Seismic structure of the Cheb Basin from high resolution surveying – traveltime tomography results

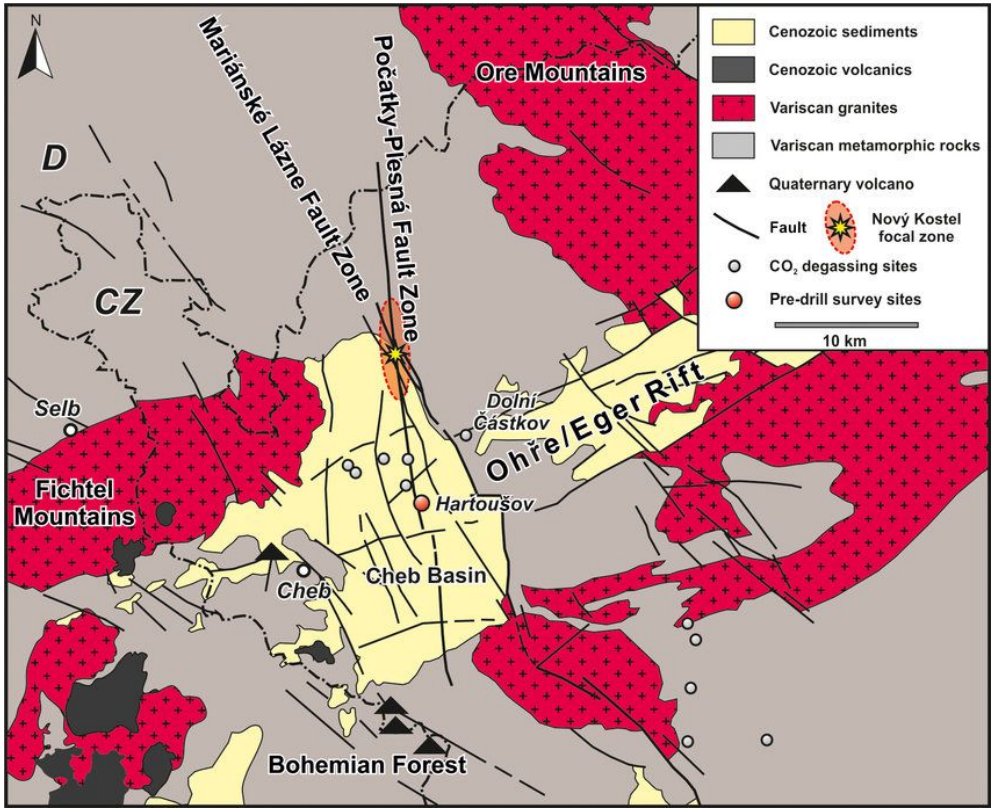
Supplementary material

Natalia Banasiak

Florian Bleibinhaus

Chair of Applied Geophysics, Department of Applied Geological Sciences and Geophysics

1. Introduction



Geological map of the Cheb Basin and surroundings
Bussert et al. (2017)

Area of investigation - **Cheb Basin**

- Largest instrumentally recorded magnitude of an earthquake M_L=4.6 (Fischer et al. 2014.)
- In the Holocene earthquakes with a minimum magnitude of M_W=6.5 (Štěpančíková et al. 2019)

What causes the earthquakes?

