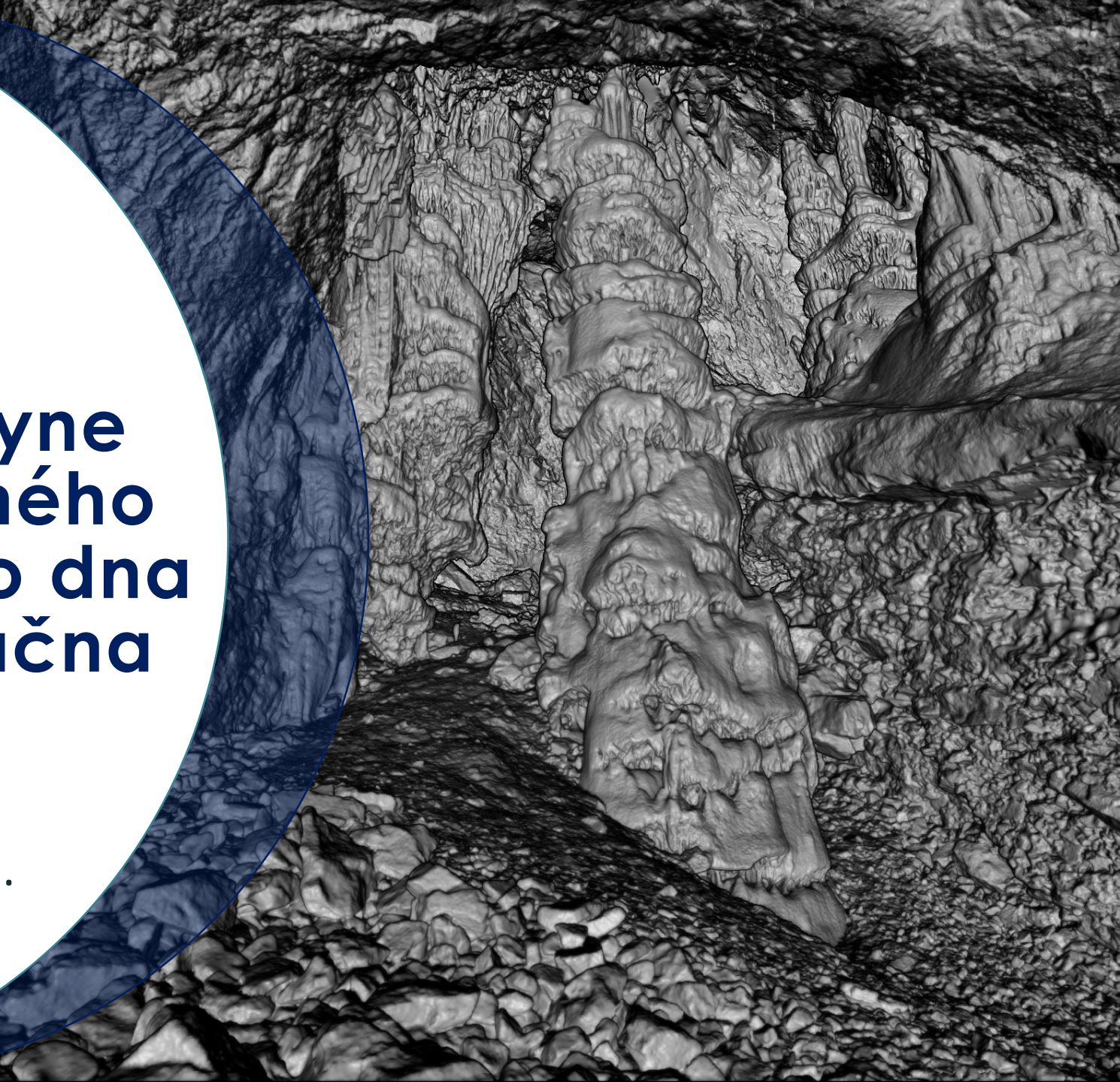
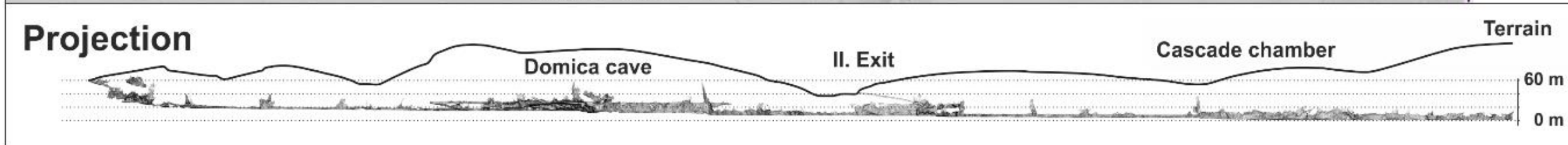
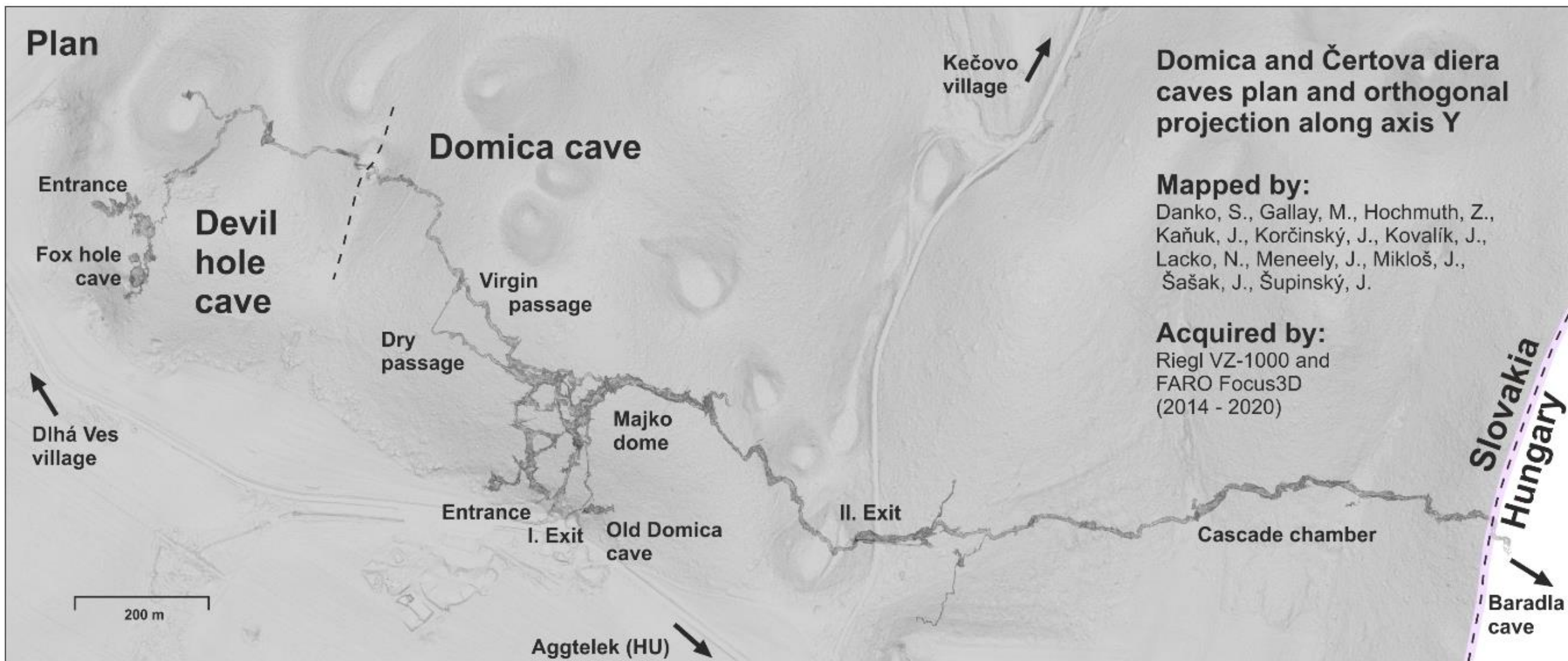


Tvorba mapy jaskyne pomocou tieňovaného povrchu jaskynného dna odvodeného z mračna bodov

Šupinský J., Hochmuth Z., Kaňuk J.



