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Research Article

Research and development of fault zone in sand and mudstone interbed formation

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Abstract: Fault deformation mechanism and internal structure of fault zone are the basis of fault sealing and fluid migration along the fault zone. The inner structure and the controlling effect of the internal structure and the control of the oil and gas are studied. Pure sandstone in the formation of the non-consolidation, semi-solid rock, the deformation mechanism of the particle boundary sliding, resulting in the particle rotation and rolling, that is, particle flow. During the consolidation stage (porosity is more than 15%), the deformation mechanism is fractured, and the fault rock is the fractured rock, and the microstructure of the formation is fractured zone. During the consolidation stage (less than 15%), the deformation mechanism is mainly characterized by rupture, the fault core is the fault zone, and the associated micro structure type is fracture. The displacement pressure of fault rocks is related to the depth of the fault, the mud content of the fault rocks and the extent of the fault rocks. At last, the paper puts forward the model of controlling hydrocarbon in the fractured zone of sand and mud interbed formation.
Keywords: Sand and mud interbed formation; Fault zone structure; Fault seal.

RESEARCH STATUS OF INTERNAL STRUCTURE OF FAULT ZONE

Along with the continuous deepening of the oil and gas exploration, people of the fault in the migration and accumulation of oil and gas clustered into reservoir and preservation of the deepening of the understanding of the role of is controlled by fault reservoirs are mainly reflected in its dual role of transporting and sealing of oil and gas. In essence, physical characteristics of fault transporting and sealing depends on oil and gas in fracture zone, namely porosity and permeability. However, the research on fault migration and plugging is to have a complex three-dimensional structure of the fault zone as a simple two-dimensional "face" to study, ignoring the characteristics of heterogeneity and physical changes of the internal structure of fault zone. So study on the interior structure of fracture belt can not only understand its three-dimensional structure, can also meet the transformation of "role" in the physical changes and in the migration and accumulation of oil and gas accumulation process. In the early stage of the study of the internal structure of the fault zone, scholars have only relatively simple understanding. As the study of the field outcrop, the researchers realized that the fault is not a simple surface, Caine [1] in 1996, the internal structure of the fault zone is described, and it is divided into two parts: fault core and damage zone. The fault core is relatively independent in fault zone, lithology and morphology. It is the main sliding surface of the fault, and the most stress and deformation are concentrated in the process of fault, which absorbs most of the faults, and is filled with [1-3], which is mainly composed of UN consolidated rich clay and brittle rocks. Broken zone is a deformed rock mass around the periphery of the fault, and the plane or section of the fault zone is a net shape distribution. It is the main shear and sliding part of the fault. It is often accompanied by fractures and minor faults, the rocks, joints, lenses and folds.

FAULT ZONE STRUCTURE IN SAND AND MUD INTERBED FORMATION

Fault zone structure in sandstone

In different stages, the microstructure of the fracture zone is different from that of the development. For a pure sandstone, shale content less than 15%), in unconsolidated-semi solid knot into diagenetic stage. The mechanism of fault deformation is mainly grain boundary sliding, resulting in particle rotation and rolling, said [4] is a stream of particles, the formation of micro structure is depolymerized with, sandstone formation fracture zone with core of fault and fracture zone bipartite structure [5]. Deep buried deep in the diagenetic stage (buried depth is greater than 3km, porosity less than 15%) sandstone fracture deformation, the same as the carbonate rocks, volcanic rocks and metamorphic rocks deformation, deformation mechanism is mainly for rupture, and is not the collapse

of the pore space, the formation of sliding surface, joints and mineral filling cracks, fault core is the fault zone, the associated micro structure type is fracture, which is typical of high permeability fracture zone. In the deep burial conditions, the formation of a large number of fractures, along with the occurrence of friction sliding along with the rotation of the particles, resulting in the fragmentation of the flow. In the super consolidation stage, the porosity of sandstone is lower (generally less than 15%), which is similar to the deformation of non porous rock in carbonate rocks, volcanic rocks and metamorphic rocks. Therefore, the porosity of the sandstone is more suitable for the 5%. The main rupture, rather than the collapse of the pore space, the formation of sliding surfaces, joints and mineral filling cracks.

DEFORMATION MECHANISM OF FAULTS IN MUDSTONE

In the burial process of mudstone, the deformation mechanism of brittle brittle plastic and plastic deformation is different from that in different mechanical properties. The first is the formation of fault zone, and the two is the deformation of brittle ductile mudstone, and the three is plastic mudstone. However, the strength of brittle mudstone is less than that of the sandstone, and it can also be a typical mudstone. Roughly divided into two categories, shale smear and cracks. In the process of brittle deformation, mudstone is mainly developed as a crack.

