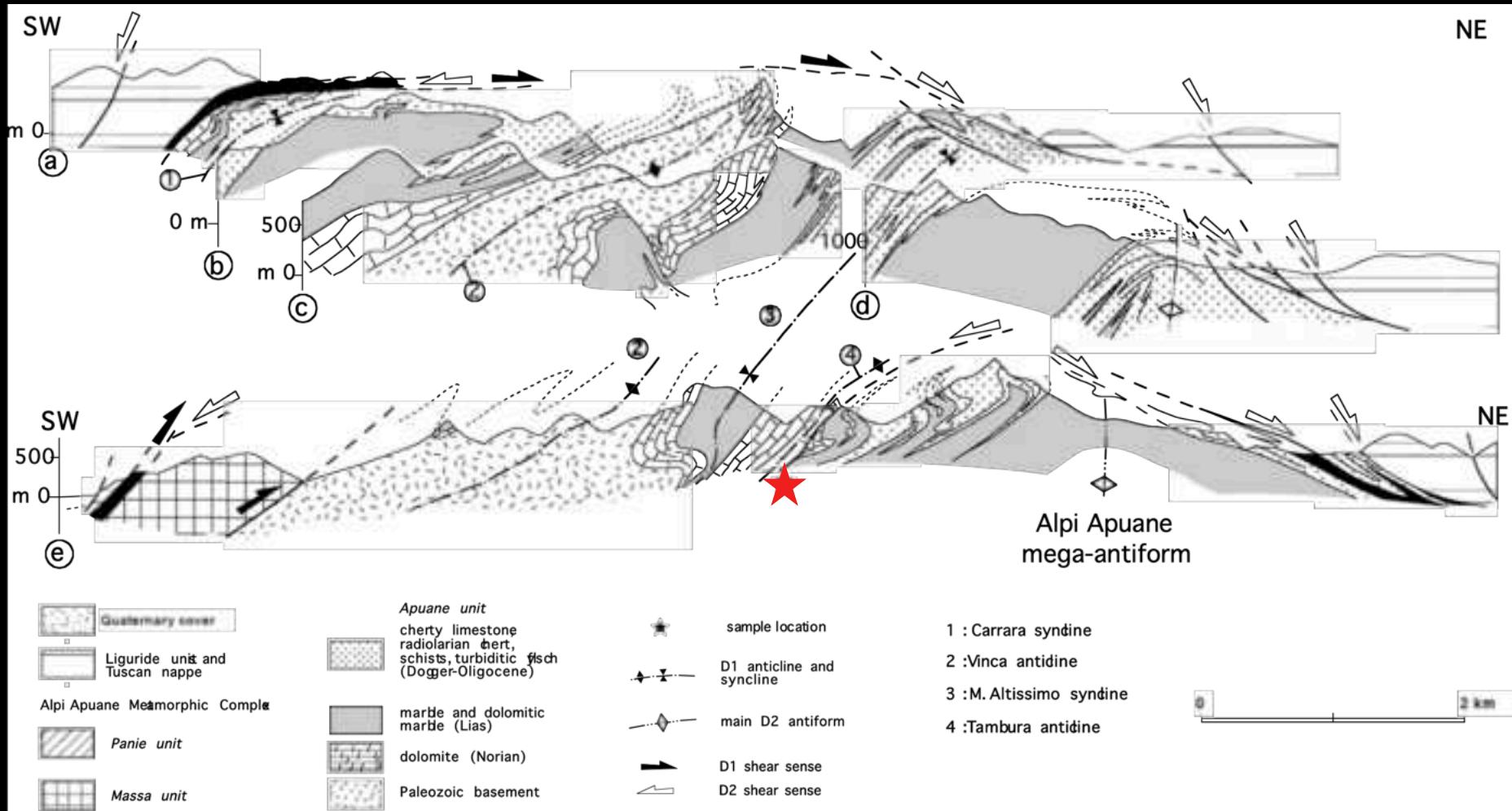


Microstructures, textures,
and deformation
mechanisms in highly
sheared two-phase
aggregates:
calcite – dolomite

Renée Heilbronner, Holger
Stünitz, Nils Oesterling,
Almar deRonde...
... and, of course, Jan Tullis

abstract

1. starting material
2. from low to high deformation (sampleA, B)
3. μ -structure as function of dolomite content (0-50%)
 - texture cc texture index 3 \searrow 1.7
 - grain size cc 140 \searrow 20 dolo = 20 μm
 - spatial distribution anti-clustered, horiz.>vert.
4. strain rate (cc, $\sim 370^\circ\text{C}$) $\sim 10^{-12} \text{ s}^{-1}$



Alpi Apuane, modified after Molli et al. (2000).



Panie unit: calcite matrix (dark gray) dolomite veins (light gray, yellow)

