

44. *A Brief Note on the Eruption of the Yake-dake Volcano of June 17, 1962.*

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Introduction.

The active volcano, Yake-dake, which is situated on the Hida Mountainland or the so-called Japanese North Alps, became suddenly active on June 17, 1962. This volcano is the only active one among several volcanoes which lie on ridges in the mountainland and which form the Norikura Volcanic Zone. It seems to have been active in ancient times, although no actual description of its eruptive activity was recorded. Since 1907, eruptions recurred and violent outbursts have occurred repeatedly on the summit as well as on the flanks of the volcano. During the last twenty years, however, it has been only in a state of fumarolic activity, displaying a number of fumaroles near the summit. In 1953 and 1958 earthquake swarms occurred, but no outbursts happened. On June 17, 1962, explosions began suddenly and two men who lived in the lodge on the volcano were injured by ejected debris. The writer had an opportunity to visit the volcano immediately after the eruption. The result of his survey is presented in this report.

The writer wishes to express his sincere thanks to Prof. Hiromichi Tsuya of the Earthquake Research Institute, University of Tokyo, for giving invaluable advice. He is indebted to Mr. Yoshichi Hosoya of the Komoro Branch of the same institute for the preparation of figures in this report. He is also indebted to many persons who gave facilities to his survey on the spot and offered information and photographs of the eruption, as well as to the newspaper offices which offered many photographs of the eruption.

Geology and Morphology of the Volcano.

The Yake-dake Volcano, which has the altitude of 2458 m above sea level, lies on the ridge running southwards from the peaks of Mt. Yari

and Mt. Hodaka which are among the highest peaks in Japan. The basal rocks of this volcano are distributed up to an altitude of 1500 m to 1800 m above sea level. They consist of the Paleozoic strata (Devonian to Permian), Mesozoic strata (mainly Jurassic and Cretaceous), Cretaceous rhyolitic ash-flow deposits and Cretaceous granitic intrusives.¹⁾ The development of basal rocks at such a high altitude suggests that the volcanic materials composing this volcano are not so thick.

Several volcanoes are distributed on the ridges in the Hida Mountainland, linking in a south-north direction to form the Norikura-dake Volcanic Zone, i. e. the Tateyama, Shirouma-Ôike, Yake-dake, Norikura-dake and Ontake volcanoes. It is a remarkable characteristic of this volcanic zone that these volcanoes generally have lavas of biotite andesite or dacite which are not found on any volcano situated in the north-eastern

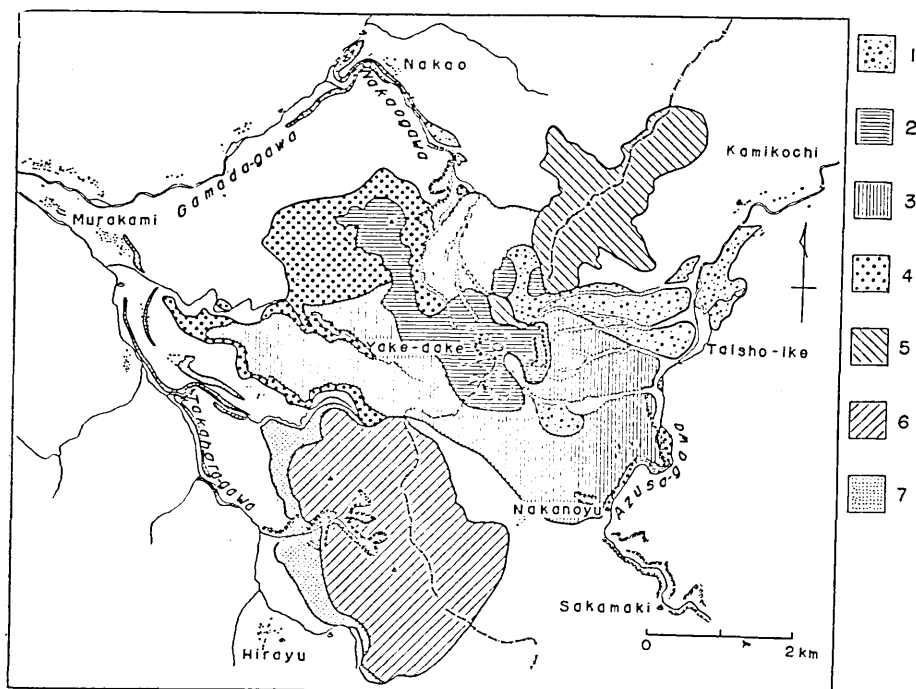


Fig. 1. Geological map of the Yake-dake Volcano. (After T. Kato, 1913, partly modified.) 1: mudflow deposits of Yake-dake. 2: upper lavas of Yake-dake. 3: lower lavas of Yake-dake. 4: tuff-breccia of Yake-dake. 5: lavas of Warudani-yama. 6: lavas of Shiratani-yama. 7: tuff-breccia of Shiratani-yama.

1) Tadao KAMEI, *Geological Research of the Hida Mountainland*, 1962, 31-43. (in Japanese).

Masatora KAWAI, *Bull. Geol. Surv. Japan*, **12** (1961), 903-920, (in Japanese).

