

Volcanoes

volcanic hazards



Image courtesy of USGS.

Volcanic hazards

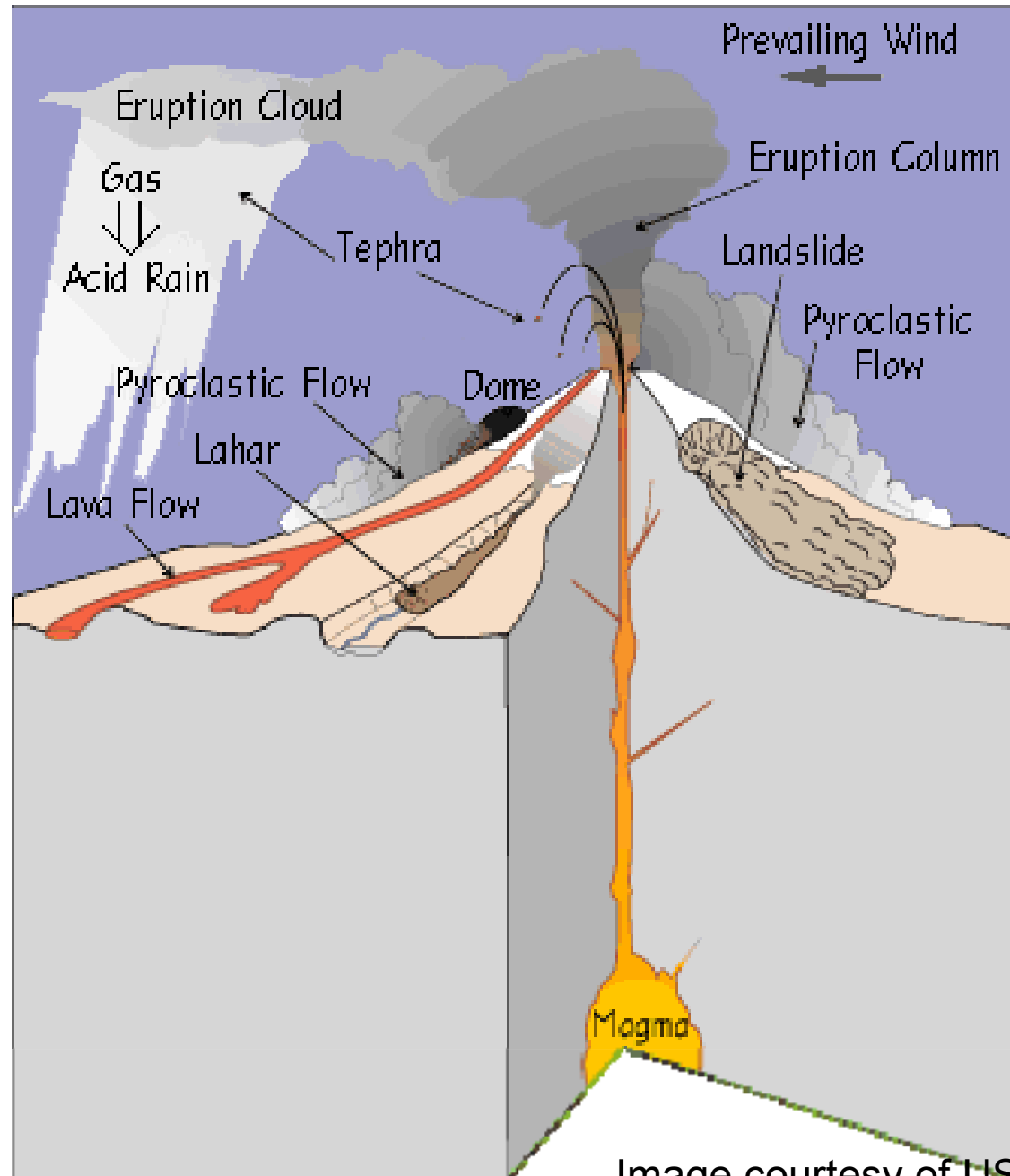


Image courtesy of USGS.

Pyroclastic flows and surges



Image courtesy of USGS.

