Soil-gas radon monitoring in rehabilitated tailings from uranium ore processing: the case of the Urgeiriça old dam, Central Portugal

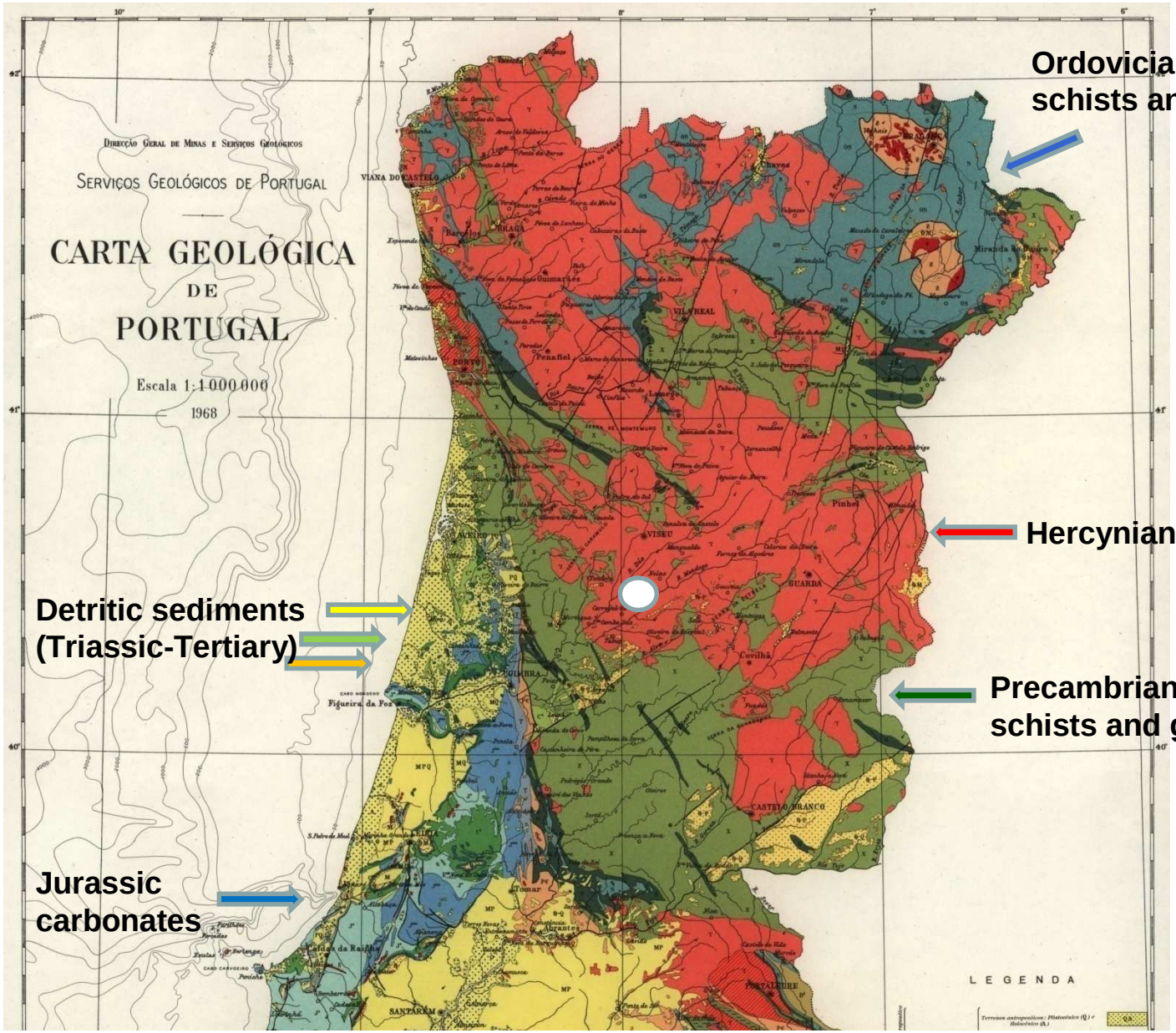
S. Barbosa[1], D. Correia[2], J. Nero[2], A. Pereira[3] & L. Neves[3]

[1] Institute D. Luis, University of Lisbon, Portugal
[2] EDM – Empresa de Desenvolvimento Mineiro, Lisboa, Portugal
[3] Laboratory of Natural Radioactivity, University of Coimbra, Portugal

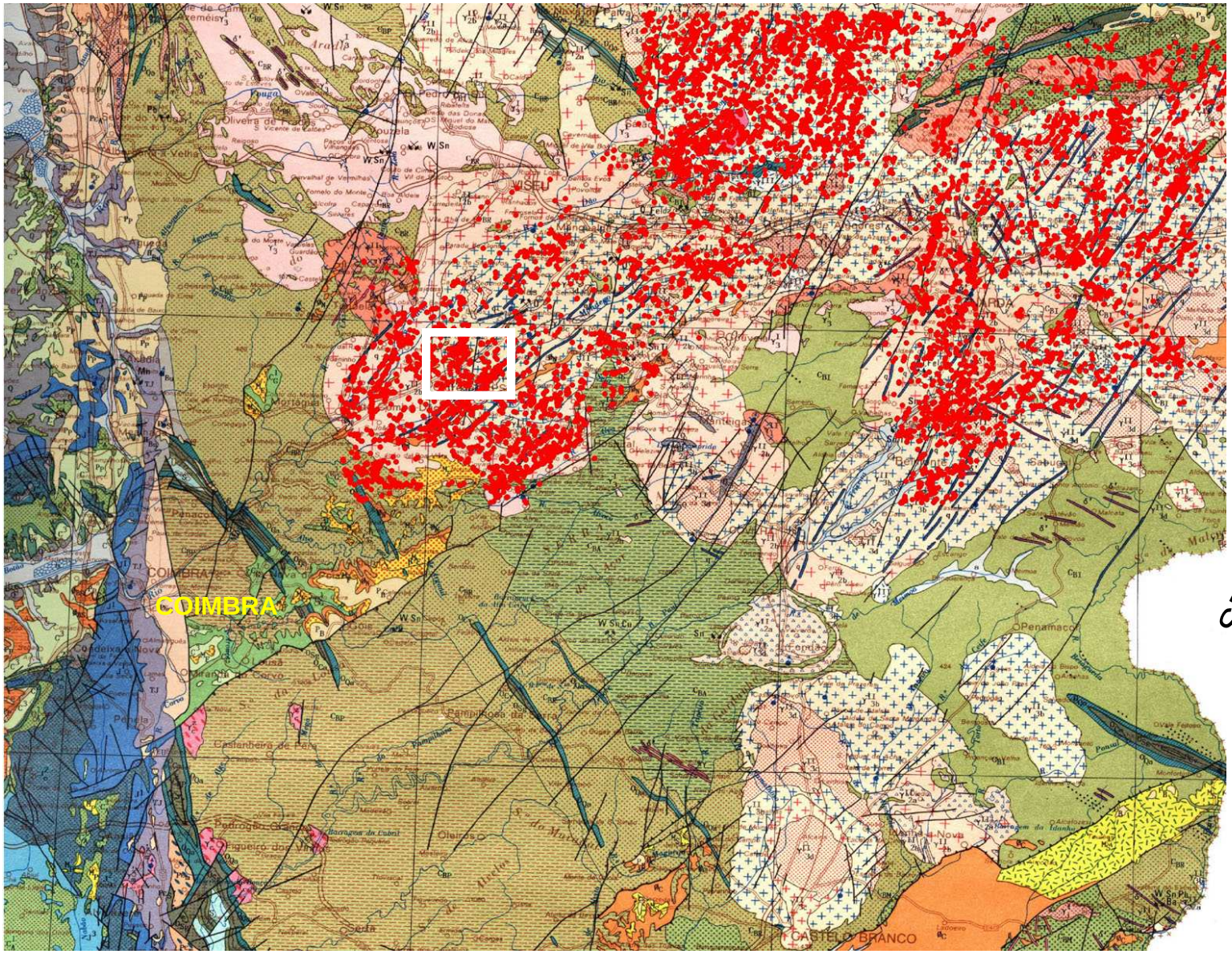
11th International Workshop on the Geological Aspects of Radon Risk Mapping

