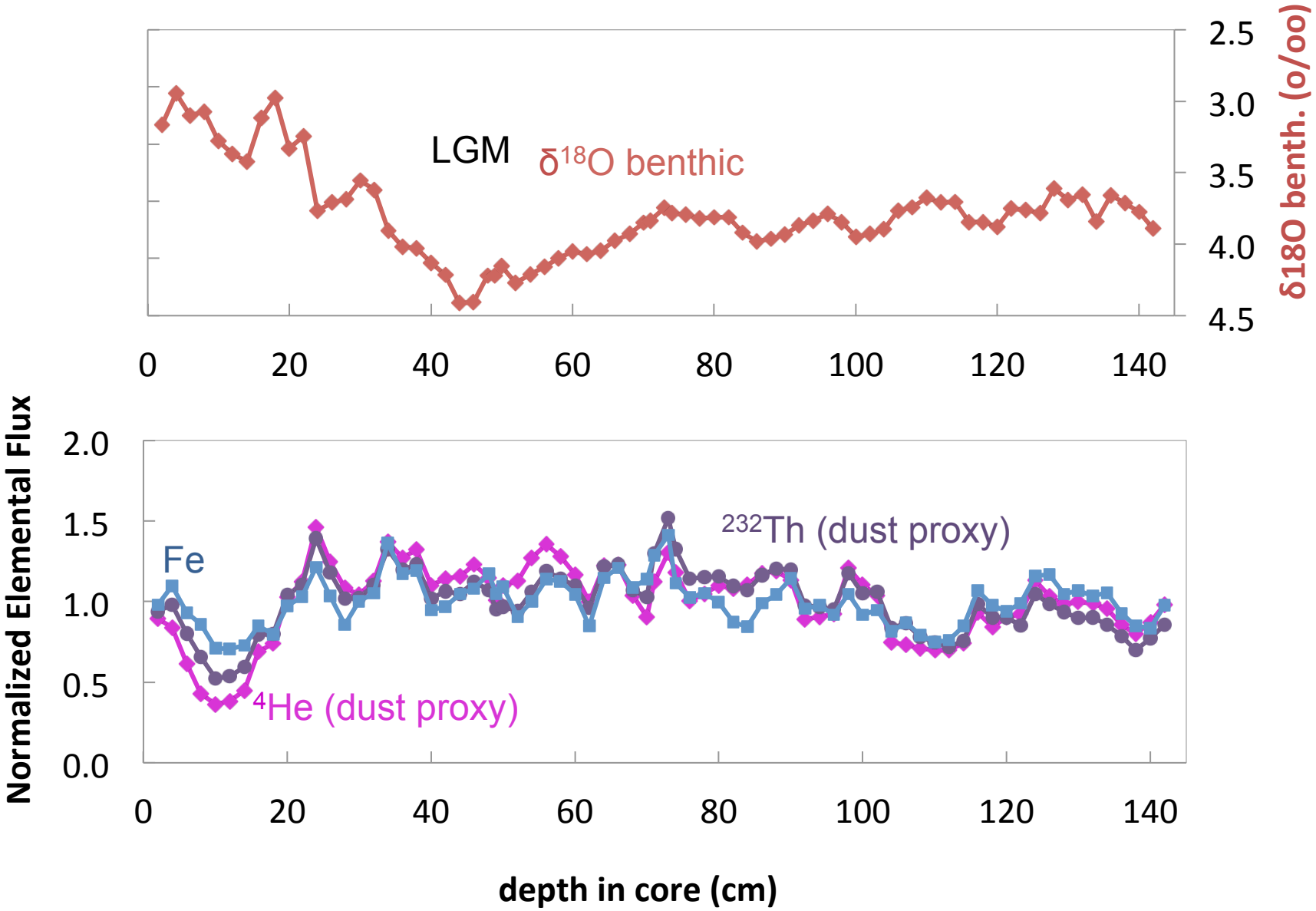

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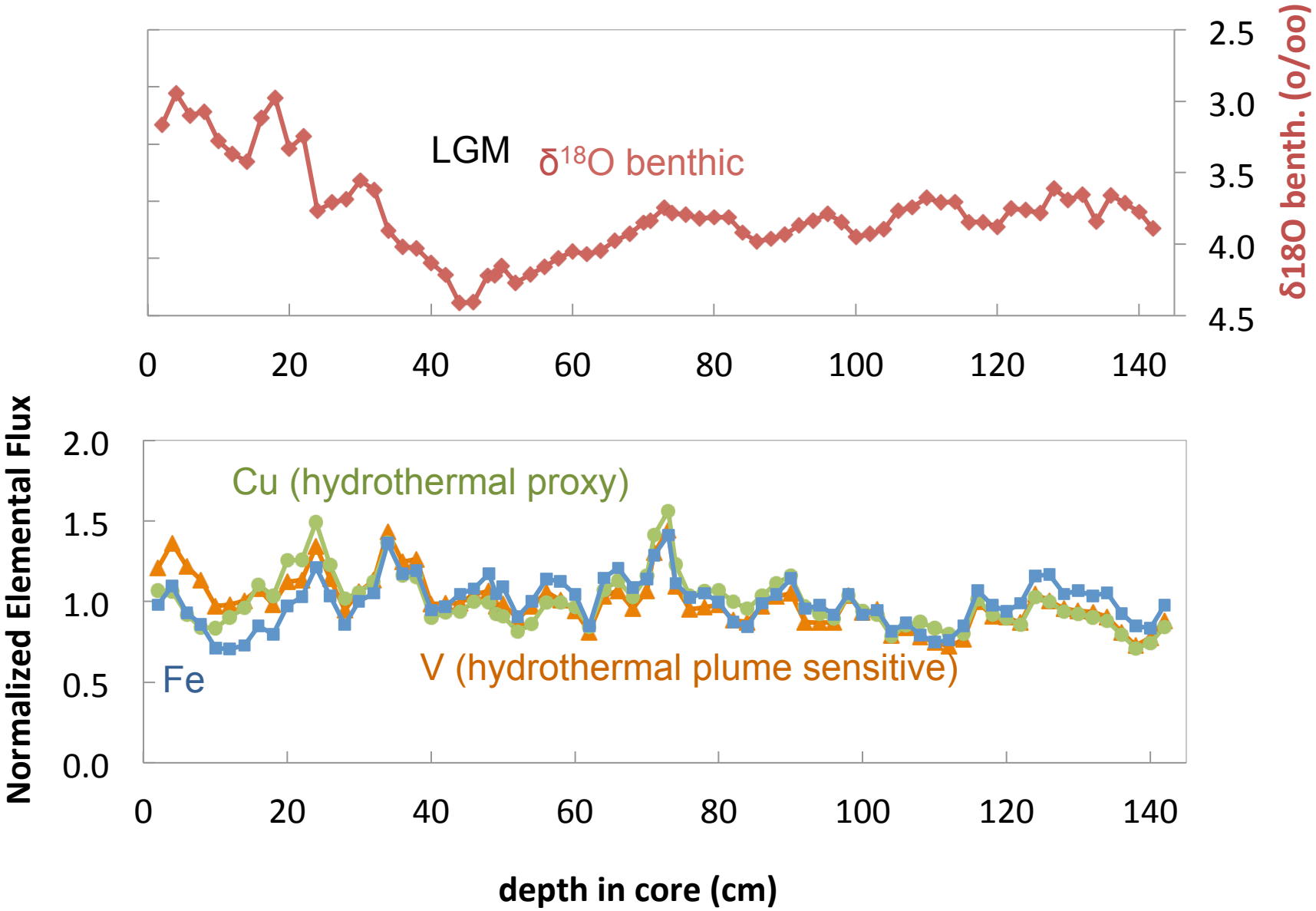

