

## A Volcano in the Alps?

L. I. Ioganson\*

*Schmidt Institute of Physics of the Earth, Russian Academy of Sciences, Moscow, 123242 Russia*

\*e-mail: iogan@ifz.ru

**Abstract**—This paper analyzes the article published in *Sankt-Peterburgskie Vedomosti* (SPV) and a number of foreign studies addressing the natural cataclysm that occurred in Savoy (Western Alps) in 1751 and was recognized by witnesses as a volcanic eruption. This event was observed by V. Donati, a famous natural scientist of the 18th century, and described by H.B. de Saussure, a prominent researcher of the Alps. Other evidence of similar phenomena in the Alps is presented from the historical data. It is suggested that a special type of explosive eruption, not accompanied by lava pouring out but still very dangerous may occur in the Alps.

**Keywords:** *Sankt-Peterburgskie Vedomosti*, Savoy, XVIII century, V. Donati, H.B. de Saussure, volcano, eruption, rockfall

**DOI:** 10.1134/S000143381908005X

### INTRODUCTION

Recently, historical sources have been actively analyzed in search for data on natural disasters that have been unknown in the scientific literature. This direction turned out to be especially productive in identifying the historical earthquakes that were not reported in official seismic catalogs. Originating in Italy, a country with increased seismicity and a rich historical tradition, this field of research is actively developing in other countries, including Russia. The analysis covers various historical sources from annals to memoirs, including periodicals. In this respect, we note the informativity of *Sankt-Peterburgskie Vedomosti* (SPV), the first Russian newspaper founded in 1728. This newspaper was the main and almost the only source of information in Russia at the beginning of the 18th century. It posted various messages from all available places. Considerable attention was also paid to reports on natural disasters, such as fires, storms, earthquakes, and volcanic eruptions. The author of this paper performed an analysis of SPV in this context within a research grant from the Russian Foundation for Basic Research starting in 2017. Among the SPV reports, we draw attention to a number of publications on the extraordinary natural phenomenon occurred in Savoy in July–September of 1751, which was recognized by the local population as a volcanic eruption. In view of the generally accepted notion that there is no modern volcanism in the Alps, we performed an analysis to elucidate the nature of the Savoy phenomenon; the results of this analysis are described below.

### REPORTS ON THE NATURAL DISASTER OF 1751 IN SANKT-PETERBURGSKIE VEDOMOSTI AND THE FOREIGN PRESS

On September 20, 1751, *Sankt-Peterburgskie Vedomosti* published the following report (SPV, 1751-09-20): August 20, from Turin.

“The following news was reported from Bonne-Ville, the main city in the province of Faucigny, on the 13th of the current month: On the thirty-first day of the past month of July, the rock mountain called Plaine-Joux, near Passy, quaked so strongly and soon that the landslide from the mountain at that time damaged the houses and killed 6 people and many cattle there. Another action resulting from this quake was that the mountain was entirely covered with ash. Thick smoke was seen at the rock bottom, going through two holes a quarter of a mile apart; this is why it was believed that the foot of the mountain is filled with tar and sulfuric matter. Although no fire was observed, the sulfuric smell spreading on the mountain confirmed this conjecture. The quake continued during the following days and is still active, with a terrible noise and thick, black and red smoke, which seems like a cloud that has the potential for hail and lightning. The Passy and Servoz graveyards at the foot of the mountain are prone to final destruction if the interior at the rock foot is filled because of the quake. Also, the Chamonix passage may close up completely. No flame has yet been observed; however, if a hole appears in the mountain and the fire comes out through it,

which we fear, then at this place two different mountains can easily appear: one in Plaine-Joux (fiery mountain) and the other in ChamoniX (icy mountain).

The recent letters received by the court from Bonne-Ville announced that the smoke-filled holes begun to release flames. Such an extraordinary adventure, which can result in another Vesuvius in Piedmont, prompted the King to send one of the most skilled professors of our university there in order to conduct more accurate investigations.”

