# MINERALOGY OF PETRIFIED TREES IN THE PETRIFIED FOREST PARK, TAK PROVINCE, THAILAND

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Srinakharinwirot University
Thailand

# Layout of presentation:

1) Introduction

2) Location, Materials, and Methods

3) Results

4) Summary of Results

5) Discussion and Interpretation

# 1) Introduction

- 7 petrified trees in the Petrified Forest Park, Tak Province in Northern Thailand were investigated in terms of mineralogy.

- The petrified tree No. 1 (BT1) is said to be **the longest one in the world**, (69 meters).

- The trees fell down and were buried in the Quaternary palaeoriver gravel beds at the depth <10 m.

- Later, the overburden was removed and now they are exposed to an open atmosphere.

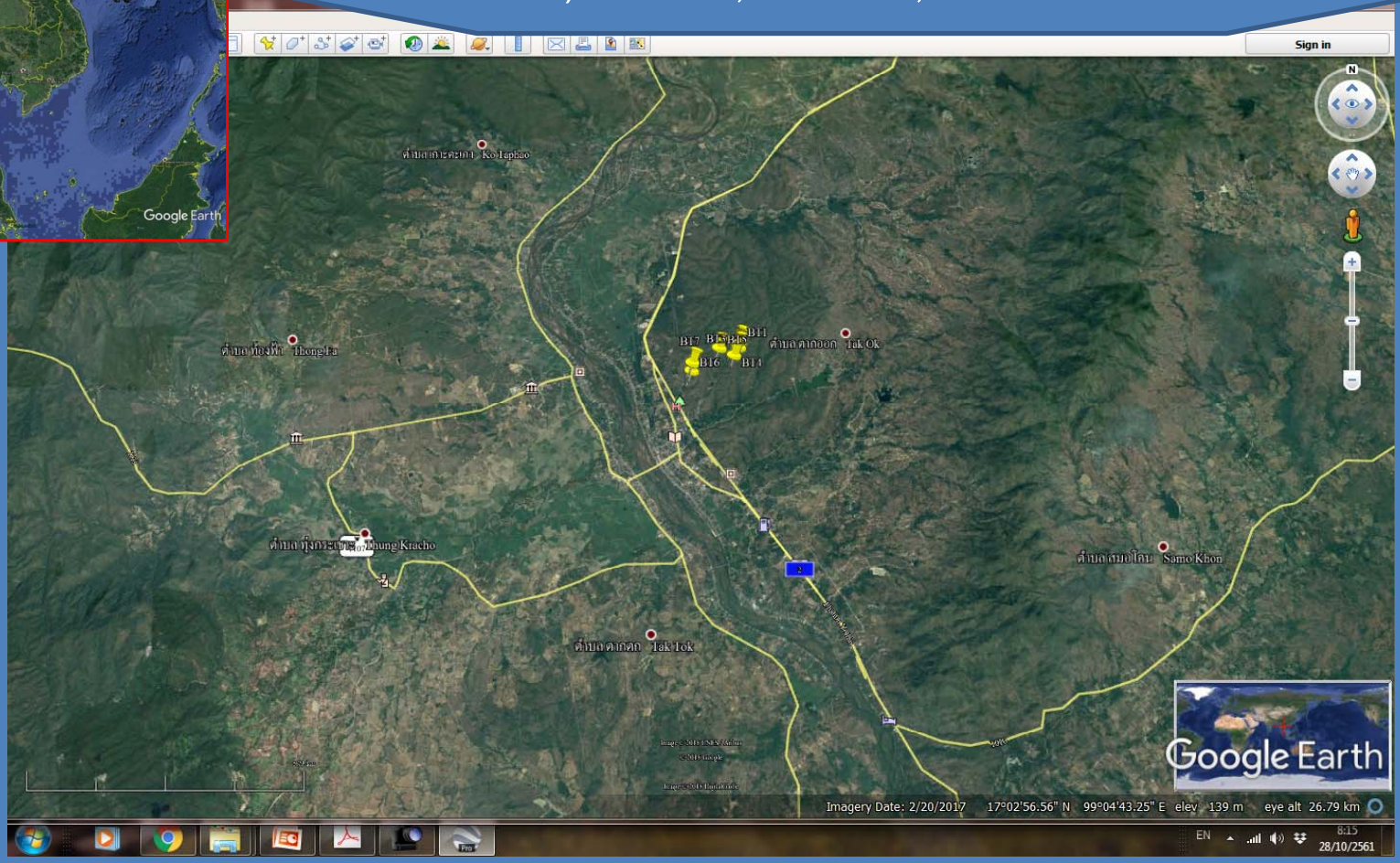
# Why do we study the minerals of petrified trees in this site?

The fossil woods have been deteriorating.

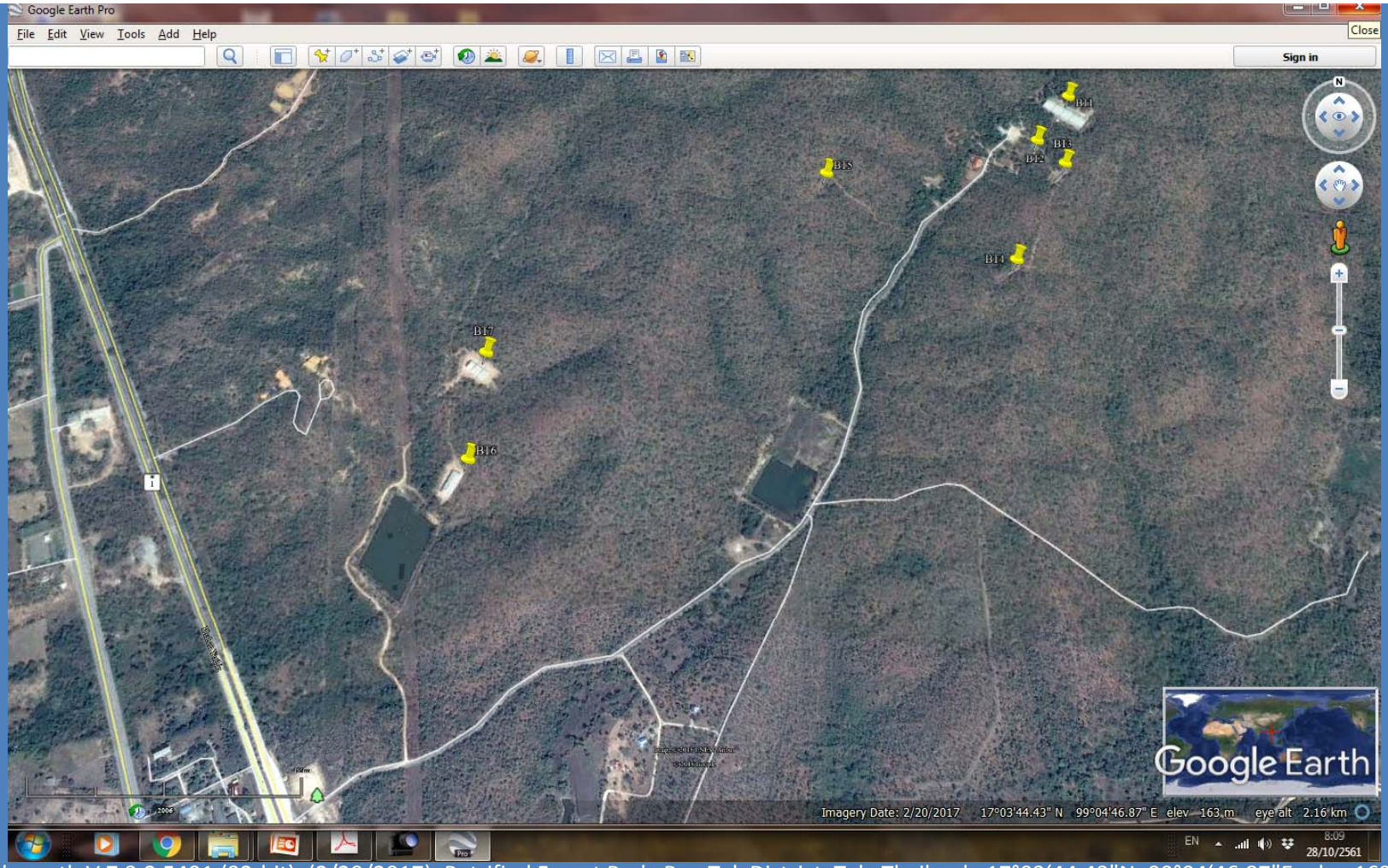
We need to know what kind of minerals in these fossils.

To perform the proper conservation means.

