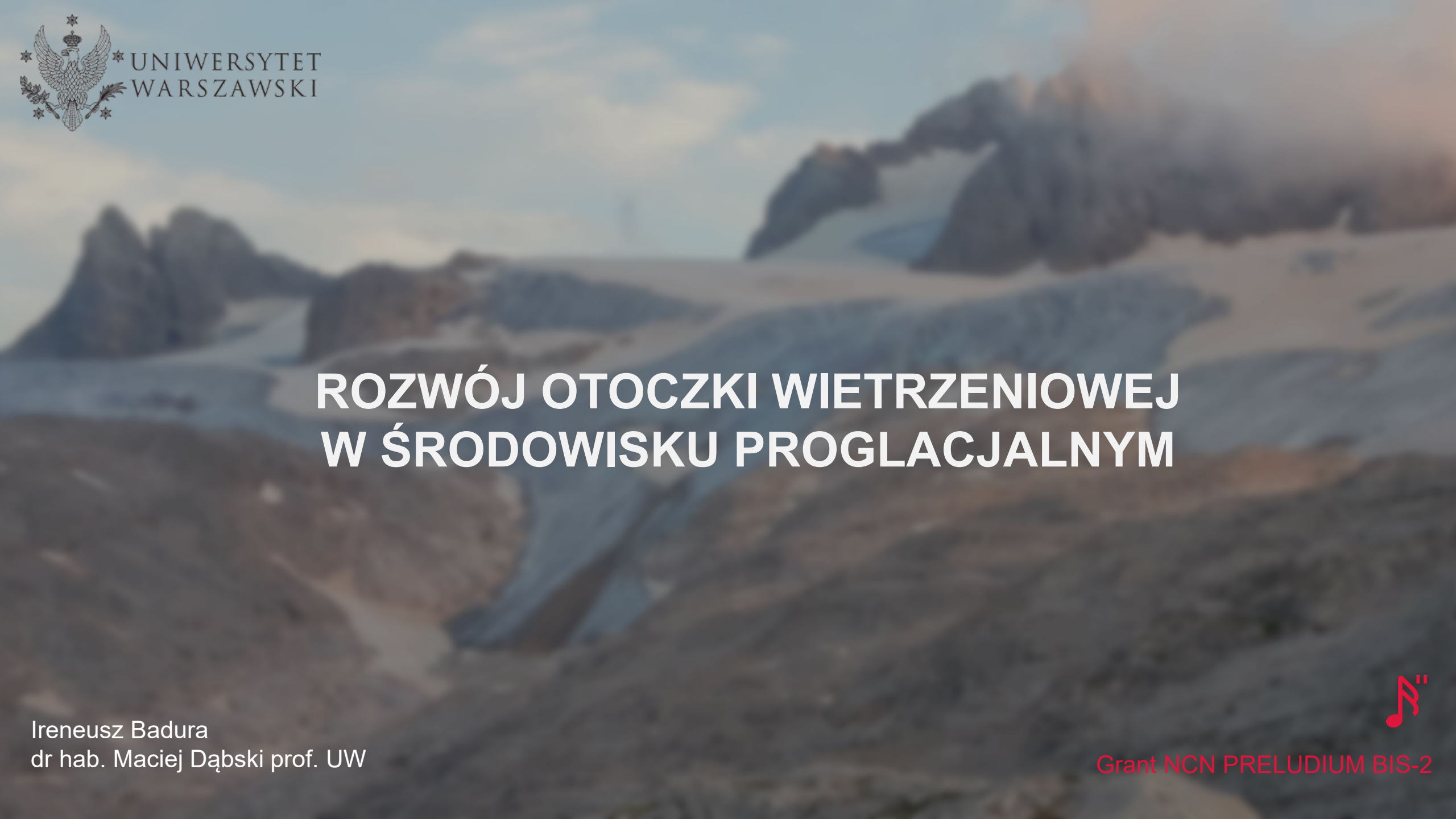


UNIWERSYTET WARSZAWSKI

ROZWÓJ OTOCZKI WIETRZENIOWEJ W ŚRODOWISKU PROGLACJALNYM

Ireneusz Badura
dr hab. Maciej Dąbski prof. UW

Grant NCN PRELUDIUM BIS-2

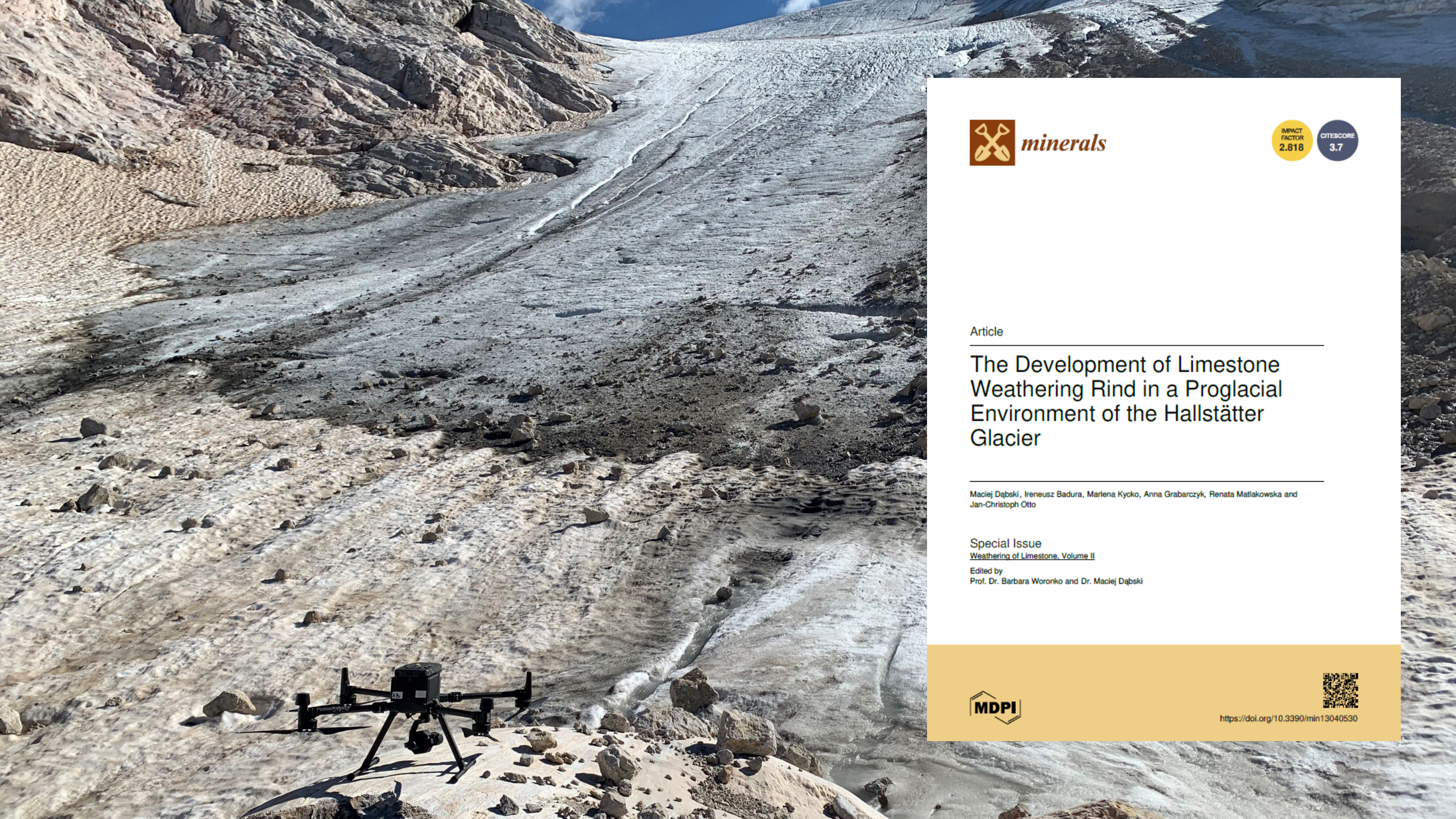
Pytania badawcze jakie postawiliśmy w projekcie:

1) Jakie jest tempo wietrzenia powierzchni skał (rozwój mikrorzeźby wietrzeniowej, otoczki wietrzeniowej, osłabienia powierzchni skał, zmian minerałów na powierzchniowych skał) na przedpolach współczesnych lodowców wykształconych w różnych typach skał w środowisku Wysokiej Arktyki i w alpejskim piętrze strefy umiarkowanej?

2) Czy zmiany mineralne powierzchni skał wynikające z warunków atmosferycznych od zakończenia MEL można zarejestrować w widmach promieniowania? Czy charakterystyki widmowe mogą być używane do datowania względnego form polodowcowych?


0
110
220 km
16°E
CZECH REPUBLIC
GERMANY
VIENNA
SLOVAKIA
Linz
48°N
Salzburg
LIECHTENSTEIN
Dachstein
Innsbruck
AUSTRIA
HUNGARY
SWITZERLAND
Klagenfurt
ITALY
SLOVENIA
CROATIA


Nordaustlandet
Kong Karls Land
Ny-Ålesund
Pyramiden
Barentsoya
Longyearbyen
Spitsbergen
Barentsburg
Sveagruva
Edgeoya
N



minerals

IMPACT FACTOR 2.818

CITESCORE 3.7

Article

The Development of Limestone Weathering Rind in a Proglacial Environment of the Hallstätter Glacier

Maciej Dąbski, Ireneusz Badura, Marlena Kycko, Anna Grabarczyk, Renata Matlakowska and Jan-Christoph Otto

Special Issue
Weathering of Limestone, Volume II

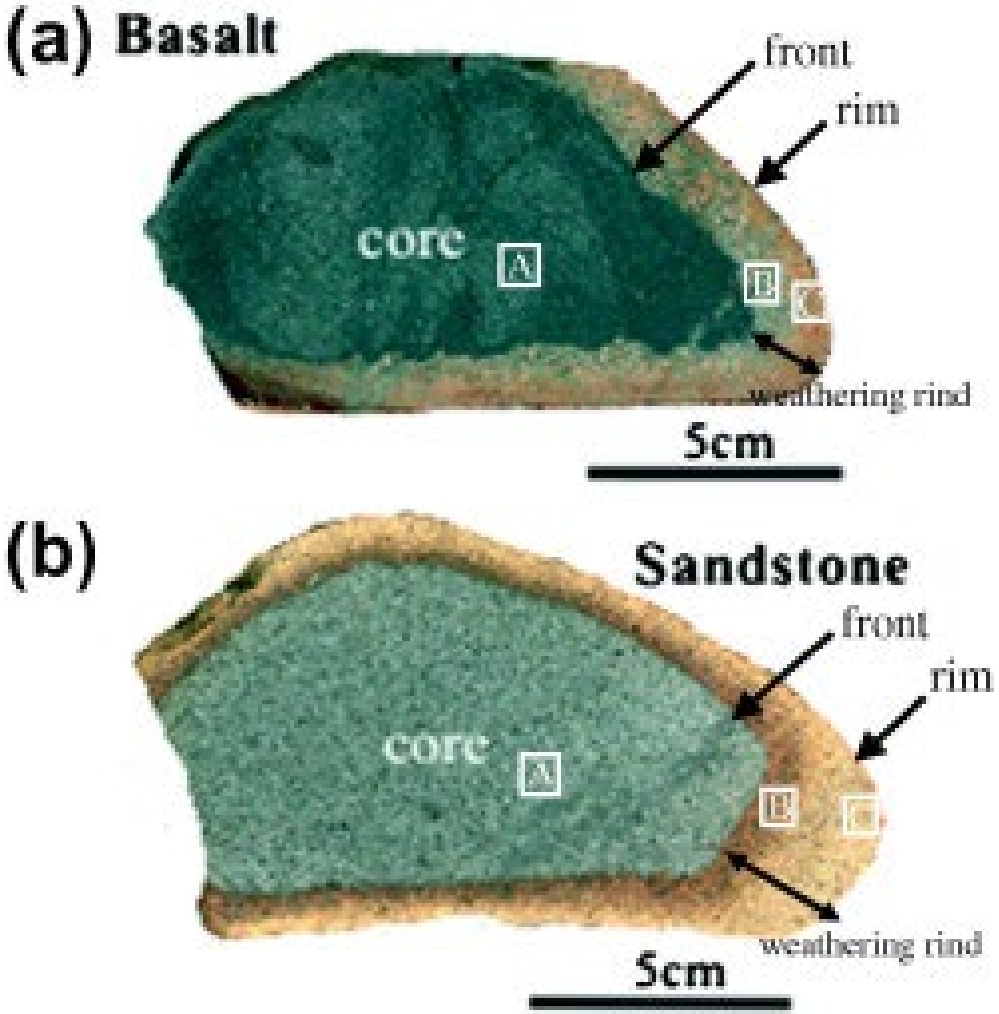
Edited by
Prof. Dr. Barbara Woronko and Dr. Maciej Dąbski

MDPI

https://doi.org/10.3390/min13040530

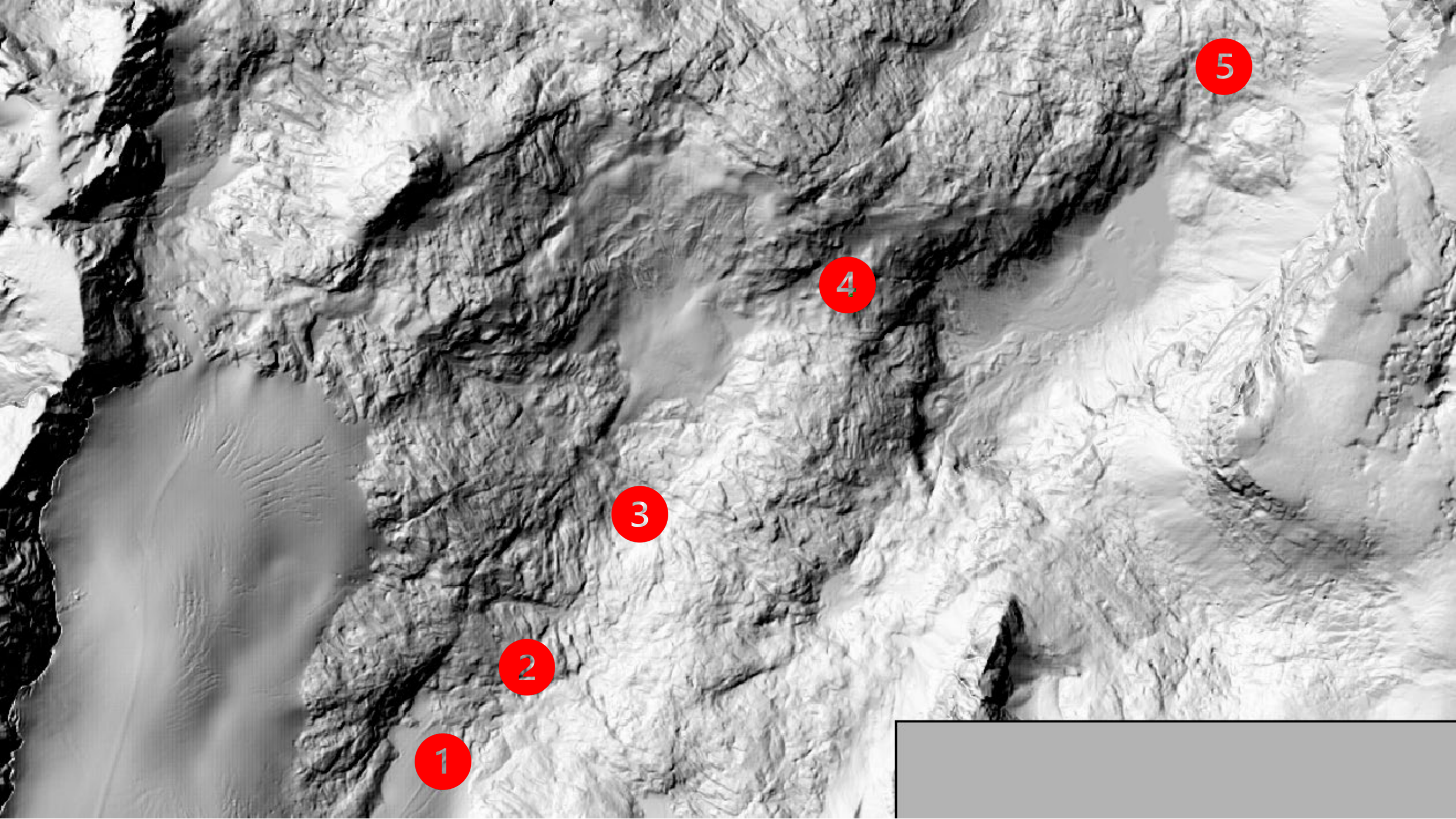
Jedną z metod badań geomorfologicznych jest kortikometria,
czyli analiza otoczki wietrzeniowej na powierzchni litych skał.