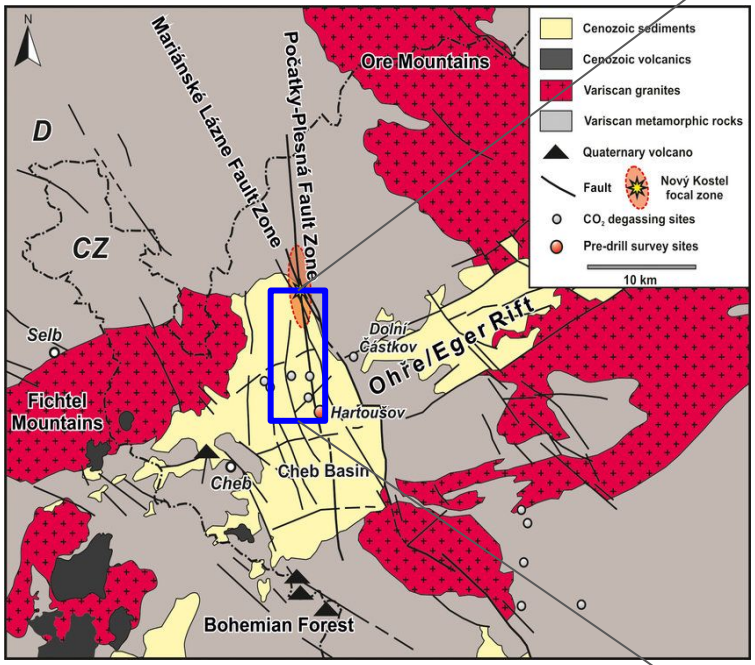
- Volcanic/tectonic origin

ICDP EGER Project

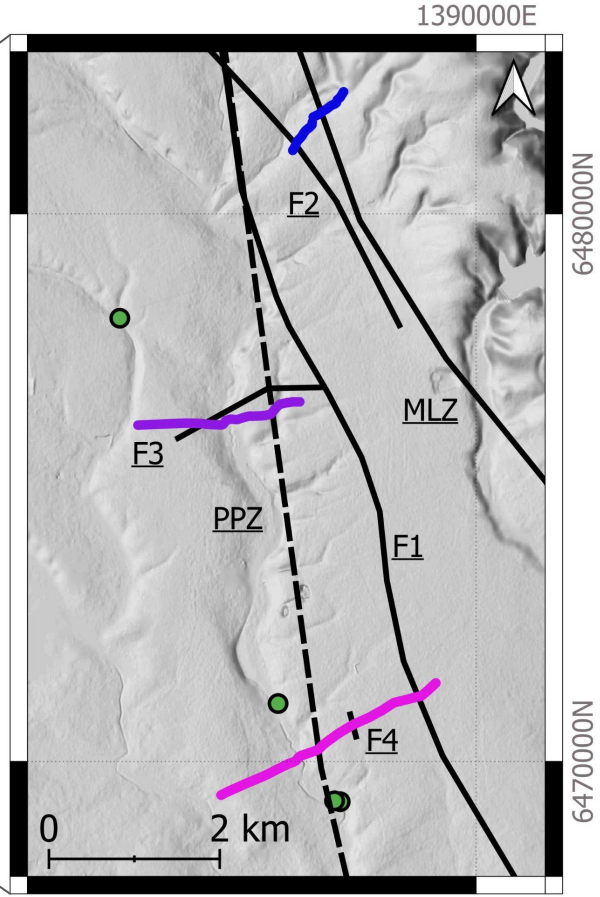
Drilling The Eger Rift: Magmatic fluids driving the earthquake swarms and the deep biosphere (EGER)

2. Seismic data

Four 2D seismic profiles



Geological map of the Cheb Basin and surroundings
Bussert et al. (2017)



Source: Open street map, QGIS software

2017
2014
2020
Degassing sites

MLZ - Mariánské Lázně Fault Zone

PPZ - Počátky Plesná Fault Zone

F1 - Bussert et al. (2017), Halpaap et al. (2018)

F2 - Špičáková et al. (2000), Halpaap et al. (2018)

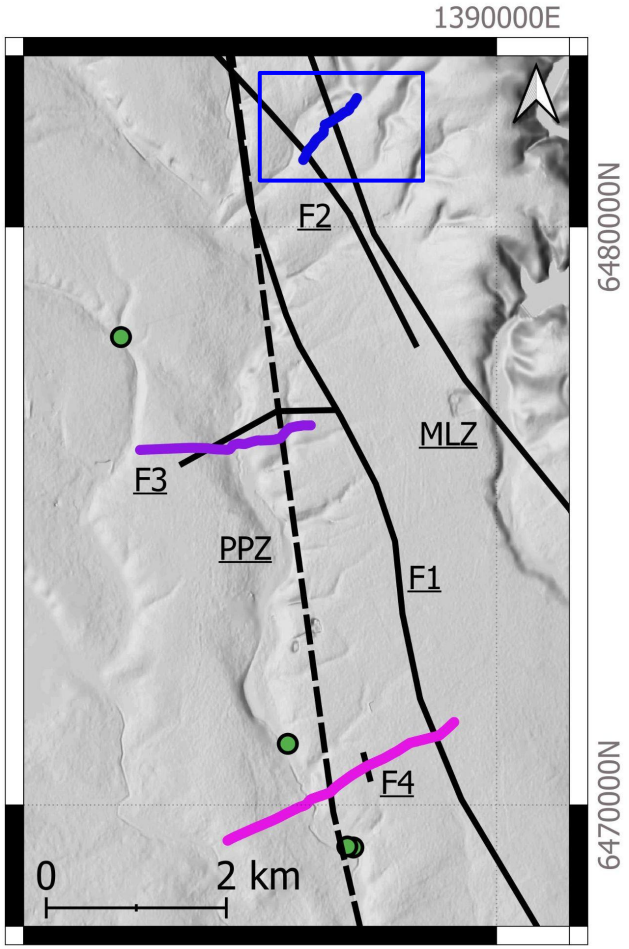
F3 - Bussert et al. (2017)

