Aplikácia GIS a 3D geologického softvéru pri výskume ložísk

Application of GIS and 3D geological software in the research of mineral deposits

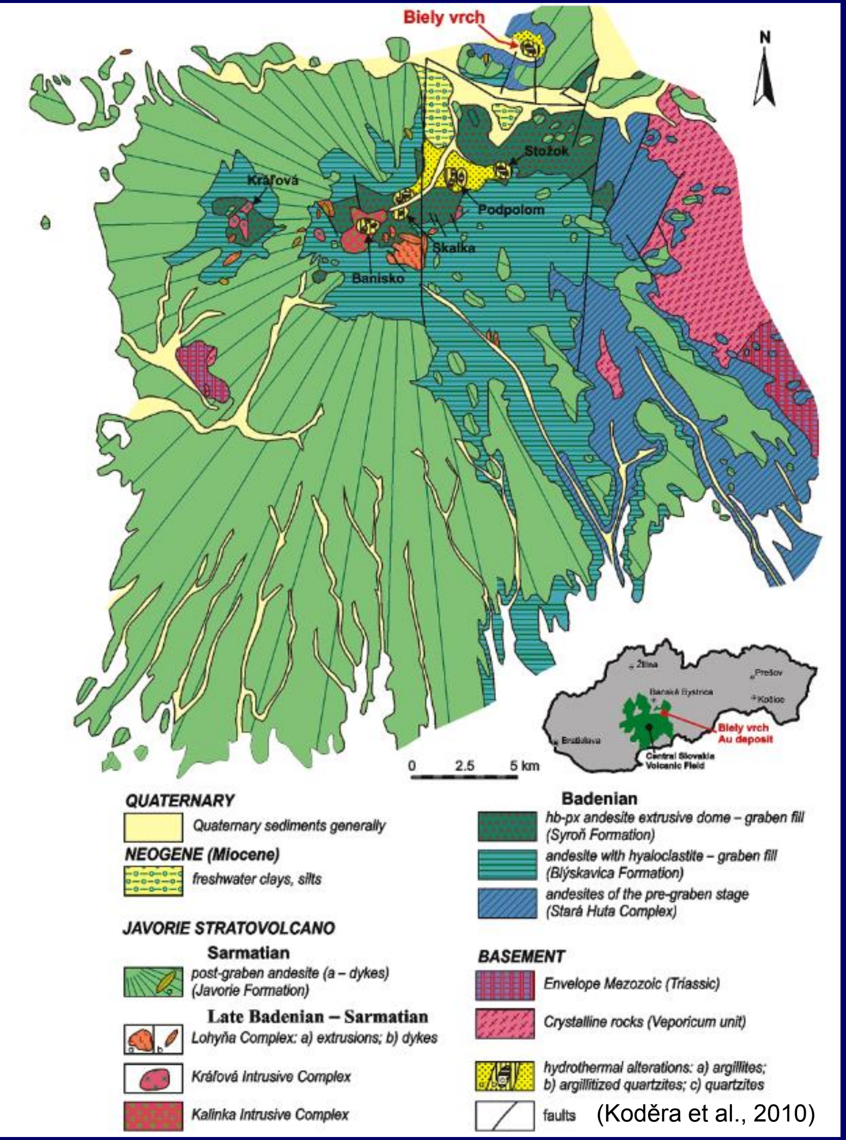
Jana Brčeková

current projects:

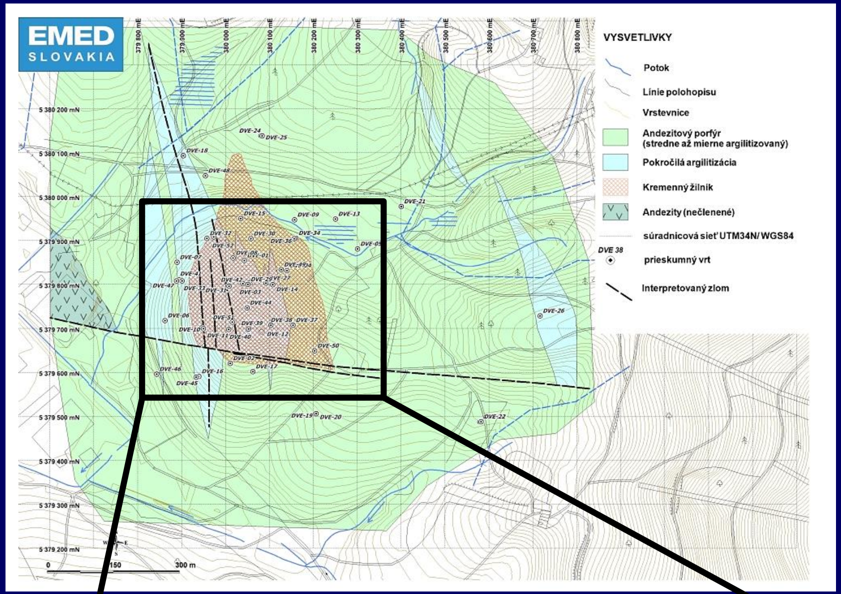
VEGA 1/0313/20 - investigator of the project (2020-2023, Principal investigator of the project is Prof. Peter Koděra, Phd.)
„Genesis of precious metal epithermal and porphyry mineralisations in the stratovolcanoes Štiavnica and Javorie".

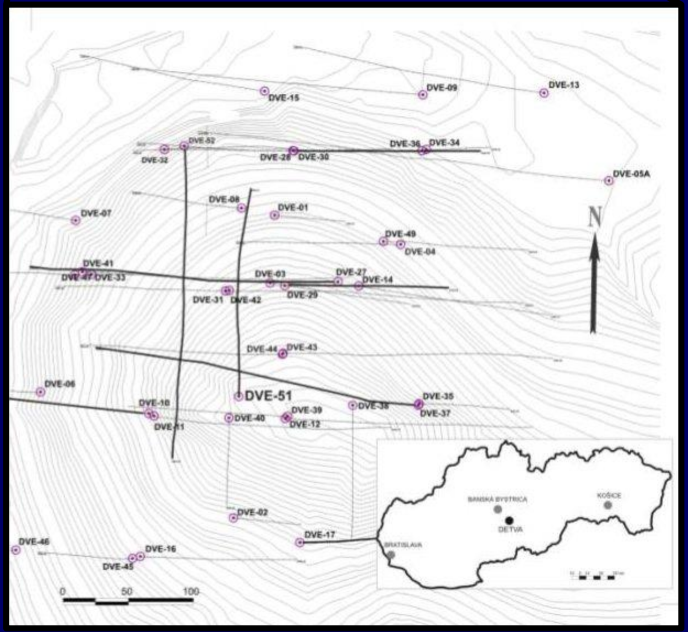
APVV-20-0175 - investigator of the project (2021 – 2025, Principal investigator of the project is Doc., Mgr. Peter Uhlík, PhD.)
„Bentonite: Slovak strategic raw material - Innovative assessment of bentonite quality and origin for its efficient use"

APVV grant - 0537-10 Au-porphyry systems deposit models in the Central Slovakia Neogene Volcanic Field and environmental a spects of their exploitation)



(Koděra et al., 2010)





Main goals of GIS and 3D modelling

3D modells

Ore mineralization (Au, Cu, Mo, Pb, Zn)

alterations (Al, Ca, Na, K, Mg, Fe, P, silicification/qtz veinlets)

Oxidation zone and potentional waste (S, As, Sb, Fe, pyrit)

Evaluation of potential secondary raw materials (clay raw material, building stone)

Dataset and data preparation

Databnase was provided by Emed Mining Slovakia

Contain 52 boreholes with sampling density 1 m (2 m for DVE-52)
(14482 drill core samples)

Geochemical data (36 chemical elements - AAS, ICP – ppm, pcnt)

Lithology, mineralogy and alterations (estimated intensity from 0 to 5)

3D modeling was supplemented by results of mineralogical research (XRD analysis and thin section observation).

Correlation analysis between ore grades, geochemical associations, chemical ratios and quantitative analysis of minerals was done for determining of threshold values of alteration boundaries.

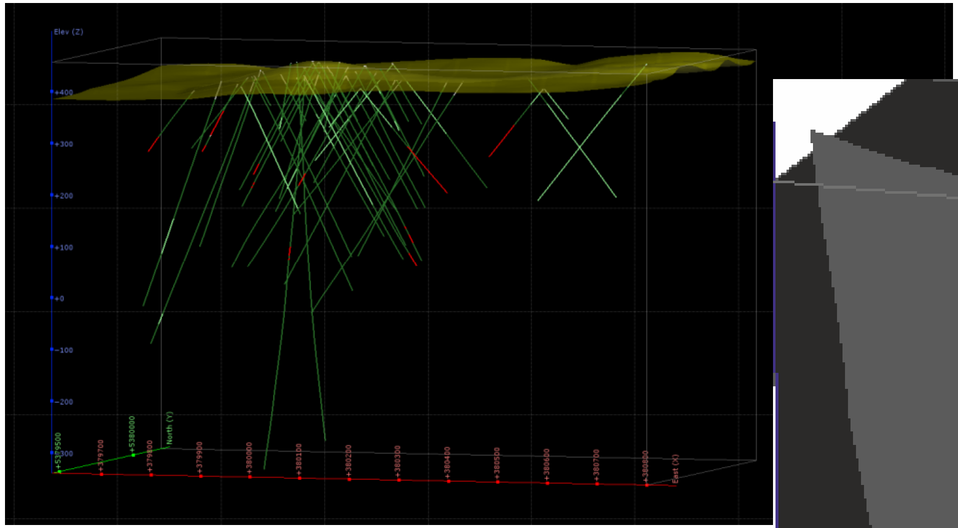
3D modelling was done using MapInfo Discover software, using
explicit domain (geology, quartz stockwork) modelling and Ordinary Kriging method for geochemistry modelling.

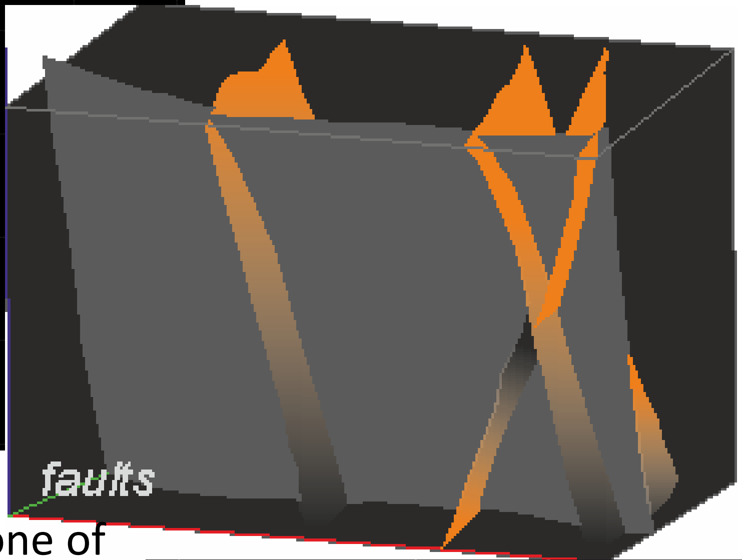
Alteration modelling was done using Voxel Calculator tool of Discover 3D software.
As the base of alteration modelling were used element grade distribution models and models of specific element rations typical for individual alteration types.