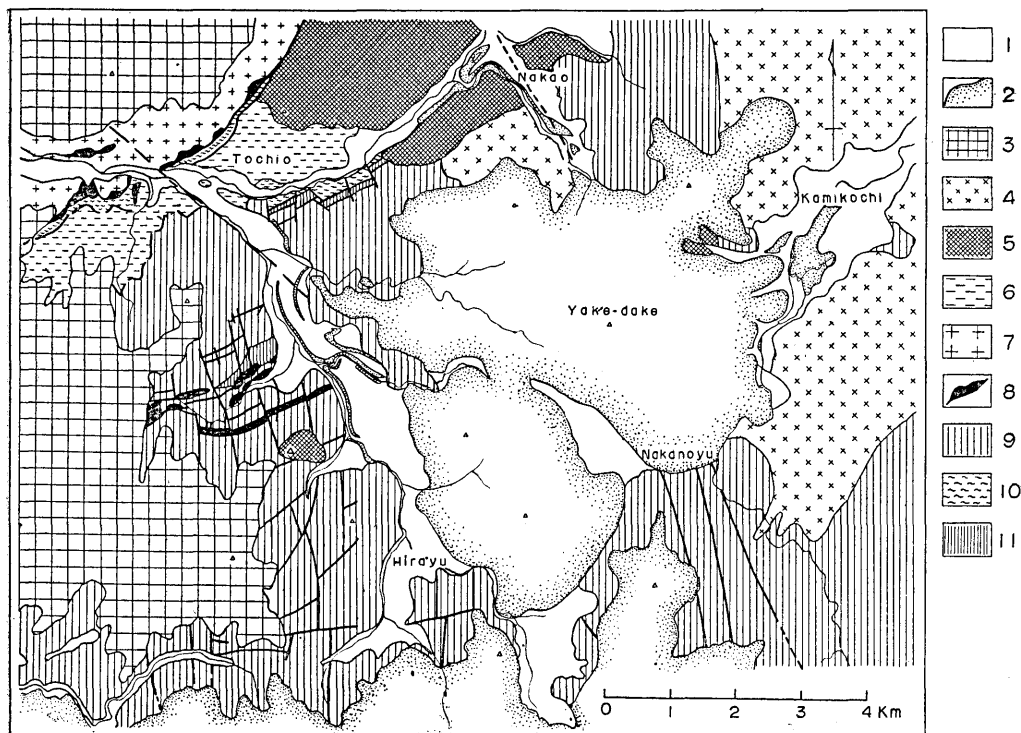


Fig. 2. Geological map of the basal rocks on the area around the Yake-dake Volcano. (After S. Kamei, 1961 and M. Kawai, 1961, partly modified.) 1: Quaternary sediments. 2: Quaternary volcanic rocks (rocks of Warudani-yama, Yake-dake, Shiratani-yama and Norikura-dake). 3: ash-flow deposits of Plio-Pleistocene. 4: younger granites (late-Cretaceous). 5: rhyolitic ash-flow deposits of late-Cretaceous. 6: Cretaceous formations. 7: older granites (Triassic). 8: serpentine. 9: Permo-Carboniferous formations. 10: crystalline schists and phyllites. 11: mid-Devonian formations.

province of the Japanese arc beyond the western margin of the Fossa Magna.

The Yake-dake Volcano is located in the adjacent district north of the Norikura-dake Volcano. There are three volcanic units in this district, i. e. the Warudani-yama, Yake-dake and Shiratani-yama volcanoes, linking in a north-south direction. The Yake-dake Volcano consists of lavas and fragmentary materials of augite-hypersthene-hornblende andesite and biotite-augite-hypersthene-hornblende andesite. Silica content of these rocks seems to be about 59 to 65 per cent, although there is little data of chemical analyses. After Kato (1913), the volcano consists of the basal component of tuff breccia and four elements of lavas.²⁾ The

2) Tetsunosuke KATO, *Report, Earthq. Inv. Comm.*, **75** (1913), 1-73, (in Japanese).

basal component has a thickness of some scores up to one hundred metres and is considered as deposits of mudflows. The lower two elements of lavas compose the main part of the volcano, overlying the basal component of tuff breccia, and the upper two elements form only the apical part of it. Rocks of the lower elements contain a less amount of biotite phenocrysts than those of the upper elements. (See Fig. 1.)

The apical part of the volcano, which shows a dome-like form, was partly destroyed by former explosions resulting in the formation of the explosion craters of Nakao-toge, Kamibori, Shimobori and Shiromizu, although no historic record of eruptions at these craters is known. The explosions at these craters seem to have been accompanied by mudflows, deposits of which are found at different places on the skirts of the volcano. There are many pits and craters on the summit as well as on the upper slopes of the volcano. Some of them have been in a dormant state for many years, while others have been active. The crater located on the eastern side of the summit named Jun-ga-ike, has no record of eruption, keeping water on its bottom. The old summit crater named Sho-ga-ike had been active from 1907 till 1911. The newer summit crater named Inkyo-ko and the flank crater of Kurodani located on the north-western slope have been active in recent years. There are many fumaroles around the summit and on the hill north of the Nakao-toge³⁾.

Former Activities of the Volcano.

This volcano seem to have been active since ancient times. Some traditions say that about 375 years ago violent outbursts occurred and caused severe mudflows which poured down along the valley of the Nakao-gawa and buried the village of Nakao, about 3.5 km away from the crater. The volcano, however, had been in a dormant state except for some fumarolic activities during a long period prior to Dec. 1907, when eruptive activities recurred at a pit newly opened in the bottom of the old crater depression on the summit. Since 1907, eruptions have occurred repeatedly on this volcano, opening new craters, pits and fissure on the summit as well as on the flanks. Among these eruptive activities the biggest surges were in March, 1909, July 1911, June 1915 and in 1925. From 1907 to 1911, eruptions took place at the pits newly opened in the old summit crater and on its wall. During the eruption

3) Takao KODAIRA, *Bull. Volcanol. Soc. Jap.*, **1** (1933), 53-64, (in Japanese).

of June 1911, a new crater was opened on the northern side of the old summit crater. The old crater itself, which had remained active before this eruption, was half buried in the ejecta and ceased its activity, forming a small pond on its bottom. During the eruption of June 1915, outbursts occurred at the new summit crater of 1911 as well as on the south-east slope of the summit, opening a big fissure of about 1 km in length in a S60°E direction. This fissure was named the Taisho Crater. A mudflow which was caused by the eruption at this fissure descended eastwards to build up a debris dam across the stream of the Azusa-gawa and formed a new lake named Taisho-ike. The eruptive activities at this fissure continued, diminishing gradually and ceasing in 1918. On Nov. 1919, an outburst occurred at the north-west flank of the volcano, at a spot 2150 m in height above sea level, opening another new crater, named the Kurodani Crater. In 1925, minor outbursts occurred very frequently at the new summit crater of 1911 and at the new flank crater of 1919. Since 1926 the eruptive activities of this volcano gradually diminished. From 1926 to 1939, the activities continued with minor outbursts occurring sporadically. Since 1940 no eruption occurred, although local earthquake swarms took place in this volcanic district in 1953 and 1958.

