Abstract

North-eastern part of the Bohemian Massif is characterised by many NW-SE striking faults. The Sudetic Marginal Fault Zone (SMFZ) and Hronov – Poříčí Fault Zone (HPFZ) represent the major seismoactive dislocations in this area. Field structural investigations, including fault-slip data collection were carried out on a number of natural outcrops and quarries with the aim of establishing a robust and field-constrained model for the local brittle structural evolution of the studied areas. Almost 5000 faults and fractures have been measured and studied in 116 localities. Two principle sets of faults within the SMFZ are oriented in the N-S and W-E directions. The faults are mainly dipping under 80-90°. The lineations found on the fault planes are mainly trending to the SW and W. The kinematic frequent analysis was performed due to the distribution of the fault types in the orientations.

The faults were divided into the different tectonic phases based on their origin or reactivation and their relative age using the calculation of paleostress analysis. The paleostress analysis of the fault-slip data within the SMFZ resulted identification of six tectonic phases from the youngest to the oldest: strike-slip regime with maximum compression σ_1 in the NNW-SSE direction, compressional regime with σ_1 in the WNW-ESE direction, extensional regime with subvertical σ_1, extensional regime with σ_3 in the ENE-WSW direction, strike-slip regime with σ_1 in the NNE-SSW direction, strike-slip regime with σ_1 in the NW-SE direction. The faults within the HPFZ are mostly oriented in NW-SE direction, nevertheless in minor they also occur in NE-SW direction. The faults are mainly vertical or subvertical dipping 70-90°. The lineations found on the fault planes are mainly trending to the NE, S, SSW and SW. The paleostress analysis of the fault-slip data within the HPFZ resulted in indentification of four tectonic phases from the youngest to the oldest: compressional regime with σ_1 in NE-SW direction, compressional regime with σ_1 in WNW-ESE direction, strike-slip regime with σ_1 in NW-SE direction, strike-slip regime with σ_1 in NNE-SSW direction.

Six GPS stations (BISK, PETR, LANS, VIDN, STAM and VRES) were employed for long-term GPS monitoring in the SMFZ area. Five GPS stations (BEZD, MOKA, TURO, UPIC a ZOLE) monitored the HPFZ area. Both horizontal and vertical components of the movements were calculated from long-term GPS monitoring data. Standard errors calculated for individual stations pointed out the permanent GPS stations provide up to a hundred times more precise positioning than the campaign stations. To highlight the local component of station movements three various methods were applied to set the regional component. The highest local horizontal velocity within the SMFZ area was found for the GPS station VIDN (1.33 mm/y). The highest local vertical velocity within the SMFZ area was calculated for the GPS station PETR (2.54 mm/y) upwards. Generally, comparing to the whole area, stations BISK and PETR move downwards, while the stations LANS, VIDN, STAM and VRES move

upwards. The highest local horizontal velocity within the HPFZ area was calculated for GPS station MOKA (2.18 mm/y). The highest local vertical velocity within the HPFZ area was calculated for GPS station TURO (2.61 mm/y) upwards. The stations BEZD, MOKA and TURO move downwards, while the stations UPIC and ZOLE move upwards.

The brittle tectonic data has been related to the recent tectonic movements indicated by the GPS measurements. Both structural and GPS data were compared and the actual activity and stress conditions of the SMFZ and HPFZ areas were constructed. The SMFZ has been a sinistral fault zone with strike-slip regime recently. The HPFZ has been a dextral transpressive fault zone in compressional regime recently. In both studied areas, the youngest tectonic phase defined by the paleostress analysis corresponds to the actual movements found by the GPS monitoring. Thus the employed methods provided useful complementary results.