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Three-dimensional microscope image using anaglyphic filters: A new aid to fluid inclusion petrography

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Abstract

This new method involves producing a stereographic image in a petrographic microscope using anaglyphic filters. The method is especially useful for fluid inclusion petrography of doubly polished thick sections.

Introduction

Fluid inclusion petrography differs from conventional thin section observations in a few important ways. According to Roedder (1984, p. 157), "one *must* view inclusions in a three-dimensional context and not in the normal two dimensions as in ordinary petrographic studies of thin sections." This is difficult with polarizing microscopes. Stereomicroscopes provide an excellent stereoscopic effect but their magnification and resolution using transmitted light equipment are limited in specialized fluid inclusion work. However, the two-dimensional image of a common petrographic microscope can be converted to a stereoscopic image using plain anaglyphic filters.

Anaglyphic method

The color filters were cut from orange-red and blue-green celluloid filters (Fig. 1). The filters were inserted in the graticule slots of the eyepieces. The dual-color filter, made up of red and green halves, was inserted in a north-south direction in the filter carrier beneath the condenser and the polarizer. In most microscope models, the red and green halves of the dual-color filter should be aligned with the red and green filters of the eyepieces.

The intensity of the stereoscopic view can be controlled by turning the dual anaglyphic filter slightly from the north-south direction. The image is three dimensional with all magnifications up to the oil-immersion range. Although the method does not affect the depth of field, the apparent depth of field increases because of the stereoscopic view. The image quality is comparable to high-quality stereomicroscopes. The only disadvantage is the monochromatic image obtained: yellow-green when red and green filters are used to produce the anaglyphic effect.

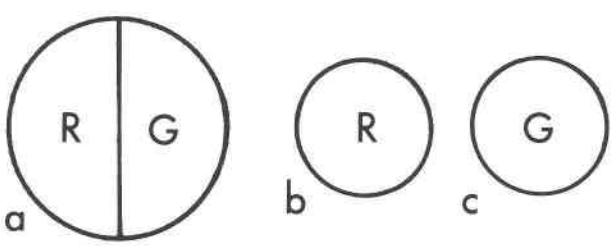

Fig. 1. The anaglyphic filter set needed to convert the polarizing microscope image to a stereoscopic image. Symbols: a = dual-color filter [orange-red (R) and blue-green (G)] to be inserted in the filter carrier; b and c = red and green filters for the left and right eyepieces.

Other techniques, described in microscopy handbooks, to induce stereoscopic effects were tried, but with inadequate results for fluid inclusion research. These techniques included (1) the use of partly covered eyepieces (the Abbe method), (2) the adjustment of the pupil distance of the eyepieces, and (3) the use of polarized filters as beam splitters. The first two methods did not give good results with wide-field eyepieces. The method using polarized filters is usable, but not with anisotropic minerals. It should be noted that, in theory, it is possible to construct an advanced stereoscopic optical system with liquid-crystal light shutters using the twinkle method. The beam should be programmed to shift between the eyepieces and the half-sections of the dual filter approximately 30 times per second in order to induce the stereoscopic effect. However, the polarizing character of the liquid-crystal cells is likely to cause problems with anisotropic specimens.

Applications

The three-dimensional image obtained with the anaglyphic method is practical and can be recommended for fluid inclusion studies. The three-dimensional view of fluid inclusion planes and microstructure is needed especially in metamorphic petrological studies. The stereoscopic view aids the identification of isolated inclusions and aids the characterization of the intersection relations of microfractures in metamorphic minerals, particularly in quartz. Sometimes it is possible to obtain additional textural criteria for the possible primary origin of the isolated inclusions. Likewise, it is possible to obtain an impression of the actual shape of the inclusion cavities and of the localization of various phases inside larger inclusion cavities.

It is possible to take anaglyphic color photomicro-

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graphs using the stereoscopic effect. For photography, the dual-color filter is used below the condenser, and the eyepiece should be without any color filter. The photomicrographs obtained can be viewed through anaglyph spectacles in the same way as anaglyphic aerial photographs.

This method has been used extensively in the Geological Survey of Finland with good results. Besides fluid inclusion work, the method can be recommended for microscope work with relatively thick sections and high magnification.

Reference cited

Roedder, E. (1984) Fluid inclusions. In Mineralogical Society of America Reviews in Mineralogy, 12, 644 p.

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