

## GEOLOGY OF OIL AND GAS

# Prospects of oil and gas bearing of the Vietnamese mainland slope and adherent shelf of the South-Chinese Sea

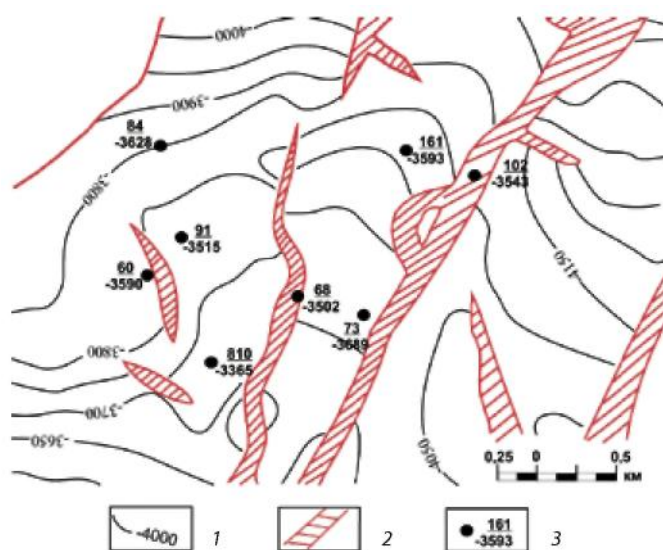
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*Over the Vietnamese shelf of the South China Sea in addition to oil deposits discovering in many structures the hydrocarbon searching (HC) were unsuccessful. According to the outcome analysis the authors come to conclusion about the presence in the region of hydrocarbons unconventional reservoir – the Caldera, and explain the reasons for negative working results. In light of the authors concept the structures found in Vietnamese shelf remain the discovery potentials. The identified features of the magmatogene deposit structure allow to use the proposed by authors hydrocarbon exploration technique explosives in regions with similar geological structure.*

About 120 structures prospective for oil and gas were revealed on shelf of Vietnam. On the majority of them searched by various subsurface users, the deposits of oil and gas in reservoirs of Miocene, Oligocene and foundation were revealed (White Tiger, Dai Hung, Dragon etc). In many of these structures, such as Bavi, Wolf, Tam Dao and other, after drilling of single unsuccessful mine hole further search works were stopped as these structures are prospectless. It decreased the resources of hydrocarbons on this territory considerably. The performed local analysis of the works evidences on prospects of reveal of hydrocarbon deposits with considerable reserves there.

The geologists paid no attention to circular minus structures as the objects for searches of hydrocarbon deposits for a long time. In 1987 in Sweden on Silan minus structure with diameter of about 40 km drilling of mine hole 1 with project depth of 6800 m was started. Manifestations of hydrocarbons, which consisted of methane for 98%, were met in mine hole on depths of 1250, 2582 and 4723 m. During trial of these intervals the influxes of oil with high concentration of vanadium and nickel were received. In Canada and USA in minus structures 20 mine holes of hydrocarbons, among which there is mine hole Barrow on Alaska, were find out. Production oil and gas bearing of different ages was defined in minus structures in Wilston basin, Southern Texas, Siberia, Tatarstan (Aksubaeva and Romashkinska circle structure), Central Asia, on Borneo Island, on continental slopes of Southern Chinese Sea and in other regions.



1. White Tiger oil deposit – northern vault. Structural map on the roof of horizon AΦ-CΓ. Scale 1:25000: 1 – isohypses of the roofs of horizon

The results of decipher of aerospace photos evidence that the circular structures on the surface of Earth are very wide-spread, the majority of them were formed at the result of volcano-

tectonic depressions because of magmatic diapirism the processes opposite to it. Many researches consider circular minus structures studied by deep mine holes as astroblemes (meteorite craters). The performed analysis of structural peculiarities of circular structures and comparison of criteria, according to which astroblemes and calderas are emphasized, showed that all similar tectonic formations are the result of deep cataclysms caused by clunkers of Paleolithic volcanoes. Depressions formed at the result of decrease of level of magma after powerful volcanic eruption cause draw and further destruction of volcano and formation of caldera.

