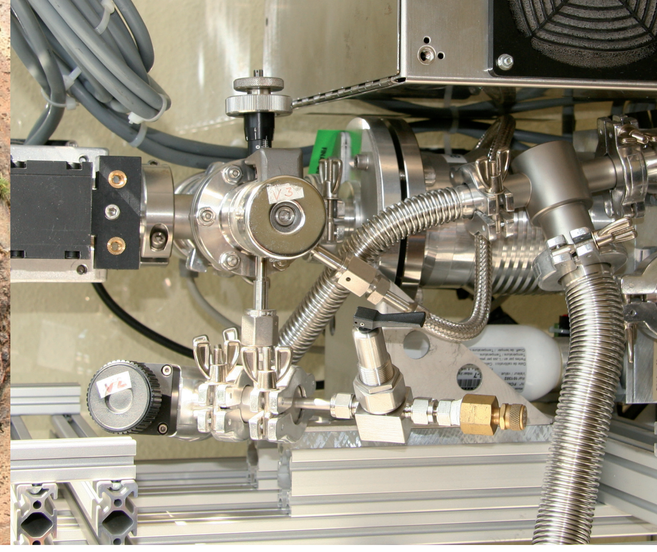
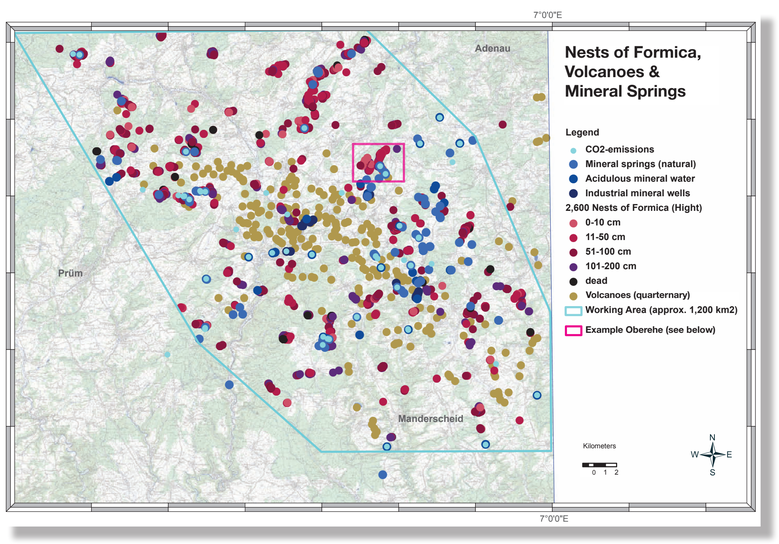


UNIVERSITÄT
DUISBURG
ESSEN

Detection of Gas permeable Strike-Slip Faults by means of Bioindicators (Hill-building Forest Ants) and Gas Analyses in the Volcanic West- and Hocheifel (Germany)

Nests of hill-building forest ants (*Formica rufa, Formica polyctena, Formica pratensis*) are a suitable tool for the detection of neogen tectonic structures in areas with less geological outcrops, e. g. the volcanic West- and Hocheifel (Germany). Their linear allocation trace obviously active fracture zones. The objective is to establish this mapping approach as a geological tool.



▲ ***Working area in the volcanic West- and Hocheifel***

More than 2,600 ant nests were recorded by GPS and mapped on fault zones in 2008/2009. In-line allocations allow to trace strike-slip faults over km-distances. Cluster of more than 100 ant nests picture the main stress directions.

Three main structure systems (NNE-SSW, NW-SE and WNW-ESE) indicated by recent NW-SE stress field, are the dominant fracture zones in the Western Eifel. Secondarily N-S fracture zones appear, corresponding to the "Eifel Nord-Süd-Zone". Only a few faults are accompanied by idiomorphic postvariscian quartz and ore mineralization. Slickensides can be measured sporadically.

Additionally, working area-wide gas analyses (CO_2, He and Rn) of 56 mineral springs and 125 soil gas sampling locations (1 m depth) were performed.

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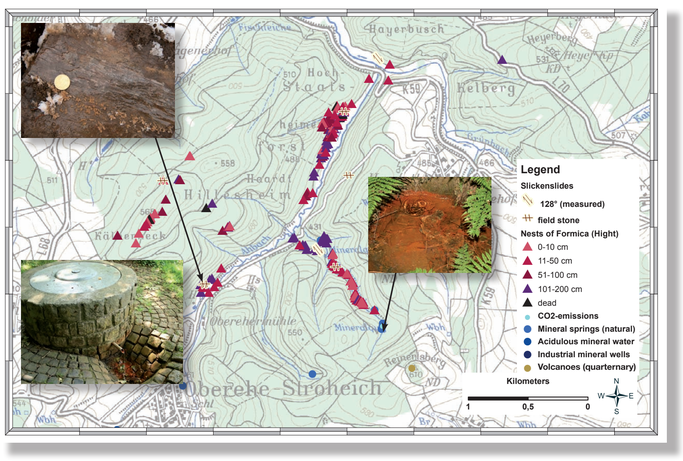
Example: Location of Oberehe

The ant nests in Oberehe show the ideal track of two almost perpendicularly located fault systems. The NNE-SSW orientated (30°) fault system (3 km-distance) is pictured by 145 ant nests along the Ahbach valley.

The NW-SE direction (128°-fault system) is followed on a 1-km-distance by 65 nests.

Several mineral springs and slickensides could be detected.

Gas analyses of one mineral spring and of 111 soil gas sampling locations were performed. Helium was analyzed via a mass spectrometer, Radon via a Lucas detector. CO_2 was measured by a mobile Dräger gas analyzer.



Results:

- Radon values (> 50 Bq/l) in combination with high CO_2 values (up to 15 Vol %) and Helium values (up to 5,700 ppb) in soil gas characterize the fault system at Oberehe.
- Ant nests only exist, if CO_2-concentrations are between 5 and 7 Vol % and Radon-concentrations do not exceed ≈50 Bq/l in the soil air.
- Ant mapping is a geological tool to identify directions of fault systems, if a terrain is afforested and/or outcrops are missing.
- Additional gas analyses (Helium, Radon and CO_2) of mineral springs and/or soil gas picture the direction of the fault system very well.

Oberehe: Results of ant mapping and gas analyses