



Radon, radionuclides and the Cretaceous Folkestone Sands – gamma spectroscopy and geochemical analysis of silver sands and associated deposits in the SE of England.

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Radon concentrations in a historic sand mine in Surrey, UK (Reigate Caves), have been measured by both real-time and time-averaged methods over a number of years. These mines are not identified as being in a 'Radon Affected Area' as defined by Public Health England, although concentrations show a summer level of 640 Bqm³ +44 Bqm³. Average radon concentrations (September 2013 to January 2014) in Reigate caves were above the UK 200 Bqm³ domestic Action Level, above the UK domestic Target Level (of 100 Bqm³) but below the current workplace Action Level of 400 Bqm³.

By way of a comparison radon has also been measured in nearby Dorking (South Street Caves). These enigmatic caves were not mined for sand for glass manufacture as Reigate Caves were and there is speculation on why the caves were created. Both are visited by tourists on a semi-regular basis. Dorking caves have a different morphology with radon concentrations in Autumn 2016 of up to 1940 +/- 230 Bqm³.

The caves in Reigate are situated along Tunnel Road. These mines were also used as air raid shelters and wine stores. They consist of an East and West system and an older cave (Barons cave) which may have a medieval origin. As the Western Caves are now a shooting range our work has been carried out in the Eastern section at Reigate.

Where Dorking is concerned the shops and houses in the town have extensive interconnected cellars and galleries cut into these sands. The caves probably date from the 17th century but were used quite extensively for wine storage in the 19th century due to their constant 14°C air temperatures.

Real-time measurements were taken with a DurrIDGE Rad7 with time-averaged CR39 SSNTDs being placed throughout the cave systems to assess radon distribution and compare results with the real-time detector. Both caves contain marine shallow-water deposited locking (having tensile and compressive strength) silica sands of the Cretaceous Lower Greensand Group, Folkestone Formation, with little cement holding the grains together (typical porosity being around 30%). Microscope analysis shows that this material contains mostly angular to sub-angular quartz grains, some with undulose extinction under cross-polarised light. This suggests a metamorphic origin for the quartz. There are also some relatively rare rock fragments present. These silver sands are a mixture of fine to medium grain sizes (0.10 to 0.5 mm) with small proportions of finer and coarser grades and are in the order of 30 - 36 metres thick at Reigate. These beds show lateral and vertical variability in their grain size, mineralogy and geochemical make up such as iron oxide content and are heavily faulted in places.

In view of these radon results, in order to determine whether these levels are supported or unsupported, samples were collected and subjected to laboratory-based Gamma spectrometry. This indicated the presence of U235 (186keV) and Pb212 (238keV) in sands from these caves. We will shortly be in a position to also report in-situ gamma spectrometry and ICPMS analysis of samples taken from these beds.