Geographic location

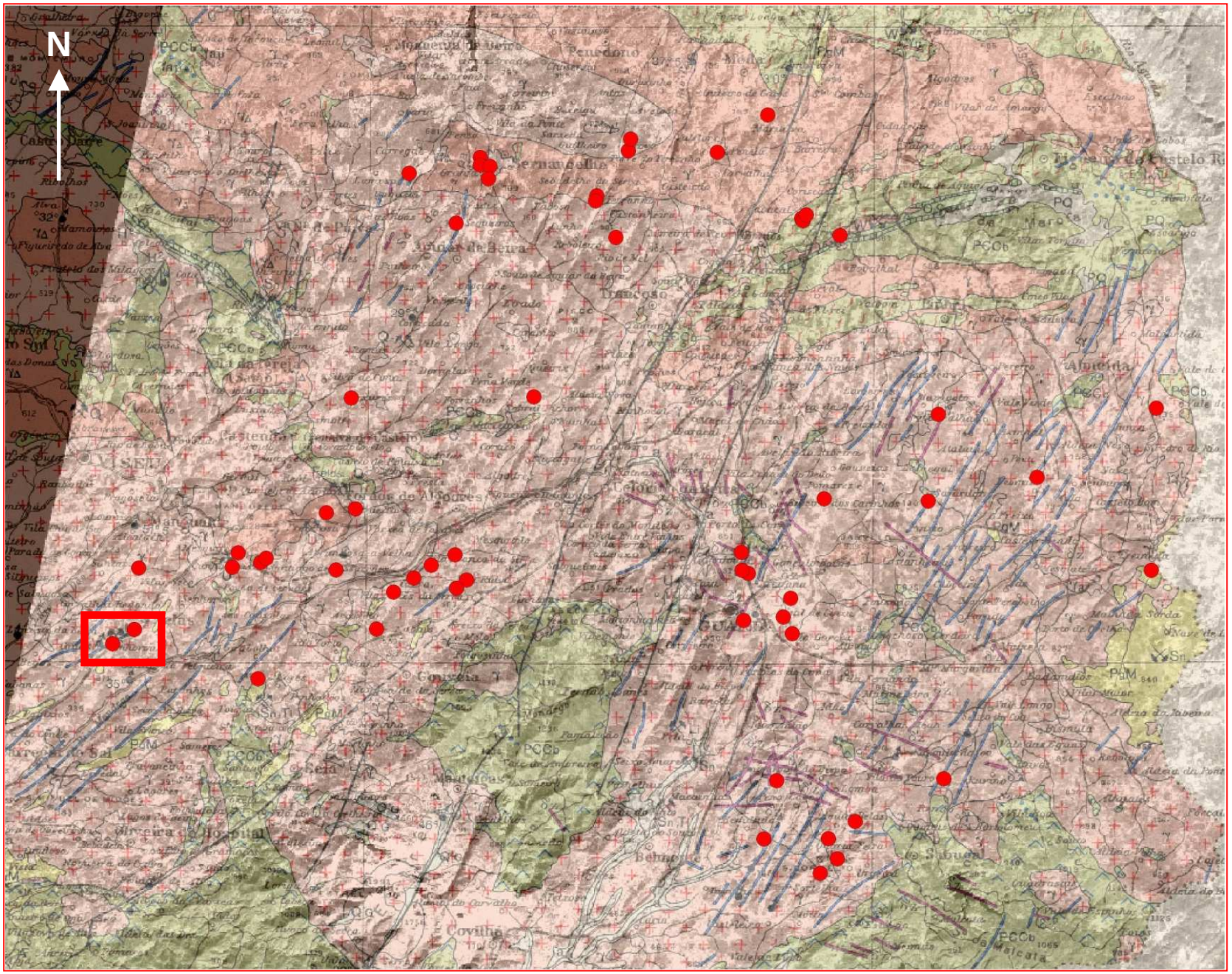
Geological Setting



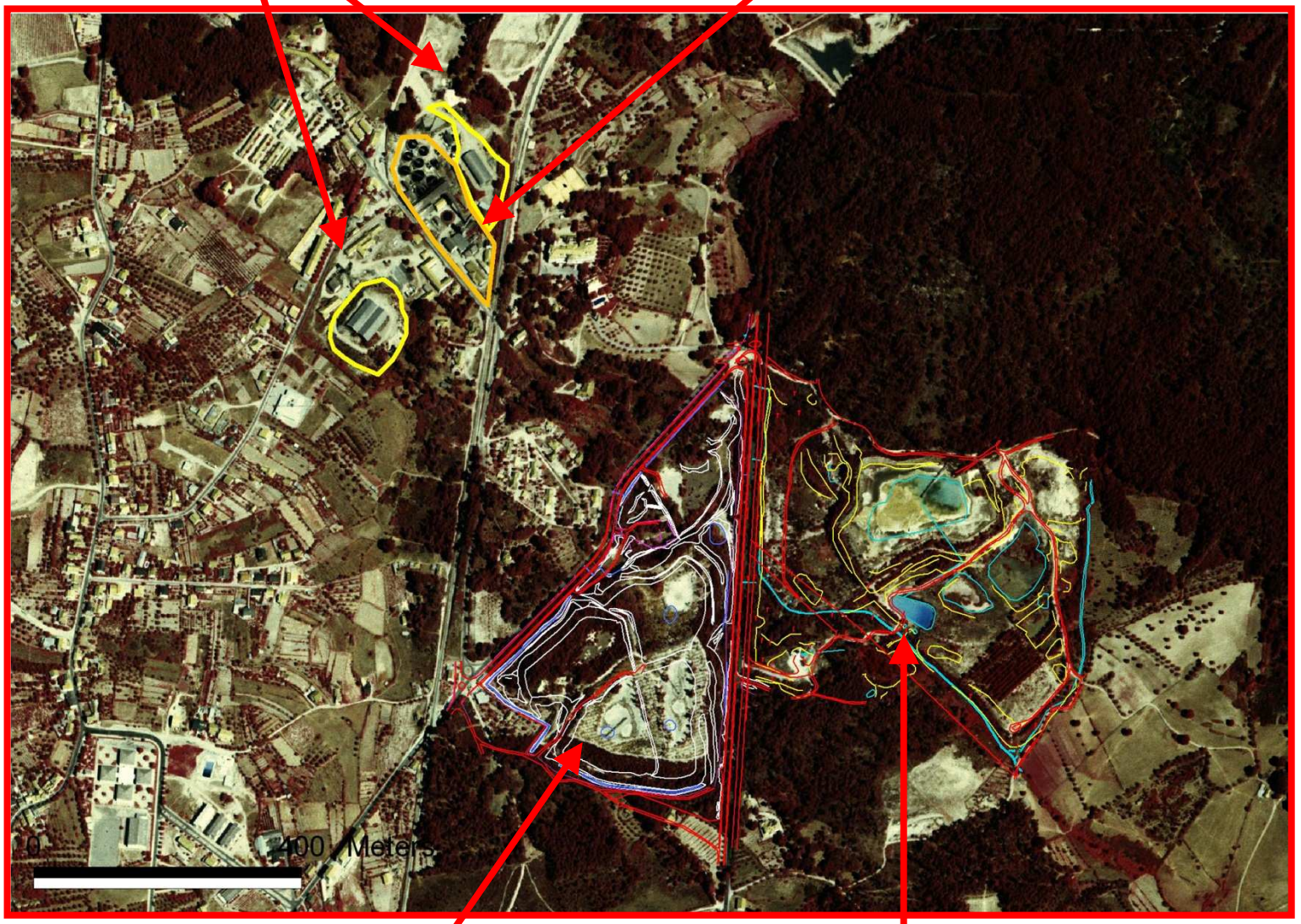
Uranium anomalies in Central Portugal



Uranium old mines in Central Portugal