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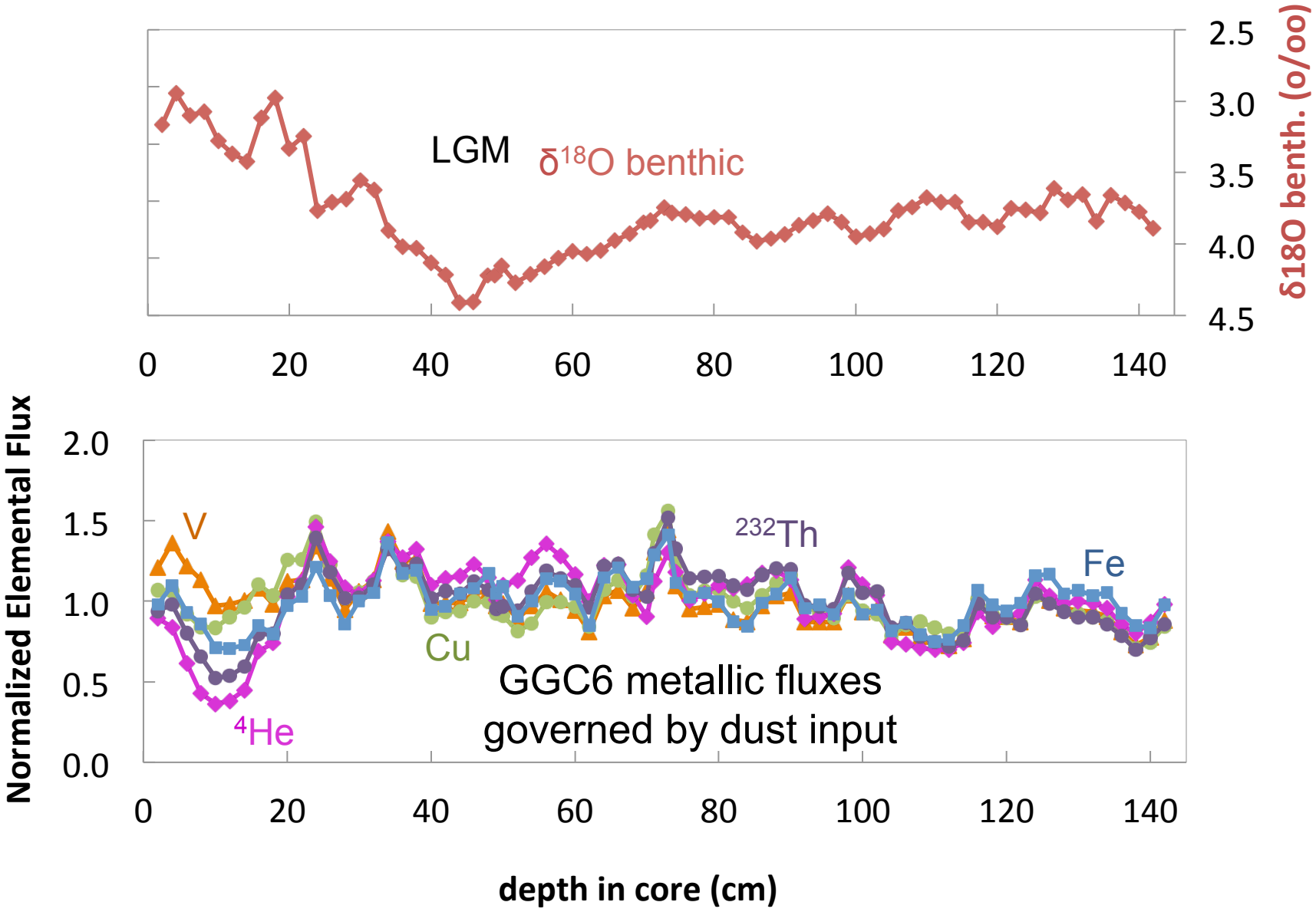
