

A New Method of Making and Observing Rock thin-sections for Classrooms

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Abstract

Rock thin-sections are the essential tools for studying geology at K12 or college-level classrooms. They can change boring lectures about rocks to fascinating practices. However, due to the difficulties of preparation, there are a few attempts to use rock thin sections as teaching tools in K12 classrooms. In this regard, we try to improve such conditions using cheap, mass-produced tools, which can be purchased from DIY stores or online net shops(Okamoto, 2020b). For example, **a bench grinder and a kitchen knife sharpener are used for a rock saw, and a grinder** with costs less than 100USD each. Also, low-cost diamond blades and wet stones less than 30USD are employed as consumables. Our project has simplified and sophisticated the section fabrication technic to a level where even high school students can do it. At the same time, for easy watching thin sections in a classroom, we developed an alternative way instead of using high expensive polarized microscopes. **Our handmade polarized units can let an ordinary microscope as a polarized one.** Low-cost binocular microscopes and USB microscopes are used for this thin section watching(Okamoto, 2020a). These low-cost polarized microscopes can be used for the petrological study to identify pleochroism, interference colors, extinction angles, textures, etc.

In recent days, we are uploading many thin section images with captions as an online thin section library for school use on our website (http://www.yossi-okamoto.net/index_e.html). Also, **3D printed parts** and some freeware are now improving our kit-making process and thin section photography. An overview of our methods and recent developments will be presented in the meeting.

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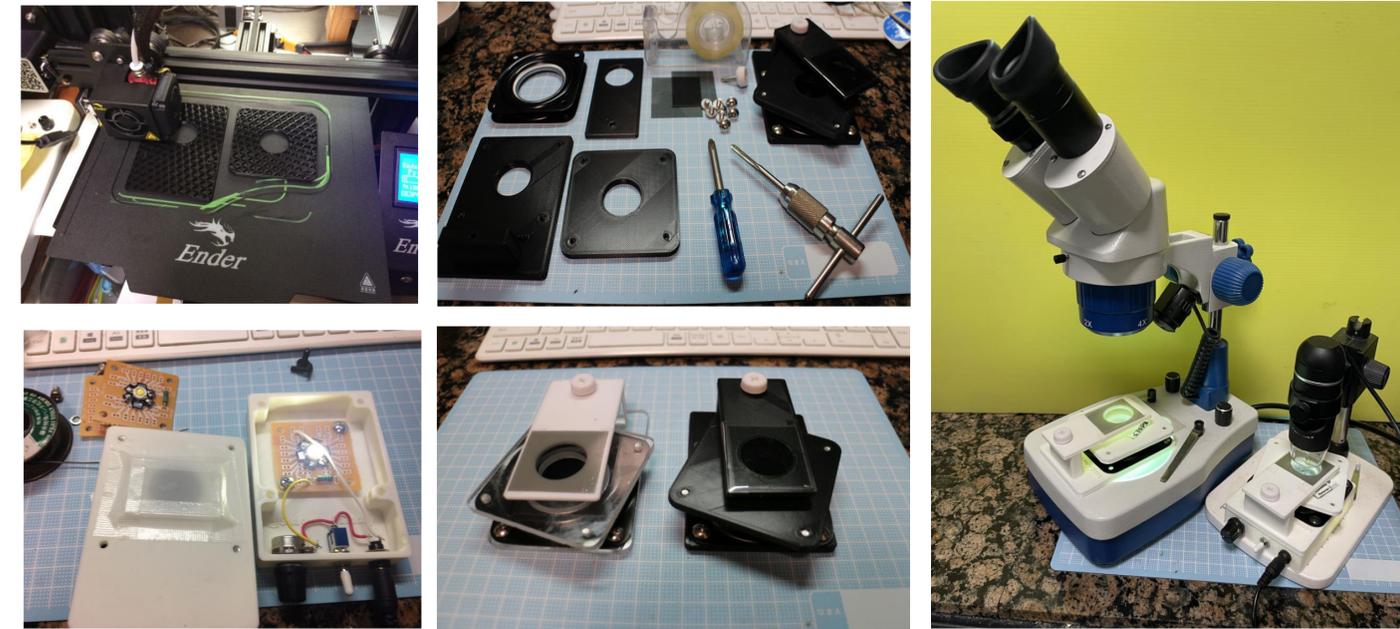
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Thin-Section Making (A tough work!)



