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Shock Demagnetization of Pyrrhotite (Fe_7S_8) – Implications for the Martian Crust and Meteorites KARIN LOUZADA, SARAH STEWART, Harvard University, BENJAMIN WEISS, Massachusetts Institute of Technology — After cessation of the dynamo on Mars, giant impact events demagnetized large regions of the crust. Models of shock pressure decay indicate that the demagnetized zones are bound by peak shock pressures between 1 and 3 GPa. Static pressure experiments at room temperature on pyrrhotite (a common carrier of magnetization in Martian meteorites) demonstrate it undergoes a magnetic phase transition at ∼2.8 GPa, with rapid loss of magnetization above 1 GPa. We performed the first planar shock recovery experiments on natural pyrrhotite using the 40-mm gas gun in the Shock Compression Laboratory at Harvard. Post-shock magnetic measurements show that pyrrhotite indeed demagnetizes significantly (∼85-90%) due to shock in the pressure range inferred around Martian impact basins, however, we were unable to completely demagnetize at 4 GPa. Permanent changes to the magnetic properties are an increase in the saturation remanence and the mean destructive field (the field required to reduce the remanence to 1/2 its initial value), indicating that shocks harden the coercivity. We conclude that pyrrhotite is a candidate for the Martian crust and that pyrrhotite in meteorites shocked to modest pressures may retain a pre-shock remanence.

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