

Nanpu sag caprock closed time effectiveness of oil and gas research

Jiang Haiyan¹, Liu Binying²

¹Northeast Petroleum University School of Geosciences, Daqing, Heilongjiang, China, 163318

²Huabei Geophysical Prospecting Bureau of BGP Lnc., CNPC

***Corresponding Author:**

Jiang Haiyan

Email: jhy19910806@163.com

Abstract: Caprock sealing effectiveness refers to the time of oil and gas cap closure forming period and matching relationships among a large amount of hydrocarbon expulsion of source rock phase, if the caprock sealing ability formed earlier than the same period or phase and a large amount of hydrocarbon expulsion of source rock, can be closed living source rocks from a large number of oil and gas, oil-gas sealing is effective on time; on the contrary, if the caprock sealing ability formed later than a large amount of hydrocarbon expulsion of source rock, closed the caprock can live amount of oil and gas mainly depends on the size of the time difference between them, the time difference is smaller, caprock can closed living relative amount of oil and gas, the greater the sealing effectiveness of oil and gas on time is relative, the better; the opposite relatively worse. Thus it can be seen that to study the effectiveness of the cap rock oil-gas sealing time must first determine caprock sealing ability formation and the large amount of hydrocarbon expulsion of source rock.

Keywords: Nanpu sag, caprock sealing oil and gas, time validity.

Hydrocarbon source rock and its developmental characteristics

Es3 hydrocarbon source rock is the most important hydrocarbon source rocks of nanpu sag, the hydrocarbon generation quantity accounted for over 70% of the Nanpu sag. The third period of development of high abundance ratios of high-quality hydrocarbon source rocks[1-3], effective thickness of hydrocarbon source rocks in the 250 m or so, the TOC is as high as 5% above, vitrinite reflectance (Ro) in more than 0.8%,

amorphous body and algite is an important source of organic matter in hydrocarbon source rocks, kerogen mainly 1) type and 2) type, and it has a high evolution degree, has a peak oil. Because of its formation in Nanpu sag is the main lacunae, deepest lake basin water, lake basin, all the gray, film of large area of deep lake facies mudstone, calcareous mudstone and shale, and large thickness, plane distribution is stable, thus have great potential of hydrocarbon generation.

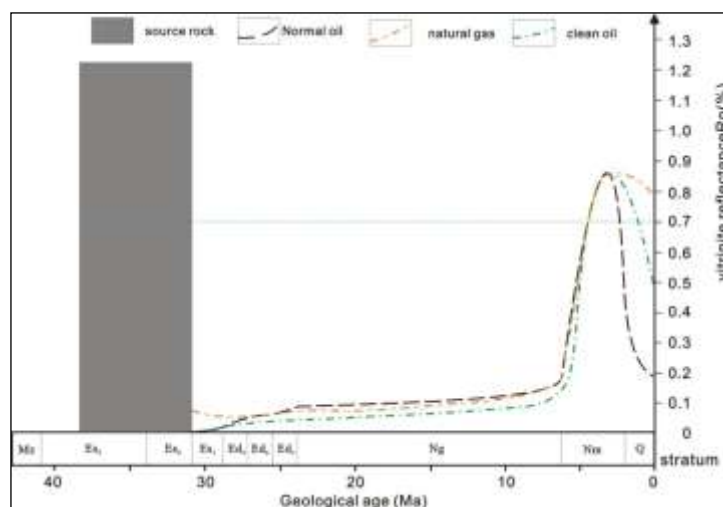


Fig-1: Nanpu sag of hydrocarbon source rock and hydrocarbon generation evolution curve

The results show that the history of hydrocarbon expulsion of source rock research [4-6], Nanpu sag of

Es3 source rock in the late guantao sedimentary begin to enter a large number of hydrocarbon expulsion

period, Ng deposit to reach peak period of hydrocarbon expulsion, normal crude oil and light oil generating function decreased significantly after, normal crude oil and reduce speed faster, and natural gas generating function abate effect is lighter, until the late quaternary sedimentary remains strong effect (figure 1).

