Geological Quarterly, 2026, 70, 6
DOI: https://doi.org/10.7306/gq.1851

A record of superimposed late- and post-Variscan regional-scale tectonic events at the NE margin of the Bohemian Massif: structural evolution of the Kamionki Graben (SW Poland, Sudetes) – reply

Aleksander KOWALSKI[1], * and Grzegorz PACANOWSKI[2]

[1] Polish Geological Institute – National Research Institute, Lower Silesia Branch, Al. Jaworowa 19, 50–122 Wrocław, Poland; ORCID: 0000-0003-4963-3995

[2] Polish Geological Institute – National Research Institute, Rakowiecka 4, 00–975 Warszawa, Poland; ORCID: 0000-0001-9045-3262

Kowalski, A., Pacanowski, G., 2026. A record of superimposed late- and post-Variscan regional-scale tectonic events at the NE margin of the Bohemian Massif: structural evolution of the Kamionki Graben (SW Poland, Sudetes) – reply. Geological Quarterly, **70**, 6; https://doi.org/10.7306/gq.1851

We appreciate the interest shown by Cymerman (2026) in our recent paper (Kowalski and Pacanowski, 2025a) and his detailed discussion of the structural development of the Kamionki Graben (KG) in the Góry Sowie Massif (Sudetes). Before addressing the individual points raised, we note that the discussion calls into question nearly all principal components of our study, including its scope, methodology and interpretation (Cymerman, 2026). In the following sections, we respond systematically to these arguments, addressing (1) methodological issues, (2) the lithostratigraphy and tectonic framework of the KG, (3) the presentation and interpretation of geophysical data, and (4) the structural dataset and its analysis, and clarify why several of the criticisms extend beyond the explicitly stated aims and analytical framework of our work.

We begin by responding to the opening argument, which characterises the title of our paper as “*provocative*” (Cymerman, 2026) and questions whether the KG, given its relatively small size as a tectonic structure, can serve as a basis for regional-scale tectonic interpretations across the northeastern margin of the Bohemian Massif. We wish to clarify that our study does not claim that the KG alone resolves the tectonic evolution of the entire Sudetes or the Fore-Sudetic Block “*over the last ~340 Myr*” (Cymerman, 2026). Rather, it documents the geometry, kinematics, and relative timing of ductile and brittle deformation within a single, well-constrained graben structure and places these observations within a broader regional framework through comparison with previously published data. We also emphasise that the results presented in our recent papers (Kowalski and Pacanowski, 2025a, b) have been discussed repeatedly at both regional and international scientific meetings, including conference field trips (Kowalski, 2024, 2025). The interpretations advanced in the paper (Kowalski and Pacanowski, 2025a) therefore form part of a broader regional discussion on the tectonic evolution of the northeastern margin of the Bohemian Massif, rather than constituting an isolated or unsupported proposal.

METHODOLOGICAL ISSUES

An important part of Cymerman’s (2026) comments on our paper (Kowalski and Pacanowski, 2025a) concerns methodological issues, particularly the documentation of geological mapping, research trenches, boreholes and related data. However, a substantial part of this criticism results from conflating the objectives and datasets of the Detailed Geological Map of the Sudetes at a scale of 1:25,000 (Pieszyce sheet; Cymerman et al., 2022; hereafter: DGMS) with those of the present structural study (Kowalski and Pacanowski, 2025a). Our paper is not intended as a cartographic or engineering report; instead, it focuses on the structural evolution of the KG based on selected geological and geophysical observations directly relevant to that objective. Although the geological map of the KG area presented in our paper (Kowalski and Pacanowski, 2025a: fig. 3) was prepared by the first author during surveying for the Pieszyce sheet of the DGMS (Cymerman et al., 2022), it is not a direct reproduction of that map. Rather, it constitutes a revised and simplified compilation, supplemented by additional structural and geophysical observations acquired within a separate research framework (see Acknowledgements in Kowalski and Pacanowski, 2025a).

The statement that “*the field mapping survey covered an area of ~10 km*^{2}” (Cymerman, 2026) refers to the area investigated within the framework of the structural study and shown in our figure 3 (Kowalski and Pacanowski, 2025a: p. 5), not exclu-

---

* Corresponding author, e-mail: aleksander.kowalski@pgi.gov.pl

Received: February 15, 2026; accepted: February 16, 2026; first published online: April 9, 2026

sively to the extent of the Mississippian graben fill. The crystalline basement geology was intentionally generalized after Gawroński (1961), as the detailed lithological subdivision of the Góry Sowie Massif lies beyond the scope of our paper. The focus of the study is the structural architecture of the graben and its sedimentary infill; therefore, incorporation of the full basement lithology was neither necessary nor methodologically justified.

Cymerman (2026) further questions the absence of detailed information on the number of documentation points, trenches, and boreholes. These data originate from the DGMS cartographic survey and were not the subject of structural analysis in the present paper. Consequently, a comprehensive listing of all 31 trenches and 42 boreholes would not enhance the interpretation of ductile and brittle deformation given in our paper (Kowalski and Pacanowski, 2025a) and would unnecessarily reduce the clarity of the figures. Only the two boreholes penetrating the Mississippian succession were included in figures 3 and 4 (Kowalski and Pacanowski, 2025a: pp. 5–6), as they provide direct constraints on the subsurface geometry of the graben-fill relevant to the structural model proposed. The remaining shallow boreholes cited in the discussion (Cymerman, 2026) do not contribute essential information to the objectives of the study.