Motivácia



Klasické mapovanie

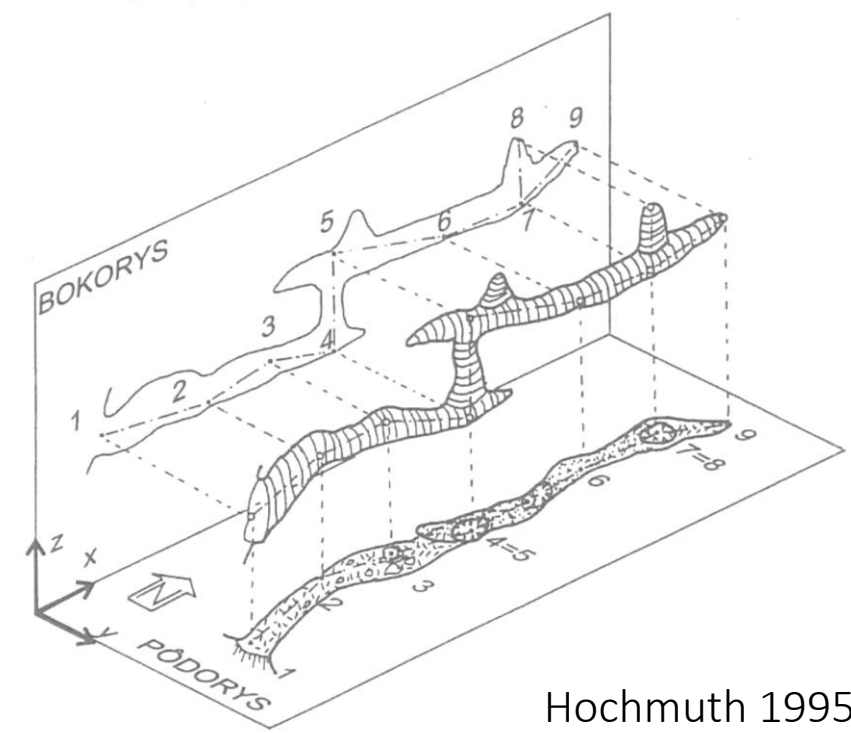
Kostra mapy = Polygónový ťah

V mapovaní prevláda digitálny diaľkomer

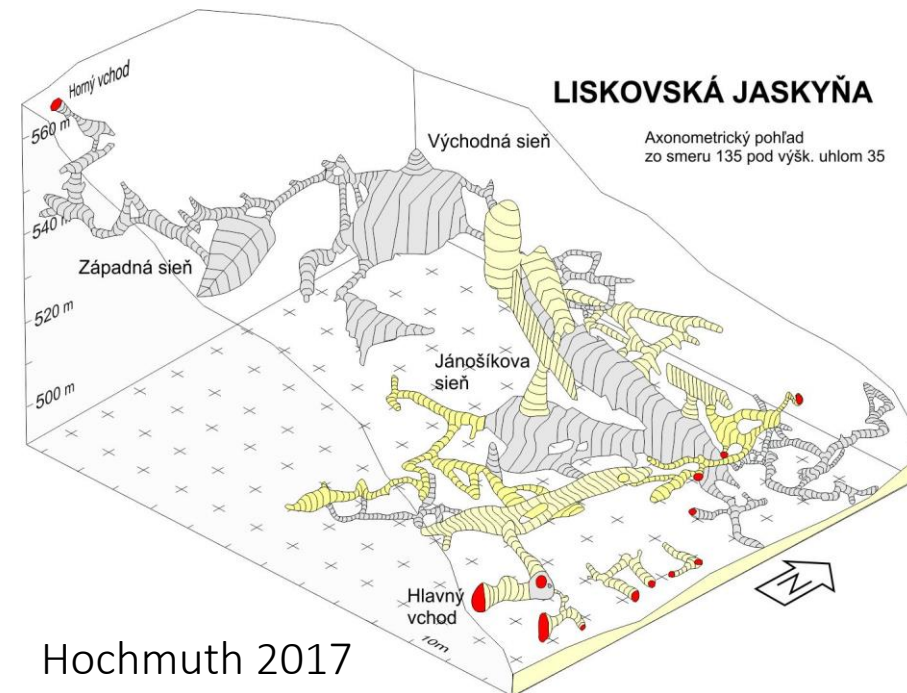
Väčšina máp jaskýň vzniká od dobrovoľných jaskyniarov

Mapa jaskyne plní dokumentačnú a najmä orientačnú funkciu

Prevažne sa jedná o pôdorysné zobrazenie podlahy jaskyne s výberom vertikálnych rezov jaskyne



Hochmuth 1995



Hochmuth 2017

Klasická mapa jaskyne

Nejednotný postup, kvalita vyhotovenia, použitý softvér, mapový kľúč

Mapy jaskýň sú značne subjektívne diela, chýba exaktnosť polohy vykreslených objektov a tvaru zakreslených priestorov

Časť autorov považuje mapu jaskyne za umelecké dielo

Owl Cave Highland Co., Va.

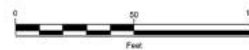
Total surveyed passage = 3004 ft.
Depth below entrance = 26.1 ft.
Rise above entrance = 37.3 ft.

A Suunto and tape survey
from 7/16/1988
to 10/21/1989

Surveyed by
Phil, Charlotte, Matthew and Charles Lucas
and Brad Blase

Map drawn by
Charles Lucas and Phil Lucas

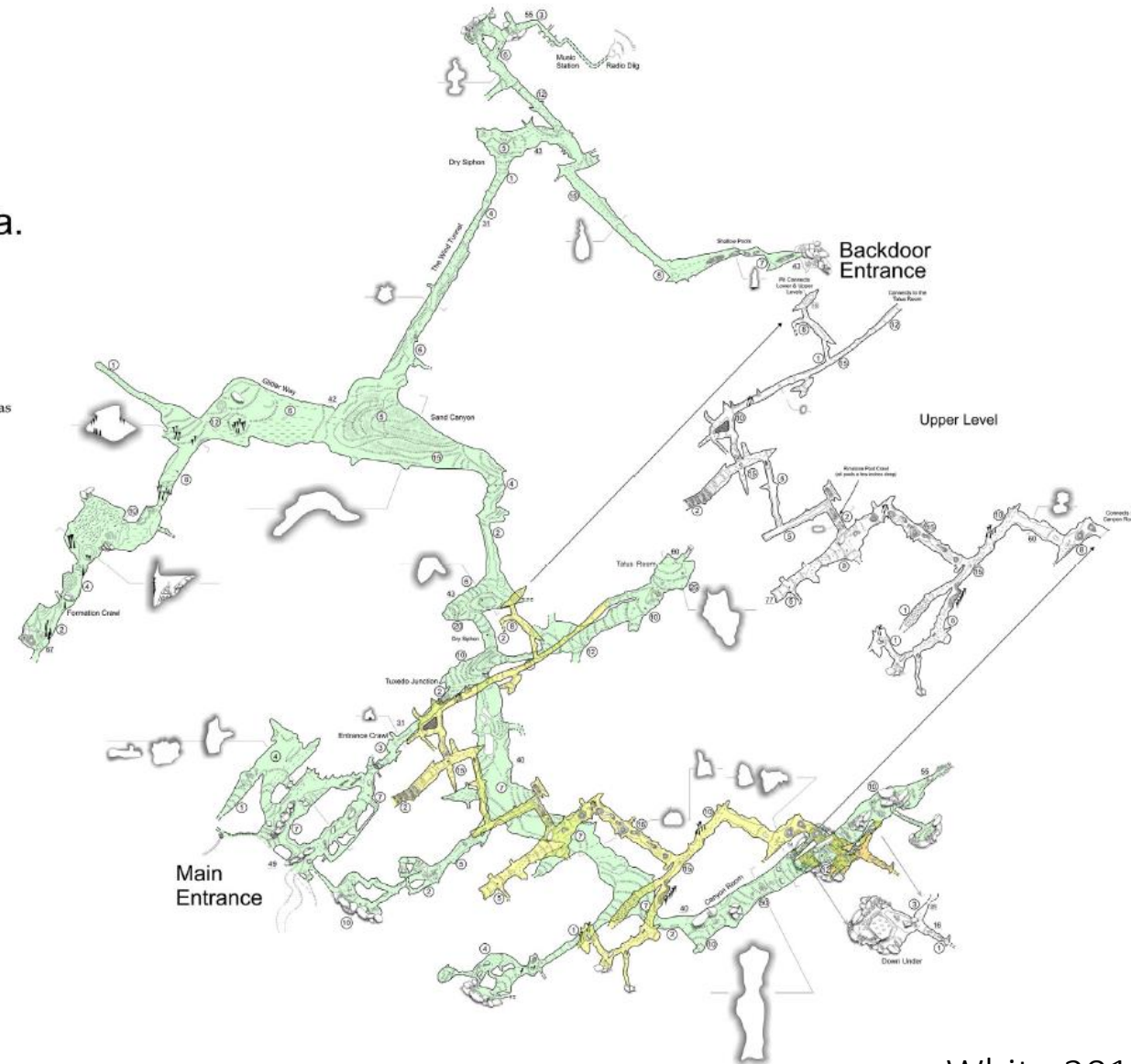
Computer graphics by Roger Baroody



Legend

Breakdown:
Large
Small
Cobble
Sand
Clay or Silt
Stratocite
Stalagmite
Column
Flowerstone Floor
Remains