Pyroclastic flows and surges

PYROCLAST: all solid fragments ejected from volcanoes

PYROCLASTIC FLOW: A flow of hot gas and volcanic material ranging from vesiculated, low-density pumice to unvesiculated, dense clasts which tends to follow topographic lows (i.e., valleys) as it moves; contains 10's% by volume of solid

PYROCLASTIC SURGE: A turbulent, low-density, high-velocity part of a pyroclastic flow - it is not constrained by topography as a pyroclastic flow; contains 0.1-1% by volume of solids

Pyroclastic flows and surges

plume

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Please see “Pyroclastic flows and surges” in:
Houghton, B., H. Rymer, J. Stix, S. McNutt, H. Sigurdsson.
Encyclopedia of Volcanoes. San Diego, Calif. : Academic, c2000.
ISBN: 9780126431407.

surge

flow

Pyroclastic flows and surges

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Pyroclastic flows and surges

SPEED: >10m/s to 300m/s (>36km/h to 1080km/h)

TEMPERATURE: 100-1100°C

DISTANCE TRAVELLED: kilometers to 10's of kilometers
(depends on H, the height drop); H/L is 0.2-0.4

Collapse of the eruption column



Image courtesy of USGS.

Directed eruption

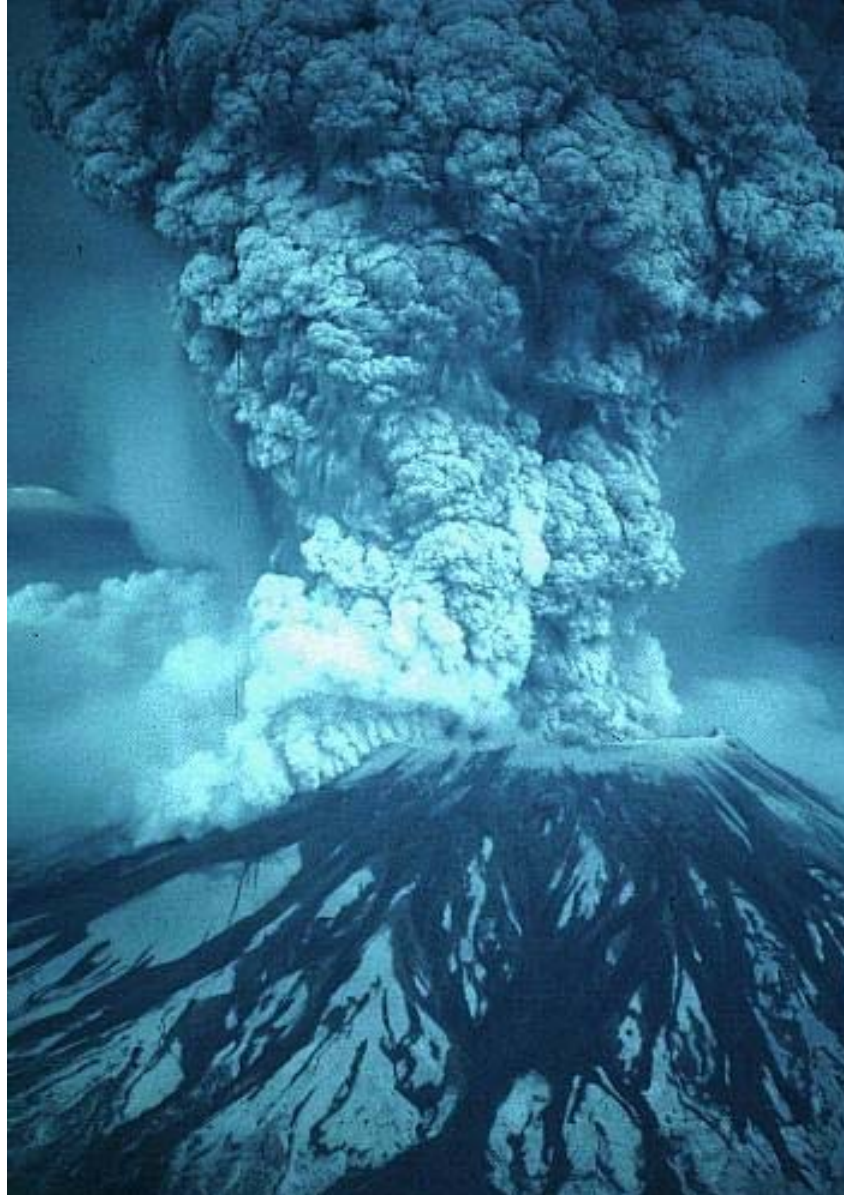


Image courtesy of USGS.

