Sedimentation and Wind Action Around Volcan Parícutin, Mexico

ROBERT R. SHROCK, Massachusetts Institute of Technology

During a recent visit[1] to the well-known active volcano, El Parícutin,[2] southwest of Mexico City in the state of Michoacan, the writer was impressed by the important role the wind was playing in the redistribution and ultimate deposition of volcanic ash blown out from the active crater. This article proposes to discuss briefly certain aspects of the wind action and some of its geological implications.

Nature of eruption. During a typical eruption there is a great column of ash-laden gas above the 1,500-foot high cone (Fig. 1). The column, composed of successive outbursts, frequently reaches upward many thousands of feet before losing its identity through disruption by high-altitude winds. These wind currents, blowing across the column in various directions, spread the ash in an extensive triangular cloud. Ultimately the ash falls to earth from this cloud, covering the entire surface with a gray or gray and black mantle (Figs. 2 and 3).

Nature of Surrounding Terrane. Upon leaving Uruapan to visit the volcano, one travels for miles across a gently rolling countryside covered by a mantle of gray and gray-black ash strongly reminiscent of a heavy snowfall in northern latitudes (Fig. 2). The trees and shrubs are heavily weighted down with ash, sharp hills and the rough surfaces of geologically recent lava flows appear much smoother because of the ash mantle, and stream courses are so choked with ash that the water frequently has been forced out of its old channel and made to follow a new one. These recently cut ravines, some over ten feet deep, reveal excellent sections of beautifully graded and stratified ash, mostly black in the coarser basal portion of layers and lighter gray in the finer grained upper part. The old roads have long since been lost under the ash and the provisional automobile trails wander over the ash flats with regard only for attaining some objective in the distance—a situation somewhat like that on the sand flats of southeastern United States.

Wind Action Around and Near Volcano. During the afternoon on the day the visit was made, the surface winds were not strong but there was enough turbulence that one had to protect his eyes and nostrils from the impalpable dust which seemed to fill the air at times even on the windward side of the volcano. On the leeward side there was a

---

[1] The visit was made on May 12, 1944. Dr. Walter L. Whitehead, Massachusetts Institute of Technology, accompanied the writer and deserves a vote of thanks for several suggestions.

[2] El Parícutin, Estado de Michoacan, Universidad Nacional Autonoma de Mexico, Instituto de Geologia, Estudios vulcanologicos, Mexico, 1945.

heavy ashfall, judging from the height and size of the columnar cloud above the crater (Fig. 1).

About 9:30 P.M., perhaps an hour and a half or two hours after the sun had set and the surface of the ash had cooled, there arose a strong wind blowing toward the volcano. This wind, apparently produced by the strong updraft of heated gases in the column over the crater[3] (Fig. 3), finally became so strong that the air was filled with

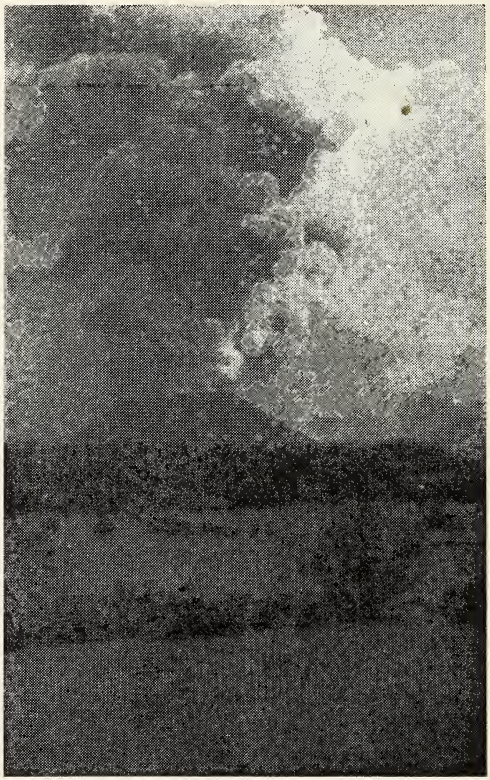

Fig. 1. View of El Parícutin, May 12, 1944, showing typical ash-laden column above the crater.

ash swept up from the surface. The sight of the volcano, made spectacular by the fiery trajectories of incandescent bombs, was blotted from view and the visitors had to retrace their steps to the nearby village. These strong nocturnal winds undoubtedly have been partly responsible for sweeping the ash off much of the surface of the recent

[3] It is probable that there also was some convection over the internally incandescent lava tongues which have flowed out from the volcano, but this is considered unimportant when compared to the strong updraft above the crater.