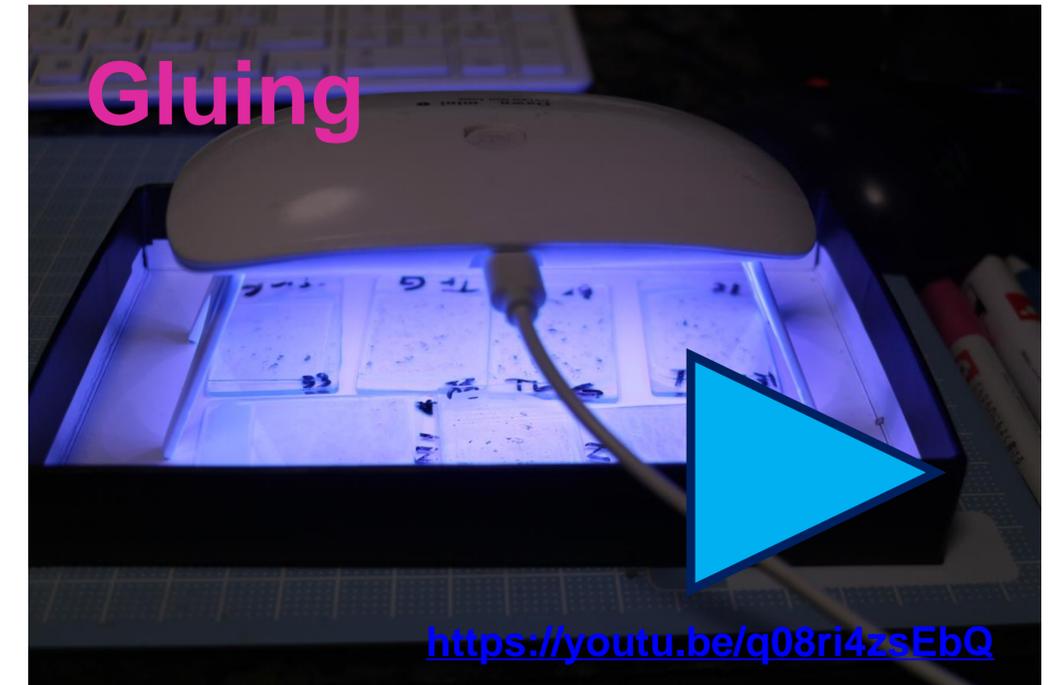
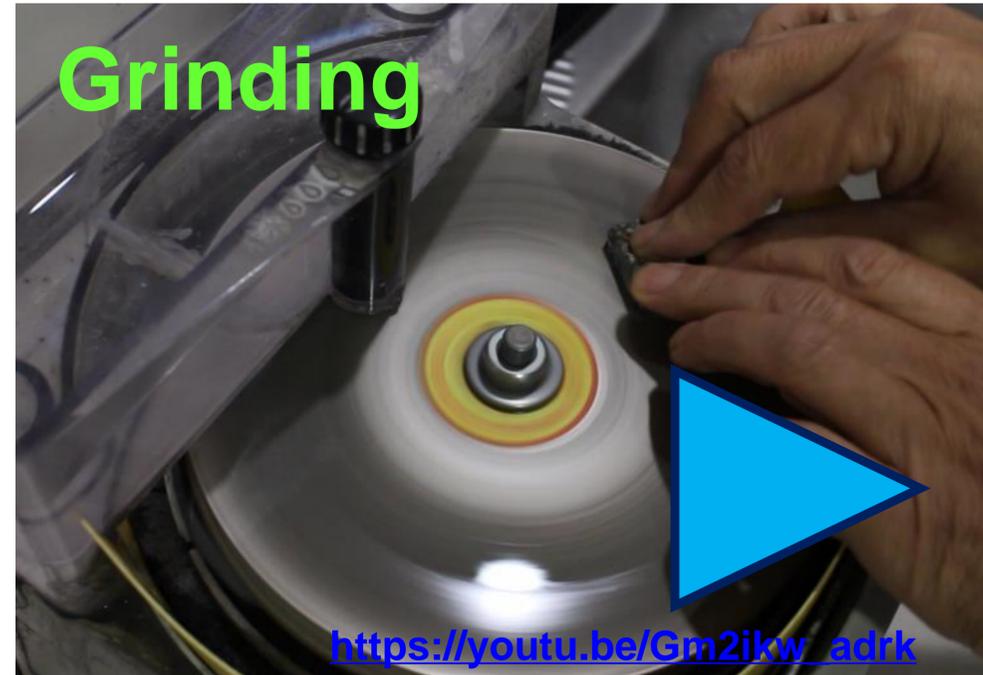
Polarized Unit Making (An easy job!)



Thin-Section Watching (A happy time!)



