

# SEISMICITY, TSUNAMIS AND MUD VOLCANOES IN THE BLACK SEA

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The presentation deals with the data about the seismicity of the Black Sea basin and its surroundings as well as the tsunamis generated and documented in the Black Sea. The data for the mud volcanoes are extracted mainly from the not complete publications based on the cruise of the Gl. Challenger boat in the Black Sea during the middle 70-ies. As a potential generator of the possible tsunamis the mud volcanoes have been included in some publications of Ranguelov during 80-ies and 90-ies of the last century. The Black Sea basin is an active geodynamic unit with a typical oceanic earth crust structure [Dachev, 1997]. The sediment layers have different volumes in the different parts of the basin. The average thickness at the deep bottom of the sediments is about 12-15 km. The “granite” layer is absent. The basalt layer due to the seismological investigations has a thickness of about 20-25 km. derived by the surface waves propagation.

The almost whole aquatory of the sea is geodynamically active. Many earthquakes, submarine and surface coastal landslides, stone- and rockfalls can be observed. Most of them act during the last quaternary period as well as at the present days. All these geodynamic phenomena are potential and real generators of the tsunamis observed, described and registered at the Black Sea. Due to the specific geometry of the bottom and the coastal lines the generated tsunamis have a specific behavior.

The seismicity is located mainly in the earth crust [Ranguelov, 1996]. The earthquake epicenters are located in the aquatory of the sea, or on the surrounding land. The observed events have great magnitudes – up to 7.0-7.5. For example the 31 March 1901 earthquake with a magnitude 7.0-7.1 located in the aquatory near the Northwest coast of the sea, generated intensity about X MSK and a tsunami effect of about 3 meters height [Ranguelov, Gospodinov, 1994]. There are a lot of data about the historical and ancient events with significant magnitudes [Nikonov, 1997]. One of the most famous strong ancient earthquakes is this one from Ist century BC, which destroyed the ancient town Bisone (a Greek colony) and produced large landslides and rock falls, as well as a strong tsunami effect. During the mid-age history several strong events and some tsunamis have been reported on the west part of the sea [Guidoboni, 1989].

More than 25 cases of tsunamis are well documented about the whole aquatory of the Black Sea. Some of them are known only by descriptions, some are registered by different devices. There are two main peculiarities observed for the Black Sea tsunamis.

The first one – the tsunami energy hits mainly the closest parts to the tsunami generation place. This is due to the specific bottom and coastal geometry and the refraction way of the wave rays [Ranguelov, Gospodinov, 1994].

The second – some tsunamis are generated by the outside sources (for example – North Anatolian fault and Vrancea intermediate seismic source [Ranguelov, 1997].

The tsunami investigations in the Black Sea have been carried out in the extensive regime during the middle 1990-ties. A lot of information has been collected and processed.

Catalogue data refinement, travel-time modeling, spectral analysis of the real registered tsunamis, energy distribution calculations according to the geometry and refraction, hazard assessment for certain time periods, etc. have been presented. A special attention has been paid to the fractal properties of the real bottom and coast geometry and the observed tsunami run-ups [Ranguelov,1997].

The works performed lead to the general conclusion that such investigations must be applied for practical purposes such as vulnerability scenarios, risk and hazard probability assessment, mean return period's calculations, source investigations when possible. The repeated time for different tsunami heights, obtained by the empirical available data are lower in comparison with other similar regions. The results show that the repeatability is more than three times lower for the relative big run-ups. The results obtained are useful for the general investigations of the regional geodynamics of the Black Sea basin and surroundings.

The observed mud volcanoes in the basin have been discovered during the middle 70-ies. The reports described not large volcanoes, but frequent and rather active at the bottom depths of about 1000-2000 meters in the southwest part of the basin. Another expression of the recent geodynamics of the Black sea are the active emissions of the organic gasses observed at the depths of about 100-300 meters near the northwest part of the sea. Similar emissions have been reported during the strong (M~6) 1923 earthquakes near Crimea. Bot cases are connected with the active seismogenic areas. On the land, the mud volcanoes on the Bulgarian territory are located at a quaternary basin near Plovdiv city – also seismic active area. They are with the diameters of about 1-2 meters and the whole number of the active fissures is 3-4.

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