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Research on the method of stratigraphic division and correlation

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Abstract: - The division and correlation of strata is the foundation and key problem in oil field development. There are many kinds of stratigraphic correlation methods: sequence stratigraphic theory system and method system; new method of division and correlation of "dumb stratum"; method of combination of the method of the key bed,thickness method,method of sequence stratigraphy,method of dense well pattern; reservoir Architectural-El-ementAnalysis; geological seismic comprehensive stratigraphic division and correlation method; log curve method with third layers of wavelet coefficients reconstruction; segmentation and comparison of fractured zone; element stratigraphic method; quantitative stratigraphic division and correlation method and so on. But each method has its own advantages and disadvantages. The research direction in the future is how the method organically, mutual supplement and perfect, in order to form a set of effective and applicable to oilfield exploration and development stages of oil and gas reservoir accurate correlation technology.

Keywords: *Stratigraphic correlation, Geological method, Mark bed, Reservoir*

I. INTRODUCTION

Stratigraphic division and correlation problems in oilfield development based key problems, especially oil field has entered the high water cut development stage, although geophysical logging curves data has become more and more abundant, understanding to the reservoir is more and more thorough, but the remaining oil distribution is becoming more and more complex predicted residual oil has become increasingly difficult and reservoir fine degree of layer division and contrast research has become a hot topic.

Stratigraphic division and correlation in the most commonly used method of lithostratigraphy, biostratigraphy and Geophysics, each method has successful side also has the limitations of side, and multidisciplinary mutual penetration, different methods of mutual combination and verification is stratigraphic division and was better than the best method.

II. METHODS OF STRATIGRAPHIC DIVISION AND CORRELATION

Starting in the 20th century 70's, according to the passive continental margin basin oil and gas exploration practice summary, proposed by researchers at the oil company Exxon and after scientists in many geological research work enrich and perfect the sequence stratigraphy theory system and method system, with its strong vitality in the world get rapid development and application. As a successful global geological theory, it is playing a great role in the exploration and development of oil and gas resources. It to the concept of advanced and applied to operation and provides a more accurate by unconformity or with corresponding unconformity boundary in the stratigraphic frame on the formation of contrast, lithofacies paleogeographic reconstruction and exploration drilling prediction before the source reservoir cap rock strata distribution of effective method. By using the principle of sequence stratigraphy of stratigraphic framework as the basis, with logo layer compared with the multilevel cycle grading control principle of "sequence lattice frame cycle grading control" combined with stratigraphic division and correlation, uniform thin layer division and contrast standards, to establish a uniform thin layer division and contrast scheme, for oilfield rolling exploration and development has laid a solid foundation. After the 90’s of the 20th century cross, a professor at the Colorado School of Mines of sedimentary base surface principle, material conservation principle, sediment volume distribution principle and divided

different principle of high resolution sequence stratigraphy of the independent school is established based on, for the application of sequence stratigraphy of fine stratigraphic correlation and the stage of development, the establishment of strata development flow units as possible. Therefore, the establishment of modern sedimentology, stratigraphy of oil and gas exploration, exploration earth physics and computer technology based on sequence stratigraphy is the embodiment of one of the development trends of contemporary geology model.

The new method of dividing and contrasting the "dumb stratum" is the optimal partition of the formation of many kinds of heavy minerals and trace elements. Because in the provenance, water the same and similar environment, the strata of the same age should have mineralogical and geochemical characteristics of the same, different strata should be different, so the application stratigraphy of heavy minerals, elements of stratigraphy, mathematical geology method is to solve dumb strata of vertical division and horizontal comparison problems. In the Tarim Basin first try this, achieved good results, establish the QIMUGEN heavy minerals and trace elements in two kinds of standard section (for Trial Implementation) to determine the division of stratigraphic units of heavy minerals and trace elements in the two sets of discriminant function. As long as the unknown samples (ground or underground) of heavy minerals data are substituted into the heavy mineral discriminant function groups, you can get the era, the unknown samples of trace element data are substituted into the trace element discriminant function group, also can get the era and in the same area test efficiency (accuracy) of more than 83%. Two methods for a two pronged approach, obtains the general age is agreement. It is the southern third red line dumb stratigraphic division has opened a new way.

In fluvial facies, well dilute, the area of the case using single stratigraphic division and correlation obtained effect is not good. The logo layer method (the introduction of coal seam as a sign of the layer and the auxiliary marker bed), thickness (adjacent to the wellbore formation thickness), sequence stratigraphy, dense well net dissection (starting from the dense well network anatomy, understanding the change rule of formation, and then extended to the sparse well network) 4 kinds of methods combined with each other and close comparison, and application of synthetic seismogram calibration (only for the check sand group) and the level of modeling, forming a a sedimentary environment is complex stratigraphic division and correlation in areas with comprehensive methods, established a new stratigraphic division and correlation of the scheme, unified formation recognition, achieved good application effect.

Reservoir Architectural-El-ementAnalysis was proposed by Canadian geologist A.D.Miall in 1985, and it is still a new subject. The method for the study of reservoir structure and reservoir heterogeneity has very strong superiority and pertinence, has a good effect in the carbonate beach dam reservoir hierarchy division and contrast. It is in conventional reservoir layer divided method comparison on the basis of the study, by reservoir hierarchy division as a guide, as in the single sand layer is further divided into sedimentary units over the same period as the goal, to the goal of reservoir fine division and correlation. It through analysis of reservoir level factors and six principles to establish recognition over the same period the sedimentary unit, to the principles as the basis for over the same period the sedimentary units of the division, divide the results reasonable reaction of beach bar sedimentation "vertical and horizontal stack structure, low angle imbricate structure" of the sedimentary characteristics, the study of oil and gas reservoir with good guidance. The results for the deep understanding of reservoir spatial distribution characteristics and the distribution of oil and water further adjustment of the accumulation, the development of measures, tapping the potential of remaining oil and favorable exploration targets are identified, all have very important significance.

