

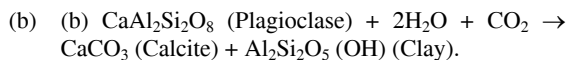
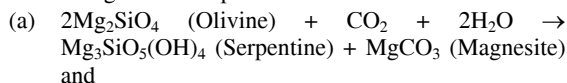
Geological sequestration of carbon-dioxide in Deccan continental flood basalt province, India

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Carbon dioxide generated by Petrochemical and Fossil Fuel based power plants contributes approximately one-third of the total carbon dioxide emissions into the atmosphere. One way of minimizing such universal CO₂ emissions is by the capture and storage of anthropogenic CO₂. Binding of CO₂ into solid mineral carbonates by the process of mineral carbonation represents a permanent, safe, and environmentally acceptable form of CO₂ disposal. Laboratory simulation experiments and field studies towards geological CO₂ sequestration are underway at present on a priority basis all over the world including India. During the process of underground storage, CO₂ reacts with Pyroxene, Olivine Spinel etc. in the host basalts leading to the formation of secondary Fe-Mg-Ca bearing carbonate minerals – resulting in the phenomenon termed as Mineral Trapping. Towards this, the mafic-ultramafic rocks constituting the Cretaceous Deccan Continental Flood Basalt Province in India and which have appreciable concentrations of iron, magnesium and calcium are well suited and to confirm such mineralogical reactions laboratory experiments were conducted in high P-T vessels by reacting supercritical CO₂ and basalt samples collected from Saurashtra. The aim of these experimental studies was to optimize T, injecting P and pH of CO₂ for enhanced mineralogical reactions. A few of the causative exothermic reactions during the above process are as follows:



Additionally, Laser Micro Raman studies carried out in our laboratory on reacted basalts confirms the formation of carbonates as reactants thus effectively trapping the injected CO₂.

Clay - prion protein interactions

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The prion protein (PrP) is the key protein implicated in the development of scrapie, a sheep- and goat-specific transmissible spongiform encephalopathy. The N-terminal tail of the protein includes five copper chelating sites as well as numerous positively charged amino acids, which all may induce a binding of the protein to clay minerals, as shown, e.g., by molecular dynamics (MD) calculations and electron paramagnetic resonance (EPR) spectroscopy. The C-terminal part of the protein has a hydrophobic core that may also interact with low-charge clay surfaces as well as organic matter. The speciation of Cu-PrP chelates changes upon adsorption on clay minerals. Cu coordination at a given pH in the adsorbed state is similar to Cu coordination in a solution of lower pH. This, together with high available Mn²⁺ concentrations, favors the exchange of Mn²⁺ for Cu²⁺, which is shown by MD to occur in three steps, and may lead to the PrPc to the pathogenic PrPSc transformation.