Eruption on June 17, 1962.

Premonitory symptoms. Before the explosion on June 17, some premonitory symptoms were recognized. On the afternoon of May 27, a sharp quake was felt in the area around the volcano, i. e. at Kamikochi, Hirayu, Nakao and Murakami. This quake was picked up by seismographs at Matsumoto, 40 km away from the volcano. On the afternoon of May 28, another earthquake was felt in the same area. In the early days of June, several premonitory quakes were felt at Nakao, i. e. on June 3, 7, etc. From about a week prior to the eruption, the temperature and volume of mineral water at Sakamaki Hot Spring, 6 km south of the volcano, somewhat increased. These symptoms, however, had not been connected with the imminent eruption by everyone in this area. A very few people noticed that the color of rocks on the wall of the Nakao-toge Explosion Crater became reddish, from about two days before the eruption, which might have suggested an increase of temperature at that spot.

Situation of the eruption. The eruption began with intense rumbling

noises. At about 9:50 p.m. on June 17, rumbling noises from the volcano were heard at Kamikochi and Nakao. At 9:55 p.m., intense outbursts began. The outbursts did not occur at the summit crater which had been active in all former eruptions from 1911 to 1939, but took place at the Kurodani Crater on the north-west flank and at the Nakao-toge Explosion Crater. The Nakao-toge Explosion Crater had been dormant for a long period except for minor fumarolic activities on its northern edge, having no record of eruption. New fissures were opened by the explosions, running in $N 30^{\circ} E \sim N 70^{\circ} E$ directions on the wall of the explosion crater. The first outburst took place at the western half of the explosion crater, and the succeeding outbursts occurred along the fissures spread northwards to the Nakao-toge. At about 10:10 p.m. on June 17, another outburst began at the Kurodani Crater. The eruption at the newly opened fissures had its culminating phase at

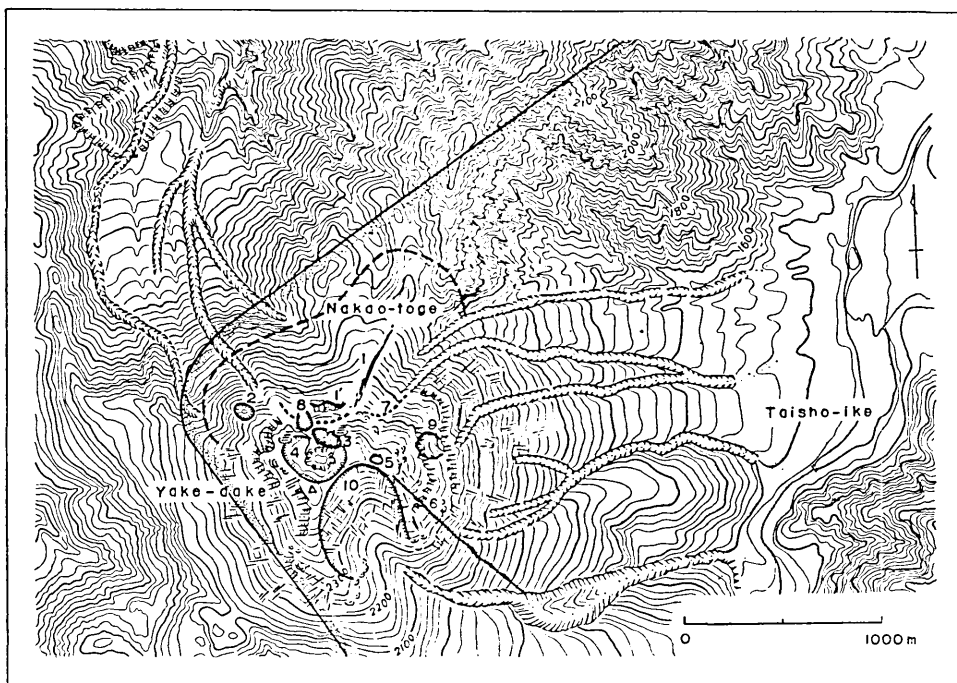


Fig. 3. Topographical map of the Yake-dake Volcano. 1, 1': new fissures opened by the eruption on June 17, 1962. 2: the Kurodani Crater, formed in 1919. 3: the new summit crater, formed in 1911. 4: the old summit crater. 5: the Jun-ga-ike Crater. 6: the Taisho Crater, opened in 1915. 7: the Nakao-toge Explosion Crater. 8: the Shiramizu Explosion Crater. 9: the Kamibori Explosion Crater. 10: the Shimobori Explosion Crater. The solid line shows the area of ash-fall, and the broken line shows the area of debris-fall.

about 10:00 p. m., while the eruption at the flank crater reached its climax at about 10:30 p. m. on June 17. Initial outbursts rose eruption clouds up to a height of about 1500 m above the summit. The tops of these mushroom-like clouds immediately disintegrated and were pushed eastwards by wind. Then, a showering of ash began over a wide area on the east of the volcano. (See Fig. 3.) The deposits of the ash-fall at the south side of Taisho-ike, 2.8 km away from the vents, were weighed 0.7 g per cm², and those at the lowest end of the gully of Shimobori, 2.4 km away from the vents, were weighed 1.0 g per cm².

Violent ejection of ash and debris continued for about an hour. Thereafter the intensity of eruption diminished gradually. Intense rumbling noises were heard until about 1:00 a. m. on June 18 at Kamikochi and Nakao. The discharge of ash and debris continued with minor surges on the morning of June 18. Many large blocks were thrown out of the vents at the initial culmination phase, but they reached at most only a few hundred meters from the throats. Two men who lived in the lodge at the Nakao-toge were injured by the falling of ejected debris. On June 18, the emission of ash-laden clouds continued till 8:00 a. m. at the flank crater and till 6:00 p. m. at the fissures. Then the emission of steam continued incessantly, forming large white vapour clouds above the volcano.

