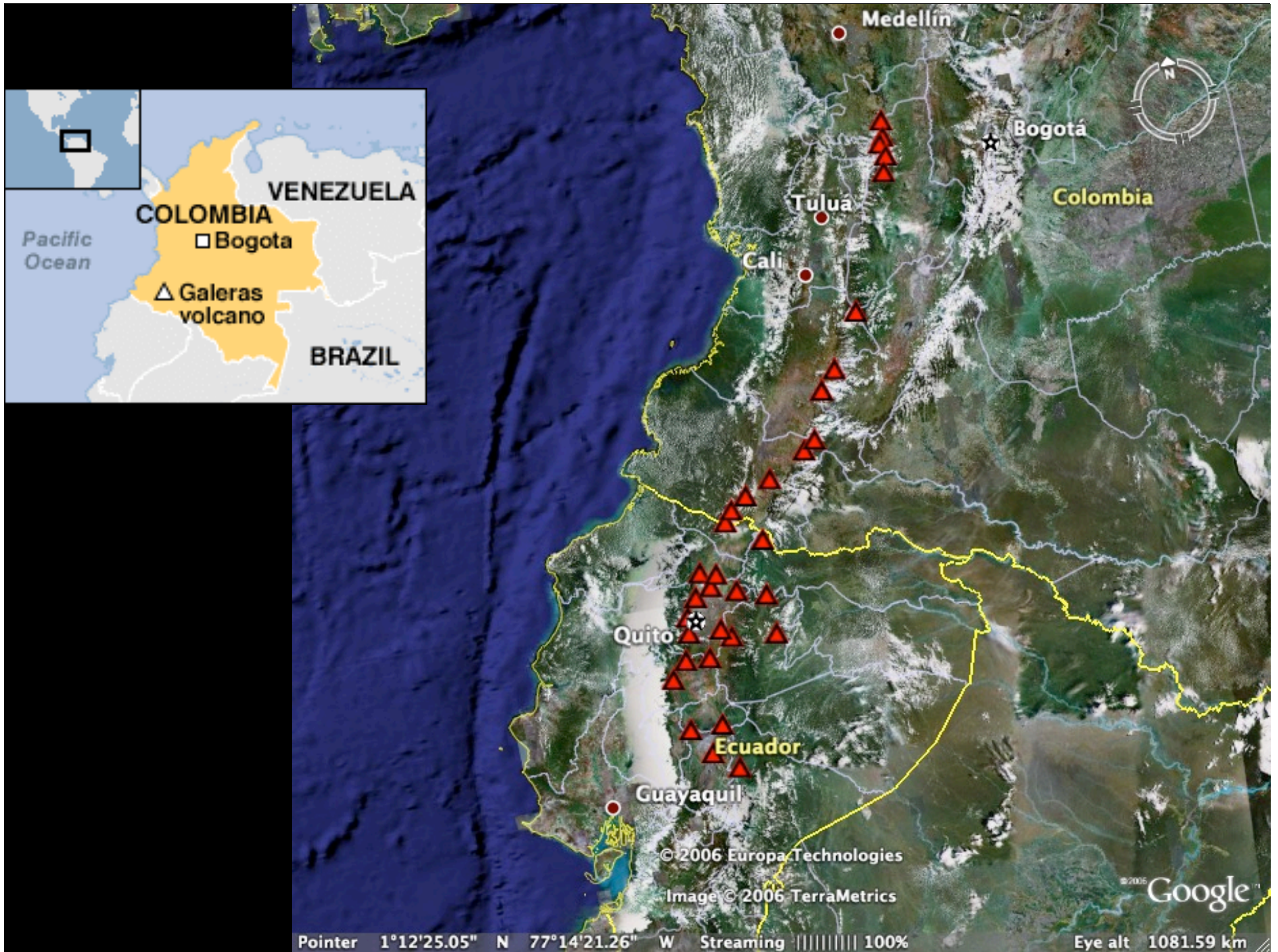


Galeras, 1993: The Role of Scientists in Hazard Mitigation

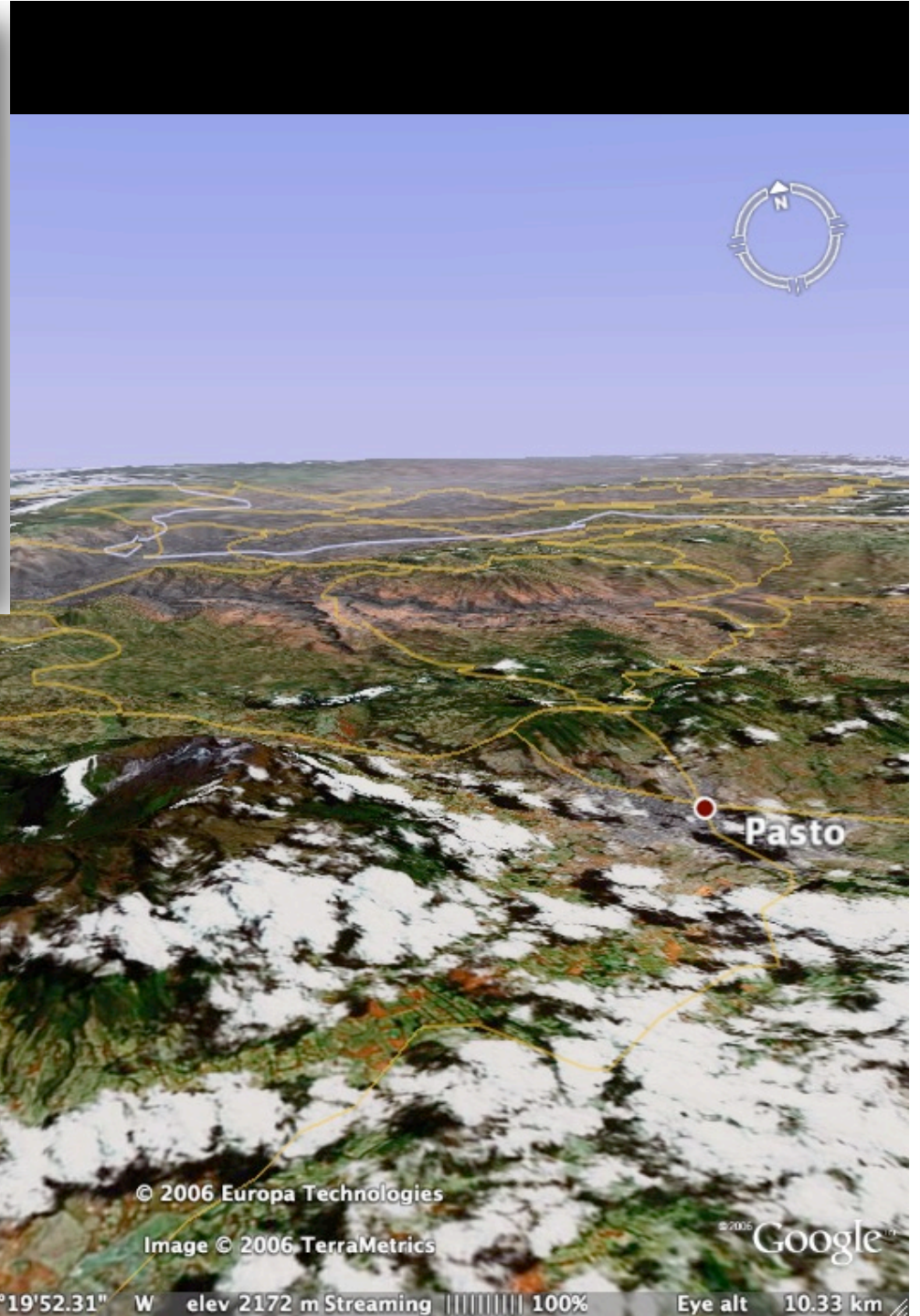
Lecture Objectives

- What was the attitude of scientists towards hazards and mitigation?
- What technological and communication problems existed?
- How did leadership, or lack of, impact the disasters?
- What could be done better (specifically)?
- How might these events affect future mitigation approaches?