Log
Stipes
Floor Ledge
Ceiling Ledge
Dome
Pond
Ceiling Height
Elevation:
Above Datum
Below Datum



Skenovanie jaskýň

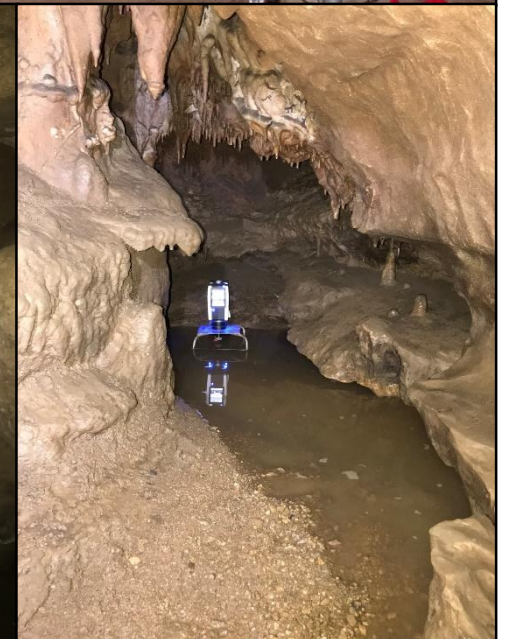
Efektívna metóda zberu dát

Veľké množstvo zákrytov

Zlá odrazivosť povrchov

Dostupnosť priestorov

Časová náročnosť



Skenovanie jaskýň

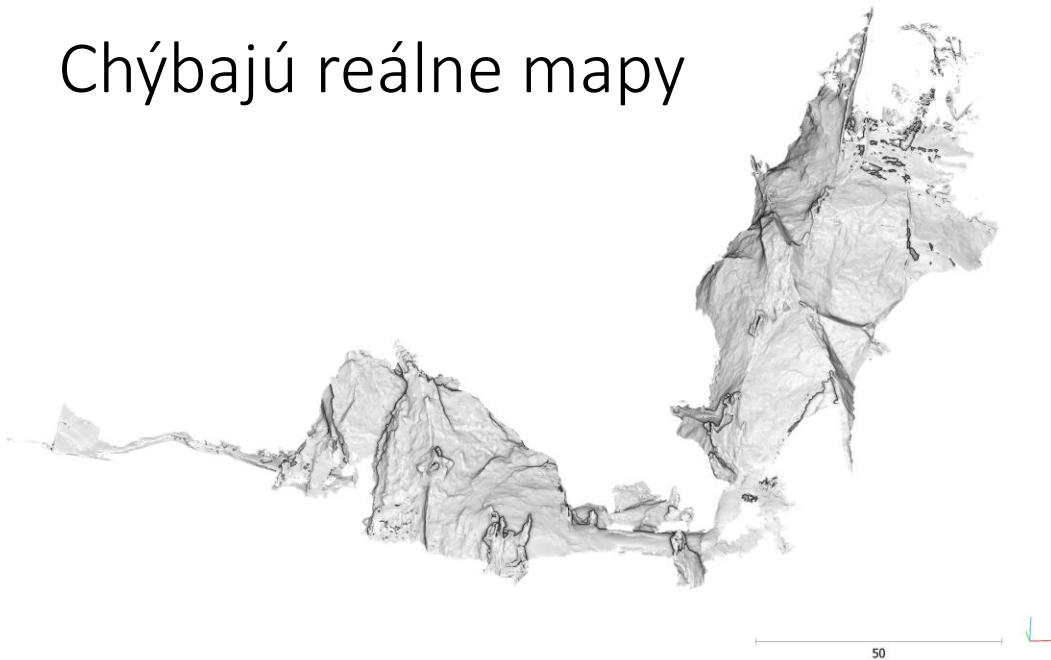
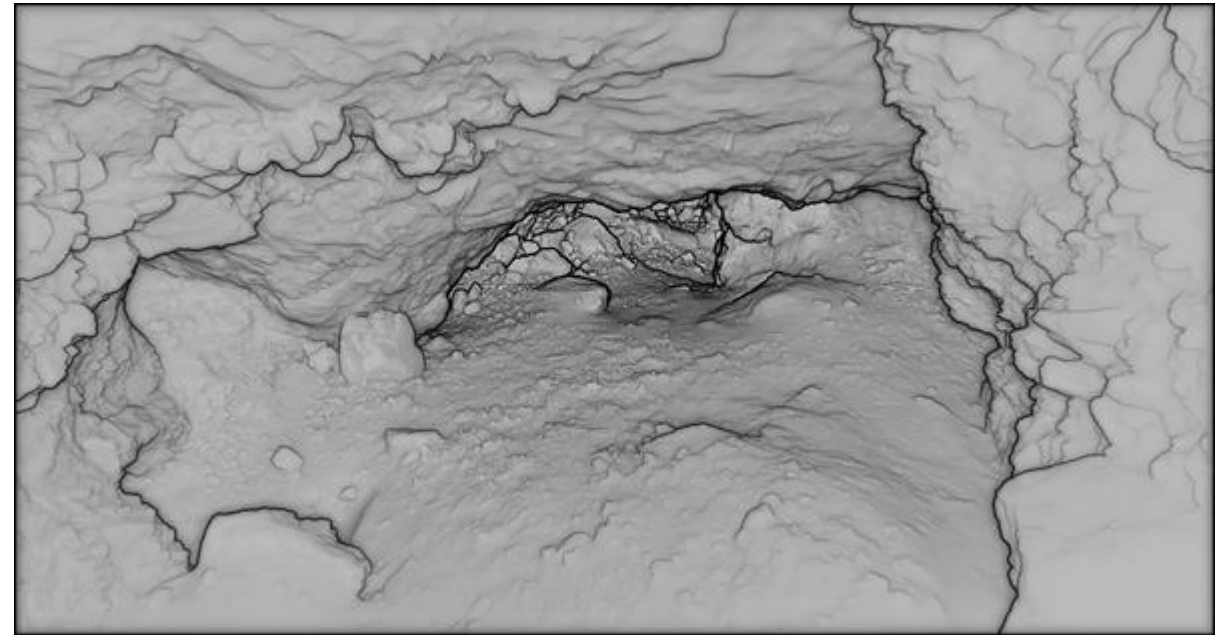
Registrované mračno bodov

3D model - segmentácia

Webová mapová aplikácia

Virtuálna prehliadka

Chýbajú reálne mapy

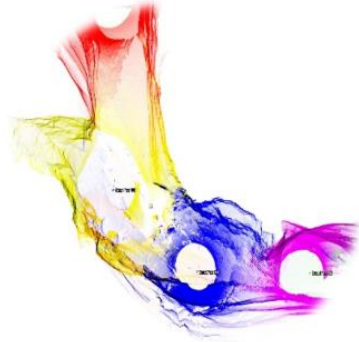


Odvodenie mapy - metodika

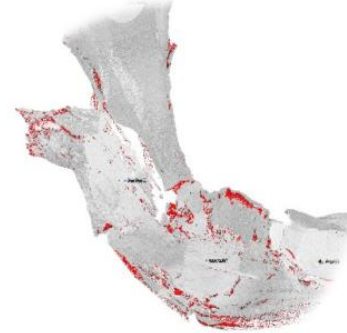
01. Data acquisition



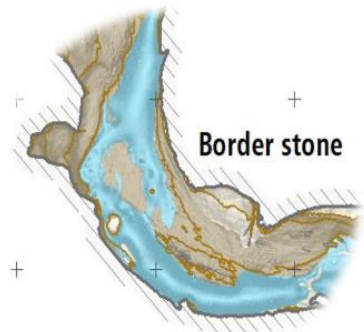
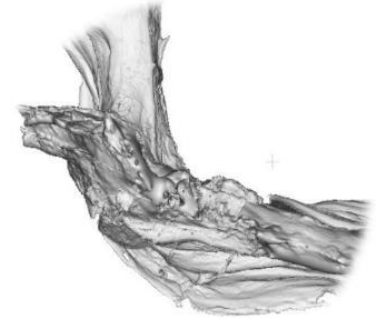
02. Data registration



