

saturation indices. Leachates with a saturation index value greater than zero are over-saturated and cannot dissolve more of that mineral. Leachates with saturation index less than zero are under-saturated and the mineral, if present, can dissolve, because the solution is holding less than the maximum. HCS-IN and LKFC-PA produced leachates that were under-saturated for calcite. These rocks have less significant sources of neutralization.

Sulfate Minerals

Gypsum ($\text{CaSO}_4 \cdot 2 \text{H}_2\text{O}$) and other sulfate bearing minerals could influence the amount of sulfate in leachates. Gypsum was identified in sample HCS-IN (chapter 5). Gypsum saturation indices, calculated using PHREEQCI, are shown in figure 8-9. Sample HCS-IN is at approximate equilibrium for gypsum, indicating solubility of that mineral is likely controlling the amount of sulfate in solution. The other four rocks are under-saturated for gypsum, and have no gypsum solubility limitations on their leachate composition.

Sulfate concentration is often used as a surrogate estimate of acid production from pyrite. For samples like HCS-IN, where sulfate concentration may be limited by solubility controls, actual acid production may be greater than estimated. Other metal-sulfate minerals such as schwertmannite, the jarosite series, and jurbanite could also control the solution concentrations of sulfate and various metals. Mineral solubility constraints should be part of the evaluation scheme for leachate interpretation.

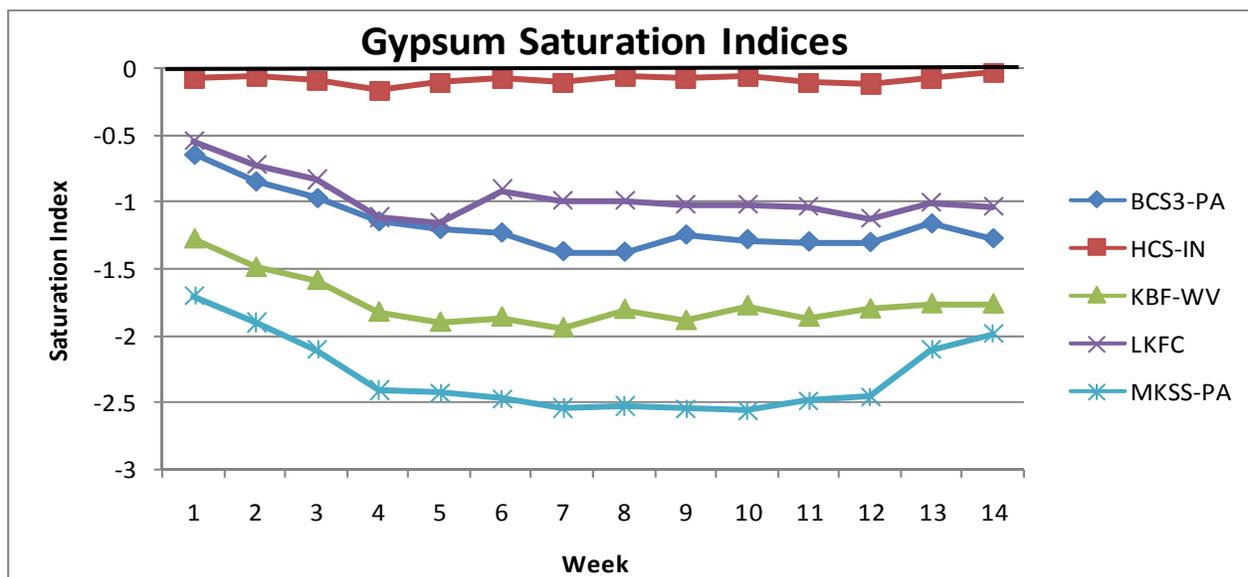


Figure 8-9. Gypsum Saturation Indices for Five Rocks. Values are medians of four labs.

Oxidation-Reduction

Oxidation reduction reactions can exert a strong influence on elements with more than one possible valence state. More than one potential valence state is possible for the elements iron(+2,+3), manganese(+2,+3,+6,-7) and selenium(-2,+4,+6). Their behavior can be estimated from the use of equilibrium calculations and graphically illustrated in Eh/pH diagrams. One laboratory measured the Eh, or oxidation reduction status of the weekly leachate samples, even though this was not a requirement of the test protocol. These data confirmed that oxidizing conditions existed, and allow equilibrium calculation of leachate speciation.