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An experiment study of quartz-coesite transition at differential stress

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In order to study quartz-coesite transition under the conditions of differential stress, experiments of quartzite deformation were carried out using a triaxial testing system with a Griggs type solid medium pressure vessel. Analyses on the plastically-deformed samples under optical microscope and Raman spectra show that fine-grained coesite was present in the region of samples adjacent to the pistons at temperatures of 950 to 1100°C, confining pressure of 1.3 GPa, differential stress of 1.5 to 1.67GPa, and total strain of 75 to 81%. It is evident that the transition pressure of quartz-coesite at differential stress and intensely-strained conditions is far lower than the pressure for coesite stability at isostatic pressure(e.g.Bose and Ganguly, 1995). The decrease in confining pressure for quartz-coesite transition under differential stress conditions is controlled by a combined effect of the maximum principal stress that provides a high stress environment, and differential stress that causes sample deformation. Coesite was produced in the plastically-deformed samples in this study, but it can occur in both semi-brittle and plastic deformation regimes as seen in previous studies(Hobbs,1968; Green,1972; Hirth and Tullis,1994). Phase transition in semi-brittle deformation regime is caused by local mechanical instability induced by shear deformation, and phase transition in plastic flow regime is due to strain instability induced by the presence of a high dislocation density within intensely-deformed quartz crystals.

Keywords: quartz-coesite transition, differential stress, high temperature, high pressure.

References

[1] Bose, K., Ganguly, J., American Mineralogist, **80**, 231(1995).
[2] Hobbs, B. E., Tectonophysics, **6**, 353(1968).
[3] Green, H. W., Journal Geophysics Research, **77**, 2478(1972).
[4] Hirth, G., Tullis, J., Journal Geophysics Research, **99(B6)**,11731(1994).