FORMATION MECHANISM AND INFLUENCE FACTORS OF FAULT SEALING PROPERTY

In the course of migration, the oil and gas often meet the fault plane, which can be used as the passage of oil and gas migration, and sometimes it can be used as a shield. The proposed and applied to the fault sealing and guidance, make people have a deeper understanding and understanding of the hydrocarbon accumulation mechanism. The category of fault sealing is a complex problem involving many factors, and it is a complex problem involving many factors. Lv Yanfang [6] put forward 10 kinds of main factors influencing the fault sealing ability is summarized: to the fault of the mechanical properties, fault surface dip, fault, fault buried deep and the fault distance, fault activity, fault density fault filling material of cemented into diagenesis, faults, two sets of opposing lithology and fault level of mudstone smearing. Study on the mechanism of fault sealing, sealing performance prediction is very important, is the key to reveal in detail the migration and accumulation of oil and gas law. Watts [7] through a large number of studies show that the fault of the non permeable formation and reservoir docking lithology is the main mechanism of fault sealing. For clastic rock stratum, the sealing ability of the fault is usually related to the clay content of the fault. In the process of fault movement, the characteristics of the fine and non permeable mud along the fault plane are enhanced by the action of the drag, extrusion, grinding and plastic flow. The sealing property of the fault is enhanced, and the related prediction formula includes SGR, CCR, SSF and CSP. In some cases, however, the SGR ratio is very low. The sandstone is also blocked by the fluid migration. This phenomenon indicates that it is not the fault of the fault, but also provides an effective seal. Doughty and Fisher pointed out that in fault activities for a long time or stress larger area, the crushing effect of the fault particles, coarse angle fault breccia and cataclasite refinement into fault gouge, the porosity and permeability variation, on both sides of the reservoir sealing effect [8]. In the deep sandstone with high content of quartz, the fault fracture is usually associated with the development of primary quartz cementation, which makes the porosity and permeability decrease, and it can also be used to form a good seal for fluid migration in the case of the development of shale smear layer. In the case of most of the cases, the fault is completely closed or completely open, and the sealing ability of the fault is different. The greater the difference between the displacements pressures of the reservoir and the fault block, the greater the height of the hydrocarbon column. In addition, there are also differences in the space of the fault. At present, the discussion about the influence of fault on oil and gas migration mainly focuses on the geometry of the fault structure, the characteristics of the internal structure of the fault, the identification of the various sealing effects and the quantitative evaluation of the physical properties of the fault.

The key parameters that determine the capacity of fault sealing are the displacement pressure of fault rocks:

- Buried depth and dip angle of fault

  If other factors are not considered, such as the time and other factors, the impact of the compaction, the degree of the fault rock is mainly determined by the magnitude of the normal pressure, the greater the degree of the fracture of the fracture filling material. And the positive pressure of the cross section depends on the depth of the breakpoint and the angle of the fault. The smaller the dip angle, the greater the depth of the buried depth, the greater the section pressure.

- Clay content of fault rocks

  In the case of the same degree of diagenesis, the higher the shale content, the smaller the porosity of the fault rocks, the greater the displacement pressure. Yieding [9], Knipe [10] and other SGR to describe the content of mud in the fault rocks.

- Diagenetic degree of fault rocks

  The evolution of fault fracture filling material is the process of the evolution of the fault rock, which is the process of gradually becoming smaller and smaller, and the degree of the formation is gradually increased.

QUANTITATIVE EVALUATION OF FAULT SEALING ABILITY

Whether the fault in the thin layer of sand and shale is closed depends on the difference of the pressure difference between the fault and the reservoir. The displacement pressure of fault rocks depends on the content of fault rocks and the extent of the formation. The diagenetic degree of fault rocks is determined by the cross section pressure. And the pressure of the reservoir is related to the content and depth of the mud. According to the principle of the pressure sealing of the rock, a quantitative evaluation method of the sealing property of the sealing property of the thin layer of sand shale is presented. Operation steps are as follows:

- The content of mudstone in the view of the fault is the ratio of the thickness of the mudstone layer and the thickness of the stratum;
- The relationship between the change of the displacement pressure of different mud rocks and the depth of burial;
- Calculate the positive pressure at the breakpoint;
- According to the relationship between the earth pressure and the depth of the formation, the depth of the buried depth is calculated;
- Stress and displacement pressure of fault rock was determined on the relationship between the pressure and the depth of the buried depth;
- According to the mud content and depth of the reservoir, the reservoir pressure is determined, and the pressure difference is obtained by using the fault rock drainage pressure and the pressure difference.

CONCLUSION

- Pure quartz sandstone in unconsolidated-semi solid forming stage of rock fracture deformation, deformation mechanism for granular flow, formed micro structure for depolymerization with porosity and permeability of with parent rocks than did not significantly decrease, fault core and fracture zone are fluid vertical channel to transport; consolidation into diagenetic stage. Stage (more than 15%) of fracture, deformation mechanism for cataclastic flow, fault rock is cataclastic rocks, formed micro structure fractured zone, permeability with parent rock ratio 1 to 3 orders of magnitude decrease, core of fault and fracture zone with sealing ability, sliding surface for oil and gas vertical migration channel.

- The displacement pressure of fault rocks depends on the clay content of the fault rocks and the extent of the fault rocks. The higher the shale content, the greater the pressure on the fault. The diagenetic degree of fault rocks is related to the depth and dip angle of the fault. The fault depth and dip angle are smaller. The fault rock is subjected to the pressure of cross section.

- According to the buried depth of the cross section and the dip angle of the fault, the normal pressure of the fault can be obtained. According to the different lithology and thickness, the pressure and the buried depth can be calculated. The pressure difference can be obtained.

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