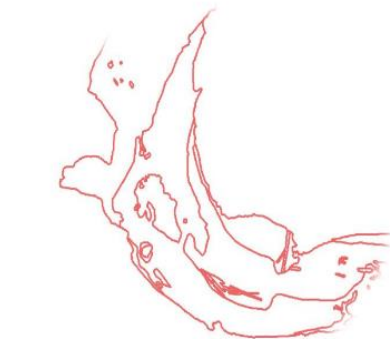
03. Data filtration and noise removal



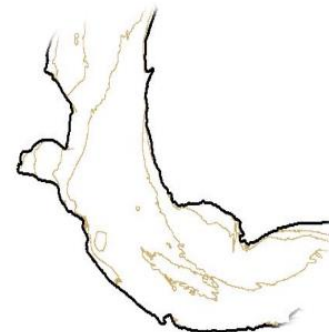
04. 3D Modelling



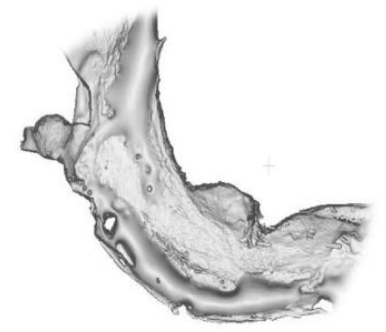
08. Cave Plan



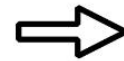
07. Additional content vectorization



06. Contours and Cave Boundary



05. Ground classification



Klasifikácia dna

Nutnosť odstránenia stropu

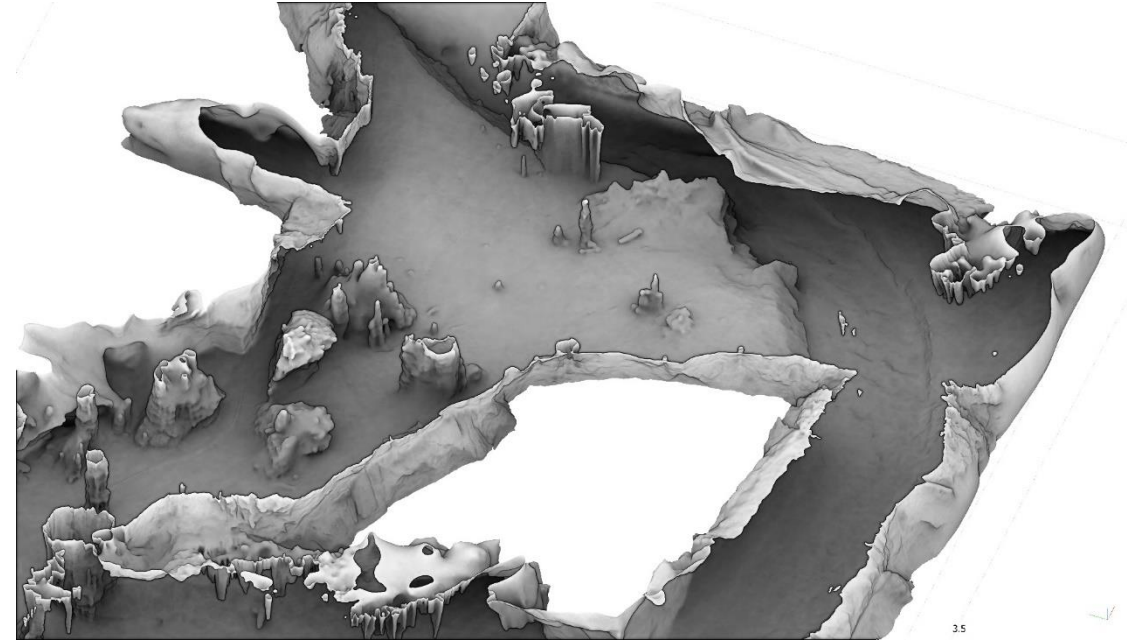
Podklad pre ďalšie vrstvy

Použiť namerané dáta/interpolovať?

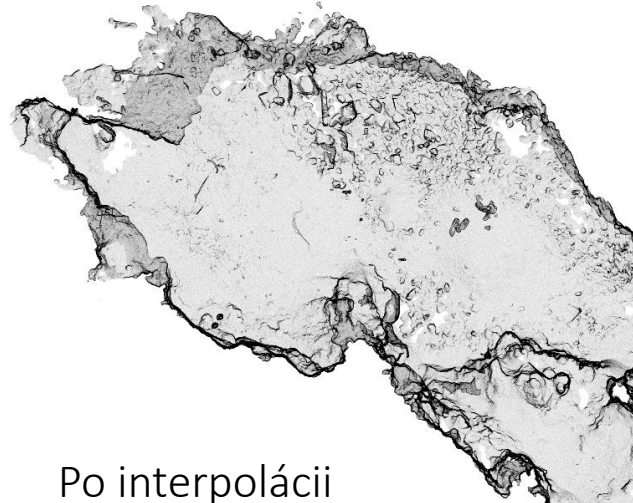
Ako určiť referenčnú výšku?

Čo považovať za dno?

