


Editorial

Editorial for Special Issue “Microtexture Characterization of Rocks and Minerals”

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Microtextures, the physical or structural aspects of minerals and rocks, may include the interrelationships of minerals, the preferred orientation of grains, the internal textures of minerals, etc., which reflect the histories of crystallization, dissolution–precipitation, and the deformation of minerals. In other words, microtextures in some rocks from various geological environments provide key information to understand the evolution of the crust and the subsequent fluid at the macro/global scales. Therefore, the detailed study of processes by characterizing microtextures becomes an important area of research. In light of these considerations, the objective of this Special Issue is to introduce the latest advances in the microtextural characterization of minerals and rocks, in the methodology, and in the various application examples.

The articles published in the issue can be divided into several topics. The articles by Park et al. [1], Mao et al. [2] and Noh et al. [3] are the case studies investigating some geological processes at the regional scale, based on microtextural characterization. Park et al. [1] present new microstructural data from two ductile shear zones, constrain the kinematics and deformation conditions of ductile shearing, and provide an improved understanding of the tectonic process of the Mesozoic East Asian continental margin. Mao et al. [2] investigated the microstructures of rhyolitic lavas filled by solidified crude oil from a Basin in NE China using quantitative image analysis, and defined the type, morphology, pore-size distribution, and pore-volume contribution of different pores, which can be beneficial to the further understanding of the microstructure and pore system of the rhyolites as a potential hydrocarbon reservoir. Noh et al. [3] examined the formation of an olivine-bearing serpentinized metasomatic zone developed on dolomitic marble through microtextural and geochemical characterization and phase equilibria modelling, and they tried to understand the infiltration metasomatism caused by a lamprophyre dyke–marble contact zone from the southwestern Korean Peninsula.

On the other hand, several articles focused on the preferred orientation of grains and crystallographic characteristics for the brittle and ductile shear zones. Sime et al. [4] proposed a 3D-shape preferred orientation (SPO) measurement method of rigid grains using synchrotron micro-computational tomography (μ -CT). The method includes oriented sampling, 3D μ -CT imaging, image filtering, ellipsoid fitting, and SPO measurement. After CT imaging, all processes are computerized, and the directions of thousands of rigid grains in 3D-space can be automatically measured. This method is optimized for estimating the orientation of the silt-sized rigid grains in fault gouge, which indicates P-shear direction in a fault system. Sim et al. [5] successfully deduced fault motion sense and quantified the fault movement for the largest fault zones in the southeastern part of the Korean Peninsula. In this study, the authors provided information about fault motion by statistically presenting shape and orientation information for tens of thousands of grains. As a result, the statistical SPO analysis approach supplements the shortcomings of previous research methods on two-dimensional planes and can quantitatively infer the three-dimensional fault motion for various fault rock samples in the same sequence, thus presenting useful evidence for structural analysis. Torabi et al. [6] studied damage zones of two active faults in South Spain using combined mineralogical and microstructural characterization



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with structural fieldwork, and in situ measurements of rock properties (permeability and Young's modulus). The authors finally found out the relation between deformation frequency, mineral processes, and changes in the soft-rock and sediment properties produced by fluid flow during seismic cycles. Kim et al. [7] conducted deformation experiments of chlorite peridotite under high pressure–temperature conditions assuming the fore-arc and back-arc regions of subduction zones by measuring the lattice preferred orientation (LPO) of elastically anisotropic chlorite. They suggested that anomalous seismic anisotropy in subduction zones can be influenced by the chlorite LPOs. Lychagin et al. [8] investigated the microstructural and crystallographic features of quartz from complex vein systems associated with the development of thrust and shear deformations in Western Transbaikalia using electron back scatter diffraction (EBSD) and optical microscopy. Microstructural and crystallographic features of vein quartz aggregates allow the authors to mark the territory's multi-stage development with the formation of syntectonic and post-deformation quartz. Additionally, the study performed by Berrezueta et al. [9] introduces an assessment of the representation of shape parameter measurements on theoretical particles. The authors tried to establish a numerical method for estimating sphericity, roundness, and roughness on artificially designed particles and to evaluate their interdependence. It can be applied to the evaluation of all parameters corroborating previous petrographic characterizations.

In particular, some articles are related to mineralization in the fluid–rock interaction based on the microtextural characterization combined with in situ micro-probe analysis using EPMA, LA-ICP-MS. Park et al. [10] report a hydrothermal-originated authigenic Mg-phengite-series mineral, which occurred as polycrystalline aggregates, pore-fillings, and well-crystallized lath form in the Haengmae Formation, South Korea. Based on microtextural observation and in situ mineral chemistry, the authors defined that the Mg-phengite should be formed by the infiltration of the highly evolved Mg- and REEs-enriched hydrothermal fluid into the clastic sedimentary rock as a strata-bound form, syngenetically or during early diagenesis. Choi et al. [11] also presented some crucial evidence for the understanding of sequential scheelite mineralization of the quartz–scheelite vein system of a W-deposit, South Korea, by defining the microtextural and geochemical characteristics. In addition, a special article was introduced by Benito et al. [12]. They observed the microstructure of the rostrum solidum of Jurassic belemnites, which was compared with that of Sepia cuttlebones, defined the characteristics, and proposed the non-classical crystallization as processes involved in its formation.

As the listed articles in this Special Issue, microtextural characterization is now a major research area, and particularly provides some fundamentals for interpreting the chemical and isotopic results of minerals. Moreover, new observational facilities and techniques, such as FE-SEM-BSE imaging, 3D micro-CT imaging using synchrotron, EBSD, and micro-scale elemental mapping of trace elements using LA-ICP-MS, are being developed and used for characterizing various microtextures with high resolution capability. Therefore, the author hopes that this Special Issue with the recent advances in microtextural characterization will be a helpful and valuable resource for anyone who is interested in microtextural studies, and will provide a fundament for further research.

Conflicts of Interest: The author declares no conflict of interest.

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