The Fifth Anniversary of Paricutin

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FIVE OBSERVERS FROM MEXICAN AND American institutions visited Parícutin on February 20, 1948, its fifth anniversary, to see what the volcano's activity was at that time and, in a sense, to make an occasion of the anniversary. The scientists at the observatory were Dr. Ezequiel Ordonez, former head of the Instituto de Geología of Mexico, and Ing. Genaro Gonzalez Reyna and William Swoboda, both of the Instituto. The Americans were Ivan Wilson, Ray Wilcox (permanent observer), of the U.S. Geological Survey, and the writer.

The American Museum of Natural History has made a motion-picture record of the growth of the volcano, and the chief reason for the trip at this time was to record the changes that have taken place in the two and one-half years since the last expedition. Since a new film, now in preparation, is to be presented this summer at the 18th International Geological Congress in London by Ing. Gonzalez, W. F. Foshag, of the U. S. National Museum, and the writer, it was desired to bring the record up to date.

Many changes were noted in the volcano and the surroundings, though the activity did not differ greatly from that previously recorded. There appears to be a diminution of the quantity of gas, and the peaks of activity are of brief duration. Tremendous quantities of lava have flooded the base of the cone, burying it in approximately 100 meters of basalt, and lava continues to pour out of the flank of the cone. A recently developed vent was producing a lava stream at the time of the visit. This vent, a few meters above the base of the cone, is on what is obviously a fracture line which bisects it. It is not far distant from the old Zapicho vent of 1944, but all traces of that old cone are now gone, for it has been buried in the lava. At the time of the last previous visit a low hill to the north of the cone was a prominent landmark; its development as a rafted portion of the cone had been noted earlier. Nearby it, a persistent fumarole constantly emitted a cloud of steam. Both of these peaks are now buried, although the higher still protrudes slightly as a monadnock in the lava stream. It is reminiscent of the opening in the lava in the Pedregal, just outside of Mexico City, where a pre-eruption temple is to be seen in such a window in the lava. The persistent fumarole still gives its column of steam, escaping through the lava of the new flow though beneath another layer of rock.

The Observatory now occupies the top of the highest ridge, which forms an ash-covered moribund forest island in a sea of lava. The flow observed from the present vent, christened *Thiporocua*, threatens to override the ridge and destroy the cabin, which can hardly retreat further. Erosion on this ridge, and on Conijuato and other nearby slopes, has been intense. Landslides have tumbled the trees as the decay of the roots and stumps have weakened their hold on the hillside and as the ash load has grown thicker. Gullies are cut well below their old level, down into the pre-Parícutin soil. All vegetation has been killed near the volcano, but its radius of devastation does not appear to be spreading. Pear and apple trees were in bloom in the remnants of San Juan, only a few meters from the now dead lava front. Pines and oaks had suffered more than some of the other trees. An almost buried maguey was still alive after almost five years of ash deposits, and the opuntias and pines near the GSA cabin seemed as healthy as ever. The impression is gained that the radius of plant destruction is now very well limited and that little more damage will be done, however long the eruption continues.

The lava flows, too, pile one on the other and appear to be unable to extend themselves much beyond their present maxima. Cooling and the migration of the activity to a new vent both play a part in this. After a time, instead of spreading further, the flow breaks out in a new place and covers an earlier flow. The indication is very strong that a century of activity at Parícutin would do little more damage than a few years. The showers of ash falling on more distant spots are too sparse and become too mixed with organic matter to be anything but beneficial.

Some changes were noted in the cone itself. Although it is apparently no higher than on the last visit, the burial of its base more than counterbalancing any growth, in February it was marked by a deep fissure at the base of which, on the Zapicho side, the lava is now flowing. Until recently it has been escaping on the other side. This activity has split the crater so that the north and south edges are much higher (perhaps 100 feet) than the east and west edges. The rift extends down the cone as a groove, a feature which would tend to disappear if no lava issued from it and there were no movement, because the natural effect of this fissure is to throw the bombs down the low sides. Consequently, also, standing in the high edges and looking into the crater is now less nerve racking.

