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DEPOSITIONAL ENVIRONMENT OF THE DANUBE-TISZA-DANUBE HYDROSYSTEM OF SOUTHERN BANAT OBTAINED FROM SOME PARAMETERS OF METAL ADSORPTION IN WATER

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ABSTRACT

An increasingly demand for meliorative action of Southern Banat region was evaluated by the parameters of adsorption of alkaline and heavy metals from suspended particles of the DTD canal water. Annual dynamics is categorized by statistical analyses, recognized trends of sodium absorption ratio and a concentration of iron in total suspended solids. All these provide preliminary informational basis for irrigation, flood areas and transportation determination. Environmental protection of these waters is required because iron and sodium are present in alluvial deposits, and the sodium is gradually increasing. EDS informative data pointed out metals (aluminum, titanium, zinc, iron) in alluvium of the Danube.

Key words:
SAR, Fe/TSS, adsorption, Box-plot, South Banat, DTD hydrosystem

1. INTRODUCTION

Large river transportation of loess material includes the loessification process which converts deposits. The building of dames and gates, and channelization of rivers slowly influnced on transportation of metals during sedimentation at the reduced river flow [2, 6, 7, 11, 12]. Meliorative canals could cause displacement of bio-activity of the soil of agricultural Vojvodina Province [5,9]. Therefore, in this paper, the movement of metals was observed from the assessment of metal adsorption in water from the index of sodium alkalization ratio- SAR and ratio of iron in total suspended solids- Fe/TSS.

