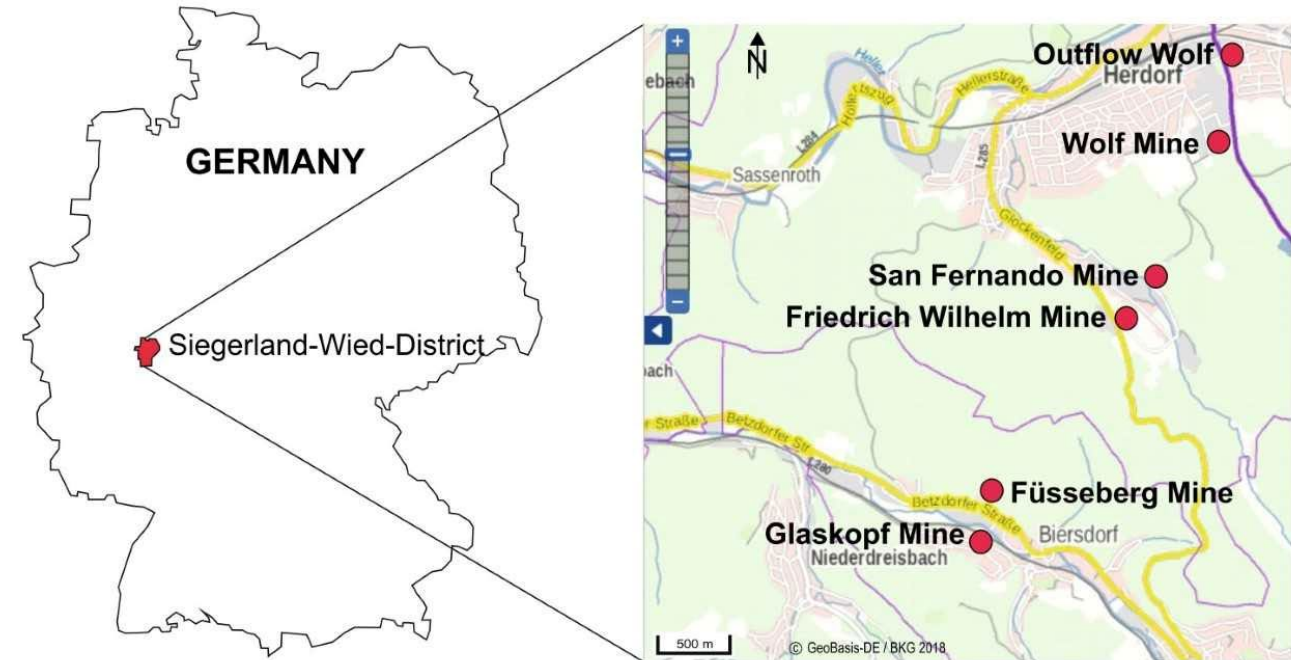


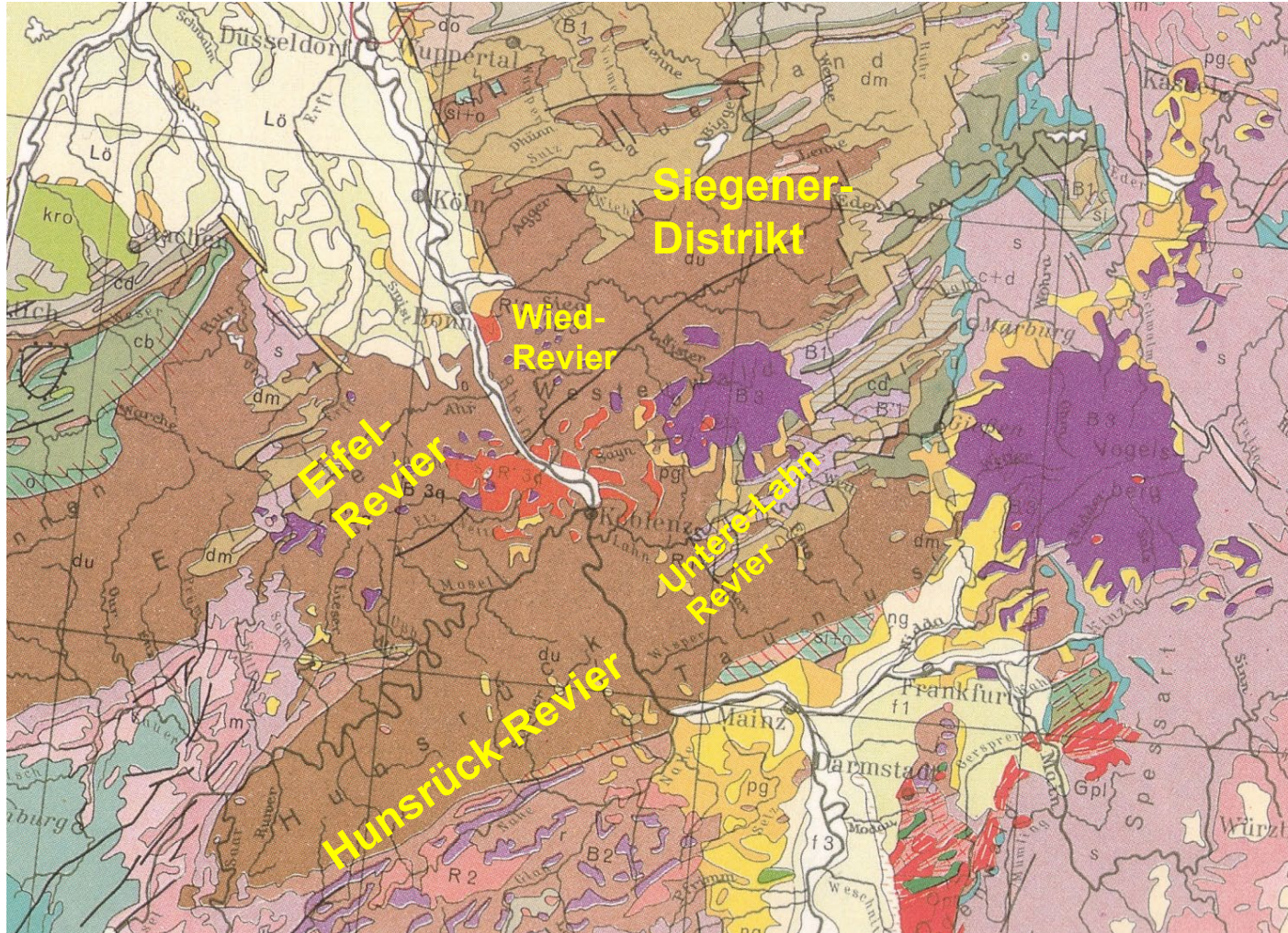
# Geothermal multiple use of mine water from the Wolf - San Fernando - Friedrich Wilhelm composite mine, Rhenish Massif, Germany



Prof. Dr. Georg Wieber,  
Dipl.-Geol. Peter Quensel

# Mining in the Rhenish Massif, Germany

## Oremining districts



### Ore:

- Fe
- Fe-Mn
- Pb-Zn

### Brennstoffe:

- coal

### Steine u. Erden:

- barite
- slate
- clay
- basalt
- tuffstone
- limestone
- etc.

