

Selective preservation of amides in marine tephra layers

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This study aims to determine whether the marine diagenesis of volcanogenic products (tephra) can play a significant role in the carbon cycle. To achieve this aim, the extent and mechanism by which C_{org} preservation in volcanic sediments is dependent on the composition of tephra layers and surrounding sediments from IODP Sites in the Caribbean (U1396) and Bering Sea (U1339) was investigated. Preliminary results (wt% total organic carbon data) suggest that there is preferential preservation of organic carbon close to and within tephra layers. To investigate this further, lipid extraction was conducted using modified Bligh and Dyer extraction for selected U1396 sediment (55) and tephra (10) samples. In nearly all cases the total organic extract (TOE) of tephra is markedly different to the sediments surrounding it, with different classes of compound identified in each respectively. Preliminary data suggest that amides and other nitrogen-based compounds appear to be preferentially preserved in the tephra. This enhanced organic nitrogen preservation is most likely the result of complexation with reactive iron species generated during diagenesis of the tephra. These amides may either have been mixed into the tephra from the surrounding sediments, or be biomarkers of preferential bacterial growth in the tephra layers. Importantly, we see this enhanced amide preservation in our oldest tephra layers at IODP340, extending back 4.5 Myr.

These findings suggest that volcanic-rich sediments, which are generally avoided by organic geochemists searching for biomarkers, may actually represent an important site for enhanced preservation of otherwise labile organic compounds.