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Volcanoes in Central America.

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Mr. President and Gentlemen,—

IN glancing over the list of addresses made before your society, I observe that they are nearly all patriotic, and I suppose as a patriotic geologist I should have come to speak about Canadian volcanoes. We geologists have one fault to find with Canada. There are examples, in Canada of nearly every possible geological formation, but not one single active volcano. (Laughter.) In fact, the nearest place where one can find an active volcano is Mexico. I had occasion to go to Mexico last summer, and saw some there, but even in Mexico they are not as active as one would like to see them. (Laughter.) You have to go to the West Indies or South America to see a real active volcano. Almost the whole of the southern part of Mexico is volcanic. Most of the high mountains and also many of the lower ones are volcanoes, and the plains that are cultivated are often composed of volcanic ash that has spread about ages ago and now makes fertile soil. Sometimes, however, these plains consist of lava sheets which do not make fertile soil, and which are called in Mexico "malpays," or bad lands.

The occasion of my visit was the World's Congress of Geologists, held at the City of Mexico. On these occasions we make interesting excursions and talk over things in whatever language we have at our command. (Laughter.) It was a polyglot gathering, the Germans in the majority. Most of our excursions were to volcanoes, but the first volcano that I

had occasion to climb was not more than 500 feet high, with nice smooth sides and a round top. The crater was filled with water and made a very pretty lake indeed.

But there were lofty volcanoes, and we geologists make a point of getting to the highest altitude we can reach. Among the half dozen lofty volcanoes in Mexico I had a chance to climb three, but only one is really active, Colima. The highest peak in North America is a volcano, Orizaba, which I had the pleasure of climbing. Our parties were in charge of Mexican Government officers and Mexican geologists, and the Mexican Government has a paternal eye on all foreigners who travel in that country and never lets them go about without an escort of some kind.

Colima is on the west coast and the first stage of our journey to it was over a very shaky railroad on which the cars jolted and rolled to such an extent as to give one an idea of sea-sickness. Our halting place was Zapothan, near Guadalajara, the little town nearest Colima. There we found the Government had provided for our escort a troop of dragoons, nearly as many dragoons as men and women in our party, and had also provided mules for the ride of twenty-five miles to the volcano. My mule was a very good one. My feet did not exactly touch the ground, but there was not much space to spare, and I was surprised how that little animal took me up those rough paths for six thousand feet. The first part of our ride was through a tropical region, something very different from what we have in Canada. Then as we went up we passed through a region that abounded in live oaks covered with vines and trailers and Spanish moss, which produced a most curious and beautiful effect. Then we came, as we moved on still upward, to a temperate region with beautiful pines such as you see in the Southern States.

Here it was that we halted for lunch at a most curious house, built entirely of straw and not nearly large enough to take in our party, which numbered about seventy-five people, including the dragoons, so we picnicked under the trees. Among other articles of food, we had some goat meat. (Laughter.) You will find that most of the mutton sold in Mexico was in life clothed with hair and not with wool. (Renewed laughter.) And we also had some beer, for a considerable number of our party were Germans, and you know the Germans have a fondness for certain fluids, so they were provided. I had thought it might have been pulque, the native drink, but that was missing.

After lunch we resumed our journey and soon had our first view of Colima, which, curious as it may seem, was from a point above it. To reach the volcano we had to pass the Nevado de Colima, over another mountain, which is really higher than it is. The point where we were standing was about 14,000 feet above sea level, and from it we could look right down on Colima, one of the most remarkable sights I ever saw. Here, in front, and a little lower than we were, was the volcano, and in the distance were the bright waters of the Pacific about twenty miles away, and the atmosphere so clear that with a good glass we could see the waves dashing on the shore.

The volcano was bare of all vegetation, rising up with a rounded top to the crater, not a very beautiful thing, I admit. It was emitting clouds of steam, but was not very active, though it had been three years before, pouring out lava and covering the surrounding country with ashes.

