**Table 1. Homogenization temperatures of the fluid inclusions in the N1s, K1q, J1b reservoir beds in the Chepaizi High, South Junggar**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Well** | **Layer** | **Depth (m)** | **Occurrence along healed fractures** | **Thaq (°C)** | | | | | **Thoil (°C)** | | | | **Gas inclusions** |
| **Th1** | **Th2** | **Th3** | **Th4** | **Th5** | **Th1** | **Th2** | **Th3** | **Th4** |
| C510 | N1*s* | 349.00 | Cross quartz grain | 75.6 | — | — | — | — | — | — | — | 75.2 | √ |
| K7 | N1*s* | 3456.5 | Cross quartz grain | — | 104.5 | 120.0 | 138.2 | — | — | — | — | — |  |
| Within quartz grain | — | 108.0 | — | — | — | — | — | — | — |  |
| SM4 | K1*q* | 3511.38 | Cross quartz grain | — | — | 114.2 | — | — | — | — | 72.8 | — |  |
| Within quartz grain | — | 95.9 | 114.4 | — | — | — | 53.7 | 72.3 | — |  |
| SM4 | K1*q* | 3511.88 | Within quartz grain | 79.4 | 97.1 | — | 124.7 | — | — | — | 73.6 | 87.5 |  |
| C90 | K1*q* | 2655.38 | Cross quartz grain | — | 97.4 | — | — | — | — | — | — | — |  |
| Within quartz grain | — | — | 116.5 | — | — | — | — | — | — |  |
| SQ2 | K1*q* | 4326.26 | Cross quartz grain | — | 98.5 | — | — | — | — | 54.2 | 73.5 | — |  |
| Within quartz grain | — | 95.5 | — | — | — | — | — | — | — |  |
| SQ2 | K1*q* | 4326.56 | Cross quartz grain | — | 91.7 | — | — | — | — | — | — | — |  |
| Within quartz grain | — | — | 114.5 | — | — | — | — | — | — |  |
| SM012 | K1*q* | 4204.34 | Cross quartz grain | — | 90.9 | — | — | — | — | — | — | — |  |
| Within quartz grain | — | 92.5 | — | 124.6 | — | — | 53.6 | — | — |  |
| SM012 | K1*q* | 4204.28 | Within quartz grain | — | 99.2 | 114.5 |  | — | — | — | — | 88.6 |  |
| C761 | K1*q* | 2789.91 | Cross quartz grain | — | — | — | 123.1 | 142.2 | — | — | — | 87.7 |  |
| K11 | K1*q* | 4243.00 | Cross quartz grain | — | — | 117.9 | — | — | — | — | — | — |  |
| Within quartz grain | — | — | 117.9 | 133.8 | — | — | — | — | 87.2 | √ |
| SM011 | J1*b* | 3722.54 | Cross quartz grain | — | 94.6 | — | — | — | — | 52.9 | 72.5 | — |  |
| Within quartz grain | 83.0 | — | — | — | — | — | — | — | — |  |
| CF5 | J1*b* | 1444.05 | Cross quartz grain | — | 93.3 | — | 136.8 | — | — | — | 73.4 | 89.2 | √ |
| CF5 | J1*b* | 1444.15 | Cross quartz grain | — | 97.7 | — | 130.4 | 141.6 | — | — | 75.3 | 88.5 |  |
| Within quartz grain | 87.3 | — | — | — | — | — | — | — | — |  |
| SM5 | J1*b* | 3722.54 | Cross quartz grain | 84.2 | — | — | — | — | — | 59.2 | — | 89.3 | √ |
| Within quartz grain | — | — | 123.0 |  | — | — | — | — | — |  |
| CF9 | J1*b* | 3437.21 | Cross quartz grain | 80.9 | 105.7 | — | — | 152.9 | — | — | — | — |  |
| C358 | J1*b* | 2611.54 | Within quartz grain | — | 89.1 | 119.2 | — | 146.3 | 39.0 | 58.3 | 76.9 | — |  |
