PostMinQuake

Monitoring of induced seismic events in German hard coal post-mining areas

Stefan Moellerherm
stefan.moellerherm@thga.de

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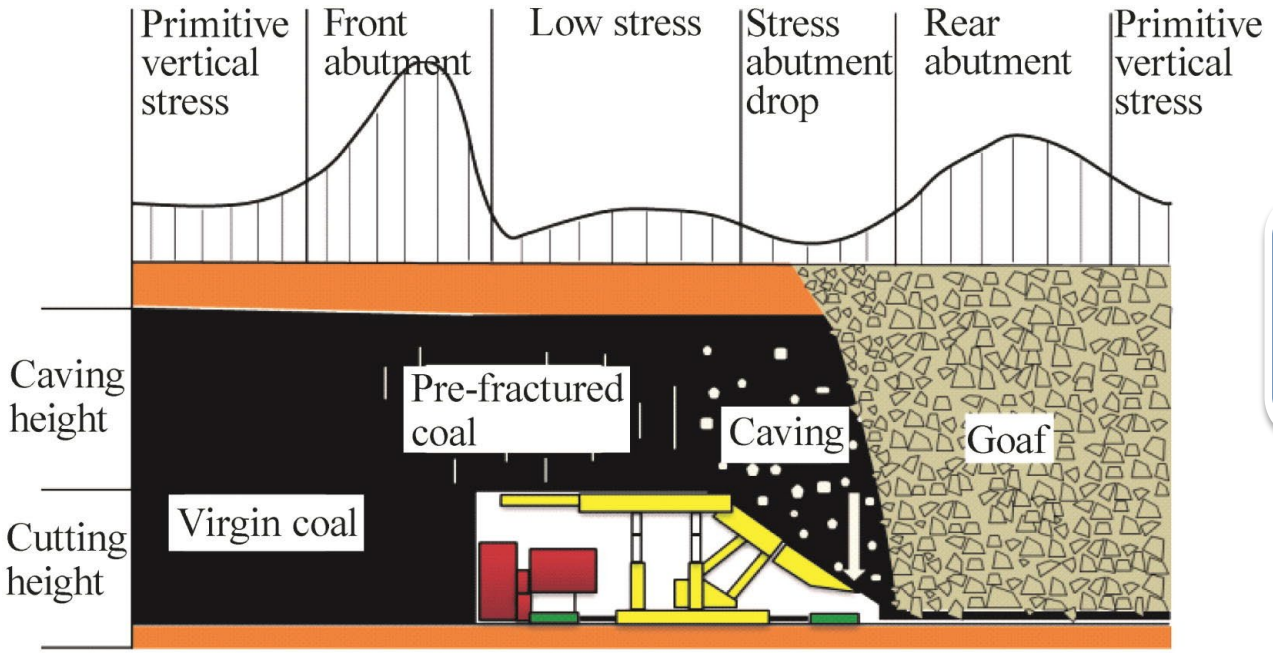
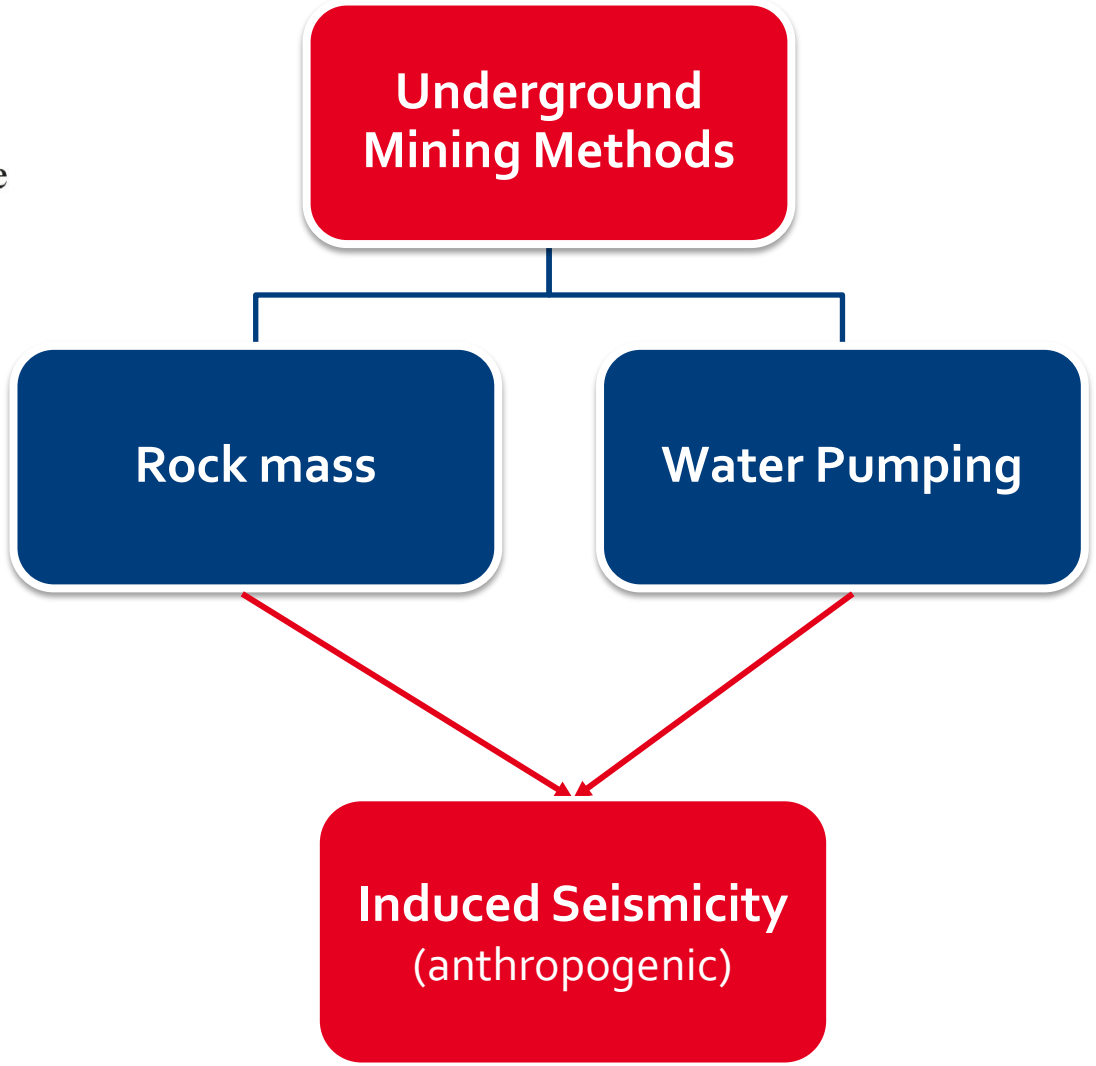
Hard Coal Mining

What happens to the rock and water underground?