Fig. 2. View of heavily ash-covered terrane along the trail to El Parícutin from San Juan de los Conchillas, May 12, 1944.

lava flows and depositing it in the lower parts of the terrane. Diurnal surface winds have also probably played an important part in this same process.

Farther away from the volcano, where the eruptive activity does not interfere with normal meteorological conditions, local and regional winds are constantly disturbing and redistributing the newly fallen ash. In this process the ash is blown off the higher and more exposed slopes and hilltops and ultimately deposited in lower, more protected

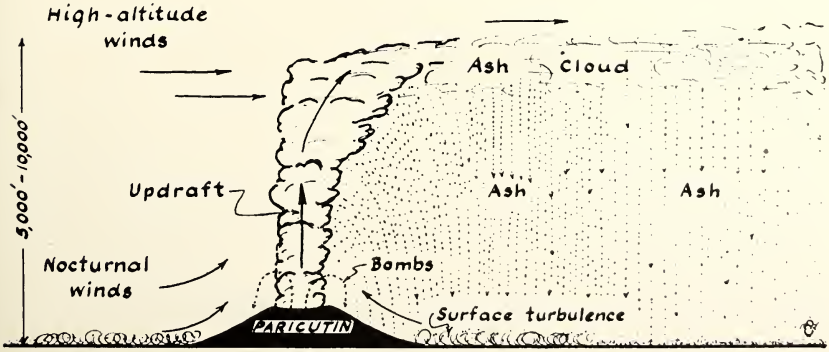

Fig. 3. Diagram showing high-altitude winds blowing ash-laden gases away from volcano and surface nocturnal winds blowing toward the volcano, the latter as a result of the strong chimney-like updraft over the crater.

areas (Fig. 4). Ripple-marked surfaces seen on some of the ash flats attest local transport. Small whirlwinds, a few tens of feet across and a hundred or so feet high, are a common sight on the white ash flats in the early afternoon. Fourteen of these were observed at once in an ash-filled basin between low, bare-rock hills. Their general effect must be to level exposed ash deposits.

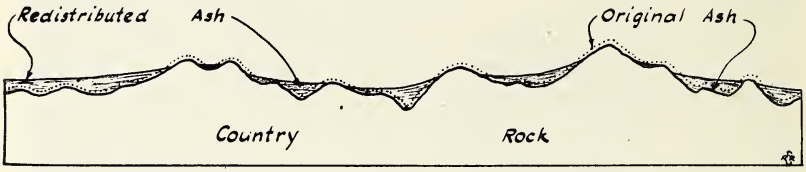

Fig. 4. Diagram to show how original ash mantle is eroded and redistributed by wind action, resulting in denudation on higher more exposed places and deposition over lower, more protected areas, with general smoothing of terrane.

Summary and Conclusions. It is here suggested that wind action around an ash-erupting volcano is an important force in redistributing the ash and forming extensive ash flats surrounding volcanic peaks. Farther afield prolonged wind action is believed to affect widespread redistribution of ash with a general tendency to level the terrane by transporting material from higher to lower places. Torrential rains are also undoubtedly important in locally transporting ash, but the water soon loses its competency by sinking into the highly porous material.

It is suggested that wind action, like that which may be observed today in the vicinity of El Parícutin and farther away, may well have played an important role in forming the extensive ash plains of the central plateau of Mexico. Furthermore, it seems altogether likely that wind was an important redistributor of ash during past epochs of volcanic activity, especially before there were any land plants to protect the surface materials.