

Text S2: Maps of the areas affected by ballistics of 24 historical paroxysms

Supporting Information for:

Ballistic projectile hazard of major explosions and paroxysms at Stromboli (Italy) with uncertainty quantification: 1. Mapping method and data analysis

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In the following list of 24 descriptive files we present the reconstructions of the areas affected by the paroxysms considered in our analysis. In particular, for every paroxysm on the left of the simplified map based on circular sectors, we show a visual summary of the available information on ballistics, following the schematics described in Figure 2 of the main text. Above the figures we report the references of the considered sources, the date and time of the event; below the figures we report the English translation of the original excerpts. Note that most of the descriptions are referenced to the historical names of topographical features, especially of the upper portion of the island, which in the first decades of XX century looked significantly different from the current features; all these place names are summarized in Figure 1 of this document. Finally, Table 1 of this document summarizes the fragmentary information on the ballistics of the paroxysms that we could not map.

The literature references that we considered include: Mercalli (1879-1888); De Rossi (1880; 1882); Riccò and Mercalli (1891); Arcidiacono (1895-1906); Platania (1906-1922); Riccò (1907; 1916); Perret (1913; 1916); De Fiore (1915; 1923); Ponte (1919-1924; 1948); Malladra (1922); Imbò (1928; 1935); Rittmann (1931); Abbruzzese (1935-1940); Hantke (1951-1962); Cucuzza Silvestri (1955); Cavallaro (1957-1967).

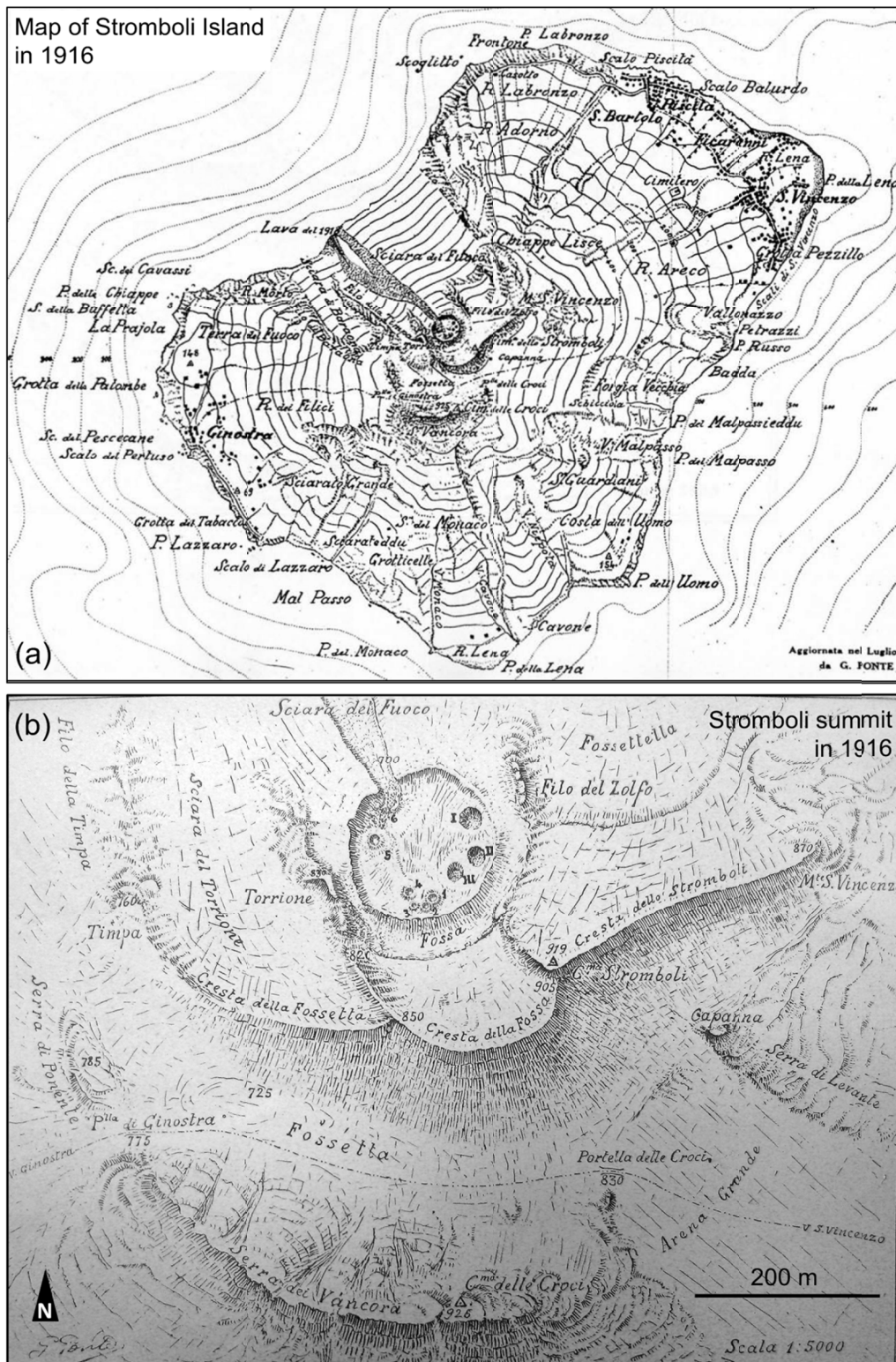


Figure 1. Historical mappings in 1916 with main place names labeled. (a) shows the entire Island of Stromboli and (b) its upper portion. Figures modified from Ponte (1921). See also Asburgo (1896).

Main sources
 INGV - reports of volcanic activity; Giordano & De Astis (2021);
 Andronico et al. (2021); Calvari et al. (2021); Pichavant et al. (2022)

FIELD DATA AND OBSERVATIONS

● affected sites → radially affected area
 previously mapped dispersal

★ 518400 E, 4293900 N

Brief summary about ballistics
 Distribution of ballistics reconstructed from photos and videos is less asymmetric compared to that of July 3. Ballistic clasts at the summit that can be clearly identified as being associated with the August 28 paroxysm appear mainly to be blocks of accidental lava lithics; difficult to identify spatter clasts which could be associated with certainty with the August 28 explosion. At Pizzo the deposit was nearly continuous and up to ca. 0.2 m thick, and composed of 90–95% fresh juvenile LP-HP magma pyroclasts. The maximum lava block equivalent diameter measured is 86 cm near the summit, decreasing to 23 cm at the 850 m a.s.l. helipad. Along the northern flank of the volcano, at elevations lower than 500 m a.s.l., ballistic bombs were made of variably vesicular juvenile material. The tephra deposit was recognizable down to 300–500m a.s.l. to the NE. Sparse clasts ranging 3–6 cm in size were found down to 200 m a.s.l., and up to 10 cm in the NNE slopes. Sporadic HP spatter bombs up to 1m in size were found at 600 m a.s.l. towards NNE, and both HP bombs and non-juvenile blocks (0.1 - 0.5 m) reached 400 m a.s.l. NE. Bush fires all around the island also starting as low as 300–400 m a.s.l., from incandescent bombs larger than 15 cm.

SIMPLIFIED MAP

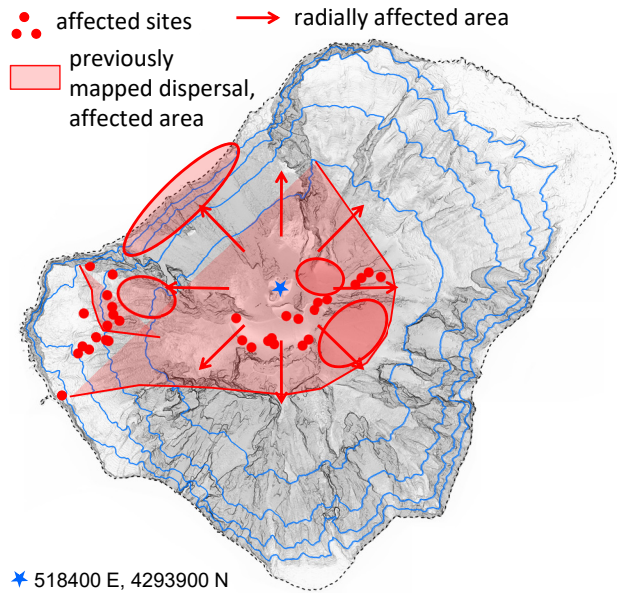
■ simplified map
 ■ uncertainty

Figure. Giordano and De Astis (2021) - Isoleth of maximum clast size. (1) crater; (2) lava block size (values in cm); (3) HP and LP bomb size and isopleth (cm); (4) pumice lapilli size and isopleth (cm); (5) limit of visible ballistics on-shore; (6) lava flow.

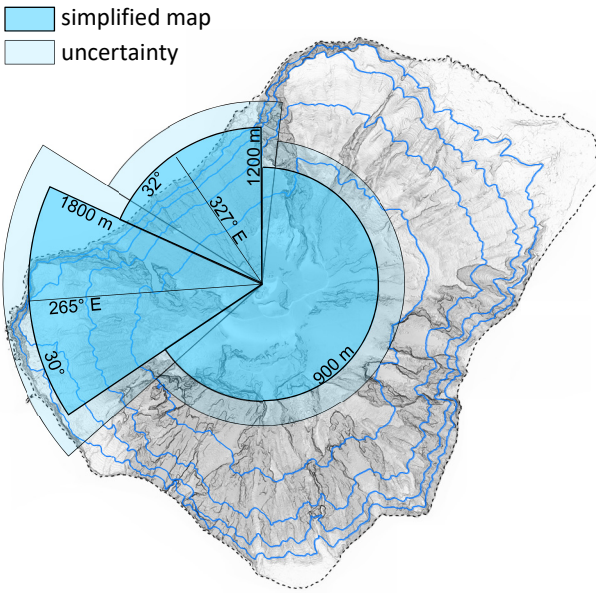
Descriptive File 2.

Main sources	Year	Month	Day	GMT
INGV - reports of volcanic activity; INGV - weekly bulletin; Giordano & De Astis (2021); Andronico et al. (2021); Calvari et al. (2021); Pichavant et al. (2022); Bisson et al. (2023); Personal Communication – Landi	2019	7	3	14:46

FIELD DATA AND OBSERVATIONS



SIMPLIFIED MAP



Brief summary about ballistics

Spatter and lava fragments become continuous a few tens of meters from the elipad towards Pizzo, and in Valle della Luna. Total thickness of the continuous spatter cover is rather uniform, from 30 to 40 cm, and only thickens where the steep slopes allowed for rheomorphic downslope flowage, up to 1 m; above it, a discontinuous layer of 0.5-3 m-sized spatter bombs of LP composition; their maximum dimension reaches the equivalent diameter of 171.7 cm in the Fossetta area, where some are coated with HP scoria and some are shattered and form large impact craters. A continuous, coarse-grained (10-50 cm) pumice bombs deposit, up to 0.7 m thick in the proximal sector, covered the upper W flank down to 500 m a.s.l.. N of Ginostra.

Descending from Pizzo towards NE, the spatter bombs cover became discontinuous below 850 m a.s.l. down to ca. 0.25 spatter per metric square at a 450 m distance from the vents; at 350 m in the NE direction, at the helipad, the max. spatter diameter is 107.7 cm, rapidly decreasing to 18.7 cm along the final section of the trail to the summit. Several fires, especially towards Punta dei Corvi. Crater changes are significant - edge of crater terrace towards Sciara del Fuoco destroyed in the N and S sides, but not in the center; N1 and N2 merged in a large pit.

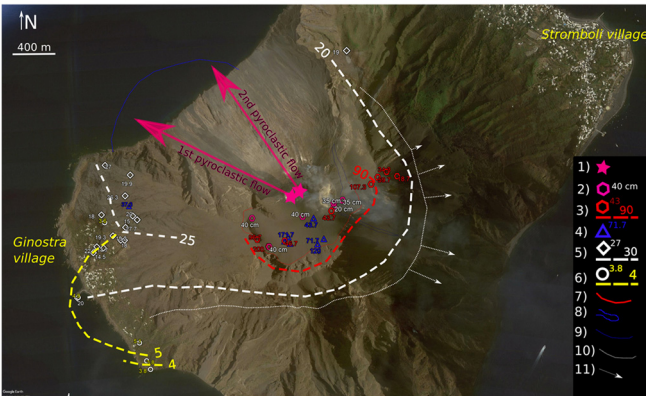


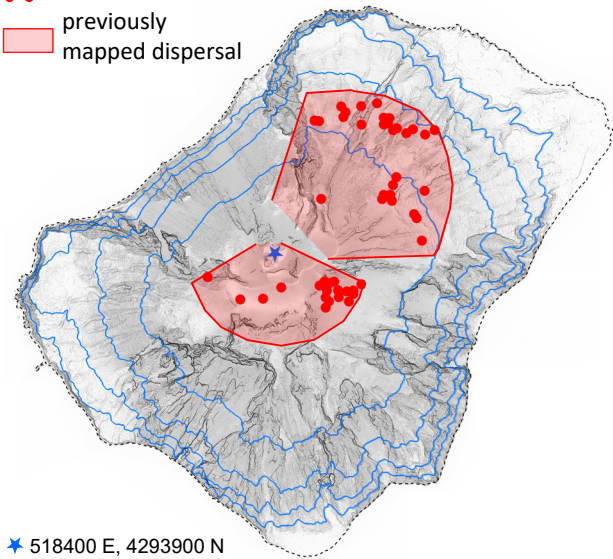
Figure. Giordano and De Astis (2021) - Isopleth of maximum clast size. (1) crater; (2) thickness of the total spatter cover (cm); (3) spatter size and isopleth (cm); (4) lava block size (values in cm); (5) HP and LP bomb size and isopleth (cm); (6) pumice lapilli size and isopleth (cm); (7) limit of total spatter cover; (8) glowing avalanche detachment and deposit; (9) limit of visible ballistics offshore; (10) limit of visible ballistics on-shore; (11) directions of incandescent rolling stones.

Descriptive File 3.