On October 1, 1751, the following was reported (SPV, 1751-10-01):

August 31, from Turin.

“According to reports from Bonne-Ville, the tremor and quake of Mt. Plaine-Joux, which was recently announced, continued with the same severity on the seventh and eighth days of the current month; and that this mountain, which several days ago threw a light flame, on the sixth day of this month released a large number of small stones around itself. Mr. Touchet, who informed the King about this event in writing, was in great danger together with the people accompanying him and was afraid of being bombarded with stones.”

And finally, on October 11, 1751, there was another report (SPV, 1751-11-10):

“The mountain that burned in the Duchy of Savoy, which was recently mentioned, has thrown out since then large stones with smoke and fire: when it suddenly opened to a great distance, 6 shepherds with all their herds died.”

An analysis of foreign periodicals of those years revealed that these publications were a repetition or duplication of the information that appeared in England and Germany. Indeed, *The London Magazine, or, Gentleman's Monthly Intelligencer* (Vol. XX of 1751) printed an extract of a letter from Bonne-Ville dated August 23, 1751 in the section *The monthly chronologer* (The London Magazine..., 1751):

“The 31st of last month, about two o'clock in the afternoon, the rock in the mountain of Plainejoux, near the parish of Passy, sunk down so suddenly, that the quantities of earth which came tumbling down at the same time from the mountain, considerably damaged the neighbouring habitations, where six persons were crushed to death, with about 30 head of cattle. Soon after the rock's sinking, the whole mountain was covered with ashes and cinders; and out of the rock there issued two columns of thick smoke, about a quarter of a mile distant from each other; whence we concluded, that it must be full of bitumen and sulphur; and the sulphurous scent from the mountain justified our conjecture. The rock continued sinking and

crumbling away the following days, and still continues, with a dreadful rumbling noise, and a thick smoke, which is sometimes black, and sometimes of a reddish colour. We do not yet perceive any flames; but if an aperture should be made in the mountain, and the flames burst forth through it, we shall then see two mountains of a very different kind, a volcano at Plainejou, and an icy mountain at ChamoniX.”

After this letter was delivered to Turin, another letter was received from Bonne-Ville reporting that the flame began to come from the same holes as the smoke; then, the king ordered one of the most skilled university professors to go there and investigate this new fiery mountain.

The text published in the German newspaper *Stats- und Gelehrte Zeitung des Hamburgischen unpartheyischen Correspondenten* (no. 150 of September 18, 1751) is almost identical with the English and Russian versions of the event, but there is an important addition that makes it possible to reveal the identity of “Mr. Touchet” as mentioned in the Russian communication (Stats-Gelehrte Zeitung..., 1751a):

“From Turin, August 22.

The court received the following message on August 13 from Bonne-Ville, the main city of Faucigny in Savoy, about an extraordinary event. On July 31, at 2 p.m., there occurred a sudden quake of the rock, along with Mt. Plaine-Joux, which is located near Passy, that damaged the lands around these mountains and the neighboring villages, killing 6 people and 30 cattle. During these quakes, the entire mountain was covered by ashes. Two holes were observed in the rock at a distance of a quarter of a mile from each other, which released thick smoke; it could be concluded from here that there was a bitumen and sulfuric substance beneath. No flame has yet been observed; only the smell of sulfur spreading on the mountain justifies this assumption. The quakes continued also on other days and were accompanied by a terrible noise and thick black and reddish smoke like clouds fraught with hail and thunder. The parishes of Passy and Servoz located at the foot of the mountain risked being destroyed if the hole in the rock enlarged due to the quakes. The road to ChamoniX will also be blocked. No flame had yet been noticed but if a hole appears in the mountain and a flame breaks through it, then two mountains will arise: one fiery in Plaine-Joux and the second icy in ChamoniX. Taking into account the state of affairs caused by the quakes, *Mr. Trusche, the chief judge of this city* [italics added by the author], issued a number of orders. He ordered those who live in the most dangerous places to leave their dwellings with their cattle and forbade them to return. After

this news arrived in the Court, other letters were received from Bonne-Ville reporting that flames began to appear through the smoke-filled holes. Such an amazing event, which is leading to another Vesuvius in Piedmont, prompted the king to send one of the most experienced university professors to study this phenomenon and identify its natural causes.”