Ejected materials. All debris ejected during the eruptions on June 17 and 18 did not belong to juvenile or essential materials brought directly from molten magmas. They were brought from the pre-existing rocks composing the apical part of the volcano. The writers examined the petrographic characteristics of one specimen of ejected debris collected on the hill north of the Nakao-toge, and found the same characteristics as those of the rocks composing the upper part of the volcano. It consisted of biotite-hornblende-augite-hypersthene andesite, having phenocrysts of hypersthene, augite, green hornblende, biotite, magnetite and plagioclase (andesine, Ab₅₀An₅₀, $n_1=1.555$), and groundmass of colorless glass ($n=1.493$). The ash-fall deposits also had the same petrographic characteristics. During every eruption of this volcano since 1907, debris of juvenile origin has never been discharged. The character of the eruption of June 17, 1962 was quite the same as at all previous eruptions occurring since 1907.

At the outbursts rock debris was thrown out of the vents with low temperature. Such debris did not burn nor scorch grass which was pinned under them. The persons who were injured by ejected debris

also did not suffer any burns. However, dark reddish clouds rising from the Kurodani Crater were seen from the Nakao-toke at the culminating phase of the eruption. The color of rocks on the wall of the Nakao-toke Explosion Crater turned red at the eruption, perhaps owing to the oxidation by the erupting gases of high temperature. It may be possible to conceive that the eruption clouds might have had fairly high temperatures up to several hundred degrees.

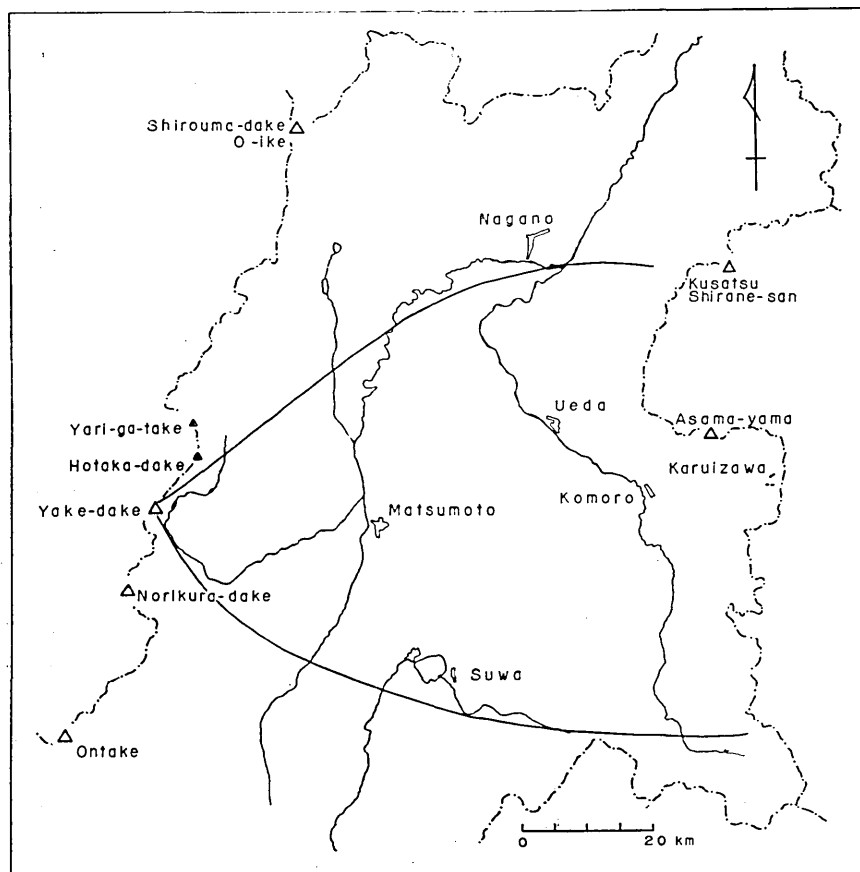


Fig. 4. Map showing the area of ash-fall from the eruption of the Yake-dake Volcano on June 17, 1962.

Mudflows.

After the discharge of the dark ash-laden clouds had ceased, intense emission of steam continued. From the morning of June 18 until the

evening of June 19, much steam was emitted continuously and noises of emission were heard at Kamikochi. The eruption consisted only of white steam clouds rising to a height of about 1000 m from the throats, and of occasional minor puffs of debris, most of which fell back into the throats. White steam clouds were pushed eastwards by wind and enveloped entirely the apical part of the volcano. Consequently, water vapour contained in the clouds condensed on the newly piled ash and debris around the summit. Then, over-saturated fragmentary materials on the steep slopes around the summit began to flow down along gullies on the slopes. From the morning of June 18 to the evening of the next day, mudflows started on the middle part of the wall of the Nakao-toge Explosion Crater and streamed down along the valley of the Nakao-gawa, reaching to the erosion control dam at Nakao. On the afternoon of June 19, at about 2:10, 2:20 and 4:25 p. m., intense noises and air shocks were heard in a wide area around the volcano. These were felt at Matsumoto, Shiojiri, Takayama, Funatsu, etc., 30 to 50 km away from the volcano. The upper half of the volcano was covered by thick cloud which prevented a clear view of the eruptive activities. However, no outburst or effusion of ash occurred, for there was no ash-fall in the area around the volcano on the afternoon of June 19. Almost simultaneously with these noises, mudflows started from the edge of the fissure at the Nakao-toge. They poured down along the gully running in a north-east direction below the pass, and reached the stream of the Azusa-gawa.

On June 20 and 21, there were rainfalls on the volcano. On the afternoon of June 21, mudflows caused by these rainfalls occurred on the eastern slopes of the volcano where there had been the thickest ash-falls from the initial outbursts. One stream of mudflow descended along the gully below the Nakao-toge, falling on the mudflow deposits of June 19. Another one streamed down south-eastwards, whose front reached the Azusa-gawa at a spot immediately below the Taisho-ike and in a short time dammed the stream.

