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Studies and projections of hydraulic conductivity of Devonian Plavinu and Daugava carbonate aquifers in Latvia

E. Pērkone, A. Dēliņa, T. Saks, B. Raga, J. Jātnieks, I. Klints, K. Popovs, A. Babre, J. Bikše, A. Kalvāns, I. Retiķe, and J. Ukass

Faculty of Geography and Earth Sciences, University of Latvia, Riga, Latvia (el.perkone@gmail.com)

Carbonate aquifers show a very wide range of hydrogeological characteristics. Carbonate rock hydrogeology display two extremes: on one hand hydrogeological properties of the carbonates are governed by the pathways of the preferential groundwater flow typical in karstic regions, on the other - some carbonate aquifers behave almost like a homogeneous, isotropic, porous medium. Most lie between these extremes, but these case variations complicates the study of carbonate aquifer properties.

In this study the results of the hydraulic conductivity in carbonate aquifers measurements, hydraulic conductivity correlation between sediments lithology and the aquifer surface depth and fractures research is presented. Upper Devonian Frasnian stage Pļaviņu and Daugava carbonate aquifers in the Latvian part of the Baltic basin is considered. The aim of this research is to elaborate characteristic hydraulic conductivity values for each aquifer based on existing data of the pumping test results and other aquifer properties.

Pļaviņu and Daugava carbonate aquifers mainly consist of jointed dolomite with intermediate layers of dolomitic marlstone, limestone, clays and gypsum. These aquifers are prevalent in most of the study area, except Northern and South – Eastern parts of the territory. In geological structure Daugava aquifer lies above Pļaviņu aquifer. Daugava aquifer depth changes from 10 - 20 and even less meters in Eastern part to 250 - 300 m in South - West part of study area, but thickness varies from few meters to 30 m. Pļaviņu aquifer surface depth varies from 20 - 30 m, but in uplands surface depth reaches more than 120 m, in Eastern part to more than 300 m in South - West part of study area. Aquifer average thickness varies from 20 - 40 m, but in areas with buried valleys thickness can be less than 10 meters. Outcrops of these sediments are occurring in banks of largest rivers and in some areas aquifers are karstified.

In studies of the carbonate aquifers it is very important to take into account the fact that groundwater flow in carbonate aquifers is often almost entirely dependent on jointing and concomitant joint enlargement by dissolution. In this study pumping test results provide a wide range of hydraulic conductivity values, for example in Pļaviņu aquifer hydraulic conductivity varies from 0,03 – 266 m/day but in Daugava aquifer values range from 0,06 – 735 m/day. Pumping test results is provided by Latvian Environment, Geology and Meteorology Centre. Studying average values of hydraulic conductivity there exists a correlation between K and aquifer flat depth – Daugava aquifer, which in geological structure, is located above the Pļaviņu aquifer has higher average K value – 32 m/day, in Pļaviņu aquifer – 27 m/day. Correlative study of the depth and hydraulic conductivity allowed to characterize the mean values as function of the aquifer depth for the regional groundwater flow modelling.

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