

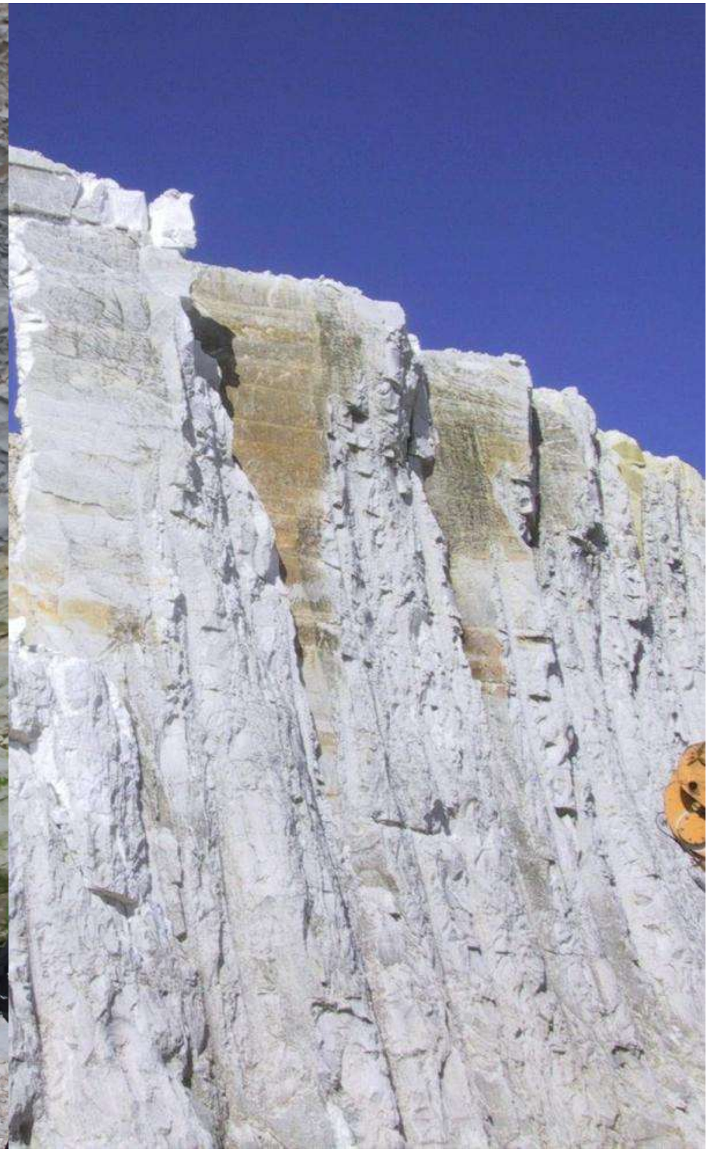

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Université de Mons

Chalk fractures geometry: a comprehensive description of fracture surfaces

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POLYTECH MONS

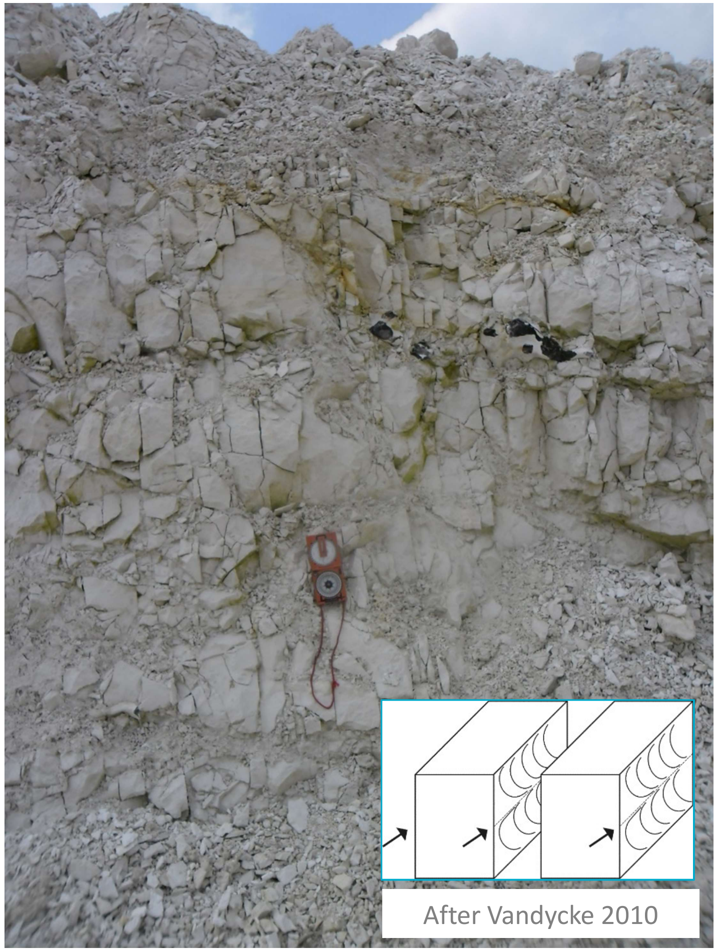
So many questions about Chalk

What can be seen at different **scale** of work?

