

Constraints on the Source of the Martian Magnetic Anomalies Inferred From Relaxation Time of Remanent Magnetization

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The strong magnetic anomalies observed over Mars originate from remanence of deep crust, which should be preserved during 4 billion years. We estimate the relaxation time of remanence carried by various types of magnetite, considering temperature and pressure dependences of magnetic parameters. The estimation shows that acicular-shaped single-domain magnetite is needed to retain the thick magnetized layer during 4 billion years in a low-Urey ratio scenario, whereas acicular-shaped single-domain, equidimensional single-domain, and pseudo-single-domain magnetites can be the source of anomalies in a high-Urey ratio scenario. In each case, fine-grained ($<10 \mu\text{m}$) and preferably high-aspect-ratio magnetite in deep crust is needed to explain the observed anomalies.

Keywords: Martian magnetic anomaly, magnetite, relaxation time of remanent magnetization