Identifying the most primitive asteroids: Amorphous material in CO meteorites and SOFIA observations of 10 Hygiea

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Carbonaceous chondrite meteorites (CCs) in the CO group are unusual for containing substantial amounts of amorphous silicates [1]. Amorphous silicates are Mg,Fe-rich phases that lack long range crystalline order. These phases have been interpreted as primary nebular condensates that coaccreted with other phases. Unlike other nebular condensates, such as CAIs and chondrules, amorphous silicates are highly susceptible to thermal metamorphism or aqueous alteration. The presence of amorphous material indicates that the parent body has not undergone heating or alteration and is therefore likely to represent some of the most primitive materials in the Solar System [1]. Studying meteorites and asteroids rich in this material will likely yield insights into the nature of asteroid formation and accretion.

In this coordinated spectral-mineralogical study, we analyze eight low metamorphic grade (3.0-3.2) and low weathering grade CO meteorites. Using mineralogy obtained through position sensitive X-ray diffraction (PSD-XRD) measurements, we can directly compare mineralogy to visible/near-infrared (VNIR) and mid-infrared (MIR) spectra of the same samples. Spectral data are obtained at the NASA/Keck Reflectance Laboratory at Brown University. Previous studies [2] have identified the presence of amorphous material in VNIR spectra of similar COs. Here we present new evidence for the spectral signature of amorphous material in the MIR as well.

The VNIR spectral signature attributed to glass has been observed in the spectra of some asteroids including 10 Hygiea [3]. We have recently observed Hygiea in the MIR using SOFIA + FORCAST. If amorphous material is found on Hygiea, this may represent one of the least processed parent bodies in the Asteroid Belt. **Ref:** [1] Howard, K. T., *et al,* (2014) LPSC #1830. [2] Cloutis, E. A., *et al.,* (2012), *Icarus, 220,* 466-486. [3] Yang & Jewett, (2010), *AJ, 140,* 692-698.