

# ERUPTION OF EL RUIZ VOLCANO, COLOMBIA

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The Republic of Colombia is situated in the northern part of South America, with coasts to both the Atlantic and the Pacific Oceans. It has a long history of natural disasters: hurricanes from the Caribbean sea have lashed the eastern seaboard more than once, while the western part of the country belongs to the so called "Pacific Fire Belt." Being in the zone of contact between the Nazca and the South American Tectonic Plates, where the former gets under the latter, it suffers from volcanic eruptions and earthquakes (Figures 1 and 2). The more recent major

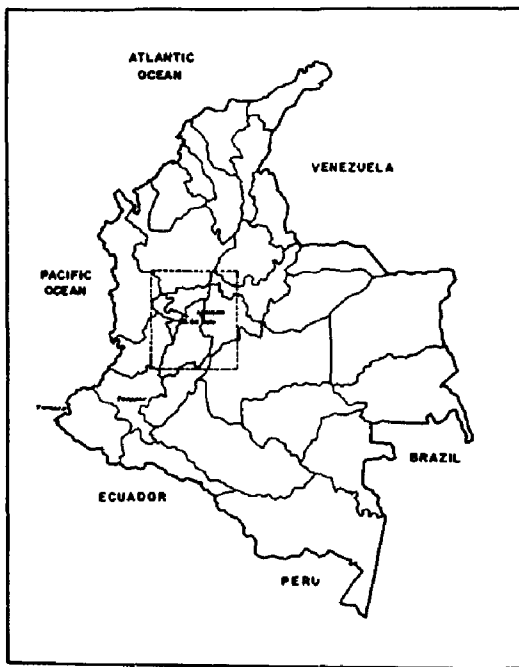


Figure 1—Colombia

earthquakes were those in Tumaco in 1979 and Popayan in 1983. In Tumaco, the combined action of the earth movement (magnitude 7.9 in the Richter

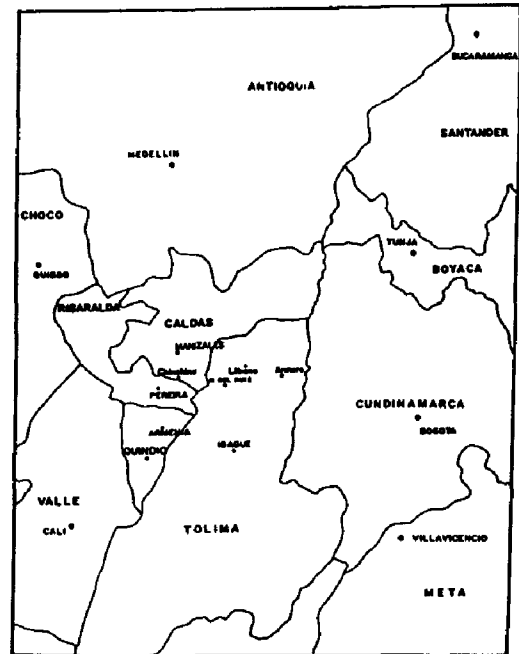


Figure 2—Inset

scale) and the subsequent Tsunami caused an estimated 500 deaths (Gueri et al). Popayan was almost totally destroyed by an earthquake of 5.3 magnitude in which over 100 people died (Gueri and Alzate).

At the moment there are in Colombia nine active volcanoes which have eruptions during historic times; all of them situated along the Andean Mountains which cross the country from north to south (Simkin et al). The "El Nevado del Ruiz" Volcano is a snow covered peak reaching 5,400 mts., whose last major eruption was in 1595. Since then it has given signs of activity on several occasions. In 1845 a mud flow along the eastern flank killed about 1,000 peasants living in the margins of the Lagunilla River (Tomblin). From that occasion it had remained dormant until November 1984 when local, low intensity earthquakes, indicated that "The Giant Could be Waking Up." The quakes were followed in December by a steam blast eruption through the Crater "Arenas" (named after the pilot who discovered it

From the Pan American Health Organization, Washington, D.C., U.S.A.

from the air some 20 years ago). A larger explosion in September 1985 prompted the authorities to expedite preparedness plans for a possible major eruption and a Risk Map was made public the following month. Towns such as Murillo, Libano and Santa Isabel were at risk of pyroclastic material (ash and rocks), while others such as Guayabal, Mariquita, Chinchiná and Armero could suffer the effects and lahars due to the thawing of the ice cap (Figure 3). This is in fact what happened in the night of November 13th, 1985.

