RECENT RESULTS OF THE GALILEO SSI CAMERA FROM SPACECRAFT ENCOUNTERS WITH GANYMEDE AND IO.

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Ganymede: The Galileo G28 close encounter provided an opportunity to obtain very high resolution images, context frames, and stereo data. Five targets were chosen to address fundamental outstanding questions raised by Voyager and earlier Galileo results about geological processes, origin of features, and history[1].

1) What is the nature of dark terrain at very high resolution? Returned images (28 m/pxl) from a typical region of Nicohlson Regio show evidence for extensive cratering at all scales, abundant fracturing and no evidence for dark terrain volcanism. Impact craters have a wide range of degradation states, and impact cratering appears to be the dominant style of resurfacing.

2) What is the nature of the smoothest regions of bright terrain, and the relative roles of tectonism and cryovolcanism? Returned images (16 m/pxl) from an unusually smooth (at Voyager resolution) region of Harpagea Sulcus show that the smooth area is very rough and heavily pitted by small craters and contains relatively common, but degraded, linear elements; this smooth terrain is clearly cut by younger grooved terrain along its eastern margin. Thus, some of the smoothest terrain appears stratigraphically old and very degraded; no definitive evidence for cryovolcanic resurfacing is observed.

3) What is the detailed nature of the bright terrain/dark terrain transition and how is dark terrain converted to bright terrain? Returned images (22 m/pxl) from a key area at the western boundary of Harpagia Sulcus with Nicholson Regio show a 28 km wide zone of 16 sawtooth-like curvilinear scarps facing the bright terrain; these scarps are interpreted as representing normal faults. The bright-dark terrain boundary at Voyager and Galileo context resolution is in the middle of this zone, with the distinctive boundary representing a prominent trough; this zone is parallel to other zones of deformation in the dark terrain. Tectonic deformation in the bright terrain is abundant in the context image but the bright lane in the high-resolution data shows several smooth patches and hummocks; this could be possible evidence of cryovolcanic resurfacing.

4) What is the nature of caldera-like features at high resolution and is there any supporting evidence for cryovolcanism? Returned images (66 m/pxl) from a region of caldera-like features in bright terrain in eastern Nicholson Regio show arcuate scarps, which do not appear to be related to impacts, which are surrounded by bright grooved terrain and some bright lanes; the data show evidence for variations in smoothness, with some of the smoothest areas inside the caldera-like feature, but linear features are still prominent in all areas. No flow fronts or lobate-like features suggestive of volcanic emplacement of bright material are seen.

5) What is the nature of very smooth bright lanes and their relation to grooved terrain and dark terrain? Returned images (35 m/pxl) from Arbela Sulcus show that the bright lane has linear structures parallelling the margin of the lane virtually throughout and no evidence for flow fronts or lobate-like features. Arbela Sulcus and the bright lane appear to have formed through a combination of normal faulting and shear, with evidence for both left- and right-lateral movement, apparently extensive in places.

Together, these new data provide evidence that smooth terrain on Ganymede can be old and can be formed by tectonic processes and subsequent degradation by mass wasting and impact. Significant shear deformation also appears to be involved[2]. Analysis of stereo data is underway to assess these new aspects of bright terrain formation and some of the potential evidence of cryovolcanic activity.

Io: Io was imaged by the Galileo spacecraft during three flybys (I24, I25, I27) in late 1999 and early 2000. The flybys brought the spacecraft within a few hundred km of the surface of Io, allowing for very high-resolution imaging. Repeat observations of several volcanic centers were obtained, showing long-lived repeat eruption. The Prometheus and Amirani flow fields are being emplaced by mechanisms similar to pahoehoe lava flows on Earth. However, the eruptions fail to produce shield volcanoes, rather forming paterae with irregular and angular boundaries. Io's unique tectonics and composition are closely related to the formation of paterae. Very high-resolution images of the flows lack evidence of high-viscosity morphologies, suggesting that the lavas are high-temperature, low viscosity and Mg-rich. The dense mafic to ultramafic lava flows could possible follow fractures, erupt, and flow down slope.

The imaging sequence also targeted mountains and large plateaus, both of which are ~40% of the time in contact with paterae hinting at a possible genetic link between the two. The styles of formation and degradation of the mountains and plateaus is under investigation, as well as their possible association with paterae. With a few exception, details of slope modification on Io generally are not obvious in Voyager images. Voyager 1 images of Io revealed steep slopes on the flanks of isolated mountains, along interior walls of calderas, and as scarps within plains units. The I24, I25 and I27 Io observations show several distinct degradation styles of slopes associated with mountain sides, caldera walls, and plateau margins, but degradation style does not always correlate directly with tectonic or volcanological setting. Galileo images of the Tvashtar Catena and the Zal Patera region's show four successive and degradation morphologies form the scarps of the plateaus and that mobilization of volatile material has an important role in mass wasting. Disaggregation from chemical decomposition of solid S20 and other polysulfer oxides may conceivably operate on Io. The textures of the bright plains, apparent sapping alcoves, the presence of bright fresh flows, and the long-lived Prometheus-type plumes all suggest that the extensive plains are rich in volatiles such as SO2 or other sulfurous material [3]. A portion of the Chaac caldera scarp was imaged at ~9 m/pixel showing that the scarp consists of a steep cliff-forming member, as well as gullies with talus deposits. A few very high-resolution images (5-20 m/pixel) illustrate the geological complexity of Io's bright plains. An unusual texture is apparent at this resolution that could result from the eroding and/or sublimation of volatile material.

References: [1] Head, J., et al. (2000) AGU, Abstracts with Programs; [2] Collins, G., et al., (2000) AGU, Abstracts with Programs; [3] McEwen, A., et al. (2000) AGU, Abstracts with Programs.