Main sources	Year	Month	Day	GMT
INGV report - Andronico et al.; Martini et al. (2007); Barberi et al. (2009); Pistolesi et al. (2011); Andronico et al. (2013); INGV - daily updates on the current eruptive phenomena	2007	3	15	20:37

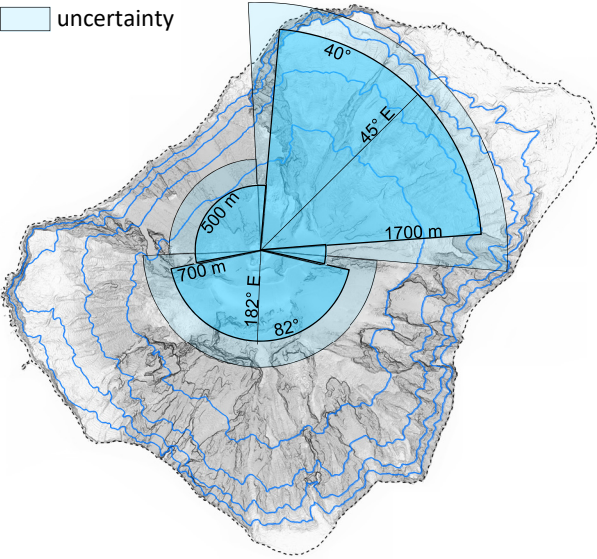
FIELD DATA AND OBSERVATIONS

- affected sites
- previously mapped dispersal



SIMPLIFIED MAP

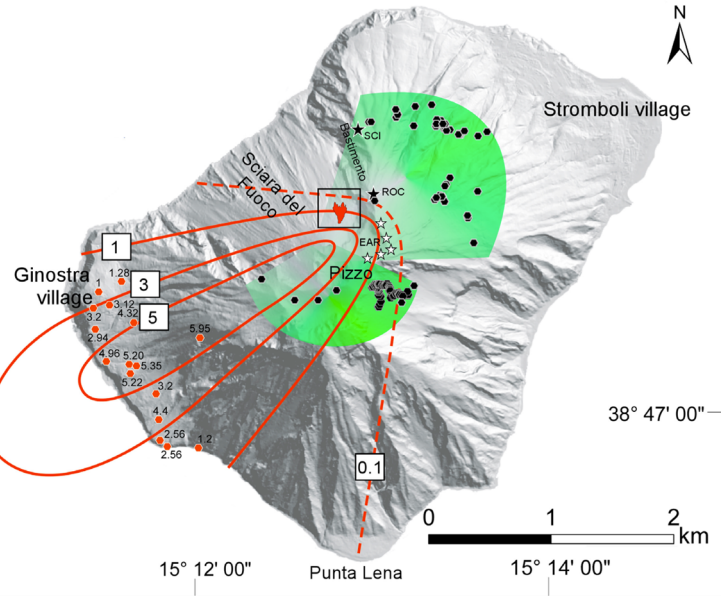
- simplified map
- uncertainty



Brief summary about ballistics
Helicopter survey 12 hours after the event, with thermal camera. New deposit on "Pianoro" under "Bastimento". Small fires at "Le Schiccirole", below Rina Grande. Field survey from Labronzo to Canestrà, many lithic blocks up to less than 300 m asl. These blocks are often associated to metric impact craters and small collapses. Greater concentrations of clasts over a stripe towards S. Bartolo village - some are below 250 m a.s.l.

Figure. Pistolesi et al. (2011) - Black hexagons enclosed in the green shadow area are ballistic blocks mapped in the field.

The black box shows the pyroclastic flow deposit emplaced on the lava flow field. The geophysical stations ROC and SCI are indicated with the black star; white stars indicate the EAR station array. Red curves indicate mass loading per unit area of the 15 March paroxysm; measuring sites are also indicated by red circles (all values expressed in kg/m2).

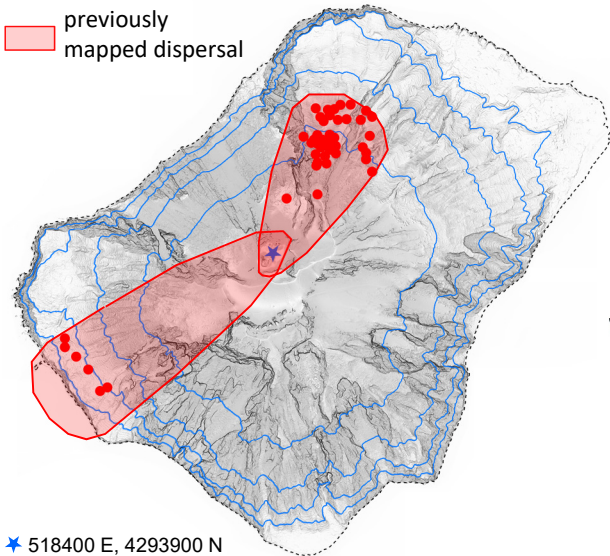


Descriptive File 4.

Main sources	Year	Month	Day	GMT
INGV - daily updates on the current eruptive phenomena; Rosi et al. 2006; Calvari et al. 2006; Pistolesi et al. 2008; Stromboli Online	2003	4	5	07:12

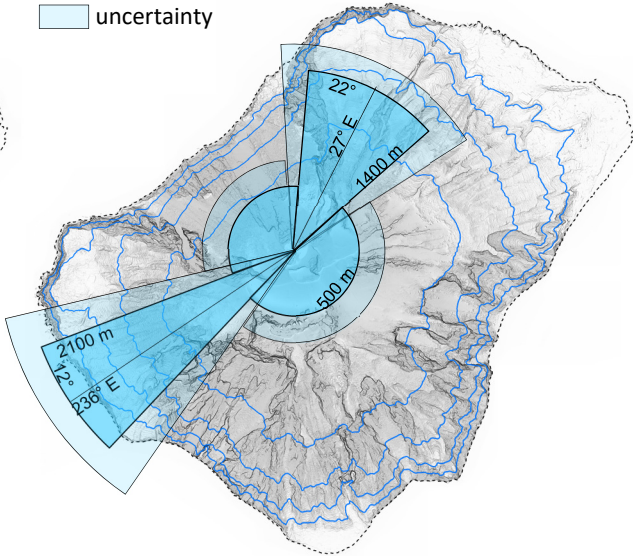
FIELD DATA AND OBSERVATIONS

- affected sites
- previously mapped dispersal



SIMPLIFIED MAP

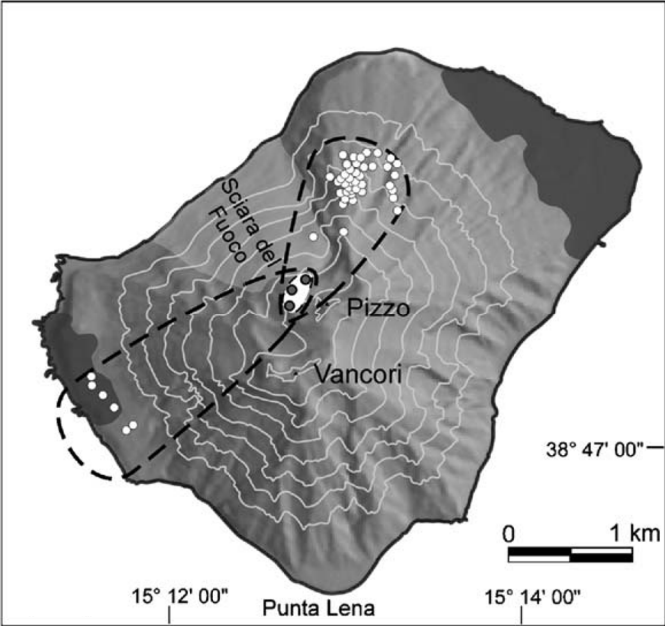
- simplified map
- uncertainty



Brief summary about ballistics
Elicopter survey during the event, lava field at 590 m asl and upper Sciara del Fuoco is buried by the explosion products. All summit above 700 m asl is continuously covered by products. Several fires on the NE flank. Field survey nine days after the event - between elipad, Pizzo and beyond there is a continuous cover of pumiceous bombs and lithic blocks, both fresh and altered. Summit trails are obliterated and "fortini" are partially buried. Average thickness is 10-30 cm. Max. size of these bombs is 60 cm, blocks are 20-30 cm on average, max. 50 cm; bombs/blocks ratio is 1:10. Massive bomb (ca. 3-4 m) and impact crater on Bastimento (600m from craters).

Figure. Rosi et al. (2006) - Mapped impact craters from larger ballistic blocks. Dashed lines enclose the areas of higher concentration of blocks.

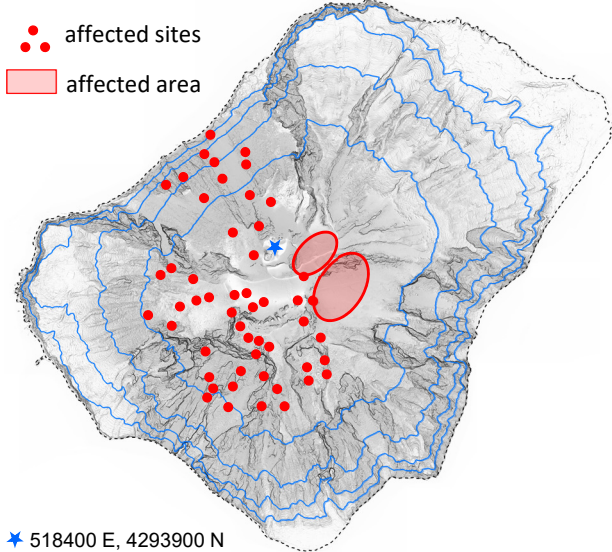
Impact craters produced by blocks with diameter ≥ 2 m were also mapped using data aerial photogrammetric surveys of the island.



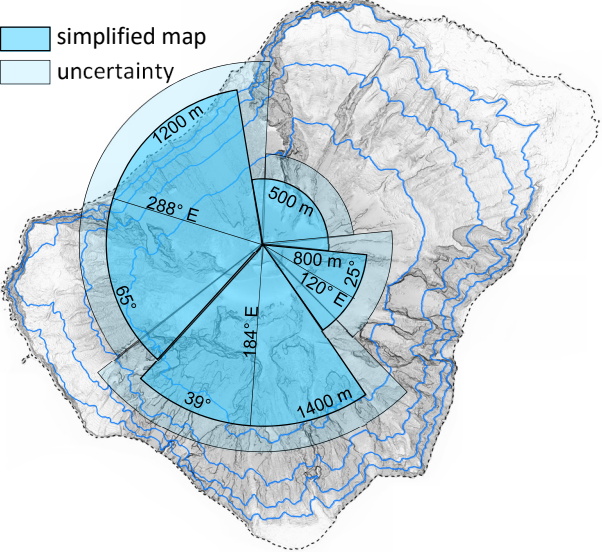
Descriptive File 5.

Main sources	Year	Month	Day	GMT
Cavallaro (1962; 1967)	1959	7	11	17:20

FIELD DATA AND OBSERVATIONS

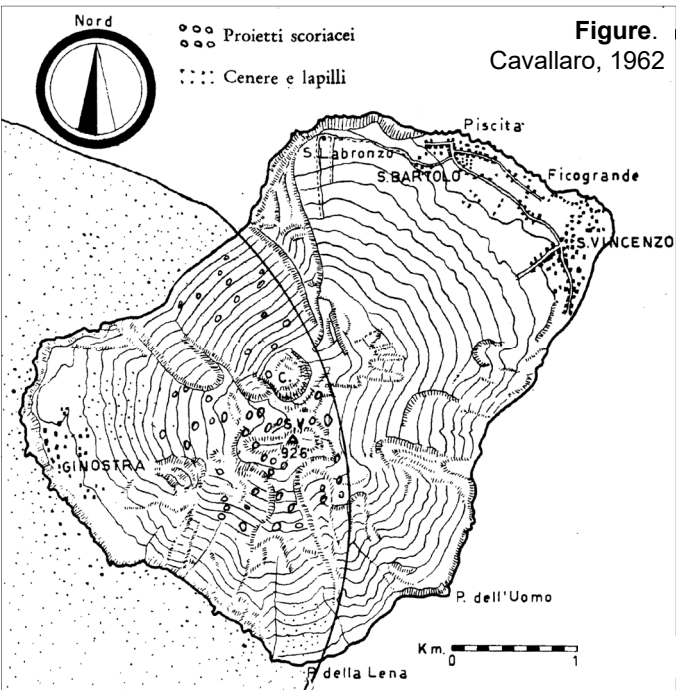


SIMPLIFIED MAP



Original historical document - excerpts about ballistics [Cavallaro (1962); Cavallaro (1967) idem] At Stromboli on the 8th, 9th, and 10th of July 1959, explosive activity intensified, accompanied by dense grey and dark fumes. At approximately 18:21 on the 11th, without any noticeable warning signs, a gigantic column of black smoke, accompanied by a loud roar, suddenly rose from the crater, reaching a height of over 500 meters. Moments later, fumes were observed rising along the Sciara slope [...]. On the Sciara del Fuoco, scoria mixed with contemporaneous boulders fell, tumbling into the sea at dizzying speeds. The motor vessel Lipari, en route to Stromboli, happened to be in the fallout area but managed to steer away just in time. From the steamer, an intense and dense fall of lapilli and ash was visible. Reports from Ginostra confirmed that a thick rain of lapilli and ash fell on the settlements of Punta Lazzaro, Punta Lena, and out at sea up to approximately 300 meters from the shoreline. Stromboli guides who visited the crater a few days later reported a significant accumulation of material, prompting us to undertake a detailed investigation on August 25th.

Upon reaching the summit above La Fossa (918 m a.s.l.), we were able to confirm that most of the reports given to us were accurate [...]. The crest of La Fossa and the Stromboli crest were covered with magma plates, which, having been ejected in a fluid state, took on various shapes and forms upon falling back to the ground. Scattered about were flat "focaccia"-shaped bombs and "cercini".



The Fossetta (730 m a.s.l.) was partially covered with a thick blanket of shredded and filamentous lava. In some steep areas, the magma resembled miniature lava flows. In certain locations, the scoriaceous blanket reached a thickness of 40 - 60 cm. Projectiles even reached Serra dei Vancora, about 200 meters above the crater floor. The Passo delle Croci and the shelter (854 m) were also impacted by scoria. On the Arena Grande, scoria was observed from 700 m to 676 m elevation; below 550 m, none was found. Near the cone of the Torrione group, large boulders were seen, undoubtedly originating from the crater structure. It was not possible to collect samples due to intense lateral explosive activity, which made access dangerous.

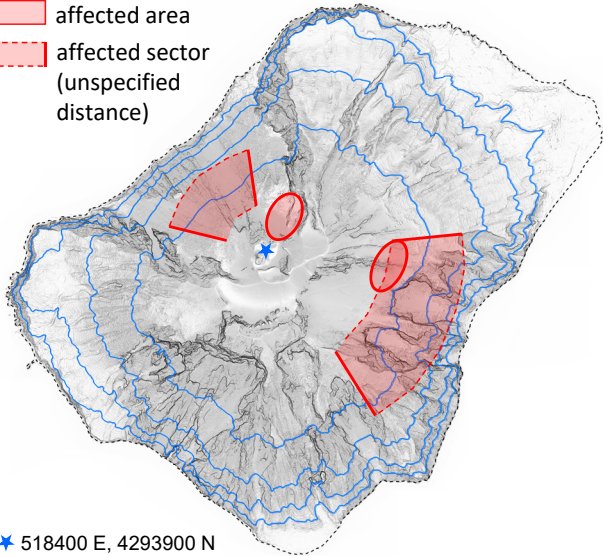
[...] The material ejected during the paroxysmal eruption of July 11th consisted of: a) scoriaceous projectiles, b) light and heavy scoria, c) lapilli, d) glassy filaments, e) augite crystals. The scoriaceous projectiles generally had a flat, "focaccia"-like shape, though some took on a "cigar" or "lemon" shape. Their size varied, with some reaching up to 40 cm in length. All were externally coated in predominantly glassy scoria and, when subjected to pressure, displayed a characteristic flaky splitting pattern, with fracture surfaces showing a resin-like sheen. The abundance of glass decreased inward, where bubble size increased - some measuring several centimeters in diameter. [...] Most of the light scoria, deformed and stretched in various ways, fell between the Fossetta and the Torrione, forming in some areas a layer 40 to 60 cm thick. The rarer heavy scoria resembled the former but were iron-grey in color and coated with a glassy layer.

