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Quo Vadis P-T? Sum igitur mechanicaturus (I am going to do mechanics)!

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Metamorphic reactions are most often considered as a passive record of the changes in pressure, temperature and fluid conditions that rocks experience. As such, they provide major constraints on the tectonic evolution of the crust and mantle. However, natural examples of strain localization in ductile shear zones show that metamorphism can modify the strength of rocks by reaction softening processes. Hence, metamorphic reactions also have an active role in tectonics by inducing softening and, probably, hardening as well. Quantifying the mechanical effect of metamorphic reactions is, therefore, a crucial task for determining the strength distribution and evolution in the lithosphere.

I will present a method that combines thermodynamic and mechanical modeling for calculating the strength of metamorphic rocks as a function of their mineral assemblages. Firstly, the Theriak/Domino package (De Capitani and Petrakakis, 2010) is used for calculating phase fractions. Secondly, mechanical parameters determined in lab experiments for all phases and the previously determined phase fractions are used as inputs for the Minimized Power Geometric model (Huet et al., 2014) for calculating the bulk mechanical behavior at desired P-T-fluid conditions. I will show an example illustrating the method and quantifying the first order impact of metamorphic reactions on strain localization.

References

De Capitani and Petrakakis, 2010. The computation of equilibrium assemblage diagrams with Theriak/Domino software. *American Mineralogist*, 95, 1006-1016.

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