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A common feature in latitudinal dependence of different geophysical processes occurring on the rotating Earth

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The concept of an essential latitudinal dependence of different geophysical processes occurring on the rotating Earth was formed in the last decade. The objective of this work is to present a few statistically reliable regularities in the latitudinal distributions of the following geophysical phenomena: earthquakes, hotspots, and major and super major ore deposits.

Firstly we analyze time-latitudinal distribution of seismic events that have caused significant damage from 2510 B.C. to 2000 A.D (according USGS catalog). This distribution has abrupt peak in Northern Hemisphere (30º-45º) during all 4000 year interval. Then authors carried out data processing of the seismic events (about 250000 earthquakes with M $\geq$ 4, compiled from the ISC catalogue from 1964 year). We considered the distributions separately in six magnitude ranges (MR): 4.0<=M<4.5; 4.5<=M<5.0; 5.0<=M<5.5; 5.5<=M<6.0; 6.0<=M<6.5 and 6.5<=M and analysis was performed separately for each MR. Because of the fact that earthquakes are concentrated along the plate boundaries, earthquake number and released energy values are normalized by length of the lithospheric plate boundaries in the given interval of latitudes. It was shown that normed by this way seismic activity of the Earth is almost absent in the high latitudes, and has clearly expressed maximums in middle latitudes of the Northern (40°-50°) and Southern Hemispheres (25°- 40°) and the local minimum near the equator. These bimodal latitudinal distributions observed both for a number of seismic events and for the released energy values. It was shown stability of the obtained bimodal distributions in time and in space. Let us propose that EQs are distributed uniformly along the lithospheric plates and bimodal distributions emerge in a random manner from uniform distribution. Then average probability of occurrence of such bimodal distributions is 10-6 only.

Then we used published data of various authors [Stothers, 1993; Courtillot et al, 2003] to examine the hotspots spatial distribution. These distributions also display the same bimodal character (peaks on 20°S-30°S and 20°N-40°N, local minimum on 0° -20°N, and almost zero values at high latitudes). After that we analyzed geoinformation system “Largest Mineral Deposits of the World (Commission on Geological Map of the World, 2006), which was carried out under the direction of D.V. Rundkvist. Current version contains data about 1242 major and super major ore deposits. It was revealed that the latitudinal distributions of deposit number and deposit density (in 10 degree latitude belts) also has bimodal character: (peaks on 20°S-30°S and 40°N-60°N, local minimum on 10° -20°N, and almost zero values at high latitudes).

The similarity of latitudinal distributions for different geophysical phenomena points on the existence of the “critical latitudes” in the Earth. The existence of the critical latitudes (at $\pm$35º) in the atmosphere and hydrosphere of the Earth was shown before in [Monin, 1999]. The attempt to define what kind of the fundamental physical phenomena can be responsible for the formation of anomalous latitudinal zones in the Earth’s interior was made in [Levin et al, 2012].