

ENVIRONMENTAL HYDROGEOCHEMICAL ASSESSMENT OF GROUNDWATER AT THE LOWER PART OF THE LESSER ZAB RIVER BASIN, NORTHEASTERN IRAQ

Younus I. Al-Saady^a, Balsam S. Al-Tawash^b, Qusay A. Al-Suhail^c

^aIraq Geological Survey, Al-Andalus Square, Baghdad, Iraq

^bDepartment of Geology, College of Science, University of Baghdad, Iraq

^cDepartment of Geology, College of Science, University of Basra, Iraq

(younusalsaady@yahoo.com)

ABSTRACT

Environmental hydrogeochemical investigation of groundwater resources of the Lesser Zab River Basin (LZRB), has been carried out to evaluate the effects of human activities on groundwater quality beneath the different types of land use and land cover classes. Eighteen groundwater samples and two spring samples are collected from unconfined aquifers and analyzed for physiochemical parameters, nutrients, major ions, minor and trace elements (Si, Fe, Al, Mn, Li, Sr, Br, Ba, B, Pb, Zn, Cr, V, Cu, Co, Ni, As, Se, Mo, Cd, Sb and U). Study results reveal that groundwater of the LZRB is alkaline in nature and HCO_3^- , Cl^- , Mg^{2+} , Na^+ and Ca^{2+} are the major contributing ions to the dissolved solids and NO_3^- is the major nutrients.

The hydrogeochemical data suggests that weathering of rock forming minerals along with secondary contributions from agricultural and other anthropogenic sources are mainly controlling the groundwater composition at the LZRB. Alkaline earth metals ($\text{Ca}^{2+} + \text{Mg}^{2+}$) exceed alkalis ($\text{Na}^+ + \text{K}^+$) and HCO_3^- dominate over SO_4^{2-} in the majority of the groundwater samples. Ca-Mg-HCO_3 and Ca-Mg-Cl-HCO_3 are the dominant hydrogeochemical facies in the groundwater of the basin.

The computed saturation indices demonstrate that the groundwater is undersaturated with respect to H_2S , halide and sulfate minerals, oversaturated with carbonate minerals (i.e. calcite, aragonite, and dolomite), sulfide minerals, oxide and hydroxide minerals, and some phyllosilicates (i.e. kaolinite, K-mica, montmorillonite-Ca, montmorillonite-berdean, talc, and chlorite).

A comparison of groundwater quality parameters in relation to international and local standard limits show that the groundwater is unsuitable for drinking purpose of human being, whereas, Pb exceeds the standard limit for most samples. There are also some of other water quality parameters are exceeding the prescribed limits for some samples. On the other hand, the result of water quality assessment shows that the ground water is suitable for irrigation and drinking of livestock.

Keywords: Lesser Zab River Basin, groundwater, hydrogeochemistry, minor and trace elements