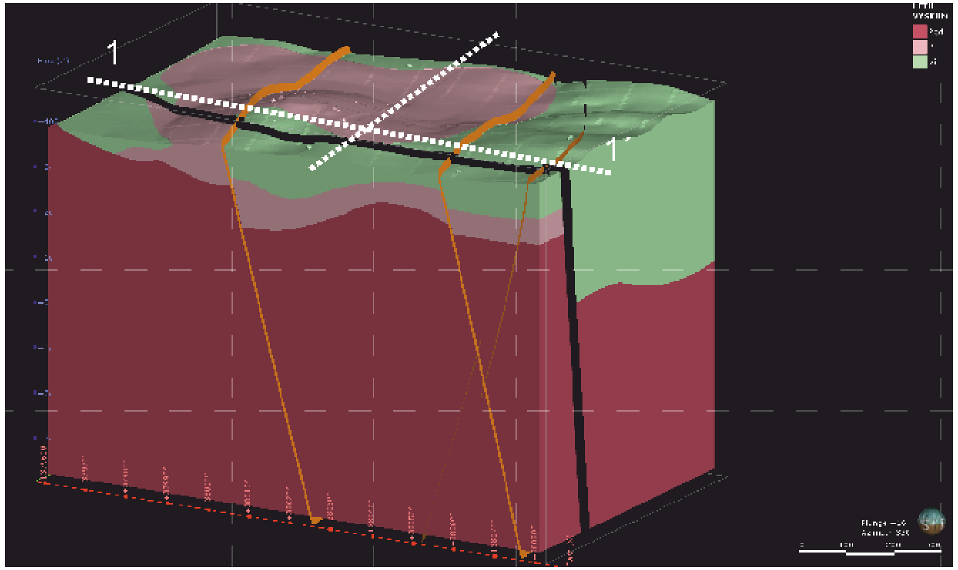
Calculator uses the grid names as arguments for the expressions.
To operate the calculator, building an expressions using the query syntax is necessary. For query syntaxes were used logical operators. Threshold values of input models were determined acording to results of geochemical modelling of alteration patterns.

Geological settings

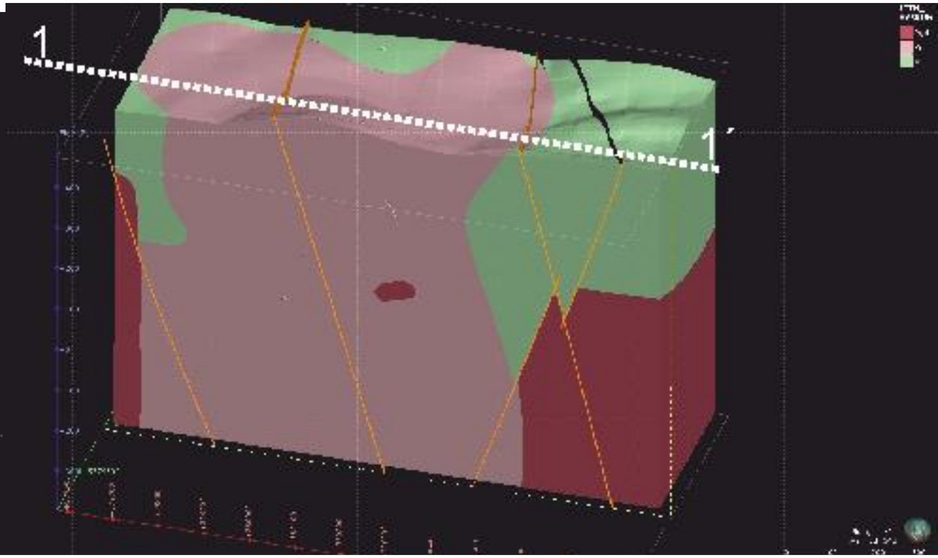
The 3D geology model was developed using the LeapfrogGeo modeling software.



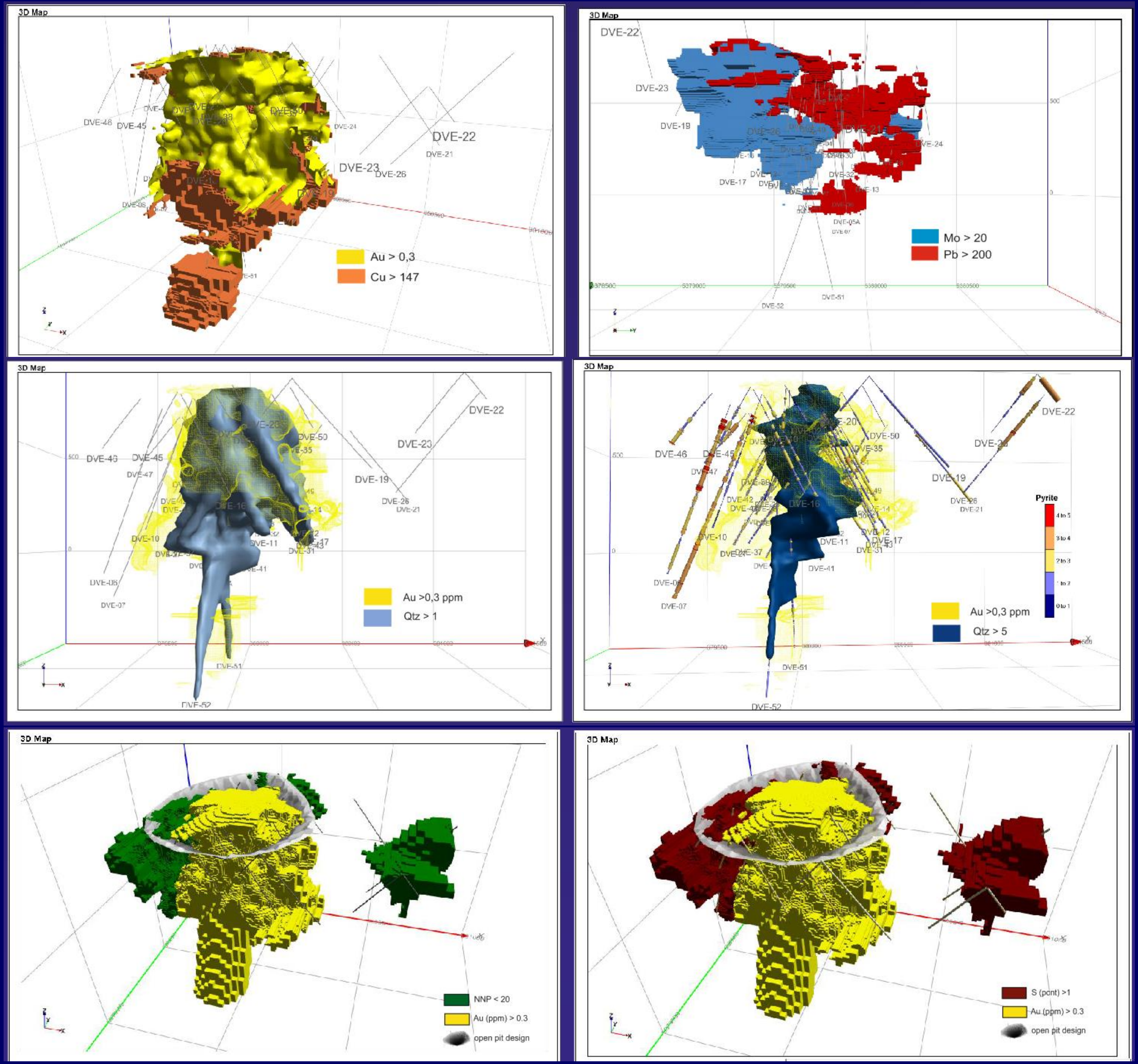




The deposit is located in the central zone of the Neogene Javorie stratovolcano, situated on the inner side of the Carpathian arc. Biely Vrch deposit and other Au-porphyry systems are centred on diorite to andesite porphyries emplaced into andesitic volcanic host rocks that rest on Hercynian basement (granodiorite, tonalite) found in blocks in some exploration holes (Fig.1). Post-mineralization andesite occurs S and E of the deposit (Koděra et al, 2009).



3D models of ore geochemistry – modelling based on geochemistry atributes



Mineralized zones with increased Au grades are accompanied by increased Cu and Pb grades within the central part of the porphyry system with advance argillic alteration (Figs. 2 and 3).

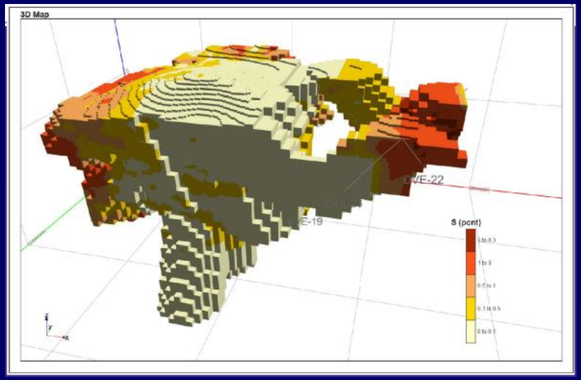
These anomalies coincide with zones of quartz veinlets with associated silicification.

The central zone contains at its margins several times lower concentrations of Au, Cu, Pb and Zn.

Furthermore, it is accessing the Mo concentrations above 10 ppm.

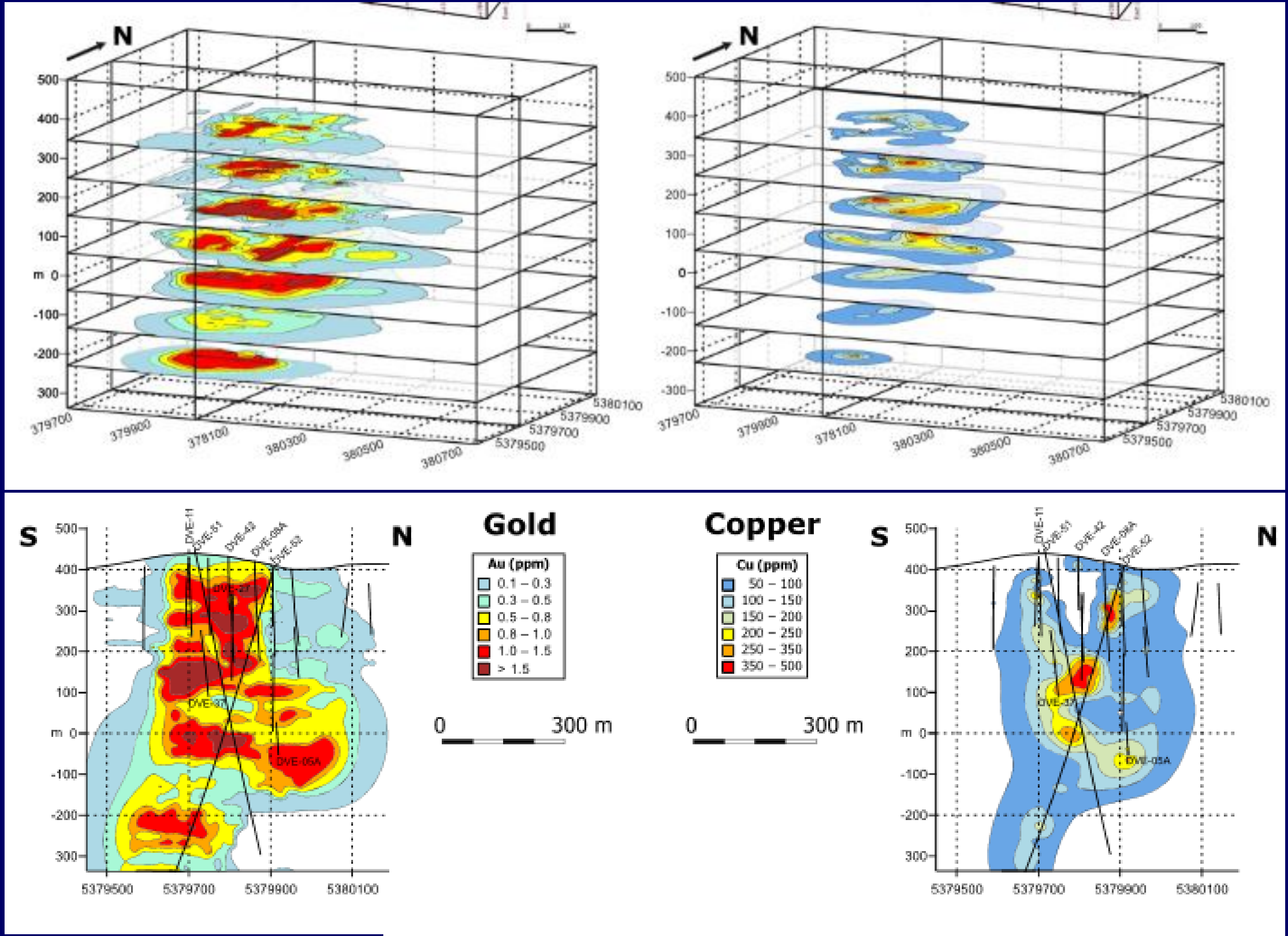
Areas of pyritization and pyrhotitization at the edge of the porphyry system are not mineralized.