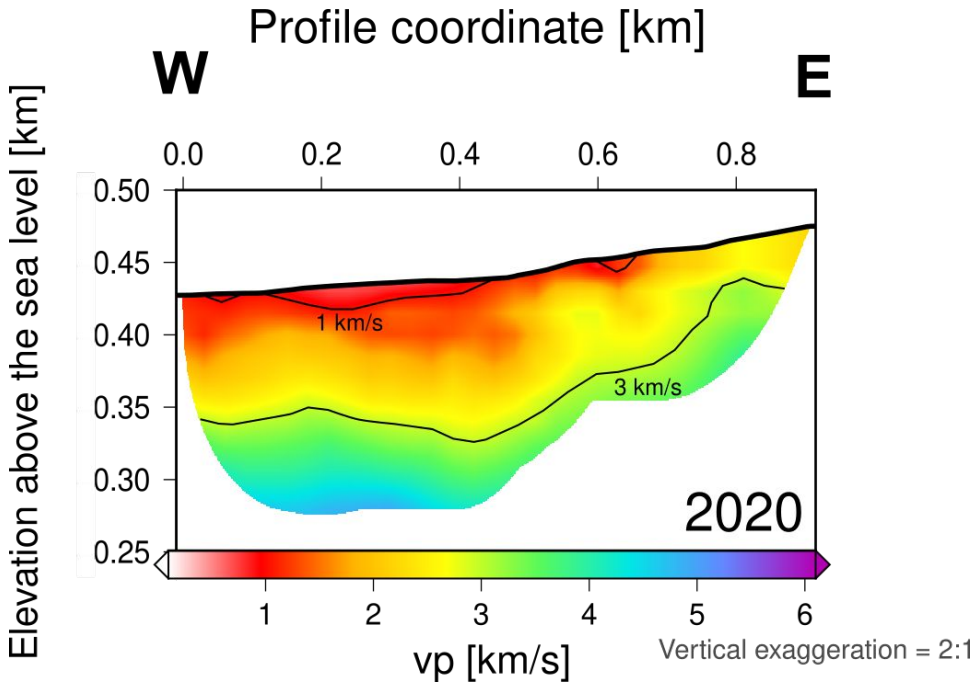
F4 - proposed fault

Traveltime tomography - *Simulr16* software (Bleibinhaus & Gebrande, 2006)

Additional acquisition and tomography details available in the supplement materials

2020 dataset





2017
2014
2020

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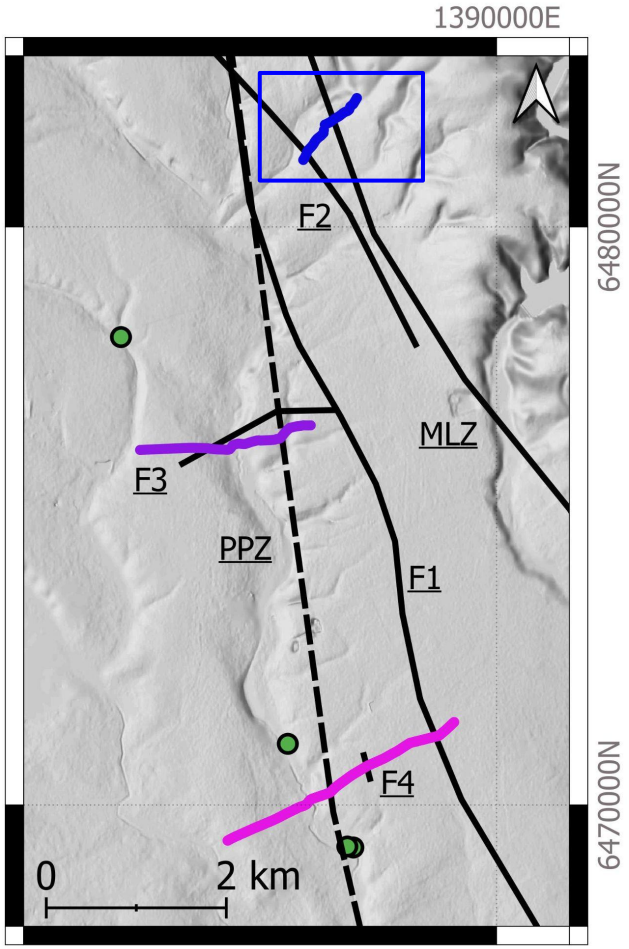
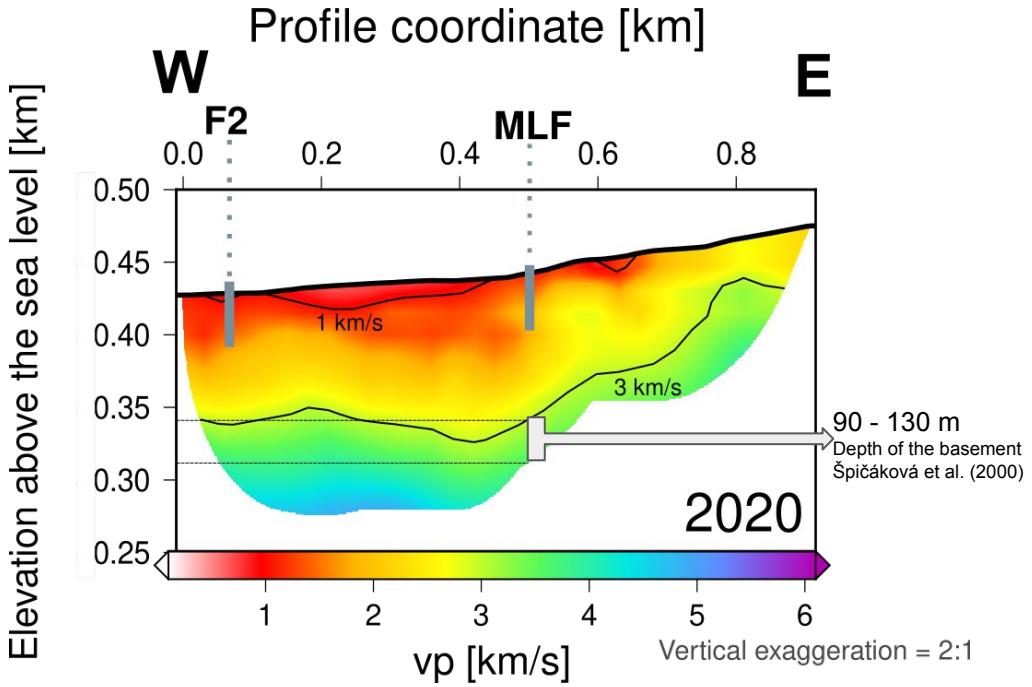
2020 dataset





