Tourmaline from mineralized porphyry systems – Red Spring

C.E. Beckett-Brown

Harquail School of Earth Sciences, Laurentian University

Overview

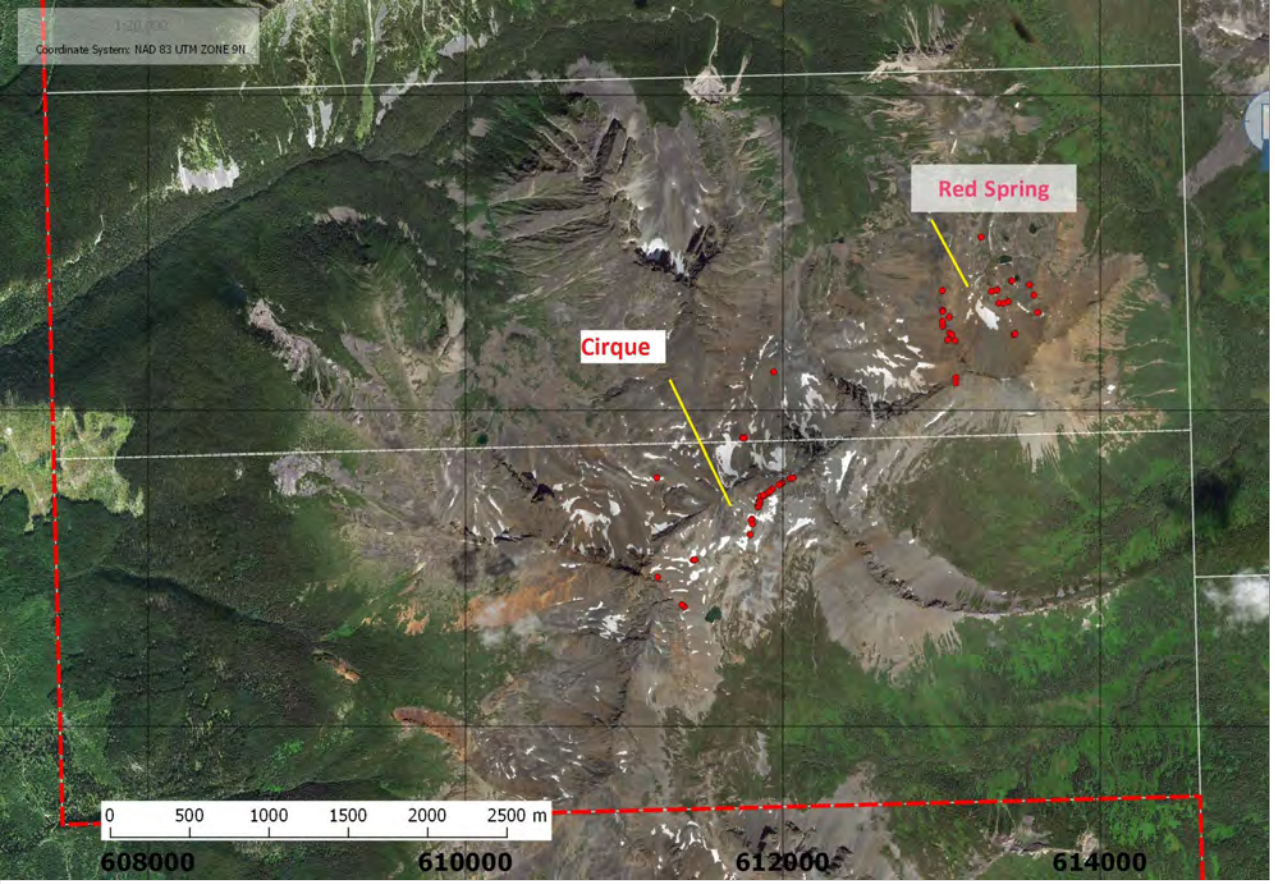
Samples

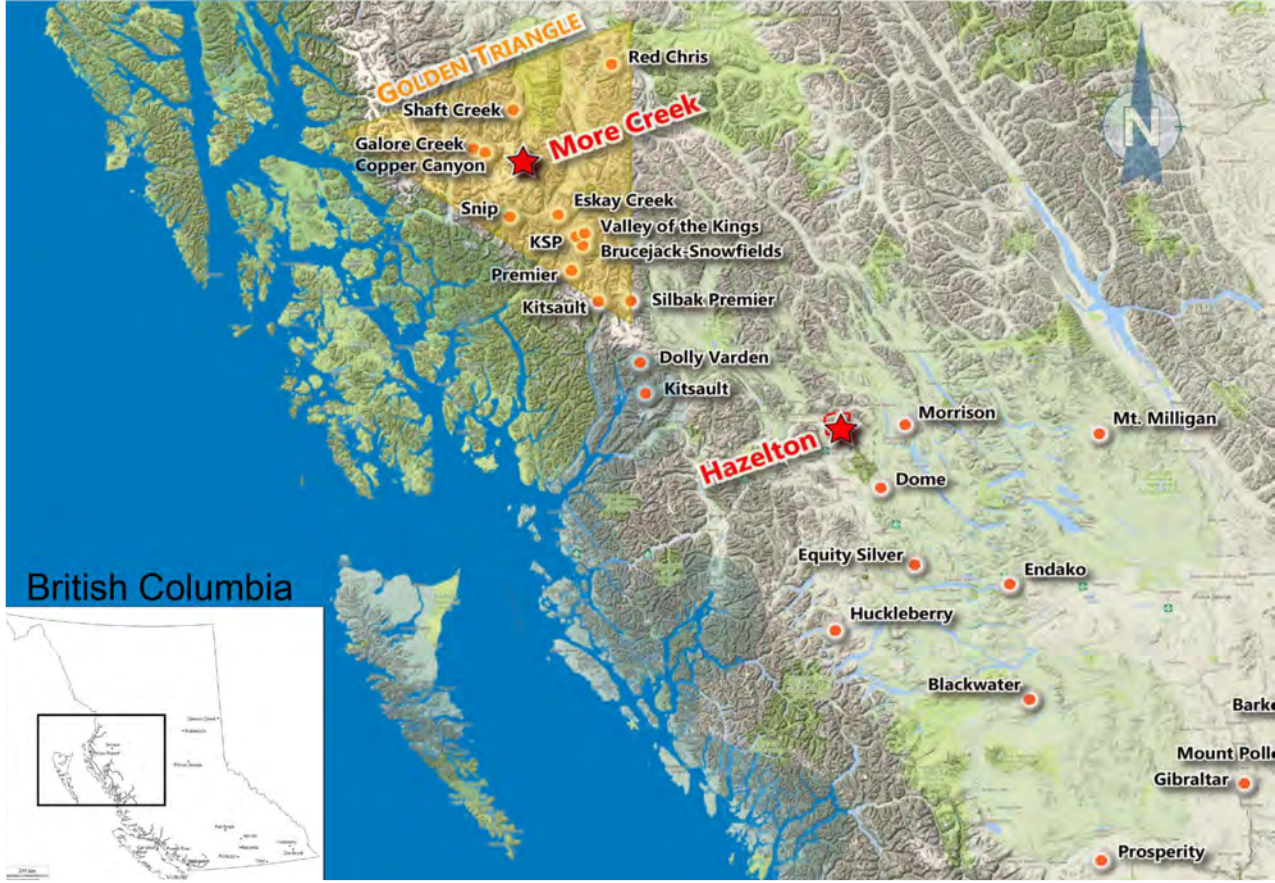
Petrography

- Tourmaline
- Ore mineralogy

Microanalyses and electron imaging

Tourmaline Major-Element Chemistry

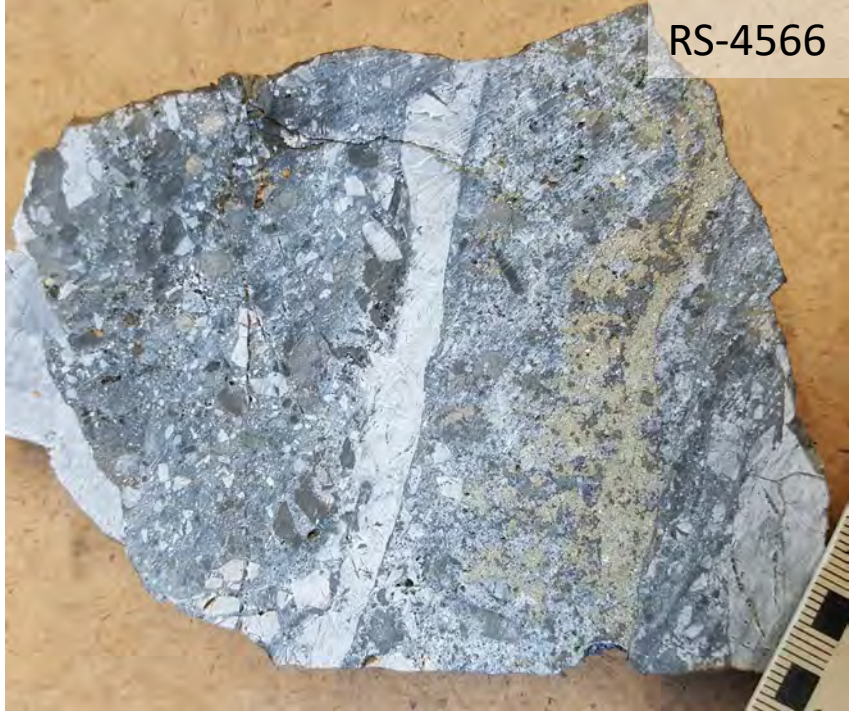




Sample Location – Red Spring

Sample	Easting	Northing	Hand Sample Description
4552	611870	6113805	Black tourmaline forming in a crack-seal vein. Tourmaline is observed throughout the vein but most notably along the contact of the vein and the wall rock.
4563	unknown	unknown	Matrix supported black-brown tourmaline breccia. No mineralization is observed.
4566	611810	6113284	Massive outcrop of tourmaline with sulfides (Aspy, Py). Sample is a breccia with a black-brown tourmaline matrix.
4567	611818	6113284	Matrix supported black-brown tourmaline breccia. Rock fragments appear to be replaced by tourmaline.
17LF46	613473	6114515	Green tourmaline breccia with abundant oxidized material filling the interstices possibly jarosite?
3675	unknown	unknown	Green tourmaline breccia with minor oxidized material but minor pyrite is observed.


