

DISASTER
RELIEF

CASE REPORT
Iceland-Volcanic Eruption
January 23, 1973

Agency for International Development
Washington, D.C. 20523



The town of Vestmannaeyjar before the volcanic eruption on January 23, 1973

Foreign Disaster Case Reports are publications of the Office of the Foreign Disaster Relief Coordinator, Agency for International Development. This office has responsibility for coordinating U.S. Government foreign disaster relief responses and for the further coordination of such activities with those of the U.S. private and international disaster relief communities.

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The same view of Vestmannaeyjar in June 1973

WESTMAN ISLANDS, ICELAND (Vestmannaeyjar Islands)

Volcanic Eruption

January 23, 1973

Iceland and surrounding islands were created by volcanic activity, and the process is not nearly complete. Some 30 volcanoes have repeatedly erupted since the country was settled. On the average eruptions occur every five years.

Seventy miles southeast of the mainland is a string of 14 islets called the Westman Islands. Heimaey, the largest and only inhabited islet, rose from the sea some 5,000 to 6,000 years ago when the now-quiet volcano Helgafell erupted. The last islet to come into existence was Surtsey, which emerged when a submarine volcano erupted off the coast of Heimaey on November 14, 1963. It is now about one square mile in area and rises 500 feet above sea level.

The most destructive volcanic eruption in the history of Iceland was the second eruption on Heimaey near the placid fishing town of Vestmannaeyjar which occurred on January 23, 1973. More than 500 houses and buildings were destroyed, and 5,300 people were left homeless. Approximately 5,000 people were evacuated, and numerous vehicles, marine products, valuable industrial equipment, and all domestic animals were transported to the mainland. The cinder-spatter cone grew in size and the volcano was dubbed Kirkjufell, or "Church Mountain," by the islanders since it burst forth near Heimaey's earliest Christian shrine. Afterwards, official designation to the mate of Helgafell was Eldfell, or "Fire Mountain." Estimated dollar damage was in excess of \$24.7 million.

Value of U.S. Government Assistance	\$ 338,703
Value of Assistance from Other Nations	1,744,095
Value of Assistance from International Organizations and Private Groups	380,278

The eruption began about 2 A.M. on the eastern side of Heimaey, about one and one-half miles from the center of Vestmannaeyjar. The volcanic fissure, more than two miles in length, opened on lush hayfields cultivated on slopes which extended from the base of the ancient Helgafell to sea level. Most islanders were first alerted by the warning sirens of fire engines and police cars racing up and down the streets. People rushed from their homes to see with astonishment the single burst of fire leaping from the ground.

Because Heimaey is only six miles in area, no place on it was considered safe, and authorities ordered an immediate evacuation of the residents to the mainland. Some were reluctant to leave, believing they could weather this eruption since they had witnessed the birth of Surtsey. Most, however, crowded willingly aboard fishing boats, taking with them only personal effects they could carry. Fortunately, the entire fishing-boat fleet was in port because of a storm the previous day, for otherwise most of the fleet would have been out to sea. Within a matter of five or six hours the mass evacuation of 5,000 or more people was completed, and neither a single human injury nor a trace of panic was reported.

The first aircraft arriving to assist in the evacuation belonged to the Directorate of Civil Aviation of Iceland. Later U.S.-manned Iceland Defense Force (IDF) helicopters and planes arrived from Keflavik and evacuated people, including patients from the hospital and the aged who could not make the trip by boat because of the rough seas. Systematic rescue flights followed when aircraft provided by Icelandair joined in the operation.

Two hundred town officials and technicians remained on Heimaey to salvage household

equipment and other valuables. Later they were joined by men who had accompanied their families in the boats and returned on the same boats after they made arrangements for onward transport of their families to Reykjavik. By January 23, the men were organized into rescue teams, and their first defense measures were to board up all windows on houses and buildings facing the volcano because red-hot pumice was raining down on windows and roofs increasing the danger of fires. As the ash-fall or tephra increased, it reached heights of 14 feet in some areas, and enormous weight lay on the roofs of many houses.

To lighten this burden, the volunteers began the tireless task of sweeping the cinders off the roof tops and placing props under the rafters to support roofs to keep them from collapsing. On February 2, a volunteer work force of U.S. military personnel from the North Atlantic Treaty Organization (NATO) base in Keflavik arrived to assist the rescue teams with the incredible job of saving houses from complete destruction.