# 2) Location, Materials, and Methods

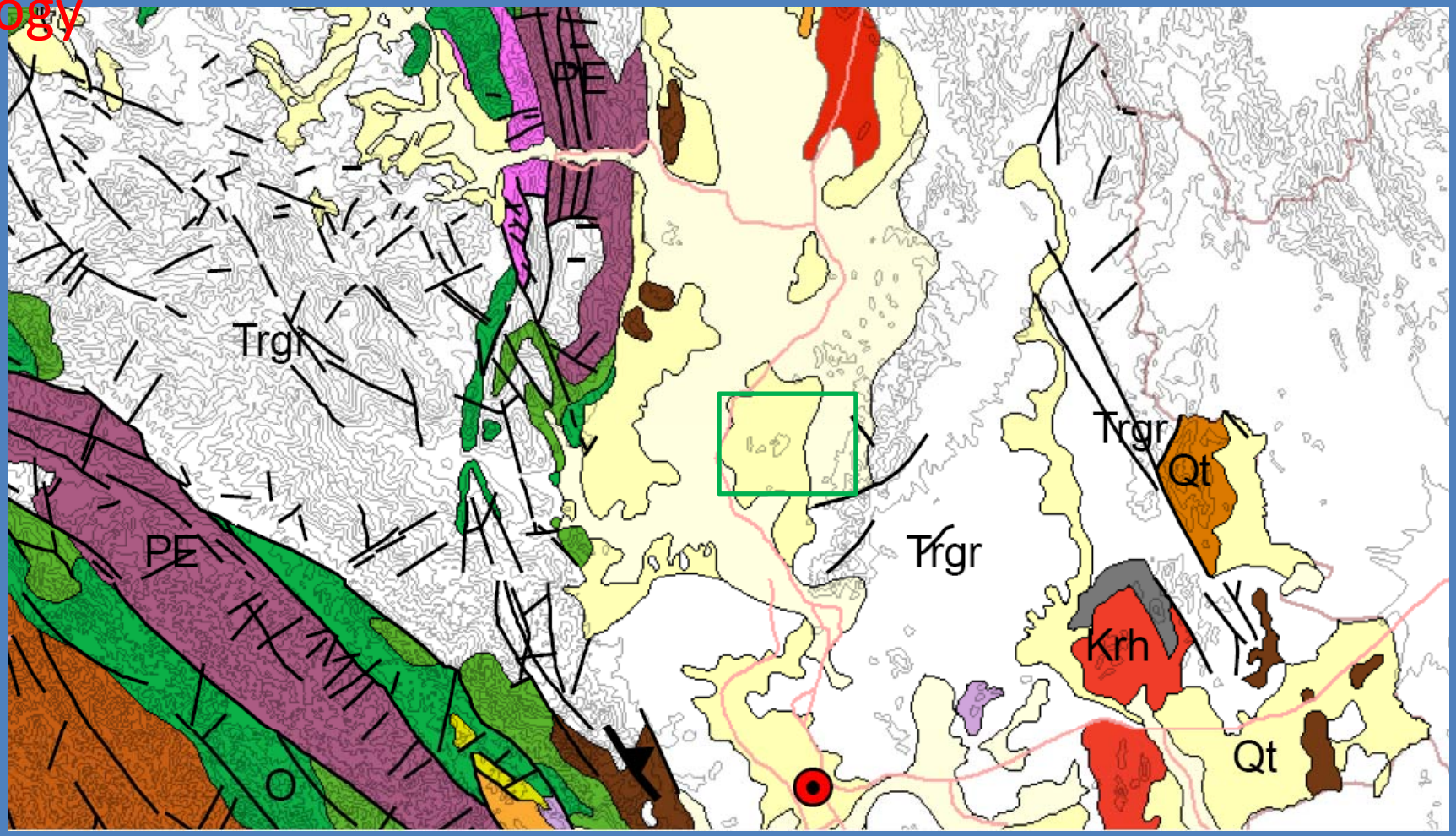




Google earth V 7.3.2.5491 (32-bit). (2/20/2017). Petrified Forest Park, Ban Tak District, Tak, Thailand. 17° 02'56.56"N, 99°04'43.25"E, elev 139 m, Eye alt 26.79 km. https://www.google.com/earth/[October 28, 2018].




Google earth V 7.3.2.5491 (32-bit). (2/20/2017). Petrified Forest Park, Ban Tak District, Tak, Thailand. 17°03‘44.43"N, 99°04‘46.87"E, elev 163 m, Eye alt 2.16 km. https://www.google.com/earth/[October 28, 2018].

# Geology




Department of Mineral Resources, 2007. Geological map of Tak province, Thailand [http://www.dmr.go.th/n_more_news.php?nid=79590].

| Tree No. | Species | Length (m.) | Width (m.) |
|---|---|---|---|
| BT1 | *Koompassioxylon elegans* | **72.2 (now 69)** | 1.8 |
| BT2 | *Pahudioxylon cf. sahnii* | 31.3 | 0.5 |
| BT3 | *Koompassioxylon elegans* | 32.4 | 2.1 |
| BT4 | *Koompassioxylon elegans* | 44.2 | 1.4 |
| BT5 | *Pahudioxylon cf. sahnii* | 22.2 | 1.2 |
| BT6 | *Koompassioxylon elegans* | 34.5 | 1.55 |
| BT7 | *Koompassioxylon elegans* | 38.7 | 1.5 |

Ref: Songtham (2010).

Boonchai, N., Grote J. P., and Jintasakul, P. (2009) Paleontological parks and museums and prominent fossil sites in Thailand and their Importance in the conservation of fossils. Carnets de Géologie / Notebooks on Geology, 3: 75-95.

http://www.satun-geopark.com


https://www.monumentaltrees.com/db/62/full/62588.jpg

https://en.wikipedia.org/wiki/Koompassia_malaccensis

*Koompassioxylon elegans*, “Thong-Berng”, currently found around the border of Thailand near Malaysia, and in Borneo and Indonesia.

http://xn--42cai1dwcbb0jeqf4pg6fht.blogspot.com/2012/08/blog-post_29.html



http://puechkaset.com

*Pahudioxylon cf. sahnii*, “Ma-Ca-Mong”, currently found in the deciduous and dipterocarp forests in Thailand, Laos, Cambodia, and Vietnam.

Tree No. 1 (BT1), The longest, 69 meters.

Tree No. 2 (BT2)

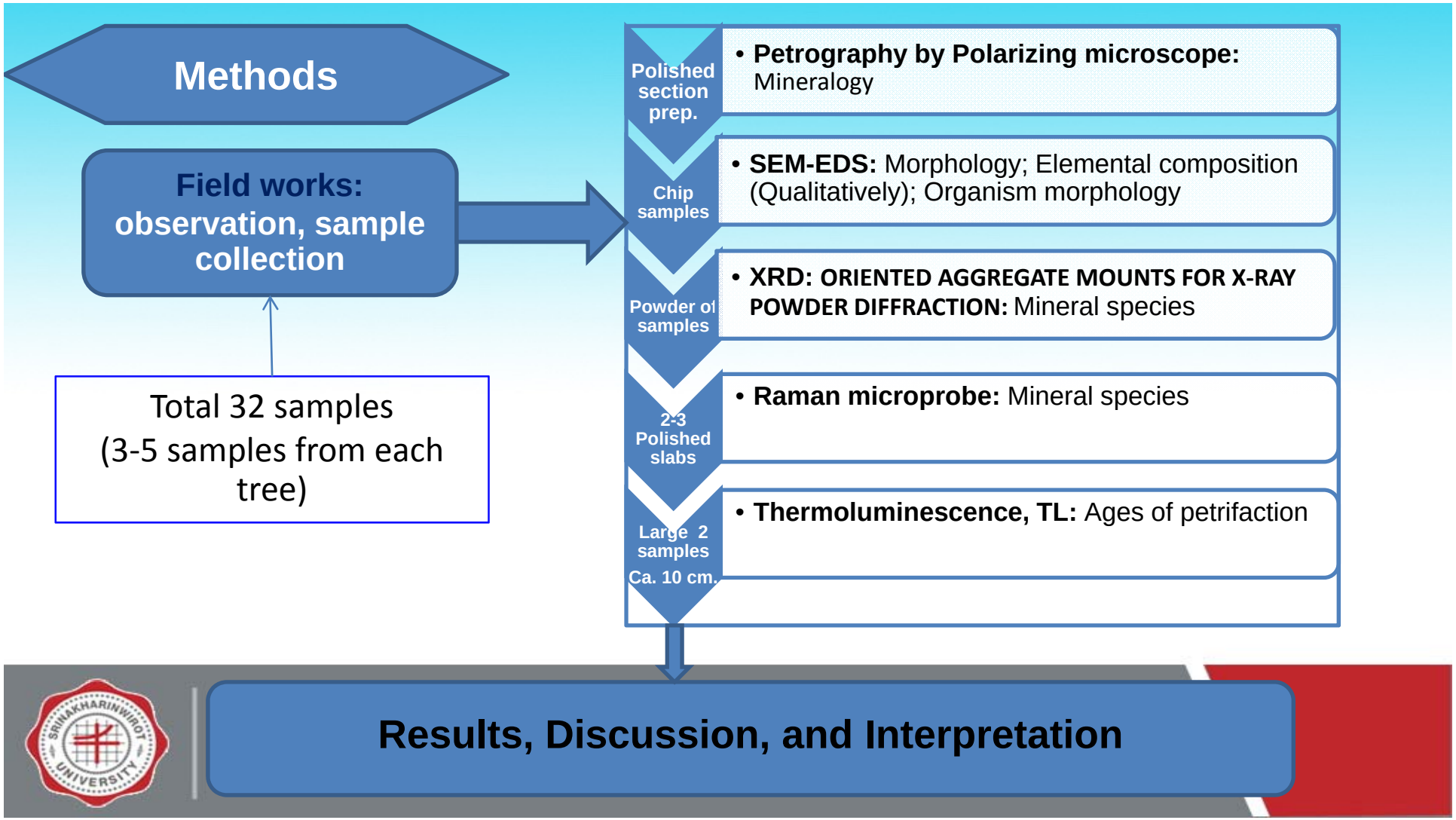
Tree No. 3 (BT3)

Tree No. 5 (BT5)

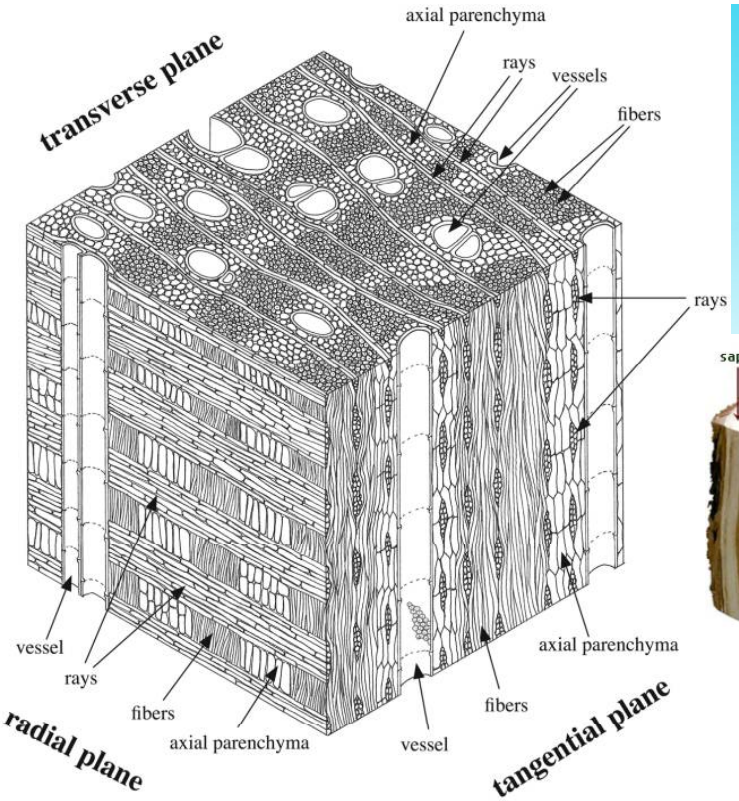
Tree No. 4 (BT4)

