Statistical approach in the microboudin method for palaeostress analysis: reliability of the relationship between far-field differential stress and proportion of microboudinage structure of columnar grains

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The microboudinage structure of columnar mineral grains can be used as a passive marker in the palaeostress analysis of the metamorphic tectonites. In this presentation, we demonstrate the stress estimation by the numerical model that uses grain-shape data to calculate the relationship between the proportion of microboudinaged columnar grains (p) and the far-field differential stress (σ_0). This model combines weakest link theory and the shear-lag model. Weakest link theory is used to derive the fracture strength of grains, whereas the shear-lag model is used to determine the relationship between the differential stress within a grain (σ) and σ_0. An intact grain becomes a microboudinaged grain when σ is higher than its fracture strength at a specific point within the grain. The relationship between p and σ_0 can be used to estimate the magnitude of differential stress. Here, we make calculations of p for all intact grains under increasing σ_0 regardinig 50–1000 tourmaline grains shape data. These data are randomly collected from the original 1432 tourmaline grains shape data. Using the calculation result, we enable to evaluate the number of measurement grain to carry out a reasonable palaeostress analysis. This procedure will contribute to resolve the particularly time consuming when conducting stress analysis for a large number of samples within a metamorphic belt.

Keywords: palaeostress analysis, numerical simulation, microboudin palaeopiezometer, tourmaline, microboudinage structure