Summary.

The eruption occurred suddenly at about 9:55 p. m. on June 17, 1962 at the Yake-dake Volcano. The outbursts did not occur at the summit crater, but took place at the Kurodani Crater and the Nakao-toge Explosion Crater. New fissures were opened on the wall of the

explosion crater. The entirety of ejected debris does not belong to the juvenile materials. They were brought from the pre-existing rocks on the upper part of the volcano. Discharge of ash and debris ceased on the evening of June 18. The total volume of ejected materials is calculated as $2 \times 10^5 \text{ m}^3$, and the total mass of them is $3 \times 10^5 \text{ ton}$ for the density of ash-fall deposits in a compact packing state is about 1.6. From the morning of June 18, minor mudflows occurred on the western steep slope of the summit. On the afternoon of June 19, other mudflows occurred from the edge of the fissure at the Nakao-toge, being accompanied with intense noises and air shocks. These mudflows might have been caused by the flowage of over-saturated ash and debris piled on the steep slopes around the summit, where tremendous amount of water vapour contained in the eruption clouds condensed on the ground and wetted newly piled ash and debris. After the eruptions on June 17 and 18, some minor outbursts took place sporadically, i. e. on July 26 and on August 9, 1962.

44. 1962年6月17日の焼岳火山の噴火について

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昭和37年(1962年)6月17日午後9時55分ごろ焼岳火山は突然爆発した。中尾峠の焼岳小屋は噴石で破壊され、管理人2名が負傷した。噴火は山頂北面の中尾爆裂口と西北中腹の黒谷火口で起こった。中尾峠爆裂火口壁には延長2kmにわたる割れ目があらたに開口した。火山灰や岩屑の抛中は翌18日午後にやんだが、多量の水蒸気を含んだ噴煙がひきつづいて噴出した。抛出された岩屑の中で新たに岩漿から由来したと見られるものは見出されなかつた。18日午前中より19日までの間に、山頂北面の斜面に小規模な泥流が発生した。19日午後に烈しい音響がこの地方一帯に聞えたが、爆発や火山灰の噴出は認められなかつた。この音響の発生とはほとんど同時に、中尾峠の割れ目の末端より泥流が流れだし、梓川の川岸まで達した。これらの泥流は、火口より噴出された多量の水蒸気が山頂付近の急斜面に堆積した火山灰上に凝縮したために発生したものと考えられる。21日午後には降雨によつて東斜面上で再び泥流が発生し、その一つは大正池のダムの直下で梓川の流れを一時的に堰止めた。

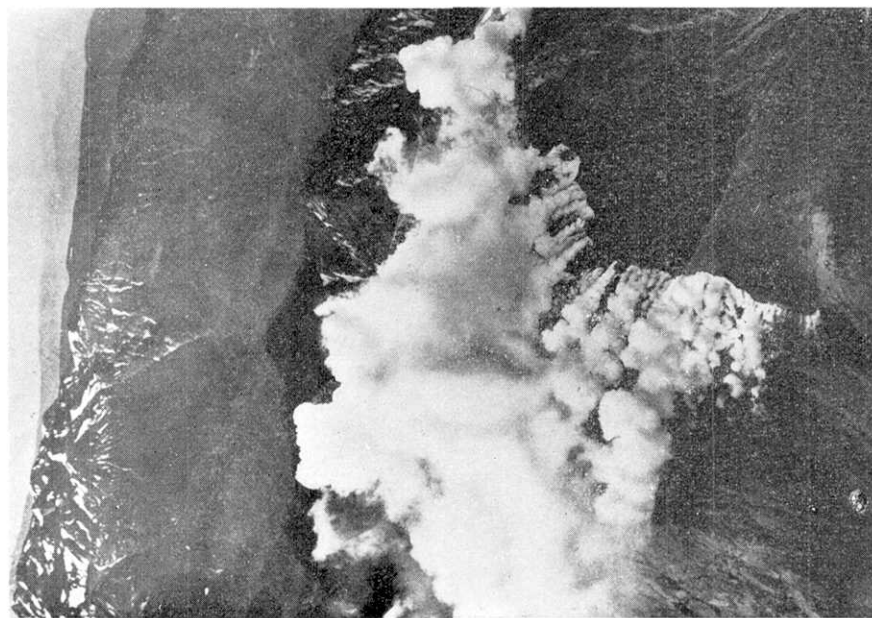


Fig. 5. An aerial photo of the eruption from the north at 8:00 a. m. on June 18, 1962. (Photo. by The Shinano-Mainichi.)

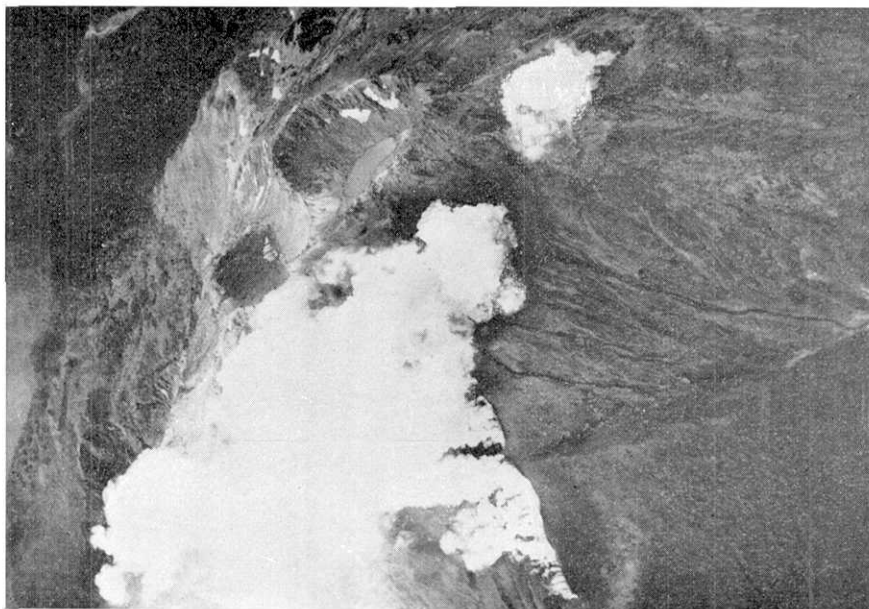


Fig. 6. An aerial photo of the eruption from the northwest at 8:00 a. m. on June 18, 1962. (Photo. by The Asahi.)



