MONITORING OF SPATIAL AND TEMPORAL HYDROCHEMICAL CHANGES IN GROUNDWATER UNDER THE CONTAMINATING EFFECTS OF ANTHROPOGENIC ACTIVITIES IN MERSIN REGION, TURKEY

Z. DEMIREL,1,* and K. KÜLEGE2

1Engineering Faculty, Geological Department, Mersin University, Mersin-Çiftlikköy Kampüsü, Turkey; 2General Directorates of Mineral Research and Exploration of Turkey (MTA), Ankara, Turkey

(∗author for correspondence, e-mail: zdemirel@mersin.edu.tr)

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Abstract. The development of groundwater resources for water supply is a favored way in Turkey. The Berdan alluvial aquifer in Mersin is particularly productive, but little is known about the natural phenomena that govern the groundwater quality and the contamination sources in this region. During 2001 and 2002, water samples for chemical analysis were obtained from 27 wells and from two points of Berdan River and analyzed by ICP. Main chemical characteristics of sampled groundwater define two aquifers, which were also determined by hydrogeological investigations. The groundwater produced from some of the wells was affected by anthropogenic activities temporally and spatially by seawater intrusion. Berdan River is polluted with the wastewater discharges and river water also influences the groundwater quality.

Keywords: groundwater quality, hydrogeochemistry, Mersin-Turkey, pollution, seawater intrusion

1. Introduction

Contaminated water resources have important implications on health and the environment (Peterson et al., 1971). The development of groundwater resources for water supply is a widespread practice in Turkey, favored by the existence of basins with thick Quaternary deposits that form aquifers with good-quality water. But excessive pumping, careless land use, air pollution and wastewater discharge, caused due to intensive industrial activities, have negatively influenced the quality and quantity of groundwater. Lately, water pollution has raised much concern, owing to the increasing significance of diffused agricultural contaminants resulting from fertilizer (Slaver et al., 1998; Borin, 1997; Bacchi et al., 1994; Decau et al., 1994; Vital et al., 2000) and of urban contamination by wastewater (Ezeonu et al., 1994; Melgar et al., 1997; Edwards et al., 1997). The Berdan–Deliçay–Müftü and Mezitli hydrogeological basins in Mersin are particularly productive. The water supply in most small villages and some factories in the area is almost exclusively groundwater. Its further intensive use for irrigation makes groundwater a critical resource for human activities. Rainwater and uncontrolled leakage from the sewage network is a source
of contamination of the groundwater in the Mersin city. On the other hand, intensive agricultural and industrial land use between Mersin and Berdan River is a potential source of contamination of groundwater. Despite its importance, little is known about the natural phenomena that govern the chemical composition of groundwater in this region or the anthropogenic factors that presently affect them. The main objective of this paper is to assess the chemistry of water, spatial and temporal changes in groundwater chemistry, and to identify the possible contamination sources.

2. Site Description

Mersin is situated in the Mediterranean region of Turkey. The study area is located between latitude 34° 37′ and 34° 57′ and longitude 36° 45′ and 37° 00′. The Mersin–Berdan basin encompasses most of southern part of Taurus Mountains with an area of 400 km². The study area is a delta plain, which is formed by Berdan River and partly by Deliçay, Müftü and Mezitli creeks in the east. The morphology in the study area is characterized by a wide flatness and it has an elevated altitude northwards. Topographic structure in the north of investigated area has a wavy character. The altitude reaches up to 300–1100 m in the north and decreases gradually towards the south.

The Berdan River flow regime is strongly dependent on the seasonal rains; average discharge at the Berdan Dam in Tarsus is 38 m³/s. The Deliçay, Müftü and Mezitli creeks flow only 3–4 months in a year and their average discharge is 2–3 m³/s.

The study area is situated in a region with a typical Mediterranean climate. Wet and mild winters, combined with dry and hot summers are typical for the coastal zone around the Mediterranean Sea. Average annual temperature in the area is 18.6 °C. The difference in the temperatures between winter and summer is fairly small, as is characteristic of the Mediterranean climate. Yearly average of rainfall is about 600–650 mm. Showers start in October and continue till mid-April. Maximum rainfall is in December.

3. Geological Setting

The Mersin–Berdan basin is filled with Quaternary and Tertiary sediments. These sediments overlay the Paleozoic metamorphic basement rocks, which crop out on the Taurus Mountain along the northern border of the basin (Figure 1). In the northwestern part outside of the study area, the ophiolitic rocks are settled. Tertiary sedimentary rocks consist of a succession of marine, lacustrine, and fluvial deposits that are rich in evaporates such as gypsum and sodium sulphate.

The oldest rock unit of the study area is Karahamzauşağı Formation of Paleozoic age, which consists of marble, schist and quartzite. This basement rock