The crater, now very steep near the summit, flattens slightly about 50 meters down, before dropping

abruptly off to the vents. Although several vents were noted, the overhang prevented the party from seeing into them. Steam appeared to be the principal product. Great quantities of it drifted from the vents, were ejected in pulsations with great force, and were accompanied by red bombs from the main vent. The steam from this vent rose 5 meters or so before losing its force and spreading into a cloud, thus making it possible to see into the opening. The odor of gas, probably SO_2, was very strong by the crater. This was the more remarkable because S has not been noted in any quantity at Parícutin.

The explosive activity and the ejection of bombs were extremely variable. Usually the bursts were infrequent, and little was thrown over crater edges. From time to time, however, brief bursts of activity at night provided spectacles comparable to those in the early days of the eruption. These continued for 5 or 10 minutes at the most and occurred only a few times during the night. On the night of the 20th, however, the activity was such that all traces of the route followed by the scientific party in their ascent of the cone were completely obliterated.

The cone has changed somewhat and now presents to the casual glance a ridged appearance which has increased since it was last observed. During the climb it was noted that the fluting was more apparent than real. The lighter-colored, sliding places are composed of larger fragments, up to several inches in diameter, while the darker, lower areas are composed of smaller pea-sized fragments. These are self-perpetuating, the larger fragments stopping the tumbling ones which cross the firmer spokes. As they grow, they tend to slip and pile up small talus cones at their bases. Their present appearance assures their future as ridges when erosion takes its toll of the dead Parícutin, some years from now. Rain will wash through the loose fragments and escape slowly, while it will run rapidly off over the surface of the smaller fragments and start its erosion. The upper part of the cone is free of the fluted effect, the long trails of loose fragments commencing about one-third of the way down. The ashes of this section of the cone are very hot just beneath the surface and can burn the fingers only a few inches down. This section of the cone steams after a rainfall or a shower of condensed vapor like that noted on the afternoon of February 20—a shower which undoubtedly originated in the plume above Parícutin itself.

Temperatures appear to be about the same at the lava vents. The Parícutin lava has never flowed rapidly, even at its hottest, and the fountains that have been observed have been composed of very viscous material. The Fifth Anniversary party was very fortunate in being able to observe two magnificent displays of lava fountains. The first which took place at about five o'clock on the morning of the 20th, was seen from the Observatory. The lower vent began to chuff, the sound resembling the chuffing of a laden steam engine, with the exception that here each successive escape of gas was of different intensity, so that the "engine" lacked the regularity and rhythm of a freight engine. The sound was loud enough to wake Sr. Ordonez, who roused the others. The fountain was of a brilliant yellow-orange color in the darkness and rose perhaps 20 meters in the air. The display which lasted approximately 3 minutes, rapidly reached a peak and then died down. After a few more heaves in the following 15 minutes the flow fell back to its former quiet lava emission. The only sound that was heard from the cabin was that of the escaping gas.

A second fountain was observed by the entire party from very close range at 2:30 o'clock in the afternoon. The prevailing wind forced us to thread our way along the edge of the cone and in the small depression that bordered the advancing lava at the flank of the cone. From nearby, the *boca* was seen to be extruding lava at a regular rate, rising and falling slightly as the quantity increased or diminished. From time to time the surface rose sharply to a level of about a meter higher than normal level. The sinking was accompanied by an escape of gas, which sometimes threw a few small fragments into the air. About 15 meters above this *boca* an upper flow was seen to be producing some lava which very slowly moved down to an intersection with the flow escaping from the lower vent. The lava from the upper vent was black and showed red only in the deeper crevices. No gas was noted from this vent.

