High resolution Cs-concentration mapping by X-ray CT

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We report the first success of nondestructive, three-dimensional, and high resolution (~20 micron for space and ±2.5 wt% for value) mapping of cesium (Cs) concentration by X-ray CT [1]. This work was performed at BL20B2 of SPring-8 and based on a "subtraction method", using two energies just below and above an absorption edge of the target element. Although the subtraction method is often used as a qualitative imaging technique of element distribution, we tried to derive quantitative information of element concentration with some corrections. First, nonlinear relation between observed linear attenuation coefficients (LACs) and theoretical LACs was corrected [2]. Secondly, difference of mass attenuation coefficients (MACs) at each slice due to vertical energy shift of an X-ray beam (Fig. 1) was corrected using a homogeneous standard material (Cs-bearing solution). With these corrections and equation in Fig. 1, we could obtain the Cs-concentration maps close to a two-dimensional map acquired by an electron probe X-ray microanalyzer (EPMA).

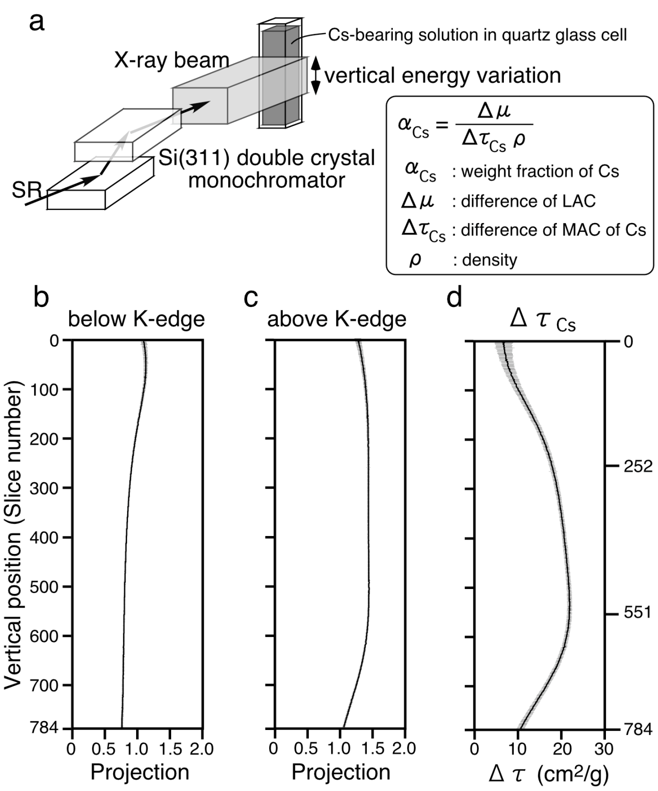

Fig.1 Effect of the variation of X-ray energy. The vertical energy shift within an X-ray beam (a) affects the projections of Cs-bearing solution (b, c) and the difference of MAC of Cs between below and above the absorption edge (d). Horizontal variation (gray error bars) in each slice is much smaller than the vertical one.

References: [1] S. Ikeda et al., Am. Mineral. **89**, 1304-1313 (2004). [2] A. Tsuchiyama et al., Am. Mineral. **90**, 132-142 (2005).