

Development of a non-volcanic hydrothermal system caused by formation of a high permeability fracture zone

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It is necessary to comprehend the formation conditions and development process of non-volcanic hydrothermal system to estimate the effect of the hydrothermal system on the geological repository. In this study, we conducted some numerical model calculations for development of a non-volcanic hydrothermal system caused by a high permeability fracture zone formed by seismic activity. There are some examples of the strong earthquakes in the area which has been considered as non-volcanic, and aseismic.

We set a high permeable zone that has a height of 12 km and exists 3 km below ground surface. The width (4 km, 6 km), length (16 km and 28 km) and permeability (1 md, 10 md, 100 md) of the zone were set as parameters of the calculations. The results of the calculations up to 100,000 years after the formation of the high permeable zone show that relatively strong convection occurs in the permeable zone in the early stage of the development process, and changes to weaker one and temperature homogenization in the zone with time. However, groundwater flow commences outside of the permeable zone. The result of the calculation up to 1,000,000 years shows that weak convection spreads over a wide area out of the permeable zone. Therefore, it is inferred that a non-volcanic hydrothermal system will be formed and the distributions of underground temperature and groundwater flow will be changed in the long term if no effect appears just after the seismic events.