ACTION TAKEN BY THE GOVERNMENT OF ICELAND

The order to evacuate Heimaey Island was given by local authorities as the volcanic eruption increased in intensity. The people were directed to go to the harbor and board small fishing boats for a trip on rough seas to the nearest port on the mainland. When the evacuees reached the mainland, city buses from Reykjavik met them at the port and shuttled them into the city, 35 miles away. School buildings were used as reception centers, and hot meals were provided while arrangements were made for temporary housing. Because it was mid-winter, the tourist hotels were almost empty, and some 600 rooms were made available. However, most of the evacuees had relatives on



A plume of ash towers over Vestmannaeyjar on the third day of the eruption

the mainland where they could stay, so only eight hotel rooms were needed the first night. In case of need, medical teams and ambulances were made available to meet the arriving fishing boats at the port and aircraft at the airport in Reykjavik.

Prime Minister Olafur Johannesson broadcast to the nation on radio and television, appealing for national cooperation. He directed all Government of Iceland (GOI) agencies to work together in solving the immediate problem of relocating the displaced Westman Islanders. The Prime Minister appointed a commission to evaluate the damage to Iceland's economy, stressing that the country's largest fish processing plants, accounting for 20 percent of Iceland's total production of frozen fish products, were on Westman Island.

Within a few days, the Icelandic Parliament passed a bill establishing an emergency relief fund and increased taxation to fund it. A Volcano Emergency Relief Committee was established under government auspices (but operating independently of the government) to carry out relief and rehabilitation operations. The Committee chartered private aircraft to assist with the removal of household effects from the island and chartered freight ships to move valuable equipment and machinery from the fish processing and freezing plants. Ships also were sent to Heimaey to evacuate Icelandic cultural art treasures from the museum.

On February 11, the lava flow broke through at the base of Eldfell, advancing 50 meters in two hours. The face of the lava flow, measuring 20 meters wide and 20 meters high, continued to move unabated towards the edge of town, threatening to fill the southern harbor mole. The Secretary-General of Foreign Ministry, Peter Thorsteinsson, contacted U.S. Ambassador Frederick Irving to officially request assistance from the IDF in moving heavy equipment that could no longer be transported on ships because the condition of the port harbor had changed, limiting sea transport to only shallow draft

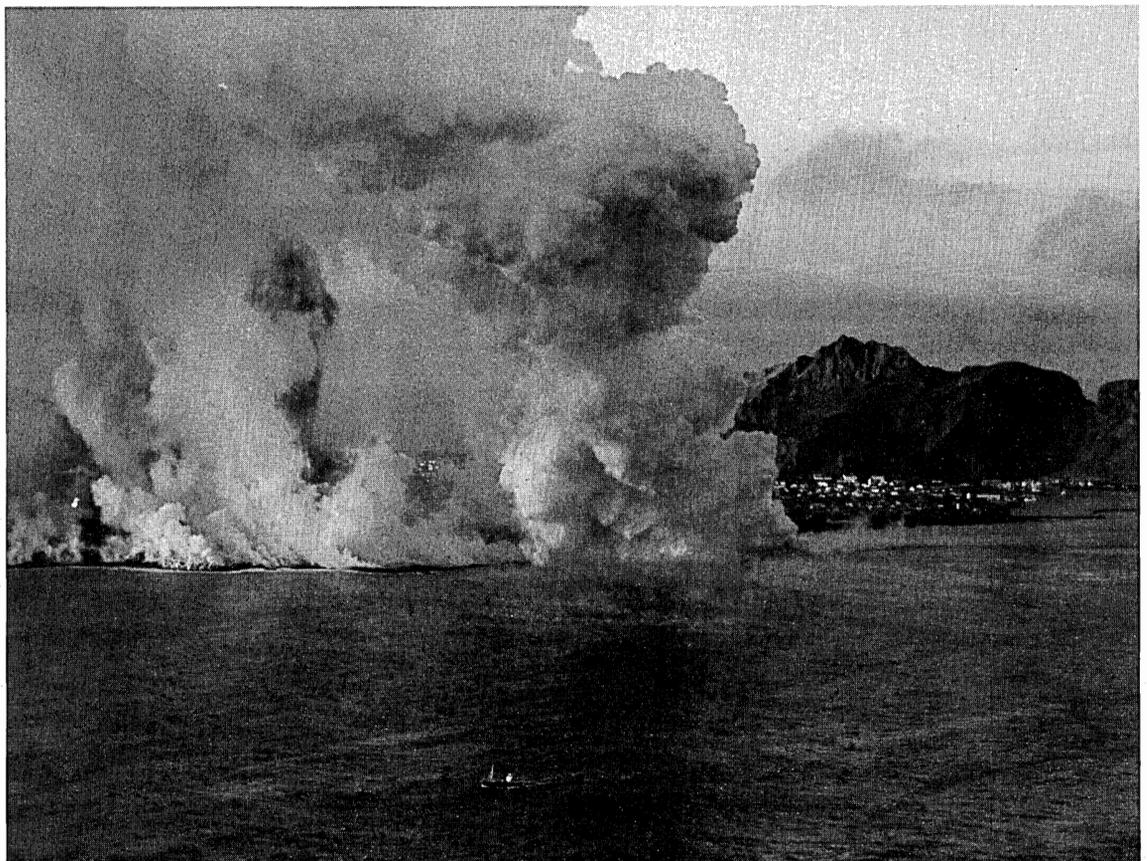
vessels. Cargo aircraft were also requested to replace the inadequate commercial-type planes originally contracted for the airlift.