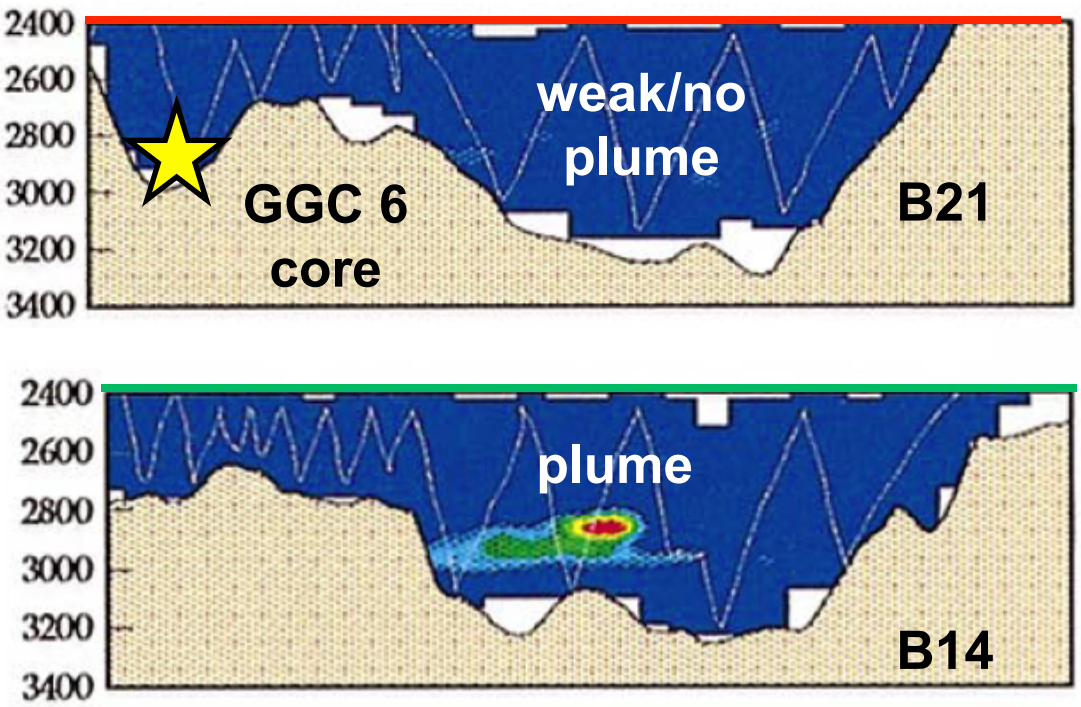
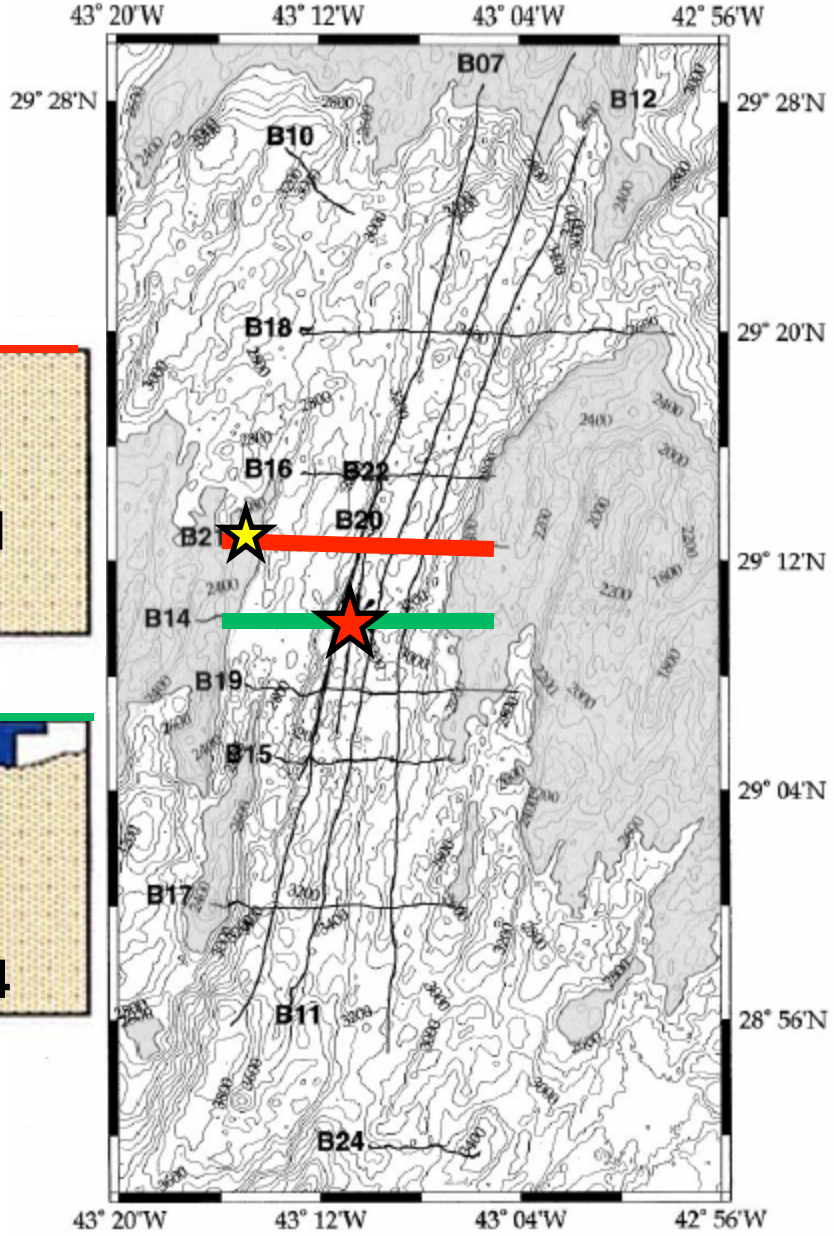


