

Earthquakes in Slovakia

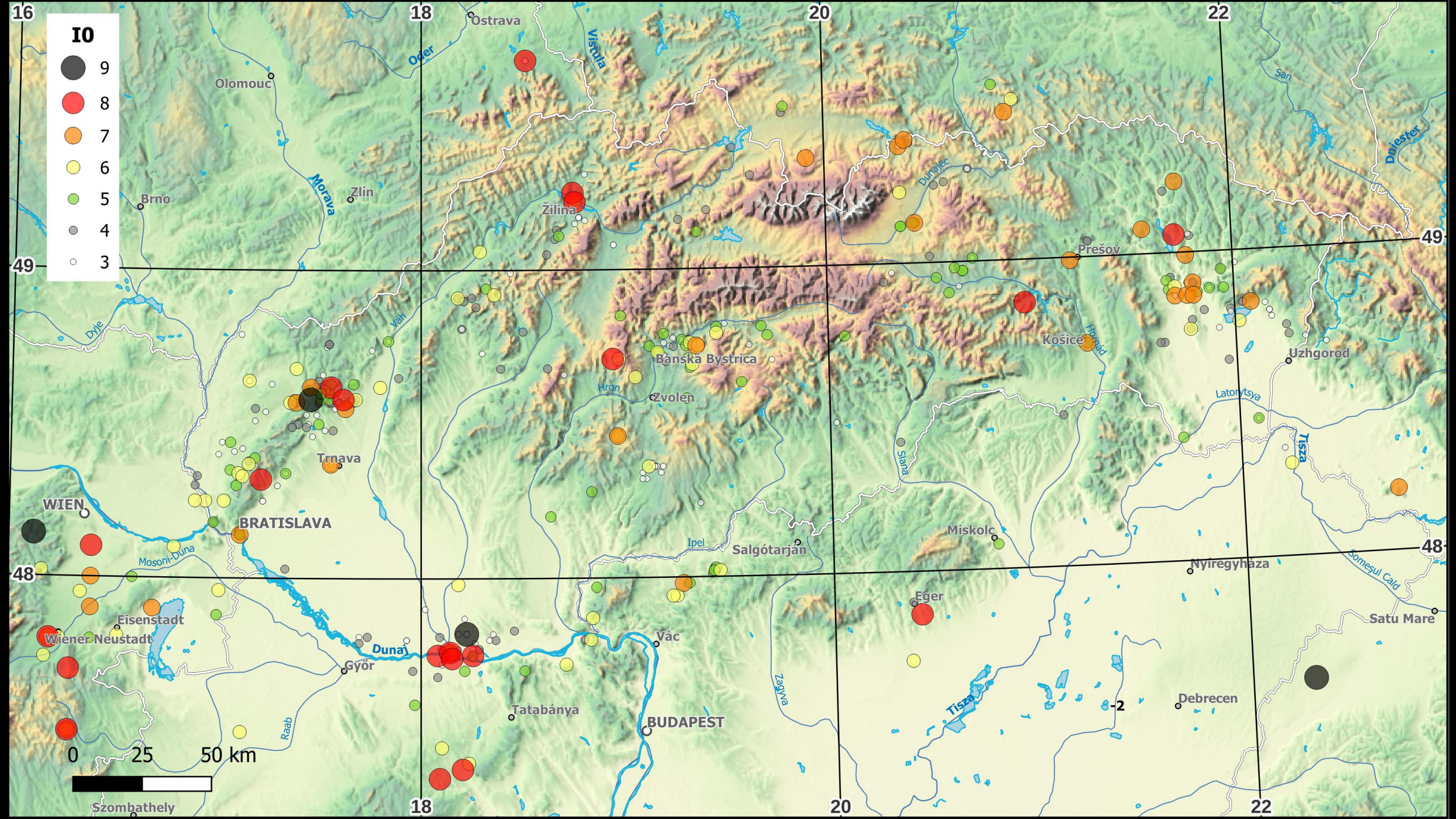
Eva Rutšeková Róbert Kysel Andrej Cipciar

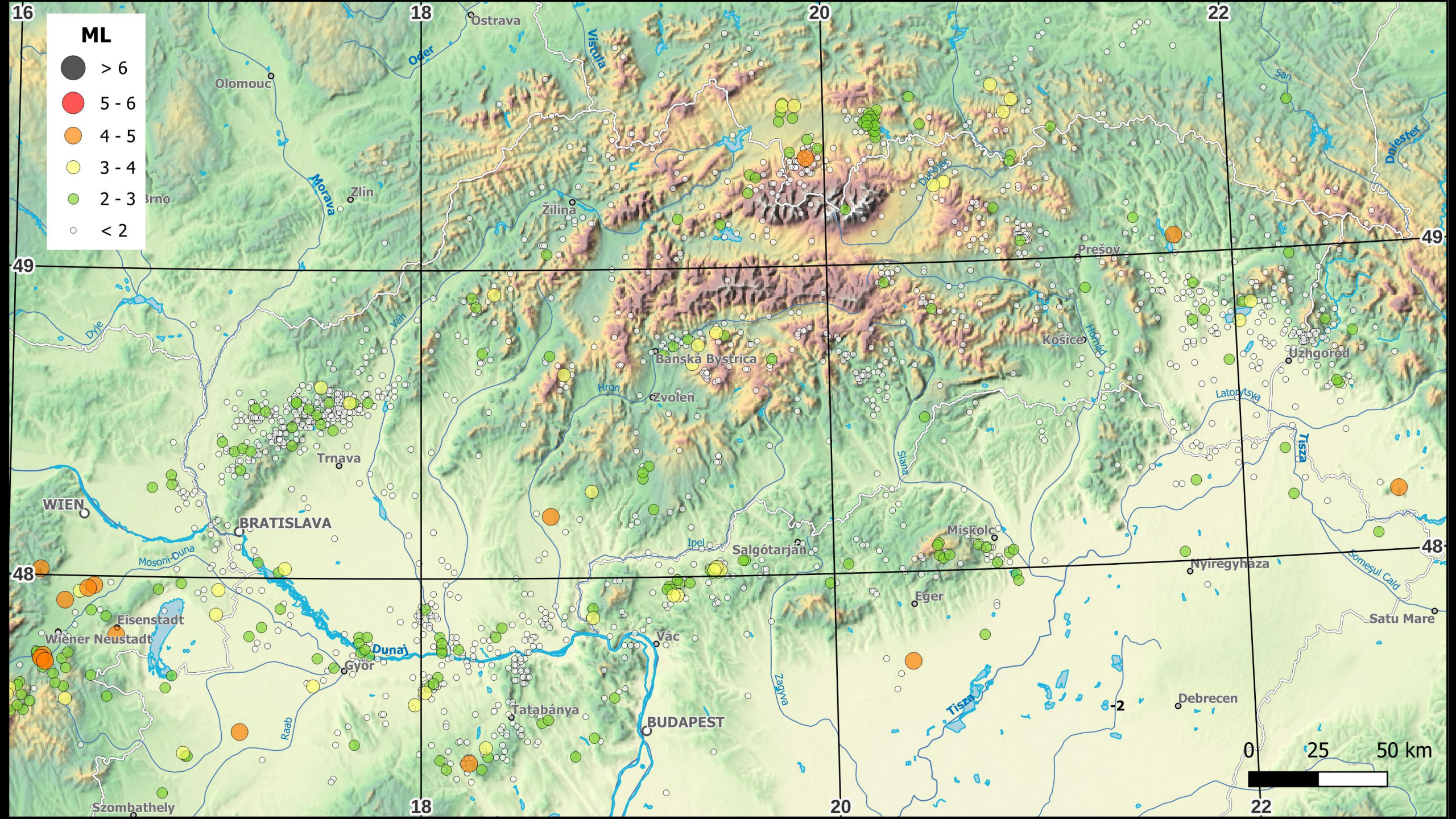
Kristián Csicsay Lucia Fojtíková Jozef Kristek

Martin Gális Miriam Kristeková Peter Moczo

Comenius University in Bratislava, Slovakia

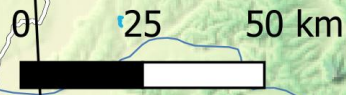
Earth Science Institute, Slovak Academy of Sciences, Bratislava, Slovakia

