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Effect of water on metal-silicate partitioning and hydrogen incorporation in the core of the Earth and Mars

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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 are limited to 1 GPa [5,6] well below the likely conditions prevailing during core formation on Earth and Mars. In the present study we use multi-anvil technique aver a range of P, T, $f_{O2} and water content (5 - -20 GPa, 2000 - -2500 K, from 1 to 5 log units below the iron - wstite buffer, and for X_{H2O}$ varying from 500 ppm to 1.5 wt.%).

The present 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 an important hydrogen incorporation into planetary cores, thus making unlikely for hydrogen to be a major light element of the core as previsously assumed [7].

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