Tree No. 6 (BT6)

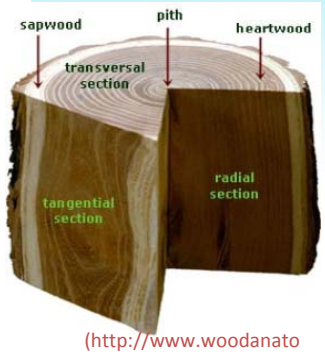
Tree No. 7 (BT7)


Methods
Field works: observation, sample collection
Total 32 samples
(3-5 samples from each tree)
Polished section prep.
• Petrography by Polarizing microscope: Mineralogy
Chip samples
• SEM-EDS: Morphology; Elemental composition (Qualitatively); Organism morphology
Powder of samples
• XRD: ORIENTED AGGREGATE MOUNTS FOR X-RAY POWDER DIFFRACTION: Mineral species
2-3 Polished slabs
• Raman microprobe: Mineral species
Large 2 samples Ca. 10 cm.
• Thermoluminescence, TL: Ages of petrifaction
Results, Discussion, and Interpretation

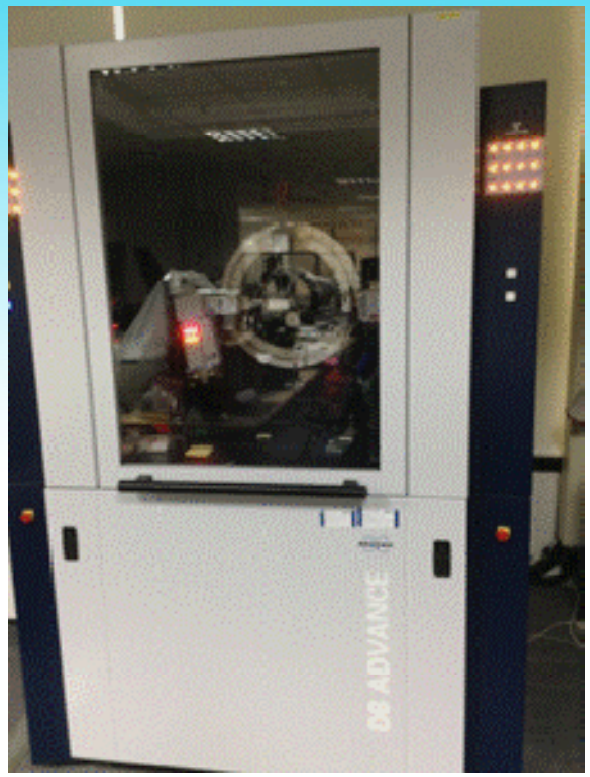

BT1(M)


(Pace and Angyalossy, 2013)




(http://www.woodanatomy.ch/macro.html)



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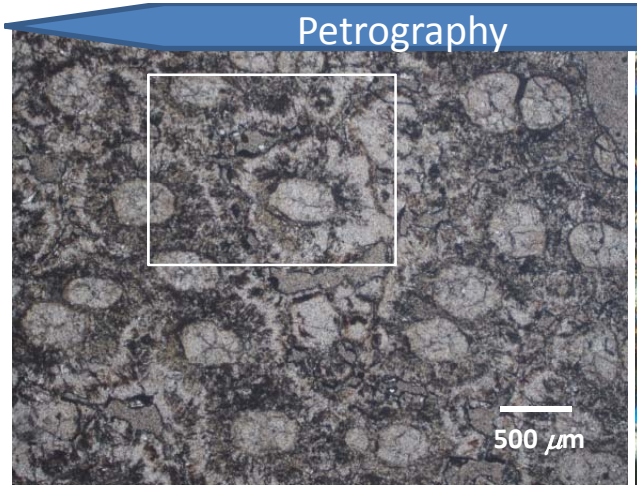
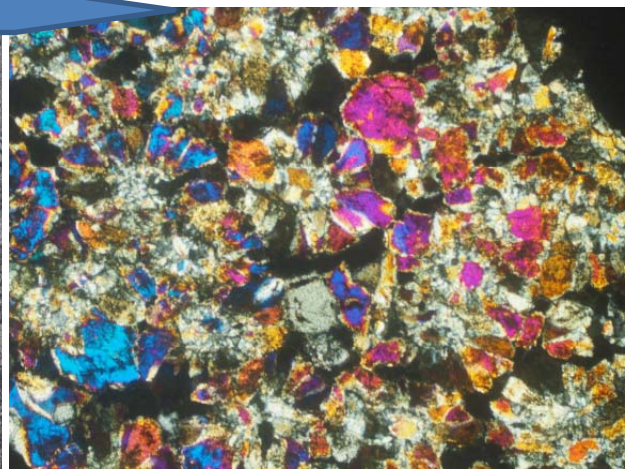
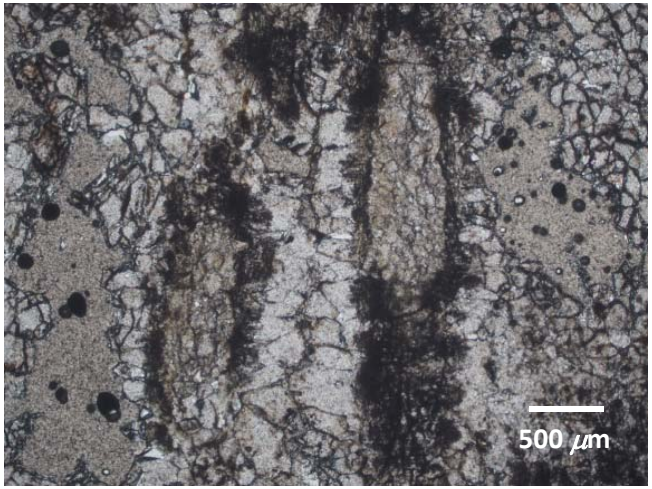
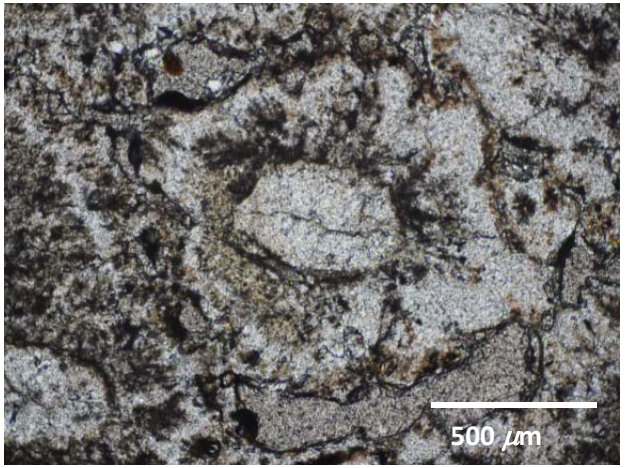
# 3) Results

