Agencija za odgoj i obrazovanje
Education and Teacher Training Agency

HRVATSKA GEOLOŠKA LJETNA ŠKOLA
CROATIAN GEOLOGICAL SUMMER SCHOOL

Geneza ležišta šljunaka na primjeru eksploatacijskog polja "Abesinija"

Dr.sc. Jasenka Sremac, red.prof. u miru

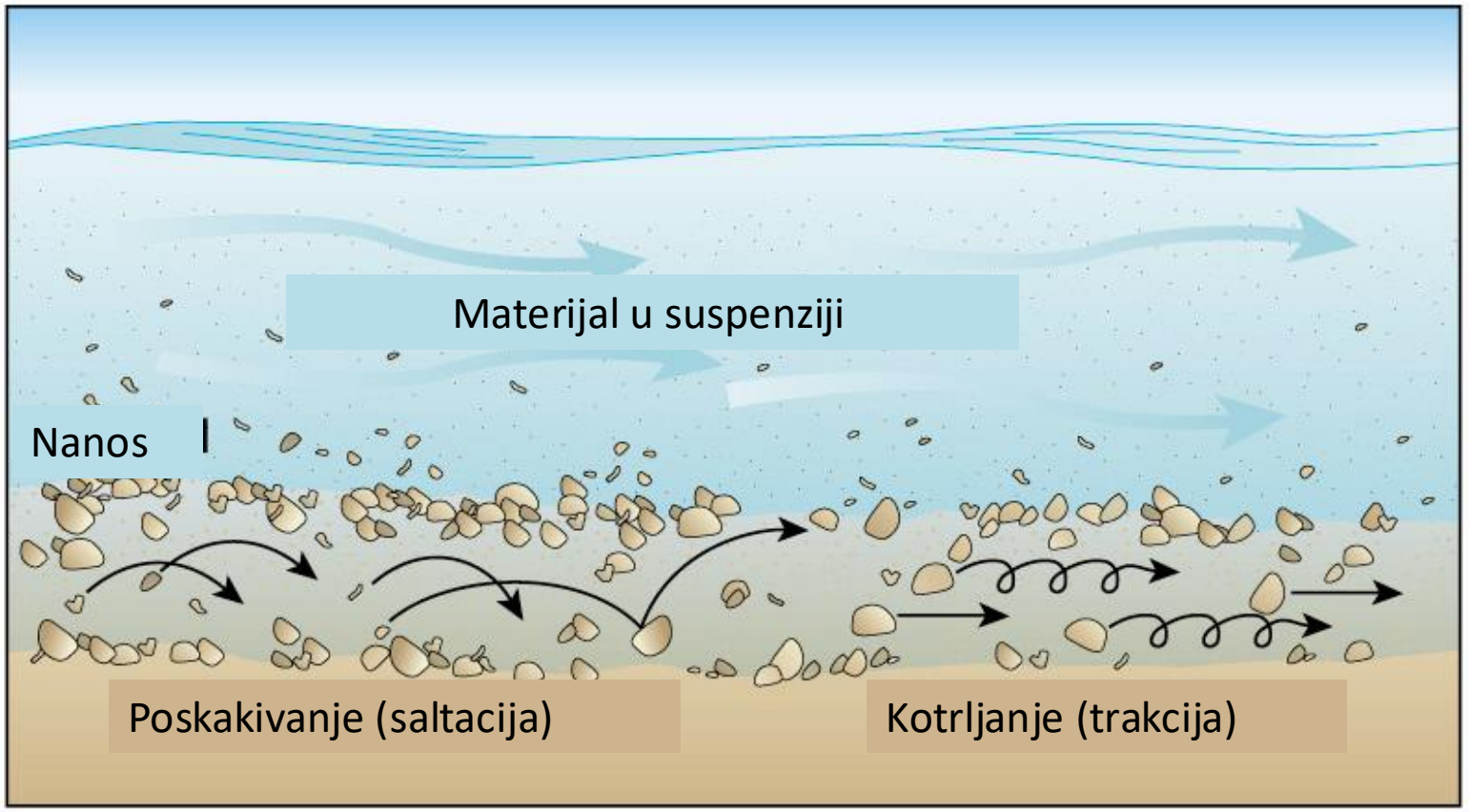
11. međužupanijski stručni skup za učitelje i nastavnike geografije
Zagreb, 1. travnja 2026.

Sadržaj

UVOD

Glavni mehanizmi postanka

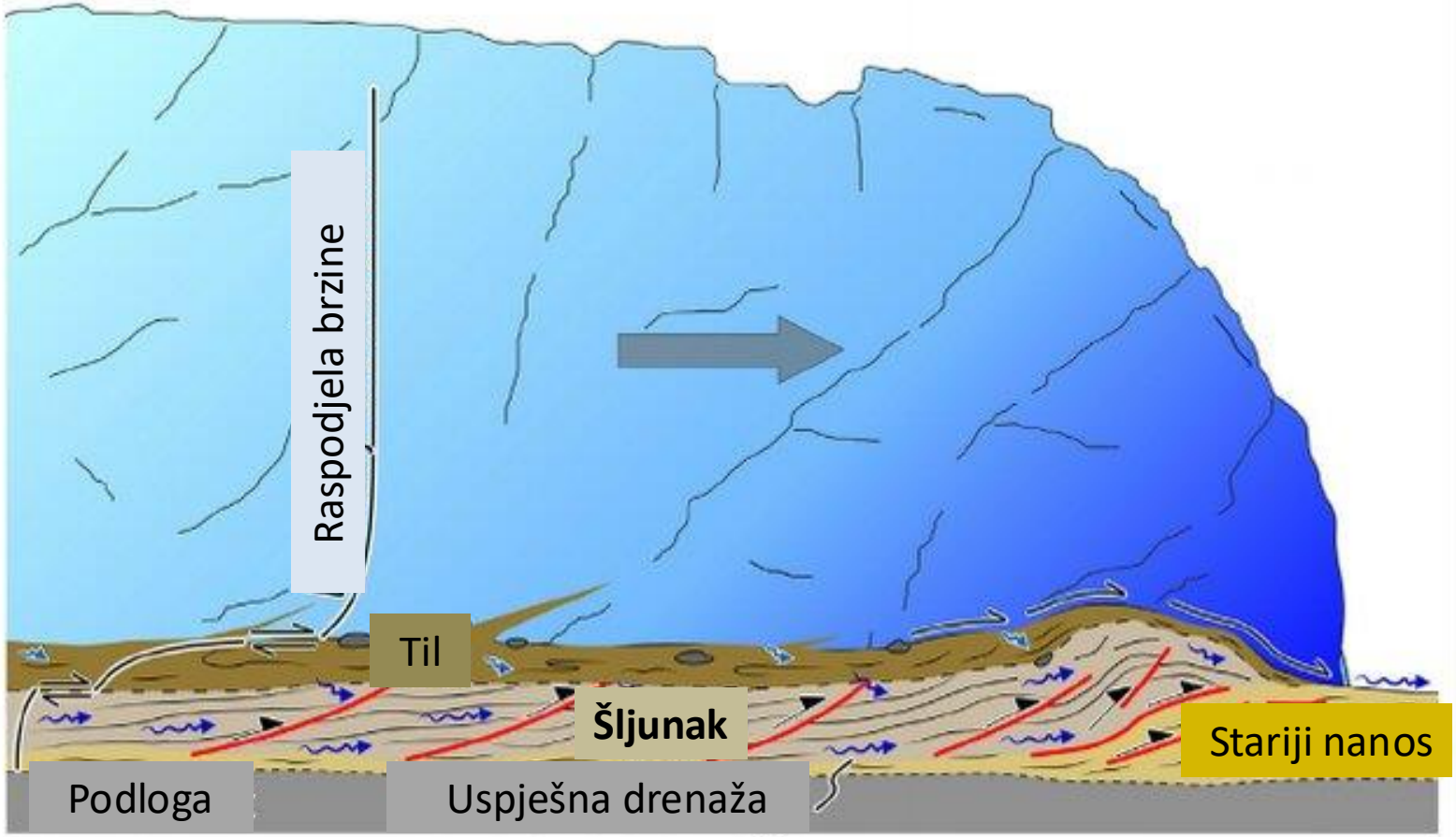
RIJEČNI ŠLJUNAK – miješani materijal duž riječnoga toka



https://www.facebook.com/Geomark.Geoscience.Edu/posts/sedimentology-sediment-transport-processestraction-saltation-suspension-and-solu/1135632285251072/; siječanj 2026

Glavni mehanizmi postanka

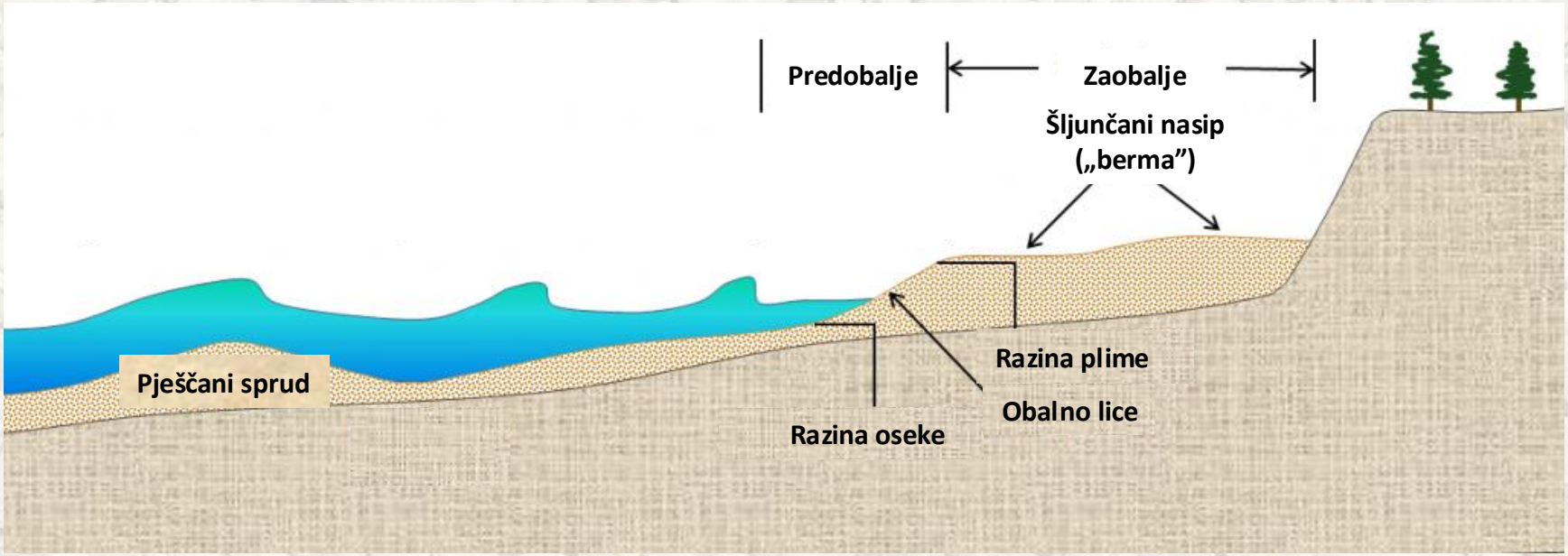
GLACIJALNI ŠLJUNAK – miješani materijal, prikupljen tijekom kretanja ledenjaka



