Natural Resources Canada | Ressources naturelles Canada

GEOLOGICAL SURVEY OF CANADA
OPEN FILE 8720

U-Pb detrital-zircon geochronology of the Woodburn Lake group, Nunavut

V.M. McNicoll

2020

Canada

GEOLOGICAL SURVEY OF CANADA
OPEN FILE 8720

U-Pb detrital-zircon geochronology of the Woodburn Lake group, Nunavut

V.M., McNicoll[1]

[1]Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario K1A 0E8

2020

© Her Majesty the Queen in Right of Canada, as represented by the Minister of Natural Resources, 2020

Information contained in this publication or product may be reproduced, in part or in whole, and by any means, for personal or public non-commercial purposes, without charge or further permission, unless otherwise specified.
You are asked to:
- exercise due diligence in ensuring the accuracy of the materials reproduced;
- indicate the complete title of the materials reproduced, and the name of the author organization; and
- indicate that the reproduction is a copy of an official work that is published by Natural Resources Canada (NRCan) and that the reproduction has not been produced in affiliation with, or with the endorsement of, NRCan.

Commercial reproduction and distribution is prohibited except with written permission from NRCan. For more information, contact NRCan at nrcan.copyrightdroitdauteur.rncan@canada.ca.

Permanent link: https://doi.org/10.4095/326019

This publication is available for free download through GEOSCAN (https://geoscan.nrcan.gc.ca/).

Recommended citation
McNicoll, V.M., 2020. U-Pb detrital-zircon geochronology of the Woodburn Lake group, Nunavut; Geological Survey of Canada, Open File 8720, 1 .zip file. https://doi.org/10.4095/326019

Publications in this series have not been edited; they are released as submitted by the author.

Introduction

This multi-component Open File report releases SHRIMP U-Pb zircon data from 6 sedimentary and epiclastic rock samples from the Woodburn Lake group (Table 1). These analyses are contributions toward the GEM 1 Uranium Project (2008-2013), in helping to elucidate basement rocks that in places host unconformity associated uranium deposits. The Woodburn Lake group contains multiple volcanic and sedimentary assemblages (Pehrsson et al. 2013), and some of these assemblages were suspected to be distributed over disparate locations. The detrital zircon suites are of great help in testing correlations of these assemblages from place to place, as well as in refining their relative ages.

This release contains one Excel spreadsheet containing the U-Pb data for each of the six samples and an accompanying Adobe pdf file containing images of the zircon grains. The zircon images have been annotated with numbers that correspond to the analysis name and the location of SHRIMP analytical pits have been recorded. The purpose of this report is to make the U/Pb detrital zircon geochronology dataset publically available for evaluation and interpretation, not to provide such interpretation herein.

Expanded information on the geological setting of these samples and representations of their detrital provenance profiles in the form of probability density plots are provided in a forthcoming publication by Jefferson et al. (in prep.).

Table 1. Sample Summary

Lab Number	Sample Number	Lithological Description	Latitude (NAD27)	Longitude (NAD27)
10810	12JP040	Sedimentary, epiclastic: well lithified thinly laminated and graded beds of siliceous siltstone interlayered with volcanic-greywacke sandstone to mudstone (now phyllite) with locally abundant phenocrysts of quartz and feldspar. Sample from AREVA drill core GG21.	64.43194	-97.75467
10807	11JP009	Metasedimentary: amphibolite grade paragneiss with relict graded bedding, interpreted as metagreywacke; beds 10s to >100 cm thick. Extensive outcrop along southwest shoreline of elongate lake ~20 km south of Marjorie Hills.	64.21557	-98.84211
10574	PQB-MDB-2011-06	Sedimentary: feldspathic lithic wacke with some pebble-sized fragments. Outcrop near the northeast corner of Third Portage Lake.	65.00381	-96.10564
10809	11PHA041	Sedimentary: schistose feldspathic metagreywacke with transposed, thinly graded beds, hosts the auriferous Jim Zone iron-formation. Broad lichen-covered outcrop.	65.2083	-96.05364
10808	11JP398A01	Sedimentary: schistose feldspathic metagreywacke, large block with graded bedding, represents one host of the Kiggavik uranium deposit. Outcrop in gully west side of Lone Gull exploration camp.	64.44028	-97.66217

10971	10JPM078A	Sedimentary: schistose feldspathic metagreywacke, type locality of the Pipedream assemblage of the Woodburn Lake group, hosts non-mineralized iron formation.From outcrop 7 km northeast of the Meadowbank gold mine.	65.066	-95.93151

Analytical Methods

All samples were disaggregated using standard crushing/pulverizing techniques followed by density separation using the Wilfley table and heavy liquids.

SHRIMP analytical procedures followed those described by Stern (1997), with standards and U-Pb calibration methods following Stern and Amelin (2003). Briefly, zircons were cast in 2.5 cm diameter epoxy mounts along with fragments of the GSC laboratory reference zircon (z6266, with $^{206}Pb/^{238}U$ age = 559 Ma). The mid-sections of the zircons were exposed using 9, 6, and 1 µm diamond compound, and the internal features of the zircons (such as zoning, structures, alteration, etc.) were characterized in back-scattered electron mode (BSE) utilizing a Zeiss Evo 50 scanning electron microscrope. On the mass spectrometer, eleven masses including background were sequentially measured with a single electron multiplier. Off-line data processing was accomplished using SQUID2 (version 2.50.11.10.15, rev. 15 Oct 2011). The 1σ external errors of $^{206}Pb/^{238}U$ ratios reported in the data table incorporate the error in calibrating the reference material. Common Pb correction utilized the Pb composition of the surface blank (Stern, 1997). Analyses of a secondary zircon reference material z1242 were interspersed between the sample analyses to assess the requirement of an isotopic mass fractionation correction for the $^{207}Pb/^{206}Pb$ age. The accepted $^{207}Pb/^{206}Pb$ age of z1242 is 2679.7±0.2 Ma, based on 59 isotope dilution fractions (Davis, 2019). Details of the analytical session, including spot size, calibration error and the any application of the isotopic mass fractionation correction are given in the footnotes of the table.

Acknowledgements

The careful field observations of Sally Pehrsson and Charlie Jefferson underpin this report. Agnico-Eagle and AREVA are thanked for facilitating fieldwork and access to samples. We are grateful for the support and assistance of the staff of the Geochronology and Mineralogy Laboratories of the Geological Survey of Canada. Raymond Chung, Ron Christie are thanked for their careful efforts in preparing high-quality mineral separates. We recognize Tom Pestaj for his excellent work in the production of ion probe mounts as well as SHRIMP instrument tuning and troubleshooting. Pat Hunt provides us with the necessary high-quality scanning electron microscope images for targeting SHRIMP analytical sites. Nicole Rayner and Sabrina Chan are thanked for their work pulling together the data for release. Nicole Rayner reviewed the manuscript and data tables.

References

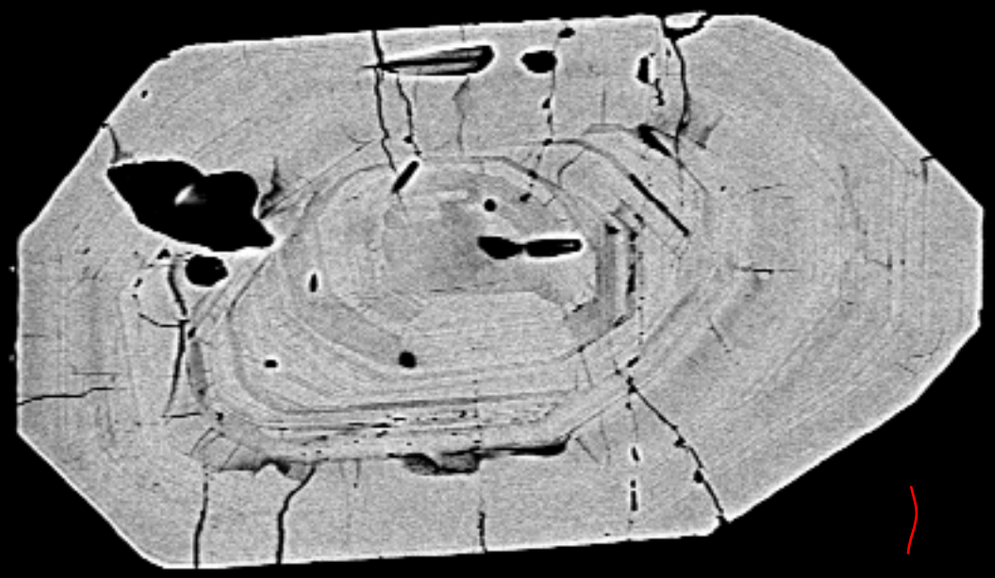
Davis, W.J., Pestaj, T., Rayner, N., McNicoll, V.M., 2019. Long-term reproducibility of 207Pb/206Pb age at the GSC SHRIMP lab based on the GSC Archean reference zircon z1242. Geological Survey of Canada, Scientific Presentation 111, 1 poster, https://doi.org/10.4095/321203

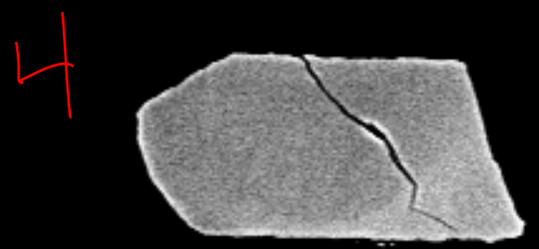
Jefferson, C.W., Pehrsson, S., Tschirhart, V., Peterson, T., Chorlton, L.1, Bethune, K., Davis, W., McNicoll, V. and Rayner, N., in prep. Geology and metallogeny of the northeast Thelon Basin region and comparison with the Athabasca Basin; in Pehrsson and Wodicka (eds.) Rae Synthesis, GEM Program, Geological Survey of Canada Bulletin xxx, p yyy-zzz.

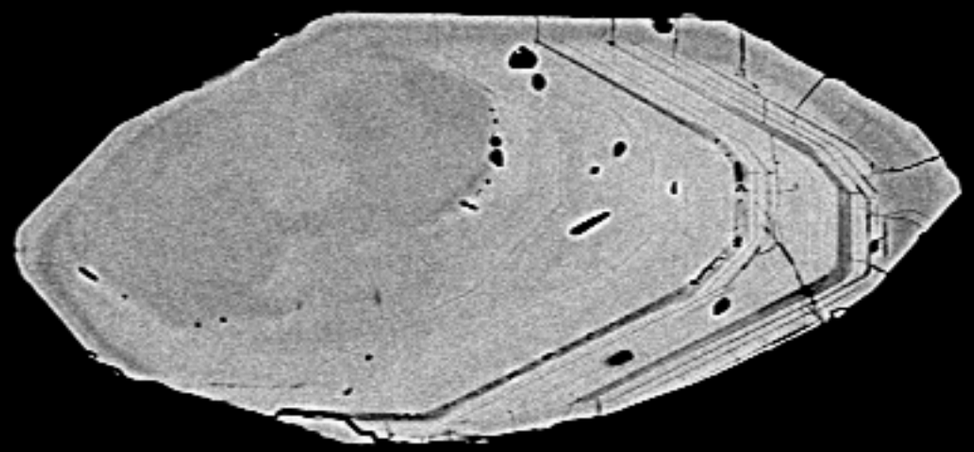
Pehrsson, S.J., Berman, R., and Davis, W.J., 2013. Paleoproterozoic orogenesis during Nuna aggregation: a case study of reworking of the Archean Rae craton, Woodburn Lake, Nunavut. Precambrian Research, 232, 167-188. http://dx.doi.org/10.1016/j.precamres.2013.02.010

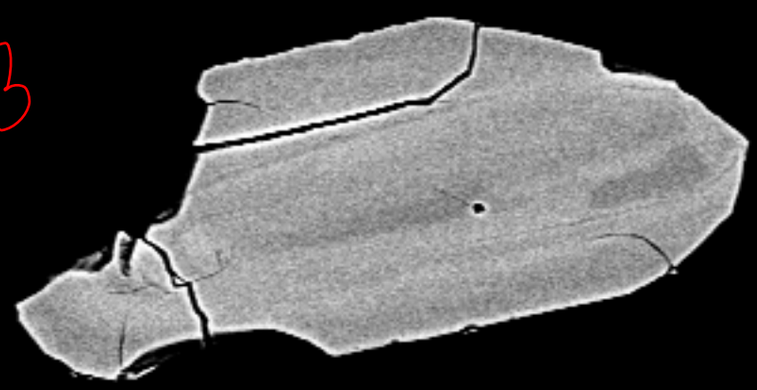
Stern, R.A., 1997, The GSC Sensitive High Resolution Ion Microprobe (SHRIMP): analytical techniques of zircon U-Th-Pb age determinations and performance evaluation: *in* Radiogenic Age and Isotopic Studies, Report 10, Geological Survey of Canada, Current Research 1997-F, p. 1-31.

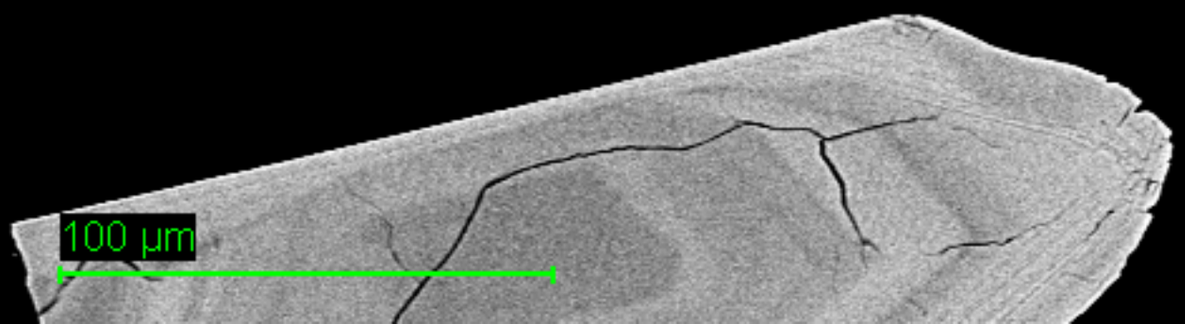
Stern, R.A., and Amelin, Y., 2003. Assessment of errors in SIMS zircon U-Pb geochronology using a natural zircon standard and NIST SRM 610 glass; Chemical Geology, v. 197, p. 111-146.











