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Hydrogen in the early magma ocean and the present topmost outer core

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Recent interest in hydrogen as a clean geological resource has been escalating, leading to active research on the formation and exploration of natural hydrogen worldwide. Paradoxically, however, hydrogen is the most abundant element in the universe and is also widely distributed in the Earth, as contained in mineral structures from the crust to the core. Hydrogen in minerals can exist in the form of molecular water (H2O), hydroxyl group (OH), or monatomic hydrogen (H), and is therefore directly related to the global transport and distribution of water. From this perspective, it is notable that the hydrogen budget increases innards to the mantle transition zone, lower mantle, and core, compared to the amount in the hydrosphere on the Earth's surface. In this presentation, I will introduce the reactions of hydrogen from water based on two recent experimental results to simulate the conditions of the early magma ocean and the present core-mantle boundary, which could be linked to the formation of the reduced atmosphere in the early Earth [1] and the hydrogen-rich layer in the present topmost outer core [2].

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[2] T. Kim, J.G. O'Rourke, J. Lee, S. Chariton, V. Prakapenka, R.J. Husband, N. Giordano, H.-P. Liermann, S.-H. Shim*, Y. Lee*, "A hydrogen-enriched layer in the topmost outer core sourced from deeply subducted water", Nature Geoscience, Vol.16, 1208-1214, 2023