The same newspaper in issue no. 153 provided some details about the development of events in Savoy (Stats-Gelehrte Zeitung..., 1751b):

“From Turin, August 31.

It has been reported from Bonne-Ville that the noise and quakes of Mt. Plaine-Joux continue with the same fury; there was a brighter flame for several days, many flint-like stones flew out of it to scatter over a long distance. Mr. Truchet, who wrote to the king, was in great danger with the people who were with him, fearing to be buried under this hail of stones.”

Further information about the events in Bonne-Ville was not available in the newspapers mentioned above.

#### RESEARCH BY V. DONATI

The natural catastrophe in Bonne-Ville that resembles by the described features an explosive eruption and is uncommon for the Alps (where modern volcanism is unknown) has attracted our attention. Since the report of this event was sent to King Karl Emmanuel III in Turin, the capital of the Kingdom of Sardinia, which then included Savoy, asking him to send the best professor of the University of Turin, it was very interesting to become familiar with the results of such an expedition if it took place. We sent a letter with the relevant request to the Department of History of the University of Turin. In their response dated October 29, 2018, Clara Silvia Roero, the president of the Center for Historical Research of the University of Turin, informed us that the requested event is known to them: professor Vitaliano Donati was sent to Savoy and his conclusion was that the described phenomenon was nothing more than a landslide. The letter was accompanied by a paper (Scalva and Caramiello, 2017) devoted to Donati’s biography (1717–1762), a prominent scientist of the 18th century, who was the head of the Chair of Botany at the University of Turin during the events described. The paper mentions only a single episode related to the 1751 phenomenon in Savoy. The following is the translation of that episode (Scalva and Caramiello, 2017, p. 90):

“At the end of the trip to Savoy it seems that the naturalist was willing to return to Padua to start a new cycle of lectures [He headed the Chair of Botany at the University of Turin, *L.I.*]. However, Donati was forced to abandon his plans

because of the order received from the king to investigate the problem of quakes in Savoy during the same period of the mineralogical journey. In the upper Faucigny, especially near the mountain of Plaine-Joux on 31 July 1751, there was a debris “of more than three million cubic toises” [1 toise = 1.949 m. – *L.I.*] that “buried six houses, six people, and many animals.” This event caused great concern to both the population and authorities; it was initially assumed that the event was caused by a volcanic eruption ... Therefore, Vitaliano Donati was forced to change his planned route to go to the place in person. When the hypothesis of the volcano could not be confirmed, he found that the destruction had been caused by erosion and infiltration of water due to the presence of three lakes, as well as by the erosive effects over the centuries, which had destroyed the natural strut. His observations were presented in the Report of doctor Vitaliano Donati, professor of botany, from Sallanche on 9 September 1751, concerning the movements of Mt. Plenejoux, the Passy territory in Upper Faucigny.”

Donati described this event in detail in a letter from Turin dated October 15, 1751 to “the Geneva physicist of a mountain dynasty.” The reference given in the paper (Scalva and Caramiello, 2017) allowed us to find the text of this letter (published by H.B. de Saussure (1740–1799) in volume 1 of his *Travel to the Alps...*) along with his personal impressions of visiting these places (De Saussure, 1779, pp. 413–414):