Descriptive File 6.

Main sources	Year	Month	Day	GMT
Hantke (1962); Cavallaro (1967)	1959	5	19	07:00

FIELD DATA AND OBSERVATIONS

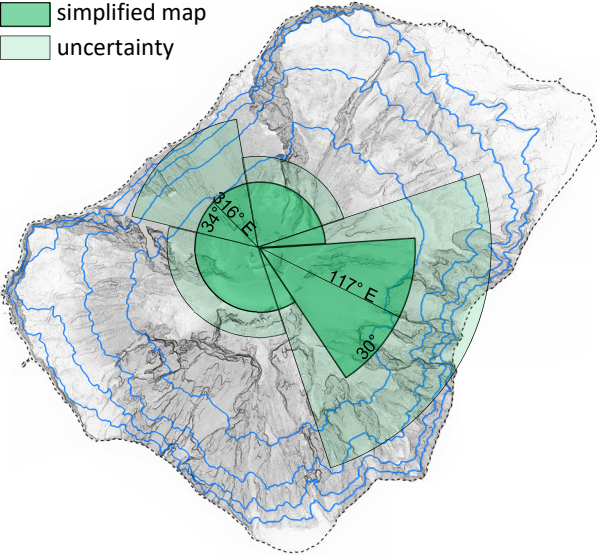
- affected area
- affected sector (unspecified distance)



★ 518400 E, 4293900 N

SIMPLIFIED MAP

- simplified map
- uncertainty

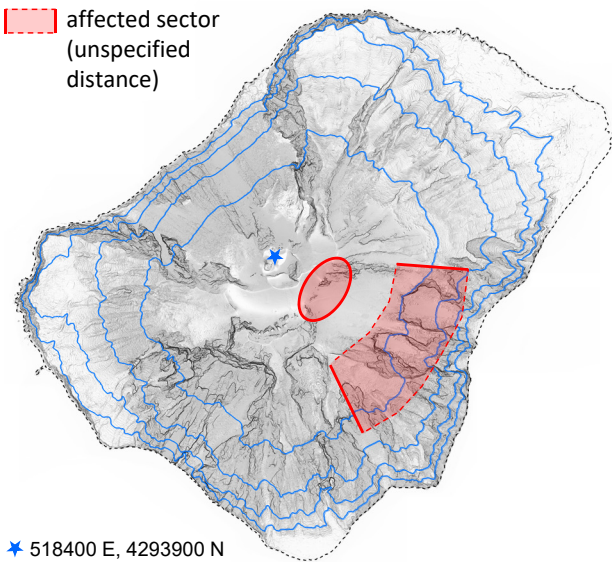


Original historical document - excerpts about ballistics
[Cavallaro (1967)] The explosion caused air displacements in certain areas of the settlements of San Vincenzo and San Bartolo. The older, more dilapidated buildings showed clear signs of the effects. [...] Large scoria and incandescent rocks were ejected to great heights. These materials fell partly on the Sciara del Fuoco slope and the eastern side of the island; falling onto the vegetation, they also sparked fires, which extinguished after about two hours due to the wind dying down. The population was seized by panic, especially because the volcano had not shown such eruptions in recent years. [...] After a survey, it was noted that the top of the material ejected was coriaceous, grey-brown, lightweight, and vesicular. One of the crater mouths of the Filo dello Zolfo group had a large chasm, with four cones emerging nearby; whose rim was crumbling and whose inner walls plunged steeply; white fumes emanated from the crevices. The area was covered with abundant magma plates. At an altitude of 480 meters above sea level, along the eastern slope, there were scoria clumps that had caused a nearby fire.

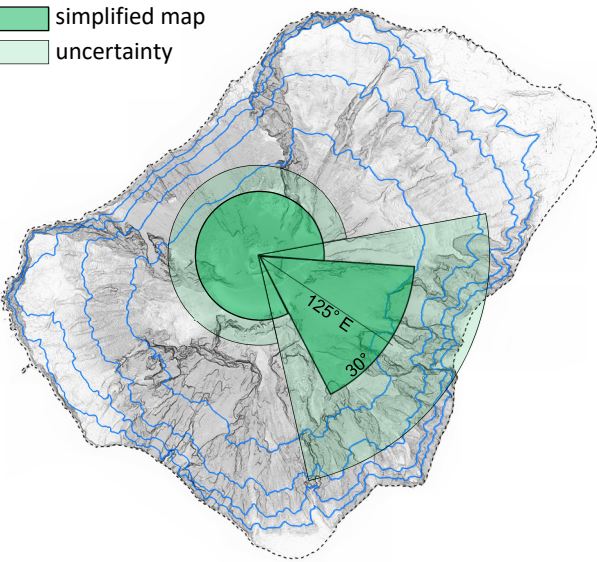
Descriptive File 7.

Main sources	Year	Month	Day	GMT
Ponte (1948); Cavallaro (1957)	1944	8	20	05:30

FIELD DATA AND OBSERVATIONS



SIMPLIFIED MAP



Original historical document - excerpts about ballistics

[Ponte (1948)] Abundant glowing scoria mixed with ash was ejected from the Torrione crater to great heights, accompanied by vivid flashes and prolonged booms. In a short time, a magnificent column of ash rose, while a gigantic lava flow poured down the Sciara del Fuoco to the sea, where enormous waves rose and nearly submerged a small boat with brave students on board. Huge glowing material, mixed with relatively large blocks and ash, fell on the upper part of the volcano and the slope of Forgia Vecchia, extending into the sea for about 100 meters, where it was soon demolished by the fury of the waves.

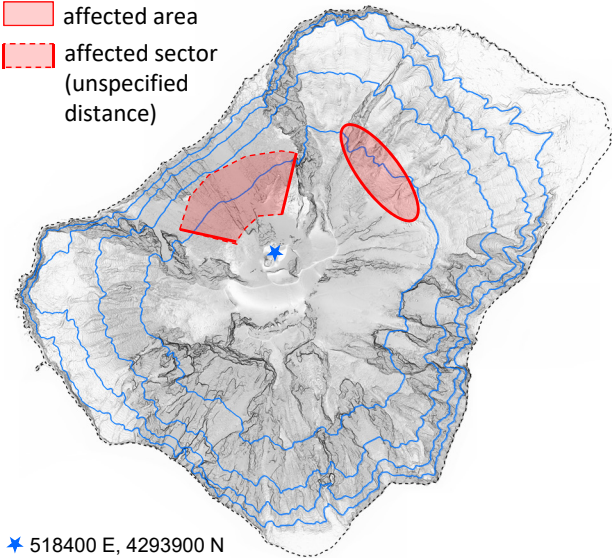
[Cavallaro (1957)] Incandescent scoria was ejected from the crater to considerable heights, accompanied by vivid flashes. A column formed, at least twice as high as the island, immediately followed by the effusion of a large amount of lava, spilling from the crater zone towards the Sciara del Fuoco. An avalanche of igneous material mixed with blocks of scoria and ash channeled down the Forgia Vecchia slope, extending to the beach with a delta of about 300 meters, continuing for over 100 meters into the sea.

Descriptive File 8.

Main sources	Year	Month	Day	GMT
Ponte (1948); Hantke (1951); Cavallaro(1957)	1941	8	22	18:00

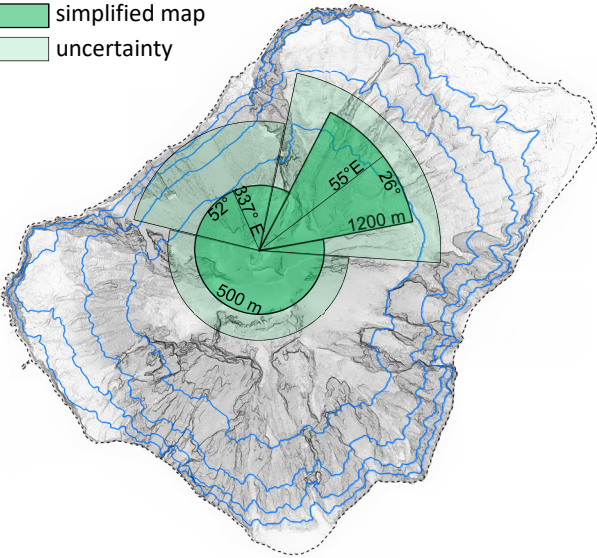
FIELD DATA AND OBSERVATIONS

- affected area
- affected sector (unspecified distance)



SIMPLIFIED MAP

- simplified map
- uncertainty



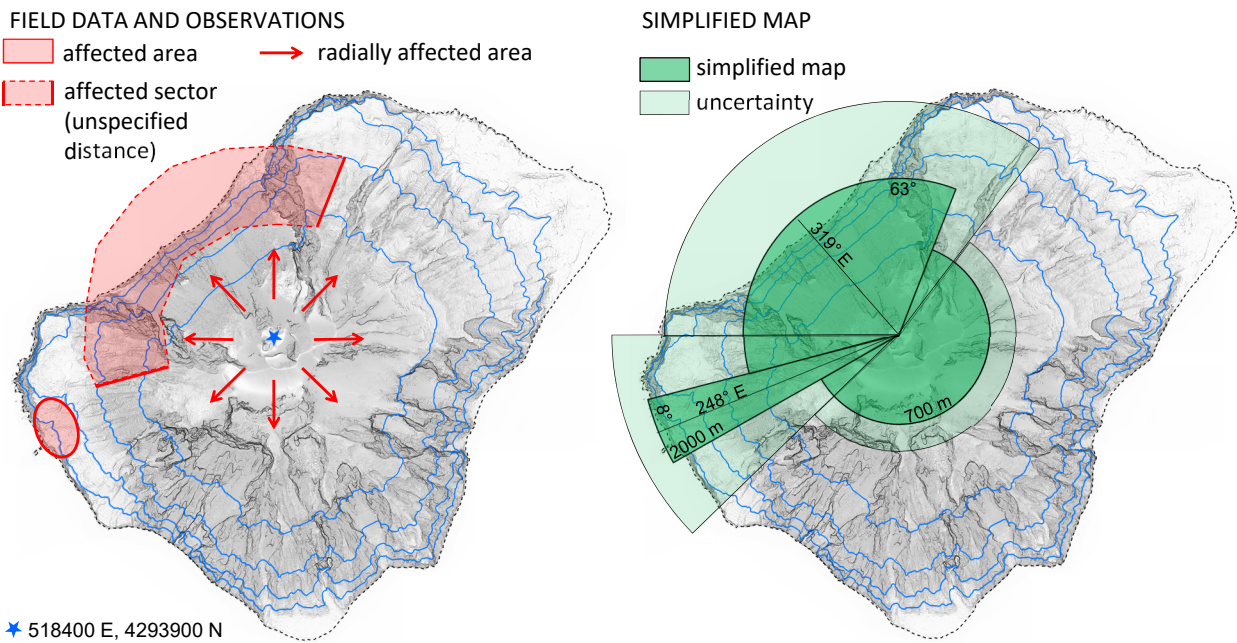
Original historical document - excerpts about ballistics

[Ponte (1948)] Myriads of glowing scoria were ejected in a fountain over a kilometer in height above the crater, amidst vivid flashes [...]. The glowing scoria that fell onto the dry grass above 400 meters on the upper part of the volcano sparked vast fires, fueled by the strong NW wind. After a day of intense efforts, the islanders were barely able to extinguish the fires.

[Cavallaro (1957)] Glowing scoria were projected to a height of over a thousand meters from the crater's rim. [...] Fragments of scoria fell on the Sciara del Fuoco and the slope leading to the villages of S. Bartolo and S. Vincenzo, up to about 400 meters above sea level, causing fires that were further fueled by a strong NW wind.

Descriptive File 9.

Main sources	Year	Month	Day	GMT
Abbruzzese (1936b; 1937a; 1937b)	1936	1	31	17:30

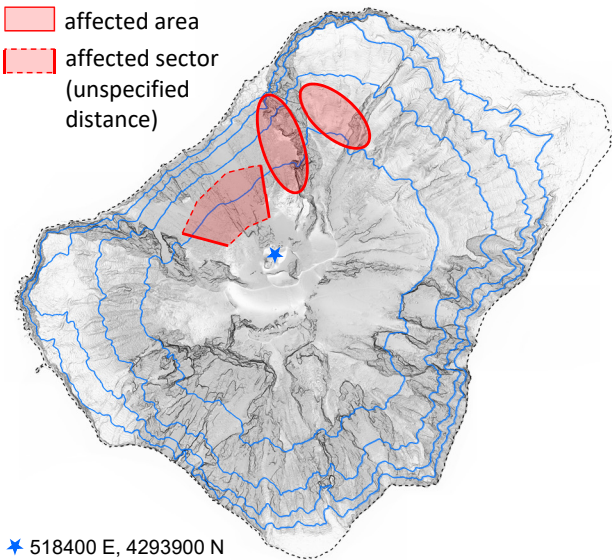


Descriptive File 10.

Main sources	Year	Month	Day	GMT
Abbruzzese (1935; 1936b; 1937a)	1935	7	21	12:10

FIELD DATA AND OBSERVATIONS

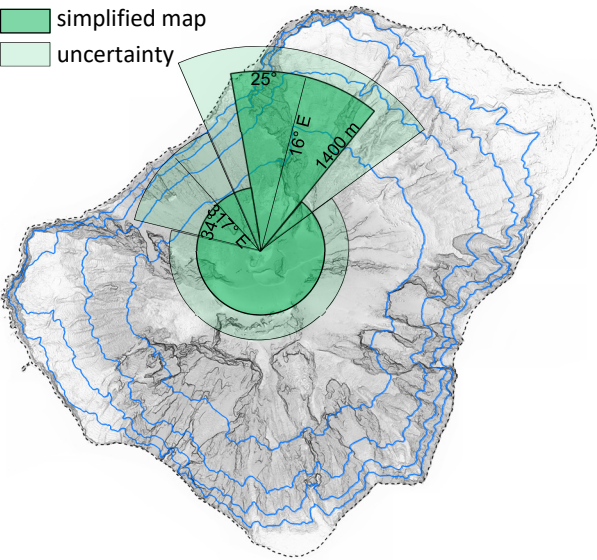
- affected area
- affected sector (unspecified distance)



★ 518400 E, 4293900 N

SIMPLIFIED MAP

- simplified map
- uncertainty



Original historical document - excerpts about ballistics

[Abbruzzese (1935)] Large, glowing rocks were projected up to 300 meters from the village. [...] There was much panic among the inhabitants, but no damage to the village or the crops.