File Name = 10574-01.tif

100 µm

File Name = 10574-02.tif

9

12

10

11

100 µm

File Name = 10574-03.tif

13

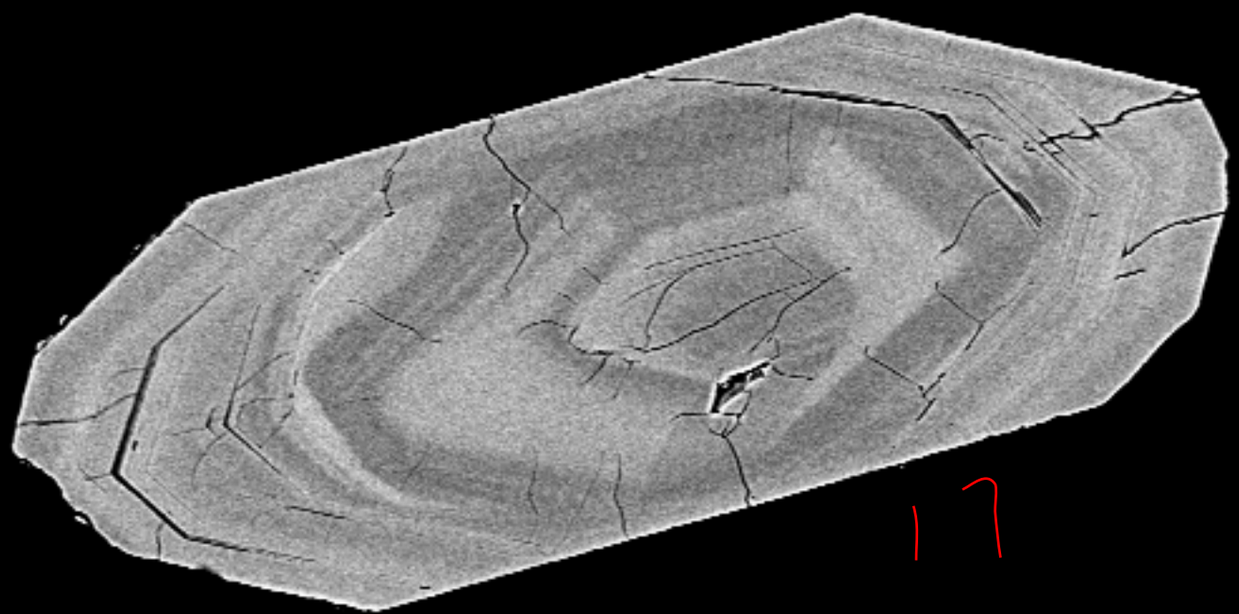
16

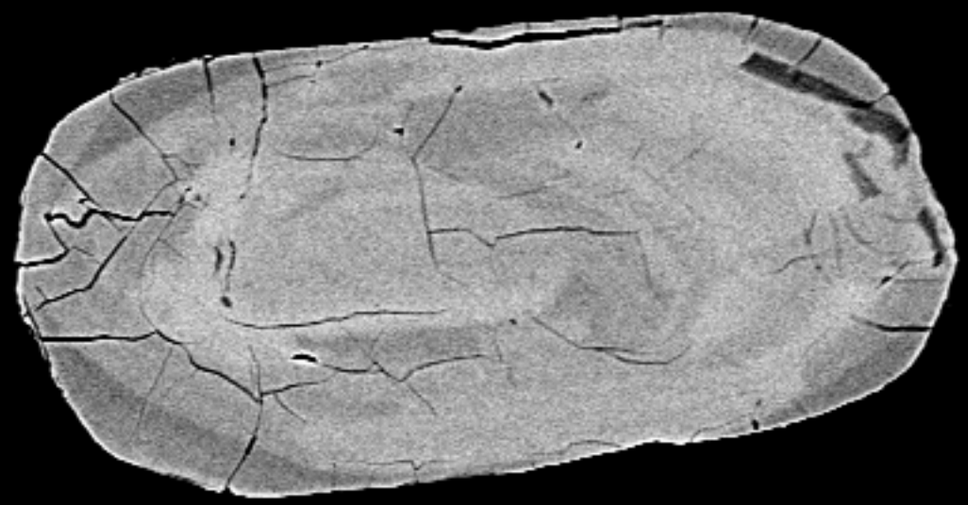
14

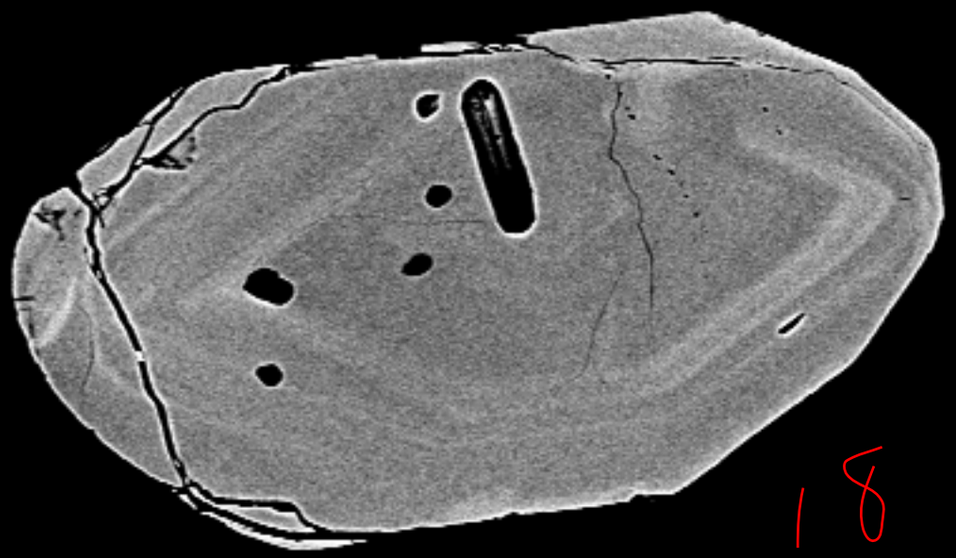
15

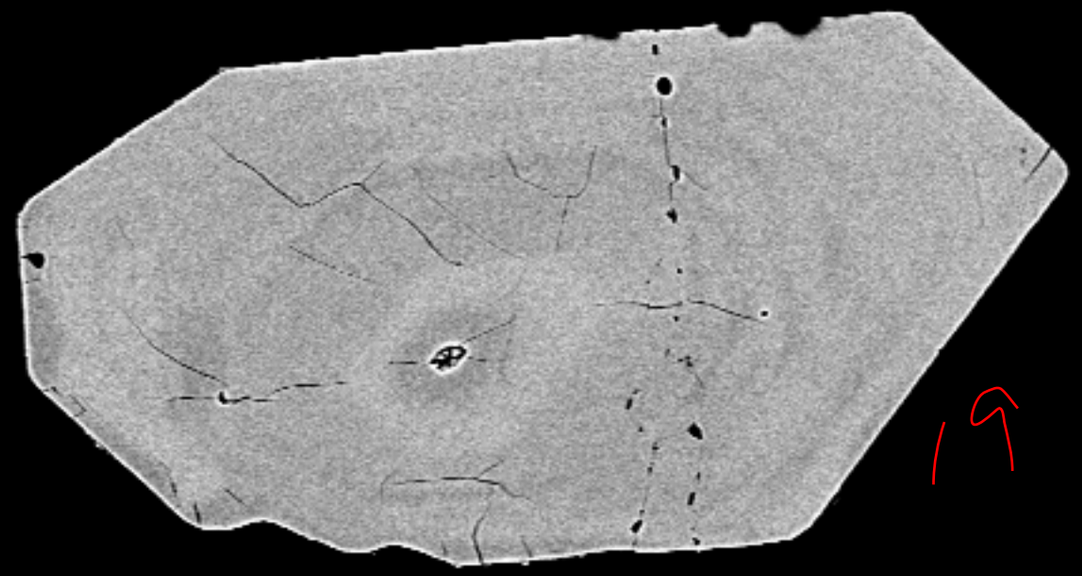
100 µm

File Name = 10574-04.tif



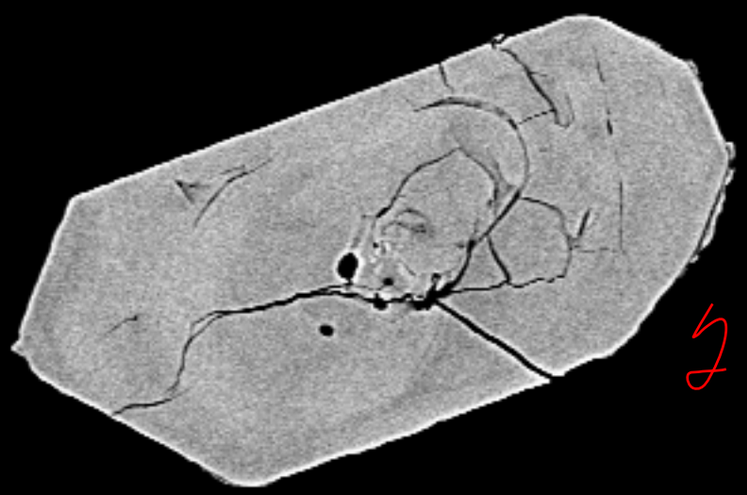


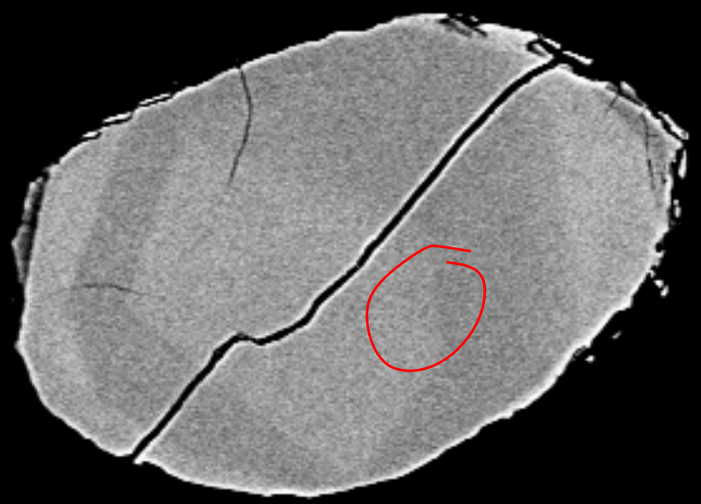


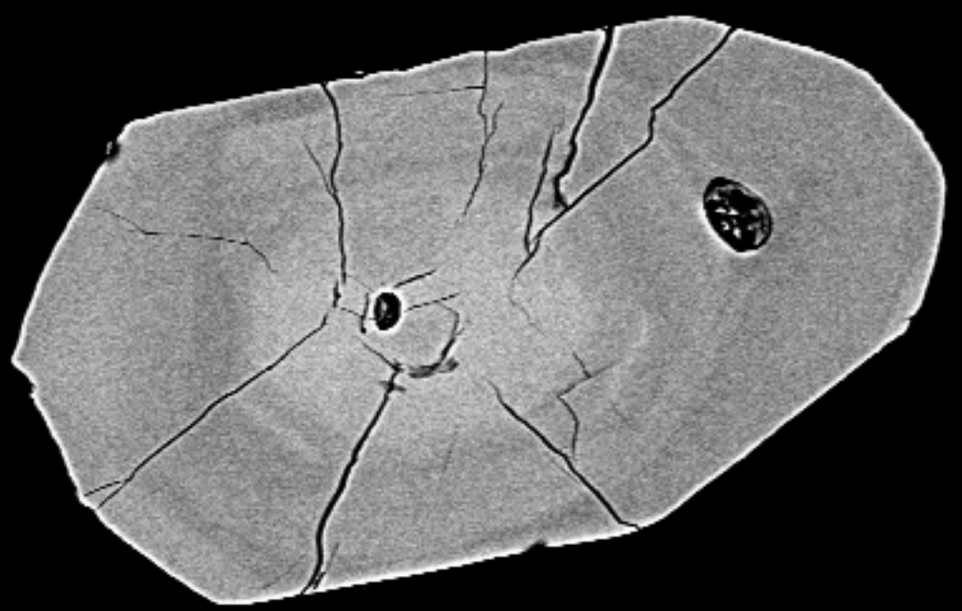


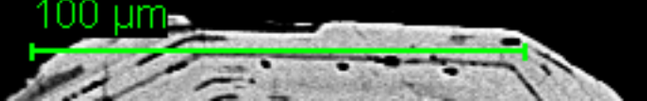
100 µm

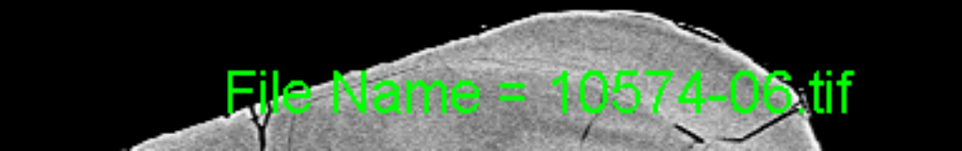
File Name = 10574-05.tif











100 µm
File Name = 10574-06.tif

25

28

26

27

100 µm

File Name = 10574-07.tif

29

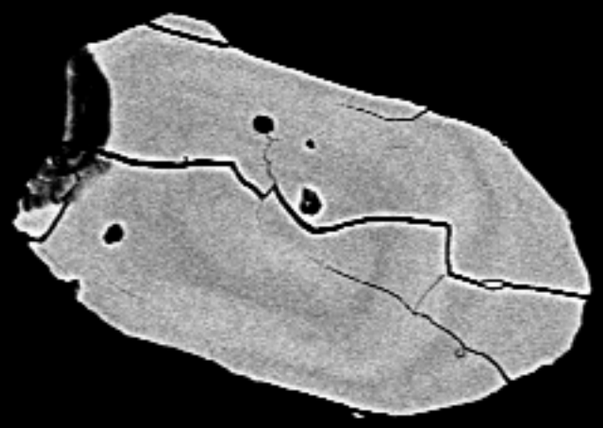
32

30

31

100 µm

File Name = 10574-08.tif



33

35

34

100 µm

File Name = 10574-09.tif

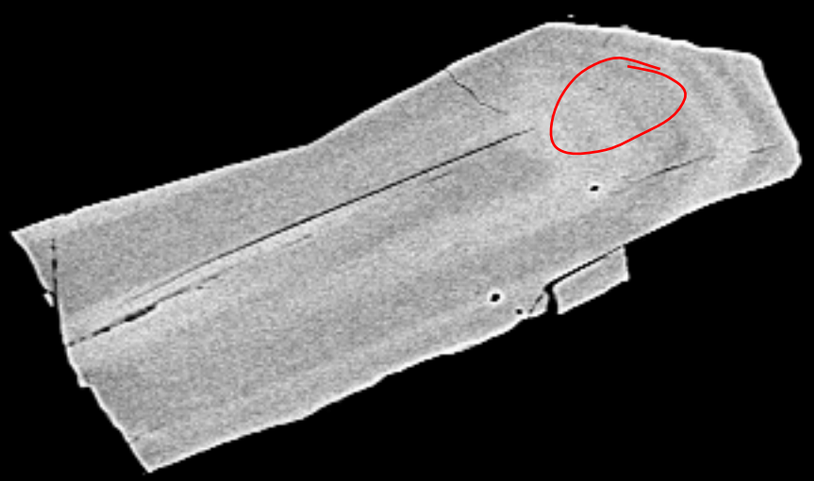
36

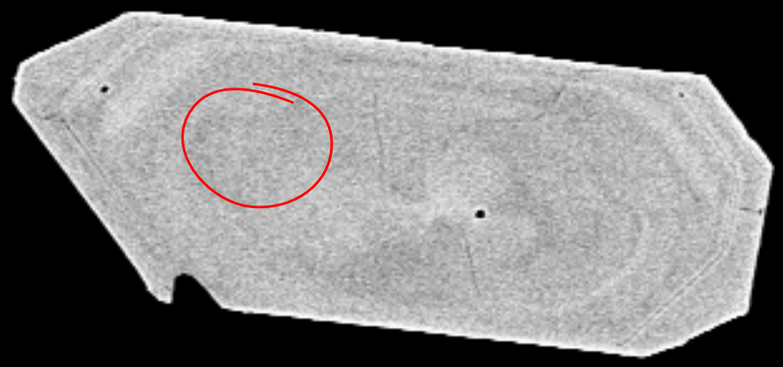
37

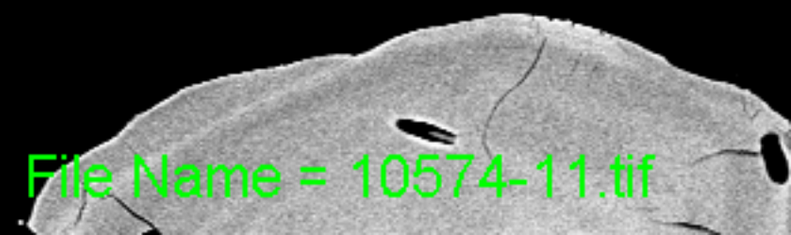
38

100 µm

File Name = 10574-10.tif







100 µm

File Name = 10574-11.tif

41

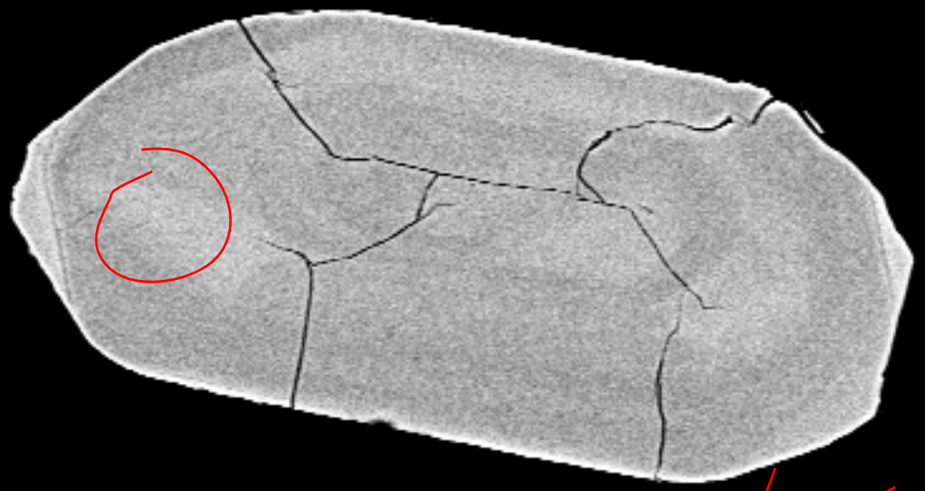
42

44

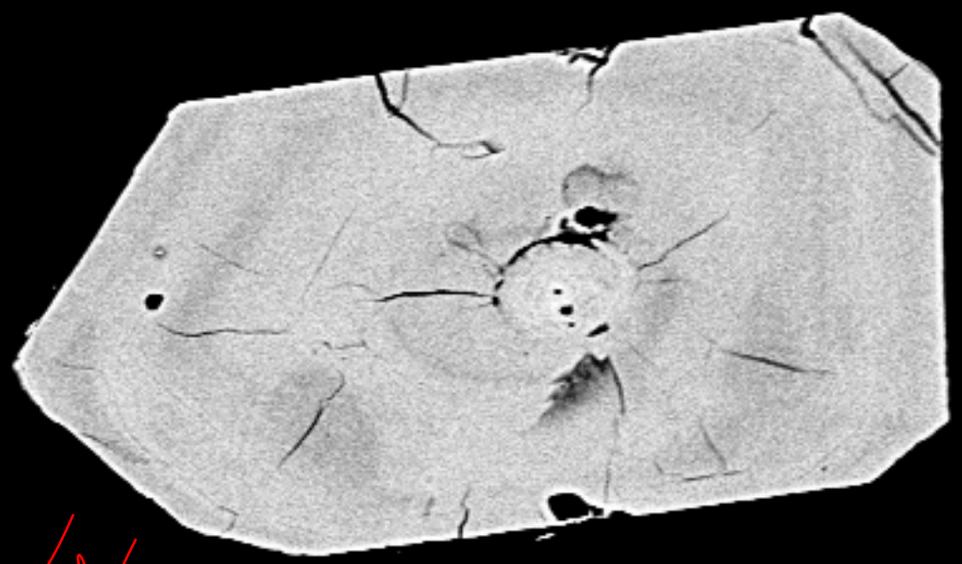
43

100 µm

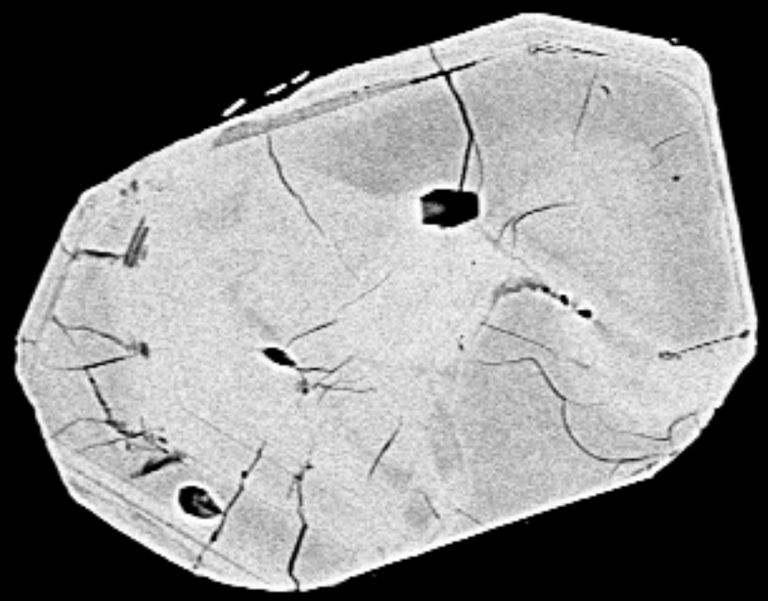
File Name = 10574-12.tif



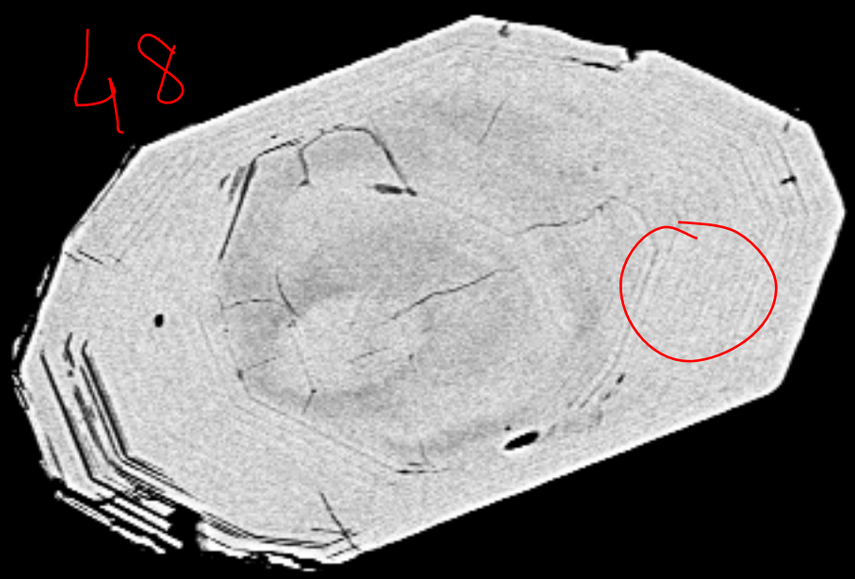
45



46



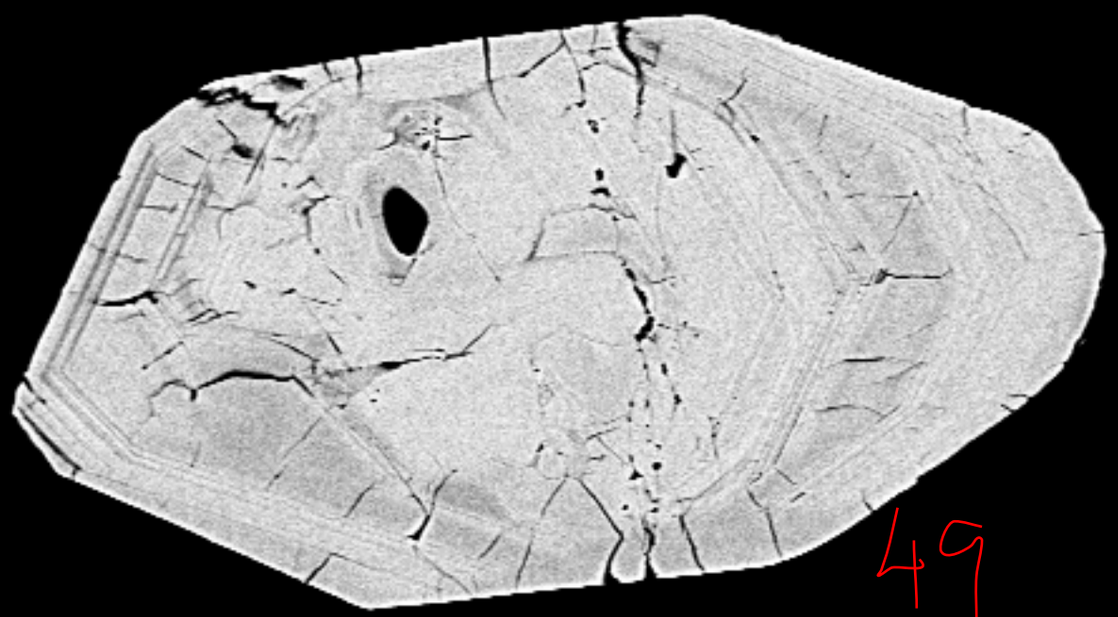
47

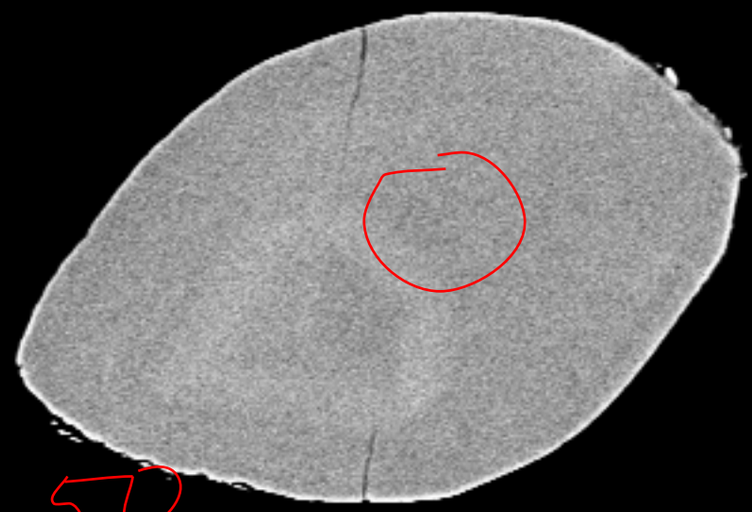


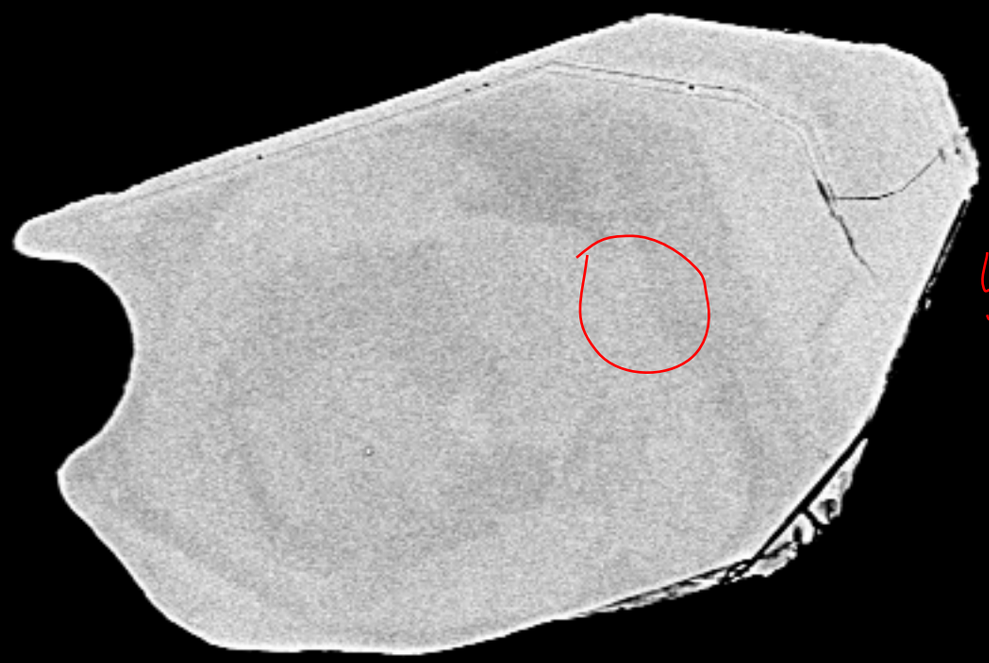
48

100 µm

File Name = 10574-13.tif







100 µm

File Name = 10574-14.tif

53

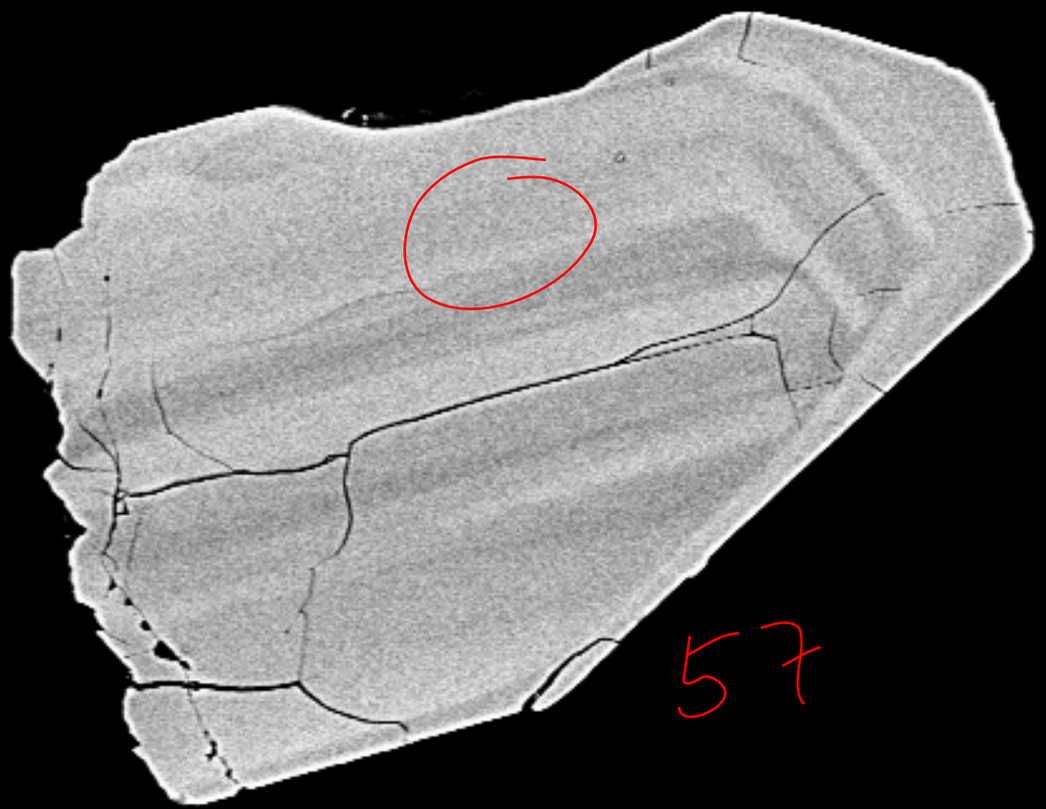
54

55

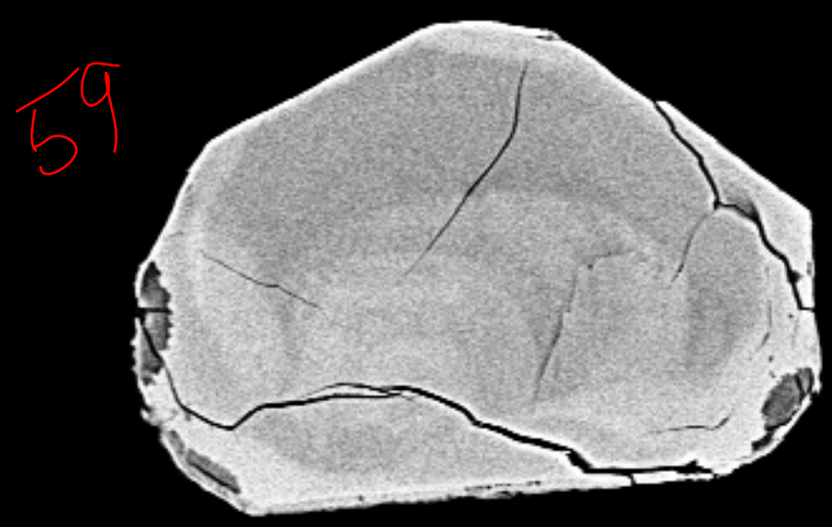
56

100 µm

File Name = 10574-15.tif


57

58


59

60

20 µm
File Name = 10574-16.tif

61

62

63

64

100 µm

File Name = 10574-17.tif

65

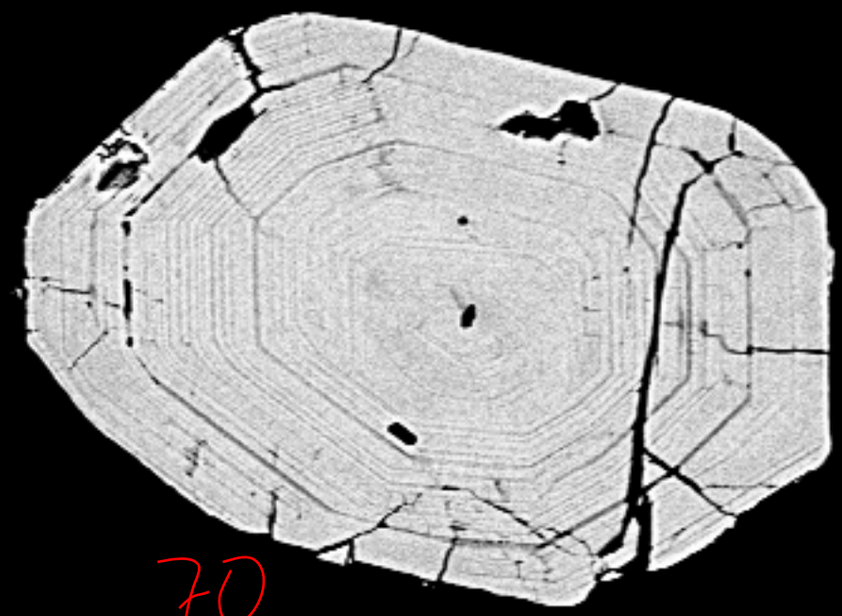
66

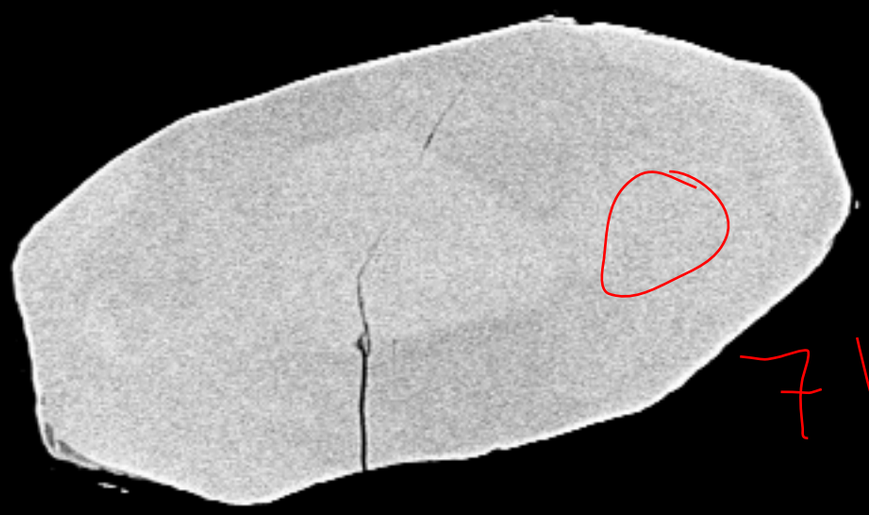
67

68

100 µm

File Name = 10574-18.tif





File Name = 10574-19.tif

73

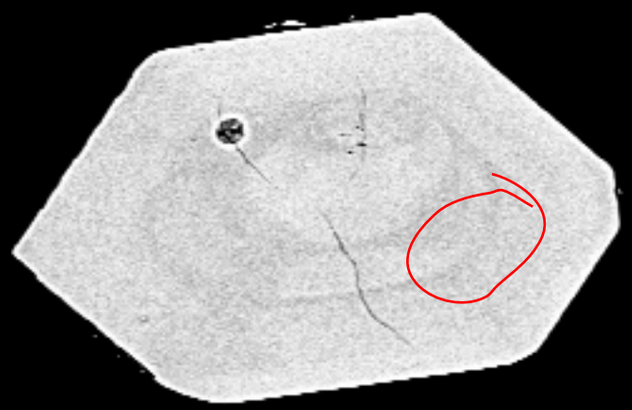
74

75

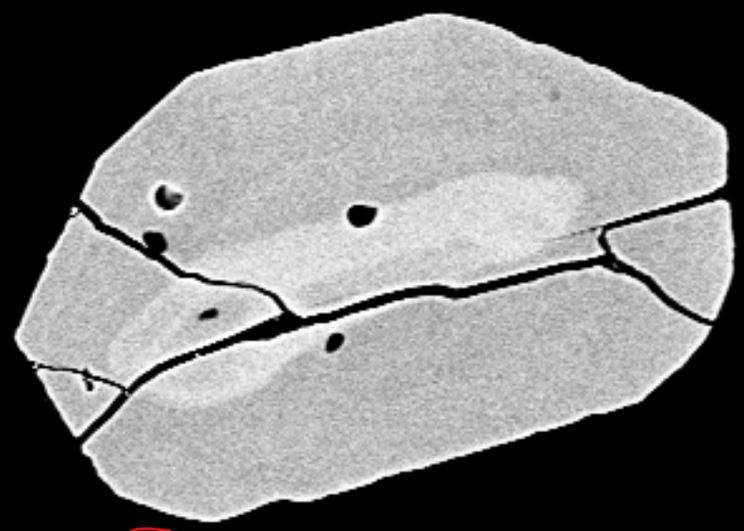
76

100 µm

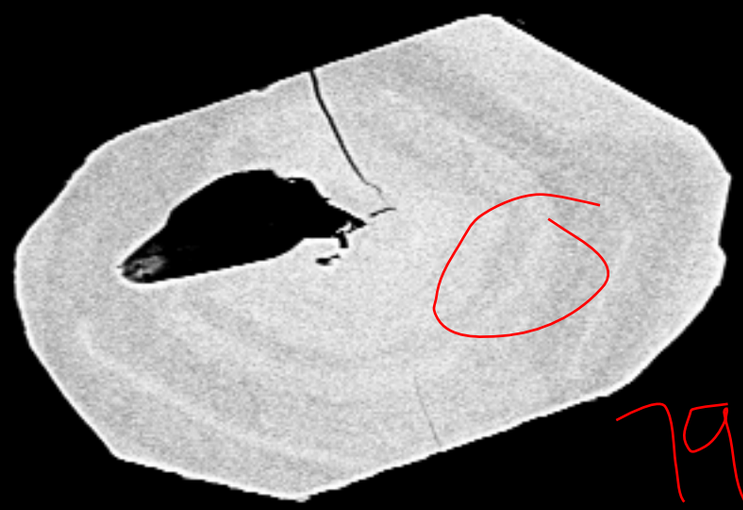
File Name = 10574-20.tif



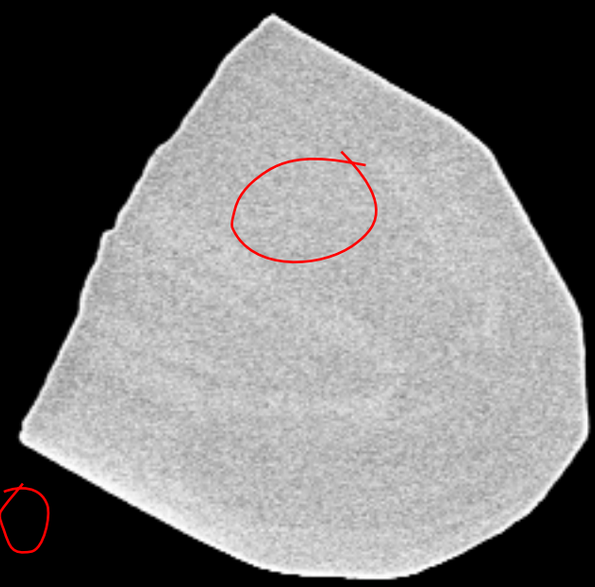
77



78



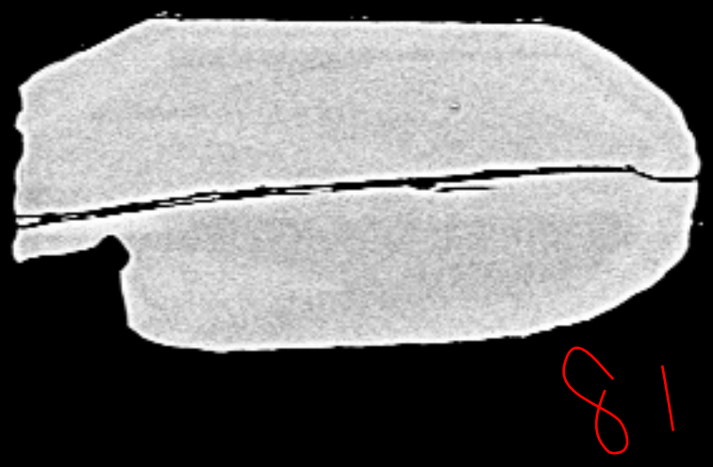
79

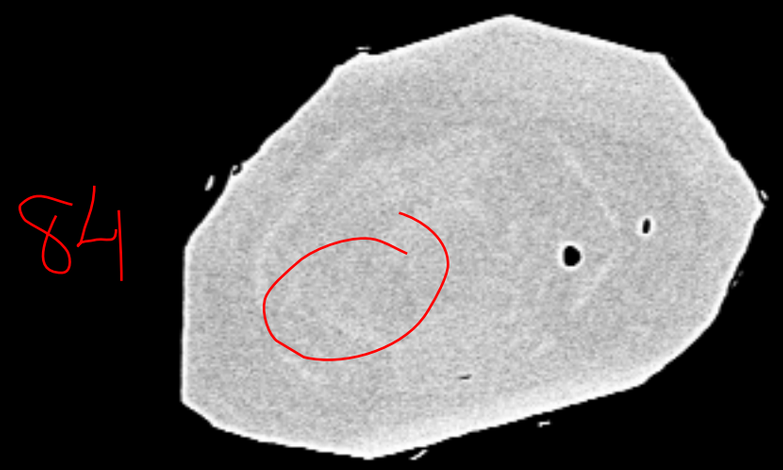


80

100 µm

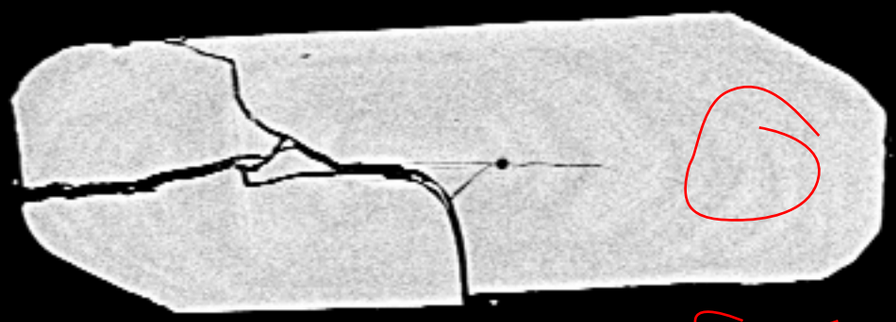
File Name = 10574-21.tif



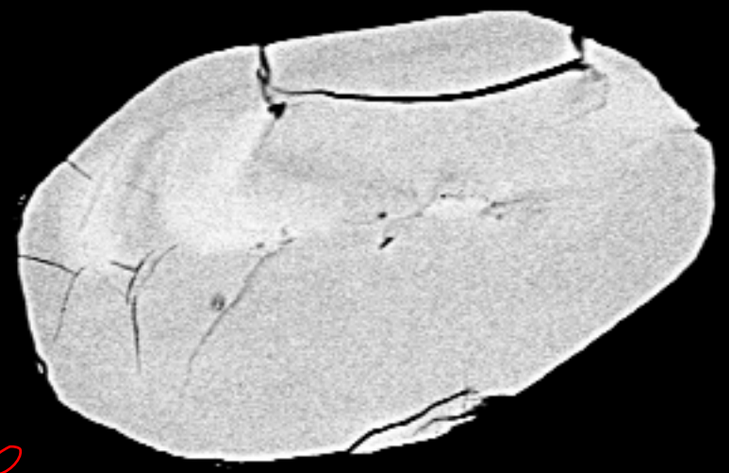


100 µm

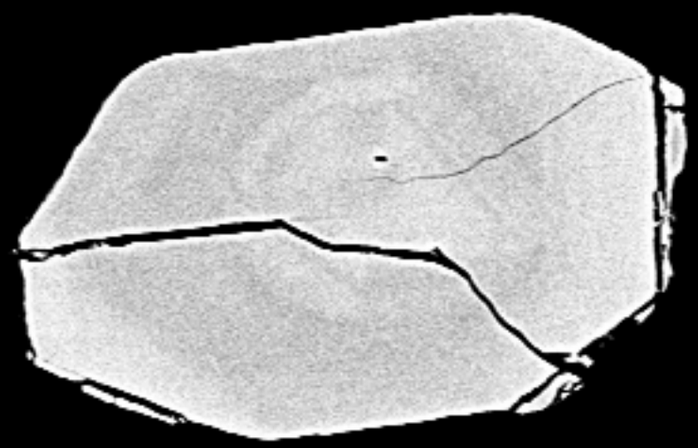
File Name = 10574-22.tif



85



86



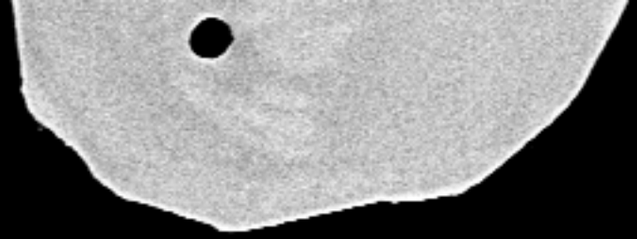
87

88

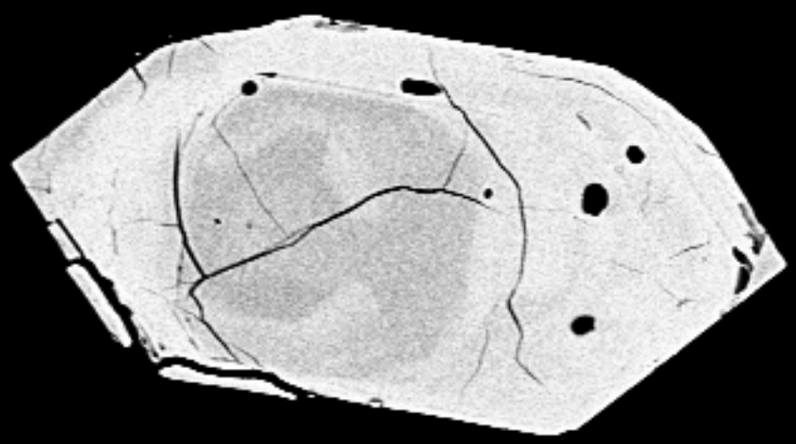
100 µm

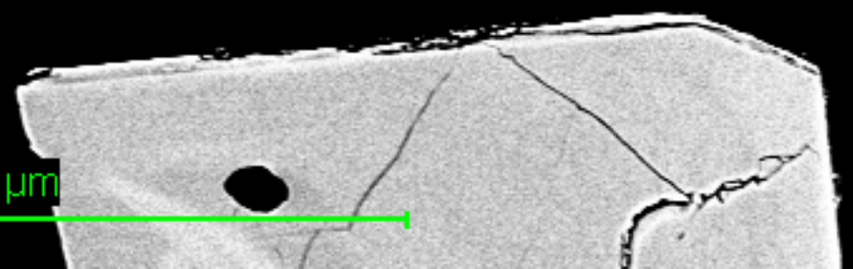
File Name = 10574-23.tif

89



90


91


100 µm

92
File Name = 10574-24.tif

93

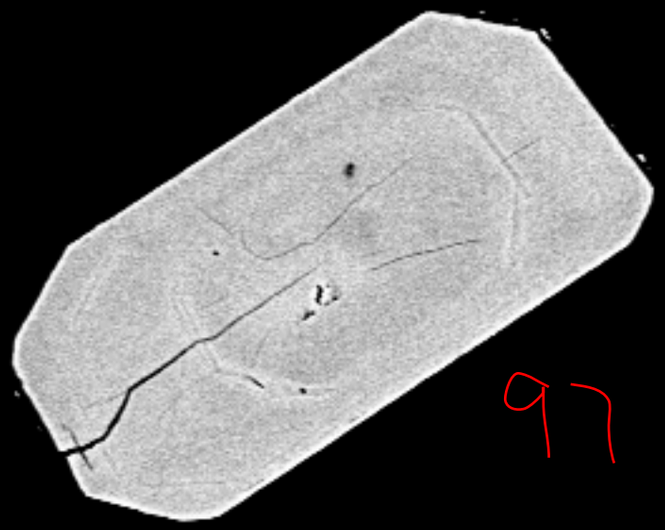
94

95

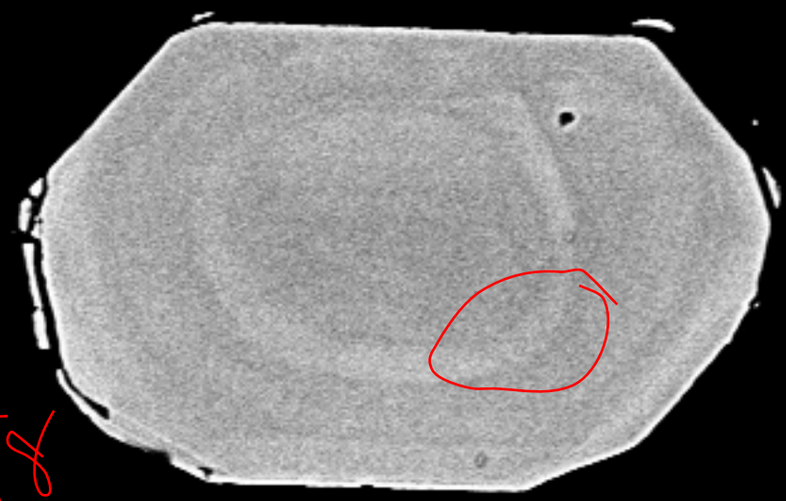
96

100 µm

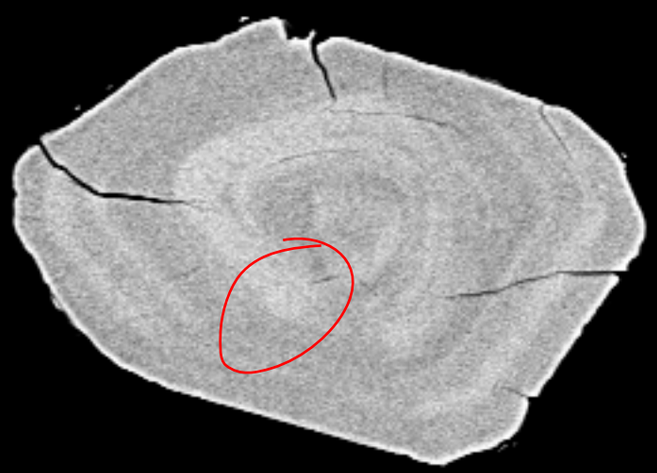
File Name = 10574-25.tif



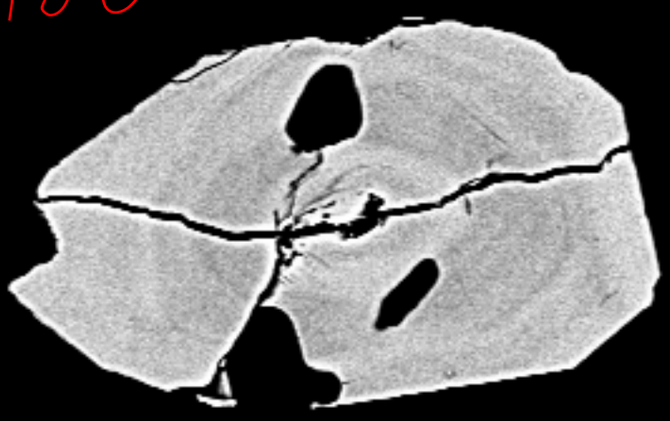
97



98



99



100

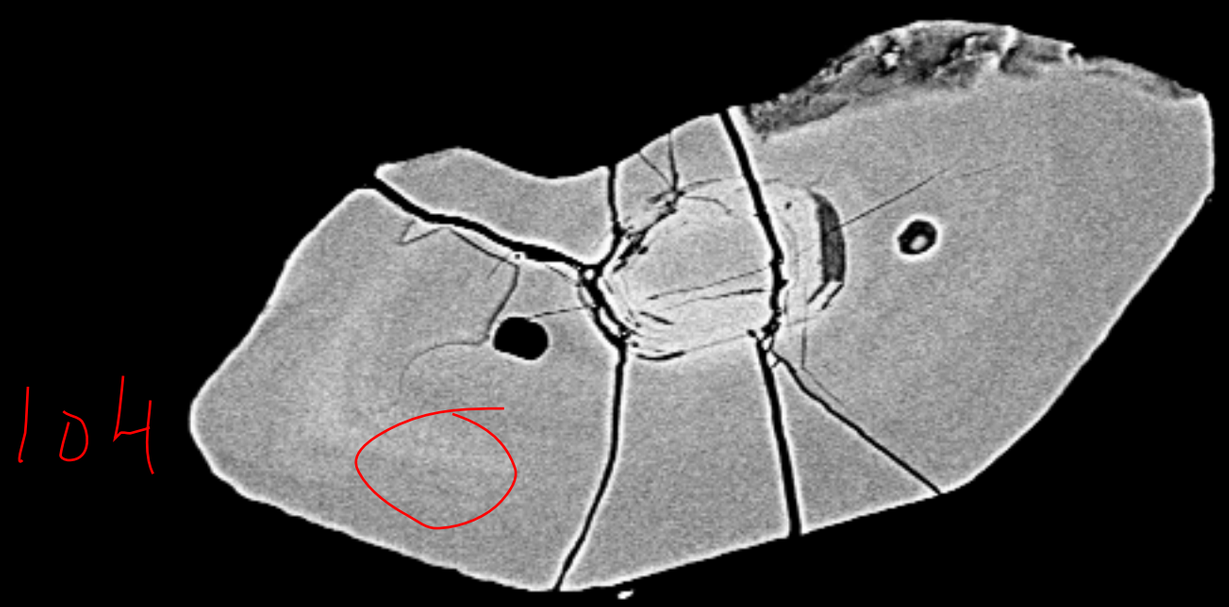
20 µm

File Name = 10574-26.tif

101

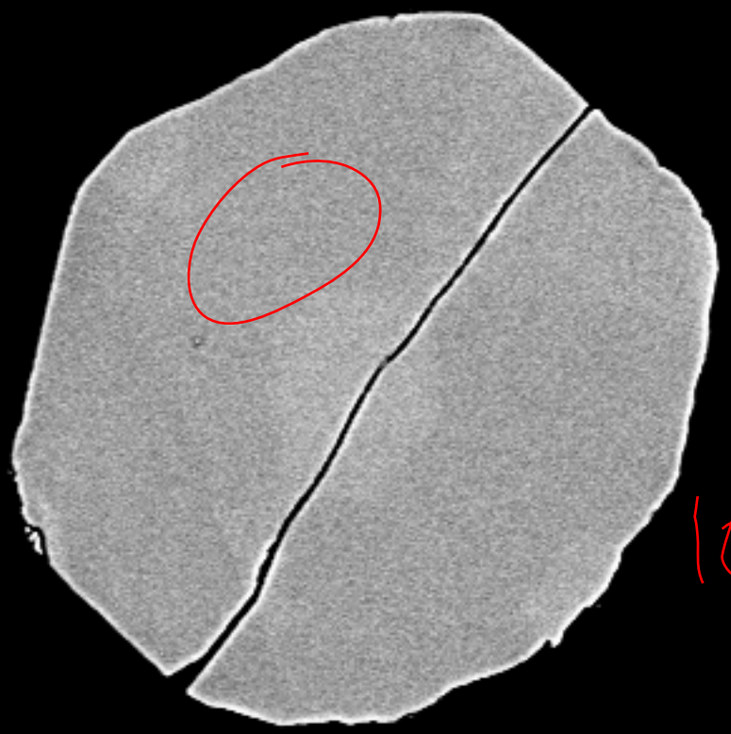
102

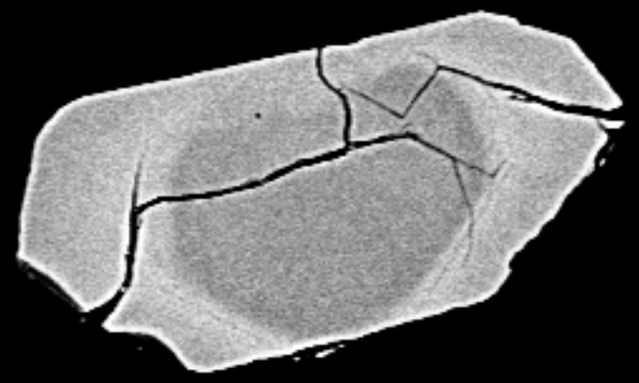
103


104

20 µm

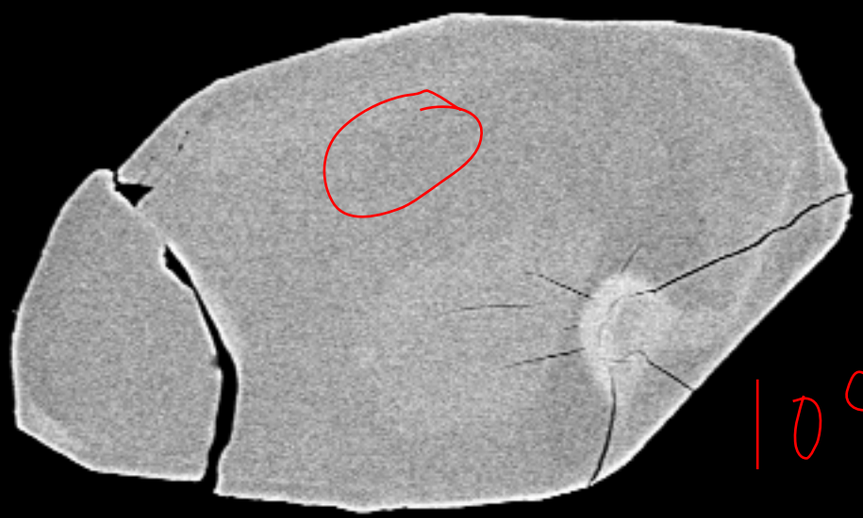
File Name = 10574-27.tif

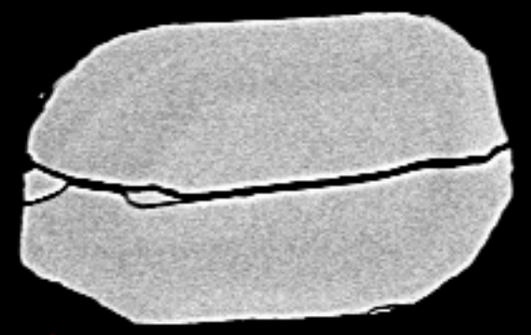


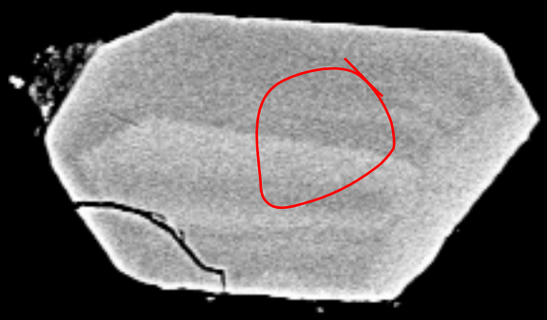


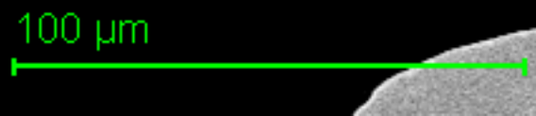
20 µm

File Name = 10574-28.tif

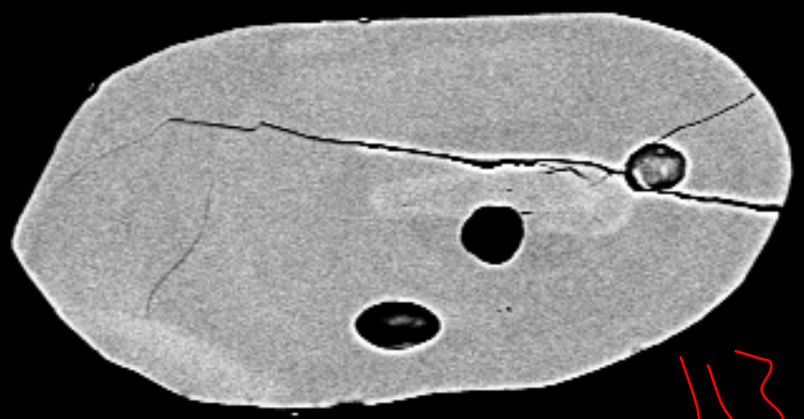


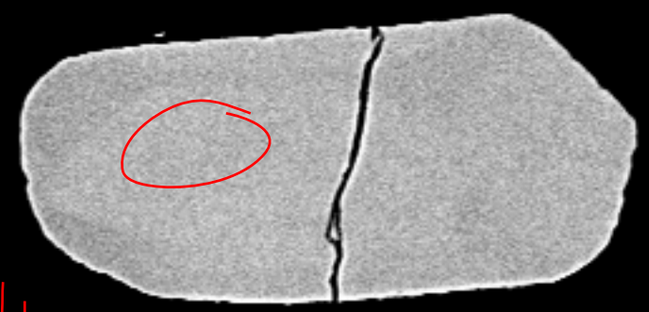


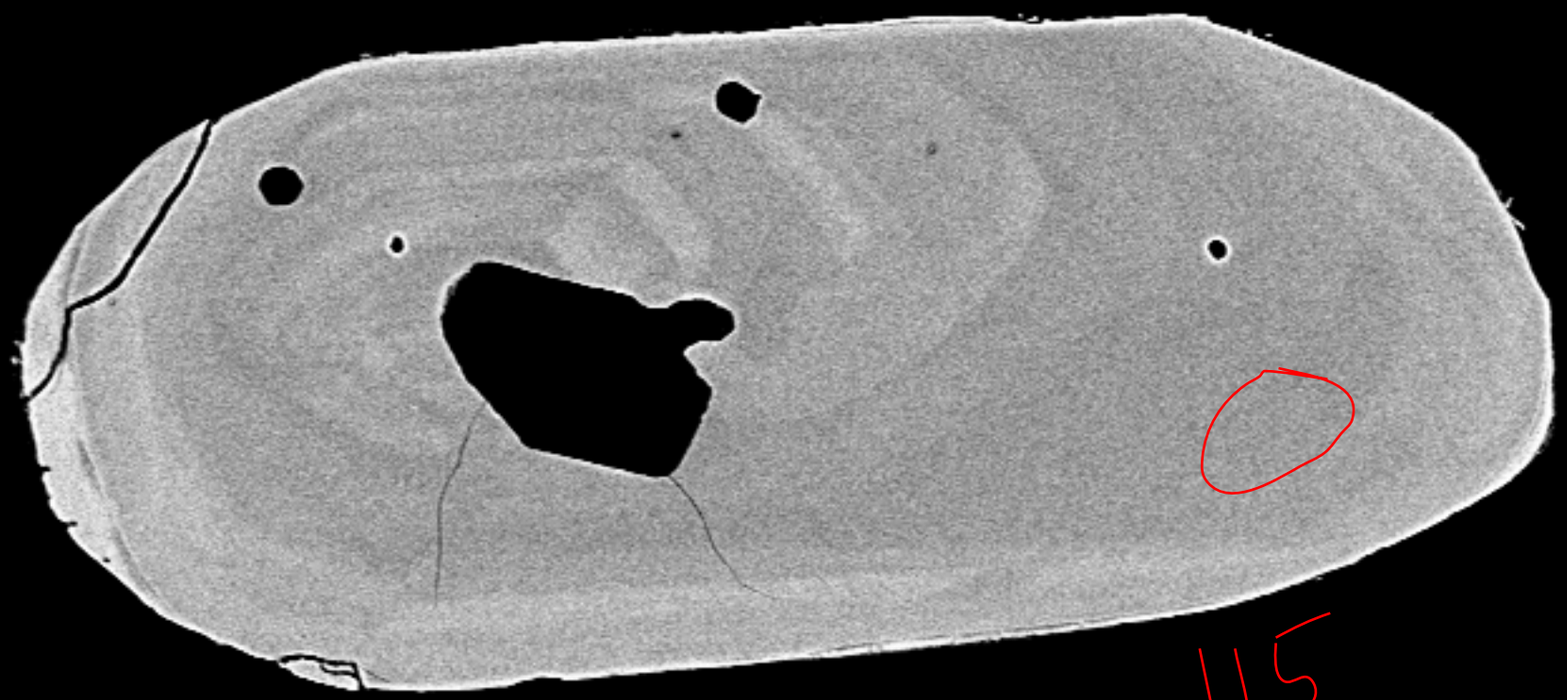




File Name = 10574-29.tif

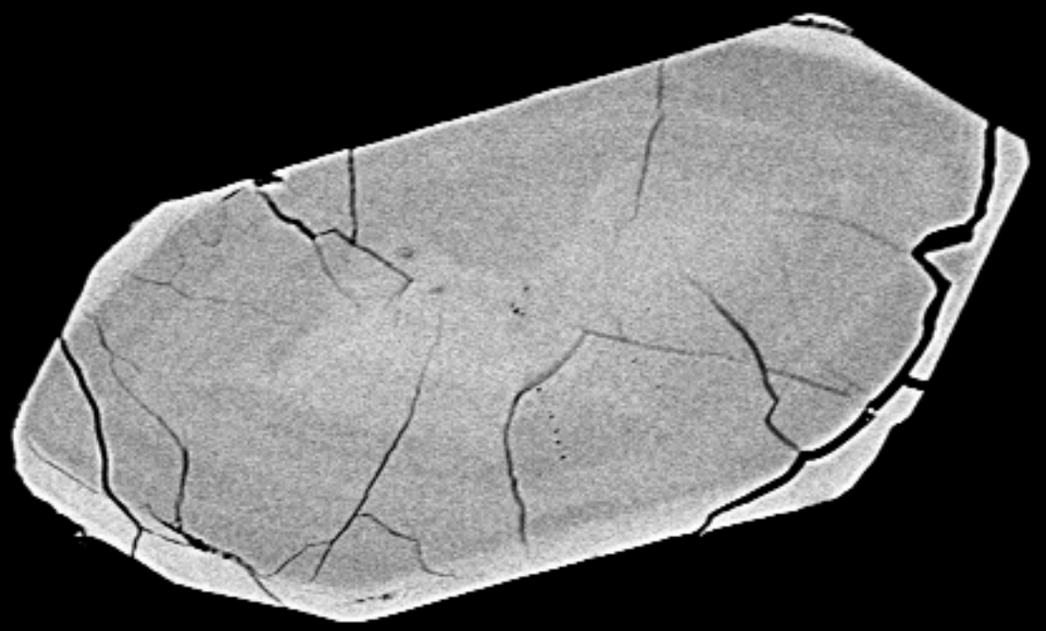




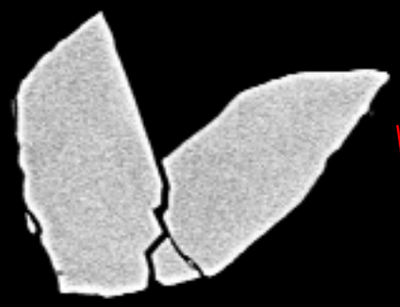


100 µm

File Name = 10574-30.tif



117

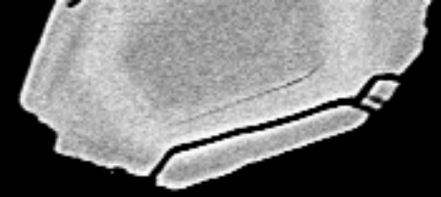


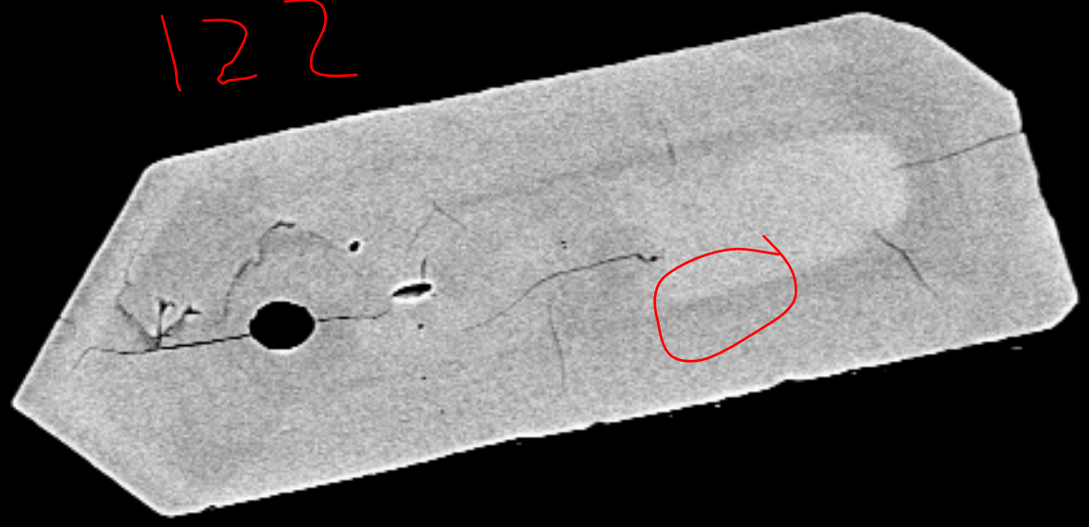
118

119

100 µm

File Name = 10574-31.tif





File Name = 10574-32.tif

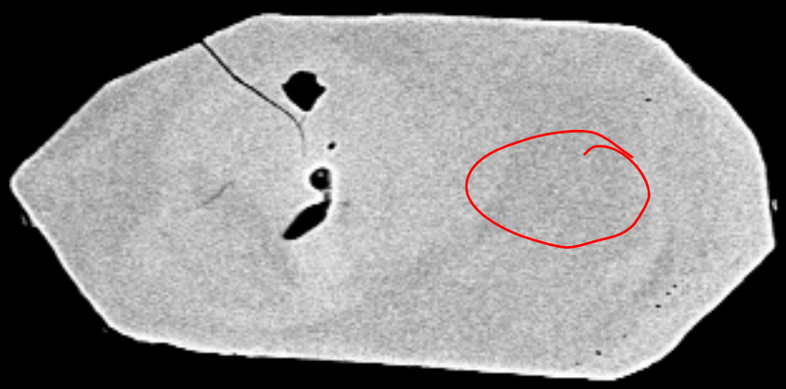
123

124

125

100 µm

File Name = 10574-33.tif



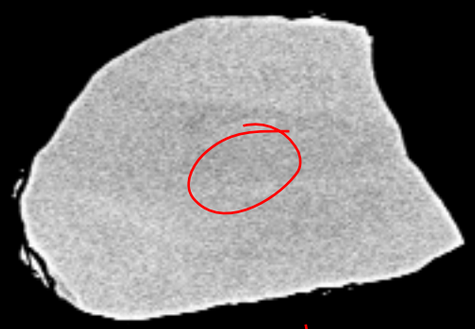
126

127

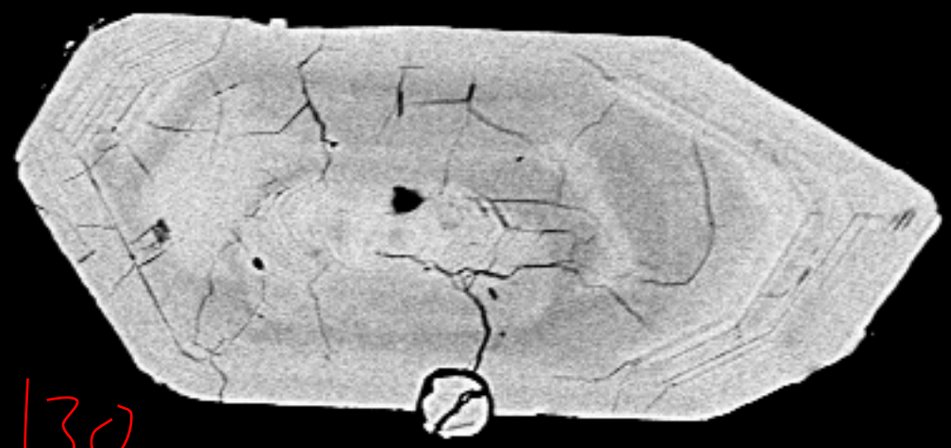
128

100 µm

File Name = 10574-34.tif

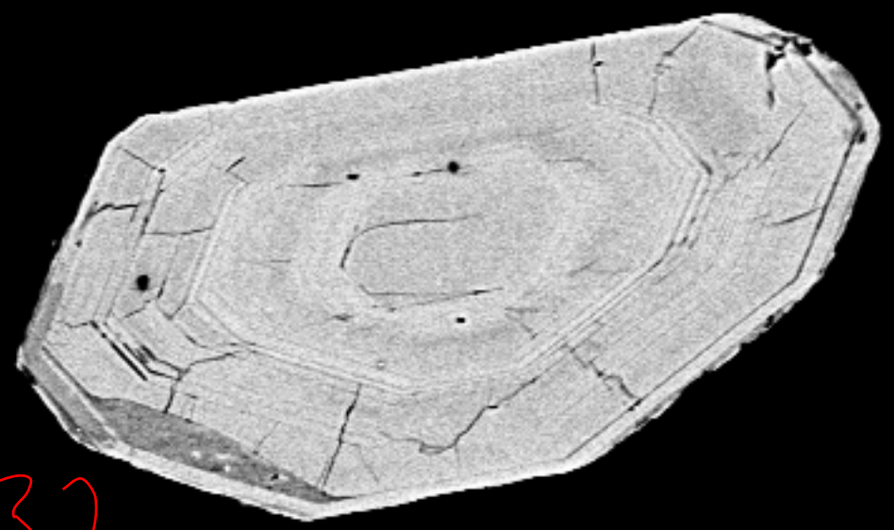


129



130

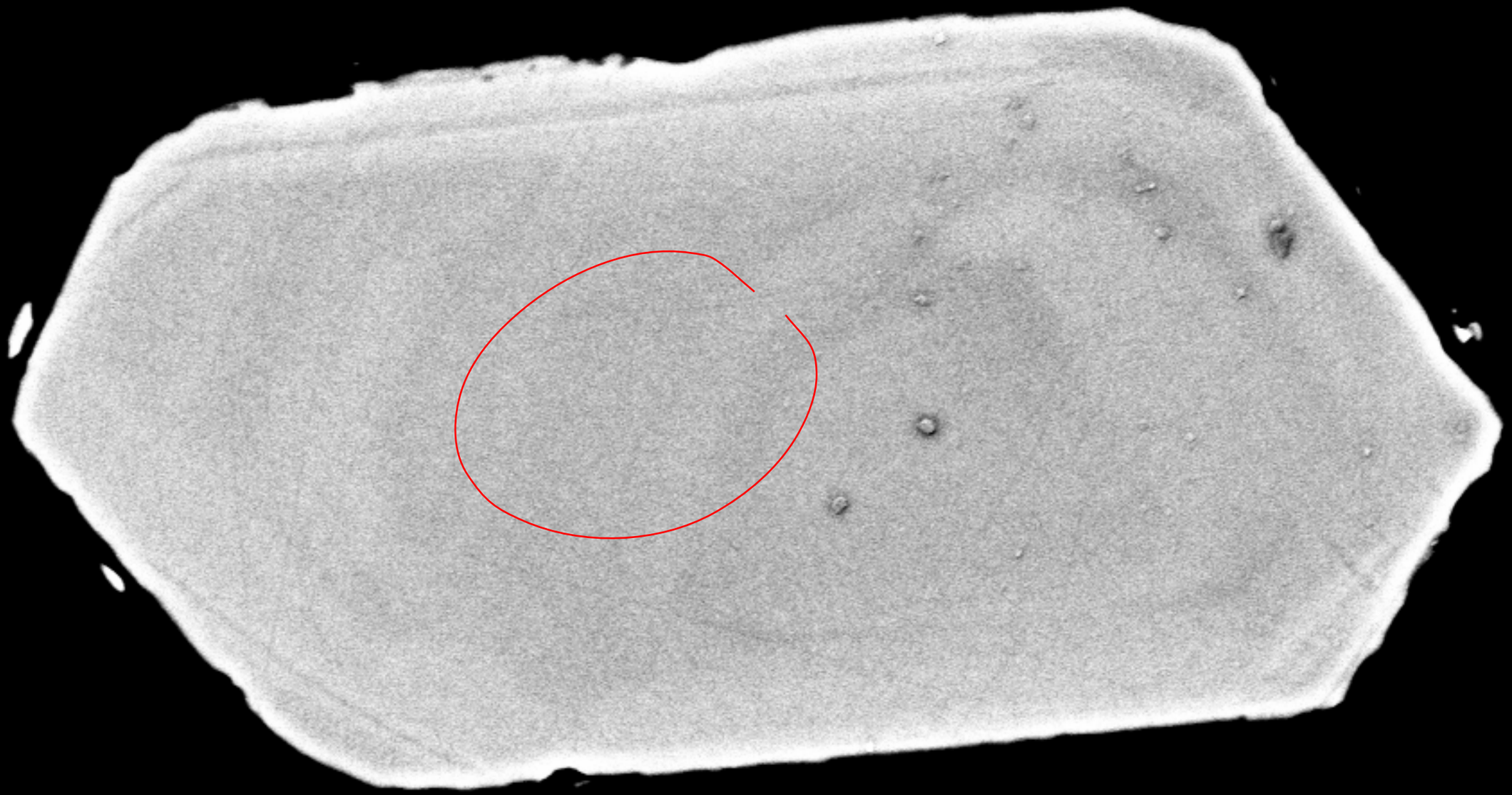
131



132

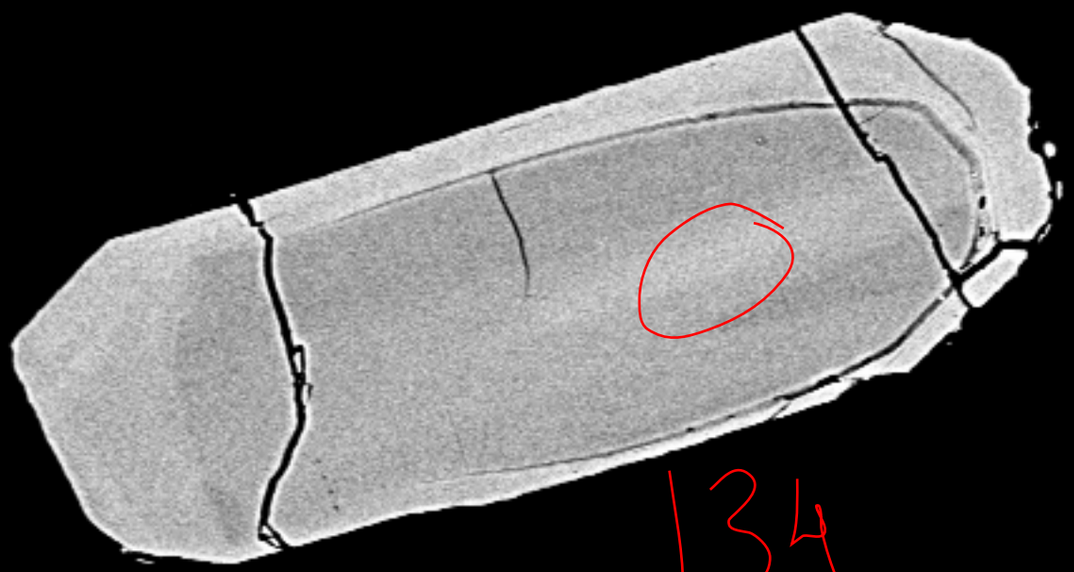
100 µm

File Name = 10574-35.tif



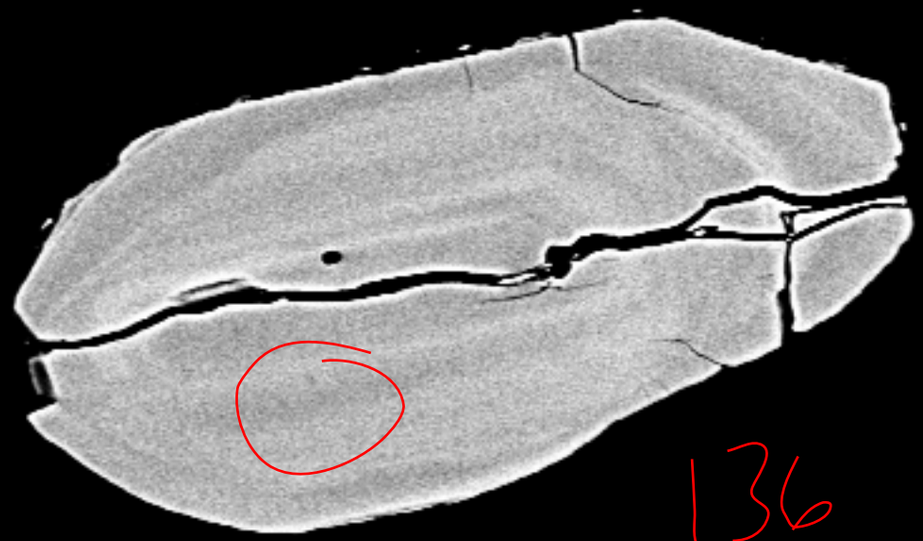
20 µm

File Name = 10574-36.tif



134

135



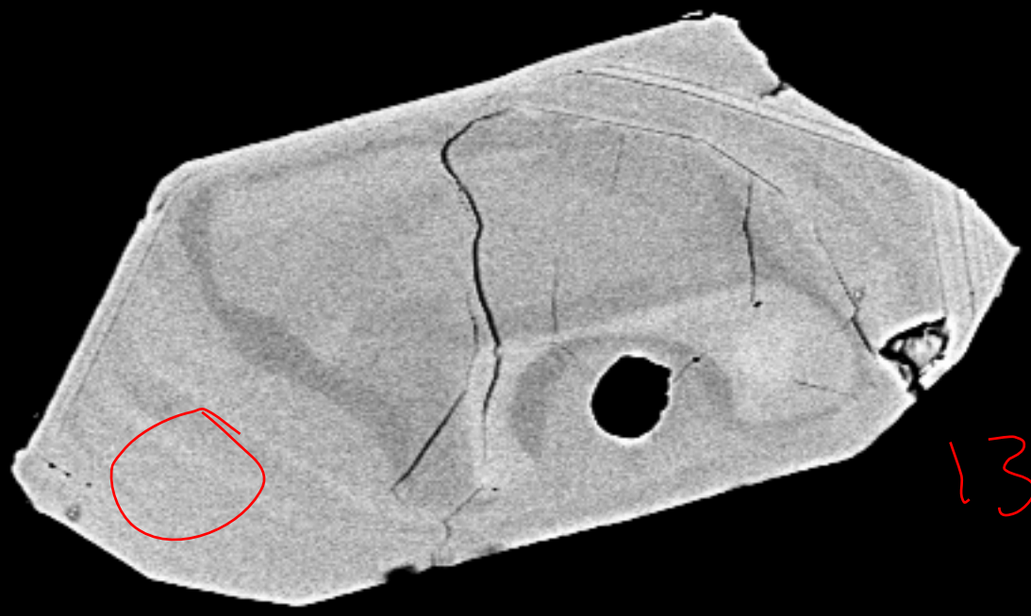
136

137

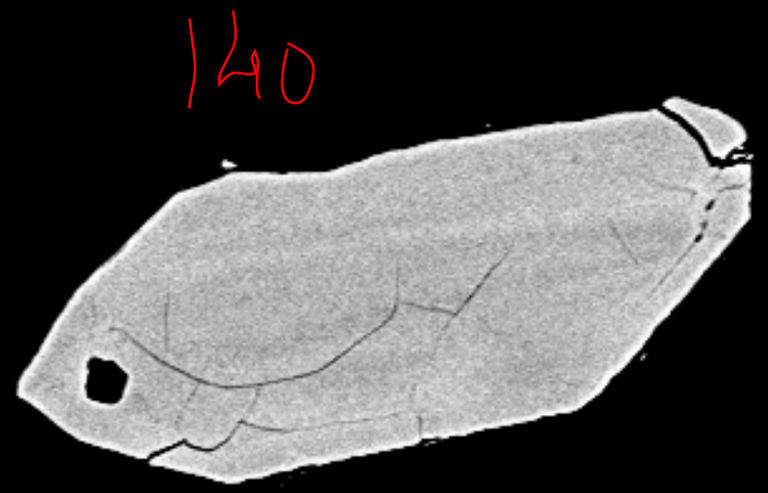
20 µm

File Name = 10574-37.tif

138



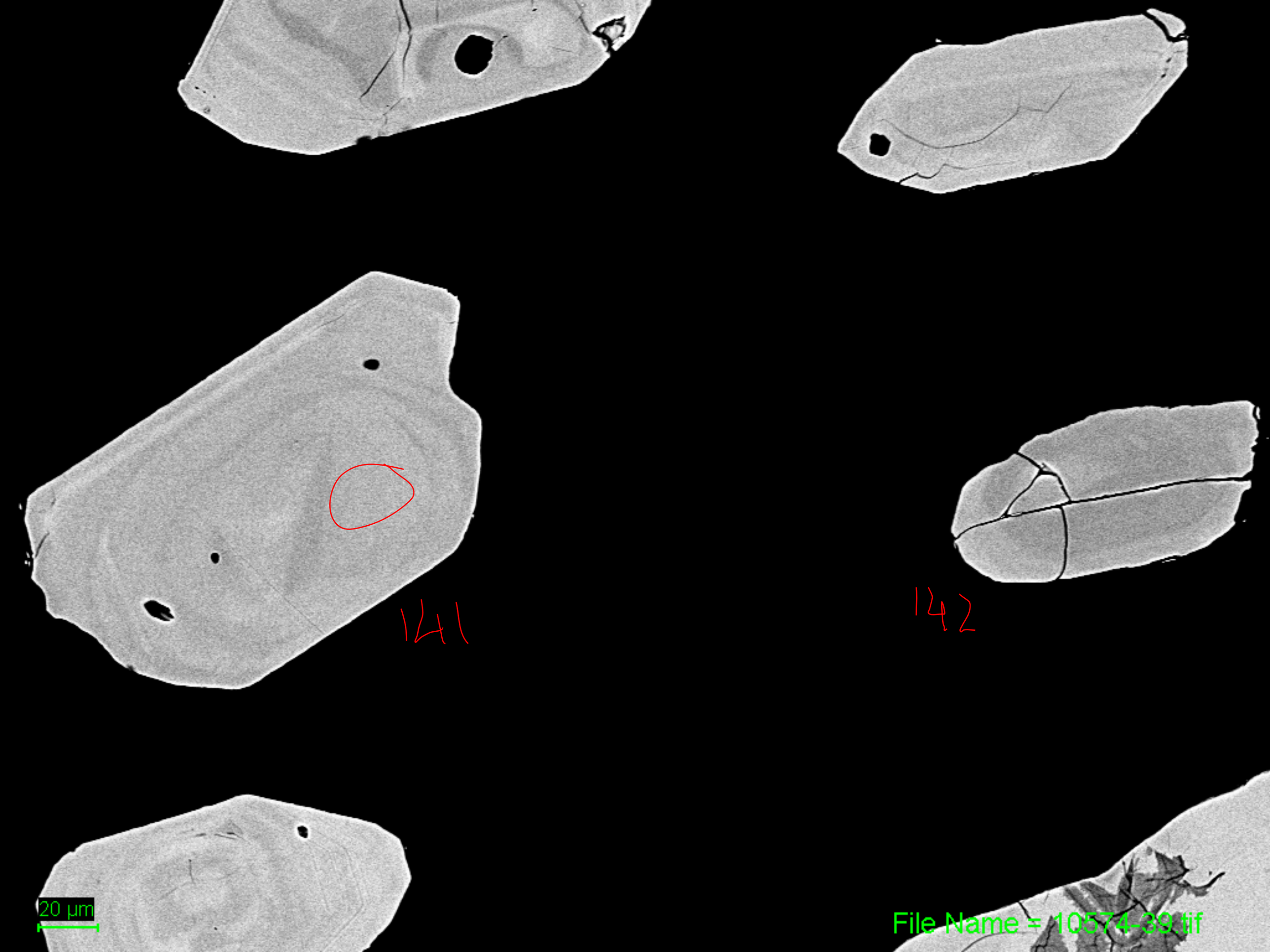
139



140

20 µm

File Name = 10574-38.tif


141
142
20 µm
File Name = 10574-39.tif

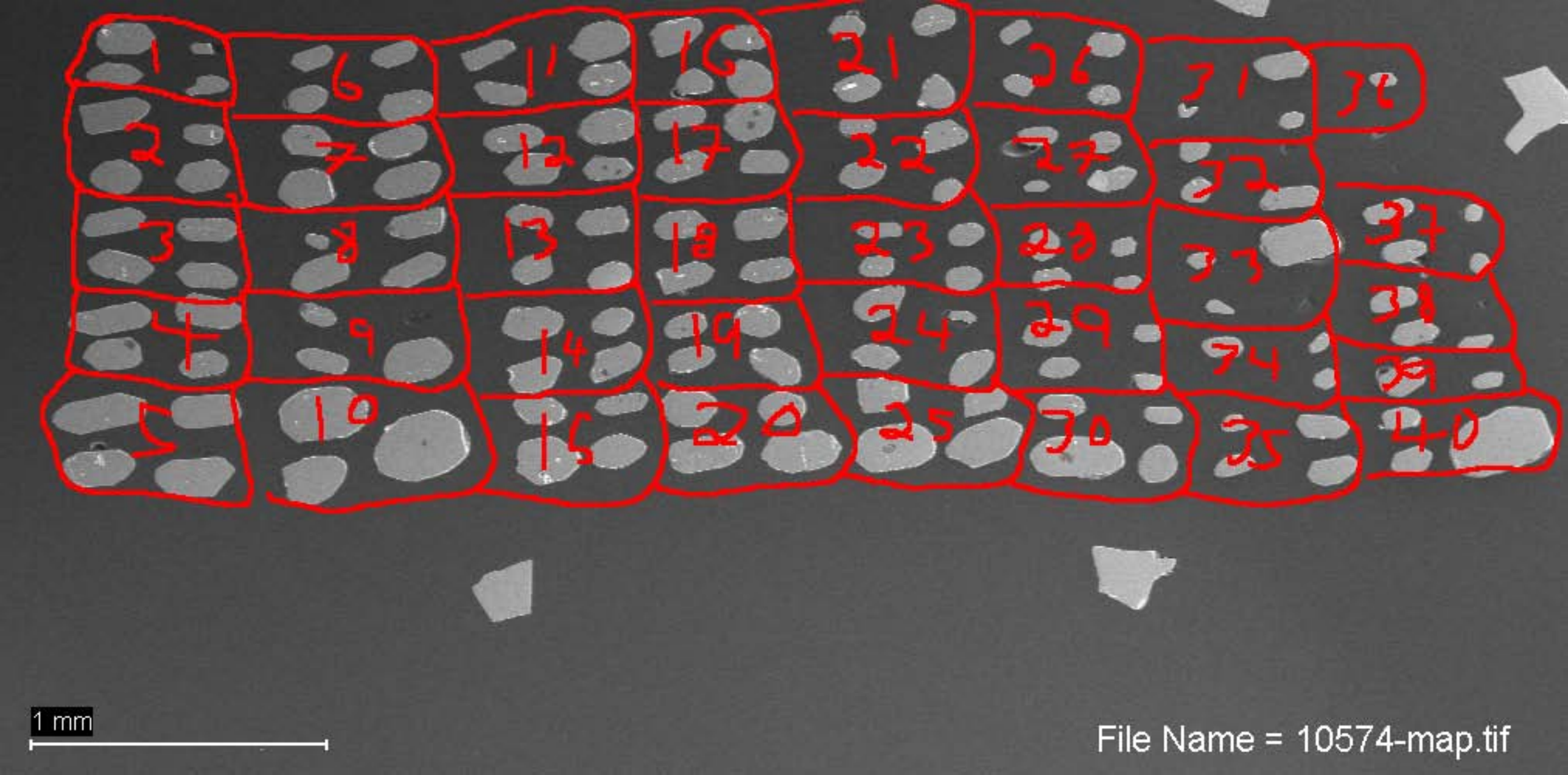
143

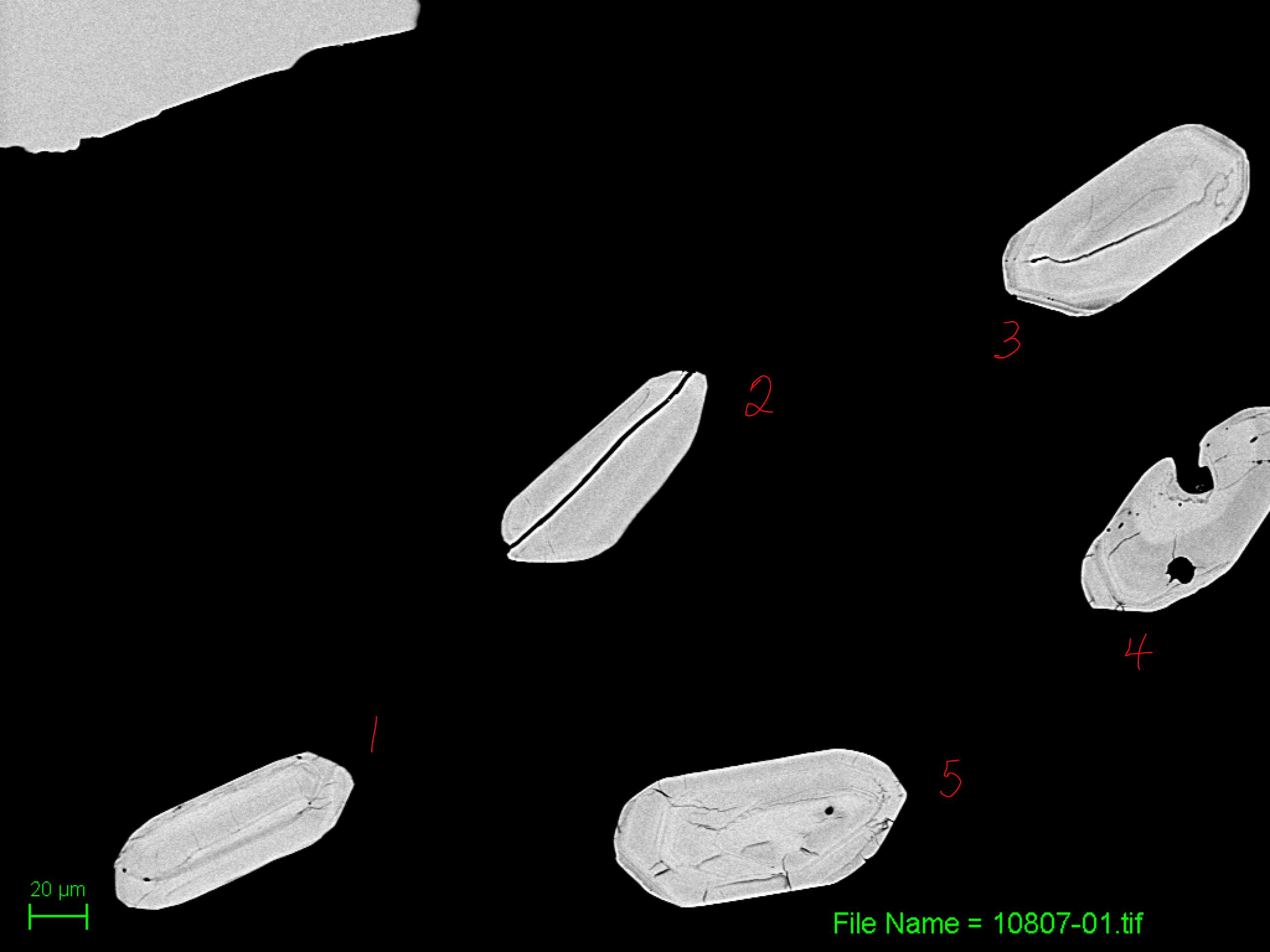
145

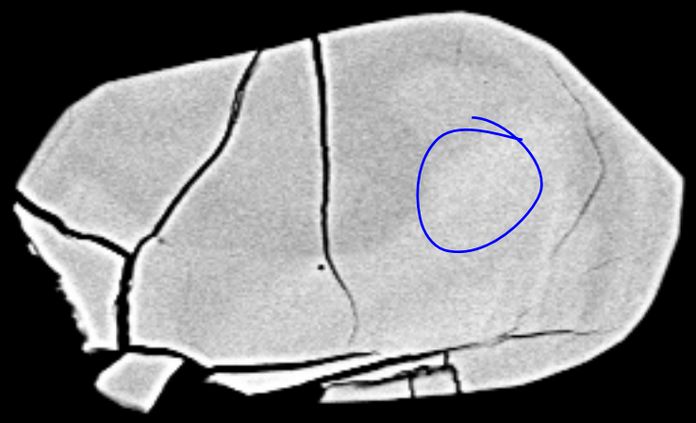
144

100 µm

File Name = 10574-40.tif


1
6
11
16
21
26
31
36
2
7
12
17
22
27
32
37
3
8
13
18
23
28
33
38
4
9
14
19
24
29
34
39
5
10
15
20
25
30
35
40
1 mm
File Name = 10574-map.tif