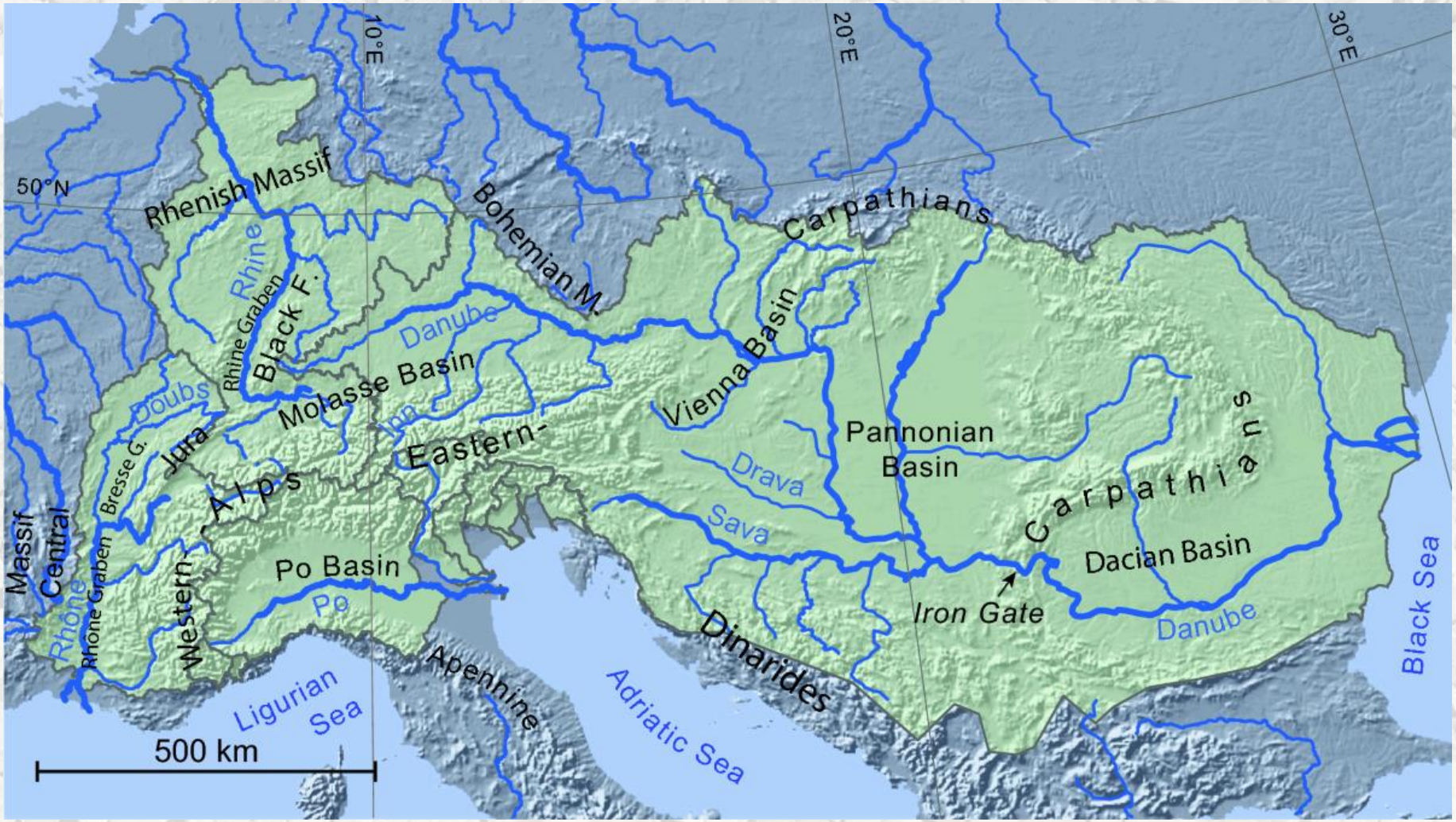
Ingolfsson et al., 2016; https://www.researchgate.net/publication/283739093_Glacial_geological_studies_of_surge-type_glaciers_in_Iceland_-_Research_status_and_future_challenges/figures?lo=1; siječanj 2026.

Glavni mehanizmi postanka

OBALNI ŠLJUNAK – sastoji se uglavnom od stijena u neposrednoj blizini



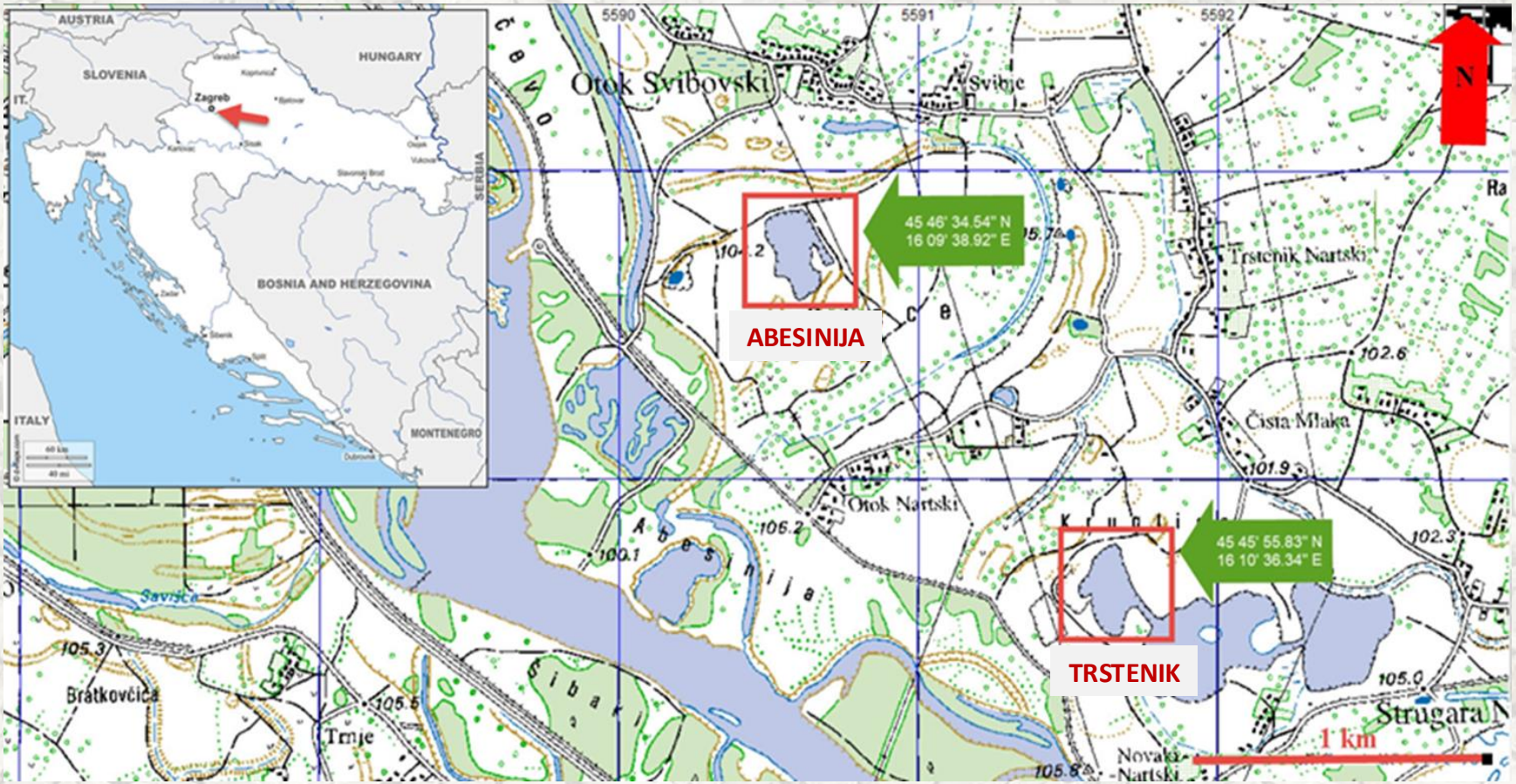
https://pressbooks.ccconline.org/physicalgeology/chapter/17-3-landforms-and-coastal-deposition-physical-geology-2nd-edition/; siječanj 2026.



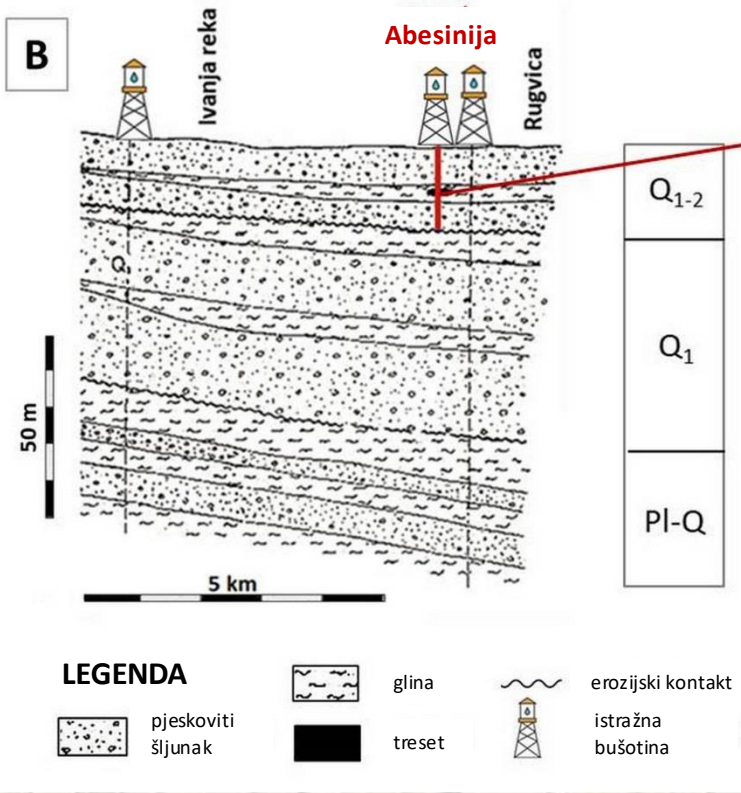
Winteberg & Willett, 2019
https://link.springer.com/article/10.1007/s00015-018-0332-5

