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Gas Hydrates investigations in the Gurian Trough

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Abstract

The geological and geophysical conditions of gas hydrates formation in the Gurian Trough in the Black Sea are given in this work. The presented results of studies conducted in cooperation with German scientists from the University of Bremen during the sea cruises. It is shown that in the case of Gurian Trough intensive gassing (Batumi seep) observed is associated with the content of gas hydrates in marine sediments in the region.

The investigation of natural gas emission sites and gas hydrates within sediment deposits is of great scientific and practical interest. Methane is twenty times more effective as greenhouse than CO_2; however, its concentration within the atmosphere is much smaller. In contrast, methane generated by microbial decay and thermogenic breakdown of organic matter seems to be a large pool in geological reservoirs. Numerous features, such as shallow gas accumulations, pockmarks, seeps and mud volcanoes are present in a wide variety of oceanographic and geological environments. Release and uptake of methane by such sources may provide positive and negative feedback to global warming or cooling. Gas hydrates are of interest from the standpoint of energy resources, because their high methane density, when occurring close to the seafloor. Investigations have shown that hydrates generate extremely high and variable fluxes of methane to the overlying water column due to their exposed position close to the sediment/water interface.

Activity studies of gas hydrates are concentrated in the Black sea for various reasons. It is the largest anoxic basin with much higher methane concentrations than in any other marginal sea. Sediments of 10-19 km thickness reveal a potential reservoir for methane generation and hundreds of methane emission site are known from water column investigations of Russian, Ukraine and German researchers.

Oil - gas bearing province of Black Sea contains the coastal shelf, eastern, northeastern and southeastern part of the Black Sea. There are certain oil and gaseous reservoirs in this area, mainly along the eastern Black Sea shelf and Guria Trough.

The zone of oil-gas formation of Guria Trough (on land) belongs to the west part of Guria sector of Ajara-Trialeti folded system. Sea prolongation of Guria foothill deflection spatially is stretched on the prolongation of the middle of rivers Supsa- Kintrishi to the south-west into paleogenic series, in the zones of shelf and the continental slope. On the whole, sea part of Guria Trough is situated in the extreme south of Georgian sector of the Black Sea.

On the basis of complex geological, geophysical, geomorphologic and cosmogeologic data, it is established that tectonic faults (observed on land) extend in the zones of shelf and the continental slope; this is well reflected in thickness distribution of separate geocomplexes of sedimentary cover and formation of wide net of submerged canyons.

These weakened zones participate in lithogenetic processes of the eastern Black Sea depression with various intensity, which is well expressed in peculiarities of separate facies and sediment

accumulation velocity, spatial distribution of diapirism, mud volcanism and intensive gas streaming areas at the sea ground. The Sea prolongation of such weakened zones has deep faults of Supsa, Natanebi, Kobuleti Chorokhi. Existence of these fluid-conductive mobile faults conditioned the formation of diapiric structures in Oligocene-Miocene sediments of Guria Trough. At modern stage of geological development (land-the Black Sea) weakened zones are within sedimentary cover, as well as foundation; they are characterized by high values of thermal indices. Ajara -Trialeti zone and Guria foothill Trough are characterized by anomalously high heat flows (80-84mvt/m^2) and anomalously high depth temperatures: on the base of sedimentary cover ~ 200^0 C , at the Conrad and the Moho discontinuities-(550-600^0 C) and (1000-1200^0 C) correspondingly.

High values of tectonically weakened zones and heat flows, as well as intensive submersions, especially in subsequent period of Eocene, condition the formation of elision fluidodynamical system of eastern Black Sea depression and Guria Trough as well. Biochemical, lithogenetic and depth genesis hydrocarbon fluids participate at certain stages of lithogenesis.

Powerful oil-gas manifestations in land of Guria deflection are connected with Middle Eocene, Middle Miocene, Sarmatian (Supsa) and Meotian (Shromisubani) collectors.