Broken Spur hydrothermal plume nephelometry map

(German et al., 1999)



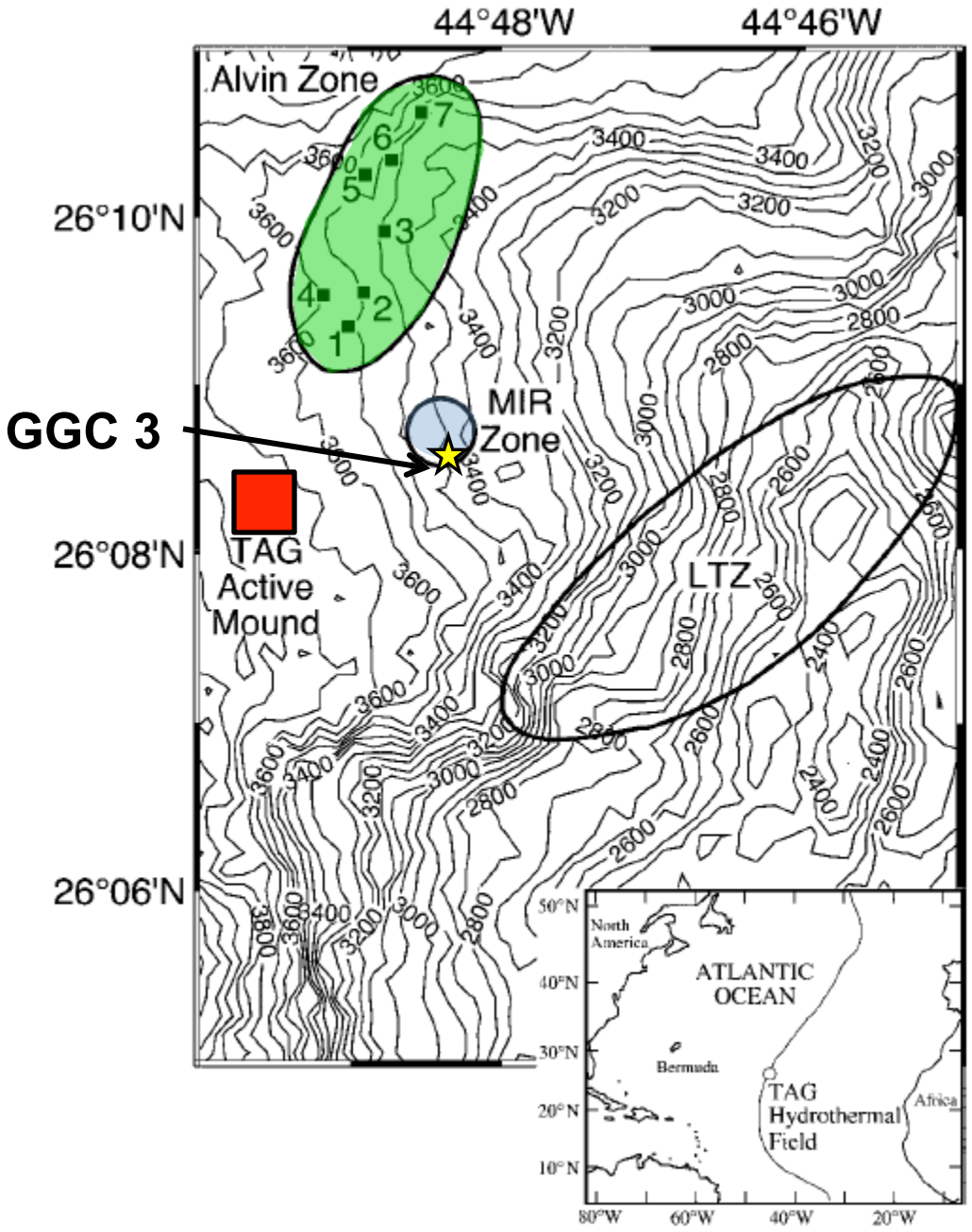


Plume Intensity (Nephels)

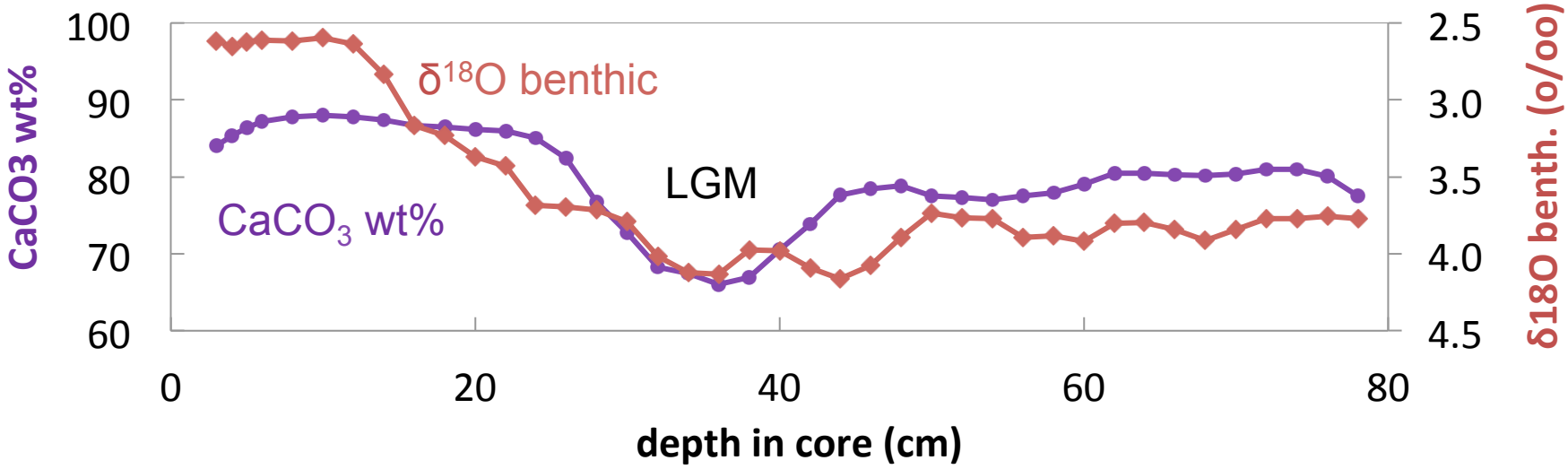
high low

TAG Core (GGC3):

TAG mound and bathymetry
(Humphris and Tivey 2000)