LITHOSTRATIGRAPHY, GEOMETRY AND TECTONICS OF THE KAMIONKI GRABEN

A substantial part of Cymerman's discussion (2026) also concerns the lithostratigraphy, geometry and tectonic interpretation of the Mississippian fill of the KG. For example, it is stated that Kowalski and Pacanowski (2025a) "*presume*" sporadic occurrences of gneissic conglomerates in the northwestern part of the graben and that "*there is no field-based evidence for this*" (Cymerman, 2026). This criticism overlooks the explicit statement in the Results section of our paper (Kowalski and Pacanowski, 2025a: p. 9), where we clearly wrote: "*The lowermost fill member of the KG, the gneissic conglomerate of the Walim Formation (fig. 2),* ***is nowhere exposed*** *at the surface in the KG and* ***has not been intersected by the hydrogeological boreholes*** *made in the central part of the graben. However, the gneissic conglomerates* ***most probably occur at the bottom of the downfaulted, northernmost part of the graben*** *(fig. 4: A–A' and B–B' cross-sections) … these conglomerates are well exposed within the Glinno Graben, located ~2 km towards the NW of the KG*". For a comprehensive description of the Mississippian infill of the Glinno Graben, including its stratigraphic and tectonic framework, we refer to our recent study (Kowalski and Pacanowski, 2025b). Accordingly, we did not assume the presence of outcrops of gneissic conglomerates within the KG (Kowalski and Pacanowski, 2025a: figs. 3 and 4). Rather, we interpreted their probable subsurface position within the KG strictly by analogy with the nearby Glinno Graben, where these deposits are well-documented (Kowalski and Pacanowski, 2025b). Consequently, the criticism does not reflect the interpretation explicitly presented in our paper.

Moreover, the position expressed in Cymerman (2026) appears inconsistent with previously published mapping results from the same area, including his own work. Gneissic conglomerates and breccias were mapped in the KG by Cymerman and Sztromwasser (2015a; Fig. 1) on the Dzierżoniów sheet of the Detailed Geological Map of Poland (1:50,000) and described in the accompanying explanatory notes (Cymerman and Sztromwasser, 2015b). In the present discussion, however, it is asserted that the eastern part of the KG is characterized by the absence of gneissic conglomerates (Cymerman, 2026). Similarly, Cymerman (2026) refers to six belts of tectonic breccias and cataclasites shown on the Pieszyce sheet of the DGMS (1:25,000; Cymerman et al., 2022) and criticises the fact that only two are shown in figure 3 of Kowalski and Pacanowski (2025a). The geological map published in our paper represents a structural synthesis rather than a reproduction of the DGMS. Only those fault-rock zones directly involved in the structural architecture of the KG were included. Fault belts located east of the Kamionka Stream valley within the Góry Sowie Massif were intentionally omitted, as their age remains uncertain.

The discussion further argues that the names of the framing faults of the KG "*need to be corrected*" (Cymerman, 2026). Specifically, it is stated that the Eastern Kamionki Fault "*should be formally named*" the Northern (NE) Kamionki Fault, the Western Kamionki Fault "*should be named*" the South-Western Kamionki Fault, and that the north-striking Pniaki Fault (Oberc, 1972; Kowalski and Pacanowski, 2025a) "*should be renamed*" the Eastern Kamionki Fault, in reference to the hypothetical Pniaki–Kamionki–Rościszów dislocation (Grocholski, 1967). The alternative names proposed in the discussion (Cymerman, 2026) have not previously appeared in the published literature as formally established fault names for the KG. On the Tectonic Map of the Sudetes and the Fore-Sudetic Block (Cymerman, 2004), the faults bounding the KG were neither named nor was the northern bounding fault indicated. Similarly, on the Pieszyce sheet of the DGMS (Cymerman et al., 2022), these bounding faults were not labelled on the tectonic sketch. Furthermore, on the Dzierżoniów sheet of the Detailed Geological Map of Poland (1:50,000), the bounding faults of KG were not shown at all, and the structure was depicted as a synclinal feature (Cymerman and Sztromwasser, 2015a; Fig. 1). This illustrates that the structural interpretation and fault framework of the graben have not been previously established. The terminology introduced in our study (Kowalski and Pacanowski, 2025a) was intended to define and distinguish these structures clearly within the structural framework of the KG.

PRESENTATION AND INTERPRETATION OF GEOPHYSICAL DATA

A further group of Cymerman's (2026) comments concerns the presentation and interpretation of the ERT and SRT-P geophysical data. The vertical exaggeration applied to the ERT and SRT-P profiles (Kowalski and Pacanowski, 2025a: figs. 5 and 6) was introduced intentionally to enhance the visibility of subsurface structures, including faults and regional-scale folds. Without moderate vertical exaggeration, fault zones and lithological boundaries would be difficult to identify. In our opinion, this approach does not represent a methodological inconsistency but reflects standard practice in integrated geological-geophysical interpretation.

The discussion further states that only 900 m of the 1250 m ERT and SRT-P profiles was interpreted and that this precludes unambiguous geological interpretation. The full geophysical profiles were acquired and analysed; however, only the structurally relevant segments were shown in the paper (Kowalski and Pacanowski, 2025a: figs. 5 and 6). For transparency, the complete original ERT and SRT-P profiles are provided in the present response (Fig. 2A, B). These full ERT and SRT-P profiles demonstrate that no additional features relevant to the graben infill analysed occur outside the portions shown in our article (Kowalski and Pacanowski, 2025a: figs. 5 and 6). The omitted segments predominantly image the crystalline base-

