

The first ascent to the volcano Cotopaxi in Ecuador by Wilhelm Reiss (1838–1908)

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Abstract The volcano Cotopaxi in South America is 5,897 m high and is one of the highest active volcanoes of the world and the second highest volcano in the Andes after the Chimborazo (6,310 m). In Ecuador, there are more than 20 volcanoes contributing to the spectacular mountain range diving this country between the western and eastern lowlands. There have been more than 50 reports of volcanic activity at Cotopaxi since 1738, among which those from the years 1744, 1768, and 1877 are the largest. During the 1877 eruption, the whole summit glacier collapsed and a huge mudflow spread out for more than 100 km and flooded the city of Latacunga. Five years prior to this catastrophic event, the German geologist Wilhelm Reiss from the University of Heidelberg ascended Cotopaxi for the first time together with his supporter Angel M. Escobar from Columbia.

Keywords Volcano · Eruption · Tuff · Lava · Biotite andesite · Pyroxene andesite

Introduction

Several German geologists and geographers achieved outstanding scientific results in Central and South America between the late eighteenth and early twentieth century, such as Alexander von Humboldt (1769–1858), Wilhelm Reiss (1838–1908), Rudolf Hauthal (1854–1930), Alphons

Moritz Stübel (1835–1904), Hans Meyer (1858–1929), Theodor Wolf (1841–1924), Karl Sapper (1866–1945), Hans Steffen (1865–1936), Carl Troll (1899–1975), Rudolf Peschreiter (1868–1938), and Walther Schiller (1879–1944).

The historic review we present here has attempted to preserve the spirit and style of the language of those days when quoting original text documents. Where we have failed in this, we ask the readers to be clement.

Alexander von Humboldt, the polymath and natural scientist, stayed for more than 8 months between January and end of August 1802 in today's Ecuador during his journey to the Spanish colonies of South America from 1799 to 1804. Crowning achievements of his scientific exploration were the ascents of the volcanoes Pinchincha (4,787 m) and Chimborazo (6,310 m), the latter was considered the highest mountain of the world at that time. In addition, he investigated also the Ecuadorian volcanoes Antisana (5,756 m) Tunguragua (5,016 m) and the Iliniza (5,126 m) (Meyer-Abich 1967).

A.M. Stübel reported (in Reiss and Stübel 1892–1899 vol. 1) on the motivation of his joint South America journey with Wilhelm Reiss, during which the capital Quito served as fixed quarter for the two researchers, the following: “The desire to study non-European volcanoes and to contribute to their investigation motivated Mr. Reiss and myself to organize a field trip, which started in 1868. Our envisaged stay in South America, where we initially began, was calculated for a few months. However, months turned into years and our journey expanded far beyond any of our original intensions, until finally we spent more than 10 years dedicated to scientific research on the other side of the ocean. We intended to study the diversification of the external and internal fabrics of the volcanic mountain ranges according to their petrographic variety and in relation to the age and

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position of underlying and accompanying rock formations. The knowledge about the numerous volcanic summits, which reached the altitude of the perennial snow cover, expanded manifold since von Humboldt's time."

"The trough within the Andean main range, known as the syncline of Quito, is bordered by a number of volcanic mountains in the south. This is one of the nodes which separates the north–south trending depression into distinct basins. A. v. Humboldt named it "node of Chis-inche", while in the country it is known as "Nudo de Tiupullo" after the pass in which the Camine real as well as the new road crosses the range" (Reiss and Stübel 1892–1899 vol 1). Both scientists are full of enthusiasm in their travel report for Cotopaxi volcano. They wrote: "The most splendid mountain in this region around Quito is Cotopaxi, which, according to its size and beautiful shape belongs to the most significant volcanic mountains of Ecuador. It presents itself as an isolated gorgeous cone covered with snow seen from all perspectives."