As it became clear that the eruption would continue for some time, the Committee obtained pre-fabricated housing for the evacuees from Sweden, Norway, and Canada. The purpose of acquiring the temporary housing was to locate the families in small ports on the mainland where the fishing boats from the islands could land their catch, and the livelihood of the evacuees would not be adversely affected.

From the very beginning, the main concern was to protect Vestmannaeyjar and the important harbor from the onslaught of the lava flows. Salvage teams began building a protective rampart by piling up pumice cinders and spraying city water on the advancing lava, causing the flow-front to thicken

and solidify. The lava-wetting technique was recommended by Icelandic geologists and geophysicists. To augment this effort, a ship outfitted with pumping equipment was moved into the harbor. This ship could pump much more water than the small pumps provided by the Westman Islands Fire Service. The operation was hampered, however, when one of two fresh-water pipelines from the mainland was broken, limiting the use of fresh-water pumps. GOI officials asked the U.S. Government for additional equipment, including sea-water pumps, hoses, pipes, fittings, and nozzles as they were unsuccessful in acquiring this equipment from Scandinavian countries on a rental basis.

By April, 47 pumps mounted on barges were in the harbor delivering a total of one cubic meter per second of sea water to the areas where needed. The water was pumped



Vestmannaeyjar is veiled behind a curtain of steam as red-hot lava flows into the sea

through three 12-inch plastic pipes, and each 12-inch pipe fed several five-inch plastic pipes. The water-cooling program changed the surface of the main lava flow, forming a natural ramp structure which slowed or diverted the lava flows, but not before three fish-freezing plants were extensively damaged and numerous houses destroyed.

In addition to the property loss caused by heavy tephra fall and lava flows, poisonous gases (deadly by-products of the inferno) accumulated in low areas of eastern Vestmannaeyjar. These gases, composed of 90 percent CO₂ and containing CO and methane, rendered many areas hazardous because of the danger of asphyxiation. A north-south trench was dug on the eastern part of town, partly to provide a conduit for gas emission and partly as an open "barrier" to movement of gases west through the tephra pile.

Systematic work on clearing up the streets of the town had begun by April. Pumice and ash were removed from the town and an area where the GOI plans to build some 600 new houses. During the latter part of May, the Icelandic Land Reclamation Service began sowing grass seed and spreading fertilizer on Heimaey using a small aircraft. Repairs were made on houses damaged directly by the volcanic eruption and tephra-clearing operations, and to the domestic heating installations damaged by freezing and breaking of pipes during cold weather. For people who were not compensated by insurance, the GOI paid all claimants for their losses so that they could begin to rebuild as soon as possible.

There was no significant lava flow after July, and the main crater was closed. However, heat will remain in the lava for many years or even decades. The eruption which lasted for five months ejected an estimated 250 million cubic meters of lava and ash. The island of Heimaey increased in size by about 2.5 square kilometers.

