faults characteristically produce rhombic pull-apart basins: the Nysa pull-apart graben (NPAG) and Upper Morava pull-apart graben (UMPAG). Also the Mohelnice pull-apart graben (geomorphologically corresponding to the Mohelnice furrow) belongs to this system.

The NPAG is genetically related to the offset between the Intra-Sudetic Fault zone and the Bušín Fault. It represents markedly asymmetrical (half-graben) and hinge-like structure (with pivot hinge near Štíty in the area of southern termination), with Cenomanian to Santonian sedimentary filling (e.g., Don, 1996). The master fault of the Nysa pull-apart graben is a high-angle normal fault on the western limit of the Sněžník Crystalline Unit. Significant post-sedimentary (post-Santonian) movement on this fault is documented by upturned to overturned strata due to flexural deformation, which is related to drag folding on the eastern normal fault.

Tectonically initiated subsidence of the UMPAG started in the Lower Badenian and was related to a sidestep (offset) of the Bušín and Temenice faults by the Konice Fault zone. The typically rhombic pull-apart basin (Fig. 1) is active up to the Recent.

Fig. 1. Digital elevation model (shaded relief illuminated from NNE) of the Upper Morava pull-apart graben and adjacent areas.

Based on geophysical and other structural data, the structure of UMPAG can be assigned to the southeastern prolongation of the Elbe tectonic zone and its long-lived dextral wrenching kinematics and stress field activity.

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On the Mineralogy and Origin of the Śnieżnik versus Gierałtów Gneisses, Międzygórze Unit, OSD, West Sudetes

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The Międzygórze Unit in the eastern part of the Orlica–Śnieżnik Dome (OSD) consists of two major groups of gneisses. One is commonly referred to as the migmatitic *Gierałtów* gneisses, the other as the mylonitic *Śnieżnik* orthogneisses. The *Gierałtów* gneisses embrace bodies of apmhibolitized eclogites. Bulk and mineral composition as well as origin and mutual structural relationships of these gneisses within the OSD have been studied for a long time; this resulted in a bunch of controversial interpretations (Smulikowski, 1979; Don, 2001; Dumicz, 1989b; Borkowska et al., 1990; Don et al., 1990; Borkowska, 1996; Borkowska and Dörr, 1998; Turniak et al., 2000; Grześkowiak and Żelaźniewicz, 2002; Lange et al., 2002, 2003). Accordingly, the *Gierałtów* gneisses have been viewed upon as being older than, coeval with, or younger than the *Śnieżnik* gneisses.

Quite recently, having interpreted chemical and isotopic data, Kröner et al. (2001), Turniak et al. (2000) and Lange et al. (2003) proposed that the two groups of gneisses have been derived from the same protolith, i.e., one large batholith, and differences between them are due to later deformation and migmatization. However, Borkowska (2002) argues for two chemically different protoliths, whereas Grześkowiak and Żelaźniewicz (2002) bring into light evidence suggesting that the *Śnieżnik* (meta)granite developed by melting of rocks of the diversified and polygenetic *Gierałtów* group. The latter opinion is supported by (1) the presence of isolated enclaves of the *Gierałtów* gneisses within the *Śnieżnik* gneisses (metagranite), (2) remarkably simpler deformation path of the *Śnieżnik* metagranite compared to that of the *Gierałtów* gneisses, and (3) meaningful differences in mineral compositions (Borkowska et al., 1990; Grześkowiak and Żelaźniewicz, 2002) of the two groups of gneisses. In the Międzygórze Unit, the *Gierałtów* gneisses are represented by (1) very fine-grained migmatitic gneiss, now sheltered in enclaves within the metagranite; (2) coarse-grained migmatitic gneiss with augen-like porphyroblasts; (3) fine-grained gneisses neighbouring eclogite and amphibolite bodies.

What follows below is the result of detailed qualitative and quantitative (750 analyses in c. 350 grains in 25 thin sections) studies of compositional variability of feldspars from gneisses of the two groups.

In the ***Śnieżnik* gneisses** more than 95 % of the whole population of K-feldspar contain 5–12 % Ab up to 15 % Ab, and less than 5 % are pure orthoclase with 0–2 % Ab. More than 90 % of the whole population of the plagioclases contain An_{15-22}, and less than 10 % contain An_{5-12}. At the contacts with the K-feldspar megacrysts plagioclases of the *Śnieżnik* metagranite do not contain more than 4–8 % Or.

K-feldspar in the migmatitic variants of the ***Gierałtów* gneisses** forms three compositional classes in proportions varying between samples. Up to 40 % of all the studied crystals have 0–5 % Ab; 20–85 % of these crystals have 5–15 % Ab and show zoning with the Ab content decreasing outwards; 0–40 % of all studied K-feldspar megacrysts have 15–22 % Ab and up to 40 % Ab in some rims and antiperthitic intergrowths. The plagioclases are even more diversified and five compositional classes can be distinguished, the proportions of which vary between individual samples. As much as 90 % of crystals with An_{0-5} may occur in some cases; 10–70 % with An_{5-12}; 0–80 % with An_{16-25}; 0–40 % with An_{25-36}; some plagioclase intergrowths in K-feldspar megacrysts are even more basic and contain An_{36-51}. Plagioclases at contacts with K-feldspars and in antiperthitic intergrowths may reach 40–55 % Or.

