Geological formations are considered always to contain fractures to some extent. Fluid flow within such rocks is strongly influenced by the degree of connectivity between these fractures and their individual permeability. This permeability, however, is rarely constant. Under conditions that permit for thermo-hydro-mechanical-chemical reactions, numerous experiments demonstrate its potential for significant and rapid change. Whether the response is that of an increase or a decrease of permeability over time seems to depend on the reactivity of the rock-fluid system. In general, low to moderate reaction rates result in a reduction of equivalent hydraulic aperture, and this compaction is attributed to different grain-scale processes, depending on temperature and pressure. The fractal nature of the underlying geometry, both at the network and at the microscopic scale, is addressed by a multi-scale approach. Changes in the fracture pore-space are evaluated at the micron scale for models considered as representative volume elements. The scale-dependent nature of reactive transport is incorporated by fracture-scale models. Finally, the transient effects on effective permeability is modeled on the fracture network scale.