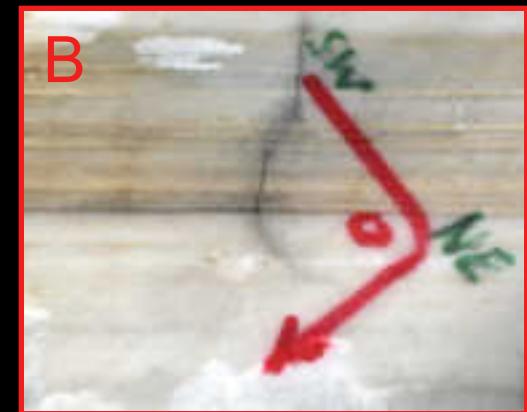
D1 deformation, 366°C

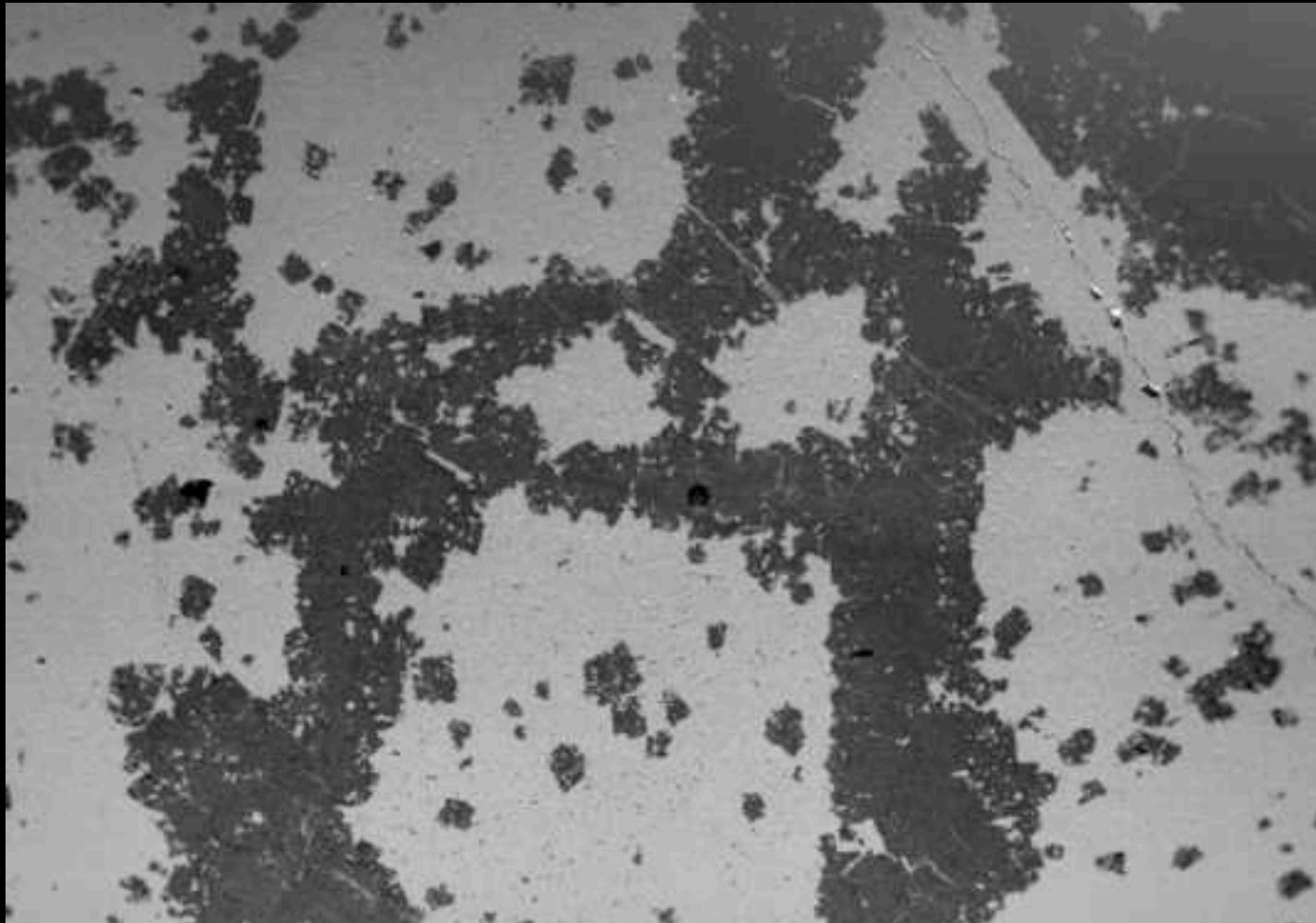


low def



high def



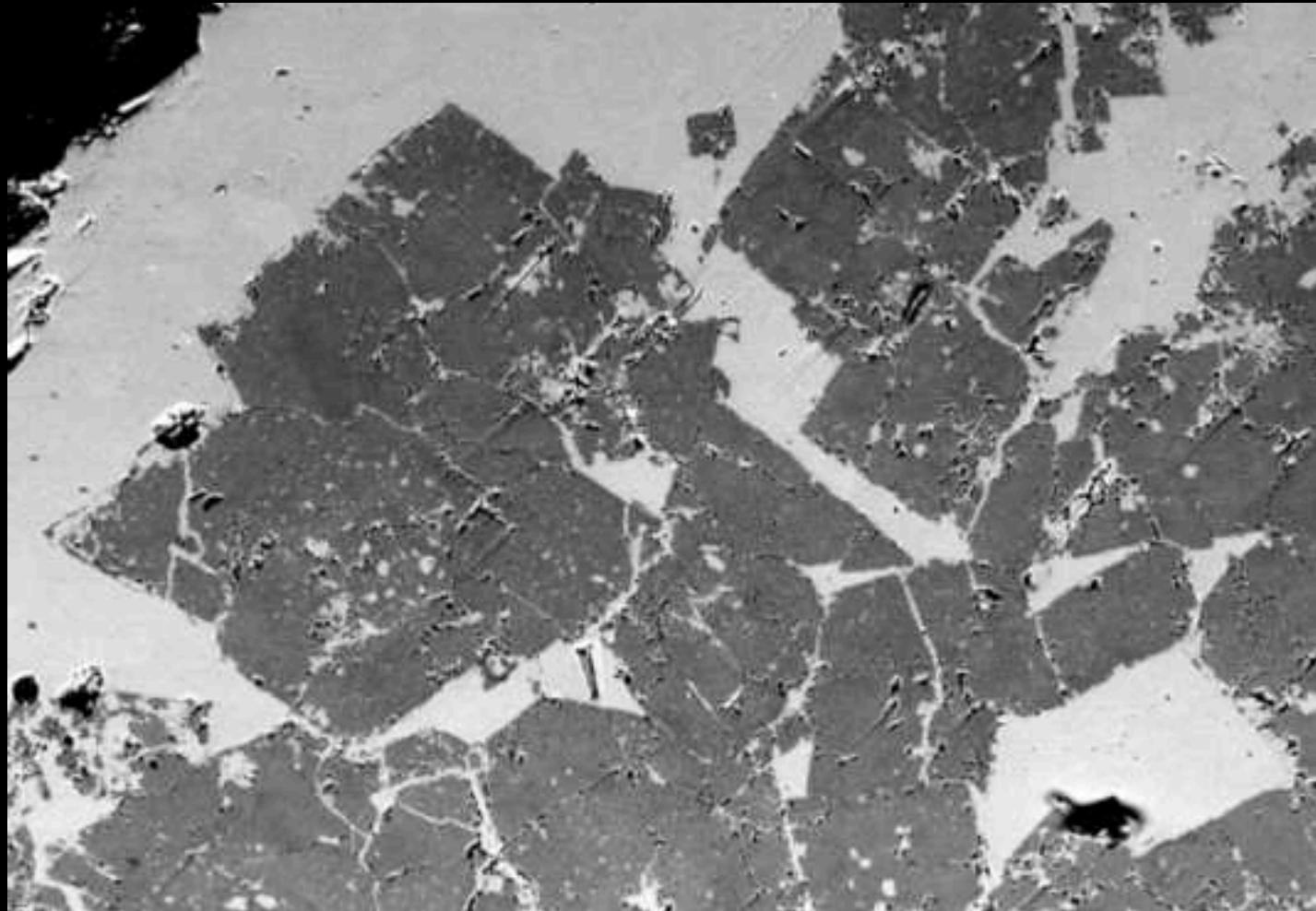


00034038

— 300 μm

ZMB
Uni Basel

dolomite (dark) - calcite (light)



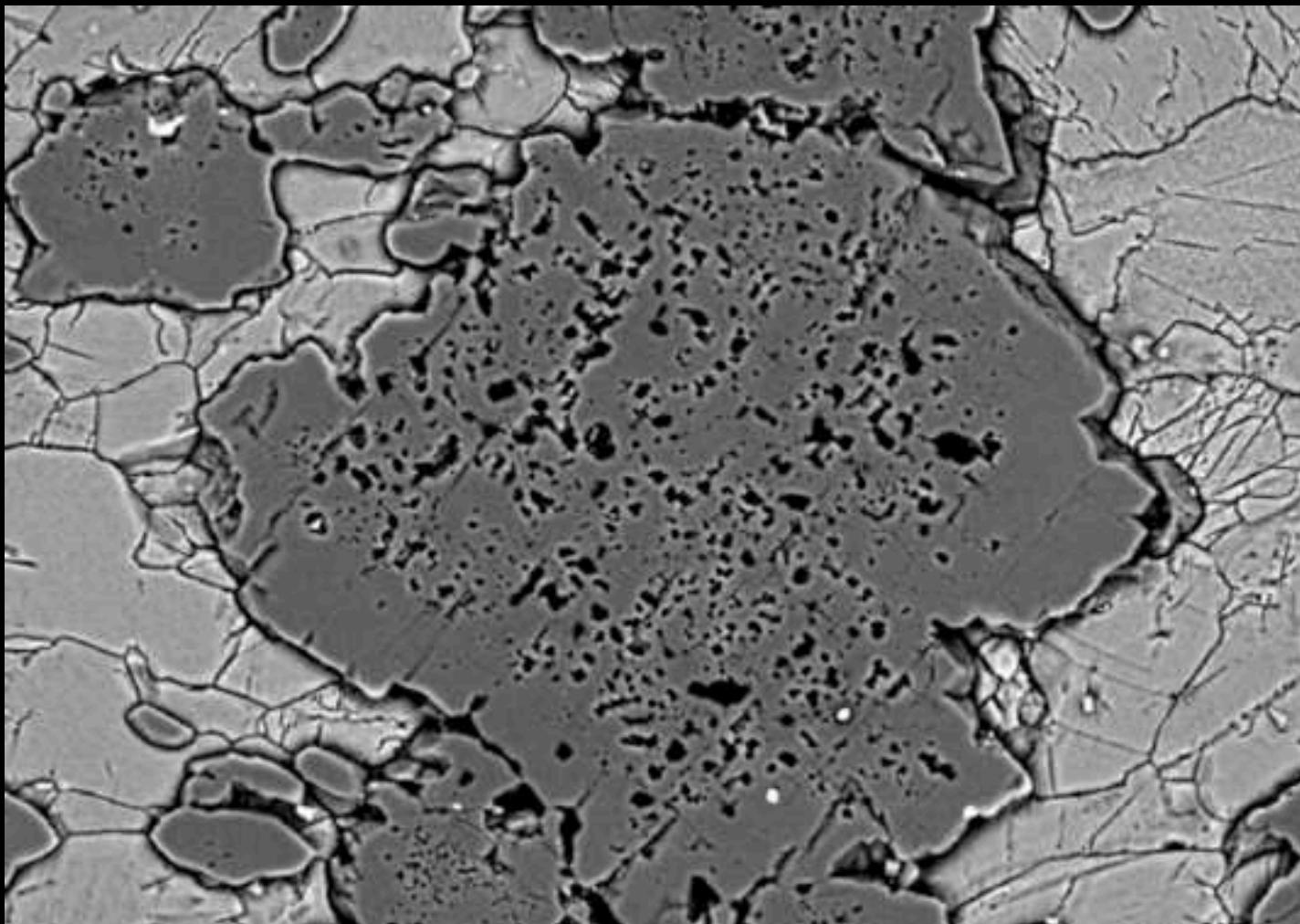
00034056



100 μm

ZMB
Uni Basel

dolomite (dark) - calcite (light)

