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Rare earth element distribution in groundwater of Mount Vulture volcanic aquifer (southern Italy)

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Rare earth elements (REEs) distribution in groundwater is an important tool for investigating water-rock interaction processes as REEs content in aqueous systems strongly depends on the degree of rock weathering. However, subsequent to REEs' dissolution from the aquifers rocks, REEs' removal from solution by sorption or coprecipitation can occur. In this work, the concentrations of dissolved REEs were determined in groundwater of Mount Vulture volcanic aquifer. Mt. Vulture is a Pleistocene composite volcano located at the easternmost border of the Apennine compressive front whose aquifer core is mainly composed of pyroclastic and subordinate lava flow of different permeability, which give rise to distinct aquifer layers. The collected water samples were cold and slightly acidic water with electrical conductivity (EC) that varies over a wide range of values; in addition, Eh and dissolved oxygen (DO) of groundwater were also measured. The water samples, due to the high variability of some physical-chemical parameters such as EC and DO, were the object of a cluster analysis, which showed the presence of two main subset having substantial differences in the measured parameters. Thus the dataset was divided into a high salinity subset (EC > 800 μs/cm) with low Eh and OD values and a low salinity subset (EC < 800 μs/cm) characterized by higher OD and Eh values. The concentration of dissolved REEs in groundwater fluctuates over several order of magnitude and shows a slightly positive correlation with water temperature and a slightly negative correlation with the dissolved oxygen (DO); relationships with EC, pH and Eh are not observed. The Post-Archean Australian Shales (PAAS) normalized pattern of the high salinity subset showed an important fractionation between LREE and HREE and moderate CeN* and EuN* anomaly. Instead, the low salinity subset showed a minor fractionation between LREE and HREE and an important EuN* anomaly compared to the previous group. The EuN* anomaly of the whole dataset is in a positive correlation with the Eh whereas the CeN* is in weak negative correlation. These preliminary results confirm the usefulness of REEs' distribution in groundwater for assess water-rock interaction processes.