MAGNETIC MINERALOGY AND ROCK MAGNETIC PROPERTIES OF IMPACT BRECCIAS AND CRYSTALLINE BASEMENT ROCKS FROM THE BCDP-DRILLINGS 7A AND 8A, A. Kontny[1] and J. Just[1], [1]Geological-Palaeontological Institute, Ruprecht-Karls University, Im Neuenheimer Feld 234, D-69120 Heidelberg, Germany, agnes.kontny@urz.uni-heidelberg.de.

Introduction: The Bosumtwi crater drilling project (BCDP) provides core samples of the impact and crystalline basement lithologies down to a depth of 540 (7A) and 450 m (8A), which help to understand the formation and effects of medium-sized impact craters. Our study contributes rock magnetic and magnetic mineralogy data of the drilled lithologies, which will better constrain the interpretation of the aeromagnetic anomaly pattern and the magnetic borehole measurements. Such data contribute to the understanding of the formation of magnetic minerals and the mechanisms creating and modifying magnetic properties like the remanent magnetization and magnetic susceptibility during impact-related processes.

Methods: Natural remanent magnetization (NRM) and magnetic susceptibility (k) were determined on cylindrical specimen with a volume of 1.8 cm^3 and recalculated to a volume of 10 cm^3. Magnetic susceptibility as function of temperature was measured between –192 and 700 °C using a KLY-4A susceptibility bridge, combined with a CS-3/CS-L furnace apparatus of AGICO to determine magnetic transitions like the Curie temperature (T_C) of ferrimagnetic phases or the Verwey transition in magnetite. Field-dependence of k was done from 2 – 450 A/m, because its behaviour is characteristic for some magnetic minerals. Stepwise alternating field and thermal demagnetization of NRM was determined in order to obtain information on the coercive spectra, the number of different magnetic phases and the unblocking temperatures. Microscopic methods were used to identify the opaque minerals.

Results: In general, k and NRM correlate positively, with largest values up to $20x10^{-3}$ SI units and up to 100 A/m, respectively in a metavolcanic rock sample from 375.6-376.1 m. Impact breccias show k values below $0.5x10^{-3}$ SI units and NRM intensities between 0.4 and 200 mA/m, similar to the majority of basement rocks. Therefore, no significant difference was found for these rock magnetic parameters between the basement rocks and impact breccia. The values, especially for the basement rocks are distinctly higher than the one reported by [1] for surrounding rocks of lake Bosumtwi (0.1 – 39 mA/m).

Rock magnetic properties are carried mainly by pyrrhotite (T_C: 310-320°C) in all lithologies. In some metavolcanic target rocks, magnetite (T_C: 580°C) or a magnetite-near phase (T_C: ~450°C) occurs in minor amounts. Few Fe-hydroxide (T_C: ~160°C) and probably greigite (T_C: ~350°C) occur in some samples, mostly from the upper part of the drill core. In the basement rocks, pyrrhotite appears as small (< 10 μm), relics in pyrite indicating a transition from pyrrhotite to pyrite. The sulfide assemblage pyrite, pyrrhotite and arsenopyrite show overgrowth of the schistosity and sulfides grew into open space affirming a genesis after the Birimian metamorphosis. Beside pyrite alteration, a replacement of ilmenite by Fe-sulfides and rutile was observed. In a first step ilmenite is decomposed to pyrrhotite and rutile and in a second step, with increasing sulfur fugacities, pyrrhotite is decomposed to pyrite and rutile. Therefore changing redox conditions accompanied the rock history before the impact event. Mostly pyrite is strongly cataclased in the impact breccias, while pyrrhotite does not show a similar strong deformation, which is odd if pyrrhotite has been formed before the impact. Probably, the small grain size of pyrrhotite (10-20 μm) prevented it from brittle deformation but caused only (rotational?) movement. Transmission electron microscopy could help to solve the question of pyrrhotite formation in relation to the shock event. Small grain sizes of pyrrhotite are magnetically confirmed by the absence of field-dependence of k and relatively high medium destructive fields between 10 and 65 mT, indicative of hard magnetic behavior.

Conclusions: Surprisingly, the supposed high content of melt rocks was not observed and only few porous glass fragments have been found in the impact breccia. The main shock deformation mechanism seems to be brittle under low temperature conditions (<200°C?). Indications for a post-impact hydrothermal system are scarce. Probably a shock-induced remagnetization of the preexisting pyrrhotite is responsible for the several times higher magnetization compared to the surrounding fall-out suevite.

References: [1] Plado J., Pesonen L.J., Koeberl C. and Elo S. (2000) *Meteorics & Planetary Science, 35,* 723-732.