

Geochemical
Perspectives
Letters



© 2024 The Authors
Published by the European Association of Geochemistry

DeVitre and Wieser
Reliability of Raman analyses of CO₂-rich fluid inclusions as a geobarometer at Kīlauea

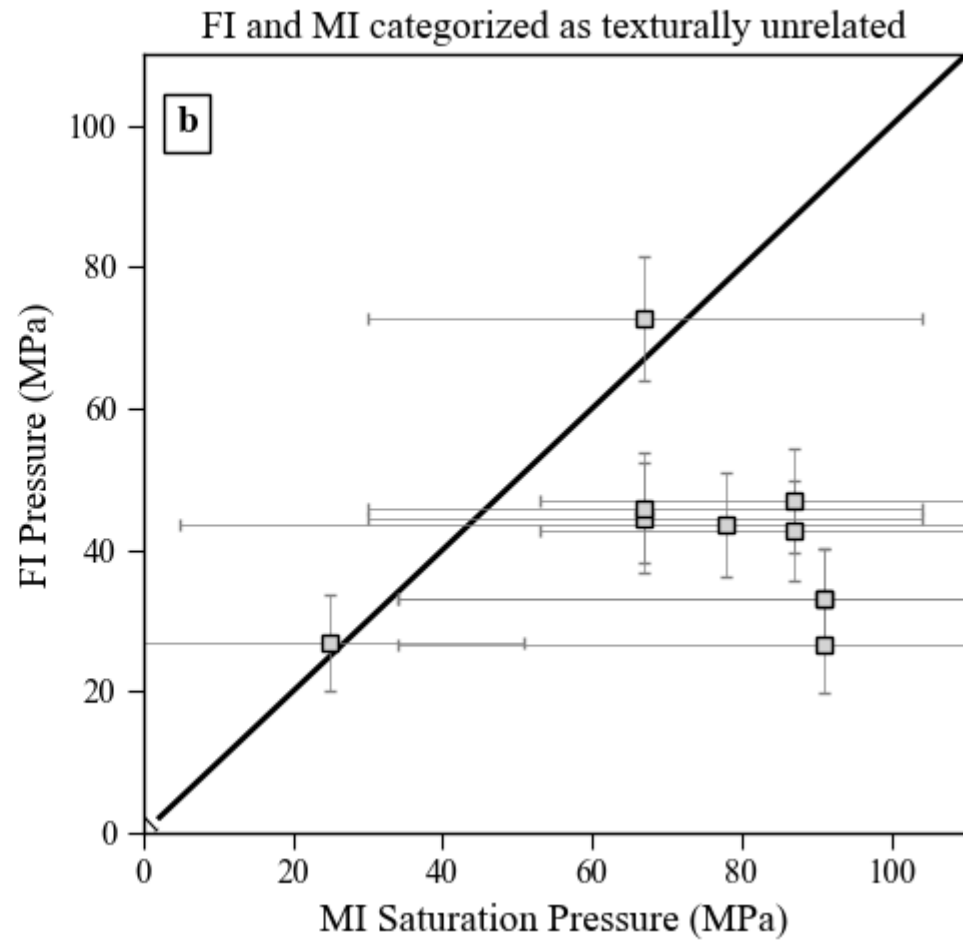
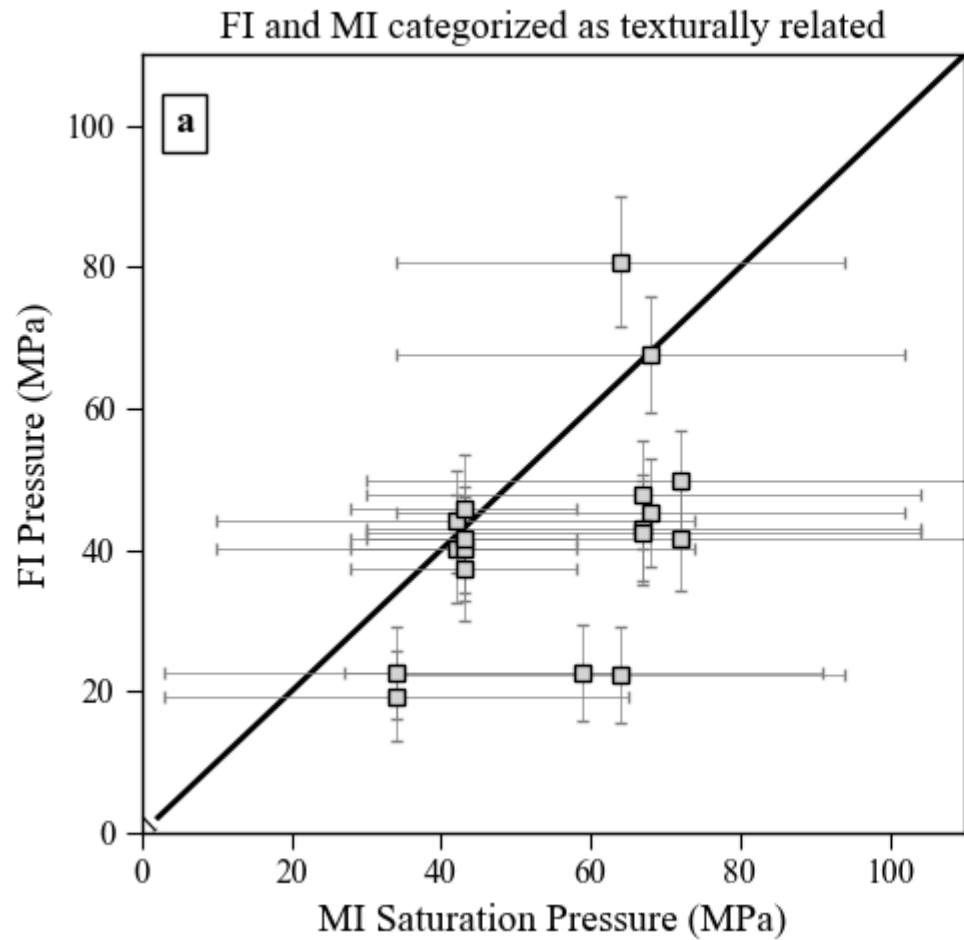
DeVitre and Wieser (2024) *Geochem. Persp. Let.* 29, 1–8 | <https://doi.org/10.7185/geochemlet.2404>

© 2024 The Authors

Published by the European Association of Geochemistry under Creative Commons License CC-BY.

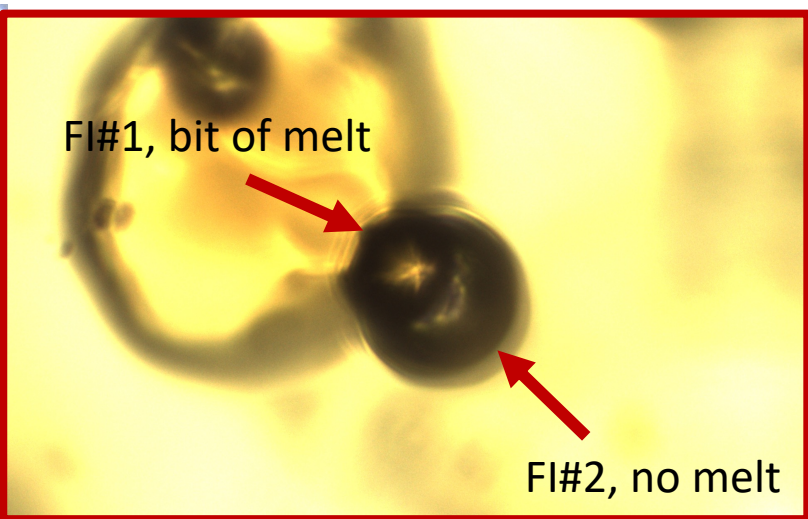
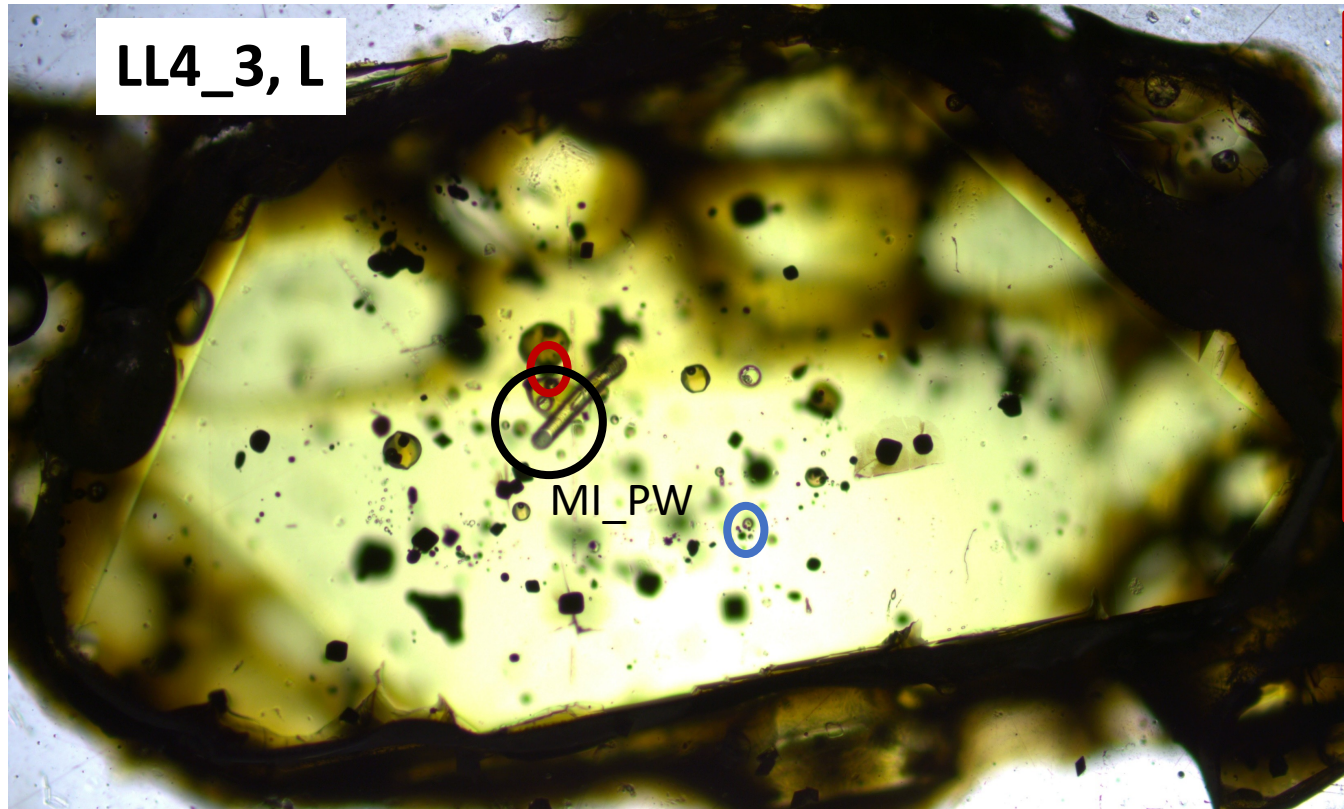
This section depicts melt and fluid inclusions found in crystals from Wieser *et al.* (2021).

Note: samples categorized as texturally related based on the information available to us are indicated with a green letter **R, and those deemed unrelated are shown with a red **UR**.**

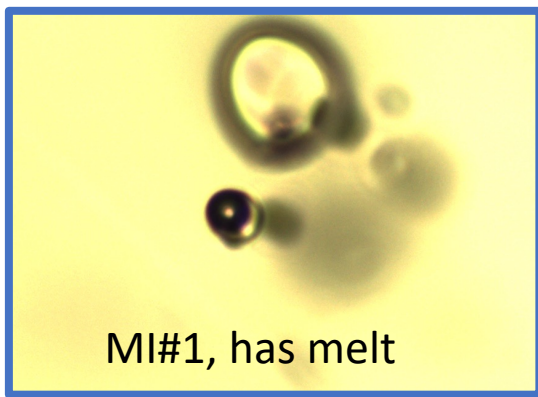


Overall comparison of melt and fluid inclusion pairs. (a) melt and fluid inclusions categorized as texturally related. (b) melt and fluid inclusions categorized as texturally unrelated. Although some of the fluid inclusions categorized as texturally related appear lightly offset from the 1:1 line, we note that they are within the large uncertainty of the MI measurements. They also tend to be fluid inclusions which were more difficult to categorize with available data and observations (e.g., on a slightly different depth plane, an apparently similar growth zone but not immediately adjacent to the melt inclusion or a slightly offset growth zone). Specific crystal plots and images are provided in the next slides for detailed comparisons.

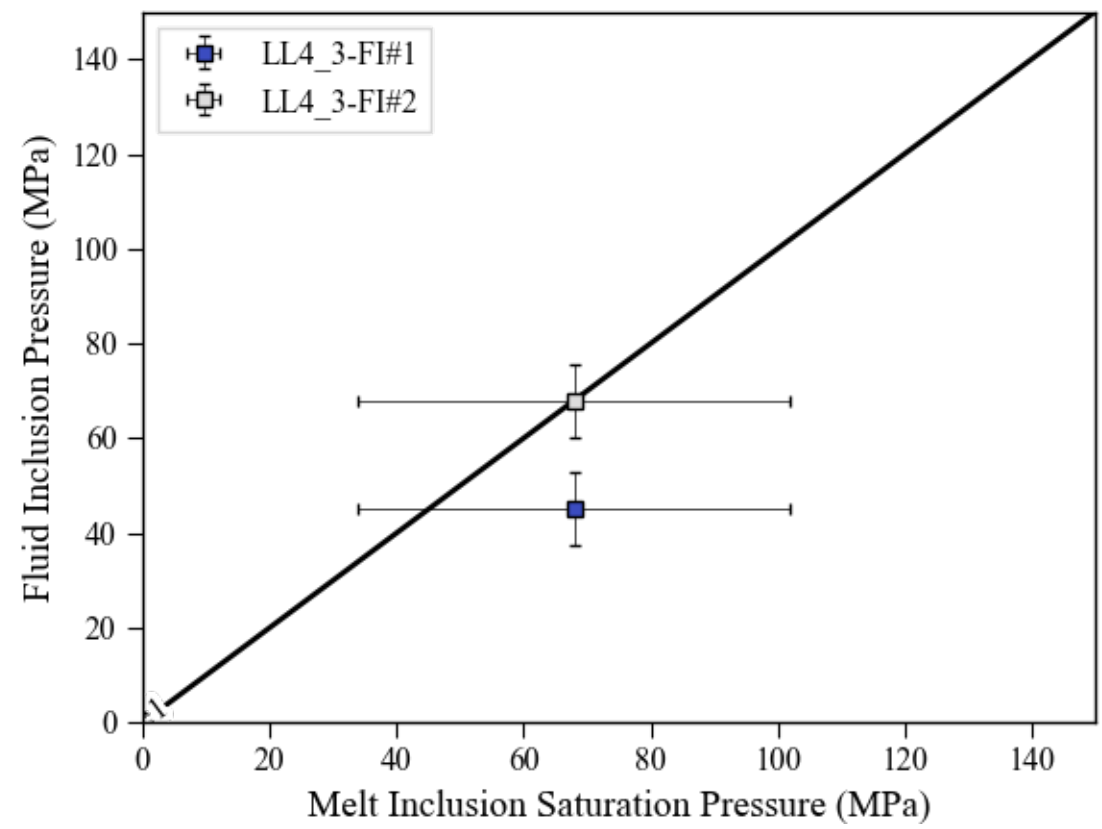
LL4_3, L



R

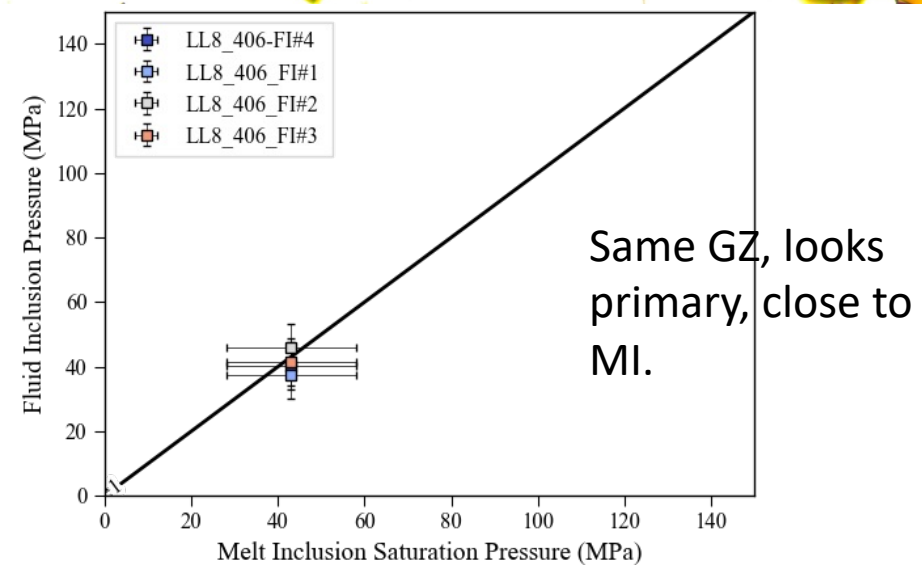
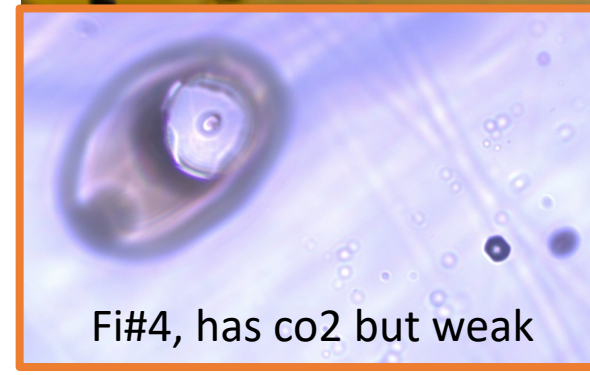
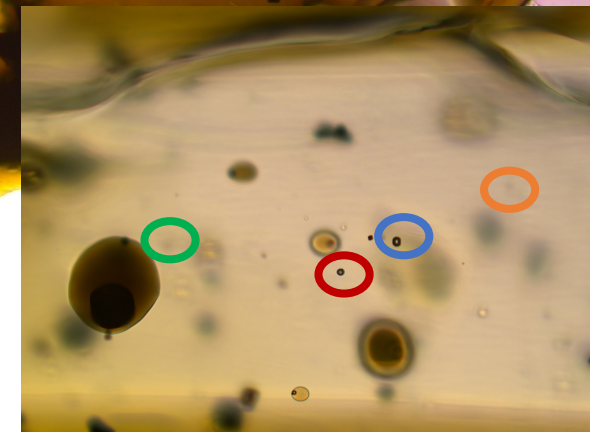
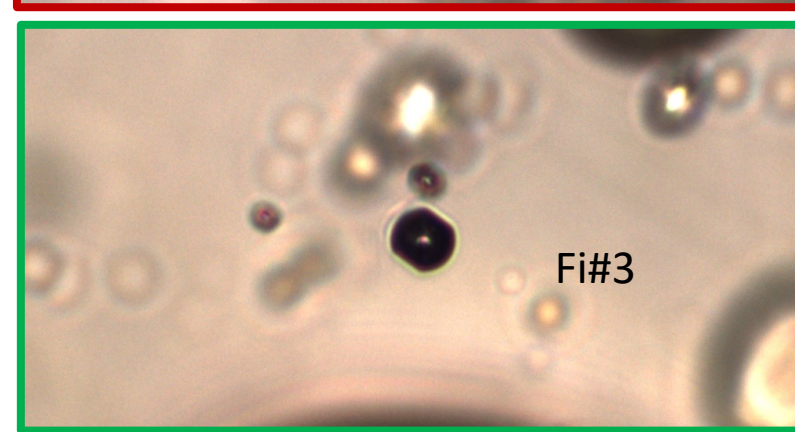
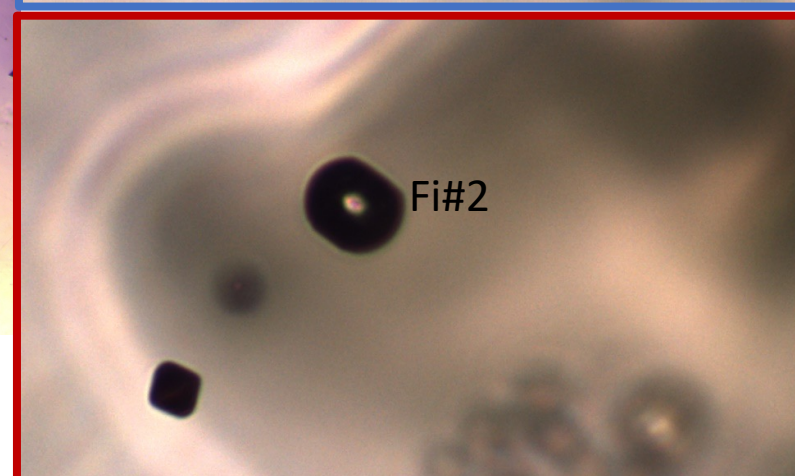
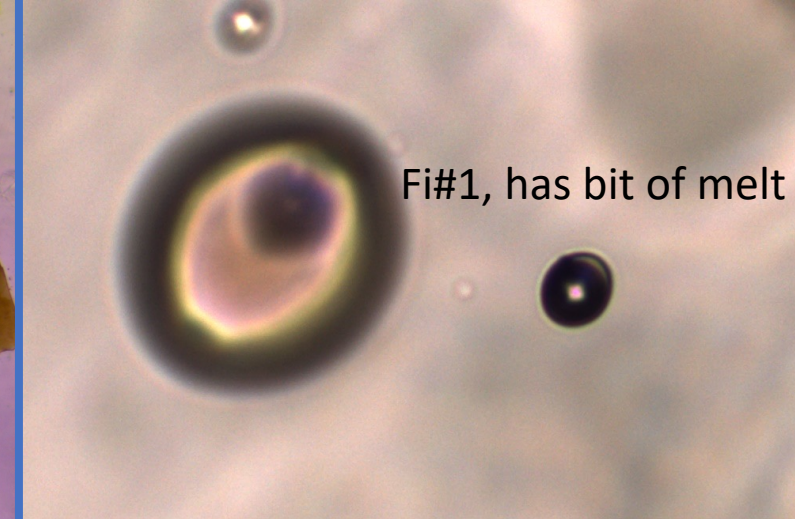
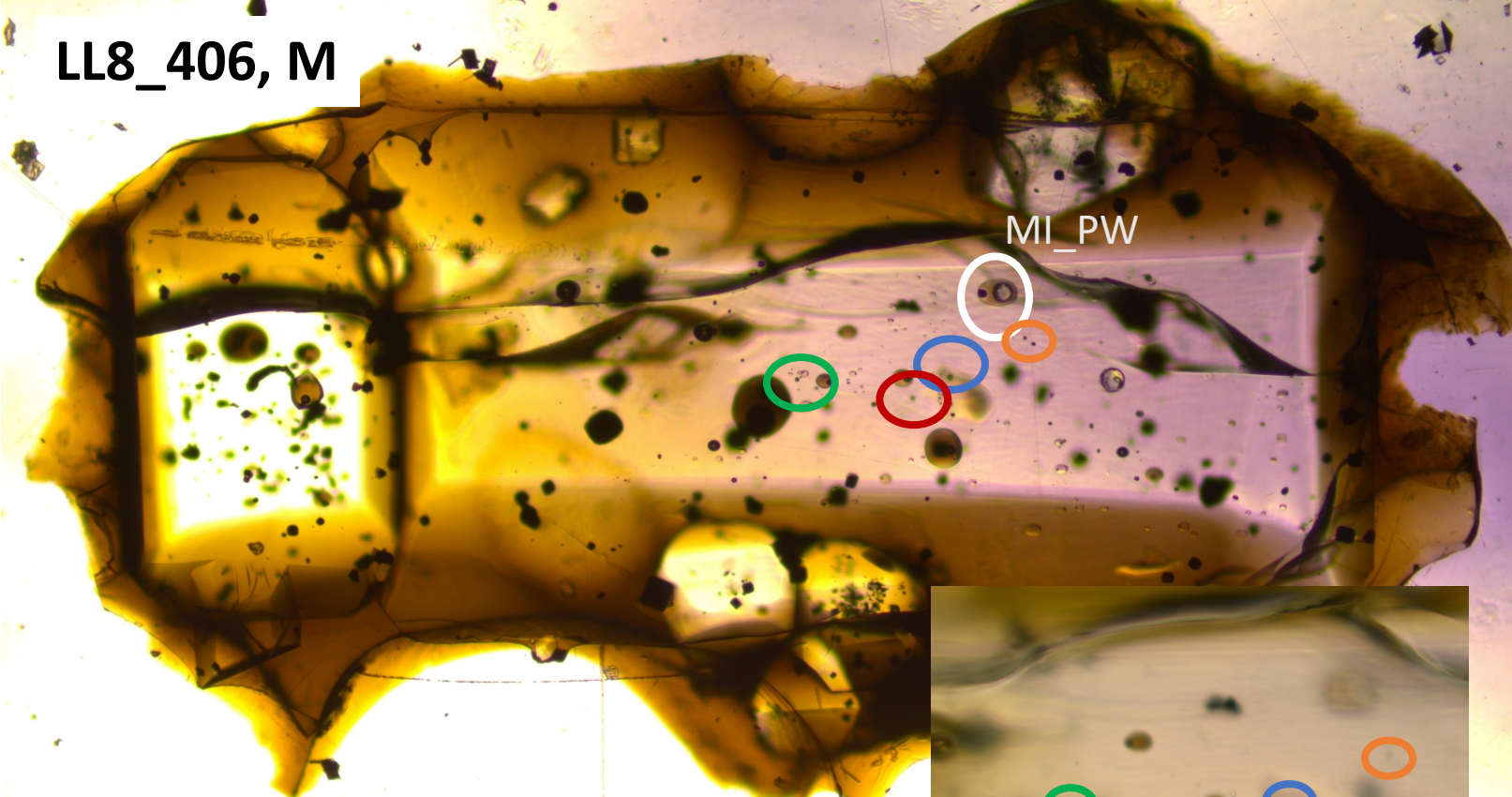


This one works,
The FI are in close
proximity to the MI
MI#1 is a bit
further but seems
on the same
growth plane
optically.

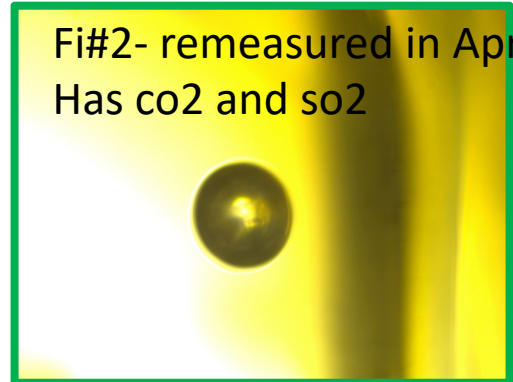
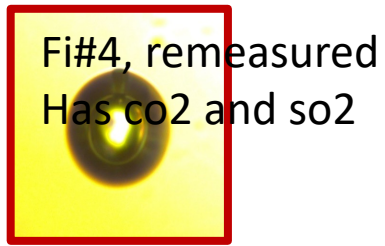
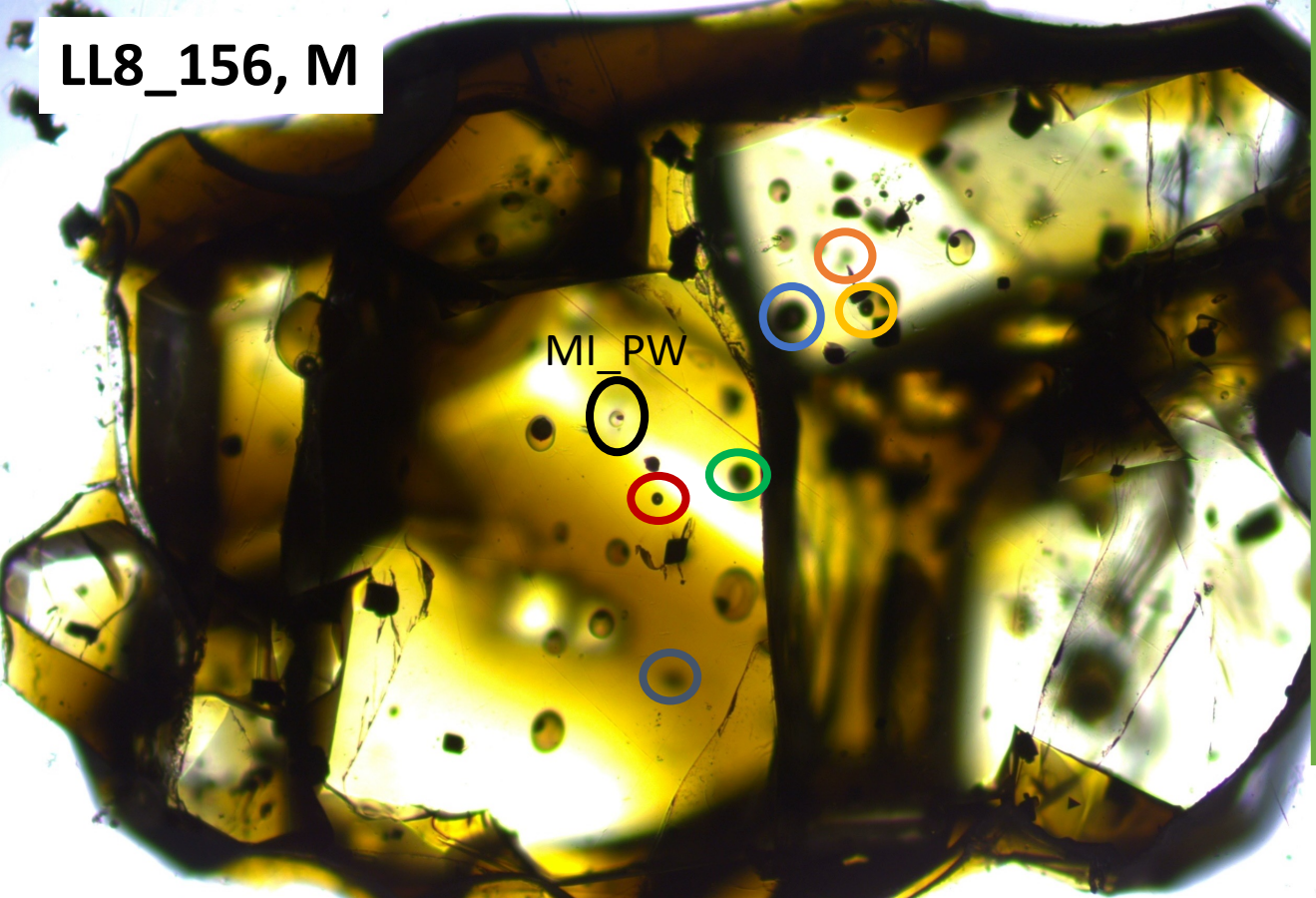


LL8_406, M

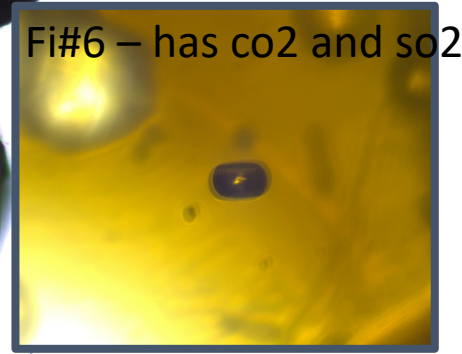
R



LL8_156, M

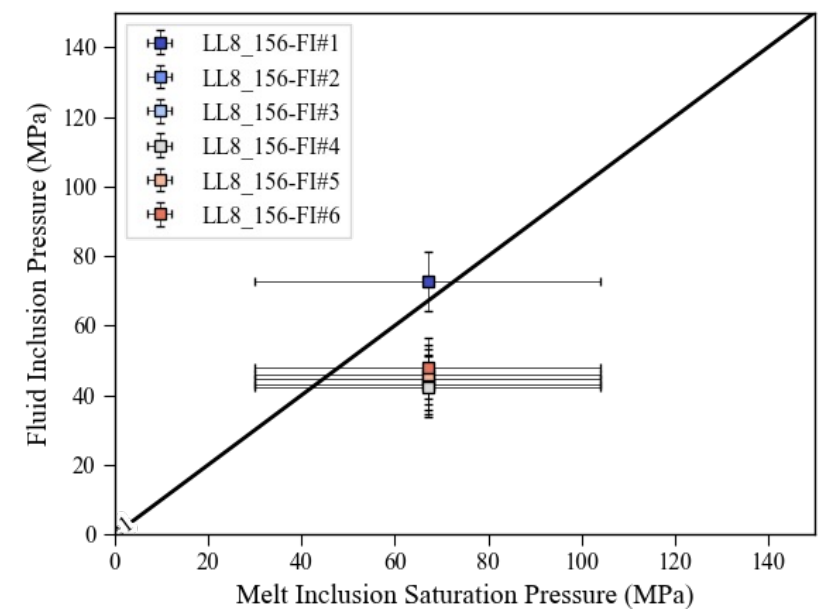
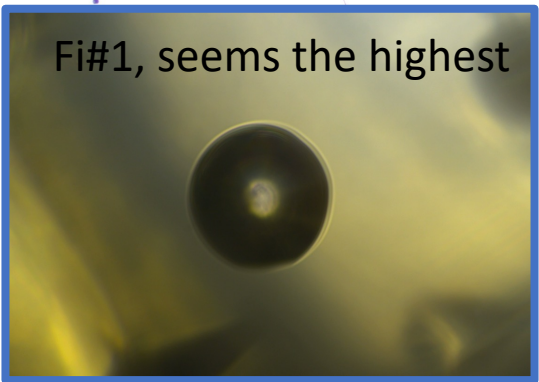
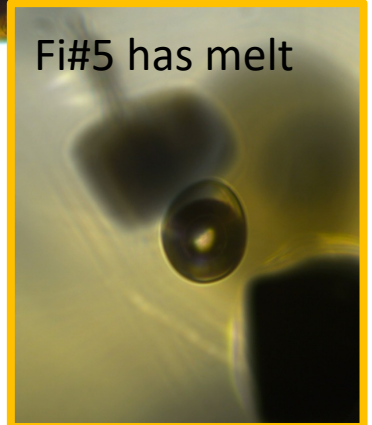
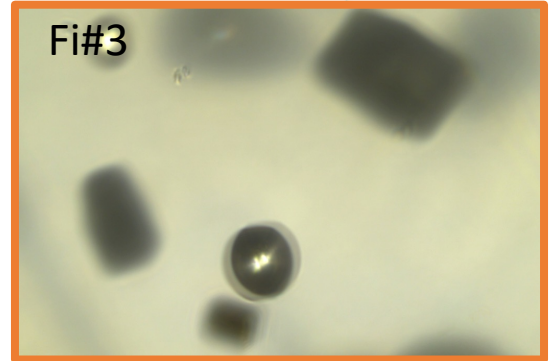


R

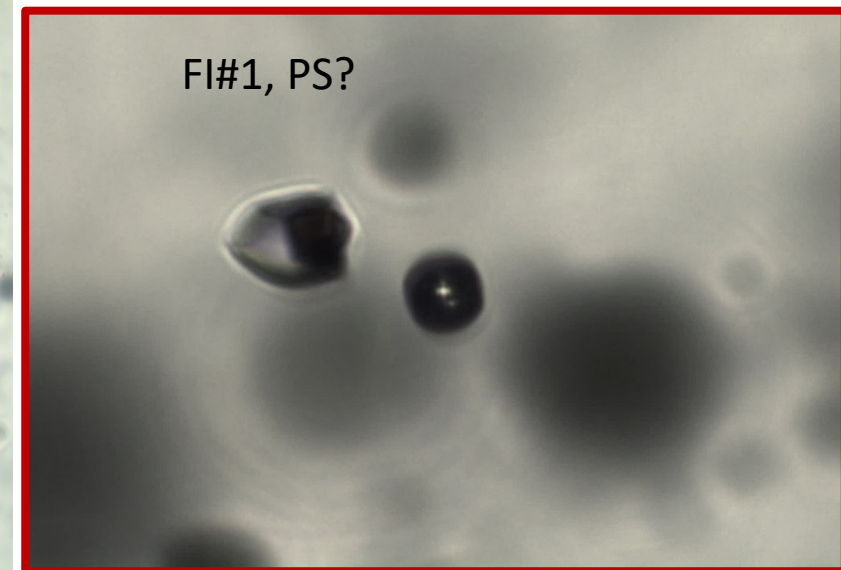
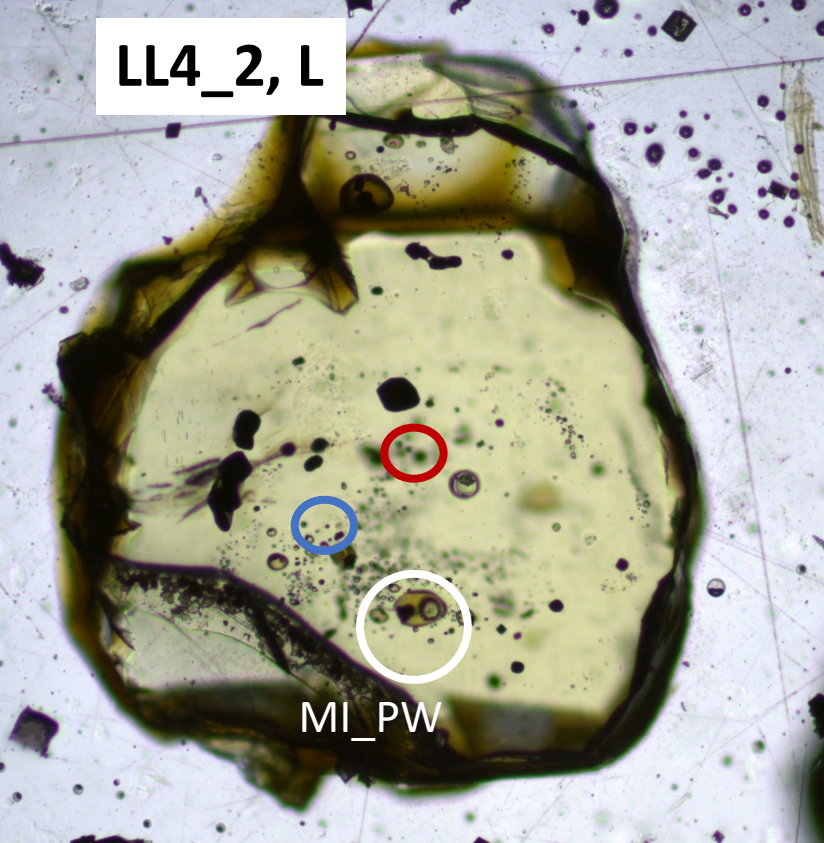


2,6,4 are in the same crystal, they are within the MI error. 1,3,5 are in a subxtal, but it could be budded. SEM needed.

UR

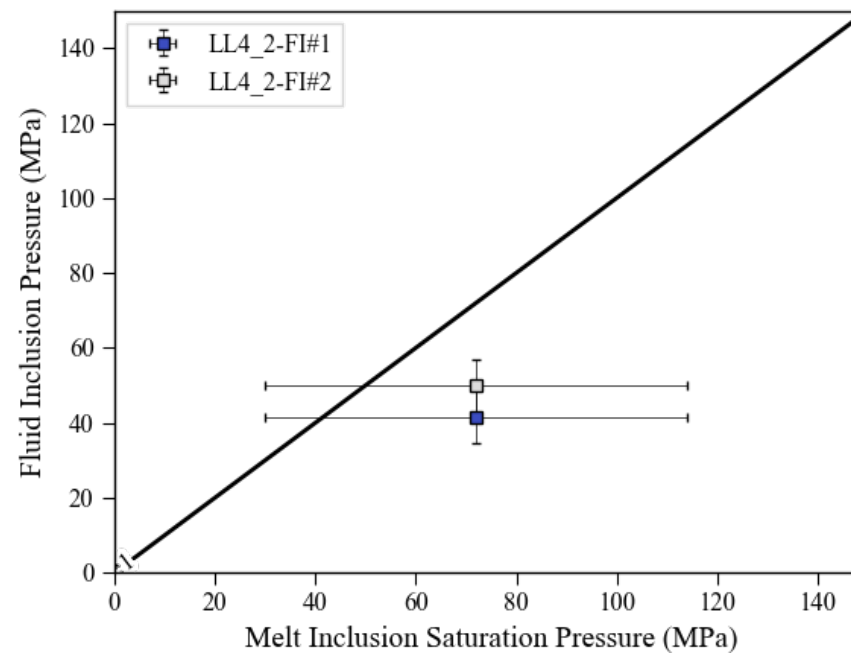


LL4_2, L

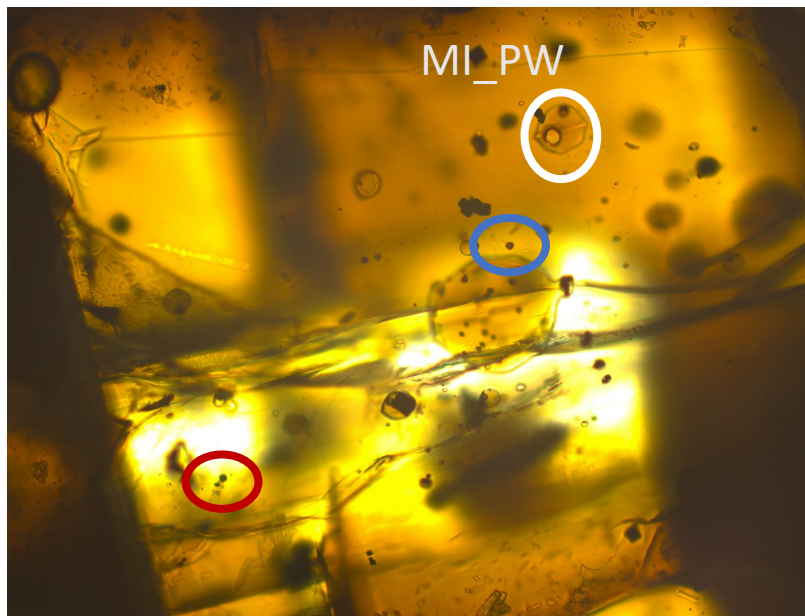
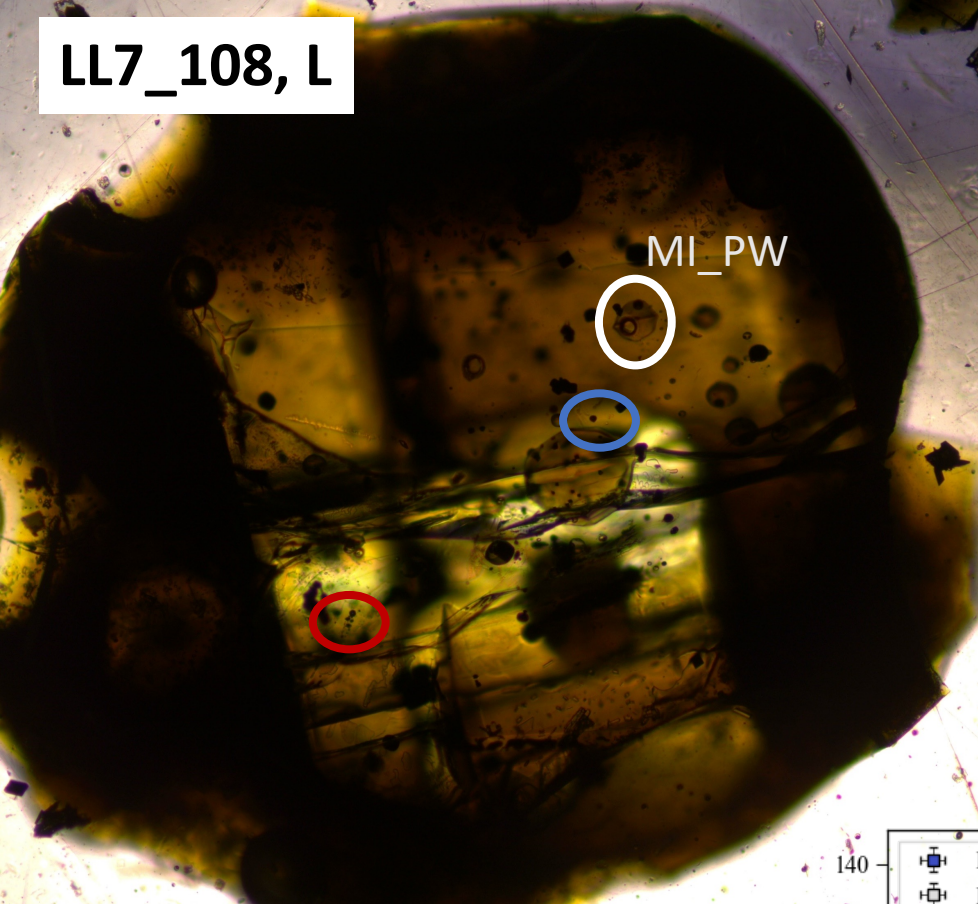


Seem to be
In the same FIA (at least
FI#2) or at least fairly coeval,
even though #1 is likely
pseudo secondary

R

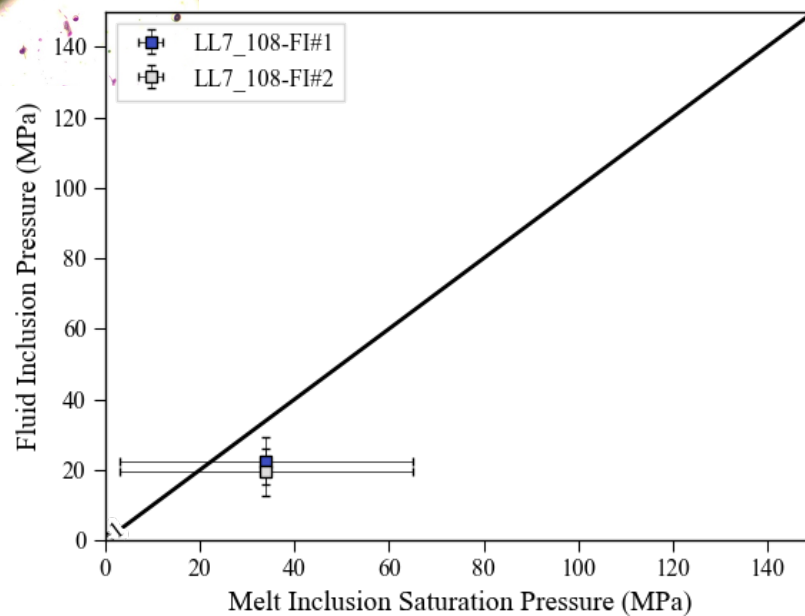
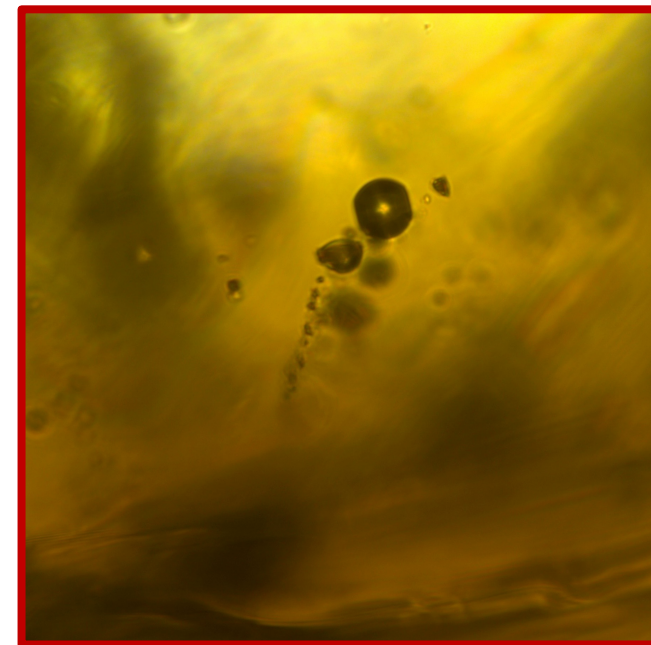


LL7_108, L



Fi#1, on a trail PS?

R



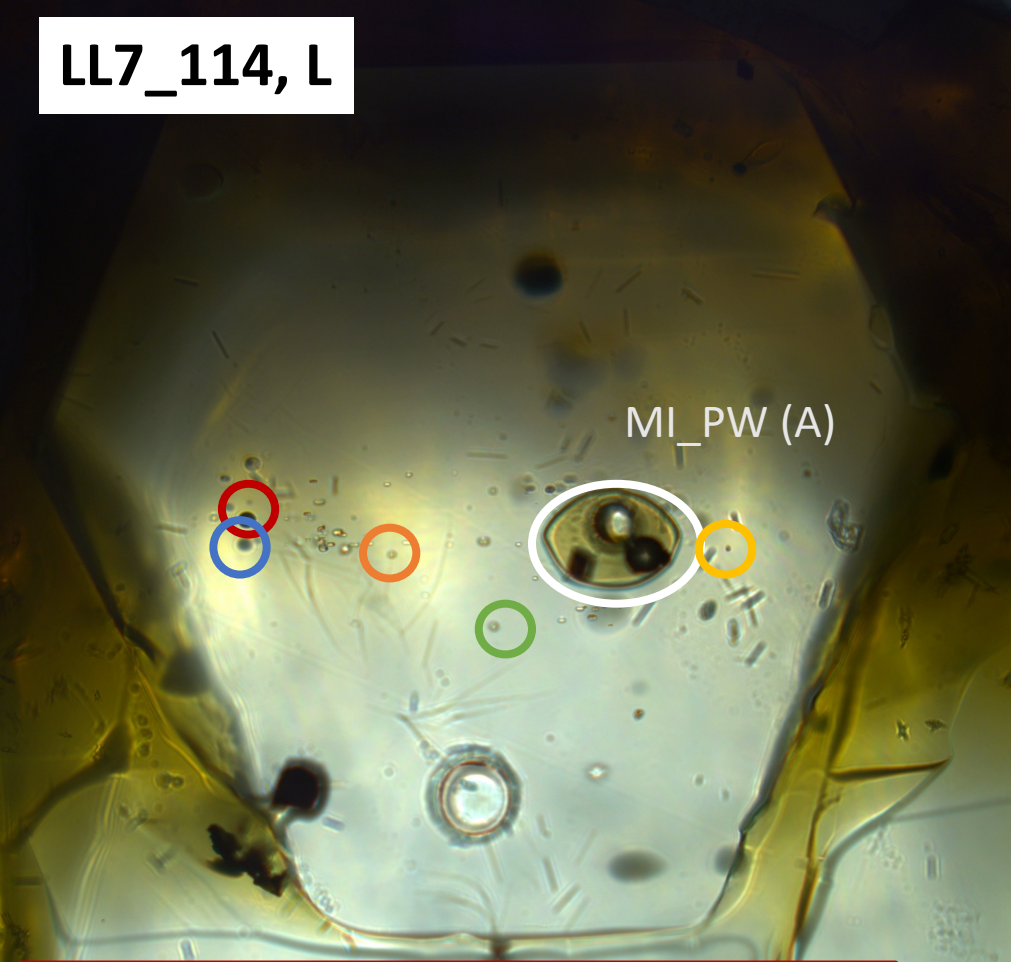
Fi#2 is close proximal to the MI, Fi#1 is further and maybe PS, but it records the same pressure.

Fi#2, Same xtal, on edge

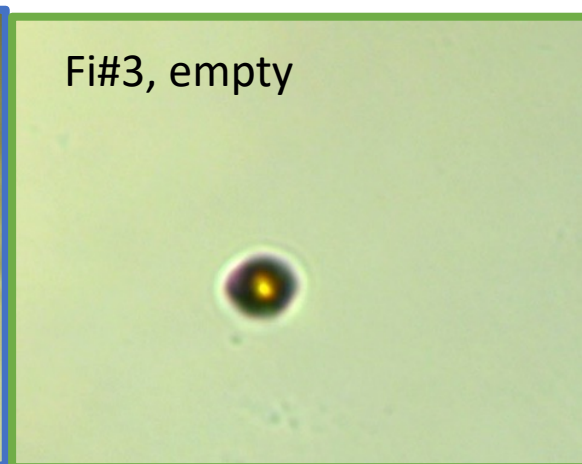
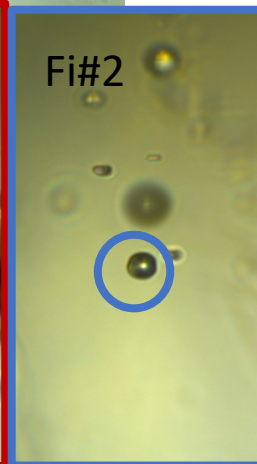
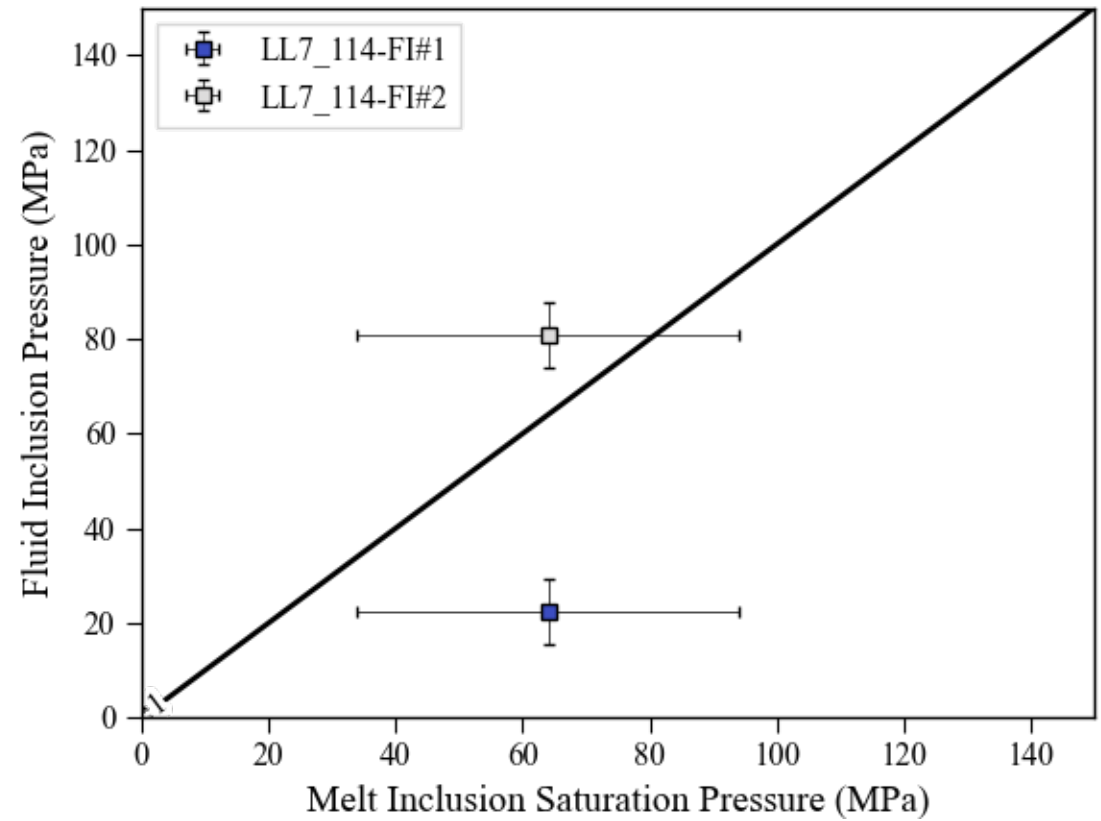


LL7_114, L

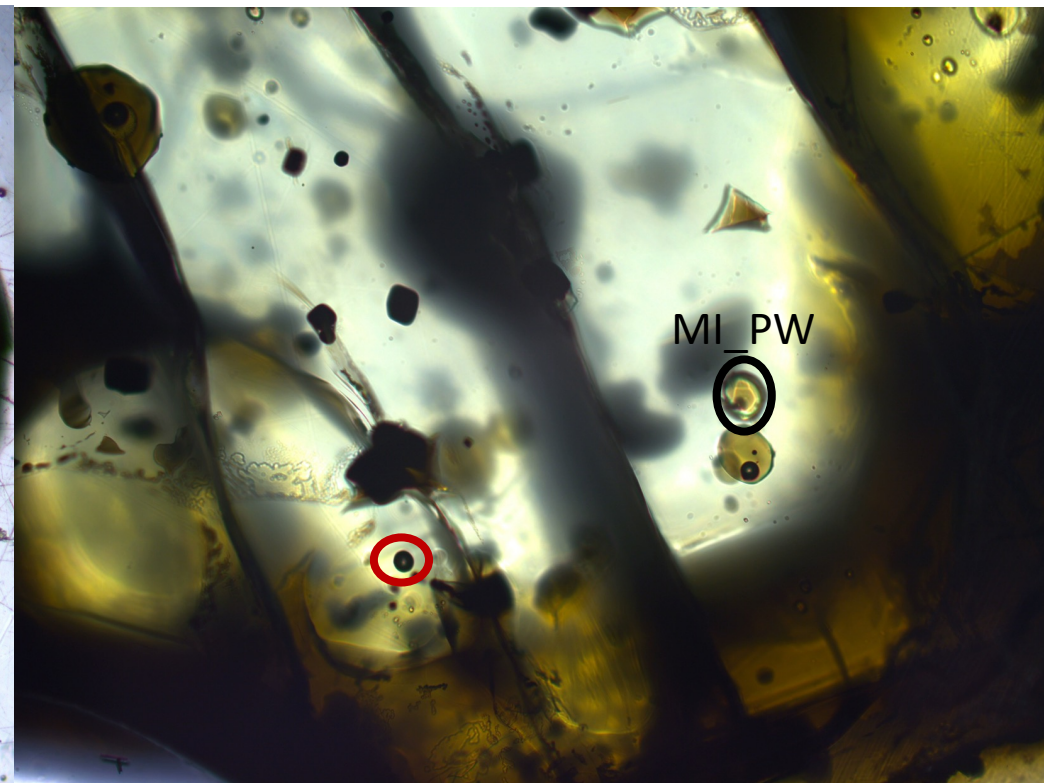
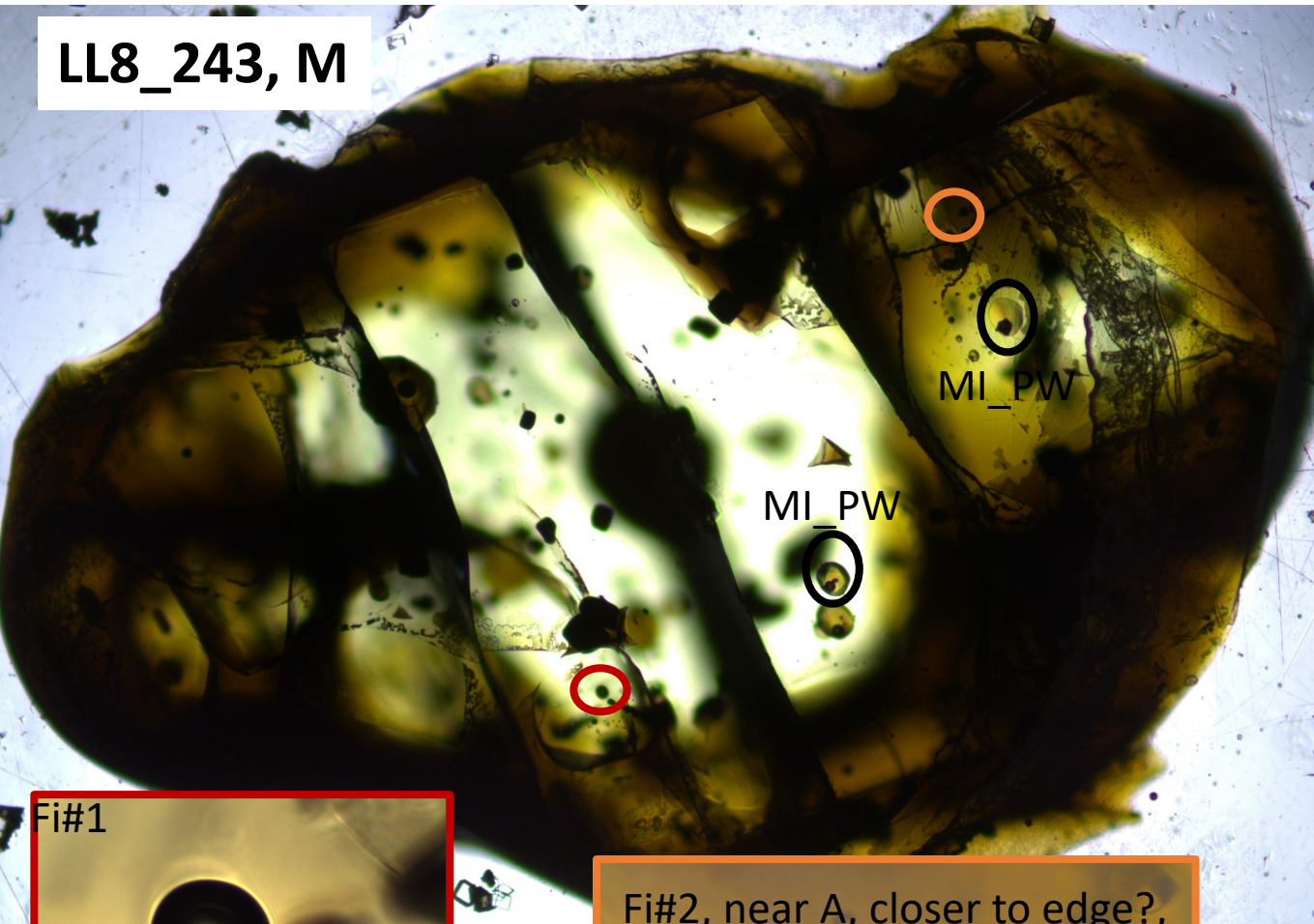
R



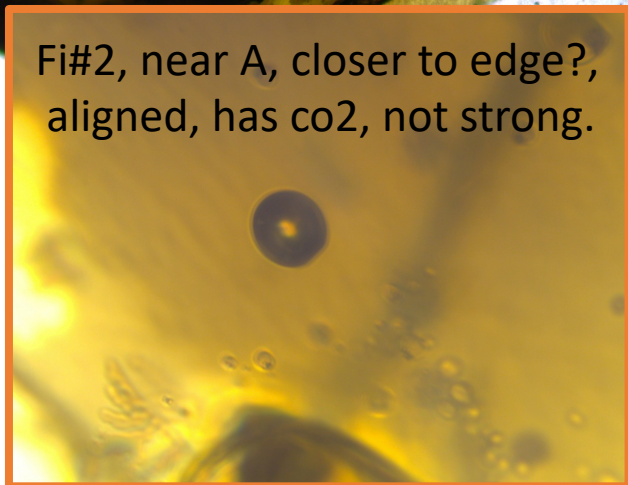
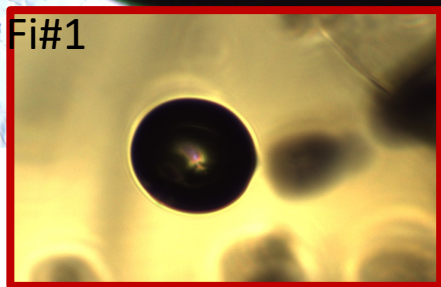
FI#2 is more in the plane of the MI, seems like a similar growth zone of the crystal. FI#1 is deeper but still within a similar GZ. They are close to the MI pressure within error.



LL8_243, M

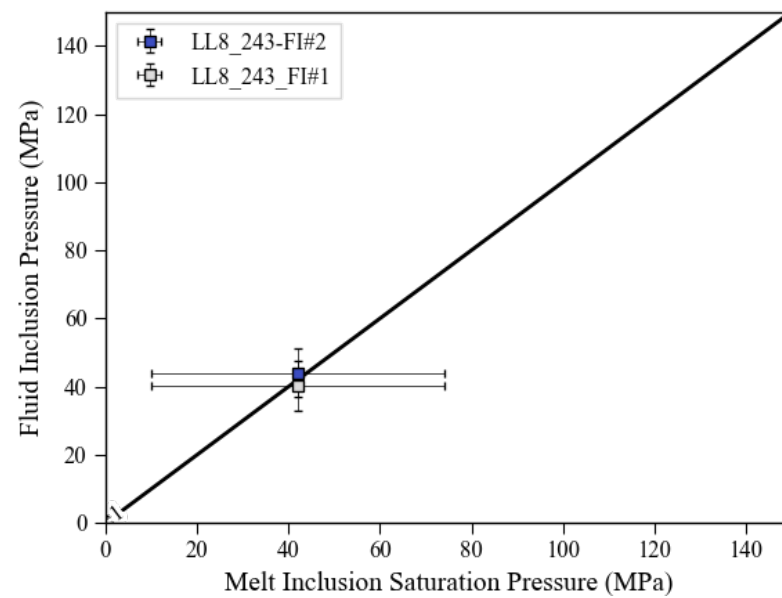


R

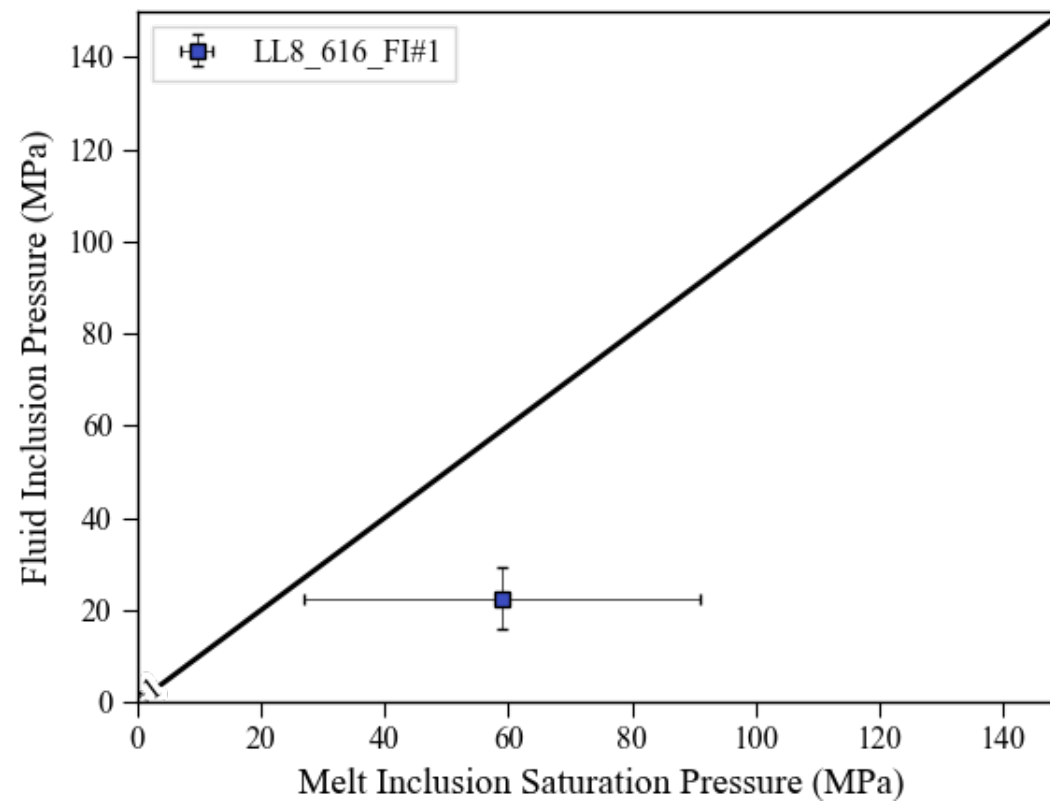
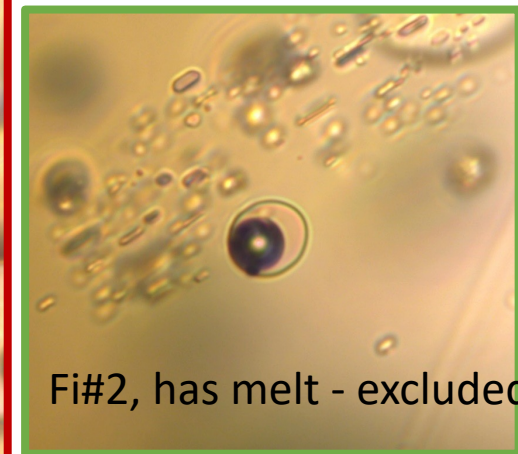
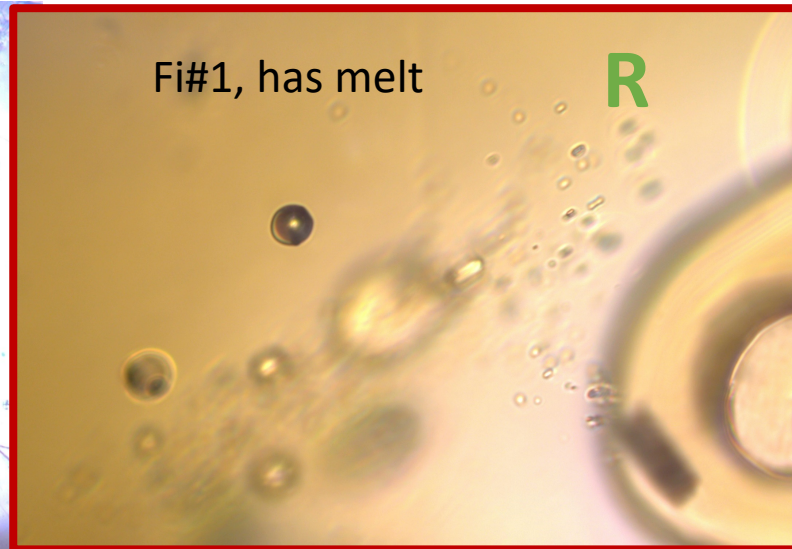
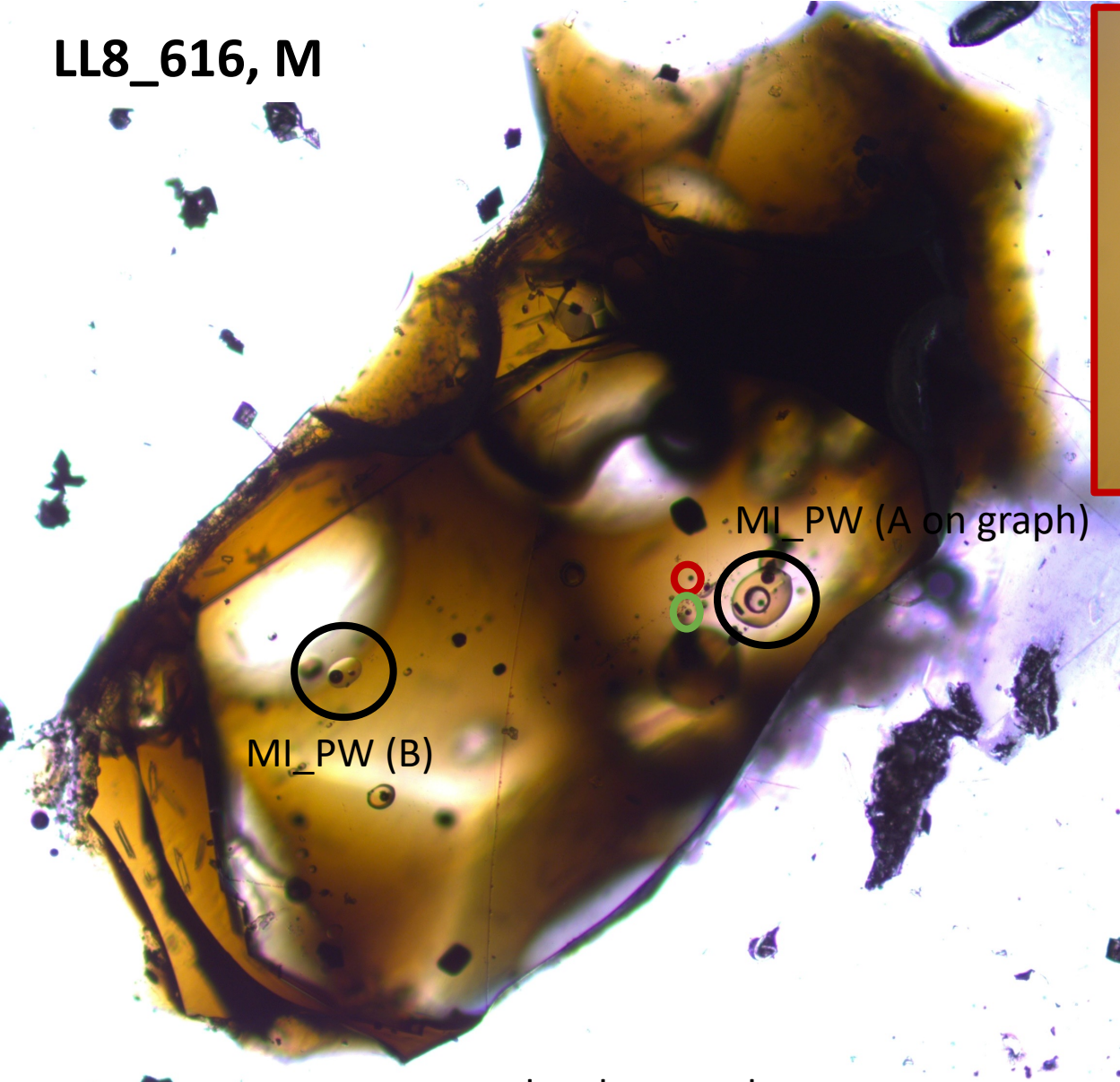


Fi#2, near A, closer to edge?,
aligned, has co2, not strong.