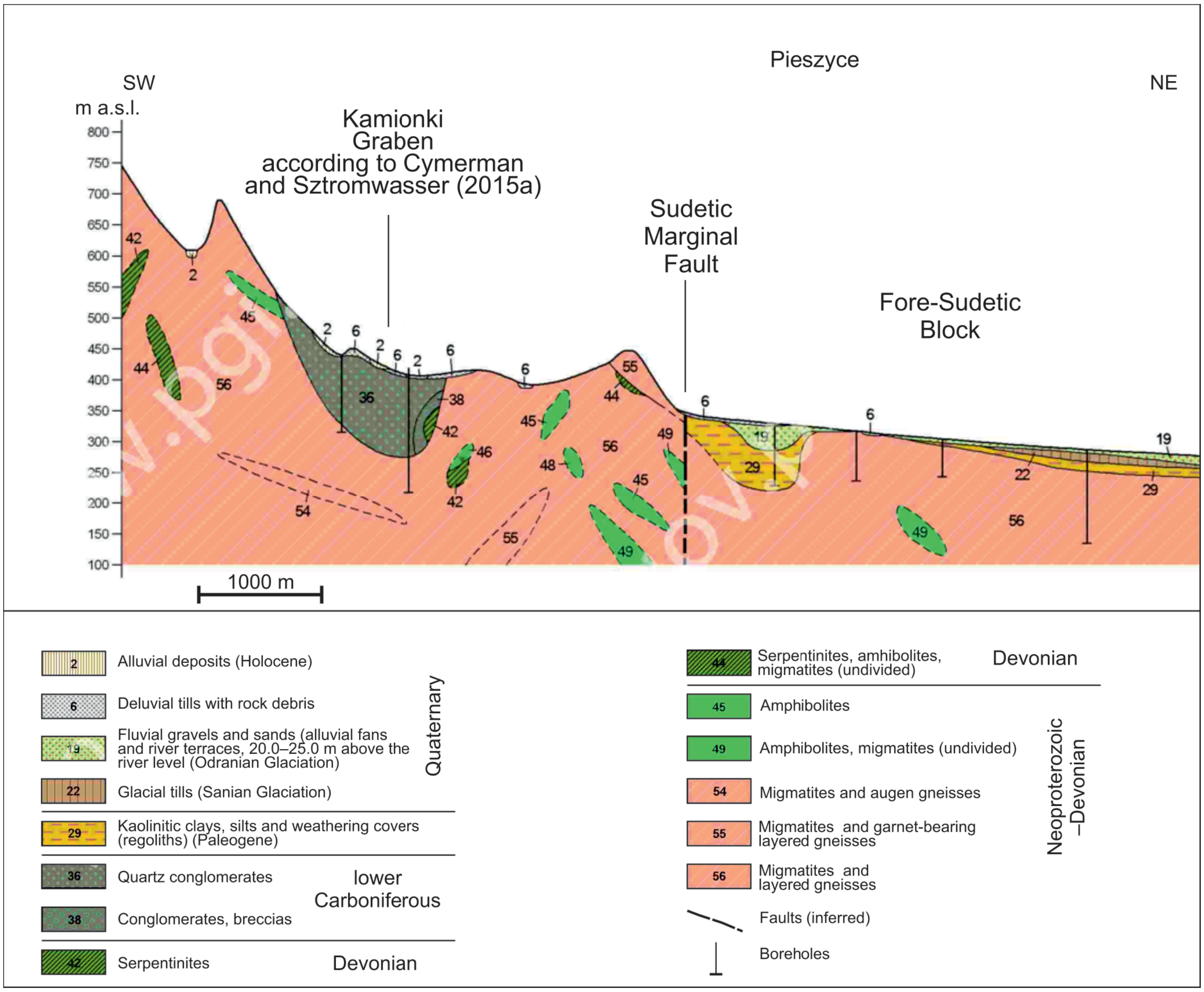

Fig. 1. Part of the geological cross-section from the Dzierżoniów sheet of the Detailed Geological Map of Poland (1:50,000; Cymerman and Sztromwasser, 2015a; legend translated from the original Polish version of the map)

The KG is depicted as a synclinal structure developed within the Góry Sowie Massif rather than as a fault-bounded graben; the cross-section also indicates the presence of conglomerates and breccias (38), whose occurrence in the area is questioned in Cymerman (2026)

ment, which was not the focus of the paper (Kowalski and Pacanowski, 2025a: figs. 5 and 6). Cymerman (2026) correctly noted that low resistivity values may characterize serpentinites, fault breccias and cataclasites. This is precisely why our interpretation does not rely on resistivity values alone, but on their spatial correlation with mapped fault zones and geological boundaries. As explicitly stated in the Results section of our paper (Kowalski and Pacanowski, 2025a: p. 10): "*The structural interpretation was developed based on horizontal variations in the resistivity image and their correlation with the results of our geological mapping (fig. 5B)*". The structural model therefore integrates obtained ERT models with geological mapping and structural data, representing a coherent interpretation rather than a simplified resistivity-based lithological assignment.

The claim that the interpretation of resistivity contrasts across the Middle Kamionki Fault is "*totally erroneous*" is unsupported, as no alternative geological interpretation is proposed by Cymerman (2026). Variations in resistivity values within polymictic conglomerates are expected due to differences in fracture density and degree of cementation, particularly in proximity to major fault zones. As explicitly stated in the Results section in our paper (Kowalski and Pacanowski, 2025a: p. 10), higher resistivity values within the sedimentary succession were interpreted as probably reflecting "*strongly cemented and brecciated sandstones with low water content (fig. 5A, B)*". Importantly, resistivity ranges of different lithologies may overlap, especially in structurally complex settings and along fault zones.

