

1 **Magnetic Susceptibility of Rock Samples of the Northern Upper**
2 **Rhine Graben Region and Adjacent Areas**

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10 We present here a comprehensive dataset on the magnetic susceptibility of the main geologic
11 units in and adjacent to the northern Upper Rhine Graben. It represents a complement to the
12 PetroPhysical Property Database (P³) of Bär et al. (2020) and thus follows the database
13 structure as described there.

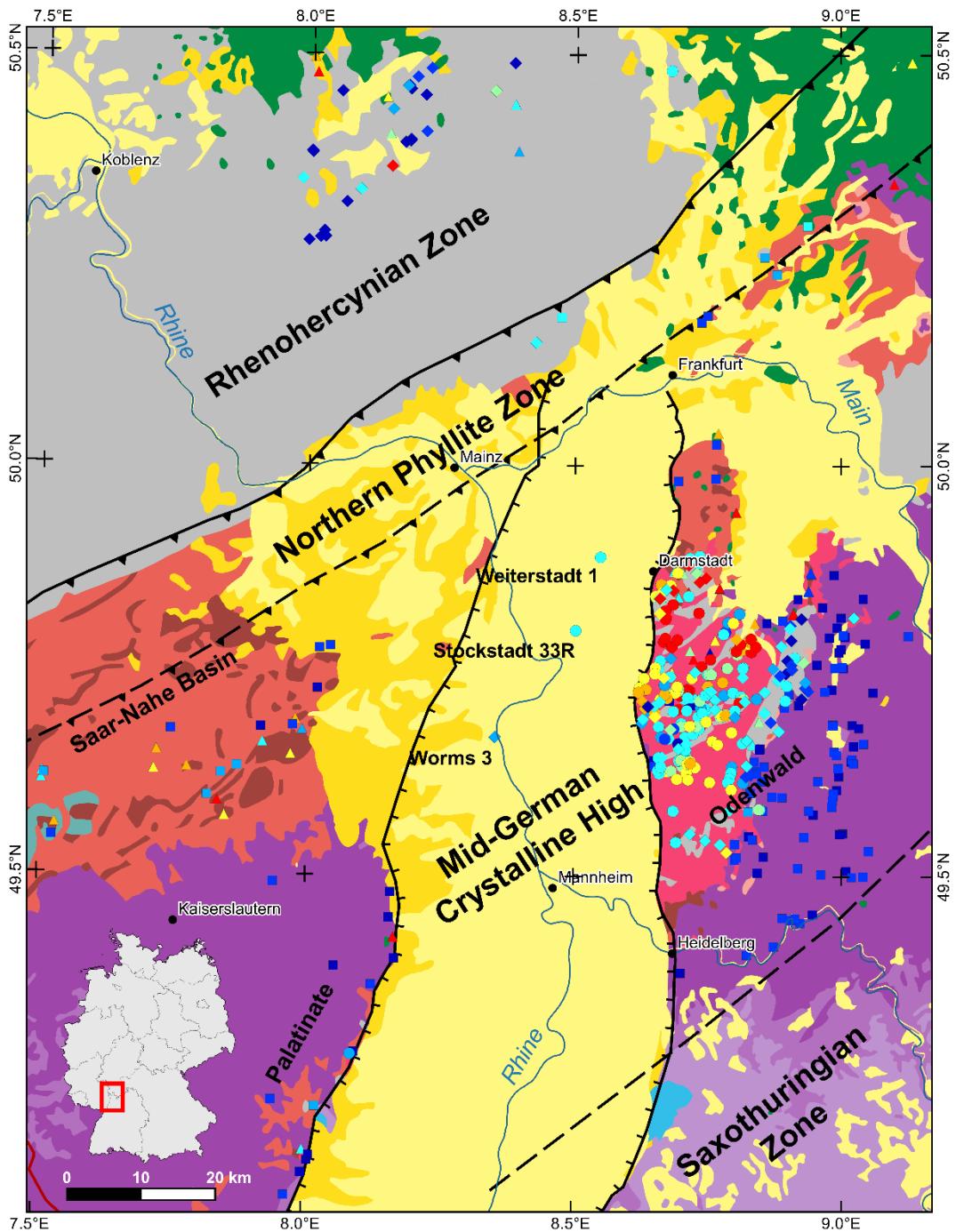
14 The magnetic susceptibility is a unitless physical quantity that describes how magnetizable a
15 material (e.g. rocks) is. It is the ratio between the magnetic field strength H and induced
16 magnetization M. Besides the remanence, the susceptibility of geological formations decisively
17 influences the amplitude of crustal magnetic anomalies. This parameter depends mainly on
18 the proportion of iron-rich minerals such as magnetite and hematite in the total rock volume.
19 Therefore, mafic rocks usually exhibit the highest susceptibilities, but variations of several
20 orders of magnitude within the same lithology are possible.