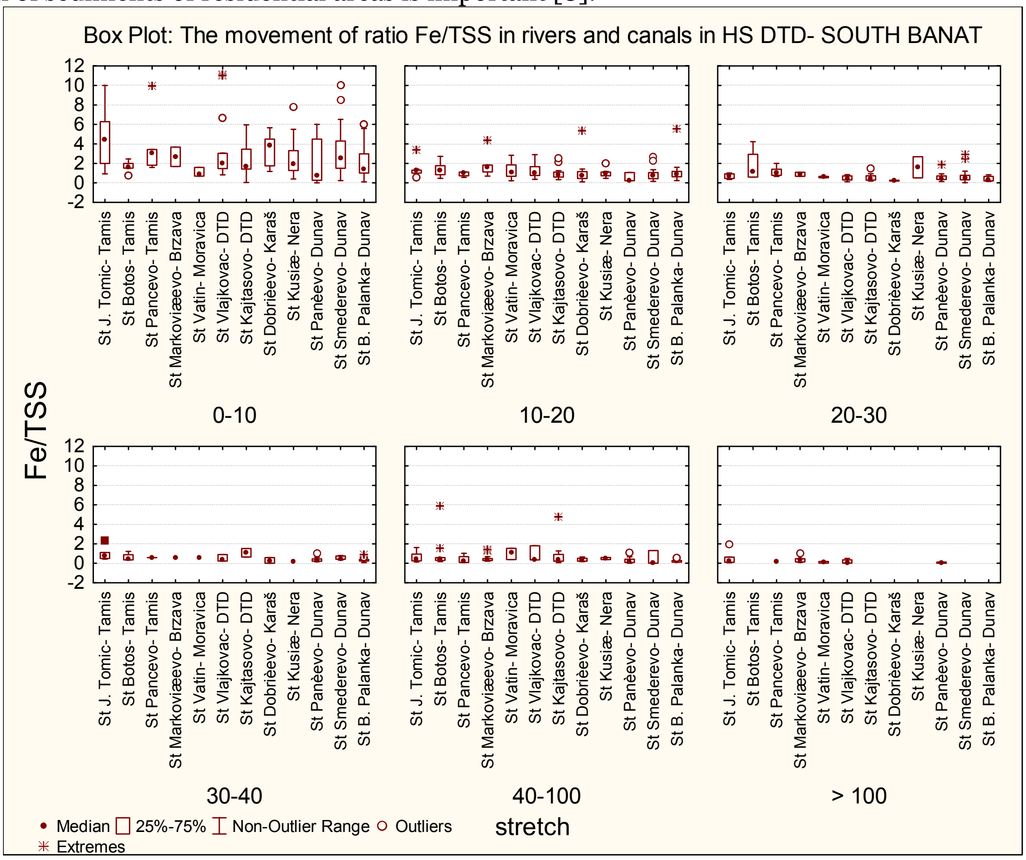
2. MATERIAL AND METHODS

Our model to study progress of alkalization of waters in Southern Banat region from continual monitoring of the Danube-Tisa-Danube hydrosystem is represented. The SAR index- sodium adsorption ratio in miliequivalents- $SAR = Na/\sqrt{(Ca+Mg)/2}$, was calculated according to guidelines for interpretations of irrigation water quality [1, 3] and the amount of iron in suspended material Fe/TSS from concentration in mg/l [2], and bioindicators [5, 9]. Integrating data are taken from Hydrological yearbooks [4].

Deposit analysis of the groundwater drainage wells was made by the use of Scanning Electron Microscope (SEM) JEOL JSM-6460 L. The EDS pattern of elemental composition (total wt %) were recorded on an OXFORD INCA Microanalyses suite and presented in diagram. A spatial framework for collecting, storing, and classifying information on the character of river network was proposed using the software Stat.soft Statistica 8 [13].

3. THE RESULTS AND DISCUSSION

Following categorization of indices and conductivity in suspended material in BLOCKS (Figs. 1-5), the ratio of iron in total suspended solids increased during the lowest concentration of solids estimated in rivers Tamis, Brzava and Moravica in the Tamis river basin. Hence, the tributaries of Great canal Banatska Palanka-Novi Becej were investigated and categorized with elevated suspended solids- an increased sedimentatation obtained from the comparison of values with the The Danube in Southern Banat (St Pančevo- at the confluence of the Tamis river, downstream St Smederevo, St Banatska Palanka- at the confluence of canal network in Banat). Near the Botos- the gate of The Tamis and DTD hydrosystem, the movement of iron in total suspended solids was narrow. Previously, the fraction of iron in total suspended solids was obtained from The Sava River in Croatia pointed out by author- median 3 % [2], while in The Danube River it stretches through 1-3 % of median values. The integrating data of the small eutrophic Moravica river pointed out 3 % median of Fe/TSS ratio and there was the smallest fraction of the iron in suspended solids obtained from a decade of the research but comparable to acceleration of alkaline metal adsorption in 2005 of depositional environment. The sedimentation of iron is clarified in the samples of The Karas River when the concentration od suspended solids was in the range 0-10 mg/l (Figs. 1-2). From this point of wiew, the importance of research of sediments of residential areas is important [8].



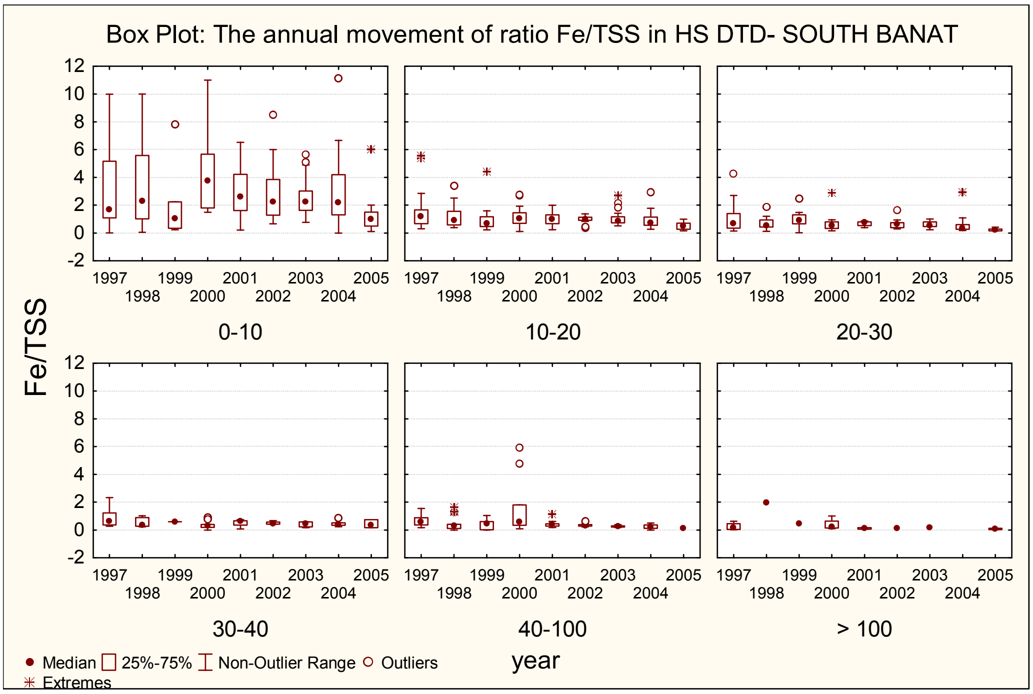


Figure 1-2. Box-plot graphs of ratio of iron in total suspended solids categorized in annual dynamics of data and stretches obtained from HS DTD of Southern Banat Region