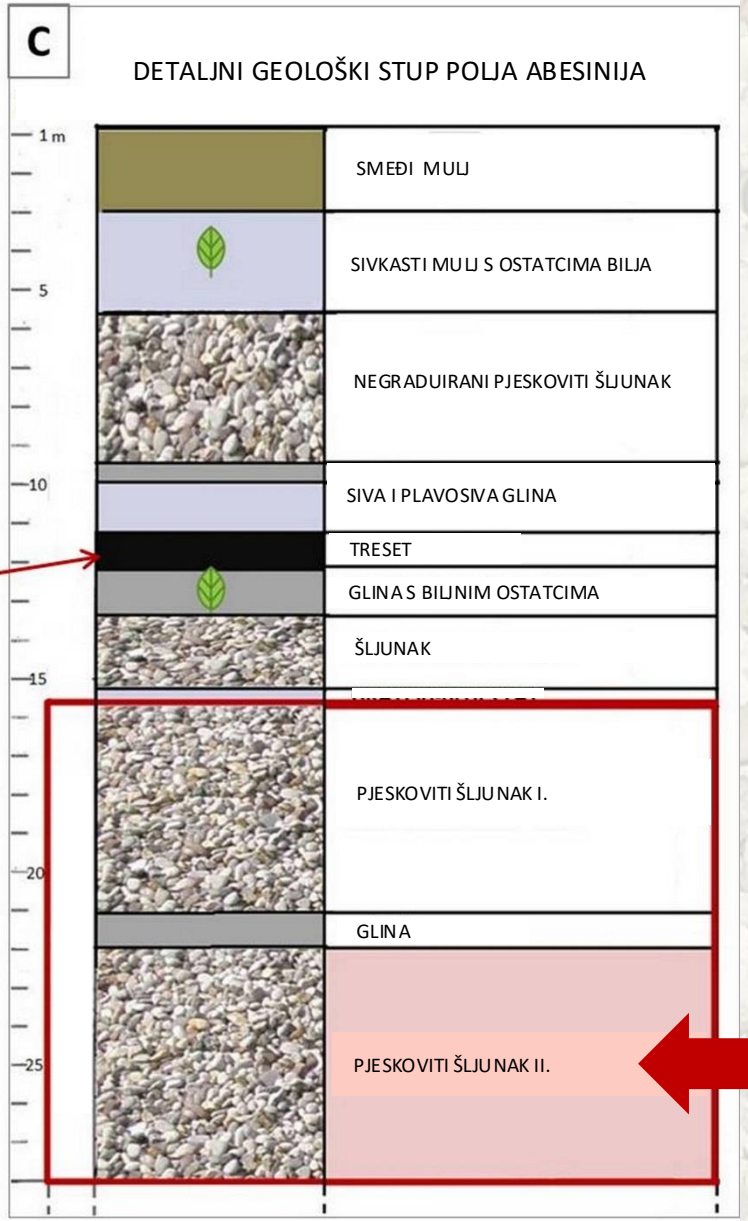
EKSPLOATACIJSKO POLJE ABESINIJA

Položaj eksploatacijskih polja na području Rugvice



Sremac et al., 2020



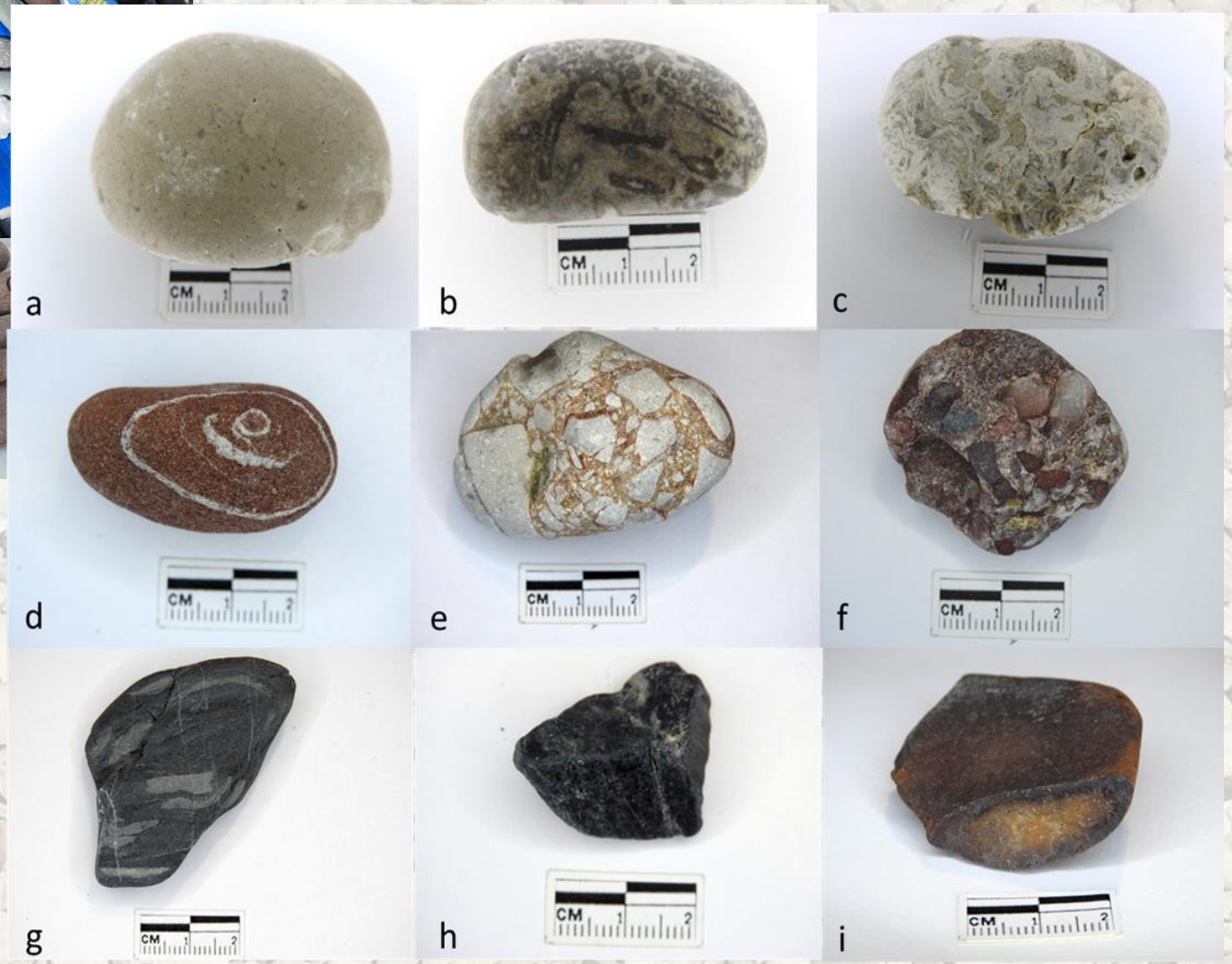


Sremac et al., 2024

Prikupljanje uzoraka

Sremac et al., 2020

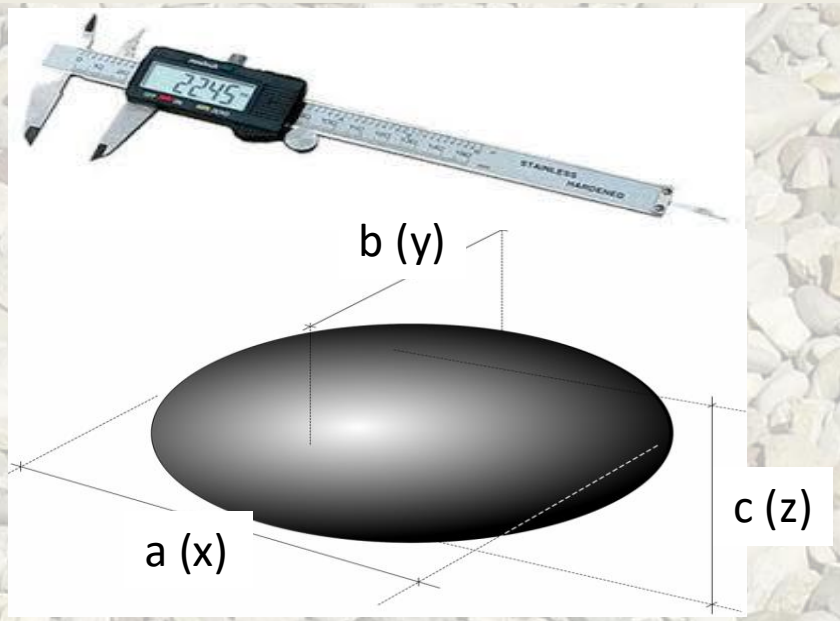
Sortiranje valutica (=oblutaka) po litologiji



Sremac et al., 2020

VELIČINA, OBLIK I SASTAV VALUTICA

Mjerenje kaliperom



Prirodni uzorak mase 5 kg sadržavao je **1399** oblutaka.
Osi a (=x), b (=y) i c (=z) su mjerene na **379** oblutaka većih od 5 mm

Sremac et al., 2020

WHITE CARBONATES

x	y	z
10,0	7.9	5.1
12.5	13.9	8.2
14.0	9.0	6.3
15.0	10.6	5.2
15.0	12.9	9.0
15.1	14.1	7.1
15.5	11.5	5.5
15.6	12.7	6.9
15.8	13.9	6.9
16.1	11.9	7.3
16.7	14.1	11.0
17.0	13.6	10.2
17.2	15.9	7.8
17.3	9.5	5.9
17.9	13.6	9.8
17.9	15.8	10.1
18.0	11.1	6.4
18.2	17.9	16.5
18.3	14.3	12.9
19.3	16.0	12.5
19.5	16.2	10.4
19.9	14.3	6.9
20.2	15.2	14.1
21.3	15.1	11.3
21.5	14.9	11.0
21.6	11.4	9.5
22.5	15.5	13.5
22.6	15.0	8.6
22.6	18.2	9.7
22.8	19.1	17.3
22.9	14.2	12.2
22.9	18.5	6.5
23.0	15.2	9.0
23.2	9.5	8.5
23.5	20.0	11.6
24.2	14.9	10.1
25.2	17.2	10.5
25.8	15.9	11.8
26.1	20.4	12.8
26.1	22.5	12.0
27.0	19.1	7.5
27.0	19.3	13.4
27.4	18.2	17.9
27.6	17.3	17.0
28.1	24.5	13.6
28.3	22.9	13.5
28.4	18.7	12.9
29.4	28.3	10.2
31.1	20.2	8.7
31.1	22.8	14.2
33.3	22.4	12.6
33.5	22.2	13.5

GREY CARBONATES

x	y	z
12.2	11.0	6.5
12.4	11.2	8.5
14.7	10.2	4.1
15.0	8.5	4.1
16.5	12.7	7.1
18.0	11.9	9.2
18.4	12.0	7.8
18.7	16.3	7.6
19.1	17.2	13.1
19.2	15.7	9.4
19.4	17.1	6.0
19.6	20.4	7.7
19.9	15.4	10.2
20.0	13.3	4.4
20.1	11.8	6.4
21.5	16.4	13.4
23.2	17.2	12.1
23.2	18.5	11.5
23.2	19.9	8.8
24.2	21.2	12.4
24.3	18.1	10.2
25.5	21.8	15.5
25.8	22.1	9.7
26.1	23.8	16.6
26.6	17.6	8.4
27.2	15.2	15.1
27.3	23.0	12.2
28.2	18.8	9.4
28.8	20.4	11.5
29.3	26.3	15.2
30.2	18.7	11.8
30.4	25.3	18.6
30.5	15.6	9.7
31.2	31.0	11.5
32.0	27.5	11.6
32.4	26.7	11.5
35.3	21.6	15.1
36.6	28.7	18.7
37.7	31.2	12.4
38.1	26.6	18.3
40.0	27.3	19.1
40.7	22.2	17.5
41.4	26.3	20.0