ASSISTANCE PROVIDED BY THE U.S. GOVERNMENT

On January 23, a U.S. Embassy officer met with the Icelandic Foreign Ministry to offer emergency assistance to meet immediate disaster needs. In the absence of the Ambassador, the Chargé d'Affaires, Doyle V. Martin, made the determination that the eruption on Heimaey constituted a disaster. He exercised his disaster relief authority and presented 2,400,000 Kronors, equivalent to \$25,000, to the Icelandic Red Cross.

Within two hours after the eruption began, the U.S. Navy dispatched U.S.-manned C-47s and helicopters from the Iceland Defense Force (IDF) base in Keflavik. A total of 87 people including the aged, ill, blind, and hospital patients were evacuated to the mainland. The IDF provided 2,000 pounds of clothing donated by base personnel to the evacuees. In addition, base facilities were made available to the GOI. The base Fire Chief was assigned with three U.S. aides and special equipment to assist in fighting fires which threatened to destroy houses and fish processing plants.

The eruption attracted a number of foreign scientists to either observe the volcanic activity or to conduct scientific experiments. Although most American scientists traveled to Iceland under their own auspices, including a number of university scientists, two U.S. Governmental organizations dispatched researchers. Dr. Thomas E. Simkin, Curator of the Division of Petrology and Volcanology of the Smithsonian Institution's National Museum of Natural History, collected samples of tephra and lava on January 24-26, 1973. Dr. James G. Moore, a volcanologist with the U.S. Geological Survey's Geologic Division, made field observations on May 3-5, 1973, which included the collection and analysis of volcanic gases, assessment of the efficacy of the water-wetting of lava, and scuba diving to observe the submarine extent of lava flow and accumulation.



Livestock were removed from Heimaey Island to the mainland by U.S. Navy cargo-

transport aircraft from the NATO base in Keflavik

Dr. Richard S. Williams, Jr., a research geologist with the U.S. Geological Survey's Earth Resources Observation System (EROS) program, made field observations on Heimaey on February 7, 1973, and again on July 21 and 23. He acquired black and white, color, color infrared, and color movie photography of Heimaey. Dr. Williams' research activities were in support of satellite geological and geophysical studies of Iceland as part of a long-term, cooperative research project begun in 1966.

At the request of the Icelandic Government, a 97-man IDF task force was sent to Heimaey on February 2. This volunteer force grew to 124, but was later reduced to 61 on February 24. The work force initially removed volcanic ash from the roofs to keep them from collapsing and shoveled out entrances to buildings to allow contents to be removed. Beginning on February 12, they were used for additional tasks including dismantling equipment from factories, operating trucks and material-handling equipment,

repairing vehicles, and loading aircraft and coastal freighters. IDF provided a shipload of container crates and 48 large truck/sea lift vans for transporting personal effects and household goods from the island.

The IDF C-47 planes that evacuated the islanders were also used to evacuate over 400 head of livestock, but were inadequate to transport heavy-bulk cargo. Two U.S. Air Force C-130 Hercules aircraft of the 9th Air Force Tactical Air Command were flown from Langley Air Force Base, Virginia, arriving in Iceland on February 12. Accompanying the flight was a cargo-handling team with two forklifts and other loading equipment.

