#0459

Backscattered electron SEM of early childhood caries

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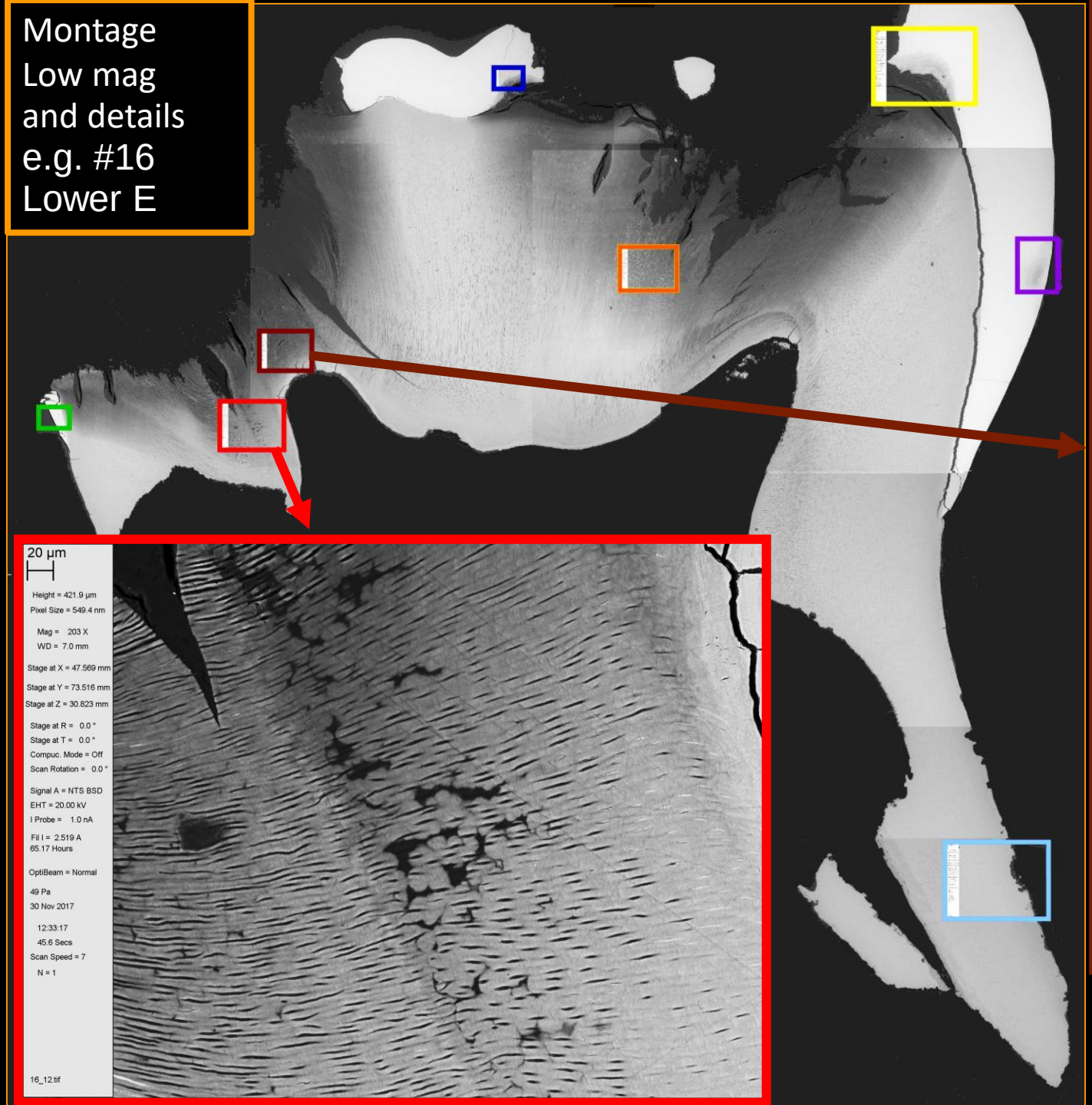
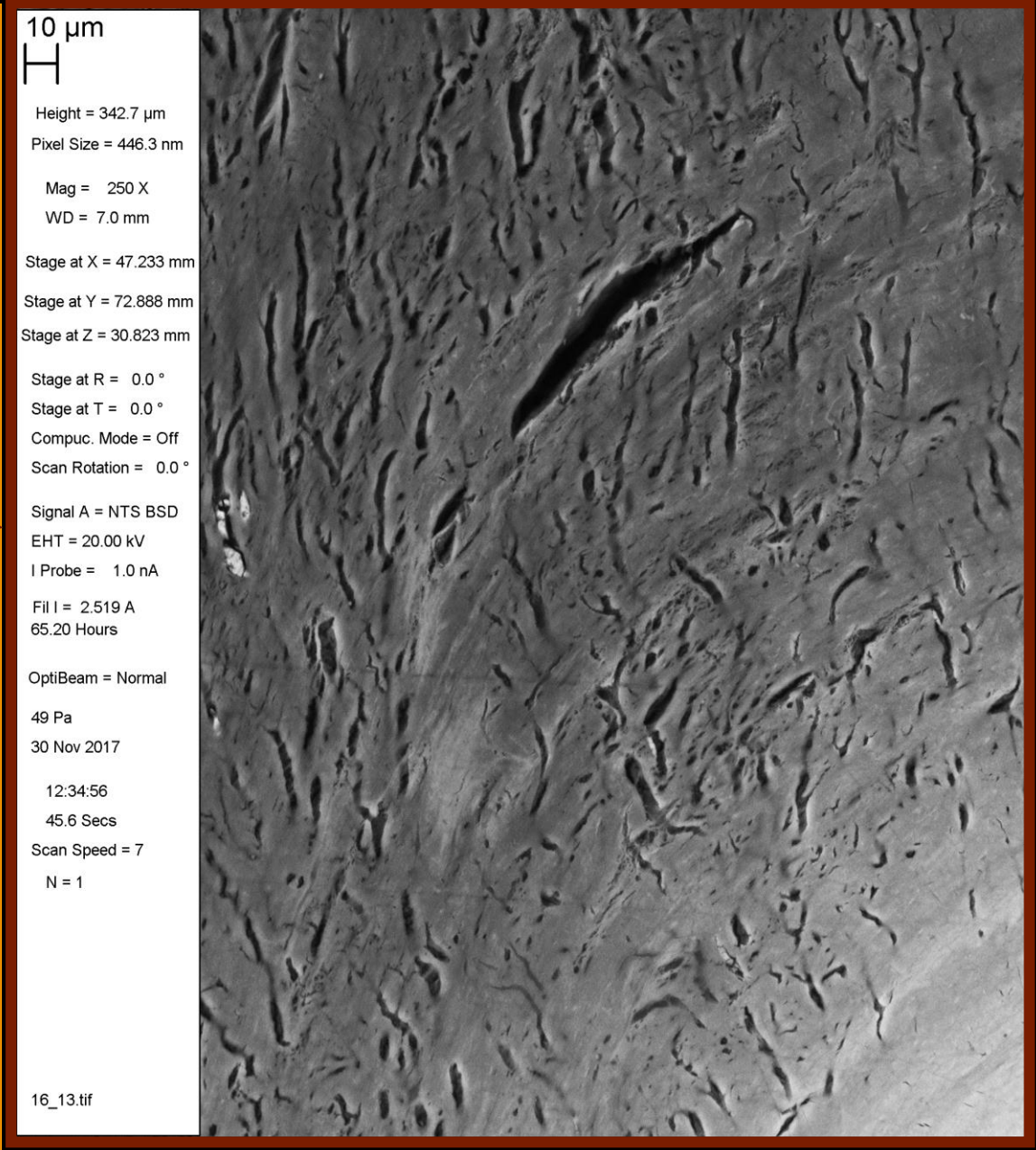
Objectives and Methods