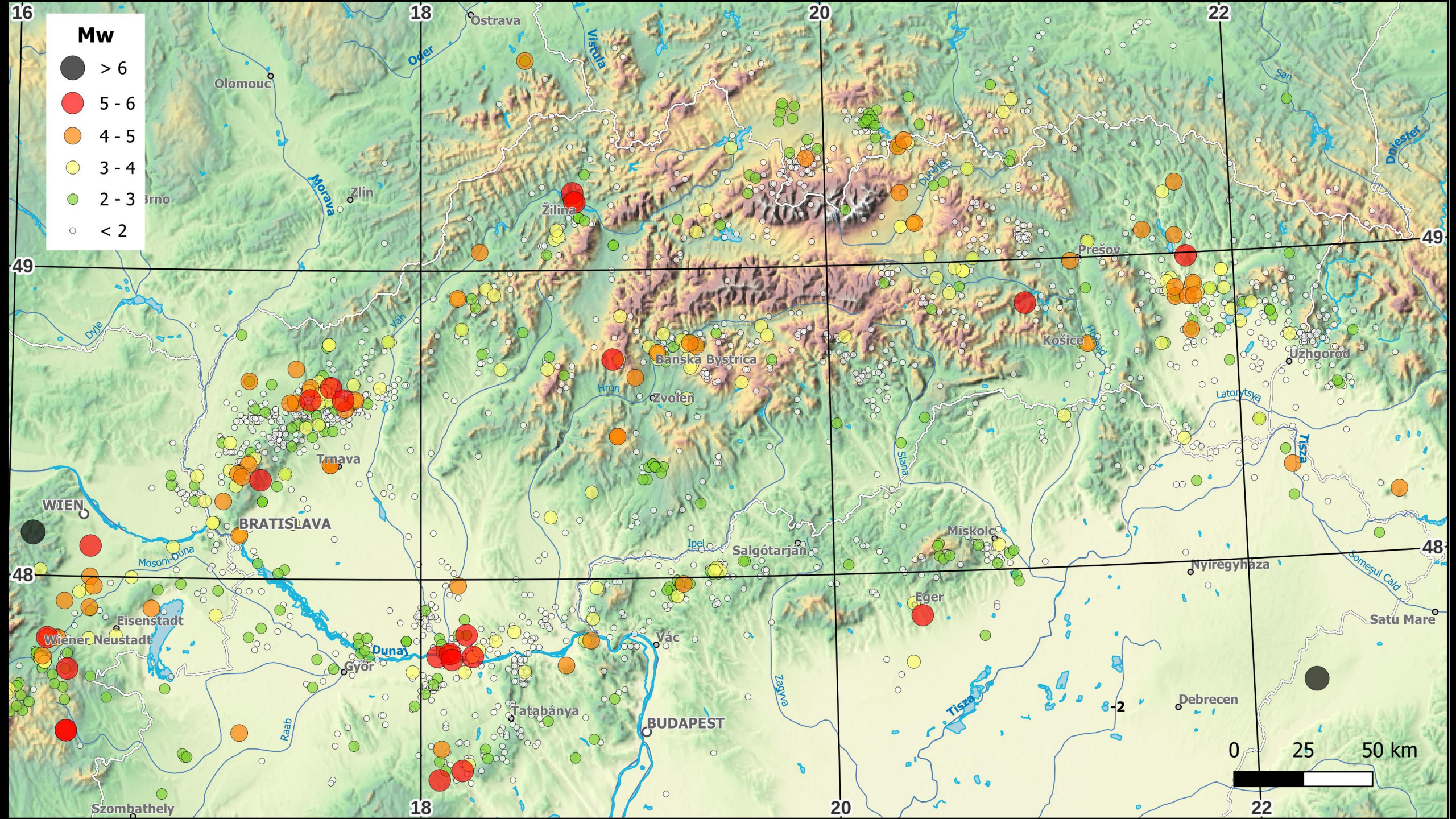




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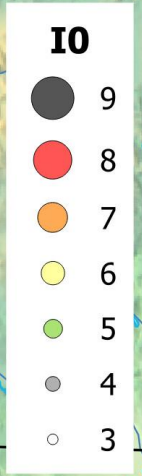
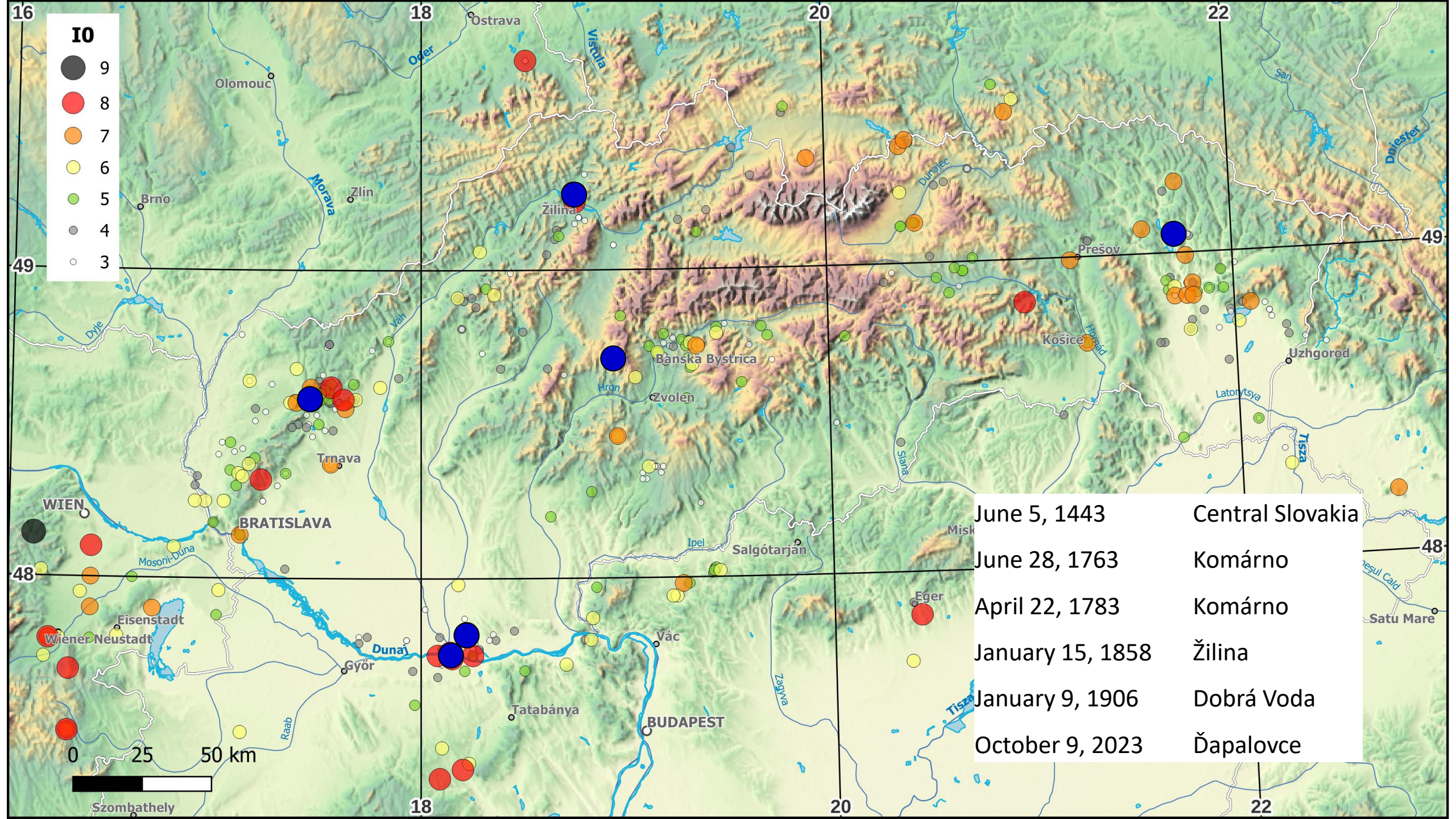
- > 6
- 5 - 6
- 4 - 5
- 3 - 4
- 2 - 3
- < 2



