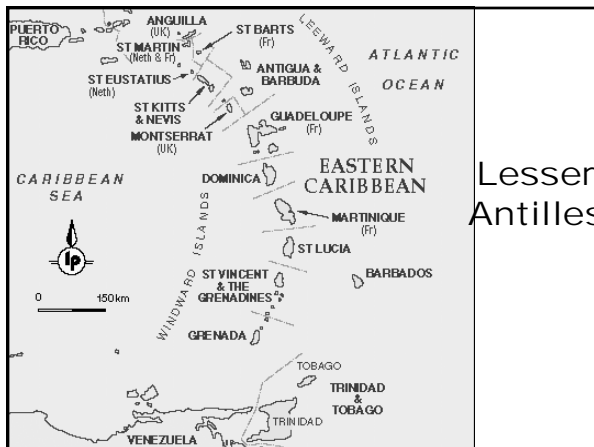
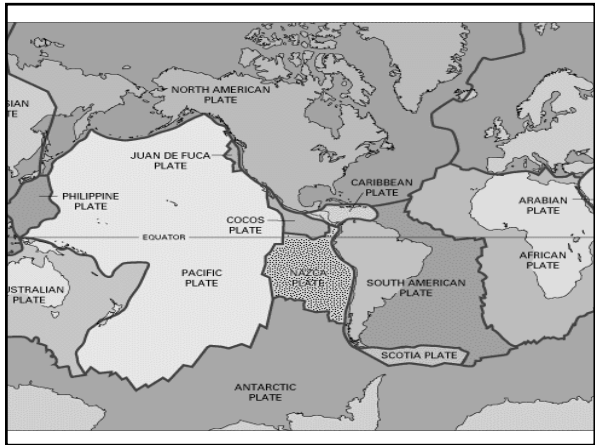


- ### History Lesson
- 1493 – Christopher Columbus sights the island which he names after a Spanish abbey
 - 1632 – Montserrat becomes a British colony
 - 1890's – Major earthquake
 - 1930's – Another major earthquake
 - 1960's – Another major earthquake
 - 1989 – Hurricane Hugo causes widespread damage
 - 1995 – Eruption begins

- ### Geological Background
- **Soufriere Hills, Montserrat, West Indies**
 - **Location:** 16.7N, 62.2W
 - **Elevation:** 3,002 feet (915 m)
 - Located on the Northern part of Lesser Antilles
 - Subduction Related Volcano – North American Plate is subducting under the Caribbean Plate
 - Andesitic Stratovolcano that is 16 km long (N-S) and 10 km wide (E-W)



Lesser Antilles

The Seven Volcanos of Montserrat
(with the order of eruption)

- Montserrat is composed of three volcanic centers.
- From oldest to youngest: Silver Hills (1.55 My BP), Centre Hills (4.4 and Soufriere Hills (South Soufriere Hills ~40 Ky BP) Soufriere Hills (began forming 24 to 17 Ky BP)

Montserrat



Precursors that indicated the eruption

- Several major earthquakes.
 - 1890's, 1930's, and the 1960's
- Increased fumarolic activity
- Rockfalls, they became more frequent the closer it came to the eruption

Pre-event Disaster Preparation and Population Awareness

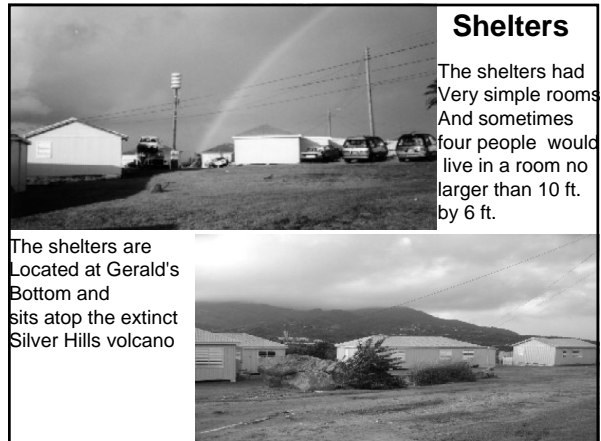
- Been under continuous surveillance for decades
- First monitored by the University of the West Indies in Trinidad
 - Montserrat Volcano Observatory (MVO) was established
- With this surveillance a team of international scientists were able to provide the authorities with critical information about the eruption in 1995

Evacuation

- Just before the eruption on July 18, 1995 the authorities evacuated ~11,000 people
- Most of the people live in close proximity to flow paths of several hazards
- The elderly were evacuated first, while the younger residents followed a month later
- After the residents of Montserrat were allowed to go home, they would be evacuated again