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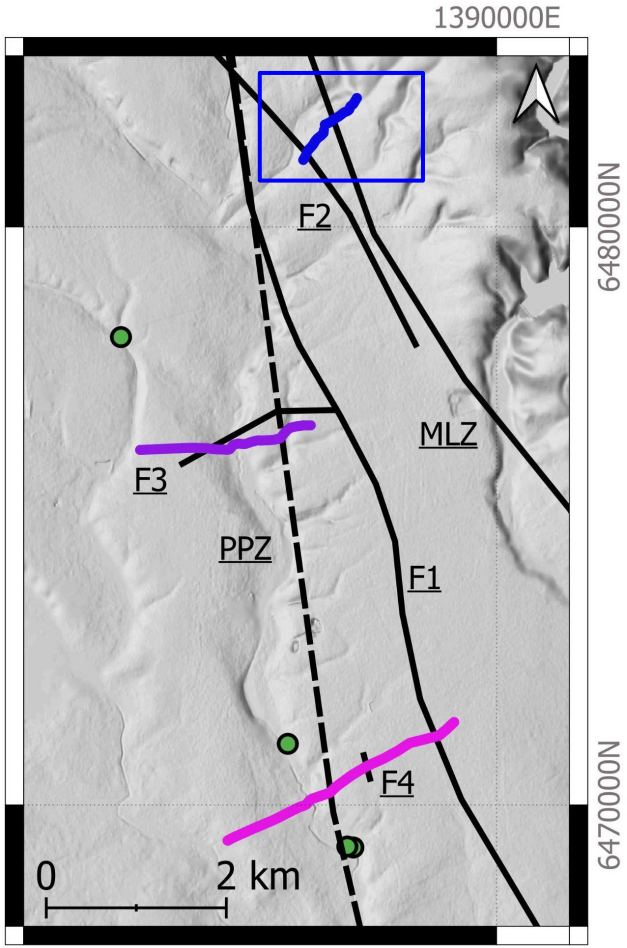

Acquisition	
Number of shots	46
Spread	478m, 240 channels 8 spreads
ΔSP x ΔPG	20 m x 2 m
Type of the source	buffalo gun

Tomography	
Number of shots used	46
Number of traces	12756
Traveltimes picked	7814 (61% of traces)
Maximum offset	461 m
Uncertainty of the data	3,81 ms
Damping	0.5

Final model	
Uncertainty of the final model	3,63 ms
Number of grid refinements	4
Final grid rate (horizontal x vertical)	53x39

2017
2014
2020

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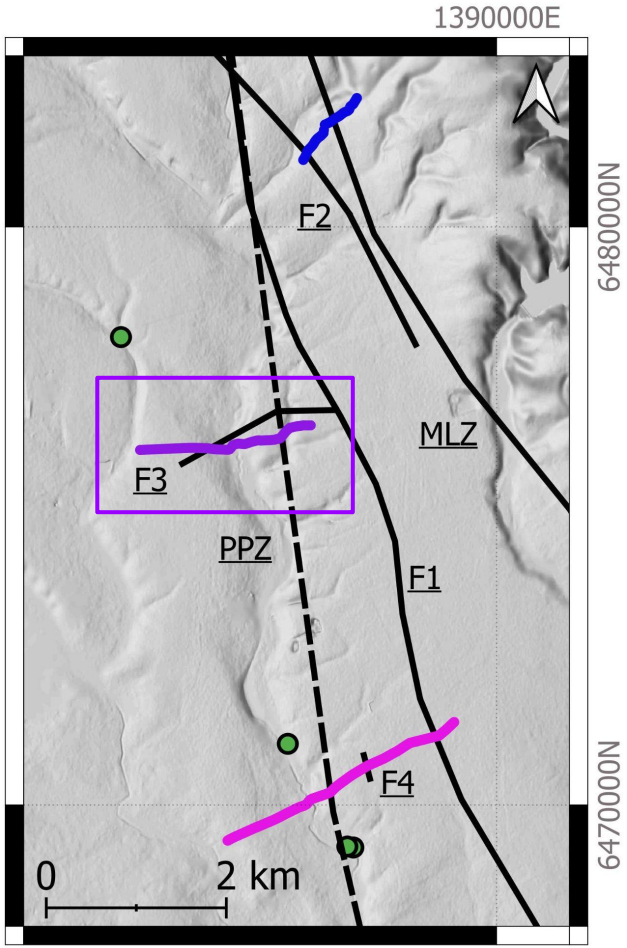
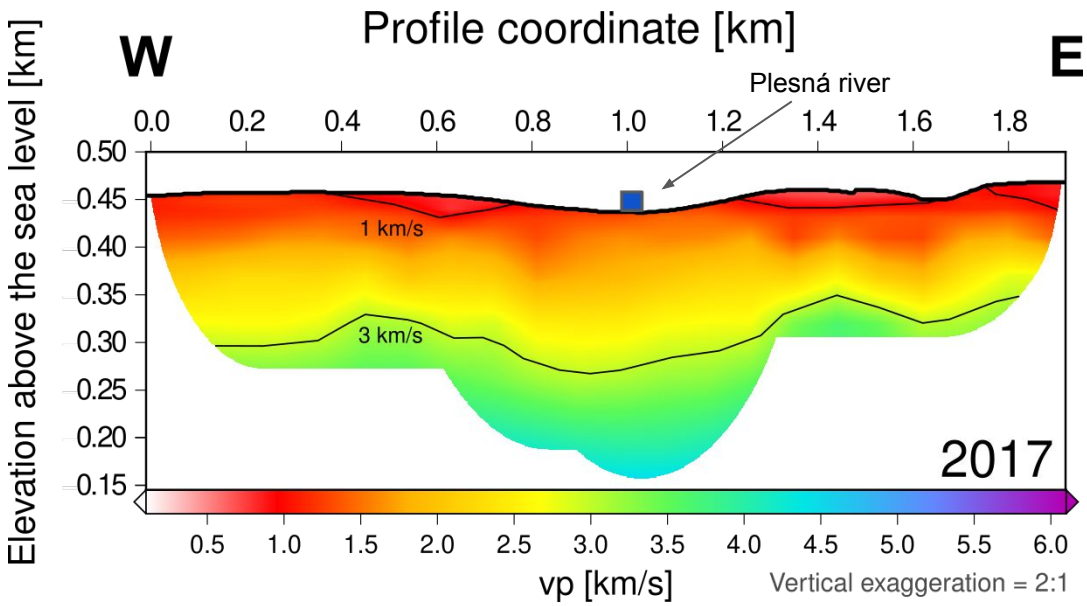
2017 dataset





