Thermal anomalies in southern Limburg (the Netherlands + Belgium)

Within the southern border area between Belgium and the Netherlands (Voeren region, Dutch Limburg) multiple observations, such as springs, borehole measurements, water outbreaks in stonedrifts and galleries within former coal mines, … are indicative of elevated temperatures.

See also

Thermal springs in Aachen

Anomalies

The abundant (historical) observations in this area show a slight local-scale thermal anomaly with surface water of about 14 °C in springs that did not freeze in hard winters. A well-known example is the water at the historical Elvenschans in Moelingen (Bless and Bouckaert, 1988; Dusar, 1999; Dusar and Hogenhuis, 1997). At three meters depth the temperature reaches already 19 °C, which is 7 °C higher than a normal groundwater temperature of maximum 12 °C. For the Elvenschans spring, it is suggested that infiltrated meteoric water (at the southern side of the Visé-Puth structure) migrates northwestwards along the Booze – le Val-Dieu uplift through the highly permeable limestones, and is being brought to the surface via the Border Fault by topography-driven fluid flow (Dusar, 1999, 2001; Dusar and Hogenhuis, 1997).

Waters with a Carboniferous signature in younger aquifers or springs in the area can be related to the Dinantian karstified limestone layer (Dusar, 1999; Dusar and Hogenhuis, 1997). The exact flow paths for the thermo-mineral water are yet uncertain for many of these geomanifestations, but it has been suggested that the water finds upward pathways along NW-SE normal faults, such as the Benzenrader, Feldbiss and Geleen faults, and is distributed more broadly where these crosscut NE-SW (Variscan) anticlinal structures such as the Puth Flexure and Waubach anticline (Kimpe, 1963). The most remarkable geomanifestation is a temperature of up to 50 °C at 250 m depth in a water breakout that was encountered during coal mining at the Oranje-Nassau mines. A hot brine welled in a stonedrift cut by a satellite fault of the NW-SE oriented Benzenrader Fault. Mixing of normal mine water with hot brine occurred at several locations, resulting in slightly elevated temperatures and salinities (Kimpe, 1963; van Rooijen, 1989). The position of the Limburg anomalies shows similarities with that of the Aachen thermal springs, i.e. on the crossing of major Variscan faults with deep-seated graben-related faults (see Herch, 2000).

