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Evidence of ancient alteration and subaqueous activity in Oxia Planum, the candidate landing site for Exomars 2020

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The ExoMars 2018 mission (ESA) has for scientific objectives to search for signs of past and present life on Mars, to investigate the water/geochemical environment as a function of depth in the shallow subsurface, to study to Martian atmospheric trace gases and to characterize the surface environment. The landing site has to be relevant with regard to these objectives while fitting the restrictive engineering constrains. From the scientific point of view, the site must be ancient, from the Early Mars period, for which many scientific evidences favor the existence of a water-related cycle. In this paper, we present the unique location called Oxia Planum, a wide clay bearing plain located between 16° and 19° North and -23° to -28° East proposed as landing site for Exomars 2020 mission. Oxia Planum is located between Ares Vallis and Marwth Vallis in a wide basin just at the outlet of Cogoon Vallis System, with elevations ranging from -2800 m down to -3100 m. The regional compositional mapping of Oxia planum has been achieved based on OMEGA data at 2.5 km/pix well as CRISM multispectral data at 200 m/pix. Mg/Fe phyllosilicates, identified and mapped based on their diagnostic absorptions at $\sim$1.4, $\sim$1.9 and $\sim$2.3 μm are exposed over about 80% of the ellipse surface. The entire unit with phyllosilicates signatures corresponds to a light-toned layered unit that is observed over a large range of elevations (from -2600 m to -3100m) suggesting that like in Marwth Vallis region, the layered and altered formation overlaps a pre-existing topography . The age returned from crater count on the clay rich formation is 3.9 Ga. At the top or embedded within the layered formation, several fluvial morphologies such as former valleys or inverted channels are observed. Also, at the top of the layered clay-rich formation, a deltaic deposit is observed suggesting sub-aqueous episodes postdating the altered layered formation. In terms of mineralogy, the putative delta fan shows layers enriched in hydrated silica. This delta fan implies a second and distinct period of alteration in Oxia Planum signed by a distinct mineralogy. In term of age, the delta has a too small surface to allow a confident age assignment from crater count. We can only state that the delta-fan is older than 3.5 Ga.
Oxia Planum recorded at least two clearly distinct alteration environments and contexts: 1) the alteration of the Noachian layers and 2) the fluvio-deltaic system post-dating the Noachian clay rich unit. Deciphering the formation environments for such diverse altered rocks would fulfill the goals of the ExoMars Rover.