Fig. 7. An aerial photo of the new fissures opened by the eruption, from the north at 8:00 a.m. on June 18, 1962. (Photo. by The Shinano-Mainichi.)

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Fig. 8. Eruption clouds from the new fissures, looking from the ridge of Warudani-yama, at about noon on June 18, 1962. (Photo. by The Chubu-Nippon.)



Fig. 9. Eruption clouds from the new fissures near the Nakaotoge, at about noon on June 18, 1962. (Photo. by The Asahi.)



Fig. 10. Yake-dake, looking from Kamikochi, at 3:30 a.m. on June 18, 1962. (Photo. by The Shinano-Mainichi.)

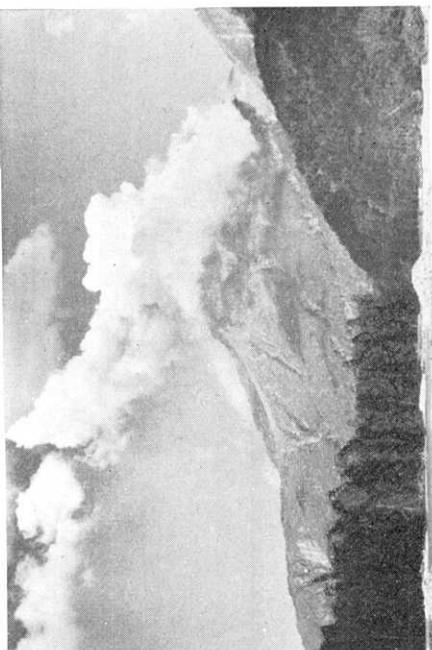


Fig. 11. Ditto, at 6:30 a.m. on June 19, 1962. (Photo. by The Shinano-Mainichi.)

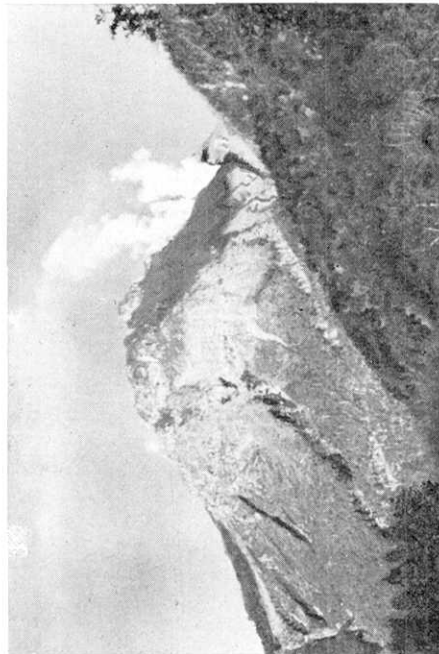


Fig. 12. Ditto, at 7:00 a.m. on June 20, 1962. (Photo. by The Shinano-Mainichi.)

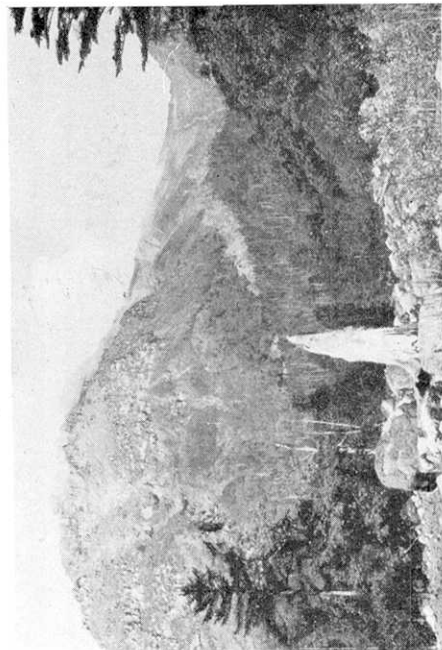


Fig. 13. Yake-dake, looking from its northeast foot, at 8:00 a.m. on June 24, 1962.

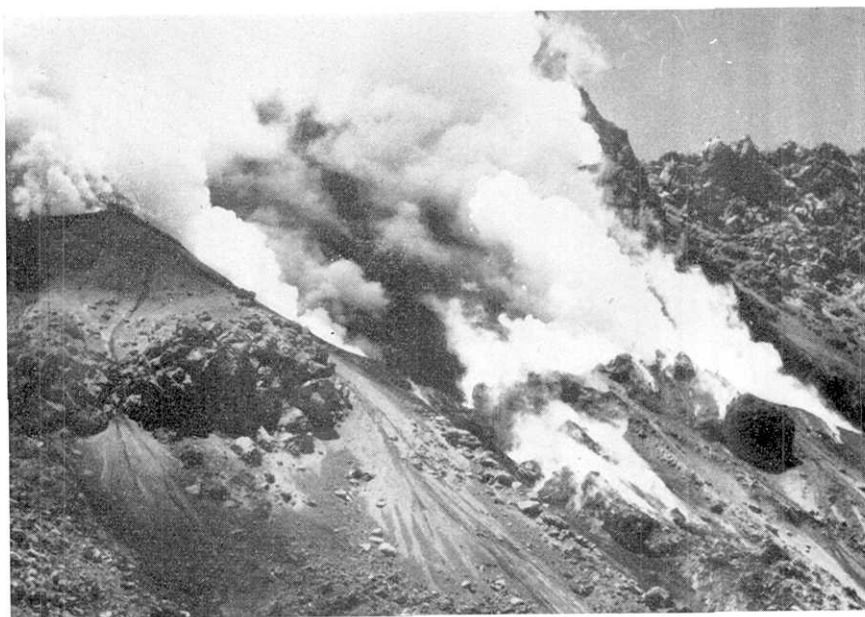


Fig. 14. The emission of steam from the new fissures and the traces of mud-flows, at the middle part of the Nakao-toge Explosion Crater on the afternoon of June 29, 1962. (Photo. by Mr. I. Imada.)

