View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by CSCanada.net: E-Journals (Canadian Academy of Oriental and Occidental Culture,...

CSCanada
Advances in Petroleum Exploration and Development
Vol. 11, No. 1, 2016, pp. 81-83
DOI:10.3968/8187

ISSN 1925-542X [Print]
ISSN 1925-5438 [Online]
www.cscanada.net
www.cscanada.org

Study on Reservoir Characteristics of Ta112 in Songliao Basin

LI Yihe[a],[b],*; GU Haiyan[b]

[a] Northeast Petroleum University, Daqing, China.
[b] Research Institute of Exploration and Development of Daqing Oilfield Company, Daqing, China.
*Corresponding author.

Supported by Scientific Research Project of the Northeast Petroleum University Graduate Education Innovation Base (YJSJD2015-003NEPU).

Received 19 February 2016; accepted 9 March 2016
Published online 31 March 2016

Abstract
Ta34 in Songliao basin is buried 1,300 metres below the band, the exploration difficulty is big and high quality recognition is difficult. According to its complex lithology characteristics, poor porosity and strong heterogeneity, with the application of comprehensive conventional coring, thin-section analysis, scanning electron microscopy and conventional curve data for analysis of reservoir characteristics of T112, lithology and reservoir criterion are established, more over the fracture strata section of the hill is identified. The reservoirs are mainly composed of carbonate rocks and quartzite, the accurate lithology identification provides geological basis for the next step of well deployment.

Key words: Lithology identification; Carbonate; Fracture identification

Li, Y. H., & Gu, H. Y. (2016). Study on reservoir characteristics of Ta112 in Songliao basin. *Advances in Petroleum Exploration and Development*, *11*(1), 81-83. Available from: URL: http://www.cscanada.net/index.php/aped/article/view/8187
DOI: http://dx.doi.org/10.3968/8187

INTRODUCTION
Many tectonic movements from the Proterozonic to Mesozoic leaded to strong tectonic deformation uplift, the layer suffered from strong weathering and erosion, remained part of the Proterozoic rock and provided good reservoir conditions for the formation of T112[1]. Large-scale tectonic activity segmented ancient bedrock into blocks. These blocks formed a series of massive hill zones according to the buried depth. T112 is in the turning parts of the sag slope and the buried depth of the hill top surface is more than 1,100 m[2].

According to previous studies, during sedimentary period of Qingshankou formation, Songliao basin suffered a large-scale transgression, the overall performance of the lake level change for two distinct retreat into a multicycle characteristics. The Qing period is the period of the lake, the two stage is the peak period of the development of the lake, and the end of the Qing period of the three stage is to uplift, which is the period of the lake in the. As the lake level of the lake in the Songliao basin depression, the area is not integrated in the formation of the Castle Peak and the formation of the. The west slope area is flat, and the three section of the green hill formation is widely eroded, and the two section of the Qing formation is preserved, the original formation and the lithologic pointed out. In many years of oil and gas exploration, it has been recognized that there are three levels of the two or three stage sequence boundary characteristics, but the three level stratigraphic sequence framework still can not meet the needs of stratigraphic and lithologic reservoir prediction. Therefore, the establishment of the four level sequence framework, to carry out the fine sedimentary system under the four level sequence framework, and further predict the stratigraphic and lithologic traps[3].

1. REGIONAL GEOLOGICAL SURVEY
Mesozoic strata of the Songliao basin from bottom to top, Huoshiling formation, Shahezi formation, camp city group is a fault depression phase, Denglouku group is a fault sag transition stage, Quantou formation, Castle Peak

Copyright © Canadian Research & Development Center of Sciences and Cultures

Export group, Yao Jiazu, Nenjiang formation, Sifangtai and Mingshui formation in the depression period. The Songliao basin is divided into 6 primary structural units, the central depression area, the southwest uplift zone, the western slope zone, the northern dumping zone, the Northeast uplift area and the southeast uplift area. The study area located in west slope of Songliao basin in the northeast, including Qijia, Taikang south, Xindian, east store, Hu Ji Mo Tu, Ta 112, tower 34 blocks.

2. LITHOLOGICAL CHARACTER

According to core observation, logging, thin section identification data, T112 was classified into three types: carbonate, metamorphic rock, and argillaceous rock. The quartzite and carbonate are reservoir rocks.

