Hill-building forest ants (Formicinae) indicate strike fault zones, a geosphere-biosphere interaction?

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During investigations of neogen tectonics in different places in Germany, a noticable linear arrangement of nests of hill-building forest ants (*Formica rufa, Formica polyctena, Formica pratensis*) was observed. This linear distribution is obviously linked to active fracture zones.

Ecological habitat requirements of formicines range from topographical parameters to climatic factors, soil and vegetation. Whether ant's site selection is linked to fault zones is not described yet. But it should be noted that correlations between formicines and geological factors are discussed in the 1930's and 1960's.

Studies in the Middle Rhine Region (MRR) near Koblenz in 2005 show that there is a correlation between ant nests and faults. 252 nests were detected on fault zones and 131 on inter fault zones. But some of the inter fault zone locations are potentially covered fault zones. The diameter and height of ant nests as much as the ant nests volumes, which represent the size of population, is significantly different on fault zones and inter fault zones (Student t-test; nest height: F=22,414, t=-1,774, P=<0,0001; nest diameter: F=23,033, t=-2,222; P=<0,0001; nest volume: F=23,412, t=-2,25, P=<0,0001). A similar occurrence could recently be noticed on the North Sea island Amrum in June 2006.

Geological studies at the MMR show that WNW-ESE structures, triggered by the recent NW-SE (s_{Hmax}) stress field, are the dominant main fracture zone. The faults are accompanied by idiomorphic postvariscian quartz and ore mineralization. Soil gas measurements are used to locate trends of covert fault zones. These gas samples were taken in 1 m depth and analysed with a portable He mass spectrometer. Above deep reaching fracture zones He-concentrations are more than 100 to 200 $ppb_{(v)}$ higher than the atmospheric concentration (5220 $ppb_{(v)}$)[1].

This observation is a subject of considerable debate. Fractures often induce discontinuities of geophysical and geochemical parameters and lithology. Therefore thermoregulation, water supply or ascending soil gases like radon, helium, carbon dioxide, hydrogen, methane and trace gases with halogenides contingently driven by seismically events [2] are potentially responsible for this site selection. Helium for example could support the absorption of oxygen and alter the rate of respiratory gas exchange in certain insects [3].

References

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