Abstracts for KALMAR (Kurile-Kamchatka and Aleutian Marginal Sea – Island arc systems) conference, May 12-20, 2011 Trier, Germany. Kiel: Hansadruck, 2011. P. 92-94

Tsunami and active tectonics along the western margin of the Bering Sea - impact on the coastal zone environment and evolution

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Over the last about 20 years, the Bering coast of Kamchatka was not considered as an area with a high level of earthquakes and tsunami risks, despite the 1969 Mw 7.7 tsunamigenic earthquake near the Ozernoi Peninsula. However, the 1991 Khailinskoe (Mw 6.6) earthquake in the southern part of the Koryakia, and especially the 2006 Olytorskoe earthquake (Mw 7.6) had raised the public and scientific concern about the possibility of large (including tsunamigenic) earthquakes in this area.

The western Bering Sea overlies a tectonically complex region. The plate

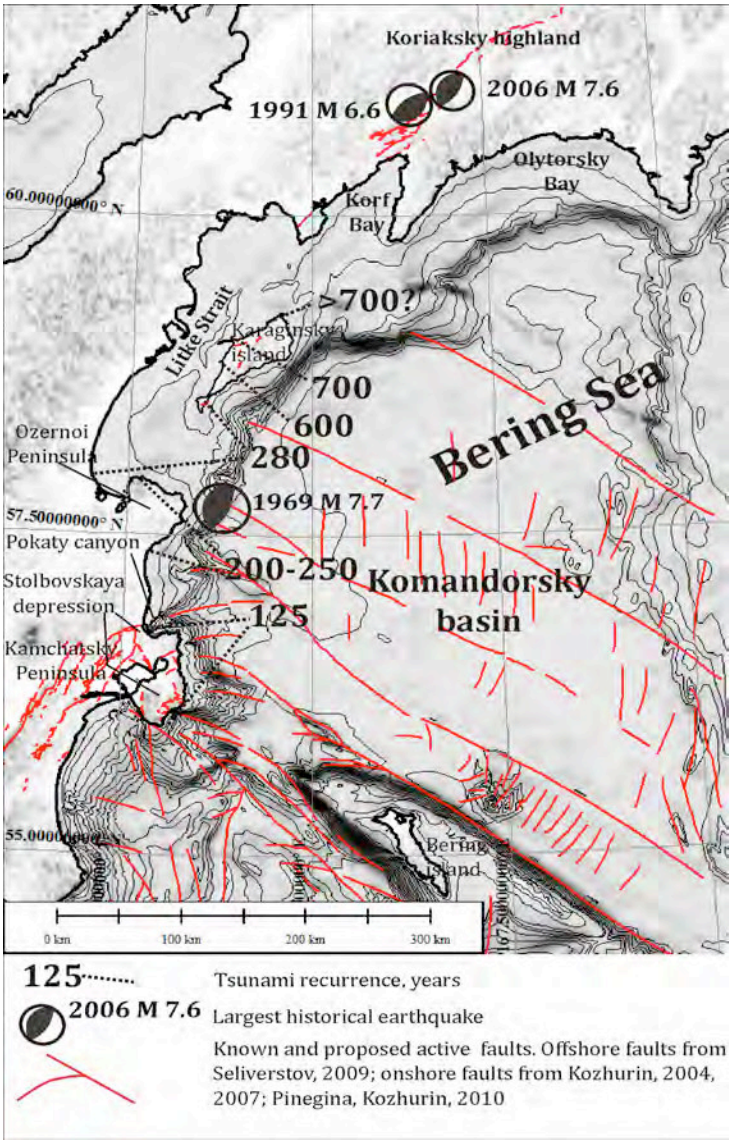

Fig. 1: Recurrence interval of tsunami with runup >5 m at the different parts of the Bering Sea coast (based on tsunami deposits for the last ~2000 years).

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in this region are not well established - geoscientists have proposed several different plate configurations. Multiplate models (Cook et al. 1986, Lander et al. 1994, Mackey et al. 1997, Apel et al. 2006) more easily explain the location and mechanisms of the 1969, 1991 and 2006 earthquakes that occurred on the inferred Okhotsk/ Bering/ and Bering/ North America plate boundaries.

During 1998-2003 field seasons we studied paleotsunami deposits along the southwestern coasts of the Bering Sea. First, we examined geological evidence for the 1969 Ozernoy earthquake and tsunami (Bourgeois et al. 2006, Martin et al. 2008). Then, we used these data as well as data on other historical tsunamis, as a guide for analyzing more than 4000 years of paleoseismic record in the southwestern Bering Sea. In this area we have documented evidence for 12-15 tsunamis during about 4500 years. Based on tsunami runup (4-8 m) and tsunami inundation (≤300-400 m), we think that these events were produced by local earthquakes with Mw ~7.5±0.5. Possibly, by kinematics, they are underwater analogues of the Olytorskoe Mw 7.6 earthquake of April 20, 2006 in Koryakia (Pinegina, Konstantinova 2006, Pinegina, Kozhurin 2010).

In 2009-2010 we extended the paleoseismological investigation to the west and northwest coast of the Bering Sea. A number of active faults, deforming late Pleistocene-Holocene marine terraces were identified. These faults, probably, have a submarine continuation in the Bering Sea. Slip along these faults may generate tsunamigenic earthquakes. Based on our data, the recurrence interval of slips along a single active fault may be as long as several thousands to ~10 thousands of years. The recurrence interval of tsunami (with runup >5 m) at the different parts of the Bering Sea coast vary, in average, from 125 years up to ~1000 years (Fig. 1). Historical data show that the tsunamis with sources situated along the Kurile-Kamchatka subduction zone do not influence the Bering Sea coast significantly. So, we suppose that most of the Bering Sea tsunamis come from local sources (Bourgeois et al. 2006). They may be generated by several zones located along the margins of the Komandorsky basin. The analysis of historical seismicity (1937-2010) clearly shows that possible tsunamigenic zones may be 1) at the western shelf of Komandorsky basin, its slope and foot, and 2) at the western end of the Aleutian Island Arc. To that, seismogenic and tsunamigenic zones may be 3) at the extension of active faults of the Stolbovskaya depression in the Pokaty canyon, and 4) at the continuation of active structures of Koriaksky highland in the Litke Strait. These last two zones are less clearly pronounced in the modern seismicity, and were identified mostly by our paleoseismological study. Still, we have no data, either historical or paleoseismological, about tsunami from local earthquakes in the Olytorsky and Korf Bays. One known historical tsunami in these Bays with ~4 m runup was transoceanic (from Chili 1960). It is no question that such events if there were any, influenced geologic history of the coastal area. For example, the coastal coseismic deformations may cause rapid fluctuations in relative sea level and produce therefore great environmental changes in the lake's and lagoon's sedimentation as a whole. Tsunami waves can inject a large amount of allogenic material into the coastal area and modify it drastically. Study of earthquakes- and tsunami-related imprints on coastal sequences should give us possibility to better understand the interaction between onshore and offshore processes in context of reconstruction of the paleoenvironmental conditions and their evolution.

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