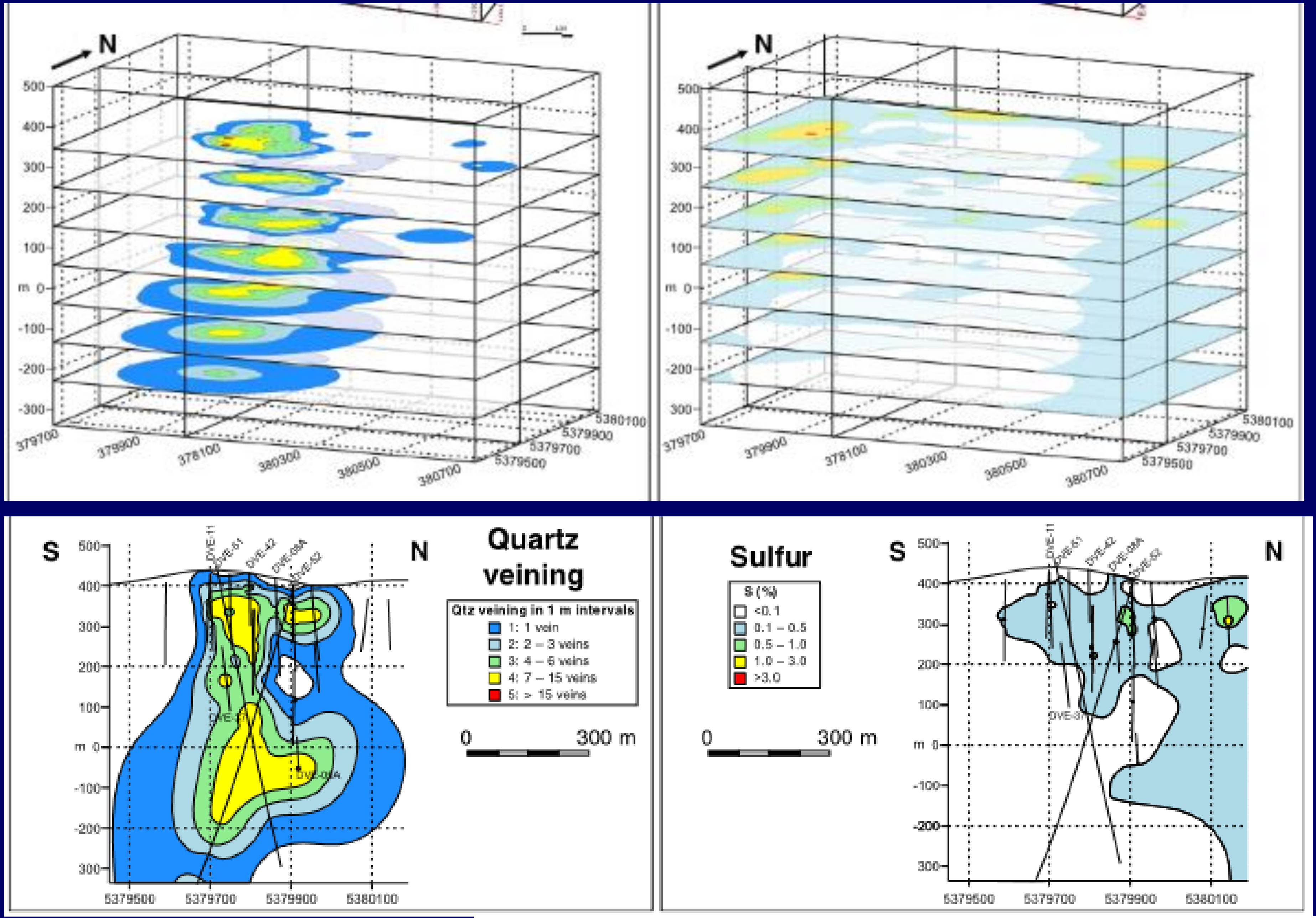
Central part of the system is typical for very low concentration of S (0 - 0,1 pcnt).



Distribution of the S correlates with areas of pyritization et the edge of the porphyry system.

NNP = neutralization potencia calculated from S contentl


N
N
S
N
Gold
Au (ppm)
0.1 – 0.3
0.3 – 0.5
0.5 – 0.8
0.8 – 1.0
1.0 – 1.5
> 1.5
0
300 m
Copper
Cu (ppm)
50 – 100
100 – 150
150 – 200
200 – 250
250 – 350
350 – 500
0
300 m
S
N
5379500
5379700
5379900
5380100


N
Quartz veining
Qtz veining in 1 m intervals
1: 1 vein
2: 2 – 3 veins
3: 4 – 6 veins
4: 7 – 15 veins
5: > 15 veins
0 300 m
S
N
Sulfur
S (%)
<0.1
0.1 – 0.5
0.5 – 1.0
1.0 – 3.0
>3.0

3D models of alterations – mineralogical criteria

Mineralogical characterization of studied samples was realized by XRD analysis of clay fraction and random specimens using RockJock software

AA	Advanced argillic (kaolinite, dickite, pyrophyllite ± APS min., pyrite)
IA	Intermediate argillic (illite, illite-smectite ± chlorite, smectite, pyrite)
Ca LT	Calcic - low temperature type with pseudobreccia texture (calcite ± zeolite, corrensite, smectite)

Early alteration patterns

Ca	Ca-silicate (plagioclase, amphibole, magnetite ± pyroxene)
K	K-silicate (biotite, K-feldspar, magnetite)
K+Ca	K-silicate + Ca-Na-silicate (biotite, K-feldspar, magnetite, Ca-plagioclase, amphibole)
Chl	Chloritic (chlorite, smectite ± pyrite)

Samples for quantitative analysis were milled in a McCrone Micronizing Mill with internal standard Al_2O_3 < 20 µm size. The XRD data were converted into wt. % minerals using the RockJock software.

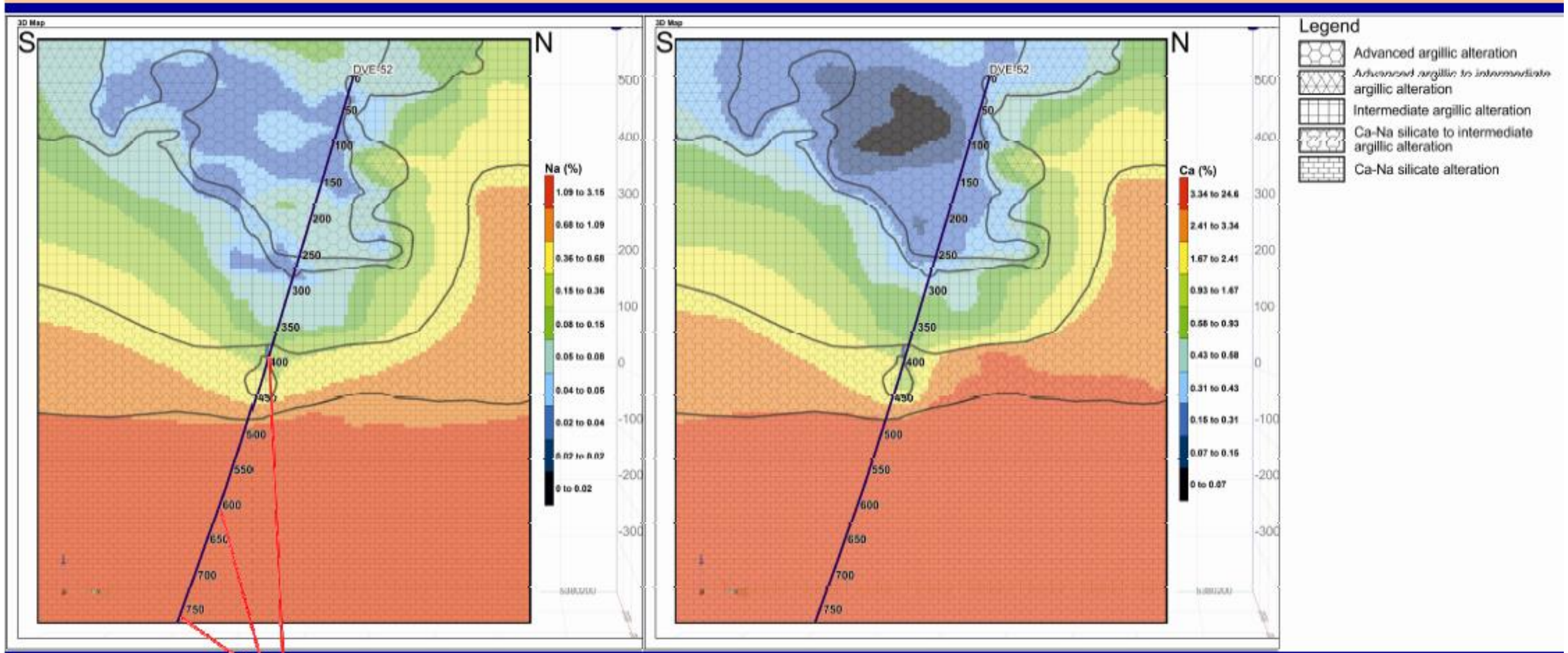
Vybrané vzorky z vrtov: v smere

Z-V, V-Z DVE-10, DVE-29

S-J, J-S DVE-51, DVE-52

Position in the graph	Alteration type	Intensity	Average content (wt. %)							
			Chlorite	C/S	Illite + I/S	smectite	Kaolinite	Pyrophyllite	Dickite	APS min
1	Intermediate arg. (Chlorite + C/S + smectite)	Low	4,1	0	0,7	3	0	0	0	0
2	Intermediate arg. (Chlorite + C/S + smectite)	High	6,1	3,4	4,4	4,4	0	0	0	0
3	Intermediate arg. (Illite + I/S + smectite + Chl)	Low	9,6	0,5	8,6	6,4	0,9	0	0	0
4	Intermediate arg. (Illite + I/S + smectite + Chl)	High	10,7	0,3	17,1	3,3	1,6	0,4	0,2	0
5	Advanced argillic (AA)	Low or none	10,4	0,3	14,1	4,5	1,4	0,3	0,1	0
6	Advanced argillic (AA)	Medium	3,1	0	15	4,1	20	2,6	1	0,4
7	Advanced argillic (AA)	High	0	0	0,6	0	35,3	5,3	3,3	0,6

