

THE GEOLOGIC STORY OF BIG CRATERS
CRATERS OF THE MOON NATIONAL MONUMENT

Notes on a Field Survey, July 16, 1957

by

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The Geologic Story of Big Craters

Because Big Craters is one of the larger craters of the Monument and the largest accessible to the visiting public, it becomes one of the focal points in the story of cinder cones at Craters of the Moon. In preparation for the designing of an aluminum interpretative plaque on Big Craters, a rough survey of Big Craters was made on July 16, 1957. A theory on the formation was reached at an earlier date. Confirmation of the theory, or the determination of facts to the contrary, became necessary, as well as to ascertain the details of the story. The research brought out the fact that the story was more complicated than suspected. However, it is felt that a simplified version can be worked out for the enlightenment of the visitor. Since visitor interest lies in the main vent, the story can be somewhat restricted to that portion.

No time interval determination between eruptions has been attempted. The formation of the Big Craters area is believed to be as follows:

The original Big Craters appears to have consisted of two cones (Figure I) with the main vent observed today marked as Vent "A". Vent "A" was considerably broader in the NE-SW direction than today and lacked the slope to the SE down which most visitors return to their cars. Vent "B" was roughly the same size and shape then as its rim appears today. Both were built of red cinder. The presence of strong westerly winds during the building of Vent "A" appears to have been present due to the height of the easterly wall over the westerly one and the long slope to the NE. Some eruption erosion may have occurred on the westerly wall to reduce its height. Vent "B" has a relatively uniform rim and slope which would indicate little wind during its building. This would indicate that the two cones were not formed simultaneously, though during the same

eruptive period.

Following the building of the cones, liquid lava rose in Vent "A". As is observed throughout the Monument, cinder crater walls are not strong. As a result, the crater broke out in two locations, the south wall and the west wall (Figure II). The former break allowed a flow to move in a south and southwest direction, while the latter break poured out lava to the west. The two flows undoubtedly joined and moved together in somewhat the same direction as the presently named Big Craters Flow.

The next eruption (Figure III), consisting of red cinder, again, rebuilt Vent "A" and constructed a third vent marked "C", parasitic on Vent "A". Vent "B" remained dormant. However, Vent "A" shifted to the NE such that the west wall was reconstructed inside the remnant wall of the old crater, (West wall remnant marked "D") and encroached on Vent "B". Cinder material from Vent "A" filled in about two-thirds of Vent "B" as seen in Figure III. Vent "C" grew along the line of shift which rebuilt Vent "A", which then coincided with Vent "B" and the present line of Spatter Cones. The construction of Vent "C" elongated Vent "A" cone SE to approximately its present size, where its slope touches the parking area.

About this time another vent opened along the chain to the NW. (Figure III, "E"). This cone appears as a parasitic cone on the dormant cone, Vent "B". Its slopes, similar to Vent "B", indicates that little or no wind blew during the building. The sides are very steep, even to this day. The cone extended the line of vents NW to the length observed by today's visitor. This formation overlapped Vent "B" on its SE side,

and reached a height of about 20 feet less than Vent "B". The construction material was, again, red cinder.

The last large quantity of lava appeared again only in the Vent "A" area. Liquid material rose in both Vents "A" and "C". Vent "C" filled to its brim and began flowing over the side of the crater in two directions. One flow started to descend the east flank of Big Craters (Figure IV - A, "F") only to be cut short as the WSW wall was eroded by flow material. The east flow never went far beyond the lower edge of the cone, forming the Slop-over photographed by Stearns. A rather large quantity of material appears to have over-flowed to the WSW from Vent "C" (Figure IV - A, "G") as indicated by the extent of the fresh material just west of the Spatter Cones.

Liquid material rising in Vent "A" finally broke through the crater wall in the same location as on the original cone (Figure IV - B, "H"). Moving SW around Silent Cone, the lava joined the material from Vent "C", forming the flow known as Big Craters Flow on the present topographic map. These two flows have covered that flow material from the original breaching of Vent "A". Floated and pushed crater wall material can be seen in the distance to the west and southwest.