“The mountains around Passy are crowned by scarps. One of these rocks is so elevated and at the same time so thin that one can hardly imagine how it can survive during a thunderstorm. Here, next to this peak, there is a mountain that collapsed in 1751 with such a terrifying roar and such thick dust that people thought about the end of the world. This dust was accompanied by smoke; the frightened people were under the impression that they had seen a flame in the curls of smoke. In Turin, it was reported that a terrible volcano arose on the place of the mountain, and the king sent the famous naturalist Vitaliano Donati to confirm this message. Donati enthusiastically followed the event and even managed to be a witness of that event before the rocks ceased to collapse. He wrote a detailed report to the king and summarized his notions in a letter to one of his friends (I own the original of this letter, dated October 15, 1751): “Dear friend, I left Turin on July 16 and was going to return in a few days. I hoped to be in Venice in September and October. But I had to go back on a tour of almost 250 leagues in the mountains, following the order of His Majesty to observe the alleged new volcano. I confess that although I doubted the

validity of this fact, however, hoping to deceive myself, I was very pleased to quickly observe such an extraordinary event. After a nonstop journey for 4 days and 2 nights, I found myself in front of a mountain completely shrouded in smoke releasing continuously day and night, along with large masses of stones that erupted with a noise similar to the thunder of guns but even much stronger. The peasants left this place, fearing to approach closer than 2 leagues or further. All the surrounding fields were covered by dust very similar to ashes; in some places, this dust was carried by the wind to a distance of 5 leagues. According to eyewitness accounts, from time to time the smoke turned red during the day and was accompanied by a flame at night. In general, there was ample evidence of an undoubted volcano. As for me, I examined the ashes and found only marble crumbled into dust; I carefully examined the smoke and did not see the flame; I did not feel any smell of sulfur. The bottom of the springs and water streams examined by me had no signs of sulfuric matter. Making sure that there were no ignited solfataras, I entered the smoke alone without any escort and reached the edge of the abyss. I saw there a huge rock that fell into this abyss and noticed that the smoke was nothing but dust rising from the fall of stones. I examined and found the cause of the fall of these stones. I saw that the mountain located under the collapsed one was mostly composed of rocks that are not visible in quarries but are represented in landslides. This allowed me to suggest that the collapsed mountain was also composed of similar rocks and that in the course of this collapse the large rock was left unsupported with a significant overhang. This rock is composed of horizontal strata, the two lower ones of which are represented by layered brittle rocks covered by fractured marbles. The upper layer is represented by layered rocks and forms the surface of the collapsed mountain. The same level involves three lakes, the water of which penetrated the cracks and destroyed the rock. The snow, which was so abundant this year that the inhabitants of Savoy took it to be abnormal, increased the effect. Combined, all this caused the fall of three million cubic toises of rocks, with a volume sufficient for the formation of a mountain. In the description of the collapse of this mountain, which I forwarded to S.M., with a drawing of the mountain itself, I formulated the cause of this collapse more accurately and predicted that it would end soon, which actually happened. So I destroyed this volcano.”

H.B. de Saussure does not comment on the conclusions about the nature of the phenomenon made by

Donati. He only notes that (De Saussure, 1779, p. 414):

“The ruins of the mountain, the collapse of which is so well described in the translated letter, are located in the northeast of the village of Servoz. I did not visit this village, but the road that we followed was covered by large debris from the height of the mountain range (including this mountain as its part), having almost the same nature. Some of this debris deserved our attention. Large fragments of calcareous rocks and one specimen of gray marble pierced by white veins of spar were found. I tried to find traces of marine organisms in this marble, but I did not find any.”

#### EVIDENCE OF EXPLOSIVE PHENOMENA IN THE ALPS FROM OTHER SOURCES

As follows from the data given above, the eruption of stones and release of smoke in the Savoy mountain gradually ceased in September 1751 and this extraordinary event was forgotten over time; however, we managed to find a mention in the scientific literature. Specifically, the following message can be found in the chapter *Volcanic regions* (Zornlin, 1848, p. 270):

“...the city of Bonne-Ville, near which significant quakes were observed in July 1751. A sudden collapse occurred at Mt. Plaine-Joux; large masses of rocks simultaneously collapsed in the neighboring valley. The mountain itself was covered with ashes, and there were powerful smoke columns coming out of two holes at a distance of a quarter mile with a strong smell of sulfur and sometimes accompanied by flames.”

