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Editorial

Editorial for Special Issue "U-Pb Dating and Chemistry of Zircon in Metamorphic, Magmatic and Sedimentary Rocks"

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This Special Issue was conceived with the aim of contributing to disclosure of the applications of U-Pb dating and zircon chemistry for deciphering the growth and the evolution of the continental crust. The twenty scientific contributions cover the most important aspects of zircon-related research, dating and chemistry, and extensively illustrate how an understanding of zircon can enable interpretation of different geological scenarios, from individual igneous units to entire orogens.

A new method for identification of promising zircon grains for geochronology is proposed by McAller et al. [1]. These authors document the use of a petrographic microscope to observe the internal textures of selected grains under ultraviolet light, returning detailed photoluminescence images.

The collected papers within the theme "Metamorphic continental crust" are dedicated to case studies regarding metamorphic basements for geological reconstruction of tectonic events forming orogenic belts. The ability of zircon to monitor the metamorphic evolution of high-grade basements affected by granulite metamorphism is revealed by Yang et al. [2] and Takehara et al. [3]. Zircon age clusters detected in leucosomes and melanosomes, together with the definition of mineral phase equilibrium during anatexis, can constrain the tectonic evolution of orogeny and demonstrate how decompression plays a relevant role in crustal melting. The ability of zircon to record the geological history of the Carboniferous–Permian orogeny and its evolution over the Mesozoic was documented by collecting U-Pb age data from magmatic protoliths of a tectonic mélange. The geochemical features of magmatism constrain the extensional and compressional phases of tectonic evolution in northeastern China [4]. Analogously, Fornelli et al. [5] show how zircon ages from metasediments affected by polymetamorphism in the Variscan orogen can reveal the timing of tectonic phases during the construction of the belt, thus establishing the origin and the maximum sedimentation age of protoliths. An example of ancient orogeny reconstruction is described in detail by Yi et al. [6], in which the timing of tectonic phases within the Ross orogeny is reconstructed by coupling mineral phase equilibria for P–T calculations with U-Pb zircon ages. Moreover, the geodynamic evolution of an Archean polymetamorphic complex is proposed by Hölttä et al. [7], linking REE distributions in garnet and zircon with precise age constraints.

The nine papers on "Magmatic continental crust" represent case studies emphasizing the central role of zircon in the characterization of magmatic intrusions and volcanic products. Zircon U-Pb ages and Hf isotopes can constrain the origin of magmatic rocks and highlight the chemical modifications of the mantle source in a subduction context. The metasomatic effect of the continental crust on the lithosphere mantle is revealed by monitoring the chemical and isotopic evolution of magmatic rocks [8,9]. Although the partial melting of younger, thinned continental crust against thickened continental crust in the temporal evolution of subduction [10,11] can be defined using classical geochemical data, isotopic markers in zircon allow more precise and accurate interpretations. The timing of the evolution of the subduction zone can be defined using U-Pb zircon data from magmatic rocks in many contexts [12,13]. The geochronology of zircon could also elucidate late pneumatolytic or hydrothermal processes associated with the formation of mineralization containing elements such as Mo, W, Sn and Cu [14–16].

The contributions on "Sedimentary continental crust" show case studies on the relevance and significance of detrital zircon ages for reconstructing the paleogeographic evolution of sedimentary basins forming younger orogenic chains. The provenance of siliciclastic detritus utilizing zircon age records [17] is particularly valuable for constraining the sedimentation age of sandstone sequences affected by a synchronous volcanic activity, as shown by Fornelli et al. [18]. The huge potential of detrital zircon ages was highlighted by Ershova et al. [19] in their study of Devonian sandstones containing zircons connected to a hidden coeval magmatism successively covered by sedimentary events, as well as by Lee et al. [20] in a subduction context.

We hope that the present volume will meet the interest of a wide audience of specialists across every geological field. Last but not least, we would like to thank all the researchers who contributed to the success of this Special Issue.

Conflicts of Interest: The authors declare no conflict of interest.

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