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Identification of thick sedimentary plains north of Hellas

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Understanding the origin and timing of intercrater plains is crucial to understand the Martian history in relation with endogenic and/or exogenic cycles. Intercrater plains north of Hellas basin on Mars are thought to have hosted different sedimentary environments during the Late Noachian/Early Hesperian, and they offer a well-preserved insight into the regional geological history of Mars. Our new geologic mapping of the intercrater plains north of Hellas Basin is based on the rich data set from MRO and Mars Express and provides new insights into the region's geological history. These findings appear to constrain the interpretation of the nature and age of intercrater plains in this region, although we acknowledge that for example the source of the sedimentary deposits must be subject to further analysis.
The northern part of Hellas basin displays topographically flat area, which was characterized during the Late Noachian by sedimentary deposition and later, in the Late Hesperian, by fissural volcanism. The map and crater retention ages enable us to interpret the geologic history of the region. The stratigraphically lower unit is represented by crustal outcrops. Across most of the region, the sedimentary unit covers the basement and is eroded into mesas, erosional windows and perched by fresh craters. Intercrater plains' sedimentary deposits north of Hellas display horizontal light-toned layered rich in Fe/Mg-phyllosilicates and local crossbedding stratification. The Noachian sedimentary deposits of the intercrater plains north of Hellas are locally covered by Hesperian lava flows, showing that intercrater plains are sedimentary and volcanic in origin. We found different erosional (regional and local) surfaces, at HiRISE scale inside sediments due to local erosional windows and at CTX scale we found two important regional erosional surfaces. The oldest between crustal outcrops and sediments, which is likely Middle Noachian in age and the youngest between sediments and volcanic deposits, which is likely Late Noachian/Early Hesperian in age. We estimated the erosion rate should have been >1.2 μm/yr.
In summary, first and foremost in importance is the fact that some intercrater plains, the oldest ones, have been proven as sedimentary whereas younger plains have been proven to be volcanic in origin. Second, the discovery of an important regional erosional surface in the Noachian sedimentary deposits implies an important erosional cycle during this period for which we estimated an erosional rate >1.2 μm/yr. Change of the sedimentary environment appears to result from changing of global climate conditions, at least in the northern part of Hellas basin at Noachian/Hesperian boundary. Moreover, sedimentary deposits, showing horizontal light-toned layered rich in Fe/Mg-phyllosilicates and local crossbedding stratification, have the same age of highland valley network (3.7 Ga). These results support the hypotheses that relatively persistent surface water activity could have been in this area at Noachian/Hesperian boundary and thus that potentially habitable conditions in this epoch could have also persisted at least regionally on Mars.