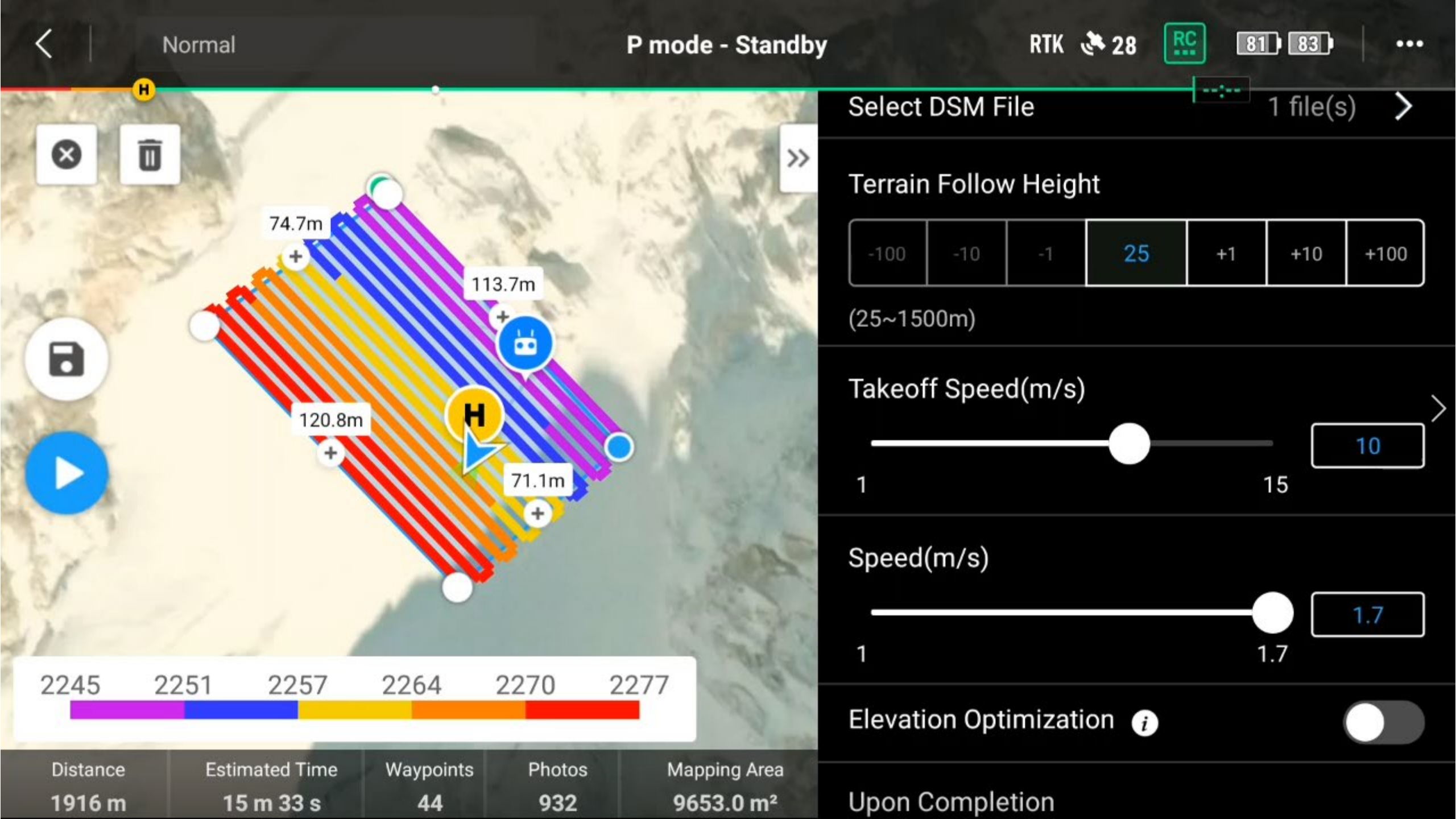
Otoczka wietrzeniowa jest wskaźnikiem zaawansowania wietrzenia,
zatem pozwala wnioskować m.in. o wieku względnych form rzeźby, a pośrednio np. o tempie deglacjacji.

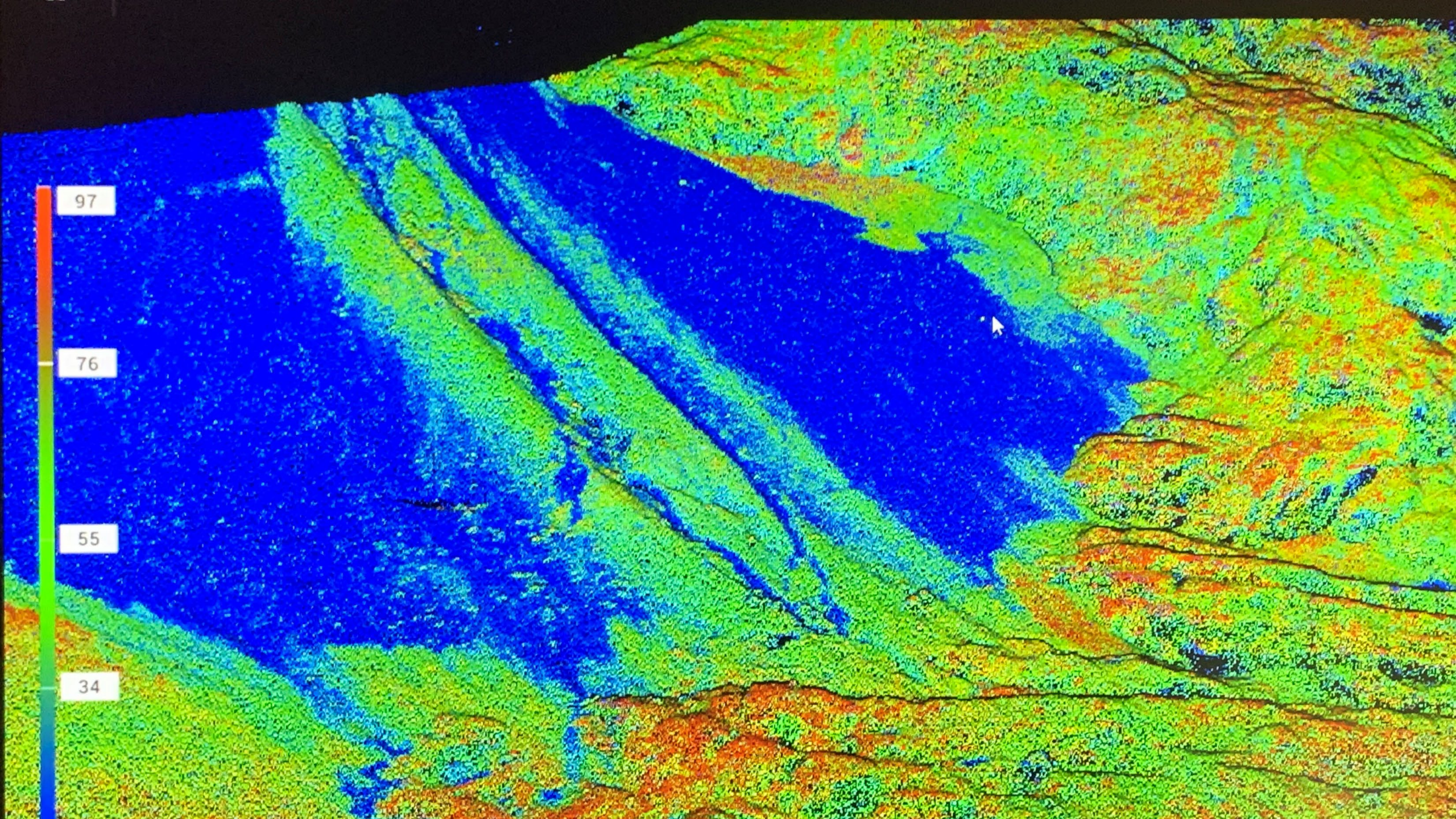


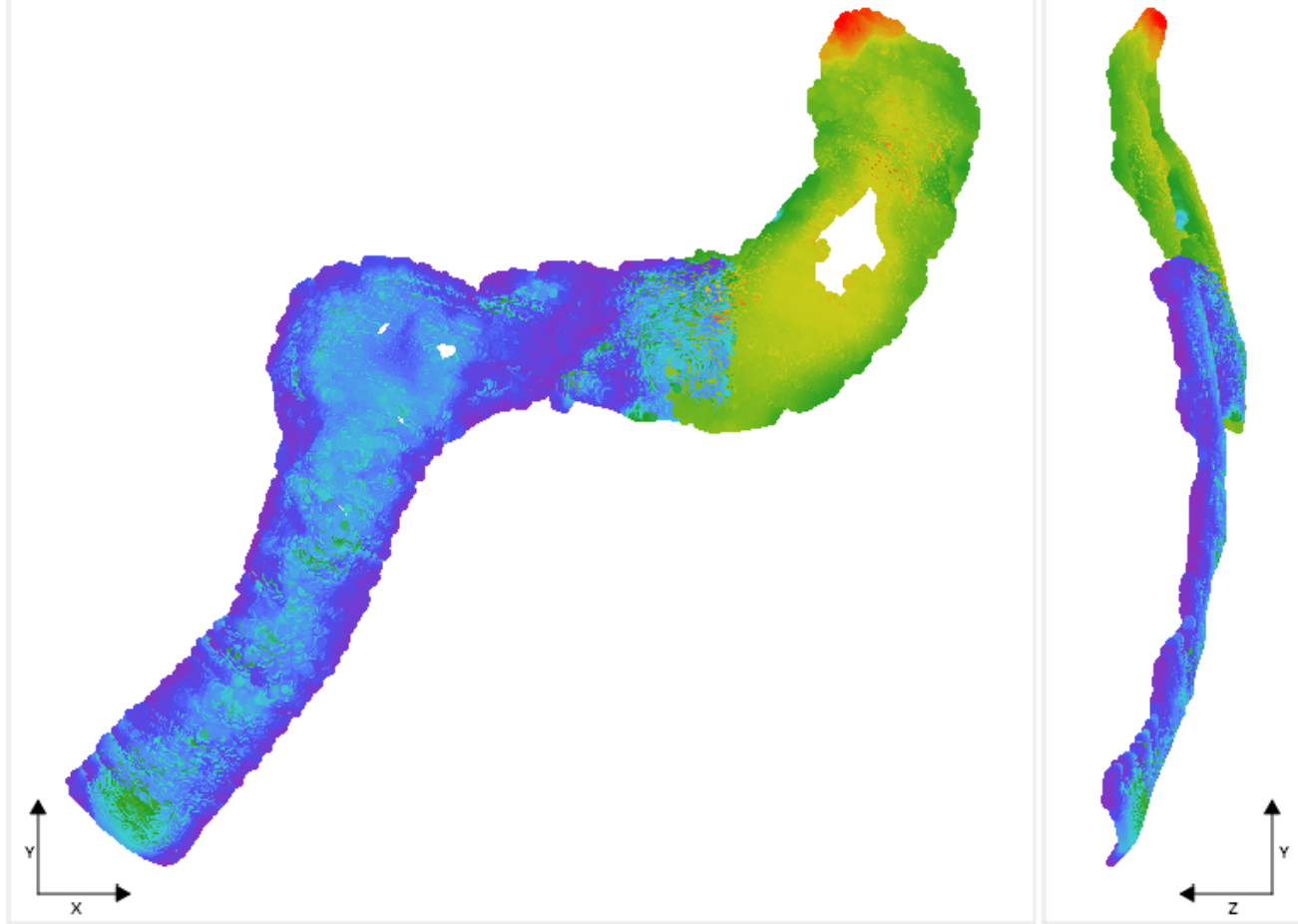
Yoshida et al. 2011


Schöberl
2428m
Schneelochgletscher

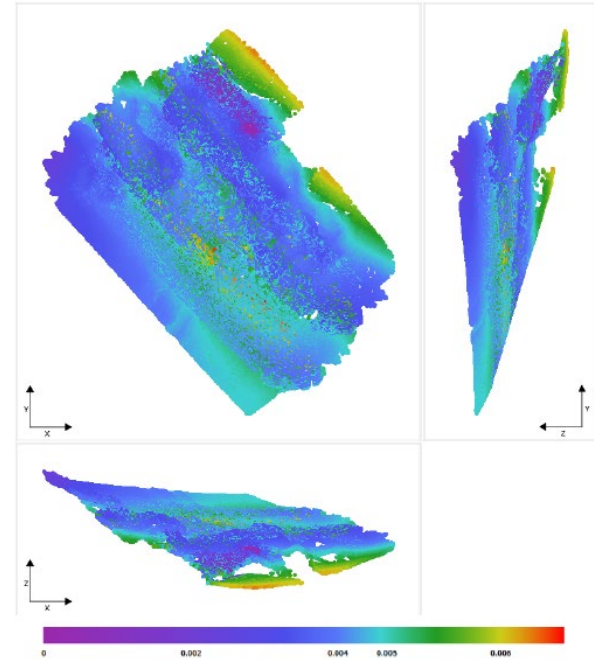

1
2
3
4
5


Normal
P mode - Standby
RTK
28
81
83
74.7m
113.7m
120.8m
71.1m
2245
2251
2257
2264
2270
2277
Distance
1916 m
Estimated Time
15 m 33 s
Waypoints
44
Photos
932
Mapping Area
9653.0 m²
Select DSM File
1 file(s)
Terrain Follow Height
-100
-10
-1
25
+1
+10
+100
(25~1500m)
Takeoff Speed(m/s)
10
1
15
Speed(m/s)
1.7
1
1.7
Elevation Optimization
Upon Completion

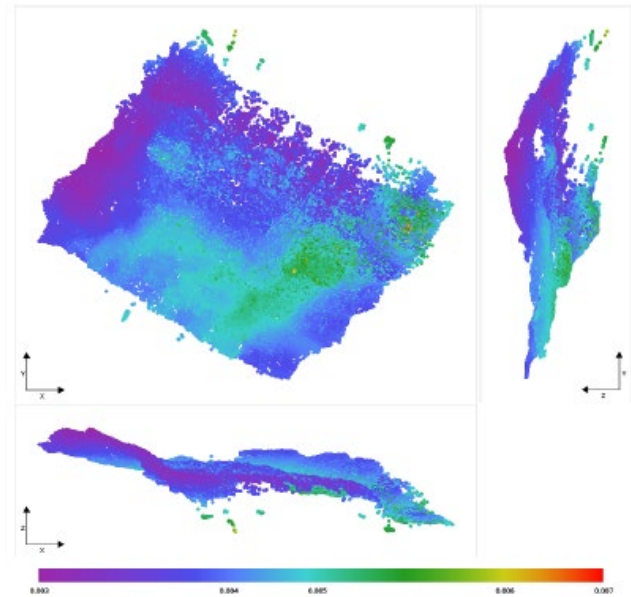

97
76
55
34



Resolution: *Top view (XY plane), side view (ZY plane) and front view (XZ plane) displays of all tie points, with colors representing resolution in the individual point position. The values are in meters/pixel, with a minimum resolution of* 0.0038 meters/pixel *and a maximum of* 0.02357 meters/pixel. *The median resolution equals* 0.00755 meters/pixel.

