MULTI-MEGAFAN LANDSCAPES AS AN ANALOG FOR REGIONAL FLUVIAL SEDIMENTATION.

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Introduction: The ~150 km-long radial sediment mass at the mouth of Hypanis Valles on Mars has been ascribed to sedimentation in a delta setting [1]. An alternative explanation that does not require the existence of a waterbody is demonstrated on most terrestrial continents by multi-megafan landscapes. Sometimes inaccurately described as large alluvial fans or 'inland deltas,' terrestrial megafans with minimum radii >80 km, recently totaled 272 in a global survey [2]. The best known such landscape may be the Gangetic Plains of north India [3]. Multi-megafan landscapes also occur in more Mars-like cratonic environments such as Africa (87 megafans) (Fig. 1) [3] and Australia. "Channel-lobe transitions" [1], adduced as evidence for the Hypanis feature's deltaic origin [1], are however, the essential style of megafan sediment accumulation, which include down-fan 'sub-apexes' from which lobes of sediment project as the prime building blocks of megafans [4].

Background: Megafans are have been regarded as a variant of the well-known smaller alluvial fan although the respective fluvial processes are entirely different [4, 5]. Numerous alluvial fans have been documented on Mars, almost always *within* impact craters. Seldom do these reach the abovementioned megafan length. Their existence within craters begs the question of why fan-like fluvial deposits are apparently not seen in the larger intercrater setting. Reasons may be similar to those listed for the surprising lack of recognition (until recently) of terrestrial megafans, namely the size and the associated age which implies erosional degradation or overprinting by subsequent (especially) eolian processes [4]. Lack of recognition has also been ascribed to lack of awareness of the features [4, 5] that are few in N America and Europe although hundreds occur on other continents [2]. Contiguous megafan surfaces cover 750,000 km2 in S America, suggesting a geomorphic analog at larger subregional/regional scales [4].

Mars: With flowing water on Mars now accepted, the megafan analog was applied as an alternative interpretation for the layered units at Sinus Meridiani [2]. This analog accounts for several problems of interpretation that have been identified [6] of this 1000 m-thick sediment package which covers ~300,000 km^2 [6]; it explains (i) the location of the sediments directly downstream of an integrated system of valley networks; (ii) the lack of evidence for an associated water body, or of a closed basin; (iii) the dimensions of the mass (>1000 km along strike by >600 km); and (iv) possibly the existence of some of the raised ridges that cover much of the outcrop (many resemble the inverted remnant channels on relict terrestrial megafans, and suggest fluvial-style interactions with ancient impact craters). The analog suggests that widespread fluvial, non-coastal emplacement is a viable hypothesis, at least for some of the Meridiani units [3].

Conclusion: The multi-megafan analog supplies (i) a *regional-scale* analog for fluvial sedimentation, (ii) at a scale appropriate for Mars's intercrater plains, and (iii) is parsimonious in not requiring a waterbody to facilitate extensive fluvial sedimentation.

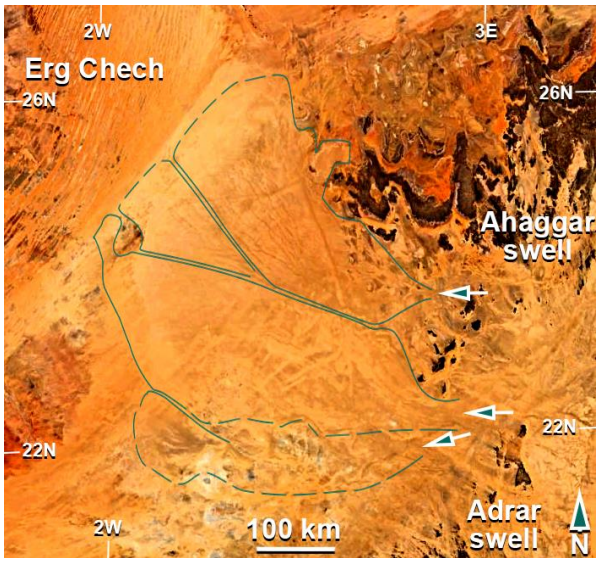

Fig. 1 Nested Saharan megafans covering 150,000 km2 (outlined); one downfan lobe top left. Arrows—fan-forming rivers at megafan apexes. Google Earth ™.

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