BLACK CALCARENITES

x	y	z
15.4	13.0	10.0
17.5	16.3	10.9
17.7	12.0	7.3
18.3	14.0	8.6
18.6	14.8	7.8
20.1	11.2	9.6
21.7	21.5	11.0
23.2	23.2	17.4
23.4	18.0	7.6
24.5	17.3	5.7
25.3	20.9	11.1
27.2	16.6	14.2
28.4	18.8	11.5
28.4	22.0	10.2
31.9	20.4	20.1
32.2	25.0	9.4
32.3	16.4	15.5
32.5	26.7	20.3
33.8	22.7	11.5
35.4	15.0	9.3
36.5	25.2	18.0
38.2	27.8	19.1
38.4	18.4	11.3
41.5	31.8	17.4
41.5	33.7	12.4
43.1	33.1	27.5
46.4	33.5	19.5
50.3	33.7	27.4

MARLY LIMESTONES

x	y	z
15.2	12.2	8.1
19.7	9.4	9.2
25.8	16.3	13.3
27.8	25.3	7.4
35.1	15.3	12.8
38.1	20.6	12.1
38.2	29.2	23.1
46.3	27.7	19.2

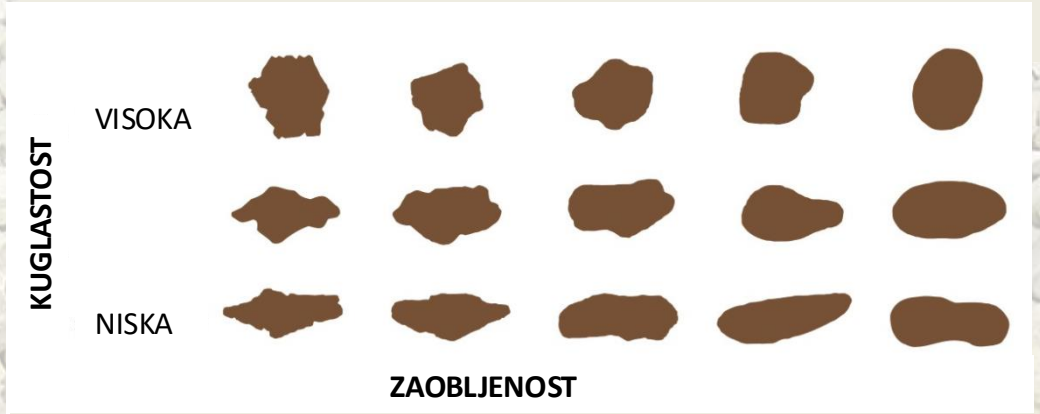
BIOCALCARENITES

x	y	z
6.8	5.0	3.5
11.2	8.9	4.9
15.0	11.5	4.7
23.8	11.5	9.6
25.4	17.0	16.0
43.5	24.8	20.0

OTHER CARBONATES

x	y	z
41.4	37.9	23.2

Zaobljenost i kuglastost; oblik



https://commons.wikimedia.org/wiki/File:Rounding_%26_sphericity_EN.

ZINGG CLASSES	$b/a < 2/3$	$b/a > 2/3$
$c/b < 2/3$	BLADE	DISC
$c/b > 2/3$	ROD	SPHERE

Zingg classes
a>b>c: axis lengths of the ellipsoid

Indeks plosnatosti (F)

$$F = (a + b)/2c$$

$F =$ *INDEKS PLOSNATOSTI*
$a =$ *NAJDUŽA OS*
$b =$ *SREDNJA OS*
$c =$ *NAJKRAĆA OS*

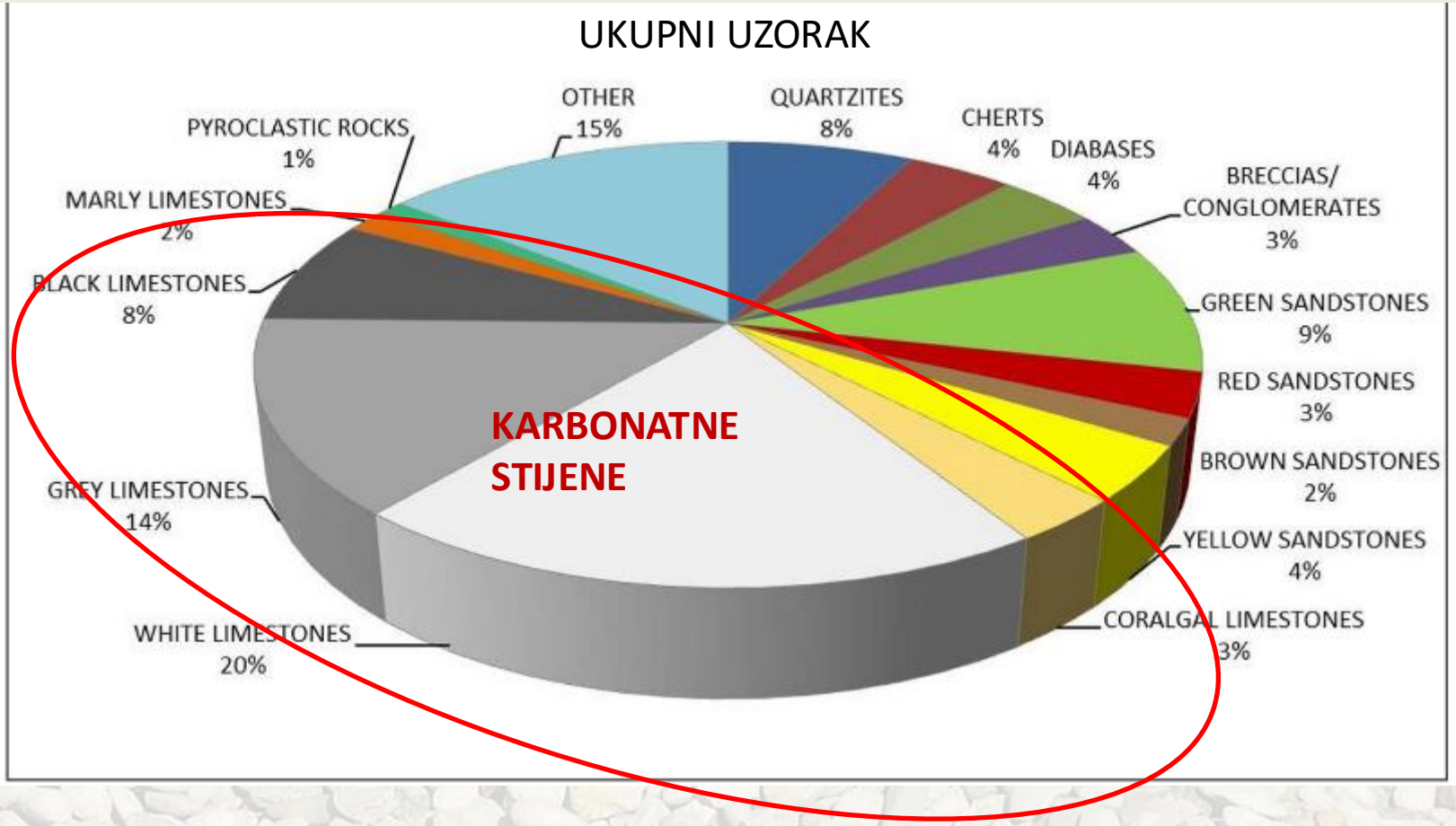
TALOŽNI OKOLIŠ	PLOSNATOST
Udubljenja u riječnim kanalima	1.2 – 1.6
Podinska morena	1.6 – 1-8
Fluvioglacijalni	1.7 – 2.0
Morska plaža	2.3 – 3.8
Jezerska plaža	2.3 – 4-4
Ledena rijeka	2.0 – 3.1
Rijeka u umjerenoj do toploj klimi	2.5 – 3.5

Sremac et al., 2020

STUPANJ ZAOBLJENOSTI I LITOLOŠKI SASTAV VALUTICA				BROJ VALUTICA U KRUPNOJ I SITNOJ FRAKCIJI			
ZAOBLJENOST	LITOLOŠKI SASTAV	TEREN. OZN.	TIP STIJENE				
UGLATE	KVARCIT	Q	SILIKATNE ST.	28	44	93	124
	ROŽNJAK	R		16		31	
	DIJABAZ	E	ERUPTIVNE ST.	15	19	144	147
ZAOBLJENE	PIROKLASTIT	Z 4		4		3	
	ZELENI PJEŠČENJAK	Z 1, Z 2, Z 3, Z 5 Z6, Z7	PJEŠČENJACI/ SILTITI	34	76	44	124
	CRVENI PJEŠČENJAK	C 1, C 2, C 4		12		57	
	SMEĐI PJEŠĆENJAK	C 3		7		2	
	ŽUTI PJEŠČENJAK	P 4		15		21	
	SIVI PJEŠČENJAK	P 1, P 2, P 3, P 5		8		0	
	KORALINACEJSKI BIOKALKARENIT		KARBONATNE ST.	12	173	28	309
	BIJELI MIKRITNI VAPNENAC	V 2		75		181	
	SIVI MIKRITNI VAPNENAC	V 1		52		66	
	TAMNOSIVI KALKARENIT	V 3		28		34	
	LAPOROVITI VAPNENAC			6		0	
DJELOM. ZAOBLJENE	BREČA/ KONGLOMERAT	BKG	OSTALO	12	67	316	316
	NEODREĐENO			55			
				379	379	1020	1020

