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Miocene Syn-Rift Evolution of the North Croatian Basin (Carpathian-Pannonian Region): 2. Initial Central Paratethys Flooding and Mt. Požeška Gora Case Record

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The spatial and temporal evolution of the Paratethys Sea during the Early to Middle Miocene, as well as the chronologic framework to disentangle geodynamic and climatic processes affecting the depositional environments, is still not resolved (HILGEN et al., 2012; de LEEUW et al., 2018; SANT et al., 2017; KOVÁČ et al., 2018). Covering almost the entire area of northern Croatia and situated southeast of the Hrvatsko Zagorje Basin (HZB; AVANIĆ, 2012), North Croatian Basin (NCB; PAVELIĆ & KOVAČIĆ, 2018) evolved during the Early Miocene, and belongs geo-tectonically to the south-western margin of the Pannonian Basin (PB, part of Carpathian-Pannonian Region, CPR; HORVÁTH et al., 2015; BALÁZS et al., 2016). Typical syn-rift sedimentary successions of the initial basal Lower-Middle Miocene (Ottnangian-Lower Badenian according to PAVELIĆ & KOVAČIĆ, 2018 and references therein) NCB comprise continental, alluvial and lacustrine (Southern Pannonian Basin Lake System, SPBLS *sensu* MANDIC et al., 2019a) sediments unconformably overlying a strongly tectonized basement. According to ĆORIĆ et al. (2009), MANDIC et al. (2012, 2019a, 2019b), MARKOVIĆ (2017) and PAVELIĆ & KOVAČIĆ (2018 and references therein), initial Miocene marine flooding of the NCB corresponds to the main Badenian (Middle Miocene) transgressive pulse of Central Paratethys, that is Middle Badenian (NN5 Zone, TB 2.4 after HOHENEGGER et al., 2014). These recent studies are based on radiometric dating ($^{40}Ar/^{39}Ar$ dating) of the pyroclastic horizons (intercalated with alluvial, lacustrine and marine NCB deposits; MANDIC et al., 2012; MARKOVIĆ, 2017) and integrated biostratigraphy, which constrained the age of Lower-Middle Miocene NCB deposits analyzed therein (e.g., Mts. Medvednica and Papuk localities).

However, according to BRLEK et al. (2018), the exact timing of the initial Early-Middle Miocene flooding of different parts of NCB, necessary for reconstructing Early-Middle Miocene stratigraphic evolution of the NCB (e.g., PAVELIĆ & KOVAČIĆ, 2018), is still unresolved due to:

1/ sparse and uncomprehensive integrated calcareous plankton biostratigraphic determinations of Lower-Middle Miocene NCB marine sediments which are insufficiently calibrated (together with lacustrine sediments) with high-precision geochronological

studies (especially necessary in semi-enclosed Paratethys Sea; HILGEN et al., 2012; SANT et al., 2017; KOVÁČ et al., 2018),

2/ absence of uniform biostratigraphic zonation and regional Early-Middle Miocene chronostratigraphic (and sequence stratigraphic) division of Central Paratethys (e.g., HARZHAUSER & PILLER, 2007; PILLER et al., 2007; HILGEN et al., 2012; HOHENEGGER et al., 2014; SANT et al., 2017; KOVÁČ et al., 2018), especially of Early/Middle Miocene boundary, as well as of Karpatian and Badenian regional stages (HOLCOVÁ et al., 2018; KOVÁČ et al., 2018). This prevents reliable stratigraphic correlation to be made based solely on biostratigraphic data. As well,

3/ assumption that initial transgression may be diachronous across the NCB (as it is diachronous across the southern margin of Pannonian Basin and across other Central European basins; MANDIC et al., 2012, 2019b; SANT et al., 2017) and/or that different parts of NCB could have been initialy flooded during different Early-Middle Miocene transgressive pulses of Central Paratethys (MANDIC et al., 2012, 2019b; SANT et al., 2017; HERNITZ KUČENJAK et al., 2018; KOVÁČ et al., 2018).

Excellent Mt. Požeška gora (Slavonian Mts. complex, Croatia) outcrop conditions (Croatian Geological Survey data) enable analysis of continuous transition from basal NCB Ottnangian–Karpatian alluvial coarse-grained deposits ("Daranovac unit") with aeolian siltstones, through Lower Badenian SPBLS brackish-lacustrine deposits ("Košćević unit"; HAJEK-TADESSE et al., 2009; MANDIC et al., 2019a) into Middle Badenian Central Paratethys marine deposits (offshore marls – "Vejalnica unit") with intercalated pyroclastics (ŠPARICA et al., 1979, 1980; PAMIĆ, 1997; HAJEK-TADESSE et al., 2009). However, the above mentioned stratigraphic ranges (KOVAČIĆ & PAVELIĆ, 2017) are uncertain. Therefore, integrated biostratigraphic (calcareous plankton) and high-precision geochronological (EARTHTIME initiative) studies are being conducted on Mt. Požeška gora marine and pyroclastic deposits. Determination and constraint of the age (time-stratigraphic correlation), stratigraphic relationships, and time-framed palaeoenvironments of Mt. Požeška gora deposits should:

1/ provide clues for the timing of the Central Paratethys initial transgression in the NCB,

2/ add new high-resolution data necessary for reconstructing Early–Middle Miocene syn-rift stratigraphic evolution of the NCB (with potential tectono-eustatic implications),

3/ provide new high-resolution data required for calibration and synchronization of NCB and in general Central Paratethys biostratigraphic zonation scheme(s)/bioevents, and

4/ provide Central Paratethys and Pannonian Basin chronostratigraphic (and sequence stratigraphic) implications.

Keywords: *Miocene, North Croatian Basin, transgression, time-stratigraphic correlation, Central Paratethys*

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Sedimentary Record of the Submerged Late Quaternary Paleoenvironments Preserved in a Silled Karst Basin (Lošinj Channel, Adriatic Sea)

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Submerged paleoenvironments have become a popular topic among the scientific community due to their relevance for the interpretation of the future sea level and climate changes and the assessment of coastal flooding. Numerous present-day shelf seas were formed by marine transgression after the Last Glacial Maximum (LGM) and have transitioned from terrestrial to marine environment and vice versa multiple times during the Quaternary glacial-interglacial cycles. Adriatic sea was no exception. Here we present the results of a comprehensive research conducted in the submerged Lošinj Channel basin, located between the islands Cres and Lošinj in the northern part of the eastern Adriatic coast. Two sediment cores (LK-12, LK-15) were extracted and analyzed in detail. The combined measurements of magnetic susceptibility, grain size, mineralogy and geochemistry (XRF core scanning, total nitrogen, organic and inorganic carbon) were performed. Paleontological data and AMS ^{14}C dating results enhanced interpretation of the obtained sediment core data. High-resolution seismic methods gave us an additional insight into the sedimentary infill of this nowadays submerged basin. Investigated sediment succession in the Lošinj Channel revealed significant paleoenvironmental changes in relation to the Lošinj Channel sill depth (-50 m) and the Late Quaternary sea level and climate changes.

Our findings include the first detailed reconstruction of the presumed MIS 5a marine sediment sequence along the eastern Adriatic coast and the existence of an isolated