The rapid lateral migration of the channels took place due to unstable, easily erodible banks. The coarse-grained fractions prevail in poorly sorted deposits. The channels are relatively wide and shallow with significant erosional bases, filled in steady upper flow regime. The deposition took place in braided river system. Bo•anov Section (SE from Broumov, see add. 3 above): The occurrence of the Gp lithofacies is restricted to the Bo•anov section. Overbank fine deposits are absent. Poorly sorted deposits with poorly developed bedding form tabular bodies showing cut-and-fill relief along their basal bounding surfaces. Unsteady traction flows were probably channelized by a network of unstable scours. A short time episodic sedimentation is likely to have taken place. The flows rapidly runoff toward the basin and partly infused into porous gravely background (clay is rarely presented as a matrix). This indicates that relatively steep gradient was developed. These deposits may represent a distal part of alluvial fan system or proximal braidplain, which corresponds to the interpretation of the nearby Radków conglomerates (Aleksandrowski et al., 1986).

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Geochemistry of the Orthogneisses from the Northern Part of the Lipowe Hills (Eastern Part of the Fore-Sudetic Block)

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The Lipowe Hills massif is located in the eastern part of the Fore-Sudetic Block (in the East/West Sudetes boundary zone), between the Strzelin crystalline massif in the east and the Niemcza-Kamieniec metamorphic complex in the west, about 40 km south of Wrocław. It consists of three main rock groups: gneisses, schist series (amphibolites, mica schists, calc-silicate rocks and marbles) of an unknown age and Variscan granitoids, dated at 329±11 Ma (Oberc-Dziedzic and Pin, 2000).

Four principal varieties of gneisses are exposed in the Lipowe Hills massif (Wójcik, 1968, 1973; Oberc-Dziedzic 1988, 1995): 1) light, laminated or augen gneiss (the light Stachów gneiss), 2) dark, fine-grained migmatitic, sillimanite gneiss (the dark Stachów gneiss), 3) light, migmatitic gneiss with sillimanite nodules (the Nowolesie gneiss) and 4) mylonitic, chlorite gneiss (the Henryków gneiss)

Geochemical investigations were carried out on samples collected from the boreholes Stachów-1 (ST-1) and Stachów-2 (ST-2), located in the middle and northern parts of the Lipowe Hills massif. For chemical analyses two samples of gneisses (ST-1 86, ST-2 233), corresponding to the so-called light Stachów gneisse, were selected.

The studied gneisses are light grey, medium to coarse-grained and show streaky texture. The rocks are composed of quartz, plagioclase and microcline. Biotite is less common. Muscovite, sillimanite (fibrolite) and chlorite (after biotite) occur as minor constituents. In places, sillimanite is replaced by large muscovite crystals. Plagioclase is often sericitized. Accessory phases comprise garnet, zircon, apatite and opaque minerals.

Discrimination plots TiO_2 vs. SiO_2 (Tarney, 1976) and P_2O_5/TiO_2 vs. MgO/CaO (Werner, 1987) show that the analysed gneisses are orthogneisses. They contain between 1.22–1.66 % of normative corundum. Chemical composition is dominated by normative quartz and feldspar (>90 %), whose proportion also suggests granitic protolith.

The orthogneisses have a composition of peraluminous, calc-alkaline granites. The value of normative corundum (>1) as well as the molar proportion of $Al_2O_3/CaO+Na_2O+K_2O>1$ (1.07–1.12) indicate S-type granites (White and Chappell, 1974). The Nb/Th ratio ~2 (0.48–1.22) is characteristic of crustal material (Shaw et al., 1986). The analysed gneisses show a flat REE pattern with Eu anomaly as compared to the composition of lower crust. Chondrite-normalized values of the gneisses display slight enrichment in LREE, strong negative Eu anomaly and flat HREE pattern (10–20 times chondrite). Negative Eu anomaly and relative LREE enrichment indicate that fractional crystalization played an important role (Pearce et al., 1984). Trace element contrentrations normalized to ocean ridge granite display geochemical patterns (K_2O, Rb, Ba Th >1, positive Ce anomaly) similar to volcanic arc granites and collision granites (Pearce et al., 1984). On the discrimination diagrams Rb vs. (Nb+Y) and Rb vs. (Ta+Yb) the analysed samples fall in the volcanic arc and late or post-collision calc-alkaline granites fields. Harris et al. (1986) provided a possibility to distinguish volcanic arc intrusion from late or post-collision one. Based on the Ta vs. Nb plot, the examined gneisses fall in the volcanic arc field. Similar conclusions may be drawn from the Rb/30-Hf-Ta*3 triangular plot (Harris et al., 1986).