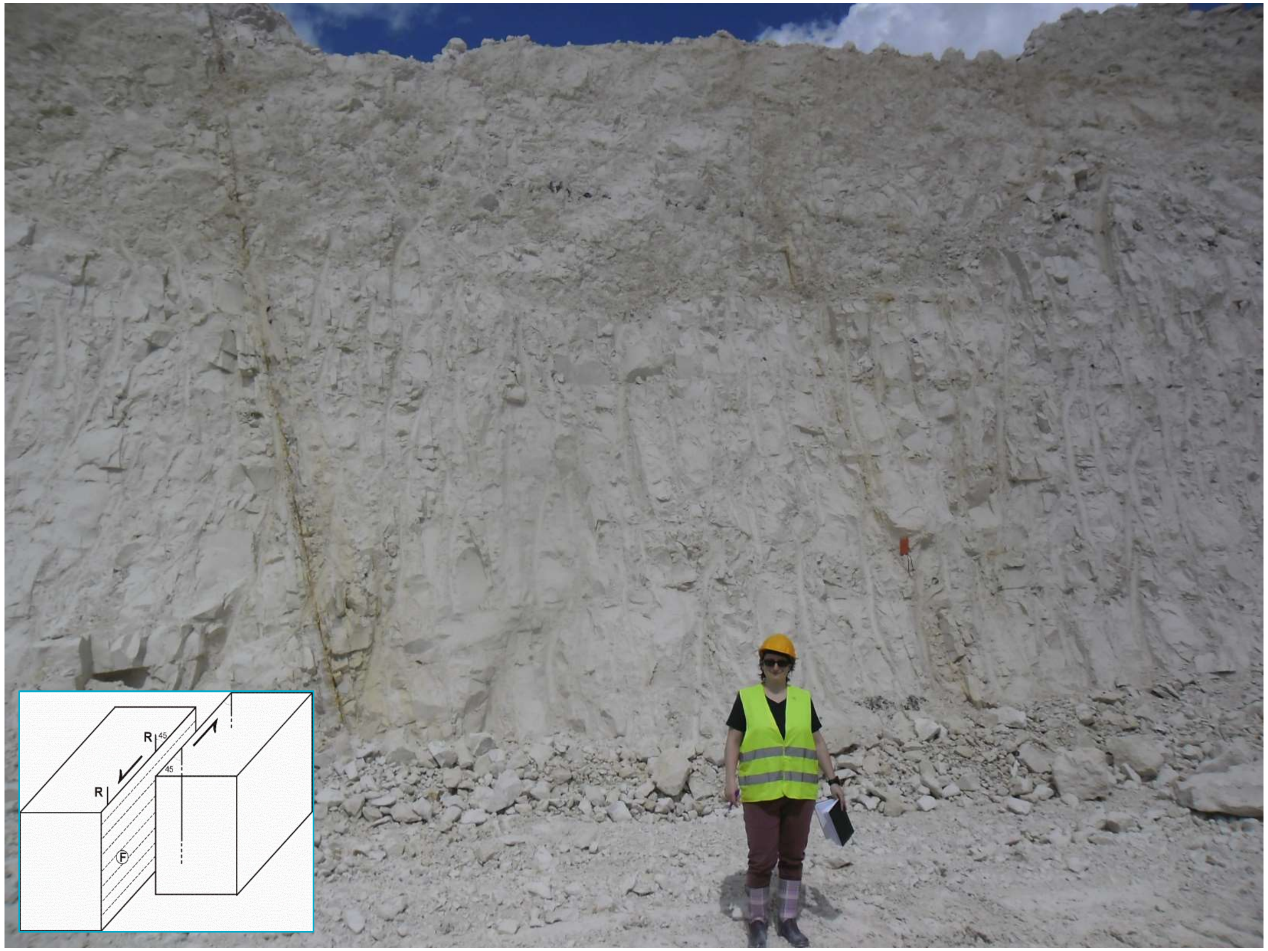
Can **lab-generated** fractures be compared to **natural** fractures?

How can we qualify fracture plane **roughness**?