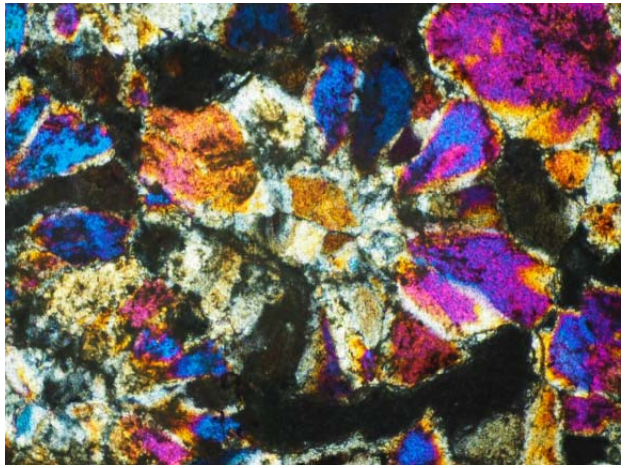
## Petrography

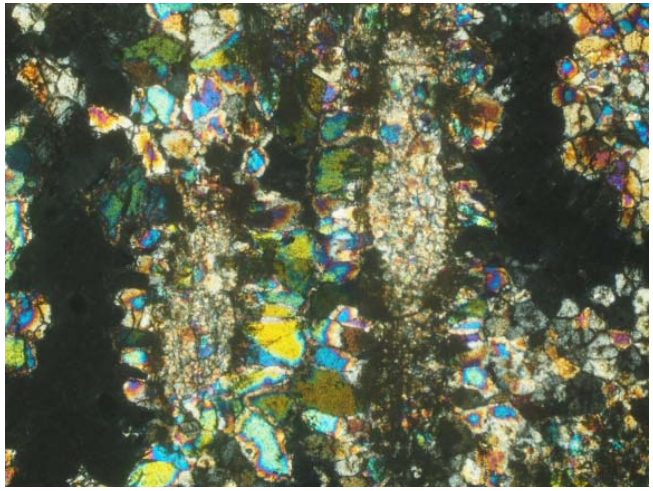




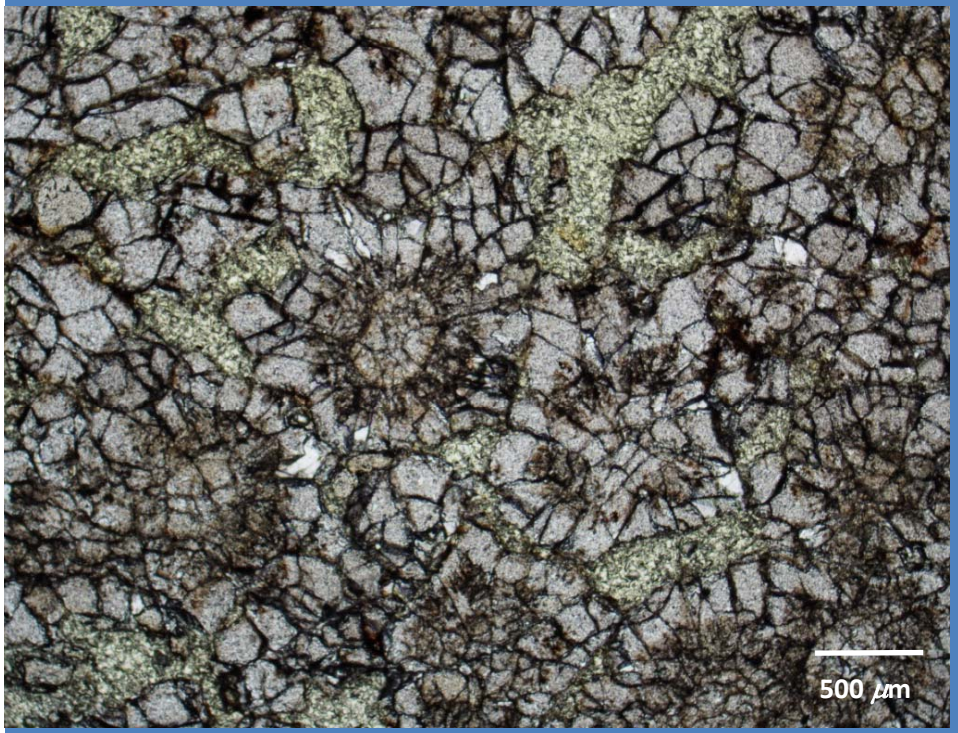



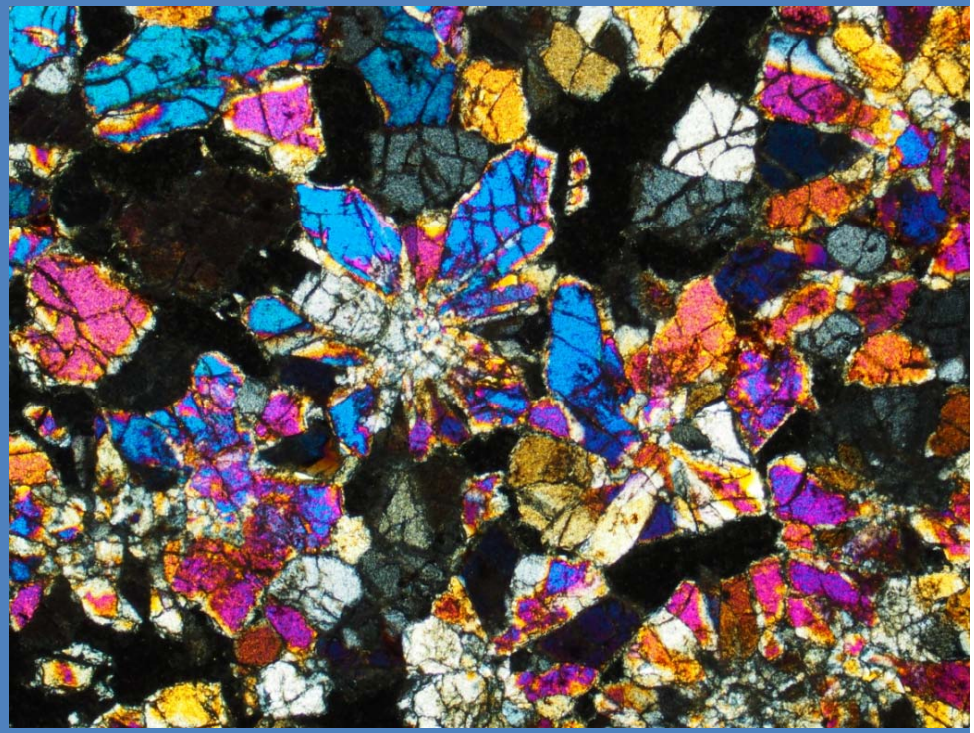





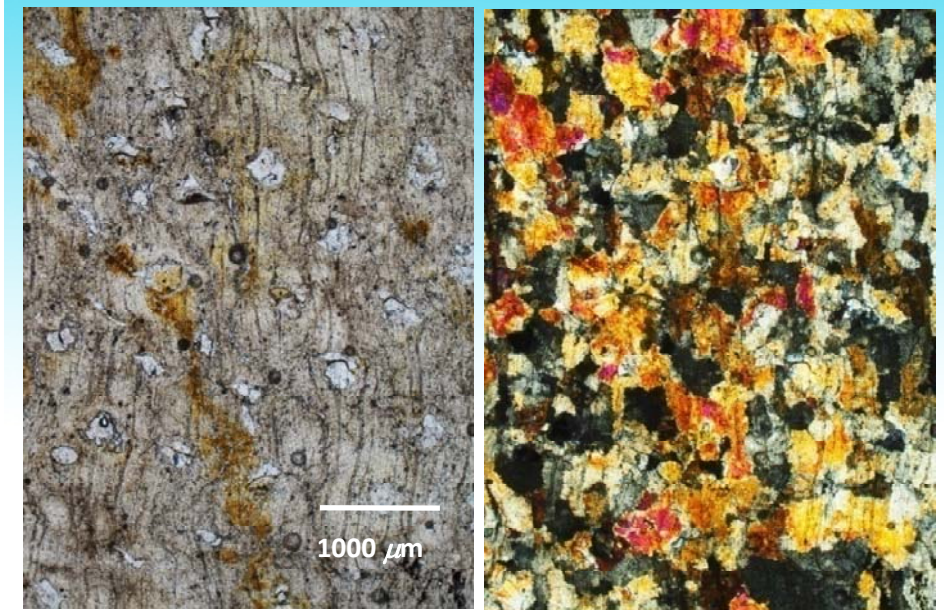
BT1-11.97(C)

BT1-11.97(R)

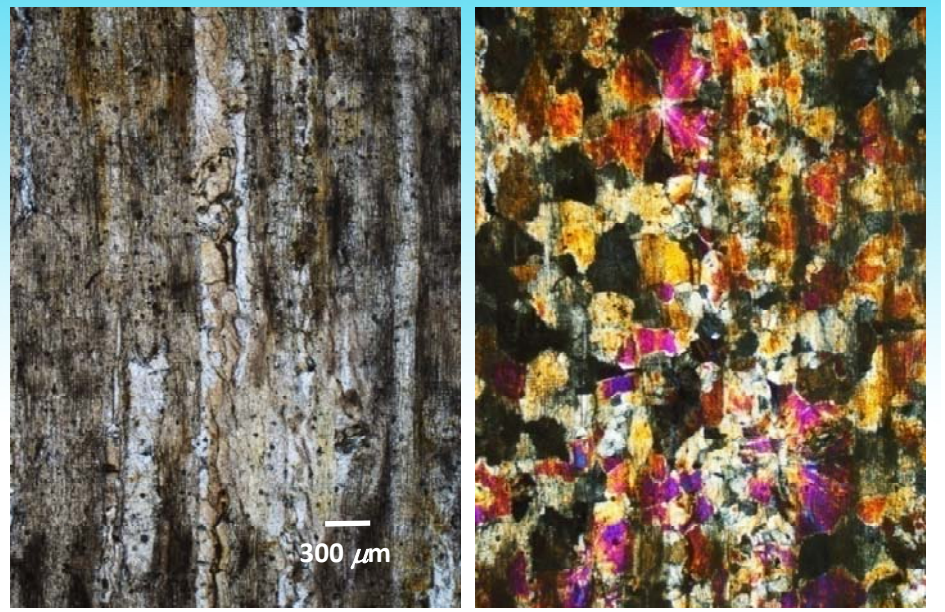


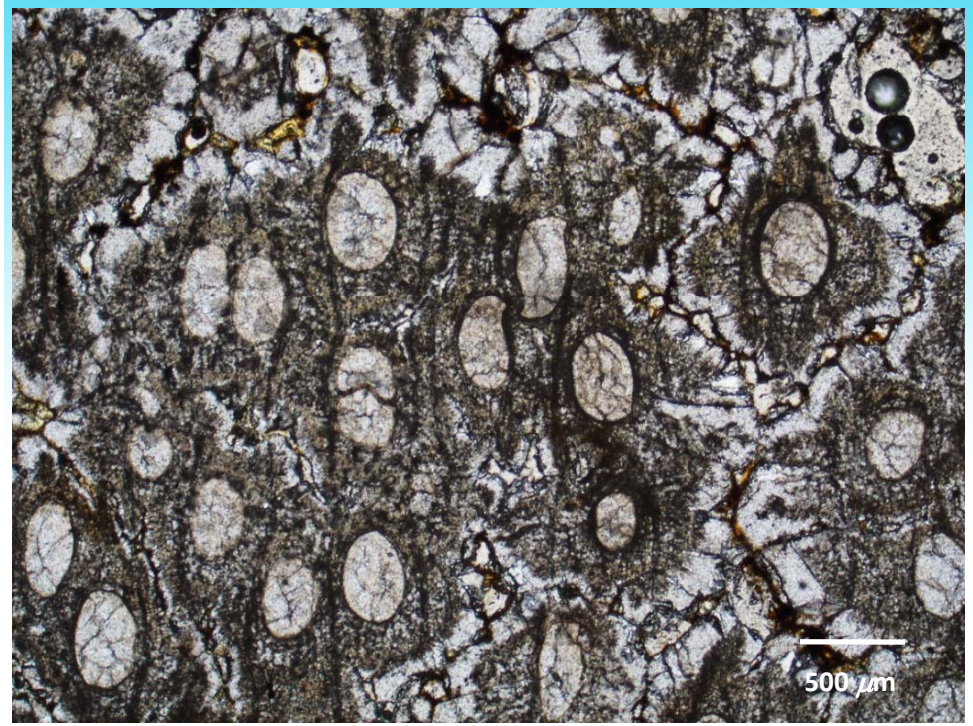
BT1-18.5(C)

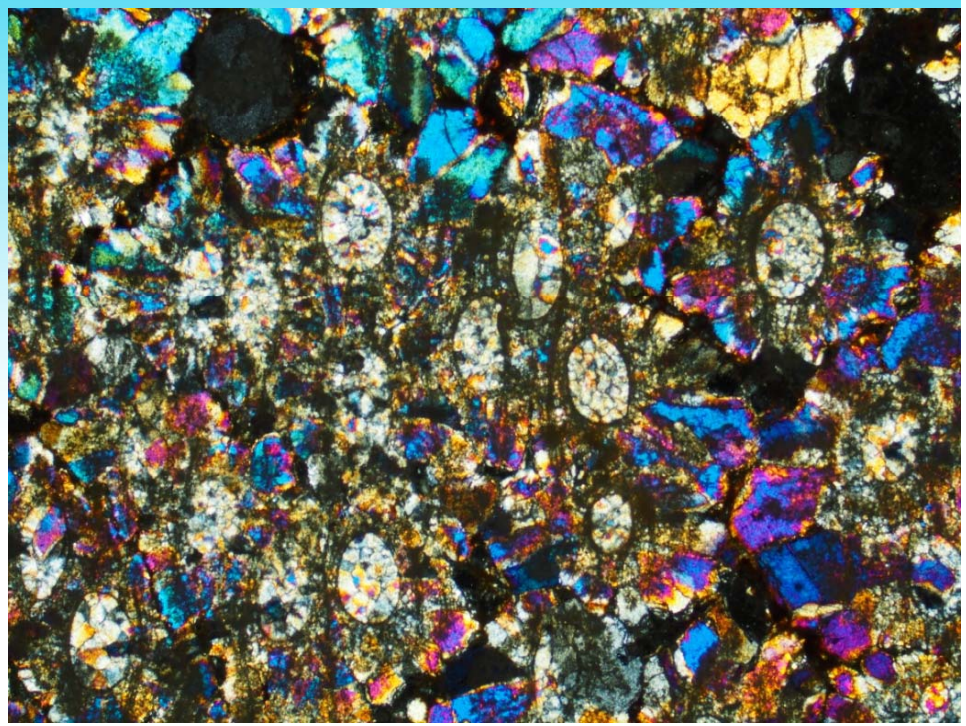



BT2(C)