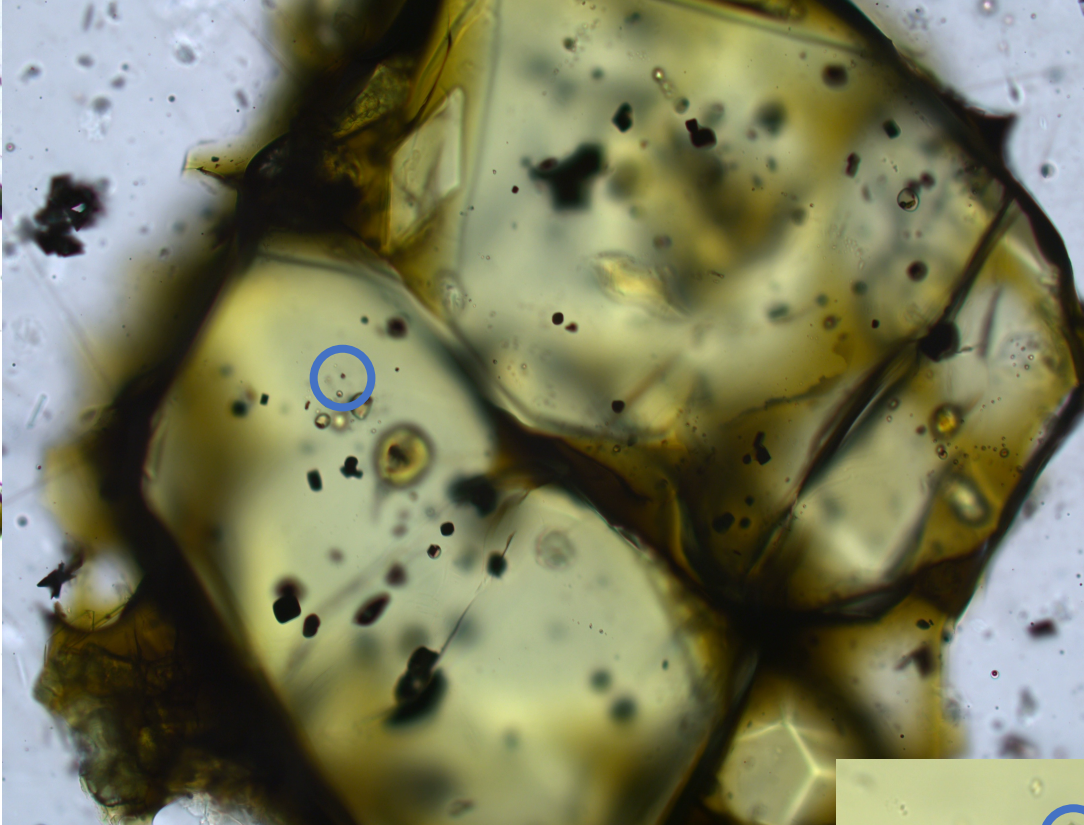
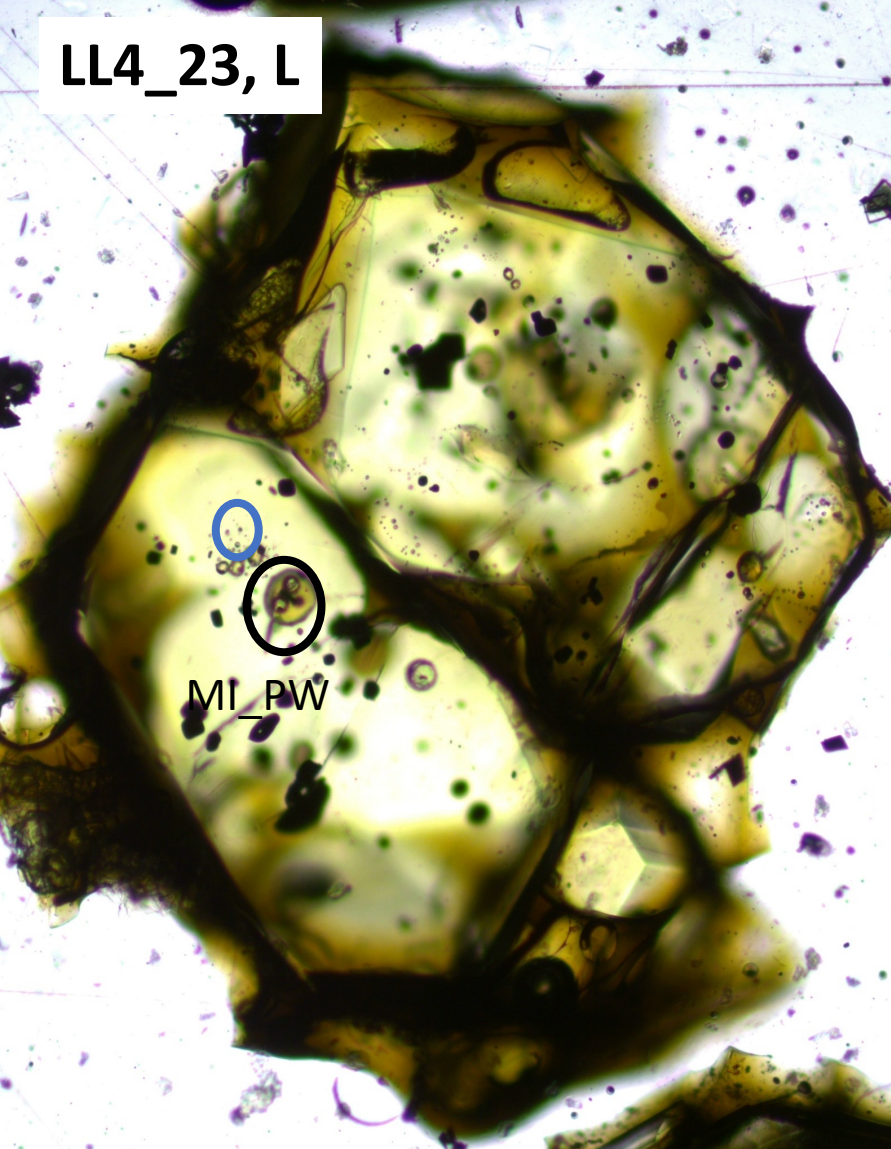
Same crystal for Fi#1.
Fi#2 is in different
crystal, but could be
budded. Fi#1 and MI are
near crystal edge.



LL8_616, M



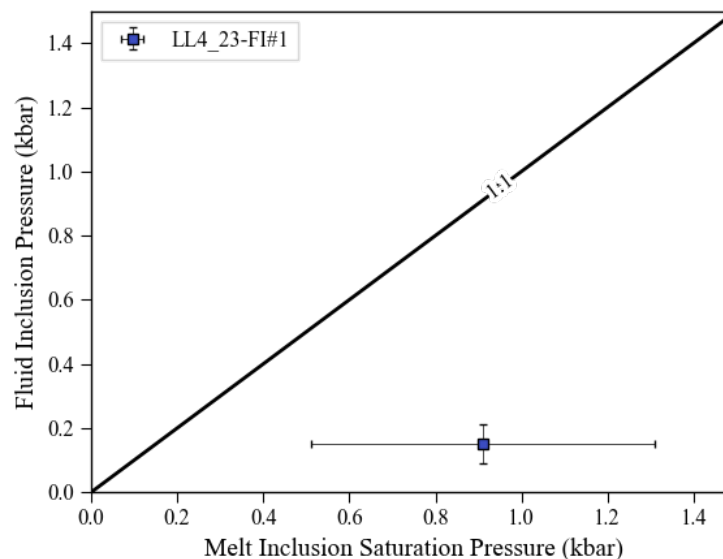
LL4_23, L



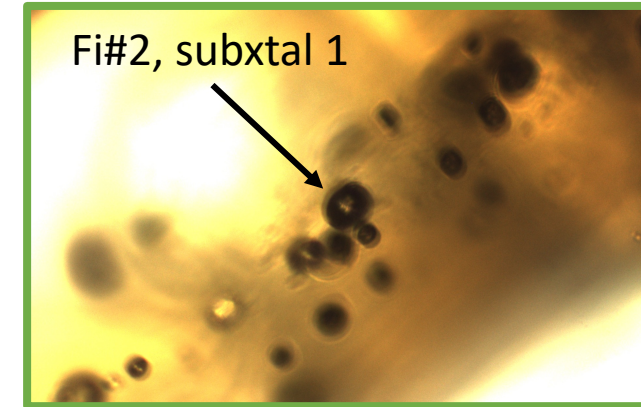
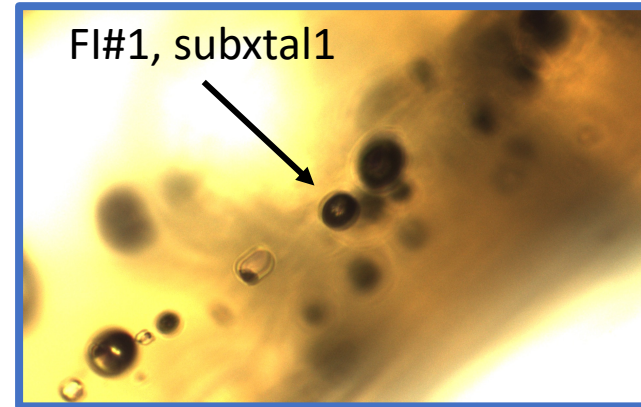
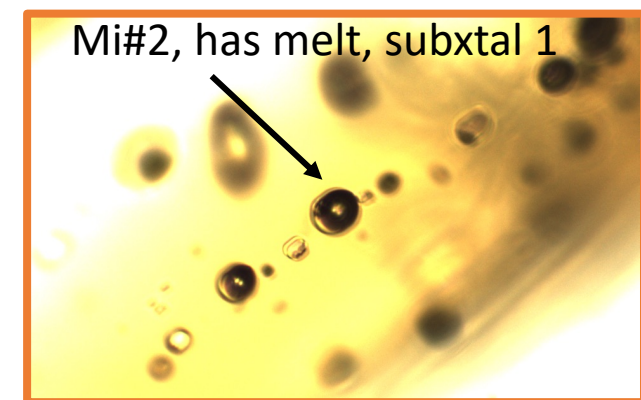
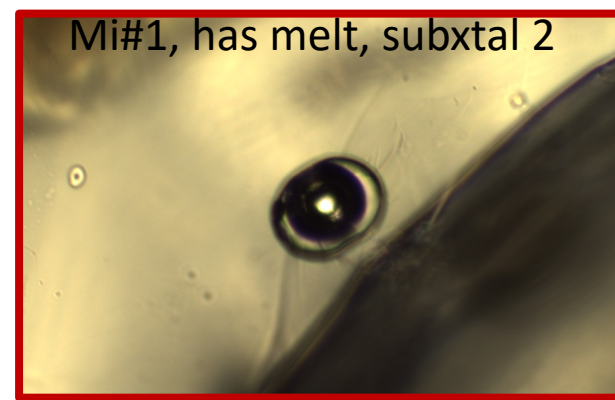
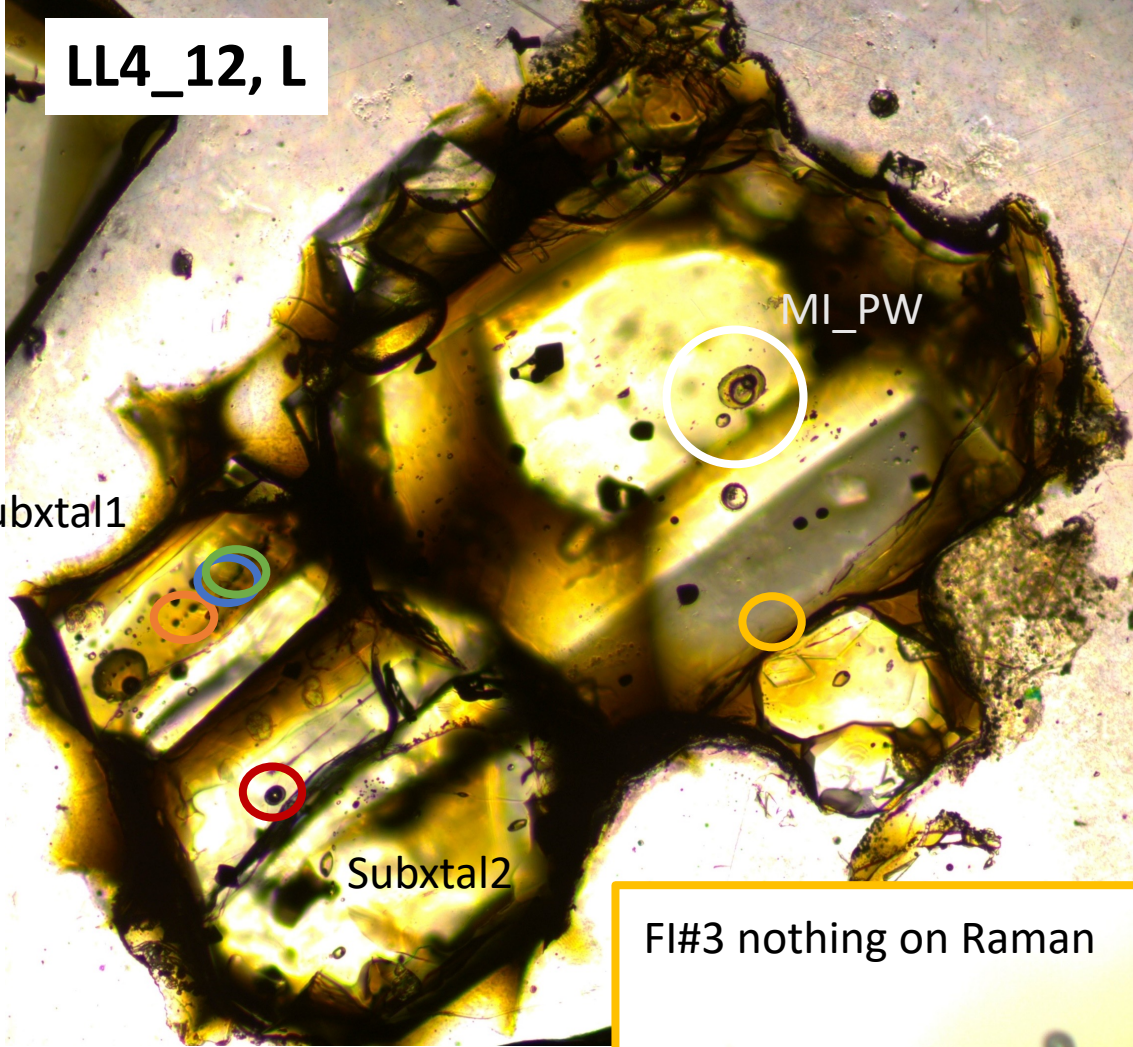
R



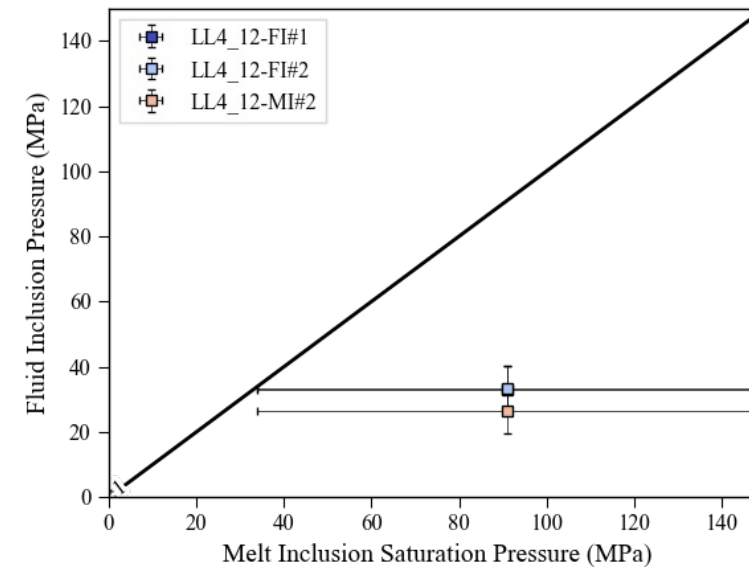
This was a really bad spec. High bckg, not lots of points above, low Intensity/FWHM ratio (below 200). the fit error was high (30% on density). It has SO₂.



LL4_12, L

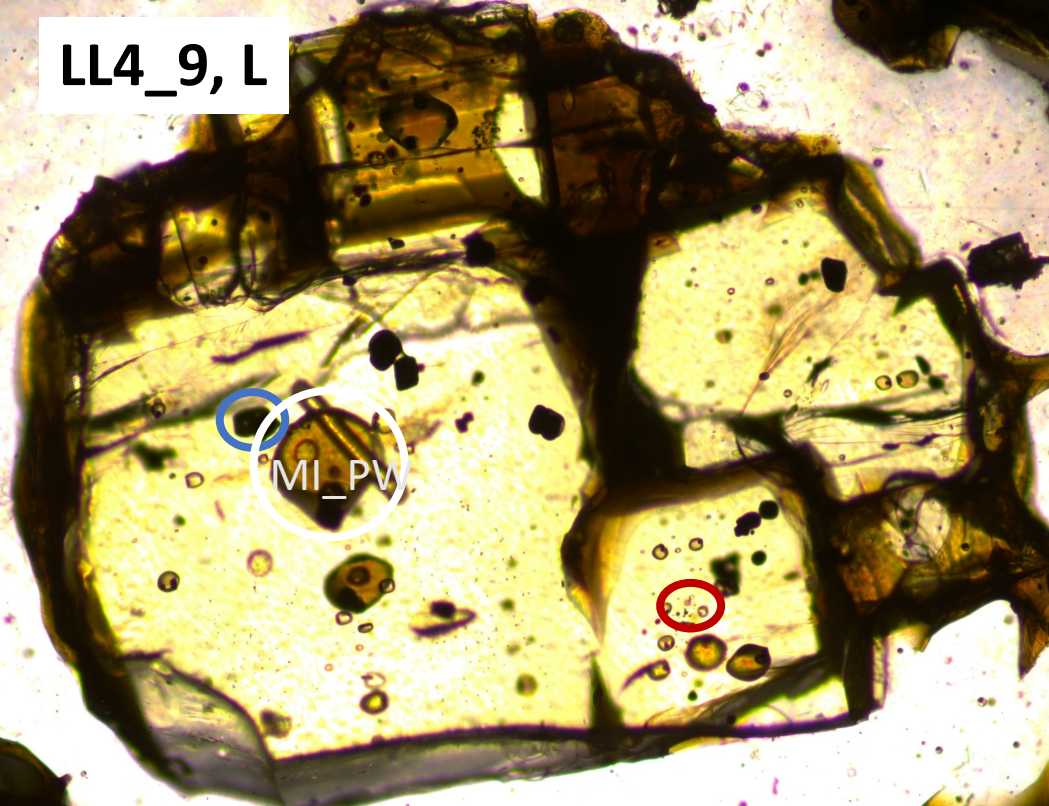


The FI are in a separate subxtal, so they don't work
 Example in main article

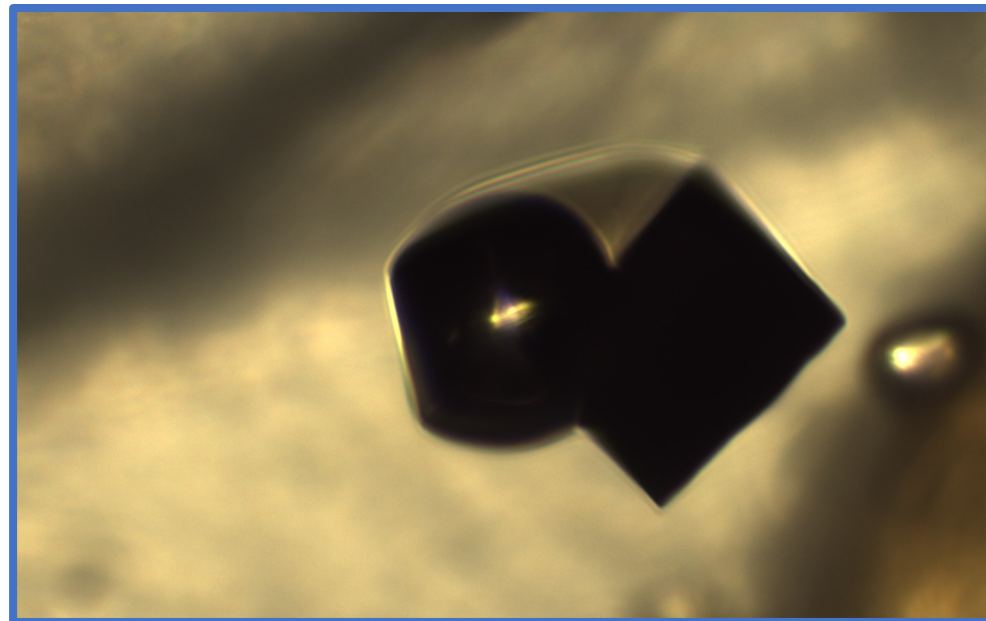


UR

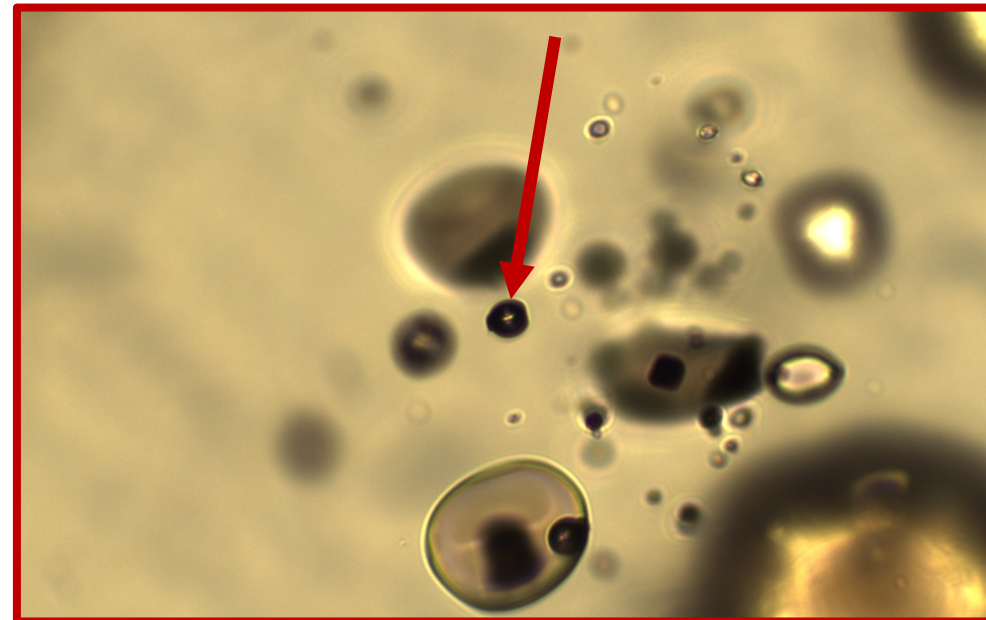
LL4_9, L



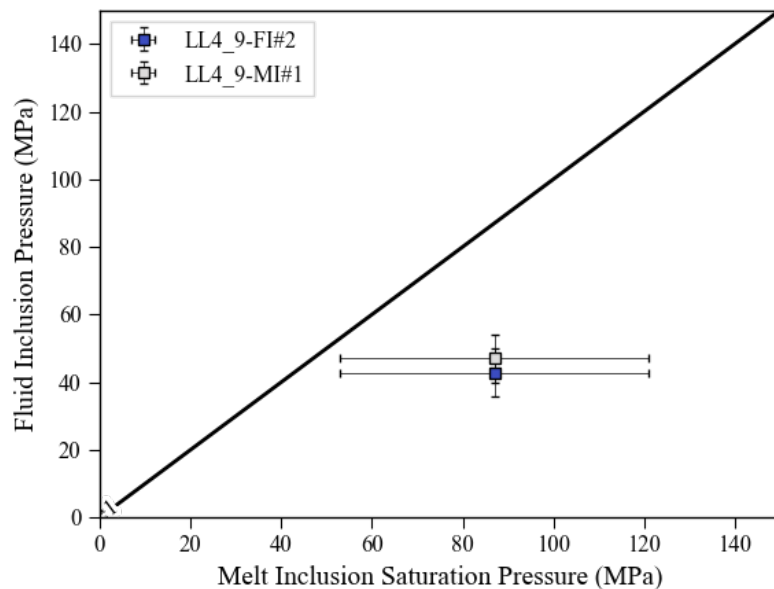
Mi#1, has some melt **UR**



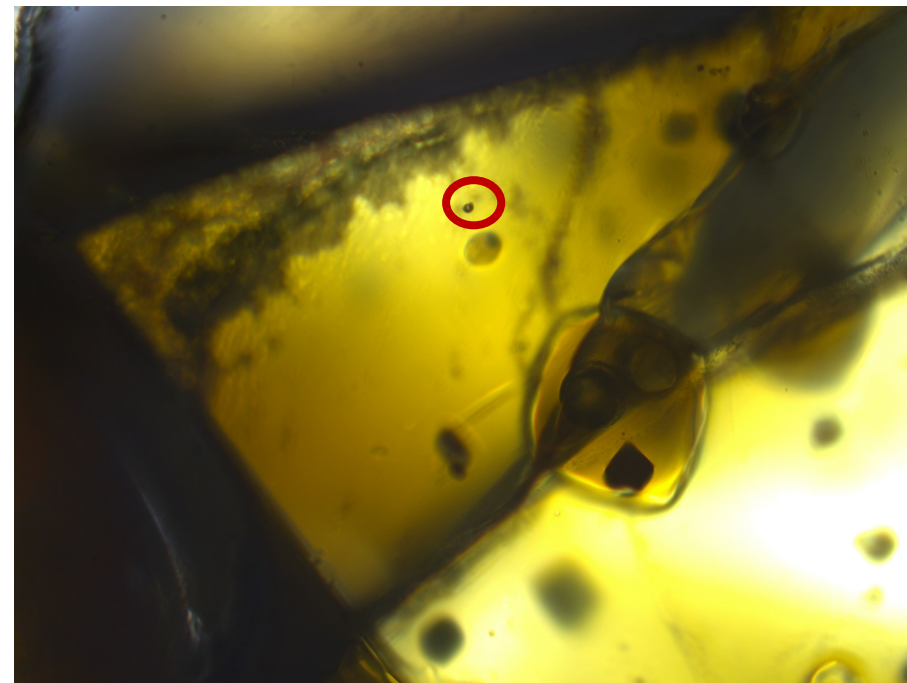
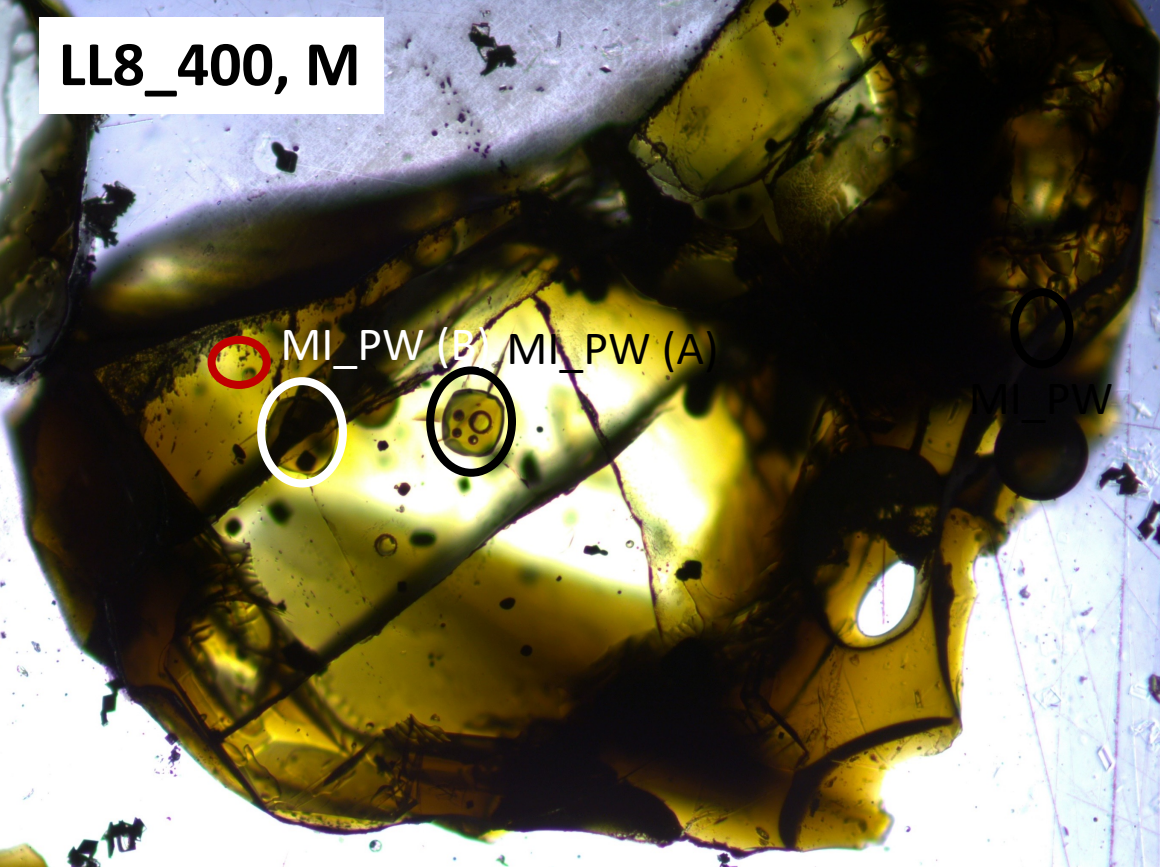
Fi#2, separate sub xtal



The FI with no melt is in a separate xtal. The other one has melt

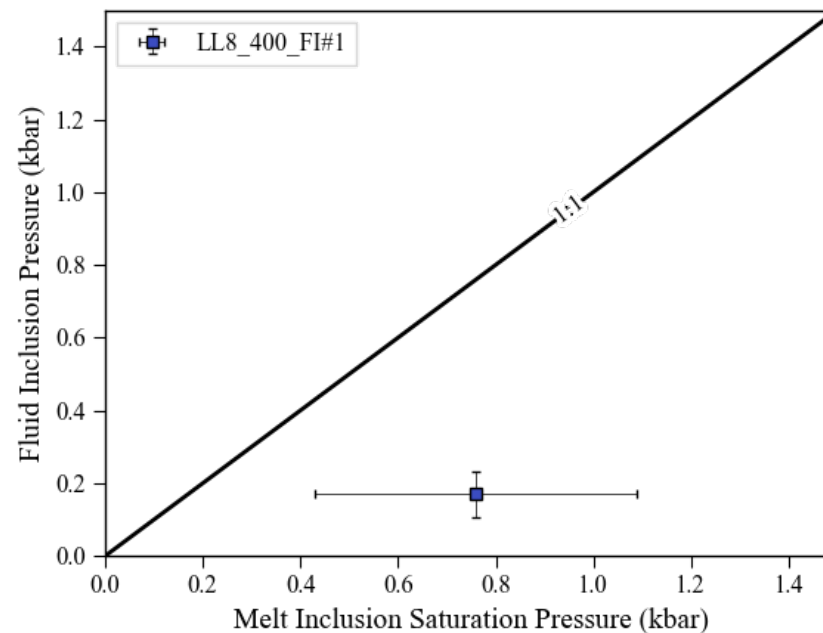


LL8_400, M



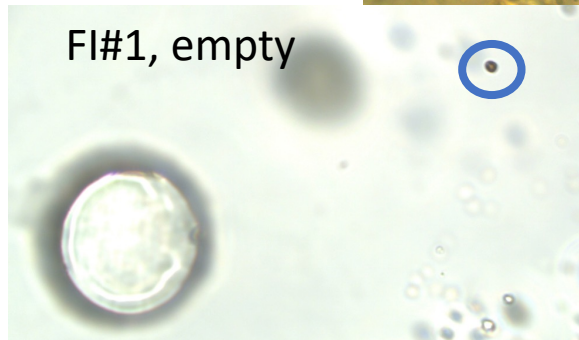
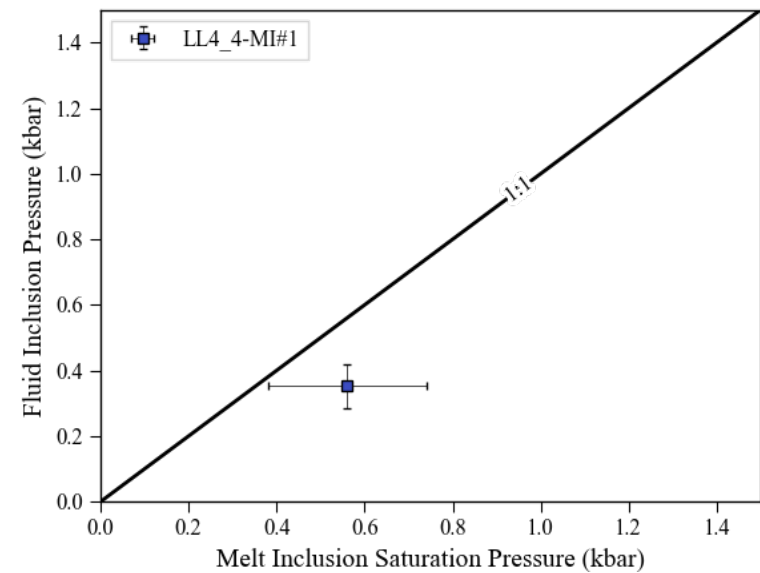
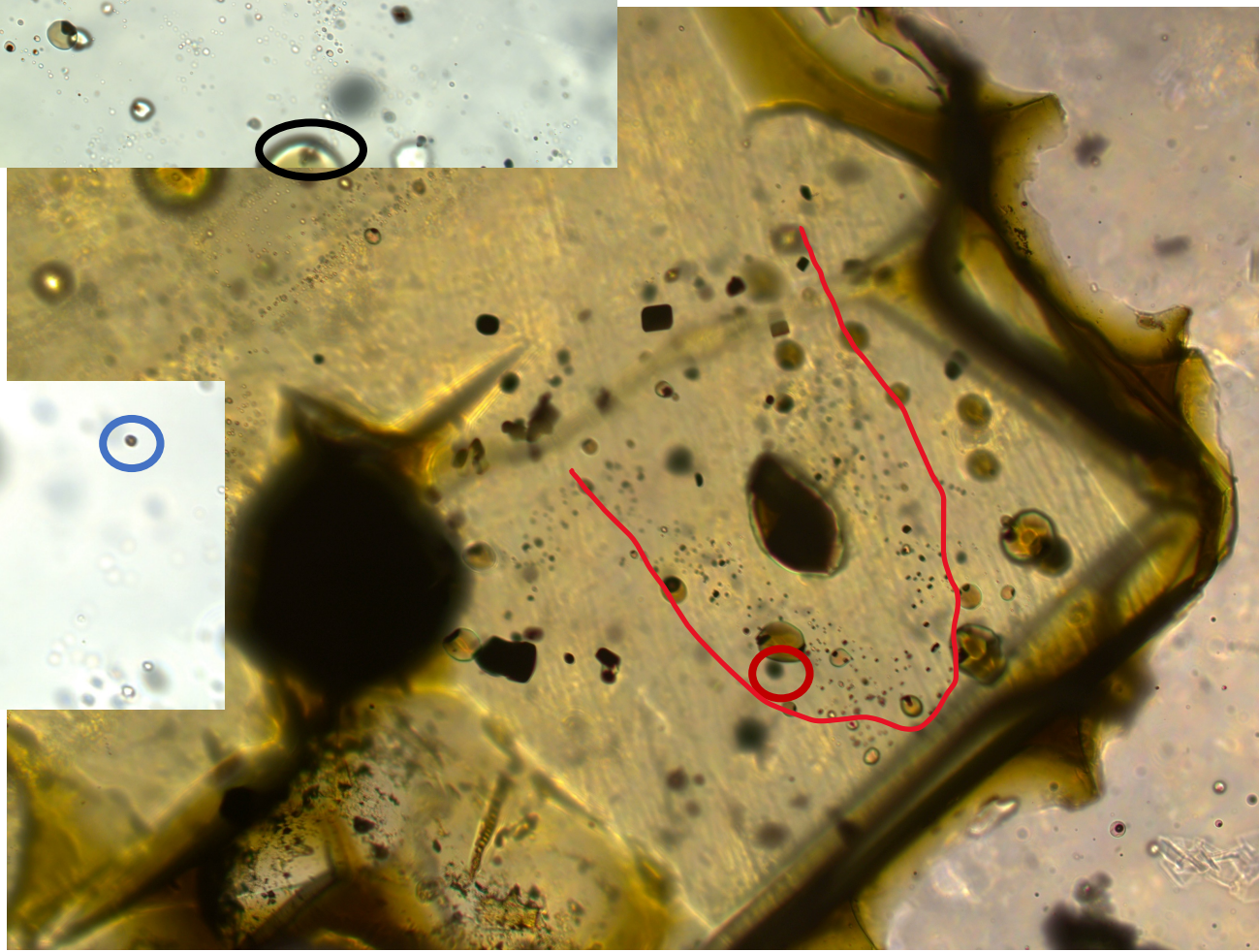
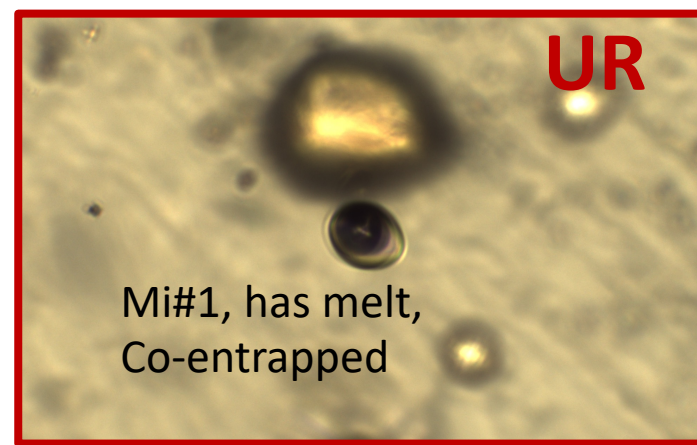
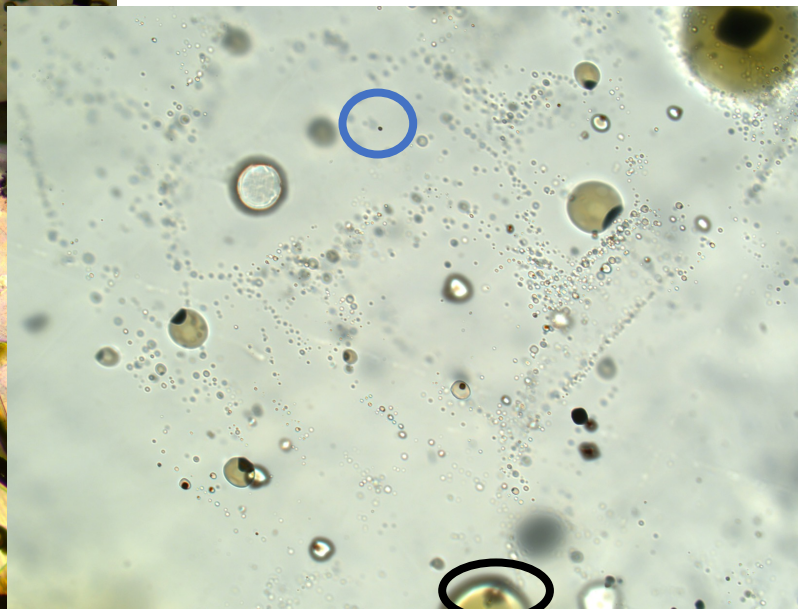
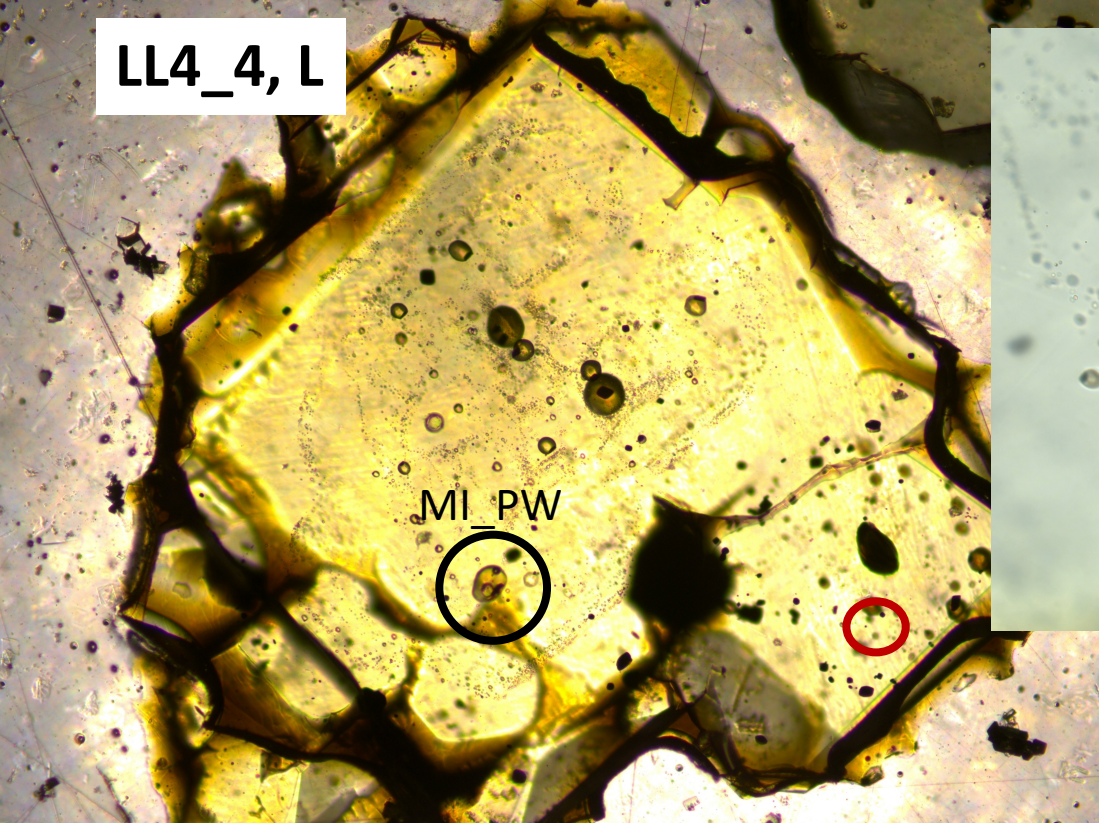
Fi#1, similar position as B,
Tiny bit of melt

This one is nearer edge
of crystal and has melt.
MI A is the good MI
here, B was cracked
(bad MI). Also, bad spec
with high error (58%)
with bad features and
low intensity/fwhm.



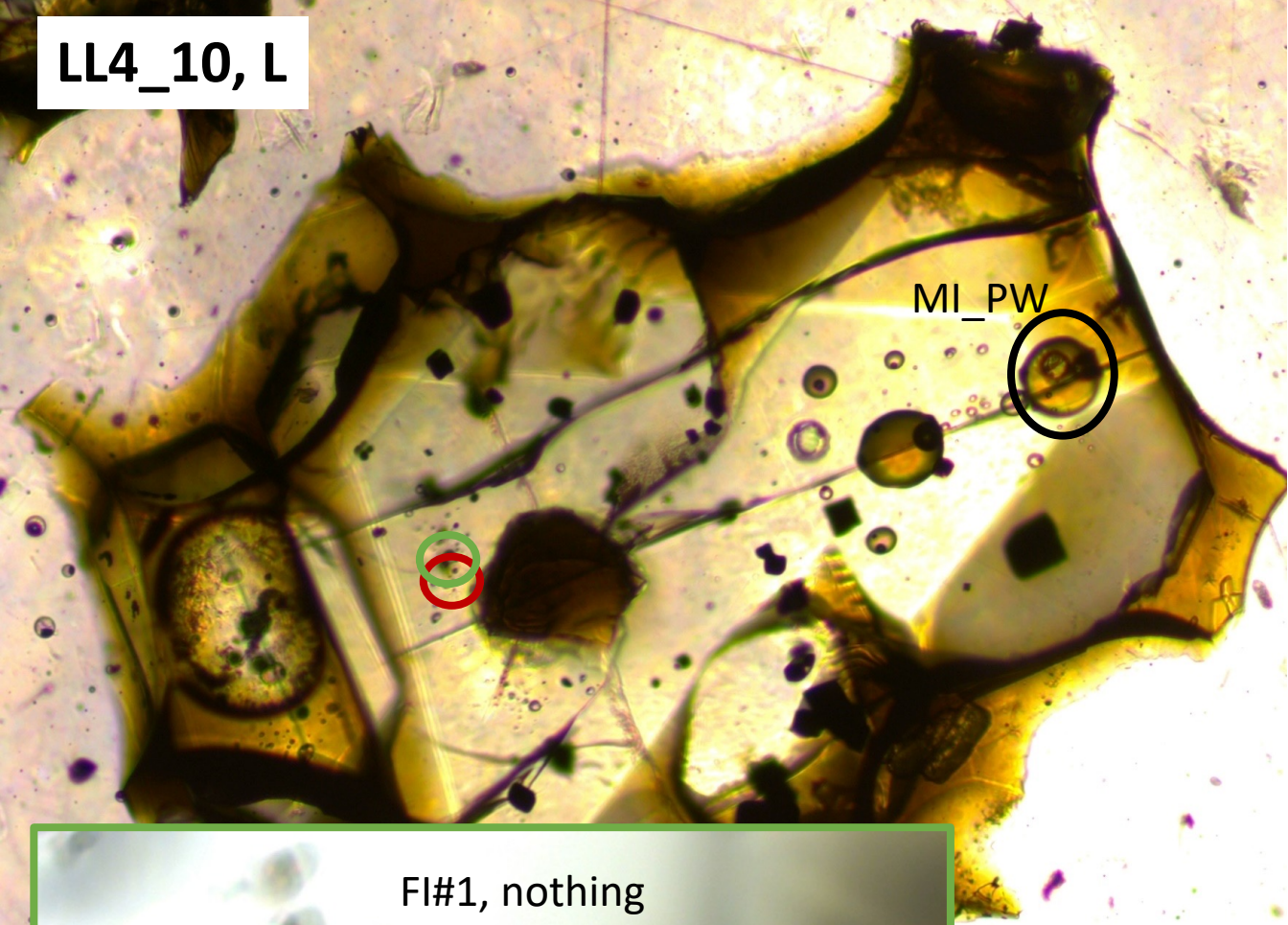
UR

LL4_4, L



This one appears to be a bud, needs more data, also has melt.

LL4_10, L



MI_PW

FI#1, nothing

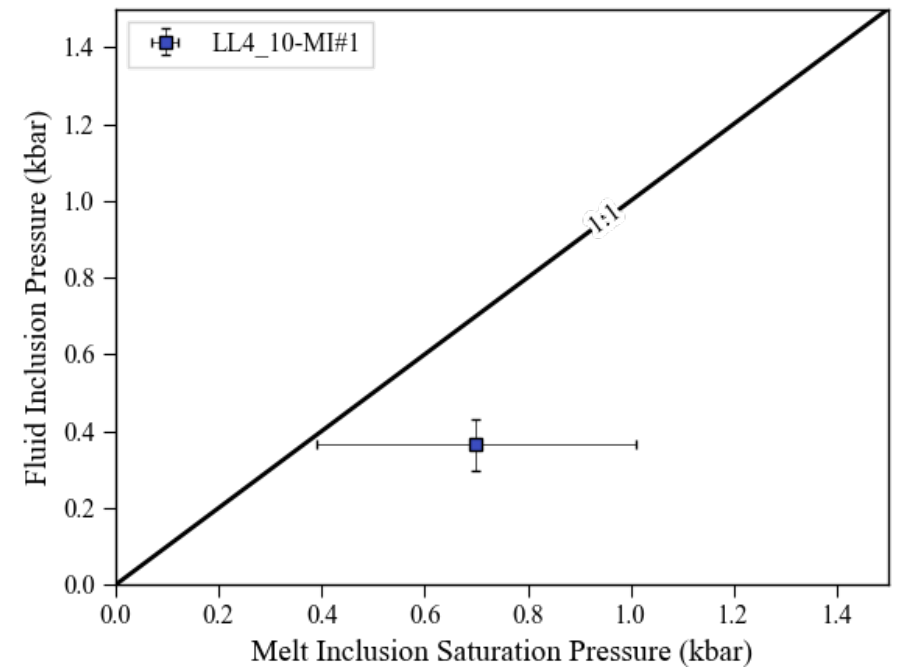


It has melt, but it could be related to the decrepitation of the big MI

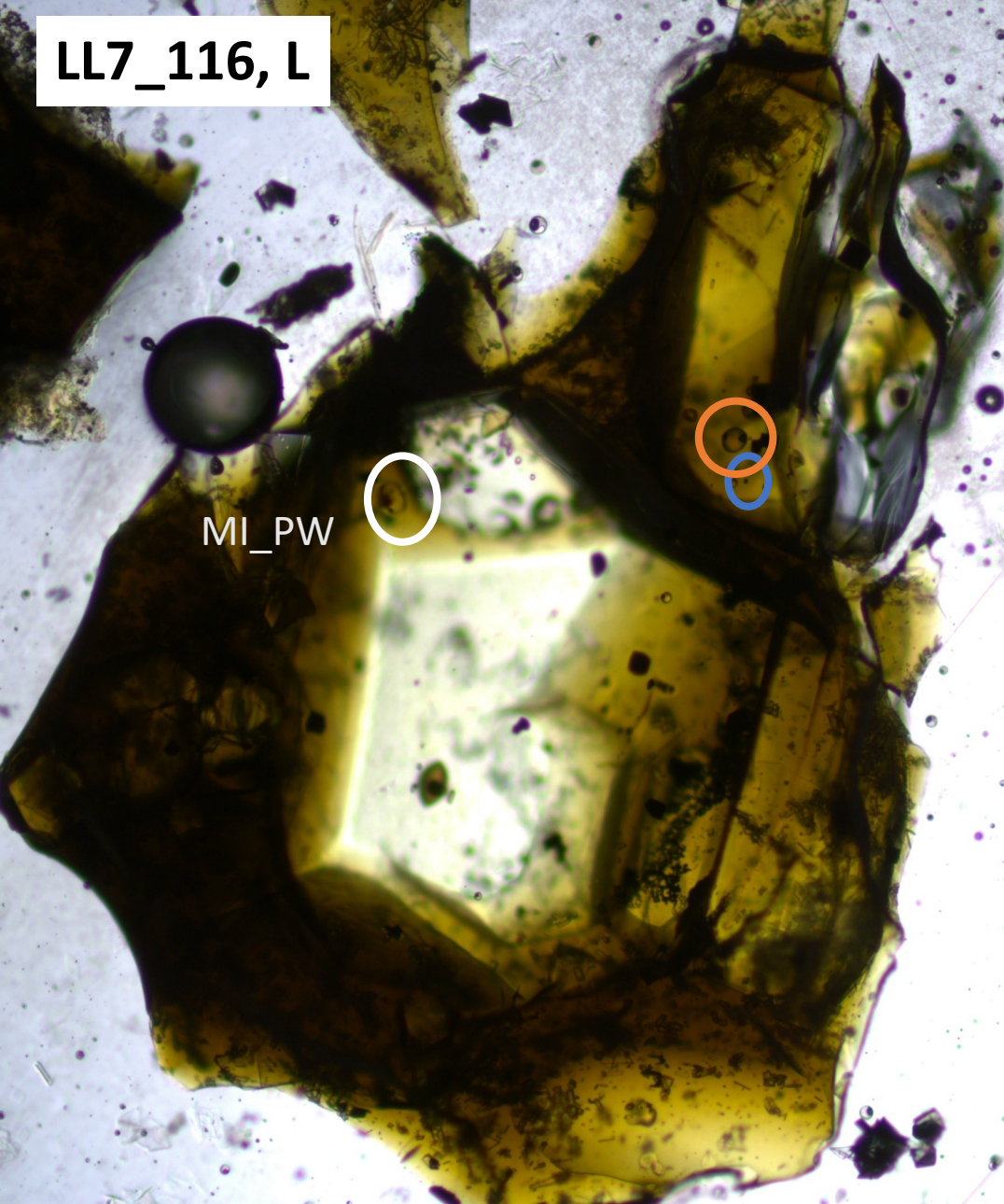


Mi#1, has teeny bit of melt

UR



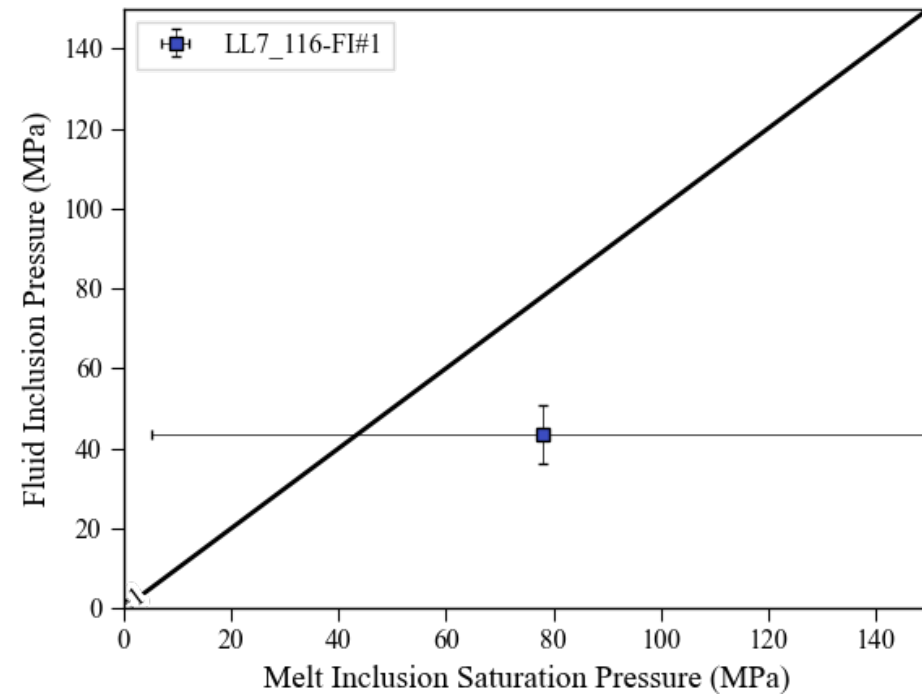
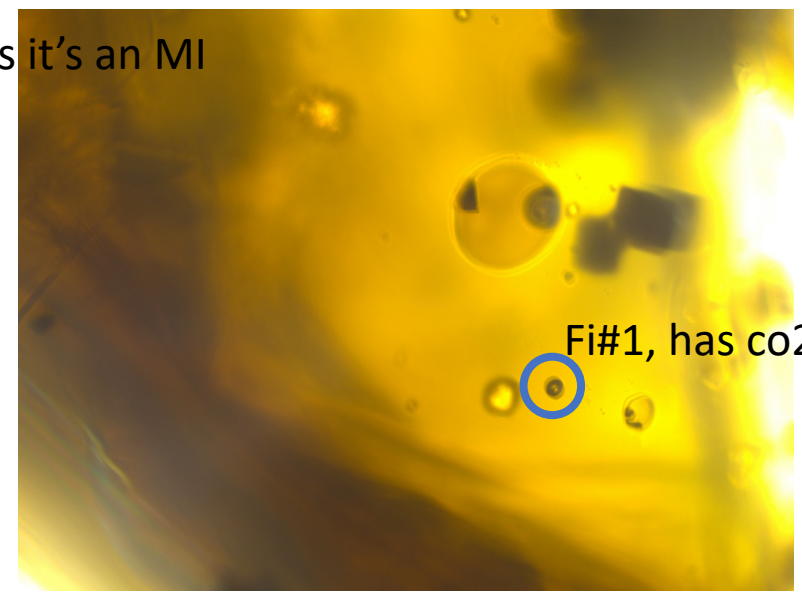
LL7_116, L



MI#1, has co2, excluded as it's an MI



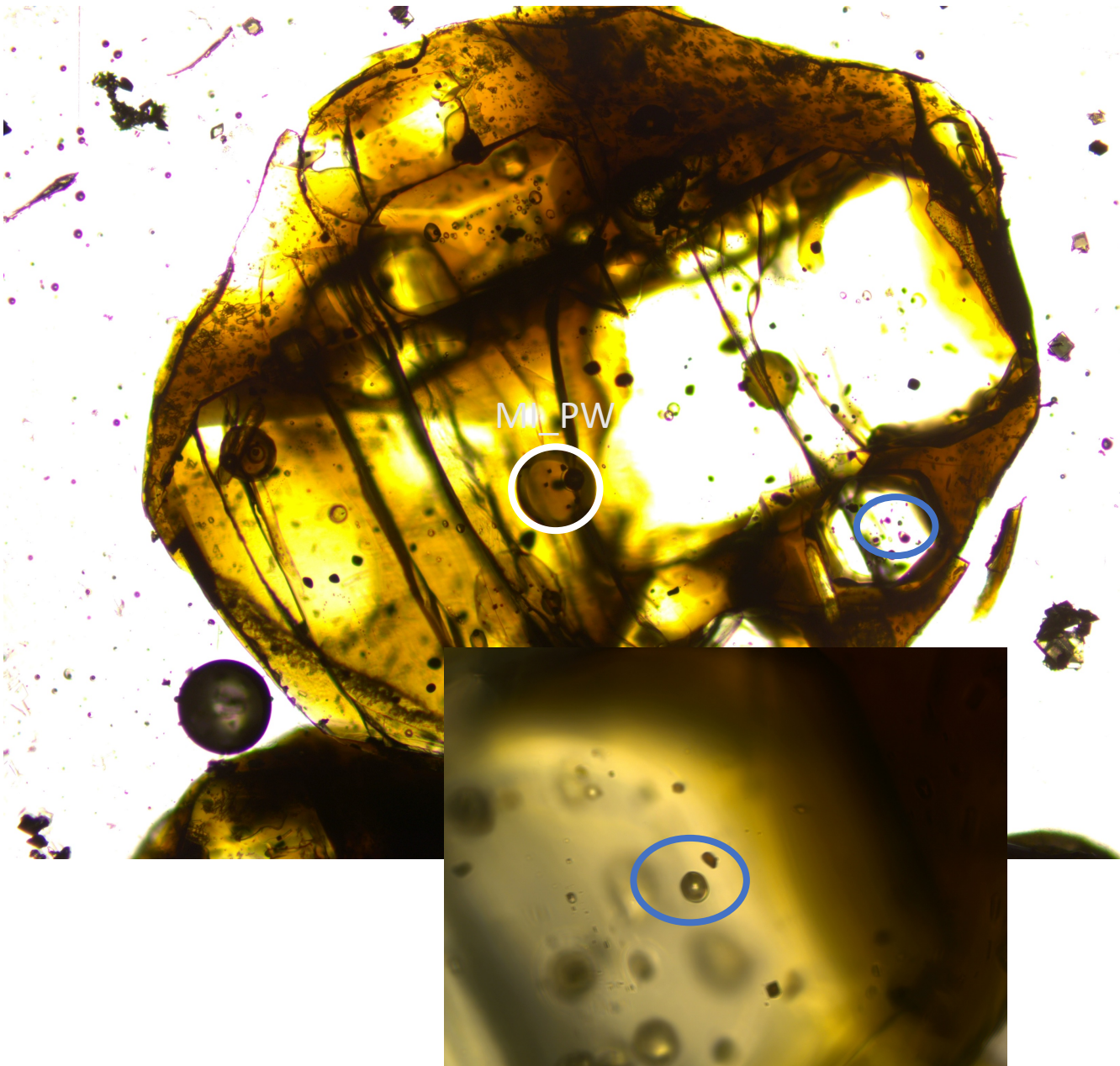
Fi#1, has co2



UR

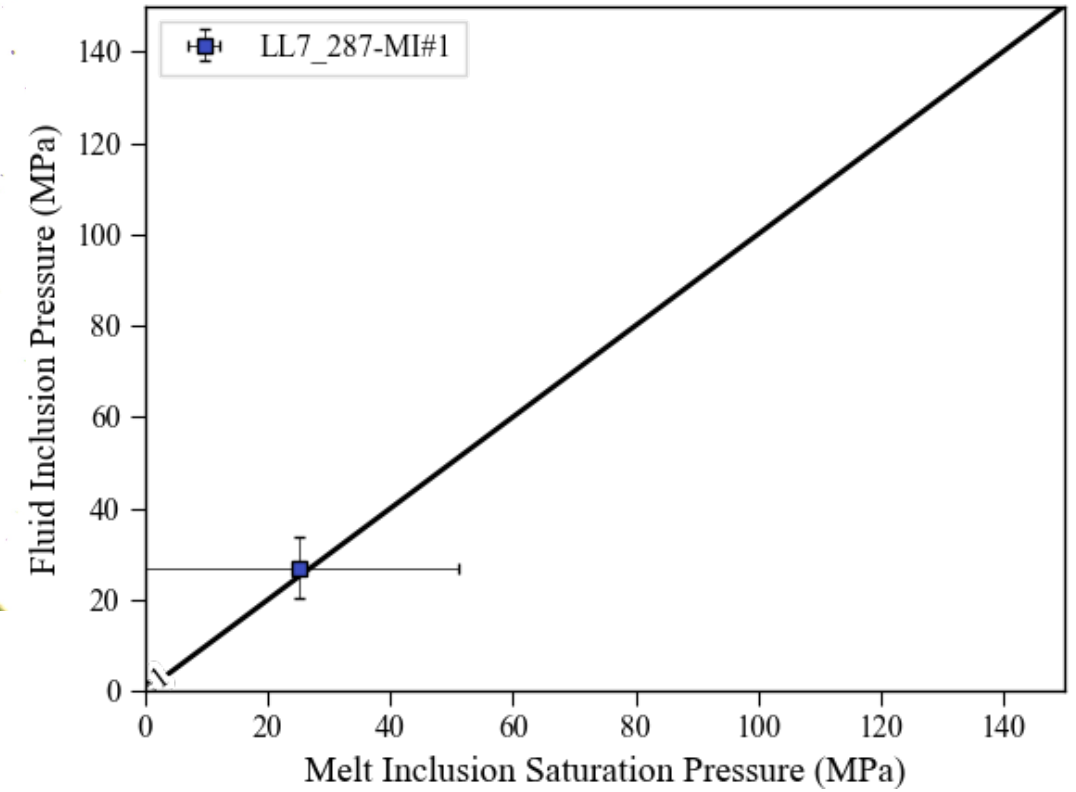
Separate xtal

LL7_287, L



This one is the same, but as in a subxtal it's unrelated and not comparable, it could be the MI lost pressure at the pressure at which this one was trapped.

