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NEW VOLCANOES AND A NEW MOUNTAIN RANGE

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IN Michoacan province, some two hundred miles due west of the city of Mexico, a volcano was born above a cornfield on February 20, 1943, is already more than 1,500 feet in altitude and is still in a lusty growth. It has been christened *El Parícutin.* The event has figured in world news, and the volcano has been visited by throngs of tourists from the city of Mexico. Already an account of this unusual event has been printed in SCIENCE (December 10, 1943) and the occurrence has been pronounced unique in history.

What is so unusual is the birth and growth of a volcanic mountain *away from other volcanoes,* for scores of such mountains have been observed as they have been born upon the flanks of giant volcanoes, such as Etna, and phenomena in all respects comparable to those observed at Parícutin are therefore familiar to volcanologists.

As I shall show, the birth of a volcano like Parícutin, which is some tens of miles distant from other volcanoes, is not unique. Below are listed seven such births recorded in literature, all from the Christian era,[1] and there must have been others which are not of record:

NEW VOLCANOES (IN ORDER OF THEIR BIRTHDAYS)

Monte Nuovo (New Mountain), September 29, 1538. Bay of Naples. 440 feet high. Description by Lyell in "Principles of Geology," Vol. 1, pp. 607–619, on the basis of accounts by contemporary observers. Important gun position in the shelling of Naples, 1943.

Jorullo. September 28, 1759. Province of Michoacan, Mexico. 1,600 feet high. Rose above the plain of Malpais. Described by v. Humboldt in *Cosmos.* Fumerole action as late as 1906.

Izalco. February 23, 1769. San Salvador. 1,900 feet

[1] Strabo in his "Geography" has reported two earlier births, that of Madane during the third century B.C. and a submarine eruption in 196 B.C., both in the Aegean. Many submarine eruptions in new localities are of record, the best known that of Nwöe Island (New Island), thirty miles off Cape Reykianes, Iceland, in May, 1783; and Graham Island between Sicily and Tunisia, July, 1831. Unless eruption is long continued such islands are cut away by the waves and are subsequently marked only by shoals.

high. Thrown up in a region used by farmers and herders of cattle. Important later eruptions in 1798, 1803, 1856, 1869, 1873. Still very active with latest eruptions in 1927 and 1939. Account by F. de Montessus de Ballore, "Tremblements de terre et éruptions volcaniques au centre-Amerique," Dijon, 1888, pp. 108–110.

El Nuevo (The New One). April 11, 1850. Also called *Volcan Nuevo* and *Cerro Negro*. Near Léon, Nicaragua. 650 feet high. Thrown up on a plain of ancient lava. Described by F. de Montessus de Ballore, *loc. cit.*, pp. 137–138.

Pochutla. 1870. Province of Oaxaca, Mexico. Briefly referred to by Neumayr in "Erdgeschichte," Vol. 1, 1887, p. 245.

Camiguin, July, 1871. Near Catarman Village on Camiguin Island, Philippines. 1,860 feet high. Thrown up over a flat section of the coast during the cruise of the *Challenger*. Described and figured in "*Challenger* Reports, Narrative," Vol. 1, second part, p. 653.

El Parícutin. February 20, 1943. Province of Michoacan, Mexico. 1,500 feet or more in height. Described by Parker D. Trask in SCIENCE of December 10, 1943.

El Parícutin is thus the latest of new volcanoes in a registered list. Five of the seven recorded—El Nuevo, Izalco, Pochutla, Jorullo and El Parícutin—were all (1) born in either Mexico or Central America, (2) during the last two hundred years, and (3) along a line close to and parallel with the Pacific coast. (See map.)

Though the birth of Parícutin is not an isolated example, the birth and growth of a mountain range which is outlined by a number of known new volcanoes is absolutely unique. Evidence of the rising range is not restricted to the existence of a line of new volcanic vents. It includes (1) volcanic activity, (2) seismicity, (3) a rising coastal ridge and (4) an offshore trough.