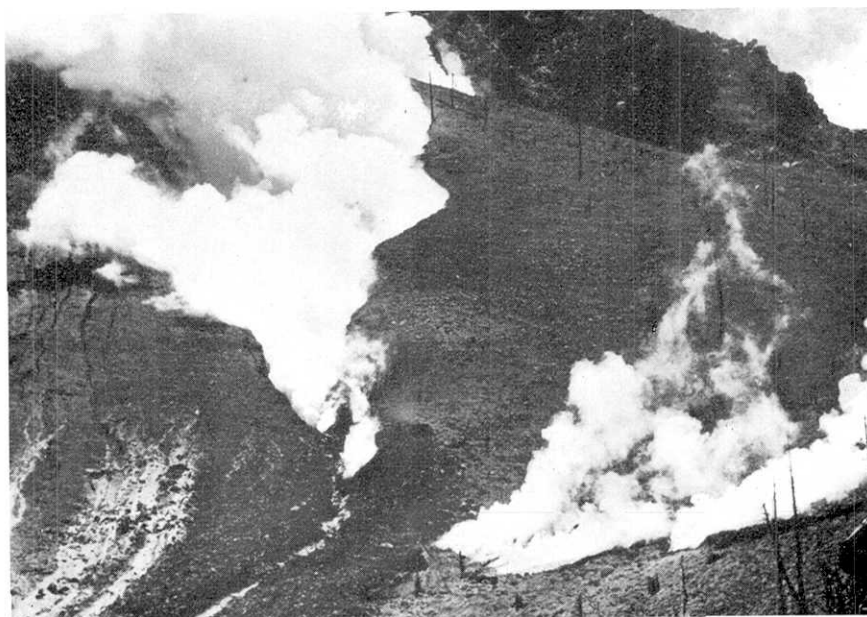


Fig. 15. Ditto, at the Nakao-toge on the afternoon of June 20, 1962. (Photo. by The Asahi.)



Fig. 17. The deposits of mudflows on June 19, 1962, at the north-eastern foot of Yake-dake.

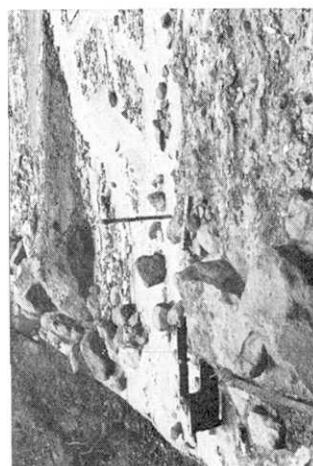


Fig. 18. The deposits of mudflows on June 18 and 19, 1962, on the erosion control dam at Nakao.

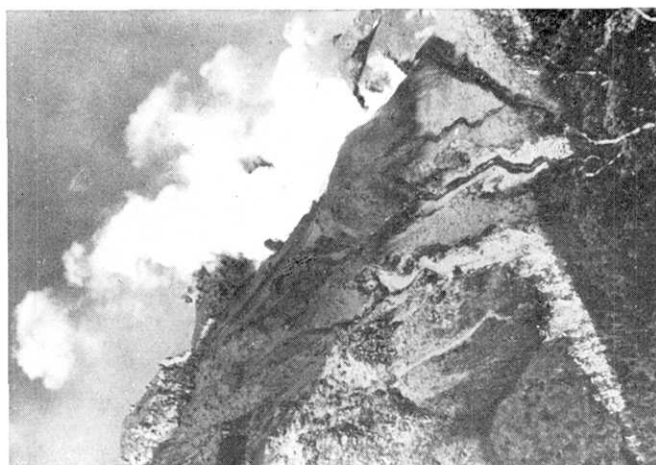


Fig. 16. The north-eastern slope of Yake-dake, wetted by the water vapour which was condensed from the steam clouds, on the morning of June 20, 1962. Some traces of mudflows on June 19, which might have been caused by the flowage of oversaturated ash and debris, are seen in gullies on the lower slope. (Photo. by The Chubu-Nippon.)



Fig. 20. The lodge at Nakao-toge, destroyed by the fall of ejecta. (Photo. taken on June 18, 1962, by The Asahi.)

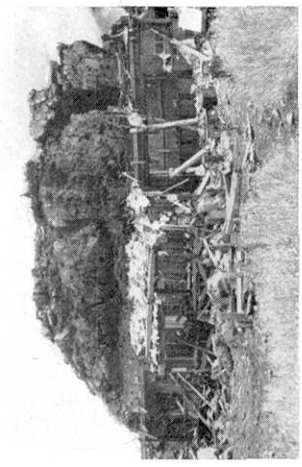


Fig. 21. Ditto.

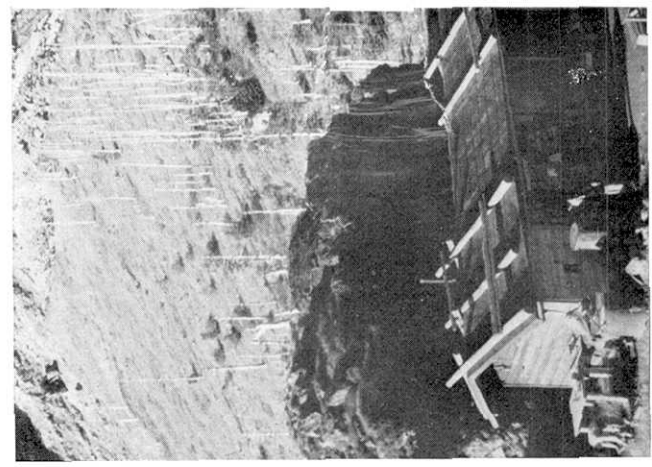


Fig. 19. The lodge and the view at the Nakao-toge, before the eruption. (Photo. taken in 1960.)