Sremac i sur., 2020

Modalni sastav šljunka



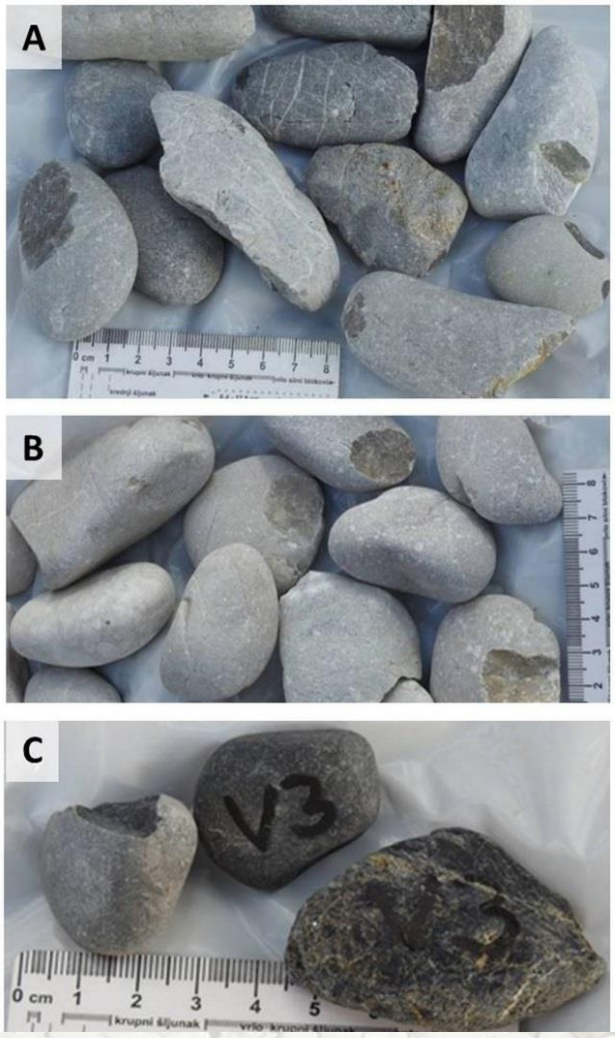
= KVANTITATIVNI UDIO POJEDINIH LITOTIPOVA VALUTICA U UKUPNOM UZORKU

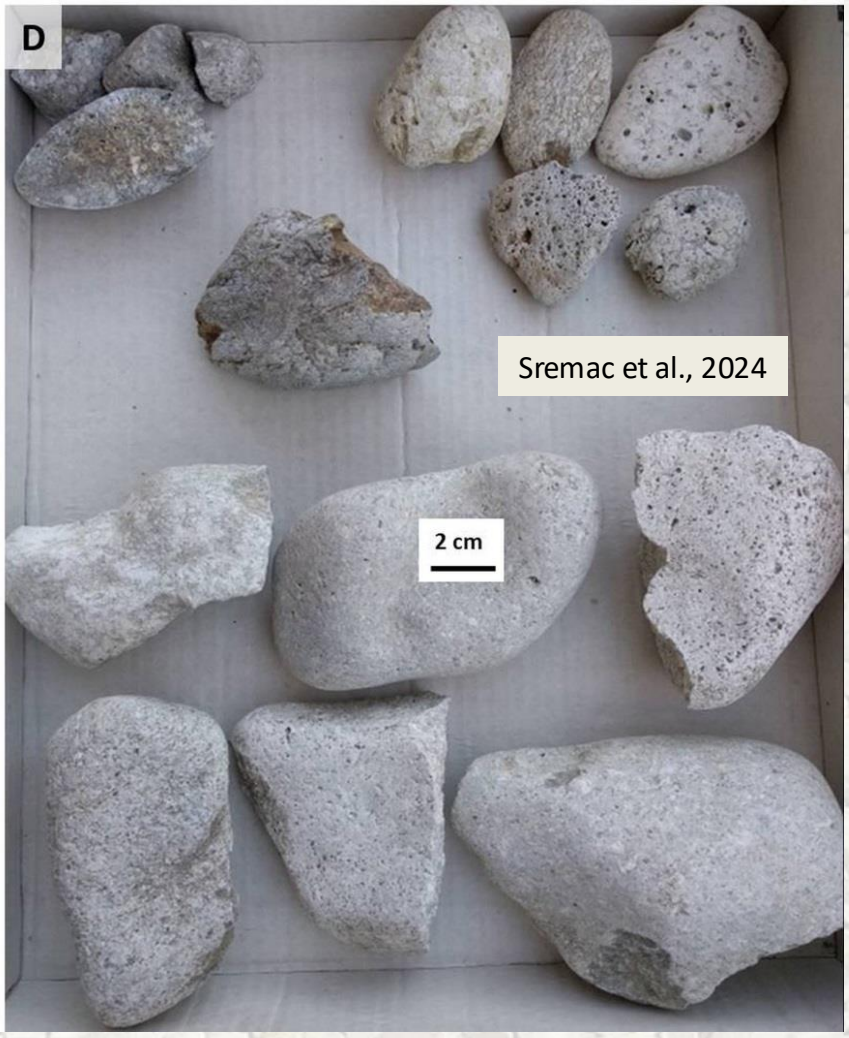
Sremac et al., 2024

STAROST I PORIJEKLO KARBONATNIH VALUTICA

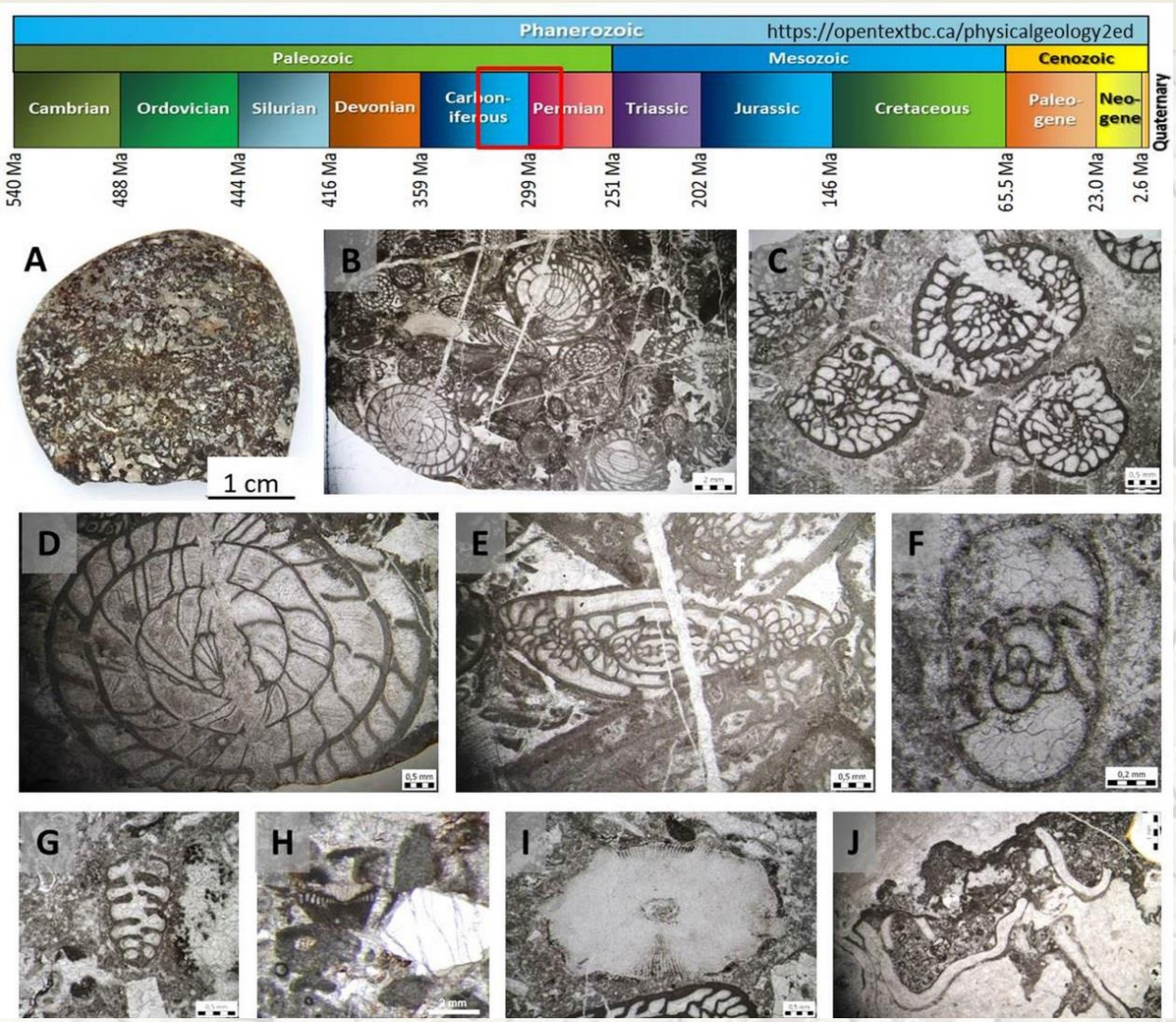
Sremac et al., 2024

Karbonatne valutice



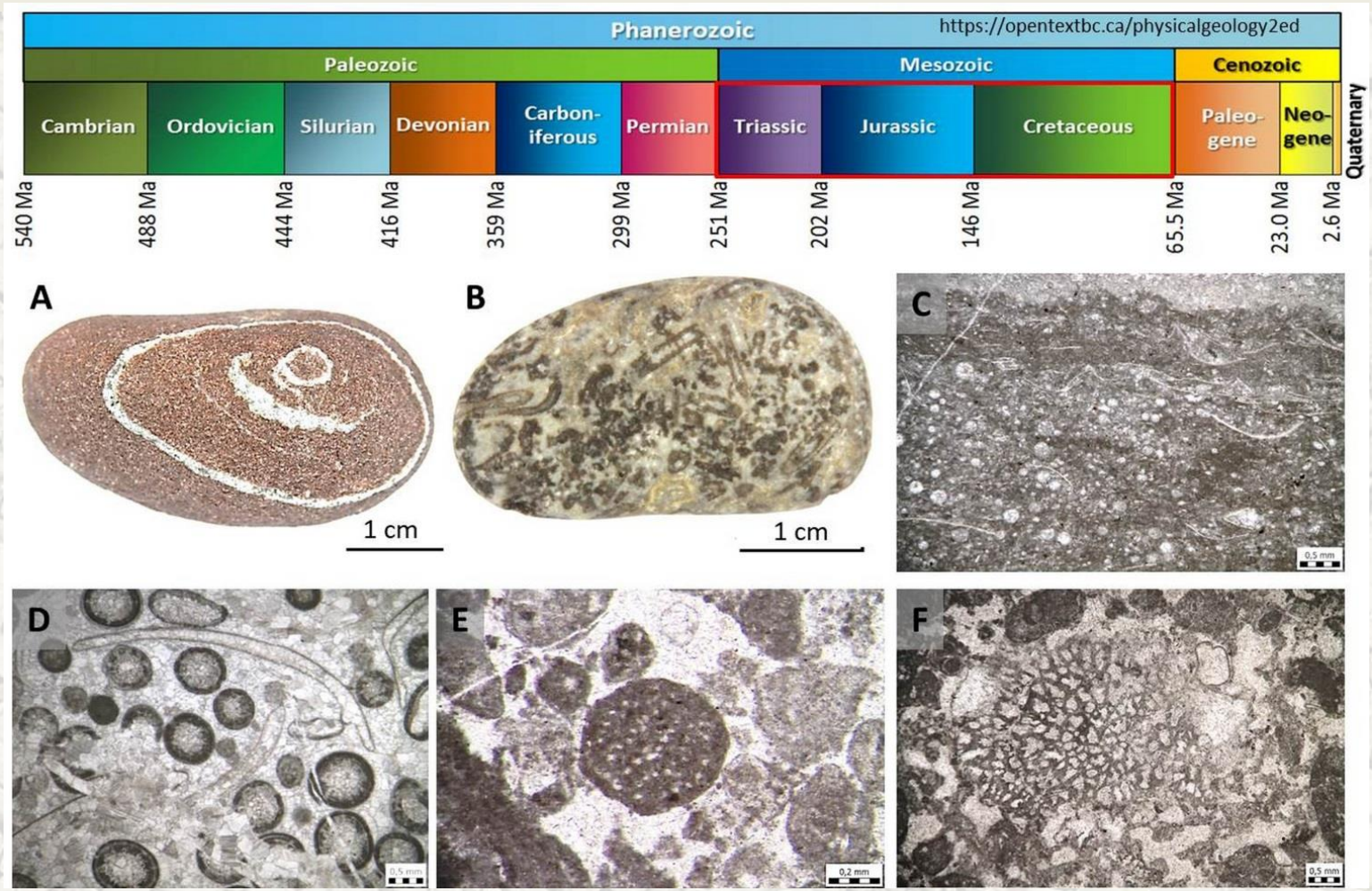


Valutice paleozojske starosti



