

Application of multivariate statistical methods and inverse geochemical modeling for characterization of groundwater—a case study: Ain Azel plain (Algeria)

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Multivariate statistical methods and inverse geochemical modeling were jointly used to define the variation and the genetic origin of chemical parameters of groundwater in the Ain Azel plain, Algeria. Interpretation of analytical data shows that the abundance of the major ions is as follows:

$\text{Ca} \geq \text{Mg} > \text{Na} > \text{K}$ and $\text{HCO}_3 \geq \text{Cl} > \text{SO}_4$. Q-mode hierarchical cluster analysis (HCA) was employed for partitioning the water samples into hydrochemical facies, also known as water groups or water types. Three major water groups resulted from the HCA analysis. The samples from the area were classified as recharge area waters (Group 1: Ca–Mg–HCO₃ water), transition zone waters (Group 2: Ca–Mg–Cl–HCO₃ water), and discharge area waters (Group 3: Mg–Ca–HCO₃–Cl water). Inverse geochemical models of the statistical groups were developed using PHREEQC to elucidate the chemical reactions controlling water ...