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The effect of hydrostatic pressure up to 1.61 GPa on the Morin transition of hematite-bearing rocks: Implications for planetary crustal magnetization

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Abstract

© 2015. American Geophysical Union. All Rights Reserved. We present new experimental data on the dependence of the Morin transition temperature (TM) on hydrostatic pressure up to 1.61 GPa, obtained on a well-characterized multidomain hematite-bearing sample from a banded iron formation. We used a nonmagnetic high-pressure cell for pressure application and a Superconducting Quantum Interference Device magnetometer to measure the isothermal remanent magnetization (IRM) under pressure on warming from 243 K to room temperature (T0). IRM imparted at T0 under pressure in 270 mT magnetic field (IRM270mT) is not recovered after a cooling-warming cycle. Memory effect under pressure was quantified as IRM recovery decrease of 10%/GPa. TM, determined on warming, reaches T0 under hydrostatic pressure 1.38-1.61 GPa. The pressure dependence of TM up to 1.61 GPa is positive and essentially linear with a slope dTM/dP = (25 ± 2) K/GPa. This estimate is more precise than previous ones and allows quantifying the effect of a pressure wave on the upper crust magnetization, with special emphasis on Mars.

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Keywords

hematite-bearing rock, hydrostatic pressure, Martian magnetic anomalies, Morin transition