

The geology of Mercury: Results from the first two MESSENGER flybys of the innermost planet

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In 2008 the MESSENGER spacecraft made two flybys of the planet Mercury, collecting a wealth of new near-global science data. These data included observations of approximately 50% of the planet that had not been viewed by the Mariner 10 spacecraft during its flybys in 1974-1975. Many of the new observations were focused on Mercury's geology, including monochrome imaging at resolutions as high as 100 m/pixel, multispectral imaging in 11 filters at resolutions as high as 500 m/pixel, laser altimetry tracks extending over several thousands of kilometers, and high-resolution spectral measurements of several types of terrain.

We present an overview of the first inferences on Mercury's global geology from the MESSENGER observations. The new MESSENGER images and altimetry provide compelling evidence that volcanism was a widespread and protracted process on Mercury. MESSENGER observations show distinct spectral units as well as morphological evidence suggesting embayment and possibly pyroclastic eruptions. Preliminary measurements of impact crater size-frequency distributions suggest that plains material on Mercury's surface ranges in age from a time shortly after the end of heavy impact bombardment to as young as perhaps 1 billion years ago. Image and laser altimeter data reveal details of Mercury's global tectonic history, including confirmation that contractional features are the dominant global landform.

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