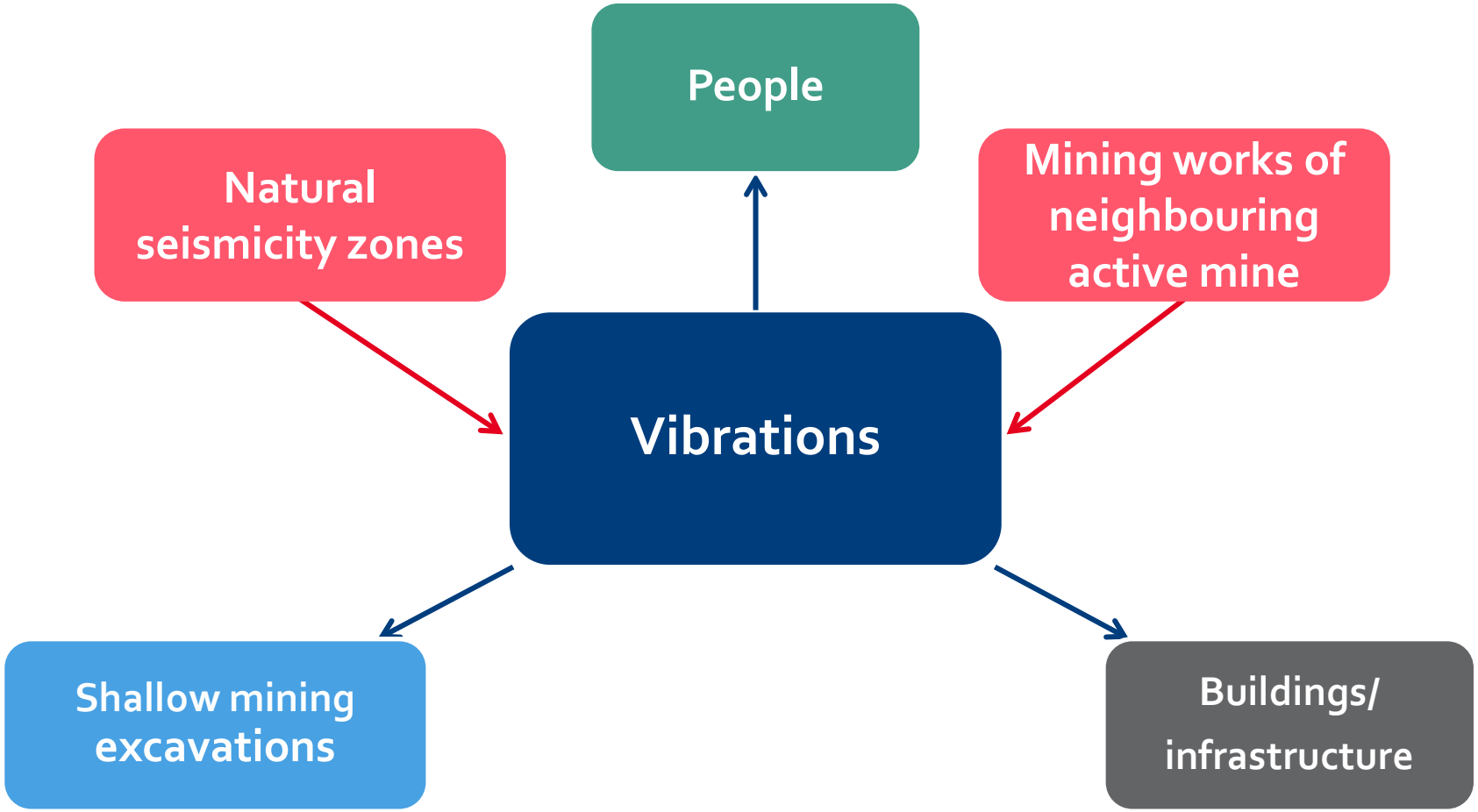


Source: Tien Dung Le et al. 2017



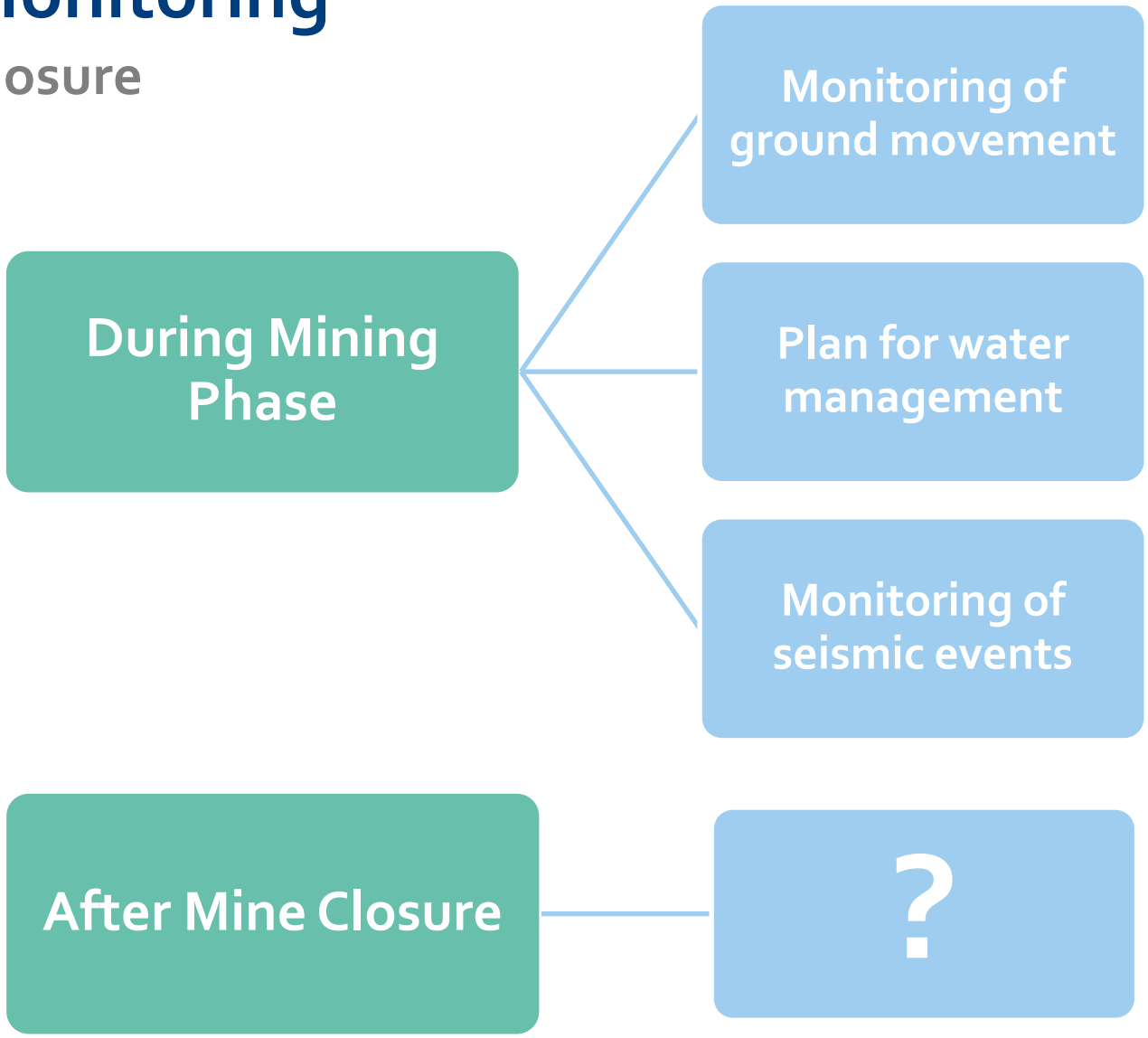
Risks and Consequences of Seismicity

Instability below surface and damage on the surface



Mandatory Monitoring

Less after mine closure



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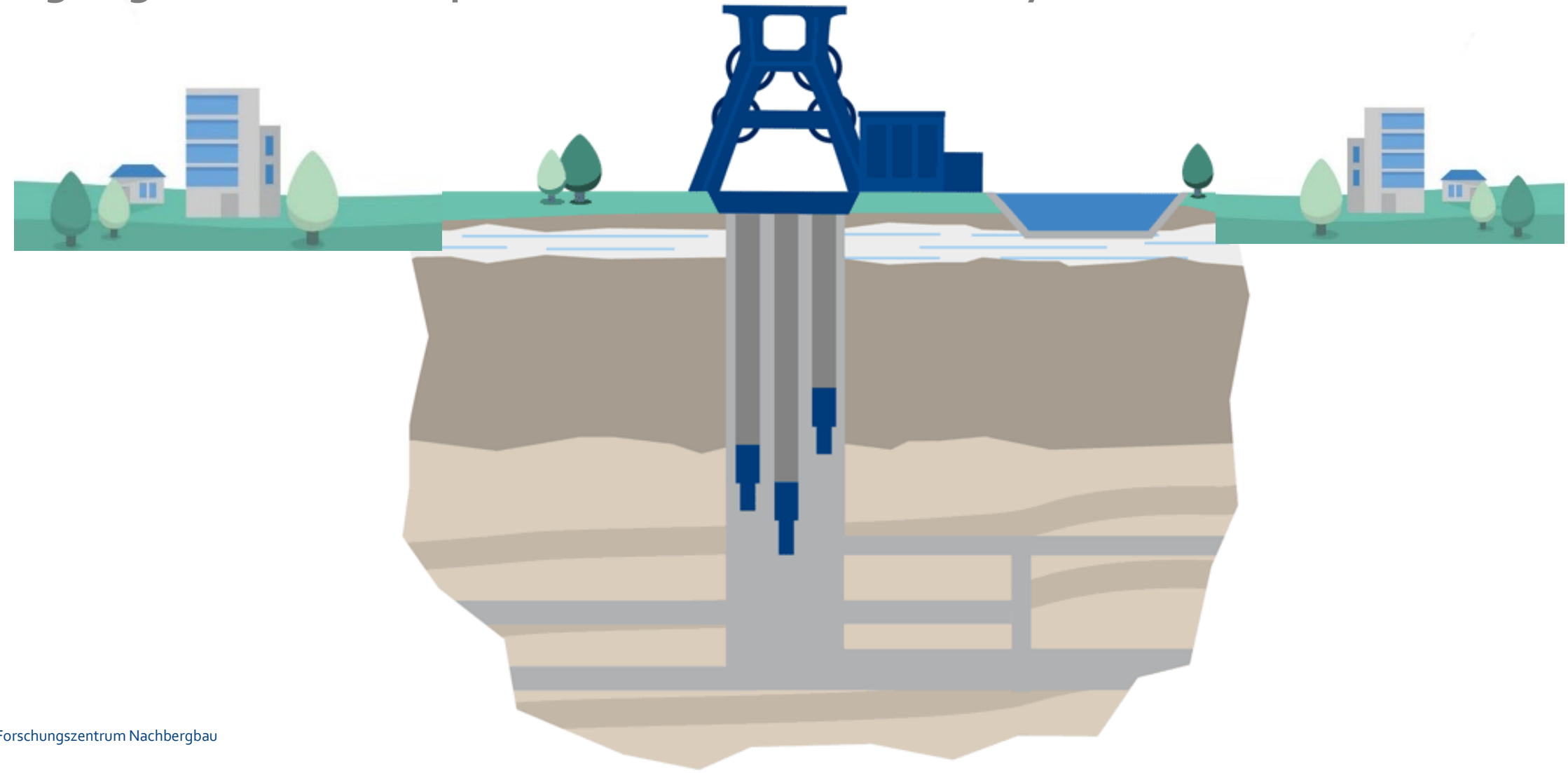
Post-Mining of Hard Coal

Rising of groundwater responsible for induced seismicity?



PostMinQuake Partners

10 Partners – 4 Countries

Helmholtz Zentrum Potsdam Deutschesgeoforschungszentrum (GFZ)

Research Center of Post-Mining, Technische Hochschule Georg Agricola (THGA)

Bureau de Recherches Geologiques et Minieres (BRGM)

Institut National de l'Environnement et des Risques (INERIS)

Spolka Restrukturyzacji Kopaln SA (SRK)