The time effectiveness of oil-gas sealing caprock layer

Nanpu sag is a bottom-up development six sets of cap, respectively Es3、Es2、Es1s、Ed3s、Ed2s、Ngx. Each set of cap rock are strong - strong sealing capacity, but the sealing capacity not once the deposit is formed. Just a deposit of mudstone cap rock diagenetic compaction degree is low, high porosity and permeability, low displacement pressure, does not have ability of oil and gas. Increase gradually with the buried depth, compaction increased, porosity and permeability gradually reduce, displacement pressure increased, when the displacement pressure reaches a certain value to have the sealing capacity. Studies show that mudstone caprock sealing process of low maturity reservoir formation displacement pressure values at around 2 MPa, effect on closed - high maturity of hydrocarbon reservoir formation in the displacement pressure of value at about 4 MPa. And with the increase of caprock displacement pressure, can caprock closed gas reservoir reserves abundance also gradually increased.

Es2-Es3 the time effectiveness of oil-gas sealing caprocks

Es2-Es3 caprock thickness between 9 ~ 880 m, most parts of thickness in the 400 m or so. Caprock the mud ratio was between 47% ~ 100%, most parts of mud

than at around 75%. Today by caprock displacement pressure is between 1.3 ~ 17.8 MPa, and most areas to more than 10 MPa displacement pressure. The figure 2a shows: Its middle and later began to form the sedimentation of the Ed3 sealing capacity of low maturity oil and gas reservoirs, in the late Ng deposit began to form in medium - high maturity the sealing capacity of oil and gas reservoirs, in Nm and the late quaternary sediments in the displacement pressure rapid growth, especially in the peak period of hydrocarbon expulsion of the Ming dynasty, in the middle of the town, its displacement pressure value reached more than 11 MPa, can effectively closed living generated a large number of oil and gas.

Es1s the time effectiveness of oil-gas sealing caprocks

Es1s caprock layer thickness between 136 ~ 330 m, most parts of thickness in the 400 m or so. Caprock the mud ratio was between 50% ~ 100%, most parts of mud than at around 75%. Today by caprock displacement pressure is between 1.0 ~ 13.5 MPa, and in most of the displacement pressure can reach more than 6 MPa. The figure 2b shows: The Ng earlier middle sedimentary began to form on the sealing capacity of low maturity oil and gas reservoirs, in Nm sedimentary began to form on the mid - high maturity the sealing capacity of oil and gas reservoirs, in Nm to quaternary sedimentary final displacement pressure rapid growth, especially in the middle of the is in the peak period of hydrocarbon expulsion of Nm, its displacement pressure value reached more than 6 mpa, can also be effectively closed living generated a lot of oil and gas.

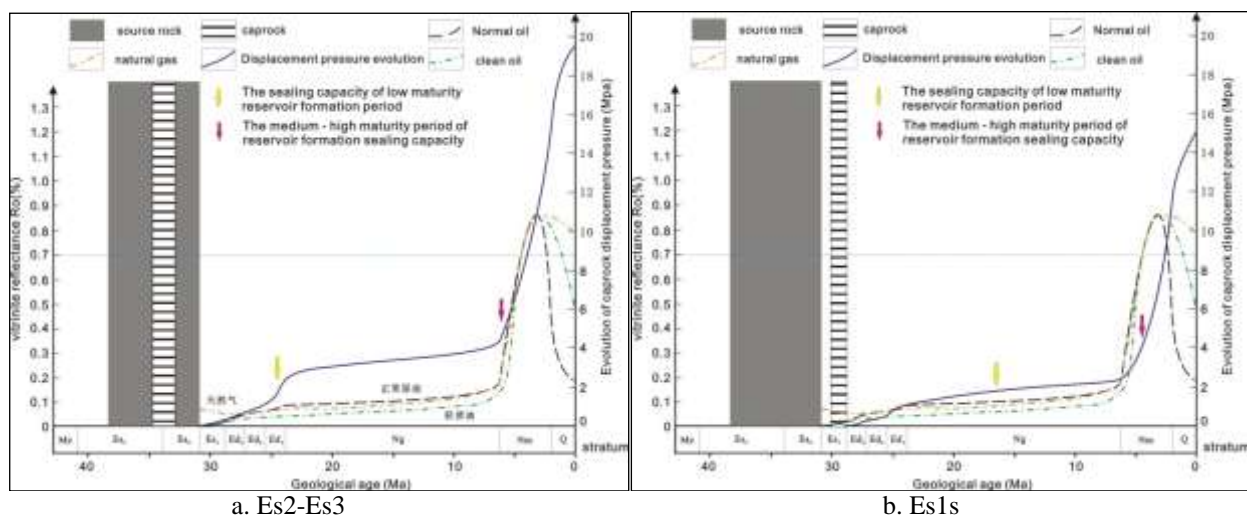


Fig-2: Nanpu sag Es caprock mudstone caprock sealing ability evolution and hydrocarbon source rock evolution history of hydrocarbon expulsion time matching relation between