(1) *Volcanic activity.* Speaking broadly, the age of volcanoes is measured in terms of their stature, increasing mass being as a rule accompanied also by decreasing activity. Old volcanic mountains are large because they are built up from the extruded lavas. The monarchs of the Mexican region—Orizaba, Ixtaccihuatl, Popocatepetl, Ajusco, Toluca, San Andres and Zamora—have summits from 12,000 to 17,000 feet in altitude, and they were built up during the Tertiary age on an east-west line behind a great mountain range. This range was parallel to the coast of the ocean of that time, one that separated North from South America. The rise of the range has now been largely completed, earthquake activity has largely ceased, and the great volcanoes are nearly or quite extinct.

To-day a range is rising parallel to the Pacific Ocean and the five known new volcanoes are ranged at its back in line with many others, all of them young and mostly active.[2] They are for the most part still of moderate size—about a third that of the earlier east-west series near the latitude of Mexico City (see map). Of those volcanoes in the new series of whose birth we have no record, one, Coseguina, was very likely born near the beginning of the nineteenth century; for though the region had been occupied by the Spaniards since the coming of the *Conquistadores* in the early sixteenth century, the eruption of 1835, one of the grandest in volcano history, is the beginning of the known history of the vent. Another active volcano is Colima at the intersection of the new with the old volcano line, but its active history likewise begins early in the nineteenth century. Its latest eruption was in 1941. Beyond Colima to the northwest activity dies out in Solfataric emanations at Guadalahara, inland from Cape Corrientes, and the circum-Pacific volcano belt is next continued in northern California. To the southward the line of volcanoes comes to an end short of Panama with the active vents in Costa Rica, where the line is separated by a wide gap from the volcanoes of Equador. (See map at end.)

(2) *Seismicity.* All the destructive earthquakes of the region during the twentieth century have occurred within the new rising range, the *Sierra Madre del Sur,* at the back of which is the line of new and youthful volcanoes (see map). If all historic earthquakes are taken into account the distribution is found to be the same.[3] Of thirteen lighter earthquakes in Mexico and Central America, yet important enough to be mentioned in dispatches to *The New York Times* during the last five years, all were from within the area of this new mountain belt.

(3) *A rising coastal ridge.* Between the line of active young volcanoes and the coast is a mountain range, the Sierra Madre del Sur. Its seaward slope is steep and marked by wave-cut terraces, a "coastal staircase," bearing witness to the fact that the land has here lately risen from the level of the sea to its present altitude. The "risers" in the staircase measure the jolting uplifts of greater earthquakes, as the "treads" do the work of sea waves during the intervening periods.

(4) *Offshore phenomena.* Offshore from the rising ridge (between Cape Corrientes at the northwest and Panama to the southeast) at distances varying from seventy to one hundred miles, there extends a deep trough in the sea discovered in 1924, which is steeper toward the land and with depths of from 3,000 to 3,500 fathoms (from over three and one half miles). This trough narrows and shallows toward each end,[4]

[2] To avoid confusion they are not entered on the map. They are mainly in Central America. (See map at end.)

[3] F. de Montessus de Ballore, "La Géographie Séismologique," figs. 66 and 67, pp. 385 and 397.