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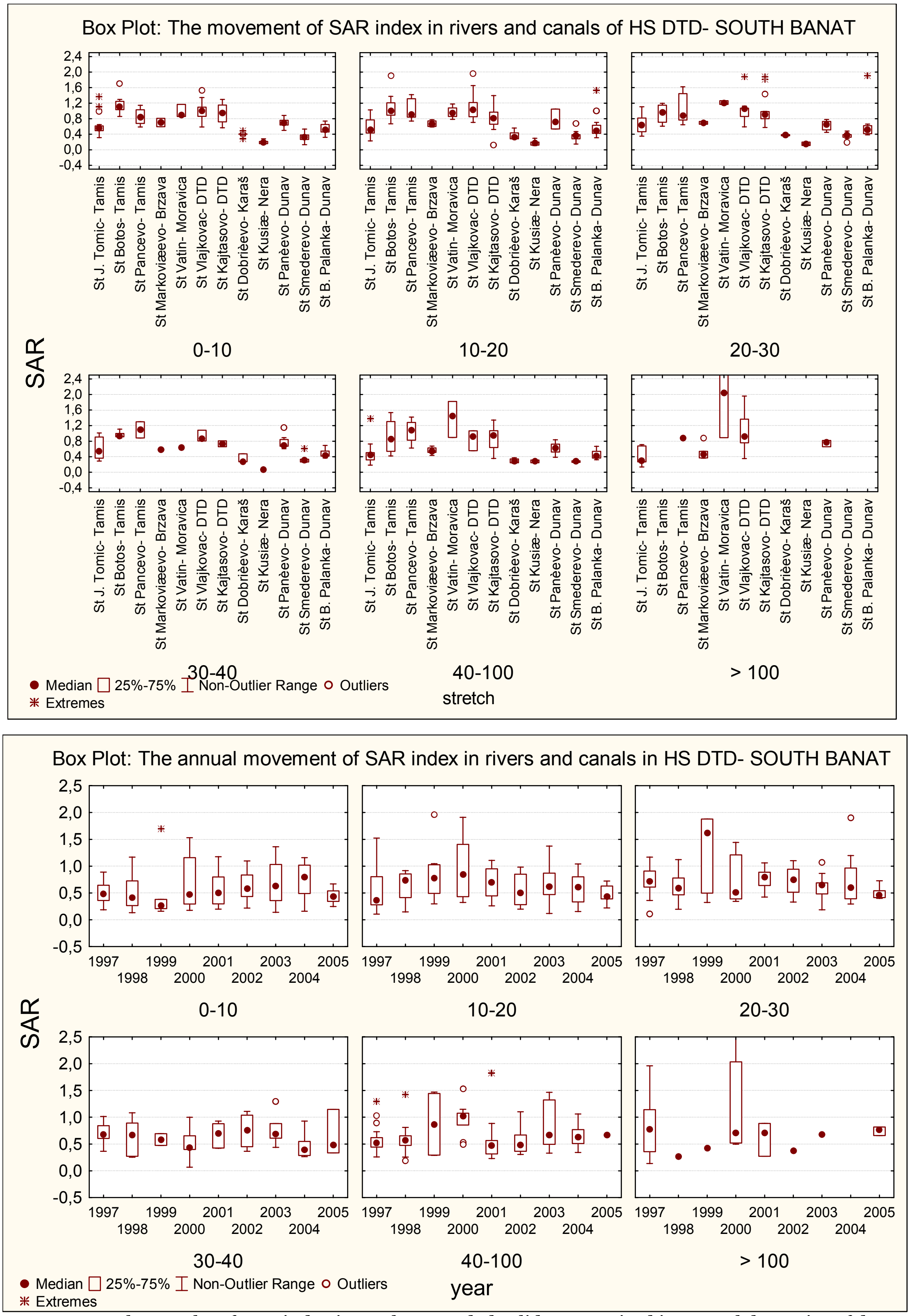

Figure 3-4. Box-plot graphs of SAR index in total suspended solids categorized in annual dynamics of data and stretches obtained from HS DTD of Southern Banat Region.