Ed3s the time effectiveness of oil-gas sealing caprocks

Ed3s caprock layer thickness between 0 ~ 434 m, most parts of thickness in the 250 m or so. Caprock the

mud ratio was between 63% ~ 100%, most parts of mud than at around 88%. Today by caprock displacement pressure is between 0.8 ~ 9.1 MPa, and in most of the displacement pressure can reach more than 5 MPa.

Figure 3a illustrates the: The end of the sedimentation of the Ng began to form on the sealing capacity of low maturity oil and gas reservoirs, in Nm sedimentary began to form on the mid - high maturity the sealing capacity of oil and gas reservoirs, in Nm and the late

quaternary sediments in the displacement pressure rapid growth, and in the middle of the is in the peak period of hydrocarbon expulsion of Nm, its displacement pressure value reached more than 4 mpa, can effectively closed living generated a large number of oil and gas.

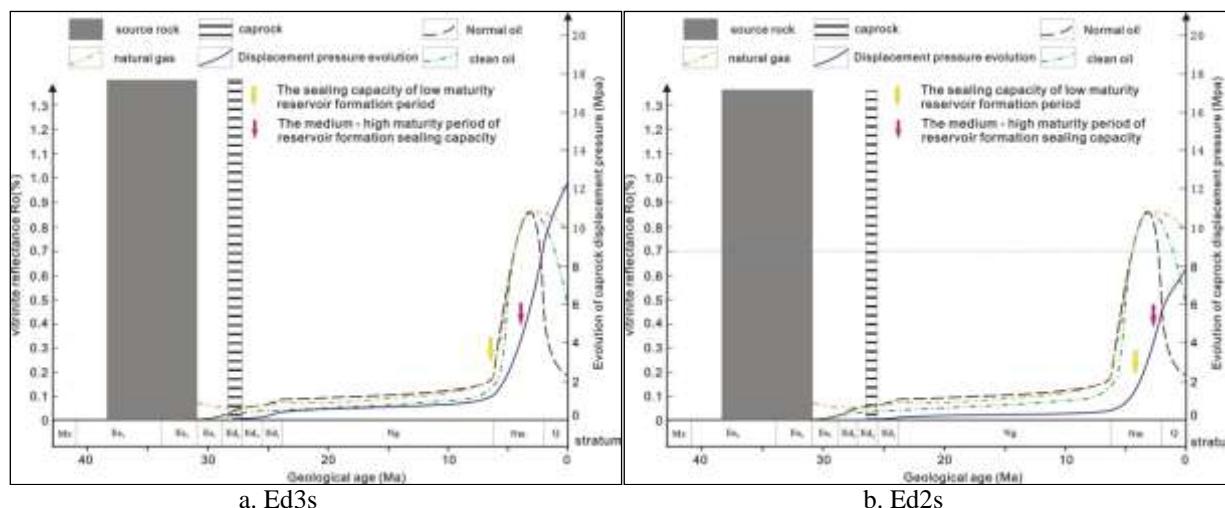


Fig-3: Nanpu sag Ed caprock mudstone caprock sealing ability evolution and hydrocarbon source rock evolution history of hydrocarbon expulsion time matching relation between

Ed2s the time effectiveness of oil-gas sealing caprocks

Ed2s caprock layer thickness between 50 ~ 414 m, most parts of thickness in the 225 m or so. Ed2 mudstone caprock except in Gaoliu fault zone north of missing, there is distribution in the sag in other areas, mainly in the nanpu structure and no. 2 and no. 3, 5 north region, and to gradually thinning, western edge parts to sag or even missing. Caprock the mud ratio was between 53% ~ 100%, most parts of mud than at around 85%. Today by caprock displacement pressure is between 1.7 ~ 7.2 MPa [7], and in most of the displacement pressure is 4.5 MPa. The figure 3b shows: Its in the middle of the Nm sedimentary began to form sealing capacity of low maturity oil and gas reservoirs, began to form the end of the sedimentation of the Nm to medium - high maturity the sealing capacity of reservoir, in the mid to late quaternary sedimentary Nm deposition in the displacement pressure rapid growth, in the middle of the is in the peak period of hydrocarbon expulsion of Nm, its displacement pressure value reached around 3 MPa, can more effectively closed living generated a large number of oil and gas, but the front 3 sets of caprock sealing ability is worse.

