

# SEISMOTECTONIC MANIFESTATIONS IN THE SOUTHEASTERN CHERSKY RANGE ZONE AND ITS CONTINUATION ON TO KAMCHATKA (NORTHEAST YAKUTIA AND NORTHERN PRIOKHOTYE)

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The Yakut and Magadan regional seismic networks have recorded more than 6000 earthquakes in northeast Russia over the past 50 years. Seismicity of the region is represented by a broad (up to 400 km) epicentral band extending from the Lena river delta along the Chersky Range system through Northern Priokhotye and Shelikhov Bay in the Sea of Okhotsk to Kamchatka peninsula. The band makes part of the large Arctic-Asian seismic belt [1] intersecting the Arctic ocean and the Asian continent and linking the seismicity of the Arctic with that of the Pacific region. The seismic zone of the Chersky Range is traceable for a distance of more than 8000 kilometers separating the Eurasian and Okhotsk plates from the North American one. Most seismically active is the southeastern flank of the Chersky Range zone. Here, on the territory between the Indigirka and Kolyma river valleys and the northern shore of the Sea of Okhotsk, including its shelf, a large epicentral cluster has been recorded. Over a dozen of the earthquakes had magnitude 5.0-6.8, among them the 1971 Artyk (M=6.8), the 1972 Kula (M=5.7), the 1979 Gizhiga (M=5.2), the 1979 and 1981 Kupka (M=5.2), the 1996 West Kamchatka (M=6.2) and other events. All the events were crustal in depth (focal depth 8-50 km) and confined to activated tectonic fault systems. The boundary between the North American and the Okhotsk plates is most clearly defined by left-lateral Ulakhan strike-slip fault about 1500 km in length which makes part of the Indigirka-Kolyma fault system. It is visible on space images as series of en-echelon features with young extension mini-basins developed on their left terminations (Upper Lyglykhtakh, Upper Sudar, Pereprava, Bugchan, Upper Erickit, etc.). Where the Ulakhan fault transects the upper reaches of the tributaries of the Rassokha and Omulevka rivers (the river basin of Yasachnaya flowing into the Kolyma river) the river channels have become offset to the left by 24 km beginning in the Middle Pliocene (3.4 Ma) [2]. This permitted estimating the mean rate of motions along the Ulakhan fault which is equal to 0.7 cm/yr. Some researchers (Gusev, Merzlyakov, Imaev, Vazhenin, etc.) have found in the zone of influence of the fault much evidence of ancient and modern seismic dislocations such as rockfalls, landslides, fallen trees and others (Tirekhtyakh, Urul'tun, Nyuchaga, Ezop, Chibagalakh, etc.) that had resulted from strong earthquakes. Some of them have dammed the river beds. An example is a rockfall with a volume of about 200-300 million cubic meters (Tirekhtyakh dislocation) in the Ulakhan-Chistay Range which formed a 360 m high dam that dammed in the valley of the 10 km long Yuryn-Tas Creek (tributary of Tirekhtyakh river in the Moma river basin). Water from the dammed up basin penetrated through the dam, while in front of the dam a mass of loose sediments up to 140 m thick was deposited. Such a dislocation could have formed at the time of a seismic hazard about 1000 years ago [3]. The Ulakhan fault is seismically active throughout its length. The earthquake epicenters look as if «strung» on the fault line in the direction from the Indigirka river through the Kolyma river valley to Gizhiga Bay in the Sea of Okhotsk. Southeastward the seismicity continues on to the northern part of Shelikhov Bay and the Shimanka and Lesnaya rivers basin on the western coast of Kamchatka. Then the «seismic line» cuts the Kamchatka isthmus and ends in Karaginskiy Island in the Bering Sea (Pacific region). Nowadays in the zone of influence of the Ulakhan fault seismic events with magnitude not exceeding 5.0-5.5 are taking place. Focal mechanisms for the events indicate north-eastern left-lateral strike slip on the Ulakhan fault coinciding with the fault plane as defined from geological data [4]. A reverse fault component is also present here. For example, left-lateral strike slip was determined for the 1974 Seimchan event, while in the case of the event in the upper Kur river (Moma river basin) left-lateral strike slip with a component of reverse faulting was recorded. In all cases, tectonic compressive stresses acted subhorizontally in a northeastward direction (mean azimuth 65°), which supports the collisional nature of local seismicity. In the extreme southeast

in Shelikhov Bay and the Kamchatka isthmus left-lateral strike slip gives way to reverse faulting, but this stress pattern is less reliable because of the limited number of observations made there. Along with the main variant of the boundary between the North American and Okhotsk plates running along the Ulakhan fault as far as Karaginskiy Island another boundary «line» is possible, which in the form of a narrow band of earthquakes branches off from Ulakhan at an acute angle (20-25°) east of the Seimchan-Buyunda basin and is traceable in the direction towards Shelikhov Bay and western coast of Kamchatka nearby South Cape. The band is clearly marked by the well-felt 1996 West Kamchatka event (M=6.2) [5] with a series of aftershocks (over 50). Interestingly, the sense of the line coincides with the strike of the Aleutian island arc. Thus, spatial distribution of the earthquake epicenters is indicative of a diffuse nature of seismotectonic processes occurring in the region, which are conditioned by compressive stresses and cause chaotic motions on collisional plate boundaries. This is also supported by the width (up to 400 km) of their zone of interaction.

### References

1. Ulomov V.I., Shumilina L., Trifonov V. et al. 1999. Seismic hazard of Northern Eurasia. // *Annali Di Geofisica*. V. 42, N 6, p. 1023-1038.
2. Mclean M.S., Fujta K., Mackey K.G., Kleber E., Koz'min B.M. and Imaev V.S. 2000. The Ulakhan Fault System, Northeast Russia. // 2000 Fall Meeting AGU. Abstracts. San-Fransisco: USA. p. F1164.
3. Imaev V.S., Imaeva L.P. and Koz'min B.M. 2000. Seismotectonics of Yakutia. Moscow: GEOS, 227 p. (in Russian)
4. Gusev G.S., Mokshantsev K.B. and Tretyakov F.F. 1976. Faults of the Verchoyansk-Chukotka fold region. // *Fault tectonics of the Yakut ASSR territory*. Yakutsk: YaF SO AN SSSR, p. 73-114 (in Russian).
5. Gunbina L.V. and Leschuk, N.M. 2002. Northeast Russia. // *Earthquakes in the North Eurasia in 1996*. Moscow: GS RAN, p. 144-147 (in Russian).