Co-funded by the European Union

Professional Development Workshop on

Critical Raw Materials Content in Thermal Waters: Analysis and Assessment

30th March 2023
University of Miskolc, Hungary

Hydrogeochemical research in the Institute of Water and Environmental Management, University of Miskolc

Márton Tóth

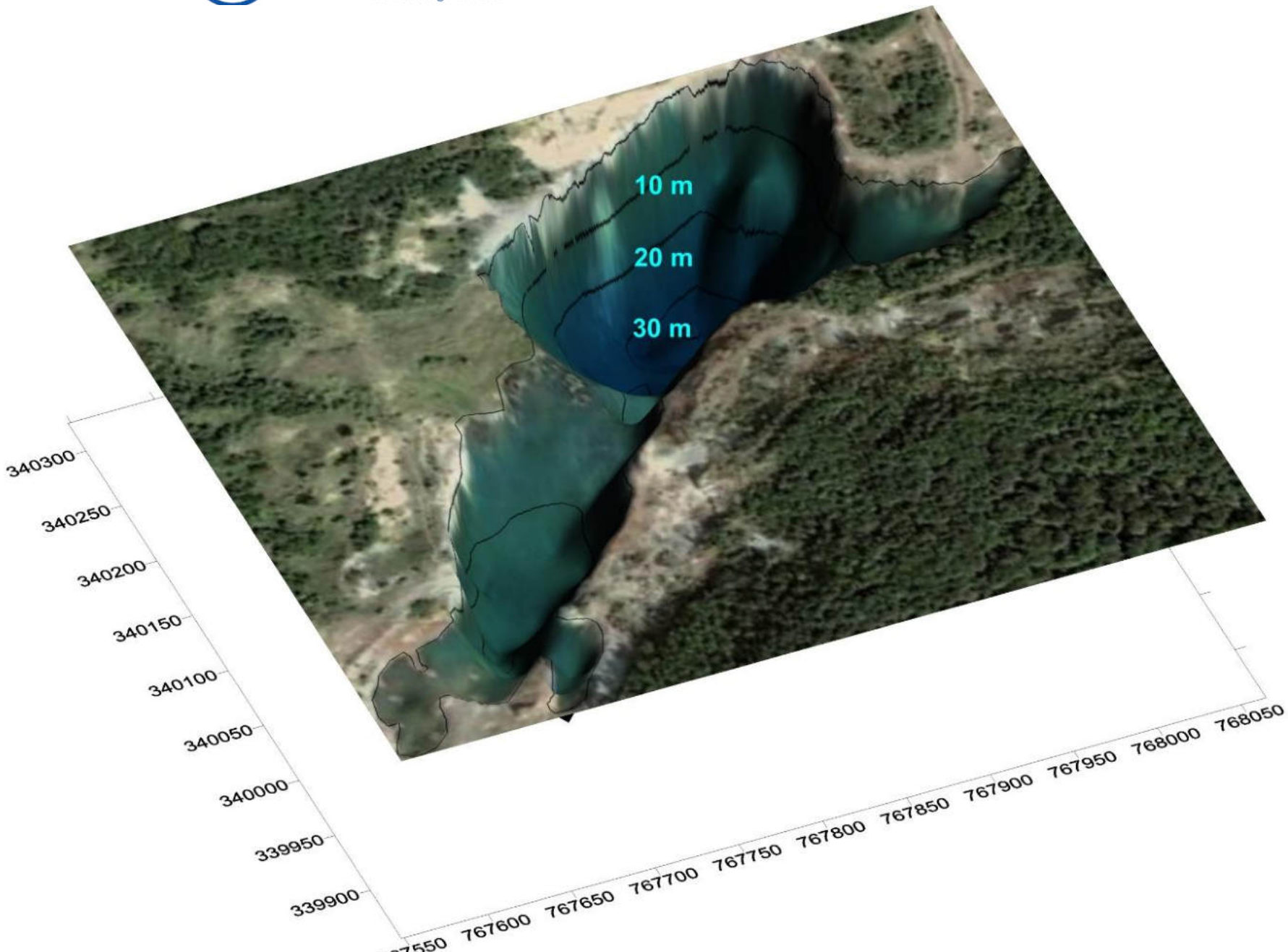
Institute of Water and Environmental Management, University of Miskolc

