Significance and purpose of the comprehensive evaluation of hydrocarbon traps

Wei Wang¹², Guomin Chen¹²³*, Lin Wang², Shenjian Wang² and Qilin Wu²

¹The key laboratory of well stability and fluid & rock mechanics in oil and gas reservoir of Shaanxi Province, Xi'an Shiyou University, Xi'an, Shaanxi, 710065, China
²College of Petroleum Engineering, Guangdong University of Petrochemical Technology, Maoming, Guangdong, 525000, China
³Guangdong Research Centre for Unconventional Energy of Engineering & Technology, Maoming, Guangdong, 525000, China

*Corresponding author's e-mail: chengwarming@gdupt.edu.cn

Abstract: A comprehensive evaluation of hydrocarbon traps is the premise of the well-drilling designs' decision-making optimization. The comprehensive queue optimization usually includes evaluations on the trap reliability, oil-bearing, and trap economy. It is crucial to work out the comprehensive queuing coefficient with one-dimensional based on a specific model that reflects the exploration stage and researchers' understanding of the multiple evaluation contents whose characteristics are the structure of systematization and hierarchy. A highly systematic and complex system engineering belonging to the evaluation and decision-making theories can emerge from the involvement disciplines. It is necessary to construct an integrated, iterative, and quantitative evaluation to improve the evaluation results' scientific rationality. It needs to integrate and combine related ideas from the multi-discipline, such as evaluation theory, decision theory, and computational science and mathematical statistics.

1. The introduction
The hydrocarbon trap is a three-dimensional semi-closed space of underground geological structure formed by geological processes. It is possible to capture and stop oil and gas because of certain functions of accumulating and gathering any of them. Therefore, whether it does exist or not under subsurface, the possibilities of oil-bearing, the resources scale, and the economy of drilling have always been the important issues concerned by petroleum geologists and exploration geologists.

As a geological site for oil and gas storage, the hydrocarbon trap, is also a vital drilling target for oil and gas exploration. Because it is invisible and inaccessible under the deep-buried underground, it can only be interpreted by indirect data, so it is of great uncertainty and risk. To avoid risks as far as possible, strengthen the efficiency of its understanding, and improve the success rate of exploration so that a whole set of ideas, methods, and techniques are constructed for its better recognition and evaluation, which is the system of trap evaluation methods and techniques.

As trap evaluation can interpret and uncover separately, the reliability, oil-bearing possibility, and the resources scale in different aspects, these issues within and between, have problematic linear and nonlinear, objectivity and the objectivity of the logical relationship and quantity, when for multiple trap delineation and evaluation, for the comprehensive assessment of each specific evaluation content [1-2].
Besides, to objectively describe the relative advantage and disadvantages of a participating trap, a comprehensive evaluation is needed. Furthermore, for different researchers to understand the integrated advantages and disadvantages of a specific evaluation-involved trap, it is necessary to give a particular number, usually one specific number between 0 and 1.

For the main contents of the evaluation need to complete the task, trap evaluation, evaluation of the environment and conditions, and the characteristics of the oil and gas exploration, researchers and workers around the world according to the different expectation with the features of the geological structure, the evaluation methods, and techniques on the oil and gas traps are developed and completed. Finally, everyone begins to obey these standards [3].

The main content of trap evaluation, significance, purpose, and characteristics of the comprehensive trap evaluation are discussed and analyzed. It will contribute to the beneficial exploration of improving the research level and pertinence of the comprehensive evaluation, referred by petroleum geologists and exploration geologists.

2. Contents of trap evaluation

Trap evaluation includes trap identification and reliability evaluation, oil-bearing evaluation, economy evaluation, comprehensive evaluation, and drilled-trap effect analysis (Figure 1).

2.1. Trap identification and its reliability evaluation

Trap identification is mainly carried out by utilizing advanced seismic technology, such as structural trap identification, lithologic trap identification, and combination trap identification by making the plane of the target layer of the study area and the section and isopachous map that can describe trap morphology.

Based on the understanding of the trap identification, the reliability evaluation of traps can be divided into three classes: the reliable, the relatively reliable, and the unreliable trap according to the control intensity of seismic profile quality, drilling data, and well-seismic matching relation.

2.2. Evaluation of trap oil-bearing

According to the result of trap identification, to assess for the reliable, relatively reliable trap, starting from the primary conditions and hydrocarbon accumulation process, for the involvement and consideration of the trap condition, hydrocarbon source and filling condition, reservoir condition, preserve condition, and so on, the above four aspects of carrying out the critical accumulation factor analysis, combining the petroleum geological characteristics of the specific exploration area, clarify the key elements of hydrocarbon accumulation in this area, understand the possible geological risk. The evaluation researchers initially describe and uncover the possibility and resource size, predicting oil-bearing probability and resource scale for the drill trap.

2.3. Economic evaluation of traps

After calculating the resource quantity of traps, the economic evaluation will be done by combining the physical quantity evaluation and the value quantity evaluation. According to the different exploration stage and the research precision, the economic evaluation generally adopts the corresponding physical quantity evaluation and value evaluation. With the various trap economic evaluation level, value evaluation can be divided into three parts: investment prediction in the trap exploration stage, investment prediction in the trap development stage, and cash income evaluation in a trap.