- Early childhood caries is a major health problem
- We looked for structural and compositional changes in primary molar decay
- Deciduous molars preserved in 70% ethanol, obtained from anonymised collection. Age at extraction estimated from remaining root lengths in the range 4 to 8 years. Photographed
- Reason for extraction most likely pulpitis - in every case there was a deep penetrating carious lesion
- Further dehydration to 100% ethanol, then xylene, and embedding in PMMA from monomer
- Teeth bisected and vertical section surfaces polished flat. Photographed
- Compositional contrast = mineral concentration dependent imaging using 20kV backscattered electron scanning electron microscopy,
  - uncoated [means we can examine number of polishing levels with no further preparation],
  - 50Pa chamber pressure
  - Fields montaged to cover entire specimen & higher magnifications for detail

- Blocks later stained with iodine vapour to study residual organic matrix and invading microbiota.

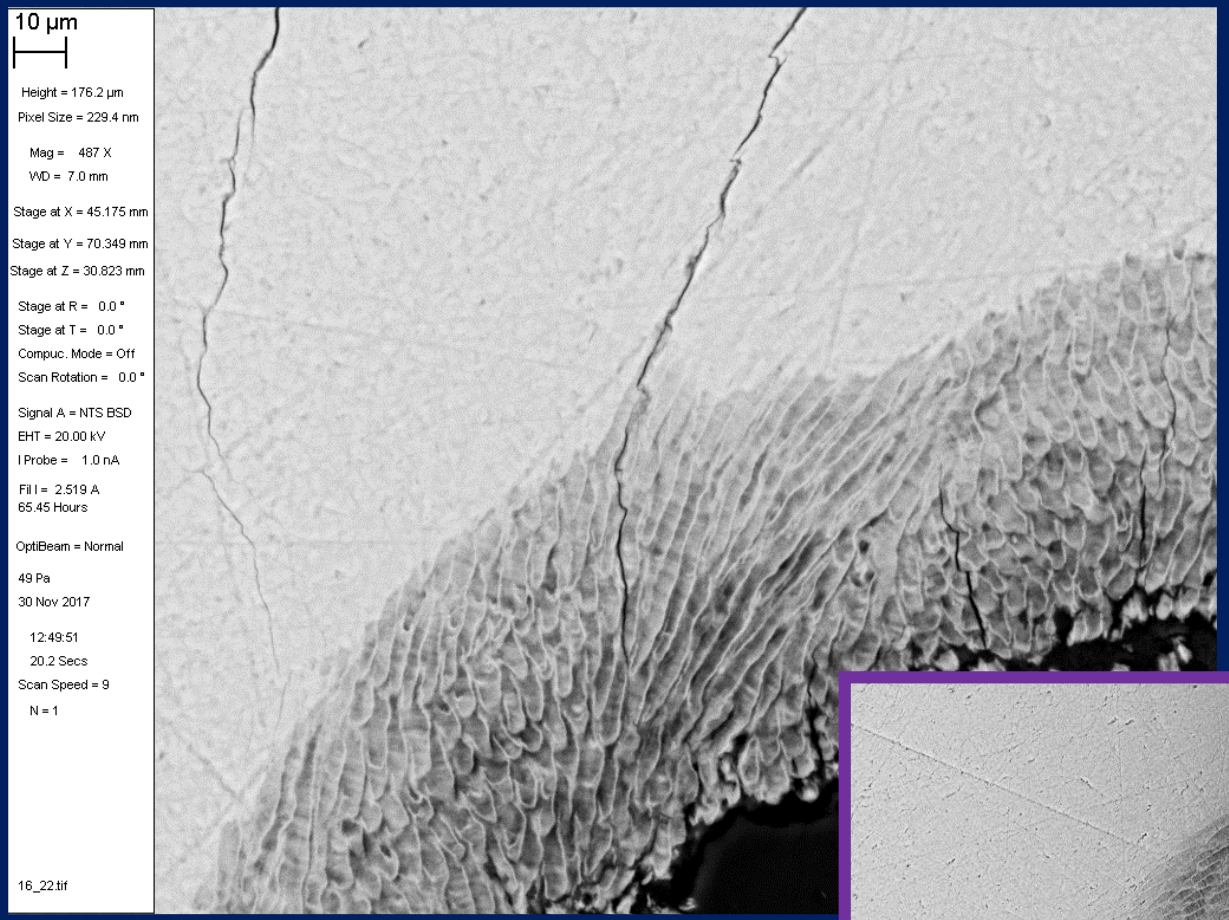
Montage
Low mag
and details
e.g. #16
Lower E



