

ONE DAY WORKSHOP

NEOGENE AND QUATERNARY STRATIGRAPHY ACTUAL TERMINOLOGY AND NOMENCLATURE

Belgrade, September 20, 2013

Programme & Abstracts



SERBIAN GEOLOGICAL SOCIETY

Commission on Neogene

Commission on Quaternary

Stratigraphy, Paleontology and Tectonics Division

LATE PLIOCENE VEGETATION FROM THE DRAVA RIVER FLOOD-PLAIN (NORTHERN CROATIA)

KORALJKA BAKRAČ¹ & JASENKA SREMAC²

¹Croatian Geological Survey, Sachsova 2, HR- 10000 Zagreb, Croatia, e-mail: kbakrac@hgi-cgs.hr

²University of Zagreb, Faculty of Science, Department of Geology, Institute of Geology and Palaeontology, Horvatovac 102 a, HR-10000 Zagreb, Croatia.

Pliocene deposits in the Drava River valley, near the town Virovitica in Northern Croatia contain plant megafossils and palynomorphs with characteristics of mixed mesophytic forest. Megafossils are scarce, but well preserved. Leaves and fructifications belong mostly to deciduous plants pollinated by wind. Collection includes one of the latest evidence of *Ginkgo* in Europe before the glaciation. Palynoflora partly coincides with megafossils, but shows wider variety of vegetation along the river basin. Arborescent and herbaceous components are both present and non-pollen grains are typical for fresh-water marshes within the flood-plain, in which all plant fossils were accumulated and preserved.

Pliocene clastic deposits with remnants of land flora in the Vicinity of Virovitica outcrop as erosional windows within the Pleistocene fine-grained loess and/or lacustrine-marsh silt and clay. They transgressive overly Pontian-Lower Pliocene Rhomboidea beds (Fig. 1) and were deposited during the 3rd depositional megacycle proposed by Saftić et al. (2003). During the basic geological mapping their age was interpreted as Late Pliocene – Early Pleistocene, due to the lack of fossils (Galović et al., 1981).

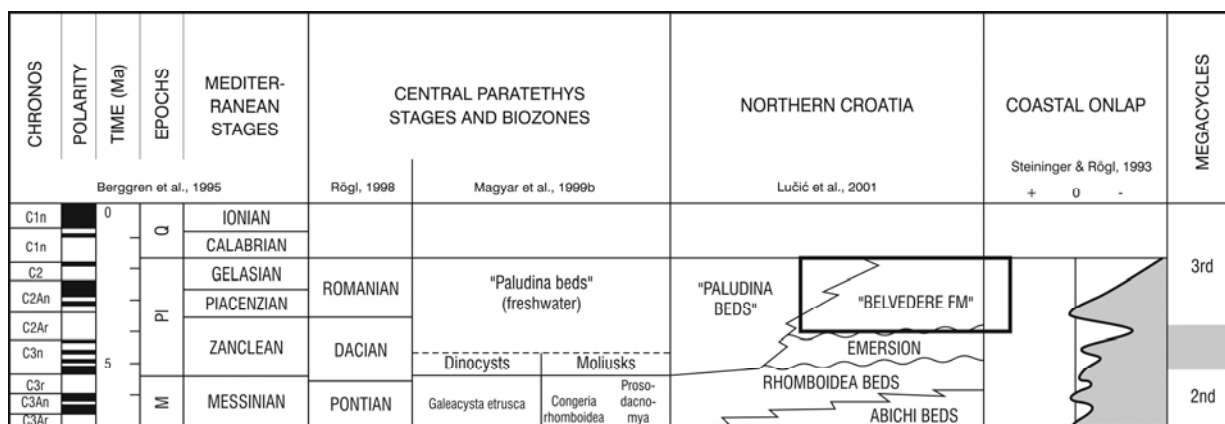


Fig. 1. Stratigraphy of Latest Miocene to Quaternary stages in Central and South-western Europe with local units in Northern Croatia published by Lučić et al. (2001) and megacycles proposed by Saftić et al. (2003) (modified after Popov et al., 2006; Janz & Vennemann, 2006). Position of clastic deposits with land flora is marked with a rectangle.

The best outcrops are present in quarries Rezovac, Cabuna and Bistrica south of the Drava River, between Virovitica and Podravska Slatina (Fig. 2).

Well preserved megaf flora was found in siltose clays in the vicinity of Virovitica. Mrinjek et al. (2006) published a short list of collected samples, noticing that megaf flora is well preserved, and dominated by maple leaves and hornbeam fructifications. During this research megaf flora from the vicinity of Virovitica was studied in detail. Thirty-five specimens were found in siltose clays. Twenty-six taxa were determined. The most diverse are fagaceans and betulaceans, represented by leaves and fructifications. Dicotyledonous leaves are the most common, often medium to small sized. Toothed leaves predominate over simply ovate forms. Dicotyledones: *Parottia*, *Liquidambar*, *Quercus mediterranea*, *Q. kubinyi*, *Myrica lignitum* and *Zelkova* represent relics of the Miocene warm period. Beech (*Betula* sp.) and alder (*Alnus julianaeformis* (Sternberg) Kvacek & Holly) were introduced in this area during the Late Pliocene cooling.