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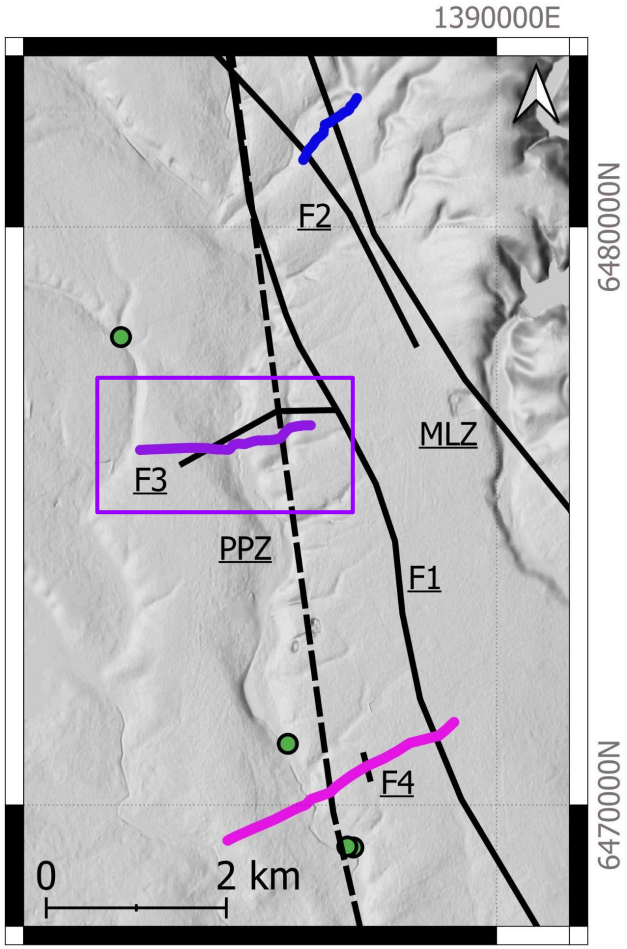
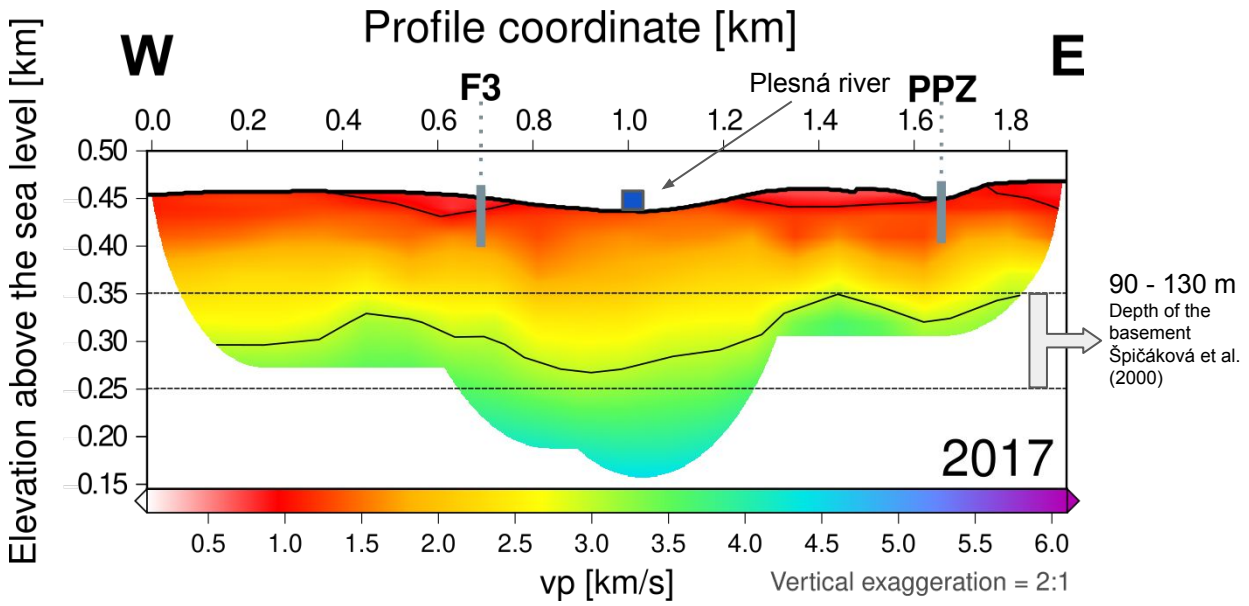
2017 dataset





