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Vortical Tectonics

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It is shown that lithospheric plates in their movement on Earth's surface do not undergo typical rotations, as was previously believed, but rather movements of more complicated type, namely vortical (or "whirl"). The specific character of vortical movements is reflective in next various structural-tectonic phenomena at global, regional, and local levels: 1. Propagating of axis of spreading with simultaneous whirling in the appropriate direction, which accompanies the opening of the oceanic basin independently of its size and age. Due to the high instability of rift-genesis and spreading processes, along with main "steam" of rift and spreading there are side "branches" branching off and developing. These are also characterized by vortical type of evolution, and they die out in time; 2. Formation of various scale "embedding" structures – into the smooth and rounded contours of oceanic basins, there are formed by vortical flow, as though a broken, stepped geometry of passive margins is embedded. This is, like segmentation of oceanic bottom, in general, the result of invariable presence of shear component inside a vortex; 3. Formation of tectonic stratification of the oceanic lithosphere, which appears as a consequence of differential rotation of various-scaled volumes of substances in a vortical flow. This causes the vortical differential of the oceanic lithosphere into particular lithospheric layers, which are moving relative to each other along a near-horizontal interface of surfaces; 4. The appearance of tension-compression deformations, cyclically superseding each other in time and space, in a zone of lithospheric accretion at crests of mid-oceanic ridges. The change is caused by the independent rotation of the crust's blocks being moved by vortical flow; here, the gradient of transition from compression to tension increases as the vortical system whirls; 5. Formation of structures of the Earth's crust, caused by the compressive tensions in the region of maximal whirling of vortical structures. The examples are submarine rises in the closing zones of the Easter and Juan-Fernandes vortical spreading systems at the crest of the Pacific Rise. Their nature is connected with the fact that, as the whirling of vortex progresses, the compression component grows; and the stronger the whirling is, the more intense the compressive tension are. Analogous to this, folded deformations within passive continental margin which are in concordance with regions of the closing of highly whirled vortical spreading system, appear. In general, the quantitative characteristics of such structural systems in the World ocean vary in more than two orders; i.e. lithospheric vortices are characterized by self-similarity.

The discovery of vortical movements and structures in the solid geospheres is evidence of concept of nonlinear, unstable geophysical medium. At the same time, due to exceptional duration of the formation of vortices in these geospheres, completely closed, matured vertical structures are rarely formed. Examples of the evolution of backarc basins in the junction zone of the Pacific Ocean and Eurasia are considered; these are evidence that energy vortical movements are sufficient to influence vitally the geodynamics of junction zone. It is suggested that the complex of lithosphere structures, being the result of vortical movements, can be considered within the specially marked out vortical tectonics, which is the key element of new geodynamical paradigm.