Described gneisses originated from granitic protolith. Pristine rocks consisted of peraluminous, calc-alkaline granite of S-type. They were probably the products of crustal material melting. Tectonic setting of the granites is very questionable, although the obtained data indicate their emplacement in a volcanic arc environment. Most of the classification diagrams used, are based on Rb, the element which can be very mobile, especially during metamorphism. Some varieties of the gneisses from the Lipowe Hills massif have their equivalents in the adjoining area of the Strzelin crystalline massif (SCM) (Oberc Dziedzic, 1988, 1995). Two types of the gneisses from the SCM were dated, giving the ages of 568±6 Ma (the Strzelin gneiss, Oberc-Dziedzic et al., 2001) and 504±3 Ma (the Gościęcice gneiss, Oliver et al., 1993). The geochemical composition of the Strzelin gneiss (Szczepański, 1999) is very similar to analysed gneisses from the northern part of the Lipowe Hills.

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Visualization of Paleostress Analysis

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In connection with work on paleostress analysis of the Ro•ná mineral deposit a new requirement for visualization of some result appears. Modern computers extend our possibility to present stress data in graphical form, so two new computer programs could be developed (Orient, WinOr) and direct and inverse tasks could be visualized.

If some stress tensor is known (e. g. $ó_1$=200 MPa in 230/30; $ó_2$=100 MPa in 123/26 and $ó_3$=10 Mpa in 0/48, see Fig. 1a), it is easy to compute value of total, normal and shear stresses on any oriented plane (see Fig. 1b, 1c and 1d). Using value of internal friction and shear strength (e. g. φ=30°, τ0=15 MPa), we are able to evaluate differences between shear stress and critical shear stress for any plane (Fig. 1e). The zero line (wide black line in white zone) divides considered equal area plot into two parts with either positive (inside) or negative (outside) deviation. The first one is a field with reactivated planes and the second one defines a field of stability. Very illustrative is equal area projection of pitch angle. Distributional function of this angle between a strike line of a fault plane and resulted slip vector has two extreme – 0° and 90°. The first one (zone of strike-slips, black zone in Fig. 1f) divides a plot into fields of normal and inverse faults and the second one (zone of dip-slips, white zone in Fig. 1f) into fields of sinistral and dextral faults.

Much more interesting is graphical presentation of paleostress inverse problems. In this case, we know fault plane, slip vector and sense of movement (e.g. plane 45/45, striae 45/45, thrust; see Fig. 2a). Based on some complicated mathematic analysis, it was possible to derive special equation for normalized shear stress $\tau' = \tau/\tau max$ in dependace on Lode parameter $m = (2ó_2 - ó_1 - ó_3)/(ó_1 - ó_3)$ and direction of main normal stresses in fault coordinate system lmn (l – parallel to striae, n – perpendicular to fault plane). In equal area projection we can plot distribution for τ' for any direction of $ó_1$, $ó_2$ and $ó_3$. The considered function gives two solutions for any s1-direction (for m = 0.5 see Fig. 2b and 2c) and similarly two solutions for any s3-direction (for m=0.5 see Fig. 2e and 2f). Very attractive is equal area plot with distribution of τ' in relationship to s2-direction. Derived function leads to one solution (for m = 0.5 see Fig.