2.4. Comprehensive evaluation of traps

In petroleum exploration decision-making, it is usually necessary to select some relatively comprehensive advantageous traps from multiple evaluation-involved traps as the target of further drilling. The conclusion of comprehensive trap evaluation reflects the integrated advantages and disadvantages of all aspects of a trap. To contribute to the evaluation result with higher scientific rationality, it usually needed to rely on the trap reliability evaluation, oil-bearing evaluation, trap
economic evaluation, combined with the preference of exploration decision-maker, and each trap's size queue coefficient to choose the comprehensive queue optimization.

Based on the result of the comprehensive trap queue and the trap exploration requirement, it is better to select the trap near the higher trap queue coefficient without being-drilled or with the higher significance of further drilling. Traps with a higher possibility of oil-bearing, larger resources scale, and better economic benefits, strategic relevance, and surface engineering conditions are selected for a detailed traps description by the exploration decision analysis method.

2.5. Analysis of the drilled-trap effect
Once the industrial oil flow drilled out from the target trap, the thinking pattern and evaluation model applying in the previous evaluation round are proven right. Furthermore, the economic evaluation should be correspondingly carried out by evaluation researchers, and the trap evaluation should be displaced by the stage of reservoir evaluation in time.

For the trap of industrial oil flow that has not been obtained by drilling, the reasons for the lack of oil flow occurrence should be analyzed in detail and specifically. If the evaluation finds it necessary to continue drilling, it should describe again before drilling, and a workgroup should provide detailed analysis and demonstration data.

The trap that has been drilled and new geological understanding has been achieved, calibrate the evaluation parameter again in time, construct a new model for the next evaluation, and carry on a new round of evaluation.

3. Significance and purpose of the comprehensive evaluation

3.1. Significance of comprehensive evaluation
The comprehensive evaluation is a systematic and integrated evaluation of each trap evaluation content to determine the comprehensive score value of all related content and their relative superiority degree and provide a reference for the comprehensive optimization of drilling targets in traps [4].

Figure 1 Main content & process of the trap comprehensive evaluation
The fast choice on exploration objects and the complicates situation, to drive the petroleum geological theory, exploration techniques and related discipline theory integration development also has given rise to the development of trap evaluation technique methods, and gradually developed into complete evaluation content, information processing of trap evaluation parameter, weight determination, and evaluation method study as the main content of the system engineering of trap evaluation (Figure 1).

The complexity of the comprehensive evaluation and the research objects that need to be investigated in the comprehensive trap evaluation are characterized by many evaluation contents, large sample size, nonlinearity among contents, the uncertainty of evaluation information, and great difficulty in the data processing. In essence, this process is an information processing system and a method of ordering disordered information. It tends to be a higher and more in-depth application of computer techniques.

Therefore, the theoretical system of a comprehensive evaluation is formed by the study of the evaluation model, the composition of evaluation content (evaluation parameter set), the qualitative and quantitative processing of evaluation content information, the analysis of evaluation parameters and evaluation criteria, the determination of weight and the comprehensive evaluation method. Among them, the mathematical method and computer modeling of a comprehensive evaluation are the most important ones. The research of mathematical methods and the mathematical model is the foundation and key to realizing computer simulation of comprehensive evaluation. Computer modeling solves the support problem of comprehensive evaluation and is the technical support for completing a comprehensive evaluation.

3.2. Purpose of the comprehensive evaluation
As a soft science formed in the long-term and regular petroleum exploration practice, trap evaluation is a highly systematic and complex system engineering. Treating its disciplinary attributes is mainly subject to the research category of evaluation theory and decision theory [1-3]. Its development needs to continually absorb advanced evaluation ideas and methods from the integration and combination of evaluation theory, decision theory, computational science, mathematical statistics, and other disciplines to improve the scientific rationality of evaluation results [1-2].

The trap evaluation is a complicated system engineering, with considering the numerous of issues of qualitative and quantitative, certainty and uncertain, and the objective and the objective, researchers and geologists tend to collective knowledge and a computer model combined with the aid of evaluation experts and trap evaluation model to build, and employing a comprehensive evaluation method to determine the trap queueing-coefficient finally. Deciding the success or failure of trap evaluation is the key to reflect geological conditions, resources scale, and economic benefit of petroleum traps and so the multiple evaluation content, with the aid of a particular evaluation method into quantitative evaluation factors, namely can reflect trap comprehensive queue coefficient of integrated quality, helpful of exploration decision [5].

4. Conclusions
Under the condition of the high frequency and high-intensity and detailed target exploration, modern trap evaluation research has developed into a complete and logical technical method system. The main research aspects, realization process, and necessary comprehensive evaluation procedures are discussed to complete a comprehensive evaluation for the trap's optimal decision. It is a system engineering with high systematicness and complexity, mainly subject to the research category of evaluation theory and decision theory from its discipline features. To improve the evaluation results' scientific rationality, it is necessary to continually draw advanced evaluation ideas and methods from the integration and combination of evaluation theory, decision theory, computational science, and mathematical statistics.

Acknowledgments
Authors wishing to acknowledge assistances from the open funding of the key laboratory of well stability and fluid & rock mechanics in oil and gas reservoir of Shaanxi Province(Xi'an Shiyou
University)(No.WSFRM20190402002, No.WSFRM20200201001), the open funding of the Guangdong Research Centre for Unconventional Energy of Engineering & Technology (No.GF2018A003, GF2018B006).

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