Pointer 1°12'25.05" N 77°14'21.26" W Streaming 100%

Eye alt 1081.59 km

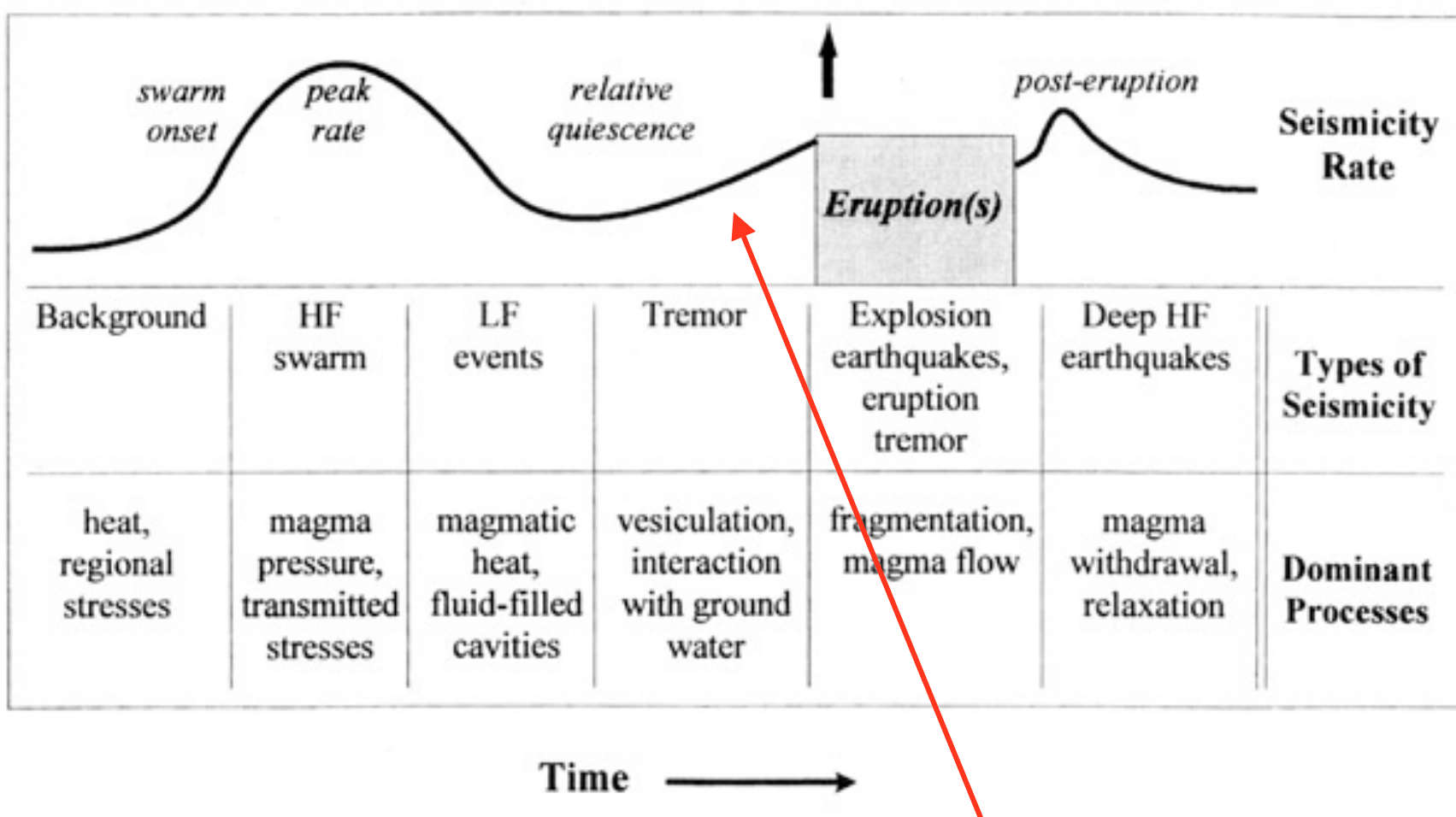


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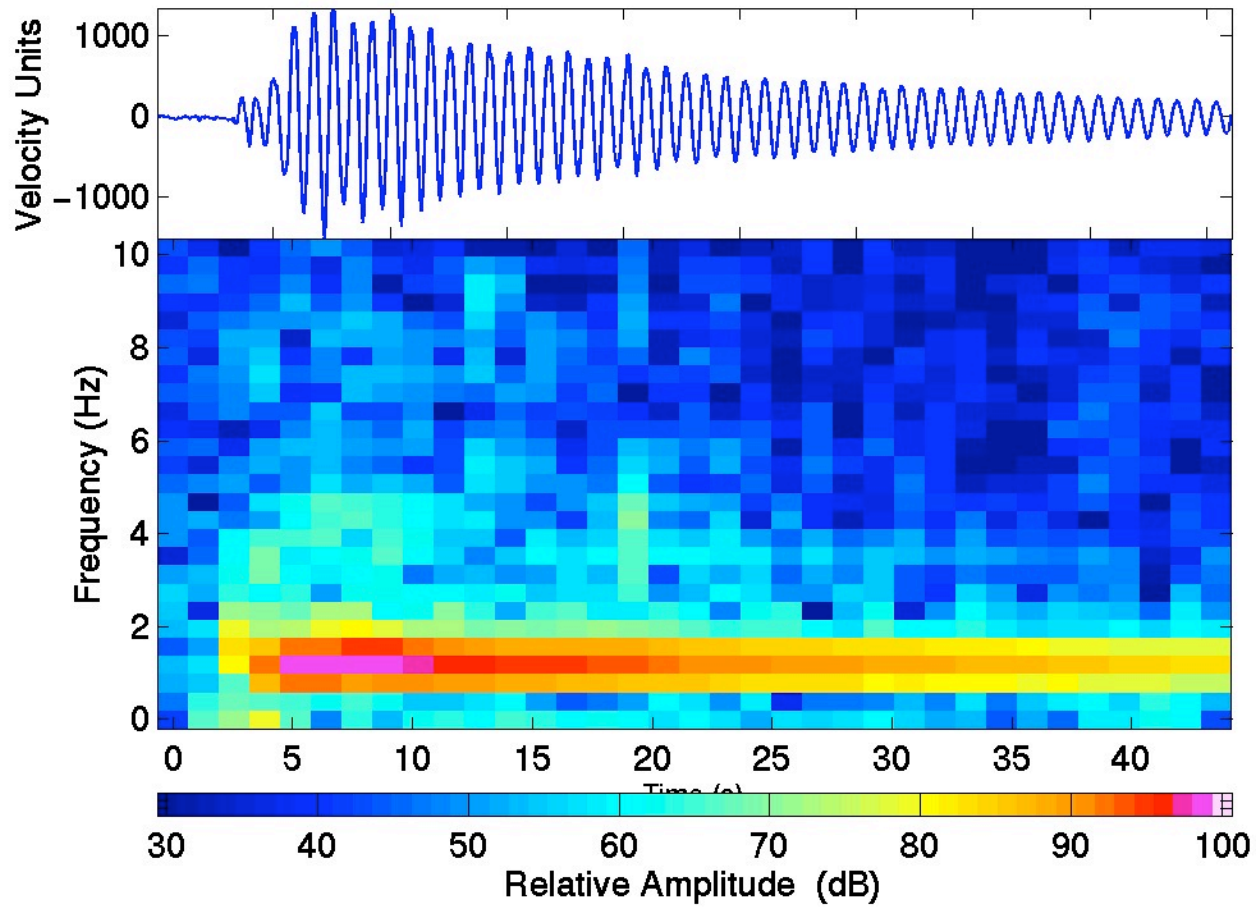
Pointer 1°17'39.35" N 77°19'52.31" W elev 2172 m Streaming ||||| 100% Eye alt 10.33 km



