PALEOMAGNETISM OF PEAK RING UNITS WITHIN CHICXULUB CRATER. S. M. Tikoo[1], W. Zylberman[2,3], Jaime Urrutia-Fucugauchi[4], Mario Rebolledo-Vieyra[5], and IODP-ICDP Expedition 364 Scientists. [1]Department of Earth and Planetary Sciences, Rutgers University, Piscataway Township, New Jersey, 08854, USA (sonia.tikoo@rutgers.edu). [2]Aix-Marseille Université, CNRS, IRD, Collège de France, CEREGE UM34, Aix-en-Provence, France. [3]University of Western Ontario, Centre for Planetary Science and Exploration and Dept. Earth Sciences, London, ON, N6A 5B7, Canada. [4]Instituto de Geofísica, Universidad Nacional Autónoma de México, Cd. Universitaria, Coyoacán Ciudad de México, C. P. 04510, México. [5]Unidad de Ciencias del Agua, Centro de Investigación, Científica de Yucatán, A.C., Cancún, Quintana Roo, C.P. 77500, México.

Introduction: Chicxulub, the 200-km diameter crater associated with the Cretaceous-Paleogene extinction, is the only known terrestrial crater that retains an un-eroded peak ring. In 2016, International Ocean Discovery Program (IODP)-International Continental Scientific Drilling Program (ICDP) Expedition 364 conducted a scientific drilling operation to sample the Chicxulub peak ring and obtained a continuous core that reached a final depth of ~1335 m below the sea floor (mbsf). The Expedition 364 core sampled a wide range of lithologies associated with the peak ring structure including post-impact sediments, melt-bearing breccias, impact melt rocks, granitic basement target rocks and a variety of pre-impact dikes. Due to the range of rock types present, magnetization within the peak ring structure at Chicxulub likely reflects a juxtaposition of several different forms of magnetic remanence that were imparted by shock, thermal, or post-impact hydrothermal activity. Our goal is to determine the different forms of magnetic remanence recorded in core lithologies and relate the origins of magnetization to impact-related physical processes.

Methods: During the Expedition 364 Onshore Science Party (OSP) in Bremen, Germany, paleomagnetic measurements were conducted on 240 impactite samples from the drill core (depths 617-1335 mbsf) (Fig. 1). Samples were collected at a frequency of ~1 sample per ~3 m-long core. Sample plugs were cylindrical in shape, with ~2.5 cm diameter and ~2.5 cm height. 45 melt-bearing breccia samples and 6 impact melt rock samples were collected from the upper melt-bearing breccia/impact melt rock section. A total of 195 samples were collected from the peak ring basement section which included mostly basement granitoids, but also pre-impact dikes, impact melt rocks, and melt-bearing breccias. All paleomagnetic measurements were conducted using a 2G Enterprises superconducting magnetometer at the Universität Bremen. The natural remanent magnetization (NRM) was measured for all samples as well as the residual magnetic moment following stepwise alternating field (AF) demagnetization up to 20 mT (the highest AF level permitted by IODP for OSP measurements).

Melt-bearing breccias and impact melt rocks: Melt-bearing breccias and impact melt rocks primarily exhibit reverse polarity NRMs with a mean inclination ~-44°. Some melt-bearing breccia samples exhibit a normal polarity NRM with ~38° inclination. These observations are consistent with prior paleomagnetic studies of melt-bearing breccias and impact melt rocks in other Chicxulub drill cores [1-3]. The impact melt rocks have the highest NRM values in the entire core, ranging between $\sim 2\times10^{-5}$ Am^2 and $\sim 2\times10^{-4}$ Am^2. The NRM data correlate well with multi-sensor core log (MSCL) measurements that demonstrate that clast-poor impact melt rocks have the highest magnetic susceptibilities of all impactites.

Basement: Expedition 364 enabled the first ever paleomagnetic study of peak ring basement rocks at the Chicxulub crater. This basement sequence primarily consists of granitoids and pre-impact dikes. Target rock NRMs range between $\sim 3\times10^{-8}$ Am^2 and $\sim 4\times10^{-5}$ Am^2. Granitoid NRMs have a mean inclination of ~-34°, whereas the NRMs of the pre-impact dolerite dikes have a mean inclination of ~-25°. However, after AF demagnetization to 20 mT, the residual moment often exhibits a positive inclination, indicating the presence of multiple magnetization components within many basement target rocks. Melt-bearing breccias and impact melt rocks present within the basement section all exhibit reverse polarity, with an average NRM inclination of -38° and maintain these negative inclination values after demagnetization to AF levels of 20 mT.