Domica – pri posvätej chodbe



Čertova diera - Vstup

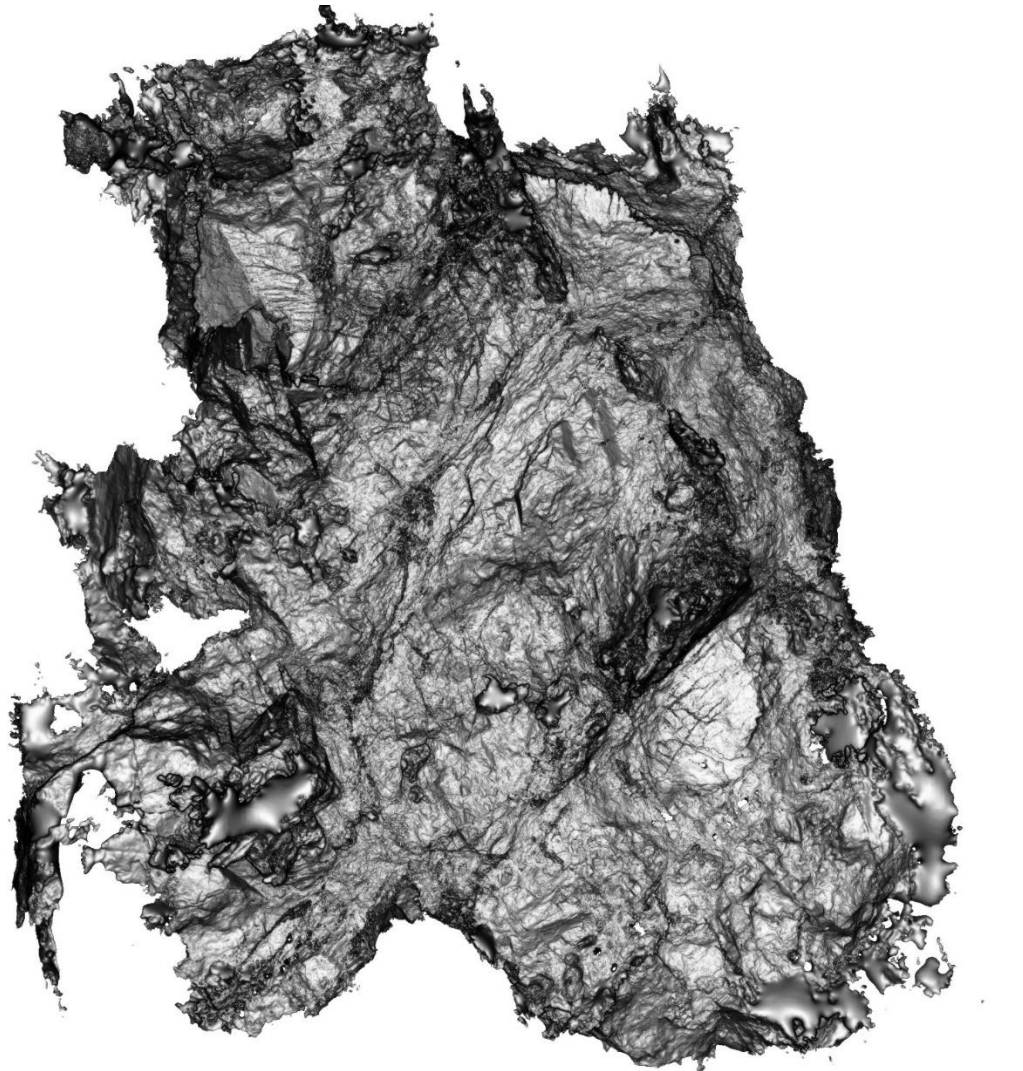


Po interpolácii



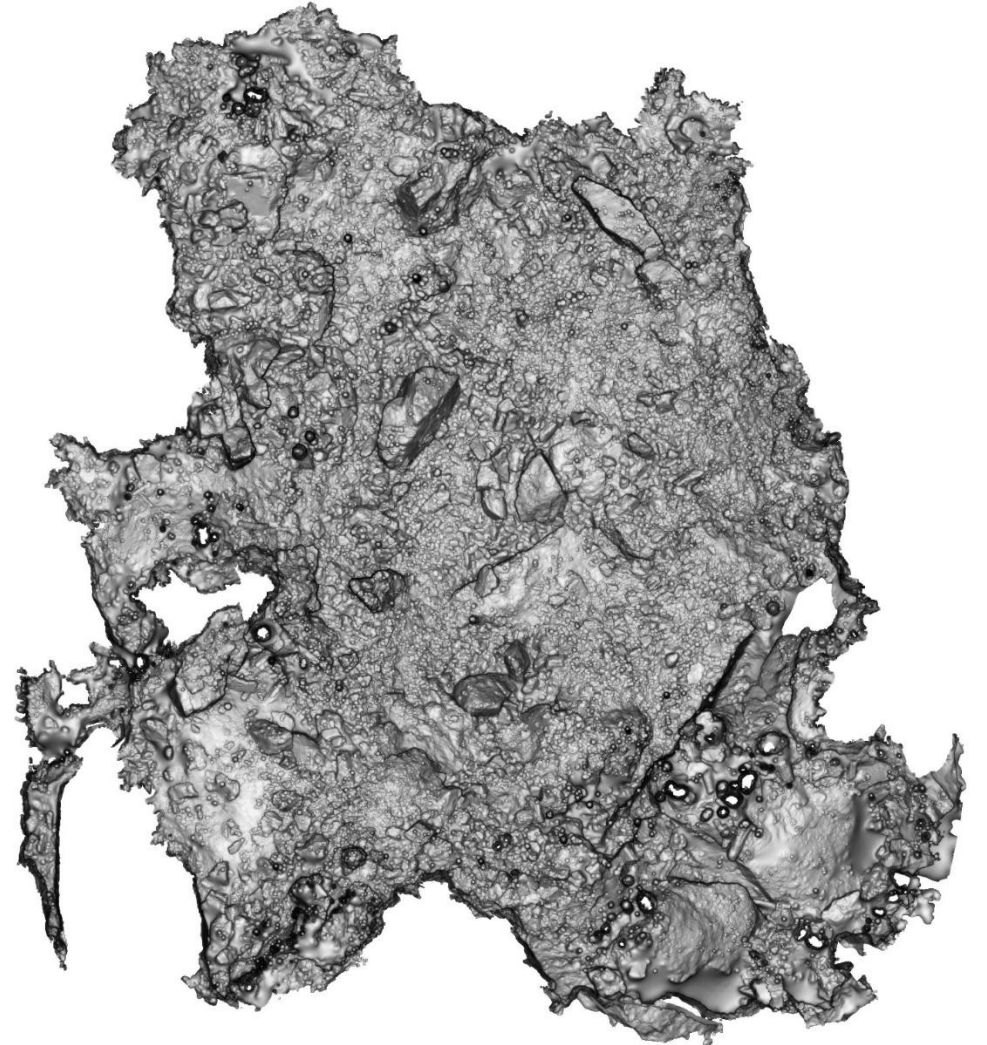
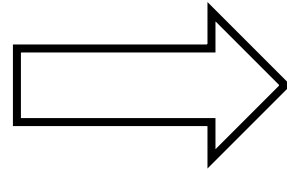
Domica – Majkov dóm

Klasifikácia dna



3D model

10



Odvodené jaskynné dno

10

Doplňkový obsah

Semi-automatická a manuálna vektorizácia

Automaticky odvodené vrstevnice a obrys jaskyne

Bodové líniové a plošné objekty v jaskyni (výzdoba, meračské body, paleontologické / archeologické nálezy, komíny, morfológicky významné prvky, typ povrchu...)

Vybrané profily

Téma mapy

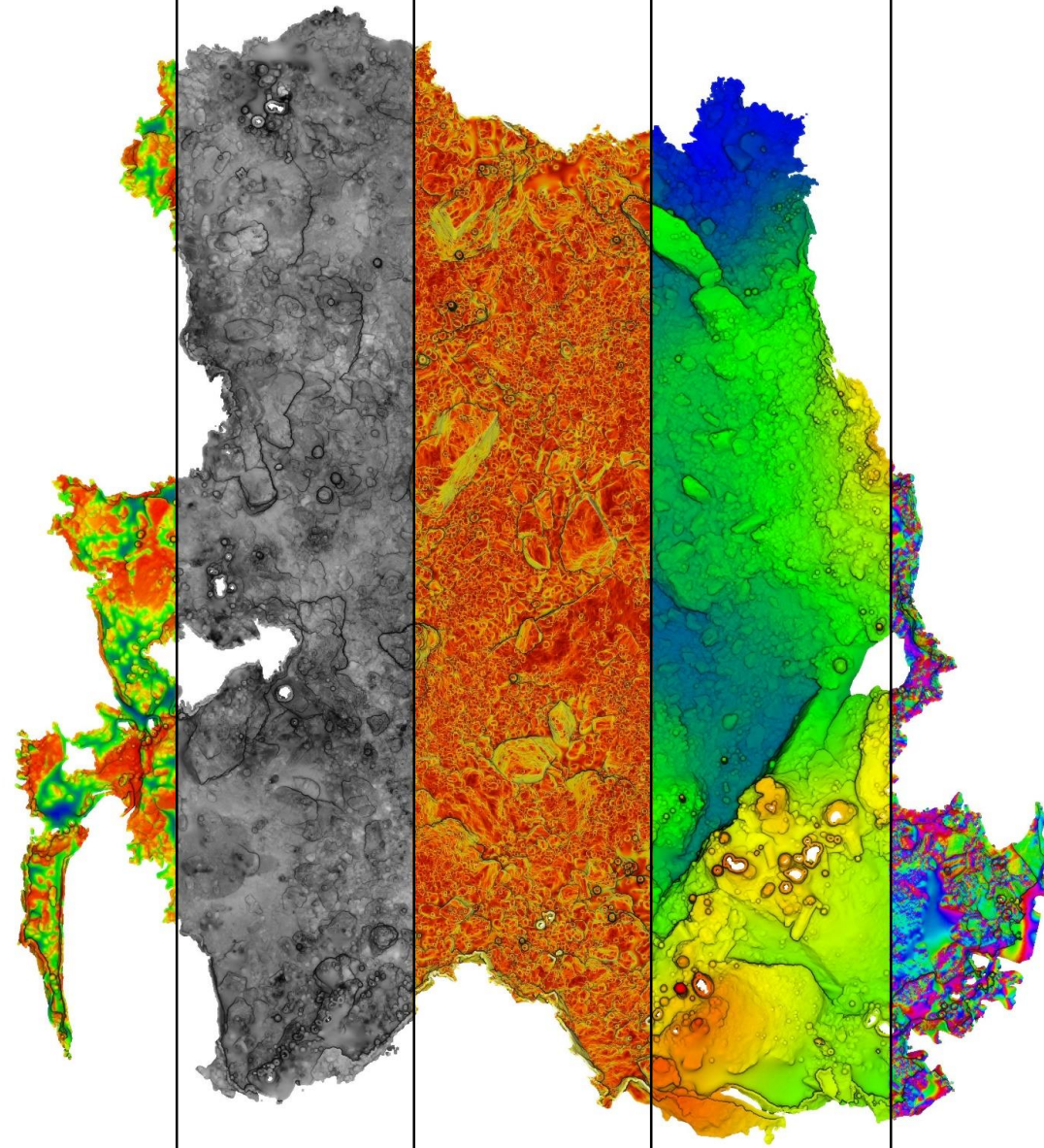
Kvalita mapovania

Intenzita

Sklon

Nadmorská výška

Orientácia



Kompozícia mapy

Domica - Majko dome

Plan view and orthogonal projections of the cave from terrestrial laser scanning with Faro Focus 3D and Riegl VZ-1000

Horizontal datum S-JTSK - Krovak East North and Vertical datum Kronstadt level Baltic height