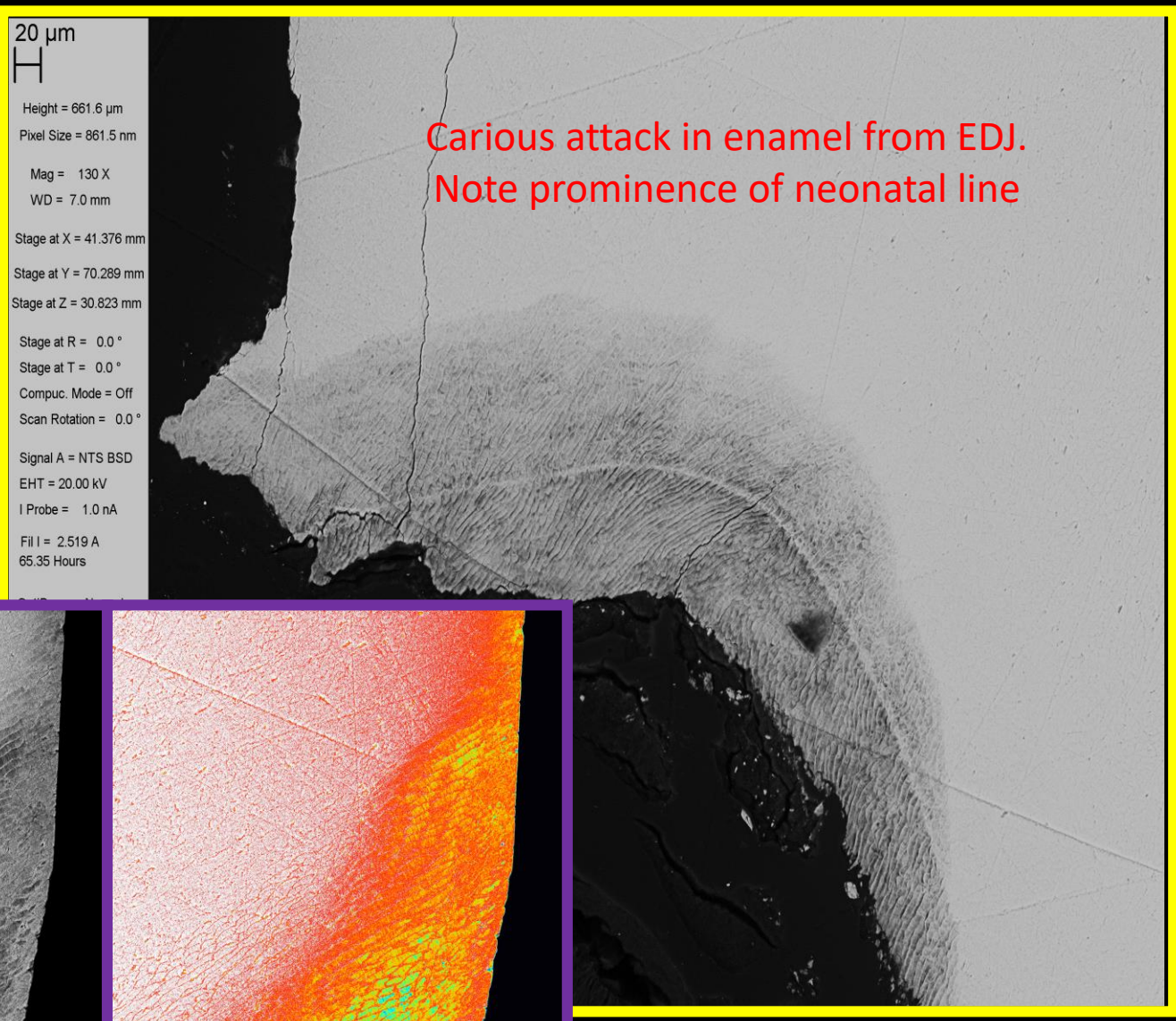


Invasive spread in dentine parallel with incremental layering of collagen during its development.

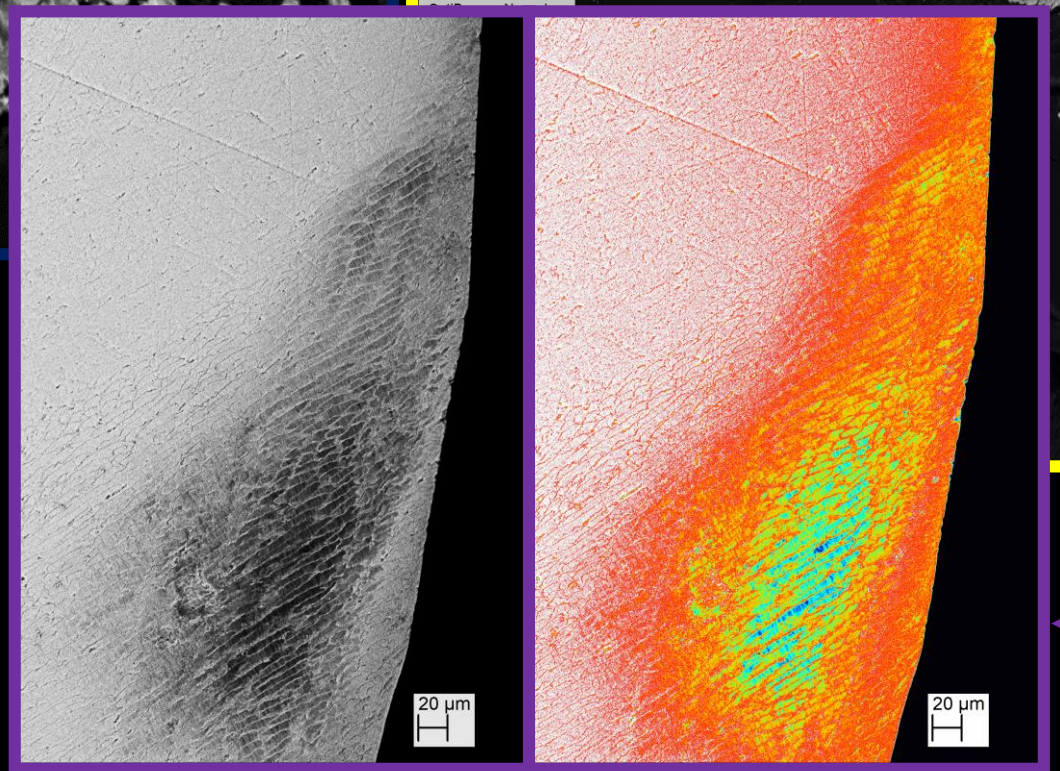
? Motile invasive species



Carious attack in enamel from EDJ; prominent cross-striations and mineral deposition within the prism boundary discontinuity spaces



