

HYDROCHEMISTRY, ISOTOPE CONTENTS AND ORIGIN OF THERMAL WATER AT NISYROS

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Water samples were taken at Nisyros from springs (3 samples) and 1540 m-deep Δ EH borehole (1 liquid and 1 vapour) for environmental isotope and chemical analyses.

By their ionic contents (Na^+ , K^+ , Ca^{2+} , Mg^{2+} , Cl^- , SO_4^{2-} and Br^-), the three spring samples are intermediate between the borehole water and sea water. On the other hand, Br^-/Cl^- ratio in the borehole water is precisely that of sea water. Thus, this water could simply derive from sea water, overconcentrated by evaporation/degassing. Cation contents were modified by water-rock interaction at high temperature and sulphate content decreased by precipitation (due to Ca^{2+} content increase) and/or by reduction. Ionic contents of spring samples can be explained either by the same processes or by a mixing between "borehole type" water and sea water.

Stable isotope (^{18}O , ^2H) contents of samples confirm the primary marine origin of water with "geothermal shift" in ^{18}O and evaporation effects. The condensed vapor sample is enriched in deuterium with respect to the corresponding liquid water sample. This enrichment allows the calculation of the degassing temperature ($\approx 225^\circ\text{C}$).

Isotope contents (^{34}S , ^{18}O) of dissolved sulphate in spring water are not significantly different from those of recent marine sulphate. From its isotope composition, the low amount of sulphate in the borehole water can result from a slight re-oxidation of H_2O , resulting itself from total reduction of marine sulphate. Equilibrium temperature deduced from the difference between ^{18}O content of sulphate and ^{18}O content of water is close to $230\text{-}240^\circ\text{C}$.

In conclusion, hydrochemical and environmental isotope analyses indicate that Nisyros geothermal system is probably fed by sea water, modified by evaporation/degassing, redox and precipitation processes. Temperatures calculated from chemical and isotopic geothermometers are in good agreement with that measured at depth in the borehole ($\approx 210^\circ\text{C}$).