1997 Evacuation

- Final evacuation was called 48 hours in advance for the capital Plymouth
- Power station, fuel reserves, the port jetty and warehouse, schools, newly built hospital, and most commercial, banking, and industrial buildings threatened
- Nearly two-thirds of the landmass was evacuated and deemed inhabitable



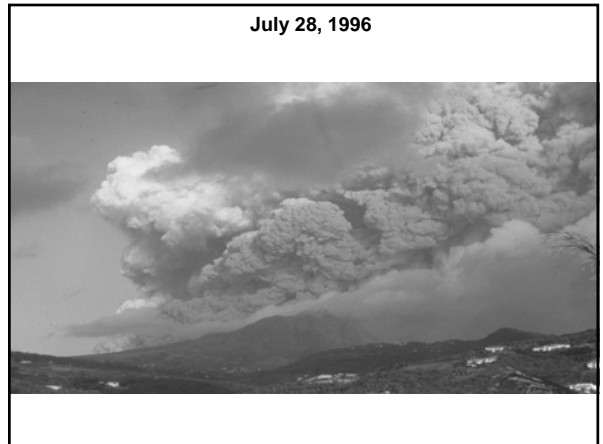
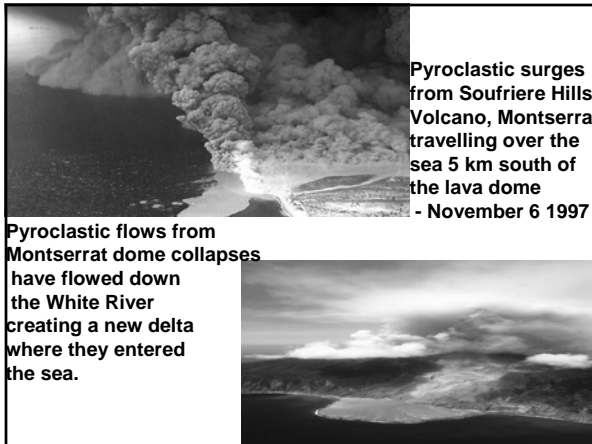
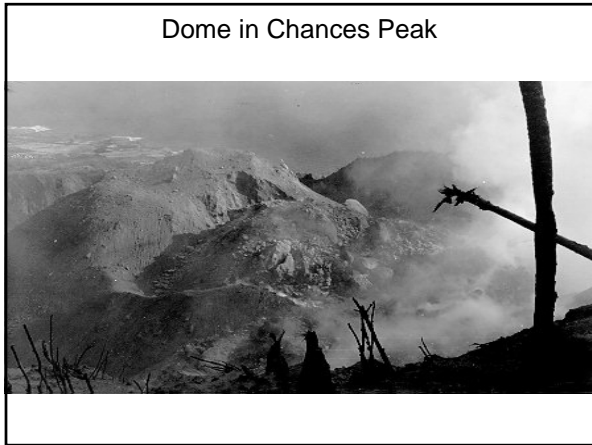
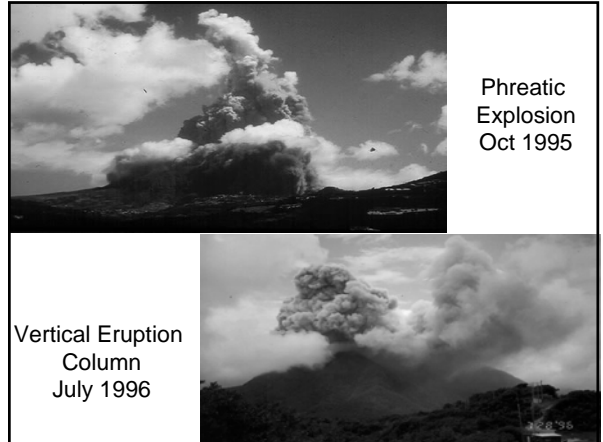
Shelters

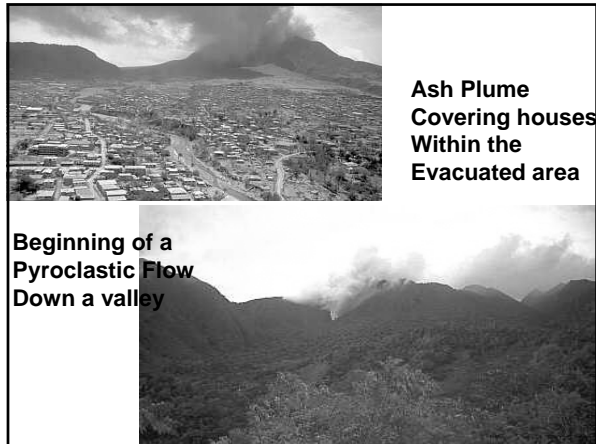
The shelters had very simple rooms. And sometimes four people would live in a room no larger than 10 ft. by 6 ft.

