Sample preparation for AMS astrophysics projects – Size does (not) matter

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The determination of long-lived radionuclides by means of accelerator mass spectrometry (AMS) is usually outstandingly successful when an interdisciplinary team comes together. The "heart" of AMS research is of course an accelerator equipped with sophisticated ion sources, analytical tools and detectors run by experienced and ambitious physicists [e.g. 1-3]. Setting-up and further developing AMS systems is one of the most interesting and challenging topics. The reputation to be reached here is the greatest uniqueness of analysis possible, lowest detection levels, and/or most reliable data world-wide.

For sure, another primary pillar of AMS research is based on the questions addressed within fundamental and applied research. "How have supernovae explosions influenced Earth, our solar system and beyond?" [e.g. 4] or "How does the Earth's surface and environment respond to earthquakes, climate change and anthropogenic influences?" [e.g. 5] are just two examples of high-quality studies.

However, somehow in-between there are groups of hidden figures like people developing software for data analysis or performing the required chemical sample preparation for AMS. These often unacknowledged individuals do crucial work for the overall outcome of the studies.

Chemists can spend weeks and months trying (and failing) on sample preparation before they find a "safe way" and start the actual work on the most valuable sample material, repeat all over again the same "recipe" for hundreds of samples, or train non-chemists the secrets of their successful recipes. Nevertheless, interdisciplinary AMS work can also be very exciting for a chemist: touching (and destroying) samples from outer space, the deep ocean or (currently) frozen places like Antarctica is quite thrilling. But at the end of the day, the whole AMS chemist's work can be described as "reducing the sample matrix, other impurities and especially isobars to a level the AMS machine can handle while enriching the radionuclide of interest".

Starting materials for applications such as astrophysical research can be "orders of magnitude" different: a neutron-irradiated sample of 1 g tungsten powder [6], over 40 g of clay-rich material from the Cretaceous–Tertiary (K-T) boundary, 100 g of ultra-pure sodium iodide, or 500 kg of snow from Antarctica [4] can cause totally different and sometimes unexpected problems in the chemistry lab. In general, smaller samples are not always easier to handle for example if they are chemically rather resistant or reactive. The cream of the crop of failure and success in a few AMS chemistry labs will be presented.

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[6] M. Martschini et al., *this meeting.*