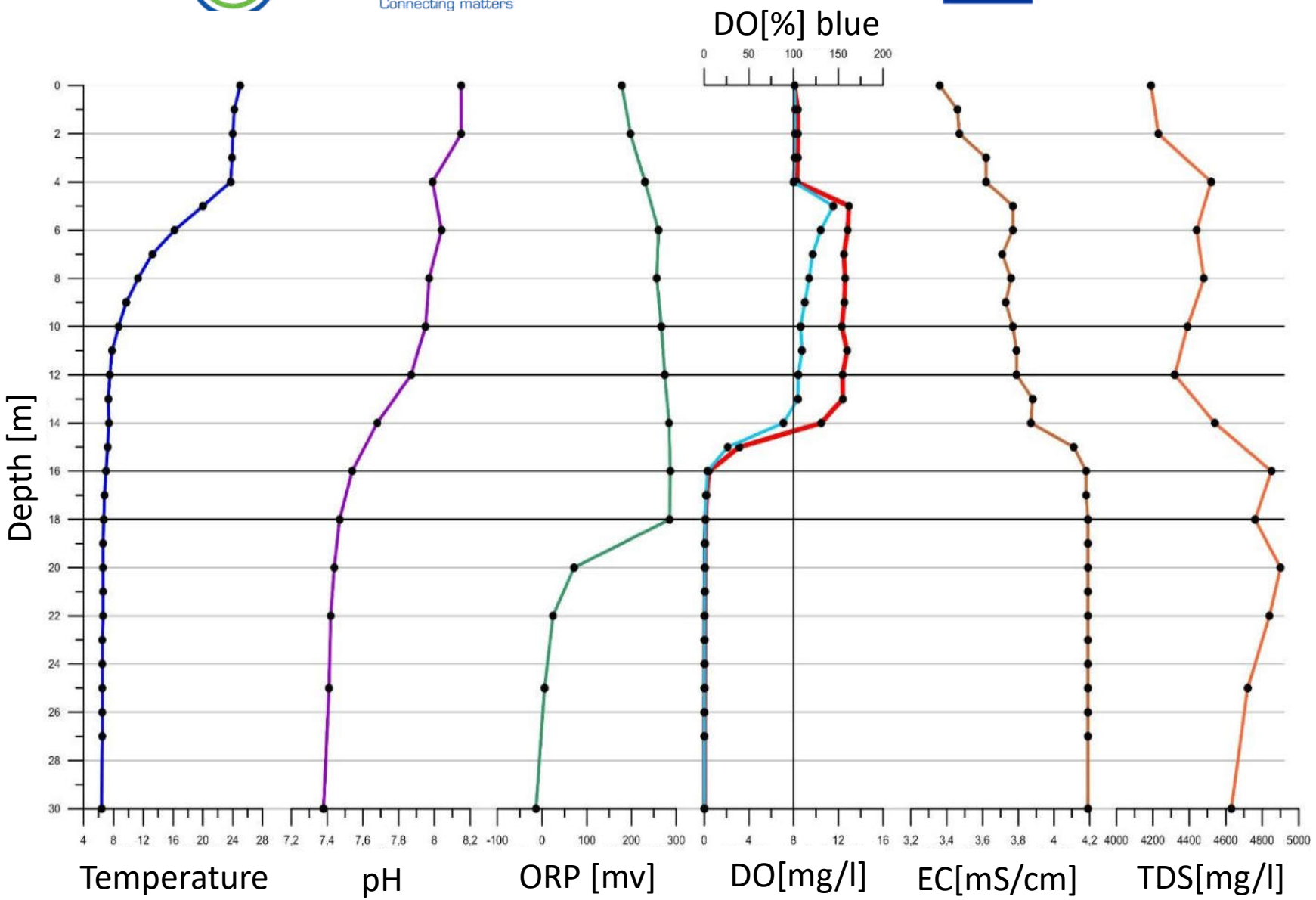
Co-funded by the European Union

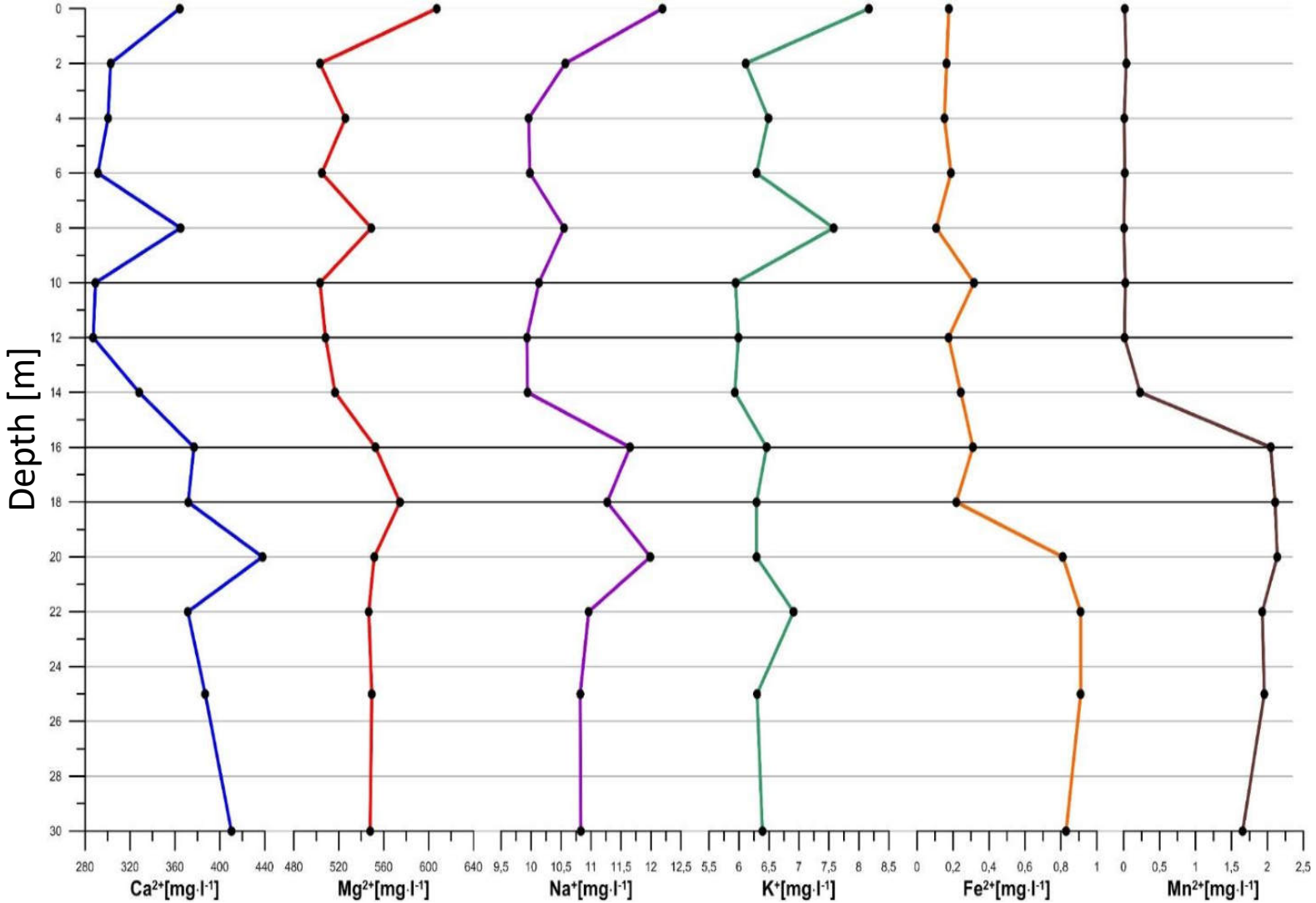
Hydrochemical investigation of Lake Rudabánya