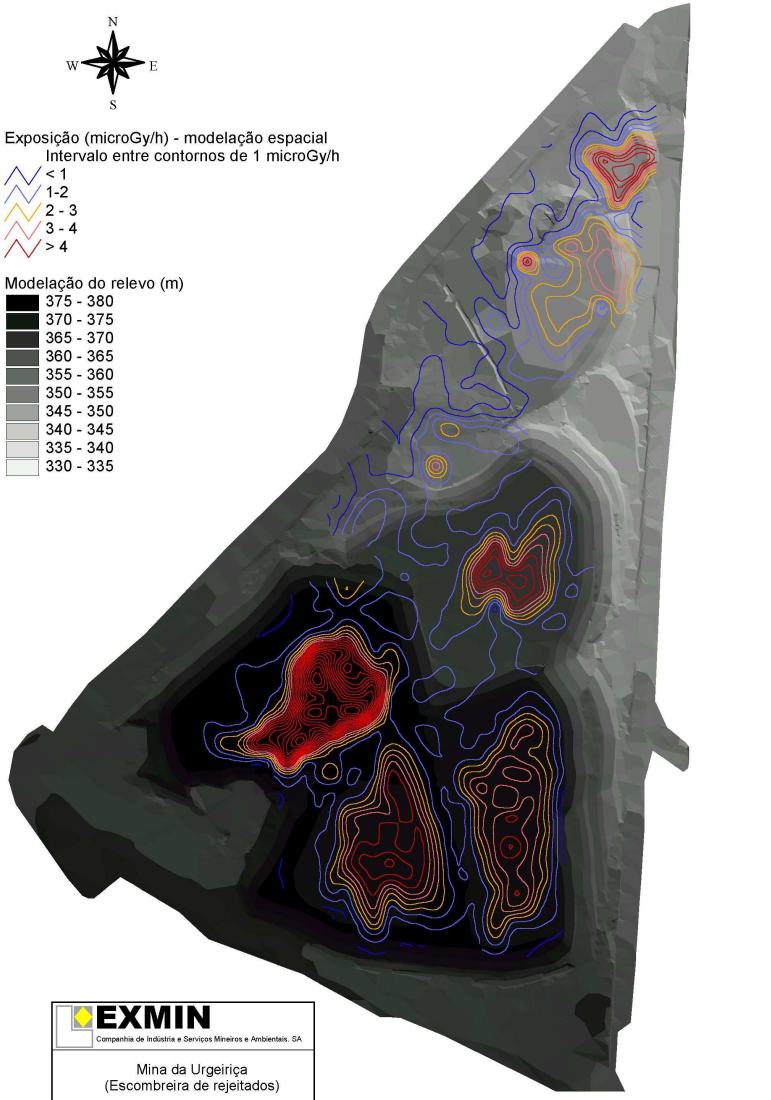
Aerial photo of the mining area



Industrial facilities

Highly radioactive fine-grained materials of the old dam