BT2(R)



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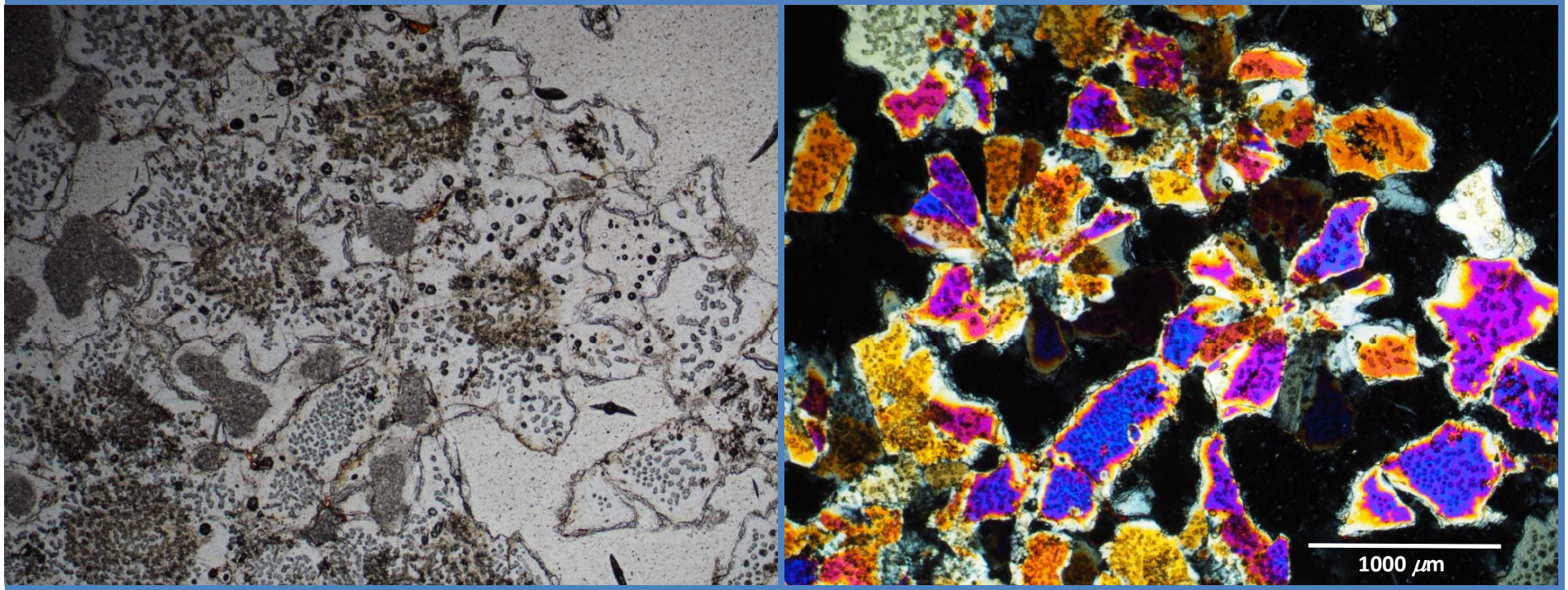
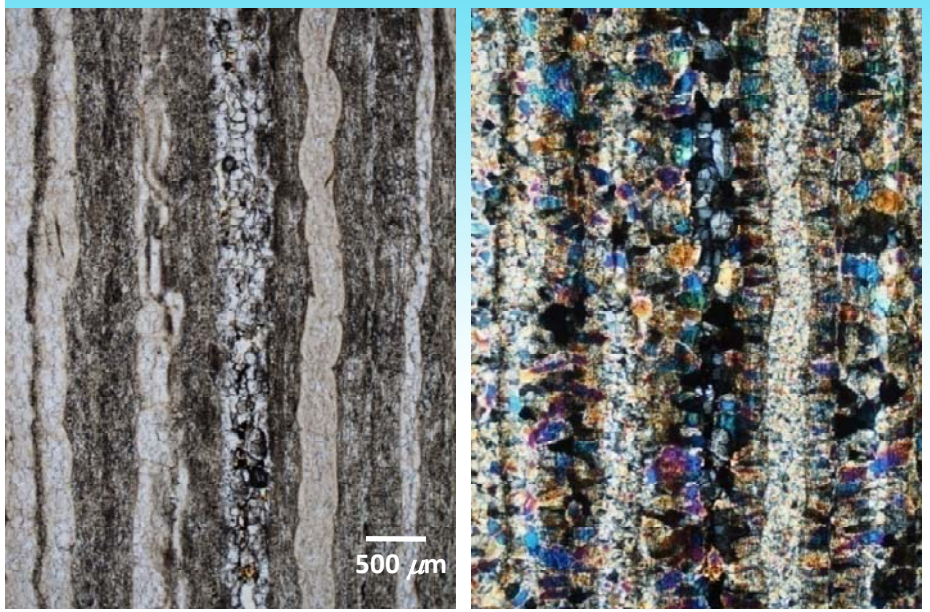
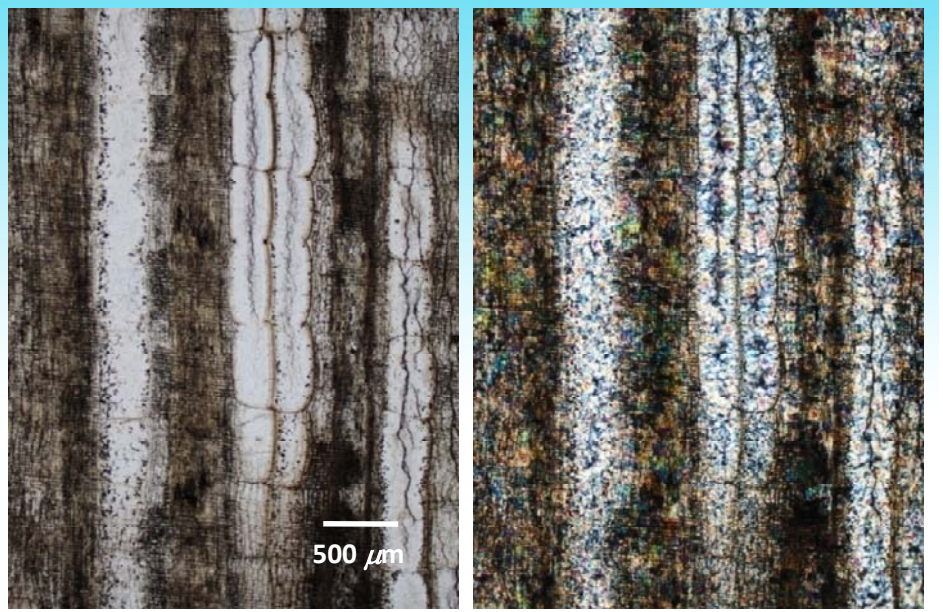


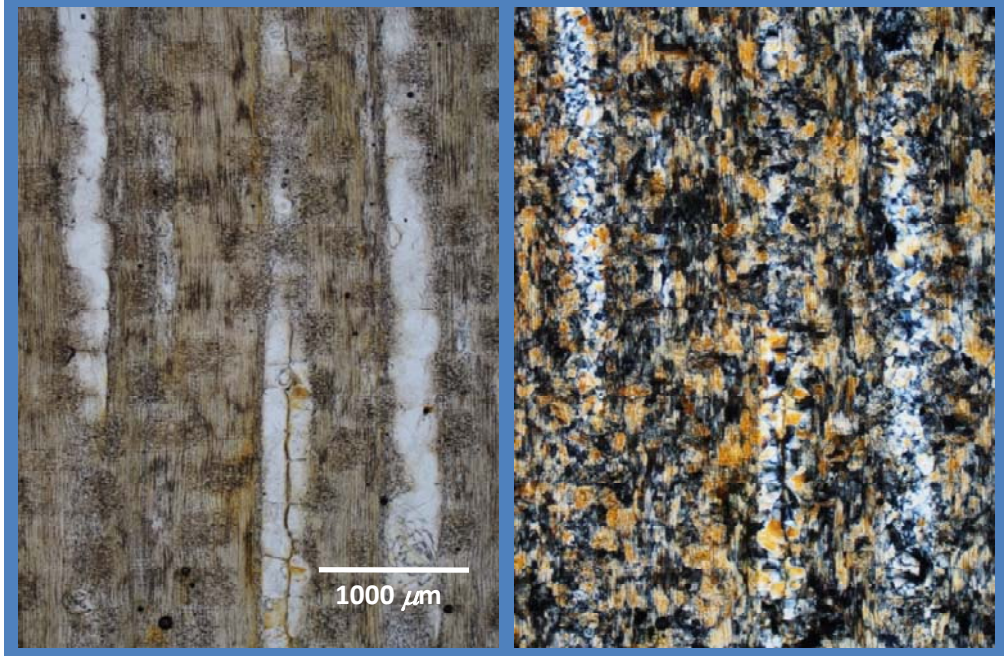

BT3-15(C)




BT3(T)