Hydrocarbon (oil, gas) resources can be revealed in anticlinal and diapiric structures of Cretaceous-Miocene geocomplexes. Deposits of biochemical gas can be revealed in geocomplexes of Mio-Pliocene-Quaternary, in the zone of deltaic sediments of paleorivers, in the form of lithologico-stratigraphic traps.

Highly perspective region of gas-hydrate formation is stretched in the zone of the continental slope, section of rivers Chorokhi-Supsa. Holocene-Quaternary sandy sediments are considered perspective. Gas-hydrate deposits can be revealed below sea ground till 500-800m depth.

In the last decade studies of gas hydrates in the Black Sea were conducted by German scientists from the University of Bremen which was coordinated by prof. Gerhard Bormann during cruises on the boards R/V Poseidon, R/V Meteor and R/V Mary S. Merian. The scientists from Georgia participated in this studies.

Shallow gas hydrates, potentially associated with free gas, are known from sediments in several areas and are of specific interest in the black Sea where a large number of active methane emission sites exist. In the territorial waters of Georgia gas flares, ascending methane gas bubbles recorded by echosounder were discovered at several sites offshore Suchumi and offshore Batumi (Guria Trough)

The area offshore Batumi (Batumi seeps area) was intensively studied by ELAC swath bathymetry, DTS side scan sonar, OFOS video sled and GC gravity corer, where gas bubbles were detected ine about 800 m water depth. There in an area of about 1 km^2, occur about 25 gas bubble streams in 10 distinguishable clusters. This is the area in the Black sea with the strongest within the gas hydrate stability zone.

Studies concentrated the seafloor observations and sediment sampling on Batumi Seep. It is placed on the ridge between the canyons and is placed on a local high that rises about 10m at 855 m water depth. This was also imaged by a high resolution 410 kHz side scan sonar survey. About six gas seeps recorded as acoustic anomalies by DTS. The gravity corer contained cm-sise gas hydrates.

At the Batumi seep site, four temperature measurements were obtained using the ROV (remotely operated vehicle) temperature lance.The temperature value ranged between 8.94^0 C and 9.17^0 C. Compared to a bottom water temperature approximately 9.1^0 C, this suggests a relatively low temperature anomaly, which may be related to gas ebullition associated with bottom water infiltration and circulation.