Altimetry and radioactivity of the old dam before rehabilitation



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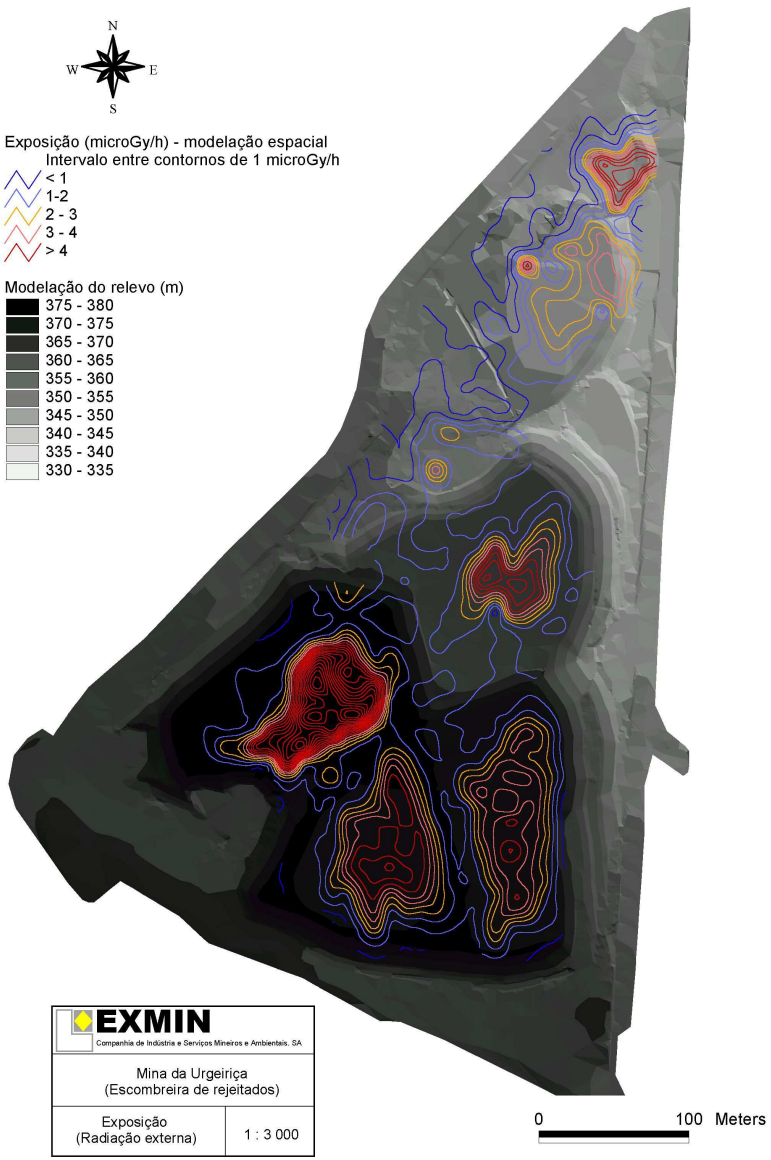
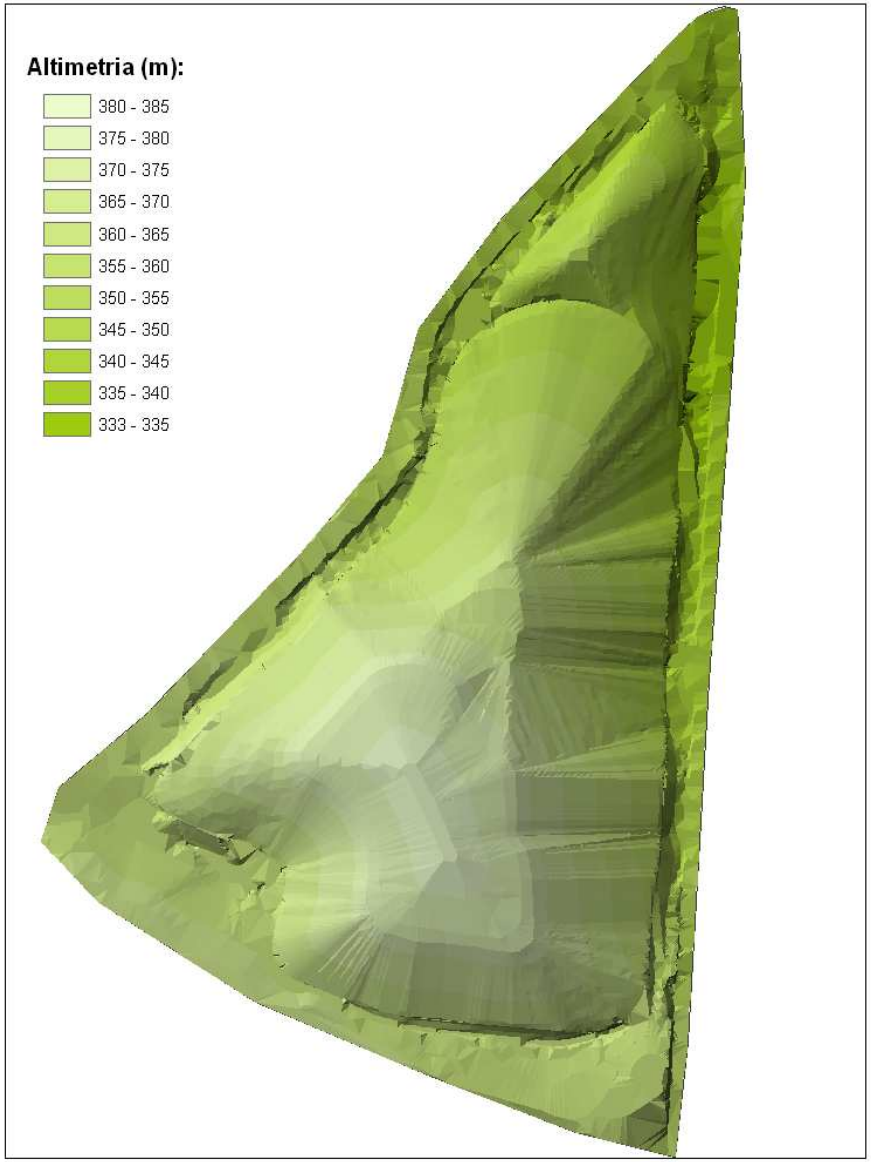


