

## Upward fluid migration in free gas zone in the Kumano basin detected from the temperature logging at IODP Site C0009

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Temperature profiles are obtained in the Site C0009 during IODP 319, one of the expeditions of IODP NanTroSEIZE Stage 2, with multiple wireline logging. These temperature logs are from independent logging runs with different lapse time since after the end of mud circulation in the borehole. We estimated equilibrated temperature profile of the formation by the Horner plot method using multiple logging data. The thermal gradient obtained from equilibrated formation temperature is different between geological units; 31 K/km in Subunit IIIA, 17 K/km in Subunit IIIB, and 28 K/km in Unit IV. The smaller thermal gradient in Subunit IIIB may be the result from larger thermal conductivity, however the data from Site C0002 suggests that the thermal conductivity of Unit III and IV has similar values. The smaller thermal gradient in Subunit IIIB would be attributed to upward migration of fluid that is produced in the Kumano forearc basin sediments. The velocity of vertical flow in Subunit IIIB is estimated to be  $9.2 \times 10^{-9}$  m/s, which is comparable to velocity estimated in situ hydraulic property measurement. Examination of temperature gradient and apparent thermal conductivity from temperature logging and core thermal conductivity is one of the crucial tools to estimate the motion of fluid flow. Fluid flow can be estimated from the deviation of temperature profile from pure conductive model. This strategy is possibly capable for fluid flow with small velocity, which cannot be detected by direct measurement of fluid flow.

Keywords: Thermal structure, crustal fluid flow, forearc basin, deep drilling, well logging, NanTroSEIZE