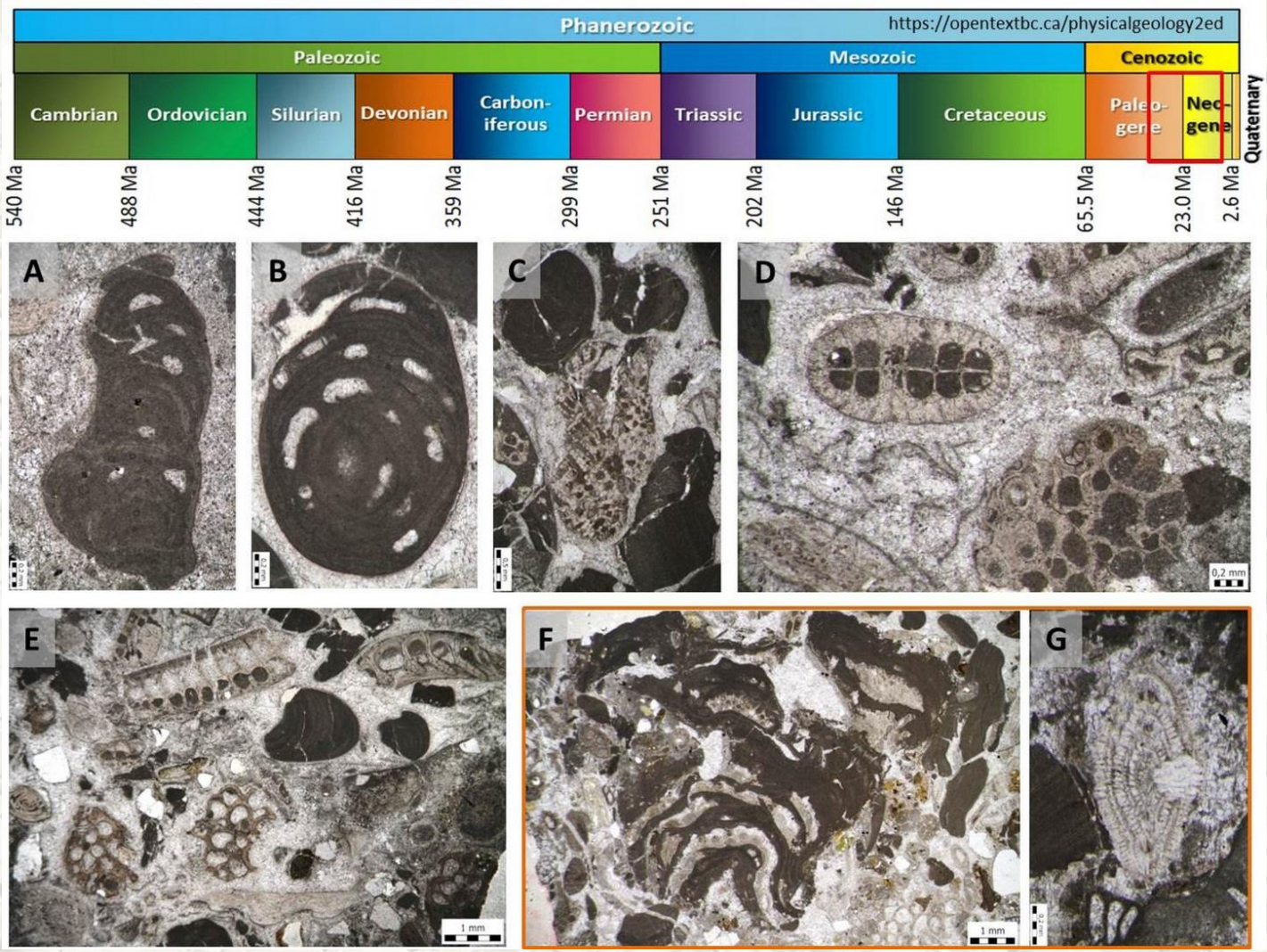
Sremac et al., 2024

Valutice mezozojske starosti



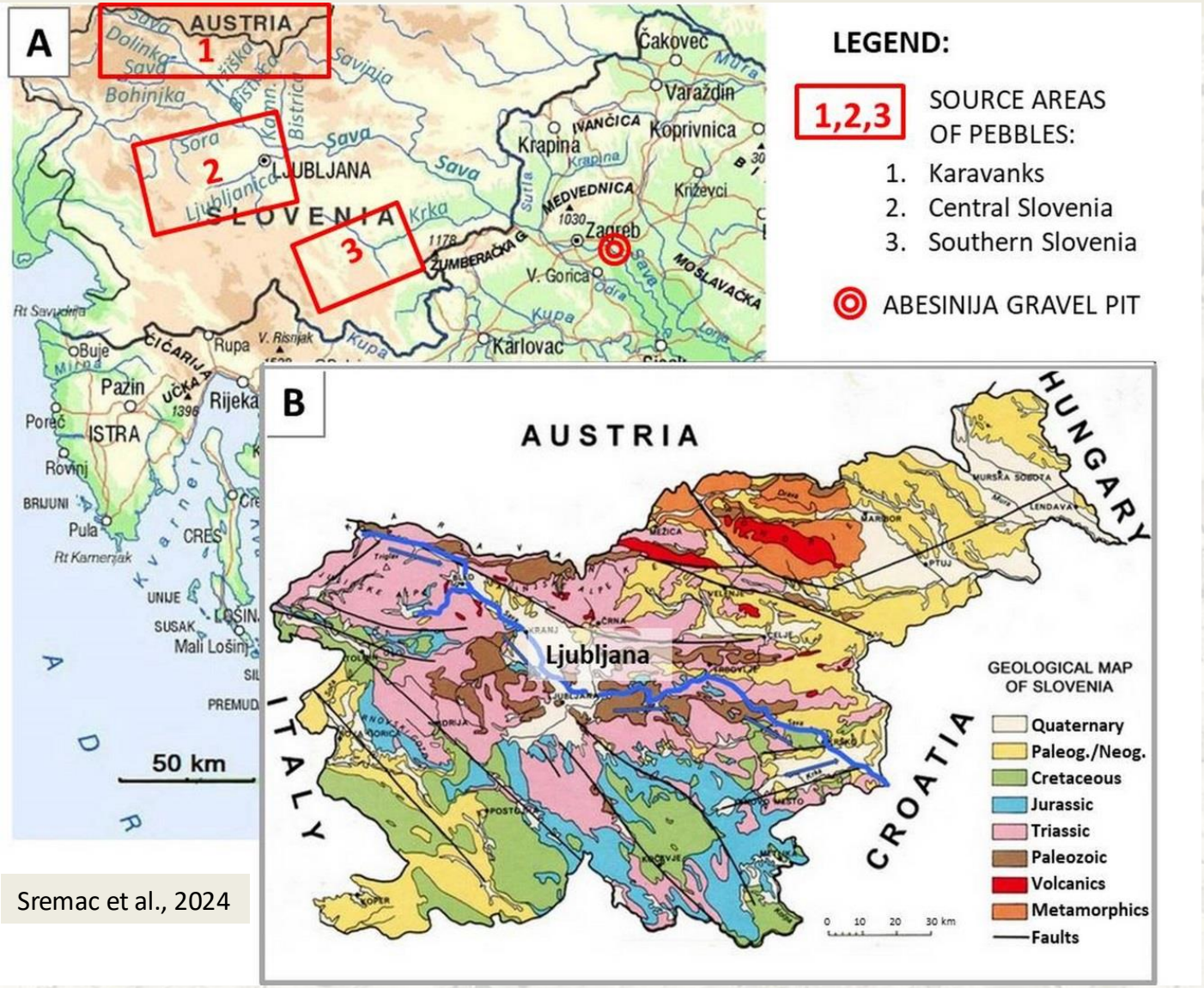
Sremac et al., 2024

Valutice kenozojske starosti



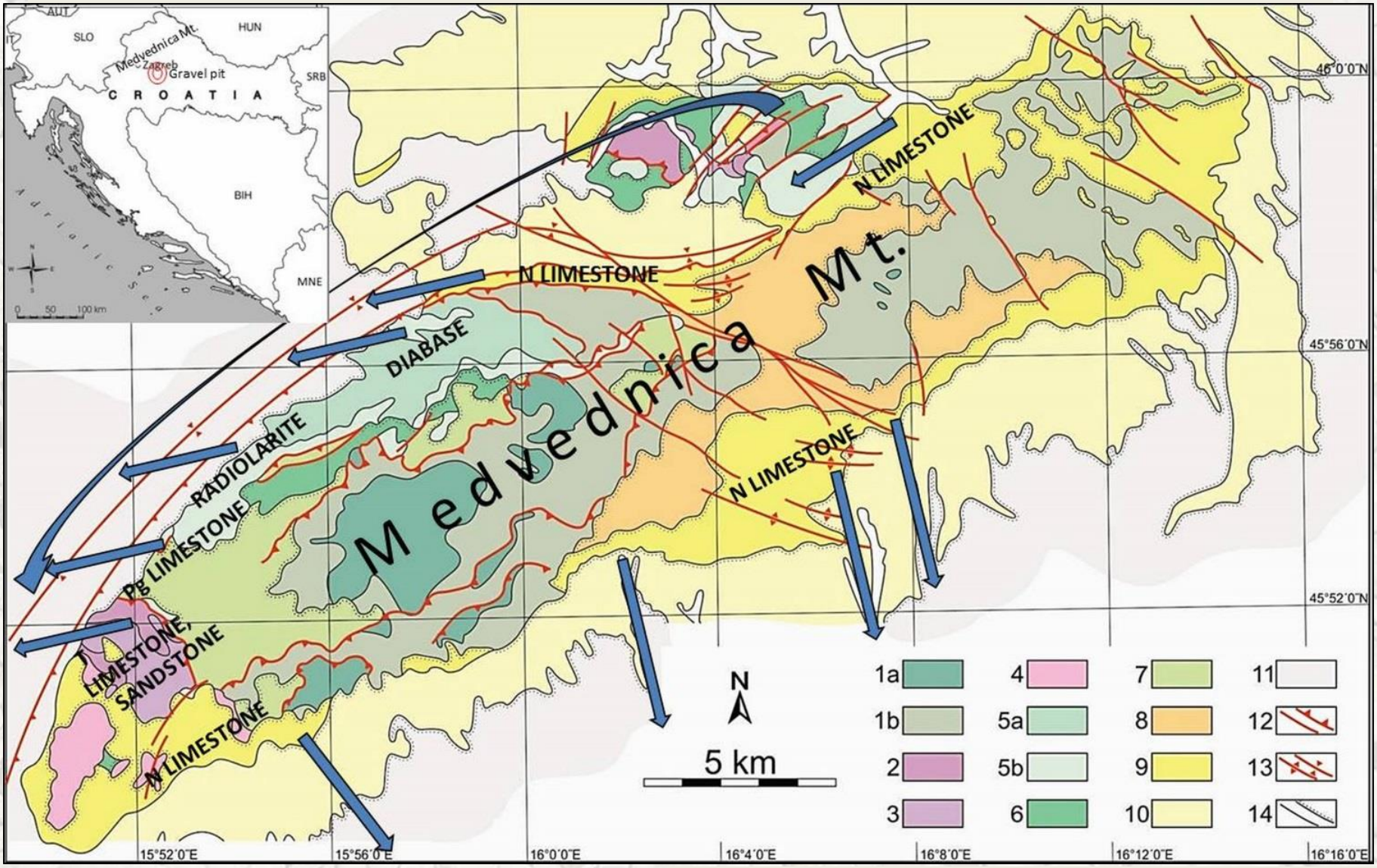
Sremac et al., 2024

Izvorišna područja



Sremac et al., 2024

Izvorišna područja



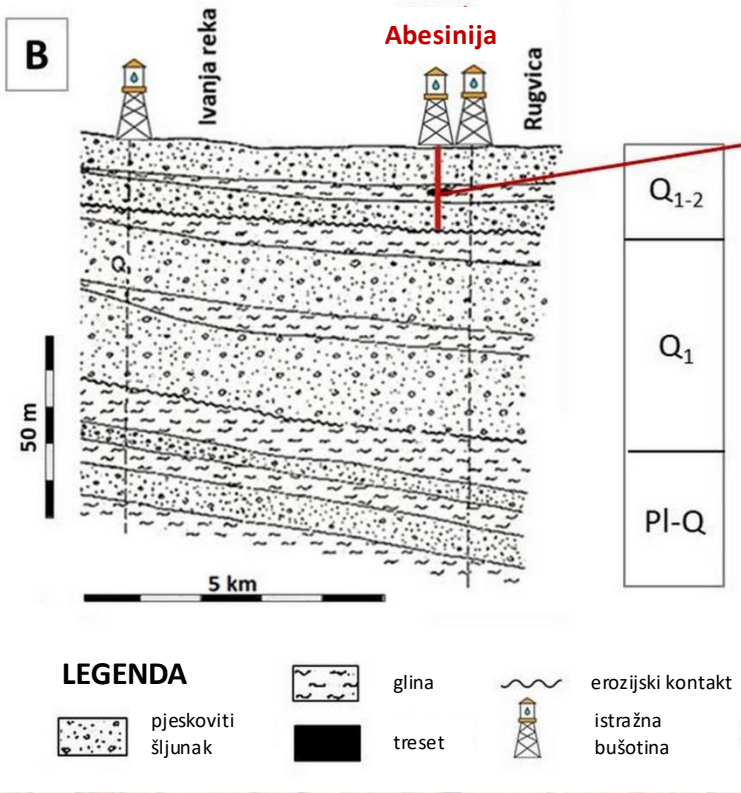
Sremac i sur., 2024; geol. karta Medvednice prema Tomljenović, 2002

