Effect of H_2O on metal-silicate partitioning of Ni, Co, V, Cr, Mn and Fe: Implications for Earth and Mars

V. CLESI[1], M. A. BOUHIFD[1], N. BOLFAN-CASANOVA[1],
G. MANTHILAKE[1] AND D. ANDRAULT[1]

[1]Laboratoire Magmas et Volcans, CNRS UMR 6524, Univ. Blaise Pascal, 5 Rue Kessler, 63038 Clermont-Ferrand, France

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 process, although well developed as model scenarii over the last few decades, are still open and much debated. For example, could the presence of water during the metallic phase segregation affect the planet-accretion models? In fact, recent geodynamical, geochemical/cosmochemical studies suggest accretion of volatile elements from wet planetesimals during the segregation of the terrestrial planets' cores [1-4].

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-wüstite buffer, and for X_{H2O} varying from 500 ppm to 1.5 wt%). The present experimental results show that, except for Fe, the metal-silicate partition coefficients for Ni, Co, V, Cr and Mn are little dependent on the dissolved water into the early magma ocean. Finally, presence of water during the core formation on Mars can explain at most 25% of the FeO content of the present martian mantle.

We will present and discuss our results on the metal-silicate partitioning of various siderophile elements under hydrous conditions, as well as the impact of those conditions on the oxidation state of the mantles of Earth and Mars.

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