The shelters are located at Gerald's Bottom and sit atop the extinct Silver Hills volcano

The Event

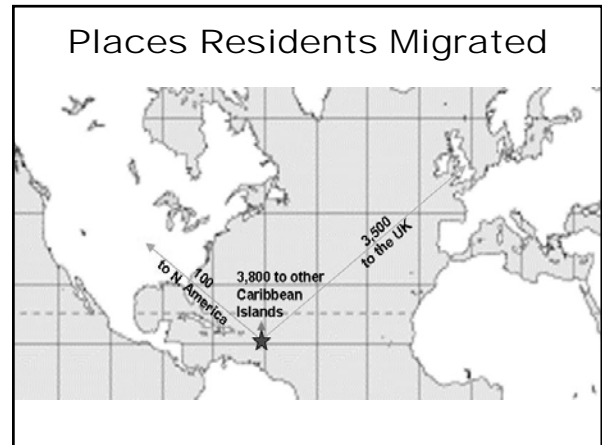
- After ~300 years of dormancy Soufriere Hills began to erupt on July 18, 1995
- Phreatic eruption which ended with the growth of a dome and pyroclastic flows
- Chances Peak
- In 1997 there were numerous dome collapses creating some of the strongest pyroclastic flows
- Soufriere Hills has a basic sequence:
 - Builds a dome
 - Dome collapses, producing pyroclastic flows
 - Quiet for a little bit





Migration

- By July 28th, 1995 migration off Montserrat began
- First year 3,000 people left
- Next two years, another 4,500 people left
- Places the residents fled to: United Kingdom, Antigua, North America, and other Caribbean islands
- About two-thirds of the population migrated
- By September 1997, only 5,300 people were left on the island



Scale of the Eruption and Disaster Relative to other Events this Century

- Soufriere Hills is similar to:
 - Guadeloupe Island, home of Soufriere Volcano, which has had nine eruptions since 1660, with the most recent in 1976. In 1976, just the opposite occurred on the Island of Guadeloupe, 50 miles south of Montserrat. A small eruption of the volcano La Soufriere, and the memory of the Pelee disaster, led to a massive and expensive evacuation of 70,000 people. The eruption waned and scientists and politicians were blamed for their "cry wolf" alarms.
 - Micotrin Volcano on the Island of Dominica, which last erupted in 1880.
 - La Soufriere Volcano, which erupted in 1718, 1812, 1902, and 1979, lies to the south on the island of St. Vincent. The eruption here in 1902 killed 1,600 people only hours before the more devastating eruption of Mont Pelee on Martinique.

Scale of the Eruption and Disaster Relative to other Events this Century (Continued)

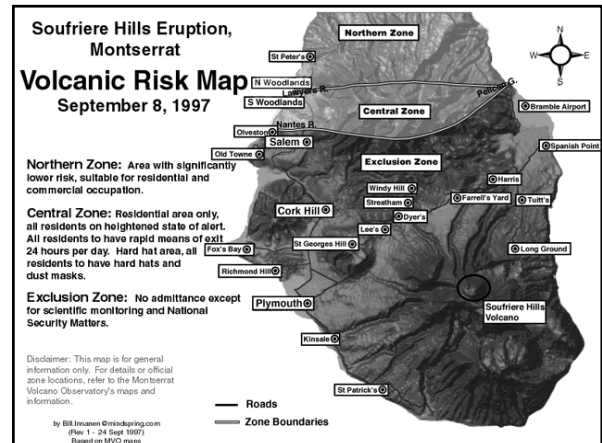
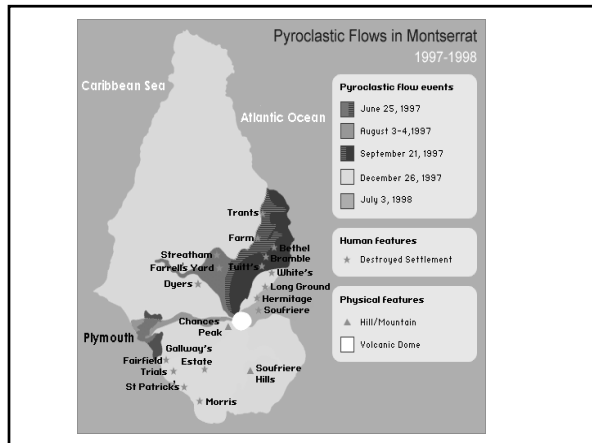
- In 1902, Mont Pelee on the French Island of Martinique, 150 miles south of Montserrat, erupted violently, killing 28,000 people in minutes. The pyroclastic flow which swept down on the port city of Saint Pierre was an especially bitter tragedy. Political elections were about to be held there, and even though the volcano had become increasingly active during the days prior to the great eruption, government officials assured the residents that there was no great danger. Worried that they would not be reelected if the city was evacuated, those officials were dead the next day along with all but two people who survived the volcanic holocaust.

