Tectonics and Paleotopography as the Main Controls on Drainage Pattern and Architecture of the Radnice Member in the Kladno-Rakovník Basin (Westphalian, Carboniferous)

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The basal unit of the Kladno-Rakovník Basin in the central and western Bohemia, the Radnice Member, is interpreted as a fill of incised or tectonically formed system of river valleys with paleotopography of the depocentre up to 200 m. Restoration of the presedimentary paleotopography was used to reconstruct paleo-drainage system of this unit. It consists of streams of four orders. The main (axial) rivers occupied tectonic valleys with the highest subsidence rate while the 2nd- to 4th-order streams drained incised valleys. The eastern part of the study area (Kladno–Rakovník Basin) was drained to the NW (?possibly to Saxony and to the North Variscan Foredeep). The western part was probably drained through its central tectonic valley to the south-southwest. The Kladno–Rakovník Basin is estimated to be located about 1000 m above the Carboniferous sea level. The five following facies associations were distinguished within this unit: proluvial-colluvial, channel, floodplain, lacustrine and lacustrine deltaic. Deposition and architecture were controlled by regional and local mechanisms inducing base-level changes expressed by the A/S ratio (Accommodation/Sediment supply). Tectonics was the most important regional mechanism responsible for basin-wide changes in architecture or formation of laterally widespread and isochronous horizons or erosion surface. The effect of other mechanisms was of more localized extent. Character and size of the drainage areas of individual streams were responsible for the amount of clastics transported into the depocentre. In addition, paleotopography controlled the distribution of clastics within the highly irregular valley network. This affected especially the mire formation: mires developed only in areas with limited clastic input. With gradual filling of paleotopography, the areas suitable for formation of long-lasting and extensive mires diminished.

The Radnice Member consists of two tectonically driven sequences separated by a basin-wide erosion surface with a relief of at least 20 m, showing an anastomosing pattern which indicates a short break in deposition within this unit. These tectonic sequences correspond with the subdivision of this unit into the Lower and Upper Radnice members. The two sub-units differ in their architecture. During the deposition of the Lower Radnice Member, the maximum base-level rise due to tectonic subsidence concentrated to narrow, SSW–NNE- or NW–SE-trending tectonic valleys occupied by main streams with high clastic input from extensive source areas outside the basin. These valleys are characterized by the maximum thickness (generally over 150 m, max. 270 m) and mostly coal-barren coarse-grained channel facies with poorly developed (?preserved) floodplain sediments interpreted as deposits of braided rivers with mixed gravel–sand load. Deposition in erosional valleys was characterized by lower rate of base-level rise and limited clastic input from much smaller source areas located on adjacent ridges. Finally, the succession of floodplain-dominated fluvial sediments, followed by two thick coal seams (Radnice Group), is terminated by lacustrine sediments deposited in most valleys. Fluvial sediments were deposited in a relatively stabilized fluvial system with high rate of aggradation.

Sedimentation of the Upper Radnice Member was characterized by generally lower base-level rise (A/S ratio) and lower influence of partly filled presedimentary paleotopography. No significant differences in thickness and character of deposition exist between the former tectonic and erosional valleys. Sediments of this sub-unit are represented by locally coal-bearing fluvial strata of various architectures. Most of the sub-unit is characterized by alternation of channel-dominated fluvial sediments with floodplain facies including coal seams of the Lubná Group. In its upper part, the proportion of floodplain sediments significantly increases due to rise in A/S ratio.

The Iapetus Ocean, Rheic Ocean and Avalonian Terranes in Central Asia

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The supercontinent of Pannotia was assembled during the latest Precambrian as a result of the Pan-African and Cadomian orogenies. Gondwana, Baltica, Siberia and Laurentia were included in this supercontinent. Laurentia, Baltica and Siberia drifted apart from Gondwana during the Late Vendian time (Torsvik et al., 1996). Their breakup led to the formation of new oceans. The Western Iapetus Ocean separated Laurentia from Gondwana. Central Iapetus was located between Gondwana and Baltica. The continents forming the core of Gondwana were: South America, Africa, Madagascar, India, Antarctica and Australia. The location of Chinese plates as well as numerous smaller continental blocks that bordered Gondwana is less certain (Golonka, 2000). Some of these plates perhaps rifted off Gondwana and drifted toward Siberia. The Eastern Iapetus was probably located between Gondwana and the plates (see Zonenshain et al., 1990) like Tuva-Mongolian, Tom, Barguzin and central Kazkhstan.

Advanced seafloor spreading occurred during the Cambrian. The width of the Iapetus Ocean reached 5000 km (Kent and Van der Voo, 1990). Subduction zone developed along the margin of Gondwana between Northwestern South America and the Chinese terranes. This subduction caused the onset of rifting of the Avalonian terranes during the Early Ordovician (Golonka et al., 1994).

The continent of Avalonia is traditionally believed to have consisted of northwestern and possibly southern Poland and their foredeep, terranes in northern Germany, the Ardennes of Belgium and northern France, England, Wales, southeastern Ireland, the Avalon Peninsula of eastern Newfoundland, much of Nova Scotia, southern New Brunswick and some coastal parts of New England. The Brunovistulicum terrane, some accreted terranes in the basement of East Carpathians, parts of the Scythian platform, parts of Kazakhstan and Southern Mongolia terrane could have constituted the eastern extension of Avalonia.

A large longitudinal oceanic unit, known as the Rheic Ocean, was formed between Gondwana and Avalonia. The Turkmen (Zonenshain et al., 1990) and Solonker (Sengör and Natalin, 1996) oceans in Asia constitute the eastern parts of this Rheic Ocean.

Sedimentary sequences in the Gobi desert area in Mongolia reflect the plate-tectonic development of Central Asia. A collision between microcontinents (Salairian orogeny) during Late Cambrian–Early Ordovician times in the Mongolia–Tuva area (Zonenshain et al., 1990) marked the onset of the formation of the Amuria (Mongolia) microcontinent. A thick pile was developed on the southern margin of this continent. With convergence of the South Mongolian terrane, these turbidites turned into synorogenic flysch and, later, into the Late Paleozoic shallow-water carbonate sequences. The collision of the North China plate and closure of the Solonker Ocean (Sengör and Natalin,1996) in the Permain concluded the orogenic process.

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Metadolerites of the Vrbno Group and their Origin, the Jeseníky Mts.

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Many occurrences of basic metavolcanic rocks described here as metadolerites (dolerites) lie between Úsov and Malá Morávka in the Jeseníky Mts. Metadolerites occur both as sills and dykes in the sequence of metasediments and metavolcanites of the Vrbno Group as well as in the rocks of the pre-Devonian crystalline complex. Their bodies are mostly elongated NE–SW, X to several X0 metres in thickness and several X0 to X00 metres in length. Metadolerites studied in borehole JR-10 form four bodies with the thickness of core of 4–21 m, with at least one of these bodies being unconformable to the main foliation (Valenta et al., 1987). In this borehole, metadolerites penetrate the lower part of the sedimentary sequence of Dobřečov Group, dated to the Givetian and Frasnian by Hladil (in Cháb et al., 1987).