| C359 | J1*b* | 2207.59 | Within quartz grain | — | 95.0 | — | 123.6 | — | — | 62.3 | 82.1 | 89.2 |  |
| **Note:** Thoil represents the homogenization temperatures of the oil inclusions. Thaq represents the homogenization temperatures of the aqueous inclusions. Th1 represents the 1st peaks of homogenization temperatures. Th2 represents the 2nd peaks of homogenization temperatures. Th3 represents the 3rd peaks of homogenization temperatures. Th4 represents the 4th peaks of homogenization temperatures. Th5 represents the 5th peaks of homogenization temperatures. The symbol ‘—‘ represents no data. | | | | | | | | | | | | | |

**Table 2. The ratio of sandstone-thickness to strata-thickness the N1s in the Chepaizi High, South Junggar**

|  |  |  |  |
| --- | --- | --- | --- |
| **Well** | **N1S1** | **N1S2** | **N1S3** |
| C2 | 0.71 | 0.30 | 0.32 |
| C27 | 0.63 | 0.48 | 0.45 |
| C45 | 0.88 | 0.52 | 0.38 |
| C53 | 0.83 | 0.42 | 0.35 |
| C64 | 0.83 | 0.59 | 0.59 |
| C85 | 0.72 | 0.59 | 0.30 |
| C88 | 0.66 | 0.54 | 0.35 |
| C94 | 0.92 | 0.58 | 0.34 |
| CF13 | 0.94 | 0.60 | 0.45 |
| CF2 | 0.93 | 0.63 | 0.60 |
| CF5 | 0.95 | 0.68 | 0.78 |
| HG4 | 0.62 | 0.64 | 0.33 |
| HG5 | 0.54 | 0.70 | 0.36 |
| K11 | 0.35 | 0.60 | 0.48 |
| K6 | 0.30 | 0.61 | 0.50 |
| K7 | 0.31 | 0.54 | 0.38 |
| K8 | 0.33 | 0.63 | 0.48 |
| K9 | 0.55 | 0.68 | 0.38 |
| SM011 | 0.51 | 0.49 | 0.32 |
| SM1 | 0.48 | 0.50 | 0.32 |
| SM2 | 0.43 | 0.53 | 0.30 |
| SM3 | 0.42 | 0.45 | 0.34 |
| SM4 | 0.59 | 0.54 | 0.38 |
| SQ1 | 0.48 | 0.62 | 0.38 |
| SQ2 | 0.51 | 0.59 | 0.37 |
|  | | | |

**Table 3. Formation pressure and oil potential of the N1s, K1q, and J1b in the Chepaizi High, South Junggar**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Well** | **Layer** | **Top-depth (m)** | **Bottom-depth (m)** | **Oil density (g/cm3)** | **Oil location (m)** | **Formation Pressure (MPa)** | **Z (m)** | **Φ (J/m)** |
| C002 | K1q | 2522.00 | 2825.50 | 0.93 | 2815.00 | 29.31 | 1656.50 | 47.90 |
| J1b | 3425.00 | 3536.50 | 0.93 | 3452.00 | 46.52 | 2343.00 | 73.23 |
| C17 | K1q | 3014.00 | 3304.00 | 0.89 | 3166.00 | 44.49 | 2007.50 | 69.60 |
| J1b | 3586.00 | 3784.50 | 0.85 | 3651.00 | 47.53 | 2542.00 | 80.76 |
| C2 | N1s | 2051.50 | 2520.00 | 0.89 | 2285.75 | 28.68 | 2308.00 | 54.96 |
| K1q | 2859.00 | 3131.50 | 0.90 | 2988.00 | 39.81 | 1829.50 | 62.15 |
| J1b | 3342.50 | 3468.00 | 0.87 | 3351.00 | 48.48 | 2242.00 | 77.93 |
| C27 | N1s | 1643.50 | 2040.00 | 0.86 | 1841.75 | 22.25 | 2021.25 | 45.81 |
| J1b | 3910.50 | 4013.00 | 0.88 | 3920.00 | 54.21 | 2811.00 | 89.03 |
| C28 | N1s | 1432.00 | 1700.00 | 0.91 | 1566.00 | 18.56 | 1626.00 | 36.30 |