The breaching of Vent "A" must have caused sufficient strain in the wall between Vents "A" and "C" to rupture it, allowing the liquid material of Vent "C" to join with Vent "A", and continue as one flow through the breach at "H". This removed the wall between Vents "A" and "C", leaving the present-day elongated crater observed by the visitor.

One can almost assume that during this period large quantities of material issued from vents all along the Great Rift Zone. Probably the

flows of the Spatter Cone area came forth about this time, making the flow down the south side of Inferno Cone and the two sinks of this area, plus some to the west. The Spatter Cones probably resulted from the dissipated force of this flow which then produced only ebulating pots along the fissure. Liquid material also issued from an open fissure just NW from Vent "E", moving eastward along the base of North Crater. However, it is believed that not all the liquid material of this area came from this crack.

Following the liquid flow, the Big Craters area returned to the production of cinder, spatter, and gas. For what appears to be the first time in its history, Big Craters blew out black cinder. Black cinder erupted from Vent "A", closing the breach to the west (Figure V, "H"). The quantity was not sufficient to raise the wall to its former height. However, black cinder was spread over the entire slope of the cone. Some of the material raised a small wall between Vents "A" and "B". Vent "B" reopened with two vents (Figure V, B1 and B2). Vent "B1" produced spatter material and black cinder which coated the Vent "B" area, while a gas and cinder vent, Vent "B2", removed most of the earlier fill material placed there by Vent "A". The present interior terrace shows the height of the old fill.

Vent "E" reopened with two vents, also. The NW vent, Vent "E1" produced black cinder while Vent "E2" produced spatter. Cone "E" area was covered with black cinder and varigated black and red spatter. Vent "E2", opened close to Vent "B" and broke through the cinder slope of Vent "B", exposing the structure of Vent "B". This establishes the fact that vent "E" was not part of the original group of Vents "A" and "B",

but was built before black cinder was produced in this area.

At sometime during this period, a gas vent appeared at the southeast tip of the line of cones (Figure V, "I"). It is believed that this depression was simply a gas vent because no cinder material appears on the Slop-over or on the flow to the WSW. It could not have occurred before the Slop-over since it would have been filled in by that flow.

Another series of four small vents opened on the SW side of Vent "E" (Figure V, "J"). These vents produced some cinder and a small amount of spatter. Spatter is particularly noticeable in the larger vent. However, there is not enough spatter to place the vent in the spatter cone classification, nor are they large enough to be called cones. Through this same area, four cracks appear in the cinder, which would make a nice demonstration of the fissures should people be conducted to this area. The North Crater - Big Craters Trail passes alongside these vents and cracks. However, a larger crack is found just north of Vent "E" on the trail which appears to be a continuation of the fissure forming the Big Craters chain and the North Crater Breach.

A final spurt of cinder activity in Vent "A" caused the building of a red cinder wall in a NE-SW direction (Figure V, "K"). This wall rises about 12 feet above the lowest point in the crater.

Subsequent to the last eruption in the Big Craters area, normal breaking-off of the crater walls has occurred. This erosion has covered any possible evidence of pooled lava on the floor of the craters. Many, large chunks of wall are to be found at the bottom. At various locations on the floor highly colored cinder material and lava appear. Colors include black, red, yellow, lavender, and purple, with the usual irrides-

cent colors found in the black cinder.

On the NW wall of Vent "A" near the bottom, a large ledge of lava juts through the cinder (Figure V, "L"). This rock was examined. At the time it was not determined whether this was an early lava flow from the vent or a segment of pooled lava which perhaps once covered the crater floor. It was determined that the rock had a dip of about 20 to 25 degrees and a NE-SW strike. This could denote flowing down the side of a low cone, or an up-tilt as a result of subsequent eruption pressures within the vent.

