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Research status of tectonic stress and the relationship between tectonic stress and oil-gas accumulation

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Abstract: - In oil-bearing basins, the relationship between tectonic stress and generation, migration, accumulation of oil and gas has been a research focus in the oil and gas dynamics. This paper takeed the research status of tectonic stress as the foothold, and the research methods of tectonic stress as foundation, summarized the effects of tectonic stress on generation, migration, accumulation of oil and gas in the tectonic active period.

Keywords: - *tectonic stress oil-gas generation migration and accumulation*

I. INTRODUCTION

Generally speaking, tectonic stress is a stress state added on static rock stress state, or the part crustal stress deviate from static rock stress state. All tectonic stress in the earth's crust have a period of time, in the period of geological history, tectonic stress in different periods have different strength and different features, which can lead totectonic movement, produce tectonic deformation, form various structural features. While in the study of stress field in oil field, tectonic stress usually is crustal stress increment caused by totectonic movement[1]. In petroleum basins, the relationship between tectonic stress and generation, migration, accumulation of oil and gas is the focus of their study of Chinese and foreign geologists all the time, and now, it is generally believed that tectonic stress play an active role in promoting oil and gas accumulation, but do not rule out destruction of oil and gas reservoirs caused by the tectonic movement after accumulation, that leads to oil and gas reservoir space and variable distribution even the oil and gas losses.

II. RESEARCH SITUATION OF TECTONIC STRESS

The study on the tectonic stress was started in 1947, it is that the tectonic movement track was used to inverse calculate geotectonic stress field which was put forward by Li Siguang, and studied the relationship between ectonic trace and stress mode, stress direction, and at the same time Ggeoff J Ki put forward studing on tectonic stress field, and Introducd the tectonic stress field study by the method that taking advantage of stereographic projection to obtain the principal stress axes[2]. From 50 to 70 years, the tectonic stress field has made great progress, study on stress field is introduced into the research field of Geology. 80 years later, more and more domestic and foreign geologists payed attention to the tectonic stress field problems, most of research contents are the tectonic stress of big plate and the ocean area. 90 years later, the international geologists mainly discussed the present tectonic stress and the ancient stress state, studied on the dynamics of the lithosphere of the problem.

III. THE MAIN RESEARCH METHOD OF TECTONIC STRESS

A That the fault slip vector method inverses the average tectonic stress field, this method was raised by French geologists, that is according to the fault section of fault group friction and quantitative inverse the

tectonic stress field with the help of computer[3]. When the faults that meet the sliding condition, which direction dislocation, that is controlled by tectonic stress state in fault location.

B Field observation method, that is observing the direction, tendency, inclination angle and the the movement properties of active faults and so on, and measuring fault slickenside, through detailed calculation, we can get the stress state in this area.

C Acoustic emission stress measurement technique, it divide the stress value that from acoustic emission into different period, thinks that the stress value that from acoustic emission corresponds different tectonic periods. Acoustic emission stress measurement technique has advantages that easily operation, relatively simple, economic and other method cannot replace and so on, and it is suitable for surface and underground geological conditions, it's sample lithology is not restricted. It has been recognized by many geologists oilfield now.

IV. THE RELATIONSHIP BETWEEN TECTONIC STRESS AND OIL-GAS ACCUMULATION

A Modern petroleum geology theory has confirmed that heat quantity has decisive effect on making organic matter into hydrocarbon of oil field. A, Before the oil and gas accumulation, The regional tectonic stress field controls the formation of vast sunken areas, that is able to control space distribution of hydrocarbon source region. B, kerogen, when it's buried deep to reach a certain temperature, is able come into being a lot of hydrocarbon, and heat is one of the most important energy types of chemical reaction, tectonic stress can provide energy for thermal evolution and transformation of organic matter, thus to promote the transformation of organic matter into hydrocarbons[4]. Tectonic stress energy originates transformation of mechanical energy into heat energy. C, Tectonic stress can the mechanical and chemical effect, thus which promotes the process of thermal evolution of organic matter[5]. Mechanical and chemical effect is between mechanics and chemistry, study chemical conversion of substance under mechanical action, from the energy point of view, the relationship between mechanics and chemistry is mutual transformation between Mechanical energy and chemical energy. Mechanical and chemical effect mainly occurs in the low temperature phase, and thermolysis in the high temperature phase far outweigh organic matter splitting action from tectonic force[6].

B When petroleum geologists emphasized the effect of abnormal formation pressure, water power, buoyancy and capillary force on ewo secondary migration of oil and gas, they also recognized tectonic stress is one of the driving force for migration of oil and gas[7~9]. The direct result of tectonic stress on crustal rock causes tectonic movement of rock mass, forms a series of tectonic deformation of different features. When rocks is squeezed by lateral tectonic stress, rocks and mineral grain would occur elastic deformation, thus make physical property inside the rock bad, porosity is smaller, at this time, if rock fluid closed well, the fluid in the pores will undertake part of tectonic stress, while form overpressure. If rock fluid closed well badly, the fluid has a flow trend to low potential area. In the tectonic stress, fluid overpressure can take shape micro crack for primary migration of oil and gas and crack, faults, unconformity for two secondary migration of oil and gas. Crack is the main channel for fluid flow in a low permeability reservoir, controlling the flow system of low permeability reservoir. Fracture and stratigraphic unconformity are the advantage channel for vertical and lateral migration of hydrocarbon. For example, oil and gas of Daqing "J" Oilfield "gu" block Putaohua reservoir oil and gas mainly comes from a large segment of the source rock of first section of Qingshankou formation, the main channel of hydrocarbon migration is active faults, which is vertical open.

C In many cases, the accumulation of oil and gas is controlled by tectonic stress field[10~14]. A, mentioned above, tectonic stress can produce cracks, micro-cracks, in a certain extent, it improves the low porosity and permeability reservoir properties thanks to cracks and micro cracks, so that reservoir porosity

increases, and this is very good for hydrocarbon accumulation reservoir[15~17]. B, Tectonic stress can also promote the formation of structural traps, lithologic traps, structural - lithologic traps, etc, when oil and gas migration along dumping sand and encountered with good lateral sealing faults cut, it will gather here. Tectonic stress also promote the formation of advantageously the cover layer, thus provide conditions necessary for accumulation of oil and gas. C, After the reservoir formation, tectonic stress may have some damaging effects on reservoirs, intense tectonic movements may reform the original reservoir, trap, etc, make oil and gas loss.

V. CONCLUSIONSTRESS

Tectonic stress have a decisive role in controlling the hydrocarbon generation and hydrocarbon source rocks distribution, also can promote the thermal evolution of organic matter, can provide power and access to oil and gas migration, and, providing oil and gas accumulation, preservation conditions. Hydrocarbon generation is the foundation, trap is a condition, the key is stored, tectonic stress has a positive role in promoting hydrocarbon generation, migration and accumulation process. But it is unavoidable, after the hydrocarbon accumulation, it will may encounter a variety of damaging effects of tectonic movements, so that the oil and gas richness and distribution change. So in the exploration and development process, in order to have a deep understanding of the study area for the oil and water distribution relationships, predict favorable areas more effectively, it is very necessary to study the tectonic stress this area.

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