Contamination Cntrolled Detection of Microbial in Fluid Inclusion for Evaluation of Underground Biosphere

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Recent studies suggest possibility for existence of huge biosphere in rocks of the earth's crust, where no life has been expected to exist for a long time. Particularly, it have been expected that living things could exist in the slab of the subduction zone at several ten kilometers depths, because of relatively low temperature (up to 100 ^{o}C). On the other hand, rock-forming minerals usually contain fluid inclusions. It is expected that the biochemical material or microorganisms exists in the fluid inclusions. In this study, fluid inclusions containing protein were synthesized in quartz under the relatively low temperature and analyzed with a contamination controlled detection technique, to investigate possibility for existence of biochemical material or microorganisms in rocks.

Four well-cracked quartz plates (3 mm x 3 mm x 7 mm) were placed in a gold tube, together with protein solution (2.0 micro g/ml) and quartz powder. The tube was placed in a stainless autoclave together with water (97-99 % filling factor). The autoclave was heated at 99 ^{o}C in a sand bath for 12 days, where hydraulic pressure in the autoclave was 6-20 MPa. After the reaction, one quartz plate was polished to prepare thin sections for fluid inclusions observation. Additionally, remained three quartz plates were used for analysis of protein in fluid inclusions with the BCA method. Before the analysis, the quartz palates were cleaned with ethanol and distilled water using an ultrasound bath. Cleaned quartz plates were crushed in 2 ml sterile water to prepare a protein solution sample, and the sample was filtered (0.22 micro m pore diameter). Then the sample was analyzed by the BCA method to measure protein concentration.

Fluid inclusions were confirmed in thin sections of the quartz plates by the observation, and the protein concentration of the sample was 5.98 micro g/ml. These results shows that three quartz plates contained 11.9 micro g protein in fluid inclusions. Considering protein concentration of the starting solution (2.0 g/ml), the fluid inclusions contained the starting protein solution of 5.98 x 10^{-3} ml (3.16 vol.% for quartz). This study suggests that there is possibility for existence of biochemical material or microorganisms in rocks, and the contamination controlled detection technique could be applied to natural fluid inclusions.