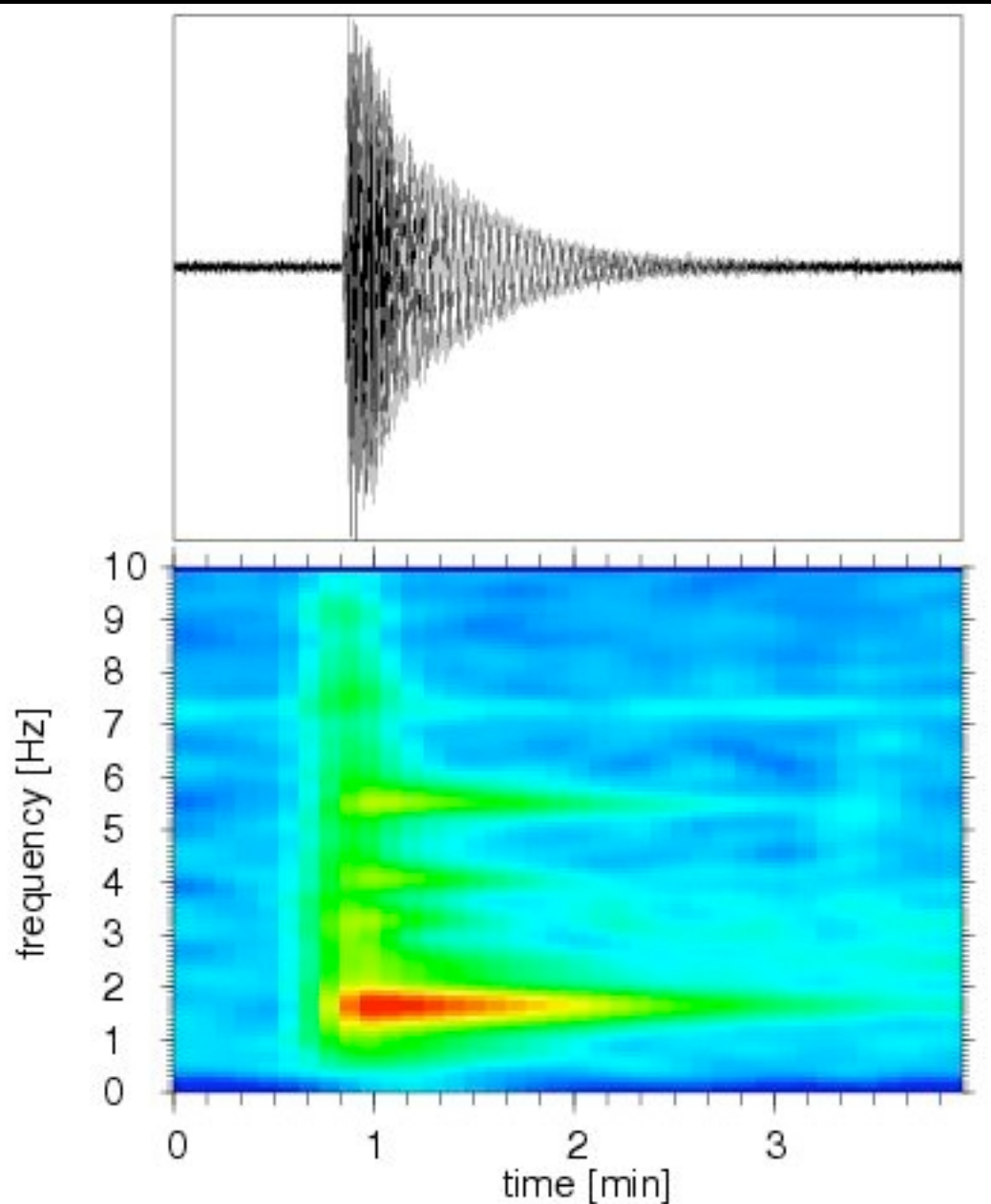
Tornillos

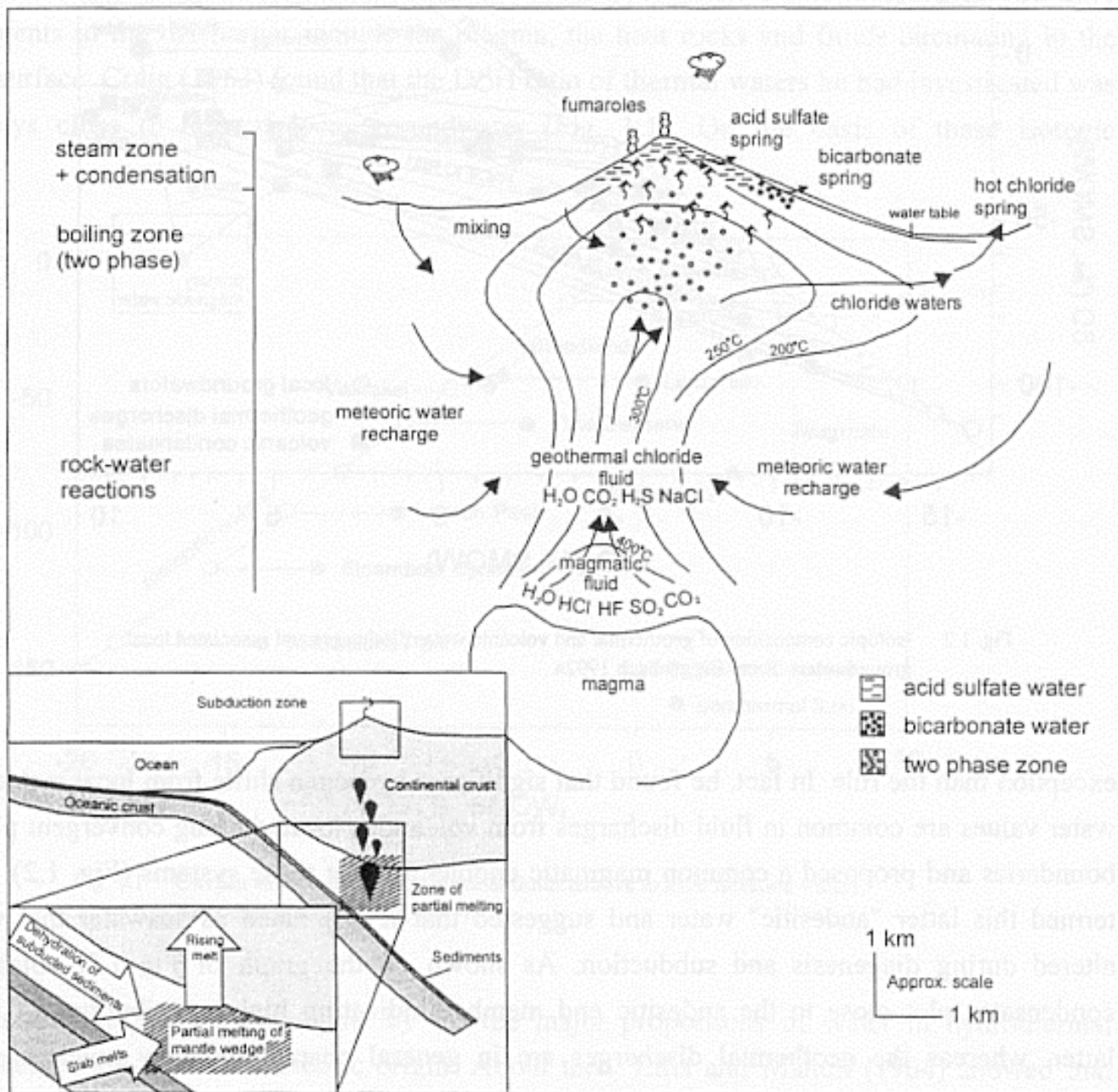
General model of seismic precursors; monitoring looks for changes in frequency, magnitude and type of events to help characterize and ultimately predict upcoming eruptions.

Tornillos



Real tornillos have a range of frequencies, but the dominant form is low (1-2 Hz)