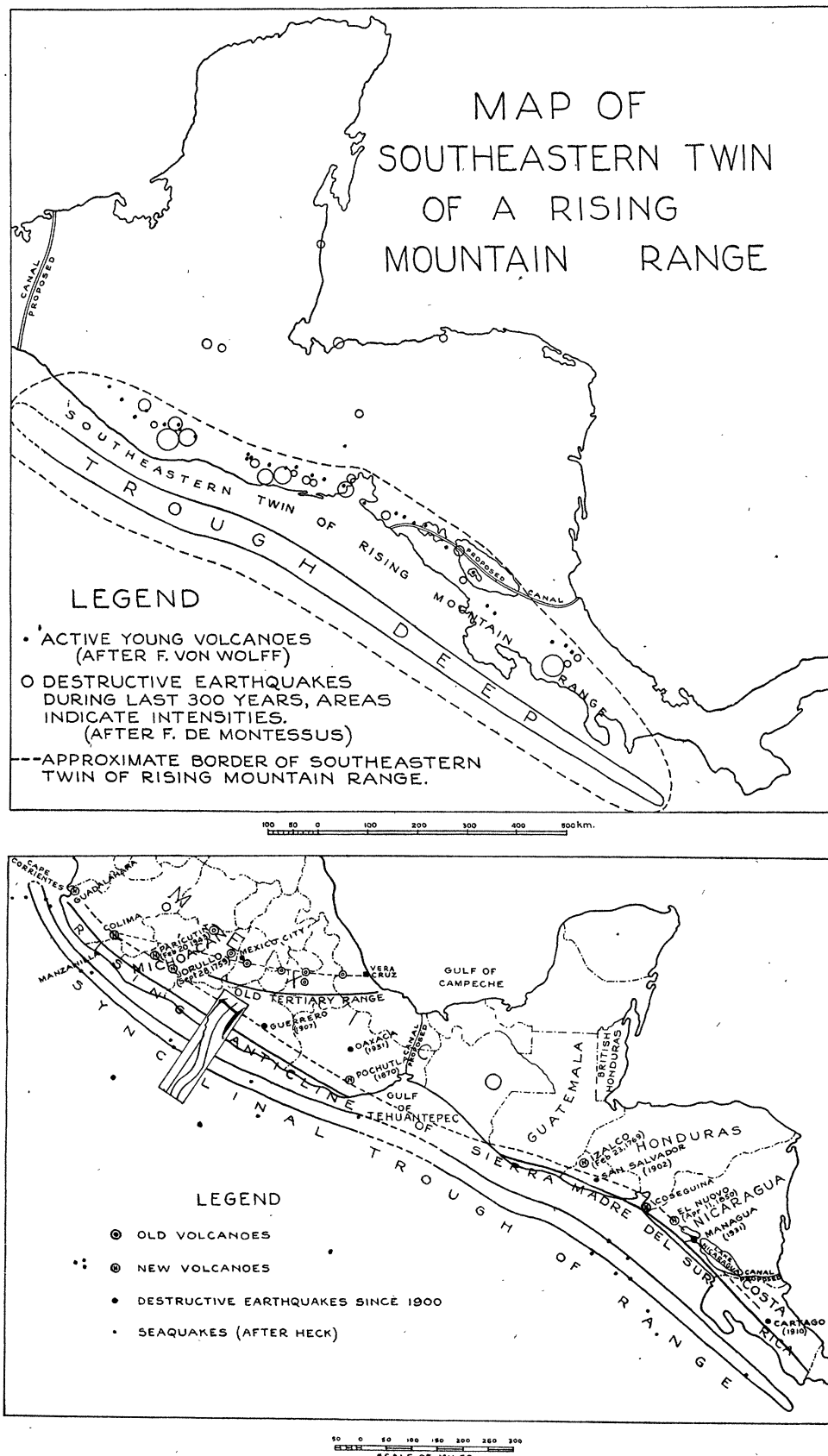

FIG. 1. Map to show a new mountain range rising on the border of the Pacific Ocean.

and appears to be interrupted near the center. The extent of the trough is thus in closest correspondence with that of the rising mountain range on the coast, and it is recognized to be the synclinal portion of the fold in the range, of which the visible portion on shore is the anticline (see sectional inset in map). Such trough-shaped deeps are the locus of seaquakes represented by individual drops of the bottom, each amounting to tens and even hundreds of feet, and these cause seismic sea waves, or tsunamis, which invade the neighboring shores and cause much loss of life and property. In all thirteen such waves have been recorded from this coast, a figure equalled only by that from two other segments of the entire Pacific border (Dutch East Indies and Japan to Kamchatka).[5] That the zone which lies just outside the trough proper also takes some part in the growth of the fold is indicated by the distribution of epicenters upon the map.