Carious attack in enamel from EDJ.
Note prominence of neonatal line



Interproximal carious lesion in enamel & pseudocoloured

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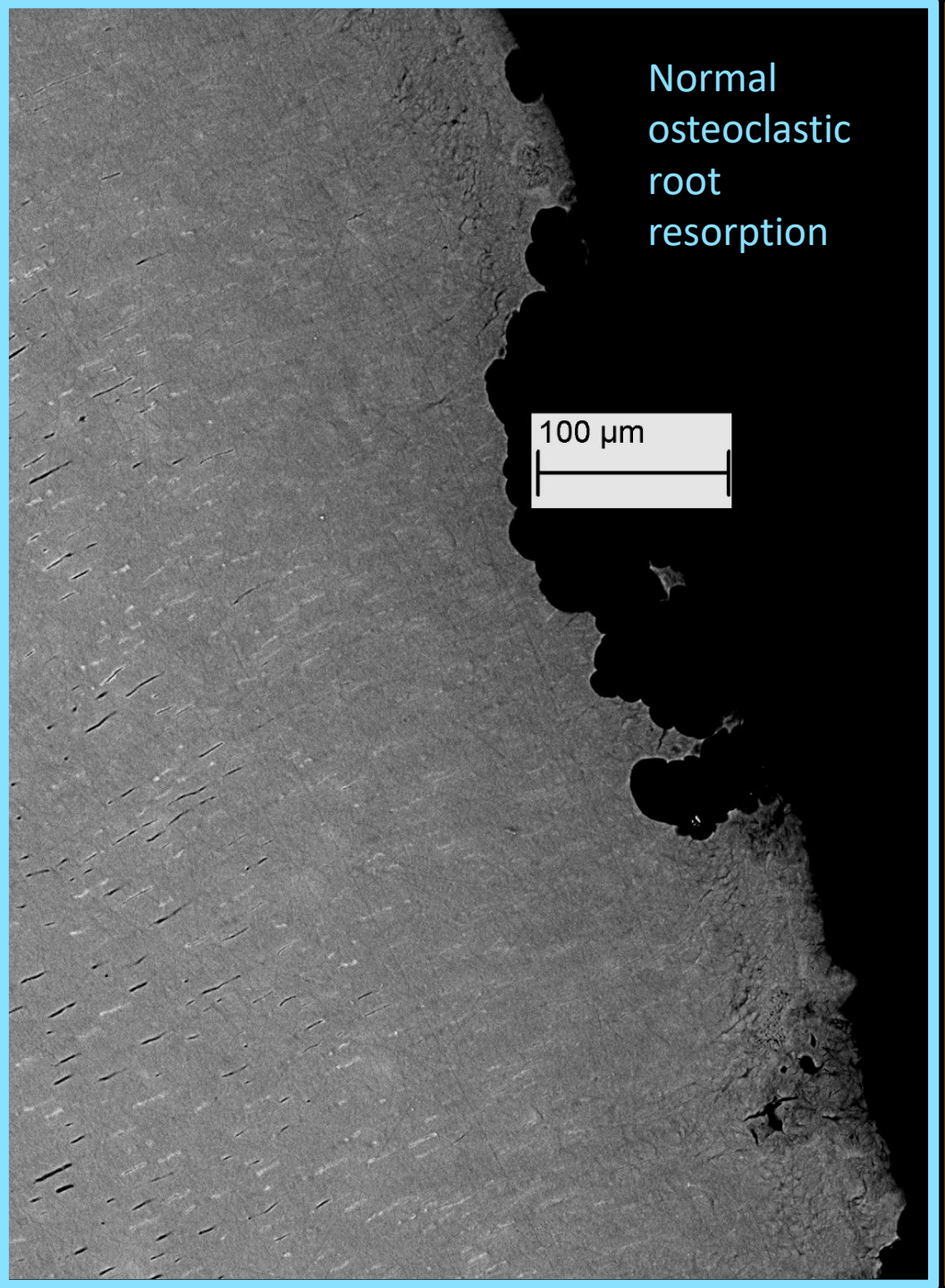
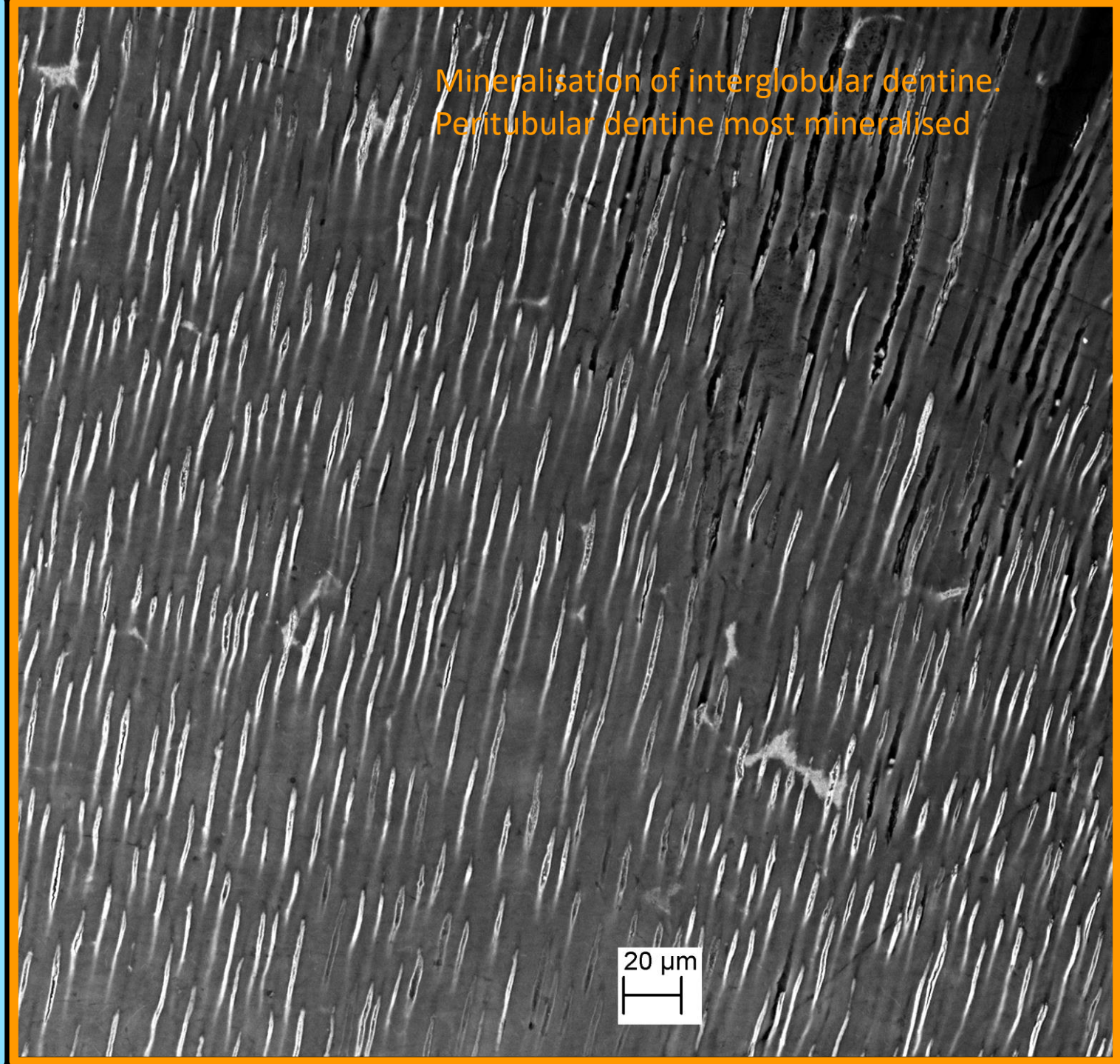
