Texture Evolution of Amphiboles - a Case Study from the Mamonia Complex, Cyprus

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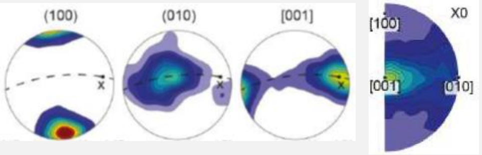
Previous studies



Soret et al., 2019

<u>Previously suggested deformation mechanisms for amphibole CPO:</u>

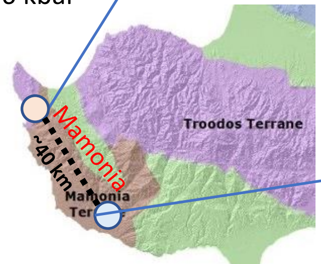
Brittle, Cataclastic, Rigid Body Rotation, Grain Growth, Dissolution-Precipitation, Diffusion Creep, Dislocation Creep

Imon et al., Diaz Aspiroz et al., 2006, Pearce et al., 2011, Soret et al., 2019

Unlike many other minerals, CPO in amphibole does not compel Dislocation Creep

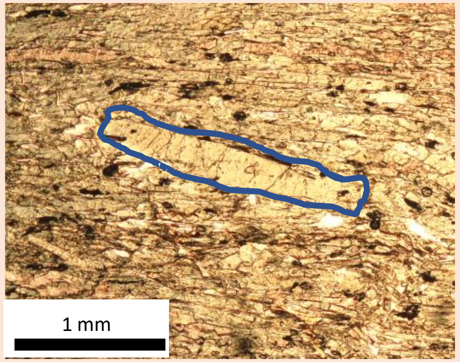
Amphibolite samples from the Mamonia complex

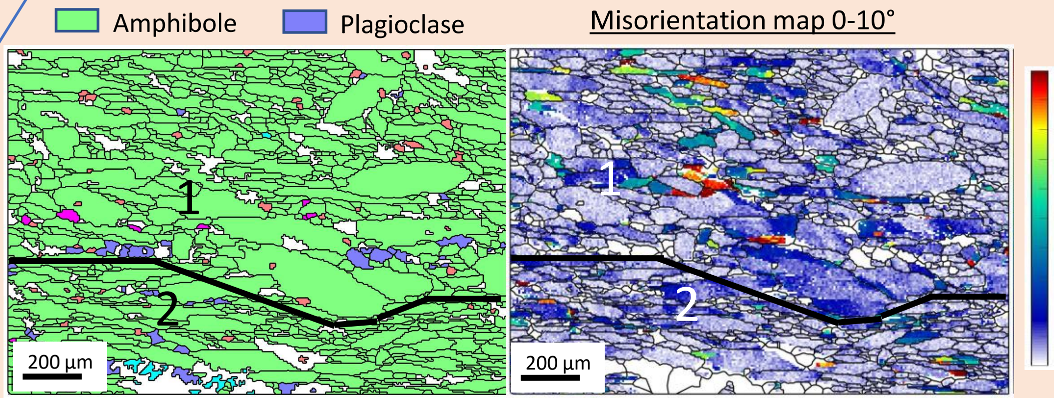
P-T: ~600 °C. 6 kbar



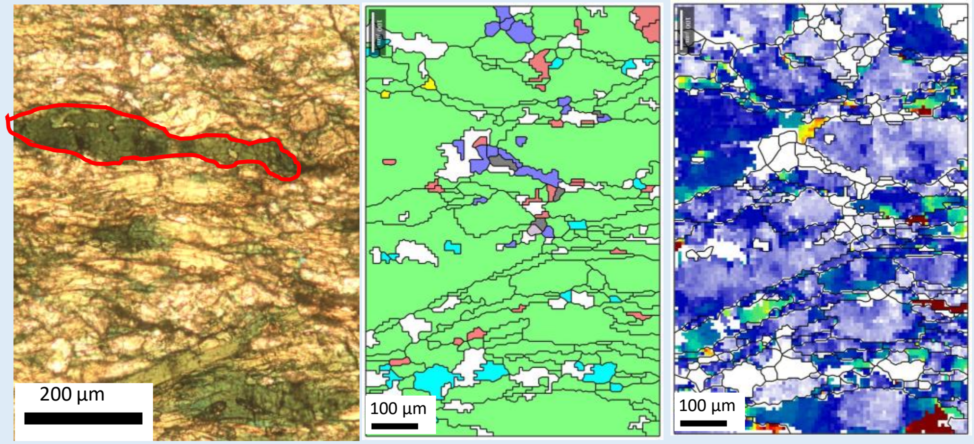
http://www.clima-project.eu/case-studies/nea-paphos/geology/

Bath of Aphrodite (BOA)



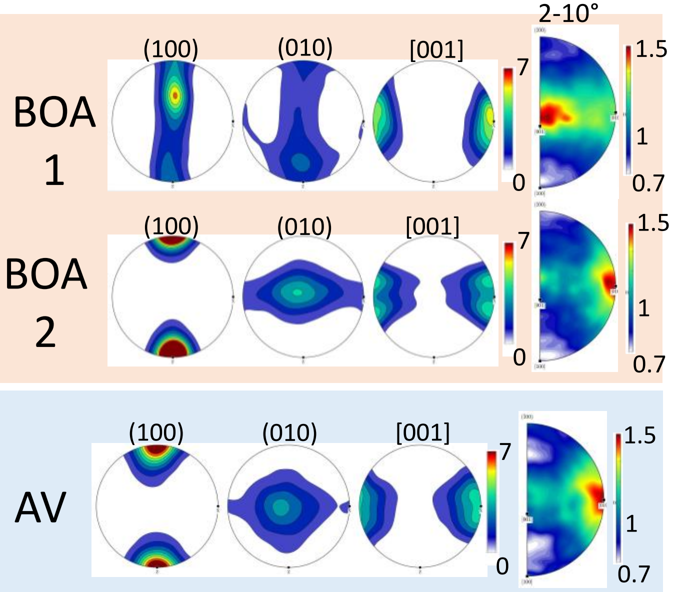


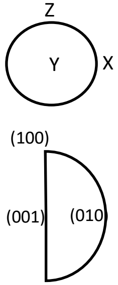
Ayia Varvara (AV)



Crystallographic preferred orientation

Mis-orientation axis





	BOA	AV
Grain Boundaries	Straight	*Lobate*
Intra-grain orientation spread	✗	✓
Shape orientation affected	✓	✗
Subgrains of (100)[001]	✗	✓
Fractures	✗	✗
Chemical Zoning	✗	✗
<u>Deformation mechanism</u>	Rigid Body Rotation (?) Anisotropic Grain Growth (?)	Dislocation Creep