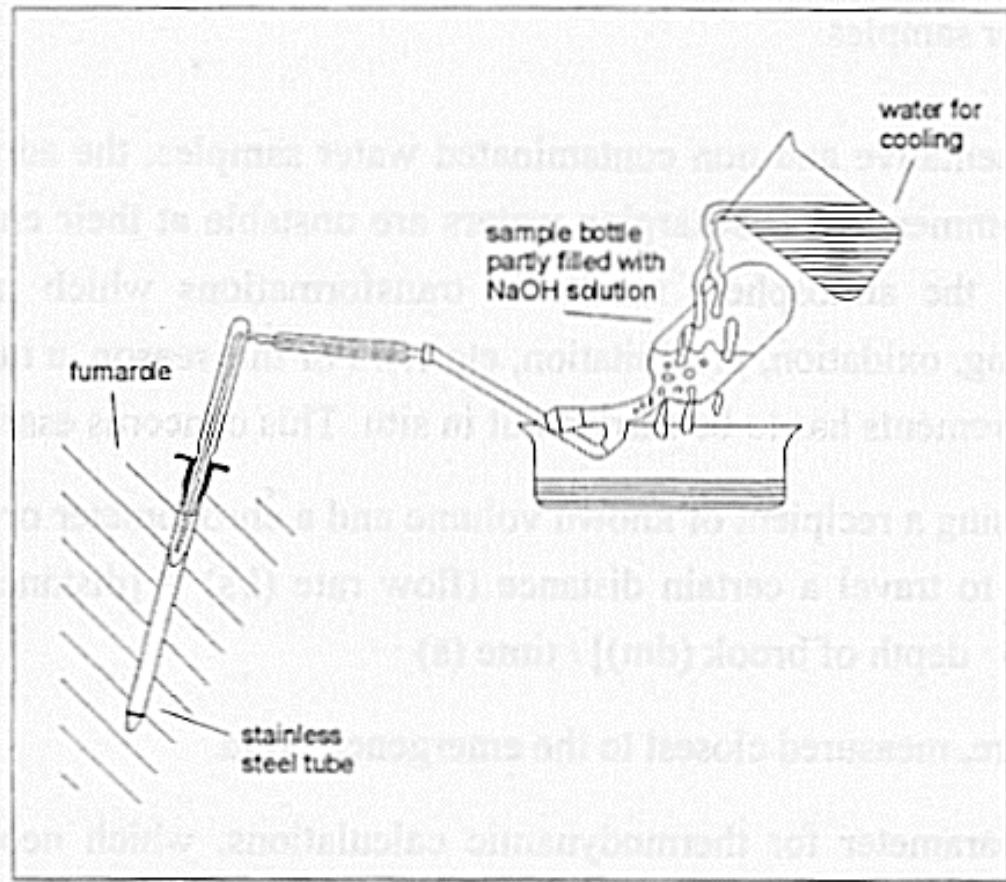




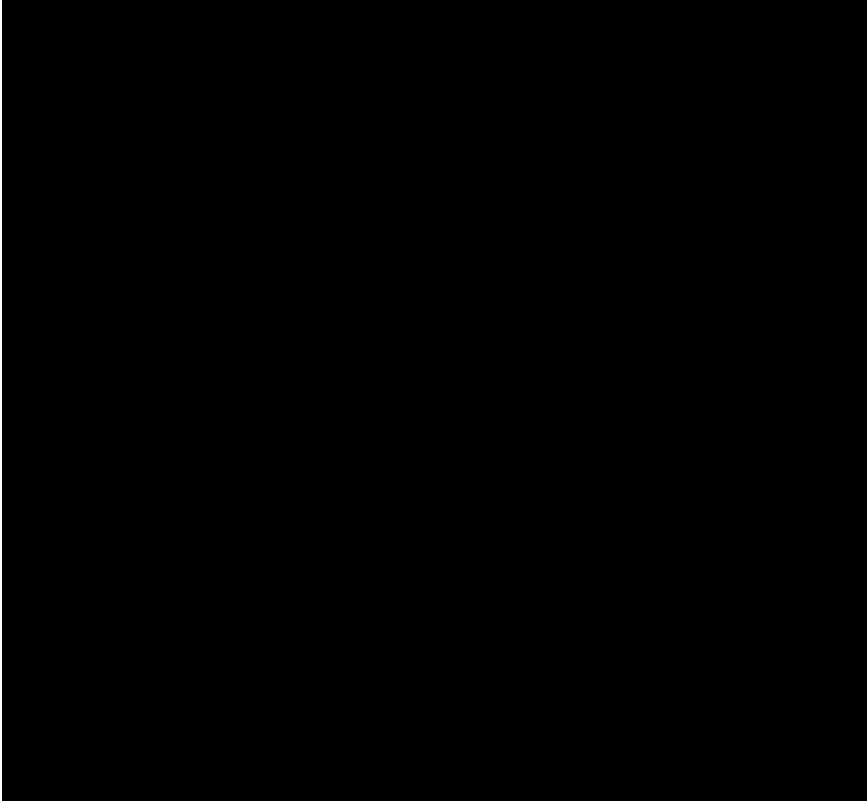
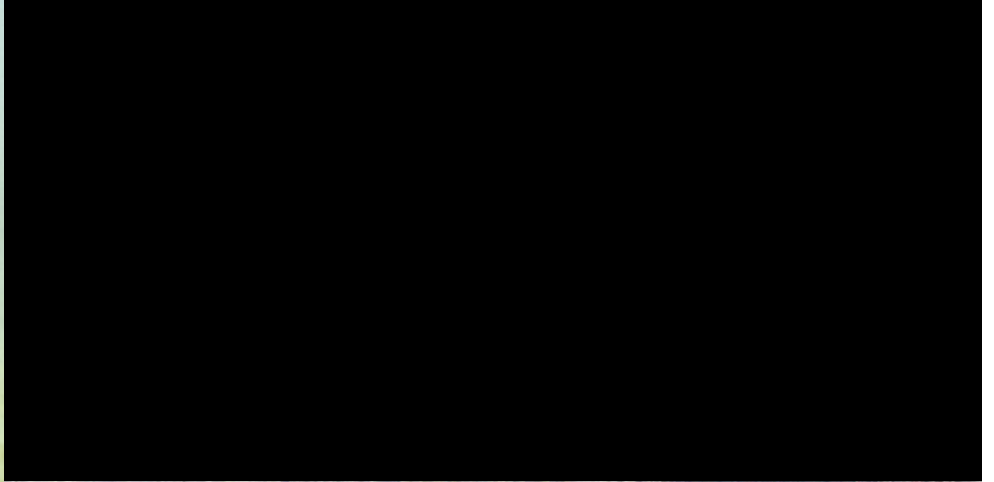
Order of gas release by magma bodies (solubility):

