Fossil sulfide bacterial mats from Bleiberg Zn-Pb deposit, Austria

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We present combined micro-, nano-textural and isotopic evidence supporting the crucial role of biogenic processes in formation of Triassic carbonate-hosted Pb-Zn deposits in the Eastern Alps (Bleiberg). Fossil sulfide bacterial mats form 0.5 to 3mm thick and several cm long discontinuous wavy bands overlain by finely banded botryoidal sphalerite layers. The mats are composed of spherical ZnS aggregates (90-180 µm) having $\delta^{34}S$ values from –30.5 to –26.4 ‰. The aggregates are composed of ZnS nano-spheres (10-90 nm); the latter are identical to those documented from mixed calcite-sphalerite peloids [1] and similar to nano-textures observed in recent bacterial biofilms made by Desulfobacteriaceae in the flooded Zn-Pb Piquette mine [2]. The nano-globules are the metabolic products of sulfate-reducing microorganisms. Agglomerations of nano-globular sphalerite from Bleiberg display S isotope values ranging from –28.84 to –27.91 ‰ and support the model that the ZnS nano-spheres formed *in situ* by bacteriogenic reduction of seawater sulfate.

The larger spherical ZnS aggregates formed by replacement of peloids (bacterial colonies composed of a Zn-calcite core and serrated ZnS rim) and/or by coalescence of nano-scale ZnS spheres secreted by sulfate reducers. The increase in size of ZnS globules was promoted by self-assembly-based coarsening mechanisms driven by minimization of surface energies and unbalanced electric charges [3].

[1] Kucha *et al.* (2005) *Mineral. Deposita* **40**, 123–126. [2] Labrenz *et al*. (2000) *Science* **290**, 1744-1747. [3] Banfield *et al*. (2000) *Science* **289**, 751-754

New PGAI-NT and PGAA at FRM II for geological samples: Test measurements on Allende meteorite

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Neutron Activation Analysis (NAA) is a well established method for non-destructive determination of elemental composition of geological samples. However, concentrations of light elements like Hydrogen, Boron or Sulphur can not be derived by NAA. Prompt Gamma Neutron Activation Analysis (PGAA or PGNAA) is the method of choice in this case to perform non-invasive investigations. The next advantage of PGAA is the rapidity: the irradiation takes max. few hours, the data analysis can be performed on the day of measurement and the sample is not activated for a long time. Furthermore, the sample needs no preparation for PGAA measurement.

Recently, we have tested a new set-up for position sensitive determination of elements in sample volume, so called PGAImaging (PGAI). To visualize and define the measured position, neutron tomography setup (NT) was installed and used. We present here the methods and the results of the test measurements on a piece of Allende meteorite (220 mg) [1].

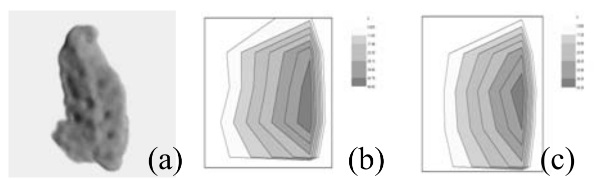

Figure 1: (a) Neutron tomography of the Allende meteorite (220 mg) (b) 2D distribution of Fe (c) 2D distribution of Si

	H	Si	S	Cr	Fe	Ni
FRM II [$‰_w$]	0.343 ± 0.004	14.81 ± 0.38	0.930 ± 0.025	0.357 ± 0.010	23.95 ± 0.46	0.879 ± 0.026
Buda [$‰_w$]	0.257 ± 0.006	14.68 ± 0.34	0.913 ± 0.021	0.334 ± 0.008	23.85 (norma-lized)	0.868 ± 0.015

Table 1: Concentration for selected elements measured with the PGAA technique at FRM II [1] and compared to the Budapest PGAA facility [2].

[1] Canella *et al*. (2009) *Appl. Rad. Isotopes*, submitted.
[2] Kudejova (2005) Ph.D. thesis, University of Cologne