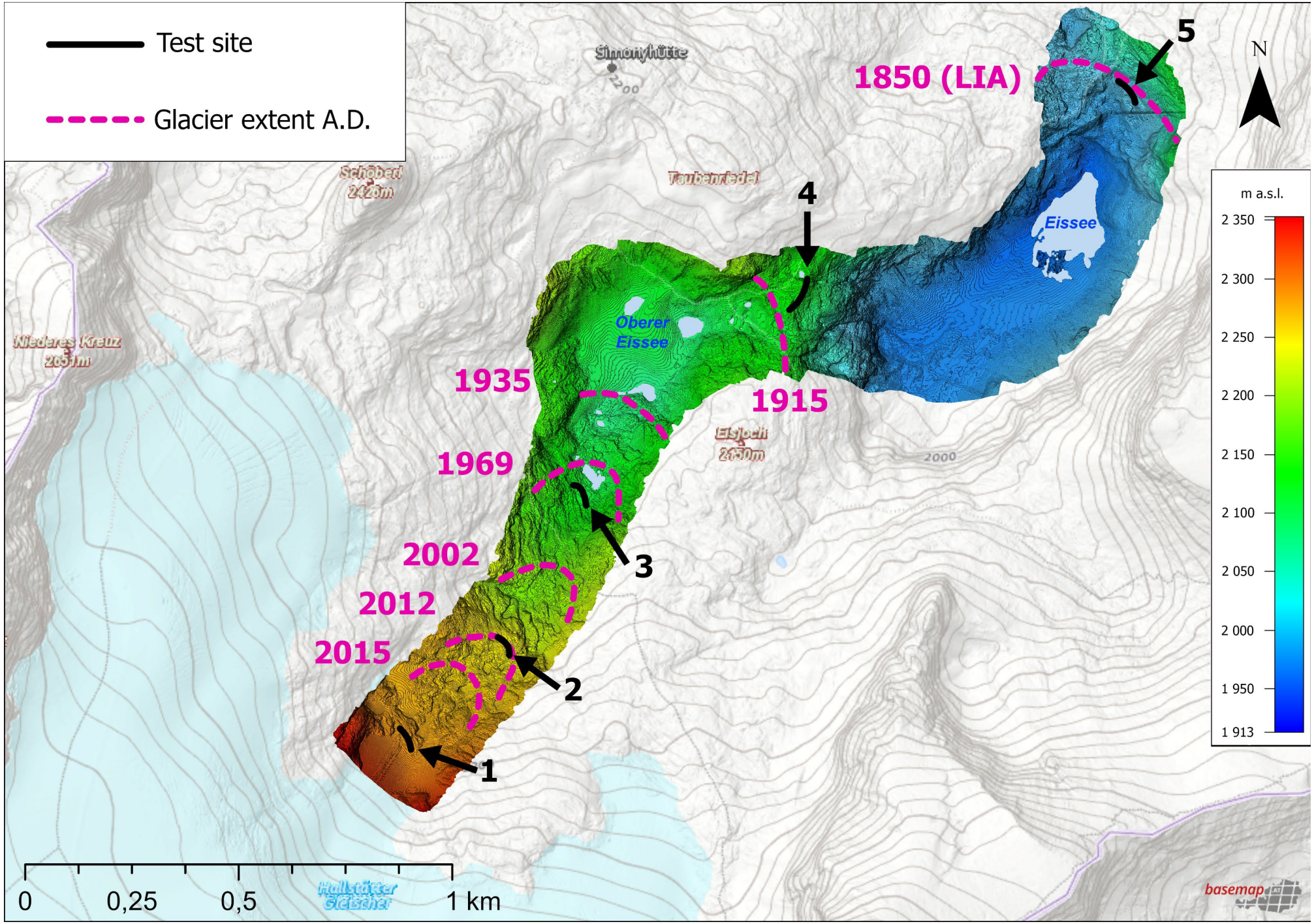


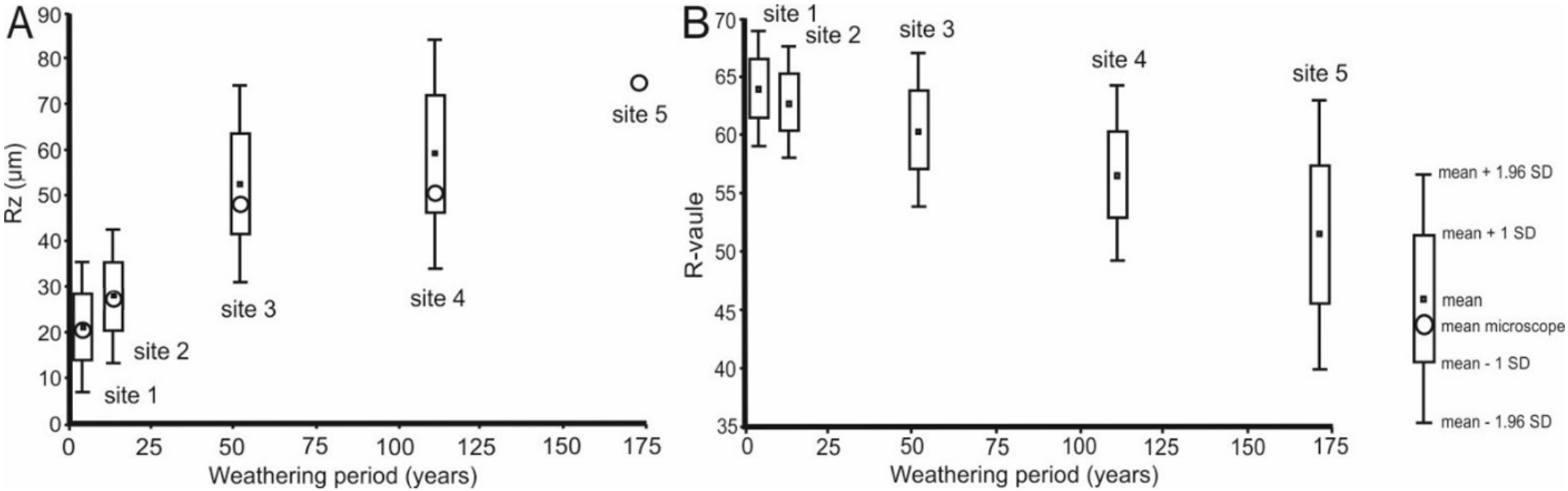
Resolution: *Top view (XY plane), side view (ZY plane) and front view (XZ plane) displays of all tie points, with colors representing resolution in the individual point position. The values are in meters/pixel, with a minimum resolution of* 0.0009 meters/pixel *and a maximum of* 0.00637 meters/pixel. *The median resolution equals* 0.00398 meters/pixel.



Resolution: *Top view (XY plane), side view (ZY plane) and front view (XZ plane) displays of all tie points, with colors representing resolution in the individual point position. The values are in meters/pixel, with a minimum resolution of* 0.00271 meters/pixel *and a maximum of* 0.00694 meters/pixel. *The median resolution equals* 0.00413 meters/pixel.

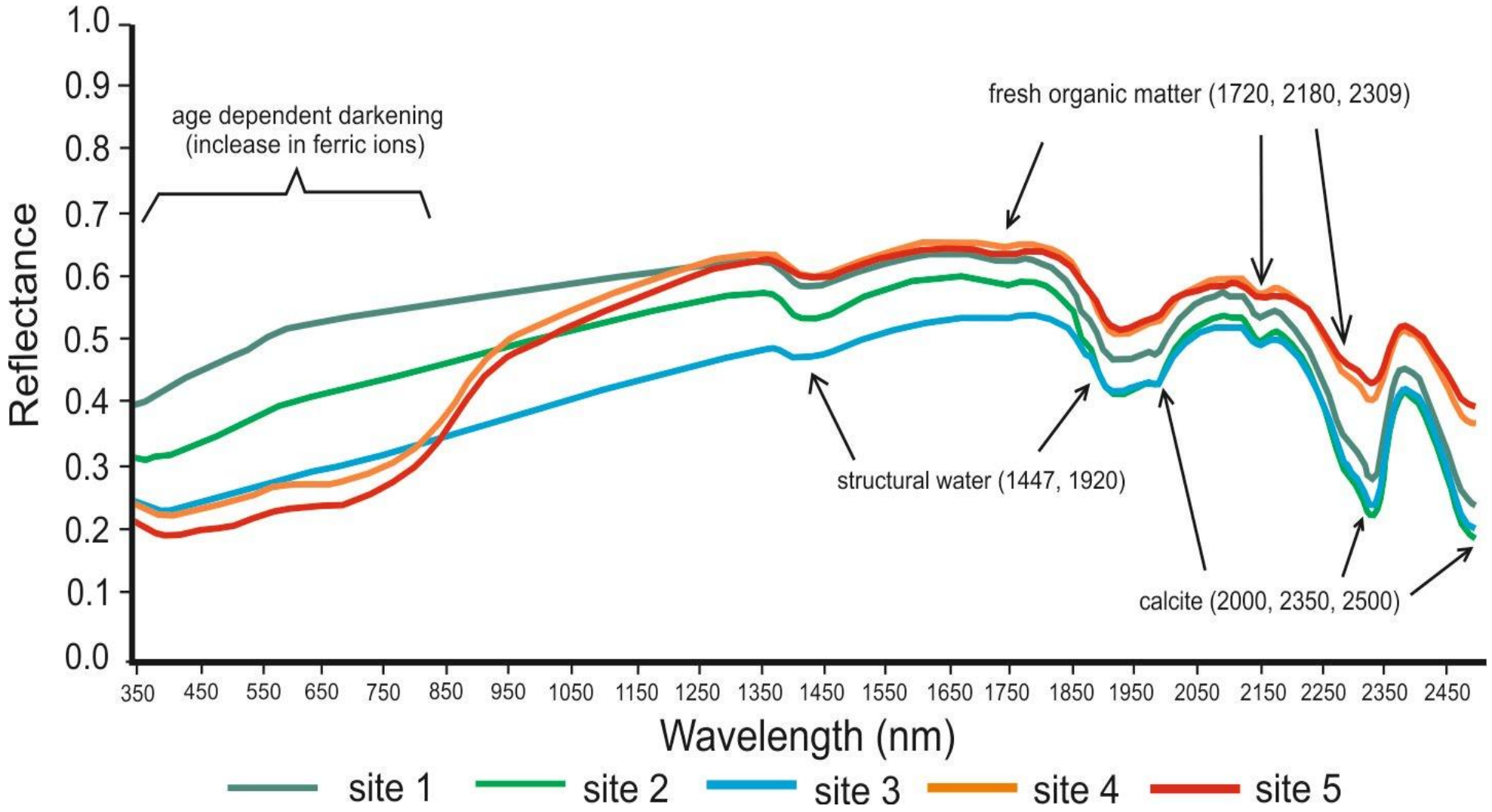

42
195K


Test site
Glacier extent A.D.
Simonyhütte
2200
Schöberl
2428m
Taubenriedel
Niederes Kreuz
2651m
Oberer
Eissee
Eissee
Eisjoch
2450m
2000
1850 (LIA)
1935
1915
1969
2002
2012
2015
1
2
3
4
5
N
m a.s.l.
2 350
2 300
2 250
2 200
2 150
2 100
2 050
2 000
1 950
1 913
0
0,25
0,5
1 km
Hallstätter
Gletscher
basemap

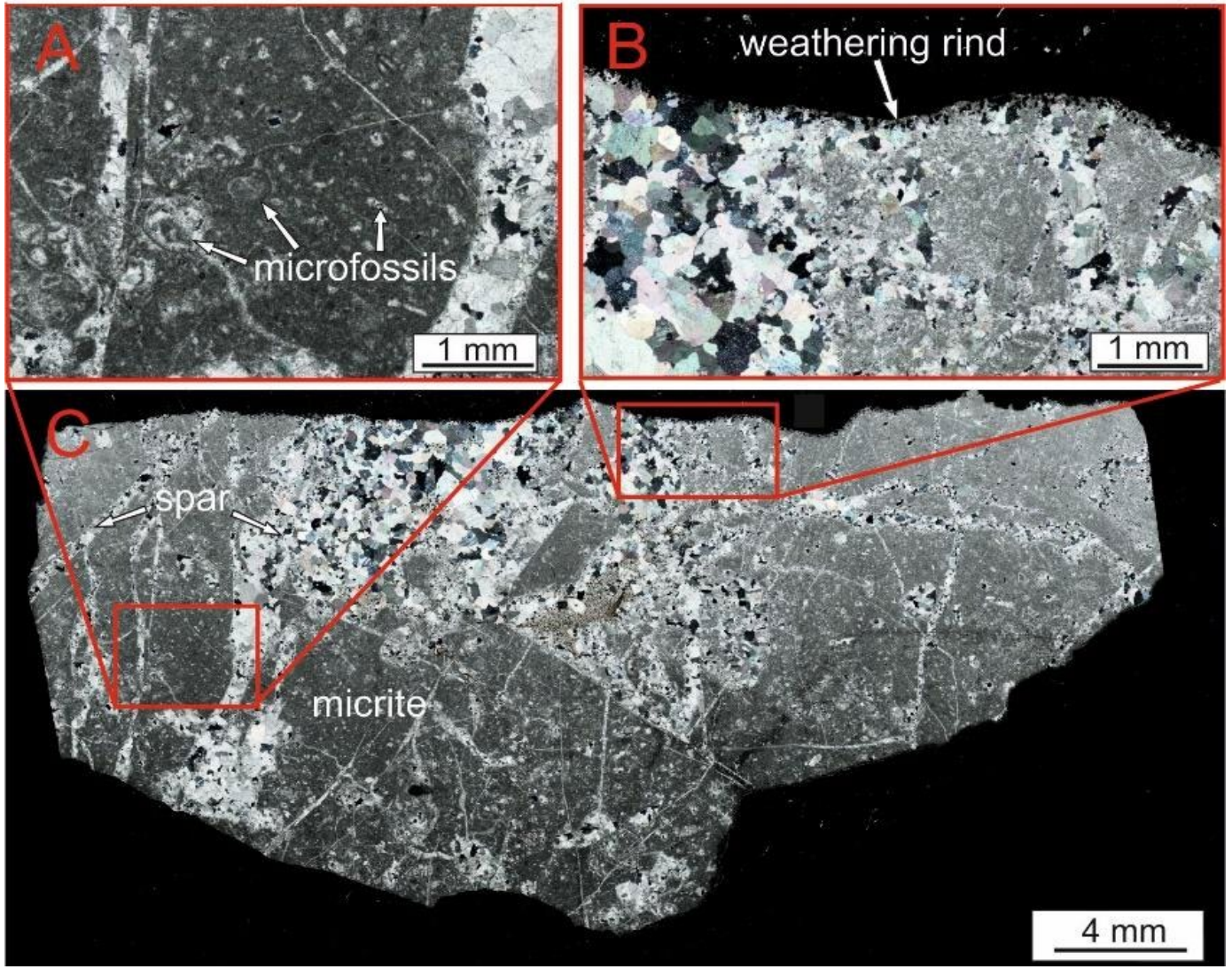


Rock surface micro-roughness (A) and strength (B) change in the Hallstätter Glacier foreland. Box-and-whisker diagram shows results obtained from the Handysurf and circles show additional results from the KDM (A).


