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克拉玛依油田七中、东区克下组砾岩储层孔隙结构特征及影响因素

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摘要：利用铸体薄片、扫描电镜、岩石物性和压汞资料，对克拉玛依油田七中、东区克下组砾岩储层孔隙结构及影响因素进行了详细分析。研究区克下组属于中孔、中渗透储层，以粒间溶孔为主，次为原生粒间孔隙，优选出孔隙度、渗透率、均值、偏态、饱和度中值半径、最大孔喉半径、平均毛管半径、视孔喉体积比和非饱和汞孔隙体积百分数共9个能反映孔隙结构的参数，采用K-Means聚类分析方法将研究区克下组砾岩储层分为4类（Ⅰ—Ⅳ），分别代表储层孔隙结构好、较好、较差、差；储层的微观孔隙分布主要有3种类型，孔隙直径分布分别呈单模态、双模态和复模态。影响孔隙结构的因素有构造作用、沉积作用和成岩作用。构造格局决定着储层的沉积格局，进而控制了储层的孔隙结构。沉积作用的影响主要表现在岩性对储层物性的控制。压实作用造成孔隙度降低；胶结作用使孔隙结构和物性变差；溶蚀作用产生的次生孔隙使储层孔隙结构和物性得以改善；重结晶作用产生的新生自形晶矿物全充填或半充填于粒间孔隙和喉道中，使孔隙减少、喉道变窄，孔隙连通性变差；压溶作用可产生压溶缝、缝合线或溶孔，扩大了孔隙空间。

关键词：砾岩储层 孔隙结构 孔隙类型 影响因素 克下组 克拉玛依油田
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砾岩储层孔隙大小和分布、孔隙和喉道的配置及连通关系、孔隙几何形态和微观非均质特征、孔隙中粘土矿物含量、成分及产状等孔隙结构特征非常复杂，对其进行分析和评价尤为重要。储层孔隙结构不但是影响储层储集能力和渗透特征的主要因素，而且决定着微观孔喉内流体的渗流和油气运聚，对油气储量及油气井的产能、驱油效率、微观剩余油分布和最终采收率等都有影响[1-8]。研究储层微观孔隙结构的主要目的是揭示影响储层物性即渗透率和孔隙度的内在因素。笔者以铸体薄片、扫描电镜、岩石物性和压汞资料为基础，采用K-Means聚类分析方法[9-10]，对克拉玛依油田七中、东区克下组砾岩储层孔隙结构特征、分类评价及影响因素进行了详细研究，以期为研究区砾岩储层油藏开发提供地质依据。

1 储层特征

克拉玛依油田七中、东区克下组为山麓—洪积相沉积，储层岩性主要为中砾岩、细砾岩、小砾岩、砂砾岩、含砾粗砂岩。砾石成分以花岗岩、凝灰岩为主，砂质成分主要为岩屑、石英和长石。储层岩石的粒度分布区间很宽，不同粒度的岩性分选有所差别，但总体都较差。砾石的分选性更差，分选系数一般为3.5~4，甚至达到5。岩石磨圆度普遍差，主要为次棱角状，部分为棱角状、次圆状。杂基主要为细粉砂级的碎屑颗粒，粘土杂基较少。胶结物以碳酸盐、硬石膏及菱铁矿为主，局部集中发育。

根据取心井储层物性统计，研究区克下组储层孔隙度平均为16.3%，渗透率平均为124×10^{-3} μm^2，属于中孔、中渗透储层。不同岩性物性差异较大，以含砾粗砂岩、小—细砾岩和砂砾岩物性较好。储层孔隙类型具有原生孔隙与次生孔隙并存的特点，发育粒间孔、溶蚀孔、杂基或胶结物中微孔、微裂缝、界面缝。一般受成岩后生变化影响较弱的储层，以原生粒间孔为主；反之，则以次生溶蚀孔为主。

对七中、东区克下组近几年的5口密闭取心井的75个储层岩样压汞资料进行分析，根据反映孔隙结构特征的16项参数的优选，确定了孔隙度、渗透率、均值、偏态、饱和度中值半径、最大孔喉半径、平

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均毛管半径、视孔喉体积比和非饱和汞孔隙体积百分数9项参数，采用K-Means聚类分析方法将砾岩储层分为4类（表1），I—IV类分别代表储层孔隙结构好、较好、较差和差。

表1 克拉玛依油田七中、东区克下组储层孔隙结构分类

类别	孔隙度，%	渗透率/10^{-3} μm^2	均值	偏态	饱和度中值半径/μm	最大孔喉半径/μm	平均毛管半径/μm	视孔喉体积比	非饱和汞孔隙体积百分数，%
Ⅰ	>17	>200	<8	>0.5	>5	>30	>15	>4	<5
Ⅱ	14~23	50~200	8~10	<0.5	0.3~5	1.5~30	0.5~15	1~4	5~20
Ⅲ	11~23	1~50	9~11	-0.7~0.1	0.1~0.5	0.5~10	0.2~3	0.5~2.5	15~20
Ⅳ	<17	<10	>10	<0	<0.2	<2	<0.5	0.5~2.0	>20

