# The Zn-Pb-(Ag) epithermal mineralization of Mazarrón (Spain): A preliminary isotope study

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The Volcanic Field of SE Spain hosts several precious/base-metal epithermal volcanic-hosted deposits [1]. Among them, Mazarron comprises several volcanic centers of high-K calc-alkaline/shoshonitic composition which show pervasive hydrothermal alteration and related Zn-Pb-Ag mineralization. Deposits occur as stockworks and vein systems of sphalerite, silver-rich galena, pyrite and marcasite with quartz and carbonates. Common Fe-Al sulfates are found in a thick net of decimeter to submillimeter size veins. Barite veins are also present.

Preliminary sulfur isotope study for the base-metal sulfides show a $\delta^{34}S$ range between 5 and 13‰. In contrast, pyrite-marcasite values show a wider $\delta^{34}S$ range: between -3 to 29‰, with depleted sulfur in earlier crystals. Barite exhibits a bimodal $\delta^{34}S$ distribution: from +14 to +18‰ and around +54‰. $\delta^{18}O_{barite}$ is more homogeneous: between +12 to +17‰); Fe-Al sulfates, show significant variations in isotopic signature of S (2-14‰), O (3 to 13‰ in $SO_4$ and 1 to 11‰ in OH group) and D (-54 to -115‰). O isotope equilibrium between $SO_4$ and OH in these minerals is only established in one case, yielding a temperature of 150°C and pointing to a typical low-temperature hydrothermal environment.

The range in sulfide sulfur isotopic is suggestive of thermochemical sulfate reduction of sea water. The extremely enriched sulfur signatures (pyrite-marcasite and barite) indicating closed system conditions. Isotopic (e.g. depleted deuterium values) and geological evidence also support a magmatic fluid input. The Fe-Al sulfate mineralizing event may represent the waning stage of the hydrothermal system, rather than a supergene event as is invoked in other epithermal deposits with similar sulfur signatures [1]. These data therefore suggest a marine-magmatic origin for the Mazarrón ore-fluids.

Mazarron in an unusual and tantalising deposit, the origin of which involved complex mineralizing processes, not typical of epithermal volcanic-hosted deposits.

[1] Arribas *et al.* (1995) *Econ. Geol.* **90**, 795–822.

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# Interaction between Aluminium ion and poly(acrylic acid) in aqueous solution

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In nature, aqua aluminium ion ($[Al (H_2O)_6]^{3+}$, Al ion) and its hydrolytic species have toxic effect for plants. However, aluminium complexes with organic compounds are less toxic. In natural organic materials that complex with Al ions, the main functional group is carboxylic group and some of them are macromolecules such as fulvic acid and humic acid. Therefore, it is important to examine the interaction between Al ion and macromolecule with carboxylic groups. Therefore, we studied the interaction between Al ion and poly carboxylic acid in solution. We used poly (acrylic acid) (PAA) as a model compound of natural organic compounds.

When Al solution and PAA solution were mixed at various molar ratio ((COOH in PAA)/Al) in the pH range 3 to 8. Precipitate was formed below the limiting ratio. For precipitate at pH 3 one Al ion combined with 4 to 7 carboxylic groups at pH 3. In contrast, for precipitate at pH 8, one Al ion combined with one carboxylic group. It is suggested that the interaction between Al ion and PAA varies by pH: the variation of chemical state of Al ion and PAA by pH strongly affects. In conclusion, it is suggested that Al ion can interact with natural macromolecule with carboxylic groups in the wide pH range.