RS-4567


RS-4566

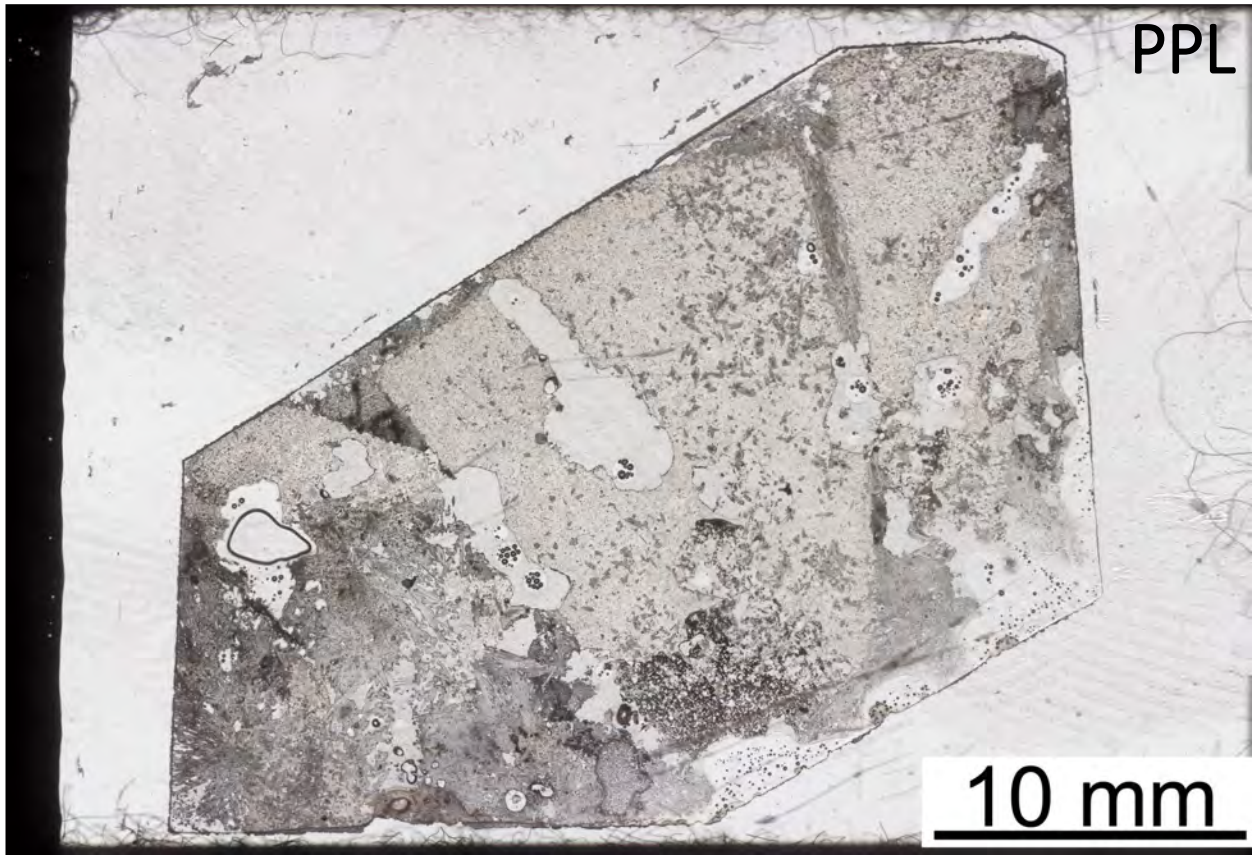

17LF46

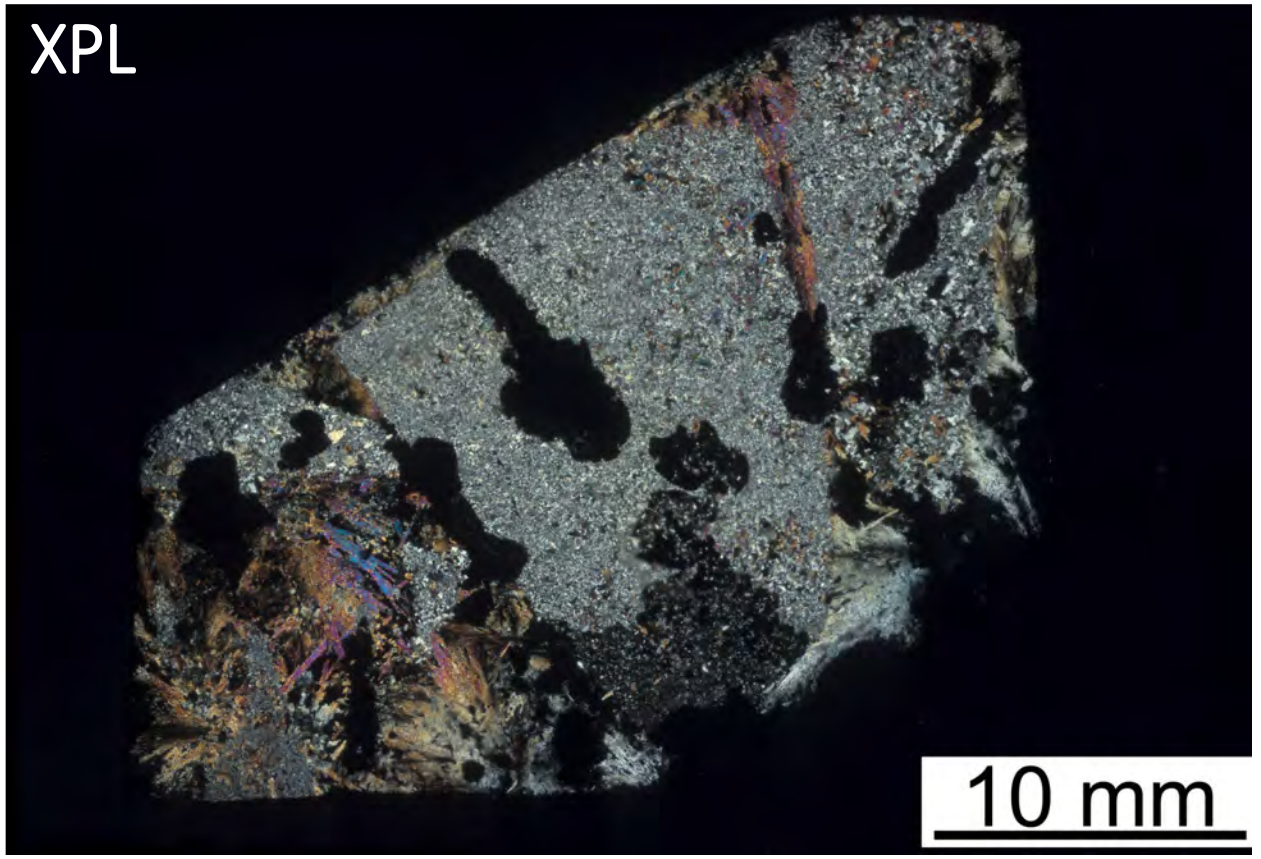

RS-4563


A0003675
A0003675
0 1 2 3 4 5 6 7cm

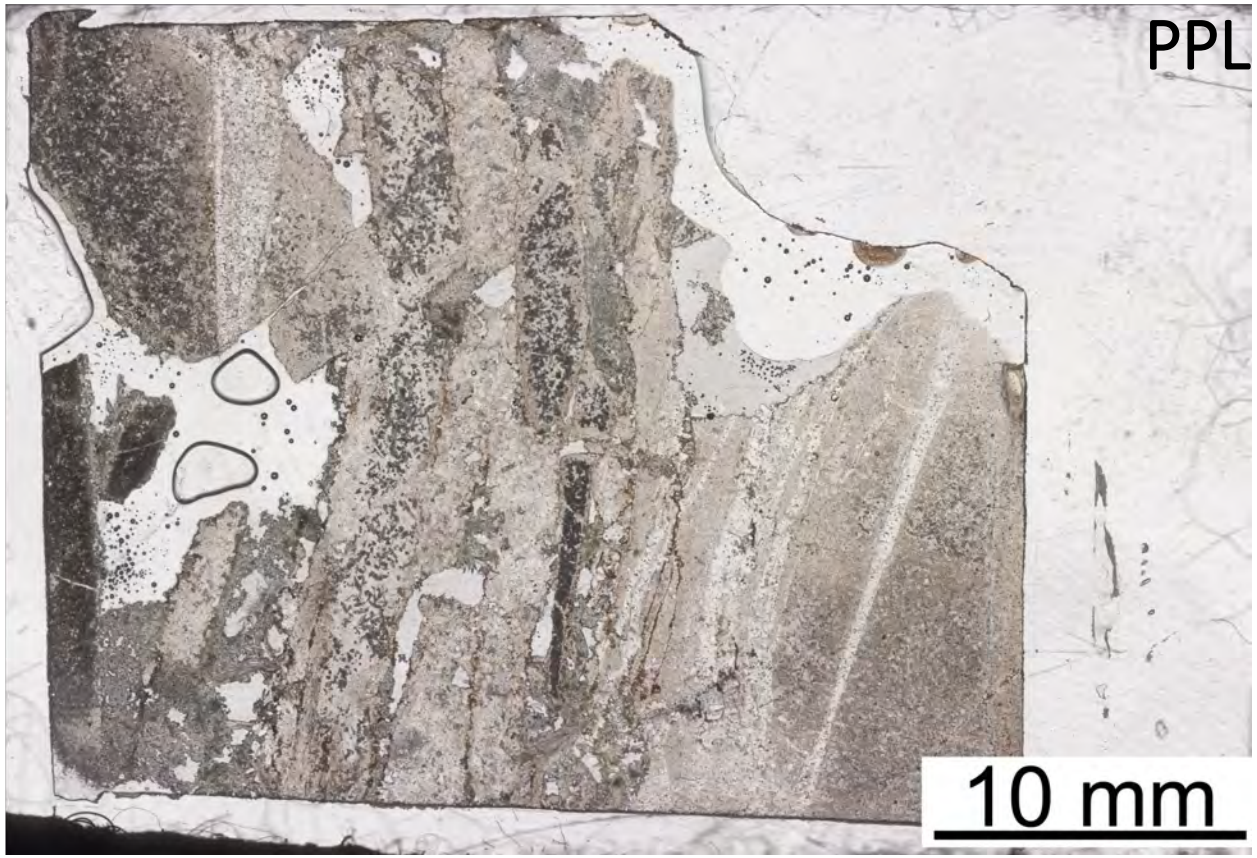

RS-4552

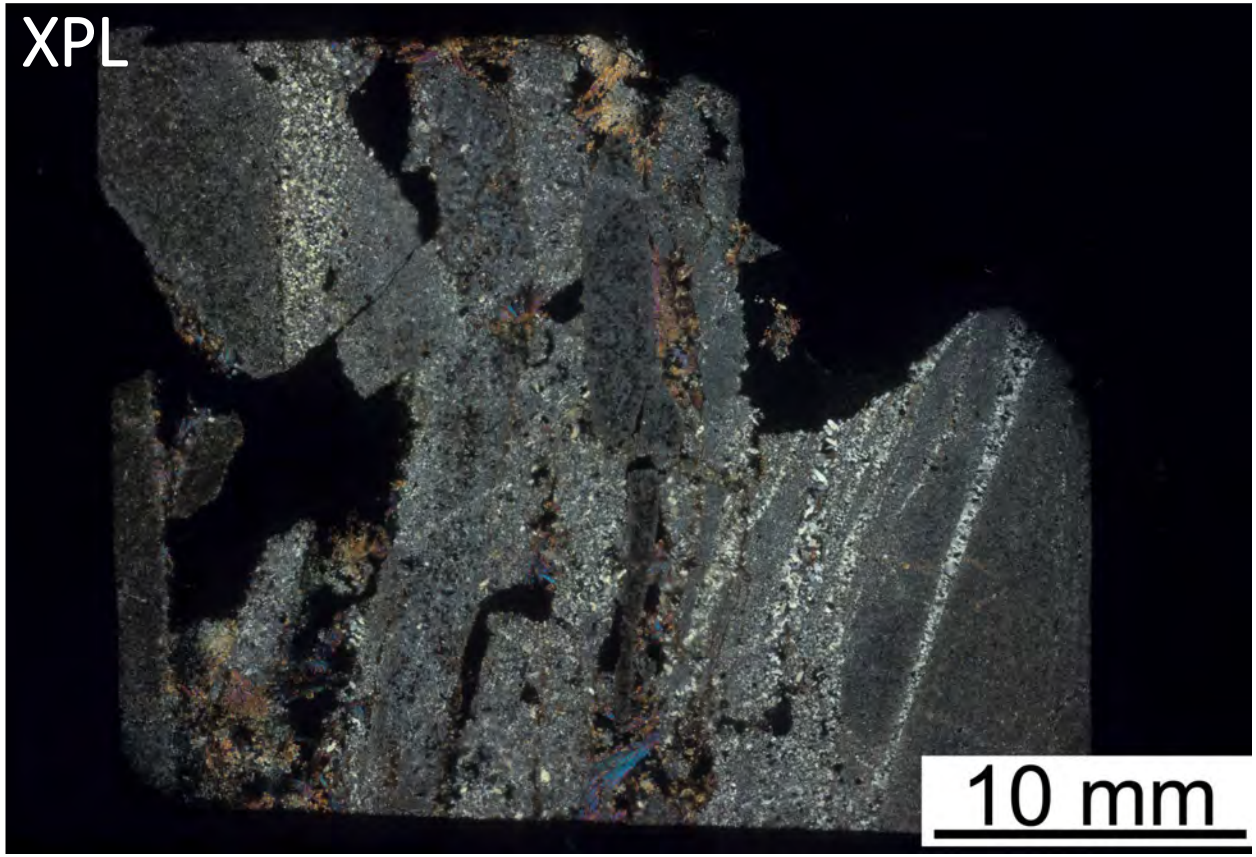
17LF46



