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Hydrogeochemical characteristics of groundwater in the karst region, southwest China

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Abstract

Groundwater is a very important source for drinking and irrigation in the karst area, and therefore understanding the hydrogeochemistry of karst water is extremely significant. Groundwater were collected, and major chemical compositions were measured to analyse the geochemical processes in Guiyang-Anshun, southwest China. The chemical compositions of the groundwater of the study area are dominated by Ca^{2+}, Mg^{2+}, HCO_3^-, SO_4^{2-}, which have been derived largely from dissolution of carbonate rocks (limestone and dolomite). Compared to the rural areas, TDS value is higher in the city centre. Chloride as a conservative tracer can be used to discuss the source of main ions in the groundwater. In this case, we support that high concentrations of Ca^{2+}, Mg^{2+}, Na^+ are observed with low Chloride concentration in the regional groundwater.

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*Keywords:*karst water; hydrogeochemcial characteristics; water–rock interaction;

1. Introduction

Karst aquifers generally have high heterogeneity characteristics, which make them very different from other aquifers[1]. And as one of the important resources of drinking water supply, it is necessary to study groundwater characteristics and hydrogeochemical processes for better management. Guizhou Province is located in the Southwest China and is the center of East Asian karst zone. Guiyang, the capital city of Guizhou Province, is a hilly basin, which is associated with the Wujiang River catchment, the largest river in Guizhou and the biggest tributary of the Yangtze River in the upper reaches, while Anshun is a peak forest–valley, belongs to the drainage divide

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between the catchments of the Wujiang River and the Beipanjiang Rive[2]. And the area between them, Guian, is a mountainous plain. The study area contains above three regions. Furthermore, we have divided the total area into five zones according to the different aquifer systems and landuse: A. Guiyang city; B. Development zone of Sanqiao; C. Dangwu town; D. Huchao town; E. Anshun city.

2. Methodology

Eighty-one groundwater samples were collected during January 2015 to analyze the chemical composition of groundwater. Field measurements of physicochemical parameters including pH, temperature and electronic conductivity were measured immediately using pH and electrical conductivity meters. After the above measurements, samples were collected into 500ml plastic bottles with no leakage of air. All the samples were filtered with a 0.45 μm filter and divided into two rinsed high-density HPDE 50ml bottles. High purity concentrated nitric acid (1.5ml) was added into the filtered groundwater for cation analysis specially. Alkalinity was measured in the field within 24h by acid filtration after back from the on-site sampling. Chemical analyses of groundwater samples were measured in the Key Laboratory of Biogeology, China University of Geosciences (Wuhan).

3. Results and discussion

3.1. Chemistry of groundwater

The features of the hydrochemistry of the groundwater are as follows. The pH values of the samples are ranging from 6.37 to 7.20 with an acidic average value of 6.78 in Guiyang city. And in other areas, the mean values of pH are also found to be slightly acidic with 6.92, 6.96, 6.96, 6.90 respectively. However, under the influence of anthropogenic processes, there is a difference of TDS values in the five areas. High levels of TDS are observed in the groundwater in Guiyang, Anshun and Sanqiao which are the development central belt with a mean of 465, 489, 449 mg/L respectively. While the TDS mean values are 359 and 369 mg/L in Dangwu and Huchao township, the rural area.

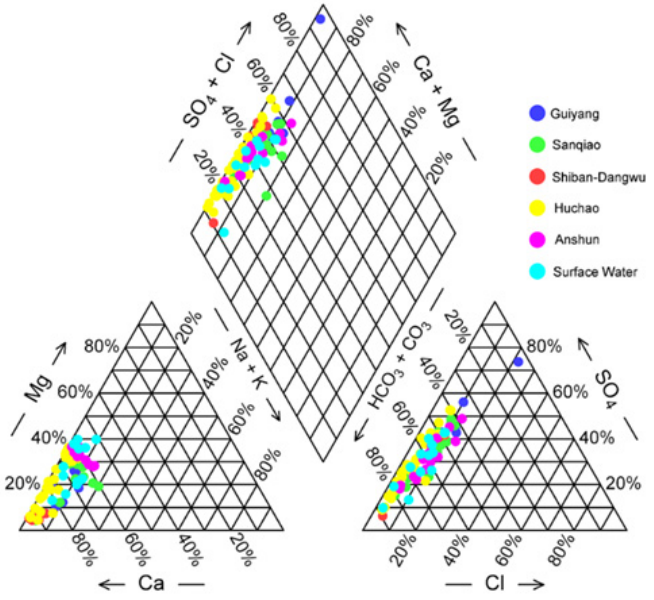

Fig.1 Piper diagram representing hydrochemicalfacies