RUNMAGEDDON
REKRUT
FINISHER

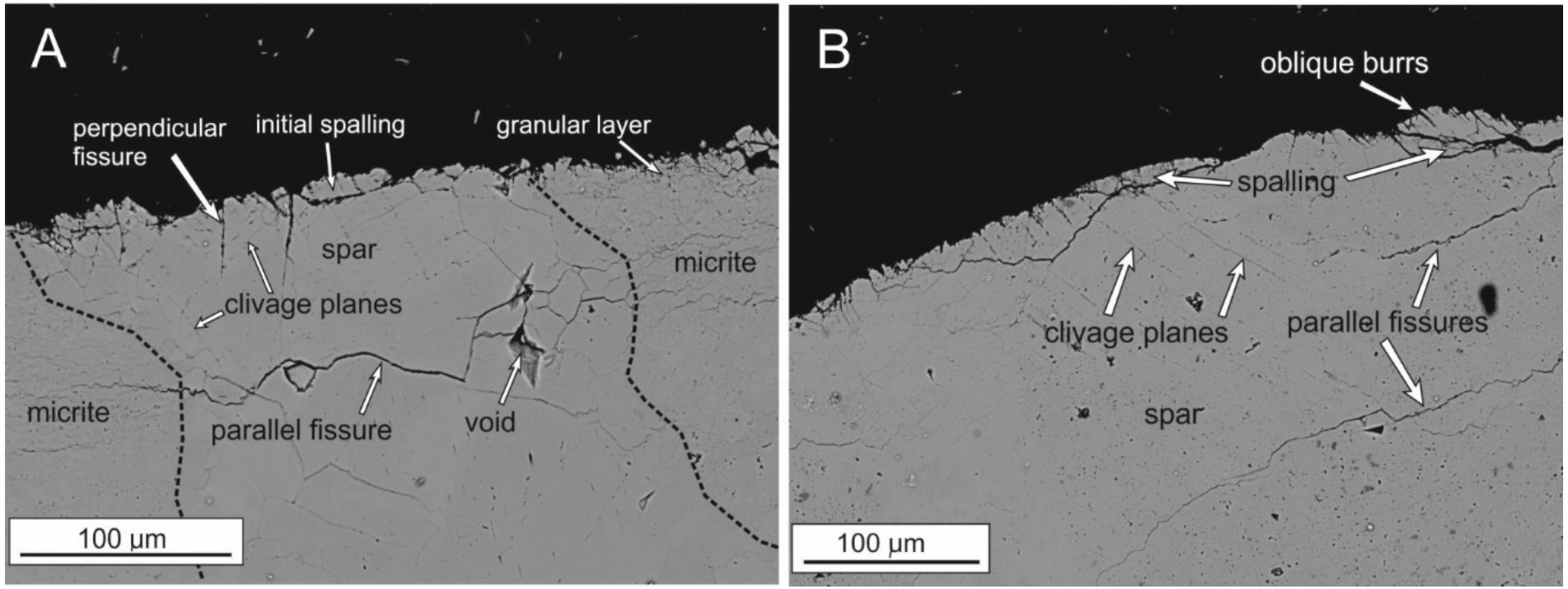


Reflectance spectra of the Dachstein limestone at Hallstätter Glacier foreland.

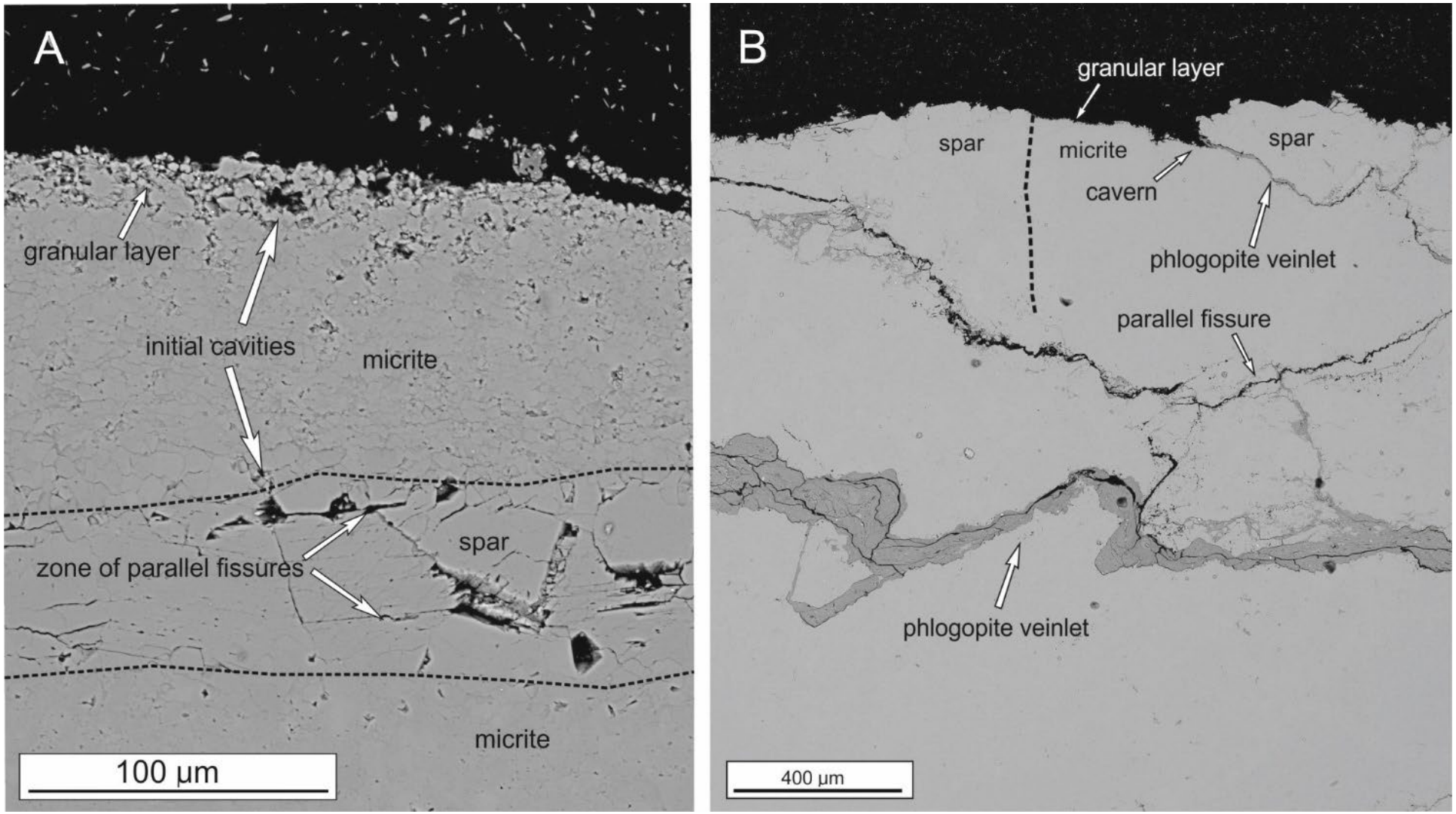


A sample of limestone taken from site 5 (upper surface was glacially abraded in LIA) visible under the optical microscope; A –foraminifera in micrite matrix, B – weathering rind on micrite and spar, C – general view of the samples with numerous micro-fossils, spar veins and micro-faults.

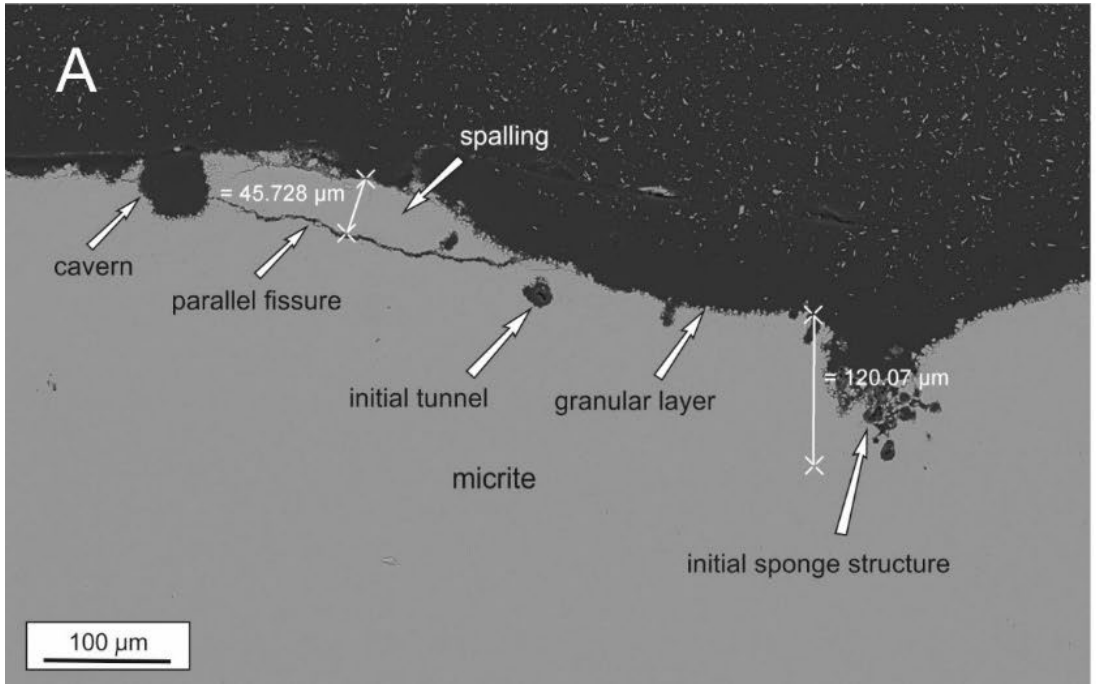
Test site 1 (3 years of weathering)

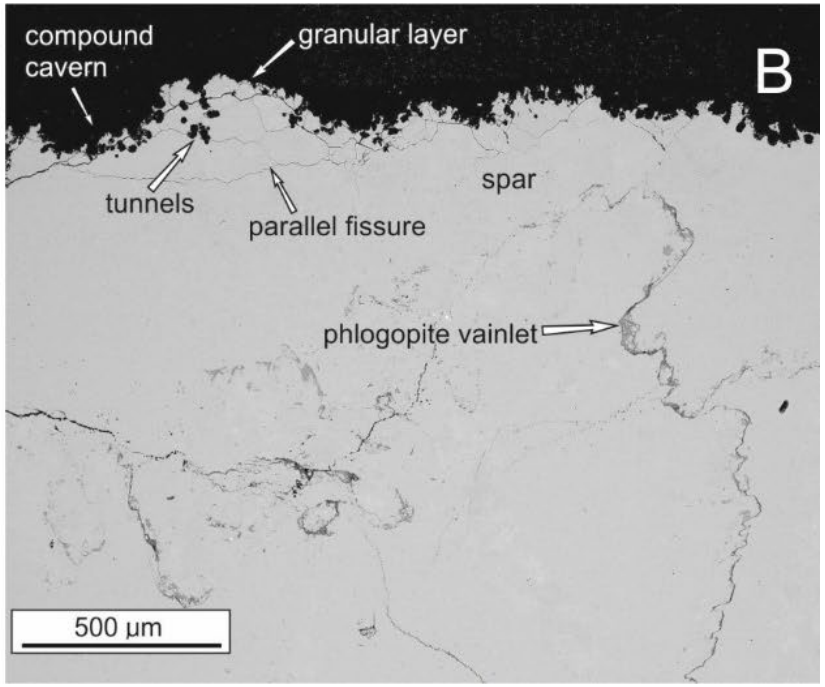


Test site 2 (10 years of weathering)