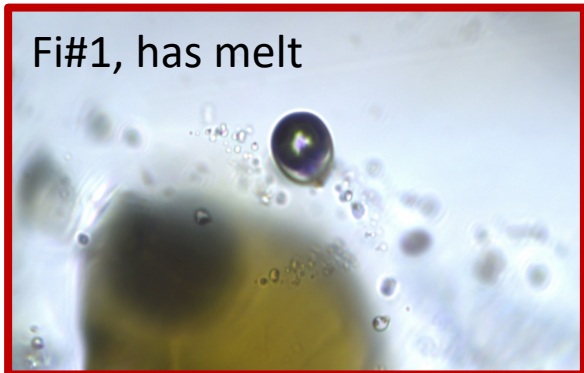
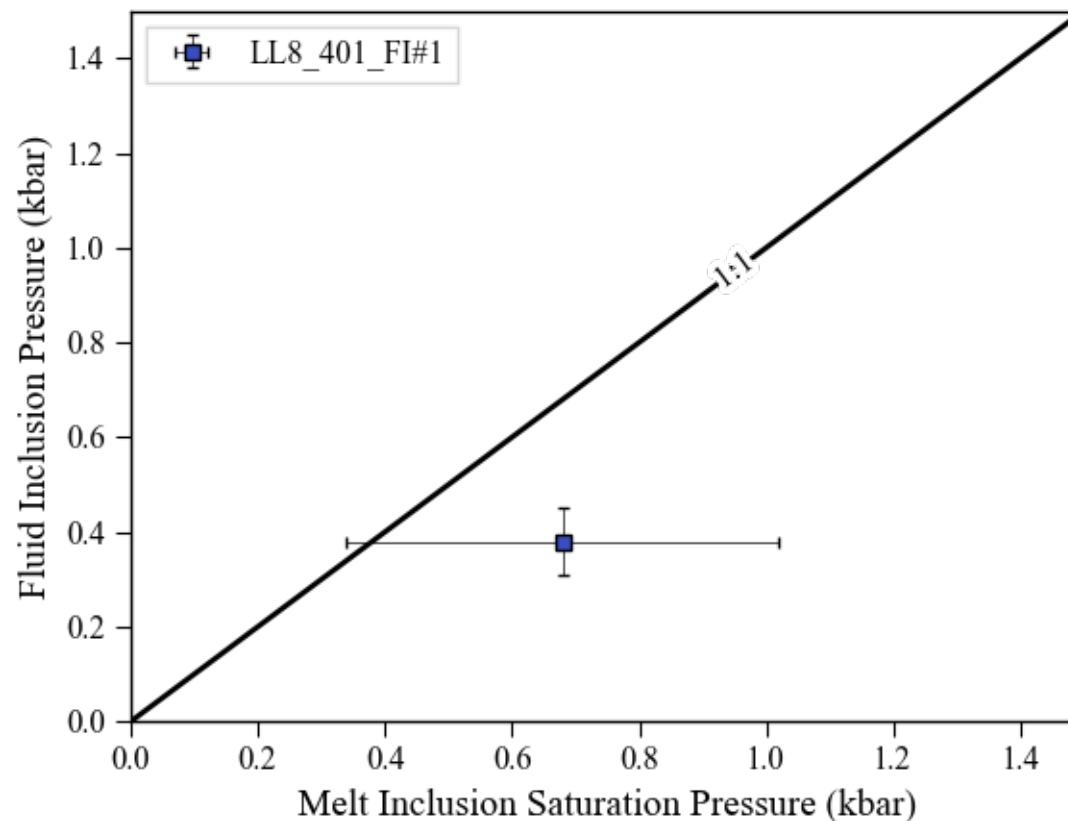
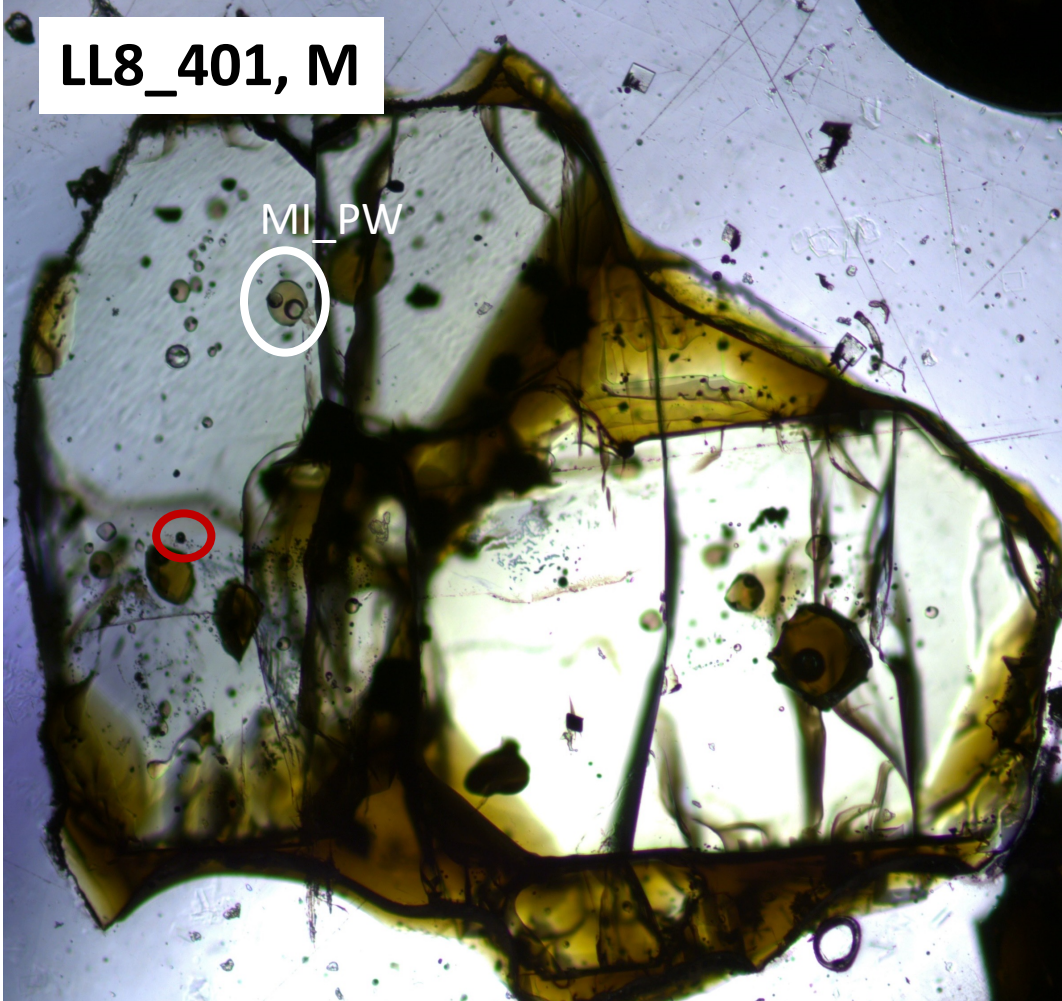
UR



MI#1, in small Xtal, has teensy bit of melt

LL8_401, M

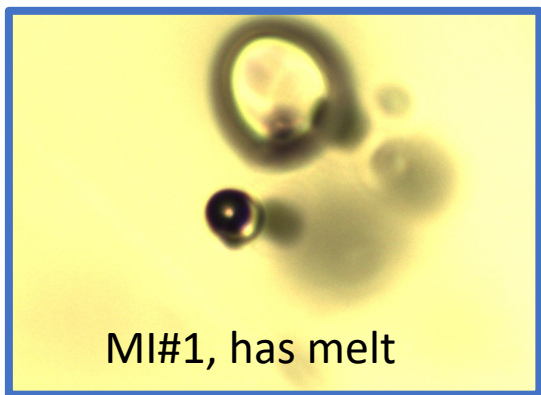
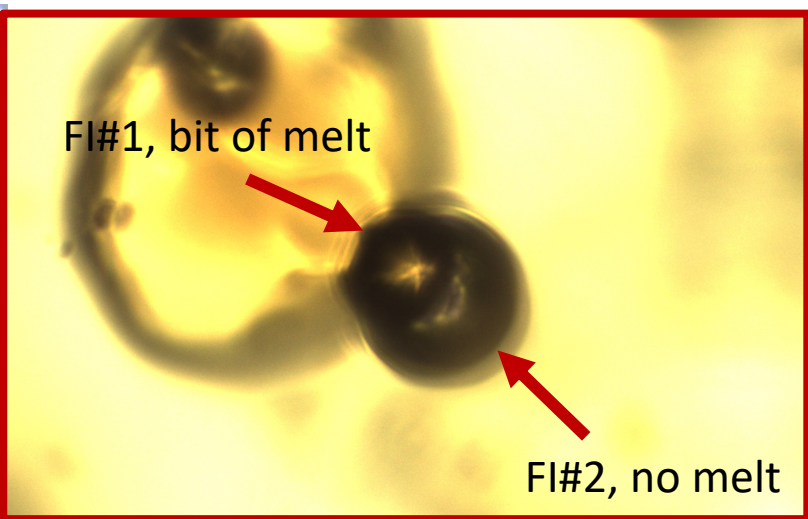
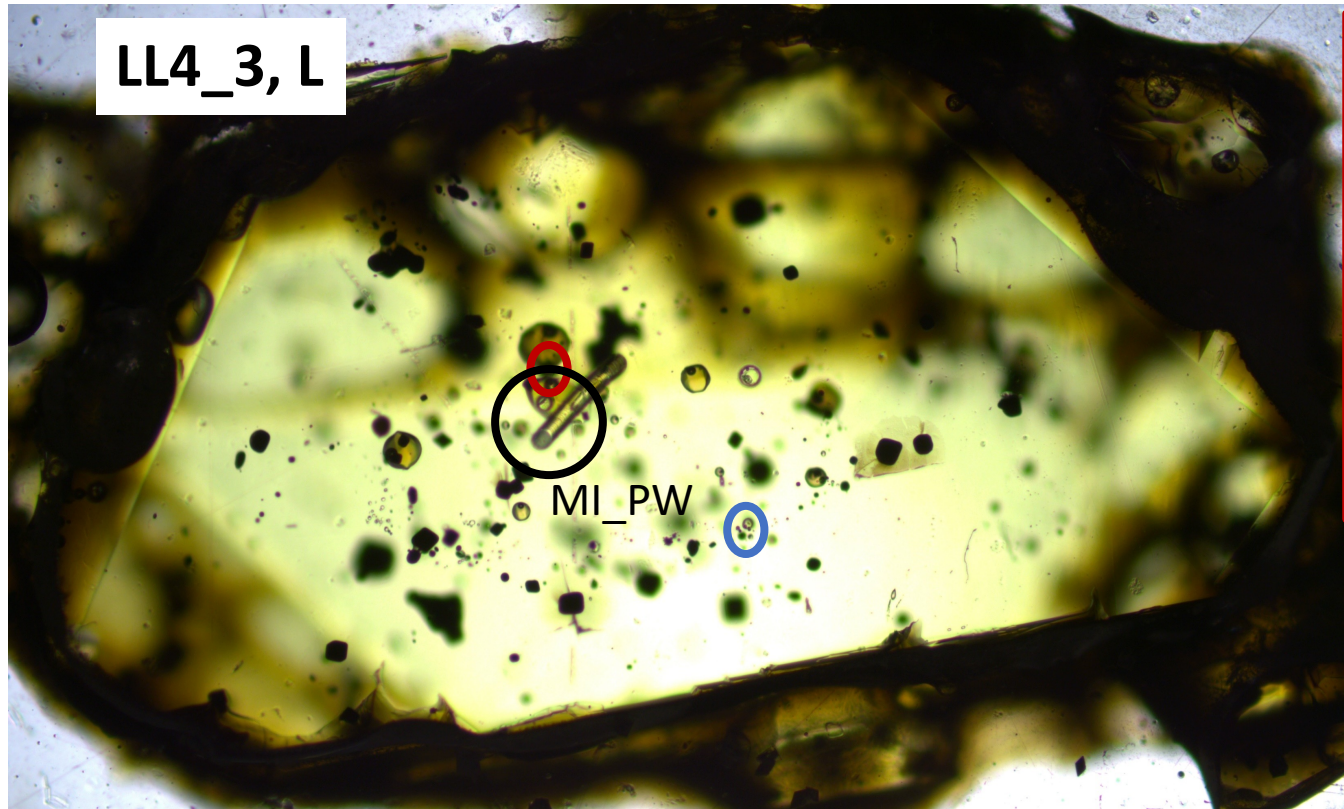
UR



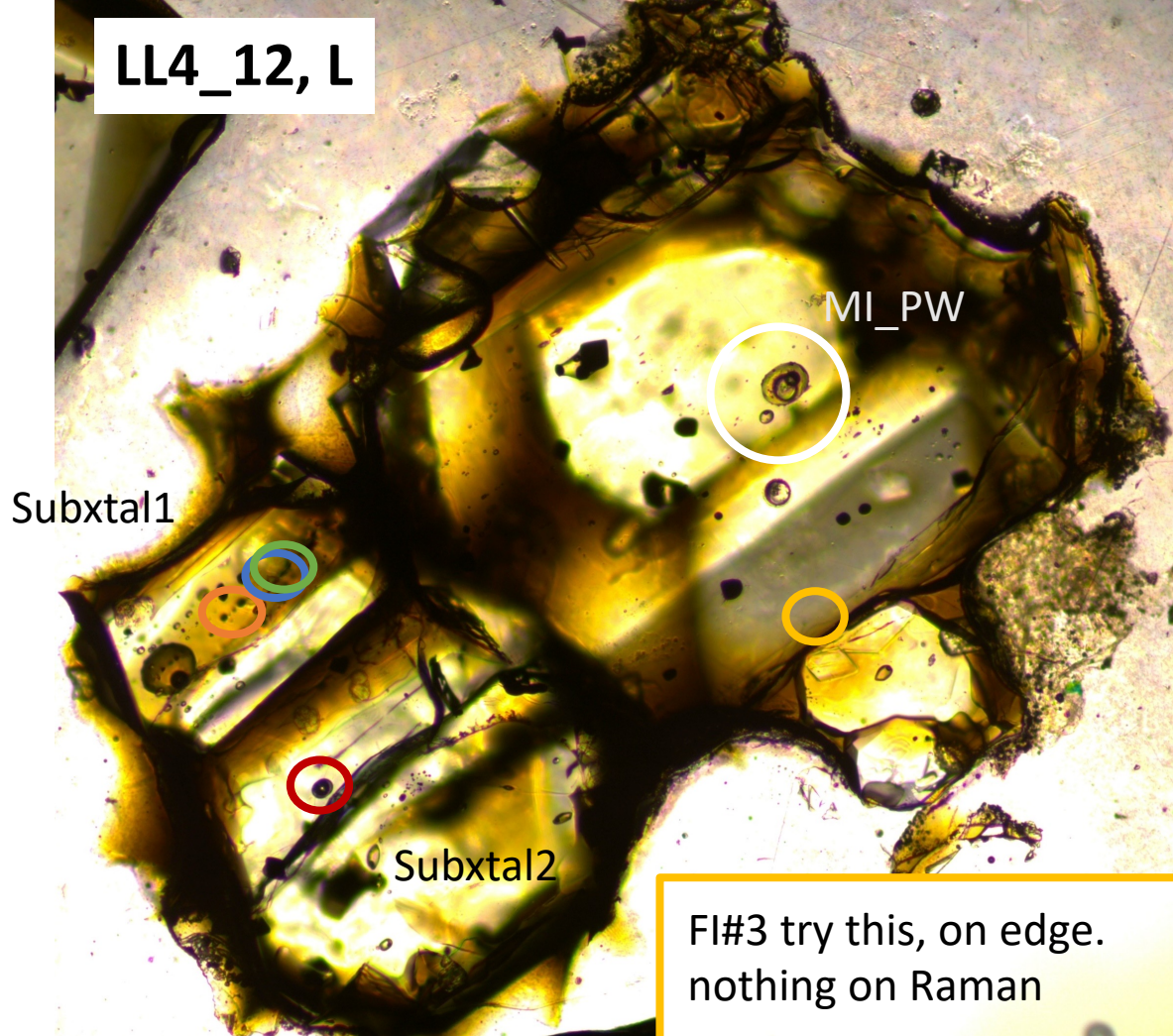
Unclear if it is in a bud or same crystal, may also be related to larger MI around it. Has teensy bit of melt

**This section depicts fluid inclusions with variable amounts of silicate melt attached,
For more information consult the supplementary information section 4.**

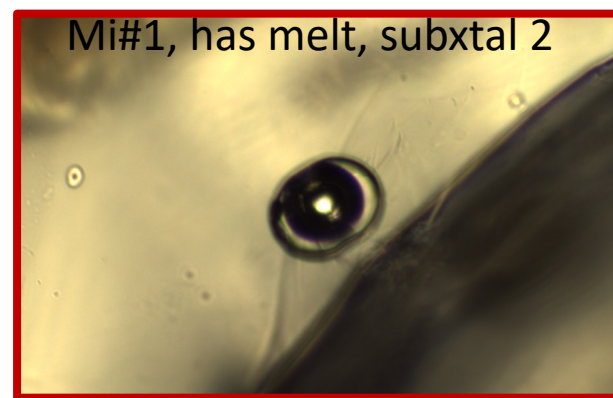
LL4_3, L



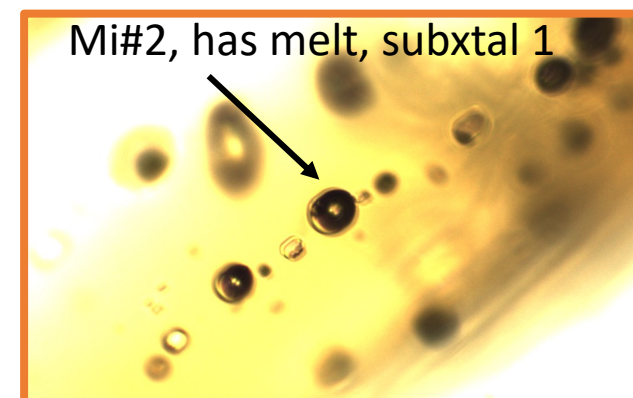
LL4_12, L



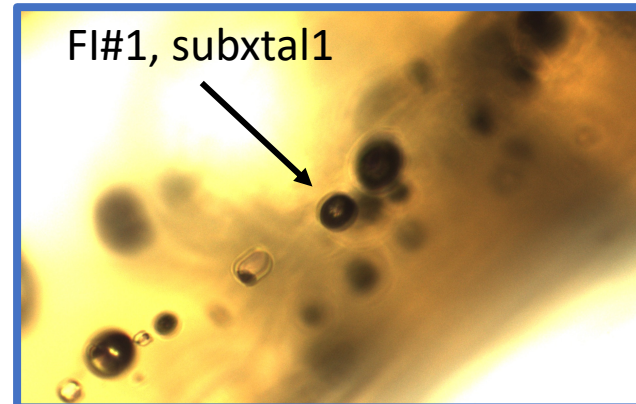
Mi#1, has melt, subxtal 2



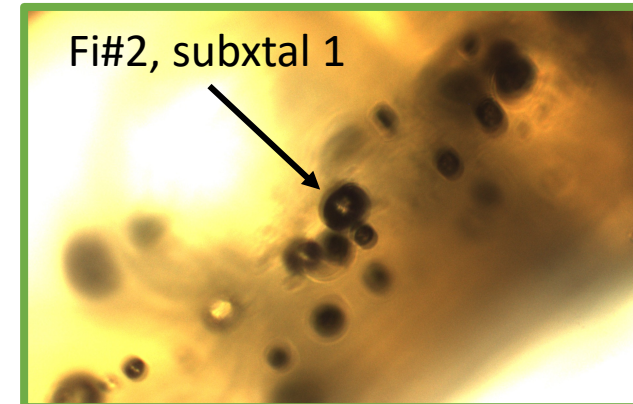
Mi#2, has melt, subxtal 1



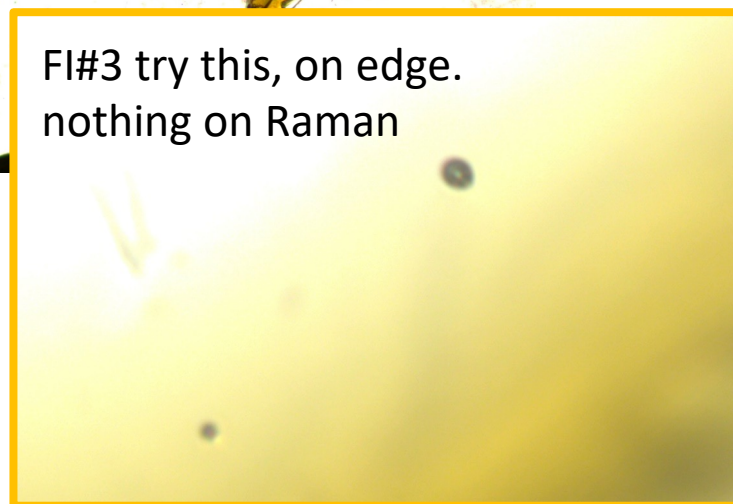
Fi#1, subxtal1



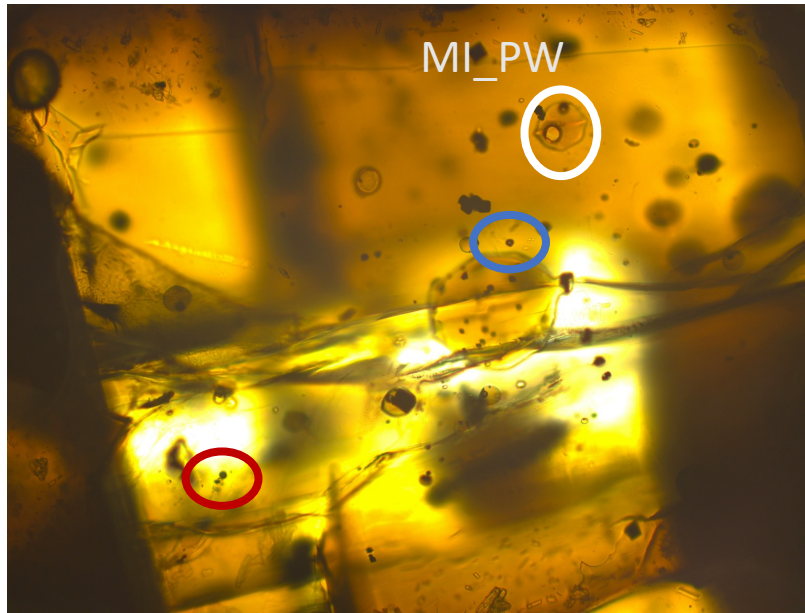
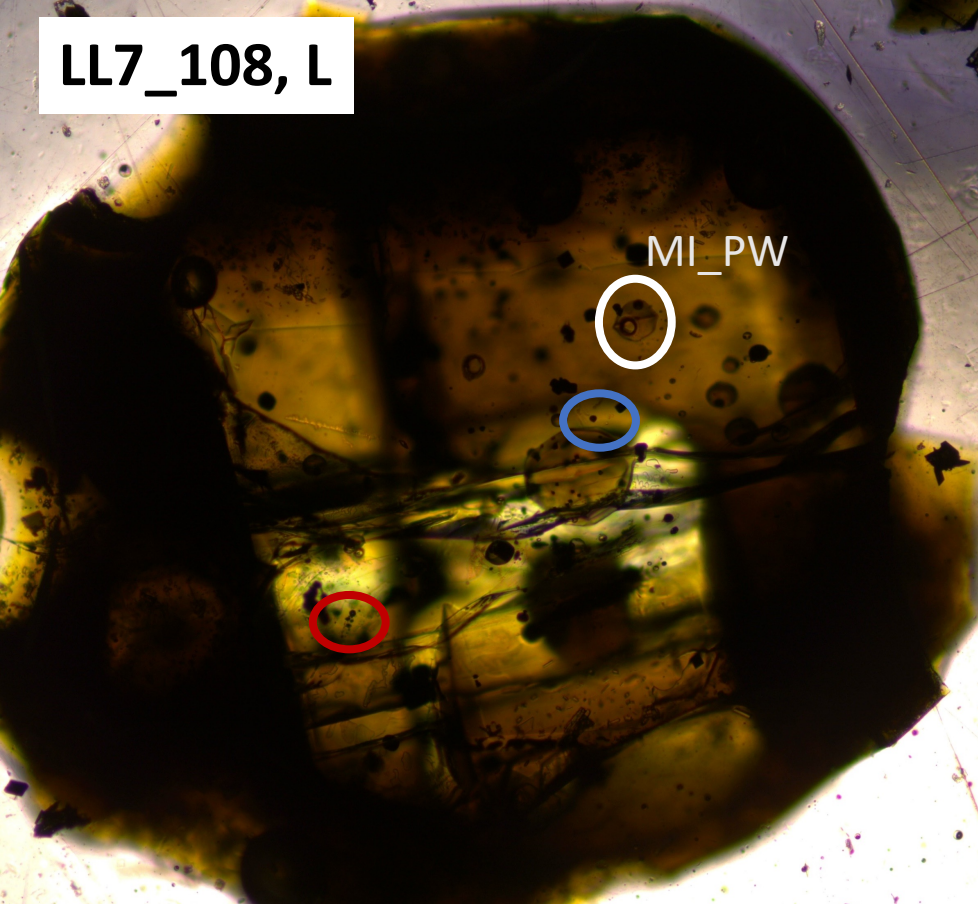
Fi#2, subxtal 1



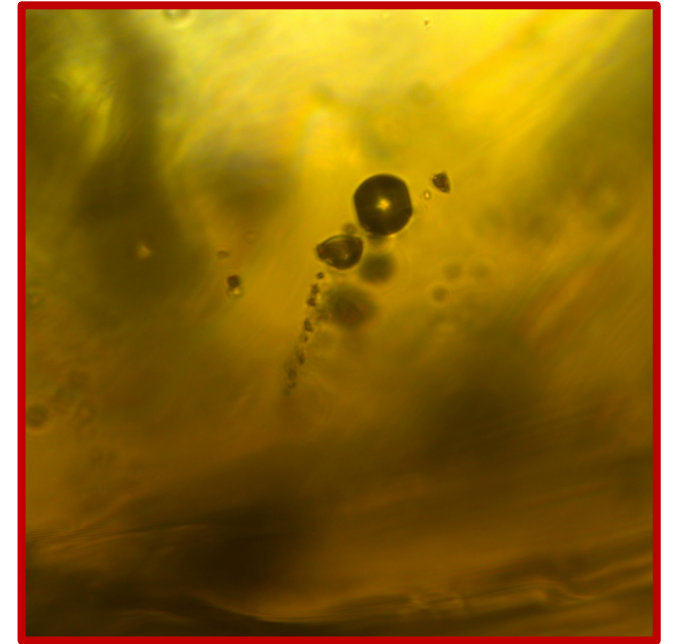
Fi#3 try this, on edge.
nothing on Raman



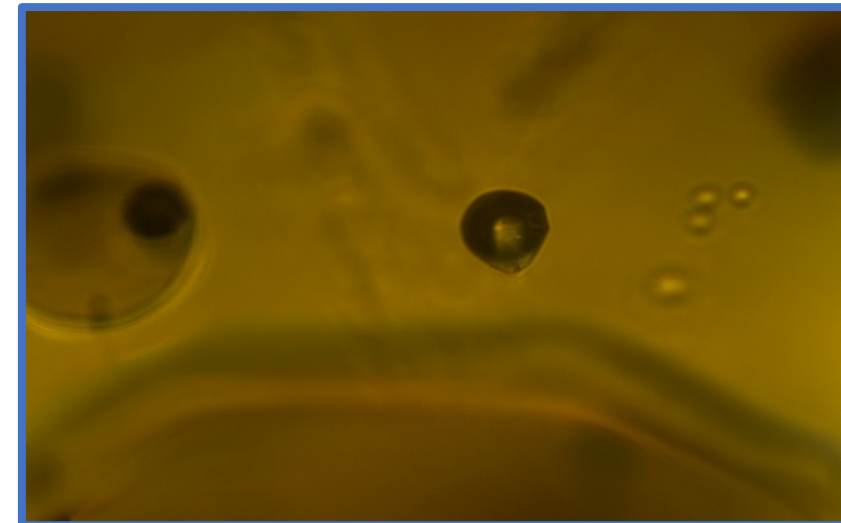
LL7_108, L



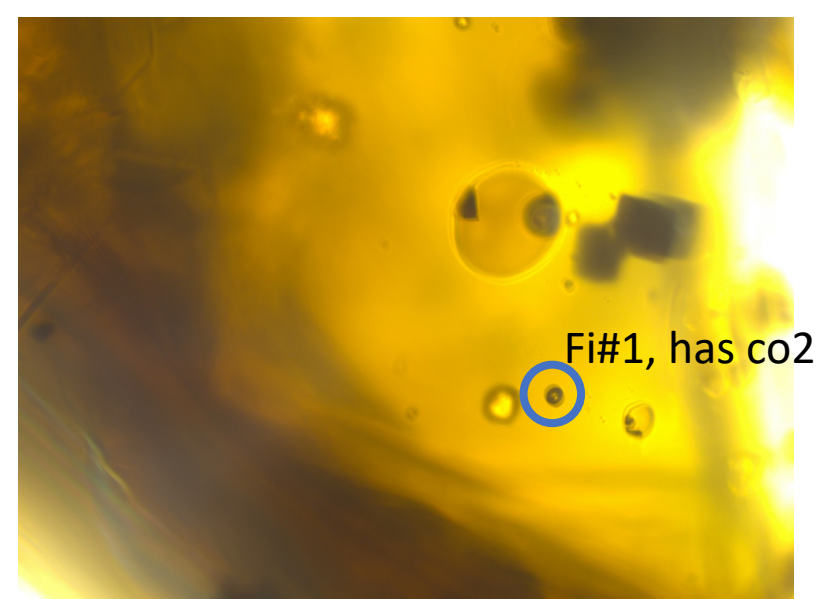
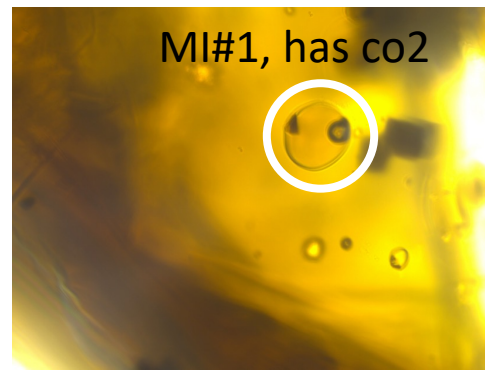
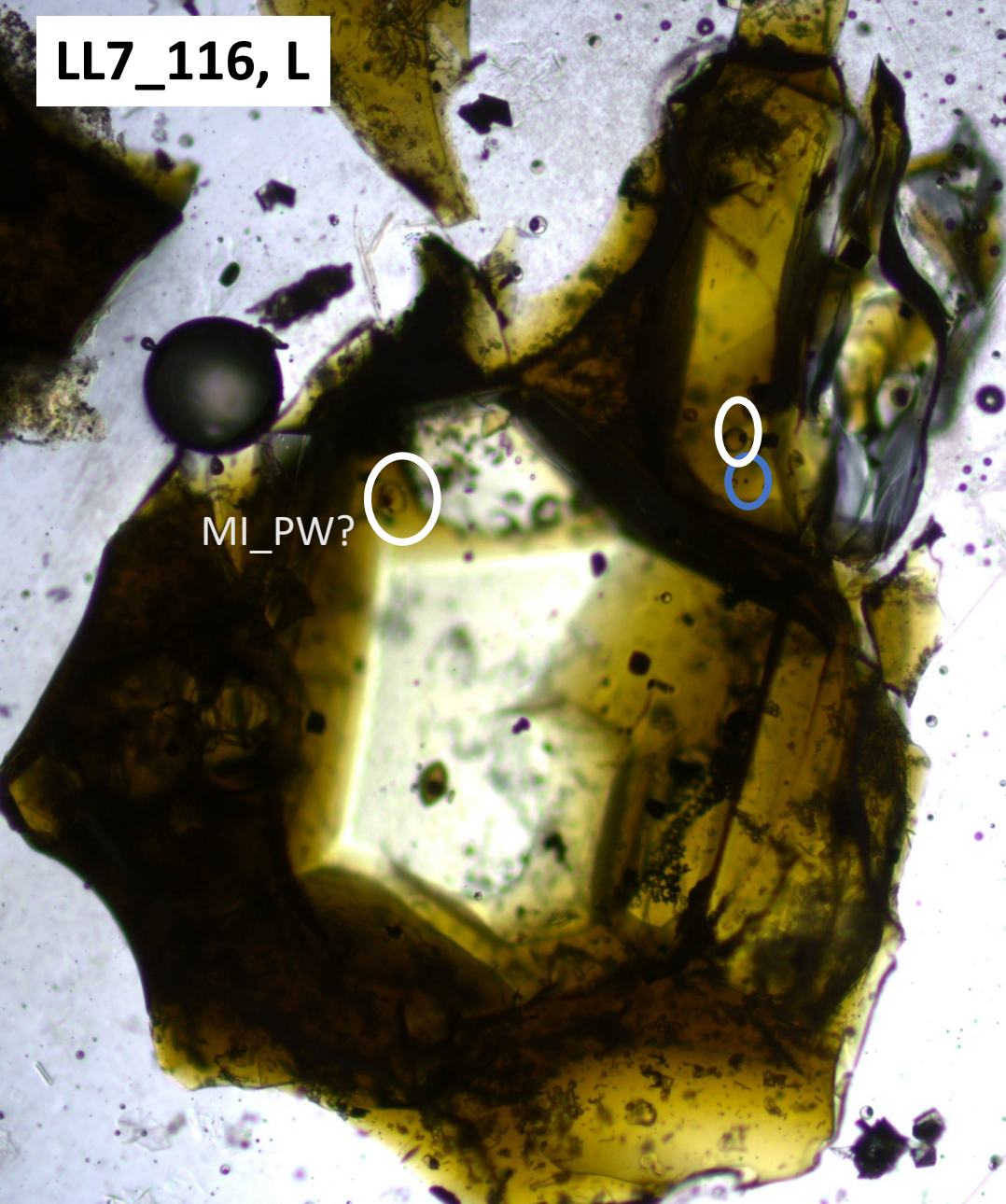
Fi#1, on a trail PS?



Fi#2, Same xtal, on edge

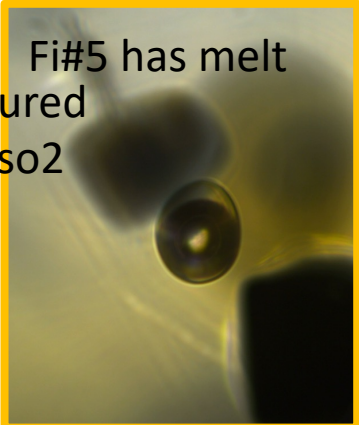
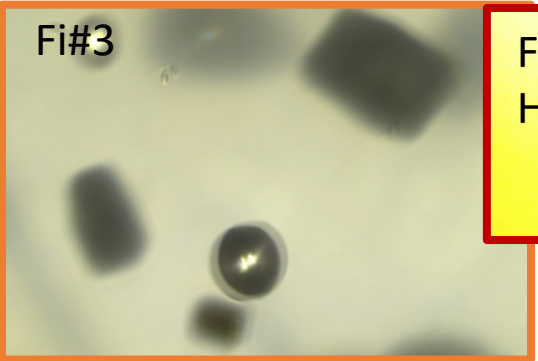
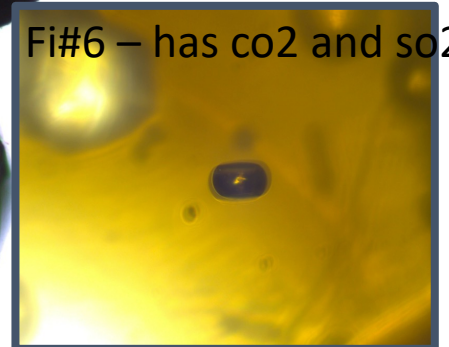
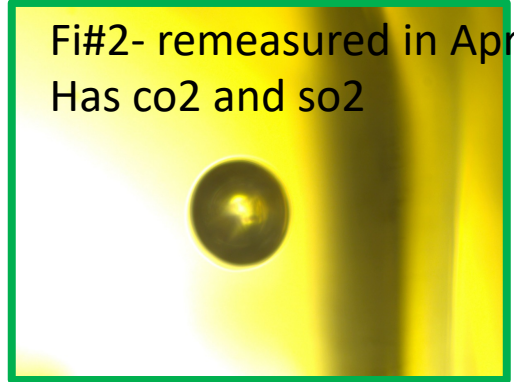
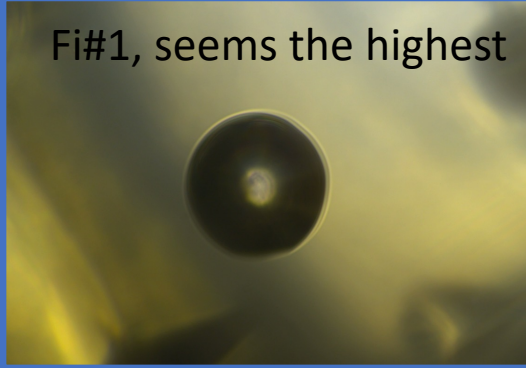
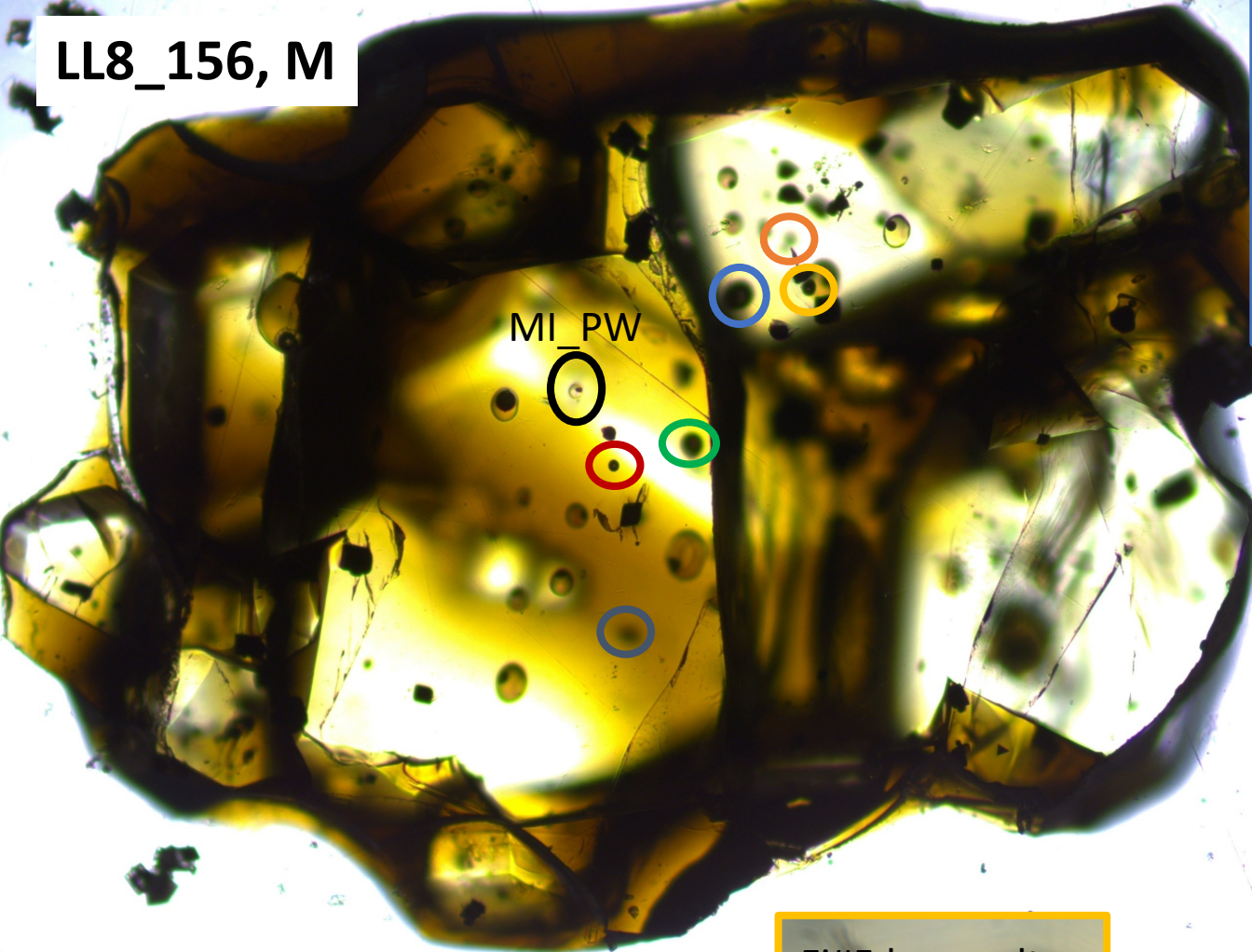


LL7_116, L

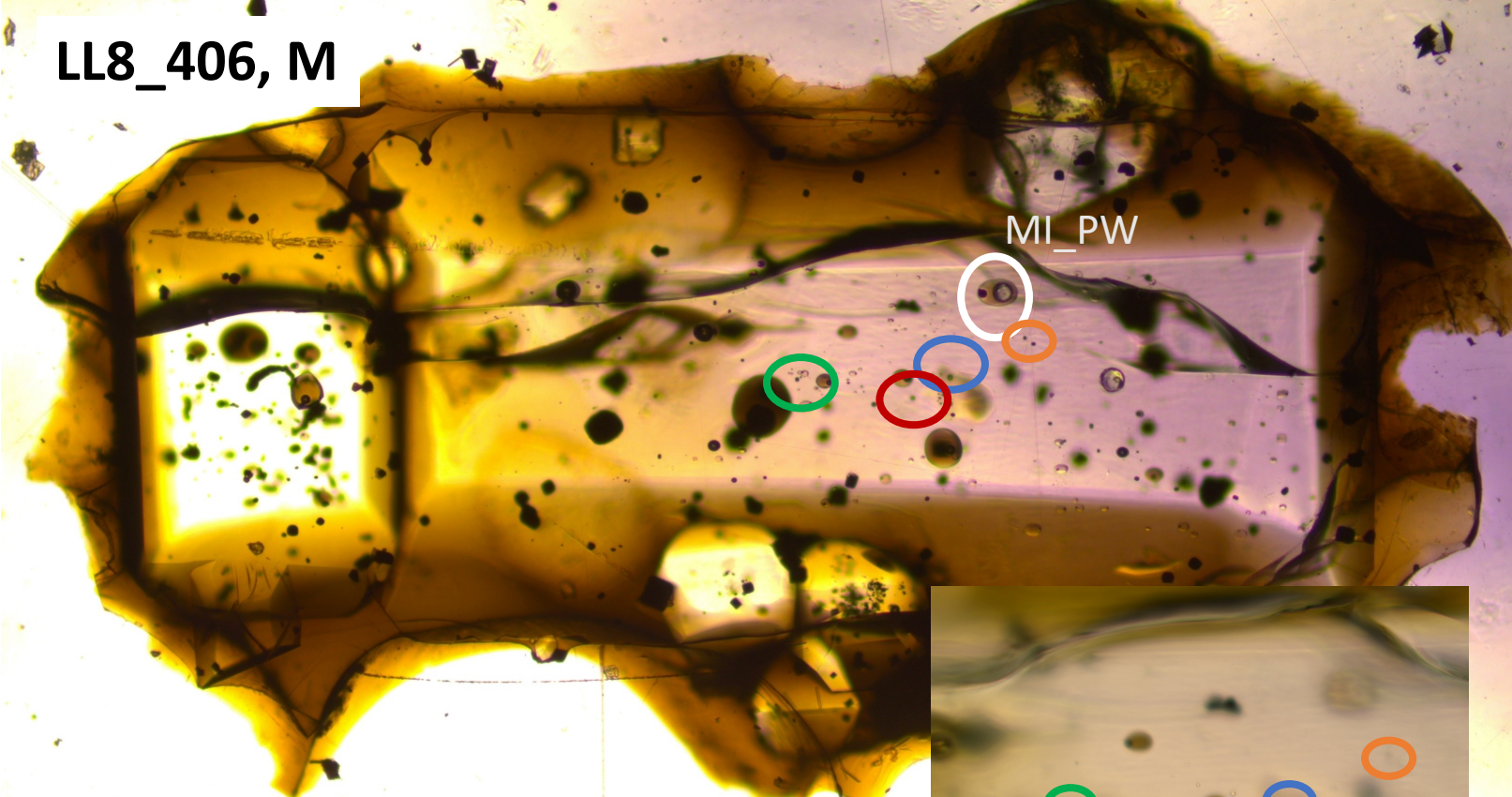


Separate xtal, but the FI and MI in same crystal, so could try the PEC thing

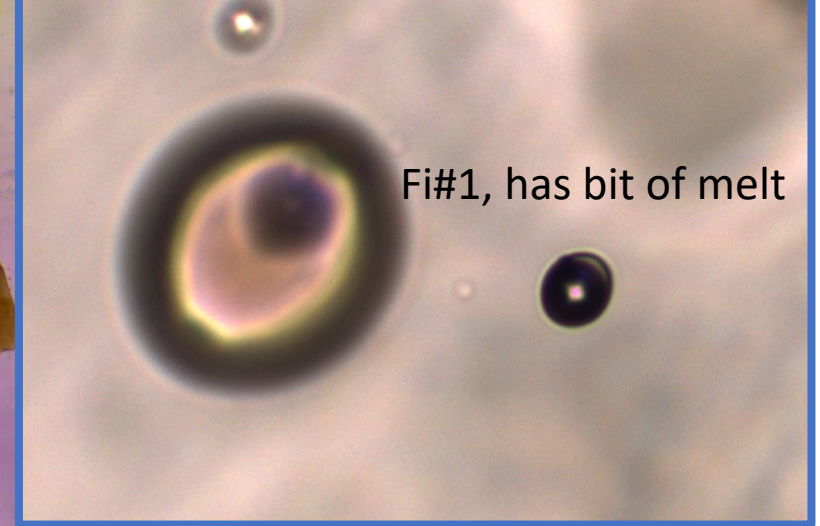
LL8_156, M



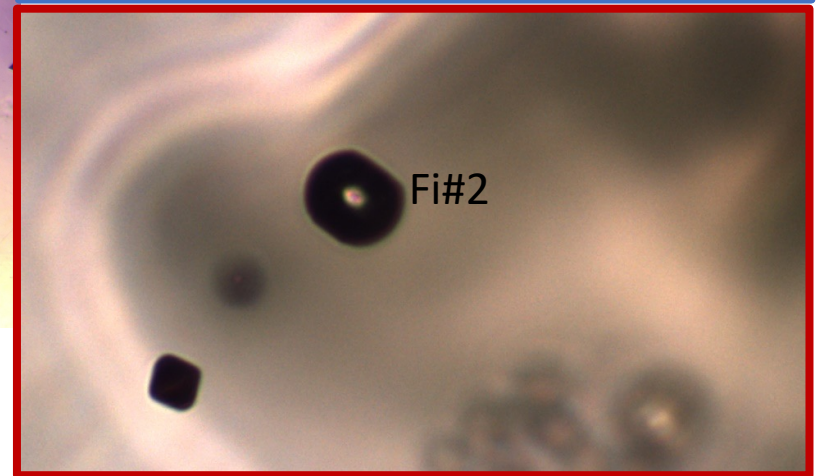
LL8_406, M



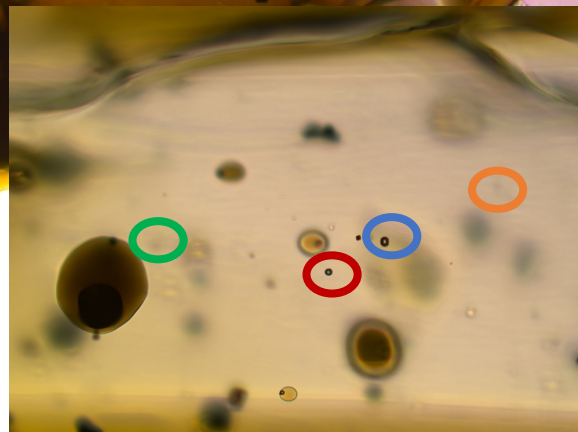
MI_PW



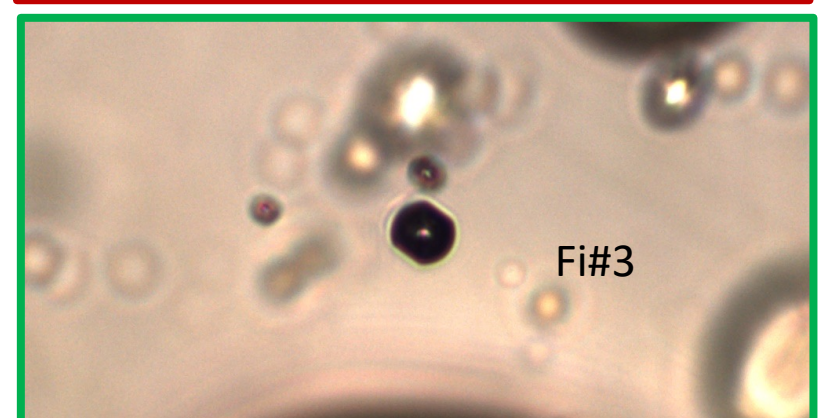
Fi#1, has bit of melt



Fi#2

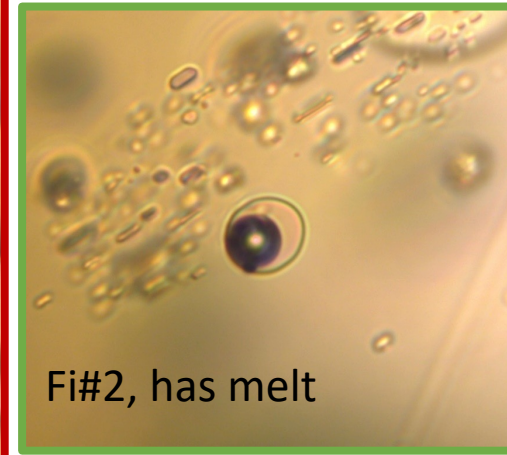
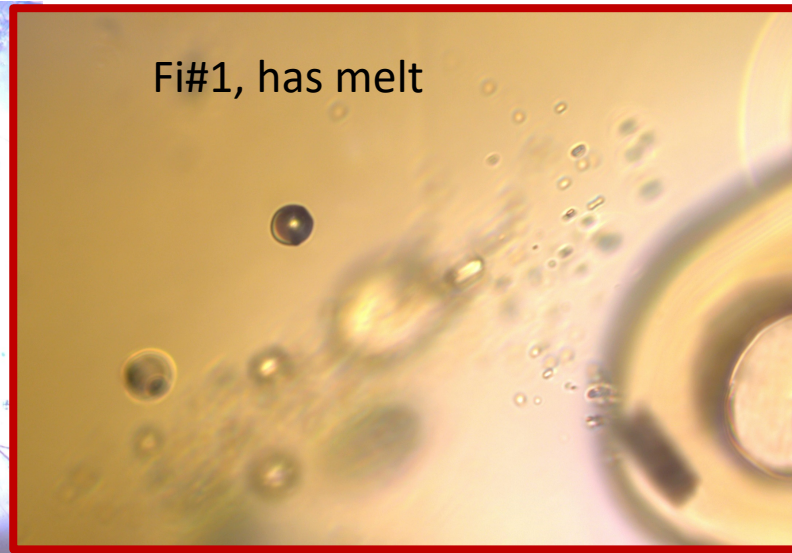
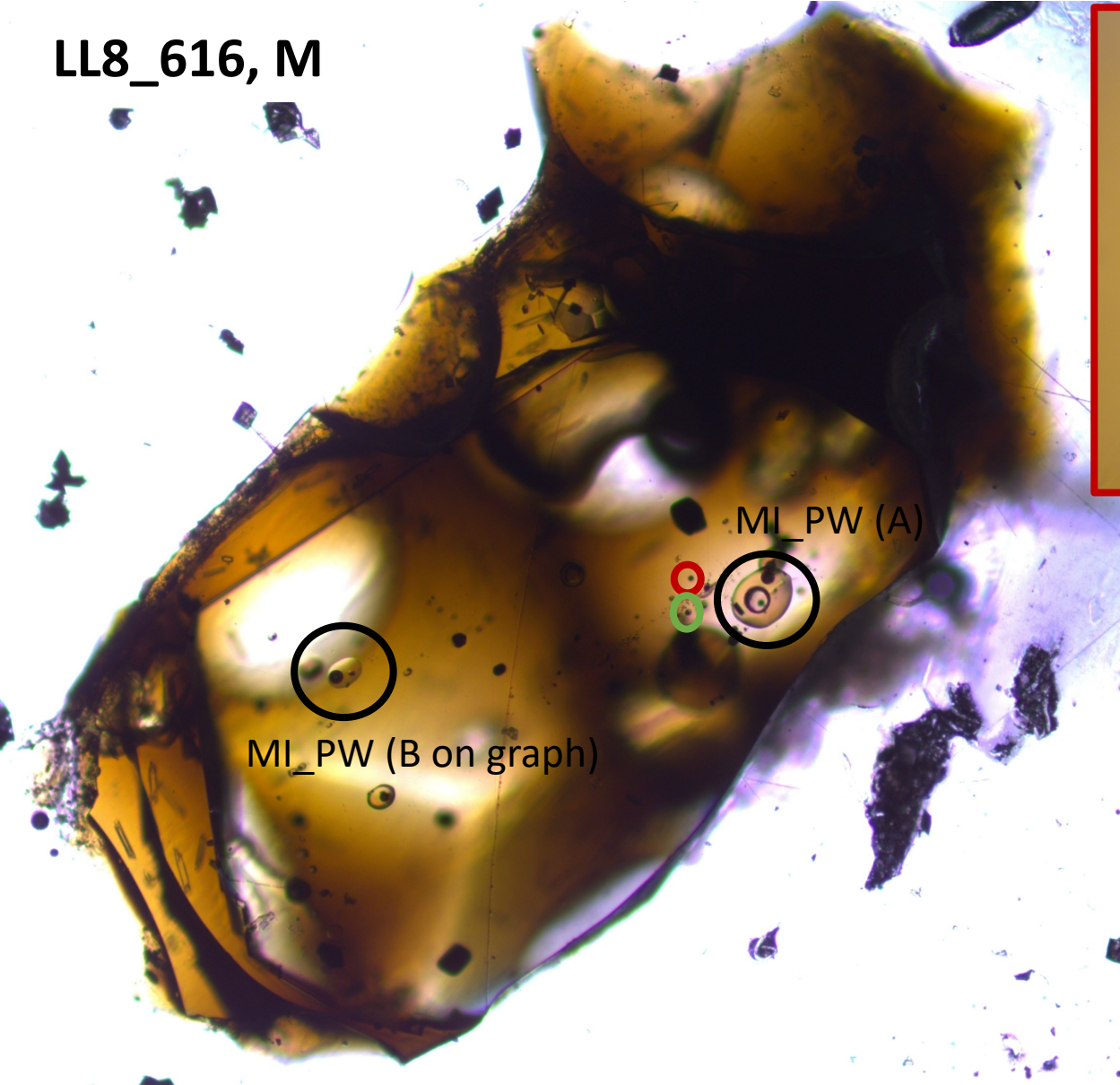


Fi#4, has co2 but weak

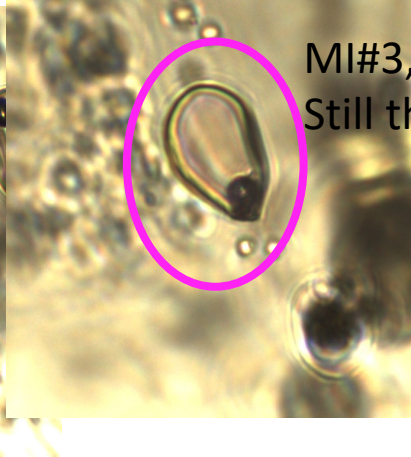
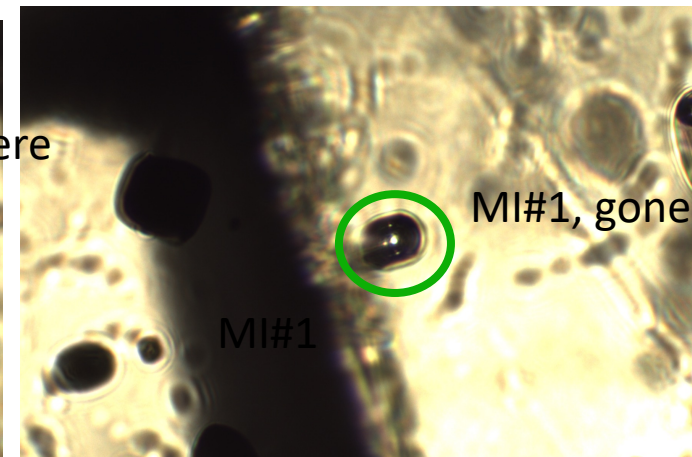
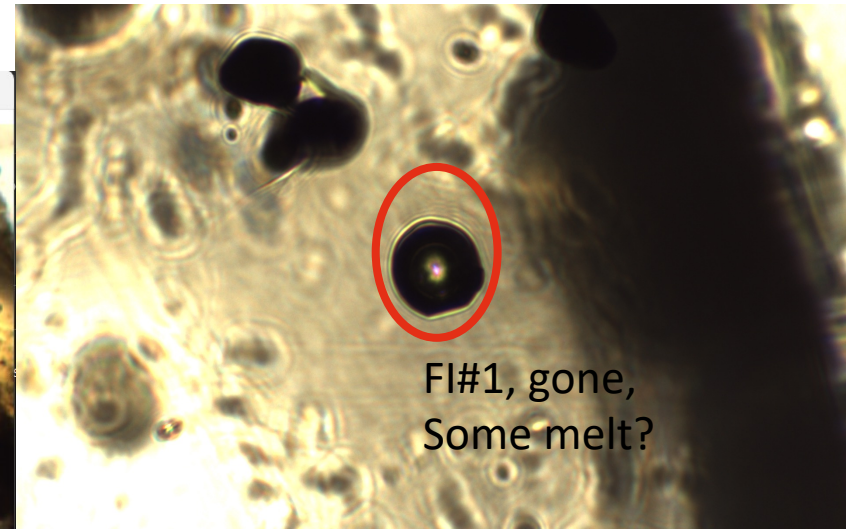
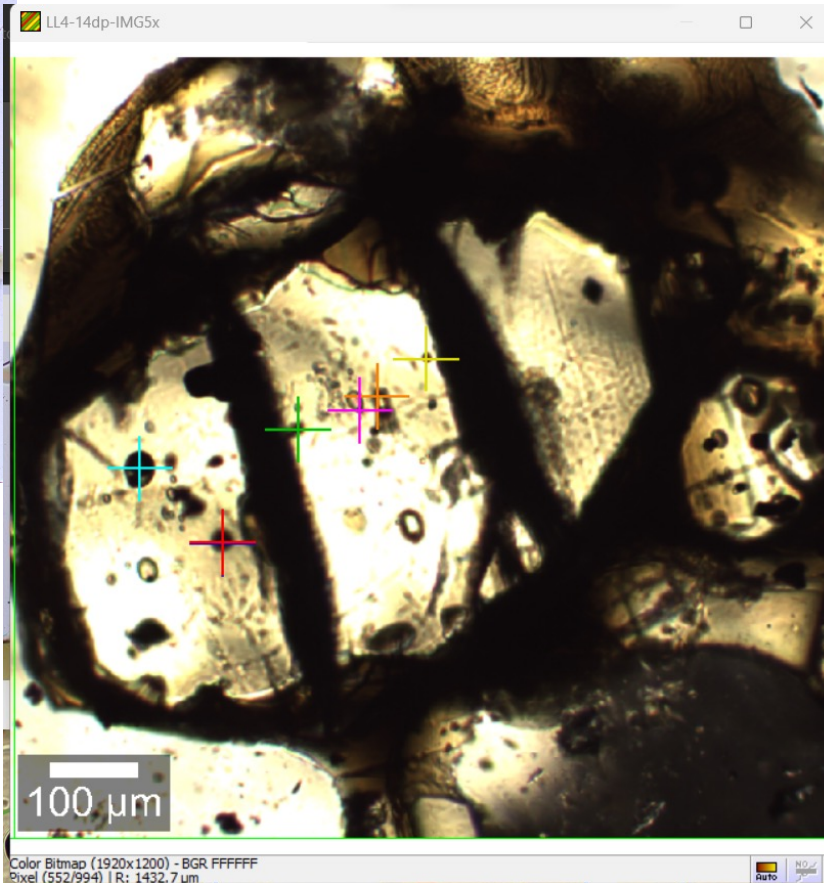
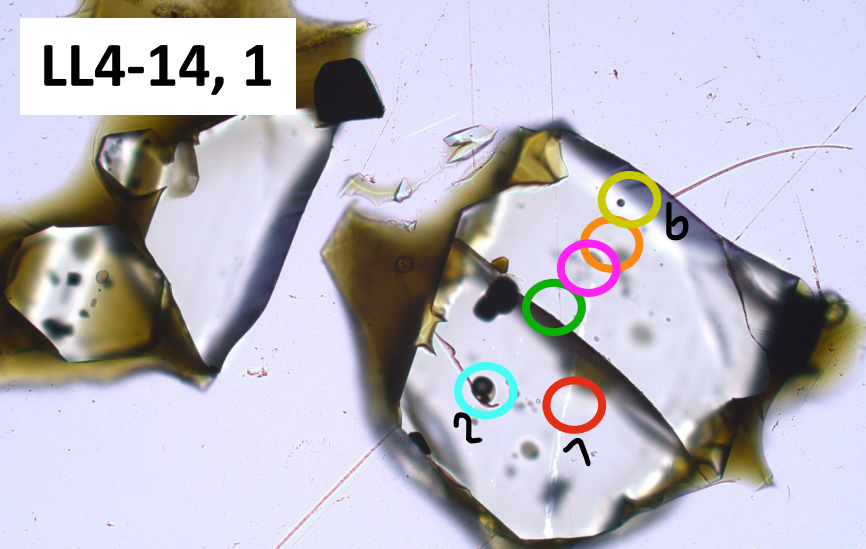


Fi#3

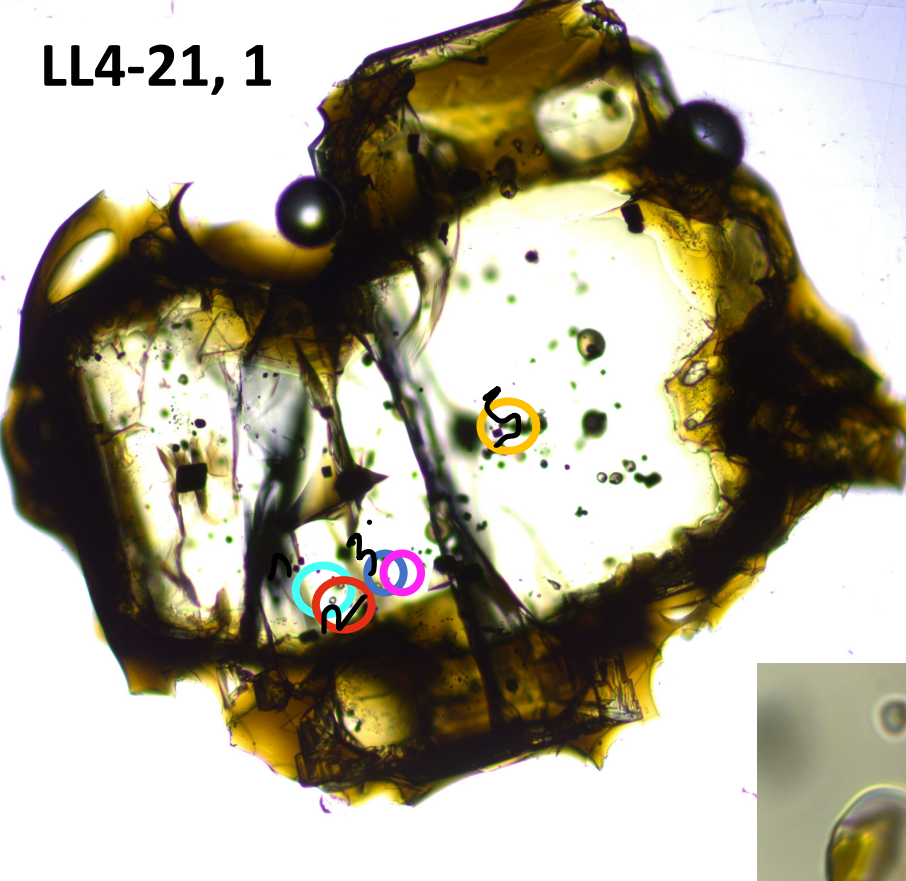
LL8_616, M



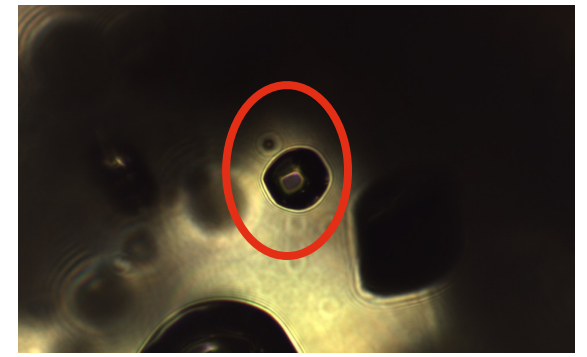
LL4-14, 1



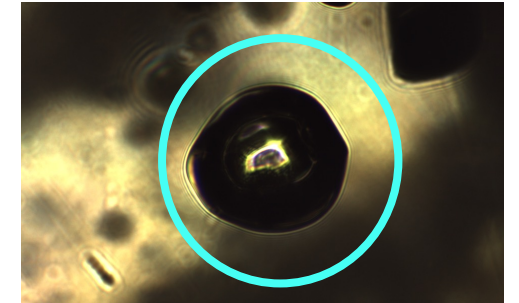
LL4-21, 1



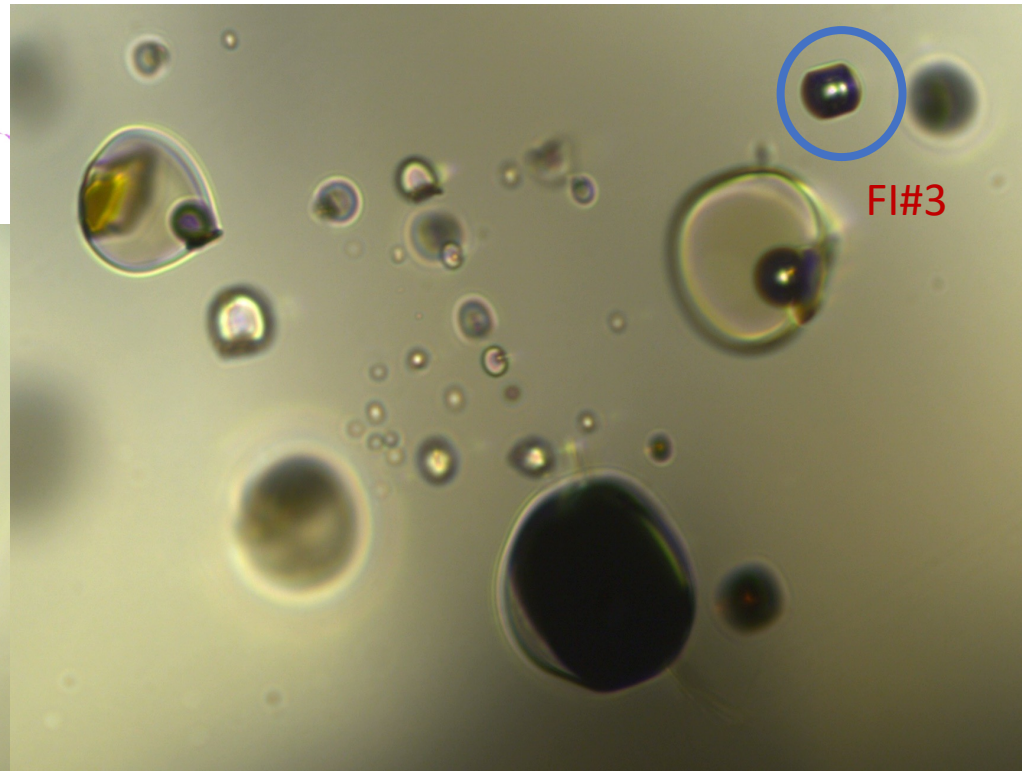
FI#2, gone



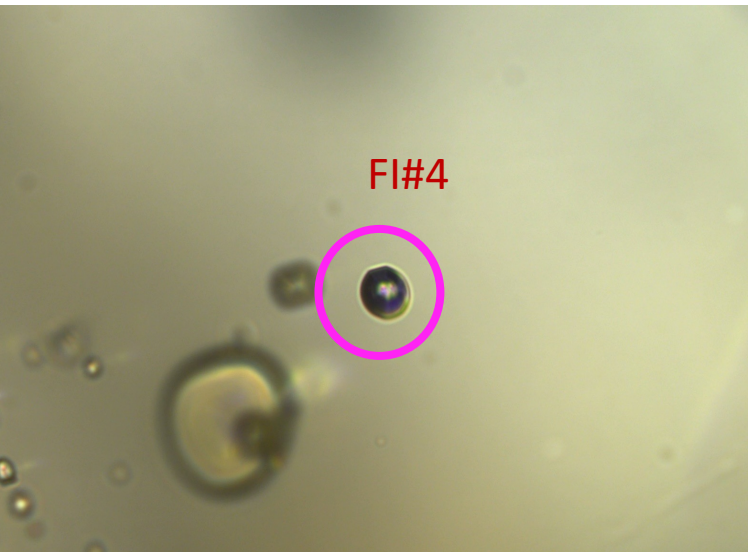
FI#1, gone,
Some melt



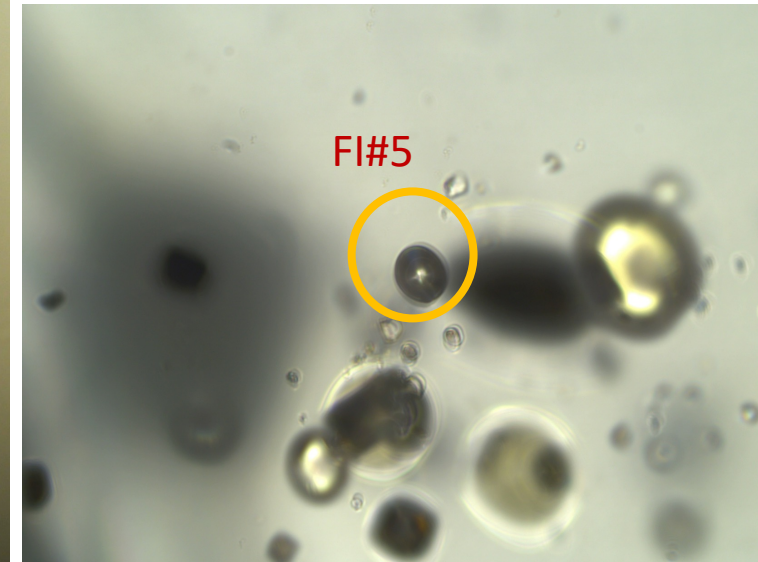
FI#3



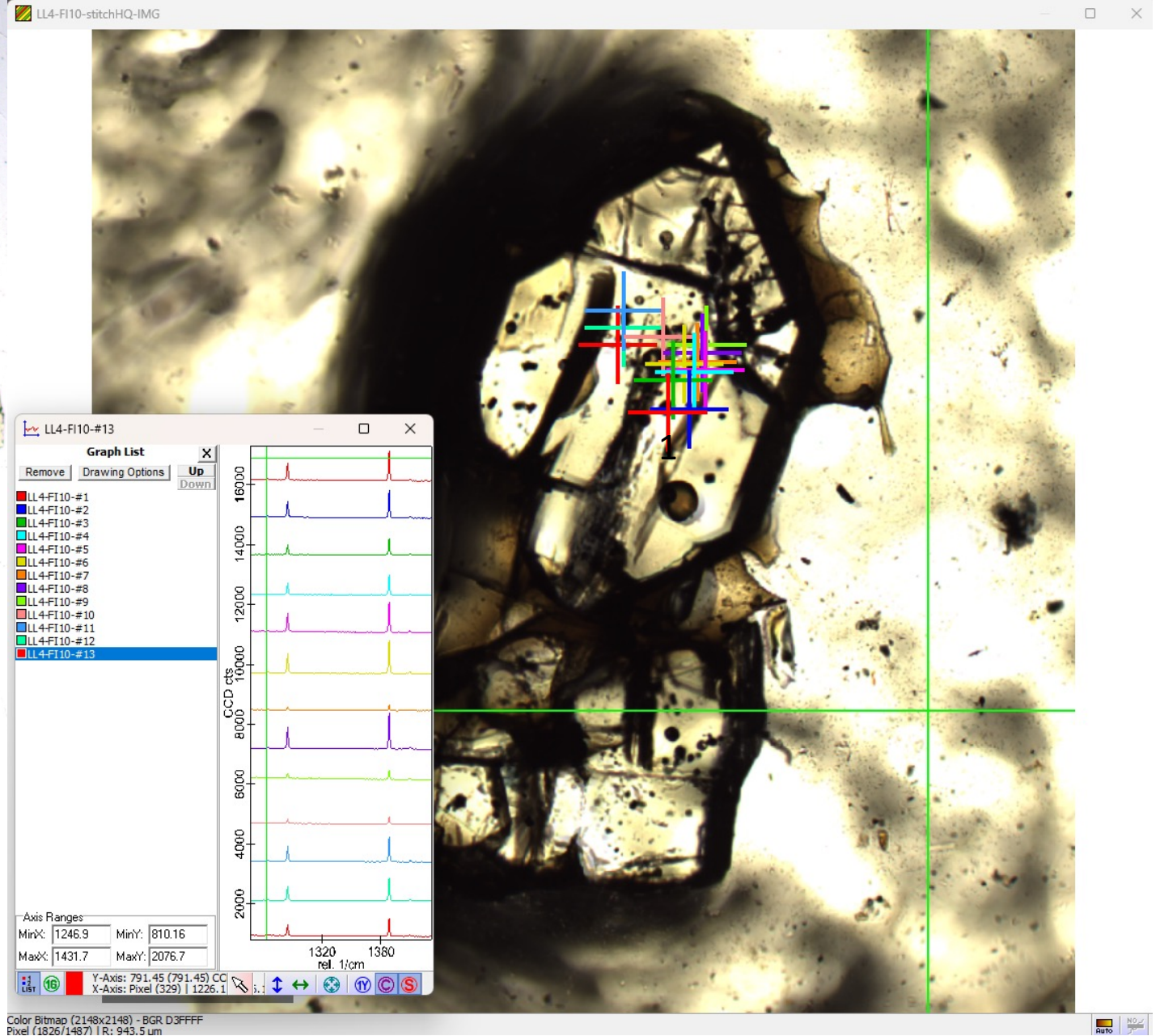
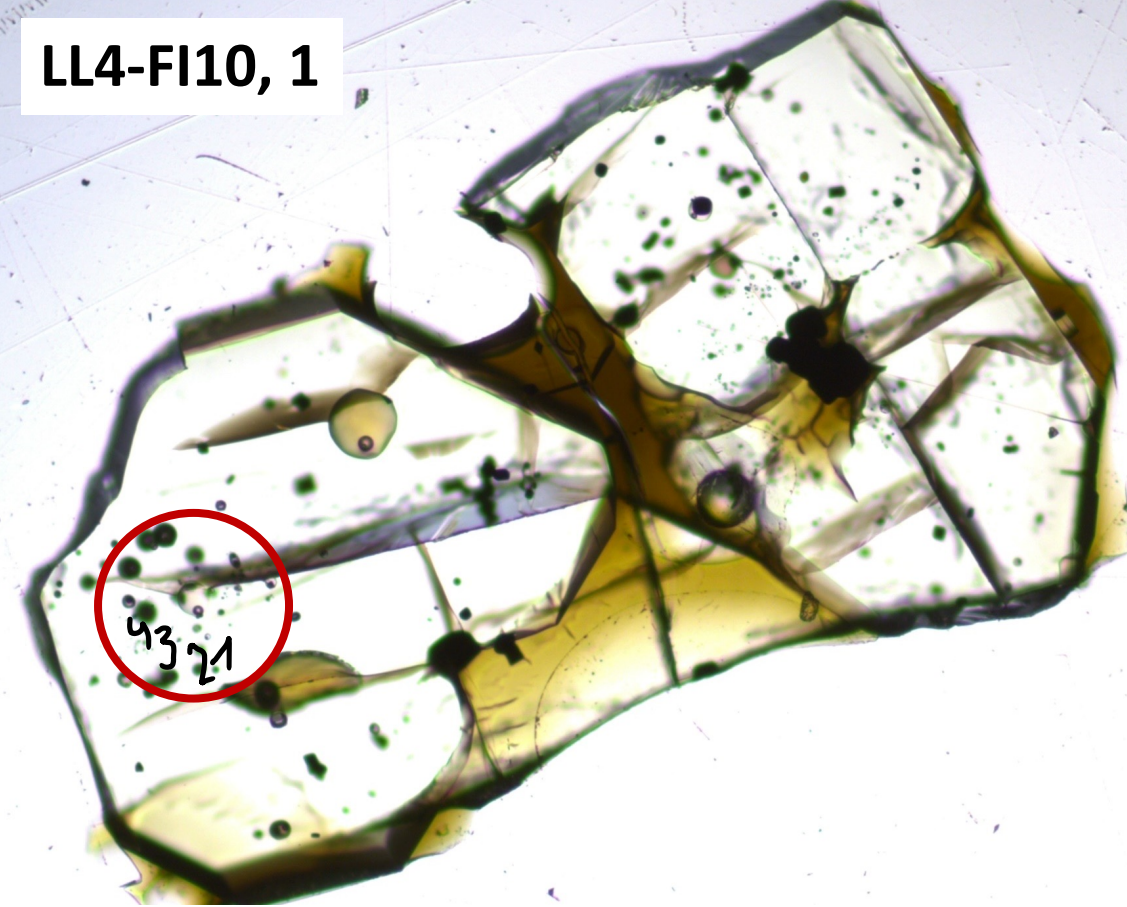
FI#4



FI#5



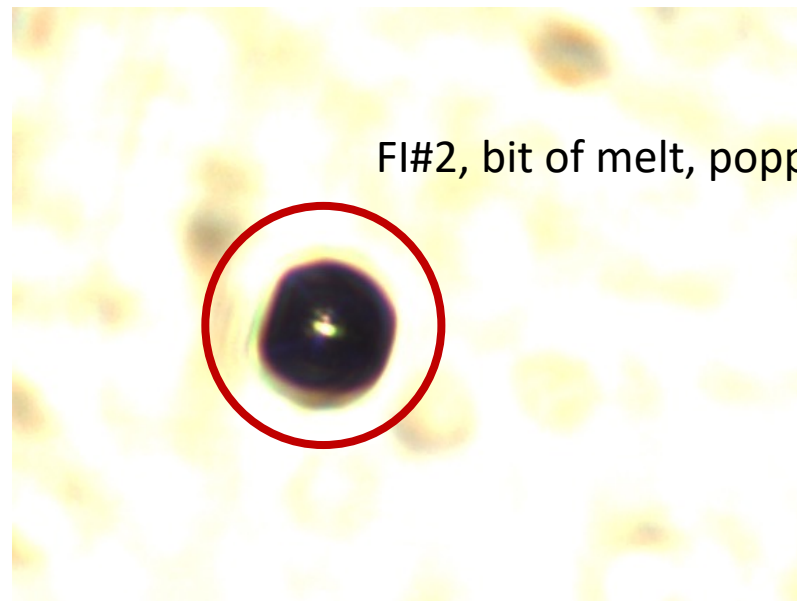
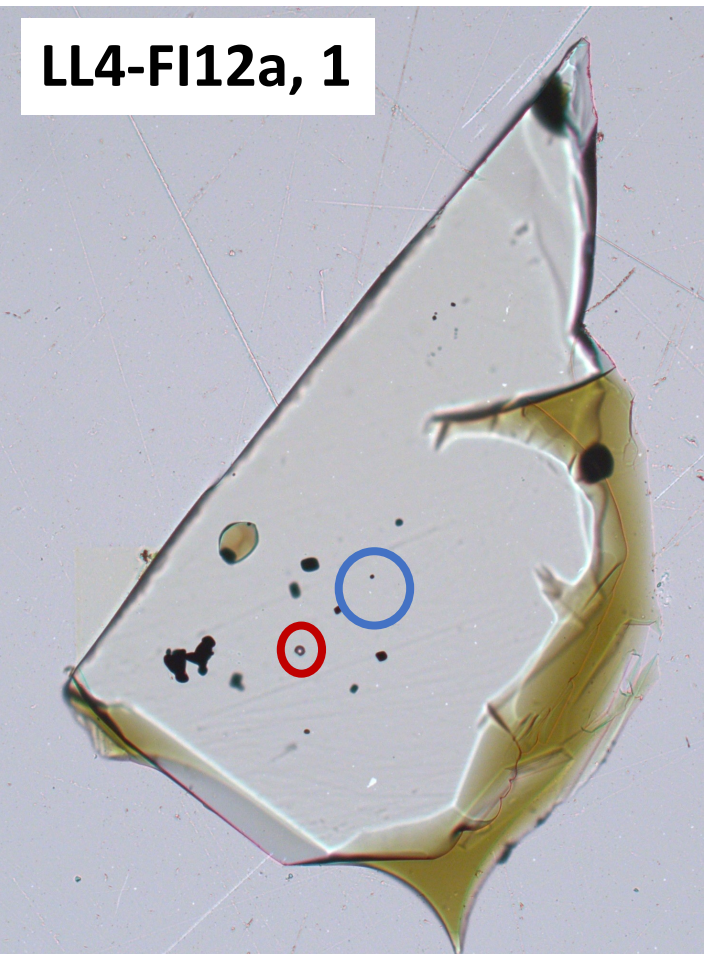
LL4-FI10, 1



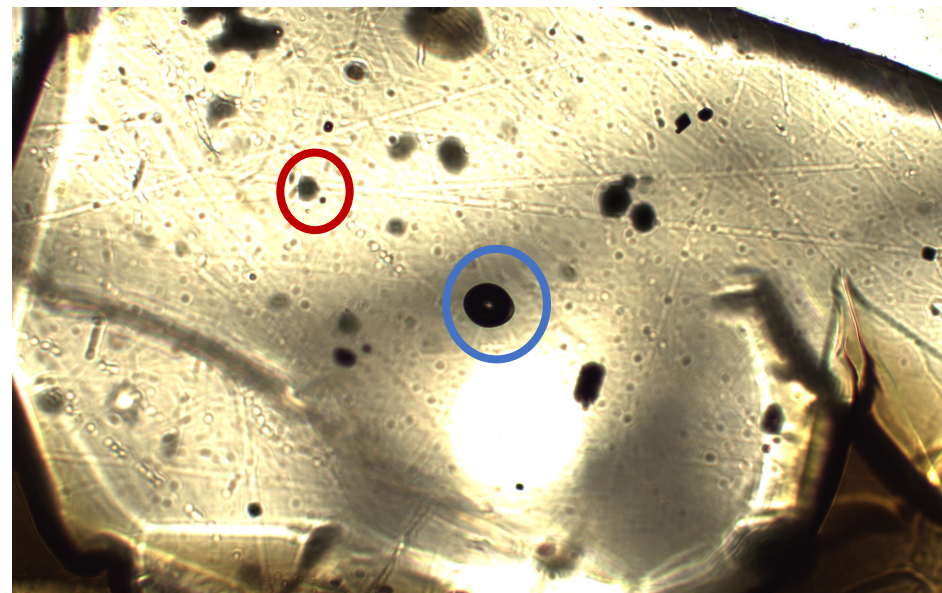
13 FI, some polished off

LL4-FI12a, 1

I labeled this crystal 12 in the early raman data.

