

Hydrochemical analyses of a disturbed aquifer of a small island in Malaysia

Abstract

The aquifer of Sipadan Island, off the eastern coast of Borneo, Malaysia, had been found to be affected by seawater intrusion associated with excessive groundwater exploitation, based on hydrochemical analytical work of 1993-2004. This research was attempted to understand the hydrochemical changes of the groundwater attributed to the salinization processes based on major ions composition (Ca^{2+} , Mg^{2+} , Na^{+} , K^{+} , HCO_3^{-} , SO_4^{2-} , Cl^{-}). The initial assessments were done in the year 1993-1994, and then followed by subsequent assessments in 2004. Methods of analyses were adopted from the recommended methods of the APHA. The hydrogeochemical saturation indexes (SI) were computed using PHREEQC program in order to assess the state of equilibrium between groundwater and the minerals present. The results of the analyses indicated that the groundwater had been highly enriched with ions of Na^{+} , SO_4^{2-} and Cl^{-} , reflecting an encroachment of marine water into the aquifer. The groundwater facies in the disturbed aquifer is classified as sodium chloride (Na-Cl) water type. Comparison between two locations showed that higher salinity of groundwater was not the direct factor that contributed to the reduction of SI for carbonate minerals such as calcite, aragonite and dolomite in the study area. This information was later conveyed to the relevant authorities of the island and has been utilized by them in coming out with urgent management actions in protecting and remediating the disturbed aquifer situation.