# Standing veins

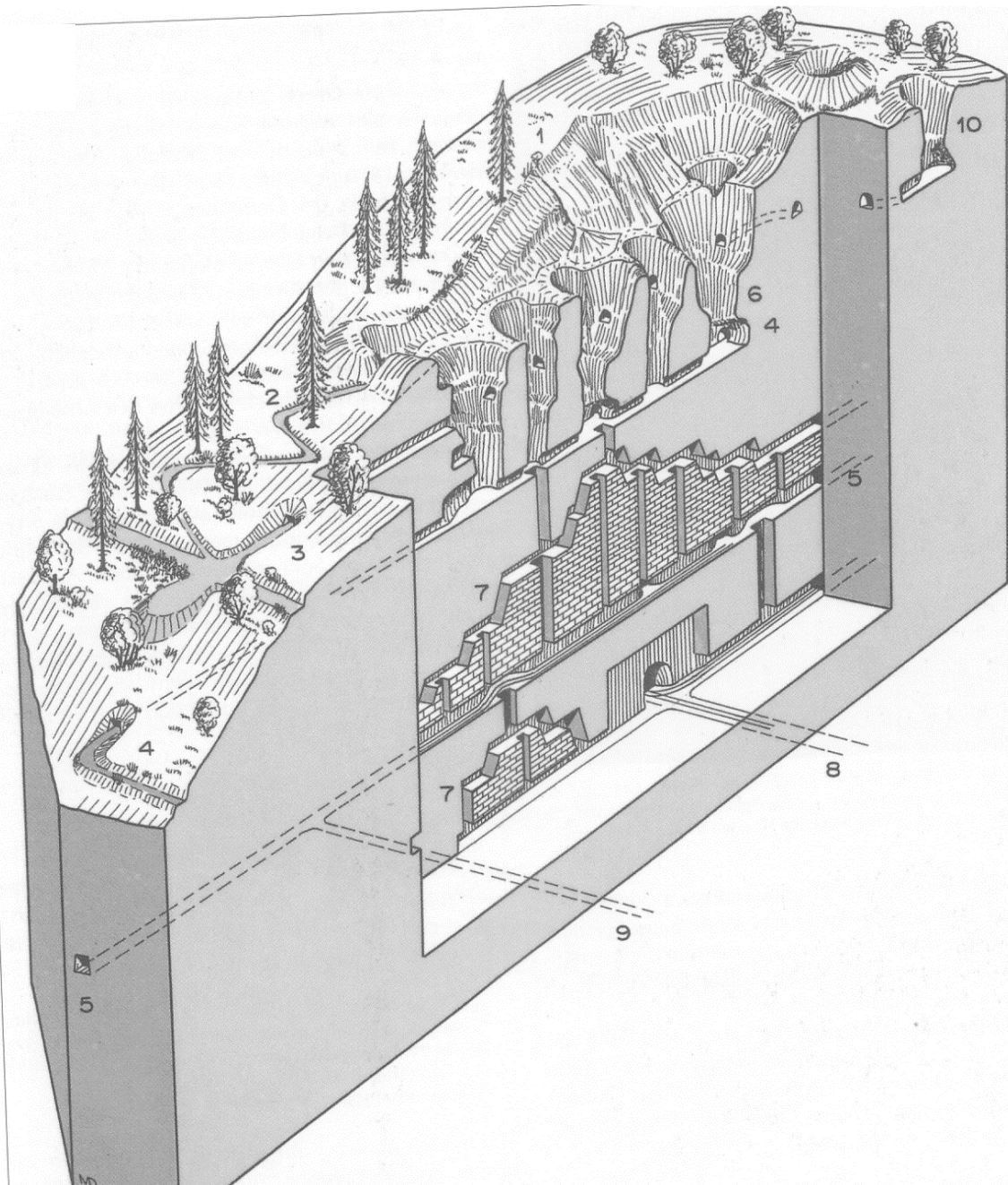


▲ Abb. 30  
Hydrothermalgänge VI:  
Unregelmäßiger, „sich zerschlagender“ Gang.

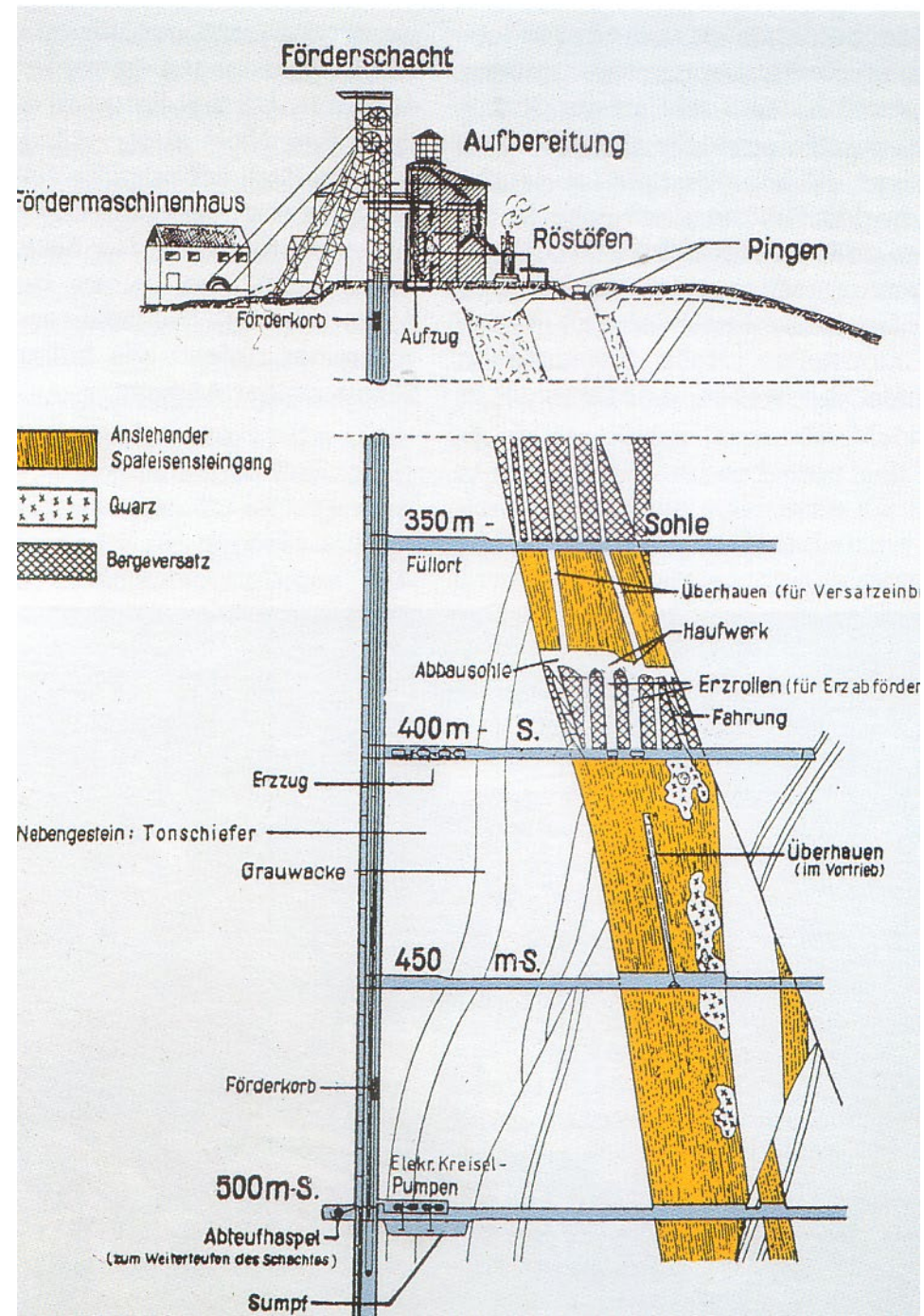


▲ Abb. 31  
Hydrothermalgänge VII:  
Parallel verlaufende, intern gebänderte Sparggänge.

