MULTIELEMENT ANALYSIS OF INTERPLANETARY DUST PARTICLES USING TOF–SIMS; **T. Stephan,[1,2,3] W. Klöck,[2] E. K. Jessberger,[3] H. Rulle,[1] and J. Zehnpfenning;[1]** [1]Physikalisches Institut der Universität Münster, Wilhelm–Klemm–Straße 10, D–4400 Münster, Germany; [2]Institut für Planetologie der Universität Münster, Wilhelm–Klemm–Straße 10, D–4400 Münster, Germany; [3]Max–Planck–Institut für Kernphysik, Postfach 103980, D–6900 Heidelberg, Germany.

Sections of three stratospheric particles, U2015G1, W7029*A27, and L2005P9, respectively, were analyzed with TOF–SIMS (Time–Of–Flight Secondary–Ion–Mass–Spectrometry) continuing our efforts to investigate the element distribution in IDPs with high lateral resolution [1] ($\sim$ 0.2 μm), to examine possible atmospheric contamination effects [2], and to further explore the abilities of this technique for element analysis of small samples. The samples, previously investigated with SXRF (synchrotron X–ray fluorescence analysis) [3,4], are highly enriched in Br (Br/Fe: 59 $\times$ CI, 9.2 $\times$ CI, and 116 $\times$ CI, respectively). U2015G1 is the IDP with the by far highest Zn/Fe–ratio (81 $\times$ CI) ever reported in chondritic particles [3].

Secondary ion images of all three samples were obtained by rastering the sample with a 30 keV Ga^+ primary ion beam. Positive and negative secondary ions were measured successively, different ion species with the same polarity simultaneously. For a more quantitative analysis selected areas of the sample were analyzed more extensively. To calculate element ratios from the detected ion signals, SIMS sensitivities for a number of elements were determined. Fig. 1 shows the results of a TOF–SIMS analysis of a homogeneous glass standard (Lunar Analog Glass). The resulting sensitivities are comparable with those in the literature [5] and were used to calculate the element ratios shown in Fig. 2.

U2015G1 consists of two well separated units. From previously reported analysis of the sample we classified these as fine–grained ($\sim$ 20 nm) Fe–oxide intergrown with an presently unidentified hydrous phase and more coarse–grained (μm) smectite–like phyllosilicate [1]. We found the halogens strongly concentrated in the fine–grained material. This was interpreted as a result of an interaction of halogen–containing aerosols with individual Fe–rich grains [1]. During the present analysis $\sim$ 3 μm of the particle were sputtered away and most of the halogens were lost supporting the assertation that they are concentrated in a small region of the particle. Especially no Br was left for a quantitative analysis. Zn, which had not been measured in the previous study, is highly concentrated in a few at present mineralogically unidentified regions of the particle, 0.5 – 1 μm in diameter, respectively. No correlation with halogens was found. This leads to the

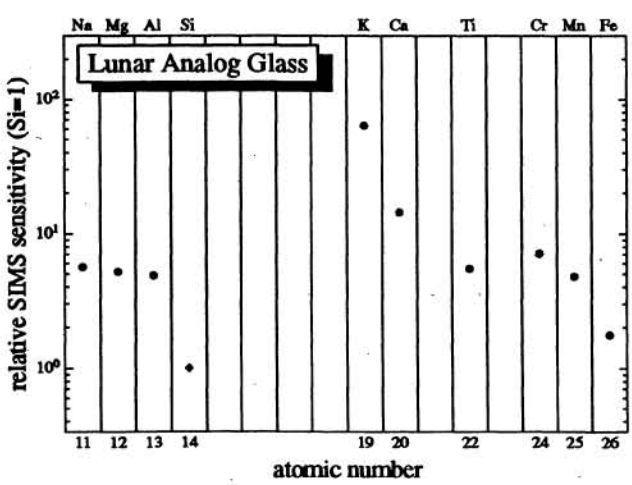

Figure 1: Relative SIMS sensitivities for positive secondary ions relative to Si. The sensitivities were determined by a TOF–SIMS measurement of a glass standard (Lunar Analog Glass) with well known composition.

interpretation that, if the Zn enrichment is a result of contamination, the incorporation process is completely different from that for the halogens, or, more likely, Zn in the particle is pristine and the enrichment is a result of a, on a μm–scale, inhomogeneous distribution of Zn in solar system material. The results of our analysis of element ratios for particle U2015G1 is shown in Fig. 2. A highly undulating abundance pattern with deviations from chondritic ratios up to a factor of 54 is apparent.

W7029*A27 shows CI abundances within a factor of 2 for most elements (Fig. 2). No Br rich phase was obvious in our section of the particle.