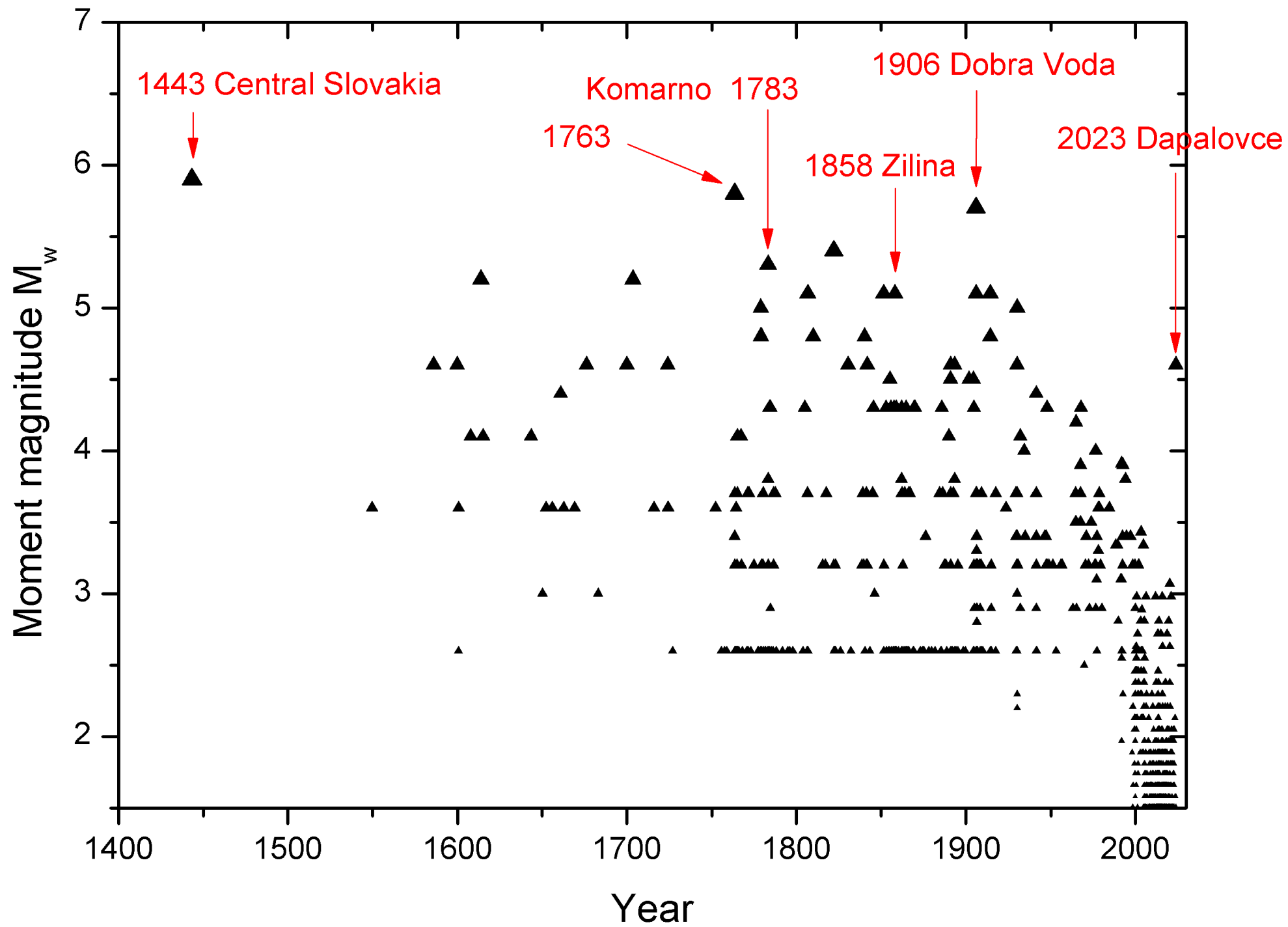


Earthquakes in Slovakia – basic statistics

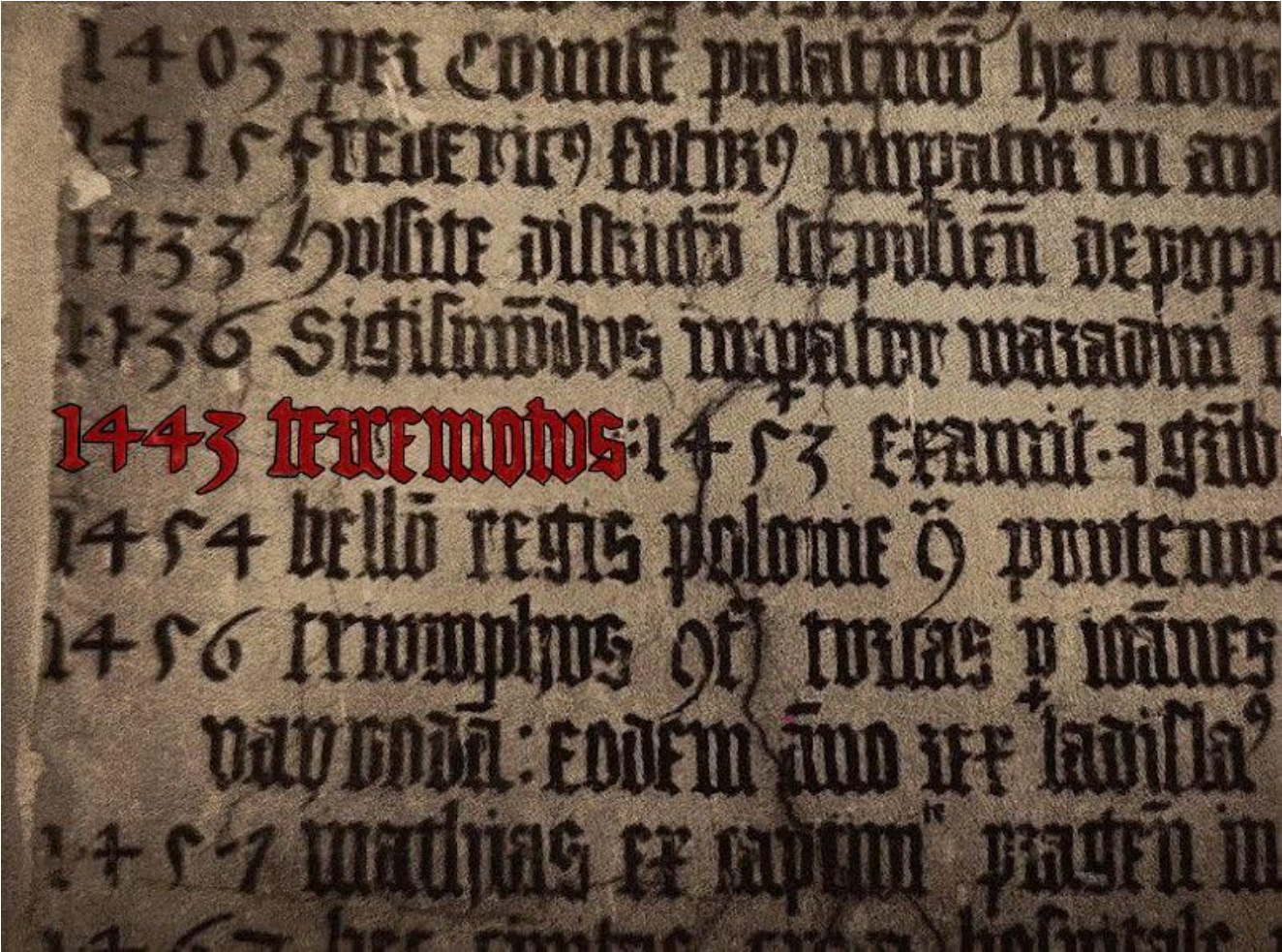
- Earthquake catalogue for Slovakia covers period **1034 – 2023**
- Total number of macroseismically observed earthquakes: **791**
- Total number of seismometrically recorded earthquakes: **2293**
- Total number of earthquakes in the catalogue: **2946**



June 5, 1443	Central Slovakia
June 28, 1763	Komárno
April 22, 1783	Komárno
January 15, 1858	Žilina
January 9, 1906	Dobrá Voda
October 9, 2023	Ďapalovce

