The presence of carbonate minerals exerts a major influence on the chemistry of a soil. In areas with inputs of acid rain, both the soils and overall watershed chemistry are best classified according to whether or not carbonate minerals are present. Most soil silicate minerals are both thermodynamically unstable relative to carbonates and also more abundant under most soil conditions. Despite these factors of stability and abundance, dissolution of alkali earth cations is usually orders of magnitude greater when carbonates are present than when they are not present. Under conditions of high rainfall, noncalcareous soils often become acidified and pH is then controlled by Al chemistry. Calcareous soils maintain much higher pH values, alkalinity and alkali earth cation concentrations than do noncalcareous soils. If carbonate minerals are present, prediction of soil pH requires consideration of carbonate equilibrium reactions. Soil pH is required for evaluation of many processes in soils, including micronutrient availability, heavy metal transport and plant availability, and Al toxicity. Under arid conditions calcium carbonate precipitation is a dominant process affecting solution chemistry and pedogenesis. The solution composition in a carbonate system, depends on the partial pressure of CO₂ ($P_{CO_2}$). The system can be described using equations for dissociation of water ($K_w$),

$$\left[H^+\right]\left[OH^-\right] = K_w$$  \[1\]

dissolution of CO₂ gas in water, and hydration of dissolved CO₂ to $H_2CO_3^*$, generally combined into the overall equation

$$\frac{\left[H_2CO_3^*\right]}{P_{CO_2}} = K_H$$  \[2\]

where $H_2CO_3^*$ denotes dissolved aqueous CO₂ + the undissociated carbonic acid, $H_2CO_3$ and parentheses denote activity. At 25°C, $H_2CO_3^*$ is almost completely