Maple and hornbeam are known as colonizers of unconsolidated soils. Maple leaves belong to the fossil species *Acer integrimum*, common in European Neogene deposits. *Ginkgo adianthoides* (equivalent of the recent *G. biloba*) was generally common in disturbed streamside and levee environments during the Cretaceous, Paleogene and Neogene (Del Tredici, 2000; Royer et al., 2003.). Escaping the unfavourable conditions during the glaciation it disappeared from Europe ca. 2.5 Ma ago. Megafloora from the vicinity of Virovitica shows significant similarity with other Late Miocene and Pliocene floras from Europe.

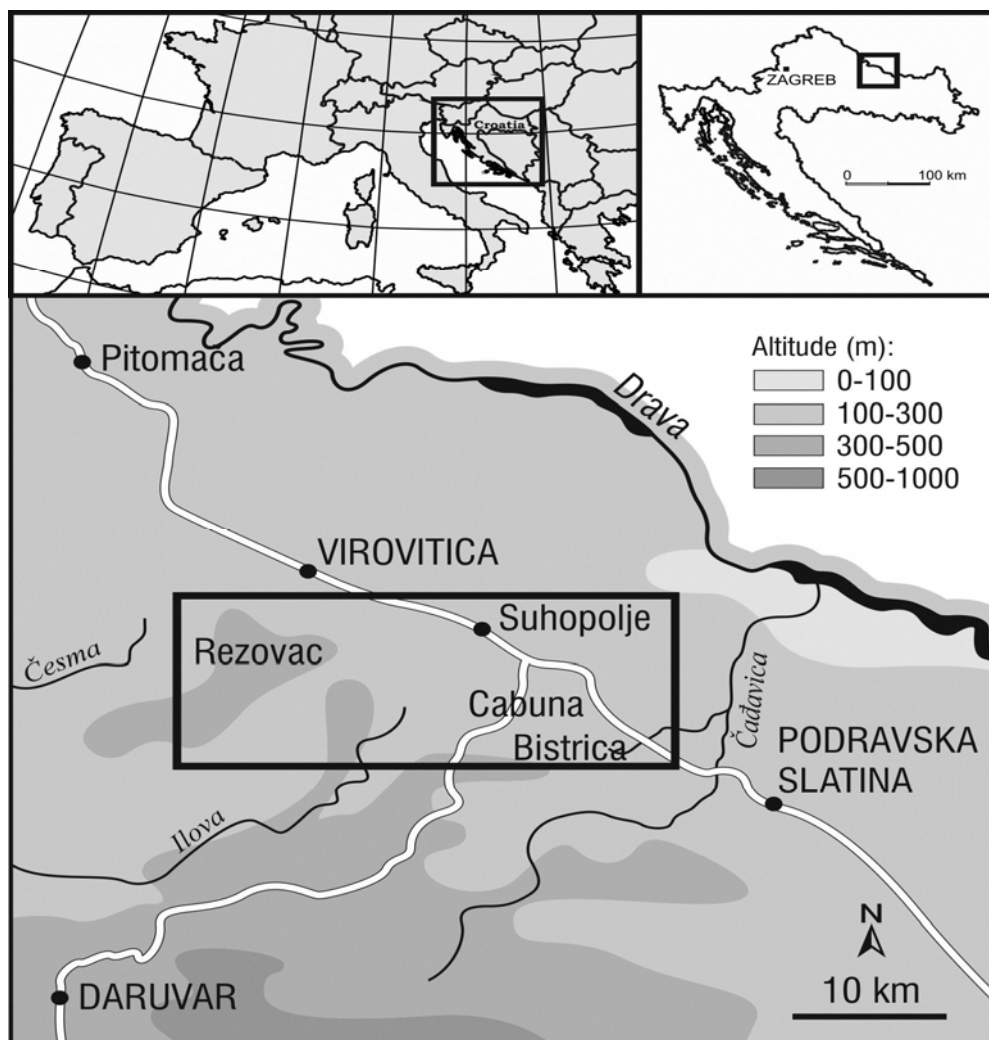


Fig.2. Map of the studied area with recent altitudinal belts (Atlas of Croatia, 1:100 000; 2002; modified).

