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Change in the Wind and Climate at the ExoMars 2022 Landing Site in Oxia Planum (Mars).

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The ESA/ROSCOSMOS ExoMars 2022 will land in Oxia Planum an area that shows outcrops of clay-rich Noachian-aged phyllosilicates overlaid by an Early Amazonian volcanic dark resistant unit (Adru) [1]. Using HiRISE images, we identified NE-SW (53.9 ± 13.2°) oriented TARs overlying an enigmatic ~EW (95.4 ± 10°) oriented ridge pattern that we interpreted as periodic bedrock ridges (PBRs) [2]. Ridges (~ 38 m spaced) display Y-junctions, show cross-cutting fractures and share the same blocky texture of the bedrock they are associated with. Ridge crestlines are locally found in continuity outside and inside heavily eroded impact craters around the dark upstanding material (Adru) exposed in the center of many craters. These stratigraphic relationships suggest that the ridges (PBRs) formed after the event(s) that eroded the crater rims and thus after deposition of the Adru (2.6 Ga). Ridges are even visible in association with impact crater ejecta and are superimposed by 10-25 m craters and boulders, so they pre-date these impact events. When associated with crater ejecta, ridges locally show two different crests. Both crests are truncated by craters suggesting they were emplaced before the impacts. We interpret this double crest arrangement as megaripples detaching from PBRs. The ejecta deposited over the megaripple-PBRs favored the preservation of the megaripple crests from a subsequent episode/s of erosion that led to the complete exposure of the PBRs on the plain. Because the preserved megaripples are locally visible on the southern edges of the PBRs, the wind that formed the megaripple-PBR system should have blown from N-NNE because the megaripples are located at the downwind side of PBRs [3]. To better understand the relative age of the ridges, we mapped their occurrence on 316 craters in the study area that we qualitatively classified as relatively degraded/old and pristine/young. Results show that ridges are only found in degraded/old craters but are never found inside pristine/young craters. Thus, the ridge forming process was only active in-between

the formation of degraded/old and pristine/young craters. A major change in the wind regime occurred during or after the event that exposed the PBRs: N-NNE winds that shaped the PBRs changed into dominant SE winds that led to the deposition of the TARs above the PBR/megaripples. This work unveils a complex history of aeolian erosion and deposition in Oxia Planum during the Amazonian. By visiting PBRs for the first time, the ExoMars 2022 mission will provide further constraints on PBR formation and paleo-winds, shedding light on a past Amazonian environment.

This work is a summary of a manuscript that is currently in press on Geophysical Research Letters: Silvestro et al. 2021, Periodic Bedrock Ridges at the ExoMars 2022 Landing Site: Evidence for a Changing Wind Regime. DOI: 10.1029/2020GL091651.

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