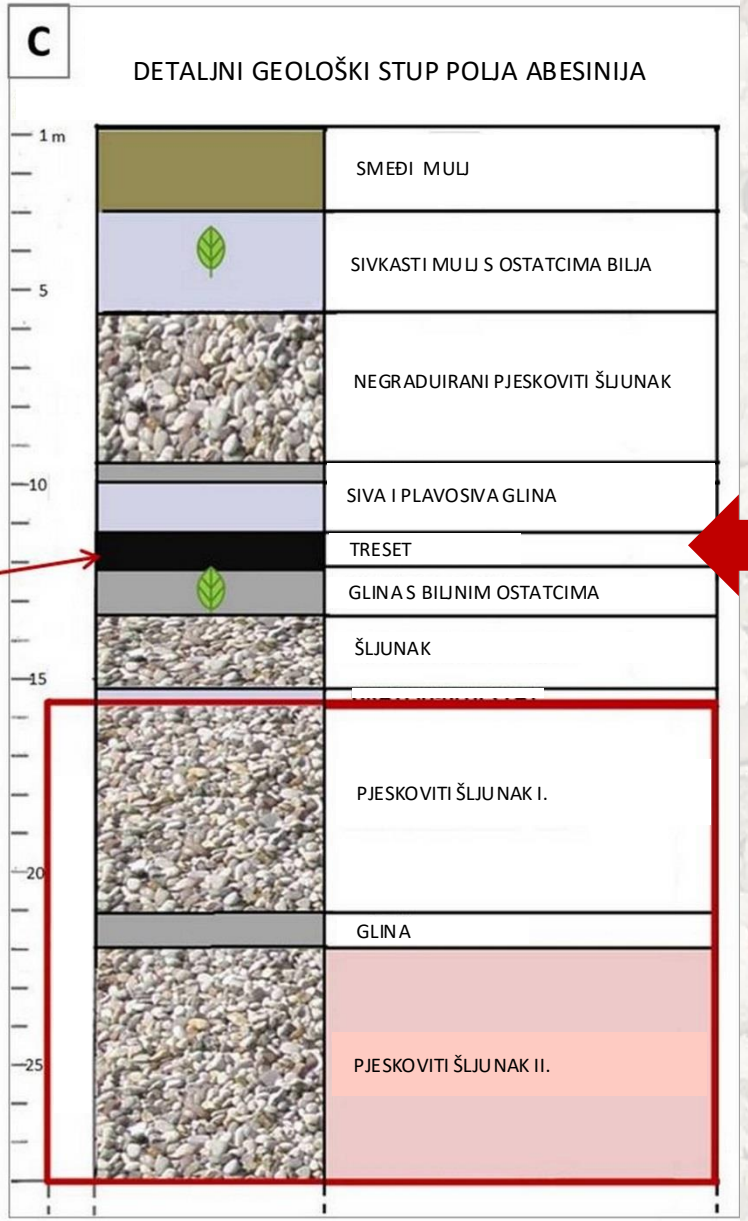
Izvorišna područja po litološkim kategorijama

VRSTA STIJENE	FOTO	%	STAROST			IZVORIŠNO PODRUČJE				
			Pz	Mz	Kz	NW SLO	CENT SLO	S SLO	SAMOB	MEDV
SIVI VAPNENAC		14%		T						
BIJELI VAPNENAC		20%		J-K						
CRNI VAPNENAC		8%	C-P							
BIOKALKARENIT		3%			M					
PJEŠČENJAK		18%		T.J.K	M					
BREČA/KONGLOMERAT		3%		J.K.M						
ROŽNJAK/KVARCIT		12%	Pz							
DIJABAZ/TUF		5%		J-K						

