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Correlations between subduction of linear oceanic features and arc volcanism volume around the Pacific basin

VALÉRIE VIDAL[1], CLAUDIA ADAM[2], PABLO GROSSE[3] AND MIE ICHIHARA[4]

[1]Laboratoire de Physique, ENS de Lyon - CNRS
[2]Kansas State University, USA
[3]CONICET and Fundación Miguel Lillo, Argentina
[4]Earthquake Research Institute, University of Tokyo, Japan

Presenting Author: valerie.vidal@ens-lyon.fr

Arc volcanoes, created by magma generated from the dehydration of subducting slabs, show great variability in their sizes and along-arc spatial distributions. In this study, we address a fundamental question, namely, how do subduction zones and volcanic arcs respond to the subduction of “atypical” oceanic lithosphere. We investigate the correlation between the geographical location and volume of arc volcanoes and the subduction of linear oceanic features, including hotspot tracks, oceanic plateaus, volcanic ridges, mid-oceanic ridges, arc volcano chains, and fracture zones, around the Pacific basin. We use multidisciplinary and complementary data sets (topography and bathymetry, seismology and volcano morphometry), and design new analytical and data processing methods. We analyze 35 oceanic linear features. The subduction of three oceanic plateaus and five hotspot chains are clearly associated with volcanism increase, whereas four hotspot chains are related to volcanic gaps. We propose that the patterns of volcanism increase or decrease related to these oceanic features depend on the interplay between chemical (potentially enhancing melting) and thermo-mechanical (inhibiting melting) effects, and/or by the variations of the chemical signatures along hotspot chains. The subduction of volcanic ridges is generally associated with small increases in arc volcanism, which may be accounted for by the fact that these features are highly hydrated and therefore promote melt. The subduction of active mid-oceanic ridges is generally associated with slab windows and arc volcano gaps. No clear inference is found for the subduction of inactive arc ridges.