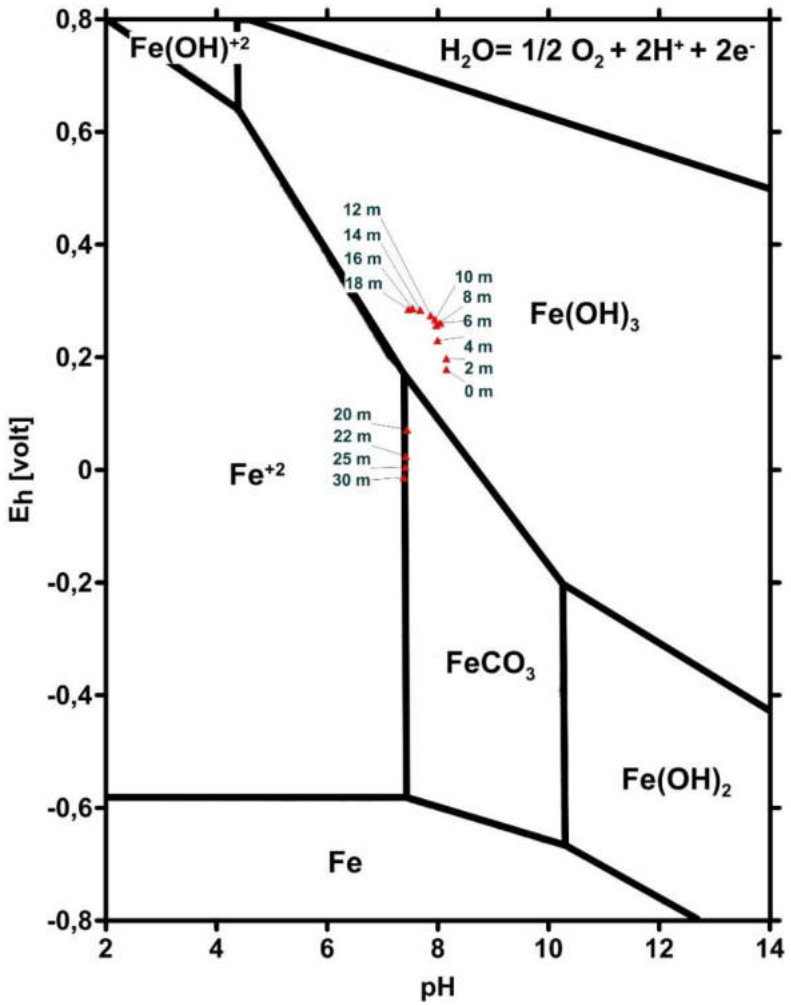
eit RawMaterials
Connecting matters
Co-funded by the European Union
BRINE RIS