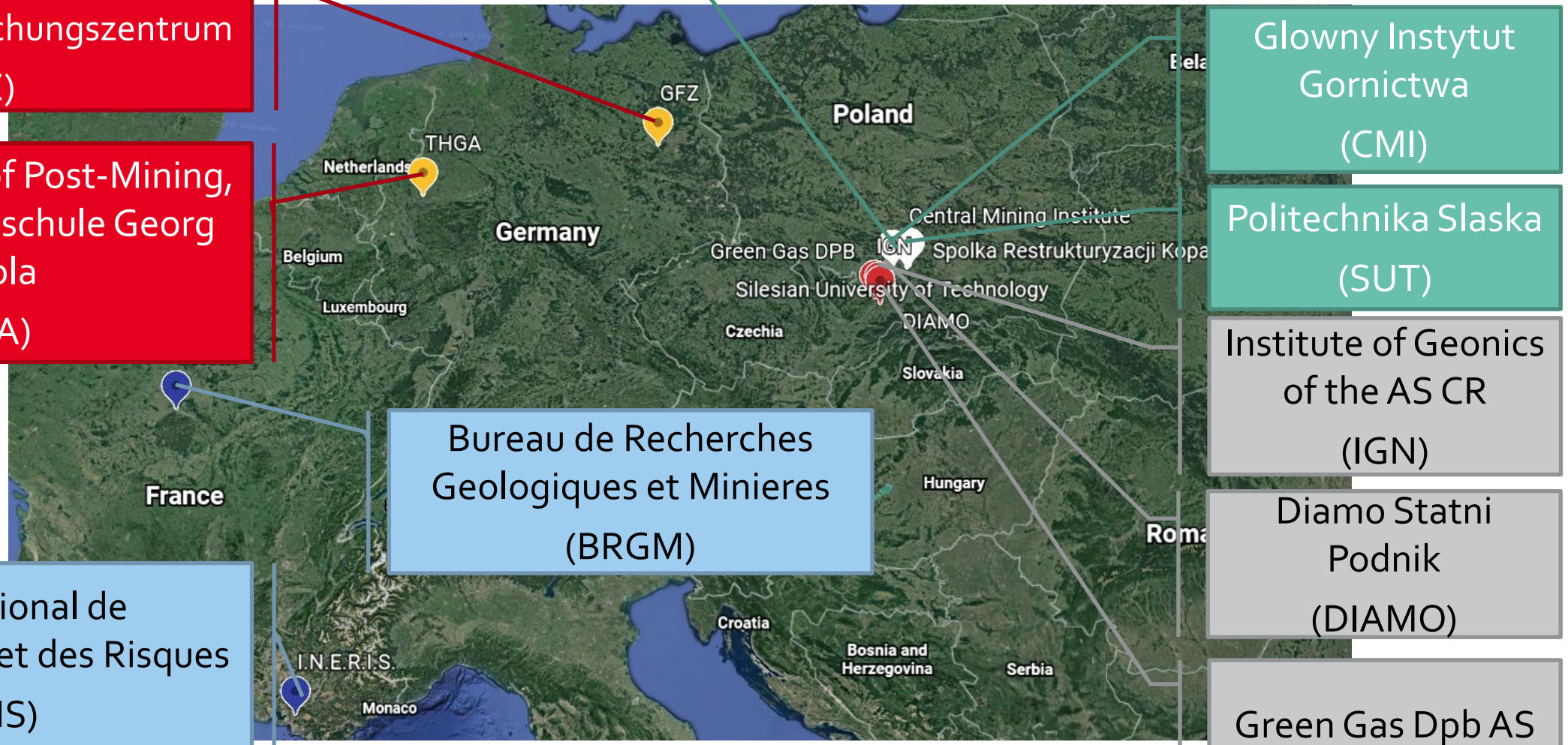
Glowny Instytut Gornictwa (CMI)

Politechnika Slaska (SUT)

Institute of Geonics of the AS CR (IGN)

Diamo Statni Podnik (DIAMO)

Green Gas Dpb AS



PostMinQuake Basins

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NRW (Germany)

- Ruhr Area
  - Prosper-Haniel
  - Auguste-Victoria
  - Hamm
- Ibbenbüren
- Aachen-Limburg
  - Cross-country deposit Germany-Netherlands
  - Several seismic events
  - Sophia-Jacoba (Erkelenz)

Provence (France)

- located about 20 km NNE of Marseille (Bouches-du-Rhône)
- covers ~60 km².
- land subsidence or/and collapses in areas of high population density.
- industrial exploitation: first half of the 19th century to 2003
- more than 500 km of tunnels
- levels exploited up to 1 350 m deep

Upper Silesian Coal Basin (Poland)

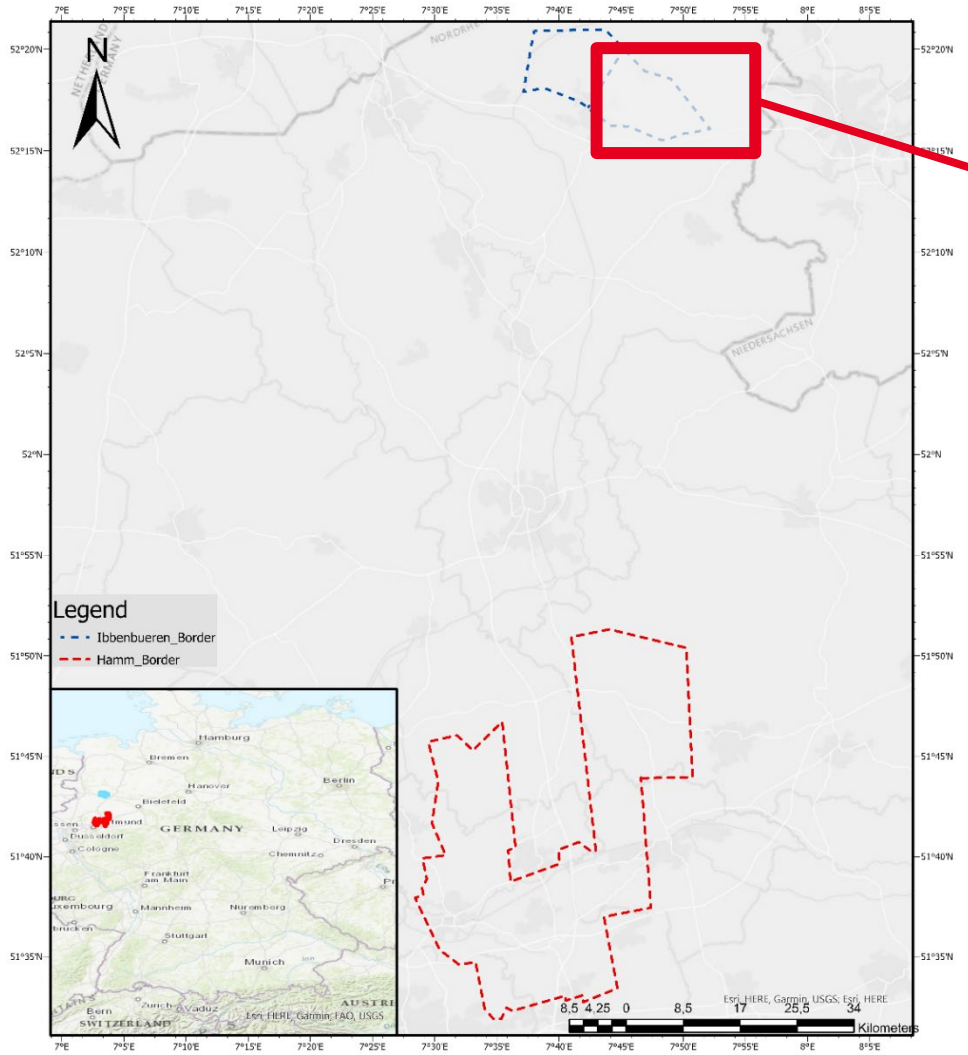
- Kazimierz-Juliusz closed in 2016
- water table lowered to depth 700 m
- Process of flooding the mine is in the early stage.
- Kazimierz-Juliusz very seismically active mine in the past (induced earthqukes with magnitudes of 2-3 until 2015).
- In 2017, systematic flooding of the mine began
- In 2018 few seismic events with magnitude higher 2 during flooding

