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Identification of Presolar SiC Grains Separated from Aguas Zarcas

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Various types of presolar grains and other rare phases (e.g., nanodiamond, silicon carbide, graphite, spinel, chromite, and hibonite) have been chemically extracted from a 22.6-gram post-rain sample of the Aguas Zarcas CM2 meteorite (FMNH ME 6254 #2). The separation procedure closely followed previously described routines [1], with the modification of using organic heavy liquids from Cargille Labs rather than sodium polytungstate for the density separations [2, 3]. The silicon carbide (SiC) fraction covered the density range of 2.30–3.31 g/cc and was extensively cleaned of organic matter with additional acid treatments [4]. It was then separated into the following five size fractions: <0.5 µm, 0.5–1.0 µm, 1.0–1.5 µm, 1.5–4 µm, and >4 µm (named HA, HB, HC, HD, and HE, respectively). Small aliquots from the HD size fraction were mounted on individual ultra-pure gold foil mounts for scanning electron microscopy (SEM) analysis. Secondary electron and backscattered electron images were used in tandem with energy dispersive X-ray spectroscopy (EDS) to identify 3 candidate presolar SiC grains, two with diameters ~4 µm, one ~1.5 µm in size, via elemental signatures and morphology. We are continuing to prepare and search mounts for more SiC grains. The SiC grains will then be analyzed for their Mg/Al ratios and undergo targeted Raman spectroscopy to identify presolar SiC grain subtypes per the method described by Liu et al. [5]. These nondestructive analytical methods confirm the successful separation of presolar SiC grains from the Aguas Zarcas meteorite, while leaving the grains intact for future work including isotopic analysis by nanoscale secondary ion mass spectrometry (NanoSIMS), resonance ionization mass spectrometry (RIMS), and noble gas mass spectrometry.

[1] Amari et al. (1994) *Geochim. Cosmochim. Acta* 58, 459–470. [2] Kööp et al. (2016) *Geochim. Cosmochim. Acta* 189, 70–95. [3] Tizard et al. (2005) *Meteorit. Planet. Sci.* 40, 335–342. [4] Levine et al. (2009) *Int. J. Mass Spectrom.* 288, 36–43. [5] Liu et al. (2017) *Meteorit. Planet. Sci.* 52, 2550–2569.