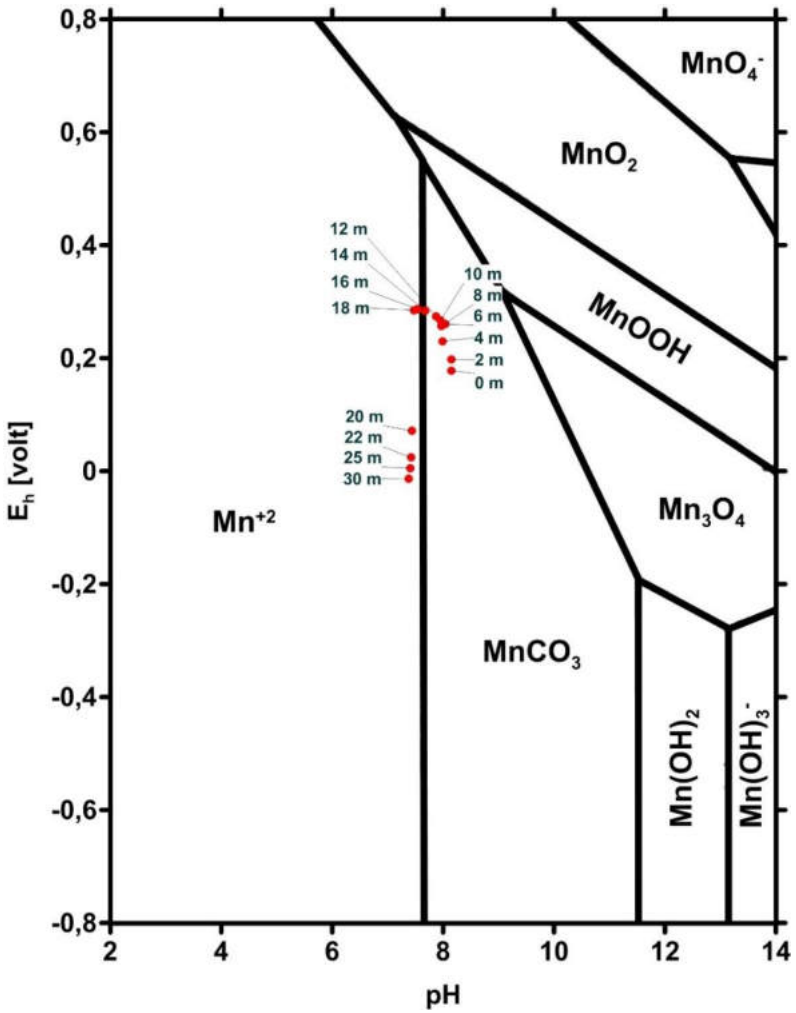

Rudabánya

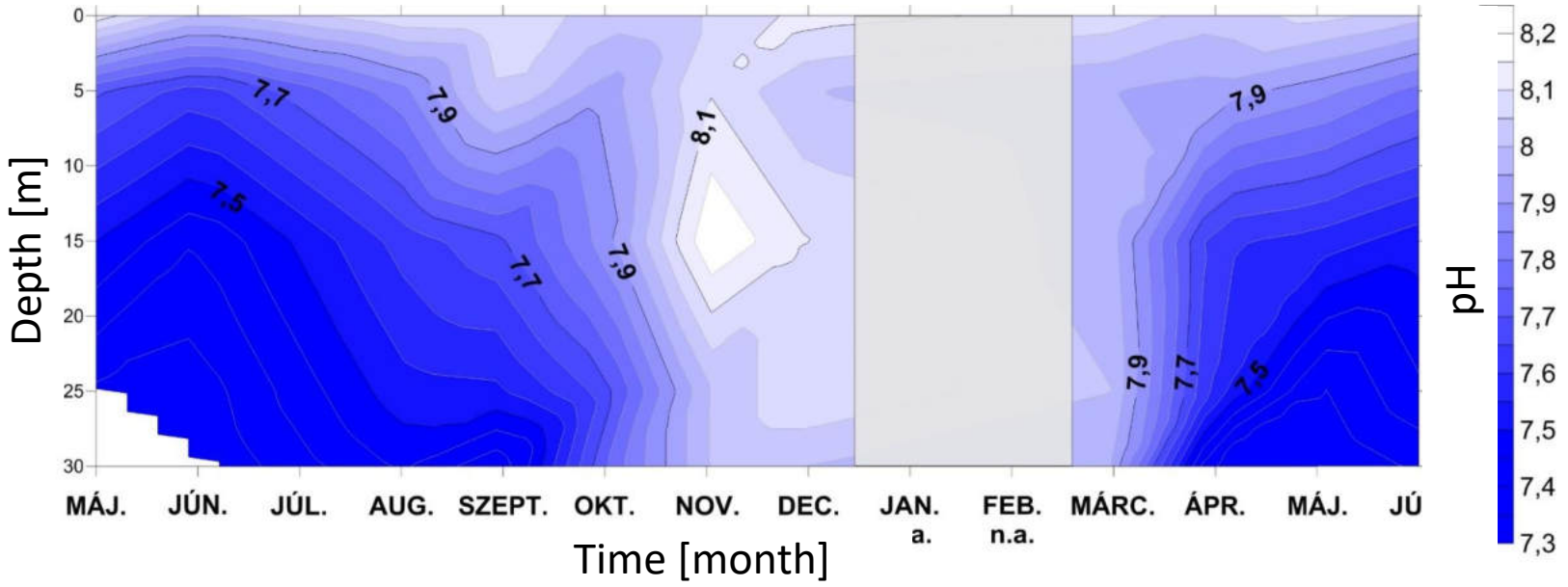

10 m
20 m
30 m
340300
340250
340200
340150
340100
340050
340000
339950
339900
767550
767600
767650
767700
767750
767800
767850
767900
767950
768000
768050