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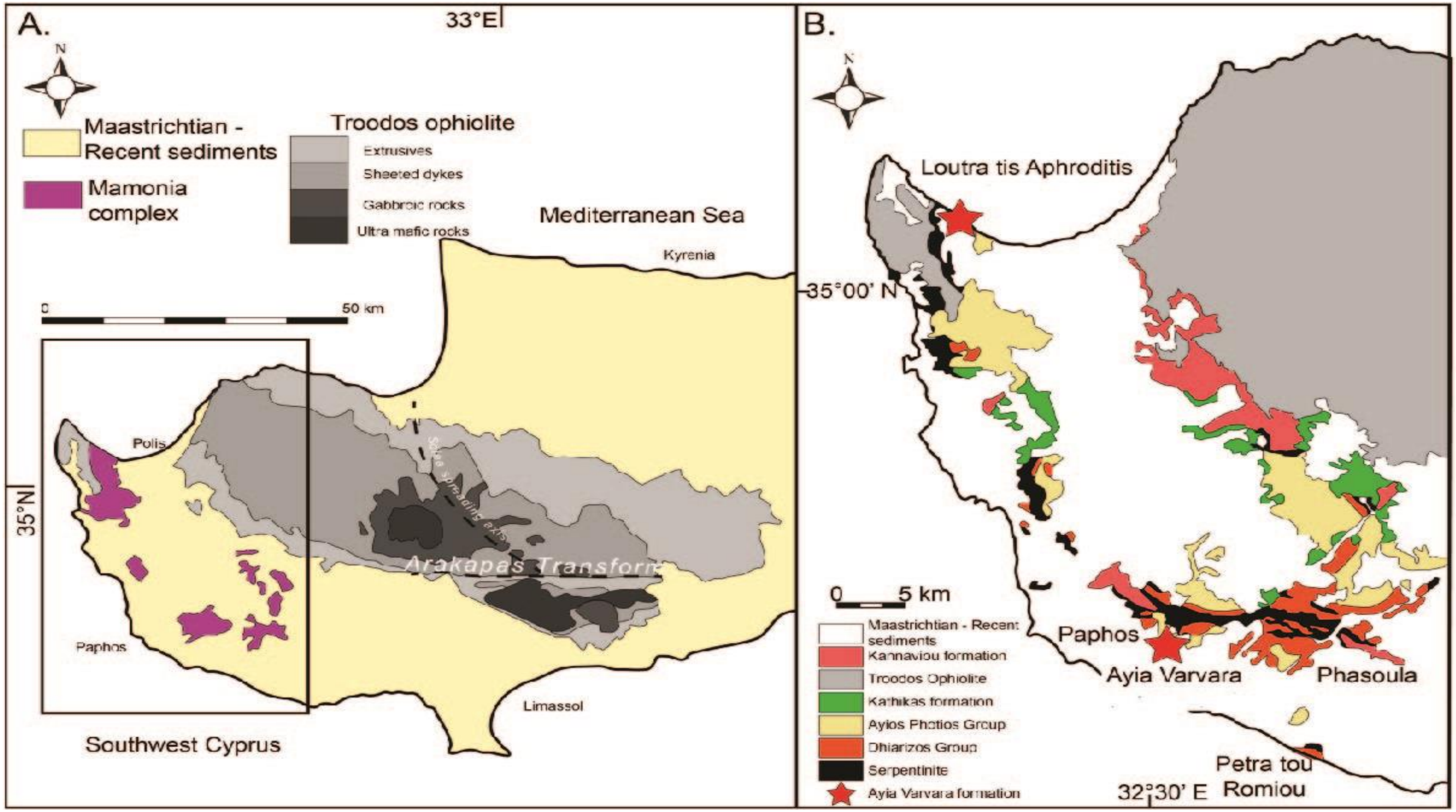
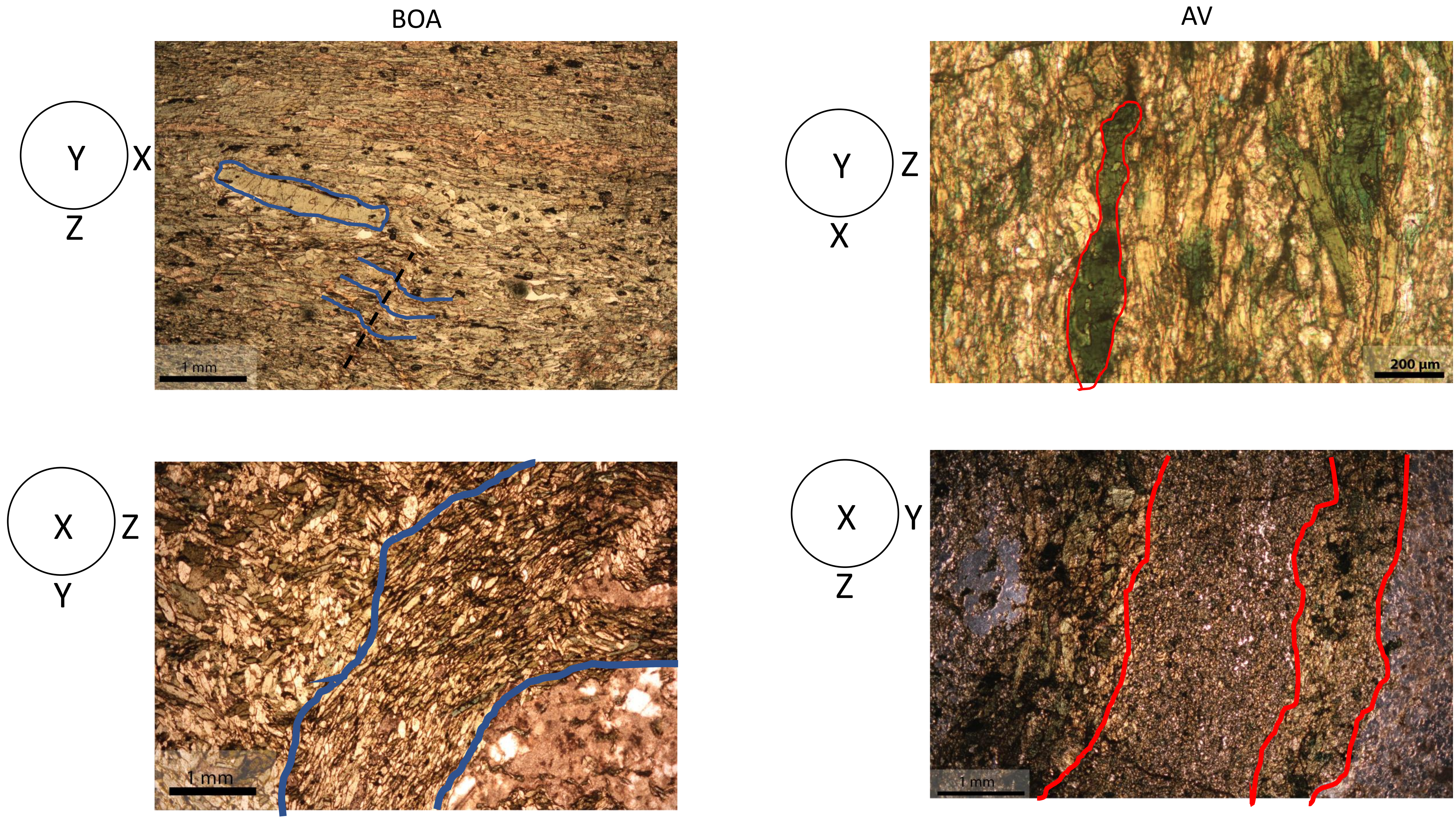
Mamonia Complex, Cyprus

