

Low hydrogen contents in the cores of terrestrial planets

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The accretion of planets from primordial materials and their subsequent differentiation to form a core and a mantle are fundamental questions in terrestrial and solar system. Many of the questions about the processes are still open and much debated. For example, could the presence of water during the metallic phase segregation affect the planet-accretion models? The existing studies on the elemental metal-silicate partitioning under hydrous conditions were extended recently to a range of P , T , f_{O_2} and water content (5 - 20 GPa, 2000 - 2500 K, from 1 to 5 log units below the iron-wüstite buffer, and for X_{H_2O} varying from 500 ppm to 1.5 wt%) [1]. These experimental results show that except for Fe, there is no effect of water on the partitioning of moderately siderophile elements. It allowed us to build consistent models of planetary accretion from reducing to oxidized conditions. Furthermore, for the range of water concentrations studied, there is no evidence of important hydrogen incorporation into planetary cores, thus making unlikely for hydrogen to be a major light element of the core as previously assumed [2]. We report H metal-silicate partition coefficients of about 0.2, up to two orders of magnitude lower than reported previously, and indicative of lithophile behavior. Our results imply H content of ~60 ppm in the Earth and Martian cores [3].

[1] Clesi et al. (2016) *Geochim. Cosmochim. Acta* 192, 97-121.

[2] Okuchi, T. (1997) *Science* 278, 1781-1784.

[3] Clesi et al. (2018) *Science Advances* 4: e1701876

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