A few minutes after the party moved to the upper vent for a better view, the lower lava flow began to roar spasmodically, making the same noise that was noted during the night, and the lava heaved more violently. With hardly more warning than this, the whole center rose in a tremendous column of rather viscous lava, in a fountain perhaps 6 meters across and 10 meters high, from which fragments flew as high again in the air. The lava of this fountain was very viscous, and the fragments did not thin themselves out to glassy fibers but remained in massive chunks of some thickness. As they fell, they plastered themselves against the bordering rocks and remained as they were, without flowing away.

As the vigor of the fountain increased, the column rose higher in the air, accompanied by a steady roar of escaping gas. At its peak it rose to the level of the upper *boca*, perhaps 16 to 18 meters in all. The entire display lasted for probably not over a minute, the fountain then subsiding almost at once to its former level. Several times afterward the level of the flowing lava rose and fell, sometimes getting very low so that

the channel was almost drained of lava, a full 3 meters below the normal level, and then rose again. There were a few further heaves, and for a moment a crevice just above the flowing mouth gave a violent jet of gas and dust, but no good fountains succeeded the warnings, and the flow became very quiet.

From the behavior of the lava and the heaving at the *boca* it is possible to say that escaping gas, not hydrostatic lift, is the cause of the fountaining. The rising of the lava at a mouth is a very common phenomenon at Parícutin, though it does not often fountain. Usually the gas escapes from many crevices in the surface of the big bubble before the bubble actually breaks. The display of the 7 simultaneous fountains observed on the Taqui side in 1944 still seems to hold the record for number and duration. One fountain, the closest to the cone, remained active there for almost half an hour after the rest had stopped, even though it was one of the later ones to develop.

On the evening of the 20th it was noted that the center of activity of the *boca* had migrated up the slope, apparently to the formerly quiet upper level. Lava was flowing rapidly from that mouth and down a steep slope, which remained incandescent for 100 meters or more during the night. The profile of the flow changed from a terraced two-step arrangement to a single steeper lava rapids. The front advanced rather slowly, in the usual blocks of various sizes, none immense, and the lava seemed to be pooling behind, breaking forth more rapidly somewhere else after it had built up sufficient pressure. This is a familiar phenomenon at Parícutin.

The expedition was unexpectedly successful in achieving a double result. It was possible not only to make the obvious observations and note the changes since the last visit, which constituted the primary goal of the geologists, but also to make closer observations on the flow and the cone than had been thought possible. The lava fountain observed from such a close range was mere good fortune. No further fountaining was observed during the visit, and it would be difficult to choose so propitious a time again.

Experimental Research Into Psychosomatic Phenomena in Medicine[1]

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PSYCHOSOMATIC MEDICINE IS CONCERNED with bodily disorders related to problems of adjustment of the personality to adverse life situations. The term psychosomatic medicine is not satisfactory, but since it has already come into common usage the world over, there is little profit in continued controversy concerning its acceptance.

Observation of the relationship of disease to social adjustment has always been an essential part of good medical practice. Only in the relatively recent past, however, through the work of Pavlov (*4*), Cannon (*1*), and others (*9*), has it become evident that psychosomatic phenomona are amenable to the experimental approach. Opportunities to pursue experimental investigations of such phenomena have not, as yet, been widely exploited by physiologists, chemists, or clinical experimenters. It must be evident, however, that while in psychology, as in mathematics and physics, many developments have been intuitive or theoretical, the facts of psychosomatic medicine eventually must be gathered in conformity with the same biologic criteria which are applied to any pathologic process.

Recently attempts to explore psychosomatic phenomena have afforded important data in support of the rapidly growing realization that the tissues of the body have only a limited number of ways in which they can react to noxious stimulation. The intense interest in pathology during the latter part of the last century had led to the notion that specific agents cause lesions of specific character in the organs. In fact, diseases of unknown origin were often classified on the basis of differing appearance of lesions under the microscope. More recently, however, it has been established that tubercles may be produced by agents other than the tubercle bacillus, and that even Aschoff bodies in the myocardium, formerly regarded as specific to rheumatic fever, may follow a variety of noxious experiences (*6, 7*). The work of Selye (*8*) has

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