

## Lava Lakes on Io

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Jupiter's moon Io is the most volcanically active body in the Solar System. The Galileo spacecraft spent nearly 8 years orbiting Jupiter, making several close passes of Io and obtaining numerous observations in visible and IR wavelengths that have led to a new view of Io's volcanic eruptions. We now know of at least 166 active volcanic centers on Io's surface and that three major eruption styles exist: long lava flows, violent fire fountaining and explosive events, and lava lakes confined within Io's many paterae. Paterae – features defined as irregular craters, or complex craters with scalloped edges – are the most ubiquitous volcanic construct on Io's surface and are interpreted as calderas or pit craters. Galileo infrared observations have shown that many paterae are volcanically active and that activity is often confined to the paterae's interior. We used 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. Several paterae viewed at high spatial resolution by NIMS 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 and images obtained by Galileo's camera support the lava lake interpretation at these paterae. However, Io's largest patera, Loki, appears to behave differently from a typical terrestrial lava lake: in terms of lava production rates, eruption frequencies and thermal output, Loki appears to be similar to a superfast spreading mid-ocean ridge on Earth. 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 how Io is resurfaced, and also for Io's interior, as it suggests open systems with ready access to magma.