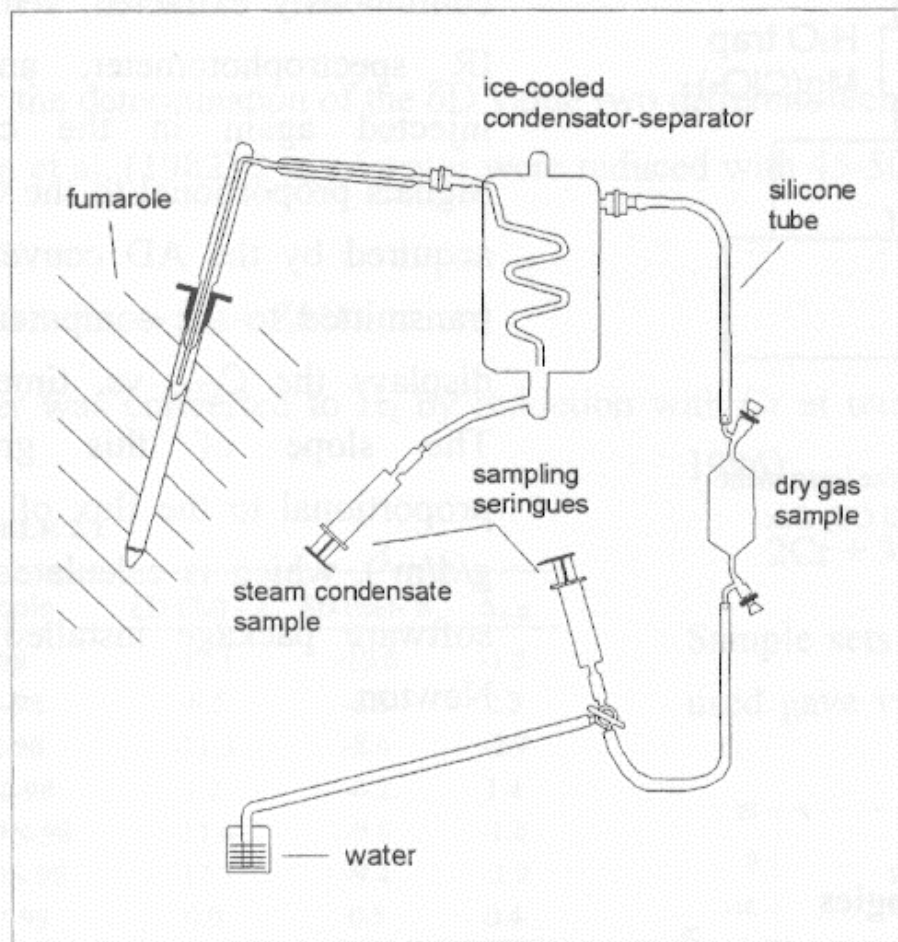
H_2O
 CO_2
 SO_2
 HCl
 F

Direct gas sampling: very difficult!



The fumarolic gas is allowed to enter the bottle by slowly opening the valve. Then, the valve must be regulated to have a high gas flow entering the bottle, to minimize water loss due to condensation. Condensation cannot be avoided, but the drops of steam condensate, which form in the pipes, have to be transferred to the bottle. The bottle must be