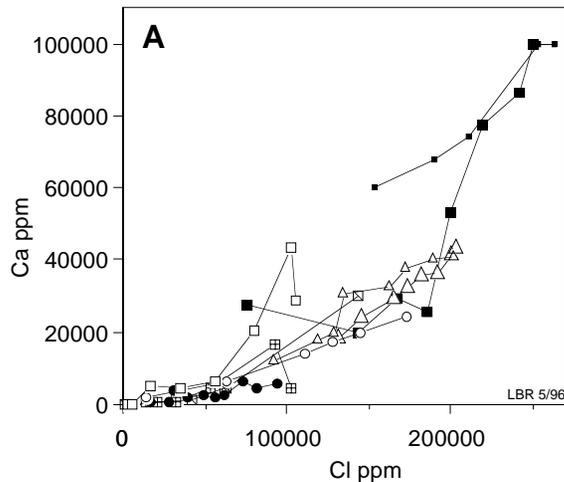
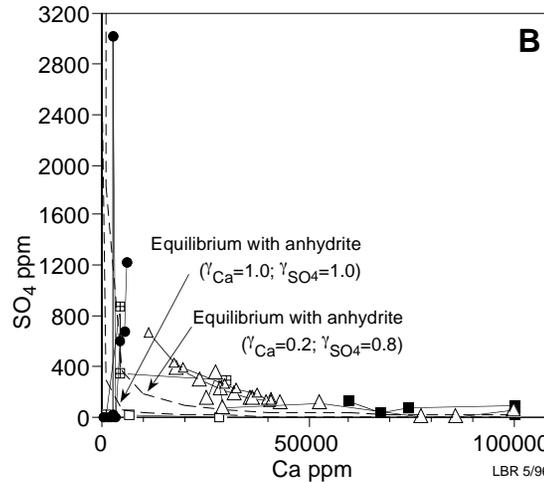


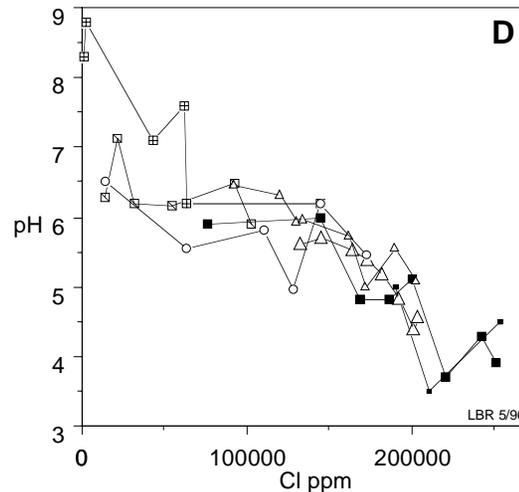
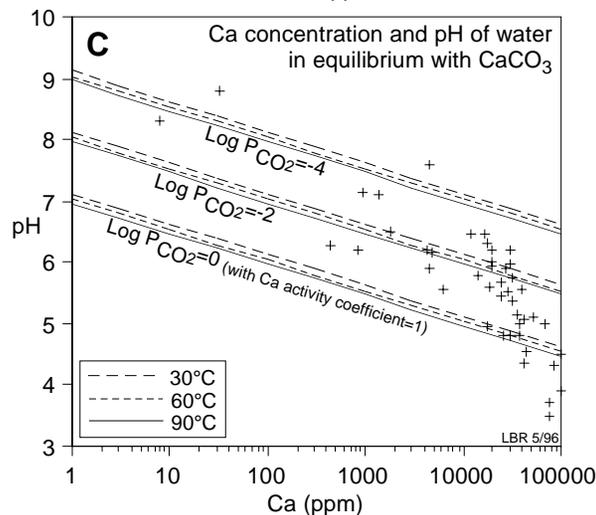
**Deep-basin brines V:  
Effect of Ca<sup>2+</sup>'s dominance on  
pH and SO<sub>4</sub><sup>2-</sup> concentration**



The huge increase in concentration of Ca<sup>2+</sup> with Cl<sup>-</sup>, and thus with TDS, in deep-basin brines (Plot A) has major ramifications for the chemistry of these brines. Ca<sup>2+</sup>



concentration and SO<sub>4</sub><sup>2-</sup> concentration can vary independently so long as their product is less than the K<sub>sp</sub> for anhydrite (i.e., so long as the solution is undersaturated with respect to anhydrite). Beyond that point, the requirement that the product of Ca<sup>2+</sup> concentration and SO<sub>4</sub><sup>2-</sup> concentration remains a constant (the K<sub>sp</sub> for anhydrite) means that, as Ca<sup>2+</sup> concentration increases, SO<sub>4</sub><sup>2-</sup> concentration must decrease. The very high Ca<sup>2+</sup> concentration in the most saline brines thus dictates proportionately low SO<sub>4</sub><sup>2-</sup> concentrations (Plot B).



The same effect happens with Ca<sup>2+</sup>, CO<sub>3</sub><sup>2-</sup>, and calcite. The requirement that the product of Ca<sup>2+</sup> concentration and CO<sub>3</sub><sup>2-</sup> concentration remains a constant (the K<sub>sp</sub> for calcite) means that, as Ca<sup>2+</sup> concentration increases, CO<sub>3</sub><sup>2-</sup> concentration must decrease. As CO<sub>3</sub><sup>2-</sup> is driven from solution at high Ca<sup>2+</sup> concentration, HCO<sub>3</sub><sup>-</sup> dissociates, so that HCO<sub>3</sub><sup>-</sup> concentration decreases too (as seen in Part IV of this series). With the removal of both CO<sub>3</sub><sup>2-</sup> and HCO<sub>3</sub><sup>-</sup> from solution, and thus the loss of most alkalinity, pH decreases to remarkably low levels (as is shown in Plots C and D).

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".