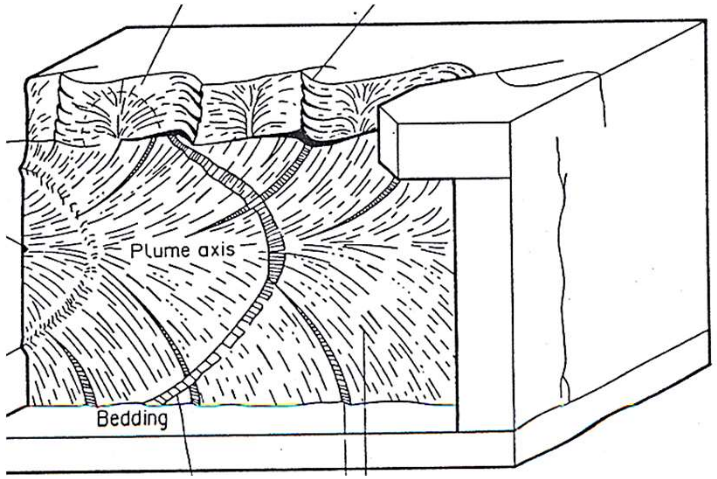
Joints and faults



After Vandycke 2010

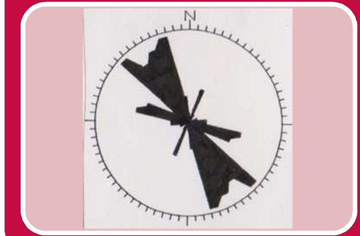


Fracture features



After Hancock 1994

Process & Tools: MACRO to MICRO

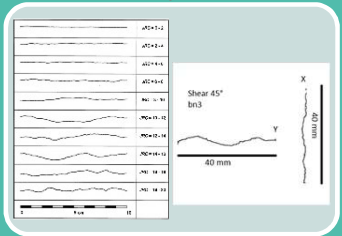


OBSERVATION ON SITE

Faults – Joints

Geological and tectonic background

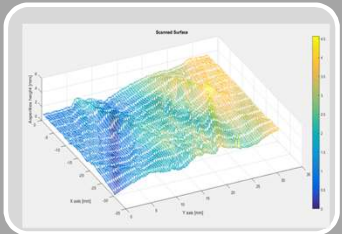
Barton & Choubey 1977



LAB VISUAL CLASSIFICATION

Unevenness and waviness

JRC



LASER SCANS

Statistical parameters Ra & σa, Z2

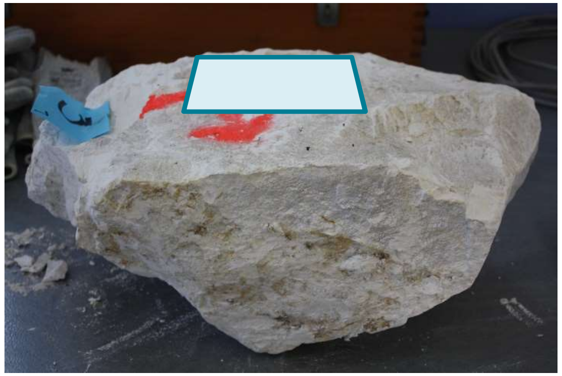
Fractal parameters Dyard and Dvar

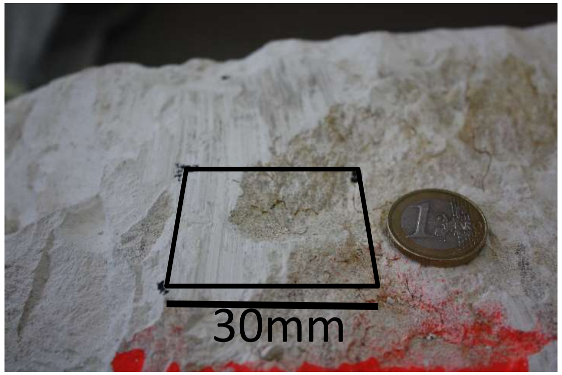
> metric

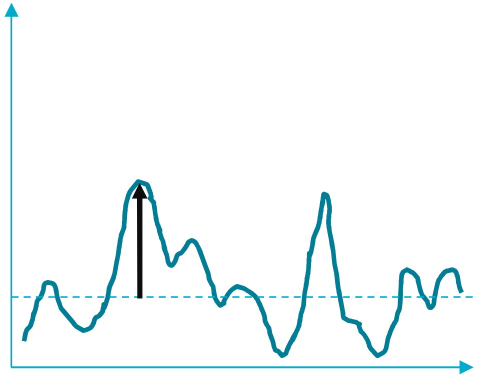
scale

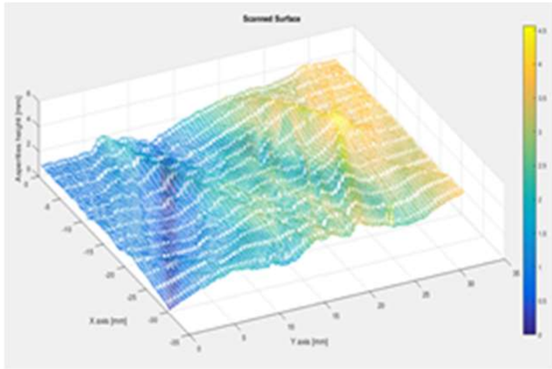
sub-mm

Roughness characterisation









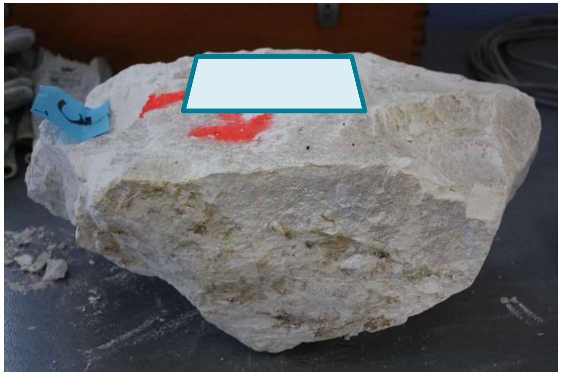
Ra: asperities height average

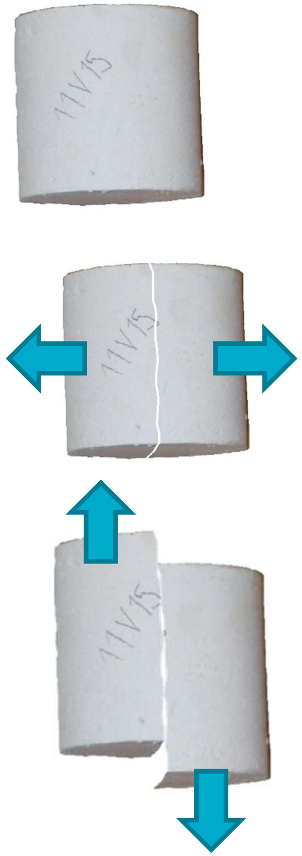
Z2: RMS average

Dvar: semi-variogram fractal dimension

Dyard: yardstick rule (divider) fractal dimension

Natural and lab-generated fractures

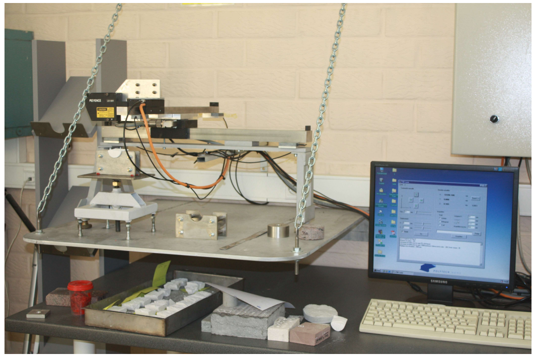




Rock strength and sample fracturing

Location	Age	Av. UCS [MPa]	Std dev. [MPa]
BELGIUM	Campanian	**5.5**	0.7
FRANCE	L. Cenomanian	**19.1**	4.2