held with the entrance down, in order to allow interaction between the gas and the alkaline solution. This interaction brings about condensation of water vapor (the process has to be favored by cooling the bottle with cold water) while the acidic gases (CO_2 and H_2S in geothermal gases, plus SO_2 , HCl , and HF in volcanic gases) are absorbed in the alkaline solution.

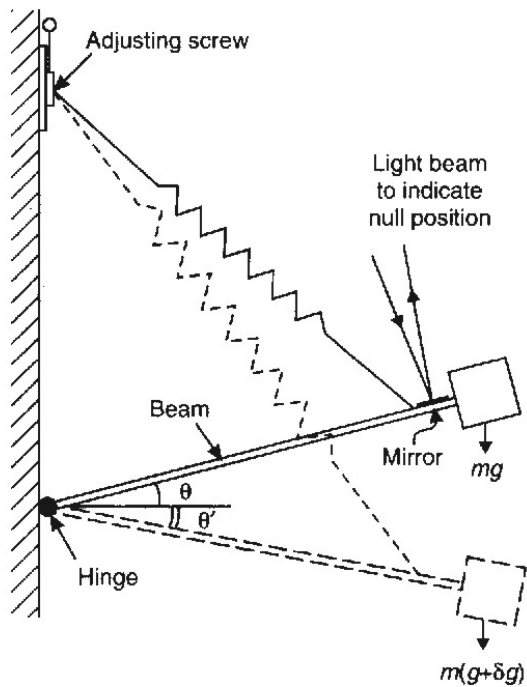
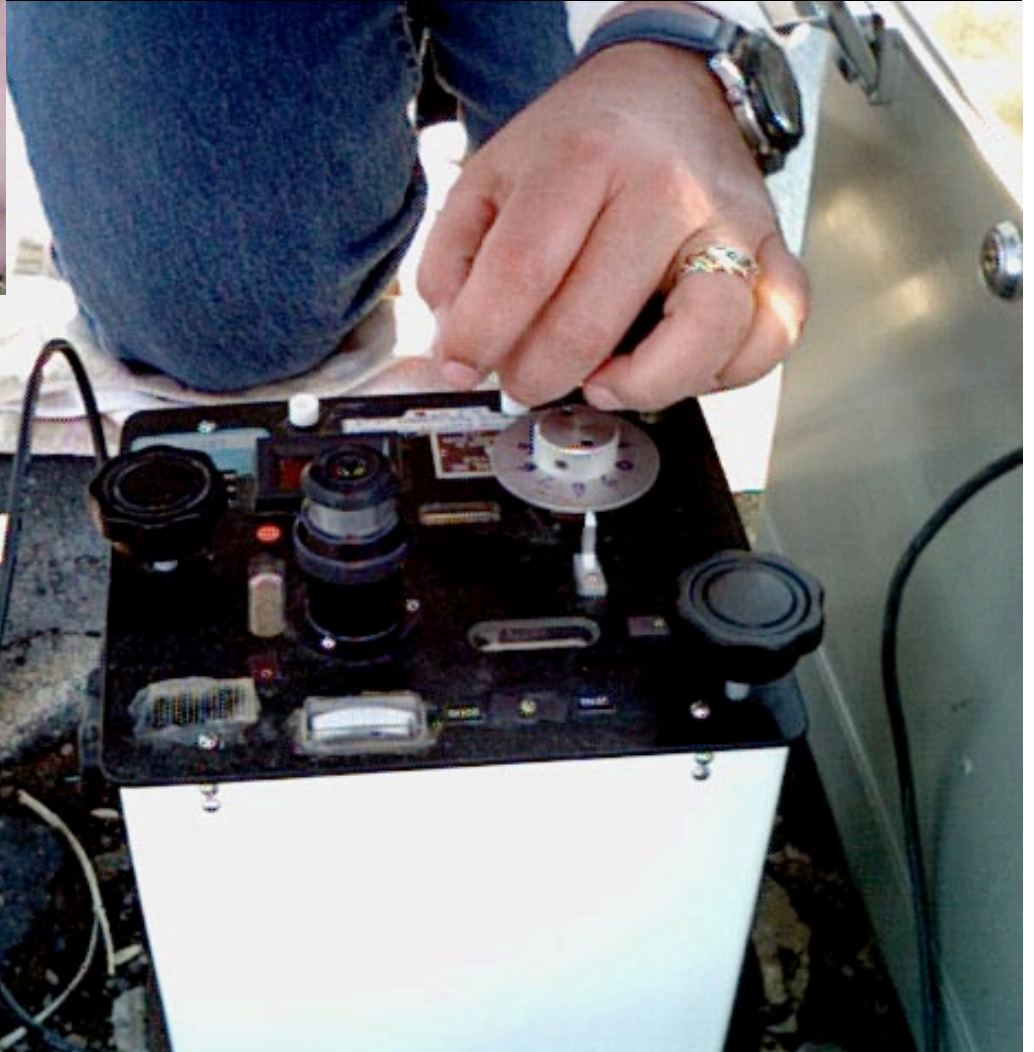




