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# High-pressure memory in magnetite found under low temperature: implication for the impacted rocks at Vredefort crater

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Low temperature magnetic measurements provide information on the impact event over planets. Normally the shock signature of minerals is dominantly centered on planer deformation feature (PDF) in quartz, phase transformation to maskelynite and diaplectic plagioclase glass. Impact shock also modifies magnetic properties of crater rocks. Here we report on an alternative pressure memory in magnetite found under low temperature. A temperature-dependent complex magnetic susceptibility of a natural magnetite sample is measured in a diamond anvil cell down to 100 K. Up to 0.7 GPa, we observed a normal single Verwey transition. On the other hand, under pressure larger than 1.6 GPa, the Verwey transition abnormally splits into two distinct transitions. The splitting may be explained by pressure-induced coordination crossover in magnetite under low temperature. In addition, the decompression from 4.5 GPa to 0.5 GPa did not erase the splitting of low temperature transition. This result is interpreted as due to irreversible change in domain structure, resulting from internal stress by compression. Our experimental result agrees with the natural observation of the splitting of Verwey transition in the impacted rocks at Vredefort crater [1]. The presence of splitting under ambient pressure suggests that the magnetite with internal stress could hold information of high pressure event during Vredefort impact, implying that the shocked magnetite becomes the alternative shock signature.

**Reference:**

[1] Carporzen, IRM Quarterly, 14(1): 3, 2004