

ISOTOPIC FRACTIONATION OF CHALCOPHILE ELEMENTS IN TEKTITES. F. Moynier¹, C. Koeberl², P. Beck³, and F. Jourdan⁴. ¹Department of Earth and Planetary Sciences, Washington University in St Louis, One Brookings Drive, St Louis, MO 63130, USA; ²Department of Lithospheric Research, University of Vienna, Althanstrasse 14, A-1090 Vienna, Austria; ³Laboratoire de Planetologie, Universite Joseph Fourier, CNRS/INSU, Bat. Physique D, BP 53, 38041 Grenoble cedex 9, France ⁴Western Australian Argon Isotope Facility, Department of Applied Geology & JdL-CMS, Curtin university of Technology, GPO Box U1987, Perth, WA 6845; Australia.

Tektites are terrestrial natural glasses produced during a hypervelocity impact of an extraterrestrial projectile onto the Earth's surface. The similarity between the chemical and isotopic compositions of tektites and terrestrial upper continental crust implies that the tektites formed by fusion of such target rock. Tektites are among the driest rocks on Earth. Although volatilization at high temperature may have caused this extreme dryness, the exact mechanism of the water loss and the behavior of other volatile species during tektite formation are still debated. Volatilization can fractionate isotopes, therefore, comparing the isotope composition of volatile elements in tektites with that of their source rocks may help to understand the physical conditions during tektite formation.

Interestingly, volatile chalcophile elements (Cd and Zn) seem to be the only elements isotopically fractionated by volatilization in tektites [1,2]. Here, we extended this study to Cu, another volatile chalcophile element, by measuring the Cu isotopic composition of 20 tektites from the four different strewn fields. All the tektites (except the Muong Nong-type) are enriched in the heavy isotopes of Cu ($1.99 < \delta^{65}\text{Cu} < 6.98$) in comparison to the terrestrial crust with no clear distinction between the different groups. Muong Nong-type tektites and a Libyan Desert Glass sample are not fractionated at all ($\delta^{65}\text{Cu} \approx 0$) in comparison to crustal composition. To refine the Cu isotopic composition of the terrestrial crust we also present data for 3 geological reference materials ($\delta^{65}\text{Cu} \approx 0$). The correlation of $\delta^{65}\text{Cu}$ with the Cu abundance probably reflect that the isotopic fractionation occurred by evaporation during heating.

A simple Rayleigh distillation cannot explain the Cu (and Zn) isotopic data. We have developed a more realistic model of evaporation of Cu and Zn from a molten sphere: during its hypervelocity trajectory, the molten surface of the tektite will be entrained by viscous coupling with air that will then induce a velocity field inside the molten sphere. This velocity field induces significant radial chemical mixing within the tektite that accelerates the evaporation process. Our model, albeit parameter dependent, shows that both the isotopic composition and the chemical abundances measured in tektites for both Cu and Zn can be produced by evaporation in a diffusion-limited regime.

References: [1] Wombacher, F et al., 2003. *Geochimica et Cosmochimica Acta*, 76, 4639-4654. [2] Moynier F. et al. 2009. *Earth and Planetary Science Letters*, 277, 482-489.