The equality of means of metal adsorption parameters downstream the main gates of the Tamis River hydrographic unit (Tamis, Brzava and Moravica) and southern tributaries of The Danube- Karas and Nera were tested by ANOVA (Fig. 7). Obtained from standardized values of the SAR index and ratio of iron in total suspended solids, the similiar values are evaluated in the rivers Tamis, Nera and The Danube River nearly The St Smederevo (correlation of the phosphates with the SAR index pointed out the level of erosion). The confluence of phosphates, obtained from standardized values, was higher

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at the localities St Jasa Tomic- Tamis River, St Markovicevo- Brzava, St Kusić- Nera and St Smederevo- The Danube during the period 1997-2005. The comparison of parameters Fe/TSS and SAR index is showing the similiar variability at the same localities 1997-2005 while the negative standardized values were observable at the boundary Station Jasa Tomic- Tamis River, Brzava, Nera and St Smederevo- The Danube (Figs. 1- 7).

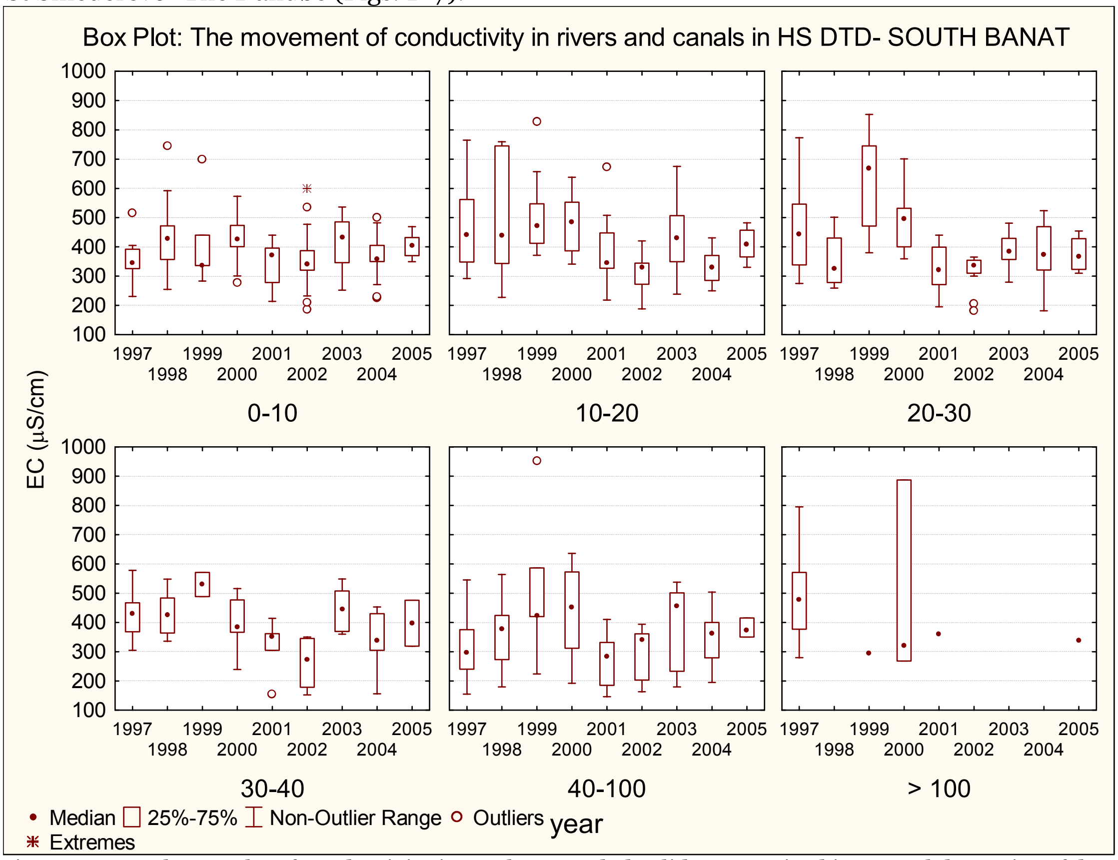

Figure 5. Box-plot graphs of conductivity in total suspended solids categorized in annual dynamics of data obtained from HS DTD of Southern Banat Region

