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The effect of muscovite on the fabric evolution of quartz under general shear

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General shear experiments were conducted to investigate the role of mica content on the microstructural evolution and rheological properties of quartz aggregates. In previous studies, axial compression experiments were conducted on quartz aggregates to develop a better understanding of the relationship between flow strength and lattice preferred orientation with varying percentages of muscovite. Other analyses have shown a relationship between the topology of second phases and the aggregate strength of the material. When the second phase exceeds a threshold percent within the aggregate, it becomes the mechanically controlling phase. In the case of muscovite in a quartzite, when the muscovite becomes abundant enough to develop an interconnected framework throughout the aggregate it becomes the controlling phase of the aggregate. Based on this previous work, we have begun an investigation to constrain the role of mica content on the strength and fabric evolution of quartz. General shear experiments were performed using synthetic quartz aggregates with 0, 5, 10, and 25 percent muscovite at 800°C and 1500 MPa. 0.1 wt % of distilled water was added to provide stabilization of the mica as well as enhance any quartz recrystallization processes. All the experiments are performed at a shear strain rate of $\sim 10^{-5}$/s. At a shear strain rate of $\sim 10^{-5}$/s the quartz deforms by a combination of bulging recrystallization and subgrain rotation while muscovite deforms by kinking and slip along the basal plane. In addition, serrated phase boundaries between quartz and muscovite demonstrate the presence of dissolution-precipitation processes that may lead to the development of an interconnected framework. Aggregates with percentages of 5% mica display a drop in mechanical strength while at percentages greater than 10% mica, an interconnected framework develops accommodating the bulk of the strain, because mica is mechanically weaker. These results produce a range of quartz grain sizes and have implications for recrystallized quartz piezometers and the development of shear zones within the continental crust.