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Abrupt or asymptotic?: how metamorphic tectonites cease plastic deformation during exhumation

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This study addresses how quartzose and calcareous metamorphic tectonites cease plastic deformation in a course of retrograde metamorphic history during exhumation by considering microboudinage structures of columnar mineral grains embedded in quartz or calcite matrix. There are possibly two causes for cessation of plastic deformation: one is disappearance of differential stress and the other is related to the plastic-brittle transition of matrix mineral. A simple speculation leads that fundamental strain data of microboudinage structures are possibly classified into 4 cases in relation of the time of plastic-brittle transition to differential stress history. The classification is closely related to the degree of obliteration of deformation microstructures and crystallographic preferred orientation patterns caused by post-tectonic annealing.

As examples, precise strain data of microboudinage of columnar minerals were presented for 3 quartzose and 1 calcareous metamorphic tectonites from high pressure/temperature metamorphic belts. The results show that they have all ceased their plastic deformation due to plastic-brittle transition, and suggest that they have sufferred from increasing differential stress during exhumation in retrograde metamorphism.