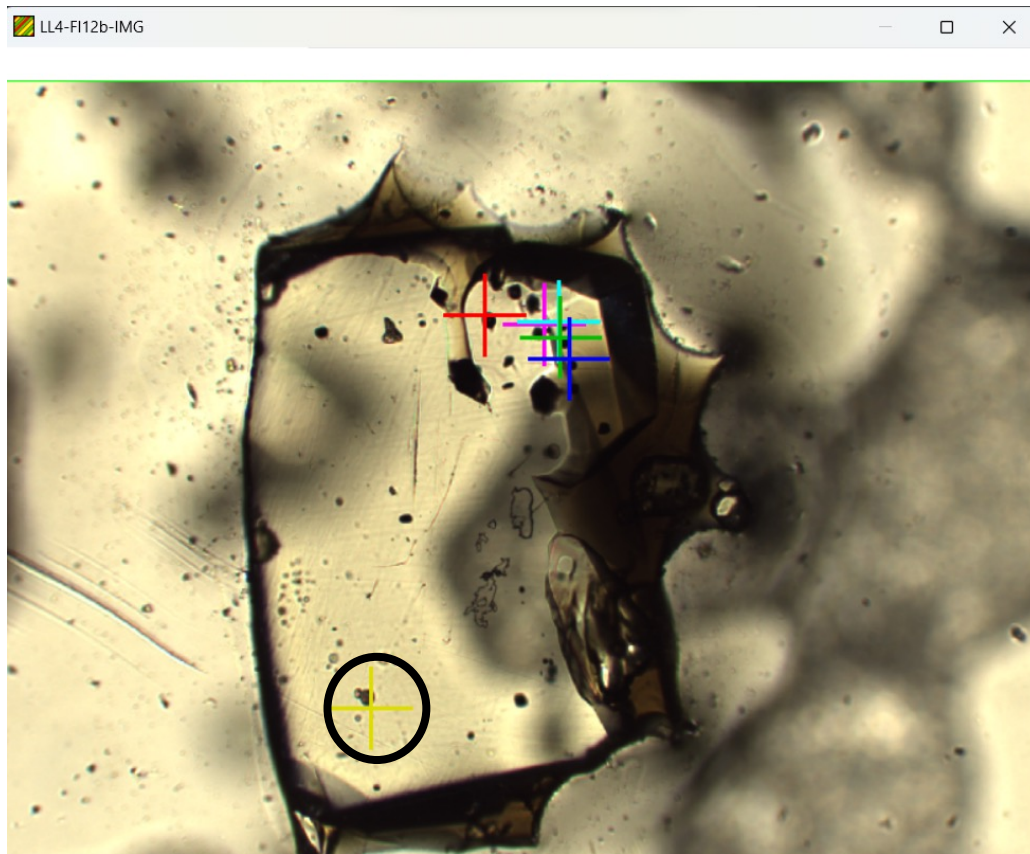
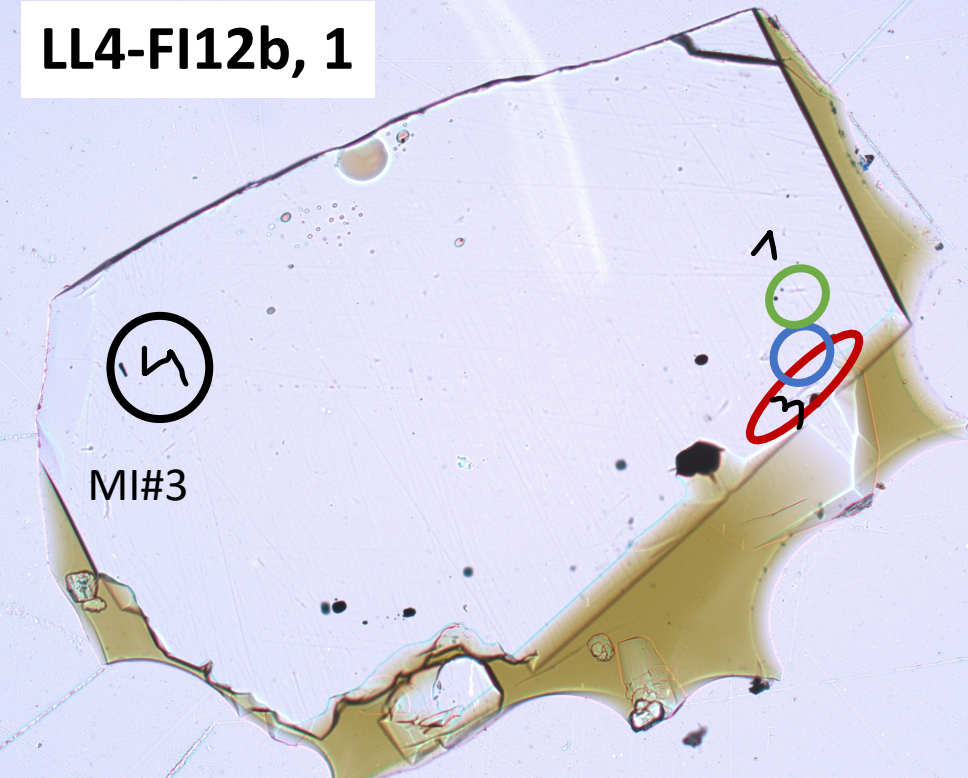


FI#2, bit of melt, popped now

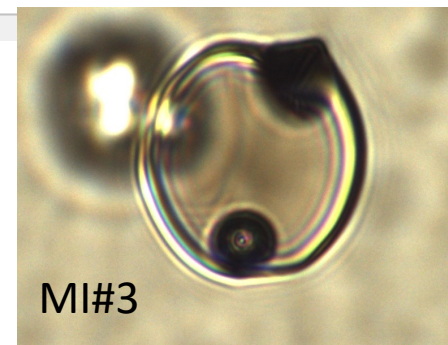
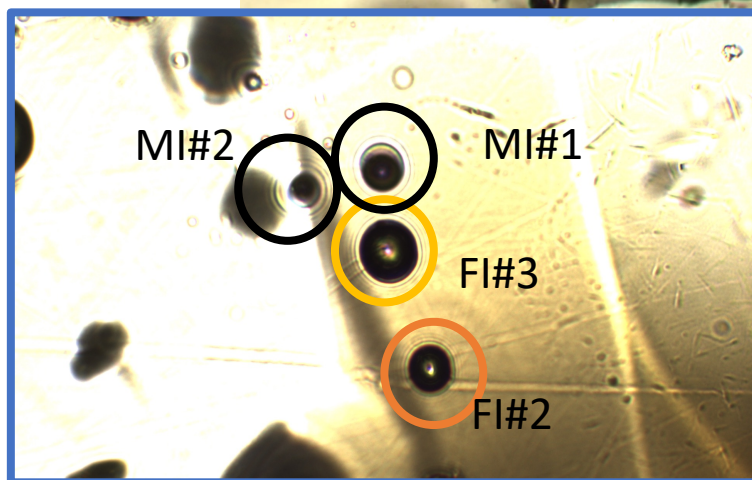
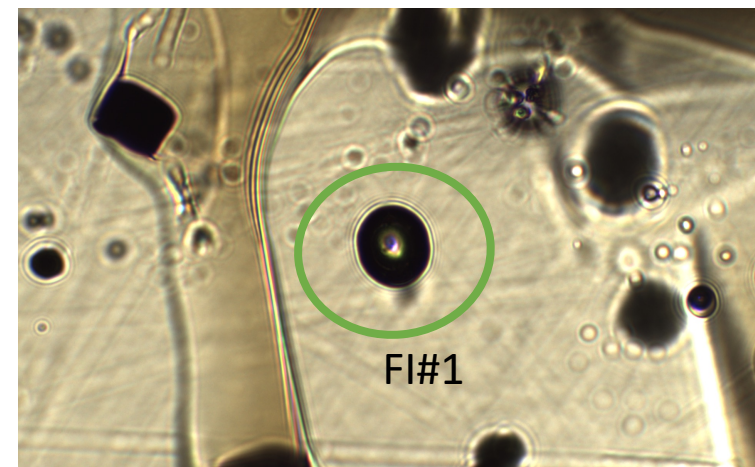
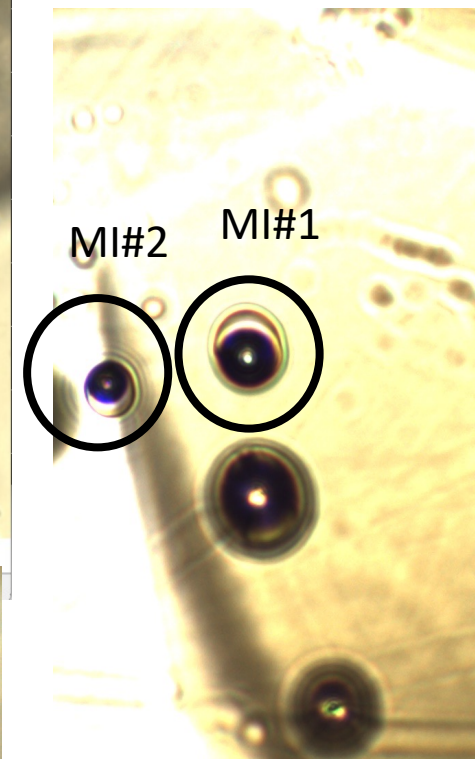


FI # 1 has melt, was polished off

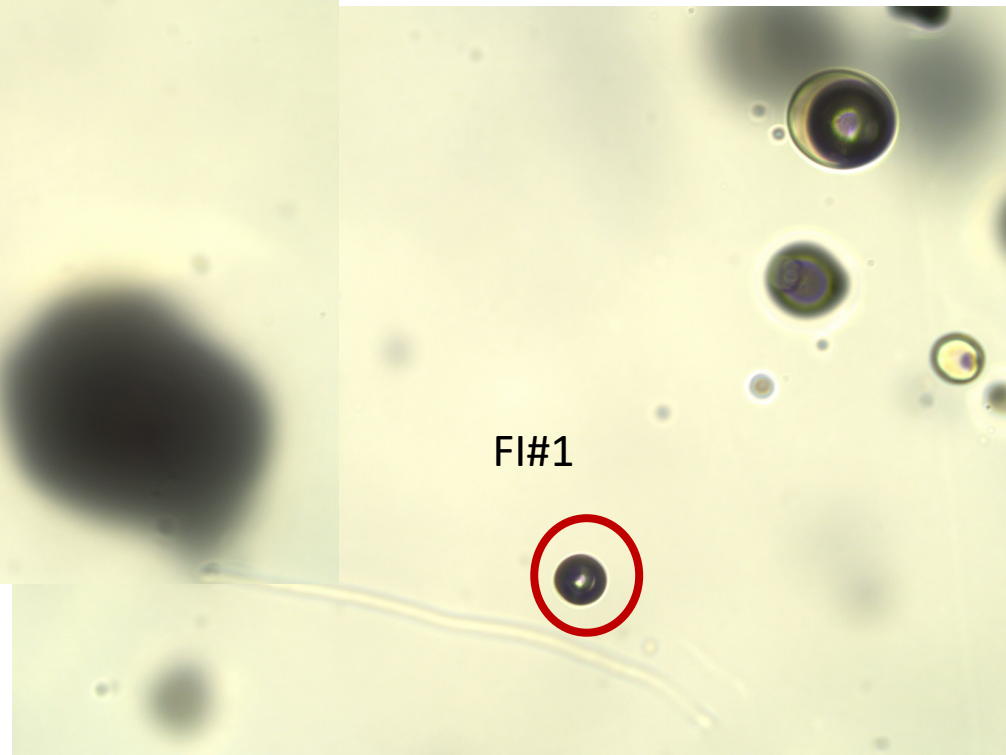
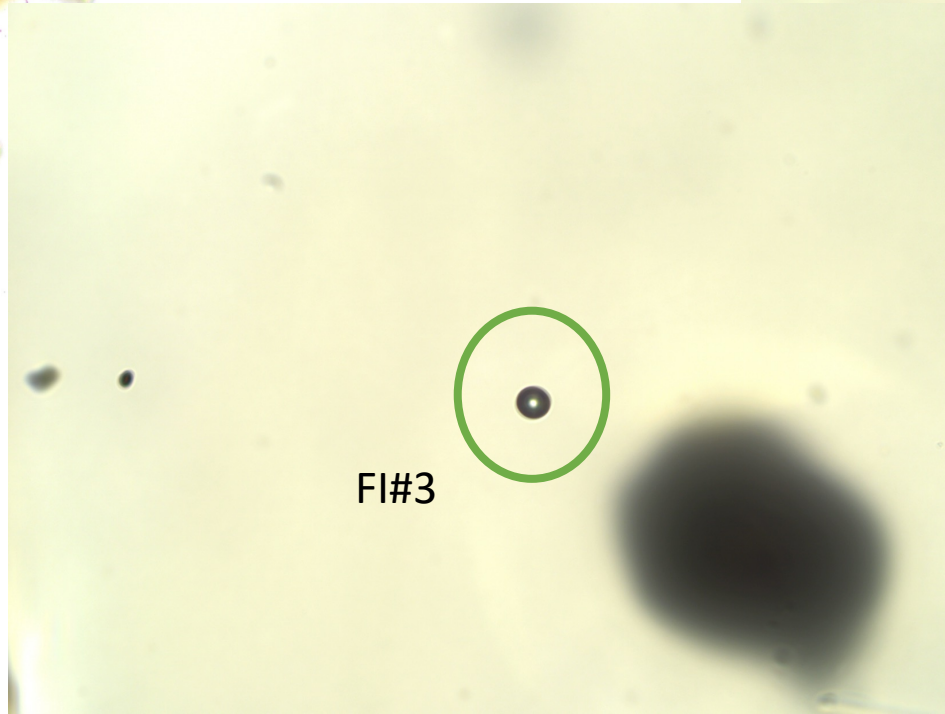
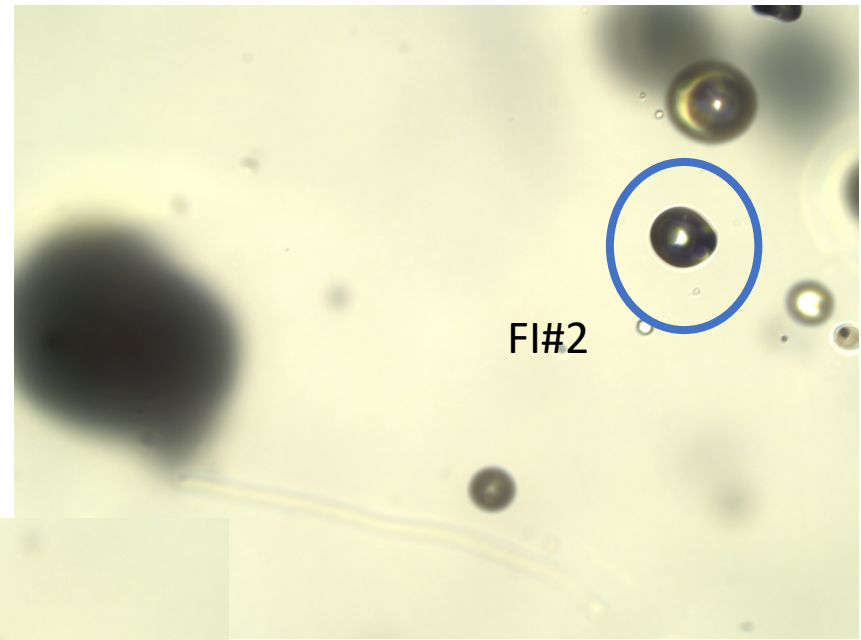
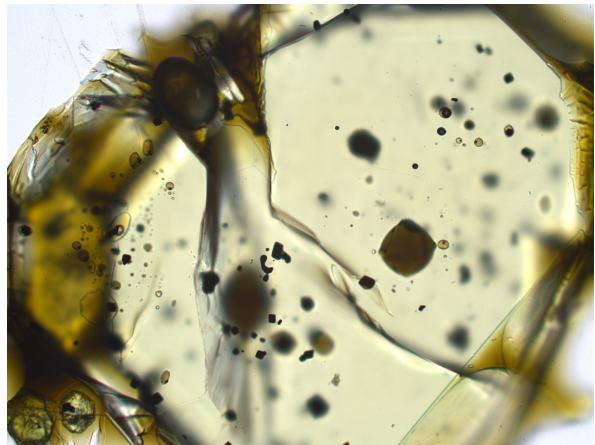
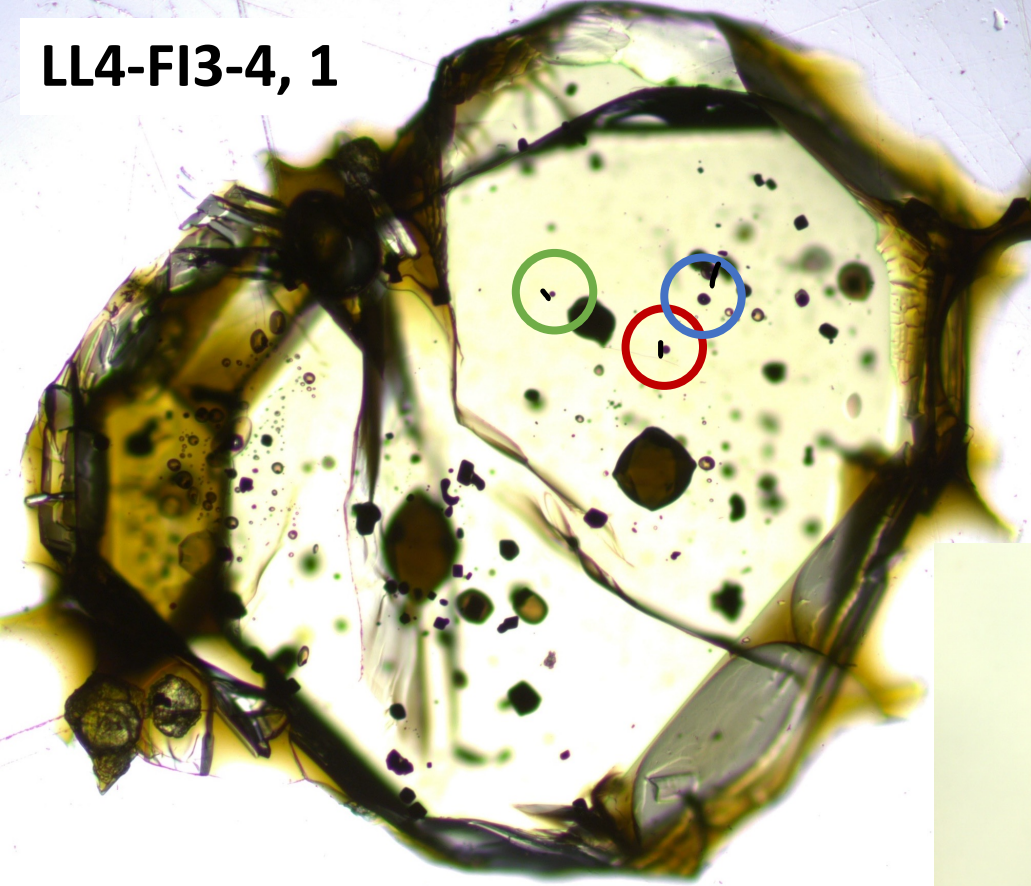
LL4-FI12b, 1



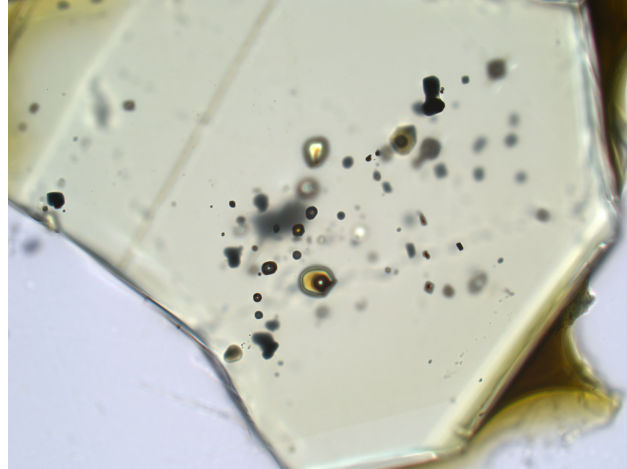
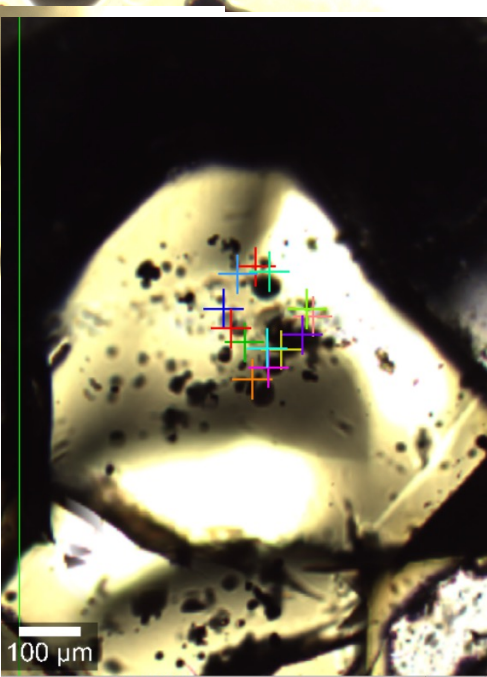
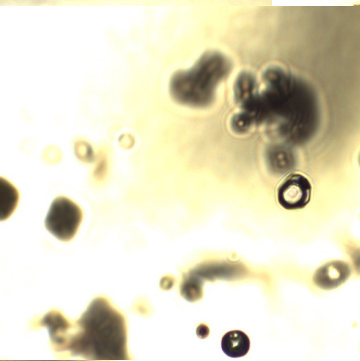
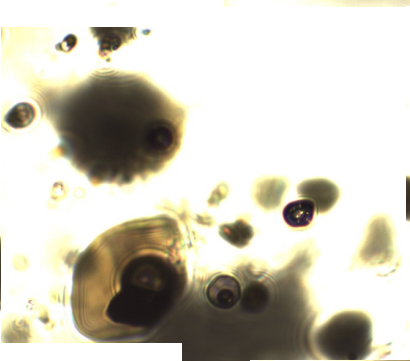
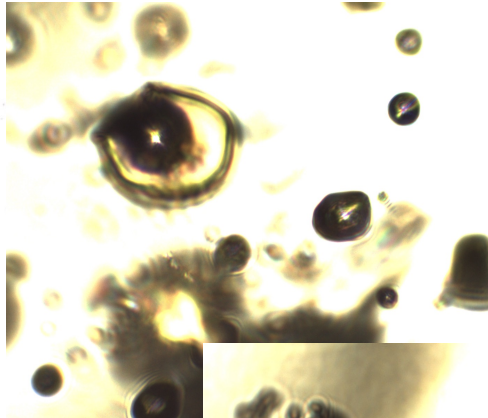
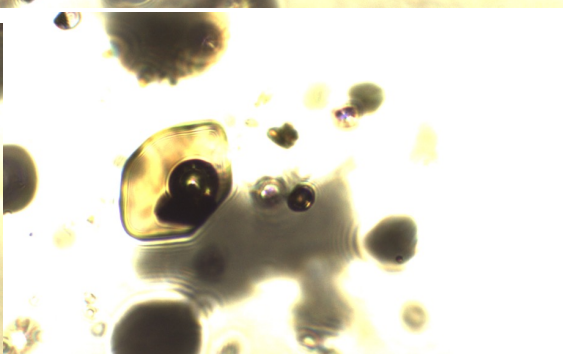
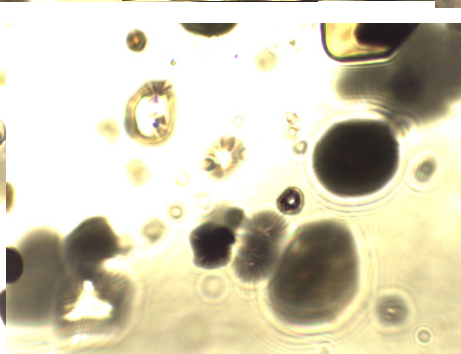
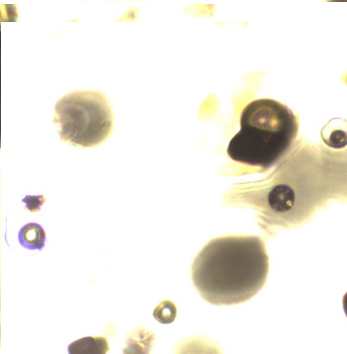
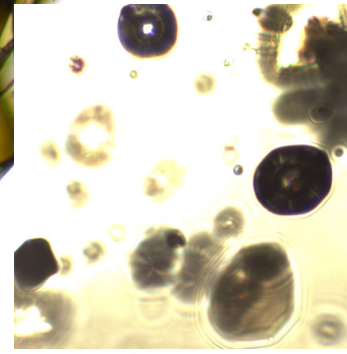
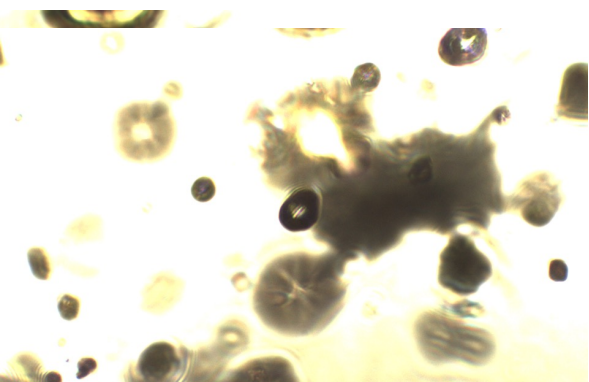
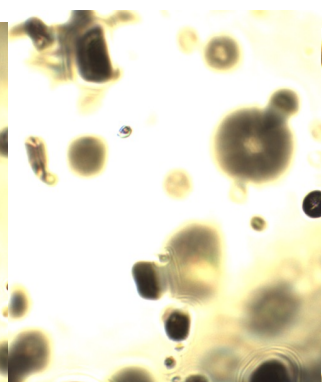
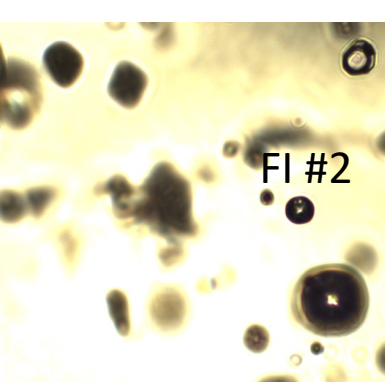
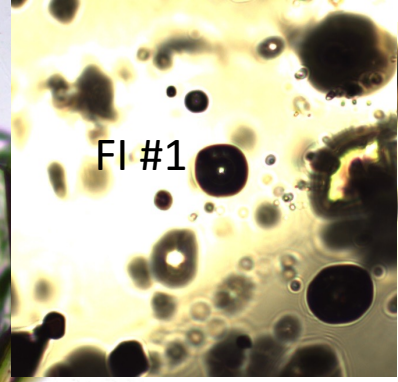
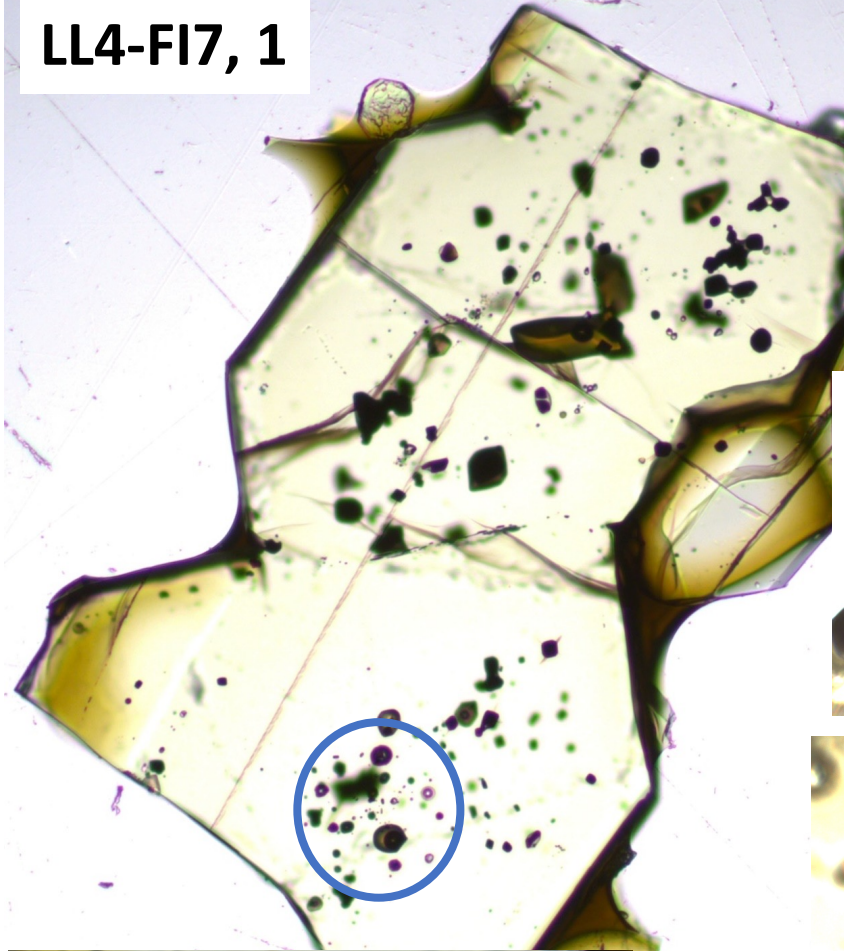
Polished away all FI and MI.



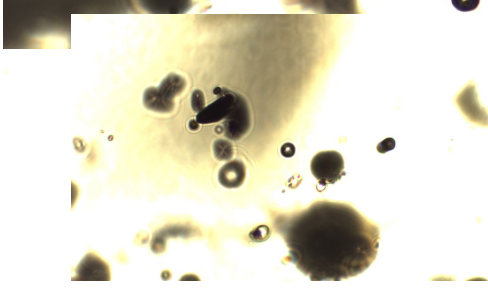
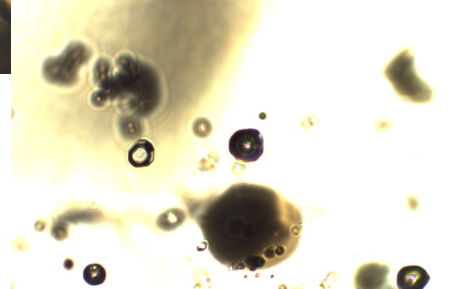
LL4-FI3-4, 1



LL4-FI7, 1

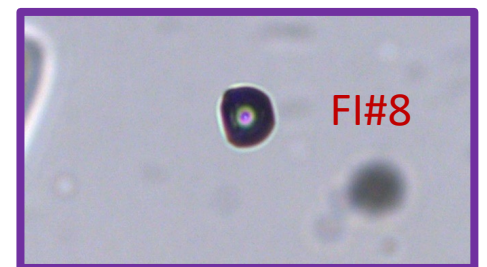
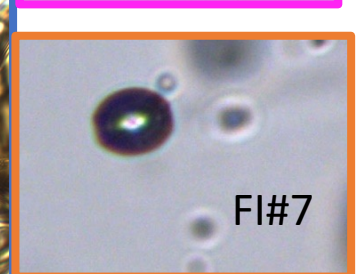
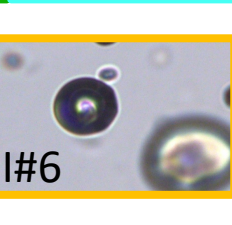
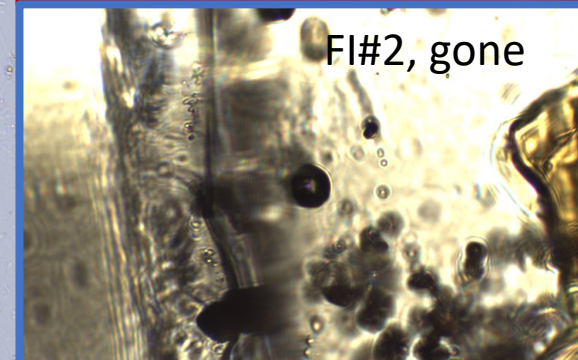
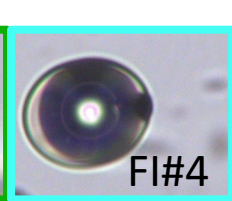
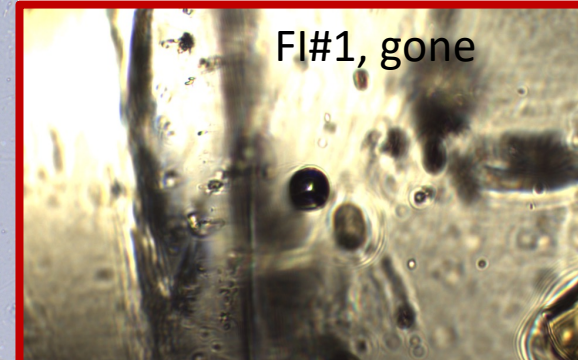
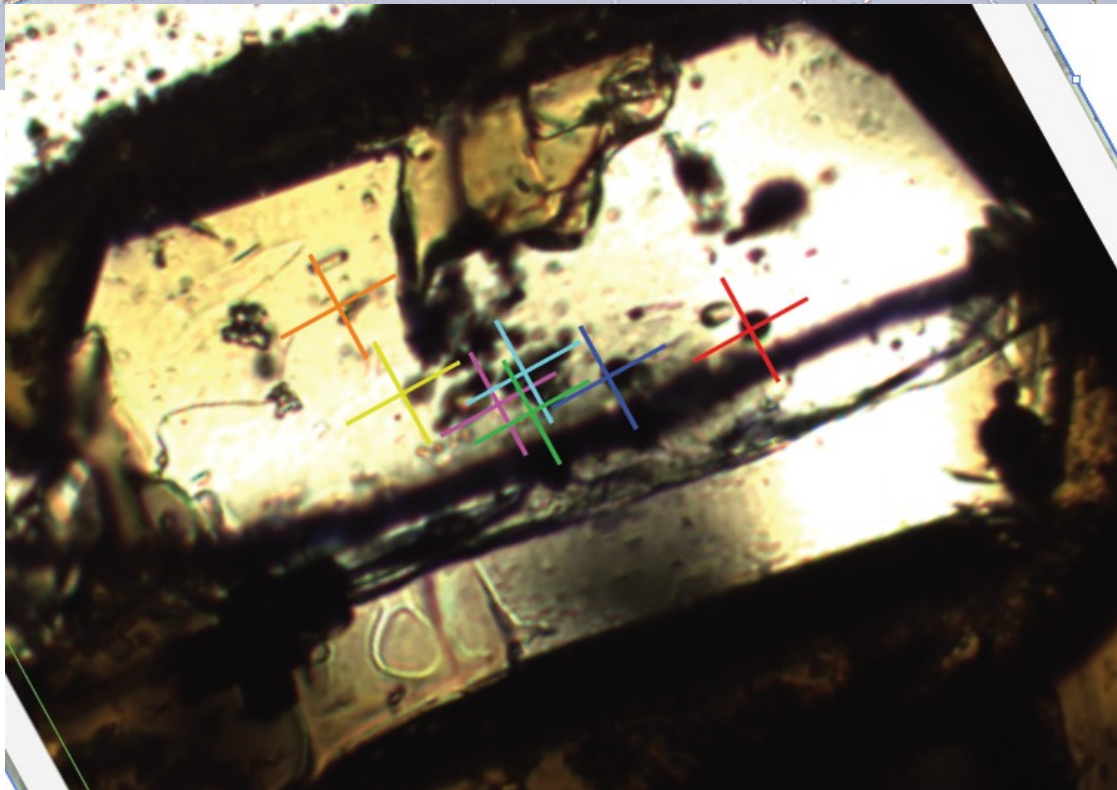
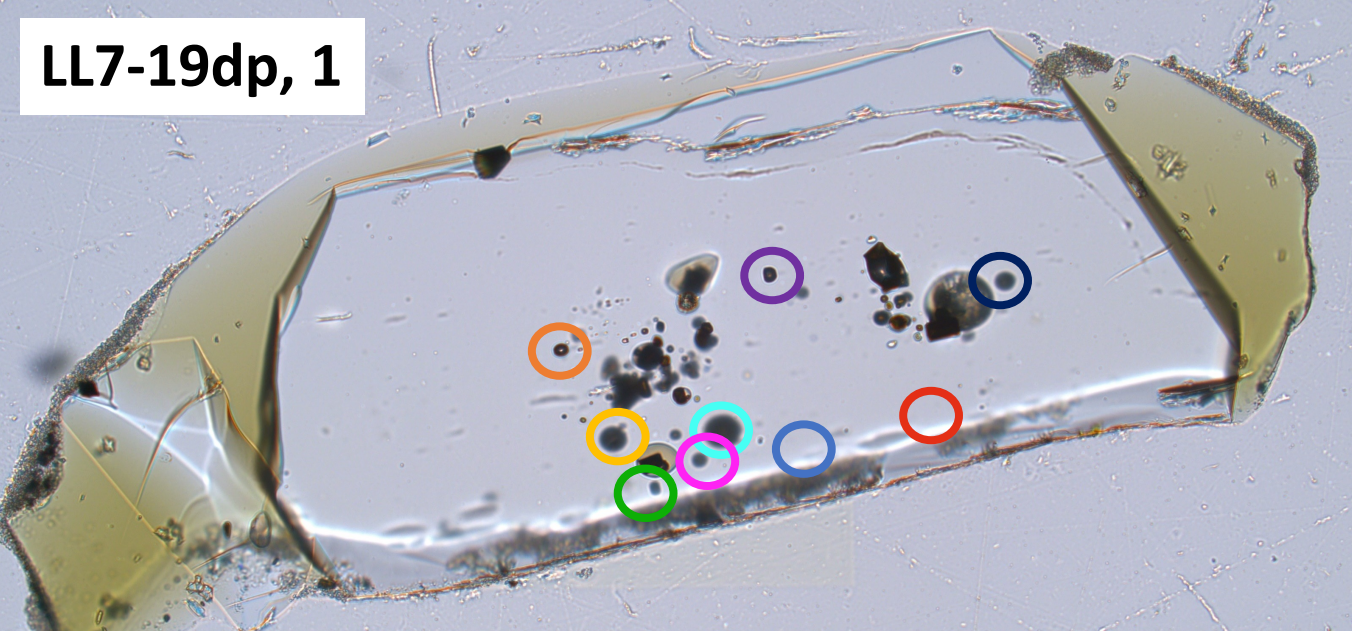


A lot gone



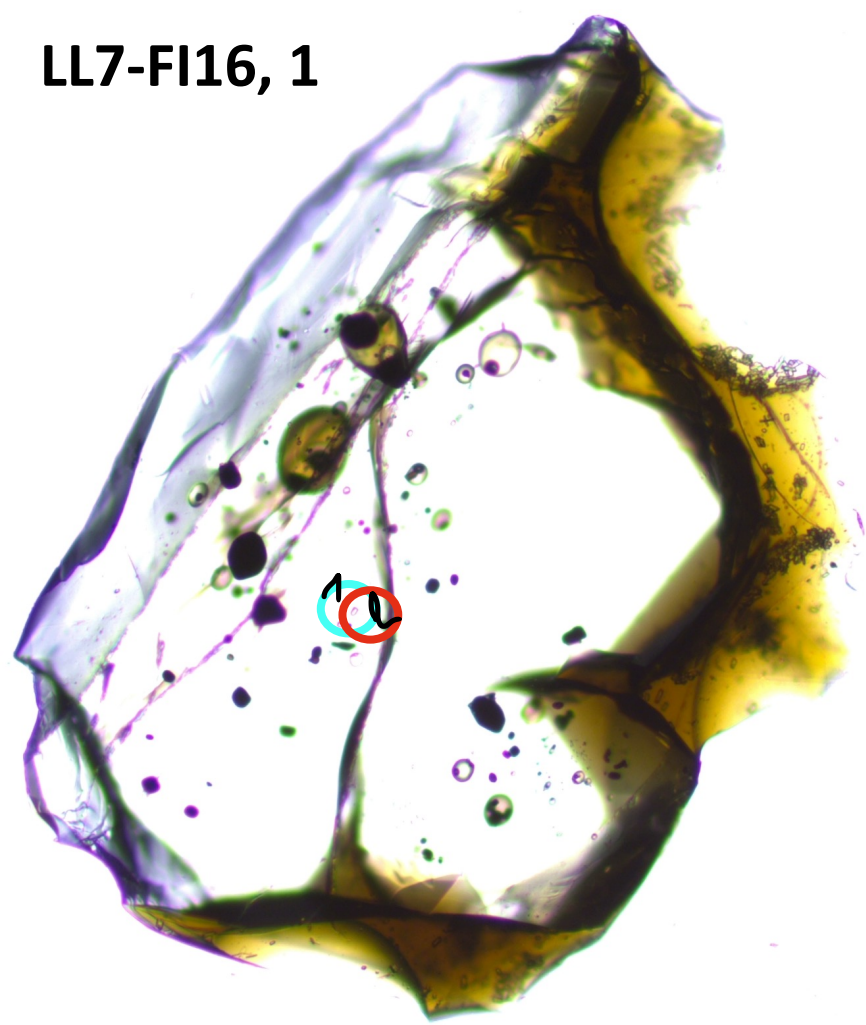
100 μm

LL7-19dp, 1

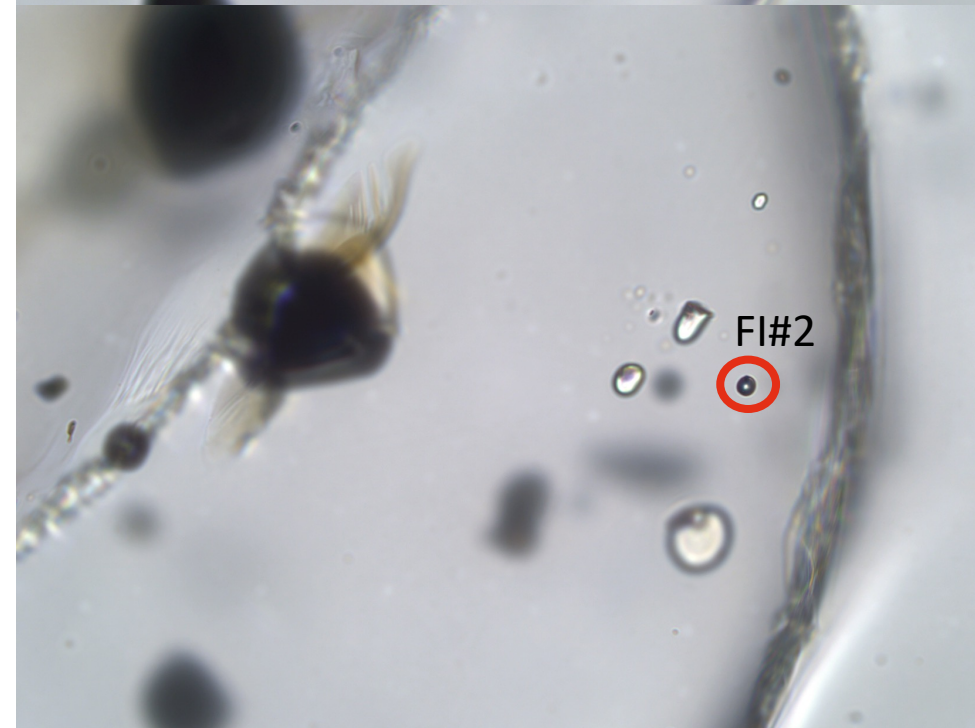
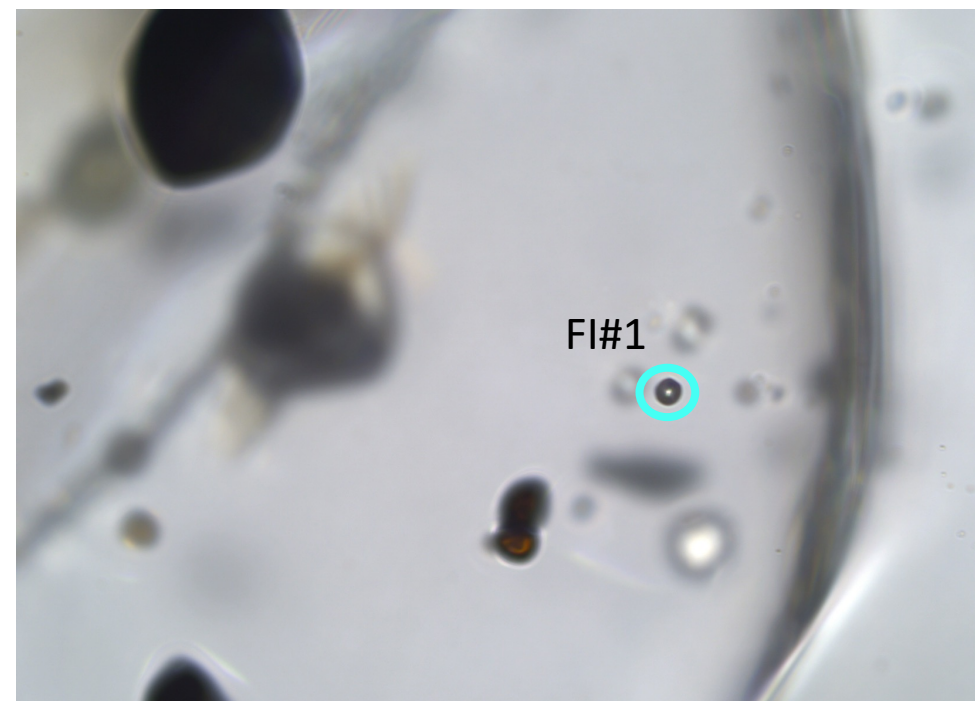


If I didn't specify probe spots here it's because it's the same order of the FI.
This one has a 19-1 spot from Oct10 22 (dark blue), but ignore it because I don't have probe spot for it.

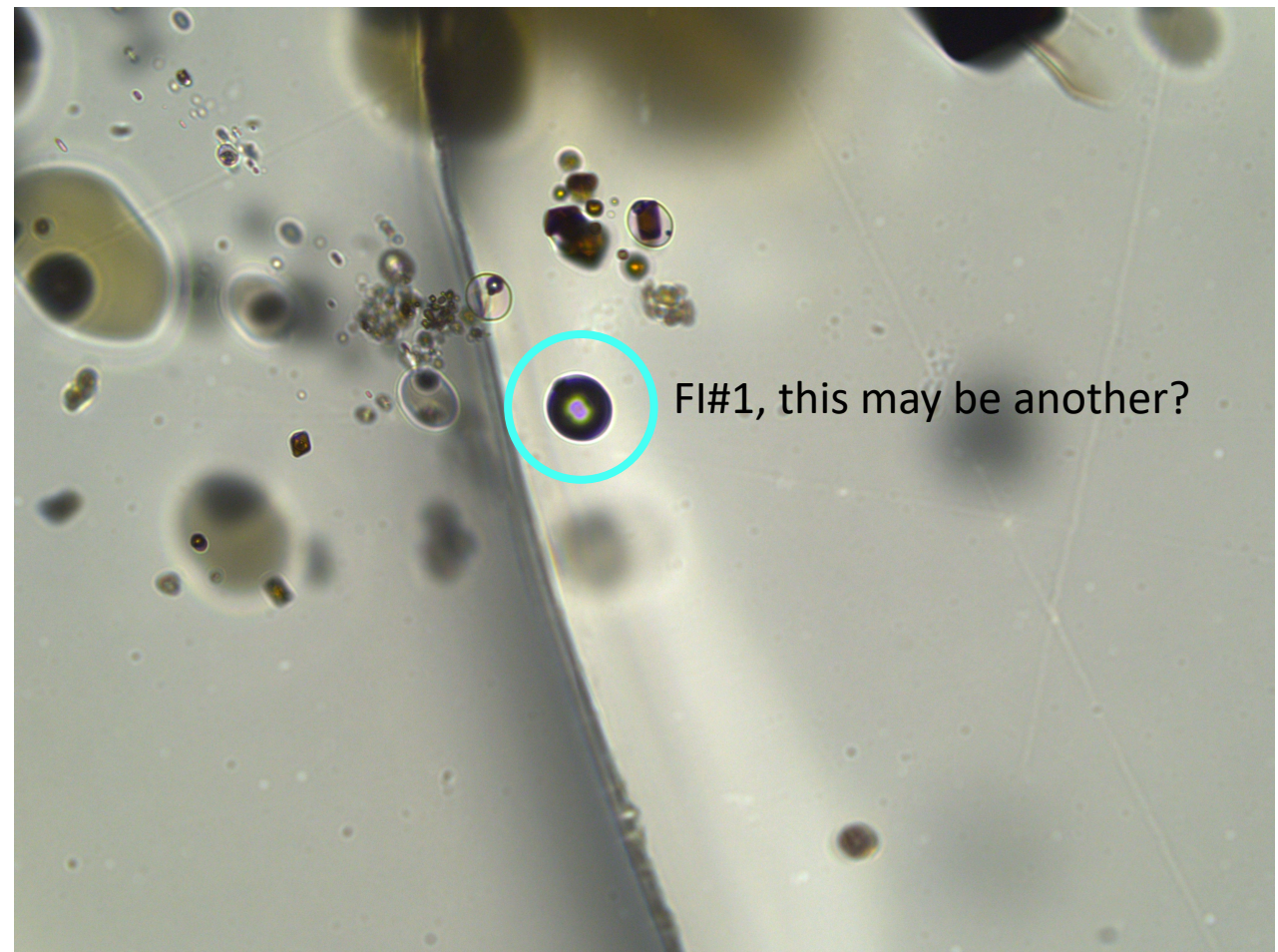
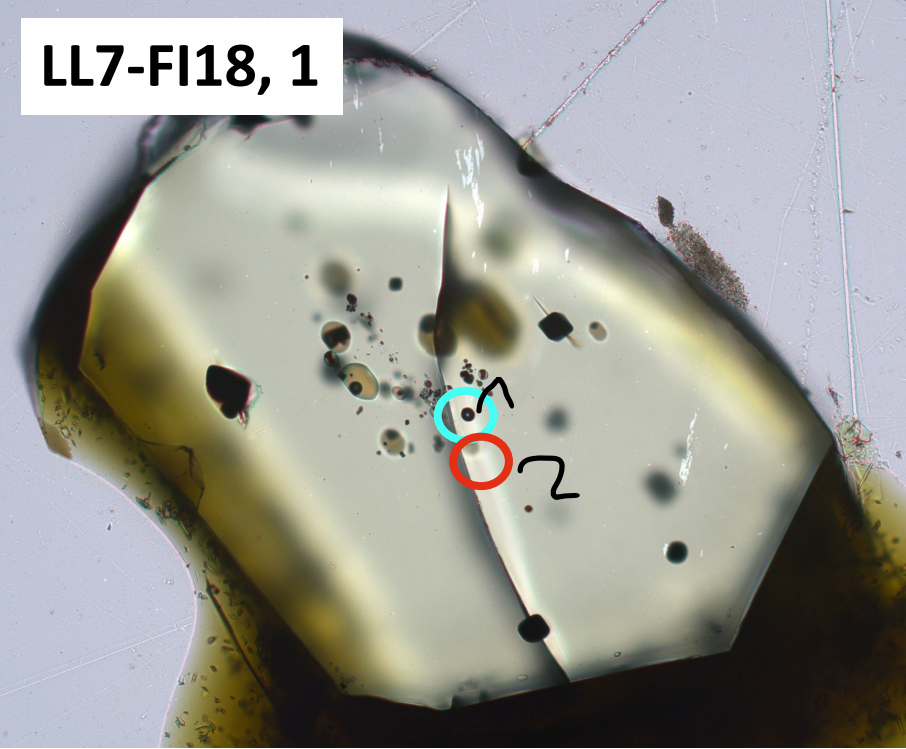
LL7-FI16, 1



No diad (raman data)

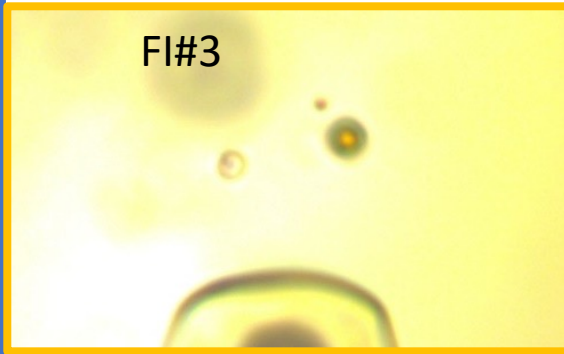
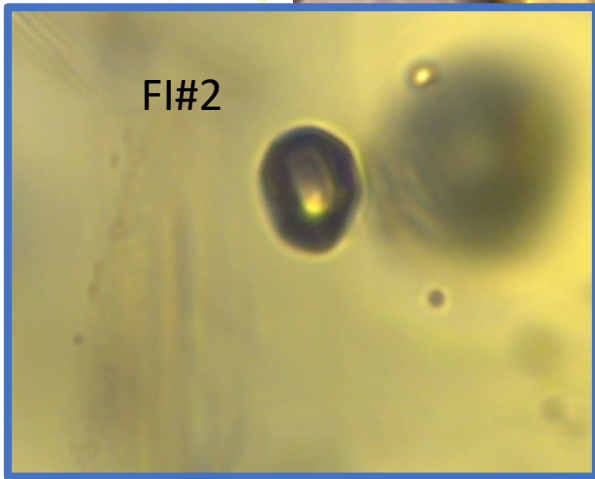
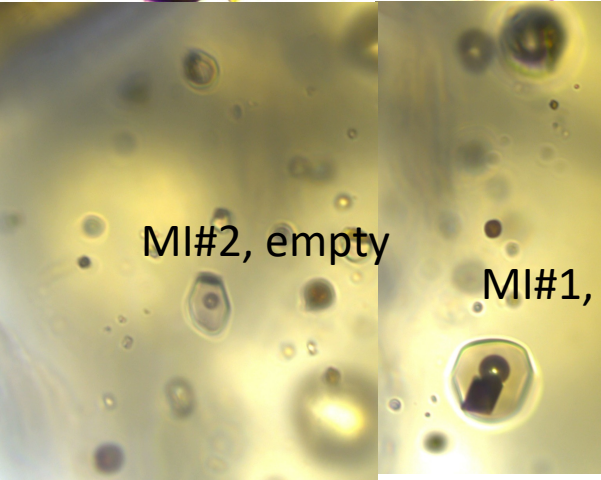
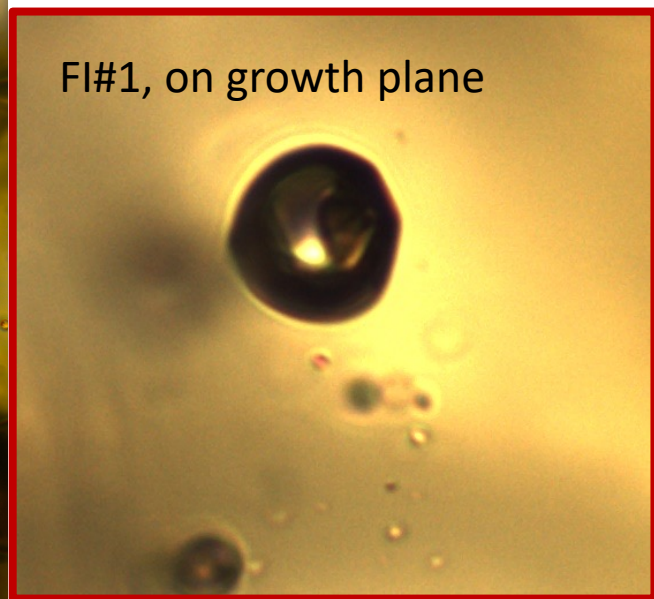
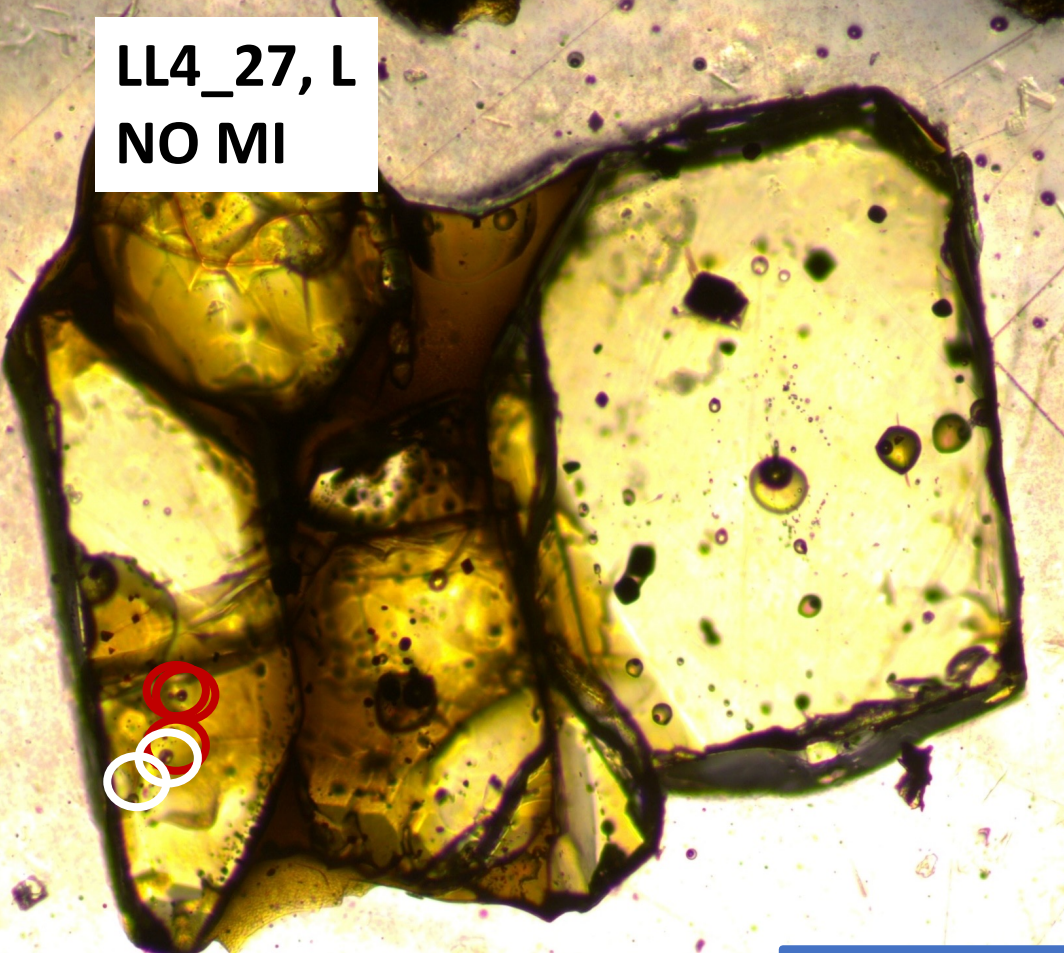


