



Thermal CO₂-rich springs in Bad Ems

The city Bad Ems is located on the banks of the river Lahn, which forms the border between the Taunus and Westerwald, two parts of the Rhenish Schiefergebirge ('Slate Mountains'). The city has been known as spa city since long because of its abundant thermal, mineral-rich springs.

Anomalies

Water temperature measurements in Bad Ems vary between 31.4 and 58.4 °C. Most springs and drillholes display a decrease in temperature over the years (Bräuer et al., 2013; Griesshaber et al., 1992; Hänel, 2020; Käß and Käß, 2008; Michel, 1997). However, the observed temperature is in all cases still significantly higher than 12 °C, the maximum expected temperature for shallow groundwater (< 500 m), therefore classifying water in Bad Ems as thermal. Regarding the CO₂-content, a broad variation has been reported as well: 560 – 1980 mg/l (Bräuer et al., 2013; Griesshaber et al., 1992; Hänel, 2020; Käß and Käß, 2008; Michel, 1997), i.e. always largely exceeding the threshold value of 250 mg/l (Weertz and Weertz, 2007). The CO₂ is interpreted to come from the nearby, still degassing Cenozoic magma chambers. The SW-NE Quellen-anticline (part of the Variscan Rhenish Schiefergebirge) mainly consists of heavily fractured quartzitic sandstone. In combination with the good hydraulic conditions, these deep fissures provide the pathway through which thermal, CO₂-enriched water can rise (Käß and Käß, 2008).