Discussion: The negative inclination directions observed within the Chicxulub peak ring samples are broadly consistent with the expected inclination at the time of the impact, which took place during reverse polarity Chron 29r, as well as the -44° mean inclination obtained for reversely magnetized melt-bearing breccia and impact melt rock samples during prior investigations of these lithologies within the Chicxulub crater [1-3]. Peak ring breccias and impact melt rocks formed and were emplaced within minutes of the impact. Therefore, their reverse polarity magnetizations may reflect either thermoremanent magnetization acquired during primary cooling or chemical remanent magnetization from formation of new ferromagnetic minerals during post-impact hydrothermal activity. Zones of normal polarity within the melt-bearing breccia/impact melt rock sequence are likely the result of the effect of post-impact remagnetization event(s) (e.g., protracted hydrothermal activity during a normal polarity interval). Basement samples often exhibit two magnetization components. However, the negative inclination NRM of most basement samples may represent a secondary, low coercivity magnetization component that overprinted primary magnetizations with mostly positive inclination. This overprint may be of shock or thermal origin. Post-expedition paleomagnetic and rock magnetic studies will focus on confirming the origins of the observed magnetization components.

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References: [1] Urrutia-Fucugauchi, J., et al. (1994) *Tectonophysics*, 237, 105-112. [2] Urrutia-Fucugauchi, J. et al. (2004) *Meteoritics & Planet. Sci.,* 39, 843-856. [3] Velasco-Villareal, M. et al. (2011) *Phys. Earth Planet. Inter.*, 186, 154-171.

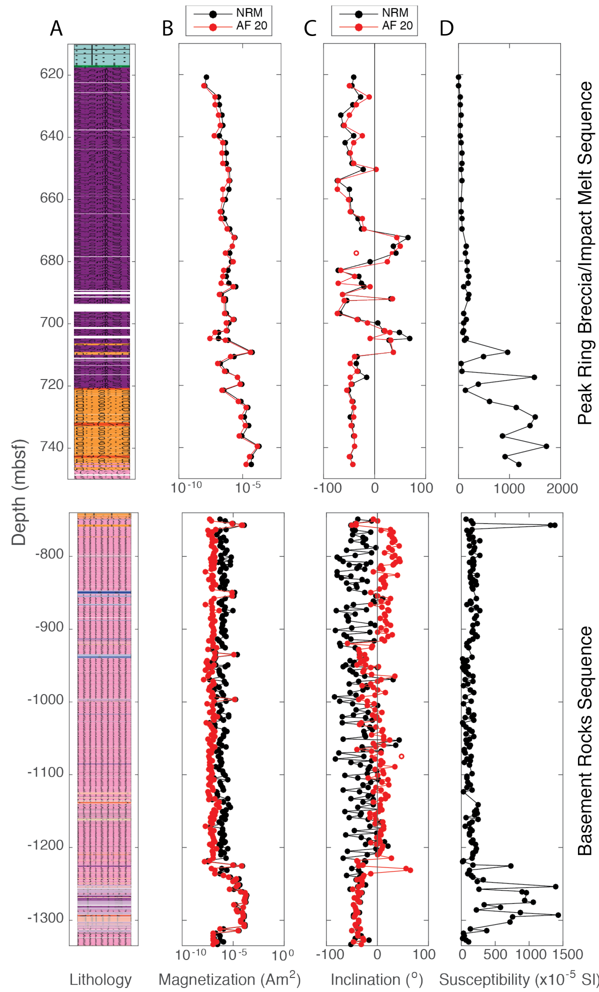

Fig 1. Stratigraphic plots of the Chicxulub peak ring impactite sequence depicting (from left to right): (A) lithology, (B) sample magnetizations at the NRM (black symbols) and AF 20 mT (red symbols) demagnetization steps, (C) magnetic inclination at the NRM and AF 20 demagnetization steps, and (D) MSCL magnetic susceptibility values measured at equivalent depths (within 2 cm of paleomagnetic sampling). Major lithologic groups are depicted as follows: melt-bearing breccias (purple), clast-poor impact melt rocks (orange) and clast-rich impact melt rocks (red), basement rocks (pink), post-impact sediments (turquoise).