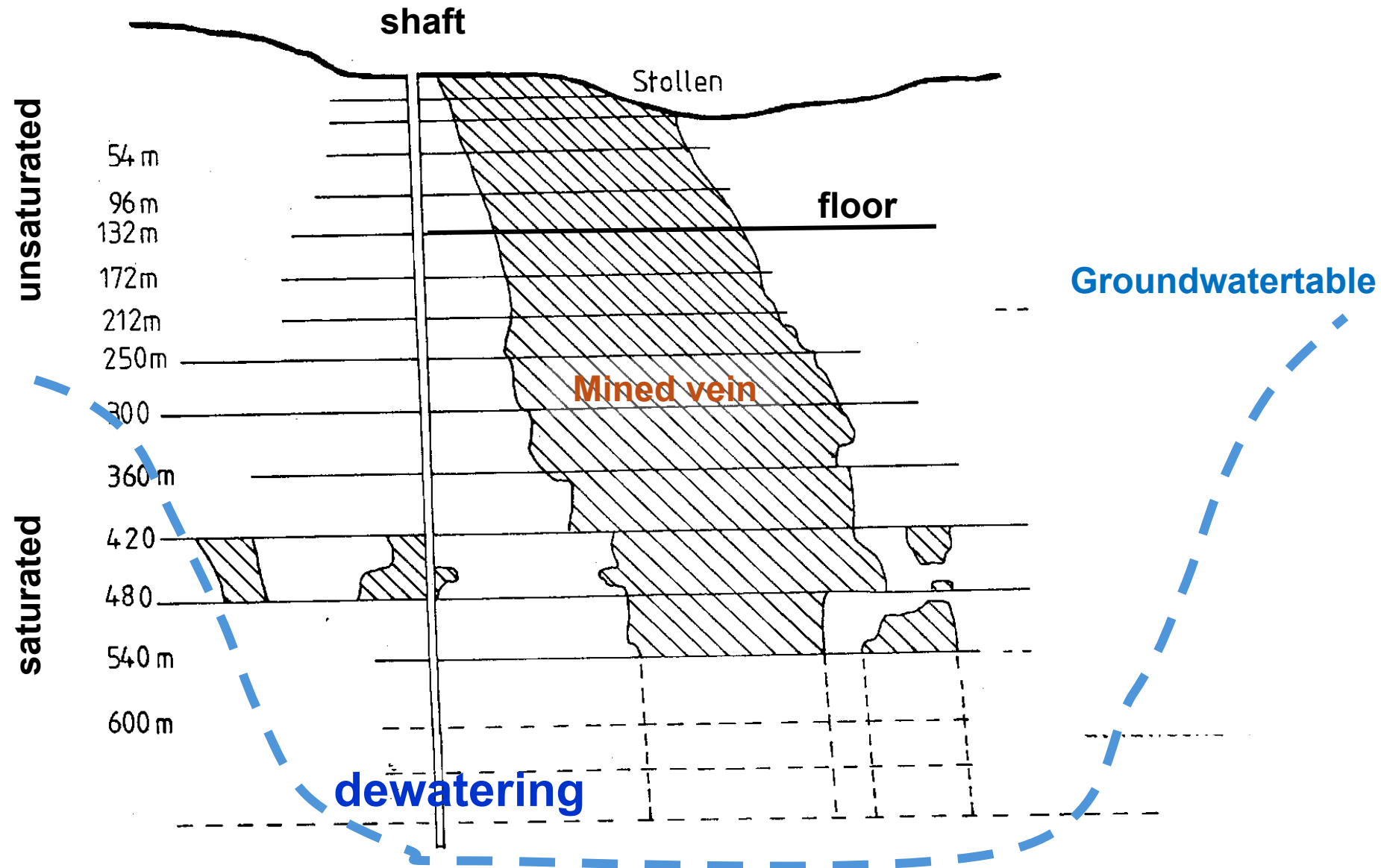
# Cut through a mine



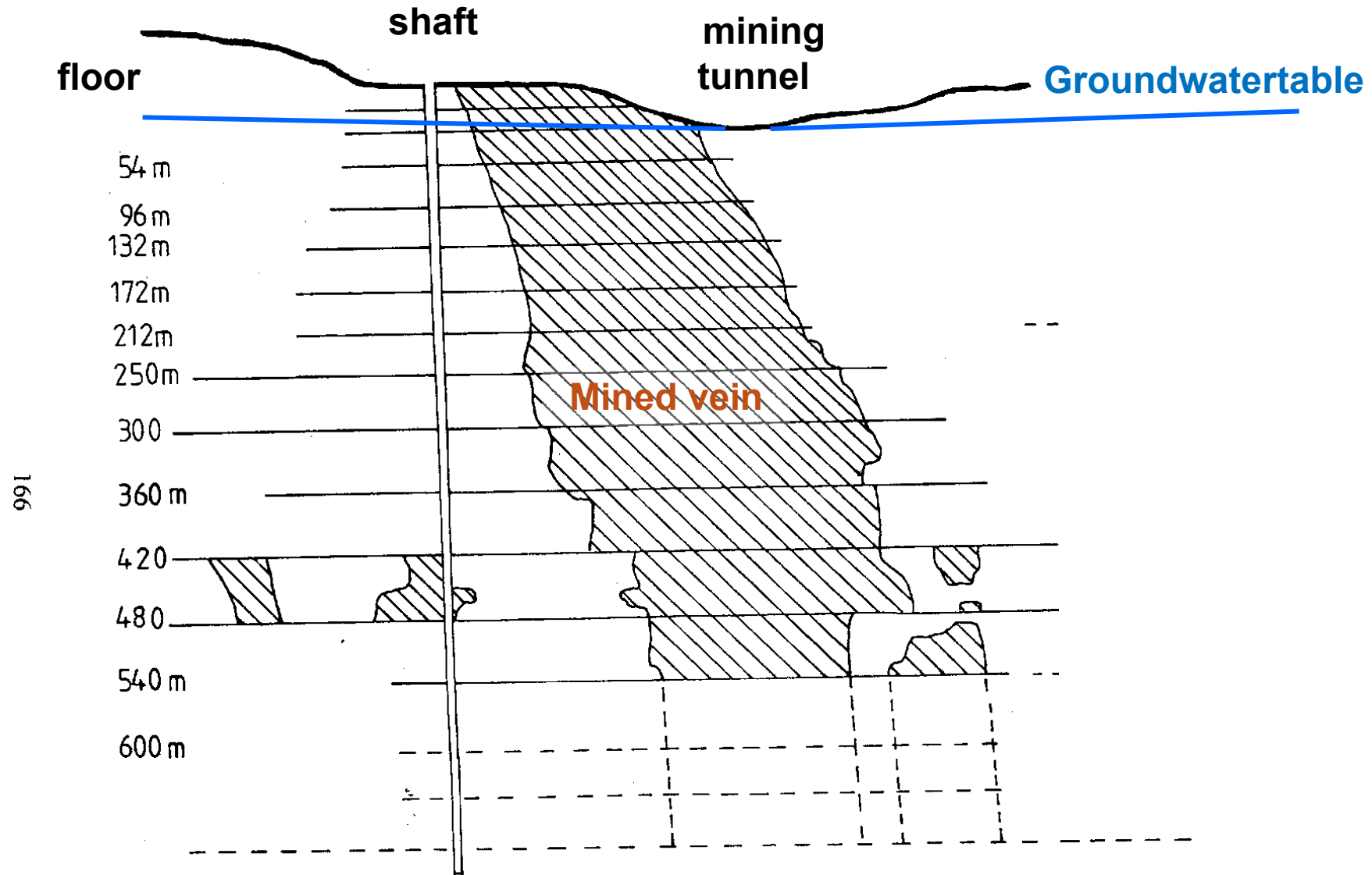
# scheme of an ore pit in the Siegerland mountains (Gleichmann, 1990)



# Hydrogeology active pits



# Hydrogeology flooded pits



# dammed watervolume

Mining unit:	dammed watervolume [m <sup>3</sup> ]	
refilled mining areas		2.022.536**
deep floors		299.064
shafts		109.393
total		2.431.095