Palynomorphs were extracted from the same clay samples from the vicinity of Cabuna, which contained the best preserved megafossils. Percentages of pollen taxa were calculated based on the complete pollen assemblage. Taxa have been grouped according to their ecological significance with respect to the Nix's (1982) classification: (1) *Cathaya*, an altitudinal conifer living today in Southern China; (2) Mesothermic (i.e. warm-temperate) elements (deciduous *Quercus*, *Carya*, *Pterocarya*, *Carpinus*, *Ulmus*, *Liquidambar*, *Myrica*, *Tilia* and *Fagus*) (3) *Pinus* and poorly preserved Pinaceae pollen grains; (4) microthermic (i.e. high-altitude) trees (*Abies* and *Picea*); (5) non-significant pollen grains (undetermined, poorly preserved pollen grains); (6) Mediterranean xerophytes (evergreen *Quercus*) and (7) herbs and shrubs (Asteraceae Asteroideae, Asteraceae Cichorioideae, Chenopodiaceae). There are no megathermic (i.e. tropical) elements, mega-mesothermic (i.e. subtropical) elements, Cupressaceae and steppe, while meso-microthermic (i.e. mid-altitude) trees (*Tsuga*) are sporadic. There are some non-pollen palynomorphs (NPP) that indicate the deposition within a flood-plain (freshwater marshes and oxbow lakes).

Megaflora from the Late Pliocene deposits of Drava river basin is well preserved, with no

fragmentation and/or size selection, which excludes long transportation and high water energy. The vegetation along the Drava river was organized in altitudinal belts. Considering the ecological needs of collected taxa, palaeovegetation from the vicinity of Virovitica dominantly belongs to a lower horizon of an evergreen and deciduous mixed forest, today growing above 700 m altitude. Within this vegetation the following arboreal taxa appear: *Quercus*, *Fagus*, *Carpinus* and *Acer*. Riparian vegetation of this horizon is composed of *Alnus*, *Carya*, *Ulmus* and *Liquidambar*. The shrub level was dominated by Asteraceae (Asteroideae and Cichorioideae) and Chenopodiaceae. Freshwater marshes and oxbow lakes contain algal remains, and ferns in marginal parts. *Myrica* is a component of a broad-leaved evergreen forest, present from coastal plains to 700 m, while *Betula*, *Fagus*, *Pinus*, *Cathaya* and *Tsuga* belonged to a mid-altitude deciduous and coniferous mixed forest. Finally, above 1800 m in altitude, a coniferous forest with *Abies* and *Picea* existed.

References

- Del Tredici, P. (2000). The evolution, ecology, and cultivation of *Ginkgo biloba*. In: Vanbeek, T. (Ed.): *Ginkgo biloba*. Harwood Academic, Amsterdam. 7–24.
- Galović, I.; Marković, S. & Magdalenić, Z. (1981). Osnovna geološka karta SFRJ 1:100000. Tumač za list Virovitica, L33-83 (Basic Geological Map of Yugoslavia – Explanatory notes for Sheet Virovitica, L33-83). Inst. Geol. Istraž., Zagreb, Savezni geol. Zavod, Beograd, 44 p.
- Janz, H. & Vennemann, T.W. (2006). Isotopic composition (O, C, Sr, and Nd) and trace element ratios (Sr / Ca, Mg / Ca) of Miocene marine and brackish ostracods from North Alpine Foreland deposits (Germany and Austria) as indicators for palaeoclimate. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 226, 216-247.
- Lučić, D., Saftić, B., Krizmanić, K., Prelogović, E., Britvić, V., Mesić, I. & Tadej, J. (2001). The Neogene evolution and hydrocarbon potential of the Pannonian Basin in Croatia. *Marine and Petroleum Geology*, 18, 133-147.
- Mrinjek, E., Sremac, J. & Velić, J. (2006). Pliocene Alluvial Sediments in the Drava Depression of the Virovitica-Slatina Area, Northern Croatia. *Geologia Croatica*, 59/1, 65-84.
- Nix, H. (1982). Environmental determinants of biogeography and evolution in Terra Australis. In: Barker, W.R. & Greenslade, P.J.M. (Eds.): *Evolution of the Flora and Fauna of Arid Australia*. InPeacock Publ, Adelaide, 47–66.
- Popov, S. V. Shcherba, I.G. Ilyna, L.B. Nevevskaya, L.A. Paramonova, N.P. Khondkarian, S.O. & Magyar, I. (2006). Late Miocene to Pliocene palaeogeography of the Paratethys and its relation to the Mediterranean. *Palaeogeography, Palaeoclimatology, Palaeoecology* 238/1-4, 91-106.
- Royer, D.L., Hickey, L.J. & Wing, S.L. (2003). Ecological conservatism in the "living fossil" *Ginkgo*. *Paleobiology* 29/11, 84-104.
- Saftić, B., Velić, J., Sztanó, O., Juhász, G. & Ivković, Ž. (2003). Tertiary Subsurface Facies, Source Rocks and Hydrocarbon Reservoirs in the SW Part of the Pannonian Basin (Northern Croatia and South-Western Hungary). *Geologia Croatica* 56/1, 101-122

The Serbian Geological Society acknowledged support and sponsorship provided in 2013 to the following companies:

Hidro-geo rad d.o.o.

Geosfera d.o.o.

InSitu d.o.o.

The workshop was organized with the support of:



ПРИВРЕДНА КОМОРА СРБИЈЕ
CHAMBER OF COMMERCE AND INDUSTRY OF SERBIA

Chamber of Commerce and Industry of Serbia



Republic of Serbia
Ministry of Education, Science and Technological Development

ISBN 978-86-86053-13-8