MECHANISM OF THE LAND-SEA INTERACTIONS IN THE NERETVA RIVER DELTA (CROATIA): THE DISTRIBUTION PATTERN OF SEDIMENTS AND TRACE ELEMENTS

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Abstract
This study, for the first time, examines the transport of sediments, their longitudinal distribution pattern, and their role in disposal of metals in river-dominated deltaic depositional system of the Neretva River and its adjacent coastal region. The results have shown that longitudinal distribution of metals in sediments follows the deposition pattern of the river-borne clayey mineral particles. The highest concentration of metals was found in the semi-enclosed area of the Neretva Channel. This region is characterized by deposition of fine-grained particles and prevalent accumulation of metals. This study exemplifies the role of Fe oxide and oxyhydroxide coatings on the clay mineral surfaces as a major factor in the adsorption and deposition pathways of trace elements.
Keywords: Adriatic Sea, Sediments, Trace Elements

Study Area
The Neretva River is the largest river on the Croatian part of the eastern Adriatic coast, and the only one forming a deltaic system. The length of the river is 240 km with the catchment area of about 10,100 km^2 [1]. Most of the sediment load carried by the river originates from the mountain region in the upper part of drainage area. At the river mouth, Neretva discharges its water into a semi-enclosed narrow bay called the Neretva Channel.

Materials and Methods
The field surveys in the Neretva delta and its adjacent coastal region were conducted in May and October 2009. Sediment cores up to 50 cm long were retrieved using Uwitec gravity corer at locations marked in Figure 1. The sediments were analysed in order to determine mineral composition, grain size distribution, SSA, CEC, and the concentration of trace elements.

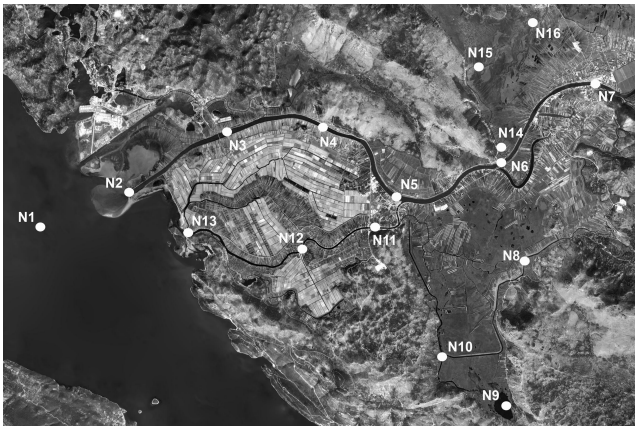

Fig. 1. The Neretva River delta system showing the sampling stations.

Results and Discussion
The Neretva River and its mouth provide a good example of the biogeochemical land-sea interactions occurring in a microtidal, low-wave energy, and river-dominated deltaic environment of the eastern Adriatic coast. As a result of a simple sedimentation dynamic, the distribution pattern of trace elements can be easily determined. According to Shepard's classification scheme [2] and the ratios of different grain size fractions, obtained by granulometric analyses, the surface sediments along the investigated area, were classified as sandy silts and silty sands with variable content of clay ranging from 1 to 12 %. All sediments were composed of quartz, calcite, dolomite, clay minerals, and feldspar and plagioclase. A significant difference in distribution of clay minerals was found. Their share is significantly higher in the adjacent coastal area, especially at the sampling station N1. The concentrations of metals showed a prevalent accumulation in the fine-grained, clayey fraction. Numerous studies have shown that clay minerals are important vehicles of transport of trace metals [3, 4]. They are involved in simultaneous and complex physico-chemical interactions with metal ions, organics, and iron and manganese oxides and oxyhydroxides. The latter, in the form of surface coatings, have significant impact on the adsorption, transport and deposition of metals. Figure 2 shows good correlation between content of Fe and the concentrations of Pb, Cu, Ni, and Co, in surface sediments. Accordingly, the distribution pathways of these metals are mainly governed by their direct binding on clayey particulate surfaces and/or on co-precipitated inorganic coatings.

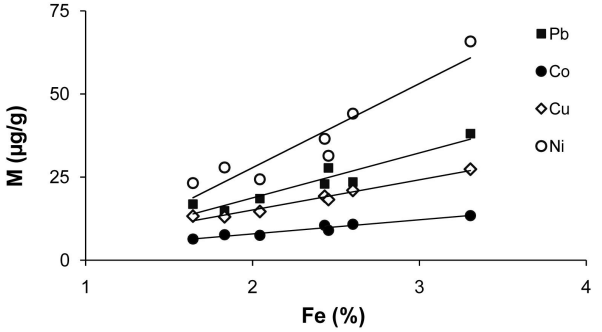

Fig. 2. Concentrations of trace metals (M) *vs*. Fe content in the surface sediments of the Neretva Channel (N1) and the Neretva River (N2-N7).

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