2 孔隙结构特征

2.1 Ⅰ类储层

Ⅰ类储层以细粒小砾岩和砂砾岩为主，其次为含砾粗砂岩，颗粒粒径为0.5~3.3 mm，岩石碎屑为颗粒支撑，呈点接触；砾石成分复杂，颗粒分选中等—差，磨圆以次棱角状—次圆状为主。矿物以石英、钾长石为主，斜长石次之；云母片常见，主要呈粒间充填及片状或弯片状产出于颗粒表面；部分发育碳酸盐矿物及少量硬石膏。填隙物含量分布不均，包括细砂级碎屑颗粒、水云母及泥质胶结物，偶见碳酸盐胶结物。

Ⅰ类储层孔隙度大于17%，渗透率大于200×10^{-3} μm^2，为高孔、高渗透储层。孔隙类型以原生孔隙为主，粒间溶孔发育，局部发育粒内溶孔（图1）。最大孔喉半径大于30 μm，孔喉分布为单峰偏粗态，孔喉组合类型为大孔中喉型，孔喉连通呈较好的网络状（图2）。

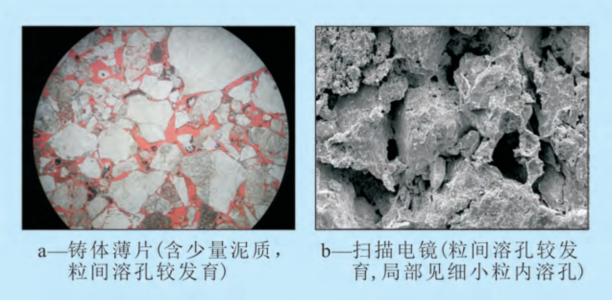

a—铸体薄片（含少量泥质，粒间溶孔较发育）
b—扫描电镜（粒间溶孔较发育，局部见细小粒内溶孔）

图1 Ⅰ类储层孔喉结构特征

2.2 Ⅱ类储层

Ⅱ类储层岩性以含砾粗砂岩为主，其次为小砾岩和砂砾岩，颗粒粒径为1~5 mm，岩石碎屑为颗粒支撑，呈点—线接触。砾石成分复杂，颗粒分选中等，磨圆以次圆—次棱角状为主。矿物以石英、钾长石为主，斜长石次之；云母片常见，主要呈粒间充填及片状或弯片状产出于颗粒表面。填隙物分布不均，包括细砂级碎屑颗粒、水云母、泥质胶结物及碳酸盐胶结物。

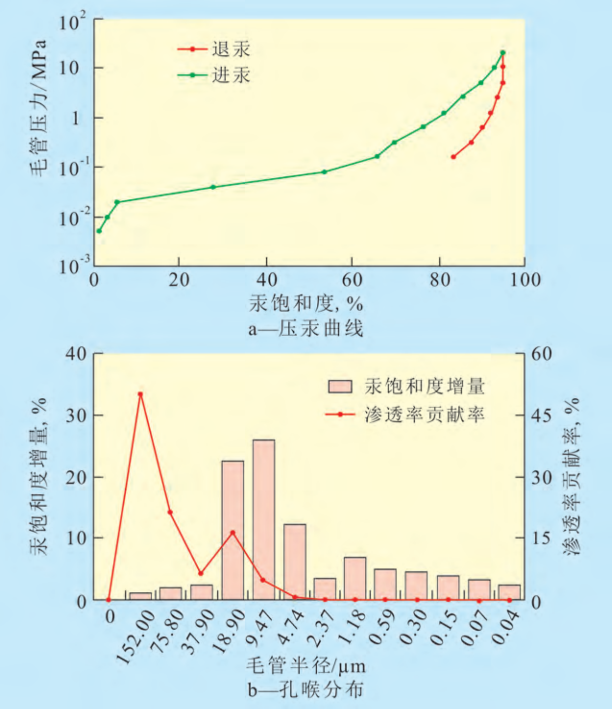


图2 Ⅰ类储层压汞曲线及孔喉分布

Ⅱ类储层孔隙度为14%~23%，渗透率为50×10^{-3}~200×10^{-3} μm^2，为中高孔、中渗透储层。粒间杂基含量高，颗粒分选差，溶蚀孔发育，孔隙中云母含量高，孔喉分布不均匀，填隙物为晶形差的粘土等，残余粒间孔发育。孔隙类型以原生粒间孔为主，残余粒间孔发育（图3），呈粒间溶孔—粒间