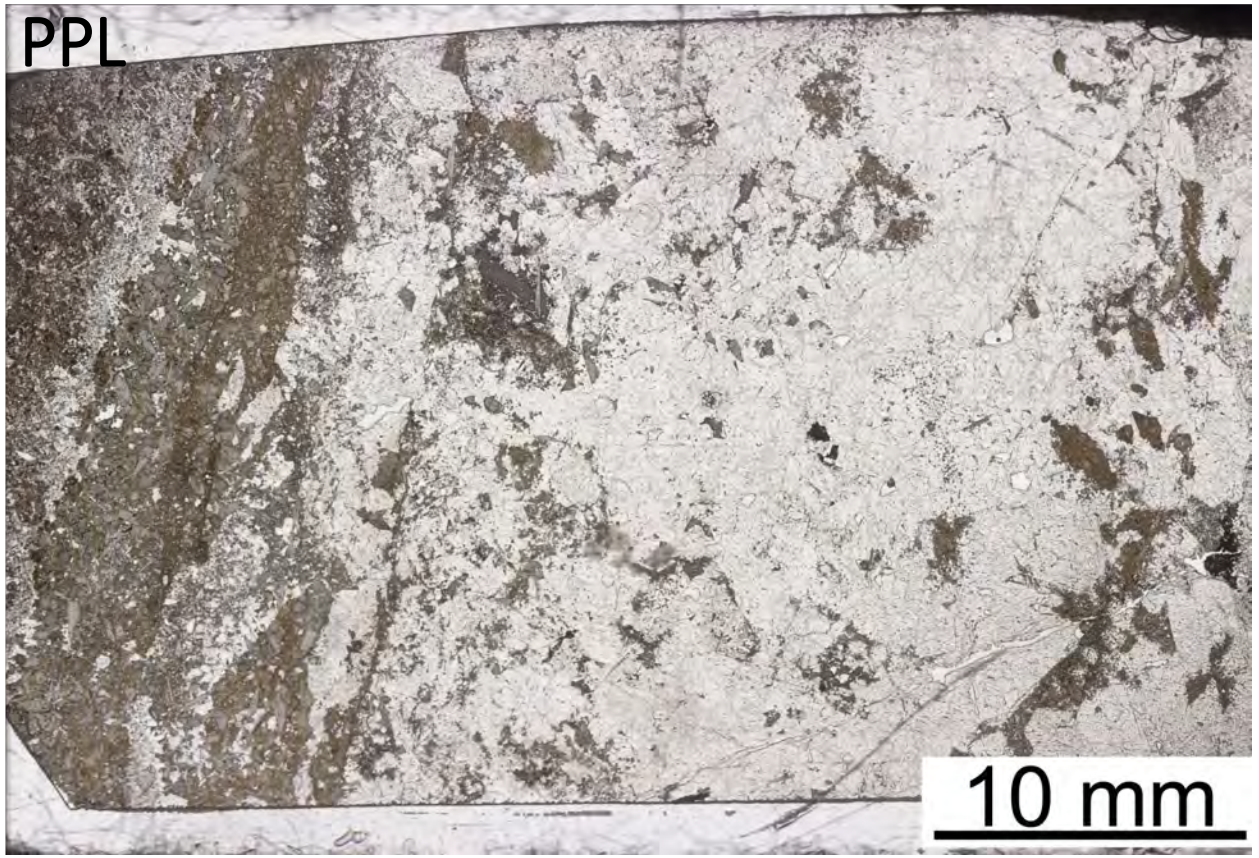


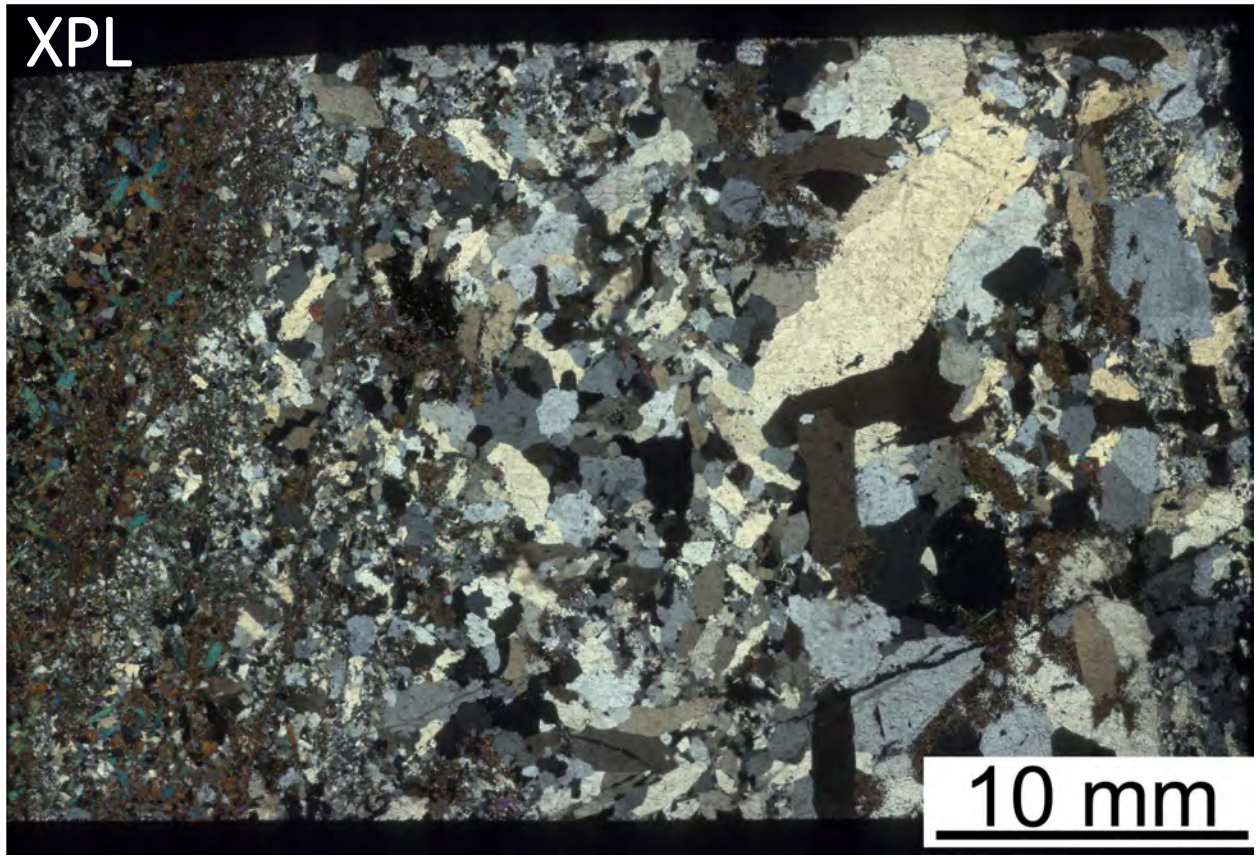
A0003675



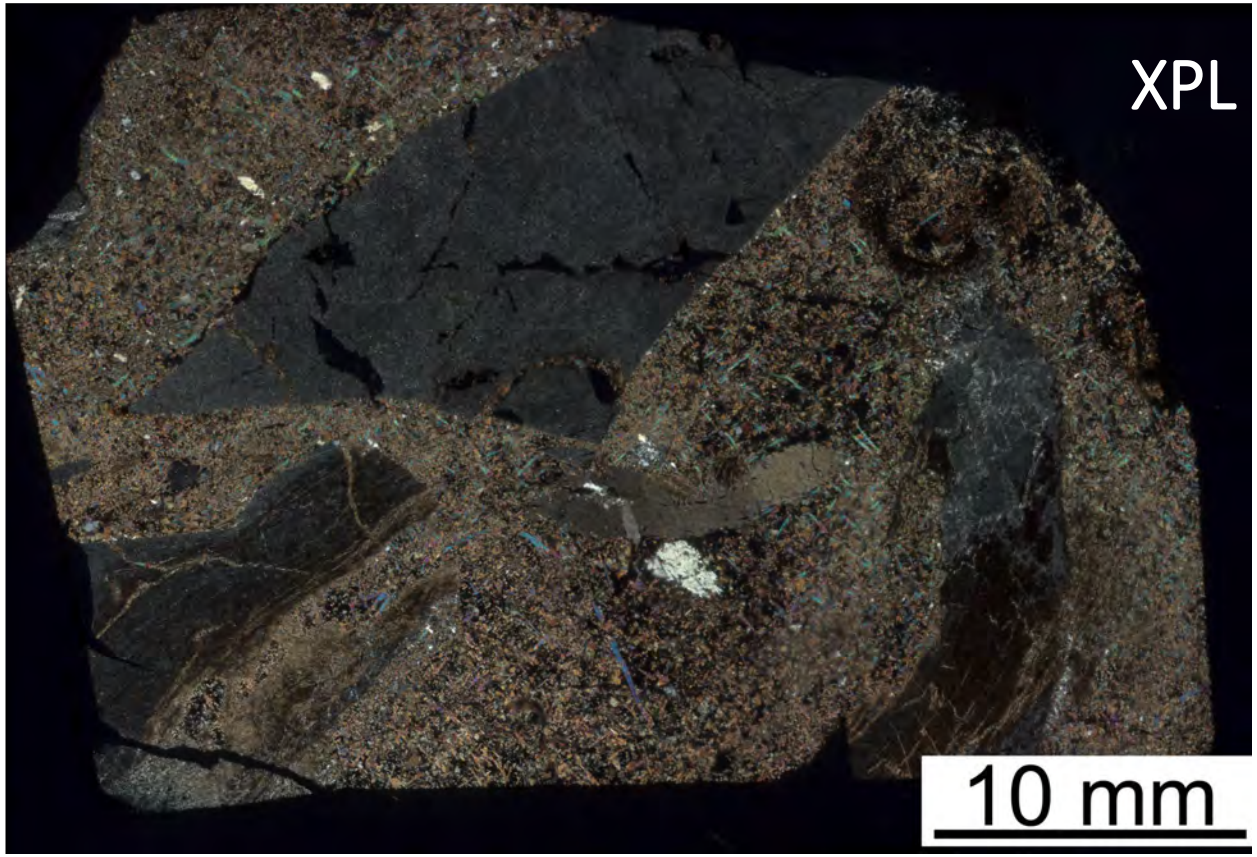


RS-4552

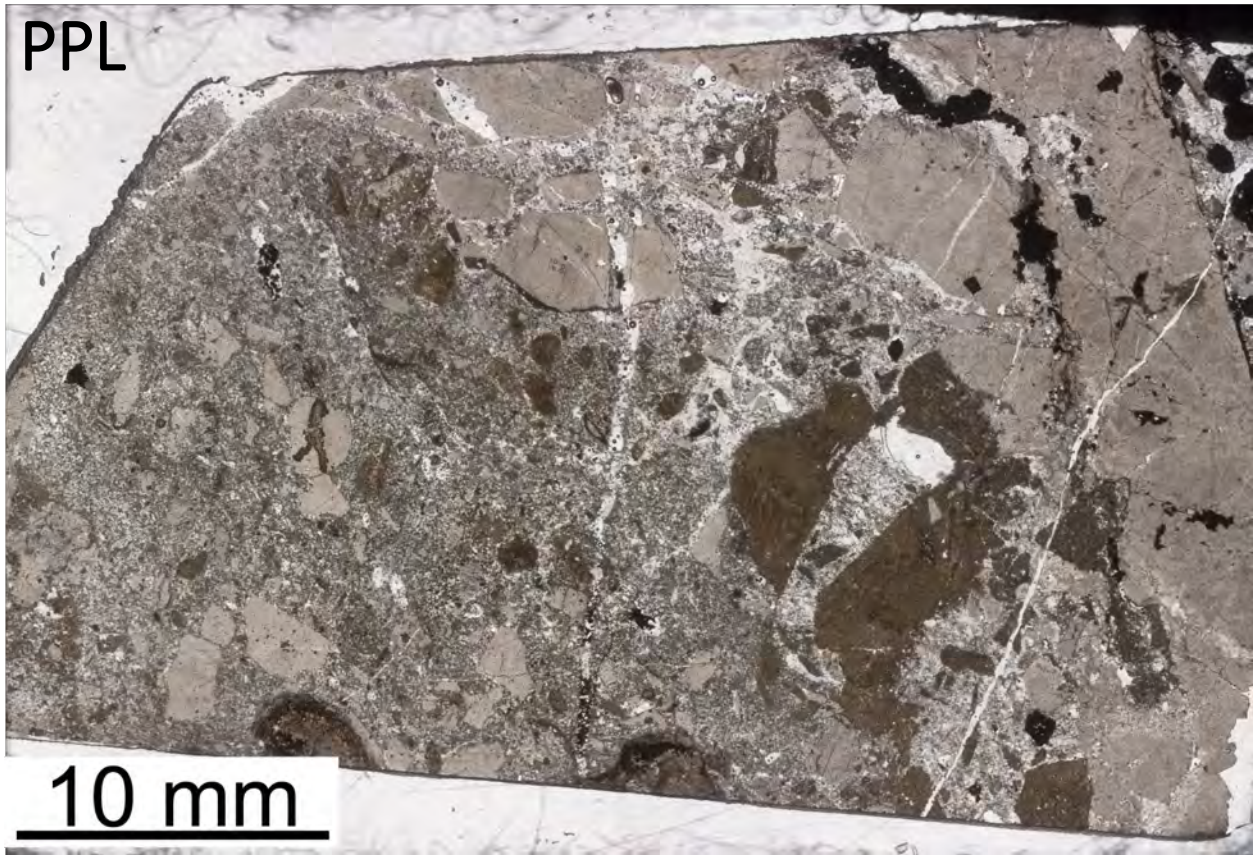


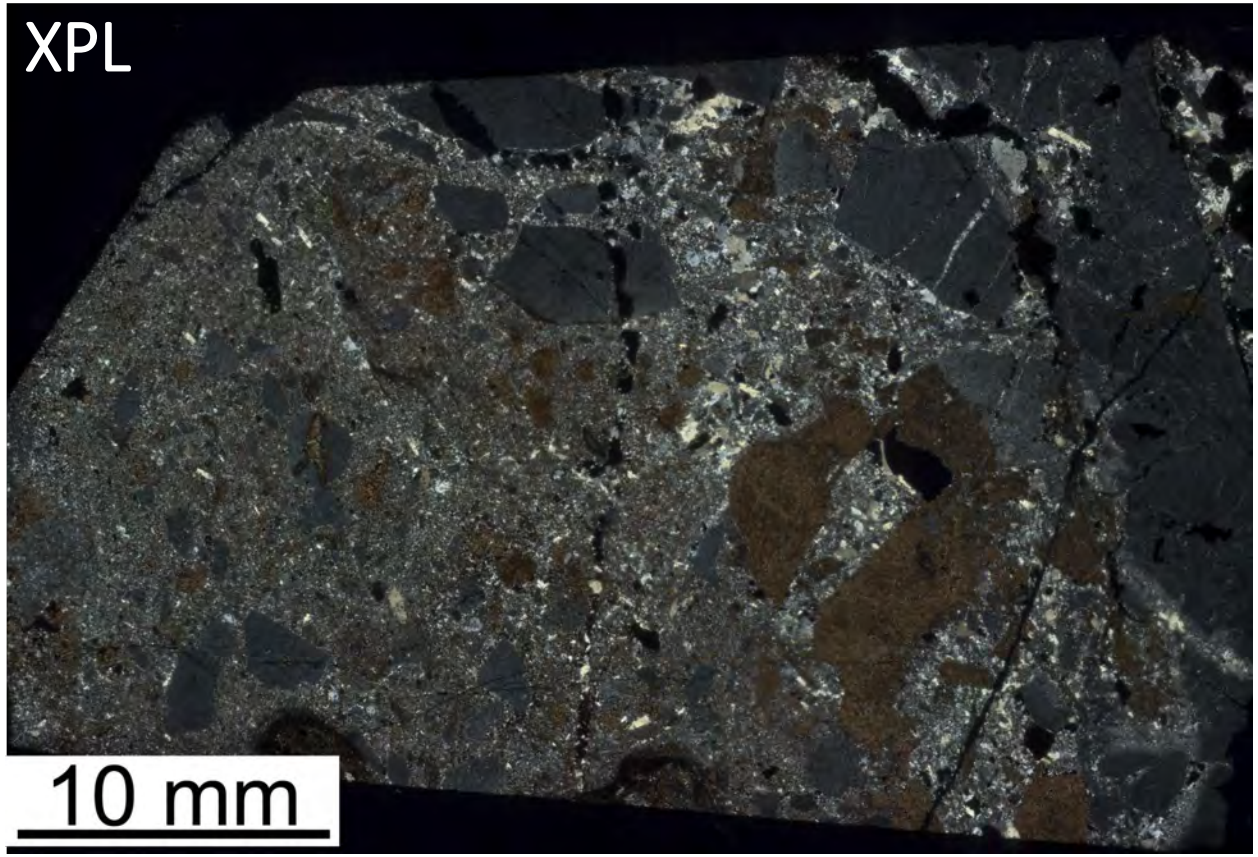


RS-4563

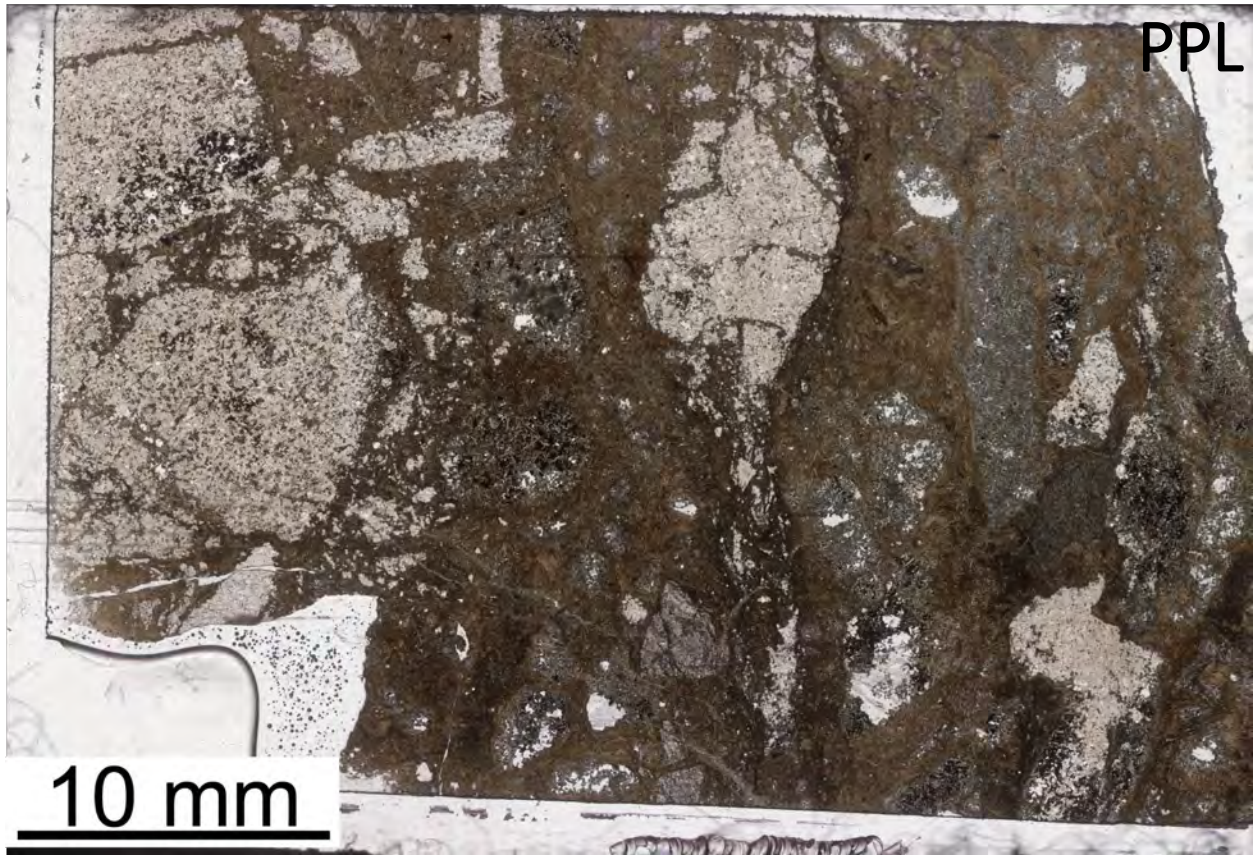