Making Videos: Click the **Triangles!**



More Details are http://seagull.stars.ne.jp/Thin-Section_Recipe/Rock_Saw/index_e.html

You can also enjoy: [My Previous Poster](#) (The tools are updated by using 3D printed tools now)

JpGU2020: <https://jpgu-agu2020.ipostersessions.com/default.aspx?s=F6-87-4C-DA-52-B5-88-5B-EB-0D-C5-6F-CA-54-45-BA>

Polarized Units Making Procedure:



Based microscopes:

For naked eye use: A binocular microscope (around 100US\$)

<https://www.aliexpress.com/item/32851539207.html>

For PC use: An USB microscope (around 75US\$)

<https://www.aliexpress.com/item/32990371667.html> (AliExpress)

https://www.amazon.co.jp/dp/B016BLTGLK/ref=sspa_dk_detail_3 (Amazon)

Parts:

Rotary tables 4US\$: <https://www.aliexpress.com/item/4001161615165.html>

Bodies: PLA filament using Ender 3 Pro 3Dprinter

Polarized films: <https://www.amazon.co.jp/-/en/Polarizing-Plate-inches-Thickness-Approx/dp/B01MXDVG12/>

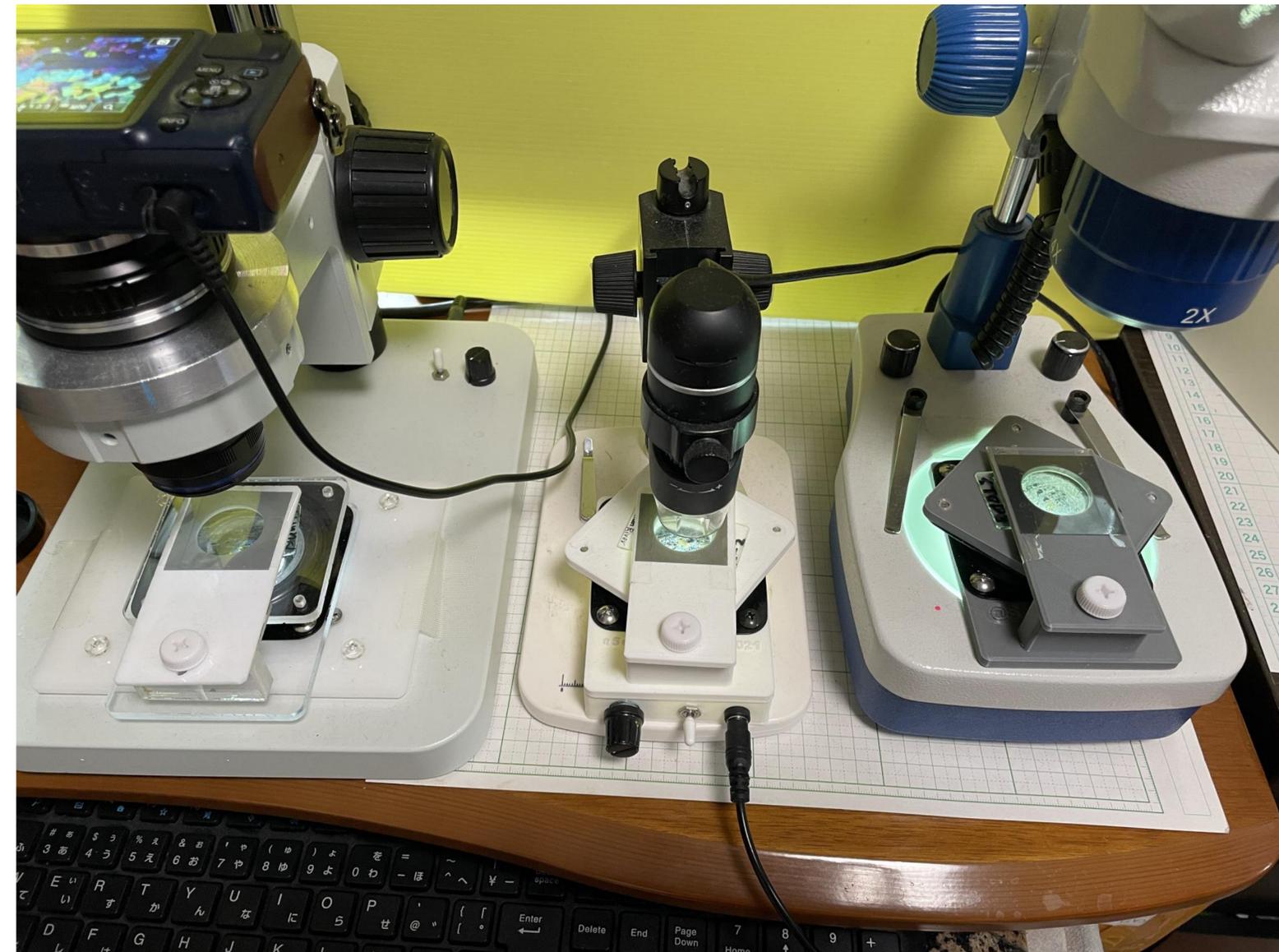
Software: 3D CADs file (.STL) for slicer is constructed using **Fusion 360**, @AUTODESK free version.

