Paper Number: 277

Basalt weathering processes and landforms in the Lesotho Highlands, southern Africa

Knight, J.[1] and Grab, S.W.[1]

[1]School of Geography, Archaeology & Environmental Studies, University of the Witwatersrand, Private Bag 3, Johannesburg, 2050, South Africa (jasper.knight@wits.ac.za; stefan.grab@wits.ac.za)

Physical, chemical and biological weathering processes are significant contributors to landscape development in mountain blocks worldwide, and over long time scales, but the interplay between different weathering processes is uncertain. Jurassic-age basalt lava flows underlie the Drakensberg mountain range of eastern Lesotho, southern Africa (summits 3200-3400 m asl), and weathered bedrock is commonly exposed on flat plateau surfaces (Figure 1). Subaerial weathering throughout the Quaternary and Holocene has resulted in a range of weathering forms, some of which exploit pre-existing cooling fractures within the basalts, and some of which appear to be independent of geological control. These forms include pseudokarst-style potholes, karren and other microforms.

The range of weathering features present across a portion of the Drakensberg mountain summits of eastern Lesotho were mapped and investigated in terms of their morphological properties, internal sediments and water chemistry. The geometry, chemistry of water contained within the potholes, seasonal presence of ice, sediment and organic residues all suggest that physical, chemical and biological weathering processes are significant at different times and contribute in different ways to net subaerial weathering. Moreover, it is also likely that these process-types show pronounced seasonal variability, and thus that the interplay between different processes and environmental conditions is subtle with as yet uncertain feedbacks. Aggregated rates of land surface denudation or geomorphic development of single landforms therefore hide this subtle interplay between different landscape-shaping processes. Changes in mountain summit soil depth (through soil erosion), ecosystems and climate will change this balance between different processes. It is also likely that subaerial weathering has been significantly underestimated as a landscape-shaping process in many mountain blocks worldwide.

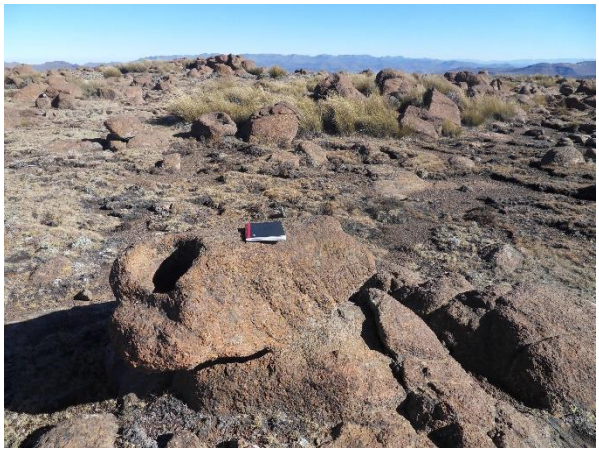

Figure 1: (Left) weathered basalt summit surface, and (right) typical pothole found on these surfaces.