Lateral explosion from a summit dome

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Please see the image on:

http://www.geology.sdsu.edu/how_volcanoes_work/Thumblinks/nuee_pelee_page.html

Gravitational collapse of lava dome



Image courtesy of USGS.

Pyroclastic flow damage



Image courtesy of USGS.

Destruction by direct impact



Image courtesy of USGS.

Destruction by direct impact

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Please see the image on:

http://www.geology.sdsu.edu/how_volcanoes_work/Thumblinks/StPierre_ruins_page.html

Sediment deposits



Image courtesy of USGS.

Melting of ice and snow



Image courtesy of USGS.

Burning of forests, crops, buildings

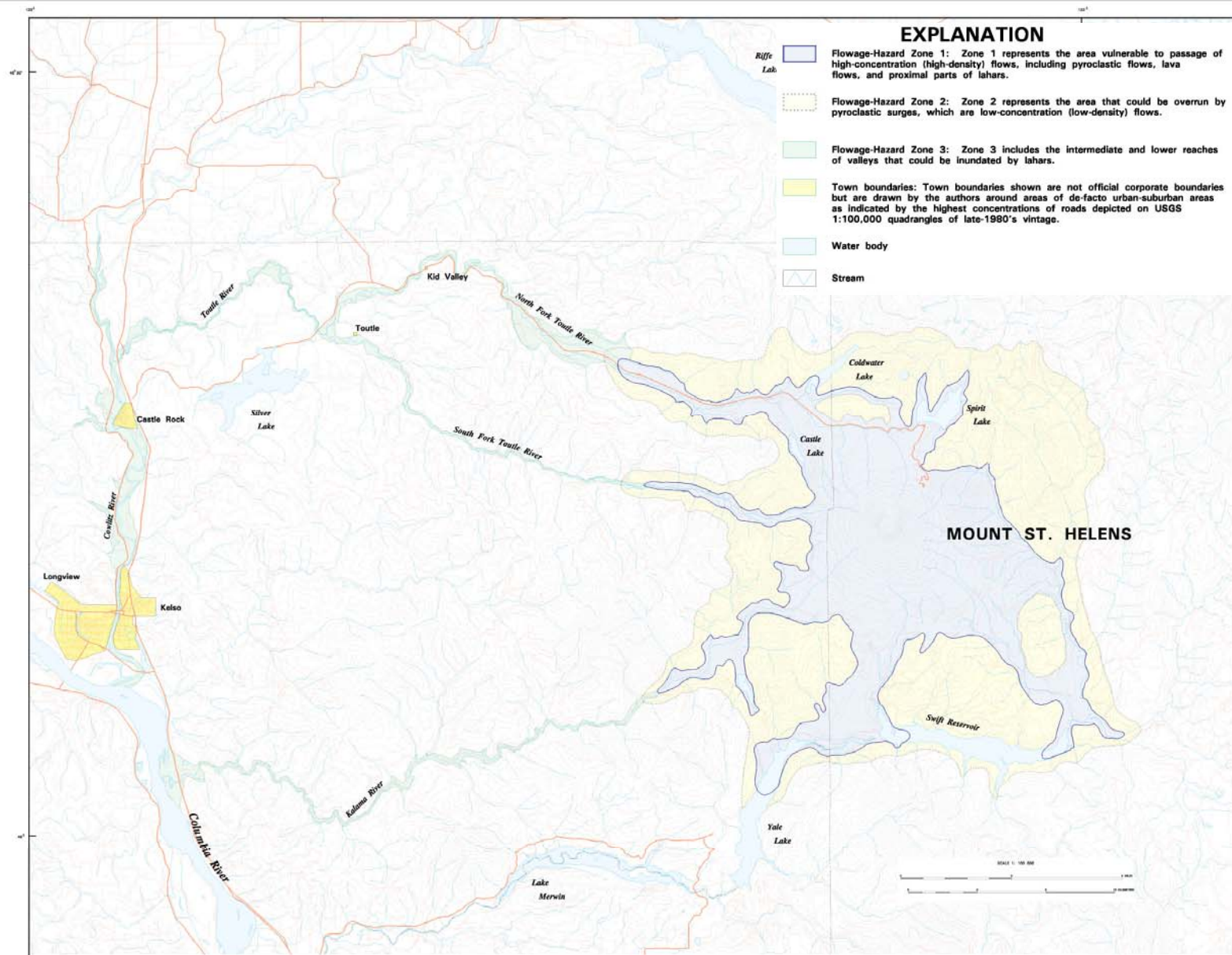


Image courtesy of USGS.