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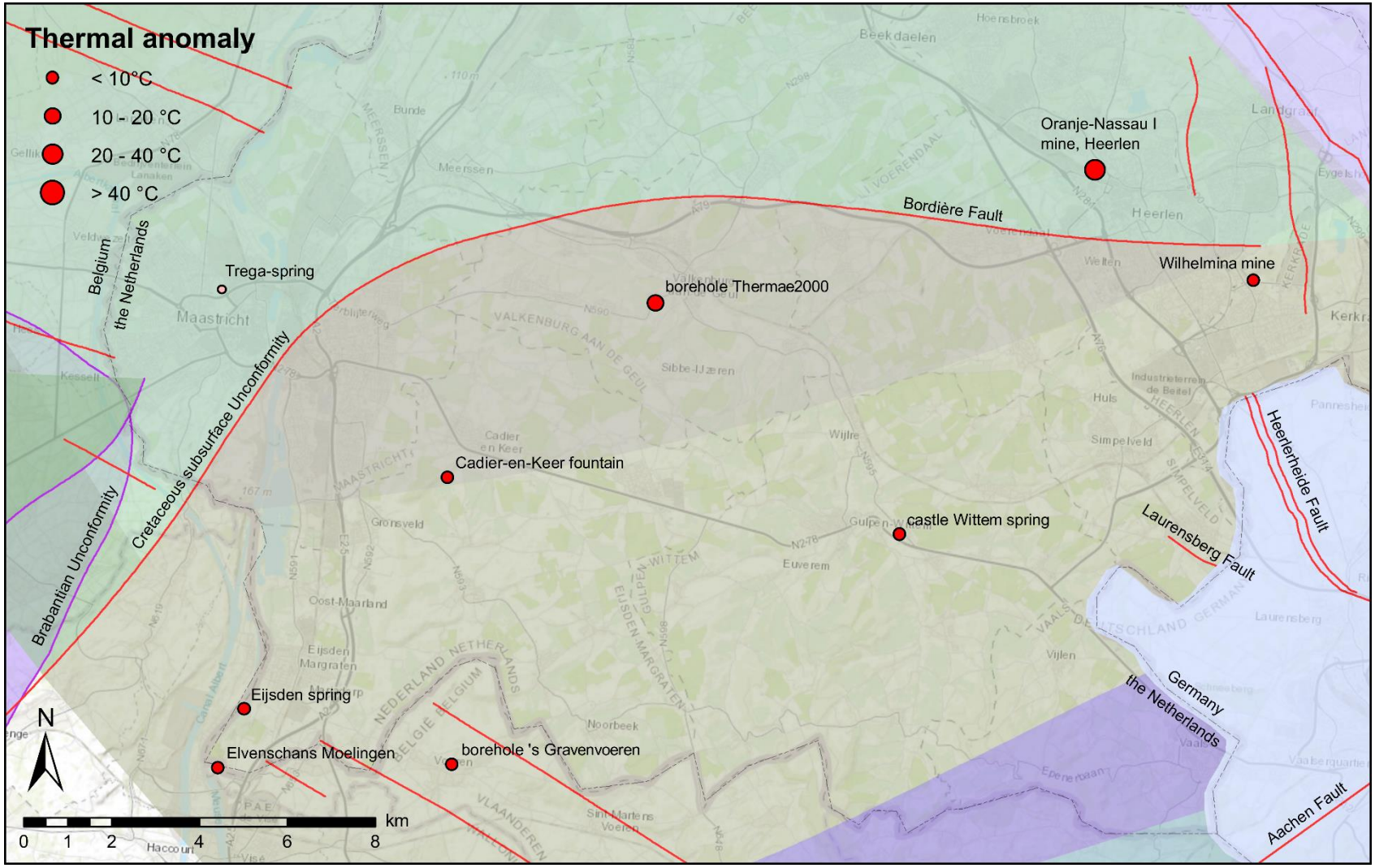

Figure 1: Thermal anomalies in southern Limburg (the Netherlands and Belgium)

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Data

ID	Coordinates	T	Depth	TDS°	Cl	Na	SO_4	Free CO_2	He	$^3He/^4He$	Analysis year	References
		°C	m	g/l	mg/l	mg/l	mg/l	mg/l	ppmv			
Borehole 's Gravenvoeren	50°45'36" North 05°45'53" East	38	865		15	28	16				1986	Sun Fan and Maes (1990)
Elvenschans Moelingen	50°45'23" North 05°41'12" East	14									<1988	Bless and Bouckaert (1988)
		13 – 18	3		150 – 296	130 – 193	39 – 72				1997	Dusar and Hogenhuis (1997)
		19	3								<1999	Dusar (1999)
Eijsden spring	50°46'09" North 05°41'39" East	14									<1987	Wolf and Bless (1987)
Cadier-en-keer fountain	50°49'14" North 05°45'28" East	14									<1987	Wolf and Bless (1987)
Borehole Thermae2000 (2002)	50°51'36" North 05°49'26" East				1540	964	124				<1986	Bless et al. (1986)
		24.5	375								<1988	Bless and Bouckaert (1988)
			380		1500	1000	550				<1989	van Rooijen (1989)
			382	3.60	1622	1083	155	51			1987	Michel (1997)
castle Wittem spring	50°48'50" North 05°54'35" East	14									<1988	Bless and Bouckaert (1988)
Oranje-Nassau I shaft (Heerlen)	50°53'36" North 05°58'06" East	19.5									1955	Kimpe (1963)
		50	250	45					1800		1960	
Trega-spring	50°51'27" North 05°40'43" East		275		1525	1000	140				<1989	van Rooijen (1989)
Wilhelmina shaft	50°52'18" North 06°01'24" East	38	670						22500		1963	Kimpe (1963)

° TDS = Total Dissolved Solids

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