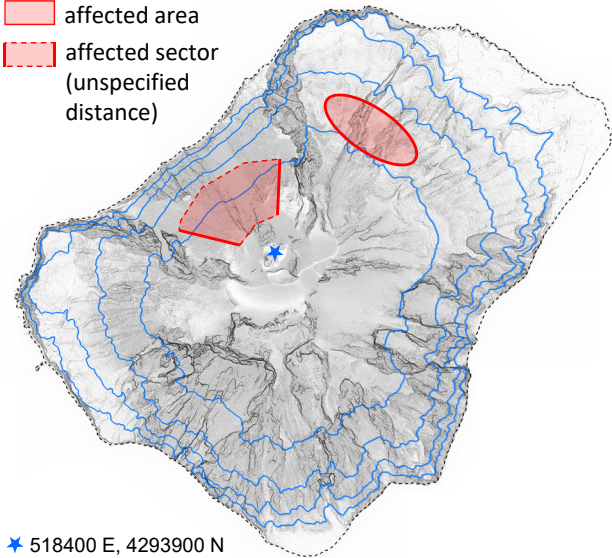
[Abbruzzese (1937a); Abbruzzese (1936b) idem] [...] Large rocks, many of them incandescent, were ejected to considerable heights and then fell towards the Sciarra del Fuoco and the Filo di Levante, while smaller ones reached the Piscità area, about 300 meters from the village. [...] The sky darkened due to the abundant ash for about twenty minutes, causing great panic among the inhabitants, further heightened by the fact that the NE wind carried much ash and light lapilli into the village.

Descriptive File 11.

Main sources	Year	Month	Day	GMT
Abbruzzese (1935; 1937a); Imbò (1935)	1934	2	2	18:10

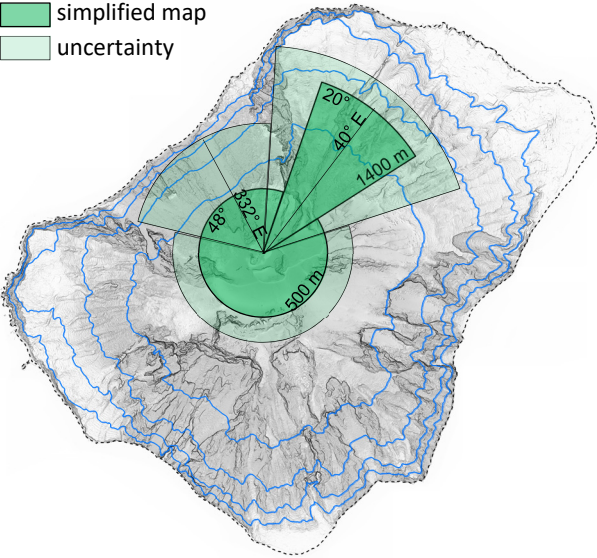
FIELD DATA AND OBSERVATIONS

- affected area
- affected sector (unspecified distance)



SIMPLIFIED MAP

- simplified map
- uncertainty



Original historical document - excerpts about ballistics

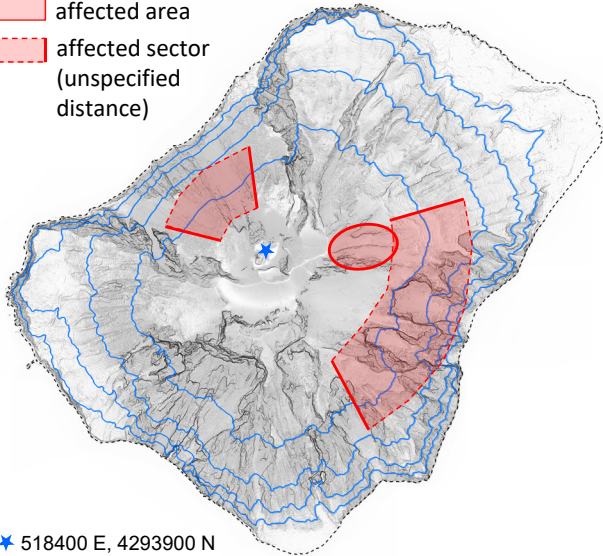
[Abbruzzese (1935); Abbruzzese (1937a) idem] Strong jets of pyroclastic material were ejected, some of which rolled down to the sea along the SdF, while part of it fell 500 meters uphill from the Church of San Bartolo, which suffered damage to its vault, likely due to the air displacement, as the inhabitants did not notice any seismic shock. For the same reason, windows of the new Semaphore and some houses were broken.

Descriptive File 12.

Main sources	Year	Month	Day	GMT
Imbò (1928; 1935); Rittmann (1931; 1933); Abbruzzese (1935)	1930	10	22	18:00

FIELD DATA AND OBSERVATIONS

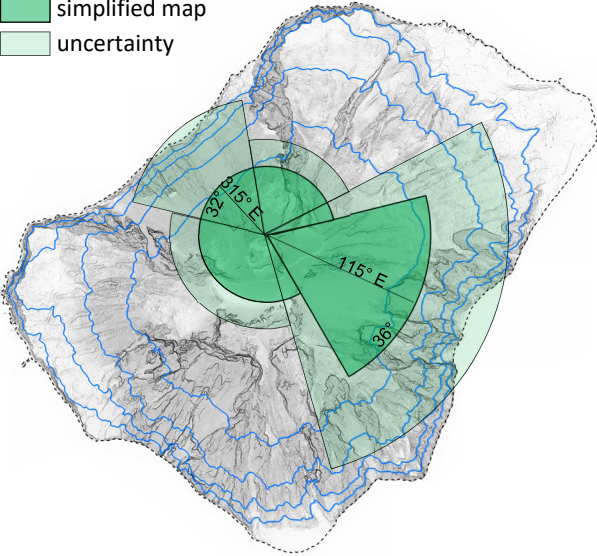
- affected area
- affected sector (unspecified distance)



★ 518400 E, 4293900 N

SIMPLIFIED MAP

- simplified map
- uncertainty



Original historical document - excerpts about ballistics

[Imbò (1928)] Formation of a huge dark pine tree inclined to the southeast and an abundant eruption of incandescent material that also predominantly flowed towards the southeast (Punta dell'Omo).

[Rittmann (1931)] Mr. Cav. F. Curulli sent me the following written communication on October 26th: "[...] The volcanic column, rising over 300 meters in height, poured down, aided by the cool wind from the north, on the southeast-southeast side of the island, cutting it into two distinct sections: the main Sciara del Fuoco and down the southeast slope to the locality of Sciara Forgia Vecchia, leaving behind a trail through which vivid flashes persisted for about 40 minutes. Masses of exceptional size were observed high in the volcanic column; a few of them fell on the slopes of the Faraglione di Levante, which overlooks the village, and were seen burning until late at night. No casualties, but much panic among the population, already alarmed by the disaster of the eruption on September 11th.

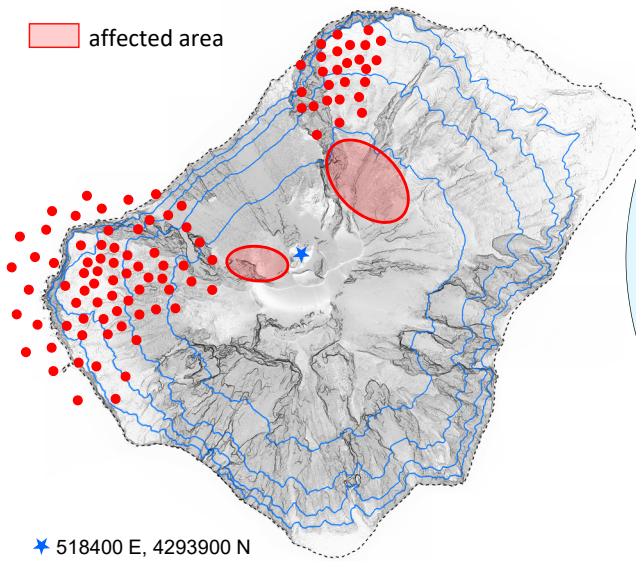
[Abbruzzese (1935)] A column of incandescent, contemporaneous material was seen rising for over 300 meters above the summit of the volcano. The igneous material fell into the Fossa and part of the SdF, where it remained hot for about 40 minutes. Rocks weighing several kilograms, projected to great heights, fell towards the slopes of the Faraglione di Levante, which overlooks the village.

Descriptive File 13.

Main sources	Year	Month	Day	GMT
Imbò (1928); Rittmann (1931); Abbruzzese (1936a)	1930	9	11	9:00

FIELD DATA AND OBSERVATIONS

- affected sites
- affected area



SIMPLIFIED MAP

- simplified map
- uncertainty

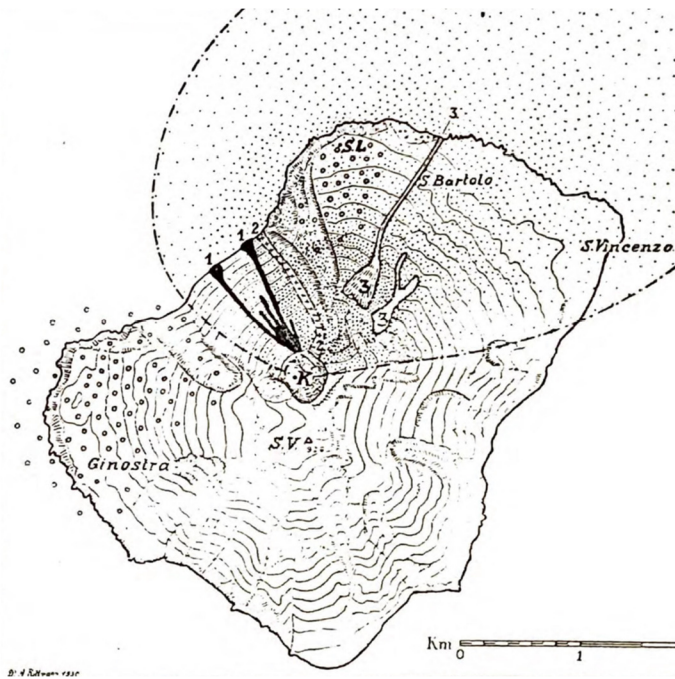
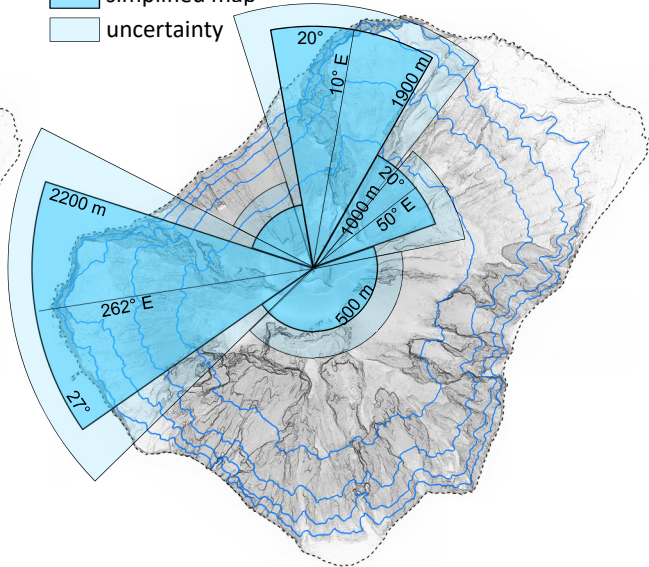


Figure.
Rittmann, (1931)

1. Lava flows on the Sciara del Fuoco.
2. Sliding channel, through which the collapsed mass of A fell into the sea.
3. Fiery avalanches that originated from the hot deposits.

Original historical document - excerpts about ballistics

[Rittmann (1931)] The first explosion hurled powerful rock blocks into the air with enormous force, which fell on Ginostra and the surrounding area like large-caliber projectiles, completely or partially destroying several houses and setting some on fire. Immediately afterward, the second explosion caused a shower of rocky debris that bombarded the coastal area east of the Sciara. The Labronzo Semaphore was hit directly, destroying the side facing the mountain. [...] The two explosions ejected only pre-existing rocky material, thus clearing the way for the advancing magma. [...] An intense eruption of ashes and scoria began. Incandescent and strongly swollen, the scoria rained on the northeast quadrant of the island, setting fire to vegetation on the higher slopes. [...] The upper northeast slope of Liscione is occupied by the Chiappe Lisce; wide slopes of ash and sand with an angle of inclination of 35°. They descend toward the valley in narrow erosive channels, the largest of which, the Vallonazzo di S. Bartolo, extends like a gorge down to the beach. [...] On the bare slopes of Chiappe Lisce, during the eruption, a layer of scoria and ash almost a meter thick formed, which lost its adhesion and began to slide.

[...] Regarding the distribution of the blocks, it is important to note that the fresh grey basalts ejected fell exclusively in the area of the Labronzo Semaphore. The blocks ejected toward Ginostra and its surroundings are composed of brown and reddish-brown weathered basalts. Significantly, this area also received projectiles made of heavily altered old volcanic scoria, some of which were coated with yellow and orange fumarolic deposits. [...] The first explosive phase of the eruption produced hundreds of blocks, some of which were of gigantic size. Upon impact, they shattered into pieces that were thrown in all directions up to 100 meters away. Where they landed on softer ground, they embedded themselves, leaving impact craters up to 4 meters deep and 12 meters wide, without causing damage to the surrounding area. It is therefore certain—and confirmed by eyewitness accounts—that the blocks fell in steep trajectories and did not roll down the mountain slope. Many were launched more than 2 km, reaching a peak height of at least 1,200 meters above sea level.

To illustrate the size and force of these projectiles, a few examples are given. A huge block of compact, slightly striated grey basalt fell about 30 meters southeast of the Labronzo Semaphore and shattered into more than 100 fragments, ranging in size from that of a fist to volumes of 2.5–3 cubic meters. I estimate the total volume to be over 10 cubic meters, corresponding to a weight of about 30 tons. Some fragments hit the upper part of the Semaphore building, completely destroying it. The main building closer to the sea was severely damaged by the impact. [...] Other fragments of the same block embedded deeply into the ground, carving a trench several meters deep and about 30 meters long, at the end of which one of the larger pieces came to a stop. There is no doubt regarding the coherence of the fragments, as not only are they petrographically identical, but they also show matching fractures, evidenced by the shape and consistent alignment of lighter striations. The effects of smaller blocks, which fell in large numbers near the Semaphore, also testify to the power of these falling masses. For instance, a block weighing about 150 kg created a crater 1.5 meters deep and nearly 4 meters wide on the path from S. Bartolo to the Semaphore. Several vineyards in the Labronzo area were devastated by countless craters and resemble a modern battlefield. Whatever wasn't destroyed by the rockfall was subsequently set on fire by later ejections of scoria.

Huge blocks also fell in the Ginostra area. Some of them surpassed in size the projectile that destroyed the Labronzo Semaphore. Near the Torre del Fuoco, north of Ginostra, a lava bank nearly a meter thick was cleanly cut by a medium-sized projectile. Another block shattered upon landing into shards that flew in flat trajectories and struck the walls of a house over 100 meters away from the impact site. Several homes were completely destroyed by direct hits. Some of the projectiles were so hot that they ignited the houses they struck. Aside from the numerous impact craters, however, there was no damage to crops on the western side of the island.