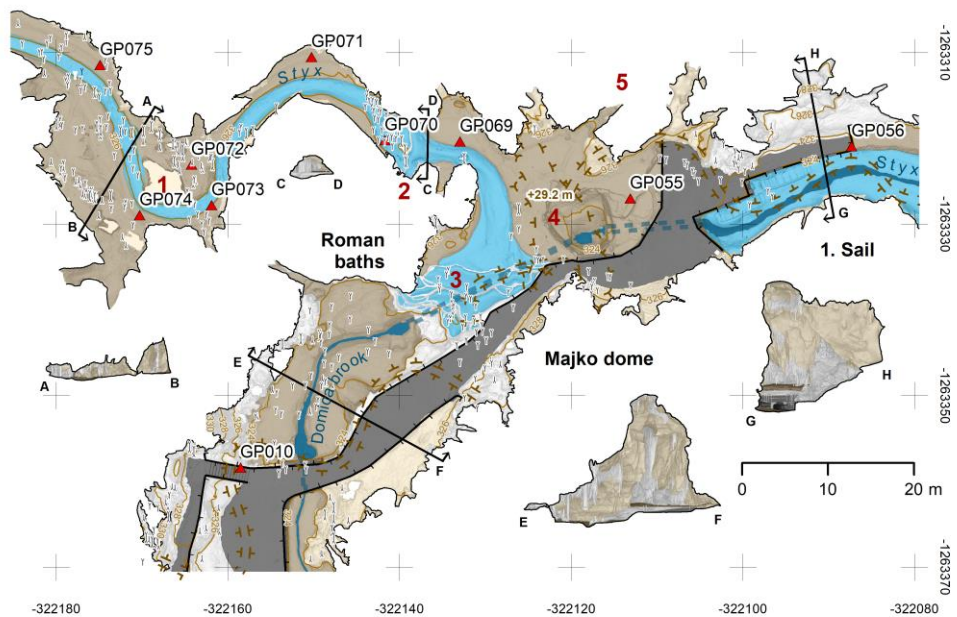
Mapped by: Gallay M., Hochmuth Z., Kaňuk J., Meneely J., Šašák J., Šupinský J.

Date of mapping: 06.03.2014 and 23.11.2018



- | | |
|-------------------|--------------------|
| ▲ geodetic survey | — railing |
| ┆ stalactit | - - - pipe |
| ┆ stalagmit | □ flowstone |
| ┆ pillar | □ limestone |
| ~ cave boundary | □ clay |
| — profile | □ concrete path |
| ┆ chimney | □ seasonal water |
| ┆ ceiling form | □ water |
| — contour | ■ max. cave extent |

Plan view



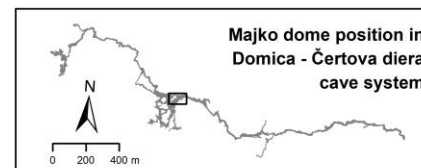
Domica - Majko dome

Plan view and orthogonal projections of the cave from terrestrial laser scanning with Faro Focus 3D and Riegl VZ-1000

Horizontal datum S-JTSK - Krovak East North and Vertical datum Kronstadt level Baltic height

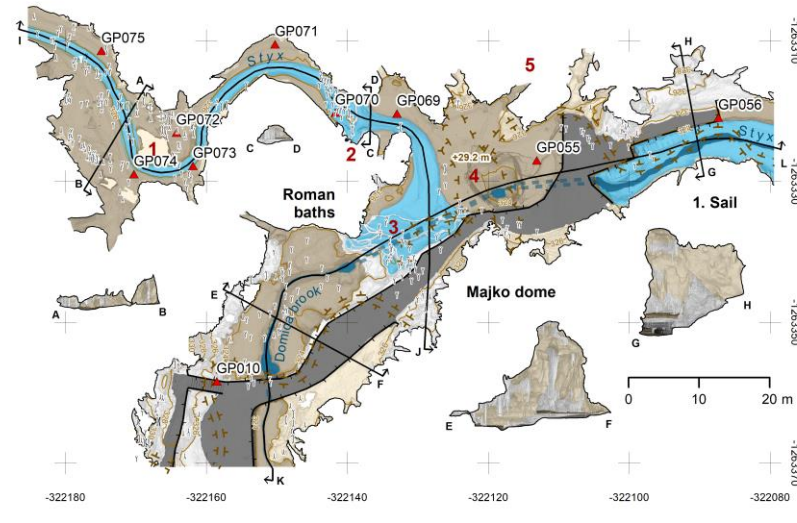
Mapped by: Gallay M., Hochmuth Z., Kaňuk J., Meneely J., Šašák J., Šupinský J.

Date of mapping: 06.03.2014 and 23.11.2018

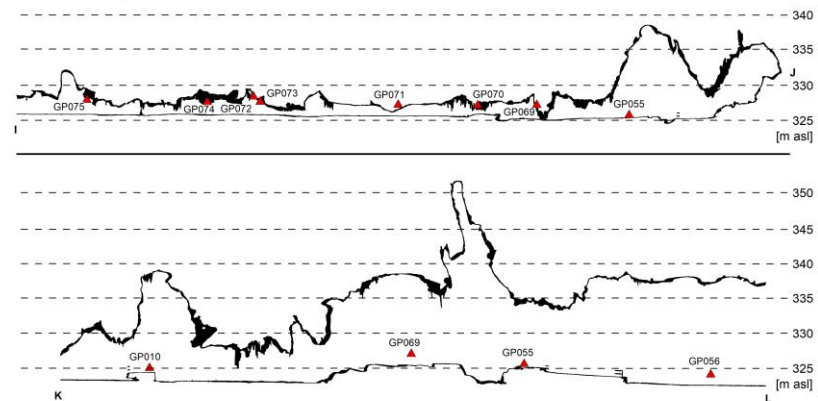


- | | |
|-------------------|--------------------|
| ▲ geodetic survey | — railing |
| ┆ stalactit | - - - pipe |
| ┆ stalagmit | □ flowstone |
| ┆ pillar | □ limestone |
| ~ cave boundary | □ clay |
| — profile | □ concrete path |
| ┆ chimney | □ seasonal water |
| ┆ ceiling form | □ water |
| — contour | ■ max. cave extent |