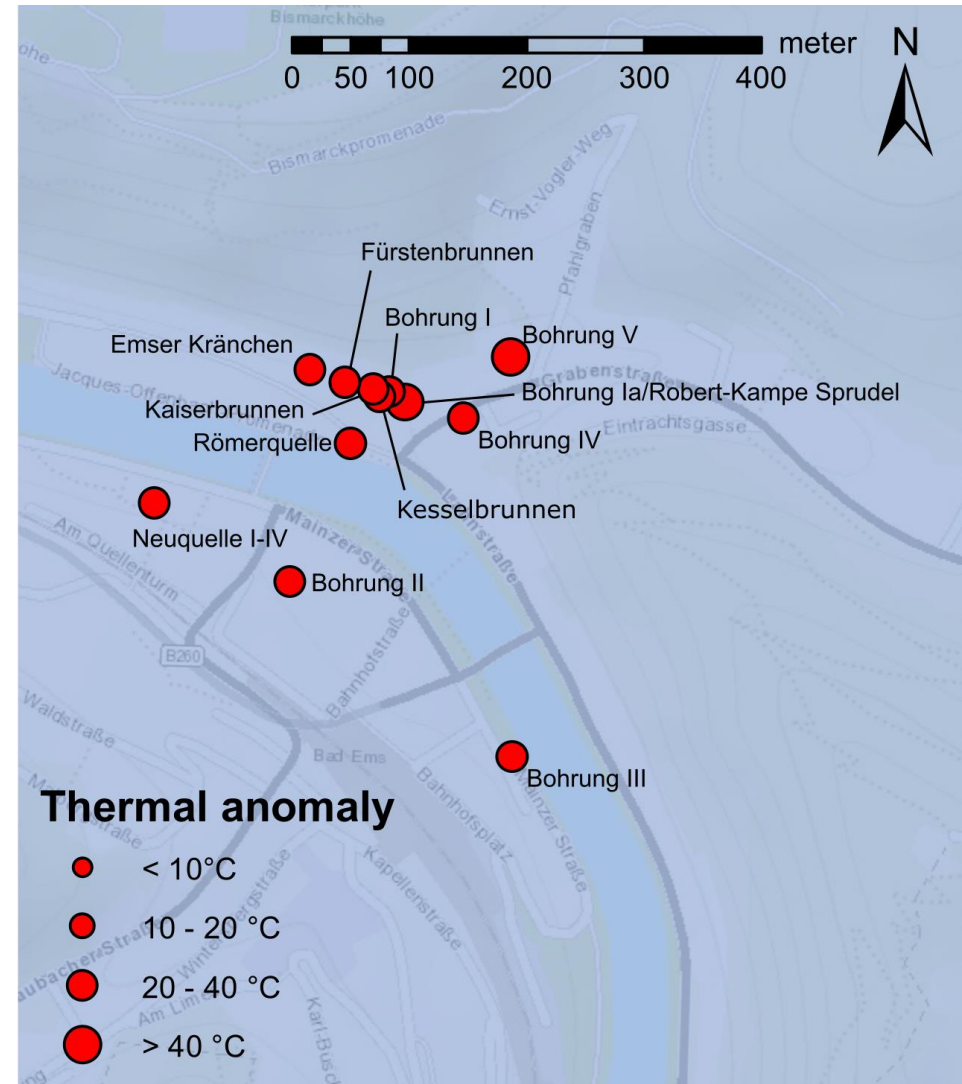
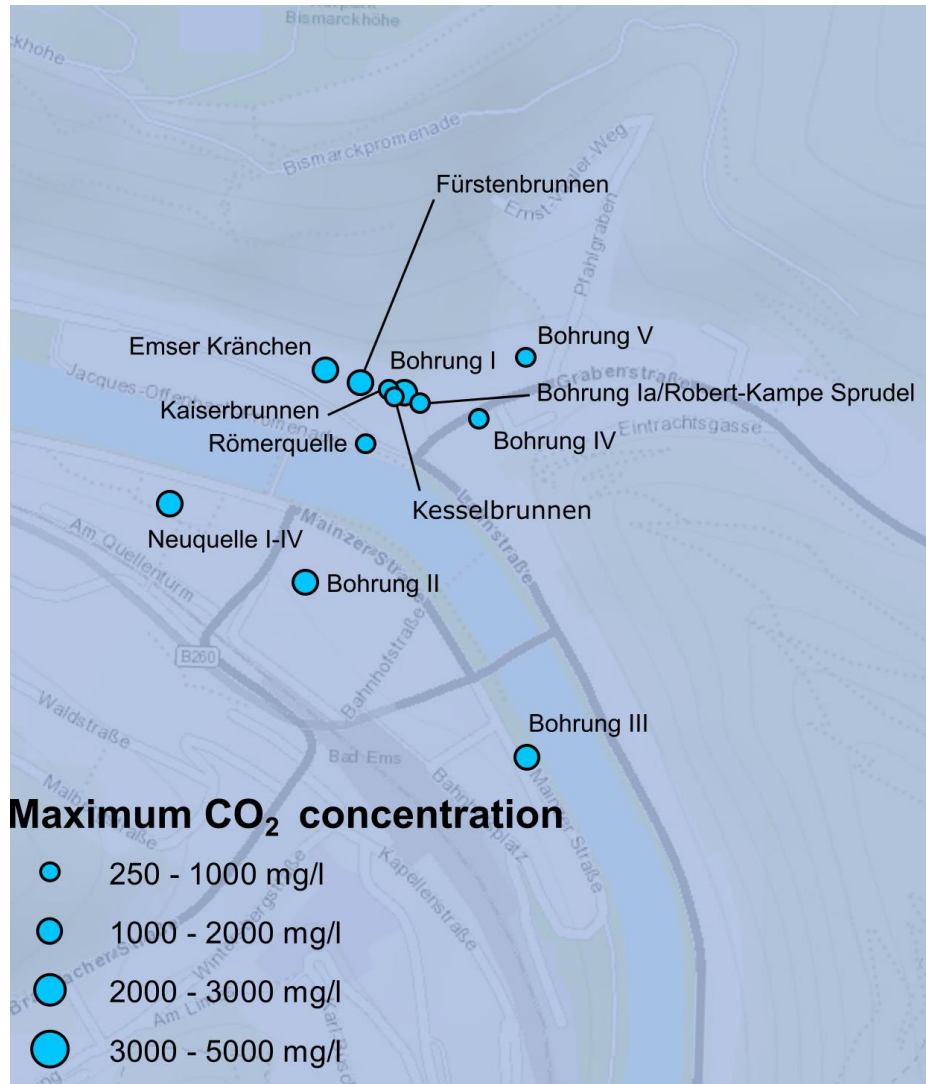