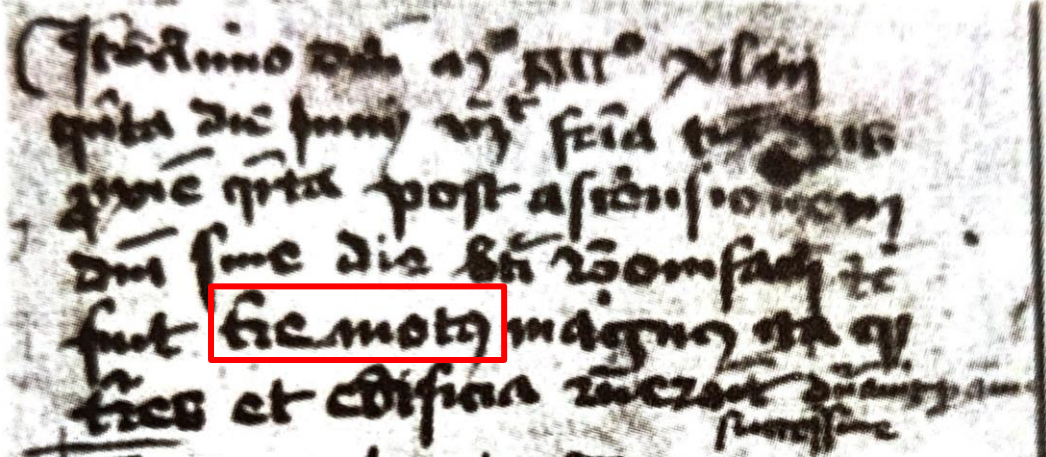


June 5, 1443 Central Slovakia

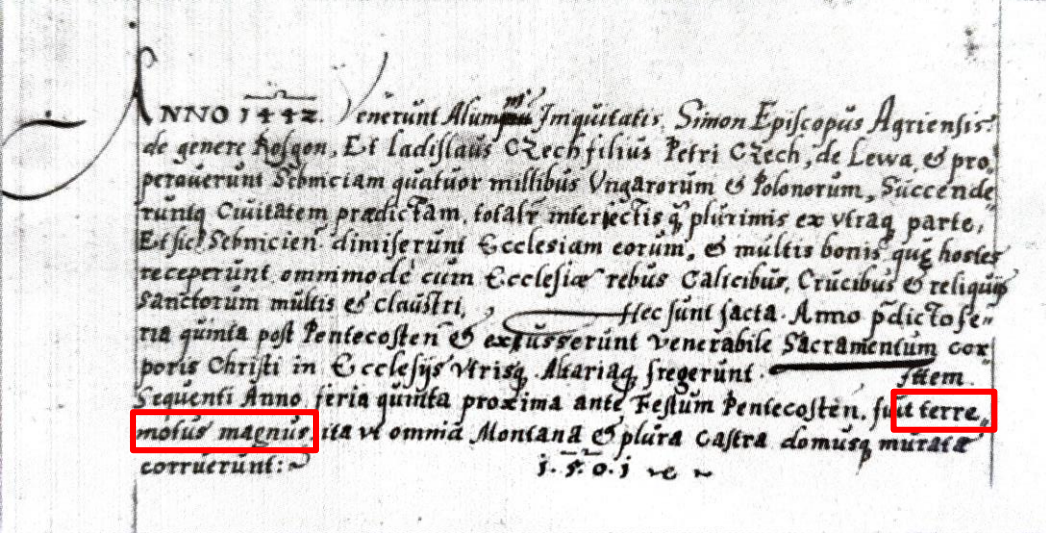


„1443 terre motus“

Henckel Library, Basilica of St. James, Levoča



Codex Cremnicensis



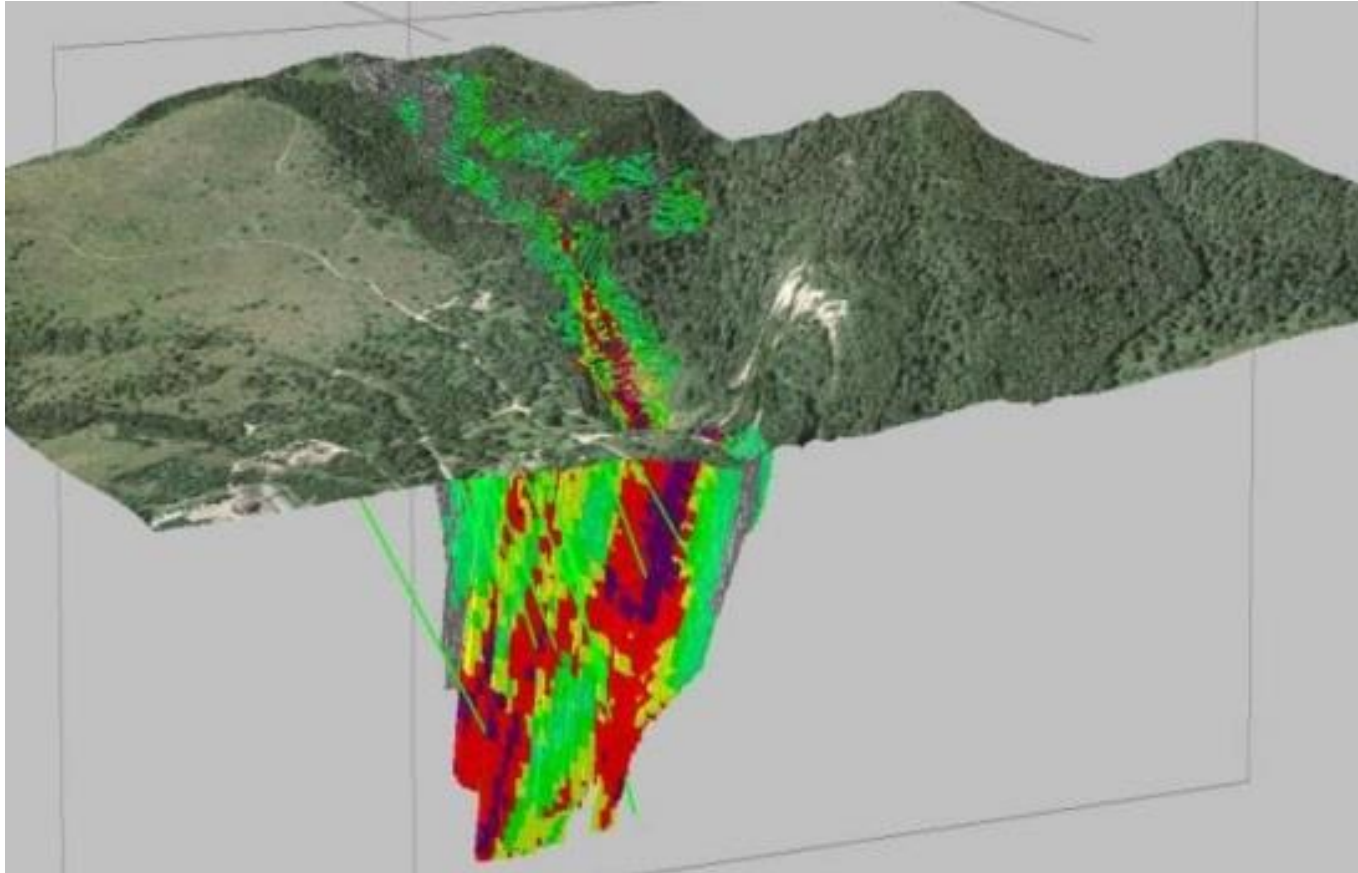
Urban records, Banská Štiavnica

June 5, 1443 Central Slovakia

Anno Domini MCCCXLIII. in die V. Junii factus est terræ motus
universalis, in ruinam multorum ædificiorum.

Inscription on the wall of south entrance, Basilica of St. James, Levoča
Karl Wagner, *Analecta Scepusii sacri et profani, pars II.*

June 5, 1443 Central Slovakia



Šturec sink-hole, Kremnica, 170 m deep

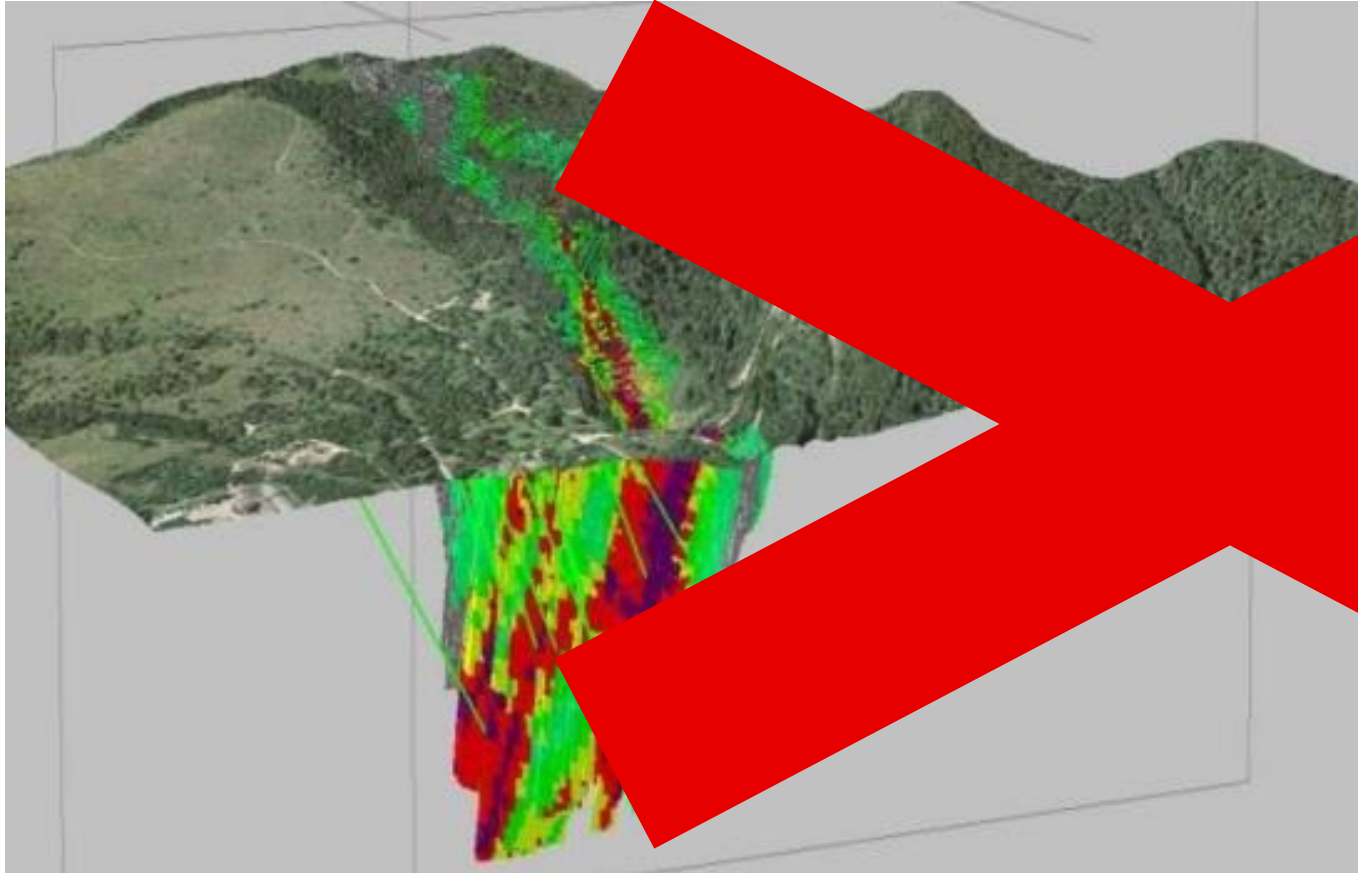
- 2 million m³ of rock slid into the excavated areas.
- The number of victims is between **90 and 450**.

It was the **God's punishment** for the disobedience of the miners who had worked in the mine on the feast day.

Those who disobeyed the call to leave their workplaces and stayed in the mines, perished.

It is said that the blood of miners flowed out of the mines.

June 5, 1443 Central Slovakia



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FACTS



Veduta of Banská Štiavnica, C. T. Della Martin, 1763

- $I_0 = 8^\circ$ EMS-98
- $M_w = 5.9$
- Damage to the **Central Slovakia mining towns rich on rare metals** – Kremnica, Banská Štiavnica
- Destruction of a **castle in Slovenská Ľupča**
- Shaking felt in **Krakov, Brno and Vienna**

*„There was a great earthquake in Hungary,
so that castles built on rocks
and the churches of towns and villages collapsed.
The castle of Slovenská Ľupča collapsed completely,
except for a vault,
and more than 30 people
were buried among the ruins.”*

