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# First Results of 1 Year Monitoring of Red Wood Ant Behaviour as Short-term (> 1h) Indicators for Earthquake Prediction

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Short-term earthquake prediction with an advance warning of several hours or days are currently not possible for technical reasons. Abnormal animal behaviours before earthquakes have been reported previously but create problems in monitoring and reliability. The situation is different with red wood ants (RWA) of the genus Formica. They have stationary nest sites on tectonic active, gas-bearing fault systems (Berberich & Schreiber 2009). These faults may be potential earthquake areas and are simultaneously information channels into the deep crust. A particular advantage of the RWA are their high sensitivity to environmental changes. They also have excellent chemo-receptors for the detection of CO2-concentrations and determination of humidity levels. Furthermore, they have an extremely strong sensitivity for temperature differences (0.25 °C) and a magnetic field sensitivity (Camlitepe et al. 2005), which enables the insects to detect changes of the electromagnetic fields. Changes of the electromagnetic fields are discussed as a precursor phenomenon of earthquakes. The fact that an enhanced CO2-degassing by earthquakes that could kill the ant population in the nest, may plausible explain the evolutionary developed sensitivity as precursor phenomena of RWA.

Over a period of 15 and 12 months respectively, two nests of the genus Formica (F. polyctena and F. pratensis) which are located at the edge of the seismically active Neuwied Basin (East Eifel, Germany) are currently being monitored 24/7 with high-resolution colour and infrared cameras. In the Neuwied Basin, an average of about 100 earthquakes per year with magnitudes up to M 3.5 occurs. The nests are located on two different fault systems about 30 km apart. Meanwhile, more than 15,000 of hours of video of both monitoring stations are analyzed. First results of this long-term observations show that ants have a well-identifiable standard daily-routine. This can be characterized by an M-shaped curve best: At dawn, the activity rises until about 11 a.m. on the top of the nest. Activity peaks can be observed at midday and in the late afternoon. During the evening the activity is reduced again. Additional parameters that might have a negative influence on the ant daily-routine (including climate data, geotectonic and biological parameters) are recorded and correlated with the calculated daily activity. Furthermore, a data logger continuously recording the temperature and humidity was placed inside the nest allowing a direct comparison of climate data. In addition and at regular intervals, nest air measurements (CO2, Helium, Radon, H2S and CH4) are performed and the nest surface temperature is recorded by a thermal infrared camera.

The standard daily-routine was correlated with local seismic events. During the observation period, four magnitude > 2.0 earthquakes occur. Significant changes in the ant's behaviour were monitored hours before the earthquake occurred. These changes were expressed in the suppression of the nocturnal rest phase. The ants did not go back into their nest, but stayed hours before the earthquake occurred at an intermediate activity level on the nest top. The daily activity peaks were also changed to a medium level. The standardized daily routine was only actually continued the next day. The investigation and results presented here are a first access to a completely new research complex. The key question is whether the ant's behaviour can be monitored before an earthquake significantly and technically. Long-term studies have to show whether confounding factors and climatic influences can clearly be distinguished. The first results show that it makes sense to consolidate and extend the research to determine a pattern for exceptional situations, which can be used as the basis for an earthquake warning system.

References:

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