



Sea water intrusion in coastal karst aquifers in Bakar Bay in Croatia

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Karst area of the Dinarides builds the south part of Croatian territory, what means the whole Adriatic coast and about the thousand of islands. Besides protection of very vulnerable karst aquifers in the continental part of large catchment areas, the main problems of coastal karst springs are the significant influence of the sea during summer dry periods, so many coastal springs are salinized. Karstification of carbonate rocks in the coastal zones is about 150 m deeper than the recent sea level and the underground flow path has been opened for the intrusion of specific heavier sea water, on some places very deep in aquifers. Deep karstification is the consequence of the sea level changes in geologic past. For this presentation have been chosen two examples in Bakar bay near Rijeka, which are slightly different due to the geologic conditions. There are two separated parts of the same aquifer, which have some differences in the discharge zone concerning the model of the fresh-salt water relation. In both cases the important hydrogeological role have the impermeable layers of Paleogene flysch sediments, which are deeply eroded, so the fresh water is in direct contact with sea water. Both springs are captured for water supply (300 l/s) and important for further development of the water supply system in the northern Adriatic area.

Spring Perilo is the example of relatively narrow contact between fresh and salt waters and what is important to emphasize with the continuous presence of salt water in deep part of the aquifer. During summer dry seasons fresh-salt water transition zone gradually rise towards the capture gallery and the final result is the complete salinization of the aquifer and nature spring zone on the coast. The reason is usually effects of uncontrolled overexploitation of the fresh water system. There are the projects of cutting the

direct contact of fresh and sea water by underground grouting curtain, but this is risky and very expensive project, which is waiting for some better time. For this moment has been constructed just the control system of transition zone using piezometric bore hole deep 200 m with monitoring instruments along the bore hole, what can be the control mechanism for the exploitation rate.

The second example is Dobrica spring, which is the kind of submarine spring in karst underground. Below the fresh water system is the sea water, through which discharge the fresh water from a deep tectonic shell of karstified limestone inside the impermeable flysch sediment. During summer dry seasons the fresh water pressure are lower and the capture from time to time salinized. By detail research has been defined the depth position of the aquifer and control system of the position of transition zone. Due to defined natural condition it is possible to construct the new capture system outside of the sea influence zone.

With these two examples we want to point the specific problems of coastal karst aquifers, which is very often present in the Mediterranean countries. Direct measurements in coastal aquifers and hydrogeochemical methods are very effective tools in the forecasting the events of salinizations. Special problems for normal functioning of coastal karst aquifers in future could be the global climatic changes, because the expected growths of sea level can essentially make worse the existing very sensitive balance.