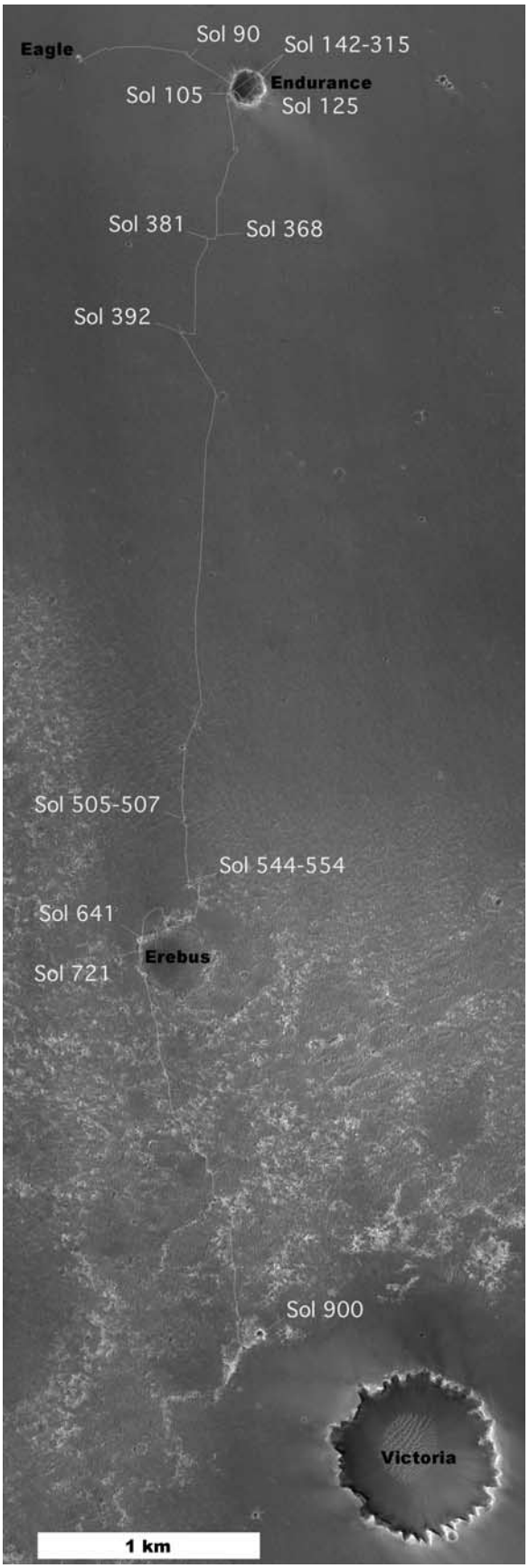

2.4. Calibration Accuracy

[16] The absolute radiometric accuracy of the Opportunity MI has been evaluated by comparing simultaneous images of the Martian sky obtained by Pancam and MI on sol 697. The radiance of the sky observed by Pancam and weighted by the spectral response of the MI is the same as the radiance measured by the MI to within 13%. The absolute radiometric calibration accuracy of the Pancam data is about 10% [*Bell et al.*, 2006]. We therefore conclude that the absolute radiometric accuracy of Opportunity MI data acquired through the first 3 extended missions is 20% or better [*Herkenhoff et al.*, 2004a].

[17] The relative (pixel-to-pixel) radiometric calibration accuracy is typically of greater interest to users of MI data, as it limits the ability to distinguish and measure small features in the images. On the basis of the results summarized above, the relative radiometric accuracy of well-exposed (>400 raw DN), calibrated MI data is ±1.5%. The error in overall bias/offset correction when reference pixels are not returned with the image data is not included in this value, as it does not affect relative radiometric calibration accuracy.

[18] The MI data obtained during the first 900 sols of Opportunity's mission do not show any evidence for changes in geometric calibration at the level of accuracy measured before flight. Therefore, the geometric calibration results reported by *Herkenhoff et al.* [2004a] are believed to be valid: The Opportunity MI pixel scale is 30.5 ± 0.9 μm and the radial distortion is less than 0.33 ± 0.03 pixels.

3. MI Communication Errors

[19] The MI is commanded by the rover computer over a serial communications interface. Between sols 176 and 826, Opportunity MI commands were not properly received 35 times. The rover flight software automatically resends commands that are not transmitted correctly, and in every case the commands were properly received on the second attempt. While these errors have not affected MI operations, they may be caused by degradation of the flex cable that connects the MI to the rover, or other hardware problems. Therefore the errors are a concern and have been studied by the MER engineering team. There are no clear correlations between the errors and IDD position, temperature, or frequency of imaging. The same communications interface is used to return MI data to the rover, so test images (constant DN) were used to diagnose the problem. However, these test images show only 3 flipped bits in dozens of images returned to date. This is puzzling, because the MI commands are much smaller (in terms of data volume transferred over the serial interface) than the test images. So while communication errors may have affected some MI images as they were transferred to the rover, such errors have not been detected. It appears

Figure 8. First 900 sols of Opportunity's traverse across Meridiani Planum, overlain on Mars Reconnaissance Orbiter High Resolution Imaging Science Experiment (HiRISE) image (illumination from lower left). Informal crater names shown in black.