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Geothermal reservoir of Hainaut (Belgium) - A multi-permeable complex aquifer

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The geothermal reservoir of the Mississipian Limestones of Hainaut is mainly formed by thick strata of limestones and dolomitic limestones, affected by a slight dip of less than 10 degrees south, decreasing with depth. It has been discovered in 1976 thanks to a geological exploration bore-hole, which became later the first geothermal well exploiting the regional reservoir. It offered many surprises, with for example the occurrence of thick and massive anhydrite layers in the upper and middle Visean, at about 2.500 m deep. At the bottom of those layers, more than two hundred meters of karstic breccias were found. Hot waters that gushed out when the drilling reached the breccias revealed the presence of the geothermal artesian aquifer.

The exploitation of the reservoir began ten years after the drilling itself, and two other wells were drilled, a few kilometers from the first one. These two wells didn't encounter anhydrite, but only a partly cemented residual breccia. They were stopped in the Upper Visean, when they reached hot waters in karstified fissures.

Several interstratifications of breccias were already known at the northern Mississippian limestones outcrops, but relics of former anhydrite presence were only found when they were searched out. Stratigraphic correlations between outcropping breccias, deep water-bearing breccias and anhydrite thick layers have been well established since then, notably using micropaleontology.

In spite of more than twenty years of exploitation, the hydrogeological behavior of the aquifer is still obscure. The fact that pressures and temperatures remain stables without any reinjection supposes a huge reservoir capacity, but its quantification is risky, particularly because of geological singularities such as the local thickening of the Paleozoic formations, and the suspected influence of Hercynian tectonic on the structure and permeability at a local scale. In addition, if the recharge zone of the aquifer can be supposed to be the northern outcrop, there is no confirmed natural exsurgence. A few springs located at the margin of the northern outcrop present anomalies in temperature and/or chemical composition, particularly the sulphate content. Isotopic analyses give confirmation of the deep origin of those waters. The localization of the springs is also very interesting, as correlations can be made between chemical and thermal anomalies and the near presence of the supposed dissolution breccias, outcropping or under thin coversand. Breccias could then be investigated as exsurgence preferential ways, linked to a residual permeability.