- Triassic passive margin
- Comprised of:
    1. volcanic and plutonic rocks (Dhiarizos Group)
    2. sedimentary cover (Ayios Photios Group)
    3. metamorphic outcrops (Ayia Varvara and Loutra tis Aphroditis)
- Juxtaposing the Troodos ophiolite
- Troodos-Mamonia interaction is a serpentinite-decorated strike-slip shear zone
- Several deformation phases were recognized, including subduction-related

- P-T: ~600 °C, 6 kbar



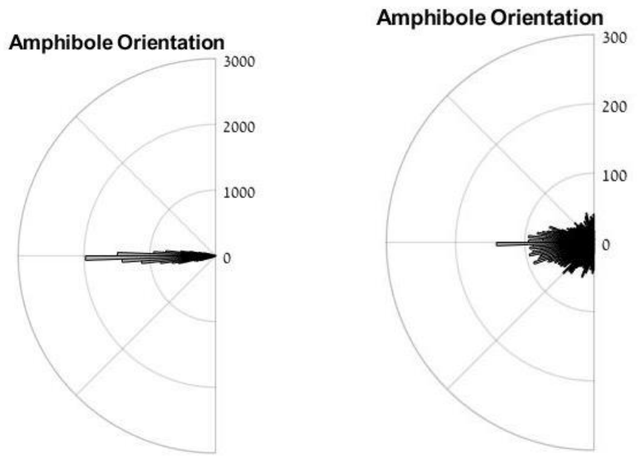
Golan PhD thesis, 2018, modified after
Robertson & Xenopontos, 1993 and Swarbrick, 1980.


BOA
AV
Y
X
Z
1 mm
Y
Z
X
200 µm
X
Z
Y
1 mm
X
Y
Z
1 mm

Shape parameters:

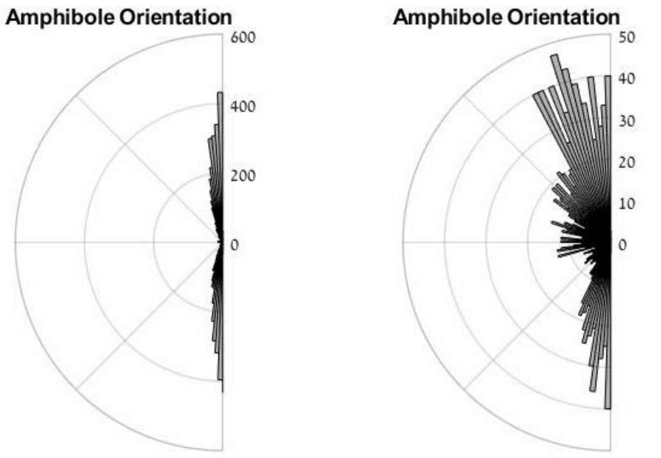
	BOA		AV	
	XZ	YZ	XZ	YZ
# of grains	13967	4116	5303	1439
long axis diameter (µm)	94	33	63	40
aspect ratio (c:a:b)	3.09:1:0.55		2.44:1:0.59	
shape factor	1.58	1.46	1.56	1.41
paris factor (%)	15.78	28.93	25.44	25.46

BOA



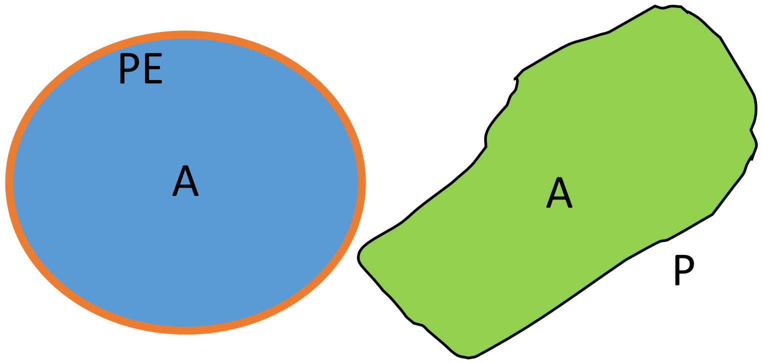
XZ YZ

AV



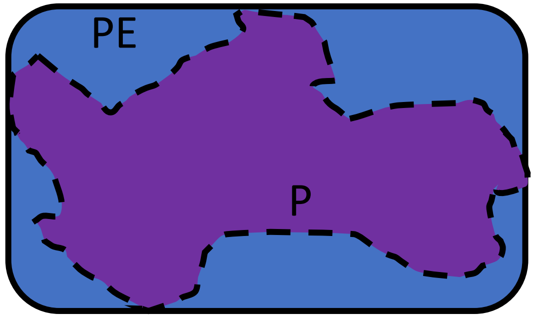
XZ YZ

$$Shape\ Factor = \frac{P}{PE} = \frac{grain\ perimeter}{area - equivalent\ perimeter}$$



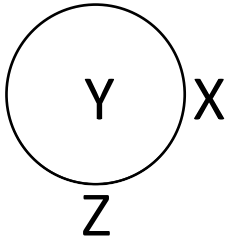
$$Paris\ Factor = 2 * \frac{\Delta P}{PE} * 100\%$$