Sremac et al., 2024

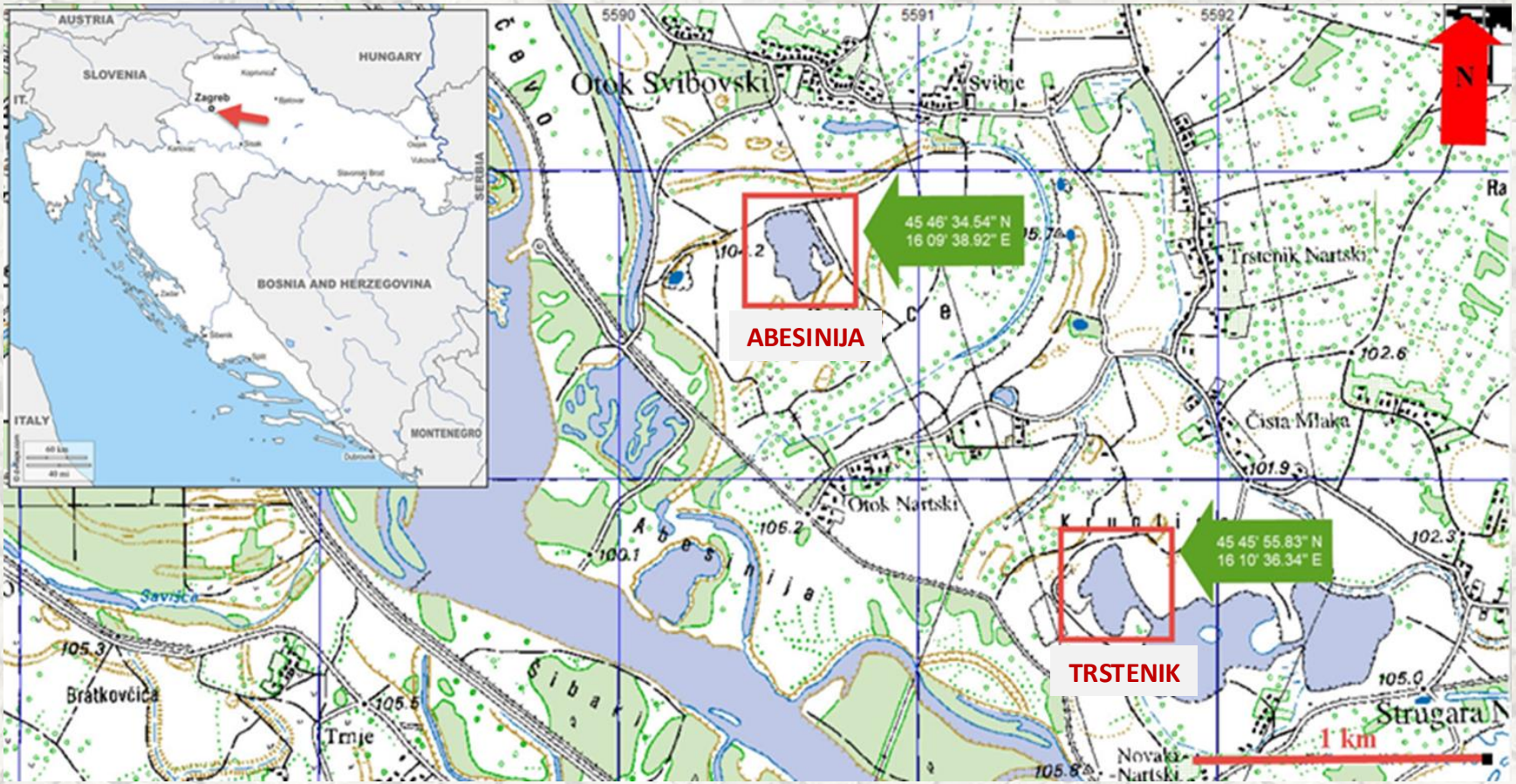
Sremac et al., 2024





Sremac et al., 2024

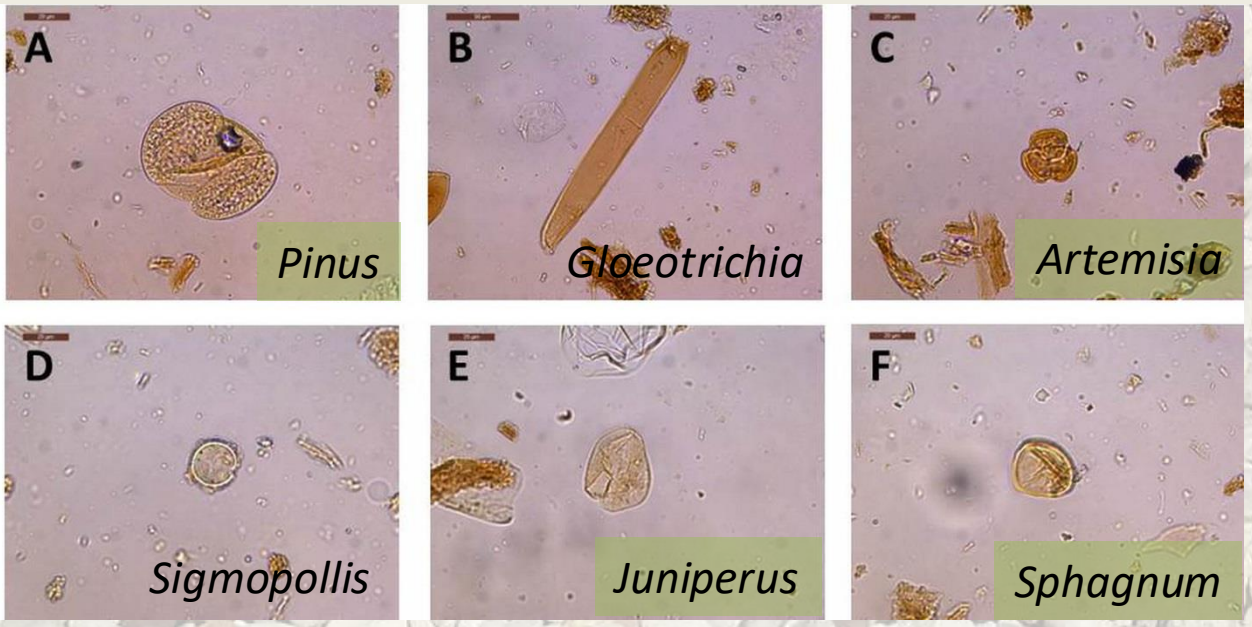
Položaj eksploatacijskih polja na području Rugvice



Sremac et al., 2020

Peludna analiza treseta

Grains	GENUS /ROD	
48	*Juniperus* = BOROVICA	TRSTENIK
201	*Pinus* = BOR	
3	*Picea* = SMREKA	
1	*Buxus* = ŠIMŠIR	
2	*Quercus* = HRAST	
1	Cyperaceae = ŠILJOVKE	
1	Poaceae = TRAVE	
3	*Artemisia* = PELIN	
4	Asteraceae = GLAVOČIKE	
2	*Filipendula* = KONČARA	
1	*Knautia* = KOZOKRVNICA	
2	*Sphagnum* = MAH TRESETAR	
1	PAPRATI	
16	*Sigmopollis*	
71	*Gloeotrichia*	ALGE
5	*Mougeotia*	
2	Fungi = GLJIVE	
2	OSTALO	
13	NEODREĐENO	
16	ex. *Lycopodium* = CRVOTOČ.	
21.04	TEŽINA (g)	
2	**Ls18584**	
379	UKUPAN BR. ZRNA	
30985	KONCENTRACIJA	



Sremac et al., 2024

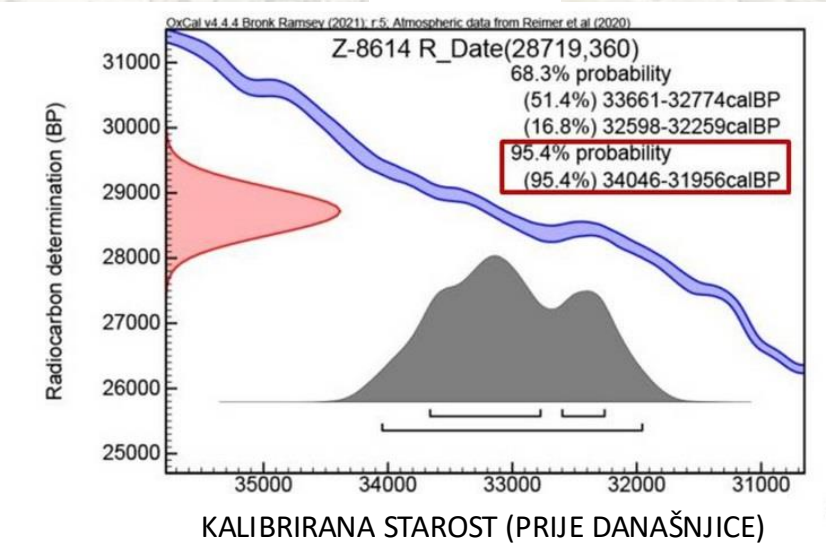
Pretpostavljeni izgled krajolika u vrijeme taloženja treseta

https://bcwfwatershedteam.ca/2025/07/27/understanding-wetland-classifications/

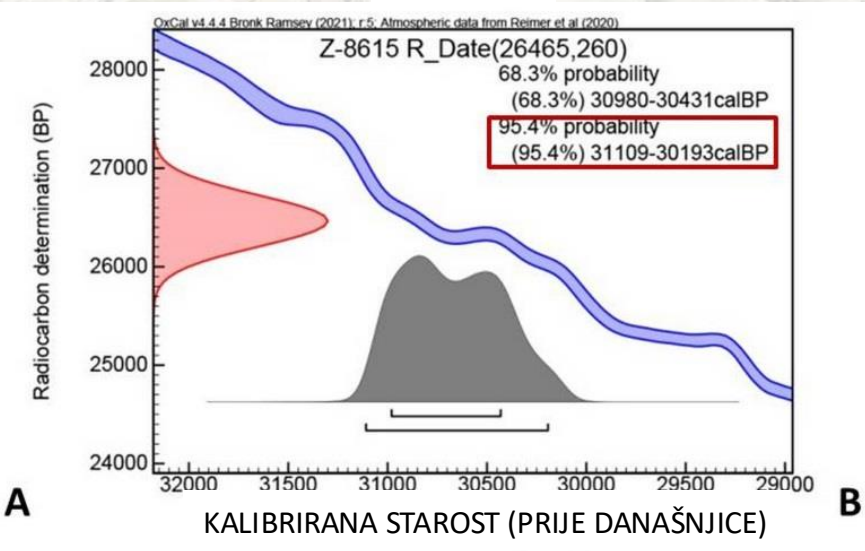
Apsolutna starost uzoraka treseta

LAB. ID	TESTING ITEM	^{14}C AGE (BP)	CALIBRATED DATE (cal BP)	PROBABILITY
Z-8614 / B1939	Lignite from Abesinija (AB)	28720 ± 360	33661 – 32774 cal BP 32598 – 32259 cal BP	51.4 % 16.8 %
Z-8615 / B1940	Lignite from Trstenik (TR)	26470 ± 260	30980 – 30431 cal BP	68.3 %

ABESINIJA

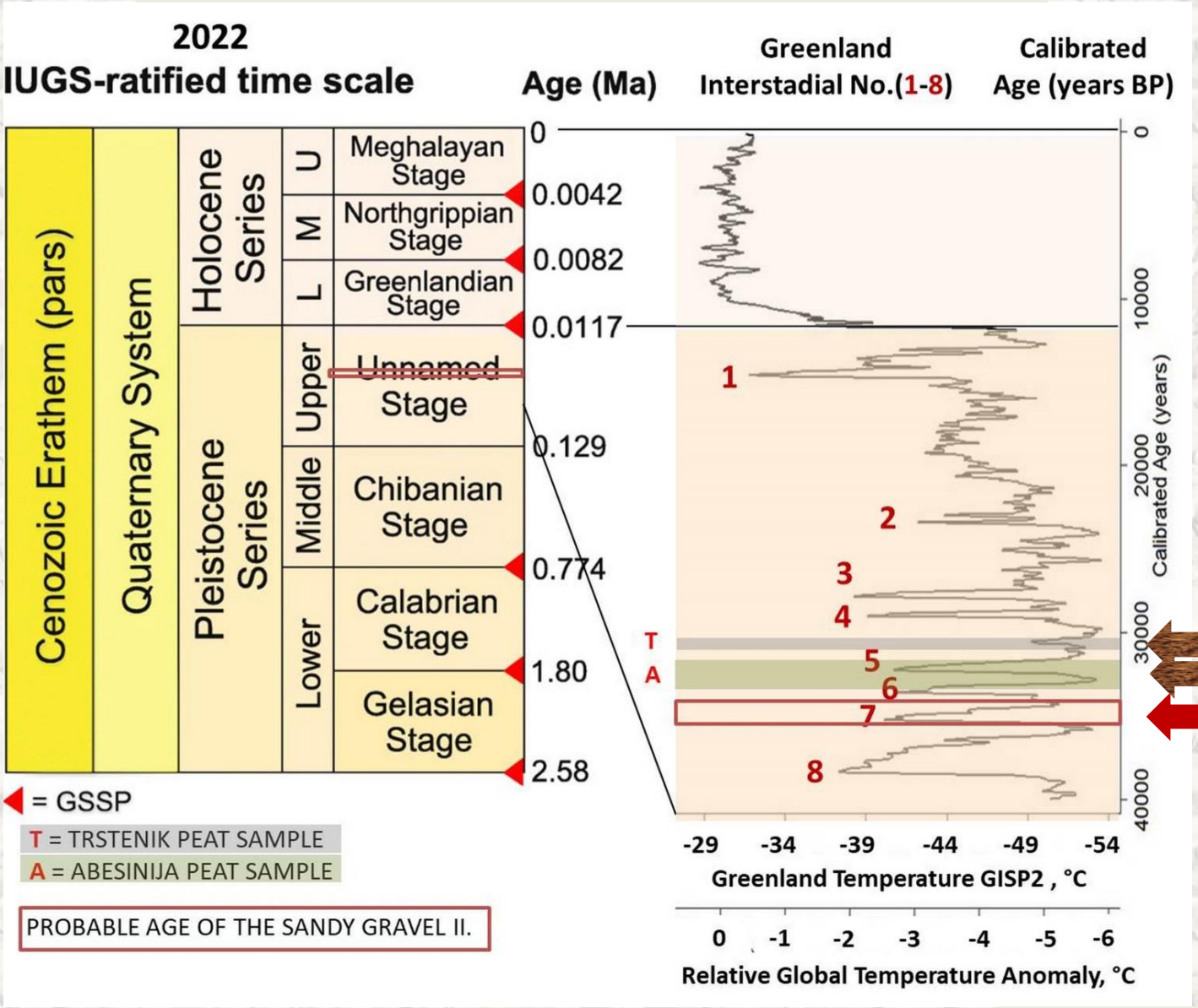


TRSTENIK



Sremac et al., 2024

Vjerojatna starost šljunaka



Sremac et al., 2024

OBJAVLJENI RADOVI

Modal composition and morphometric characteristics of gravels in exploration field “Abesinija” (Otok Svibovski; SE from Zagreb, Croatia)

Mathematical methods and terminology in geology 2020
(*Matematičke metode i nazivlje u geologiji 2020*)

Original scientific paper

Jasenka Sremac[1]; Josipa Velić[2]; Marija Bošnjak[3]; Ivo Velić[4]; Tomislav Malvić[2]; Daniel Fotović[5]; Renato Drempetić[6]

Rivista Italiana di Paleontologia e Stratigrafia
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GENESIS OF THE UPPER PLEISTOCENE GRAVEL FROM THE ABESINIJA PIT SE FROM ZAGREB (CROATIA)

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Hvala na pozornosti!