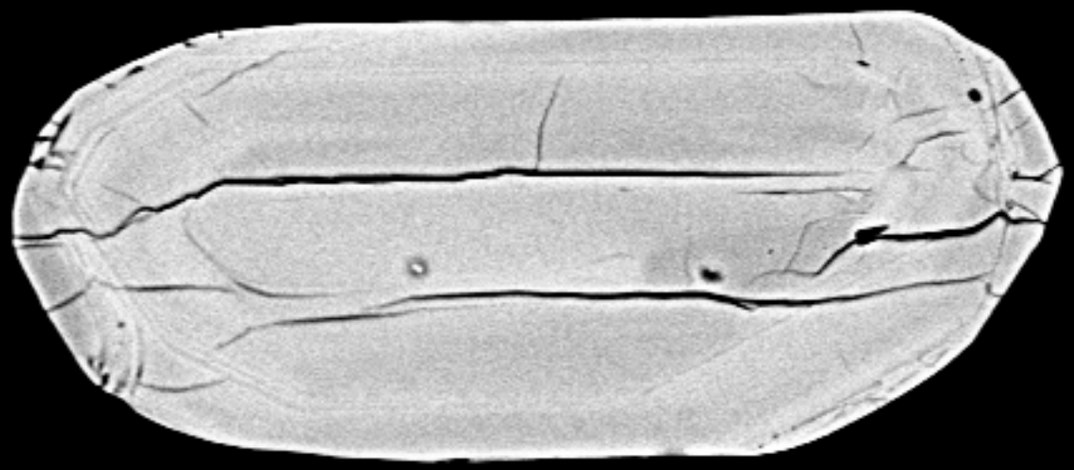

3
2
4
1
5
20 µm
File Name = 10807-01.tif



9

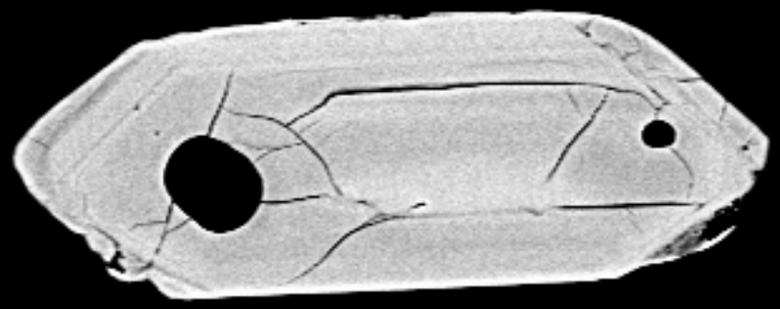
11

10

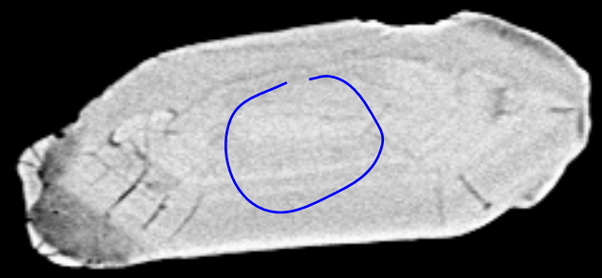


30 µm

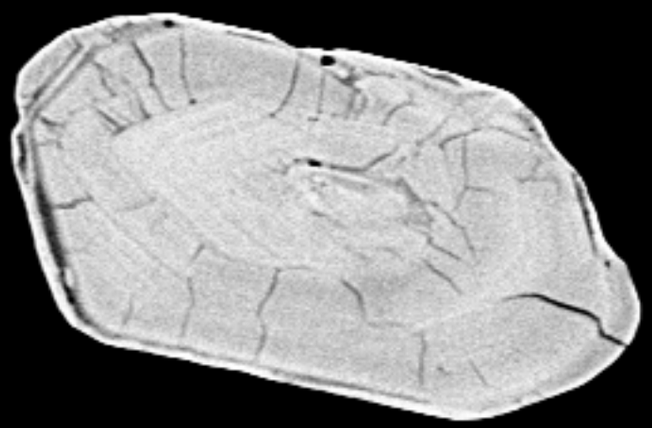
File Name = 10807-03.tif



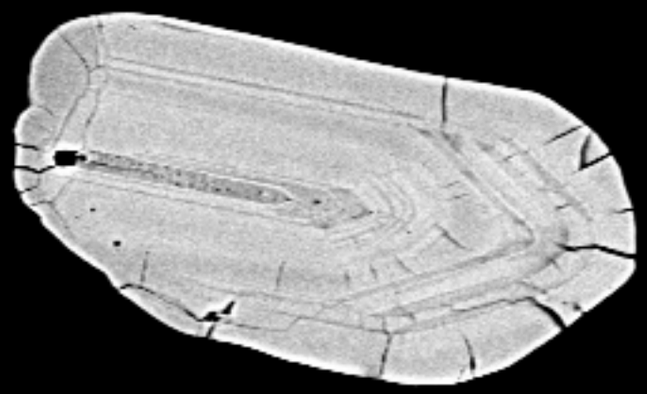
12



13



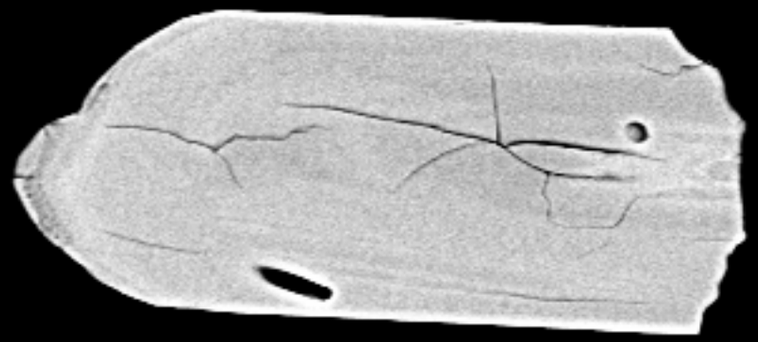
15



14

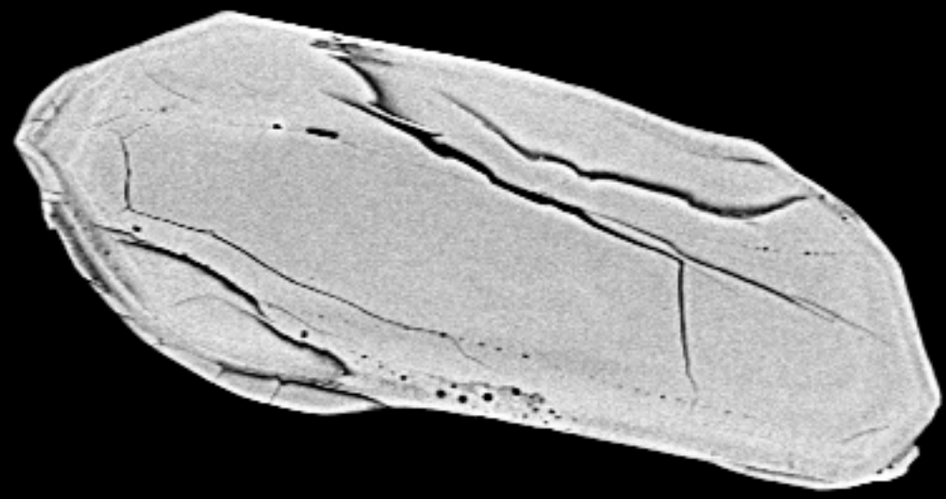
20 µm

File Name = 10807-04.tif



6

7



8

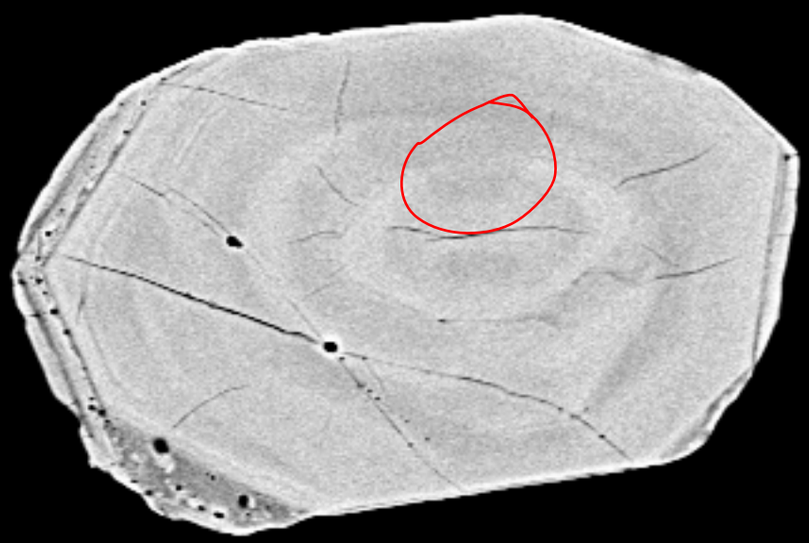
20 µm

File Name = 10807-02.tif

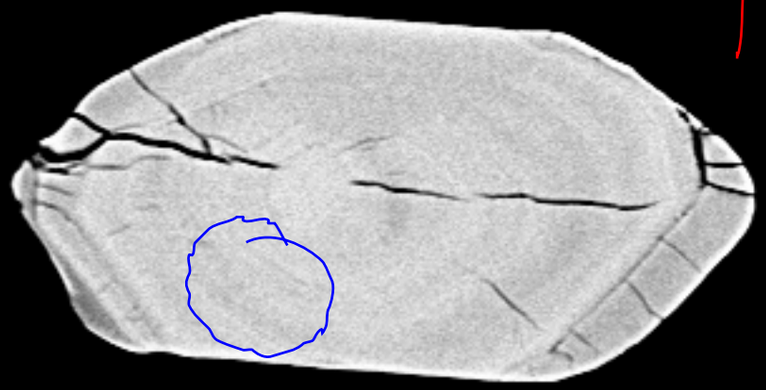
16

17

18



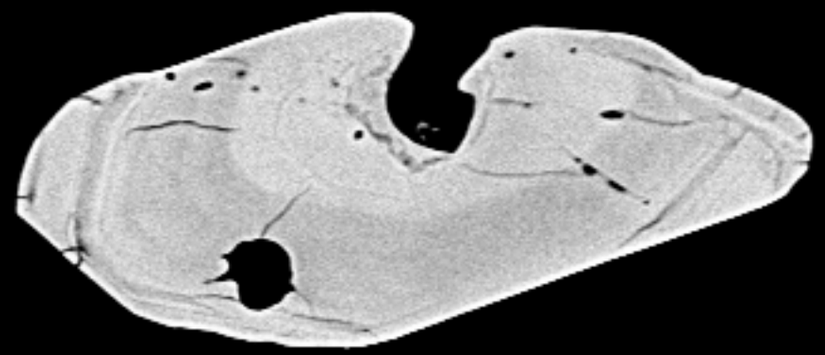
19



30 µm

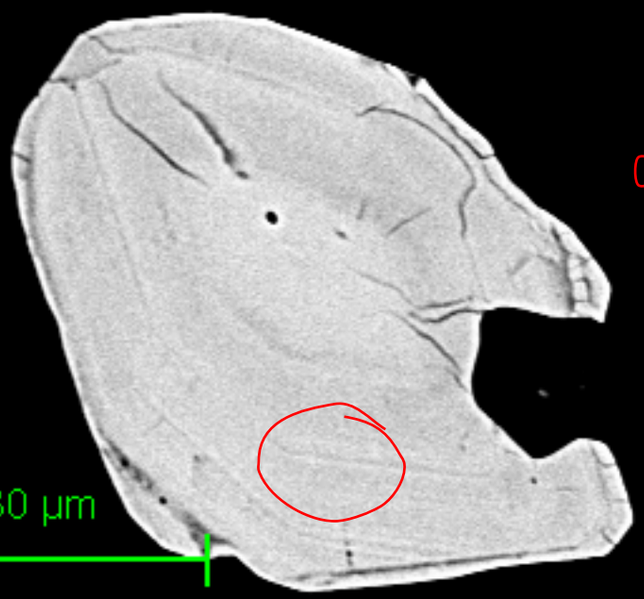
File Name = 10807-05.tif

20

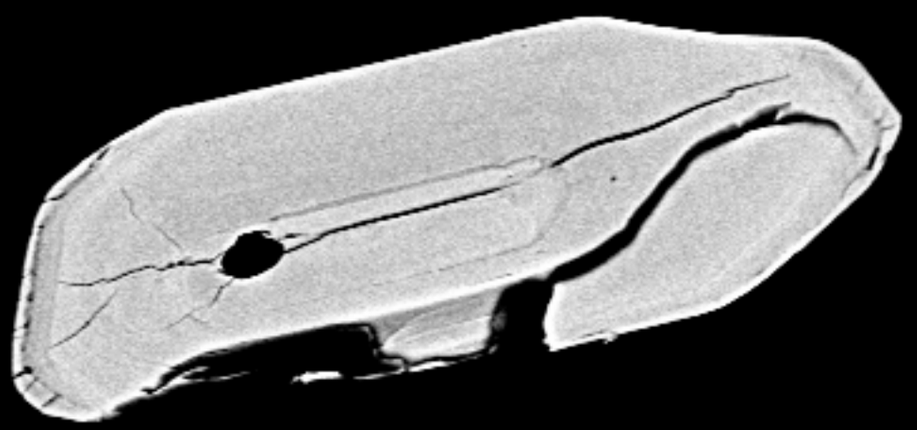


21

22



23

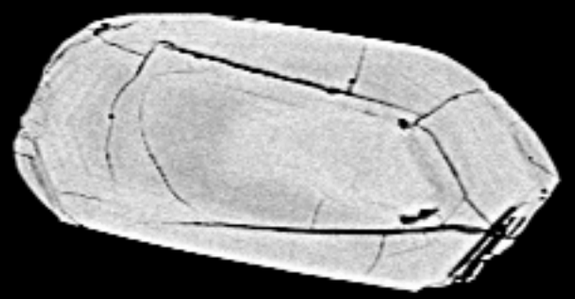


File Name = 10807-06.tif

24

25

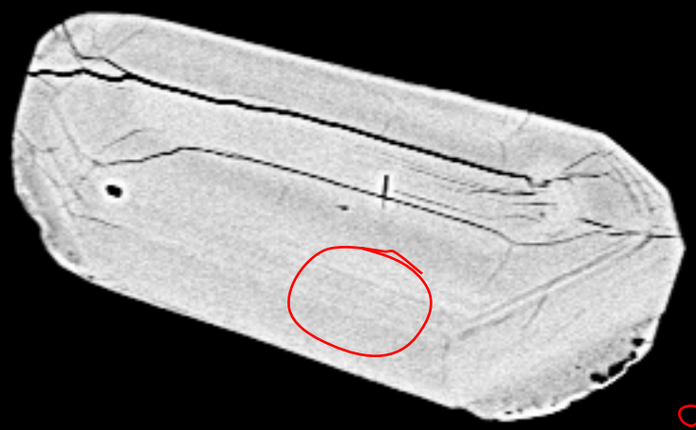
27



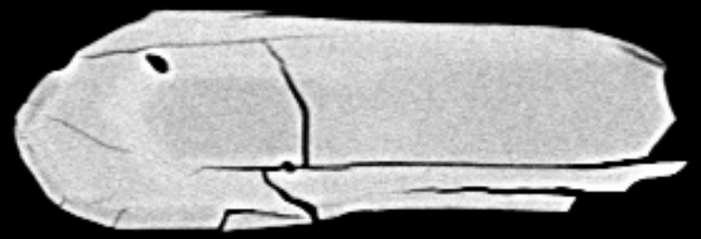
26

30 µm

File Name = 10807-07.tif



28



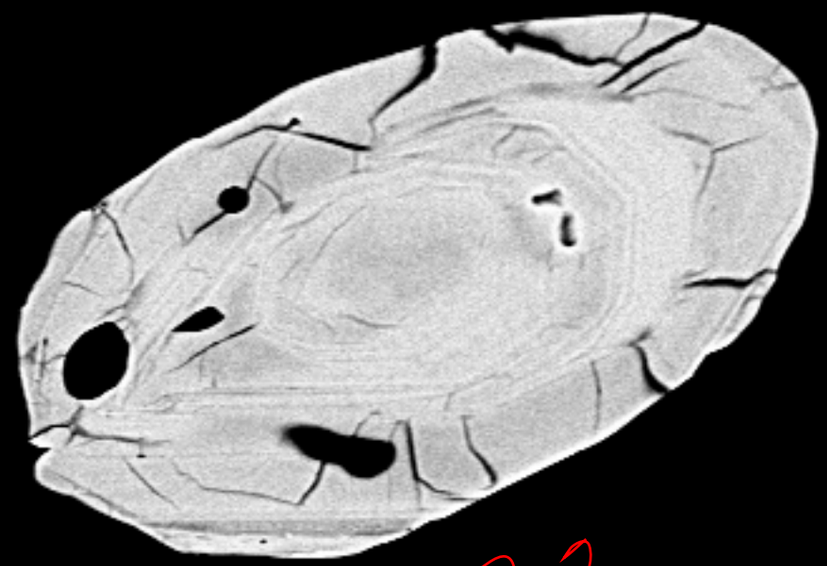
29

31

30 µm

30

File Name = 10807-08.tif



32

34

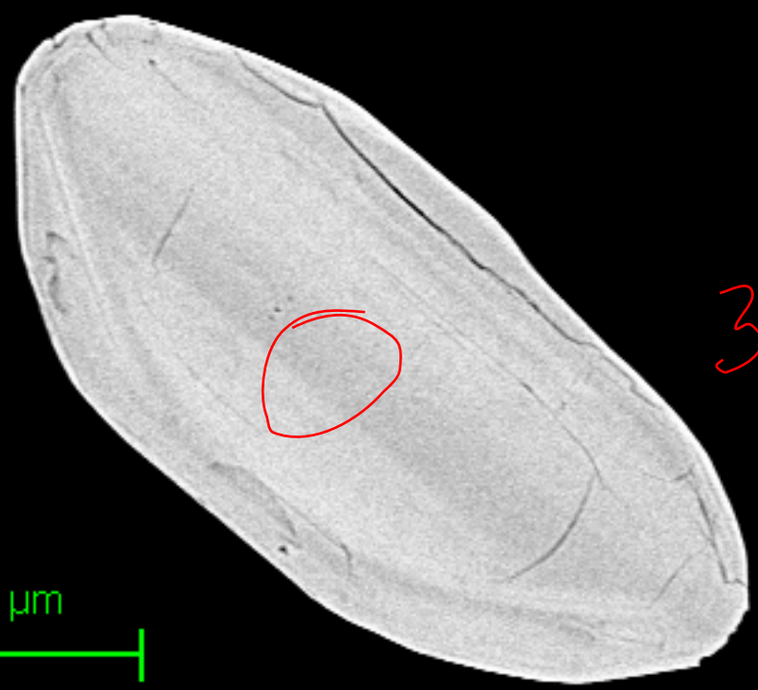
33

30 µm

File Name = 10807-09.tif

35

36

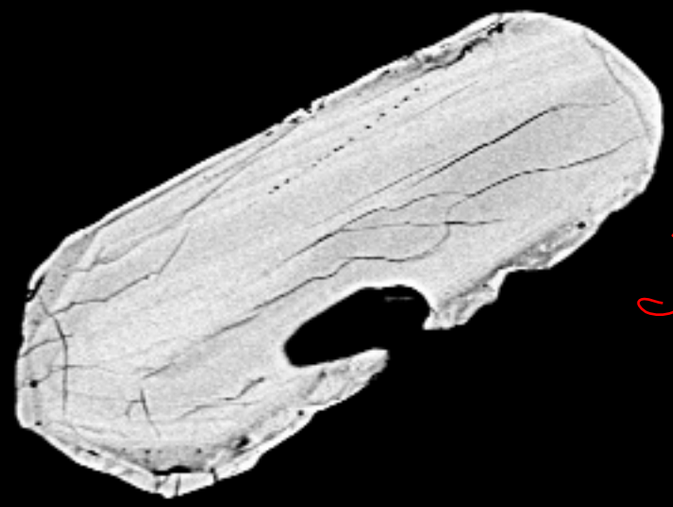


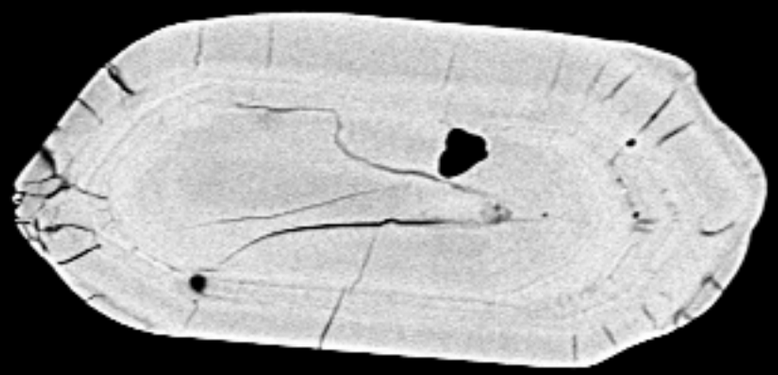
38

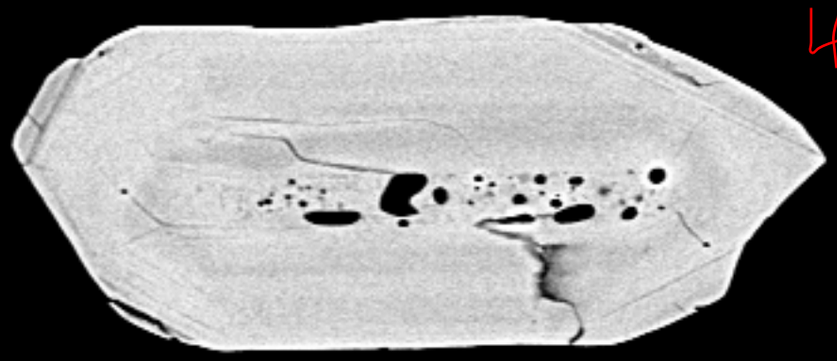
37

30 µm

File Name = 10807-10.tif

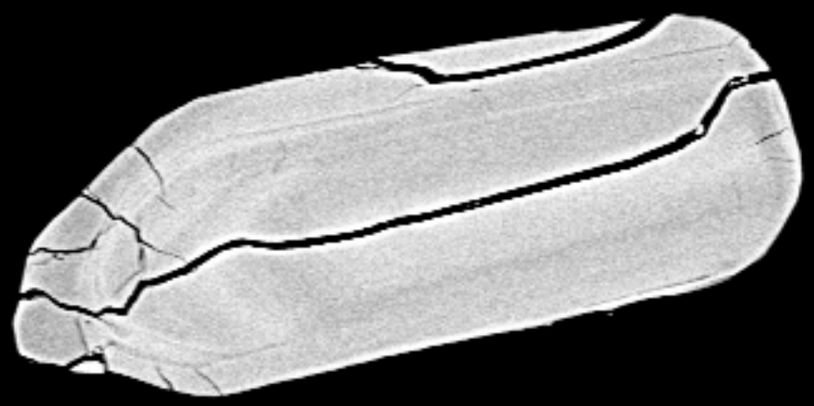


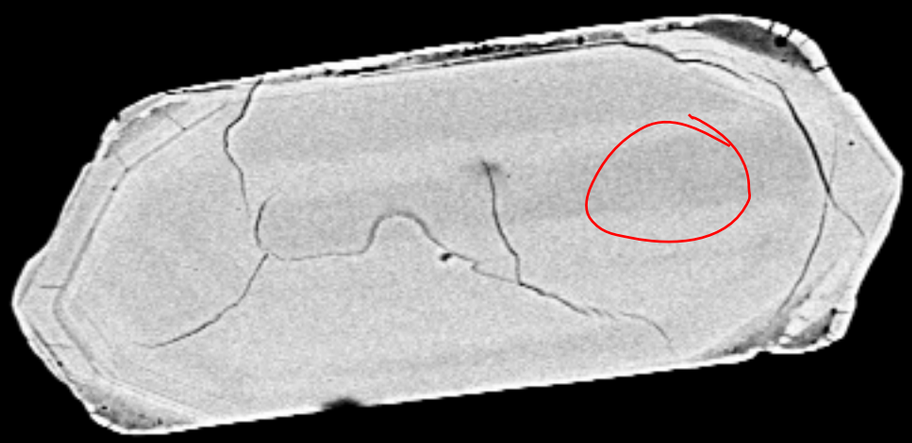




30 µm

File Name = 10807-11.tif





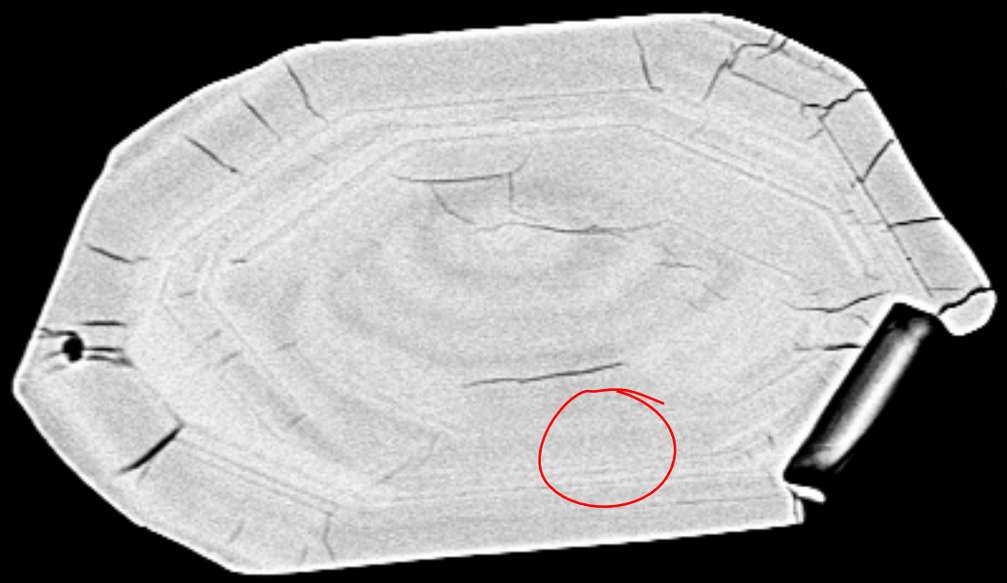
20 µm

File Name = 10807-12.tif

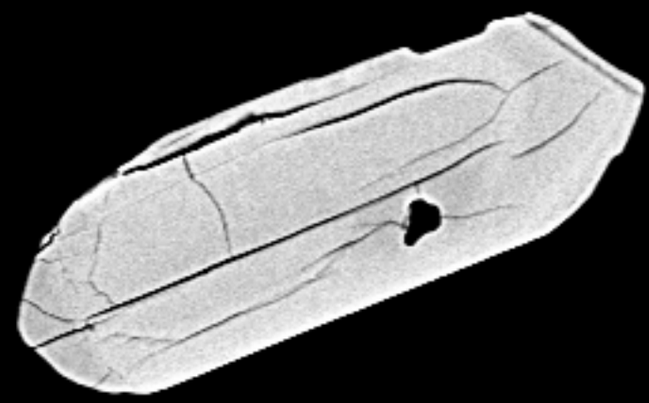
47

48

49

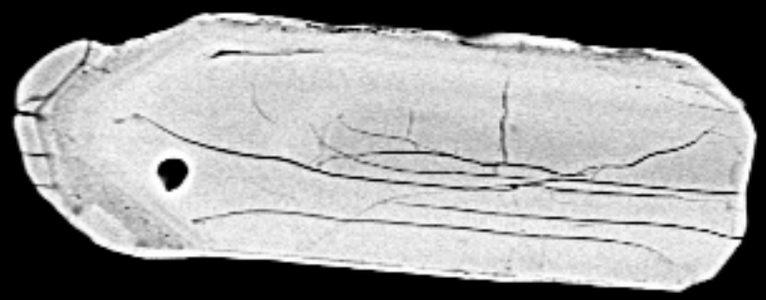


50

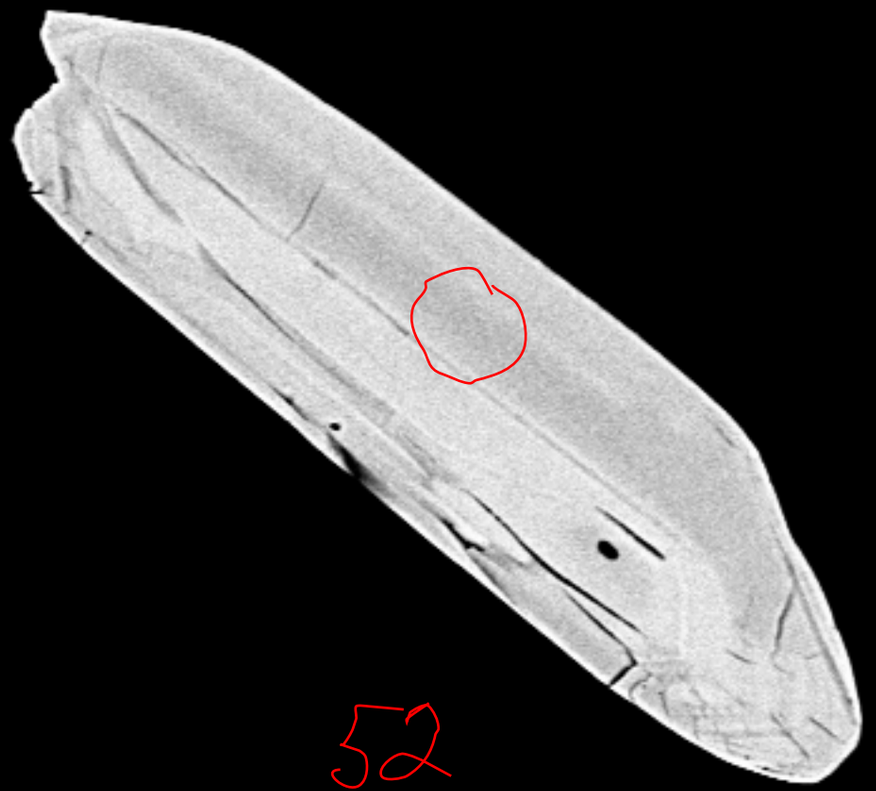


20 µm

File Name = 10807-13.tif

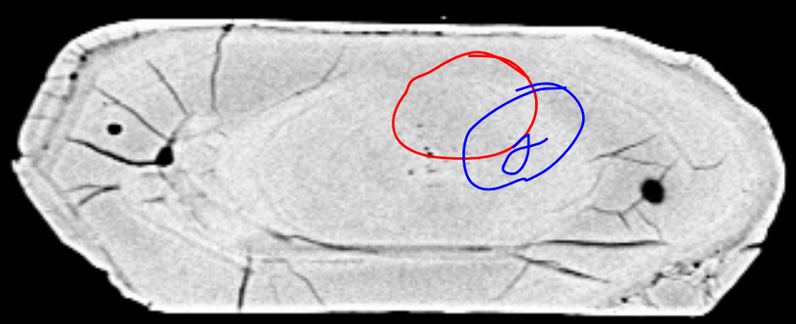


51

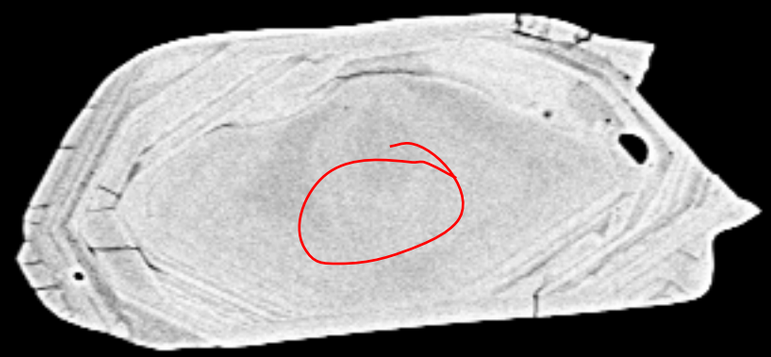


52

54



53

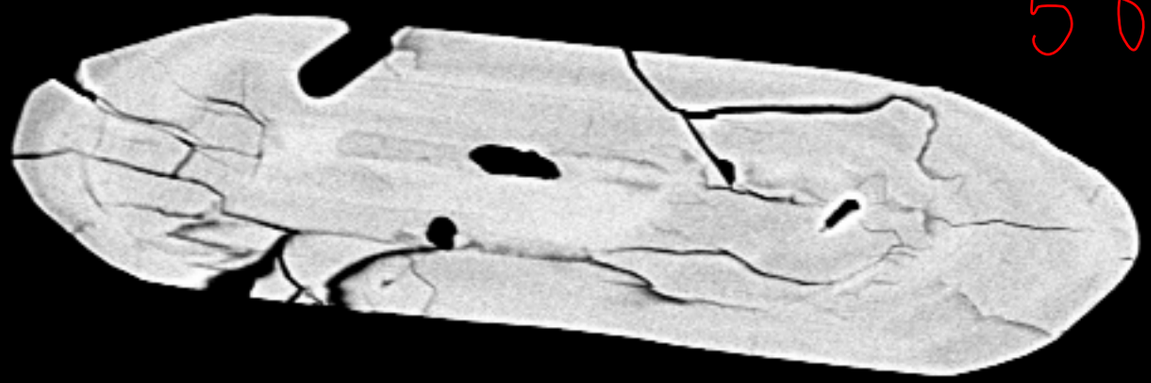


30 µm

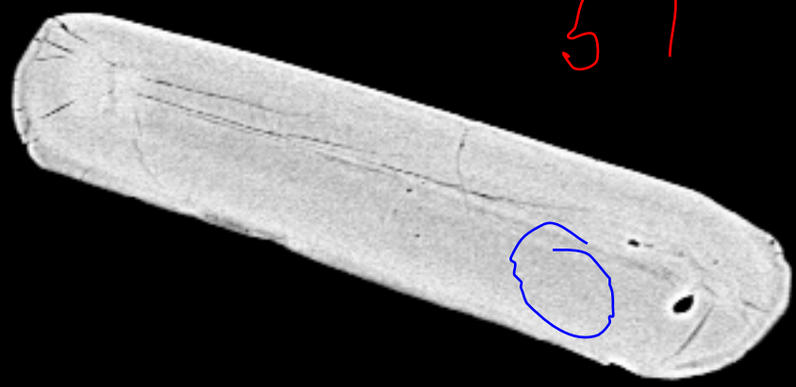
File Name = 10807-14.tif

55

56



58

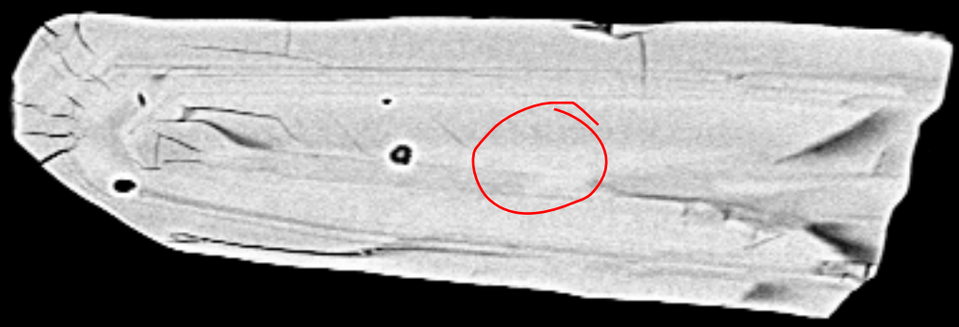


57

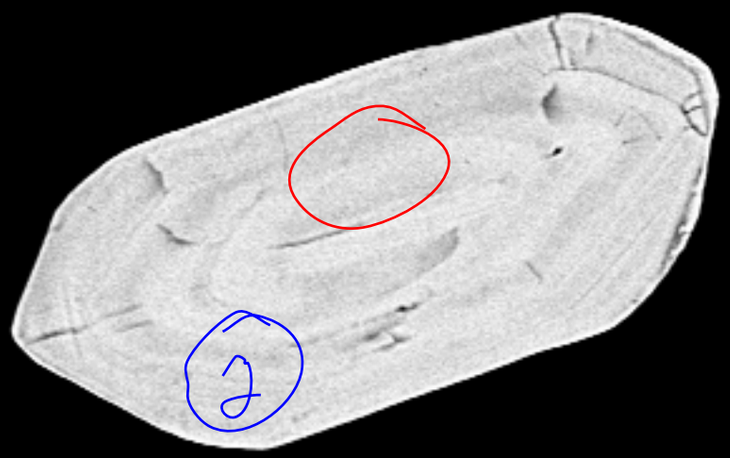
30 µm

File Name = 10807-15.tif

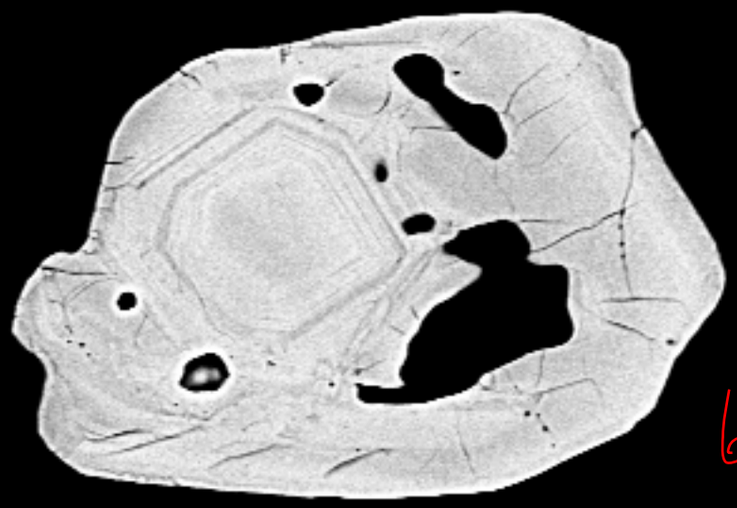
59



60



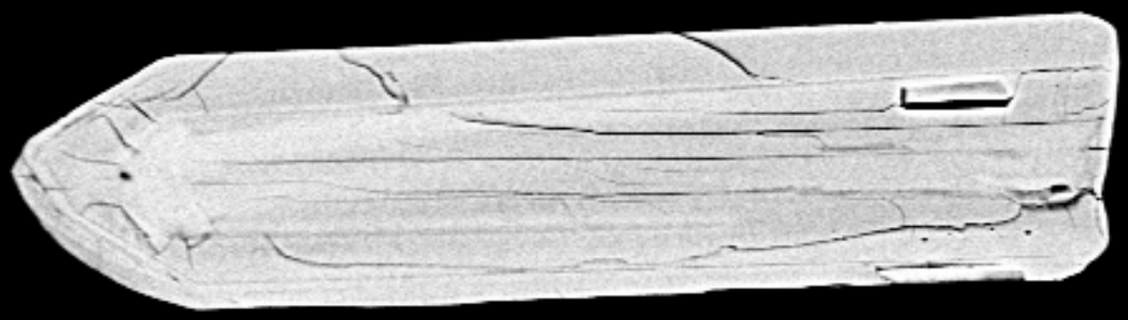
62



61

30 µm

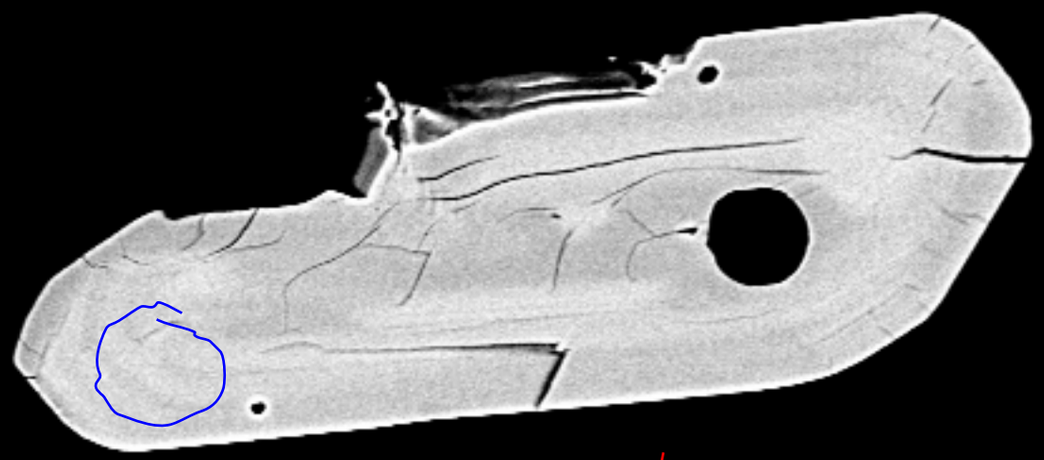
File Name = 10807-16.tif



63

64

66

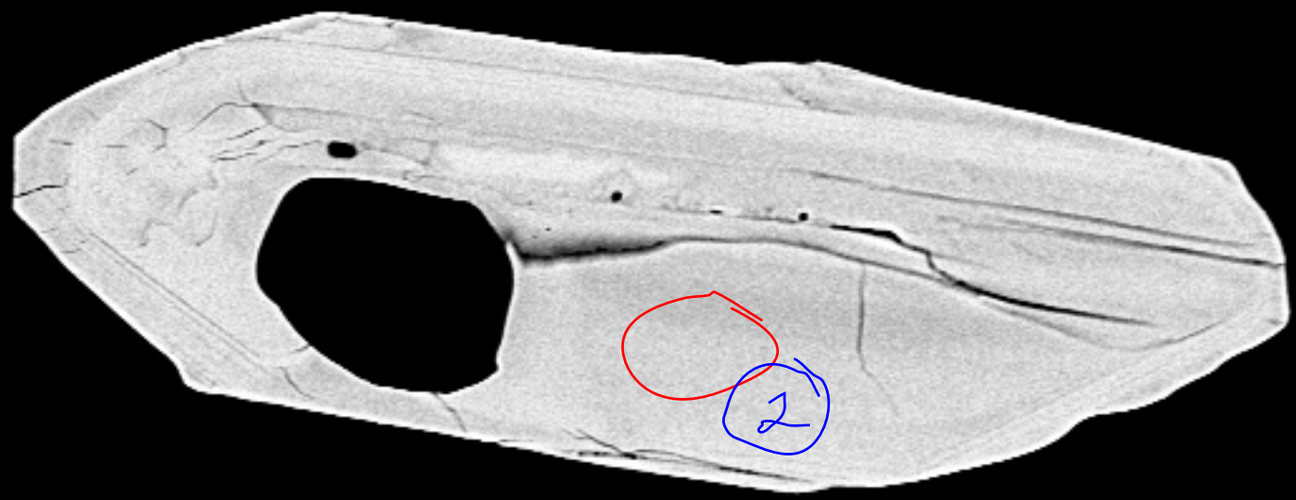


65

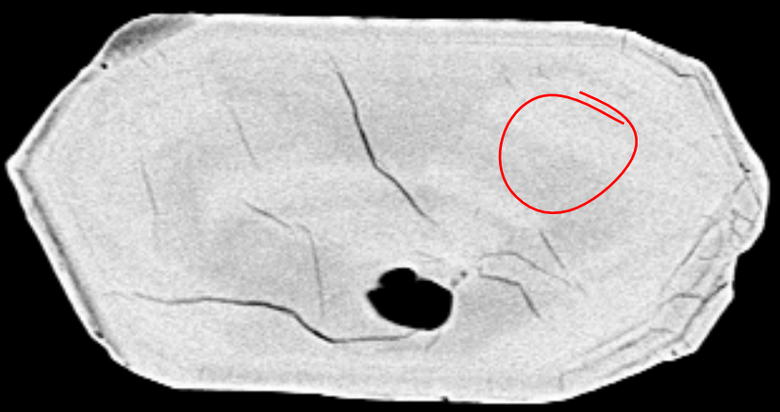
30 µm

File Name = 10807-17.tif

67



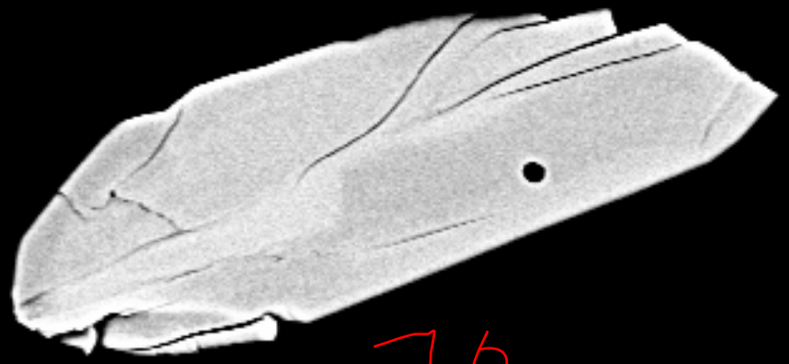
68



69

20 µm

File Name = 10807-18.tif



76

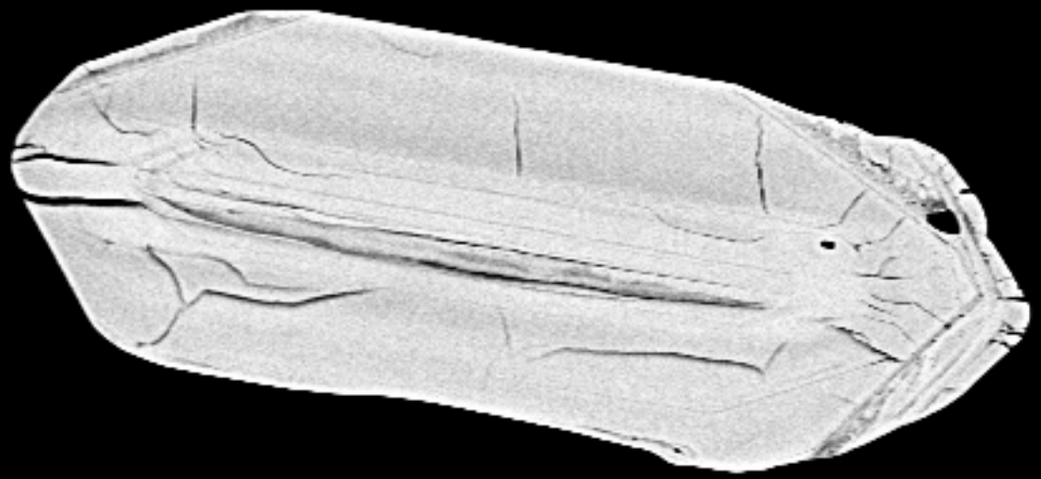
71

73

72

20 µm

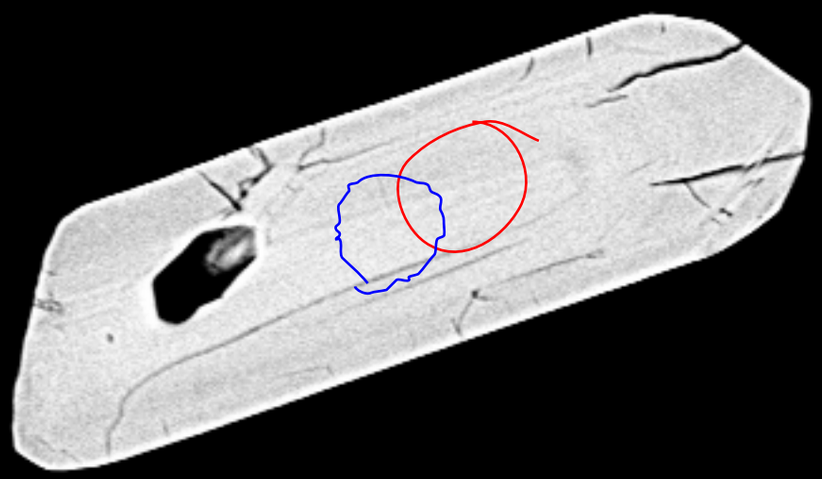
File Name = 10807-19.tif



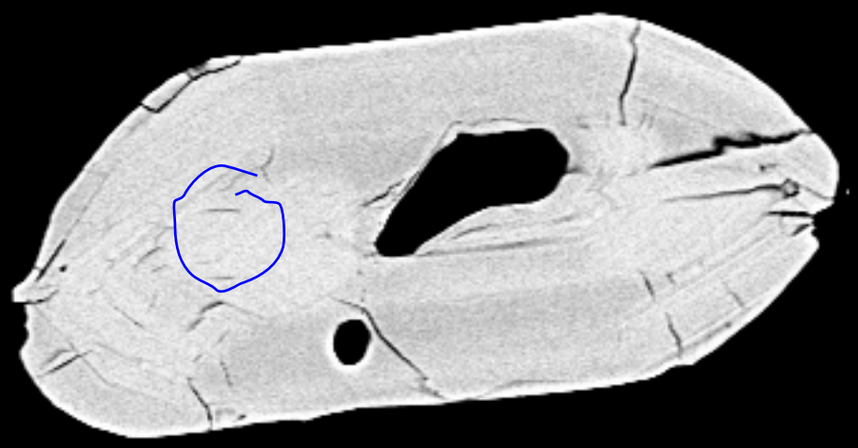
75

74

77



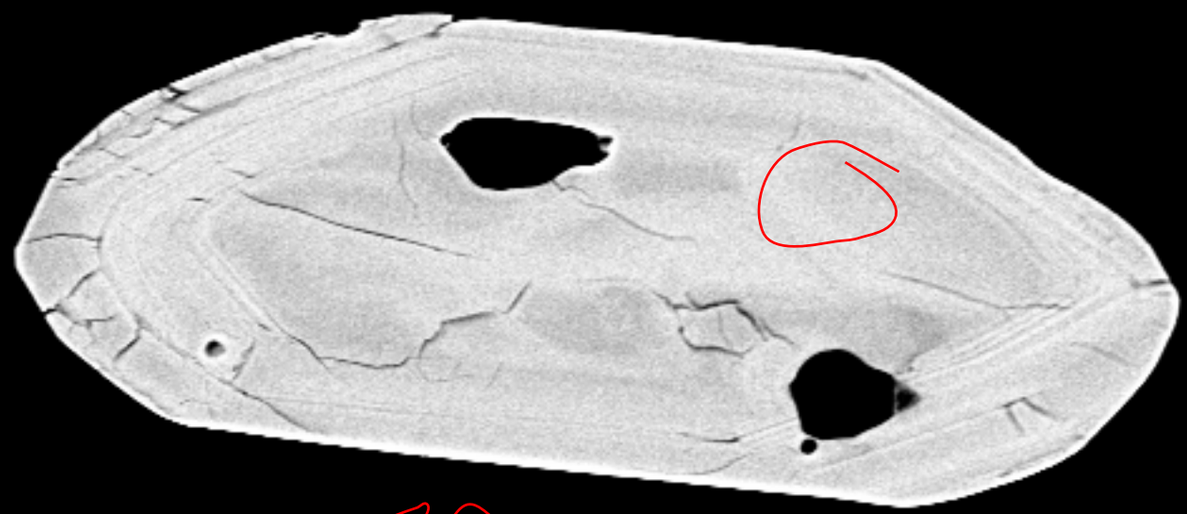
76



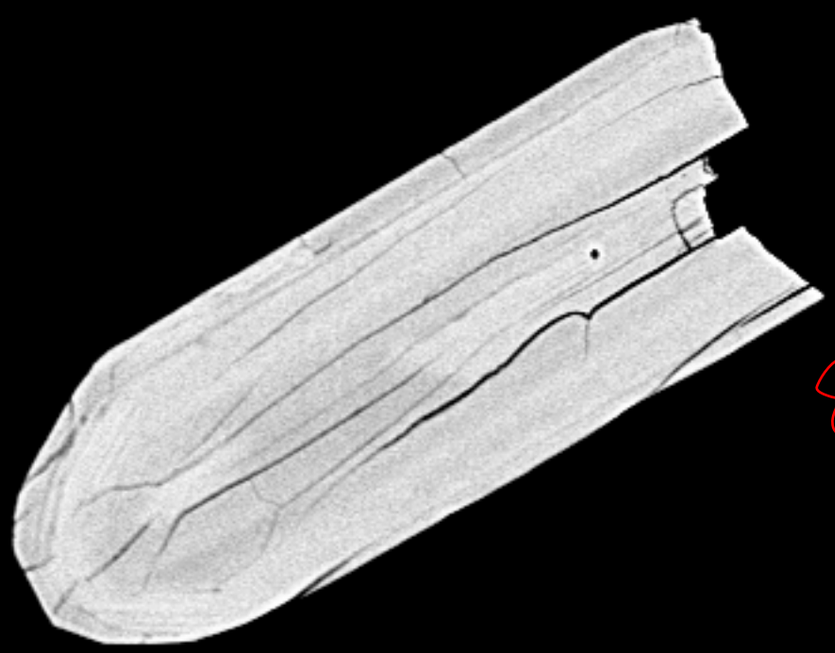
20 µm

File Name = 10807-20.tif

78



79

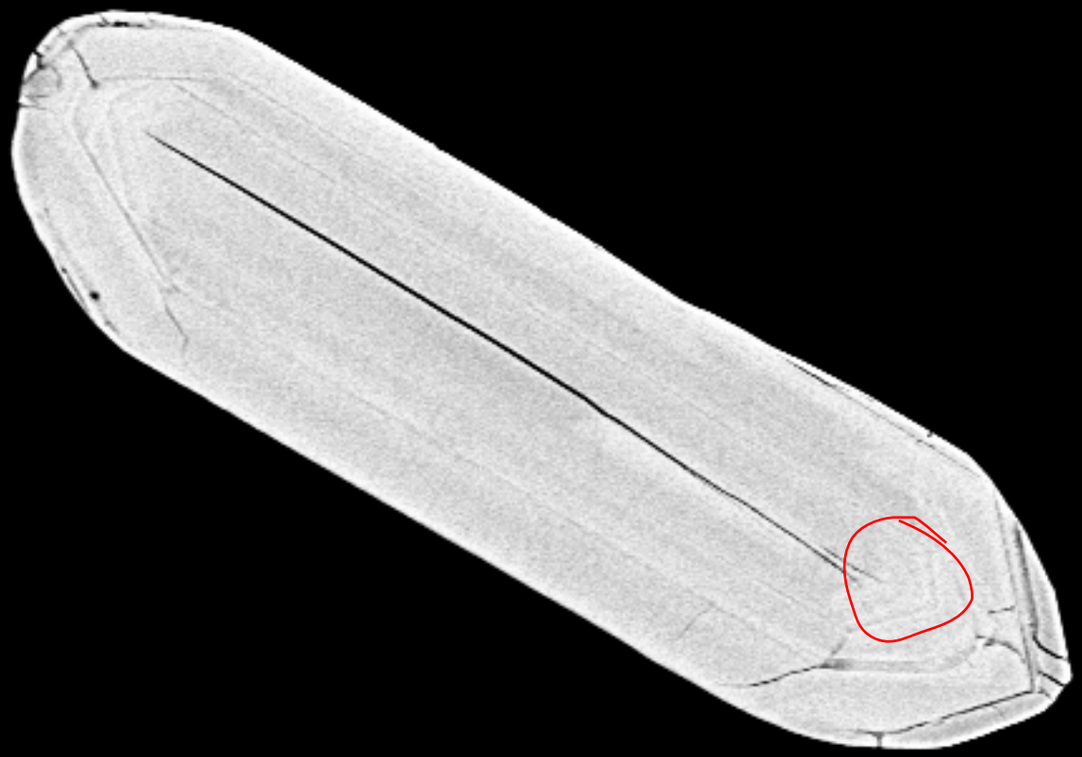


81

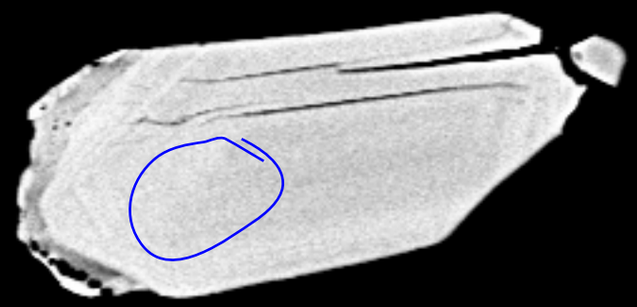
80

20 µm

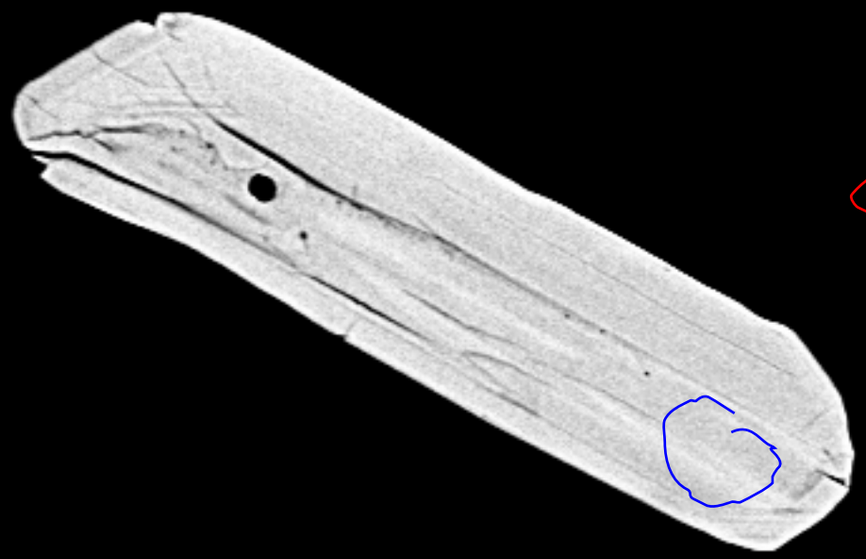
File Name = 10807-21.tif



82



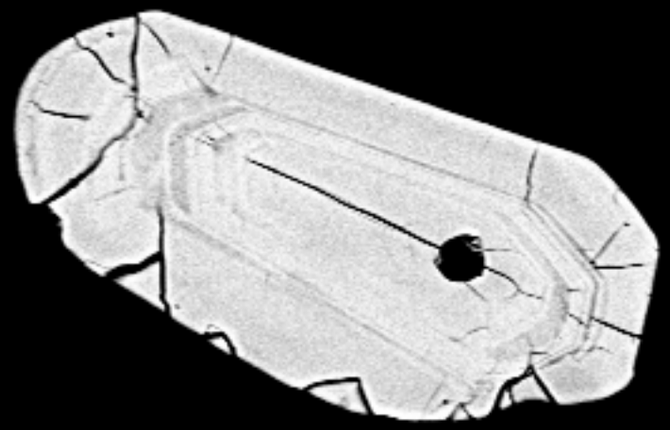
83



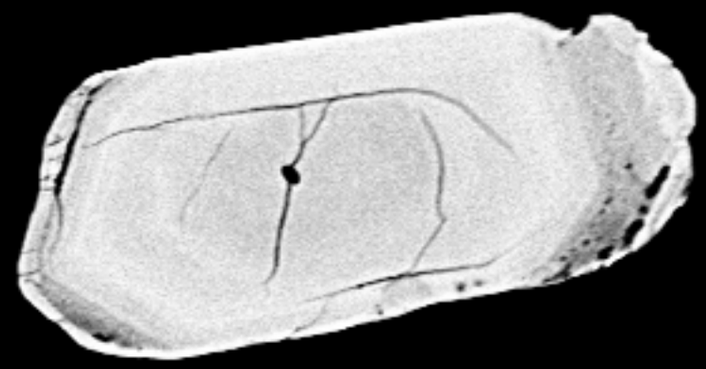
84

30 µm

File Name = 10807-22.tif

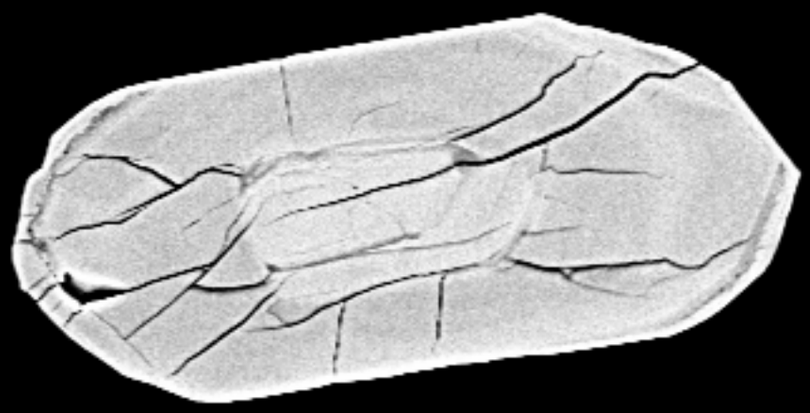


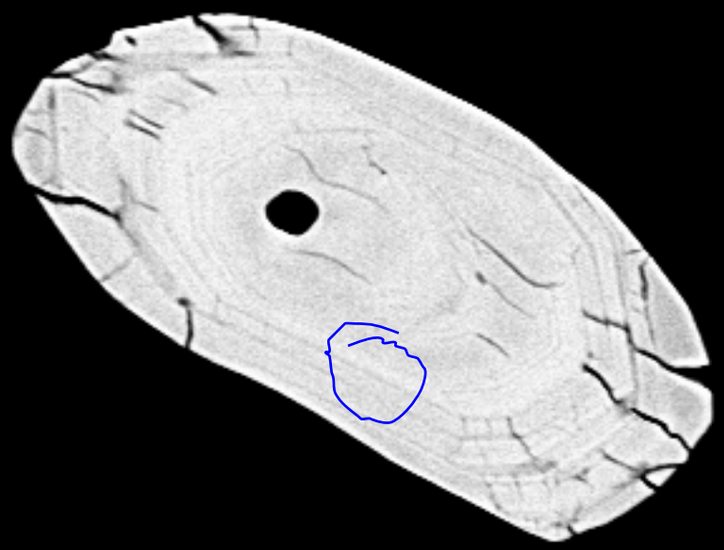
85



86

87





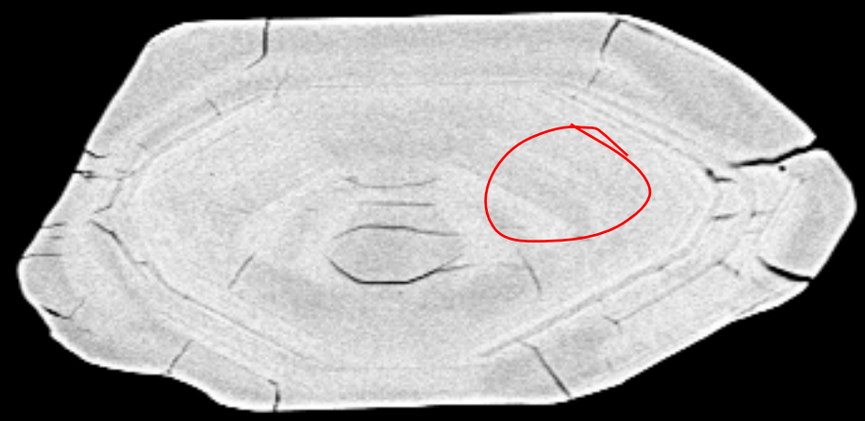
88

30 µm

File Name = 10807-23.tif

89

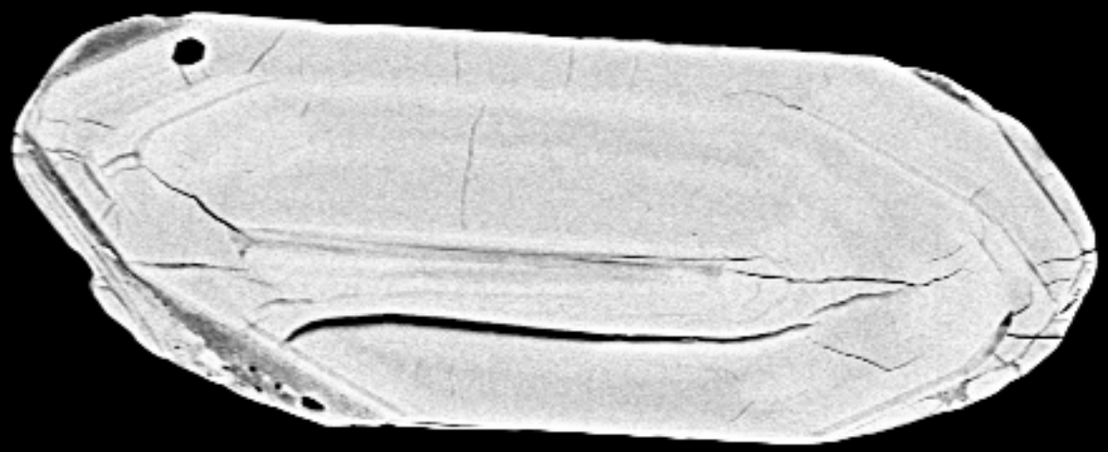
90



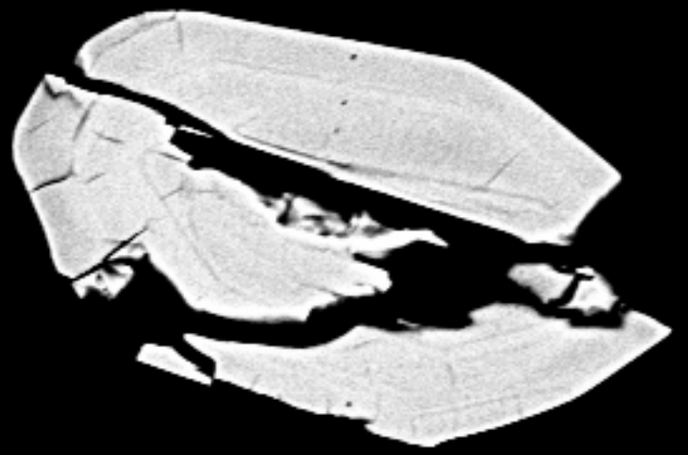
91

30 µm

File Name = 10807-24.tif



92



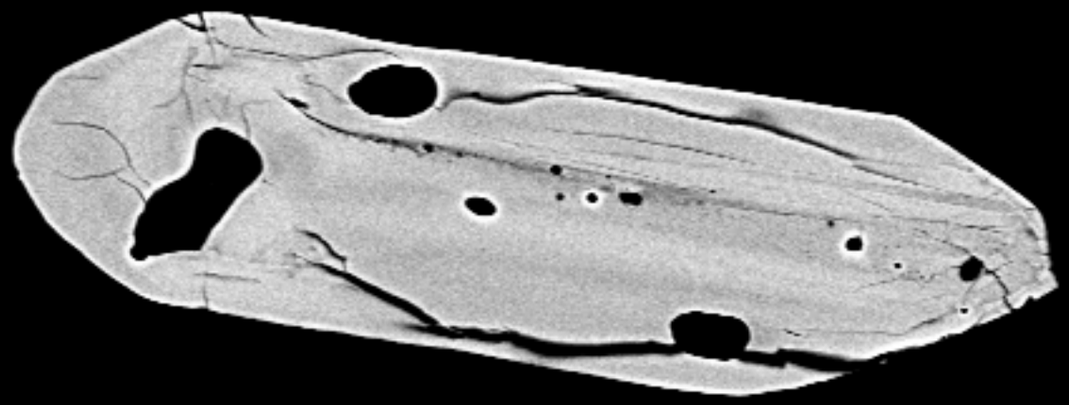
93

95

30 µm

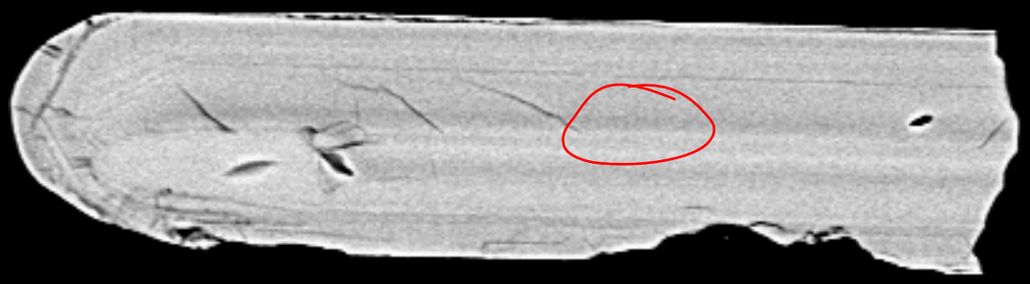
94

File Name = 10807-25.tif



96

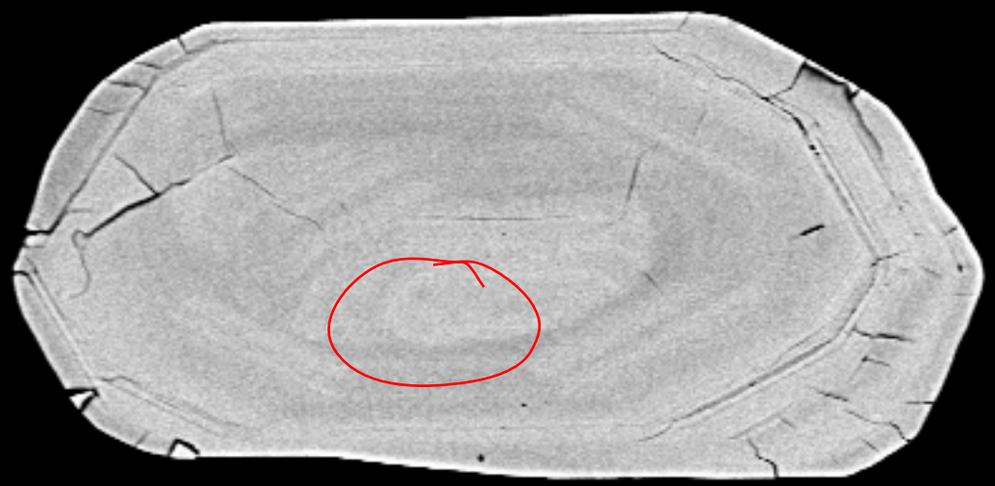
97



98

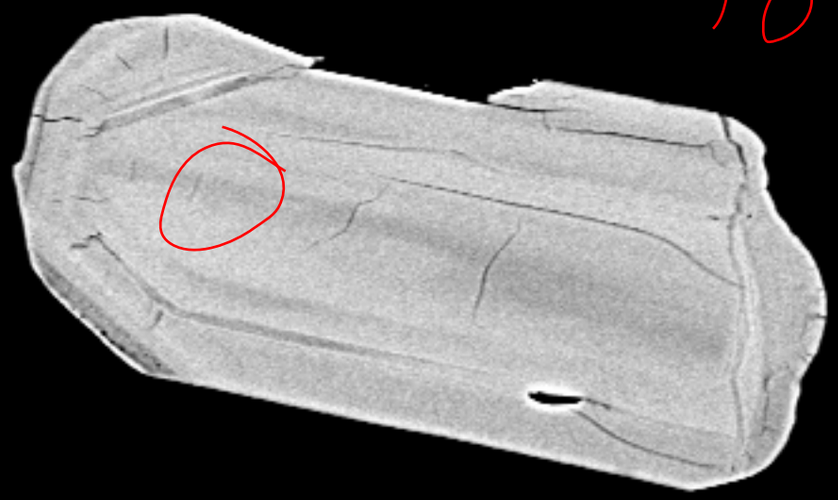
30 µm

File Name = 10807-26.tif



99

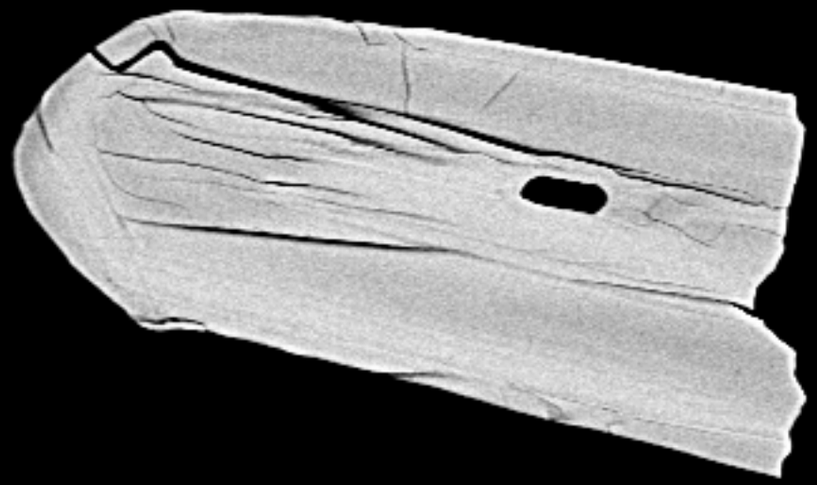
100



101

20 µm

File Name = 10807-27.tif



102

103

105

104

20 µm

File Name = 10807-28.tif

106

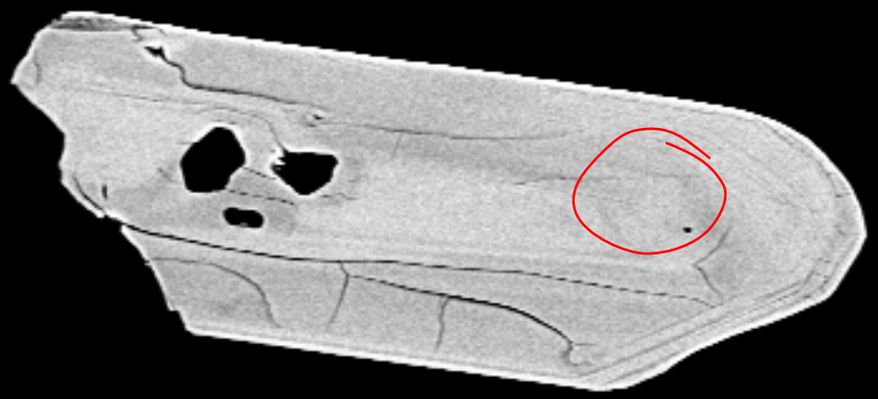
107

109

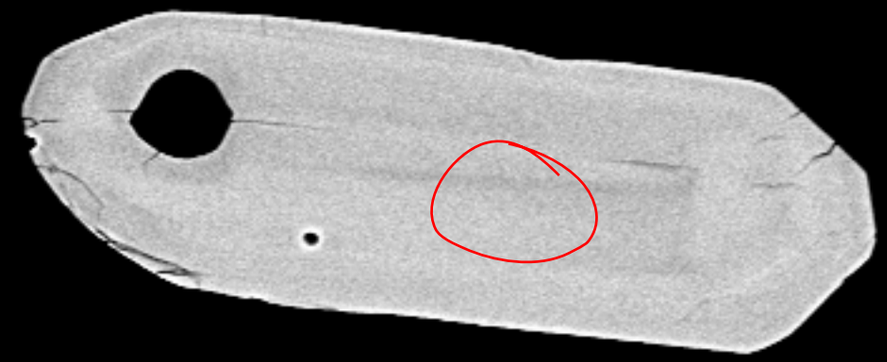
108

20 µm

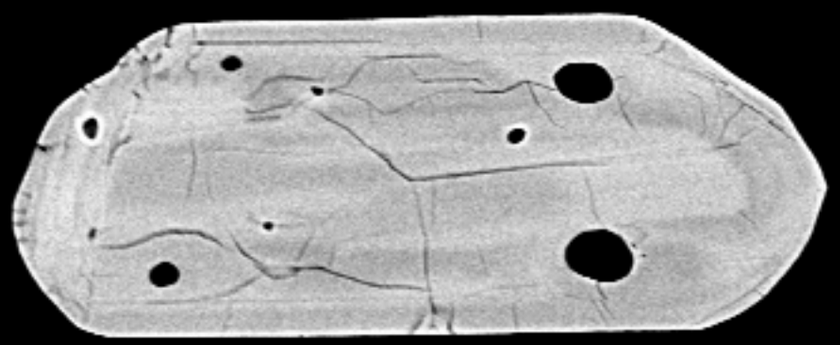
File Name = 10807-29.tif



110



111



113

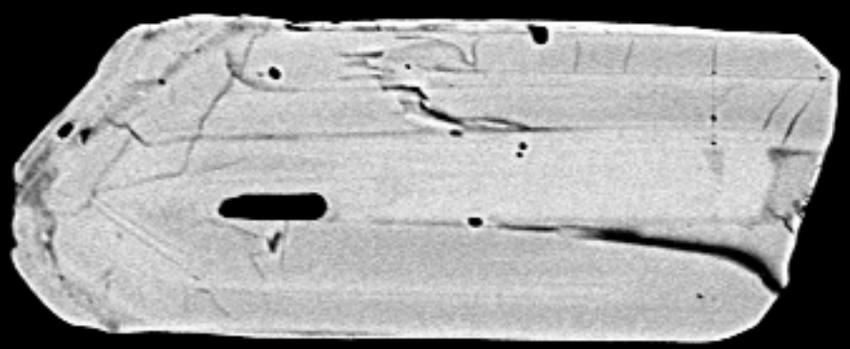
112

30 µm

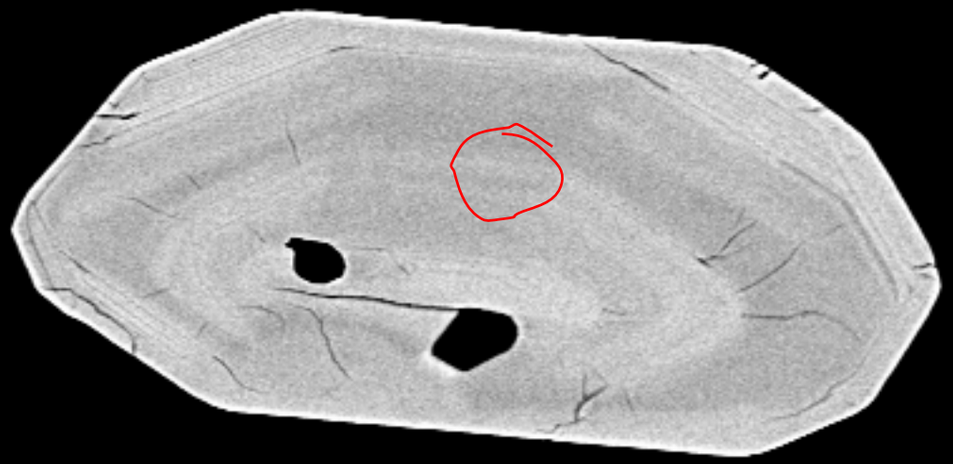
File Name = 10807-30.tif

114

115



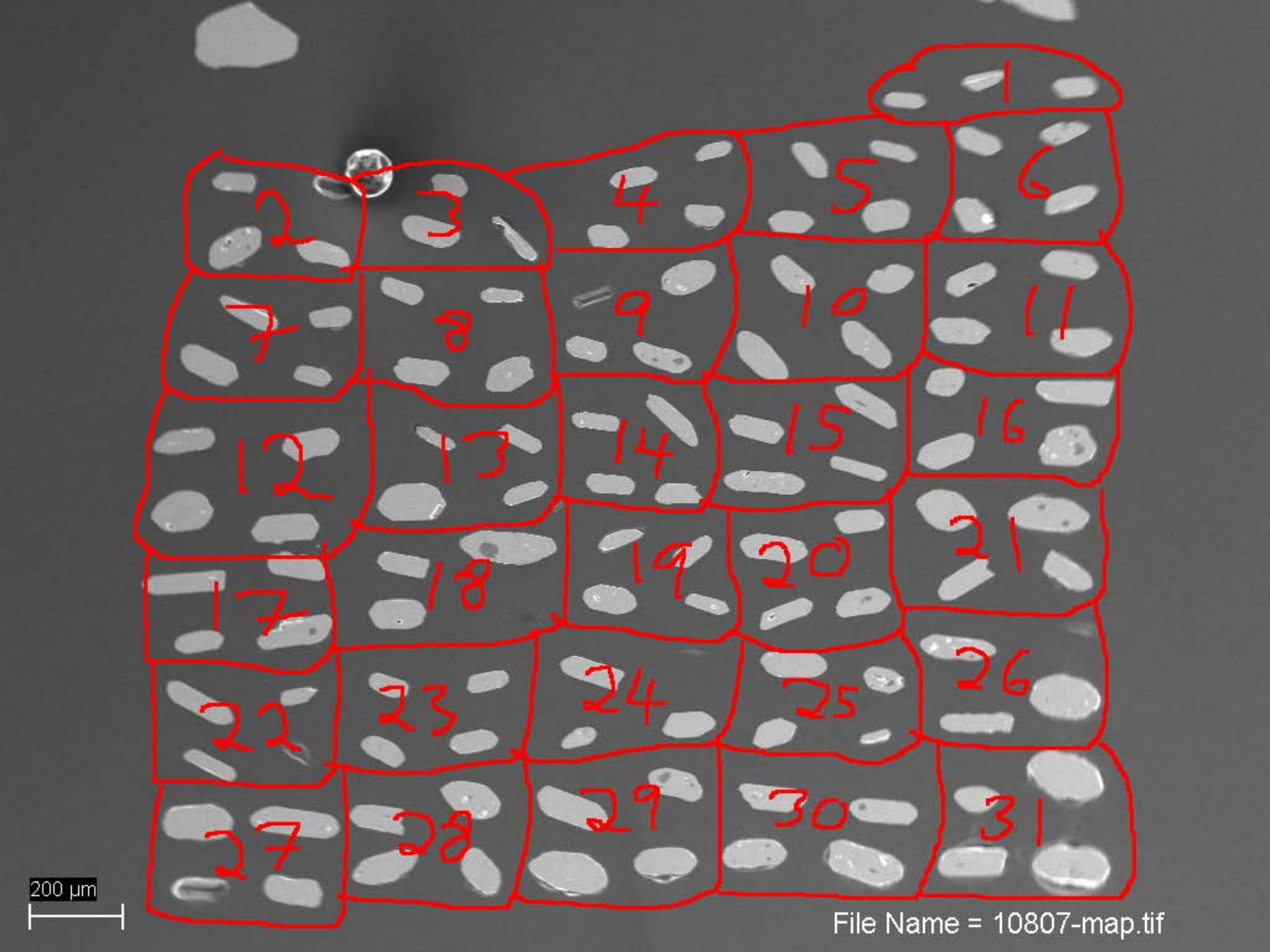
117

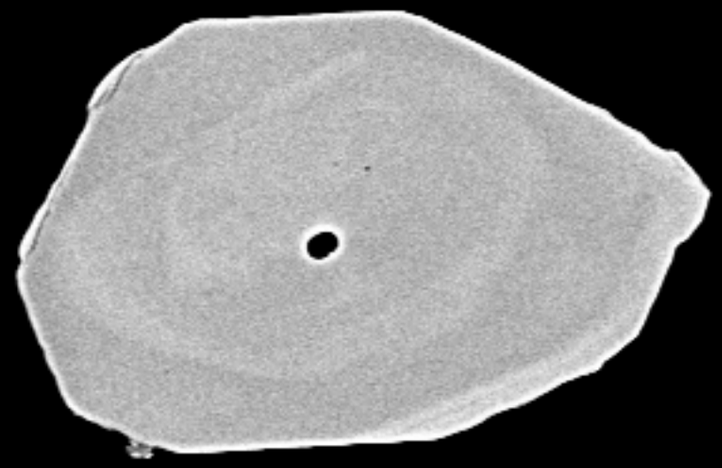


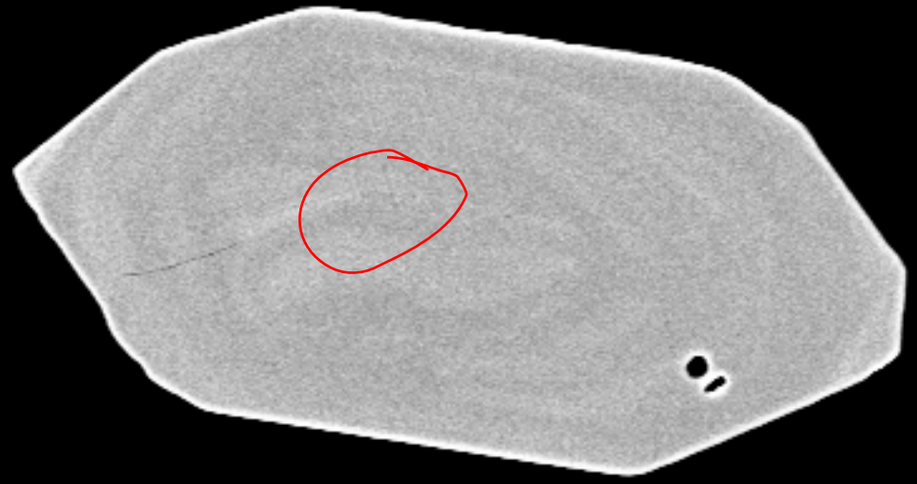
116

20 µm

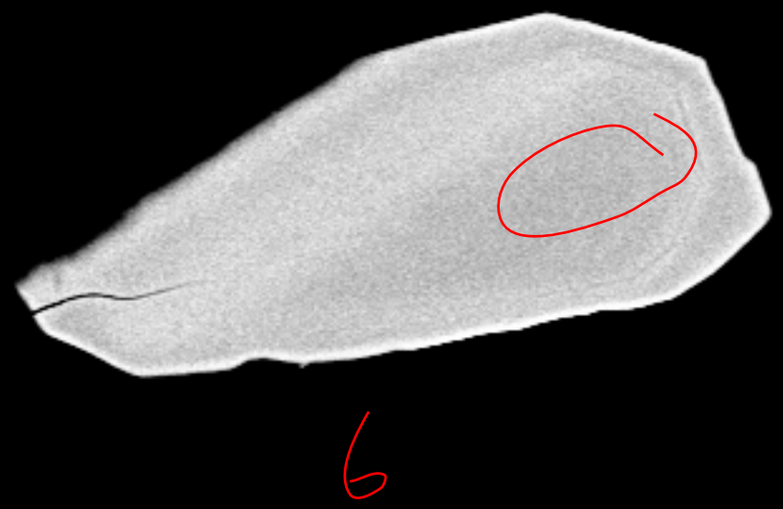
File Name = 10807-31.tif

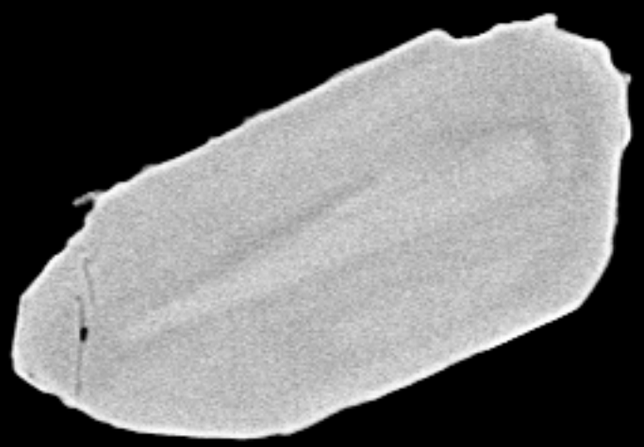

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
200 µm
File Name = 10807-map.tif

