Contribution to volcano disaster prevention based on geological mapping; Case study on Fuji Volcano

Hoei crater =1707 eruption

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Geological Survey of Japan, AIST

View from the south
Fuji Volcano

summit in the summer

Highest in altitude
Biggest in volume

→ 300,000 climbers/year (July to September)
Last eruption occurred at SE flank (sub-plinian eruption in 1707)
Research system for volcanoes in Japan

Scientific Research

National Institute

Geological Survey of Japan (GSJ)
National Research Institute for Earth Science and Disaster Prevention (NIED)
Meteorological Research Institute
And others

Universities

Earthquake Research Institute (ERI) of Univ. Tokyo
Disaster Prevention Research Institute (DPRI) of Kyoto Univ.
Other universities

Disaster prevention authority
Monitoring and Alert authority:
Japan Meteorological Agency (JMA)

Evacuation and risk management:
Local Government
Study volcanic phenomena on various time scales

- **10^{-1}** Year
- **10^{0}** (Month) Year
- **10^{1}** Ma
- **10^{2}** Ma
- **10^{3}** Ma
- **10^{4}** Ma
- **10^{5}** Ma
- **10^{6}** Ma
- **10^{7}** Ma

**Phenomenon**
- Eruption Event
- Volcano Growth, Caldera Forming

**Purpose**
- Short-term eruption prediction
- Middle ~ long-term activity prediction
- Migration of Volcano Center
- Volcano space-time distribution
- Country use (radioactive waste disposal)

**Society**
- Ensuring safety of inhabitants (refuge project)
- Disaster prevention plan (hazard map)

**GSJ**
- Eruption crisis
- Volcanic gas
- Geological map
- Volcano Database

**Time Scale for Volcano Research**
Volcanoes in Japan

- More than 460 Quaternary volcanoes (from 2.6 Ma to present)
Variations of volcanoes in Japan
From basaltic small volcanoes to large silicic calderas

Nishinoshima, south Tokyo
- Produce new land

Ontake, Central Japan
- Make mountain large

Fuji, near Tokyo
- Make mountain high
  - 3,776m a.s.l.

Towada Caldera, Northeast Japan
- Make mountain low (depression)
  - 11km diameter
Active volcanoes

= the past 12,000 years or with vigorous fumarolic activity

- 111 active volcanoes

★ Continuously monitored by Japan Meteorological Agency (JMA)

- 50 continuously monitored volcanoes
Geological Maps of Volcanoes

Index Map of the Geological Map of Volcanoes

- 16 Tokachidake Volcano
- 2 Usu Volcano
- 5 Hokkaido-Komagatake Volcano
- 15 Tar
- 21 Esan
- 13 Iwate Volcano
- 18 Zao
- 3 Kusatsu-Shirane Volcano
- 6 Asama Volcano
- 22 Nikko-Shirane and Mitsudake Volcanoes
- 9 Nasu Volcano
- 10 Izu-Oshima Volcano
- 12 Miyakejima Volcano
- 20 Hachijo-jima Volcano
- 14 Kuchinoerabu-jima Volcano
- 7 Aogashima Volcano and Submarine Volcanoes, South of Izu Islands
- 8 Unzen Volcano
- 4 As
- 11 Kuchinoerabu-jima
- 1 Sakurajima
- 17 Suwan

Geological Survey of Japan, AIST
Using a small excavator

Lava flow

Lava flow
At 146 sites, charcoals/paleosoil were determined the age of eruption for Fuji.
Trench by man power

Can not use excavators

Top of a scoria cone

Excavating down to scoria cone deposits
First Edition in 1968


48 years
89 eruption sites were clarified in the last 8,000 years

Eruption sites, ages and scales were revised in this geological map, and local governments were reflecting it in hazard map revision in 2021.
Assumed crater area and eruption scale


Revised Hazard map of Fuji Volcano (2021)
2011 Kirishima Eruption

Miyakonojo City (27km from volcano) : Two days after

Volcanic ash more than 5 mm thick was accumulated in the city with a population of over 100,000.
Evaluating eruptive material

Ballistic bombs (broken) and impact crater at proximal area (2km from crater)

Distribution survey
- How large is the eruption?

Ejecta analysis
- Magmatic material involved?
- What is the feature of magma?

Volcanic ash and lapilli near volcano
Distribution of ejecta for 2011 Kirisima Eruption

Estimated volume about 70 million tons (≡ Magma). =(10 times of the pyramid)

The scale of the eruption is "severe".
First survey around summits by volcanologists one month after the eruption.

64 hikers were lost by ballistic bombs (including missing)

Y.Ishizuka, GSJ, AIST
<table>
<thead>
<tr>
<th>year</th>
<th>volcano</th>
<th>victims</th>
<th>cause</th>
<th>VEI</th>
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<td>1, 2018</td>
<td>Kusatsu-Shirane</td>
<td>1</td>
<td>skier</td>
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<td>2, 2014</td>
<td>Ontake</td>
<td>64</td>
<td>hiker</td>
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<td>Unzen</td>
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<td>local people, journalist, fireman etc.</td>
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<td>pyroclastic flow</td>
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<td>hiker</td>
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</tbody>
</table>

Last 70 years, at least 180 were lost in Japan by volcanic eruptions

- **Sudden explosive eruption near crater (mostly phreatic eruption) causes fatal accidents**
- **Visiting people are sacrificed: Eruption alert system for visiting people is not fully provided.**
Contribution to volcano disaster prevention based on geological mapping

- Highly accurate geological mapping contributes to hazard maps that lead to the evacuation of residents.
- GSJ is using its knowledge of geological mapping to conduct emergency surveys at the eruptions. We provide data to the Japan Meteorological Agency and make the results available to the public and media.
Thank you

Viewed from the south