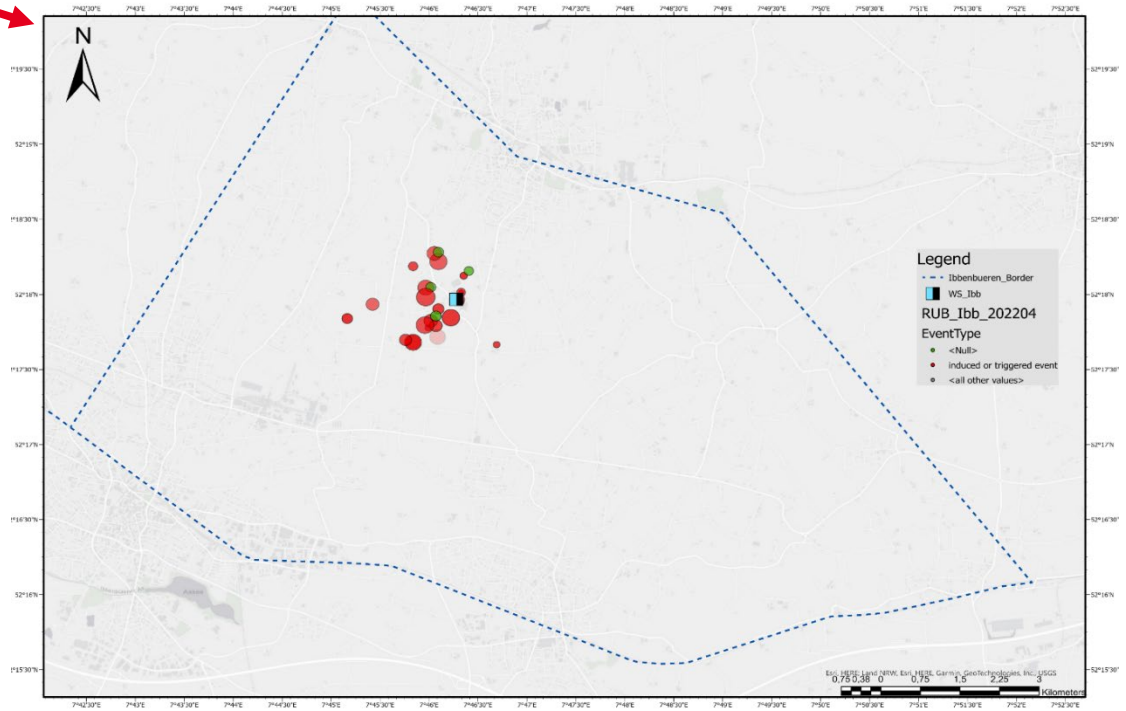
Upper Silesian Coal Basin (Czech Republic)

- Ostrava sub-basin: finished in 1994, flooding started
- 2001: water level on altitude -388.5 m below sea level (depth 600 m below surface) in Jeremenko pumping shaft
- 2001: water level on altitude -483 m below sea level (depth 680 m below surface) in Zofie pumping shaft
- Petrvald sub-basin
- Karvina sub-basin: to prevent of water over flooding due to connection of all sub-basins (tectonic structures and underground openings)

Ibbenbüren

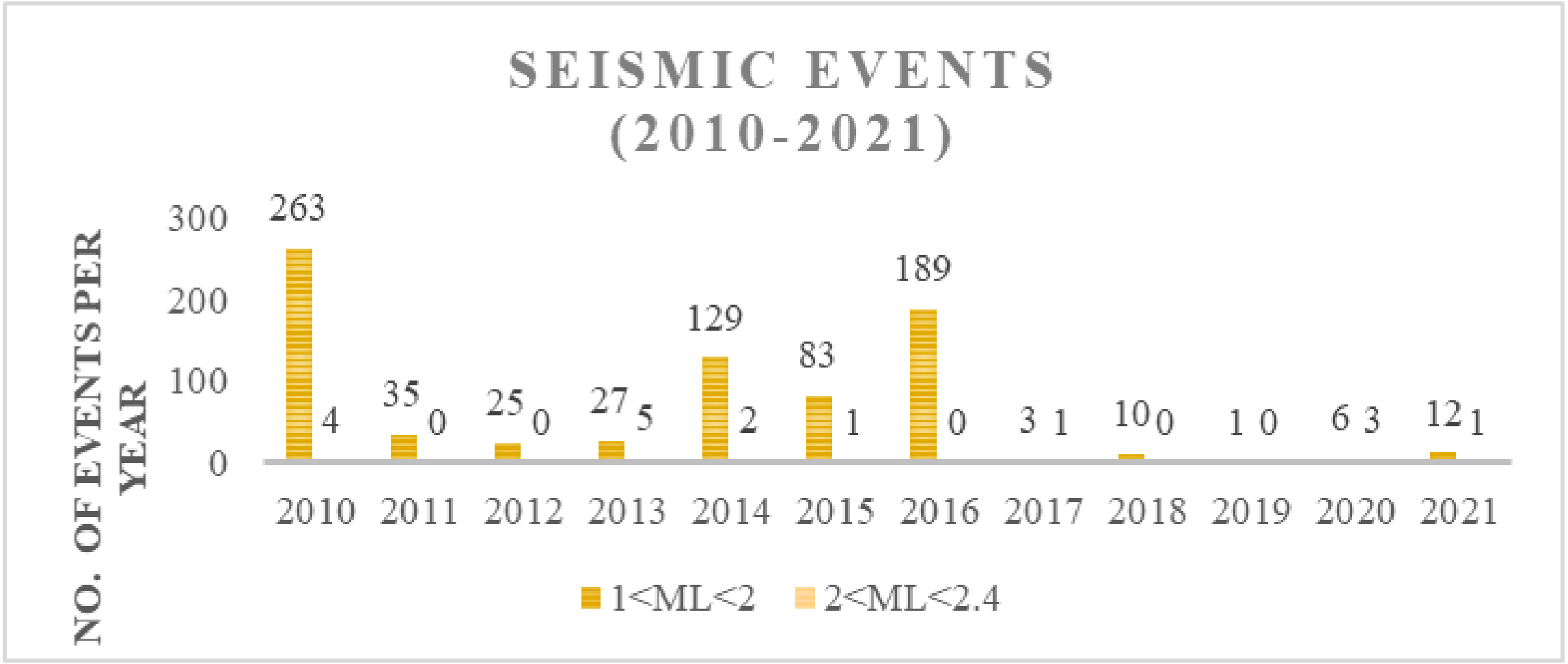
Closed in 2018 - only 3 Seismic Stations and 1 for Groundwater Level