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2014	
2020	

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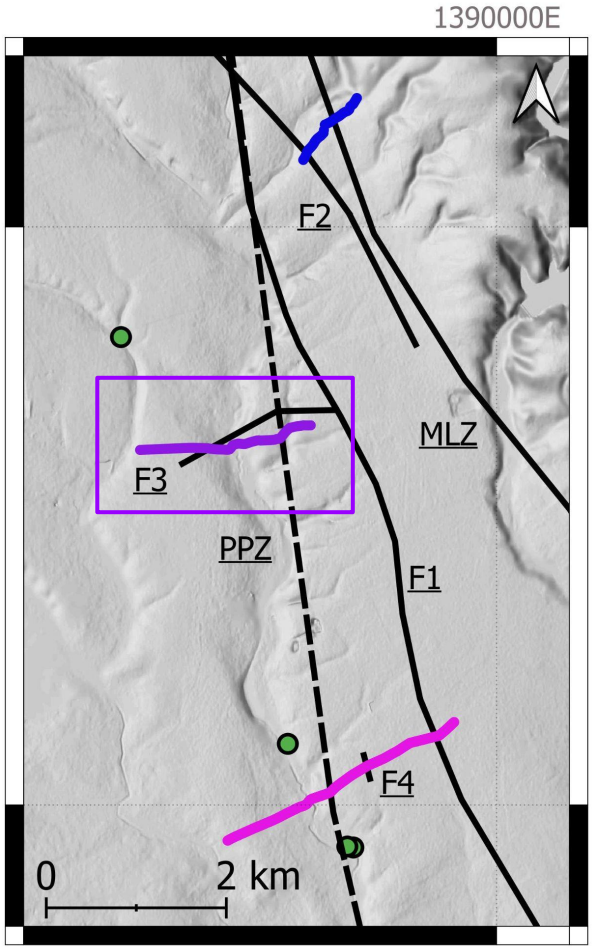
2017 dataset



Acquisition	
Number of shots	101
Spread	478m, 240 channels 23 spreads
ΔSP x ΔPG	20 m x 2 m
Type of the source	buffalo gun

Tomography	
Number of shots used	98
Number of traces	24100
Traveltimes picked	16084 (67% of traces)
Maximum offset	1016 m
Uncertainty of the data	5,64 ms
Damping	2

Final model	
Uncertainty of the final model	5,52 ms
Number of grid refinements	3
Final grid rate (horizontal x vertical)	53x23

2017
2014
2020

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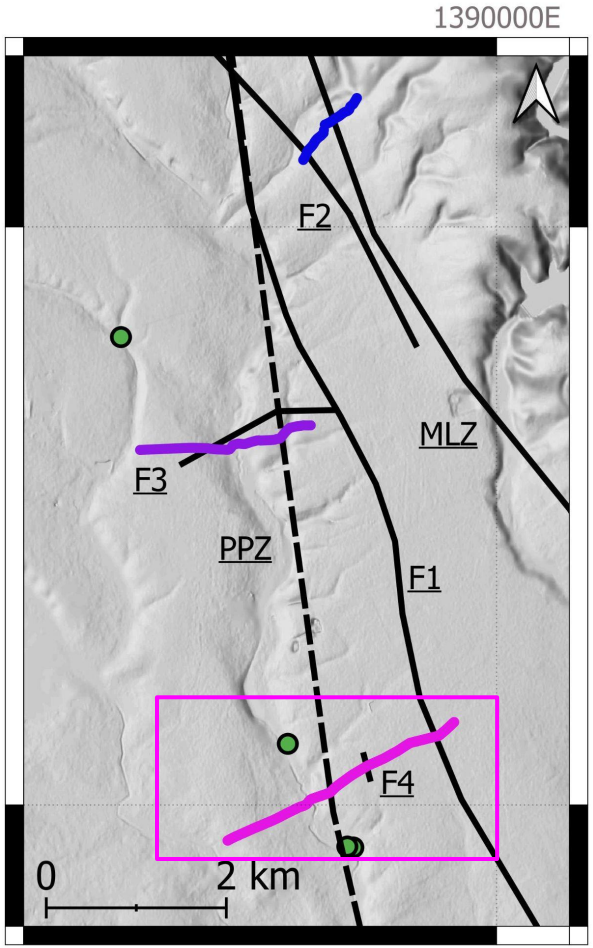
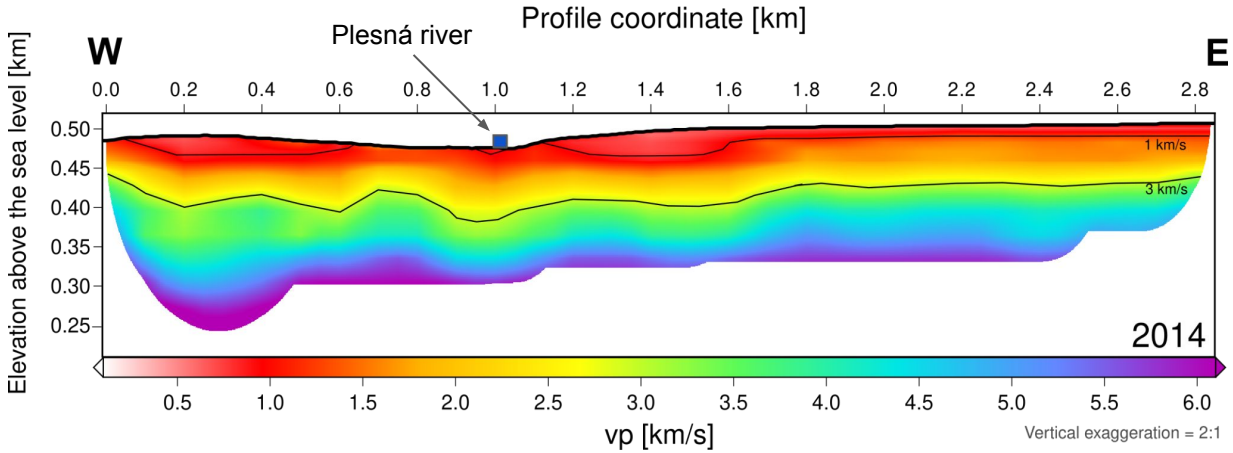
2014 dataset





