Polar wandering on dwarf planet Ceres revealed

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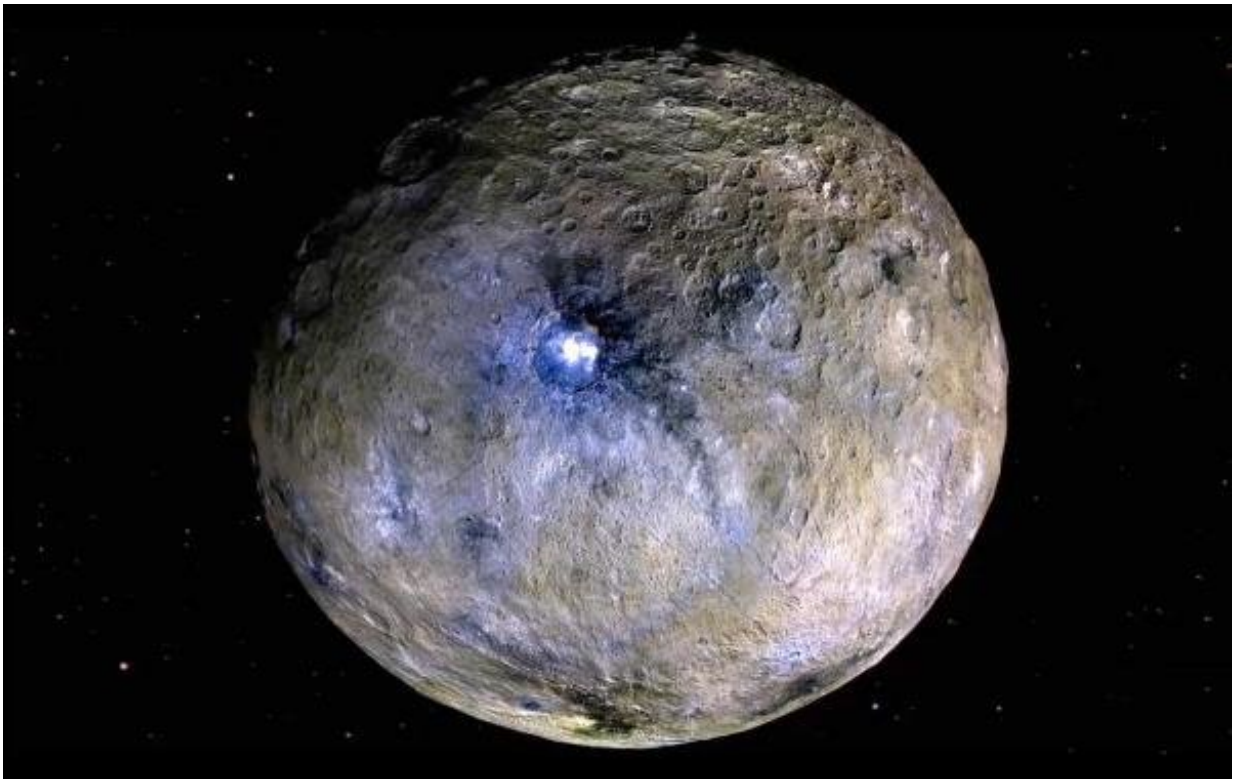

Credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

Dwarf planet Ceres experienced an indirect polar reorientation of approximately 36 degrees, a new paper by Planetary Science Institute Senior Scientist Pasquale Tricarico says.

Tricarico's paper "True polar wander of Ceres due to heterogeneous crustal density" appears in *Nature Geoscience*.

Using data from NASA's Dawn mission, Tricarico determined the magnitude of the reorientation with three independent and corroborating lines of evidence. Global Gravity Inversion, from a paper Tricarico published in 2013, helped determine the density variations of Ceres, especially in the crust. This is what was used to find the equatorial density anomaly. Statistical analysis of topography was used for ridge analysis and the paleo-pole. And for matching the crustal fractures, a well-proven method by Matsuyama and Nimmo was used.

"The most surprising aspect of this paper is to me the observation that the pole of Ceres must have followed an indirect path to its current pole. A multi-step reorientation could mean that the equatorial density anomaly was still evolving during the reorientation, and this could be because the crust and mantle were weakly rotationally coupled, allowing the crust to start reorienting while the mantle would lag behind," Tricarico said. "If crust and mantle are allowed to shift with respect to one another, that could point to a layer of reduced friction between crust and mantle, and one of the possible mechanisms to reduce friction could be an ancient water ocean beneath the crust."

The Dawn mission has orbited Ceres for more than three years, gathering very detailed observations and allowing the construction of detailed geophysical models. These detailed models can then be adapted for comparison to other icy bodies, Tricarico said. One such example is the parallel between the well-known equatorial ridge of Iapetus, the moon of Saturn, and the remnants of the paleo-equatorial ridge of Ceres.

More information: P. Tricarico. True polar wander of Ceres due to heterogeneous crustal density, *Nature Geoscience* (2018). DOI: 10.1038/s41561-018-0232-3