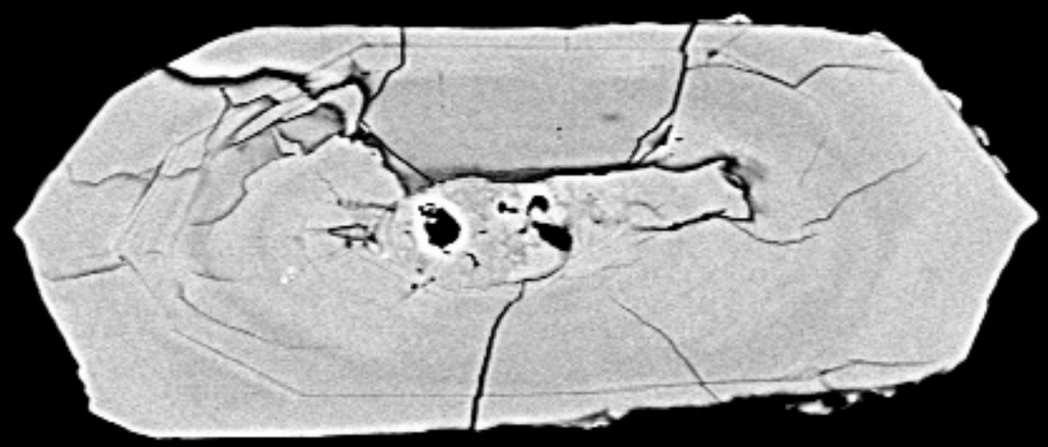




File Name = 10808-01.tif







20 µm

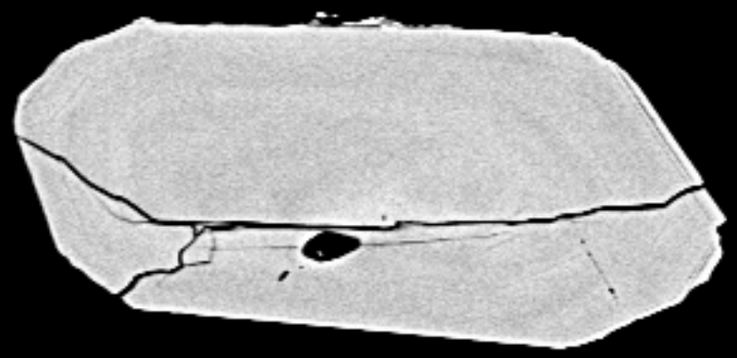
File Name = 10808-02.tif

9

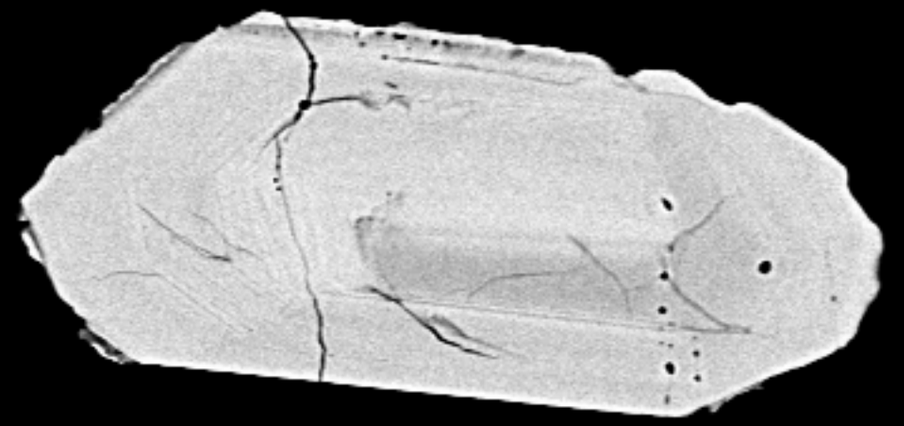
10

20 µm

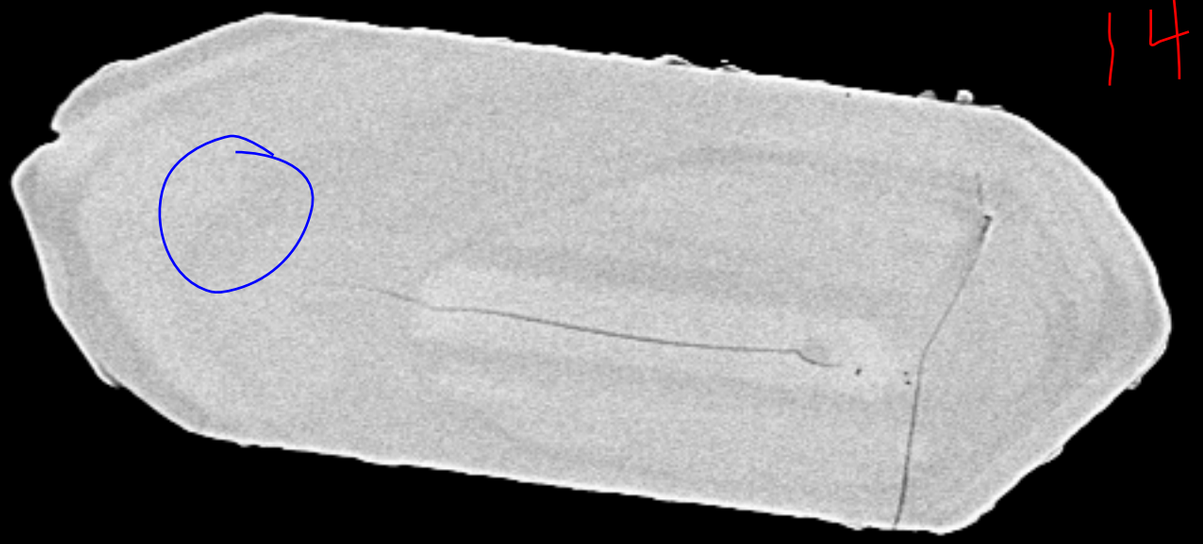
File Name = 10808-03.tif



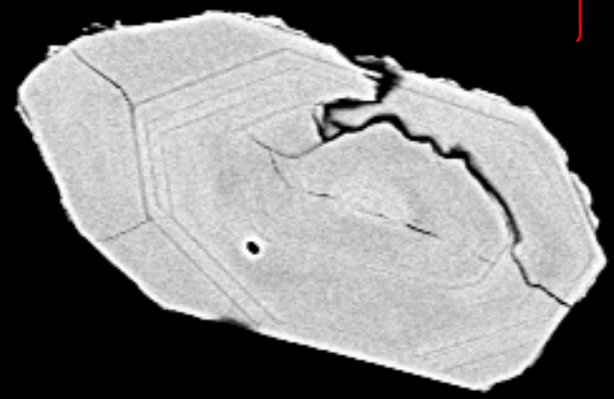
11



12



14

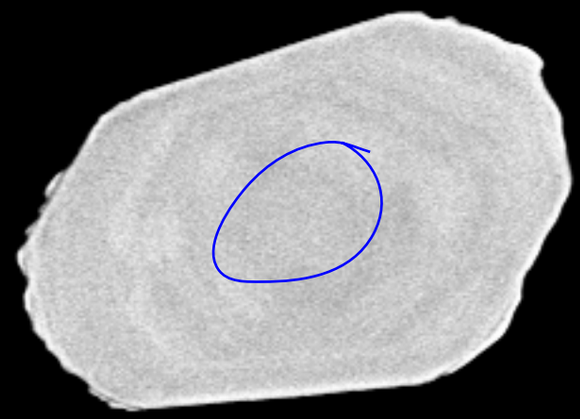


13

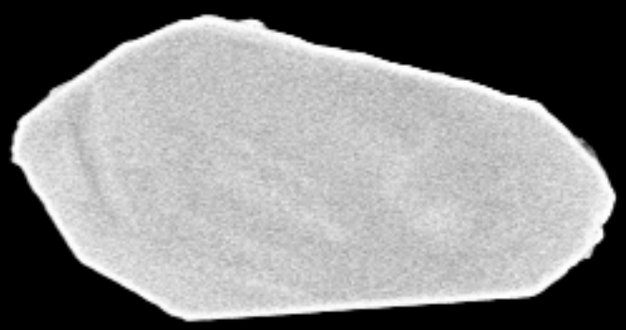
30 µm

File Name = 10808-04.tif

15



16

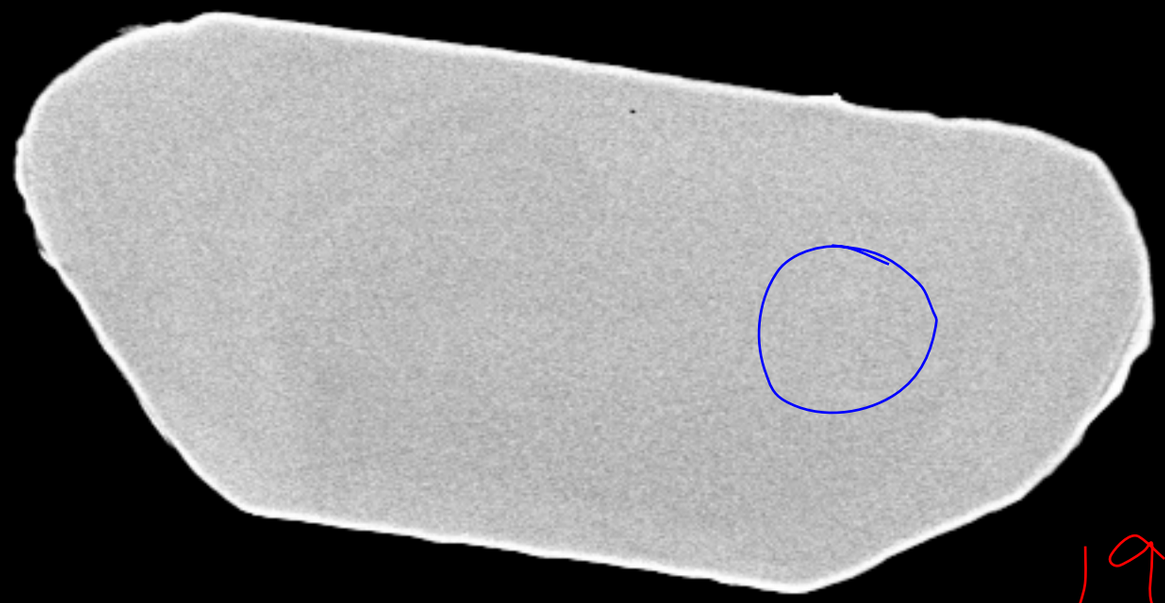


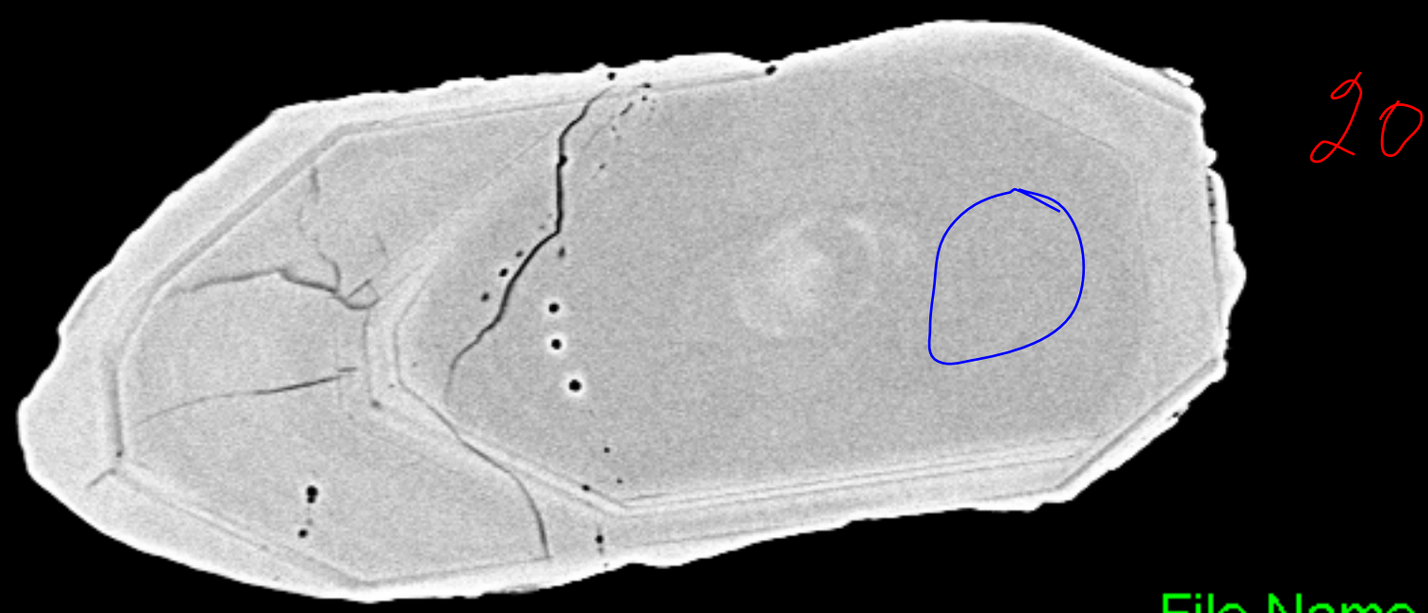
18

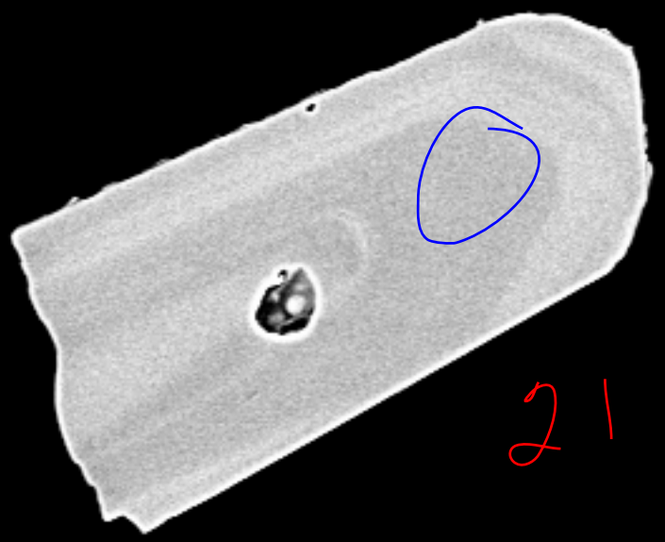
17

30 µm

File Name = 10808-05.tif

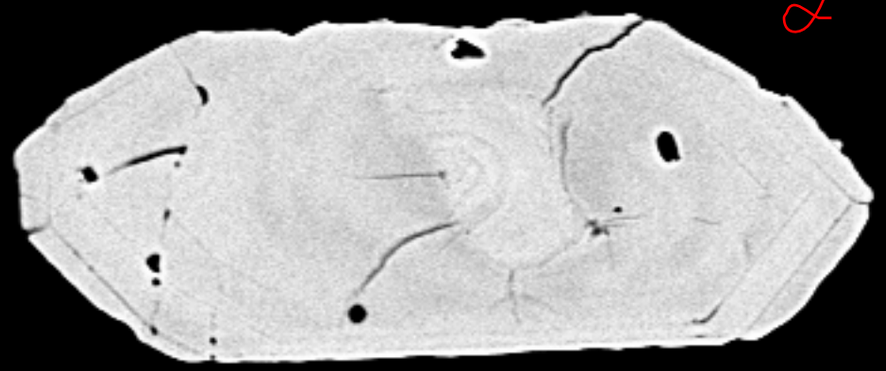

19


20
30 µm
File Name = 10808-06.tif

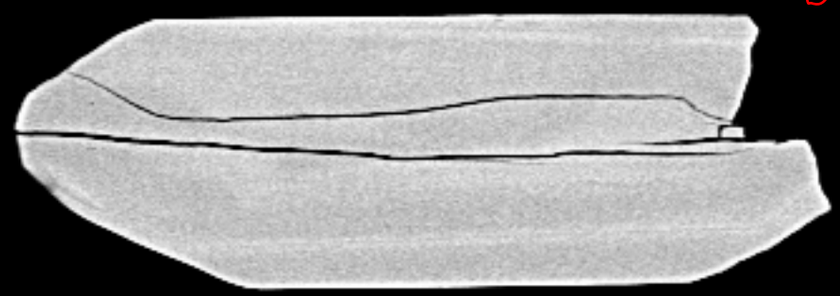


21

22



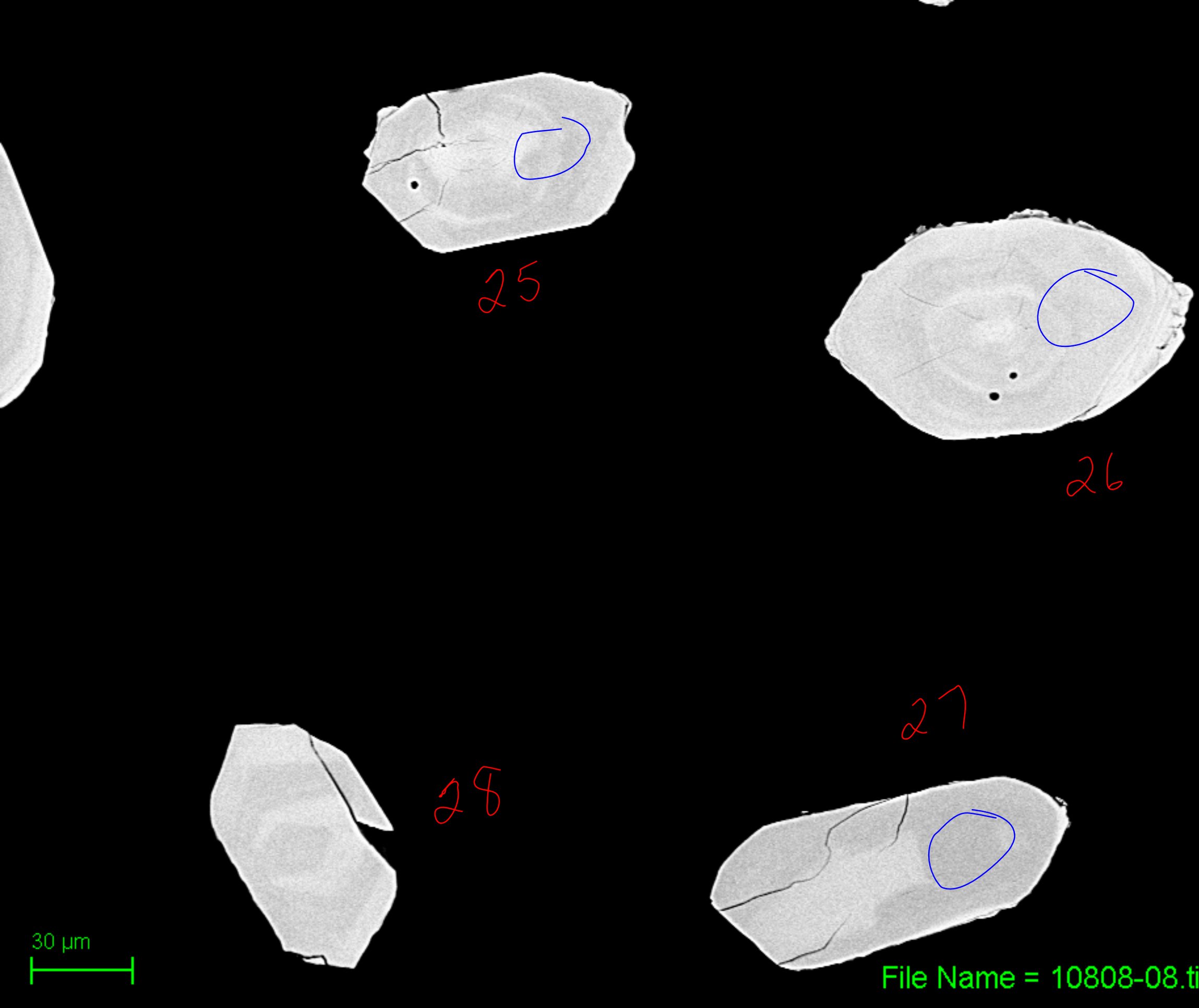
24



23

30 µm

File Name = 10808-07.tif

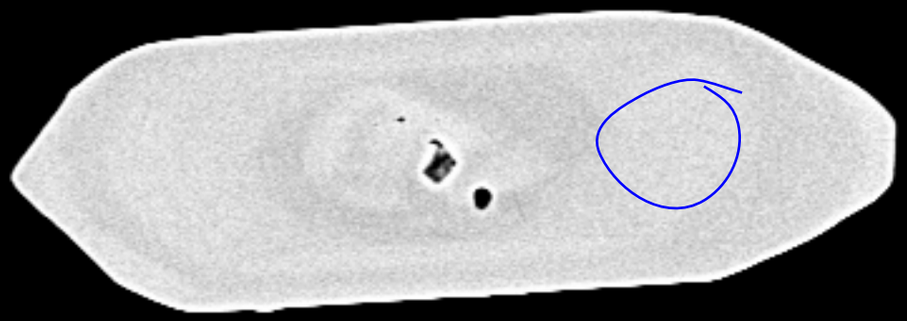

25
26
28
27
30 µm
File Name = 10808-08.tif

29

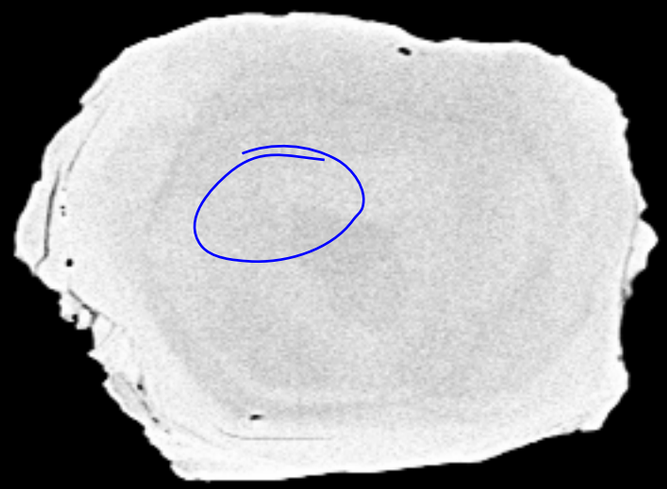
30

30 µm

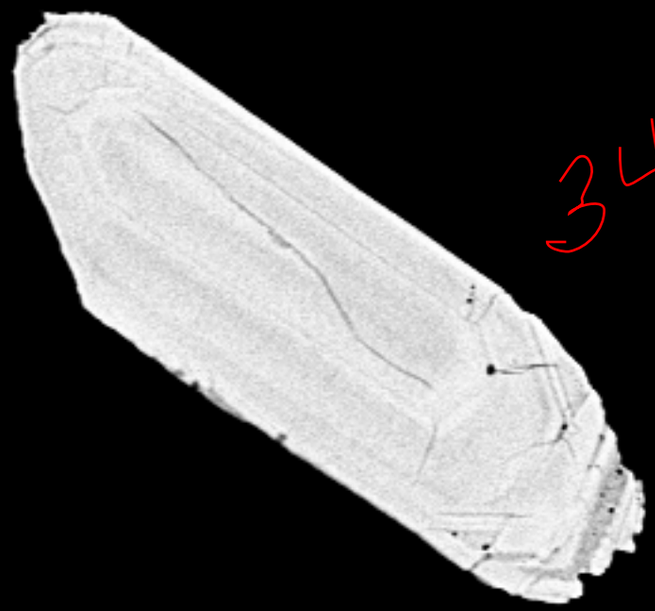
File Name = 10808-09.tif



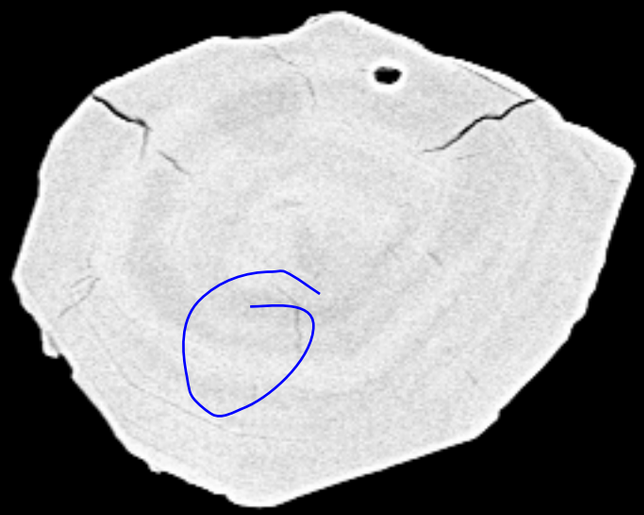
31



32



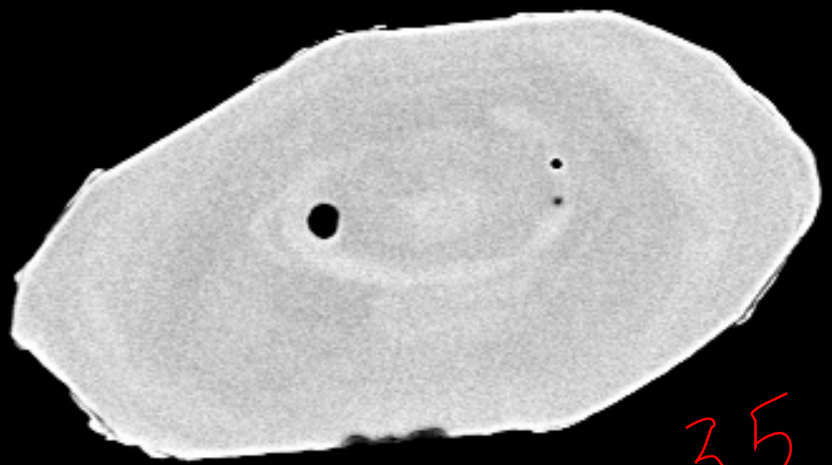
34



33

30 µm

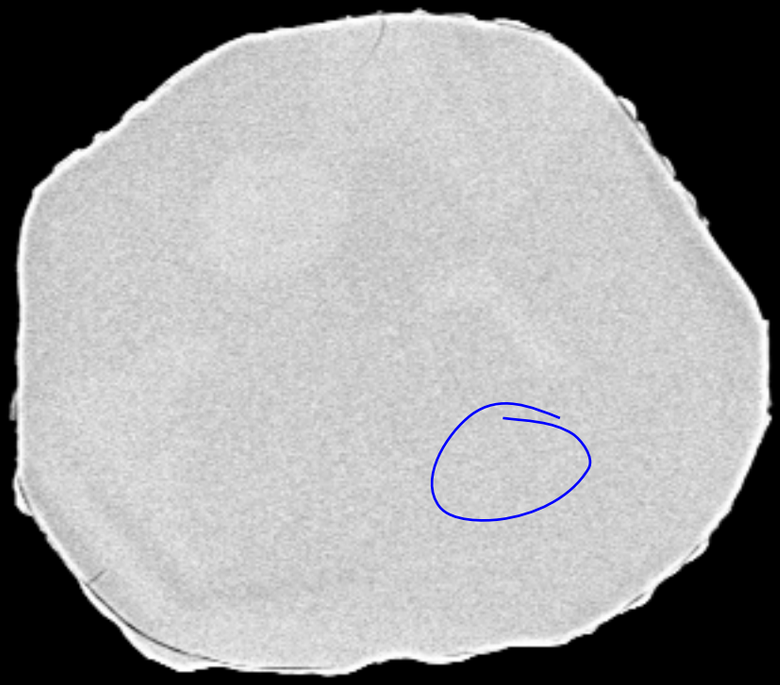
File Name = 10808-10.tif

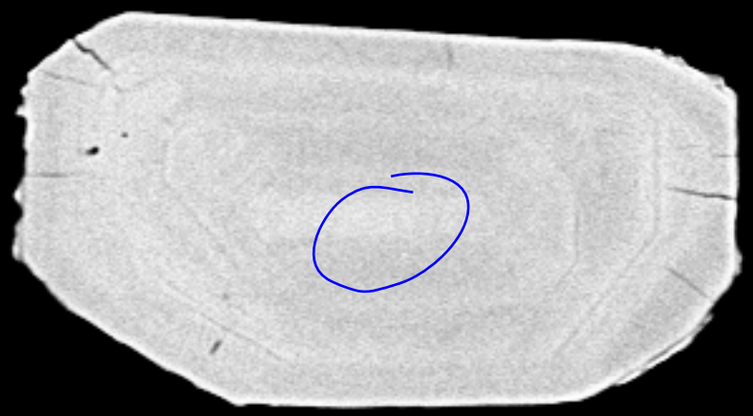


35

36

37

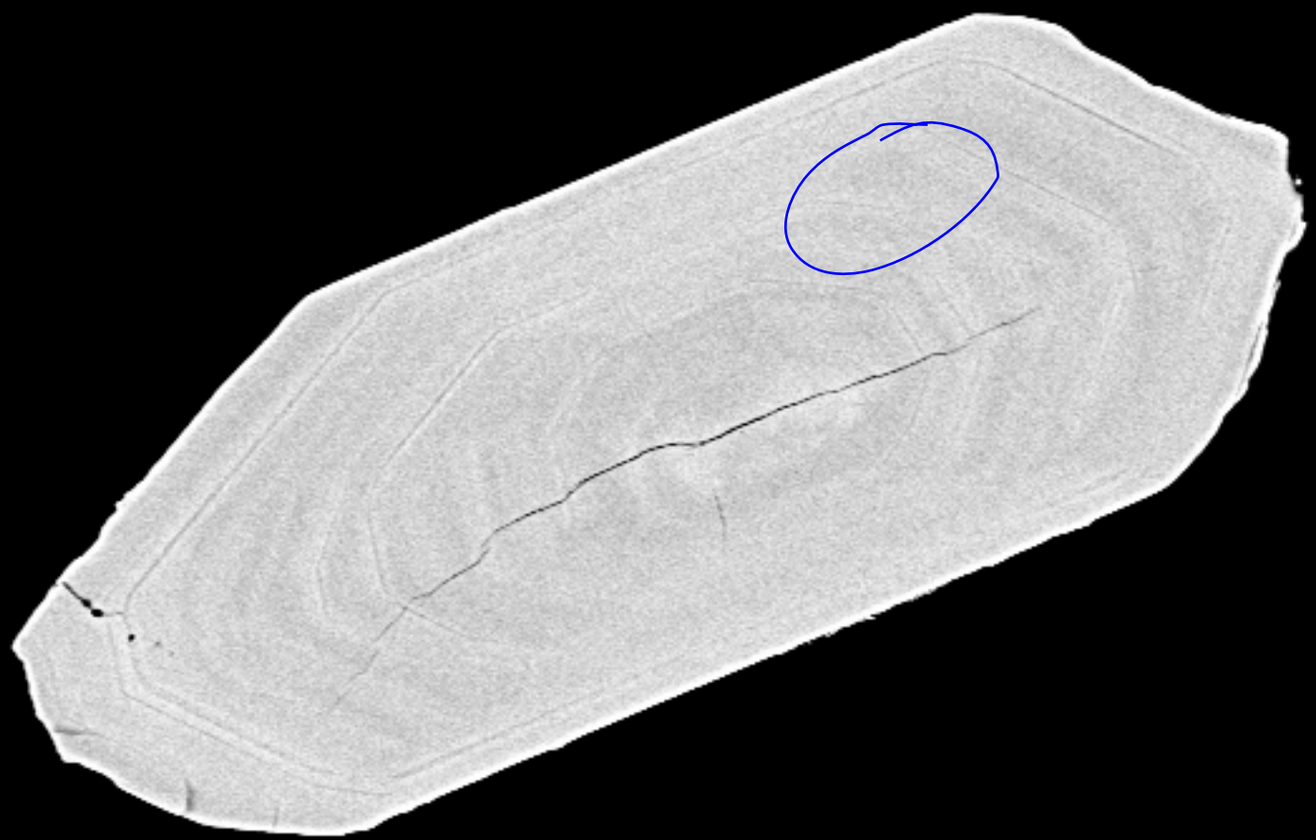


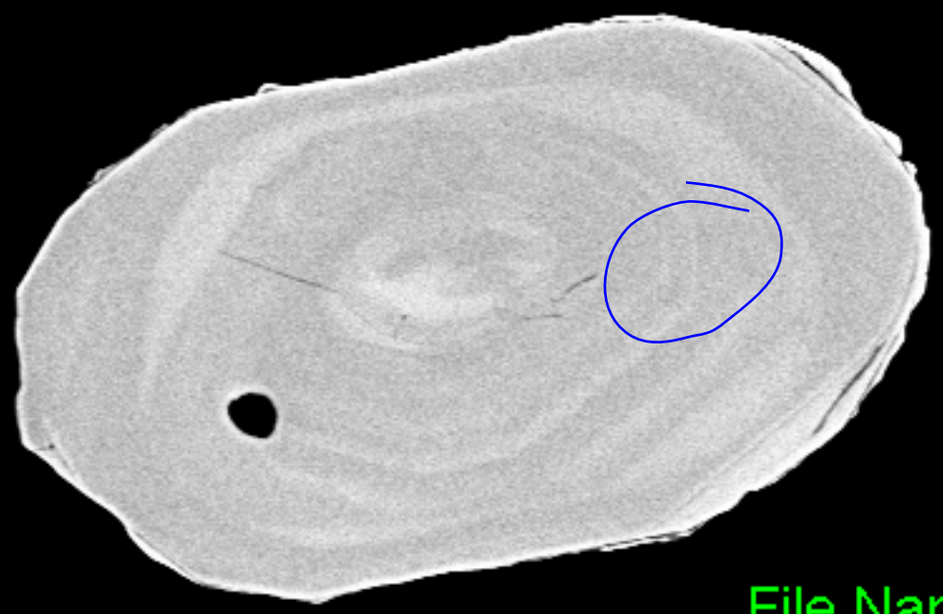


38

30 µm

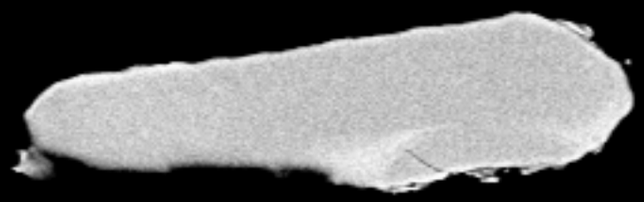
File Name = 10808-11.tif





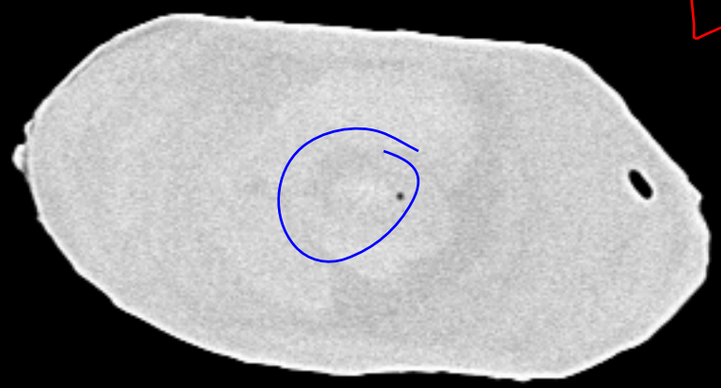
30 µm

File Name = 10808-12.tif

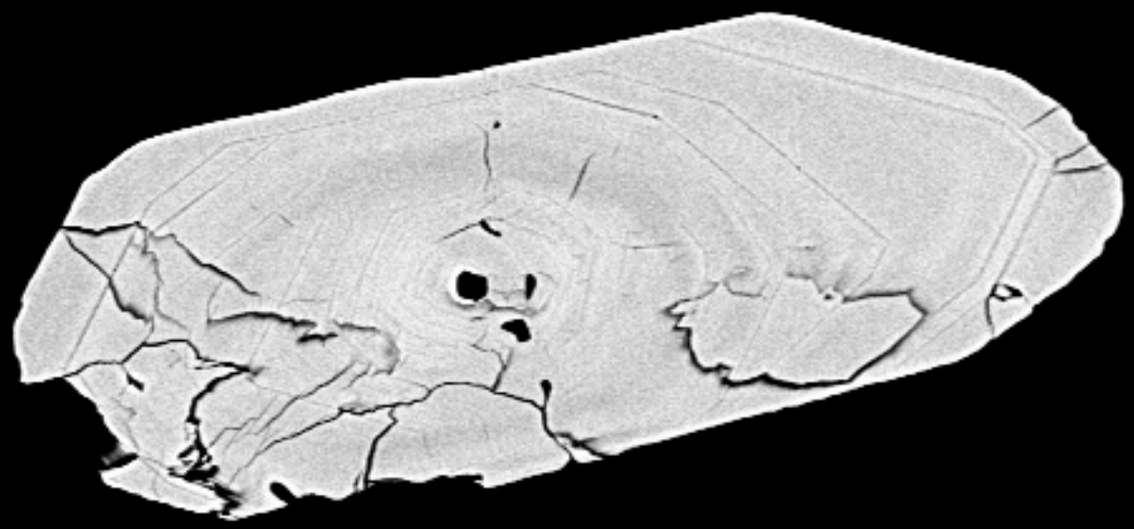


41

42



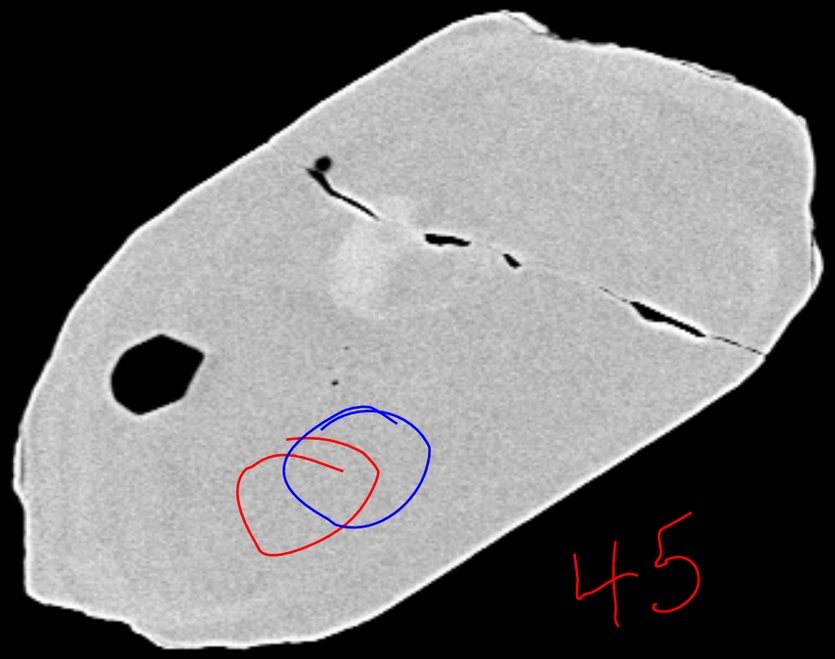
44



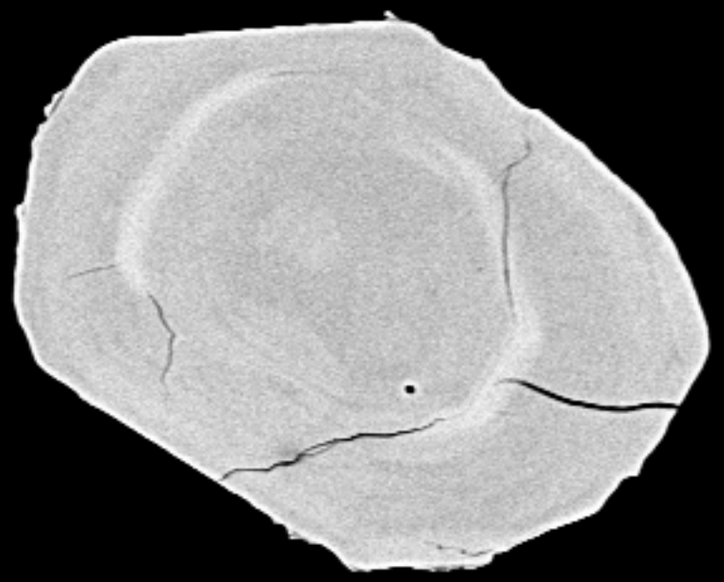
43

30 µm

File Name = 10808-13.tif

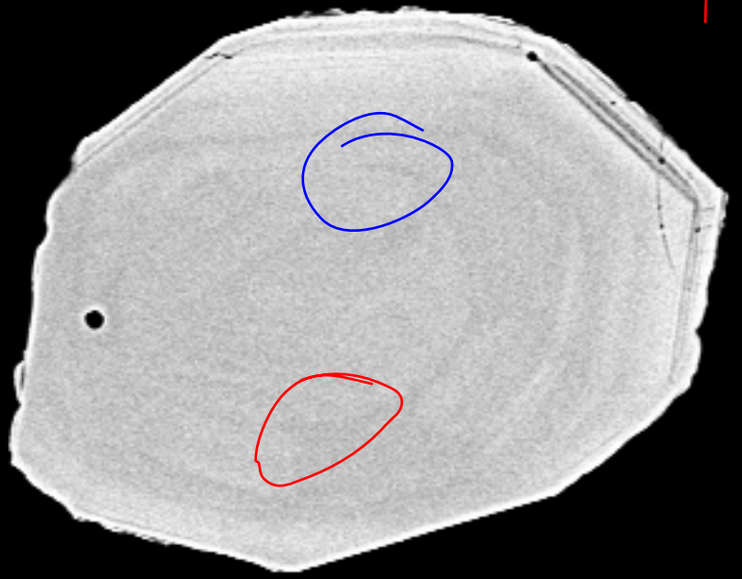


45



46

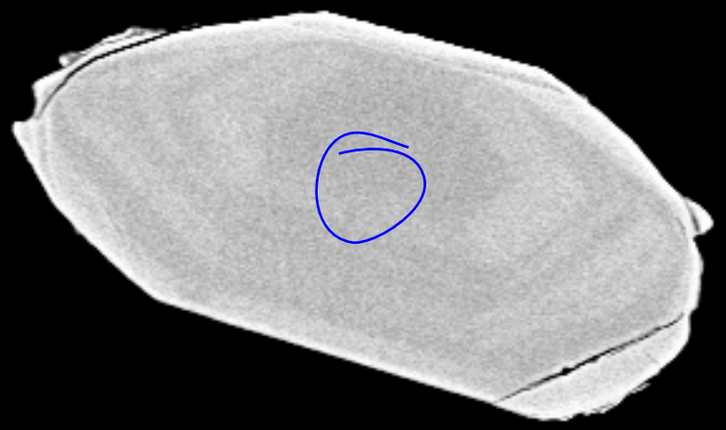
47



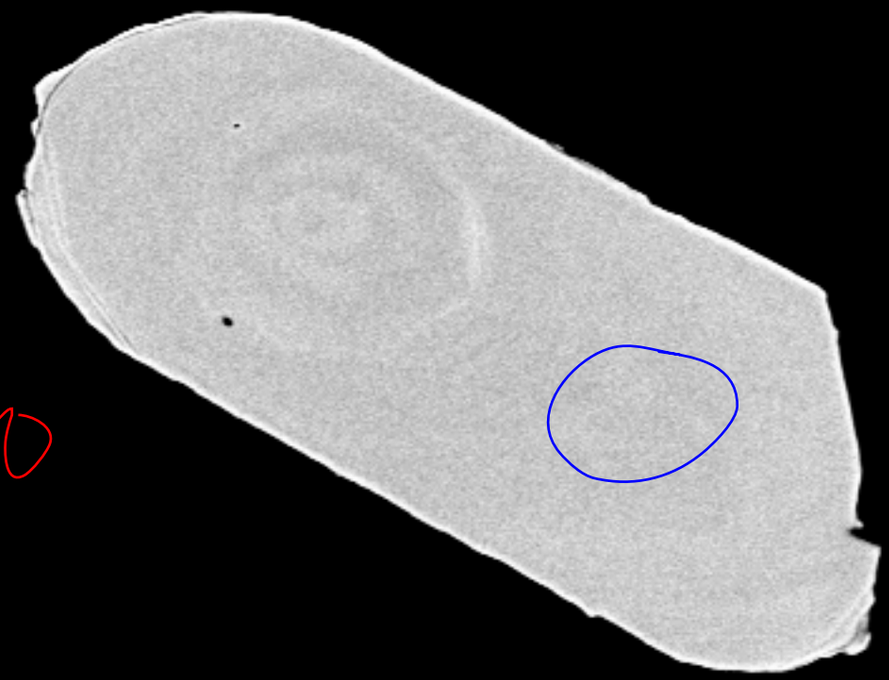
48

30 µm

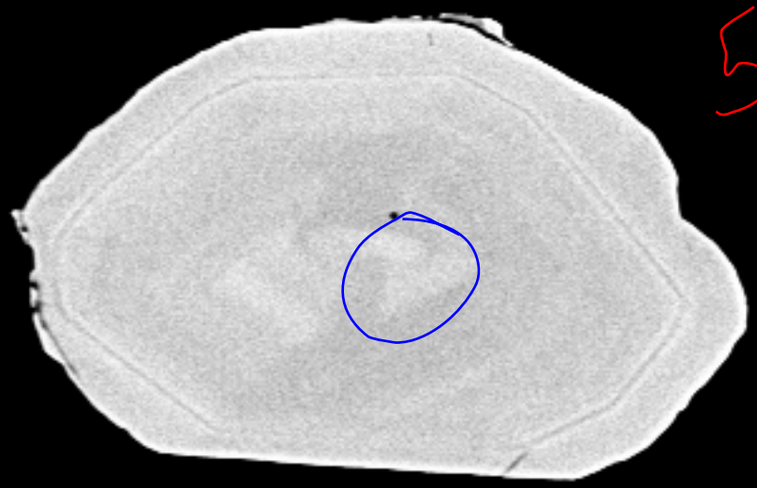
File Name = 10808-14.tif



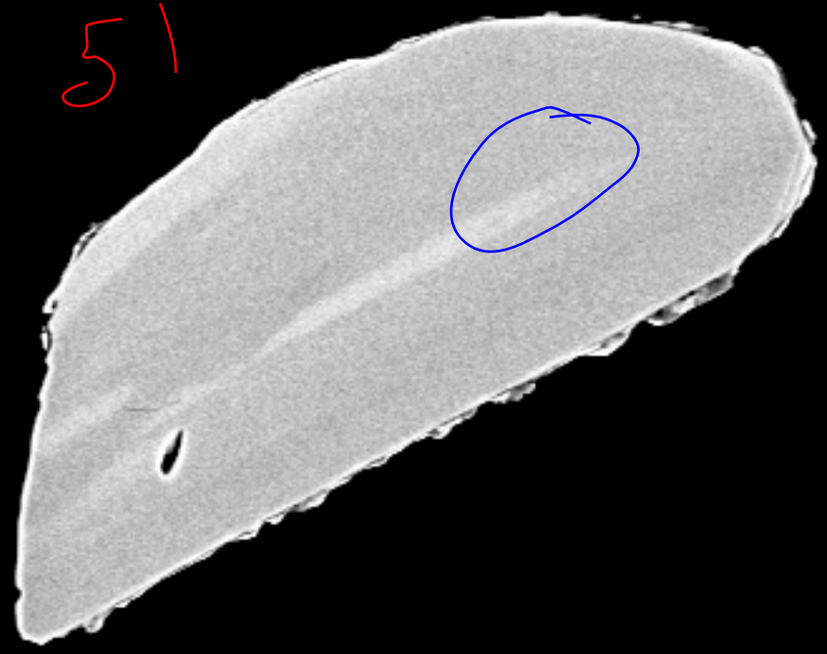
49



50



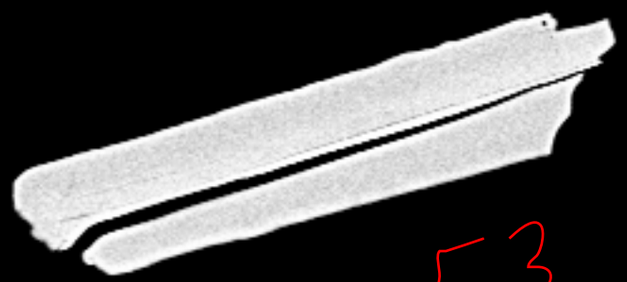
52



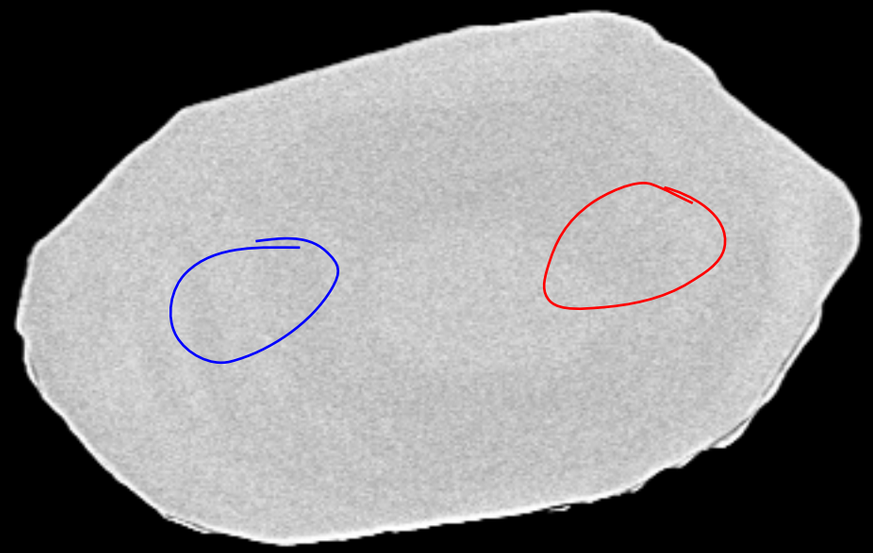
51

30 µm

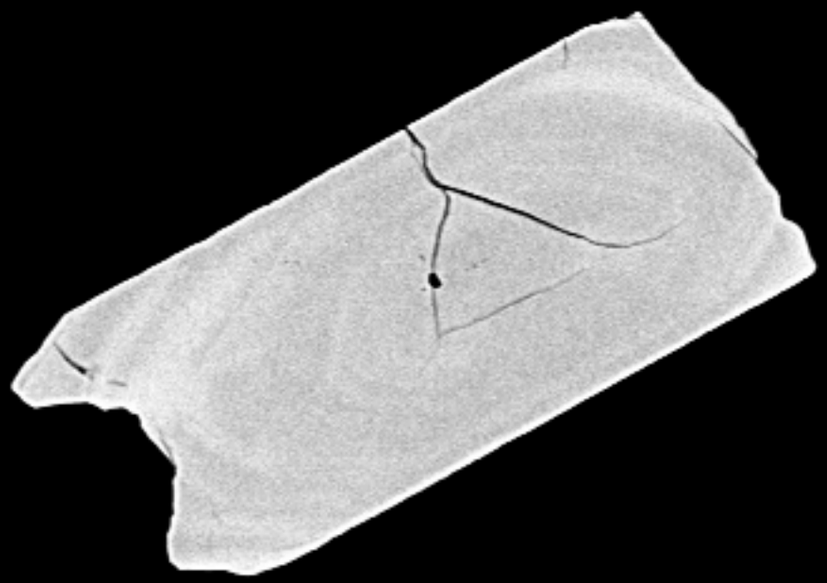
File Name = 10808-15.tif



53

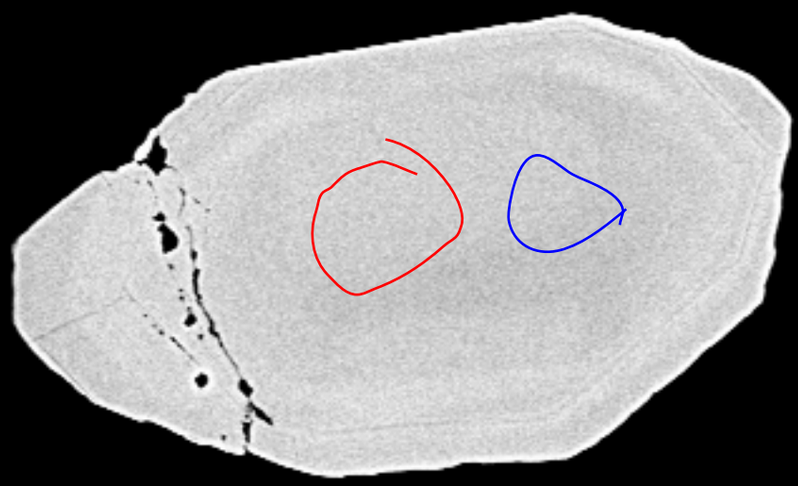


54



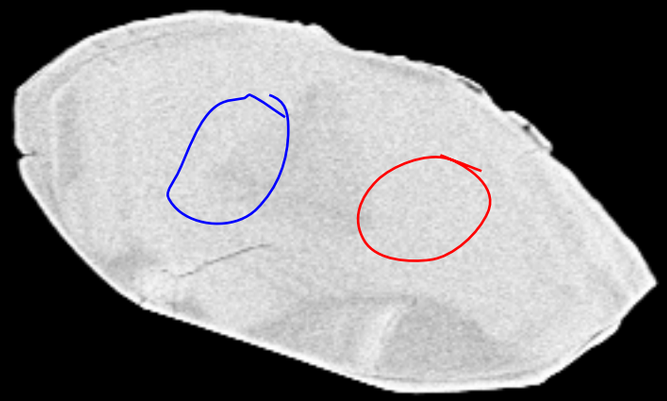
56

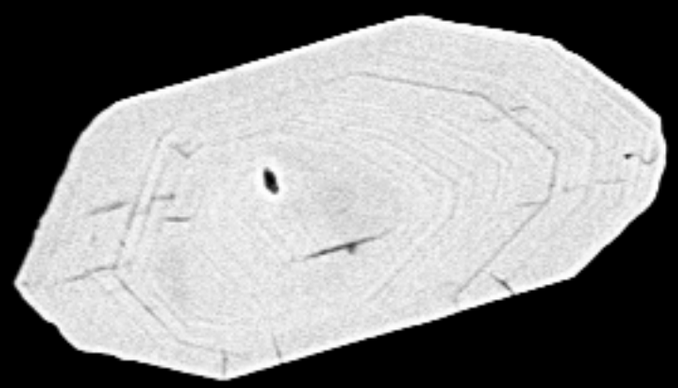
55

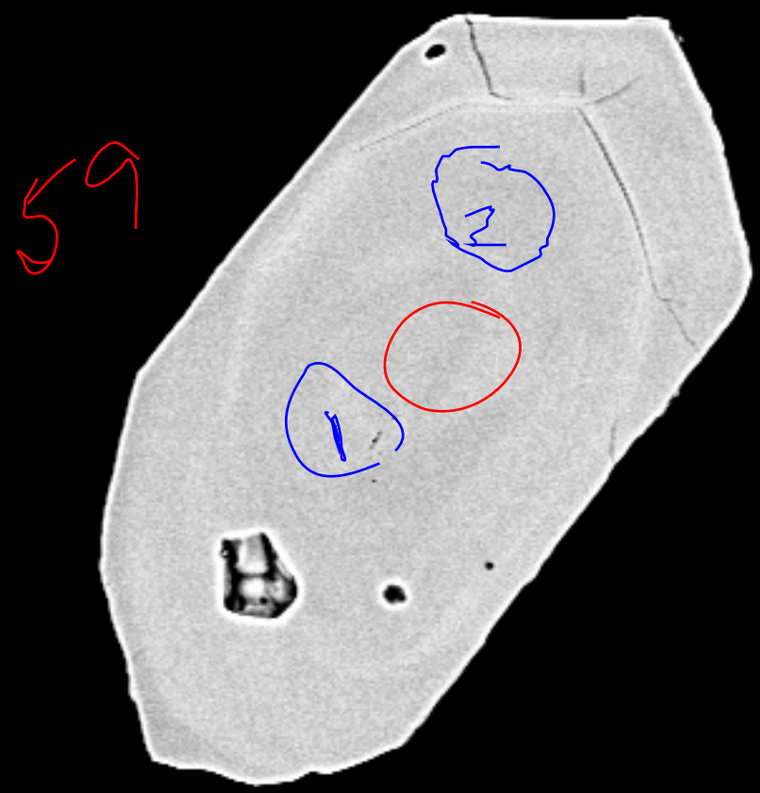


30 µm

File Name = 10808-16.tif







30 µm

File Name = 10808-17.tif

61

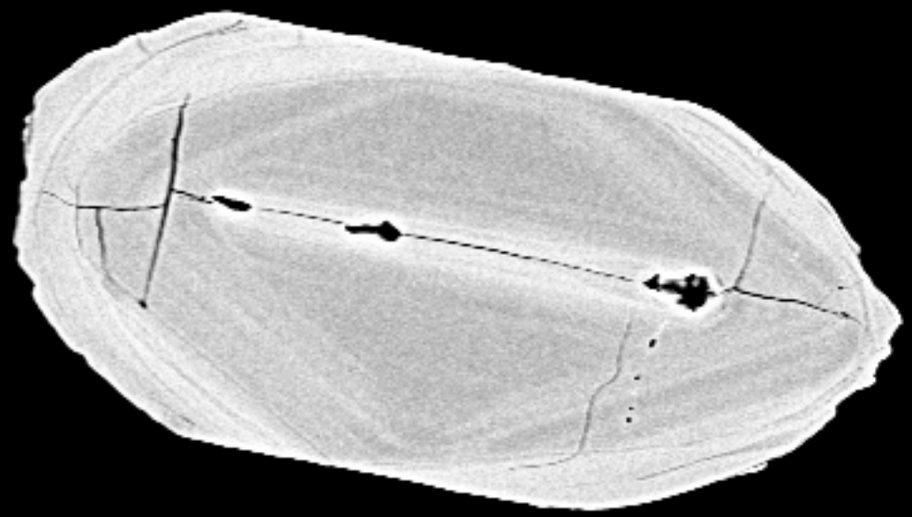
62

63

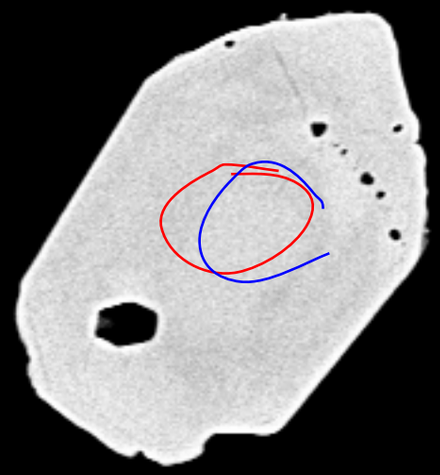
64

30 µm

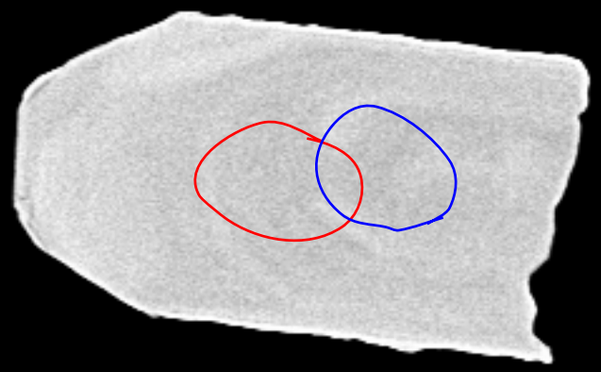
File Name = 10808-18.tif



65

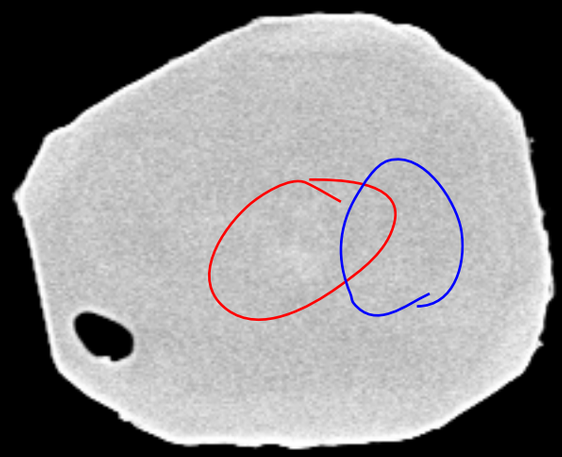


66



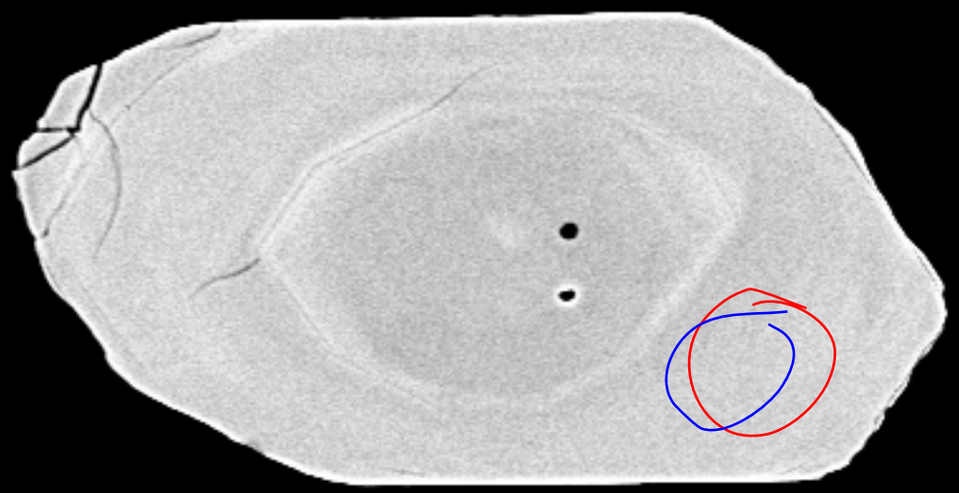
68

67



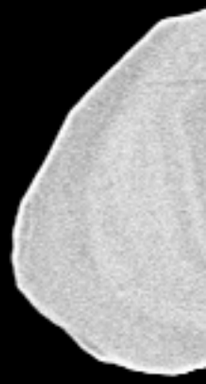
30 µm

File Name = 10808-19.tif

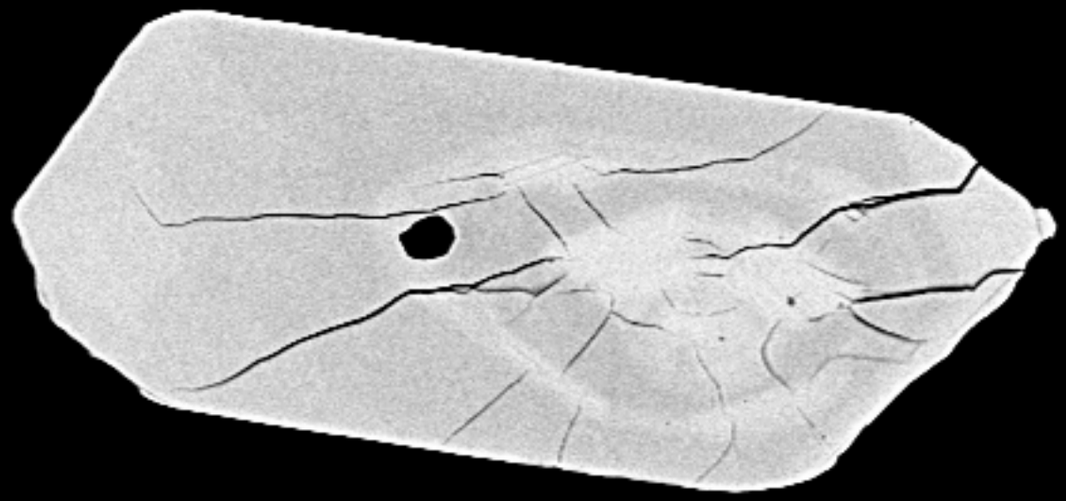


69

70



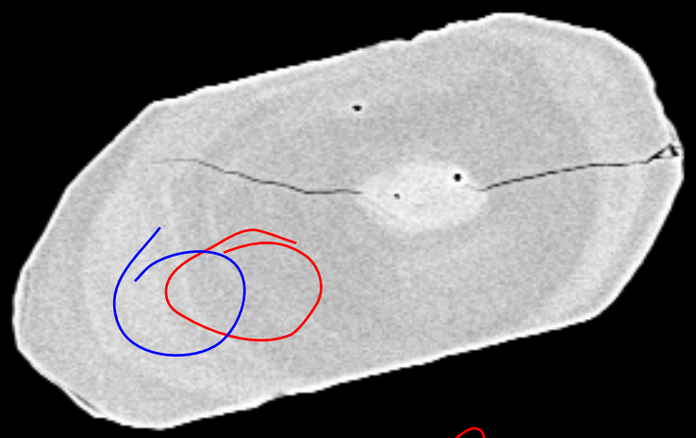
72



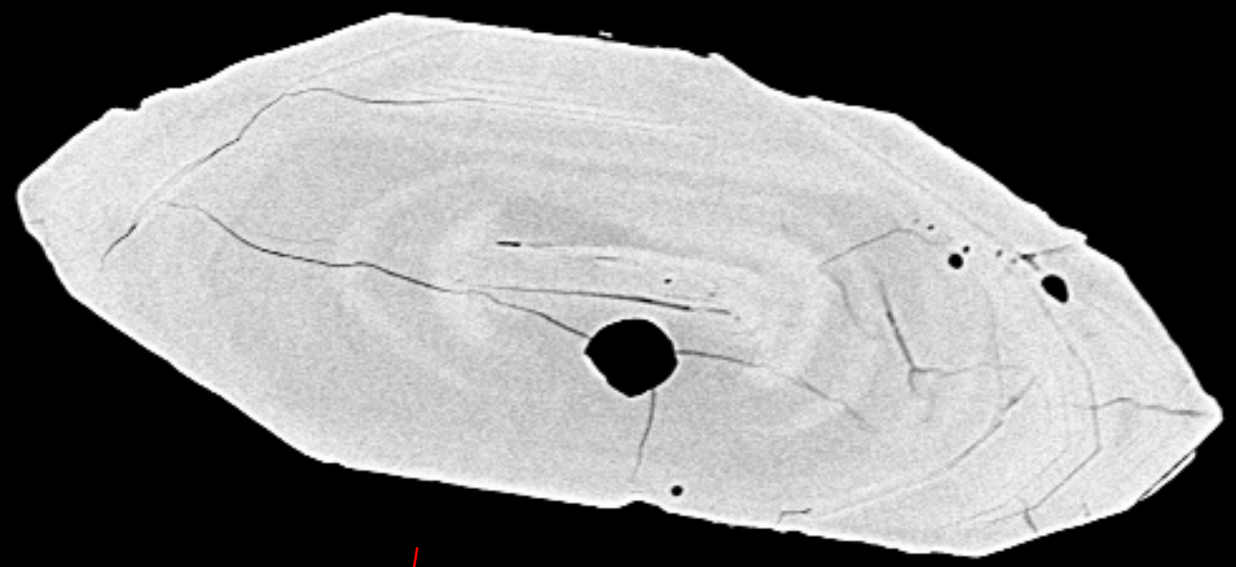
71

30 µm

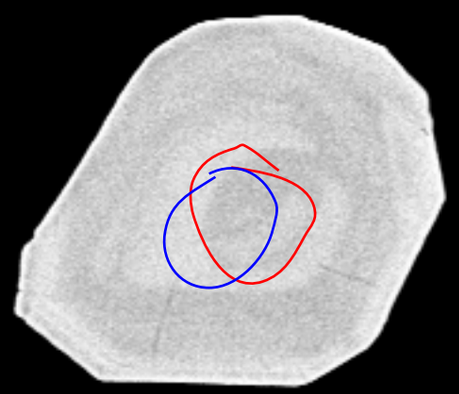
File Name = 10808-20.tif



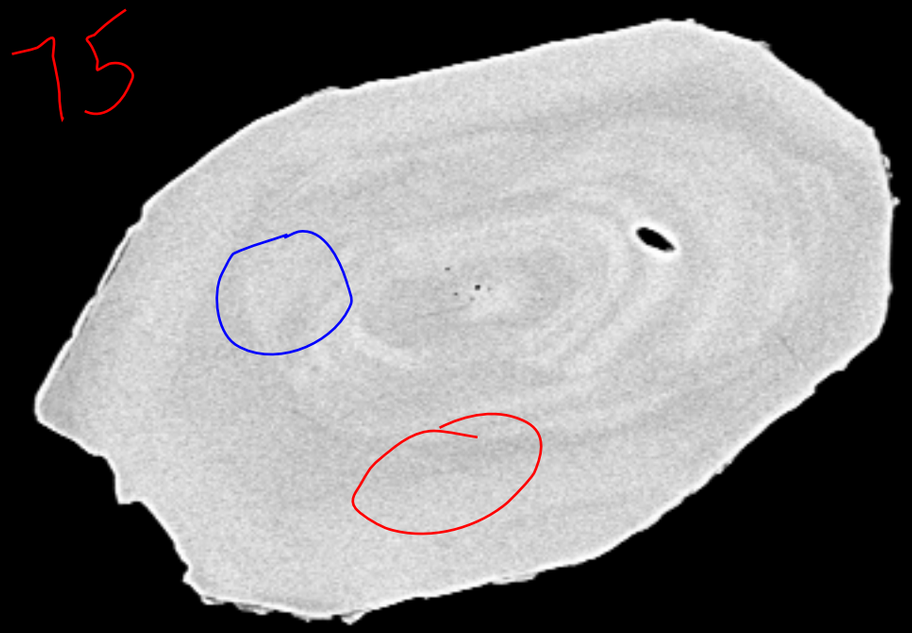
73



74



76

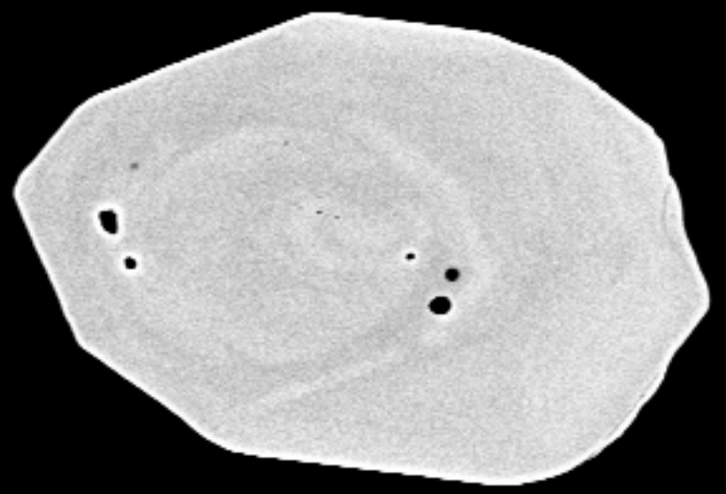


75

30 µm

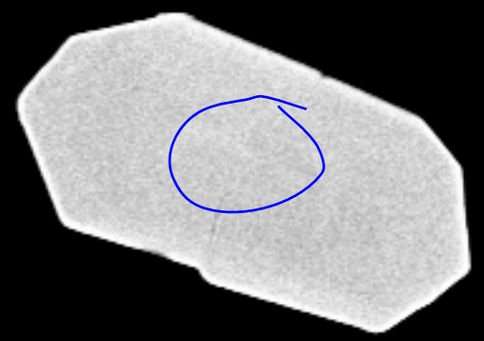
File Name = 10808-21.tif

77



78

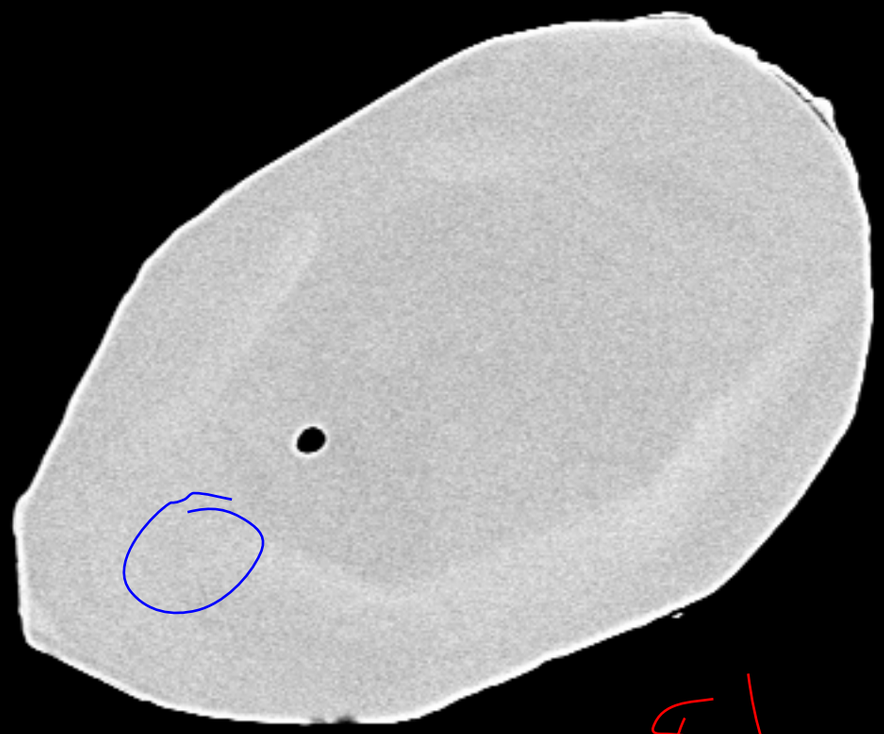
80



79

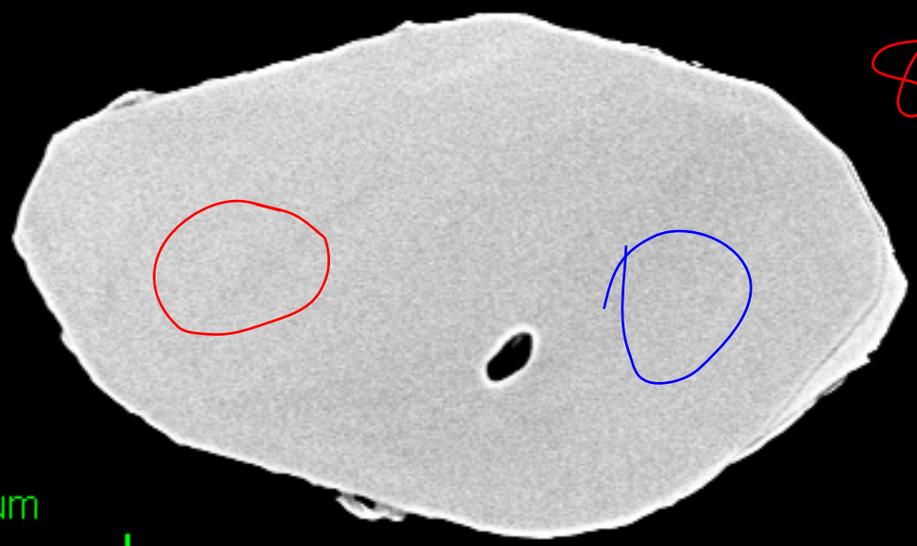
30 µm

File Name = 10808-22.tif

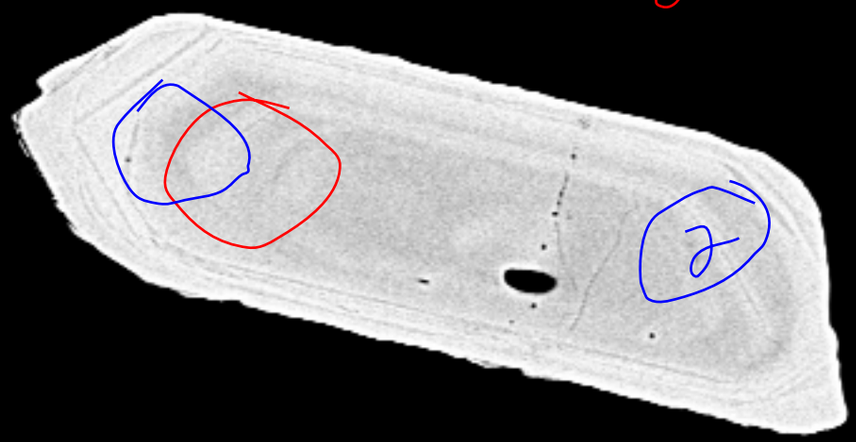


S1

S2



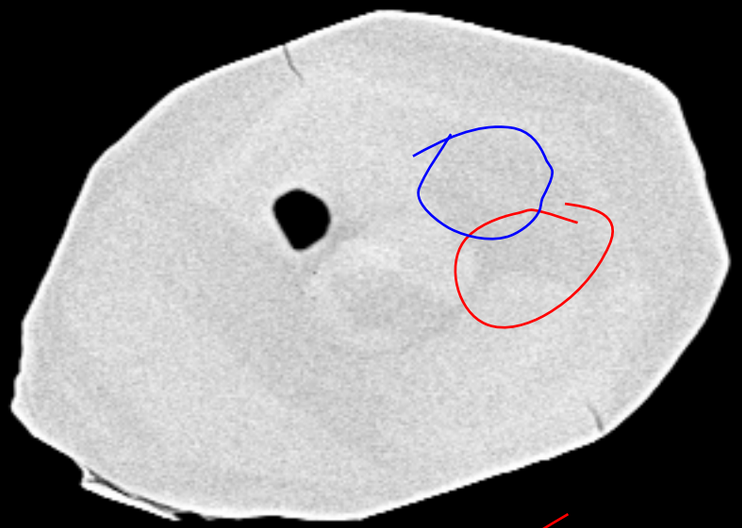
S4



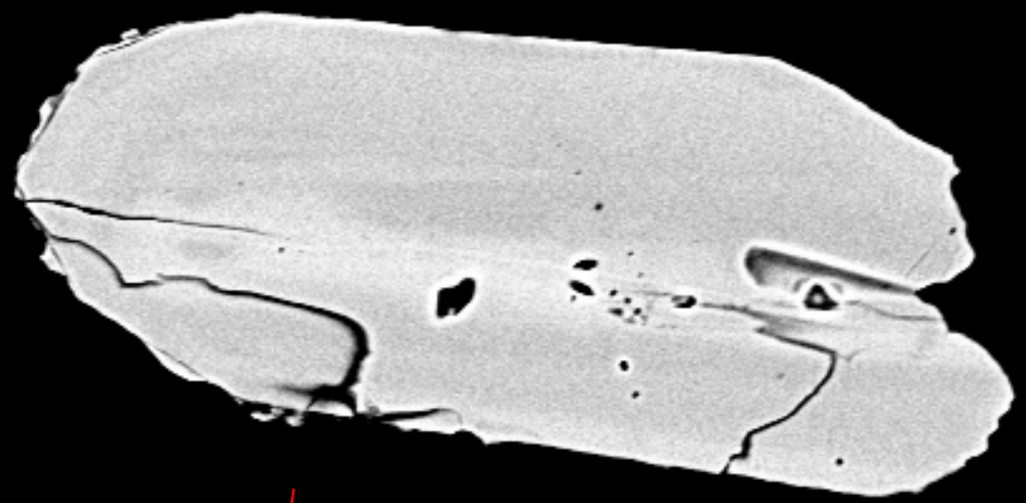
S3

30 µm

File Name = 10808-23.tif

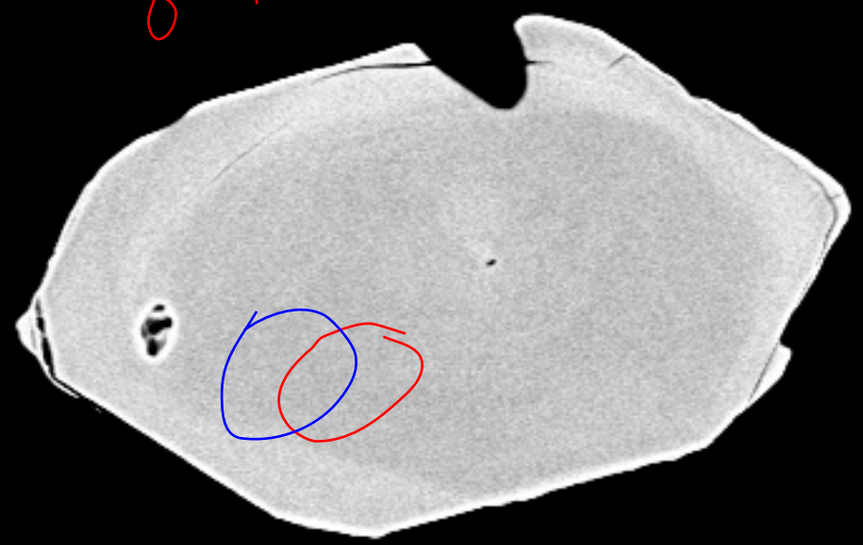


85



86

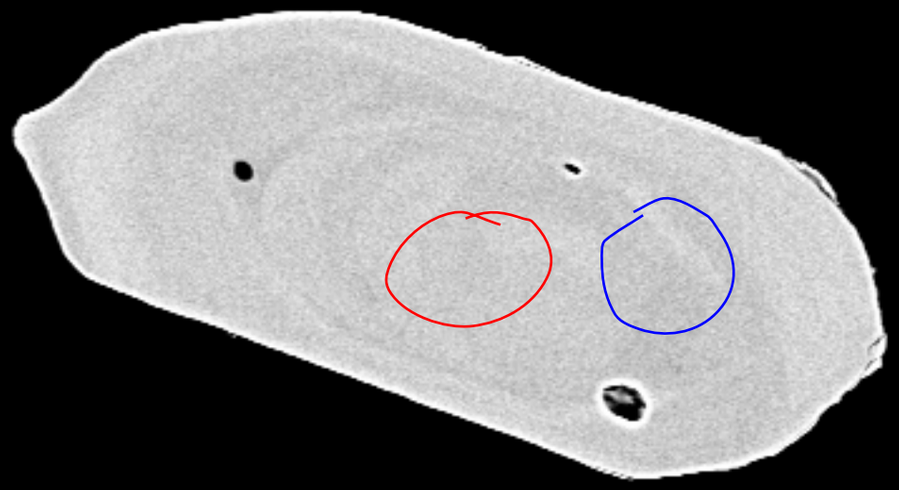