2017
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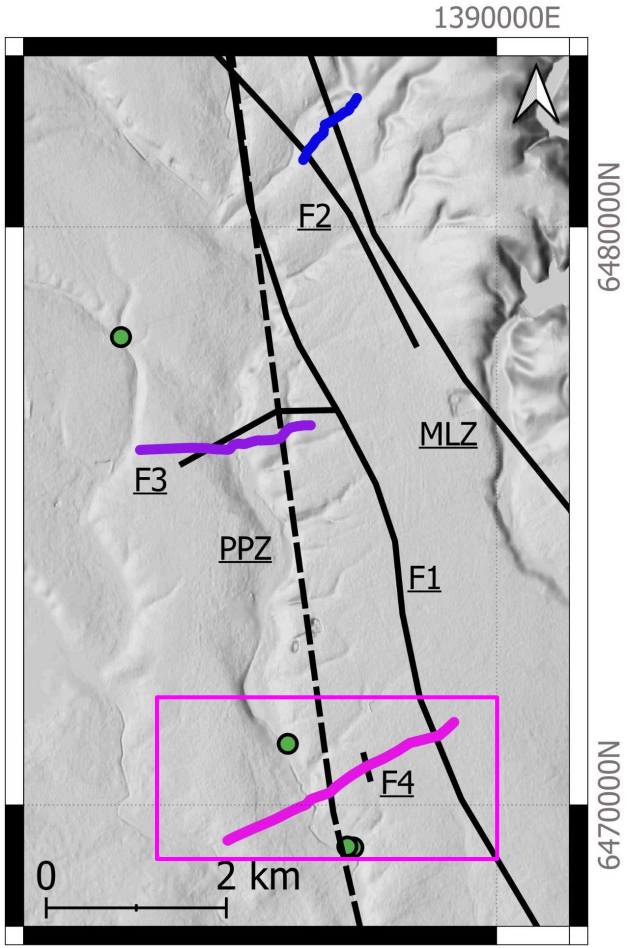