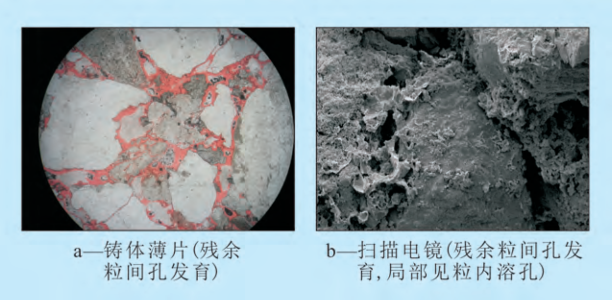
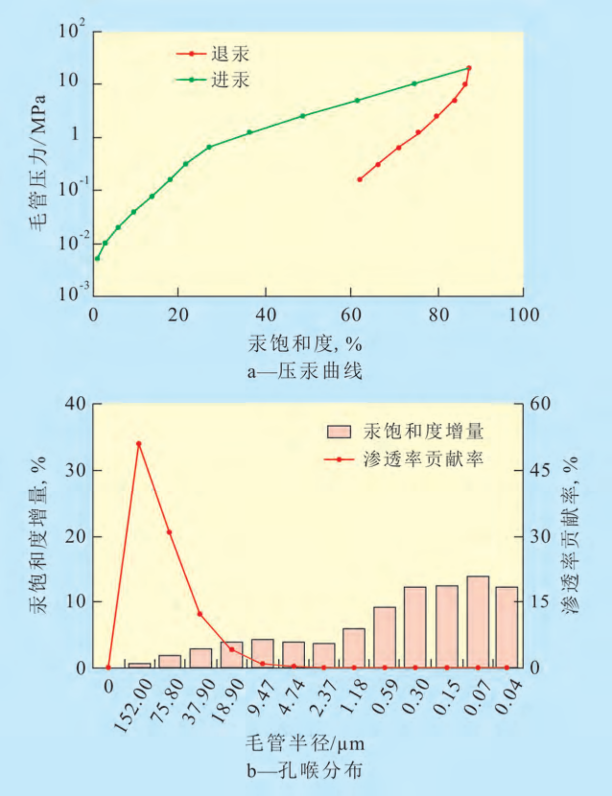

a—铸体薄片（残余粒间孔发育）
b—扫描电镜（残余粒间孔发育，局部见粒内溶孔）

图3 Ⅱ类储层孔隙结构特征

孔—粒内溶孔的组合，孔喉分布呈多峰偏细型（图4），孔喉组合类型为中孔中喉型，孔喉连通呈稀疏网络状。



a—压汞曲线

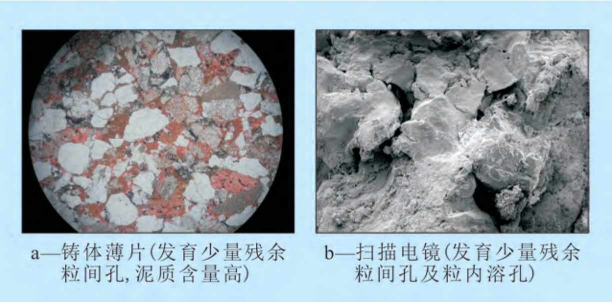
b—孔喉分布

图4　Ⅱ类储层压汞曲线及孔喉分布

2.3　Ⅲ类储层

Ⅲ类储层岩性主要为不等粒砾岩、砂砾岩，岩石碎屑为杂基支撑，呈点—线接触。砾石成分复杂，颗粒分选差，磨圆以次棱角状—次圆状为主。矿物以石英、钾长石为主，斜长石次之；云母常见，主要呈粒间充填及片状或弯片状产出于颗粒表面。填隙物含量高，广泛分布，包括细砂级碎屑颗粒、水云母及泥质胶结物、碳酸盐胶结物。

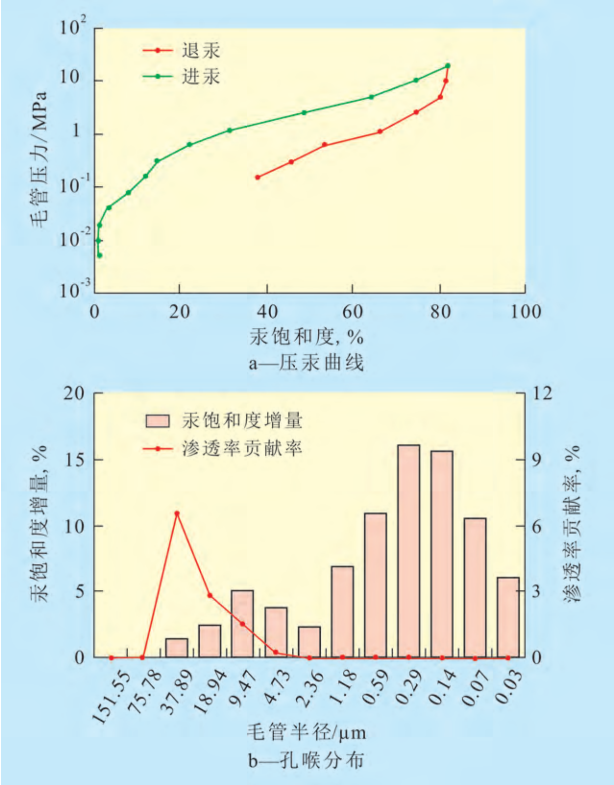
Ⅲ类储层孔隙度为11%~23%，渗透率为1×10^{-3}~$50\times10^{-3}\ \mu m^2$，为中孔、中低渗透储层。孔隙类型以次生孔隙为主，粒间溶孔、粒内溶孔及粒内缝为其主要的孔隙形式（图5），孔喉组合类型为小孔细喉型，其次为小孔微喉型。孔喉分布呈多峰偏细型，主流喉道为少量粗大喉道（图6）。



