Neotectonic setting of the North American plate in relation to the Chicxulub impact.

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The neotectonic setting of the North American plate (NAP) is mapped using terrestrial geophysical data with geographic information systems. NASA's GPS records of crustal plate motion show rotation of the NAP and the Caribbean plate about a hub that is circumferential to the Chicxulub impact crater (~65 Ma). Outboard rings of crustal uplift and subsidence occur at punctuated intervals from the hub center where plate convergence involves multiple subduction zones in the Central American region. The vertical component of current plate motion on Earth is delineated utilizing a triangulated integrated network surface. Currently rising and subsiding areas in the NAP continental interior reflect the multi-ring basin architecture, as do regional Bouger gravity anomalies in the west-central Atlantic. A scatter plot of the horizontal component of plate motion for the NAP vs. distance from impact shows an abrupt increase in plate motion at 2900-km, the same distance from impact as the depth to the core-mantle boundary. The impact produced multi-ring percussion structures in the NAP with crustal arches centered about 1600 and 2900 km from impact, both distances corresponding to active intraplate seismogenic zones, and the latter distance corresponding with the Laramide and Adirondack epeirogenic uplifts. NAP sub-plate boundaries may involve zones of crustal fracturing and faulting lying above mantle-rooted structures having the geometry of spherical percussion shells. A geometric model of crustal rotation and associated fractures preceding and following the impact is consistent with overlapping fracture systems mapped in the Triassic-Jurassic Newark basin. The model depicts a switch in NAP rotation polarity and regional stress from clockwise extension preceding impact to counterclockwise compression postdating it. The NAP plate rotation pole also flips from high northern latitudes before impact to an equatorial position afterwards. If this hypothesis is confirmed, impact tectonics is certain to play an important role in plate tectonic theory by elucidating large epeirogenic crustal episodes, as well as effecting wholesale changes in regional plate dynamics.

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