THE IMPACT OF AMBIENT ORGANIC MATURITY ON THE THERMAL AUREOLE OF IGNEOUS INTRUSION

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Introduction

The thermal effect of igneous intrusion on organic matter maturation have been widely discussed by many researchers. While most intrusions cited are of diabasic intrusion with similar intrusion temperature (ca. 1000°C), the maximum distance (or thermal aureole extent) from the contact, to which organic matter maturation is affected, varies from place to place. Dow (1977) showed that the maximum distance was about twice the thickness of the intrusion in a well from Delaware Basin, while in another case from DSDP site 368, the maximum distance was the same as the thickness of the intrusion (Dow et al., 1978). Chen et al. (1989) also reported a case from Geyucheng-Wenan area of Hebei province in China, where the maximum distance even reached 2.7 times the thickness of the intrusion. However, the causes of such variation of thermal aureole extent with respect to the thickness of intrusion has been rarely discussed.

In this paper, two wells from structures along Yilan-Shulan fault zone, north-eastern China (Fig. 1), were geochemically analysed in detail. Both wells have been intruded by a diabasic sill but at different diagenetic phase. The thermal aureoles of the two wells are different and the causes were discussed.

Results and discussion

The well Fang20, located in the Fangzheng fault depression, is in the early diagenesis with ambient organic maturity less than 0.6%Ro. The well was intruded by a diabasic sill with the thickness of 150m in the Miocene (17.7Ma, based on K-Ar dating). The extent of thermal aureole is about the same thickness of the diabasic sill, with the maximum Ro of 2.5%. The well Bin2, located in the Suibin depression, is in the middle-late diagenesis with ambient organic maturity greater than 1.0%Ro. The well was intruded by a diabasic sill with the thickness of 100m in the Early Cretaceous (101-96Ma, Zhu et al., 2009). The extent of thermal aureole is about twice the thickness of the diabasic sill, with the maximum Ro of 4.0%.

In comparison with other published data (Dow, 1978; Simoneit et al., 1978; Chen et al., 1989; Othman et al., 2001, etc.), we suggest that the specific heat capacity and thermal conductivity of source rock are most important factors controlling the extent of thermal aureole, as opposed to the lithology, thickness and temperature of intrusion body. In the early diagenetic phase (i.e. low organic maturity), source rock has high specific heat capacity and low thermal conductivity, resulting in narrow thermal aureole. In contrast, in the middle-late diagenetic phase (usually higher organic maturity), mainly due to compaction, source rock has lower specific heat capacity and higher thermal conductivity and the resulting thermal aureole is much wider.

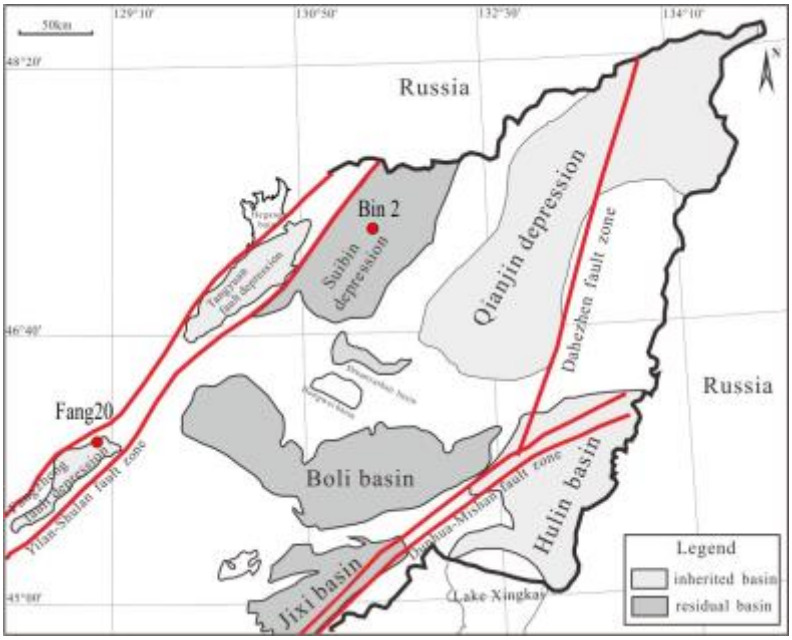

Figure 1 *Sample location and geologic settings.*

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