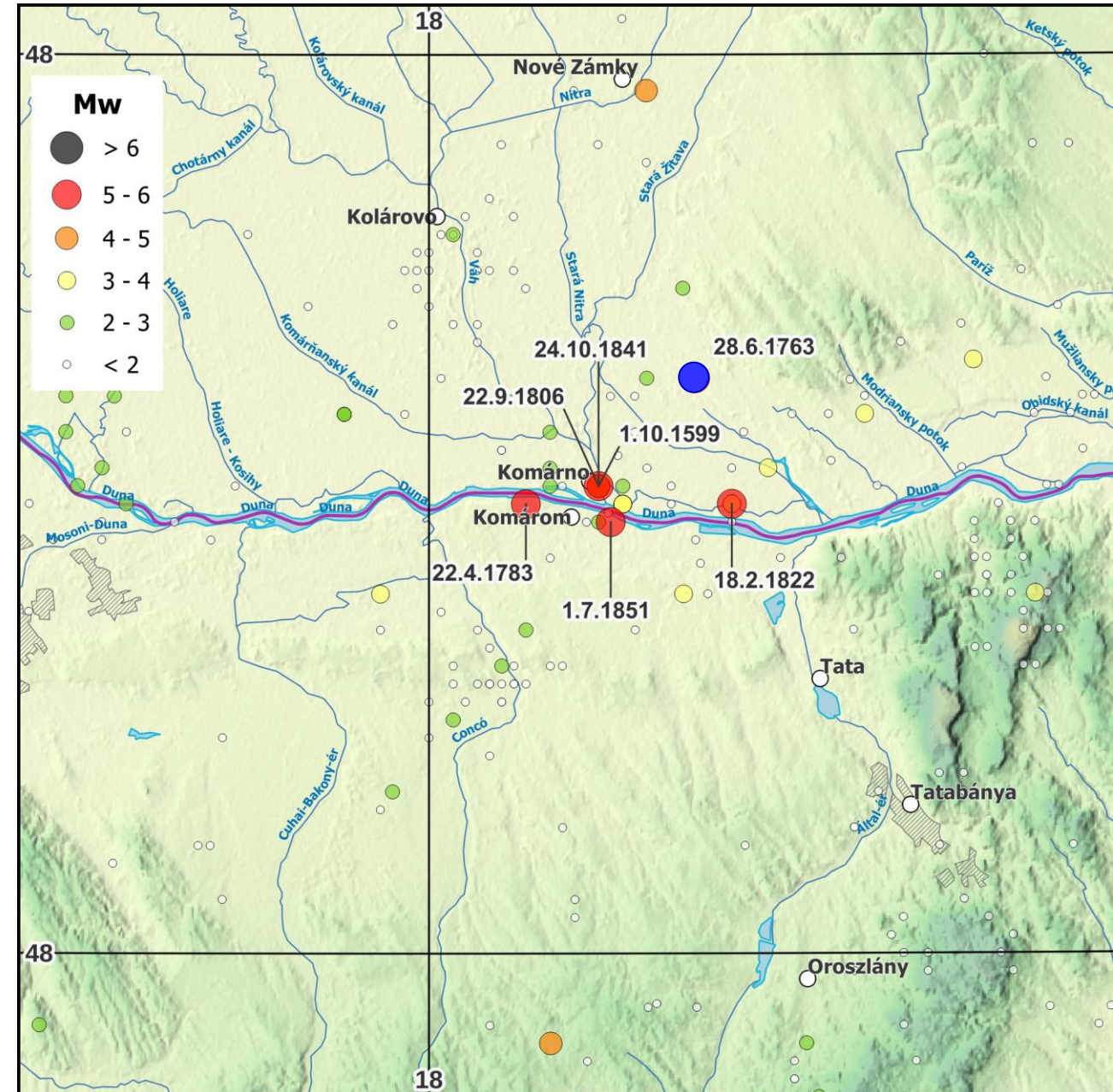
June 28, 1763 & April 22, 1783 Komárno



Komárno earthquake 1763, Karl Friedl, 1763-1773, ordered by the Council of Komárno

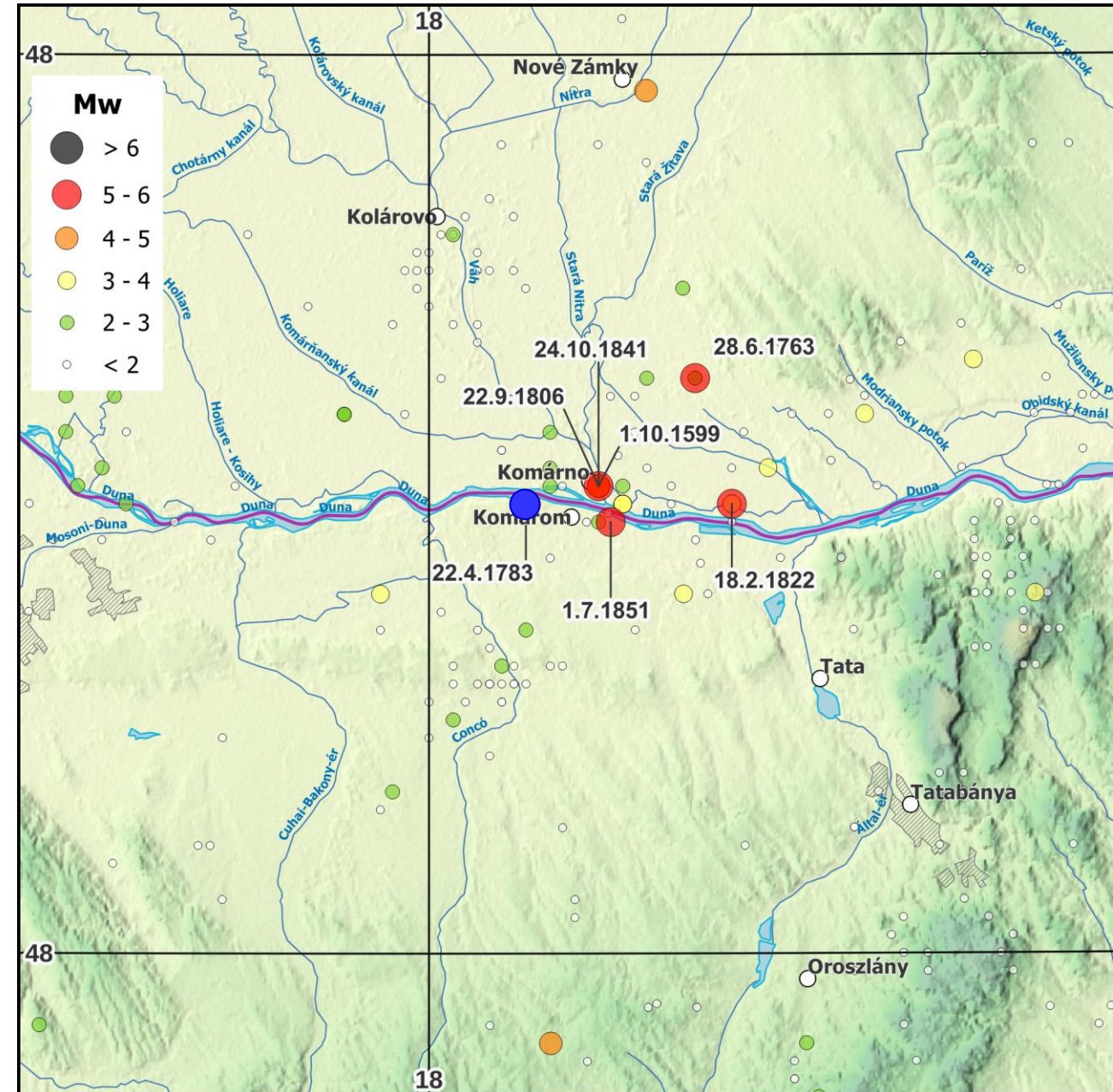
June 28, 1763

- $I_0 = 8-9^\circ$ EMS-98
- $M_w = 6.3$ or $M_w \geq 6.5$
- June 28, 1763, 5-5:30 AM
- Macroseismic effects reported on an area of over **87 800 km²**
- Felt in **Leipzig, Dresden** and **Belgrade**
- In Komárno **91% of buildings** were damaged
- **63 dead and 102 wounded** in Komárno



April 22, 1783

- $I_0 = 7-8^\circ$ EMS-98
- $M_w \leq 6.0$
- Damage or collapse of **more than 500 houses in Komárno**
- **No reported victims**
- Fortress in Komárno **lost its great military significance**
- Followed by a **century of increased seismic activity in the region**

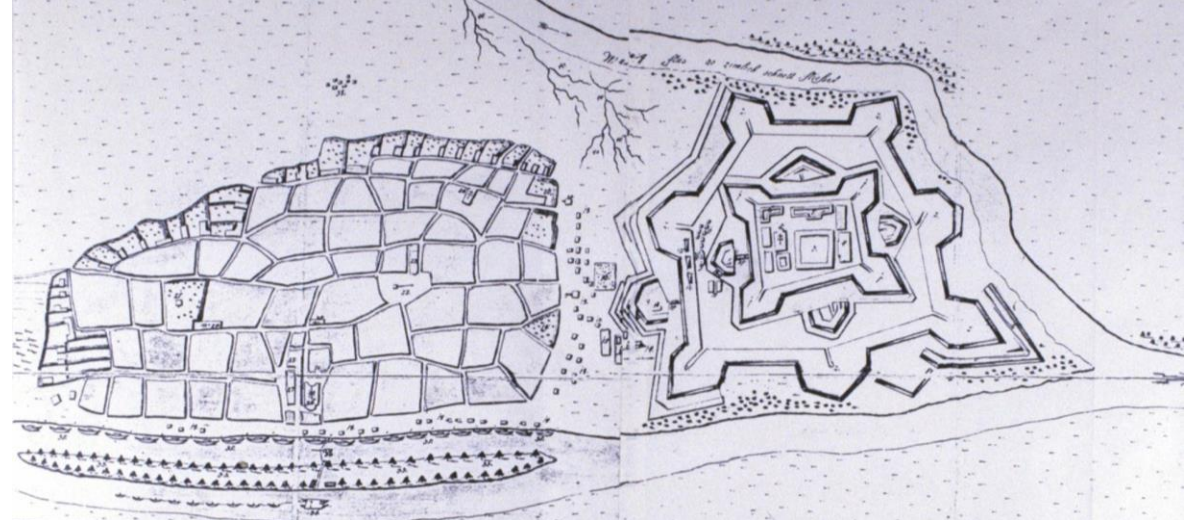




Unknown Author, 1766, Frauenkirchen, Austria



Phil. Binder Sc., Budae, 1766, SNM, Martin, Slovakia



Joseph Kastner, 1763, ÖNB, Vienna, Austria



Karel Jaurnich, 1763, NM, Prague, Czech Republic

Štefan Korbel' (1763)

A memorable reflection on the terrible earthquake in which especially the glorious and capricious city of Komárno, impoverished beyond measure and deprived of its glory, was ... Year 1763.

Dávid Baróti Szabó (1777)

About the Departure of the Komárom Land

Johannes Baptista Grossinger (1783)

Elegia de nuperrimo terrae motu Comaromiensi, qui incidit in Feriam III. Paschatis, seu XXII. Aprilis Anni 1783. sub mediam quartam antelucanam.

