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Subsurface fluid migration associated with feeding systems of mud volcanoes in Northwestern Caucasus, results of passive seismic studies

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The results of passive seismic studies of subsurface fluid transport systems associated with mud volcanic phenomena in Northwestern Caucasus and the Taman mud-volcanic province are presented. Comparative analysis of results of geophysical cross-sections featuring the deep subsurface structures of several mud volcanoes obtained by means of passive microseismic sounding approach with respect to previous studies has demonstrated advantages of the ambient noise seismic prospecting. It has been shown that subvertical pathways of hydrocarbon migration and so feeding systems of mud volcanoes represent nearly-ideal case of local geological heterogeneities affecting the amplitudes of low-frequency microseismic noise. The analysis of the results was performed with respect to available geological as well as geomorphological data. At the same time, results of past active seismic experiments with controlled vibroseismic sources were reanalyzed and followed by mathematical modeling of processes of hydrodynamic outflow under various mechanisms of mud volcanic eruptions. For several mud volcanoes there were outlined three-dimensional subvertical feeding structures in sedimentary layers and deeper in the crust, responsible for fluid migration and eruptive activity. Specific features of volcanic products (gas components and mineral inclusions in breccia) were analyzed with respect to the new geophysical data obtained.