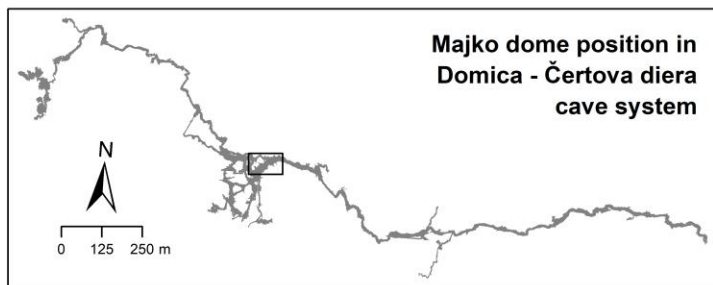
Plan view



Unfolded profiles



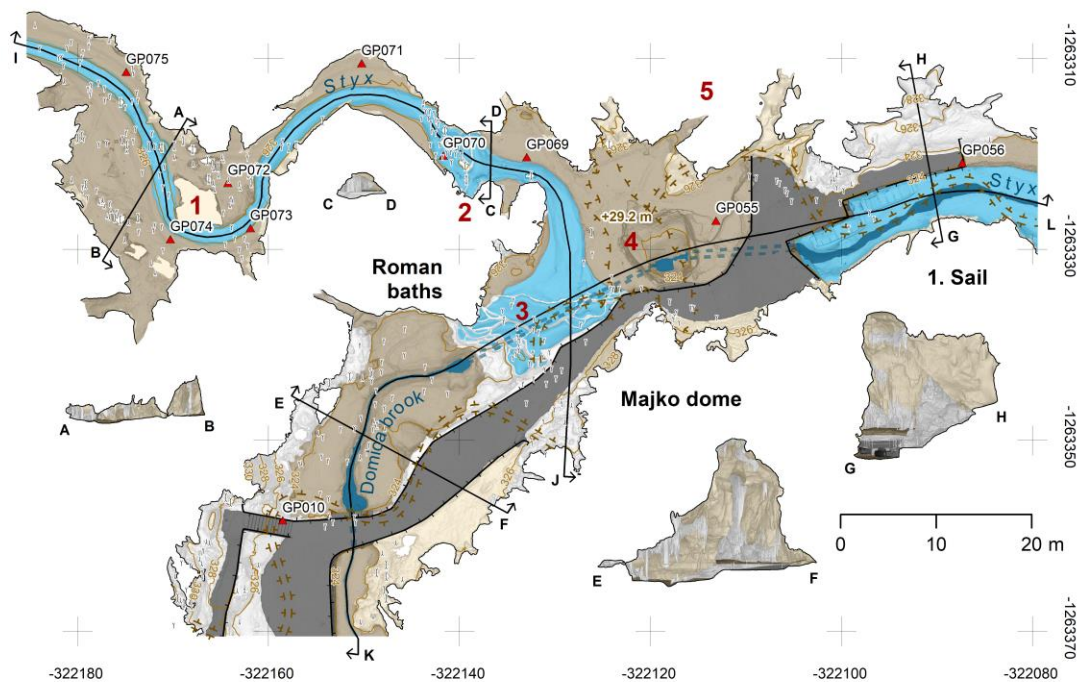
Domica - Majko dome



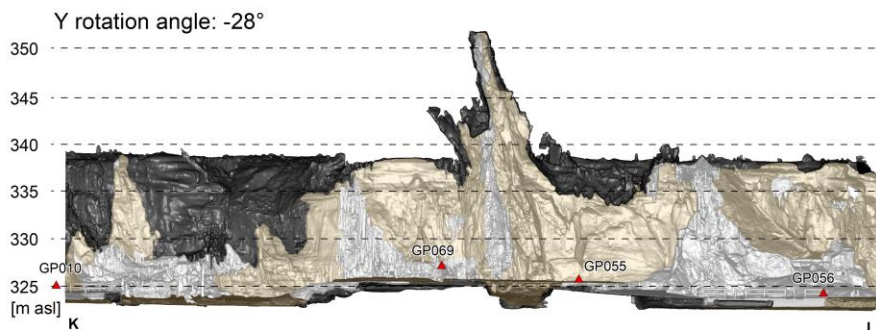
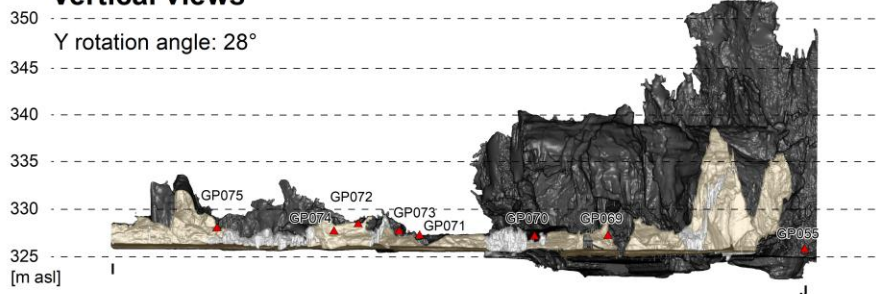
Plan view and orthogonal projections of the cave
 Laser scanner: Faro Focus 3D and Riegl VZ-1000
 Registration StDev: 0.004 m
 Horizontal datum: S-JTSK - Krovak East North
 Vertical datum: Kronstadt level Baltic height
 Mapped by: Gallay M., Hochmuth Z., Kaňuk J.,
 Meneely J., Šašak J., Šupinský J.
 Date of mapping: 06.03.2014 and 23.11.2018

- | | |
|-------------------|--------------------|
| ▲ geodetic survey | — railing |
| ○ stalactit | - - - pipe |
| ○ stalagmit | □ flowstone |
| ○ pillar | □ limestone |
| ~ cave boundary | ■ clay |
| — profile | ■ concrete path |
| ⋈ chimney | ■ seasonal water |
| ⋈ ceiling form | ■ water |
| — contour | ■ max. cave extent |

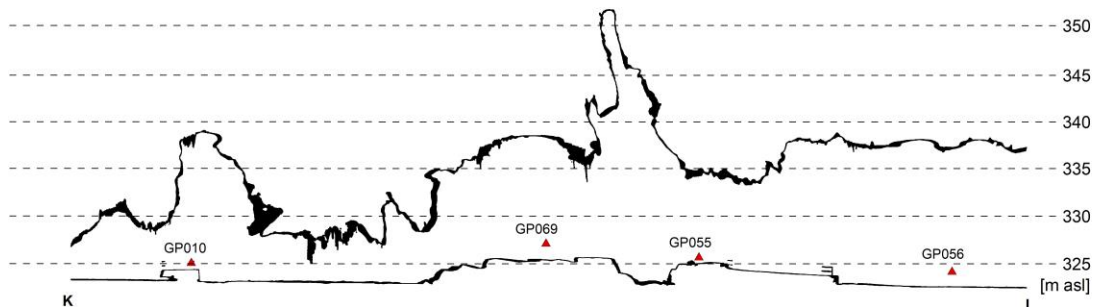
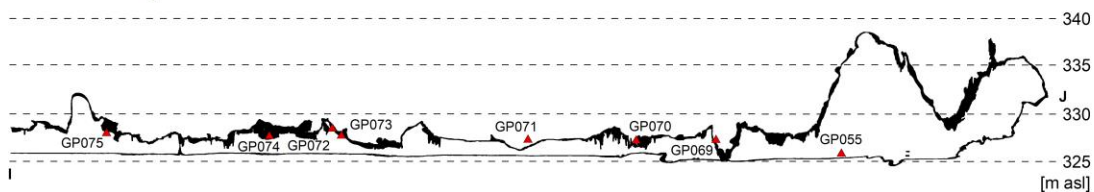
Plan view



