·油气藏工程·

东辛复杂断块油藏层块分类评价方法与调整对策

王端平[1],杨 勇[2],牛栓文[3],张进平[3],庞丽丽[3]
(1.中国石化股份胜利油田分公司,山东 东营 257001;2.中国石化股份胜利油田分公司 地质科学研究院,山东 东营 257015;3.中国石化股份胜利油田分公司 东辛采油厂,山东 东营 257094)

摘要:东辛复杂断块油藏已进入高含水开发阶段,为进一步提高其水驱采收率,适应精细开发需要,综合考虑静态地质特点和动态开发特征,对复杂断块油藏提出层块分类综合评价的方法,制定了研究区层块分类的量化标准,并提出不同层块组合开发与调整的方法。分类中静态因素按照断块形状、含油面积、储层厚度及储层物性的先后顺序考虑,动态因素主要考虑水驱油规律、剩余油分布及驱动类型,不分先后顺序,将层块划分为Ⅰ,Ⅱ,Ⅲ和Ⅳ共4类。Ⅰ类层块是开发的主力阵地,开发调整思路主要是在构造高部位、油层顶部部署水平井单层开发,在原始油水边界外实施人工仿强边水实现高效水驱;Ⅱ和Ⅲ类层块存在层间干扰,储量动用不均衡,应依据相似组合原则进行合理组合;Ⅳ类层块储量控制程度低,井网完善难度大,开发中采取复杂结构井或就近挂靠的原则提高储量控制与动用。

关键词:断块油藏 层块 静态地质特点 动态开发特征 采收率
中图分类号:TE112.23 **文献标识码**:A **文章编号**:1009-9603(2012)05-0084-04

东辛复杂断块油藏平面上断层多、断块小而破碎,纵向上储层多、井段长、非均质性强,不同地质圈闭下形成的断块其形态、能量、性质均存在较大差异,在井网部署和开发方式等方面也各不相同。为了大幅度提高断块油藏水驱采收率,必须将精细油藏分类作为明确潜力并提出调整的基础和前提。笔者在综合考虑地质条件与开发特点2大因素的前提下,提出断块油藏层块分类综合评价的方法,以单砂体为纵向上的分类对象,平面上考虑断块的切割或岩性边界的变化,即以层块为油藏分类的基本要素,对断块油藏进行精细分类评价,并在此基础上提出了不同层块的组合调整对策,取得了较好的开发效果。

1 问题的提出

东辛复杂断块油藏在区域构造上处于济阳坳陷东营凹陷中央隆起带东段,具有中国陆上断陷油气藏的典型特征,平面上,全区315条大小不一、纵横交错的断层将其分割成289个断块;纵向上,含油井段为1 500~3 100 m,包括7套含油气层系、43个砂层组、100多个含油小层,其各自具有独立的油水系统,油水关系复杂。

早期的油藏分类根据实际与开发需要,按油藏圈闭成因分为小型构造油藏、岩性油藏、断层遮挡岩性油藏和断层遮挡层状构造油藏4种基本油藏类型。考虑对开发的适用性,在油藏基本分类的基础上,又考虑油藏在几何形态、性质、油层发育组合和天然能量类型等方面存在较大差异,从而反映在井网部署、开发与开采方式上的具体做法不同,因此又将断块油藏分为开启型扇形断块油藏、简单断层遮挡条带形断块油藏、三面断层切割遮挡半封闭断块油藏、四周为断层切割的封闭断块油藏和断裂破碎带的小断块油藏5类[1]。

早期的油藏分类已经采用了地质与开采特点相结合的油藏综合分类法[2],但是,随着目前大幅度提高水驱油藏采收率的总体要求以及深入贯彻精细开发理念的提出,这种油藏分类方法表现出一定的不适应性,具体体现在2个方面:①在同一个断块区内存在多个不同形态、不同类型、不同开发特点的小断块,其地质特点及开发特征存在较大差异,在同一断块区开展技术研究或调整方案时,倘若只对应一种油藏类型进行开发效果评价,无法满足精细开发的需求,因此并不适合采用同一套开发技术

收稿日期:2012-07-23。
作者简介:王端平,男,教授级高级工程师,博士,从事油气开发研究。联系电话:(0546)8501116,E-mail:wangduanping.slyt@sinopec.com。
基金项目:中国石化科研攻关项目"胜利油田复杂断块油藏立体开发技术研究"(P09037)。

