Geochemistry of related inner Solar System chondrites

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Of the various chondrite groups, the Enstatite (E), Ordinary (O), Rumuruti (R) chondrites and the newly discovered grouplet of metal-rich chondrites (NWA 5492 and GRO 95551) [1-3], referred to here as "G" chondrites, have characteristics that suggest they are related. E chondrites are particularly intriguing having O, N, Mo, Ru, Os, Cr and Ti isotopic compositions similar to the Earth and Moon [e.g., 4 and references therein]. Here we further explore these primtive materials. The G chondrites are the newest addition to the inventory of primitive materials. Although only two examples are known, they have remarkable characteristics including reduced silicates (near-pure endmember enstatite and forsterite) and >20 % metal, based on thin section area maps. The average $\Delta^{17}O$ of the G chondrites (~0.6 ‰) is between E (0.03 ‰) and H (0.7 ‰) chondrite. Oxygen isotope compositions of chondrule silicates in the G, EH3, L3, LL3 and R3 chondrites show considerable overlap [1, 5-8], suggesting a close genetic relationship and mixing between these materials. Although some ^{16}O-rich material is found in OCs [5,7], mixing between the E, O, R, G with carbonaceous (C) chondrite parent bodies seems less common. The surface chemistry of Mercury, from MESSENGER, suggests the dominance of reduced Mg-rich silicates (forsterite and enstaite) and possibly oldhamite (CaS) [9], suggesting a link to G and E meteorites. Mercury's large core may be due to accretion of metal-rich precursors, such as G chondrites. Other liness of evidence suggest E, O, R and G chondrites formed relatively close to the sun [10]. Thus these chondrites or their mixtures may have supplied materials for the emerging inner planets

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