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*Editorial*

# Editorial of Special Issue "Tectonics and Morphology of Back-Arc Basins"

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Back-arc basins are tectonic domains within subduction systems shaped mainly by extensional and transtensional tectonics or in some cases by compression, volcanism and intense hydrothermalism. Understanding their shallow and deep structure allows geologists to not only to infer their formation processes, but also the geodynamic evolution of the associated tectonic plates. This Special Issue collects recent morphological, tectonics, geochemical/petrological analyses and numerical modelling on some back-arc basins distributed around the world. Our aim is to improve our knowledge on their formation and evolution, adding new pieces to this complex and fascinating geodynamic puzzle.

Palmiotto et al. [1] focus on the back-arc spreading centers of the Northern Lau basin (Tonga subduction system). Based on the regional morphology and magnetic data, they improved our knowledge on spreading center velocities. The numerical model, based on visco-plastic rheologies and prescribed surface velocities, of the second invariant of the strain rate shows active deformation in the mantle from the Tonga trench to ~800 km along the overriding plate. This explains the abnormally abundant magmatic production along all the volcanic centers of the Northern Lau Back-Arc Basin.

Magni et al. [2] analysed the main factors controlling phenomena observed within back-arc basins such as (i) the ridge jump, (ii) mantle exhumation and/or intrusive magmatic bodies, (iii) continental crust fragmentation and (iv) asymmetric extension. Dynamics controlling the formation of these structures has been analysed producing 2D numerical models of continental extension, with asymmetric and time-dependent boundary conditions that simulate episodic trench retreat. The main result of the simulations is that the episodic extension exerts a first-order influence on rift and ridge jumps. More generally, the transient nature of trench retreat, which can determine fast and slow extensional episodes, is the cause of ridge jumps, mantle exhumation and continental fragments formation.

Nomikou et al. [3] focused on the geohazards assessment of the Nisyros volcanic system, performing a detailed morpho-analysis, together with an estimation of volcanic body volumes using geospatial techniques combined with geophysical data and seafloor observations. Considering that Nisyros is part of the highly-active volcanic arc and that it does not shows activity since 1887 except for the unrest period from 1996 to 1997, the volcanic hazard is one of the main risks among the several geohazards, i.e., the tectonic, volcanic and tsunamigenic, to which the area is exposed.

Loreto et al. [4] analysed the recent contractional tectonics acting into the southwestern part of the Tyrrhenian back-arc basin, historically dominated by extensional tectonics, which causes the inversion of sediments filling several continental slope basins. This work highlights the strong complexity of this back-arc basin that, even if it belongs to an active subduction system in its eastern part, it starts to reveal contractions in its western part due to the Africa–Eurasia convergence. The tectonic complexity of the area is further increased by the presence of a paleo-step fault responsible, in the past, for transcurrent tectonics but currently locus of contractional tectonics. It is suggested as the best candidate for a future subduction initiation zone.



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Trua et al. [5], with the main aim to constrain the pre-eruptive processes that modulate the chemical evolution of erupted magmas, analyse clinopyroxene crystals of the Tyrrhenian back-arc lavas in order to identify processes driving magma evolution within a transcrustal plumbing system. Thanks to this analysis, the authors suggest that the heterogeneity found within the clinopyroxene population is unusual since it provides, for the first time, a complete set of mush-related scenarios by which the mantle melts evolve from basalt to andesite compositions. They suggest that the archive can be used to interpret the record preserved in the clinopyroxenes of basalt to andesite lavas elsewhere, giving insights into the magma dynamics of the feeding plumbing system, usually lost when whole-rock chemistry is used.

Werner et al. [6] analyse the dynamics of the Kurile back-arc basin using radiometric ages and geochemistry of magmatic rocks sampled at two submarine volcanic edifices, one belonging to the volcanic arc and the other located in continental slope bounding the Kurile Basin. Trace elements and isotopes analyses suggest that both volcanic systems derive from a common magma source. This allowed the authors to conclude that the age of the slope continental volcanoes marks the time of opening of the Kurile Basin, implying slow back arc spreading rates. Moreover, they suggest that the Kurile Basin opening and frontal arc extension occurred synchronously and that extension in the rear and in the frontal parts of the Kurile Island Arc must have been triggered by the same mechanism.

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