**Assessing rates and timing of aeolian bedrock erosion in Payunia, western central Argentina**

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* **This abstract is for an Oral**
* **Indicate the Proposed Session: Landscape and Climate Change**
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# ABSTRACT

# Even though wind represents the major geomorphic process in drylands on Earth and many extra-terrestrial planets, our understanding of aeolian erosion rates is still very limited. This study aims at quantifying timescales and rates of bedrock erosion by wind in one of South America’s largest extra-Andean yardang fields in the volcanic region of Payunia (southern Mendoza province, Argentina). Here, yardangs have formed in an extensive ignimbrite pointing to wind abrasion and deflation as the dominant agent of late Quaternary landscape change. In this context, we applied (i) single grain Ar-Ar dating on biotite and sanidine to determine the timing of ignimbrite emplacement. We then measured (ii) cosmogenic 36Cl on nine ignimbrite bedrock surface samples to determine rates of surface erosion and investigate the relative importance of vertical cliff retreat at the yardang front vs. horizontal surface lowering by weathering and abrasion along a downwind transect across a yardang cluster.

# Our Ar-Ar results suggest that ignimbrite emplacement was associated with a caldera forming eruption of the nearby Payun Matru volcano at ~85 ka, providing a maximum estimate for the onset of aeolian bedrock erosion in the area. Concentrations of 36Cl were corrected for background production. The corresponding model bedrock surface erosion rates are highest (ca. 25-70 mm/ka) in the immediate vicinity around yardangs, identifying cliff retreat by abrasion as the dominant process of yardang formation. Model bedrock erosion rates decrease away from the yardang cluster and confirm the spatial variability and topographic dependence inherent to most geomorphic processes. Lowest rates between 4-6 mm/ka were measured on low-relief and/or protected bedrock surface settings, likely reflecting surface lowering by a combination of physical weathering processes followed by aeolian deflation. In addition, our Ar-Ar and 36Cl data suggest that aeolian bedrock erosion was pronounced throughout the last glacial cycle while the data confirms our field-based interpretation of general landscape stability over Holocene timescales. In summary, our study shows that the strategic combination of geochronological techniques provides a promising approach towards the assessment of regional to global-scale wind-driven erosion rates, facilitating the quantification of late Quaternary, climate-driven changes in dryland landscapes around the world.