

## CALDERAS (PATERAE) ON JUPITER'S MOON IO

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Jupiter's moon Io is the most volcanically active body in the Solar System. Paterae – features defined as irregular craters, or complex craters with scalloped edges – are the most ubiquitous volcanic construct on Io's surface [Radebaugh et al. 2001, *JGR*, 106, 33,005-33,020]. Ionian paterae are interpreted as calderas or pit craters. Observations from the Galileo spacecraft have shown that many Ionian paterae are volcanically active and that activity is often confined to the interior of the crater or caldera, with no apparent lava flows spilling out over the edges. We use observations from Galileo's Near-Infrared Mapping Spectrometer (NIMS, spanning the wavelength range 1-5 microns) to examine the distribution of thermal emission at several paterae, how the thermal emission has varied with time, and the implications for eruption styles on Io. Galileo's close fly-bys of Io from 1999 to 2001 have allowed NIMS to observe the volcanoes at relatively high spatial resolution (1-30 km pixel). At these scales, several of the paterae reveal greater thermal emission around the edges, which can be explained as the crust of a lava lake breaking up against the caldera or crater walls, similar to what has been observed at lava lakes on Earth. Comparisons between the NIMS data with images obtained by Galileo's camera show that lower albedo areas (which on Io are generally indicative of young lavas) coincide with the higher thermal emission areas on NIMS data and support the lava lake interpretation at these paterae. At other paterae, however, thermal emission and features in visible images are more consistent with lava flows spreading out over a solid caldera or crater floor, indicating that the predominant eruption style varies among paterae. Identifying eruption styles on Io is important for constraining resurfacing rates and interior models. Large lava flows and explosive eruptions producing giant plumes have been identified on Io, but our results indicate that lava lakes within calderas are likely the common style of activity. Ionian lava lakes appear to be long-lived, lasting from years to a decade or more. Persistent lava lake activity has important implications for the interior of Io, as it suggests open systems with ready access to magma, which on Io possibly exists in the form of a magma ocean underneath the crust [Kezthelyi et al. 1999, *Icarus* 141, 415-419].