

特別セミナー

講演題目：Metallic Fe in the lower mantle: implications for melting and core formation

講演者：唐戸 俊一郎 教授

所属：イェール大学

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場所：地震・噴火予知研究観測センター 第2講義室

担当教員：大谷 栄治 教授 (ohdani@m.tohoku.ac.jp)

小澤 信 助教 (shin.ozawa@m.tohoku.ac.jp)

講演内容の概要：

The lower mantle occupies the largest rocky portion of the Earth. This region is mostly made of silicates and oxides, but the presence of metallic Fe was documented in several studies. The presence of metallic Fe in the lower mantle will substantially modify the geochemistry of this region including partial melting and the behavior of siderophile elements. Metallic Fe has a large solubility of hydrogen and carbon, and therefore it will make dehydration melting difficult. Consequently, the explanation of a velocity drop in the shallow lower mantle by dehydration would require major modifications. Similarly, discussions on the core formation based on the isotopic composition of tungsten would need a revision because a substantial amount of tungsten would be preserved in the lower mantle if metallic Fe were present throughout the lower mantle. However, the depth range in which metallic Fe is present in the lower mantle has been poorly constrained. Although the presence of ~1 wt% of metallic Fe is well documented at the shallow lower mantle conditions, other studies report no or much smaller amount of metallic Fe at higher pressures. Here we report experimental observations showing that a substantial amount (~1 %) of metallic Fe is formed only in the shallow lower mantle (660-730 km) and present a model to explain the strong pressure dependence of the conditions where metallic Fe exists. Our results explain the recent seismological observations, and have important geochemical implications for melting and the interpretation of tungsten isotope observations in terms of core formation.