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Spatio-temporal patterns of radon along the western fault of the Dead Sea Transform, NW Dead Sea

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An extensive and strong radon anomaly is developed along the western boundary fault of the Dead Sea Transform in the NW sector of the Dead Sea. The anomaly, extending 15-20 km north-south, is developed in the gravel to the east and adjacent to the exposed boundary fault. The highest radon values occur in proximity to the fault scarp composed of Mesozoic carbonates. Using gamma and alpha detectors radon (Rn-222) is measured in the gravel at several sites, at depths of 1.5 -3 meters, at a time resolution of <1 hour. Relative to the main tectonic element these sites are located at a) on-fault positions, in the range of 1-30 meters to the east of the fault scarp, and b) off-fault positions located 600 and 800 meters east of the fault. The large variability of radon encountered entails systematic spatial and temporal patterns. Prominent signals occur in the annual and daily periodicity bands, as well as non-periodic multi-day variations (2-20 days). A multi-year trend is indicated at one site. Modulations occur among the different signal types. The annual variation influences the multi-day and the daily signals, and the multi-day variation is modulating the daily signal. The overall variation patterns as well modulations between types of signals differ among sites. These are manifested primarily as dissimilar temporal variation patterns that occur at on-fault and off-fault sites. On-fault sites exhibit very prominent annual variations and relatively weak signals in the daily band. Off-fault sites exhibit mild to weak annual variation and relatively intense signals in the diurnal band. Within the diurnal periodicity band the relative amplitude of the S1 and S2 periodicities differs among the on- and off-fault sites. Decomposition of the signal types and inter-site comparison shows that: a) significantly different signal patterns occur perpendicular to the fault trace, at on- and off-fault positions which are several hundred meters apart; b) similar patterns, especially of the multi-day signals, are observed from sites 3 to15 km apart at on-fault positions. Bearing in mind that: a) semi-confined conditions exists at 2.5-3 meter depth; b) the uniformity of the host rock (gravel) at the sites; c) the uniformity of the local climatic conditions, and d) the similar emplacement of the sensors - it is concluded that: 1) the patterns and their modulations are similar to those encountered in experimental simulations using radon within confined volumes; 2) above surface atmospheric influences can be excluded as drivers of the signals; 3) a remote above surface influence probably drives the periodic components of nuclear radiation from radon in the annual and diurnal bands; 4) the latter signals as well as the multi-day signals are modified and inter-modulated by near field geological (static) and geophysical (dynamic) influences. So far the nature of these near field influences is unidentified. Still systematically different influences are operating at on-fault versus off-fault positions. If verified then a new aspect in geodynamic research is implied.