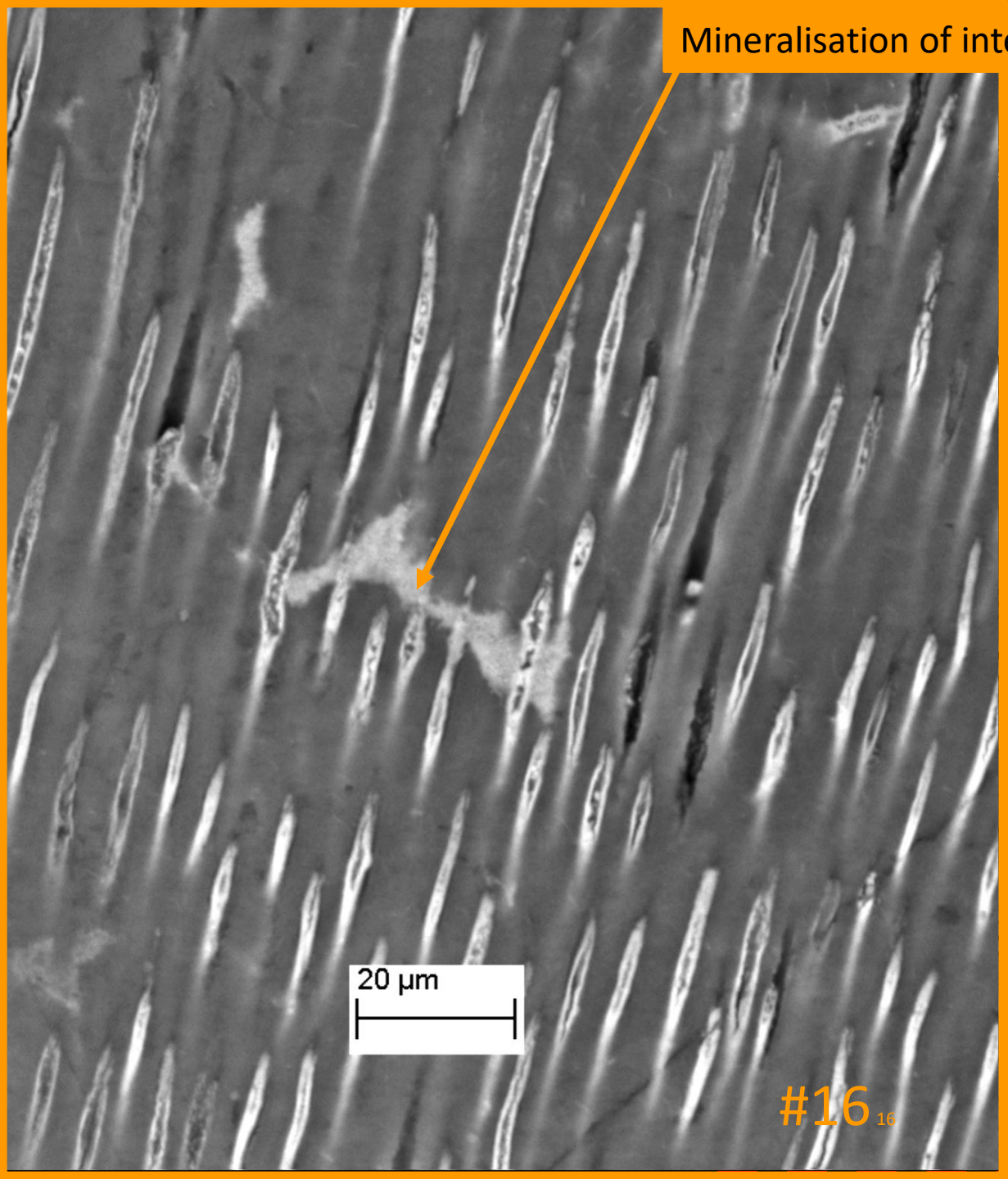
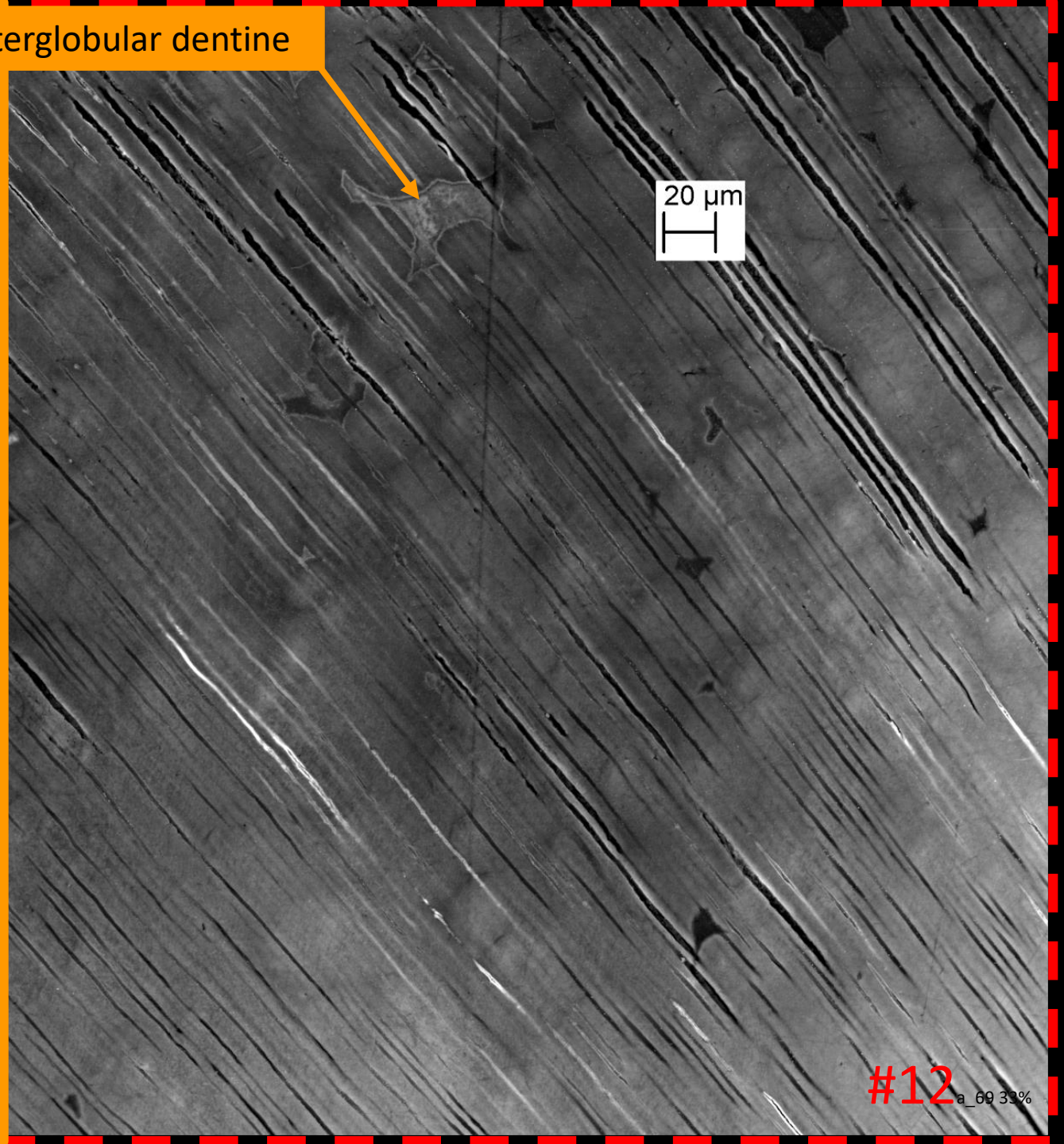
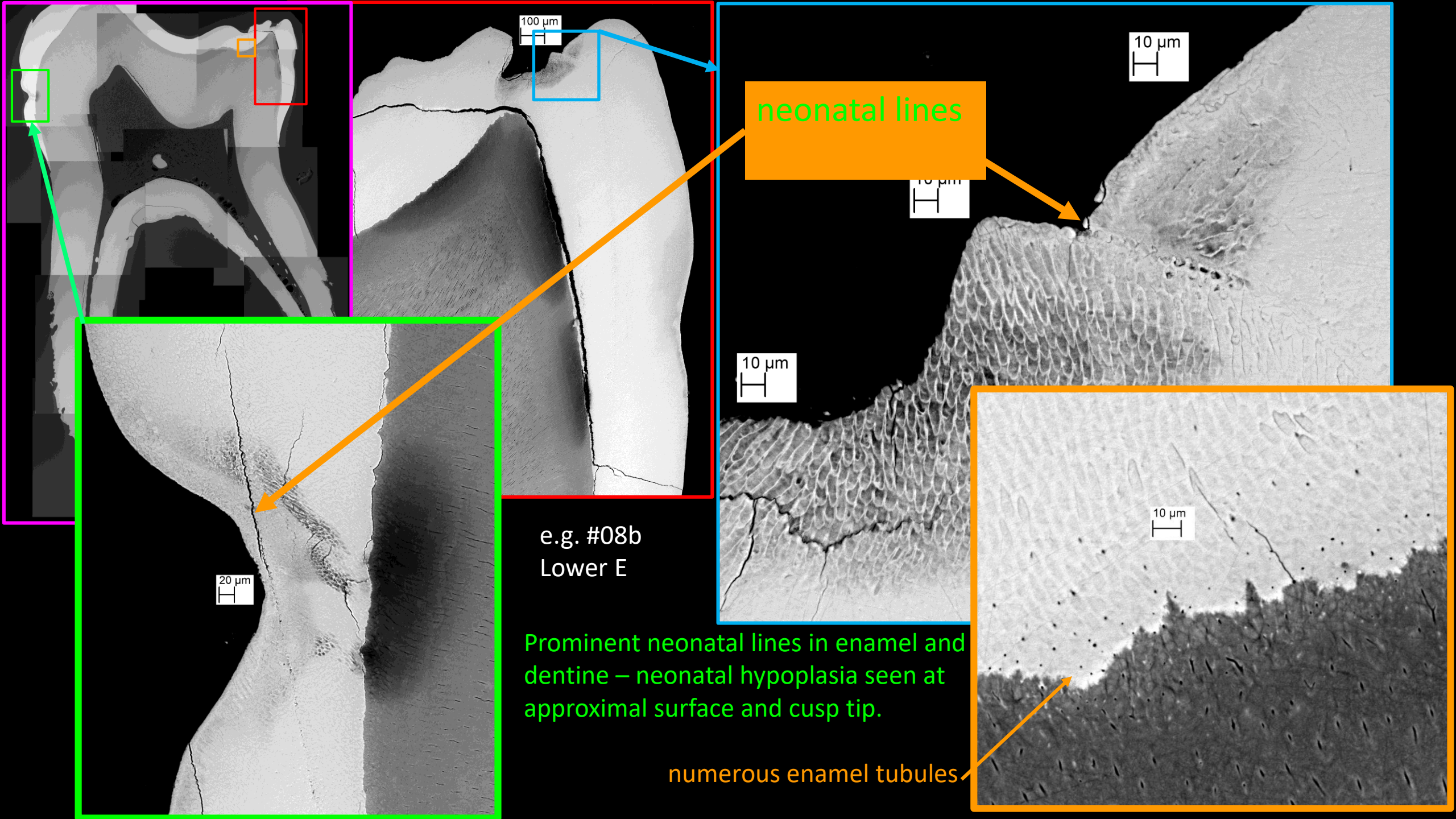