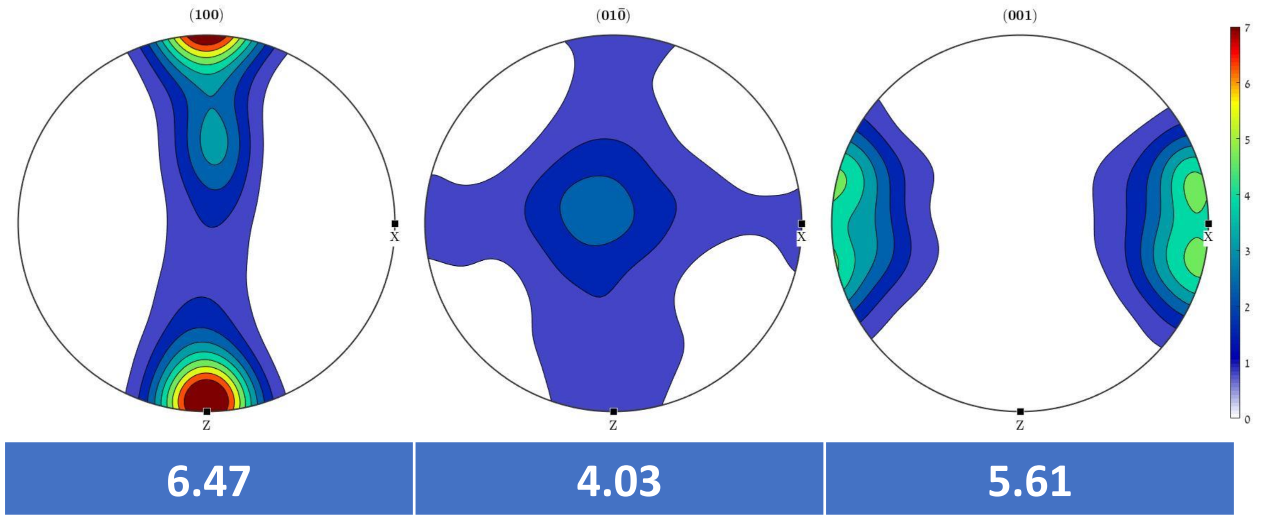
$$percentile\ average\ relative\ indented\ surface$$