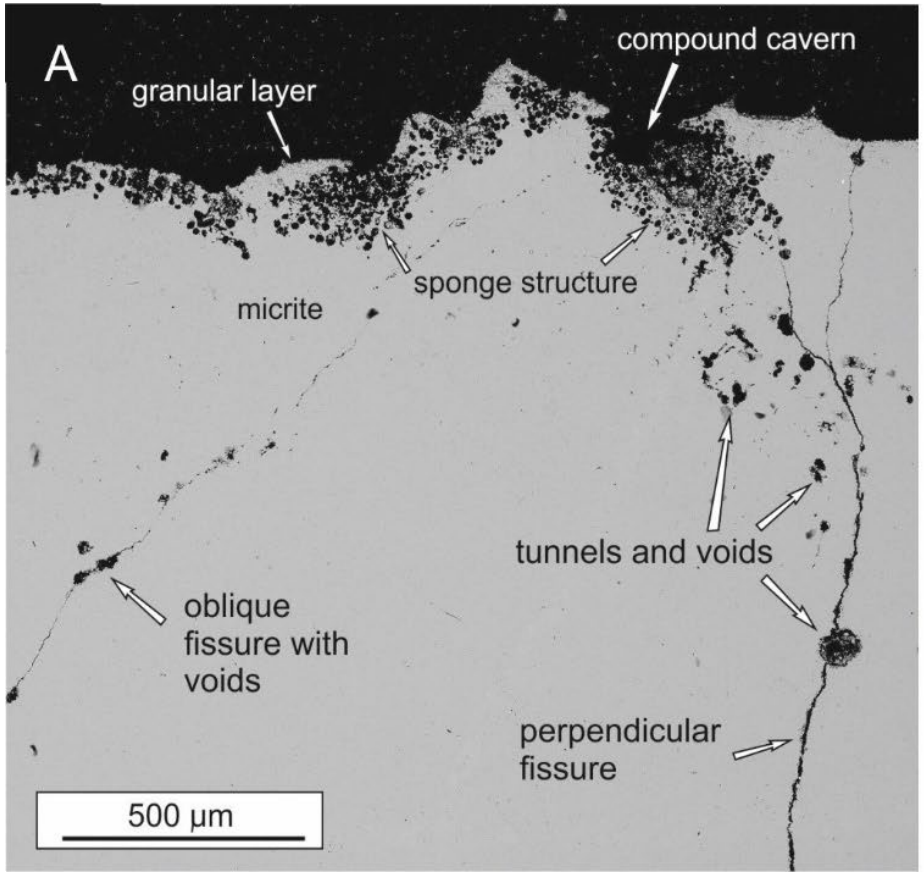


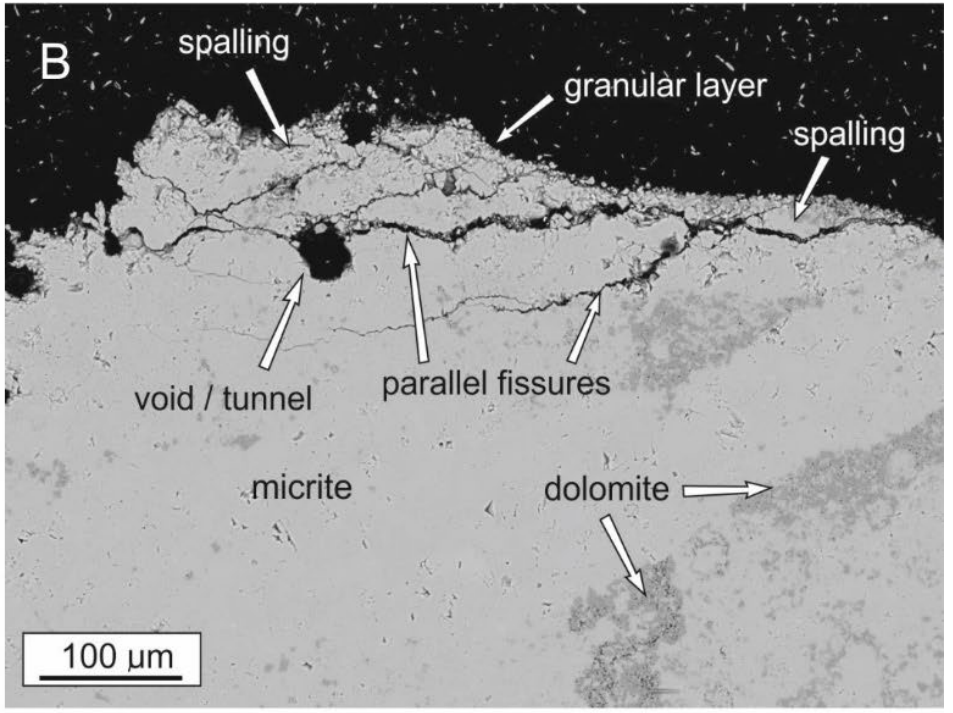
Test site 3 (52 years of weathering)



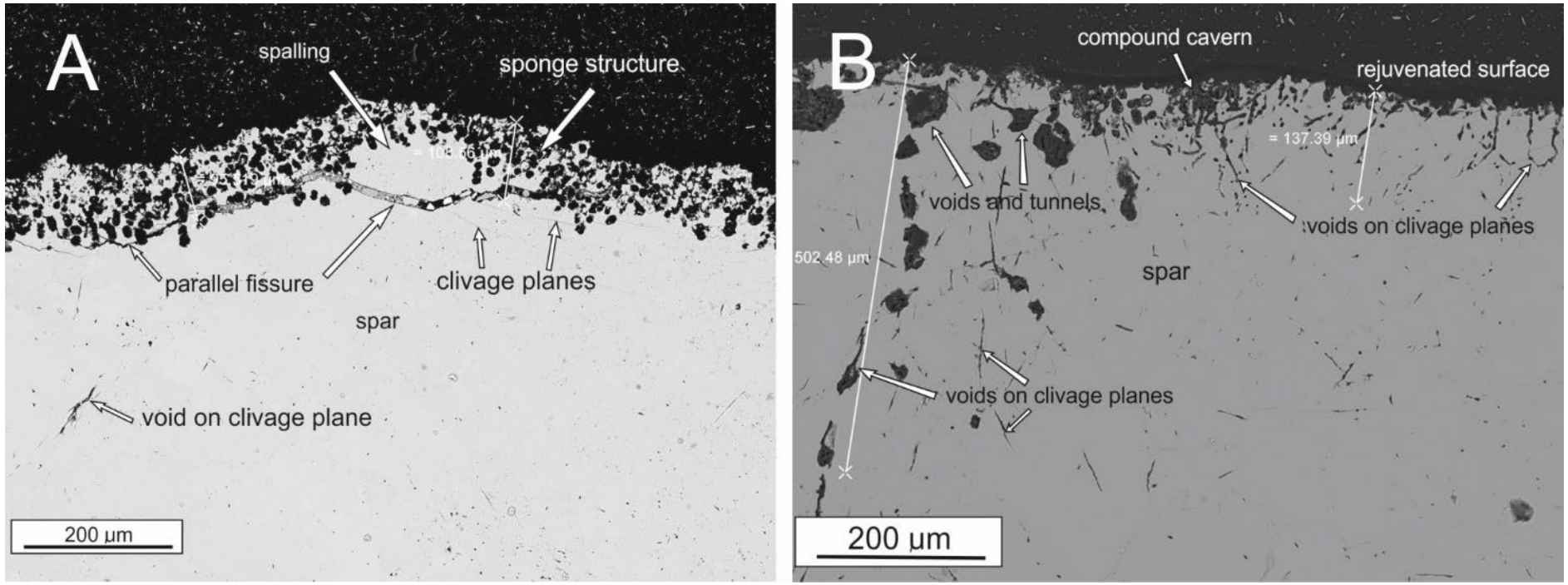


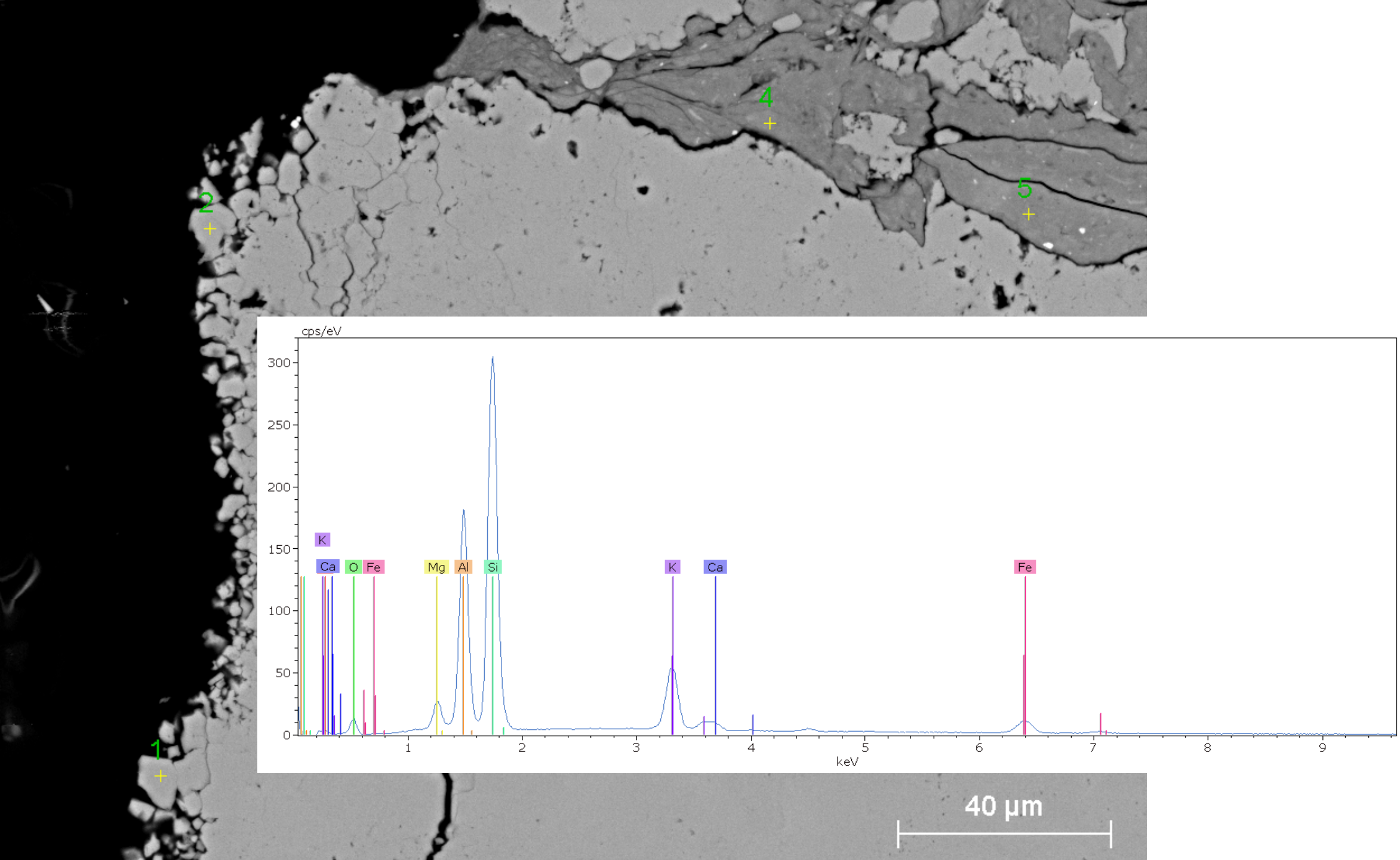
Test site 4 (105 years of weathering)



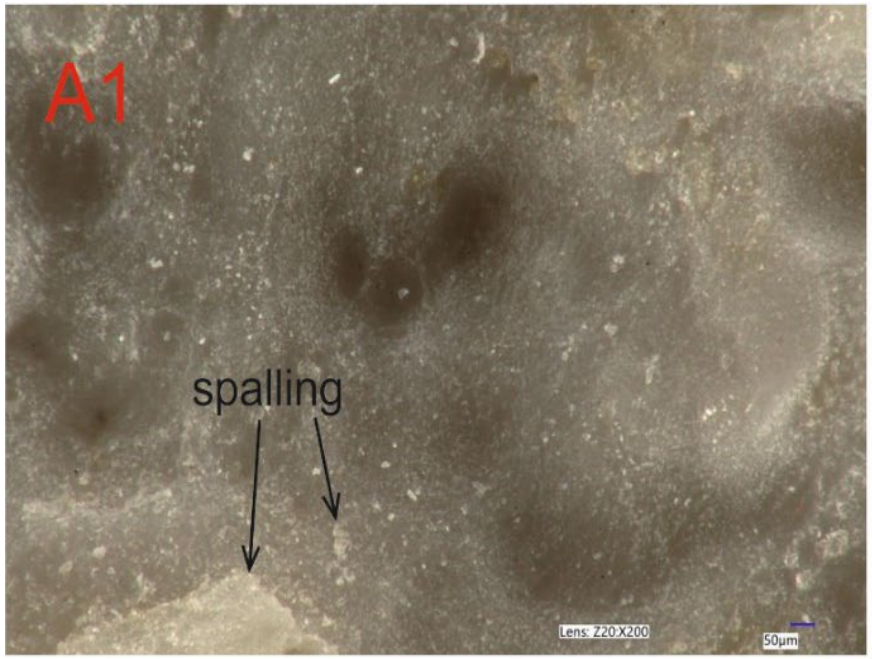


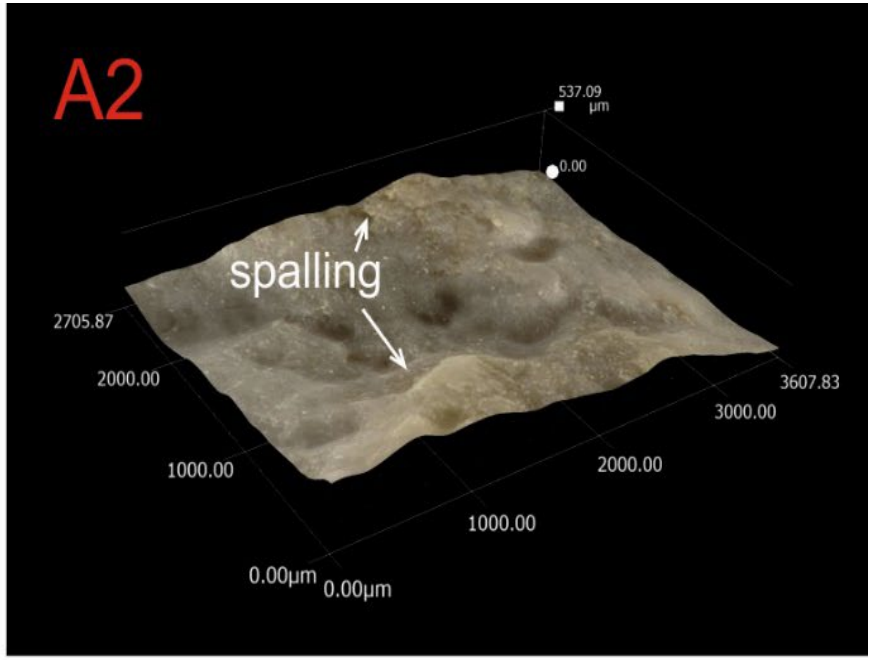
Test site 5 (172 years of weathering)

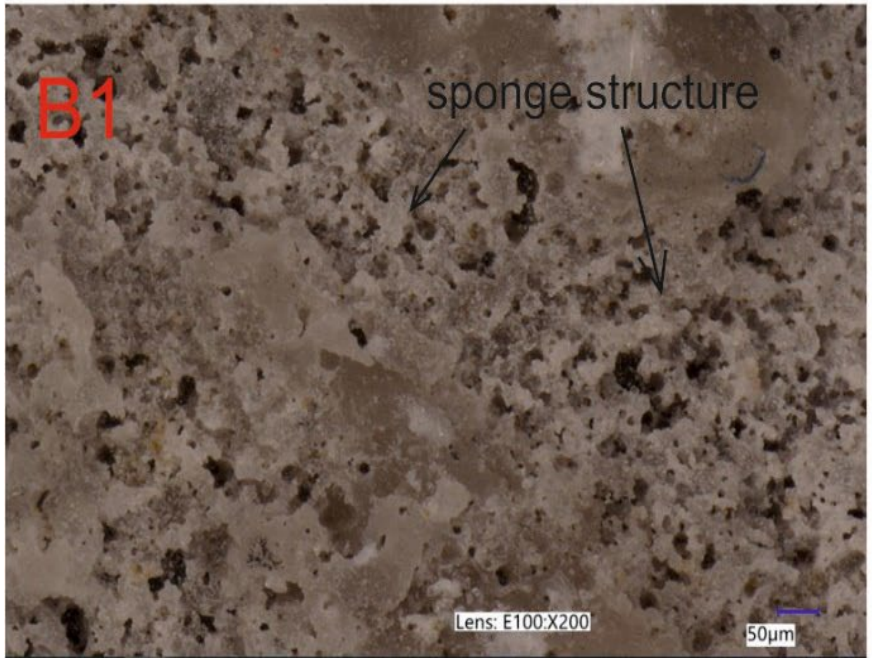


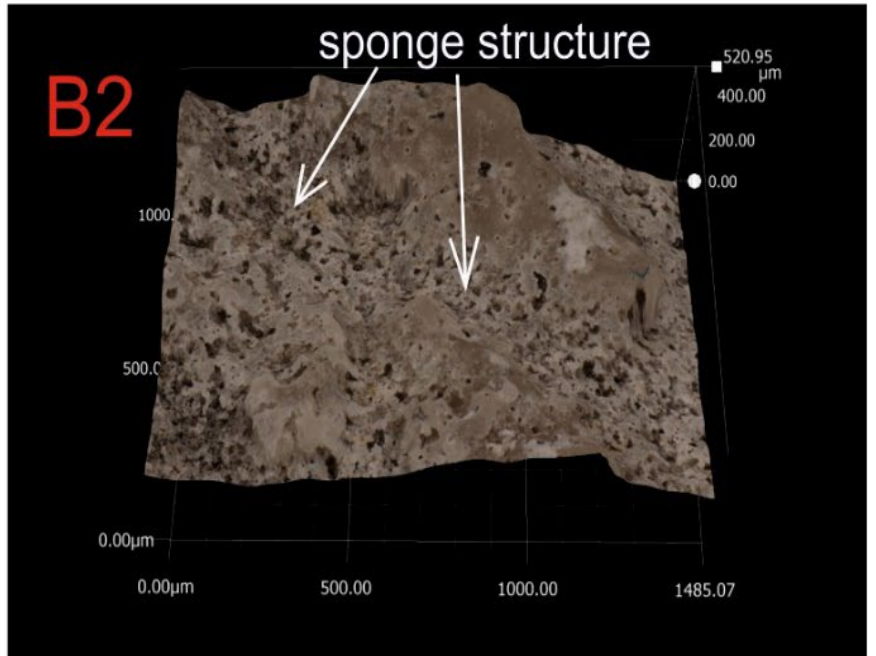

1
2
4
5
cps/eV
300
250
200
150
100
50
0
K
Ca
O
Fe
Mg
Al
Si
K
Ca
Fe
1
2
3
4
5
6
7
8
9
keV
40 µm