88

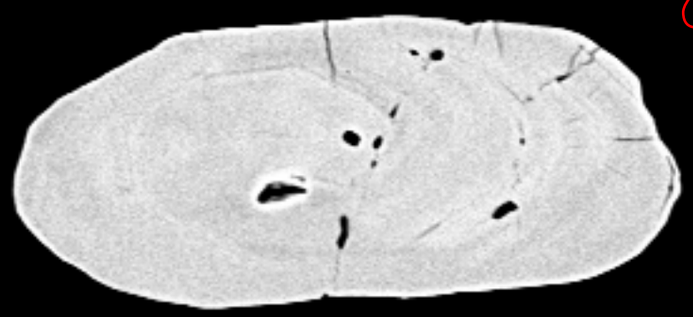


87

30 µm

File Name = 10808-24.tif





30 µm

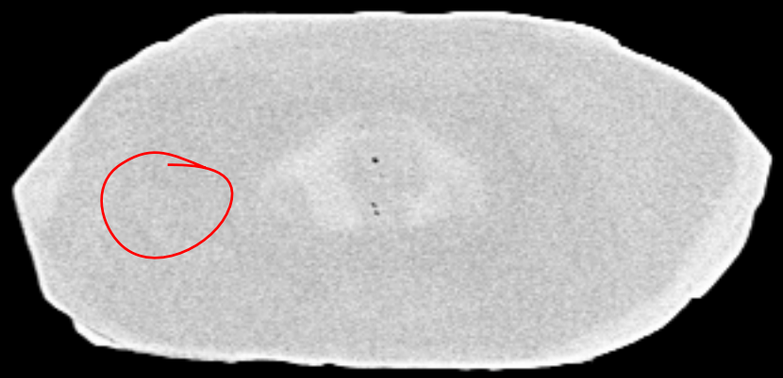
File Name = 10808-25.tif

93

94

95

96

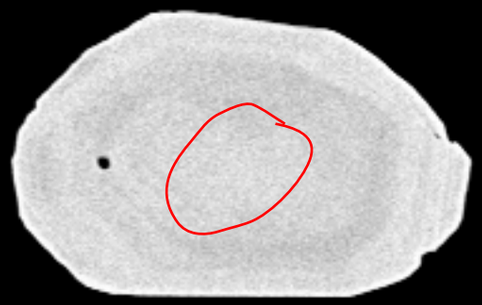


30 µm

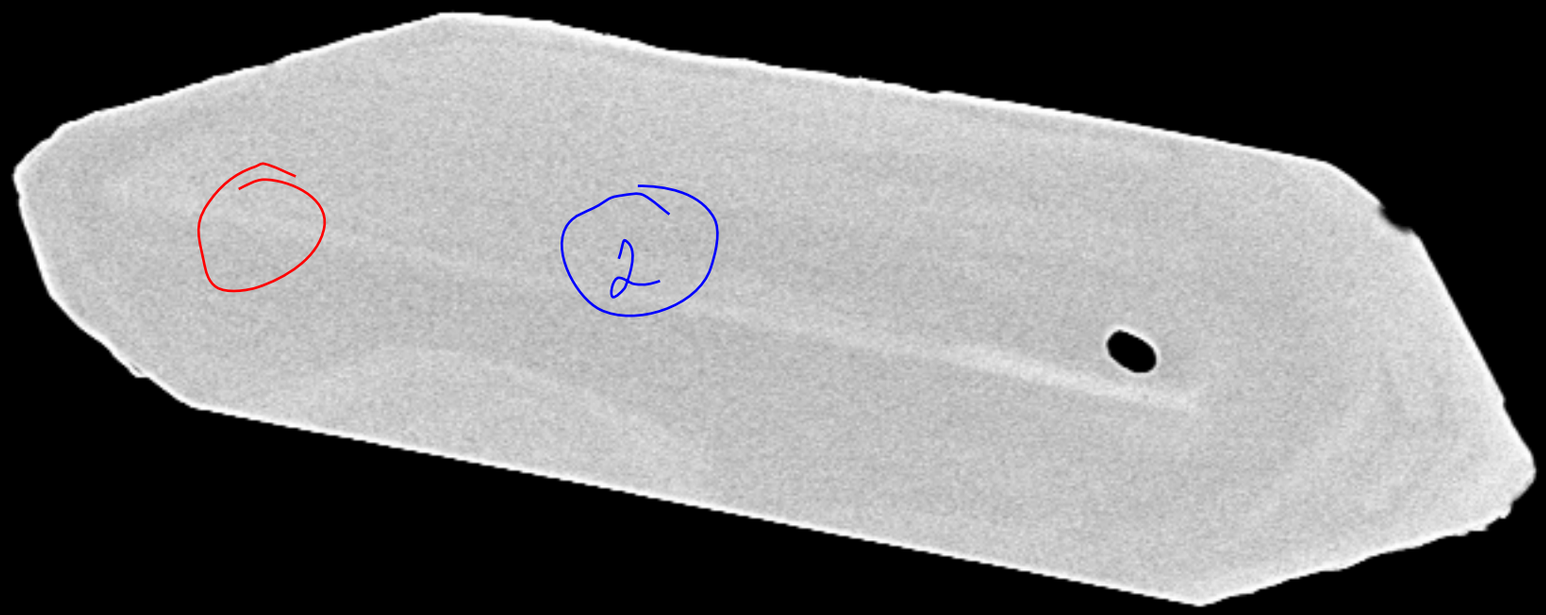
File Name = 10808-26.tif

97

98



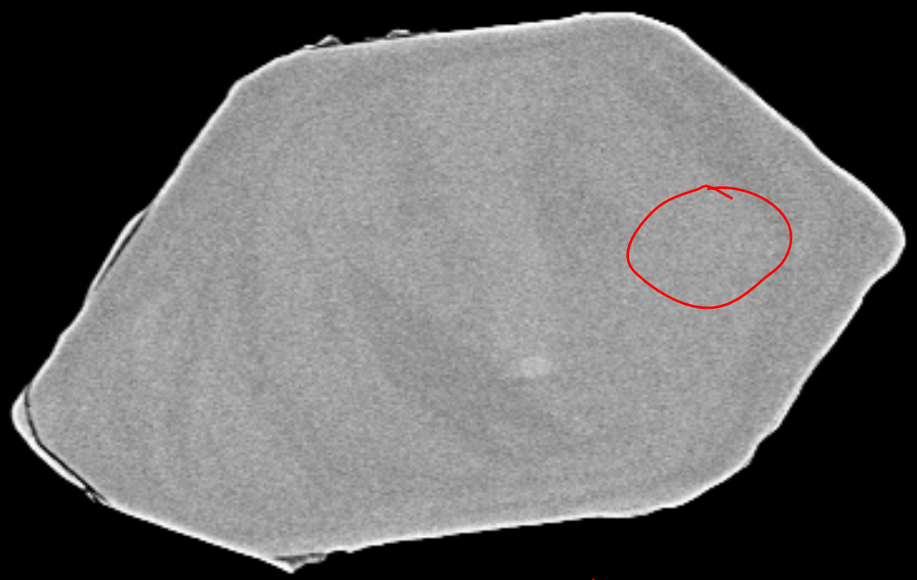
100

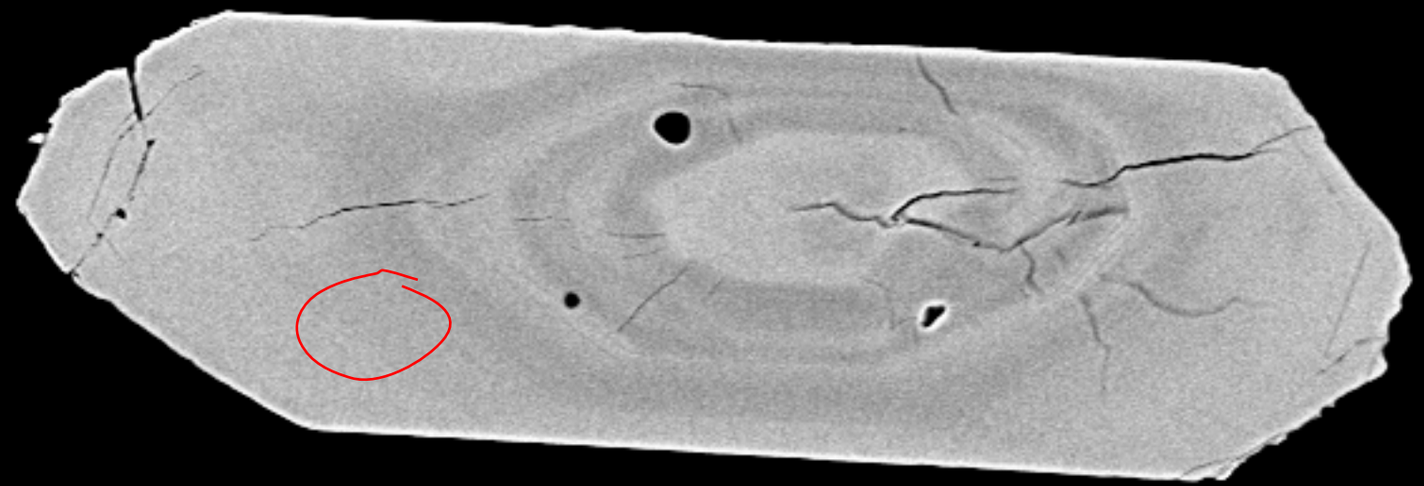


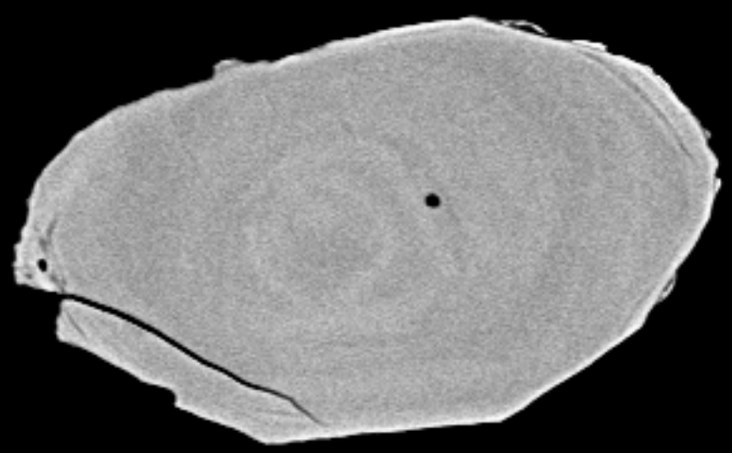
99

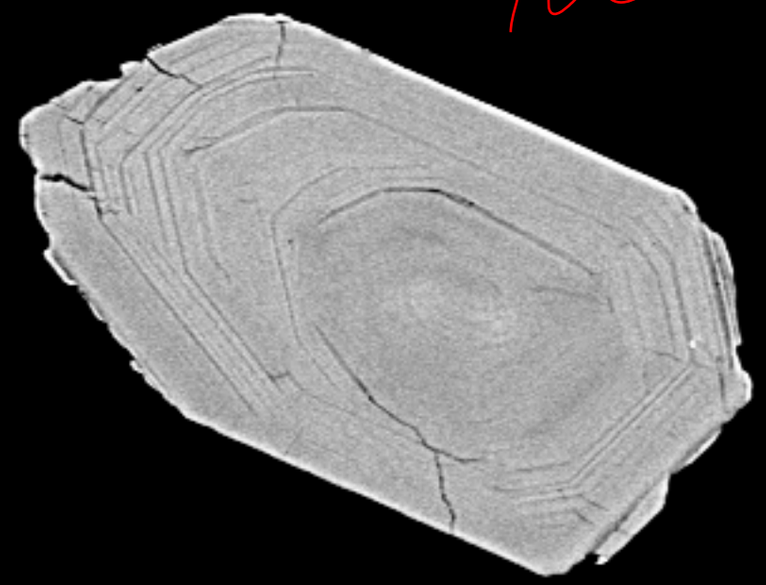
30 µm

File Name = 10808-27.tif



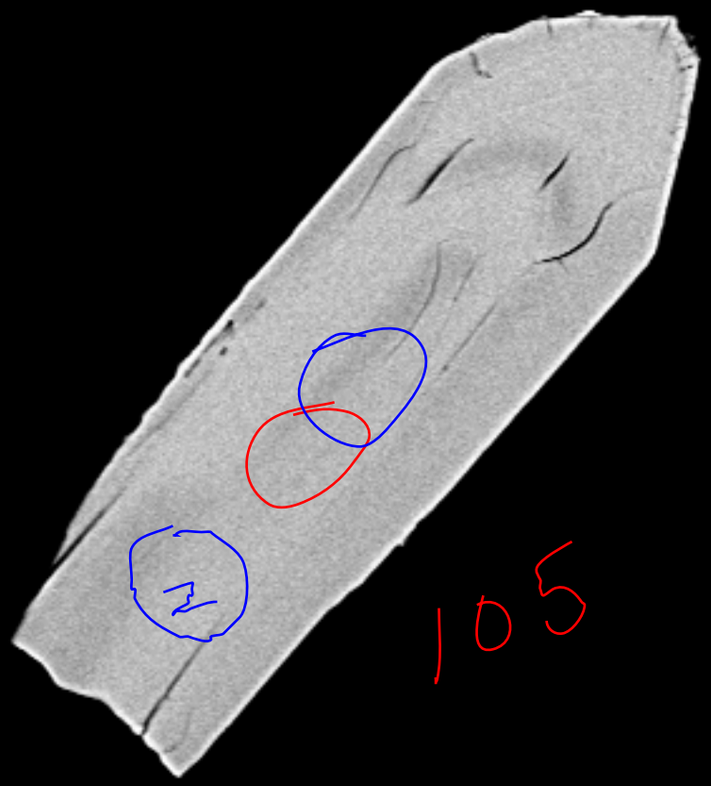


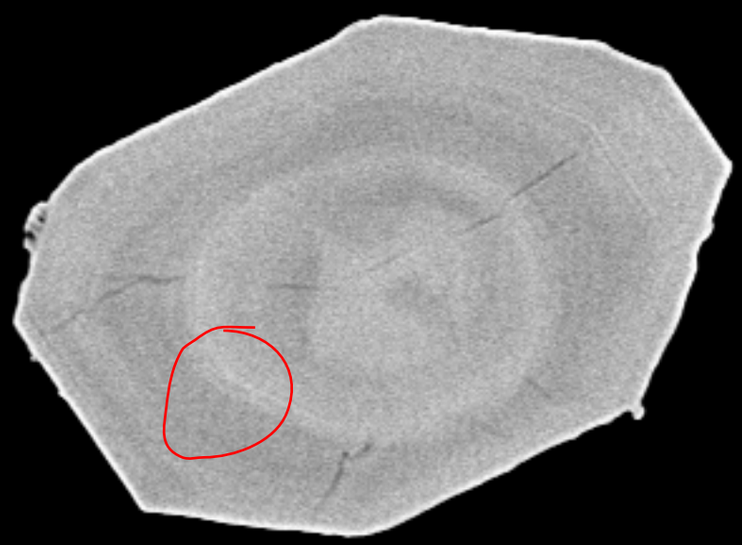




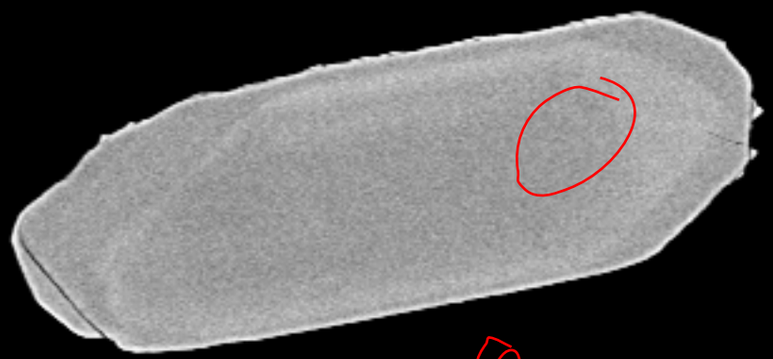
20 µm

File Name = 10808-28.tif

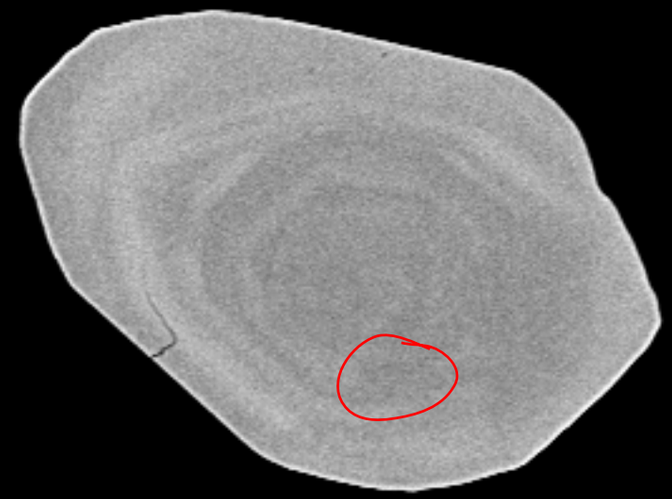




File Name = 10808-29.tif

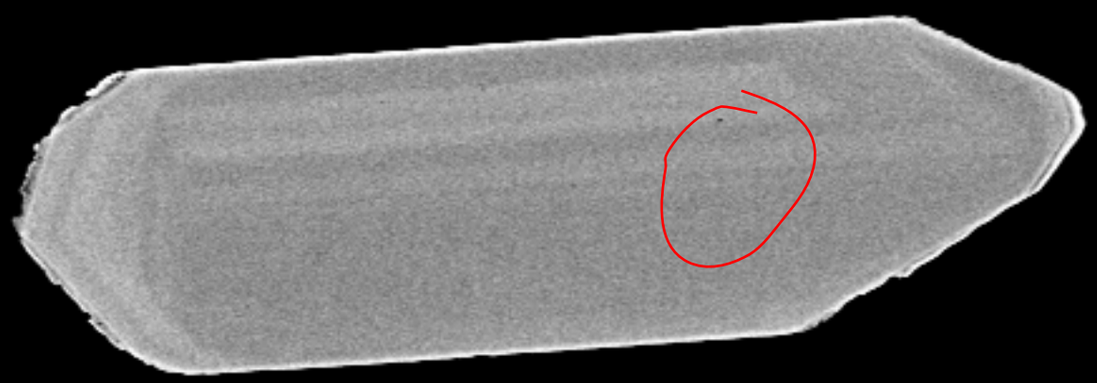


109

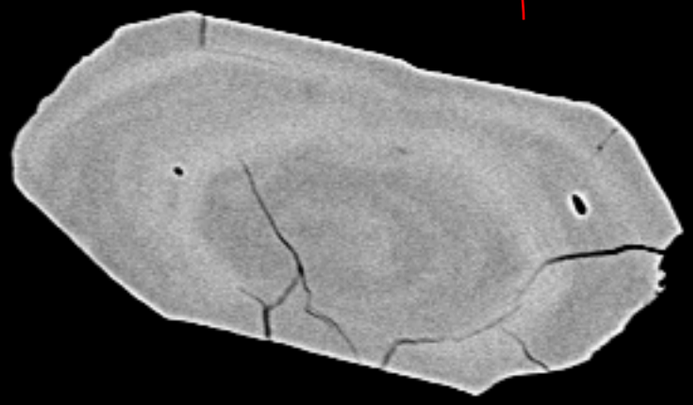


110

111

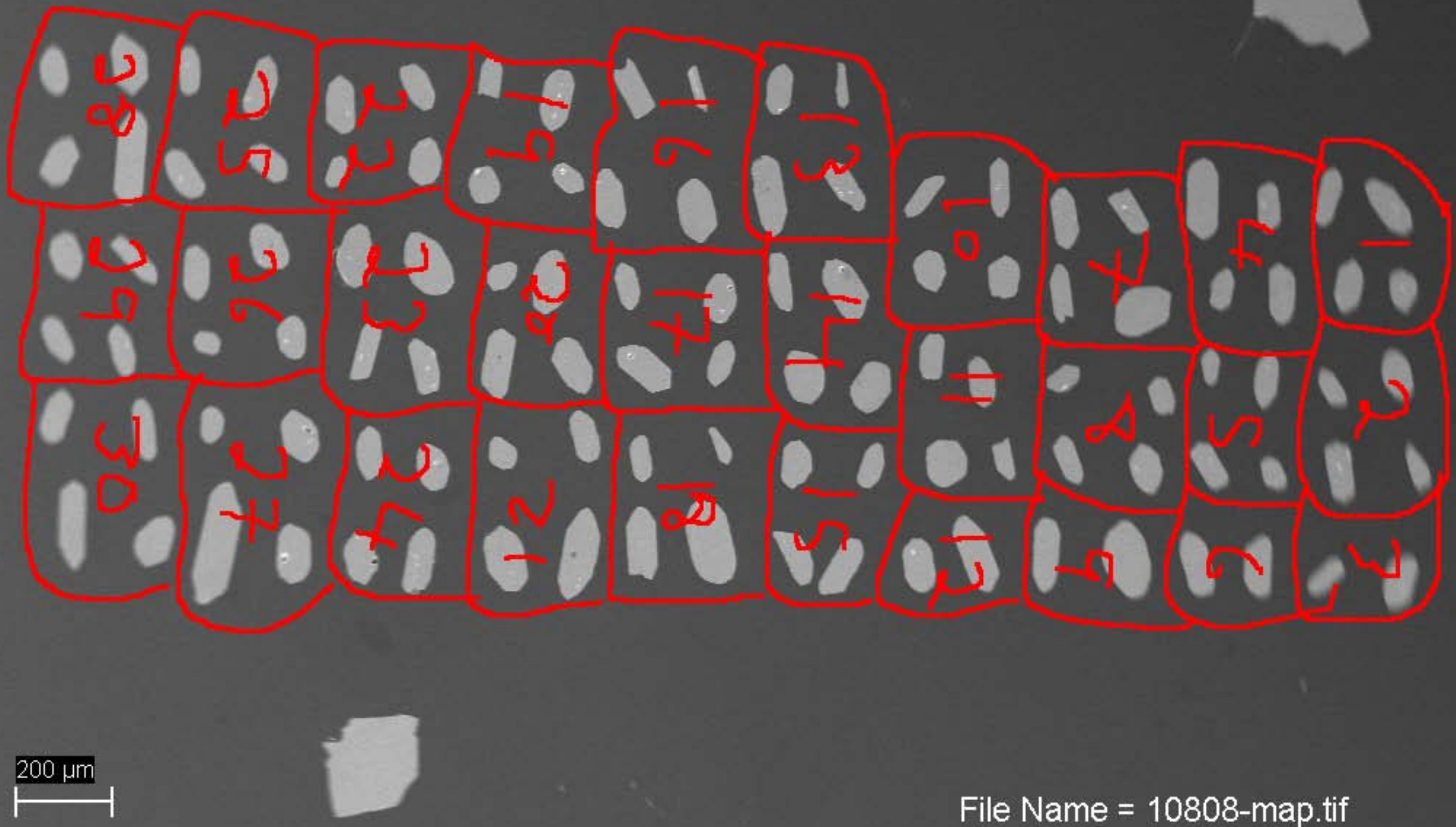


112



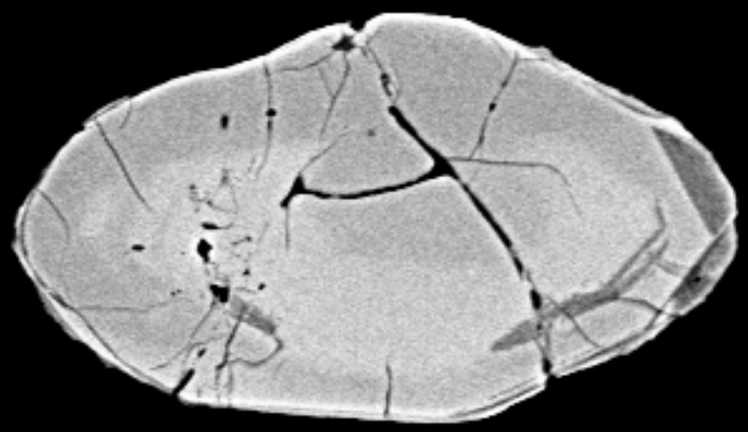
20 µm

File Name = 10808-30.tif


200 µm
File Name = 10808-map.tif

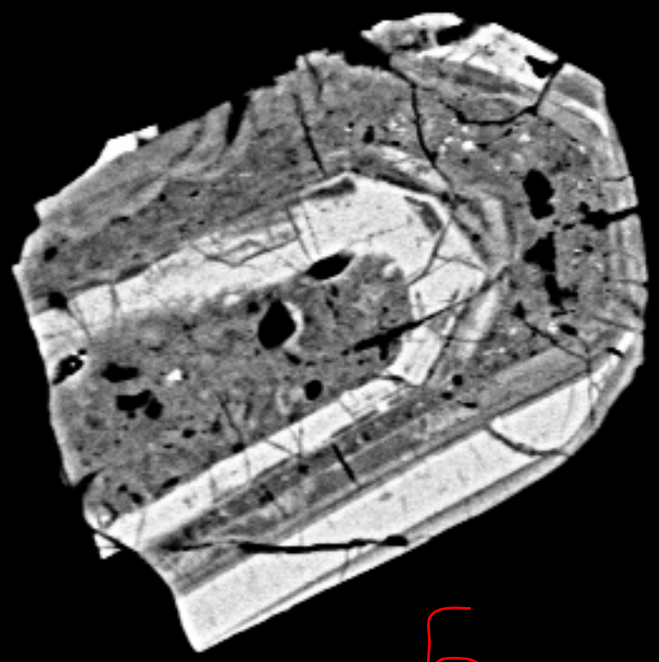
1
2
20 µm
File Name = 10809-01.tif

3



4

File Name = 10809-02.tif

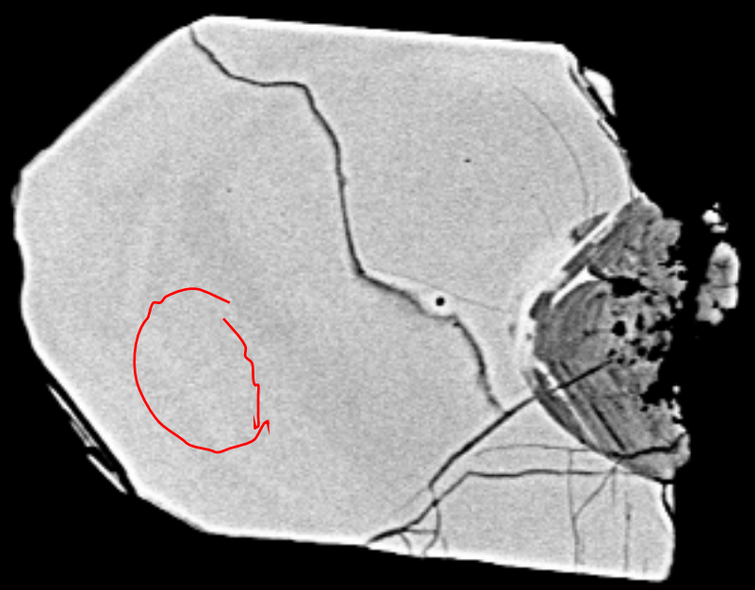


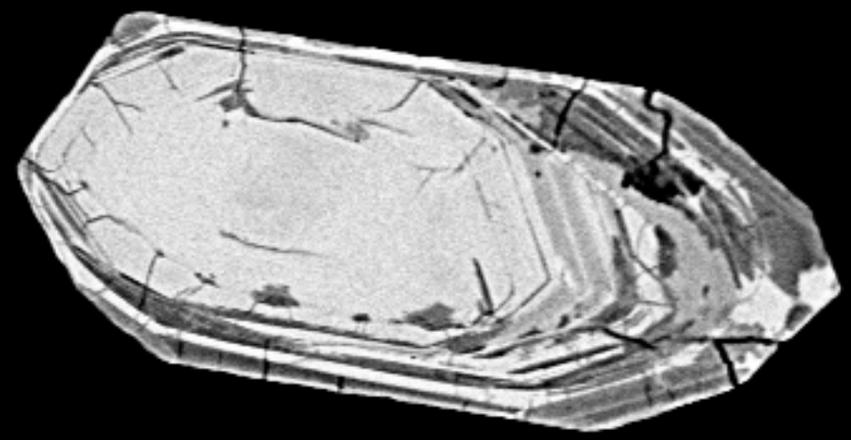
5

6

10 µm

File Name = 10809-03.tif

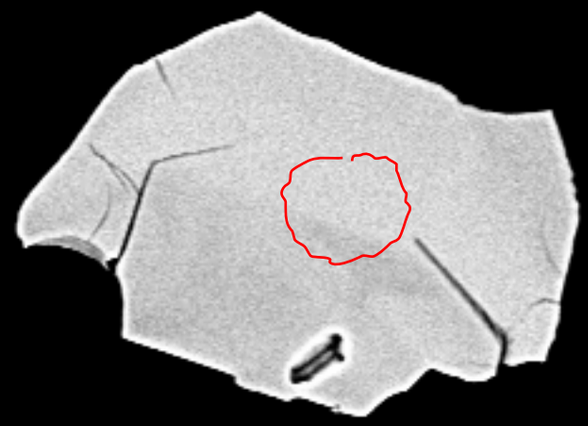

7


8

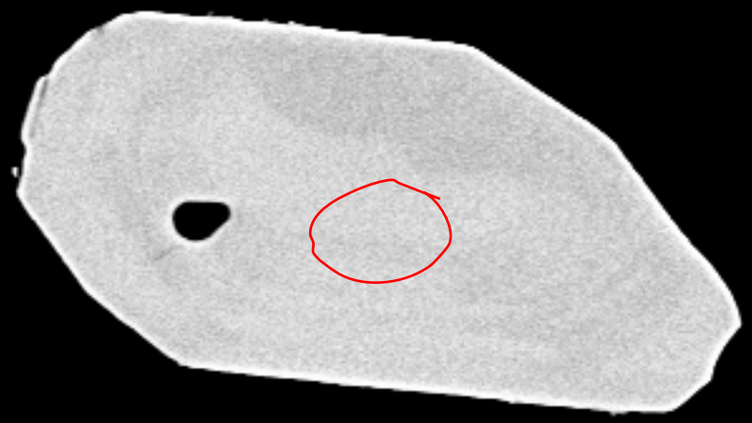
20 µm

File Name = 10809-04.tif

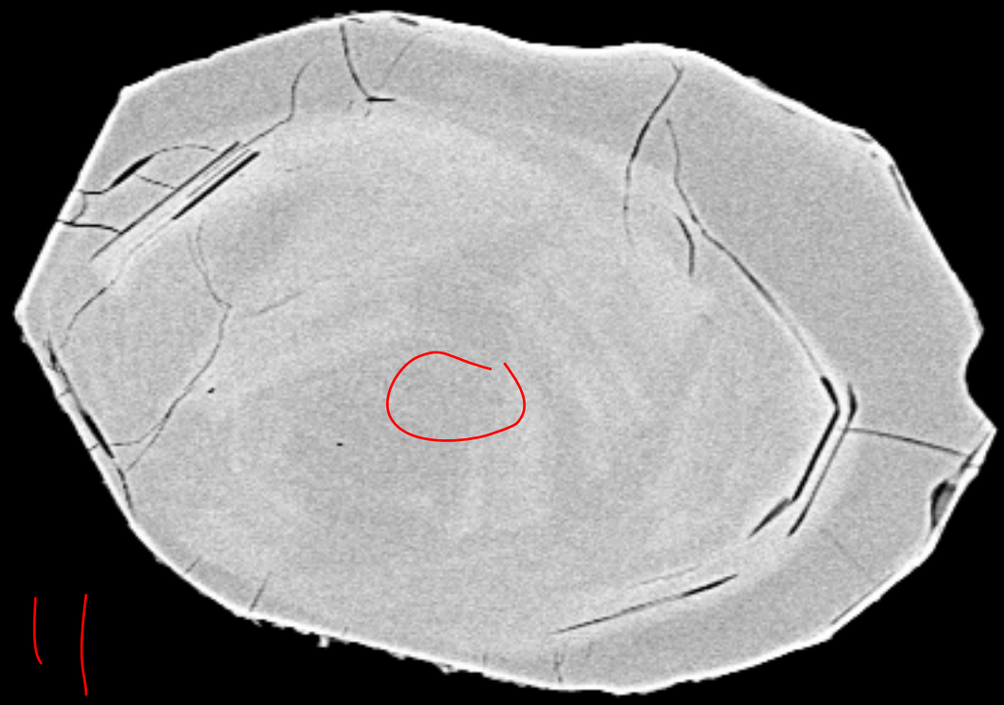
9



10



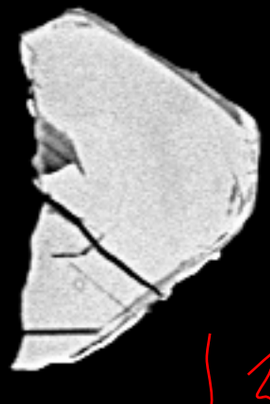
12



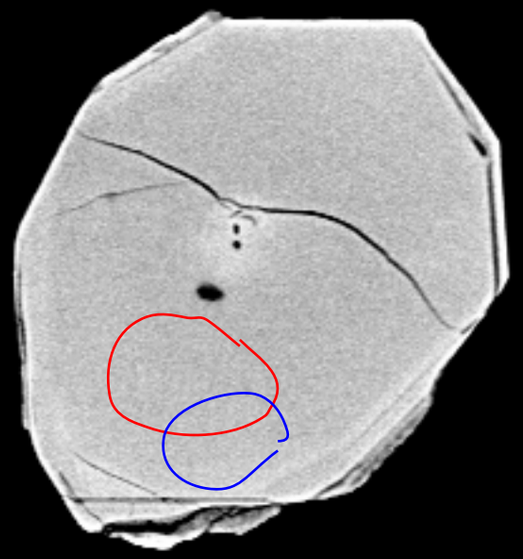
11

20 µm

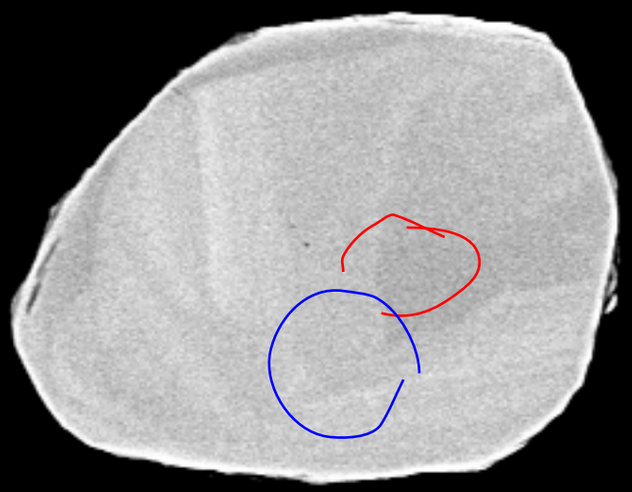
File Name = 10809-05.tif



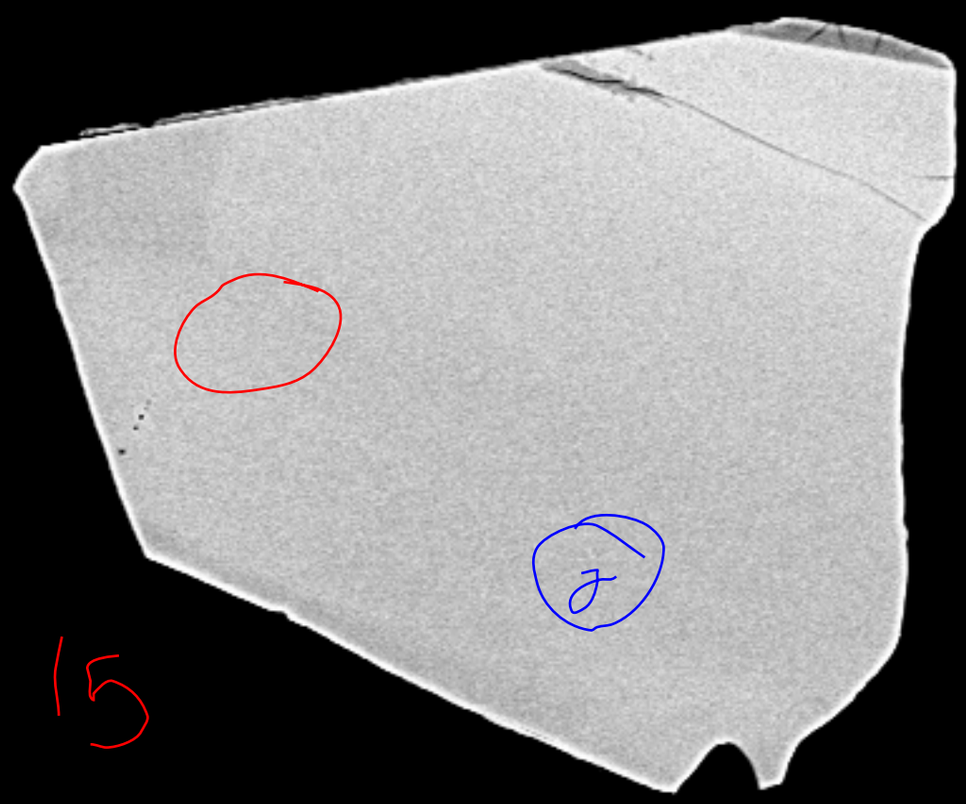
13



14



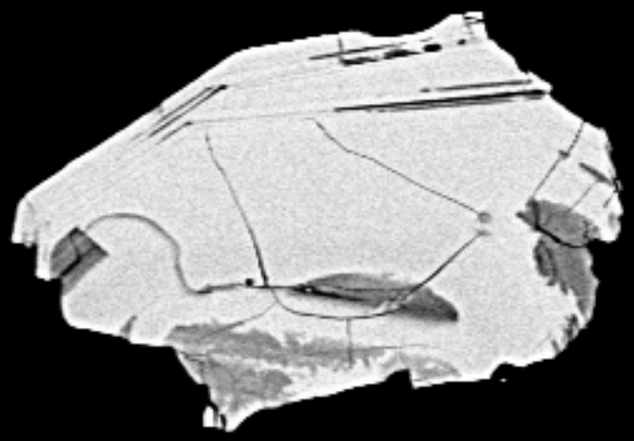
16



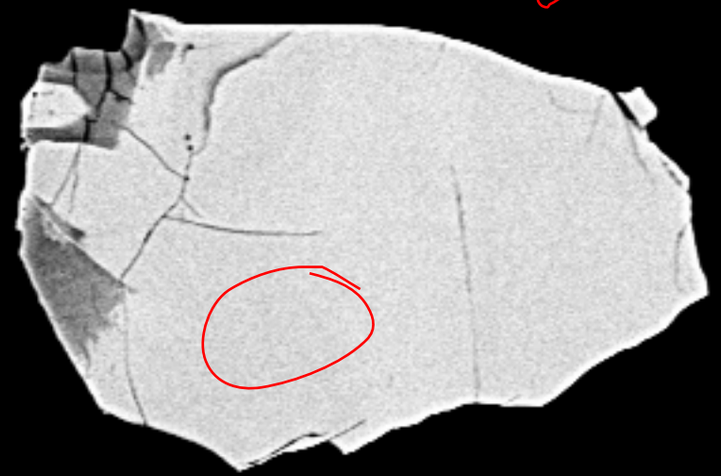
15

20 µm

File Name = 10809-06.tif

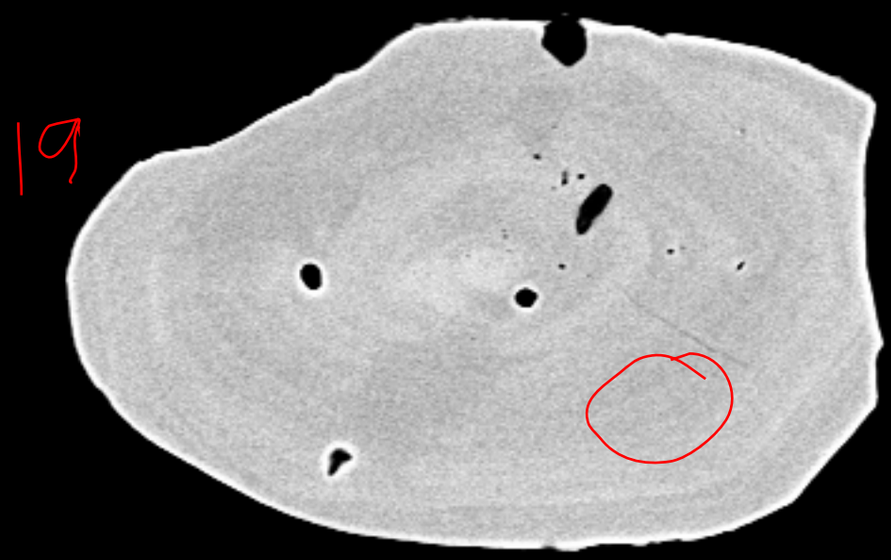


17



18

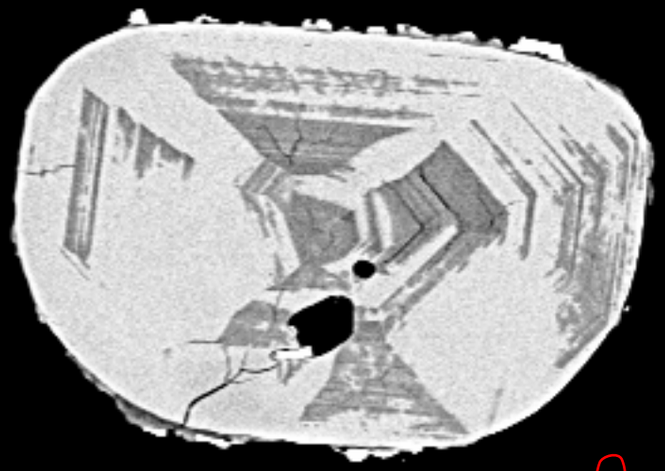
20



19

20 µm

File Name = 10809-07.tif



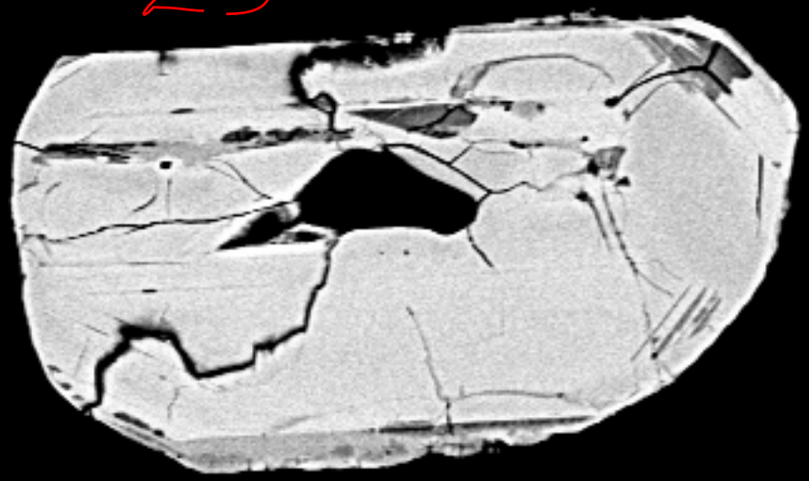
21

22

24

20 µm

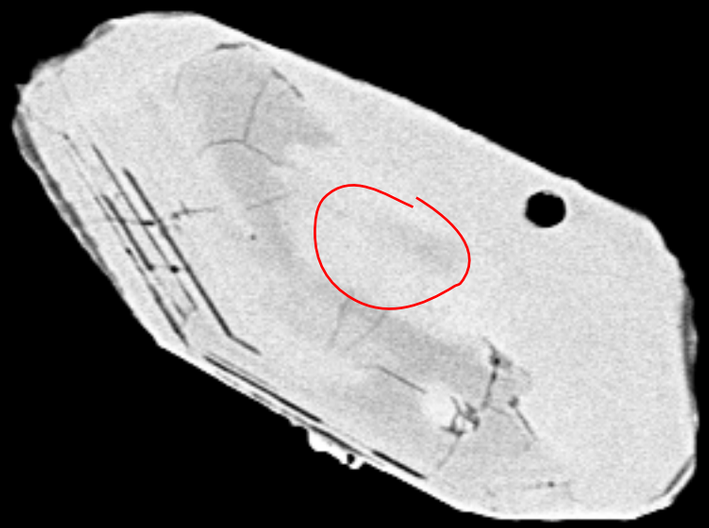
23



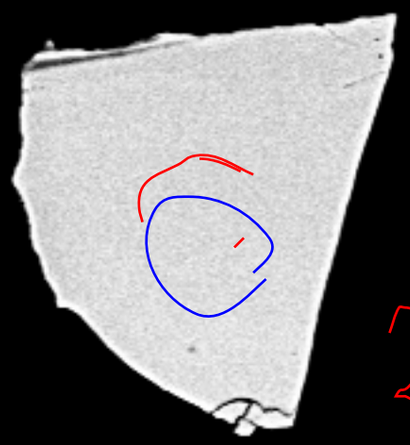
File Name = 10809-08.tif

25

26



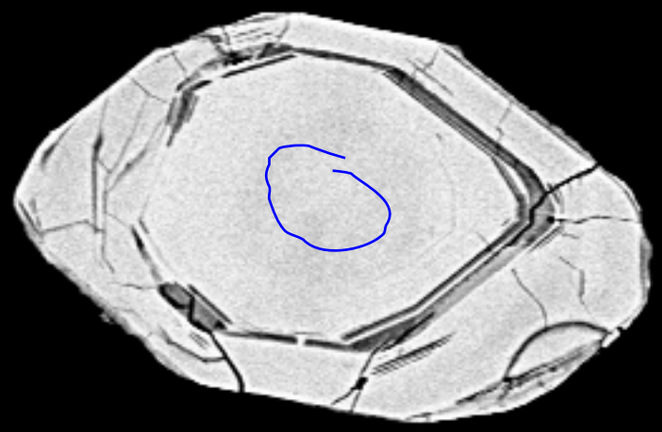
28



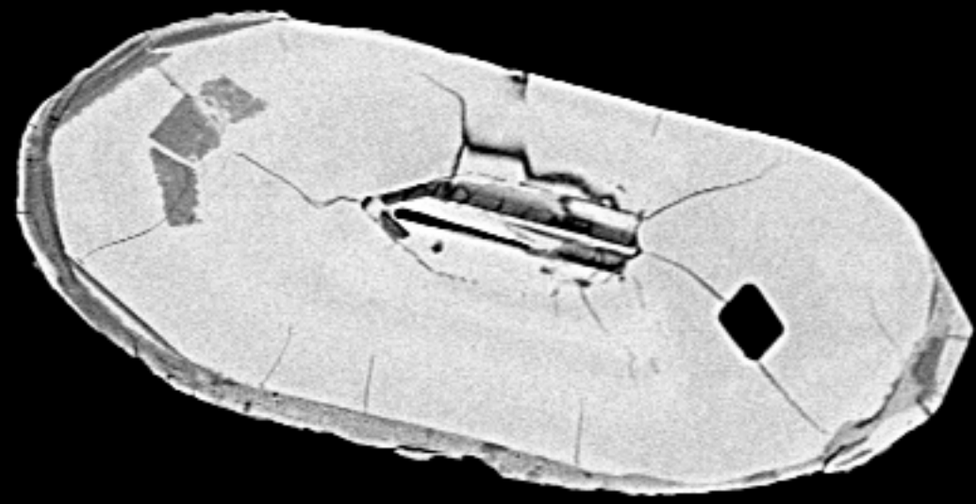
27

20 µm

File Name = 10809-09.tif

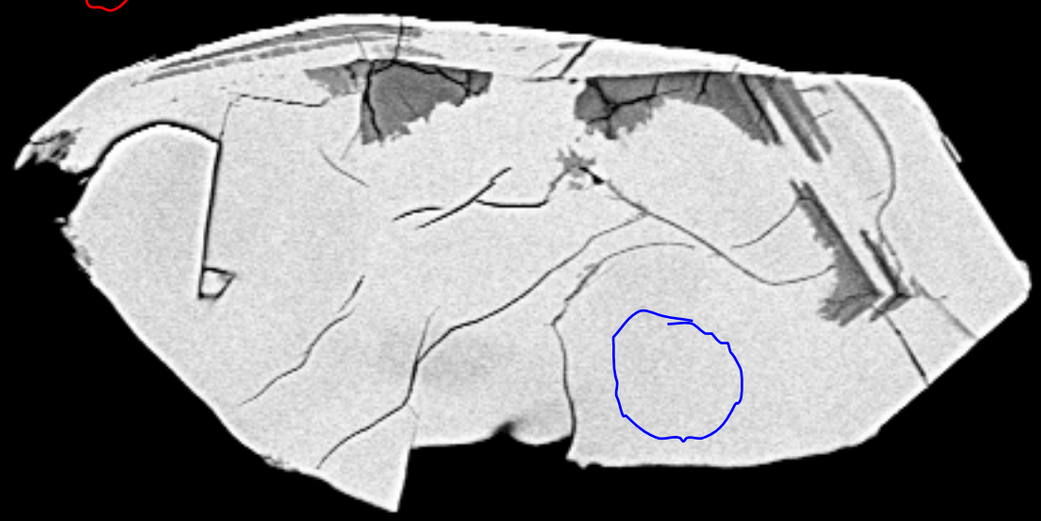


29



30

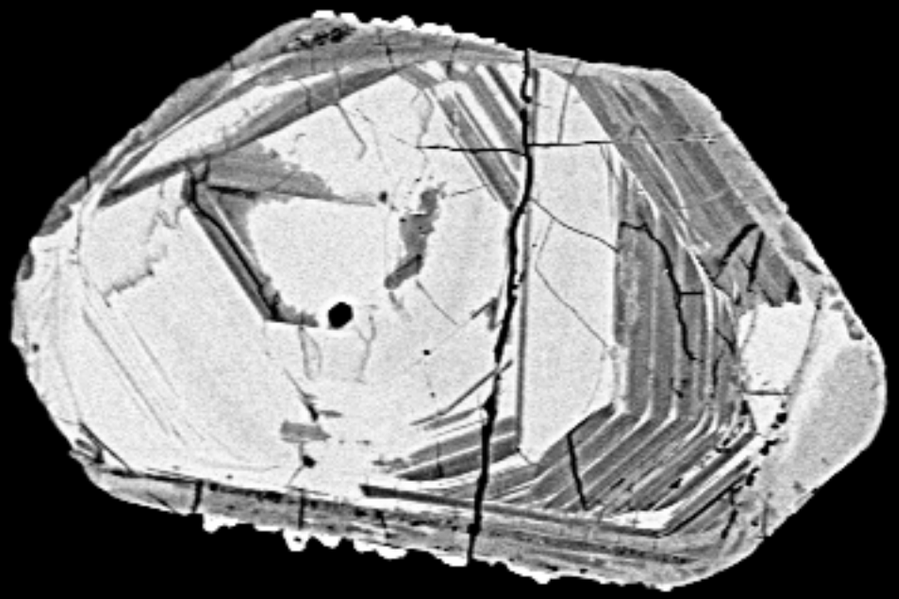
32



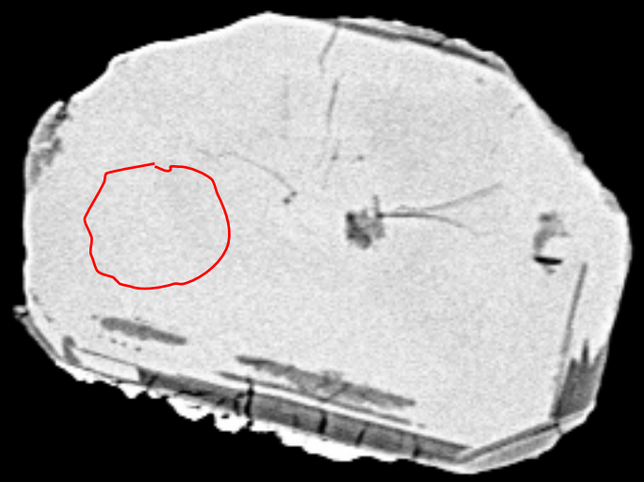
31

20 µm

File Name = 10809-10.tif

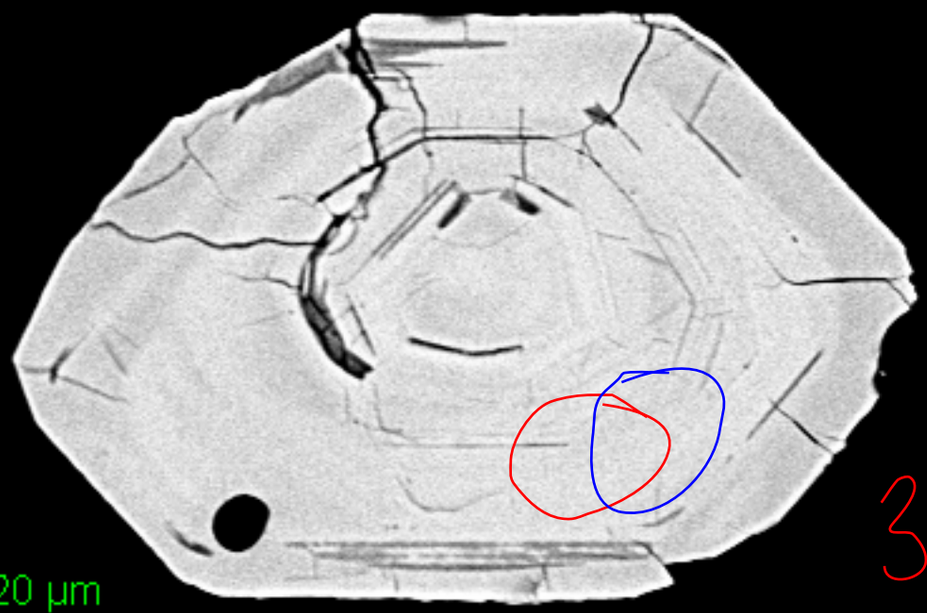


33

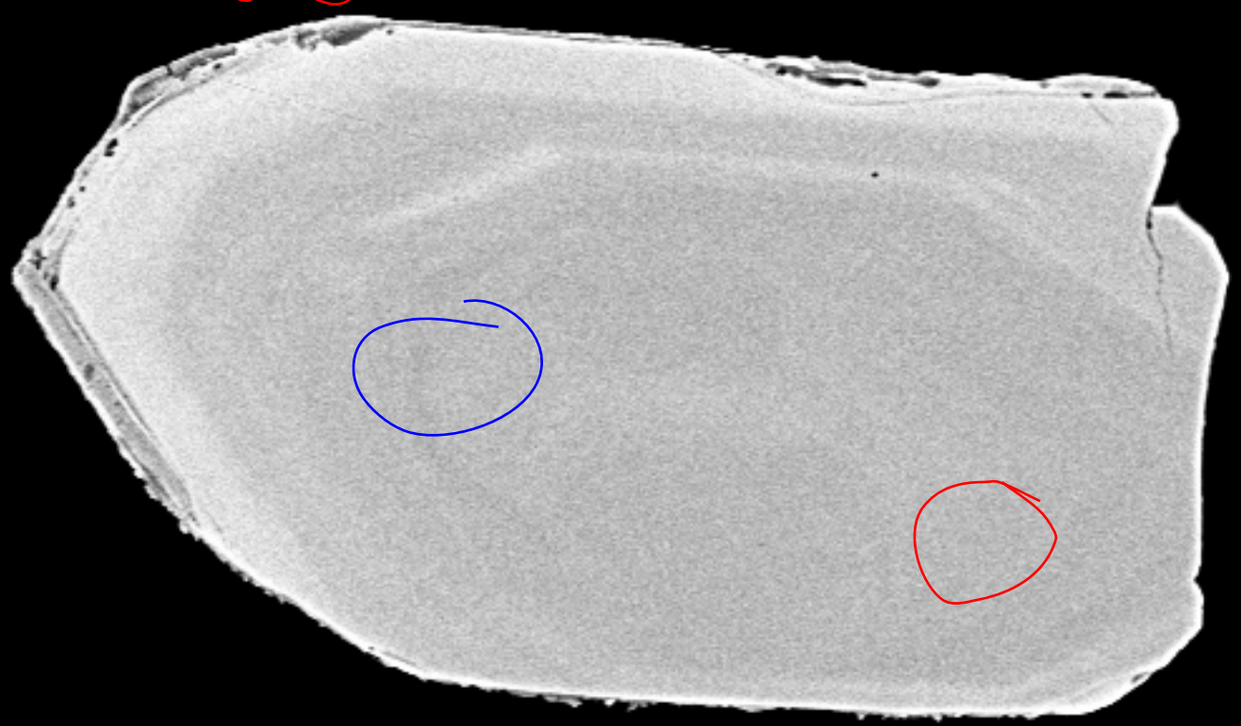


34

35

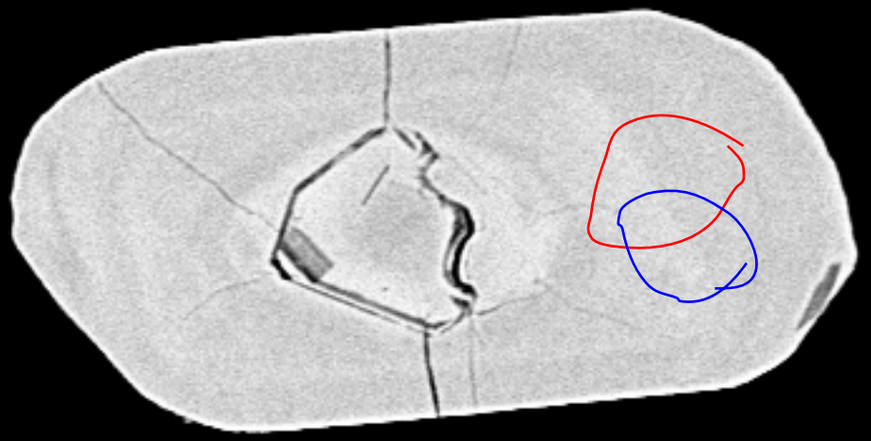


36

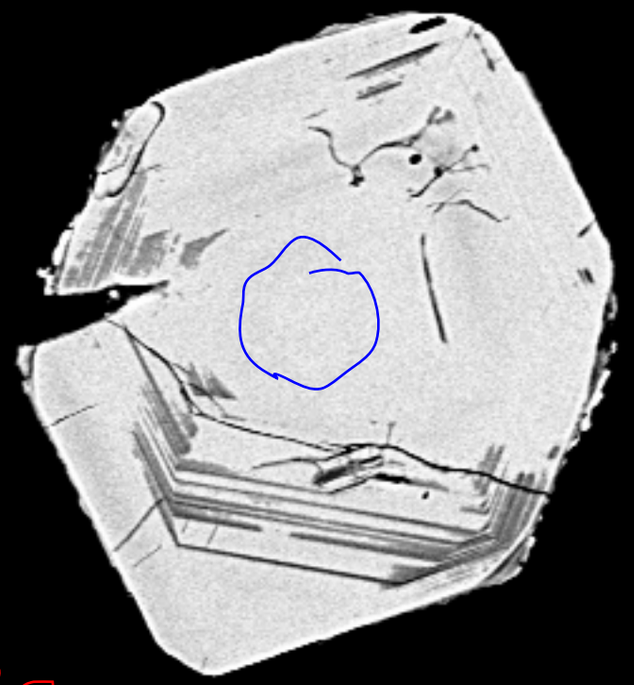


File Name = 10809-11.tif

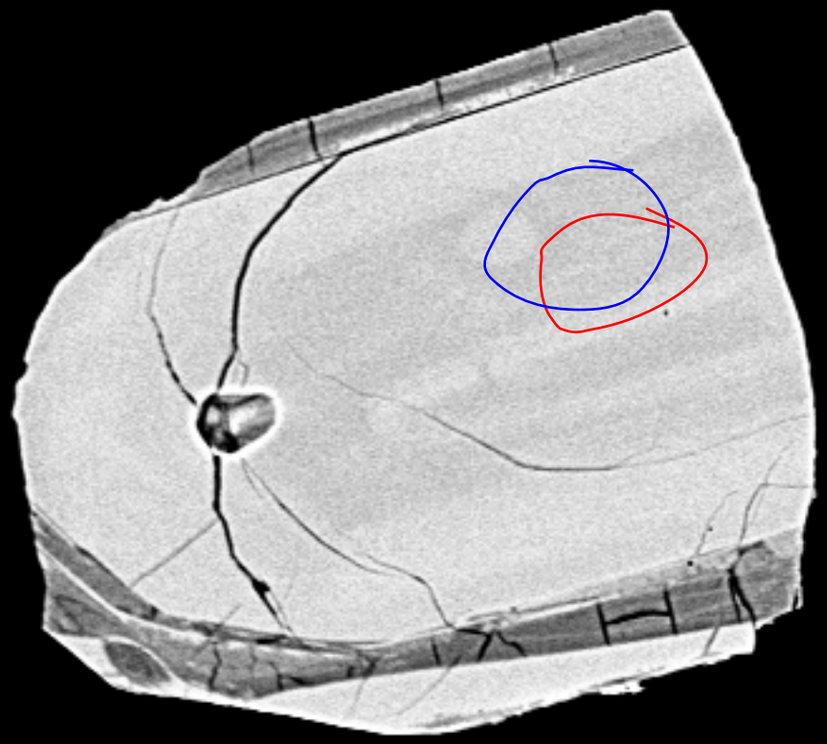
37



38



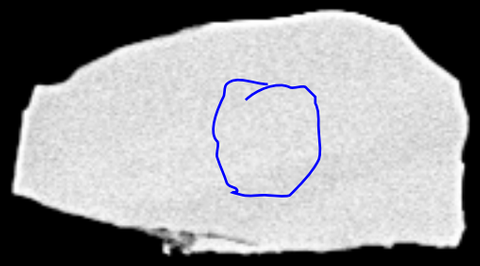
39



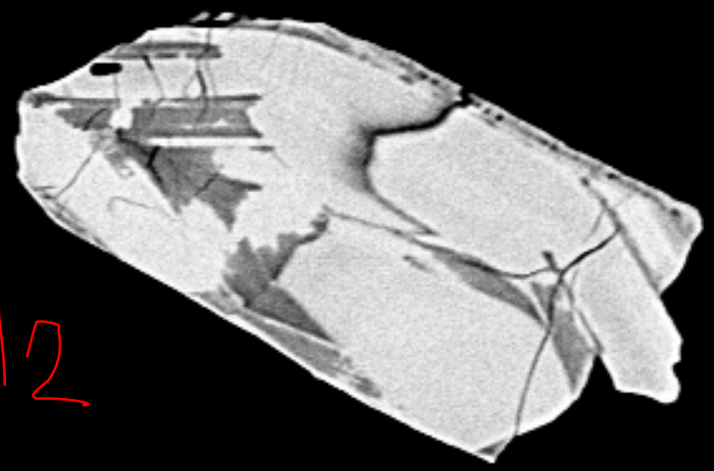
40

20 µm

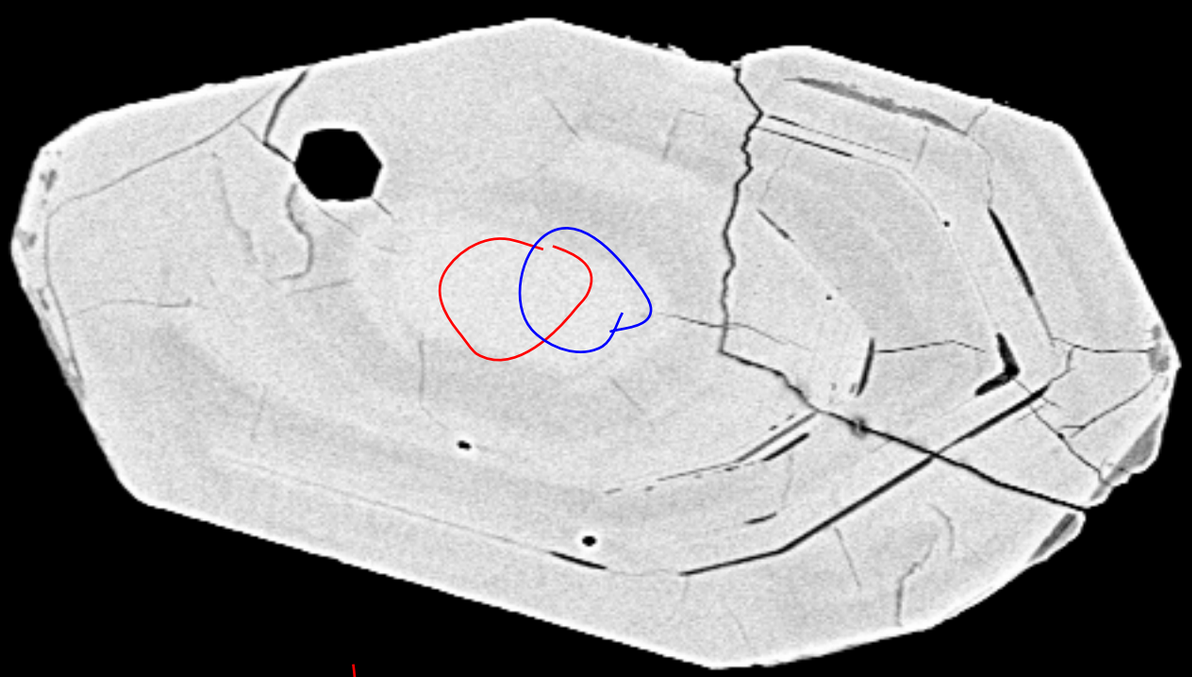
File Name = 10809-12.tif



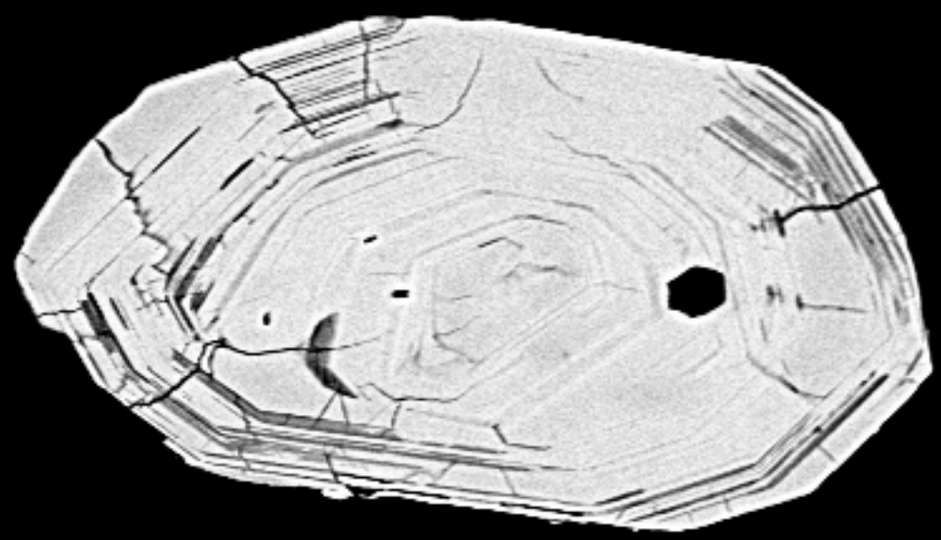
41



42



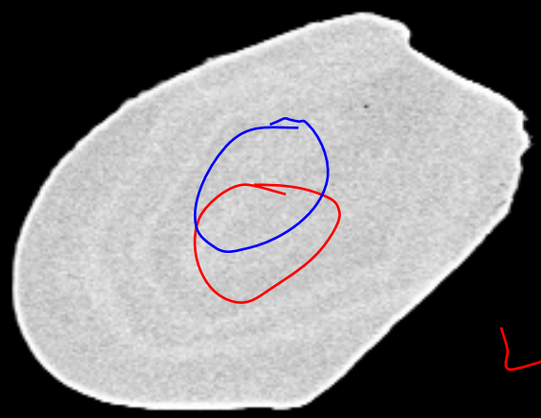
44



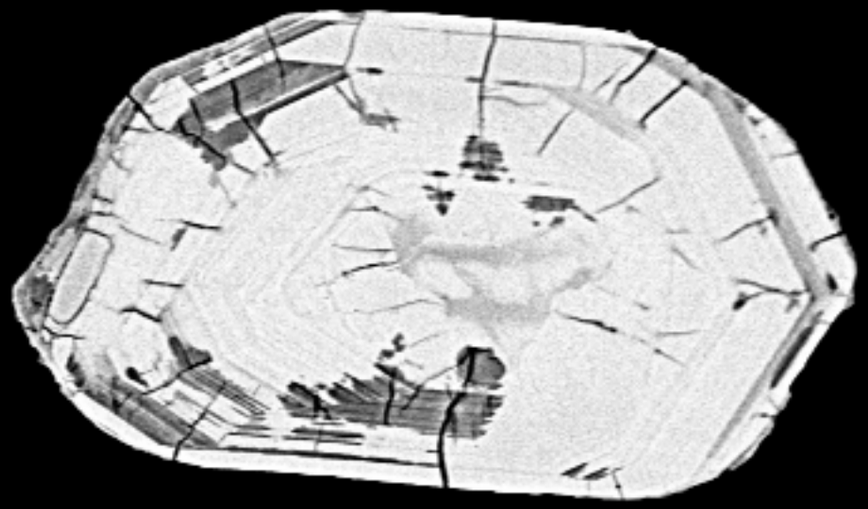
43

30 µm

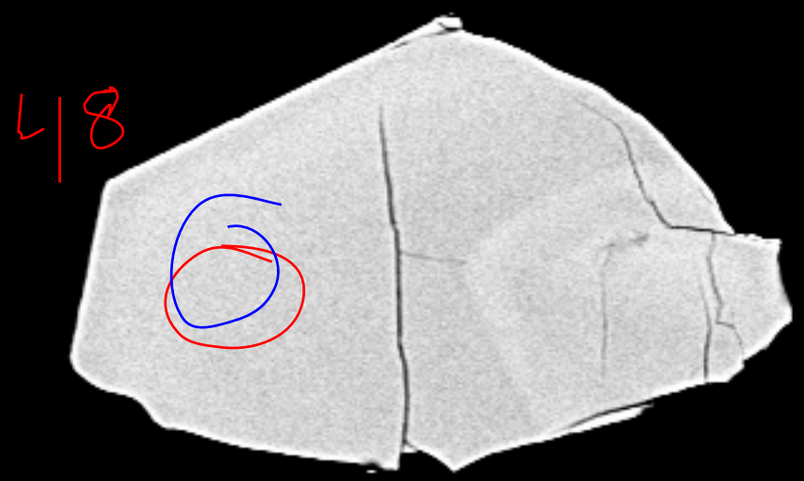
File Name = 10809-13.tif



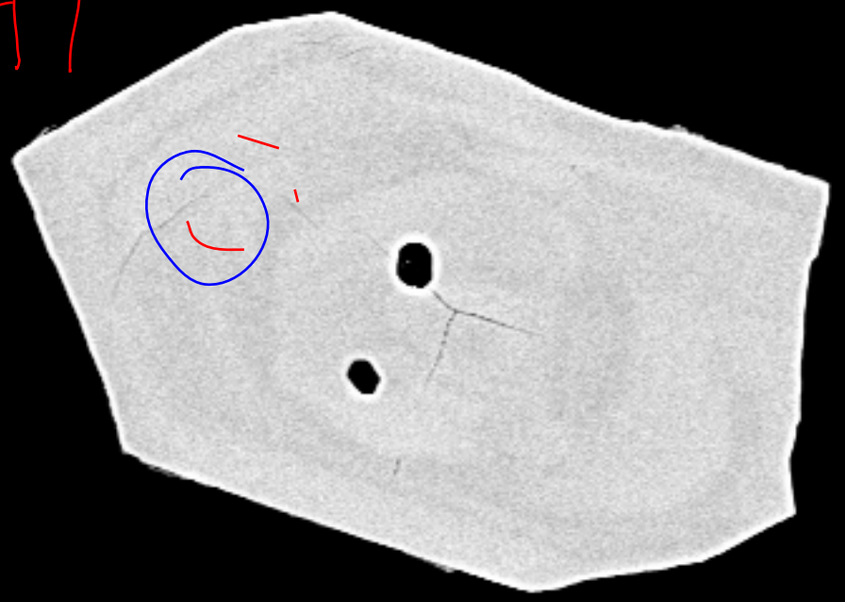
45



46



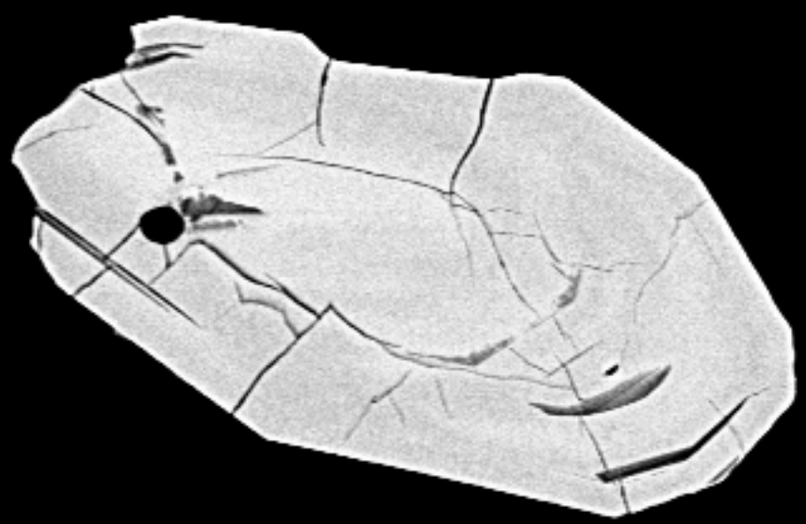
48



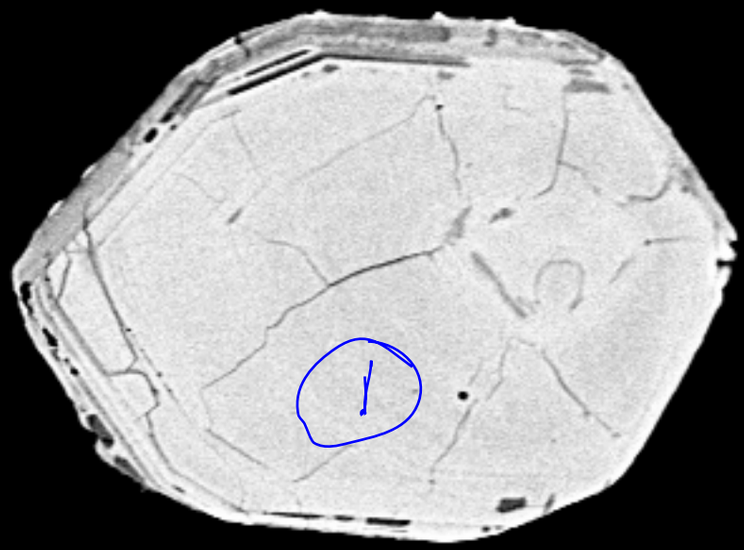
47

30 µm

File Name = 10809-14.tif

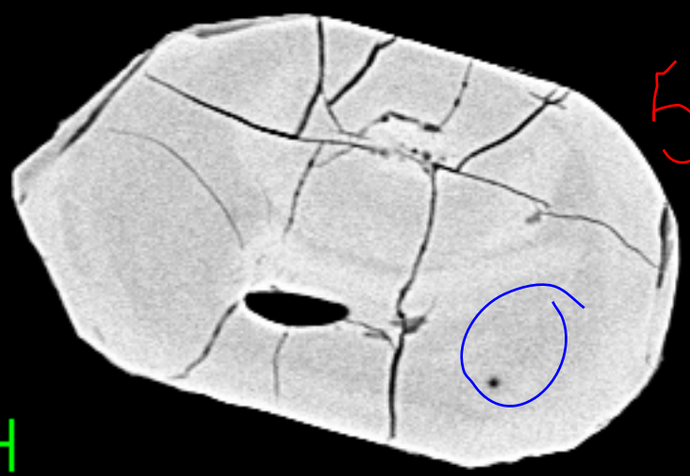


49



1

56

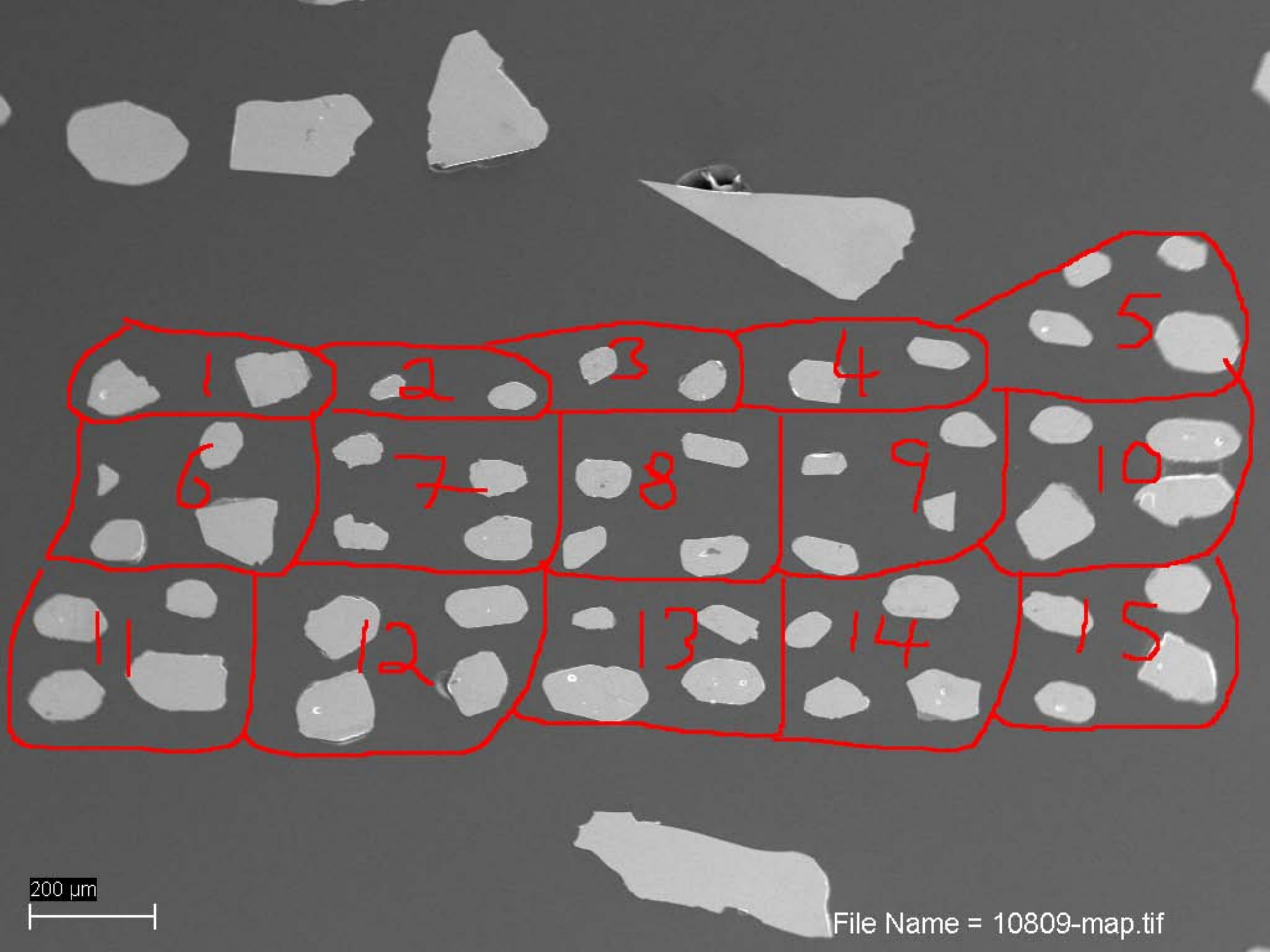


52

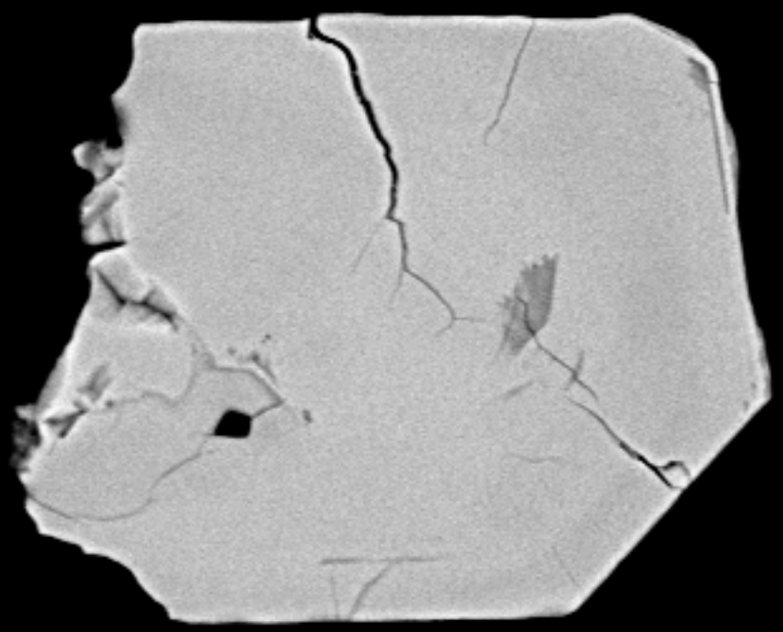
51

30 µm

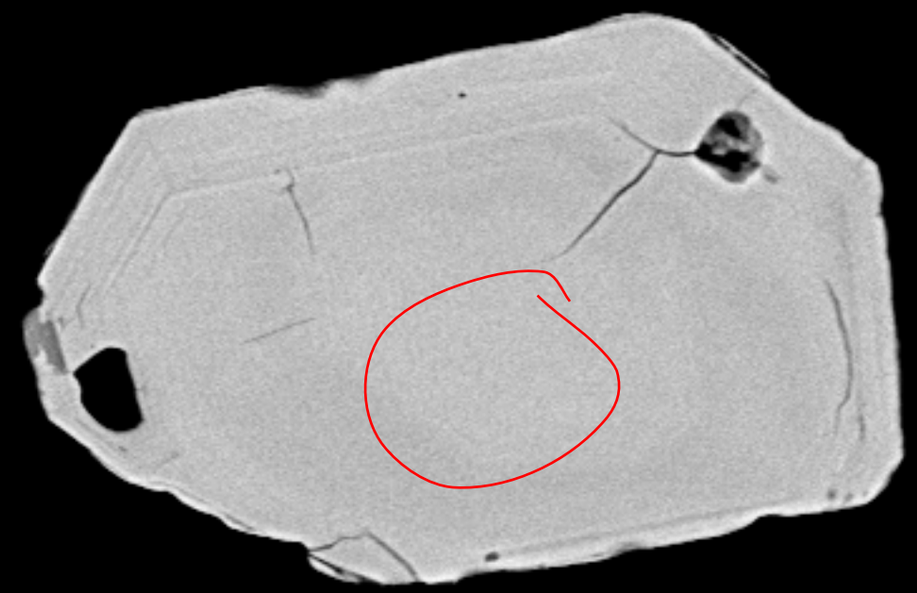
File Name = 10809-15.tif


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
200 µm
File Name = 10809-map.tif