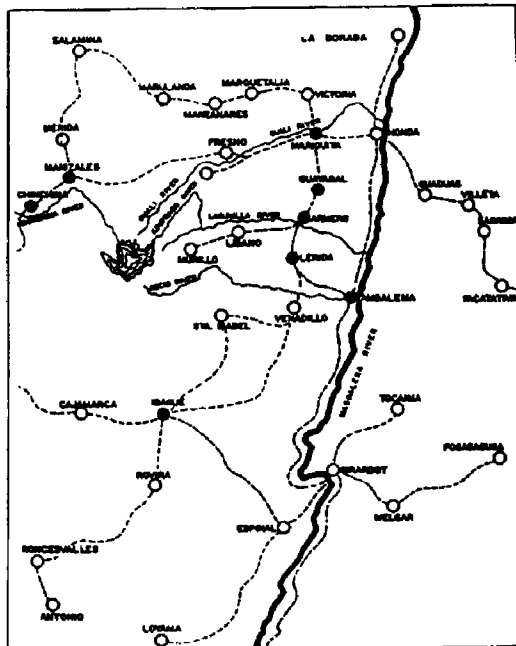


Figure 3—Area of disaster

The afternoon of the 13th, there was an earth tremor of greater intensity than those previously reported, and at around 5 p.m. fire ash fell over Armero. At about 9 p.m. two loud explosions and rumbling sounds were heard. The explosions were followed by a rain of pumice blocks and ash, (UNDRO). The great increase in temperature of the volcano's walls caused the melting of a small portion of the icecap, small but large enough to cause an avalanche coming down the gorges feeding some of the rivers originating in "El Nevado," particularly the Azulfra, Lagunilla and Chinchina Rivers. The avalanche destroyed about 5% of the town of

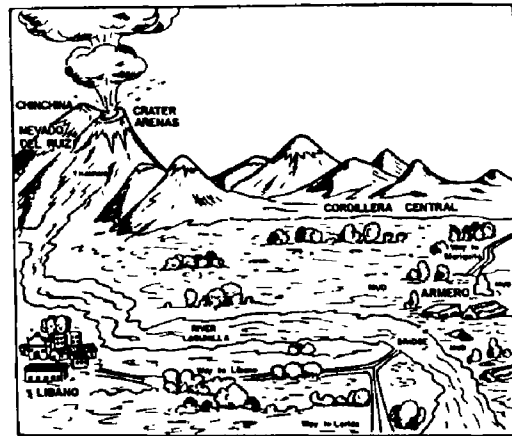


Figure 4—The avalanche (adapted from "El Espacio", Colombian Newspaper)

Chinchiná on the west (pop. 61,909) and 85% of Armero in the eastern side (pop. 29,170): officially 374 and 4,180 houses respectively, with a death toll estimated at 1,927\* in the former and 20,806\* in the latter, plus a further 209\* in other places along the rivers. Of the neighborhoods razed in Chinchiná 50 people were rescued. In and around Armero an area of 36 sq. kms. was covered by mud as deep as 15 mts. in places, scattered with bodies dead and alive, partially buried or entangled in the debris. The very fluid consistency of the mud made rescue by land impossible except in the periphery. As soon as daylight broke out rescue by helicopter began, hampered by heavy rains.

### The medical response

As soon as the news of the disaster was known medical teams were organized in Ibagué (the capital of the Department of Tolima) and in Bogotá, to assist the victims of Armero. For geographical reasons Chinchiná was assisted mainly from Cali: Stabilization and triage stations were established in Guayabal, Mariquita and Lerida (Figure 3), the bases for the rescue helicopters. In addition, these teams strengthened the small local hospitals. When the triage stations were overwhelmed by victims the cases were sent to the local hospitals as soon as the helicopters landed, but were not admitted there as these towns were themselves at risk of new avalanches. They were sent to Ibagué (on days 1 and 2) or Bogotá when the comparatively small "F. Lleras" Hospital in Ibagué became overcrowded.

(\*) Official estimates: "Report No. 6 from the Ministry of Health", November 20th, 1985.

It soon became evident that the state of the victims' wounds made it unwise to perform any suturing or major surgical operation except for life saving. The casualties had been dragged and rolled over and over by the avalanche and had been submerged in the mud for hours or days; they were covered from head to foot by a thick layer of mud and, in fact the wounds proved to be infected practically in all cases. The routine at the triage centers was to clean the wounds as best as it could be done (which in places was difficult such as in Mariquita, where the avalanche had destroyed a stretch of the aqueduct supplying the town and water had to be brought in by tankers and any other possible means, even flown into the town in all sorts of containers), dress them and give a booster of tetanus toxoid and a large dose of an antibiotic (usually crystalline penicillin intramuscularly).

It is worth noting that a public appeal for blood donations which began on the radio during the morning of the 14th (day one) was discontinued in the afternoon of the same day with the information that blood was not needed. This has been our experience in other natural disasters: the need for fresh blood during the early emergency phase is very limited.

Because of the very real danger of a new avalanche, it was considered advisable not to admit any patients to the hospitals along the rivers fed by the "El Nevado del Ruiz" and as from day 3 to keep more than half of the beds at the "F. Lleras" Hospital empty to receive the first wave of possible victims.

It was decided then to transfer the largest number of victims who required hospitalization to Bogotá and the two second largest cities in the Country: Cali and Medellín, distance from Ibaque some 150, 230 and 220 kms, respectively. Practically all the transport was done by air. This operation was met with a series of logistic problems. First there were delays and hold-ups in selecting the patients that had to go to different places. Second, when the selection on medical grounds had been carried out there were conflicts on social grounds because of times, members of the same family had been destined to different places, or because some people did not want to go to an unknown city where they could get stranded. Third, there was discoordination between the transport of the victims to the airport and the availability of airplanes. Fourth, some airplanes that had been waiting for a long time received a batch of patients scheduled to go to Cali, for instance, when that particular plane could not fly over the very high mountainpeaks that had to be crossed, and that group of patients had to wait for another plane or ended up somewhere else.

