MEASUREMENTS OF LIGHT NOBLE GASES IN THE GENESIS POLISHED ALUMINUM COLLECTOR. A. P. Meshik[1], Y. Marrocchi[1], C. M. Hohenberg[1], O. V. Pravdivtseva[1], J. C. Mabry[1], C. Olinger[2], D. S. Burnett[3], J. H. Allton[4], R. Bastien[4], K. M. McNamara[5], and E. K. Stansbery[5]. [1]Washington University, Physics Department, St. Louis, MO 63130 (am@physics.wustl.edu), [2]Los Alamos National Laboratory, [3]Geology 100-23, CalTech, Pasadena, CA91125, [4]Lockheed Martin c/o NASA/Johnson Space Center, Mail Code KT, Houston, TX 77058, [5]NASA/JSC, Mail Code KA, Houston, TX 77058.

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Introduction: A 245cm^2 surface of polished Al 6061 T6 alloy was attached to the science canister for the purpose of thermal shielding and collecting bulk solar wind noble gases [1]. The details of preparation of this "kidney-shaped" collector, its flight conditions, recovery, and subdivision will be discussed in the accompanying presentation [1]. Different parts of this collector experienced various degrees of contamination (both during flight and in landing) and mechanical damage during the landing in Utah, September 8, 2004. In January 2005, just after the initial subdivision, the most damaged part #50684.5 (Fig. 1) were delivered to St. Louis in order to answer the following questions: (1) Is it possible to use laser ablation to recover solar noble gases from this mechanically damaged collector, (2) Has the mechanical stress caused by the shock during the landing affected noble gas retention (3) Does surface contaminate removal affect the shallowly implanted noble gases. The polished Al-collector 50684 (Fig. 1) has both severely curved and relatively flat areas, and also heavily contaminated and relatively clean areas (Fig. 1), making this sample most suitable to address these questions.

Fig. 1. "Kidney" collector after initial subdivision.

Further subdivision: Fragment 50684.5 was further subdivided at Washington University using clean MidWest snipers (part # P127S) acquired from Sears. These snipers tend to curl the cut pieces, which we attempted to straighten with some success. Fig. 2 shows two sub-samples 50684,5A and 50684,5B cut from the original 50684,5.

Fig. 2. Further subdivision of sample 50684.5

Fragments A and B were divided once more, giving us 5 relatively flat samples (Fig. 3).

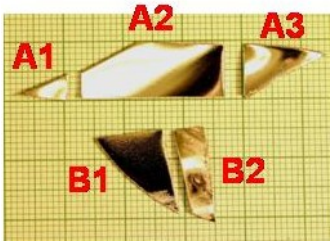

Fig. 3. Final subdivision of kidney sample 50684.5.

Noble gas extraction: The low-blank extraction of noble gases from this material is not a trivial task. For the high-abundance noble gases (He, Ne and, to some extent, Ar) total pyrolisis works just fine, but for the low-abundance heavy noble gases, Xe and Kr, the procedural blank is unacceptably high. We cannot use laser ablation with the long wavelength IR-laser, as we do for Aluminum on Sapphire Collectors, because of poor surface coupling of the 1064 nm beam and little depth control on the highly polished surface of the Al–collector. We, therefore, used a frequency quadrupled Nd-YAG laser (Continuum 6030) operating at 30 Hz at 266nm for the Al kidney. The Pockels cell Q-switch for this laser generates short (~ 7 ns) pulses of about 16 mJ each. The pulse width assures that energy is transmitted to the metal in a time short compared with thermal diffusion, explosively excavating Al in the laser pit without heating the surrounding metal. The intensity/pulse delivered to the surface is controlled in two ways. The first one adjusts the total power using a polarizing cube beamsplitter. The second method varies the intensity (power/area) by slightly defocusing the beam when needed. The beam first goes through the beam expander, then is reflected by a 45-degree dychroic mirror and finally focused at

slightly varying positions below the Al-collector surface (controlled defocusing). Using these two methods we can easily control the amount of Al removed (from < 60 Å to > 1050 Å at full power but still defocused) and consequently measure concentration and isotopic composition as a function of depth for implanted SW He and Ne.

Mass-spectrometry: We encountered two problems specific for high precision Ne analysis in solar wind collectors: First is the NeH problem, with significant ^{20}NeH interference at ^{21}Ne. Second is pressure dependence where the quantity of He released from the collector might lead us into the region of pressure nonlinearity of the GS-61 ion source.