Freeware slicer, Ultimaker **CURA** making a .gcode file for the printer.

3D Printer: **Creativity Ender 3Pro** (250 US\$ from Amazon or AliExpress)

<https://www.creativity3dofficial.com/ja/products/creativity-ender-3-pro-3d-printer>

From my web site: Thin-Section Page <http://yossi-okamoto.net/Thin-Sections/index.html>

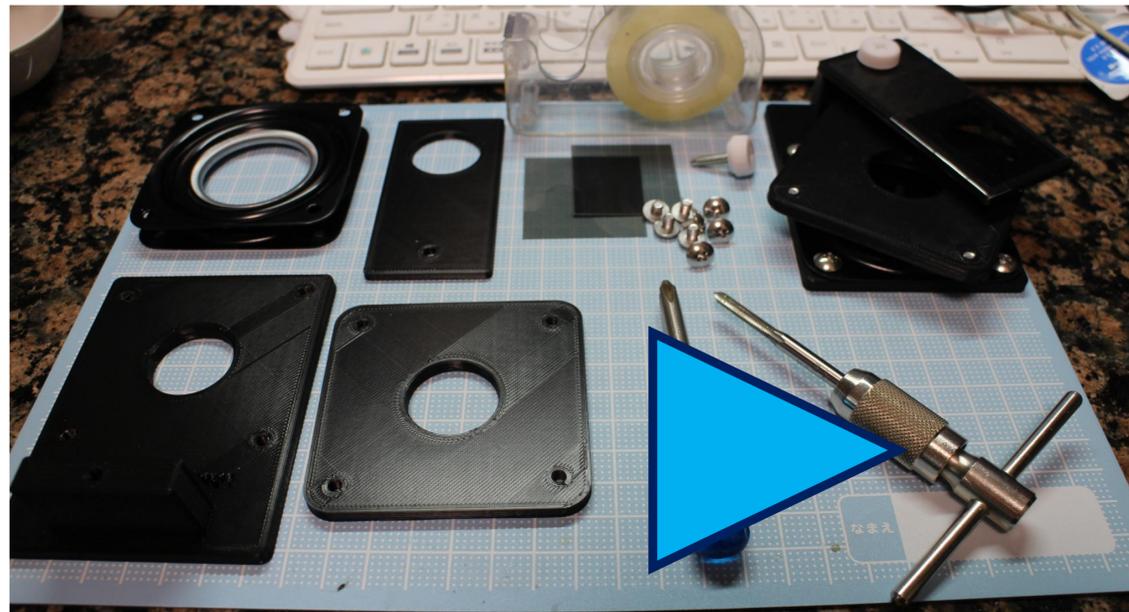
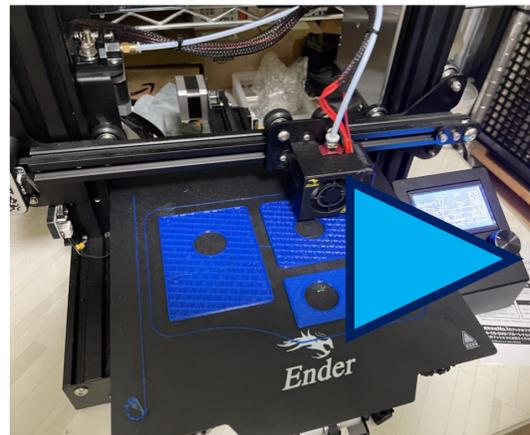


Left: LAOWA 25mm High-Resolution Close up Lens

Center: Cheap USB Microscope 80USD

Right: Cheap Binocular Microscope with a bottom LED

“Zerene” software, instead of the high-cost LAOWA lens, can be used for focus stacking with a cheap USB microscope images.



