Stylolite stress inversion

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Stylolites are localized dissolution seams that can be found in a variety of rocks, and can form due to sediment compaction or tectonic forces. Dissolution of the host-rock next to the stylolite is a function of the applied stress on the stylolite plane. Stylolite teeth indicate the direction of the main compressive stress. Recent advances have shown that the stylolite roughness also shows a stress scaling relation that can be used to calculate magnitudes of stress. Elastic and surface energies produce a different roughness, and the transition between the two is stress dependent and can be quantified. In order to measure the roughness a two or three-dimensional section of a stylolite plane is taken and transferred to a one-dimensional function. The cross-over in the roughness is then picked with the help of an FFT plot. Using this method the burial depth of sedimentary stylolites can be determined. Moreover, tectonic stylolites can be used to determine the full three-dimensional stress tensor if the paleodepth of the tectonic stylolite is known. Stylolites can also be used to find fault offsets and to understand when these faults were active and how the paleotopography looked like at the time the stylolites grew. However, uncertainties remain since Youngs Modulus, Poisson Ratio and surface energy may vary in rocks. In addition, the stylolites record only a snapshot in time, probably the moment when they closed and stopped dissolving. We show examples of the use of stress inversion for stylolite formation conditions in different tectonic settings, and discuss the potential of the method.