a—铸体薄片（发育少量残余粒间孔，泥质含量高）

b—扫描电镜（发育少量残余粒间孔及粒内溶孔）

图5　Ⅲ类储层孔隙结构特征



a—压汞曲线

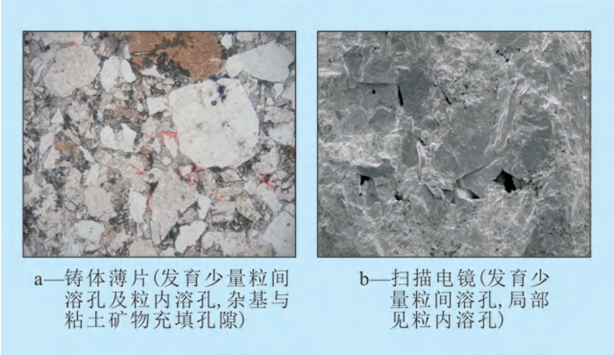
b—孔喉分布

图6　Ⅲ类储层压汞曲线及孔喉分布

2.4　Ⅳ类储层

Ⅳ类储层岩性主要为泥质小砾岩、砂质砾岩，岩石碎屑为颗粒支撑，呈点—线接触。砾石成分复杂，颗粒分选中等—差，以次棱角状—次圆状为主。矿物以石英、钾长石为主，斜长石次之。填隙物含量高，包括细砂级碎屑颗粒、水云母及泥质胶结物、碳酸盐胶结物。

Ⅳ类储层孔隙度小于17%，渗透率小于$10\times10^{-3}\ \mu m^2$，为中孔、低渗透储层。孔隙以次生微孔隙为主，主要是晶间孔、粒内溶孔（图7），孔喉组合类型为小孔微喉型，孔喉分布呈单峰偏细型，主流喉道为少量粗大喉道（图8）。



a—铸体薄片（发育少量粒间溶孔及粒内溶孔，杂基与粘土矿物充填孔隙）

b—扫描电镜（发育少量粒间溶孔，局部见粒内溶孔）

图7　Ⅳ类储层孔隙结构特征

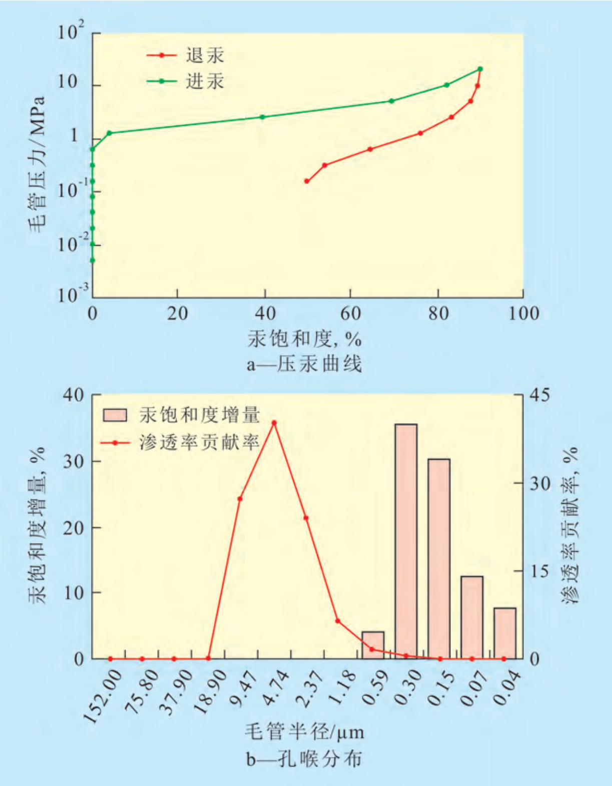


图8　Ⅳ类储层压汞曲线及孔喉分布

2.5　微观孔隙分布特征

应用铸体薄片资料对储层不同岩石相的微观物性差异进行分析。克下组储层孔隙类型以粒间溶孔为主，次为原生粒间孔隙，微裂缝、粒内溶孔等其他次生孔隙所占比例很小，微观孔隙分布特征可分为3种：①粗砂岩相和中—细砂岩相，分选中等，粒级单一，主要为砂级颗粒，孔隙直径分布多呈单峰特征（单模态）。粗砂岩相孔隙直径均值为153.6 μm，孔喉比为4.75，配位数为3~5（图9a）。中—细砂岩相粒度较粗砂岩相细，孔隙直径均值为135.4 μm，孔喉比为6.28，配位数为3~4。②小—细砾岩相，分选差—中等，以细砾为骨架，孔隙中填充不等粒的砂质颗粒，孔隙直径分布多呈双峰特征（双模态）（图9b）。细砾岩相孔隙直径均值为144.8 μm，孔喉比为5.41，配位数为2~3。③中砾岩相和细—中砾岩相，分选差，以砾石为骨架，孔隙部分被砂粒充填，砂粒组成的孔隙又部分被粘土级颗粒充填，孔隙直径分布一般呈多峰特征（复模态）（图9c）。中砾岩相和细—中砾岩相孔隙直径均值为100.04 μm，孔喉比为7.27，配位数为1~2。