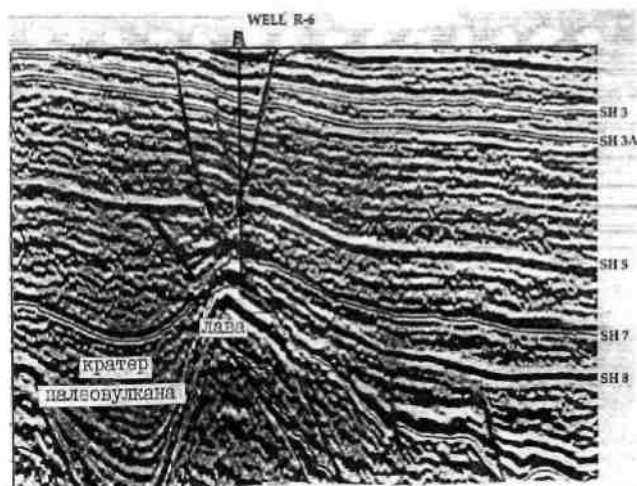


Figure. 2. Oil mine hole Dragon. Fragment of seismic cut DR 93-800

In practice of geological survey works for oil and gas the special researches of Paleolithic volcanoes, batholiths and calderas with the purpose of reveal of the prospects of their oil and gas bearing were not performed. Since 1190 the authors of the article performed researches in this direction, the results of which gave opportunity to ground the main criteria necessary for search of such non-traditional objects. Staged approach of the researches of dynamics of geologic processes with use of analytical methods gave opportunity to state the model of tectonic construction of oil and gas prospective structures on shelf and continental slope of Southern Chinese Sea in a grounded way.

On Vietnamese shelf White Tiger and Dragon are explored in the most detailed way. Both structures on aero-space photos are the concentrically located circles, and in gravitation and magnetic fields there are positive and negative anomalies. On seismic cuts they are mapped clearly according to four reflecting horizons: CF-AФ, CF-12, CF-7 and CF-5. In the plan Paleolithic volcanoes and calderas are presented by positive and negative structures on before-Oligocene surface. Both structures are located near each other and zones of their mutual influence in sedimentary mantle are overlaid, which cause difficulties during interpretation of seismic materials and results in low quality of structural constructions in the vault of batholiths and faults during evaluation of reserves of hydrocarbons.

White Tiger and Dragon areas consist of the object of different geologic structure: Paleolithic volcanoes, batholiths and calderas located in volcano and tectonic depression – Kiulonz cavity. The above-stated objects are mapped reliably by seismic reconnaissance (figure 1). Structure of Paleolithic volcanoes was explored partially on Dragon area and on southern slope of White Tiger area. Generation of volcanoes is assumed in early Cretaceous period, and the traces of their last explosion were fixed in high Oligocene. In the period of life of volcanoes during almost 100 million years their numerous destructions and renewals of ejections took place.

Craters of volcanoes are saucer-like cavities with vertical walls. Numerous injection of magma to sediments caused formation of granites of different age. Number of layers of effusive formations corresponds to the phases of awakening of volcano. Type of magma is acid. On the

slopes of volcanoes there are cloves spreading radially from the top to the bottom, the so called barrancoses. Till this moment geologists of Vietnam consider batholiths crystal foundation.

They shall be considered big intrusive bodies that have a bottom, and under metamorphosed occur sediments not revealed by mine holes. On the slopes of batholiths calderas are presented by the cavities formed on place of old volcanoes at the result of their flashes or destructions of walls of craters. Sediment and effusive stratas to the tops of volcanoes wedge, and subject to gravitation they droop through slopes forming the shifts of drooping and olistostromes.

In the middle of high Oligocene the volcanic relief was already formed. In late Oligocene the processes of destruction of subsurface rocks facilitating formation of accumulative bodies activated. In the beginning of Miocene the relief was leveled in general. In Pliocene and Pleistocene at the result of active increase of constructions the relief gained clear contours (figure 2).

Since late Oligocene character of formation of sediment strata became relatively calm. Sea streams redistributed terrigenous material brought down from the land, at the result of which bars, alluvial cones, shoal heads and lenses were formed. In cuts revealed by mining holes the traps of various types – lithologic, stratigraphic and tectonic screen, where the reservoirs are organogenic constructions, fracture and porous limestones, sandstones and untraditional formations – fracture argillites and lumpy clays were revealed (figure 3).

The main horizon of oil extraction are the crystal formations of acoustic foundation, revealed by mine holes for 20–550 m. Debits of the oil from mine holes don't depend on the thickness of revealed horizon and are determined by place of location of mine hole in structure. After accumulation of sufficient data in deposit three zones of effectiveness were defined: I – with debits of over 3 0 0 m<sup>3</sup>/day, II – less than 3 0 0 m<sup>3</sup>/day and III – with restricted effectiveness up to 30 m<sup>3</sup>/day.

