



## Monitoring of volcanic gases and particles with passive samplers

### Particles

- Sampling by Sigma-2 passive sampler
- Suitable for particles with a diameter of 2.5 – 80  $\mu\text{m}$
- Determination of mass concentrations using optical microscopy
- Particle characterization based on morpho-chemical SEM/EDX analysis
- After the VDI 2119:2013 guideline

### Gases

- Sampling by diffusion.
- Suitable for  $\text{SO}_2$ ,  $\text{H}_2\text{S}$ ,  $\text{CO}$ ,  $\text{HF}$ ,  $\text{HCl}$  and other gases
- Determination of concentrations using spectrophotometry and ionchromatography
- In cooperation with:

**passam ag**

Laboratory for environmental analysis

### Ideal for electricity independant...

- ... mapping of gases and particles
- ... examination of critical concentration values
- ... studies on resuspension of volcanic particles
- ... studies on the impact of volcanic emissions on the environment
- ... etc

### Contact us:

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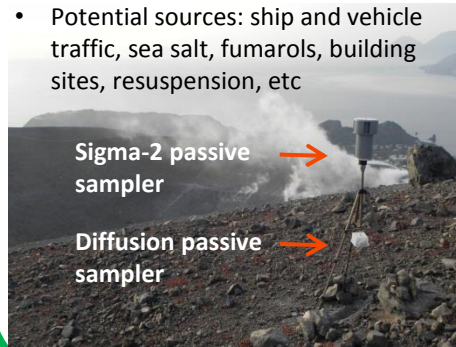
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# Case study: Does the activity at Vulcano (Eolian Islands, Italy) represent a potential health threat for inhabitants and tourists?

## Measuring concept

### Sampling

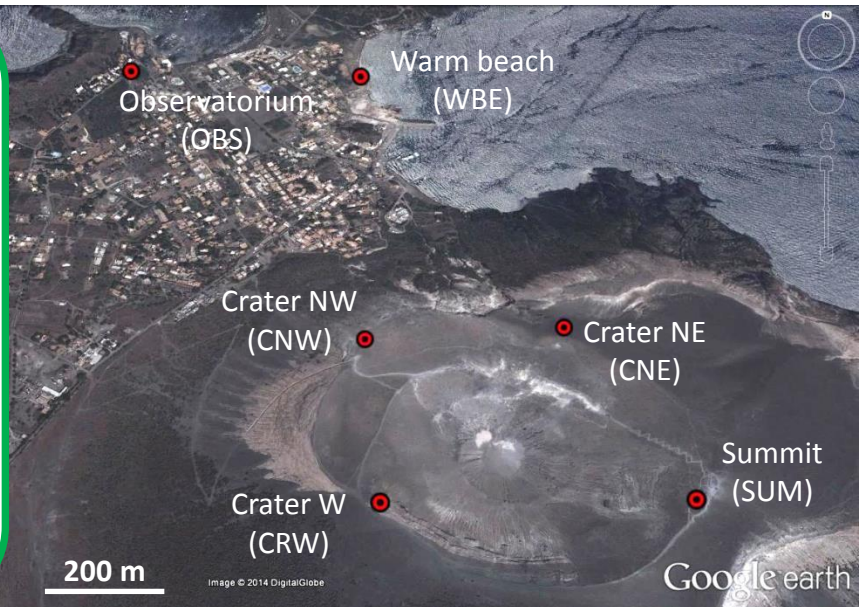
- 6 sites on Vulcano (measuring interval: 5 days)
- Sigma-2 passive sampler for particles
- Diffusive sampler for SO<sub>2</sub>, H<sub>2</sub>S, CO, HF, HCl und NO<sub>2</sub>
- Potential sources: ship and vehicle traffic, sea salt, fumarols, building sites, resuspension, etc



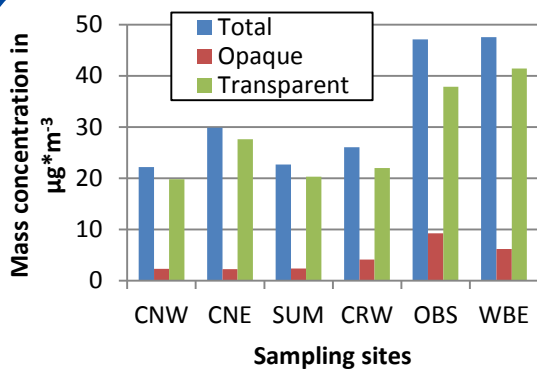
Sigma-2 passive sampler

Diffusion passive sampler

Sampling site: «Summit»

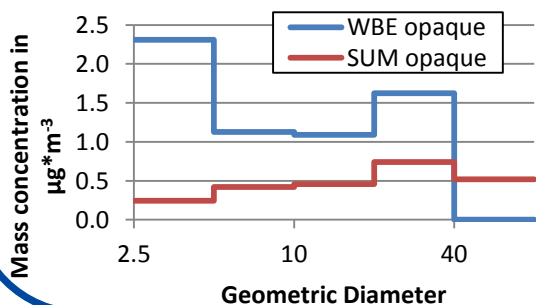


## Particle analyses



**Above:** Mass concentrations of transparent and opaque particles with geometric diameters of 2.5 - 80 µm, obtained by light microscopy analysis. The morphochemical analyses using SEM/EDX show that the mineral dust is dominated by silicates and Na-chlorides.

**Below:** Size dependant mass concentration of opaque particles at sampling sites «Summit» and «Warm beach». The different distributions are the result of different sources and processes of formation.



## Gas analyses

Concentrations in µg m<sup>-3</sup> of sampled gases

	H <sub>2</sub> S	SO <sub>2</sub>	NO <sub>2</sub>	CO	HCl	HF
CNW	81.0	324.3	5.0	5.0	0.1	0.9
CNE	90.3	477.4	-	9.0	0.9	0.2
SUM	13.4	84.6	-	3.0	0.7	2.4
CRW	16.1	106.1	2.8	2.4	0.7	0.1
OBS	2.6	0.4	5.6	0.7	0.1	2.0
WBE	105.5	800.2	15.8	15.1	0.9	0.2

## Some Conclusions

- The highest concentrations of volcanic gases (H<sub>2</sub>S and SO<sub>2</sub>) have been determined at sites located close to fumaroles. Some WHO limit values are exceeded at the site «Warm beach», which is highly frequented by tourists. **Therefore a potential health threat exists.**
- The high concentrations of NO<sub>2</sub> and opaque particles at the sites «Warm beach» and «Observatory» are interpreted as a result of anthropogenic sources (traffic, building sites etc.)
- The dominant particle classes in terms of mass concentration are silicates and Na-chlorides.
- Most volcanic particles represent resuspended particles.

**Passive sampling of gases and particles are powerful methods for volcanological studies.**