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Caves, mines and subterranean spaces: hazard and risk from exposure to radon.

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Radon is a naturally occurring radioactive gas. It is colourless, odourless and chemically inert. The most hazardous isotope is 222Rn. Radon is formed in the natural environment by the radioactive decay of the element uranium (238U) and is a daughter product of daughter product of radium (226Ra). Uranium and radium are found, in differing degrees, in a wide range of rocks, soils (and building materials that are made from these).

Radon concentrations in caves, e.g. limestone caves such as the Great Cave of Niah, Borneo, and caves in the Mendips and Peak District in the UK, has been documented and reveal that both (prehistoric) cave-dwellers and other users such as archaeologists are at risk from exposure to radon a naturally occurring radioactive gas. In general, but dependent on cave geometry and ventilation, radon concentration increases with increasing distance from the entrance, implying that the hazard also increases with distance from the entrance.

With regard to mines and mining operations, as well as modern extraction of uranium and radium ores, both ores commonly occur alongside other metallic ores, e.g. silver at Schneeberg and Joachimsthal, and tin in Cornwall, and in some instances, waste from earlier metalliferious mining activity has itself been ‘mined’ for uranium and/or radium ores. It is not solely the miners and other subterranean workers which are at risk, other workers and local inhabitants are also at risk. Also, that risk is not eliminated by protection against dust/airborne particulates: the risk from inhalation of radon is only reduced by reducing the inhalation of radon, i.e. use of breathing apparatus.

Amongst the general population, radon is the second most significant cause of lung cancer behind tobacco smoking. Estimates vary but 6-9% of lung-cancers are attributable to radon and approximately 2% all cancer deaths are attributable to radon. These proportions will increase in higher-radon environments such as caves, mines and mining areas (via spoil heaps, settlement lagoons etc. containing uranium and radium).

We here present an overview of the potential hazard presented by radon in subterranean spaces and by metalliferous mining activities. We also present some speculation as to evidence of (pre-) historic exposure to radon which might potentially exist in archaeological remains and oral traditions.

Keywords: radon; caves; metalliferous mining; cave-dwellers; archaeologists.