Geophysical Research Abstracts
Vol. 17, EGU2015-15040, 2015
EGU General Assembly 2015

Accelerated weathering of carbonate rocks following the 2010 forest wildfire on Mt. Carmel, Israel

Nurit Shtober-Zisu (1), Naama Tessler (2), Alexander Tsatskin (3), and Noam Greenbaum (4)

(1) Department of Israel Studies, University of Haifa, Mount Carmel, Haifa, 3498838, Israel, (2) Department of Biology and Environment, University of Haifa, Mount Carmel, Haifa, 3498838, Israel, (3) Department of Archaeology, University of Haifa, Mount Carmel, Haifa, 3498838, Israel, (4) Department of Geography & Environmental Studies, University of Haifa, Mount Carmel, Haifa, 3498838, Israel

Massive destruction of carbonate rocks occurred on the slopes of Mt. Carmel, during the severe forest fire in 2010. The bedrock surfaces exhibited extensive exfoliation into flakes and spalls covering up to 80%–100% of the exposed rocks; detached boulders were totally fractured or disintegrated. The fire affected six carbonate units—various types of chalk, limestone, and dolomite. The burned flakes show a consistent tendency towards flatness, in all lithologies, as 85%–95% of the flakes were detached in the form of blades, plates, and slabs.
The effects of the fire depend to a large extent on the rocks' physical properties and vary with lithology: the most severe response was found in the chalk formations which are covered by calcrete (Nari crusts). These rocks reacted by extreme exfoliation, at an average depth of 7.7 to 9.6 cm and a maximum depth of 20 cm. The flakes formed in chalk were thicker, longer, and wider than those of limestone or dolomite formations. Moreover, the chalk outcrops were exfoliated in a laminar structure, one above the other, to a depth of 10 cm and more. Their shape also tended to be blockier or rod-like. In contrast, the limestone flakes were the thinnest, with 99% of them shaped like blades and plates. Scorched and blackened faces under the upper layer of spalls provided strong evidence that chalk breakdown took place at an early stage of the fire.
The extreme response of the chalks can be explained by the laminar structure of the Nari, which served as planes of weakness for the rock destruction. Three years after the fire, the rocks continue to exfoliate and break down internally. As the harder surface of the Nari was removed, the more brittle underlying chalk is exposed to erosion.
If fires can obliterate boulders in a single wildfire event, it follows that wildfires may serve as limiting agents in the geomorphic evolution of slopes. However, it is difficult to estimate the frequency of high-intensity fires in the Carmel region over the past 2-3 million years. It is even harder to assess the frequency of fires (and the destruction) of a single rock outcrop. Our findings show that rock outcrop may lose even 20 cm of its thickness in a single fire. This value, if accounted to the long run, can be responsible for a high percentage of the total denudation rate and therefore, in the mountainous carbonate slopes of the Mediterranean region, wildland fires may serve as extremely important factors in landscape evolution.