\*\*mine offset 0,35  
35 % pore space



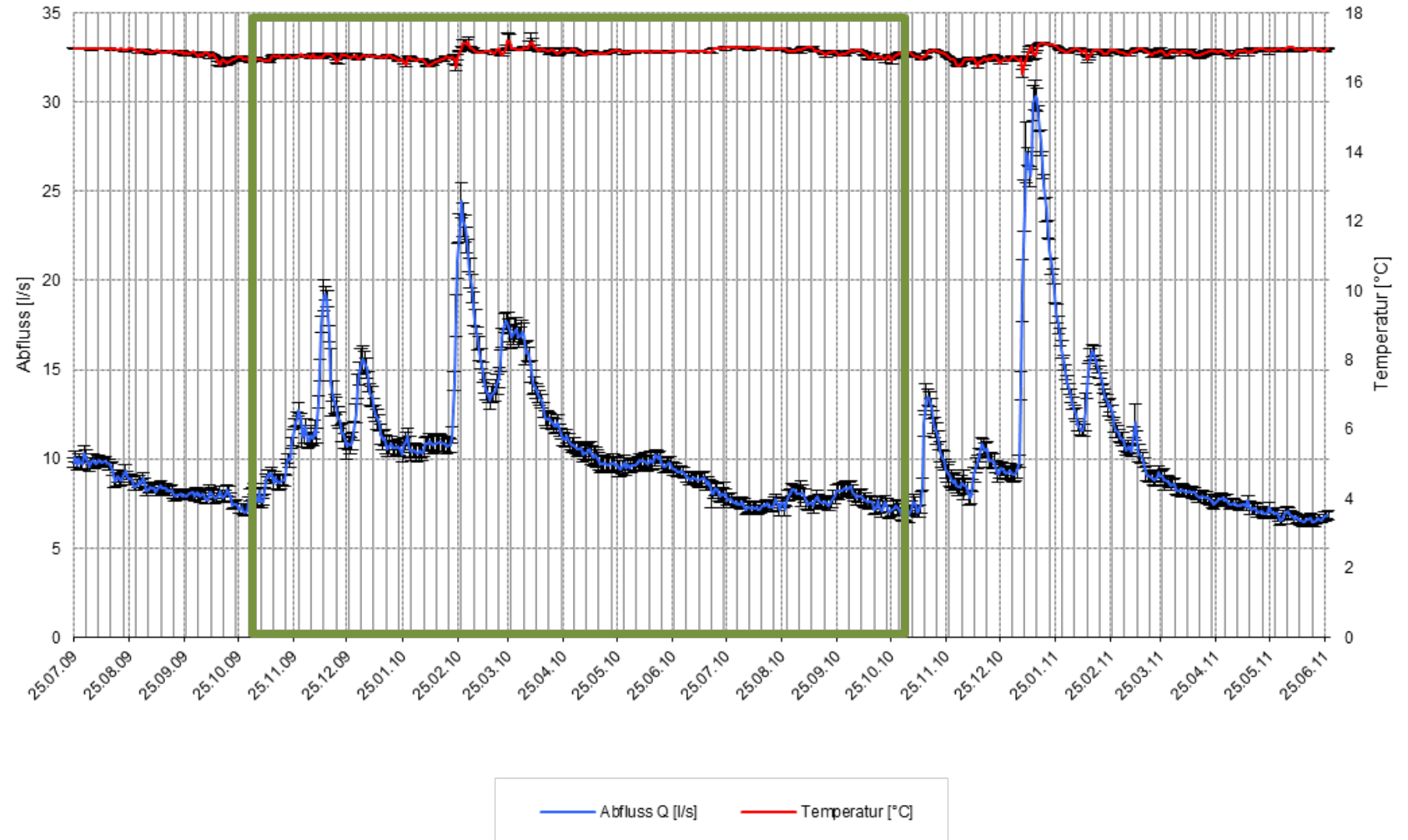
# Discharge measurement at the deep adit

Grube Wolf

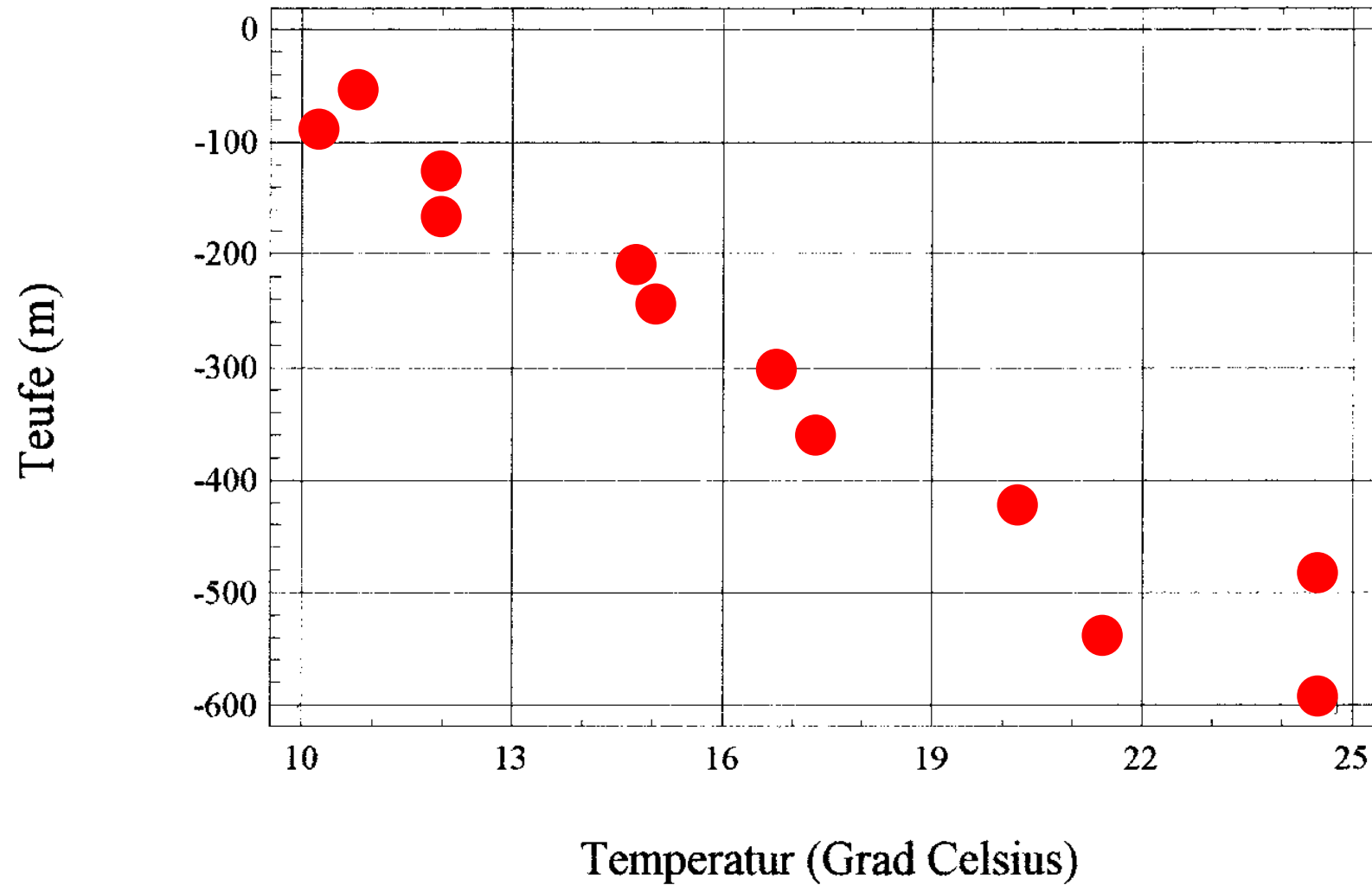


triangle weir  
(Thomson-Wehr)