A clear example is provided by geophysical data from the Jugów sheet of the DGMS (Cymerman et al., 2023: figs. 2C and 3), from the boundary zone between the Intra-Sudetic Synclinorium and the Góry Sowie Massif. In the NW–SE-trending horst (Golec Graben of Oberc, 1972), strongly cemented and faulted upper Carboniferous sandstones of the Wałbrzych Formation, dipping ~45° to the SW, are tectonically wedged between two fault zones and rest directly on GSM gneisses (Fig. 3). The sandstones display resistivity values comparable to,

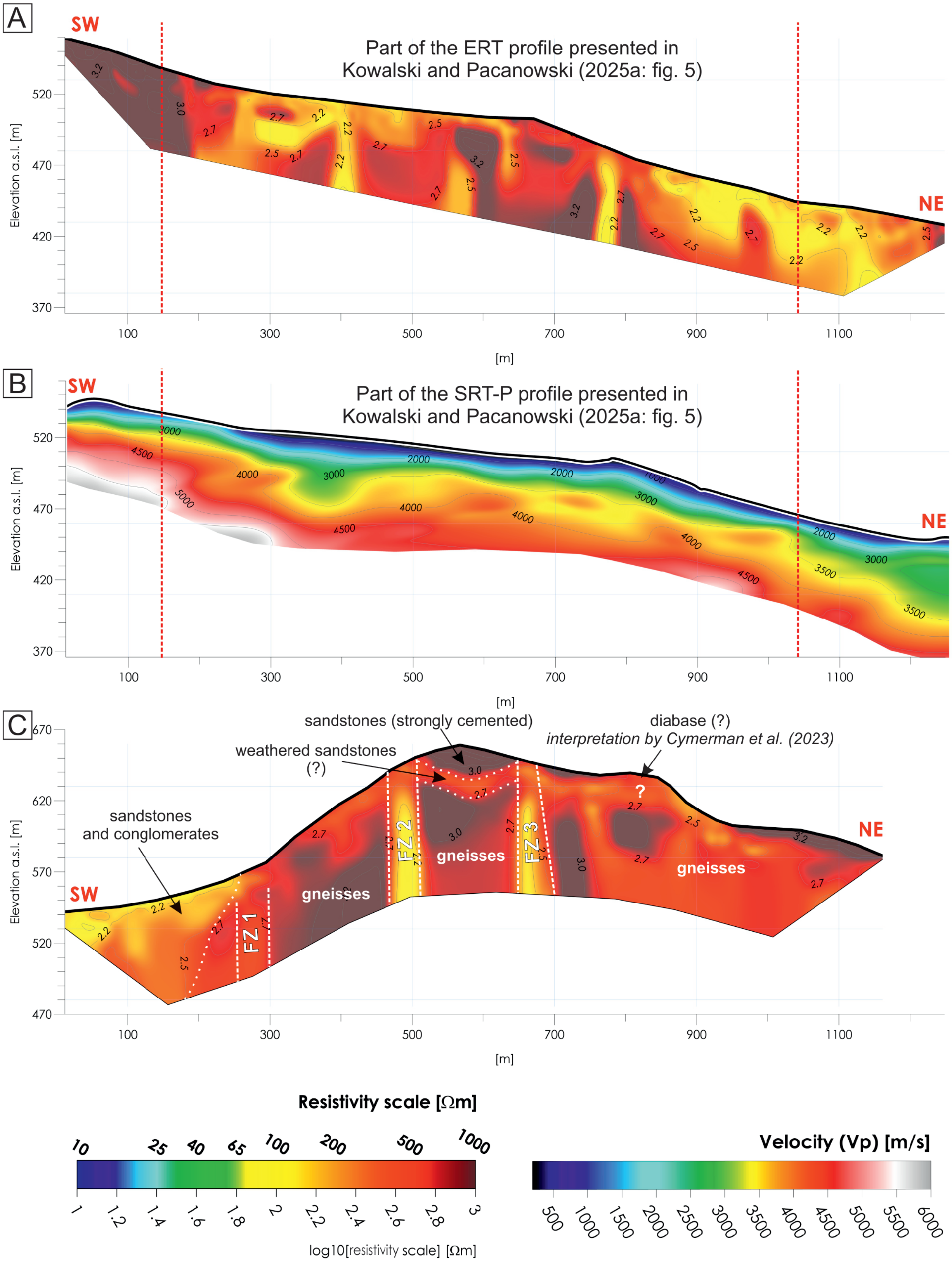

Fig. 2. Complete ERT (A) and SRT-P profiles (B) acquired across the KG. In Kowalski and Pacanowski (2025a), only the structurally relevant segments of these profiles (shown in figs. 5 and 6 therein) were presented. The full profiles provided here demonstrate that no additional features relevant to the structural interpretation of the graben infill occur outside the published sections. The omitted segments predominantly image the crystalline basement, which was not the focus of our work. For the location of the profiles, see figure 3 in Kowalski and Pacanowski (2025a); C – ERT profile from the Jugów sheet of the DGMS (Cymerman, 2023), located at the boundary between the Intra-Sudetic Synclinorium and the Góry Sowie Massif. The profile shows the NW–SE-trending horst, where the Wałbrzych Formation sandstones display higher resistivity than the underlying GSM gneisses and are bounded by fault zones (FZ)