Once in the receiving hospitals, the medical management was satisfactory, as Colombia has an adequate number of excellent and well trained staff. Some of the social problems, however, took longer to solve than the medical ones.

### The survivors

It is estimated that about 10,000 people survived the Armero tragedy. It will never be known why in an "Announced Tragedy" (as it was called by the Press) so many people died. It appears that the people did not want to follow the order to evacuate which reportedly had been given early in the evening or afternoon. Many went to bed and others wandered toward the main square when the explosions were heard. In any case, the reports are varied and sometimes conflicting.

The speed of the avalanche when it reached Armero (from 5,400 mts. to about 300 mts. over sea level) is said to be about 40 kms. per hour (UNDRO), and there are cases of families found dead in their cars overtaken by the avalanche.

As many as half of the survivors were rescued mainly by Civil Defence and Red Cross Volunteers, most of them during the first three days (14th to 16th of November). They came out of the mud with nothing, many of them even without clothes, literally. Those who did not require hospital admission were housed in schools, churches and improvised tent camps. Some went to live with friends or relatives elsewhere. The great majority had lost absolutely everything.

The question as to whether to reconstruct Armero or not is as yet undecided. Many survivors have settled in neighboring towns, houses having been built by several agencies. Others have moved far away. And others still are returning to Armero.

The number of wounded has been estimated at 4,470, of which 1,244 (27.8%) were admitted to different hospitals. Of these, 138 died after admission.

In a survey carried out in 23 hospitals accounting for 834 (67%) of the victims admitted, the hospital records showed that most of the cases presented multiple lesions. Lacerations were the commonest (578 cases), followed by penetrating wounds (343 cases) and fractures (312). Among the fractures, the most frequent one, by far, was that of lower limbs (128 cases) and then upper limbs (70 cases) and ribs (56 cases).

Ocular lesions were very common. There were 272 cases, with the majority conjunctivitis, but there

were also subconjunctival hemorrhages and palpebral lacerations.

Skin abrasions followed lacerations in frequency (156 cases), and far behind a host of practically all type of lesion imaginable (burns, trauma of internal organs, luxations, concussions, lesions of the gastrointestinal and genitourinary systems, etc.). The full details and results of the survey are published elsewhere (Gueri and Pérez).

What the investigation did not contemplate were the psychological lesions which affected not only the survivors but also the rescue workers.

### **The international response**

During the first two days after the avalanche, supplies were very scarce at the scene of the disaster: from rescue equipment to basic drugs. At the expense of emptying many hospitals all over the country (later they would be restocked somehow) supplies were made available from national resources for the first few days. The more serious problem during the acute phase was getting them to the disaster area.

In the meantime the international response became overwhelming. There seemed to be a rush for being among the firsts to send aid to Colombia, regardless of what was sent (unfortunately not always what was needed). Boxes and boxes of unclassified supplies began to pile up at the airport: drugs for every type of illness imaginable, clothing, shoes, food-stuffs, etc. Some of those supplies were not required; some drugs were close to expiration date or had already expired. Not all the food was in good condition and some of the clothes were rather old and raggedy. Two Army Field Hospitals from two friendly countries were flown in (at great expense to the donors), and as it happened there was no need to set up the tents: one of them functioned in Mariquita's Hospital and the other one in a building in Ambalema. The highly trained army medical specialists found themselves cleaning up wounds and giving penicillin shots. A field hospital composed of several tents, camp beds and a self contained, "shipping container"—type operating room was given to Colombia. It was set up in Guayabal in January, and was visited by the author at the beginning of February. The cost of the infrastructure (water and sewage), maintaining the staff (supplied by a Faculty of Medicine) and the running expenses was not inconsiderable for the restricted national health budget.

The hospital had been functioning really as a health center where about four or five dozen patients had been seen over a two week period (no emergencies whatsoever related to the avalanche). Temperatures of 35°C. and more are not uncommon in the area, and the Operating Room where the air conditioner had never functioned was an oven. Only two patients had been operated, for chronic complaints; they were the only two hospital patients. The fact is that with adequate medical and surgical facilities only some kilometers away, it was unjustifiable to perform any mildly serious interventions or admit seriously ill patients.

Stories like those above are endless. The sad point is that the right type of assistance was indeed very much needed. What has been more useful is what was requested after a proper but quick assessment of needs was performed: specific drugs for certain resistant strains, or drugs to replace those which had been used during the first few days, sanitation equipment for the shelters and to restore damaged water mains, building materials for permanent homes, specialists with certain skills for very specific problems, prostheses, equipment for physical rehabilitation, etc.

It is far more useful to the stricken country if the donor one holds on for a few hours, or even one or two days, to allow a quick, even rough, first assessment of needs so as to ensure that the right type of assistance is sent.

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