[...] Among the scoriae ejected in large quantities, several varieties can be distinguished: 1st Variety: Hollow scoriae similar to crusted bombs, rounded or ellipsoidal in shape, were found in large numbers between S. Bartolo and Labronzo, mostly covered by ash and scoriae of the second variety. Almost all were shattered on impact; the larger fragments showed flattening and folding, indicating they were still plastic when they fell. Their dimensions range from 20 to 60 cm in length and 15–40 cm in smaller diameter [...]. 2nd Variety: More widespread are pumice-like scoriae, lacking "bread-crust" surfaces and without a single central void. They are found in fragments up to 0.5 meters in diameter. Their shape is irregular, more or less isometric, often flattened from the impact. After cooling, they become so fragile that it's difficult to lift one without it breaking into pieces [...]. 3rd Variety: In the upper parts of Labronzo and the area of Filo della Sciara, large flat scoriae with a fibrous surface texture were abundantly deposited. This texture results from long, thin glassy filaments with tubular pores, sometimes forming tufts of Pele's hair. Their surface shows colors ranging from light olive to straw yellow, with a beautiful silky sheen. The interior consists of darker, finely porous pumice. These third-variety scoriae must have still been fluid upon impact, as they moved along steeper slopes and dripped from surrounding rocks. The large discs were 3.5–4 meters long and about 2 meters wide, but only 20 to 25 cm thick. [...] Bombs: Among the bombs, two types can be distinguished, connected by transitional forms. The moment of their ejection cannot be determined with certainty based on their deposition, as they are mostly found on the southern edge of the crater and in the upper part of Filo di Baraona, where no scoriae or ash fell. I was able to collect very rare bombs between S. Bartolo and the Labronzo Semaphore. Here, it seems they fell after the scoriae and ash. Their structure also suggests that they were ejected during the lava-feeding period, i.e., during the third eruptive phase.


[Imbò (1928)] The ancient lava ejecta [...] would appear to be evenly distributed from the summit to the base in both directions, Ginostra and Labronzo, are actually found only in the lower part. However, it seems that they poured uniformly between the two mentioned directions, and the blocks that fell at higher elevations disappeared beneath the layer of contemporary material (as is clearly visible for some blocks partially coated by lava crusts) that gradually thickens as one proceeds upward, forming from an altitude of about 400 meters "pseudo-lava flows" in the areas not shaded by Serra Vancora [...]. Under the bombardment of these large-caliber projectiles, several buildings in the Ginostra district on the southern side were seriously damaged, while on the northern side, the Labronzo Semaphore was hit - the side facing the crater was completely destroyed [...]. It is likely that as a result of this shelling, part of the edge of the Filo dello Zolfo ridge was demolished. [...] Over time, the explosion involving ancient material occurred first, followed by that with contemporary material.

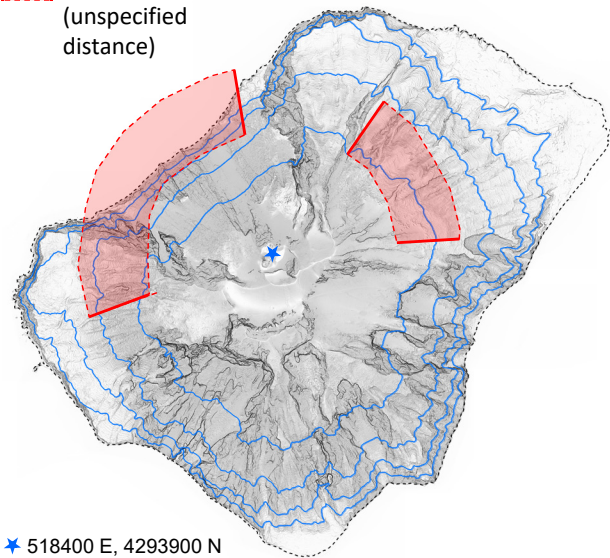
[Abbruzzese (1936)] At first, material from the crater structure was ejected, followed subsequently—predominantly—by contemporaneous pumice scoriae; in fact, near the Crater, the older material appears to be coated with contemporaneous scoriae. The explosion shattered all the craters in the Fossa area and tore apart part of the rim facing the Sciara del Fuoco. The blocks hurled by the explosion fell on the western and southwestern flanks of the volcano, striking the Labronzo Semaphore and bombarding the village of Ginostra, where almost all the rooftops were destroyed and many plants were burned. In the Terra del Fuoco area, I observed several boulders weighing several tons, deeply embedded in the sandy ground, which I still found warm. But what impressed me the most was a massive boulder that had landed on the Sciara del Fuoco, which I observed while crossing from Stromboli to Ginostra. Six days after the explosion, it was still so hot that one couldn't approach it due to the intense heat it radiated; the boulder was nearly cubic, measuring about 3 meters on each side. Another boulder landed just a few meters from the Labronzo Semaphore, and the shock from the impact caused the collapse of the west wall and part of the roof of the two small rooms; the flooring was also disrupted, and large cracks opened in the walls, rendering the building unstable and completely uninhabitable. The glowing-hot boulder embedded itself in the ground and was entirely covered by displaced material. The resulting depression was about 5 meters in diameter. Other extremely hot boulders were found in the vicinity. [...] The upper part of the volcano was covered in filamentous pumice, which must have been highly viscous, allowing it to spread easily over the terrain. [...] The material ejected during the explosions consisted of scoriae that were torn apart and sprayed in all directions like a fountain, often reaching heights greater than that of the Torrione (the Tower). [...] Most of the crater structure had been thrown onto the Sciara del Fuoco, where wide rings of contemporaneous pumice were visible—so numerous that they covered almost the entire upper portion of the slope.

Descriptive File 14.

Main sources	Year	Month	Day	GMT
Eredia (1924); Ponte (1924); Christa (1925)	1924	3	28	2:41



FIELD DATA AND OBSERVATIONS

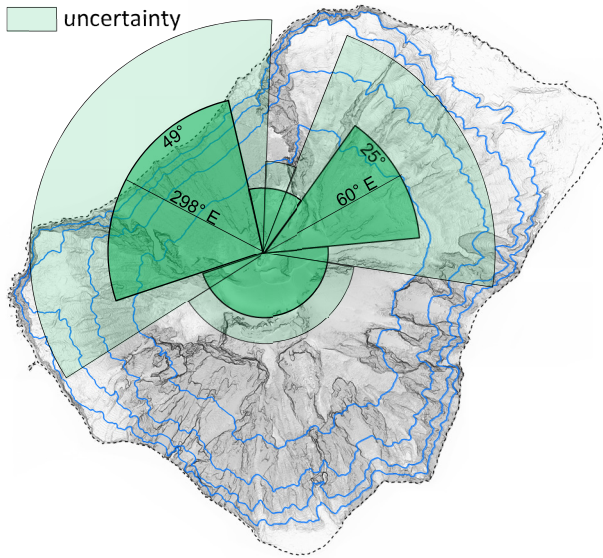
 affected sector
(unspecified distance)



★ 518400 E, 4293900 N

SIMPLIFIED MAP

 simplified map
 uncertainty



Original historical document - excerpts about ballistics

[Eredia (1924)] Eruption of abundant igneous material, and blocks of stone that fell across the countryside, a little above the town, and into the sea on the side of the Sciara. [...] Stones and slag fell abundantly into the sea on the side of the Sciara, while on the opposite side, incandescent boulders fell at various points, but outside the inhabited area. Some shattered upon impact, while others created enormous craters, one of which measures about 60 square meters.

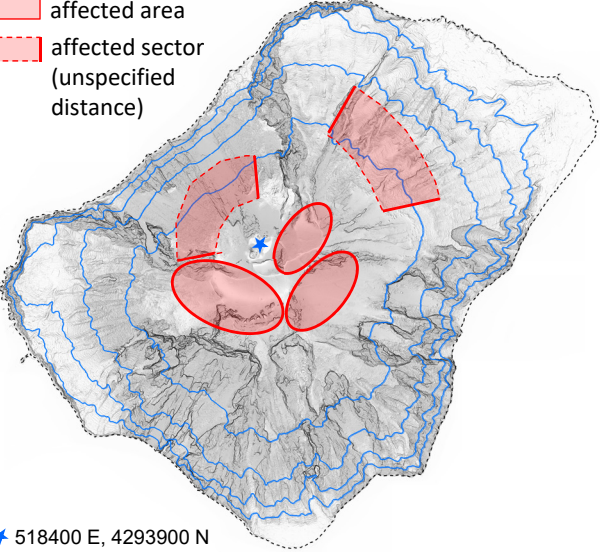
Descriptive File 15.

Main sources	Year	Month	Day	GMT	
Malladra (1922)	1921	6	27	18:45	

FIELD DATA AND OBSERVATIONS

affected area

affected sector
(unspecified distance)

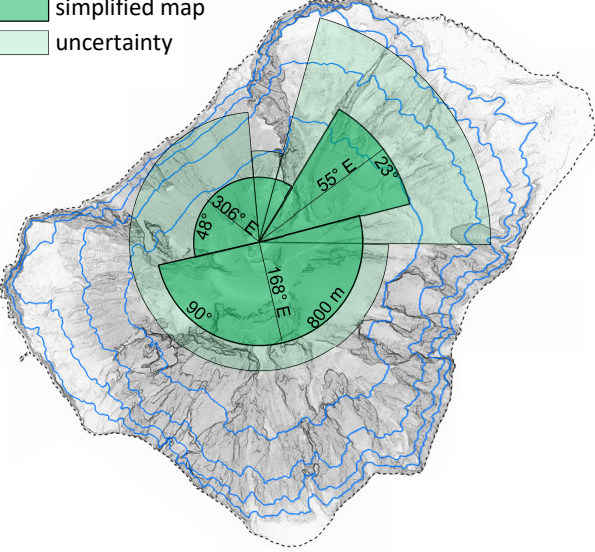


★ 518400 E, 4293900 N

SIMPLIFIED MAP

simplified map

uncertainty



Original historical document - excerpts about ballistics

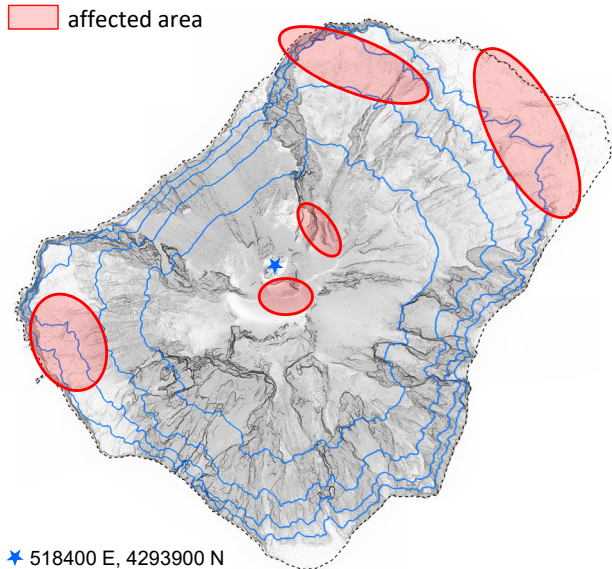
[Malladra (1922)] These two detonations were accompanied by the launch of enormous and impressive quantities of incandescent material, consisting of very large blocks of old lava torn from the volcanic conduit and thousands of large slag from coeval material, which were projected 600 meters or more above the crater; at the same time, columns of smoke in great plumes were vomited from the various mouths of the crater, which, spilling into the town, made the air almost unbreathable due to the large amount of sulfurous gases. [...] The crash caused by all this material falling from above onto the Sciara del Fuoco and on the cultivated slopes above S. Bartolo and S. Vincenzo was terrifying and beyond all imagination; several fires were triggered by the incandescent slag falling into the reed beds that serve as boundaries for private properties. The dust resulting from the fall of these thousands of projectiles, mixed with the fumes of the explosions, caused, with the onset of night, such thick darkness that lanterns could barely penetrate it for a few decimeters; leading to an indescribable terror among the horrified population, who fled their homes with no hope of returning. [...] Beneath the tip of S. Vincenzo, isolated slags began to appear, some of which had volumes ranging from half to a cubic meter; but they proved to be extraordinarily light in comparison to their volume, due to the significant amounts of large cavities, crossed by thin laminations and stretching threads. [...] As one ascends, the slag appears more numerous and forms increasingly larger patches, until, upon reaching the Crigna, they constitute a general and compact covering of the entire summit, with thicknesses varying from a few decimeters to over a meter, as can be seen in fractured zones. [...] The steep slope of the Crigna now appeared like the scaled and armored back of a gigantic saurian. The slag mass, extremely fragile, crumbled under our steps, producing a characteristic crunching sound, as if walking on a layer of eggshells. Also, the Fossetta, from the Portella delle Croci to the Timpa di Baraona, as well as the slopes to the NW between the Torrione and the Filo di Baraona, were similarly armored, with the difference that in these areas the deposit was much thicker and so fragile that at times we would sink up to the knee. While previously it took only a few minutes to descend into the Fossetta from the highest ridge of the crater, this time we needed more than half an hour. The same applied to the Rina Grande, which for at least 400 meters in length below the Portella, was so clogged with large slag material that it took more than two hours to cross, whereas previously, one could reach the first areas of greenery below in just 10-15 minutes of running on the fine sand.

[...] But what was most curious and interesting were the precipitous walls of the Serra di Vancora, covered with abundant slag material everywhere a protrusion, a less steep slope, or a horizontal section could have provided support. Just like after a heavy snowfall, long cornices and snow-packed capitals appear on the mountain walls wherever they can find a foothold, with profusions of jagged fringes, hanging veils, and stalactites, so did the enormous amount of slag that had fallen on the walls of the Serra; the only difference was the color, from brown to black, dark gray, or greenish [...]. The material, therefore, erupted during the June paroxysm, was mostly coeval; if there was a significant amount of old material at the beginning, it was buried by the subsequent Strombolian products. In fact, very little of it was seen, in the form of rare blocks that peeped here and there among the slag. Almost in the middle of the Fossetta, there lay two enormous blocks, one about 15, the other about 20 cubic meters, about two meters apart, whose front surfaces were so aligned that it was clear they were part of the same block, split during the fall. The upper part was covered with a few slag layers. This block, based on its position, I assumed to belong to the paroxysm in question, testified by the extraordinary violence of the explosions. At first, I doubted that all this grand accumulation of slag, which in several places of the Fossetta and Rina Grande appeared as pseudo-lavas, was the product of the previous paroxysm of May 1919; but Cav. Perret, who visited the summit of the mountain twice after that eruption, informed me that although large slag sheets had indeed fallen in quantity in the Fossetta, the walls of the Serra did not present the appearance I described, and the Rina Grande remained sandy as before. My guide had been away for a few months and did not expect to find such terrain, and she was horrified and distressed by her rope sandals, which were rapidly tearing.

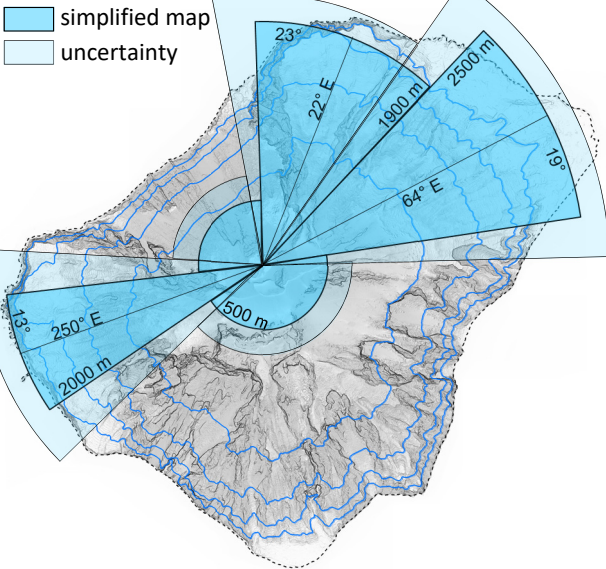
Descriptive File 16.