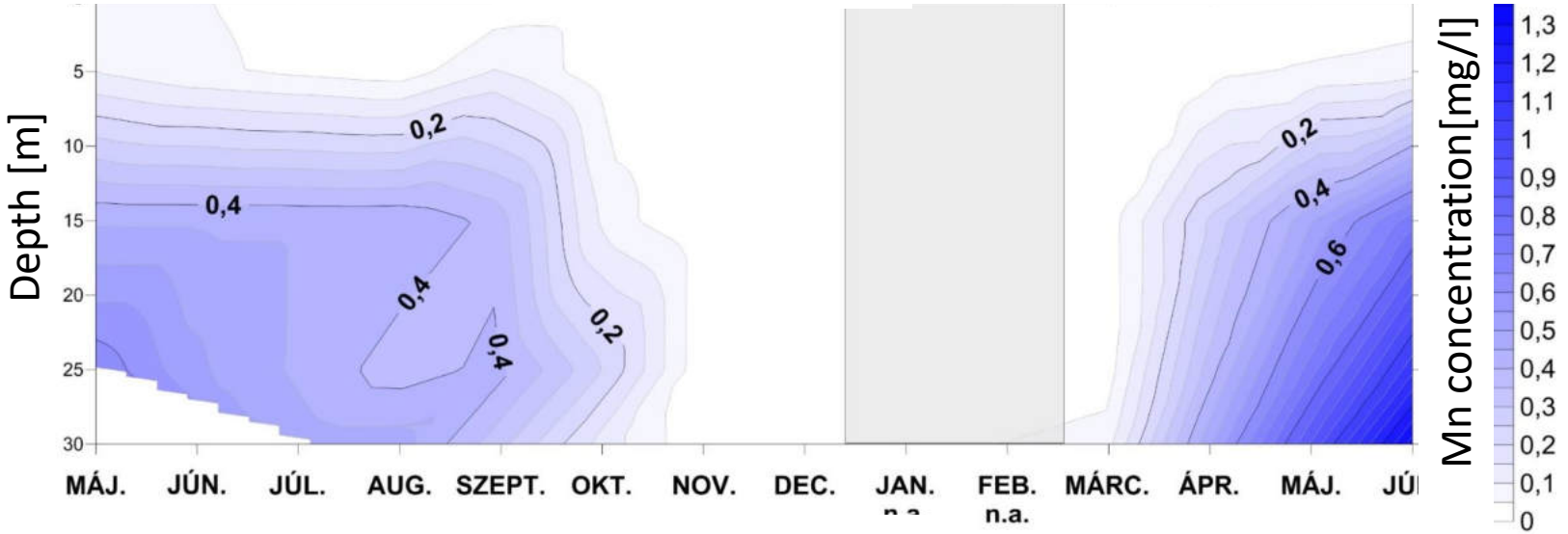

DO[%] blue
Depth [m]
Temperature
pH
ORP [mv]
DO[mg/l]
EC[mS/cm]
TDS[mg/l]


Depth [m]
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
280 320 360 400 440
Ca2+[mg·l-1]
480 520 560 600 640
Mg2+[mg·l-1]
9,5 10 10,5 11 11,5 12 12,5
Na+[mg·l-1]
5,5 6 6,5 7 7,5 8 8,5
K+[mg·l-1]
0 0,2 0,4 0,6 0,8 1
Fe2+[mg·l-1]
0 0,5 1 1,5 2 2,5
Mn2+[mg·l-1]

