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A Microscopic Information System (MIS) to assist in petrographic analysis

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Rock texture results from all the petrological processes that have affected the rock system. The interpretation of a rock texture relies on the analysis of the morphometric parameters of the constituting components (e.g. crystals or grains). A consistent and statistically sound quantification of components size and shape is crucial to adequately unravel the petrology of a rock, but the gathering of these measurements may be time-consuming or difficult to achieve using low-cost facilities.
The basic technique for texture analysis of rocks is the observation of thin sections in transmitted light by using a petrographic microscope. To automate and speed-up textural measurements from thin section in transmitted light, several image processing procedures have been published in the last two decades. Nevertheless, the complexity of the optical properties of crystals hampered the determination of a method that is completely satisfactory, especially for complex polymineralic plutonic rocks. This work provides a contribution to solve this problem.
We present a novel composite procedure based on four approaches: i) the use of a slide scanner to acquire the input imagery in transmitted light from thin sections without using the petrographic microscope; ii) the storage of the resulting images in a GIS-like database structure that is extremely useful to retrieve, browse and analyze a large archive of images from a high number of thin sections; iii) the application of a custom image analysis procedure based on two region growing functions; iv) the refinement of the regions after raster to vector conversion using GIS software.
We call the obtained analysis system a Microscopic Information System (MIS), because it relies on GIS software but it is not a geographic system. In this study we apply this technique to analyze 137 thin sections obtained from 49 samples of 8 different granitoid rocks that are commonly used in the decorative stone industry. For each thin section 5 collimated RGB images are scanned: 4 under different direction of crossed polarization and 1 without polarization. The input device warrants a pixel of 9.4 microns. Two image processing functions (a seeded and an unseeded ones) work on a multi-band selection of the input imagery to account for the most represented intra-crystalline colour patterns observed in the minerals constituting the samples (plagioclase, quartz, K-feldspar and femic minerals). The flexible multi-format data visualization provided by GIS software offers an improved working environment compared to standard image processing units. This system can also substitute the petrographic microscope in performing a preliminary thin section survey. This method provides accurate measurements using an inexpensive device and proved to be fast, reliable and flexible. Once tuned, it has been successfully applied to all the analysed thin sections without further calibrations. The obtained measurement database is constituted by the morphometric measurements of about 87,000 crystals. The GIS structure of this database makes easy the analysis of the obtained results allowing an instant visualization of the outcomes of morphometric or modal queries over any selection of samples.