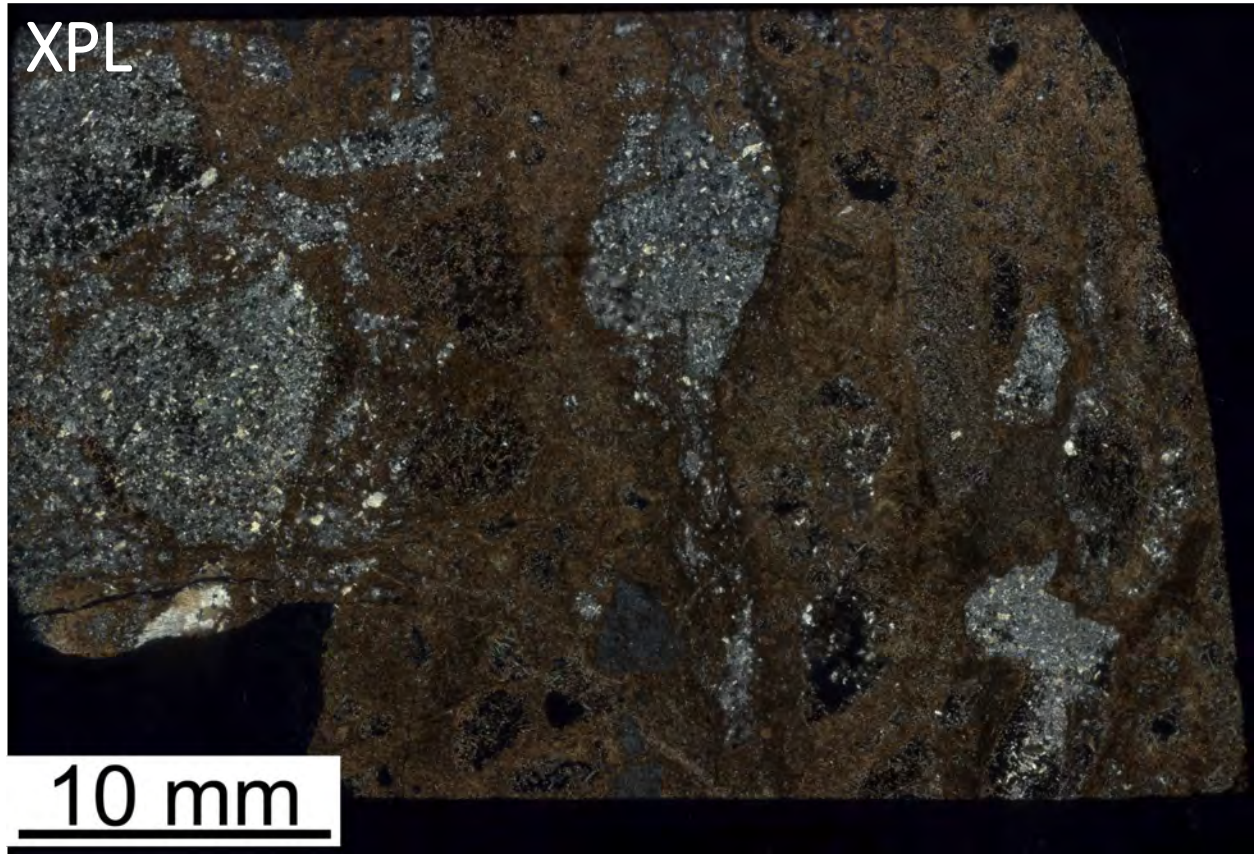
RS-4566

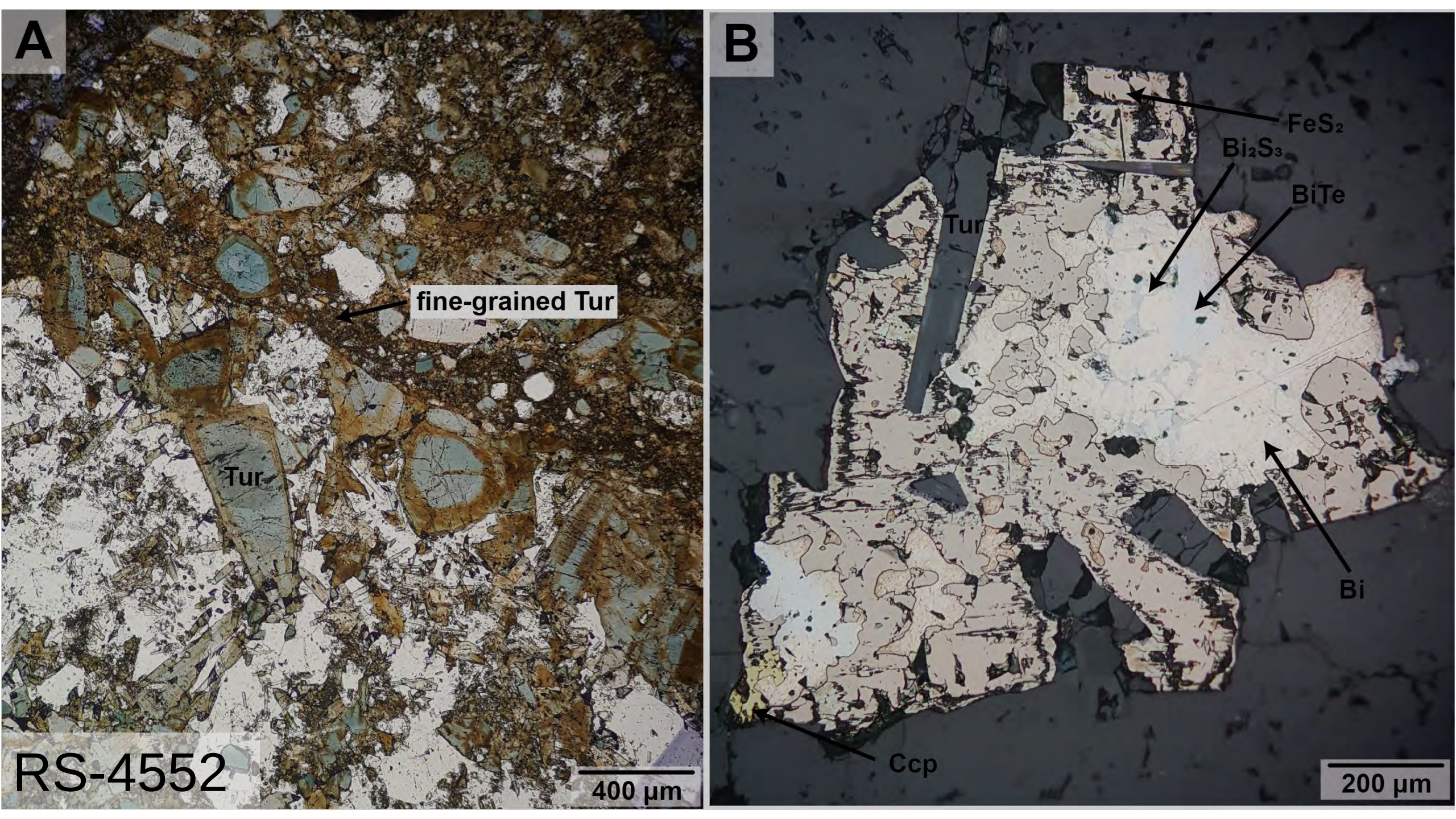




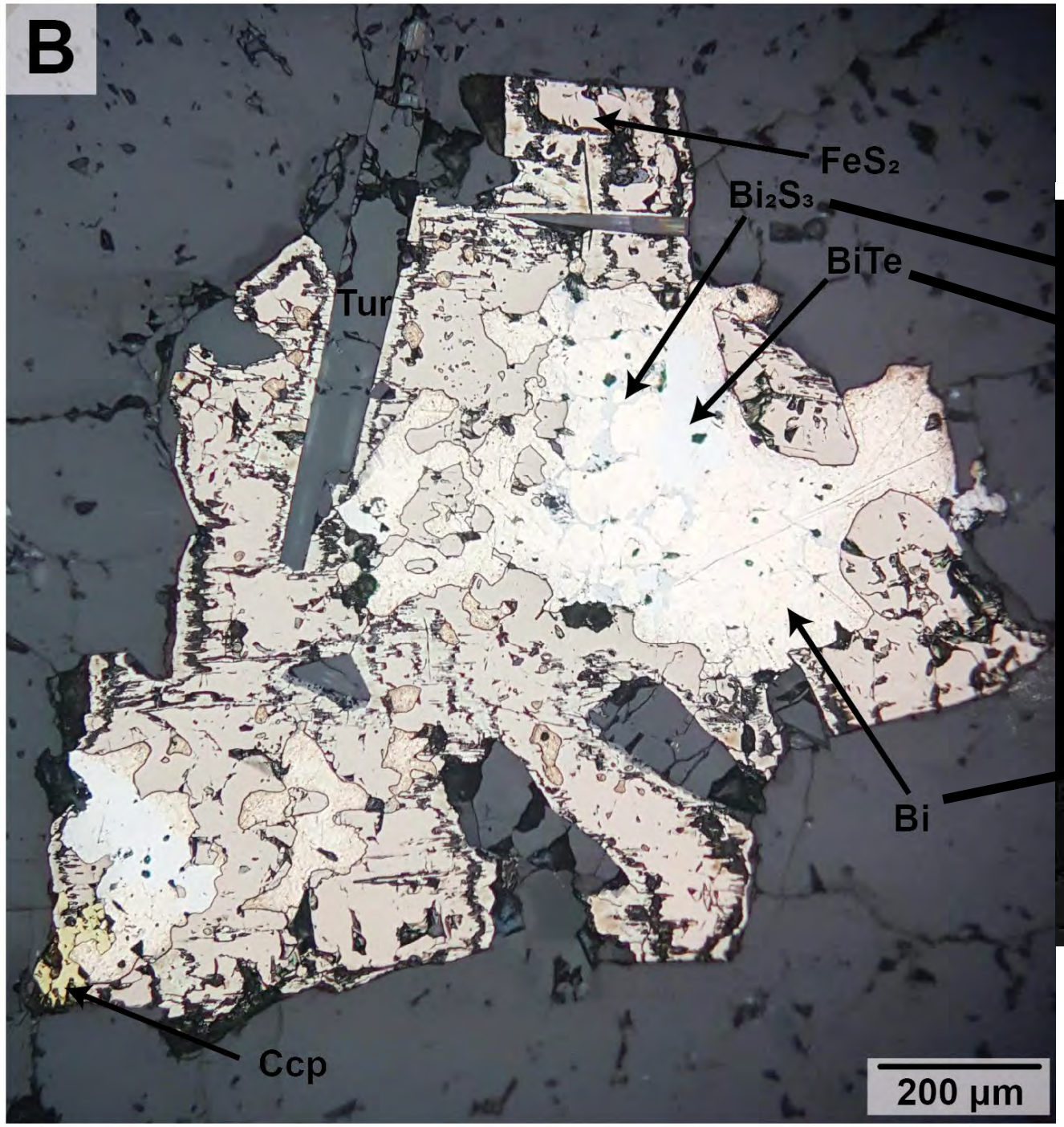
RS-4567

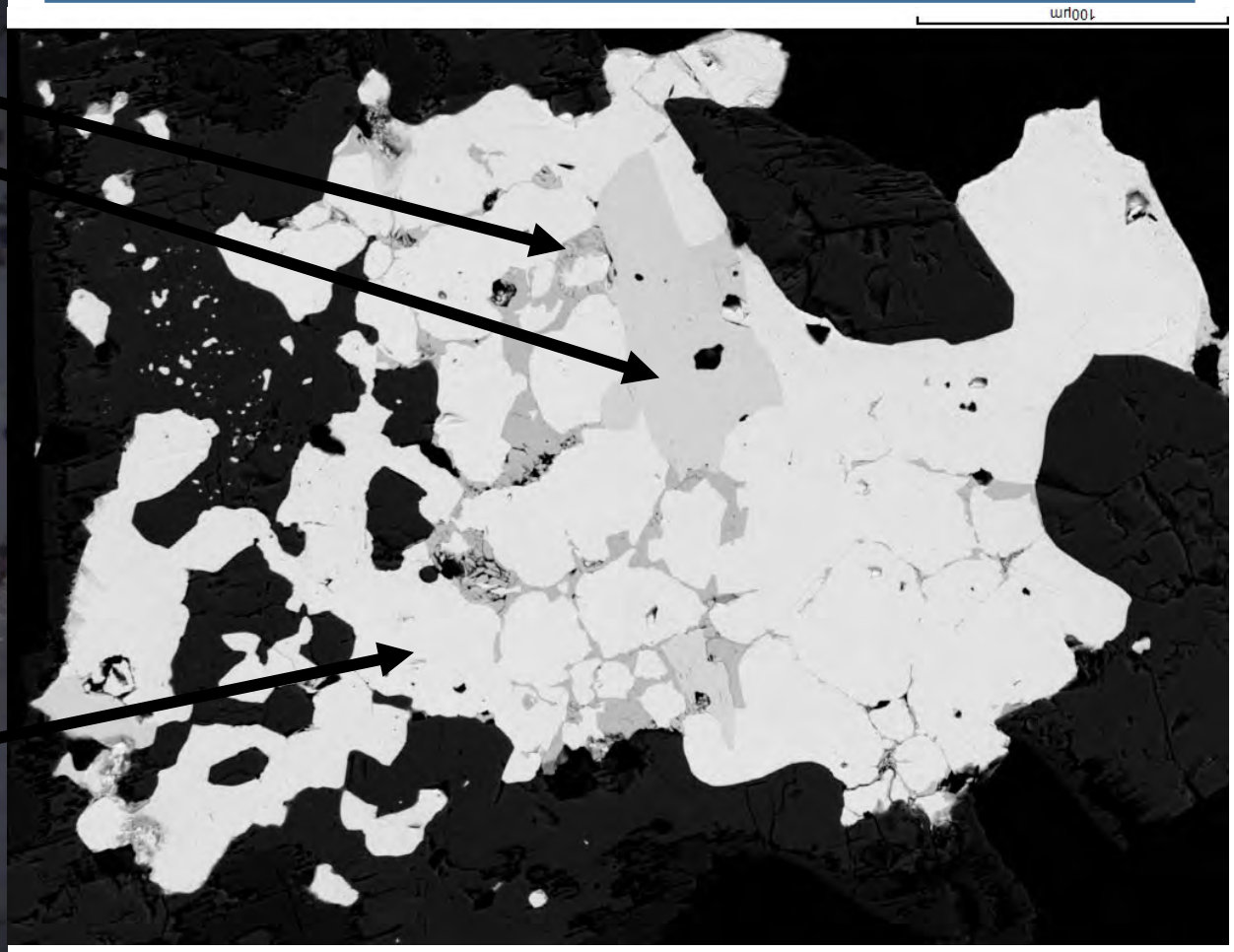




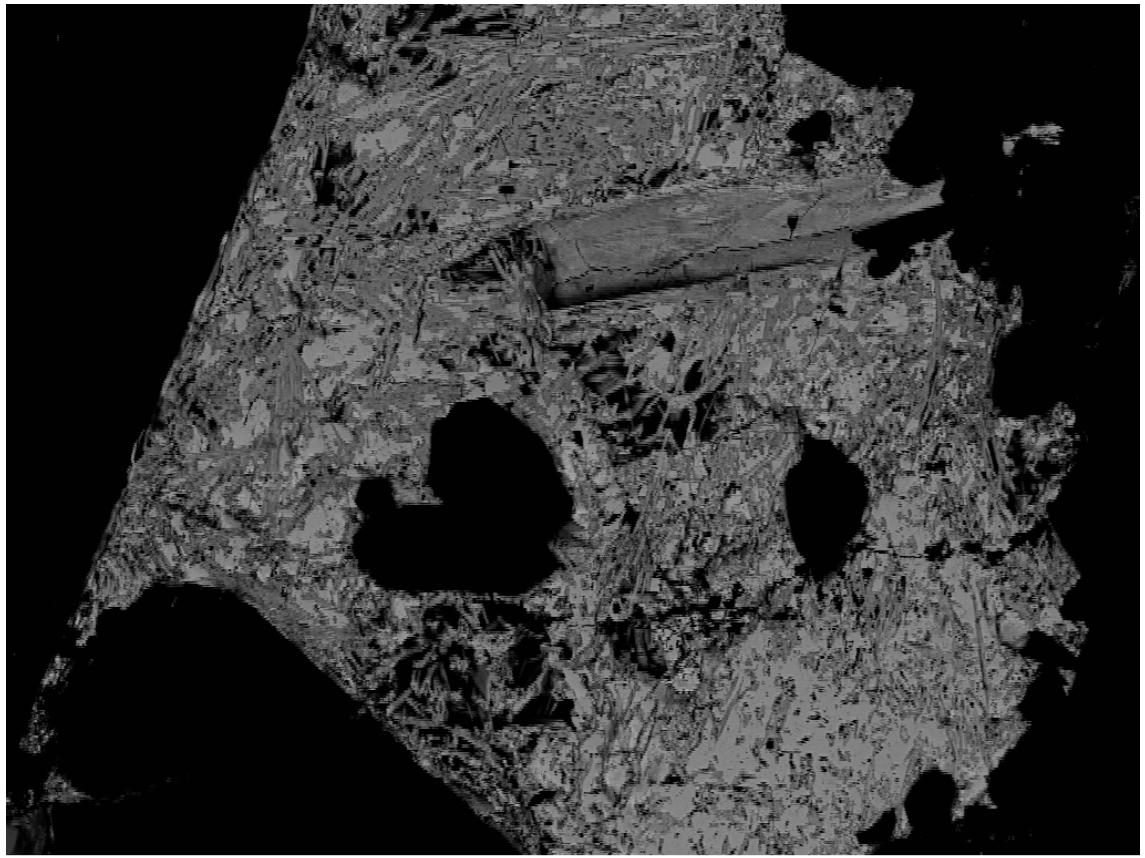

A
fine-grained Tur
Tur
RS-4552
400 µm