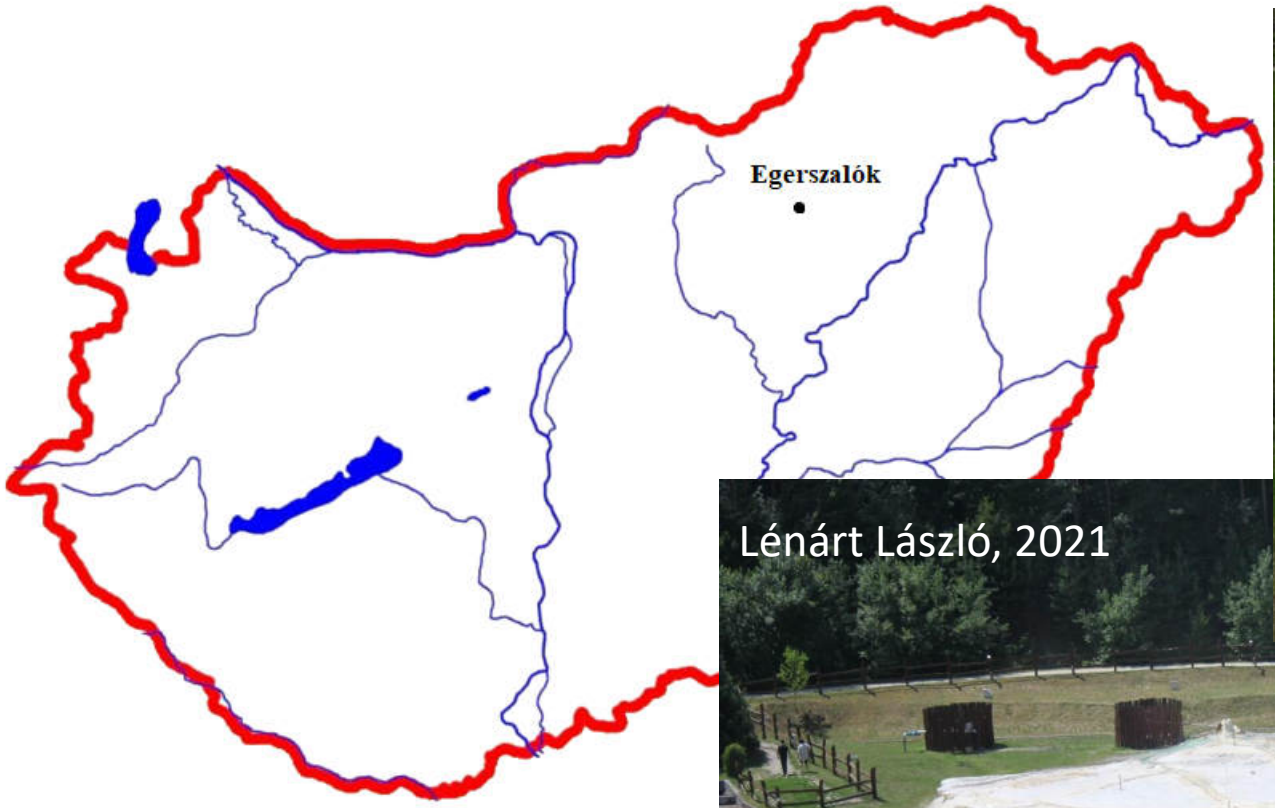

Fe(OH)+2
H2O= 1/2 O2 + 2H+ + 2e-
Fe(OH)3
Fe+2
FeCO3
Fe(OH)2
Fe
12 m
14 m
16 m
18 m
10 m
8 m
6 m
4 m
2 m
0 m
20 m
22 m
25 m
30 m
Eh [volt]
pH


MnO4-
MnO2
MnOOH
Mn3O4
Mn+2
MnCO3
Mn(OH)2
Mn(OH)3-
12 m
14 m
16 m
18 m
10 m
8 m
6 m
4 m
2 m
0 m
20 m
22 m
25 m
30 m
Eh [volt]
pH


Depth [m]
0
5
10
15
20
25
30
7,7
7,9
8,1
7,5
7,1
7,9
7,9
7,6
7,7
7,5
MÁJ.
JÚN.
JÚL.
AUG.
SZEPT.
OKT.
NOV.
DEC.
JAN.
a.
FEB.
n.a.
MÁRC.
ÁPR.
MÁJ.
JÚ
Time [month]
pH
8,2
8,1
8
7,9
7,8
7,7
7,6
7,5
7,4
7,3


Depth [m]
5
10
15
20
25
30
0,2
0,4
0,4
0,4
0,2
0,2
0,4
0,6
MÁJ.
JÚN.
JÚL.
AUG.
SZEPT.
OKT.
NOV.
DEC.
JAN.
FEB.
n.a.
MÁRC.
ÁPR.
MÁJ.
JÚ
Time [month]
Mn concentration[mg/l]
1,3
1,2
1,1
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0