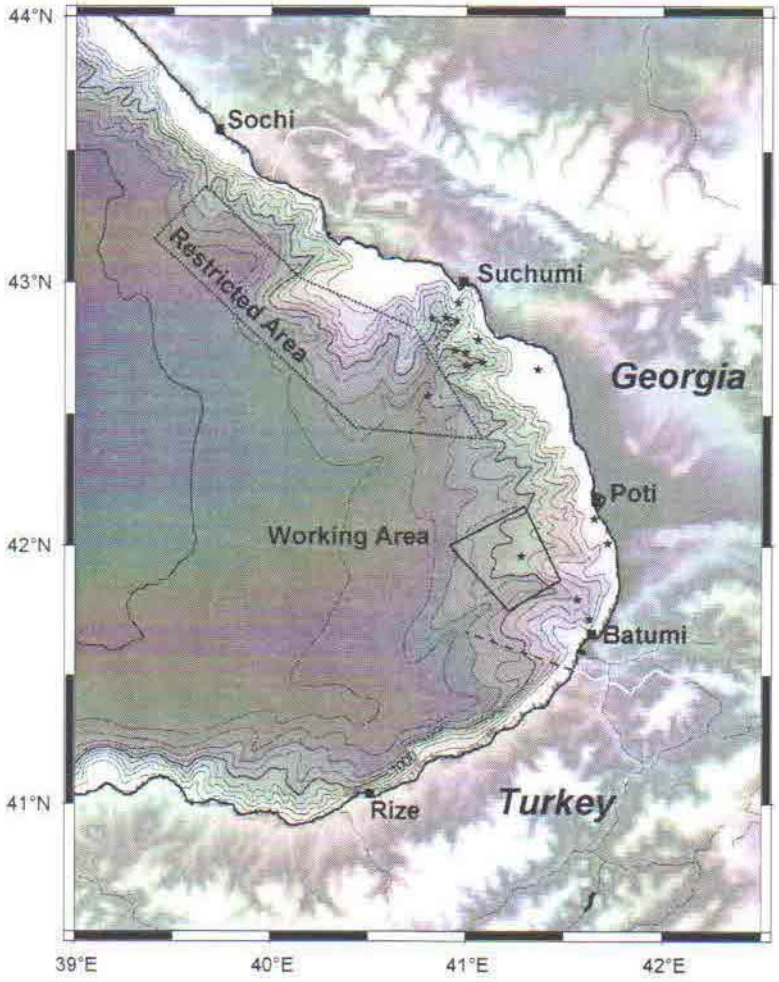

Fig.1 The working area of Georgia, stars – the location of gas flares.

References

[1] E. Sakvarelidze, N. Mamulia. Some Results of the investigation the Heat Regim of the Crust for the Water Area of the Black Sea. Bull.of the Georg Acad.of Sciences, 161,1, 2000

[2] E. Sakvarelidze, G. Tumanishvili, I.Amanatashvili, V Meskhia, Prospects of Revelling Gase Hydrates in Guria Depression. (Georgian Sector of the Black Sea) TTR-17 Post-Cruise Meeting end Intern. Conf. Granada 2-5 February 2009.

[3] E. Sakvarelidze,I Amanatashvili,V.Meskhia, M. Otinashvili Heat Flow And Temperatures in the Sedimantari Complex in the Eastern Black sea Region And Adjacent Territory. Journal of the Georgian Geophysical Sosieti. Issu A. Physics of Solid Earth, vol 14A 2011.

[4] G. TumaniSvili, T. LasaraSvili The Methane hydrate carrying perspectives of Georgian Sector of Black Sea. Second International Symposium on the petroleum Geology and Hydrocarbon potential of the Black Sea Area 22-24 September, Istanbul, Turkey, 1996

[5] H. Sahling, V. Blinova, G. Cifci, N. LursmanaSvili e.o. Report and preliminary Results of R/V Poseidon Cruise P317/4, 2004

[6] G. Bohrman, G. Pape and cruise participants. Report and preliminary Results of R/V Meteor Cruise M72/3,2007

[7] G. Bohrman, V. blinova, K. Dehning, E. Eakvarelidze e.o. Origin and Structure of Methane, Gas Hydrates and Fluid Flows in the Black Sea. Report and preliminary Results of R/V Maria S.Merian Cruise MSM 15/2.

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Исследование газовых гидратов в Гурийском Прогибе

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Резюме

В работе рассмотрены геолого-геофизические предпосылки образования газовых гидратов в Гурийском прогибе на шельфе Черного моря. Приводятся результаты исследований, проведенных совместно с немецкими учеными из Бременского университета во время морских круизов. Показано, что в Гурийском прогибе имеет место интенсивное газовыделение (Батумское газовыделение), которое связано с содержанием газовых гидратов в морских осадках данного региона.

გაზური ჰიდრატების კვლევა გურიის როფში

ე. საყვარელიძე, გ. თუმანიშვილი

რეზიუმე

ნაშრომში განხილულია შავი ზღვის შელფზე გურიის როფში გაზური ჰიდრატების წარმოქმნის გეოლოგიურ-გეოფიზიკური წინაპირობები. მოყვანილია ბრემენის უნივერსიტეტის მეცნიერებთან ერთობლივი საზღვაო ექსპედიციების დროს მიღებული კვლევების შედეგები. ნაჩვენებია, რომ გურიის როფში აღინიშნება გაზების ინტენსიური გამოყოფა (ბათუმის გაზგამოყოფა), რომელიც არის დაკავშირებული ზღვის ნალექებში გაზური ჰიდრატების არსებობასთან.