Geophysical Research Abstracts
Vol. 14, EGU2012-12970, 2012
EGU General Assembly 2012

What controls the distribution of volcanoes within monogenetic volcanic fields: Insights from spatial distribution and alignments of volcanic centers

N. Le Corvec, K.B. Sporli, J.V. Rowland, and J.M. Lindsay
The University of Auckland, School of Environment, New Zealand (n.lecorvec@auckland.ac.nz)

Basaltic volcanic fields are distributed worldwide in tectonic environments ranging from extensional to convergent. Understanding similarities and differences between these fields may help us to characterize key controls on their generation. Basaltic volcanic fields are composed of numerous volcanic centers which represent the end point of the pathway of magma from its source to the surface. We analyzed the spatial distribution of volcanic centers of 37 different monogenetic volcanic fields using similar analyses for each volcanic field: 1) the Poisson Nearest Neighbor (PNN) analysis representing the degree to which an observation (i.e. the distribution of the volcanic centers) departs from a predicted Poisson distribution; here we assume that the distribution of volcanic centers relative to each other is representative of the source behavior within the mantle, and 2) a volcanic alignment analysis to ascertain the preferential pathways, if any, used by the magma to reach the surface. We consider the end-member geometries for magma pathways within the brittle upper crust to be representative of: 1) newly formed extension fractures perpendicular to the least compressive stress ($\sigma 3$), or 2) pre-existing fractures that are near-parallel to the maximum principal stress ($\sigma 1$). Although these methods have been used to characterize monogenetic volcanic fields elsewhere, this is the first comprehensive global comparison of the resulting data using these methods.
The results of the PNN analysis show that most volcanic fields display a clustered distribution of their volcanic centers, which is independent of the tectonic environment. The results of the volcanic alignment analyses show either that the tectonic environment may exert a strong influence on the preferential orientations of the volcanic alignments, or be in competition with other factors (e.g., pre-existing structures, local stress changes due to older intrusions). The combination of these results emphasises the interplay between the deep (i.e. behaviour of the source) versus shallow (i.e. stress field, crustal pre-existing structures) levels within the lithosphere on the propagation of the magma, and therefore on the spatial distribution of the volcanic centers within volcanic fields.