Pyroclastic flow mitigation

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT
85-487



VOLCANIC-HAZARD ZONATION FOR MOUNT ST. HELENS, WASHINGTON

by
Edward W. Wolfe and Thomas C. Pierson

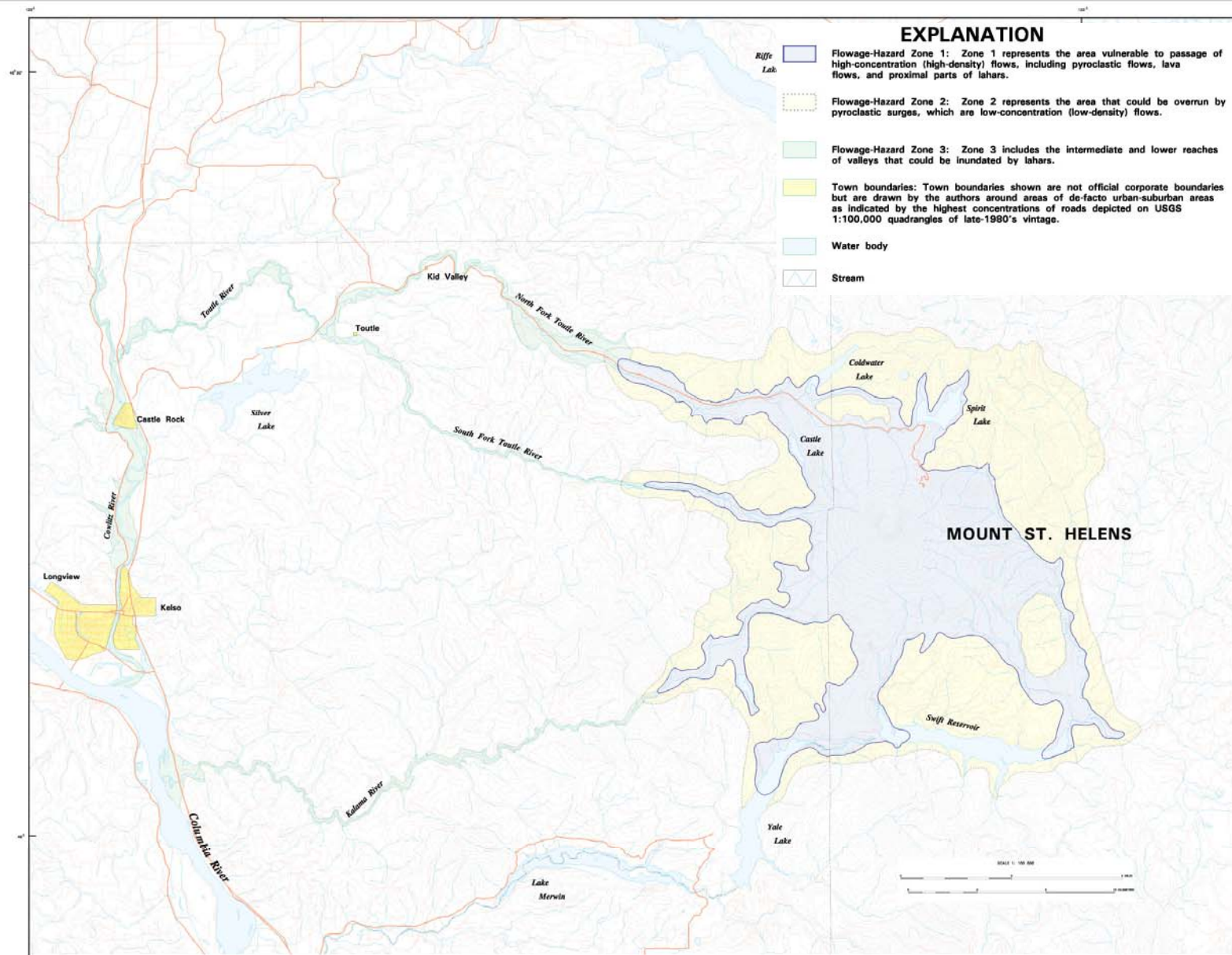
1995

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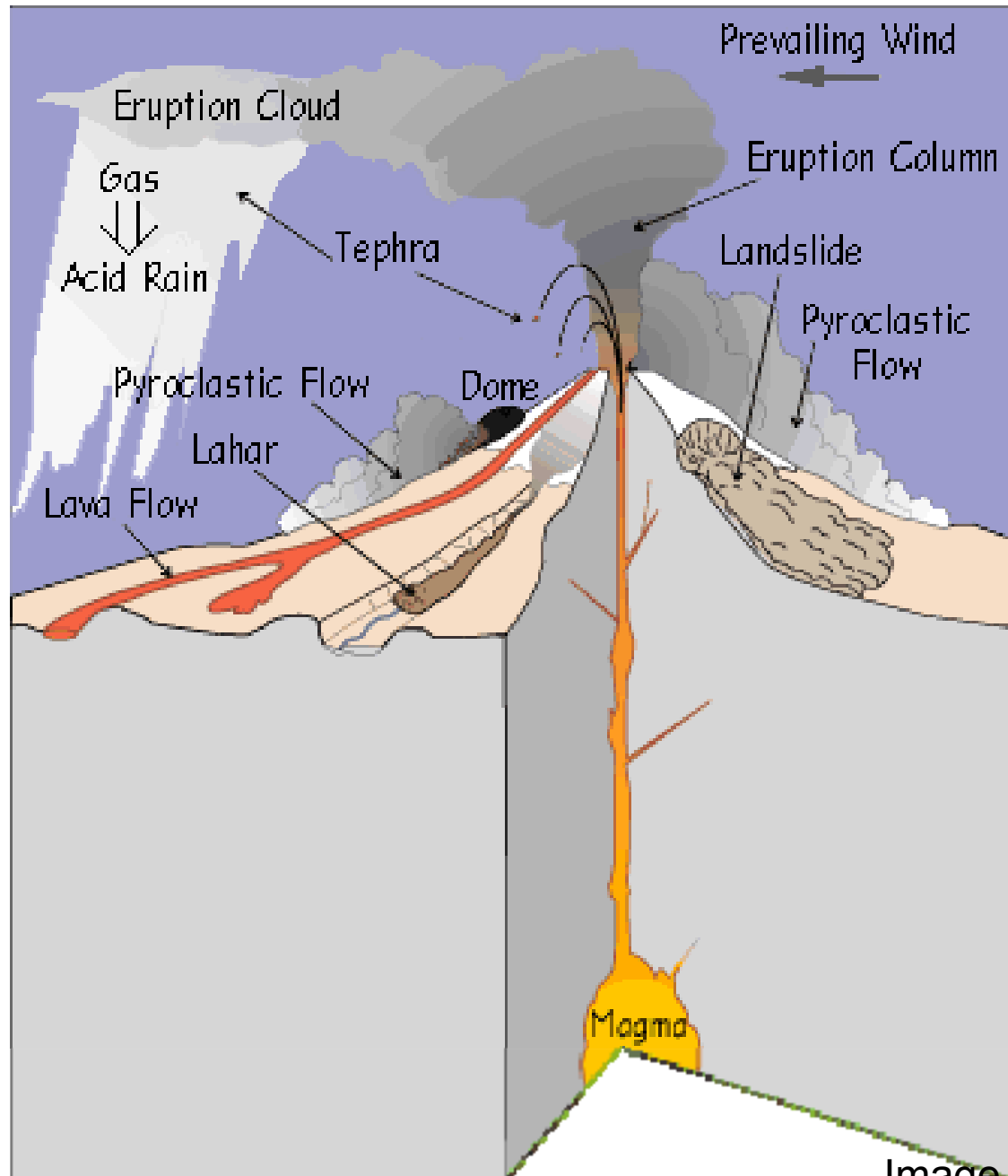


Image courtesy of USGS.

