ON THE WAVE NATURE OF SEISMODISLOCATIONS: RESONANCE MODEL (AS EXEMPLIFIED FROM EAST ASIA)

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The wave nature of the seismodislocations observed, obviously, should not give rise to doubts of specific character. By definition it is as such, so far as these dislocations express the character of manifestation of the wave seismic process at the surface. But from this it follows that the formation of seismodislocations should obey the regularities of these wave processes. The wave processes are widespread greatly in all the open systems, which are irreversibly developing. The conditions, as well as the forms of their display, are sufficiently diverse. Correspondingly, this impedes extremely giving the common definition which is non-contradictory. In this connection, it is expedient to quote the G. Whitham’s statement from the book «Linear and nonlinear waves» [1977]: «...to cover the entire range of the wave processes, it is more preferable to follow the intuitive concept on the wave as on a recognized signal, transmitted with a velocity from one part of the medium to another. Such a signal can be a disturbance of any type, for example, the maximum of a value or its sharp changes on condition that this disturbance is clearly distinguished».

Within the framework of the synergetic model all the processes occurring in the crust in the cyclic, pulsating and oscillatory regime, can be represented as the interrelated, chierarchically organized wave set. As for the permanently developing geological systems of the crust, the synchronism and interrelationship of the riftogenic and orogenic systems which are polar in terms of their final morphostructural manifestation, are considered as an expression of the wave character of their structuralization. In particular, for Late Mesozoic-Cenozoic, this was clearly displayed in East Asia [A.A. Kokovkin, 2003, 2004]. The seismic process, caused by the affect of local energy source- the earthquake epicenter on the open lithosphere system, is realized instantly in it slowly developing system in terms of geology, being accompanied by highly diverse dislocations from the viewpoint of morphology and intensity.

Development of the wave processes in the open self-organizing systems, which are relatively well-studied in thermodynamics, acoustics, aero- and hydrodynamics, obeys the nonlinear laws. Regimes «with exacerbation» formed under sharp increase of fluctuations of the regulative parameters of the system (temperature, concentration, pressure) due to feedback between the system and the environment are considered to be one of the characteristic nonlinearity manifestations [I.R. Prigozhin et al., 1986, 2002; E.N. Knyazeva, S.P. Kurdyumov, 1994]. The resonance effects are the most clearly expressed manifestations of these regimes. «The resonance effect is a sharp amplitude increase of the steady oscillations, taking place under approximation of the frequency $\omega$ of the external harmonic effect to the frequency $\omega_1$ of one of the natural oscillations of the oscillation system» (Phys. Encycl. Dictionary, MSE, 1965, V. 4, p.395.).

As follows from a great number of sources of information, a «running» seismic wave which is well-expressed at the surface accompanies a large enough natural or man-made seismic event. It is appreciably noticeable in the plain areas in the relatively homogeneous horizontally-lavered medium, particularly, in the riftogenic structures formed by loose flooded deposits. So, this phenomenon accompanied the 1957, Gobi-Hinggan earthquake and explosion at the DSS observation point in the Chu-Sarysuiskaya depression (1973). It appears that it is just the surface seismic wave resonance which leads to the occurrence of the major number of seismodislocations observed. The conditions of wave motion in the non-homogeneous medium at the contrasting «surface-to-air» interface are exclusively favourable for development of the resonance phenomena. The interface mentioned suggests the sharp seismic wave amplitude increase. The «rootless» character and regularity (with correction for the nonlinear process) of the resonance seismodislocations should be considered as their specific peculiarity. Particularly,
it is possible to observe regularity of such dislocations from the materials, which illustrate the character of destruction at Spitak and Neftegorsk catastrophic earthquakes.

The dislocations, revealed by the author in the upper layers of the Pleistocene and Holocene deposits at the southwestern edge of the Khabarovsk-Khekhtsir system of the inversion uplifts are considered as the private example of the «rootless» seismodislocations (the flexure in combination with the vertical fault, displacement being to 1.2 m), [A. A. Kokovkin et al., 2004]. The regularity is noted for these dislocations with 15-20 m distance at the Krugosvetka observation point. These dislocations can be related to the 1888 earthquake according to a range of indications [I. Mushketov and A. Orlov, 1893]. The «rootless» dislocations of the other type (fractures to 1 m thickness, pinching with depth) were observed in the Pliocene deposits in the southern edge of the same system of uplifts in the area of the Osinovaya Rechka settlement. Here they are filled with the Early Neolith deposits bearing traces of human civilization, for which the radiocarbon datings are available of 12500-9890 years [I.Ya. Shevkomud et al., 2001]. The analogous fractures occurring in the loose deposits (the thickness being to 4-8 m, while the depth being only 3-4 m) and the wave dislocations also, (which are positive by the form) are described for the 1957, Gobi-Altai earthquake [Solonenko V. P. et al., 1960]. In the last case, the definition quite corresponds to the nature of the phenomenon, though the authors put in only the structural-morphological sense in it.

Seismodislocations, being instantly formed in terms of geology have been developing in East Asia in the lineament-block inhomogeneity of the crust, at the background of the «slow» wave interaction of the riftogenic and orogenic systems acting in its upper part. The deep-fault zones structuralizing these systems develop according to the author’s model [A. A. Kokovkin, 2003, 2004] in the regime of reversed sense shear. It is just this factor which provides the high level of the spatial-temporal stability to the riftogenic and orogenic structures. The major active deep fault zones (the Stanovaya, Hinggan, Tan-Lu, Namurkhe), which control the lithosphere block displacement and earthquake epicenter locations, are distinguished for the significant thickness (to 100 and more km) and high degree of flooding, which determines specialization of their influence on the seismic process. Within these faults seismic waves cause stresses with dislocations, which are on a larger scale and more contrasting as compared to those in the enclosing lithospheric blocks. It is seen from the well-known paleoseismic dislocations in the Hinggan and Tan-Lu fault zones [V. P. Solonenko et al., 1989]. The resonant seismic wave causes a sharp compressional stress increase in the «non-compressible» flooded medium of the active faults. These stresses are accompanied by the corresponding dislocations. Earlier, [1973], the similar phenomenon has been identified by G. L. Pospelov as the effect of the «hydraulic wedge».