政策。如在永3–1断块区，按照早期的油藏分类方法，整个断块区可以被划归为四周为断层切割的封闭断块油藏，但是从断块区的不同小断块来看，还包括三面断层切割遮挡半封闭断块油藏和断裂破碎带的小断块油藏（图1），在这个大断块区内同时包括3种不同的油藏类型，其开发特点、潜力以及开发调整对策、井网部署方式都不尽相同，如果还按照早期分类的1种类型来对待，将难以实现大幅度提高采收率的目的。②早期的分类方法[3–4]多体现平面断块形态，未展现纵向油层的非均质性，进入开发后期不同类型油层表现出不同的水驱油特点和剩余油规律，不利于进一步提出针对性的调整对策。如在永3–1断块区，纵向上，既有厚度达到40 m的层内相对均质的箱型巨厚层，也有厚度约为10 m的层内非均质性较强的正韵律层、反韵律层，还有厚度为1~8 m的层间强非均质性的薄互层，这些物性、厚度、能量差异较大的油层交互存在，在开发中互相干扰，受不同水驱油规律影响，剩余油分布、采出程度、剩余储量都不同，因此在油藏分类过程中也要充分体现出来。

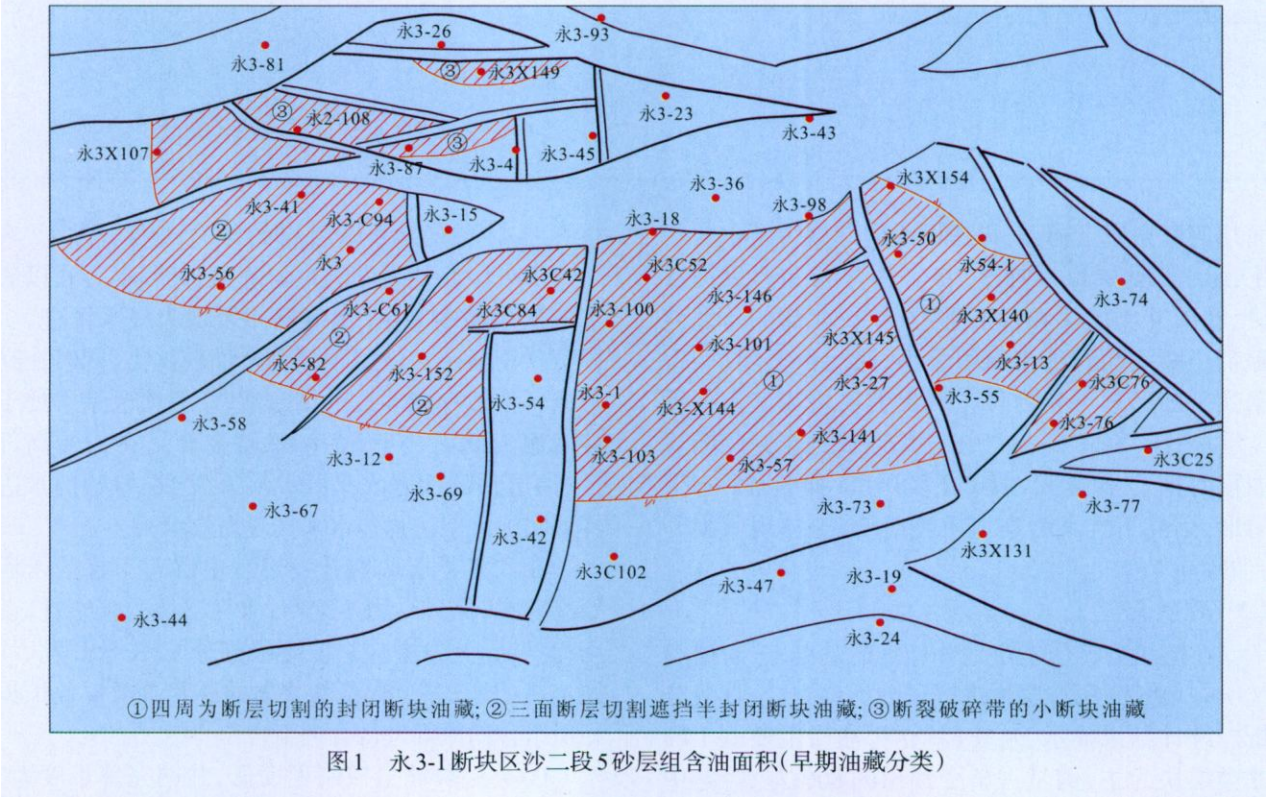

图1　永3-1断块区沙二段5砂层组含油面积（早期油藏分类）

2　层块分类评价与挖潜

2.1　分类原则

根据储层的静态地质特点[5]，综合考虑动态开发特征，进行层块分类。静态地质特点首先考虑断块形状，可以根据不同的几何形态将其分为长方形、梯形、长条形、三角形、扇形等，不同的形状描述可反映出断块是封闭或开启，表达出天然能量状况，如长方形说明断块是四周被断层遮挡的封闭断块，天然能量较弱，而扇形则反映出断块是半开启形态，边水活跃，天然能量充足。其次考虑含油面积，根据统计，在东辛油田断块油藏的289个小断块中，含油面积小于0.1 km^2的有144个，含油面积大于0.1 km^2且小于0.5 km^2的有101个，含油面积大于0.5 km^2且小于1 km^2的有30个，含油面积大于1 km^2的仅有14个。从开发角度统计，断块油藏到目前开发阶段注采井距多为200~300 m，考虑注采井距，最终将含油面积的界限界定到0.07 km^2。再次考虑储层厚度，按照厚度分为厚层（8 m以上）、中厚层（4~8 m）和薄层（0.5~4 m）。最后考虑储层物性，根据储层的渗透率可分为高渗透层、中渗透层、中—低渗透层和低渗透层。

