

## The July 17, 2017 Mw7.8 Earthquake in the Bering Fracture Zone: Dynamics of Foreshock-Aftershock Process

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The July 17, 2017 Mw7.8 earthquake ruptured the back-arc Bering Fault between the Komandor Block of the Aleutian Arc and Bering Plate - the Near-Aleutian earthquake (Chebrov et al., 2017; Lay et al., 2017). The location, depth, and focal mechanism solution of the earthquake are consistent with rupture on the main plate boundary, as right lateral faulting. The length of its rupture is estimated at 350-470 km, and the aftershock cloud stretched out along the Aleutian arc by ~500 km (рис. 1). Thus, rupture length is in 3-5 times longer than the linear size of the earthquakes source for magnitude Mw7.7-7.8 occurring in continental and subduction areas. In terms of the rupture length, the source motions, magnitude and seismic moment, this earthquake can be compared to the San Francisco earthquake of 1906 on the San Andreas fault. The July 17, 2017 rupture passed along the northern edge of the zone of relative seismic quiescence - the so-called Kommandor seismic gap (the length 600-650 km, which corresponds to the potential earthquake with M9) (Lobkovsky et al., 2014).

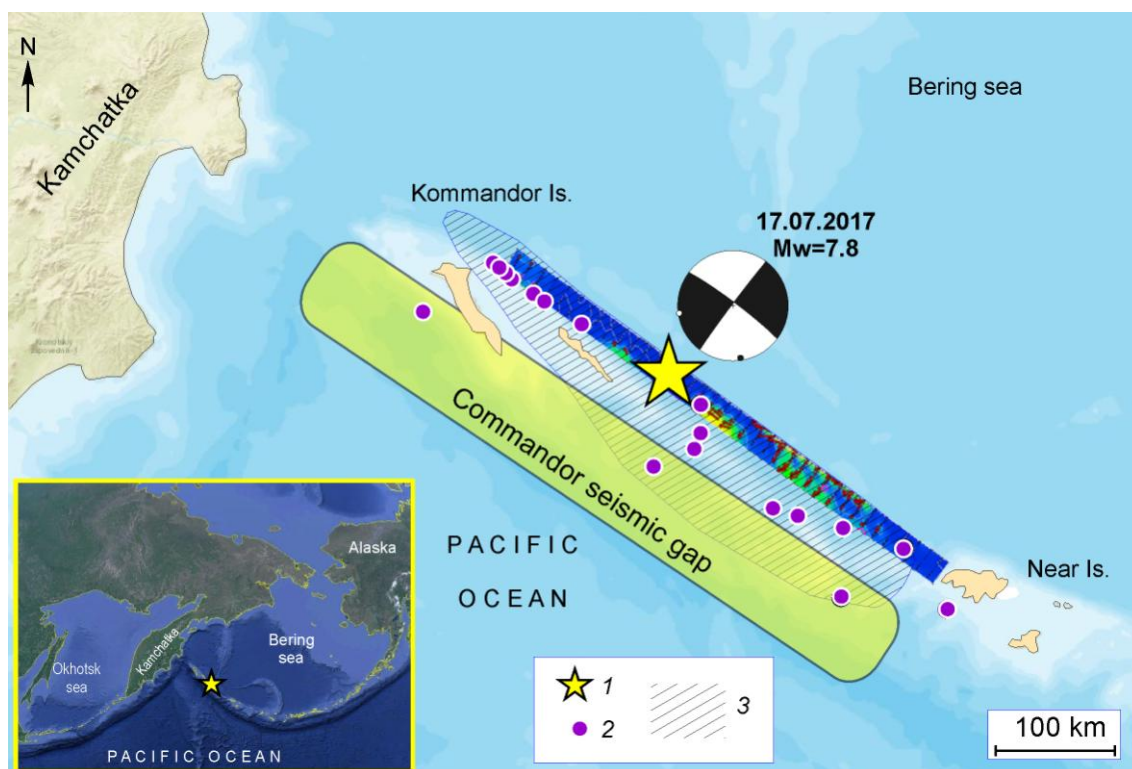


Fig. 1. The July 17, 2017 Mw7.8 earthquake. 1 – epicenter of mainshock; 2 – epicenters of the  $M \geq 5.0$  aftershocks; 3 – area of the first day aftershocks. Kommandor seismic gap according to (Lobkovsky et al., 2014). Bilateral slip model for the Near-Aleutian earthquake according to (Lay et al., 2017), the total rupture duration is  $>80$  s.

