

A field study of the effect of carbon dioxide on chemical weathering rates, Sierra Nevada, CA

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Abstract. Measurements show that the concentration of carbon dioxide (CO₂) has increased from 316 ppm to 360 ppm since 1959 (Baird, 1999), primarily due to human activities such as the burning of fossil fuels. The chemical weathering of silicate minerals is a natural sink for atmospheric CO₂ (Volk, 1987), but is not rapid enough to balance the current anthropogenic inputs to the atmosphere. Studies have shown that these elevated levels of CO₂, which is a greenhouse gas, may be contributing to global warming (reference). Recently proposals call for the sequestration of CO₂ by injection into depleted natural gas reservoirs where it will react with the reservoir rocks (Stevens et al 2000). This process is an extension of the enhanced oil recovery techniques presently used by many oil companies. Quantification of sequestration and the effects of injecting large amounts of CO₂ into the ground will require knowledge of mineral dissolution rates at the elevated CO₂ content caused by injection. This relationship has proven to be the largest unknown when trying to model this process.

While rates for weathering reactions can be determined in the laboratory for the reservoir conditions, field weathering rates are 2-4 orders of magnitude slower than lab measured rates (White et al 2001), making the application of laboratory rates to field conditions questionable. The proposed research will determine field and laboratory mineral dissolution rates for alluvium that has a composition analogous to many oil and gas reservoirs over a range of CO₂ partial pressures from atmospheric to 100X atmospheric. The laboratory experiments will imitate field conditions as closely as possible to eliminate deviations from variables other than PCO₂. Further, most experiments determining weathering rates have been conducted at atmospheric CO₂ concentrations, which are much lower than proposed for CO₂ sequestration.

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