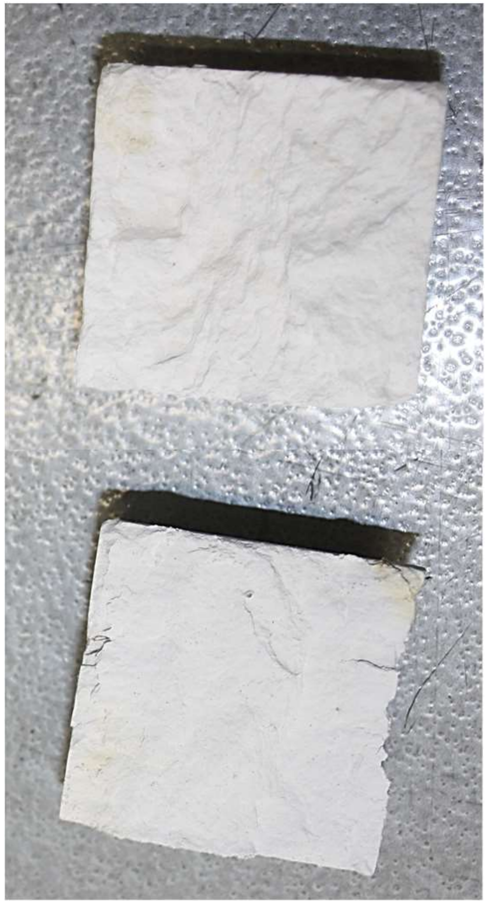
Fault striation

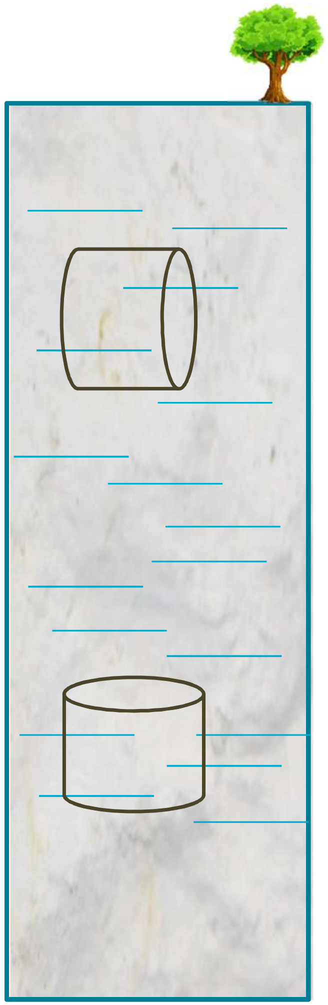
Twist hackles and ridges

40mm

Plumose

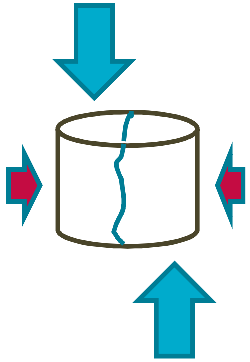
Sample orientation matters



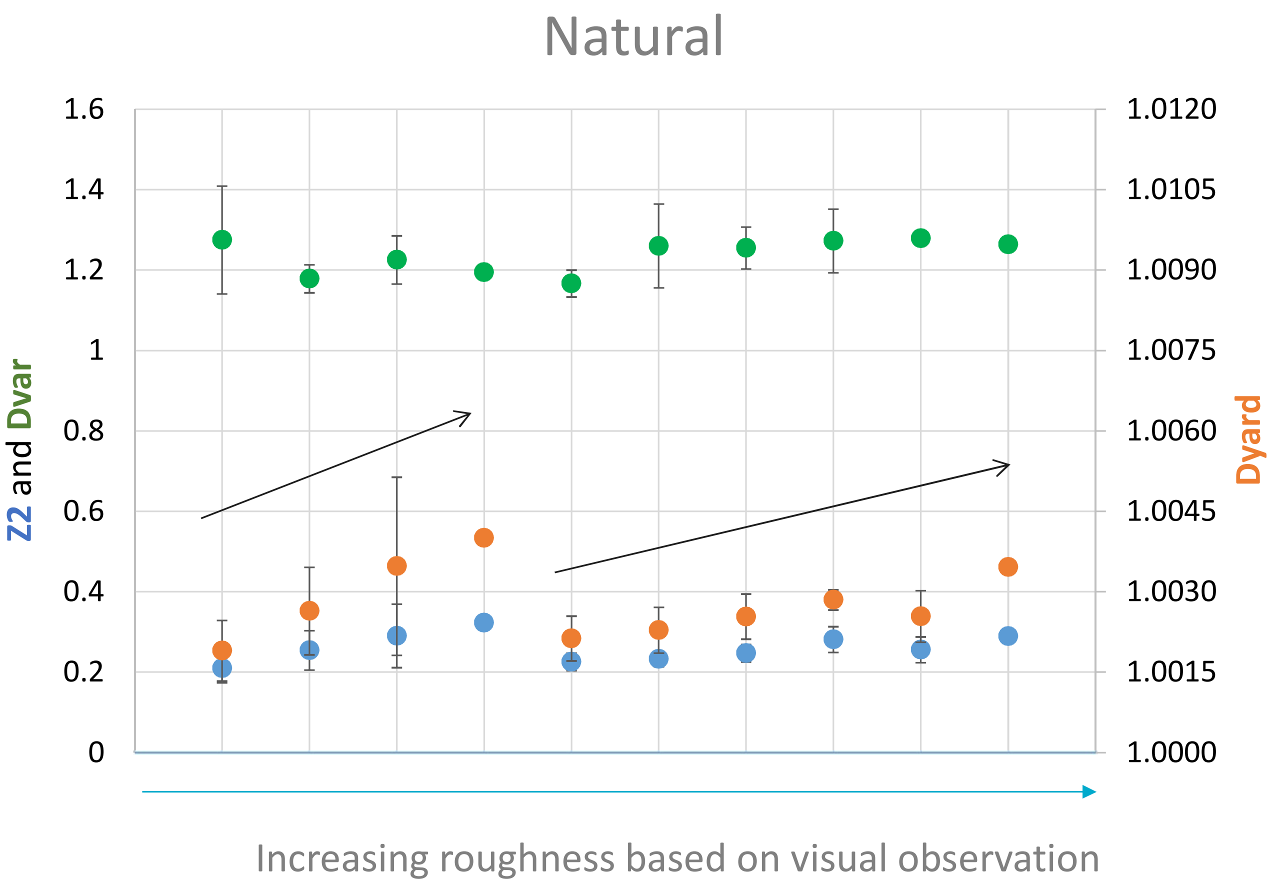


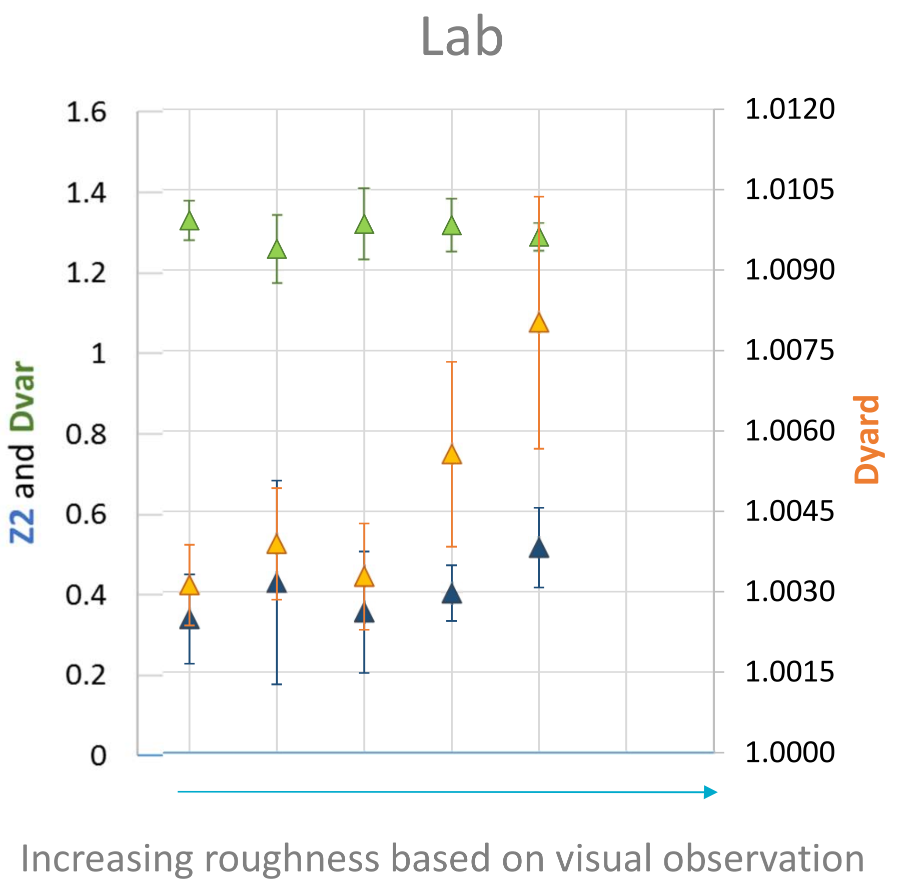
H series

V series



ROUGHNESS RESULTS

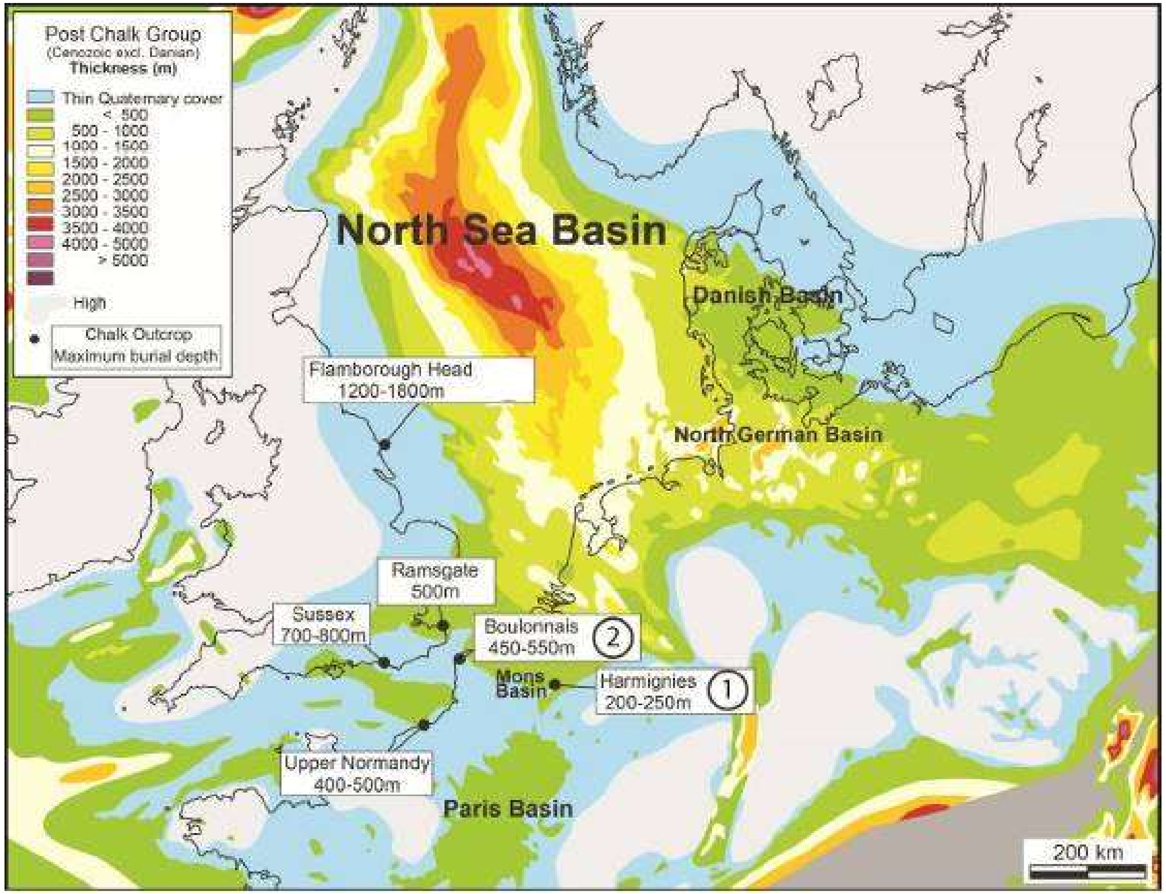




