

初期火星コアにおける亜臨界的ダイナモ

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Subcritical dynamos in the early Mars' core: Implications for cessation of the past Martian dynamo

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Mars has no active dynamo action at present, but likely had one in the early stage of its history. Clarifying why and how ceased is a challenging question. Several different scenarios have been proposed so far, here we explore the possibility that the dynamo stopped operating due to its subcritical nature. Former studies suggested that the subcritical regime is rather narrow, indicating that it may therefore not play an important role for the cessation.

Here we show that a more appropriate model for the early Martian dynamo, driven exclusively by secular cooling and using heat flux conditions at the outer boundary, yields a much wider subcritical regime than previously reported. This increased extent of the subcritical regime makes it more likely that this effect may have played a role in the shutdown of the early Martian dynamos.

The magnetic field may thus have decayed rather quickly from its typical strength within a few thousand years after the heat flux through the core-mantle boundary became too low to support dynamo action.