动态开发特征主要考虑水驱油规律、剩余油分布及驱动类型，不分先后顺序。在开发中边水、底水、人工注水等不同的驱动特点产生的水驱油机理不同，最终导致强水洗、水洗、见水、弱见水等不同的剩余油表征。

综合考虑静态地质特点和动态开发特征，将层块划分为Ⅰ，Ⅱ，Ⅲ和Ⅳ共4类。其中，Ⅰ类层块具

有一定面积，厚度大，物性好，以高渗透层为主以底水或次生底水为主，能量充足，水淹程度高；Ⅱ类层块具有一定面积和一定厚度，以中—高渗透层为主，能量较充足，以边水或人工注水为主，水淹程度较高；Ⅲ类层块具有一定面积，以中—低渗透层为主，人工注水补给能量，开发中往往受Ⅰ和Ⅱ类层块干扰，水淹程度较低，动用差；Ⅳ类层块含油面积小，储量控制和动用程度均较差，以破碎小断块和岩性砂体为主，无法形成规模井网或注采井对。

2.2 量化标准

结合研究区所有单元的动静态特征，制定东辛复杂断块油藏层块分类的量化标准（表1）。在层块分类标准的指导下，对永3-1断块区进行了重新分类。中部的四周为断层切割的封闭断块油藏，其平面几何形态属于梯形，再考虑纵向储层特征包含了Ⅰ，Ⅱ，Ⅲ类层块，因此可将其细分为梯形Ⅰ类层块、梯形Ⅱ类层块和梯形Ⅲ类层块；北部的断裂破碎带小断块油藏由于面积很小，属于Ⅳ类层块，根据其平面形态可分为长方形Ⅳ类层块或三角形Ⅳ类层块等；西部的三面为断层切割遮挡半封闭断块油藏面积大、厚度大，属于Ⅰ类层块，其平面形态呈扇形，因此可定义为扇形Ⅰ类层块，也体现其半开启的特征。

表1 东辛复杂断块油藏层块分类标准

层块分类	面积/km^2	厚度/m	渗透率/$10^{-3}\mu m^2$	天然能量	驱动方式	水淹状况
Ⅰ类		>8	>800	强	边水、底水、次生底水	水洗—强水洗
Ⅱ类	>0.07	4~8	500~1 000	较强	边水、人工注水	见水—水洗
Ⅲ类		0.5~6	50~400	较弱	人工注水	弱见水—见水
Ⅳ类	<0.07	0.5~5	50~600	弱	人工注水	弱见水—见水