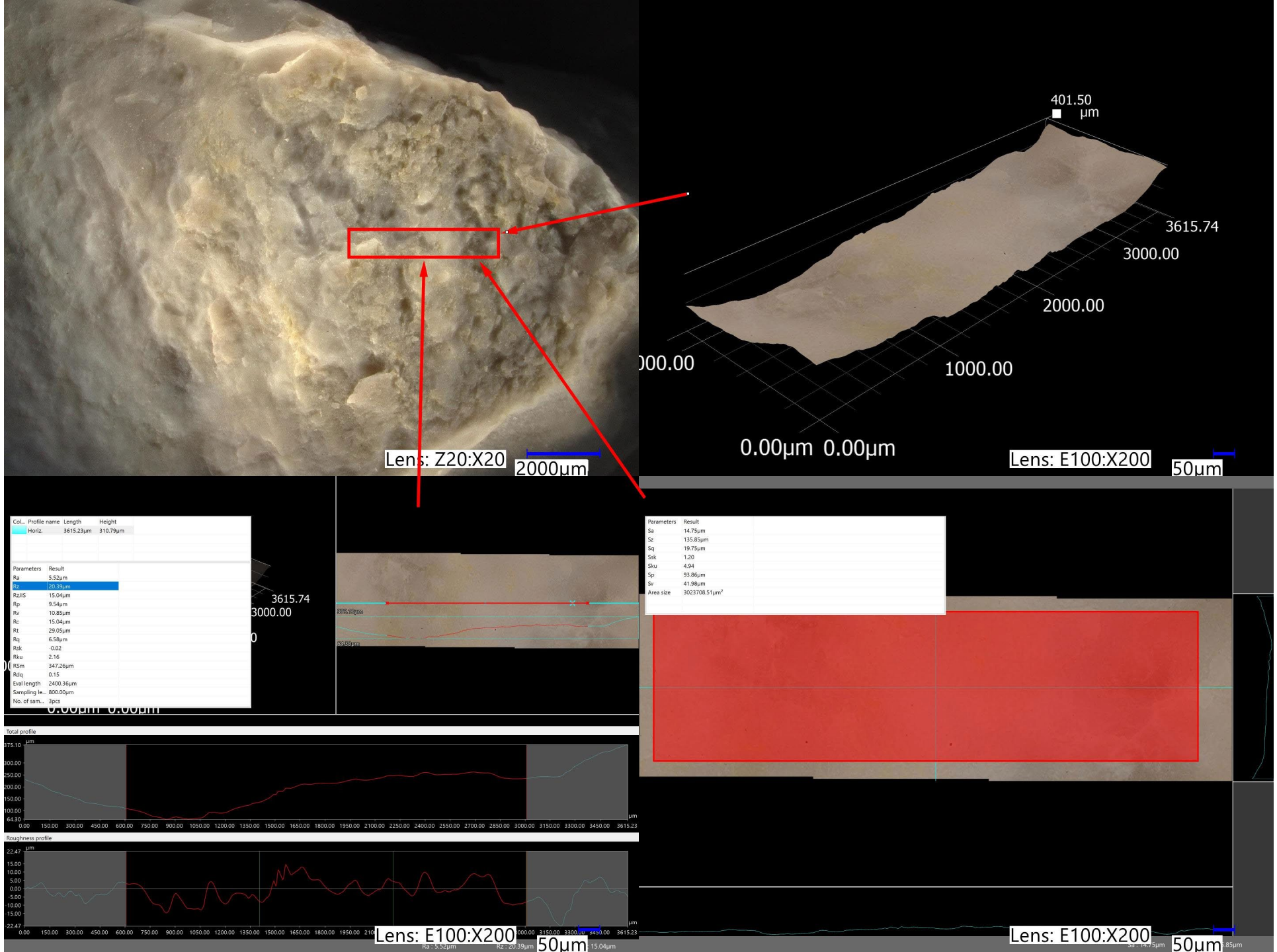
Images from Keyence Digital Microscope (A – site 1, B – site 5)

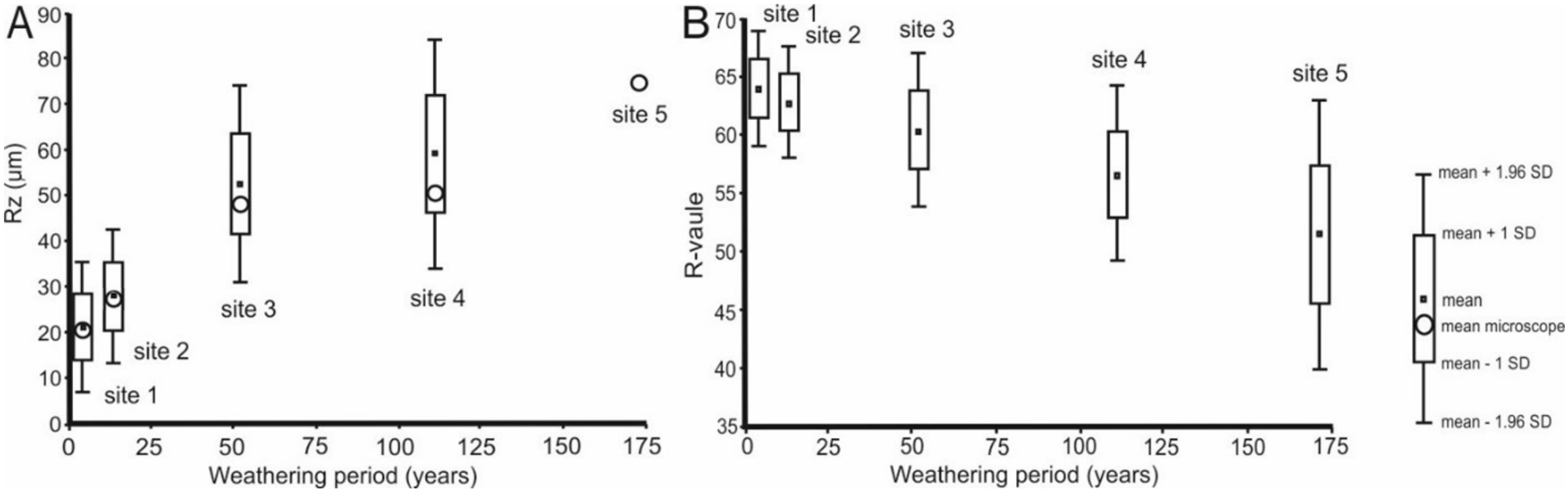




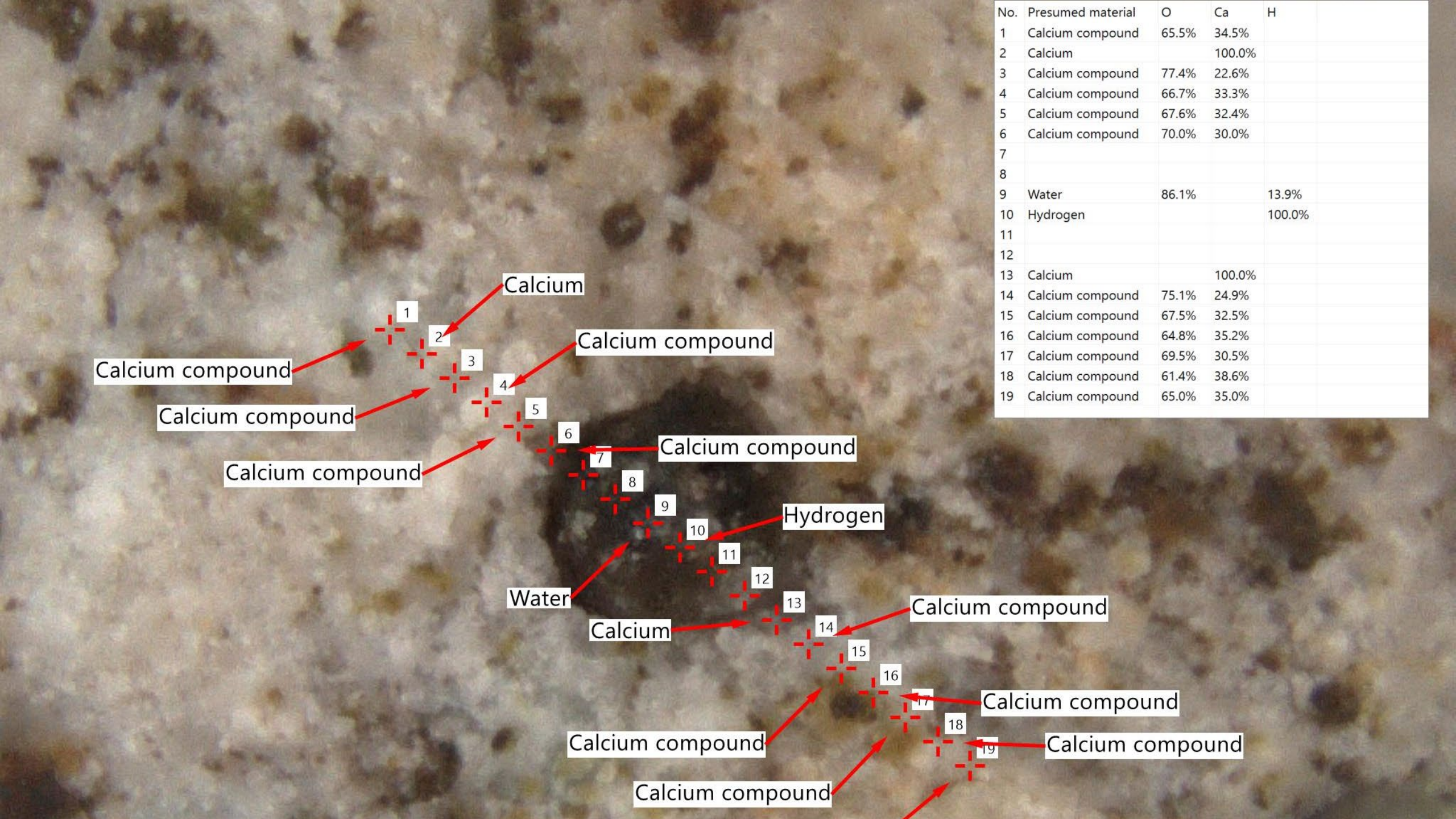




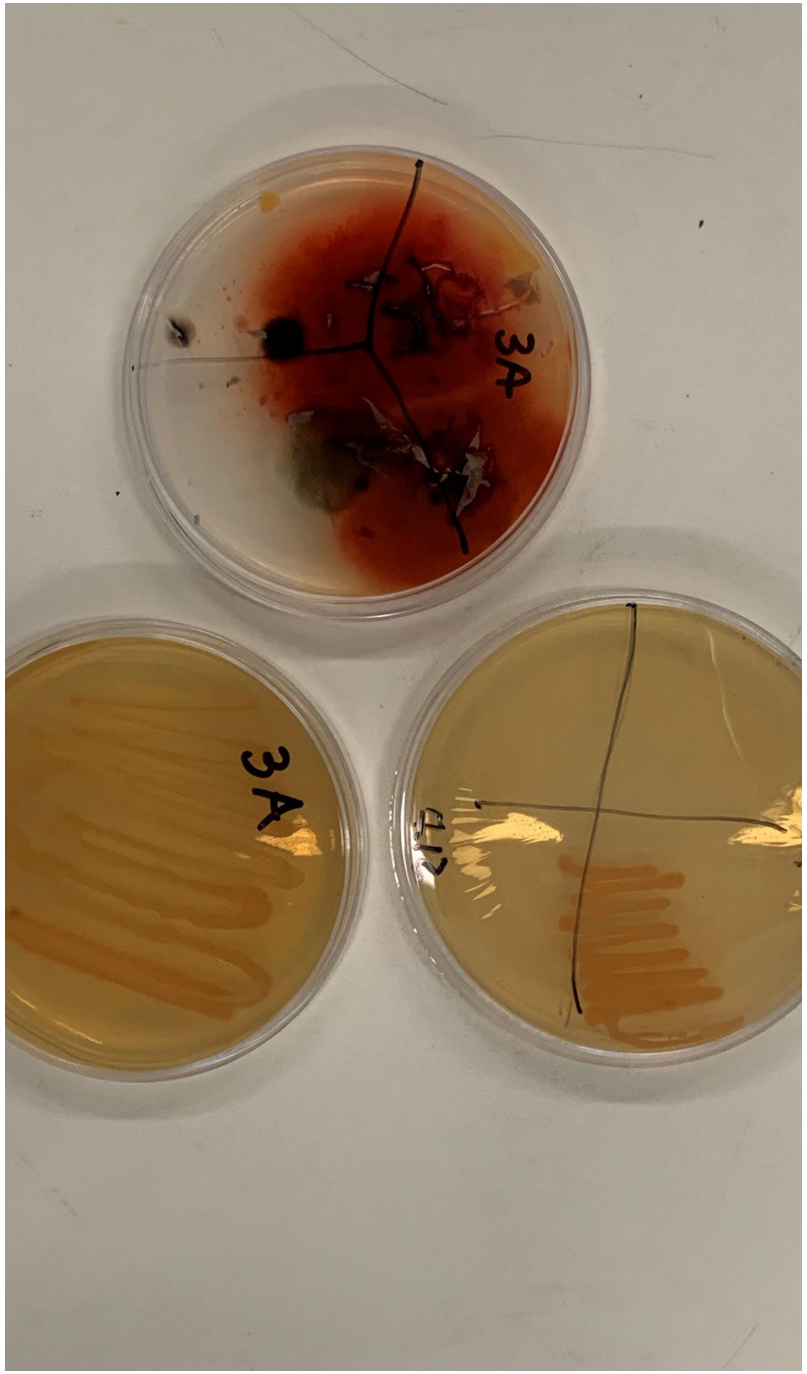

401.50
µm
3615.74
3000.00
2000.00
1000.00
0.00µm 0.00µm
Lens: Z20:X20
2000µm
Lens: E100:X200
50µm
Col... Profile name Length Height
Horiz. 3615.23µm 310.79µm
Parameters Result
Ra 5.52µm
Rz 20.39µm
RzJIS 15.04µm
Rp 9.54µm
Rv 10.85µm
Rc 15.04µm
Rt 29.05µm
Rq 6.58µm
Rsk -0.02
Rku 2.16
RSm 347.26µm
Rdq 0.15
Eval length 2400.36µm
Sampling le... 800.00µm
No. of sam... 3pcs
3615.74
3000.00
Parameters Result
Sa 14.75µm
Sz 135.85µm
Sq 19.75µm
Ssk 1.20
Sku 4.94
Sp 93.86µm
Sv 41.98µm
Area size 3023706.51µm²
Total profile
Roughness profile
Lens: E100:X200
50µm
Lens: E100:X200
50µm