Main sources	Year	Month	Day	GMT
Ponte (1919); Ranfaldi (1921); Platania (1922); Ponte (1924)	1919	5	22	16.47

FIELD DATA AND OBSERVATIONS



SIMPLIFIED MAP



Original historical document - excerpts about ballistics

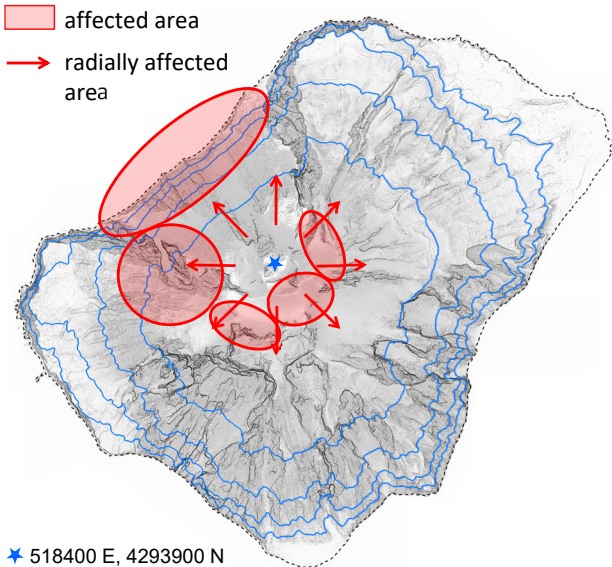
[Ponte (1919)] There were masses of pasty lava, weighing several quintals, launched with high trajectories up to three kilometers from the craters. The house of Antonio Famulari, in the village of San Vincenzo, was reduced to rubble by a lava mass weighing about 10 tons. Many bombs fell on the island, causing ruins and fires. Fortunately, the large rocks fell spread out over a large area, sparing greater casualties and damage. Around twenty houses were demolished or collapsed in all the inhabited districts of Stromboli; there were four fatalities among the population and several injuries, mostly caused by the airshock, which broke closed doors and windows. [...] The bombs that fell remained hot for several days; the one that fell on Famulari's house, which was broken with a hammer in the search for a soldier trapped among the rubble, was still hot and pasty inside after two hours, so much so that an iron pole could easily be sunk into it. Near the Fossetta, close to Portella delle Croci, about 400 meters from the craters, a large rock arrived and, upon falling, broke into three blocks, one of about 40 cubic meters. [...] On the crigna (ridge) of Stromboli, a rock of such size fell that it deformed the crest on the northern side, producing cracks. [...] The most abundant material that fell consisted of scoriae, externally filamentous, gray-blond in color, and internally very vesicular, steel-gray in color. [...] On the Crigna della Fossa and Fossetta, a deposit of scoriae, 2 to 3 meters thick, was formed. Strong winds carried the smaller scoriae to the Sicilian coast, and many remained floating on the sea for several days, especially on the SW side of Stromboli, while the heavier material, unaffected by the wind, fell on all sides of the volcano. Many islanders agree in stating that at first, an enormous dark cloud rose from the crater, accompanied by reddish flashes, and after about 10 seconds, the explosion was heard; the rocks fell on the village a little later, almost all at the same time.

[Platania (1922)] An abundant eruption of large lava blocks of exceptional size, ranging from 30 to 60 tons, was launched to considerable heights, which affected the entire village of the island. A subsequent eruption of larger igneous material, scoriae, stones, and large lapilli caused fires on the slopes of the mountain in several places, while the eruption of large incandescent blocks led to the destruction of eight houses and the severe damage of another ten in the village of Stromboli, and the destruction of two more in the Ginostra district. [...] Severe damage in the surrounding fields, which burned in several places all night. Unlike previous eruptions that only caused material damage, this eruption unfortunately resulted in 3 deaths and 20 injuries, caused by being struck or buried by massive lava rocks, others burned more or less severely, some from broken doors or glass, and from collapsed houses. The destructive fury lasted about 2 minutes. [...] I went to the area of Punta Labronzo, about 200 meters from the Sciarra del Fuoco, and confirmed that a large amount of different material had been ejected, large boulders semi-buried, big scoriae, and stones. [...] The erupted material [...] consists of three types: (i) Large blocks of several tons that fell in the village and also in the sea. These are solid stone, gray or rust-yellow in color, very heavy and compact. This type of material caused the destruction of houses. When incandescent, it was a filamentous paste, not very sensitive to water, and remained in a fiery state for three days. (ii) Smaller blocks (five or six tons), heavy but less so than the first type, iron-gray in color. When incandescent, it was pasty and filamentous. (iii) Large and small scoriae, very light, spongy, and friable, black in color. This material caused fires on the slopes of the mountain, and only a small amount reached the village, which was affected only by the large lava boulders mentioned above.

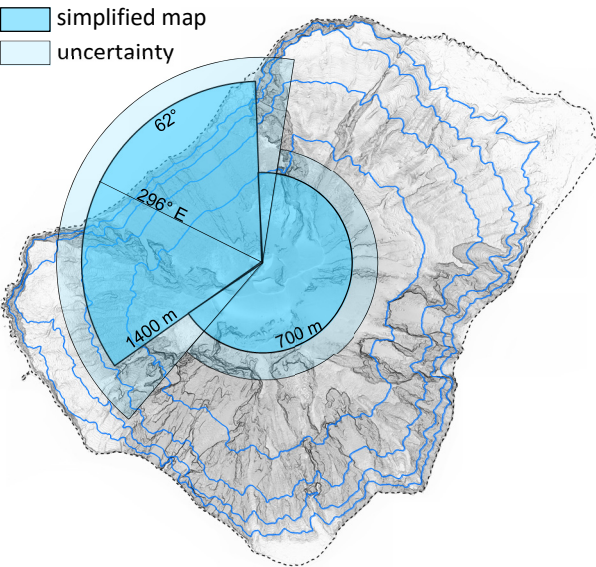
Descriptive File 17.

Main sources	Year	Month	Day	GMT
Ponte (1921); De Fiore (1923)	1916	7	4	19:30

FIELD DATA AND OBSERVATIONS



SIMPLIFIED MAP



Original historical document - excerpts about ballistics

[Ponte (1921)] I report the exact description made by the Labronzo station: 'At midnight, a terrible explosion occurred with the launch of abundant incandescent fragments of various sizes up to 1000 meters high. A grandiose fireball rose from the mountain, while through the dense smoke an enormous fountain of fire was seen, the hot material falling on the slopes of the mountain up to a quarter of its height, making it look like an immense blazing furnace. After about 7 minutes, a very dense rain of ash and scoria lapilli, the size of chickpeas, arrived at the station. The great fire rain lasted about 15 minutes, but the mountain remained glowing for about half an hour. [...] At dawn, we noticed that the crater's edge on the Sciara side had noticeably lowered, allowing us to see the entire Torrione from the station. [...] On the NE side of the island, the rain of lapilli and ash was very abundant, reaching the coast and covering the roofs of the houses in S. Vincenzo, Ficaranni, S. Bartolo, and Piscit . On the roofs of some houses, I collected some scoria as big as a fist, but filamentous and very light; some were fibrous with a greenish color and silky shine, others steel-gray and shiny. [...] The hot scoria fell as far as the cultivated areas, igniting dry grass; some got stuck in the branches of broom, which were then charred. On the morning of July 4th, the sea, especially near the Sciara del Fuoco, was covered with tiny floating scoria, giving the water a curious green-yellowish color.

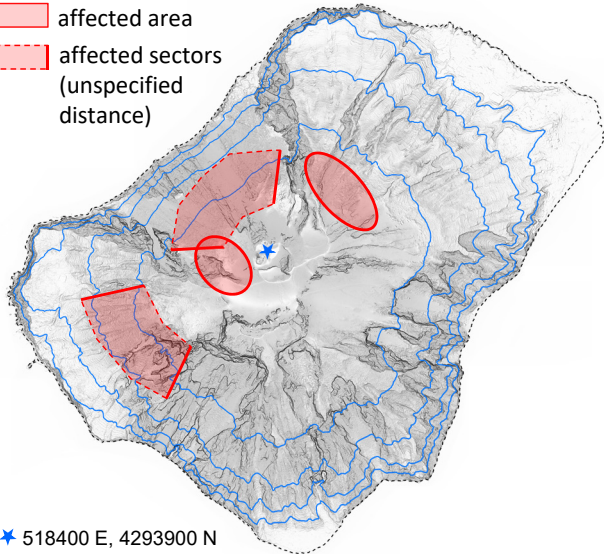
[...] At Portella delle Croci, I found a block of about 4 m³, weighing approximately 11 tons, which, launched during the explosion, followed such a trajectory that it surpassed the height of the Fossa crest (200 m above the crater) and fell 400 m from the explosion center. The block created a depression in the ground, 1.5 m deep, 4 m wide, and bounced with a 10 m leap. Another block of about the same size fell on the Cresta dello Stromboli, tearing it apart as if it had been struck by a large projectile. On the Cresta della Fossa, about 200 m above the crater, another block of around 8 m³ was found half-buried in the ground. These large compact rock blocks probably belong to the lava banks that formed the roof of the eruption conduit. Considering that the 8 m³ block had to be launched at least 250 m high to fall on the Cresta della Fossa, one can imagine the enormous violence of the explosion. Bombs the size of a human head reached the sea directly, and some fell on the Sciara del Fuoco beach. One of these bombs landed on the beach, sinking slightly into the ground and cracking apart, assuming the shape of a priest's hat. To get an idea of the quantity of solid and fluid material projected after the first formidable explosion, one only had to look at the Fossetta, which in some areas was completely covered with chaotic masses cemented by a large amount of filamentous lava, which must have been ejected in a very fluid paste state. These lava projections reached the summit of the Vancora, about 200 m above the crater and 550 m away from it. The Portella di Ginostra, the Serra di Ponente, the Fossetta, the Sciara del Torrione, and the Timpa were completely covered by these scoria, which resembled bovine excrement. In some areas, they fell so abundantly and fluidly that they flowed down the slopes like lava flows. The material left by the explosion on the night of July 3rd in some areas, especially on the southwestern side of the crater, covered an area of about 500 m radius. An approximate calculation suggests that during the few minutes of the fire rain, at least 200,000 cubic meters of lava material mixed with blocks from the old crater structure were ejected. About half of this enormous material fell on the Sciara del Fuoco and rolled down to the sea. On the Sciara del Fuoco beach, the remains of the huge mass of ejected material can still be seen, now partly eroded by the sea.

Descriptive File 18.

Main sources	Year	Month	Day	GMT
Perret (1916); Platania (1916); Riccò (1916); Ponte (1916); De Fiore (1923)	1915	11	13	8:15

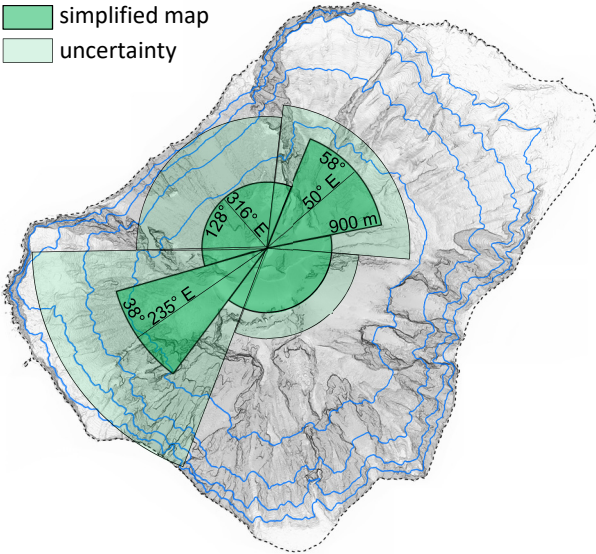
FIELD DATA AND OBSERVATIONS

- affected area
- affected sectors (unspecified distance)



SIMPLIFIED MAP

- simplified map
- uncertainty



Original historical document - excerpts about ballistics

[Perret (1916)] A shower of large but light-weight scoriae fell at San Vincenzo in from five to six minutes after the explosion. In ascending the mountain directly afterwards, the detritus was found in masses of constantly increasing density as the crater was approached. On the slopes of the cone were splashes of fresh lava which had fallen in an incandescent state and set fire to dry grass and straw, a woman working in the vineyards being slightly burned in this way. There was also ejected a large quantity of gray, vesicular lava in small fragments with edges rounded as by attrition, and large blocks half buried by their fall, still too hot to be touched. Many of these were coated with fresh lava which had been drawn by the movement into a filiform condition. Finally, there were large conglomerate boulders, consisting mainly of old altered lava masses cemented together by fresh lava.

[Platania (1916)] On the summit of the mountain, a huge pine tree was seen rising, followed shortly by a second, more pointed, dark plume, and then a third jet further down towards the Sciara. After about 5 minutes, a heavy shower of lapilli and scoriae began to fall on the town. [...] As we made our way to examine the craters up close, we quickly began to find cakes of dark or yellowish scoriae that had incinerated the bushes they fell on, and projectiles made from older, more or less heavy material that had dug wide holes in the ground and were still scorching hot, and very light bombs swollen with glassy material, and fragments of scoriae that, still soft when they fell, conformed to the irregularities of the terrain. [...] Upon reaching our usual observation point, beyond the Faraglione di Ponente, we found that the large explosion had also thrown a great number of consolidated blocks and not a few fragments of lava in that direction. Some of the blocks were partly covered with a scoriaceous coating, now light and filamentous, now dark in color; others were made of scoriaceous fragments more or less reddened, cemented together by veins of new dark scoriaceous lava; others had almost completely shed their lava covering, which lay around their base. All had dug more or less deep holes, and all were still scorching hot. [...] A particularly remarkable filmy scoria was made up of a mass of fragile intertwined threads, which, when it fell to the ground while still fluid, flattened out, taking the shape of the terrain and spreading over an area of more than forty decimeters squared, reducing to an average thickness of just 2-3 centimeters.

[De Fiore (1923)] Three enormous pine trees rose in quick succession, shooting into the sky, and from them fell a hailstorm of projectiles and scoriae. The pines were dark gray. Roaring blocks fell on the vegetated region, setting fire to grasses and vines. In the village, 5 minutes after the explosion, a hailstorm of light, bubbly, glassy scoriae fell. On the upper part of the mountain, numerous angular blocks of crystalline compact lava fell, which were still hot on the 14th. In some cases, they were covered with glassy, filamentous scoria.

[Riccò (1917)] From the eruptive system, first one, then three columns of dark gray materials rose, and after 5 or 6 minutes, a hailstorm of vesicular glassy scoriae began to fall in the town, which lasted several minutes. [...] They (Platania and Perret, ndr) then ascended the semaphore path to Punta Labronzo (i.e., towards the northwest) to be in sight of the eruptive system. At 500 meters in altitude, masses of roving lava were already visible, which had burned grass and vines. Higher up, they encountered a large quantity of crystalline, very bubbly lava, recently fallen, generally with smoothed edges from friction. And all over the upper part of the volcano, there were many angular blocks of ancient lava torn from the interior of the volcano, which were still hot on the 14th, so much so that they could not be touched with the hands. Some were partly covered with new glassy lava, stretched into beautiful filaments.