For the location of the profile, see Figure 3A

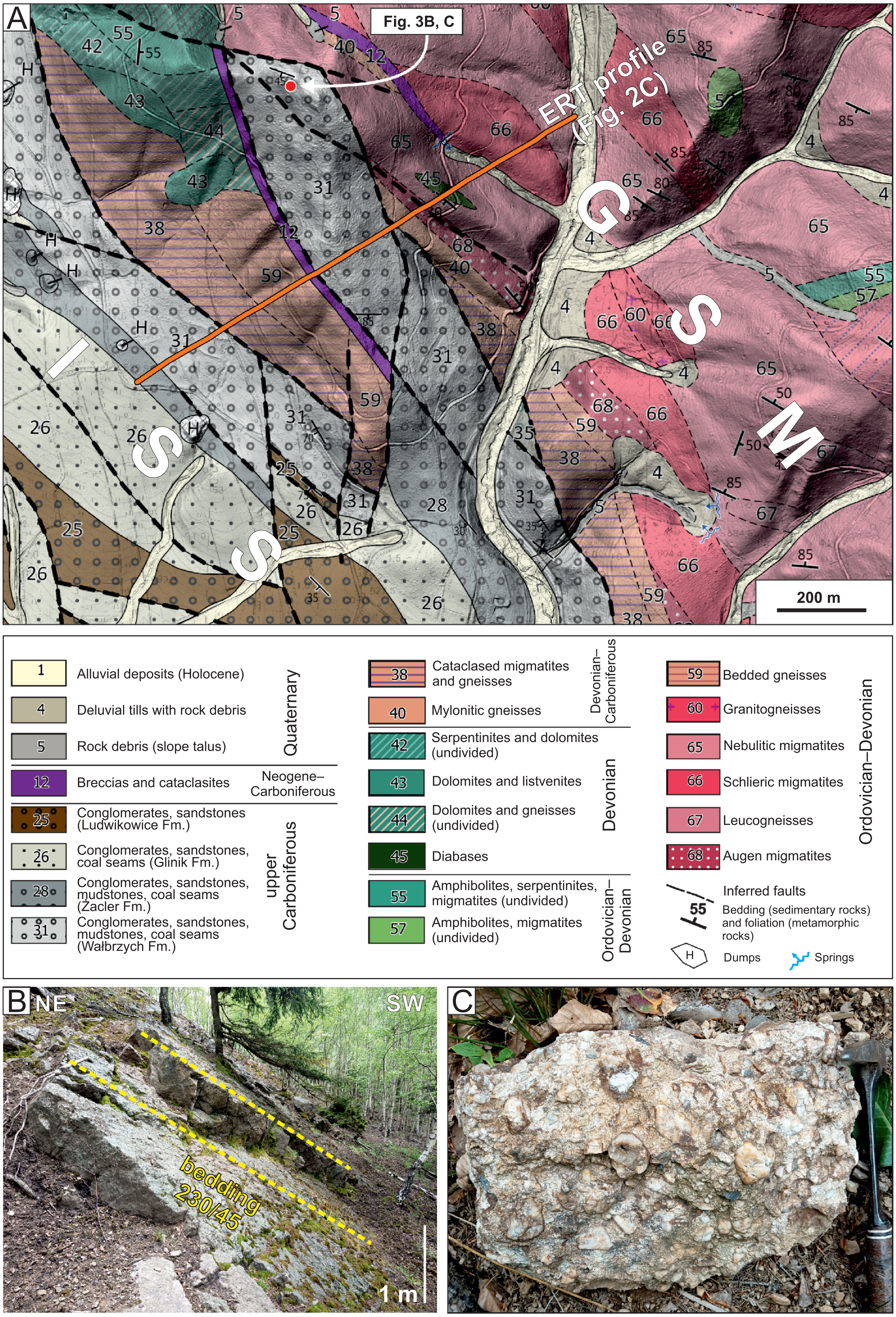

Fig. 3A – part of the geological map of the boundary zone between the Intra-Sudetic Synclinorium (ISS) and the Góry Sowie Massif (GSM), Jugów sheet of the DGMS (after Cymerman et al., 2023), superimposed on a LiDAR-based shaded digital terrain model; legend of lithological units translated from Polish by the authors; B – exposure of strongly cemented upper Carboniferous conglomerates of the Wałbrzych Formation, steeply dipping towards the SW; C – close-up view of a Wałbrzych Formation conglomerate sample

and locally several times higher than, those of the adjacent crystalline basement. The gneisses show resistivity values ranging from ~196 to 6328 Ωm (mean ~718 Ωm), whereas the Wałbrzych Formation sandstones range from ~556 to 7319 Ωm (mean ~2645 Ωm). On average, the sandstones therefore exhibit resistivity values approximately three to four times higher than those of the gneisses; however, the resistivity intervals clearly overlap. Fault zones show lower resistivity values (~105–668 Ωm; mean ~290 Ωm), most likely reflecting enhanced fracturing and higher water content. These data demonstrate that overlapping resistivity ranges between crystalline and sedimentary rocks are typical of structurally complex, fault-bounded units and that lithological interpretation cannot rely on resistivity contrasts alone. This is further illustrated by the diabase lens mapped by Cymerman et al. (2023; cf. Figs. 2C and 3A), which does not produce a distinct anomaly on the corresponding ERT profile (Fig. 2C), highlighting the limits of resistivity data when used alone.

STRUCTURAL DATA AND ITS INTERPRETATION

A further group of Cymerman's (2026) comments concerns the presentation and notation of the structural dataset. We are, however, genuinely surprised that several of these remarks appear to result from a selective reading of the figures and from a different interpretation of the purpose of the various data representations used in the structural analysis.

For example, Cymerman (2026) reported that 35 bedding measurements are indicated on Figure 3 and that 16 bedding and 15 structural elements are shown on figures 7–9 (Kowalski and Pacanowski, 2025a), yet it overlooks that the individual stereoplots (e.g., fig. 7B–D) together contain 48 bedding measurements (Kowalski and Pacanowski, 2025a: p. 11). Moreover, fig. 8A alone includes 92 joint-surface measurements (Kowalski and Pacanowski, 2025a: p. 12). The structural dataset presented in our paper is therefore substantially larger than suggested in the discussion (Cymerman, 2026) and may give a misleading impression of the actual scope of the field data. The discussion further claims that "*no information is provided on the number of measured tectonic structures*". In the light of the data explicitly presented in the figures (Kowalski and Pacanowski, 2025a), this statement is factually incorrect. Bedding attitudes and other structural measurements (joints and faults) are documented on the geological map (Fig. 3) and on the stereographic plots (figs. 7–9). The use of different notation styles in figures 7–10 for planar structures reflects their distinct analytical purposes. Bedding attitudes, fault surfaces, and fracture orientations are presented graphically in two-part notation in the figures to enhance clarity of presentation. In contrast, fault orientations listed in table 1 (Kowalski and Pacanowski, 2025a: p.14) are given in three-part notation to allow quantitative kinematic analysis using the kinematic method of "P" (shortening), "T" (extension) and "B" (neutral) incremental strain axes (PBT method), incorrectly referred to as the "*PTB method*" by Cymerman (2026). Consequently, the assertion that different attitude conventions "*complicate the analysis*" is unfounded.