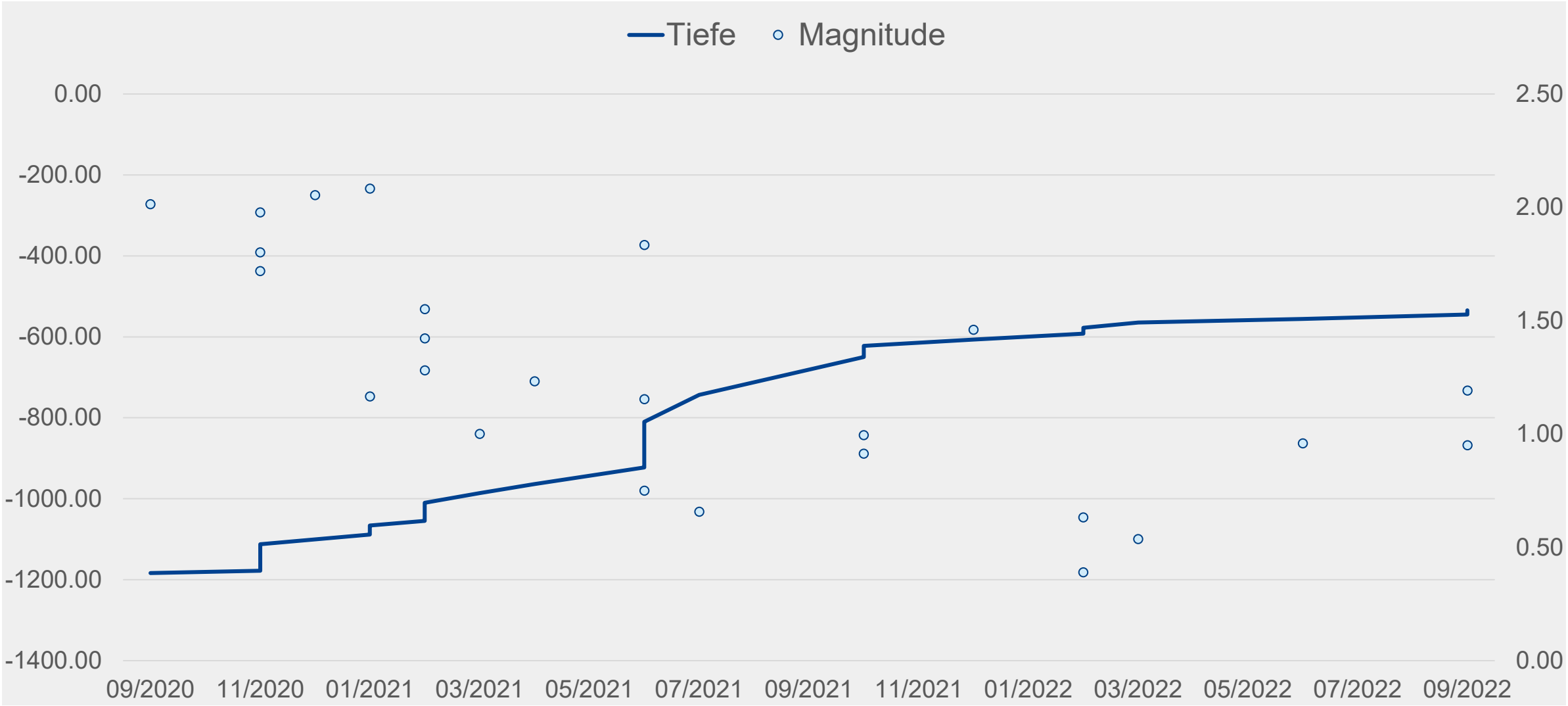
Ibbenbüren

Induced seismic events in Ibbenbüren Ostfeld with ML>1



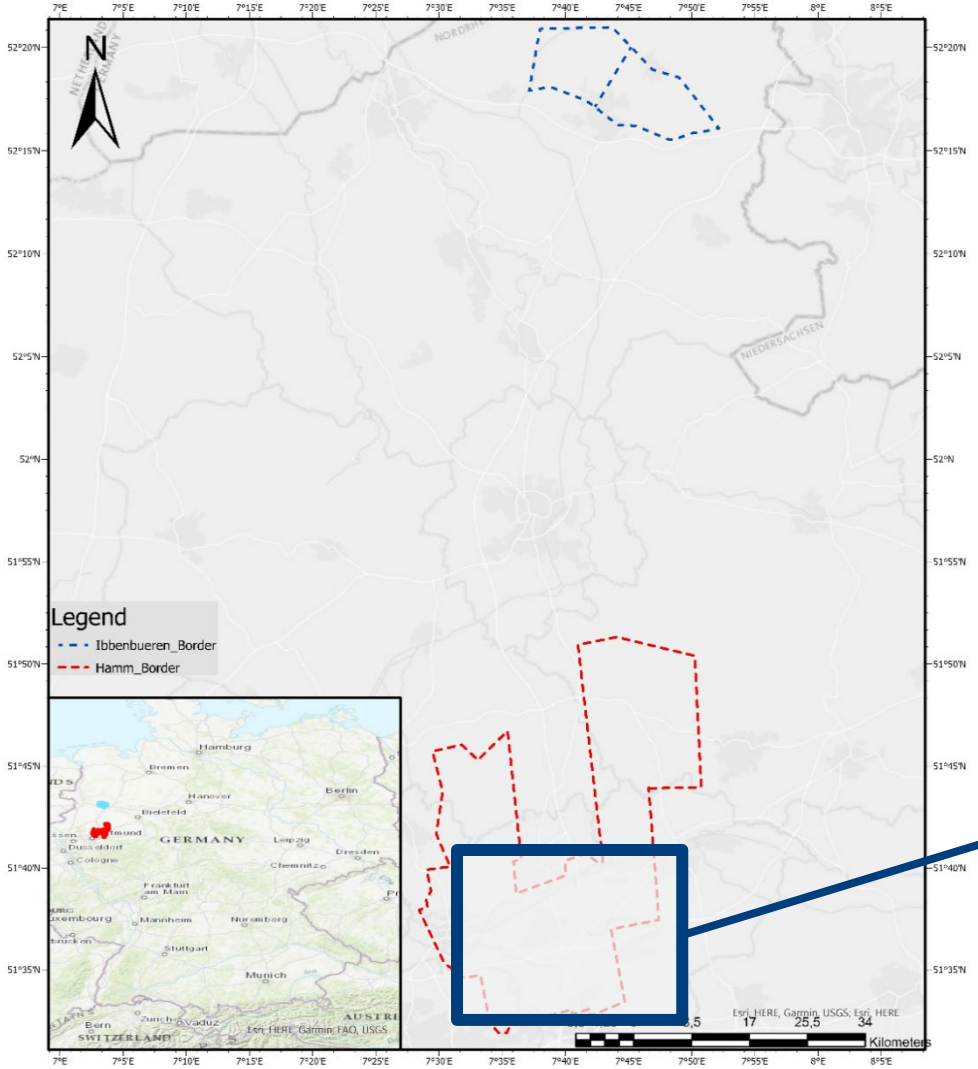
