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Delta Deposits on Mars: A Global Perspective

Barbara De Toffoli, Ana-Catalina Plesa, Ernst Hauber, and Doris Breuer
Institute for Planetary Research, DLR, Berlin, Germany (Barbara.Detoffoli@dlr.de)

The presence of delta deposits on Mars has been thoroughly demonstrated for decades and large scale mapping [1,2] highlighted the presence of several delta fans mainly located on the dichotomy boundary. While a previous delta inventory was compiled by Morgan et al. [3], we aim to update and finalize a complete mapping of delta deposits in order to allow the examination of the evolution and distribution of standing bodies of water on Mars. The objective of our project focuses on the production of a global catalogue of water-related features at the Martian surface, which are commonly studied separately or at smaller scales.

Globally, we located around 150 deltas among which many were not previously included in published literature [e.g. 1,2,4]. We then examined the deltas based on two main traits. Firstly, we measured the length of the feeding channels since it may be (i) a proxy for the duration of the aqueous activity in the channel-delta system, and (ii) proportional to the age of the delta [2]. The latter relationship links older deltas near Chryse Planitia (>3 Ga) to longer valleys, while younger deltas are usually fed by shorter valleys [2]. Secondly, we measured the elevation of the delta population and compared the obtained dataset with the hypothesized sea level elevation of -2540 ± 177 m firstly suggested by Di Achille and Hynek [1] for a northern ocean through the analysis of deltas.

We observed that, if the relationship between feeding channel length and delta age found for a sub-group of the population [2] is applicable as a rule of thumb to all deltas, many of the deposits have the potential to be Hesperian or Amazonian in age. They would thus be younger than the ocean that might have occupied the northern lowlands during the Noachian-Hesperian boundary period [1] and thus be unrelated to a global sea level range. In fact, less than half of the delta population is related to medium/long feeding channels (>30 km). Abundant pristine morphologies, both related to channels and deltas, also supports the hypothesis that part of the population is younger than Noachian. Additionally, the large variety of elevations where the deltaic deposits can be found and the very small amount of deltas included in the sea level elevation range proposed by Di Achille and Hynek [1] raise questions about the generation and environmental implications of these features, especially when seen at global scale.

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[3] Morgan, A. M., et al., Lunar Planet. Sci. Conf. (2018).

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