Figure 1: Thermal CO₂-rich springs in Bad Ems



Data

ID	Coordinates	T	Depth	TDS°	Cl	Na	SO ₄	Free CO ₂	He	³ He/ ⁴ He	Analysis year	References
		°C	m	g/l	mg/l	mg/l	mg/l	mg/l	ppmv			
Kesselbrunnen	50°19'50" North 07°43'45" East	43.6		3.23	527	849	22	940			1997	Käβ and Käβ (2008)
		42.7			513	836	25	724			2008	Hänel (2020)
Kaiserbrunnen	50°19'50" North 07°43'44" East	34.6		3.57	570	924	30	970			1997	Käβ and Käβ (2008)
		35.9			568	949	32	836			2008	Hänel (2020)
Fürstenbrunnen	50°19'50" North 07°43'43" East	34		3.56	566	922	30	1200			1997	Käβ and Käβ (2008)
Emser Kränchen	50°19'51" North 07°43'41" East	32.1		3.58	560	935	38	1400			1997	Käβ and Käβ (2008)
		31.4			565	957	35	746			2008	Hänel (2020)
Römerquelle	50°19'49" North 07°43'43" East	46.2		3.49	574	921	22	680			1997	Käβ and Käβ (2008)
		46.3			577	922	21	785			2008	Hänel (2020)
Bohrung I	50°19'50" North 07°43'45" East	51	80.4	<3	324.3	683	48.7	1427			1934	Käβ and Käβ (2008)
Bohrung Ia = Robert-Kampe Sprudel	50°19'50" North 07°43'46" East									1.57	1992	Griesshaber et al. (1992)
		58.4	73	3.70	579	963	26	560			1983	Michel (1997)
		57.2	73	3.79	587	996	30	370			2001	Käβ and Käβ (2008)
		52							55.5	1.6	2003	Bräuer et al. (2013)
		55	73								<2020	Hänel (2020)
Bohrung II	50°19'45" North 07°43'41" East	48.6	52.6	3.80	621.6	1005	21.5	1180			1986	Käβ and Käβ (2008)
Bohrung III – Haustrunk	50°19'40" North 07°43'51" East	40			435	835	56	890			<1992	Griesshaber et al. (1992)
										1.55	1992	
		39.5	431.8	3.79	486	940	63	1370			1997	Käβ and Käβ (2008)
Bohrung IV (Kränchen- Versand-Quelle)	50°19'50" North 07°43'48" East	39.3			477	935	66	1980			2006	Hänel (2020)
		50	130	4.41	586	1115	63	730			1985	Michel (1997)
Bohrung V	50°19'51" North 07°43'50" East	39	130.5	4.50	580	1140	73	844			1995	Käβ and Käβ (2008)
		55.2		3.34	395	820	43	664			1995	Käβ and Käβ (2008)



Neuquelle I-IV	50°19'47" North 07°43'35" East	45		3.37	508	870	39	1070			1986	Käβ and Käβ (2008)
----------------	-----------------------------------	----	--	------	-----	-----	----	------	--	--	------	--------------------

° TDS = Total Dissolved Solids

References

- Bräuer, K., Kämpf, H., Niedermann, S., Strauch, G., 2013. Indications for the existence of different magmatic reservoirs beneath the Eifel area (Germany): A multi-isotope (C, N, He, Ne, Ar) approach. *Chemical Geology* 356, 193-208.
- Griesshaber, E., O'Nions, R.K., Oxburg, E.R., 1992. Helium and carbon isotope systematics in crustal fluids from the Eifel, the Rhine Graben and Black Forest, F.R.G. *Chemical Geology* 99, 213-235.
- Hänel, M., 2020. Wasserquellen-Atlas. <http://www.quellenatlas.eu/39994.html>
- Käβ, W., Käβ, H., 2008. *Deutsches Baderbuch*, 2 ed. Vereinigung für Bäder- und Klimakunde e.V., Stuttgart.
- Michel, G., 1997. *Mineral- und Thermalwässer - Allgemeine Balneogeologie*. Bornträger, Berlin Stuttgart.
- Weertz, J., Weertz, E., 2007. Eifelbronnetjes met een vulkanisch trekje. *Grondboor en Hamer* 2, 37-41.

Cite this source

Van Daele, J. & Ferket, H., 2021. Thermal CO₂-rich springs in Bad Ems [Fact sheet]. Flemish Planning Bureau for the Environment and Spatial Development (VPO).