Normal
osteoclastic
root
resorption
100 µm

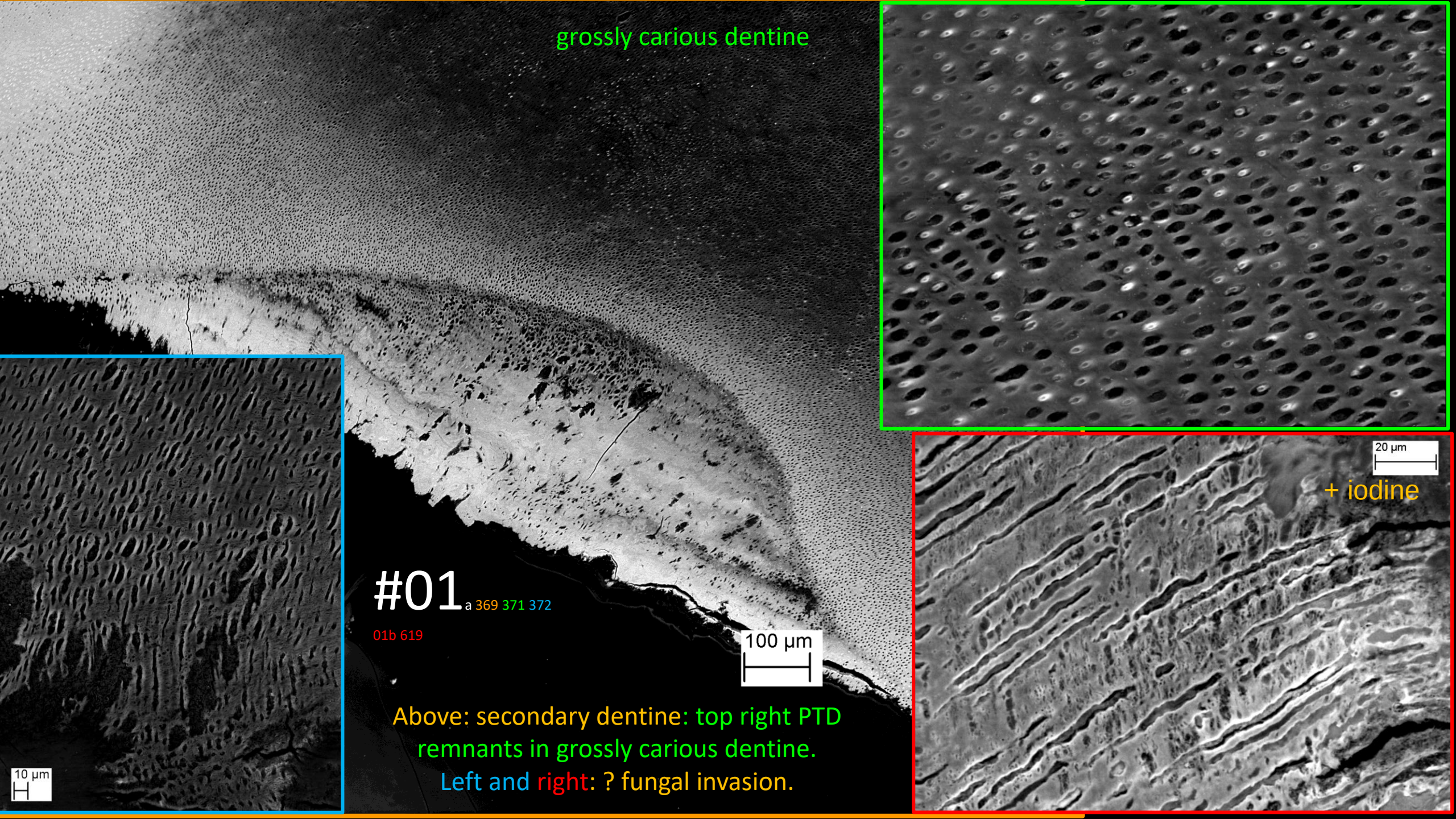

Mineralisation of interglobular dentine.
Peritubular dentine most mineralised
20 µm