TAG Core (GGC3): Context



lat. 26.142 °N long. 44.804 °W depth 3433 m

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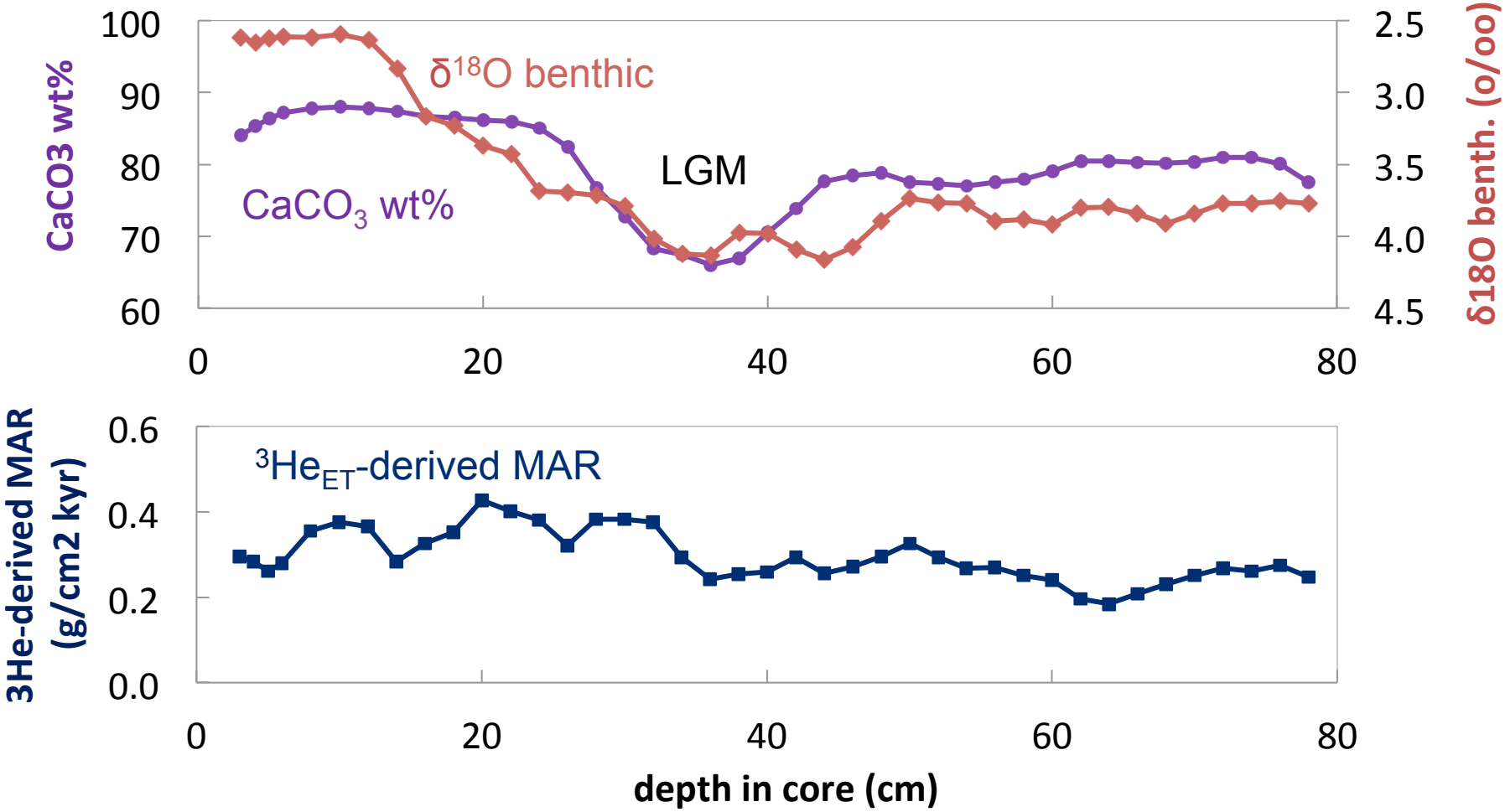

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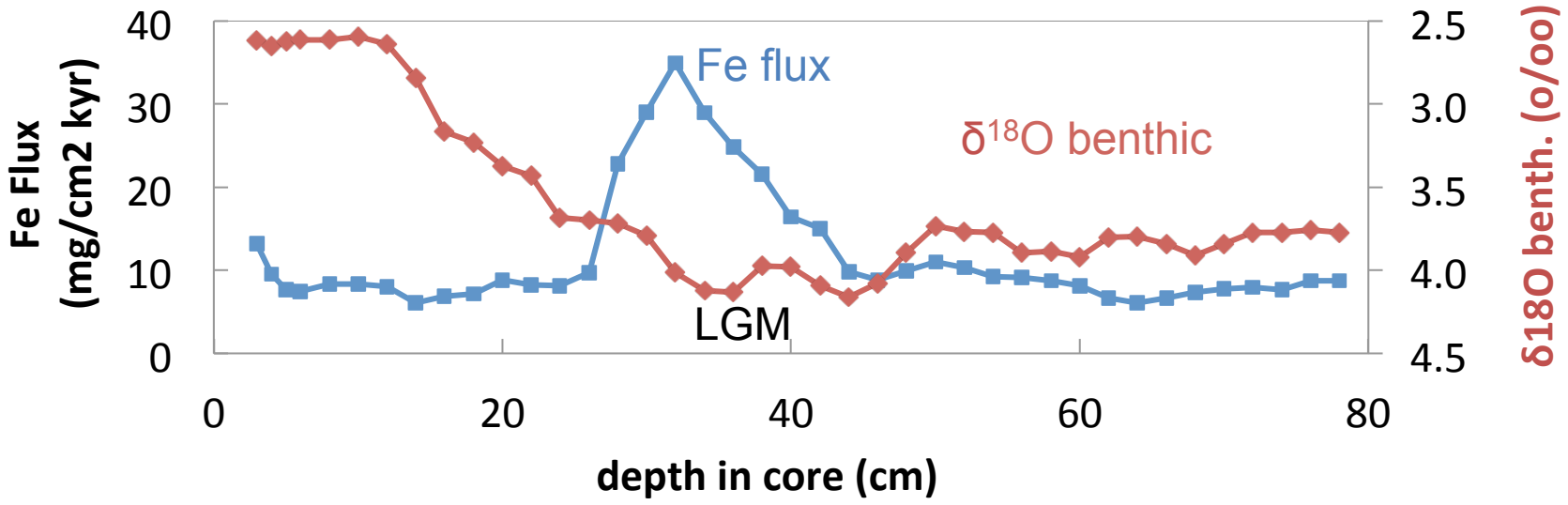
TAG Core (GGC3): Elemental fluxes and climate