An interesting sidelight encountered on the floor of Big Craters was the wind erosion occurring on the lava material outcrop. Here, the wind has whirled fine material around in the gas holes of the flow material and worn out the back. The result is a thin, lacey layer of rock supported an inch or two away from the parent rock. Fine rock and flake material lies about the area. The whole area is about four feet long and two feet high in the center of the outcrop area.

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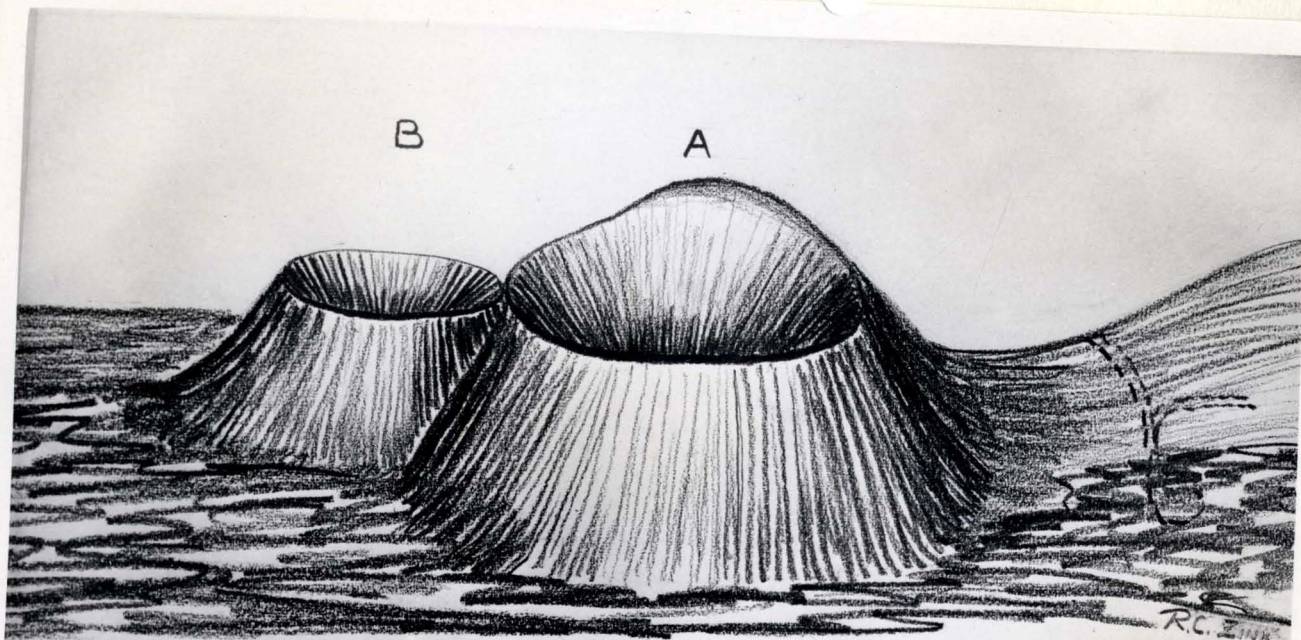