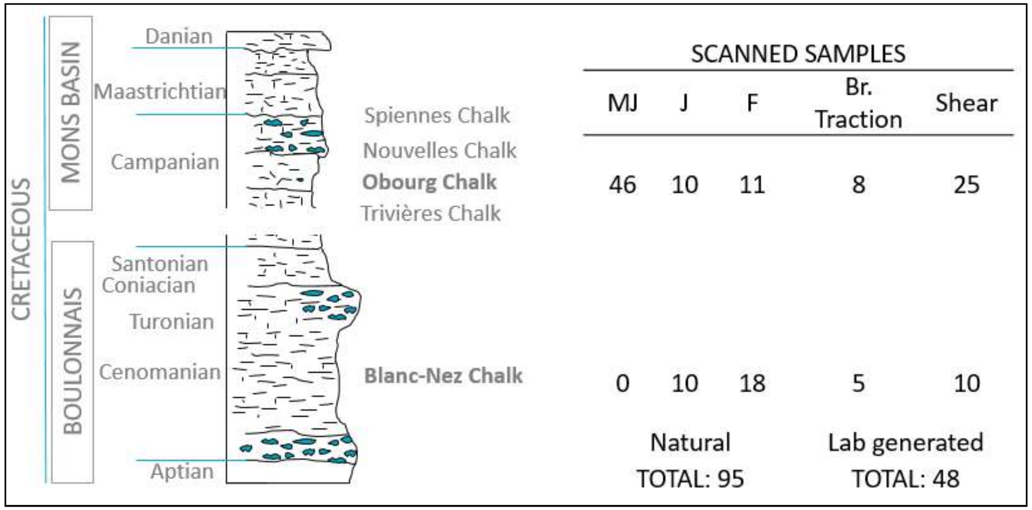
CONCLUSIONS

- **Natural vs. lab:** it works!
  but lithology and anisotropy affect fracture morphology
- **Scale of work:**
  ✓ *repeatability of method gives consistent results*
  ✓ *a holistic approach is likely best*
- **Roughness** computation is relevant

WHERE



Post Chalk Group
(Cenozoic excl. Danian)
Thickness (m)
Thin Quaternary cover
< 500
500 - 1000
1000 - 1500
1500 - 2000
2000 - 2500
2500 - 3000
3000 - 3500
3500 - 4000
4000 - 5000
> 5000
High
Chalk Outcrop
Maximum burial depth
North Sea Basin
Danish Basin
North German Basin
Flamborough Head
1200-1800m
Ramsgate
500m
Sussex
700-800m
Boulonnais
450-550m
2
Mons
Basin
Harmignies
200-250m
1
Upper Normandy
400-500m
Paris Basin
200 km