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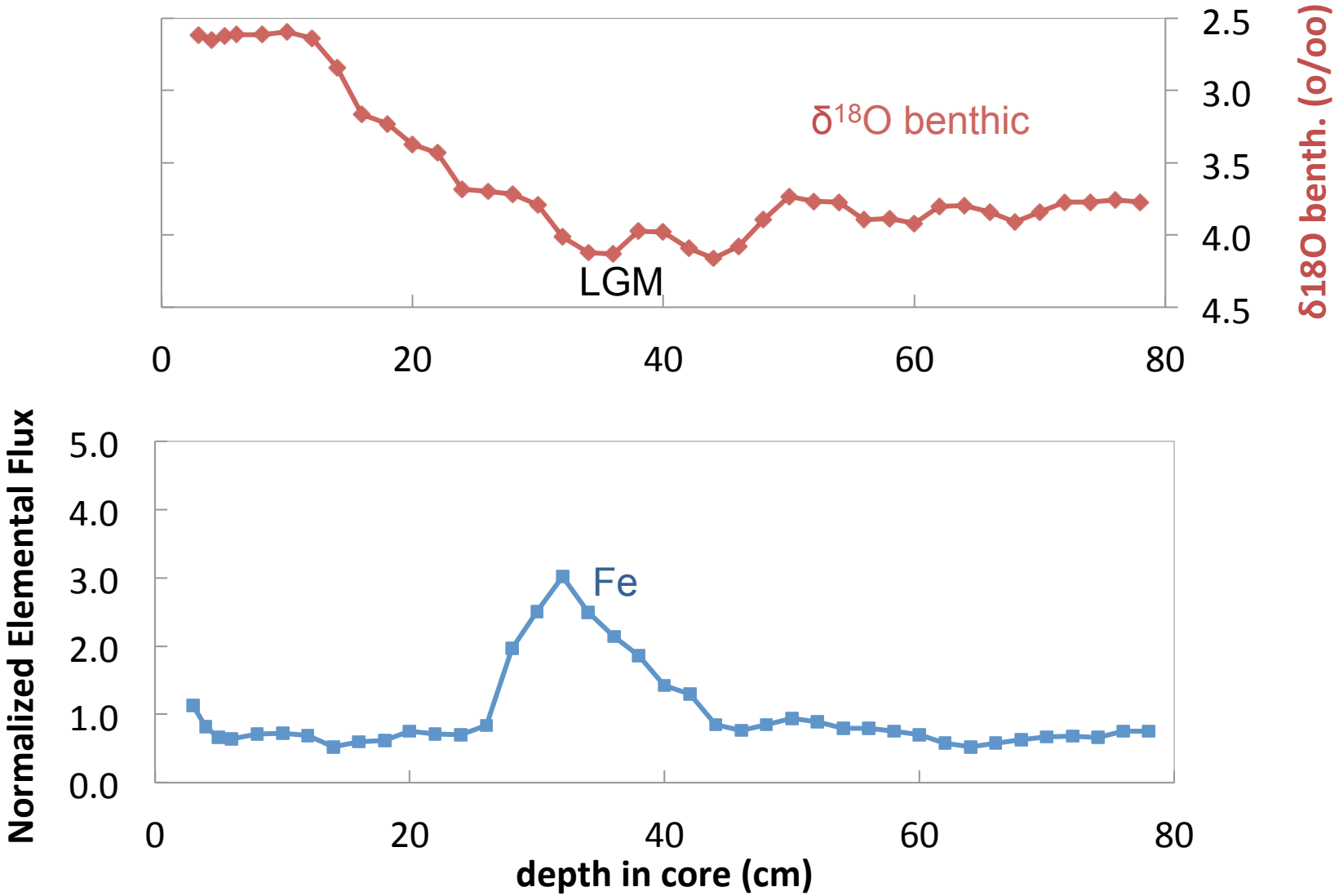

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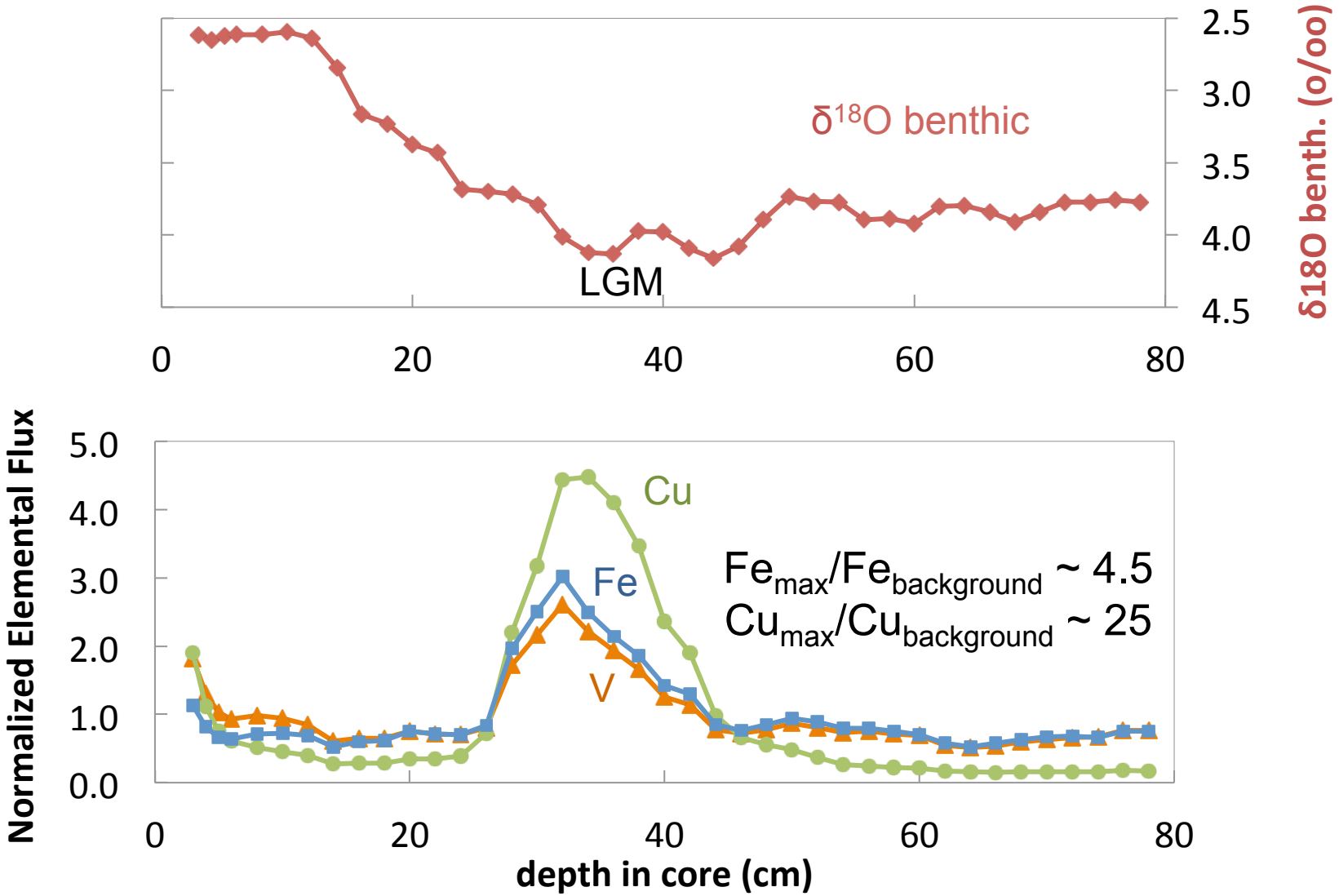