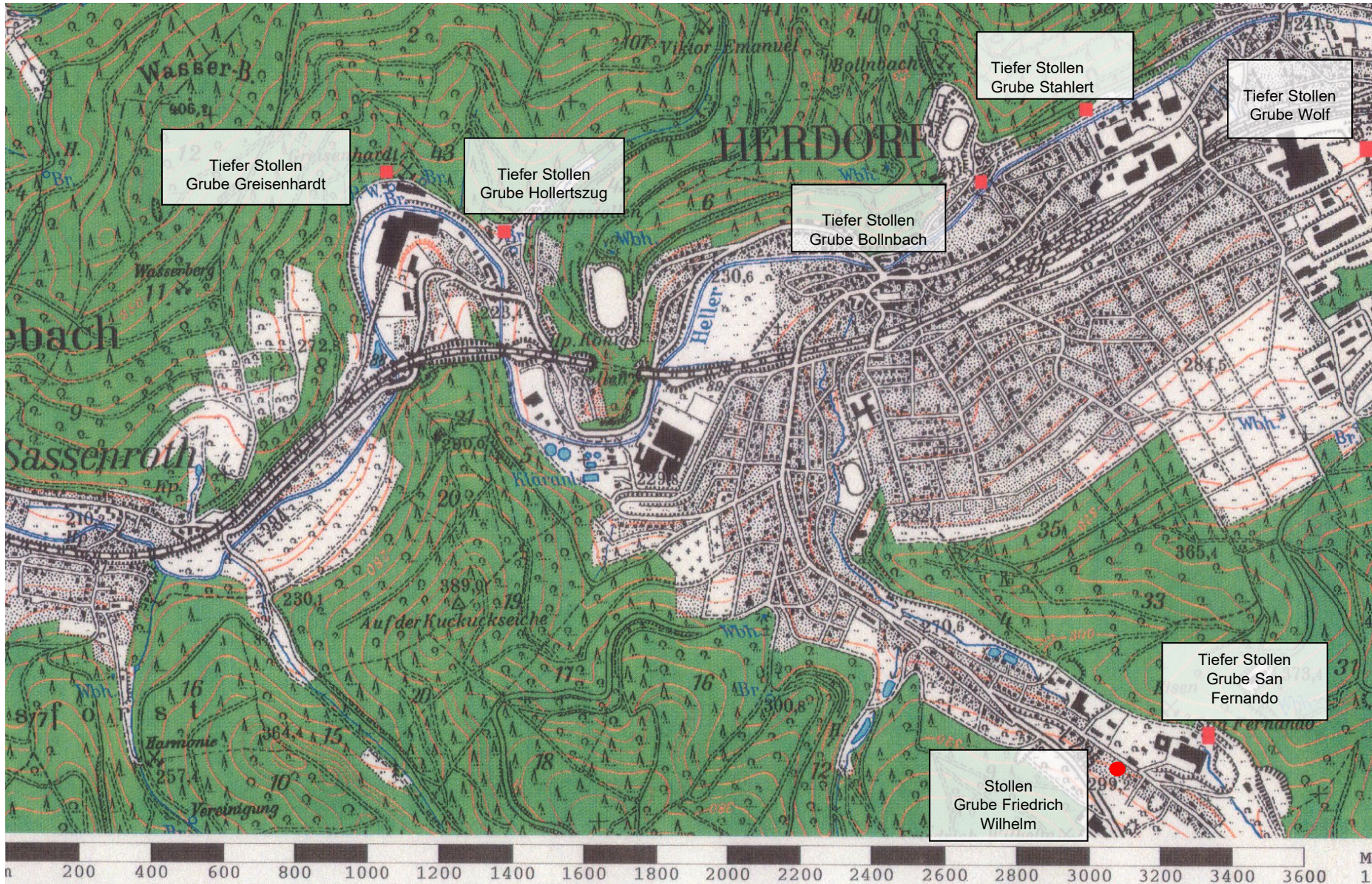
## Mining water discharge



# Pits in Siegerland (Wieber, 1999)



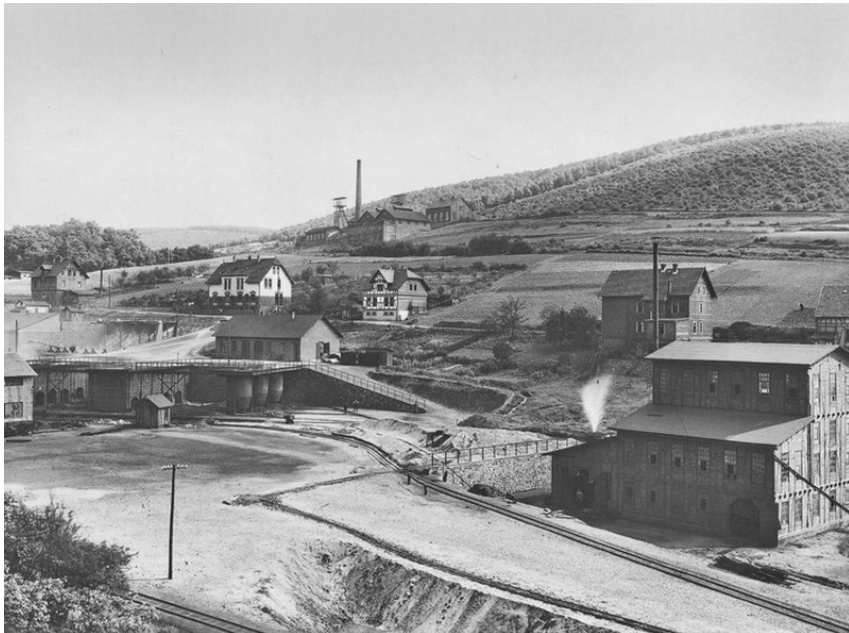
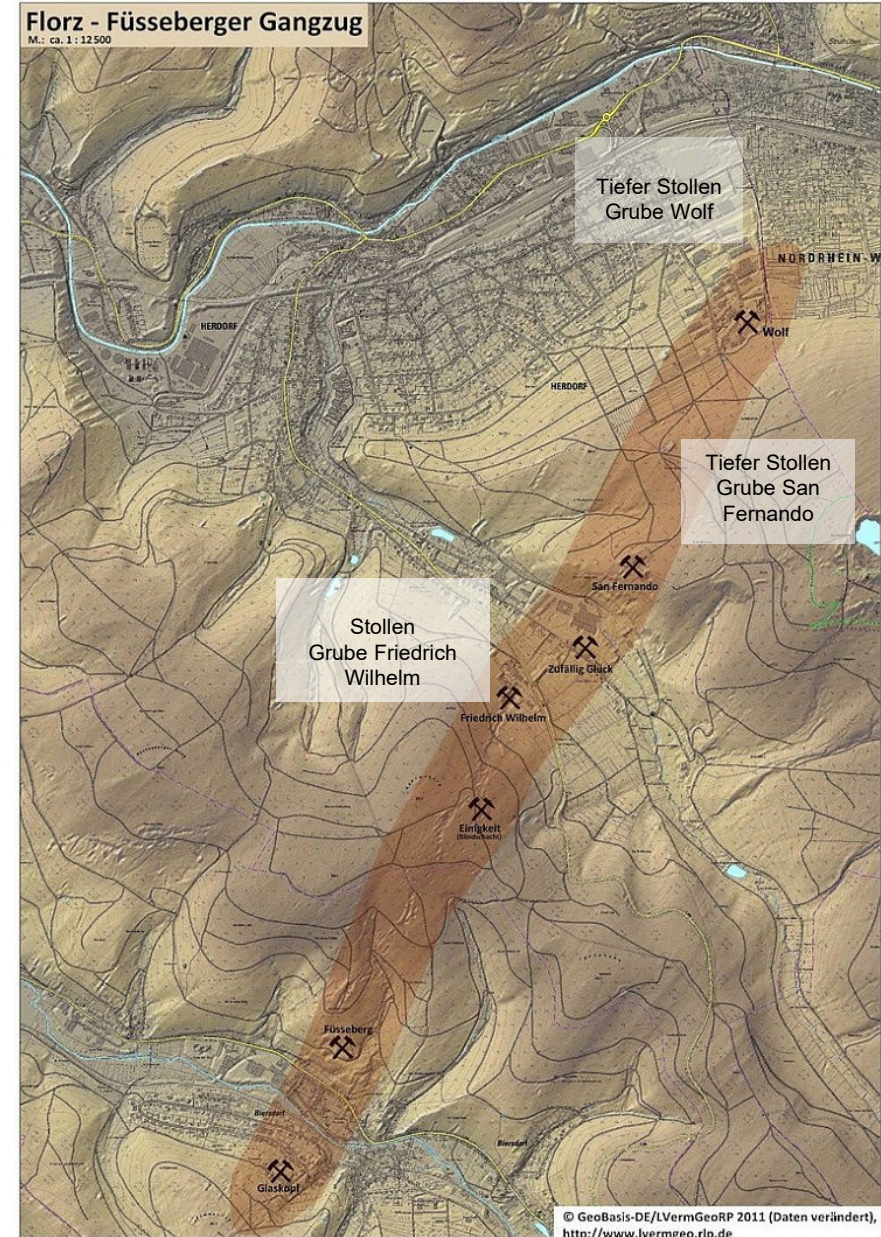
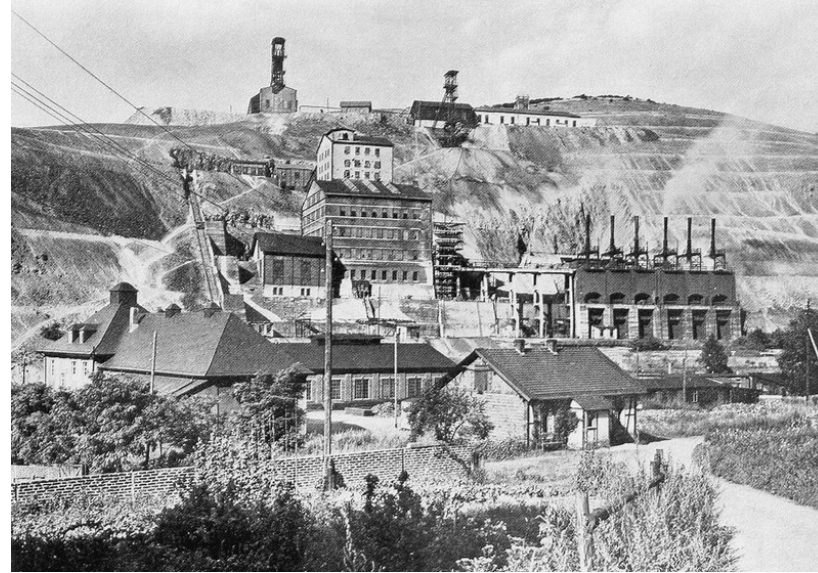
# Orepits in Herdorf