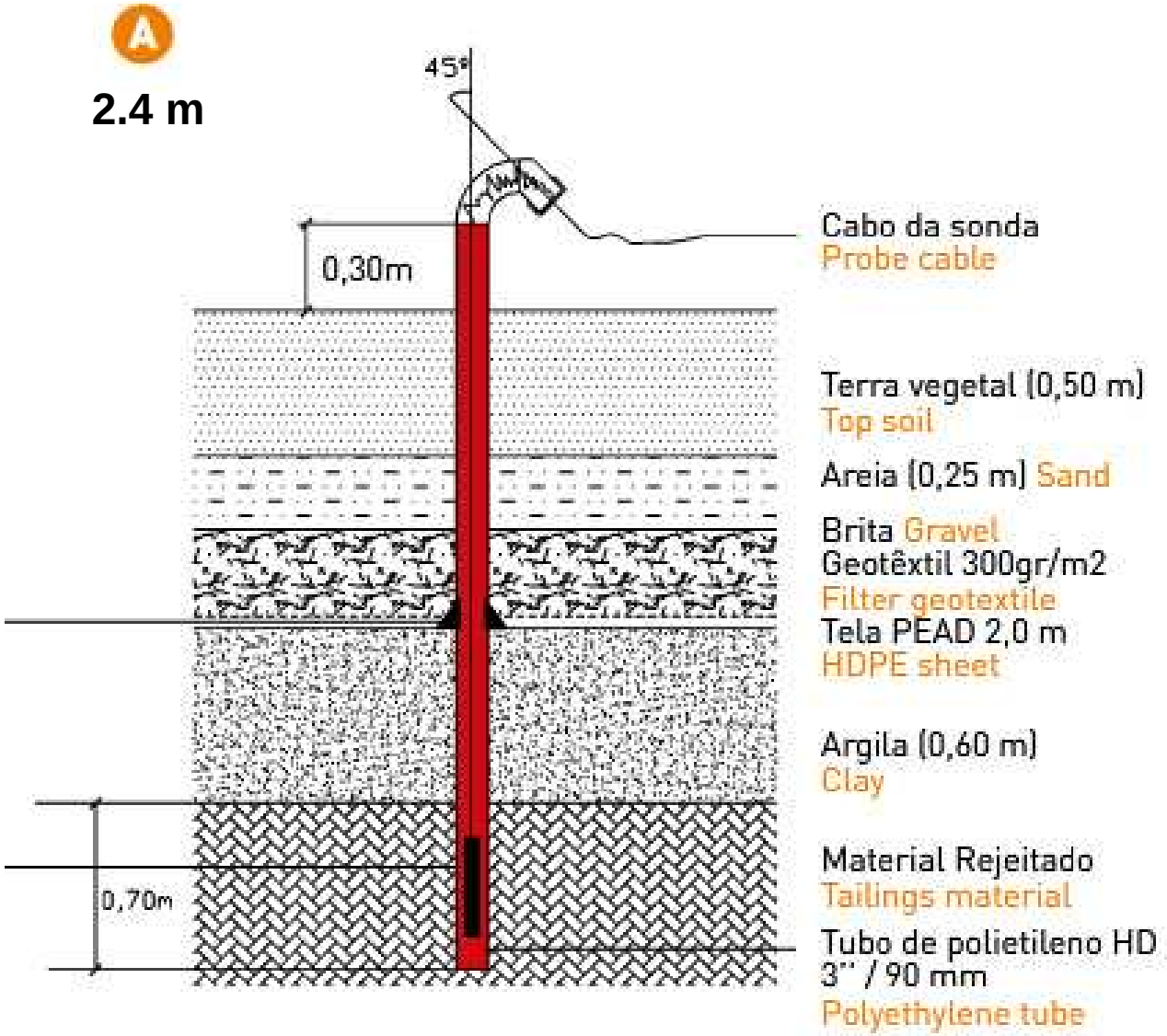


Rehabilitation works

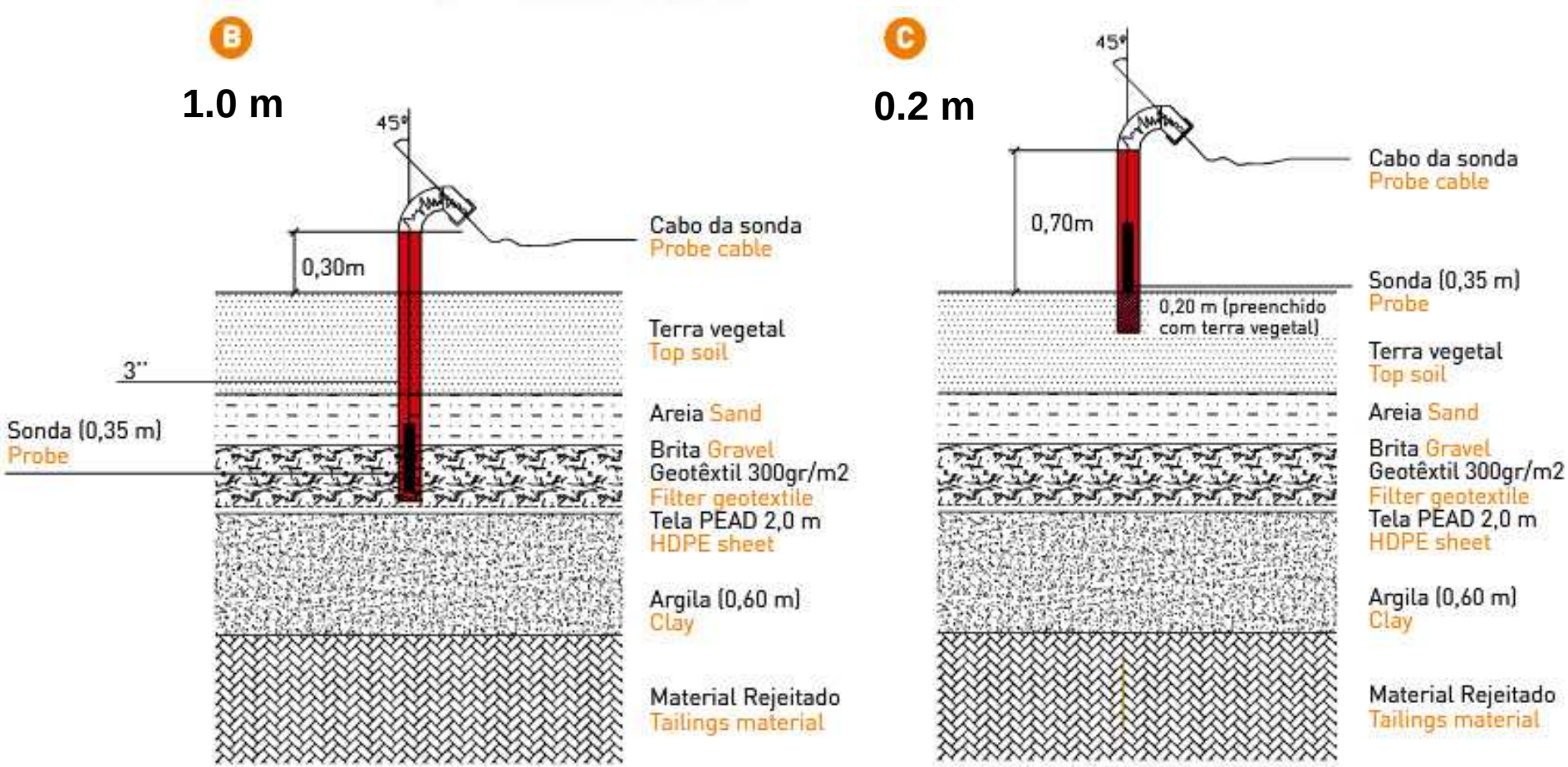
Absorbed dose reduction

Multilayer cover and radon monitoring probes

Barasol
BMC2 probe



Multilayer cover and radon monitoring probes

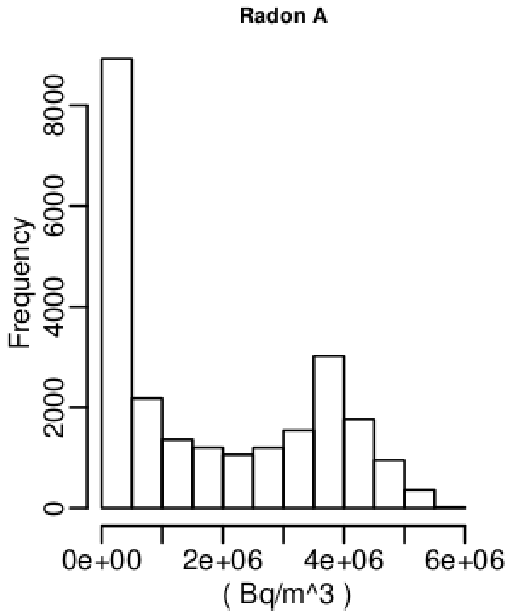


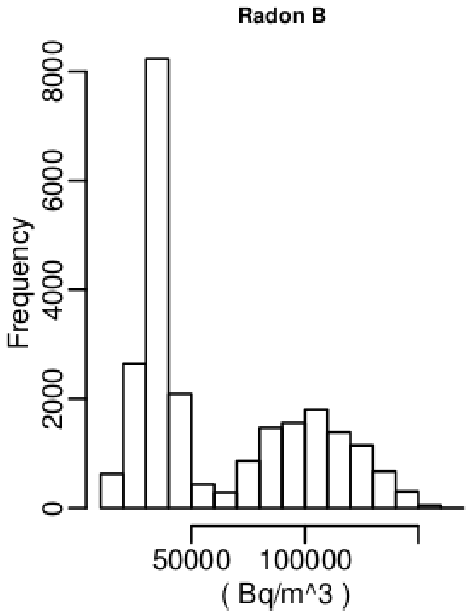
Environmental variables, period and sampling rate

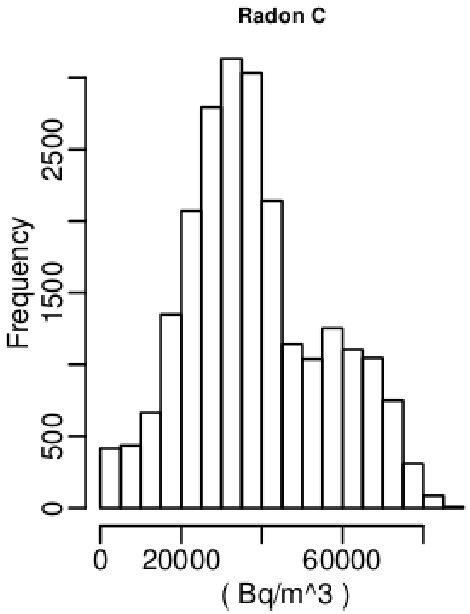
Variable	Period	Rate
Radon A (Bq/m^3)	16 Jan 2011 – 30 Dec 2011	15 min
Radon B (Bq/m^3)	16 Jan 2011 – 30 Dec 2011	15 min