LL7-FI18, 1



This crystal was flipped weird, hard to know for sure if the FI are just gone

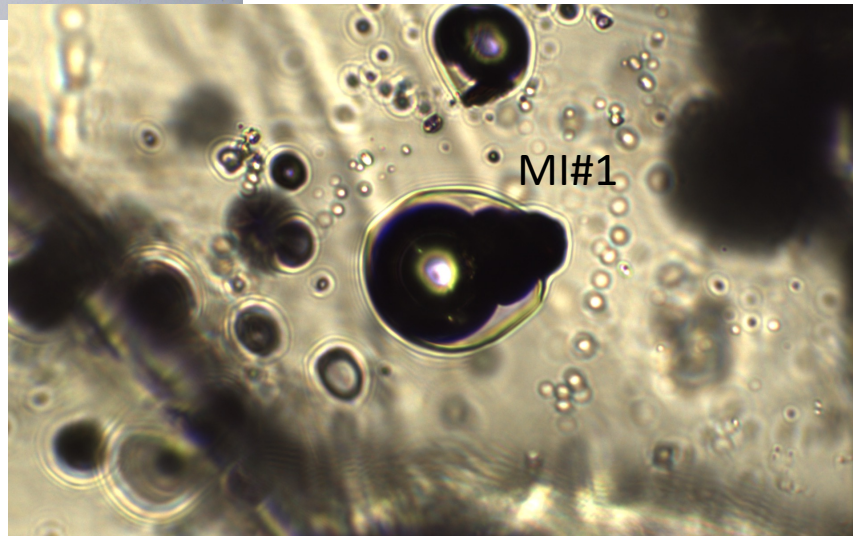
LL4_27, L
NO MI



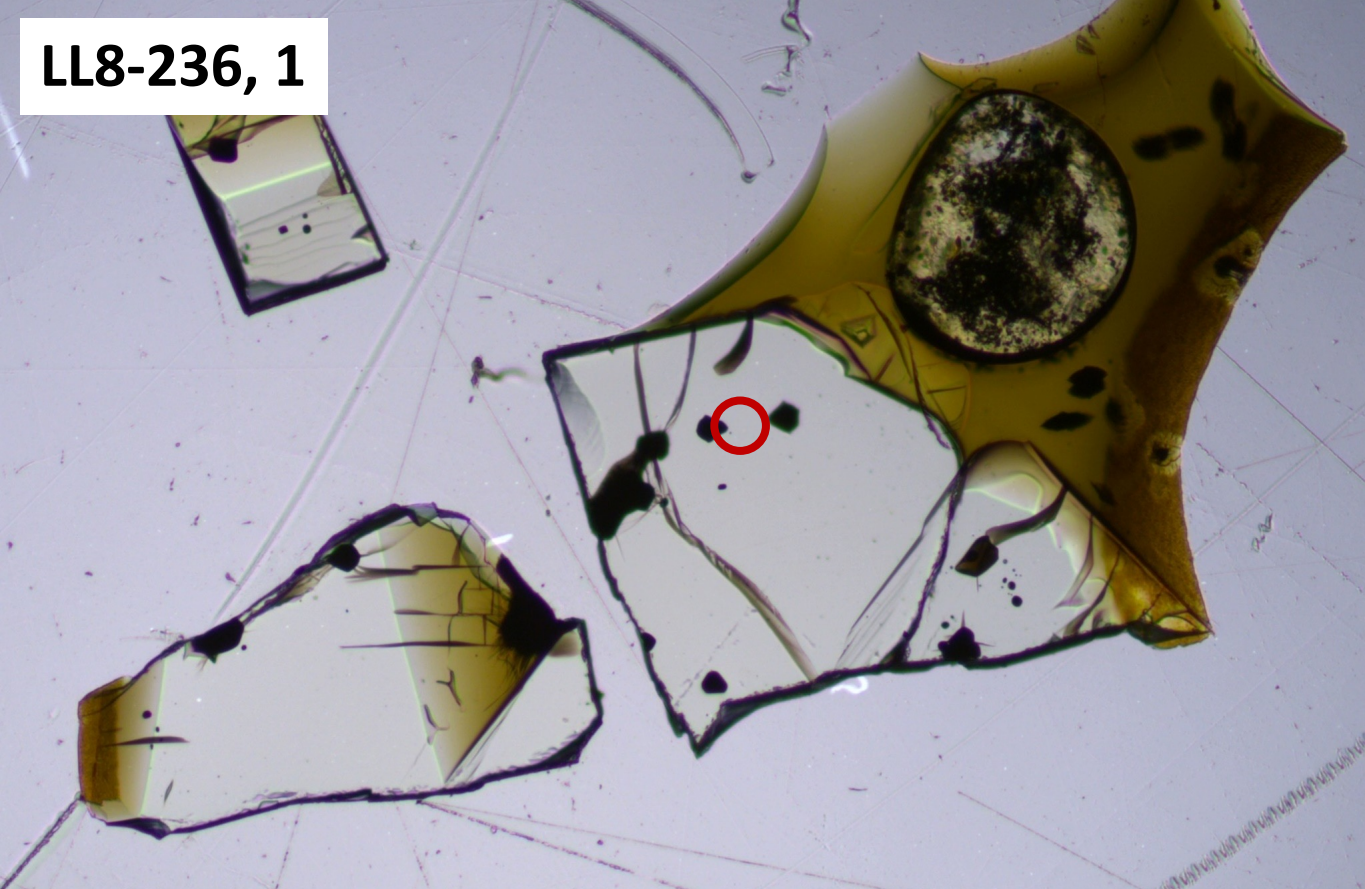
LL8-C15, 3



Was here

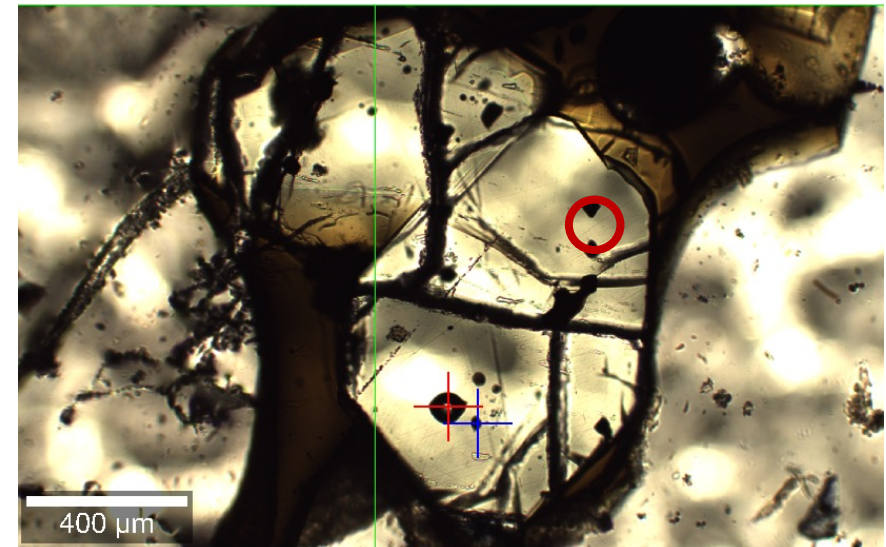


LL8-236, 1



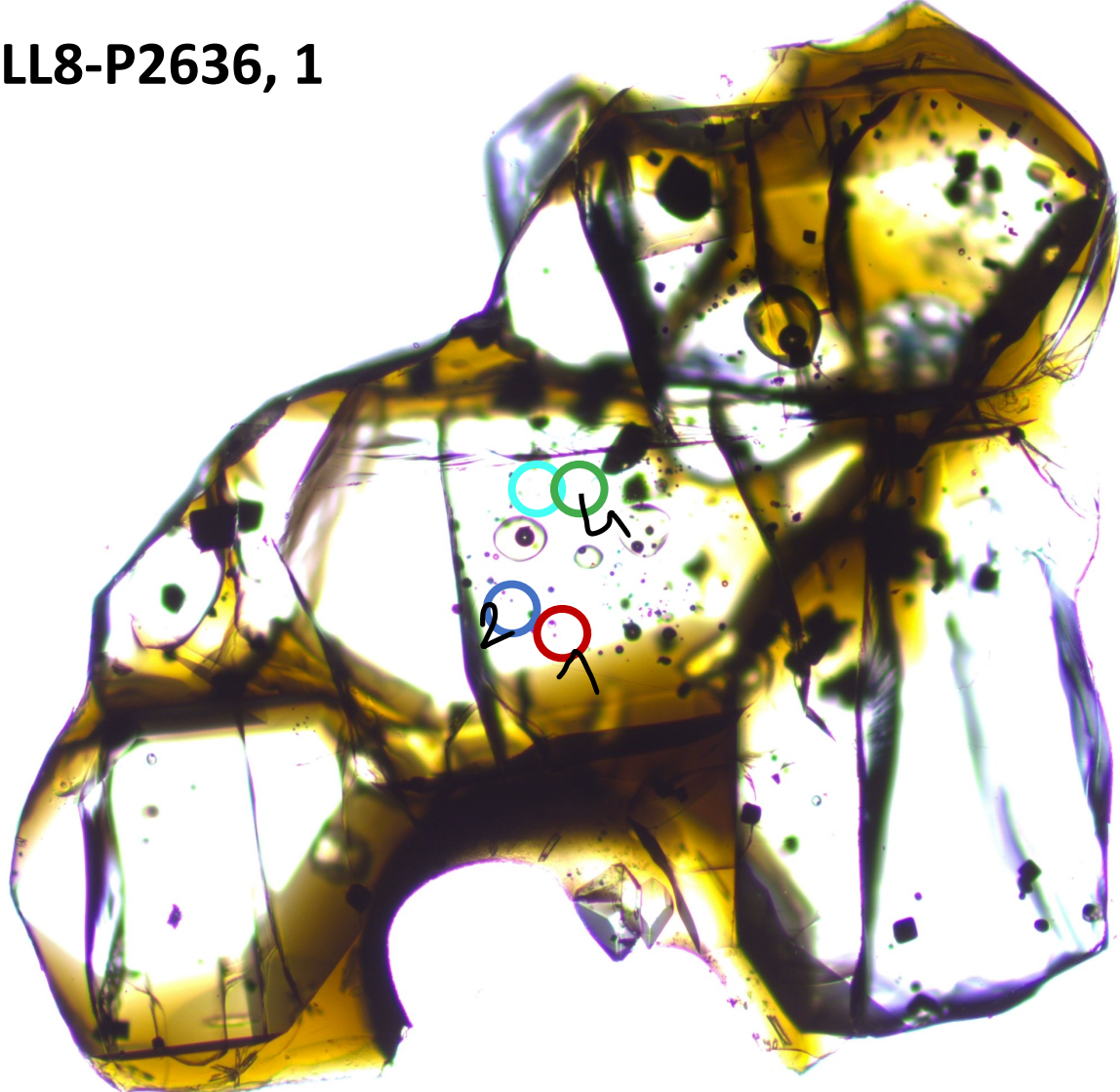
Fl#1 and 2 were lost (a piece that broke off but Those two spinels are in a similar growth zone As they would have been)

LL8-FI236-IMG5x

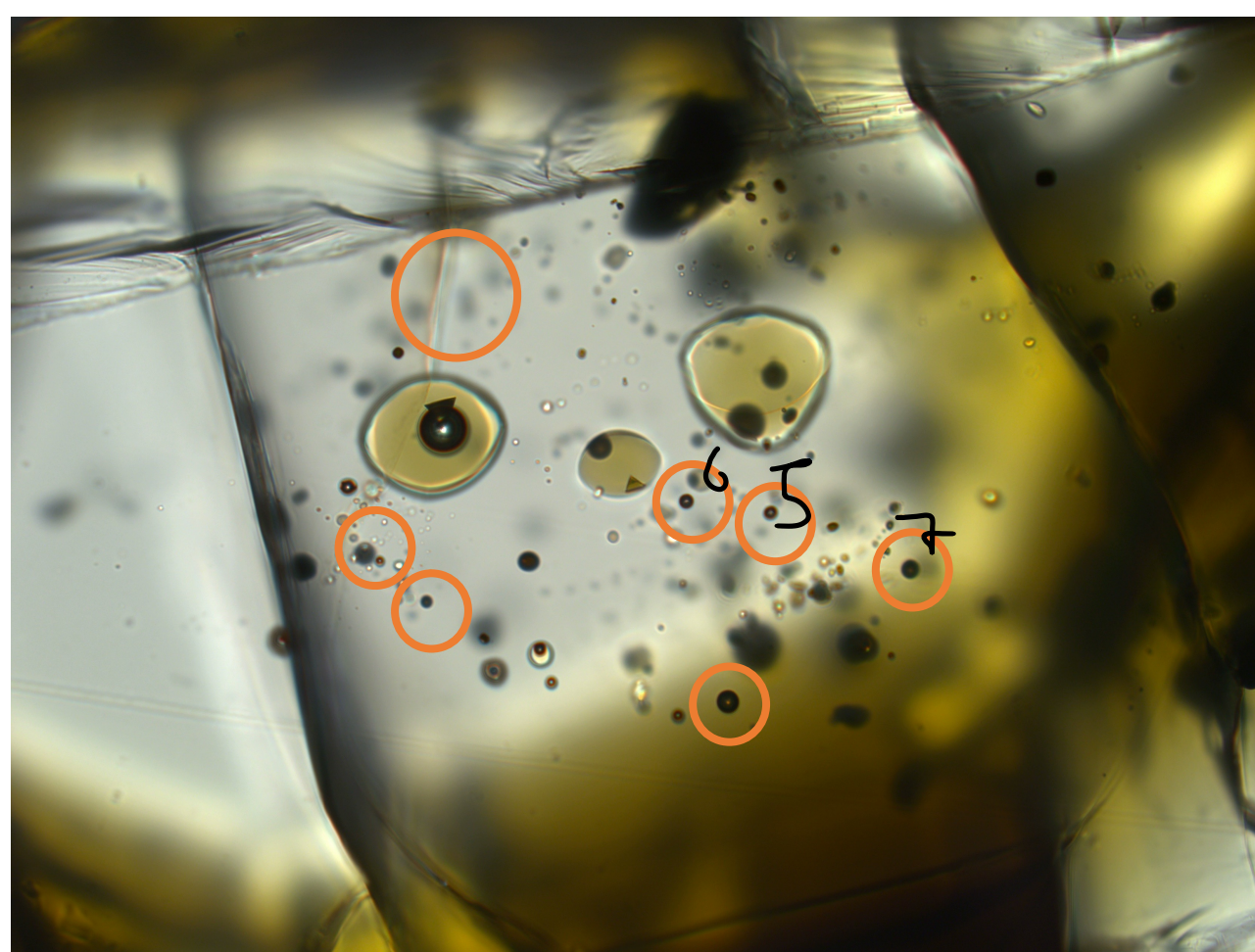


Color Bitmap (1920x1200) - BGR_090708
Pixel (794/0) | R: 545.14 μm

LL8-P2636, 1

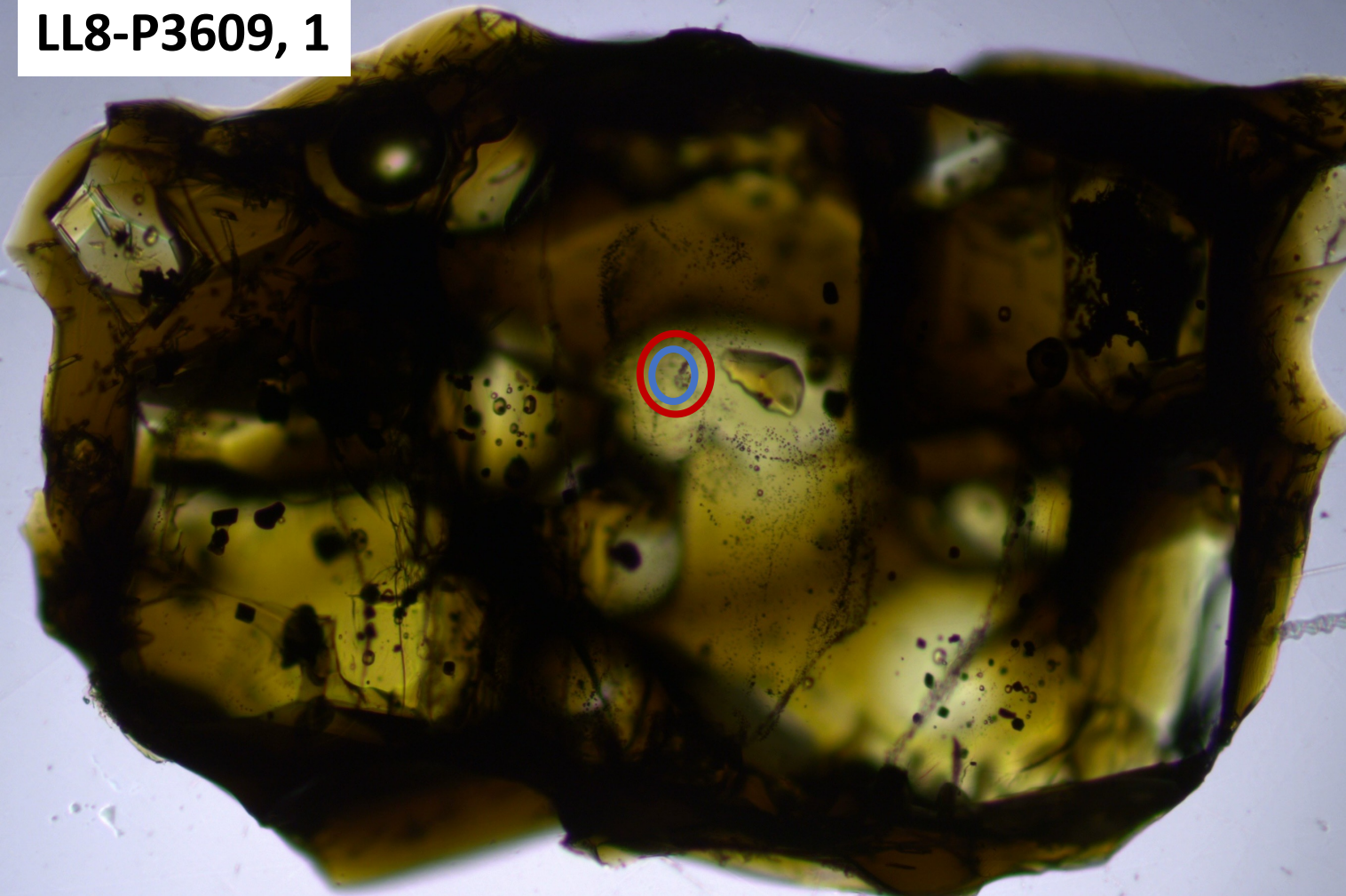


Hard to figure out which are the original ones, but that was general location
(1 red, 2 blue, 3 green, 4 cyan)

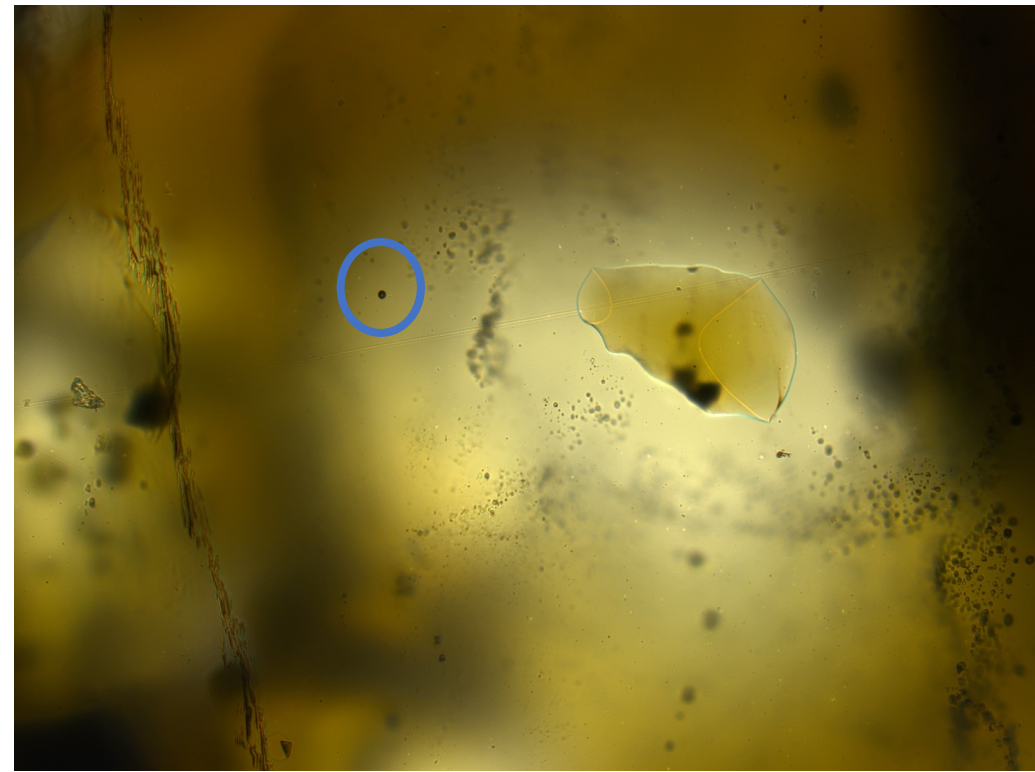


New visible FI, plenty to raman on GZ

LL8-P3609, 1



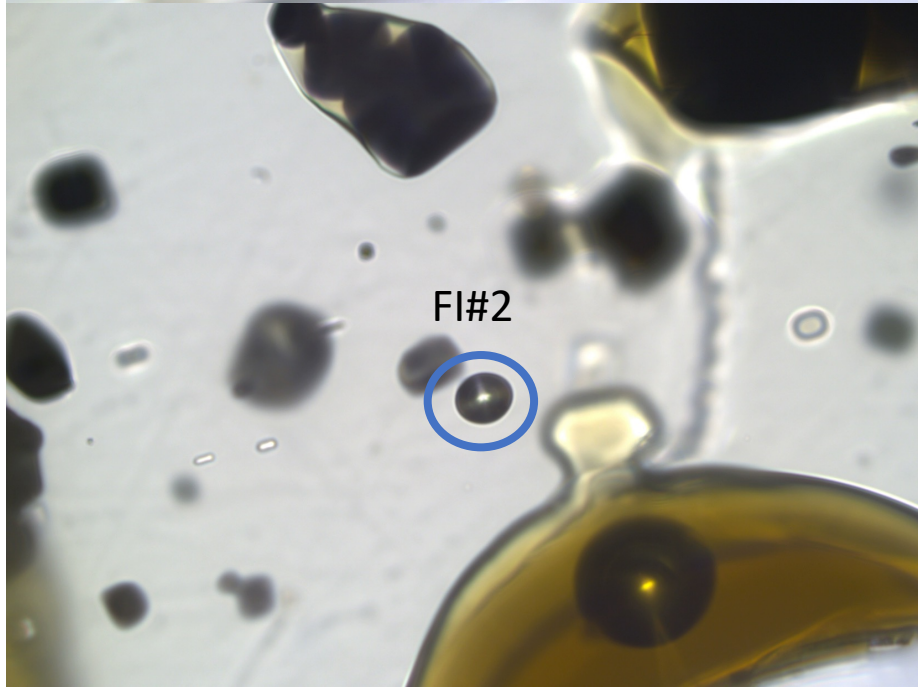
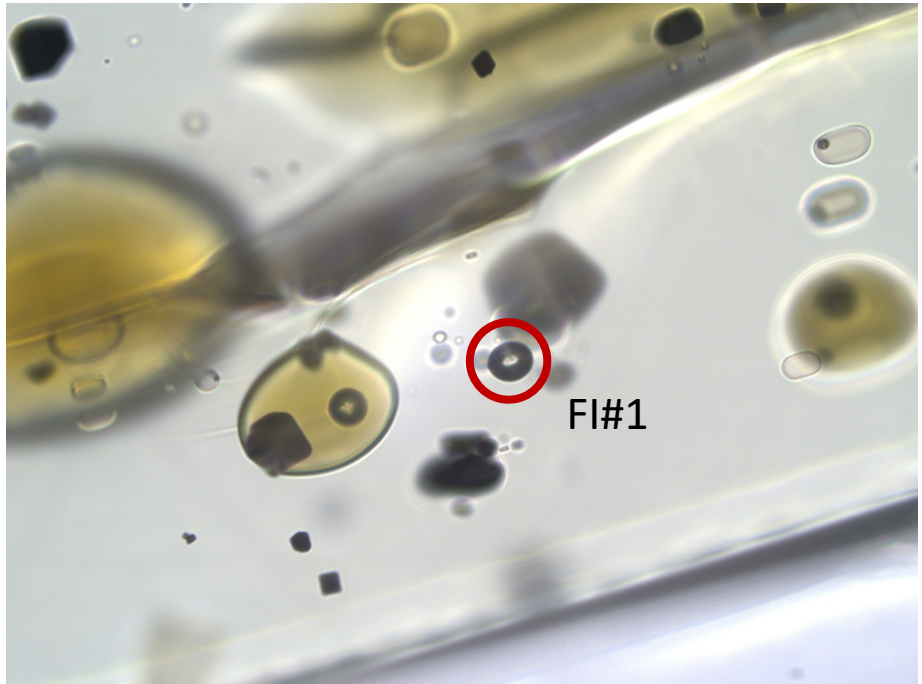
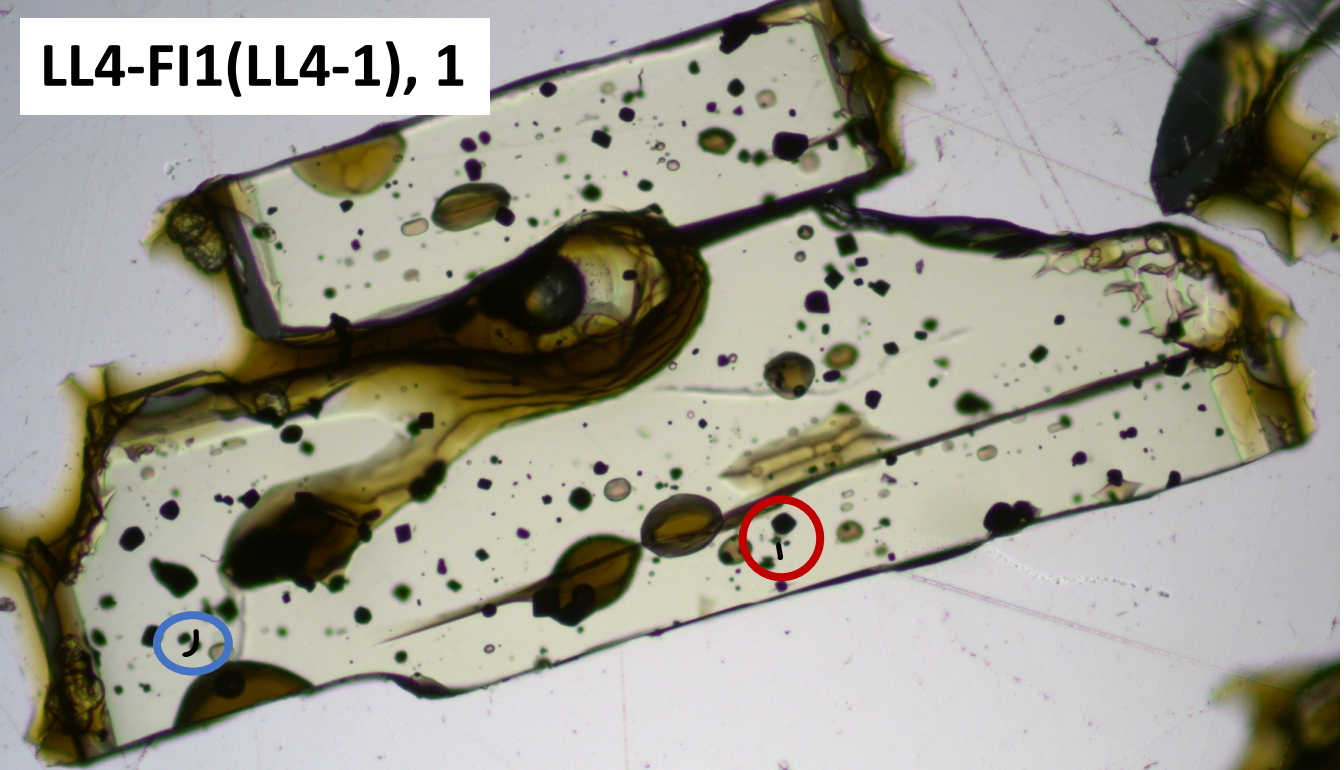
FI#1,2,3 polished out



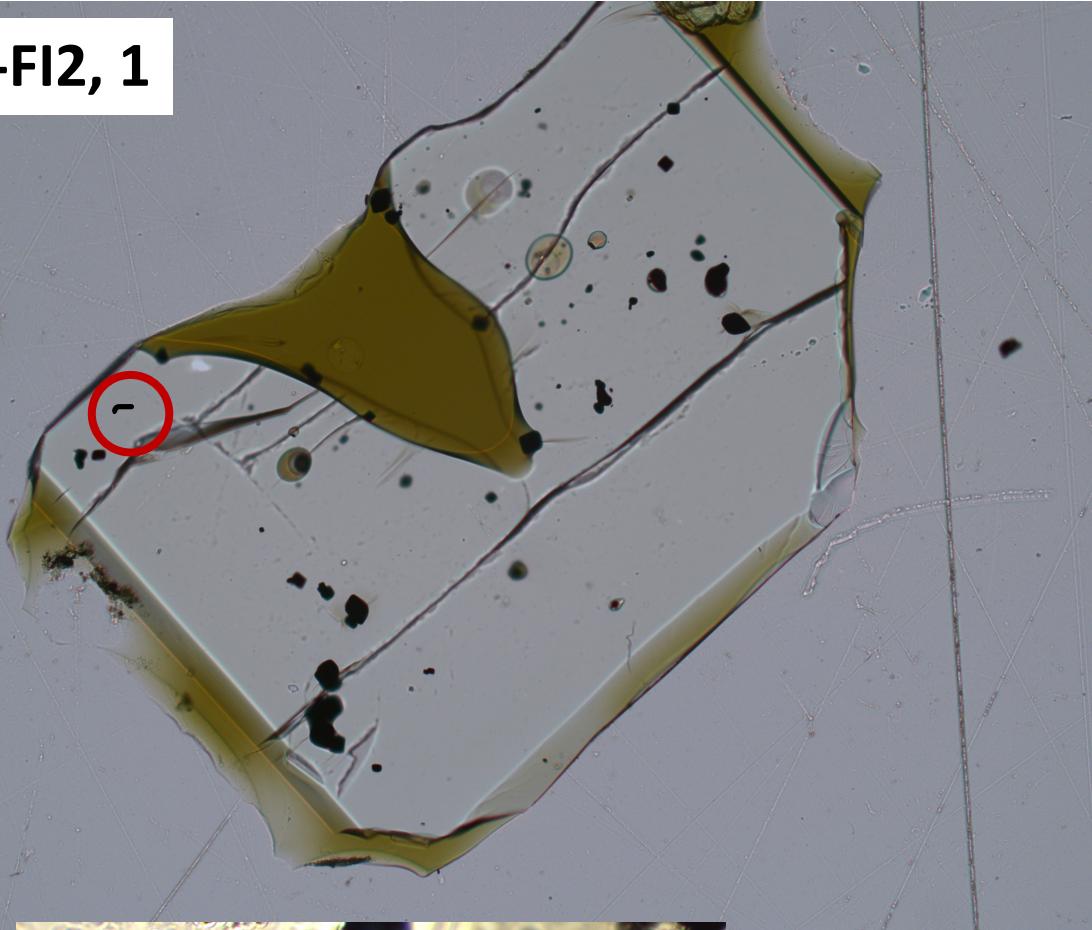
FI# 4,

This section has all the other FI in this study

LL4-FI1(LL4-1), 1

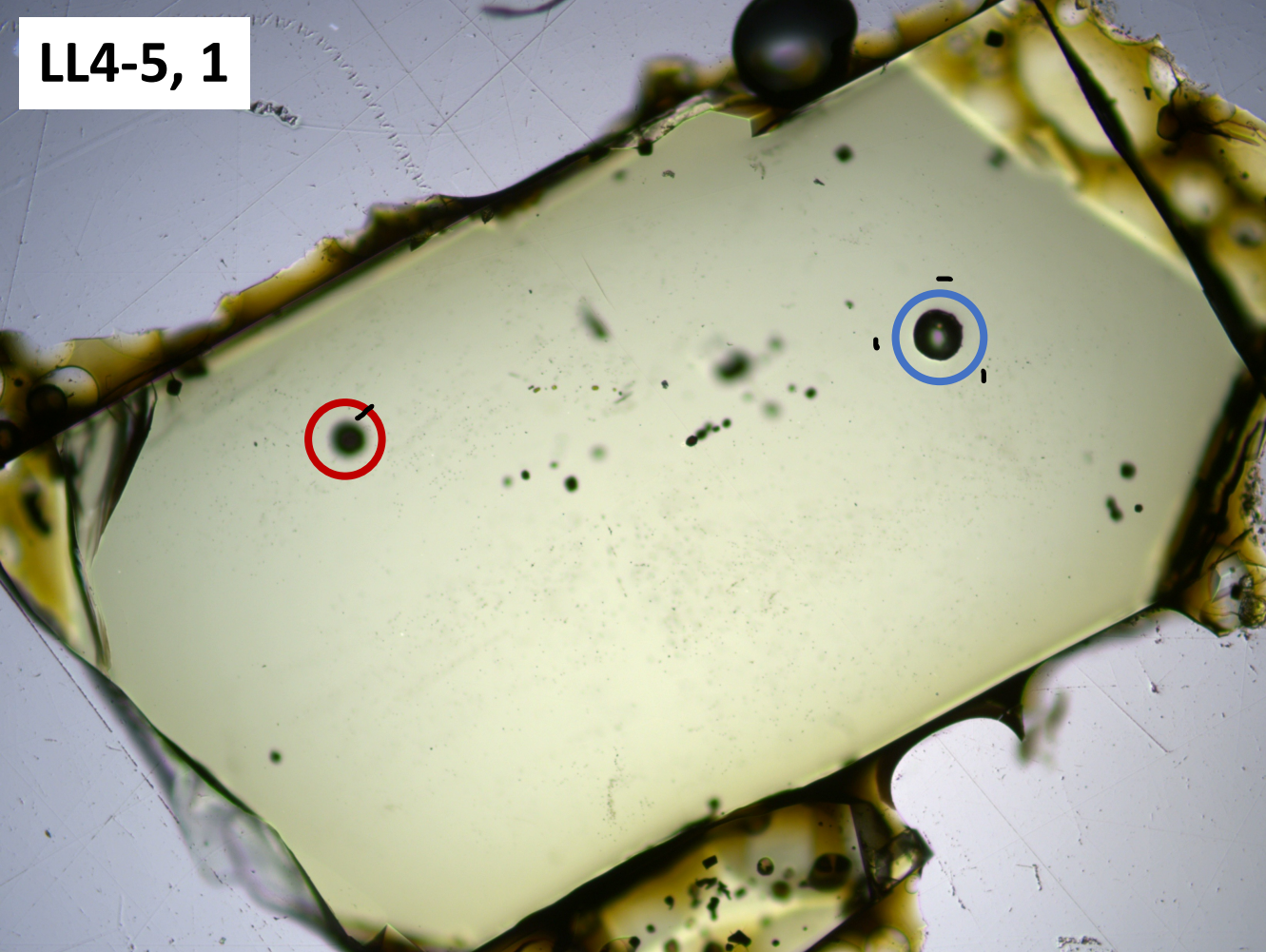


LL4-FI2, 1

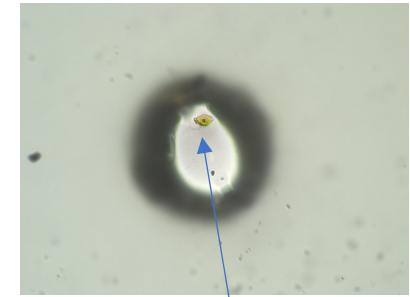
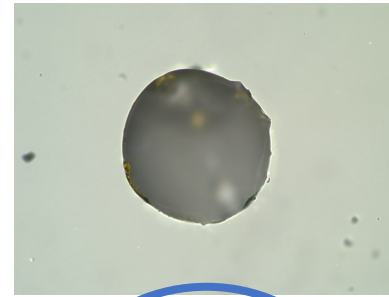


FI#1, was polished out

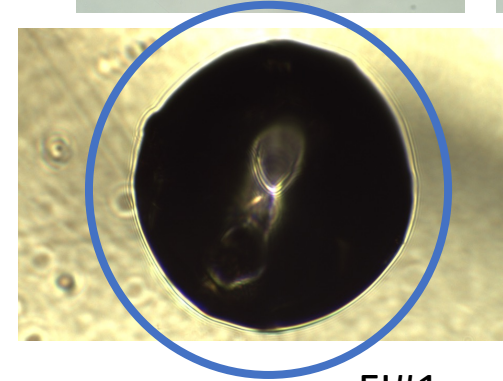
LL4-5, 1



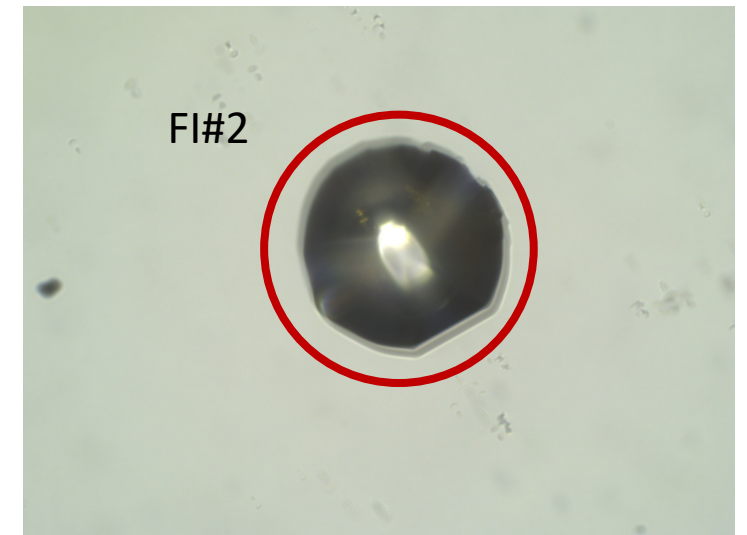
3 probe spots near 1



Tiny MI in FI??!

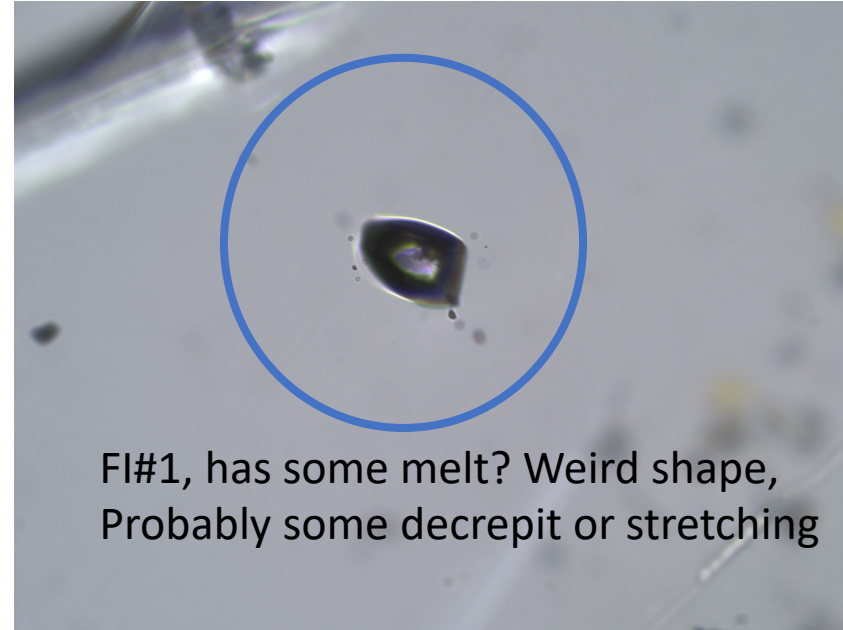
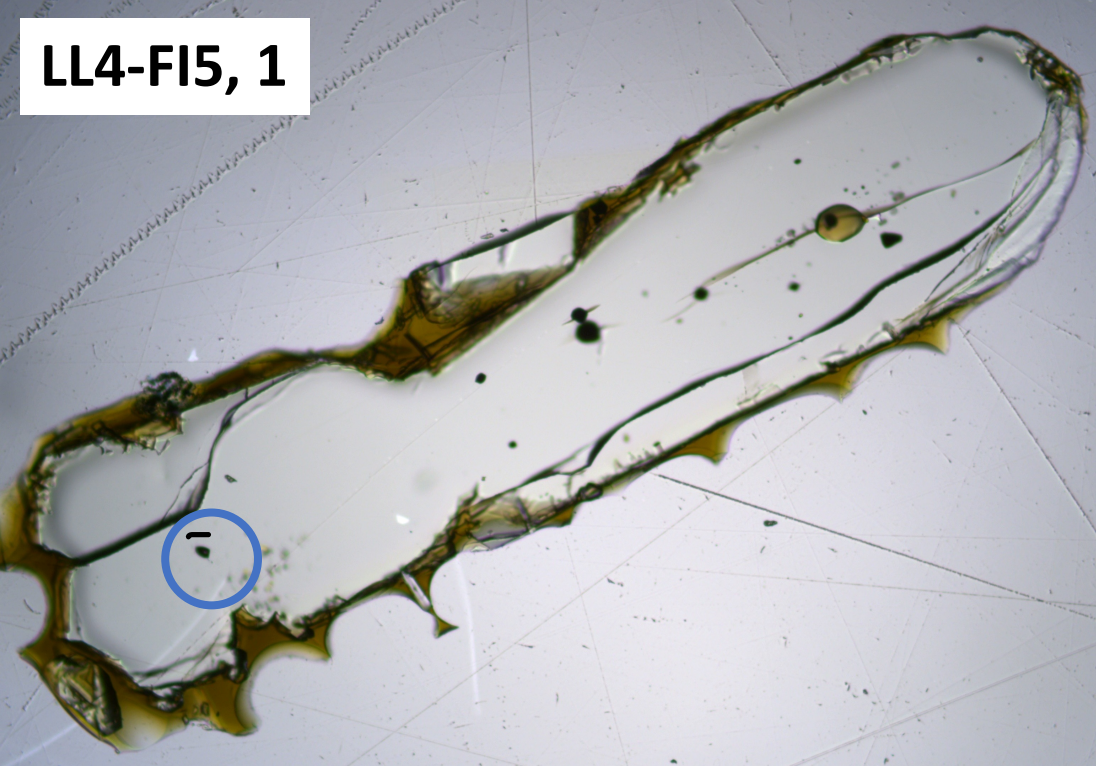


FI#1



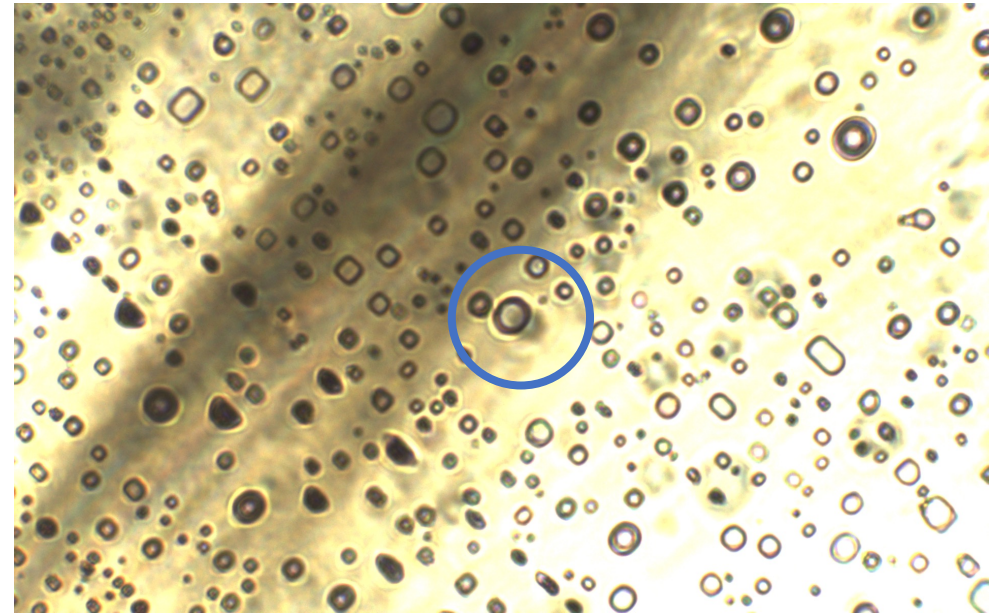
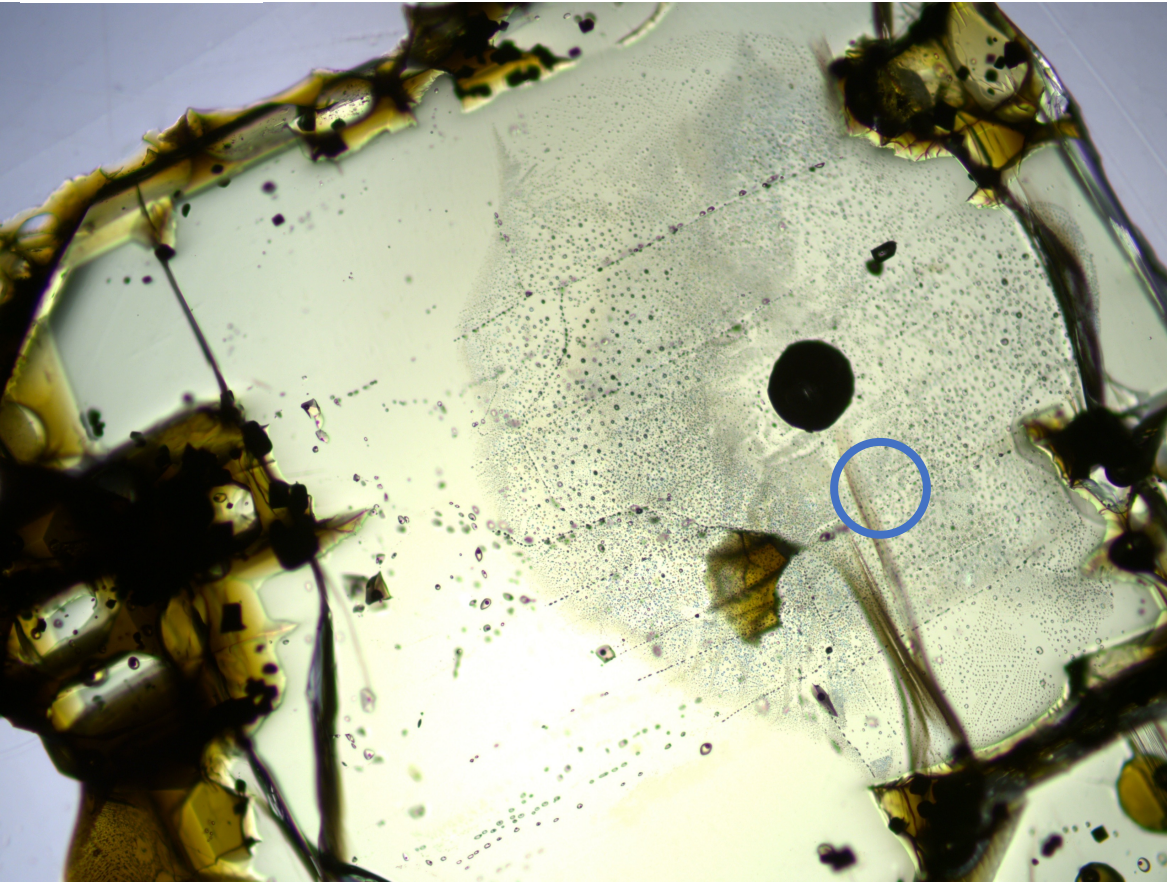
FI#2

LL4-FI5, 1



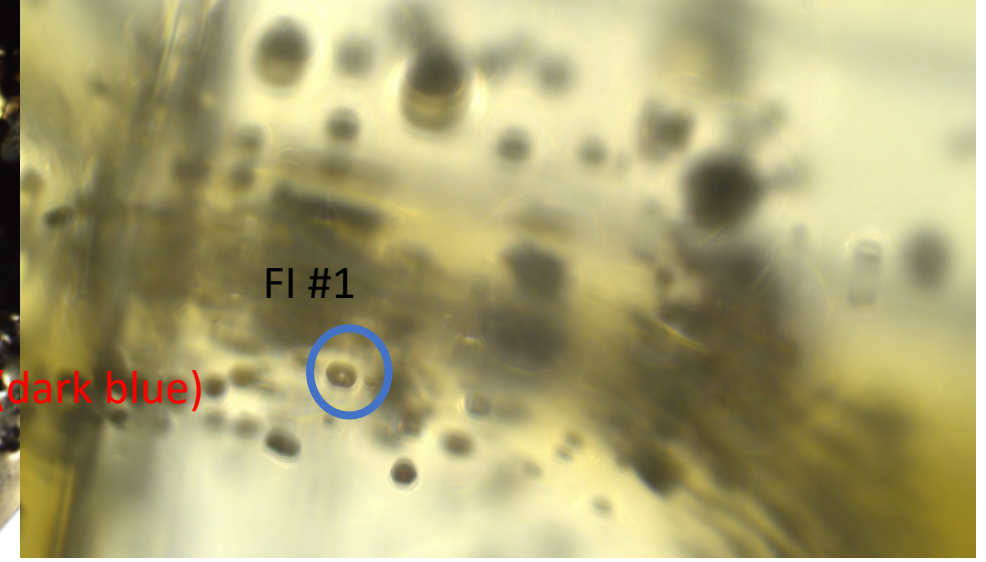
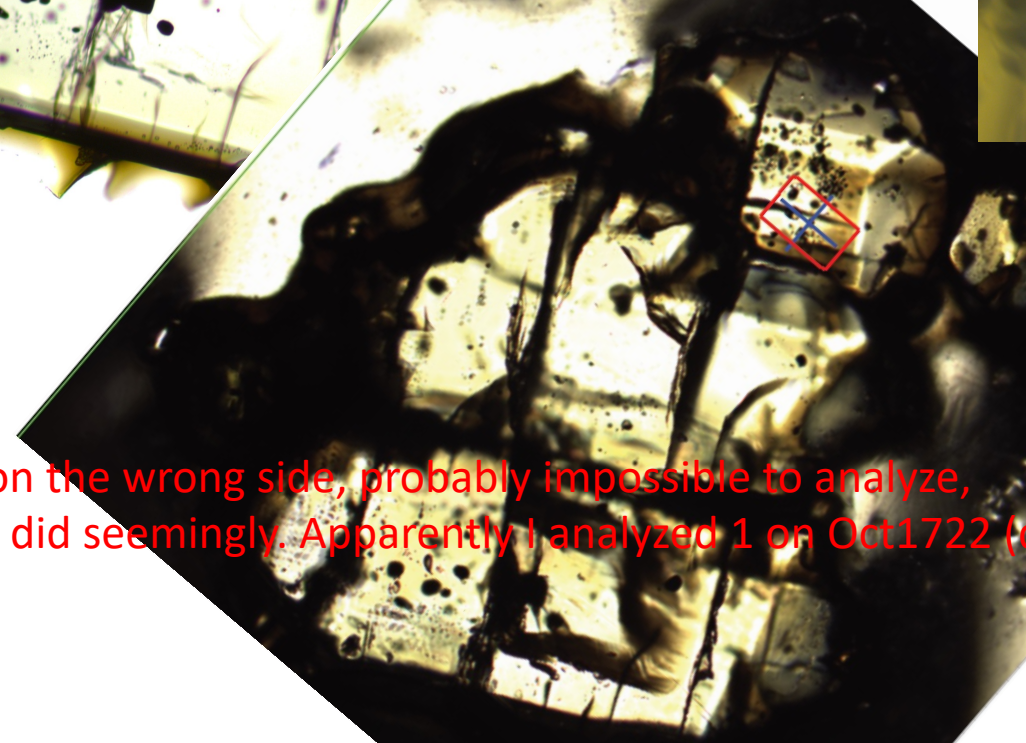
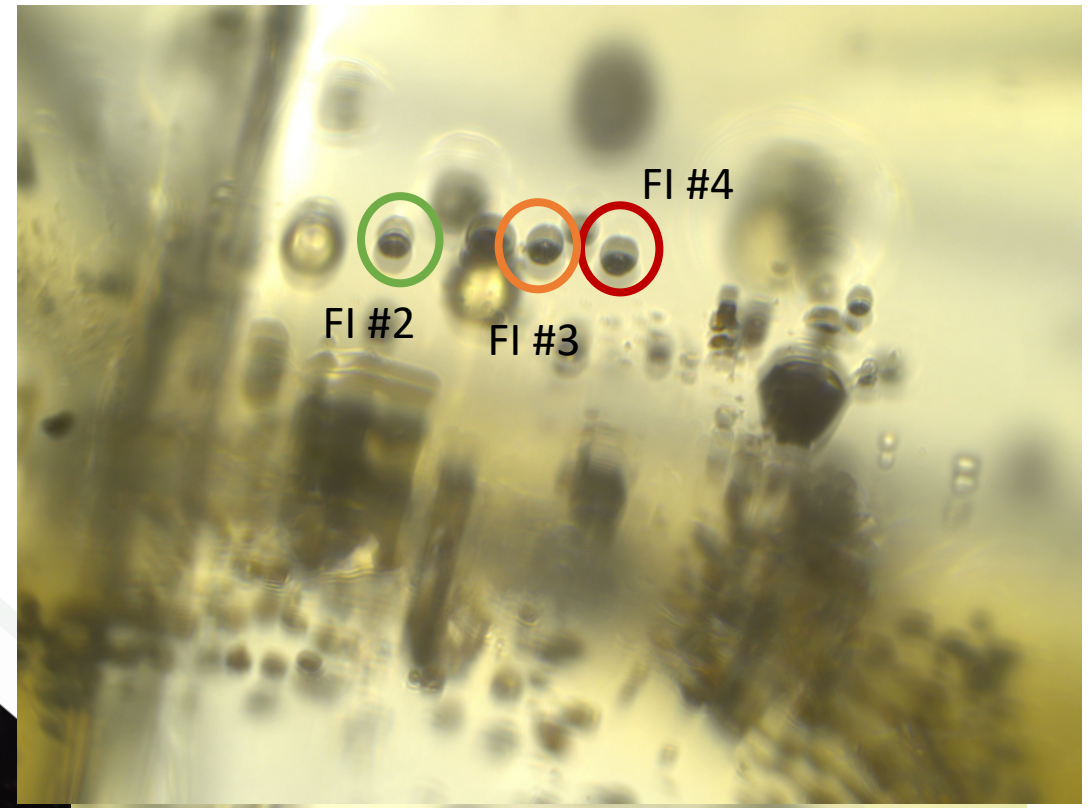
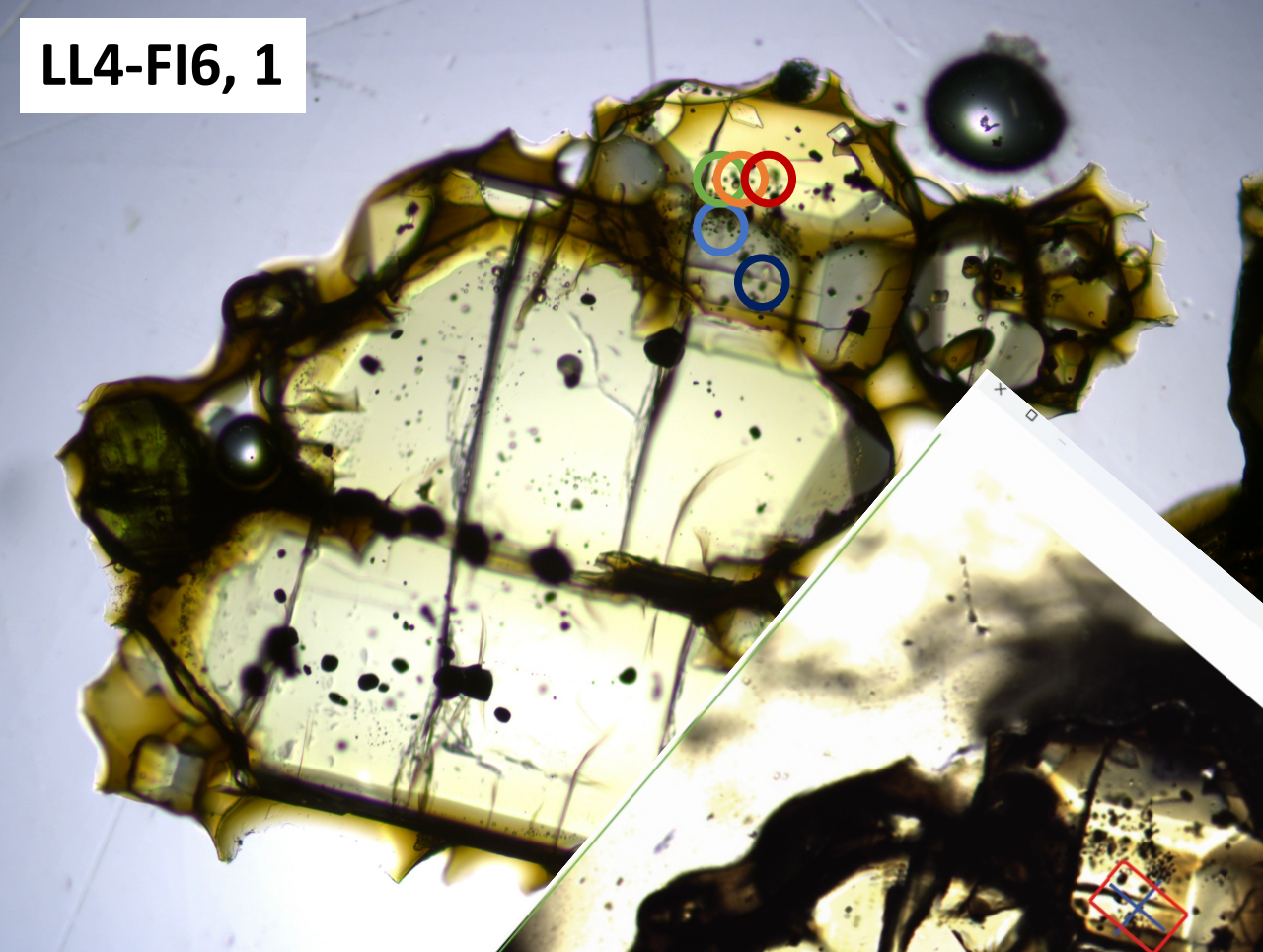
FI#1, has some melt? Weird shape,
Probably some decrepit or stretching

LL4-6, 1



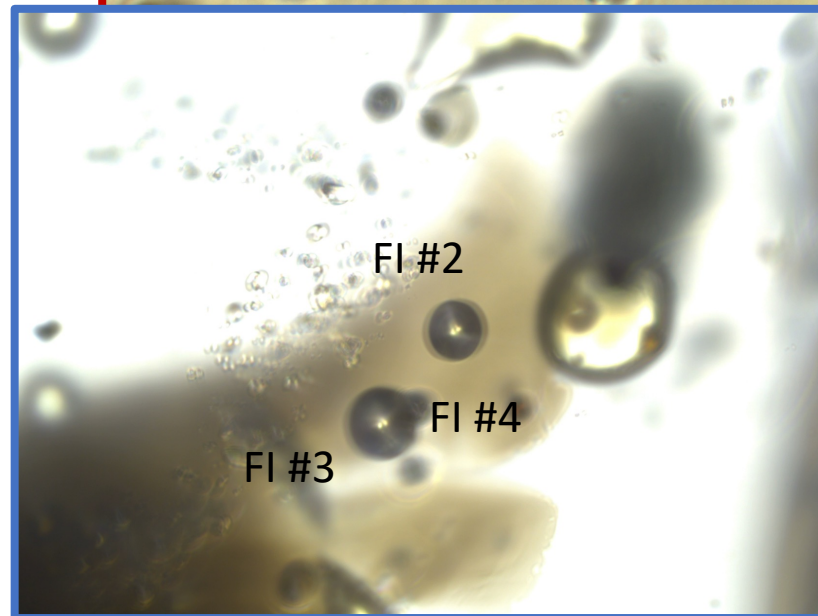
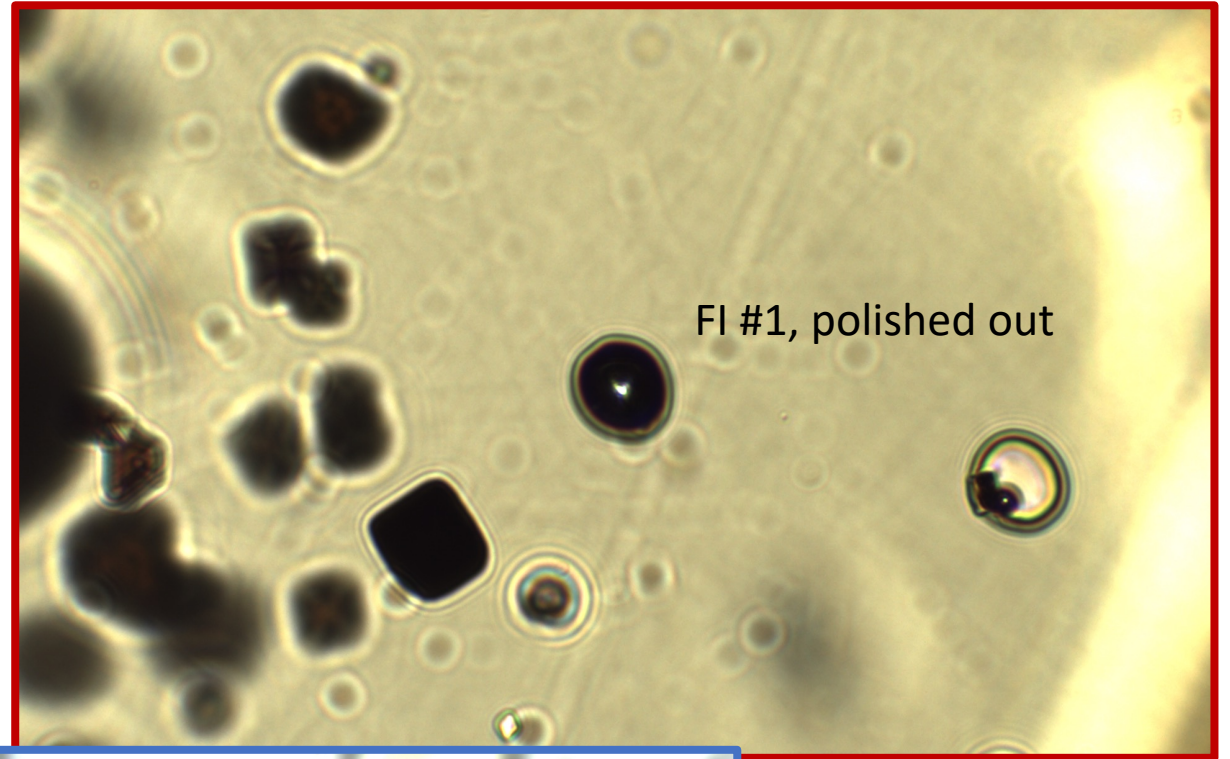
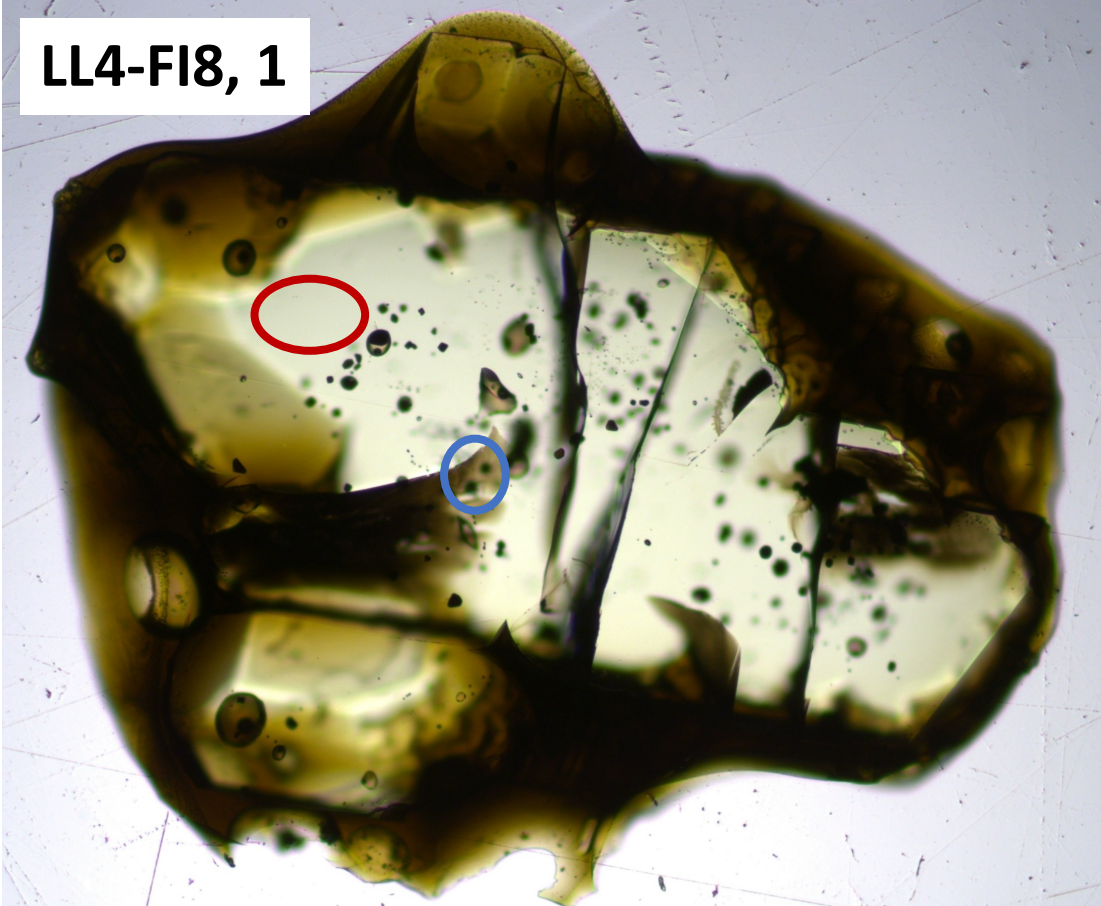
FI#1, They are probably result of decrepitation of the big one. Cloud of FI around the big decrepit one. Cross cut by many Secondary planes.

LL4-FI6, 1

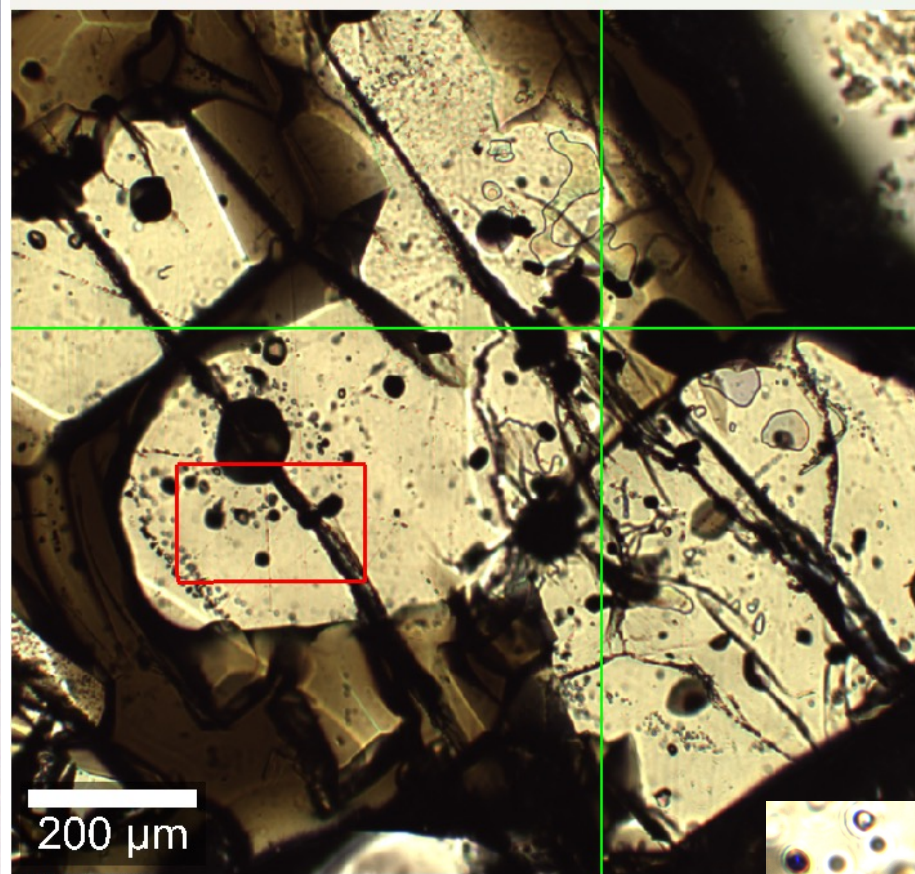
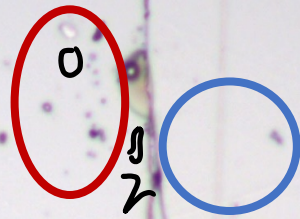


FI are on the wrong side, probably impossible to analyze, I never did seemingly. Apparently I analyzed 1 on Oct1722 (dark blue)

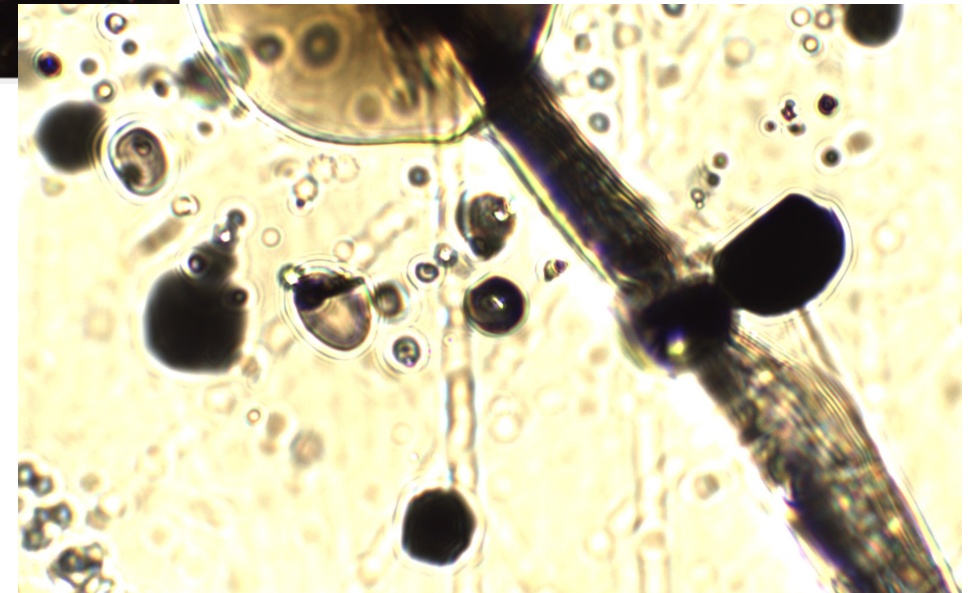
LL4-FI8, 1



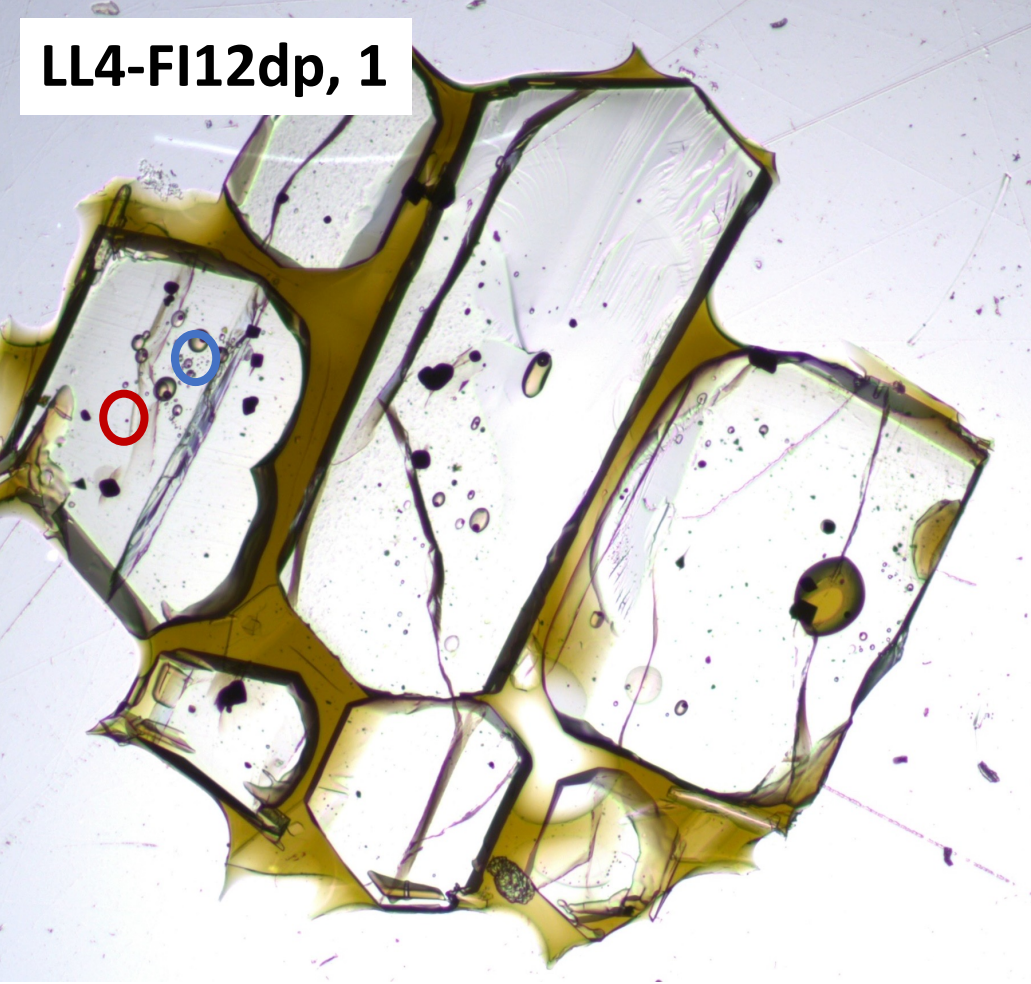
LL4-FI9, 1



FI #1, broken off, would have been
Near the blue, but if I analyse
In the red area it should be good.