Mineralisation of interglobular dentine

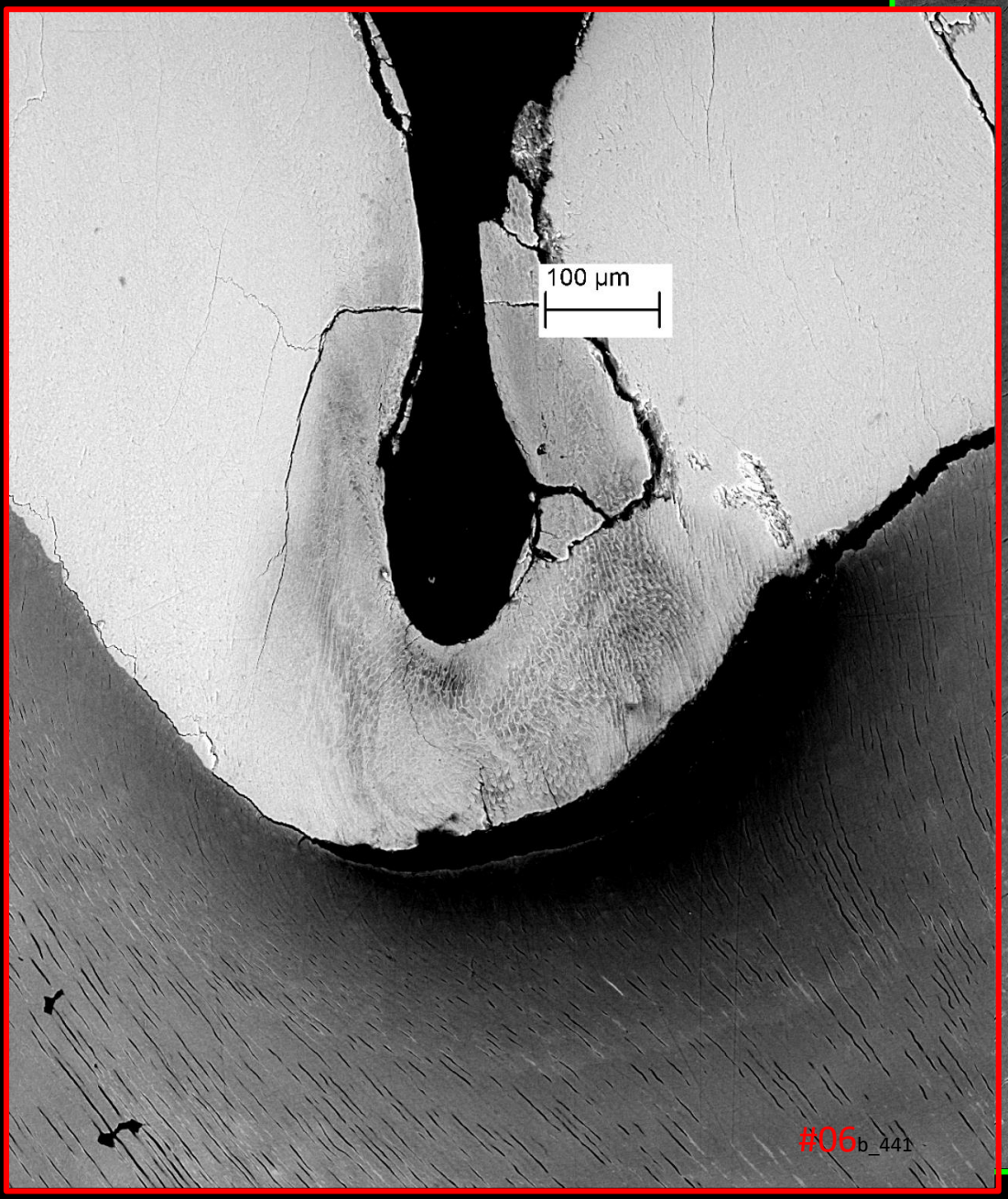


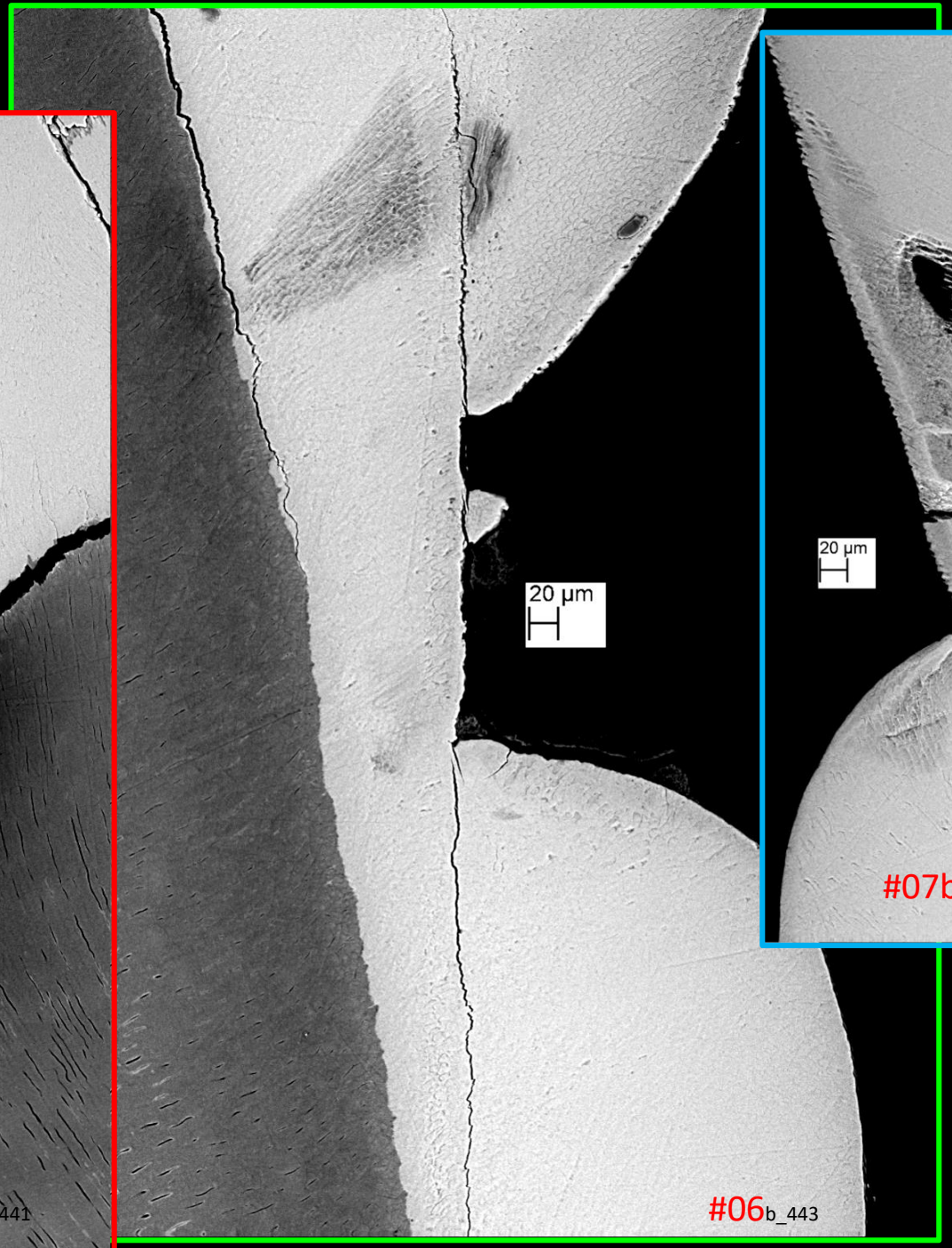


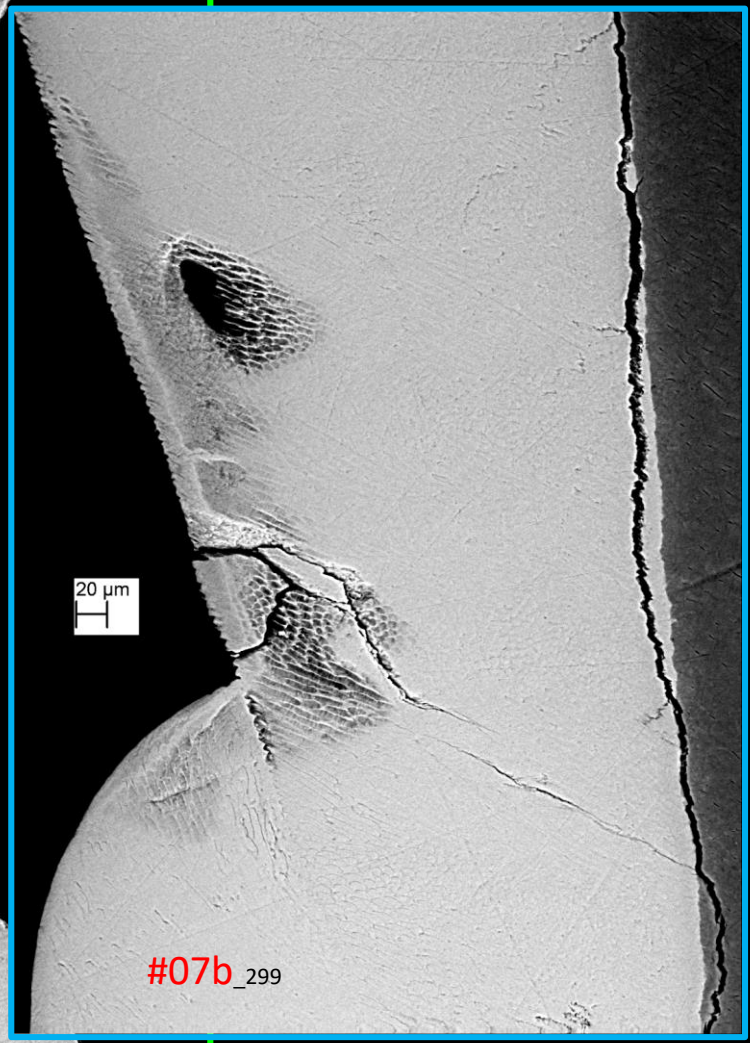

100 µm
10 µm
neonatal lines
10 µm
20 µm
10 µm
e.g. #08b
Lower E
Prominent neonatal lines in enamel and dentine – neonatal hypoplasia seen at approximal surface and cusp tip.
numerous enamel tubules


grossly carious dentine
#01
a 369 371 372
01b 619
100 µm
10 µm
20 µm
+ iodine
Above: secondary dentine: top right PTD
remnants in grossly carious dentine.
Left and right: ? fungal invasion.

Fissure caries







Two more cases of neonatal hypoplasia

Results and Conclusions and THANKS

- We studied disease which must have spread rapidly through dentine
- Much destruction of enamel occurred from within, attacking enamel from the EDJ
- Neonatal enamel hypoplasia an important factor in several cases
- Even most demineralised carious dentine showed hyperdense ‘peritubular dentine’ (PTD)
  - or locally expanded tubules, probably fungal invasion (e.g., Candida spp.)
  - or multiple fine tubes crossing the tubule axis in the collagen fibre direction of the dentine matrix, a hallmark of motile invasive species (e.g. Capnocytophaga spp.)
- Patches of interglobular dentine (IGD), normally unmineralised, sometimes more densely calcified than surrounding carious matrix
  - This is the first report of addition of mineral to IGD in association with remineralisation phenomena in caries
- Calcospheritic de-mineralisation pattern indicates different state of intra- vs. inter-collagen mineral
- Caries involves many microbial species which cannot be identified by morphology alone
- but there are many morphological types of dentine caries.
- In future work, it might be possible to reach some spp. identification, with, e.g., Matrix Assisted Laser Desorption/Ionization Time Of Flight {MALDI-TOF} mass spectrometry