"GOING NANO": TECHNOLOGICAL ADVANCES IN EDS/ EBSD ANALYSIS AND THEIR MINERALOGICAL APPLICATIONS

T. Salge[1] and D. Goran[1]. [1] Bruker Nano GmbH, Schwarzschildstraße 12, 12489 Berlin, Germany. tobias.salge@bruker-nano.de

Within the last decade, SDD systems have become state of the art technology in the field of energy-dispersive spectroscopy (EDS). The main characteristic of the SDDs is their extremely high pulse load capacity of up to 750,000 counts per second at good or reasonable energy resolution (<123 eV Mn-Kα, <46 eV C-Kα at 100,000 cps). Compared to crystal wavelength dispersive X-ray spectroscopy (WDS), EDS provides better geometric collection efficiency and overall quantum efficiency [1]. This and the high pulse throughput capability of the SDD result in a significant faster signal collection compared to WDS. The inferior energy resolution of SDDs that causes peak overlaps can be compensated by deconvolution. Even for strong overlaps it is possible to deconvolve element lines in order to determine peak intensities using an extended atomic database. The latter has been updated by Bruker with a focus to line families in the low energy range (E <1 keV) and M lines leading to over 250 additional lines in the energy range of 0–4 keV [2]. These properties in conjunction with electron backscatter diffraction (EBSD) technique, modern data processing and automated stage control opens a range of innovative analysis options, not only high speed mapping but also hyperspectral imaging techniques.

This paper presents mineralogical applications with the QUANTAX system with EDS SDD and EBSD detector using the options described above: (1) Drill core analysis of a Chicxulub impact ejecta sequence from the K/Pg boundary at ODP leg 207 [3] using fast, high resolution element maps. (2) Detection of monazite in granite by the Maximum Pixel Spectrum function [4]. (3) Distribution of elements with overlapping peaks by deconvolution at the example of rare earth elements (REE) in zoned monazite. (4) Automated mineral particle search by feature analysis. (5) Detection of andradite garnet in the lower Yaxcopoil-1 impact breccia by high resolution composite maps [5]. (7) EBSD studies with examples of impact-induced, recrystallized carbonate melts [6] and iron meteorites.

In addition, continuing technological advances require the elemental analysis of increasingly smaller structures in many fields, including mineralogy and nanotechnology in general. It will be demonstrated that using low accelerating voltages, the element distribution of nanometer-sized structures in bulk samples can be displayed in a short time due to optimized signal processing and solid angle. Peaks composed of contributions from several overlapping elements (e.g. N-K and Ti-L) can be deconvolved. Another example is the analysis of taenite [γ-(Ni,Fe)] lamellae in iron meteorites by deconvolution of Fe-L, Ni-L and Co-L.

Acknowledgements: We thank P. Schulte, A. Deutsch, ODP, L. Hecht and A. Kearsley for providing samples.

References: [1] Goldstein et al. 2003, *Scanning electron microscopy and X-ray microanalyis*. Kluwer Academic/ Plenum Publishers, New York. [2] Aßmann A. and Wendt M. 2003, *Spectrochim. Acta* 58:711-716. [3] Schulte P. et al. 2010 *Science* 327:1214-1218. [4] Bright D.S. and Newbury D.E. 2004 *Journal of Microscopy* 216:186-193. [5] Newsom H. E. et al. 2010. Abstract #1751 *41th LPSC*. [6] Deutsch et al. 2010, Forthcoming abstract, *IMA2010*, 21-27 August 2010, Budapest.