The first ascent to Cotopaxi

Already in 1870, Reiss and Stübel ascended the volcano Corazon (4,861 m) and admired the deeply sunken caldera at the summit, into which they were, however, unable to descend. About the first ascent of Cotopaxi in (1872), Reiss (1873) reported in extracts the following: "When examining Cotopaxi from all sides and in great detail during my previous travels, hoping to find a point from which an ascent might be possible, I chose the most inclined part of the summit, where a few black stripes extended downhill to the lower snow line. I had the opportunity to study the summit of Cotopaxi while I was engaged with trigonometric measurements staying at the Hacienda da Chaupi. At the beginning of November, the slopes were still covered with snow and there was not a single black dot to be observed. This condition justified von Humboldt's statement that Cotopaxi appears to be shaped in turns. Gradually, the snow melted during the dry and hot weather of November and the path uphill to the crater was free of snow on the 24. On November 25, I went to Santa Ana de Tiupullo to make immediate arrangements for an ascent. "During the preparation of the supporting team, Reiss used the time to visit the nearby ruins of the ancient Inca palace at Cerrito de Calla, which served as hog house at that time.

"Early in the morning on November 27, 1872, all mountains were hidden in clouds and unfortunately there was nobody among the supporters who was familiar with Cotopaxi. We crossed the Rio Cutuche, which flows around the western foothills of Cotopaxi, with our pack animals heading toward the Hacienda of San Joaquin, passing through low hills of volcanic tuff. A flat area expands between

Ventanillas and the steep downward slope of the volcanic cone. The plant cover, three to four feet high, consists of nothing other than dense scrub growing on the dry and desiccated pampa, where cattle cannot exist due to the deficiency of water. All humidity penetrates through the permeable tuff downward to well up in scarce springs from small bank walls and in such a way leaves the ground area completely dry. The expedition reached the point from where the ascent of the volcano commences. From now on, we followed small gullies cut into the lavas running downslope. We had to set up our tents during heavy snowfall, which covered the black ashes with almost one inch in a very short time. This was not an easy task, since most of the peons (porters) refused any assistance, settled displeased on the snow, and observed calmly as I made myself busy for them to set up their tents. In order to rest on these hillsides, it is necessary either to take refuge in the snow or to carry water uphill from the Rio Cutuche, since thirst might be more terrible in this altitude than in the hot zone of this country.

The upper part of the mountain cleared off during the evening, which provided us the pleasure of a gorgeous and sublime view. The exhalation of the fumaroles rose in small and white clouds along the almost vertical walls of the rocks, which surround the crater on this side as well as from the crater rim itself. The 28 of November was excellent. The mountain stood there unveiled in the early morning light. Breaking camp was delayed, since the melt water of the snow had changed into a covering of glassy ice over night."

The expedition then crossed the lava field resulting from the volcanic eruption in 1854, which had caused enormous mud floods in the valley due to melting snow. "We reached the end of the lava flow after we ascended more than 900 m within 2 h." The ascent was more and more complex from this position uphill. "The path continued between snowfields partly over clear ice or loose sand. Crossing in-between, we progressed only gradually, since the loose sand rapidly tired us and forced us to rest more and more after ever shorter distances and I had even to stop smoking my cigar. When I reached a cliff in 5,712 m I sat down for the first time, to wait for my companions. Looking around, all I could see was my mayordomo (butler: Angel M. Escobar), who has stayed with me faithfully throughout all my travels during these past 4 years and my poor dog, who followed howling and pained with much effort because he did not want to leave his master. The ascent became more and more difficult due to the hard as well as slippery ground, so that we needed our hands to hold on and we had to rest repeatedly.

Since the summit was veiled in clouds, all the rocks and cliffs in front of us seemed to be very high and far away, however, as soon as we turned a little more to the south we

reached the summit suddenly. In this instance, the clouds parted and human eyes fell upon the ground of Cotopaxi crater for the first time. Neither do I nor can I deny my satisfaction that I was the first person who ever ascended the highest active volcano on Earth for the first time. A sense of satisfaction, similar to my own, was expressed on the face of my loyal companion, Angel Maria Escobar de Bogotá, who achieved a real victory in ascending to this altitude, since he suffered from the dilution of the air extremely, while I felt nothing during the whole trek.

