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Reconstructing nuclear events from annually laminated lake sediments in Northern Finland

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The annually laminated sediments deposited in Lake Kevojärvi (69°45N, 27°00'E) in the municipality of Utsjoki in Northern Finland were investigated for radioactivity. A freeze cores recovered from the 35-m deep basin preserve a distinct succession of annual laminations deposited between 1909 and 2015. The basic varve structure was composed of a detrital snowmelt layer and an organic-rich post-snowmelt layer lying on top of the snowmelt layer. A total of 53 annual laminations were taken for gamma spectroscopic measurements using low-background gamma spectroscopy. This allowed a reconstruction of 137Cs, 241Am and 210Pb fallout history in the Lake Kevojärvi region. This highly resolved profile revealed a detailed record of anthropogenic radioactive fallout from atmospheric nuclear testing conducted in the 1950s and 1960s and the Chernobyl accident in 1986. The 137Cs concentrations in sediment varves were first found to increase in 1956 while the peak years occurred in 1964, 1970 and 1986 varves. The 241Am concentrations peaked in slightly different years in 1960-1962, 1964 and 1970 varves. Each peak was found to correspond to different nuclear testing campaigns. A two-year time delay between years of intensive nuclear weapons testing and peaks in the sediment records was observed due to sedimentation from the stratosphere.

Promotional text

Analysis of gamma-emitting radionuclides in annually laminated lake sediments are presented focusing on the anthropogenic 137Cs and 241Am which are also products of nuclear weapons testing.

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