Variation of Seismic Activity of Platform Regions Caused by the Ridge Push Force

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The plot of temporal variation in the seismic activity level of the 40˚-80˚N segment of
the Mid-Atlantic Ridge (MAR) over the period from 1917 through 1987 is rather similar in shape with an analogous plot for Fennoscandia (Skordas et al., 1991, *Tectonophysics*) and, as is shown in the present work, for the eastern part of the North American platform (NAP). However, the characteristic features of the MAR plot are repeated
with a ∼3-yr delay in Fennoscandia and with a 4-8-yr delay in the NAP. This positive
phase shift is consistent with the hypothesis on a significant dynamic control of a mid-ocean ridge (MOR) over seismic activity in adjacent platforms. This control is realized
via the MOR push force. Variations in this force induced by the nonstationary process
of dike intrusion in the axial zone of the ridge bring about migration of perturbations
in the stationary stress-strain state of the lithosphere away from the MOR and induce
seismic activity variations in platform regions adjacent to the MOR. The positive time
shift in plots of platform seismic activity relative to the corresponding MOR plot is explained in terms of the delay in the arrival of the stress perturbation wave at platform.
Due to energy dissipation in the asthenosphere, the amplitude of the wave significantly
attenuates during its propagation from the MOR. Using the Elsasser model and the observed time shift, an estimate $\eta=10^{17}$ Pa·s accurate to within $\pm 30\%$ is obtained for the
asthenosphere viscosity in the case under consideration. Such values of the viscosity
are sufficient to bring about the triggering effect of the stress-strain state perturbations
on platform seismicity. An increase in the obtained value of η by a few times would
lead not only to overly large traveltimes of the stress wave, but to the over-exhaustion
of its amplitude as well. The seismic activity would remain unaffected by such a wave

at distances of the order of 2000 km.

The examined numerical model is indirectly supported by the variation amplitude of seismic activity: as compared with Fennoscandia, this amplitude is lower in the central and eastern NAP, located farther from the MAR. On the other hand, the stationary seismicity level on the NAP is higher than in Fennoscandia, which can explained by the difference between stationary values of the shear stress intensities τ in the regions considered. The smaller stationary values of τ in Fennoscandia are due to that it is encompassed by the MAR trajectory to a greater extent than the NAP and thus more shielded against penetration of shear stresses (Mukhamediev & Grachev, 1998, *Izvestiya, Physics of the Solid Earth*).

Results of this work not only confirm the idea previously proposed by the authors according to which the MOR push force affects the stationary level of seismic activity in adjacent platform regions but also provide new insights into the mechanism of this effect in a nonstationary state.