



Structural–dynamic model of the Chersky seismotectonic zone (continental part of the Arctic–Asian seismic belt)



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ABSTRACT

To construct a model for modern geodynamics of the Chersky seismotectonic zone (continental part of the Arctic–Asian seismic belt) we analyzed the available data on its structural–tectonic setting, depth structure, kinematics of active faults, morphotectonic features of modern topography, tectonic stress fields as derived from the earthquake focal mechanisms as well as the types of Late Cenozoic fold and rupture deformation. It is established that the Yana–Indigirka and Indigirka–Kolyma segments in the central part of the Chersky zone underwent transpression due to collision of the Eurasian (EU) and North American (NA) lithospheric plates. This was only possible if, in course of the plate convergence, the Kolyma–Omolon block in the frontal part of the NA plate formed the active indentor. Under the block pressure, geodynamic settings experience horizontal compression, in which case some of the blocks are being extruded along the system of northwestern and southeastern strike-slip faults. This results in the formation of major seismogenic structures with a high seismic potential in the marginal and frontal parts of the Chersky zone.

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1. Introduction

Combined geological–geophysical and seismological studies in northeast Asia revealed the extensive Arctic–Asian seismic belt (AASB) (Fig. 1), which marks the boundary between the major North American and Eurasian lithospheric plates (Chapman and Solomon, 1976; Imaev et al., 2000; Fujita et al., 2009). Geodynamic processes occurring within the belt cause seismotectonic deformation of the Earth's crust in the zone of contact between the plates. Tectonically, the AASB can be divided into major regional segments (Laptev Sea, Kharaulakh, Chersky, and Sea of Okhotsk) (Imaev et al., 1990). Structural paragenesis of active faults developed in the segments is controlled by the stress state of the Earth's crust (Imaev et al., 2000, 2009; Koz'min et al., 2001). Instrumental seismic observations conducted by Geophysical Surveys of Russian Academy of Sciences and its Siberian Branch (<http://www.ceme.gsr.ru>) and the Michigan State University (USA) (Mackey et al., 2007) in northeast Russia, and available geological–structural (Parfenov et al., 2001) and morphotectonic (Imaeva et al., 2009) data helped elucidate the dynamics of seismogenic structures of constituent

segments of the Chersky seismotectonic zone (CSZ) and develop a regional structural–dynamic model.

The investigations were aimed at:

- analyzing the published structural–tectonic, geological–geophysical and seismological data and compiling additional morphotectonic maps for the region;
- estimating effect of reactivated Late Mesozoic structures on Cenozoic tectonics and modern structural pattern;
- making structural–dynamic analysis of the strong earthquakes epicentral zones and refining the kinematics of active faults;
- elucidating the kinematics of motions and developing regional structural–dynamic models of major seismogenic structures in some CSZ segments.

Below two local segments within Mesozoides of the CSZ, which are the Yana–Indigirka and Indigirka–Kolyma (Okhotsk) segments, are considered. Their location is shown in Fig. 1. The segments were recognized by specific structural paragenesis of active faults characteristic of certain types of crustal stress state (Gusev, 1979; Imaeva et al., 2011; Parfenov et al., 2001), geophysical field structures (Suvorov and Kornilova, 1986; Imaev et al., 2000), morphotectonic features (Imaev et al., 2000, 2009) and dynamics of major seismogenic structures (Imaev et al., 2009; Imaeva et al., 2009) of the segments.