The crater seemed to be elliptical in shape. We observed also some sizeable fumaroles exhausting dense clouds of white smoke without any noise, which smelled like sulphurous acid and formed small deposits of sulphur (hornillo de azufre) around them. The depth of the Cotopaxi crater seemed to be 500 m. While I was sitting on the rim of the crater almost side-saddle, with one hand holding Angel Maria and investigating the deposits of the fumaroles with the other, a wind gust filled both of my eyes with sand impregnated with sulphurous acid causing an immediate inflammation, which affected me seriously for several weeks. From now on, almost blind, I was only able to think of a descent into the valley as quickly as possible. Soon we met the first porters we had left behind and then the one among them who carried the bag with the breakfast. Although we had only one cup of coffee in the morning, we were unable to eat anything. A few fruits from a cactus mixed with brandy and ice refreshed us and we descended glad and blithely. A strong snowstorm hit us when we reached our first camp."

Wilhelm Reiss engaged 13 porters and guides for his ascent to Cotopaxi.

The large eruption of the Cotopaxi in 1877

Cotopaxi experienced its largest eruption, which was reported by Theodor Wolf (Reiss and Stübel 1898–1902, vol 2:80), 5 years after this successful first ascent. Wolf described the sight of the crater as it was seen on the 9 of September 1877, almost two and half months after the eruption: "Unfortunately, the weather became worse and worse and the snow storm more and more intense. We waited for 2 h to no end hoping to see the rim of the crater. Although the wind disrupted the clouds, we never saw more than one third of the rim unveiled shortly on the northwest or northeast side, and the view into the depth extended only approximately 200 m during favorable instances. Dr. Reiss estimated the depth to be 500 m".

The foothills of Cotopaxi consist to a large extent of tuffs, which contain larger blocks of biotite andesite according to Reiss and Stübel (1892–1899 vol1:193). The older lavas of the Cotopaxi cone are predominantly pyroxene andesites with feldspar with few exceptions.

Reiss and Stübel (1892–1899 vol1:121) supposed that the eruption from 1877 was the only one which had been geologically investigated together with the origin and course of its lava flow: "In the morning around 10 o'clock on June 26, 1877, the major eruption occurred. The southwest side of the mountain and its summit were completely free of clouds in clear sight, that many persons were eye-witnesses of the large lava eruption in Mulaló and Cosiguango. They became animated when they described and portrayed the terrific scene and sight of the mountain when the eruption commenced like an "upsurge" (ebullicion) and a fuming, steaming black mass swelled out over all parts of the crater rim at the same moment. Several of the people present used the picture of a rice pot suddenly boiling over. Soon after that the volcano was veiled in clouds."

Prior to this largest eruption, several different activities were observed in the years 1534, 1742, 1743, 1744, 1750, 1766, 1768, 1803, 1845, 1850, 1851, 1853, 1854–56, 1858–59, 1866, 1870–75, all reported in Reiss u. Stübel, (1892–1899 vol1) und Sapper (1917). The chronology of the erupted tephra and the volcanic activity comprising the last 5,000 years are well documented and described by Barberi et al. (1995). Details of very recent activity from this century are presented by Molina et al. (2008).

Wilhelm and Reiss and Alphons Stübel: two different characters in science

Reiss (Fig. 1) had studied volcanic activity on Madeira, the Azores, and the Canary Islands in the Atlantic Ocean as well

