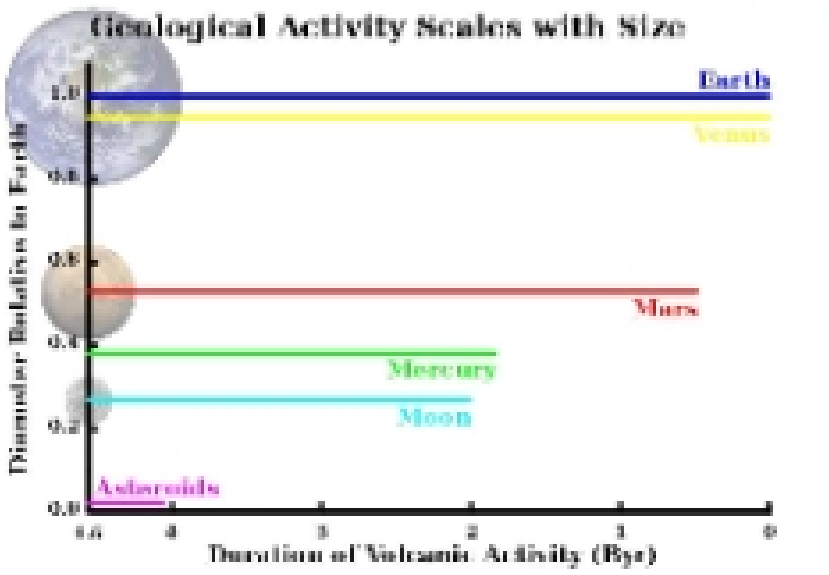
Question of the Day

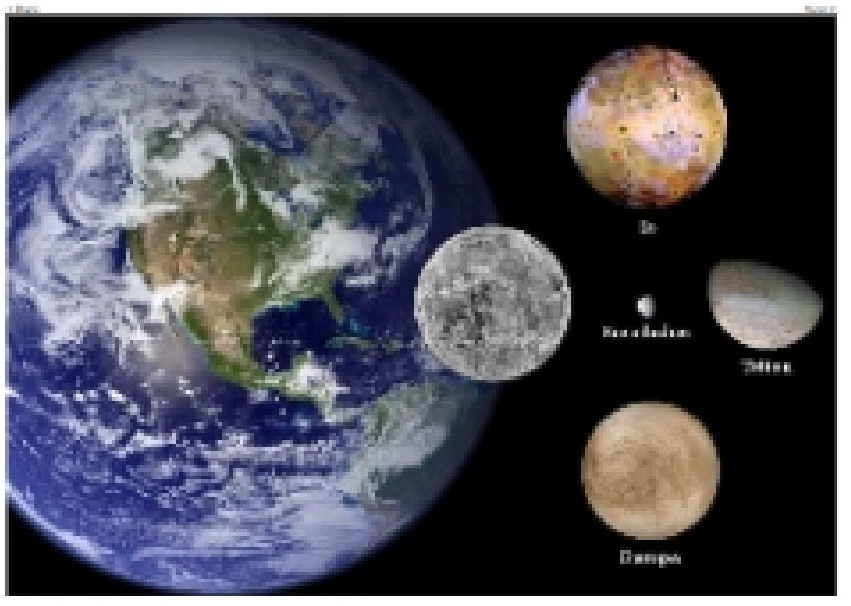
Outer Worlds III - Active Worlds

Io (J) **Europa (J)**

Enceladus (S) **Triton (N)**

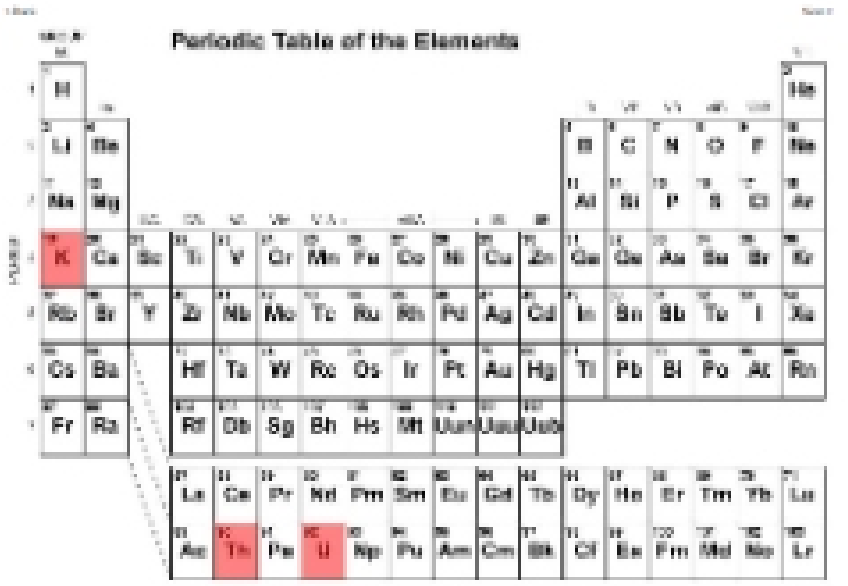
- **Why are they so geologically active?**
- **How are Io's volcanoes similar/different from volcanoes elsewhere in the Solar system?**
- **Why might Europa be an interesting place to look for life?**
- **What processes have modified the surface of Triton?**