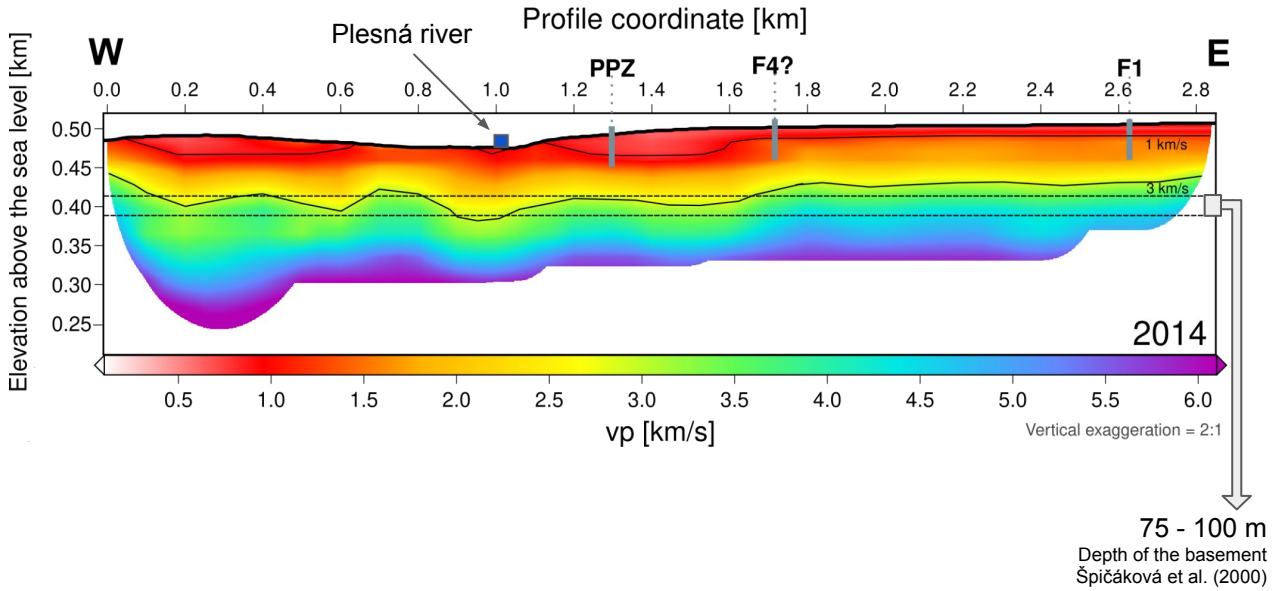

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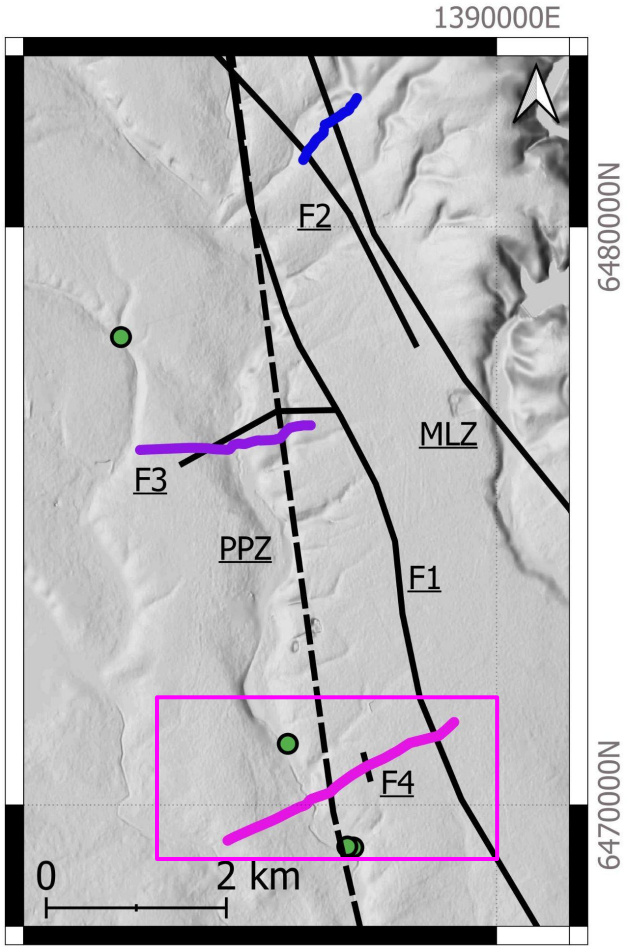
2014 dataset



Acquisition	
Number of shots	285
Spread	564m, 282 channels 23 spreads
ΔSP x ΔPG	10 m x 2 m
Type of the source	Weightdrop, Sissy gun (SP 175-210)

Tomography	
Number of shots used	282
Number of traces	155916
Traveltimes picked	68147 (44% of traces)
Maximum offset	539 m
Uncertainty of the data	7.21 ms
Damping	10

Final model	
Uncertainty of the final model	7,56 ms
Number of grid refinements	2
Final grid rate (horizontal x vertical)	32x16

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2014
2020

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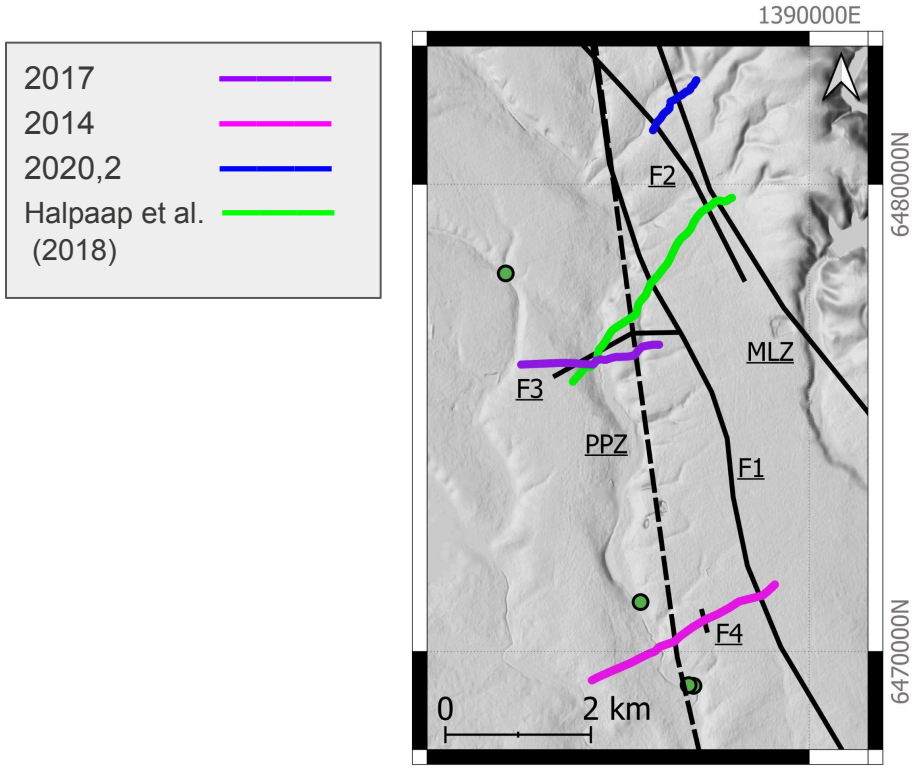
Conclusions

Shallowest layer of unconsolidated, dry sediments (velocity up to 1000 m/s) is found irregularly along the sections with depth from 0 to 40 meters.

The basement rock on the tomographic profiles is recognised at depth from 50 to 150 m. It is consistent for the most part with the model of the Cheb Basin from Špičáková et al. (2000).

In 2017 line the fault pattern differs from the one mapped in Bussert et al. (2017).

Outlook: The outcome of the traveltime tomography will be used for seismic reflection processing



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Bibliography

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Thank you for your attention