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Gas hydrate occurrences and mud volcano activity in the Sorokin Trough, Black Sea

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During the CRIMEA expeditions in 2003 and 2004, gravity cores (up to 3.5 meters long) have been recovered in the Dvurechenski area of the Sorokin Trough in the Black Sea. They consist of Holocene fluffy layer and sapropel to Pleistocene mud as well as mud breccia of several generations. Gas hydrates have been observed in several cores, or are suggested by the presence of highly fluidized, degassing sediment. When comparing our observations with the cores collected in the area of Sorokin Trough during the MARGASCH cruise of RV Meteor in winter of 2002; the samples taken during TTR'11 cruise of RV Prof. Logachev in summer of 2001; and the samples of TTR'6 in 1996, it appears that more than 70% of all these cores are gas saturated and gas hydrates have been revealed in 41 of them. In the same time acoustic and seismic data as well as the seafloor video observations along several tracks show that some features in the Sorokin Trough have been active during the periods of investigations.

Several conclusions are suggested by the analysis of the shallow geological sampling and other observations:

shallow gas hydrates occur mostly in restricted areas of fluid discharging structures such as mud volcanoes and active and conductive fault zones; hydrates preferentially occur in mud breccia both matrix or clasts supported and appear as: i) numerous needle-like crystals a few millimeters in size near the seafloor in the active venting sites or within fresh breccia; ii) massive nodules as big as 6 cm at subbottom depths higher than 0.7 m or; iii) lenses or veins in older mud breccia flows; and iv) are very rare within hemipelagic deposits. This could be explained by the high pore space and water content of the mud breccia sufficient favouring gas hydrate formation; several cores taken on features outside the known mud volcanic structures or those that are supposed by seismic or sonar data reveal mud breccia, which suggest that mud vol-

canism is widespread in this area; a few cores taken on the flanks of Dvurechenskiy mud volcano show two or three generations of mud breccia separated by not disturbed hemipelagic sediments suggesting a periodic long term activity of this mud volcano at least for the last 6-7 ky; variations in the acoustically observed gas flare in the vicinity of Dvurechenski mud volcano - about 400 m above the seafloor the first detection in January, 2003 and no indications for gas vents before that; the highest plume ever recorded of near one kilometer in May, 2003, which shrinks to about 300 m in May, 2004, suggest that this particular mud volcano most probably is of Schugin type, with an active stage starting at the end of 2002 reaching its maximum in the middle of 2003 and back to quiescent period at the end of 2004; geothermal measurements along the belt of mud volcanoes from Meteor to Dvurechenski to Tbilisi show an increased heat flow suggesting the presence of a conductive fault zone along this lineament.

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