Rez 52



774 m
kremeň 24,8%
chlorit 2,5%
K-živec 1,5%
biotit 18,4%
magnetit 3,5%
plagioklas 46,6%
ostatné 2,7%

ostatné 1,4%

Ca-Na silikátová premena

Na plagioklas $NaAlSi_3O_8$

Ca plagioklas $CaAl_2Si_2O_8$

Aktinolit $Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$

Magnetit Fe_3O_4

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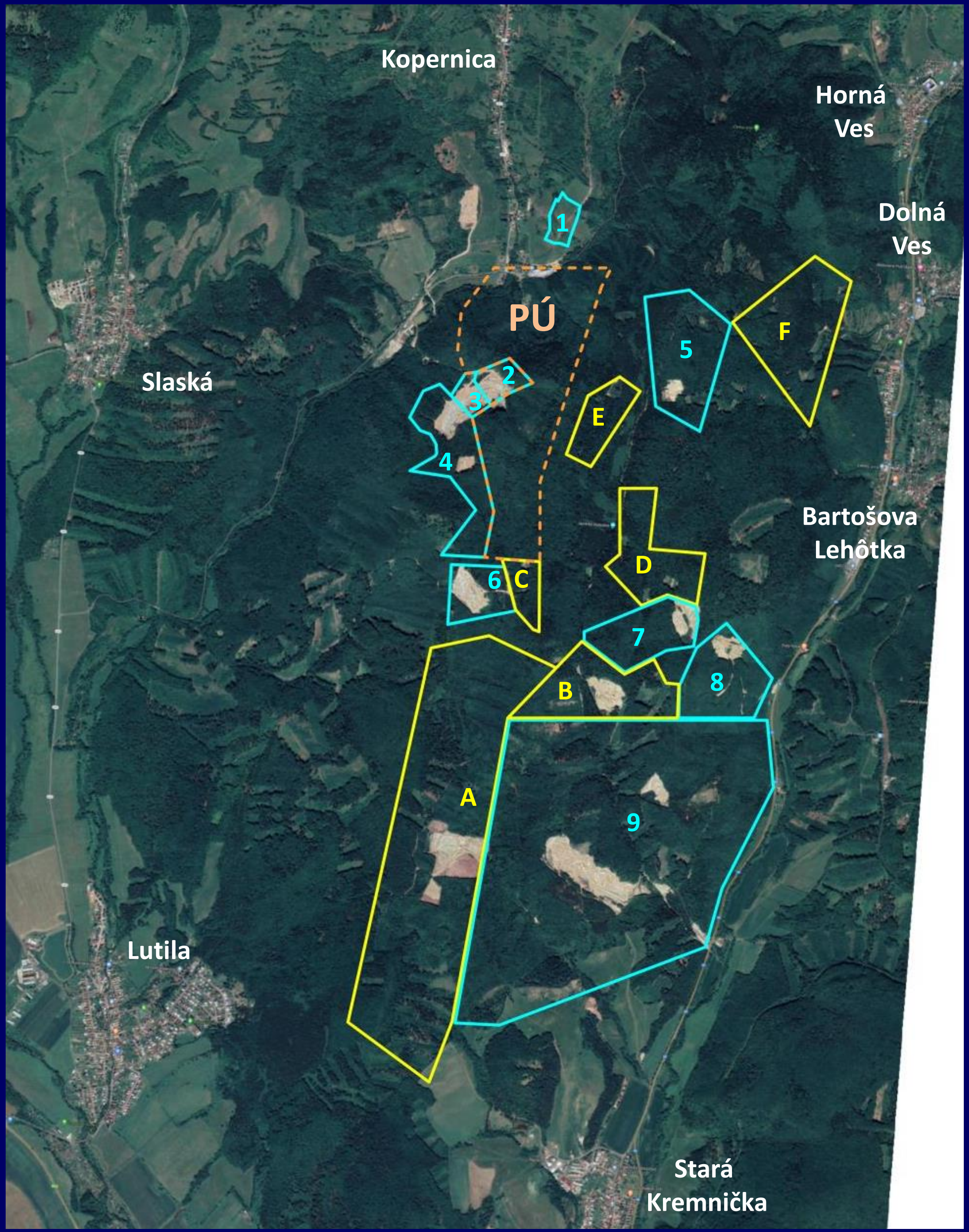
The project will include modeling of the deposit in the geographic information system (GIS), which will take place throughout its duration.

the project in cooperation with the REGOS company



In 2014, 11 exploration areas with a total area of 39.41 km2 were allocated to several organizations in the area of interest, which were intended for prospecting and deposit exploration of bentonite and ceramic clays, or kaolin and zeolites. REGOS s.r.o. of this number was allocated 3 survey areas with a total area of 17.36 km2.

REGOS s.r.o. has 6 mining areas with a total area of 3.82 km2.

REGOS – bentonite

A – DP Lutila I
B – DP Stará Kremnička III
C – DP Lutila II
D – DP Bartošova Lehôtka II
E – DP Kopernica V
F – DP Dolná Ves

(zdroj: M. Pereszlény) REGOS

Overall, the company REGOS s., R., O. has data from 360 exploration drillholes.

E.g. areas of the Lutila I. deposit, detailed positional and spatial data on the 90th exploration drillholes, which are 20 to 50 m deep and sampled at 2 m depth intervals, are available for modeling.

Detailed drillcore documentation contains a lot of data:

from geological documentation,

bentonite granularity,

bentonite types present,

presence of late water

and data on geochemical analyzes of drill core samples.

During the project, a series of analyzes will be performed on core samples at selected depth intervals of drillholes with regard to the purposes of 3D modeling of the selected deposit and at the same time to provide sufficient characteristics of identified types of bentonite at other deposits of the customer.

Goals of GIS and 3D modeling

The overall goal of modeling will be to create a

3D conceptual model that will include –

3D models of subsurface geology situation of deposite,

geochemical and physical parameters of the deposit.

A lithological model will be created using data:

from borehole documentation,

point samples,

as well as from 2D maps and sections, drawn on the basis of older and new geological documentation, which will be digitized and georeferenced in 3D space.

The modeling methodology can be summarized into a several main steps:

data collection,

georeferencing and digitization of data in a valid coordinate system and appropriate scale

creation of a complex structured relational database,

creation of 3D models and the resulting 3D visualization of models.

QGIS software will be used for data processing in 2D space.

3D modeling will be performed on the basis of analysis and synthesis of information using specialized geological GIS software (eg Leapfrog Geo, MapInfo-Discover 3D, KLG PRIF UK)

with the possibility of conversion into an interchangeable format, importable into programs used by

Current state

data collection and preparation

MapInfo - Discover 2013 Opus

Dopĺňajú sa tabuľky o obah vody, zrnitosť ..

lutila_collar Browser

holeID	X	Y	elevation	depth
V7	-438 812,27	-1 239 002,49	447,83	33
VZ60	-438 939,5	-1 240 479,19	387,18	52,6
VZ61	-439 041,42	-1 240 411,24	397,91	57,2
ZKV34	-438 535,1	-1 238 290,35	468,66	14,5
ZKV42	-438 705,6	-1 239 293,42	441,75	10
VLI1	-438 740,06	-1 238 936,9	436,49	26
VLI10	-438 976,93	-1 238 775,17	481,42	7,3
VLI10A	-438 998,35	-1 238 794,97	482,34	28
VLI11	-439 017,84	-1 238 872,31	479,65	10
VLI12	-438 724,66	-1 238 809,49	436,35	12
VLI13	-438 810,71	-1 238 806,44	444,35	26,5
VLI14	-438 586,47	-1 238 997,18	426,11	22
VLI15	-438 831,67	-1 238 508,54	481,86	20
VLI16	-438 649,86	-1 238 295,03	475,73	20
VLI17	-438 844,41	-1 238 903,1	445,64	42
VLI2	-438 739,59	-1 238 848,38	434,62	14
VLI18	-438 883,67	-1 238 860,3	459,93	28
VLI19	-438 875,65	-1 238 808,94	462,61	37
VLI20	-438 809,02	-1 238 953,55	446,29	42
VLI21	-438 808,55	-1 238 918,15	438,6	28
VLI22	-439 015,03	-1 239 036,05	467,18	20
VLI23	-438 901,66	-1 239 063,25	452,45	20
VLI24	-438 708,77	-1 238 974,38	445,5	42
VLI25	-438 654,07	-1 238 983,92	441,75	33
VLI26	-438 888,71	-1 238 926,98	458,05	23
VLI27	-438 921,37	-1 238 912,53	463,83	14
VLI28	-438 754,63	-1 238 375,53	475,73	20
VLI29	-438 915,37	-1 238 725,75	478,32	13
VLI3	-438 652,5	-1 238 851,01	432,12	14
VLI30	-438 921,6	-1 238 876,43	466,68	13,5
VLI31	-438 915,83	-1 238 845,55	468,1	14
VLI32	-438 908,35	-1 238 812,78	470,08	23
VLI33	-438 814,84	-1 238 980,72	446,62	43
VLI34	-438 780,14	-1 238 985,54	444,99	37
VLI35	-438 840,6	-1 238 955,44	455,51	32
VLI36	-438 865,38	-1 238 957,78	453,11	18
VLI37	-438 876,58	-1 238 988,14	454,5	27
VLI38	-438 887,03	-1 239 025,58	454,13	19
VLI39	-438 857,35	-1 239 059,12	450,51	17
VLI4	-438 599,23	-1 238 870,94	432,41	15,8
VLI40	-438 829,07	-1 238 847,12	445,69	35
VLI41	-438 742,9	-1 238 893,58	431,2	16

lutila_survey Browser

Hole_ID	depth	dip	azimuth
V6	20	90	0
V7	33	90	0
VZ60	52,6	90	0
VZ61	57,2	90	0
ZKV34	14,5	90	0
ZKV42	10	90	0
VLI1	26	90	0
VLI10	7,3	90	0
VLI10A	28	90	0
VLI11	10	90	0
VLI12	12	90	0
VLI13	26,5	90	0
VLI14	22	90	0
VLI15	20	90	0
VLI16	20	90	0
VLI17	42	90	0
VLI2	14	90	0
VLI18	28	90	0
VLI19	37	90	0
VLI20	42	90	0
VLI21	28	90	0
VLI22	20	90	0
VLI23	20	90	0
VLI24	42	90	0
VLI25	33	90	0
VLI26	23	90	0