To get from where we stood to the volcano the first thing we had to do was to descend to the valley between the two mountains and then to cross a stream of lava which had flowed there thirty years before. Though only about half a mile across, it took us nearly two hours to cross it. What was it like? You have seen our streets when they have been torn up to put down sewers and make other repairs, and you can imagine what it would be like to climb over such obstructions. Now if you will magnify these heaps of debris and imagine them composed of rocks half the size of this room, you will have an idea of that lava bed. Then we had to go through a zone of volcanic ash, where you sank over your boot-tops and seemed to slip back about as far as you went ahead. So I admit that I was well tired when I got to the top. And then in those high altitudes your lung power gives out. I noticed our party had begun to grow less some distance back. At an old volcanic vent on the side of the larger one a good many of them stopped. Among them was our one lady member, a charming lady, and we were all sorry she did not go further, but skirts are not suitable for that kind of travelling.

It was here that the only thing approaching an accident on the trip occurred. I am sorry to disappoint the hopes of the recital of exciting adventures raised by certain stories which appeared in the papers, but the nearest approach to an accident was when Dr. Adams sat down on a fumerole. Now, perhaps you don't know what a fumerole is. It is a little opening in the rock from which issues steam and volcanic

gas. The surroundings are not very pleasant, because the gas contains a good deal of sulphur dioxide, something that we used to smell when an old-fashioned match was struck, though now they make matches differently. All that happened was that he arose quickly. (Laughter.)

We got right up to the edge of the crater, where at first we could see nothing but a thick cloud of steam, which was very disappointing, I assure you. Then the wind shifted and carried the steam away from us and we could see somewhat dimly into the crater. Later we could see the reddish rocks at the bottom of the crater, not so hot as a few years before, but still retaining sufficient heat to throw off clouds of steam. I took several photographs which have been developed since I returned home, but I am sorry to say that they show mostly steam. We then moved along and got a short distance down the side of the crater, which we entered for a hundred yards, but the sulphurous gases were choking, so we went no farther.

In coming down we chose the spot where the ash deposit was broadest. It had been very difficult to toil through this ash going up, but coming down was a different matter. We took strides about half as long as this room, and we came down in fifteen minutes that part of the mountain which had taken us an hour and a half to climb up. Then we had the lava stream to cross, to which I have previously referred, so that when we got back to the little camp between the mountains we were all thoroughly tired out with our day's climbing.

Next I am going to tell you about another volcano right across Mexico near the Gulf. To reach it we passed the famous volcano Popocatepetl, which you must have noticed if you have ever been in Mexico, looking white and beautiful, standing out against the sky like a cloud which keeps its form. Near by is the lower volcano Iztaccihuatl, which means the woman in white. Wherever you have mountains you will have some which will suggest to the mind of the beholder the form of men or animals. At Port Arthur it is the giant lying on his back, and here in Mexico it is the woman in white. In the white and shrouded figure there is a faint resemblance to a woman lying dead.

I had been to Vera Cruz, on that swampy shore level where yellow fever persists—there was one case while we were there, and we were not sorry to get out of the city. We went down to the coast by one railway and came back by

another, and from the lines of both we could see, for a long distance, Orizaba, the finest mountain south of the Yukon. It stands out without any rivals near it, rising up to a height of 18,300 feet. But though it is the finest mountain in Mexico, no excursion had been arranged for us to visit it. When I asked Mr. Aguillera, the director of our Congress, why none had been arranged, he said it was a bad mountain and the season of bad weather. It was certain to be raining. However, we were not to be beaten, and I got up a party composed of Prof. Wolff of Harvard, Prof. Reid of Johns Hopkins, and Mr. Chamberlin of Chicago. As it was an independent party, we did things our own way and took our own time. The nearest railway station is San Andres, and from there there is a remarkable tramway that runs about three miles uphill to the town of Chalchicomula, which is the point of departure for the mountain. The tramway looks all right, and when you get on board the cars they hitch on the mules and you go up gently and leisurely. When you come down there are no mules. They simply start the car and let it run down all the way. I do not think there is Canadian capital behind this railway—(laughter)—although, as you know, several things in Mexico are run with Canadian capital, including some excellent street railway lines.

