Geophysical Research Abstracts
Vol. 17, EGU2015-6031-3, 2015
EGU General Assembly 2015

Dynamic Modeling of Back-arc Extension in the Aegean Sea and Western Anatolia

Ziya Mazlum (1), Oğuz H. Göğüş (1), Hasan Sözbilir (2), Hayrullah Karabulut (3), and Russell N. Pysklywec (4)

(1) Eurasia Institute of Earth Sciences, Istanbul Technical University, Istanbul, Turkey (mazlumz@itu.edu.tr), (2) Department of Geological Engineering, Dokuz Eylül University, Izmir, Turkey, (3) Kandilli Observatory, Boğaziçi University, Istanbul, Turkey, (4) Department of Geology, University of Toronto, Toronto, Canada

Western Anatolian-Aegean regions are characterized by large-scale lithospheric thinning and extensional deformation. While many geological observations suggest the formation of rift basins, normal faulting, exhumation of metamorphic rocks, and back-arc volcanism, the primary cause and the geodynamic driving mechanisms for the lithospheric thinning and extension are not well understood. Previous studies suggest three primary geodynamic hypotheses to address the extension in the Aegean-west Anatolia: 1) Slab retreat/roll-back model, inferred by the southward younging magmatism and metamorphic exhumations; 2) Gravitational collapse of the overthickened (post orogenic) lithosphere, interpreted by the structural studies that suggests tectonic mode switching from contraction to extension; 3) Lateral extrusion (escape tectonics) associated with the continental collision in East Anatolia. We use 2-D thermo-mechanical numerical subduction experiments to investigate how subduction retreat and related back-arc basin opening are controlled by a) changing length and thickness of the subducting plate, b) the dip angle of the subducting slab and c) various thickness and thermal properties of the back-arc lithosphere. Subsequently, we explore the surface response to the subduction retreat model in conjunction with the gravitational (orogenic) collapse in the presumed back–arc region. Quantitative model predictions (e.g., crustal thickness, extension rate) are tested against a wide range of available geological and geophysical observations from the Aegean and west Anatolia regions and these results are reconciled with regional tectonic observations. Our model results are interpreted in the context of different surface response in the extensional regime (back-arc) for the Aegean and western Anatolia, where these two regions have been presumably segmented by the right lateral transfer fault system (Izmir-Balıkesir transfer zone).