Illite authigenesis - new constrains on fundamental clay crystallization processes using the NANOKIN code

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Illite clay formation occurs widely in sedimentary basins. Illite is formed mainly in low-temperature environments where mineral reactions are governed by kinetics rather than equilibrium thermodynamics. Dissolution and precipitation processes resulting from water rock interaction are time dependent and can take place in far from equilibrium conditions. We present results of illite crystallization processes in sandstones at burial temperatures from 25 to 150°C simulated with a new geochemical "numerical reactor" NANOKIN (Noguera et al., 2006, 2010, 2011, Fritz et al., 2009). The model provides, for the first time, real data of illite nucleation and time dependent evolution of particle and crystal size distribution. The NANOKIN code provides a fundamental description and understanding of Oswald ripening processes in relation to illite formation. The model examines the state of the aqueous solution with various mineral phases and combines the classical theory of crystal nucleation with size and morphology dependent kinetic rate laws for growths and/or dissolution of particles i.e. Oswald ripening processes, which are often used to explain age distribution pattern of illite fractions. Grain-size fractions of new-grown illite are mixtures of illite particles formed at different times during growth. The NANOKIN code provides information about fundamental processes of crystal formation and subsequent crystal size distributions with implications for illite age dating.

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References

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Notes