Evolution of the natural gases and source rocks of the dismembered coal-bearing Variscan fore-deep developed on Avalonian Bruno-Upper Silesia-Moesia-Istanbul-Zonguldak superterrane

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As a result of the Variscan orogeny a chain of the fore-deep Pennsylvanian coal basin was formed. The eastern segment of the chain rested on the Cadomian-consolidated Avalonian basement. Subsequently the activity of a majör transcontinental strike-slip fault zone resulted in a translation of the eastern from the western part of the basin. From Permian to Jurassic this primarily single basin was dismembered into two remote segments (Tari 2007). The resulted coal sub-basins were: the Upper Silesia basin in the north and the Dobruja basin (lying on Moesia Cadomian terrane) with Zunguldak-Amasra in the south (Kalvoda et al 2008 and citatins therein). During the Cretaceous time, this southern segment was separated into two pieces, and one of them was rifted out the European mainland, due to the formation the Black Sea back-arc basin. Finally, the rifted out part of the basin took rest in its recent position in the western Pontides. Its erosional remnants are located in the Zonguldak-Amasra region (Okay et al. 1994; 2006). The common origin of the rock sequences in the Zonguldak-Amasra and the Upper Silesia sub-basin allows us comparison of source rocks and natural gases between both segments dismembered along the Kraköw-Hamburg-Dobruja fault. This study, based on new geochemical data, may reveal differences in late diagenetic evolution of the coal-bearing sedimentary cover of the composed Brno-Upper Silesia-Moesia-Istanbul-Zonguldak superterrane. in addition it may shed light on the actual extension of the Upper Silesia coal basin, which must be wider than directly recognized with boreholes. The pre-Permian basement of the Polish part of Central European Basins is poorly recognized due to deep burial (> 6 km) and a thick red-oxidized palaeoweathered crust on the top of the Carboniferous, however there are strong premises for the occurrence of coal-bearing sequences at depths.

in the Zonguldak-Amasra basin the thermal maturity is generally lower and more uniform $(R_T=0.$6-1.0%) than in the Upper Silesia. A higher variability of maturity in the Upper Silesia basin can be attributed to the observed west (R_r=ca 0.6%) to east increasing trend (i?$_r$=ca 2.0%), perpendicular to the Variscan front. in the Upper Silesia, the further complications result form the influence of post-Variscian thermal gradients related to deeper burial, e.g. under the Carpathians nappes. Thus, molecular and isotopic composition of the coal associated gases in the Upper Silesia and the Zonguldak-Amasra areas reveals distinct similarities apparently resulting from similar types of source rocks, maturity and generation history. in the USCB gas isotopic composition is in the range 8D CH_4 -160 to -190%o and 8^{13}C -40 to -70%o (Kotarba 2001), which is close to the appropriate values for the samples in the Zonguldak-Amasra basin (8DCH_4 ca. -180%o and 8^{13}C -50%o; Hoşgörmez et al. 2002). These data suggest similar proportion of thermogenic and biogenic components in gases of both basins.

in the eastern Poland, however gas generation history was different. Gases group into two domains: the first, comprising uniform dry, isotopically heavy (813C -35 to -30%o and 8D -130 to -150%o) and nitrogen-rich up to 66% of (CH_4/N_2 ratio 0.5) thermogenic gases and the second compositionally less homogenous with variable contribution of biogenic component. Compositions of the most of the analysed dry thermogenic gas plot in the region of the evolution path of Type III kerogen derived gases. in addition, such gases comprise isotopically heavy nitrogen characterized by 8^{15}N values up to 5%o, suggesting a signifıcant release of nitrogen (as NH_3 and/or N_2) from a pool enriched in the residual nitrogen, presumably mature source rocks of the Pensilvanian age.

Hoşgörmez H., Yalcın M.N., Cramer B., Gerling P., Faber E., Schaefer R.G., Mann U. 2002. Organic Geochemistry
33, 1429-1439. Kalvoda J., Babek O., Fatka O., Leichmann J., Melichar R., Nehyba S., Spacek P. 2008. International Journal of
Earth Sciences 97, 497-518.
KotarbaM.J. 2001. Organic Geochemistry 32,163-180. OkayA.L, Sengör A.M.C., Görür N. 1994. Geology 22, 267-270.

Okay A.I., Satir M., Siebel W. 2006. Geological Society, London, Memoirs 32, 389-405. Tari G,. 2007. Article #90072, AAPG and AAPG European Region Conference, Athens, Greece.