Carbonate is the main rock type in T112, including dolomite, limy dolomite, limestone. This kind of rock in tectonic activities generated in structural fractures, strong corrosion and weathering dissolution emerge bead holes and large water-eroded caves along the structural fractures. Carbonate become the best rock in T112, it was called the I type of reservoir rock.

Dolomite mainly includes dolomicrite, microcrystalline dolomite, crystal power dolomite. Microcrystalline dolomite and crystal power dolomite are on the argillaceous or siliceous well section. This kind of rock is on Gu1 block and G234 block. According to the thin section identification, dolomite is composed of dolomicrite and microcrystalline dolomite, fine parcitle is less. Dolomite content is 75%~96%, calcite content is lower than 15%, generally in 7%~10%.

Limy dolomite mainly includes muddy limy dolomite, crystal power limy dolomite and class limy dolomite. These rocks mainly distributed in G21 block and little in G34 block. On the basis of thin section identification, dolomite content is about 60%, calcite content is about 30%, grain of dust and mud filled. Grain of dust and mud are less than 10%. But a few thin grain of dust in the proportion is as high as 35%~45%. Rock recrystallization is uneven and structure-dissolved fracture is developed. Some rocks are polluted by asphalt.

Dolomitic limestone mainly includes micritic limestone, grain of dust dolomite. This kind of rock is one of the main rock types of the hill area. Dolomitic limestone distributed in each block of T112. The calcite content is 45%~60%, dolomite content is 30%~44%. Grain of dust is common in rock slice, most particle size is about 0.5 mm.

The main types of metamorphic are quartz sandstone, metamorphic quartz sandstone, basalt, mixed granite. According to the testing for oil and production data, the brittle of quartz sandstone and metamorphic quartz sandstone is strong, they broke easily and develop structural fractures, they are called the class II reservoir rock. The quartz content is 85%~90%, feldspar content is below 3%, quartz content is 65%~70%. Cracks is filled with argillaceous.

3. CARBONATE ROCKS

(a) Micro Pore

There are 62 pieces of conventional physical property analysis samples. Porosity is between 1%~7.87%, an average of 1.9%, the main distribution is between 3%~5%, permeability is less than 1 mD. According to the scanning electron microscope analysis that dolomite has pores, the pore has boundary of rules. Dolomite has many intergranular pores. The pore is irregular polygon, uneven distribution, size of 15~30 um. From that carbonate has less developing micro pore and poor reservoir properties.

(b) Dissolved Pore

Dissolved pore has irregular pore size and shape formed by the dissolution. Based on the core slice observation, dissolved pore has irregular border, solution pore size is not uniform. Dissolved pore cannot be identified on the well logging curve. By scanning electron microscopy, G12 well and G309 well developes solution pores, the biggest pore diameter is 10 mm, the minimum pore diameter is 2 mm, most of the pore diameter is 4~8 mm, development degree of pore is 20~30 /m, pores are connecting with the cracks.

(c) Large Dissolved Cave and Medium-Sized Cave

Large dissolved cave is refered to more than 5 m in thickness of dissolved cave, major developed in the buried hill near the top of the weathering crust. Due to dissolved cave size is large and deep, the collapse is easily piping and cave sediments is filling in geological history period, so contribution to reservoir space is not too big[4]. Thickness of medium cave refers to the log in 1~5 m of dissolved caves. On the well logging curve, cave with natural gamma ray and acoustic increased, density and resistivity dropped. Such as G15 well of 1,164 m, the resistivity droped from 300 Ω·m down to 10 Ω·m, the bedrock density decreased 2.73 g/cm^3 to 2.63 g/cm^3, natural gamma ray from 101API increases to more than 170API, so this well section is mudstone. Through drilling coring data and trying for oil, this section is carbonate and mudstone layer, refered to dry layer.

(d) Macro Fracture

Crack density: Fracture developed more than three sets on the basis of core observation, net-like distribution, part of the core broken serious, performance in low core recovery. According to core statistics, the crack opening is an average of 0.01~0.05 mm, the average volume fracture density is 0.02~0.6 mm^2/mm^3, fracture porosity is 0.02%~2.4% (shown in Table 1). The fracture fillings are mainly argillaceous. Cracks in varying degrees, affected by the late dissolution, characterized by a local bead dissolved pore phenomenon. Fracture developed the two stages fracture system, fissure wall has corrosion phenomenon in the early opening, the calcite crystal groups along the cross section. Cracks were full of oil. The late cracks are perpendicular to the early cracks.