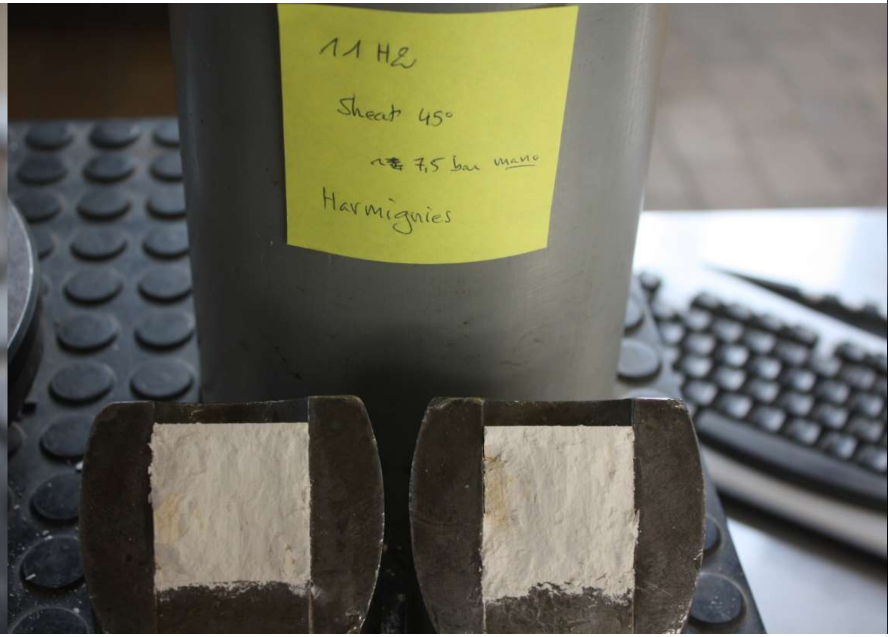
CRETACEOUS
MONS BASIN
BOULONNAIS
Danian
Maastrichtian
Campanian
Santonian
Coniacian
Turonian
Cenomanian
Aptian
Spiennes Chalk
Nouvelles Chalk
Obourg Chalk
Trivières Chalk
Blanc-Nez Chalk
SCANNED SAMPLES
MJ J F Br. Traction Shear
46 10 11 8 25
0 10 18 5 10
Natural
TOTAL: 95
Lab generated
TOTAL: 48