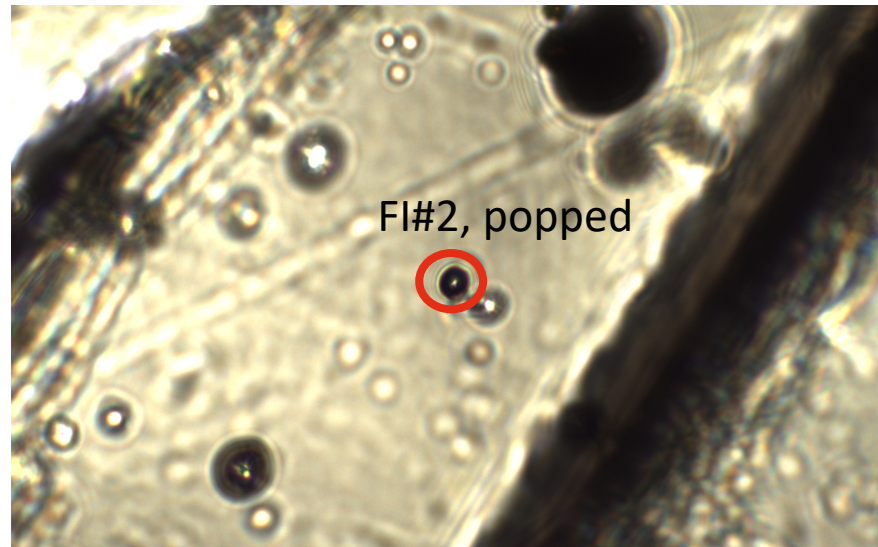
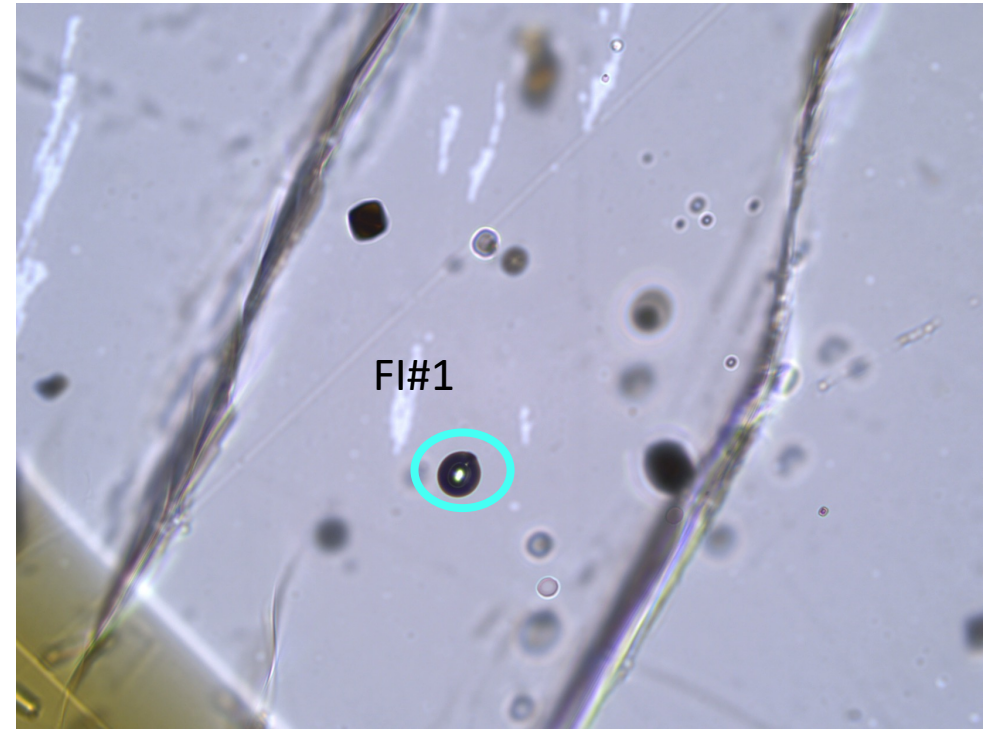
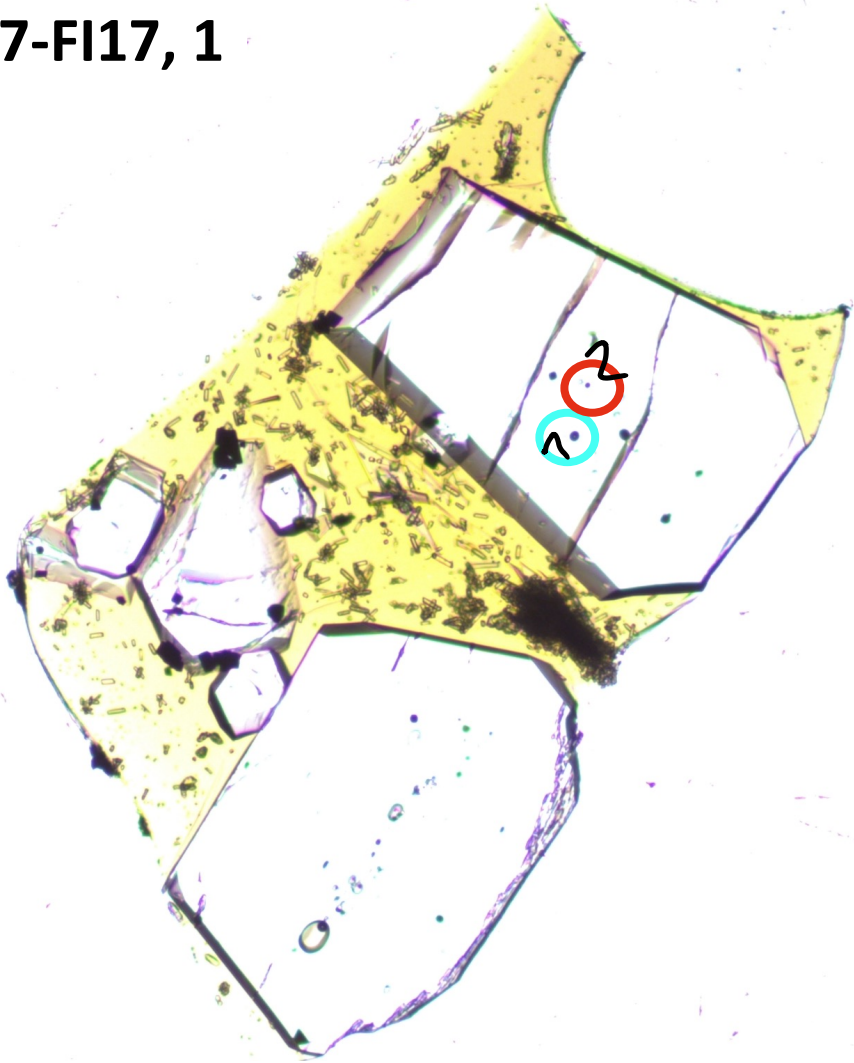
LL4-FI12dp, 1



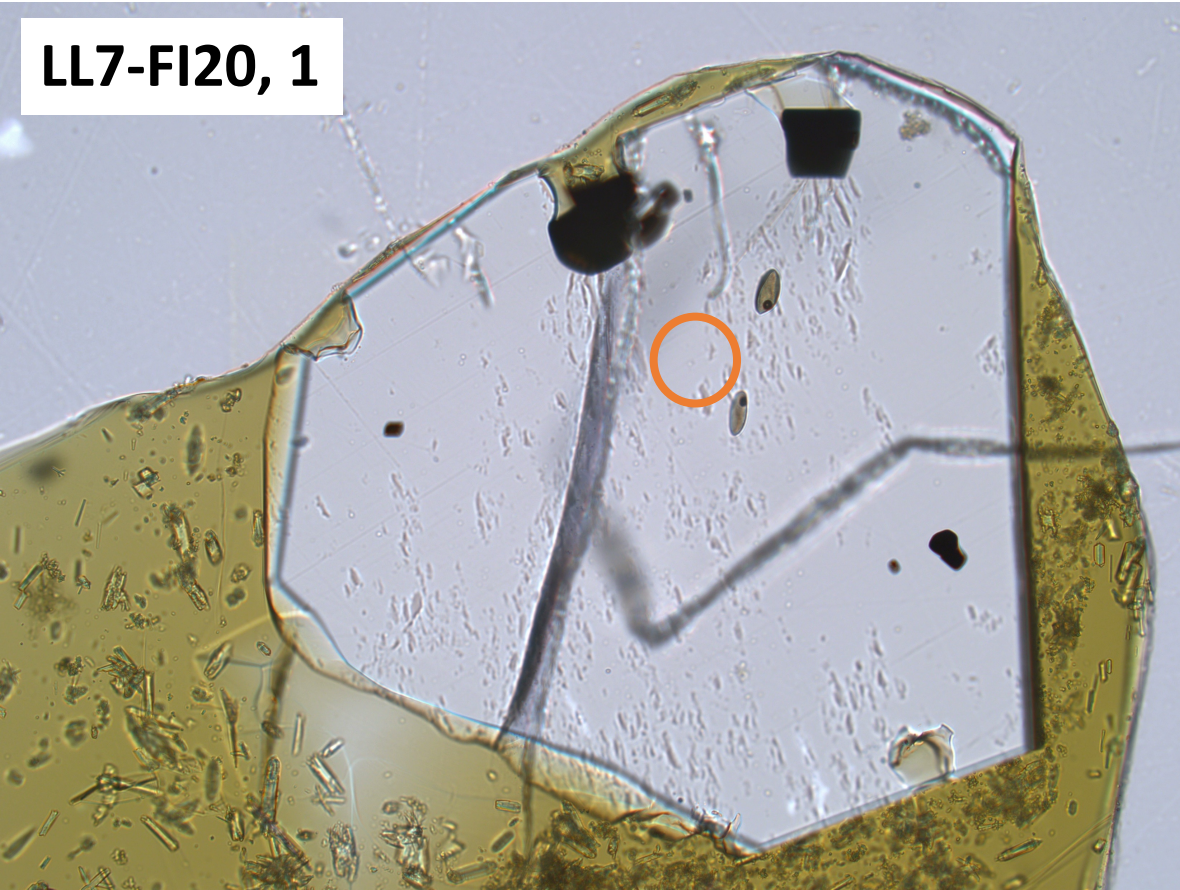
I never analyzed this



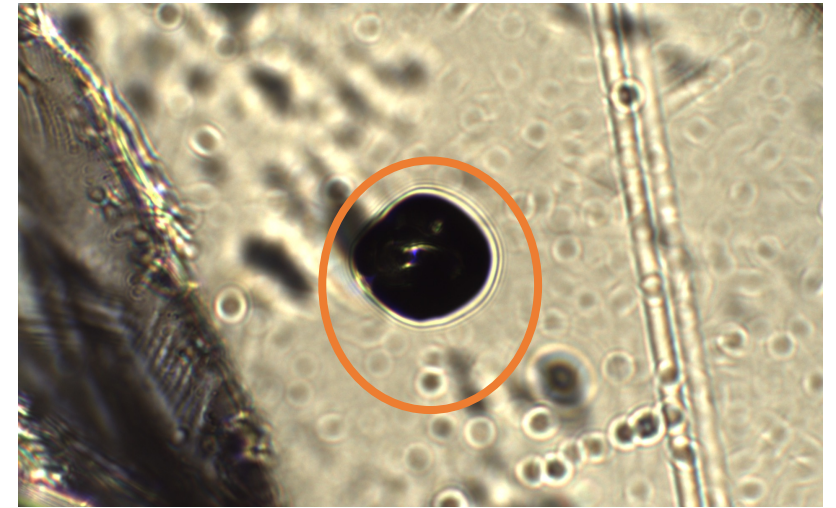
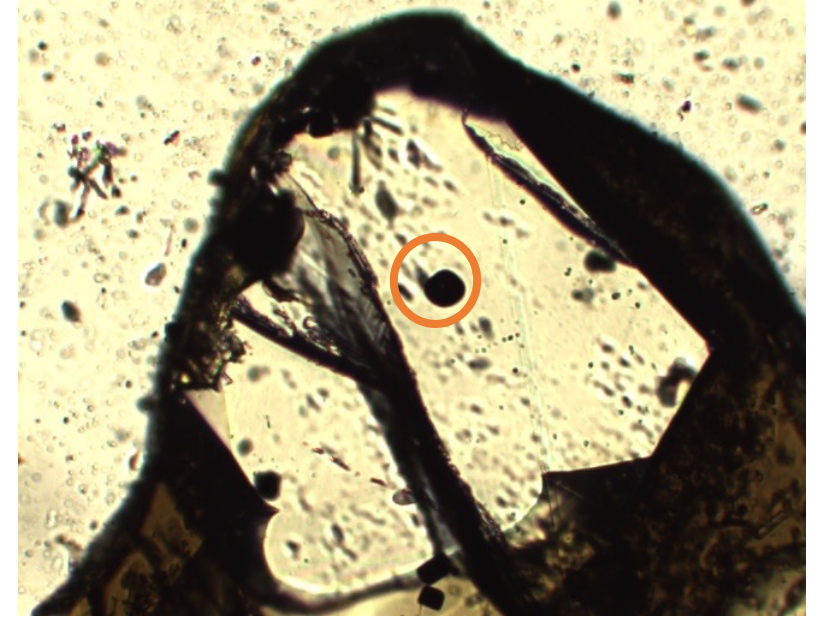
LL7-FI17, 1



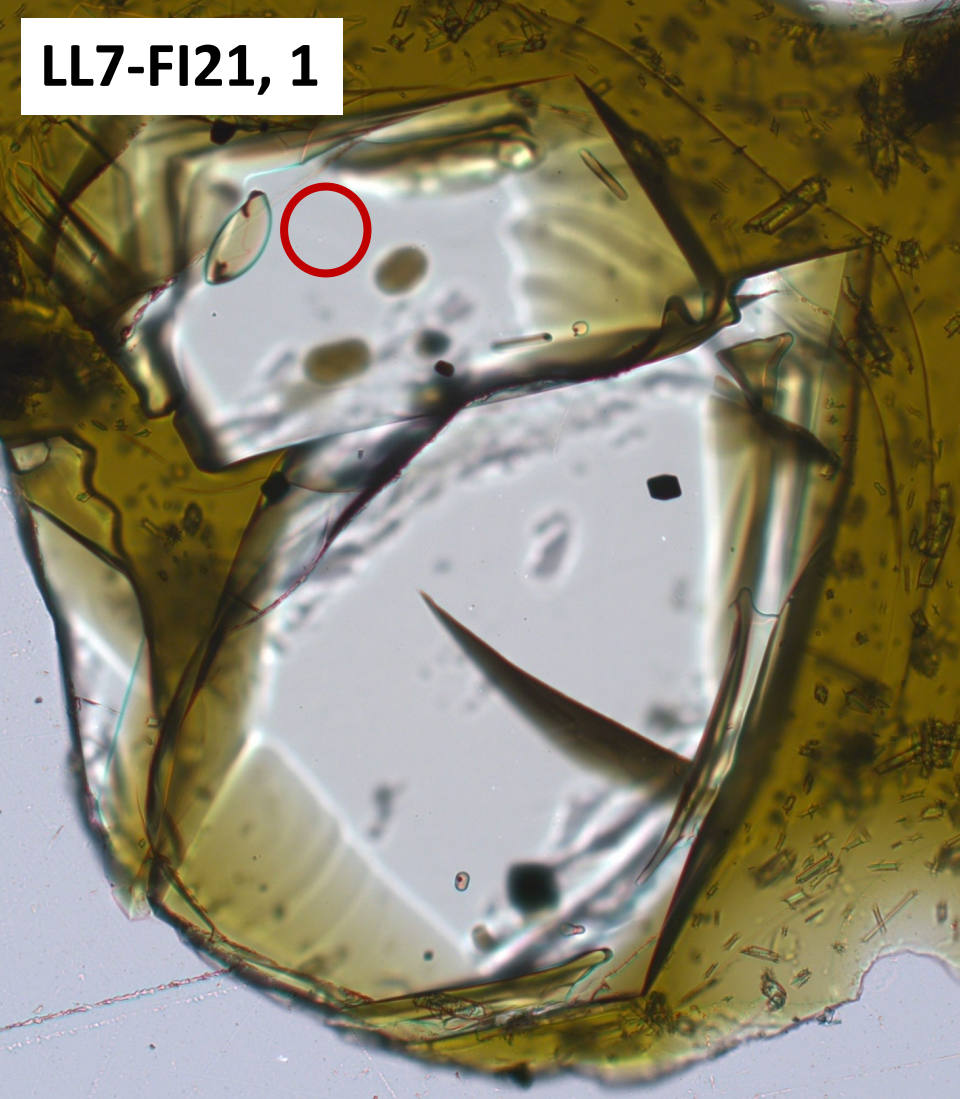
LL7-FI20, 1



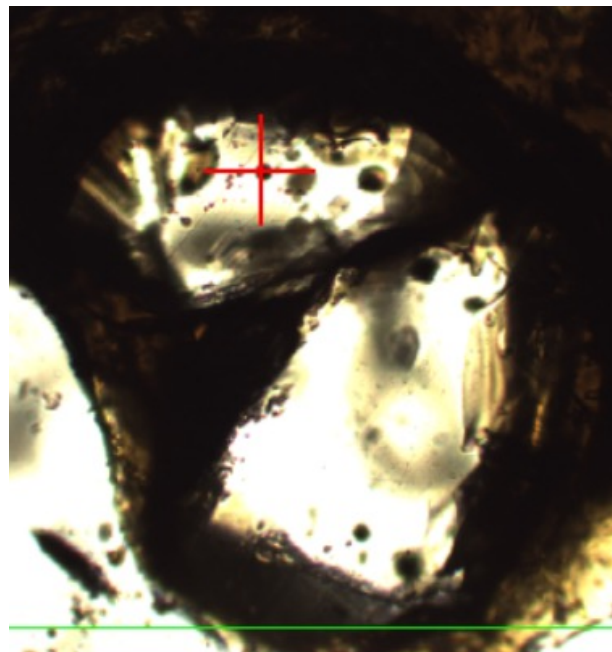
Fl#1 gone



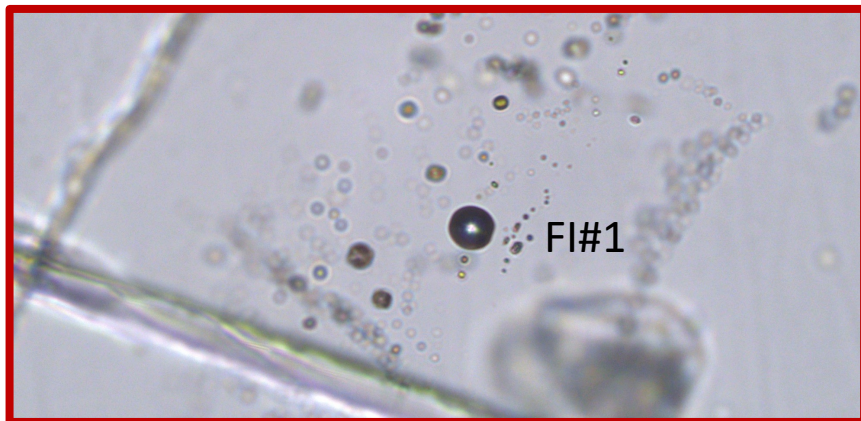
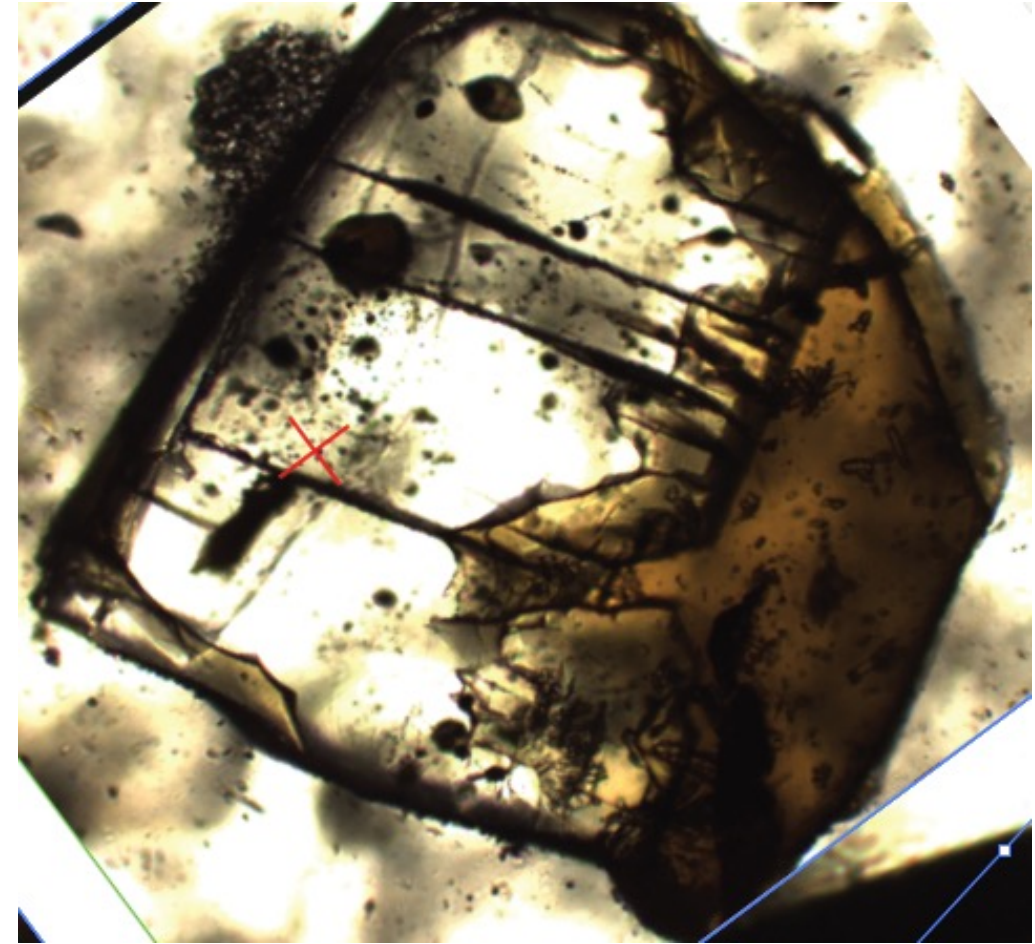
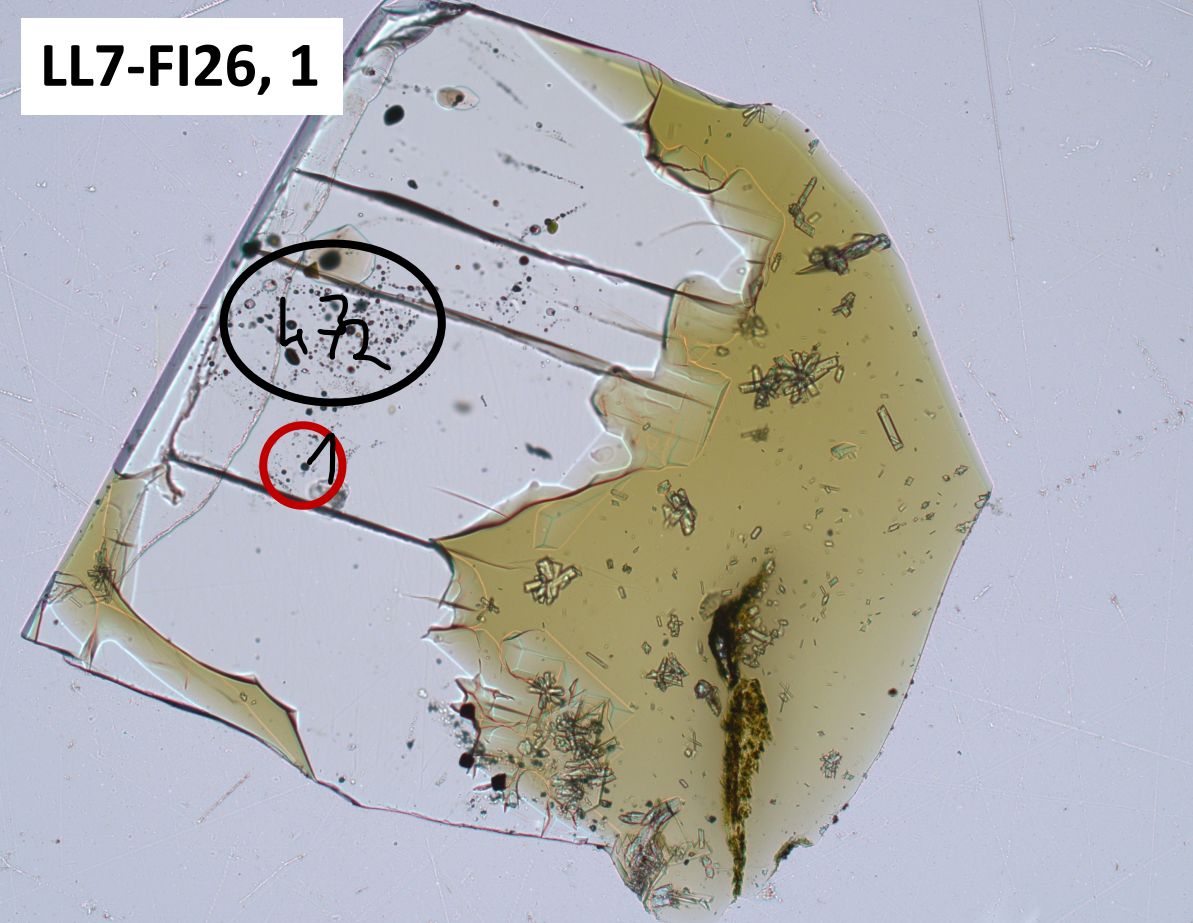
LL7-FI21, 1



Fl#1 gone

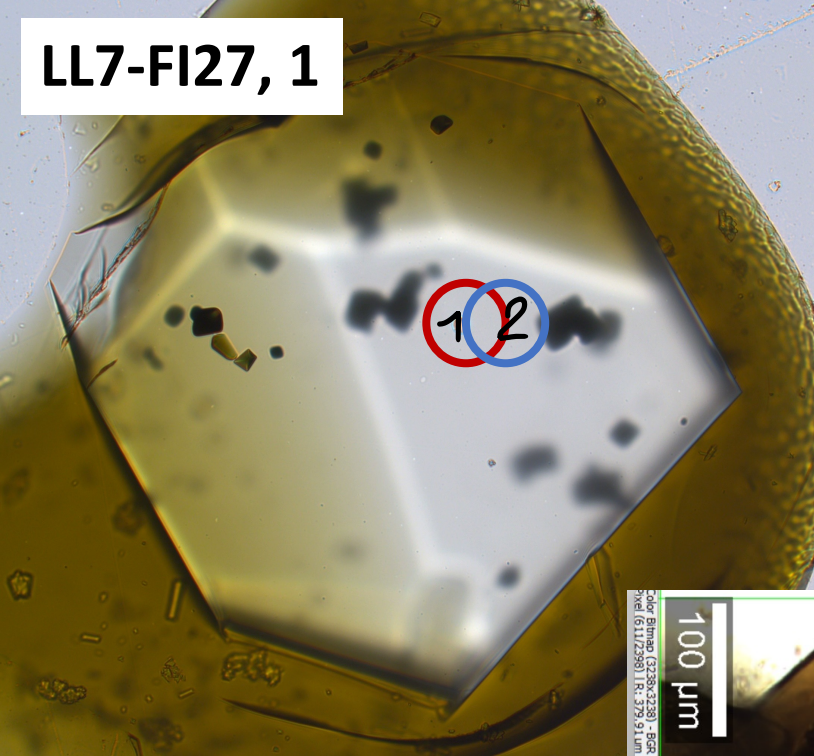


LL7-FI26, 1

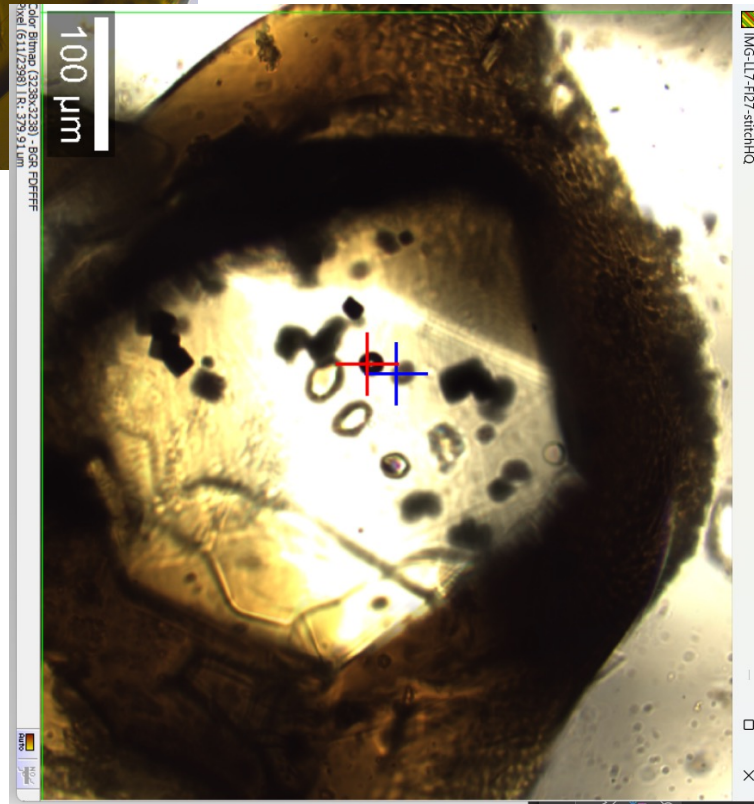
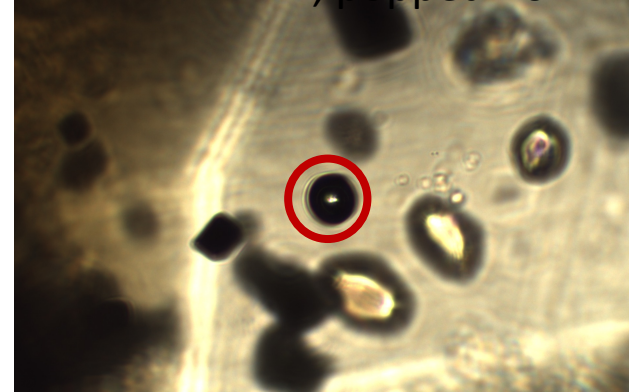


This crystal has a whole cluster with various amounts of melt

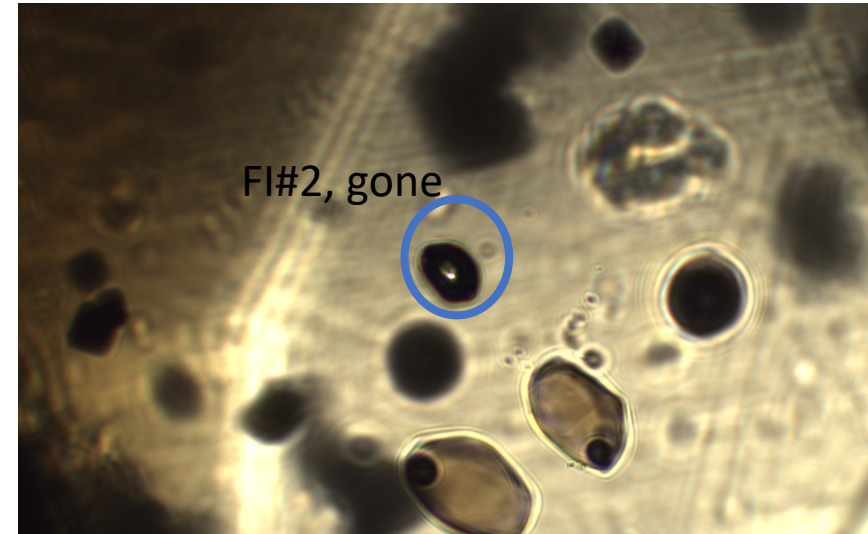
LL7-FI27, 1



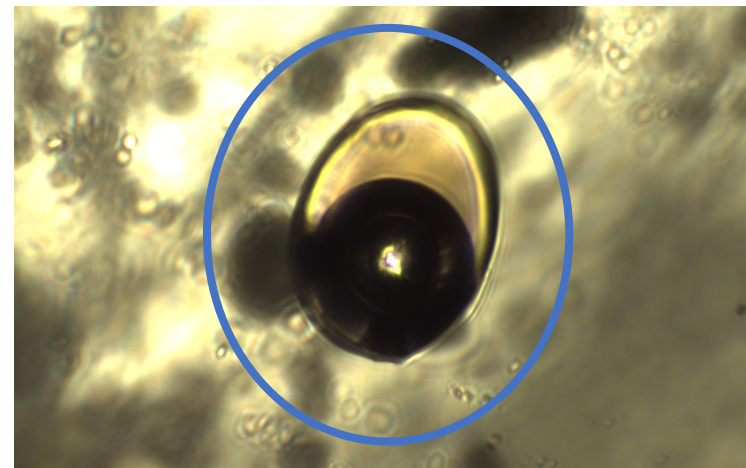
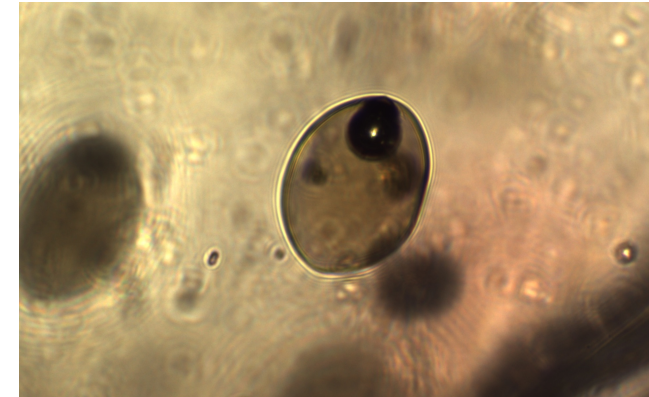
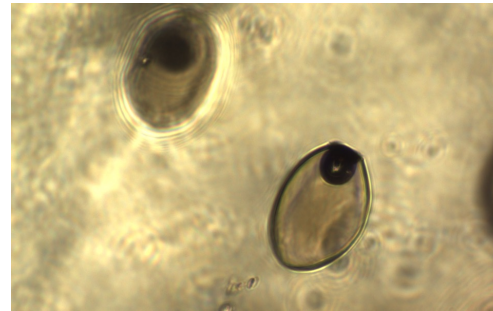
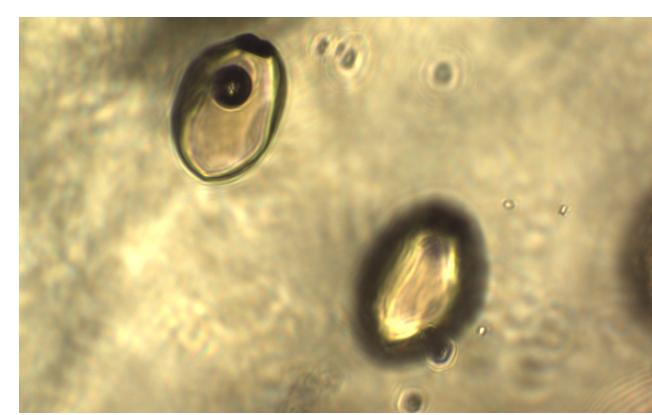
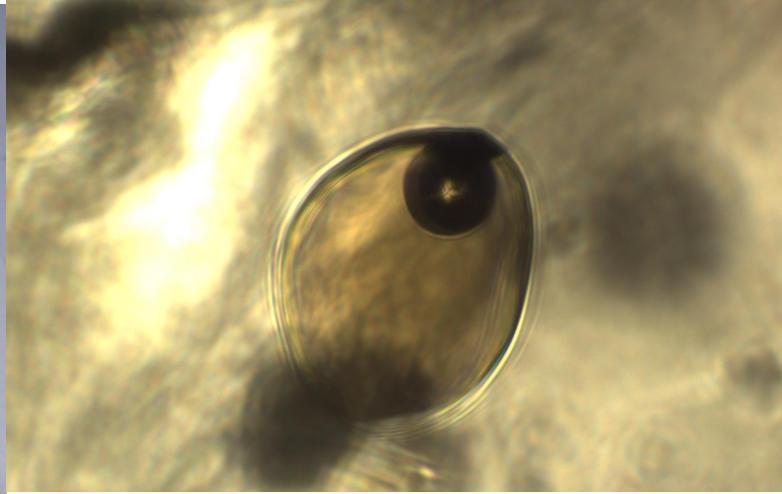
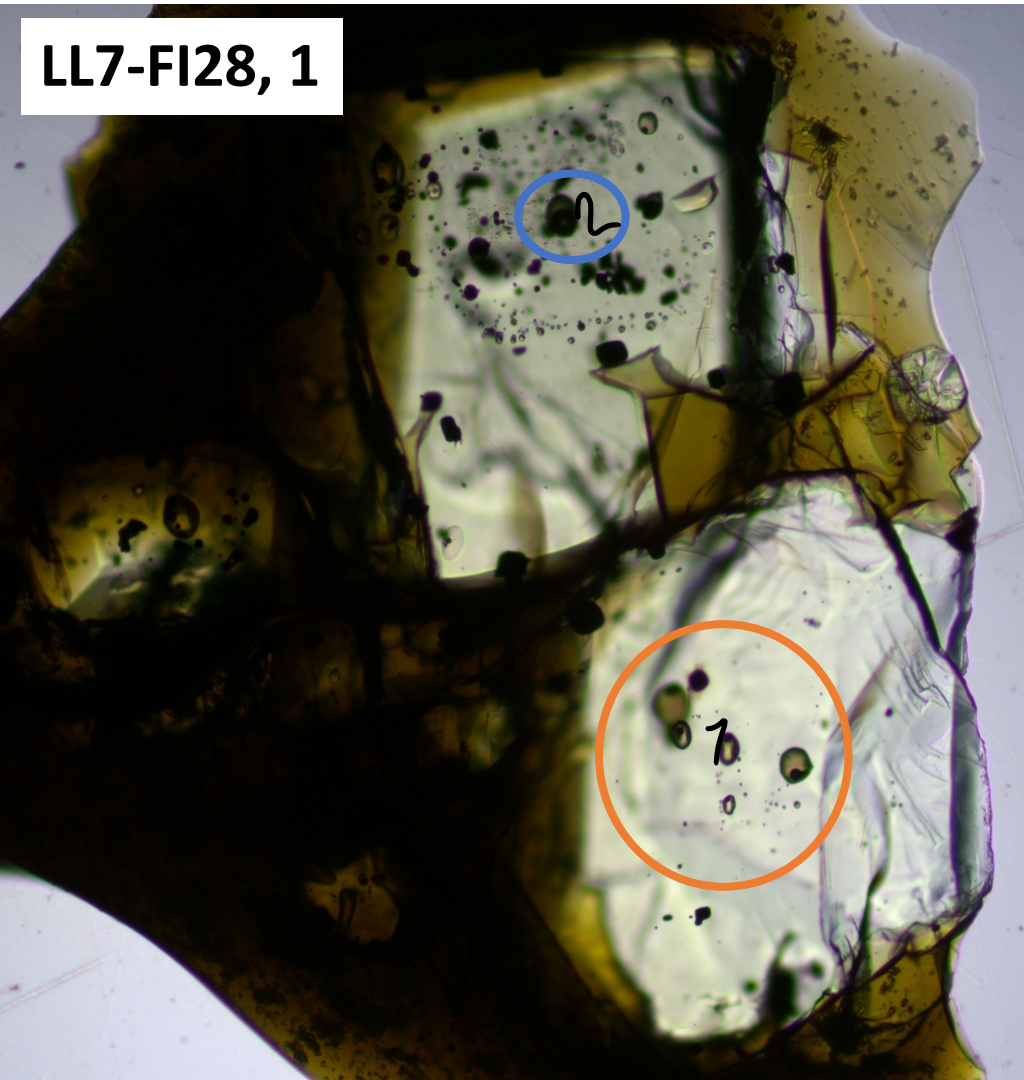
FI#1, popped now



FI#2, gone

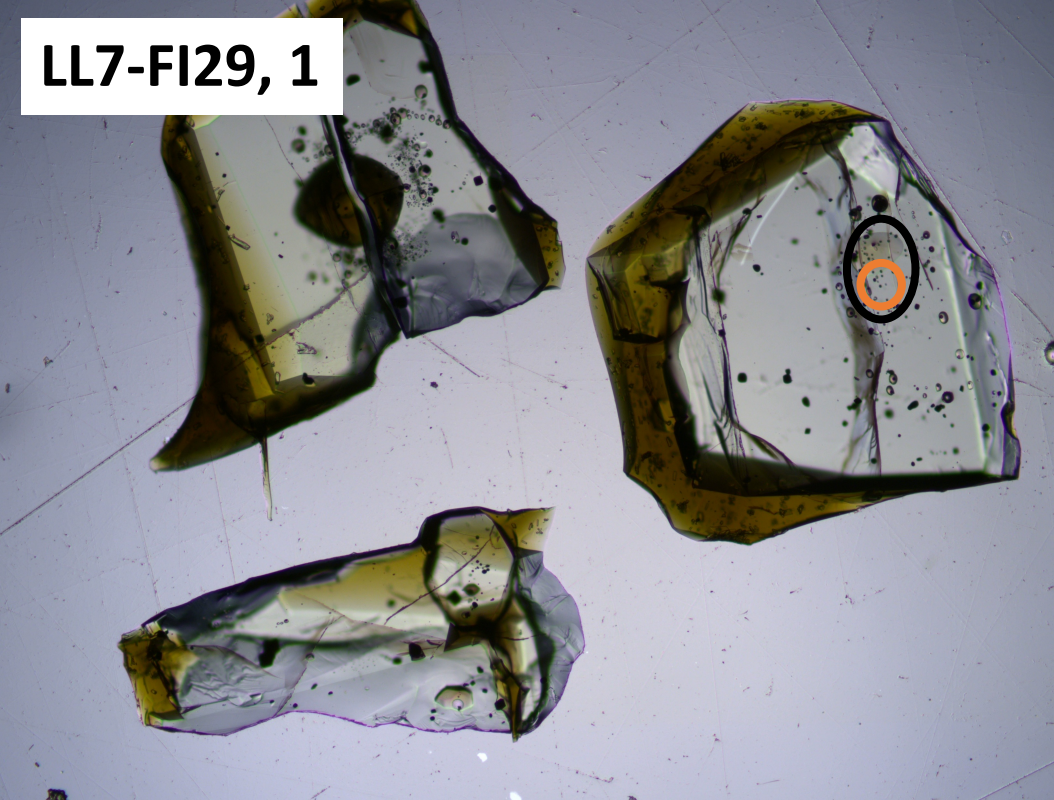


LL7-FI28, 1

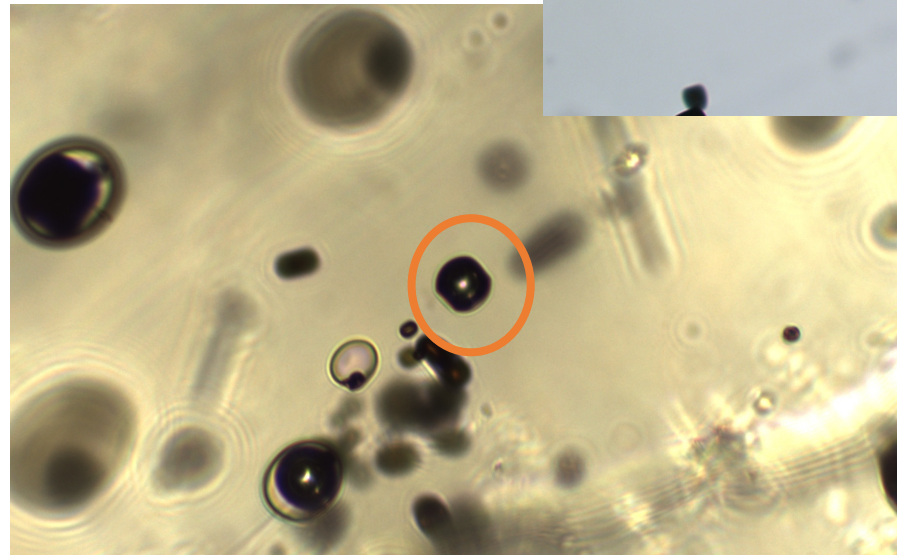
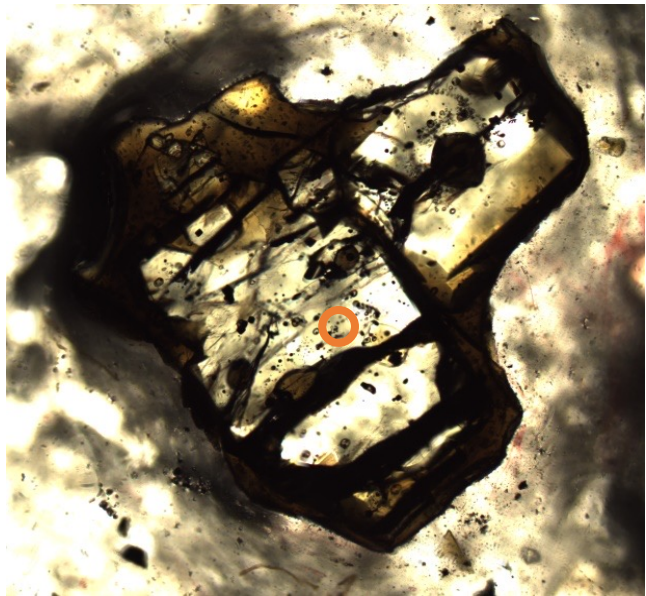
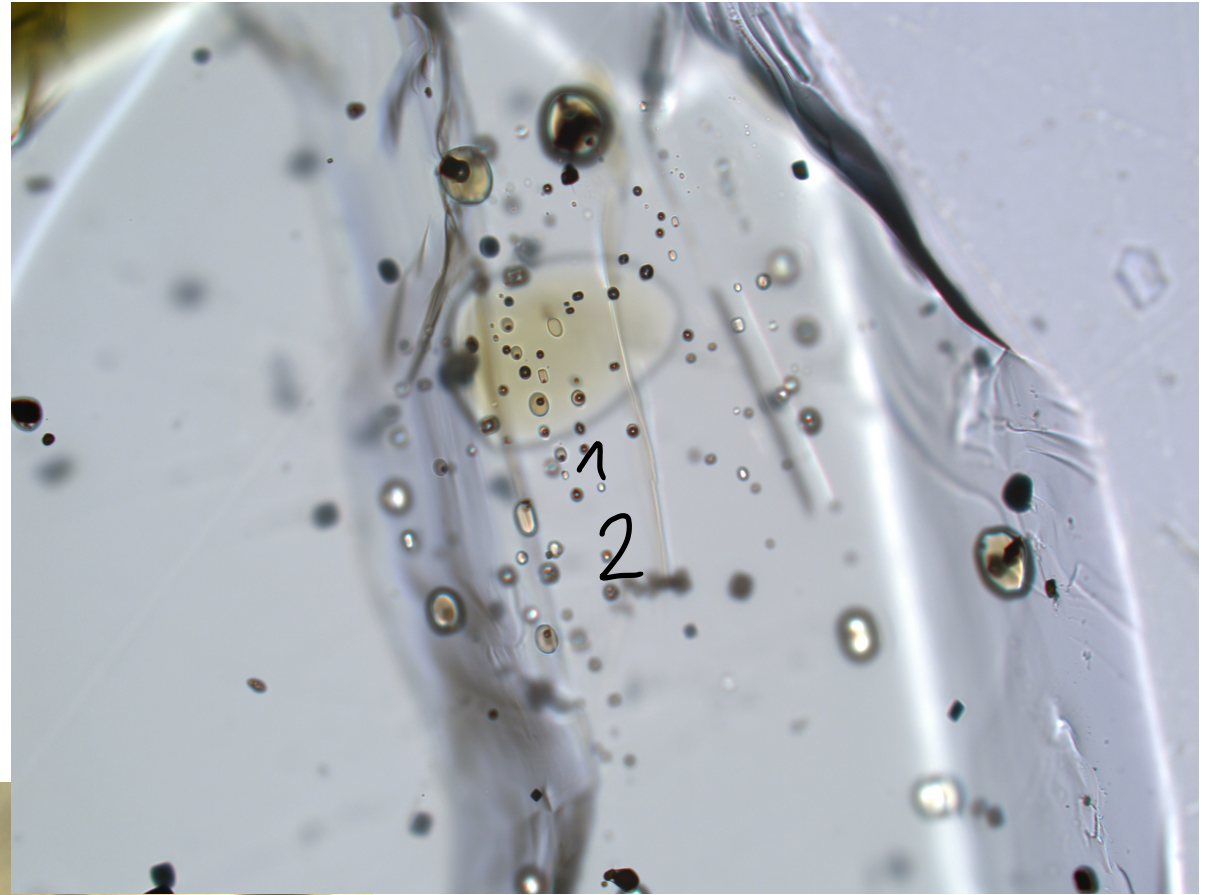


Mis only, maybe has some tiny FI in top crystal but not analyzed

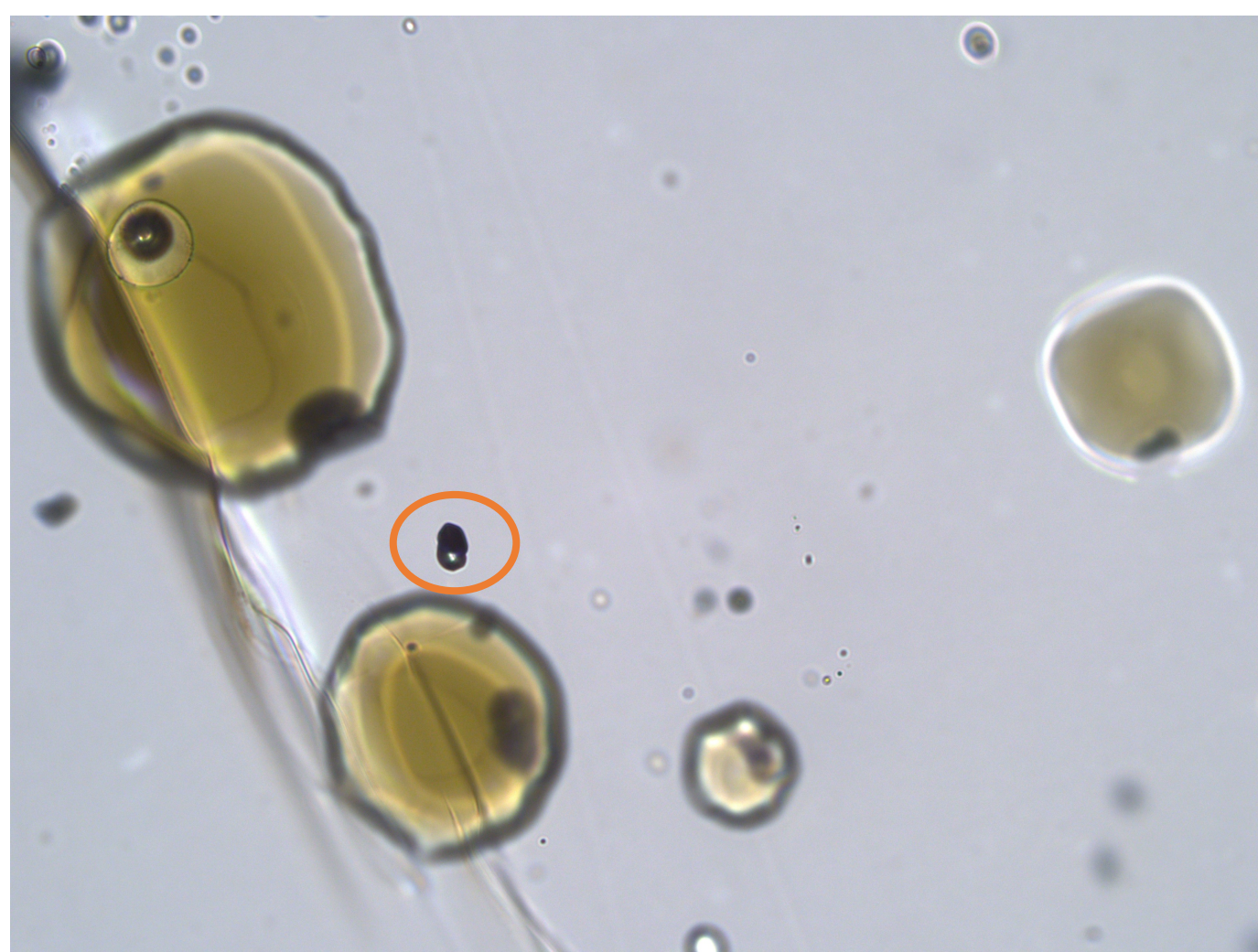
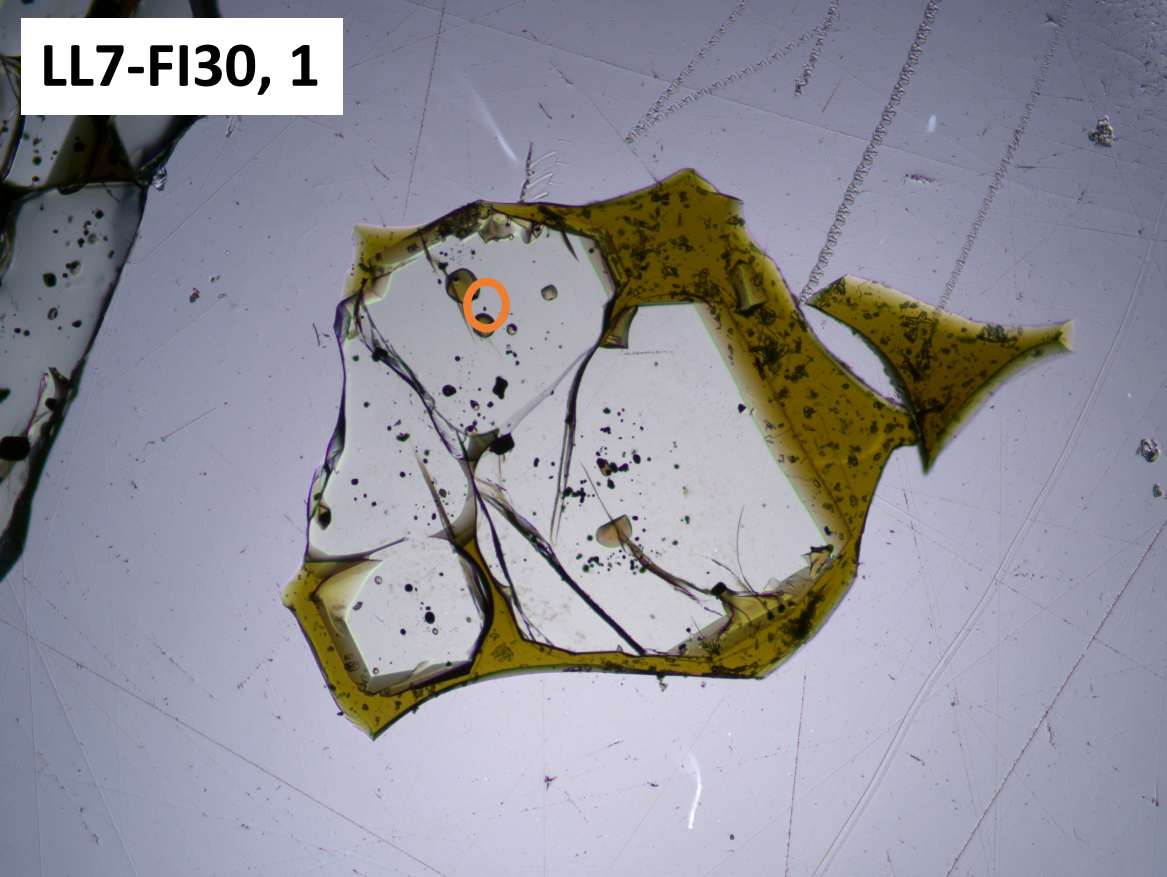
LL7-FI29, 1



FI# 1 gone. But there is a cluster visible with lots of FI

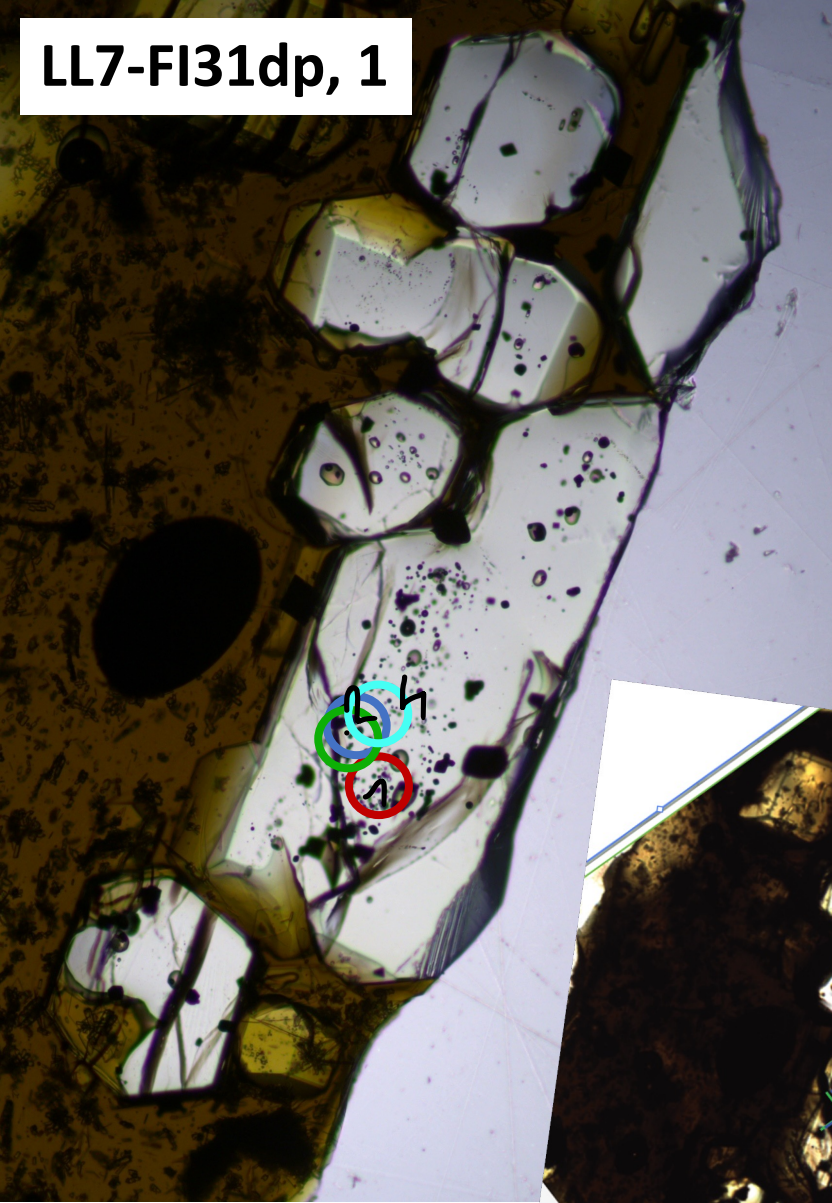


LL7-FI30, 1

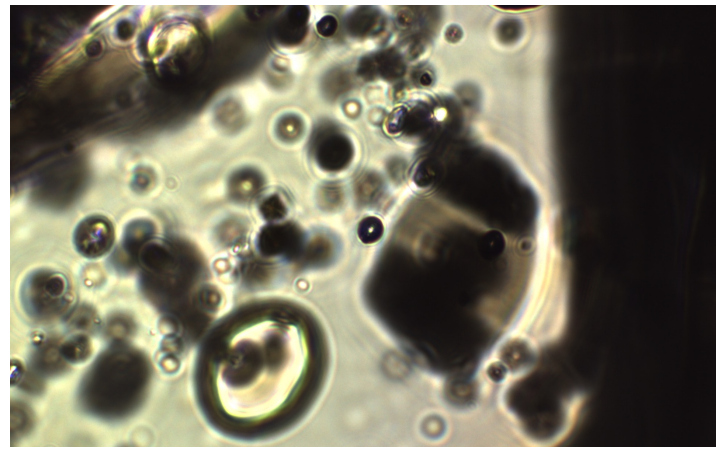


FI#1 never analyzed, attached to spinel

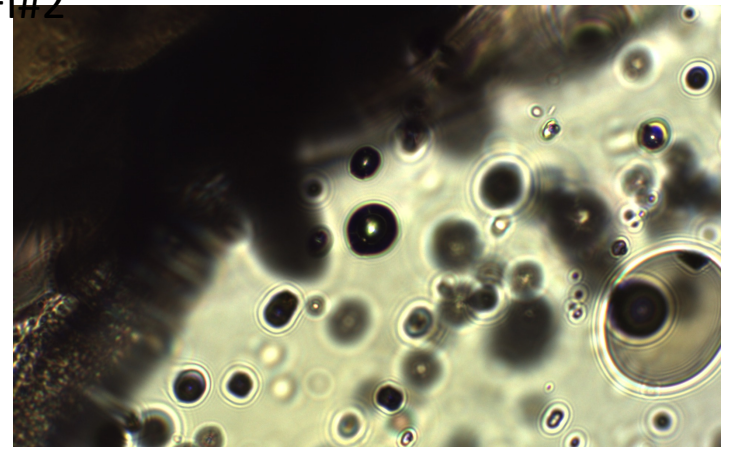
LL7-FI31dp, 1



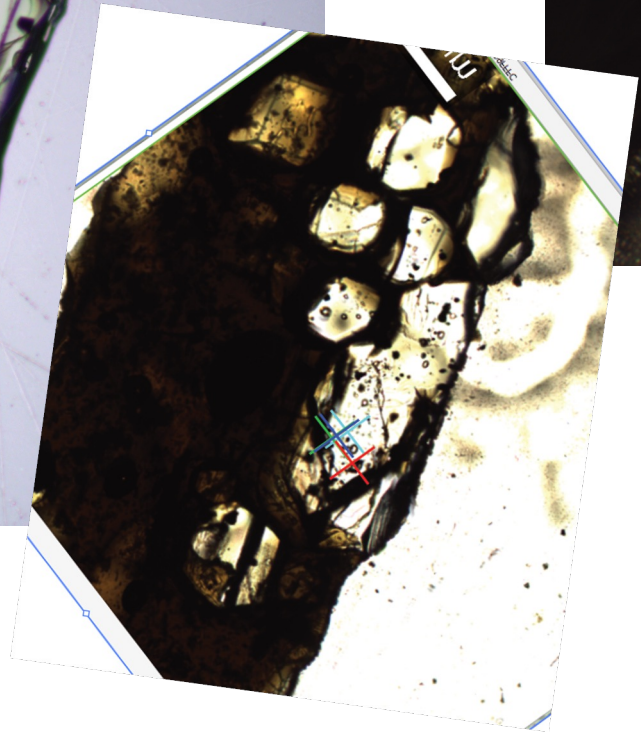
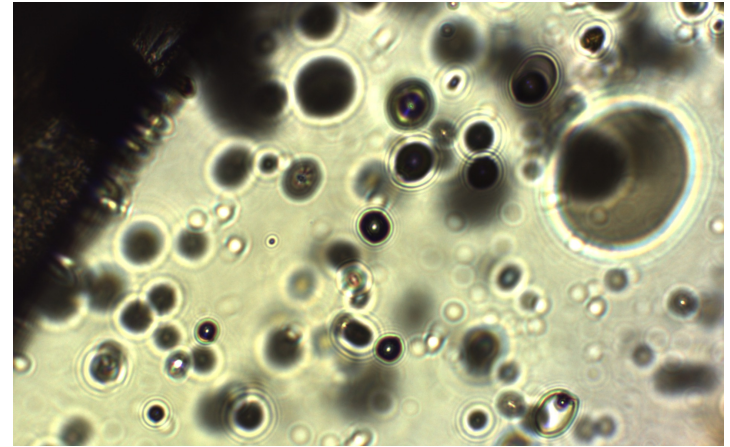
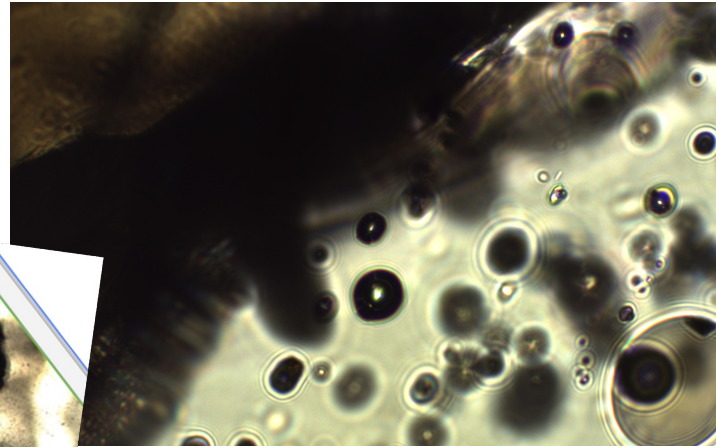
FI#1



FI#2

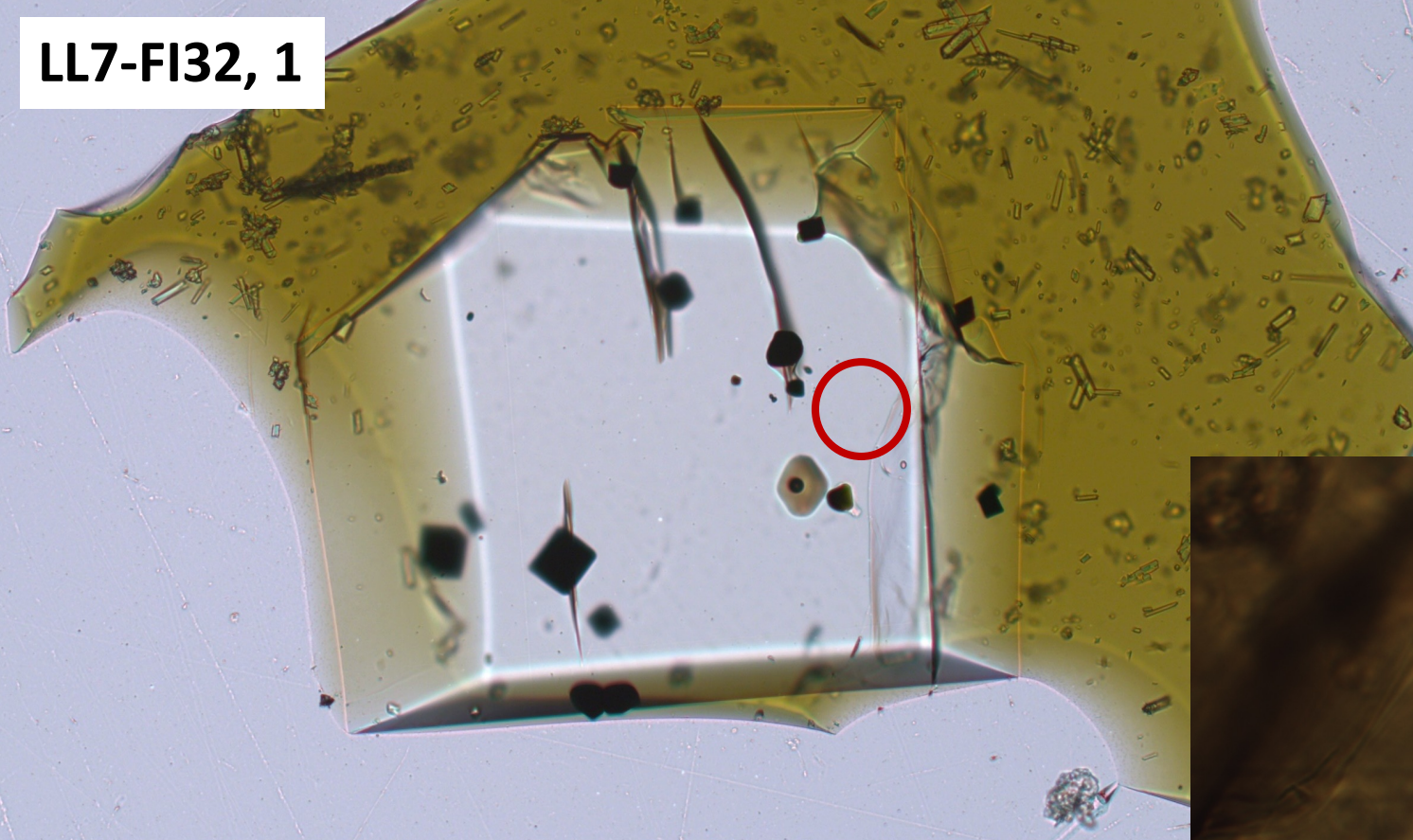


FI#3

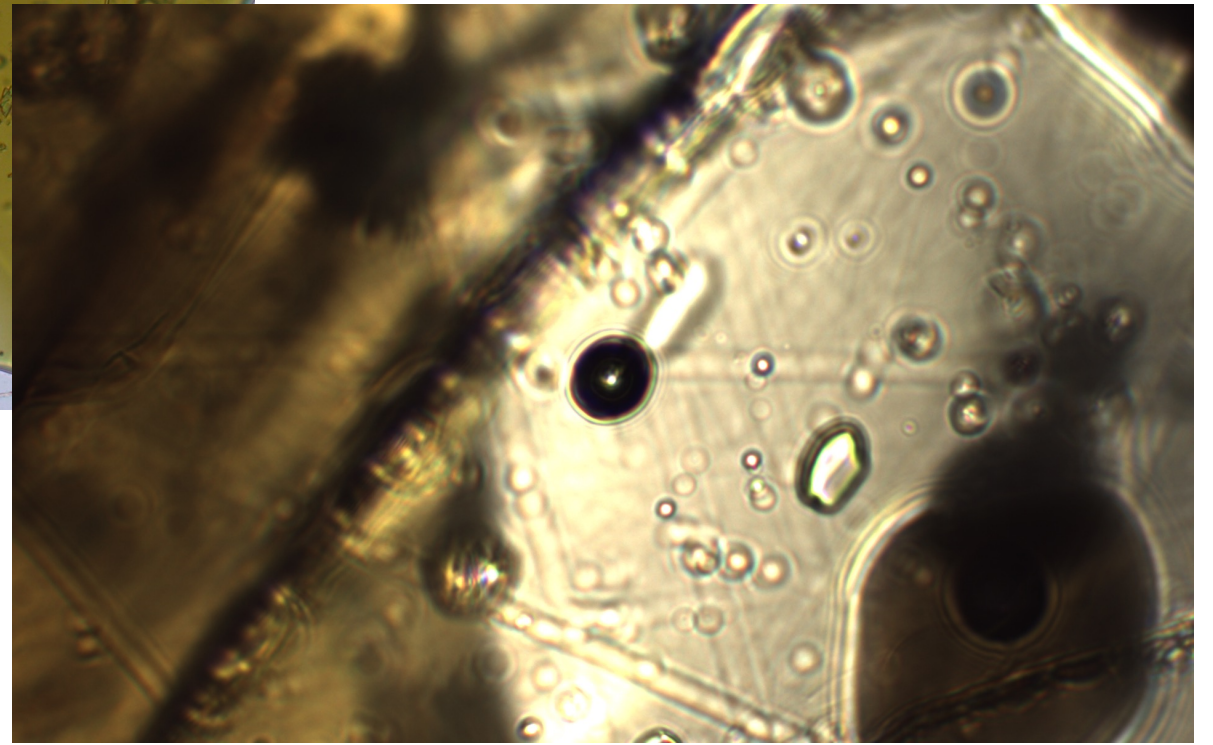


Cluster, looks like it's following growth zones

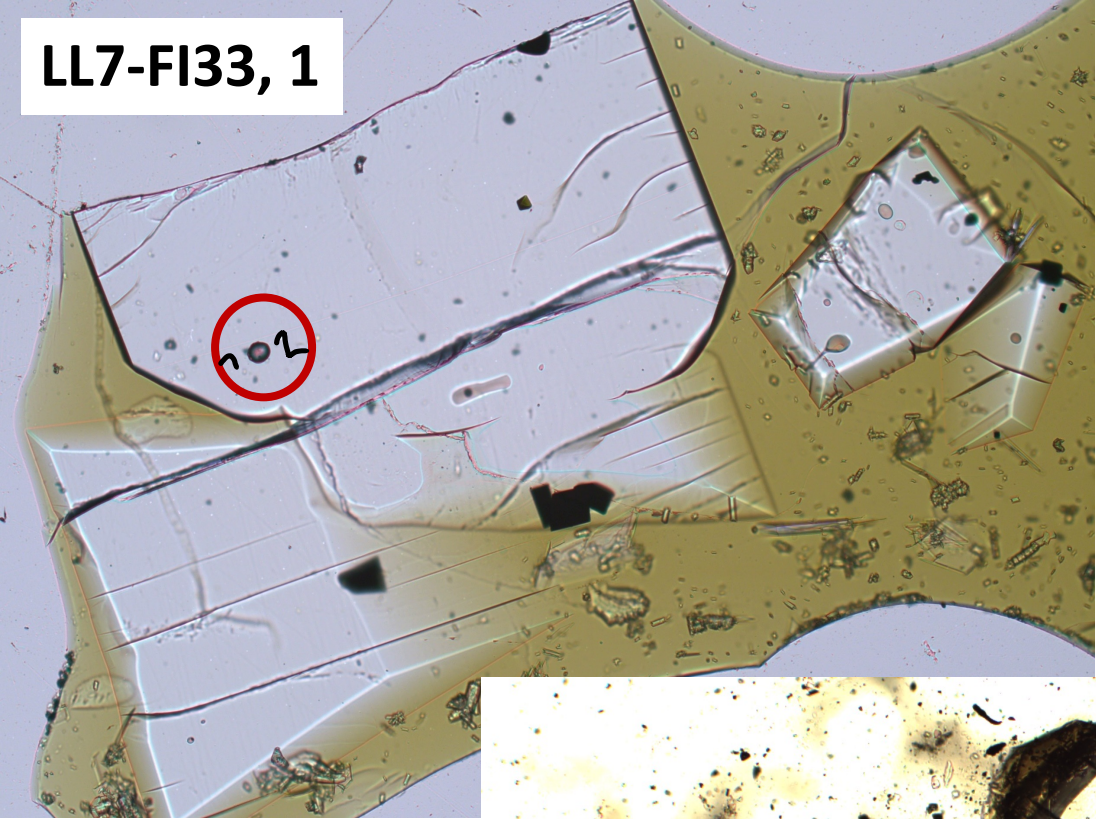
LL7-FI32, 1



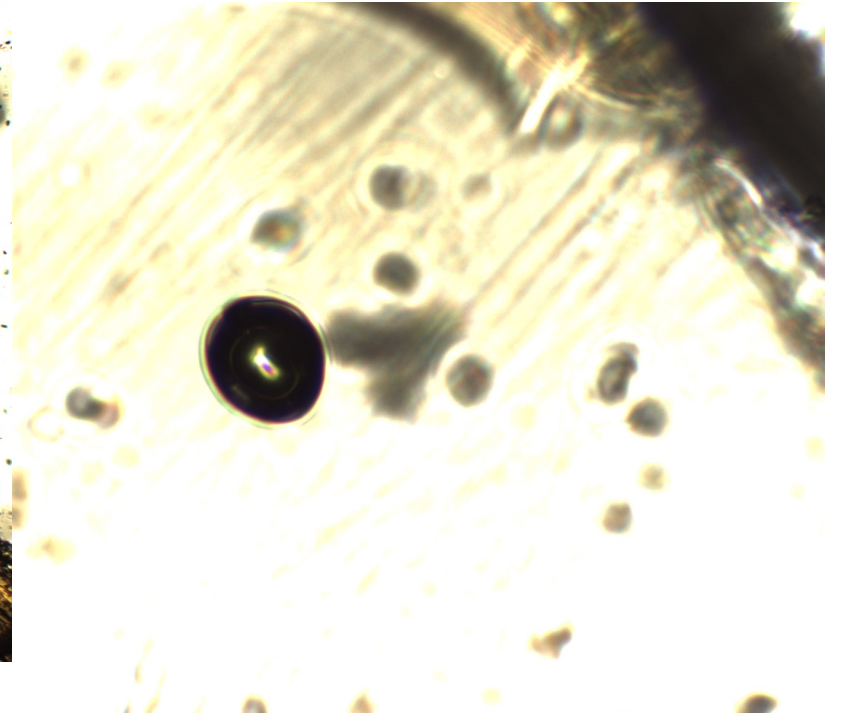
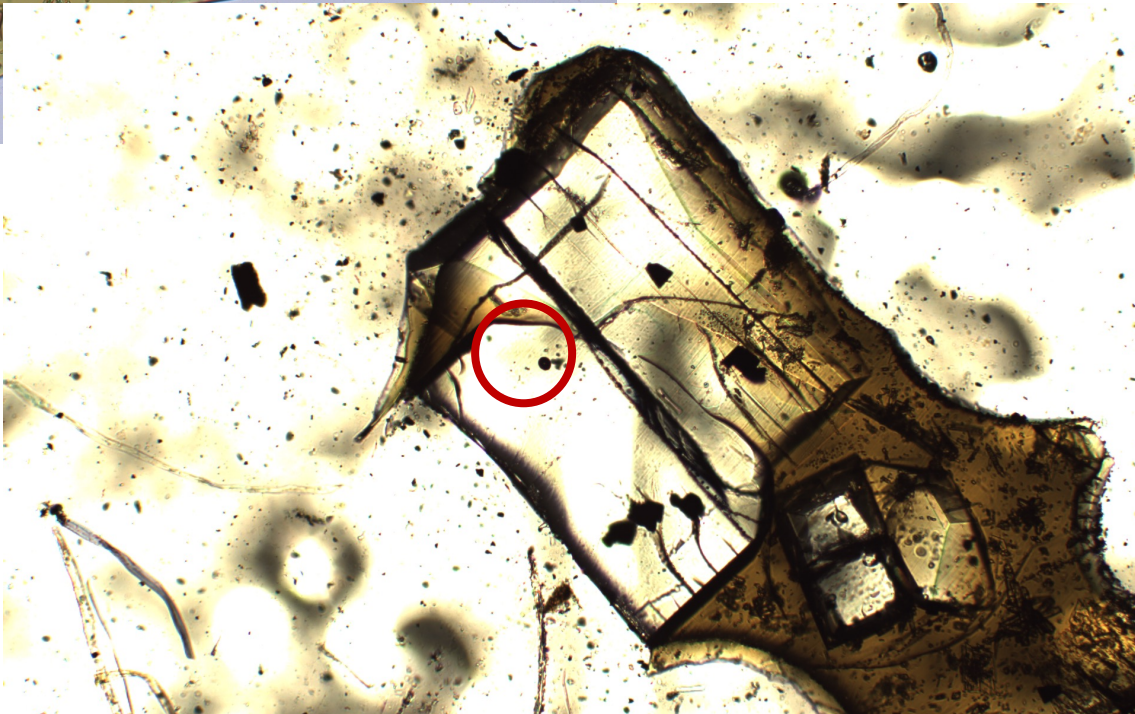
FI#1 gone



