The oxygen isotopic composition of captured solar wind: first results from the Genesis mission.

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Oxygen is the major constituent of rocky planets and the third most abundant element comprising the Sun, yet the solar oxygen isotopic composition has remained essentially unknown. One reason is that the usual appeal to primitive meteorites does not work because oxygen is isotopically distinct in all different classes of meteorites. The cause of this premier "isotopic anomaly" (first discovered in 1973) has been variously ascribed to nucleosynthetic input, e.g. from a nearby supernova, or to exotic isotope-selective chemistry in the solar nebula, e.g. based on molecular symmetry or UV photolysis. Knowledge of the average starting composition of the solar system, which is preserved in the Sun, would provide a baseline from which one could interpret the oxygen isotopic compositions of planetary materials. To this end, NASA flew the Genesis Mission to capture samples of the solar wind (SW) in ultra-pure target materials and return them to Earth for laboratory analysis. At UCLA, we have designed and constructed a hybrid secondary ion and accelerator mass spectrometer (SIMS/AMS), called the "MegaSIMS", specifically to tackle the unique analytical challenges posed by the Genesis samples: dilute elemental concentrations, limited sample material, and close proximity of likely surface contamination to the implanted solar wind ions. Three years after the crash-landing of the sample return capsule in the Utah desert, we have succeeded in making oxygen isotopic measurements on SW captured in a SiC target from the Genesis SW concentrator. Our preliminary data indicate that the Earth and meteorites are grossly isotopically anomalous. Implications for planetary science will be discussed.