FIGURE I
PRESENT ROAD INDICATED ON RIGHT

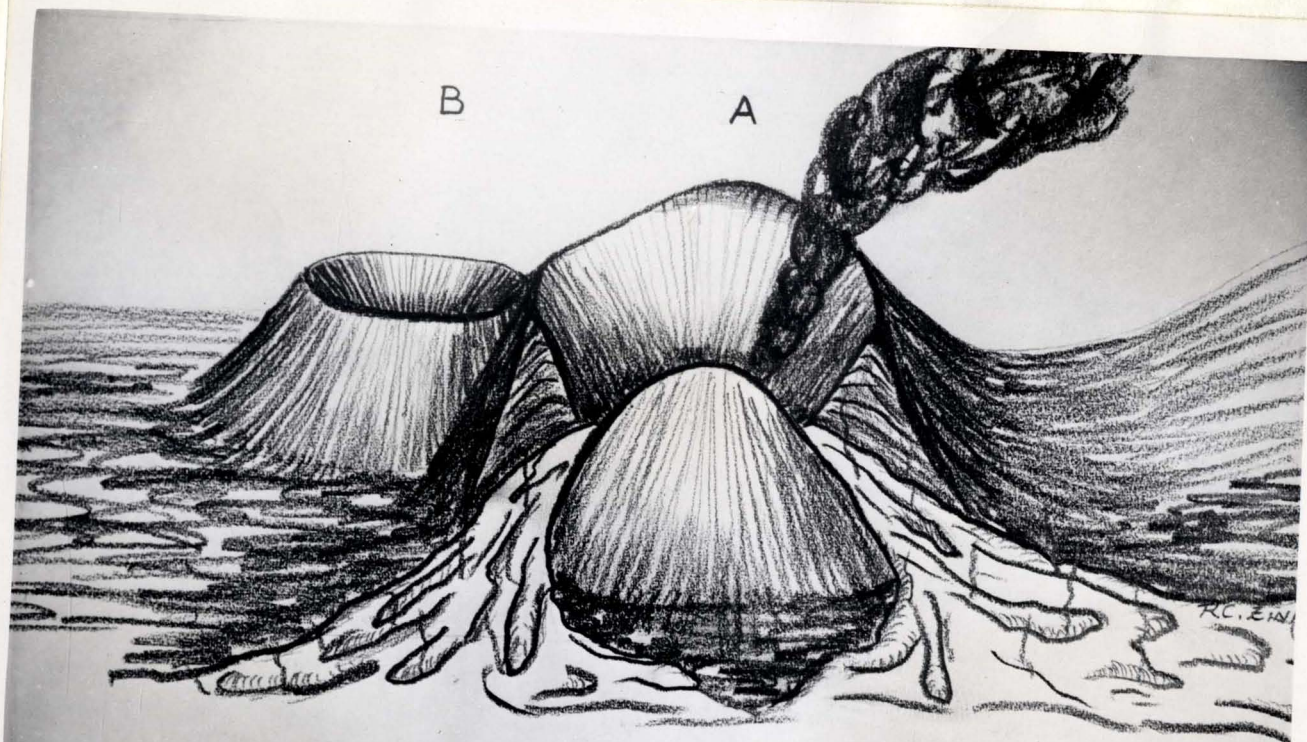


FIGURE II

