WORKING TOWARDS A CLASSIFICATION SCHEME FOR SEDIMENTARY ROCKS ON MARS.

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Introduction:

An analysis is presented here of sedimentary rocks on Mars using various data sets such as the High Resolution Imaging Science Experiment (HiRISE) and Context Imager (CTX) on the Mars Reconnaissance Orbiter (MRO), and the Mars Orbiter Camera (MOC) on the Mars Global Surveyor (MGS). This is a systematic study for the purpose of distinguishing various types of sedimentary rocks, and then for their further subdivision into subtypes.

Methods and Analysis:

Images are being examined from the three data sets for evidence of layering in bedrock (polar deposits excluded). The HiRISE camera takes images at resolutions up to 26 cm/pixel that are 6 kilometers wide and of variable length. The Context Imager takes images at 6 m/pixel at a width of 30 kilometers. MOC narrow angle images are at a resolution of 1.5 to 12 m/pixel.

There is a diversity of sedimentary rocks on the surface of Mars that represent eolian, fluvial, and possibly lacustrine depositional environments. In addition, we recognize that pyroclastic and also impact-generated deposits could be present. Using a comparative approach of these data sets, all acquired HiRISE images are being inspected within the latitude range of 60 degrees north and south. Layered deposits are classified as being inside or outside of craters, and then the process is repeated with CTX data. Due to the large volume of CTX data, areas that have no HiRISE coverage, or areas suspected to have layered deposits based on similar morphologies seen in nearby images are being examined first. From there, the layered deposits are further subdivided based on criteria such as morphology, blockiness, relative thickness, tone, types of layers, and if there is CRISM coverage, what types of mineralogical correlations are seen among different types of layers. While the project begins at a global mapping scale, more detailed analysis will be done on specific areas where layers are particularly well exposed.

The global and regional mapping of layered deposits is based on characteristics such as tone/albedo, apparent (and in some cases, true) thickness of stratification, weathering characteristics, larger scale textures and patterns, and whether the layers are found inside or outside of crater walls and canyon walls. As a first pass using visual inspection, layered bedrock of any kind was searched for (volcanic, sedimentary, etc.) and then plotted to create a global map with their locations (Figure 1). From there we are attempting to distinguish if the rocks can be classified as sedimentary and whether it's a definitive case, suggestive, or not possible to distinguish the type of stratified material. The locations of the layers can also be compared based on elevation, age of terrain, relationship to valley networks and impacts with lobate debris aprons. The goal is to make regional and global maps of stratified terrains with probably sedimentary origin based on these defining characteristics and then build a stratigraphy for regions of Mars.

The data sets that are being created with locations of layered deposits are being made for GIS. Ultimately, when classification schemes for the various deposits has been completed, there will be a comprehensive set of files for GIS which can be sorted based on all the criteria used.

Additional Information:

HiRISE data can be found at http://hirise.lpl.arizona.edu and CTX data can be found on the PDS at: http://pds-imaging.jpl.nasa.gov/Missions/MRO_mission.html

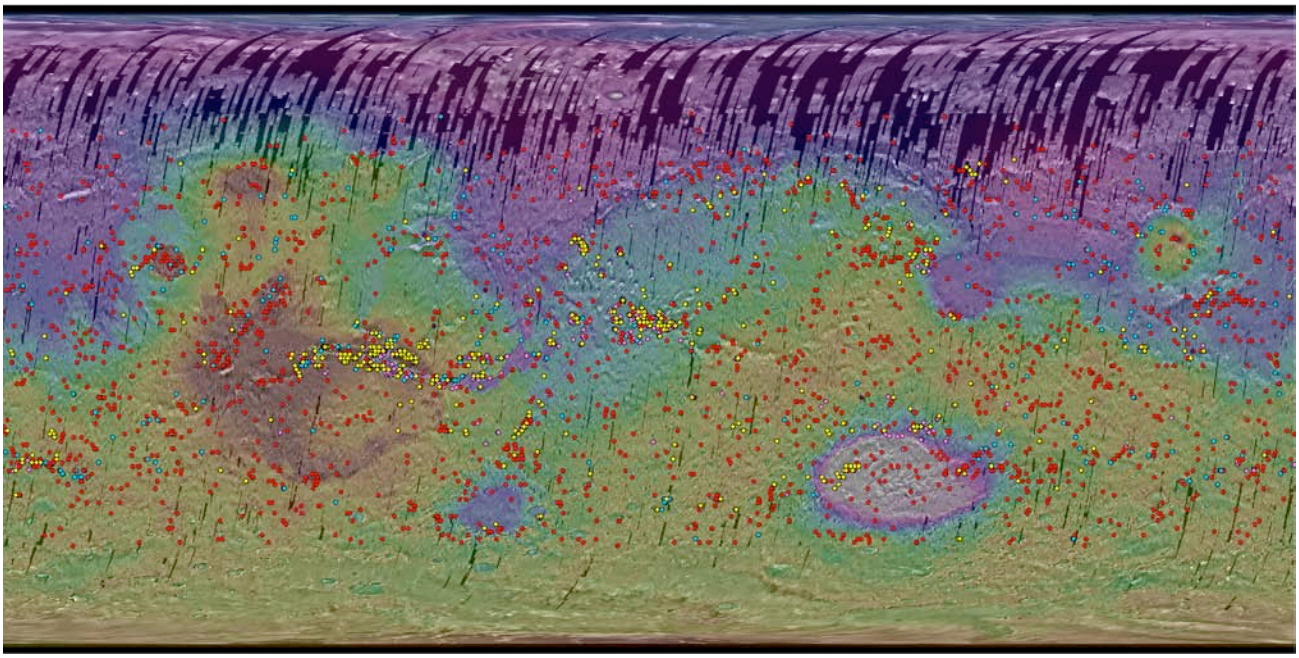

Figure 1. Preliminary map of stratified rocks on Mars based on HiRISE and MOC. Red dots: No layered deposits visible in image. Yellow dots: Stratified bedrock observed. Blue dots: Stratified bedrock observed in crater or canyon walls. Pink dots: Layers observed in MOC image.