

Fluid inclusion evidence for boiling process of petroleum fluid in the north Qaidam Basin (NW China)

Y.T. LIU, K. HU, J. CAO, S.Y. YANG, L.L. YAN
AND K. WANG

Department of Earth Sciences, Nanjing University, Nanjing
210093, China (kaihu@nju.edu.cn)

Boiling process has been usually defined for the activity of hydrothermal fluid. During this process, a large number of boiling fluid inclusions can be formed. In this study, we reported the fluid evidences for boiling process of petroleum fluid in the northern Qaidam Basin (NW China). Such fluid inclusions are present as a group consisting of different types of inclusions. They are hosted in one single grain. Besides saline inclusions, oil inclusions take the majority. Gaseous and liquid oil inclusions are coeval, and they have similar homogenization temperatures (30-50°C). Thus, it is suggested that they were captured simultaneously. The gaseous inclusions are characterized by the ratio of gas to liquid largely greater than 1. In contrast, in liquid inclusions, the vapour phase only accounts for less than 5-10%, and sometimes even can not be micro-observed. These indicate that such fluid inclusions were captured in the boiling of petroleum fluid, with vapour phase mainly for gaseous inclusions and liquid phase mainly for liquid inclusions. These inclusions are found mainly in the Neogene sandstone reservoirs of the northern Qaidam Basin. The primary petroleum fluid must have much gas component. In addition, the forming mechanism of such inclusions implies that the underlying reservoir must have been under over-pressure condition before its boiling. Combined with the tectonic setting of this area, we concluded that it is fault's occluding and opening that cause this boiling process. During the death of the fault, hydrocarbons were generated more and more with the formation pressure increasing. Later, structural movement or the breaching of fluid itself made the fault open. This rapid and sharp decrease of pressure ignited the boiling of petroleum fluid. Fluid ascended up along the fault from the Jurassic source sequences to the Neogene reservoirs in the area and boiling fluid inclusions were formed. The boiling of petroleum fluid also can make the fractionation of oil-gas during the migration. The light hydrocarbons are favourable for ascending up with the opening of fault. Consequently, gaseous inclusions are formed and residual condensate will be trapped. This result indicates that, in the boiling process of petroleum fluid, the hydrocarbon pathway is mainly the fault. In addition, in the northern Qaidam Basin, gas/condensate is a key for petroleum exploration.