The section of **L2005P9** we analyzed was contaminated during sample handling with terrestrial material mainly consisting of Na, K, Ca, and Cl. Besides this contamination our TOF–SIMS analysis yields chondritic abundances for most elements (Fig. 2). Br was found only in the contamination. The extremely high Br content reported by [4] has vanished as with the other IDPs, and was neither found in the contamination nor in the extraterrestrial particle.

The fact that extreme Br–enrichments are *present* initially in whole rock studies and are *absent* in subsequent detailed analyses with high spatial resolution deserves further studies but in any case demonstrates that Br is distributed highly inhomogeneously and is therefore possibly not indigenous to the IDPs.

References: [1] Stephan T. *et al.* (1992) *Meteoritics 27*, 292. [2] Jessberger E. K. *et al.* (1992) *EPSL 112*, 91. [3] Sutton S. R. and Flynn G. J. (1988) *Proc. 18th LPSC*, 607. [4] Thomas K. L. *et al.* (1992) *LPS XXIII*, 1427. [5] Lange G. *et al.* (1986) *LPS XVII*, 456.

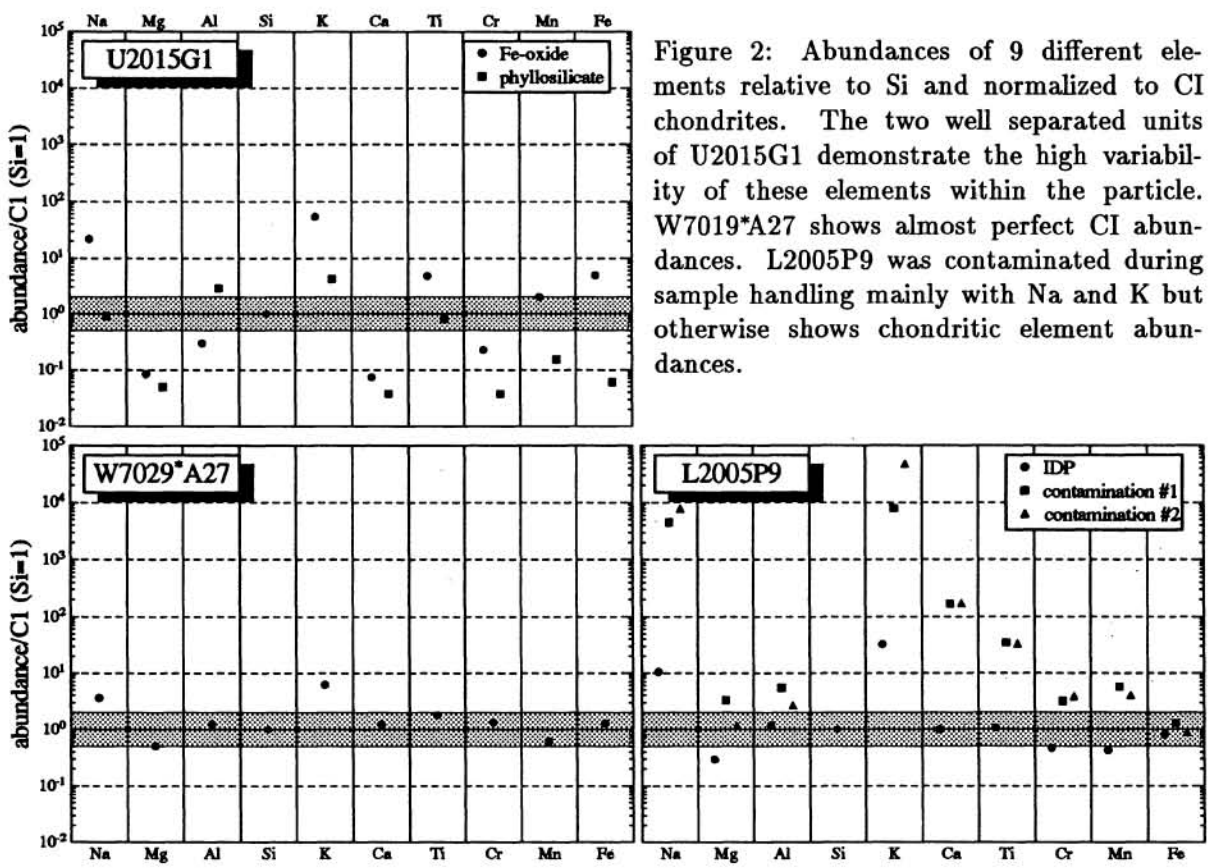

Figure 2: Abundances of 9 different elements relative to Si and normalized to CI chondrites. The two well separated units of U2015G1 demonstrate the high variability of these elements within the particle. W7019*A27 shows almost perfect CI abundances. L2005P9 was contaminated during sample handling mainly with Na and K but otherwise shows chondritic element abundances.