The consequence of seasonality between November-February from weather warming generated high water because of snow melting after cold period in February of 1999 when the huge quantity of precipitation in Bega river basin contributed in high water level [10]. During the same period of high water in hydrographical basin of the Tisza and The Danube River, the weather in Ukraine triggered increasing of cezium in The Danube [7]. Taking responsible activities of Romania-Serbia engineers: hydroelectrical interventions, retention and distribution of water in Banat region are concerned for the next decade.

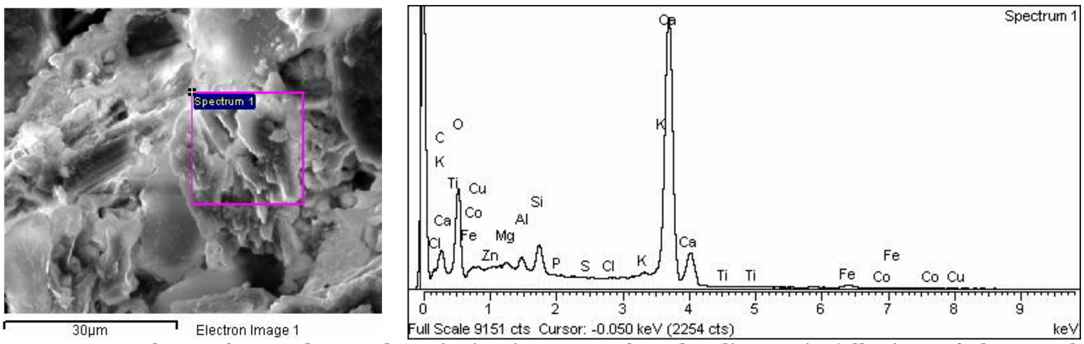

Figure 6. EDS analyses of groundwater deposits in piezometer from locality Kovin (alluvium of The Danube in Southern Banat nearby St Smederevo) (December, 2007). Elemental composition in wt %: O: 61.09, Al: 1.20, Si: 2.46, P: 0.00, K: 0.47, Ca: 33.11, Ti: 0.00, Fe: 1.05, Zn: 0.00, Cl: 0.00, Mg: 0.62, S: 0.00, Co: 0.00.

Integrating data of iron and alkaline metals of Danube-Tisza-Danube hydrosystem pointed out depositional environment (Figs. 1 - 8). The alteration of indices was observed in drought 2000 year. Obtained through the dynamics of metals in alluvion of Carpathian rivers entering Serbia, there was measured the highest concentration of metals and conductivity during sedimentation in DTD

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hydrosystem in Banat region in 2000. The concentration of copper significantly increased during the drought 2000 year, but the metal reduction gradually decreased in rainy year 2001 [4]. After the high erosion of water, the movement of metals in DTD hydrosystem could be categorized as C 3 - S 1 – good irrigation water quality of meliorative hydrosystem. The study of biodiversity of algae in southern Banat indicated good ecolological potential compared with the brackish water diatoms such as *Entomoneis paludosa* and *Bacillaria paradoxa*. The prominent algae of Banat from genus *Cymbella* thrive in canals during the low iron content (Fig. 8).

