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Oxygen Isotope Measurements of Comet Wild 2 Fines

RYAN C OGLIORE[1], ANDREW WESTPHAL[2], ZACK GAINSFORTH[2], GARY HUSS[3], DAVE JOSWIAK[4] AND DON BROWNLEE[4]

[1]Washington University in St. Louis
[2]UC Berkeley
[3]University of Hawaii at Manoa
[4]University of Washington

Presenting Author: rogliore@physics.wustl.edu

Sixteen years of analyses of material returned by NASA's Stardust mission to comet Wild 2 have shown that many of the larger terminal fragments are similar to igneous rocks found in meteorites from primitive asteroids. This high-temperature material was likely transported to the outer Solar System where it was mixed with primordial ices and local dust to form Wild 2's nucleus. Fine-grained dust, with grain size smaller than a micrometer, is found in the Stardust samples but it is difficult to analyze because it is usually mixed with aerogel. Comet Wild 2 fines may be the missing primordial dust that was indigenous to the comet's formation region in the outer Solar System, beyond the orbit of Neptune. Primordial dust, consisting primarily of isotopically inconspicous molecular cloud dust, should show a more diverse sampling of oxygen isotope compositions than dust formed from a well-mixed solar nebula reservoir.

We have developed novel sample-prepartion techniques and SIMS analytical methods to accurately measure the O isotopic composition of fine-grained cometary material returned by the Stardust mission. We will report on measurements of comet Wild 2 fines from different aerogel tracks and compare these measurements to samples from other Solar System bodies.