Geophysical Research Abstracts
Vol. 19, EGU2017-8189, 2017
EGU General Assembly 2017

The boundary effect of hydrocarbon-producing sag and its control on the structural deformations and hydrocarbon accumulation pattern: An example from the Paleogene hydrocarbon-producing sag in the western Qaidam basin, China

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The western Qaidam basin is divided into the southwestern Qaidam (SWQ), Yinxiongling Range (YXR) and northwestern Qaidam (NWQ) areas in petroleum exploration, the tectonic landforms and subsurface structural styles are utterly different respectively in these three areas. The YXR is the largest scale and most complicated NW-trending structural belt in the western Qaidam basin with a length of approximately 180 km and width of 20-30 km width. The NWQ area is characterized by a series of NW-trending rows of long-axis anticlinal belts. The SWQ is nearly whole covered by Quaternary, in which the NNW- and nearly SN- trending neotectonic activity records can be recognized. The oilfields that had been found are nearly all located in the YXR and the SWQ areas, and their distribution directions are highly consistent with the structural directions. The residual thicknesses of each horizon in Paleogene indicate that NW- and NNW- trending (present coordinates) hydrocarbon-producing sags, occupied by thick and soft argillaceous sediments that are rich in organic matter, were developed in the YXR and the SWQ areas, but the NWQ area is located at the lateral side of these sags. The width and depth of these sags, and the strength contrasts between filling compositions inside and outside of these sags and their controls on structural deformations in Neogene are discussed using physical simulations. The YXR developed atop the NW-striking sag, whereas the NWQ area is characterized by a series of long-axis anticlinal belts due to the thinner argillaceous layer for being at outside of the sag. We call this deformational phenomenon the boundary effect of hydrocarbon-producing sag. There are three types of structural positions favored for the hydrocarbon accumulation under the control of the boundary effect of hydrocarbon-producing sags. The first is the structural high parts generated by boundary effect along the sag edges, in which the near-source accumulation of hydrocarbon develops; the second lies outside of the sags, where the hydrocarbon accumulates outward to the structural, lithologic, and stratigraphic traps in the delta and transition regions of the shore, shallow to semi-deep lacustrine zones; and the last is the structural and lithologic traps with internal hydrocarbon accumulation inside the sag.