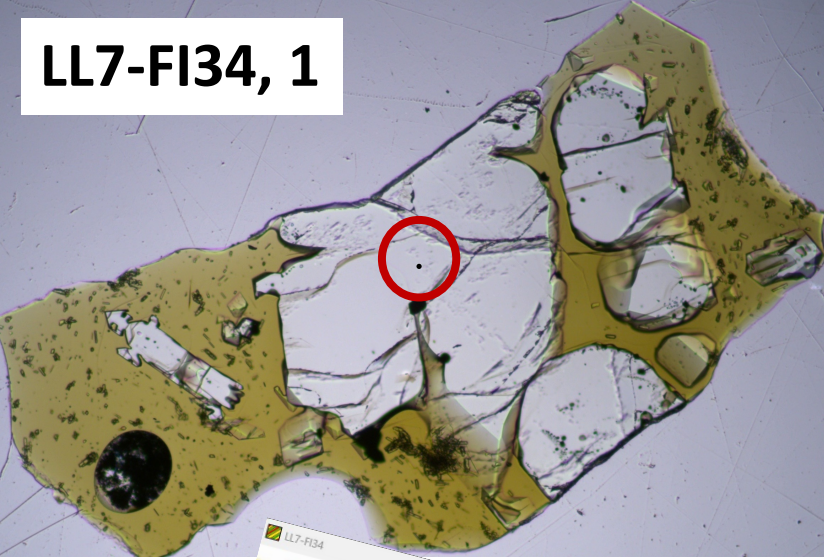
LL7-FI33, 1



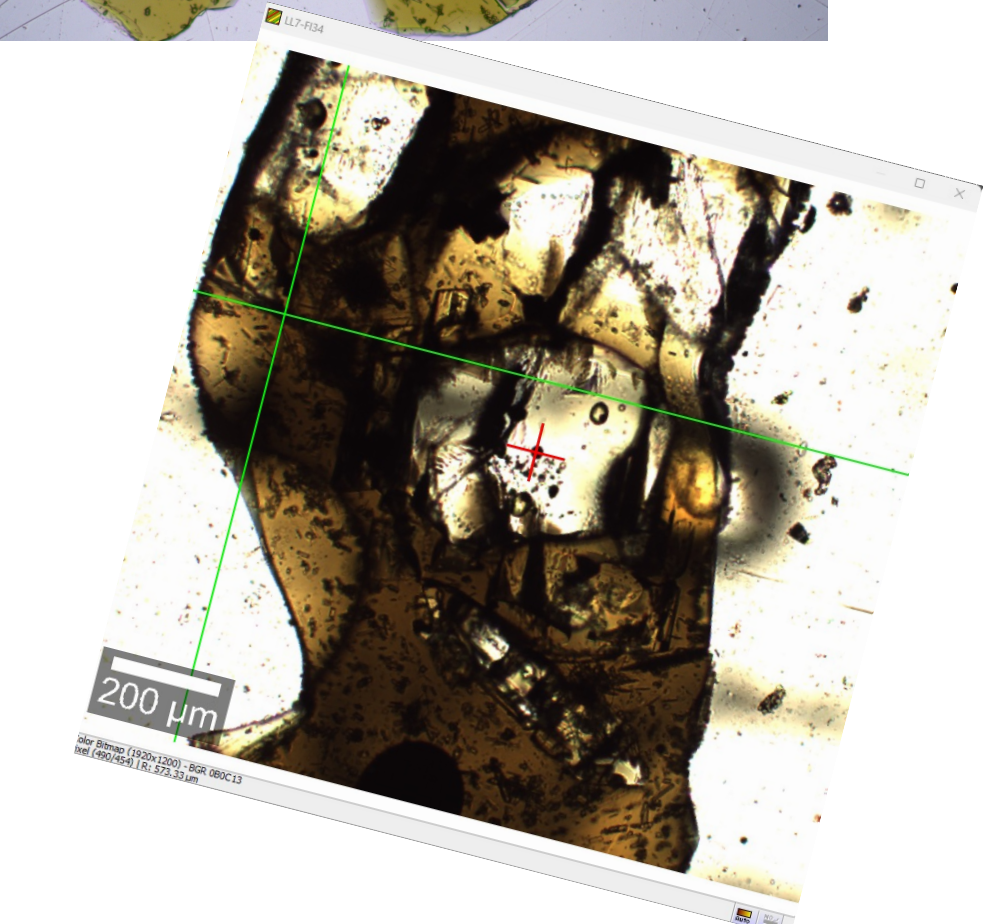
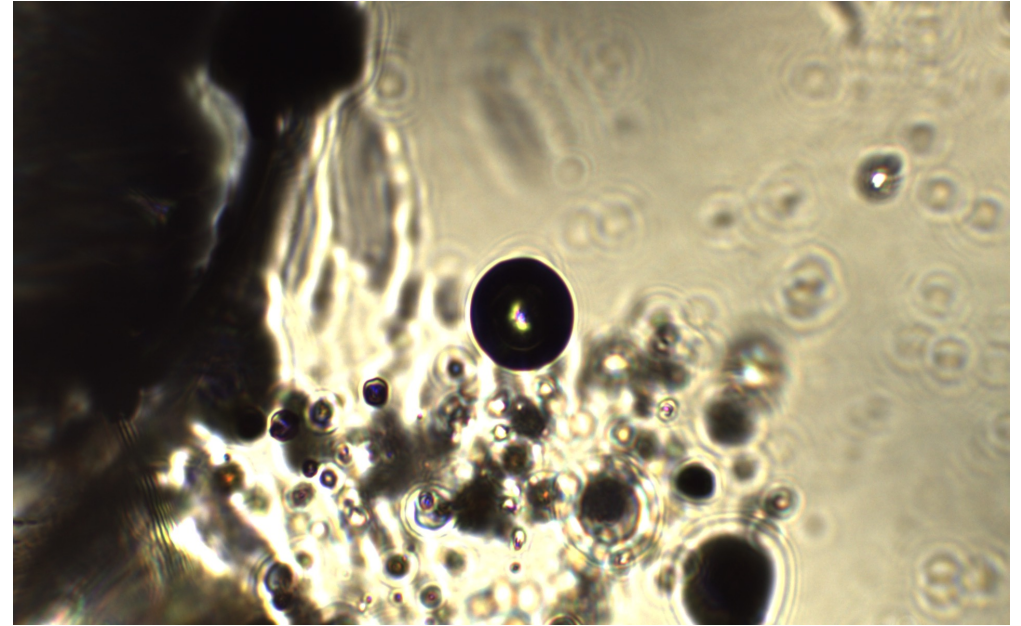
Fl#1 popped



LL7-FI34, 1



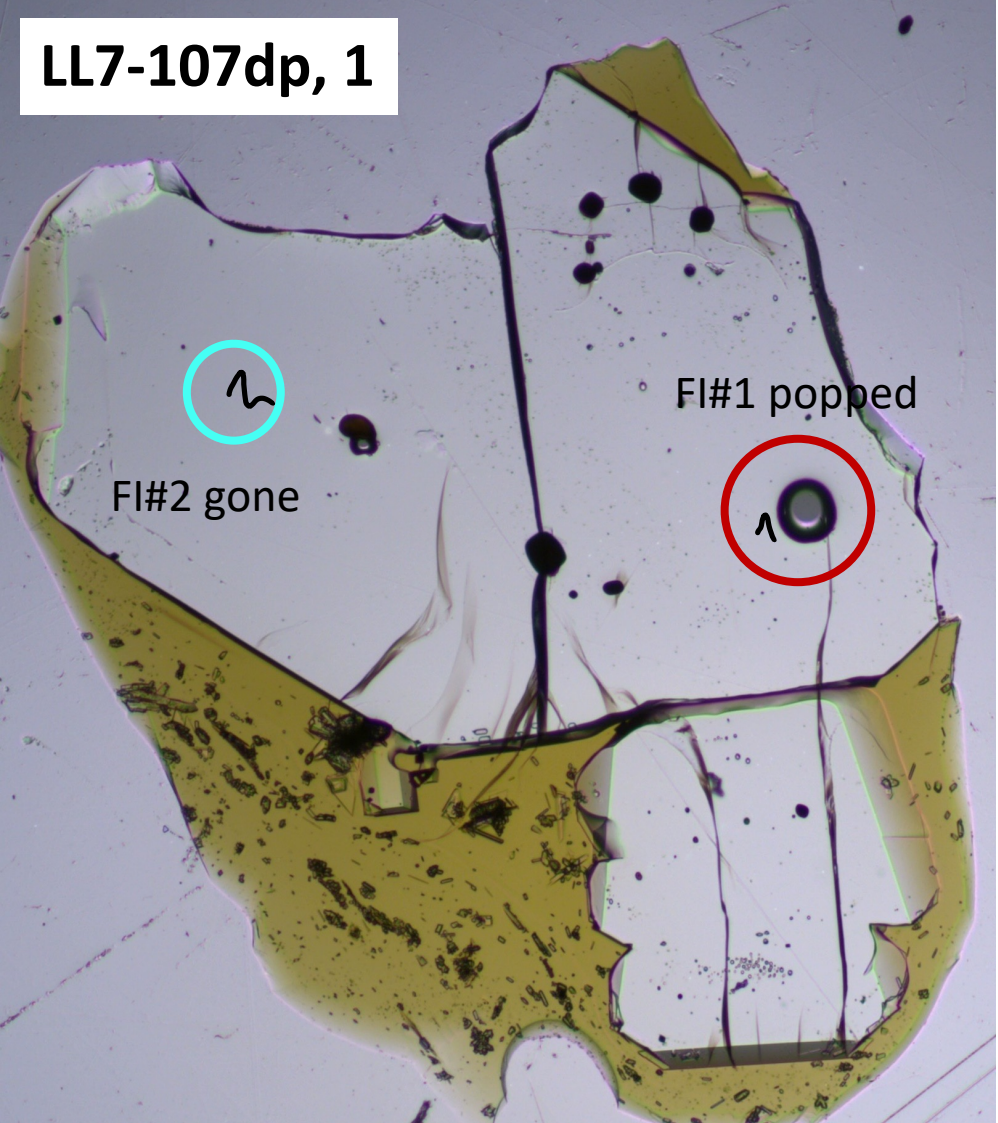
Fl#1 gone



200 μm

Color Bitmap (1920x1200) - RGR 080C13
Incl (490/459,1R): 573.33 μm

LL7-107dp, 1



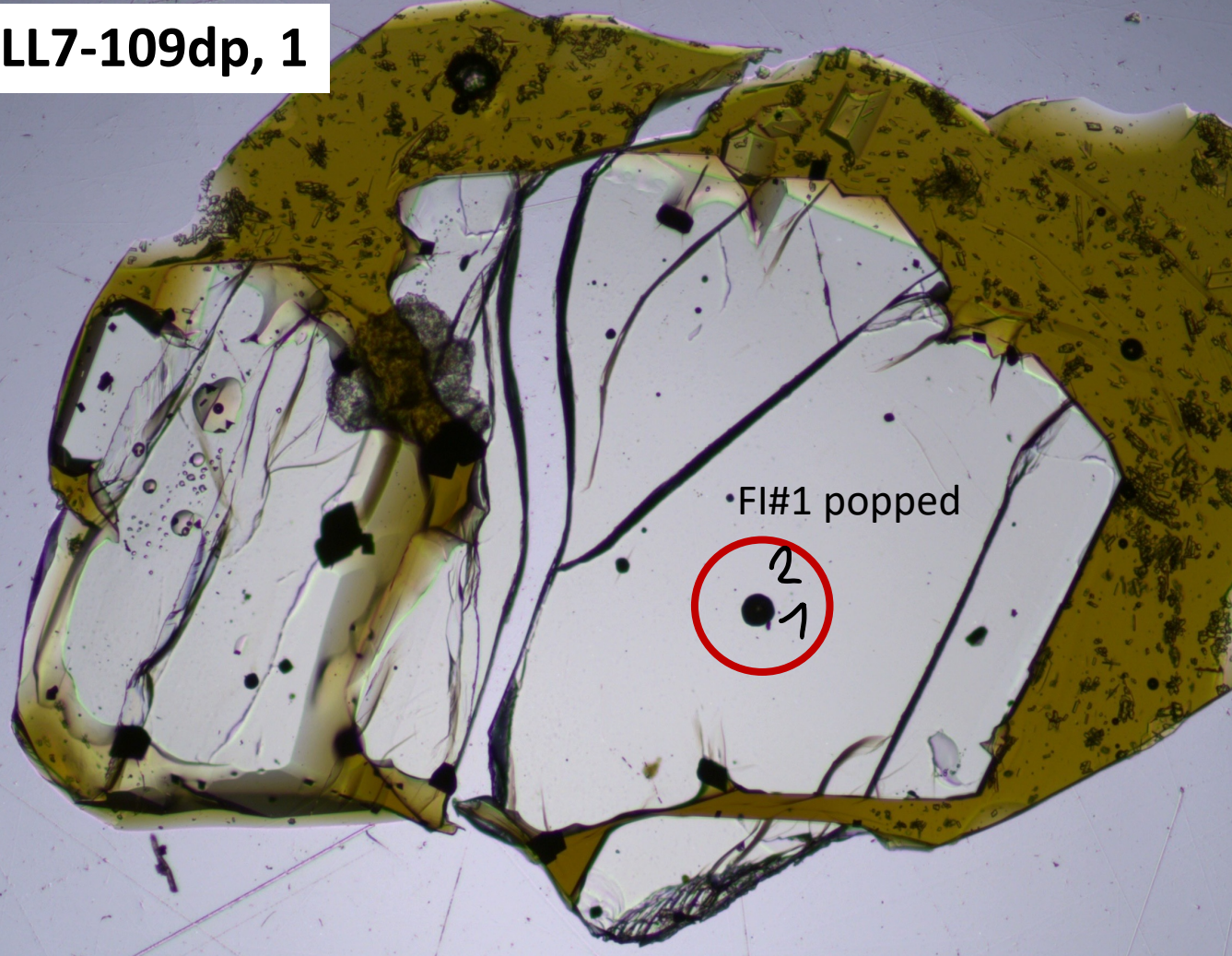
FI#2 gone

FI#1 popped

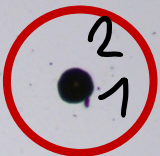


λ

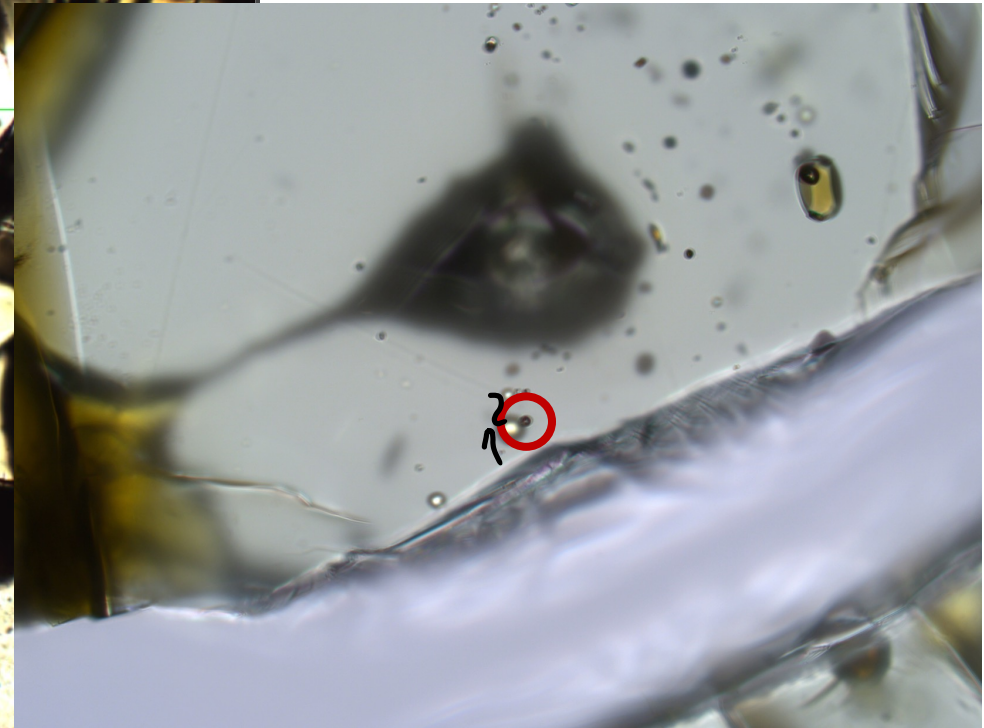
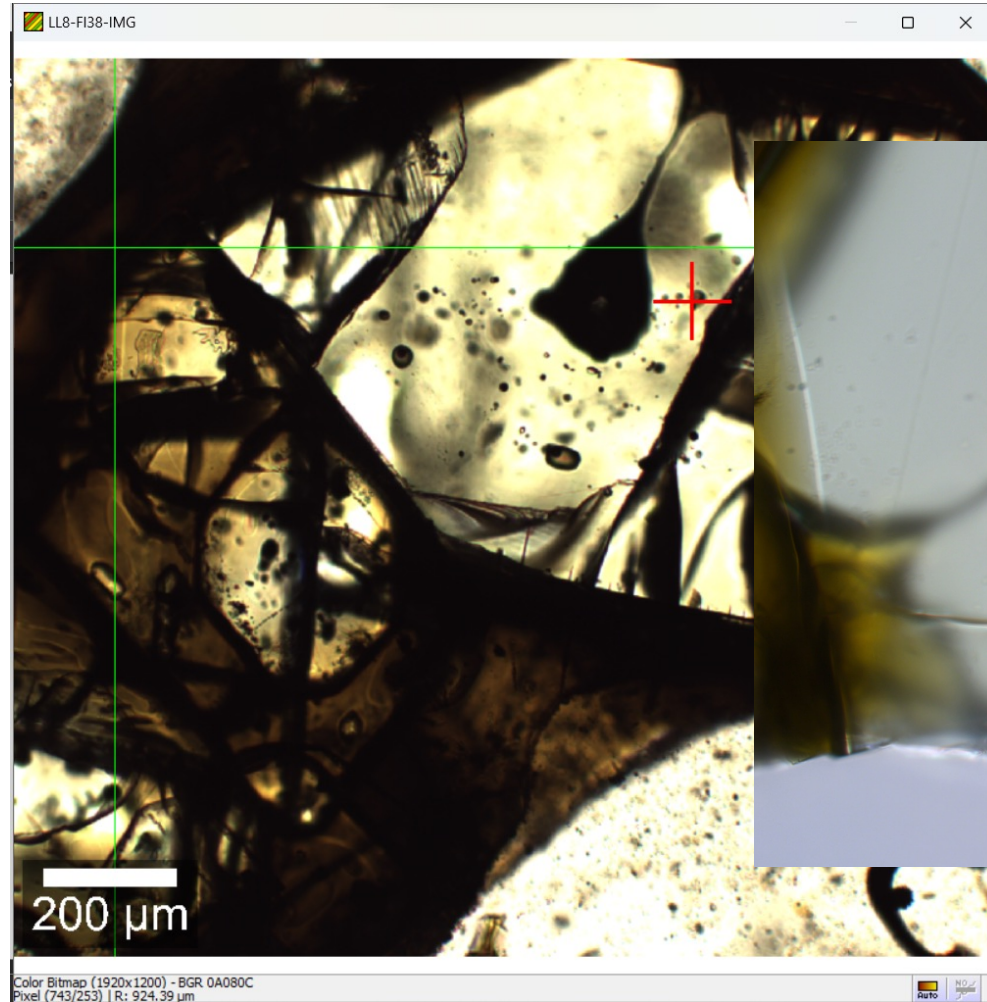
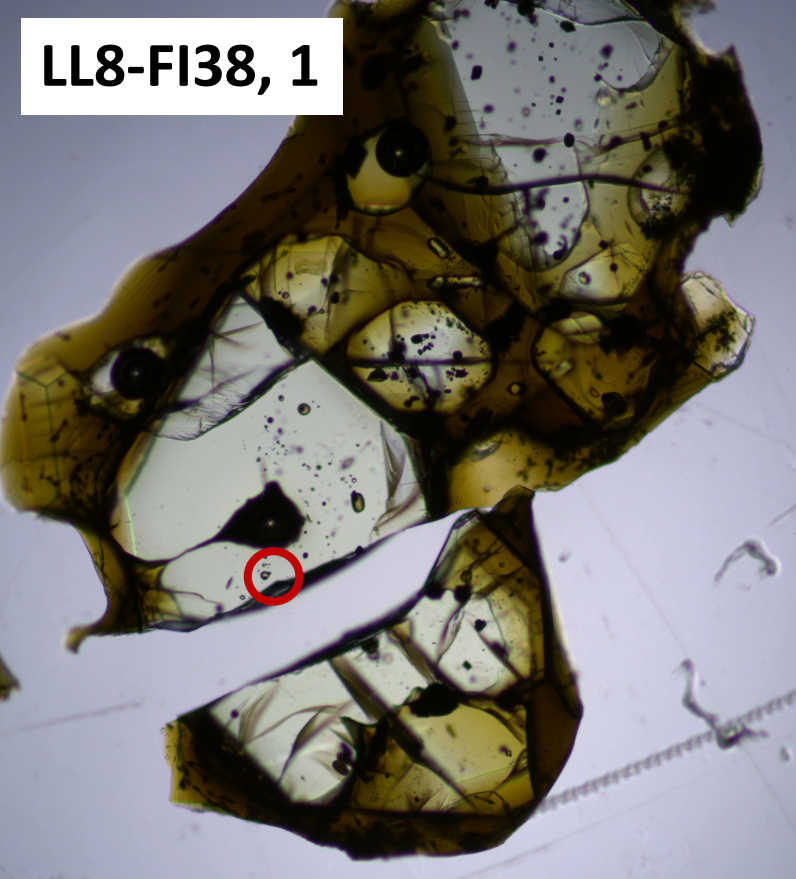
LL7-109dp, 1



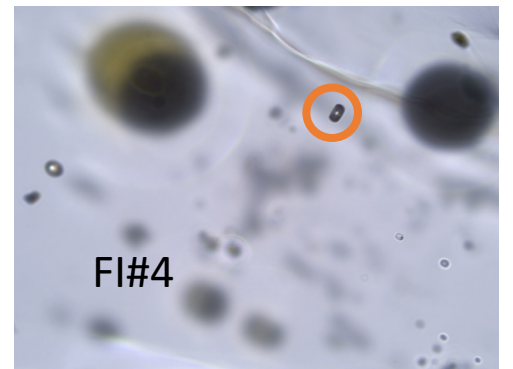
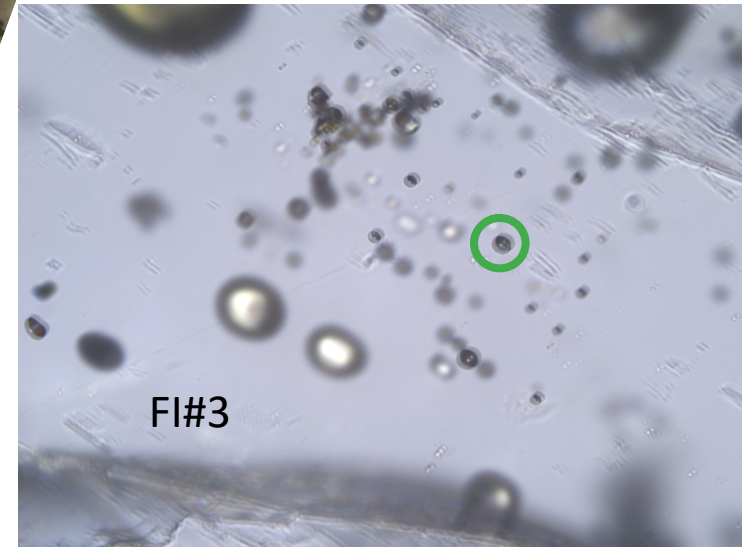
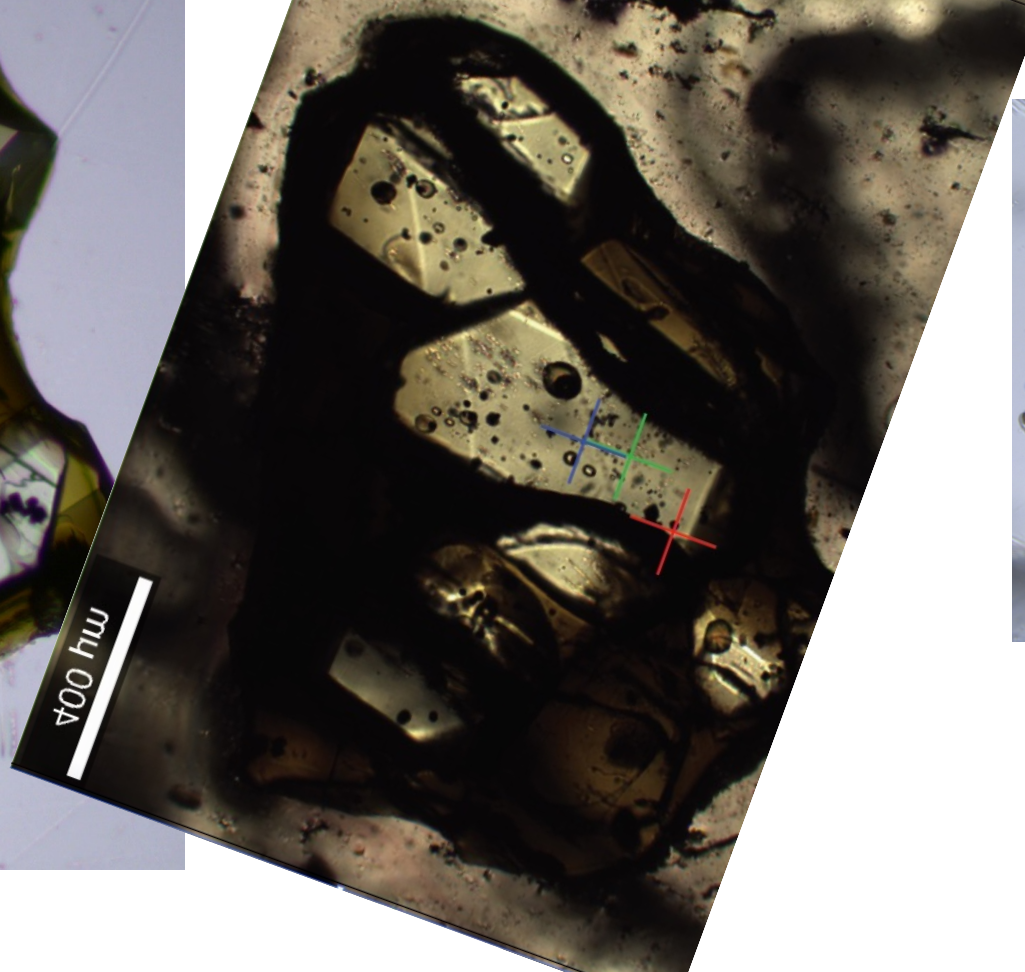
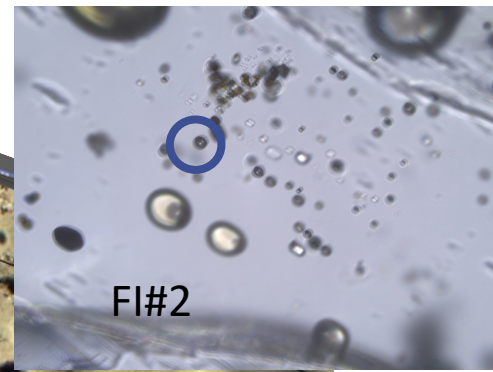
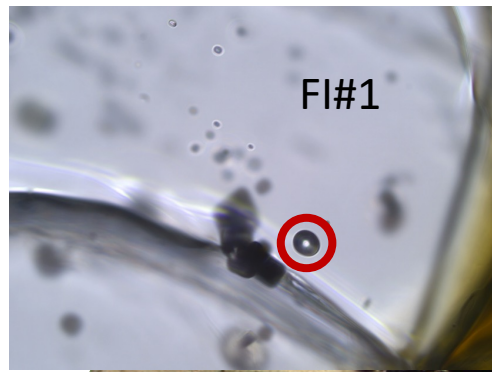
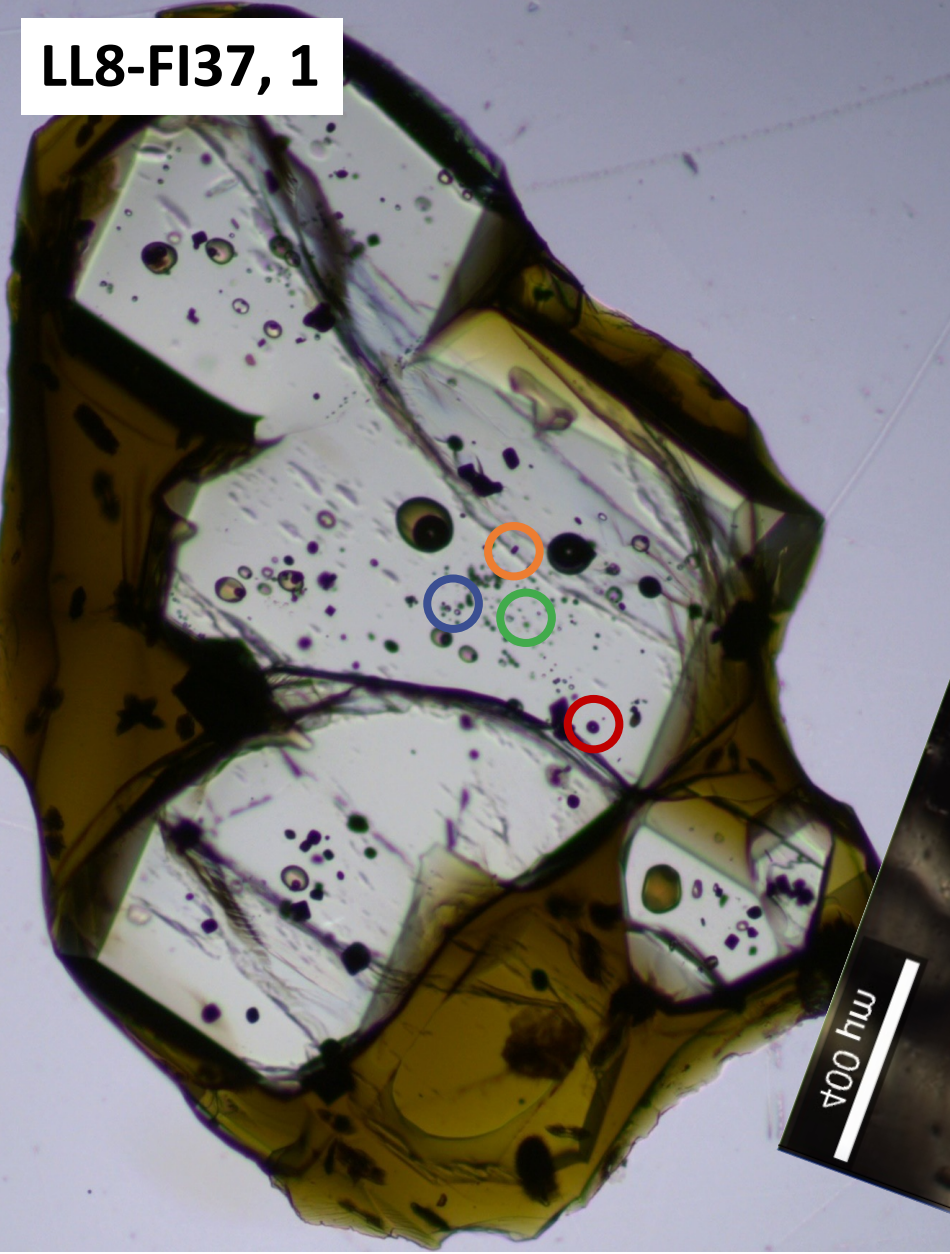
• Fl#1 popped



LL8-FI38, 1

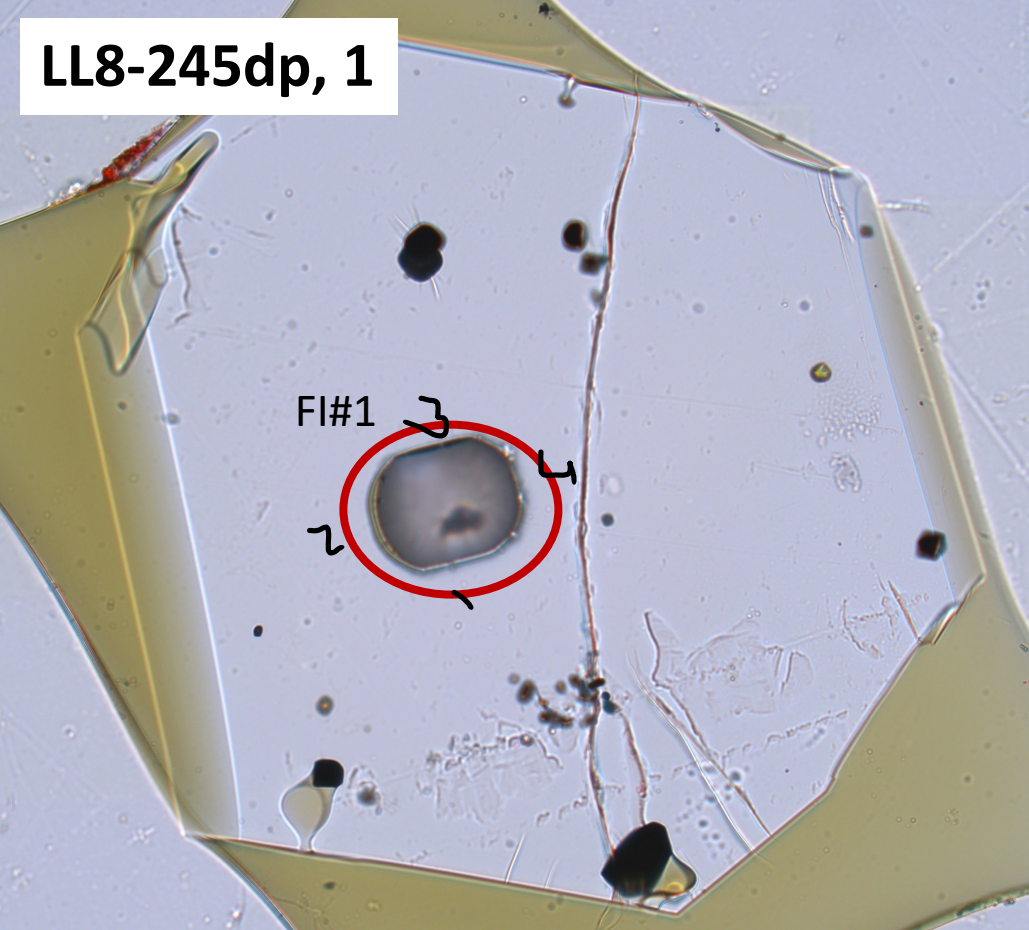


LL8-FI37, 1



Plenty more as well. FI#4 never analyzed. This area seems like an early GZ maybe

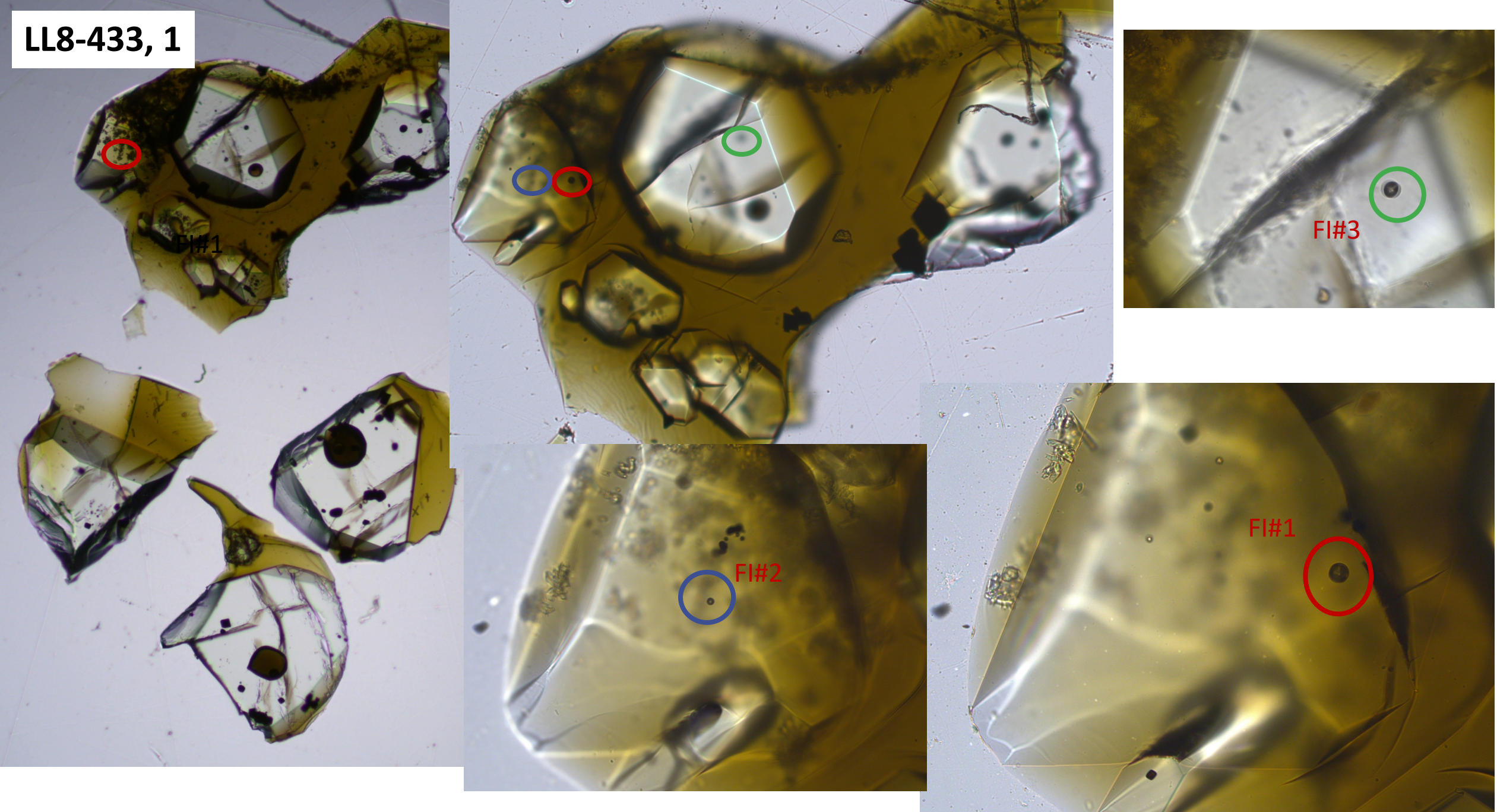
LL8-245dp, 1



This one was empty anyways

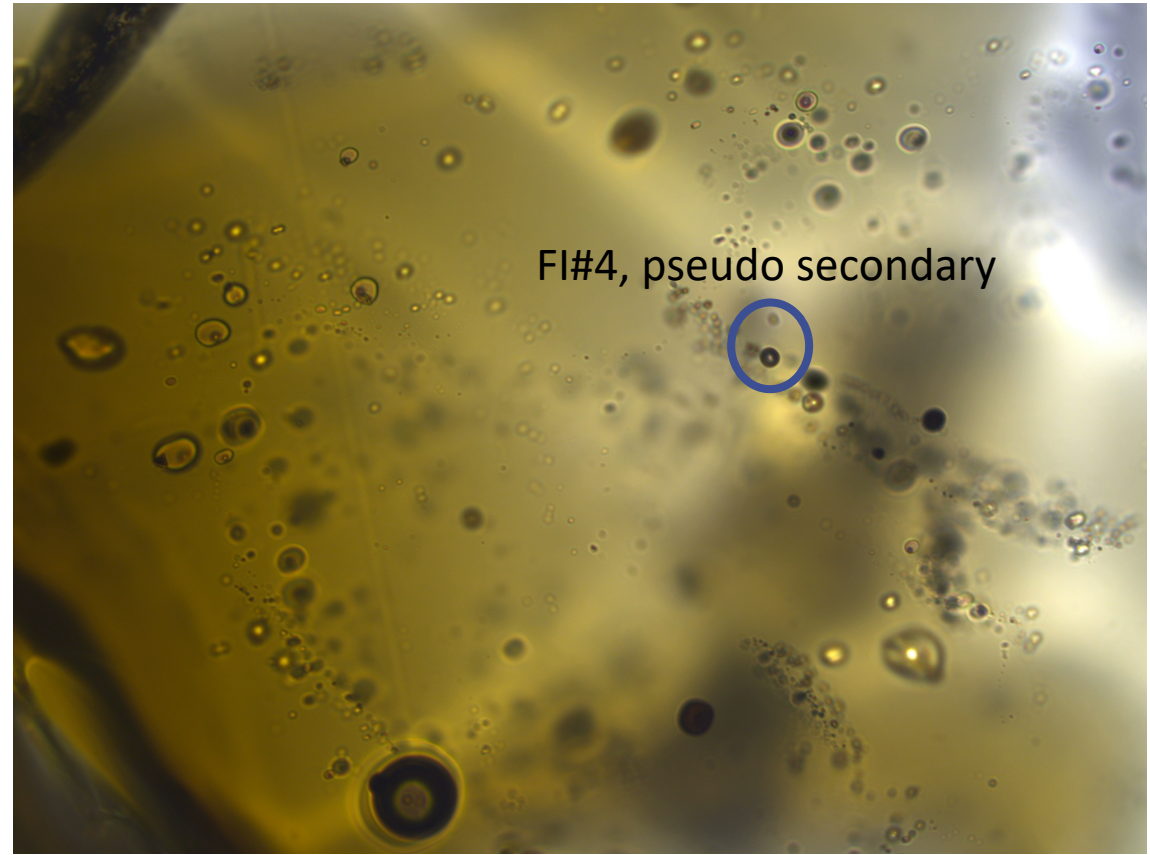
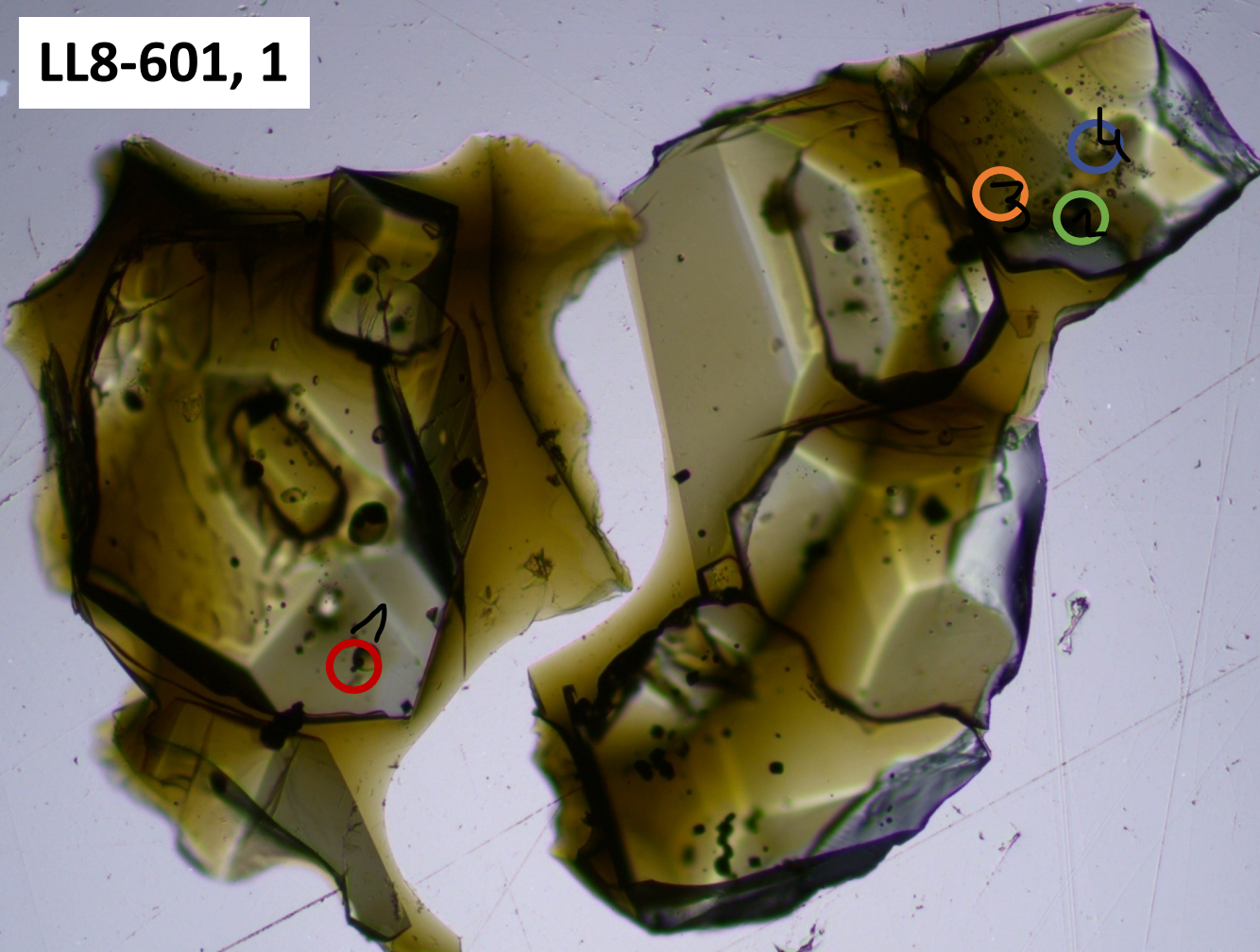
LL8-FI36 was mislabeled in the raman as LL8-3b but is also gone from the epoxy mount. Polished out completely probably

LL8-433, 1

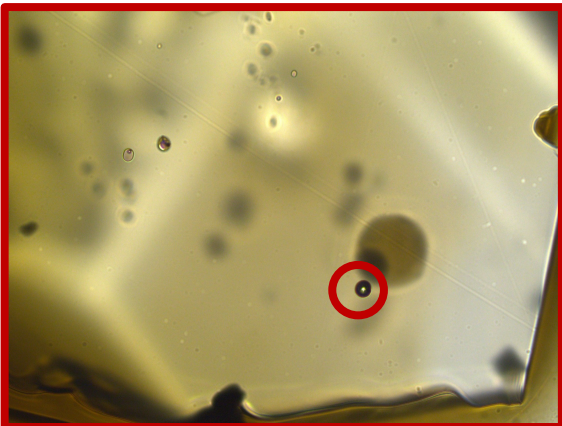


Really tough, broken, polished moved. PROBABLY RERAMAN

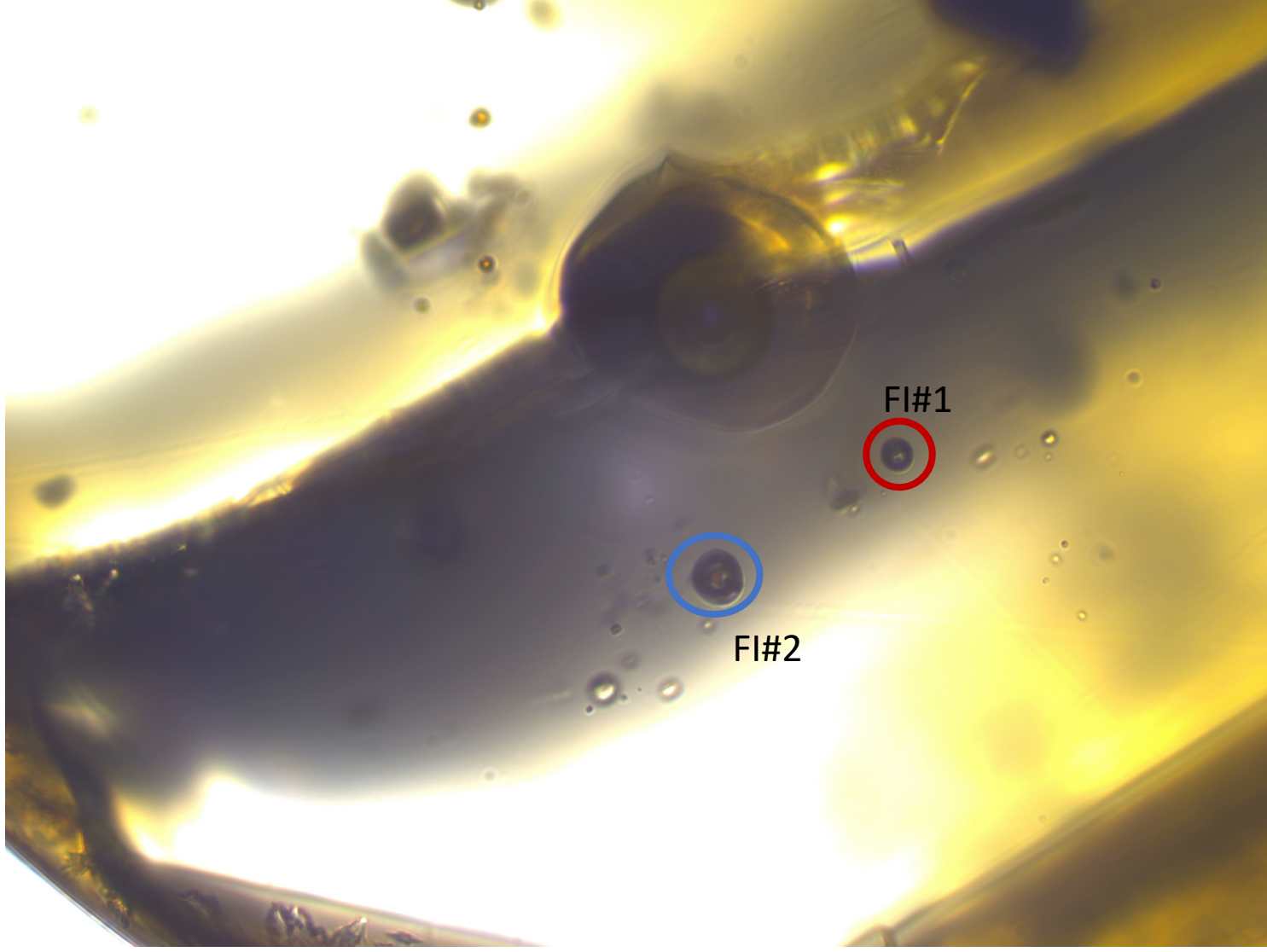
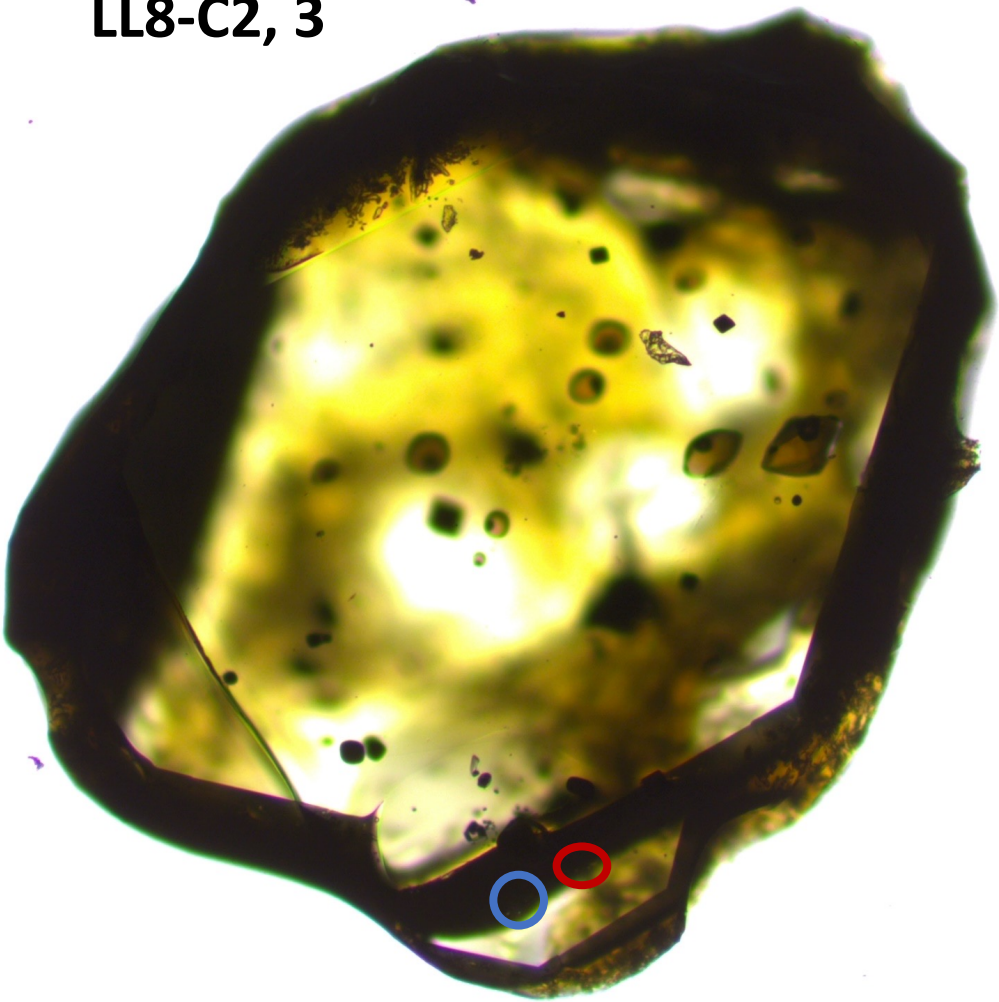
LL8-601, 1



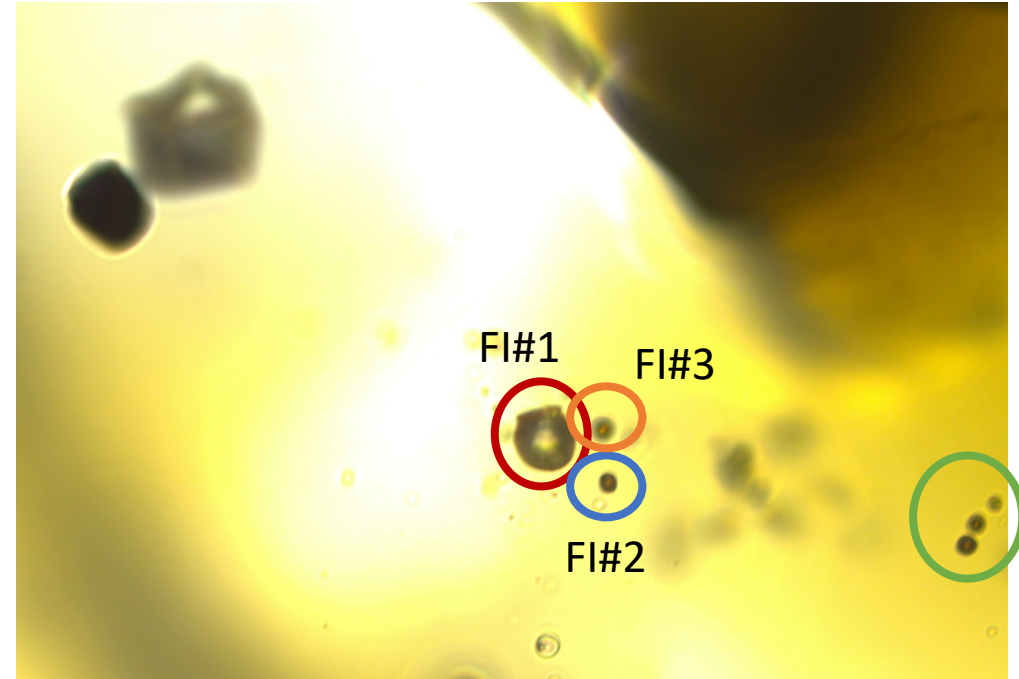
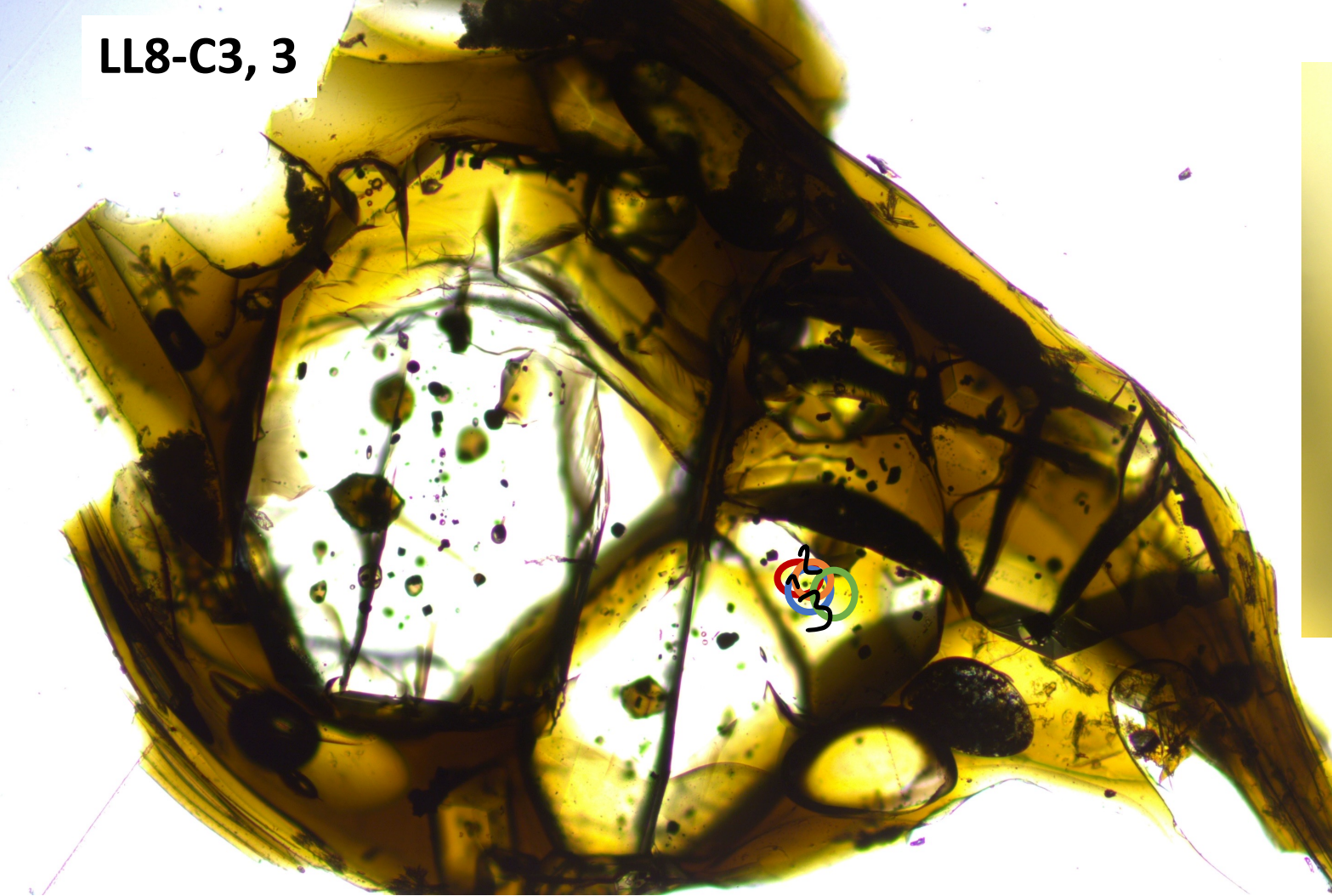
FI#1, others are lost



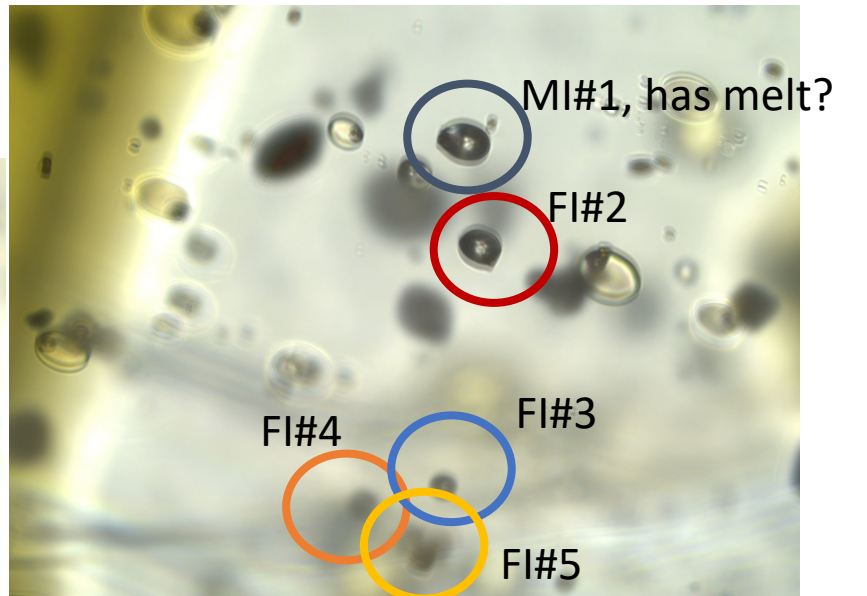
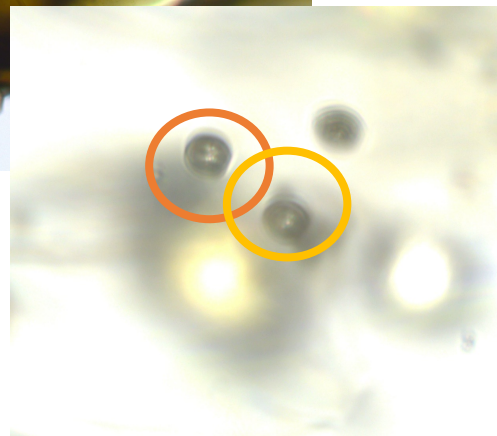
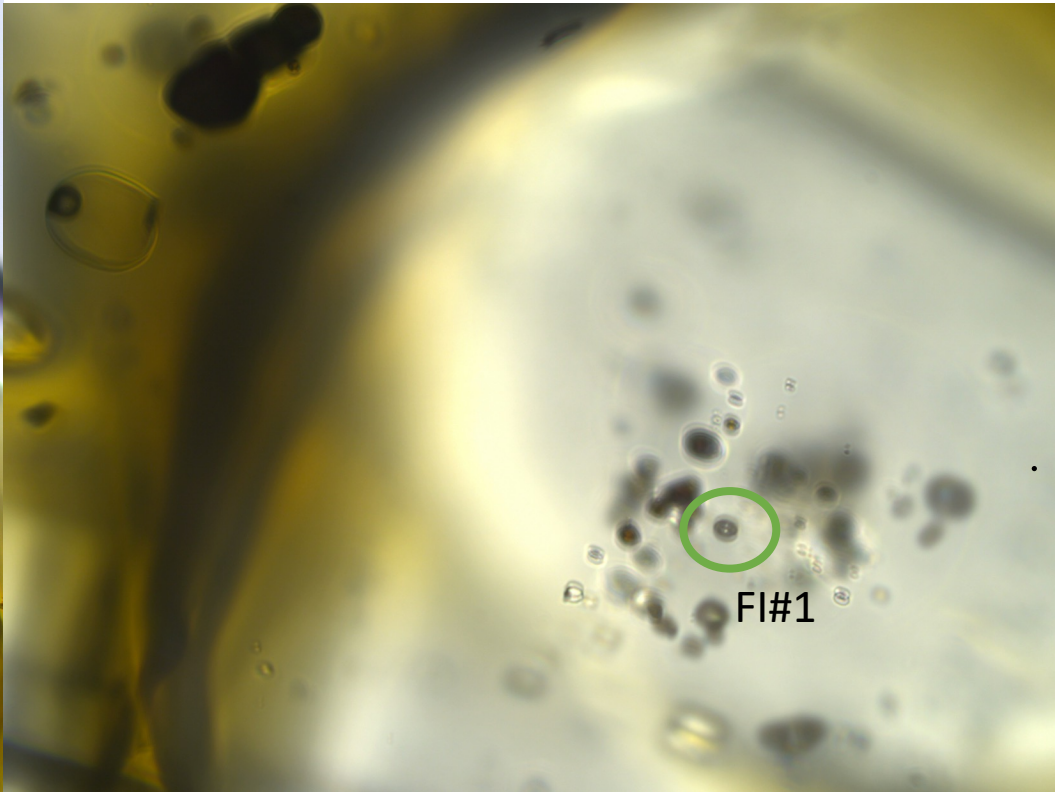
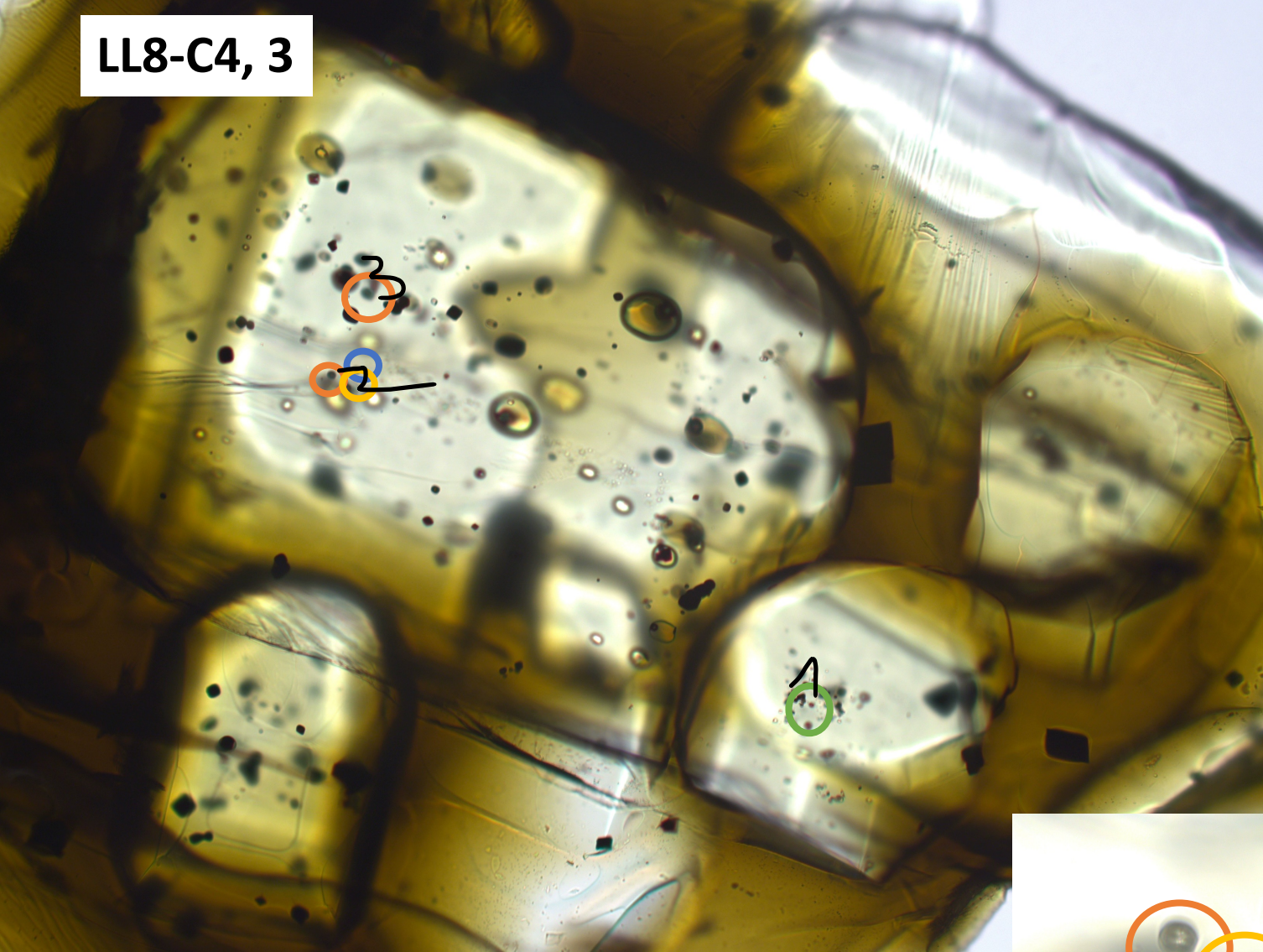
LL8-C2, 3