1
2
20 µm
File Name = 10810-01.tif



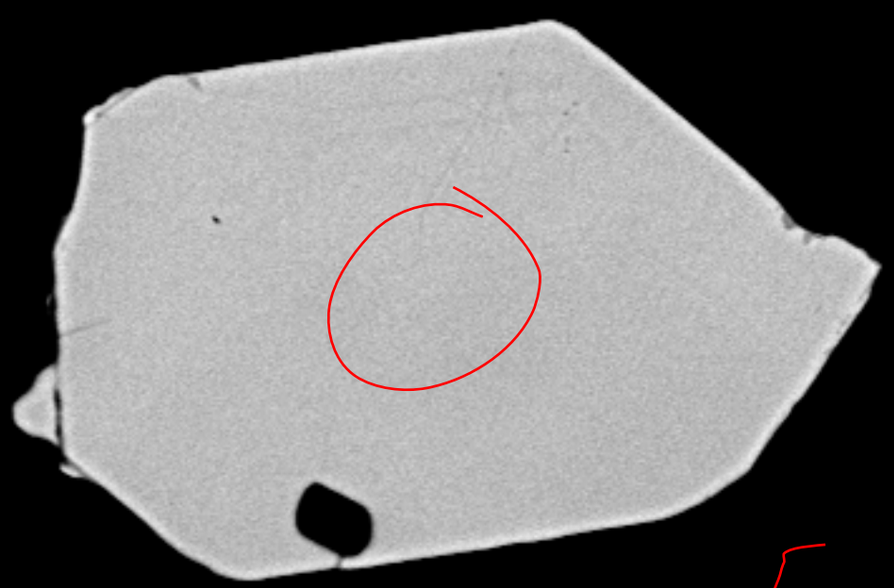
3

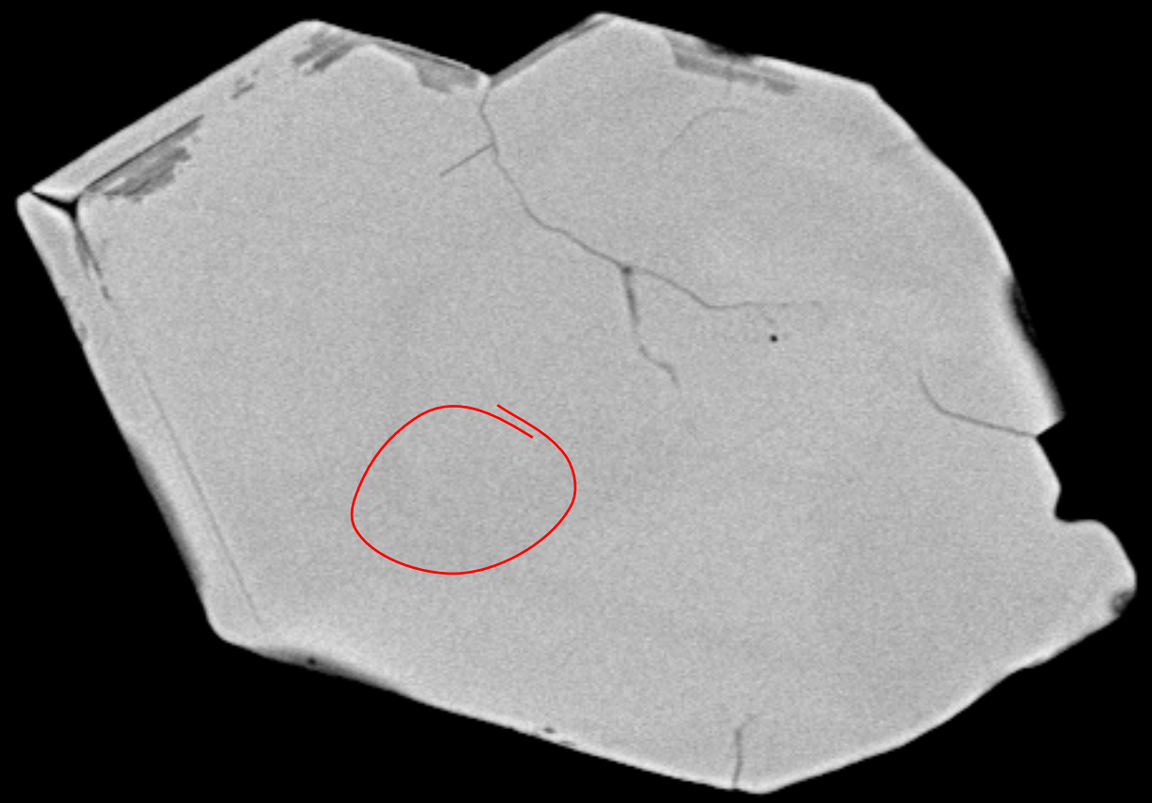


4

20 µm

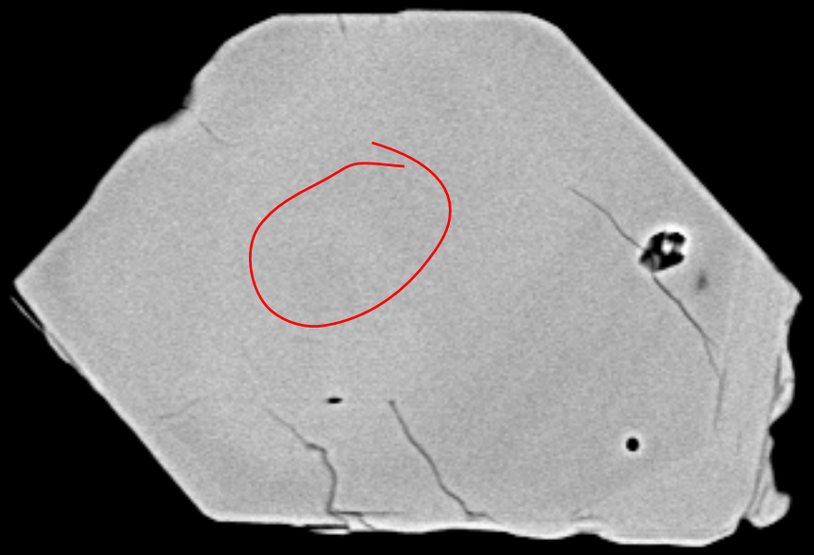
File Name = 10810-02.tif



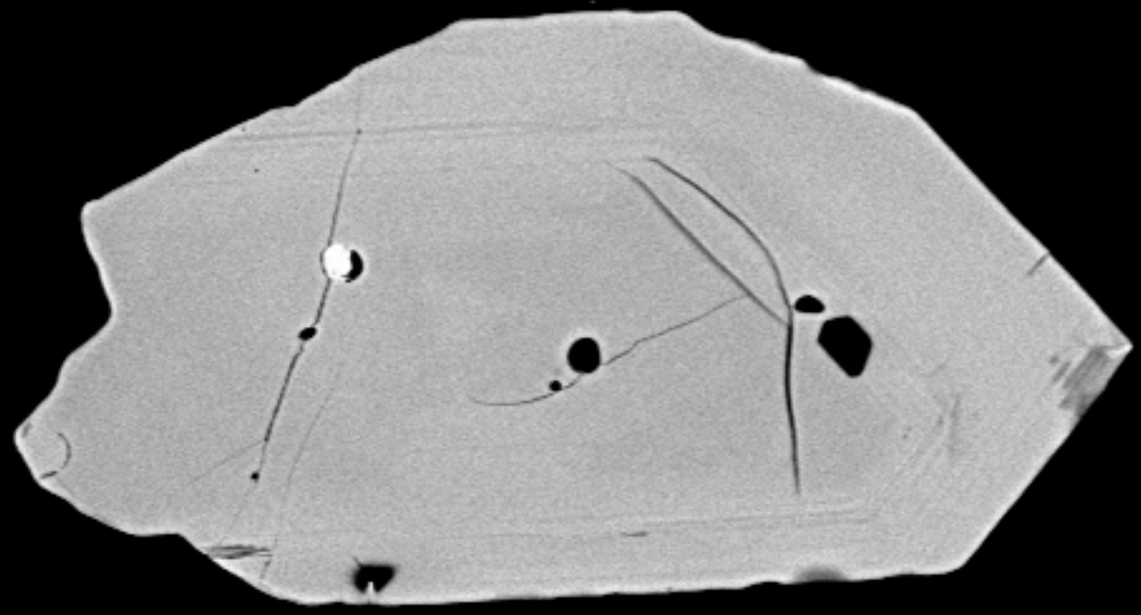


20 µm

File Name = 10810-03.tif



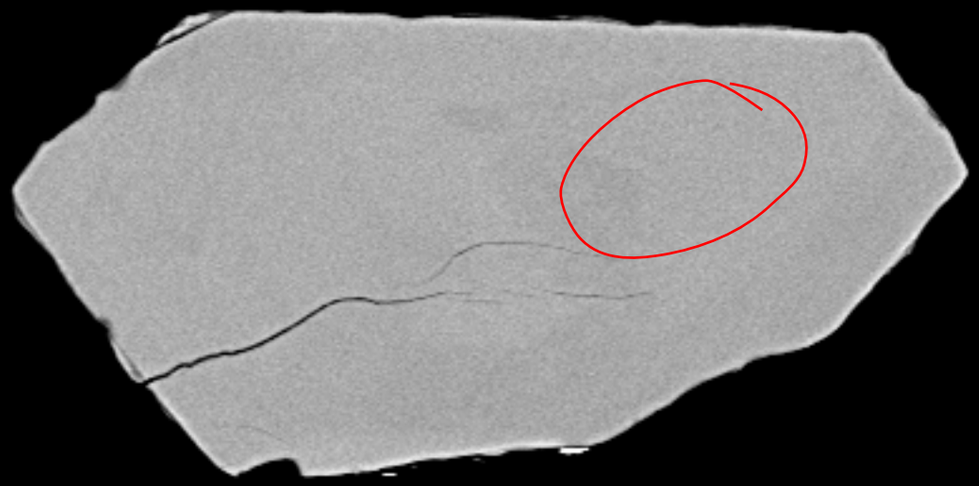
7



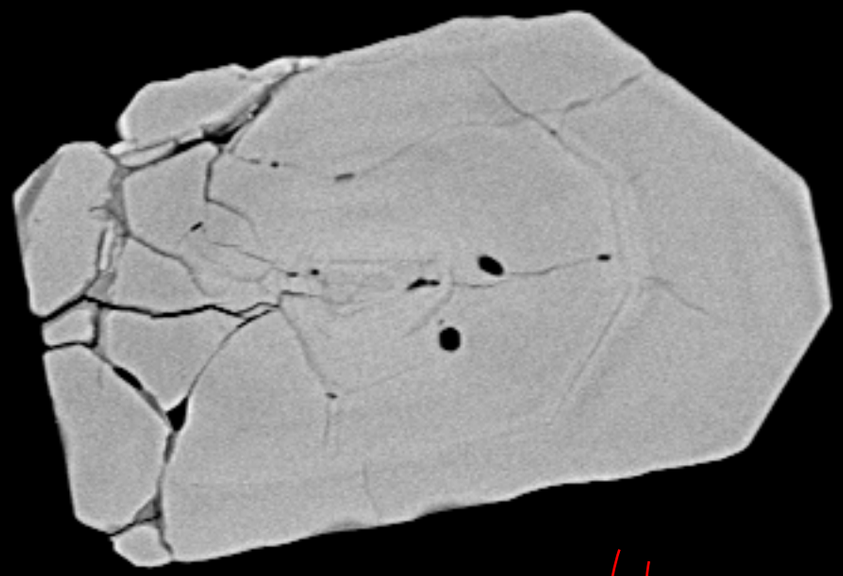
8

20 µm

File Name = 10810-04.tif

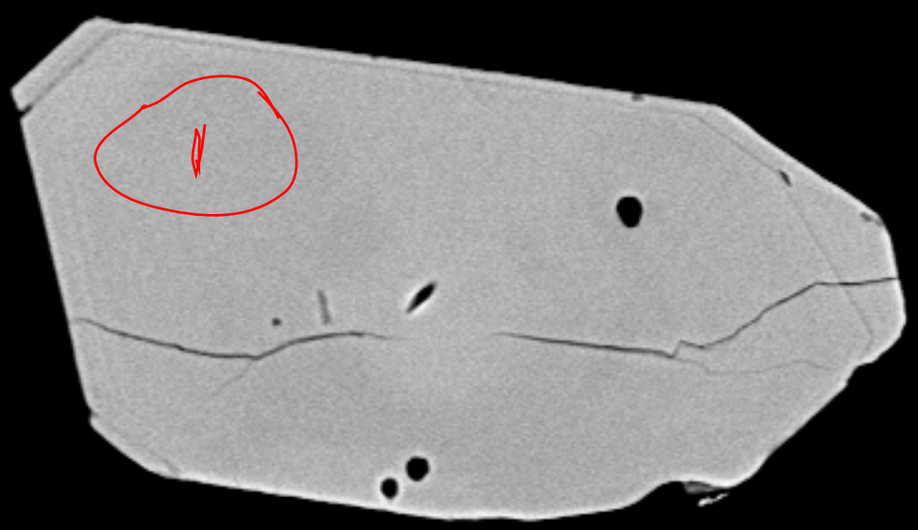


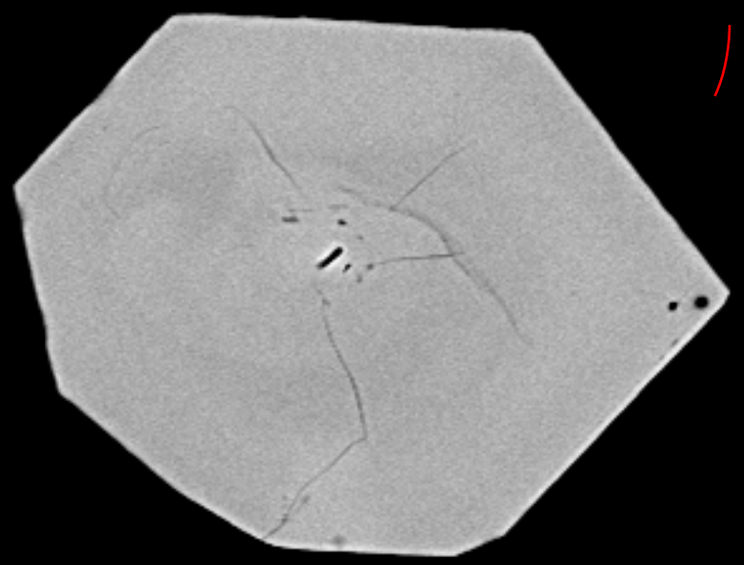
10



11

9

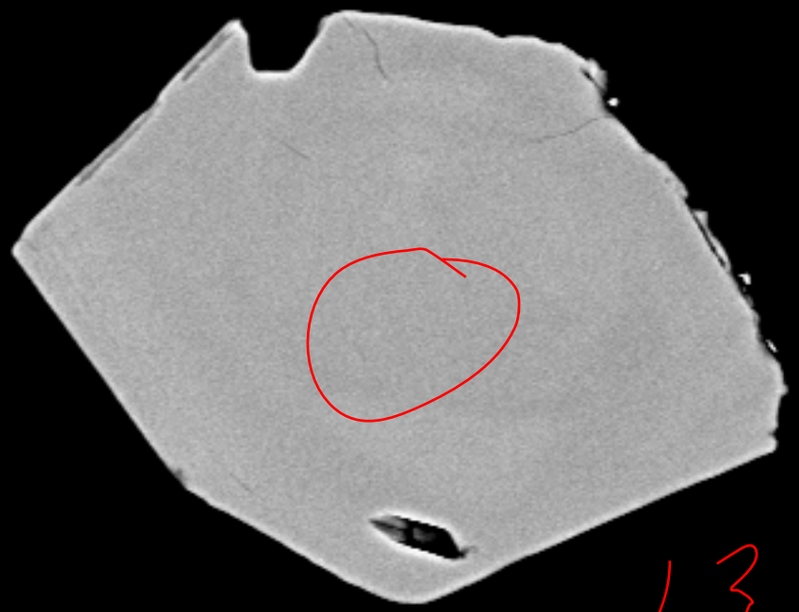


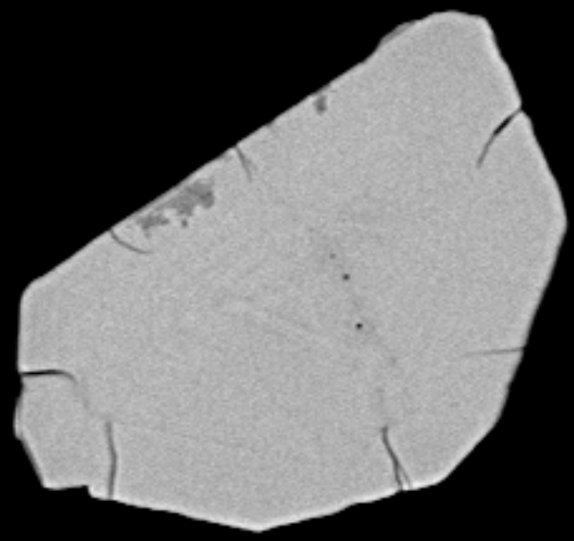


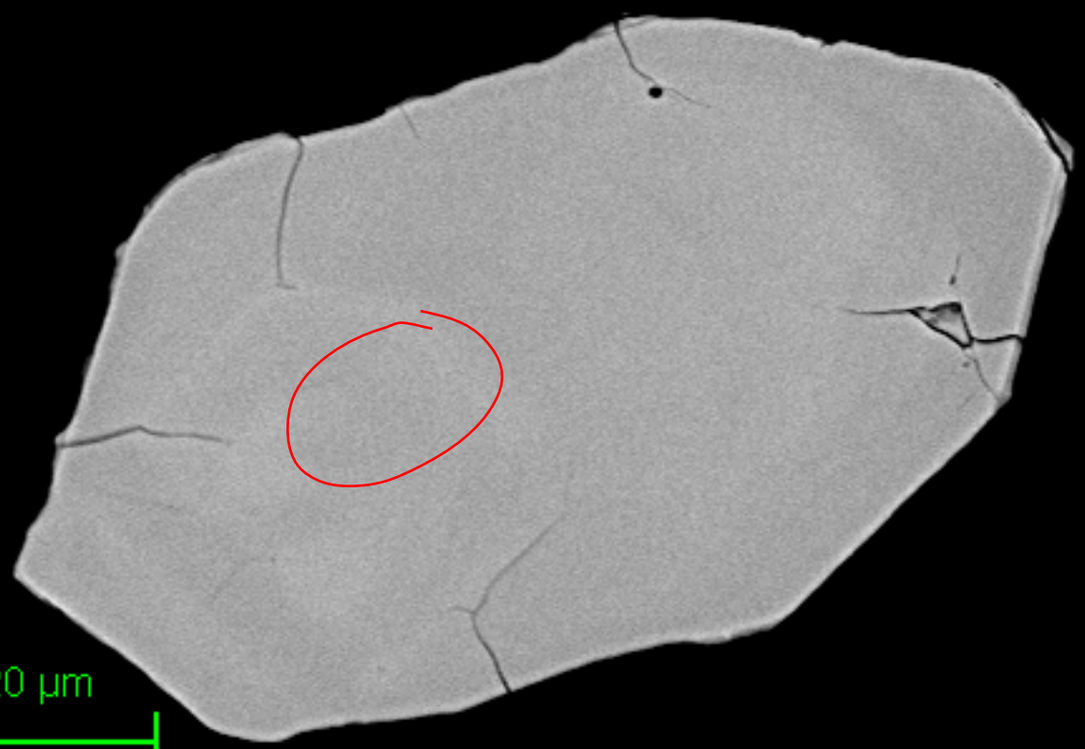
12

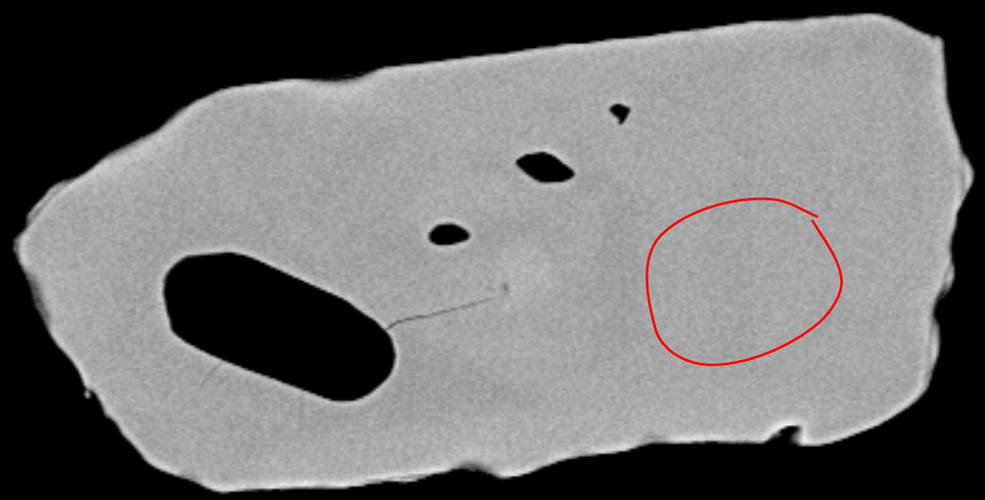
20 µm

File Name = 10810-05.tif

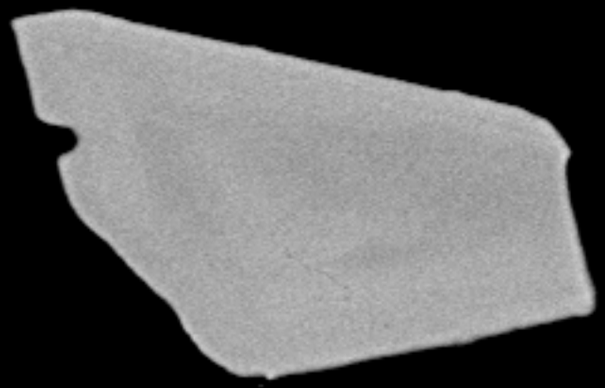




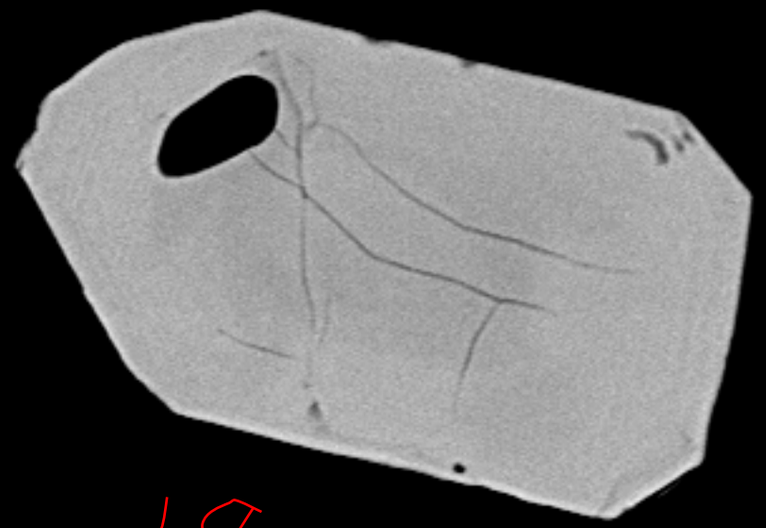




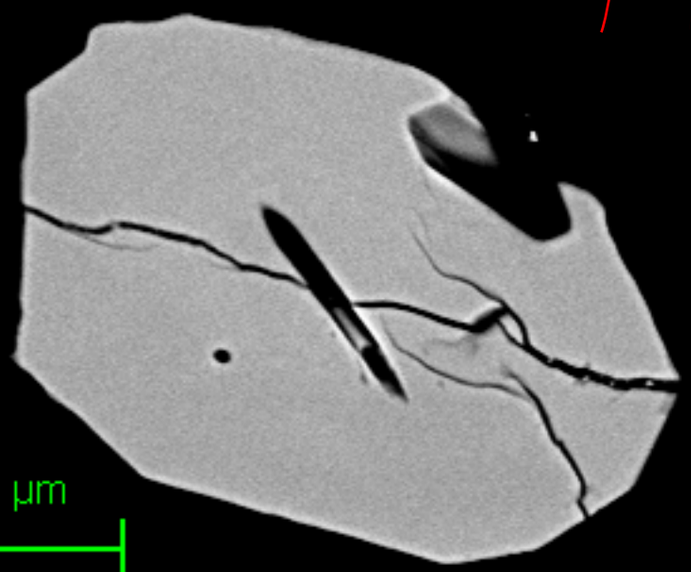
File Name = 10810-06.tif



17

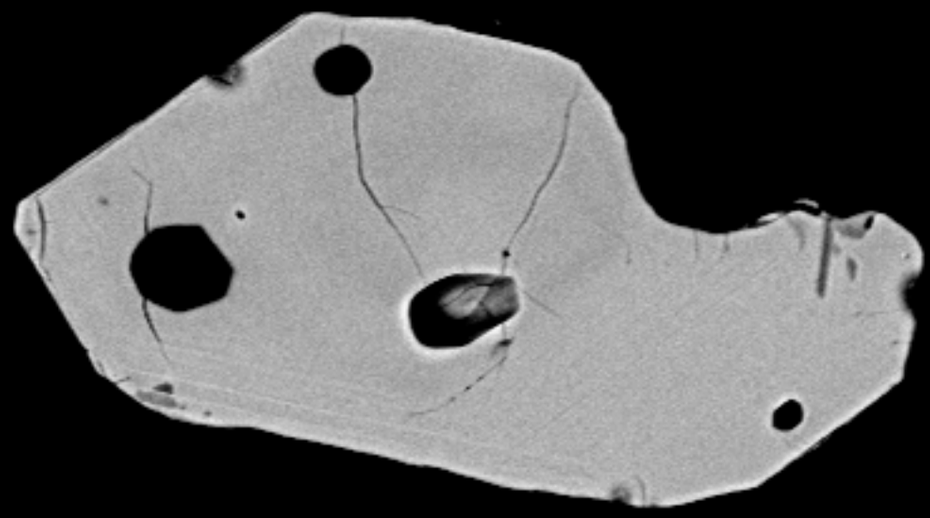


18



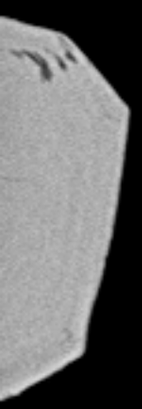
19

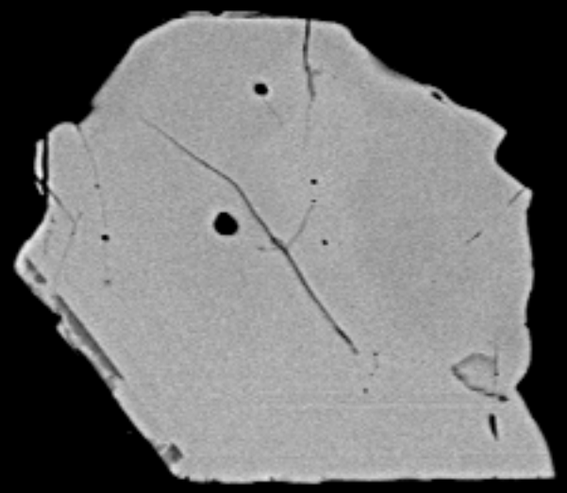
20 µm



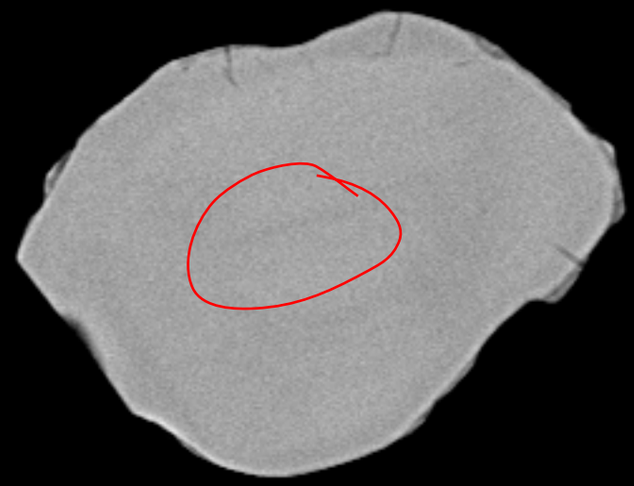
20

File Name = 10810-07.tif





21



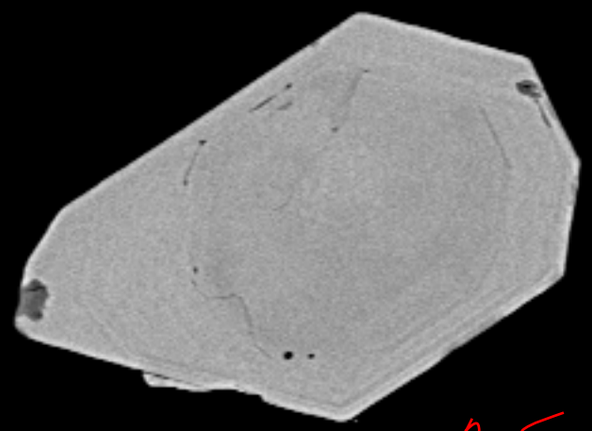
22

23

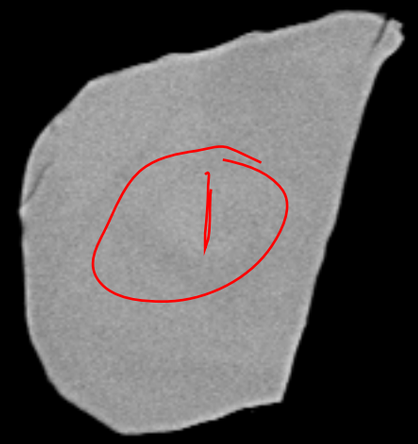
24

20 µm

File Name = 10810-08.tif



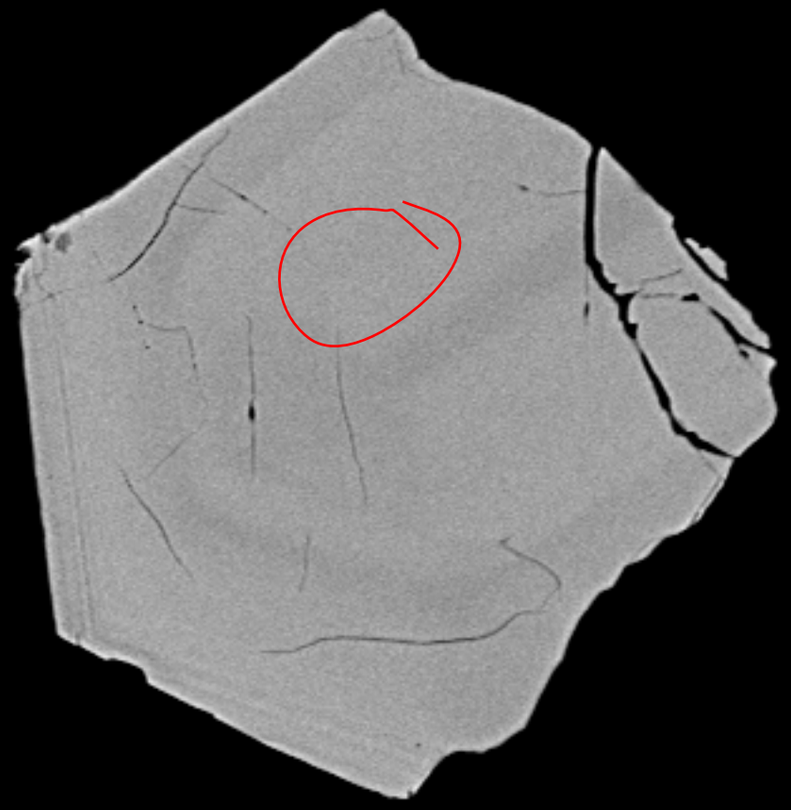
25



26

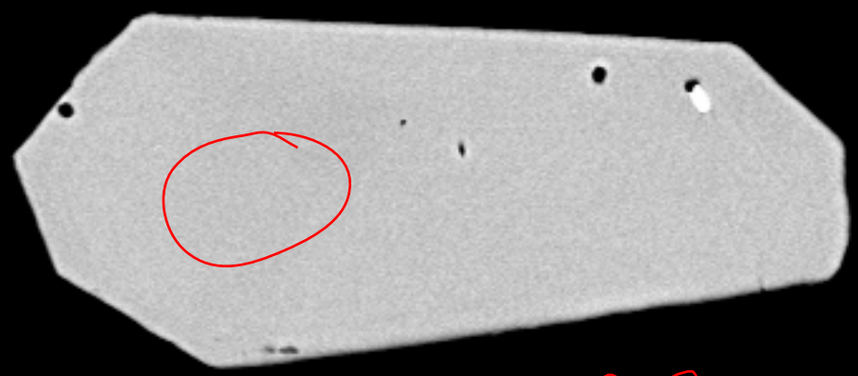
28

27

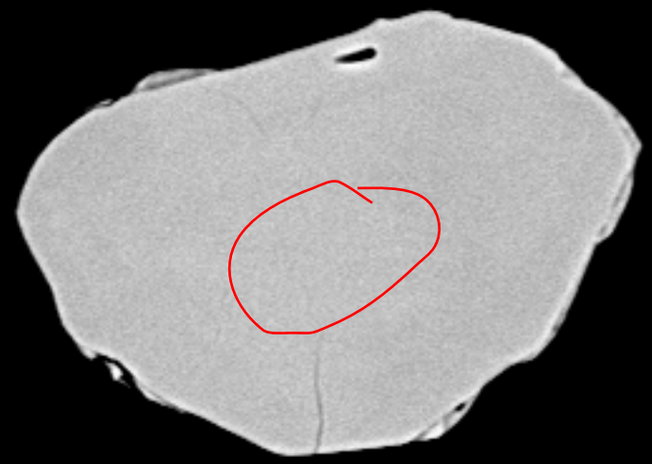


20 µm

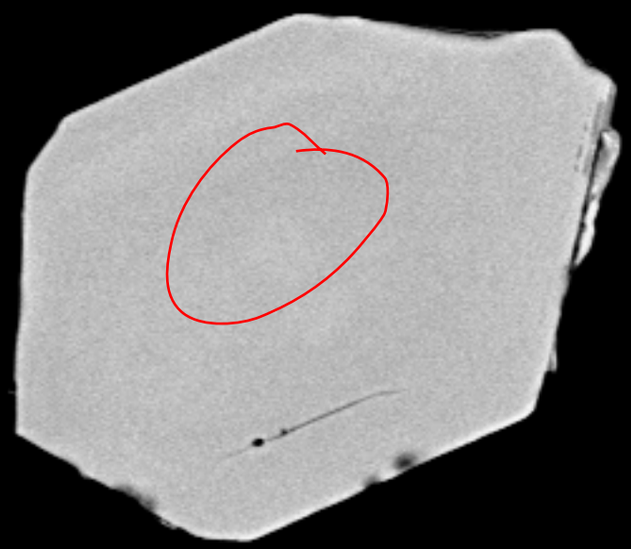
File Name = 10810-09.tif



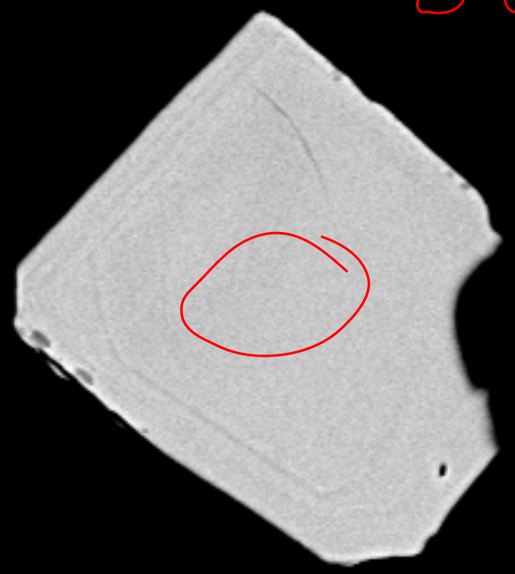
29



30



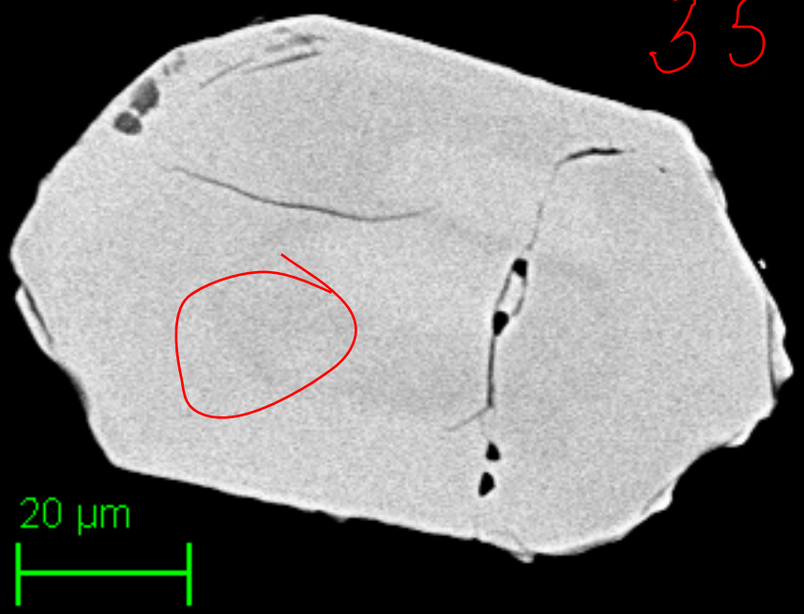
31

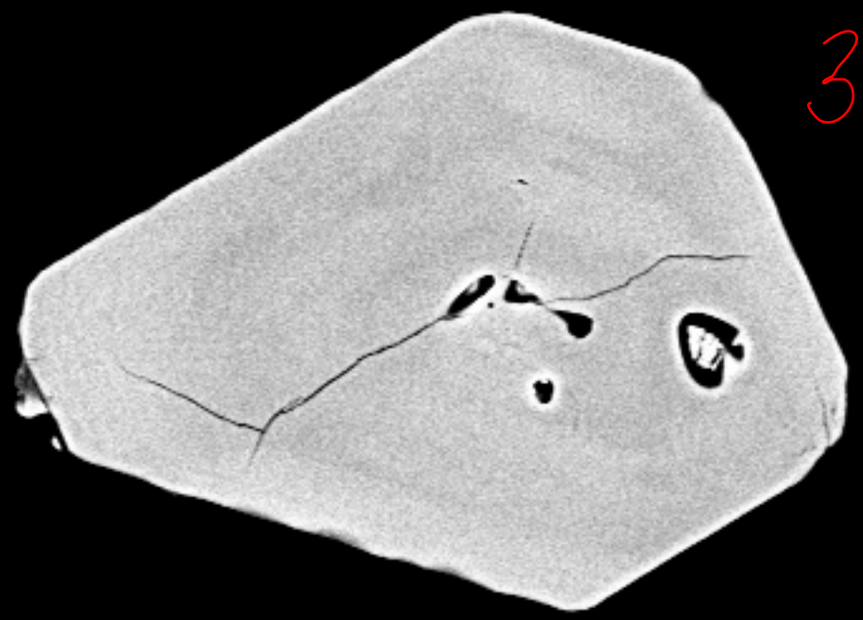


32

20 µm

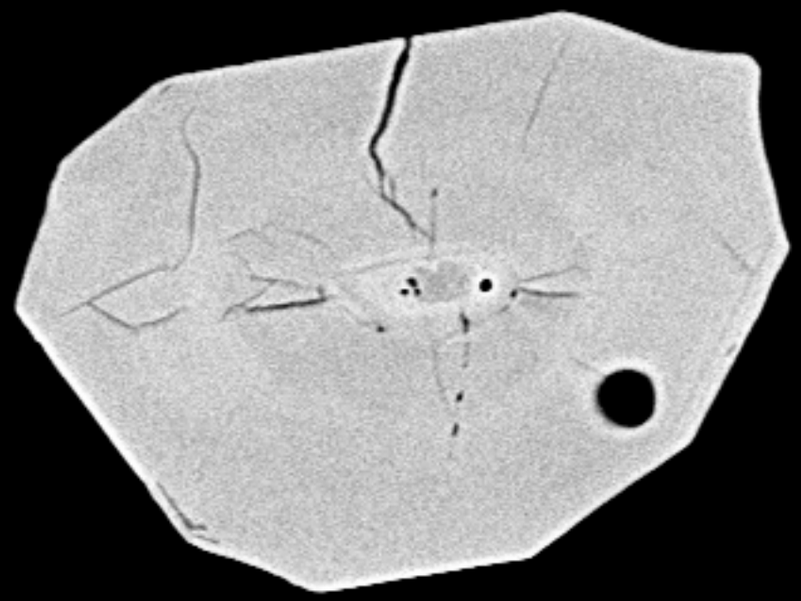
File Name = 10810-10.tif



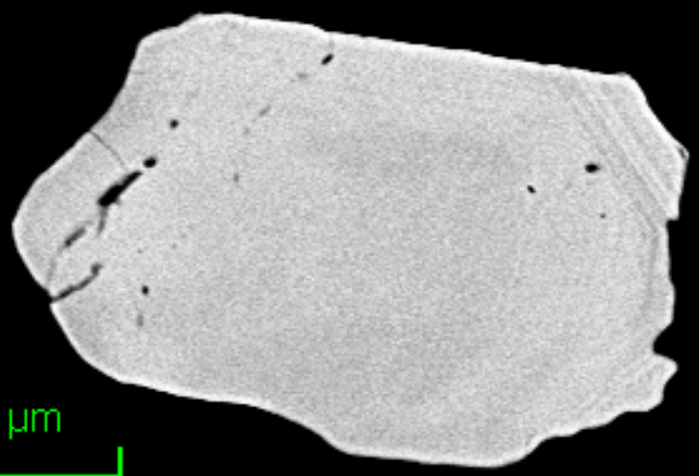


File Name = 10810-11.tif

37

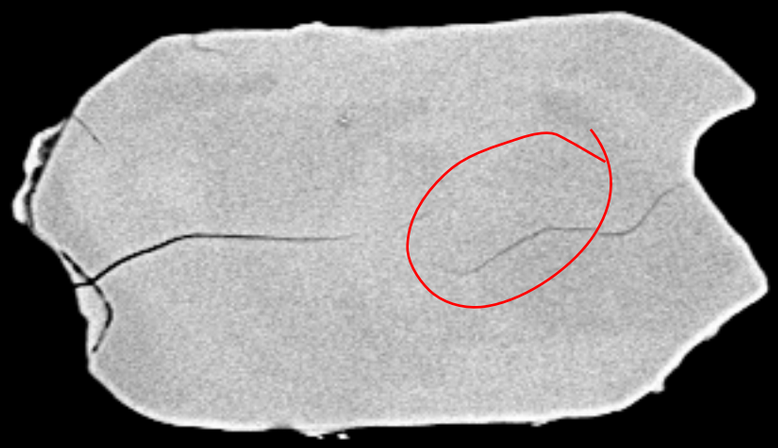


38



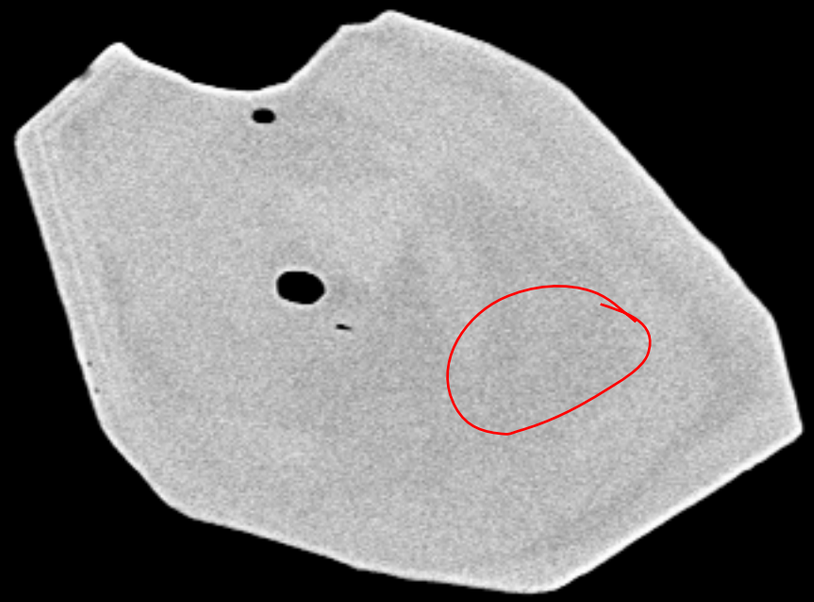
39

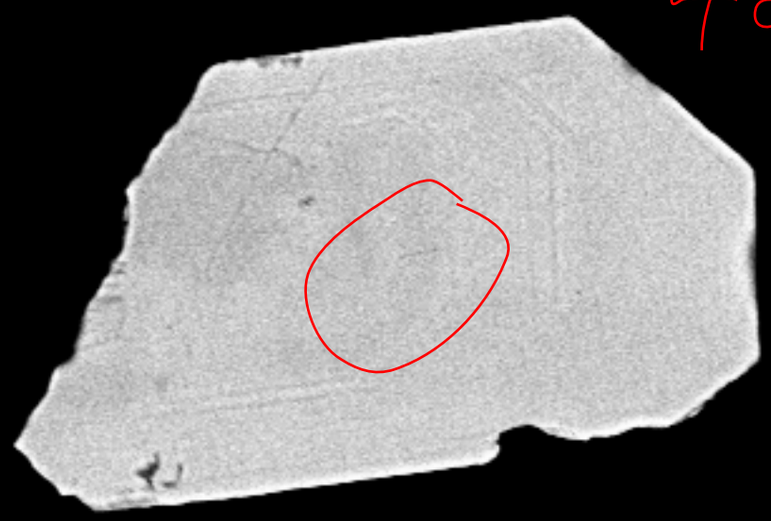
40

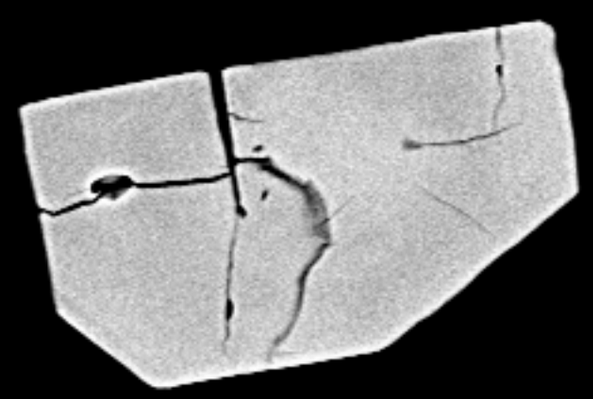


20 µm

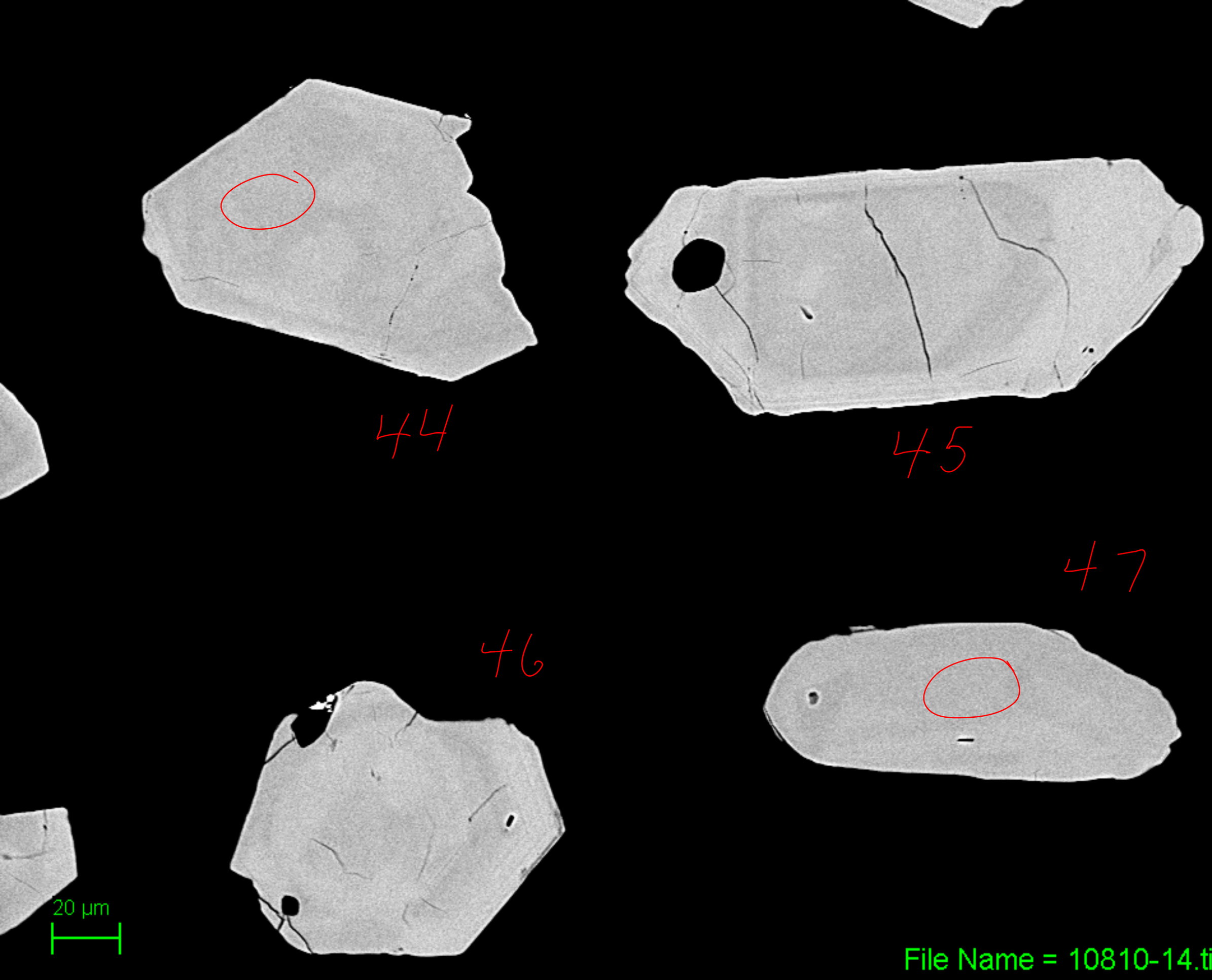
File Name = 10810-12.tif







File Name = 10810-13.tif


44
45
46
47
20 µm
File Name = 10810-14.tif

48

49

50

51

20 µm

File Name = 10810-15.tif

52

53

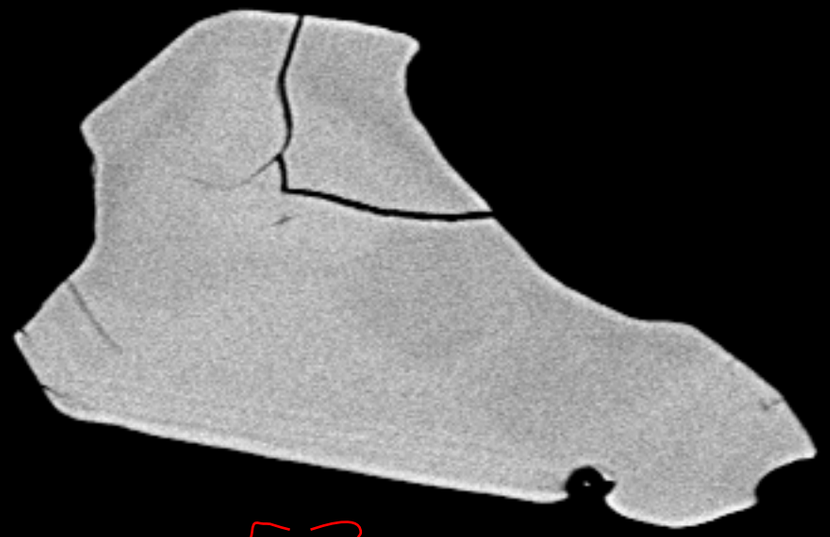
54

55

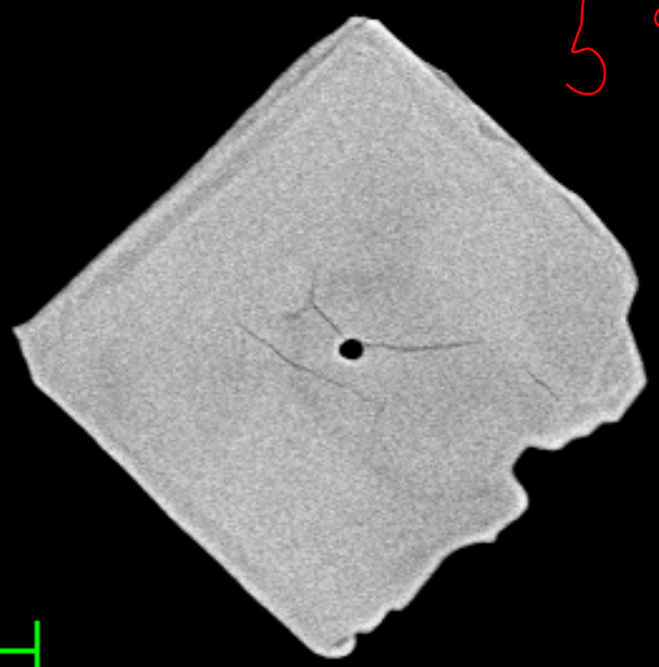
20 µm

File Name = 10810-16.tif

56

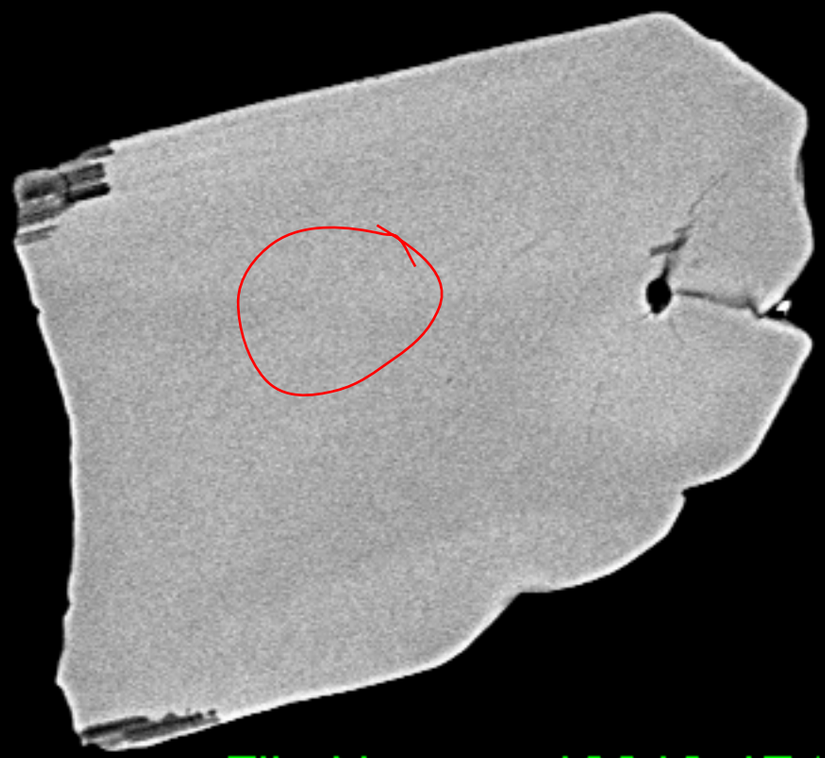


57



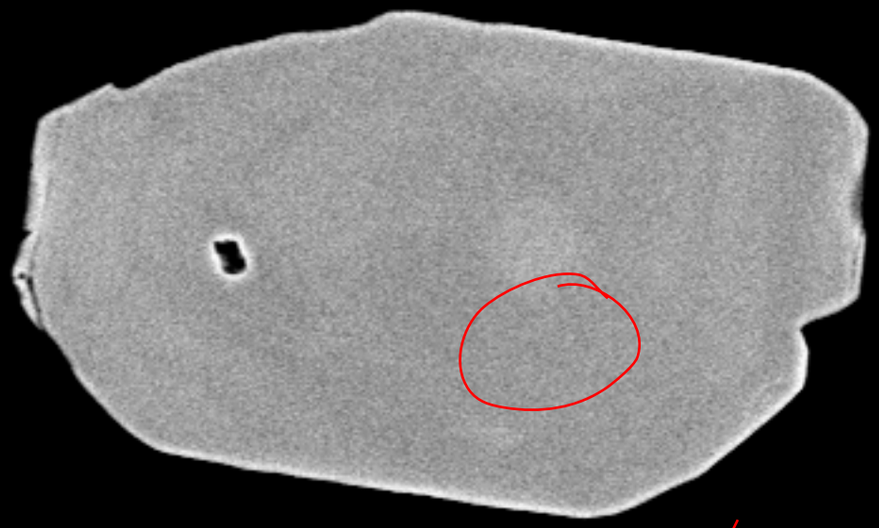
58

59

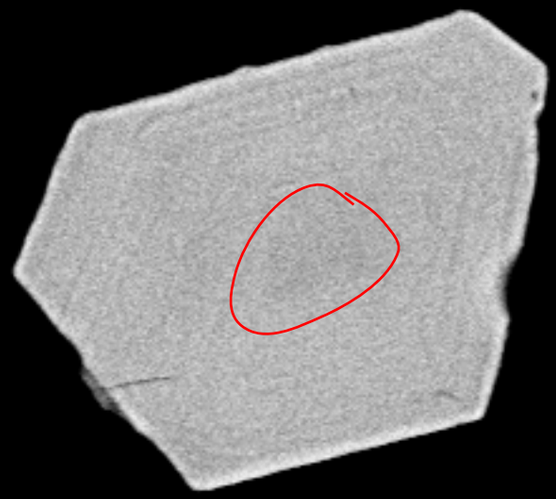


20 µm

File Name = 10810-17.tif



60



61

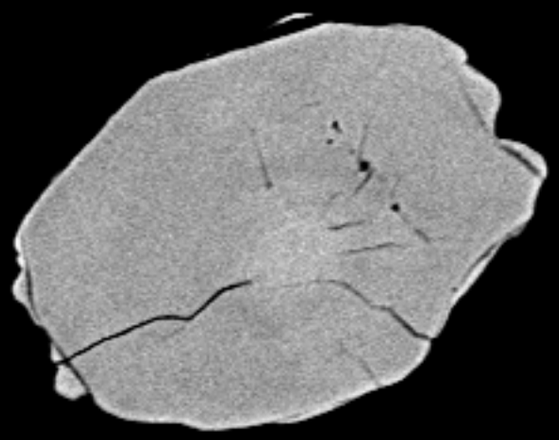
62

63

20 µm

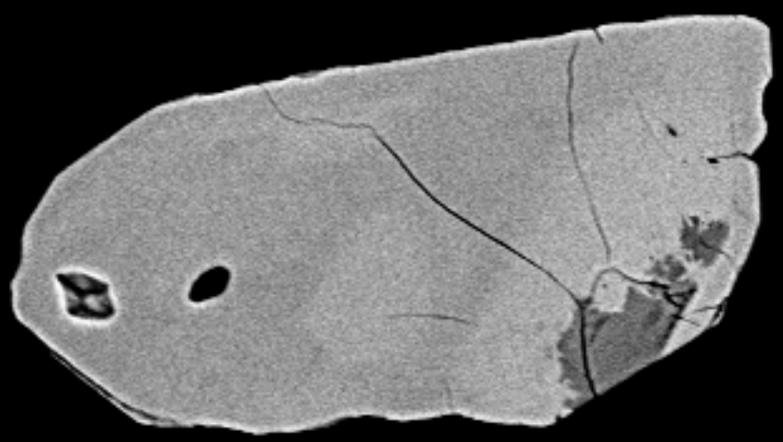
File Name = 10810-18.tif

64



65

66



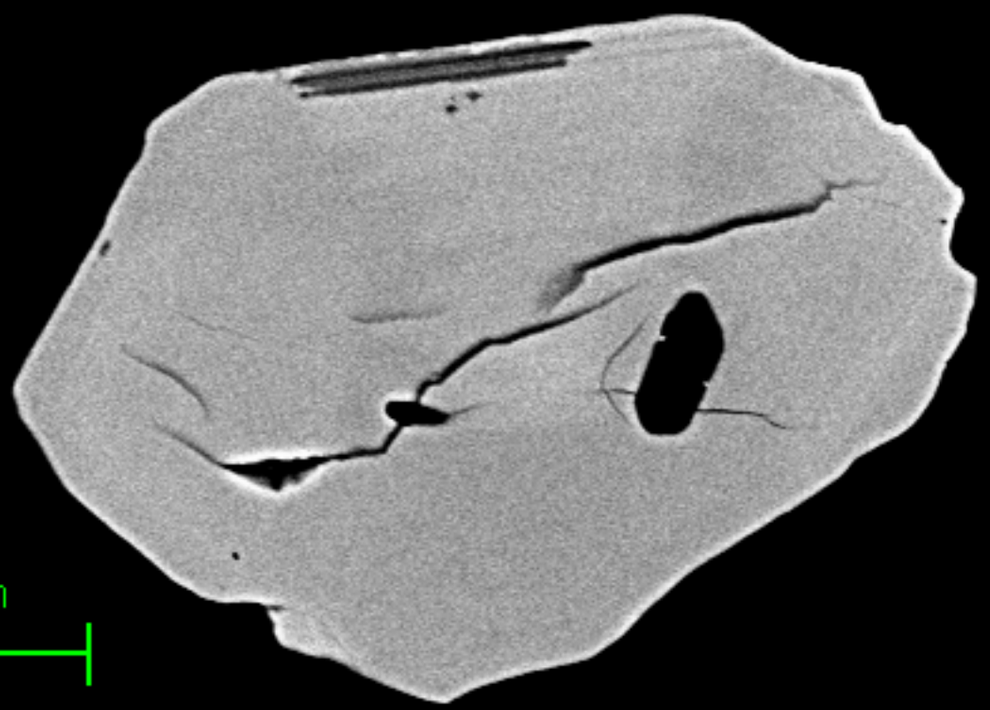
67

20 µm

File Name = 10810-19.tif

68

69



70

20 µm

File Name = 10810-20.tif

71

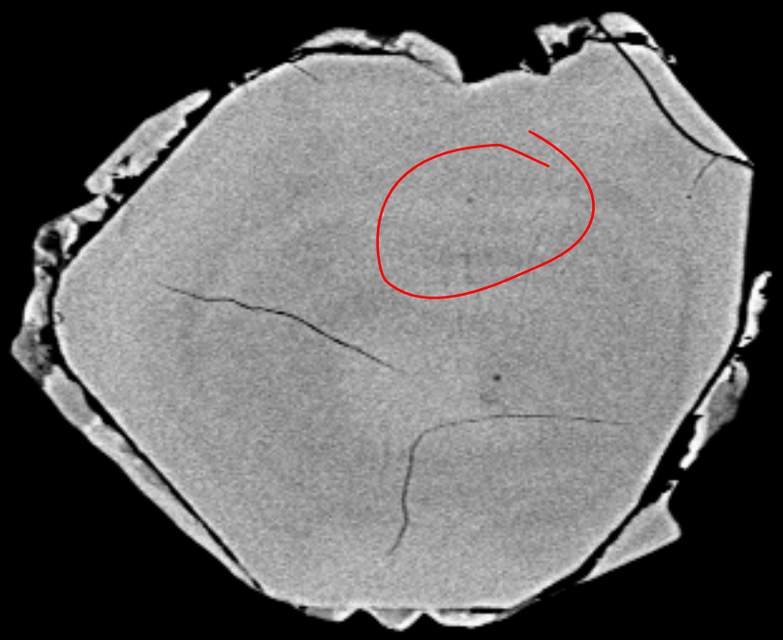
72

73

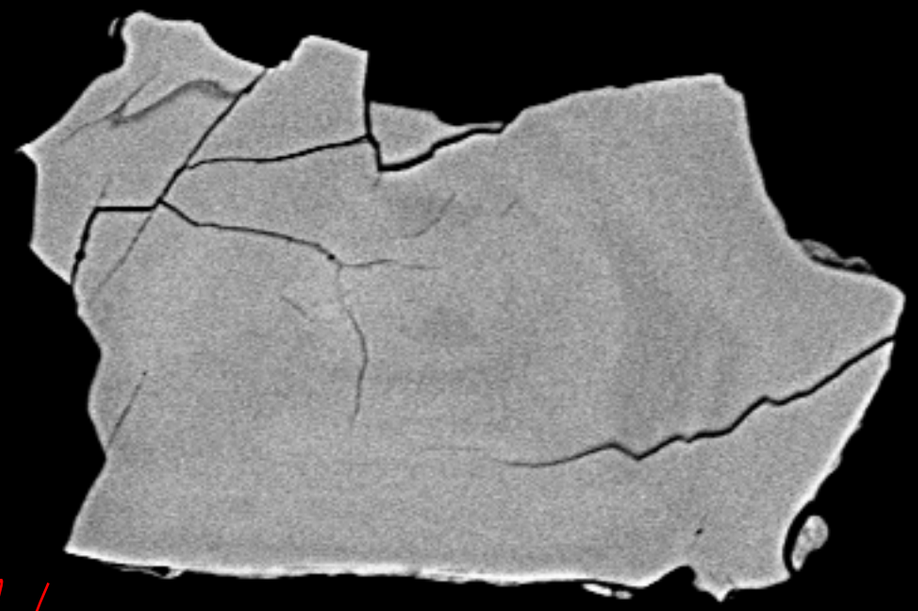
74

20 µm

File Name = 10810-21.tif

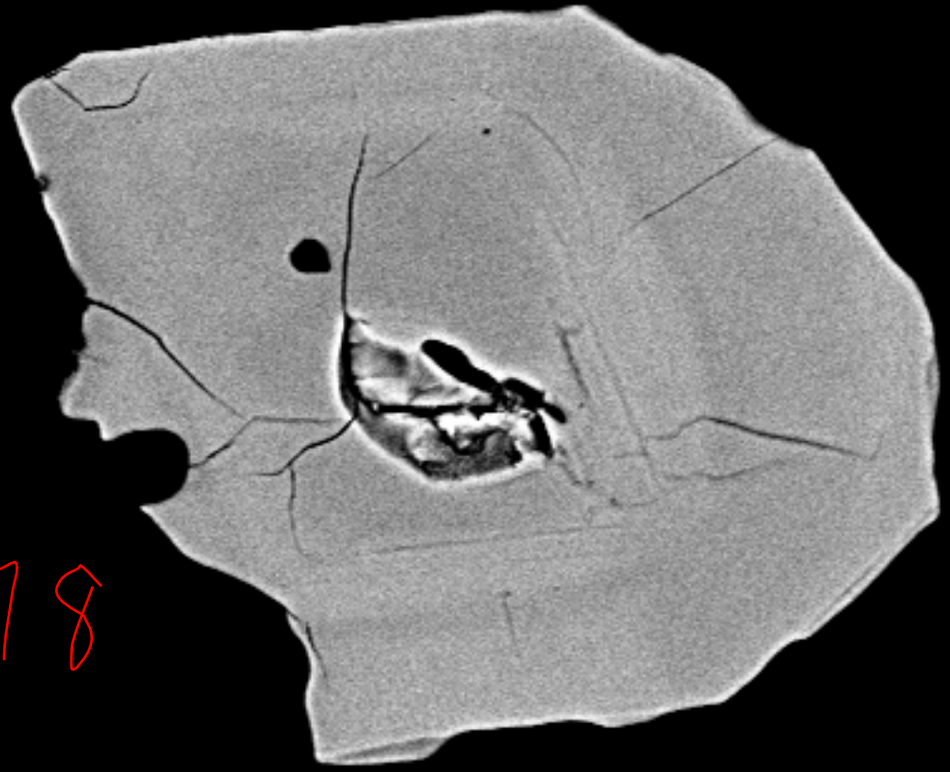


75



76

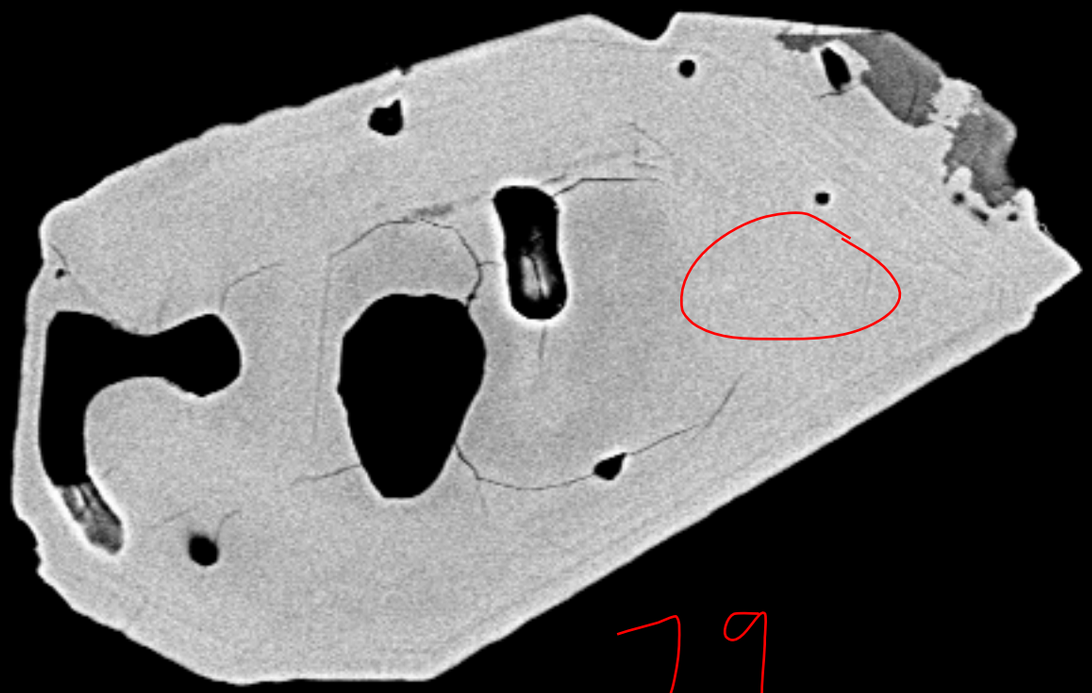
77

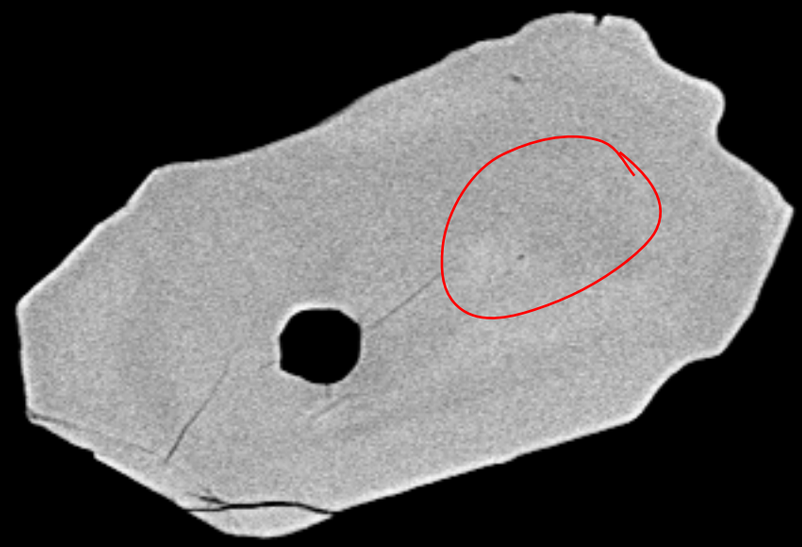


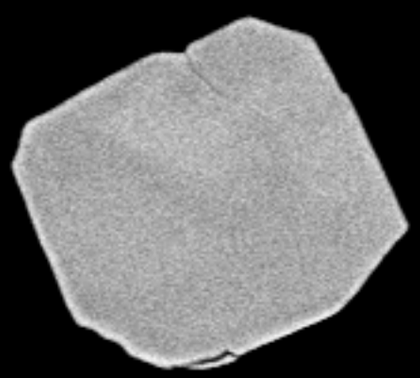
78

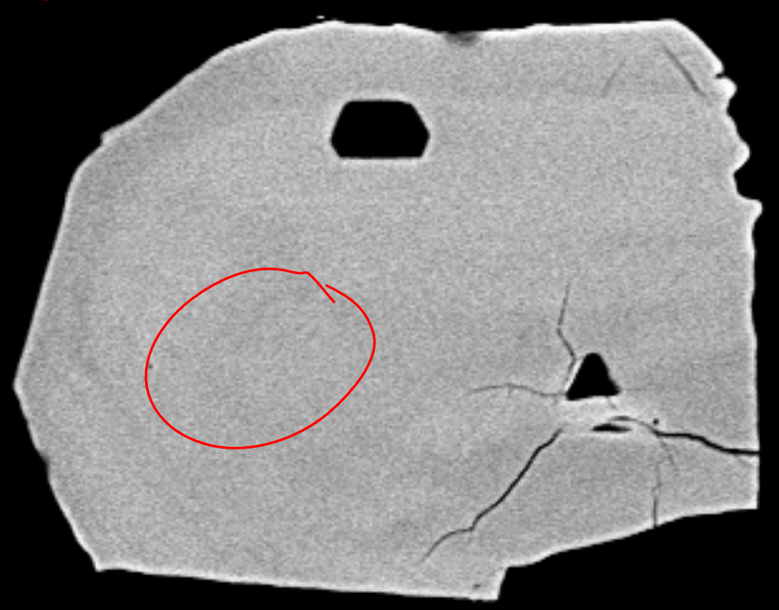
20 µm

File Name = 10810-22.tif



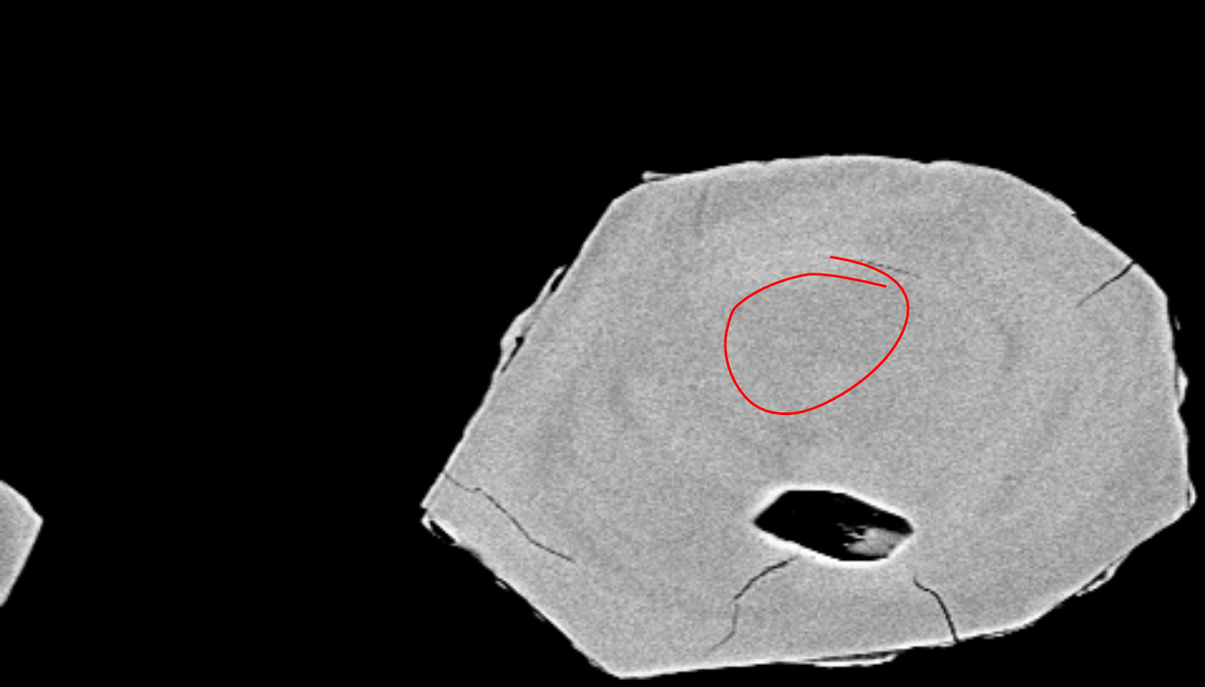


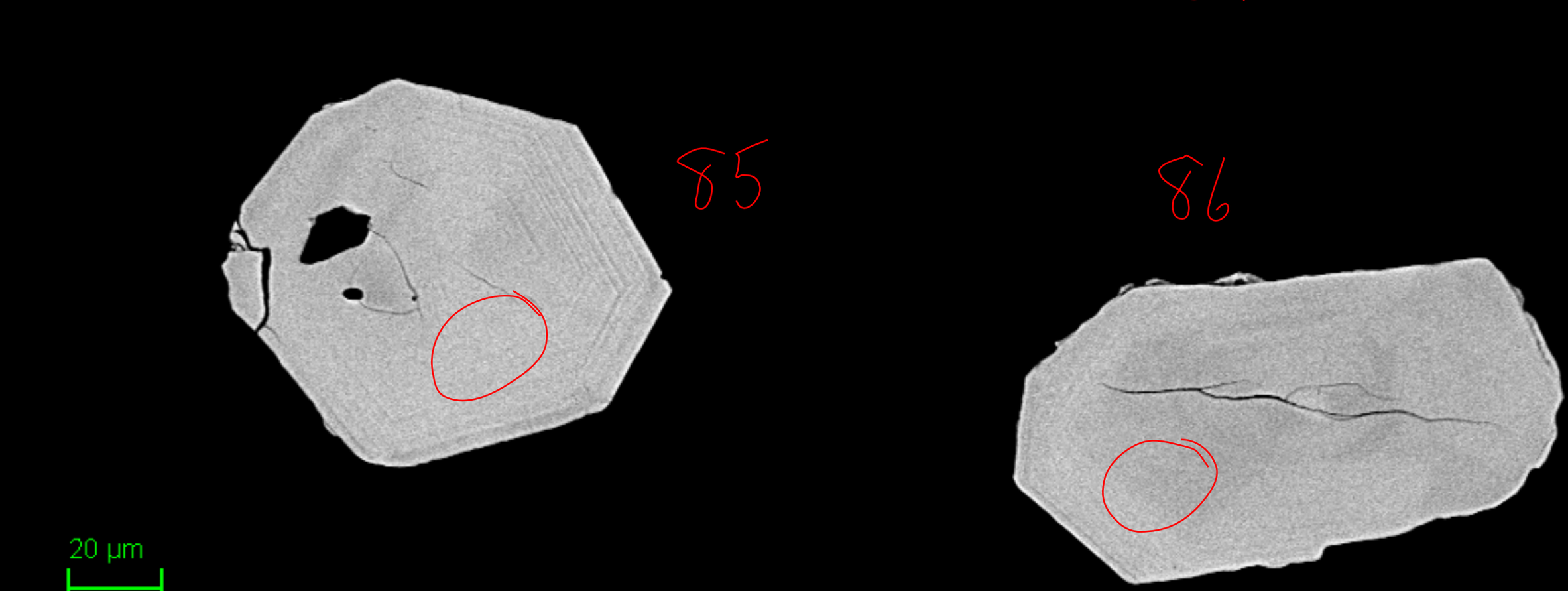


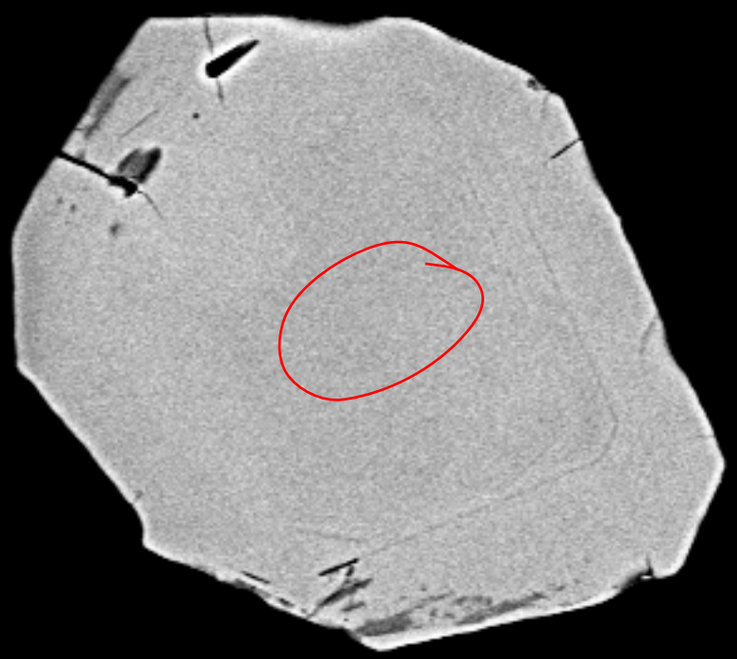


20 µm

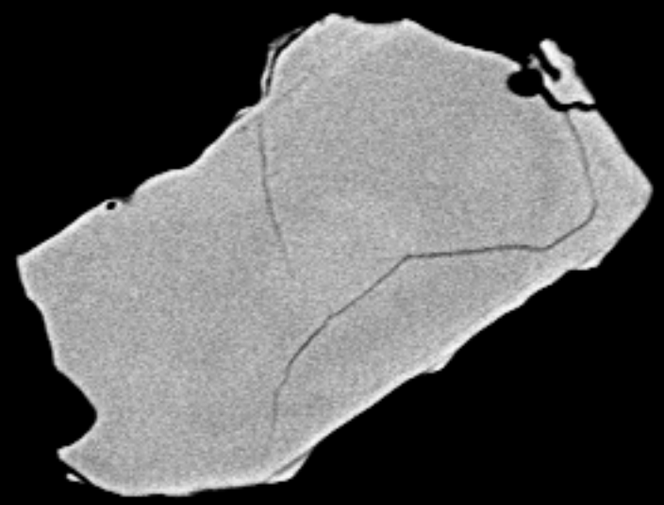
File Name = 10810-23.tif


83
84


85
86
20 µm
File Name = 10810-24.tif

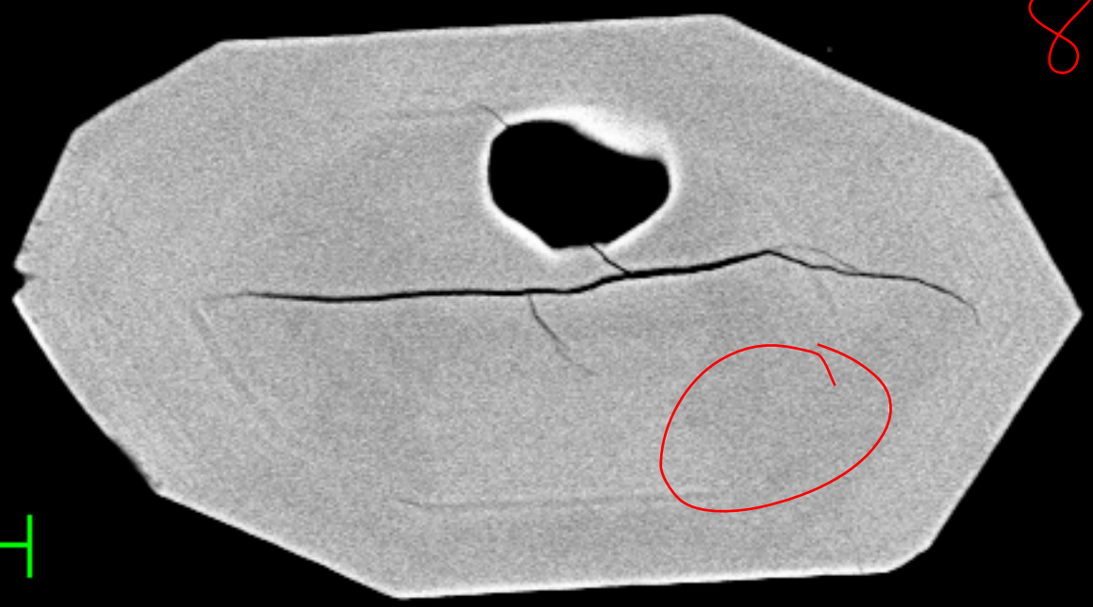


87



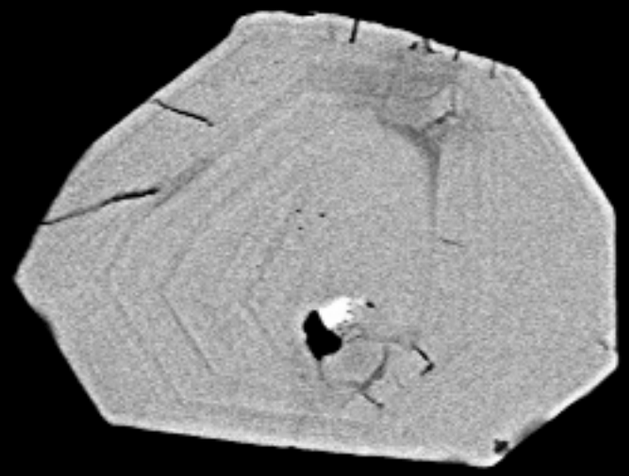
88

89

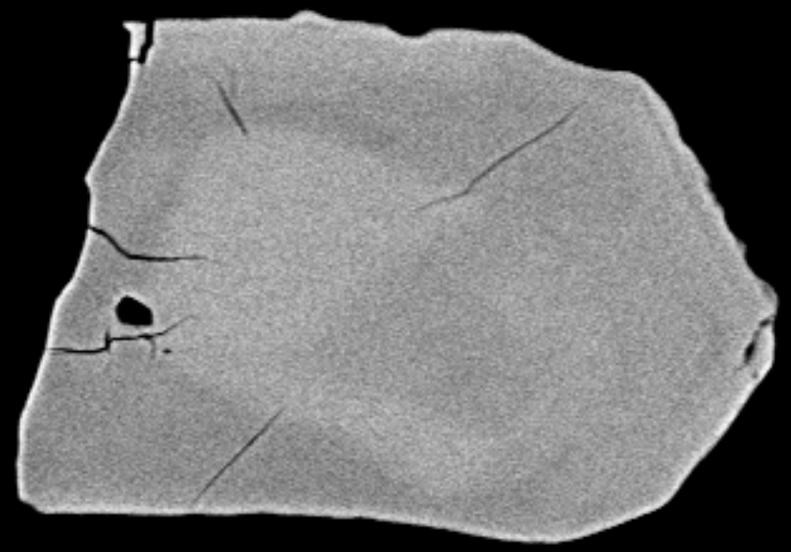


20 µm

File Name = 10810-25.tif

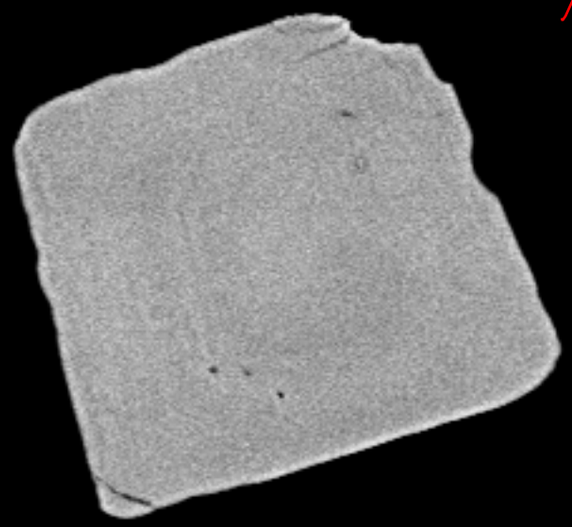


90



91

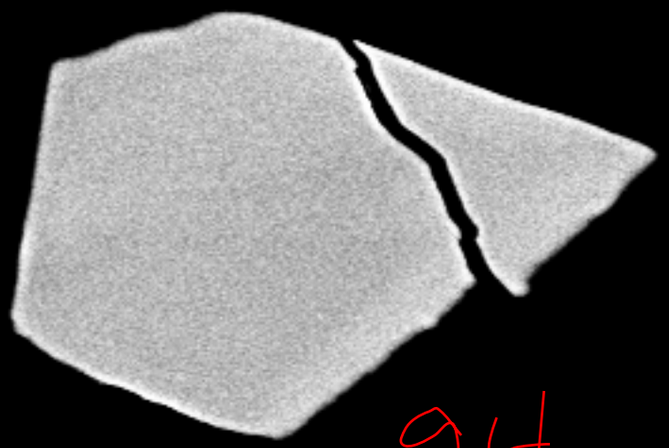
92



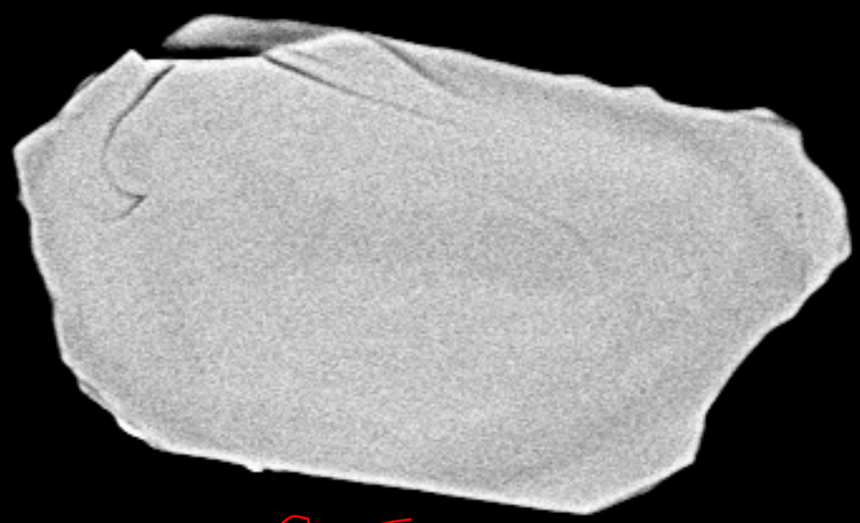
93

20 µm

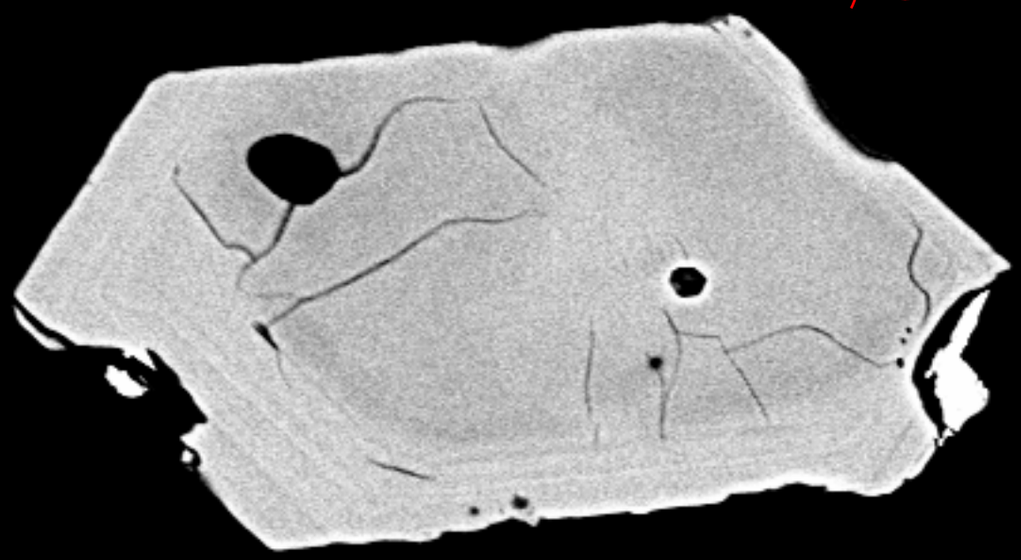
File Name = 10810-26.tif



94



95

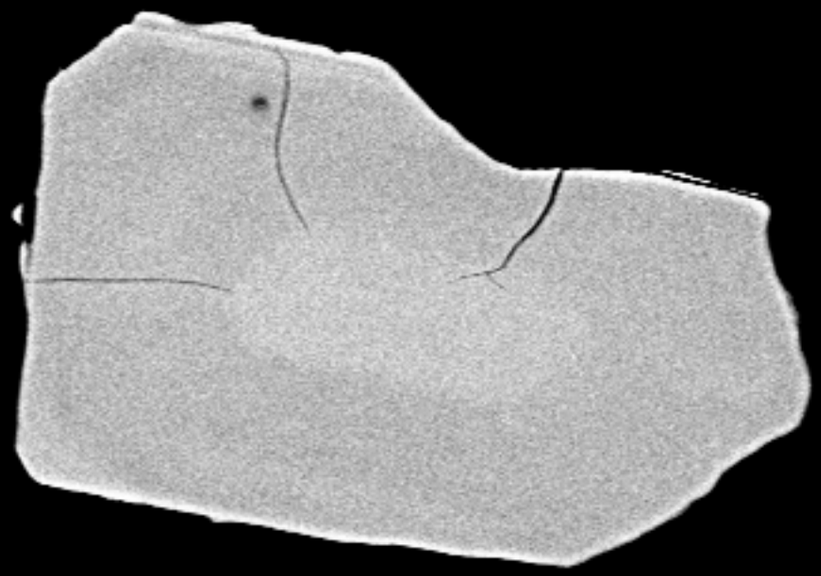


96

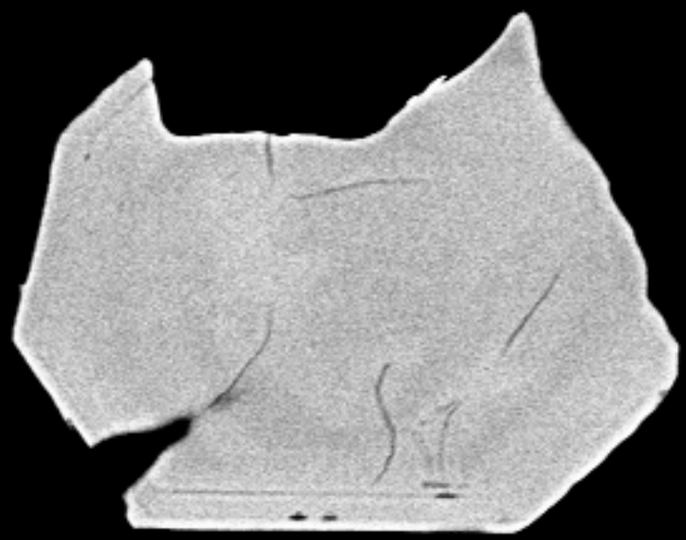
97

20 µm

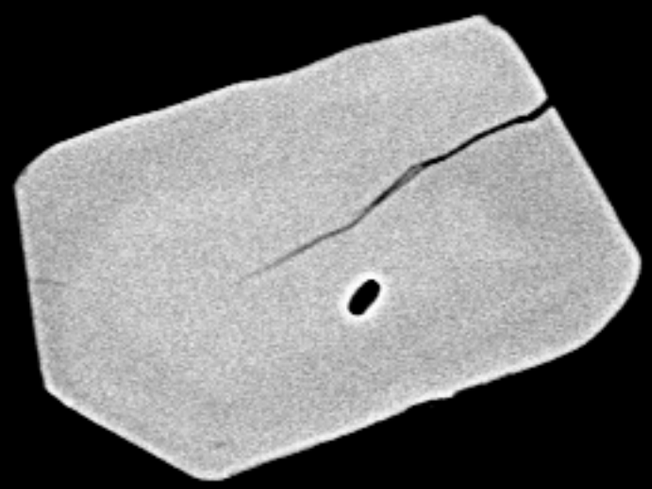
File Name = 10810-27.tif



98

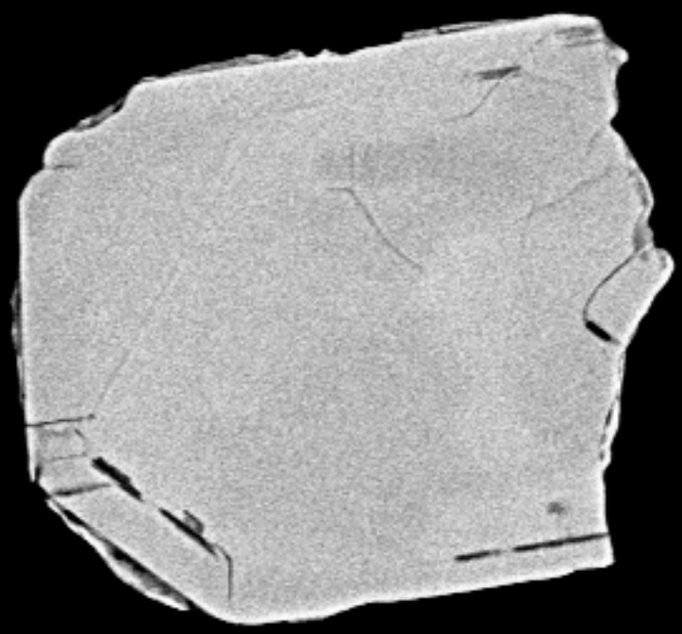


99



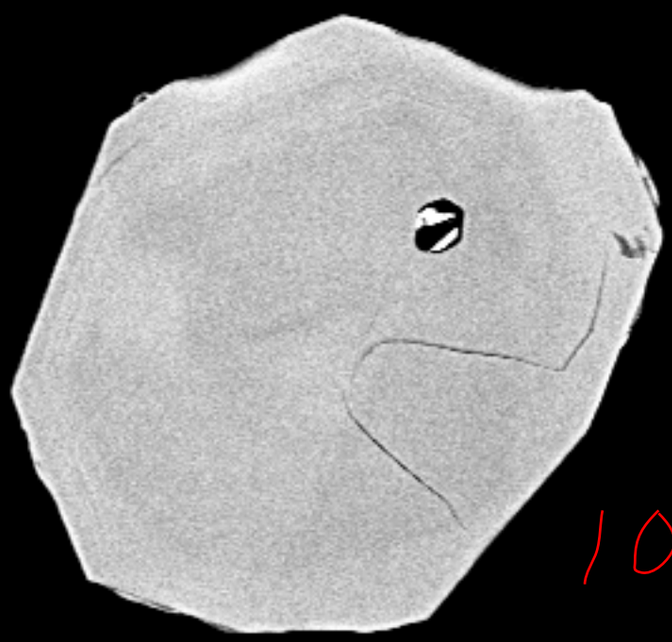
100

20 µm

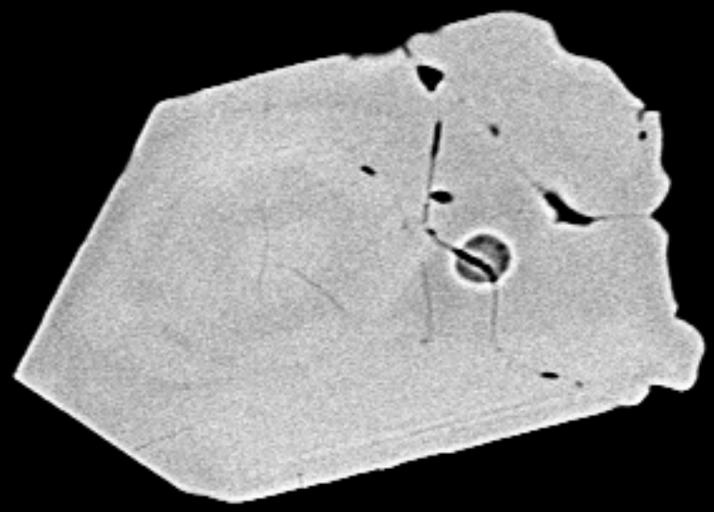


101

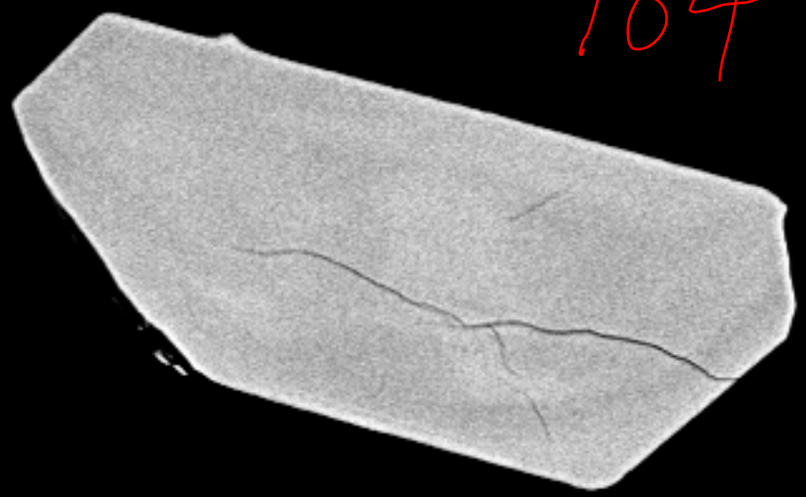
File Name = 10810-28.tif



102

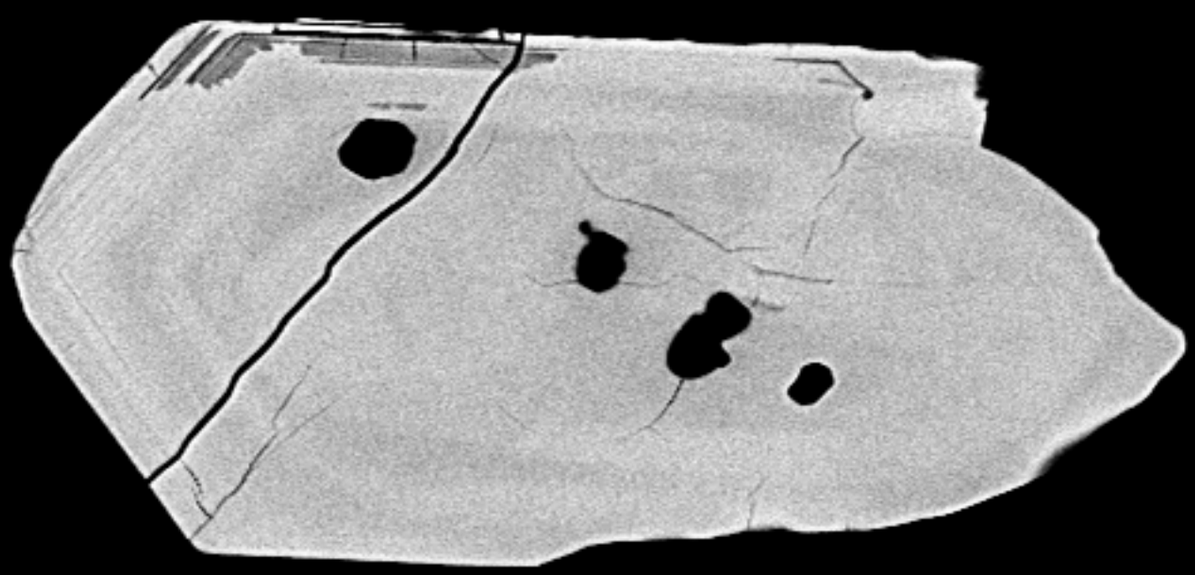


103



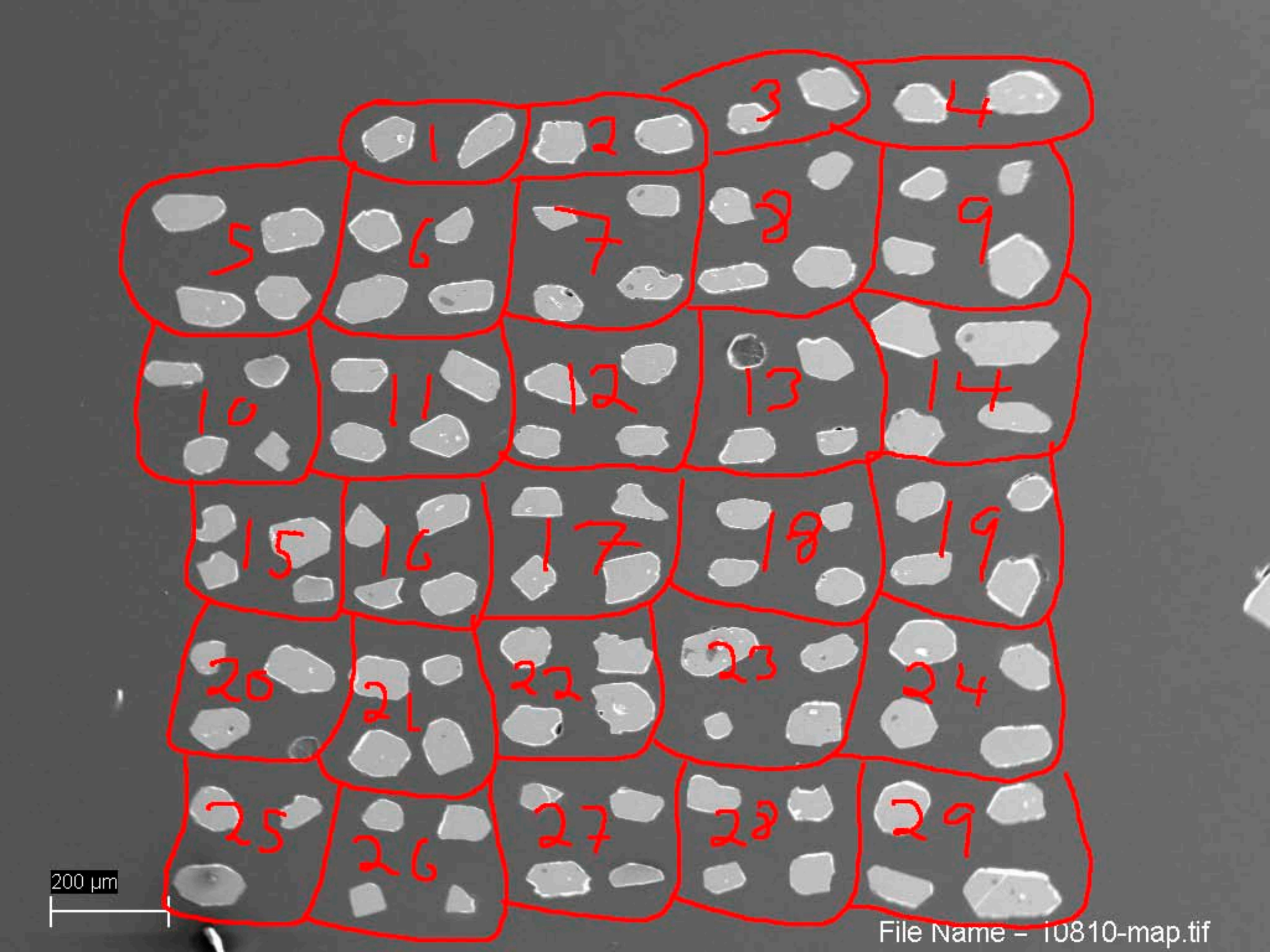
104

105



20 µm

File Name = 10810-29.tif


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
200 µm
File Name = 10810-map.tif

