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Possible «Polygenetic» Hydrocarbon Fields in Eastern Indian Ocean Triggering by Hydrothermal Activity along Deep Faults

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ABSTRACT

Most of hydrocarbon fields in oceanic and thin suboceanic crust are located near deep faults. Generation of methane under serpentinization of upper mantle's rocks and its next upwards migration into sedimentary cover due to hydrothermal activity along the deep faults could be the responsible processes. Northern part of the Central Indian Ocean diffuse deformation zone appears to be a promising area where hydrocarbon fields of such origin could be formed. Thick sedimentary cover and long hydrothermal activity above deep faults, which are identified there, contribute to that. Any hydrocarbon reservoir might be predicted near the buried anticlinal structure 450 km south-east of Sri Lanka where acoustical anomaly looking like "bright spot" was observed during #32 cruise of RV Academic Kurchatov in1982.

KEY WORDS: hydrocarbon field; fault; fluid; hydrothermal; Indian Ocean.

INTRODUCTION

Analysis of geological situation for oceanic oil and gas fields off continents shows that nearly all of them are located near deep faults in oceanic and thin suboceanic crust. For example, similar correlation of large hydrocarbon fields «Prirazlomnoe» and «Shtokmanovskoe» with tectonic disturbances are observed evidently in the Eastern Barents Sea (Kleshchev et al., 1997). Active mud volcano and gas hydrate accumulations were found near the Senja transform fault between the Greenland and Barents Seas where high heat flow appears be evidence of functioning hydrothermal water (Kleshchev et al., 1997).

Most favorable geological environment for accumulation of hydrocarbon fields is sedimentary strata with alternation of permeable and impermeable layers which is disrupted by faults; active hydrothermal fluids migrate along these faults upwards into overlaid permeable sandy sediments (Dmitrievsky et al., 1997). In the oceans, such situation is mostly near transform boundaries between lithosphere plates and microplates where movements of lithospheric blocks (including oceanic crust and upper mantle) occur for a long time. As it was sown by authors in the Pacific, group of hydrocarbon fields along the Western Canada margin could be formed in that way near the Queen Charlotte-Fairweather deep fault zone between the Pacific and North American plates as well as hydrocarbon fields near transform fault running along the Eastern Sakhalin coast (Matveenkov et al., 2002; 2005).

Such spatial relationships would be not explained by ordinary classic model of biogenic genesis of hydrocarbons. Evidently, the simple conversion of the organic substance into hydrocarbons in situ appears to be not acceptable there and some supplementary source of hydrocarbon emanation would be the essential conditions. Theoretical predictions testify that such source of the supplementary methane would be serpentinization of upper mantle rocks by bottom oceanic and pore sediment water (Dmitrievsky et al., 1997). Hydrothermal activity along the deep faults contributes to migration of the nascent methane upwards.

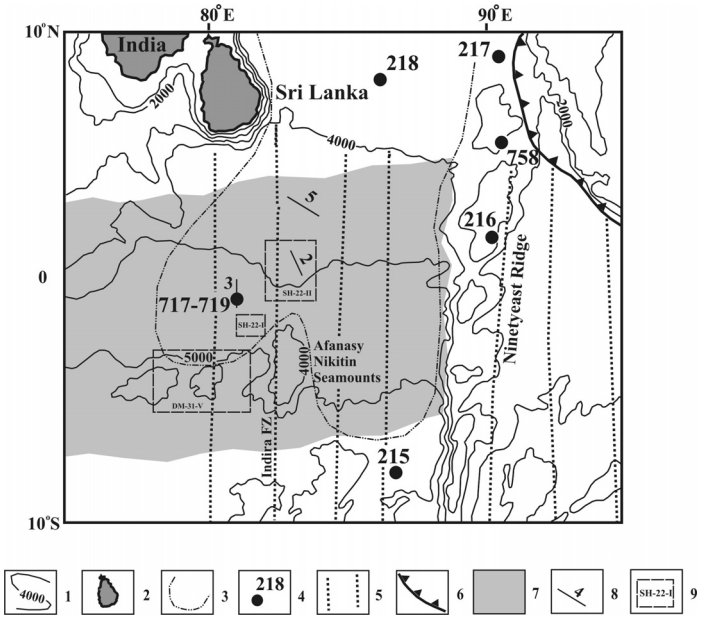

Fig. 1. North-eastern Indian Ocean. 1- isobath, m; 2- land; 3- Bengal Fan; 4- DSDP and ODP site; 5- transform fault; 6- Andaman subduction zone; 7- intraplate or diffuse deformation zone; 8- presented seismic reflection section; 9- detailed survey area.