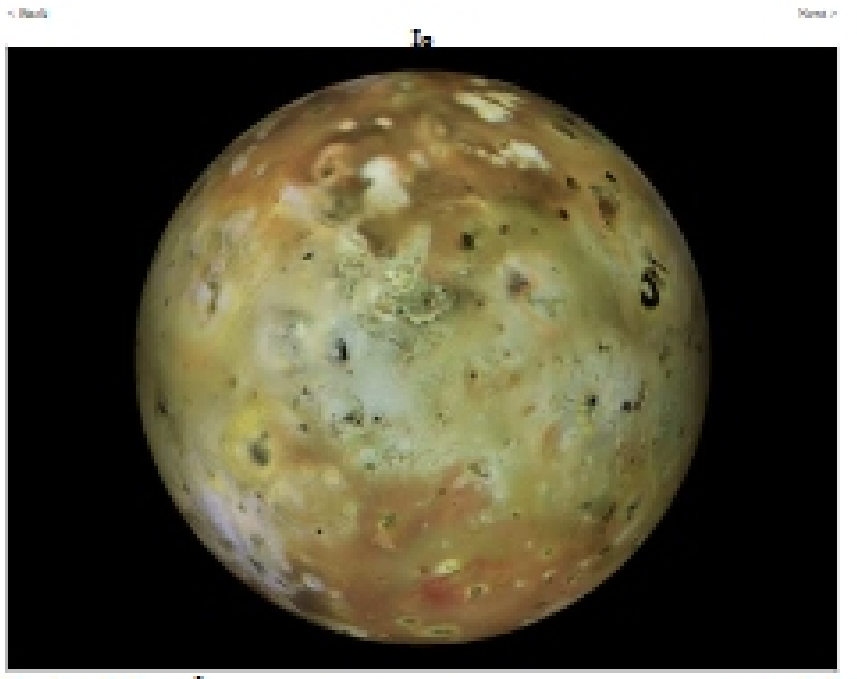


Worlds with D $\gtrsim$ 2000 km

Completly melt during formation

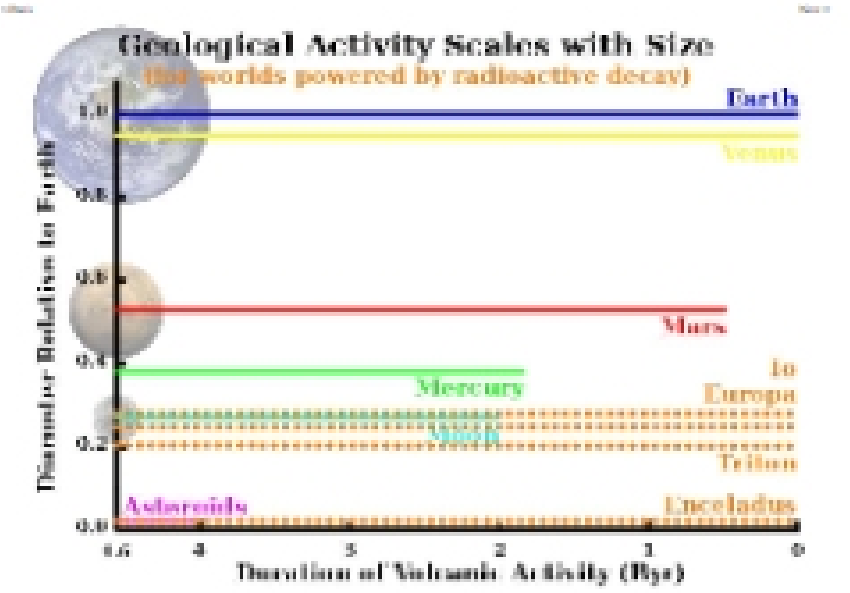

Periodic Table of the Elements

1


Io
Density = 3.53 g/cm³
Δ = 0.60

2

3


Geological Activity Scales with Size
(for worlds powered by radioactive decay)
Earth
Venus
Mars
Mercury
Io
Europa
Moon
Triton
Asteroids
Enceladus
Duration of Volcanic Activity (Gyr)

4

Melting of Io by Tidal Dissipation SCIENCE, VOL. 203, 2 MARCH 1979

Abstract. *The dissipation of tidal energy in Jupiter's satellite Io is likely to have melted a major fraction of the mass. Consequences of a largely molten interior may be evident in pictures of Io's surface returned by Voyager 1.*

The free eccentricity of Io's orbit is approximately 0.0001 (1). If this eccentricity accounted for all of the variation in the Jupiter-Io separation, the dissipation of energy from tides raised on Io by Jupiter would be negligibly small (2), since Io is synchronously rotating. But the resonant structure of the Galilean satellite leads to forced eccentricities that are considerably larger than the free values. Although still modest by most standards, these forced eccentricities coupled with the enormous tides induced by Jupiter lead to magnitudes of tidal dissipation that are certainly important and may completely dominate the thermal history of the innermost satellite Io. We will first establish values of the forced eccentricities and later substitute these into an expression for the total tidal dissipation.

Voyager images of Io may reveal evidence for a planetary structure and history dramatically different from any previously observed.

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$$F_{\text{gravity}} \propto \frac{Mm}{d^2}$$

Strongly Depends on Distance