Ibbenbüren

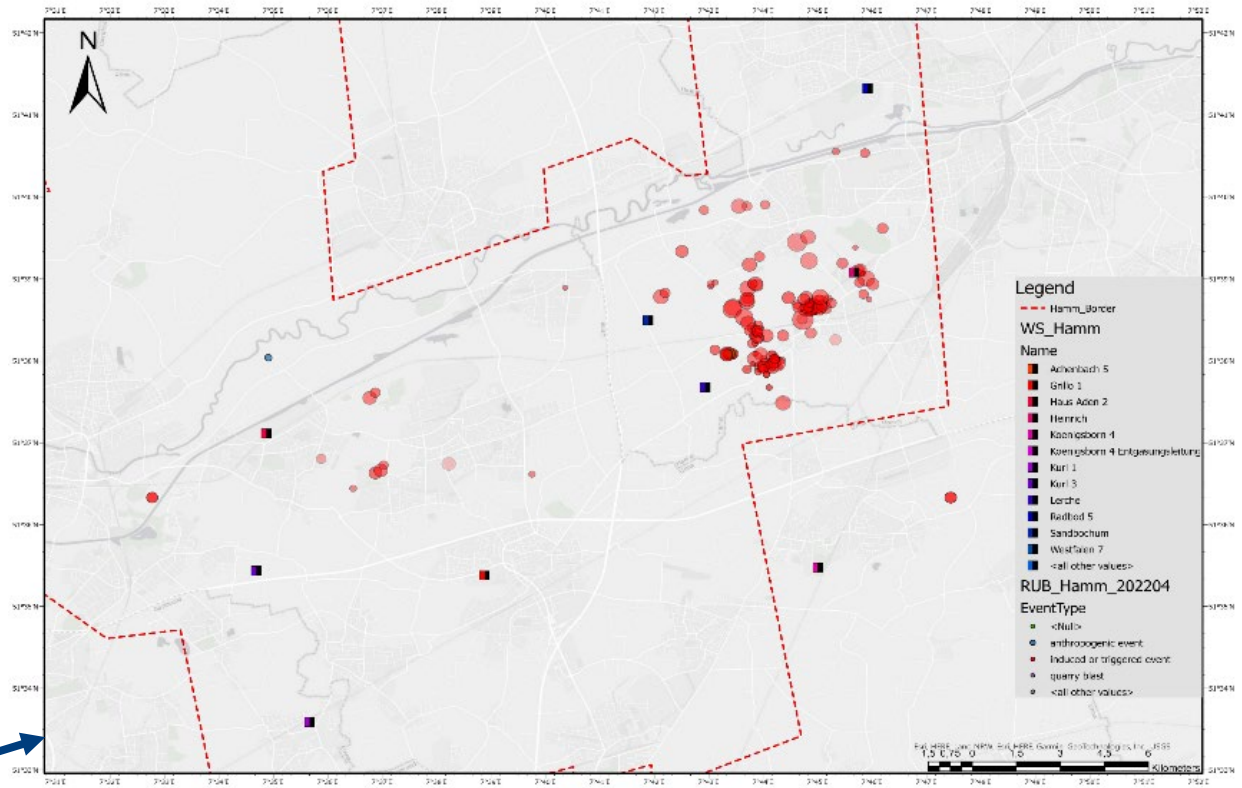
Watertable vs Magnitude of Seismic Events



Hamm (Ruhr Basin)