Cymerman (2026) stated that "*from a variety of palaeostress analyses (direct inversion, dynamic numerical analysis, dihedrals, and PTB axes), the graphically constructed PTB method (Kowalski and Pacanowski, 2025a) was used to reconstruct the main stress axes ($\sigma_1 > \sigma_2 > \sigma_3$). FaultKin8 software was used to analyse data on fault displacement from the KG*". This statement rests on a fundamental methodological misinterpretation. Nowhere in our paper did we claim to reconstruct principal stress axes (σ_1, σ_2, σ_3) using stress inversion techniques. The PBT method (cf. Angelier, 1984; Marrett and Allmendinger, 1990; Pascal, 2021) was applied strictly as a kinematic tool to determine incremental strain axes derived directly from measured fault-planes and slip directions. It does not reconstruct stress tensors and does not require validation via Mohr-circle representations or fluctuation histograms, which are relevant only in formal stress inversion procedures (Pascal, 2021).

The reference to alternative software packages (*Win-Tensor*, *Tectonics FP*, *T-TECTO*) is therefore methodologically irrelevant, as these programs are designed for reduced stress tensor inversion – an analytical step that was neither performed nor implied in our study. The *FaultKin8* software was used solely as a graphical and computational tool to visualize fault-slip data and to calculate the orientation of P, B and T axes (Kowalski and Pacanowski, 2025a). It was not used to derive complete stress tensors nor to evaluate stress ratios. The criticism concerning the absence of "*quality ranking*" of kinematic indicators would be valid in the context of formal stress inversion requiring statistical weighting of data. The suggestion that the fault-slip data are of "*rather poor quality*" due to the lithology is not supported by any quantitative evaluation. In our study, only fault planes with clearly identifiable slip indicators were included in the analysis. Ambiguous or poorly preserved structures were excluded. The measured trend and plunge of striae were obtained using standard structural geological field measurements. The nominal reading precision of 1° reflects not only the instrumental resolution of the compass, but also the calculated rake value derived from the measured orientation of the fault plane and the observed striation direction. An identical level of angular precision (1°) was adopted by Cymerman (2014: table 4, p. 42) in the presentation of fault-slip data from the Cieszów Unit (Sudetic Block). It should be noted that 53 fault-slip measurements in that study were collected from exposures located in the vicinity of the Cieszów PIG 1 and Cieszów PIG 2 boreholes; however, no photographs of spatially oriented fault surfaces are provided. Instead, the faults illustrated derive from non-oriented cores (cf. Cymerman, 2014). In contrast, the present discussion characterizes our dataset by stating that "*fault displacement data are of rather poor quality*" (Cymerman, 2026). In summary, the criticism by Cymerman (2026) conflated kinematic strain analysis with stress tensor inversion and evaluated our methodology against criteria applicable to a different class of analytical techniques. The objections are therefore not directly relevant to the methodological framework employed in our study.

The criticism that the synchronous occurrence of dextral strike-slip faults (population I), associated with NNE–SSW shortening, and reverse faults with NNE-directed displacement during the Late Namurian is "*unacceptable*" (Cymerman, 2026) appears to overlook well-established principles of transpressional deformation mechanics (e.g., Fossen, 2016). In transpressional regimes, deformation partitioning commonly produces coeval strike-slip faulting together with synthetic and antithetic reverse or oblique-slip faults, often accompanied by folding, depending on the orientation of pre-existing structures. Such structural associations have been widely documented in both natural examples and analogue modelling studies (e.g., Tikoff and Peterson, 1998). Dextral strike-slip faulting combined with a component of NNE–SSW shortening is fully compatible with the development of reverse faults and folds within the same kinematic framework. Cymerman (2026) also questioned why the dextral transpressional regime was attributed to the Late Serpukhovian. This issue is explicitly addressed in the Discussion section of our paper (Kowalski and Pacanowski, 2025a:

pp. 14–18), where the deformation phase is correlated with the late Mississippian–early Namurian regional compressional event.

The further remark that it is "*surprising*" that fault population II (late Carboniferous–early Permian) and fault population IV (Neogene) were formed under similarly oriented NE–SW extension (Cymerman, 2026) overlooks the well-documented fact that the Sudetic Block experienced multiple deformation events under comparable stress regimes (e.g., Oberc, 1972; Mazur et al., 2005, 2006; Coubal et al., 2015; Nádaskay et al., 2019, 2024; Głuszyński and Aleksandrowski, 2022). Also, a late Carboniferous-early Permian extensional phase has previously been postulated by Cymerman (2002, 2014) for the Kaczawa Metamorphic Complex, located north of the Góry Sowie Massif. The statement that, during formation of fault population IV, "*a large SGMC block was displaced several hundred metres to the WNW along strike-slip faults*" (Cymerman, 2026) misrepresents our conclusions. Nowhere in the paper did we postulate such strike-slip displacement associated with the fault population IV. Fault population IV was explicitly interpreted as a set of normal faults formed under NE–SW extension. No large-scale "*WNW-directed strike-slip displacement*" was inferred for this phase. Finally, the criticism regarding table 1 appears to stem from a misunderstanding of its purpose. Table 1 (Kowalski and Pacanowski, 2025a: p. 14) does not present regional palaeostress tensors from selected areas of the Bohemian Massif. Instead, it contains measured parameters of individual faults in the KG area, including site location, lithology, slip sense, fault population assignment, and the calculated principal axes of the finite strain ellipsoid derived from PBT analysis. The table documents the kinematic dataset used in our study; it is not a compilation of external palaeostress results. The objection therefore addresses a table content that is not present in the paper.