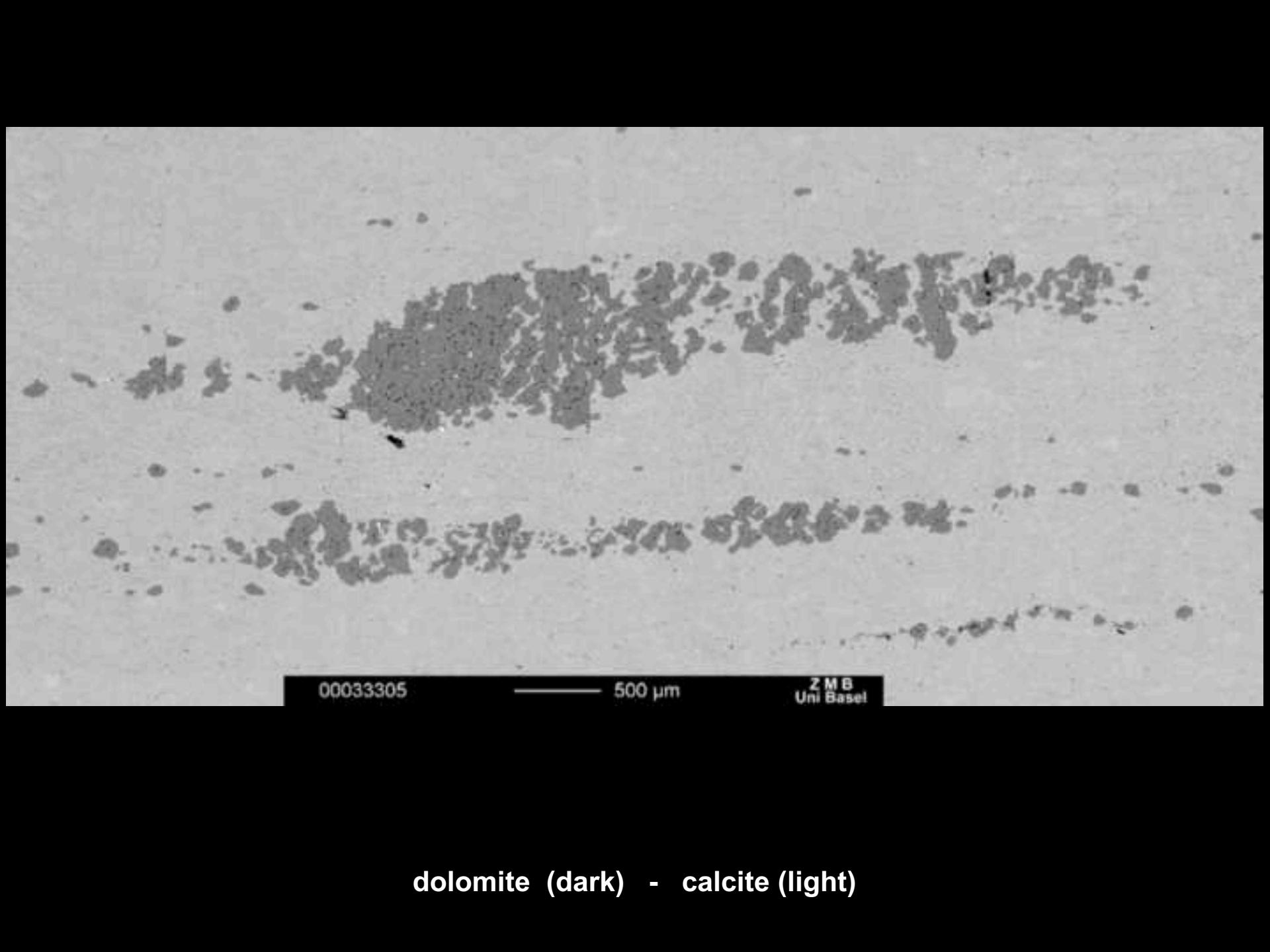


00033296

— 30 μm

ZMB
Uni Basel

dolomite (dark) - calcite (light)

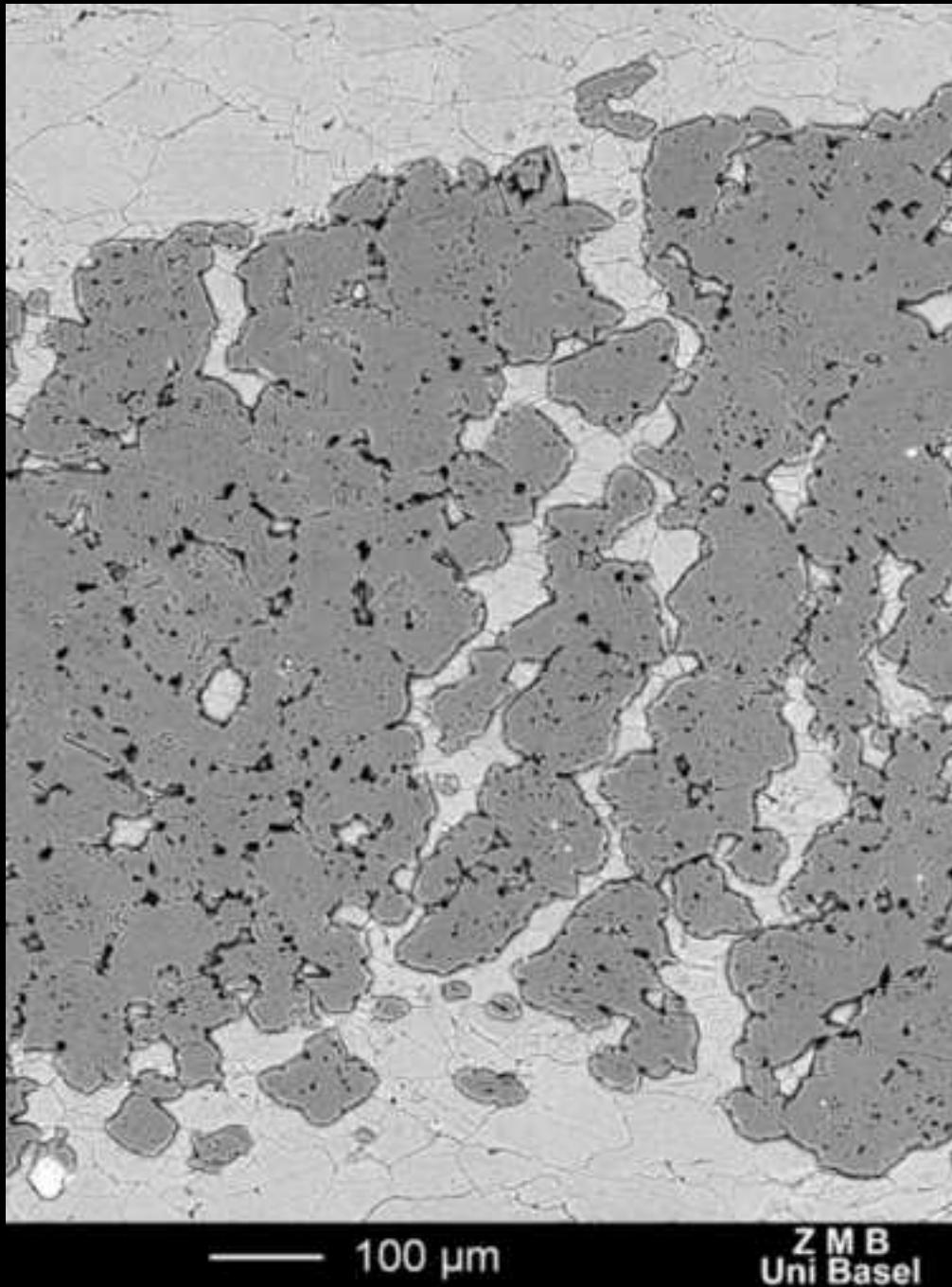
A black and white micrograph showing two distinct horizontal bands of mineral crystals. The upper band consists of dark, irregularly shaped dolomite crystals, while the lower band consists of lighter-colored, more elongated calcite crystals. Both bands are set against a light gray background.

00033305

500 µm

ZMB
Uni Basel

dolomite (dark) - calcite (light)



dolomite (dark)
calcite (light)

