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POTENTIAL MERCURIAN ANALOGUES: AUBRITE AND ENSTATITE CHONDRITE IMPACT MELT METEORITES

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The MESSENGER (MErcury Surface Space ENvironment GEochemistry and Ranging Spacecraft) mission provided new data that have helped us better constrain the surficial mineralogy and composition of Mercury. Mercury has an extremely low oxygen fugacity (fO_2) (Iron Wüstite (IW) -7.3 to IW-2.6), and at these unique conditions, elements, which usually exhibit lithophile behavior on Earth, can exhibit chalcophile or siderophile behavior on Mercury. No samples have been returned from Mercury; therefore, we must study candidate meteorite analogs to better understand the formation conditions of minerals inferred to be present at the mercurian surface and mercurian magmatic processes.

In this study, we present a comprehensive analysis of a representative suite of eight aubrites and four enstatite chondrite impact melts (ECIM), which both have a similar fO_2 to Mercury, and contain exotic sulfides that have been inferred to be present at the mercurian surface. These characteristics allow us to assess their relevance for understanding the mineralogy and magmatic processes of Mercury. The ECIM were previously classified as aubrites, but we show that they are actually ECIM with a potential EH parent body origin due to the presence of niningerite, Si-enriched kamacite, and uniform Ni in schreibersite. We propose that, with respect to the aubrites, the ECIM represent an ideal candidate for mercurian studies due to their mineralogy and modal mineralogy. Compared to the aubrites, the ECIM samples do not contain forsterite or diopside, show a poorer sulfide diversity, contain graphite, and have a higher volume percentage of metal phases. Although the mercurian surface contains forsterite and diopside, graphite and a similar amount of metal and sulfides as seen in the ECIM are inferred to be present on Mercury. According to the calculated normative mercurian mineralogy, both candidate meteorites are most analogous to the Caloris Basin and Northern Plains Lower Mg regions.