CONCLUDING REMARKS

The discussion of Cymerman (2026) raises several critical points concerning the scope, methodology, and regional implications of our recent study (Kowalski and Pacanowski, 2025a). In particular, the example of the Wleń Graben (Kowalski, 2021) is invoked to argue that the record of superimposed late- and post-Variscan tectonic events proposed for the northeastern margin of the Bohemian Massif, based on the structural evolution of the KG, is "*rather speculative*", owing to an insufficient structural dataset derived from a relatively small tectonic unit (Cymerman, 2026). We consider this comparison methodologically inappropriate.

The Wleń Graben (WG) and the KG are distinct tectonic structures characterized by markedly different exposure conditions. In the WG, exceptionally favourable exposures of Permian-Upper Cretaceous sedimentary rocks permitted documentation of 806 measurable fault-slip data (Kowalski, 2021). This reflects exposure quality and accessibility rather than intrinsic structural significance. In contrast, the KG exposes only limited sections of Mississippian strata. The fact that 32 fault-slip measurements were obtained from the KG (Kowalski and Pacanowski, 2025a) does not render the structure insignificant nor invalidate its kinematic interpretation. Structural analysis is inherently constrained by available exposures rather than by arbitrary numerical thresholds. A comparable approach was applied by Cymerman (2014), who based the structural interpretation of the Cieszów Unit (Sudetic Block) on 53 measured faults (table 4, p. 42) and subsequently proposed a broader evolutionary scheme for the Middle Sudetes and the Fore-Sudetic Block (fig. 19, p. 51). Similarly, Cymerman (1998) proposed a regional model of transpressional deformation for the entire Western Sudetes (fig. 11, p. 352) based on fold analysis from a single quarry in Raciborowice Górne (North-Sudetic Synclinorium area).

In summary, the structural evolution proposed for the KG (Kowalski and Pacanowski, 2025a) should not be regarded as "*speculative*" solely because it is based on a smaller dataset than studies from other tectonic units. Given that fault-slip datasets across the Sudetic Block remain unevenly distributed, each well-documented structural dataset contributes meaningfully to the regional reconstruction of brittle deformation history (e.g., Pešková et al., 2010; Coubal et al., 2015; Nováková, 2015; Kowalski, 2021; Sobczyk and Szczygieł, 2021). Our paper presents the first integrated analysis of fold geometry, fault-slip data, and geophysical constraints for the KG. Describing the results as "*provocative*" or "*speculative*" does not appear proportionate to the methodological and factual basis of the study. We consider our contribution part of the broader discussion on late- and post-Variscan deformation at the northeastern margin of the Bohemian Massif, while recognizing that further investigations will refine and develop the tectonic model proposed. We do not claim that our interpretation (Kowalski and Pacanowski, 2025a) is final or exclusive; however, no alternative kinematic model for the KG has been proposed to date.

REFERENCES

Angelier, J., 1984. Tectonic analysis of fault slip data sets. Journal of Geophysical Research: Solid Earth, **89**: 5835–5848; https://doi.org/10.1029/JB089iB07p05835

Coubal, M., Málek, J., Adamovič, J., Štěpančíková, P., 2015. Late Cretaceous and Cenozoic dynamics of the Bohemian Massif inferred from the paleostress history of the Lusatian Fault Belt. Journal of Geodynamics, **87**: 26–49; https://doi.org/10.1016/j.jog.2015.02.006

Cymerman, Z., 1998. Młodoalpejskie fałdy w depresji północnosudeckiej: przykłady z wapienia muszlowego z Raciborowic (in Polish). Przegląd Geologiczny, **46**: 348–354.

Cymerman, Z., 2002. Structural and kinematic analysis and the Variscan tectonic evolution of the Kaczawa Complex (the Sudetes) (in Polish with English summary). Prace Państwowego Instytutu Geologicznego, **175**.

Cymerman, Z., 2004. Tectonic Map of the Sudetes and the Fore-Sudetic Block, 1:200 000. Polish Geological Institute, Warszawa.

Cymerman, Z., 2014. The contact zone between the Kaczawa Structural Complex and the Świebodzice Depression (Central Sudetes, SW Poland) in the light of new research boreholes Cieszów PIG 1 and Cieszów PIG 2 (in Polish with English summary). Prace Państwowego Instytutu Geologicznego, **200**.

Cymerman, Z., 2026. A record of superimposed late- and post-Variscan regional-scale tectonic events at the NE margin of the Bohemian Massif: structural evolution of the Kamionki Graben (SW Poland, Sudetes) – discussion. Geological Quarterly, **70**, 5; https://doi.org/10.7306/gq.1850

Cymerman, Z., Sztromwasser, E., 2015a. Szczegółowa Mapa Geologiczna Polski w skali 1:50 000, arkusz Dzierżoniów (in Polish). Państwowy Instytut Geologiczny – PIB, Warszawa.

Cymerman, Z., Sztromwasser, E., 2015b. Objaśnienia do Szczegółowej Mapy Geologicznej Polski w skali 1:50 000, arkusz Dzierżoniów (835) (in Polish). Państwowy Instytut Geologiczny – PIB, Warszawa.

Cymerman, Z., Sztromwasser, E., Kowalski, A., 2022. Szczegółowa Mapa Geologiczna Sudetów w skali 1:25 000, arkusz Pieszyce (835C) (in Polish). CAG PIG-PIB, Warszawa, nr 3652/2025.

