Reservoir Architecture Characteristics and their Control on the Remaining Oil of a Shallow Water Delta Plain

Min Li[1], Xiongqi Pang[2], Zhidong Bao[3], Dongsheng Zang[1], Bo Niu[1]
[1]China University of Petroleum (Beijing); [2]State Key Laboratory of Petroleum Resources and Prospecting, China University of Petroleum (Beijing); [3]China Univ. of Petroleum

9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

Taking the shallow water delta of Fourth Member of Lower Cretaceous Quantou Fomation in Xinmin Oilfield, Songliao Basin as an example, based on cores, well logs of dense well pattern and production data, the reservoir architecture of shallow water delta plain is analyzed by using the analytic hierarchy process. Then combining the results of 3D geological modeling and numeral simulation, the comprehensive control of different levels of architecture elements and bounding surfaces on remaining oil distribution is discussed and clarified. Distributary channels are skeletal sand bodies of shallow water delta plain. By dissecting compound distributary channel sand bodies, the reservoir architecture characteristics are clarified. Single distributary channel has a width of 165.5m~521.6m and a thickness of 4.2m~5.8m. There are few muddy interlayers exist between distributary channels because single distributary channels are mainly lateral and vertical tangency and superposition. Along channel are several point bars with spans of 350m~550m which compose single distributary channel and are separated by abandoned channels. A series of lateral accretion bodies and lateral accretion layers which form a point bar distribute obliquely and parallel in the vertical direction of the channel. A lateral accretion body has a width of 57m~64m and a thickness of 2.0m~3.5m. Between two lateral accretion bodies is a lateral accretion layer with a thickness of 0.4m~0.8m and a dip angle of 5.0°~5.5°. Moreover, these architectural elements and bounding facies control the distribution of remaining oil. Due to few muddy interlayers between distributary channel single sand

bodies, the connectivity between single sand bodies is fairly good. Remaining oil mainly distributes on the edge of the upper single sand body because of two reasons. The first one is that water drive usually firstly occurs in the lower single sand body by gravity. The second one is that the physical properties of middle part of a single sand body are better than the edge's. The connection between point bars is poor because they are separated by impermeable abandoned channels. Therefore remaining oil in a point bar mainly distributes near an abandoned channel. The upper and middle parts of lateral accretion bodies are separated by lateral accretion layers while the lower part of every lateral accretion body is connected with each other. Thus the water drive at the bottom of lateral accretion body is good and remaining oil exists in the top of each lateral accretion layer. Finally putting the above all factors together, the distribution of remaining oil in shallow water delta plain is figured out. In plane remaining oil mainly distributes discontinuously on the edge of a distributary channel and on both sides of an abandoned channel and looks like a series of separated lobes. And vertically remaining oil mainly exists on the top of each lateral accretion body.