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JpGU2020: <https://jpgu-agu2020.ipostersessions.com/default.aspx?s=63-95-91-C8-E3-97-87-7E-C6-63-61-40-65-C7-6E-D1>



To Home

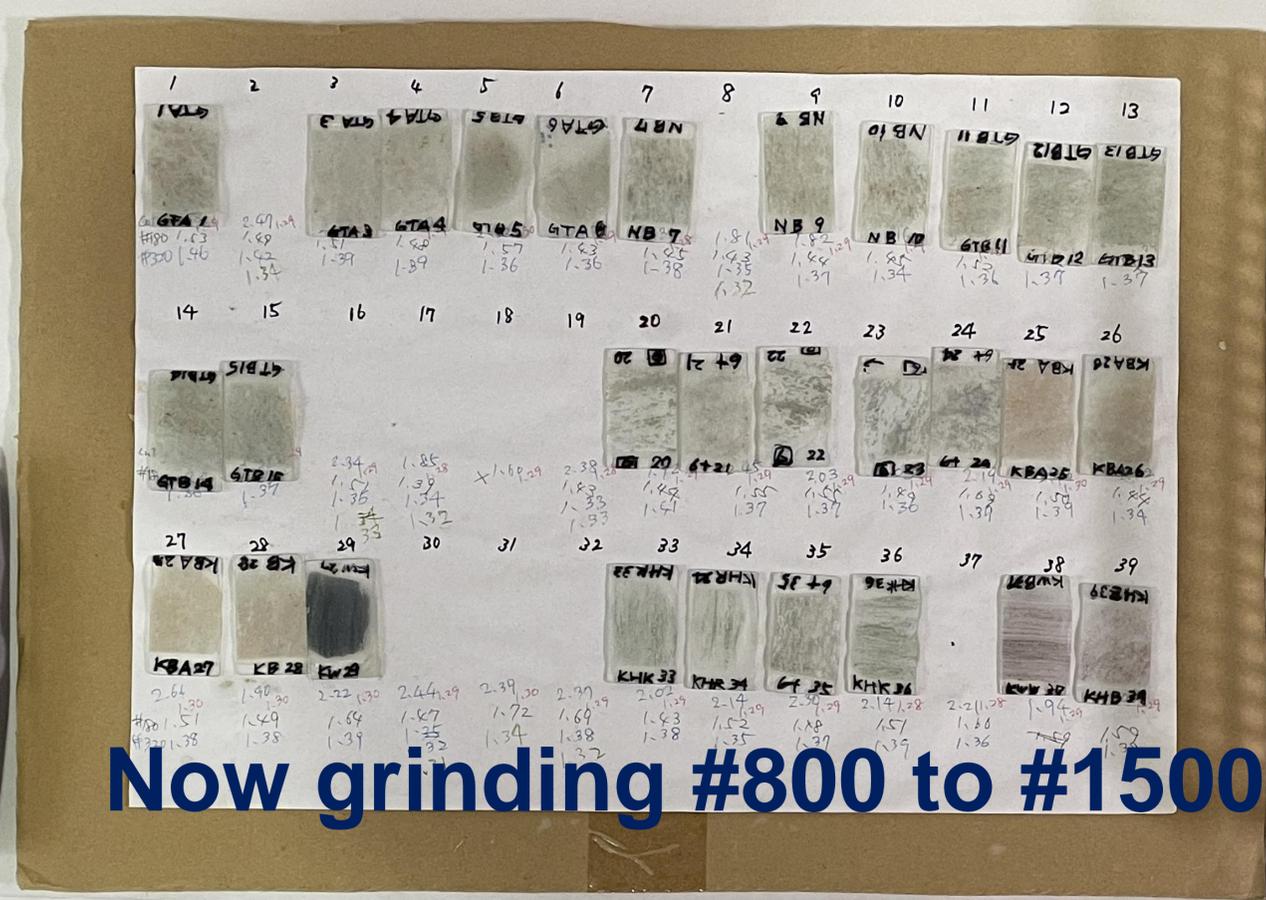
After a couple of trial years, Now, we have more than 1000 Thin-Sections of various types of rock samples.

Our method is now still updating to seek powder-less approach In grinding process.