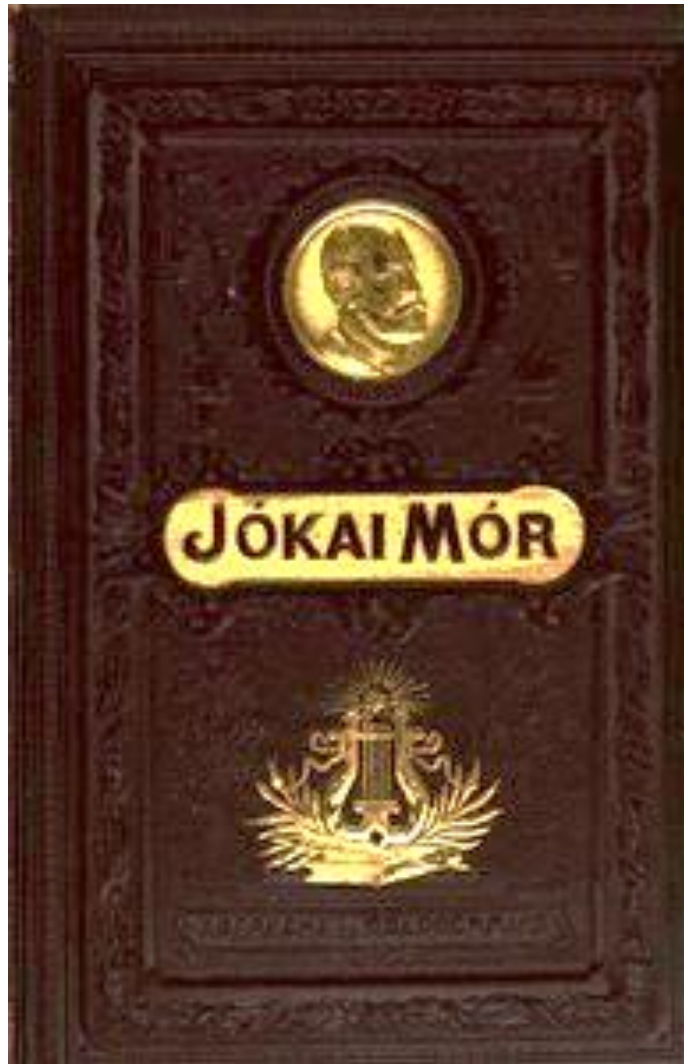
Verse correspondence between Komárno poets **Julianna Fábián** and **József Gvadányi (1798)**

*These were taken to Pest for burial,
With other documents, they were buried there.*

*Many names were omitted, and not written down,
Especially foreigners were left out.*

*Those who came to work from counties,
Unrecognized, they were not included.*

*Many locals were also not recognized,
Their faces were badly damaged.*



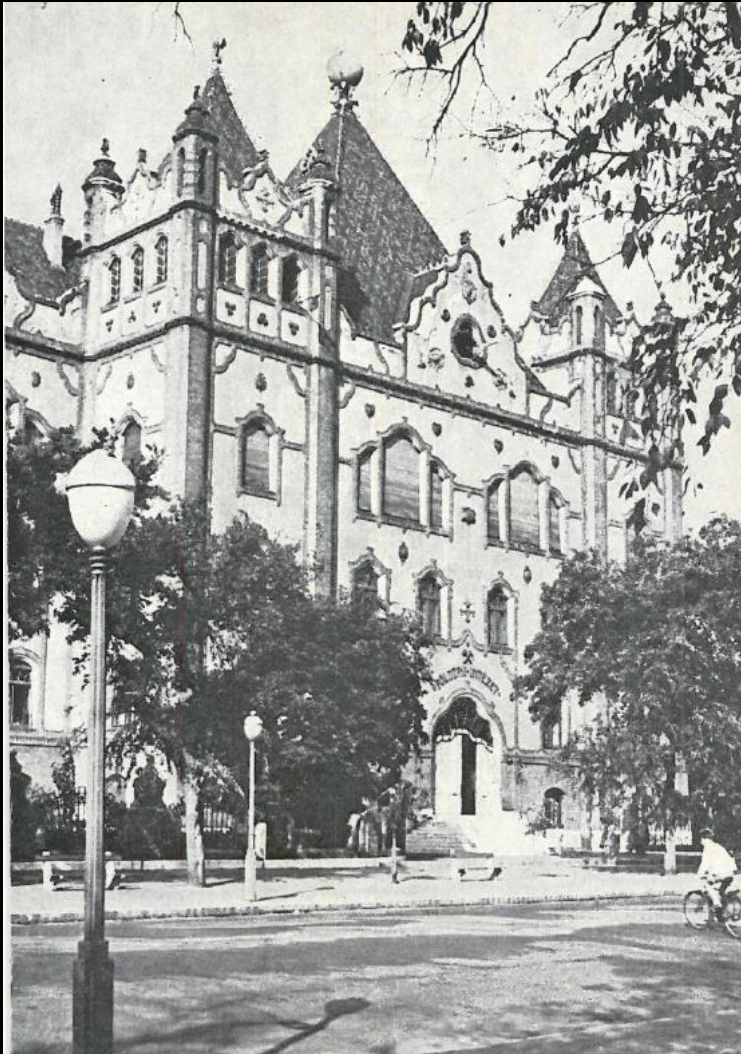
„It is now ninety-six years since this event took place.

None of those who saw that day with their own eyes are alive, even those who were born that year, are all long since buried, but the memory of the day remains a holiday for the late grandchildren and for all those who live within the gates of that city, which the recent years gave another historical name.“

Mór Jókai, *The Cursed Family*, Preface, 1852







Headquarters of
the Hungarian Geological Society
founded in 1848



Franz X. Schafarzik (1854-1927)
founded the Hungarian
Earthquake Committee in 1881

