ZOOPHYCOS **THROUGH PALEOCENE SEDIMENTS FROM THE IODP-ICDP EXPEDITION 364: PALEOENVIRONMENTAL CHANGES AFTER THE CHICXULUB IMPACT.** F. J. Rodríguez-Tovar[1], M. T. Whalen[2] and K. O'Malley[2], J. Morgan[3], S. Gulick[4], C. L. Mellett[5], and Expedition 364 Scientists [1]Departamento de Estratigrafía y Paleontología, Facultad de Ciencias, Universidad de Granada, Granada 18002, Spain; fjr-tovar@ugr.es, [2]Department of Geosciences, University of Alaska Fairbanks, Fairbanks, AK, 99775, mtwhalen@alaska.edu, [3]Department of Earth Science and Engineering, Imperial College London, SW7 2AZ, UK; j.v.morgan@imperial.ac.uk, [4]Institute for Geophysics, Jackson School of Geosciences, University of Texas at Austin; sean@ig.utexas.edu, TX 78758-4445, USA, [5]British Geological Survey, The Lyell Centre, Research Avenue South, Edinburgh, EH14 4AP, UK; cmell@bgs.as.uk.

Introduction: In recent years, ichnological data have proven to be a useful tool in the interpretation of major environmental changes associated with bio-events, such as those of the K/Pg boundary [1], [2], [3], [4], [5], even more so when integrated with geochemical and isotopic analyses [6], [7], [8], [9], [10]. Some ichnotaxa are of particular interest, when they can be used to indicate specific paleoenvironmental conditions. This is the case for *Zoophycos*, one of most important spreite structures in deep-sea sediments, which are easily recognizable in core. However, although this trace fossil has been intensely studied, the paleoenvironmental significance and interpretation of environmental conditions of the *Zoophycos* tracemakers remain controversial. In Cenozoic hemipelagic sediments *Zoophycos* tracemaker has been associated with calm conditions, and used to assess energy changes, sedimentation rate, food content, or bottom-water oxygenation (see [11] for a recent review). Recently, their stratigraphic distribution has been used as a proxy in paleoceanography during glacial-interglacial variations in relation to high and seasonal organic-matter deposition and primary productivity [12].

The Chicxulub impact crater. Post-Impact sediments: From April to May 2016, the IODP and ICDP drilled the Chicxulub peak ring offshore during Expedition 364 at site M0077A (21.45° N, 89.95° W). The Expedition recovered core between 505.7 and 1334.7 m below the seafloor (mbsf). Aproximately 110 m of post-impact, hemipelagic and pelagic, Paleogene sediments were recovered, ranging from middle Eocene (Ypresian) to basal Paleocene (Danian). Studied Paleocene rocks extend from 607.27-616.55 mbsf, and include upper part of Core 364/77A/40-R-1, Core 364/77A/39-R, Core 364/77A/38-R, and Core 364/77A/37-R). Unit 1F consists of interbedded light gray to light bluish gray wackestone and packstone, and light to dark bluish gray marlstone at cm to dm scale. Core analyses during the offshore and onshore science party revealed the presence of bioturbation within the Paleocene rocks [13].

In accordance with this, we start the ichnological analysis of the post-impact sediments, for use as as a potential proxy to help us understand the local paleoenvironmental changes that occurred after the Chicxulub impact.

Results: *Zoophycos* in the Paleocene sedimentary rocks: Preliminary ichnological analysis reveals the generalized presence of *Zoophycos* throughout the Paleocene sediments. In most of the cases *Zoophycos* is registered as repeated, more or less horizontal, spreiten structures, consisting of alternating dark and light material forming the internal lamellae into the lamina, in cases showing internal pellets. A variable degree of diffusiveness is observed. In some intervals, several successive spreiten structures, probably belonging to a unique specimen are recorded, showing a variable depth of penetration. Locally, a more or less complete structure, with the vertical shaft and multiple spreiten structures coming from this central shaft, is preserved. In some cases, the marginal tube at the extreme of the spreiten structure is recognized. Some *Zoophycos* structures cross-cut other spreiten lamellae as well as other trace fossils.

Zoophycos shows clear variations in its distribution and abundance along the studied materials, from the absence of spreiten structures, and isolated records, to a high abundance and density, in cases appearing as the exclusive trace fossil (Fig. 1). Variable pattern in distribution can be characterized, from long-range trends allowing a clear differentiation between the lower and upper parts of the entire Paleocene, to short-range alternations mainly related to minor order lithological changes.

Discussion: The observed variability (i.e., size, infilling, diffusiveness) of the *Zoophycos* specimens, as well as the non-random distribution and abundance, but the evident pattern disposition, could be interpreted as a response to changes of variable scale in paleoenvironmental conditions, probably linked to regular variations in paleoclimate or atmosphere-ocean dynamics. This variability, however, implies that there is not an unique parameter determining the *Zoophycos* record during the Paleocene, post-Chicxulub impact event, but probably a variable combination of sedimentation rate, substrate consistency, oxygen conditions and nutrient availability as these are the most significant environmental conditions affecting *Zoophycos* tracemaker.

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Fig. 1. Abundant *Zoophycos* in Core 364/77A/39-R-1.

Acknowledgements: The Chicxulub drilling expedition was funded by the International Ocean Discovery Program as Expedition 364 with co-funding from the International Continental scientific Drilling Program. The European Consortium for Ocean Research Drilling (ECORD) implemented Expedition 364, with contributions and logistical support from the Yucatán state government and Universidad Autónoma de México (UNAM).

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