2.3 现状调查

在层块分类依据及划分标准的基础上，对研究区所有单元的所有层块进行了分类调查、统计及分析。统计结果显示，永安、新立村油田主要以Ⅰ和Ⅱ类层块为主，储量占整个油田的80%左右，其中Ⅰ类层块占近60%；广利油田整体以Ⅱ类层块为主，其储量占油田的近80%；而东辛油田自东向西4类层块均有不同程度发育，主要以Ⅱ和Ⅲ类层块为主，其储量占整个油田的70%~80%。

统计各类层块的开发状况，开发特征表现为：Ⅰ类层块能量强，产液能力高，含水率高，集中在95%及以上，采收率高，采出程度为40%~60%，生产该类层块的油井大多因高含水停产；Ⅱ类层块储量规模大，动用好，采出程度为30%~40%，含水率以90%~95%为主；Ⅲ类层块因受Ⅰ和Ⅱ类层块干扰，动用较差，采出程度为10%~35%，产液能力低，含水率低，为70%~90%，能量较差；Ⅳ类层块动用程度差，以低采出程度、中—低含水率为主。

2.4 组合开发与调整

东辛复杂断块油藏各类层块开发矛盾不同，调整过程中要充分考虑层块的组合进行开发[6-11]。

Ⅰ类层块是开发的主力阵地，其驱动方式以底水或次生底水为主，水淹规律表现为底水锥进，多种资料均显示在油层顶部剩余油较富集，同时在高水淹区依然存在零散的剩余油[10]，目前已基本处于技术废弃状态，开发调整思路主要是在构造高部位、油层顶部部署水平井单层开发，在原始油水边界外实施人工仿强边水来实现高效水驱。

Ⅱ和Ⅲ类层块在开发过程中层间干扰的矛盾始终存在，储量动用不均衡，Ⅲ类层块受到干扰，动用程度低，开发中应采取逐级细分[7]、矢量开发、均衡水驱的调整思路，将断块内的Ⅱ和Ⅲ类层块依据相似组合的原则进行合理组合。

Ⅳ类层块储量控制程度低，井网完善难度大，开发中应采取复杂结构井或就近挂靠的原则提高储量控制与动用程度[8]。

3 应用效果

以复杂断块油藏层块分类评价方法及调整对策为指导，对各类层块潜力认识准确、到位，为实施整体开发政策的优化调整提供依据。例如在永3-1断块区沙二段5-1梯形Ⅰ类层块，层块分类后评价剩余油富集区为沿屋脊一线宽度为100 m的构造高部位，部署1口近断层水平井永3平8井，该井距断层最近距离为3 m，完钻水平段长度为280 m，投产初期产油量为22 t/d，不含水。2008年以来，在Ⅰ类层块共部署实施水平井71口，累积产油量为46×10^4 t，单井累积产油量为0.65×10^4 t，提高采收率为5.2%。

4 结束语

东辛复杂断块油藏经过几十年的开发，已进入高含水深度开发阶段，而断块油藏层块分类评价方法是实现其精细开发的基础。层块分类的方法是平面划分到断层切割或岩性边界，纵向划分到每一个单层，同时综合考虑储层的静态地质特点及开发过程中的渗流规律、水淹程度、能量状况等，这种在静态和动态2大因素控制下的分类方法一方面能直观反映出油藏的地质特点、储层类型，另一方面还可体现出开发中受不同水驱油规律影响，各类型水驱油渗流特征、采出程度等开发特点，更有利于有针对性地提出调整方案。

不同类型层块具有不同的开发调整对策，断块油藏复杂地质体的特点决定着在同一断块包含多种层块类型，因此调整过程中还要充分考虑各层块的组合开发，通过多种开发技术手段的组合应用，最大化提高各类层块的储量控制与水驱动用程度。

层块分类方法在平面、纵向均已分到最小单位，较之前分类方法有一定进步，也可与目前常用的分类方法进行适当融合，同时层块分类方法对分小层、分油砂体储量计算和统计提出较高要求，在评价过程中需要以精细的地质研究为保障。

参考文献：

[1] 程世铭，张福仁，等.东辛复杂断块油藏[M].北京：石油工业出版社，1997：56-58.

[2] 王洪宝，宋绍旺，田仲强，等. 不同类型油藏的分类治理与分类开发——以东辛油田为例[J]. 应用基础与工程科学学报，2003，11(1)：10-18.

