Compilation, Linsser filtering and interpretation of the gravity map of Germany and adjacent regions at a scale of 1:1,000,000

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We present a new Bouguer gravity anomaly map of Germany and adjacent regions at a scale 1:1,000,000, which is the first large-scale compilation of currently accessible, standardised gravity data in central Europe. The new Bouguer gravity data were used for LINSSER filtering, a method which enables a tomography of the Bouguer gravity field at selective depth levels. Analysis and interpretation of the LINSSER data at depth levels of 2.5, 5, 7.5, 10, 15, and 20 km produced a three-dimensional model of the subsurface distribution of geological bodies and structures in the crust of central Europe.

The boundary between the Moldanubian and Saxothuringian is marked by massive and deep-extended gravity bodies over a distance of 600 km and 20 km depth. The connection between separated and rotated basement complexes (microterranes) and the extension of granite belts is seen. In contrast, similar structures could not be proved along the boundary zone between Saxothuringian and Rhenohercynian, represented by the Mid German Crystalline Rise.

Late-Variscan granitic intrusions, well-known from the surface geology, form two granite belts which extend NNE-SSW to NE-SW from the North Vosges to the Harz Mts. and ENE-WSW from Bayreuth to the Riesengebirge. Another region with abundant late-Variscan granitic intrusions extends under the sedimentary cover of the Süddeutsche Scholle. This region is potentially the largest subsurface occurrence of late-Variscan granitic rocks in central Europe.

The linear LINSSER patterns show a predominance of E-W strike at all depth levels (2.5–20 km), whereas a N-S strike becomes more significant with increasing depth. At 20 km depth, only the E-W and N-S structures are present.

Three main N-S zones are recognised. The most western N-S zone is the Rhine Graben and its extension into the Hessische Senke, which are marked by strong indicator patterns to 15 km depth. Generally, the Rhine Graben is oriented NNE-SSW, but the *en echelon* arrangement of short N-S striking linear indicators is responsible for its apparent NNE-SSW. The covered Rotliegend graben system of the Lower Saxony Rift is the continuation of the Hessische Senke. The graben system fans out to the north. A second significant N-S zone, which is not evident on the geological map, extends from the northern Harz and ends in the region of the impact structure Nördlinger Ries, north of the Alpine molasse. The structure is about 400 km long and 50–70 km wide. The intrusions of the Ramberg pluton and rhyolite dyke swarms are the fingerprints of this structure in the Harz. In the south, the structure is marked by the gravity minimum of the Thuringian pluton and by Tertiary basaltic dyke swarms of Heldburg in the South German Triassic. The third N-S zone forms a ca. 500 km long and up to 70 km wide axis, which expands from the SW margin of the Tepla-Barrandian in the south, crossing the Erzgebirge and the North German Line, and ends up in the East Elbe Massif in the north. The primary indicators of the N-S zone are Upper Carboniferous intrusions of topaz-bearing granites in the Oberpfalz (Kreuzstein Granite), which are related to this structure.

The spatial connections between the Triassic German Basin and the Tethys, the opening of the North Atlantic and associated grabens are related to the long-term activity of the N-S structures. Similar extensive N-S-trending linear zones has been recognised in the Variscan crust on the territory of Czech Republic, Austria, and Slovakia. These structures can be of fundamental importance for future exploration strategies.

Another significant structure extends along the southern margin of the North German Basin. This E-W to ESE-WNW striking structure, named as North German Lineament, is about 100 km wide and extends across the entire study area. The average density of the rocks north of this structure is higher than the density of rocks south of the line. The structure is characterised by an intense, endemic Cretaceous magmatism, which is reflected by the NW-SE striking gravity highs of Bramsche, Vlotho, Magdeburg, and Lower Lusatia. These mafic intrusions become more abundant within the lineament with increasing depth. The formation of the North German Lineament is explained by dextral strike-slip faulting with multiple reactivation during the Upper Jurassic/Lower Cretaceous and during Upper Cretaceous.

The near surface, NW-SE structures are mainly caused by block and fault tectonics of the Variscan basement. Due to their shallow extension, the NW-SE structures form only weak gravity signatures.