

## Controls on Fluid Chemistry in Natural Systems

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The composition of crustal fluids reflects their source, the rocks with which they have interacted and the P-T conditions under which interaction took place, and most importantly the phase diagram for the H<sub>2</sub>O – CO<sub>2</sub> – salt system. The solubility of gas species and related volatile elements in water is strongly affected by salinity (“salting-out”), and so except under deep mantle conditions fluids are either low salinity H<sub>2</sub>O – gas fluids or brines low in gas. Depending on the bulk composition of the system, there may be a single fluid or two coexisting immiscible fluids, although these separate rapidly due to different transport properties. Both types of fluid are well known from all geological settings and neither can be considered as distinctive of any one origin.

Brines are usually dominated by Na, Ca, K and/or Fe, with the proportion of divalent to monovalent cations normally increasing with salinity. The concentrations of transition metal cations primarily reflect chloride concentration and temperature, with Fe becoming a major component in magmatic brines. Most brines contain significant Ca which prevents high concentrations of sulphate, bicarbonate, fluoride or phosphate in the fluid.

Low salinity CO<sub>2</sub>-rich fluids are also widespread and are commonly rich in reduced S and As. Examples of such fluids are found in fluid inclusions from the Muiane pegmatite, Mozambique. These contain a highly evolved magmatic fluid low in Ca but rich in As, Sb, Be, Li, Au and B as well as all the alkali metals, at concentrations of 100's to 10,000's ppm and demonstrate a different pattern of metal enrichment from that commonly found in brines.