Study on the Influence of the Degree of Cap Rock Fracture and Burial Depth on the Preservation Conditions in Shale Gas Region, Southeast Sichuan, China

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Abstract: There has been a great breakthrough in shale gas exploration and development in Southeast Sichuan, but there are great differences in the gas content of shale in different regions. 3.98 party/ton of Well Jiaoye 1, 3.15 party/ton of Well Longye 1, 2.46 party/ton of Well Pengye 1, studies show that differences in preservation conditions affect gas content in different regions (Zou et al., 2010; Guo et al., 2013; 2014). Based on the thickness of the overlying cap rock thickness and FSI index, the fracture degree of the rock and the capping ability of the cap rock is characterized(Wo et al., 2009; Pu et al., 2010), and then to comprehensively evaluate the favorable region for shale gas preservation conditions in Southeast Sichuan.

The thickness of overlying strata not only determines the capability of preventing gas permeation losing and diffusion velocity, but also reflects the stability and distribution range of sedimentary environment, that is, the stability of sealing ability and sealing area of overlying strata, and determines the continuity and stability in plane. Generally speaking, the greater the thickness of overlying strata is, the better the continuity of lateral distribution is, and the larger the distribution area is. The smaller the thickness of overlying strata is, the worse the continuity of lateral distribution is, and the smaller the distribution area is. The thickness of overlying strata in the study area shows that the largest thickness is Hexi syncline in Nanchuan (Fig. 1), which can reach 6050 m. The thickness of overlying strata in Wulong syncline can reach 4250 m, followed by Shuanghe syncline in Nanchuan and Baima syncline in Wulong. The thickest overlying strata is 3650 m, and the thinnest overlying strata is Sangtuoping syncline in Pengshui with a thickness of only 2600 m. In terms of the distribution range of overlying strata, Hexi Syncline in Nanchuan is the most extensive and continuous, with the north to the town of Linshi and the south to Nanchuan city. The other areas are Baima syncline, Wulong syncline, Daozhen syncline, Sangtuoping syncline and Puzi syncline from large to small, and the smallest is Shuanghe Syncline in Nanchuan.

Using the 22 site data of Nanchuan, 40 of Wulong, 18 of Pengshui, and 23 of Daozhen to calculate and analyze the FSI index (Non-dimensional) in each region (Table 1), the results show that: The correlation coefficient of calculating FSI index is between 0.7074 and 0.832. The FSI index of Nanchuan area is 1.2536. Statistical analysis shows that the FSI index of Wulong area is 3.2679, that of Pengshui area is 5.3955, and that of Daozhen area is 9.4767. According to the calculation results, the FSI index is quite different. The nearest area near Sichuan Basin is Nanchuan, followed by Wulong and Pengshui areas, and the largest is Daozhen area near the top of rhombic structure area in Jinfoshan.

Table 1 Types and characteristics of fine-grained sedimentary rocks of Chang 7 oil-bearing formation in Ordos Basin

<table>
<thead>
<tr>
<th>Region</th>
<th>Data Point</th>
<th>FSI</th>
<th>Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nanchuan</td>
<td>22</td>
<td>1.2536</td>
<td>0.7074</td>
</tr>
<tr>
<td>Wulong</td>
<td>40</td>
<td>3.2679</td>
<td>0.7517</td>
</tr>
<tr>
<td>Pengshui</td>
<td>18</td>
<td>5.3955</td>
<td>0.8095</td>
</tr>
<tr>
<td>Daozhen</td>
<td>23</td>
<td>9.4767</td>
<td>0.832</td>
</tr>
</tbody>
</table>

Based on the analysis of fracture degree and burial depth, it is considered that the bottom boundary of Wufeng Formation, west of Shuitjiang-Nanchuan, is buried between 2000 and 4000 meters, which has a certain protective effect on shale gas, while the fracture degree in this area is relatively small (FSI 1.2536), which is conducive to the enrichment and accumulation of shale gas.

Key words: burial depth, preservation conditions, shale gas, degree of fracture

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References

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