Ngx the time effectiveness of oil-gas sealing caprocks

Nanpu sag are oil and gas than other downfaulted basin, one of the key factors for oil and gas enrichment is its development of a set of large thickness, wide

distribution of Ng dense basalt caprock. Ngx cap rock is a set of large thickness, wide distribution of volcanic rock caprock layer, its thickness between 0 ~ 402 m, the maximum thickness of more than 500 m, most parts of the thickness of about 210 m, the cap rock body, mainly in nanpu no. 1 structure, and gradually thinning, round to the edge of the north and west sag and the eastern thickness decreases to less than 50 m. The set of the equivalent mud cap than at around 88%. Today by caprock displacement pressure is between 0.1 ~ 6 MPa, and in most of the displacement pressure can reach more than 3 MPa. The figure 4 shows: The sedimentation in the Nm from the formation of the sealing capacity of low maturity oil and gas reservoirs, began in the late quaternary sedimentary formation of medium - high maturity the sealing capacity of oil and gas reservoirs, the middle to the late quaternary sediments in the Nm sedimentary displacement pressure rapid growth, in the middle of the is in the peak period of hydrocarbon expulsion of Nm, its displacement pressure value of 2 MPa. And because its lithology is basalt, compared with general sedimentary primary igneous rock is very dense, the density of the igneous rock of the oil and gas migration have effective shade effect, become a good cap rock of reservoir forming, this particular accumulation conditions was does not have other fault basin, thus effectively closed in oil and gas.

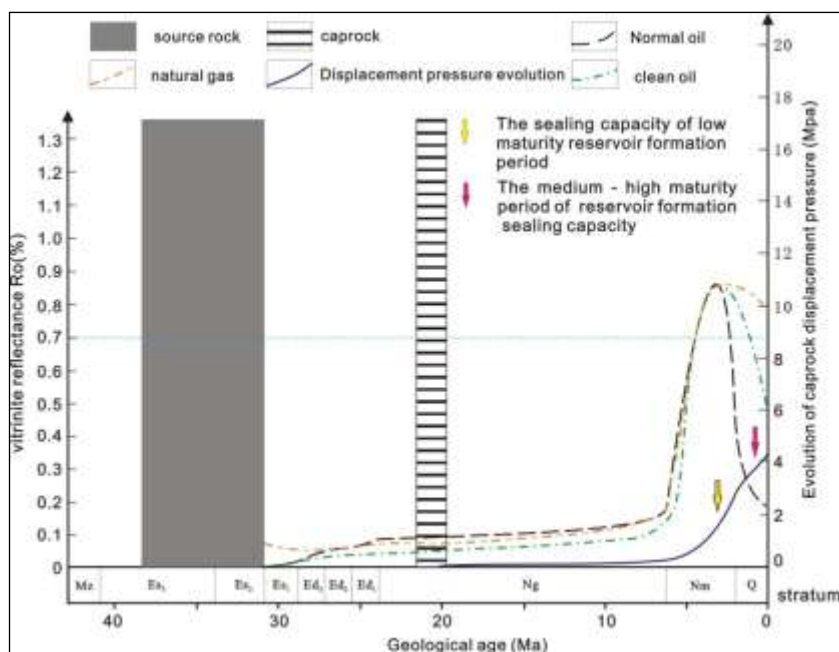


Fig-4: Nanpu sag Ngx caprock mudstone caprock sealing ability evolution and hydrocarbon source rock evolution history of hydrocarbon expulsion time matching relation between

CONCLUSION

Ed nanpu sag fan delta and fluvial facies sedimentary system and sand layer thickness, layer number of more, these high quality reservoir and cap rock formation from bottom to top set of configuration is superior. In addition, the hydrocarbon accumulation elements match, accumulation time later; Accumulation factor space on effective combination, Nm - Ng shallow combination, Es and Ed middle combination, the ordovician buried hill deep combination of three sets of oil-bearing series in the vertical superimposed each other and compound gathered themselves together, and decide the nanpu sag become the oil-rich sag of bohai bay basin.

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