Dissolution of hydrogen into iron by the dissociation of hydrous minerals under pressure

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Although hydrogen is the most abundant element in the solar system and one of the candidates of the light element in the core, the process how the hydrogen can get into iron remains not so clear. High-pressure and high-temperature in situ neutron diffraction study on the iron-hydrous mineral system using “PLANET” at J-PARC clearly showed that when the dissociation of hydrous mineral occurred at about 4 GPa, the released water reacted with iron and formed both iron oxide and iron hydride. Iron oxide reacted with silicates and formed iron containing olivine and pyroxene. Iron hydride remained stable after further increase in temperature. This formation of iron hydride occurred below 1000K, at the temperatures no materials melted. This suggest the possibility that in the very early stage of Earth evolution, hydrogen has dissolved into iron before any other light elements have dissolved.

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