21 The northern URG region is characterized by several distinct elongated magnetic anomalies
22 associated with the high susceptibility of magmatic complexes in the crystalline basement and
23 in particular in the Mid-German Crystalline High. The basement represents an important
24 reservoir for geothermal projects due to the very high temperatures. Detailed geological
25 modelling of this horizon is thus being performed within the BMWi funded Hessen 3D 2.0
26 project (Bär et al. 2016) and the Interreg NWE project DGE-ROLLOUT
27 (www.nweurope.eu/DGE-Rollout). Since very deep boreholes and seismic profiles are sparse,
28 magnetic anomalies provide important insights about the structure and composition of the
29 basement. For realistic modelling of these anomalies, an extensive investigation of the
30 magnetic susceptibility in the model units was required.

31 The analyzed rock samples, mostly derived from abandoned and active quarries as well as
32 natural and other artificial outcrops, were provided by the Institut für Steinkonservierung Mainz
33 e.V. The majority of the in total 430 samples were collected in the Odenwald. Additional sample
34 locations are in the Saar-Nahe Basin, the Palatinate, the Vogelsberg and the Rhenish Massif.
35 Apart from outcrop samples, the susceptibility was measured on 24 core plugs from the three
36 wells Weiterstadt 1, Stockstadt 33R and Worms 3. The measurements were carried out at
37 about 20 °C with the SM-30 handheld device from ZH instruments and were usually repeated
38 three times for each sample, but the number may vary depending on the heterogeneity and
39 size of the samples.

40 The results of the susceptibility measurements are shown in Fig. 1. The values range from
41 about -2.4e-5 to 0.07 [SI]. The susceptibility of the post-Variscan units is generally very small,
42 meaning that their effect on the crustal magnetic field can be neglected. This excludes the
43 Permo-Carboniferous and Tertiary volcanic and volcano-sedimentary horizons, which are
44 likely sources of stronger anomalies in the Saar-Nahe Basin, the northernmost URG and the
45 Sprendlinger Horst. The highest susceptibility values were measured in gabbros of the
46 Frankenstein complex.

47 The dataset is a supplement to another publication (Frey et al. 2020, subm.) that presents the
48 results of the joint inversion of gravity and magnetic data in the northern Upper Rhine Graben.
49 The measured magnetic susceptibilities were a key input for this study.



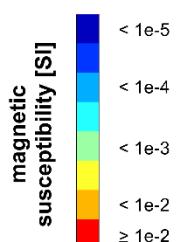
Cenozoic
Quaternary
Tertiary
Tertiary Volcanics

Mesozoic
Jurassic
Upper Triassic
Middle Triassic
Lower Triassic

Paleozoic
Upper Permian
Permo-Carb. Volcanics
Permo-Carboniferous
Carboniferous
Magmatic Basement
Metamorphic Basement

sample classification

- plutonic
- ◆ metamorphic
- ▲ volcanic
- sedimentary



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51 **Figure 1:** Geological map and location of the analyzed rocks samples in the northern Upper Rhine Graben region.
52 The value of the measured magnetic susceptibility is indicated by the symbol color. The classification of the rock
53 samples is represented by the symbol shape.

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