SPIRAL FEATURES AND THE CORIOLIS EFFECT ON VESTA'S BASIN RHEASILVIA.

K. Otto[1], R. Jaumann[1,2], K. Krohn[1], K.-D. Matz [1], F. Preusker[1], T. Roatsch[1], F. Scholten[1], I. Simon[1], K.Stephan[1], C. A. Raymond[3] and C. T. Russell[4], [1]Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institute of Planetary Research, Germany (Rutherfordstraße 2, 12489 Berlin, (katharina.otto@dlr.de), [2]Institute of Geosciences, Freie Universität Berlin, Germany, [3]California Institute of Technology, Jet Propulsion Laboratory, Pasadena, USA, [4]Institute of Geophysics and Planetary Physics, University of California, Los Angeles, USA.

Introduction: The Dawn space craft orbited asteroid Vesta for one year arriving in August 2011 [1]. The on-board Framing Camera (FC) collected image data with a resolution up to 20 m/pixel [2]. Stereo images from the High Altitude Mapping Orbit (HAMO, 60 m/pixel) were used to construct a Digital Terrain Model (DTM) of Vesta's surface [3].

The FC images and the DTM revealed a large impact basin in the southern hemisphere, named Rheasilvia. Rheasilvia's central peak located at 75°S and 301°E nearly coincides with Vesta's south pole. Its diameter of about 500 km has the dimension of Vesta's diameter (525 km) [2, 4]. This and Vesta's relatively short rotation period of 5.3 hours indicate that the Coriolis force is likely to have an effect on mass motions within the Rheasilvia basin [5]. Indeed, a pervasive spiral deformation pattern has been observed [6].

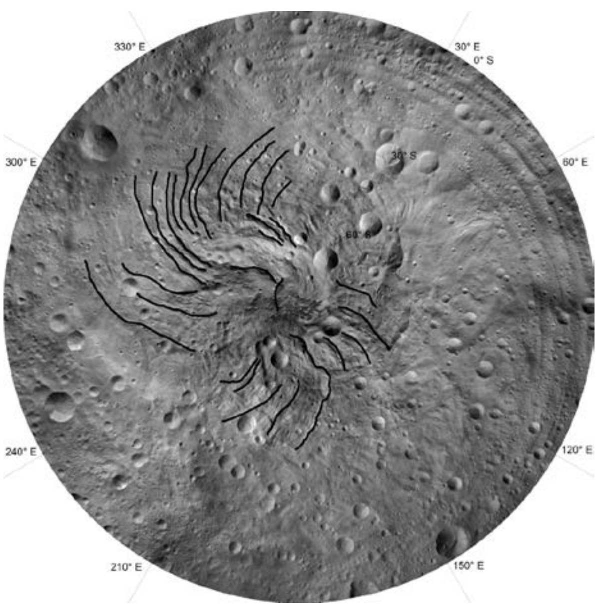

Figure 1: **S**piral pattern in Vesta's southern hemisphere. Shown is a stereographic projection (equal angle) on a sphere of 255 km.

The Coriolis Effect: The Coriolis force is a fictional force associated with rotating systems. The rotation deflects the motion perpendicular to the rotation axis to cause curved trajectories. The Coriolis force F_C is given by

$$\vec{F_C} = -2m\vec{\Omega} \times \vec{v} \qquad (1)$$

where m is the mass of the moving body, Ω the angular velocity of the rotating body and v the velocity of the moving object. The trajectory of a mass moving in the horizontal plane on a rotating sphere is described by a circle with inertial radius R. The inertial radius is dependent on the magnitude of the velocity v, the latitude ϕ and the magnitude of the angular velocity Ω. It is given by

$$R = \frac{|\vec{v}|}{2|\vec{\Omega}|\sin\phi}. \qquad (2)$$

Note that the radius is only dependent on the speed of the moving body but not on its mass. Solving Eq. 2 for the velocity v yields

$$|\vec{v}| = 2R|\vec{\Omega}|\sin\phi. \qquad (3)$$

Method: We mapped the most prominent curved features of the spiral deformation pattern in the Rheasilvia basin and used the data to calculate their three dimensional location. A reference spheroid of 285 km by 229 km was used to approximate Vesta's shape and to determine the three dimensional location. At each point along a curved feature we approximated a circle and determined the inertial radius R. Knowing the angular velocity Ω, the latitude ϕ and the inertial radius R, we calculated the velocity of the motion using Eq. 3.

Results: The velocities were plotted against the DTM profile of each feature. We analysed the correlation of elevation and velocity to find implications for the mass wasting type.

References: [1] Russell, C. T. et al. (2013) Dawn completes its mission at 4 Vesta, *Meteorit. Planet. Sci.*, 1-14. [2] Jaumann, R. et al. (2012) Vesta's shape and morphology, *Science, 336*, 687-690. [3] Preusker, F. et al. (2012) Topography of Vesta from Dawn FC stereo images, *EPSC 2012*, Abstract epsc2012-428-1. [4] Russell, C. T. et al. (2012) Dawn at Vesta: Testing the protoplanetary paradigm, *Science, 336*, 684-686. [5] Jutzi, M. et al. (2013) The structure of the asteroid 4 Vesta as revealed by models of planet-scale collisions, *Nature, 494*, 207-210. [6] Schenk, P. et al. (2012) The geologically recent giant impact basins at Vesta's south pole, *Science, 336*, 694-697.