Copyright © Canadian Research & Development Center of Sciences and Cultures

Table 1
Core Crack Density Statistics

Well	Depth	Core	Open fracture	Fracture density	Fracture porosity
G17	1,173~1,174.27 m	0.45	0.03	0.2	0.6
G21	1,058~1,059 m	0.27	0.03	0.6	1.8
	911~912 m	0.25	0.01	0.1	0.1
T2-6	812~814 m	0.75	0.03	0.15	0.45
	820~822 m	1.2	0.01	0.02	0.02
T12	959.4~962.4 m	0.2	0.01~0.03	0.2	0.6
	Average	0.52	0.038	0.18	0.57

4. QUARTZITE

(a) Matrix Porosity

T54 well has 9 conventional lithological analysis quartz sandstone samples, porosity distribution is between 0.9%~1.9%, an average of 1.9%, the permeability is less than 1md. Formation testing is dry layer, thus effective reservoir matrix porosity should be greater than this value. The type of reservoir is low permeability and compact reservoir.

(b) Macro Cracks

Quartzite reservoir crack developed and uneven distributed, some rocks broke into small pieces. Mainly for the high angle fractures and mesh seam, the crack opening is 0.01~0.03 mm commonly, up to 0.05 mm.

5. ANALYSIS OF ROCK MASTER FACTOR

(a) The Influence of Lithology

The lithologies of this researching area are carbonate and quartz, as the reservoir bed of the area. From the point of view of distribution of petroleum's trait, there are hydrocarbon distributions in carbonate and quartz[4].

(b) Weathering Erosion

The weathering curst of carbonate rock is the major growing porosity belt of the buried hill, so the carbonate buried hill is distributed near to the weathered curst. In the process of carbonate rock buried hill's forming, the action of weathered leaching and dissolution is one of the most significant conditions[5]. The action of solution is included in the action of weathered leaching, but this affection occurred mainly in carbonate rock, exposed to the surface of super gene stage. The action scope limited to the carbonate in contact with the atmospheric fresh water around, typically a few meters to dozens of meters thickness. Corrosion solution occurs in carbonate super gene period, at the same time also occurs in carbonate buried period, also in the period of buried deep. Groundwater have dissolution effectment, especially in the special geological conditions, dissolved groundwater force is very strong. The lithology is mainly limestone, more easily dissolved, so the thickness of the weathering crust reservoir plays an important role.

(c) Tectonic Stress

Fault activity is the dominant external cause of fracture development. In fracture development areas, the more obviously formation properties such as strain and curvature changed, the more acutely crack developed. In the equivalent stress, weathering crust under the action of weathering and denudation is easy to form cracks than dense layer, it also creates conditions for overall oil-bearing weathering crust. From the drilling of wells, production wells are distributed in the fracture development zone.

CONCLUSION

(a) Different types of rocks in T112, the porosity development degree is different. Carbonate and quartz development scale, oil and gas enrichment degree and the reservoir performance is good, suitable for oil and gas reservoir.

(b) T112 for secondary pore type, solution pores and structural fractures as the main reservoir space. The reservoir space development mainly by rock properties, degree of weathering, denudation, tectonic movement intensity and controlled by fractures. Compaction and filling effect is smaller,as long as there is proper accumulation conditions, can be gathered in all kinds of buried hill oil and gas accumulation.

REFERENCES

[1] Zhang, X. T., Zhou, X. H., & Li, J. P. (2014). Unconfined flow deposits in front sand bodies of shallow water deltaic distributary systems. *Acta Sedimentologica Sinica*, *2*, 260-269.

[2] Sun, Y., Ma, S. Z., & Jiang, H. F. (2010). Sedimentary mode of shallow lacustrine fluvial-dominated delta of putaohua reservoies in the Sanzhao depression, Songliao basion. *Acta geologica sinica*, *10*, 1502-1509.

[3] Zhu, W. L., Li, J. P., & Zhou, X. H. (2008). Neogene shallow water deltaic system and large hydrocarbon accumulation in Bohai bay, China. *Acta Sedimentologica Sinica*, *4*, 575-582.

[4] Olariu, C., & Bhattacharya, J. P. (2006). Terminal distributary channels and delta front architecture of river-dominated delta system. *Journal of Sedimentary Research*, *6*, 212-233.

[5] Wang, Y., Chen, S. Y., & Liang, H. Y. (2015). Sedimentary model of braided river delta of the Jurassic in Heshituoluogai Basin. *Lithologic Reservoirs*, *5*, 81-86.

Copyright © Canadian Research & Development Center of Sciences and Cultures