Osmium Isotopes and Highly Siderophile Elements Establish Volcanism as Causing Younger Dryas Geochemical Anomalies ca. 13,000 CAL BP

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The Younger Dryas (YD) cooling event at 12.9±0.1 ka is proposed to have resulted from a bollide impact or airburst. Purported impact markers peak at or near the YD basal boundary layer at Northern Hemisphere locations. However, there is a lack of marker reproducibility and chronological control for many examined YD sites. Here, we report $^{187}Os/^{188}Os$ ratios and highly siderophile element (HSE: Os, Ir, Ru, Pt, Pd, Re) abundances in a well-dated sediment section at Hall's Cave, Texas, USA. Unradiogenic $^{187}Os/^{188}Os$ ratios of 0.12 to 0.42 were obtained in five horizons spanning above, within, and below the YD basal boundary layer. A previous study [1] found that surface films on spherules from the Younger Dryas site in Melrose, Pennsylvania have low $^{187}Os/^{188}Os$ ratios of 0.113 to 0.121. Two-endmember mixing between the spherule surface films and Hall's Cave sediments successfully reproduce the Hall's Cave unradiogenic $^{187}Os/^{188}Os$ ratios, indicating Melrose and Hall's Cave were modified by the same event(s). Mixing between chondrites or iron meteorites with upper continental crust do not duplicate the HSE abundances of the Hall's Cave unradiogenic Os samples. Instead, volcano gas condensates have HSE abundance patterns and ratios that overlap with these Hall's Cave samples. Therefore, the most likely explanation for the HSE and Os isotope systematics of the unradiogenic Os samples is episodic, distant volcanic emissions in the Northern Hemisphere being preserved in Hall's Cave sediments at and near the beginning of the Younger Dryas.

References

[1] Wu, et al. (2013) *Proc Natl Acad Sci* 110(38): E3557–E3566