Other people put forward the geological seismic comprehensive stratigraphic division and correlation method, the use of drilling data for stratigraphic division, only to solve the problem of the formation of some points in the basin. The stratigraphic framework of the whole basin is mainly depended on the seismic information, which is obtained by combining the point (drilling) and the surface (seismic profile). How to make

full use of Limited drilling geological data, combined with seismic information secondary depression between the stratigraphic correlation, and thus the whole basin stratigraphic division and correlation of the, the key is can find a "bridge" of connecting strata and seismic information, establish the relationship between strata information and seismic information. The synthetic seismic records obtained by sonic log, contact formation (lithology) and seismic information (reflection) the best link information, can well determine the seismic reflection events corresponding to the geological strata. This method can avoid the one sidedness, all data can learn from each other. From the known drilling geological layering of through the well of the acoustic travel time information synthetic seismic records, as "bridge" of seismic and geological layers of contact information" and calibrate the seismic horizons well geologic and seismic profiles, to establish the relationship between the two, combined with the regional tectonic evolution in the process of retention in the formation of various seismic response characteristics, comprehensive division and correlation of seismic stratigraphy, this is seismic geological comprehensive stratigraphic division and correlation of the basic idea.

From a variety of data in the study area reality, combining logging wavelet transform is used for the third layer wavelet coefficients to reconstruct the logging curve and conventional logging curve, high resolution stratigraphic division and stratigraphic correlation, and interlayer analysis show that can accurately and directly reflect the lithologic interface layer and interface by using the logging of the third layer wavelet coefficients are reconstructed. The traditional logging curve has the significance of lithology and physical property, the combination of the two can establish a new stratigraphic division and contrast section, to achieve high resolution lithologic division and stratigraphic correlation. This stratigraphic division and correlation method has achieved good results in the division and correlation of the sedimentary strata of the delta front in the low energy deposition environment. This method is introduced into the study of the heterogeneity of the low permeability reservoir, which can satisfy the requirements of the partition and evaluation of the compartment.

In addition, there is a fracture zone reservoir subdivision and contrast method. The 3 main aspects of the method are "gradual subdivision, division by division, and unity of the whole region". Emphasize the segmentation step by step is vertical by reservoir sand group a small layer of a single sand body of subdivision and correlation, choice good auxiliary sign layer and adjacent wells contrast logo is to do a good job of key of the segmentation step by step. Emphasizes using plane partition comparison of adjacent wells correlation marker distribution range and overlap has certain characteristics, control principles are compared with the multi partition sign, realize the whole region contrast and unity. The innovation of this method lies in the discovery and application of mudstone auxiliary sign layer, the comparison method of the adjacent wells to determine the contrast mark and its system classification, the first time to put forward the application of multi symbol comprehensive overlay. Finally, the method in the fault zone storage layer subdivision and correlation have very good effect, can effectively solve the problems of other than a single method, the low accuracy of contrast, have contributed to similar complicated fault block reservoir layer fine division and correlation of the work.

Elementary stratigraphy is according to the characteristics of the formation of the various elements of the composition, content and distribution to determine its representation of the original geochemical and geophysical environment, and then according to the evolution of the environment on the formation of division and correlation. With combination of various elements in strata of the study methods of mathematical geology, content, distribution characteristics and provide basis for element stratigraphy stratigraphic division and correlation of and enriches the content of element stratigraphy in the research project. Choose "orderly quality optimal segmentation", "discriminant analysis","cluster analysis "method to calculate, the elementary stratigraphy point of view put forward scheme of stratigraphic division and correlation and geological problems related to the view.

Quantitative stratigraphic division and correlation is a kind of data processing method for stratigraphic division and correlation by drilling lithology or integrated column section, including a heavy horse chain formation division, the inverted frequency method of unequal weight sliding matching, and in order to improve the accuracy of the contrast calculation using multiple sequence sliding contrast, cross section stretching and breakpoint identification, etc.. The method not only has the correct geological model and mathematical model, but also has a high practical value, especially in the petroleum geological exploration and drilling database to realize the automatic contrast between wells have broad application prospects. Quantitative stratigraphic division and correlation is a kind of mathematical geology method using quantitative analysis method and computer technology to divide the drilling section. Over the years, some foreign geologists have done a lot of research work on the formation of well logging data (curve sequence), and put forward some successful methods. The lithologic sequence stratigraphic division and correlation of the data processing method, although in the calculation method still follow the basic ideas about "sliding contrast" abroad, but in the specific application make some improvements. Such as "inverted frequency ranging in sliding matching", "sequence moving contrast", a new method is proposed, compared to improve calculation accuracy and further toward practical has taken a successful step. The preliminary application show that geological model and mathematical model on the basis of the method is correct, practical value, especially in solving the problem of the transformation and thickness variation are small drilling section division and correlation of the aspects can be expected to obtain satisfactory results. But like other methods of mathematical geology, due to the influence and restriction of complicated geologic factors, not all drilling section can be solved. How to solve the problem of phase change and thickness variation and the identification of small break point and multi breakpoint in complex strata is still a very difficult research topic in the future.

III. DEVELOPMENT DIRECTION OF STRATIGRAPHIC DIVISION AND CORRELATION METHOD

In summary, there are many methods of stratigraphic division and correlation, but all kinds of methods have their own advantages and disadvantages. The research direction in the future is how the method organically, mutual supplement and perfect, in order to form a set of effective and applicable to oilfield exploration and development stages of oil and gas reservoir accurate correlation technology.

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