

## Evaluation of thermal and hydrothermal effects on geological repository -example of Chugoku-Shikoku district-

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### 1. Correlation between subsurface temperature and epicenter in Chugoku-Shikoku

The model field in Chugoku-Shikoku is the quadrangle delineated by latitude 33.00N to 35.67N, and longitude 132.00E to 135.00E. 74 drill holes are available for calculation of thermal gradients under the condition of more than 300m depth (Tanaka et al., 1999) in this field. Using these data, the subsurface temperatures until -5 km asl (above sea level) are extrapolated by this thermal gradient provided that surface temperature is 15 degree C. The location map of the drill holes indicates that drill holes are unevenly dispersed.

The overlay of subsurface temperature (-5 km asl), micro-seismicity and Curie-point isothermal depths is shown in plan views. The plan view indicates that subsurface temperature is anomalously high near Tottori and Kurayoshi where include the hot spring areas not related to Quaternary volcanoes. However, both areas are relatively close to Quaternary volcanoes, Mt. Daisen, and Oginosen those are parts of Quaternary volcanic front in northern part of Chugoku. Other temperature anomalous areas are Dogo hot spring area near the Median Tectonic line. The epicenters occurred from January 1998 to December 2003 are plotted on the plan view, and concentrate in Quaternary volcanic terrains in northern part of Chugoku and Shikoku off shore. Some other epicenters dispersed in whole area.

The cross-section indicates that subsurface temperatures based on drill hole data are generally concordant with the Curie point depth assumed as the isotherm of 650 degree C with exception of regional anomalies in southern part of Chugoku. Most epicenters occurred from -25 km to -5 km depth. The depth of epicenter in San-in is relatively shallow, and deeper in southern part of Chugoku. In Shikoku, there are two groups of epicenters: one is shallow crustal one and the other related to Philippine Sea plate.

A bird's-eye picture of micro-seismicity and Curie-point isothermal depths indicates that epicenters in northern part of Chugoku mostly occurred near the Curie point depth assumed as 650 degree C, and those in southern part of Chugoku below the Curie point depth. In Shikoku, the depths of epicenters vary from below to above of Curie point depth. This means seismicity is relatively more active and shallower in Quaternary volcanic terrains compared to in fore arc regions with exception of deep seismicity by plate subduction.

### 2. Result

The model field, Chugoku-Shikoku was studied to make clear the subsurface thermal structure and relationship between the thermal structure and epicenters by overlay method by computer. It is generally concordant between the temperatures estimated by drill hole thermal gradients and temperatures assumed by Curie-point depth as 650 degree C. Surface thermal manifestation such as hot springs is mainly controlled by the subsurface thermal structure. While, many epicenters occurred near volcanic front, and it is interpreted as microseismicity is caused by upward migration of magma and hydrothermal fluids. In general, the degree of microseismicity suggests the degree of tectonism and magmatism. The cut-off depth of upper crustal seismicity, so-called brittle-plastic boundary, is not clearly identified.

The district including high-temperature areas is classified respectively into 5 types as characterized regional zones; fore arc lowland, fore arc mountain country, Quaternary volcanic terrain, back arc lowland and back arc mountain country. Conceptual model for representative cross sections of Chugoku-Shikoku district is investigated and generalized.