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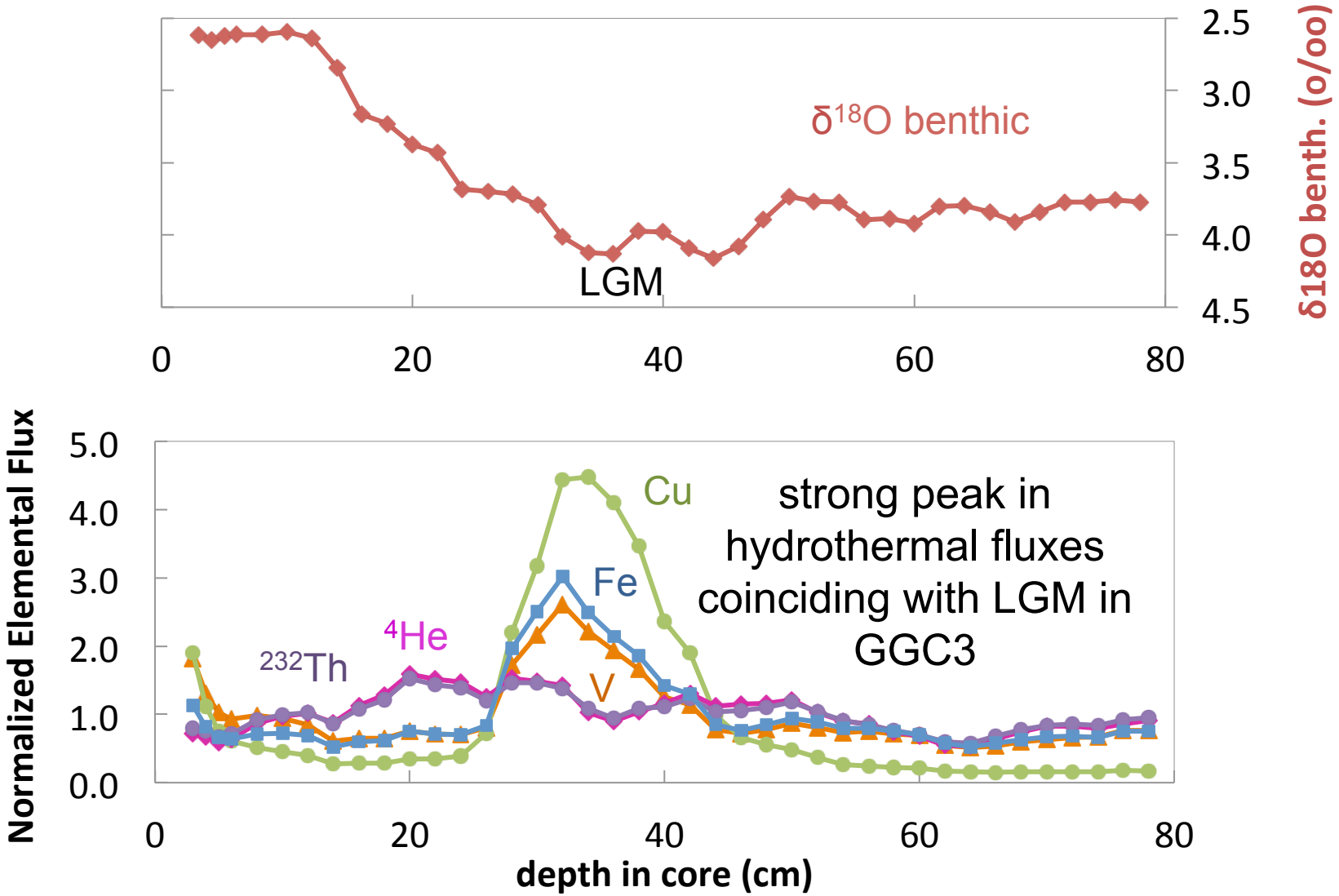
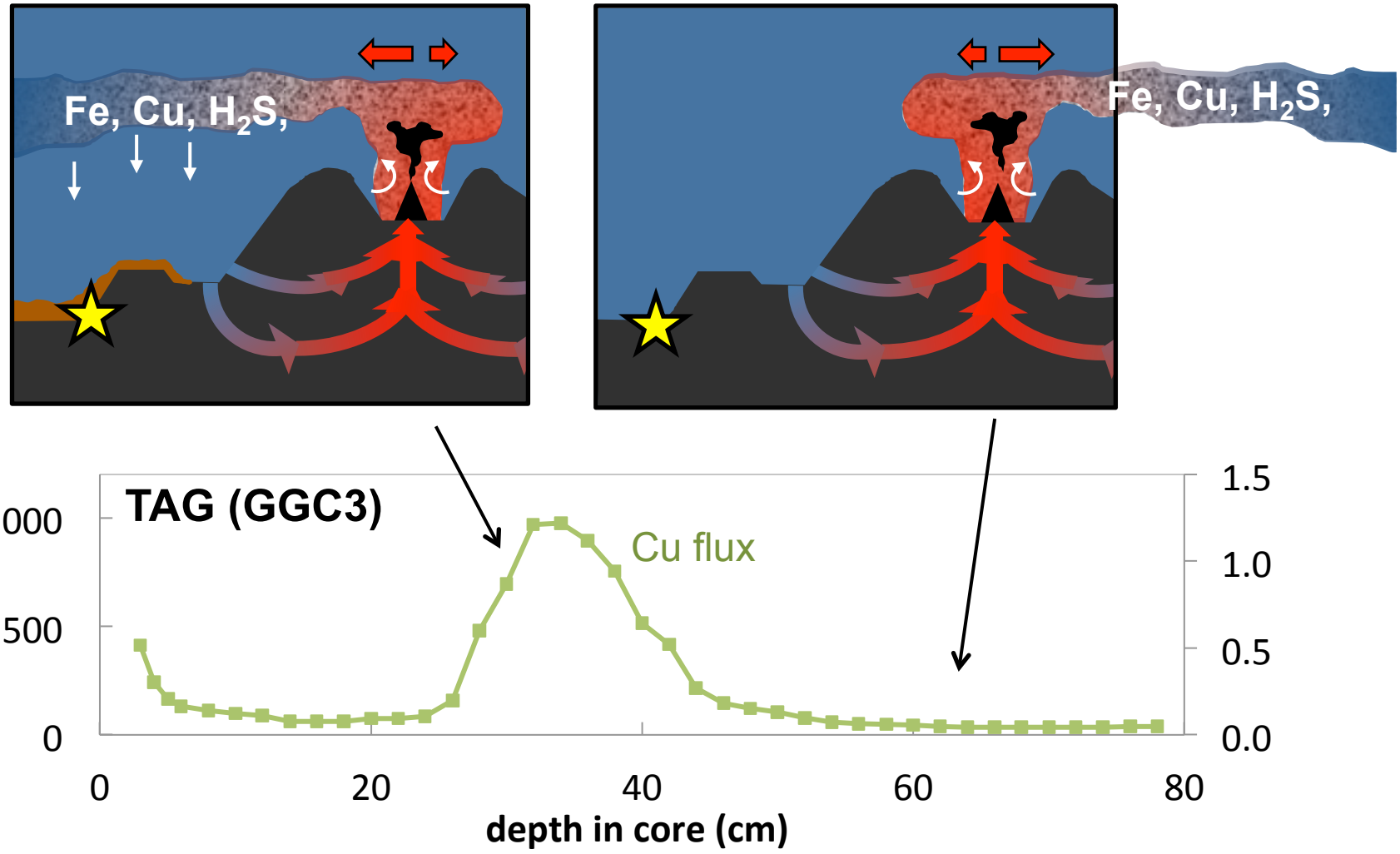
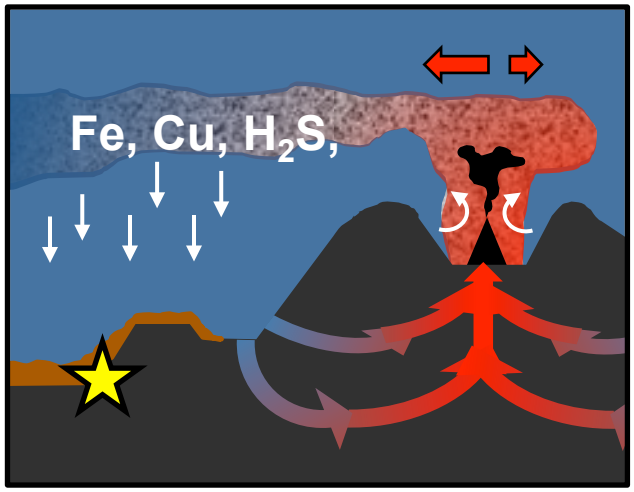