B
FeS₂
Bi₂S₃
BiTe
Tur
Bi
Ccp
200 µm

RS-4552

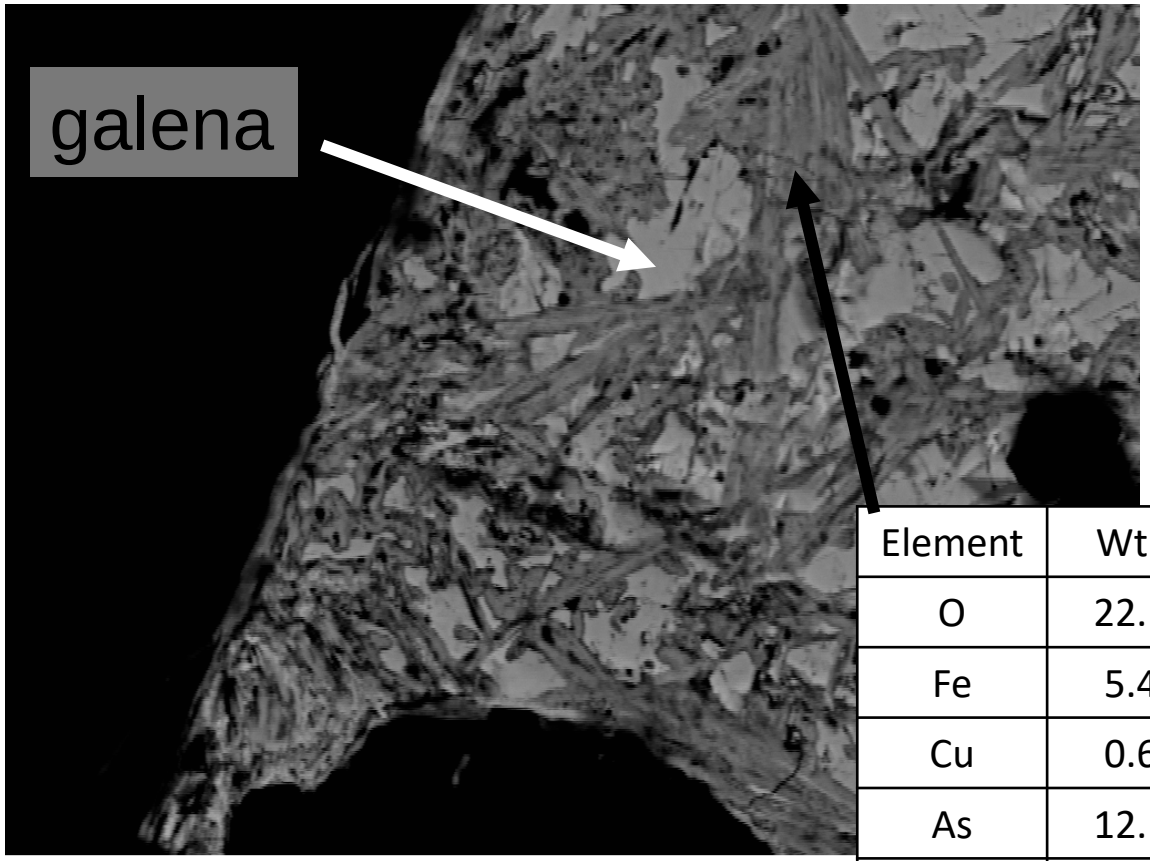




Alteration of Sulfides to Oxides



100μm

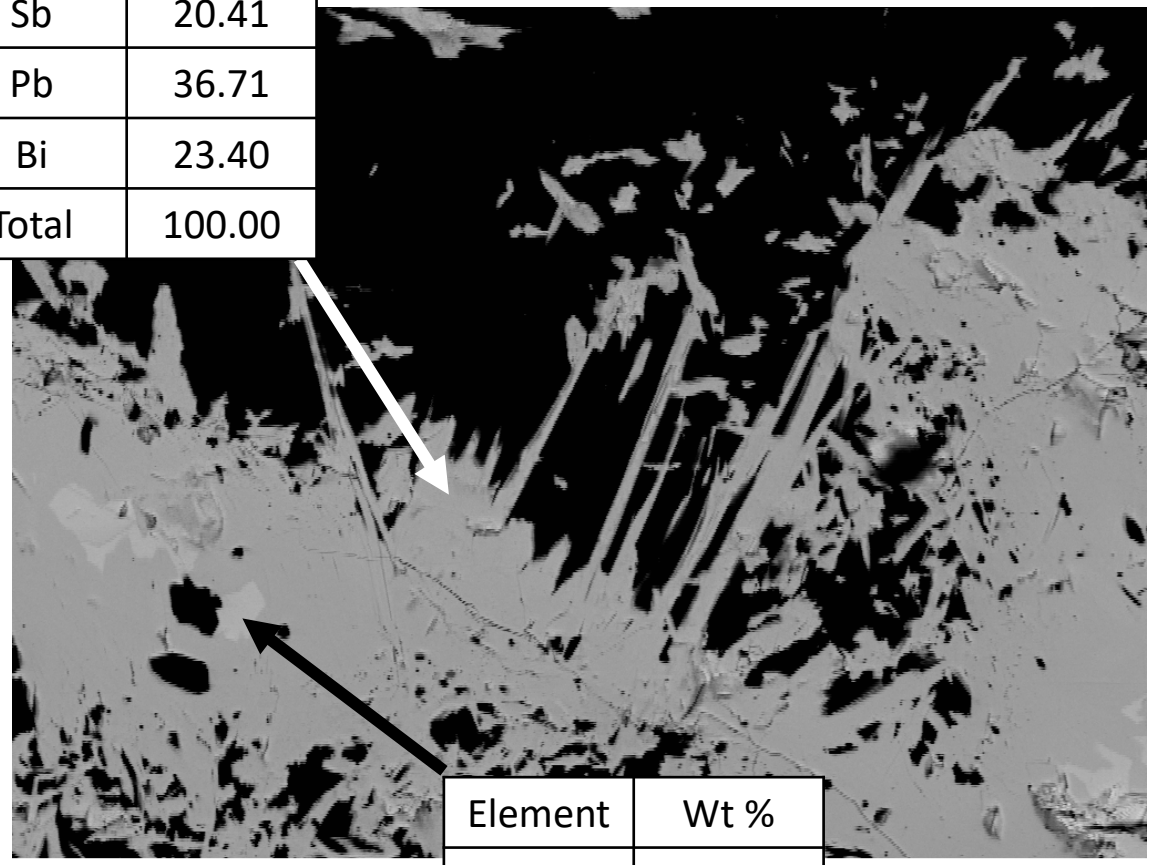


60μm

Element	Wt %
O	22.17
Fe	5.49
Cu	0.60
As	12.15
Sb	21.29
Pb	12.68
Bi	25.79
Total	100.17

