

Recipe 2.0 for rock thin-section study in a classroom. Part 1.

Observation

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In geoscience education, the thin-section study is a fundamental method to comprehend geology. However, it is tough to carry out a thin-section study in a secondary school classroom. It is difficult for the ordinary school to prepare enough number of polarized microscopes and thin-sections. Therefore we introduce an alternative method to carry out the thin-section study in a secondary school classroom. Our study divided two categories; i) Home-made polarized microscope unit: observing thin-sections and ii) An alternative thin-section making method: using new tools for rock cutting and grinding. The title 2.0 means a sophisticated method rather than a traditional 1.0. Also, I am not a specialist in petrology, so please let me know if mistakes.

In this article, we describe the first method. The making process of thin-sections is described in the next poster. Usually, a polarized microscope is high expensive and not be prepared in the science classroom at secondary school. Therefore, we propose an easy-made polarized unit assembled with a cheap microscope sold at the online shopping site around 160 USD. It has two light systems at the top and the bottom. The alternative USB microscope sold reasonable cost, is also useful to capture photos using this unit.

The unit consists of three parts; 1) turntable; a cheap one purchased from the online net shop (70mm square having 37mm hole in the center, 4 USD) 2) polarized film; purchased from the same shop (10 pieces of 8cm square size, 9 USD) and are used in quarter size. 3) acrylic plates: 70x70mm, 5mm thickness with 25mm center for the turntable, 45x90mm, 3mm thickness for the upper Nicol.

The turntable and two 5mm thick plates are assembled with 4mm bolts sandwiching a polar film. The upper Nicol is made by a 3mm thick plate and a polarized film. It can be turned over the stage. Acrylic glue is used to join the plates. The acrylic end materials are sold at some online shops.

The unit is set on the microscope stage, and thin-sections are placed on the turntable for observing. We made ten units of the units and twenty of more simplified units (the rotation is made by hand) attached with binocular microscopes. The total number of microscopes is 42, including 12 professional polarized microscopes. Forty-two students of our geoscience class can use their microscopes and some thin-sections. The observation time is 50 minutes; the students observe granite, andesite, basalt, and gabbro samples. For help to the observation, we use a USB microscope to show the thin-section images on the big monitor. We presented how to identify the minerals and optical properties: 1) non-color minerals; quartz and feldspar (form, cleavage, twin) 2) colored minerals; biotite, hornblende, pyroxene, olivine (form, cleavage, refractive index, interference color, pleochroism, extinction angle, twins) The students thoroughly enjoyed the observations, sketching their eye view, or taking a picture by smartphones for uploading to their SNS. The questionnaire results also show an excellent performance of this practice. The details of the questionnaire results will be presented at the conference.

The merit of our unit is low cost about 170 USD for a microscope and 20USD for a polarized unit. Also, such cheap microscopes already installed the bottom LED system, so the students can easily carry out their observation. However, their low magnification around 20x to 40x is somewhat insufficient for optical mineralogy, and cheap turntables show some backlashes. Also, our system has no aperture system, so it is hard to recognize Becke lines. Moreover, our system has no subsequent functions of advanced optical mineralogy such as interference plates, or a conoscope imaging system. However, our system has an excellent feature for educational geology, and some improvement for high magnification will increase the

performance in the future. The making process of the thin-sections is presented at our next poster: Part 2.

Keywords: Thin-section, Polarized microcope, observation, classroom