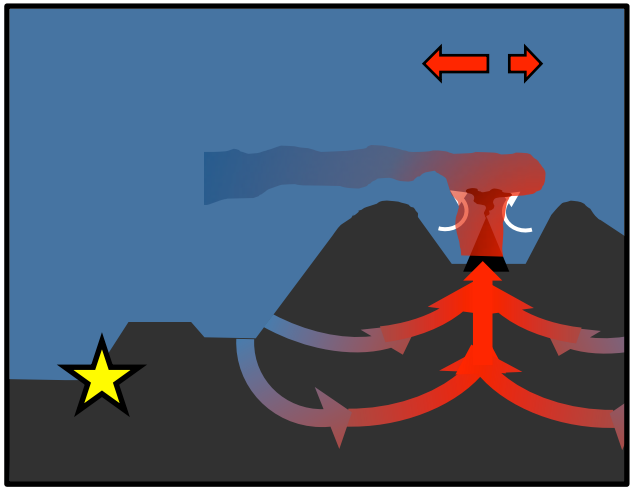
Hydrothermal Sed. Flux Variations: Local current shifts direction?

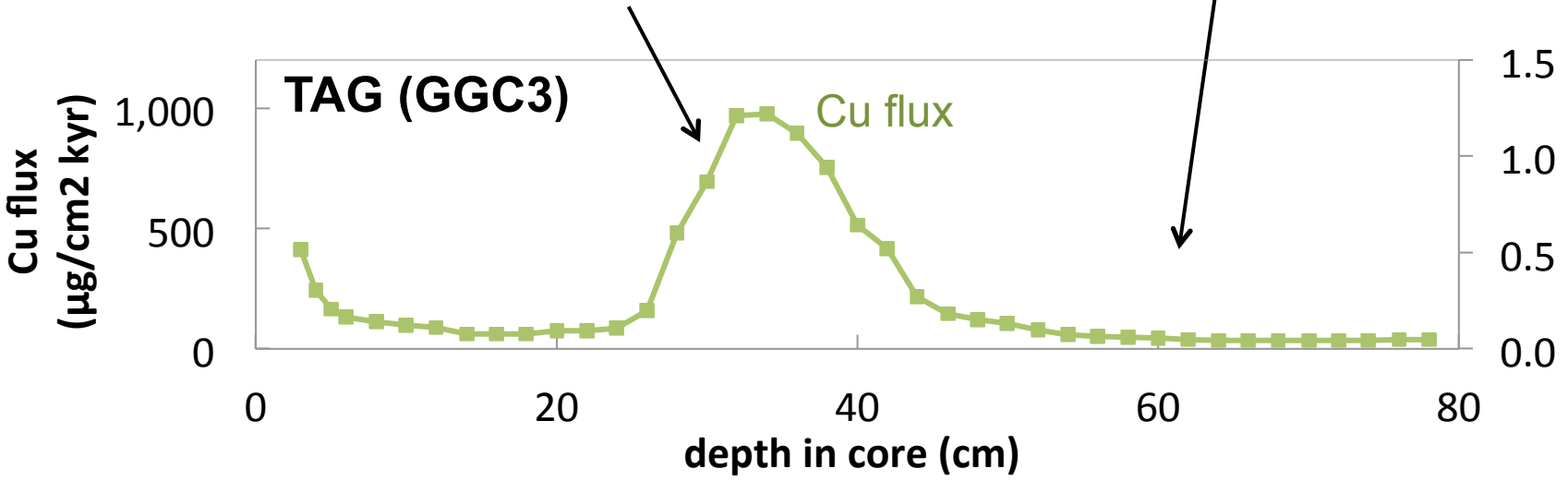


Would local current only shift during LGM and not otherwise?

Hydrothermal Sed. Flux Variations: Change in hydrothermal activity







We interpret the signal as a likely indication of increased hydrothermal activity near the TAG core

Conclusions:

No sign of hydrothermal sediment in Broken Spur core (GGC6)

Clear spike in hydrothermal accumulation during Last Glacial Maximum (LGM) at TAG

→ may record large increase in hydrothermal activity