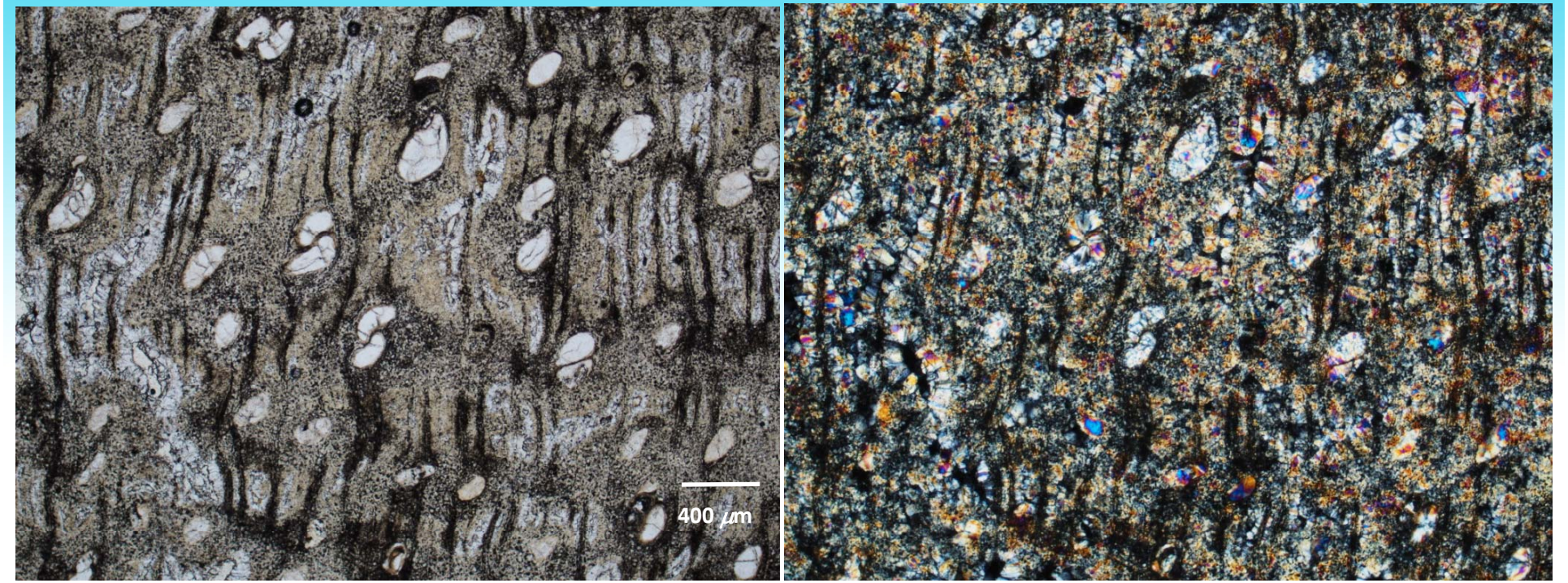



BT4(R)

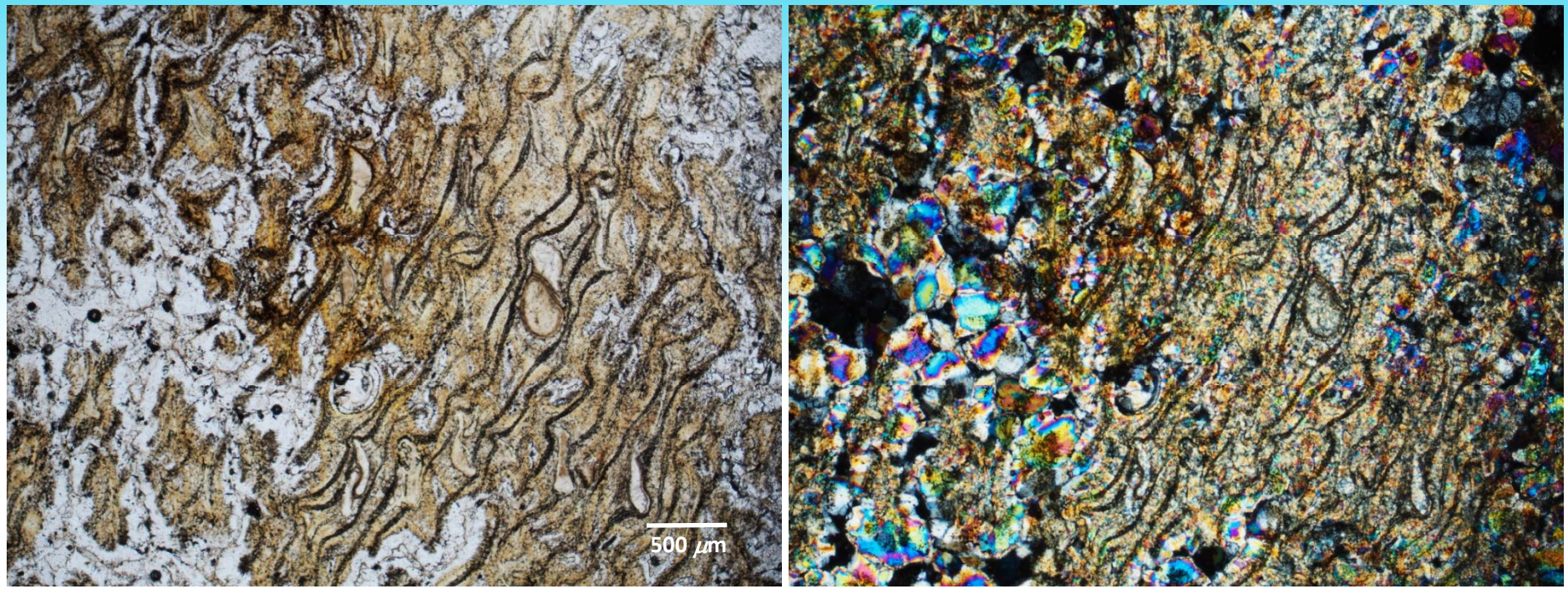



BT5(R)

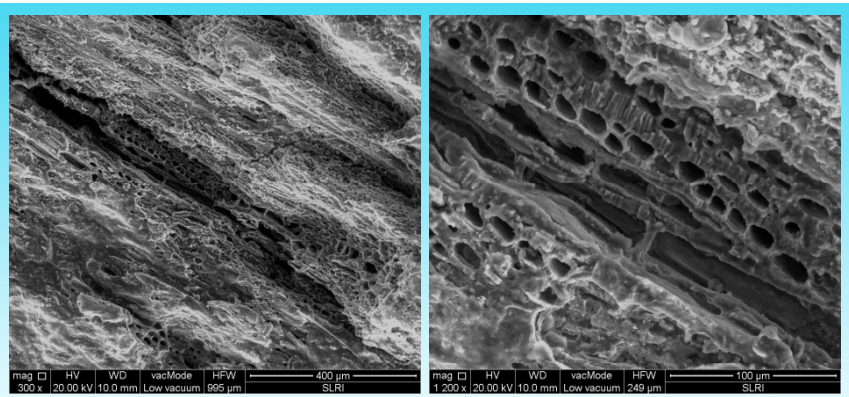

BT5-14(T)



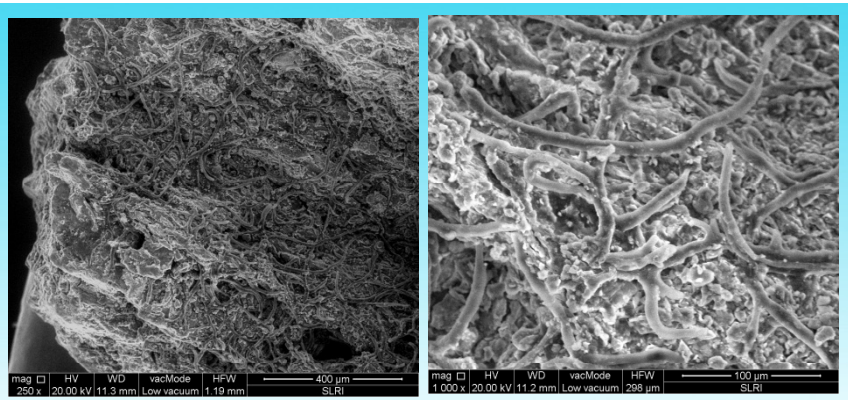

BT6(C)



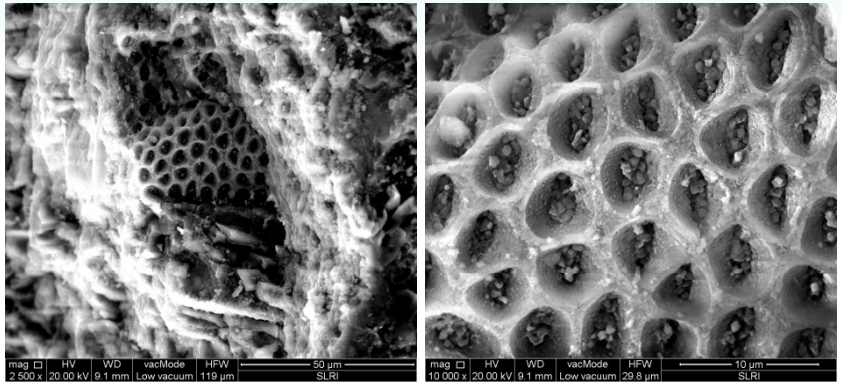

BT7(C)