1

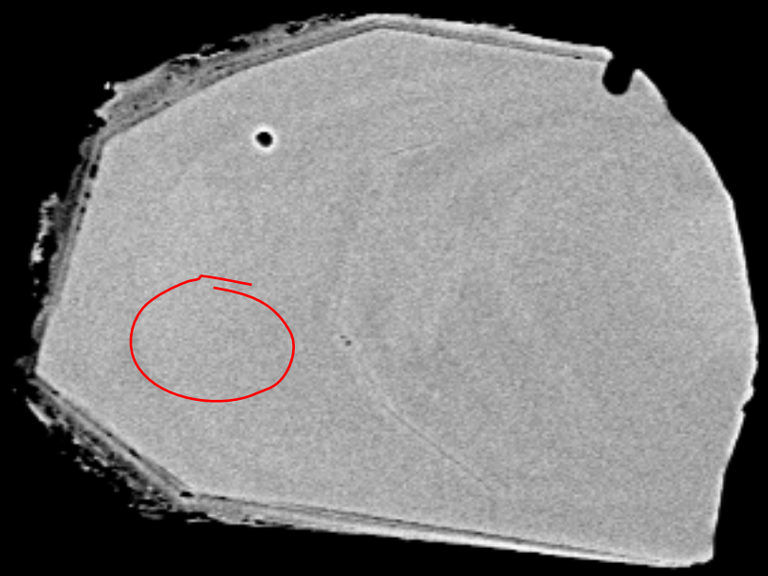
2

4

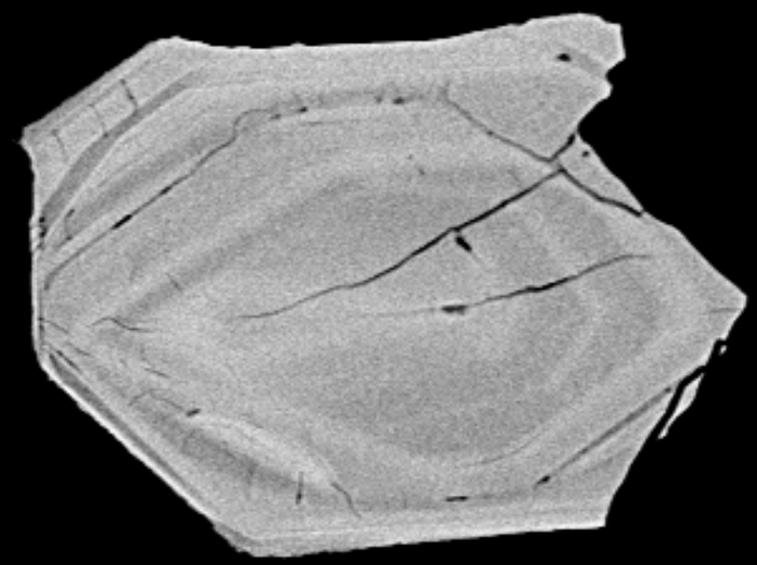
3

20 µm

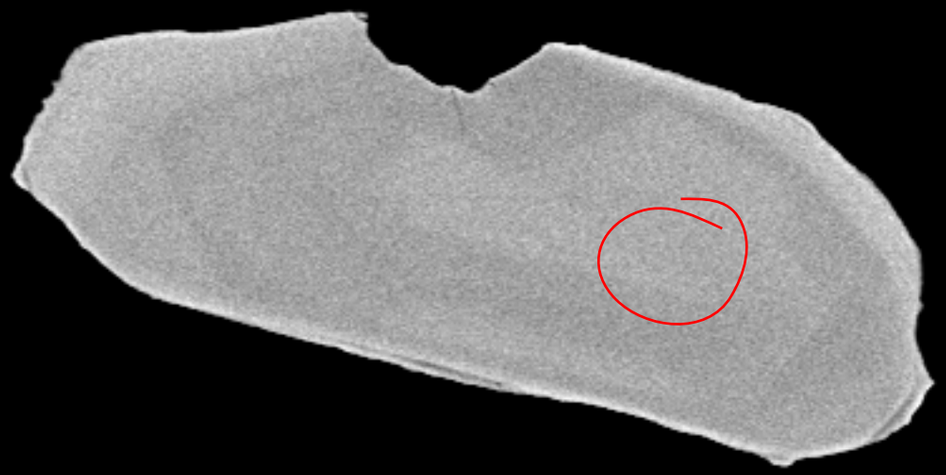
File Name = 10971-01.tif



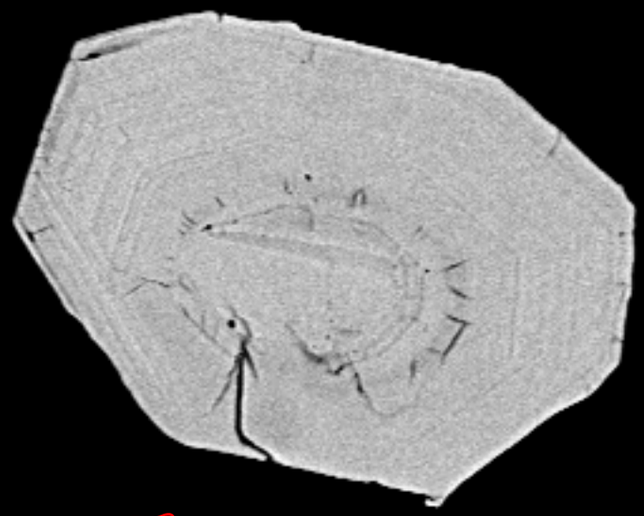
5



6



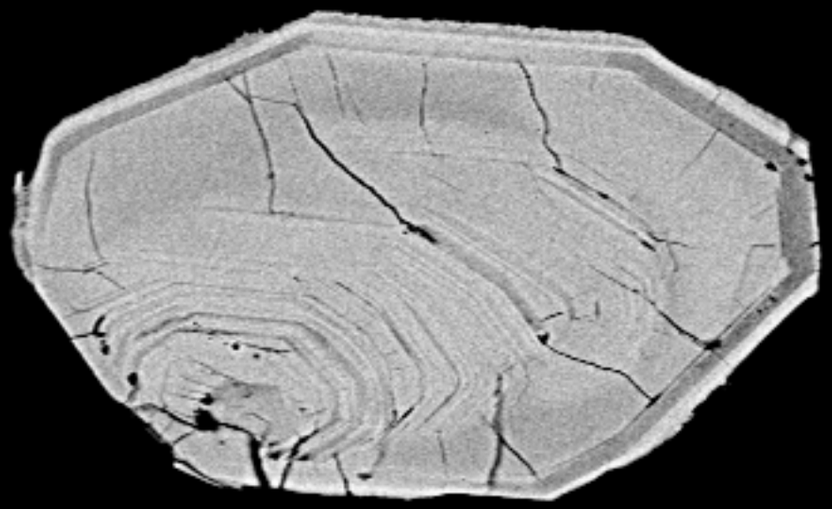
8



7

20 µm

File Name = 10971-02.tif

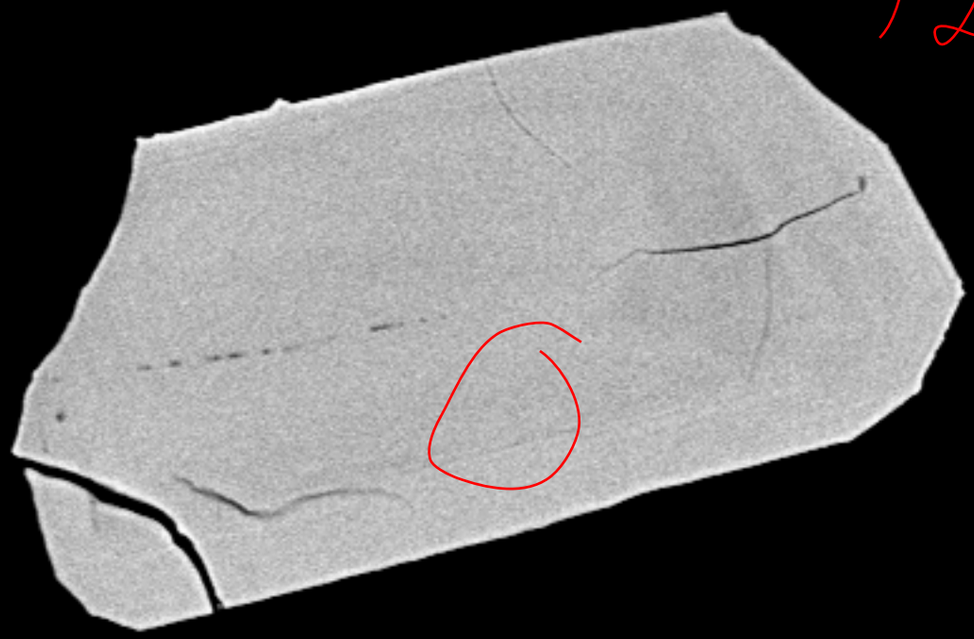


9

10

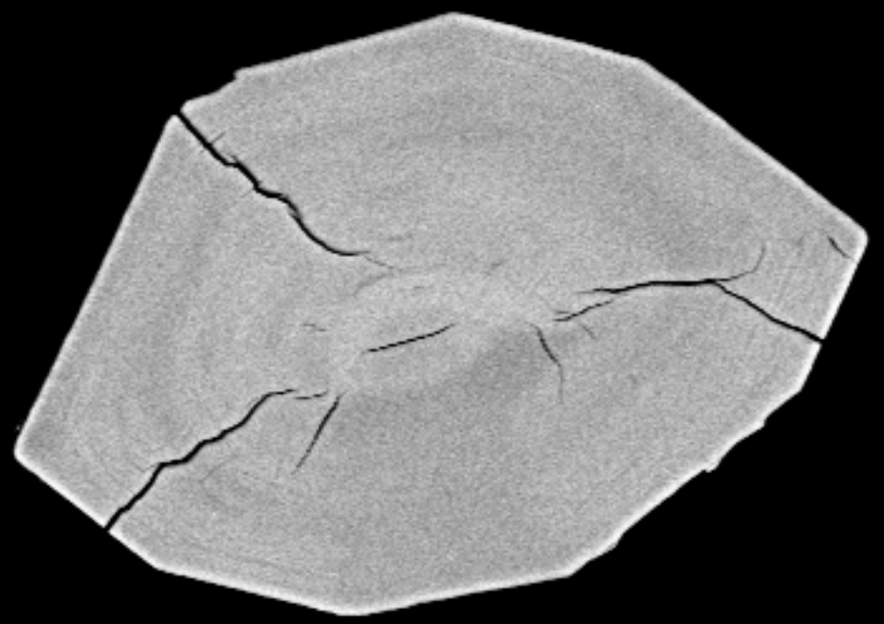
12

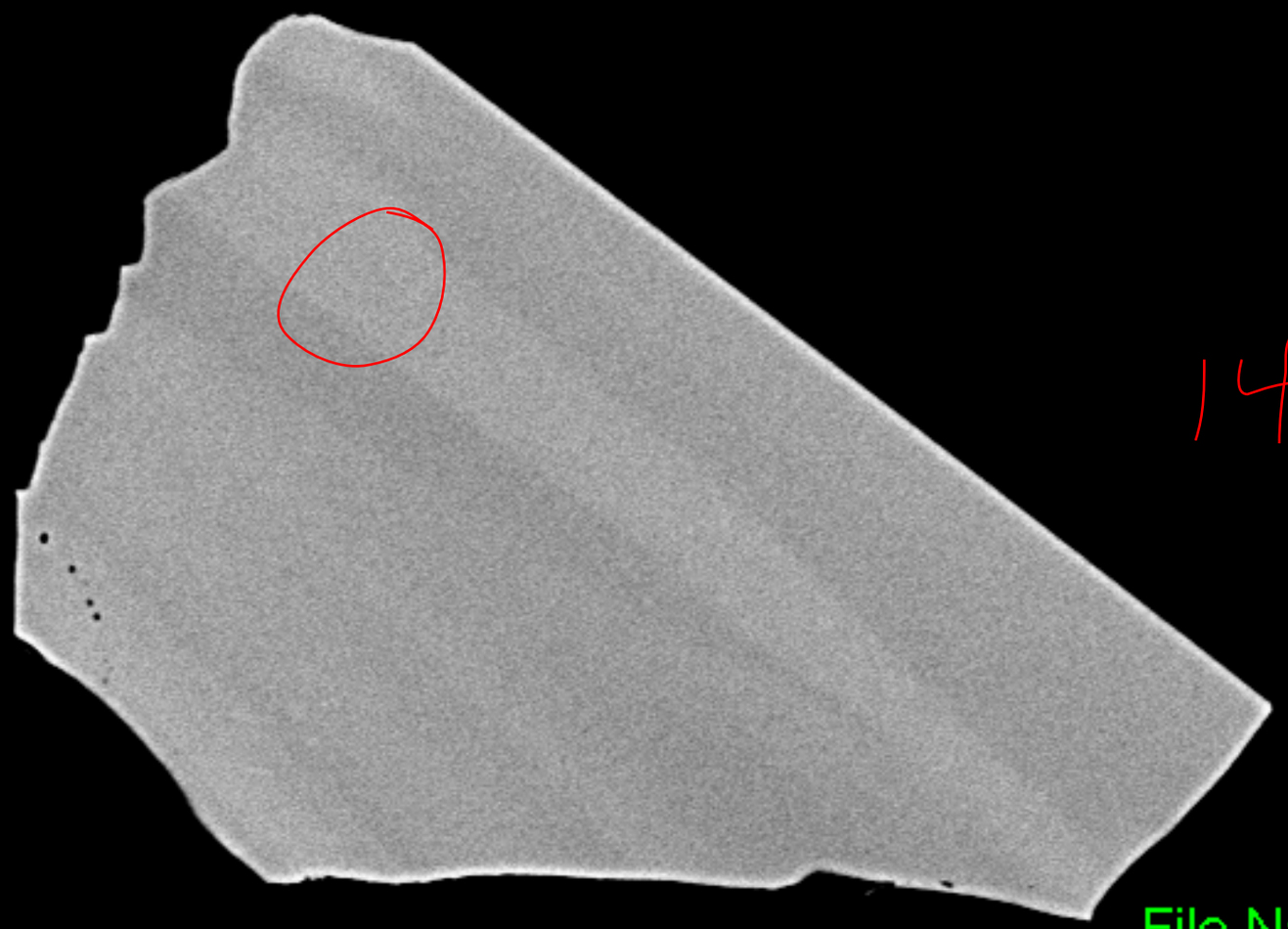
11



20 µm

File Name = 10971-03.tif


13


14
20 µm
File Name = 10971-04.tif

15

16

18

17

20 µm

File Name = 10971-05.tif

19

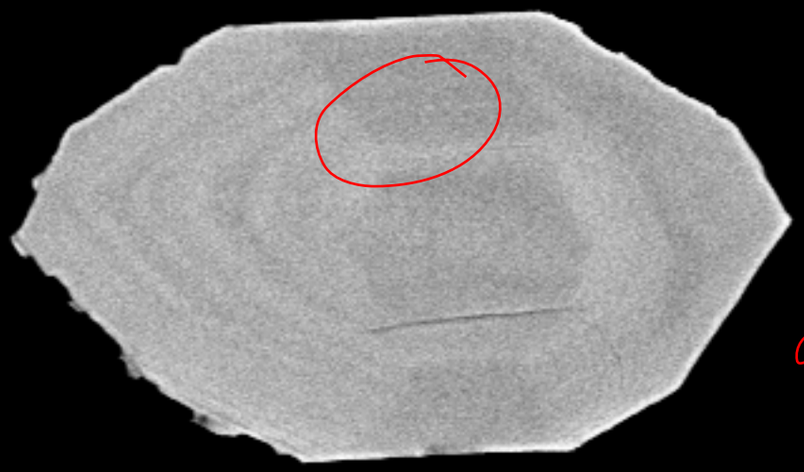
20

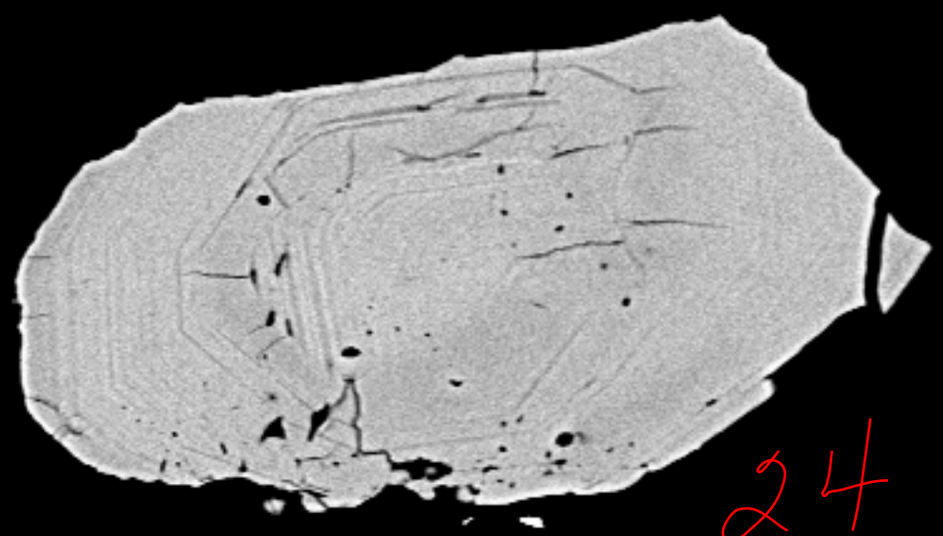
21

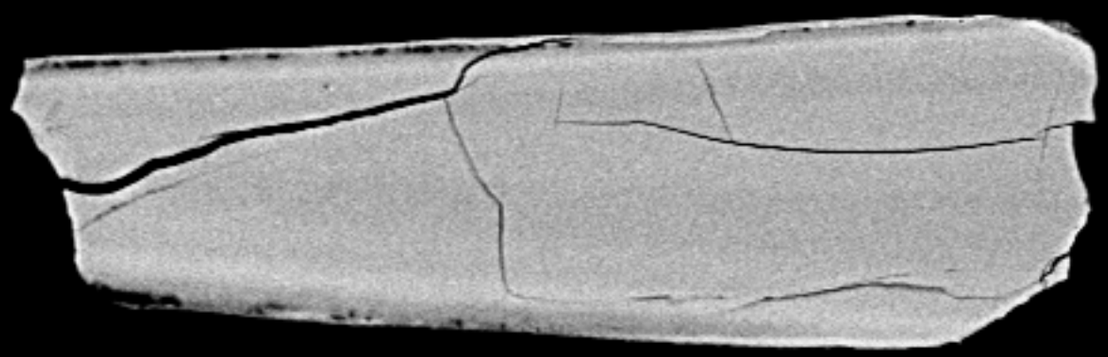
22

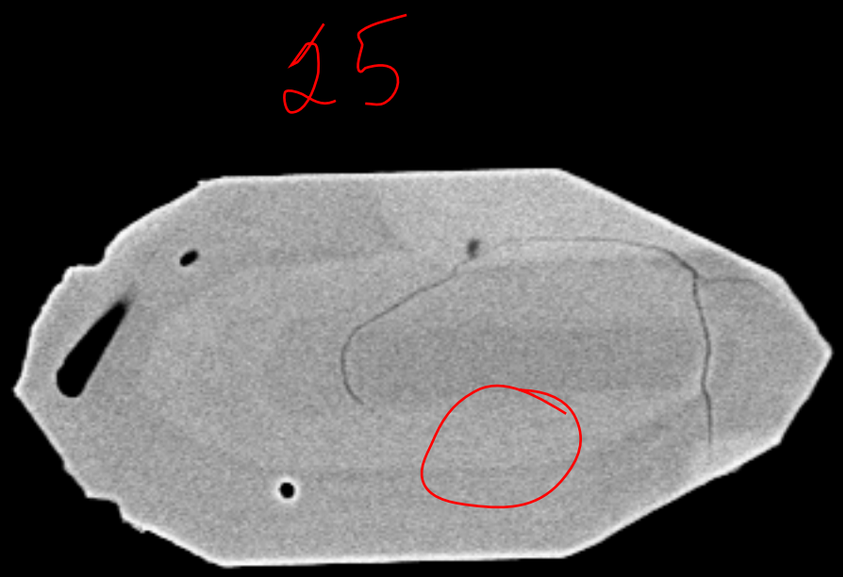
20 µm

File Name = 10971-06.tif



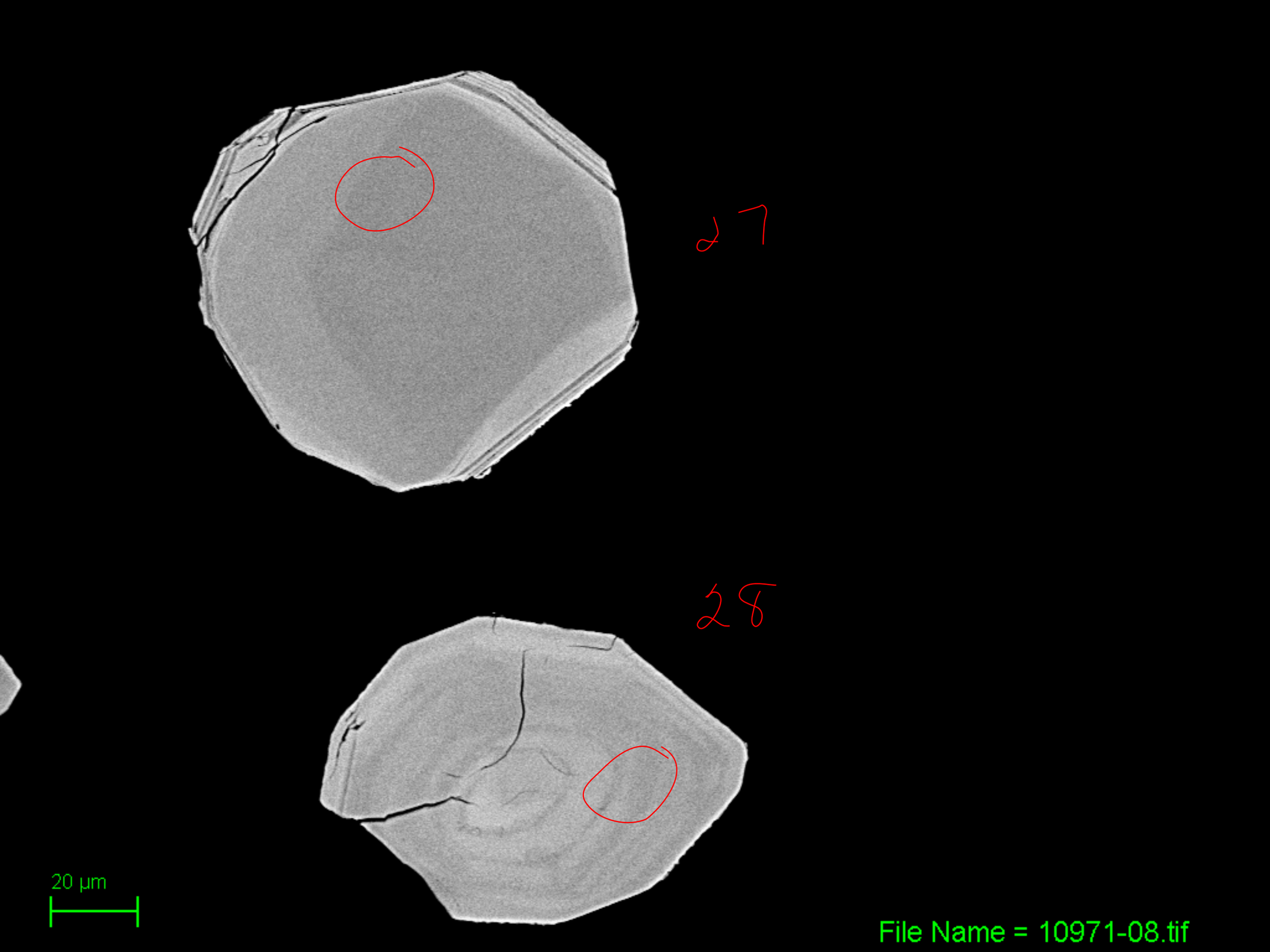






20 µm

File Name = 10971-07.tif


27
28
20 µm
File Name = 10971-08.tif

29

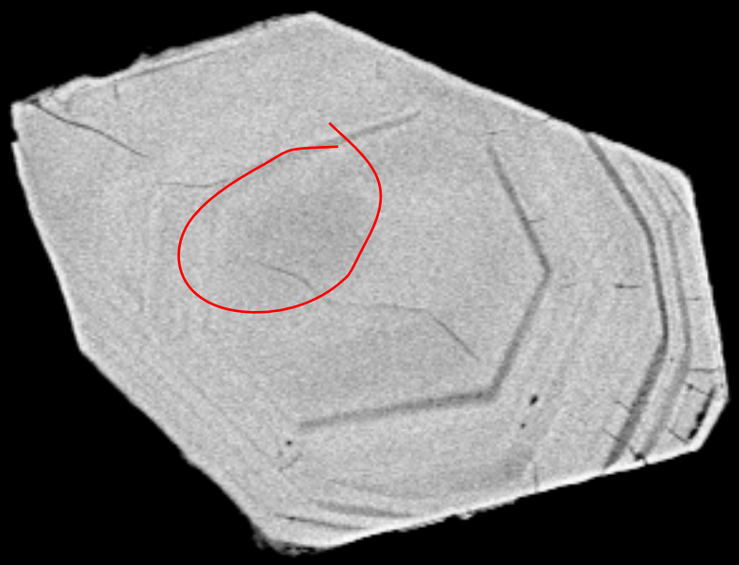
30

32

31

20 µm

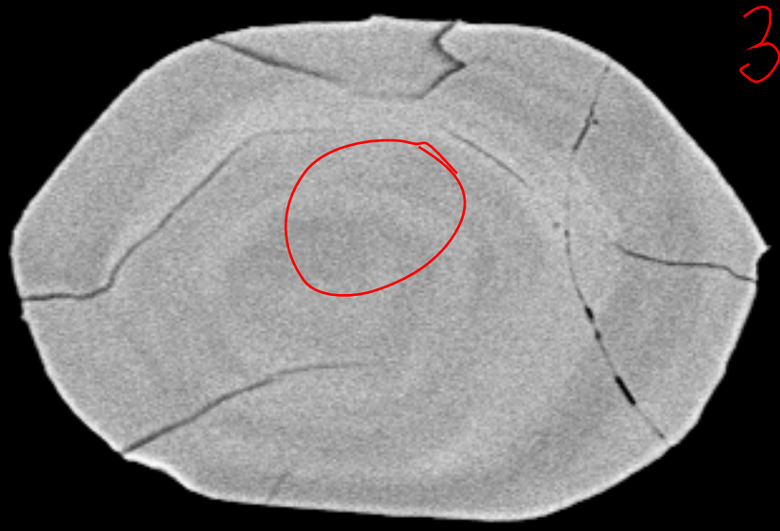
File Name = 10971-09.tif



33

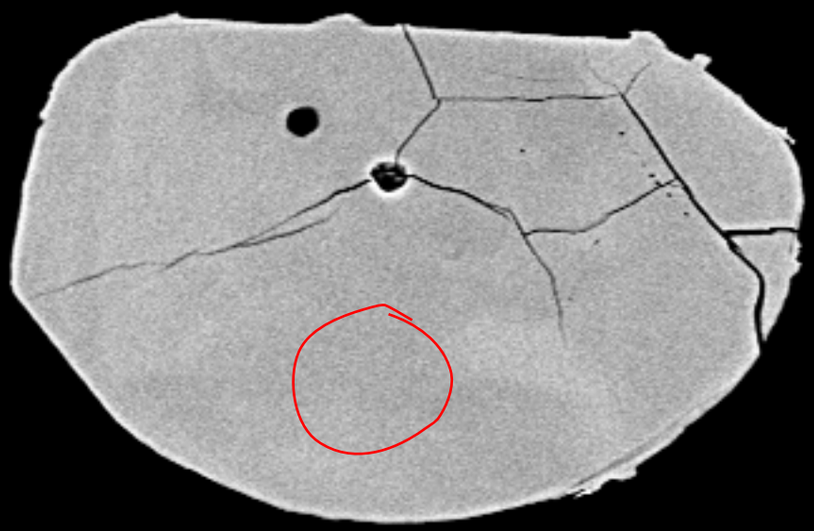
34

35

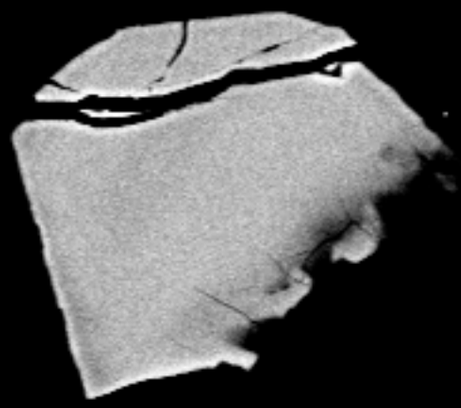


20 µm

File Name = 10971-10.tif

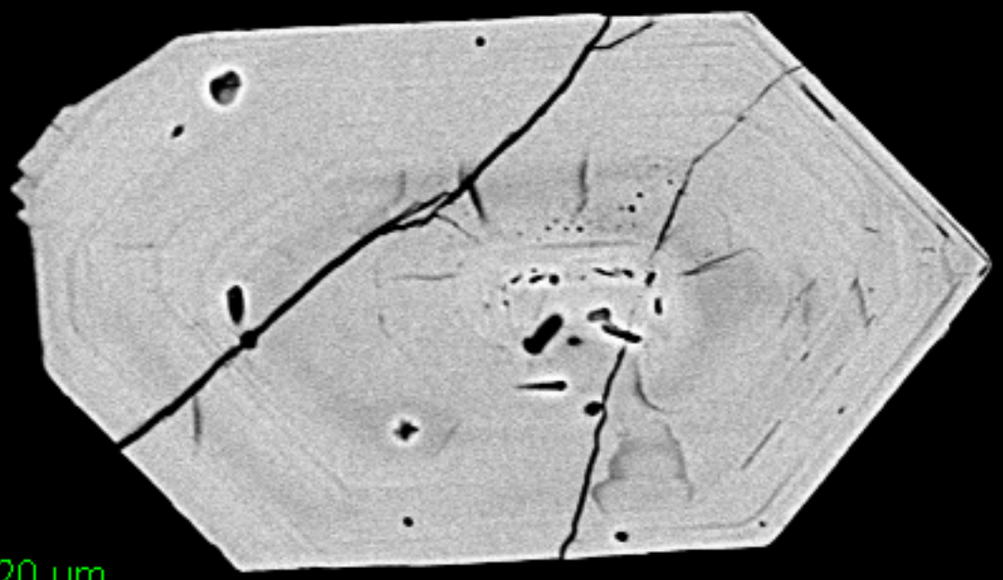


36



37

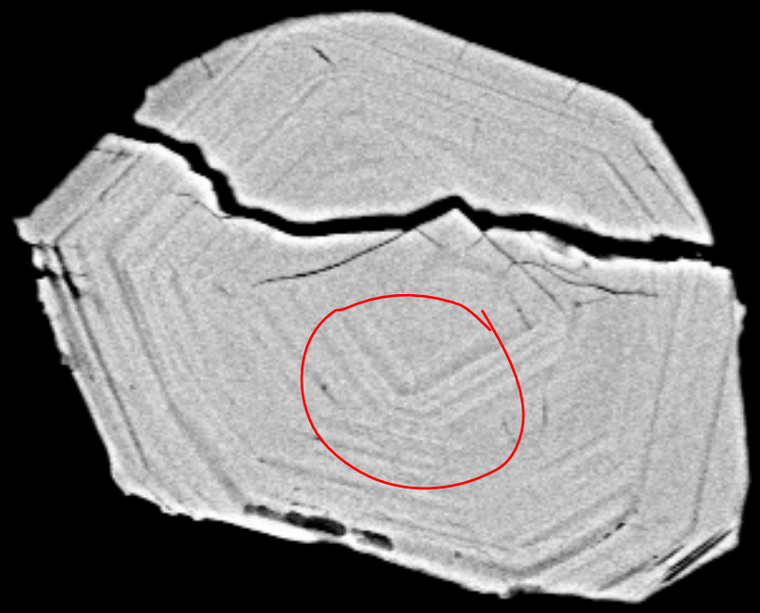
38



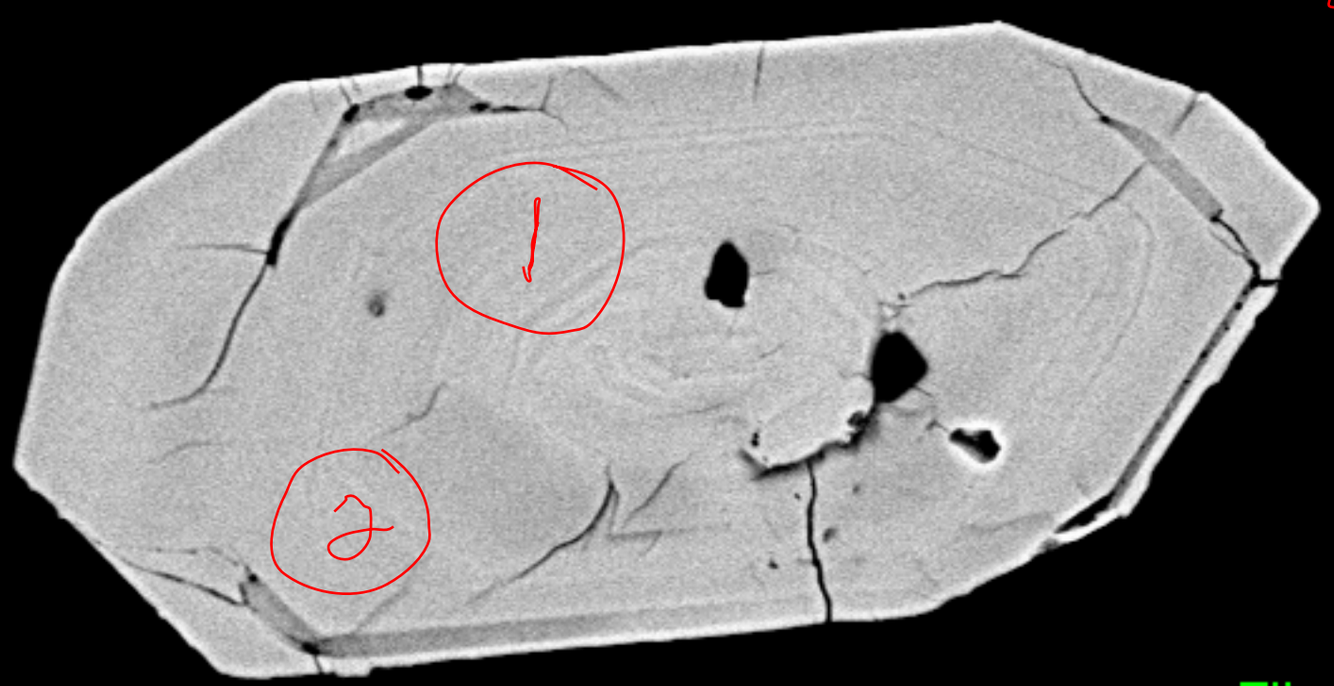
39

20 µm

File Name = 10971-11.tif

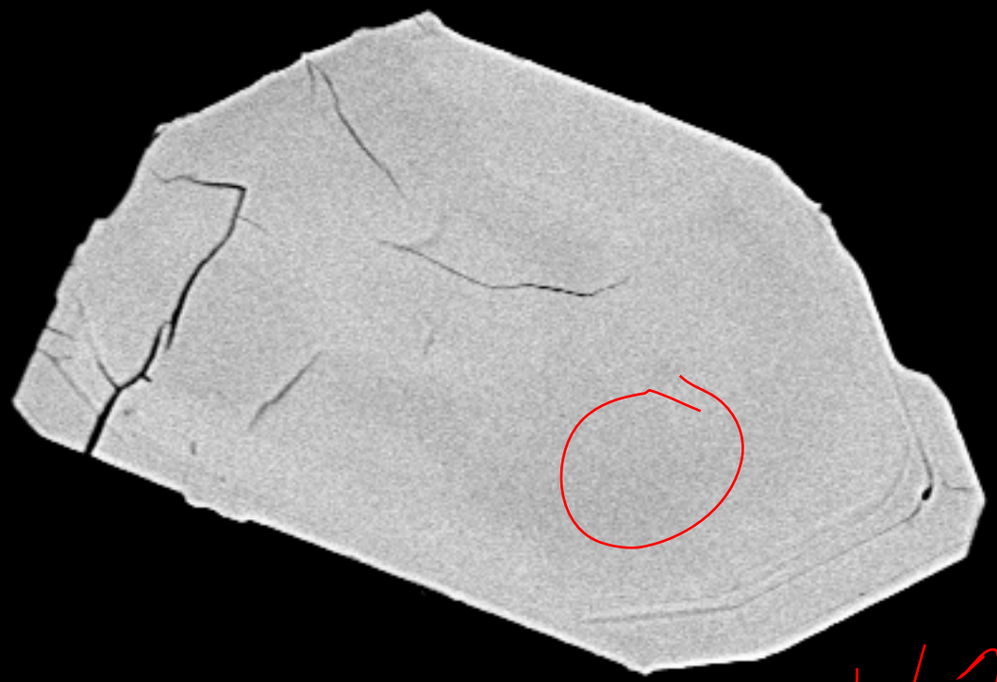


40



41

File Name = 10971-12.tif

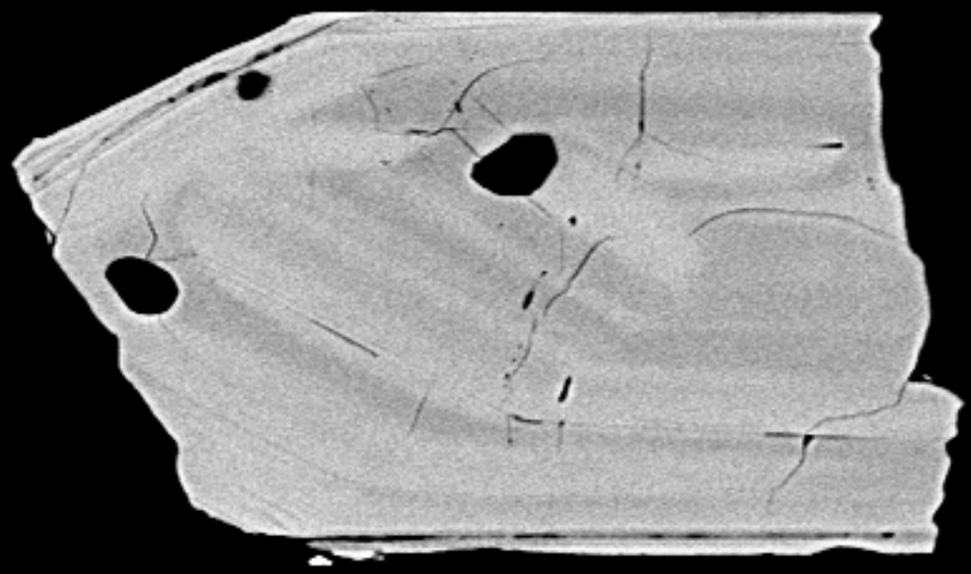


42

43

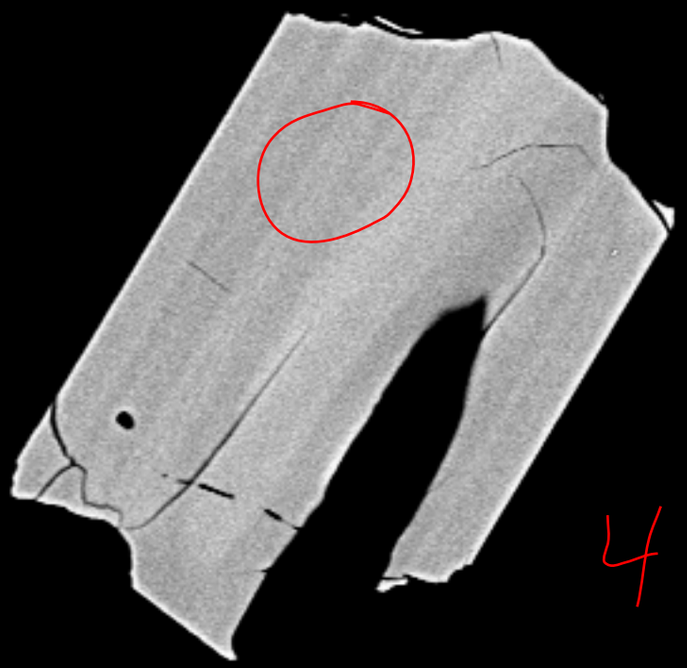
44

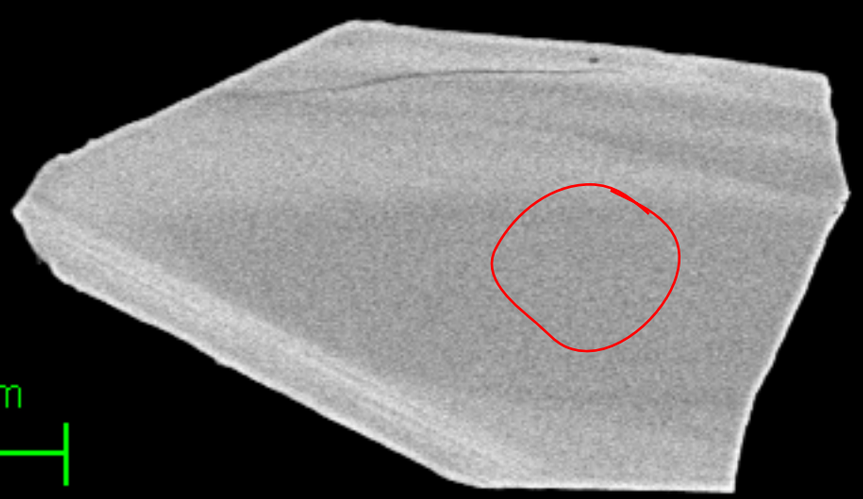
45

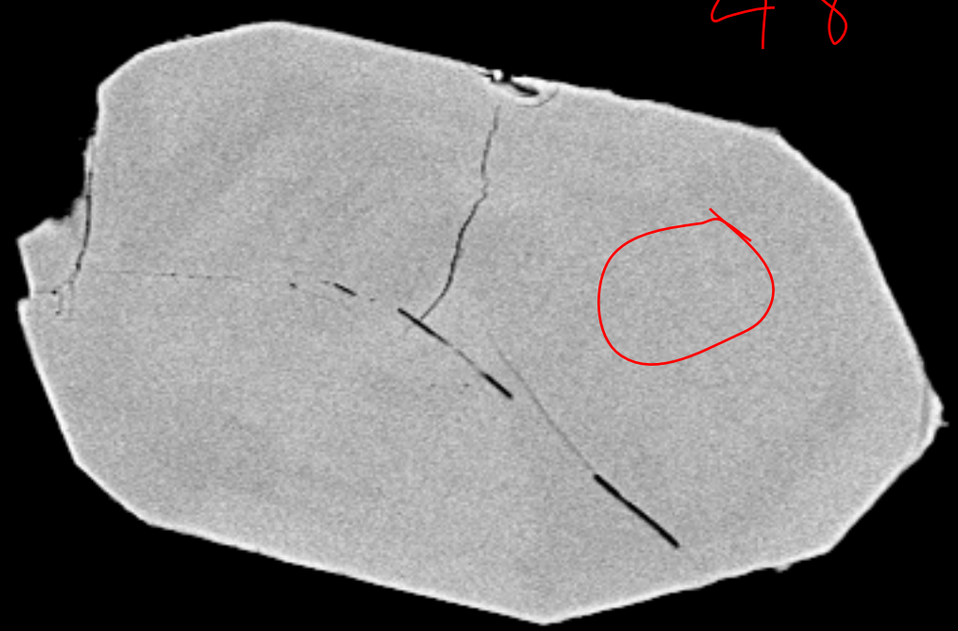


20 µm

File Name = 10971-13.tif

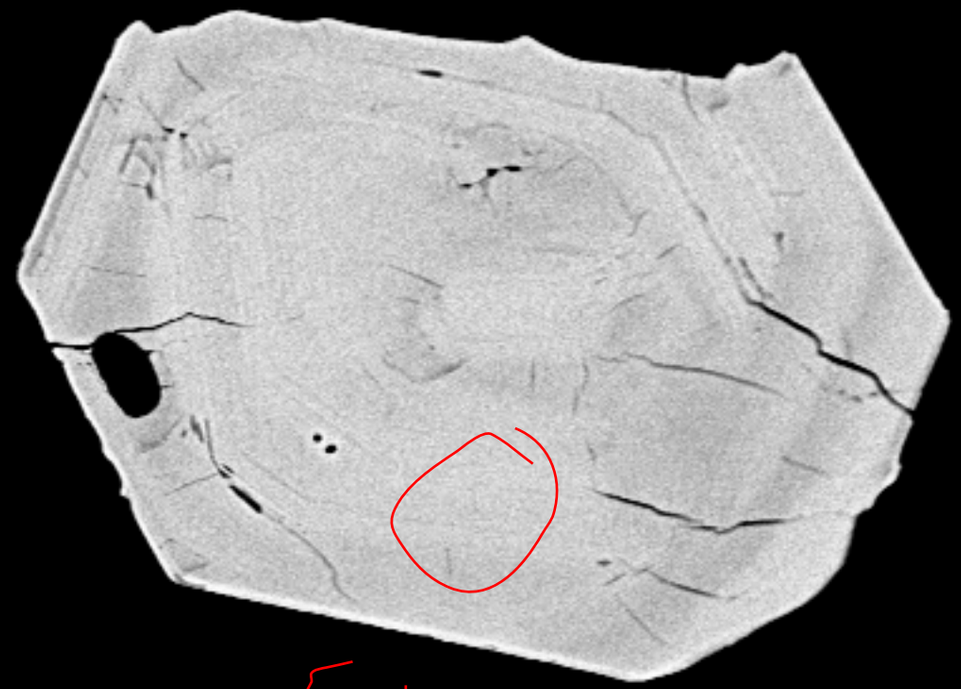




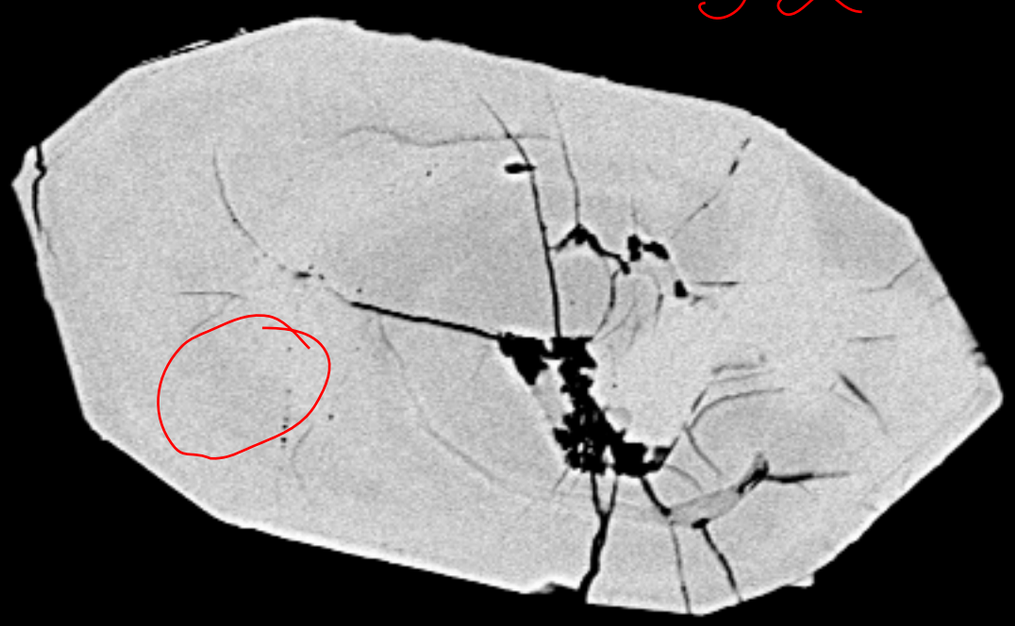


File Name = 10971-14.tif

50



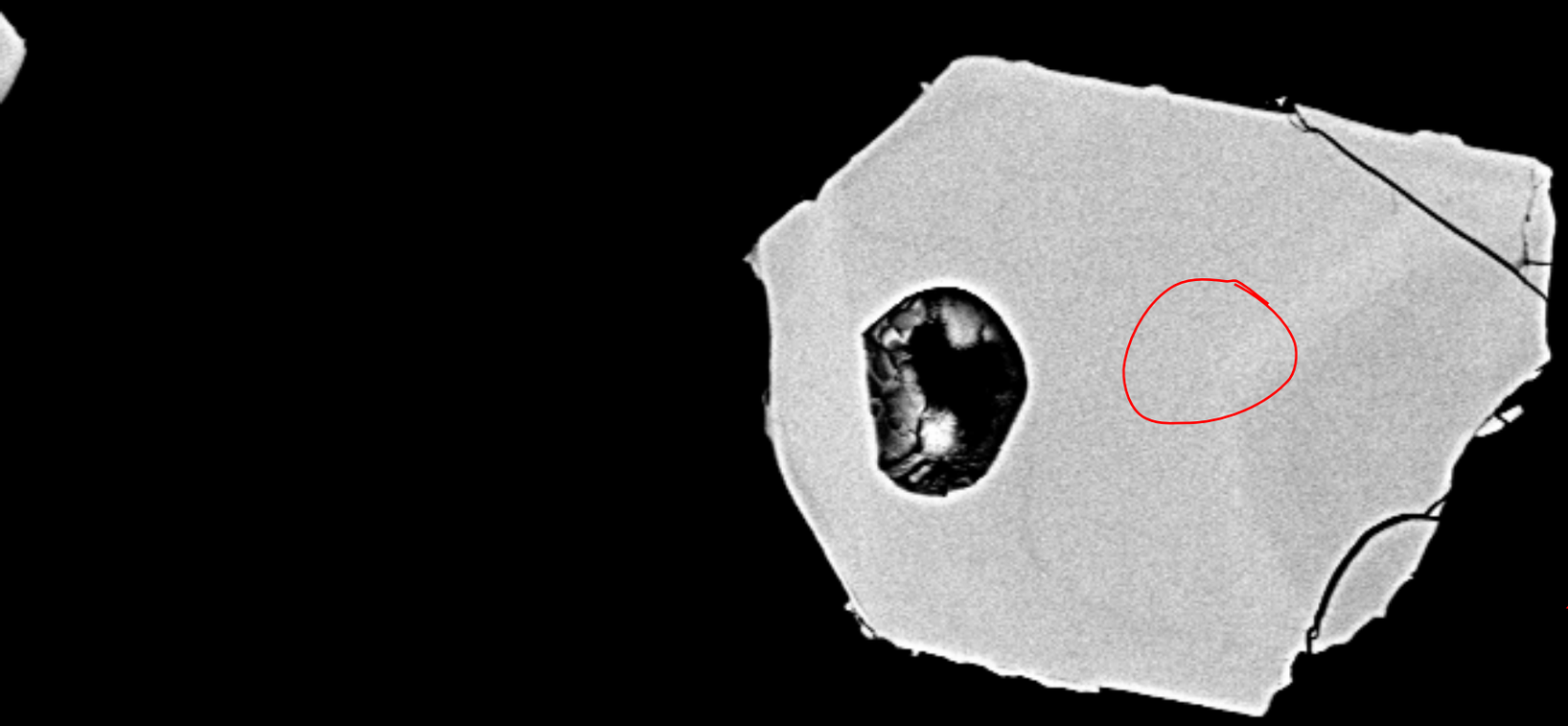
51



52

20 µm

File Name = 10971-15.tif


53
54
20 µm
File Name = 10971-16.tif

55

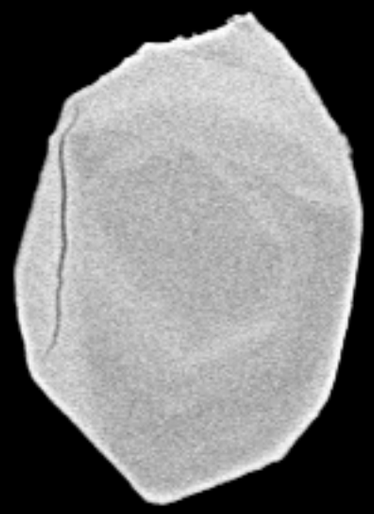
56

58

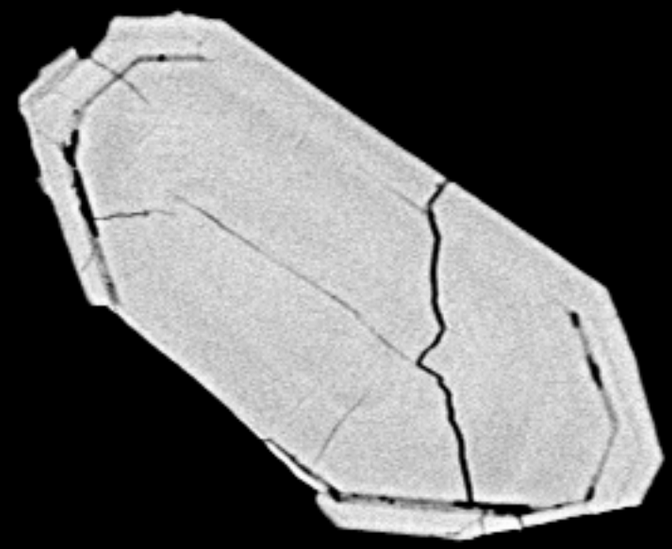
57

20 µm

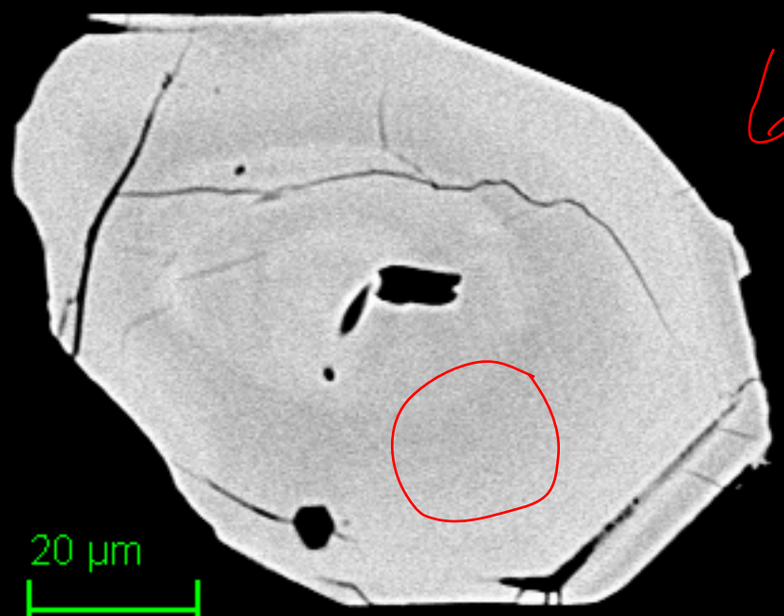
File Name = 10971-17.tif



59



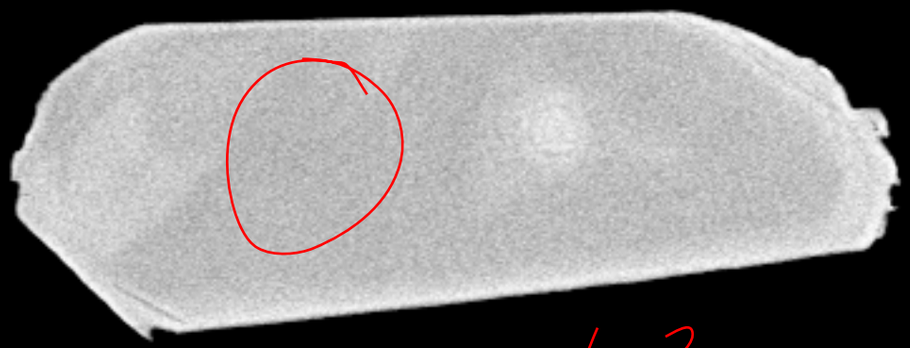
60



62

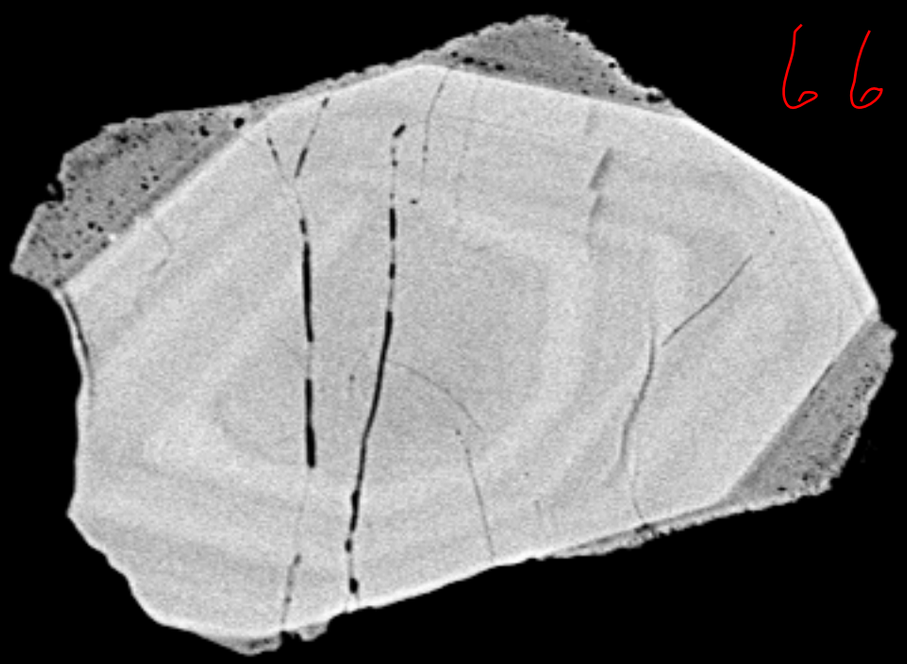
61

