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## Distribution of Fe, Mn, Zn and As in groundwater of Slavonia and Baranja Region - Croatia

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Contamination of groundwater by heavy metals due to agricultural, industrial and mining activities is becoming increasingly present worldwide yet in the Slavonia and Baranja regions of Croatia high

concentrations of heavy metals in the groundwater are geogenic in origin. Slavonia and Baranja are situated in the Pannonian Basin, bordered by the three large rivers: Danube, Drava and Sava. (Fig.1). On the western part of the region Slavonian Mountains surround the Požega Valley whereas the Sava and Drava valleys and Đakovačko-vinkovački plateau lie to the east. It is mainly agricultural area where crop production prevails. The largest town is Osijek (Fig.1).



*Fig.1: Position map of research area (from <http://www.croatia-official.com/Travelling-to-Slavonia.html>)*

The region includes three groundwater bodies: i) The catchment of Orłjava river; ii) East Slavonia – catchments of Drava and Danube rivers and iii) East Slavonia – catchment of Sava river. Aquifers of intergranular porosity are a dominant source of drinking water for public water supply and only small portion of water is captured from carbonate aquifers situated in mountainous regions. Aquifer systems of intergranular porosity are of Quaternary age and composed of alluvial sediments deposited by Sava, Drava and other smaller rivers and creeks. Swamp and lake sediments occur as well. Most of the region is overlain by relatively thick, low permeable deposits forming an aquitard, except in Požega valley where these deposits are thin. High concentrations of Fe, Mn, Zn and As are widely present in aquifer systems with intergranular porosity. The data from National monitoring network, which is under surveillance of Croatian Waters, were analysed for the period 2005 – 2013. Concentrations of Fe, Mn, Zn and As exceed the Maximum Contaminant Level (MCL) at most observation wells. The Croatian Drinking Standard for Fe, Mn, Zn and As are: 200 µg/L; 50 µg/L; 3000 µg/L; 10 µg/L [1]. At four pumping sites (Luke, Zapadno polje, Istočno polje and Vesela) which are situated in Požega valley, two of them (Luke and Zapadno polje) have only high Mn concentrations that exceed MCL while others have lower values. Fe, Zn and As concentrations are very low. However, at other pumping sites, concentrations of all four metals - Fe, Mn, Zn and As, often exceed MCL. A connection between agricultural activities and metal concentrations has not been proved. Hydrogeochemical modelling using PHREEQC showed that the sources of heavy metals are sulphides, hydro/oxides and organic matter, suggesting that the high concentrations are consequence of environmental enrichment. The origin of high concentrations of metals has been recently investigated by other researchers [2] and they too point to a geogenic origin.

*References:*

[1] Official Gazette (2013) OG 125/13

[2] Ujević et al. (2010) Applied Geoch. 25:1017–1029