Radon C (Bq/m^3)	16 Jan 2011 – 30 Dec 2011	15 min
Temperature (C)	01 Jan 2011 – 19 Dec 2011	10 min
Precipitation (mm)	01 Jan 2011 – 19 Dec 2011	10 min
Relative humidity (%)	01 Jan 2011 – 19 Dec 2011	10 min
Wind speed (m/s)	01 Jan 2011 – 19 Dec 2011	10 min
Wind direction (°)	01 Jan 2011 – 19 Dec 2011	10 min

Radon monitoring results – basic statistics (Bq.m^{-3})

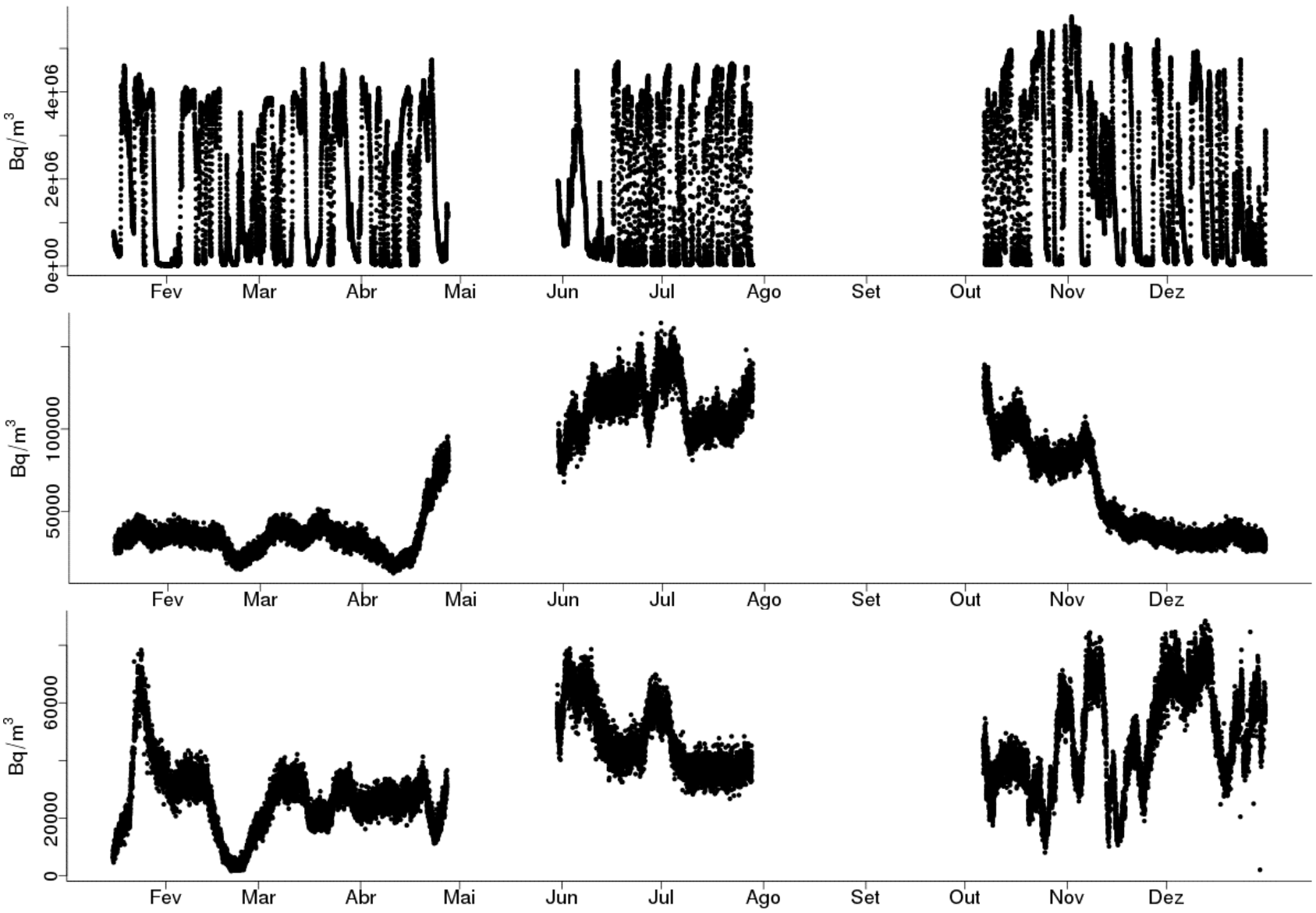
Borehole	Minimum	Median	St. Dev.	Maximum
A	15,230	1,239,000	1,686,673	5,733,000
B	12,380	40,520	36,861	164,500
C	1,656	35,750	17,207	88,490