File Name = 10971-18.tif

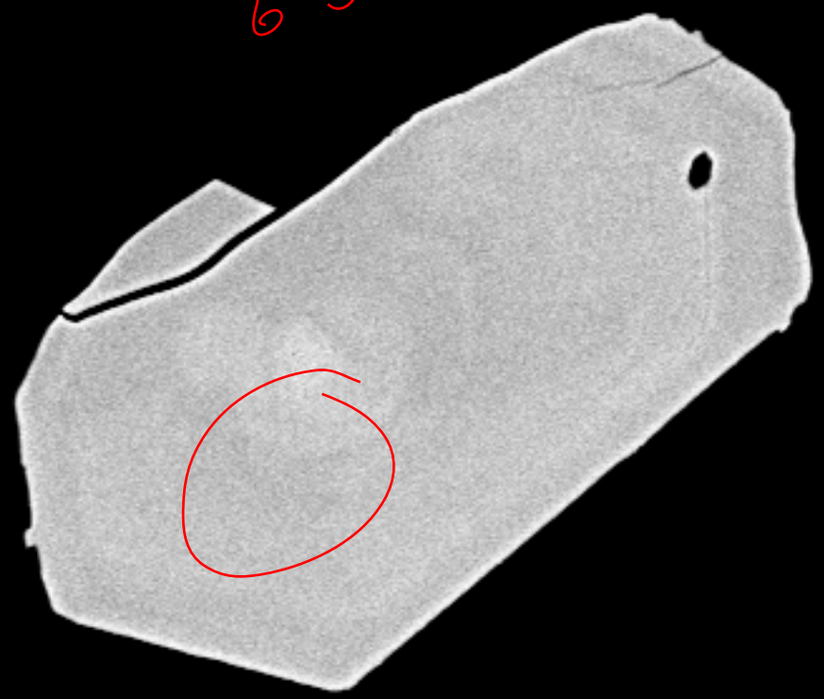


63

64



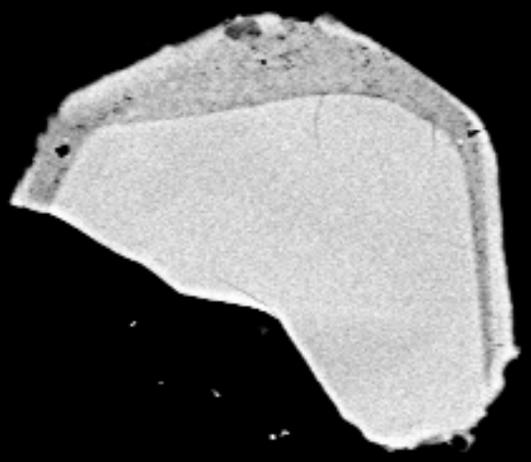
66



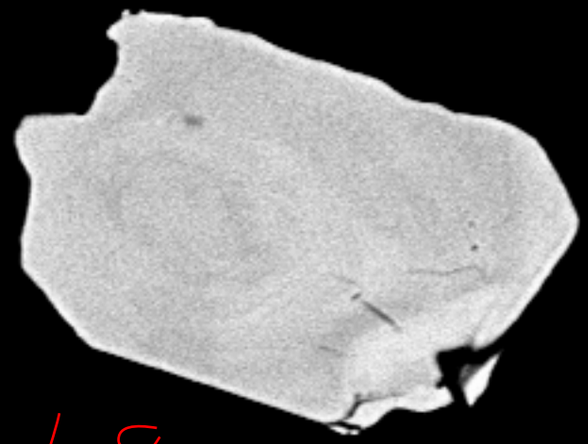
65

20 µm

File Name = 10971-19.tif

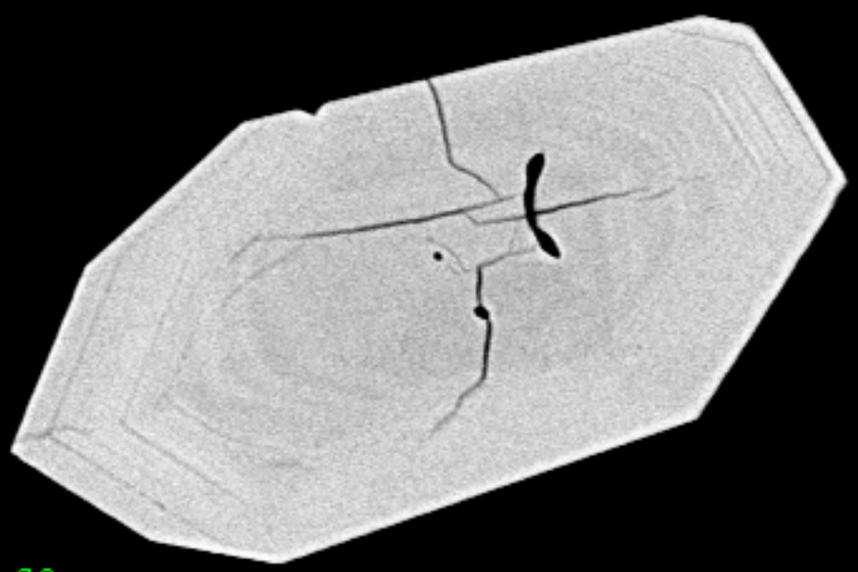


67

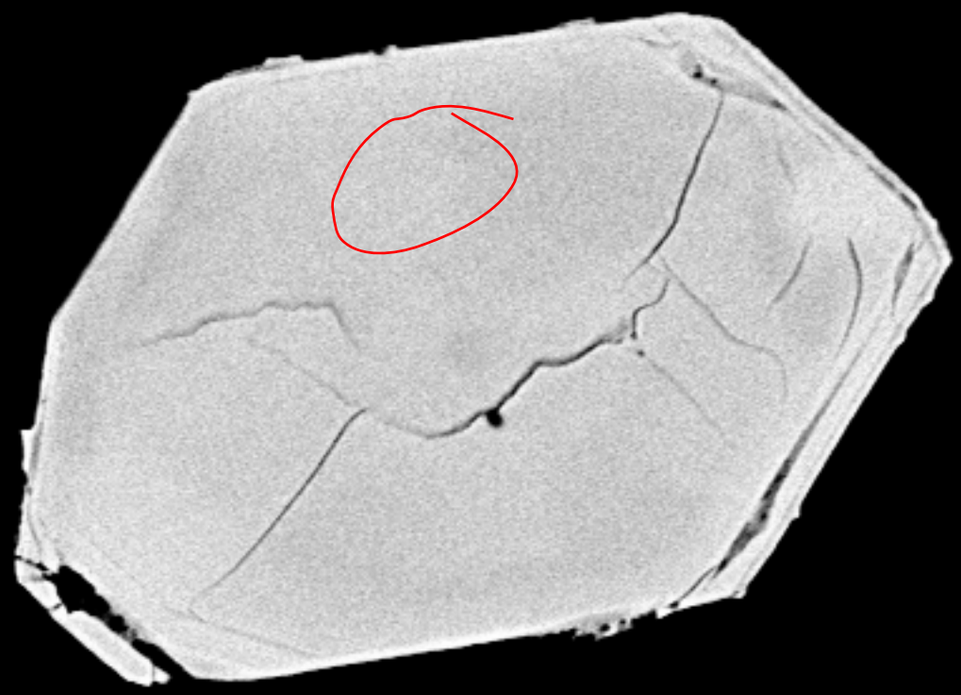


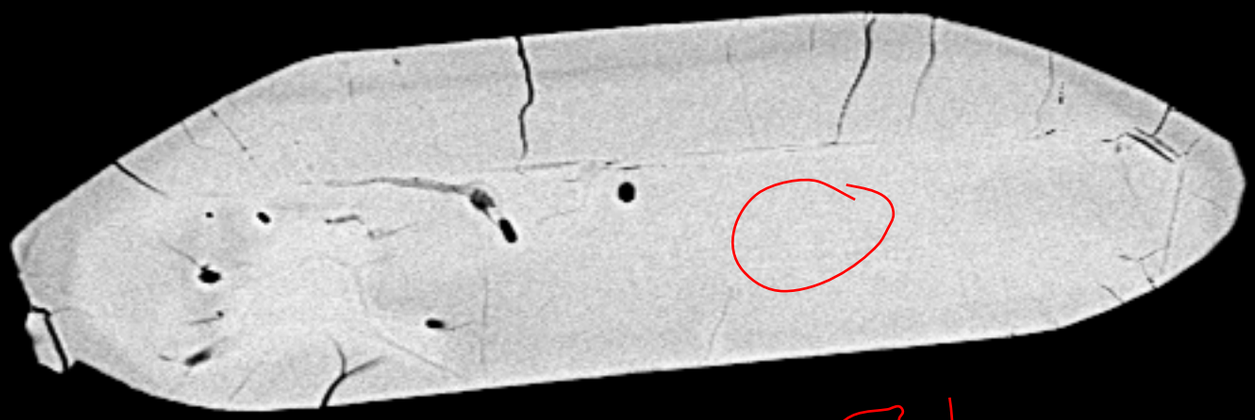
68

70



69

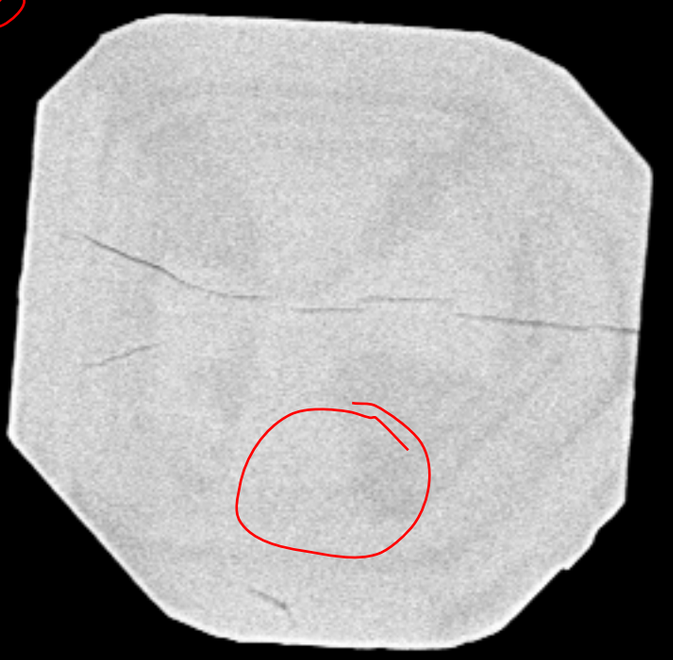




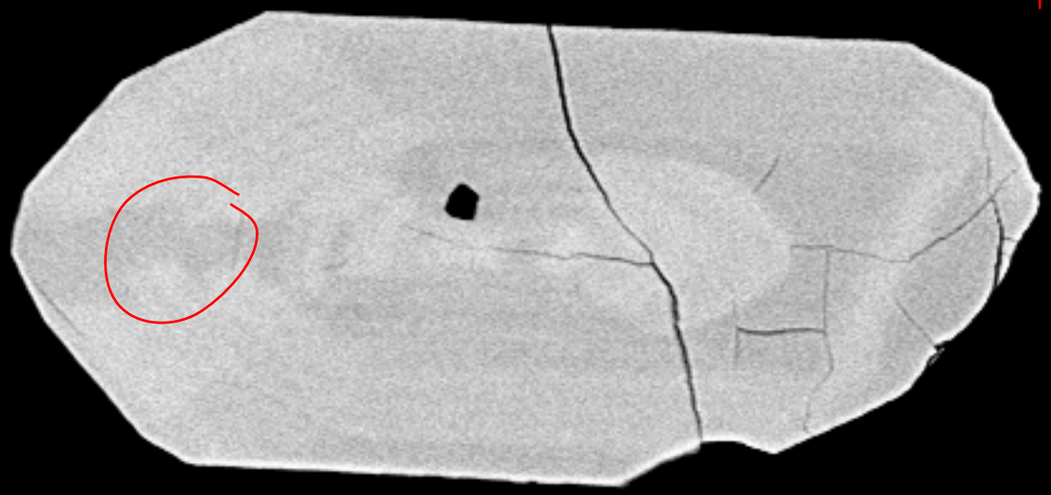
71

72

73

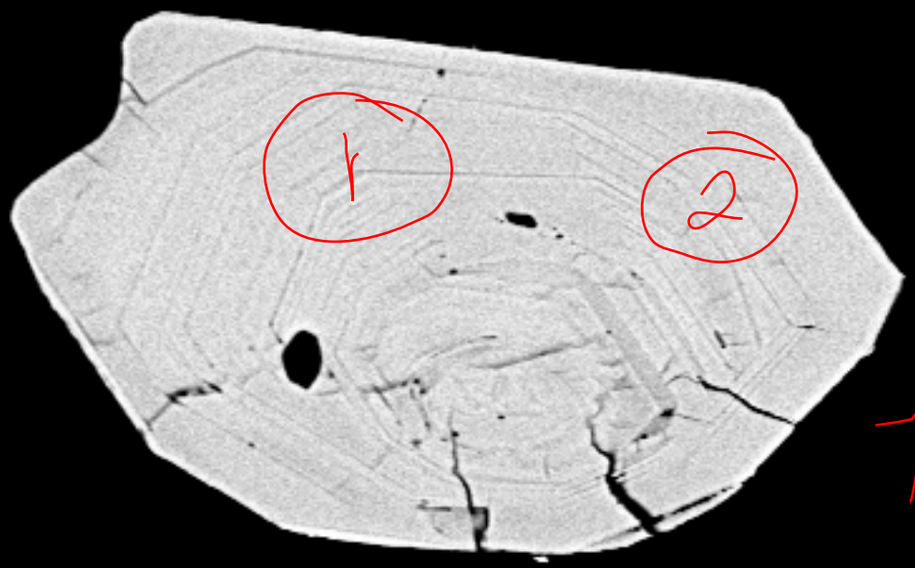


74



20 µm

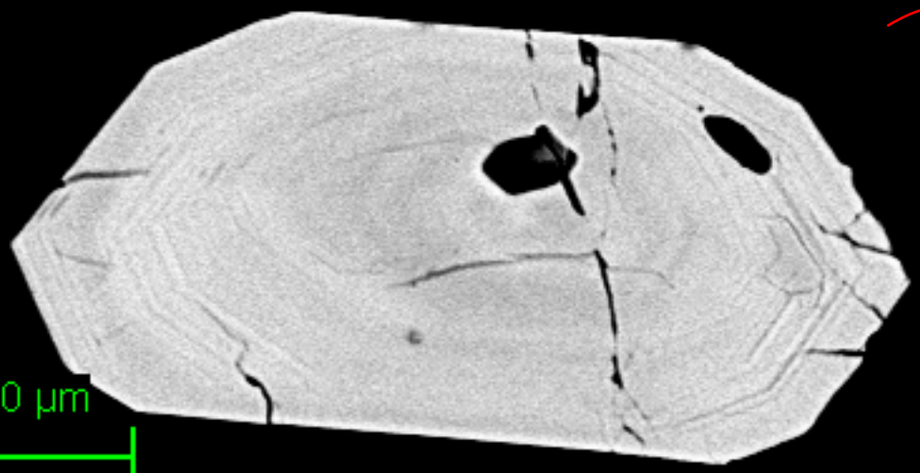
File Name = 10971-21.tif



75

76

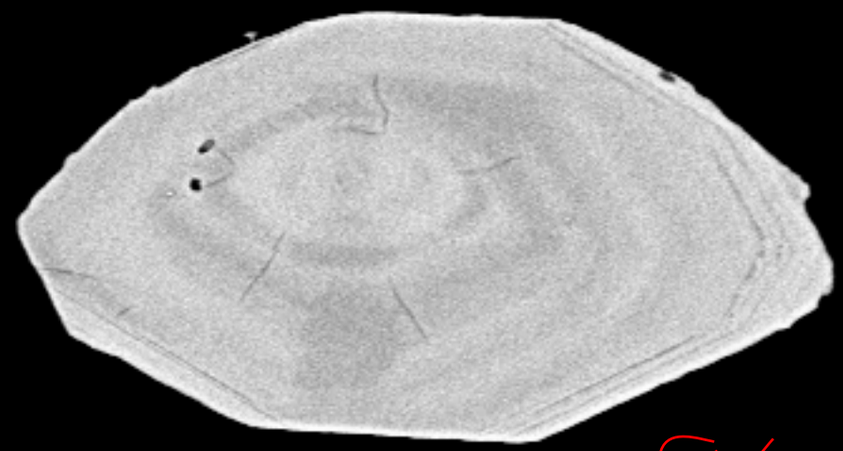
77



78

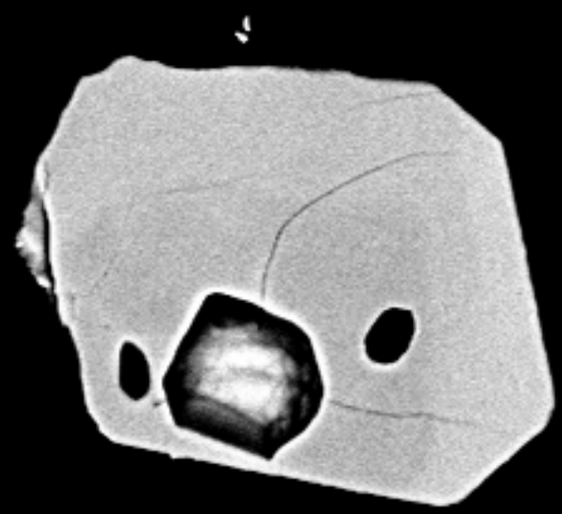
File Name = 10971-22.tif

79



86

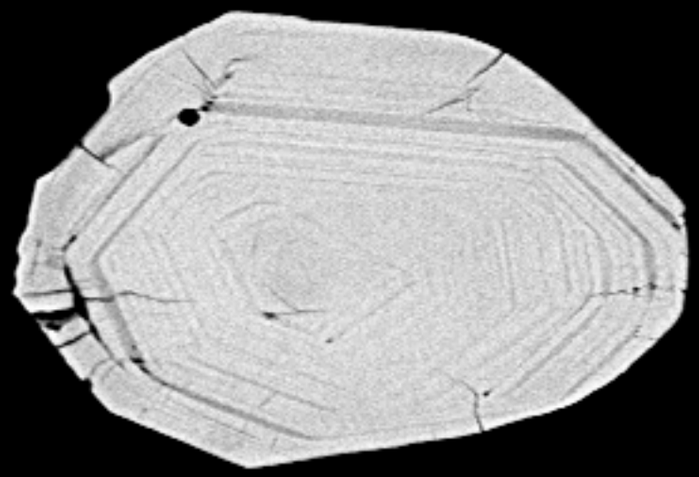
82



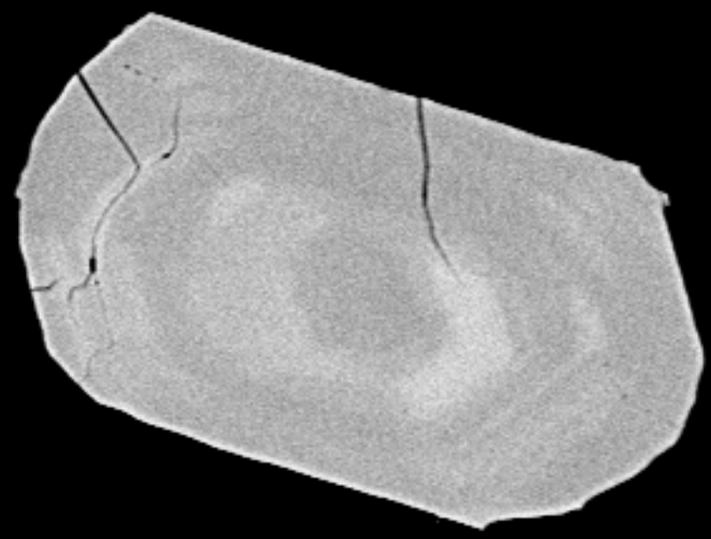
81

20 µm

File Name = 10971-23.tif



83



84

85

86

20 µm

File Name = 10971-24.tif

87

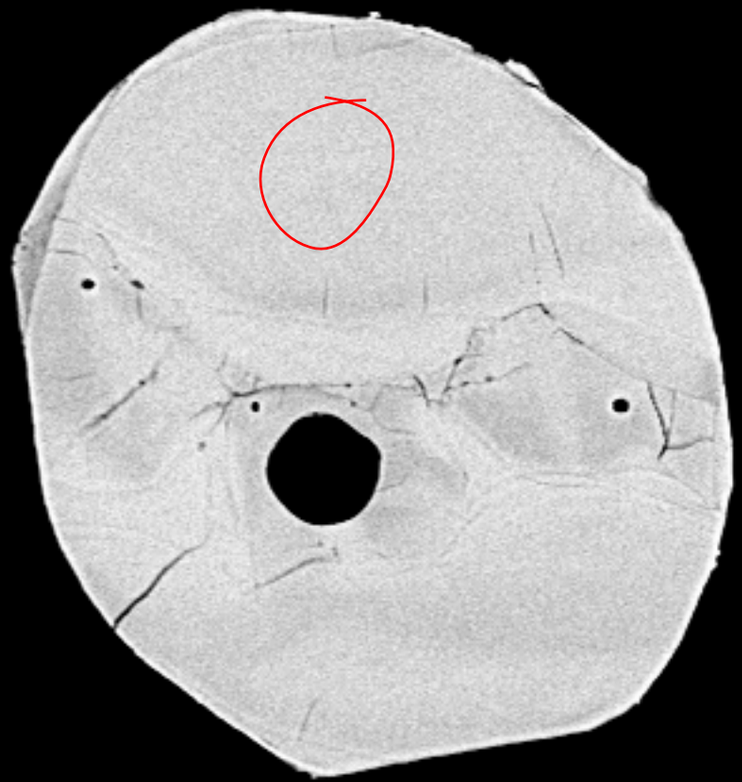
88

96

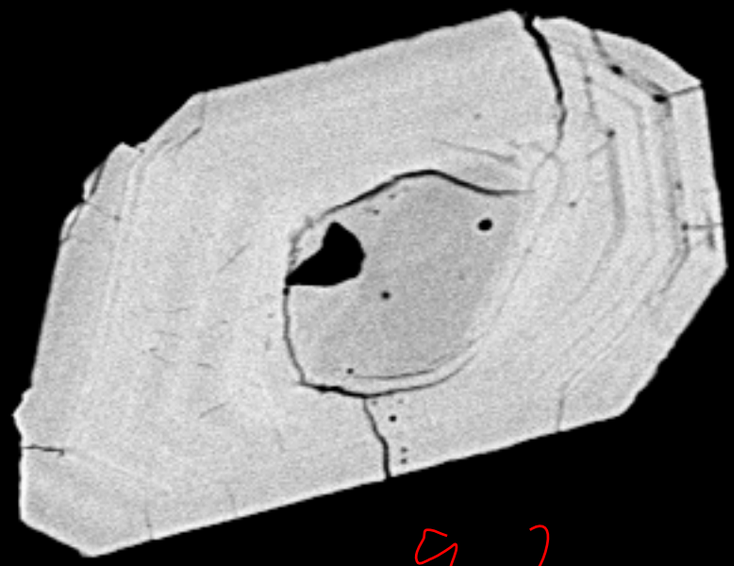
89

20 µm

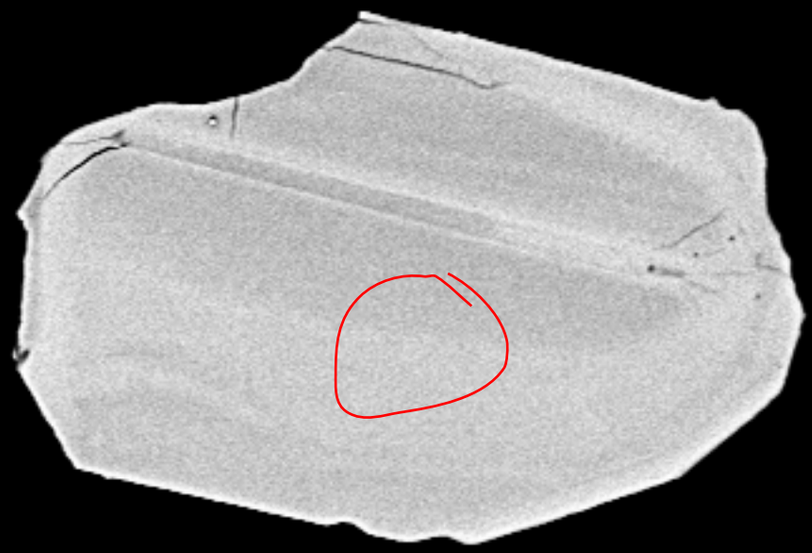
File Name = 10971-25.tif



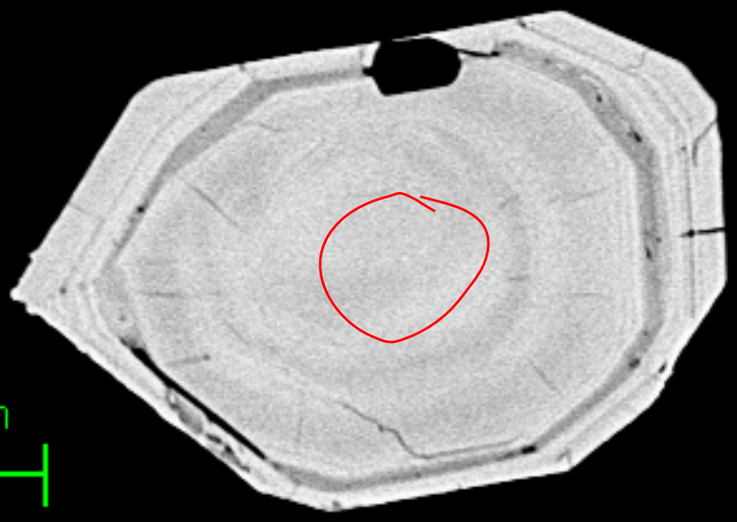
91



92



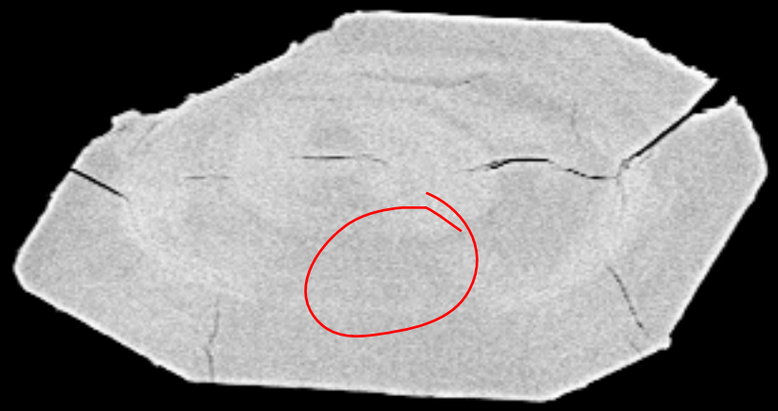
93



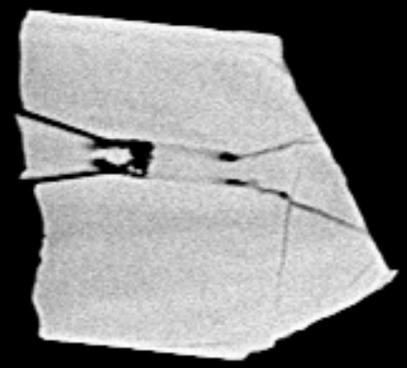
94

20 µm

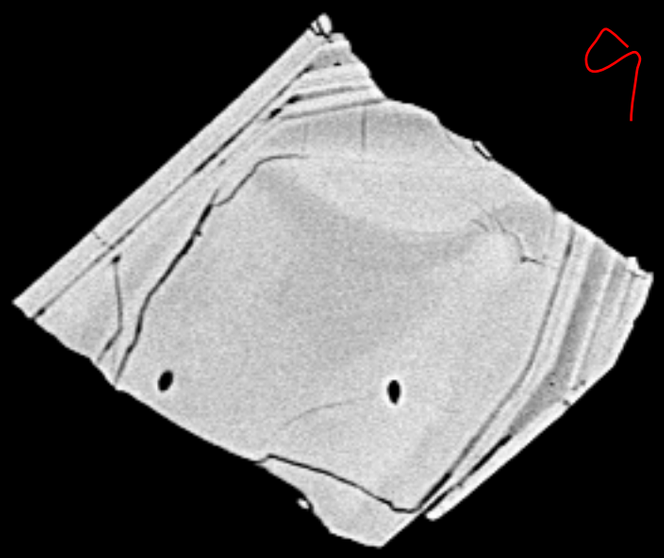
File Name = 10971-26.tif



95

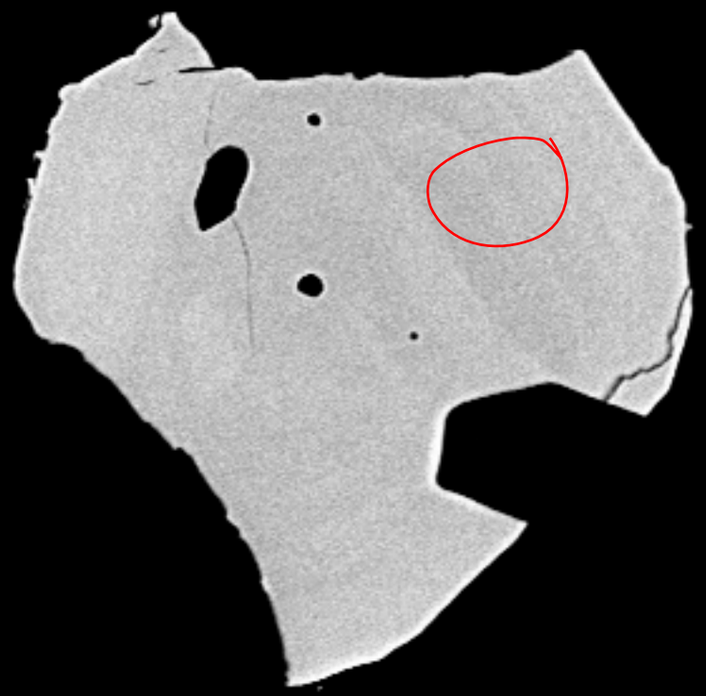


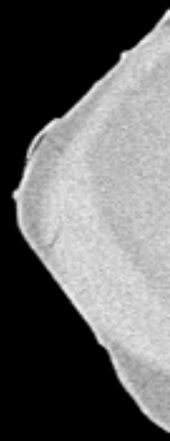
96



98

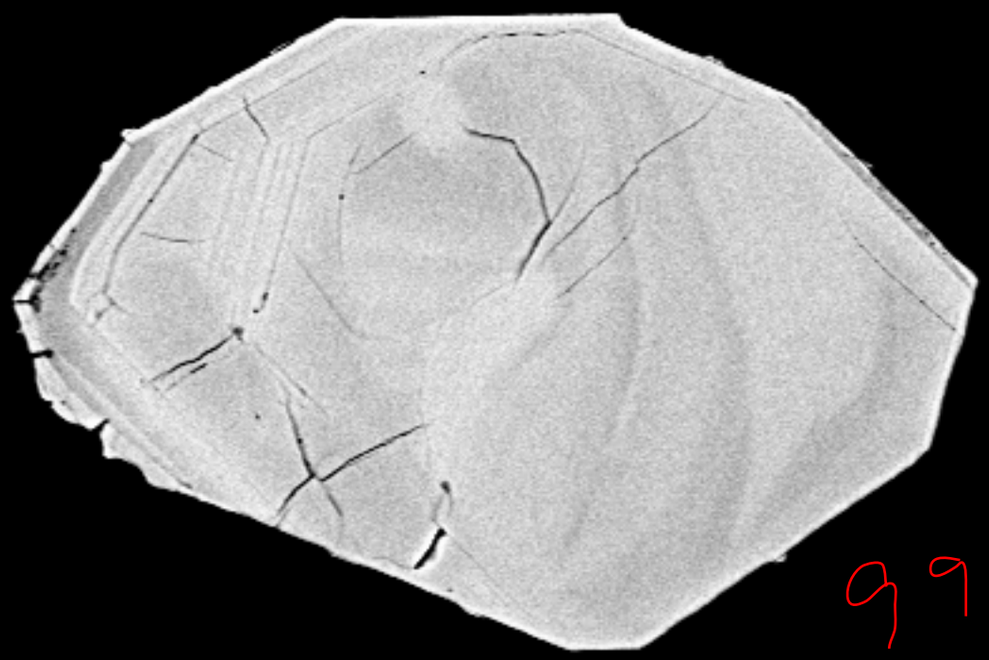
97





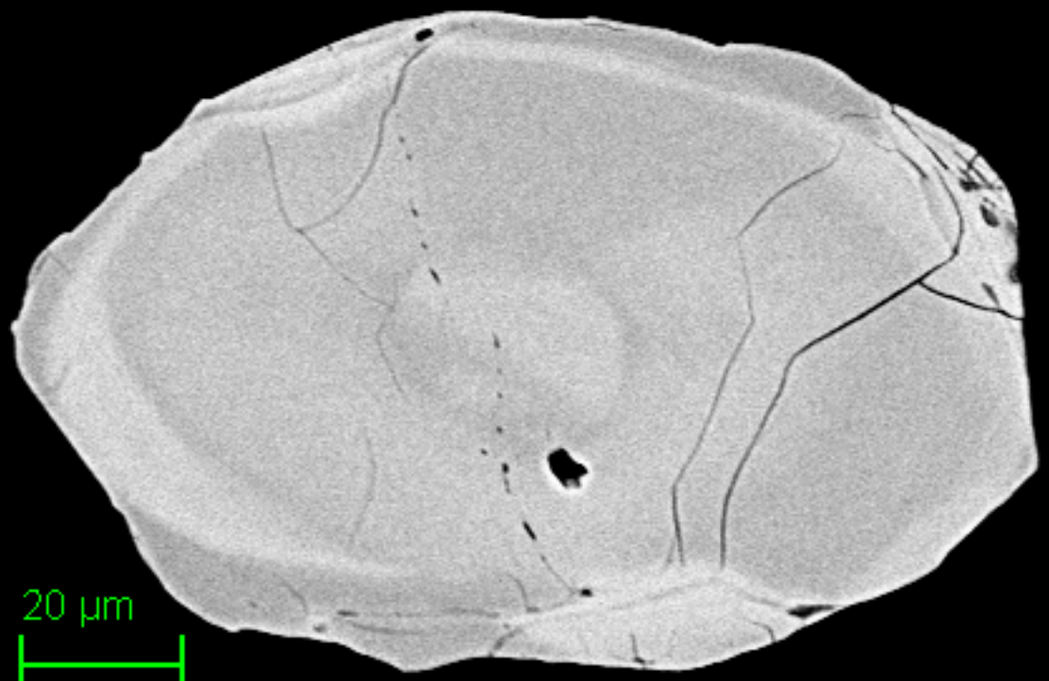
20 µm

File Name = 10971-27.tif

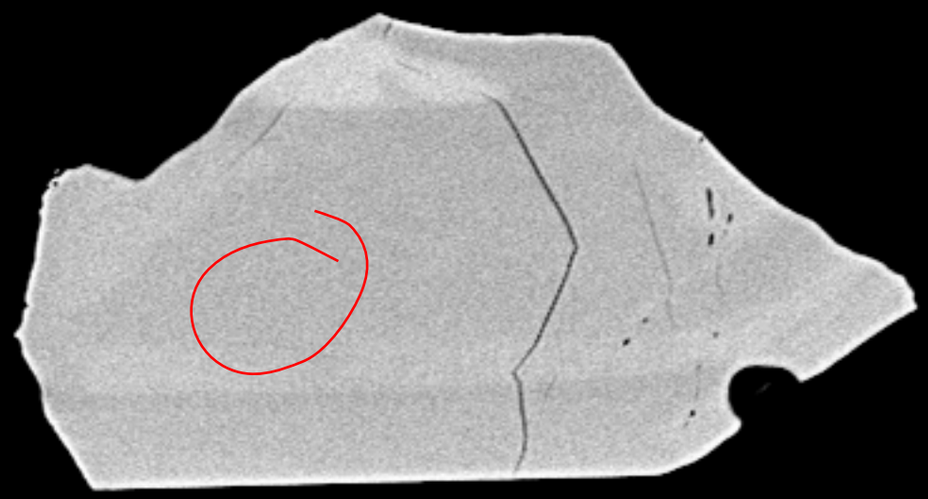


99

100

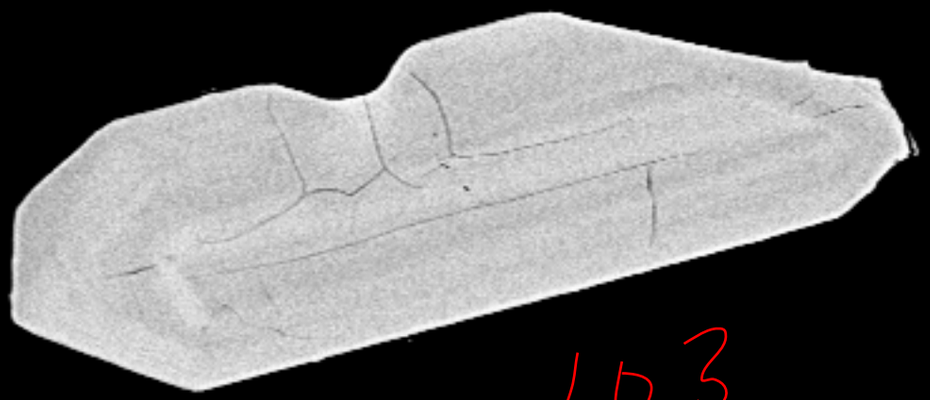


102



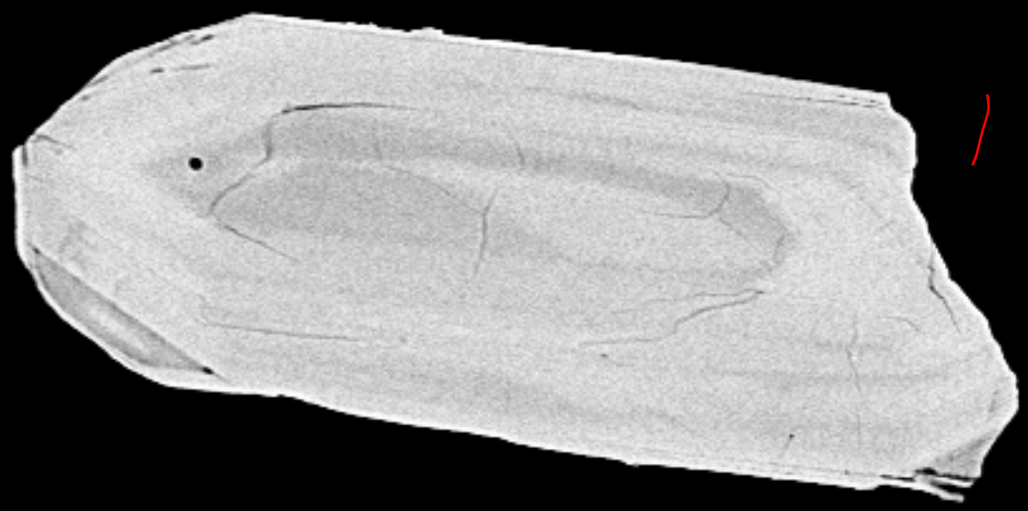
101

File Name = 10971-28.tif



103

104



106

105

20 µm

File Name = 10971-29.tif

107

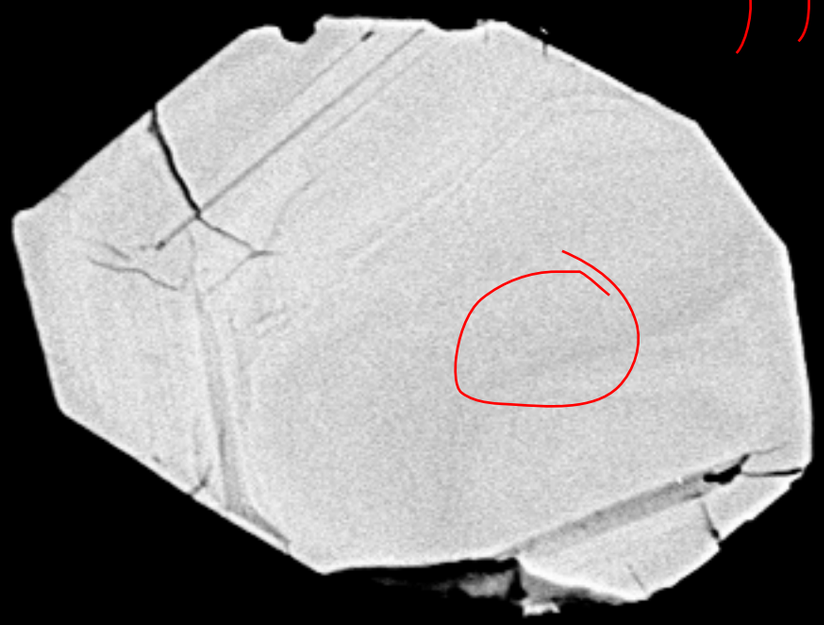
108

116

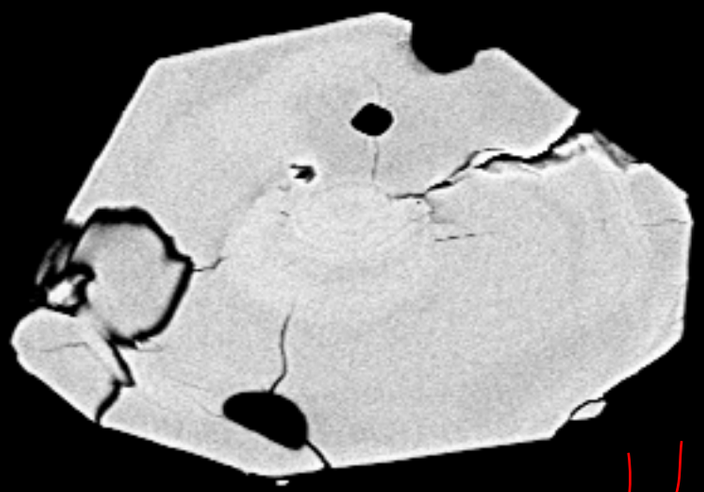
109

20 µm

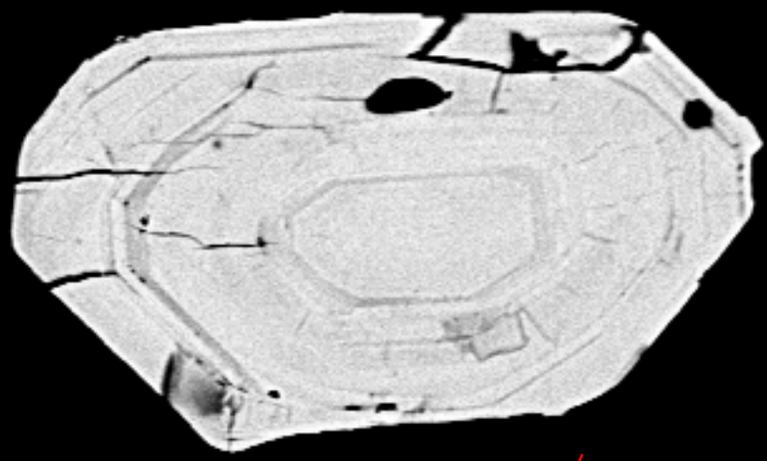
File Name = 10971-30.tif



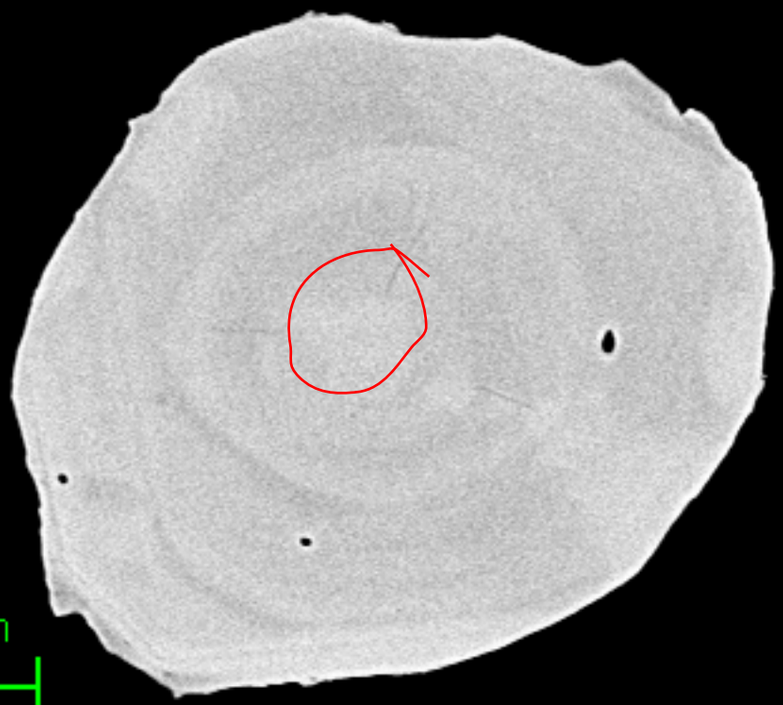
File Name = 10971-31.tif



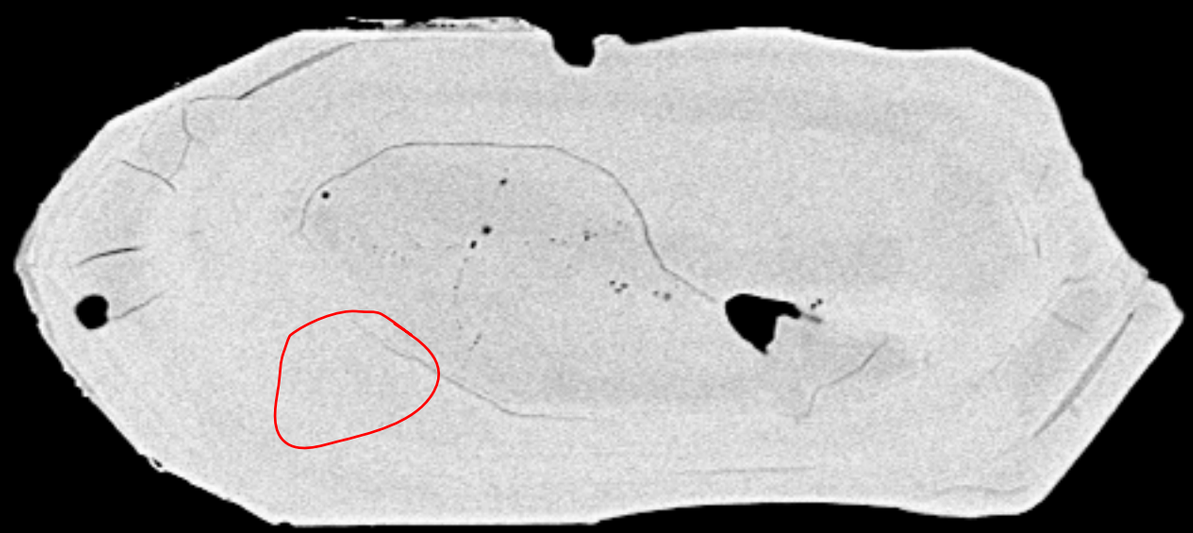
115



116



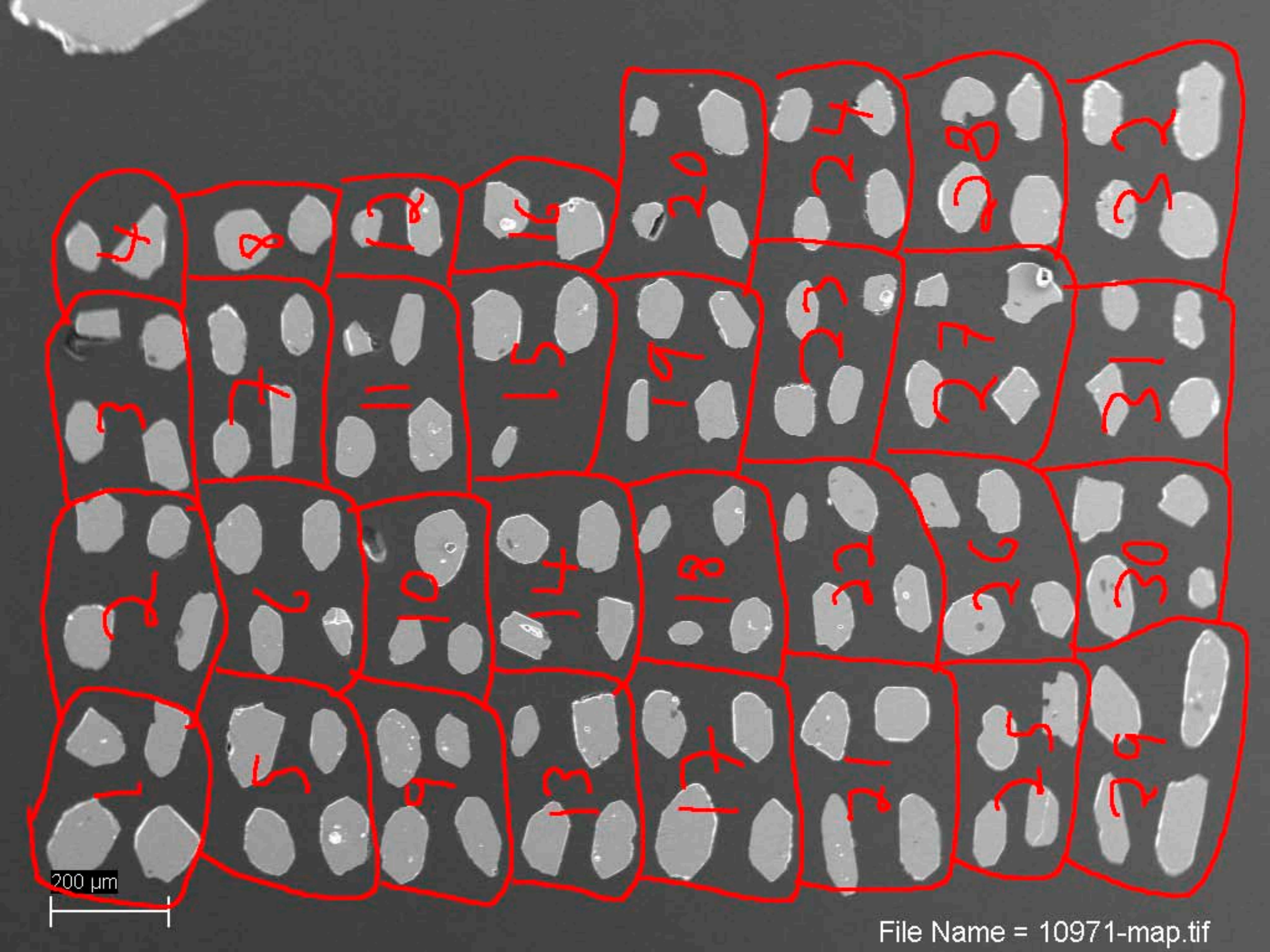
118



117

20 µm

File Name = 10971-32.tif


200 µm
File Name = 10971-map.tif