Development of the lime tuff hill of Egerszalók


Egerszalók


Lénárt László, 2010


Lénárt László, 2021

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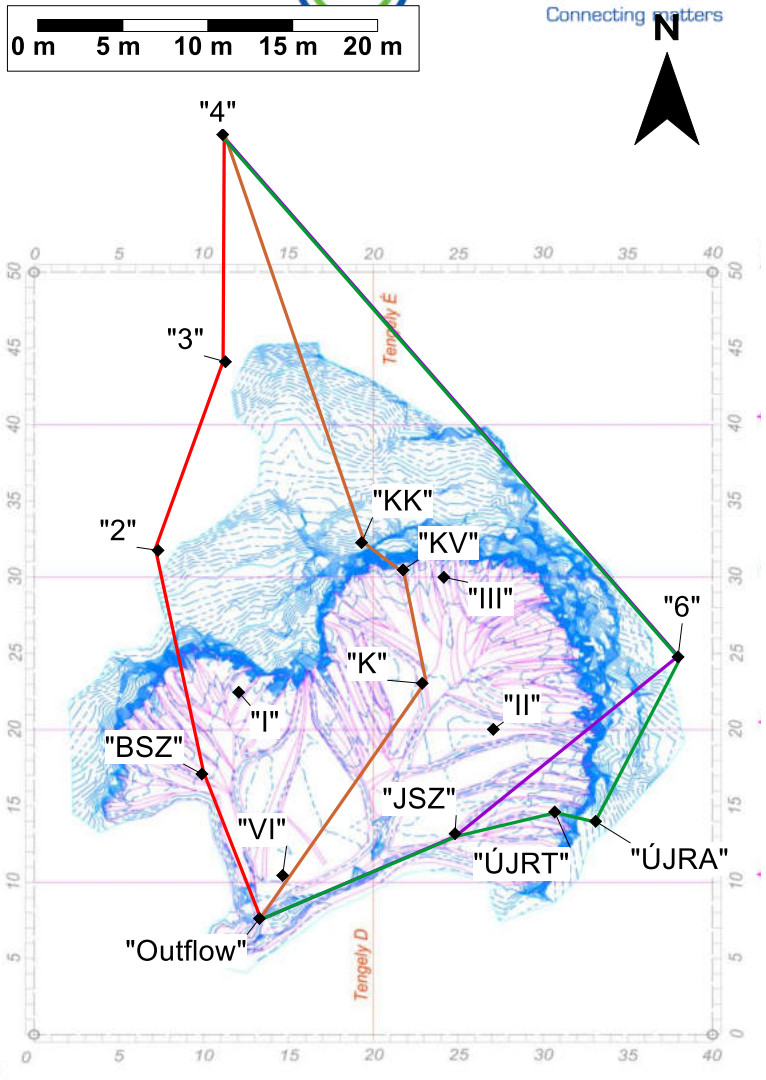
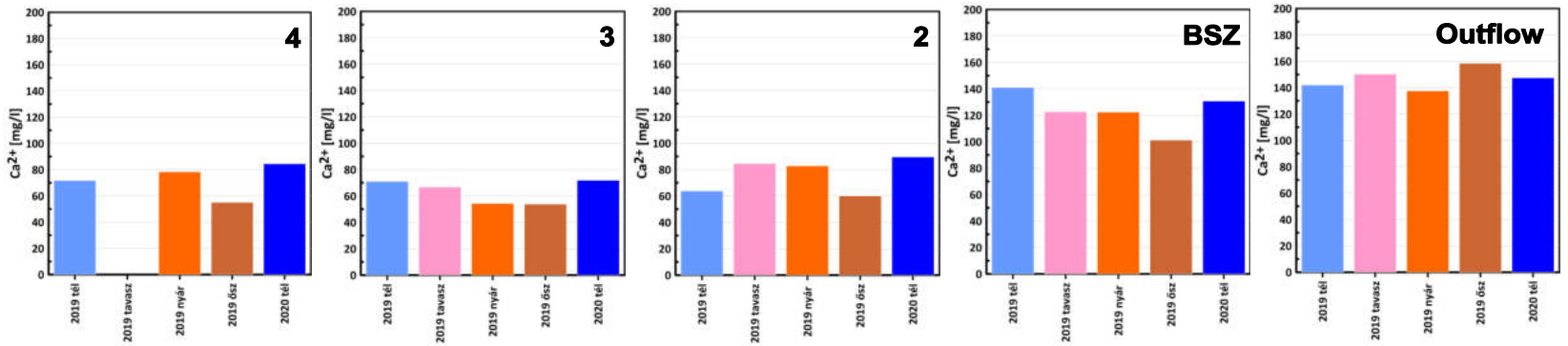
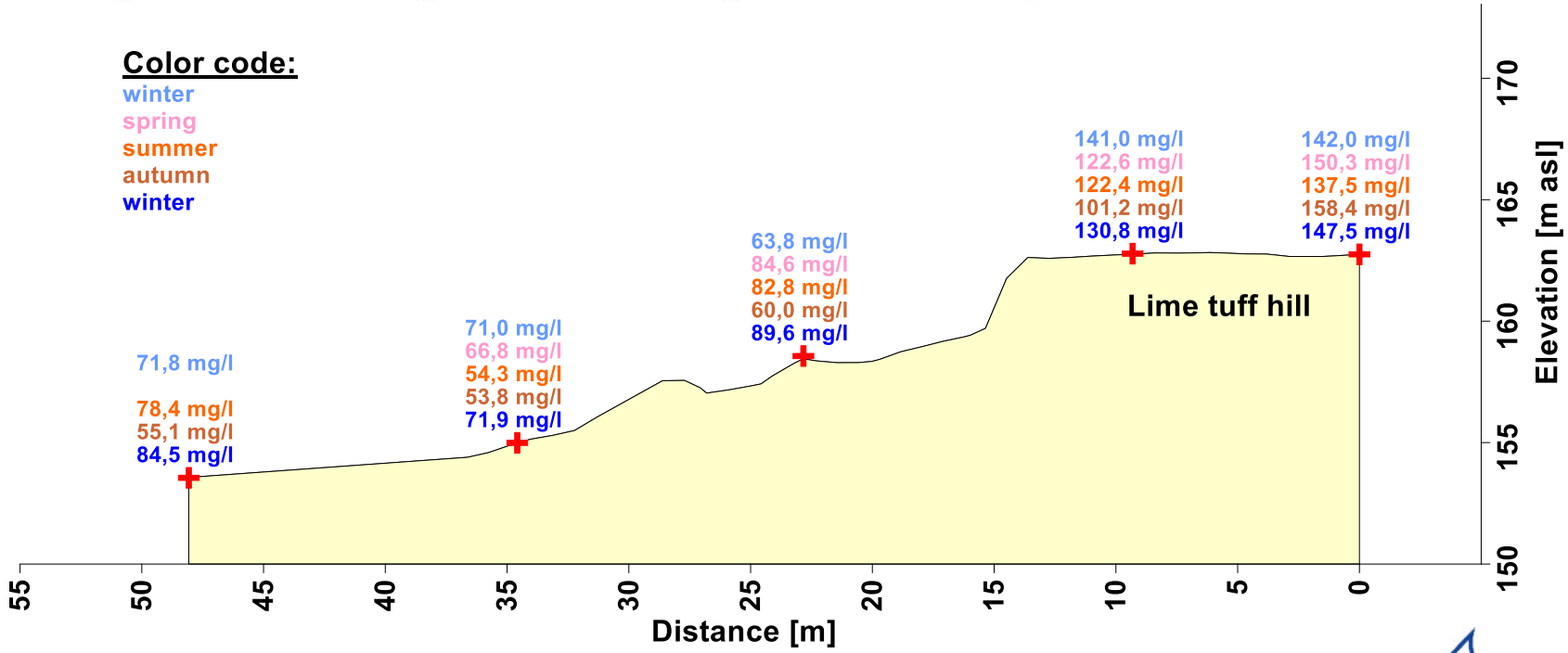