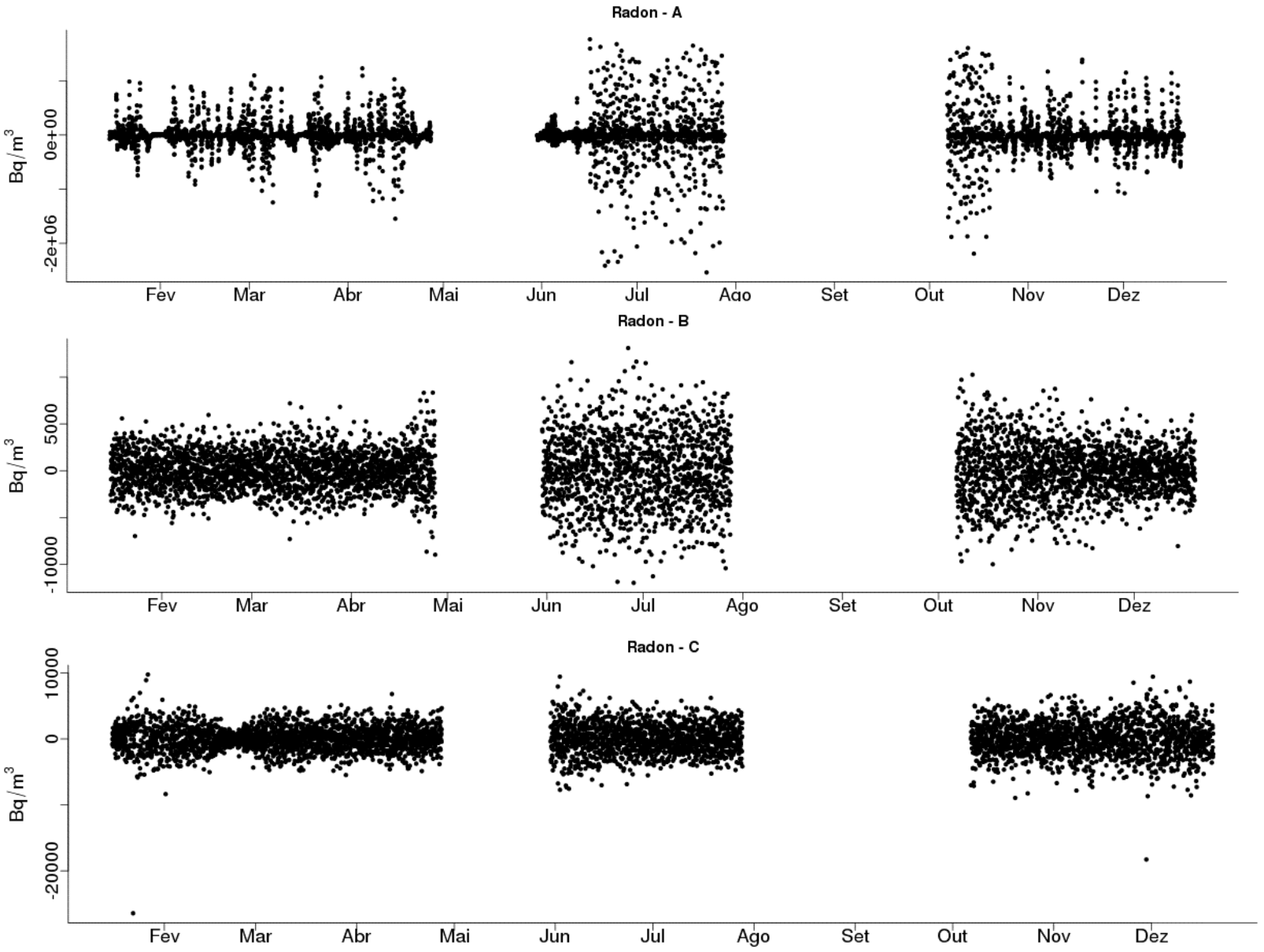




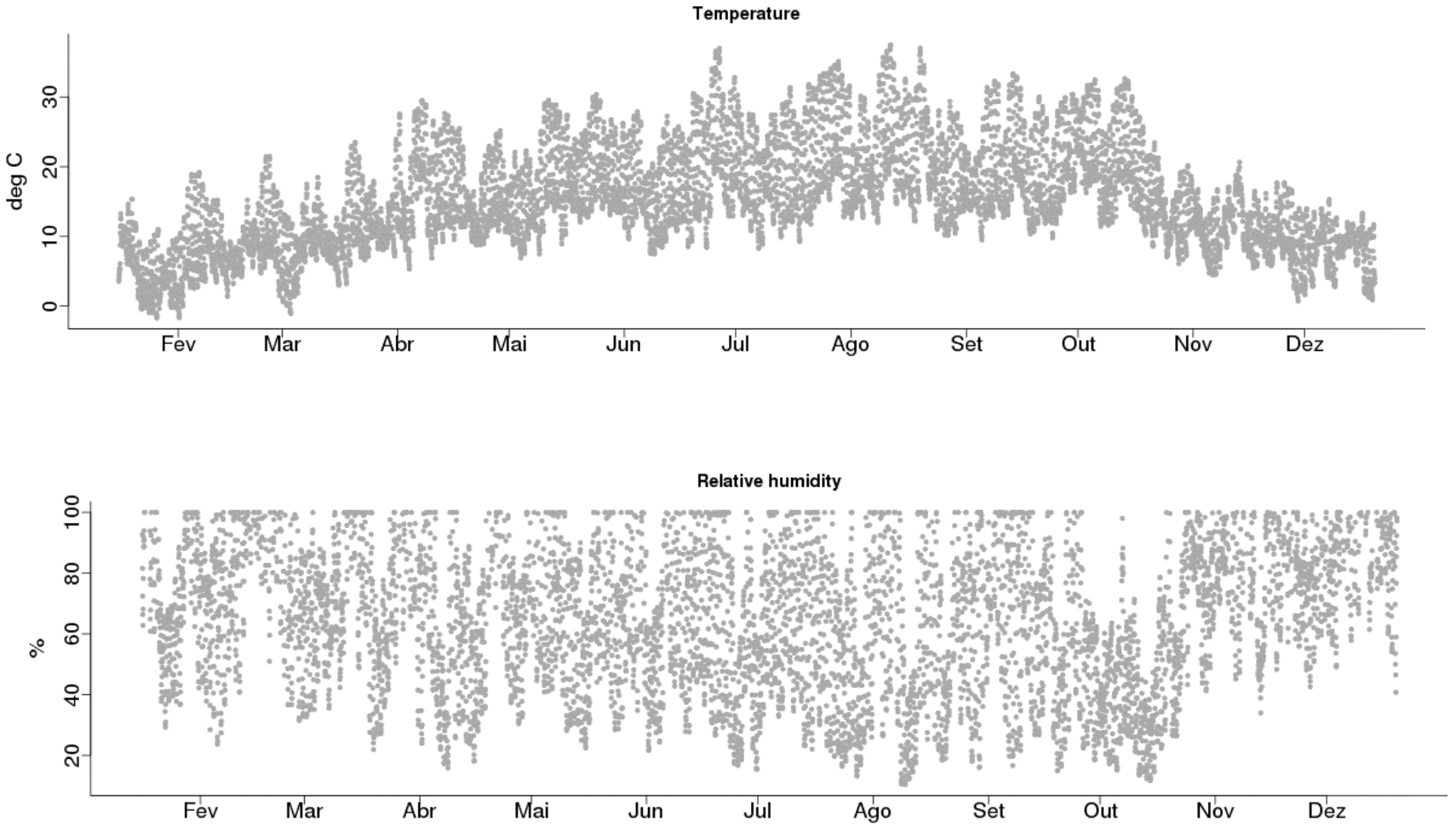
Radon hourly time series



Differenced hourly time series X_{t+1}-X_t



Other environmental hourly time series



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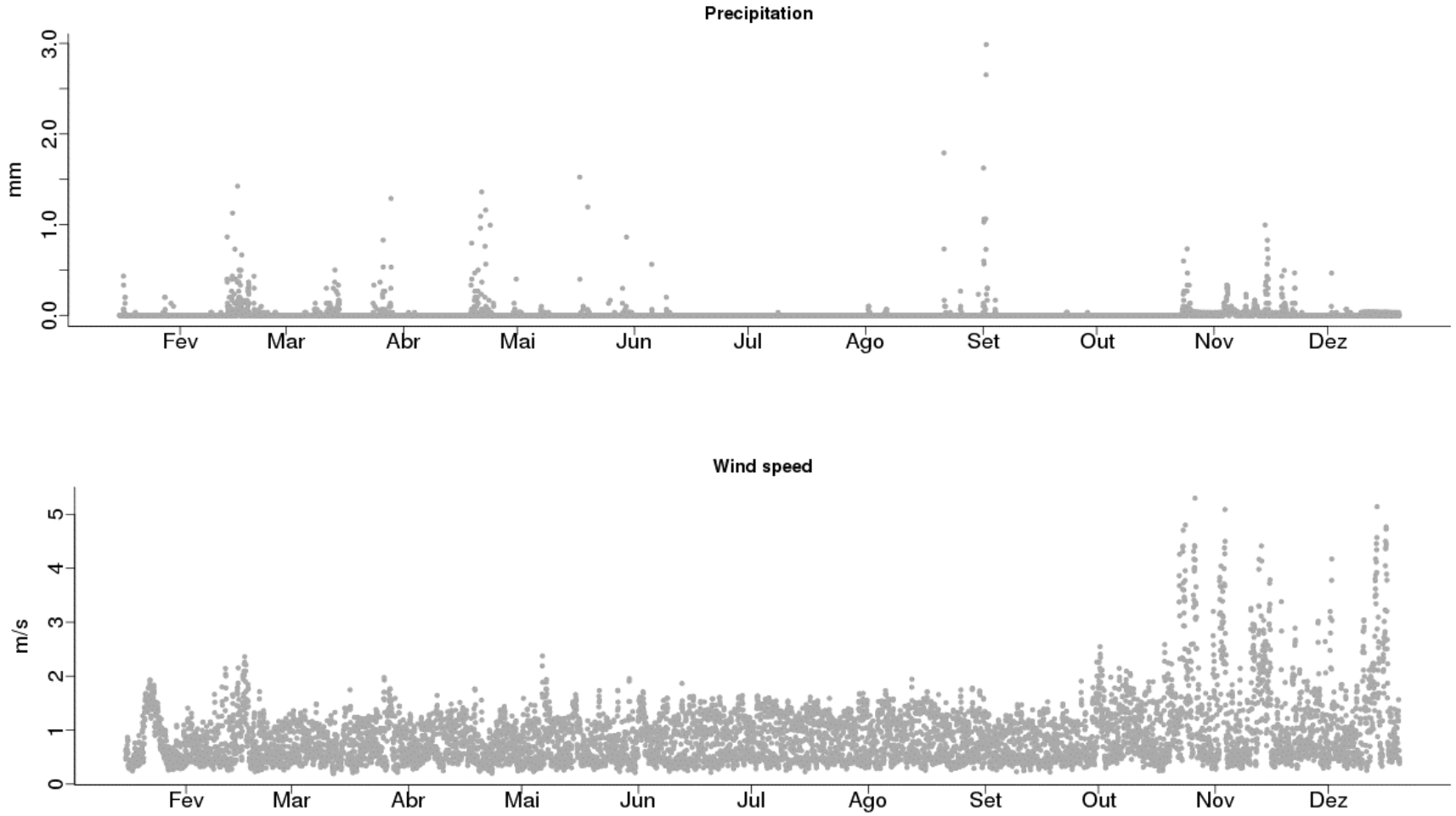

Analysis carried out for all environmental parameters

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Correlations between results obtained were determined for all the above cases

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Short-term (sub-daily) variability in radon concentration at the subsurface levels (points A and B) is correlated and characterized by large volatility in July/August and mid-October, and also correlated with corresponding changes in temperature.

Daily and long-term (weekly) variability in radon concentration is correlated for the shallower levels (points B and C) and associated with corresponding changes in temperature.