Cymerman, Z., Kowalski, A., Brytan, J., Szadkowski, M., Szadkowska, K., 2023. Szczegółowa Mapa Geologiczna Sudetów w skali 1:25 000, arkusz Jugów (868A) (in Polish). CAG PIG-PIB, Warszawa, nr 5990/2025.

Fossen, H., 2016. Structural Geology. 2nd ed. Cambridge University Press, New York.

Gawroński, O., 1961. Szczegółowa Mapa Geologiczna Sudetów w skali 1:25 000, arkusz Pieszyce (in Polish). Wydaw. Geol., Warszawa.

Głuszyński, A., Aleksandrowski, P., 2022. Late Cretaceous-Early Palaeogene inversion-related tectonic structures at the NE margin of the Bohemian Massif (SW Poland and northern Czechia). Solid Earth, **13**: 1219–1242; https://doi.org/10.5194/se-13-1219-2022.

Grocholski, W., 1967. Structure of the Sowie Mts. (in Polish with English summary). Geologia Sudetica, **3**: 181–249.

Kowalski, A., 2021. Multistage structural evolution of the end-Cretaceous–Cenozoic Wleń Graben (the Sudetes, NE Bohemian Massif) – a contribution to the post-Variscan tectonic history of SW Poland. Annales Societatis Geologorum Poloniae, **91**: 37–66; https://doi.org/10.14241/asgp.2020.21

Kowalski, A., 2024. Late- to post-Variscan structural evolution of tectonic grabens on top of the Góry Sowie Massif. In: 20th Jubilee Meeting of the Central European Tectonic Studies Groups CETEG (eds. R. Sikora, M. Olkowicz and M. Adamuszek): 153–182. Srebrna Góra, 24–27.04.2024, Poland. Abstract Volume and Field Trips Guide.

Kowalski, A., 2025. Karbońska pokrywa osadowa masywu Gór Sowich (in Polish). In: Krystaliczne podłoże i karbońskie baseny sedymentacyjne w masywie Gór Sowich (ed. A. Kowalski): 22–35. Materiały Konferencji Terenowej, Polskie Towarzystwo Geologiczne, Glinno, 21–23.05.2025.

Kowalski, A., Pacanowski, G., 2025a. A record of superimposed late- and post-Variscan regional-scale tectonic events at the NE margin of the Bohemian Massif: structural evolution of the Kamionki Graben (SW Poland, Sudetes). Geological Quarterly, **69**, 6; https://doi.org/10.7306/gq.1779

Kowalski, A., Pacanowski, G., 2025b. From late-Variscan localised folding to post-Variscan brittle tectonics: Structural evolution of the Glinno Graben, Góry Sowie Massif, SW Poland (NE Bohemian Massif). Geological Quarterly, **69**, 48; https://doi.org/10.7306/gq.1821

Marrett, R., Allmendinger, R.W., 1990. Kinematic analysis of fault-slip data. Journal of Structural Geology, **12**: 973–986; https://doi.org/10.1016/0191-8141(90)90093-E

Mazur, S., Scheck-Wenderoth, M., Krzywiec, P., 2005. Different modes of the Late Cretaceous–Early Tertiary inversion in the North German and Polish basins. International Journal of Earth Sciences, **94**: 782–798; https://doi.org/10.1007/s00531-005-0016-z

Mazur, S., Aleksandrowski, P., Kryza, R., Oberc-Dziedzic, T., 2006. The Variscan Orogen in Poland. Geological Quarterly, **50**: 89–118.

Nádaskay, R., Žák, J., Sláma, J., Sidorinová, T., Valečka, J., 2019. Deciphering the Late Paleozoic to Mesozoic tectono sedimentary evolution of the northern Bohemian Massif from detrital zircon geochronology and heavy mineral provenance. International Journal of Earth Sciences, **108**: 2653–2681; https://doi.org/10.1007/s00531-019-01781-z

Nádaskay, R., Valečka, J., Opluštil, S., Mlčoch, B., Skácelová, Z., Horna, F., 2024. Pennsylvanian–Permian deposits in northern Bohemia: a correlation with neighbouring basins and discussion of their formation and demise within the "Elbe Zone System". Geological Quarterly, **68**, 42; https://doi.org/10.7306/gq.1770

Nováková, L., 2015. Tectonic phase separation applied to the Sudetic Marginal Fault Zone (NE part of the Czech Republic). Journal of Mountain Science, **12**: 251–267; https://doi.org/10.1007/s11629-014-3297-5

Oberc, J., 1972. Sudety i obszary przyległe (in Polish). Budowa Geologiczna Polski, **4**. Tektonika, Part 2 (ed. W. Pożaryski). Wydaw. Geol., Warszawa.

Pascal, C., 2021. Paleostress Inversion Techniques: Methods and Applications for Tectonics. Elsevier; https://doi.org/10.1016/C2016-0-01840-5

Pešková, I., Hók, J., Štěpančíková, P., Stemberk, J., Vojtko, R., 2010. Results of stress analysis inferred from fault slip data along the Sudetic Marginal Fault (NE part of Bohemian Massif). Acta Geologica Slovaca, **2**: 11–16.

Sobczyk, A., Szczygieł, J., 2021. Paleostress reconstruction of faults recorded in the Niedźwiedzia Cave (Sudetes): insights into Alpine intraplate tectonic of NE Bohemian Massif. International Journal of Earth Sciences, **110**: 833–847; https://doi.org/10.1007/s00531-021-01994-1

Tikoff, B., Peterson, K., 1998. Physical experiments of transpressional folding. Journal of Structural Geology, **20**: 661–672; https://doi.org/10.1016/S0191-8141(98)00004-2