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Reservoir characterisation of the deep carbonate aquifer in the Molasse Basin: A multi parameter approach

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The deep Upper Jurassic aquifer in the Bavarian Molasse Basin has a great potential for hydrogeothermal energy supply. Understanding this complex carbonate aquifer system is of key interest for a successful long-term geothermal exploitation strategy. The geothermally used water is associated with geological structures (rock matrix, fault systems and karstic features) which may influence the isotopic and hydrochemical fingerprints of the deep groundwater. At present there is an incomplete understanding of the origin of the deep Upper Jurassic groundwater, the possible occurrence of different reservoirs and the complex flow regimes.

Therefore, more than 60 water samples and 15 rock samples were characterized in a multi parameter approach to develop a better understanding of the complex deep groundwater system of the Bavarian Molasse Basin. To this end, several environmental isotopes were measured, including 1) stable water isotopes (δ^{18}O, δD), 2) strontium isotopes (^{87}Sr/^{86}Sr) and noble gas 3) helium (^{3}He/^{4}He) and 4) argon isotopes (^{40}Ar/^{36}Ar). The results may allow deriving information about the interaction of the water with the host rock and possible exchange processes between the deep Upper Jurassic water with water from nearby aquifers.

Using statistical factor and cluster analysis, up to five different water types were separated in the central Molasse Basin around the city of Munich. The geographical occurrence of the derived water types led to the characterisation of several deep groundwater reservoirs within the Upper Jurassic aquifer: a western and eastern reservoir in the central Molasse Basin, a reservoir in the north-east of the Molasse Basin, a reservoir east of the Landshut-Neuöttinger Hoch, so-called Braunauer Trog, and a western reservoir in the Bodensee area. In addition, it was possible to show existing hydraulic interactions between some of these reservoirs and to delineate local, regional and supra-regional flow systems. These results may contribute to a better understanding of the deep groundwater system of the Molasse Basin and the planning of future geothermal well localization, especially in the southern area of the Bavarian Molasse Basin.