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Editorial

Special Issue: "Seismotectonics, Active Deformation, and Structure of the Crust"

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Knowledge of seismotectonics, active deformation, and the structure of Earth's crust is key for the first-order perception and assessment of the seismic hazard, and consequently the seismic risk, of an area. It is moreover essential for understanding the geodynamics and ongoing surface processes (i.e., erosion, sedimentation, etc.), and for the exploration and management of georeservoirs for energy and waste. This Special Issue aims to reveal comprehensive images of shallow earthquake physics, active tectonics, crustal structures, and deformation, on continental, regional, and local scales. The implementation of modern theories, the introduction of innovative methods, the application of cutting-edge computational and mapping tools to overcome longstanding problems in tectonics and seismology, and the presentation of comprehensive data analyses representing various geodynamic regimes are presented in a collection of five research articles and two review articles.

Tsampouraki-Kraounaki et al. (2021) [1] processed, analysed, and interpreted a set of bathymetric and seismic data with the aim of unravelling the geomorphological configuration, seismic stratigraphy, structure, and evolution of the Santorini-Amorgos Shear Zone in the South Aegean back-arc domain of Greece. The study reveals that dextral shearing and oblique rifting are accommodated by NE–SW striking, dextral oblique to strike-slip faults, and by roughly W–E striking, normal, transfer faults. The authors postulate that enhanced shearing in the NE–SW direction and oblique rifting may be the dominant deformation mechanisms in the South Aegean since the Early Quaternary associated with the interaction of the North Anatolian Fault and the slab roll-back.

Nomikou et al. (2021) [2] conducted a morphotectonic analysis along the northern margin of Samos Island in the Eastern Aegean Sea in order to decipher the fault system responsible for the October 2020 M = 7.0 seismic crisis. The authors obtained a new detailed bathymetric map of the Samos basin based on a 15 m grid, which is presented with 50 m contours. The study revealed that the active tectonics in the area are characterized by an N–S extension that differs from the Neogene tectonics of Samos Island, characterized by an NE–SW compression. The Samos basin is an E–W striking tectonic half-graben with abrupt slopes (30°) along its active southern margin, with more than 650 m of throw. The mainshock and most of the aftershocks of the October 2020 seismic activity occurred on the prolongation of the north-dipping E–W-trending normal fault zone at about 12 km depth.

Rimando et al. (2020) [3] conducted a detailed mapping of the ground rupture following the 6 February 2012 M_W = 6.7 Negros earthquake, and aimed to sort out the mechanism of deformation in the Visayas Islands region of Central Philippines. The detailed field-mapping revealed a ~75 km long ground rupture along the eastern coast of Negros Island. The authors demonstrate that the earthquake's rupture pattern, scarp types, and offset of man-made structures are similar to those of recent reverse/thrust round ruptures mapped globally and are distinct from those associated with erosion, landslide, and liquefaction.

The authors also postulate that the 2012 Negros earthquake ground rupture probably occurred along a pre-existing structure belonging to the set of structures generated in the time since the Miocene, with active deformation related to complex shear partitioning.

Valkaniotis et al. (2020) [4] integrated and analysed InSAR and geodetic data with the aim of identifying the source of the Mw = 5.6 earthquake that occurred in west-central Epirus (NW Greece) on 21 March 2020. The source was modelled by inverting the INSAR displacement data, suggesting a shallow source on a low-angle fault dipping towards the east with a centroid depth of 8.5 km. The study revealed the seismogenic source to be identified along the west-verging Margariti thrust fault, located within the frontal area of the Ionian fold and the thrust belt of the Hellenic orogen, and which accommodates part of the convergence within the collision zone between Apulia and Eurasia. The authors also processed new GNSS data and estimated a total convergence rate between Apulia and Eurasia of 8.9 mm yr^{-1}, of which the shortening of the crust between the Epirus coast and Paxos Island in the north Ionian Sea (across the active Ionian thrust) is equivalent to ~50% of it or 4.6 mm yr^{-1}.

Ganas et al. (2020) [5] unravelled the ground deformation and seismogenic source of the M = 6.4 earthquake that struck north-central Albania on 26 November 2019. The authors used InSAR data tied to GNSS stations to model the source by inverting the displacement data. The modelling revealed that the earthquake occurred deep in the crust on a low-angle reverse fault dipping towards the east with a centroid at 16.5 km of depth. The geometry is compatible with a blind thrust fault that may be rooted in the main basal thrust front that separates Adria-Apulia from Eurasia. The study showed that there is a 123 ns yr^{-1} active shortening of the crust between the GNSS stations at Durres and Tirana (equivalent to a shortening rate of 3.6 mm yr^{-1}), roughly in the east–west direction.

Guerriero and Mazzoli (2021) [6] provide a review about the theory of effective stress in soil and rock, discussing the implications for fracturing processes. An updated overview of the different theoretical and experimental approaches to the effective stress principle and related topics is presented with particular reference to geological fracturing processes. Moreover, they discuss some issues about faulting and hydraulic fracturing in rocks which are still unsolved.

Kassaras et al. (2020) [7], in their review article, present the first version of the new Seismotectonic Atlas of Greece. The data incorporated in the Seismotectonic Atlas of Greece are composed of sets of active faults, historical and instrumental era seismicity, focal mechanisms, stress- and strain-rate field distributions, active volcanoes, historical and instrumental era tsunamis, and gravity and magnetic anomalies. Each of these datasets has been constructed as a GIS layer, augmented with interactive access to enable the user to inspect the respective attributes.

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