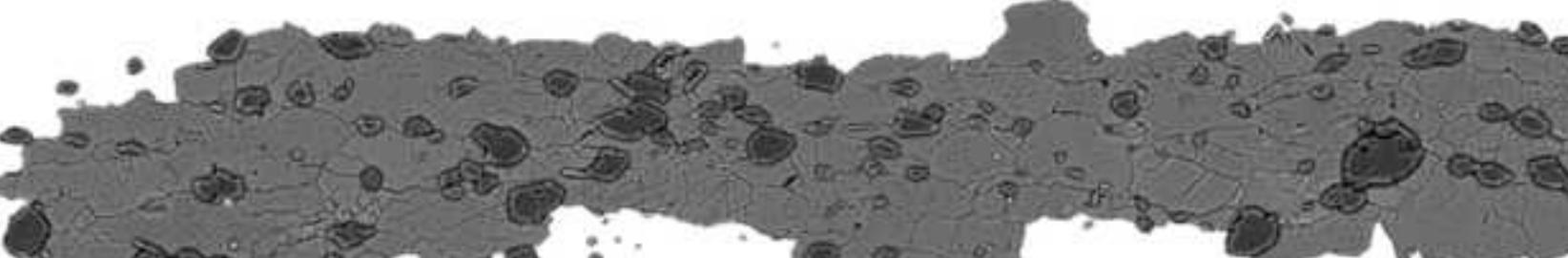
— 100 μ m

ZMB
Uni Basel

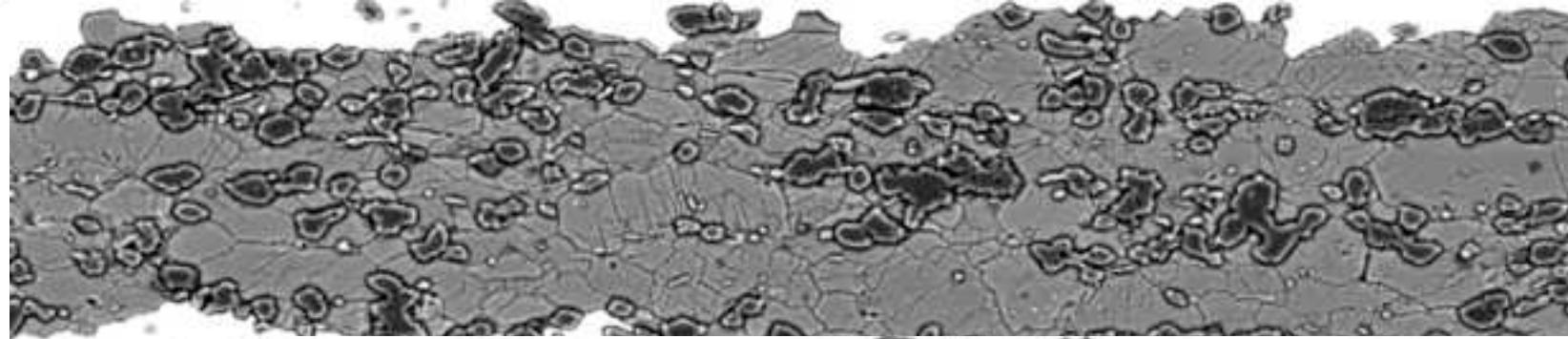
~0 %



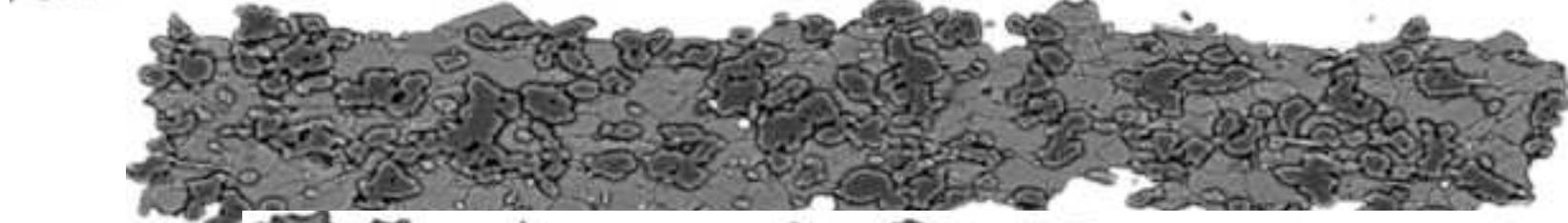
13 %



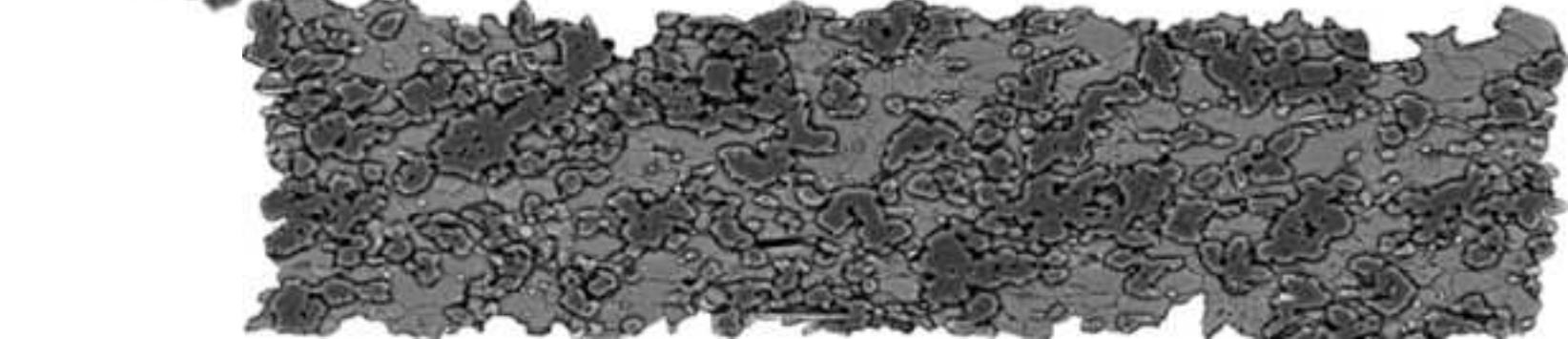
26 %



40 %



50 %

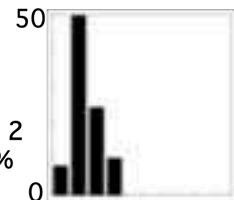


dolomite

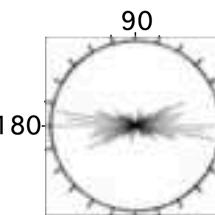
calcite

Site 1
0 %
dol.

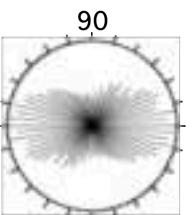
3D grain diameter



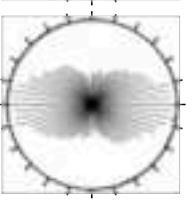
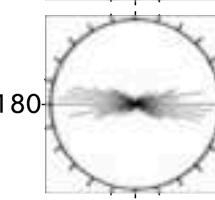
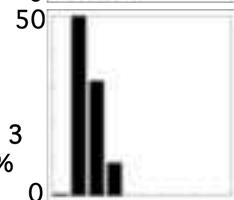
PAROR



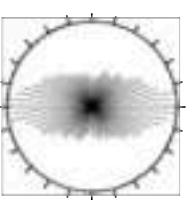
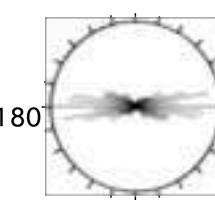
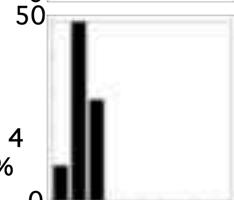
SURFOR



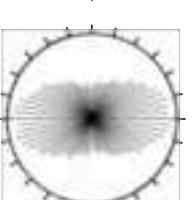
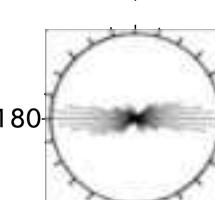
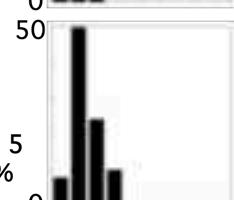
Site 2
13 %
dol.



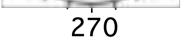
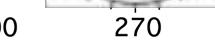
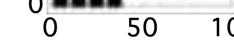
Site 3
26 %
dol.



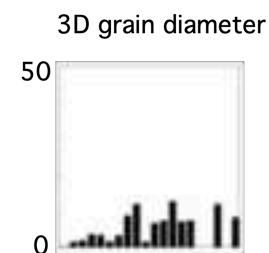
Site 4
40 %
dol.



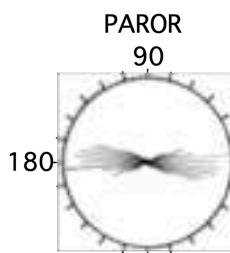
Site 5
50 %
dol.



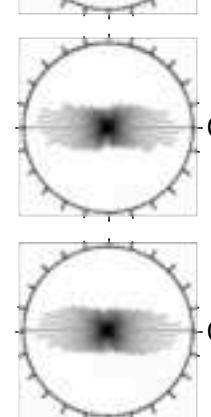
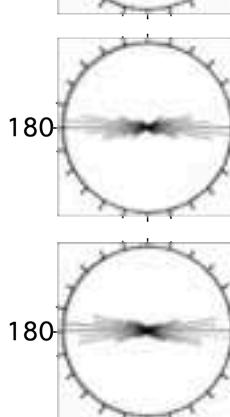
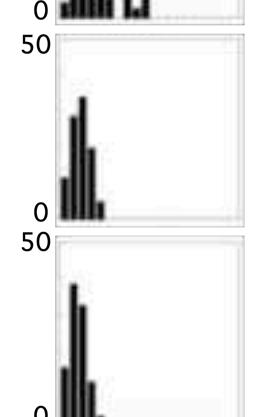
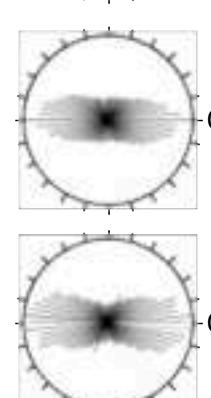
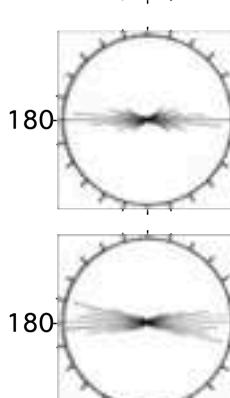
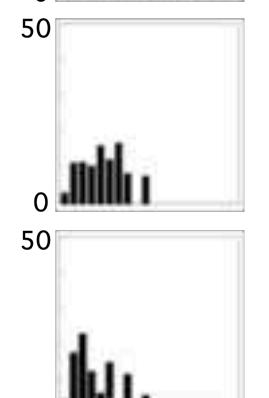
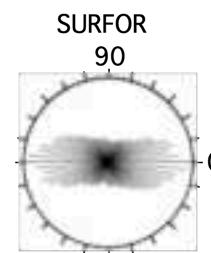
3D grain diameter



