



Chemical and isotopic compositions of thermal waters in Anatolia, Turkey: A link to fluid-mineral equilibria

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The complex magmato–tectonic setting of Turkey has resulted in the occurrence of numerous geothermal fields with distinct chemical and isotopic fluid compositions. We evaluate the data on these fluids in terms of water-rock interaction, mineral equilibrium conditions and reservoir temperatures of each geothermal field. The Ca–HCO₃ rich nature of most waters is ascribed to derivation from carbonate-type reservoir rocks. SO₄-type waters are found in areas where the reservoir is partly comprised of evaporite units. Na–Cl type waters are characteristic for the coastal areas of west Anatolia. Chemical geothermometer applications estimate average reservoir temperatures of 180 °C for the western Anatolian region, 120 °C for the Balıkesir region, 130 °C for the eastern Anatolian region, 140 °C for the North Anatolian Fault Zone and 70 °C for the Eskişehir region. For most of the waters, chalcedony controls the silica solubility and the majority of waters are equilibrated with calcite and chalcedony minerals. Oxygen and hydrogen isotope compositions (–13.5 to –4 permil (VSMOW) and –95.4 to –23 permil (VSMOW), respectively) are generally conformable with Global Meteoric Water Line (GMWL); however, stable isotope systematics of geothermal waters close to the coast are consistent with the Mediterranean Meteoric Water Line (MMWL). Carbon and sulfur isotope compositions ($\delta^{13}\text{C}$ (VPDB): –17.7 to +5.6 permil and $\delta^{34}\text{S}$ (VCDT): –5.5 to +45.7 permil) suggest marine carbonates and terrestrial evaporite units as the main source of dissolved carbon and sulfate in the waters.