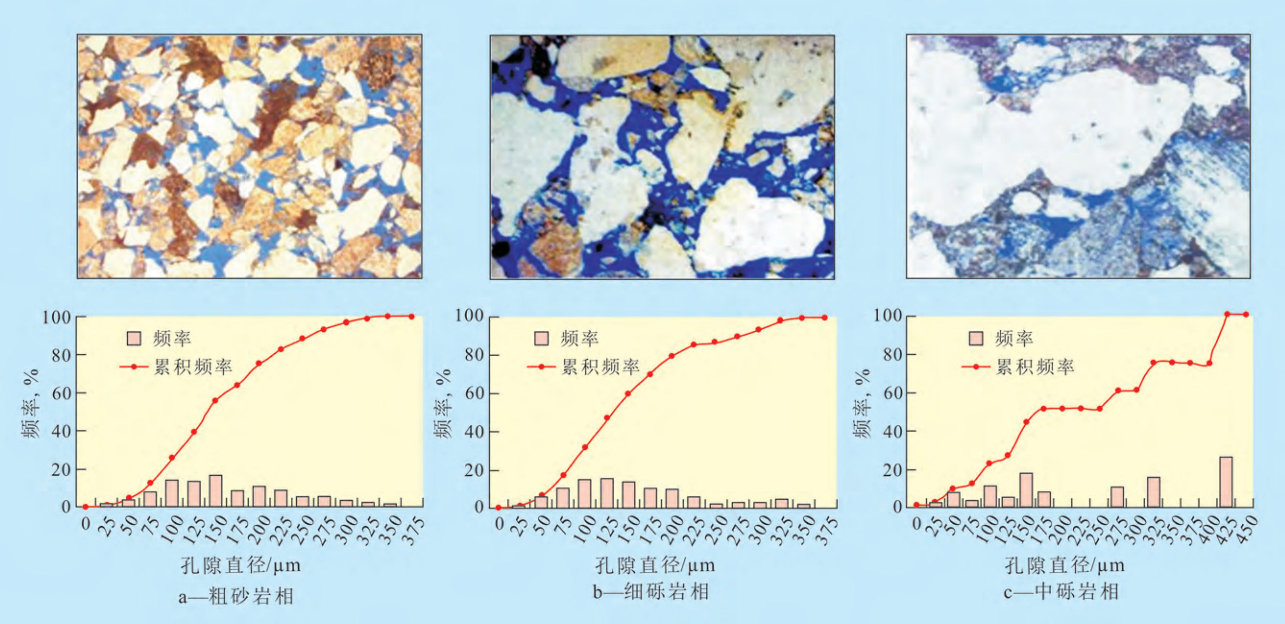


图9　不同岩石相孔隙结构铸体薄片和孔隙直径分布

3　储层孔隙结构影响因素

岩石的孔隙结构是影响储层物性的主要因素，而构造作用、沉积作用、成岩作用则是控制储层孔隙结构特征的主要因素。

3.1　构造作用

构造格局决定着储层的沉积格局，进而控制了储层的孔隙结构。准噶尔盆地西北缘是一个由西北老山边缘向东南盆地缓倾的断阶带（斜坡带），主断裂（克—乌大逆掩断裂）为一纵穿整个断阶带的同生断裂，断面北倾并具上陡（倾角为50°~80°）、下缓（倾角为5°~40°）的特征，这一构造格局决定了储层的沉积格局。在断裂上盘的构造高部位，山麓—洪积扇的粗碎屑沉积非常发育，越靠近老山，岩性越粗，砂砾岩体的岩矿成分与母岩成分越相似，不

稳定性重矿物相对较多。由于埋藏较浅，岩石的成岩作用主要以机械压实和不完全胶结作用为主，储层以原生孔隙为主。而在断裂下盘，构造位置较低，储层埋深增大，岩性相对变细，且越向盆地中心岩性越细，沉积物以化学压实、胶结和重结晶作用为主，次生孔隙较为发育。

断裂活动会改造储层的原生孔隙结构。断裂的拖拉作用在断层面附近形成局部高点，并产生大量裂缝和微细裂缝网络，为地层流体的分异运移，尤其是为地层水中矿物析出创造了良好的条件，从而改变了储层沉积早期的孔隙结构。而在局部高点上，由于孔隙结构有所改善，油气易于富集，为油井高产创造了条件。

