

# THE THERMAL SPRING OF ELVENSCHANS-NAVAGNE IN MOELINGEN (VOEREN-FOURONS) AND ITS GEOLOGICAL ORIGIN

NEW INSIGHTS AS A RESULT OF GEOLOGICAL RECONNAISSANCE FOR A GAS PIPELINE

Michiel DUSAR<sup>1</sup>

1. Geological Survey of Belgium, Jennerstraat 13, B-1000 Brussel

The originally artesian thermal well of Elvenschans-Navagne served for the water supply of the medieval moat Elvenschans, later Spanish bastion Navagne, overlooking the Meuse river. A farmhouse De Schans was later built on the ruins of the historic site.

The thermal well is located on the lower terrace of the Meuse river, above the highest flood level. The artesian nature (which gradually disappeared since a new water production well tapped the same aquifer at 15 m distance), the temperature (19°C at 3 m depth when the well was naturally overflowing) and the mineralisation (ca 1 g/l Na-Cl-HCO<sub>3</sub> mineral water) clearly show that the water is not derived from the phreatic aquifer in the Meuse gravels. Deep convective water transport in high-permeable pressured Lower Carboniferous limestones is responsible for the water supply to the well. This unique water circulation system is vulnerable for mixture of the phreatic and confined aquifers because the karstified and fractured limestones locally reach to the base of the Quaternary deposits. The construction in 1997-98 of a vertical shaft, 30 m deep and 16 m wide, at 50 m distance from the thermal well, and a tunnel under the Meuse for a gas pipeline added to the risks. Fortunately, monitoring of water quality indicate that contamination nor pressure change has been caused by the works.

Geological and hydrogeological reconnaissance of the Euregio, which already led to the Thermae 2000 project in Valkenburg, provide the clues for interpreting geological structure and water circulation.

The subsurface is composed of turbiditic limestones of Upper Viséan age, attaining easily 500 m in thickness. All these beds dip 30° East, probably resulting from a transpressional bulge over the southern Border Fault ('faille bordière') of the Brabant Massif which must follow here a NNE-SSW direction along the west margin of the Meuse river valley incision. The Visé-Puth subsidence basin, located in between the Border and Anticlinaal-Oranje fault systems, accomodated thick carbonate sequences derived from a shallow, highly productive carbonate platform near Visé and deposited as seasonal(?) mudflows on the unstable slope.

Pervasive silicification affected these beds in and around karst solution structures developed during different emersion phases from the base Namurian onwards. Tropical weathering during the Cretaceous installed a 100 m deep paleosol on the silicites, characterised by a bleached kaolinised upper zone and an black carbonaceous lower zone. Late Cretaceous to Tertiary tilting and subsequent erosion finally resulted in variable depths to relative unaltered but karstified limestones, silicites, black and white paleosols.

The flowpaths for the thermal-mineral water are yet uncertain. Analogies with the Chaudfontaine system and the systematic variation in salinity between different mineral waters East of the Brabant Massif and North of the Variscan thrust suggest infiltration in the Berwinne valley along the Booze-le Val Dieu uplift, about 6 km to the Southeast, circulation through the Viséan limestones, and upwelling against the Border Fault to the Northwest. A breach in the relatively impermeable paleosol cover under the Elvenschans/Navagne site caused outflow of pressured water through the phreatic aquifer, and tapping in the historical well.

## REFERENCES

DUSAR, M. & HOGENHUIS, J.E.J., 1998. De Elvenschans te Moelingen, een thermale bron in Limburg bedreigd? Verduidelijking vanuit nieuwe geologische prospecties. *LIKONA, Limburgse Koepel voor Natuurstudie, Jaarboek 1998*: 23-35.