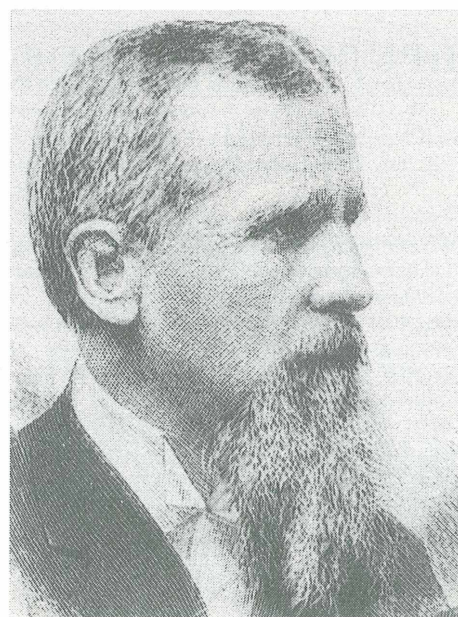


Fig. 1 Wilhelm Reiss (1838–1908), taken from Stamper (1894)

as on Santorini in the Mediterranean prior to his departure in 1868 to the Andean mountains of South America together with the Saxon geologist Alphons Stübel. Both travelled through Columbia, Bolivia, Ecuador, Peru, and Brazil until 1876. Between 1870 and 1874, Reiss stayed in Ecuador where he ascended the volcanoes Pichincha, Corazón, Rumiñagui, and Antisana occasionally together with Stübel, as well as his first ascent of Cotopaxi (Figs. 2, 3).

The very different characters of these two geologists caused interpersonal tensions among them and finally they went their separate ways. According to Brogiato (2003), this is the reason for the different scientific research, documentation, and evaluation of their work. Stübel assigned his research results and transferred his collections to the Grassi Museum fuer Voelkerkunde in Leipzig. Part of Reiss's inheritance is deposited in the municipal Reiss Museum of his hometown Mannheim; however, the most comprehensive part is located in the archive for geography of the Leibniz Institute for Regional Geography in Leipzig.

Biography of Wilhelm Reiss

Johann Wilhelm Reiss was born on 13 of June 1838, in Mannheim, close to where the Neckar joins the Rhine.

His father was a rich manufacturer and mayor of the city of Mannheim, where Wilhelm visited the civic school of higher education.

File number H-IV-102/62-63 of the archive of the Ruprecht-Karls University in Heidelberg documents the vita of Wilhelm Reiss as a super career, which was possible only in the nineteenth century. After he visited a commercial college in Belgium, he studied three semesters science at the Universities in Berlin, Bonn, and Heidelberg, where he did his PhD. His vita, written in Latin, lists Heinrich Ernst Beyrich (1815–1896), Heinrich Wilhelm Dove (1803–1879), Eilhard Mitscherlich (1779–1859), Johann Christian Poggendorf (1796–1877), Carl Ritter (1779–1859), Gustav Rose (1798–1873), and Heinrich Rose (1795–1864) as his academic teachers in Berlin and Bonn. For the time in Heidelberg, Reiss mentioned especially Hermann von Helmholtz (1821–1894), as well as Johann Reinhart Blum (1802–1883) for mineralogy, and Robert Wilhelm Bunsen (1811–1899) for chemistry. The presentation of a written dissertation was not obligatory according to the applicable law of those days. An oral examination was sufficient, which he passed with “summa cum laude” (excellent).

The following day (March 1, 1864) he received his PhD degree and 5 days later he submitted his application to receive the postdoctoral lecture qualification (Habilitation). In order to be granted the Habilitation, he submitted previously published papers: (a) “The diabase formation and lava formation of the Island Palma” (1861), (b) “Communication on the Tertiary layers and their organic inclusion of Santa Maria, the southernmost Island of the Azores” (1862), and (c) a handwritten document about the coal pit of Sant Petro da Coava in Concelbo de Condomar, district of Porto (Portugal). He received his Habilitation through the faculty on March 27, followed by a lecture on April 29, and was appointed as a new member of the private lectures (Privatdozent) at the University of Heidelberg.

