



Tectonic features on Saturn's satellites Dione and Rhea: Morphology and stratigraphy derived from Cassini ISS images

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Introduction: The second- and fourth-largest satellites of Saturn, Rhea (1528 km in diameter) and Dione (1124 km), harbor old, densely cratered surfaces but also show evidence of resurfacing through tectonism in the images taken by the two ISS cameras aboard the Cassini spacecraft since July 2004. On Dione, tectonic features are more widespread than on Rhea implying that geologic activity has been going on for a longer time, whereas on Rhea tectonic activity may have ceased early in its history. The tectonic inventory of both satellites incorporates (a) troughs (graben), (b) scarps, (c) ridges, (d) lineaments, and (e) plateaus on Dione. **Procedure:** In this paper we focus on the stratigraphic sequence of events which created these tectonic landforms, independent of specific stress origins which are the topic of further work. Our investigation is based on the global ISS image coverage at regional (150 – 500 m/pxl), and, for selected target areas, at high-resolution scale (< 50 m/pxl). Relative ages of tectonic landforms are constrained by (1) cross-cutting relationships, (2) by their degree of degradation, (3) and by their superimposed crater frequency. On Dione, the image resolutions are sufficient to examine stratigraphic relationships between tectonic features while on Rhea the areas affected by tectonism could not yet be observed so far at regional or high resolution. **Stratigraphy:** On both satellites, densely cratered plains are the dominant geologic units with inferred high ages of $\sim 3 - 4.2$ Gyr from cratering chronology models. Degraded, densely cratered graben in the high northern and southern latitudes on Dione were formed early in its history. On Rhea, ridges seen in stereo data also appear to be rather old features. Troughs and graben on Rhea's trailing hemisphere could be old, but further regional- and high-resolution imaging is needed for detailed investigations. On Dione's trailing hemisphere, a stratigraphic sequence of horsts, graben and scarps has been derived by mutual crosscutting and truncation. Three age groups can be observed: (1) Clusium and Carthage Fossae are the oldest, truncated by (2) Eurotas and Palatine Chasmata which in turn were truncated by (3) Padua Chasmata representing the youngest set of troughs. Time and duration of tectonic activity on the two satellites is difficult to determine because of uncertainties in cratering chronology models. In the Eurotas Chasmata region, for example, cratering models suggest either older tectonism of about ~ 3 Gyr, or even younger events of about ~ 1 Gyr. No age determinations of tectonic events on Rhea have been made so far due to lack of sufficient image coverage.