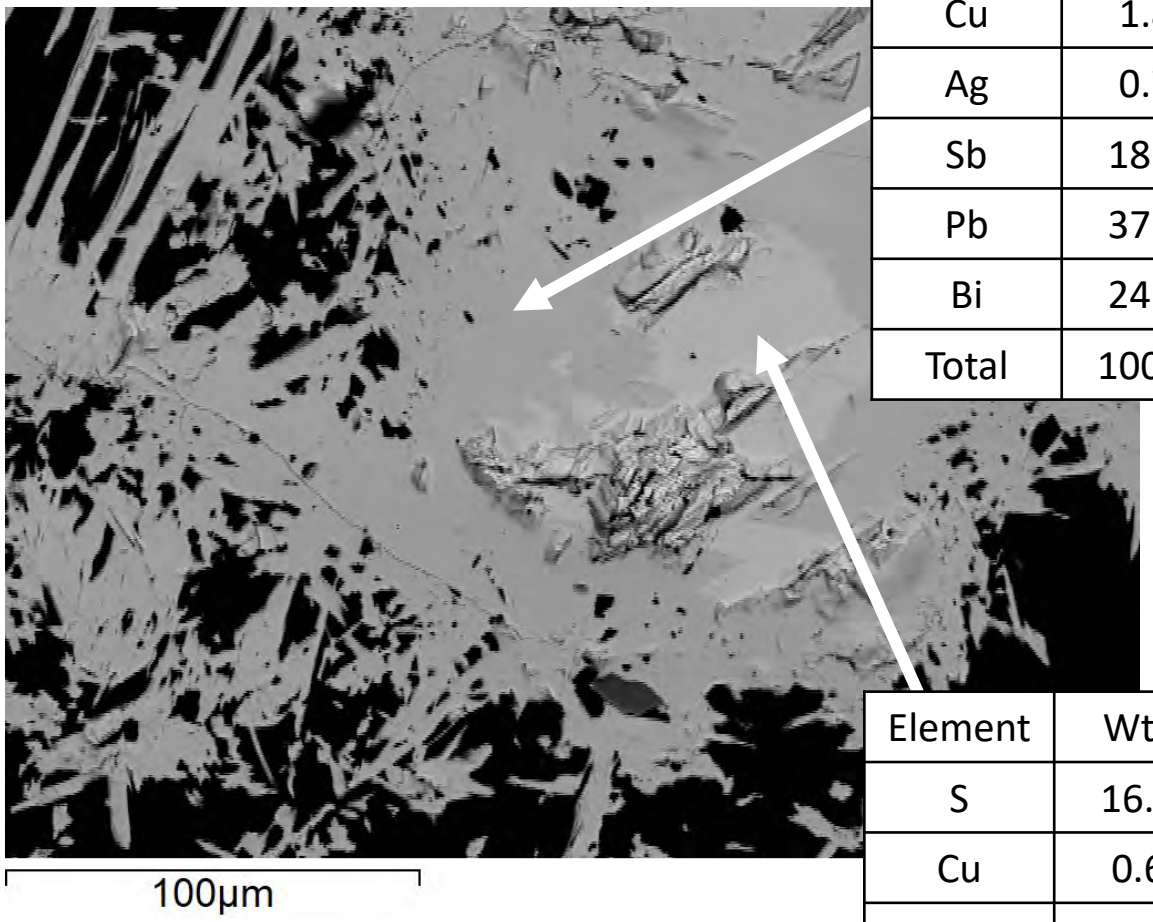
Sulfosalt Minerals – Boulangerite?

Element	Wt %
S	17.67
Cu	1.81
Sb	20.41
Pb	36.71
Bi	23.40
Total	100.00

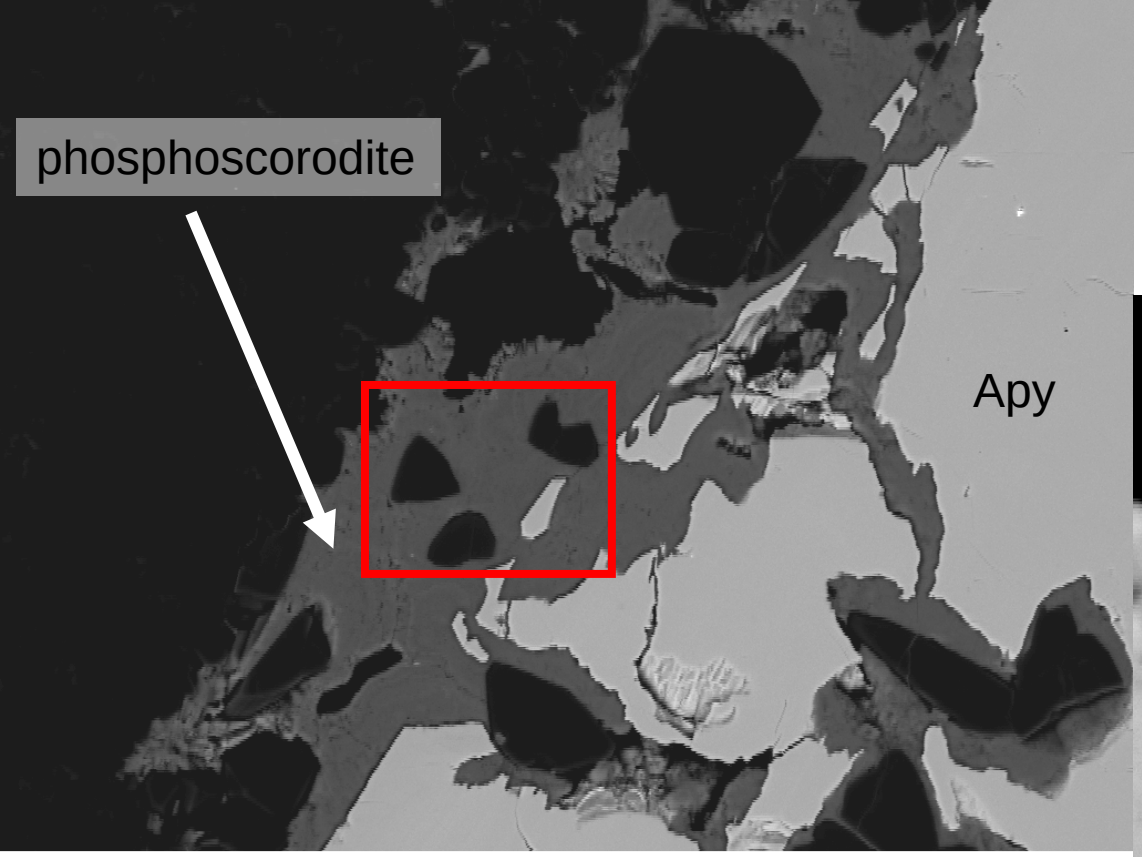


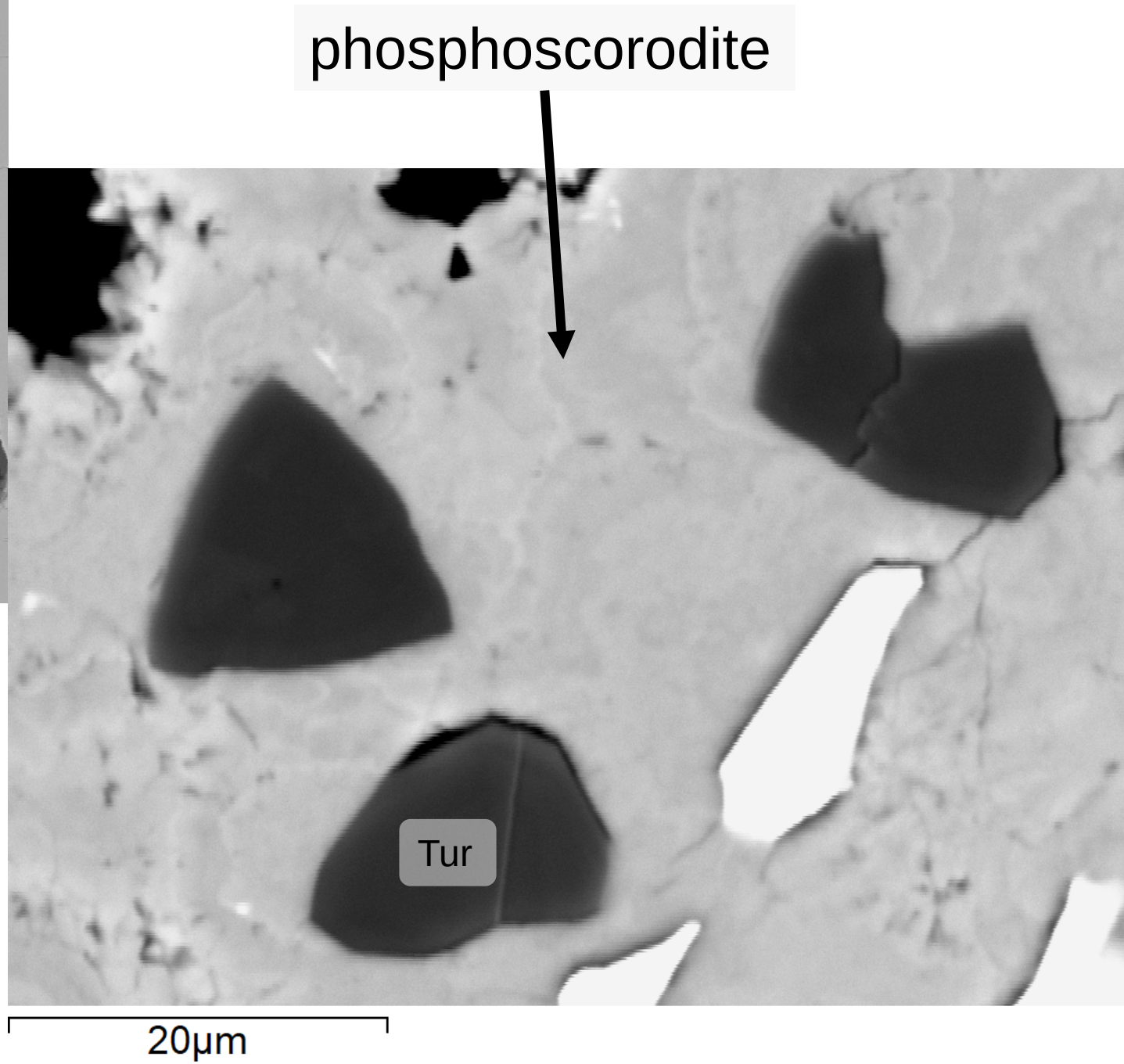
Element	Wt %
S	16.49
Cu	0.71
Pb	7.57
Bi	75.23
Total	100.00

Element	Wt %
S	17.29
Fe	0.34
Cu	1.80
Ag	0.72
Sb	18.49
Pb	37.31
Bi	24.06
Total	100.00



Element	Wt %
S	16.39
Cu	0.63
Sb	0.94
Pb	6.68
Bi	75.36
Total	100.00

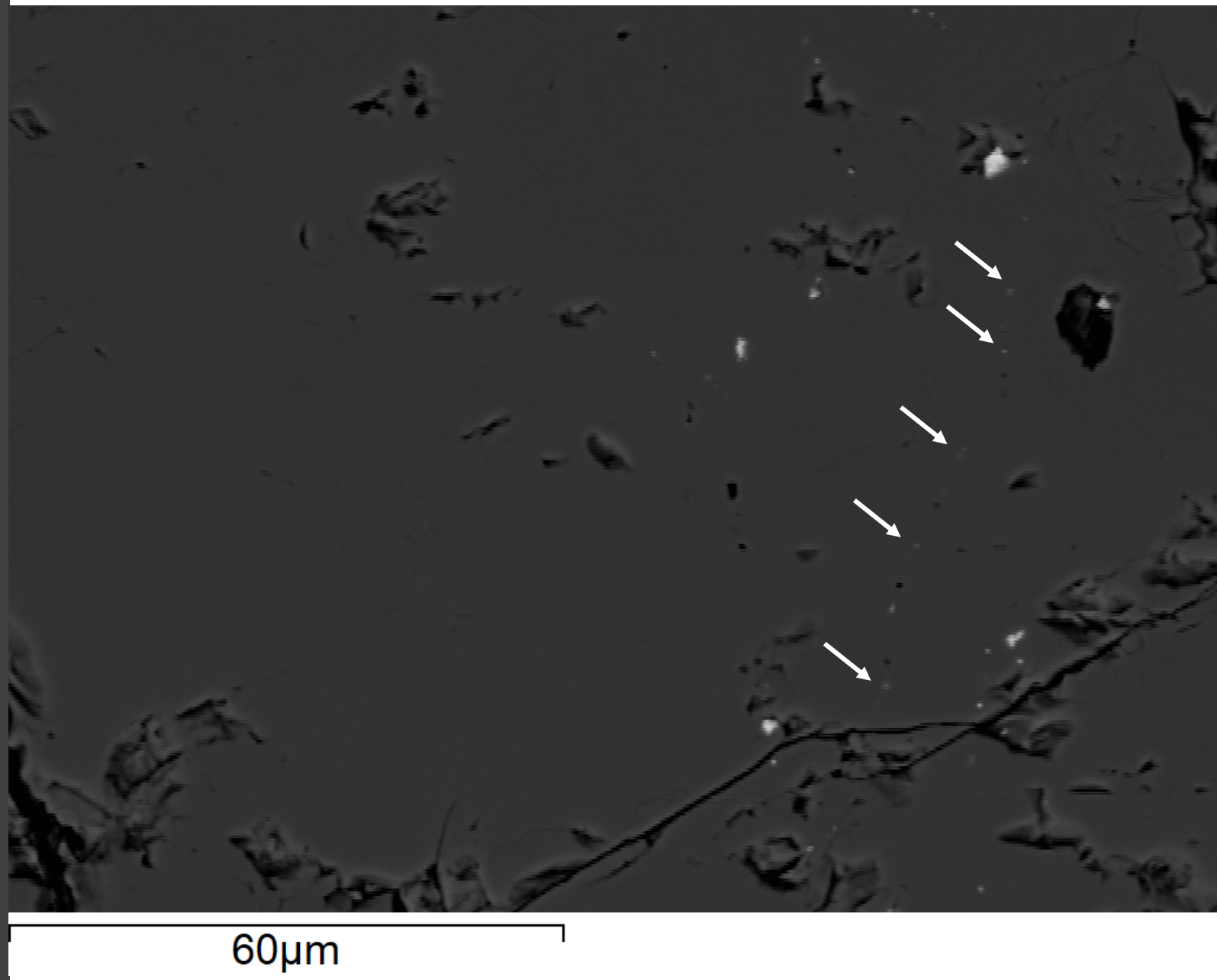




Phosphoscorodite [$Fe(As,P)O_4.H_2O$] formation as the result of the breakdown of Arsenopyrite. Note how the tourmaline appears un-affected by the alteration