In volume 1 of *Traité de géologie*, the French geologist G.É. Haug (1907) omits the details of the event and mentions only briefly the collapses in Servoz.

However, other historical sources contain evidence of such phenomena in the Alps. For example, the review by the academician of the St. Petersburg Academy of Sciences A.N. Grishov (1794) has the following passages:

“All the letters written to Lyon from Geneva and Switzerland, where the earthquake of 1682 caused similar devastation, include information that it was preceded by a flame that appeared four days before the earthquake from a mountain near Geneva.” (Grishov, 1794, p. 74)

and

“In August of 1738, a very high mountain located in the Fribourg canton of Switzerland near the city of Gruyères unfolded with a terrible crack and threw a great flame and many large stones.” (Grishov, 1794, p. 86).

Another indication of similar phenomena can be found in (Explanation..., 1791, p. 272):

“Plutarch would say that Gallia was free from this; however, after his times, earthquakes occurred many times in this state, and flames were thrown in the provinces of Auvergne and Faucigny.”

The fact that Auvergne and Faucigny are mentioned here is indicative. Faucigny was mentioned above. The province of Auvergne in the Central French Massif had extinct volcanoes; it is currently a tourist place. According to the data provided by the German geologist M. Schwarzbach for determining the absolute age by the radiocarbon method, the last eruptions in the province of Auvergne occurred 8800–7700 years ago. However, it is worth mentioning that it was in 1751 that the French geologist Jean-Etienne Guettard (1715–1786) conducted research here to establish that the material used in the construction of houses and for paving roads is volcanic lava, which led to the discovery of the extinct volcanoes of Auvergne (Schwarzbach, 1973). It was in Auvergne that disputes broke out between Neptunists and Plutonists over the origin of basalts. It is also interesting that on August 30, 1833, on the initiative of Lecock, the foundation of the French Geological Society was commemorated in *Le Puy du Pariou*, the most picturesque crater in the province of Auvergne. “The ceiling of the meeting room was the blue sky, the lamp was the sun; the carpets were green grass and flowers hiding the center of a former eruption. Craters and geologists have never been so friendly” (Schwarzbach, 1973, p. 233). Nevertheless, the mention of “the ejected flame” in this place, which was accepted to be safe in historical times, deserves attention.

### CONCLUSIONS

According to the data from historical sources given in this paper, it can be assumed that very dangerous phenomena are possible both in Auvergne and in the Alps, although not comparable with typical volcanic eruptions, but of the same class of explosive manifestations. The conclusions made by V. Donati that the event that occurred in the province of Faucigny is solely related to the collapse of Mt. Plaine-Joux as a result of groundwater washing is doubtful if only because this event does not correspond to catastrophically rapid collapses in time: Mt. Plaine-Joux released smoke and stones for more than a month. It should be remembered that Donati arrived at this place more than a month after the start of the process, when the energy of the cataclysm was apparently on the decline. By this time, neither the red smoke color nor even the flame could be observed. This absence is explained by Saussure (obviously, following Donati) rather simply due to “scared eyes.” By the time of the arrival of Donati, the sulfuric odor, which was persistently reported in the letters from Bonne-Ville, had also disappeared in all likelihood. The explanation of smoke and ashes is likewise questionable: Donati claims that

it is marble dust but does not explain how such an amount of dust could have formed during the collapse of the mountain that it could rise from mountain crevices for more than a month. In addition, in the description of the phenomenon (even Donati) emphasizes its predominantly explosive character. However, modern researchers, according to the letter by C.S. Roero, regard this phenomenon as a landslide; according to the eyewitness accounts and the duration, the event cannot be associated only with the creep of a part of the mountain range.