# Wolf



# Pits in the Herdorf district

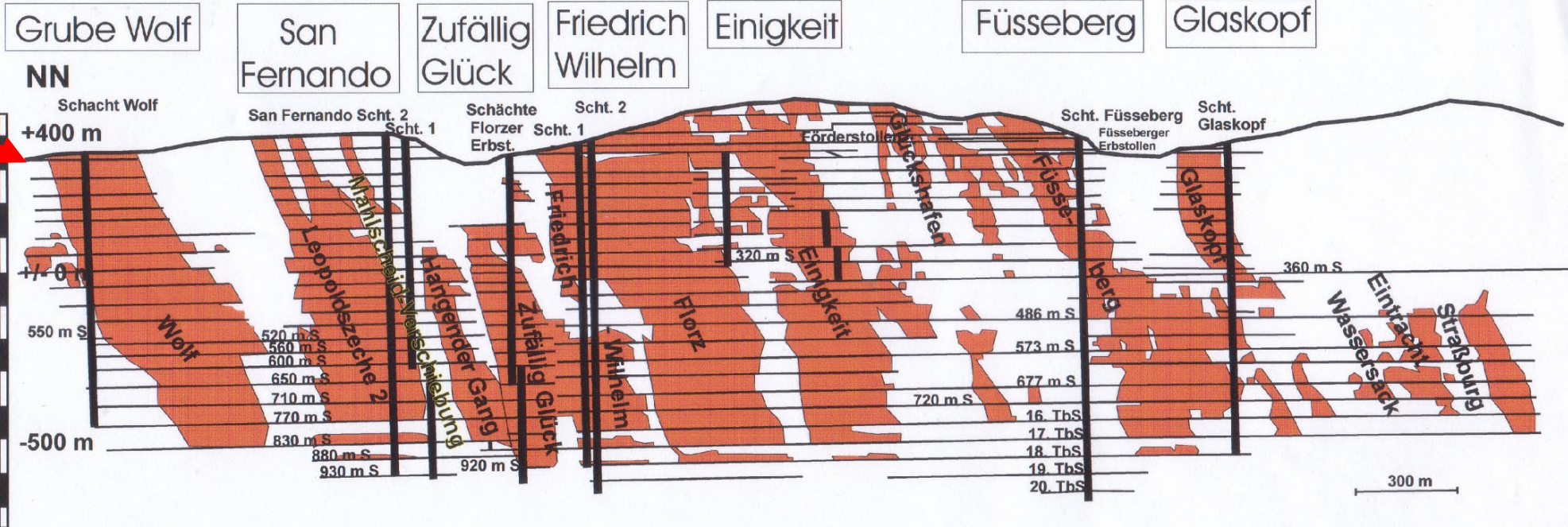


# San Fernando 1962

# Friedrich Wilhelm 1965

discharge

10 l/s with 17°C



 **mined vein**

TbS: Tiefbausohle  
520 m S: 520-Meter Sohle

Erb- bzw. Tiefe Stollen:

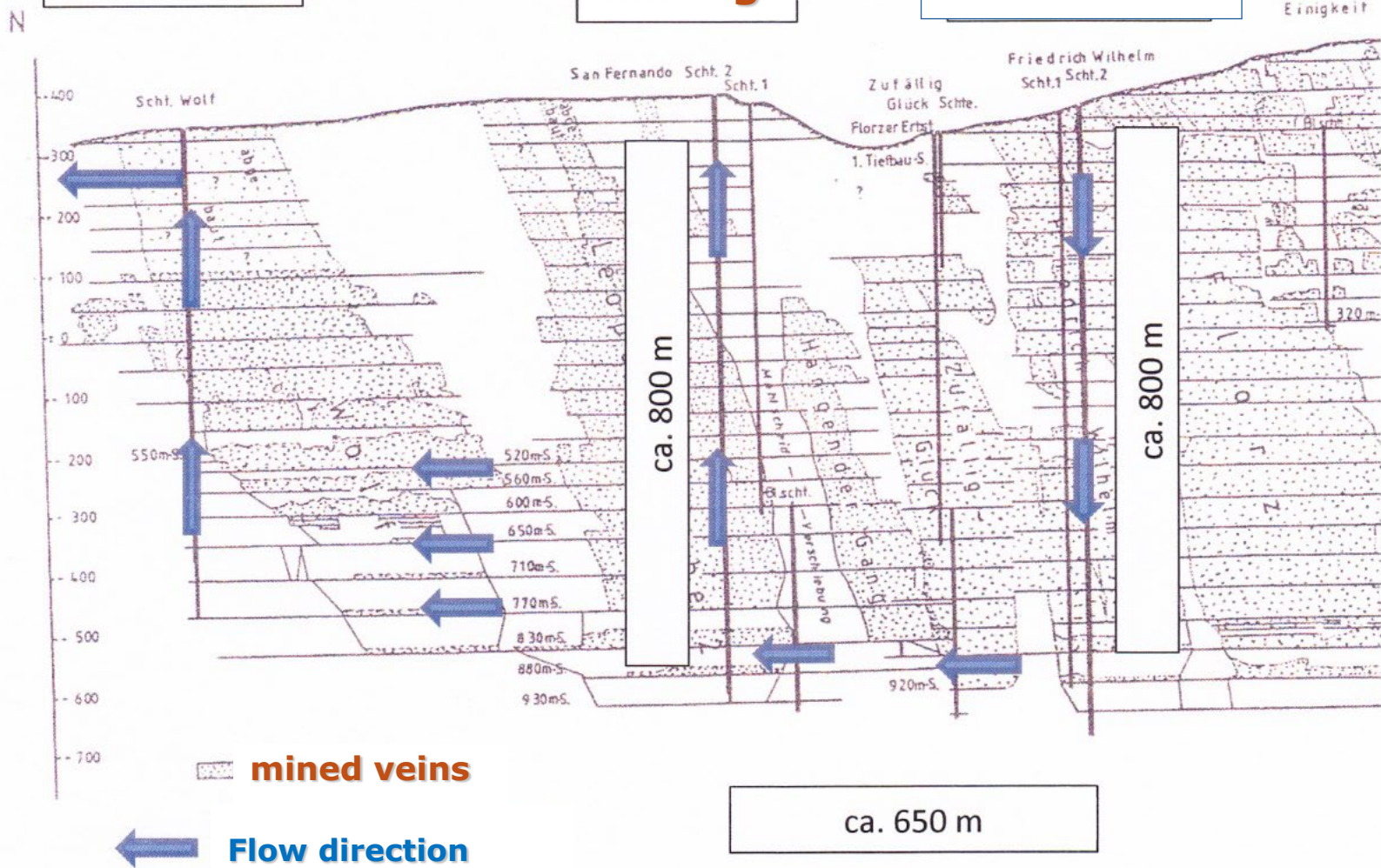
Grube Wolf:	+279,0 m NN
Grube San Fernando:	+288,9 m NN
Grube Zufällig Glück:	+ 293,0 m NN
Gr. Friedrich Wilhelm:	+ 288,3 m NN
Grube Füsseberg:	+269,2 m NN
Grube Glaskopf:	+ 266,2 m NN

