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Subsurface granites in the Franconian Basin, Germany: gravity model, plausibility of depth range from microstructural constraints and calculated radiogenic heat supply

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The Franconian Basin in NE Bavaria is seen as a region of low gravity between the Bohemian Massif in the E and the Kraichgau terrain in the W. Borehole measurements have identified the northern part of the Franconian basin as regional geothermal anomaly and new heat flow calculations give values of > 100 mW/m2. Distinct negative Bouguer anomalies realized in this basin have been modeled as granitic intrusions into the Saxothuringian basement which underlies the Permo-Mesozoic units. Interpretation of gravity gradients in shape and steepness in combination with filtering of gravity data give possible depth constraints of intrusive bodies and is cross-checked by microstructural studies in quartz veins in the basement rocks (at > 1341 m depth). The quartz shows structures typical for low temperature plasticity and a deformation temperature of c. 300°C is inferred. This indicates a considerable pre-Permian uplift of at least 7 km for the Saxothuringian basement and supports depth estimates from gravity data.

The heat supply of granitic intrusions by radiogenic decay is modeled considering several scenarios for the geological setup recovered by the drilling Obernsees (conductive heat transfer model). The 1390 m deep drillhole is in marginal position to the most pronounced negative Bouguer anomaly. It could be shown that the Saxothuringian basement including heat producing granites (heat production rates: 4-6 μW/m3) covered by the insulating sedimentary rocks (1.35 km of Permian to Lower Jurassic units) can account for the enhanced geothermal gradient (38°C/km) measured in the borehole.