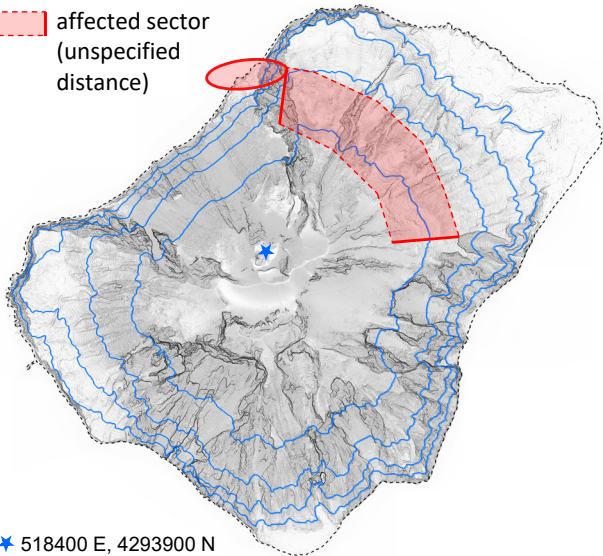
[Ponte (1916)] (From December 24 to 31, 1915) [...] With the facilities provided and with the guidance of Bartolo Tizio, an excellent guide of Stromboli, I was able to make many successful observations during a week's stay on the volcano under rather favorable weather conditions [...] Among the materials ejected during the violent explosions of November 13 and December 10, there are some around the craters, especially on the southwest side, consisting of old volcanic rocks covered with filamentous scoriae of yellowish-gray color, which I wanted to name "bombs with coiffures" because the scoriae covering them, entirely or partly, have the appearance of disheveled hair. To the west of the Torrione, more than 300 meters from the craters, there is a boulder ejected during the recent paroxysm, with a volume of about one cubic meter, demonstrating the extraordinary violence of the explosions.

Descriptive File 19.

Main sources	Year	Month	Day	GMT
Riccò (1907a)	1906	7	16	16:50

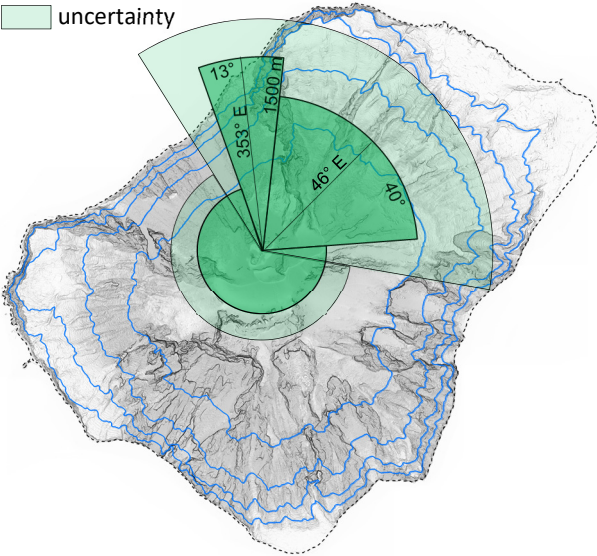
FIELD DATA AND OBSERVATIONS

- affected sites
- affected sector (unspecified distance)



SIMPLIFIED MAP

- simplified map
- uncertainty



Original historical document - excerpts about ballistics

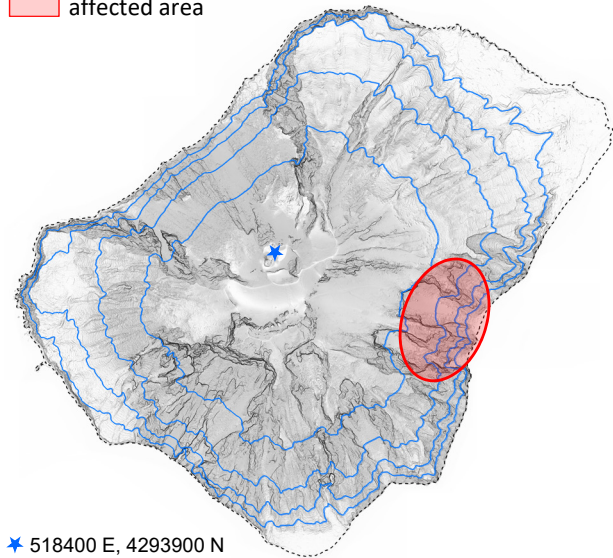
[Riccò (1907a)] A large quantity of stones and lava flows fell down the northeastern slope, setting fire to the first vineyards, which are 300 meters from the eruptive system! Abundant ash darkened the sun for the entire day. [...] In this paroxysm, a block weighing one ton was thrown 1.5 km north-northwest of the eruptive system, remaining almost buried in the ground.

Descriptive File 20.

Main sources	Year	Month	Day	GMT
Riccò (1907a)	1906	7	15	19:35

FIELD DATA AND OBSERVATIONS

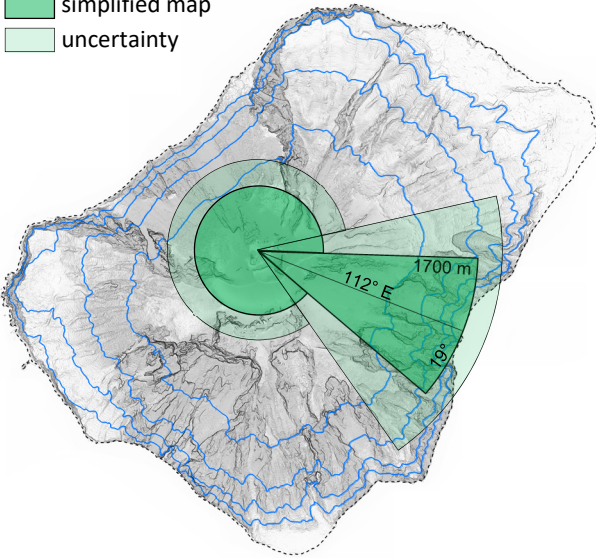
affected area



★ 518400 E, 4293900 N

SIMPLIFIED MAP

simplified map
 uncertainty

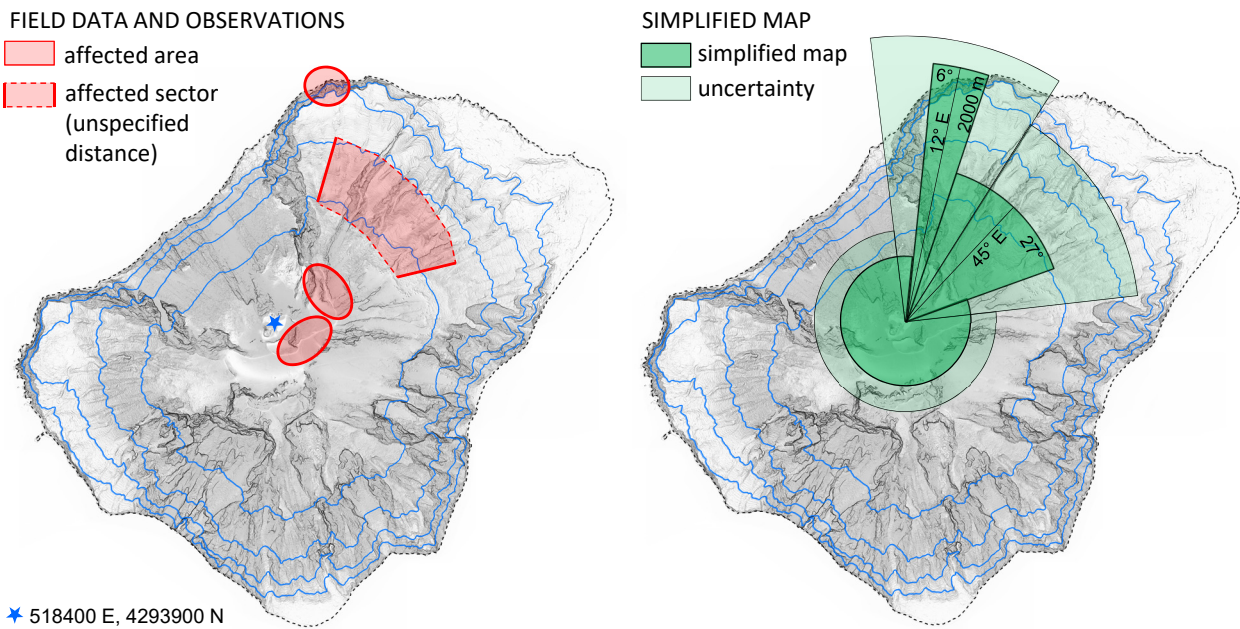


Original historical document - excerpts about ballistics

[Riccò (1907a)] A very strong eruption of a large amount of incandescent material that struck the Forgia Vecchia area on the southeast slope of the island, setting fire to the underbrush and reaching the sea. A column of fiery material poured in the direction of the village of Ginostra, west-southwest of the eruptive system.

Descriptive File 21.

Main sources	Year	Month	Day	GMT
Riccò & Mercalli (1892)	1891	6	24	11:45



Original historical document - excerpts about ballistics

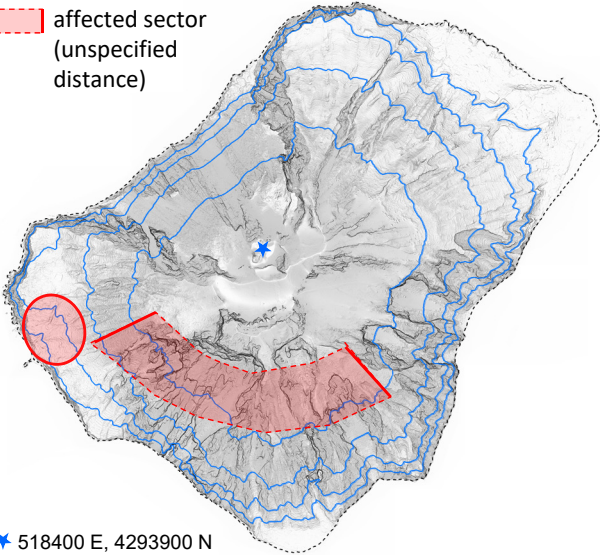
[Riccò & Mercalli (1892)] Two powerful columns of smoke and fiery materials rose from the crater, so high that they significantly surpassed the highest peak of the island. From the town of San Vincenzo, where Mr. Renda was observing the phenomenon, the boulders being ejected appeared to be of considerable size despite being about two and a half kilometers away. For some time, after these eruptions, the mountain appeared covered with fiery materials. Some large slag pieces reached the cultivated part of the island, towards the north, and burned some grass and fig plants. [...] A small amount of lapilli, formed by pieces of lava a few centimeters thick, reached as far as about one and a half kilometers from the craters. The staff at the Semaphore attest to having seen a rather large projectile thrown into the sea, passing near their building. [...] In the higher parts of the island, a large quantity of very light pumice stones fell, although they only reached a short distance from the active crater. [...] Climbing up the northeastern side [...] between 750 and 800 meters in height, we began to find scattered on the ground, though not very frequently, materials from the recent eruption, namely slag and projectiles clearly launched by the latest explosions. When we reached the northern summit of the island (918 meters according to the General Staff map), we found the ground completely covered with a layer of lapilli and slag from the recent explosions. [...] Near the Filo del Fuoco, between 750 and 800 meters in height, we found scattered here and there various isolated pieces of small and large dark slag, [...] ejected by the last strong explosions. [...] Of great interest is a larger slag piece, shaped like a focaccia, 4 to 5 decimeters in diameter and 3 to 4 cm thick; [...] Stromboli, during its strong explosions on June 24 and 30 (a major explosion, editor's note), also threw out a good number of projectiles formed by shapeless pieces of ancient basaltic lava, more or less deeply altered [...] Near the Filo del Fuoco, at about 800 meters altitude, we found several of these projectiles covered externally and within their porosities by a reddish material mixed with very hygroscopic and deliquescent salts [...]. The rock of the projectile itself is deeply decomposed, so much so that it crumbles easily in the hands.

Descriptive File 22.

Main sources	Year	Month	Day	GMT
De Rossi (1882); Mercalli (1884); Riccò & Mercalli (1892)	1882	11	18	5:45

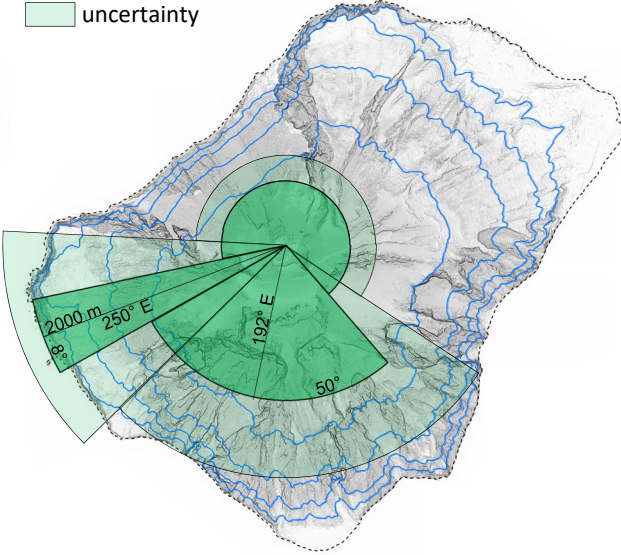
FIELD DATA AND OBSERVATIONS

- affected area
- affected sector (unspecified distance)



SIMPLIFIED MAP

- simplified map
- uncertainty



★ 518400 E, 4293900 N

Original historical document - excerpts about ballistics


[De Rossi (1882)] A loud cannon-like explosion was heard, it was Stromboli, which at that moment was sending a considerable amount of incandescent lava from the south-east side, which is uncultivated and uninhabited. [...] From the so-called Sciara del Fuoco, the eruption opened halfway, with two other lateral craters, and it sent out incandescent materials. [...] An infinite number of incandescent stones were being thrown up from the summit of the mountain to a height I cannot measure. [...] The incandescent stones, upon falling, declined towards the south; and one of them, a very large one, weighing more than 50 quintals, fell on Ginostra, about two kilometers from the crater mouth.

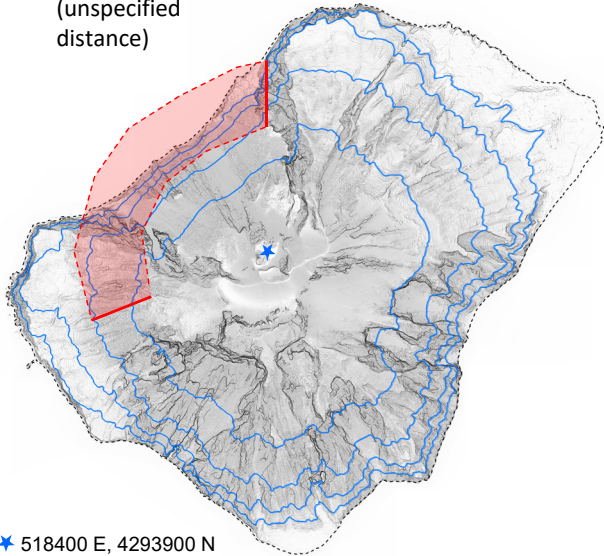
[Mercalli (1884)] The mountain was seen illuminated, and an infinite number of burning stones rose up from it to considerable heights [...] On the north-western side of Stromboli, about 100 meters below the normally active crater, five craters opened, which erupted stones and debris [...] The erupted stones rolled down the southern side of the mountain, and one, weighing several tons, fell on the village of Ginostra. [...] The entire southern side of the mountain was covered with slag and erupted stones: no flowing lava was observed.