industrial area

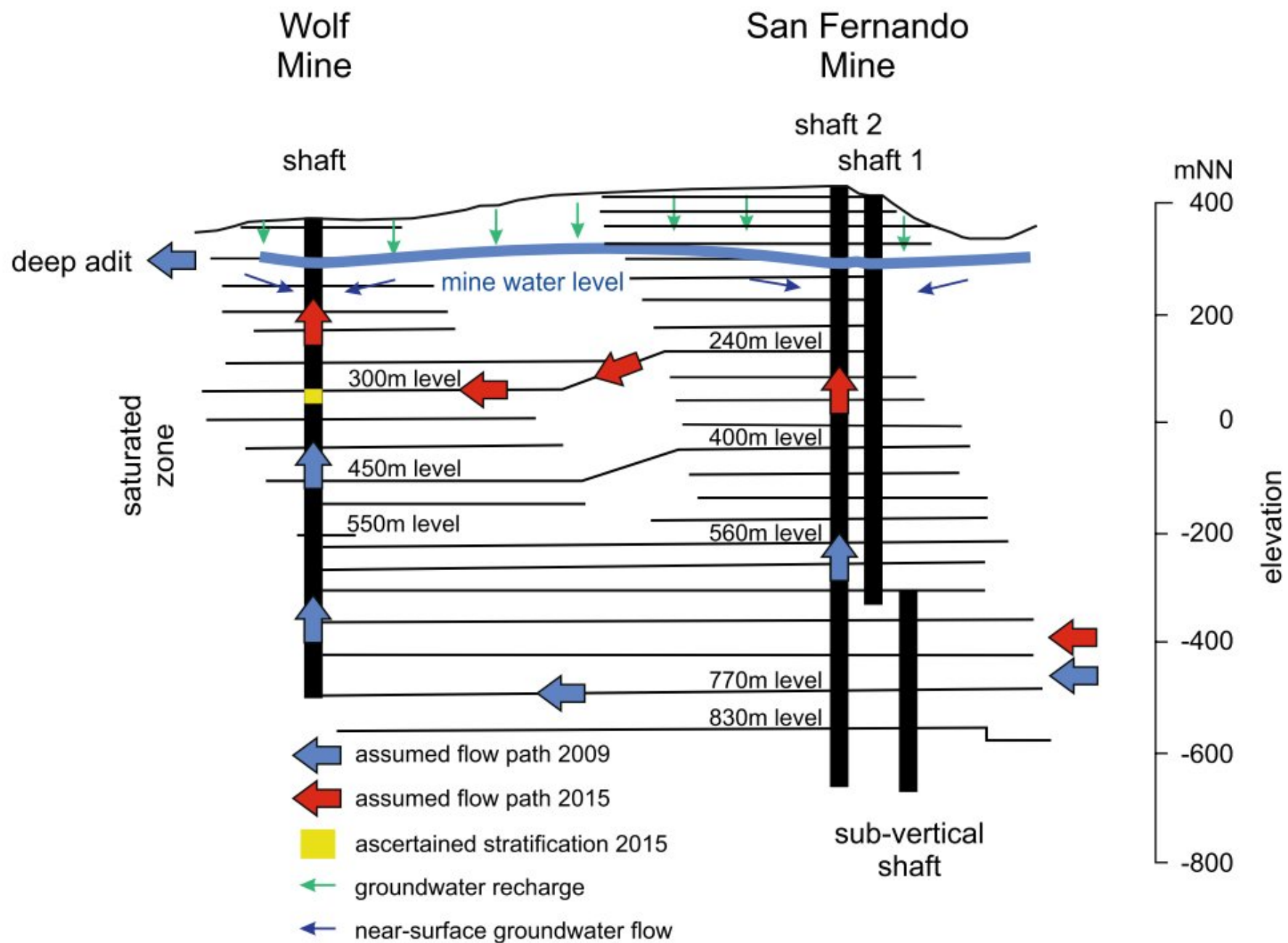
deep adit

mining

reinfiltration



**Fig.** Schematic diagram of the Wolf Mine and the neighbouring San Fernando Mine (Streb 2012) illustrating inferred flow paths and stratification