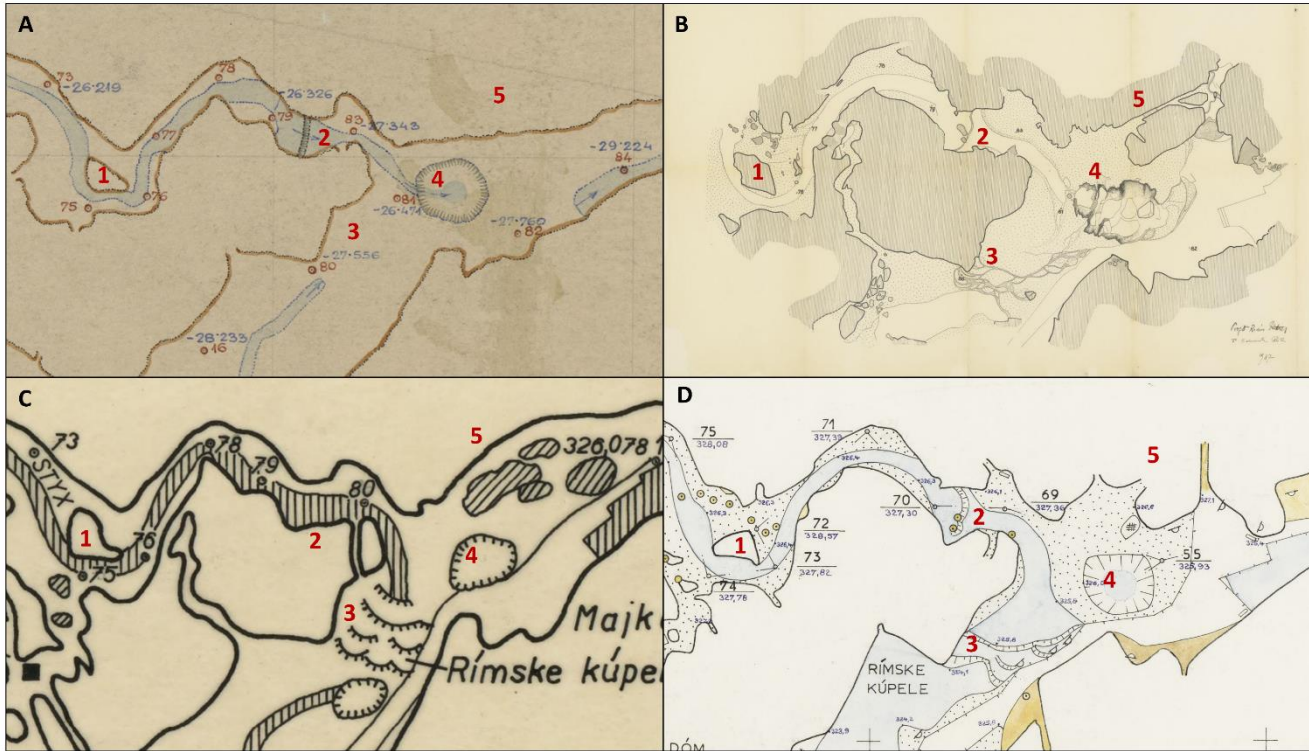
Vertical views



Unfolded profiles



Porovnanie

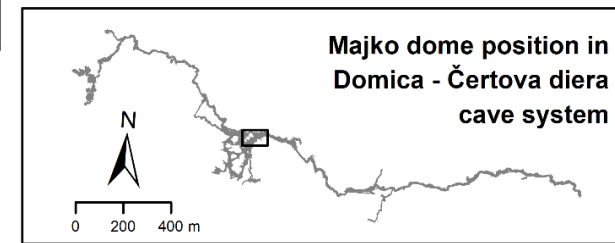
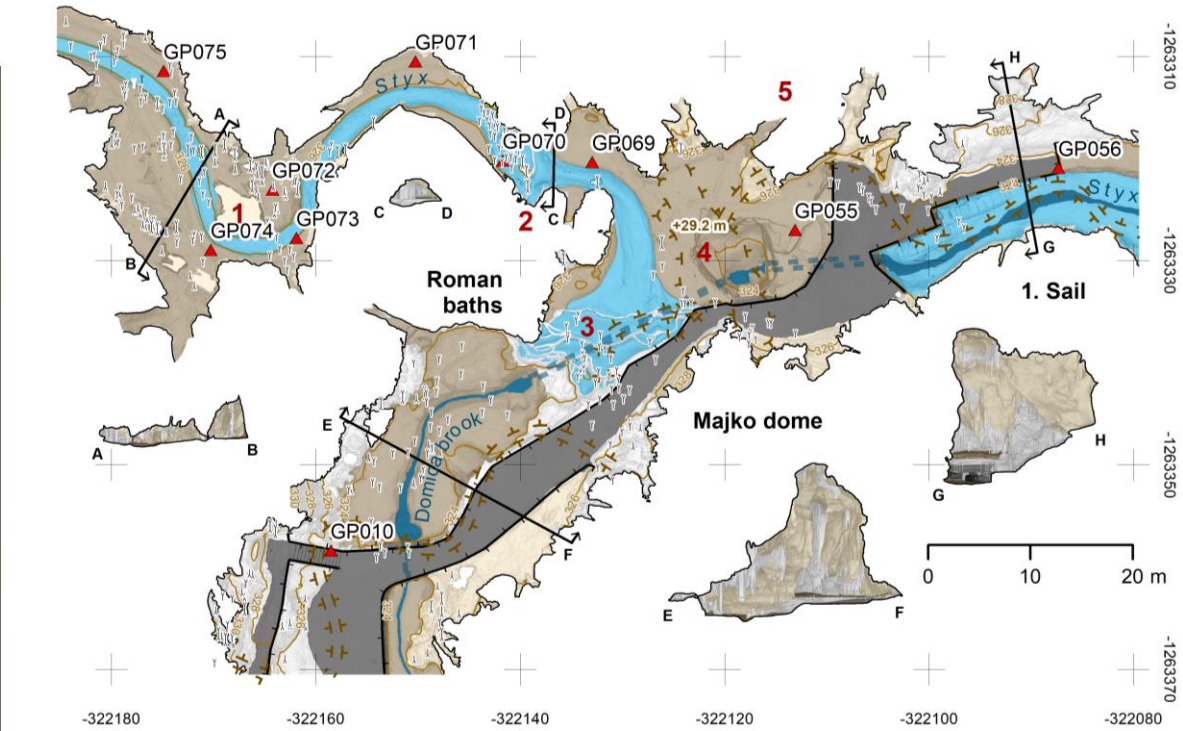


A – Paloncy 1931

B – Kettner a Roth 1938

C – Droppa a Chovan 1964

D – Novoveský - Geologický prieskum 1975



- | | | | |
|---|---------------|-------|------------------|
| ⌋ | stalactit | — — — | pipe |
| ⌋ | stalagmit | □ | flowstone |
| ⌋ | pillar | □ | limestone |
| ⌋ | cave boundary | □ | clay |
| — | profile | □ | concrete path |
| ⌋ | chimney | □ | seasonal water |
| ⌋ | ceiling form | □ | water |
| — | contour | □ | max. cave extent |

Záver

Inovatívny prístup pre odvodenie mapy jaskyne s tieňovaným dnom jaskyne

Použitie mapového kľúča UIS

Nezávislosť od polygónového ťahu

Prechod od kreslenia k odvodu mapy

Exaktizácia polohy a tvaru objektov

Možnosť odvodu akéhokoľvek rezu jaskyňou a použitia ľubovoľnej témy mapy

Problém orientácie v labyrintoch

Rozpracovaný príspevok o tvorbe mapy jaskyne z laserového skenovania

Vytvorenie atlasu jaskynného systému Čertova diera – Domica

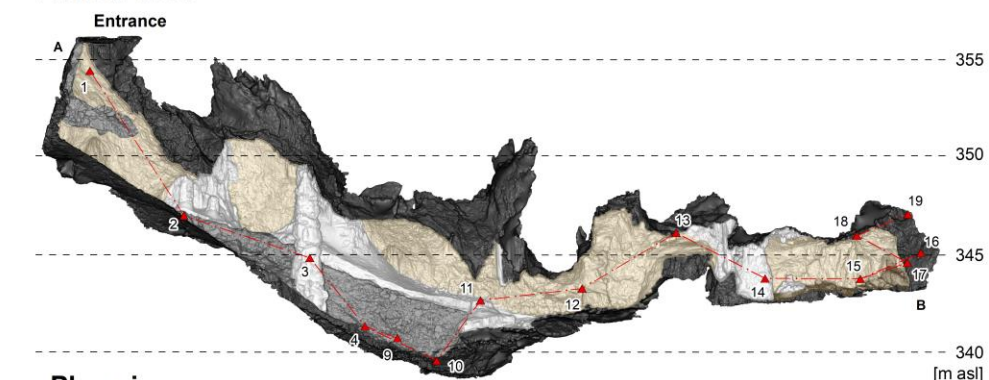
Stará Domica

Plan view and orthogonal projections of the cave
Terrestrial laser scanning with Riegl VZ-1000
Registration StDev: 0.0036 m
Horizontal datum: S-JTSK - Krovak East North
Vertical datum: Kronstadt level Baltic height
Mapped by: Hochmuth Z., Mikloš J., Šupinský J.
Date of mapping: 27.08.2019

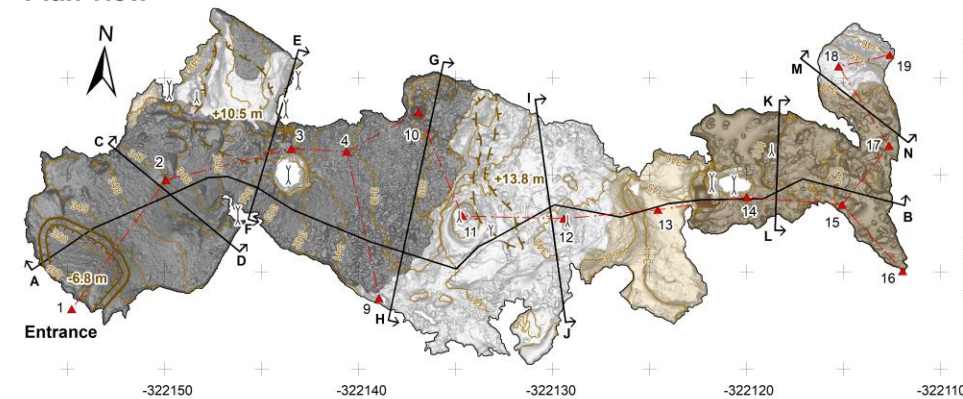
Legend:

	stalagmite		chimney
	stalactite		contour
	pillar		flowstone
	survey		massif
	cave boundary		clay
	profile		debris
	open pit		max. cave extent

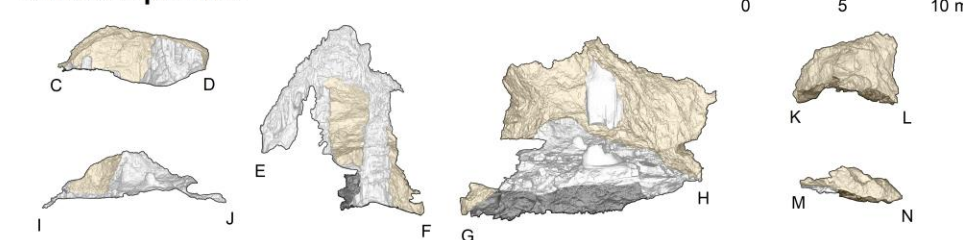
Vertical view



Plan view



Selected profiles



Ďakujem za pozornosť

jozef.supinsky@upjs.sk
geografia.science.upjs.sk