| C45 | K1q | 2165.00 | 2407.00 | 0.78 | 2365.25 | 29.00 | 1206.75 | 49.07 |
| J1b | 2663.00 | 3115.00 | 0.78 | 2944.25 | 39.40 | 1835.25 | 68.60 |
| C501 | K1q | 1721.00 | 1982.00 | 0.86 | 1910.00 | 19.67 | 751.50 | 30.22 |
| J1b | 2256.50 | 2422.00 | 0.86 | 2620.00 | 27.89 | 1511.00 | 47.22 |
| C502 | K1q | 1568.00 | 1887.50 | 0.85 | 1853.00 | 18.90 | 694.50 | 29.08 |
| J1b | 2494.50 | 2676.00 | 0.85 | 2573.63 | 24.07 | 1464.63 | 42.72 |
| C53 | J1b | 2918.00 | 3002.00 | 0.86 | 2971.70 | 30.63 | 1862.70 | 53.95 |
| C56 | J1b | 3368.00 | 3479.00 | 0.85 | 3384.00 | 48.34 | 2275.00 | 79.10 |
| C64 | N1s | 930.00 | 1091.00 | 0.81 | 1010.50 | 9.91 | 1031.00 | 22.29 |
| K1q | 2369.00 | 2726.00 | 0.81 | 2547.00 | 22.48 | 1388.50 | 41.29 |
| C66 | J1b | 2671.50 | 3009.50 | 0.90 | 2958.50 | 32.48 | 1849.50 | 54.21 |
| C67 | J1b | 2271.00 | 2665.50 | 0.88 | 2623.00 | 28.22 | 1514.00 | 47.08 |
| C71 | K1q | 1326.00 | 1721.00 | 0.91 | 1574.50 | 15.53 | 416.00 | 21.15 |
| J1b | 1804.00 | 1868.00 | 0.91 | 1827.50 | 19.23 | 718.50 | 28.18 |
| C80 | K1q | 2872.00 | 3098.00 | 0.86 | 2982.00 | 31.89 | 1823.50 | 54.84 |
| C83 | K1q | 2924.00 | 3308.00 | 0.76 | 3117.63 | 33.52 | 1959.13 | 63.04 |
| J1b | 3574.50 | 3929.50 | 0.84 | 3841.38 | 42.56 | 2732.38 | 77.27 |
| C85 | N1s | 1717.50 | 2137.00 | 0.85 | 1927.25 | 21.11 | 1956.00 | 43.90 |
| C88 | N1s | 1688.00 | 2035.00 | 0.81 | 1861.50 | 19.86 | 1808.00 | 42.23 |
| K1q | 2934.00 | 3154.00 | 0.81 | 3044.00 | 38.61 | 1885.50 | 66.14 |
| C90 | N1s | 1435.00 | 1607.00 | 0.87 | 1521.00 | 20.04 | 1595.00 | 38.75 |
| J1b | 2899.00 | N/A | 0.87 | 2921.00 | 33.33 | 1812.00 | 56.19 |
| C93 | N1s | 1330.50 | 1764.00 | 0.84 | 1547.25 | 17.68 | 1528.13 | 36.08 |
| J1b | 3596.00 | N/A | 0.86 | 3638.13 | 57.29 | 2529.13 | 91.40 |
| C94 | N1s | 893.00 | 1052.50 | 0.82 | 972.75 | 9.83 | 933.00 | 21.11 |
| J1b | 1944.00 | 1958.00 | 0.87 | 1978.00 | 25.42 | 869.00 | 37.74 |
| CF13 | K1q | 872.00 | 1445.00 | 0.85 | 884.13 | 10.74 | -274.38 | 9.95 |
| CF2 | N1s | 578.00 | 706.00 | 0.90 | 642.00 | 5.10 | 643.50 | 11.95 |
| K1q | 1135.00 | 1624.00 | 0.86 | 1365.50 | 11.98 | 207.00 | 16.04 |
| J1b | 1624.00 | 1765.00 | 0.90 | 1658.50 | 17.43 | 549.50 | 24.66 |
| CF5 | N1s | 490.00 | 543.00 | 0.90 | 516.50 | 5.27 | 532.00 | 11.04 |
| J1b | 1397.00 | 1455.00 | 0.90 | 1415.00 | 14.98 | 306.00 | 19.57 |
| CF7 | J1b | 1109.00 | 1202.00 | 0.91 | 1127.50 | 9.27 | 18.50 | 10.36 |
| CP2 | J1b | 2544.00 | 2976.00 | 0.95 | 2874.88 | 24.71 | 1765.88 | 43.44 |
| HG4 | N1s | 2124.00 | 2644.00 | 0.87 | 2384.00 | 28.87 | 2371.63 | 56.56 |
| HG5 | N1s | 2016.00 | 2404.00 | 0.96 | 2210.00 | 23.33 | 2214.63 | 45.90 |
| J1b | 2812.00 | 2870.00 | 0.96 | 2821.63 | 36.62 | 1712.63 | 54.78 |