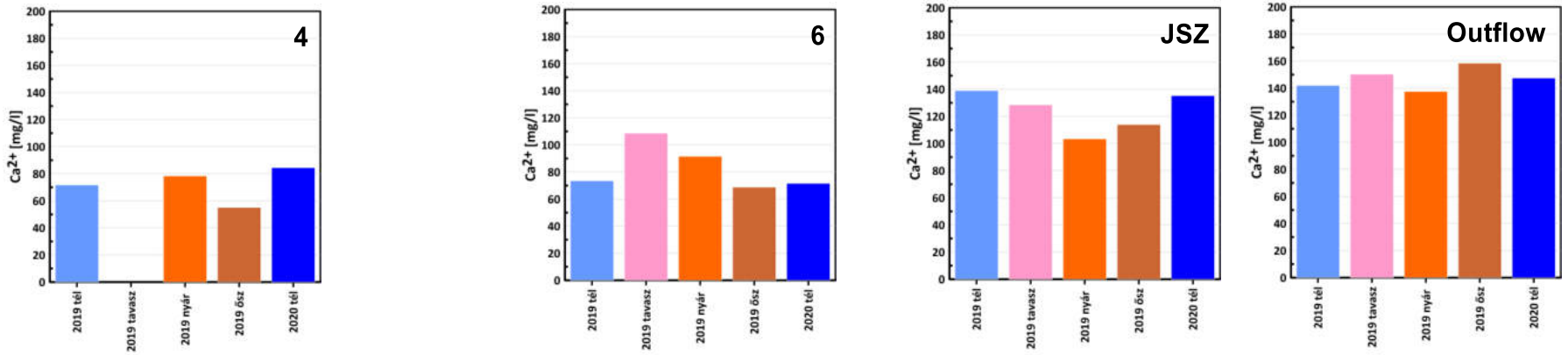
		Min	Max
pH	[-]	6.6	8.18
Temperature	[°C]	30	63.9
ORP	[mV]	-282.9	-8
EC	[µS/cm]	658	1272
Al	[mg/l]	0.0	2.9
B	[mg/l]	1.8	2.1
Ba	[mg/l]	0.0	1.0
Ca	[mg/l]	53.8	158.4
Cu	[mg/l]	0.0	0.1
Fe	[mg/l]	0.0	7.3
K	[mg/l]	7.8	43.6
Li	[mg/l]	0.2	0.3
Mg	[mg/l]	20.8	25.0
Mn	[mg/l]	0.0	0.5
Na	[mg/l]	49.8	68.2
Si	[mg/l]	17.2	24.7
Sr	[mg/l]	1.0	3.0
HCO_3^-	[mg/l]	291.5	677.1
Cl^-	[mg/l]	17.8	32.7
SO_4^{2-}	[mg/l]	70.0	105.0

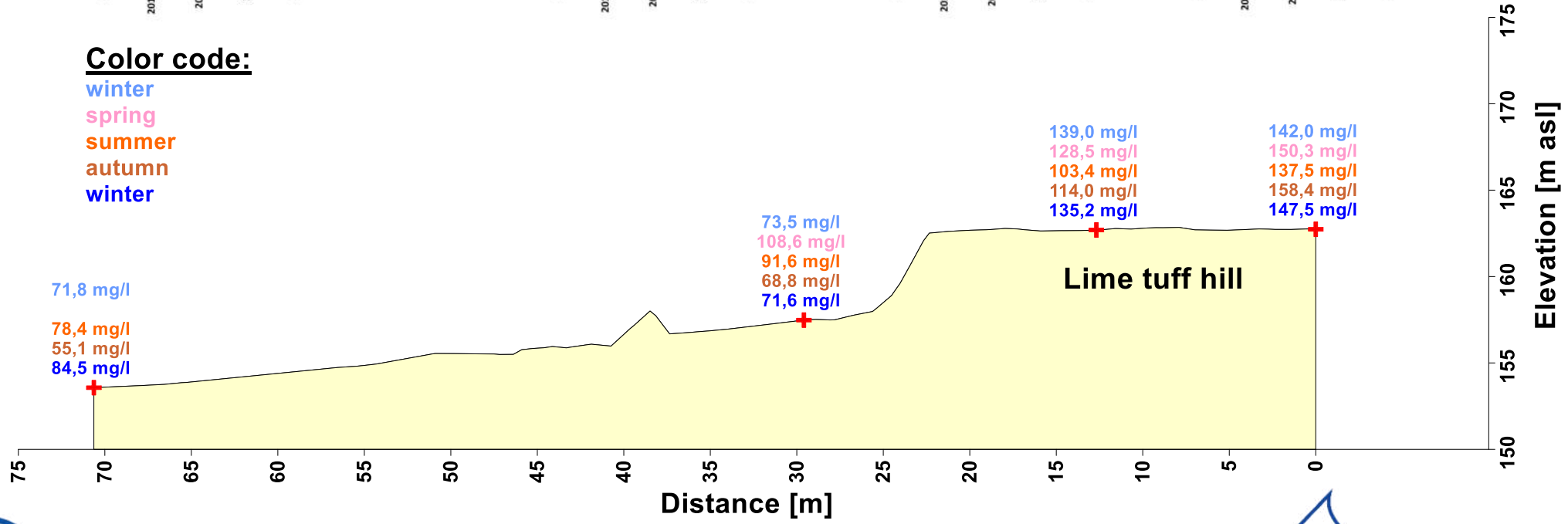
Change of calcium concentration along cross-section BSZ





Change of calcium concentration along cross-section JSZ





Thank you for your attention!

CA questions: