TRAPPING OF HETEROGENEOUS FLUIDS

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In theory, the formation of a fluid inclusion assemblage from a multi-phase state (i.e. heterogeneous entrapment) is a common process at natural geological conditions. The immiscibility of multi-component fluids may occur at high temperatures and pressures and is not restricted to diagenetic conditions. Specific fluid systems are even immiscible at Greenschist-, Amphibolite-, Blueschist-, and Granulite-facies metamorphic conditions. The identification of a heterogeneous fluid inclusion assemblage in natural rock is a major challenge in fluid inclusion research, and it is expected to be a common phenomenon. There is only little experimental knowledge about the formation of heterogeneous fluid inclusion assemblages. The synthesis of these assemblages has been used in only a few experimental studies to investigate the boundary conditions of fluid immiscibility fields. These studies included the analyses of only a few fluid inclusions (between 1 and 10 per experiment), but do not reveal the variability of the assemblage or systematics on the distribution or deviations of distinct fluid inclusion types. One inclusion is not representative for specific experiments that usually result in a variety of fluid properties. Fluid inclusions are synthesized at approximately 600 ˚C and 80 MPa, from a 30 mass% NaCl aqueous solution (SR-020) and a 10 mass% NaCl aqueous solution (SR-019). For both experiments, the conditions are within the two-fluid phase field, and both should result in the formation of similar liquid-rich inclusions and similar vapour-rich inclusions, but in different proportions. Due to the unmixing at experimental conditions, two fluids are present in the capsules, i.e. a liquid-like fluid relatively enriched in NaCl (40.42 to 41.40 mass%) and a vapour-like fluid relatively depleted in NaCl (2.41 to 2.71 mass%). The measured dissolution and homogenization temperatures are not consistent with values calculated with the thermodynamic model (Fig. 1). These preliminary results of experiments in the H_2O-NaCl fluid system have illustrated that predicted fluid properties do not correspond to the observed assemblage. Therefore, the processes that are involved during heterogeneous entrapment need to be investigated in greater detail by systematic analyses of entire fluid inclusion assemblages to be able to predict fluid entrapment in natural systems, and to be able to deduce natural trapping conditions from the observed assemblages.

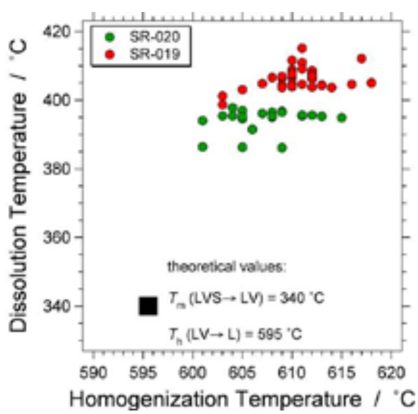

Figure 1. Microthermometric results of liquid-rich fluid inclusions from SR-019 and SR-020. The expected values are illustrated by the black box.