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The Aare main overdeepening on the northern margin of the European Alps: basins, riegels, and slot canyons

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Supplement S1: Gravity data collected along the Bern2 profile, estimation of the residual gravity anomaly along this profile and results of 3D gravity modelling.

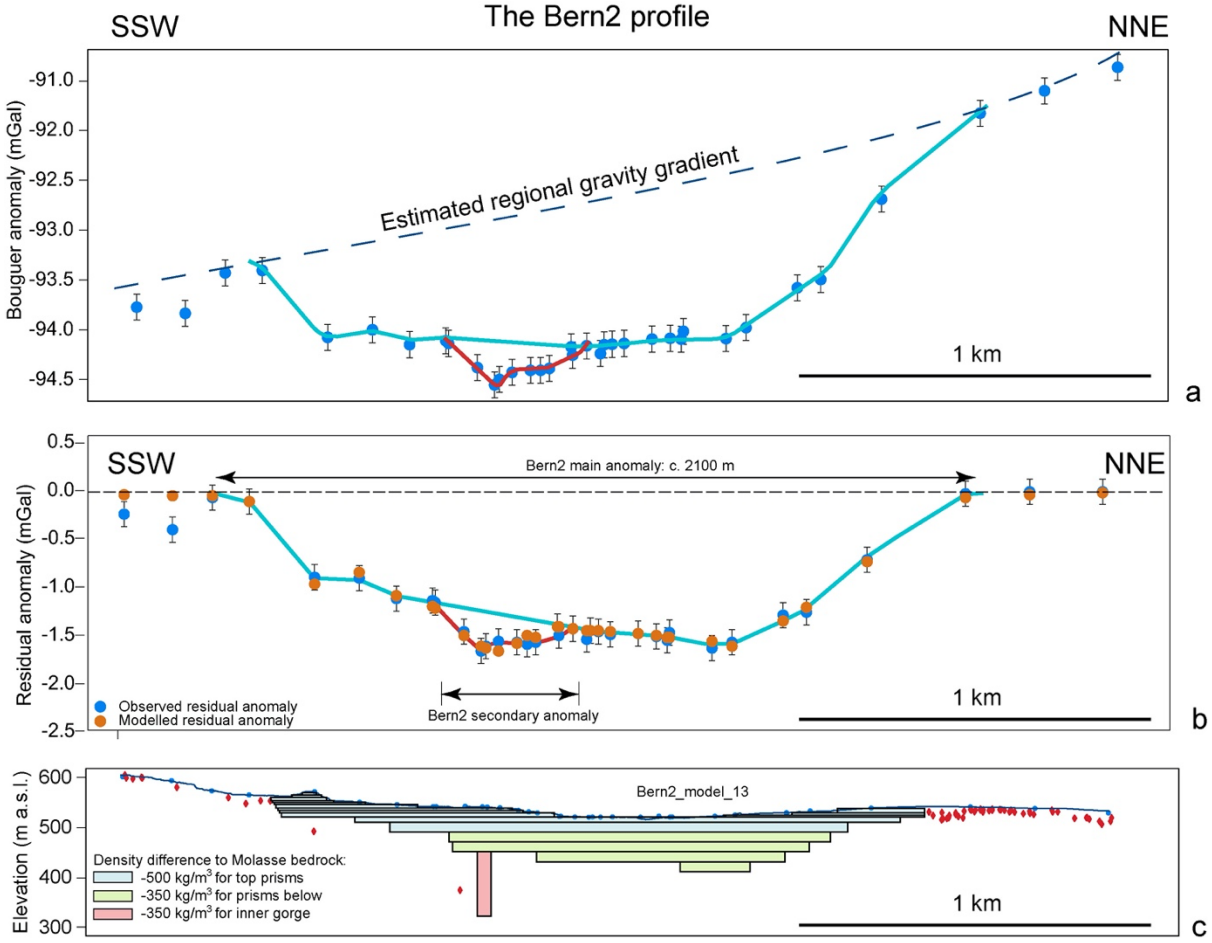

Figure S1 shows the results where the determination of the bedrock topography with gravity data was accomplished by three steps. For figures a and b, The blue dots are the observed residual anomaly, where the black bars indicate the maximum uncertainty of ± 0.13 mGal determined by Bandou et al. (2024). The orange dots are the modelled residual anomaly values for Bern2_model_13. The light blue line highlights the main anomaly, and the red line shows the secondary anomaly of the inner gorge. See main text for location of profile.

Figure S1a: The regional gravity gradient was determined using gravity data from the Gravimetric Atlas of Switzerland (Olivier et al., 2008, 2011), which was complemented by the results of a more detailed gravity survey where the distance between the gravity stations was much shorter.

Figure S1b: The differences between the Bouguer anomaly values measured at the individual stations (and calculated using the standard density of 2670 kg/m^3) and the regional gravity gradient are displayed as results in this figure. It shows the residual gravity anomaly caused by the effects of the local topography above the valley botton, and the Quaternary fill of the overdeepening. Accordingly, the residual gravity anomaly along the Bern2 profile can be characterized by two components: A longer wavelength anomaly (blue solid line) suggests the occurrence of a wide somewhat asymmetric trough reaching a maximum depth beneath the NNE part of the profile, and a short wavelength (width of approximately 350 m) local anomaly (solid red line), which is defined by 10 stations. This secondary anomaly reaches an additional -0.5 mGal (relative to the longer wavelength anomaly) and points towards the occurrence of a deep and narrow local bedrock depression underneath the main trough. Gravity modelling was

accomplished through multiple steps using prisms that are placed perpendicularly to the orientation of the profile.

Figure S1c: Results of the final model_13 from Bandou et al. (2023). For details see their Figure 9 and related explanations. Here, the rectancles result from the intersection between the prisms applied in the model and the profile. The colors of the rectancle fill display the density contrasts between the Quaternary fill and the Molasse bedrock that yield a best fit solution between observed (blue dots) and modelled gravity signals (organge dots on Figure S1b). As a first step, the gravity signal exerted by the positive topography on either side of the profile was modelled. These values were then subtracted from the residual anomalies to yield the signal of the overdeepening fill, displayed in Figure S1b. Upon modelling, Bandou et al. (2023) explained the main wavelength and amplitude of the remaining signal by the fill of an overdeepening with a U-shaped cross-sectional geometry where the deepest location is situated on the NNE side of the profile. Gravity modelling also showed that the secondary residual anomaly signal could be caused by Quaternary material and particlarly by the sedimentary fill of a slot canyon, which is deeply carved into bedrock (text modified after Bandou et al., 2023).

References

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