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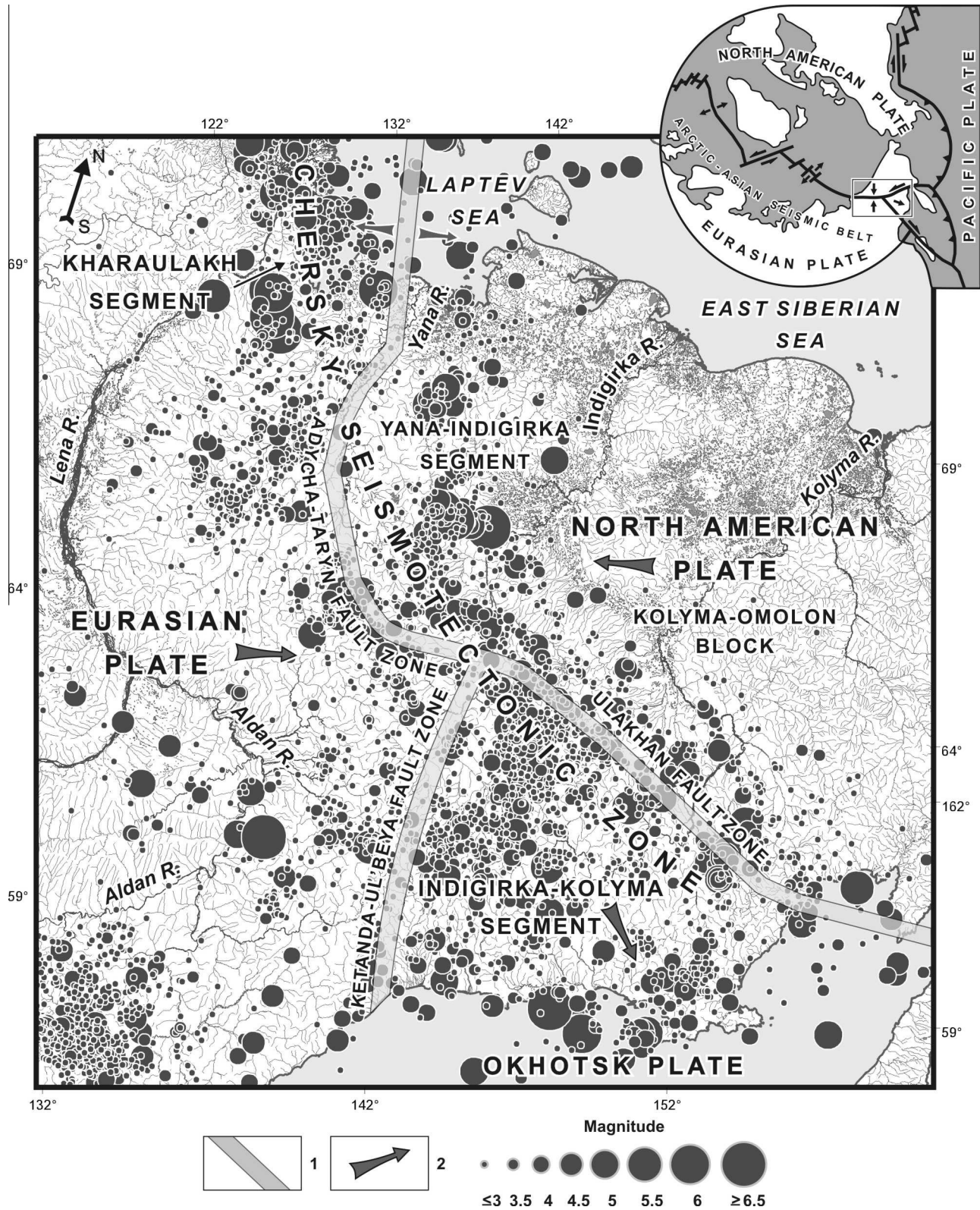


Fig. 1. Map of earthquake epicenters within the Chersky seismotectonic zone. Based on the materials of the RAS and SB RAS Geophysical Surveys (<http://www.ceme.gsras.ru>, URL:ftp.gsras.ru/pub/Teleseismic_bulletin) and International Seismological Centre (<http://www.isc.as.uk>). (1) Boundaries of the Yana-Indigirka and Indigirka-Kolyma segments; (2) sense of motion of lithospheric plates. Outset shows kinematics of recent lithospheric plate in Northeast Asia and location of Arctic-Asian seismic belt. The study area is shown in box.

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