Descriptive File 23.

Main sources	Year	Month	Day	GMT
De Rossi (1882); Mercalli (1884); Riccò & Mercalli (1892)	1882	3	13	3:00



FIELD DATA AND OBSERVATIONS

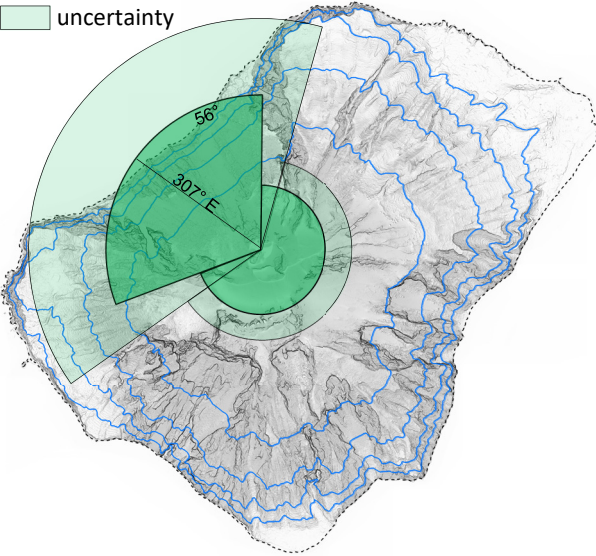
 affected sector
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distance)



★ 518400 E, 4293900 N

SIMPLIFIED MAP

 simplified map
 uncertainty




Original historical document - excerpts about ballistics

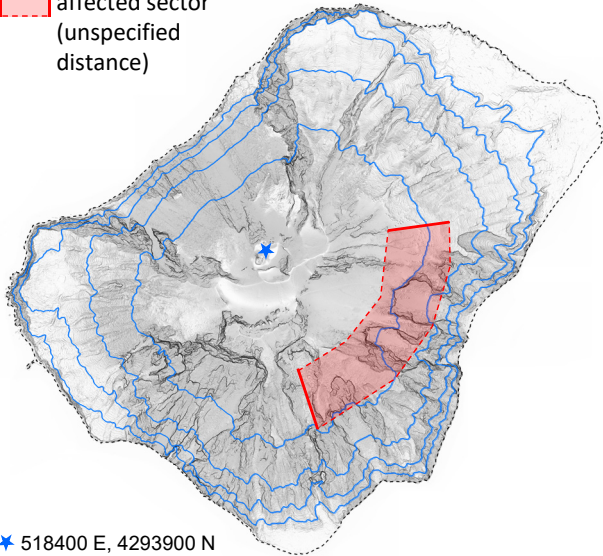
[De Rossi (1882)] Stromboli had a significant eruption, sending a good amount of burnt, dark-colored stones down the north-western slope. So much so that the inhabitants of the village of Ginostra, feeling their beds roll and fire raining down on their roofs, fled in groups, and some ran to the little church to sound the alarm, pleading with the parish priest to provide help, as they felt threatened by the fire.

Descriptive File 24.

Main sources	Year	Month	Day	GMT
Mercalli (1879; 1881); De Rossi (1880); Riccò & Mercalli (1892)	1879	6	8	1:00



FIELD DATA AND OBSERVATIONS

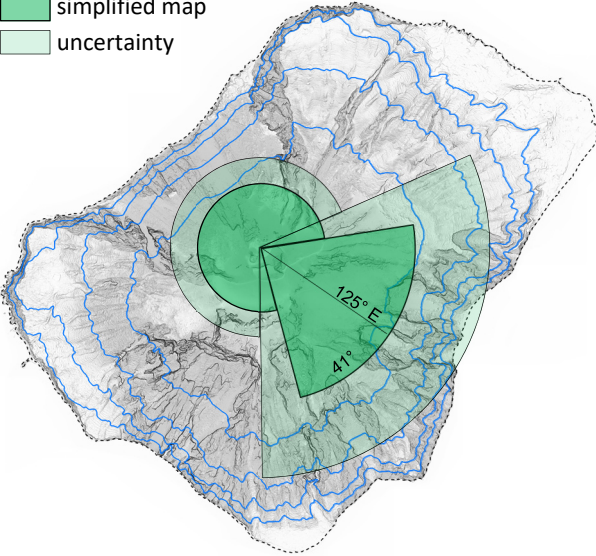
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★ 518400 E, 4293900 N

SIMPLIFIED MAP

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 uncertainty



Original historical document - excerpts about ballistics

[Mercalli (1879); Mercalli (1881) idem] Stromboli [...] erupted incandescent stones on the eastern slope, fortunately uncultivated: but all the rare plants and scattered woods on that side were burned, so much so that the locals initially believed new craters had opened and were frightened by it.

Table 1. List of the 16 paroxysms for which there was insufficient information to map ballistics.

Main sources	Year	Month	Day	GMT	Location affected by large ballistics	Main directions of ballistics	Original historical document - excerpt about ballistics
<i>Mercalli (1879; 1881)</i>	1879	2	5	09:00	-	-	[Mercalli (1879); Mercalli (1881) idem] A heavy rain of pumice stones poured into the sea, and in such quantity that it is reported that 'the sea was so full that it appeared to the eye as an extended and flat land.
<i>Mercalli (1884); Riccò & Mercalli (1892)</i>	1883	3	16	10:00	-	-	[Mercalli (1884)] At Stromboli, a loud rumble is heard, and later the sea is found to be covered with pumice.
<i>Mercalli (1888); Riccò & Mercalli (1892)</i>	1887	1	31	06:00	-	West? (plus 1 to the East)	[Mercalli (1888)] Stromboli [...] threw boulders of enormous size towards the West (only one from the eastern side).
<i>Mercalli (1888); Riccò & Mercalli (1892)</i>	1887	3	31	20:00	-	East? (seen from 20 km far, by a ship from Calabria)	[Mercalli (1888)] The burning boulders were thrown to an enormous height, because, after the explosion ended and most of the smoke had dispersed, several were still seen falling from above like shooting stars. And the sailors of a boat coming from Calabria, being 20 kilometers away, noticed the eruption, having seen the sides of Stromboli illuminated by a large number of incandescent points [...] They are mostly slag, generally dark-colored, with some being brick-red, very light and porous, and often fibrous like true pumice.
<i>Mercalli (1888); Riccò & Mercalli (1892); Platania (1910)</i>	1887	11	18	??:??	-	-	[Platania (1910)] There was a violent explosive eruption that covered the sea with pumice slag.
<i>Riccò & Mercalli (1892)</i>	1891	8	31	06:48	vineyards closest to the craters	North? (vineyards burnt)	[Riccò & Mercalli (1892)] With the explosion, Stromboli threw into the air a dense column of eruptive smoke, mixed with sand, ash, and accompanied by fragments of burning lava, bombs, and other projectiles of varying sizes, which were scattered over relatively considerable distances, causing some small fires at the farthest limits of the cultivated region and producing some insignificant damage to the vineyards closest to the crater. Shortly after the explosion, almost throughout the entire circuit of Stromboli, there was a thick rain of very fine sand, dark red in color, which in some areas reached a thickness of several centimeters.
<i>Platania (1906; 1910); Riccò (1907a)</i>	1907	4	13	20:50	-	-	[Platania (1906); Platania (1910) idem] A loud rumble, violently shaking the air, shattered the windows of many houses, while a great deal of incandescent material was ejected from the craters.
<i>Platania (1906; 1910); Riccò (1907a); Perret (1913)</i>	1907	4	27	08:40	vineyards burnt, large pumices fell into the sea	North? (blocks roll down and hit the vineyards)	[Riccò (1907)] Boulders ejected by the volcano rolled down the slopes, devastating and setting fire to the nearby vineyards; the rain of ash and lapilli lasted throughout the day, varying in intensity. [Platania (1906); Platania (1910) idem] A sharp, terrible blast shattered the remaining windows and even shook the shutters, while the crater emitted an enormous amount of fragmentary material, which set fire to the vegetation on the higher part, where the more vesicular fragments, which fell in the lower part, took much longer to descend, both due to their lightness and their longer trajectory, arriving at a lower temperature. [Perret (1913)] The lava was thrown out in large masses so hot as to retain its plasticity and be conformed to the surface upon which the mass fell [...]. The eruption lasted several weeks and produced a true crater 200 meters in diameter, and the eruption mouths, with no exception, were sunk to the bottom of this abyss.
<i>Perret (1913); De Fiore (1915)</i>	1912	7	27	??:??	large block 2m diameter ejected 500 m from the crater, great blocks roll in Rina Grande	East? (blocks roll down in Rina Grande)	[Perret (1913)] Lava was ejected in solidified form [...] in irregular blocks of all sizes up to two meters in diameter. One of these [...] fell 500 m distant from the crater. The rock was compact basaltic lava containing a considerable proportion of olivine. Besides this rock the chief product of this eruption was the enormous quantity (for Stromboli) of ash. This reached a depth of over 2 meters on the upper parts of the mountain [...] In addition to the solid blocks and the ash, a very large quantity of porous, vitreous scoriae or lapilli were ejected. [...] In falling, they were still plastic to the extent of conforming to the forked branches of the Genesta [Genistae] plants and even to be impaled upon the spines. [De Fiore (1915)] The rain of lapilli on the island and in the surrounding sea was continuous and persistent, while the ashes fell as far as Calabria and Sicily. The incandescent material, consisting of large blocks, often rolled over the Arena Grande on the side of the mountain opposite the crater, damaging and setting fire to the nearby vineyards and crops. During the strongest explosions, the summit of the island was literally covered by a mantle of burning scoriae. [...] Large blocks, some of them truly colossal and thrown over considerable distances, consisted of altered and non-altered compact lava.

<i>Perret (1916); Riccò (1917); De Fiore (1923)</i>	1915	11	26	06:12	-	-	<p>[Perret (1916)] The products of this second explosion were more compact than those of the first - fresh lava masses of a beautiful steel gray luster, and conglomerate boulders of great general density and up to a cubic meter in size.</p> <p>[Riccò (1917)] Perret was able to confirm that the explosion of the 26th had thrown blocks weighing more than a ton, made of a conglomerate of blocks cemented by new lava, and possibly also free crystals of pyroxene; as well as new vesicular lava, but denser than the light scoria of November 13, and of a beautiful gray color.</p>
<i>Abbruzzese (1935); Imbò (1935)</i>	1931	4	23	20:47	summit of the volcano and Sciara del Fuoco	West?	<p>[Abbruzzese (1935)] A large dark pine was seen rising, tilted towards the northeast, and abundant volcanic material poured down on the upper part of the island, especially on the SdF. Immediately after, at 21h 55m, there was a rain of ash and sand that reached the village and lasted about ten minutes. The entire eruptive apparatus remained brightly illuminated for about ten minutes. The air displacement caused by the explosion broke several windows and opened some doors.</p> <p>[Imbò (1935)] Many scoriae projected during the paroxysm accumulated in the central part of the terrace, forming a dome-shaped pile. Overall, after the paroxysm, the average level of the terrace had risen by about 30 meters compared to the level determined by Rittmann in the previous September.</p>
<i>Abbruzzese (1940)</i>	1937	1	21	12:22	large blocks fell on the summit	-	<p>[Abbruzzese (1940)] A dense pine rose to a considerable height, and significant boulders fell on the upper part of the volcano. A notable amount of lapilli and abundant ash fell on the town, covering the roofs of houses. There was a lot of panic among the population, but no harm came to the people. Numerous windows were broken due to the air displacement caused by the explosion, and pieces of plaster detached from some houses.</p>
<i>Abbruzzese (1938); Abbruzzese (1940)</i>	1937	12	14	06:55	large blocks fell on the summit	-	<p>[Abbruzzese (1938)] A large amount of hot material was projected onto the upper slopes of the volcano. The island's population poured outdoors in a state of panic, especially because abundant lapilli and volcanic sand fell onto the town of San Vincenzo.</p> <p>[Abbruzzese (1940)] A tremendous explosion, followed by another of lesser intensity, shook part of the crater structure, launching significant boulders and hot debris to considerable heights, which rolled down the mountain's slopes, while a dark pine tree, with large coils of smoke, rose rapidly to about 600 meters above the crater. The air displacement caused by the powerful explosion forced many doors and windows open; several windows shattered. The island's population, struck by great panic, flooded the streets, shouting and crying, fearing the repetition of the 1930 disaster. Fortunately, the projected material spread only over the upper part of the volcano, while the town experienced a heavy rain of ash for about 30 minutes, which covered the roofs of houses by several centimeters.</p>
<i>Abbruzzese (1940)</i>	1938	5	22	16:45	spatter bombs on the summit	-	<p>[Abbruzzese (1940)] Another massive pine, with large coils of smoke, rose densely for about 600 meters above the crater. Clastic material poured onto the upper part of the island, while in the town and at sea up to two kilometers from the beach, a heavy rain of sand fell, covering the fields and the roofs of the houses with a layer several centimeters thick.</p>
<i>Ponte (1948); Cavallaro (1957)</i>	1943	12	3	12:30	fiery scoria over entire island; much damage to houses and cultivation	North? (above the village)	<p>[Ponte (1948)] Ejection of glowing scoria mixed with ash and water vapor, which together formed large masses that were violently lifted from the crater to great heights. Significant damage was caused to the settlement and the crops, and the population was in great panic. [...] The glowing scoria, some larger than a walnut, fell across the island, and people were able to save themselves by taking shelter in their homes.</p> <p>[Cavallaro (1957)] A large quantity of such material fell, with a loud crash, over the entire island, causing some fires in certain areas, but without causing any casualties. However, the population was still overwhelmed with panic due to the fall of scoria in the settlement and fearing the repetition of the famous paroxysm of September 11, 1930.</p>
<i>Ponte (1948); Cavallaro (1957)</i>	1944	1	25	08:44	Punta dell'Omo? Forgia Vecchia?	East?, SouthEast? , South?	<p>[Ponte (1948)] Fortunately, the explosion caused no casualties or damage, because all the massive material ejected was carried by a strong N-NW wind and fell on the uninhabited areas of Punta dell'Uomo and Forgia Vecchia, where all the shrubs and grasses were destroyed and covered. After this explosion, which can be considered one of the most terrible and prolonged of the historical period, the volcano did not calm down: frequent bursts of ash followed, causing considerable alarm among the population.</p> <p>[Cavallaro (1957)] The material ejected into the air was carried by a strong N-NW wind toward the areas of Punta dell'Uomo and Forgia Vecchia, where large fires broke out. The explosion was followed by the emission of ash that lasted for several days.</p>