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Foreword

From past to current tectonics: Thematic issue dedicated to Jean-François Stéphan (1949–2013)

This thematic issue of *Comptes rendus Geoscience* has been assembled to honor the memory of our late colleague and friend Jean-François Stéphan. Jean-François was a great scientist, specialized in tectonics, and a great colleague who devoted his time for his community. His work and actions deeply imprinted both the French and the International Earth Science communities. This volume brings together contributions of colleagues of Jean-François, who were also close friends or colleagues who knew and deeply appreciated him. Naturally, tectonics is the common theme of these contributions. Some of the papers presented here focus on tectonic questions and/or regions Jean-François worked on during his career; other papers present studies Jean-François motivated or encouraged in one way or another; other papers are simply tectonic studies he would have liked. Taken together, the nine papers of this thematic issue take the reader on a beautiful trip, from past to current tectonics.

The first three papers revisit the subduction factories that were operating in Eurasia in Triassic to Cretaceous times. Faure et al. (2016) analyze the Triassic tectonic features that form the southern margin of the South China Block, and show from lithostratigraphic, structural and chronological evidence that the South China Block subducted southward below the Qiangtang–Indochina block, i.e. in opposite direction to the common vision. The southward subduction was coeval with the intracontinental subduction well documented in South-East China. These results therefore provide a new vision of the Triassic subductions in China. The papers by Chorowicz (2016) and Sosson et al. (2016) then take the readers further west, in Europe and adjacent regions. Based on lithostratigraphic and tectonic analyses, Chorowicz (2016) shows that the present Pieniny Klippen Belt in the Carpathians formed originally along a large ~north–south transform fault that cut the Neotethys domain from Permian to Early Paleogene. The transform fault was likely separating the Penninic and Insubric Oceans in the west from the Carpathian Embayment and the Vardar oceans in the east. Its transcurrent motion allowed subductions and obductions to operate with reverse vergence north and south of the Neotethys. Sosson et al. (2016) provide additional information on the Neotethys, in its prolongation further east, in the Eastern Black Sea-Caucasus region. From new stratigraphic, tectonic, and petrologic data acquired on ophiolitic units in the zone, they show that an intra-oceanic northward subduction was operating within the Neotethys during the Cretaceous. When the spreading center of the back-arc basin created by this intra-oceanic subduction was carried into general subduction below Eurasia, it opened a window into the slab that weakened the overlying Eurasia plate. The plate weakening in turn favored the opening of the Black Sea. The paper thus shows how the Neotethys subduction factory resulted in producing some of the major tectonic elements of the Southern Eurasia plate.

The next paper, by Rangin (2016), examines the subduction process at a more focused scale, that of the active margins where two convergent plates are in contact. Rangin (2016) takes the reader to Asia again and, based on tectonic data, analyzes the zones of micro-plates that have formed the active margins in the Philippines, Andaman Sea, and Burma regions during the Cenozoic. The Philippines and Andaman Sea margins are shown to have deformed in a fairly rigid manner, whereas the Burma margin attests to a non-rigid behavior. The work thus opens questions on which large-scale mechanisms might control the mechanical behavior of subduction margins.

The following paper by Calais et al. (2016) keeps the focus on subduction zones, but now examines how a typical frontal subduction – that in Lesser Antilles, transitions to strike-slip fault zones on its lateral edges. Combining current GPS and long-term geological data, the authors show that the Caribbean–North American plate boundary is segmented laterally from frontal subduction in the east, to oblique subduction with no strain partitioning

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in the center (Puerto Rico), to oblique subduction/collision with strain partitioning further west (Hispaniola). The segmentation of the plate boundary is shown to arise from its Neogene tectonic history, which highlights the control of the long-term plate boundary properties onto current deformation, including earthquakes and inter-seismic loading.

The next two papers consider faults in general and examine some of their fundamental properties. Perrin et al. (2016) analyze the surface traces of about 50 continental faults spanning a broad range of lengths, ages, and slip modes, and whose direction of long-term lengthening is known. They show that, independently of the parent fault size and slip mode, networks of splay faults are systematically observed off the propagating fault tips, where they have a length and a map-view width systematically scaled to the parent fault's length. The genetic and generic tip splay networks are discussed in terms of permanent damage resulting from fault growth. Chemenda et al. (2016) provide a numerical model describing the 3-D formation and evolution of a strike-slip fault in an elastoplastic medium. The model reveals the development of a wide and deep damage zone adjacent to the parent fault, with a flower-type geometry in the vertical plane. The details of the fault and damage evolution are revealed, which provides important insights into the understanding of natural faulting. In particular, the fault evolves as a complex 3-D fault zone including different segments, and damage widens rapidly as the fault grows, both away from its trace and from surface to depth.

The next paper by Aguilar et al. (2016) keeps the reader on strike-slip faults, and more specifically focuses on the El Pilar dextral fault in Venezuela. The question is to examine whether large prehistorical earthquakes on this fault have significantly disturbed sedimentation in the Gulf of Cariaco. Based on various sedimentary analyses of twelve short cores extracted in the Gulf, the authors find evidence of a widespread fine-grained siliciclastic deposit within the Gulf, whose age suggests that it likely formed during the large 1853 AD earthquake on the fault. It is proposed that the earthquake induced large submarine landslides that modified the topography of the Gulf entrance, which in turn promoted upwelling and open marine water flows from the Cariaco Basin, presently attested to by the observed siliciclastic deposit.

Finally, Masse and Laurent (2016) take the reader to the present time, and place him/her at the boundary between geology and tectonics, history of geological sciences, and exploitation of natural resources. The authors show how geological studies have progressed over the last century in Angola, and how this progress has been fed both by mining and petroleum companies interested in the local resources, and by the passion of scientists that were also explorers.

Altogether the nine papers brought together in this issue provide important new insights into some of the most important tectonic features: subduction zones, continental (especially strike-slip) faults, large earthquakes, and interseismic deformation. In doing so, they render a tribute to Jean-François Stéphan, who worked on all these topics, with constant passion and creativity.

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