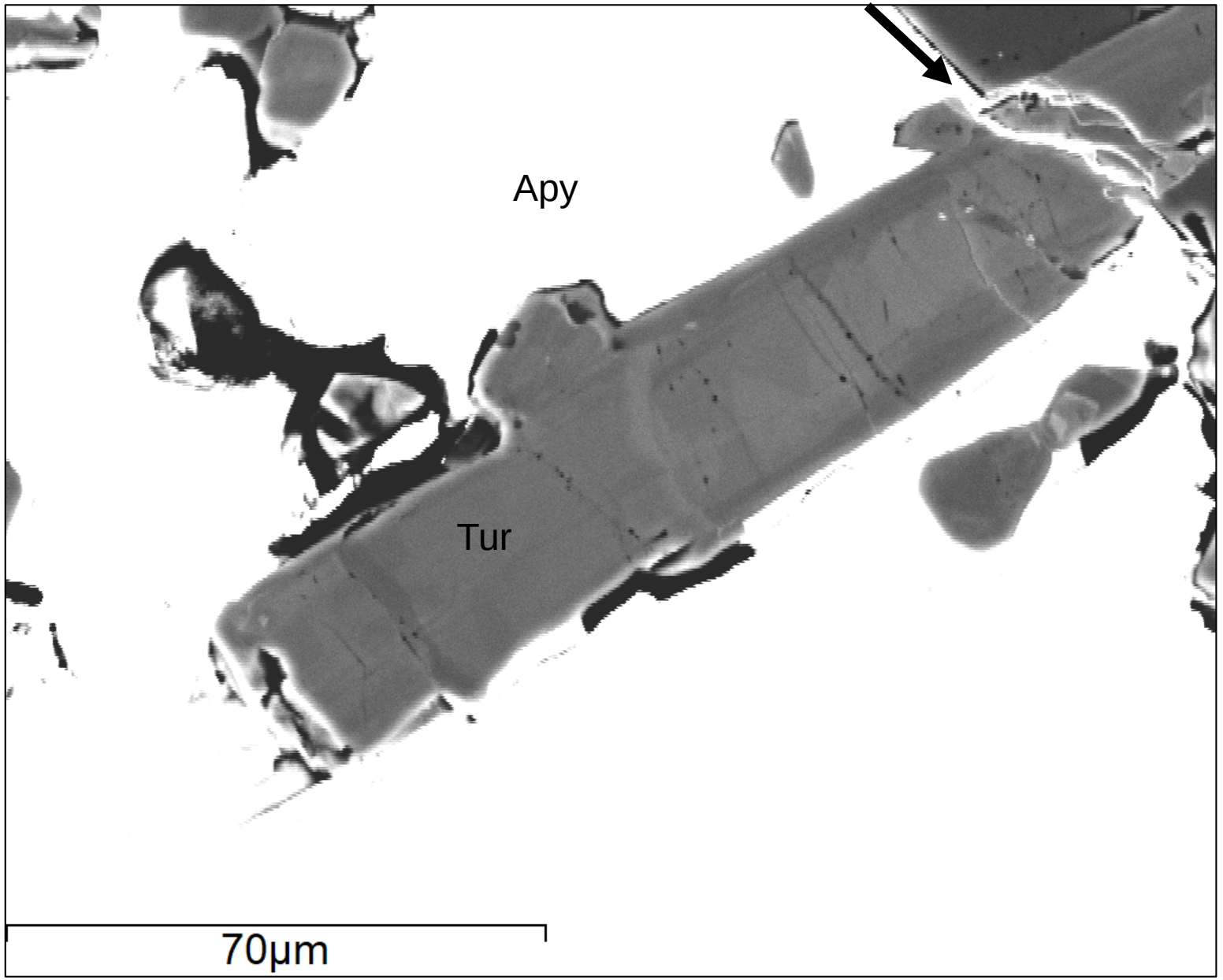
Native Bi in Arsenopyrite Sample: RS-4566

- Inclusion trails of native Bi in arsenopyrite which appear to be along micro-fractures.
- Bi mineralization may be a later event post arsenopyrite formation



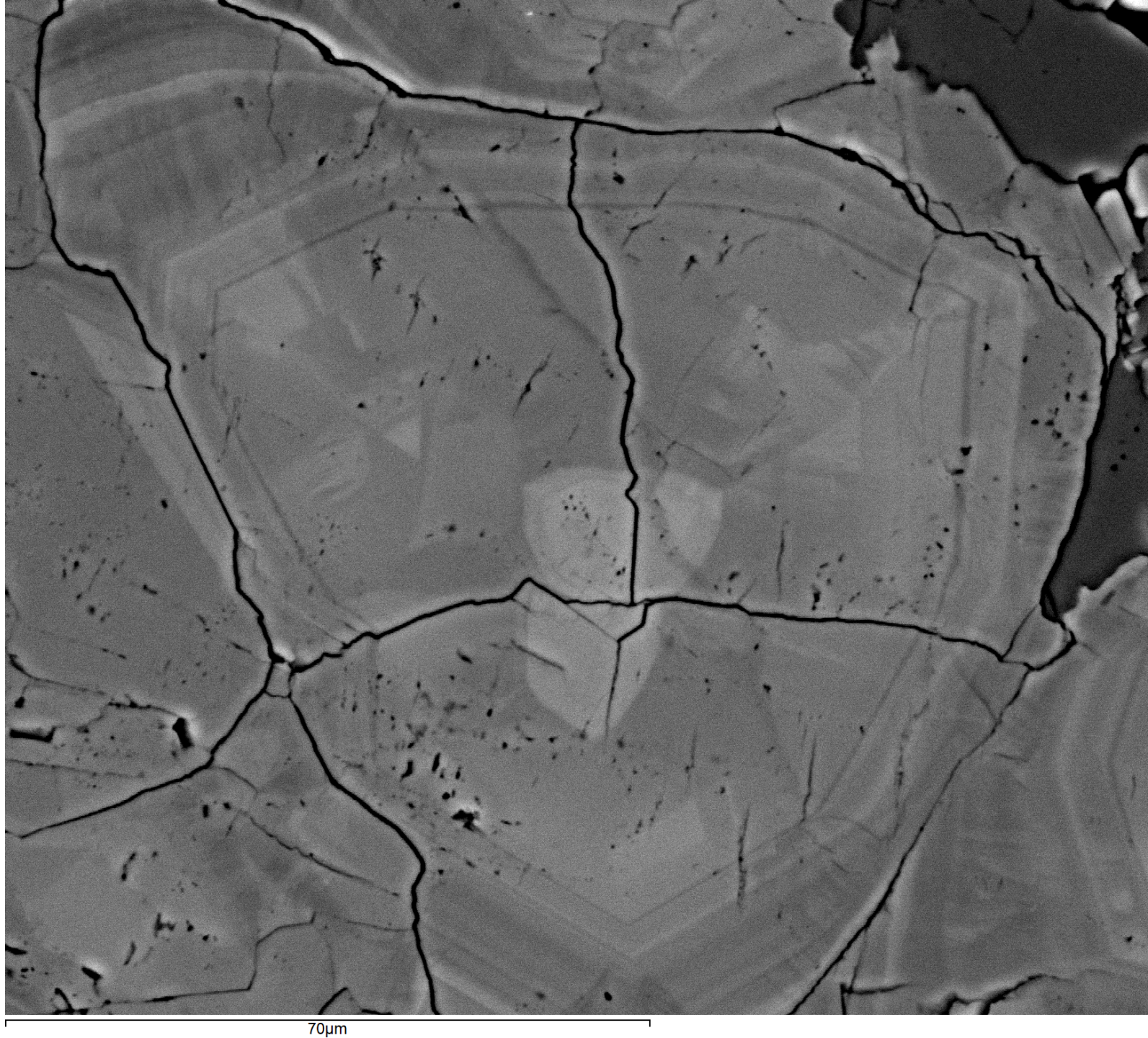
Evidence for tourmaline pre-dating ore minerals