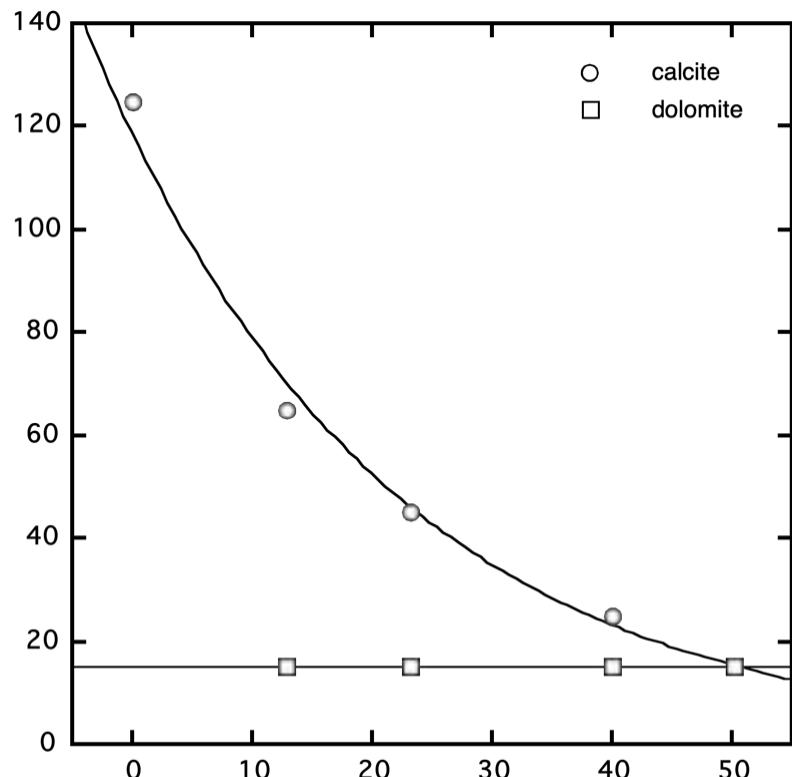
PAROR



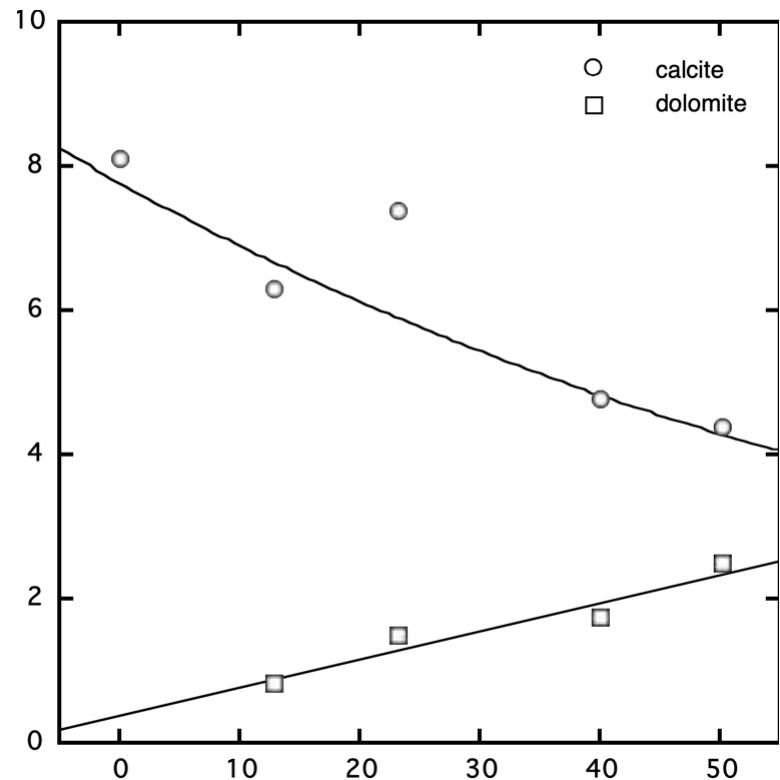
SURFOR



grain size (3-D, vol%)

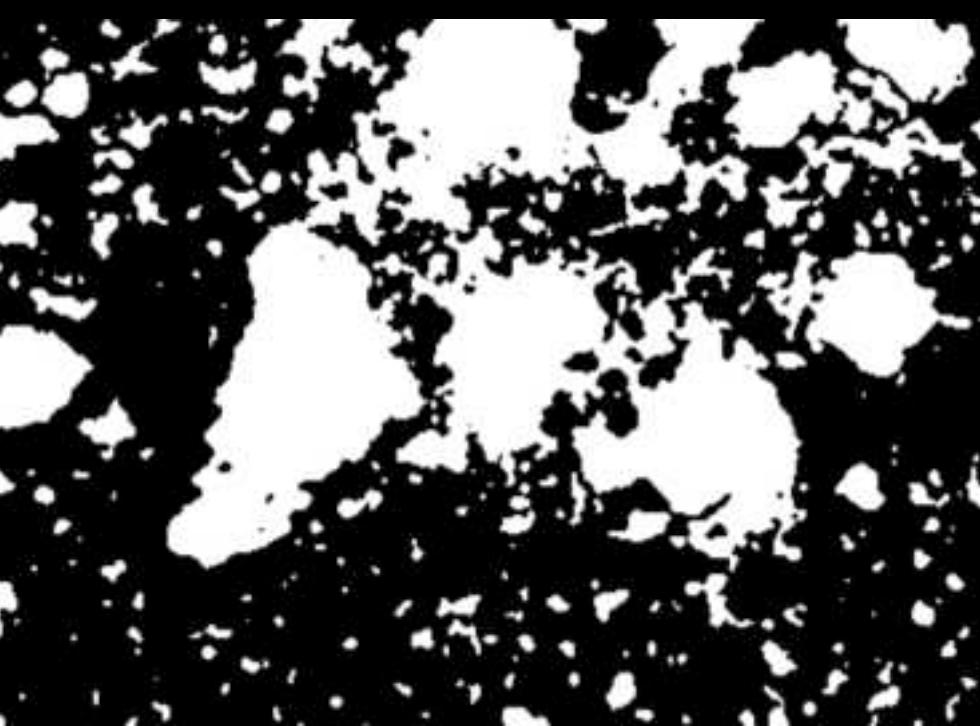
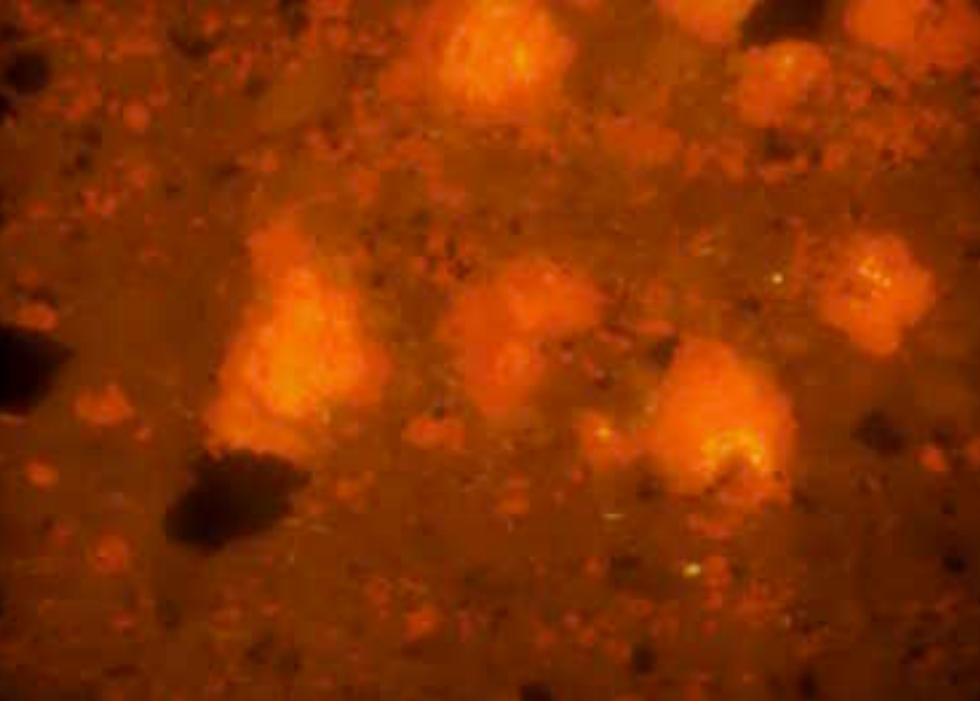


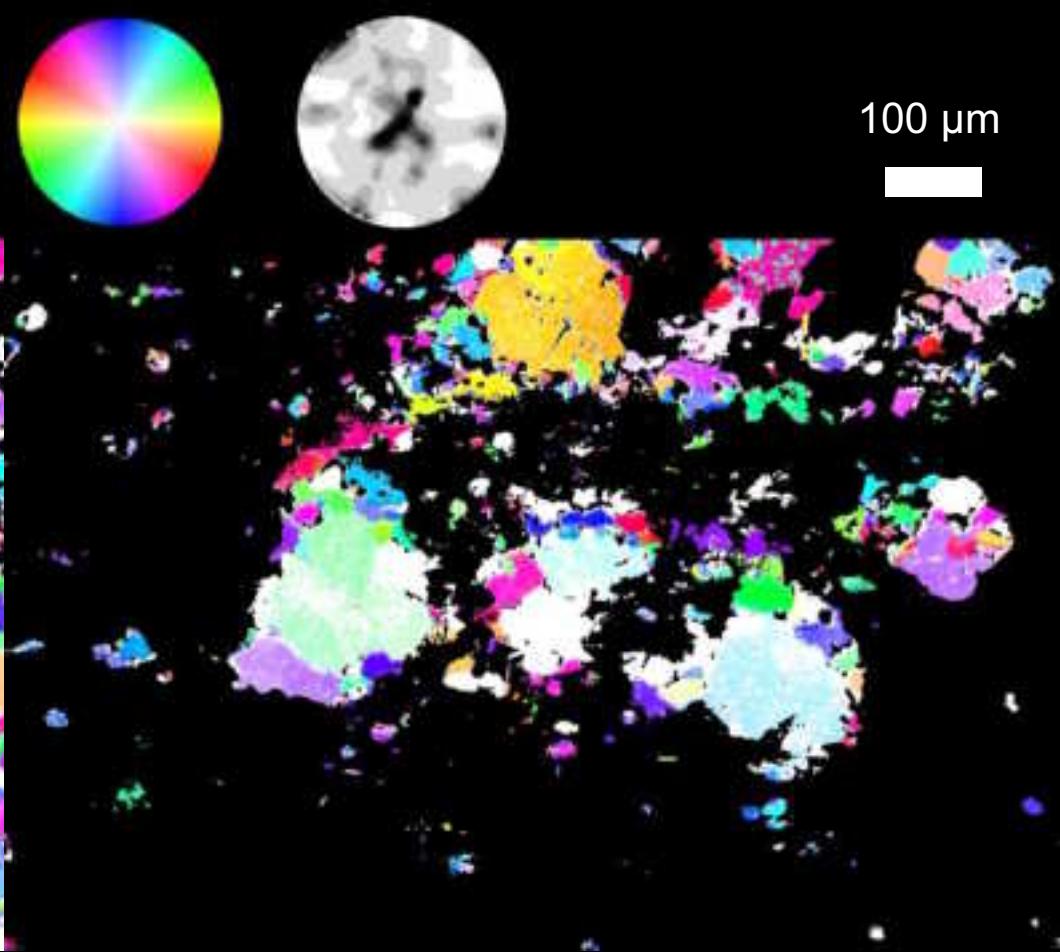
shape (PARIS factor)



average grain diameter (μm)
dolomite content (vol %)

