AUBRITE AND ENSTATITE CHONDRITE IMPACT MELT METEORITES: ANALOGS TO MERCURY? Z. E. Wilbur[1,2], A. Udry[1], F. M. McCubbin[3], K. E. Vander Kaaden[2], R. R. Rahib[1], and T. J. McCoy[4]. [1] Department of Geoscience, University of Nevada, Las Vegas, Las Vegas, NV 89154, USA (wilbur@unlv.nevada.edu), [2]Jacobs, NASA Johnson Space Center, Mail Code XI3, Houston, TX 77058, [3]ARES, NASA Johnson Space Center, 2101 NASA Parkway, Houston, TX 77058, [4]Natural Museum of History, Smithsonian Institution, Washington, D.C., USA.

Introduction: New data obtained during the MESSENGER mission has allowed us to better contrain the composition and mineralogy of the mercurian surface [e.g., 1-3]. One unique feature of Mercury is its extremely low oxygen fugacity (fO_2) (Iron Wustite (IW) -7.3 to IW-2.6) [4–6]. At such extreme conditions, elements that exhibit lithophile behavior on Earth can exhibit chalcophile or siderophile behavior, leading to the formation of exotic sulfides and metals [5,7–9].

As no samples have been returned from Mercury, it is critical to study meteorite analogs to better understand the formation conditions of the minerals present at the mercurian surface, as well as mercurian magmatic processes. Given the low fO_2 on Mercury, we have selected to investigate potential meteoritic analogs for Mercury among the most reduced meteorite types, including the aubrites and enstatite chondrite impact melts. The aubrites are differentiated meteorites that show varying degrees of brecciation, have a similar fO_2 to the mercurian surface and interior, and contain exotic sulfides that have been inferred to be present on the mercurian surface [13–15]. The enstatite chondrite impact melts are from undifferentiated parent bodies, have a similar fO_2 to the mercurian surface and interior, and contain exotic sulfides that have been inferred to be present on the mercurian surface [13–15].

In this study, we present a comprehensive analysis of a representative suite of aubrites and enstatite chondrite impact melts and assess their relevance to understanding magmatic processes on Mercury.

Samples: We have gathered 14 aubrites: Allan Hills (ALH) 78113, ALH 84007, Bishopville, Cumberland Falls, Khor Temiki, LaPaz Icefield (LAP) 02233, Larkman Nunatak (LAR) 04316, Miller Range (MIL) 07008, MIL 13004, Mount Egerton, Northwest Africa (NWA) 9396, Norton County, Peña Blanca Spring, and Shallowater; and 4 enstatite chondrite impact melts (NWA 4799, NWA 7214, NWA 7809 and NWA 11071).

Preliminary results:

Aubrites: The aubrites are composed of FeO-poor enstatite, forsterite, diopside, plagioclase, metal, and exotic sulfides. Miller Range 13004, Bishopville, Cumberland Falls, and Mount Egerton contain Ti-bearing troilite, Mg-bearing daubréelite, Mn-bearing oldhamite, ferroan alabandite, schreibersite and perryite within Si-bearing Fe, Ni kamacite, caswellsilverite, brezinaite, and djerfisherite.

Enstatite Chondrite Impact Melts: These meteorites are composed of FeO-poor enstatite, interstitial plagioclase, metal, graphite, and exotic sulfides. Wilbur et al. [13] show that these samples contain Ti-bearing troilite, niningerite, possibly indicating an EH parent body origin; Mn-bearing daubréelite, Mg-bearing oldhamite, caswellsilverite, and schreibersite present within Si-bearing Fe, Ni kamacite.

Implications for Mercurian Mineralogy: The mineralogy of the mercurian surface is complex [1–13], and MESSENGER data and meteorite analogs will help us better understand elemental partitioning at extremely reducing conditions. The aubrites and enstatite chondrite impact melts in this study contain similar sulfide mineralogies inferred to be on the mercurian surface (FeS, MgS, and CaS) [5,12]. However, the meteorite samples have a lower sulfide vol.% compared to most mercurian terrains (1.23–6.3% normative sulfides) [5,12]. The enstatite chondrite impact melts have higher abundances of albitic plagioclase than aubrites and higher abundances of Na_2O than aubrites, which may make them a better match for a mercurian analog than aubrites.

Conclusions: Neither the aubrite meteorites nor impact melts from enstatite chondrites represent perfect analogs for mercurian rocks; however, both provide valuable insights into the distribution and geochemical behavior of natural systems under highly reducing conditions. The bulk compositions of the enstatite chondrite impact melts are a better match to the mercurian surface than aubrites [15–18]. However, unlike Mercury, the enstatite chondrite impact melts are from undifferentiated parent bodies.

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