

Nitrate radical and its formation in Antarctic calcitic evaporate

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Nitrate radical ($\text{NO}_3^{\cdot-}$) in calcitic evaporate was discovered in Antarctica. The distribution and formation of nitrate radical ($\text{NO}_3^{\cdot-}$) in the calcite have been studied using pulse and continuous wave electron spin resonance (ESR). In samples that had been annealed to destroy the $\text{NO}_3^{\cdot-}$, regeneration of the radical using gamma-rays or UV light indicated that the radical was formed by UV light (with wavelengths less than 340 nm) from solar rays, not by environmental radiation. The nonuniform spatial distribution of the nitrate radical, which was deduced from high ratios of local spin density to total spin density, suggests that the nitrate impurity was introduced into the calcium carbonate after carbonate grain formation. Formation of the carbonate-containing nitrate requires the presence of high amounts of nitrate and a dry climate. Formation of the nitrate radical requires sample exposure to UV light. These conditions are satisfied in the environment of Antarctica.