MM_lutila_copy Browser

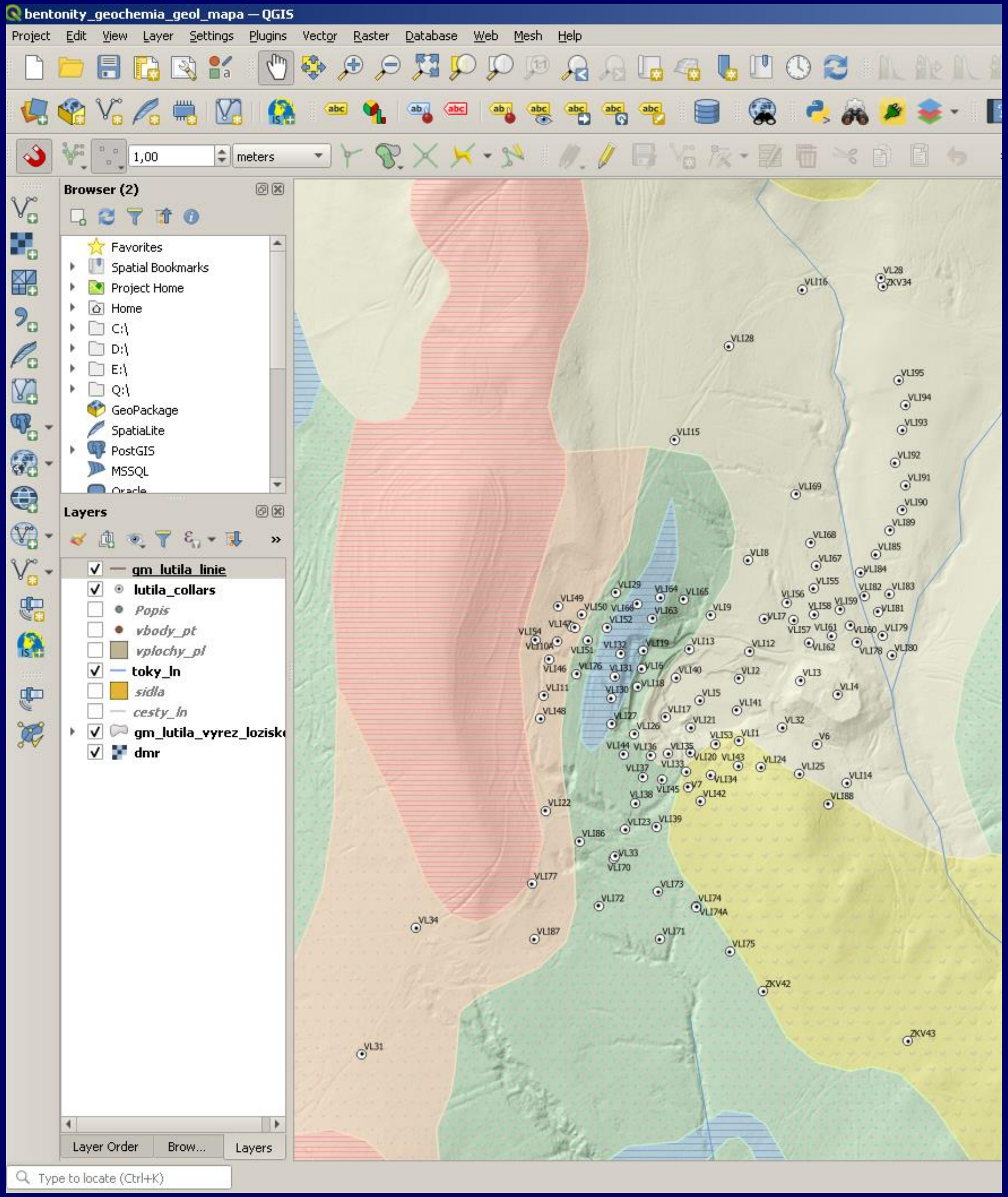
Hole_ID	From_	To	Thickness	MM	LK	G	H
V6	0	1	1	0	D		
V6	1	1,6	0,6	10,2	D		
V6	1,6	3,1	1,5	8,1	D		
V6	3,1	3,7	0,6	23,2	D		
V6	3,7	6	2,3	65	B		
V6	6	8	2	72,2	A		
V6	8	10	2	73	A		
V6	10	12	2	74,3	A		
V6	12	14	2	71,3	A		
V6	14	16	2	77,7	A		
V6	16	17	1	23,3	D		
V6	17	17,8	0,8	8,1	D		
V6	17,8	20	2,2	2	D		
V7	0	2,4	2,4	0	D		
V7	2,4	7	4,6	55,9	B		
V7	7	8,5	1,5	36,4	D		
V7	8,5	15	6,5	32	D		
V7	15	17,5	2,5	30	D		
V7	17,5	33	15,5	0	D		
VL28	0	0,2	2	0	D		
VL28	0,2	1	1,8	0	D		
VL28	1	1,9	4,4	0	D		
VL28	1,9	8	2,2	0	D		
VL31	0	0,5	0,5	0	D		
VL31	0,5	1,2	0,7	0	D		
VL31	1,2	2,7	1,5	0	D		
VL31	2,7	2,8	0,1	0	D		
VL31	2,8	4,3	1,5	0	D		
VL31	4,3	4,5	0,2	0	D		
VL31	4,5	4,7	0,2	0	D		
VL31	4,7	5,3	0,6	0	D		
VL31	5,3	7	1,7	0	D		
VL31	7	8	1	0	D		

