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Coupling of dynamics and physical property in hydrocarbon accumulation period control the oil-bearing property of low permeability reservoir: Take the case of the low permeability turbidite reservoir of the middle part of the third member of Shahejie formation in Dongying Sag

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The coupling relationship between physical property and dynamics of hydrocarbon accumulation period determines oil bearing property of low permeability reservoir. Studies on reservoir physical property evolution and accumulation dynamics of low permeability turbidite reservoirs have been carried out by means of core observation, thin section identification, fluid inclusion analysis, carbon and oxygen isotope analysis, mercury penetration, physical property testing, basin modeling, combined with analyses of burial history, thermal history and hydrocarbon charge history in the middle part of the third member of the Shahejie Formation in Dongying Sag. The petrophysical cutoffs of reservoirs in the accumulation period were calculated after recovery of accumulation dynamics and reservoir pore structures and then the distribution laws of the oil-bearing property of reservoirs controlled by the matching relationship between dynamics and physical property during accumulation period were summarized. On the basis of diagenesis features study and with the guide of 'diagenesis-filling' evolution sequence, the reservoirs can be subdivided into four kinds of diagenetic facies. The reservoir experienced two period of hydrocarbon accumulation. In the early accumulation period, reservoirs have middle to high permeability from 10×10-3 μm2 to 4207.3×10-3 μm2 except diagenetic facies (A). In the later accumulation period, reservoirs have low permeability from 0.015×10-3 μm2 to 62×10-3 μm2 except diagenetic facies (C). The fluid pressure generated by hydrocarbon forming is 1.4 Mpa to 11.3 Mpa with an average of 5.14 Mpa and the surplus pressure is 1.8 Mpa to 12.6 Mpa with an average of 6.3 Mpa in the early accumulation period. In the later accumulation period, the fluid pressure generated by hydrocarbon forming is 0.7 Mpa to 12.7 Mpa with an average of 5.36 Mpa and the surplus pressure is 1.3 Mpa to 16.2 Mpa with an average of 6.55 Mpa Different kinds of reservoirs all can accumulate oil in the early accumulation period. Different kinds of reservoirs all can accumulate oil under high accumulation dynamics whereas reservoir with diagenetic facies (A) and diagenetic facies (B) could not accumulate oil in the late accumulation period. Vertically, when burial depth of turbidite reservoir is more than 3000 m, reservoirs are all oil-filled and the hydrocarbon-filling degree is higher and so can the isolated lenticular sand bodies. When burial depth of turbidite reservoir is less than 3000 m, the development of oil-source faults controlled the accumulation of reservoirs and the isolated lenticular sand bodies cannot get hydrocarbon filling. For flat surface, hydrocarbon always accumulated in reservoirs around the oil-source faults and areas near the center of subsag with high accumulation dynamics.

Biography

Tian Yang has completed his B.E and M.E. in Geology from School of Geosciences, China University of Petroleum, China. He will complete his Ph.D. in July 2016 from School of Geosciences, China University of Petroleum (CUP).

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