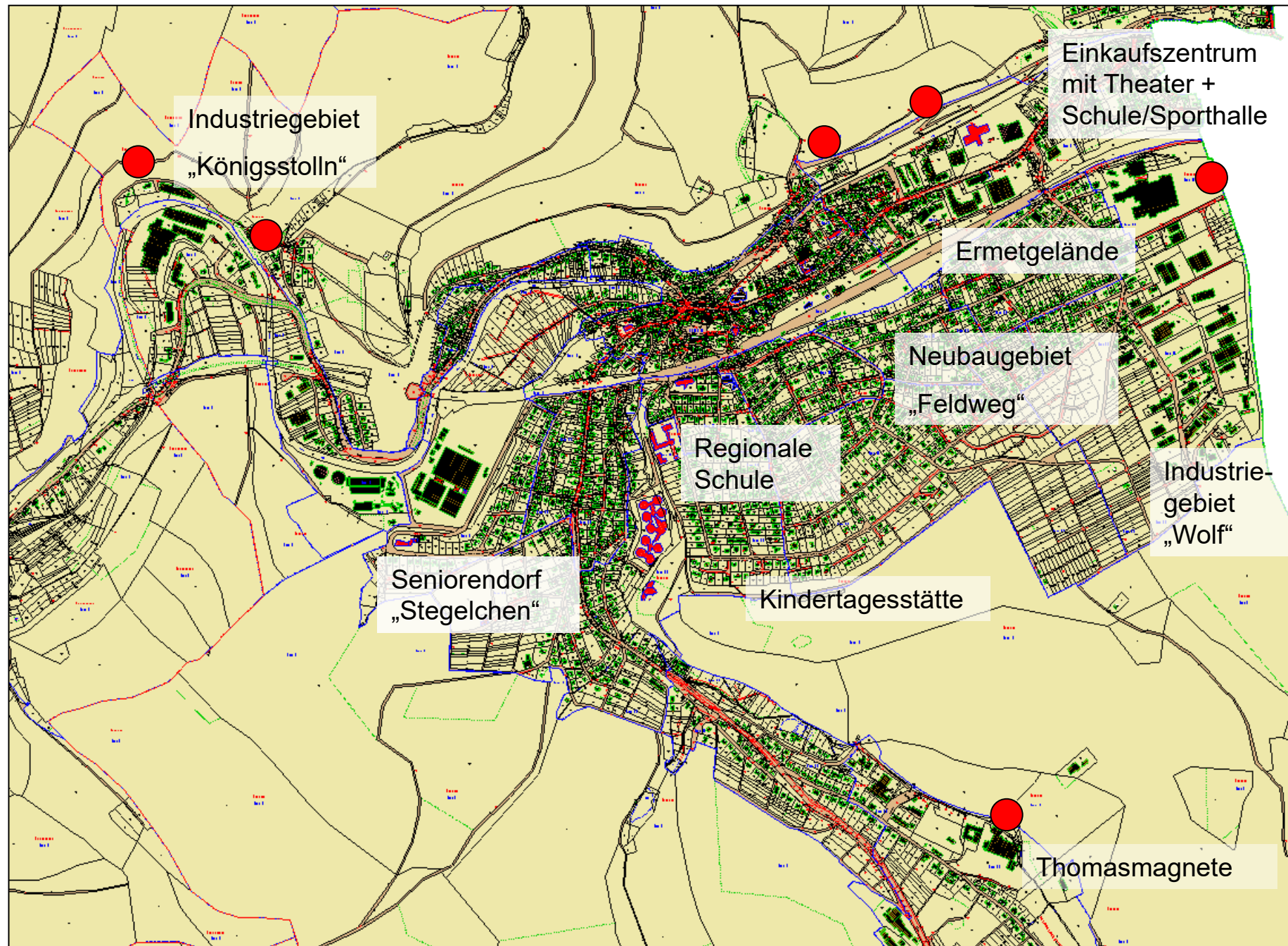


# Thermal output

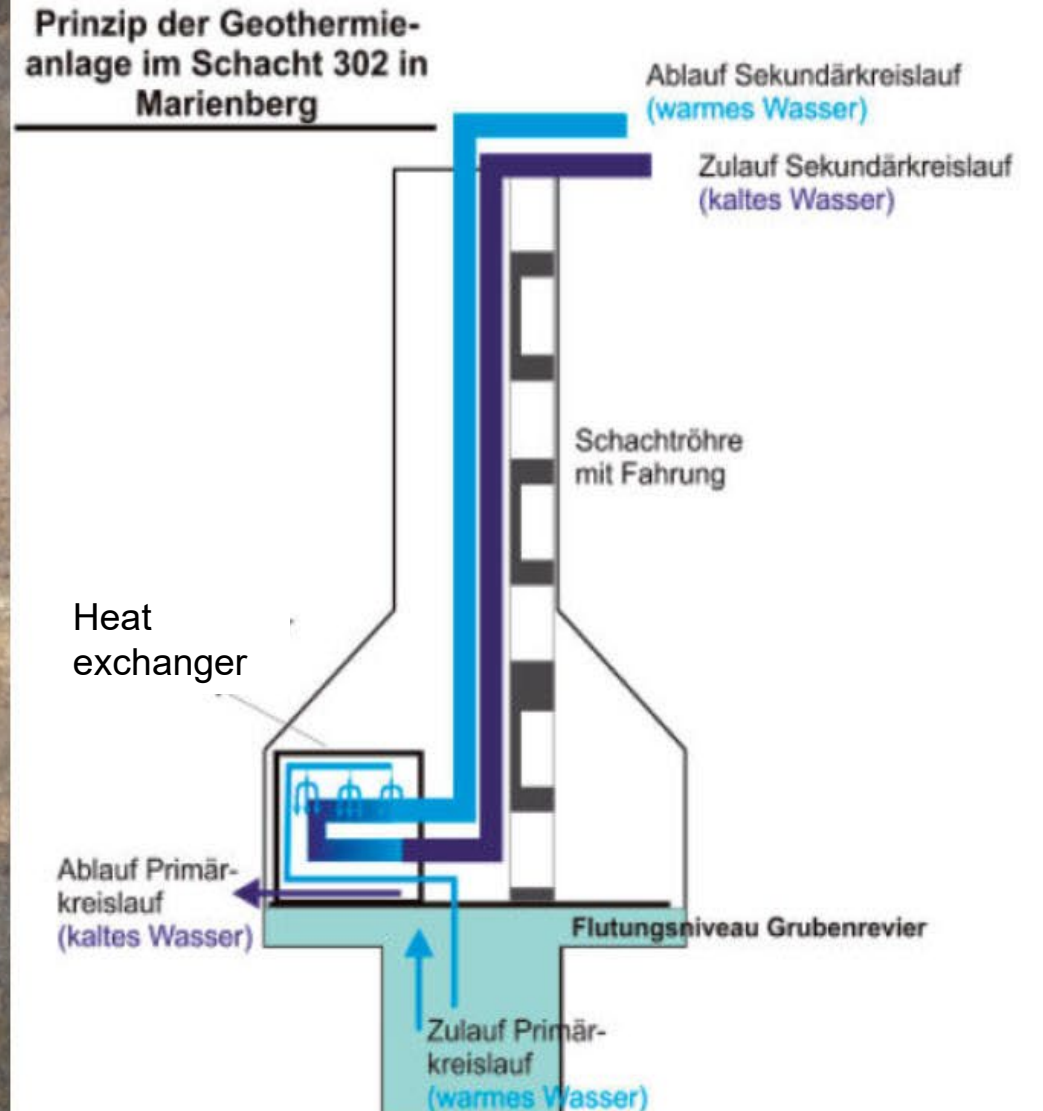
<b>Tiefer Stollen:</b>	<b>Source fill (l/s):</b>	<b>Temp. (°C):</b>	<b>delta T (°C):</b>	<b>thermal output</b>	<b>heat supply for number of houses</b>
Grube Wolf	20	15	12	1052 kW	100
Grube Stahlert	10	13	10	438 kW	40
Königsstollen	10	10	7	307 kW	30
Grube Greisenhardt	10	10	7	307 kW	30



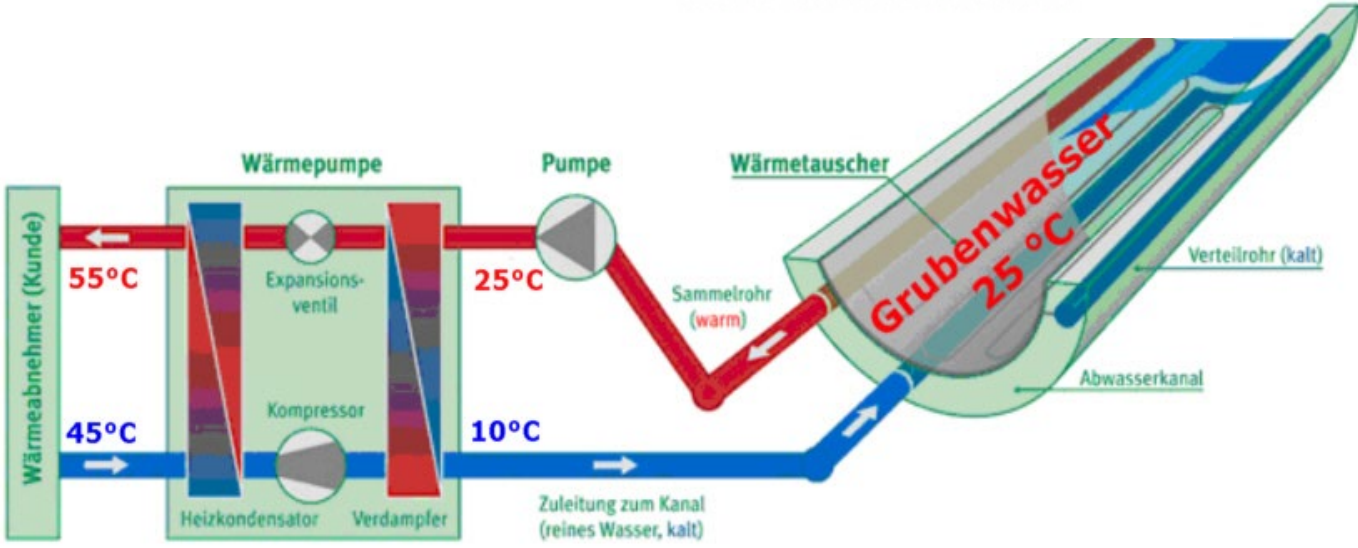
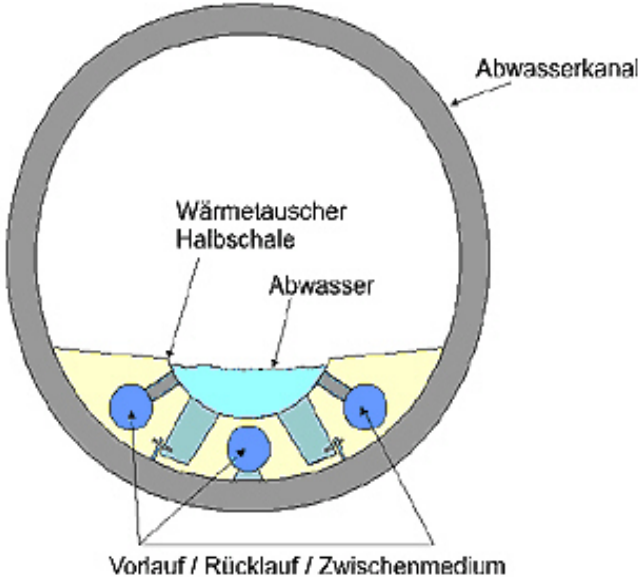
# possible users



# Thermal use of mine water with underground heat exchangers



# wastewater heat exchanger



# Examples for the use of geothermal energie

- bathing
- greenhouse
- Fish farming
- Industrial use
- Agricultural drying
- Apartment heating



# Evaluation

<b>Natural and technical local factors</b>	<ul style="list-style-type: none"><li>• Size of the mining facilities,</li><li>• Depth of the pit (m),</li><li>• Source flow (l/s),</li><li>• Temperature of the water (°C),</li></ul>
<b>Possibilities for using</b>	<ul style="list-style-type: none"><li>• Distance to possible users,</li></ul>
<b>Chemical nature of the water</b>	<ul style="list-style-type: none"><li>• aggressivity: heat exchanger, water pipes,</li><li>• pollution of the, problems with water discharge</li><li>• mineralisation: precipitates</li></ul>
<b>Economics</b>	<ul style="list-style-type: none"><li>• Distance to possible users,</li><li>• Condition of the pit</li></ul>

# Many thanks for your attention



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