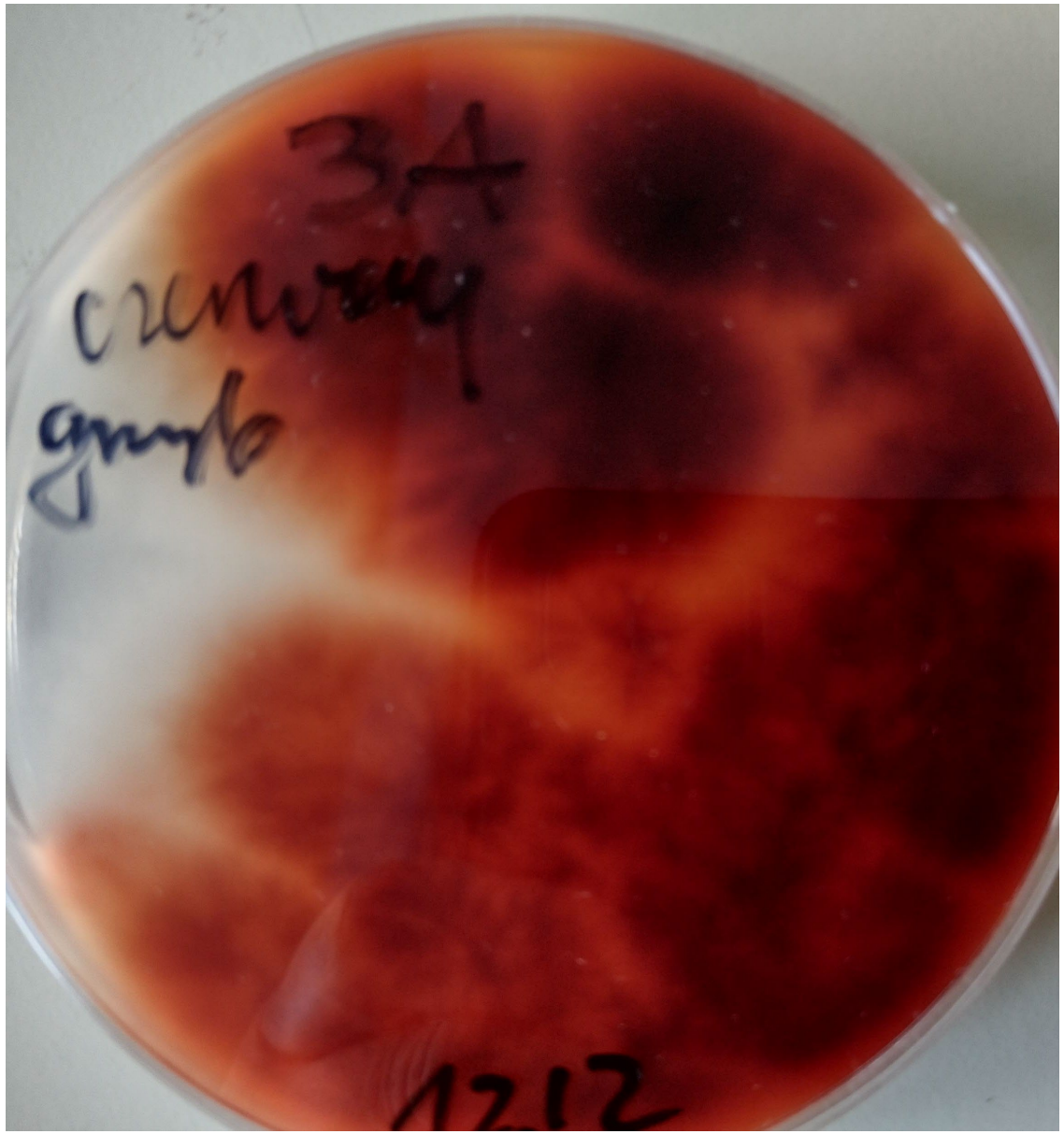
Rock surface micro-roughness (A) and strength (B) change in the Hallstätter Glacier foreland. Box-and-whisker diagram shows results obtained from the Handysurf and circles show additional results from the KDM (A).

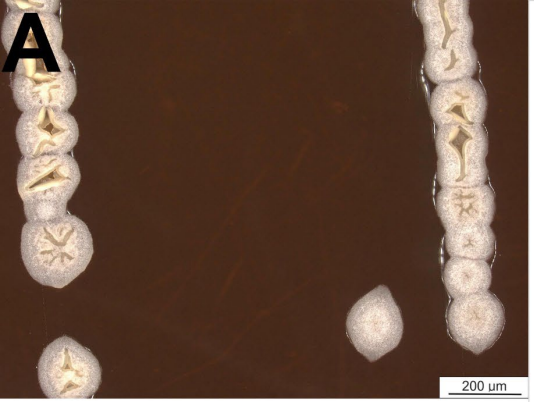


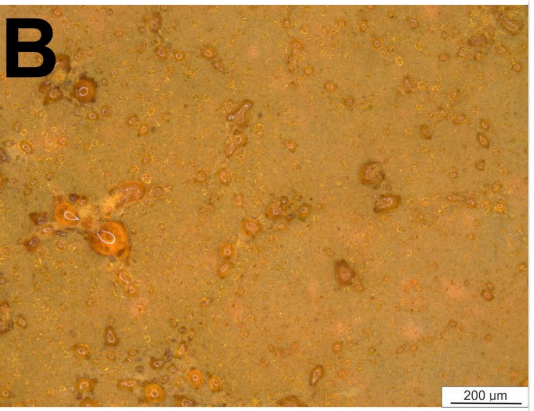
No.	Presumed material	O	Ca	H
1	Calcium compound	65.5%	34.5%	
2	Calcium		100.0%	
3	Calcium compound	77.4%	22.6%	
4	Calcium compound	66.7%	33.3%	
5	Calcium compound	67.6%	32.4%	
6	Calcium compound	70.0%	30.0%	
7				
8				
9	Water	86.1%		13.9%
10	Hydrogen			100.0%
11				
12				
13	Calcium		100.0%	
14	Calcium compound	75.1%	24.9%	
15	Calcium compound	67.5%	32.5%	
16	Calcium compound	64.8%	35.2%	
17	Calcium compound	69.5%	30.5%	
18	Calcium compound	61.4%	38.6%	
19	Calcium compound	65.0%	35.0%	

