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Geothermal potential of Mesozoic carbonates on the example of the Rüdersdorf Formation (“Schaumkalk”, Lower Muschelkalk): opportunity or not?

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The Mesozoic succession of the North German Basin (NGB) yields enormous resources of heat in place bound to Mesozoic sandstone reservoirs located at depths of up to 2500 m. Compared to highly permeable sandstone reservoirs, which have been exploited for heat production since the 1980s, carbonate reservoirs are underexplored so far. This study evaluates the potential of Mesozoic carbonates on the example of the Rüdersdorf Formation (“Schaumkalk”) in the subsurface of Berlin-Brandenburg.

The data are based on an extensive bed-by-bed outcrop study in the Rüdersdorf open-pit mine to the East of Berlin, and examination of well cores from Berlin-Spandau, Potsdam, and Fürstenwalde. The vertical succession exposed in outcrop and well cores shows gradual transitions from mud-dominated lithofacies (“Wellenkalk”) to thick cross-bedded oolitic grain- to packstone reservoir facies (“Schaumkalk”).

Based on analyses of carbonate microfacies and reservoir properties, oolitic reservoir facies exhibit high secondary porosities but low permeabilities. The late-diagenetic dissolution of ooids and bioclasts, resulting in the typical foamy texture, contributed to moldic porosity volumes averaging 23,8 % in Rüdersdorf and 2,15 % in the subsurface of Potsdam. However due to matrix-supported grain fabrics and the lack of intergranular porosity, the pore connectivity remained low as emphasized by very low average permeabilities of 0,005 mD in Rüdersdorf and 0,001 mD in Potsdam.

The potential of the reservoir facies is further limited as fluid circulation along open fractures and faults did obviously not contribute to the development of intergranular porosity. Additionally, the Rüdersdorf Formation is sandwiched between two saliniferous formations (Röt and Middle Muschelkalk evaporites), posing a risk of halite clogging in a geothermal well especially when fracture zones are developed. Accounting for this and the limited lateral extent of thick oomoldic reservoir facies, the opportunities in the Rüdersdorf Formation seem to be limited.