

DOCTORAL DISSERTATION INFORMATION

PhD student name: **TA THI THU HOAI** Course: **2005**
Major: **Tectonic** Code: **62445505**
Dissertation Title: **Late Mesozoic - Cenozoic deformation history in
Cuu Long basin and adjacent aontinental areas
and their relationship with petroleum system.**
Scientific Advisor: **1. Associate Professor, Doctor LA THI CHICH
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DISSERTATION SUMMARY

To explore and produce petroleum more effectively in the Cuu Long basin, especially in fractured granite reservoir, the author has analyzed and classified deformational relics: geological formations, unconformity surfaces, paleo-geomorphology, folds, faults, and fractures. Particularly fractures in the Pre-Cenozoic basement was defined in out crop and depended on geological, geophysical (seismic, magnetic, gravity), drilling (cutting, core and side wall core samples, logs) data using the following methods: discontinuity and unconformity analysis, petro-tectonic assemblage analysis, facies and thickness analysis, geomorphologic analysis, structure analysis (folds, faults, fractures) in order to divide tectonic evolution periods, deformation phases and reconstruct the tectonic stress-strain field following “Lithosphere Plate Tectonic theory” and “Analyzing the new one from the old one” methodology. The analyzing results of deformation have allowed the author divides the history of developed deformation of the Late Mesozoic-Cenozoic Cuu Long basin and an adjacent continent into four phases which are characterized by four different geol-dynamic settings: Early-Middle Jurassic post-collision orogenetic period (D1), Late Jurassic-Paleocene Active continental margin (D2), Eocene- earliest Early Miocene rifting period (D3) and latest Early Miocene- Quaternary passive continental margin stabilizing and blocky uplift (D4).

The rift Eocene-early Early Miocene stage (D3) that created Cuu Long rifting basin includes three extension phases alternating with three compression phases. The extension phases D3.1, D3.5 have the northwest-southeast extension axial stress and phase D3.3 has the north-south extension axial stress. The compression phases D3.2, D3.4, D3.6 have the northwest-southeast compressional stress axis.

Main relics of the extensional process (D3.1, D3.3, D3.5) are attenuation of Pre-Cenozoic continental crust, creating a closed basin in Eocene-starting early Miocene that was complicated by the half grabens, half horsts, folds and syn-sedimentation faults. The syn-sedimentation faults are often normal listric, right strike slip faults with large displacement and long operating time. The faults formed during the extensional phase have destroyed the Indochina leveled surface aging Paleocene, the erosional surface on the top of the layers E, D and make the trough as the half graben, half horst that have the same strike with that of syn-sedimentation faults. The trough is filled with the formation of lacustrine sediment, alluvial sediment that plays a role as a source rock, reservoir and regional seal.

Relics of the compression phase (D3.2, D3.4, D3.6) are the folds and post-sedimentation faults that are strike slip, reverse, reverse-strike slip or normal-strike slip; the regional opened fractures zones strike northwest-southeast and north northwest-south southeast. The compression phases created convex structure that is the trap containing oil, producing fractures and faults in granite basement creating the reservoir in the basement and destroying the trap structures.

Many faults of these two groups reactivated in one or more phases as strike slip, reverse, reverse-strike slip faults caused by post-sedimentation compressing phases striking northwest-southeast (D3.2, D3.4, D3.6) with a smaller displacement than normal phases, and short operating time.

Most tectonic activities during the Cenozoic are related closely with petroleum system in Cuu Long basin: extensional phases formed basin filled up with sediment which is capable source rocks, reservoirs and seals; compressional phases formed convex structures (traps), caused faults and fractures in destructive granitoid basement which is the main target in Cuu Long basin. In additional, young faults also ruin old structure and it is a cause which oil and gas re-migrated to new traps.

NEW CONTRIBUTIONS / RESULTS OF THE DISSERTATION

The research results of the thesis have the following contributions:

1- For the first time the author has clarified the relationship between faulting action with the sedimentary process in the Cenozoic in Cuu Long basin.

2- For the first time the Eocene-earliest Early Miocene rift stage is detail divided into six deformation stages including two phase orienting northwest-southeast (D3.1, D3.5), an extensional phase trending north-south (D3.3). Ending these three extensional phases is three compressional phase orienting northwest-southeast (D3.2, D3.4, D3.6). The author has clarified their role in changing the surface morphology of the top of the sequences and sedimentary cover.

3- For the first time the author has predicted the regional opened fractures zone orienting northwest-southeast, north northwest-south southeast and determined the correlation factor between the width of the associated fracture zone with the length of faults is 1/40 to 1/60 developing in the convex structure of the granitoid basement in Cuu Long basin.

4- For the first time, fractures map was established for Pre-Cenozoic basement target in Cuu Long basin and Da Lat zone.

5- Study results shows that the northwest-southeast regional open-fracture zones and the associated fracture zone of faults acts as the potential oil and gas reservoir in the pre-Cenozoic basement in Cuu Long basin.

SIGNIFICANCE OF SCIENCE AND PRACTICE

This study contributes to clarify structural features of folds, faults, fractures and detail divide the deformation period and deformation phase; identify the regional dynamics of each phase and recovery tectonic stress field for each phase of deformation in the Cuu Long basin and adjacent continent; forecast of relicts that have not been observed in the existing document.

Research results contribute to evaluate petroleum system of the Cuu Long basin in general and of each structure particularly. Based on the principle distribution of the regional opened fractures zones and associated fracture zone which is the potential reservoir in the pre-Cenozoic basement one can contribute to identify locations and trajectory of exploration/production wells at the oil and gas structures/fields such as Ca Ngu Vang, Diamond, Doi Moi, Hai Su Den, Lac Da Vang, Lac Da Nau .v.v...

Determination results of correlation factor between associated fracture width and length of faults as well as the result of recovery stress field of deformation phase, the stress field along faults (especially post-sedimentary strike-slip faults) provided input parameters for building a static geological model (3D model), the distribution model of permeability, porosity of pre-Cenozoic basement. All these have been applied in the Ruby, Hai Su Den, Su Tu Den and Lac Da Nau oil fields.

Scientific Advisors

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