In their classical work *Orogenic Volcanism and Tectonics of the Alpine Belt of Eurasia*, E.E. Milanovskii and N.V. Koronovskii (1973) explain the absence of modern volcanism in the Alps. According to these authors, the tectonic structure of this mountain system (namely, its folded structure with a wide development of thrusts and sheets), as well as the presence of horizontal vectors of compressive stresses in earthquake centers serve as indicators for the compression of the region. These regions are unfavorable for the occurrence of magma chambers and the development of volcanism (Milanovskii and Koronovskii, 1973). In some opposition to these views, V.I. Shevchenko suggests that orogenic regions contain coupled processes of regional contraction and autonomous processes of their internal expansion, possibly under the influence of ascending fluids (Shevchenko et al., 2017). It is not unlikely that the phenomena in the Alps described above are a consequence of these processes.

### ACKNOWLEDGMENTS

The author thanks Cand. Philos. Sci. S.Yu. Nechaev for the English and German print publications of the 18th century, as well as Clara Silvia Roero, the president of the Center for Historical Research of the University of Turin, for providing us with the data that made it possible to reconstruct the history of the investigation of the Savoy event in 1751.

### FUNDING

This work was supported by the Russian Foundation for Basic Research, project no. 17-01-00503a.

### CONFLICT OF INTEREST

The author declares that he has no conflict of interest.

### REFERENCES

- De Saussure, H.B., *Voyages dans les Alpes, précédés d'un essai sur l'histoire naturelle des environs de Genève*, Neuchâtel, 1779, pp. 413–414.
- Grishov, A.N., Reasoning on earthquakes and spitfire mountains, *Nov. Ezchemes. Soch.*, 1794, pp. 91–100.
- Haug, É., *Traité de Géologie*, vol. 1: *Les Phénomènes géologiques*, Paris: Librairie Armand Colin, 1907; Mos-

- cow—Leningrad: NKTP, 1932. *Iz'yasnenie estestvennykh prichin zemletryaseni: Sobr. soch., vybrannykh iz Mesyatseslovov za raznye gody* (Explanation of the Natural Causes of Earthquakes: Collected works from the Menologion Various Years), St. Petersburg, 1791.
- Milanovskii, E.E. and Koronovskii, N.V., *Orogennyi vulkanizm i tektonika Al'piiskogo poyasa Evrazii* (Orogenic Volcanism and Tectonics of the Alpine Belt of Eurasia), Moscow, 1973.
- Sankt-Peterburgskie vedomosti, Septeber 20, 1751.
- Sankt-Peterburgskie vedomosti, October 1, 1751.
- Sankt-Peterburgskie vedomosti, October 11, 1751.
- Scalva, G. and Caramiello, R., Da Torino all'Oceano Indiano, passando per le Alpi. Vitaliano Donati scienziato e viaggiatore, alle origini della scienza moderna, *Riv. Stor. Univ. Torino*, 2017, vol. 6, no. 2, pp. 83–106.
- Schwarzbach, M., *Berühmte Stätten geologischer Forschung*, Stitgart: MBH, 1970; Moscow: Mir, 1973.
- Shevchenko, V.I., Lukk, A.A., Guseva, T.V., *Avtonomnaya i pleittektonicheskaya geodinamiki nekotorykh podvizhnykh poyasov i sooruzhenii* (Autonomous and Plate-Tectonic Geodynamics of Some Mobile Belts and Mobile Edifices), Moscow: IFZ RAN, 2017.
- Stats-Gelehrte Zeitung des Hamburgischen unpartheyischen correspondenten, 1751a, no. 150.
- Stats-Gelehrte Zeitung des Hamburgischen unpartheyischen correspondenten, 1751b, no. 153.
- Zornlin, R., *Recreations in Physical Geography or the Earth as it is*, London, 1848.

*Translated by V. Arutyunyan*