Acıgöl Lake is the second largest alkaline lake in the world and is in a region that is one of the most important sodium sulphate production fields in Turkey. The present study focuses on determination of sources of the Na2SO4 deposits with main-trace element contents based on hydro-geochemical studies in the lake basin. The geological and hydrogeological properties of the study area were primarily determined. To identify the hydrogeochemical characteristics of spring/groundwater and lake water, chemical analyses results were evaluated with graphical plots such as Piper, Gibbs and Chadha diagrams and the conceptual hydrogeological model was prepared for the area. Mineral paragenesis of the lake sediments mainly consist of gypsum, aragonite, halite, calcite, dolomite, quartz, muscovite, smectite and illite besides tenardite, mirabilite and bloedite minerals. The dominant hydrogeochemical facies are Na-SO4, Na-Cl, Ca-Mg-HCO3 and Ca-Mg-SO4 which are due to water-rock interaction. The mean Na, Ca, SO4, Cl and Mg concentrations in the spring waters are 221.27, 152.62, 374.81, 185.46 and 58.50 ppm respectively; whereas mean concentrations in the lake waters for Na, Ca, SO4, Cl and Mg ions are 22 507, 646, 16 186, 35 691 and 2399 ppm respectively. These major elements have very high concentrations in the lake waters due to the evaporation leading to enrichment. The main mechanism controlling water chemistry in the Acıgöl Lake basin is the process of water–rock interaction. The enrichment of these elements in the springs waters originate from lithological units such as sedimentary, ophiolitic and young magmatic rocks.