Ce que je cherche

Hancock – structures – cause->effect

Barton - JRC

RESULTS: PICTURES OF SAMPLES

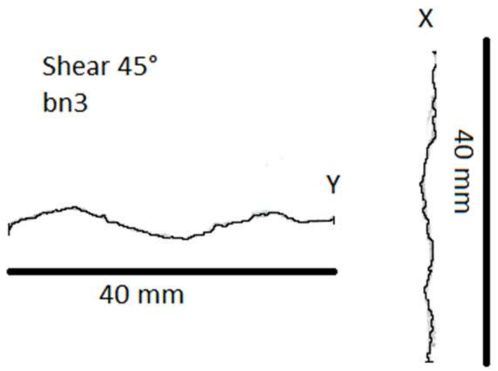


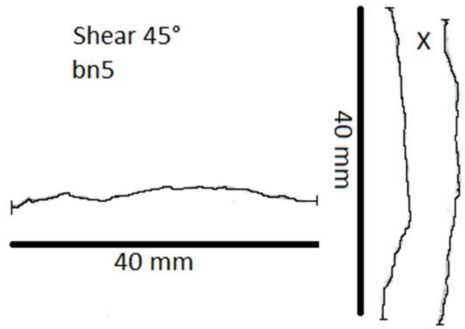
Harmignies 30-45-60

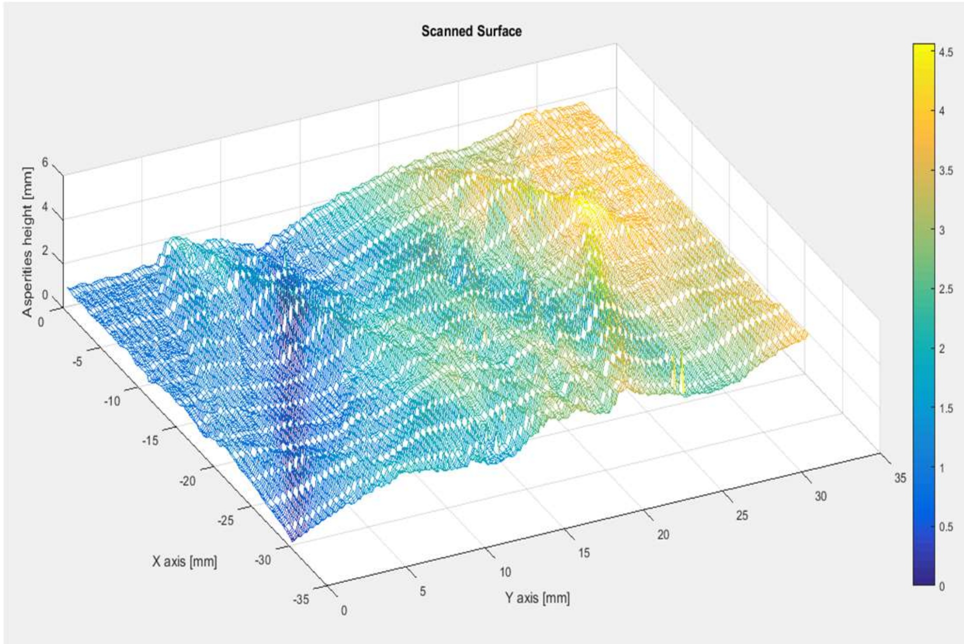
SAMPLES TAKEN

Sample origin	**Mode**	**Structure**	Strike dip, dip (striation)	Scans
Harmignies	**I**	**MJ**	N20°, 87°E	21
	II	**Fn**	N121°, 70°S	6
	I	**Js**	/	5
	I	**MJ**	N130°, 88°S	5
	/	**Js**	/	5
	I	**J**	N106°, 85°N	20
	II	**Fn**	120°N / ESE, 80°S	5
Blanc-Nez	**II**	**Fn**	N65°, 60°S (85°N)	8
	I	**J**	N105°, 35°S	5
	I or II	**J**	N-S or E-W or N135°	5
	II	**Fd**	N25°, 75°N (10°N)	5
	II	**Fd**	N25°, 75°N (10°N)	5

RESULTS: JRC and SCANS







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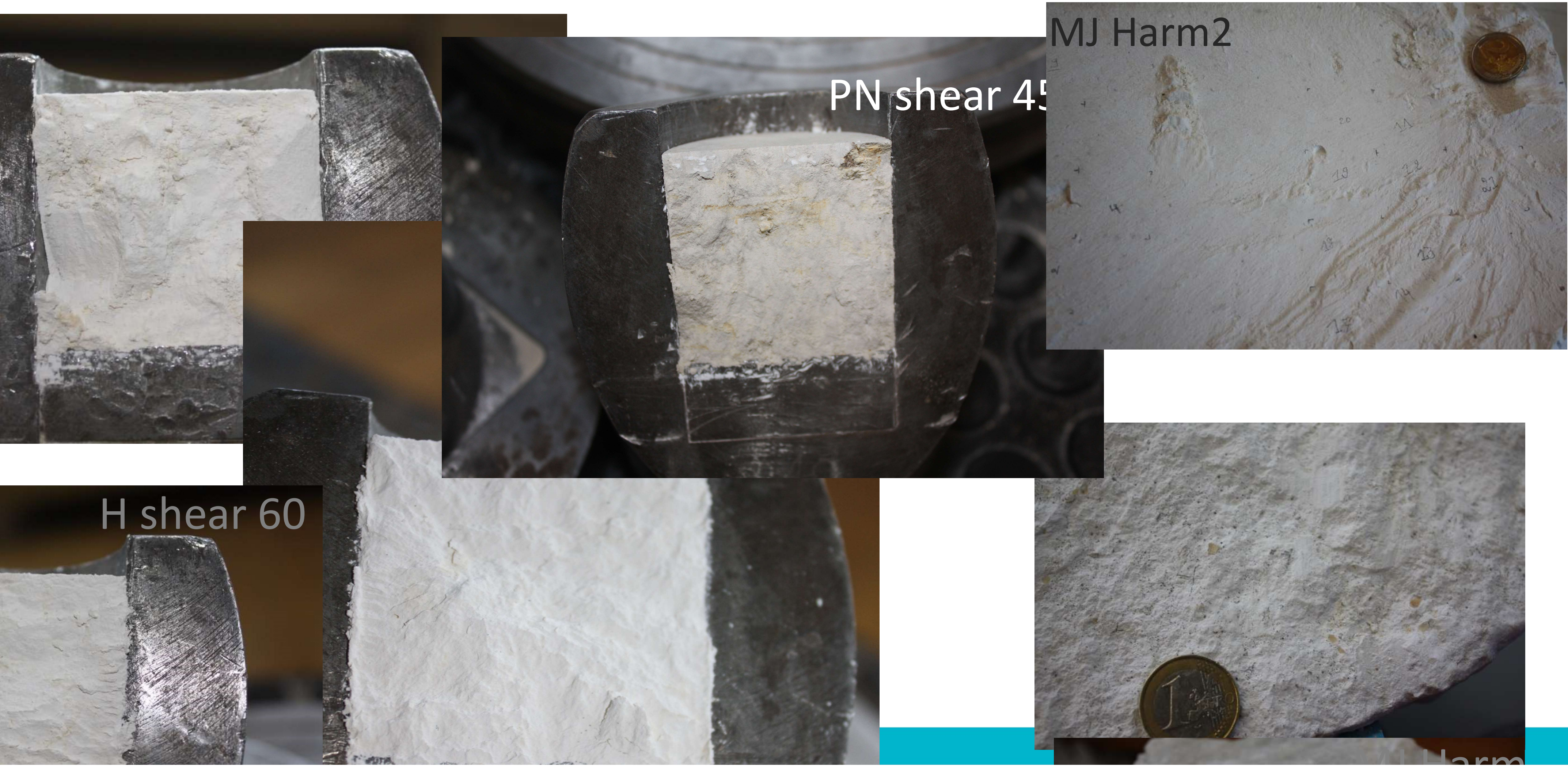

DETAIL OF TOOLS - FORMULAE

And references