We were eager to begin the journey at once, but the hotel keeper said it was quite impossible to go that afternoon, and we had first to get permission. For this we had to visit the Jefe Politico, the Mayor. The town council didn't count—(laughter)—I don't think there was any.

When that duty was performed we found that the mountain stood in a famous hacienda, a large estate, and that we would have to go to the agent to get permission to pass through. Well, we got it, all very correct and nicely written in French, and then we went to bed. The next morning we found the mountain was there all right, with only a few clouds about it. Our guides were on hand, and a mounted policeman, for the Government will not let you go anywhere in that country without a soldier. They wanted us to take three, but we compromised on one, because we knew we would have to give a pretty good tip to every one we took. We had mules to carry the baggage, and a spare jackass tied behind for what purpose I never understood. (Laughter.) Then we started, the guides and mule drivers on foot, while we and the policeman rode ponies. The guides always managed to keep up with the ponies. They were able to cut across lots, so to speak, while we had to keep to the road.

We camped for the night in one of the most peculiar camping places that I have ever seen, and I am somewhat of an old campaigner in that respect, in a small cave under a lava stream. In the lower levels we had been suffering from the heat, but up here at 13,000 feet it was bitterly cold. The guides had camped where there was a good supply of wood, and we had a big roaring fire, but in spite of that it was so cold that it was almost impossible to sleep under all our blankets in the draughty cavern.

We waked at 3.30 a.m. and after breakfast started up the mountain at 4.30, riding our ponies as far as the snow line. That morning I wished I had never come at all. It was cold and shivery; the night was still dark and the moon and stars had a cold, icy glitter. However, off we started, each carrying a bottle of water on his back and other things. (Laughter.) At the snow line we left the ponies and started to climb but as the ascent was pretty tedious I will not describe it in detail. It was up a steep slope of snow which impeded our walking, and you must remember that when you are up 18,000 feet above sea level you only draw in with each breath about half as much oxygen as when on normal levels. Therefore you breathe about twice as fast as under ordinary circumstances. So with this and the shifting snow into which we had to dig our heels to get a foothold, toward the end we were glad to stop about every ten steps to rest. It took us about four and a half hours to reach the top, a climb of 3,500 feet above snow line.

The glitter of the snow was very trying, accompanied as it was by the glare of the nearly vertical sun, as there was only a very thin atmosphere to screen us from its full force. We had to use snow-glasses to protect our eyes, and Dr. Wolff got his eyes very badly injured because he was not as well protected as the rest.

On the return we made use of the snow that had impeded us on the way up, and "glissaded" to the bottom, *i.e.*, we went down sliding over the snow. I say that because in some reports it was stated that we went down on a snow-slide and that the snow took us along. We slid over the snow and used our alpinestocks for steering and regulating our speed, going down in twenty minutes what had taken us four and a half hours to climb.

Mr. Mason suggested that I might tell some stories of volcanoes in general. Volcanoes are not always on land; they are sometimes under water, and if you desire to have an

island all your own it is very handy to have such a volcano about. (Laughter.) On one occasion when an island so formed appeared above the sea in the Mediterranean a British man-of-war was cruising in the vicinity and at once claimed it for Britain. The new island, however, was in sight of French territory, and the French claimed it. Moreover, it was also in sight of that part of Italian territory ruled by Austria and the Austrians claimed it. Matters were looking fair for a first-class international complication when somebody suggested that they should go to have a look at the island, and when they reached the spot behold it had disappeared. (Laughter.)

While we have no active volcanoes in Canada, we have a number of extinct volcanoes, and deposits of volcanic ash just as in Mexico, except that they are millions of years old and have been compacted into rock. In the great Sudbury mining region and also in the Cobalt district in which you are interested, and from which you doubtless draw large dividends—(laughter)—there are volcanic formations, and while the majority of the mineral deposits of Cobalt are not in this formation; yet some of them are—(applause)—so that volcanic rocks have a practical interest even now in Ontario.