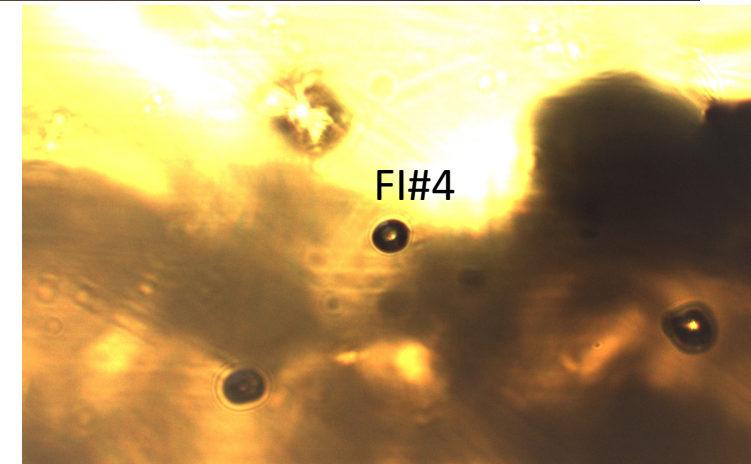
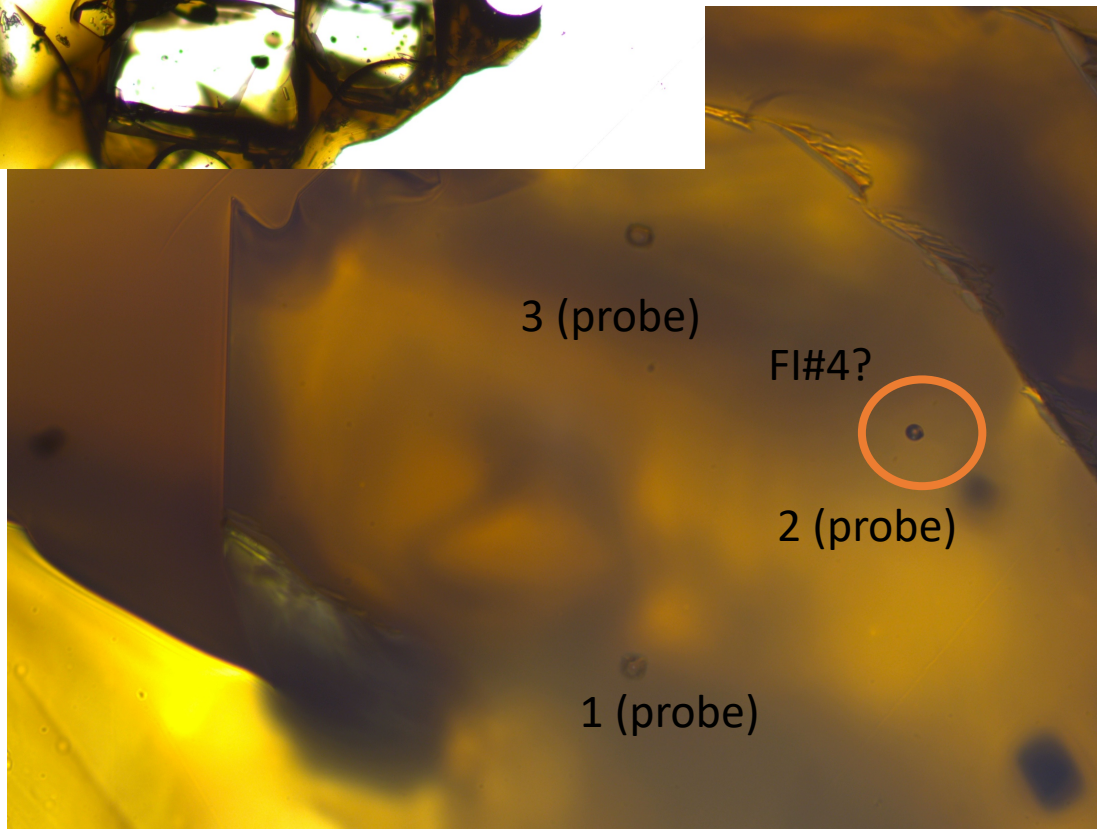
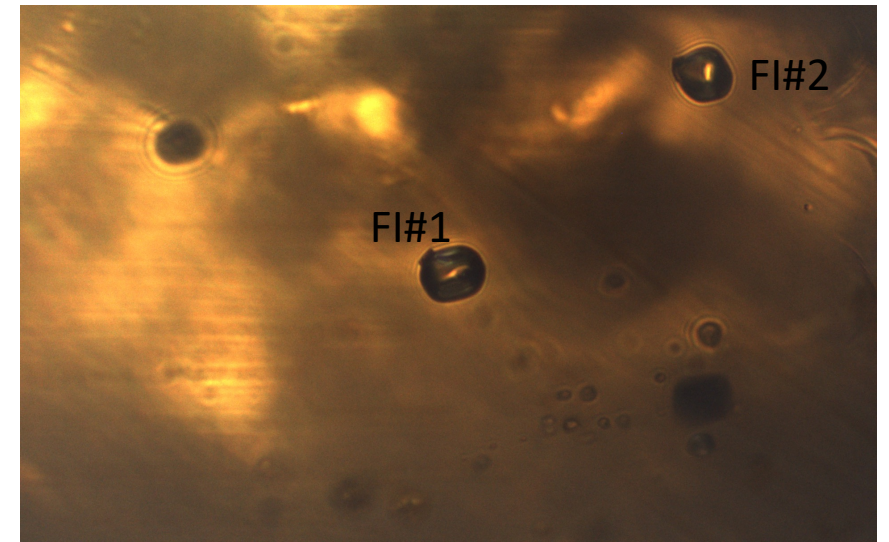
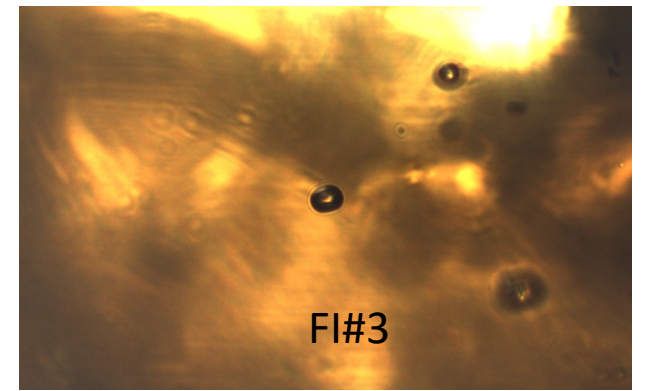
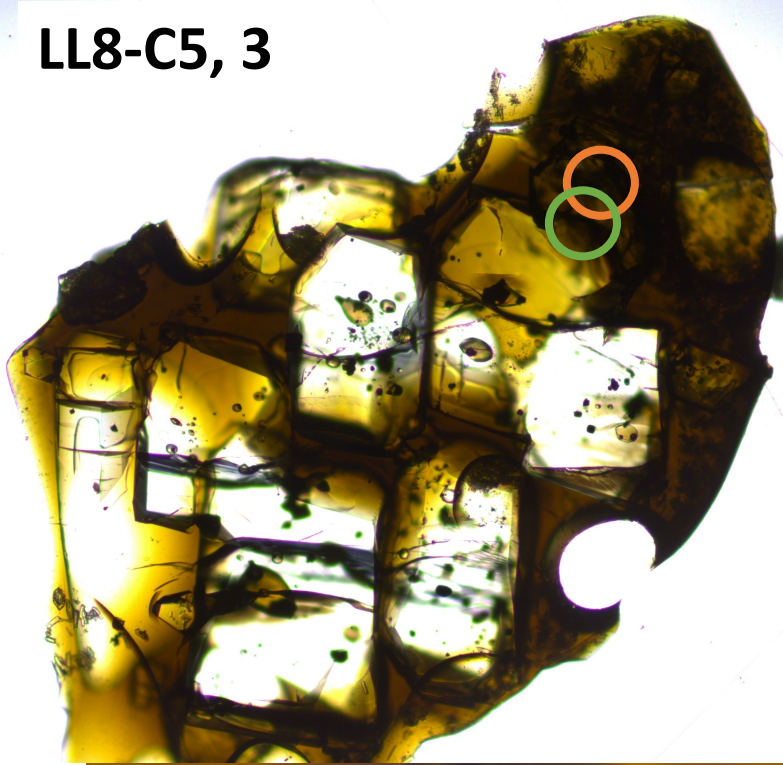
LL8-C3, 3



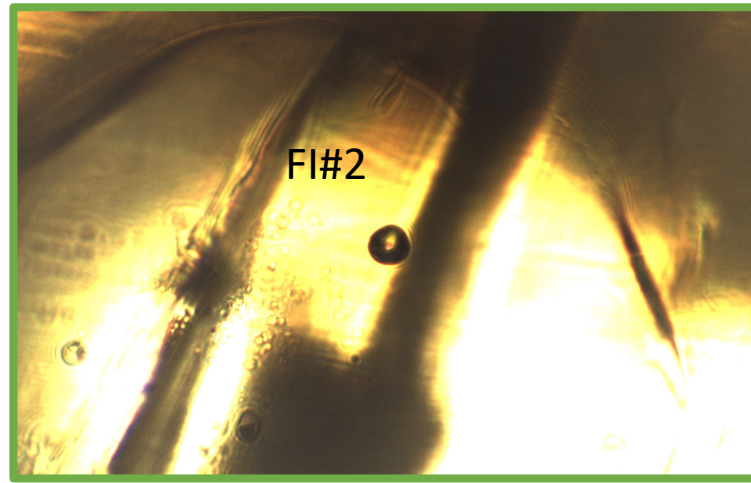
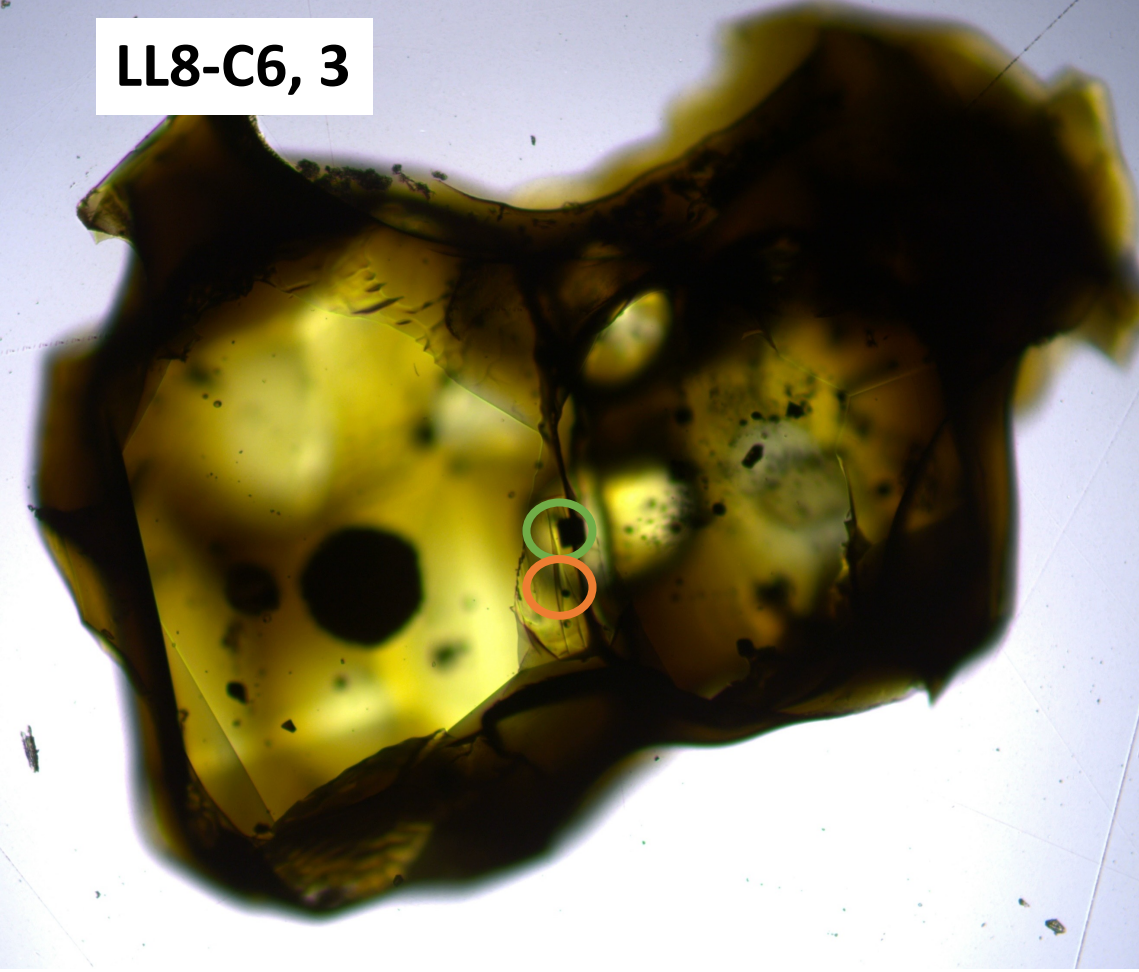
LL8-C4, 3



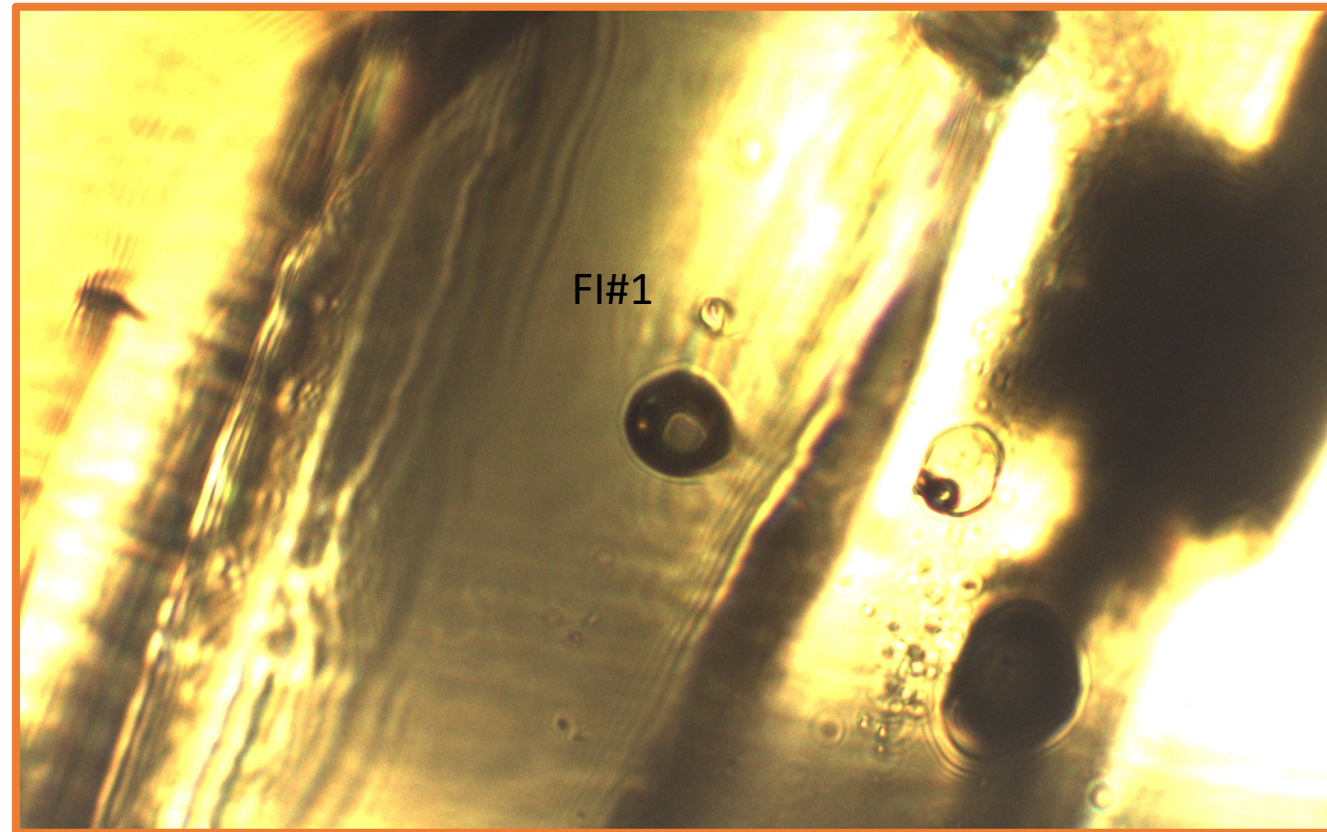
LL8-C5, 3



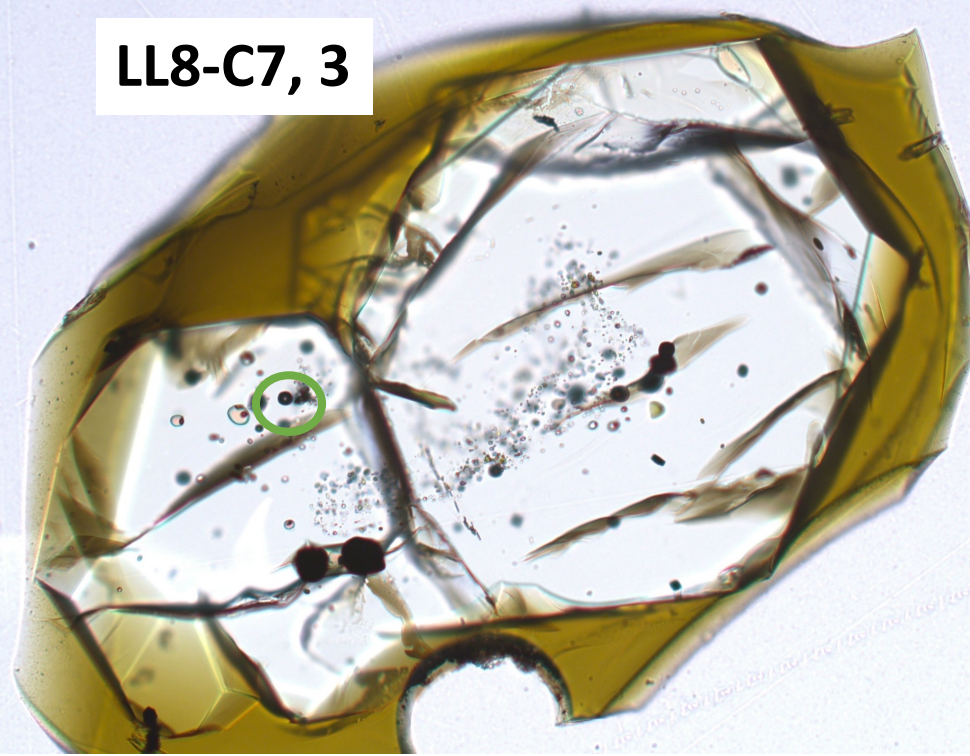
LL8-C6, 3



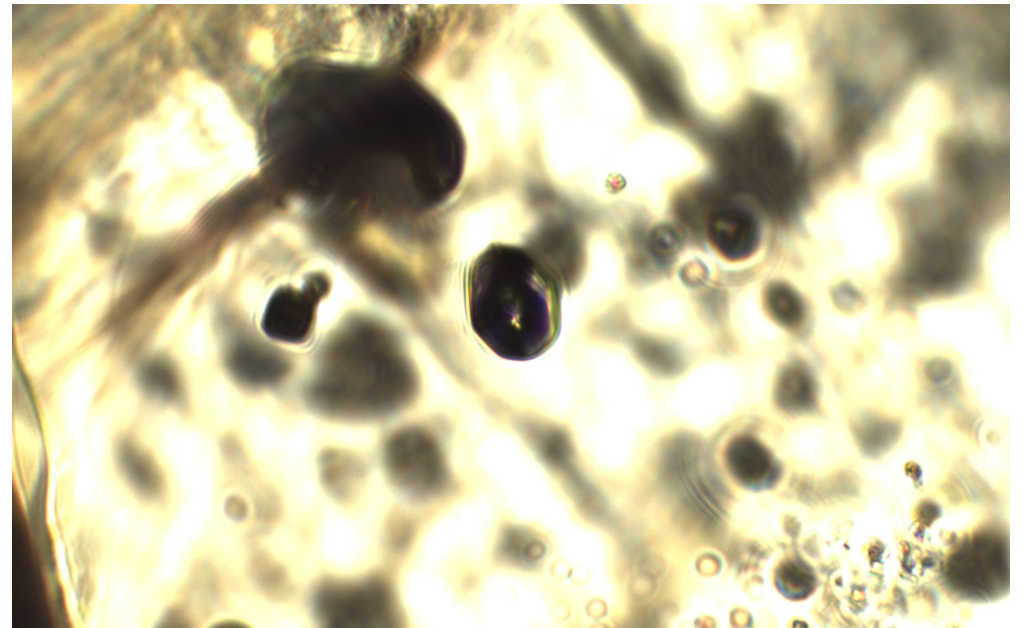
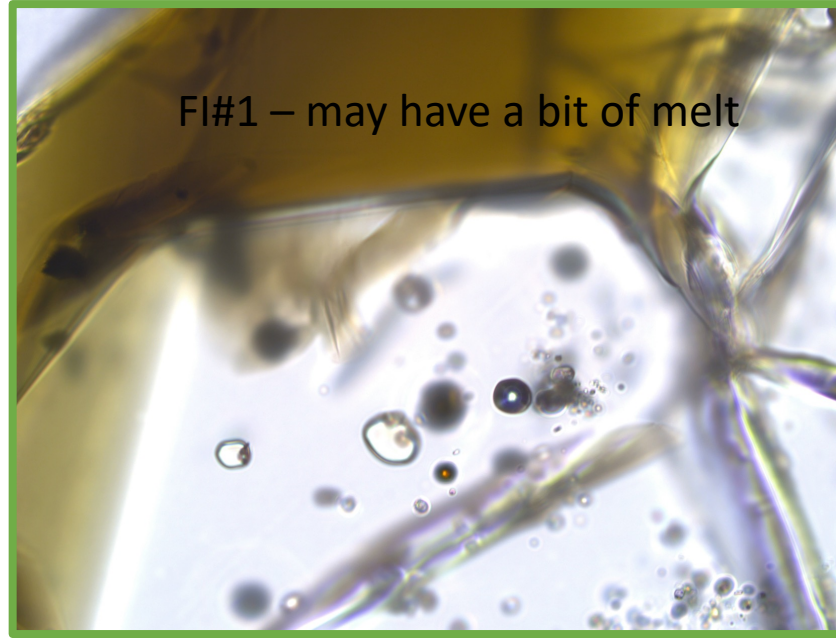
Small xtal in between



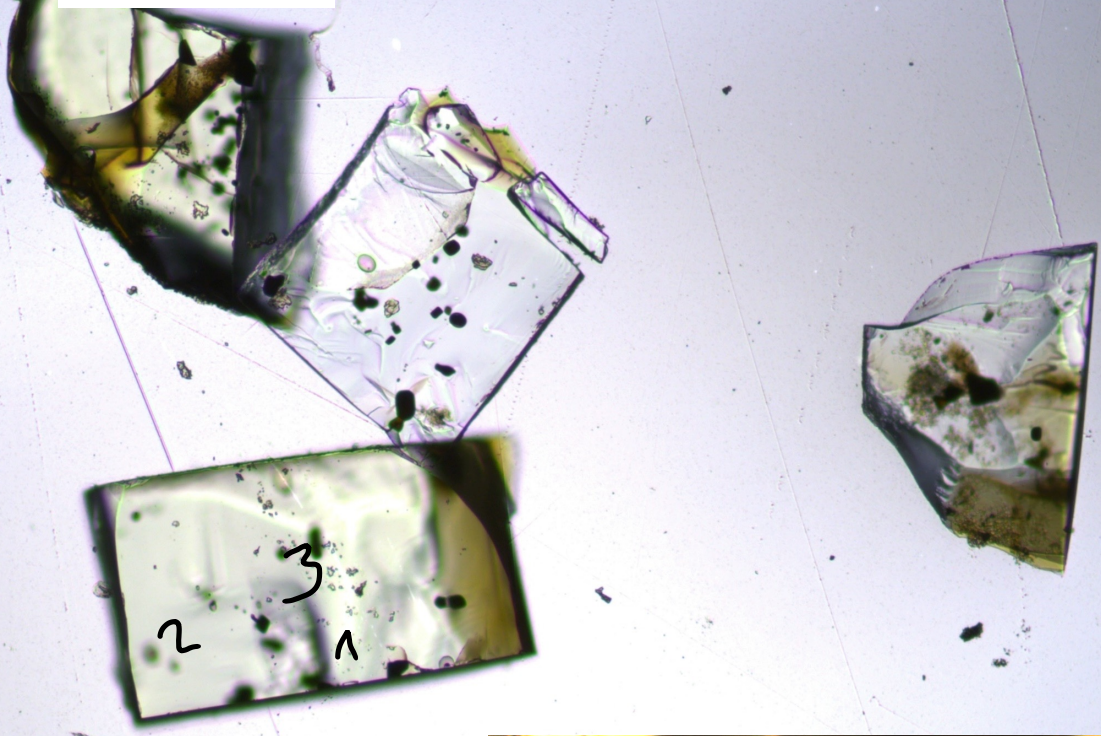
LL8-C7, 3



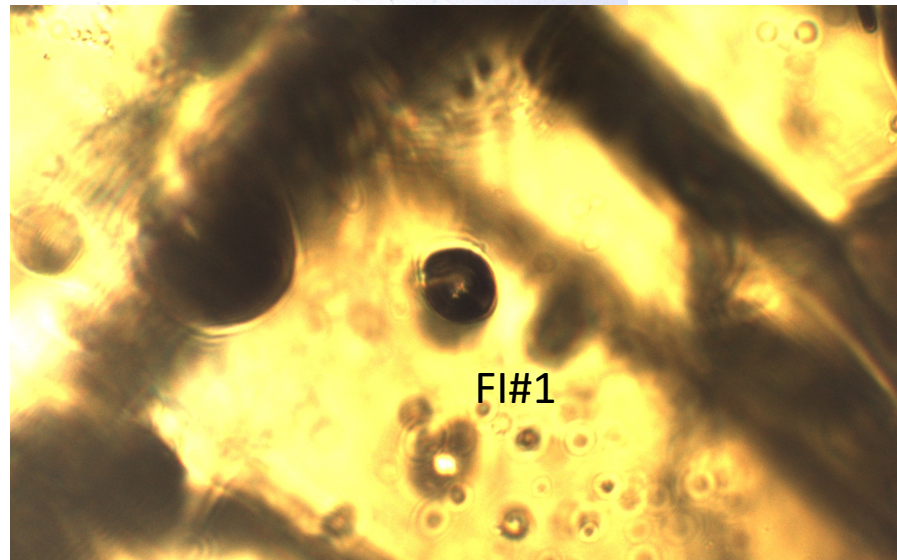
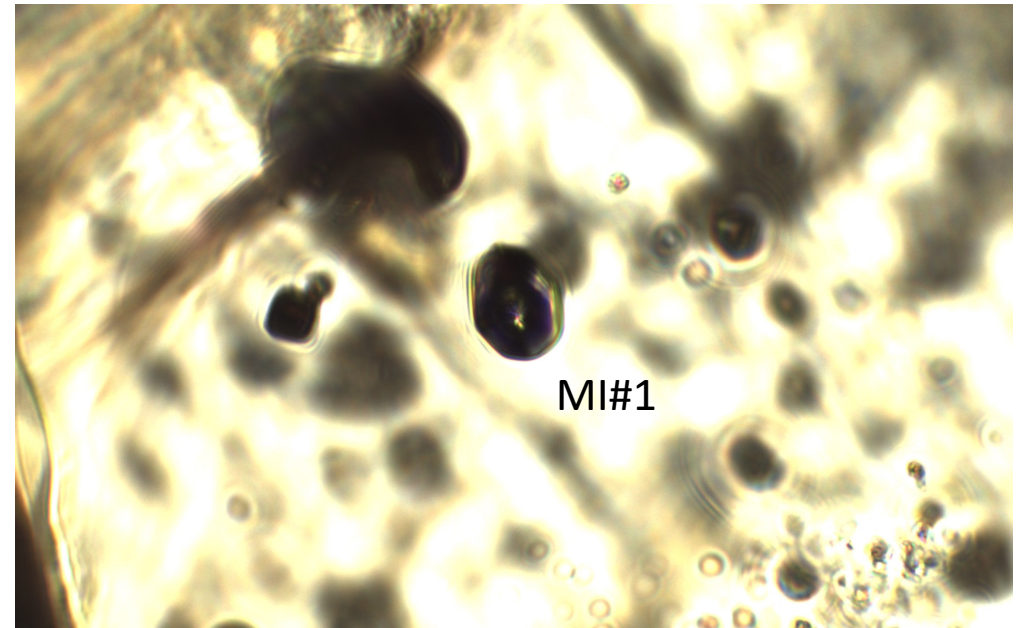
FI#1 – may have a bit of melt



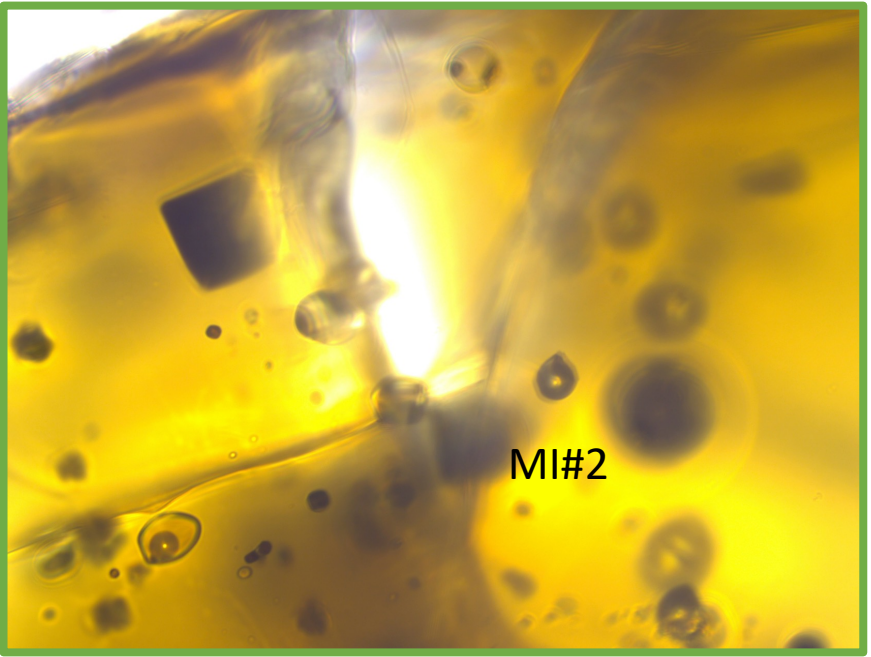
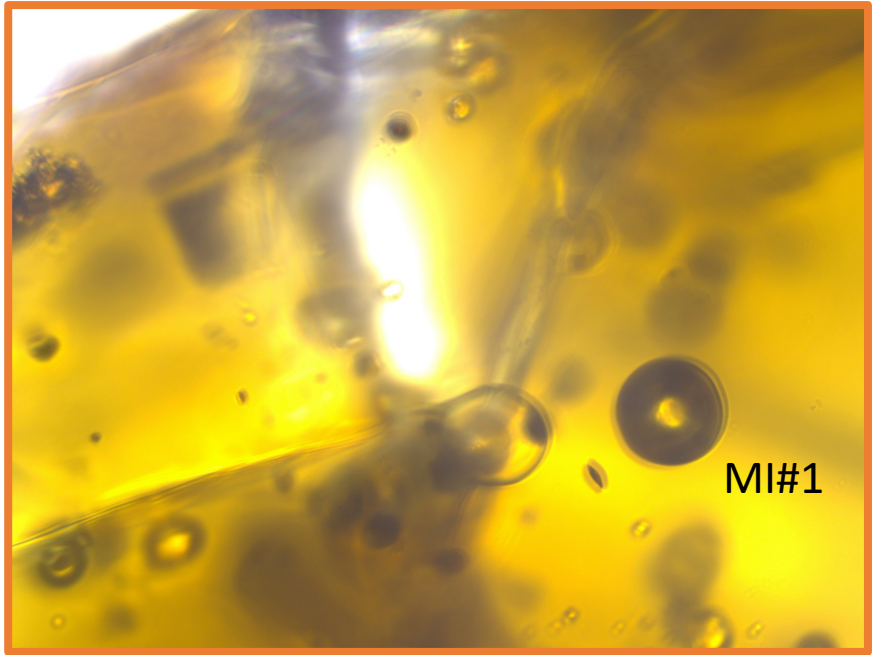
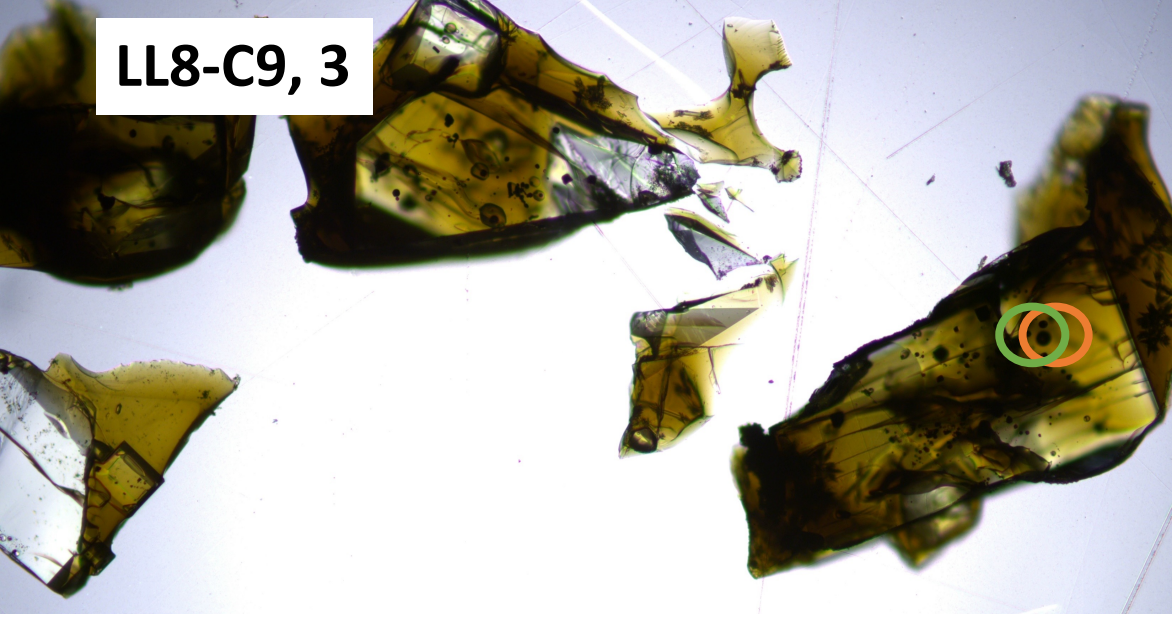
LL8-C8, 3



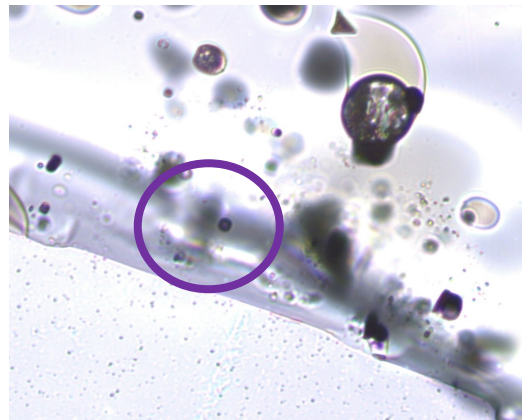
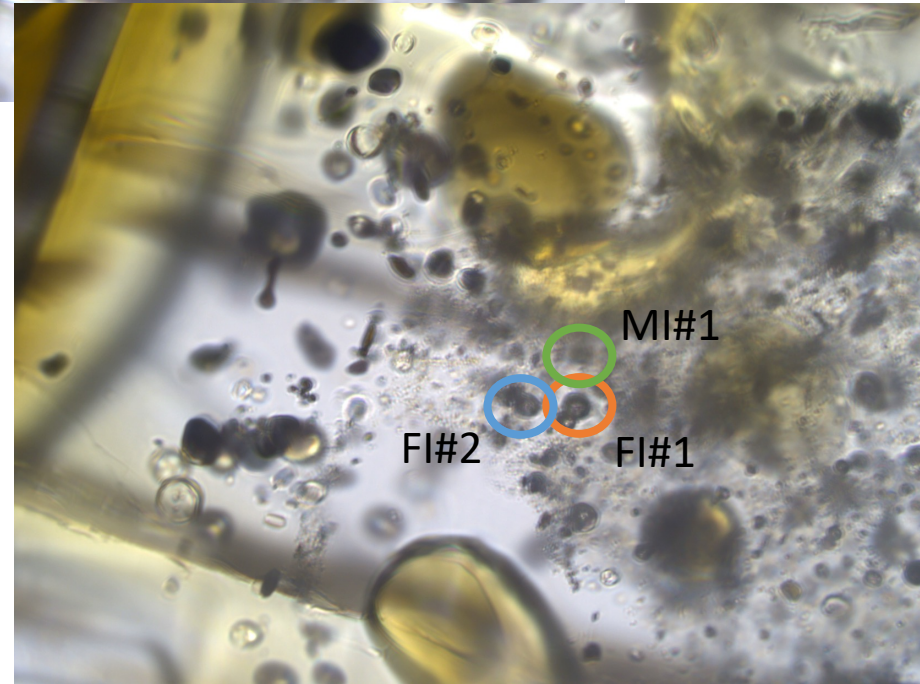
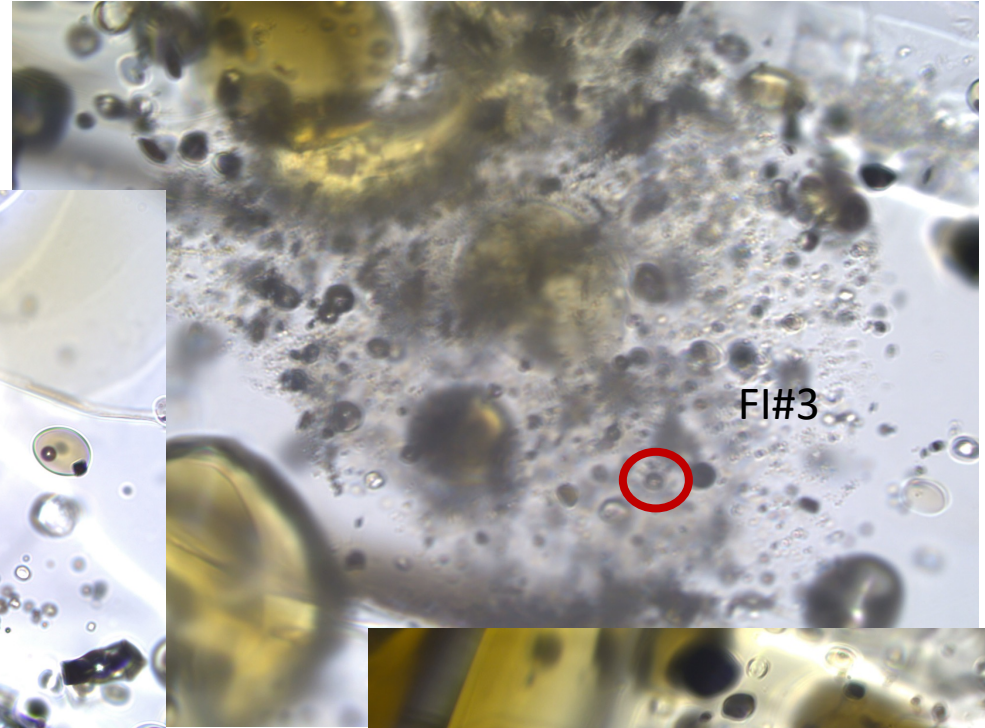
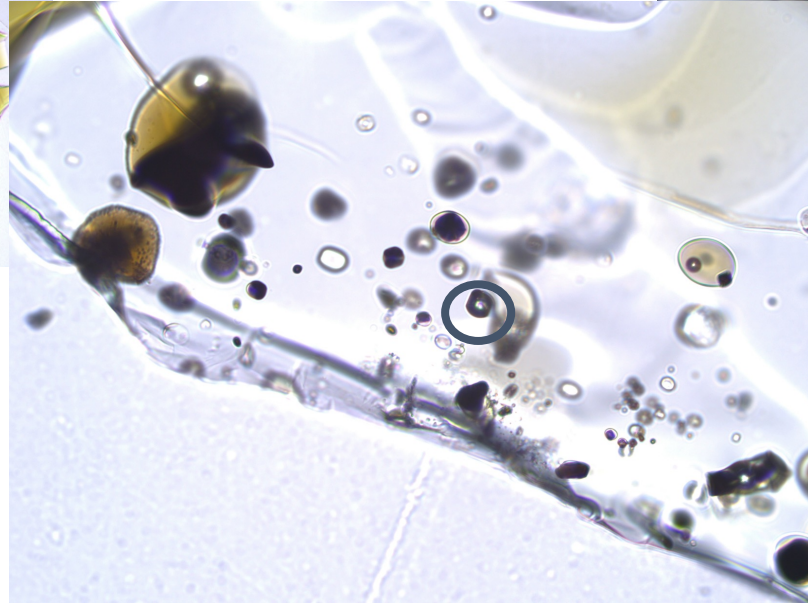
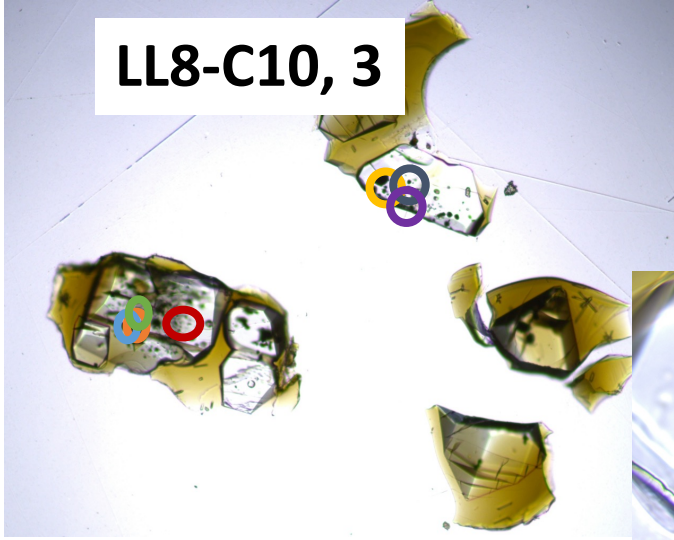
Got split into pieces and polished out



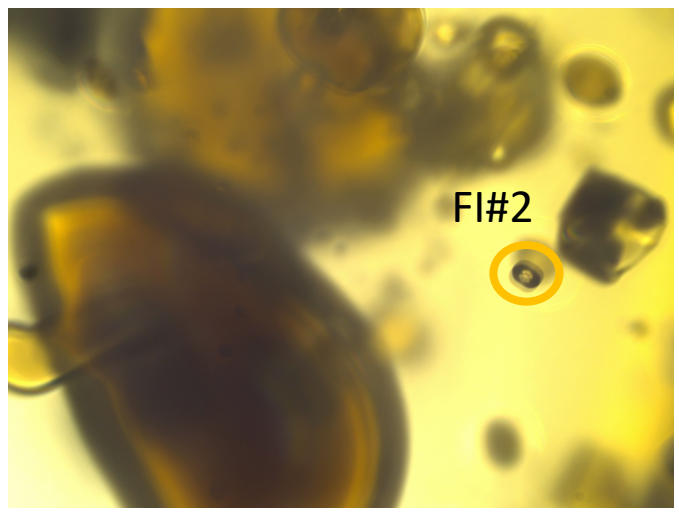
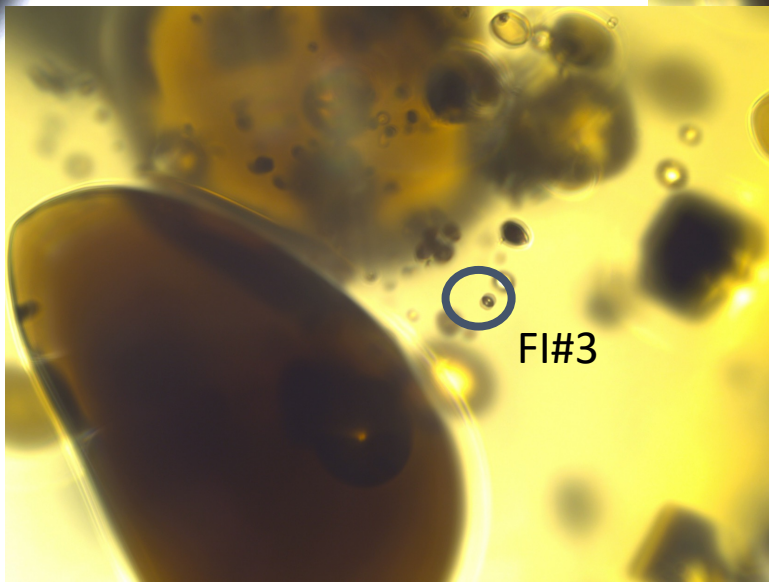
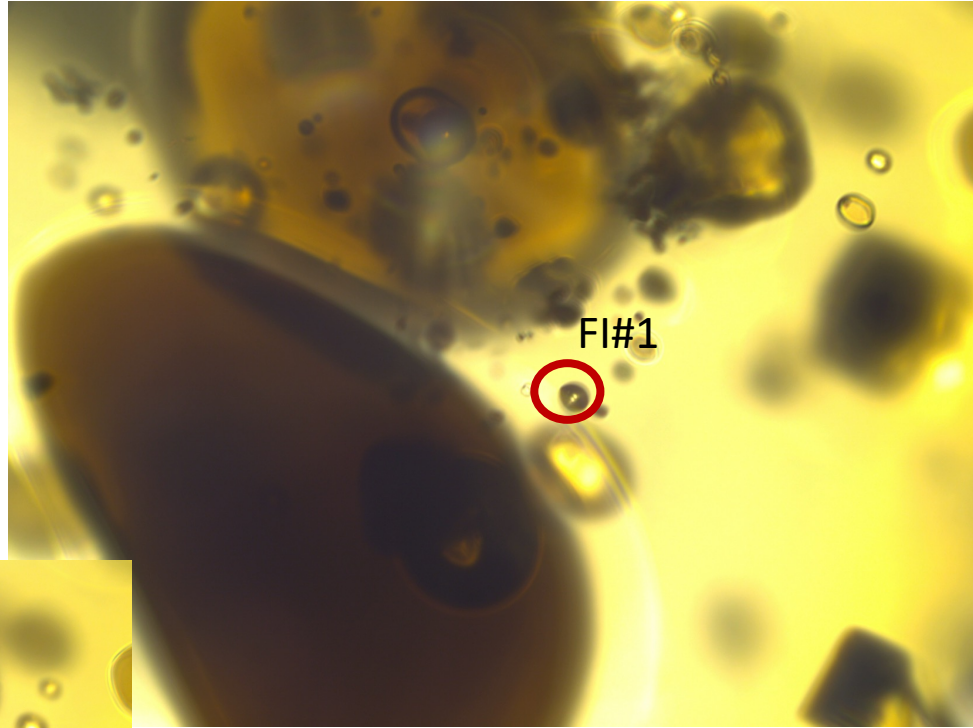
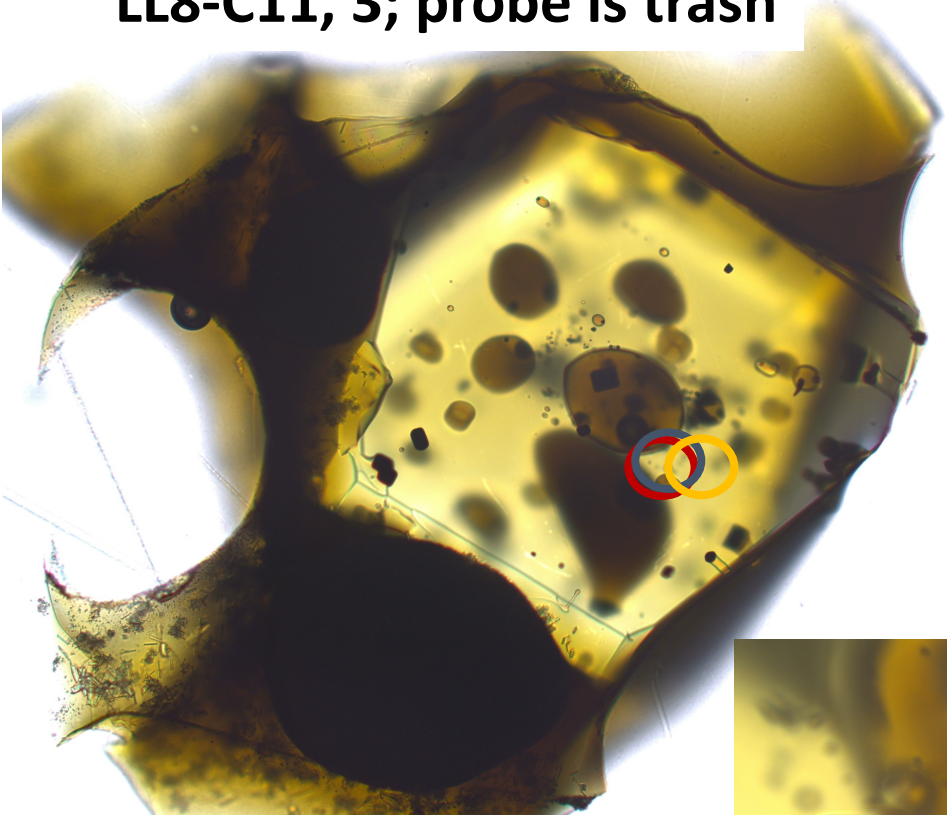
LL8-C9, 3



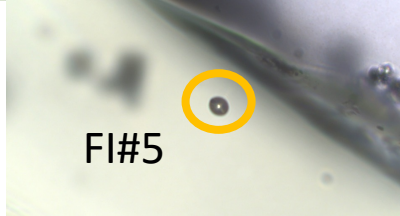
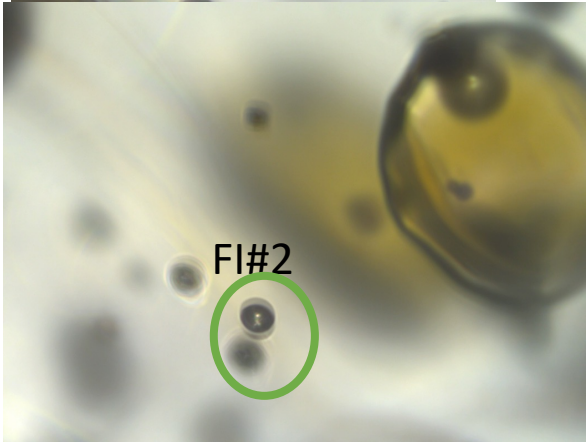
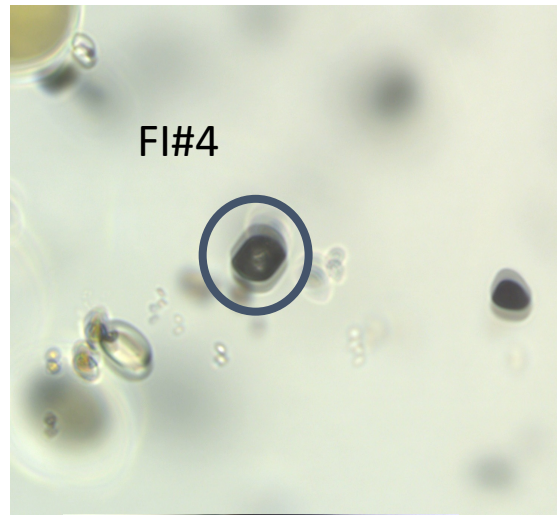
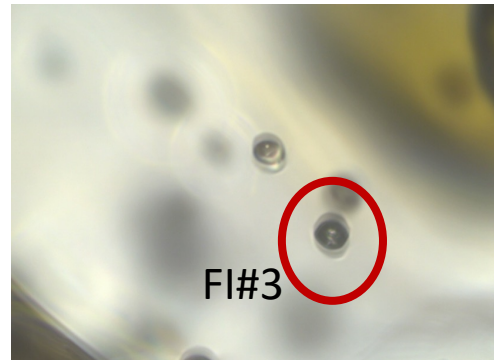
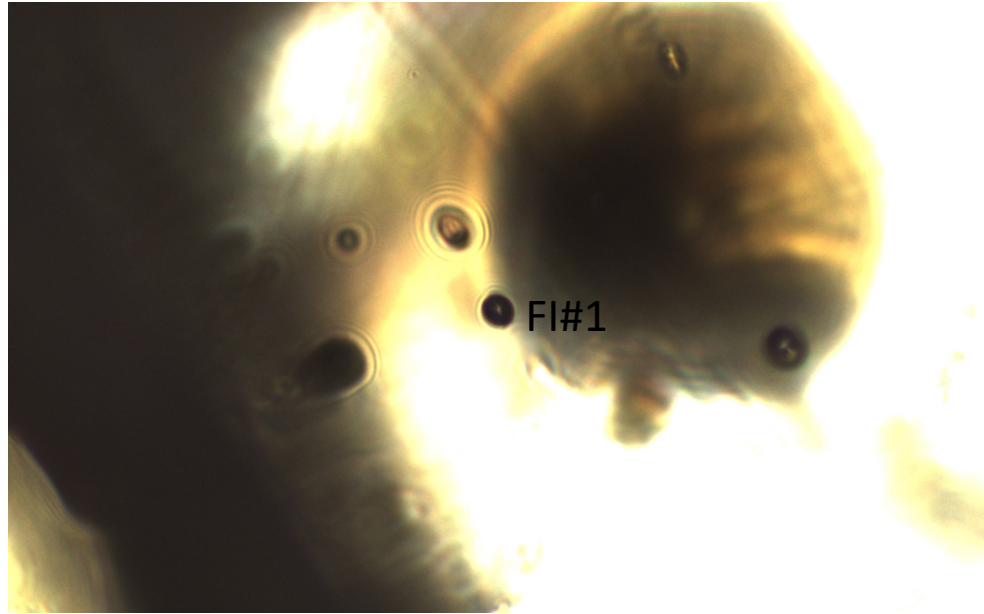
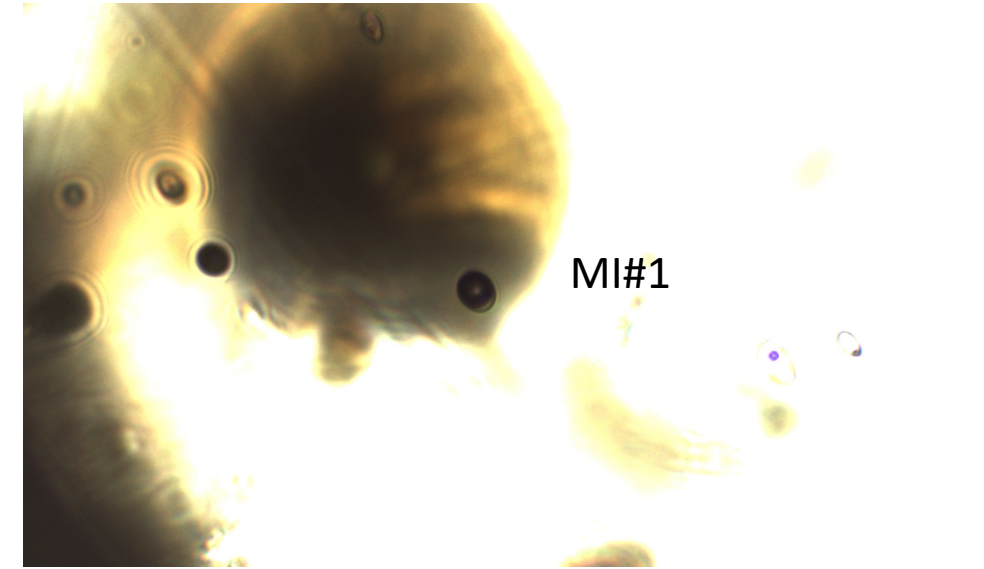
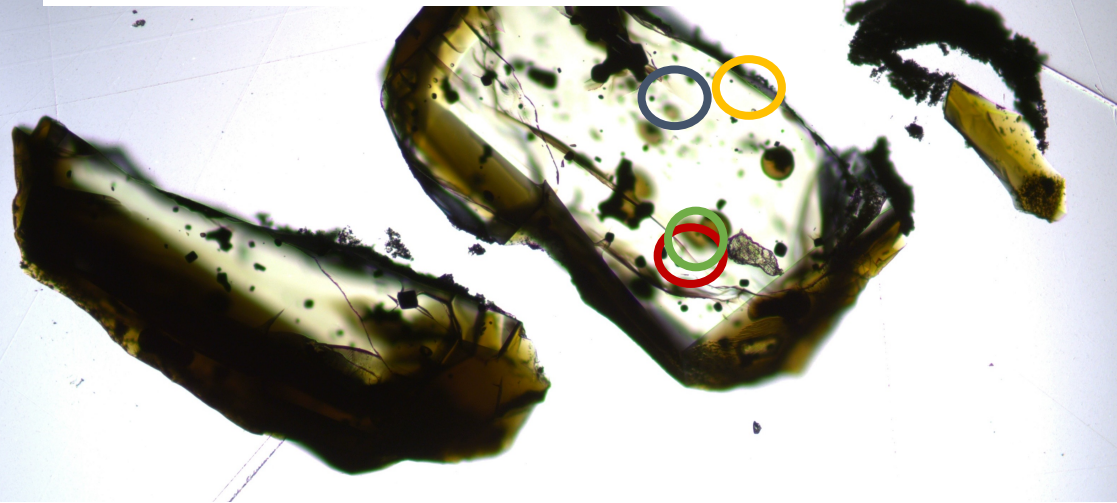
LL8-C10, 3



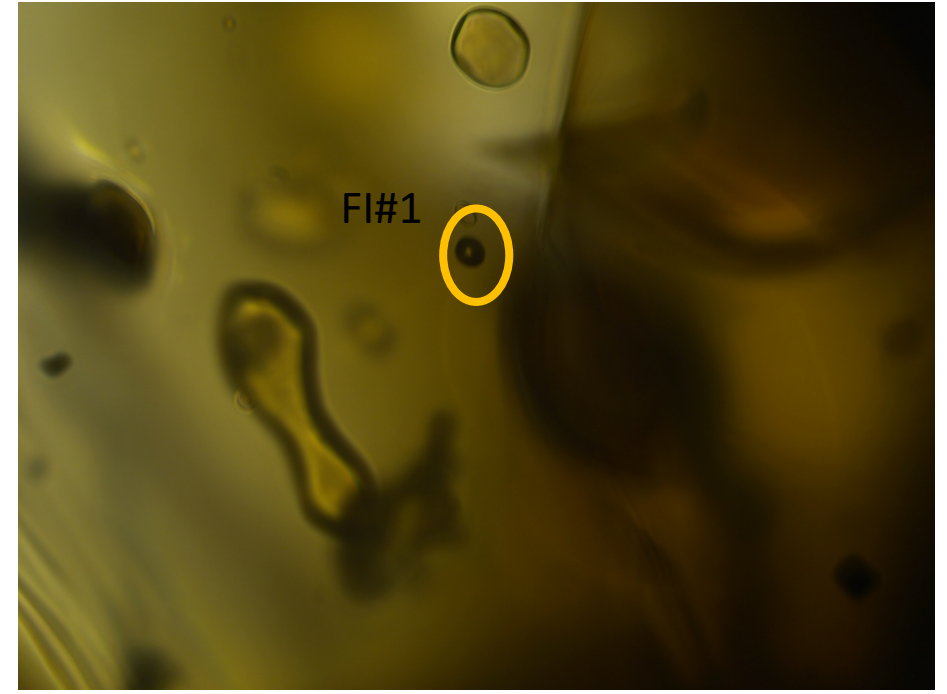
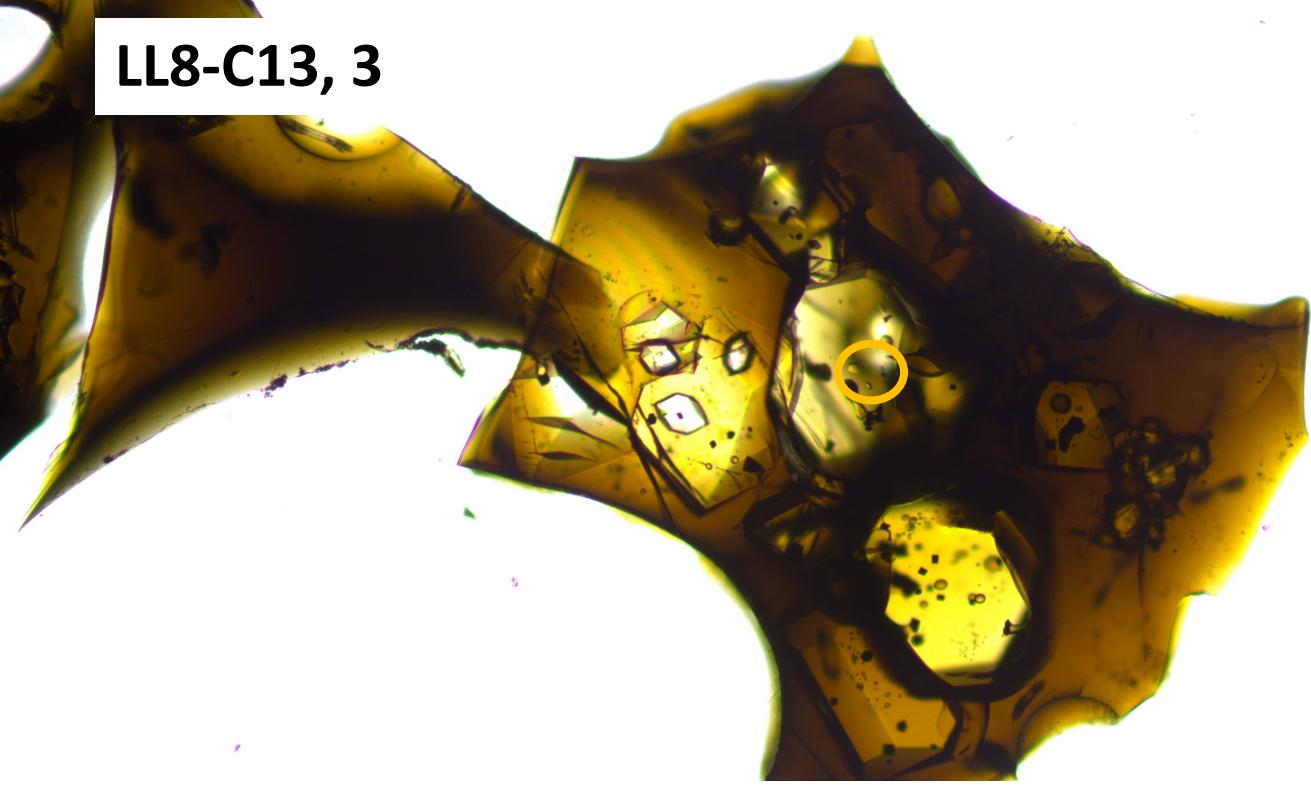
LL8-C11, 3; probe is trash



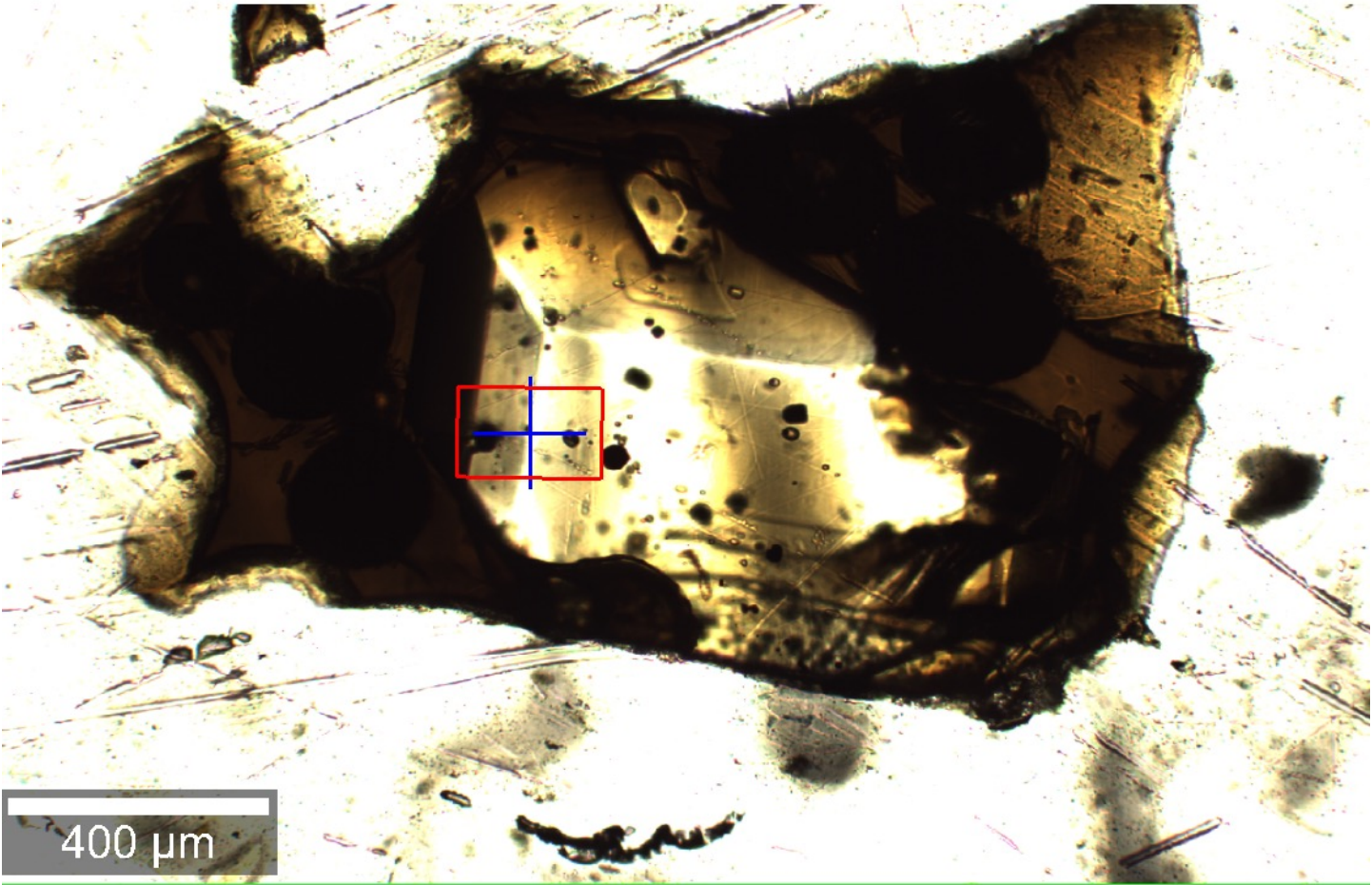
LL8-C12, 3, probe is trash



LL8-C13, 3



LL8-C18, 3



400 μm

FI#1

