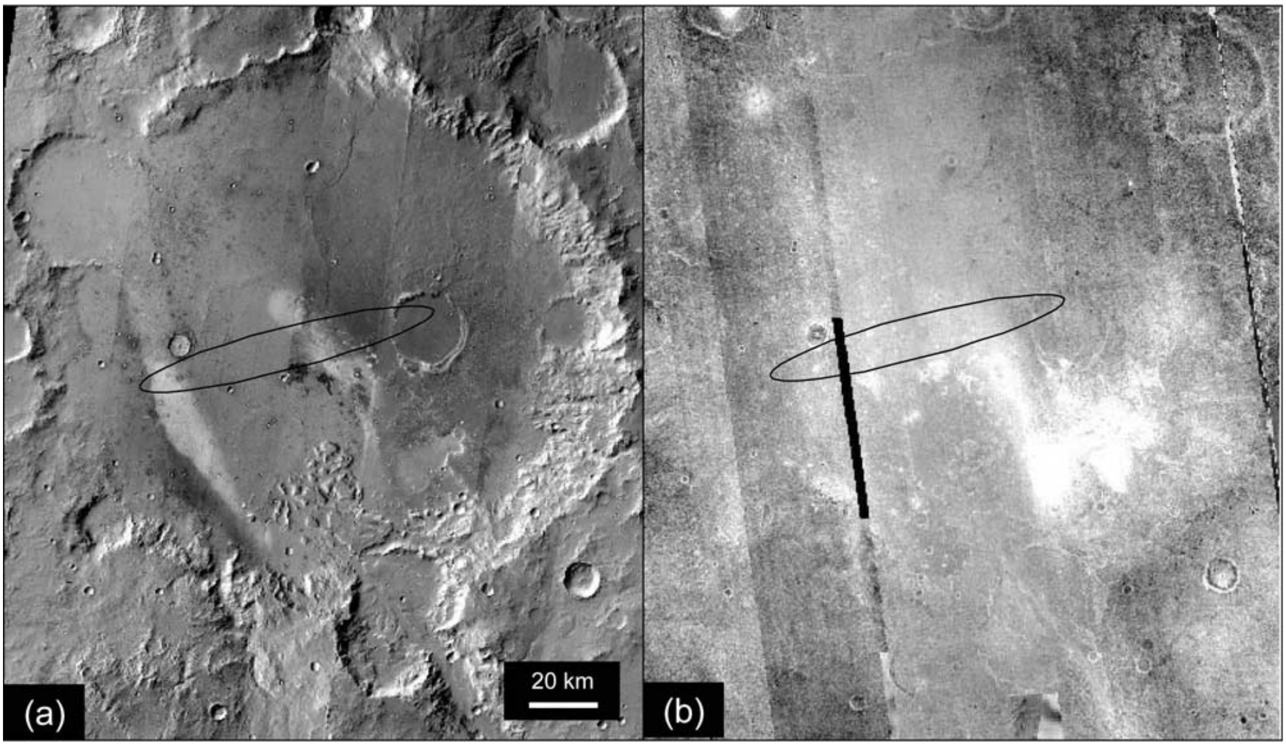

Figure 2. THEMIS (a) daytime TIR and (b) night TIR image mosaics (Band 9) for Gusev crater. Black ellipse shown represents the MER-A landing ellipse.

within Gusev analogous to sedimentary structures formed in terrestrial ice-covered lakes by sub-glacial rotary currents [*Grin and Cabrol.*, 1997a, 1997c]. Recent studies have also proposed this hydrologic system to have been active for 2 Ga over the Noachian-Hesperian periods [*Cabrol and Grin*, 1997; *Grin and Cabrol*, 1997b].

[4] Evidence of a paleolake in Gusev crater [*Masursky et al.*, 1988; *Landheim et al.*, 1993; *Cabrol et al.*, 1994; *Cabrol and Brack*, 1995; *Cabrol et al.*, 1996; *Cabrol and Grin*, 1997] makes it an attractive candidate for a MER landing [*Cabrol et al.*, 2002] for several reasons. First, potential lacustrine environments like Gusev may contain sedimentary structures (flow margins, shorelines, channels, ripple marks, etc.) or mineral deposits (evaporites, tufas, etc.) indicative of former aqueous activity [*Eugster and Hardie*, 1978]. Second, continuous settling of fine-grained sediment in terrestrial lacustrine environments leads to the burial and preservation of biomarkers. If life formerly existed on Mars, fluvio-lacustrine environments like Gusev would thus be a favored setting for fossil preservation [*Farmer and Des Marais*, 1999]. Also, relatively flat "lake beds" are devoid of many hazards posed to lander missions.

[5] Although there is much that may suggest an ancient lacustrine environment at Gusev, no unequivocal evidence (such as evaporite deposits or shorelines) has been found to confirm the proposed hypothesis. With this in mind, we take a first look at new data from the Mars Odyssey Thermal Emission Imaging System (THEMIS) to provide insight into the geologic environment of Gusev crater. This study also employs data from the Mars Global Surveyor (MGS) Thermal Emission Spectrometer (TES), Mars Orbiter Camera (MOC), and Mars Orbiter Laser Altimeter (MOLA) instruments to:

[6] • map surface units by their thermophysical and morphologic properties

[7] • derive a stratigraphic sequence

[8] • make comparisons with previous geologic surveys-with the ultimate aim of evaluating various depositional hypotheses for Gusev crater.

2. Methods

[9] Data from THEMIS, TES, MOC, and MOLA were used to provide thermophysical, morphologic, topographic, and temporal perspectives of Gusev crater. Thermal infrared (TIR) data from THEMIS and TES was first used to identify and map units on the basis of thermophysical properties (temperature and albedo). THEMIS visible and daytime TIR data, along with high-resolution MOC images, were then used to map units on the basis of morphology and texture. These data were also used for crater counting/age determination, and to search for evidence of layering. MOLA data provided elevations of contacts between units, estimations of strata thicknesses, and confirmation of unit boundaries.

[10] Data collected from THEMIS include visible images in 5 bands at 20 m/pixel spatial resolution and TIR images at 100 m/pixel spatial resolution using 8 spectral bands from 6.8 to 12.6 μm (1563–690 cm^{-1}). TIR images were collected during the Martian day ($\sim$1600 local solar time) and night ($\sim$0400 local solar time) to observe diurnal changes in surface temperatures [*Christensen et al.*, 2003]. THEMIS TIR bands were chosen for their usefulness in detecting relevant geologic materials including silicates, carbonates, and sulfates. Currently, THEMIS has collected 27 visible, 28 daytime, and 11 nighttime TIR images of Gusev, producing $\sim$75%, 100%, and 100% coverage for