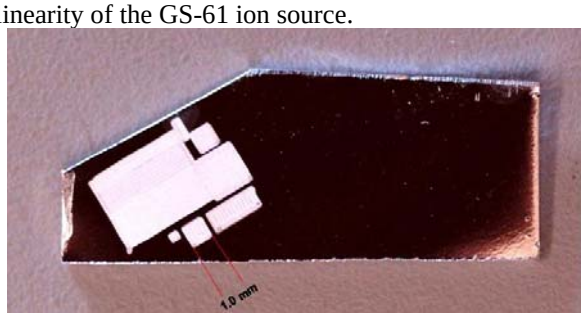

Fig. 4. Partially ablated fragment 50684.5A2 of the Genesis Polished Aluminum Collector. White rectangles are degassed areas, the dark area still contains implanted solar wind. The rastered areas did not contain impact craters >10 μm.

These two problems were addressed by simulating actual conditions in calibrations. Here we report He and Ne results from laser extractions of 3 small areas of fragment A2 (bottom of Fig. 4). The first 2.5mm^2 area was rastered 5 times, incrementally increasing the intensity and decreasing the area to avoid edge effects. Other areas, 0.1 and 1mm^2 were rastered with full laser power to verify total extraction and explore any residual pressure dependence effects on apparent Ne and He compositions and concentrations.

Results: Incrementally increased laser power resolves the Ne depth profiles (Fig. 5). Comparison of the amounts released/step with TRIM-simulated implantation profiles indicates the 5 steps degassed 63, 550, 800, 1050 and >1050Å respectively. Summation of the 5 steps provides the same compositions as the two total extractions. The weighted average of the three can be considered as our current best estimate for bulk solar wind Ne, which continues to be refined. And the measurements do demonstrate depth dependent resolution of noble gases from polished Al. This verifies the procedure we will use for the analyses of heavy noble gases.

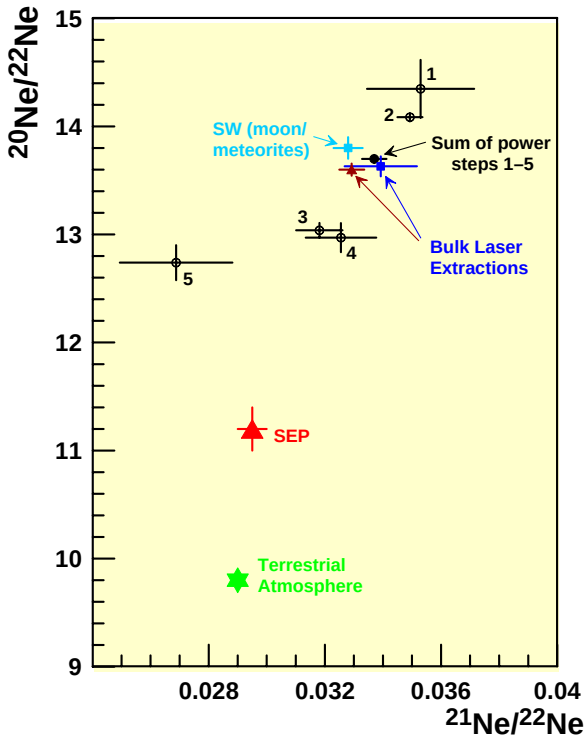

Fig. 5. Ne isotopic composition in the Al-collector compared with known Ne components. Numbers 1-5 indicate the subsequent power steps.

Table 1. Ne composition from Genesis, three different areas of the sample of polished aluminum 50684.5A2 compared with other results [2].

Source	^{20}Ne/^{22}Ne	^{21}Ne/^{22}Ne
Apollo foils	13.7 ± 0.3	0.0333 ± 0.0044
SOHO	13.8 ± 0.7	0.0314 ± 0.0080
Moon/meteorites	13.8 ± 0.1	0.0328 ± 0.0005
Genesis polished Al-collector areas of 2.5, 1.0, and 0.1 mm^2 (this work).	13.70 ± 0.04 13.61 ± 0.06 13.62 ± 0.09	0.0337 ± 0.0004 0.0329 ± 0.0004 0.0339 ± 0.0012

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References: [1] Allton J. H., *et al.* (2005) *LPSC XXXVI*, Abstract #1806 [2] Geiss J. et al (2004) Space Science Review 110: 307-335.