The Petrography Analysis Toolbox (PetPAT)
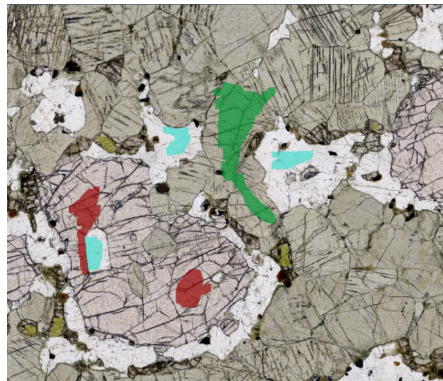## Quantitative analytics for light microscopy

ZEISS Axioscan 7 Geo

ZEISS Axioscan 7 Geo can create all the imaging modes required for optical mineralogy, and convert digital information into powerful quantitative analytical information for modal abundances, orientation, grain size and more.
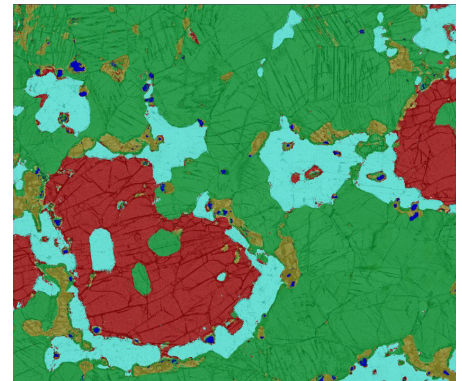

ZEN Intellesis gives you the power of machine learning segmentation with ease of use. Label each mineral phase of interest using an intuitive painting interface and allow the software to build a model of the mineralogy across your entire sample.

ZEISS Axioscan 7 Geo produces unique datasets for polarization microscopy with multiple light modes captured in multiple orientations. This enables digital thin sections to be viewed within a virtual petrographic microscope or interrogated for pixel or grain scale information.

The Petrography Analysis Toolbox (PetPAT) accesses the rich data that underpins Axioscan 7 Geo imagery. By analyzing multiple orientations of polarized light images, the PetPAT creates a variety of key sample outputs including the angle of extinction relative to the analyzer and the position of grain boundaries. This information can be combined with ZEN Intellesis phase segmentation to produce grain size distribution and grain orientation information for multiple distinct phases in transmitted light.

Multiple image modes for quantitative analysis

The unique capabilities of ZEISS Axioscan 7 Geo begin with the ability to capture so much digital information. High resolution images of full thin sections can be captured in plane, cross, and circular polarized light (PPL, XPL & CPL), brightfield (BF) and reflected light (RL), providing a huge range of flexibility for segmentation and quantitative analytics that goes far beyond simply visualizing digital datasets.

Machine learning segmentation

Optical mineralogy provides many challenges for classic image segmentation. Multiple orientations in polarized light modes means that the same mineral can appear with a very wide variation across a sample due to variable pleochroism and birefringence/extinction. ZEISS Axioscan 7 Geo collects additional images in BF and CPL, which provide the style of images seen in PPL and XPL respectively, but with no rotational variation and no minerals in extinction. The BF-CPL images provide a powerful combination for machine learning segmentation using ZEN Intellesis. Intellesis allows rapid segmentation of distinct phases by "painting" minerals and building a mineralogy model for your samples.

Seeing beyond
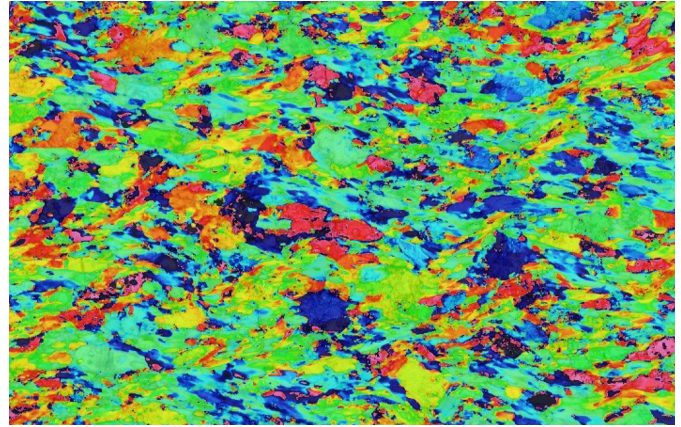
New powerful orientation analysis package turns entire thin sections into mineral orientation maps. These datasets can be used in conjunction with mineral segmentation for detailed studies and used to generate grain size distribution data.

The Petrography Analysis Toolbox (PetPAT)

The PetPAT software package takes analytics a step further, taking full advantage of the unique stack of XPL images in multiple orientations.

1. Orientation analysis

Using XPL image stacks it is possible to calculate the angle at which any given pixel would be at maximum or minimum luminance, corresponding to the maximum birefringence or extinction angle respectively. Using these data allow for the entire thin section to be mapped for orientation of mineral grains in transmitted light – the light microscopy equivalent of large area EBSD analysis. Angular resolution can be smaller than 1° with just a handful of images.

2. Grain boundary analysis

The orientation analysis allows for further analytics not possible with segmentation alone. Orientation analysis maps can be converted into grain boundary maps using an angular threshold for adjacent pixels. This allows grain size distributions to be calculated across entire samples in transmitted light.

Powerful analytics package

By using a combination of ZEN Intellesis and PetPAT, individual mineral species can be identified, segmented, and have orientation and grain size/boundary analysis performed. This provides a powerful workflow for building large projects entirely from thin sections, allowing for "big data" projects and statistical relevance of samples to be determined. With the ability to load up to 100 thin sections, batch processing, and automated analytics, Axioscan 7 Geo is the ultimate tool for quantitative petrography.

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