rotation. In the Sopron Hills one locality failed, three localities were rotated counterclockwise and one clockwise (Fig. 2).

The paleomagnetic observations indicated dominant counterclockwise rotation taking place during or after Pannonian in the Transdanubian Range and after the Badenian in the Sopron Hills (the latter suggestion is also supported by results from the Vienna Basin, Scholger and Sting, 2004). It is quite possible that the rotation occurred in the two areas simultaneously. However, there are outliers which maybe due to secondary remagnetization or undetected slumping. This rotation may have caused the apparent change in stress field orientation between the second (F2) and the third (F3) phases of extension.

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Fluids and Earthquake Swarms in Western Bohemia Region

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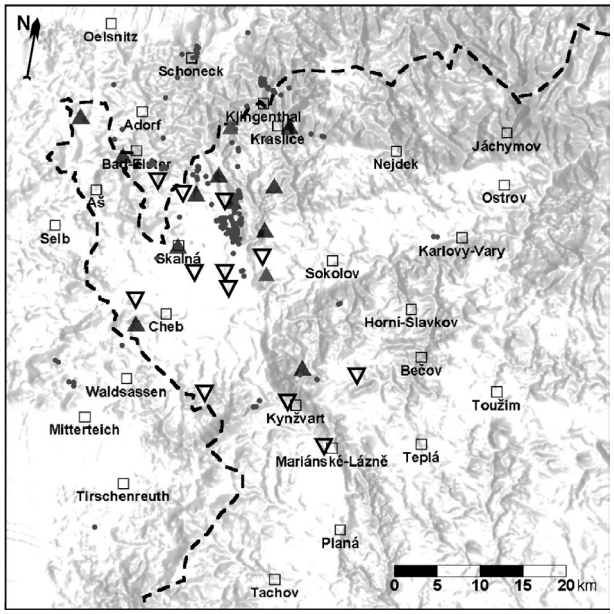
The western part of the Bohemian Massif is a well-known resort landscape of Bohemia, Saxonia, and Bavaria. The Karlovy Vary spa with 12 mineral springs ranging in temperatures between 42 °C and 72 °C is the best-known spa town in the region. Besides the spas, the recent geodynamics, complex structure, and singular geological evolution range this region among unique natural laboratories in Europe. In addition to the carbonated mineral springs, one of its most spectacular geodynamic feature is periodically reoccurring intraplate earthquake swarms, mostly of magnitude $M_L < 3.5$ at focal depths below 6 km, and exceptional occurrence of earthquakes with magnitudes $M_L > 4.5$.

This type of seismicity is, generally, associated with active volcanism, geothermal fields, and sea-floor spreading. Its origin is usually explained as an interaction of the tectonic stress and high-pressurised crustal fluids in a subcritically loaded rock environment. Evidence of the fluid-triggered swarm earthquakes also stems from stable tectonic areas, e.g. the Vosges Massif in France (Audin et al., 2002).

The region is intersected by an ENE-WSW trending neotectonic structure, the Ohře rift, and by the NNW-SSW striking Mariánské Lázně fault (Fig. 1). According to Bankwitz et al. (2003), the Ohře rift and the active faults trending N-S and E-W serve for fluid transport in the region. More than one hundred mineral springs and a few hundred gas vents in eight moffete fields are located at the intersection of these fault zones. Current hypotheses claim that all mineral springs and moffetes in the WBM are supplied with CO_2 and other gases from a magmatic reservoir located in the uppermost mantle (Weinlich et al., 1999). Two Quaternary volcanoes, Komorní Hůrka and Železná Hůrka, are located in the seismoactive region; the age of the later is about 0.3 Ma.

A total CO2 discharge in the whole region was valuated to be about 330 m^3/hour. The highest CO_2 discharge in the Cheb basin (20 m^3/hour) and the anomaly of the occurrence of a He of a deep origin, were found at the Bublák mofette (Weinlich et al., 1999), that is situated in the southern tip of the main epicentral



■ **Fig. 1.** Relief of the West Bohemia region with well evident structures of Ohře rift and Mariánské Lázně fault. Dots represent epicentres of seismic events in the period November 2003 – December 2004, full triangles mark the WEBNET stations, empty triangles gas monitoring places.

zone Nový Kostel (NK). It is presumed that at least 99 % of the CO_2 released at Bublák originated from the upper mantle (Bräuer et al., 2003). The isotope composition of the free gas of Bublák and at the Eisenquelle mineral spring at Bad Brambach (Saxony) was monitored simultaneously in the period 1994–1996. After the December 1994 earthquake swarm (M_{Lmax}=2.2), which occurred in the NK zone, the $^{13}C_{CO2}$ values of Bublák as well as the $^{13}C_{CO2}$ and 3He/4He values of the Eisenquelle gases distinctly dropped for several months. That is explained by an admixture of crustal fluids released in earthquake foci to the permanent mantle volatile flux. Moreover, it could imply that the NK focal zone is associated with gas channels supplying both Bublák and Eisenquelle.

Noticeable variations in discharge of mineral springs in Františkovy Lázně spa (Novotný and Matyska1988) and changes in the groundwater chemistry and the water level of mineral springs at Bad Elster (Saxony) (Kämpf et al. 1989) were as well indicated during the 1985/86 earthquake swarm. Distinct anomalies of the groundwater level, hydrostatic pressure, and free gas flow were indicated before and in the beginning of the 2000 swarm at Bad Brambach, co- and post-seismic effect of hydrological parameters were recorded at mofettes Soos (SSW of the NK zone) and Bublák (Koch et al. 2003).

The gas discharge in the West Bohemia earthquake swarm region has been measured by the Saxonian Academy of Sciences in Leipzig (Research Group Bad Brambach), a survey geophysical company GEKON-GF, Ltd., Praha, and by the Federal Institute for Geosciences and Natural Resources (BGR) in Hannover. The measurements are performed in four different ways:

(1) continuous monitoring of the CO_2 discharge at four boreholes supplied from deep-seated sources – Kyselecký Hamr, Mariánské Lázně, Prameny and Dolní Částkov, and at the Soos mofette;
(2) periodic measurements of the CO_2 and Rn percentage volumes in the soil air at seven localities: Františkovy Lázně, Mostek, Plesná, Mariánské Lázně, Lázně Kynžvart, Prameny and Kyselecký Hamr, carried out in the 21-day cycle;
(3) precise continuous monitoring of the CO_2 and Rn percentage volumes in the soil air at Oldřišská village that is located just in side the NK focal zone (close to the NKC seismic station);
(4) continuous monitoring of CO_2 flux at Bublák and Soos mofettes.

Our contribution shows first results of gas monitoring from two monitor sites, Oldřišská and Horní Částkov, during seismicaly quiet period November 2003 – December 2004 and discusses possible relations between the earthquake activity and parameters of gas discharge.

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