[3] 李武广，邵先杰，康园园，等.油藏分类体系与方法研究[J]. 岩性油气藏，2010，2(2)：125-129.

[4] 王平.论含油断块的分级[J]. 断块油气田，1997，4(7)：1-4.

[5] 郭长春. 模糊数学方法在划分流动单元中的应用[J]. 油气地质与采收率，2010，17(5)：32-35，45.

[6] 王端平，杨勇，许坚，等.复杂断块油藏立体开发技术[J].油气地质与采收率，2011，18(5)：54-57.

[7] 王端平，杨勇，梁承春，等.复杂断块油藏三级细分技术的研究与应用——以永安镇油田永3-1断块沙二段7-9层系为例[J]. 油气地质与采收率，2011，18(2)：62-64.

[8] 季静，宗杰，刘安元，等.复杂断块油藏组合模式研究与应用[J].断块油气田，2010，17(1)：35-37.

[9] 吕庆仙.胜利油区断块油气藏开发潜力及技术对策[J].油气地质与采收率，2010，17(4)：91-93，96.

[10] 李春英，吴晓东，李淑霞.特高含水深度开发阶段调整挖潜技术政策界限——以胜坨油田坨28断块沙二段7—8单元为例[J]. 油气地质与采收率，2010，17(6)：97-100.

[11] 朱学谦，周琦，宋冬梅，等.提高复杂断块油藏开发效益[J].大庆石油地质与开发，2003，22(2)：21-23.

编辑 经雅丽

oxygen in the end gas and acid value, viscosity and group composition of the oil with additives in the high temperature autoclave. The heavy oil was from the producing well 951217 in the Block J230 of Xinjiang Oilfield. It is found that the acid value of the oxidized oil is 8.37 mg/g and its viscosity is 3 787 mPa · s but oxygen volume fraction decreases to 4.75 vol% after 72 h with 0.10 wt% catalyst of FeL and air injected at 1.2 MPa and 200 ℃. Furthermore, the viscosity of emulsion is 42 mPa · s at 50 ℃ after mixing 70 g oxidized oil, 30 g water and 0.07 g caustic additives R1. Good results can be achieved through decreasing the volume fraction of oxygen with catalyst and reducing the viscosity of heavy oil with caustic additives during the process of cyclic steam with air.

Key words: steam stimulation; air; low-temperature oxidation; catalysis; viscosity reduction

Luo Qiang, Research Institute of Experiment and Detection of Xinjiang Oilfield Company, PetroChina, Karamay, Xinjiang, 834000, China

Zhang Enlei, Gu Daihong, He Shunli et al. Experiment study on effect of impurities on CO_2 drive. *PGRE*, 2012,19(5): 75-77.

Abstract: Carbon dioxide flooding is a promising tertiary oil recovery technology in respect both to technical and, if operating costs are properly controlled, to economic benefit. Moreover, the injection of this greenhouse gas also has environmental merits. Flue gas from power plants and natural CO_2 gas is the main available source of the CO_2, however, CO_2 sources are rarely pure. Purifying the flue gas will increase operating costs significantly. Therefore, understanding the roles of impurities in fluid phase behavior and miscibility characteristics is necessary for designing a cost-effective CO_2 enhanced oil recovery process. This paper studies the effect of the different impurities in the CO_2 stream on the phase behavior and the MMP. With the effect of impurities on the CO_2 MMP, it is shown that the presence of intermediate hydrocarbon gas solvents in the CO_2 gas stream can reduce the CO_2 MMP, whereas, the N_2 and CH_4 tend to have the opposite effect. EOS simulation is demonstrated to be an effective toll to analyzing the miscibility of oil-gas systems. Core flood tests are conducted to investigate the oil recovery behavior resulting from CO_2 injection. The ultimate oil recoveries of the tests show that the miscibility and near-miscibility have the same mechanism. The presence of intermediate hydrocarbon gas solvents in the CO_2 gas stream can enhance the ultimate recovery, whereas, the N_2 and CH_4 tend to have the opposite effect.

Key words: CO_2 drive; minimum miscibility pressure; impurities; slim tube test; displacement experiment

Zhang Enlei, MOE Key Laboratory of Petroleum Engineering, China University of Petroleum (Beijing), Beijing City, 102249, China

Lou Yi, Yang Shenglai, Zhang Xing et al. Experimental research on CO_2 miscible flooding by advanced gas injection in low permeability reservoir-case of H79 block, Jilin oilfield. *PGRE*, 2012,19(5):78-80.