Foreshock activity lasted about 11 months. Foreshocks appeared along all formed rupture of a strong earthquake, but foreshock distribution was irregular. Four strongest foreshocks  $M_w 6.1-6.7$  were accompanied by their own aftershock groups. The foreshock process illustrated the activation of transverse tectonic structures - Riedel shear structures in the zone of transform faults on the border of Bering plate. The most interesting is the group of foreshocks (more than 30 seismic events) with  $M_L 3.0-6.3$ , starting about 12 hours before the mainshock.

An important feature of the preparation of the the July 17, 2017 Mw7.8 Near-Aleutian earthquake is a two-phase seismic quiescence flanked to the mainshock epicenter, formed simultaneously with foreshock activity. seismic quiescence and seismic silence were detected by two methods: *RTL* and *Z-function* (рис. 2).

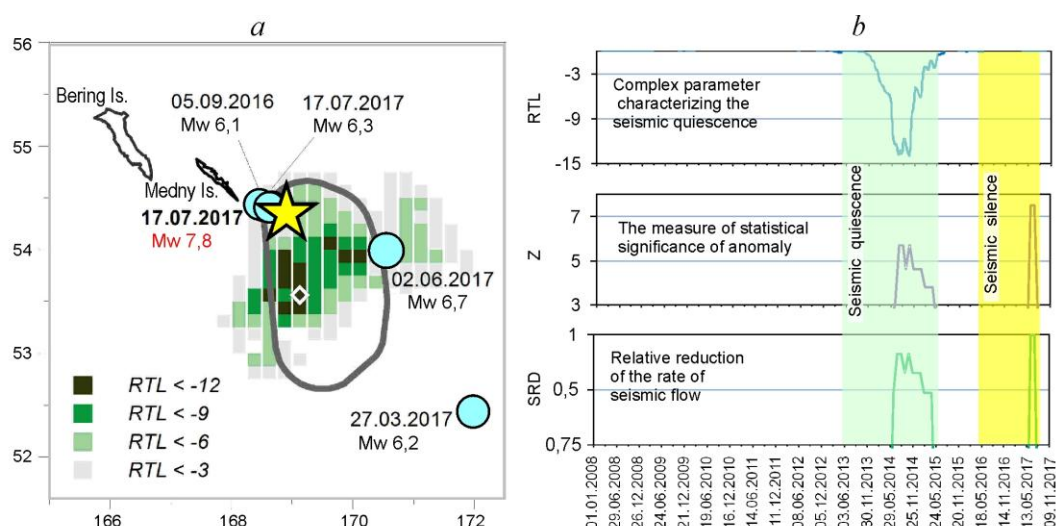


Fig. 2. Two-phase seismic quiescence before the July 17, 2017 Mw7.8 Near-Aleutian earthquake. *a* - map of the minimum RTL values. The region of absolute seismic quiescence, detected by Z-function is outlined. The epicenters of the Near-Aleutian earthquake (the star) and the strongest foreshocks (circles) are noted. *b* - temporal variations of the parameters of the seismic regime. The graph of the RTL parameter corresponds to the characteristic point of the anomaly identified by the diamond on fig. 2a. Z-function is calculated in a time window of 1 year.

The seismic inversion in the quiescence region that followed the Near-Aleutian earthquake, may suggest that it spatially corresponded to the asperity on the Bering fault.

The aftershock process is not over. Over 7 months, more than 900 aftershocks were recorded, ~20 of them are with  $M \geq 5.0$ . The source mechanism of the strongest aftershock corresponds to mainshock one. The aftershock process had a two-stages and after ~4 days passed into the phase of exponential attenuation. Already in the first hour after the mainshock, a 500-kilometer segment along the Aleutian arc was worked out by aftershocks, and in the first place - the southeastern pattern. Aftershock seismicity of the first day had a tendency to migrate along the Aleutian arc.

The strongest seismic event Mw6.2 occurred on 25.01.2018, six months after the mainshock 17.07.2017 in the vicinity of Bering Island, on the north-western edge of the main rupture zone. After that 150 more weak earthquakes occurred here as own aftershock series of the Mw6.2 earthquake.

The irregularity of the space-time distribution of the foreshocks and aftershocks is one of the main features of the Near-Aleutian earthquake, that important for the study of the tectonics and rupture models in more details.

## References

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