AGU FALL MEETING
San Francisco | 14 – 18 December 2015

V53A-3126: Mid-Ocean Ridge Magma Supply and Glacial Cycles: Long Time Series Studies of Crustal Thickness and Seafloor Topography

ABSTRACT

Friday, 18 December 2015
13:40 - 18:00
Moscone South - Poster Hall

Glacial loading has been shown to modulate volcanic melt generation in subaerial systems, and recent studies suggest that eustatic sea level fluctuations induced by glacial cycles may influence mantle-melting regimes at mid-ocean ridges. Models predict temporal variation in crustal thickness, and seafloor topography, linked to sea level change. Recent studies of bathymetry as a proxy for crustal thickness show significant spectral energy at periodicities linked to Milankovitch cycles of 23, 41, and 100ka (Crowley et al., 2015; Tolstoy, M., 2015). In this study we investigate climate driven periodicity in mid-ocean ridge magma supply utilizing basement topography and crustal thickness data. We use multichannel seismic reflection (MCS) data from two prior studies of the flanks of the Juan de Fuca (JdF) ridge, and 3D MCS data from the Northern East Pacific Rise (EPR) 9°37-57'N. The JdF datasets extend to crustal ages up to 8.78 Ma, and EPR data to ~180 ka. By performing spectral analysis on these data along with dO18 climate records from Lisiecki and Raymo (2005) for the last 5.32ma and Zachos et al. (2001) for earlier times we investigate intervals of similar periodicities in order to identify potential links between climate and magma supply to mid-ocean ridges. Further analysis is undertaken to determine whether depth to basement and crustal thickness are correlated within and across datasets, and whether significant spectral peaks occur in basement and crustal thickness data outside of known climate cycles. Initial results show significant spectral energy in basement depth at the 100ky cycle in the 0-1Ma time series, when eccentricity is understood to have the most impact. Long-term temporal variability is apparent in JdF data, with low relief abyssal hills (~70m on average) present 1-3.2Ma and 6-8.78Ma, but higher relief bathymetry (~200m) from 3.2-6Ma. These subsets align well with previously identified climatic subgroups (Zachos et al., 2001), correlating both low relief time periods with cooling trends and the high relief era with warming climate. Basement and crustal thickness are well correlated at long wavelengths within JdF datasets, with basement leading crustal thickness in most cases and lags less than the expected half width of the crustal accretion zone.

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