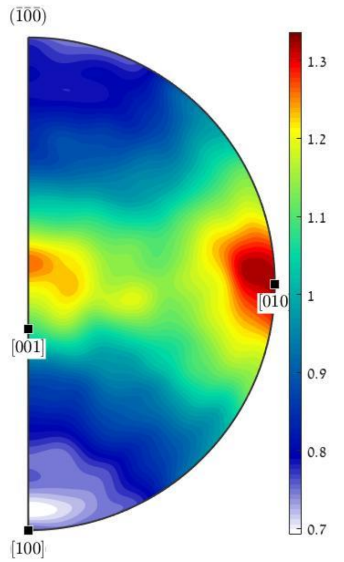


CPO and Misorientation

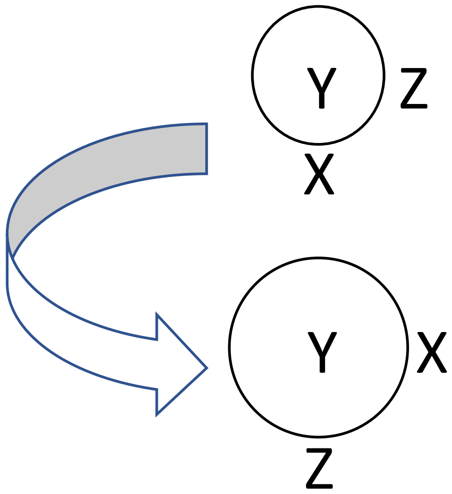
BOA

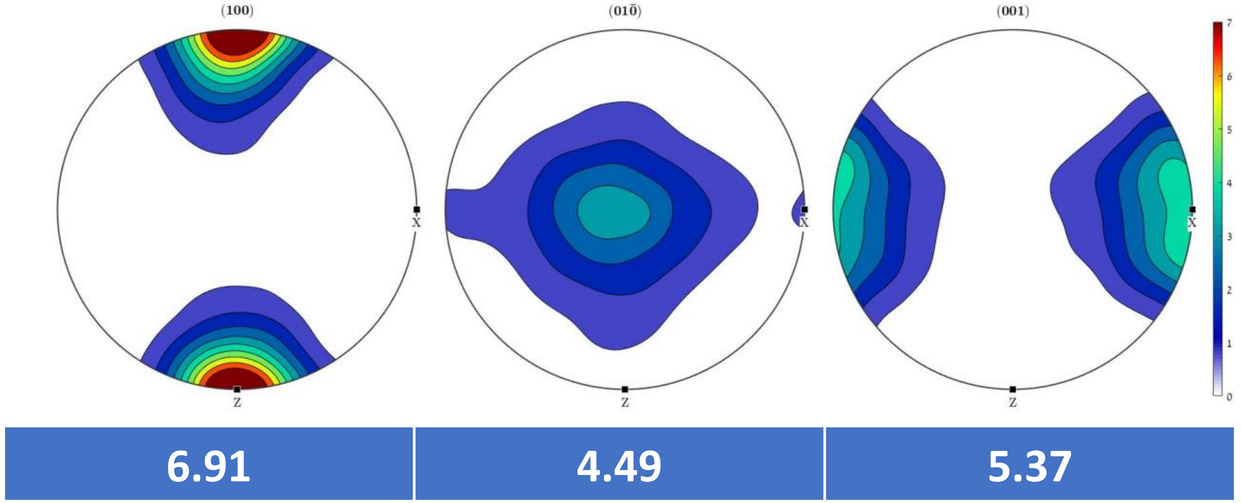


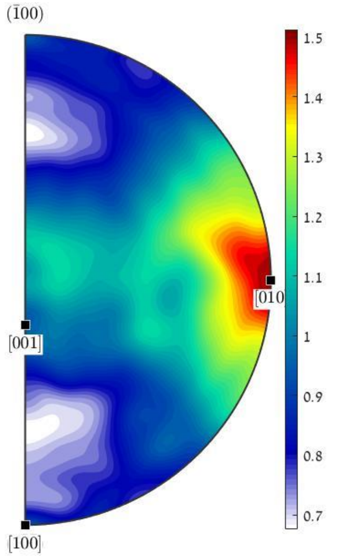




AV







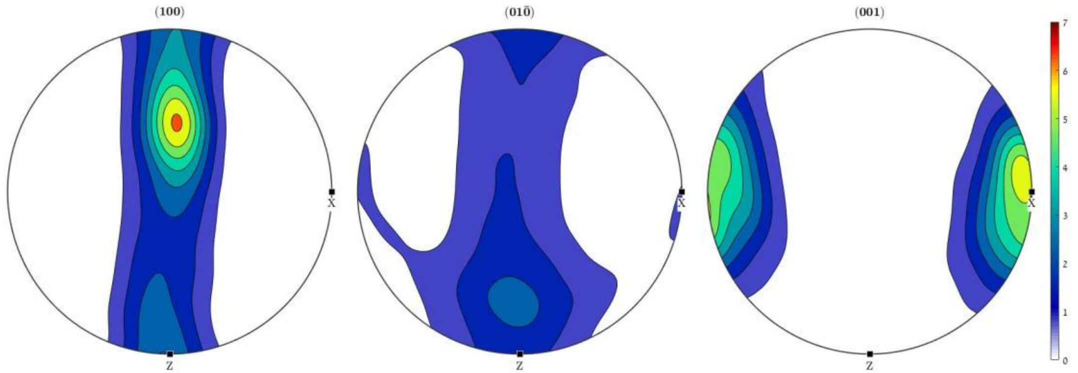
*EBSD data rotated

Crystallographic preferred orientation
*1 point per grain

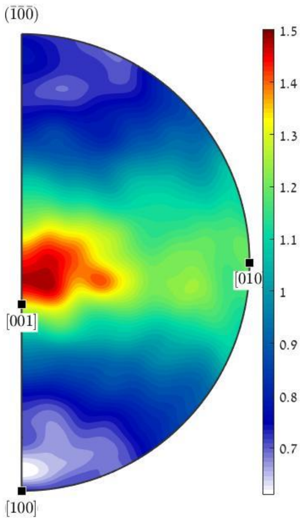
Misorientation axis (2-10°)

BOA – two different textures

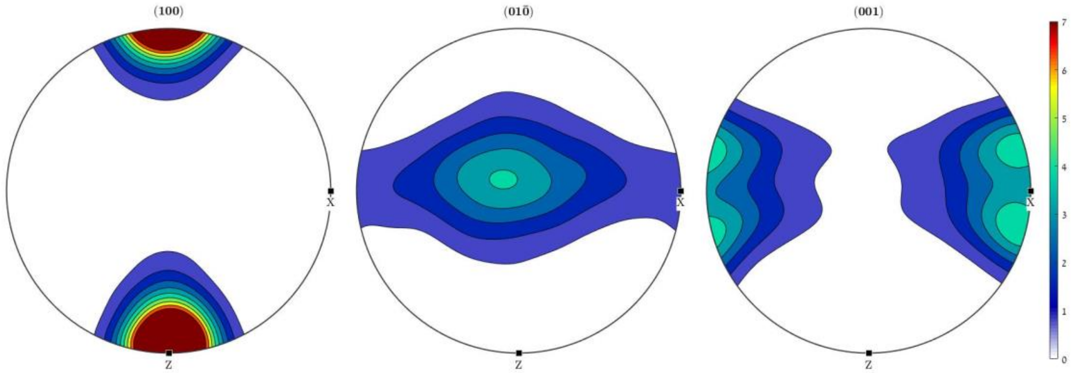
1.



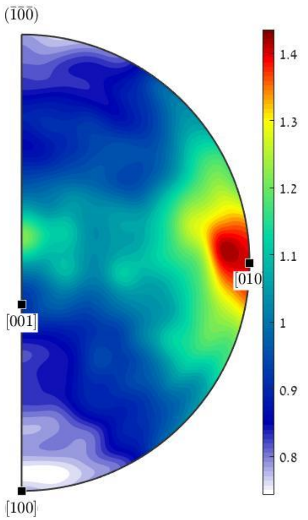
5.90	4.01	6.01



2.



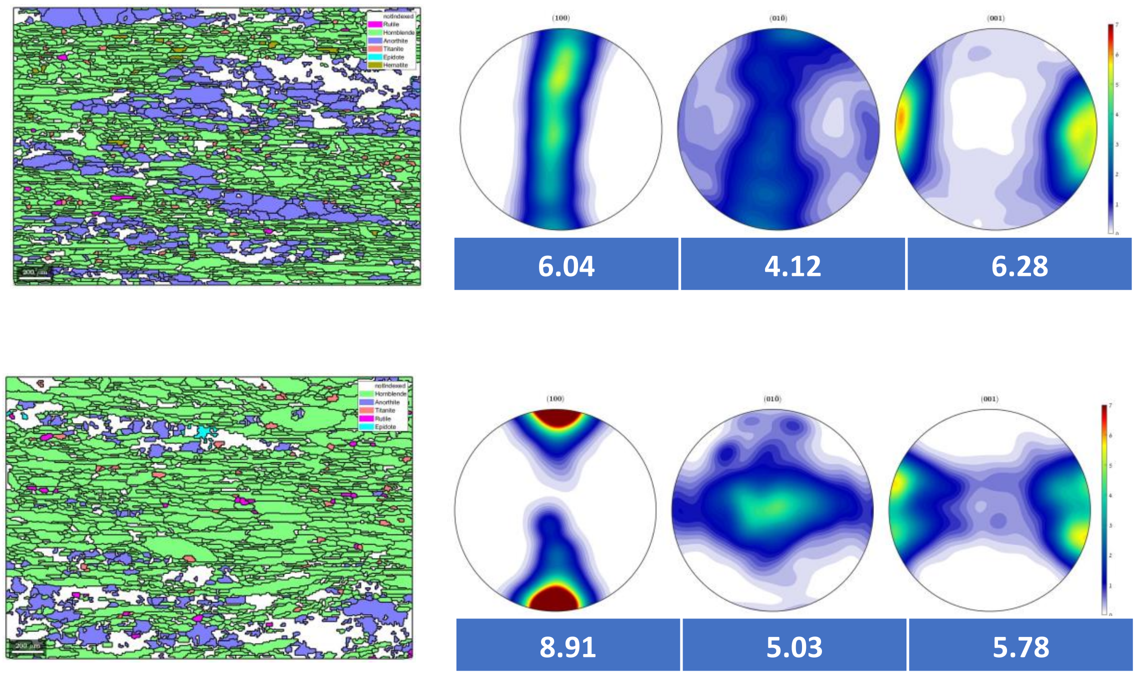
8.97	4.91	5.44



	plane	# of grains	long axis diameter (µm)	aspect ratio (c:a:b)	shape factor	paris factor (%)
Type 1	XZ	7642	91	3.35:1:0.50	1.62	15.20
	YZ	1933	41		1.44	22.15
Type 2	XZ	6492	88	3.04:1:0.59	1.58	17.15
	YZ	2574	28		1.46	31.75

