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Changes of permeabilties as a result of Hydrate Dissociation in Sand-Clay Sediment from Qilian Mountain Permafrost, China

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Permeability is known as a key factor affecting the effectiveness of gas production from a natural gas hydrate reservoir. In addition to the lithological effects of the hydrate-bearing sediment itself, the formation and dissociation processes of gas hydrate in the sediments may also have an influence on the permeability. In this study, samples from a gas hydrate reservoir in the Qilian Mountain permafrost (borehole DK-8 and SK-2 in northern Muli coalfield) were taken for the permeability experiments. Permeabilities were measured before hydrate formation, with hydrate and also after hydrate dissociation. The presence of solid methane hydrate in the pores lowers the permeability depending on hydrate saturation. However an unexpected high permeability decrease was observed after the dissociation of methane hydrate. Six kinds of permeability tests were carried out to detect the reason for formation damage after hydrate dissociation. The results indicate that the fresh water released from the hydrate dissociation may cause an activation and following the migration of fine particles which block the pore throats and finally result in a decrease of permeability. Scanning Electron Microscopy (SEM) analysis on the filter papers which attached on the inlet and outlet of the core sample provides visible evidence on fine migration. In our study we present the experimental results of the permeability tests under different conditions and discuss the potential reasons for our observations. One possible explanation for this phenomenon may be that the release of fresh water causes an increase in the double layer thickness at the water mineral surfaces and therefore increase the repulsion forces between rock particles. This process can release small particles which were attached to the surface of bigger sediment grains.