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Chemical and isotopic analysis to define how many groundwater types could be hosted in a fractured flysch delimited by clayey and evaporites rock masses

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The aim of the research is to define using chemical and isotope analysis how many groundwater types are present in 100 meters of thickness of a fractured volcanoclastic flysch, which is delimited by evaporites and clayey rock masses and outcropping in the northern Apennines. Chemical analysis have defined the content of: Ca, Mg, Na, K, B, Sr, HCO_3, SO4, Cl. Isotope analysis have defined the content of the oxygen, deuterium and tritium. Groundwater samples have been collected from springs and deep wells. The research highlights the presence of four groundwater types and of some mixing products, that are the interaction between the four groundwater types. Chemistry and age of the four groundwater types are in agreement with the mineralogical composition of the different interacting rocks and with the mean groundwater transit time. In particular the research discovers the presence of: 1) a shallow and recent Ca-HCO_3 groundwater, that is the product of interaction between rainfall and flysch; 2) a shallow and deep not recent Ca-HCO_3 groundwater, rich in Na, which moves only under high hydraulic gradient and that is the product of a long interaction between rainfall and flysch; 3) a deep and old Ca-SO4 groundwater, rich in Na, which is the product of a long interaction between rainfall and evaporates, in an oxic environment; 4) a deep and old Na-Cl groundwater, which is the product of a long interaction between rainfall and evaporites in an anoxic environment.