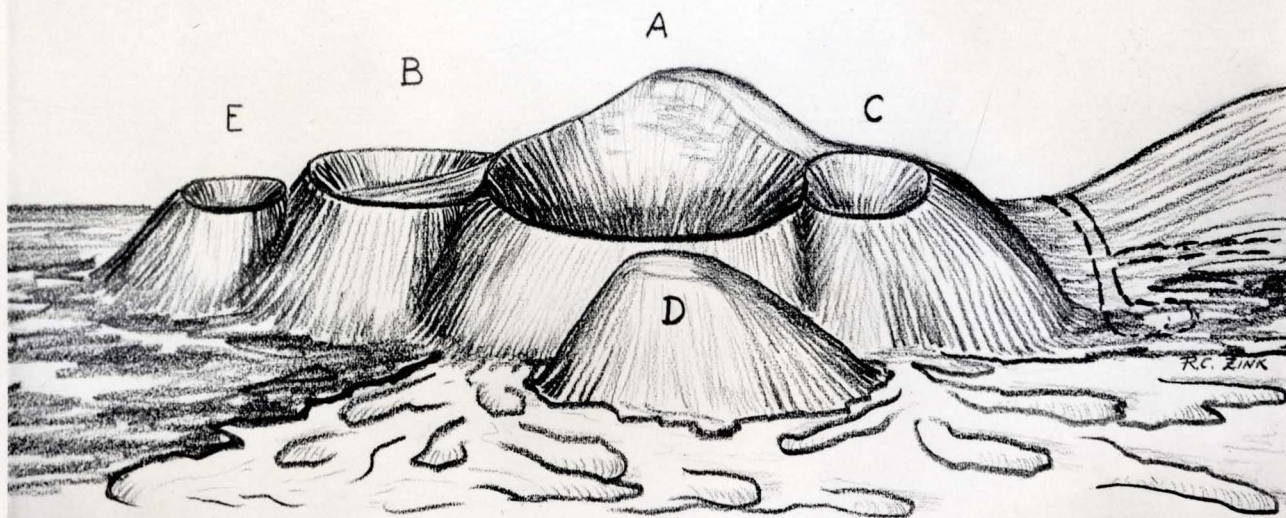


FIGURE III

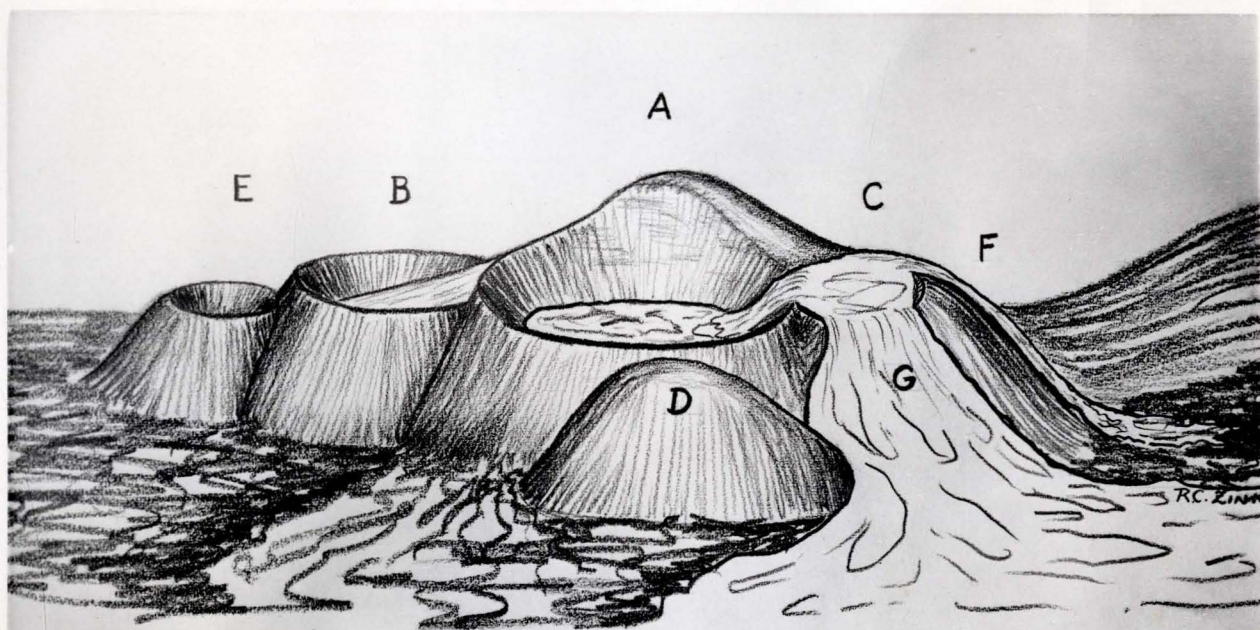