Isolated **enclaves** of fine-grained, biotite and migmatitic gneisses within the *Śnieżnik* metagranite fit compositionally the *Gierałtów* gneisses, thus being considered their variants. 65–90 % of all K-feldspars in the studied migmatites from enclaves contain 5–12 % up to 15 % Ab, but may reach even 16–42 % Ab in some grains (up to 10 %) as well as in intergrowths with plagioclase; 5–20 % of all K-feldspars have 0–5 % Ab. 5–60 % of the plagioclase population have An_{0-5}; 20–70 % have An_{5-15}; and up to 50 % of all plagioclase grains have An_{16-22}. In other enclave gneisses, up to 40 % of plagioclase population have An_{28-36} and up to15 % have An_{36-40}. Some plagioclase grains contain even Or_{40}.

The obtained results show that both K-feldspars and plagioclases from the *Śnieżnik* metagranite have distinctly much less diversified mineral composition than feldspars from other gneisses in the Międzygórze Unit. It is suggested that such a uniform composition could only be attained by the *Śnieżnik* granite during its formation via melting of the *Gierałtów* group and akin gneiss protolith, which explains the repeatedly reported similarities in chemical and isotopic characteristics of the two groups of gneisses, and entirely confirms the earlier view of Grześkowiak and Żelaźniewicz (2002). The significantly increased content of Or in part of the plagioclase grains from the *Gierałtów* and enclave gneisses testifies to the process of K-feldspathization in these rocks and supports the proposed interpretation.

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From Extension to Inversion – Sedimentary Record of Mesozoic Tectonic Evolution within the Marginal Fault Zone, SE Mid-Polish Trough

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The Mid-Polish Trough (MPT) belonged to a system of epicontinental depositional basins of western and central Europe and formed the SE axial part of the Danish–Polish Basin (Ziegler, 1990). It developed from Permian to Cretaceous times and was filled with several kilometres of sediments, mainly siliciclastics and carbonates (e.g., Kutek, 2001). The MPT was located along the NW–SE-trending Tornquist–Teisseyre Zone. It stretched from the Baltic Sea towards the SE and, from the Jurassic onwards, it also included the area of the present E Carpathian Foredeep basin (cf. Hakenberg and Świdrowska, 1998; Kutek, 2001). The MPT was inverted in the Late Cretaceous – Paleocene times, at which time its axial part was strongly eroded (Ziegler, 1990). In its SE part (Holy Cross Mts. and Małopolska Massif), its Palaeozoic basement was exposed as a result of this inversion. Within the SE Mid-Polish Trough (NE margin of the Holy Cross Mts. area), tectonic structures responsible for MPT's extension and inversion were recently revealed on high-quality petroleum seismic data (Krzywiec, 2002). They form a typical system of inverted normal faults, with their SW parts characterized by significantly increased thickness of Mesozoic (mainly Upper Jurassic) deposits related to their extensional activity. Inversion structures are accompanied by thickness reductions and progradational patterns within the Upper Cretaceous deposits. Such features are typical for syn-depositional tectonic activity. Thickness reduction above the uplifted basement blocks, local erosion and relatively short distance of sediment supply resulted in thickness reductions and progradational pattern in close vicinity of master reverse faults.

Stratigraphic data derived from the well cores, neighbouring outcrops and regional interpretations (e.g., Gutowski, 1998; Kutek, 2001) combined with the seismic interpretation allow to recognize the following succession of tectonic/depositional events along the NE margin of the MPT's Holy Cross segment:

- Permian – Triassic: initial extension stage connected with possible deposition of continental clastics followed by uplift and erosion
- Early – Middle Jurassic (Pre-Bathonian?): extension interrupted by minor uplift. As sediments older than the Oxfordian are absent or of very low thickness along the investigated seismic line, a more detailed interpretation is not possible.
- Late Jurassic: major extension and subsidence, recorded by the Oxfordian (Bathonian?)–Kimmeridgian sedimentary sequences, especially by the relatively thick Middle Oxfordian – Lower Kimmeridgian highstand systems tract, the thickness of which rapidly increases within the SW limb of the marginal fault.
- post-Tithonian – pre-Late Valanginian: uplift recorded by stratigraphic gap and/or subtle angular unconformity between the Upper Kimmeridgian (locally up to the Lower Kimmeridgian Divisum Zone) and the Upper Valanginian successions.
- Early Cretaceous: possibly prevailing extension/subsidence interrupted by minor uplift events as indicated by thickness of the Upper Valanginian – Middle Albian succession increasing towards the NW, including some sedimentary discontinuities.
- post-Middle/pre-Late Albian: major uplift resulted in sedimentary discontinuity and correlative erosional gap which underlie the Upper Albian transgressive sediments. Relevant erosion locally removed the Lower Cretaceous sediments and even cut the Kimmeridgian sequence down to the Divisum Zone sediments.
- Late Albian – Early(?) Turonian: extension related to the increased thickness of the relevant sequence within the SW limb of the marginal fault.
- Late(?) Turonian – Maastrichtian: inversion of the marginal fault resulted in NE-directed progradation of the Upper(?) Turonian – Maastrichtian succession and its significantly greater thickness in the NE limb of the marginal fault.

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