PARIS factor (%)
dolomite content (vol %)





~0 %

13 %

26 %

40 %

50 %

calcite

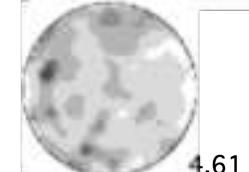
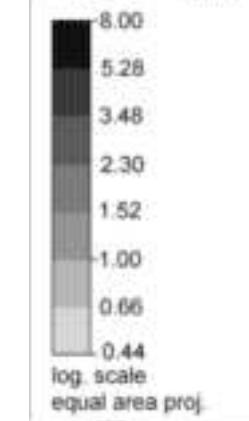
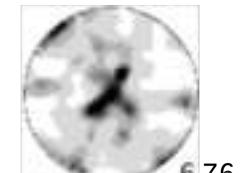
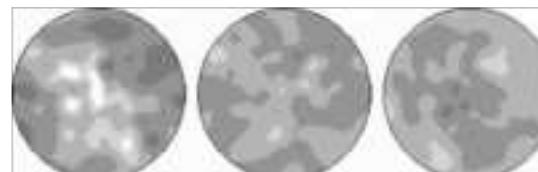
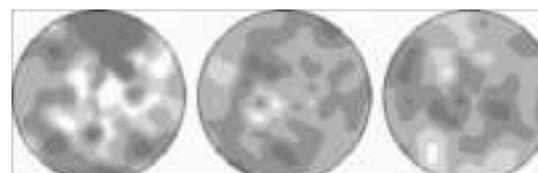
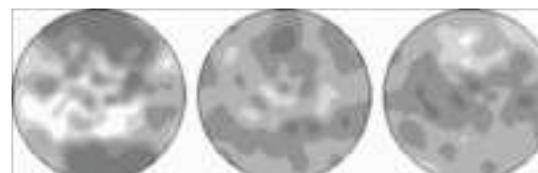
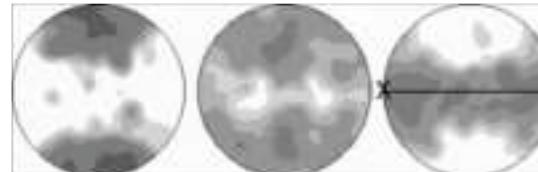
dolomite

c
(0001)

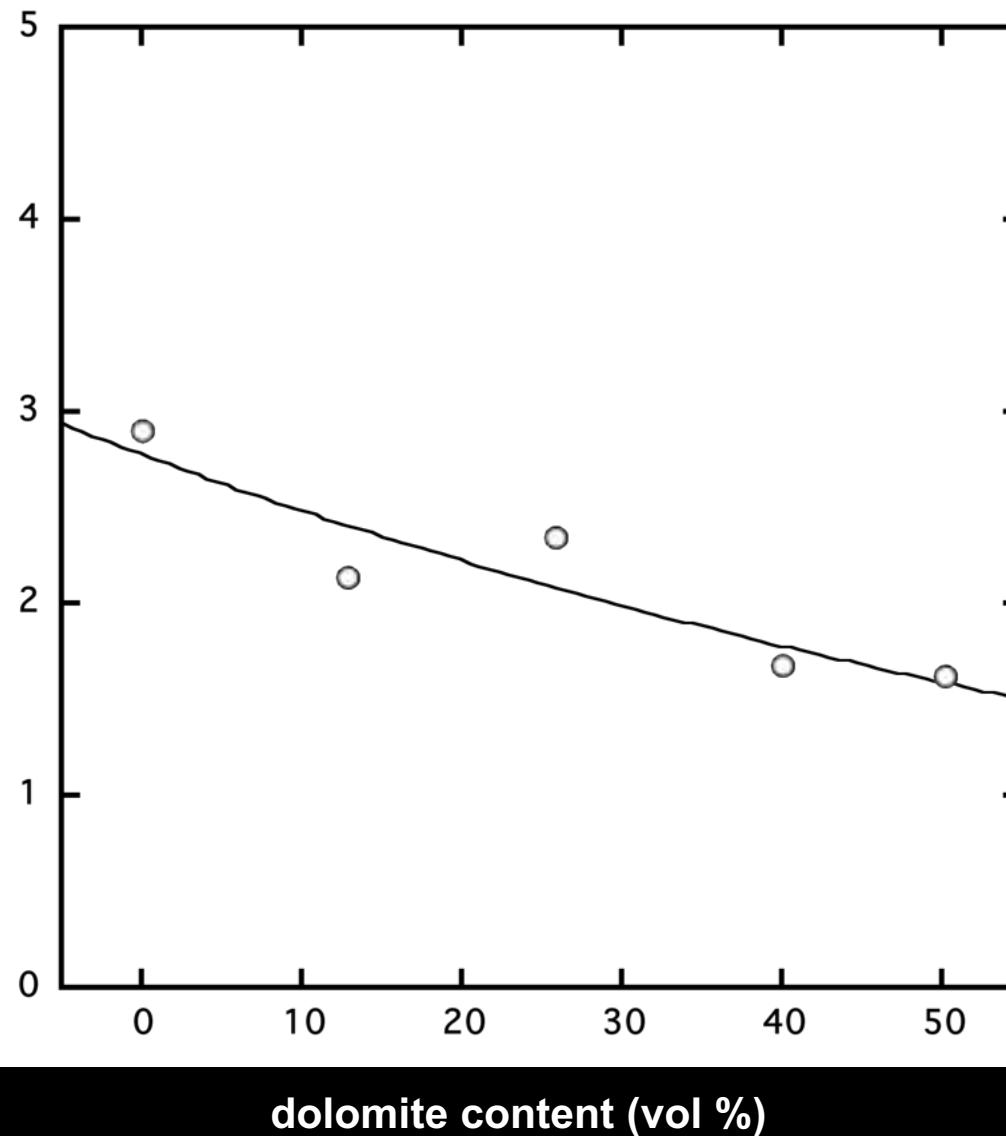
r
(10-14)

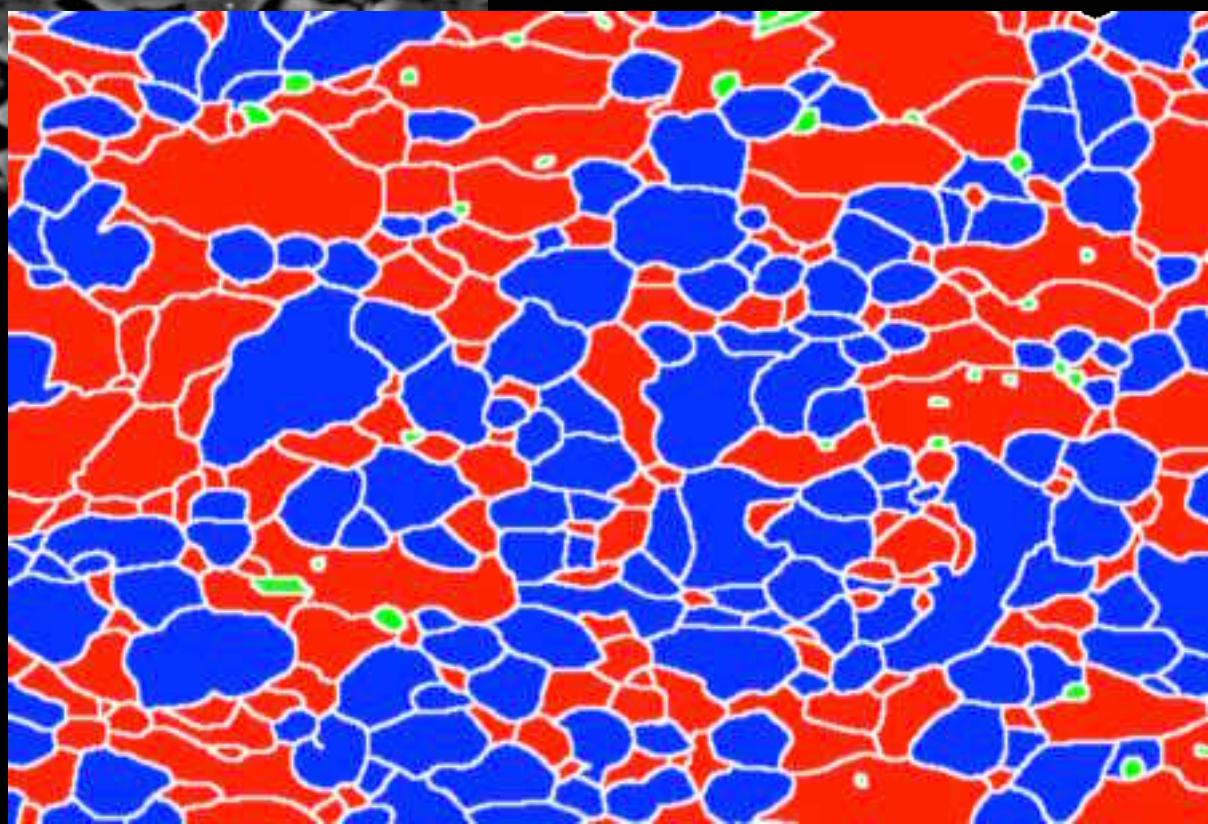
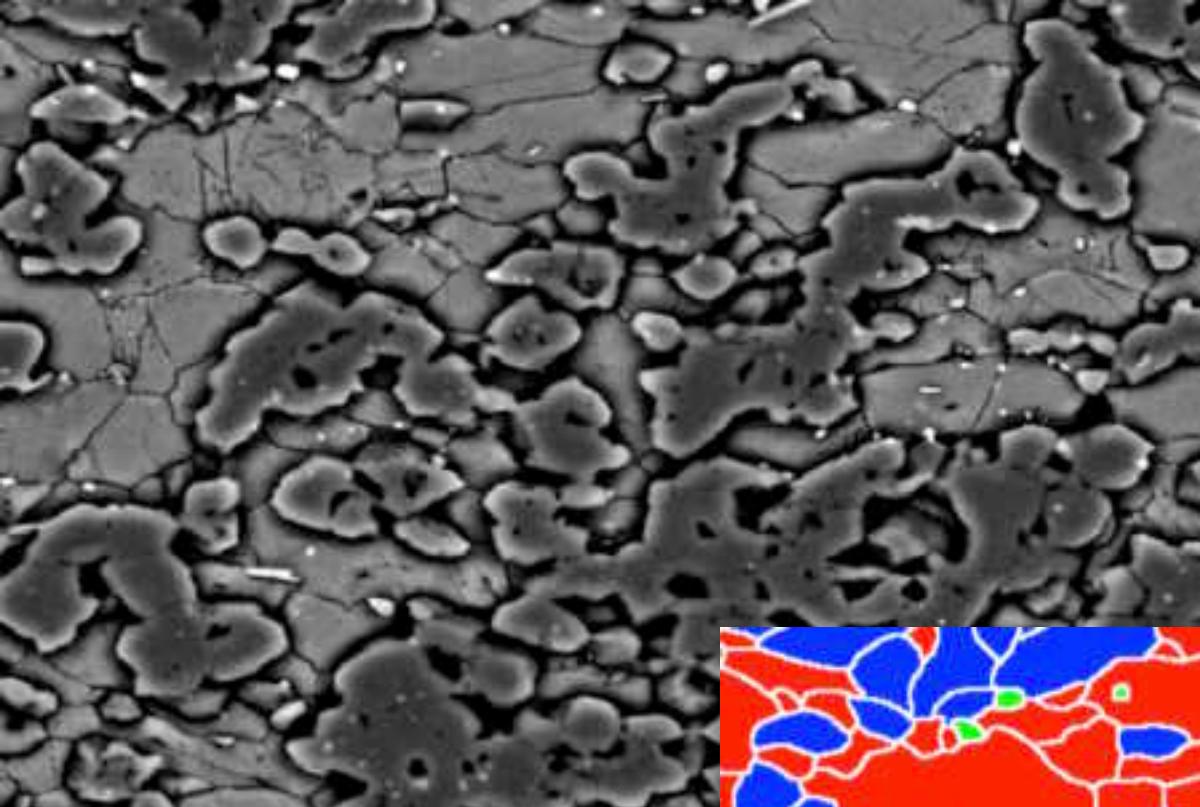
a
(2-1-10)

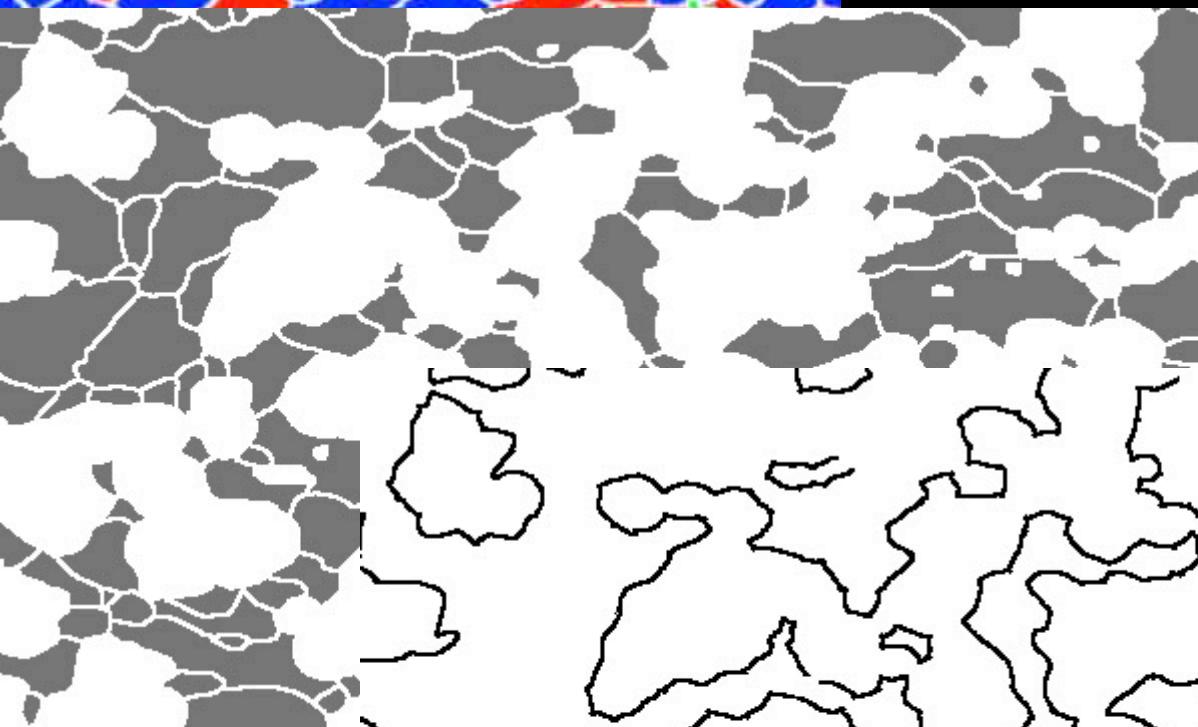
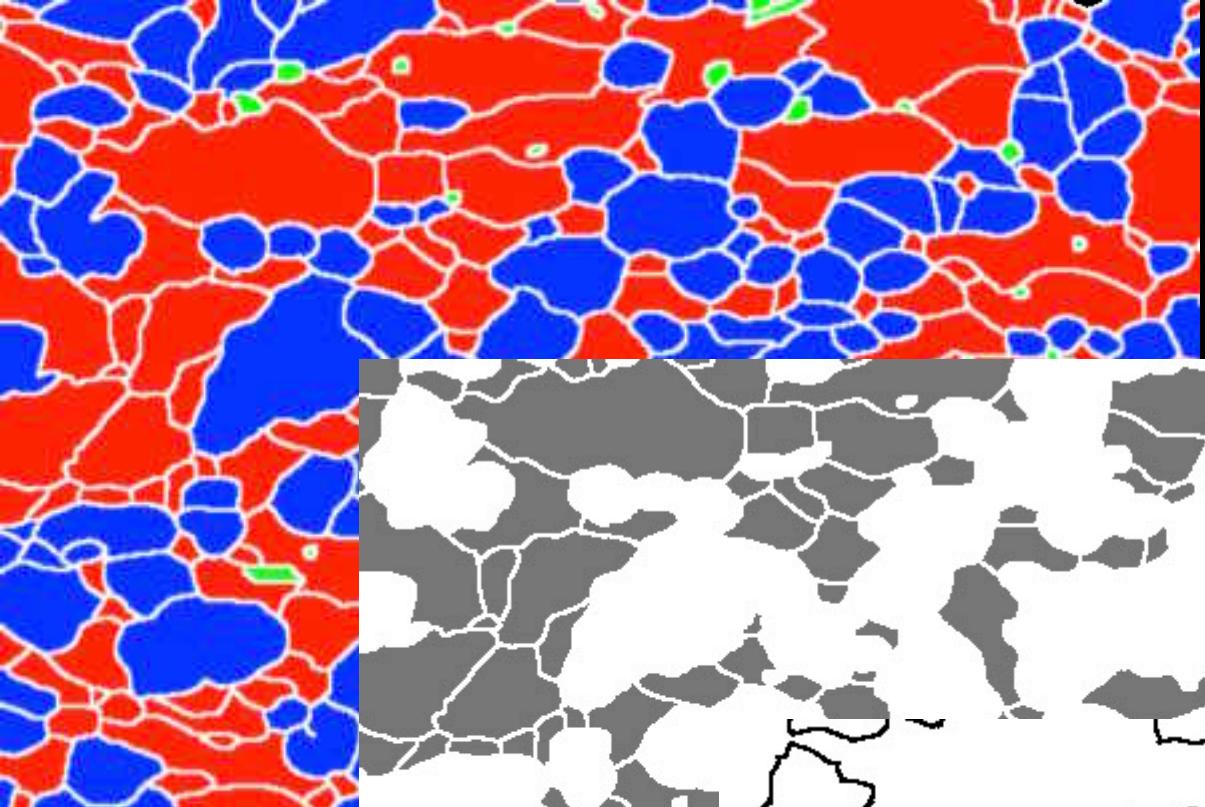
c
(0001)



