Effects of hydrothermal on organic matters in oil/gas-bearing basins

DONGYA ZHU[1], WENXUAN HU[1], ZHIJUN JIN[2], XUEFENG ZHANG[1] AND JUNTAO ZHANG[1]

[1]Department of Earth Sciences, Nanjing University, Nanjing, 210093, China (zhu_dongya@sohu.com)
[2]Petroleum Exploration and Development Institute of SINOPEC, Beijing, 100038, China (zjjin@pepris.com)

Thermal energy is one of the most important factors that control the evolution of sedimentary organic matters and petroleum in the oil/gas-bearing basins. Hydrothermal associated with magma/volcanic activities would carry large amount of heat and could probably accelerate the evolution of sedimentary organic matters from immature to mature or even to overmature and impel the conversion of petroleum to bitumen or even to graphite. A place where magma intruded in a sedimentary basin provides a natural laboratory to examine the above processes in that the intrusion would release a great amount of hydrothermal to its surrounding rocks.

A diabase intrusion of about 60m thick was found intruding into a set of Paleogene black mudstone source rocks in Jiyang Depression, East China. Below the diabase intrusion, sixteen vitrinite Ro values of kerogen in mudstones at intervals of several metres were measured. The results indicate that the source rocks are substantially influenced to some different degrees by the intrusion, and the thickness of influenced source rocks is nearly equal to that of intrusion. The Ro values roar from 1.0% up to as high as 3.8% upwardly within a thickness of about 10m below the intrusion, showing that the organic matters had been highly metamorphosed by hydrothermal.

Another diabase intrusion was found intruding into Silurian sandstone reservoir rocks in the center of Tarim Basin, Northwest China. The pre-existing petroleum in the surrounding sandstones had been extremely alterated and completely converted into bitumen and even graphite. The average bitumen reflectance of the hydrothermally altered bitumen is 3.6%, indicating that the bitumen is highly overmatured.

The high heat-potential hydrothermal associated with magma/volcanic activities in oil/gas-bearing basins should be paid more attention with respect to petroleum exploration because it can not only accelerate the maturation and hydrocarbon-generation of hydrocarbon source rocks but also destroy the previously existed petroleum reservoirs.