

MARS LOWLAND SEQUENCE STRATIGRAPHY – A CONCEPTUAL APPLICATION. D. C. Barker¹ and J. P. Bhattacharya², ¹University of Houston (University of Houston Geosciences, 4800 Calhoun Road, 77004), ²University of Houston (University of Houston Geosciences, 4800 Calhoun Road, 77004).

Introduction: Sequence stratigraphic principles based primarily on stratal stacking patterns, sequence position and bounding surfaces [1, 2] are applied to describe an approach to the geochronological reconstruction of the Martian northern plains. Based on the hypothesized presence of an early ocean [3, 4], sediments associated with the erosion of the valley networks and later outflow channels, are expected to have been widely distributed throughout the lowlands [5, 6]. Regional scale unconformities are therefore postulated to result from these catastrophic floods throughout the end of the Hesperian and possibly into the Amazonian.

However, global environmental changes and a progressively cooling climate would have led to a protracted loss of surface water and eventual cold-trapping within the cryosphere or at higher latitudes -- resulting in a prolonged forced regression [7] within the depositional environment. Detrital sediments deposited onto the northern plains would constitute a Falling Stage Systems Tract (FSST) [8, 9]. A Highstand Systems Tract (HST) would have been emplaced at the time of maximum ocean level; and a sequence boundary (SB), which by definition is delineated when sea level first begins to drop and would lie between the HST and the FSST. Intermittent or cyclic episodes of flooding, erosion, icing and burial after the depletion of the early ocean would emplace additional sequences to the overlying and confining stratigraphy of the lowlands.

The Messinian Crisis [10, 11] is proposed as a potential terrestrial analogue of the depositional consequences of the removal of large standing bodies of water. This short lived event is estimated to have transformed as much as 6% of the Earth's ocean salt into a giant regressive evaporitic deposit that diachronously drapes the Mediterranean sea floor.

The model proposed herein is graphically depicted in Figures 1 and 2. Figure 1a shows an early Mars with the hypothesized northern ocean. This is followed by the progressive freezing, sublimation, and redistribution of water to the cryosphere and higher latitudes, resulting in a reduction of sea level as depicted in Figures 1b and 1c. This long term progressive loss of water constitutes the Martian forced regression. Figure 2a shows the early Hesperian with an established, dust and ice covered northern lowland sea and the beginnings of a phase of regional cyclic, flood-incurred stratigraphy. Finally, Figure 2b depicts the present surface covering the northern plains.

We therefore suggest that the evolution of such conditions on Mars would have led to the emplacement of diagnostic sequences of deposits and regional scale

unconformities consistent with intermittent reponding, resurfacing, and the progressive loss of an early ocean by the end of the Hesperian.

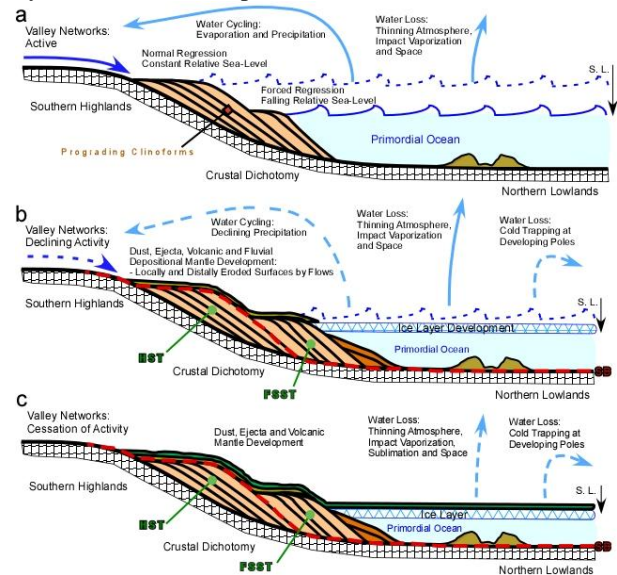


Figure 1. a) Early Noachian; b) Middle and Late Noachian; c) Early Hesperian.

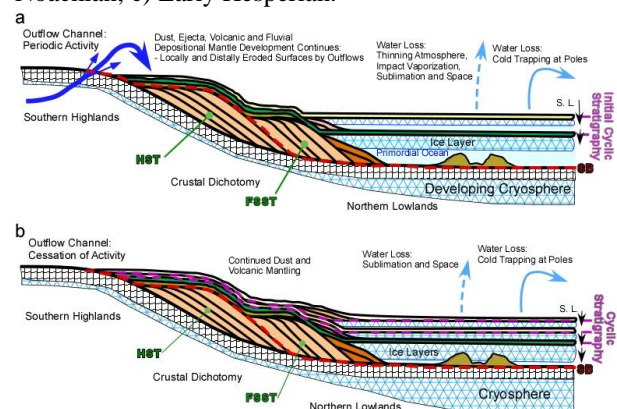


Figure 2. a) Middle and Late Hesperian; b) Amazonian.

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