

### IRON OXIDATION STATE IN MICROTEKTITES BY HIGH-RESOLUTION XANES SPECTROSCOPY.

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We examined the iron oxidation state and coordination number in a number of microtektites from all three known strewn fields for which microtektites have been reported (namely, the North American, Ivory Coast and Australasian strewn fields). Also, a few microscopic glass spherules from the immediate post-impact fallback layer retrieved from a core drilled at the Bosumtwi impact crater (Ghana) were also analyzed.

The samples were studied by Fe K-edge high-resolution X-ray Absorption Near Edge Structure (XANES) spectroscopy, and  $K\alpha$ - or  $K\beta$ -detected XANES spectroscopy.

Despite the availability of geochemical studies on microtektites, very few studies exist of the Fe coordination number and oxidation state in such materials. As micro-tektites constitute a large fraction of the mass of the glass produced by a tektite-generating impact event, such studies are of great importance for a more complete study of impact-generated glasses and, in particular, to try to reconstruct the oxygen fugacity conditions prevailing during impact melt formation.

The XAS data have been collected at the ID26 beamline of the ESRF storage ring (Grenoble, F) using a Si (311) monochromator and with a beam size at the sample of 55 x 300  $\mu\text{m}$ . The pre-edge peaks of our XANES spectra display well discernible variations in intensity and energy, which are indicative of significant changes in the Fe oxidation state.

In the Australasian and Ivory Coast microtektites all Fe is divalent. Small components in the pre-edge peak are detected related to  $\text{Fe}^{3+}$  at well below 10 mole % level. North American microtektites display varying  $\text{Fe}^{3+}/(\text{Fe}^{2+} + \text{Fe}^{3+})$  ratio ranging from 0 to 0.5. All data plot along a trend, falling between two mixing lines joining a point calculated as the mean of a group of the tektites studied so far (consisting of 4- and 5- coordinated  $\text{Fe}^{2+}$ ) to  $^{44}\text{Fe}^{3+}$  and  $^{56}\text{Fe}^{3+}$ , respectively. Thus, the XANES spectra can be interpreted as a mixture of  $^{44}\text{Fe}^{2+}$ ,  $^{56}\text{Fe}^{2+}$ ,  $^{44}\text{Fe}^{3+}$  and  $^{56}\text{Fe}^{3+}$ . There is no evidence for six-fold coordinated Fe; however, its presence in small amounts cannot be excluded from XANES data alone.

Bosumtwi glass micro-spherules display small variations in the pre-edge peak shape but contain essentially only divalent Fe. It is somewhat surprising that the Bosumtwi glasses are relatively reduced, because proximal impact glasses often are not as reduced as distal ones.

The relatively high  $\text{Fe}^{3+}/(\text{Fe}^{2+} + \text{Fe}^{3+})$  ratio in North American microtektites poses a problem regarding the mechanism of impact melt reduction. No obvious relationship is evident between Fe oxidation state and glass composition. Possibly several parameters affect Fe oxidation state, including target rock type, marine/vs continental target, amount of energy released, and mass of produced glass.