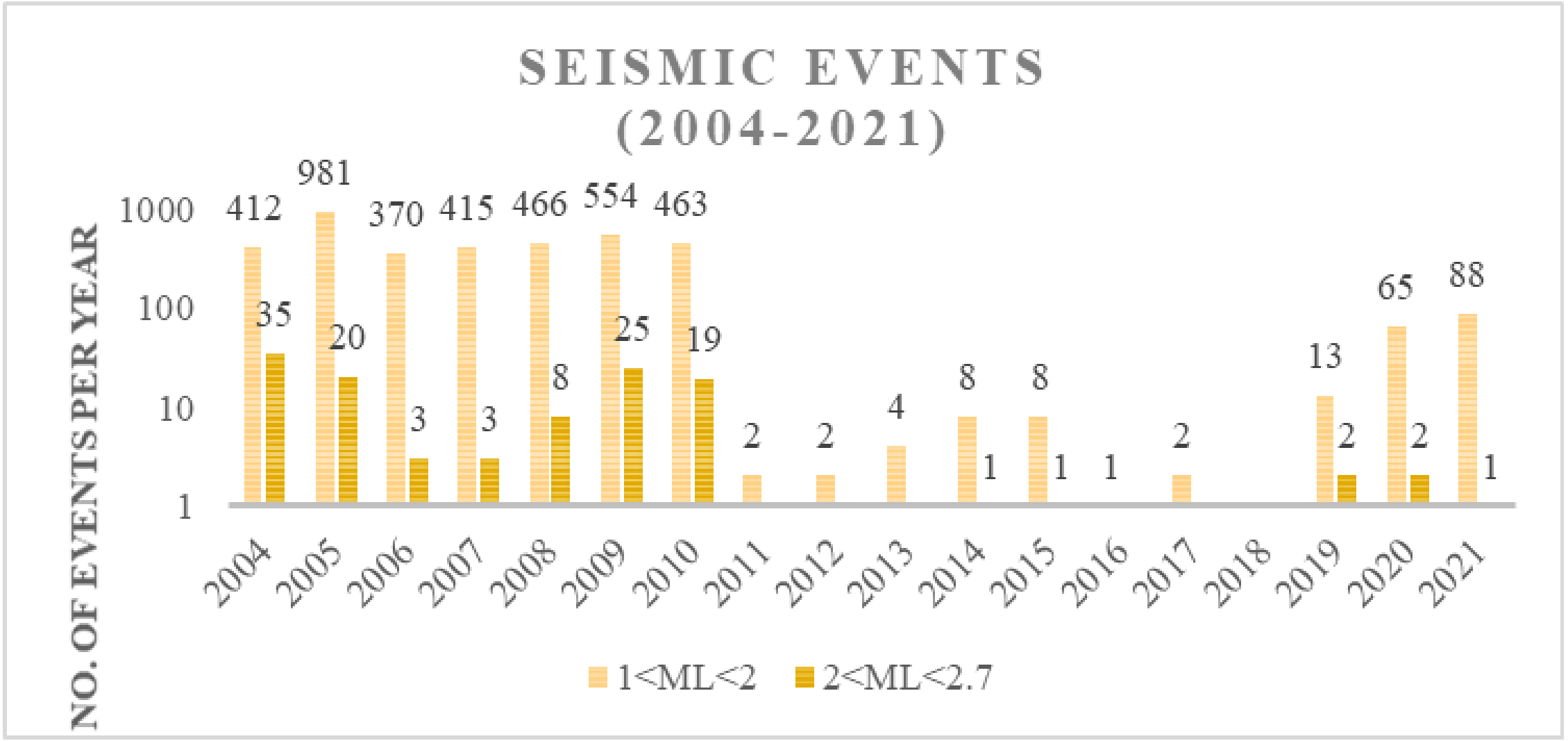
Closed in 2010 – More Monitoring Stations, More Microseismicity





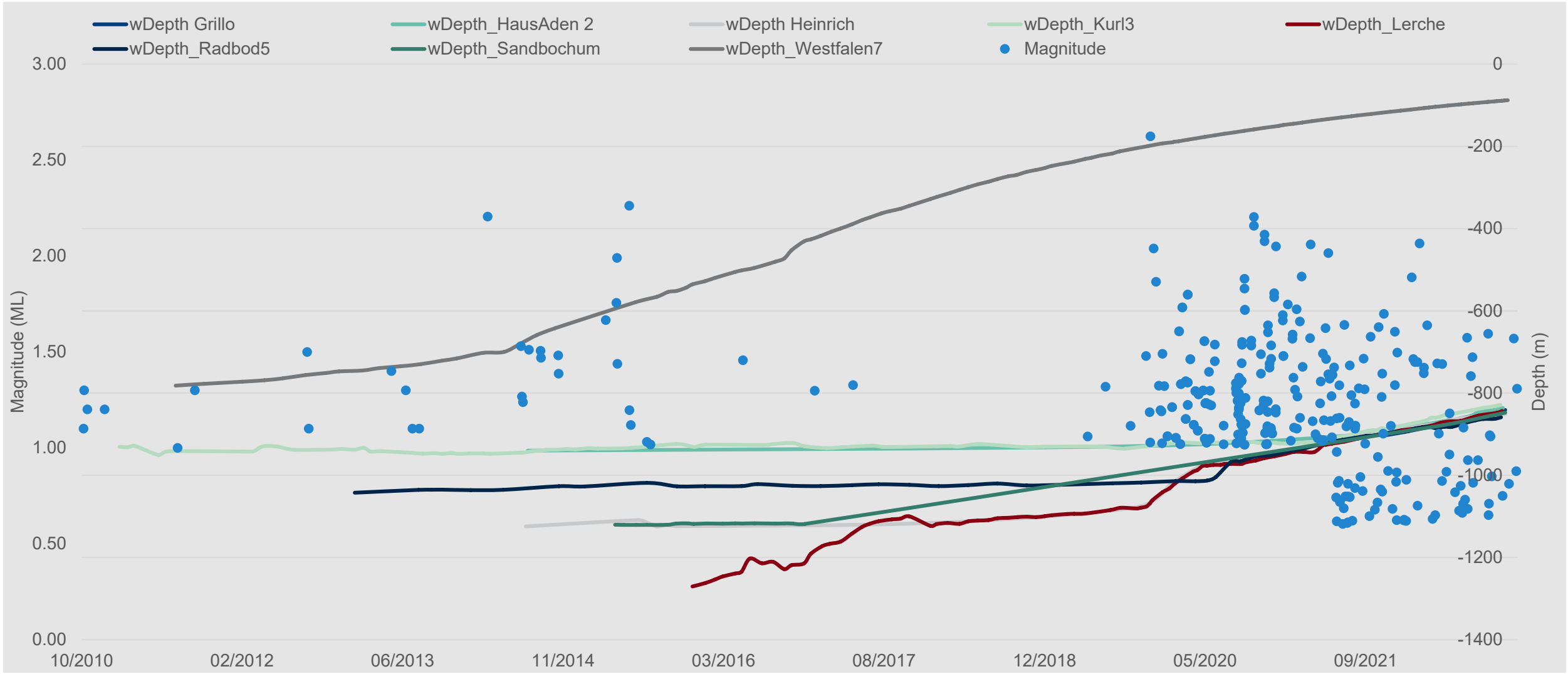
Hamm (Ruhr Basin)

Induced seismic events in Hamm with ML>1



Hamm (Ruhr Basin)

Watertable vs Magnitude of Seismic Events



Future Steps for Post-Mining Monitoring

Although Lower Magnitudes and Events of Seismicity…

During Mining Phase

- Monitoring of ground movement
- Plan for water management
- Monitoring of seismic events

Post-mining vs Mining Phase

- Less events
- Lower intensity

During Post-mining Phase

- Monitoring of ground movement
- Plan for water management
- ~~Monitoring of seismic events~~

Future Steps for Post-Mining Monitoring

Seismic monitoring is a must!

During Mining Phase

- Monitoring of ground movement
- Plan for water management
- Monitoring of seismic events

Post-mining vs Mining Phase

- Less events
- Lower intensity

During Post-mining Phase

- Monitoring of ground movement
- Plan for water management
- **Monitoring of seismic events**

Thank you for your attention!

Glück auf!

Technische Hochschule Georg Agricola
Forschungszentrum Nachbergbau

https://fzn.thga.de/

Stefan Moellerherm
stefan.moellerherm@thga.de