Composition and redox conditions in historic nuclear fallout

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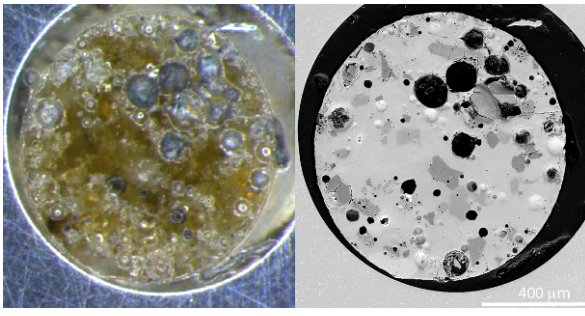
When testing ended in 1992, nearly 1 MCi of actinide activity was generated as a result of US underground nuclear weapons testing alone [1]. Credible modeling of radionuclide migration necessitates a thorough understanding of this source material. It was recently suggested from studies performed on Trinity debris that nearly all of the environmental Fe incorporated into fallout was reduced to ferrous forms [2]. In Trinity this is complicated by the metallic iron present from the tower and may not be representative of fallout from other tests.

Figure 1: Optical microscopy (left) and backscattered electron microscopy (right) of aerodynamic fallout glass.



In this study we combine XANES/XAFS, autoradiography, and SEM/EDS to characterize aerodynamic fallout from nuclear tests. Both U and Fe were characterized by XANES/XAFS to determine redox conditions in fallout from four nuclear tests. Autoradiography was used to map actinide concentration and correlate that data with major element composition as determined by SEM/EDS. This more complete description of the actinide material in nuclear fallout will aid in the modelling of radionuclide migration.

[1] Bowen et al. (2001) *LANL Report* LA-13859-MS [2] Giuli et al. (2010) *Geological Society of America Special Paper* **465**, 653-660