PALEOCENE-EOCENE CLIMATIC EVENTS IN THE IODP-ICDP EXPEDITION 364, CHICXULUB IMPACT CRATER: GEOCHEMICAL PRELIMINARY RESULTS. Pérez-Cruz[1], L., A. Keller[2], S. Kirtland Turner[2], K. Choumiline[2], E. Chenot[3], M. J. L. Coolen[4], R. Ocampo-Torres[5], A. Pickersgill[6], H. Sato[8], A. Wittmann[9], K. E Yamaguchi [10] and Expedition 364 Scientists. [1]National Autonomous University of Mexico (UNAM), C. P. 04510, Mexico City, Mexico, perezcruz@geofisica.unam.mx. [2]University of California Riverside, 900 University Ave., Riverside, California, USA. [3]Université de Bourgogne-Franche Comté, Dijon 21000, France. [4]Curtin University, Bentley, WA 6102, Australia. [5]Université de Strasbourg–CNRS, 67000 Strasbourg, France. [7]University of Glasgow, Glasgow, G12 8QQ, UK. [8]Japan Agency for Marine-Earth Science and Technology, Kanagawa, 237-0061, Japan. [9]Arizona State University, Tempe, AZ 85287. [10]Toho University, Chiba 274-8510, Japan.

Introduction: The International Ocean Discovery Program (IODP) and the International Continental Scientific Drilling Project (ICDP) Expedition 364, drilled the Chicxulub Impact Crater at Site M0077A, recovering a continuous core from 506.7 to 1334.7 mbsf (meters below sea floor), sampling the post-impact rocks, suevites and impact melt rocks and granitic basement [1]. One of the aims of the drilling was to unravel how did ocean life recovered after the impact, and what changes occurred across the Paleocene and Eocene. For this study, we analyzed the post-impact section (~110 m) from 507 to 620 mbsf, corresponding to the Paleogene sedimentary rocks.

In the Early Paleogene a series of transient warming events were recognized [2]. These short events, called "hyperthermals", have been associated with changes in the carbon isotope composition of the ocean–climate system. The input of carbon is evidenced by the conspicuous negative carbon isotope excursions (CIEs) in carbonates and organic matter, as well as by deep–sea carbonate sediment dissolution intervals [3]. These intervals are characterized by the presence of distinct clay layers associated with abrupt decreases in carbonate content. These have been interpreted as abrupt climatic changes associated with increasing atmospheric pCO_2, shoaling of the lysocline and the calcite compensation depth (CCD), and a general lowering of the carbonate saturation state [3] induced by the dissociation of gas hydrates. It is also suggested that during these hyperthermals, the hydrologic and weathering cycles were strengthened, providing a link to humid–warming phase alternation [4]. These events influenced calcareous assemblages (such as, foraminifera and calcareous nannofossils) [5], possibly triggering biotic evolution. The best–studied hyperthermal is the Paleocene–Eocene Thermal Maximum (PETM), which occurred about 55 million years ago and lasted less than 170 kyr [3]. During the PETM global temperature increased by more than 5°C, leading to a 2–6‰ negative CIE in terrestrial and marine records.

Samples and methods: Thirty three samples were oven-dried and ground before $\delta^{13}C$ and $\delta^{18}O$ determination using a Kiel IV carbonate preparation device attached to a Thermo Delta V Mass Spectrometer at the University of California, Riverside, using standard dual inlet techniques. All values are reported relative to Vienna PeeDee Belemnite (VPDB). Replicate analyses of NBS-19 standard were run concurrently with samples yielding machine error of 0.04‰ ($1\sigma, n = 303$) for $\delta^{13}C$ and 0.07‰ ($1\sigma, n = 303$) for $\delta^{18}O$. Bulk samples were dried, ground, and homogenized, and split into three subsets for the following analyses: 1) Total and organic carbon, using a LECO CS-300 carbon analyser, 2) Concentrations of major, minor and trace elements measured by energy dispersive X-ray fluorescence (ED-XRF) spectroscopy, using a PANalytical Epsilon 3-XL benchtop EDXRF spectrometer, and 3) mineralogy by X-Ray Diffraction (XRD) using a Philips X'Pert Pro multipurpose diffractometer, in 37 discrete samples, in the laboratories of MARUM (Universität Bremen) [1].

