

Clay minerals in the mud and soil that coat the Earth's surface are part of a clay cycle that breaks down and creates rock in the crust. Clays generated by surface weathering and shallow diagenetic processes are transformed into mature clay mineral assemblages in the mudrocks found in sedimentary basins. During metamorphism, the release of alkali elements and boron from clay minerals generates magmas that are subsequently weathered and recycled, representing the magma-to-mud pathway of the clay cycle. Volcanogenic clay represents an important but hitherto underestimated proportion of recycled clay. Within sedimentary basins, immature clays are transformed to mature and supermature clay assemblages by a series of reactions that generally obey the Ostwald Step Rule. Bedding-parallel microfabric generated by these reactions produce significant changes in the physical properties of deeply buried mudrocks. Clay minerals react to form equilibrium assemblages in  $1 \times 10^4$  years in some hydrothermal systems, but immature clays may survive for up to  $2 \times 10^9$  years in mid-continent rift basins. Clay mineral assemblages and the *b* cell dimension of K-white mica can be used to infer the geotectonic settings of sedimentary basins.