

Effects of Valley Wall Steepness on Rock Glacier Formation, Frequency, and Morphology on Earth and Mars

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Rock glaciers are common in periglacial environments which makes them potentially useful for paleoclimate studies. One factor that may impact the frequency of rock glacier formation other than climate is topography. If topographic conditions, such as the steepness of the valley wall, have a significant impact on whether rock glaciers will form and how they form, this could affect the accuracy of paleoclimate reconstruction utilizing rock glaciers since an abundance of rock glaciers in one region and dearth of rock glaciers in another region may have more to do with local topography than climate difference. Satellite images and measurement tools on Google Earth were used to measure the valley wall and glacier slope steepness, length, width, and gradient for 105 rock glaciers in the Sierra Nevada (Earth) and Valles Marineris (Mars). Analysis of the resulting data set reveals a minimum value for the cirque wall steepness of about 24 degrees and an apparent maximum of about 40 degrees for both the Sierra Nevada and Valles Marineris rock glaciers. It also indicates that the average glacier slope steepness and valley wall steepness for terrestrial rock glaciers are higher than the same for Martian rock glaciers. Additionally, the Martian rock glaciers studied tend to have significantly greater length than the terrestrial rock glaciers examined. These findings show that the shape of rock glaciers and the locations where they form can vary depending on topography and the planet on which they are located. This suggests that it could be worthwhile to investigate the effects of topography on rock glacier formation if they are to be used in studying past climate on Earth and Mars.