| SM011 | N1s | 1736.00 | 2396.00 | 0.85 | 2066.00 | 26.01 | 2093.38 | 51.01 |
| K1q | 3808.00 | 4228.00 | 0.86 | 4018.00 | 45.54 | 2859.50 | 81.10 |
| J1b | 4362.00 | 4568.00 | 0.82 | 4393.38 | 56.27 | 3284.38 | 100.41 |
| SM1 | N1s | 1818.00 | 2516.00 | 0.87 | 2167.00 | 29.38 | 2169.88 | 55.17 |
| SM2 | N1s | 1922.00 | 2676.00 | 0.87 | 2299.00 | 34.08 | 2302.25 | 61.79 |
| K1q | 3990.00 | 4487.00 | 0.87 | 4240.25 | 55.88 | 3081.75 | 94.51 |
| J1b | 4487.00 | 4614.00 | 0.87 | 4550.25 | 72.92 | 3441.25 | 117.64 |
| SM3 | N1s | 1718.00 | 2408.00 | 0.86 | 2063.00 | 27.41 | 2071.25 | 52.28 |
| K1q | 3966.00 | 4482.00 | 0.87 | 4224.00 | 59.32 | 3065.50 | 98.26 |
| J1b | 4708.00 | 5036.00 | 0.87 | 4871.25 | 80.03 | 3762.25 | 128.91 |
| SM4 | N1s | 1935.00 | 2366.00 | 0.90 | 2150.50 | 26.02 | 2144.13 | 49.91 |
| K1q | 3461.00 | 4042.00 | 0.90 | 3722.13 | 47.71 | 2563.63 | 78.10 |
| SM5 | N1s | 1918.00 | 2172.00 | 0.88 | 2045.00 | 25.89 | 2106.13 | 50.06 |
| K1q | 3294.00 | 3561.00 | 0.86 | 3426.13 | 36.80 | 2267.63 | 65.01 |
| J1b | 3561.00 | 3732.00 | 0.86 | 3656.13 | 44.68 | 2547.13 | 76.94 |
| SQ1 | N1s | 2398.00 | 3344.00 | 0.82 | 2871.00 | 38.56 | 2871.75 | 75.29 |
| K1q | 4354.00 | 4600.00 | 0.82 | 4481.75 | 55.76 | 3323.25 | 100.74 |
| SQ2 | N1s | 2266.00 | 2973.00 | 0.84 | 2619.50 | 39.30 | 2882.38 | 75.03 |
| K1q | 4025.00 | 4364.00 | 0.85 | 4215.38 | 61.36 | 3056.88 | 102.15 |

**Table 4. Geochemical parameters of crude oil for hydrocarbon migration trace in the Chepaizi High, South Junggar**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Well** | **Layer** | **Carbazole compounds (μg/g)** | **Alkyl carbazole (μg/g)** | **C2-carbazole (μg/g)** | **Benzo carbazole (μg/g)** | **Sterane C29ααS/(S+R)** | **Sterane C29ββ/(αα+ββ)** | **Rearranged sterane/(Rearranged sterane + Regular sterane)** | **17α(H)21β(H)-Hopane/Hopane** |
| C510 | N1s | 0.50 | 0.40 | 0.09 | 0.09 | — | — | — | — |
| C509 | N1s | 7.47 | 7.21 | 1.39 | 0.26 | — | — | — | — |
| CF19 | N1s | 17.58 | 7.29 | 2.25 | 10.29 | — | — | — | — |
| C810 | N1s | — | — | — | — | 0.29 | 0.65 | 0.04 | 0.79 |
| C95 | N1s | — | — | — | — | 0.35 | 0.76 | 0.05 | 0.82 |
| C89 | N1s | — | — | — | — | 0.33 | 0.75 | 0.05 | 0.80 |
| C45 | K1q | 8.53 | 6.87 | 1.87 | 1.66 | — | — | — | — |
| CQ6 | K1q | 11.70 | 6.96 | 1.87 | 4.21 | — | — | — | — |
| SM4 | K1q | 22.74 | 20.77 | 4.42 | 5.97 | — | — | — | — |
| C90 | K1q | 2.89 | 2.77 | 0.49 | 0.11 | — | — | — | — |
| C761 | K1q | 2.78 | 2.65 | 0.57 | 0.13 | — | — | — | — |
| SM012 | K1q | 5.22 | 3.86 | 1.03 | 1.36 | — | — | — | — |
| C67 | J1b | 2.27 | 2.07 | 0.58 | 0.16 | — | — | — | — |
| C58 | J1b | 3.29 | 3.01 | 0.89 | 0.28 | 0.45 | 1.04 | 0.07 | 0.80 |