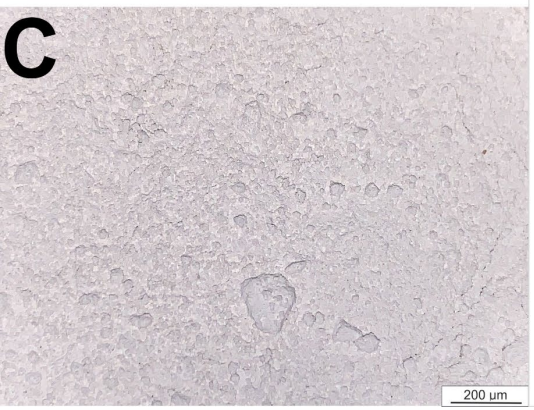

3A
3A

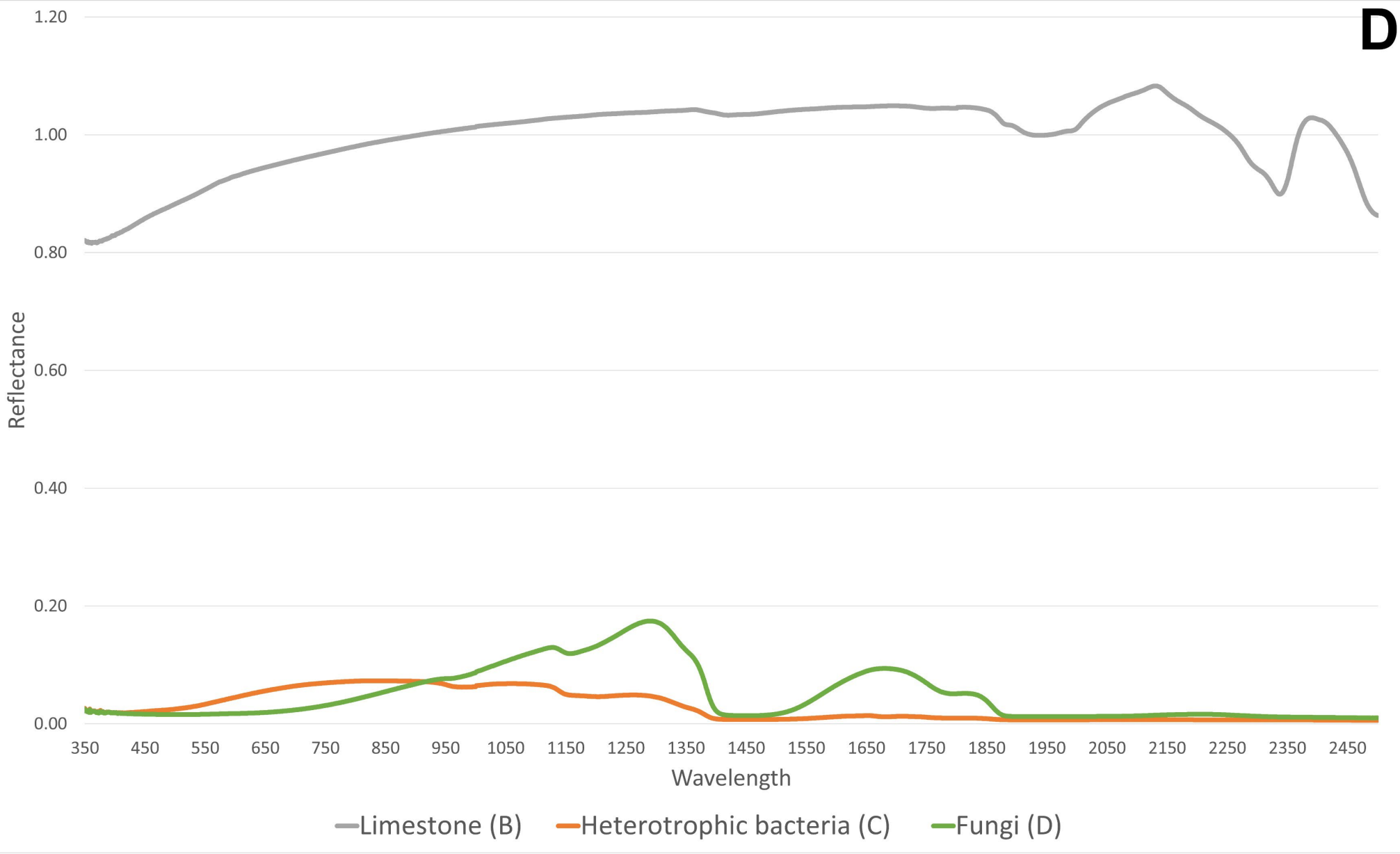

5A


3A

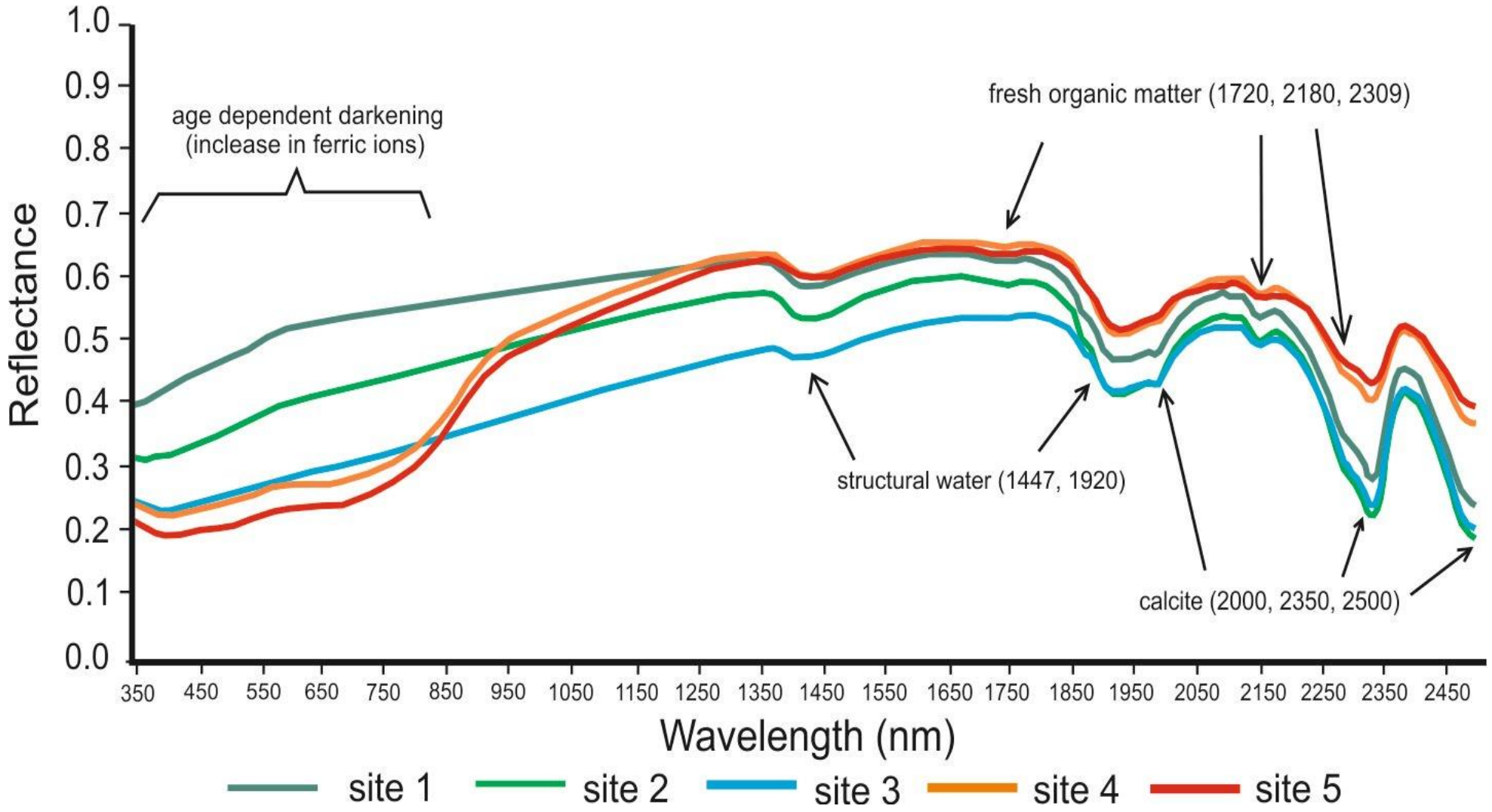




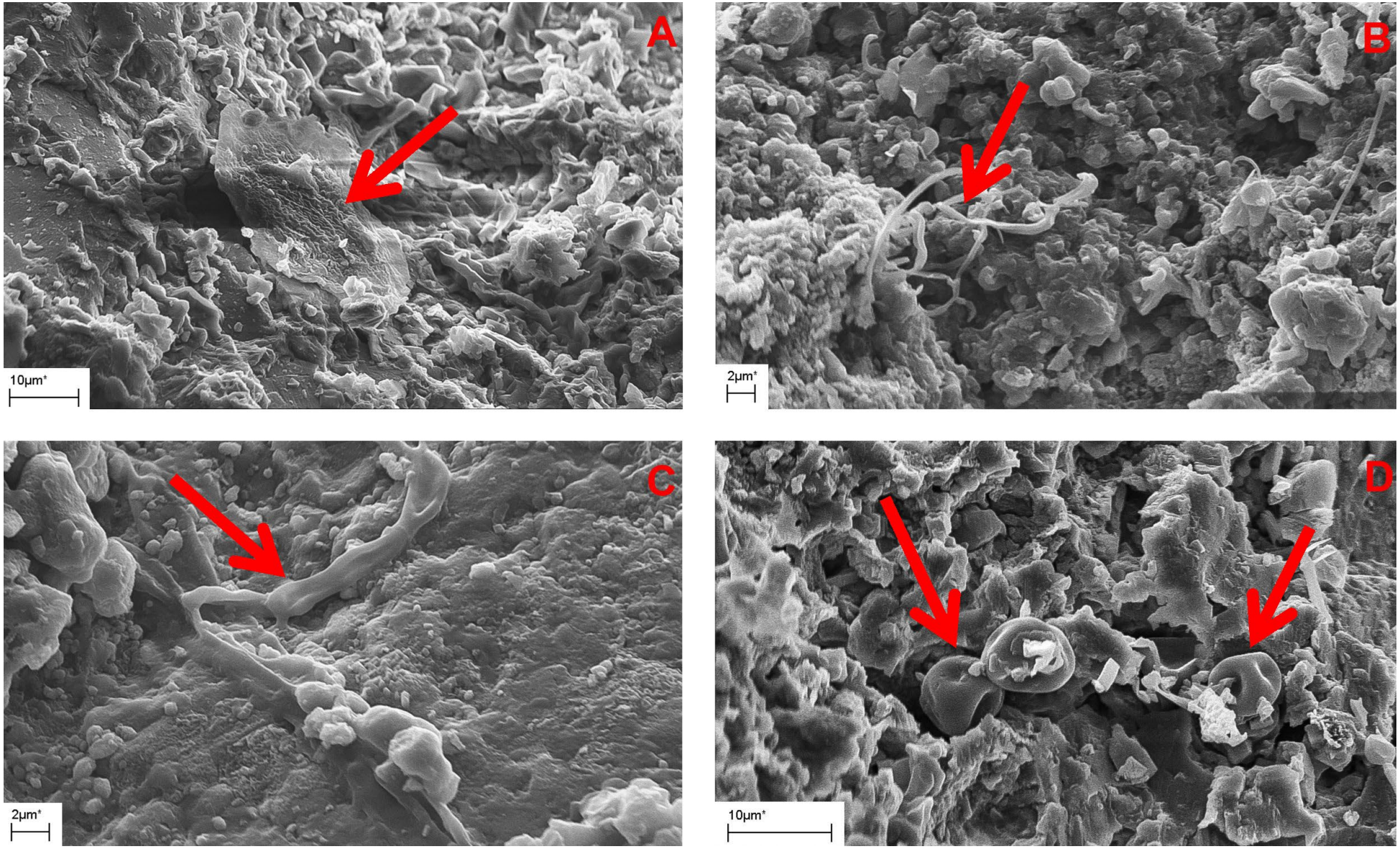




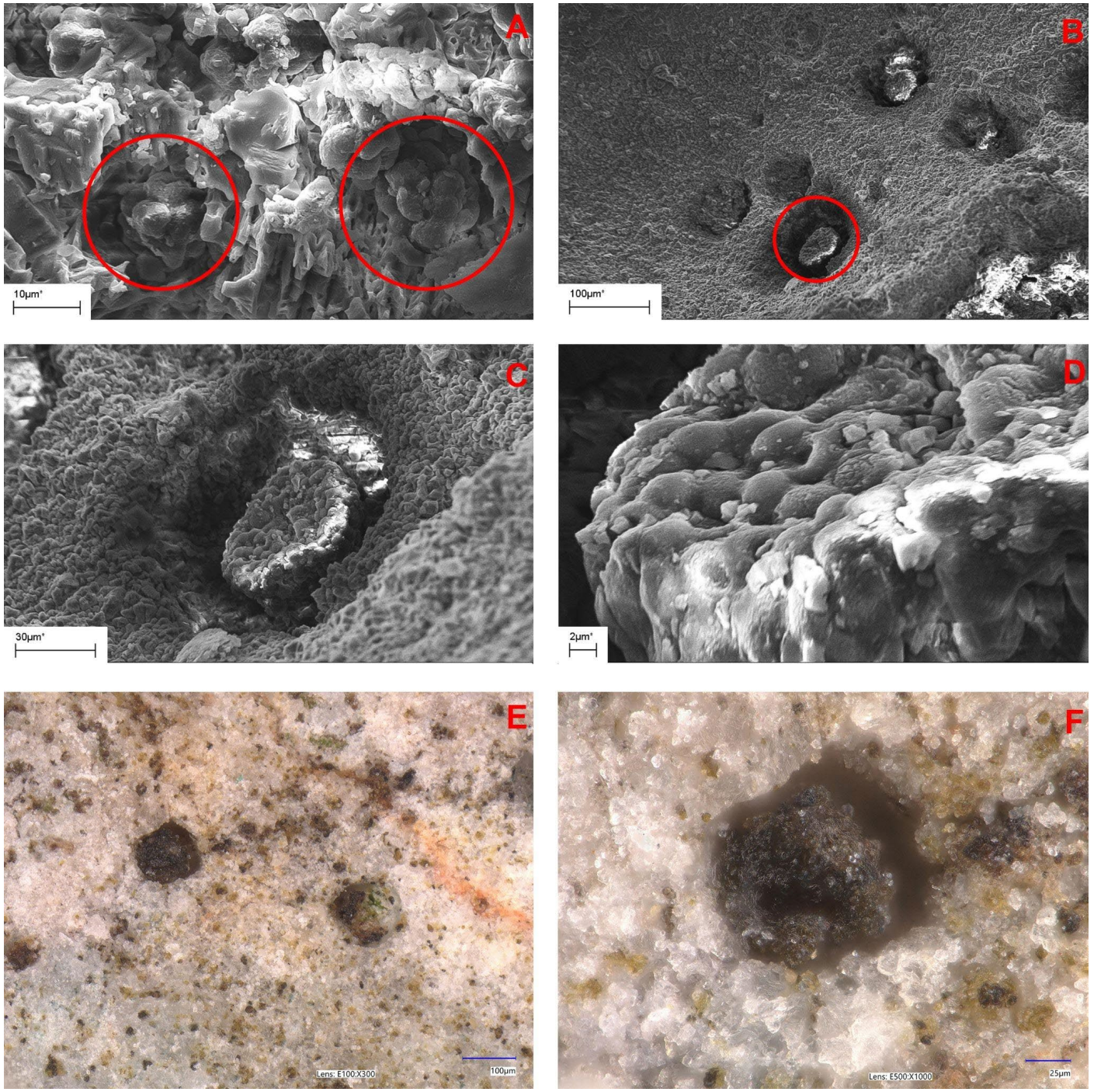
KDM images of colonies of isolated bacteria (A), fungi (B), and Dachstein limestone powder (C) which were subjected to reflectance analysis (D).



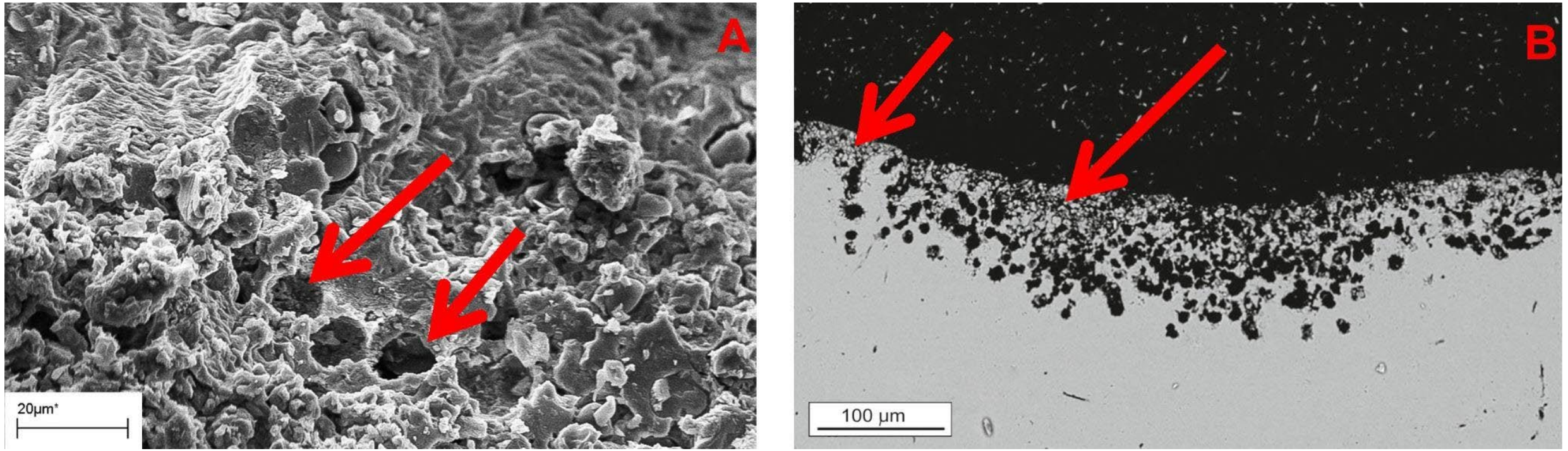
Reflectance spectra of the Dachstein limestone at Hallstätter Glacier foreland.



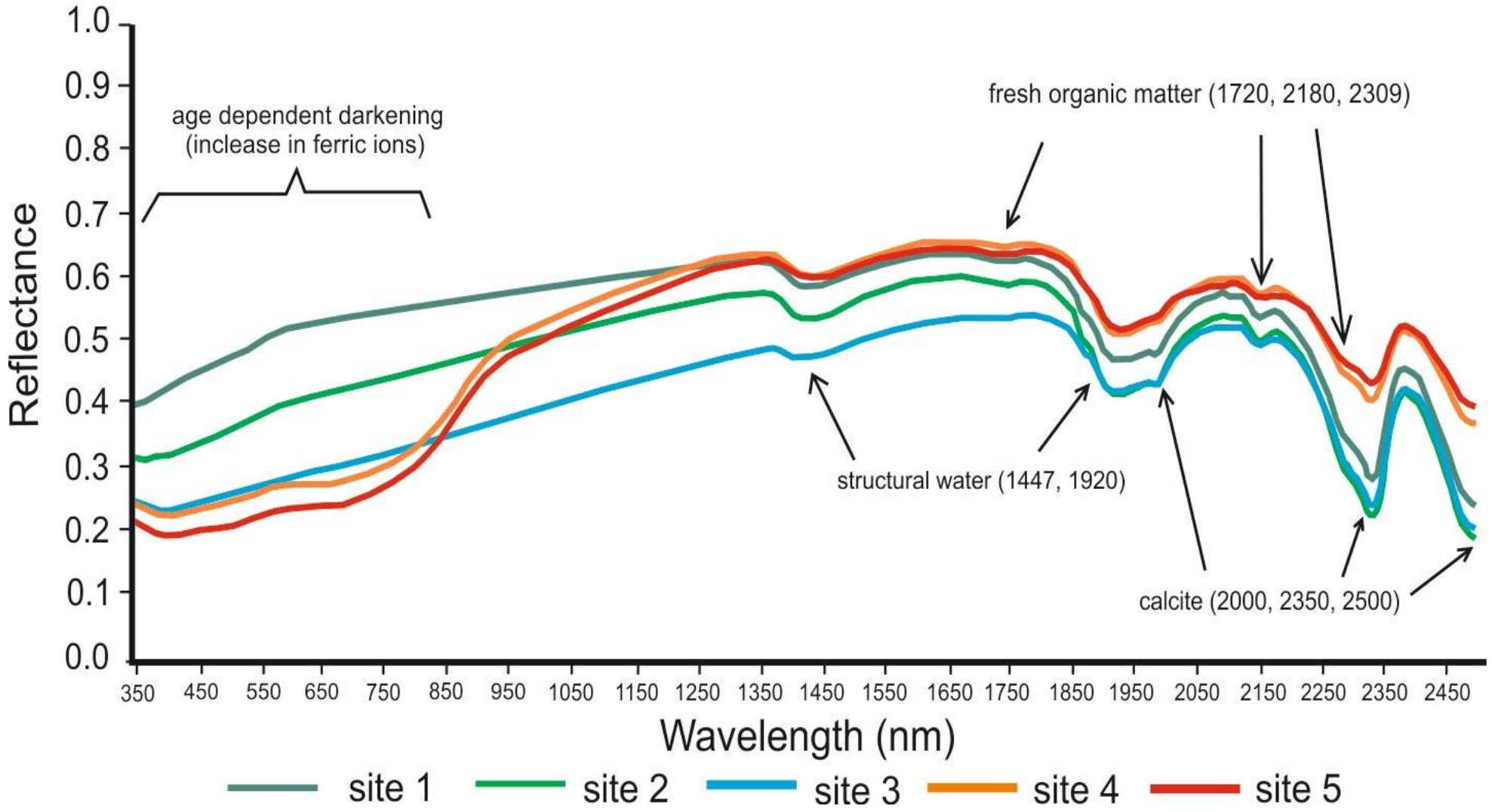
SEM images showing microbial biofilm (A); actinobacteria-like cells (B), fungi (C), and epilithic cyanobacterial cells embedded with secondary calcite (D) observed on the surface of the weathering rinds from all test sites (Hallstätter Glacier foreland); arrows indicate microbial cells.



The influence of microorganisms on the weathering of limestone detected in SEM – A (site 2), B, C, D (site 4), and KDM – E, F (site 5).



SEM images showing a porous layer of limestone (arrows) probably formed with the involvement of cyanobacteria—top view (A) and cross-section (B) (Hallstätter Glacier foreland; site 5).



Reflectance spectra of the Dachstein limestone at Hallstätter Glacier foreland.


PRIVATE