Among the peculiarities of oil deposits in White Tiger deposit it is necessary to mention the absence of layer water and increase of time of oil debits from mine holes. It is explained by the fact that the oil of abiogenic origin during its lift upwards supersedes water to up horizons and Automated water fire-fighting systems exist there. Overheated water steam together with gases flows to the sedimentary mantle, where their differentiation takes place.

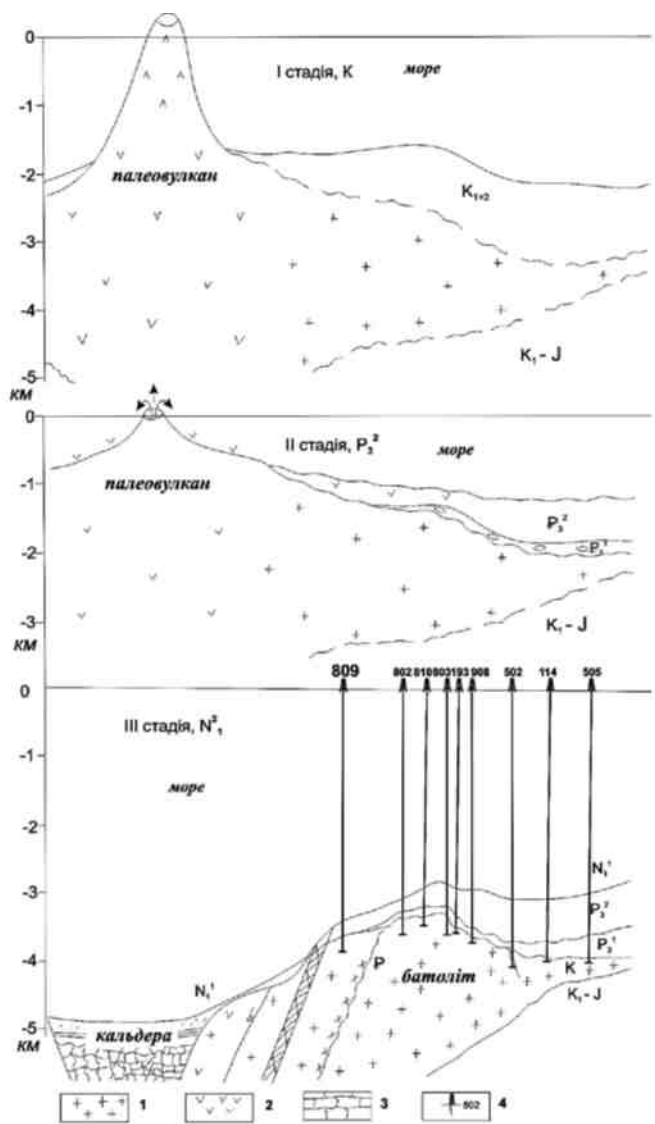


Figure. 3. White Tiger oil deposit. Paleolithic cuts. Scale 1:50000. Drawn up by L. M. Kukhtina according to complex of data of prospecting surveys

Mine holes exploiting deposit in vault of batholiths work with oil and gas, and mine holes located in lower marks give waterless oil. It gives grounds to forecast availability of considerable reserves of water in moulds.

The connection between location of hydrocarbon deposit on the structure and composition of oil in it was found out. In zones of influence of Paleolithic volcano highly paraffinic oils and oil gas with hydrogen was received. In zones of influence of calderas light oils and condensates with high concentration of vanadium and nickel became spread, which is the reason of increase of commercial price of these hydrocarbons. The received results give grounds to expect for similar differentiation of fluids in newly revealed traps.

The performed zoning of territory according to perspective with consideration of Paleolithic volcano processes helps to reestimate perspective of the areas with negative results of work, and also to reveal there new reservoirs for search and increase of reserves of hydrocarbons.

Increase of the park of Ukrainian sea drilling platforms will cause in the nearest time the dramatic increase of volumes of drilling works in Azov and Black Sea oil and gas bearing basin (ABSGBB). With the purpose of increase of efficiency of search works and taking into account that in ABSGBB magmatogenic formations are widely spread and with numerous oil and gas manifestations during their search it is reasonable to use the peculiarities of structure and oil and

gas bearing of Paleolithic volcanoes, batholiths and calderas revealed on Vietnam shelf of Southern Chinese Sea.

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