| CF9 | J1b | 54.99 | 45.20 | 12.68 | 9.79 | — | — | — | — |
| C358 | J1b | — | — | — | — | 0.48 | 1.11 | 0.08 | 0.85 |
| C94 | J1b | 4.56 | 3.68 | 0.73 | 0.88 | — | — | — | — |
| SM5 | J1b | 21.78 | 21.45 | 1.55 | 0.33 | — | — | — | — |
| SM011 | J1b | 66.31 | 57.01 | 17.74 | 9.30 | — | — | — | — |
| The symbol ‘—‘ represents no data. The data are collected from the Research Institute of Petroleum Exploration and Development in Xinjiang Oilfield, CNPC. | | | | | | | | | |

**Table 5. Physical parameters of crude oil for hydrocarbon migration trace in the Chepaizi High, South Junggar**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Well** | **Layer** | **Depth (m)** | **Density (g/cm3)** | **Viscosity (MPa**·**s)** |
| CF15 | N1s | 584–590 | 0.8538 | 5.00 |
| CF13 | N1s | 684–689 | 0.8385 | 3.33 |
| CF19 | N1s | 772–777 | 0.8379 | 3.28 |
| C903 | N1s | 899–901 | 0.8294 | 3.51 |
| C89 | N1s | 1019–1025 | 0.8266 | 2.60 |
| SQ1 | K1q | 4570–4578 | 0.8180 | 3.34 |
| SM2 | K1q | 4212–4222 | 0.8689 | 26.15 |
| SM4 | K1q | 3633–3729 | 0.9005 | 62.46 |
| SM011 | K1q | 3812–3858 | 0.8528 | 10.70 |
| C80 | K1q | 3083–3089 | 0.8625 | 15.40 |
| C56 | K1q | 3178–3183 | 0.8656 | 15.81 |
| C761 | K1q | 2781–2785 | 0.8921 | 64.20 |
| C90 | K1q | 2655–2661 | 0.8672 | 19.71 |
| C83 | K1q | 2788–2791 | 0.7647 | 0.68 |
| C53 | K1q | 2649–2660 | 0.8846 | 41.23 |
| C60 | K1q | 2315–2335 | 0.9013 | 62.50 |
| C281 | K1q | 2152–2169 | 0.9102 | 110.54 |
| CF9 | K1q | 2495–2559 | 0.8435 | 7.58 |
| C64 | K1q | 2537–2541 | 0.8134 | 2.86 |
| SM011 | J1b | 4513–4540 | 0.8248 | 2.97 |
| C77 | J1b | 3810–3826 | 0.8596 | 12.71 |
| C2 | J1b | 3202–3207 | 0.8663 | 18.09 |
| C83 | J1b | 3850–3862 | 0.8430 | 7.96 |
| C53 | J1b | 2990–3001 | 0.8727 | 17.98 |
| CF9 | J1b | 3438–3443 | 0.8993 | 115.34 |
| C71 | J1b | 1847–1867 | 0.9097 | 73.97 |
| C912 | J1b | 1745–1758 | 0.8919 | 54.25 |
| C67 | J1b | 2542–2547 | 0.8751 | 27.09 |
| C502 | J1b | 2496–2500 | 0.8484 | 13.81 |
| The data are collected from the Research Institute of Petroleum Exploration and Development in Xinjiang Oilfield, CNPC. | | | | |

**Table 6. The Hydrocarbons charging episodes and timing in the N1s, K1q, J1b reservoir beds in the Chepaizi High, South Junggar**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Episodes** | **Age** | **Hydrocarbons charging**  **timing in the J1b (Ma)** | **Hydrocarbons charging**  **timing in the K1q (Ma)** | **Hydrocarbons charging**  **timing in the N1s (Ma)** |
| 1st | K2 | 89–84 | N/A | N/A |
| 2nd | K2–E1 | 74–52 | N/A | N/A |
| 3rd | N1 | 23–20 | 23–20 | N/A |
| 4th | N1 | 18–10 | 16–11 | N/A |
| 5th | N2 | N/A | 7–5 | N/A |
| 6th | Q1 | 5–3 | ~2 | 5–2 |