POLYCYCLIC AROMATIC HYDROCARBONS IN ALLAN HILLS 84001 – A RESULT OF TERRESTRIAL CONTAMINATION? T. Stephan and E. K. Jessberger, Institut für Planetologie, Interdisciplinary Centre for Electron Microscopy and Microanalysis, Wilhelm-Klemm-Str. 10, 48149 Münster, Germany (stephan@uni-muenster.de).

Introduction: Since the first observation of polycyclic aromatic hydrocarbons (PAHs) in the Martian meteorite Allan Hills 84001 [1], their origin and possible role as proposed biomarkers for past life on Mars has been discussed controversially [2–11]. In continuation of our previous work [6–9, 11], which seem to disprove a suggested correlation of PAHs with carbonate globules—carriers of proposed nanofossils [2]—we focussed our efforts on two major questions: (a) Is it possible to explain the lack of PAH enrichments on carbonates by instrumental effects, namely matrix effects during time-of-flight secondary ion mass spectrometry (TOF-SIMS) analysis? (b) Do the PAHs in ALH 84001 show any correlation that might help to shed light on their origin?

The Contamination Experiment: To investigate possible matrix effects of PAHs on mineral surfaces during primary ion bombardment in the SIMS process, we contaminated a small piece from ALH 84001 with a specific PAH (coronene, $C_{24}H_{12}$) and analyzed the resulting PAH distribution on its surface with imaging TOF-SIMS. Matrix effects in SIMS are well known. They can feign high or low concentrations of an ion species since the ionization efficiency strongly depends (up to several orders of magnitude) on the chemical neighborhood of an atom or molecule.

However, from the TOF-SIMS results we infer that these effects are not decisive for the determination of PAHs in ALH 84001. Orthopyroxene, feldspathic glass, and carbonates showed no substantial differences in their PAH signals.

Search for Correlations: To elucidate the origin of PAHs in ALH 84001, TOF-SIMS is predestined not only from its lateral resolution of ~0.2 µm but also from the quasi-simultaneous detection of all secondary ions with one polarity. This allowed a more detailed investigation on possible correlations.

All freshly fractured surfaces of ALH 84001 investigated in our TOF-SIMS study surprisingly showed lead being present in the mass spectra. Although statistical errors are relatively high (~5 %) due to the low count rates, the relative intensities of $^{206}Pb^+$, $^{207}Pb^+$, and $^{208}Pb^+$ (1:0.84:2.06) in the mass spectra clearly suggest a terrestrial origin of lead. It agrees well with lead isotopic ratios observed for modern ocean sediments (1:0.83:2.06 [12]), representative for lead contamination in Antarctic meteorites including ALH 84001 [13,14]. Similar to the PAHs, lead showed no preference in its lateral distribution for any mineral phase, but a general trend of high lead concentration in areas with high PAH abundances was observed.

Conclusions: Our contamination experiment clearly demonstrates that matrix effects during SIMS analysis of PAHs in ALH 84001 cannot account for different results from TOF-SIMS and microprobe two-step laser mass spectrometry (μL^2MS) [1,2,5] measurements. Since the μL^2MS results are highly ambiguous [1] and only TOF-SIMS provides a sufficient lateral resolution, a *spatial association* of PAHs and carbonates [2] now is disproved.

The general trend of lead contamination in areas with high PAH abundances supports the idea that at least some PAHs in ALH 84001 result also from contamination, probably during residence in the Antarctic ice [3,4,10].

References: [1] Thomas K. L. et al. (1995) *LPS XXVI*, 1409–1410. [2] McKay D. S. et al. (1996) *Science, 273*, 491–504. [3] Becker L. et al. (1997) *GCA, 61*, 475–481. [4] Jull A. J. T. et al. (1998) *Science, 279*, 366–369. [5] Clemett S. J. et al (1998) *Faraday Discussions, 109*, 417–436. [6] Stephan T. et al. (1998) *LPS XXIX*, Abstract #1263. [7] Stephan T. et al. (1998) *MAPS, 33*, A149–A150. [8] Stephan T. et al. (1998) *LPI Contrib. No., 956*, 50–51. [9] Stephan T. et al. (1999) *LPS XXX*, Abstract #1569. [10] Becker L. et al. (1999) *EPSL, 167*, 71–89. [11] Stephan T. and Jessberger E. K. (2000) *LPS XXXI*, Abstract #1326. [12] Ben Othman D. et al. (1989) *EPSL, 94*, 1–21. [13] Lugmair G. W. and Galer S. J. G. (1992) *GCA, 56*, 1673–1694. [14] Borg L. E. (1999) *Science, 286*, 90–94.