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The role of static processes on microstructures and textures

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In natural microfabrics both dynamic and static processes are observed, having a combined effect on the final microstructure of rocks. In order to better understand the resulting rheology of a rock, we have to unravel the static effects (e.g. annealing) form the deformational ones. The present study focuses on the effect of static conditions on polymineralic microfabrics for polymineralic carbonates and analogue materials. Generally two different types of growth behavior can be distinguished: (1) As long as the driving forces of the matrix grain growth is smaller than the dragging forces of the second phases, they retard or even stop the growth of the matrix grains and the matrix grain size stays relatively small. Depending on T and the time available, mass transfer between second phases can occur allowing the second phases to grow simultaneous with the growth of the matrix phase. (2) For progressed grain growth stages, the matrix grain even overgrows the second phases due to the ambition to reduce the boundary curvature. Thus, the second phases are included and chemically isolated from the mass transfer pathways between them. Since some of the second phases have been newly formed due to mineral reactions, such included phases can preserve the conditions of grain growth at the time they were overgrown by the matrix minerals. We performed in-situ rock analogue experiments using rigid non-reacting phases (microbeads) embedded in a norcamphor matrix. Similar to natural polymineralic carbonates, we observed an influence of temperature as well as a dependency on the quantity and size of the second phase on the matrix grain size. In our experiments, the size of the micobeads has more pronounced effect on pinning than their quantity resulting in very heterogeneous grain growth. This effect is particularly enhanced when microbeads are clustered together and thus impedes a larger pinning force on the matrix grain boundaries. Such heterogeneities are further enhanced by the time-dependency of the pinning. With increasing time, the grain boundary cur-

vature of matrix grains increases at pinned grain boundaries. As a consequence, the driving force for grain boundary migration is enhanced and can even overcome the counteracting dragging force of the microbead. Once detached from the microbead, the norcamphor grain boundary migrates at high speed and the grain size of the corresponding matrix grain can dramatically increase and can attain grain sizes even larger than those of freely grown grains. This considerable heterogeneity in growth rates is very important for the interpretation of microfabrics of polymineralic rocks found in nature, suggesting that different parts in the fabric may have formed during different time intervals of the geologic history.