

Tectonic stress of the southeastern part of the Gorny Altai

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Abstract. Data on the stress-strain state of the rocks in the area of the Chuya and Kuray depressions located in the southeastern part of the Gorny Altai were obtained using field tectonophysical methods. The characteristics of local stress tensors obtained at the field observation points were used to determine the averaged regional stress field responsible for the formation of the regional tectonic structure. The tectonic position of the area in a complex node of the concentration of faults and various paleofacial zones determines the nature of the single averaged stress field. In the area of the Chuya and Kuray depressions, the maximum horizontal compression was revealed, which is established at the local level and the level of the regional stress field of the three observation sites. The deviation from the submeridional direction of tectonic stress, which is general for the Gorny Altai, and the increased number of stress regimes of horizontal extension compared to other parts of the region are associated, in our opinion, with WSW regional dextral strike-slip structures and a change in the type of stress regime within the superimposed Cenozoic depressions. Such variations in the stress field characteristics are noted not only for paleostress inversion but also for the changes occurring as a result of the development of modern seismic processes and related earthquakes in this seismically active region of the Gorny Altai.

Keywords:

Gorny Altai, Chuya depression, Kuray depression, tectonic stress, fault tectonics, slickenside, paleostress reconstruction (paleostress inversion)

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References

1. Delvaux D., Theunissen K., Van der Meer R., Berzin N. **1995**. Dynamics and paleostress of the Cenozoic Kurai-Chuya depression of Gorny Altai (South Siberia): Tectonic and climatic control. *Russian Geology and Geophysics*, 36(10): 26–45.
2. Dobretsov N.L., Buslov M.M., Delvaux D., Berzin N.A., Ermikov V.D. **1996**. Meso-Cenozoic tectonics of the Central Asian Mountain Belt: effects of lithospheric plate interaction and mantle plumes. *International Geology Review*, 38: 430–466. <https://doi.org/10.1080/00206819709465345>
3. Lunina O.V., Gladkov A.S., Novikov I.S., et al. **2006**. Seismotectonic deformations and stress fields in the fault zone of the 2003 Chuya earthquake, Ms = 7.5, Gorny Altai. *Geotectonics*, 40(3): 208–224. <https://doi.org/10.1134/S0016852106030058>
4. Delvaux D., Cloetingh S., Beekman F., Sokoutis D., Burov E., Buslov M.M., Abdrakhmatov K.E. **2013**. Basin evolution in a folding lithosphere: Altai–Sayan and Tien Shan belts in Central Asia. *Tectonophysics*, 602: 194–222. <https://doi.org/10.1016/j.tecto.2013.01.010>
5. Marinin A.V., Sim L.A., Manuilova E.A., et al. **2022**. Neotectonic stress state of the Chuya–Kurai depression and adjacent structures (Southeastern Altai Mountains). *Seismic Instruments*, 58(Suppl 2): S345–S355. <https://doi.org/10.3103/S0747923922080096>
6. Sim L.A., Sycheva N.A., Gordeev N.A. **2023**. Neotectonic and modern stresses of the south-eastern Altai. *Izv., Atmospheric and Oceanic Physics*, 59: 1750–1761. <https://doi.org/10.1134/s0001433823110051>
7. Omar Kh.M., Arefiev S.S., Rebetskiy Yu.L. **2012**. Mechanisms of aftershocks of 2004–2005 years and stress-state in the source region of Altai, 2003, earthquake. *Geophysical Research*, 13(3): 56–73. (In Russ.).
8. Leskova E.V., Emanov A.A. **2013**. Hierarchical properties of the tectonic stress field in the source region of the 2003 Chuya earthquake. *Russian Geology and Geophysics*, 54(1): 87–95. <https://doi.org/10.1016/j.rgg.2012.12.00>

