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Rock Magnetic and Magnetostratigraphic Study of Chicxulub Crater Impact Breccias and Post-Impact Carbonates in the Yaxcopoil-1 and Santa Elena Boreholes

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Chicxulub crater was formed ~66 Ma ago by an asteroid impact at the Cretaceous/Paleogene (K/Pg) boundary on the Yucatan carbonate platform in the southern Gulf of Mexico. The crater is the youngest and best preserved of the three large impact basins, with a ~200 km diameter and multi-ring and peak ring morphology. The crater, covered by post-impact carbonate sediments with thickness up to ~1.1 km, has been investigated by geophysical studies and drilling programs. Initial drilling in Yucatan was carried out by the Pemex oil company, followed by the National University UNAM Chicxulub program, the ICDP Yaxcopoil-1 project and the IODP-ICDP Expedition 364 marine drilling. Here, results of combined paleomagnetic, rock magnetic, petrographic and geochemical studies are used to characterize the sequence and constrain the unit's emplacement and crater formation. We analyze core samples of suevitic breccias and Paleogene carbonates from the Yaxcopoil-1 and Santa Elena boreholes drilled in the southern sector, inside and to the south of the crater rim marked by the ring of cenotes. Magnetic hysteresis, low-field susceptibility and coercivity analyses indicate that main carriers are titanomagnetites and magnetite. Mineralogical and magnetic properties indicate effects of hydrothermal alteration, associated with the high temperature system generated by the impact. Higher coercivity minerals are also observed in some samples. In the carbonate sections, hydrothermal effects as marked by the geochemical logs decrease upwards from the breccia-carbonate contact. Alternating field and thermal demagnetization is used to investigate the magnetization vector composition and isolate the characteristic remanent components. Magnetic polarities defined from the inclination data show a sequence of reverse to normal, which correlate to polarity chrons 29r to 26r, with impact occurring within 29r chron. The correlations of the magnetostratigraphy and stable isotopes indicate a hiatus at the basal Paleocene section. In Santa Elena cores, $\delta^{13}\text{C}$ values range from 1.2 to 3.5‰ and $\delta^{18}\text{O}$ values range from -1.4 to -4.8‰, with variation trends correlating with the marine carbon and oxygen isotope records for the late Maastrichtian and early Paleocene. The positive carbon isotopes indicate high productivity after the K/Pg extinction event, while the oxygen isotope values are more negative reflecting regional and local effects. Silica contents decrease from high in the suevites to low values in carbonates showing higher variability and then

increased contents at the Paleocene-Eocene Thermal Maximum (PETM). The geochemical trends correlate in other elements including iron, titanium, potassium and aluminum that record impact-induced hydrothermal effects and possibly changing depositional conditions. Ca shows an opposite trend, with lower values in the upper suevitic breccias, higher values in the Paleocene carbonates and lower values in the PETM.