Effect on Plate Motions caused by Meteorite Collision at K-T boundary

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It is believed that Meteorite collided at Yucatan Peninsula of Mexico at the Cretaceous to Tertiary (K-T) boundary, and formed crater. The meteorite collision might affect the Plate motion.

K-T boundary at 65Ma locates in the interval of the last 85 million years when the Plate motions can be traced back continuously based on the banded marine geomagnetic anomalies, later than magnetic quiet zone. The quantitative analysis on the Plate Dynamics across the K-T boundary has been carried out based on the difference rotation of stage rotations of Plate motions with 5 millions intervals and moment tensor of inertia of plates.

The dynamics on rigid body can be applied on motion of Plate. Plate motions are constrained on the Earth surface. The constraint is simulating as motion of dish (bowl or plate) on the surface of sphere where gravity is directing toward the center. All motions of dish on the sphere are rotations around axes passing through the center of sphere. The force of the rotation relates with the maximum of inertia corresponds to a rotation for motion along long axis, the intermediate to a rotation along short axis, and minimum to a rotation around centroid. When the direction of force at the stressed point on the dish coincides with the direction for the centroid, the force induce a rotation for motion of centroid, and when the direction of force is orthogonal, the force induce a rotation around centroid. For arbitrary directional force is composition of rotations for motion of centroid and around centroid correlated with the orthogonal components. The rotation around centroid is proposed with the distance from the stressed point to centroid, and the rotation for motion of centroid related with the direction to the long and short axes. The force can be calculated with the change in the rotation, the inertia and the position of stressed point on dish.

The moment tensor of inertia can be calculated for irregular shaped Plate, using the outline and position. The Eigen values and vectors are correlated with the maximum, intermediate and minimum inertias and the principle axes. The analysis on the force for change in Plate motion on the Earth can be realized with the inertia like as the dish motions on sphere.

Before 65 Ma in the 65-70Ma interval, total rotation of global plates 4.7 was cancelled out to 5% 0.2 of net rotation by Pacific Group of PC, FA, and KU plates and Continental Group of EA, AF, ID, AN and AU plates.

After 65 Ma in the interval of 60-65 Ma, the total rotation reduced to 4.0, however, the net rotation increased to 0.9 of 22 %. The plate motion of PC was decelerated, and FA was accelerated.

The changes of rotations at 65 Ma on the other all plates excluding EA, NA, and ID have same trend as PC and FA. The change on EA & NA and ID are independent from the global changes. The Euler poles EA & NA and ID located antipodal. ID decelerated and EA & NA accelerated. Closing of the Euler poles of EA and NA indicates the incomplete opening of north Atlantic and EA & NA changed as one body.

The longitudes of stressed points can be calculated as 58E for EA & NA and 69E for ID under the assumption for the latitude to be 17N as same as their plate boundary. The calculated points are enough close to treat as common stressed point. Stress directions and torques (inertia x rotation angle in radian) can be calculated at the points as N15W 0.0055 for EA & NA and S3W 0.0035 for ID which are opposite and support rebound of Indian collision to Eurasia with North America. The torque is about half of the torque of 0.0104 for PC which is maximum in the global change.

The Euler pole of NA located 4 degree north of Euler pole of EA. The candidate course of the stressed point for the rotation of NA for the difference can be calculated within 30 degree from Yucatan Peninsula. The torque is calculated as 0.0002, which is 4% of Indian collision.