Abstract: In order to enhance the oil recovery in low permeability reservoir by CO_2 miscible flooding through advanced gas injection, its feasibility is tested in laboratory. The minimum miscible pressure is determined by micro-tubes tests; the laboratory result of CO_2 miscible flooding by advanced gas injection with long core physical simulation device is researched and the result is compared with that of synchronous gas injection and water flooding. The ultimate recovery of CO_2 miscible flooding by advanced gas injection is 77.03%, synchronous gas injection is 73.09% and water flooding is 56.47%. Results show that, since the advanced gas injection can increase the formation pressure and energy, the oil's viscosity is reduced and its mobility is increased because gas injected in advance is contacted with oil, recovery of advanced gas flooding is higher than that of synchronous gas injection and water flooding.

Key words: low permeability reservoir; CO_2 miscible flooding; advanced gas injection; physical simulation; Jilin oilfield

Lou Yi, MOE Key Laboratory of Petroleum Engineering, China University of Petroleum (Beijing), Beijing City, 102249, China

Zhang Jiyao, Gao Ruimin, Yu Huagui et al. Preliminary study about oxygen consumption of injecting air into low-temperature and low-pressure reservoir. *PGRE*, 2012,19(5):81-83.

Abstract: The Ganguyi blocks is the main production area of Yanchang oilfield, the main developing oil layer is Chang 6 reservoir with low pressure, low permeability and low temperature characteristics. Since 2007, the air-foam enhance oil recovery technology is used, and it achieved good results. An instrument is used to simulate the oxygen consumption of injecting air into a reservoir with 30 ℃ and 6 MPa, and the oxygen content diminishes with index, it will drop under the explosion limit after 80 days, and it can run out if the time is long enough, the law is verified in field test based on a low-temperature and low-pressure reservoir. So, the air-foam enhance oil recovery technology can be used in the low-temperature and low-pressure reservoir.

Key words: low-temperature and low-pressure reservoir; air injection; oxygen consumption; Yanchang oilfield; Ganguyi blocks

Zhang Jiyao, Shannxi Yanchang Petroleum (Group) Co., Ltd, Xi'an Ctiy, Shannxi Province, 710075, China

Wang Duanping, Yang Yong, Niu Shuanwen et al. Layer block classification evaluation and adjustment of complicated fault block oil reservoir. *PGRE*, 2012,19(5):84-87.

Abstract: In order to improve the water flooding recovery factor of the fault block oil reservoir and adapt to the needs of the development, this paper considers the static geological features and dynamic development features, then, it proposes layer block classification method of comprehensive evaluation for complicated fault block oil reservoir. A single sand body is the classification object in the vertical, moreover, the cutting of fault block and the change of lithological boundary are considered in the plane. In other words, using "layer block" for the basic elements of the reservoir classification, this paper classifies and evaluates precisely the fault block oil reservoir, and proposes combination of different layers block developed and adjustment program. The practice shows that this method is the base for carrying out potential assessment and adopting the accurate adjustment policies, it has the guiding signifi-

cance to further improve the water flooding recovery factor of the fault block oil reservoir in high water cut stage.

Key words: fault block reservoir; layer block; static geological feature; dynamic performance; recovery factor

Wang Duanping, Shengli Oilfield Company of SINOPEC, Dongying City, Shandong Province, 257001, China

Liu Chao, Ma Kuiqian, Chen Jian et al. Research on quantitative characterization of reservoir heterogeneity and adjustments suggestion in LD oilfield. *PGRE*, 2012, 19(5): 88-90.

Abstract: There are some defects in the existing evaluation systems of reservoir heterogeneity such as its unbounded parameters, high subjectivity classification and low degree of quantification. Based on Lorenz curve method, with the new transform process of data, a new parameter named as comprehensive coefficient of heterogeneity is used in reservoir heterogeneity research. This operation is very simple and the parameter has the virtues of strong comparison, quantitative characterization of heterogeneity degree and is applicable for any type of reservoirs. In the comprehensive research of reservoir heterogeneity in LD oilfield, the application result indicates that the level of LD oilfield reservoir heterogeneity is moderate, but the interlayer and horizontal heterogeneity is strong. For the heterogeneity characteristics of LD oilfield, the appropriate development adjustments are carried out: the main development method is directional wells with few horizontal wells or multi-lateral wells supplemented in E_3d^{2U} reservoir. At the same time, the separate stratum development and separated layer and injection process are used in E_3d^{2L} reservoir. It has significant practical guidance in oilfield adjustment and enhanced oil recovery. It is remarkable that the reduction in water cut is 9%, while the daily oil production increased by about 1 000 m^3/d.