Surface Glued samples

Now grinding #800 to #1500

A part of Completed Thin-Sections

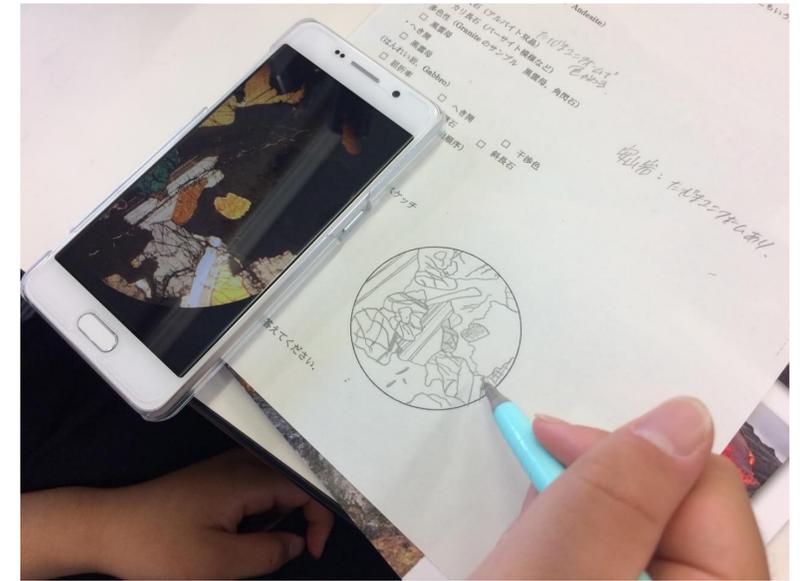
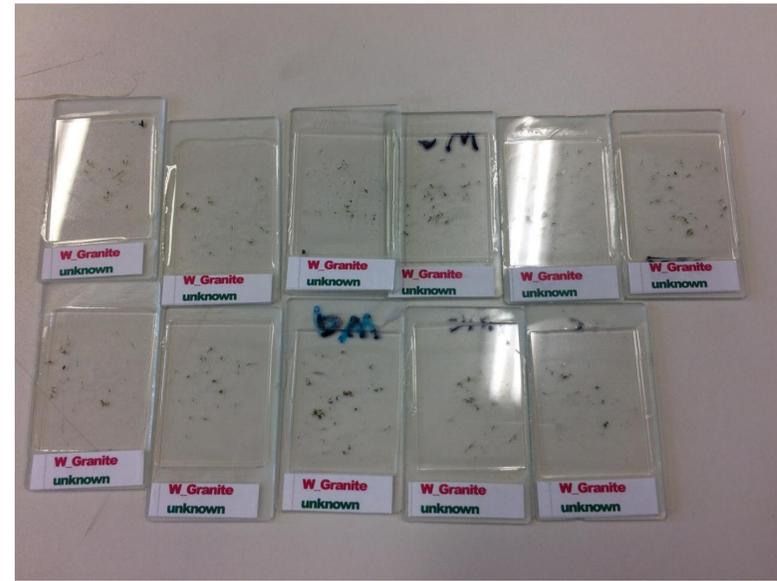


Tips



Thin-Section Watching at Tennoji Senior High-School attached to Osaka-Kyoiku University in 2019

from the slides of the IGC36 (2019: My final year as a geoscience high-school teacher)



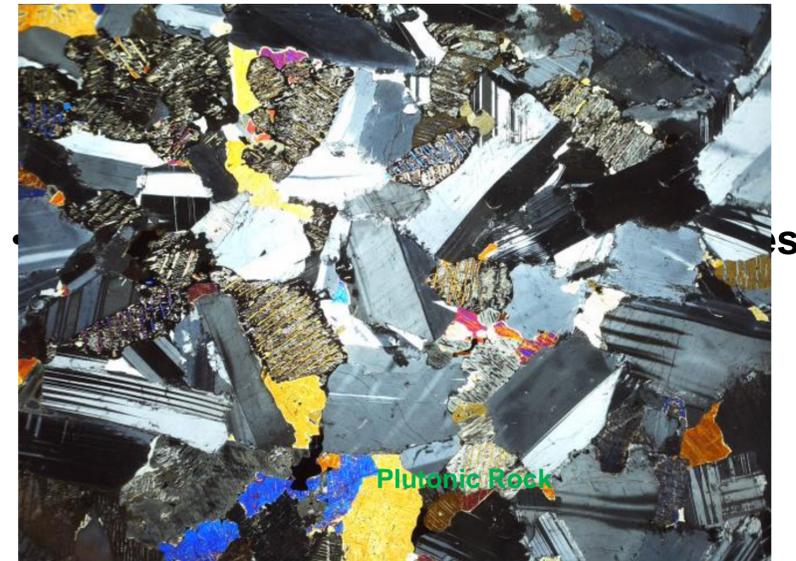
**40 students;
16 legacy PL
microscopes
and 24 general
microscopes
with our
cheap PL units
The watching
points are
Introduced
using a USB
microscope**

