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Asthenospheric counterflows beneath the moving lithosphere of Central and East Asia in the past 90 Ma: volcanic and tomographic evidence

Sergei Rasskazov (1,2), Irina Chuvashova (1,2), and Vladimir Kozhevnikov (1)

(1) Institute of the Earth's crust, Russian Acadimy of Sciences, Irkutsk, Russian Federation (rassk@crust.irk.ru), (2) Irkutsk State University, Irkutsk, Russian Federation

Asthenospheric counterflows, accompanied motions of the lithosphere in Central and East Asia, are defined on basis of spatial-temporal activity of mantle sources [Rasskazov et al., 2012; Rasskazov, Chuvashova, 2013; Chuvashova, Rasskazov, 2014] and the tomographic model of the Rayleigh wave group velocities [Kozhevnikov et al., 2014]. The opposite fluxes are defined relative to centers of convective instability (low-velocity anomalies), expressed by thinning of the mantle transition layer under Southwestern Gobi (44 °N, 95 °E) and Northern Baikal (52 °N, 108 °E). Cretaceous-Paleogene volcanic fields in Southern Gobi are shifted eastwards relative to the former anomaly over 600 km with the opposite sub-lithospheric flux at depths of 150-300 km. Likewise, the Late Tertiary Vitim volcanic field is shifted relative to the latter anomaly over 100-200 km. We suggest that the Gobi and Baikal asthenospheric counterflows contributed to the rollback mechanism of downgoing slab material from the Pacific under the eastern margin of Asia in the Cretaceous-Paleogene and Early-Middle Miocene. The east-west Gobi reverse flux, caused by differential block motions in front of the Indo-Asian convergence, resulted in the oblique Honshu-Korean flexure of the Pacific slab that propagated beneath the continental margin, while the Japan Sea was quickly opening at about 15 Ma. The Baikal N60°W reverse flux, originated due to oncoming traffic between Eurasia and the Pacific plate, entailed the formation of the Baikal Rift Zone and direct Hokkaido Amur slab flexure [Rasskazov et al., 2004].
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