Lahars

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Lahars

DEBRIS FLOW: Viscous, flowing slurry of rock fragments containing 10 to 25 wt % of water - solid material carries the water, water lubricates the flow

HYPERCONCENTRATED FLOW: Turbulent flow of water mixed with enough sediments (60-75 wt %) to possess some yield strength

LAHAR: Indonesian term that describes a hot or cold mixture of water and rock fragments flowing down the slopes of a volcano and/or adjacent river valleys - comprises debris and hyperconcentrated flows

Lahars

SPEED: 10's to ~200 km/h

TEMPERATURE: <100°C

DISTANCE TRAVELLED: kilometers to 10's of kilometers

BEHAVIOR/PROCESSES: erosion and bulking

Causes of Lahars



Image courtesy of USGS.

Lahars



Image courtesy of USGS.

Lahars



Image courtesy of USGS.

Destruction by direct impact



Image courtesy of USGS.

Buried villages and towns



Image courtesy of USGS.

Deposition of sediments



Image courtesy of USGS.

Temporary blockage of streams



Image courtesy of USGS.

Lahar Mitigation

- Recognizing old lahar deposits
- Delineating lahar paths
- Monitoring
- Communication
- Structural measures
- Temporary refuges

Volcanic hazards

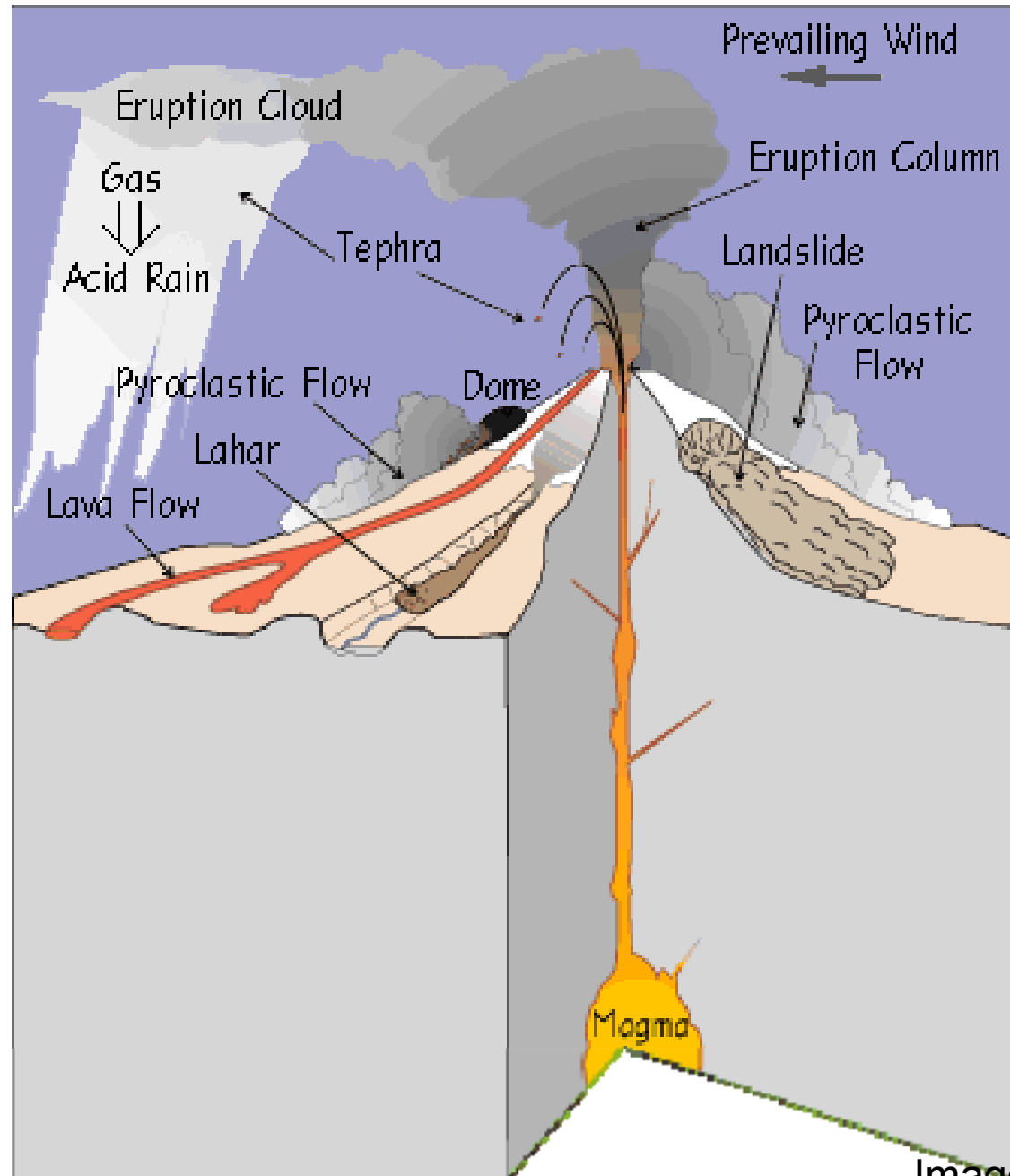


Image courtesy of USGS.

Lava flows



Image courtesy of USGS.

Lava flows

LAVA FLOW: Outpouring of molten rock from a vent or fissure spreading along the ground

aa lava



Image courtesy of USGS.

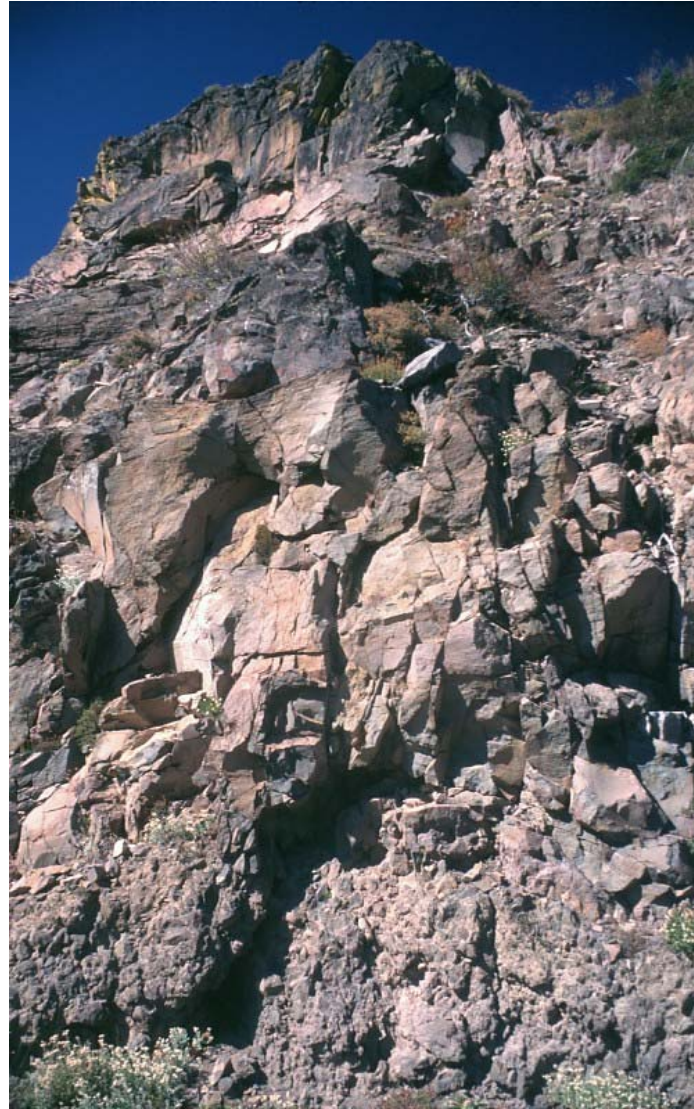
Lava flows with extremely irregular surfaces, usually covered with fragments of broken crust that are typically decimeter thick

pahoehoe lava



Lava flows with smooth, continuous surfaces
Image courtesy of USGS.

blocky lava



Lava flows with fractured surfaces, usually covered by debris up to meters across.

Image courtesy of USGS.

lava flow properties

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hazards: bury structures and infrastructures



Image courtesy of USGS.

hazards: burning and melting



Image courtesy of USGS.

hazards: jökulhlaups



Image courtesy of USGS.

lava diversion



Image courtesy of USGS.