Petrologic features under our polarized microscope

Slides from the "Teacher Sharing" at KVIS-ISF 2021



• Textures: Gabbro



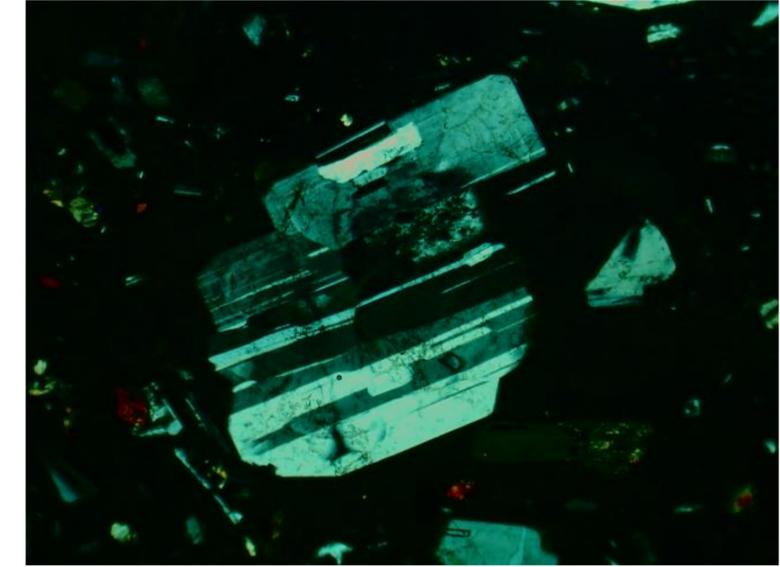
Basalt (12mm field width)



