MICRO-SPECTROSCOPIC MAPPING: REVEALING INTERNAL STRUCTURES OF ZIRCON CRYSTALS

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Natural zircon crystals typically deviate from perfect crystallinity and ideal chemical composition. If non-ideality features are not homogeneously distributed within a crystal but show a heterogeneity pattern, this is referred to as its "internal structure". Internal structures of zircon are mostly first caused by the heterogeneous incorporation of trace elements during crystal growth. Over time, these primary patterns may become more complex after being overprinted by radioactive self-irradiation and heterogeneous alteration or recrystallization. Internal structures may provide valuable information about the origin and post-growth history of zircon crystals. Further, they need to be recognized for sound microprobe dating, for instance to avoid biased results when straddling zones of different age. Revealing internal structures has thus become an important tool in zircon research. It is mostly done by means of backscattered electrons or cathodoluminescence imaging. These two techniques are advantageous over optical microscopy in the cross-polarized mode as the volume resolution is better and simple polished mounts instead of doubly-sided sections are needed. A disadvantage, however, is that the impact of electron beam during analysis causes local structural changes. Quantitative studies of the real structure of zircon samples, such as determination of the degree of the radiation damage, is therefore tainted with potential uncertainty when being done after electron probe analysis. As an alternative, we present images of internal zircon structures generated through visible laser excitation and mapping of the Raman and photoluminescence light. Due to the time-consuming mapping procedure, such images will perhaps not be routinely used. For detailed stud-
ies, however, they may provide most valuable information. Photoluminescence maps provide, for instance, information on both the distribution of rare earth elements (band integrals) and the short-range order (band broadening) whereas Raman-based images are most sensitive for revealing patterns of heterogeneous radiation damage. Application of micro-spectroscopic mappings to the study of zircon crystals from the Gold Butte block, Nevada, and the Adirondack Mountains, New York State, are presented.