Geophysical Journal International

Geophys. J. Int. (2010) **180,** 651–665 doi: 10.1111/j.1365-246X.2009.04450.x

Radon signals in the Gavnunim intrusion, Makhtesh Ramon, Israel

G. Steinitz and O. Piatibratova

Geological Survey of Israel, Jerusalem, Israel. E-mail: steinitz@gsi.gov.il

Accepted 2009 November 6. Received 2009 October 14; in original form 2009 July 1

SUMMARY

High time resolution monitoring of radon, using alpha detectors is carried out in a massive and jointed syenite located in arid southern Israel. Monitoring, at a resolution of 15-min, is conducted in two boreholes at depths of 1.2 and 85–90 m, resulting in more then 10-yr long time-series. Systematic temporal variation patterns, manifesting large relative signals are composed primarily of annual (AR), multiday (MD), daily (DR) and subdaily (SDR) radon signals. Prominent periodic diurnal variation underlies the DR and probably also the SDR signals. Diurnal (S1; 24-hr) and semidiurnal (S2; 12-hr) constituents characterize the DR signal at 1.2 m, while diurnal constituents typical for gravity related periodicities (M2, O1) are absent. The amplitudes of the S1 and S2 constituents, calculated for consecutive 512-hr-long time intervals, exhibit a similar covarying annual pattern. The periodic DR signal is absent at 85 m depth. The peak time of SDR signals, occurring at this depth in some days, exhibits a 24- and 12-hr periodicity. Time offsets of hours are observed between time-series of the measured signal from the two levels. The lag, investigated for the decomposed MD signal, using consecutive 20-d-long time intervals, shows that the signal at depth systematically lags by around 9 hr the signal at the shallow level. Discrepancy of the patterns of the temporal variation in the time domain, and also in the frequency and time-frequency domains of the diurnal periodic components, indicates that atmospheric influence on the radon signal is insignificant even at a depth of 1.2 m. Combining this conclusion with the compound interrelations occurring among the different radon signals suggests that other geophysical processes are driving the radon variation in the subsurface geogas. It is suggested that the significant S1 and S2 signatures, and their modulations, are imposed on the radon system by means of a direct link with solar radiation tide. To the full article.....

Key words: Time-series analysis; Tides and planetary waves; Gas and hydrate systems.