



Geological mapping and stratigraphy of Gusev region; implications for timing of geological processes

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The Gusev crater and surrounding terrains contain the geological record of Martian processes from approximately 4 Ga to present. This record includes the Noachian evolution of the Martian Highlands, fluvial processes in the Hesperian, and most recent aeolian processes.

Using Themis IR and visual images, combined with narrow angle MOC images and recent HRSC data, we mapped the wider region of the Gusev crater (172° E to 179° E by 10° S to 18° S), focussing on the geological units and their geometrical relationships.

In addition to the image data, the stereo data from HRSC were used to study the three dimensional geometry of units and structures. To this end a number of geological cross sections were constructed, based on HRSC digital elevation models. The cross-section were used to establish the thickness of various geological units and their relative age relationship. Using this method 17 different units could be distinguished

To determine the absolute surface ages of various units, we measured the crater size frequency distributions. This provides temporal constraints to the stratigraphic units, showing that 1) the highland units were formed up to ~ 4 Ga, 2) the Gusev crater impact occurred at ~ 4 Ga, 3) the Apollinaris volcanic apron formed 3.8-3.7 Ga, roughly contemporaneous with surface modification of parts of the Highland units, 4) the majority of the units deposited in Gusev crater gave ~ 3.6 Ga surface ages, similar to units found directly north of Gusev crater, 5) youngest units in Gusev crater, probably related to mass wasting, gave ~ 3.3 Ga surface ages.

Geological mapping in combination with structural analysis and crater count age determinations, provide a framework for understanding geological processes, such as fluvial activity and sedimentation, volcanic events, and formation of chaotic terrains.