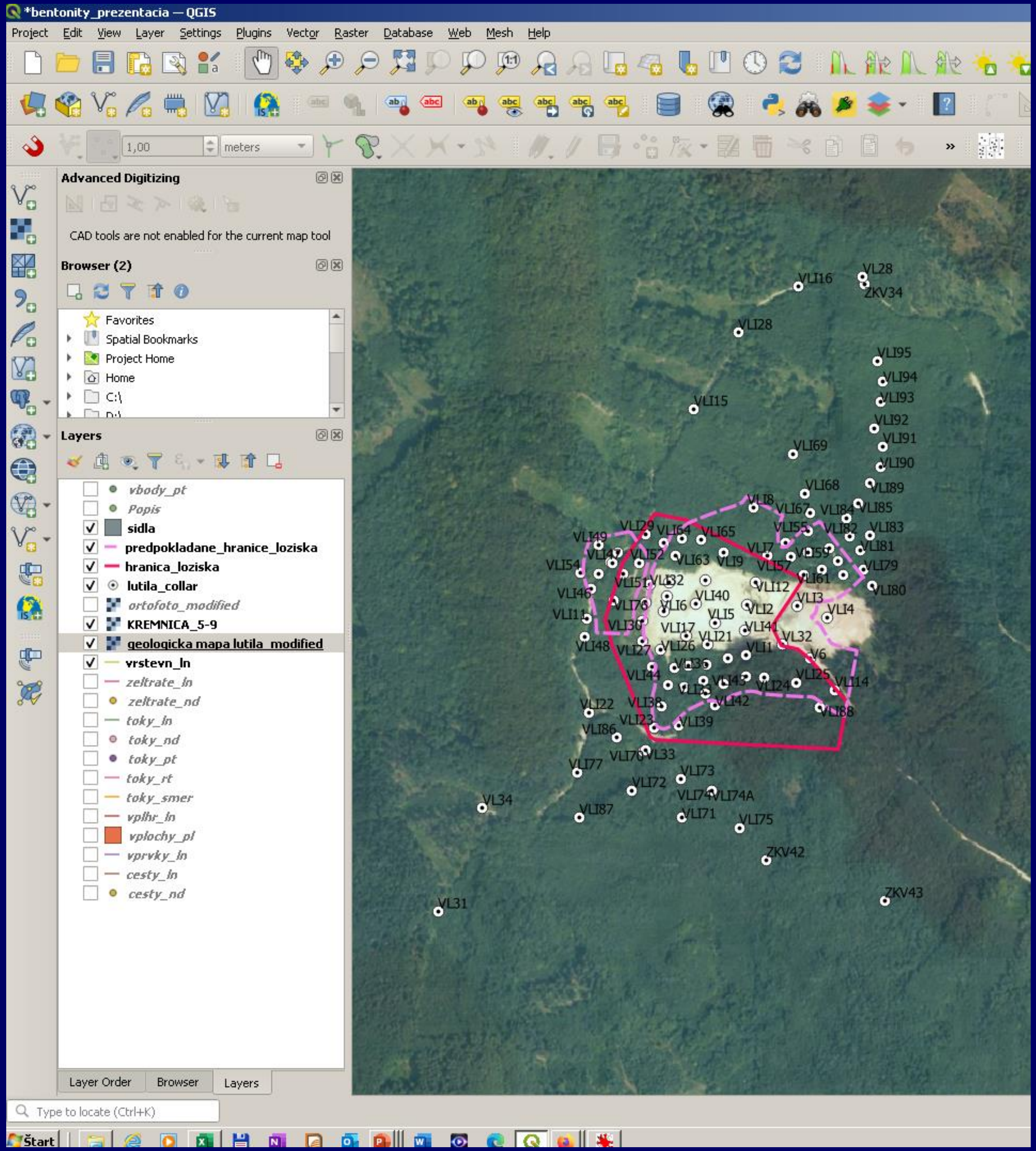
lithology_lutilaB Browser

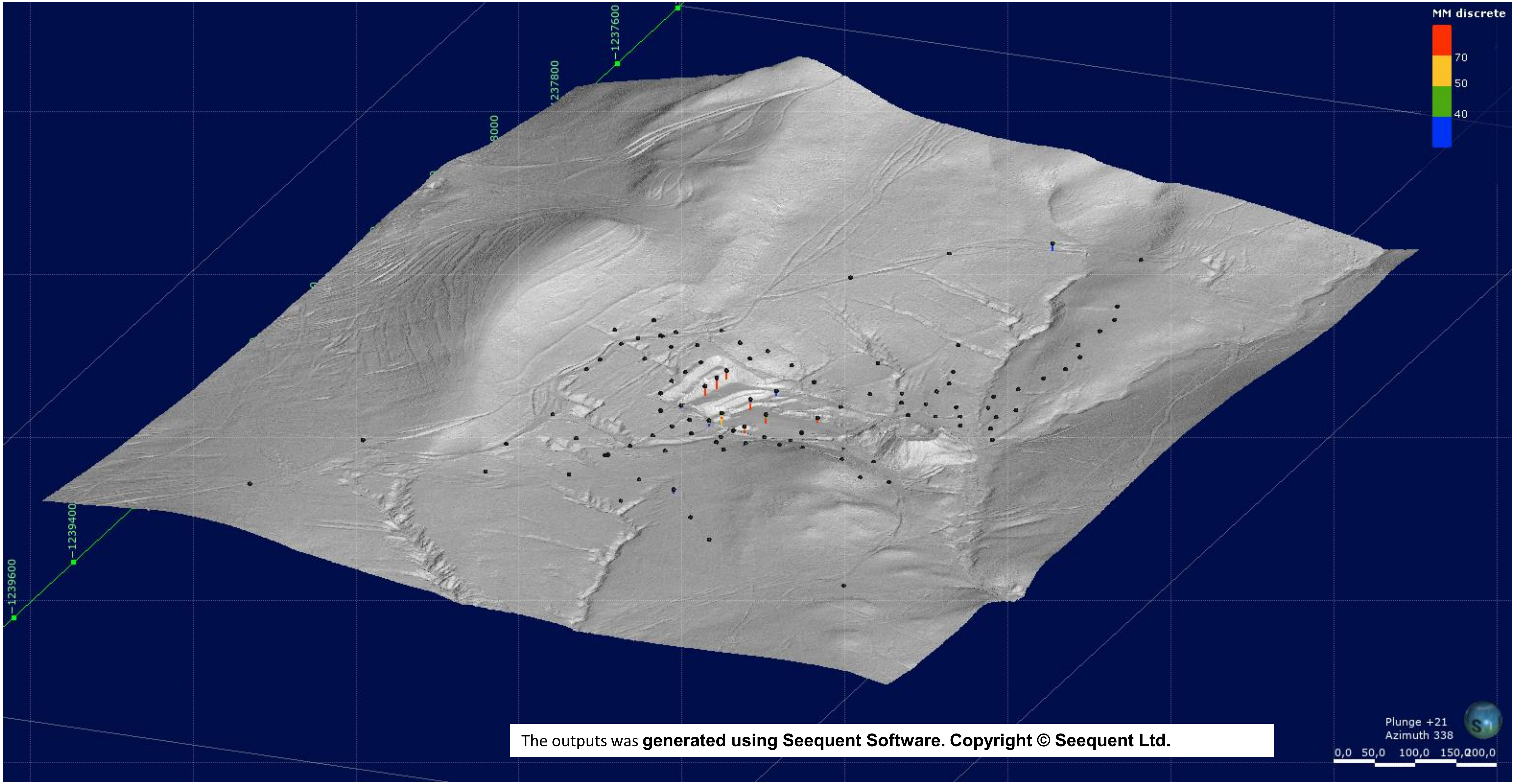
holeID	From	To	litholog	comment
VLI95	21,7	23		- svetlosivý, ružovkastý až hnedý, piesčitý, rozpadavý slabo spevnený tuf s úlomkami fialového ryolitu do 3 cm
VLI95	23	24		- hrdzavohnedý tufitický íl
VLI95	24	25,5		- červenohnedý, hrudkovitý, mierne plastický tufitický íl, miestami s úlomkami sivého nerozloženého ryolitu do 3
VLI95	25,5	27,3		- tmavohnedý tufitický íl s polohami sivého piesčitého ílu a úlomkami sivého ryolitu do 5 cm, miestami úlomky až
VLI95	27,3	30,5		- červenohnedý mierne piesčitý tufitický íl
VLI95	30,5	34		- sivý, sivomodrý hrudkovitý bentonit
VLI95	34	35		- tmavozelený piesčitý bentonitizovaný tuf
VLI95	35	38,5		- sivozelenkavý, sivohnedý piesčitý tuf, slabo rozložený s úlomkami sivého ryolitu a pevného tufu do 3 cm
VLI95	38,5	39,3		- bentonitizovaný sivý tuf
VLI95	39,3	40		- fialový nerozložený ryolit
V6	0	0,1		čiernohnedý lesný humus
V6	0,1	1,6		sutina, v 0,10 – 1,00 m hlinito kamenistá drobno až hrubo úlomkovitá s úlomkami ryolitu do 5 cm, v 1,00 – 1,60
V6	1,6	2,3		svetlosivý piesčitý bentonit
V6	2,3	2,9		svetlosivý hrubo piesčitý bentonit
V6	2,9	3,1		svetlosivý jemne piesčitý bentonit
V6	3,1	3,7		svetlohnedý bentonit, v 3,10 – 3,30 m jemne piesčitý, v 3,30 – 3,70 m hrubo piesčitý, V 3,70 m valún sivo zelen
V6	3,7	6		svetlohnedý mastný bentonit s veľmi hojnými bielymi škvrnami (leopardia či mačacia farebná textúra), miestami
V6	6	12,8		bielosivý stredne zrnný bentonit, v 6,50 – 6,70 m s reliktom menej bentonitizovaného ryolitu, V 8,00 – 8,30
V6	12,8	13,6		bielosivý hrubo zrnný bentonit
V6	13,6	14		svetlo žltkavo bielosivý stredne zrnný bentonit so svetlosivo zelenkavými subhorizontálnymi vrstvičkami jemne z
V6	14	16		svetlo žltkavý až svetloružový hrubozrnný bentonit v 15,00 – 15,70 m so svetlosivo zelenkavými sub horizontáln
V6	16	17		svetloružový silne bentonitizovaný ryolit
V6	17	17,8		svetloružový slabo bentonitizovaný ryolit
V6	17,8	18,8		svetloružový zvetraný hrubozrnný ryolit s puklinami 0 - 10o k osi vrtu zatečené limonitom a bielym ílovitým mine
V6	18,8	20		svetlofialový hrubozrnný ryolit s alterovanými živcami
V7	0	0,15		čiernohnedý lesný humus
V7	0,15	0,6		svetlohnedá prachovitá hlinitá suť
V7	0,6	2,4		svetlo hnedo zelenkavý hrubozrnný bentonitový íl so slabo opracovanými úlomkami veľkosti do 1,50 – 2,00 cm (
V7	2,4	3,4		bentonit, v 2,40 – 3,20 m svetlosivý – bielosivý piesčitý, v 3,20 – 3,40 m biely jemnozrnný s reliktami svetlosivéh
V7	3,4	4,3		bielosivý až hnedočierny limnokvarcit s bielosivým bentonitom
V7	4,3	5,4		sivo zelenkavý ryolitový tufit v 4,30 -4,90 m húževnatý

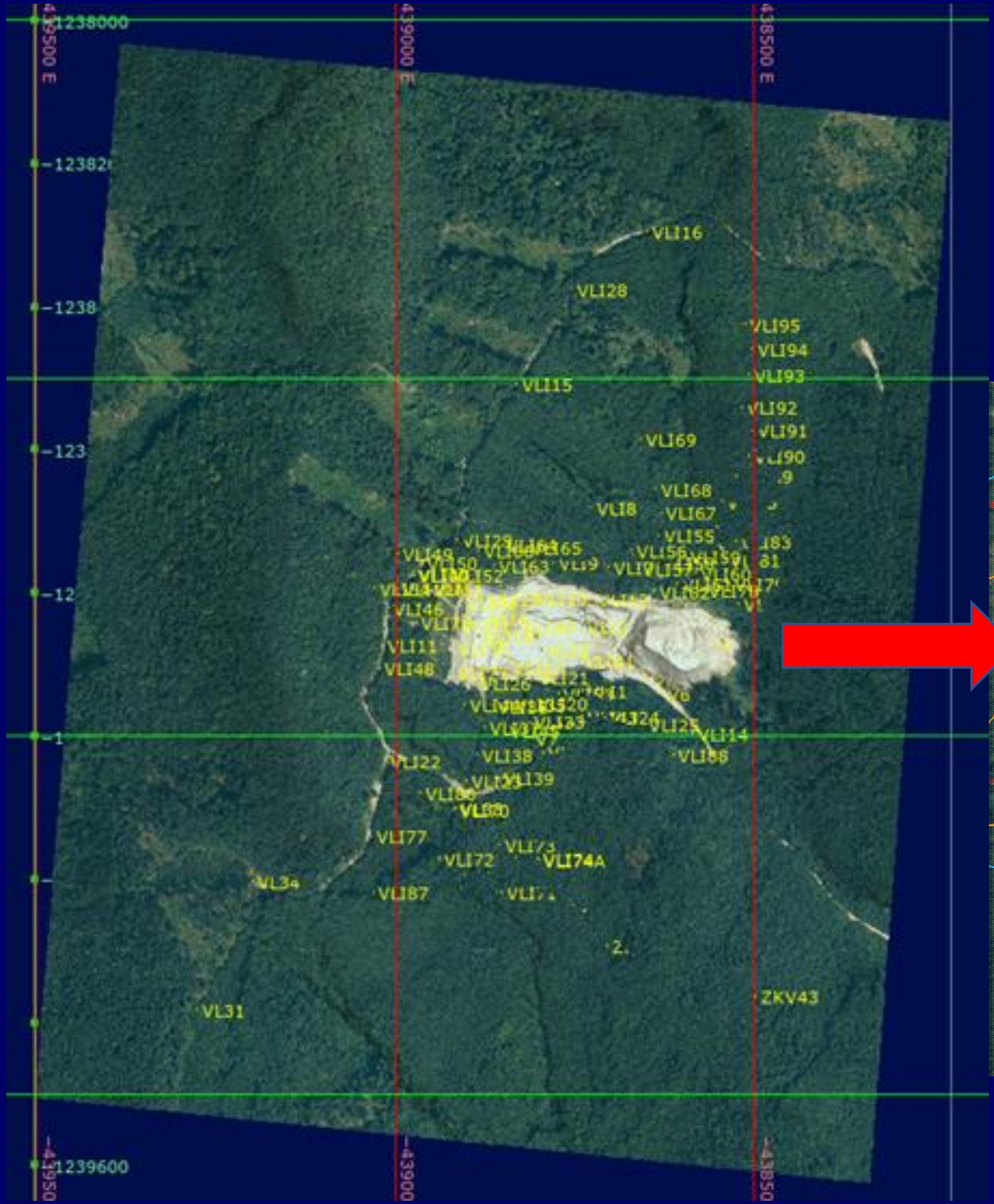
records 2 - 43 of 112

georeferencing and digitization of data in a valid coordinate system and appropriate scale

