A magnesium isotopic study of the evaporite deposits of the Messinian salinity crisis

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The Messinian salinity crisis (MSC) is a hydrological and biological crisis that occurred in the Mediterranean basin at the latest Miocene. The salt deposit reaches a maximum apparent thickness of ~3,000 m and are composed mainly of gypsum/anhydrite and halite. From a natural resources perspective, the MSC evaporates are important for such as potash salts and hydrocarbons resources. A large amount of the MSC salts originates from the evaporative concentration of seawater flowing in through the Strait of Atlantic gateway. The Mediterranean Basins have experienced repeated refilling of seawater and freshwater with different hydrological scenarios between western and eastern basins and between marginal and centers of basins. The Mg isotope ratios in seawater are homogeneous because of its long mean residence time (>10^7 years) in the modern ocean. As evaporation proceeds, soluble potash salts start to accumulate in highly restricted depositional settings. Because Mg isotope fractionation is mainly related to low temperature processes at the surface environments, our aim is to use magnesium isotope ratios (δ^{26}Mg) of the Messinian evaporites to constrain evaporative concentration histories and the hydrochemical processes during the MSC. The δ^{26}Mg values of the MSC evaporates ranged from -3.18‰ to -1.22‰, which is highly varied and significantly lower than the value of modern seawater. Elucidation of the basin hydrochemistry from Mg isotopes is a new potential indicator of an extent of evaporative concentration events and dissolution/recycling of coeval marginal marine deposits.

Keywords: Messinian salinity crisis, Evaporites, Magnesium isotope ratios