Tourmaline fractured and cross-cut by arsenopyrite

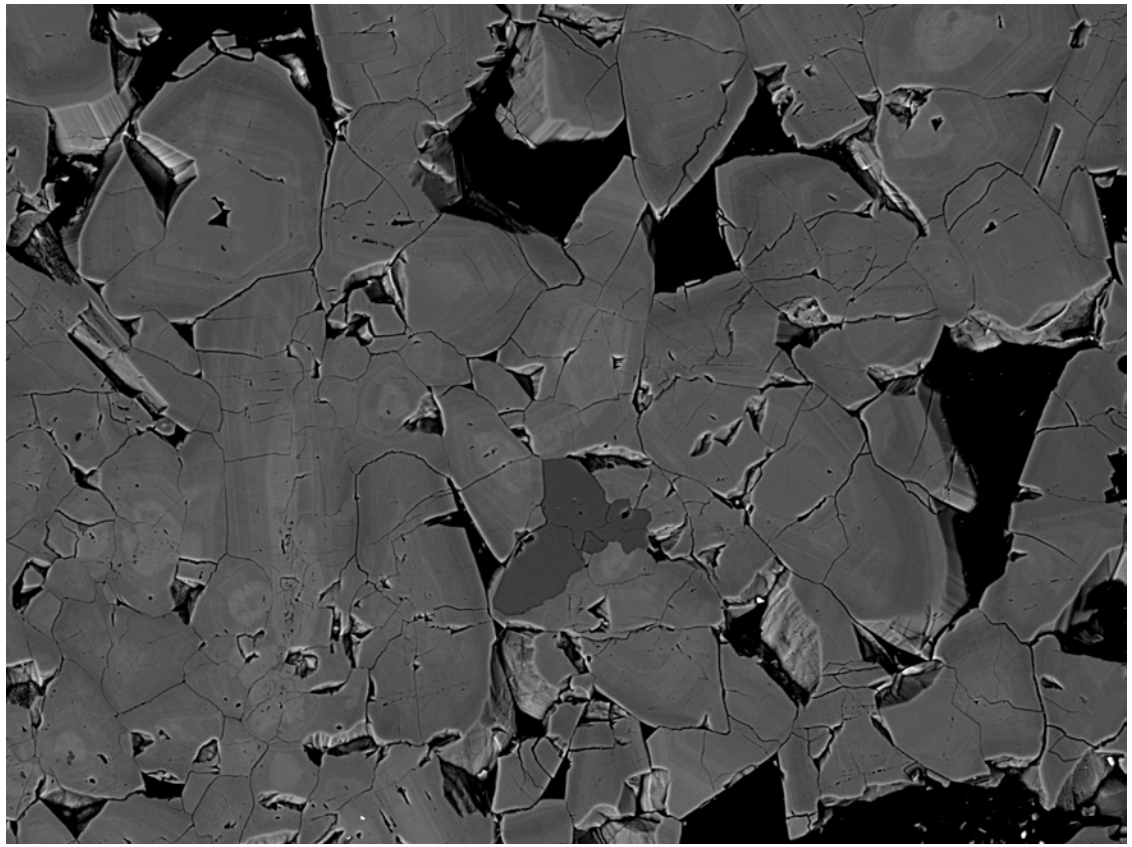


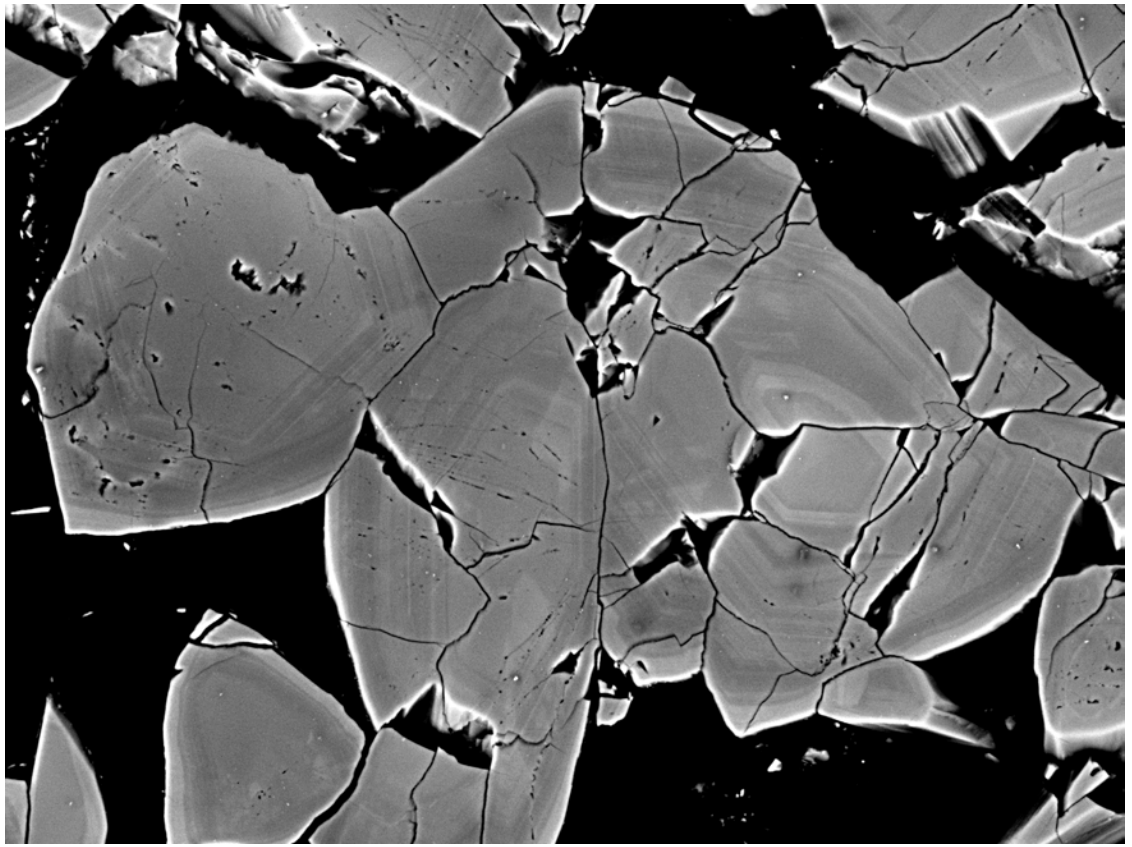
Unique Internal Textures

- Analogous chaotic zonation, typical of mineralized porphyry systems
- Oscillatory zonation overprinted by post crystallization processes (PCPs)
- Porosity could indicate dissolution and re-precipitation



Rhythmic oscillatory zonation of tourmaline grains

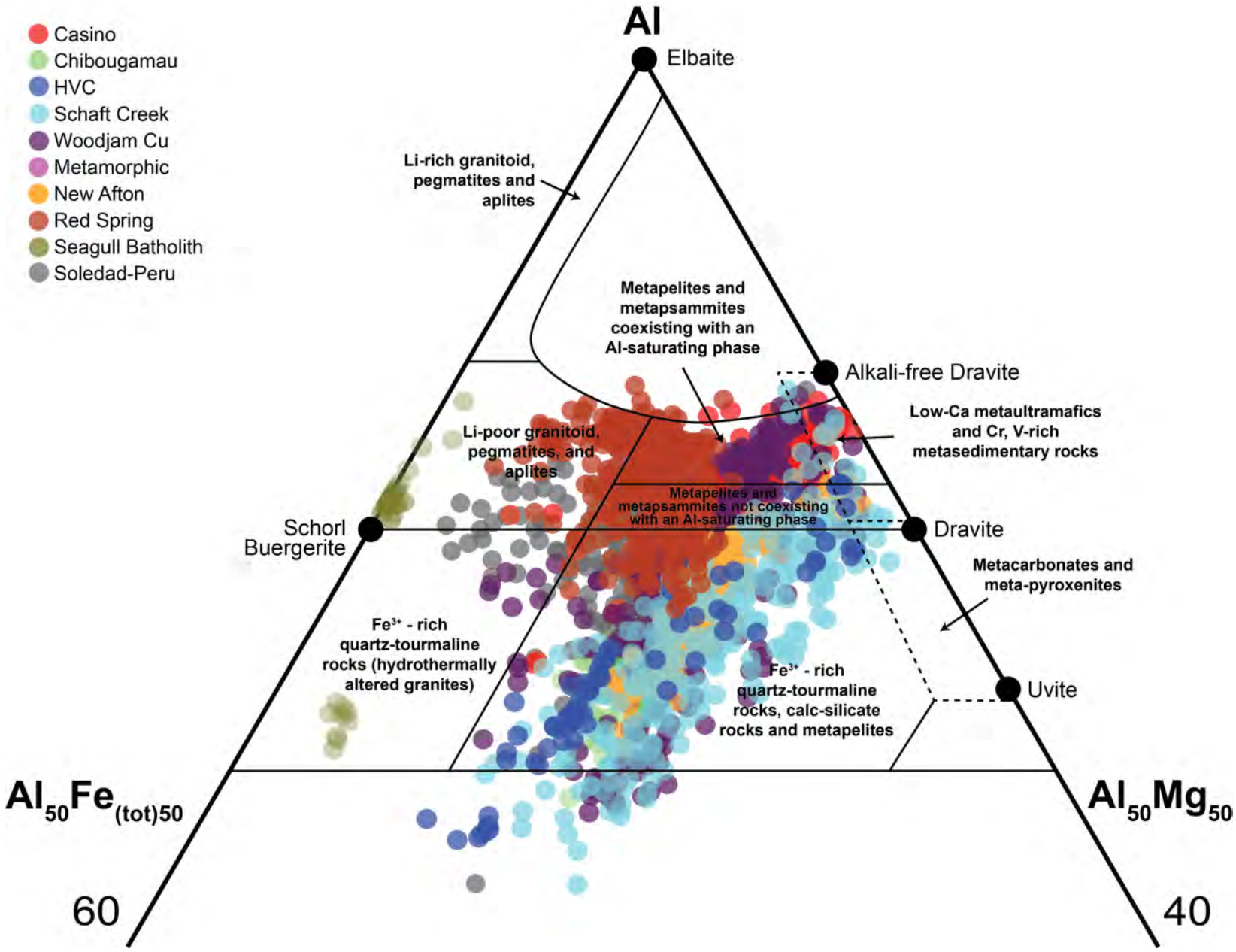


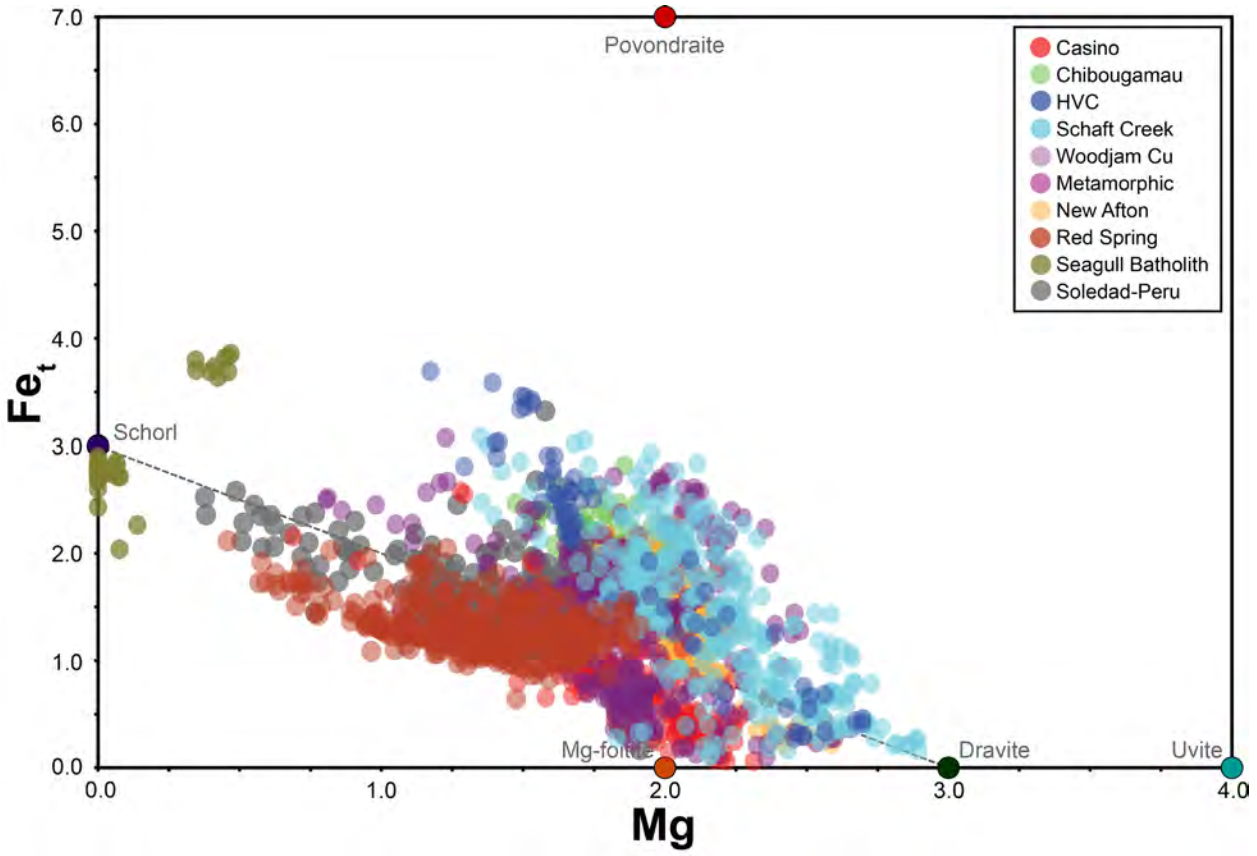


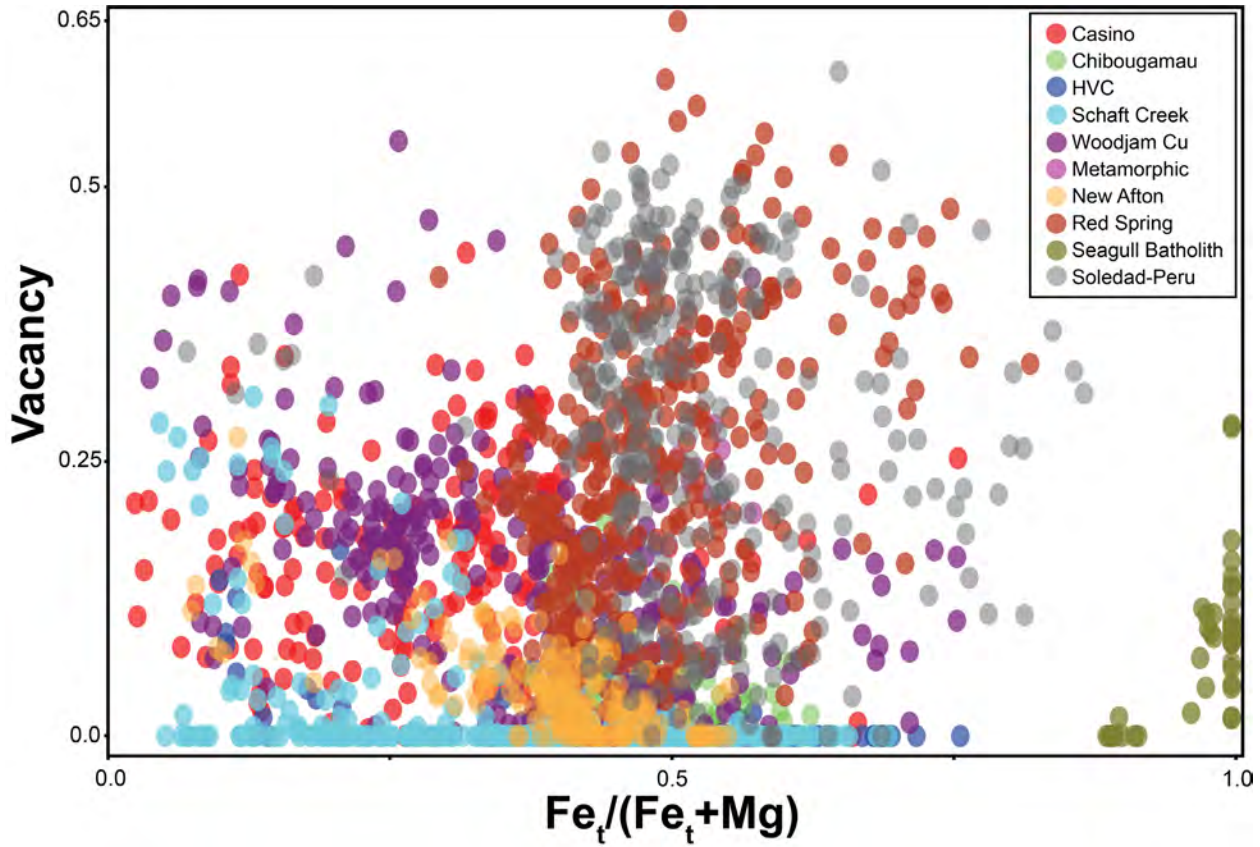
RS-4563

Major-Element Trends

- Lack of typical “O-P” trend.
- Al-rich compared to “typical” porphyry tourmaline.
- Low alkali/alkali-earths, high X-site vacancy







Mg vs Fe *apfu* showing dravite-schorl substitution for the Red Spring samples

A plot showing the elevated abundance of vacancies in the Red Spring samples possibly reflecting a lack of alkali/alkali-earth elements

Acknowledgements

- Supervisor – Dr. A.M. McDonald
- Beth McClenaghan – Geological Survey of Canada
- Companies: Western Copper and Gold, Woodjam Copper, Teck, Jaxon Mining, Chakana Copper, and the USGS