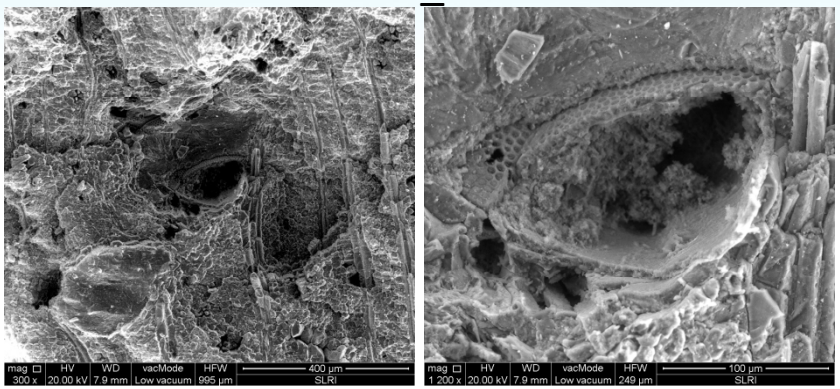
BT1_24.2_M



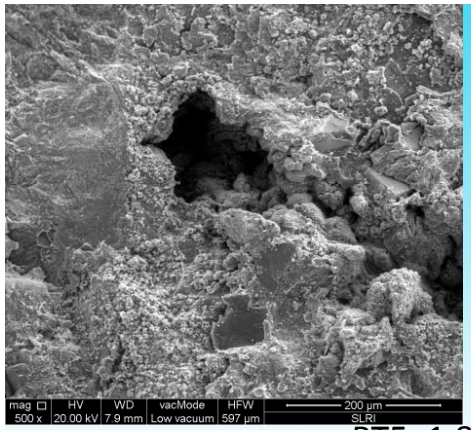
BT1_26

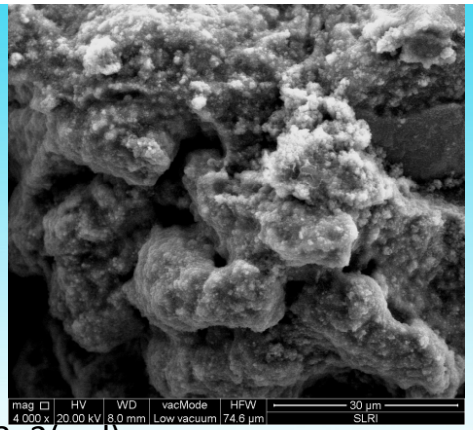


BT2_30.8_M

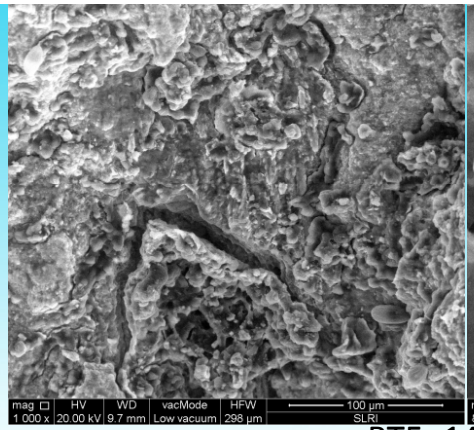


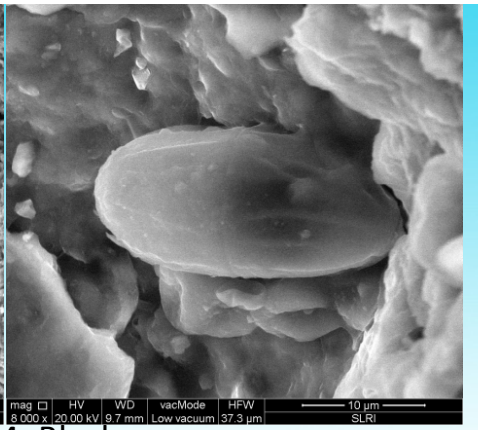
BT2_30.8_U



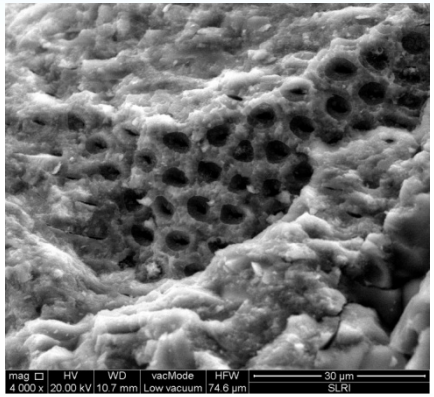



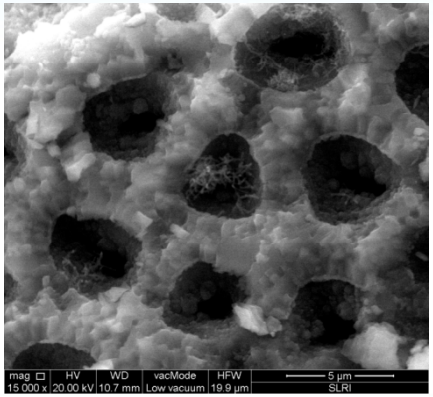

BT5_1.8_3(red)

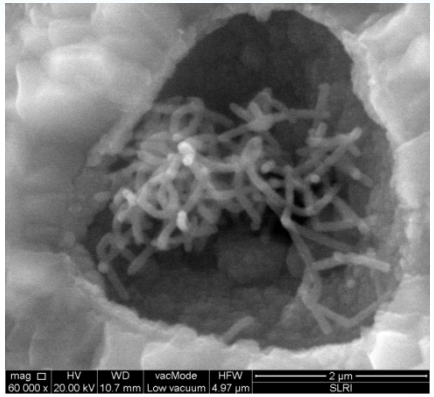


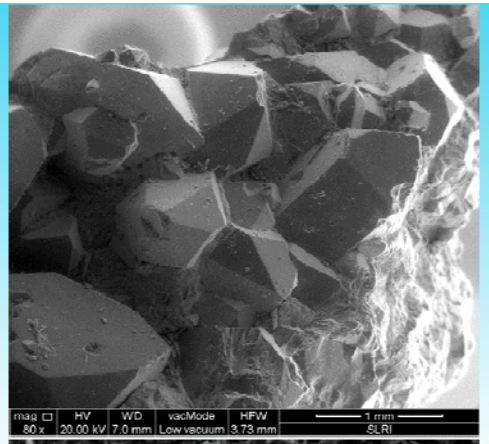

BT5_14_Black

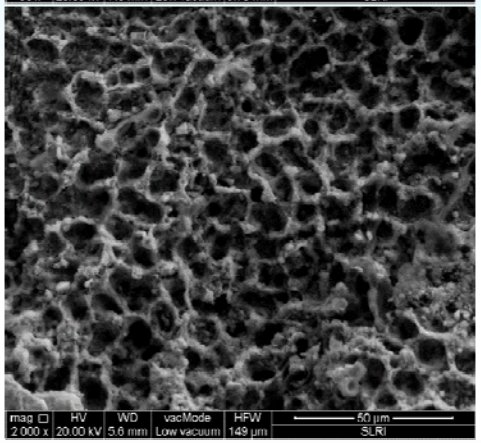


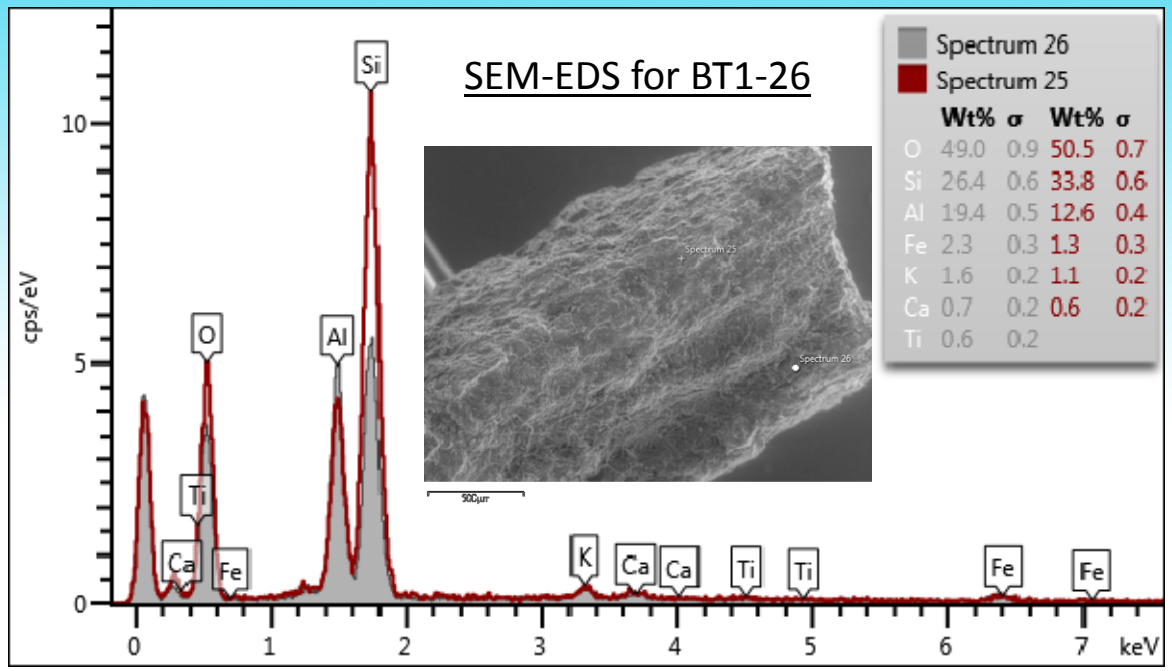

BT5_1.8_3(brown)