The circumscribed area of this rising mountain range (1,500 miles by 200) is probably surpassed for instability, if at all, only by the two other segments of the Pacific coastland which are cited above. Here we are able to note great geological changes brought out of past "eons" and encompassed within centuries. The belt is thus for human activities most dangerous.

It is not without interest that the future second Isthmian Canal, certain to be constructed, should not take its course through Nicaragua, since that route would intersect the rising range and require locks at Managua, already rebuilt seven times after its destruction by earthquakes.[6] As the map shows, the Tehuantepec project is immune from this supreme hazard because of the break in the rising range at the Gulf of Tehuantepec. As the second map shows, the belts of earthquakes and of active volcanoes, as well as the deepening sea trough, are all interrupted at the Isthmus of Tehuantepec. The newly born range is thus shown to be a twin, even if of the Siamese variety.

The next great earthquakes of the twin-range will in all probability occur within the northern portion of the northern twin and in the very near future.

[4] N. H. Heck, Pub. 108, U. S. Coast and Geodetic Survey, 1824, pp. 3–17, Fig. 1; *Bul. Seis. Soc. Amer.*, 14: 200, 1924. Also *ibid.*, 16: 182–186, map Fig. 1, 1926.

[5] From a list compiled by N. H. Heck.

[6] The city of San Salvador a little farther to the northwest on the rising range has a similarly disastrous history of seven destructions in three centuries. The latest destruction of Managua was in 1931 when 2,000 persons perished.

OBITUARY

WILLIAM GEORGE MacCALLUM

DR. MACCALLUM was born in Dunnville, Ontario, and died in Baltimore on February 3, 1944, at the age of 70. He took his B.A. degree at the University of Toronto in 1894, and his M.D. degree at the Johns Hopkins Medical School in 1897. After a year's interneship at the Johns Hopkins Hospital, he became assistant in pathology under Dr. William H. Welch, and successively associate professor of pathology, professor of pathological physiology, a chair created for him in 1908, and in 1917, on the relinquishment of the professorship of pathology by Dr. Welch to assume the directorship of the School of Hygiene and Public Health, MacCallum was chosen his successor. In the interval between the two professorships, MacCallum was professor of pathology at Columbia University from 1909 to 1917.

There was something precocious about MacCallum which marked him out in the medical school. He came to the school exceptionally well prepared for the career in scientific medicine which lay ahead of him. He grew up in an environment of science. His father, Dr. George Alexander MacCallum, besides being a busy general practitioner, was an accomplished naturalist and a collector of birds and Indian relics. His house in Dunnville, in which he had set up a laboratory, was virtually a museum. Later, when he had retired from practice, the elder MacCallum was to write on and collect parasitic worms, concerning which he was an authority. At the University of Toronto, William MacCallum came under the tutelage of Ramsey Wright, an Edinburgh man, zoologist and professor of biology, whose particular field was comparative anatomy. At an early age, therefore, MacCallum was given that bent toward biological science the influence of which is apparent in all his published work.

While still a medical student, MacCallum made a fundamental discovery in biology and medicine. The disease, malaria, was very prevalent in the environs of Baltimore at the close of the nineteenth century. Dr. Osler and his staff became deeply interested in the study of the malarial parasite, which Laveran had discovered in 1880, the life history of which was being actively investigated in Italy and elsewhere at the time. The observation in 1885 that birds harbored a similar parasite (a haematozoon) stimulated the studies at Hopkins, and MacCallum was one of the undergraduates who devoted themselves in the summers of 1896 and 1897 to the investigation of avian malaria. On his return to Dunnville in 1897, and through the study of infected crows, he succeeded in witnessing and in interpreting the phenomenon of flagellation of the parasite, which had baffled all investigators beginning with Laveran. The phenomenon, which had been regarded