Fig. 22. Trees blasted by the eruption, on the eastern slope of the Nakao-toge.



Fig. 23. Blocks ejected by the eruption, near the fissures at the Nakao-toge.



Fig. 24. A hole dug by an ejected block, on the western slope of the Nakao-toge.

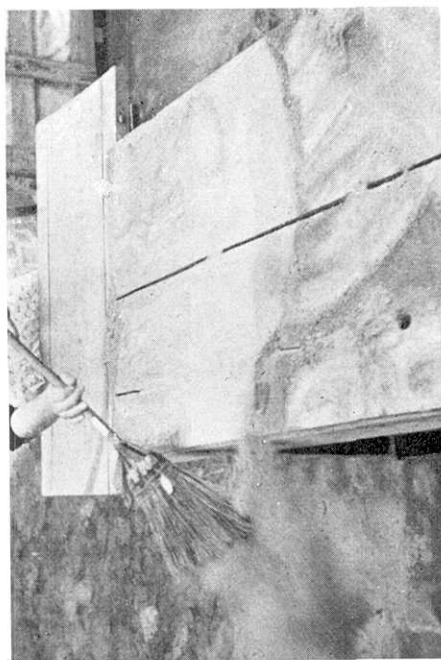


Fig. 25. Ash-fall at Kamihochi, on June 18, 1962. (Photo. by The Shinano-Mainichi.)

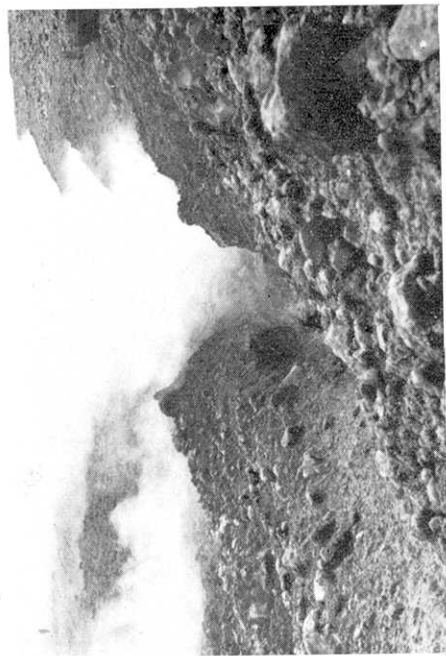


Fig. 26. The edge of a new fissure at the Nakao-toge, and the deposits of mudflows. The mudflows started repeatedly from this edge on June 19 and 22, 1962.

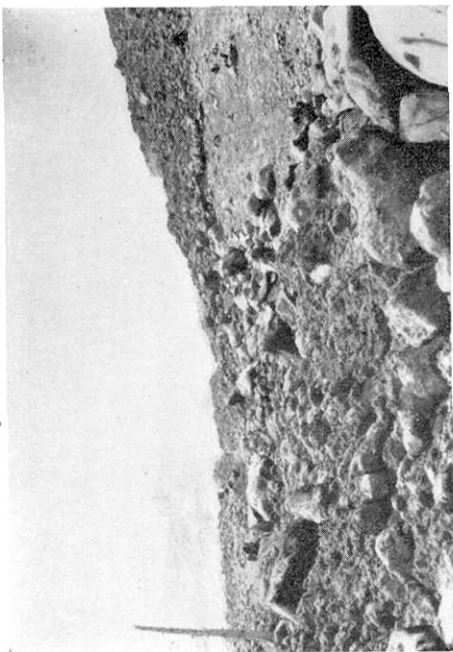


Fig. 27. The deposits of mudflows on the slope immediately below the Nakao-toge.

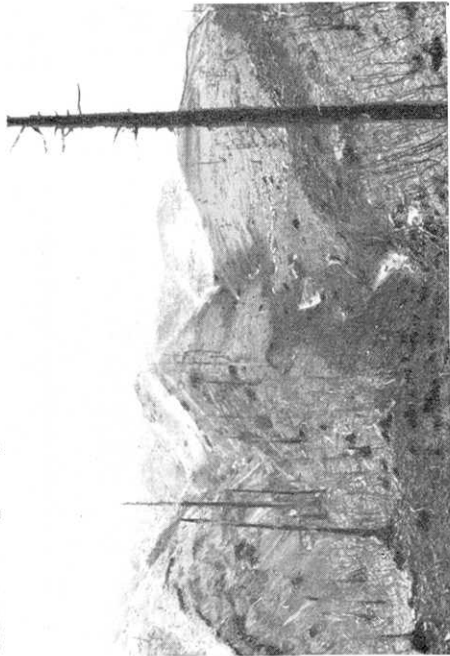


Fig. 28. The trace of mudflow on June 22, and trees blasted by the eruption, on the eastern slope of the Nakao-toge.

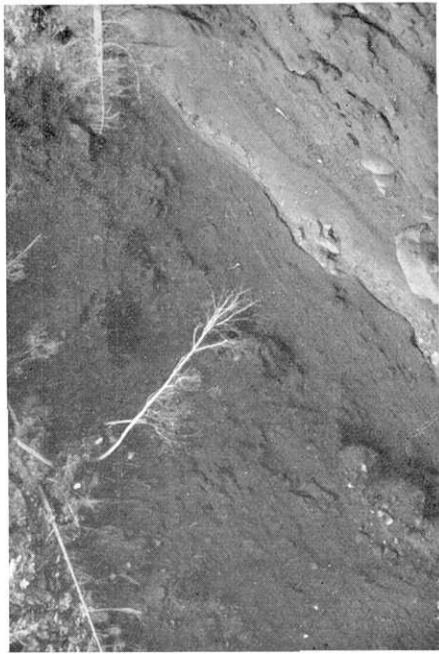


Fig. 29. The trace of mudflow in a gully on the northeastern slope of Yake-dake.