

Consensus Reference Materials for Aerosols

Aerosol chemistry, solubility, and flux to the oceans are key parameters in the GEOTRACES Science Plan. Intercalibration is essential for producing aerosol data that will be accepted into any GEOTRACES Intermediate Data Product, and should include the following steps:

1. Replicate aerosol collections and distribution of the filters to multiple labs (at least two labs).
2. Multiple labs perform the total analysis and/or leaching experiments for these samples.
3. Multiple labs also conduct total analysis and leaching experiments on Standard or Certified Reference Materials (SRMs/CRMs) and/or Arizona Test Dust (ATD; see below for details) in parallel with the samples on a frequent basis during analyses. Total wet digestion of aerosol samples for trace element analysis can be accomplished using hot concentrated nitric and hydrofluoric acids with modest pressure (see Morton et al., 2013). HF is required in wet digestion to totally dissolve Al and Ti oxides.
4. Analyses of powder (solids), fresh water, or seawater SRMs/CRMs appropriate for your digestion and leach methods must include all the elements you want to report.
5. Perform the intercalibration with the other lab(s) by quantitatively comparing sample results, ATD results, and SRM/CRM recoveries.

The GEOTRACES Standards and Intercalibration Committee can provide advice on setting up an appropriate intercalibration program for aerosol sampling and analysis.

<https://www.geotraces.org/the-geotraces-standards-and-intercalibration-committee/>

An effort is underway to utilize Arizona Test Dust (Nominal 0-3 μm ; Powder Technologies Inc.: ISO 12103-1, A1 Ultrafine Test Dust), as a potential “consensus reference material”. It is more like a true aerosol material, and testing has shown that it appears to be homogeneous for total trace elements down to sample sizes as small as 2-10 mg. The major element composition of ATD is shown below in Table 1. The size distribution of ATD is shown in Table 2. The ATD provided by FSU is also recommended for use in both total digestion and aerosol leaching experiments and governed by the same intercalibration guidelines as for SRM/CRM analysis. Furthermore, upon request, samples of ATD can be prepared on filters (provided by you) for analysis by XRF or other techniques that require material deposited on a filter.

We recommend that interested people contact William Landing (wlanding@fsu.edu) or Peter Morton (pmorton@fsu.edu) to obtain a sample of Arizona Test Dust to use. We provide this material at no cost and ask that you only pay for shipping. It is possible to buy batches of ATD directly from Powder Technologies, but you may not get a batch with the same composition and size distribution of the large batch we have available.

Acceptance of a subsample from Landing and/or Morton assumes your commitment to sharing results with the organizers. When analyses are completed, we request that you report your results to Landing or Morton along with appropriate metadata (e.g. digestion and analytical methods, analytical figures of merit). We will collate the data with the intention of including all data contributors in publications describing the total and soluble fractions of ATD.

Table 1. Major element composition of Arizona Test Dust (Nominal 0-3 μm ; Powder Technologies Inc.: ISO 12103-1, A1 Ultrafine Test Dust).

	<u>SiO₂</u>	<u>Al₂O₃</u>	<u>Fe₂O₃T</u>	<u>MnO</u>	<u>Na₂O</u>	<u>K₂O</u>	<u>TiO₂</u>	<u>CaO</u>	<u>MgO</u>
<i>Average (%)</i>	32.74	12.5	3.5	0.094	3	3.5	0.75	3.5	1.5
<i>+/-</i>	4	2.5	1.5		1	1.5	0.25	1.5	0.5
<i>MWt</i>	60.09	101.96	159.694	70.94	61.98	94.2	79.87	56.08	40.31
<i>AWt</i>	28.09	26.98	55.847	54.94	22.99	39.1	47.87	40.08	24.31
<i>ppm (element)</i>	153,048	66,153	24,480	728	22,256	29,055	4495	25,014	9,046

Table 2. Size distribution (by volume) of Arizona Test Dust (Nominal 0-3 μm ; Powder Technologies Inc.: ISO 12103-1, A1 Ultrafine Test Dust).

<u>Size</u> <u>(μm)</u>	<u>% Less Than</u>
0.756	10
0.838	25
0.988	50
1.232	75
1.591	90



An International Study of the Marine Biogeochemical
Cycles of Trace Elements and their Isotopes

References cited:

Morton, P.L., Landing, W.M., Hsu, S.C., Milne, A., Aguilar-Islas, A.M., Baker, A.R., Bowie, A.R., Buck, C.S., Gao, Y., Gichuki, S., Hastings, M.G., Hatta, M., Johansen, A.M., Losno, R., Mead, C., Patey, M.D., Swarr, G., Vandermark, A. and Zamora, L.M. (2013) Methods for the sampling and analysis of marine aerosols: results from the 2008 GEOTRACES aerosol intercalibration experiment. *Limnology and Oceanography-Methods* 11, 62-78.