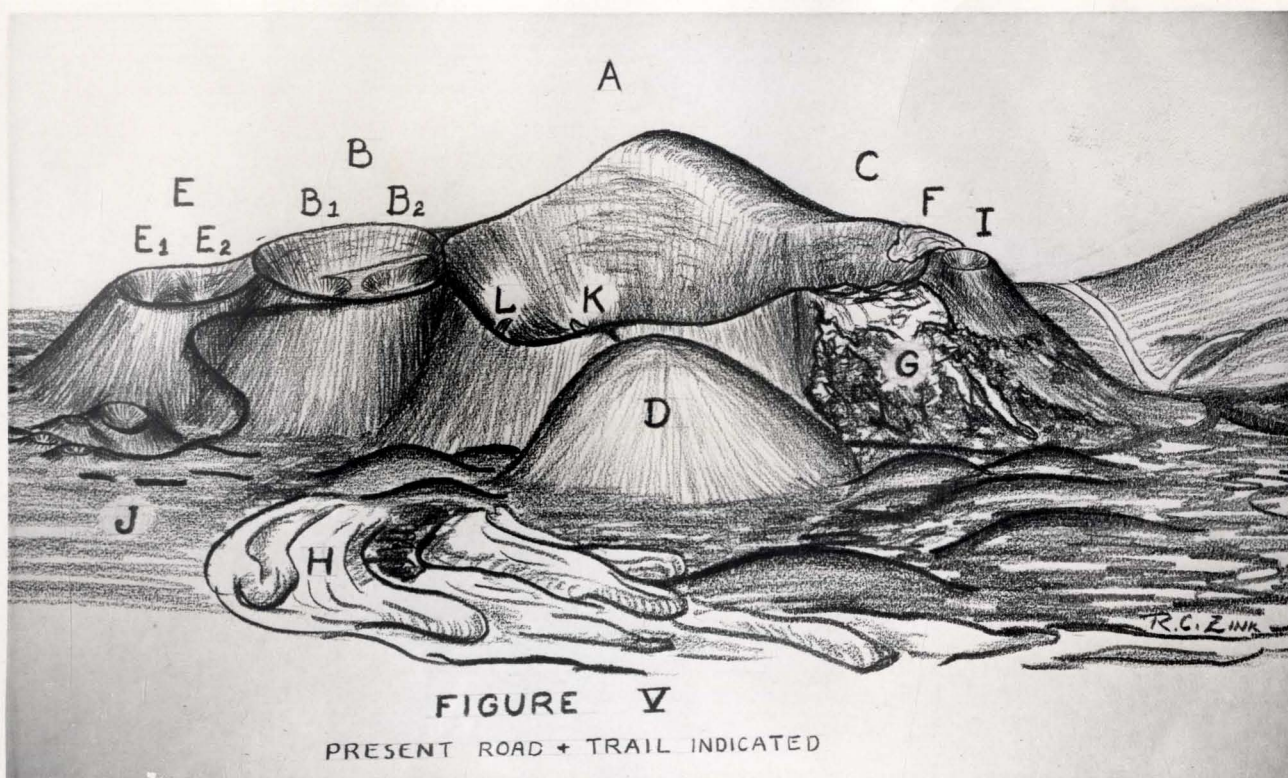
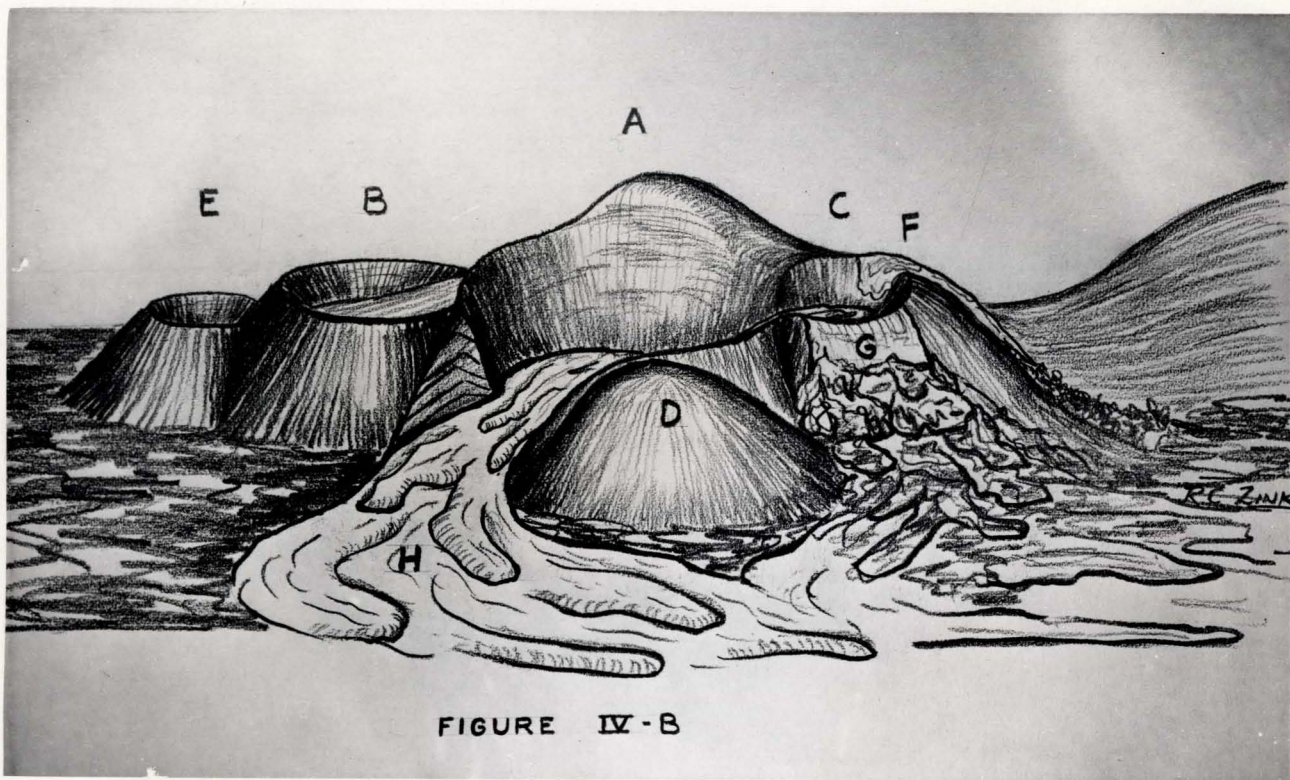