Key words: reservoir heterogeneity; Lorentz curve; formation interference; separate stratum development; development adjustments

Liu Chao, Tianjin Branch of CNOOC Ltd., Tianjin City, 300452, China

Du Dianfa, Wang Yujing, Hou Jiagen et al. Study on water flooding pattern of thin-layered reservoirs with edge and bottom water-case of $K_1h_2^3$ reservoir of Lu9 wellblock in Luliang oilfield. *PGRE*, 2012, 19(5): 91-93.

Abstract: Thin-layered reservoirs with edge and bottom water are rare home and abroad. The water intrusion to oil well in this kind reservoir is very complex. The water cut of the oil well increases fast after the well is put into production, and the recovery factor is low. The production rate declines rapidly, and the ultimate recovery ratio is also very low. Taking $K_1h_2^3$ reservoir of Lu9 wellblock in Luliang oil field as an example, a concept model is built on the base of the whole region history matching. An orthogonal test is introduced to study the sensitive parameters and the water/oil distribution feature of water flooding pattern of the thin-layered reservoir with edge and bottom water. According to the numerical modeling result and dynamic documents of the whole region, five kinds of water flooding patterns are classified, which are injecting water enhanced bottom, injecting water cross-flow, bottom water coning, edge water intruding and compounding. And, the target boundary is given to the patterns. It is presented by the field application that the target boundary is reliable and it can be supplied as the theoretic foundation for the water/oil control measures for this kind of reservoir in the middle and later stage.

Key words: thin-layered; edge and bottom water; numerical simulation; orthogonal test; water flooding pattern

Du Dianfa, College of Geosciences, China University of Petroleum (Beijing), Beijing City, 102249, China

Cui Chuanzhi, Jiang Hua, Duan Jiehong et al. Reasonable injection rate allocation method of separate-layer water injection wells based on interlayer equilibrium displacement. *PGRE*, 2012, 19(5): 94-96.

Abstract: Affected by the differences of reservoir properties between layers, the interlayer producing situation and interlayer inconsistency of commingled reservoirs have large differences in the long-term process of water flooding. Separate-layer water injection technology is an effective method to ameliorate the contradictions among the high water cut stage layers. The key to the success of separate-layer water injection is to determine the distributional water injection rate according to the reservoir properties and development situations of each layer. This paper presents a method to calculate distributional water injection rate of each layer by use of the Buckley-Leverett displacement theory. This method takes into account of the reservoir physical properties and development situations. The aim of this method is to realize the interlayer equilibrium displacement. The results show that the differences of distributional water injection rate among layers is comprehensively affected by layer thickness, development status and regulatory time etc. And, the calculated distributional water injection rate in the regulatory time can make each layer achieve a balanced flooding state, and can meet the requirements of injection rate allocation of separate-layer water injection wells.

Key words: multilayer reservoir; interlayer contradiction; separate-layer water injection; computation model; equilibrium displacement

Cui Chuanzhi, College of Petroleum Engineering, China University of Petroleum (East China), Qingdao City, Shandong Province, 266580, China

Xiao Yang, Jiang Tongwen, Feng Jilei et al. Study of dynamic analytic method on fractured-vuggy carbonate reservoir. *PGRE*, 2012, 19(5): 97-99.

Abstract: Fractured-vuggy carbonate reservoir has very strong heterogeneous, anisotropic and multi-scale feature. The applicability of traditional development dynamic analytic method of sandstone reservoirs and fractured carbonate reservoir is limited. In order to solve the problems appeared in the process of production dynamic analysis in Tarim oilfield, this paper is based on the applicability of traditional dynamic analytic method, and considering the features of fractured-vuggy carbonate reservoir, as well as the research result in recent years and the author's research experience to analyzes the practical conditions equivalent for various production dy-