

Oil and gas formation under organic-inorganic interaction in crust-mantle system

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Abstract: As relatively stable blocks in the earth system, petroliferous basins are affected by the evolution of earth system in many aspects. Deep fluids act as a bridge communicating the internal and external factors of basins, and they participate in the whole process of oil and gas formation and accumulation by means of organic-inorganic interaction. Deep fluids carry many nutrients, provide extra carbon and hydrogen sources for basins. Besides, deep fluids promote the development of high-quality source rocks and the increase of their hydrocarbon potential. Moreover, the energy carried by deep fluids can also accelerate the maturation of source rocks and increase the production of hydrocarbons by activating the hydrogenation reaction of high-mature source rocks. Deep CO₂-rich fluids improve the deep reservoir space by dissolving carbonate and clastic rocks, which allows the reservoir space to extend to the deeper strata as well. In addition, deep CO₂-rich fluids can also increase the fluidity of hydrocarbons in deep and tight reservoirs by displacing the crude oil retained in deep layers and CH₄ in shales. Meanwhile, the substances (C, H, catalytic substances) and energy carried by deep fluids not only promote the generation of CH₄ by Fischer-Tropsch synthesis, but also lead to the thermal alteration of crude oil derived from organic source and the formation of "hydrothermal oil". Therefore, from the perspective of the interaction among the spheres of earth, deep fluids not only provide a great deal of extra carbon and hydrogen for basins, but also improve the oil and gas storage space and promote the enrichment and accumulation of oil and gas.