**Radon exhalation from polymetallic nodules collected for research from the Clarion–Clipperton zone of the Pacific Ocean**

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For several decades, polymetallic nodules lying on the ocean floor have been the subject of intensive global research, regarded as a potential future source of strategic metals. Recently, the issue of ionizing radiation exposure affecting personnel involved in the extraction, transport, storage, and processing of these nodules has become a topic of increasing scientific debate (Volz et al., 2023; Kunze et al., 2024; Dołhańczuk-Śródka et al., 2024). This concern arises from the fact that, in addition to valuable metals, these nodules also contain naturally occurring radioactive elements.

The aim of the present study was to assess the potential radiological hazards associated with polymetallic nodules. Samples used for radon exhalation analysis were obtained from the Interoceanmetal Joint Organization repository. These nodules were originally collected from the Clarion–Clipperton Zone in the Pacific Ocean.

Radon-222 exhalation was measured using an AlphaGUARD radon monitor in flow mode, employing a sealed exhalation chamber. The nodules were selected randomly, with each sample originating from a different collection site. Nodules from geologically diverse environments may differ not only in their mineralogical composition and origin but also in their radionuclide content, which directly influences their radon-emitting potential. Consequently, even under identical measurement conditions, nodules from different locations exhibited significantly varied radon exhalation coefficients.

The highest recorded surface exhalation rate was 2.45 × 10⁻² Bq·m⁻²·s⁻¹. Such elevated emission could be attributed to localized enrichment in Ra-226, a highly porous structure, or the presence of fissures and channels that facilitate radon transport to the surface. This particular sample stood out both in absolute terms and in the variability of its readings.

The remaining samples showed exhalation coefficients ranging from approximately 3.3 × 10⁻³ to 1.5 × 10⁻² Bq·m⁻²·s⁻¹, reflecting considerable variability in the emission properties of the nodules studied. These results provide a valuable basis for assessing potential exposure risks associated with contact with this material during storage and transport.

References

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