Deep-basin brines II: Variation in major cations

Deep-basin brines are rich in the four cations common in all groundwaters: Ca\(^{2+}\), Mg\(^{2+}\), Na\(^{+}\) and K\(^{+}\). The concentrations of all four generally increase with Cl\(^{-}\) concentration, as is evident below.

With that said, one should note two things. First, the differing vertical scales of the plots below show that the concentration of Ca\(^{2+}\) increases far beyond that of the other three major cations (a thought to which we will return in Part III of this series). Secondly, the concentration of Na\(^{+}\) reaches a peak and then diminishes with increasing Cl\(^{-}\) concentration. That reversal takes place where the concentrations of Na\(^{+}\) and Cl\(^{-}\) reach saturation with respect to halite. Beyond that point, the requirement that the product of Na\(^{+}\) concentration and Cl\(^{-}\) concentration remain a constant (the K\(_{sp}\) for halite) means that, as Cl\(^{-}\) concentration increases, Na\(^{+}\) concentration must decrease.

Data are from sedimentary basins in the US., Canada, and the North Sea. The legend for the symbols is shown on “Deep-basin brines I: Density, TDS, and chloride”.

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