Geophysical Research Abstracts
Vol. 20, EGU2018-18103, 2018
EGU General Assembly 2018

Geochemical and isotopic characterization of a volcanic-sedimentary coastal aquifer in the archaeological site of Cumae (Phlegraean Fields, southern Italy)

Luisa Stellato (1), Vincenzo Allocca (2), Michele Arienzo (2), Silvio Coda (2), Pantaleone De Vita (2), Brunella Di Rienzo (1), Luciano Ferrara (3), Fabio Marzaioli (1), and Marco Trifuoggi (3)

(1) Centre for Isotopic Research on Cultural and Environmental heritage (CIRCE), Dept. Mathematics and Physics, Università degli Studi della Campania "Luigi Vanvitelli", Caserta, Italy (luisa.stellato@unicampania.it), (2) Dipartimento di Scienze della Terra, dell'Ambiente e delle Risorse, Università degli Studi di Napoli "Federico II", Napoli, Italy., (3) Dipartimento di Scienze Chimiche, Università degli Studi di Napoli "Federico II", Napoli, Italy.

The Cumae archaeological site extends for about 3.0 km^2 along the Tyrrhenian coast of the southern Italy, north-west of the active volcanic system of Phlegraean Fields, about 20 km north of Naples bay. The coastal plain of the Cumae archaeological site is an area of relevant environmental and archaeological interest. The ancient city of Cumae, in the Naples Province, was the first Greek colony, named Kyme, founded in mainland southern Italy along the Tyrrhenian coast in the 730 B.C., and remained continuously occupied until the 1207 A.D. During the Holocene epoch the coastal plain has changed significantly, due to endogenous and exogenous phenomena, such as volcanic eruption, bradyseismic crises, eustatic sea-level variations, shoreline changes and formation of lake environments and palustrine wetlands. As a result of these natural processes, the coastal plain is characterized by a complex volcanic-sedimentary sequence formed by sands, silts, silty clays and volcanoclastic sediments, resting on a substrate of yellow tuff and trachytic laves, outcropping in the surrounding reliefs.
Land use of this coastal area is mainly characterized by intensive irrigated agriculture, with use of pesticide and organic fertilizers.

A well-designed hydrological, hydrogeological, chemical and isotopic monitoring program has been carried out in an experimental site within the coastal plain, having an extension of approximately 1 km^2, during the period from December 2013 to February 2015 in thirteen wells (six shallow, up to 15 m, and 7 deep wells, up to 80 m) on a monthly basis.

Based on a detailed stratigraphic model of the study area, multidisciplinary investigations (hydrological monitoring, piezometric measurements, field parameters determinations, isotopic and hydrochemical water analyses) were conducted to characterise: i) groundwater flow and quality, ii) natural and anthropogenic processes affecting the hydrochemical and isotopic composition of groundwater in the coastal volcanic-sedimentary aquifer, iii) and spatial and temporal variations of the contamination sources by anthropic activities of the coastal aquifer.

Groundwater samples were analysed to identify physico-chemical, hydrochemical and isotopic parameters: temperature, pH, electrical conductivity, total dissolved solids, major ions and trace elements, delta-18O, delta-D, Radon-222, delta-15N and delta-18O of dissolved nitrates and delta-11B.

Hydrostratigraphic data and piezometric monitoring confirm the presence of a multi-layered coastal aquifer, whereas all the hydrochemical and isotopic observations show that the groundwater quality is affected mainly by: i) aquifer lithologies and localised rise of deep magmatic fluids highly mineralized, ii) freshwater-saltwater interactions (induced by groundwater pumping), and iii) contamination from non-point agricultural sources.