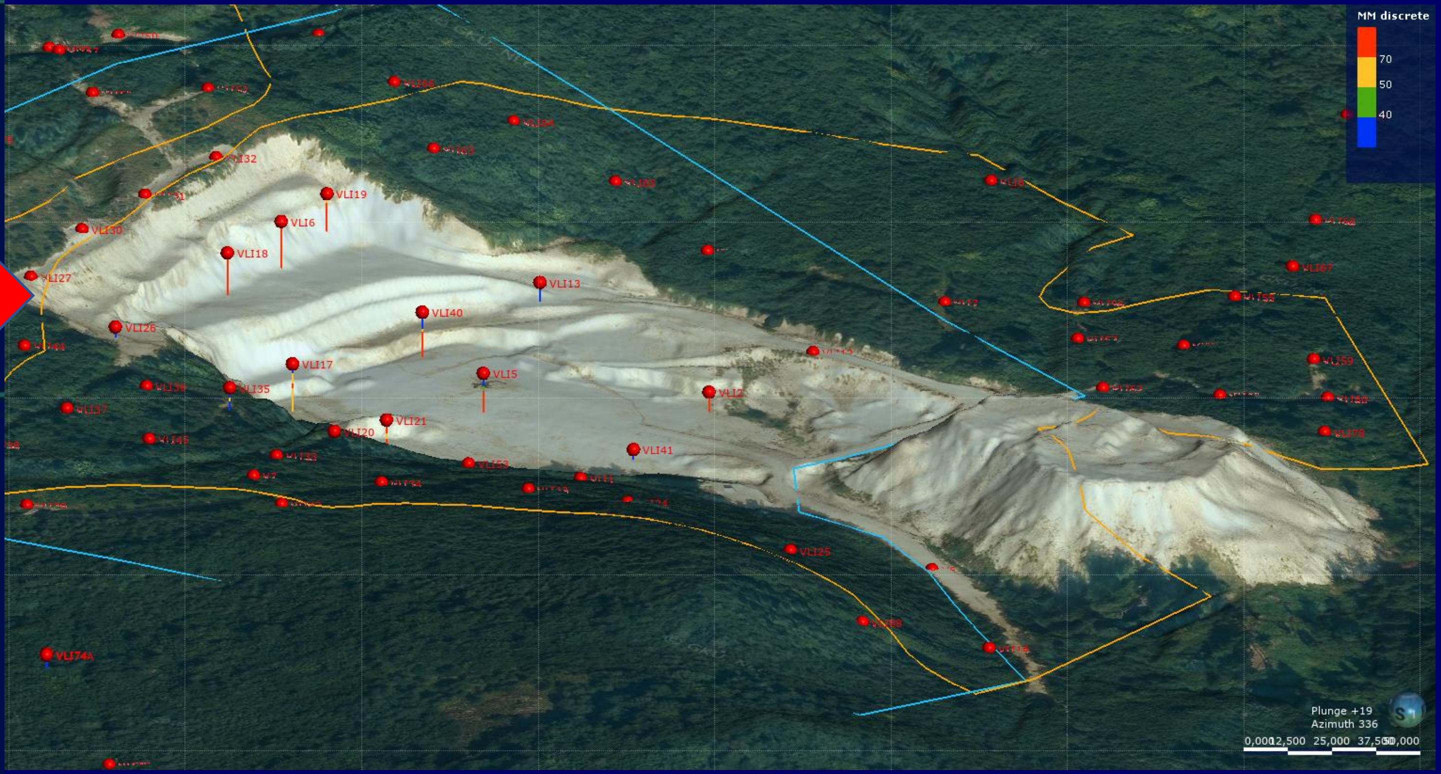


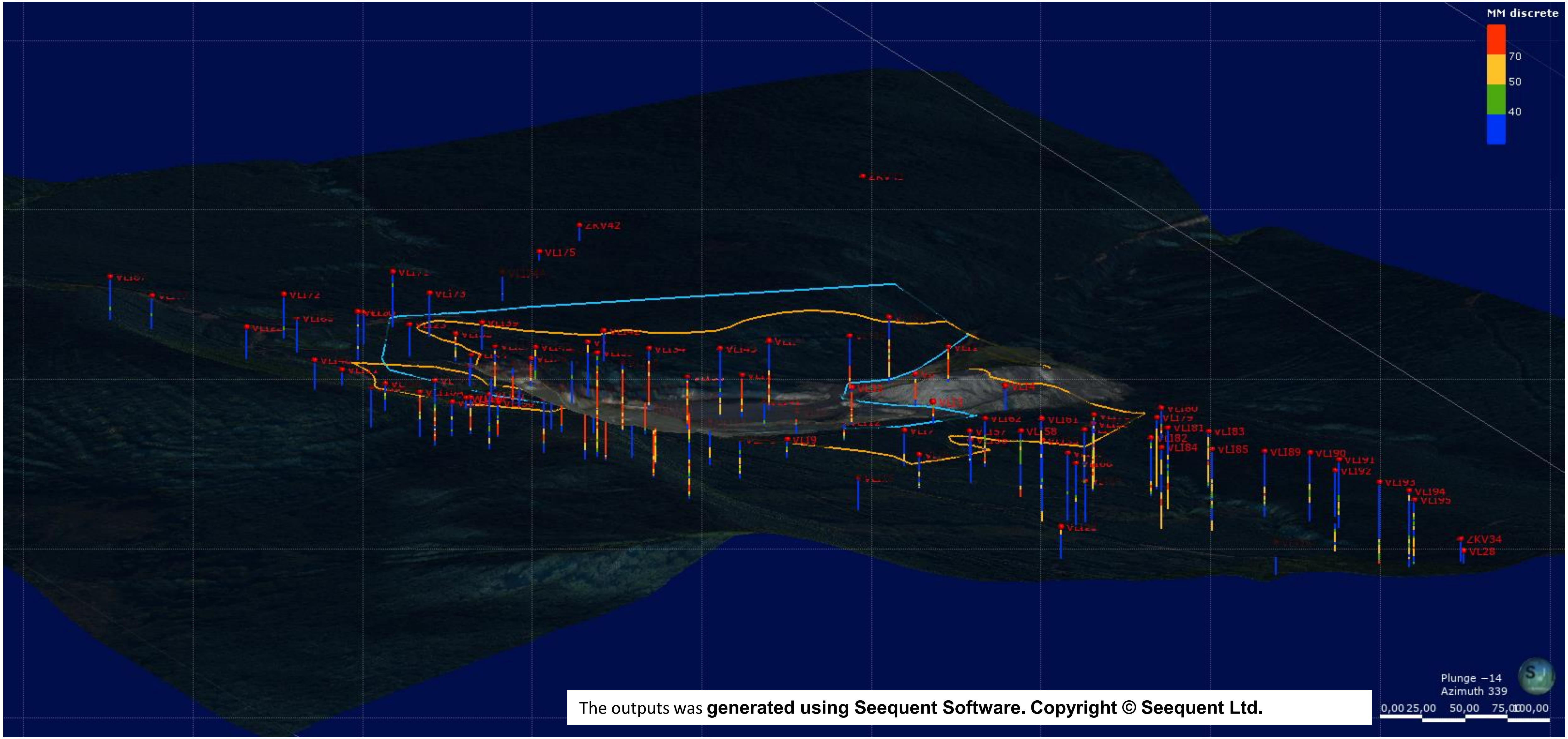


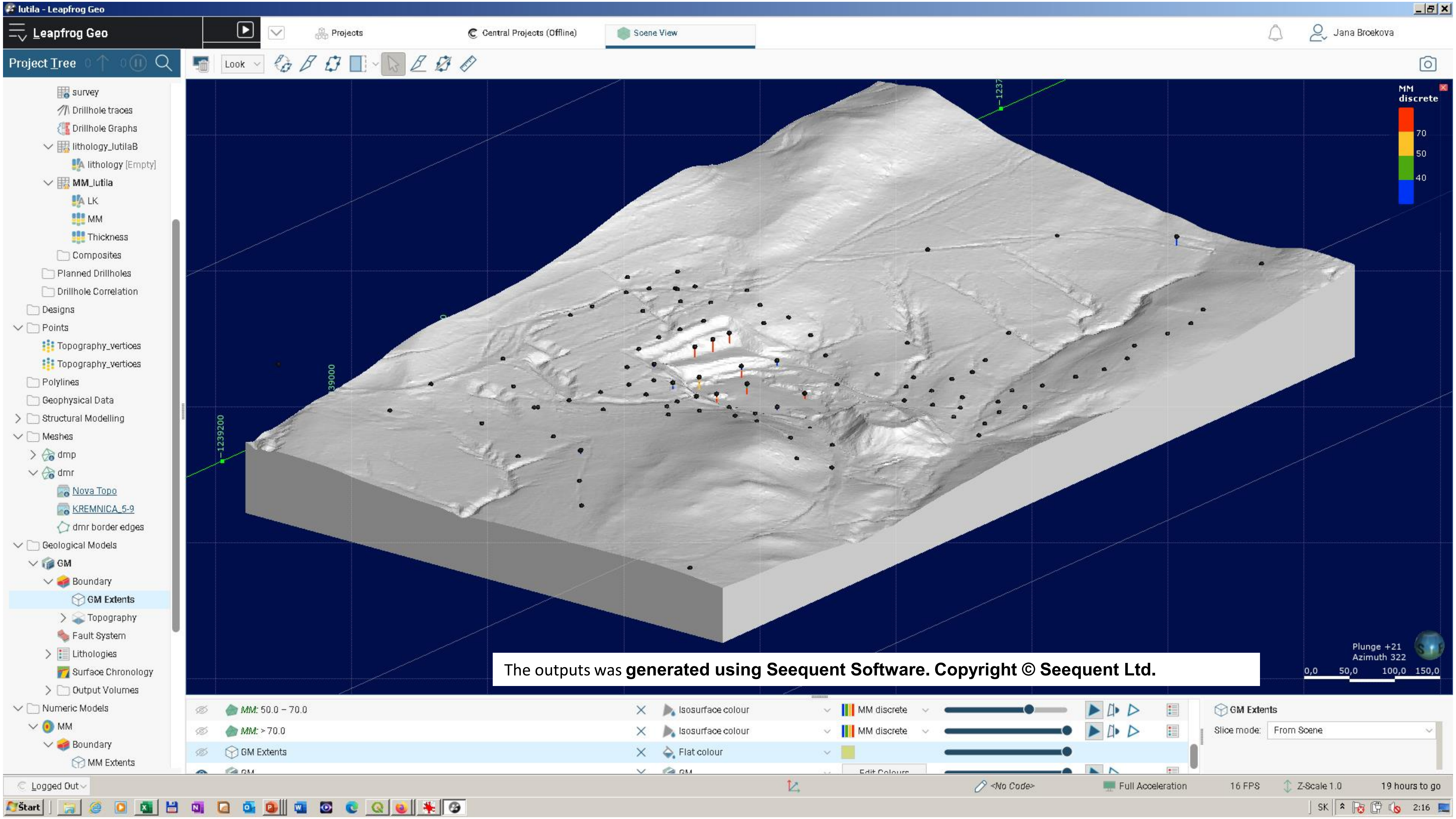

MM discrete
70
50
40
-1237600
-1239400
-1239600
Plunge +21
Azimuth 338
0,0 50,0 100,0 150,0200,0