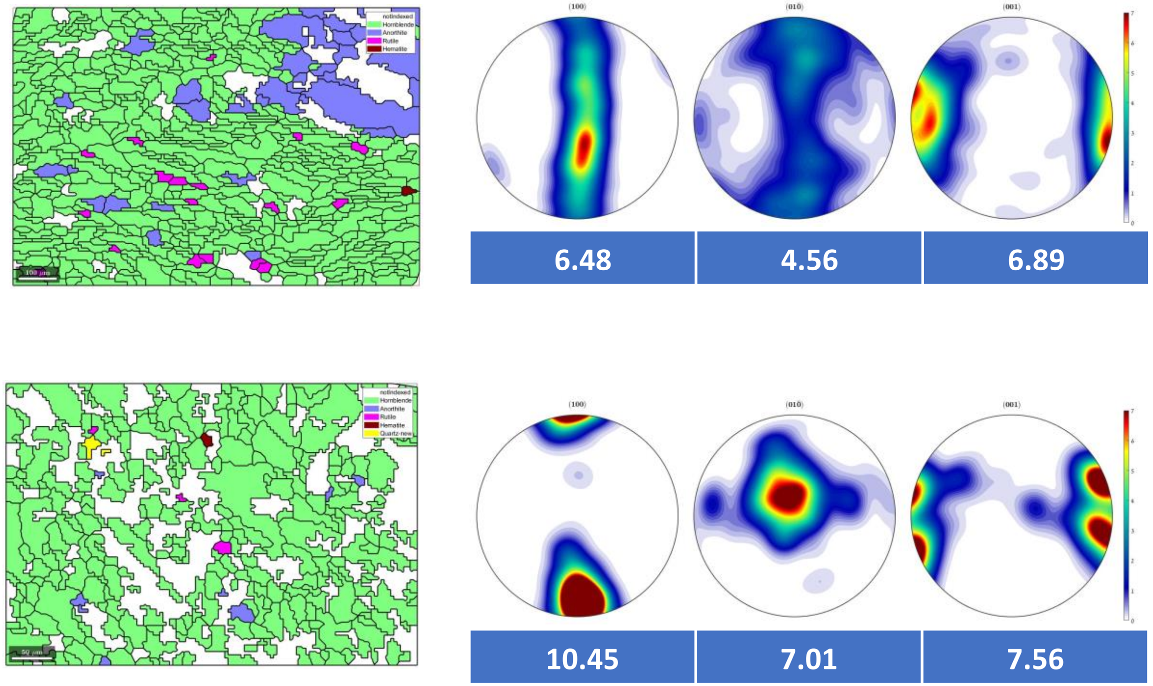
BOA TYPE 1

Y X
Z



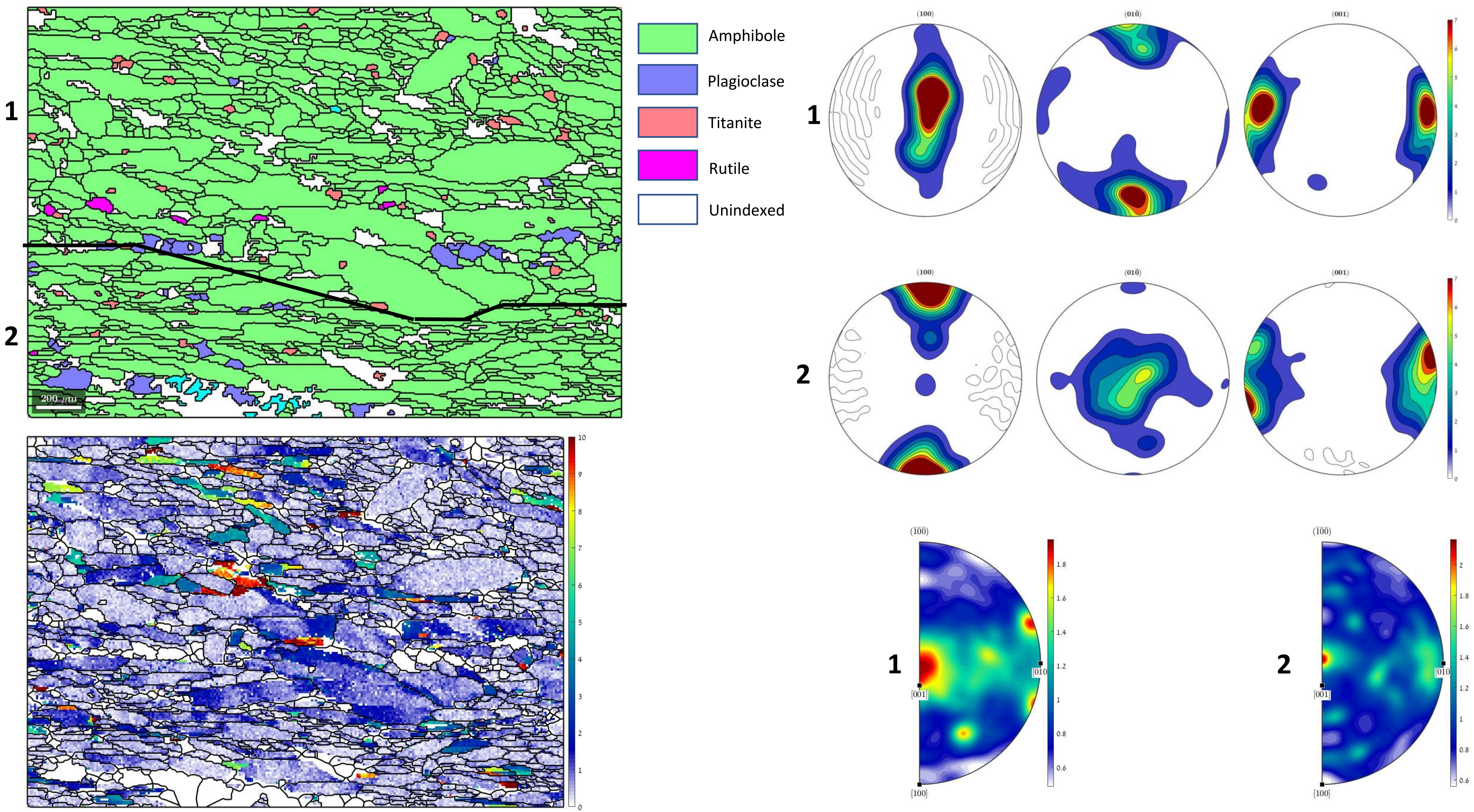
BOA TYPE 2

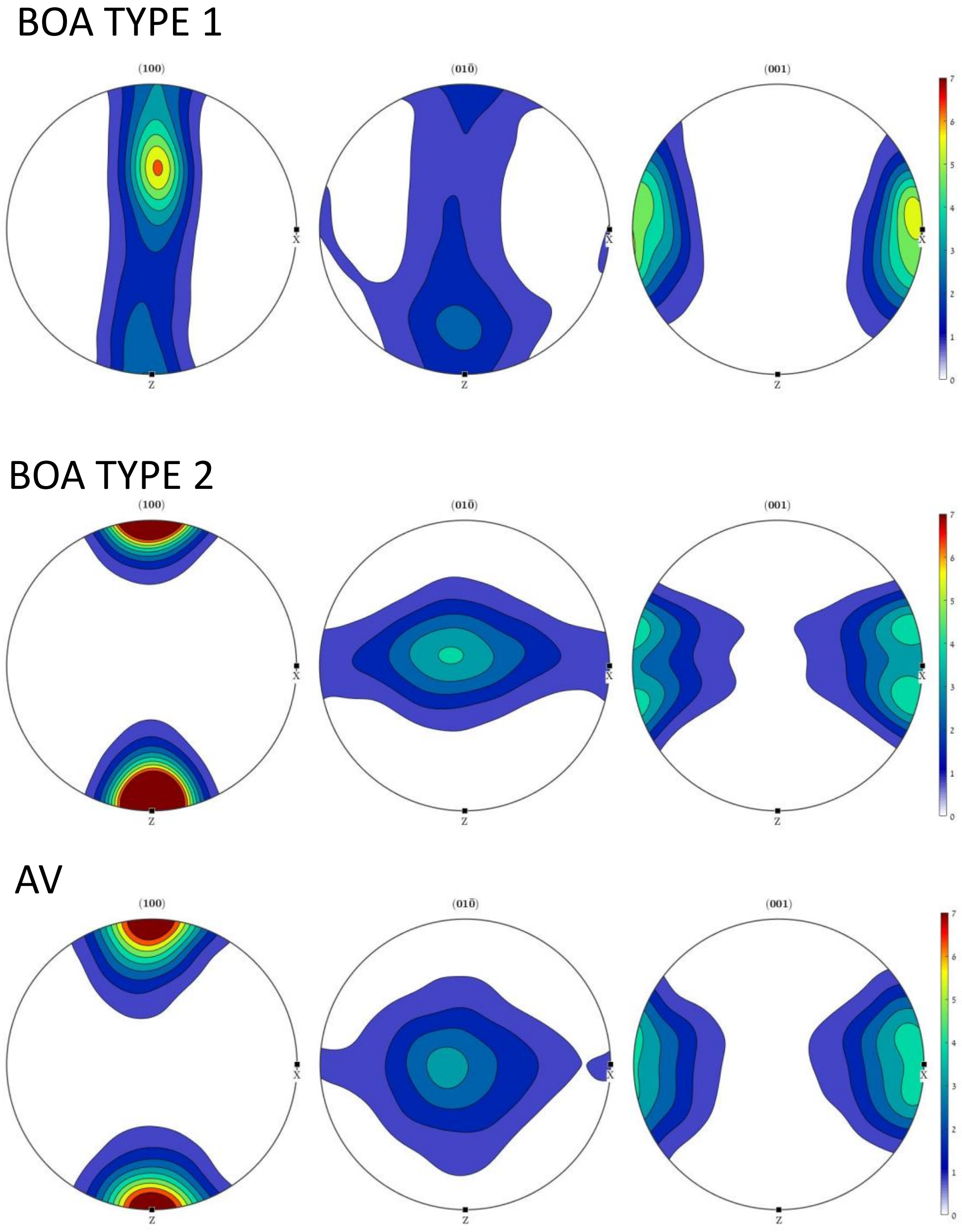
Y Z
X



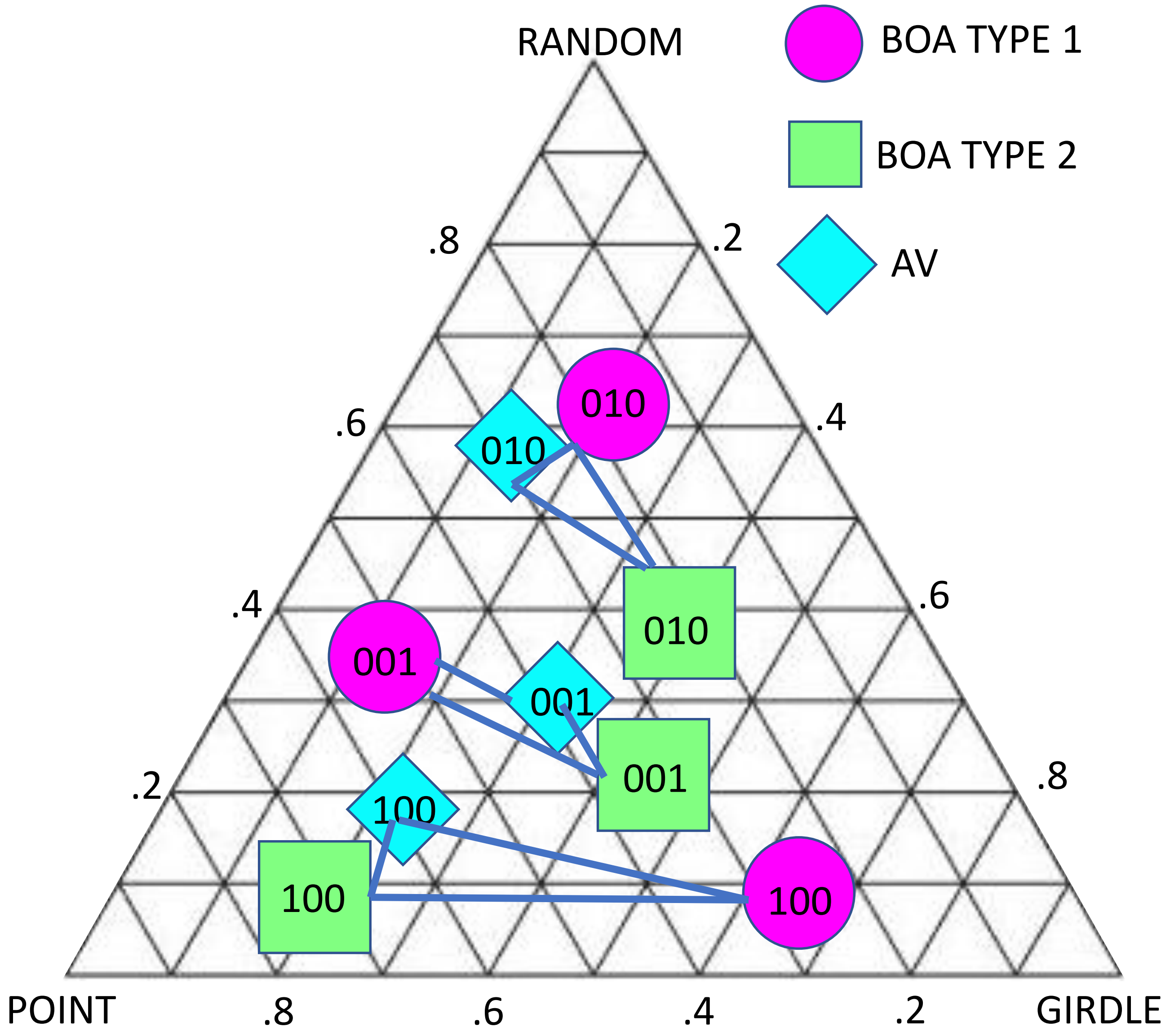
	plane	# of grains	long axis diameter (µm)	aspect ratio (c:a:b)	shape factor	paris factor (%)
Type 1	XZ	7642	91	3.35:1:0.50	1.62	15.20
	YZ	1933	41		1.44	22.15
Type 2	XZ	6492	88	3.04:1:0.59	1.58	17.15
	YZ	2574	28		1.46	31.75

* CPO area-weighted

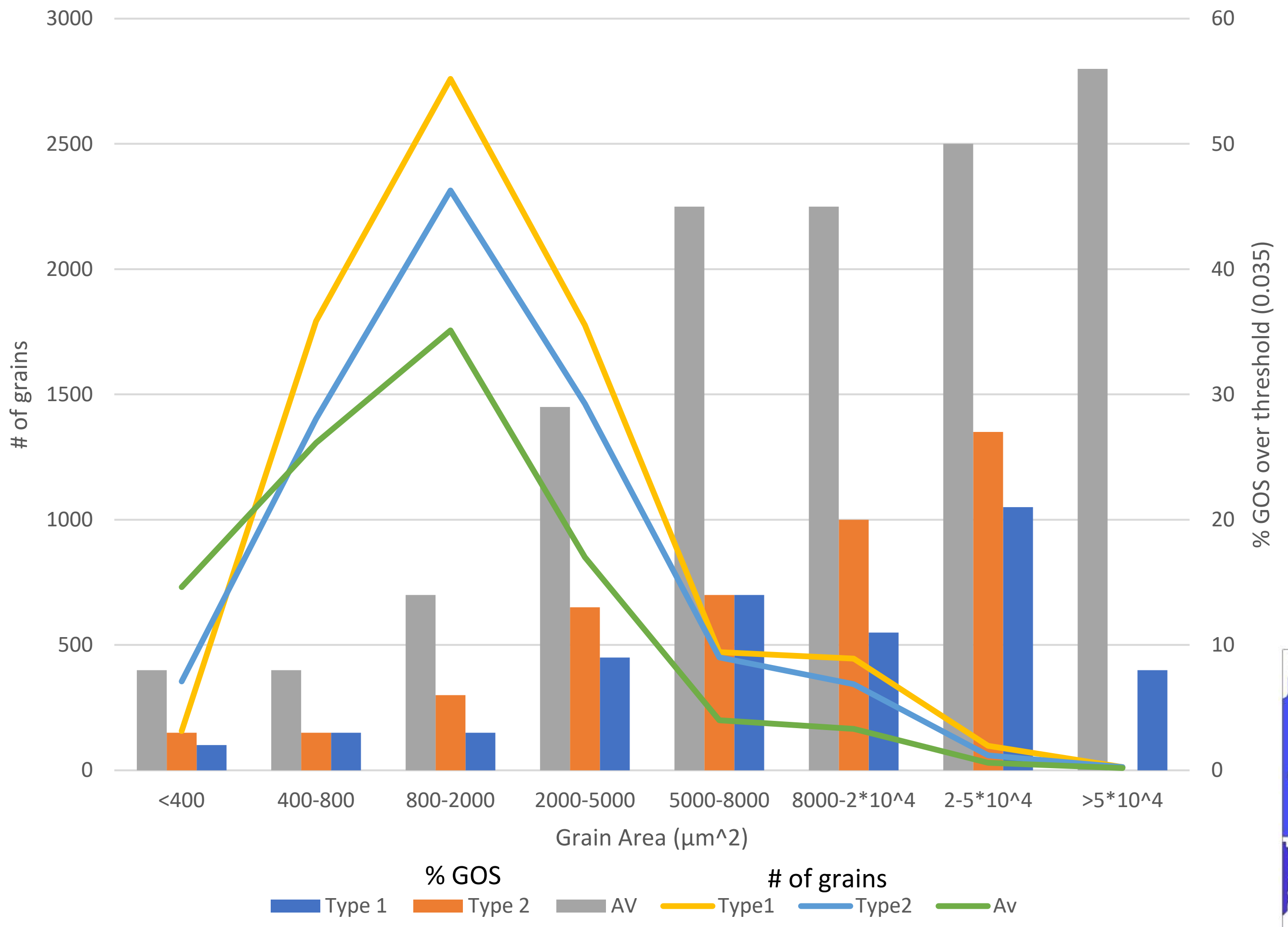

1
2
Amphibole
Plagioclase
Titanite
Rutile
Unindexed
200 μm
(100)
(010)
(001)
[001]
[100]
[010]



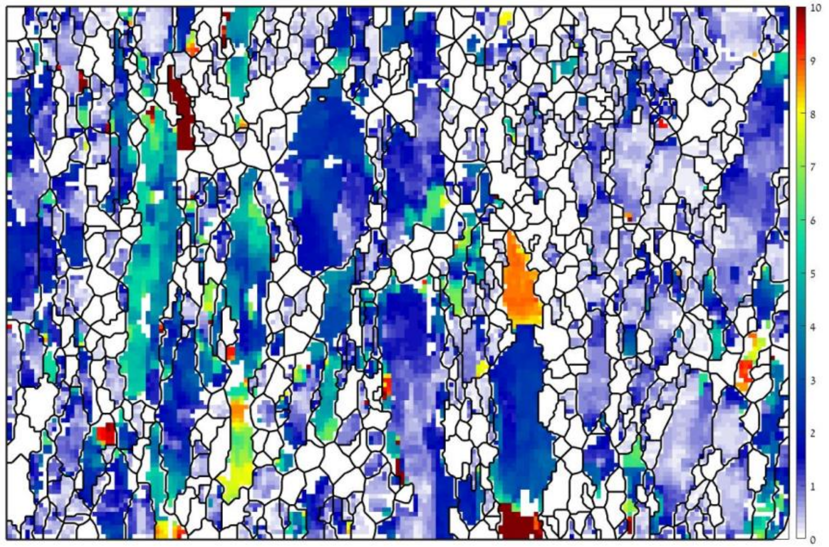
Texture Symmetry



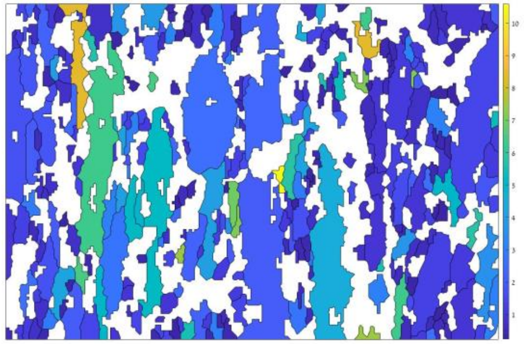
GOS – Grain Orientation Spread



Intra-grain misorientation map



GOS map



GOS> threshold map