AGU 100 FALL MEETING
Washington, D.C. | 10–14 Dec 2018

PP53B-04: The recovery of the deep biosphere at the Chicxulub impact crater

Friday, 14 December 2018
14:25 - 14:40
Walter E Washington Convention Center - Salon I

The Chicxulub crater, Mexico, is the site of the asteroid impact that led to the end-Cretaceous mass extinction. While impact events are known to be able to cause severe disruption to surface-dwelling organisms, the effects of such catastrophic perturbations on the deep biosphere are not known.

Deep ocean drilling into the peak ring of the Chicxulub impact crater (IODP expedition 364) in 2016 allowed us to study the modern deep biosphere within the (a) high-porosity melt-bearing impact breccia/suevite (617-740 mbsf) emplaced within a day or so of the Cenozoic, (b) the overlying low porosity post-impact marine Cenozoic carbonates (504-617 mbsf), and the impacted and fractured granitic basement (740-1334 mbsf). The microbial biomass (~10^6 cells/g wet weight) was highest in the upper suevite, in underlying non-granitic subvolcanic pre-impact basanite, and at the intercalation of suevite and impact melt rock. Pre-impact sterile conditions of the uplifted granitic basement rocks and mineralogical evidence of impact-induced sterilization suggest that the basement rocks have only been amenable to microbial colonization for less than 66 Myr. Enrichments at *in situ* 50-60 °C show the presence of heterotrophic lifestyles in the suevite and bacterial sulfate reduction extending into the top of the granitic basement. Cultivation-independent 16S diversity profiling revealed the presence of heterotrophic (fermentative) as well as autotrophic C-fixing thermophilic bacteria in the organic-rich (up to 4 wt % total organic carbon; TOC) Cenozoic sediments. The organic-lean suevite (< 0.1% TOC) showed the unique presence of sequences related to thermophilic *Synechococcus* (cyanobacteria) and S-oxidizing green sulfur bacteria (chlorobi), and Chloroflexi often associated with organic-poor deep-sea sediments. Alphaproteobacteria, predominated in the upper part of the granitic basement (<1000 mbsf), while putative manganese-oxidising Bacilli (Firmicutes) predominated in the melt-rich granitic basement (>1200 mbsf). Our data suggest that the catastrophe that led to the end-Cretaceous mass extinction caused geological disruption and recolonization of microbial life in the deep subsurface biosphere at the Chicxulub impact site.

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