Geochemical portrayal of the Pacific ridge using statistical techniques

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Recent advances in analytical mass spectrometry techniques dramatically increases the number of isotopic data. Nowadays, the complete analysis of Sr, Nd, Pb, Hf and He isotopic compositions for a set of samples has become achievable. Working with such a multidimensional dataset implies a new approach in data interpretation, preferably based on statistical analysis techniques. Principal Component Analysis (PCA) is a powerful mathematical tool to study this type of multidimensional data set. The goal of PCA is to reduce the number of dimensions in a data set by keeping only those that contribute most to its variance. Samples collected during the PACANTARCTIC 2 cruise fill a sampling gap from 53° to 41° S of the Pacific Antarctic Ridge (PAR). Sr, Nd, Pb, Hf and He isotopic compositions of this new mid-ocean ridge basalt collection are shown together with published data from 66°S to 53°S and from the EPR. Using the PCA tool, it becomes possible to get a statistical picture of the geochemical variations along the entire PAR, from the Australian Antarctic Discordance (AAD) to the Juan Fernandez microplate. Based on the incomplete sampling of the ridge a previous study led to the identification of a large scale division of the south Pacific mantle with a limit at the latitude of Easter Island [1]. The complete dataset reveals a different geochemical profile. Along the Pacific ridge, a large scale variation reaches an extremum which corresponds to a less ‘depleted’ isotopic signature at the Juan Fernandez microplate latitude. Hot spot-ridge interactions are marked by anomalies superimposed on this curve. The PCA method allows to interpret this large scale variation as a progressive geochemical change of the depleted matrix of the mantle. This variation is unrelated to the effect of the hot spot-ridge interactions.