Geophysical Research Abstracts
Vol. 20, EGU2018-19701, 2018
EGU General Assembly 2018

Climate change and the deep biosphere in igneous oceanic crust; is there a connection?

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Climate change has a profound impact on the ocean chemistry and the marine organisms, which is recorded in the marine sediments. As a result, most research related to climate change has been focused on sedimentary archives in order to reconstruct past climate events in Earth's history. It is only recently that a fossil record in igneous oceanic crust has been recognized, representing an important, and yet underexplored microbial habitat on Earth, opening up for the question:

Could igneous oceanic crust be used as a climate archive?

If so, a vast and unexplored record would be available that could enhance our understanding of Earth ´s climate in deep time.

The aim of this project is to explore this possibility by evaluating how a dramatic climate change, such as a Snowball Earth or an impact event, might have influenced the deep biosphere and its habitats. This could give us a better understanding of climate impact on a large scale. Questions of interest are:

–Stable isotopes of C and O in carbonate minerals and microfossils
Will we see the same climatic trends as found in the sedimentary record?

–Elemental changes in fossilization minerals
Are there any elemental changes, and if so, do they correlate with other climatic trends?

–Preservation of Ir deposited on the igneous seafloor
Could Ir be preserved in fossilized microorganisms or secondary- and biomineralization?

–Changes in microbial abundance and taxa
Can we see changes in the biological diversity during climatic events corresponding to changes seen in other biotas?

Climatic impact affects the geochemistry in the ocean, where such changes can be preserved due to fossilization and secondary mineralization in for example vesicular basalt. The study has so far shown a high abundance of microorganisms in samples covering the K/T boundary and the Eocene-Oligocene transition, where the abundance and diversity changes for the microbial community over the K/T boundary. Isotope studies has also indicated a possible trend that corresponds to previous climate studies. More work is needed, as well as more samples from geological periods of interest, to confirm any connection between the deep oceanic crust, its biosphere and our climate.