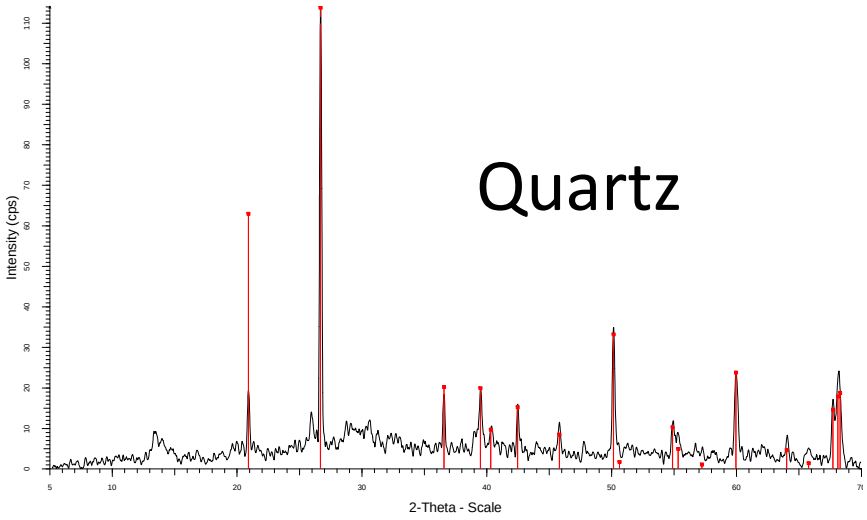


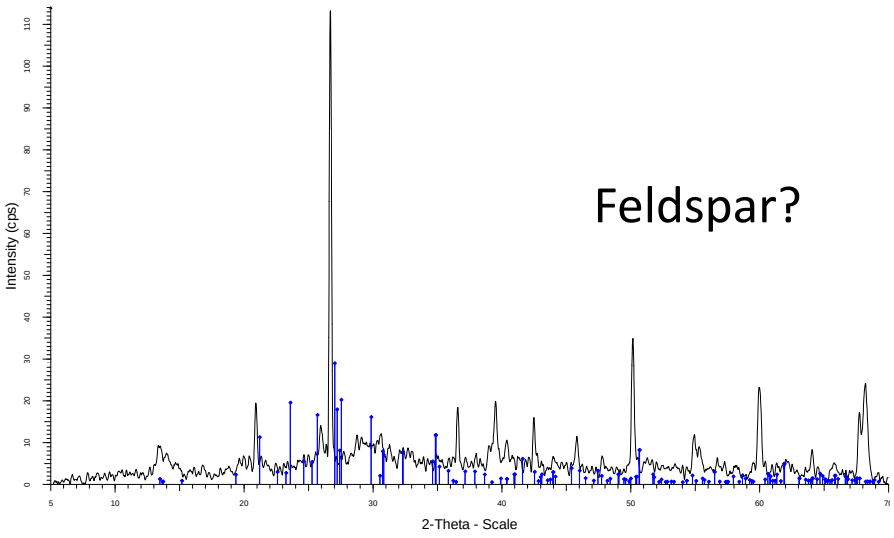



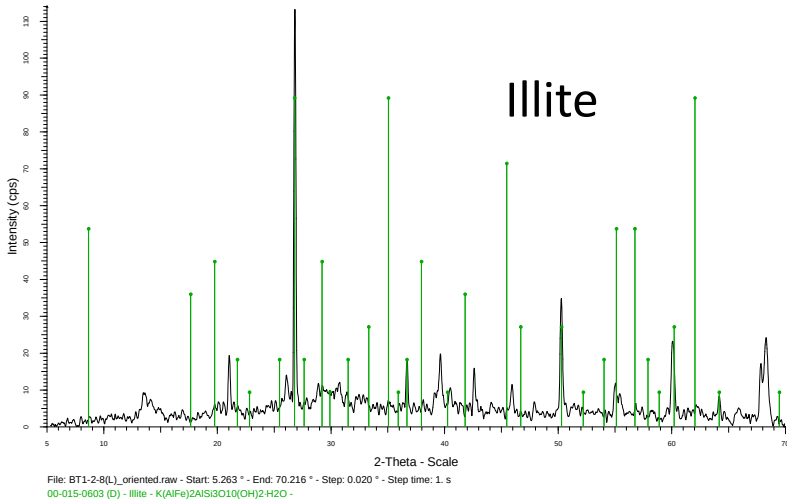

BT5-1.8_2

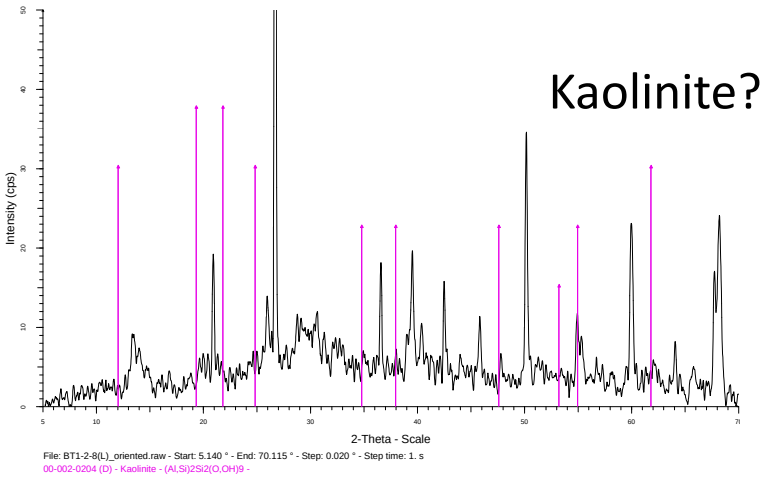
## SEM-EDS for BT1-26



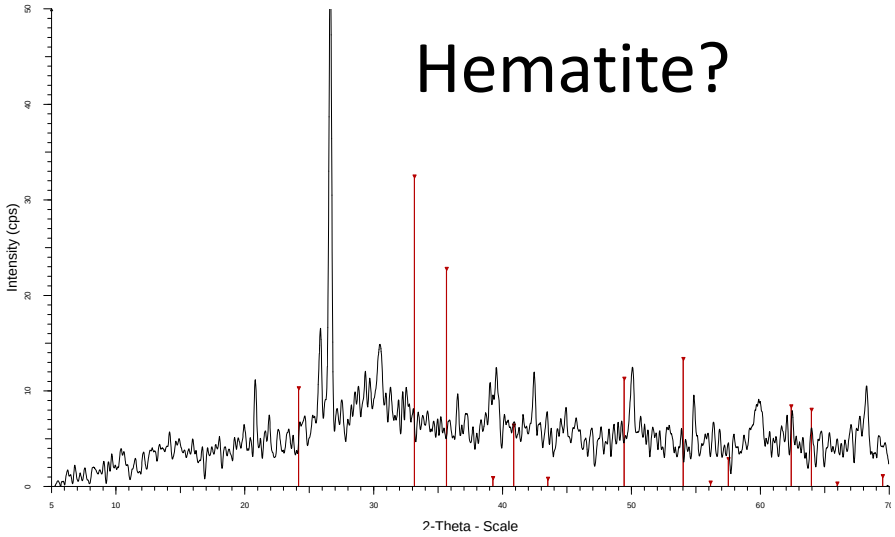

Quartz
Intensity (cps)
2-Theta - Scale
File: BT1-2-8(L)_oriented.raw - Start: 5.132 ° - End: 70.108 ° - Step: 0.020 ° - Step time: 1. s
01-086-1630 (C) - Quartz low - SiO2 - Hexagonal


Feldspar?
Intensity (cps)
2-Theta - Scale
File: BT1-2-8(L)_oriented.raw - Start: 5.132 ° - End: 70.108 ° - Step: 0.020 ° - Step time: 1. s
01-083-1324 (C) - Feldspar - K.59Ba.19Na.22(Al1.18Si2.82O8) - Monoclinic


Illite
Intensity (cps)
2-Theta - Scale
File: BT1-2-8(L)_oriented.raw - Start: 5.263 ° - End: 70.216 ° - Step: 0.020 ° - Step time: 1. s
00-015-0603 (D) - Illite - K(AlFe)2AlSi3O10(OH)2·H2O -


Kaolinite?
Intensity (cps)
2-Theta - Scale
File: BT1-2-8(L)_oriented.raw - Start: 5.140 ° - End: 70.115 ° - Step: 0.020 ° - Step time: 1. s
00-002-0204 (D) - Kaolinite - (Al,Si)2Si2(O,OH)9 -

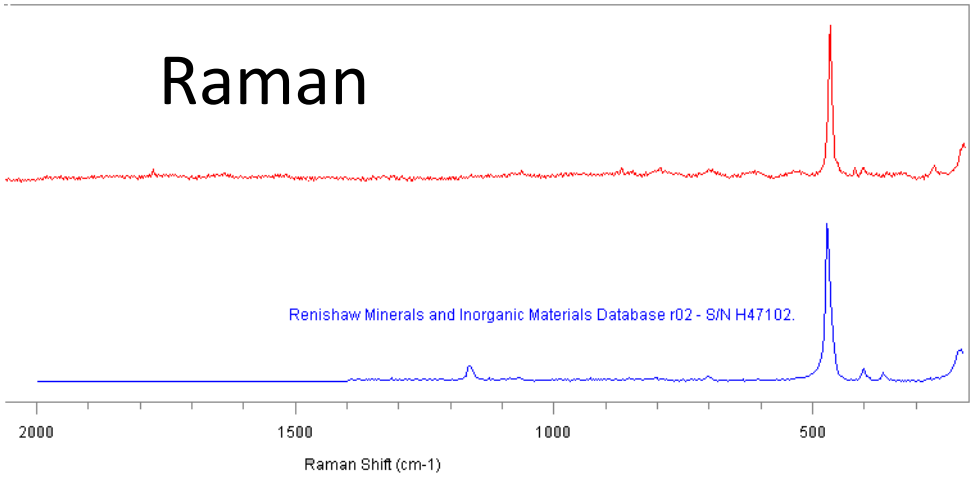
# Hematite?




File: BT1-11-97_oriented.raw - Start: 5.061 ° - End: 70.050 ° - Step: 0.020 ° - Step time: 1. s

01-072-0469 (C) - Hematite - Fe2O3 - Hexagonal (Rh)

# Raman



# Ages by Thermoluminescence, TL

**BT6, age = 185,880±9,852 years**

**BT7, age = 138,970±12,785 years**

(Won-in et al., 2018)

# 4) Summary of Results

**1) Petrography and SEM →**

- Quartz grains: Euhedral prismatic habit and granular habit.
- Chalcedony in some samples (a spherulitic texture of fibrous quartz grains radiating from the vessel).
- The wood structures can be overgrown by the quartz.
- The weathered woods → show spongy appearance.
- Microorganism  probably fungi is seen under the SEM.
- Fe-oxide compounds, red or reddish brown stains in other cells outside the vessels.
- Some samples→ contortion cells, suggesting that the wood was subjected to a pressure after the deposition.

**2) SEM-EDS:**

- O, Si, and Al → major elements
- Fe, K, Ca, Ti → trace elements

**3) XRD and Raman** → Quartz, illite, hematite?, kaolinite?, and feldspar?.

**4) TL ages** ~130,000-180,000 years BP.

## 5) Discussion and Interpretation

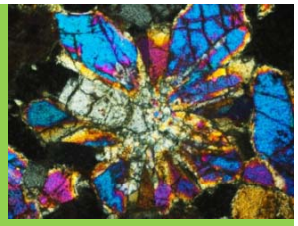
1) Silica solution penetrated to the wood structure then quartz crystallized.

2) The outer part of the vessel's cell wall has a larger area and higher resistant from the weathering than those of other cells. This provides a suitable area for prismatic quartz grains to grow in the divergent habit.

3) Other cells (e.g. ray, fiber, parenchyma), having their smaller structures which are perforated by the solution, and then they were overgrown by irregular/granular quartz grains.

4) The turbid inclusions seen in the grains are the impurities which their composition is not the same as the quartz ($SiO_2$) and they are still not identified at this stage.

## ACKNOWLEDGEMENTS



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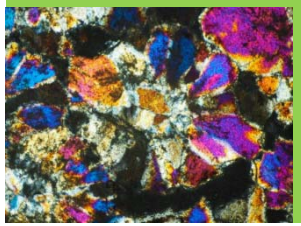

and

**THANK YOU FOR YOUR ATTENTION.**