9. Kuchai O.A. **2012**. Specific features of fields of stresses associated with aftershock processes in the Altai-Sayan mountainous region. *Geodynamics & Tectonophysics*, 3(1): 59–68. (In Russ.). <https://doi.org/10.5800/gt-2012-3-1-0062>
10. Rebetsky Yu.L., Kuchai O.A., Marinin A.V. **2013**. Stress state and deformations of the Earth's crust in the Altai-Sayan mountain region. *Russian Geology and Geophysics*, 54(2): 206–222. <https://doi.org/10.1016/j.rgg.2013.01.011>
11. Rogozhin E.A., Ovsyuchenko A.N., Larkov A.S. **2021**. Source of strong earthquake as a geological object. *Geotectonics*, 55(3): 307–333. <https://doi.org/10.1134/s0016852121030079>
12. Rebetsky Yu.L., Marinin A.V., Sim L.A. **2019**. Tectonophysical paleostress reconstructions: Interpretation challenges and possible solutions. *Russian Geology and Geophysics*, 60(6): 675–689. <https://doi.org/10.15372/RGG2019048>
13. [State Geological map of the Russian Federation]. Scale: 1:1 000 000. **2011**. Ser. Altai–Sayan. Sheet M-45 (Gorno-Altaysk): Explanatory notice. Authors: Fedak S.I., Turkin Yu.A., Gusev A.I., Shokal'skii S.P., Rusanov G.G., Borisov B.A., Belyaev G.M., Leont'ev E.M. Saint Petersburg: VSEGEI, 567 p. (In Russ.).
14. [Tectonic map of Russia with data on CIS countries]. Scale: 1:2 500 000. **2008**. Eds: O.V. Petrov, Yu.G. Leonov, and S.P. Shokal'skii. Saint Petersburg: VSEGEI, VNIIOkeangeologiya. (In Russ.).
15. Deev E.V., Krzhivoblotskaya V.E., Borodovskiy A.P., Entin A.L. **2022**. Active faults and Late Holocene surface rupturing earthquakes in the Kokorya Basin (Gorny Altai, Russia). *Doklady Earth Sciences*, 506(1): 666–670. <https://doi.org/10.1134/s1028334x22700039>
16. Rastsvetaev L.M. **1987**. [Paragenetic method of structural analysis of disjunctive tectonic faults]. In: [Problems of structural geology and physics of tectonic processes]. Moscow: GIN AN SSSR, 2, p. 173–235 (In Russ.).
17. Rebetskiy Yu.L. **2007**. *Tectonic stresses and strength of rock massifs*. Moscow: Akademkniga, 406 p.
18. Rebetskiy Yu.L., Sim L.A., Marinin A.V. **2017**. [From slickensides to tectonic stresses: Methods and algorithms]. Moscow: GEOS, 234 p.
19. Sim L.A. **1982**. [Determination of the regional field by the data on the local stress in separate areas]. *Izv. vuzov. Geologiya i razvedka = [Geology and exploration]*, 4: 35–40. (In Russ.).
20. Sim L.A. **2000**. [The influence of global tectogenesis on recent stress state of European platforms]. In: *M.V. Gzovskii i razvitie tektonofiziki = M.V. Gzovskii and the progress in tectonophysics*. Moscow: Nauka, p. 326–350. (In Russ.).
21. Osokina D.N. **1987**. [The relationship of fault displacement with tectonic stress fields and some issues of massif destruction]. In: [Fields of the stress and strain in the crust]. Moscow: Nauka, p. 120–135. (In Russ.).
22. Tveritina T.Yu., Marinin A.V., Deev E.V. **2023**. Geodynamics of the Katunsky fault (Gorny Altai) according to structural and kinematic data. *Moscow University Bulletin. Series 4, Geology*, (1): 46–59. (In Russ.). <https://doi.org/10.55959/MSU0579-9406-4-2023-63-1-46-59>
23. Leskova E.V. **2013**. [Spatiotemporal structure and tectonic stress field of the aftershock region of the 2003 Chuya earthquake according to 2003–2012 monitoring data]: extended abstract of the thesis ... Cand. Sci. (Phys. and Math.). Novosibirsk, 17 p. (In Russ.).
24. Mikhailova A.V. **2007**. [Geodynamic characteristics of structures formed in the layer above active basement faults (according to tectonophysical modeling)]. In: [Geophysics of the XXI century: Proceedings of the 8th geophysical readings named after V.V. Fedynsky, March 2–4, 2006]. Moscow: INTEK-GEON, p. 111–118. (In Russ.).
25. Mansurov A.N. **2023**. [Calculation of the distribution of recent deformations of the Earth's crust for the territory of the Gorny Altai, and Sayan and Kazakh platforms according to cosmogeodesic observations]. *Fundamental'nye i prikladnye voprosy gornykh nauk = Fundamental and applied issues of mining*, 10(2): 53–58. (In Russ.).
26. Mansurov A.N. **2024**. [Coordination of velocity catalogs of three GNSS networks of Altai, Sayan, Mongolia and East Kazakhstan for the calculation of the distribution of the velocity tensor of the Earth's crust deformation in this territory]. In: [Problems of geodynamics and geocology of intracontinental orogens]: Abstracts of the IX Intern. symp. Bishkek, p. 96–99. (In Russ.).