Geophysical Research Abstracts
Vol. 13, EGU2011-14174, 2011
EGU General Assembly 2011

Backarc basins opening, contributions from slab retreat, mantle flow and intracontinental strike-slip shear zones (Stephan Mueller Medal Lecture)

Laurent Jolivet

ISTO, Université d'Orléans-CNRS (UMR 6113), Campus Géosciences, 1A Rue de la Férollerie, 45071 Orléans Cedex 2, France (laurent.jolivet@univ-orleans.fr)

As they form on the margins of continents behind retreating subduction zones, backarc basins are under the control of forces originating from the contact between the subducting and overriding plate and from the underlying mantle flow but they can also be influenced by forces due to distant tectonic processes. A comparison between the Oligo-Miocene western Pacific (mainly the Japan Sea and South China Sea) and Mediterranean backarc basins illustrates these various factors. In eastern Asia large-scale strike-slip faults have interacted with the formation of backarc basins and the Japan and South China Seas have been described as pull-apart basins. In the case of the Japan Sea approximately 450 km of dextral displacement have been accommodated by a N-S trending strike-slip system (Sakhalin-Hokkaido Shear Zone and its southern continuation in the Japan Sea) during the formation of the backarc basin. This 2000 km-long dextral shear zone oblique on the trench can hardly be explained by an oblique convergence between the Pacific and Eurasia plates and a link with the India-Asia collision has been proposed. The South China Sea formed at the same time as a major left-lateral strike-slip system, the Ailao Shan-Red River (ASRR) shear zone that has accommodated several hundreds of kilometers of displacement and its relations with the opening of the South China Sea are debated as well as its extension at depth. The ASRR is one of the most important strike-slip fault formed as a consequence of the India-Asia collision. In the Mediterranean region a large strike-slip fault (the North Anatolian Fault, NAF) has propagated from eastern Turkey to the Aegean domain during the Late Neogene. The westernmost part of the fault system ends in a complex system of grabens (Volos, Corinth) before joining the Hellenic trench. The southern part of the Aegean domain is moving southward faster than the Anatolian plate is extruded westward, calling for a component of pure extension driven from the south. This component of backarc extension in the Aegean Sea started earlier than the NAF some 35 Ma ago and is mainly due to the retreat of the Hellenic slab. The case of the Aegean and other Mediterranean backarc basins further shows that slab detachments and slab tears partly control their tectonic history and contribute to the localisation of deformation in the crust, including that of the NAF. Despite these various sorts of interaction between strike-slip faults and backarc basins the flow of mantle beneath the basin always seems perpendicular to the trench as suggested by the patterns of SKS waves anisotropy, suggesting that mantle flow due to slab retreat is one of the major driving forces for backarc extension. The interactions between crustal and mantle deformation seems simple in a first approach as suggested by the parallelism between asthenospheric flow and crustal stretching but the presence of large-scale strike-slip faults makes things more complex. Based on these examples I discuss these interactions and the degree of coupling between crust and mantle.