Mantle iron content and H-rich cores: Regulation by hydrogen in the proto-atmosphere

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Recent mineral physics models support the existence of up to ~1 wt.% hydrogen in the Earth's core. This requires a wet magma ocean during core formation and H-incorporation via a reaction like H_2O+Fe->2H+FeO. Some of the FeO produced by this reaction remains as residue in the silicate, such that the Earth's mantle would have a larger FeO content than observed. This discrepancy can be reconciled if the proto-Earth atmosphere accreted sufficient amounts of hydrogen gas to drive reactions like H_2+FeO->H_2O+Fe atop a magma ocean surface, thus consuming excess FeO and replenishing H_2O in the magma. Earth should have accreted more H_2 than Mars, thus consuming more FeO and possibly providing an alternative explanation for differences in iron content between the mantles of these differently-sized planets. While accreted H_2 gas has been proposed as an important actor in planets larger than Earth, such a role has not been considered for Earth-sized and smaller planets, and opens the possibility for more extensive interactions between disk gas and planetary interiors during the early stages of planetary accretion.