Results: Preliminary low-resolution geochemical data revealed short warm events in the post-impact rocks at ~512 to 514, 527-529, 567-570, 588-5929 and 607-609 mbsf. They are generally characterized by (1) negative shifts in bulk carbon isotope ratios ($\delta^{13}C$), (2) negative shifts in oxygen isotope values ($\delta^{18}O$), (3) decrease in carbonate content, and (4) a significant decrease in Corg and phosphorus concentrations**.** Declines in oxygen isotope ratios indicate warming conditions; meanwhile a negative shift of $\delta^{13}C$ could be related to a decrease in productivity or/and increased weathering of organic rich rocks. Corg and low phosphorous values also suggest a decrease in productivity. The decrease in carbonate content suggests dilution by detrital input or/and dissolution due to ocean acidification. Variation trends are similar in elements like Al, Ti and K, which are all major metals in detrital materials recording changing conditions in the platform. The increase in content of Al, K, and Ti indicate chemical weathering and might reflect a change to humid conditions. Calcium shows the opposite trend, with low values in these intervals (Fig. 2). The lower portion of this section, between 616 to 606 mbsf, shows positive carbon isotopes values ranging from 0.5 to 1.0‰ and d18 O values ranging from -10 to -4‰. Positive values suggest enhanced productivity, with apparent recovery following the K-Pg extinction event. Higher density sampling might provide better temporal resolution of the hyperthermal events, including the PETM, which with the preliminary sampling was challenging to resolve/recognize.

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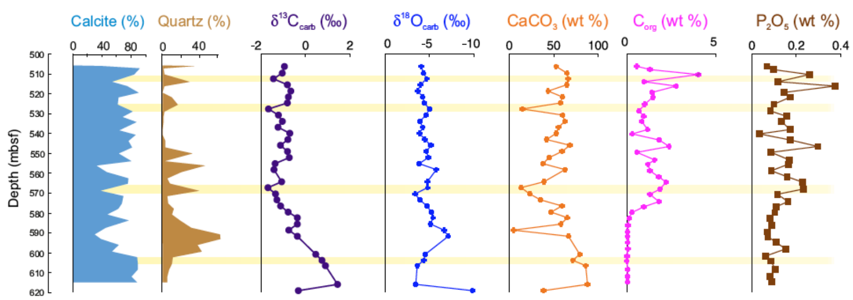

Fig. 1 Geochemical data in the core M0077A. Yellow lines suggest warm events.

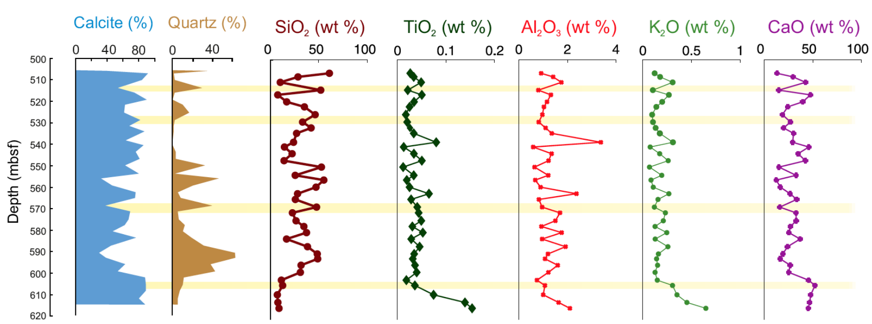

Fig. 2 Mineralogy and major elements in the core M0077A. Yellow lines suggest warm events.