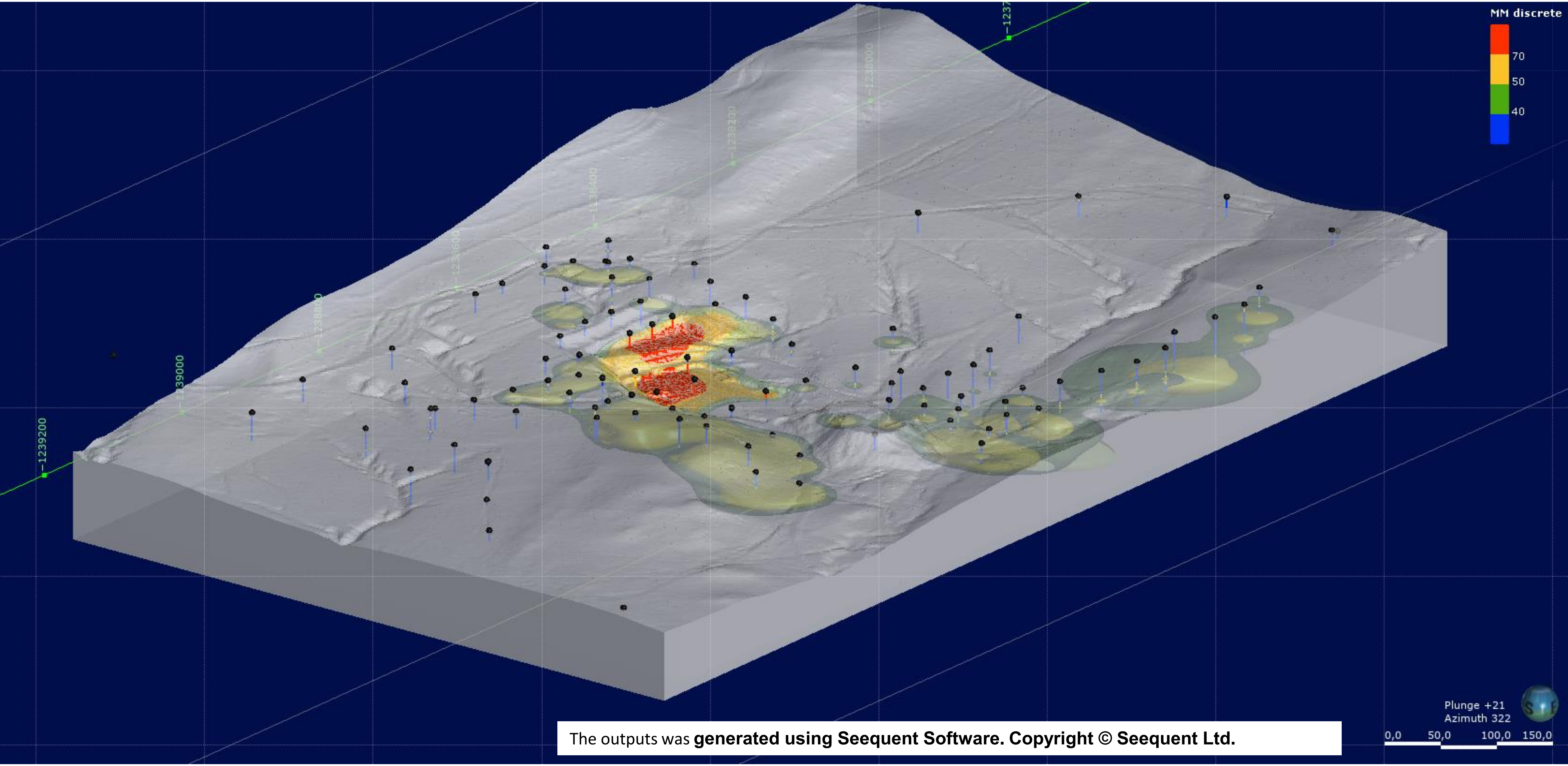
Preliminary 3D visualization

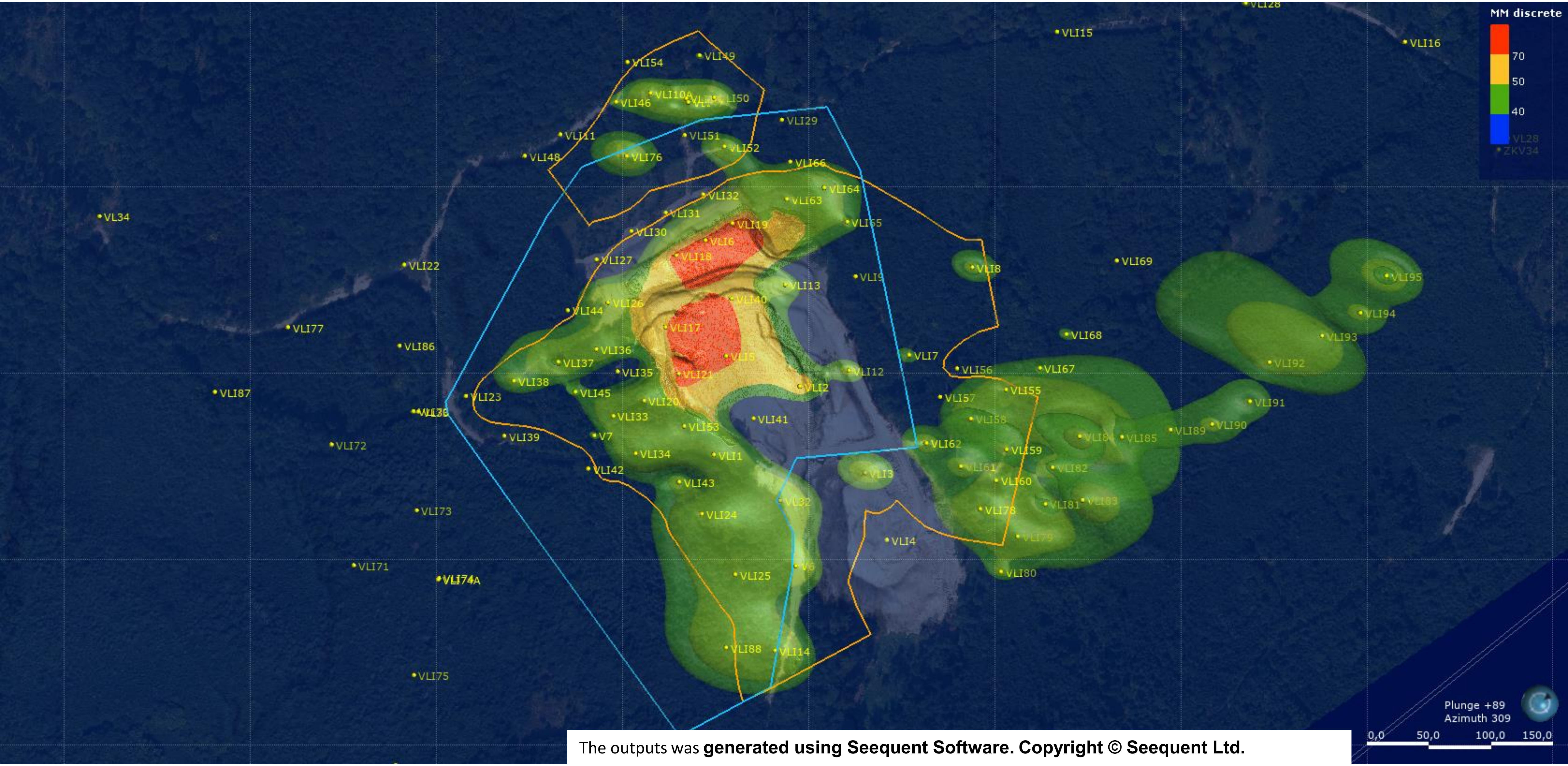



MM discrete
70
50
40
ZKV42
VL175
VL172
VL173
VL139
VL134
VL180
VL179
VL181
VL183
VL182
VL184
VL185
VL189
VL190
VL191
VL192
VL193
VL194
VL195
VL161
VL162
VL158
VL19
ZKV34
VL28
Plunge −14
Azimuth 339
0,00 25,00 50,00 75,00 100,00



The outputs was **generated using Seequent Software. Copyright © Seequent Ltd.**


MM discrete
70
50
40
1239200
1239000
1238800
1238400
1238200
1238000
Plunge +21
Azimuth 322
0,0
50,0
100,0
150,0


MM discrete
70
50
40
Plunge +89
Azimuth 309
0,0
50,0
100,0
150,0
VLI15
VLI16
VLI54
VLI46
VLI50
VLI29
VLI11
VLI51
VLI48
VLI76
VLI52
VLI66
VL34
VLI64
VLI32
VLI63
VLI31
VLI30
VLI6
VLI18
VLI27
VLI22
VLI69
VLI8
VLI13
VLI26
VLI44
VLI94
VLI93
VLI77
VLI17
VLI68
VLI86
VLI36
VLI7
VLI37
VLI35
VLI21
VLI12
VLI56
VLI67
VLI92
VLI38
VLI87
VLI45
VLI23
VLI2
VLI57
VLI55
VLI91
VLI33
VLI41
VLI53
VLI39
V7
VLI62
VLI85
VLI89
VLI90
VLI72
VLI34
VLI1
VLI59
VLI42
VLI82
VLI60
VLI43
VLI81
VLI73
VLI24
VLI4
VLI71
VLI25
VLI80
VLI74A
VLI88
VLI14
VLI75

Visualization and 3D modelling of geology

A	B	C	D	
VLI-54	16	18,4	t	- sivý piesčitý tuf s hrdzavohnedými škvrnami a
VLI-54	18,4	25		- zelené a sivozelené tufitické piesky, v 18,4 až
VLI-56	0	0,8		- svetlohnedá lesná zemina
VLI-56	0,8	1,5		- sivo svetlohnedá hlina
VLI-56	1,5	2,5	t	- kaolinizovaný? svetlosivý íl s drobnými mm úl
VLI-56	2,5	4		- plastický svetlosivý až bielosivý kaolinit?
VLI-56	4	10		- plastický bielosivý kaolinit? S úlomkami do 3
VLI-56	10	18		- plastický bielosivý hrudkovitý kaolinit (kaolinit
VLI-56	18	24	t	- bielosivý slabšie rozložený kaolinizovaný jem
VLI-56	24	26	bt	- striedanie polôh (cca 30 cm) sivého, ružovéh
VLI-56	26	27	r	- ružovofialový zvetralý ryolit
VLI-57	0	1,5		- svetlo sivohnedá piesčitá hlina
VLI-57	1,5	2,5		- sivobiely kaolinizovaný? piesčitý tufitický íl
VLI-57	2,5	14		- plastický svetlosivý až sivobiely kaolinit?, mie
VLI-57	14	17		- plastický sivobiely kaolinit?, pribúdajú hrudky
VLI-57	17	18,5	bt	- striedanie polôh sivého a ružového bentonitu
VLI-57	18,5	19,5	r	- ružovofialový zvetralý ryolit
VLI-58	0	0,5		- svetlohnedá hlina a lesná zemina
VLI-58	0,5	2		- sivo okrové bentonitové íly, výrazne piesčité s
VLI-58	2	6,9		- svetlo sivozelené až svetlosivé plastické bent
VLI-58	6,9	7,8	bt	- žlto okrové plastické bentonity s úlomkami hr
VLI-58	7,8	9,5	bt	- svetlosivé plastické bentonitové íly s úlomkan
VLI-58	9,5	12		- sivé až svetlo olivovozelené plastické bentoni
VLI-58	12	20,7		- biele až sivobiele bentonitizované? kaolinizov
VLI-58	20,7	30		- sivozelený piesčitý bentonitizovaný? tufitický í
VLI-58	30	30,6		- plastickejší svetlo sivožltý bentonitizovaný? tu
VLI-58	30,6	31,9		- svetlo sivozelený piesčitý bentonitizovaný? tuf
VLI-58	31,9	34,6	bt	- svetlo hnedožltý slabo piesčitý plastický bent
VLI-58	34,6	41	bt	- svetlo sivožltý hrudkovitý mierne piesčitý bent
VLI-59	0	0,5		- svetlohnedá piesčitá hlina
VLI-59	0,5	3,2		- svetlosivý, slabo spevnený, silne piesčitý tufiti
VLI-59	3,2	15,5		- svetlosivý, slabo spevnený, silne piesčitý tufiti
VLI-59	15,5	23,5		- olivovozelený veľmi pevný tufitický íl, miestam
VLI-59	23,5	24,6		- svetlo sivomodrý piesčitý tufitický íl
VLI-59	24,6	30		- silne piesčitý svetlo sivomodrý tufitický íl s úlo

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	A	B	C	D	E	F
1	Hole_ID	From	To	Thicknes:	MM	LK
2	V6	0,00	1,00	1,00	0,00	D
3	V6	1,00	1,60	0,60	10,20	D
4	V6	1,60	3,10	1,50	8,10	D
5	V6	3,10	3,70	0,60	23,20	D
6	V6	3,70	6,00	2,30	65,00	B
7	V6	6,00	8,00	2,00	72,20	A
8	V6	8,00	10,00	2,00	73,00	A
9	V6	10,00	12,00	2,00	74,30	A
10	V6	12,00	14,00	2,00	71,30	A
11	V6	14,00	16,00	2,00	77,70	A
12	V6	16,00	17,00	1,00	23,30	D
13	V6	17,00	17,80	0,80	8,10	D
14	V6	17,80	20,00	2,20	2,00	D
15	V7	0	2,4	2,4	0	D
16	V7	2,4	7	4,6	55,9	B
17	V7	7	8,5	1,5	36,4	D
18	V7	8,5	15	6,5	32	D
19	V7	15	17,5	2,5	30	D
20	V7	17,5	33	15,5	0	D
21	VL28	0,00	0,20	2,00	0,00	D
22	VL28	0,20	1,00	1,80	0,00	D
23	VL28	1,00	1,90	4,40	0,00	D
24	VL28	1,90	8,00	2,20	0,00	D
25	VL31	0,0	0,5	0,50	0,00	D
26	VL31	0,5	1,2	0,70	0,00	D
27	VL31	1,2	2,7	1,50	0,00	D
28	VL31	2,7	2,8	0,10	0,00	D
29	VL31	2,8	4,3	1,50	0,00	D
30	VL31	4,3	4,5	0,20	0,00	D
31	VL31	4,5	4,7	0,20	0,00	D
32	VL31	4,7	5,3	0,60	0,00	D
33	VL31	5,3	7,0	1,70	0,00	D
34	VL31	7,0	8,0	1,00	0,00	D
35	VL31	8,0	8,4	0,40	0,00	D

V6