COORDINATED MINERALOGICAL AND ISOTOPIC ANALYSIS OF A COSMIC SYMPLECTITE IDENTIFIED IN A STARDUST TERMINAL PARTICLE. A. N. Nguyen[1,2], E. L. Berger[1,2], K. Nakamura-Messenger[2], and S. Messenger[2]. [1]JETS, NASA Johnson Space Center, Houston TX. [2]Robert M. Walker Laboratory for Space Science, ARES, NASA Johnson Space Center, Houston TX. lan-anh.n.nguyen@nasa.gov.

Introduction: Comet Wild-2 samples returned by the Stardust spacecraft contain a chemically diverse mixture of material, underscoring the complex nature of comets [1]. Studies of entire Stardust aerogel tracks afford the opportunity to examine the fine-grained particle fragments distributed along the length of the track as well as the terminal particles [2]. Previous TEM characterization of a terminal particle (TP) in track #147 revealed a symplectically intergrown iron sulfide and oxide assemblage [3]. Mineralogically similar assemblages, known as cosmic symplectites (COS, formerly termed "new-PCP"), have only been identified in the primitive carbonaceous chondrite Acfer 094 [4, 5]. Meteoritic COS have isotopically heavy O compositions ($\delta^{17,18}O$ = 180‰) that point to interactions with early solar system primordial water. In this study we report mineralogical and O isotopic measurements of the Wild-2 COS assemblage.

Experimental: Track #147 is a "bulbous"-type track (4600μm long) containing 7 terminal particles. The TPs were removed from the track, embedded in epoxy, and ultramicrotomed. A JEOL 2500SE 200 keV field-emission scanning-transmission electron microscope was used to obtain quantitative elemental maps and detailed mineralogical characterization. Following TEM analysis, two thin sections of TP4 (12 μm) were analyzed for O isotopes by raster ion imaging with the JSC NanoSIMS 50L. All three O isotopes were measured simultaneously using electron multipliers. San Carlos olivine grains were used as isotopic standards.

Results and Discussion: The COS in the Wild-2 track #147 TP4 sample consists of symplectically intergrown pentlandite and nanocrystalline maghemite which coexists with high-Ca pyroxene with Na and Cr (kosmochlor component). This kosmochlor component could have a nebular origin and be precursors to type II chondrules in ordinary chondrites [6]. Yet pentlandite is not a stable phase in the nebula. The COS in Acfer 094 also consists of pentlandite, but contains magnetite [4] rather than the more oxidized maghemite observed in the Wild-2 COS.

The Acfer 094 COS display heavy O isotopic compositions that are the result of sulfidization and oxidation of Fe,Ni-metal grains and sulfides by ^{17}O- and ^{18}O-rich water in the solar nebula or possibly on the parent body [4, 5]. The O isotopic composition of the Wild-2 COS, however, is indistinguishable from terrestrial, indicating it was not altered by the same primordial aqueous reservoir as the Acfer 094 COS. The alteration could have occurred on the parent body by isotopically equilibrated ice. The mineralogy and petrography of Wild-2 samples suggests an incomplete or nascent hydration process [7, 8]. In future work we will analyze S isotopes in the track #147 TP4 COS and search for additional COS in Stardust samples.

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