# Supporting Online Material for 

## Flood Volcanism in the Northern High Latitudes of Mercury Revealed by MESSENGER

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SOM Text
Figs. S1 to S3

Background information is provided here on the major trends of wrinkle ridges in the northern smooth plains of Mercury (Fig. S1), on the sources and locations of images shown in Figs. 2 and 3, and on the crater size-frequency distributions shown in Fig. 4.

MDIS images used in Figs. 2 and 3 include the following:
Figure 2A is a mosaic of MDIS wide-angle camera (WAC) images EW0216111194G, EW0216154655G, EW0216328459G, EW0216154692G, EW0216111231G, EW0216328496G, EW0216328533G, EW0216285083G, EW0216111157G, EW0216067718G, EW0216024238G, EW0215850878G, EW0216154729G, EW0216067794G, EW0216024357G, EW0216067754G, EW0216285046G, EW0219011490G, and EW0216241538G. The mosaic is centered at $57.16^{\circ} \mathrm{N}, 115.48^{\circ} \mathrm{E}$, and north is indicated by the arrow.

Figure 3A is a mosaic of MDIS WAC images EW0216241574, EW0216328459, and EW0218969021. The mosaic is centered at $59.07^{\circ} \mathrm{N}, 109.86^{\circ} \mathrm{E}$, and north is up. Figure 3B is a mosaic of MDIS WAC images EW0216328459, EW0216241574, and EW0218841531. The mosaic is centered at $57.69^{\circ} \mathrm{N}, 113.58^{\circ} \mathrm{E}$, and north is up. Figure

3C is a mosaic of MDIS WAC images EW0216328496G, EW0216154692G, EW0216328459G, and EW0216154655G. The mosaic is centered at $56.24^{\circ} \mathrm{N}, 115.46^{\circ} \mathrm{E}$, and the direction of north is given by the arrow. Figure 3D is from MESSENGER EW0216458429G. Figure 3E is a mosaic of MDIS WAC images EW0212981818G, EW0213068758G, EW0213068737G, EW0213068716G, EW0213155678G, EW0213155657G, and EW0213242588G. The mosaic is centered at $78.62^{\circ} \mathrm{N}, 67.82^{\circ} \mathrm{W}$, and the direction of north is given by the arrow. Figure 3F is a mosaic of MDIS WAC images EW0211764860G, EW0211982155G, and EW0211982184G. The mosaic is centered at $82.89^{\circ} \mathrm{N}, 28.95^{\circ} \mathrm{W}$, and north is up. Figure 3 G is a mosaic of MDIS WAC images EW0212286395G, EW0212286421G, EW0212373314G, EW0212634088G, and EW0212634112G. The mosaic is centered at $81.50^{\circ} \mathrm{N}, 51.30^{\circ} \mathrm{W}$, and north is up.

In Fig. 4, two representations of size-frequency distributions are shown. The R plot is derived from a differential distribution $n(D)$, where $n$ is the number density of craters in a count area within an increment or bin of diameter $D$, after normalizing by a power law of slope -3 . Specifically, the plot depicts the $R$ value, defined as $R=n_{\mathrm{bin}}<D>^{3} /\left[A\left(D_{\mathrm{b}}\right.\right.$ $\left.D_{\mathrm{a}}\right)$ ], where $n_{\text {bin }}$ is the number of craters in the diameter range between $D_{\mathrm{a}}$ and $D_{\mathrm{b}}, A$ is the count area, and $\left\langle D>\right.$ is the geometric mean of $D_{\mathrm{a}}$ and $D_{\mathrm{b}}$, respectively. The cumulative plot depicts the number of craters $N(D)$ within a count area having a diameter $\geq D$. The locations of the craters included in the size-frequency distributions plotted in Fig. 4 are shown in Figs. S2 and S3.


Fig. S1. (A) Image mosaic showing MESSENGER MDIS and Mariner 10 coverage of the northern smooth plains area. Smooth plains are outlined in white (solid, certain; dashed, approximate). (B) Distribution of smooth plains in the high northern latitudes of Mercury, as mapped from MDIS image data. Smooth plains are outlined in black (solid, certain; dashed, approximate); exterior to smooth plains are intercrater plains and other older units. Major trends of wrinkle ridges on the smooth plains are shown as straight line segments. The locations of Fig. 2 and Figs. 3A-G (small boxes with letters) are indicated.


Fig. S2. Distribution of impact craters $>8 \mathrm{~km}$ in diameter in the northern smooth plains (Fig. 1). Image is centered at $72^{\circ} \mathrm{N}, 5^{\circ} \mathrm{W}$. The blue line denotes the boundary of the count area. See Fig. 4 for plots of crater size-frequency distributions.


Fig. S3. Distribution of impact craters $>8 \mathrm{~km}$ in diameter in the smooth plains interior to the Caloris basin. Image is centered at $32^{\circ} \mathrm{N}, 161^{\circ} \mathrm{E}$. The blue line denotes the boundary of the count area. See Fig. 4 for plots of crater size-frequency distributions.