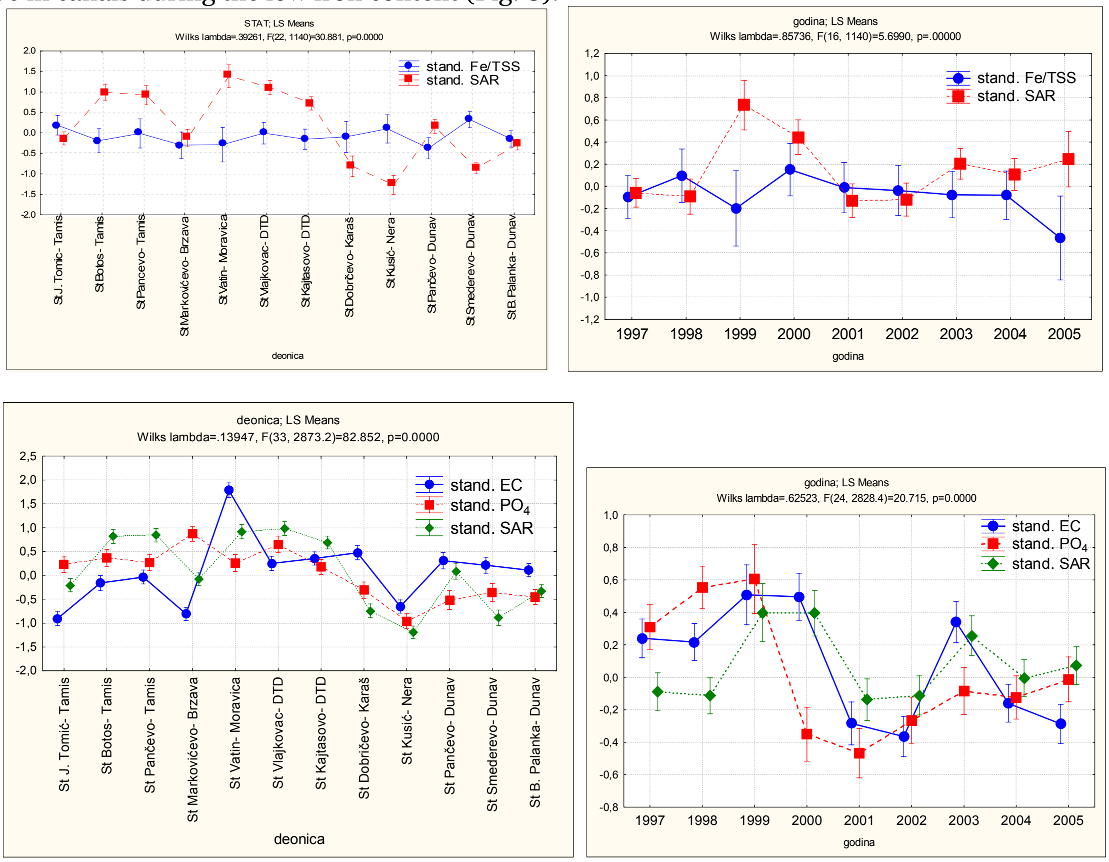

Figure 7. Equality of means was tested by ANOVA for standardized parameters: SAR index, ratio Fe/TSS, phosphate concentration and conductivity

4. CONCLUSION

In general, picture of the relations of some metals obtained through indices of alkalization and corrosion- the ratio of iron during sedimentation is represented in box-plot categorized graphs- „BLOCKS“ of rivers of Southern Banat. Because of the movement of metal adsorption in hydrosystem, considering gradual alkalization of surface and groundwater water, during the lowest concentration of suspended material, an attention is given to changes of Danube-Tisza-Danube hydrosystem water quality.

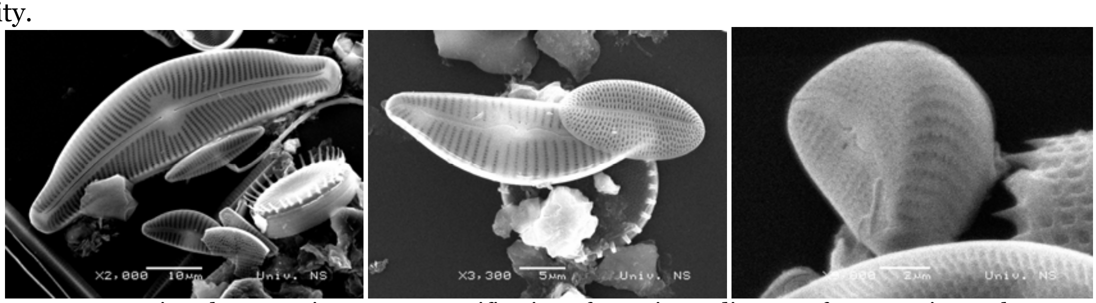

Figure 8. Scanning electron microscopy magnification of prominent diatoms of HS DTD in southern Banat region in 2004 (genus *Cymbella* with centric diatoms). Genus *Cymbella* thrive in canals with low iron content.

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