

Io's Volcanism: Similarities and Differences with the Earth and Moon,

Matson, D. L., Blaney, D. L., Johnson, T. V., Vecder, G. J., and Davies, A.

Galileo and ground-based data have produced a revolution in our ideas of how volcanism on Io operates. Io can be used as a model for how high eruption rate events evolve and how high heat flow and a lack of plate tectonics influence volcanic eruptions.

There is now overwhelming evidence that high temperature silicate volcanism dominates Io's volcanic activity (Belton et al. 1996, Science 274, 377-385, Blaney, D. L., et al. 1995, Icarus 113, 220-225, [Blaney, D.L. et al.; Davies A. G. et al.; LopesGautier, R., et al.; McEwen et al.; Spencer, J. R. et al.; Stansberry, J. A. et al. All in press GRL, 1997]; Vecder, G. J. et al., 1994, JGR Planets 99, 17095-17162).

Observed temperatures of erupting magmas are in excess of 1000 K and temperatures have been observed as high as 1500 K (Blaney et al. 1995, 1997; Davies, A. 1996, Icarus 124, 45-61; Howell, R. R. 1997, Icarus, 127, 439-446; Spencer et al. 1997, Stansberry et al. 1997). These high temperature magmas seem to be preferentially associated with the dark caldera features on Io (McEwen et al. 1997).

Observations of specific events have imply effusion rates of $10^5 \text{ m}^3/\text{s}$ (Blaney et al. 1995, 1997), which are similar to estimates of lunar eruptions (Head, J. W., and L. Wilson, 1981, LPSC XII, 427-429; Hulme, G. and G. Fielder, 1977, Philos. Trans. R. SW. London, Ser. A., 285, 227-234) and Hualalai (Baloga, S. and P. Spudis, 1993, LPSC XXIV, 55-56),

The source of Io's heat flow is tidal dissipation. Io's heat flow is 200 times larger than could be produced by radiogenic heating. Values for the Earth, Moon (which is about the same size as Io), and Io are:

	Power (W)	Heat Flow (W/m ²)	Urcy Ratio
Earth	4.42e13	0.087	0.6
Moon	7.58e11	0.02	0.9
Io	1.00e14	2.52	214

(Earth value- Pollack, H.N. et al., 1993, RcKkophys.31, 267-280; Lunar value- Langseth et al. 1976, Lunar Sciences VII, 474-475; Io value- Vecder et al. 1994). This work was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under contract to NASA.