FIGURE IV-A





This picture gives a general view of the overflow from Vent "C", (1) covering the earlier breach of Vent "A" in this location. Also shown are the Spatter Cones and lava flows issuing from this area of the fissure, (2).



This view covers the overflow area from Vent "C", (1) which coalesces with flow material from the Spatter Cones, (2) and the final breaching of Vent "A", (3). The crater wall remnant of Vent "A" appears at (4). Vent "C" shows at (5), the evidence of the wall between Vents "A" and "C" at (6), the red cinder structure of the second building of Vent "A" at (7), topped by the final eruption of black cinder (8).



This view shows the second flow from the breached Vent "A", (1). Crater wall sections appear throughout the flow and on the skyline at (2). The slopes of Silent Cone are seen on the right, (3), the crater wall remnant of Vent "A" at (4). The second building of Vent "A" of red cinder shows at (5), with the black cinder breach fill of the final eruption at (6).



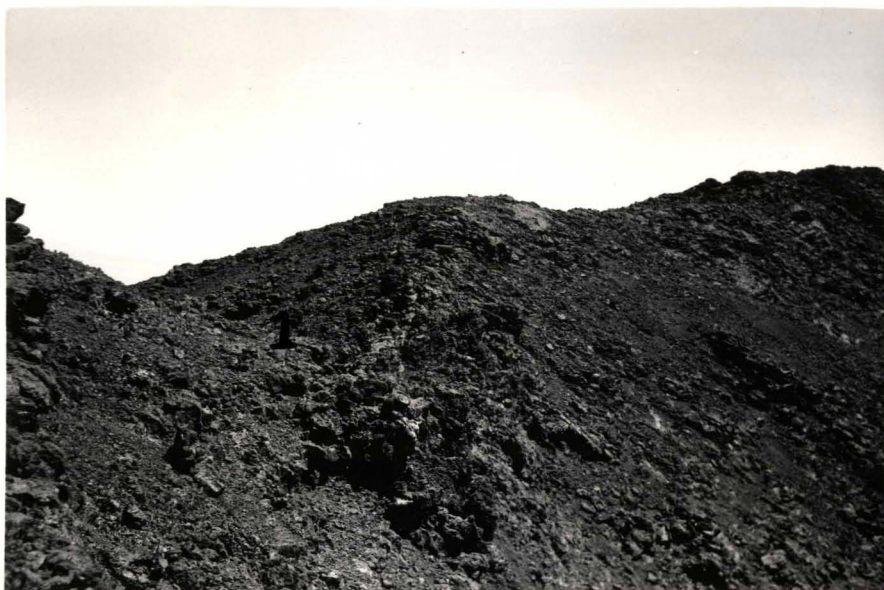
A general view of the area between Vents "A" and "B". The crater wall remnant of the original Vent "A" appears at (1), the terrace of cinder material filling Vent "B" from Vent "A" at (2), the wall material of black cinder raised between Vents "A" and "B" during the final eruption, and the original wall of Vent "B" at (3) and (4) respectively.