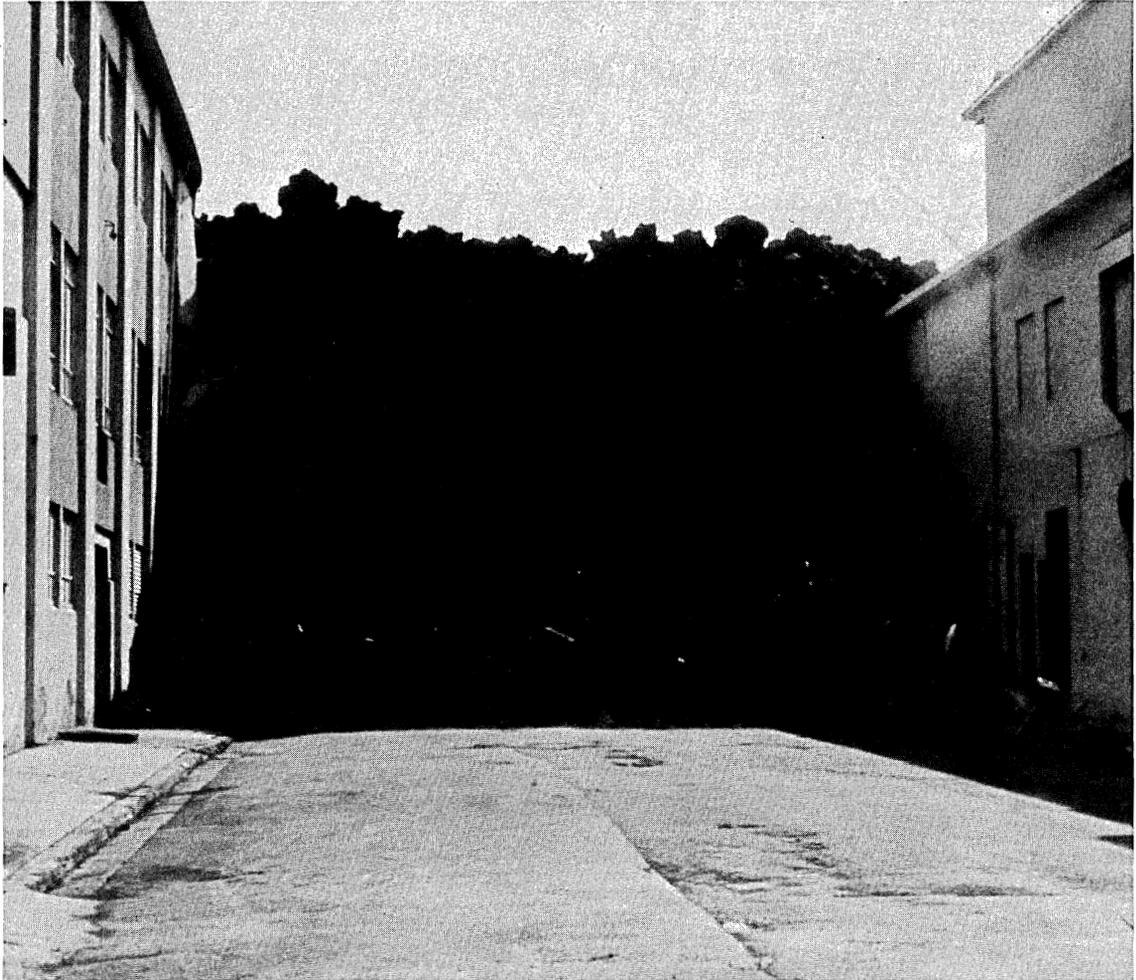
During the period of operations from February 16-28, the C-130s transported 711.6 tons of cargo and 224 passengers from Heimaey to Keflavik and 89.5 tons of cargo and 220 passengers from Keflavik to Heimaey. The cargo carried from Heimaey consisted mainly of heavy machinery, communication gear,

and hospital equipment. The passengers were primarily rotating IDF work force personnel. After the successful airlift was completed, the planes returned to the United States on March 2, 1973.

The experiment of spraying water on the lava flows which began in February did indeed slow their advances. Additional pumps, pipes, replacement parts, and equipment were needed to deliver water not only to the flow front, but to many sites on the surface of the flows. This operation involved

a large-scale procurement and transportation effort by AID/Foreign Disaster Relief Coordinator (FDRC) and the U.S. Department of Defense. The timely arrival of the water pumping equipment was credited with saving the harbor and center of Vestmannaeyjar. The high pressure water pumps and pipes from the United States made it possible to pour copious quantities of water onto the lava.

The pumping activities ceased at the end of June 1973, after an estimated 5.5 million tons of seawater had been pumped onto the lava.