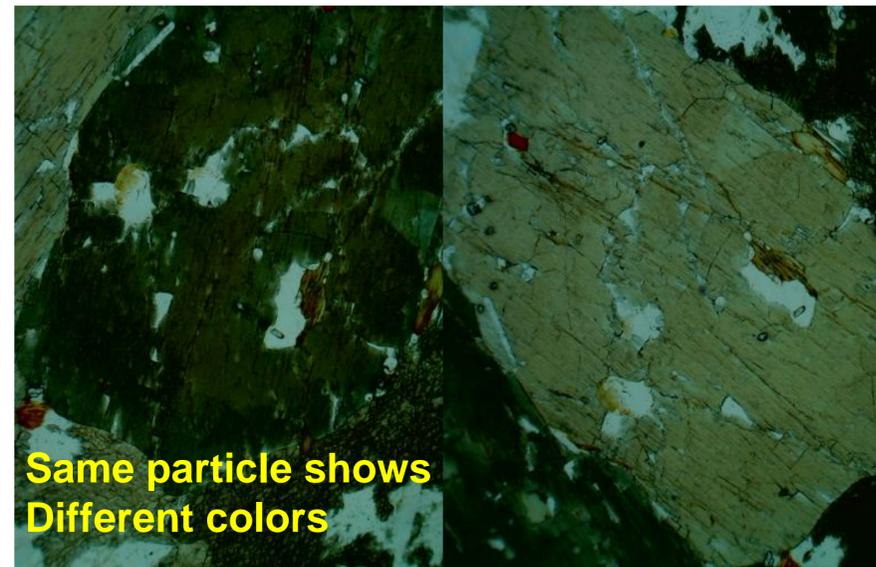
Cleavage: 120deg. Hornblende



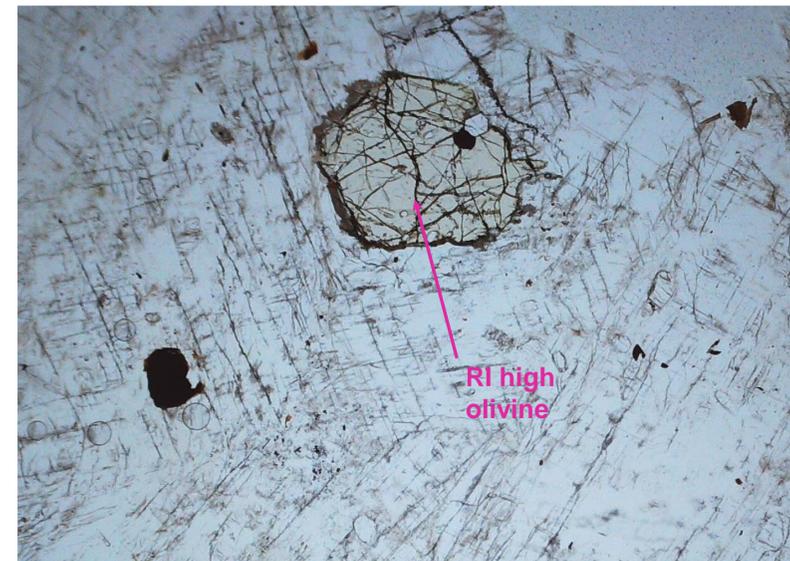
Twins: Plagioclase



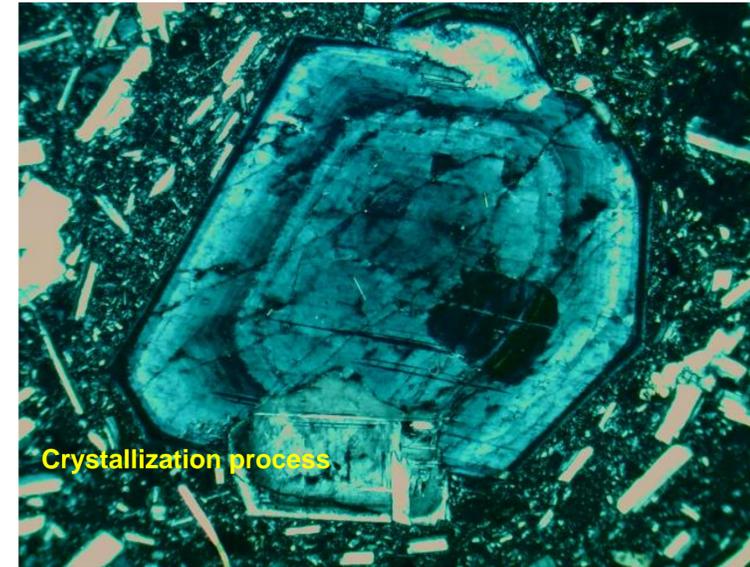
• Pleochroism: Hornblende



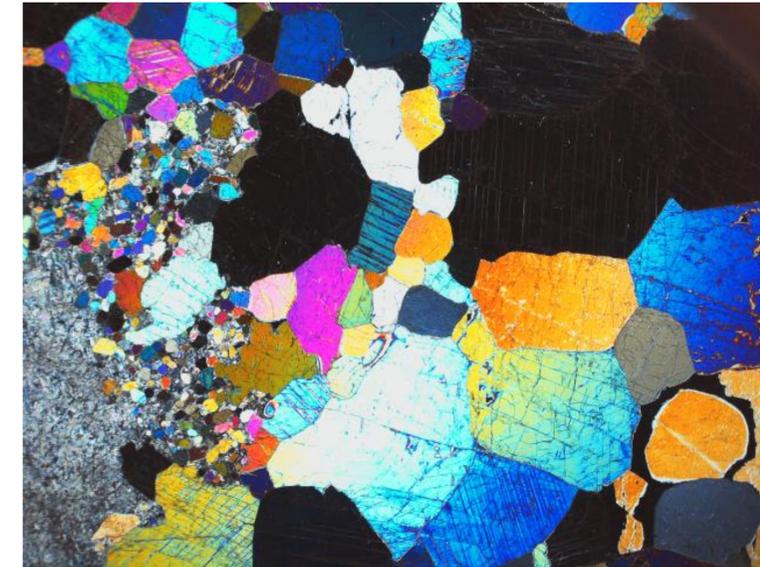
Refraction Index: Olivine



Crystal growing



Interference colors



Extinction angles, Euhedral/Anhedral etc..

References:

Andrew Barker: A key for identification of Rock-Forming minerals in thin-section, Taylor & Francis Group, pp173, 2014

W.S.Mackenzie et.al.,: Atlas of igneous rock and their textures, Longman Group UK Limited, pp.148, 1982

Acknowledgements:

**I thank the following researchers and a stone shop;
Dr.Kiyonobu Niida**

**(https://apoi-geopark.jp/geological_institute/)
suggested me the method using a diamond plate as an alternative to a glass with abrasives, and kindly guided us to the geological sites in Horoman area, including famous Horoman peridotites.**

Mr.Mamoru Miyazaki, an amateur geologist living in Mie Prefecture, gave us much advice about making a homemade rock-saw and related technics.

My old friend, Dr.Takanori Bessho gave me his polarized microscope and provided me much useful technics for making and observing thin-sections.

Mr.Rei Mitsunashi (a laboratory teacher of Tennoji Highschool attached to Osaka-Kyoiku University) made same tools of mine for thin-section making and carried out many trials for the use of the diamond saw and the rotating grinder. Also, he tried to make 3D printer models for making thin-sections to evaluate the process of grinding. His trials and results are very much useful to improve my tools and method.

Appendix

**The hours of Rendezvous 2021 in the US is at midnight in my hometown, Japan. So, if I can not attend a real-time meeting, please send me comments via e-mail.
yossi.okamoto <at mark> gmail.com**

The contents include our previous presentations partly at IGC36 (now is still postponed on 16-21 August 2021) , JpGU2021 (May, this year), and Teacher Sharing in KVIS-ISF 2021 (February, this year)

Improvement of our method using 3D printing is now developing day by day.

**The latest updates are as following page,
<http://yossi-okamoto.net/Thin-Sections/updates/index.html>**

**More details, including how to make tools and thin-section galleries, are on my following web page,
<http://yossi-okamoto.net/Thin-Sections/index.html>.**

**An old version of making recipe is the following page,
http://seagull.stars.ne.jp/Thin-Section_Recipe/Thin-Section_Recipe.html.**

Any comments and questions are to my following address;

yossi.okamoto <at mark> gmail.com

