



## **Mechanism of regression, transgression and inversion of the sea level in geological history**

Yu.V. Barkin

Sternberg Astronomical Institute, celestial mechanics and gravimetry department, Moscow, Russian Federation  
(barkin@inbox.ru, 07-495-9328841)

1 Base mechanism. The base mechanism of fundamental geological changes of ocean (its transgression and regression, and also the observably phenomenon of inversion of sea levels and opposite parts of ocean) is the mechanism of inversion deformations of the Earth surface (and the bottom of ocean) due to gravitational action of the Earth core displacing relatively the deformable and changeable mantle. In present the core executes the polar drift in northern direction and as consequence of mentioned mechanism is observed a redistribution of the ocean and atmospheric masses from southern hemisphere to the northern hemisphere [1, 2]. The geodynamic model according to which the basic mechanism responsible for fundamental geological changes of ocean: its transgressions and regressions, and also the observably phenomenon of inversion of levels of the seas and corresponding parts of ocean is the inversion mechanism of deformations of a surface of the Earth (and a bottom of ocean). An action of this mechanism occurs on a background of moving of lithosphere plates and global relative turns of the core and mantle and is accompanied by slow inversion tides between the hemispheres of the Earth organized by a gravitational attraction of superfluous mass of the core, slowly drifting (wandering) relatively to a viscous-elastic and thermodynamically unstable mantle [1-3]. Modern geodetic methods and satellite altimetry observations give all new confirmations, that the specified geological processes occur both in present period and actively occurred in the last geological epoch.

2 Inversion of a sea level in opposite hemispheres of the Earth. An explanation of a possible simultaneity of the phenomena of regression and transgression. According to developed geodynamic model the modern trend of the core in the direction of North Pole causes both atmospheric tides in northern hemisphere, and similar oceanic inversion tide [3]. This tide is observed in present period, and also proves in longer time scales, including geological. The data on change of a level of ocean, on the flooded continental areas testify to it etc. in Phanerosous and other periods [4]. As a major factor of inversion changes of sea level the deformation of a surface of the Earth and, in particular, a bottom of ocean acts. So in present period the southern hemisphere of the Earth is extended, while northern does not show the obvious tendency to change of the average radius [5]. In the result, superseded waters of ocean result in fast increase of an average level of ocean with speed about 1.5 mm/yr (the contribution of deformation of a bottom is estimated by us approximately in 0.8 mm/yr). Thus we expect contrast inversion behavior of mean sea levels of ocean in northern and southern hemisphere (various average velocities). The similar phenomena should be observed in longer time scales. Variations of a mean sea level, contrast variations of mean levels of ocean in opposite hemispheres of the Earth with Milankovitch's periods (the periods of planetary secular perturbations), and also with the geological periods [4] should be observed, for example. At an extreme displacement of the core (aside hemisphere with a primary arrangement of continents) the tectonics will be slowed down (the original periods of standing). To these periods there corresponds just the greatest tide to continents and, accordingly, the greatest flooded area.

Tidal waters, redistributed in the hemisphere occupied with continents, are forced will be redistributed at coast and to occupy more and more high levels of standing. Increasing deformation of a bottom of an oceanic hemisphere results in replacement of oceanic waters in an opposite hemisphere. That results in additional rise of a mean sea level. If continents are located in opposite hemispheres, that, naturally, they will test simultaneously various tendencies by way of flooding of continental territories (inversion in changes of a level of ocean). Nevertheless, the tendency can be expressed clearly enough if continents are mainly located in a hemisphere on a course of displacement of the core. Thus, the explanation to the known observant facts which conducting geologists of time Shatskii

(1955) and Yanshin (1973) [4] specified here is actually given. These scientists believed, that transgressions and regressions of ocean in various sites of its coast could occur and simultaneously, being determined by development of structures of an earth's crust therefore significant sites of coast could rise or fall simultaneously. We can specify this position: sites of rise and lowering of coast mainly settle down in opposite hemispheres [6].

3 Synchronism and inversion of variations of levels of Caspian sea and global ocean in the last of 400 thousand years. The offered model of geodynamics allows to explain the full synchronism established earlier in time of glacial epochs of Northern hemisphere, transgressions of Caspian sea and generally-planetary regressions of world ocean [3]. An inversion of hydrological cycles in last 400 thousand years is precisely established in [4]. The global sea level and a level of Caspian sea change in antiphase and synchronously. A synchronism of inversion peaks of activity is precisely shown in epoch: 20, 55, 115, 175, 225, 315 thousand years back. In our terminology - the specified processes have a inversion character. The matter is that Caspian sea is situated in northern hemisphere and global ocean is located mainly in opposite southern hemisphere of the Earth. In rough approach it is possible to accept northern hemisphere - a hemisphere of Caspian sea, and a southern hemisphere where the basic oceanic masses have settled down, - a hemisphere of ocean. The core is cyclically displaced along an axis of the specified hemispheres. At displacement in northern direction there are also tectonic changes and water accumulation in northern hemisphere which reach Caspian sea are forced. And tides here in some times higher, than similar increase of an mean level of all world ocean. Thus waters of ocean from a southern hemisphere are redistributed in northern hemisphere where they meet high coast. Hence, the level of ocean at coast zones starts to grow, reaching on the big intervals of time in tens thousand years of enormous marks in hundreds meters.

If formally to apply the theory of inversion tides caused by displaced gravitating core [2, 3], for the specified periods of time in hundred thousand years it is possible to give a rough estimate of displacement of the core for variations of a level of Caspian sea with amplitudes about 50-60 meters and world ocean with amplitudes about 80-90 meters. To these variations there correspond displacements of the centre of mass of the Earth (with amplitude about 150 meters). The appropriate displacement of the centre of mass of the core relatively to the centre of mass of elastic mantle is estimated thus in 750 - 800 meters. The mean velocity of displacement of the core (during 100 000 years) thus is rather small and makes about 8 mm per one year. In the peak periods of fast change of levels of Caspian sea and ocean this speed can achieve 40 mm/yr and more that is close to modern value of velocity of secular drift of the centre of mass of the Earth about 30 mm/yr [2, 3]. The work has been fulfilled in framework of RFBR projects N 07-05-00939 and CGP-RFBR N 09-05-92507.

#### References

[1] Barkin Yu.V. (2002) An explanation of endogenous activity of planets and satellites and its cyclisity. *Izvestia sektsii nauk o Zemle Rossiiskoi akademii estestvennykh nauk*. Vyp. 9, VINITI, pp. 45-97.