Wilhelm Reiss had already visited Sicily, the Azores, and the Canary Islands as well as southern Portugal before he commenced his studies in science during the years 1858–1860. After his PhD and Habilitation, he travelled with Stübel and Karl von Fritsch (1883–1906) to Greece in 1866 before he left for his comprehensive studies to South America. After his return to Europe, Reiss settled in Berlin and married in 1883. He was appointed chairman of the Society for Geography Berlin (Gesellschaft für Erdkunde Berlin) in 1885. Three years later in 1888, he was additionally appointed chairman of the Society for Anthropology, Ethnology, and Prehistory. In Berlin, his inheritance enabled him to live as a freelance scientist and he achieved a high reputation which in turn granted him the title of a senior civil

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Fig. 2 Title page of the travel report to South America (Ecuador) together with A. Stübel, 1896–1902

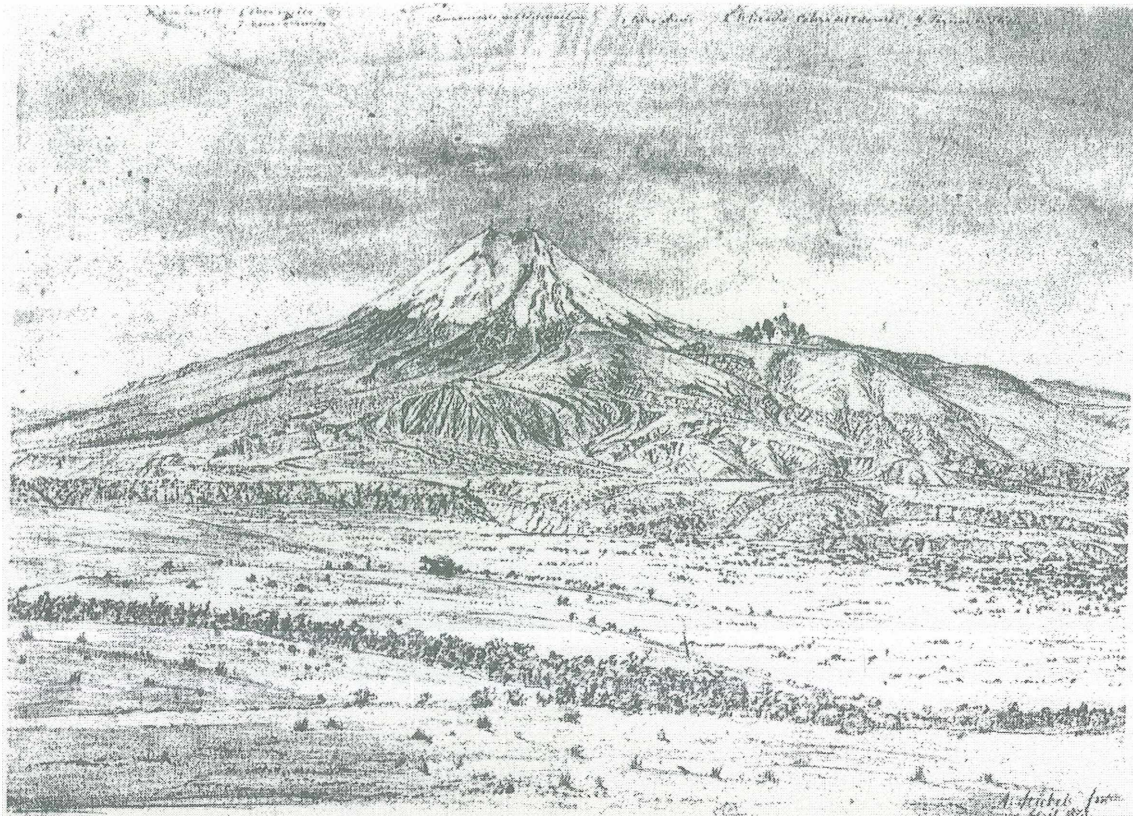


Fig. 3 The volcano Cotopaxi in Ecuador (drawing by Alphons Stübel, taken from Brogiato 2003)

servant (Regierungsrat). In 1892, he moved to the castle of Könitz near Saalfeld in Thuringia, where he passed away on September 29, 1908.

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