

OXYGEN ISOTOPE VARIATION, MOSSBAUER SPECTRA OR IRON OXIDATION AND VOLATILE CONTENT OF TEKTITE GLASSES FROM THE CRETACEOUS-TERTIARY BOUNDARY, HAITI; N. Oskarsson, Nordic Volcanological Institute, Reykjavik, Iceland; M. Steinberg and Ph. Pradel, Laboratoire de Geochimie Sedimentologie, Universite d'Orsay, 91405 Orsay, France; O. Helgason, Science Institute, Reykjavik, Iceland; H. Sigurdsson and S. D'Hondt, Graduate School of Oceanography, University of Rhode Island, Narragansett, U.S.A.

Tektite glasses in the Beloc section of the KT boundary in Haiti display a range in composition between a dominant black high-silica glass and a subordinate yellow lime-glass (up to 30 % CaO). Sigurdsson et al. (1991) have proposed a derivation of these two glass types by impact-generated fusion of continental crust of broadly andesitic composition and of carbonate-rich sediment or marl, respectively. Analyses of $\delta^{18}\text{O}$ in the two glass types support this hypothesis, giving $\delta^{18}\text{O}$ SMOW of about +7‰ and +13.5‰ in the black and yellow glasses, respectively. This range, which is wider than observed for all other tektites combined, supports a crustal and marine origin of the glasses. The low $\delta^{18}\text{O}$ ratio in the andesite-like black glass is similar to that in pristine igneous rocks or relatively unaltered crustal rocks. The $\delta^{18}\text{O}$ data thus reveal the terrestrial sources of the glasses and put geochemical constraints on the nature of the geological strata which suffered fusion.

The ferric/ferrous ratio in the black siliceous glasses was determined by Mossbauer spectroscopy. The low-velocity Mossbauer spectrum shows the typical broad line doublet of amorphous materials and can be fitted satisfactorily with Fe+3 doublet with isomer shift of 0.32 mm/s and quadrupole split of 1.18 mm/s and with two Fe+2 doublets with identical isomer shifts of 1.05 mm/s and quadrupole splits of 1.05 and 2.18 mm/s, respectively. The high velocity Mossbauer spectrum confirms the absence of magnetite crystals larger than 10 nm diameter, which indicates a very high quench rate and quench temperature of the glass, unknown in volcanic glasses. Calculated Fe+3/Fe+2 atomic ratio for the tektite glass is 0.7 ± 0.1 . According to Helgason et al (1989), this ratio corresponds to log $f\text{O}_2$ of about -3. Thus the tektite glass is considerably more oxidized than glasses formed during magmatic processes.

Dissolved volatiles in the glass were determined as 0.04 wt.% by pyrolysis/mass spectrometry of a 106 mg bulk sample dried in vacuum at 450°C. The glass is degassed (69 mol% H_2O and 31 mol% CO_2) in the temperature interval 1000-1200°C, indicating its quenching from a melt well above the liquidus temperature and at very low partial pressures of the dissolved species. According to solubility data (Holloway and Jakobsson, 1986), this corresponds to a confining gas phase of maximum H_2O content of 18 mol%, and a minimum CO_2 content of 82 mol% at 1200°C.

Based on the dissociation reaction of H_2O and CO_2 and assuming ideal behaviour, the confining gas phase (82% CO_2) reaches log $f\text{O}_2$ of -3 within the temperature interval 1450-1700°C. This indicates that the high oxidation state of the iron in the impact-fused tektite glass was controlled by the CO_2 -dominated gas cloud at about 1600°C prior to fallout and the rapid quenching of the melt droplets.