View looking from the rim of Vent "A" into Vent "B". The original wall of Vent "B" appears in the background, (1), with Vent "B₁", the spatter vent at (2). The terrace of cinder fill material from Vent "A" into Vent "B" appears at (3).



View from the crater wall remnant of the original Vent "A". The third rebuilding of Vent "A" appears at (1) and is entirely made of black cinder. Vent "B", (2) shows in the background with the cinder fill terrace visible at (3).



This view shows the character of the spatter material ejected by Vent "B₁". The encroachment of Vent "E₂" on Vent "B₁" is shown at (1).



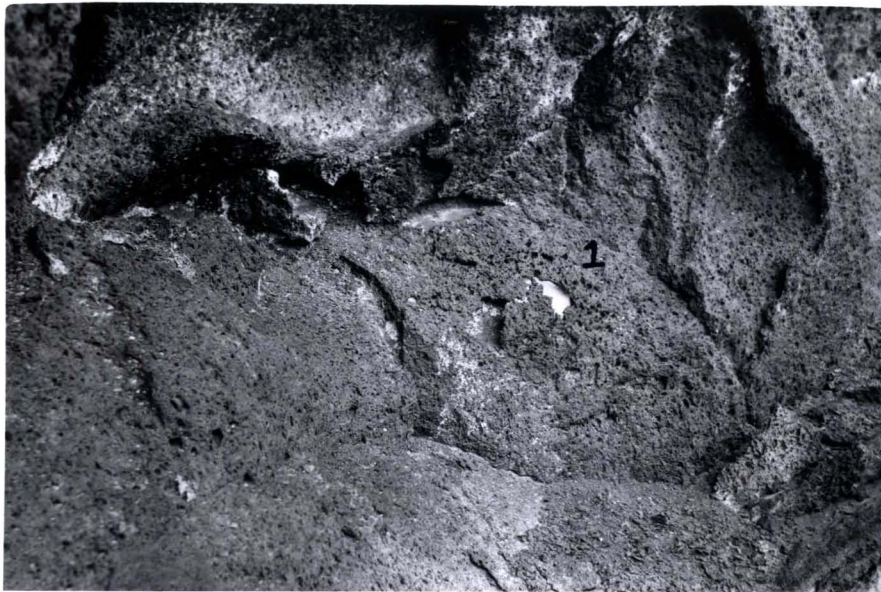
Vent "E₂" showing how this vent exposed the structure of Vent "E", (1) and the material which was laid on top of this old slope by Vent "E", (2).



This view from the northern end of Vent "E" shows the open fissure from which liquid lava moved along with spatter material probably during the last eruptions from this general area. Open fissure appears at (1) and the trail from North Crater to Big Craters at (2).



A view of the lava outcropping on the floor of Vent "A". This outcrop has a dip of about 20 to 25 degrees and a strike NE-SW. The wind eroded section is indicated at (1).



The rather spectacularly wind eroded area of the lava outcrop on the floor of Vent "A". The separation of the lacy lava from the parent rock shows at (1) where a piece of white paper was placed behind the lacy rock. The process is going on at other areas within the photograph at various stages of progress.