3.2　沉积作用

不同的沉积环境、沉积相，其矿物种类、含量及胶结物的分布有很大差异[7]，造成储层的孔隙结构不同。对于砾岩储层，较好的孔隙结构一般分布在洪积扇扇根内带的槽流砾石体、扇根外带的片流砾石体以及扇中的辫流水道等微相带中。对比研究区克上组的辫状河流亚相，若以孔喉比、孔喉配位数及不同渗孔比（渗透率与孔隙度比值）条件下的平均孔喉半径等参数来衡量，则辫状河流亚相的砾岩孔隙结构比山麓—洪积相的砾岩优越（表2），但二者都不及分支河流及河口砂坝相的砂岩优越。

表2　不同沉积环境的砾岩、砂岩孔隙结构对比

沉积相带	岩性	模态结构	孔喉比	孔喉配位数	平均孔喉半径/μm		
					渗孔比为0.01 μm^2	渗孔比为0.1 μm^2	渗孔比为1 μm^2
山麓—洪积相	砾岩	复模态	271	2.5～3.5	0.06	0.23	0.59
辫状河流亚相	砾岩	复模态	90	3.5	0.16	0.48	1.95
分支河流及河口砂坝相	砂岩	双模态	<10	4～6	0.62	1.92	6.1

3.3　成岩作用

目前所研究的储层的孔隙结构与物性，实际上都是在不同程度上经过成岩后生作用改造了的次生或后生的产物，既具有成岩期的痕迹，又具有后生期的痕迹。由于成岩后生作用的类型不同，有的能使岩石的孔隙结构及物性变好，有的能使其变差。

机械压实作用　山麓—洪积相砾岩储层的颗粒结构与大小差别很大，以多级支撑为主。理论计算结果表明，三级颗粒支撑的松散岩石孔隙度为10.8%，当压实成紧密堆积时孔隙度减小为1.74%，机械压实作用造成孔隙度降低。

胶结作用　准噶尔盆地西北缘砾岩储层中的主要胶结物有伊利石、高岭石、绿泥石、蒙脱石、伊/蒙混层、高岭石/绿泥石混合物等粘土矿物及方解石、方沸石、片沸石、橘红色沸石、菱铁矿、黄铁矿和少量石膏、硬石膏等矿物。这些矿物以不同的含量充填或半充填于各储层孔隙中，对粒间孔隙起着封闭、堵塞和隔离的作用，破坏了孔隙连通性，使孔隙结构和物性变差。

溶蚀作用　溶蚀作用在研究区表现为先期形成的粘土矿物被溶蚀和分解，如蒙脱石溶解变为绿泥石；部分骨架颗粒或基质被溶蚀，如各类长石在高盐度水介质中分解而形成沸石；自生矿物析出后被溶蚀，如沸石、方解石等矿物析出后又遭溶蚀。一般情况下，溶蚀作用产生的次生溶蚀孔隙使储层的孔隙体积扩大，孔隙结构得到改善，物性变好，但也存在着不利的一面，当矿物颗粒被溶蚀而泥化时，微细的泥质颗粒容易堵塞粒间孔隙的喉道，使孔隙结构和物性变差。

重结晶作用　在压力增大（或伴有温度升高）的情况下，岩石中的矿物成分在固态下重新结晶，使晶粒增大，如细晶方解石变为粗晶方解石、黄铁矿、高岭石等。新生的自形晶矿物全充填或半充填于粒间孔隙和喉道中，使孔隙减少、喉道变窄，孔隙连通性变差。

压溶作用　岩石颗粒在压力作用下，在受力方向上发生溶解，而在垂直力的方向上发生沉淀。岩石通过压溶作用可产生压溶缝、缝合线或溶孔，扩大了孔隙空间。

4　结论

克拉玛依油田七中、东区克下组砾岩储层孔隙结构特征可划分为4类，分别代表储层孔隙结构好、较好、较差和差。研究区砾岩储层储集空间以粒间溶孔为主，次之为原生粒间孔隙，先期形成粘土矿物、长石、沸石和方解石胶结物的溶解是形成次生孔隙的主要原因。克下组储层孔隙度平均为

16.3%，渗透率平均为$124\times10^{-3}\ \mu m^2$，属中孔、中渗透储层。孔喉组合类型主要有大孔中喉型、中孔中喉型、小孔细喉型和小孔微喉型，储层的微观孔隙分布主要有3种类型，孔隙直径分布分别呈单模态、双模态和复模态。

影响孔隙结构的因素有构造作用、沉积作用和成岩作用。构造作用决定着储层的沉积格局，进而控制了储层的孔隙结构。沉积作用对孔隙结构的影响主要表现在岩性对储层物性的控制。成岩作用对孔隙结构的影响主要表现为：①机械压实作用造成孔隙度降低；②胶结作用充填原生孔隙，破坏了孔隙连通性，使孔隙结构和物性变差，但也为后期溶解作用对孔隙改造奠定了基础；③溶蚀作用产生的次生孔隙使储层孔隙体积扩大，孔喉间的连通性变好，孔隙结构和物性得到改善，但也存在着不利的一面，当矿物颗粒被溶蚀而泥化时，微细的泥质颗粒容易堵塞粒间孔隙的喉道，使孔隙结构和物性变差；④重结晶作用产生的新生自形晶矿物全充填或半充填于粒间孔隙和喉道中，使孔隙减少、喉道变窄，孔隙连通性变差；⑤压溶作用可产生压溶缝、缝合线或溶孔，扩大了孔隙空间。

