

Reconstruction of Late Paleozoic heat flow and burial history at the Rhenohercynian Zone, Czech Republic

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The Paleozoic rocks of the north-easternmost part of the Variscan external zones thrust eastward over the Bruno-vistulicum are exposed predominantly in the Nížký Jeseník Mountains. The further east extension is buried below the Carpathian Foredeep or the Carpathian thrust belt. The investigated area is located in the Rhenohercynian zone in the classical concept of the Central European Variscides.

This study was performed in order to determine the thermal maturity evolution of the north-easternmost part of the Variscan orogeny in the Culm area of Nížký Jeseník Mountains. The emphasis was performed in order to improve the understanding of tectonic evolution in the area and to present a possible way how the metamorphic inversion of Culm and underlying Duplex system of Paleozoic carbonates drilled by deep borehole Potštát-1 could be created. The 2D model is based on the older updated geological interpretation of continuing seismic profiles 5/83 and 5/84 and deep borehole Potštát-1, from which calibration data were used. However, another dataset of random vitrinite reflectance from outcrops nearby were also taken into account. The investigation is based on real measured petrophysical data from Potštát-1 deep borehole which were added into the model. The model was created using Schlumberger's PetroMod PetroBuilder[®] 2D 2014.1 with TecLink[®] 2D module.

The model of thermal maturity evolution is evaluate by EASY%Ro. Drilled Culm reached the level of thermal maturity as a result of higher heat flux and burial prior to overthrust. The model calibration is based on the combination of basal heat flow of 63 mW/m² at the base of drilled sequence together with burial to depth of 7.3 km. These conditions caused the temperature range from 310 °C at the top of drilled part (at depth of 7.3 km) to 395 °C at its base, resulting the over-maturity (> 4 % VRr). The modelled total eroded thickness of Culm is also confirmed by the lithostatic pressure based on the fluid inclusion studies nearby.

The Duplex system of Paleozoic carbonates drilled by Potštát-1 deep borehole reach the thermal maturity as a result of the burial to the depth of 7.0 km caused by overthrusting by Culm. These conditions caused the temperature range from 265 °C at the top of drilled part of the Duplex system of Paleozoic carbonates (at depth of 7.0 km) to 290 °C at its base, resulting the maturity from 3.8 to > 4 % VRr, partly within the dry gas generation window.