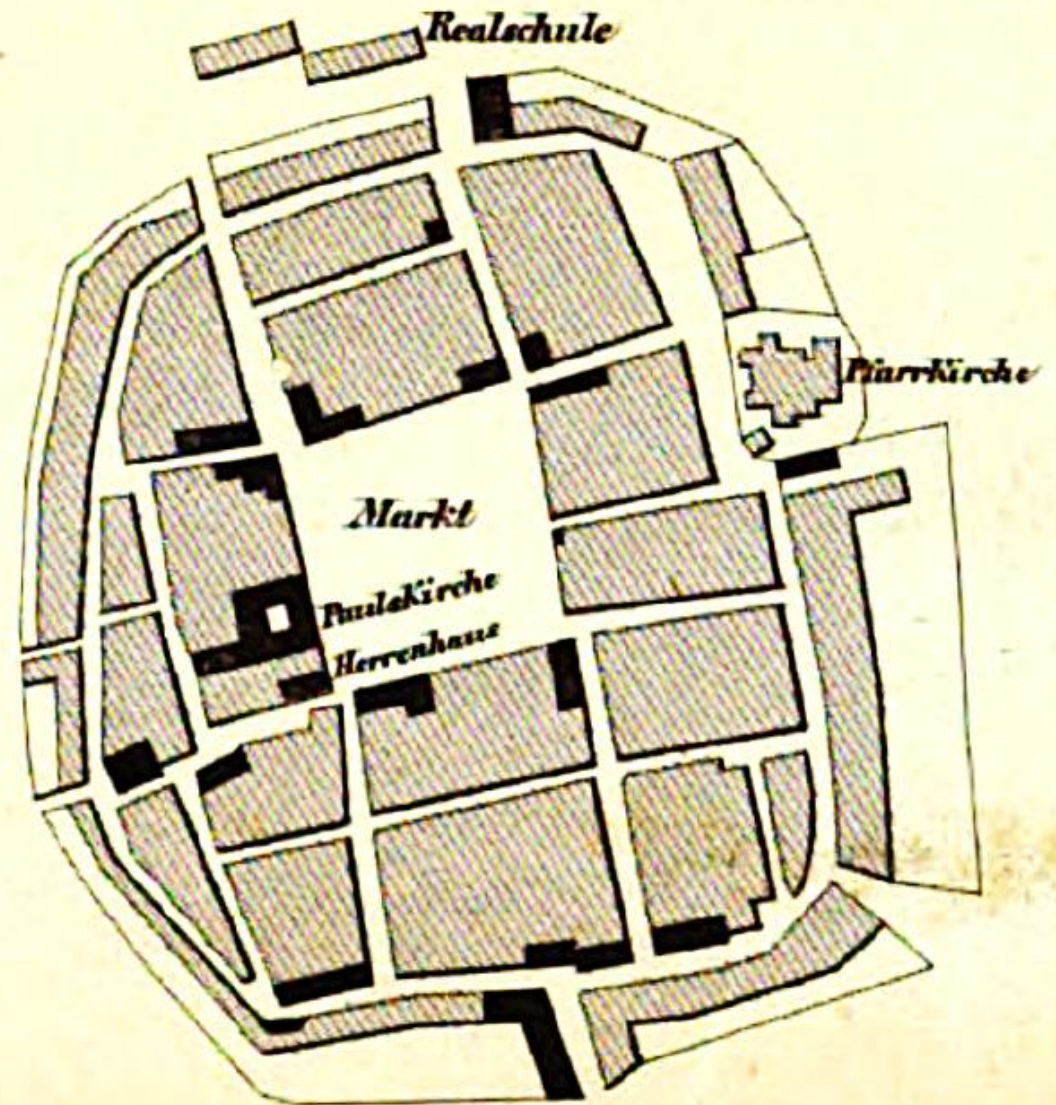


Journal of
the Hungarian Geological Society,
1871, vol. 1

January 15, 1858 Žilina

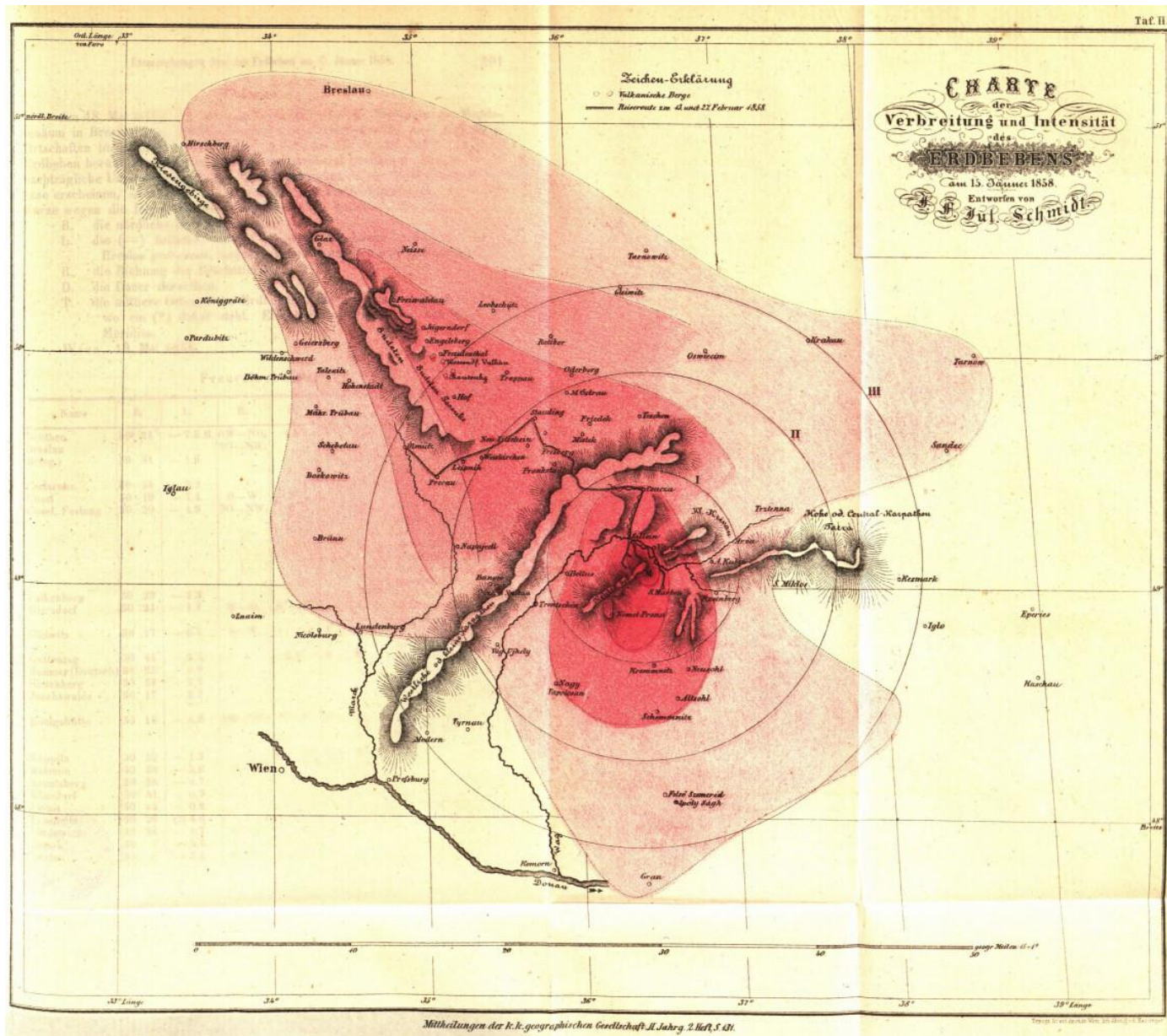
- $I_0 = 7-8^\circ$ EMS-98
- $M_w = 5.9$
- Most important earthquake in 19th century
- Damage to all buildings in Žilina
- No victims or severely wounded
- Felt on an area of 66 000 km² in Slovakia, Silesia, northern Moravia, Austria
- For the first time, a questionnaire was used for earthquake research in Slovakia = a breakthrough in the documentation and analysis of earthquakes in Slovakia

Grundriss der Stadt Sillein.

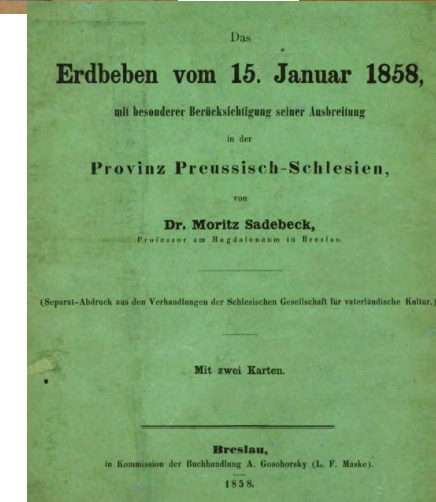
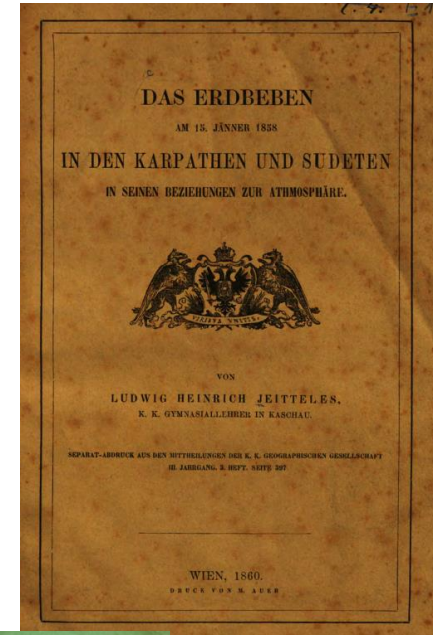
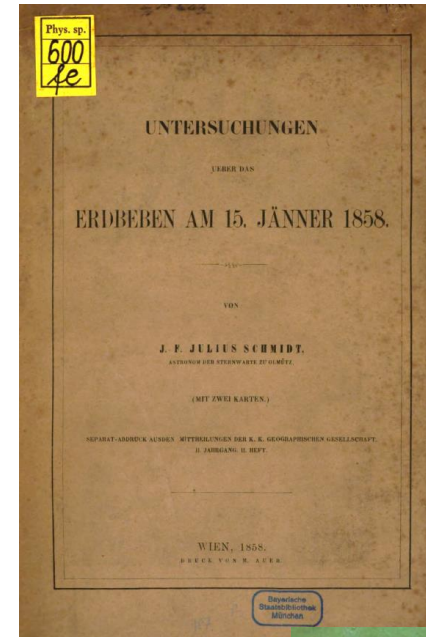


Sadebeck, 1858

Maafsstab = $\frac{1}{7000}$



Macroseismic survey by
H. L. Jeitteles, Kornhuber, M. Sadebeck,
J. F. Julius Schmidt, J. Hunfalvy



J. F. Julius Schmidt's generalized map of the January 15, 1858, Žilina earthquake, 1858

ZO STAREJ ŽILINY

Zemetrasenie lokalizoval maliar Jozef B. Klemens



Aj keď nepoznáme presnú intenzitu zemetrasenia, od historikov vieme, že otrasy spôsobili poškodenie všetkých domov v Žiline, pričom niektoré sa stali neobývateľnými. Kľúčovým človekom, vďaka ktorému sa podarilo zemetrasenie lokalizovať i zaznamenať, bol čestný Žilinský mešťan Jozef Božetech Klemens. 17. januára uplynulo 119 rokov od jeho smrti.

Klemens sa preslávil najmä ako portrétista slovenských dejateľov. Známe sú jeho olejomaľby Štúra, Moyzesa, Sládkoviča. Okrem vyštudovaného výtvarného umenia sa však vážne venoval aj staviteľstvu, bol učiteľom, publicistom, botanikom, vynálezcom a tiež zamieneným geológom. Vlastnil jed-

Koniec januára 1858 Žilinou otriasol. Doslovne. Len desať rokov po obrovskom zničujúcom požiari, pri ktorom okrem niekoľkých domov lahla popolom celá Žilina, postihlo mesto a blízke okolie zemetrasenie. Najväčšie a najsilnejšie v doterajšej histórii.

nu z najbohatším mineralogických zbierok na Slovensku, objavil ložisko kamenného uhlia a farebného mramoru, ba dokonca sa pokúšal v oblasti geológie aj podnikáť. Aj keď bolo Klemensove podnikanie neúspešné, bohaté vedomosti a geologické skúsenosti sa mu zišli práve pri Žilinskom zemetrasení v januári 1858. Klemens vtedy robil odborné pozorovania, ktoré potom posielal rôznym vedeckým inštitúciám. Sám bol členom Ríšskeho geologického ústavu vo Viedni, Uhorskej prírodovednej spoločnosti v Pešti a neskôr aj členom prírodopisno-geologického odboru Matice slovenskej. Po vyhodnotení Klemensových pozorovaní sa podarilo presne určiť epicentrum zemetrasenia, a lokalizovať ho na východ od Žiliny.

Polyhistor Klemens nebol rodený Žilincan. Narodil sa v Lipovskom Mikuláši a do Žiliny ho v 39-tich rokoch priviedlo jeho zamestnanie. Od roku 1856 pracoval na tunajšej reálke ako učiteľ kreslenia. Žil bohatým pracovným životom. Popri povinnostiach



v škole stihol napríklad vytvoriť aj sakrálnu olejomaľbu pre žilinský Kostol najsvätejšej trojice, či pripraviť projekt obnovy zrúteného farského kostola, ktorý bol realizovaný v rokoch 1866 až 1869. Jozef Božetech Klemens si v Žiline

