GALE CRATER MOUND IN A REGIONAL GEOLOGIC SETTING:
MAPPING AND PROBING THE SURROUNDING OUTCROPS FOR AREAS AKIN TO THE CENTRAL MOUND AT GALE

Lisa Korn
Carlton Allen

University of Massachusetts Amherst
NASA Johnson Space Center

Gale Crater and Mt. Sharp:
The Mars Science Laboratory rover, Curiosity, is currently conducting research within Gale Crater as it makes its way towards a channel and layered deposits that will provide insight into the sedimentary history of Gale [1]. Gale Crater is a 155km diameter, Late Noachian/Early Hesperian crater that is located along the dichotomy boundary on Mars [2]. Gale’s central mound, Mt. Sharp, is divided into an upper and lower mound which are separated by an erosional unconformity [3] and differ in age [2], erosional patterns [2-4], and mineralogy [1]. Though the age of the upper mound is poorly constrained, the lower mound is Late Noachian/Early Hesperian, like Gale [2].

There are several hypotheses on the origin of Mt. Sharp. These include ground water upwelling [2], aeolian, ice, volcanic [2-4], lacustrine [2-4], hydrothermal [2-4], and polar deposits [3].

Procedure:
We employed orbital remote sensing data to determine if areas within 1,000km of Gale have features akin to Mt. Sharp.

Large areas (marked in yellow) match Gale Crater’s Mt. Sharp in age (Late Noachian/Early Hesperian) [5], altitude (~4,600m to ~4,000m), and nighttime infrared brightness (proxy for thermal inertia) [6-7]. Data were taken from the Thermal Emission Imaging System (THEMIS) [6], Mars Orbital Camera (MOC), Mars Orbiter Laser Altimeter (MOLA), Context Camera (CTX), and High Resolution Imaging Science Experiment (HiRISE).

Could Gale have been filled? Many large (140 – 170km in diameter) Martian craters contain layered deposits, some of which have been eroded. The volume of fill in Gale is approximately 10% of the total crater volume, a smaller ratio than for any other crater of similar size.

Specific outcrops within the larger areas show analogous morphology and erosional characteristics, with similar layering, altitude, age, and brightness as Mt. Sharp’s upper and lower mound.

References:
http://www.mars.asu.edu/data/them_drs/
http://www.gale-mosaic.com