texture index (J) of calcite, EBSD





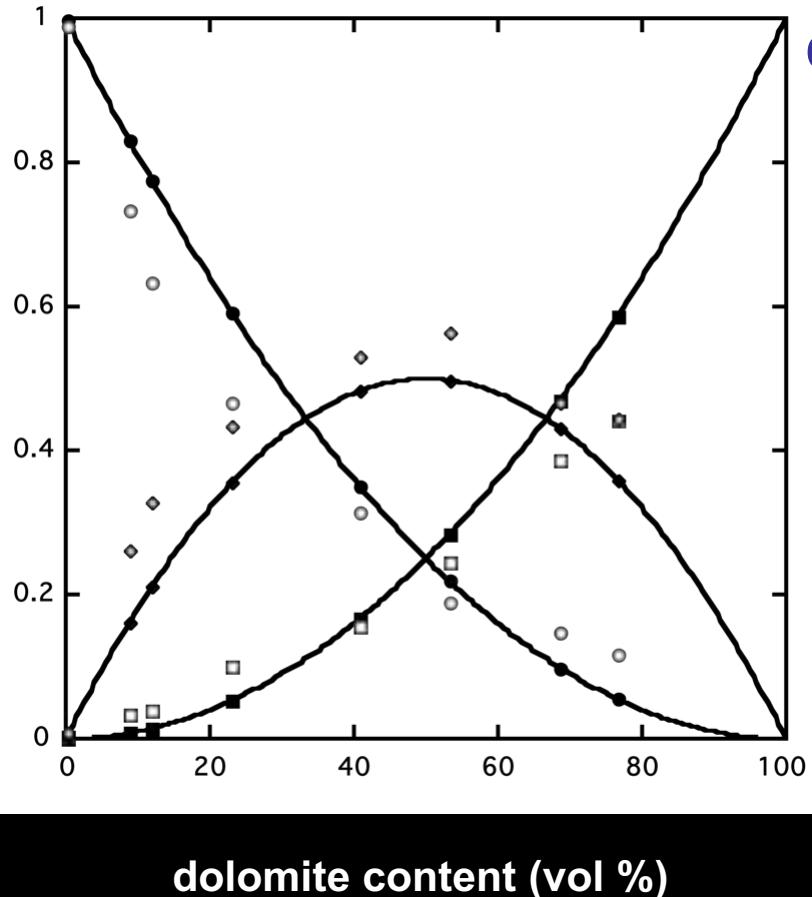


phase and grain boundaries

calcite-calcite

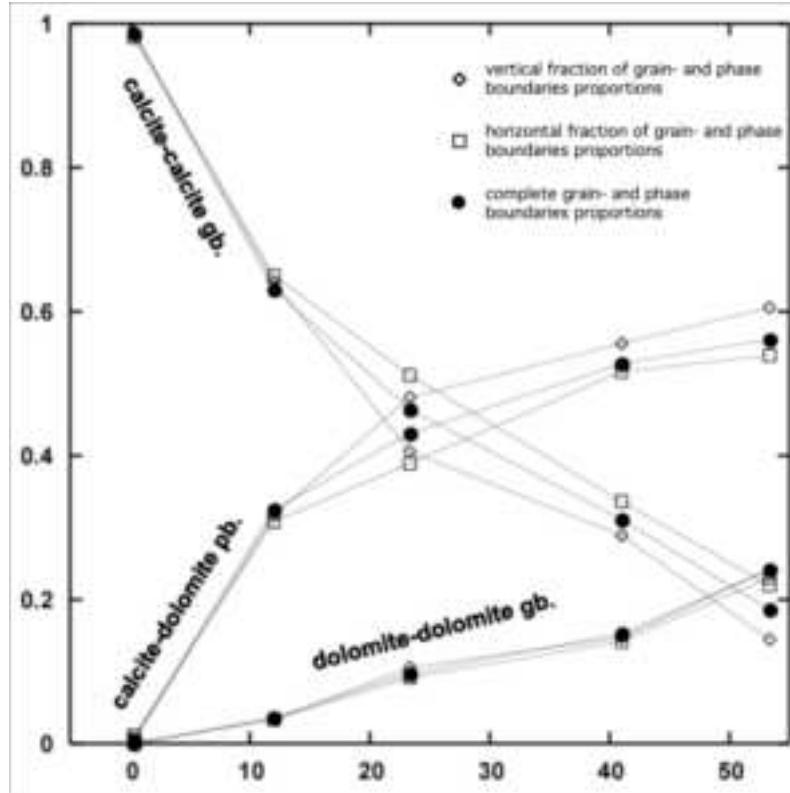
dolomite-dolomite

dolomite-calcite



vertical and horizontal grain boundaries

calcite-calcite



dolomite-calcite

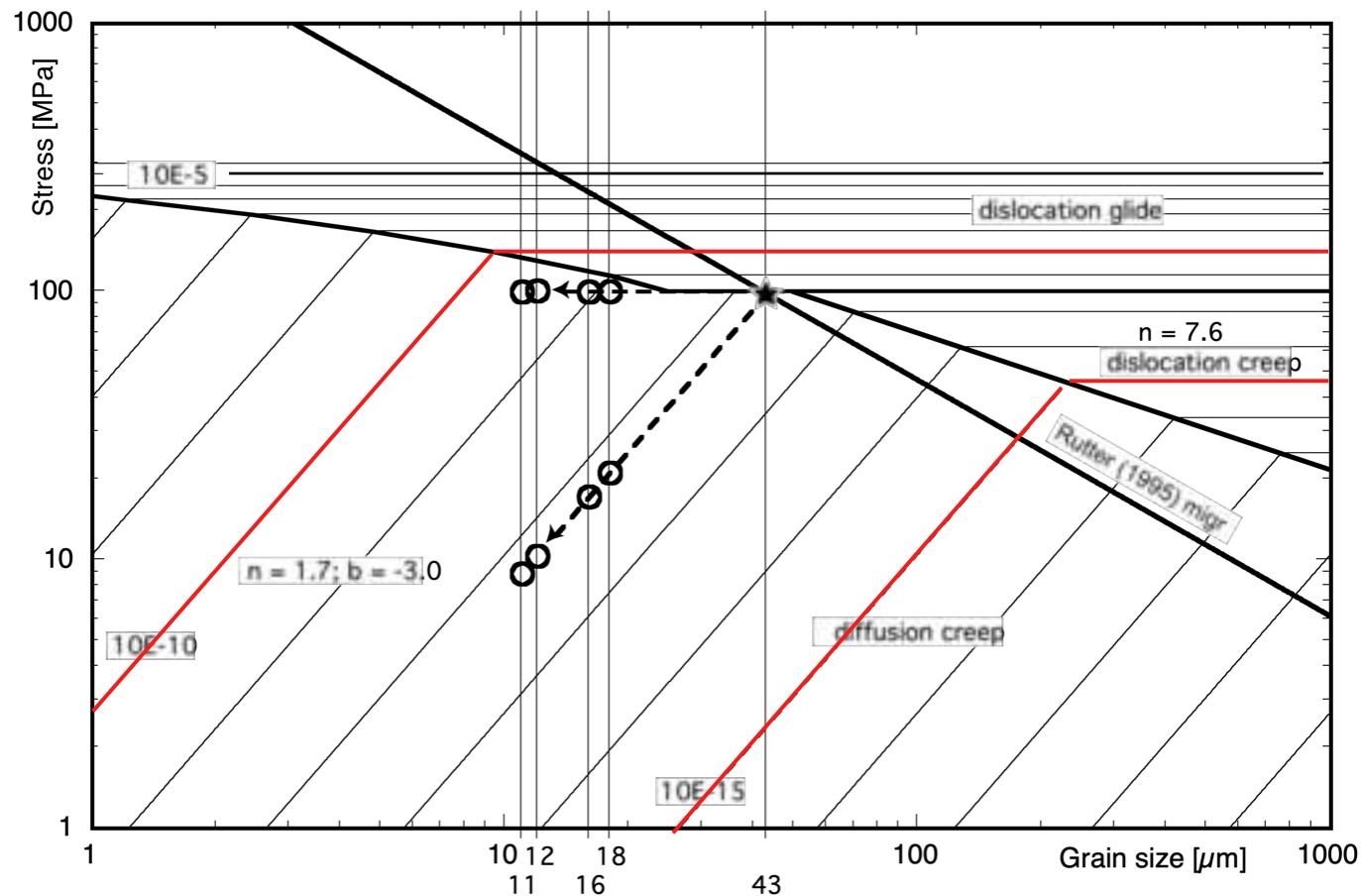
dolomite-dolomite

filled symbols = all outlines
open diamonds = vertical boundaries
open squares = horizontal boundaries

increasing dolomite content



decreasing calcite grain size



after Schmid et al. (1977), Schmid et al. (1980), Rutter (1995)

open questions

- how to describe def.mech of polyphase
- how to quantify μ -structure of mixing
- how to quantify intensity of localization
- description of texture
 - ✓ PDI
 - ✓ misor tracking