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Qiu Longwei, Zhou Yongyi, Gao Qingsong et al. Study of porosity structure and its influences on Carboniferous and Permian tight sand reservoir rock in Danniudi gasfield, Ordos basin. *PGRE*, 2013, 20(6): 15–18

Abstract: The porosity structure and its influences on Carboniferous and Permian tight sand reservoir rock are studied through observation on the casting thin section and analysis on mercury data in Danniudi gasfield, Ordos basin. And, we made a conclusion that, the secondly porosity, such as intergranular pore and innergranular pore are the dominant reservoir space in the study area. There exists similar change trend between the average value of displacement pressure and that of maximum pore throat in different formations. While the average value of p_{c50} tends to be smaller with the increment of depth, changes reversely with that of displacement pressure. The low pore–throat sorting, scattered distribution, with micro pore and fine throat, micro throat combination are the dominant pore throat combination type. The pore structure in the area is influenced by buried depth and detrital particular materials. The displacement pressure increases, and the pore and throat decrease along with the increment of the burial depth. Higher content of feldspar and rock fragments is more beneficial to the reservation of pore and throat for the influence of selective pressure dissolution and secondly growth under the detrital components and diagenetic environment in the study area.

Key words: tight sand; reservoir characteristics; pore structure; expulsion pressure; Daniudi gasfield

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Ge Zhongwei, Fan Li. Some notable problems about shale gas in the scientific research. *PGRE*, 2013, 20(6): 19–22

Abstract: China's shale gas exploration and research is still in the primary stage, and facing many complicated geological and engineering problems. Although it has obtained a large number of precious experiences through the analogy of matured shale gas in the United States, it has its unique characteristics. Therefore, it is necessary to establish a set of effective resources evaluation system. Based on the exploration target of shale gas, this paper provides some questions about the different reservoir characteristics at home and abroad, such as the "formation water" storage and percolation mechanism in shale reservoir, the relationship between fracturing effect and genetic types of natural gas, then suggesting the shale reservoir classification evaluation in different depositional system so as to look for the shale gas "dessert", and realize the reasonable and maintainable development of shale gas in China.

Key words: shale gas exploration target; reservoir classification evaluation; pressure coefficient; fracturing; natural gas origin; throat diameter

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Liu Jie, Cao Yingchang, Fan Tailiang et al. Sequence stratigraphy and modeling of sandbodies distribution in Yonganzhen delta, Dongying depression. *PGRE*, 2013, 20(6): 23–28

Abstract: The Yonganzhen delta is developed in Minfeng sag and its peripheral area are important oil and gas accumulation belts in Dongying depression, Bohaiwan Basin, China. Based on the principles of seismic sequence, combined with logging and drilling, the target strata of Yonganzhen delta, the middle and the lower submember of third member of Shahejie formation (Es_3z–Es_3x) are divided into a third–order sequence separately. In the sedimentary stage of Es_3z, three fourth–order sequences (MSC1–MSC3) and eight fifth–order sequences (Z1–Z8) are developed; in the sedimentary stage of Es_3x, two fourth–order sequences (MSC4–MSC5) and two fifth–order sequences (X1–X2) are developed. Meanwhile, the scales of Yonganzhen deltaic deposition was small in the periods of MSC5–MSC3; in the period of MSC2, the strength of source supply increased from the Qingtuozi salient, the Yonganzhen delta prograded massively, and reached the downthrown block of Shengtuo fault with the depositions of mixed sources; in the period of MSC1, the Yonganzhen delta migrated to the north is affected by the deposition of the Dongying delta. Moreover, the Yonganzhen delta has the characteristic of self–similarities for development of sandbody controlled by sequence. The self–similarities illustrate that the delta sandbody is developed within the dropping semi–cycle in each grade of base level cycle, with the sand content higher than that of the rising semi–cycle.

Key words: Yonganzhen delta; sequence stratigraphy; sedimentary system; sequence stratigraphy controlled sandbody; Dongying depression

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Zhang Daiyan, Peng Yongcan, Xiao Fangwei et al. Pore structure and influence factors of conglomerate reservoir–case study of lower Karamay formation in mid and east of 7th block, Karamay oilfield. *PGRE*, 2013, 20(6): 29–34

