Pressure solution in natural samples: FIB/TEM study on orthogneiss from South Armorican Shear Zone, France

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Pressure solution is an important mass-transfer mechanism driven by dissolution and (re)precipitation creep. It occurs in rocks that contain intergranular fluids and may operate in a wide range of temperature, pressure and rock types. Indicative features for the operation of these processes at microscale were studied in the samples of deformed granites that were sheared in the South Armorican Shear Zone, France. Evidences such as truncate grain and phase boundaries of quartz, K-feldspar and white mica via transmission electron microscopy (TEM) and evidence of pressure solution activity was observed in phase boundaries between white mica - quartz and white mica - K-feldspar. In the quartz-white mica phase boundaries we have found evidences for the island-and-channel model of Wassmann and Stöckhert (2013). Quartz dissolution along the phase boundaries is crystallographically controlled. The partial dissolution phase boundary is characterized by very rough surface forming triangular, trapezoidal and asymmetric voids that represent channels for fluid migration in the island-and-channel model, while the undisturbed boundary represents islands. These features are confirmed in the 3D nanotomography in the form of short movie. When white mica basal plane is not parallel to the phase boundary, amorphous material and mica overgrowing quartz may occur. In white mica - K-feldspar boundaries, amorphous material representing leached K-feldspar at the K-feldspar interface was observed as previously described by Hellmann et al. (2012). Overall the dissolution reprecipitation seems to be complex mechanism that forms significant features in different phases according to respective crystallographic orientation.