Geophysical Research Abstracts
Vol. 15, EGU2013-12192, 2013
EGU General Assembly 2013

Subduction of fracture zones

Vlad Constantin Manea (1), Taras Gerya (2,3), Marina Manea (1), Guizhi Zhu (2), and William Leeman (4)

(1) Universidad Nacional Autonoma de Mexico, Centro de Geociencias, Computational Geodynamics Laboratory, Juriquilla, Queretaro, Mexico (vlad_manea@yahoo.com), (2) Department of Geosciences, Swiss Federal Institute of Technology (ETH-Zurich), CH-8092 Zurich, Switzerland, (3) Geology Department, Moscow State University, 119899 Moscow, Russia, (4) Department of Earth Science, Rice University, Houston, TX 77005, USA

Since Wilson proposed in 1965 the existence of a new class of faults on the ocean floor, namely transform faults, the geodynamic effects and importance of fracture zone subduction is still little studied. It is known that oceanic plates are characterized by numerous fracture zones, and some of them have the potential to transport into subduction zones large volumes of water-rich serpentinite, providing a fertile water source for magma generated in subduction-related arc volcanoes. In most previous geodynamic studies, subducting plates are considered to be homogeneous, and there is no clear indication how the subduction of a fracture zone influences the melting pattern in the mantle wedge and the slab-derived fluids distribution in the subarc mantle. Here we show that subduction of serpentinized fracture zones plays a significant role in distribution of melt and fluids in the mantle wedge above the slab. Using high-resolution tree-dimensional coupled petrological-termomechanical simulations of subduction, we show that fluids, including melts and water, vary dramatically in the region where a serpentinized fracture zone enters into subduction. Our models show that substantial hydration and partial melting tend to concentrate where fracture zones are being subducted, creating favorable conditions for partially molten hydrous plumes to develop. These results are consistent with the along-arc variability in magma source compositions and processes in several regions, as the Aleutian Arc, the Cascades, the Southern Mexican Volcanic Arc, and the Andean Southern Volcanic Zone.