A lava flow that stopped between and against two fish processing plants. Three

plants were extensively damaged by the advancing lava

The following is an account of assistance provided by the U.S. Government:

Donation to the Iceland Red Cross	\$ 25,000
Airlift of pumps, motors, pipes, nozzles, gaskets, and fittings for spraying	112,824
Flying hour costs of U.S. Navy and Air Force aircraft	153,552
Overtime pay of civilian employees from Keflavik Air Base (IDF)	12,835
Rations for relief/salvage workers on Heimaey	5,834
Packing containers and crates used in removing possessions and machinery	16,992
Local transportation on the mainland	1,846
TDY and per diem costs of U.S. Air Force personnel on Heimaey	1,189
Estimated cost for reconditioning pumps (U.S. Navy) not covered by funds previously made available by the Government of Iceland	8,631
Total	\$338,703

Assistance Provided by Other Nations

China (People's Republic of) ...	\$ 67,623
Denmark	1,488,253
Faeroe Islands	97,600
Germany (Federal Republic of) .	31,849
Italy	10,000
Sweden	25,000
United Kingdom	23,770
Total	\$1,744,095

Assistance Provided by the League of Red Cross Societies

Canada	\$ 211
Finland	7,950
New Zealand	1,339
Sweden	38,484
Switzerland	3,155
United States	5,000
USSR	82,339
Total	\$ 138,478

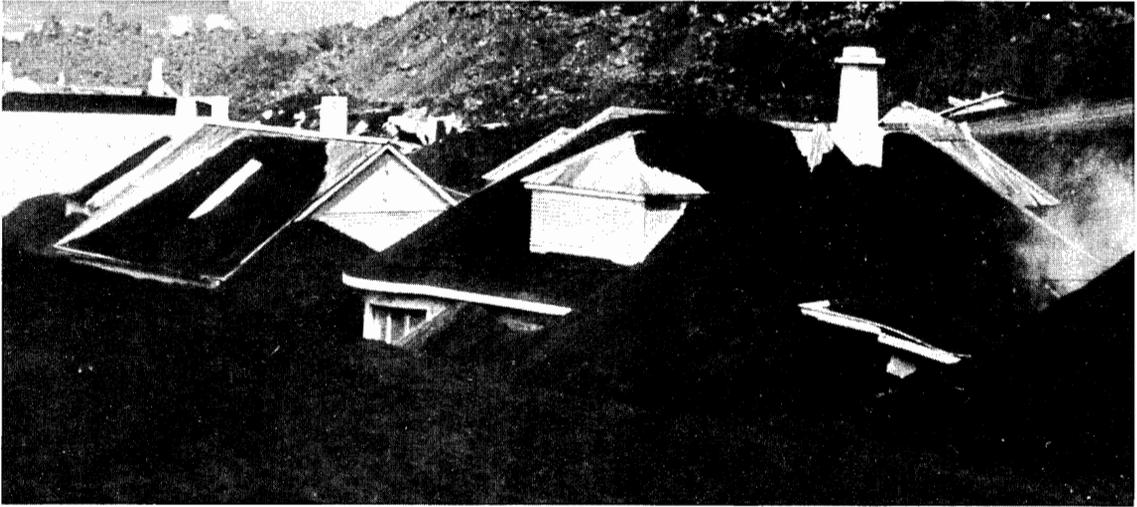
Assistance Provided by the United Nations System