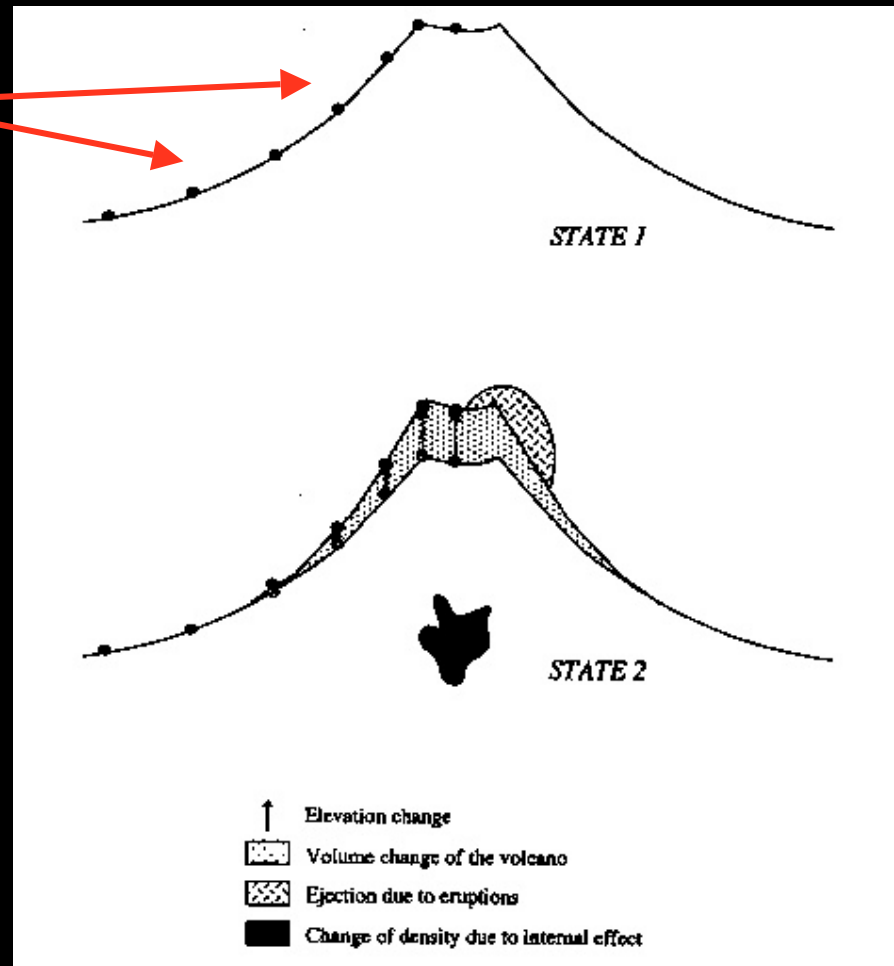
A disadvantage of the NaOH procedure is the reaction of excess NaOH with CO to produce sodium formate. For CO determination, separate samples have to be collected, downstream of a condenser-separator, which is cooled with either boiling diethyl ether or ice + liquid water or just water. Use of ether or ice maintains condensation temperature constant at 38°C or 0°C, respectively, whereas if water is used, condensation temperature must be checked and kept constant by regulating the water flow.

Gravimeter

Measures the changes in gravity, based upon the variation of densities in the ground, originally by determining the deflection of a cantilever towards the earth.



Measurement points



Gravity may change on volcanoes because of:

- deformation of the volcano
- displacement of mass at the surface or within the edifice (water, magma)
- change in density within the edifice

Gravity measurements from November 1997 to May 1998, and model interpretations (Komagatake volcano, Hokkaido, Japan)

observations