Volcanic hazards

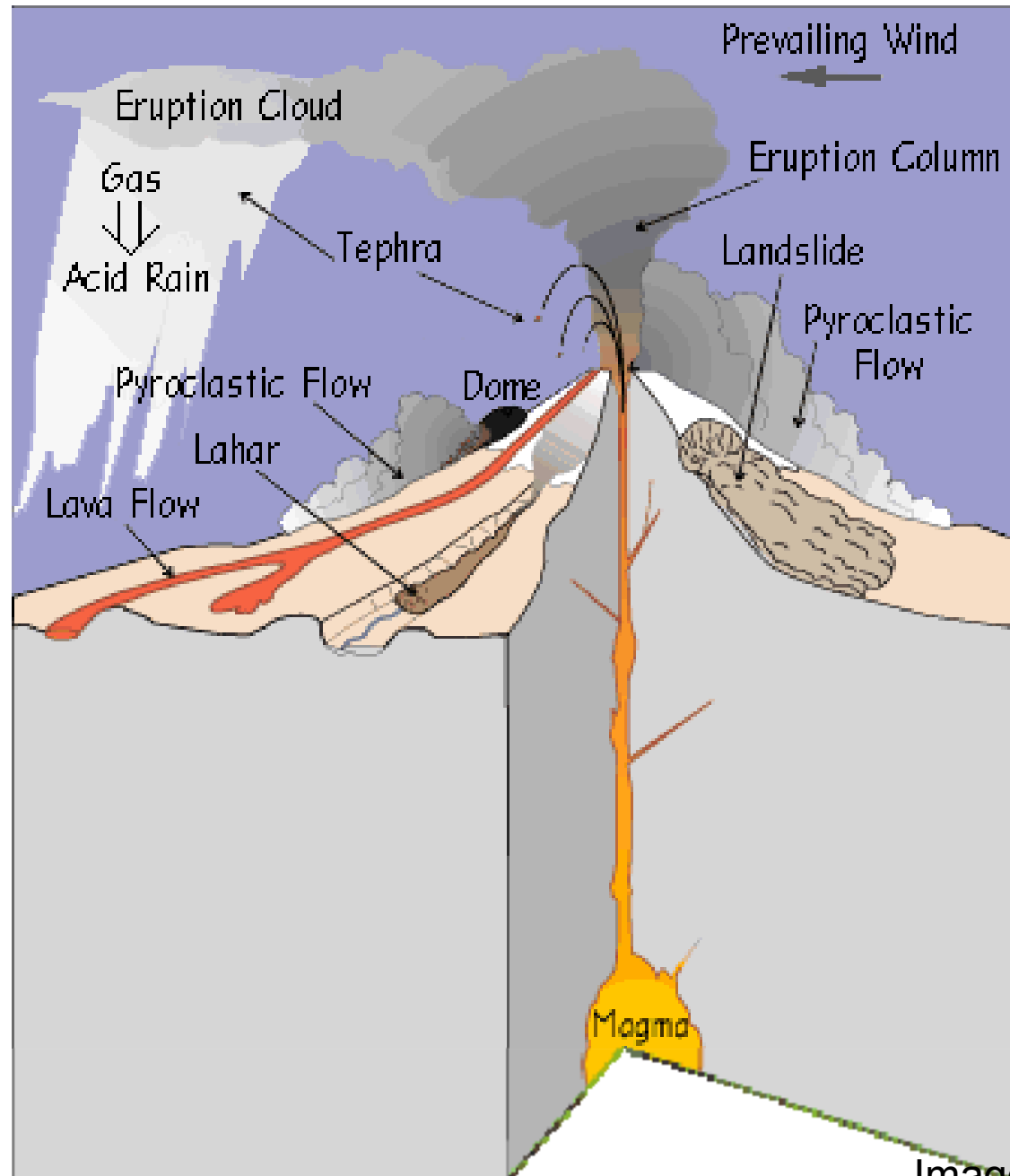


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Volcanic ash hazards to aviation

Mitigation

color coded warning:

http://www.avo.alaska.edu/color_codes.php

volcanic activity reports:

<http://www.avo.alaska.edu/activity/>

MIT OpenCourseWare
<http://ocw.mit.edu>

12.103 Science and Policy of Natural Hazards
Spring 2010

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