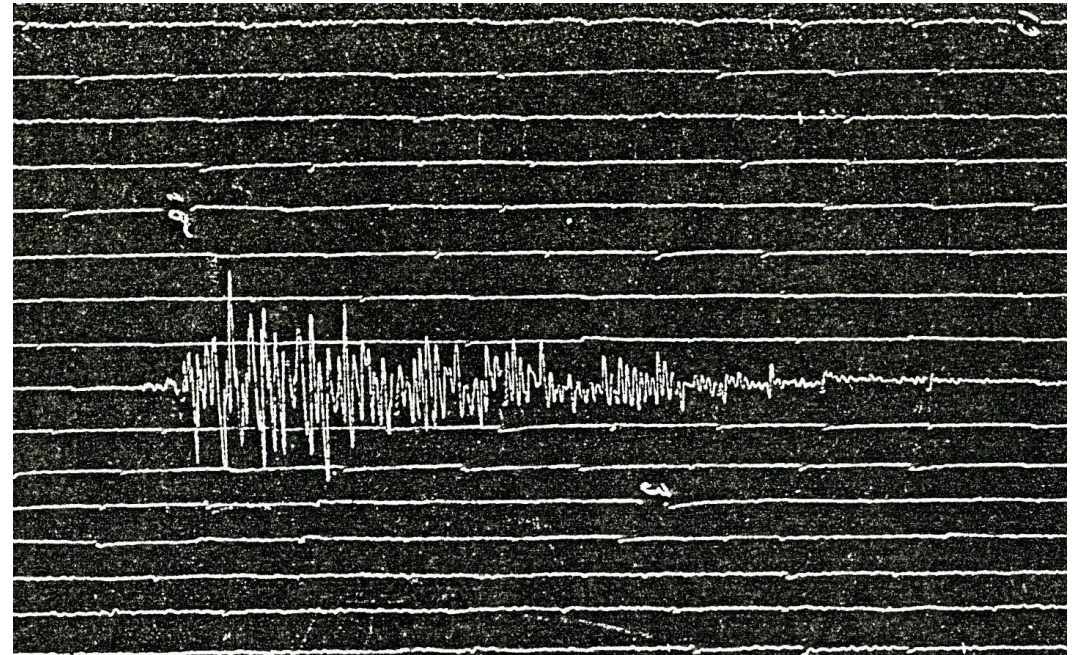
získal obľúbenosť aj vážnosť. Vďačil za ňu práve svojej mimoriadnej všestrannosti a angažovanosti. V roku 1860 bol preto menovaný za čestného mešťana. Bohužiaľ, tento učený muž zostal v našom meste pôsobiť len sedem rokov.

Po zrušení tunajšej reálky odišiel v roku 1863 do Banskej Bystrice. Jozef Božetech Klemens zomrel vo Viedni na následky nevydarenej operácie presne dvadsať rokov po svojom odchode zo Žiliny.

(far)

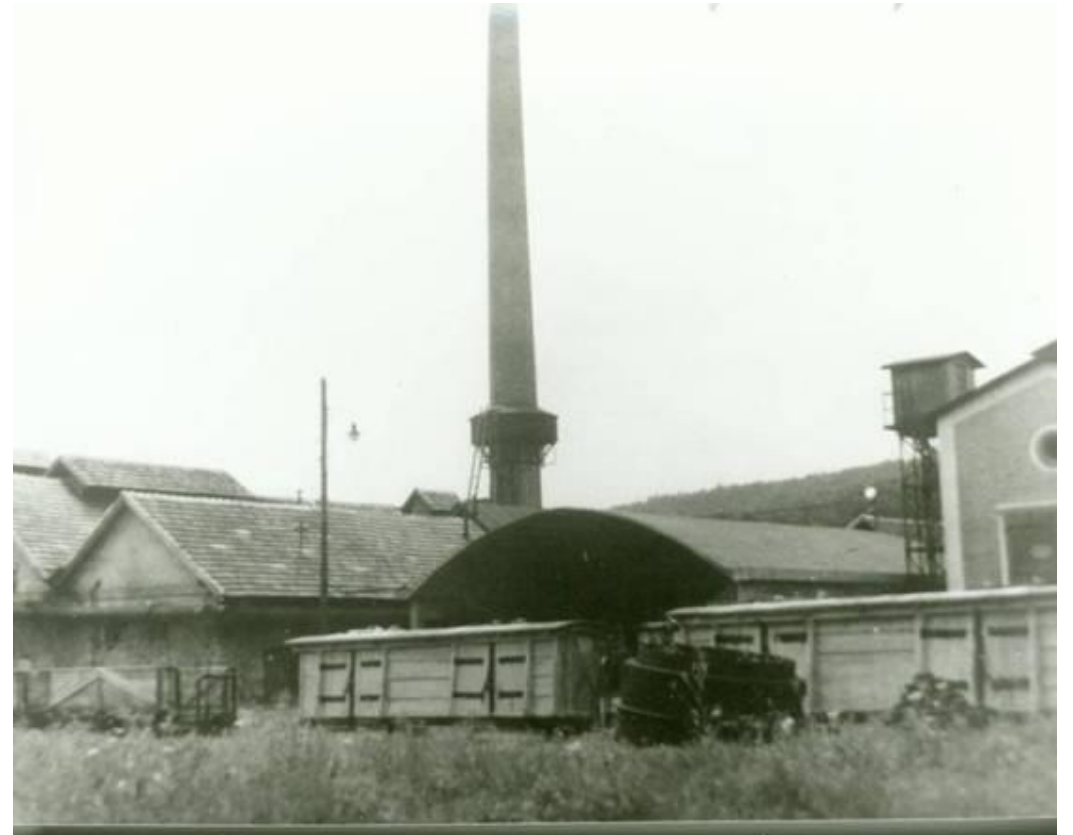
January 9, 1906 Dobrá Voda (Jókő)

- Strongest earthquake in the 20th century ($I_0 = 8^\circ$ EMS-98, $M_w = 5.7$)
- First recorded earthquake on the territory of Slovakia
- Réthly (1907): felt on the territory more than 30 000 km²



January 9, 1906 Dobrá Voda (Jókó)

- Chimney on the chemical factory in Dobrá Voda broke and rotated 45 degrees
- Aftershock January 16, 1906, rotated the chimney back



Před týdnem ve Vídni.



Baron Gautsch: »Co to?! Zemětřesení?? Přec
tedy nemáme pevnou půdu pod nohama??«

January 9, 1906 Dobrá Voda (Jókó)

Humoristické listy [Humorous Letters]

No. 3, January 19, 1906, p. 4

Baron Gautsch:

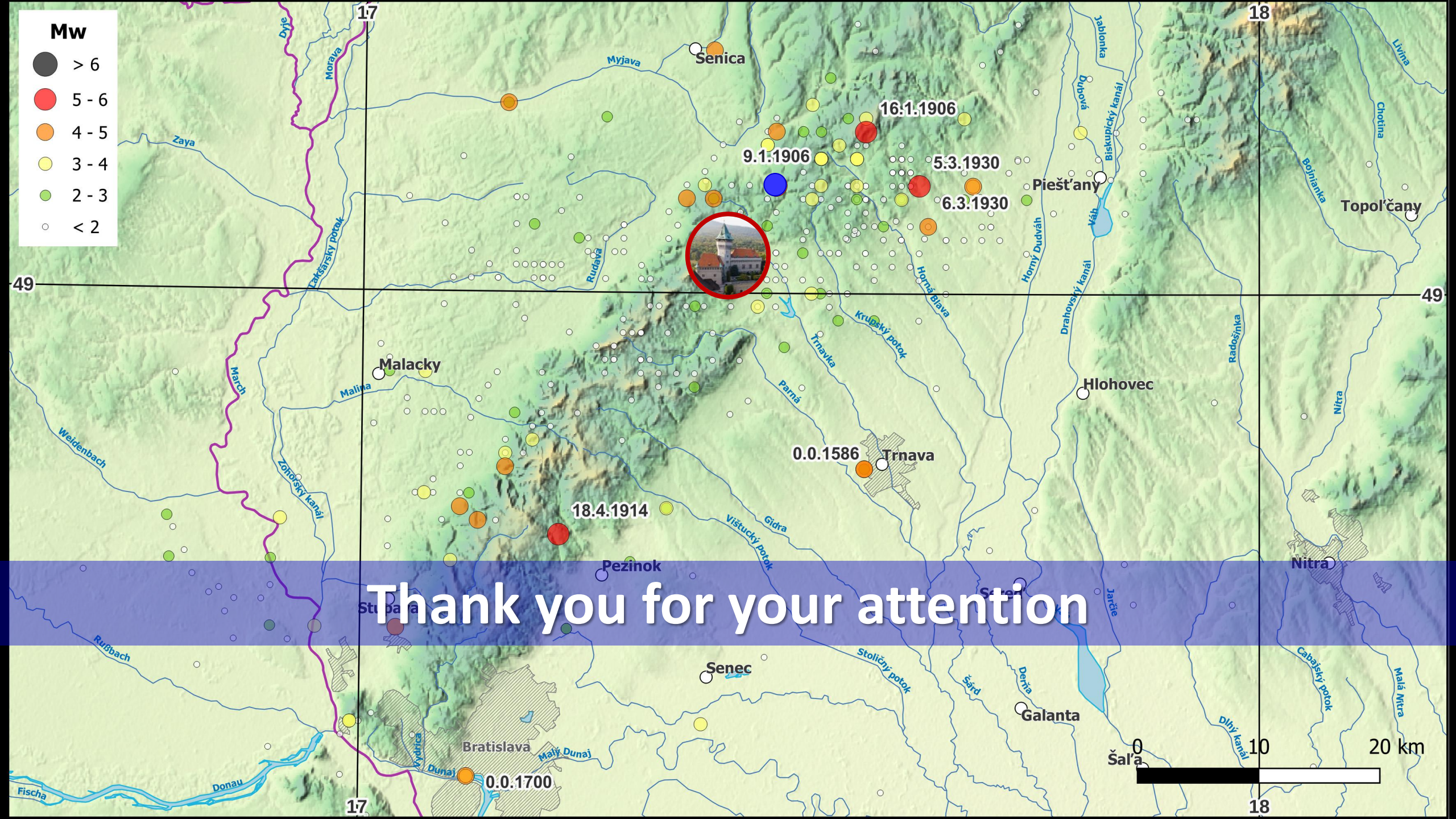
What?! An earthquake?!?

Are we losing solid ground under our feet???

Paul Gautsch Freiherr von Frankenthurn
was an Austrian statesman
who served in January 1906
as Minister-President of Cisleithania.

Mw

- > 6
- 5 - 6
- 4 - 5
- 3 - 4
- 2 - 3
- < 2



Thank you for your attention

