Mofette plants: Can vegetation help in predicting earthquakes or volcanic eruptions?

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Mofettes (or natural CO_2 springs, NCDS) are geogenic CO_2-emissions consisting of pure gaseous carbon dioxide sometimes contaminated with traces of CO, CH_4 or even H_2S. Independent of the origin of the CO_2(which may be earth mantle or crust) the emitted gas influences organismic life on the earth surface. After leaving the soil medium, the gas is either immediately diluted by winds and therefore has no direct consequences for life, or, as CO_2 is heavier than air, it forms transient gas lakes (depending on surface morphology) greatly influencing life in the surroundings of the vents. Above concentrations of 8-10% CO_2 irritates animals leading to a loss in consciousness and to death because of anoxia or acidosis if concentrations exceed 15-20%. Plants are not that sensitive and some species are able to tolerate CO_2 concentrations as high as 100% for a certain period. Several distinct plant species are indicative for mofette fields and for changes within the emission regime. Sometimes mofettes can therefore be distinguished from their surroundings due to their specific vegetation regime. In some special mofettes, plants form concentric rings around the CO_2 vents which correlate with the CO_2 concentration within the rooting zone. Aside from changes in species composition, plants occurring within mofettes reveal differences in habitus and growth. The closer the plants grow to the emitting CO_2 vents the smaller they get. Growth reduction is often accompanied by a slight chlorosis. Plants also react physiologically to changes in atmospheric/geogenic CO_2. At concentrations between 0 and 3000 ppm plants increase photosynthesis with increasing CO_2. Yet, when CO_2 concentrations reach the percentage range (5-10%) photosynthesis gets reduced. A further increase in carbon dioxide may lead to a total (but mostly transient) loss of photosynthesis. This is the case in and around mofettes where CO_2 concentrations may far exceed 90%. Plants can thus react in two main ways to CO_2 extremes: (i) with **fast** physiological/biochemical reactions e.g. photosynthesis or respiration; reactions that are obvious and can be monitored within a few **minutes to hours** using special equipment and (ii) with **slow** reactions like chlorosis or changes in growth; reactions that will be evident after **days/weeks or months**. There is some evidence in E-Germany (Vogtland) and NW-Czech Republic (Cheb basin) that pre-earthquake events may change the geogenic gas composition and the overall CO_2 gas flux to the atmosphere. If this change would be large enough, vegetation could be used to monitor or indicate earthquake related reactions.

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