Post Disaster Effects

- Greatest losses Montserrat endured was the loss of their medical school and their new hospital (rebuilt after Hurricane Hugo)
 - Final evacuation of much of the hospitals equipment was lost
 - The new location of the hospital lacked supplies and was inadequate in patient care
 - Also 50% of the nursing staff left the island
- Transportation Improvements
 - A new Emergency Jetty and Port was built
 - 300-passenger Ferry that shuttles to Antigua was built
 - Regular Helicopter service was chartered
 - New 600-m runway airport was built

Post Disaster Effects Continued

- Infrastructure Improvements
 - New temporary power station was built
 - New bulk fuel depot
 - Upgrades to the island road systems were introduced
 - New water storage tanks upgraded
- Housing Improvements
 - 250 new houses have been built as government housing stock
 - Over 200 site and service plots are under construction for private houses
- Government Improvements
 - New police station complete with holding cells
 - New prison
- Volcano and Disaster Preparedness
 - Montserrat Volcano Observatory was built
 - New hazard maps



Main Causes of Death and Property Destruction

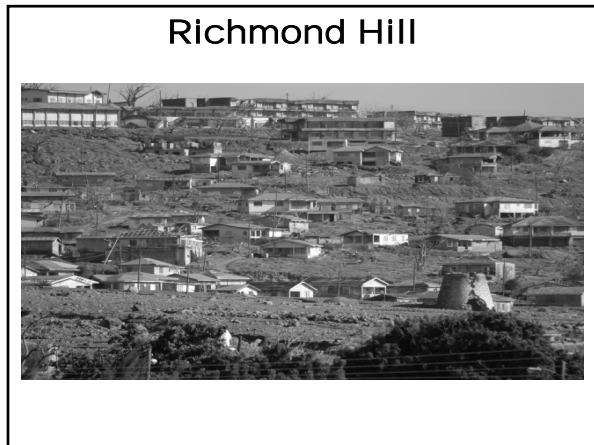
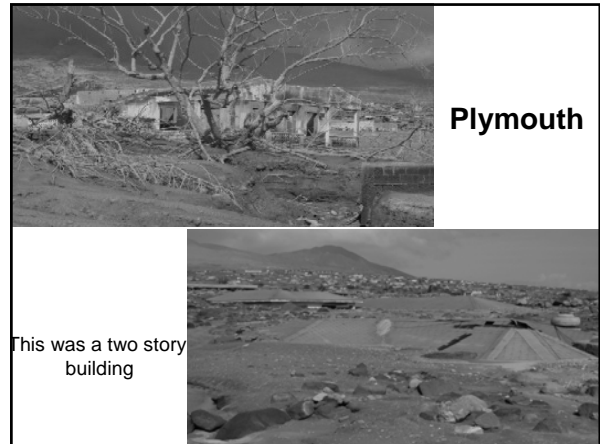
- 19 people killed in 1997, because a small group of people chose to stay behind on the island to watch over their crops
- Lahars have destroyed large areas of Montserrat including the capital, Plymouth, which was also covered in layers of ash
- Pyroclastic Flows and Ash

Town of Plymouth




Before

After



Actions that could have reduced the Losses

- Could have forced the 19 people out of their homes
- This area is susceptible to multiple volcanic hazards, so residents of Southern Montserrat were instructed to abandon home and community, leaving behind shells of former lives.



General Evaluation of the Mitigation Process

- Great Britain
 - Vowed \$64 million to replace housing, hospitals and the airports
 - Offered adults \$4,000 if they leave and children \$1,700 if they leave
 - Free transportation off the island
- Residents had to move to the North part of the island

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