UNESCO	\$ *
United Nations Disaster Relief Coordinator	12,000
Total	\$ 12,000

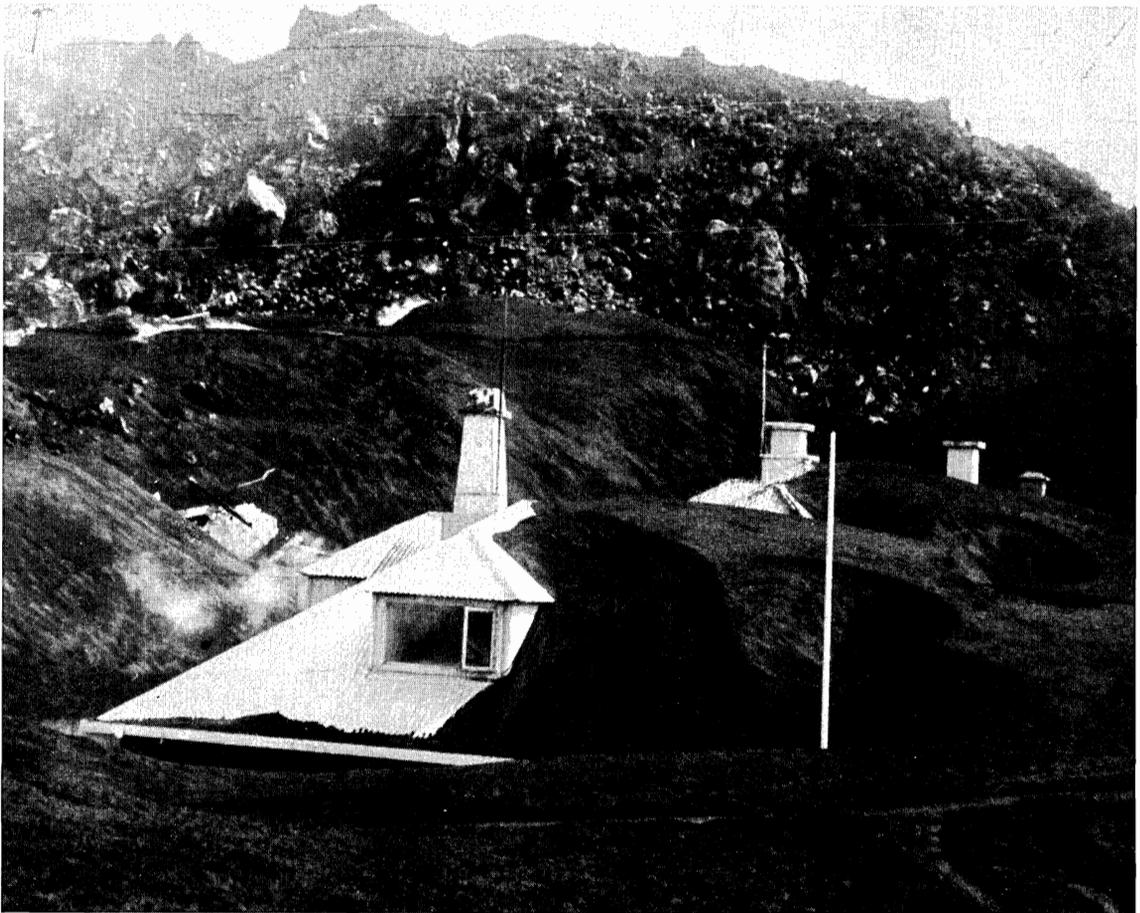
Assistance Provided by Private Groups and Organizations

Aalborg, Denmark Shipyard	\$ 2,199
Alusuisse (Swiss Aluminum Company)	97,600 ^c
Bergen, Norway City Council ...	3,762 ^c
Danish Coal Importers	1,759 ^c
Danish-Icelander Society of Aarhus, Denmark	293 ^c
Danish Royal Family	10,930
Diplomatic Chiefs of Mission in Reykjavik	1,127 ^c
Halmsted, Sweden, Lions Club .	1,063 ^c
Icelandic Consuls in Bremerhaven and Cuxhaven, Federal Republic of Germany	1,055
Iceland Patriotic Society in the U.S.	2,640
International Development Agency	25,000
Norwegian Fishermen's Association	15,048
Norwegian-Icelandic Federation	7,524
Private Danish Contributors	56,137
Vaerlose, Denmark, Town Council	3,663
Total	\$ 229,800

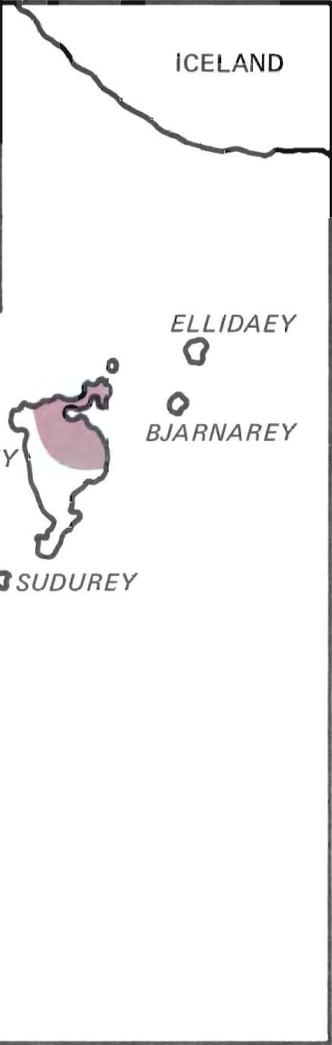
* Value of assistance not reported.



More than 500 houses and buildings were destroyed by lava and ash



A view of houses partially buried under ash. A lava flow is in the background



ICELAND