Isotope Composition of Precipitation and Groundwater in Northern Chile

R. Aravena, Department of Earth Sciences, University of Waterloo, Waterloo, Canada

Northern Chile is one of the most arid regions in the world. Annual precipitation is nil at lower elevations and reaches about 200 mm yr^{-1} above an altitude of 3500 m.a.s.l. The main source of the precipitation in this region is the Atlantic Ocean and most of the rains fall between December and March. Groundwater and surface water originating from the high part of the Andes are the main water resource for urban development and for agricultural and mining activities. The strategic importance of water resources in northern Chile has led to several studies aimed at evaluating these resources. Isotope hydrology has been one the scientific disciplines used in some of these studies. Environmental isotopes have been used to provide information about the origin and residence time of the groundwater, evaporation rates from Salares and, influence of floods in aquifer recharge. An extensive evaluation of the isotope composition of the precipitation and groundwater was carried out as part of these studies.

The isotope data on precipitation show a very distinct pattern with altitude. The precipitation at high altitude areas is much more isotopically depleted than the rains at the lower altitude areas. This pattern is related to the origin of the air masses and processes that affect their isotope composition during transport from their source to the site of precipitation. The wide isotope range observed in the precipitation is also observed in the groundwater, which implied that the aquifers are associated to recharge areas located at different altitude. These findings have significant implications for the development and management of groundwater resources.

This presentation will focus on the discussion of the isotope data in northern Chile waters in the context of the present and past precipitation regime and their interrelationship with groundwater recharge.