Abstract: The conglomerate reservoir pore structure of the lower Karamay formation in mid and east of 7th block, Karamay oilfield, is fully studied by means of casting thin sections, SEM and petrophysical and mercury injection data. There are three main types of microscopic pore distribution in the conglomerate reservoir of the lower Karamay formation in the study area, the pore diameter distribution is monomodal, bimodal and complex modal. According to nine parameters screened out (porosity, permeability, mean, skewness, the saturation median radius, the maximum pore throat radius, the average pore throat radius, as the pore volume ratio and the percentage of non–saturated mercury pore volume), using K–Means clusterting analysis method, the conglomerate reservoir is divided into four major categories of class I, II, III and IV, which are on behalf of the reservoir good, moderate, poor and very poor, then, each type of reservoir pore structure characteristics is summarized. The analysis of the main factors, affecting the pore structure, shows that the factors affecting the pore structure are tectonic, sedimentation and diagenesis. The influence of deposition on the pore structure is mainly characterized by the lithologic control on the physical properties of the reservoir, and for diagenesis on pore structure, mainly by compaction resulting in lower average porosity; and the cementation deteriorates the pore structure and physical properties; meanwhile, the secondary porosity generated by dissolution improves the reservoir pore structure and physical properties; however, the authigenic euhedral crystal mineral by recrystallization filled or partially filled in the intergranular porosity and throat has reduced the porosity by narrower throat and poorer pore connectivity; the pressure solution can generate pressure solution seam, suture, or dissolved pores so as to expand the pore space. The research results provide the basis for the formulation of oil field development decision–making and stimulation.

Key words: conglomerate reservoir; pore structure; pore type; influence factors; lower Karamay formation; Karamay oilfield

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Zhao Lei, Sun Qiang, Ji Jianqing et al. Hydrocarbon–generating potentials analysis on late Paleozoic residual ocean basin in West Junggar. *PGRE*, 2013, 20(6): 35–37

Abstract: The hydrocarbon–generating potentials of residual ocean basin get more and more attention. Based on the fact that the Junggar basin is underlain by the Precambrian continental block, an upper Paleozoic residual ocean might exist in west Junggar and aast Kazakhstan named the Balkhash–West Junggar residual ocean. Bole–Ebinur Lake sag lies in the south margin of the basin. Many sets of source rocks composed of upper Devonian–lower Carboniferous mudstone, marlstone and biolithite limestone are discovered from Bole–Ebinur Lake sag in southwestern margin of basin. The average *TOC* of source rocks is 2.19%, and the maximum is 7.11%. And, more close to oil–soaked clastic rocks in Bole–Ebinur Lake sag, the saturated hydrocarbon of source rock extract shows bimodal distribution type with odd–carbon predominance. According to light–to–heavy carbon–number ratios and asphaltenes contents, the upper Paleozoic source rocks well–preserved in the basin are still in a medium mature stage with high hydrocarbon–generating potentials.

Key words: residual ocean basin; source rock; hydrocarbon–generating potential; Bole–Ebinur Lake sag; Junggar basin

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Xu Guihua. Reservoir risk assessment methods on stratigraphic traps, Jiyang depression. *PGRE*, 2013, 20(6): 38–41

Abstract: In this stage, the stratigraphic traps in Jiyang depression is low in success rate of exploratory wells, and pre–drilling risk is difficult to predict. Through the analysis and summary of wells drilled in the "Tenth Five–Year", the failure of the exploration well is attributed to poor transportation conditions, low filling of oil–gas in reservoir, lack of effective reservoirs and traps, at 49%, 21%, 15% and 15% respectively. The reservoir analysis shows that the positive structural background and the neighboring oil–source fault is the key stratigraphic trap reservoir. Based on the analysis herein, the geological conditions influencing the accumulation of stratigraphic reservoir are mainly migration and accumulation, storage, trap and reservoir property. According to the evaluation of the geological conditions of stratigraphic traps in Jiyang depression, we establish the pre–drilling risk assessment method for stratigraphic trap, and then it is tested and verified. The results show that the evaluation results accords well with the actual drilling results, and the well of Jinping2, Chengdong112 with higher geological risk are all hydrocarbon accumulated, but the well of Chengdong111, Wang951 and other wells with low geological risk are not hydrocarbon accumulated.

Key words: stratigraphic traps; exploration well success rate; reservoir forming risk; assessment methods; Jiyang depression

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Wang Quan, Li Xiaohong, Zhao Xuan et al. Main controlling factors of sedimentary sandbodies distribution in fault sag, Erlian basin. *PGRE*, 2013, 20(6): 42–45

Abstract: The Erlian basin is consisted of a group of middle Mesozoic and Cenozoic small fault lake basins, and it is geologically favorable for the formation of stratigraphic–lithologic reservoirs. Considering that these fault lake basins are characterized by small size, multiple sources, rapid deposition and abrupt facies belt change, this paper focuses on the formation process of sedimentary sandbodies distribution and analyzes the key factors controlling of sandbodies in terms of source material supply, transport pathway and sandbody distribution by means of research techniques of palaeostructure analysis, seismic sedimentary facies analysis and typical sedimentary sandbody analysis. It is indicated that the key factors controlling sandbodies distribution are the ancient material source, ancient valleys and slope breaks. Entry position and distribution of depositional systems are controlled by the sag margin and the internal ancient highlands. The transport pathways of sandbodies within the lake basins are controlled by ancient valleys formed by sag–controlling faults. In different types of slope break zones, the sandbodies present different characteristics of superposition and distribution. The an-