

PREFACE

Birth and death of oceanic basins: geodynamic processes from rifting to continental collision in Mediterranean and circum-Mediterranean orogens

GEOPROB Project

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Preface

The study of the evolution of ocean basins from birth to death is crucial for the understanding of the geodynamic evolution of orogenic systems. Exhumed ophiolite-bearing orogenic belts represent significant fossil analogues of different types of modern oceanic basins, allowing detailed multiscale and multidisciplinary investigations. Such investigations are highly important to our understanding of the ancient and modern geodynamic processes connected to the different stages of complete tectonic evolution, from rifting to subduction, collision and exhumation.

Subduction systems are characterized by huge mass transfers between the subducting lithosphere and the overlying plate, causing the formation of complex lithospheric structures (i.e. subduction complexes, orogenic wedges) made of oceanic and continental slices. An important role in the subduction initiation, evolution and mechanism is played by: (1) the composition and thermal state of the oceanic lithosphere (linked to the rift phases); (2) the reactivation of main shear zones in the passive margin; (3) the type of subducted plate and age of oceanic slab; (4) the convergence rate and its eventual changes, induced by subduction of ocean-floor asperities or by phase transitions in the upper and lower mantle; and (5) the role played by continental collision in driving the exhumation of portions of the subducted slab by channel flow, buoyancy or extrusion, as described by recent conceptual and numerical models.

All of the above lithospheric processes affect the Earth dynamics at different structural levels from the deep-seated part of the subduction system, with related high-pressure metamorphic transformations, fluids and volatile recycling, melting and so on, to the

shallower parts, with the evolution of accretionary and erosive complexes and the triggering of earthquakes.

The papers published in this Special Issue describe different key sectors of the circum-Mediterranean and Mediterranean Tethys mountain belts, being representative of different stages of geodynamic evolution of oceanic basins associated with two different types of suture (the Alps–Apennines – Maghrebides–Betic belts and the Dinarides–Hellenides belts; Fig. 1) that continue into Turkey and Iran. These orogenic belts differ from each other in terms of occurrence of obduction processes, back-arc basins, different volumes of mélanges and more; in addition, a wide variety of structural levels are exposed in both belts. These papers therefore unravel significant aspects of the opening and closure of oceanic basins, as well as the role played by oceanic-related structural inheritance in controlling processes from subduction to collision and exhumation stages.

We grouped the papers published here by the geodynamic process they discuss, keeping track of their geographical relevance in order to understand the spatial relations among different portions of the complex Mediterranean collisional setting. In addition, some papers go beyond the specific geodynamic process and discuss the regional geodynamics of key areas. The different processes and zones investigated in this Special Issue are rifting, subduction, exhumation, continental collisions, plate interface and accretionary prism dynamics, and regional geodynamics.

Rifting

Investigations of rifting processes include the study of: the structures linked to the extensional tectonic phases; the thermal anomalies; and the sedimentary and

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