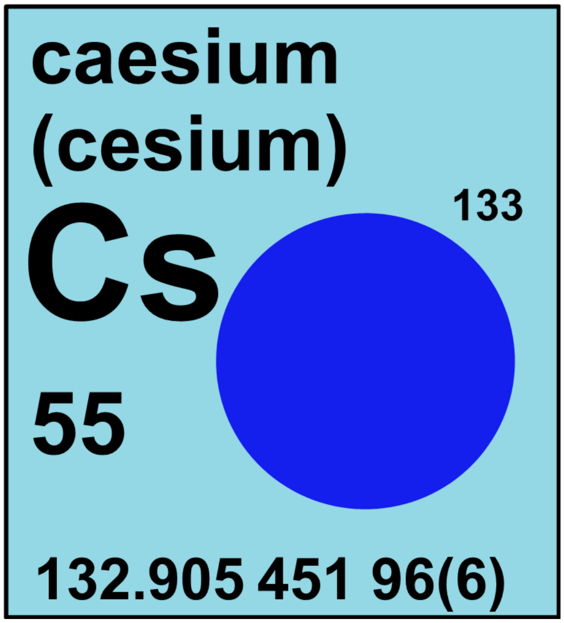
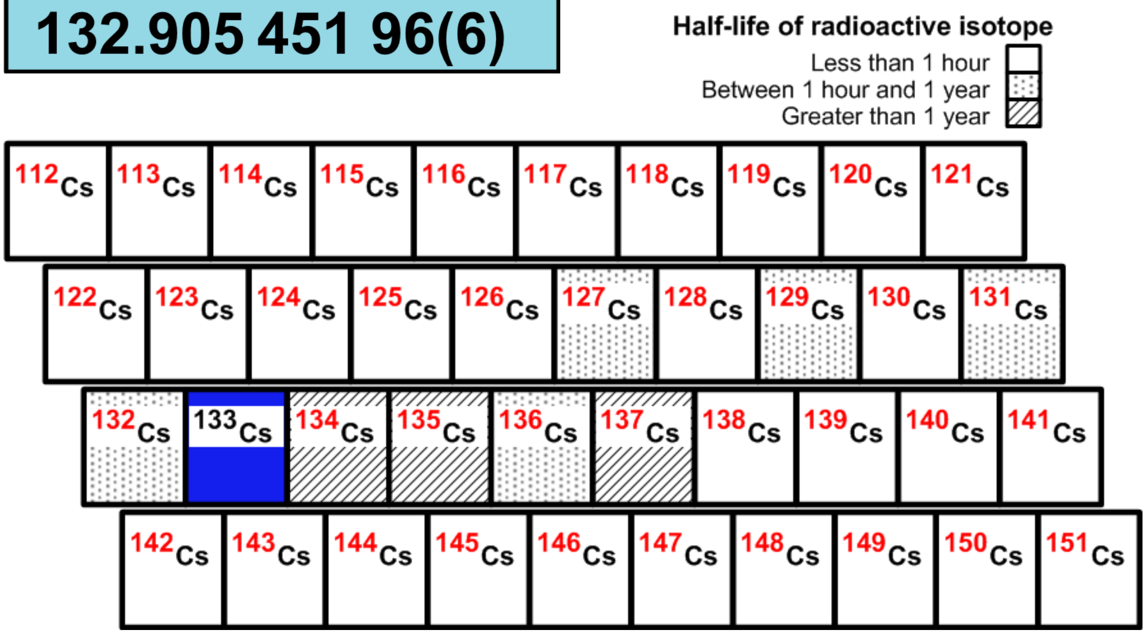
4.55 caesium (cesium)



Stable isotope	Relative atomic mass	Mole fraction
^{133}Cs	132.905 451 96	1



4.55.1 Caesium isotopes in biology

^{137}Cs (with a **half-life** of 30 years) can be used as a **tracer** in fungal mycelia (an extensive matrix of underground hyphae (stems of growth from a fungus) to monitor the immobilization of this radioactive caesium **isotope**. After the nuclear reactor accident at Chernobyl, large quantities of ^{137}Cs were released as **fission** products into the environment. Areas with large fungal populations and fungal mycelia seemed to immobilize the ^{137}Cs isotope, which limited the spread of the **radioactive isotope** [396, 397].

4.55.2 Caesium isotopes in Earth/planetary science

River floodplains are an important site for storing suspended sediments and contaminants transferred from upstream catchments. ^{137}Cs measurements of floodplain sediments provide a technique for estimating overbank sediment deposition, and it can provide information on spatial patterns of sediment deposition (Figure. 4.55.1). [398-400].

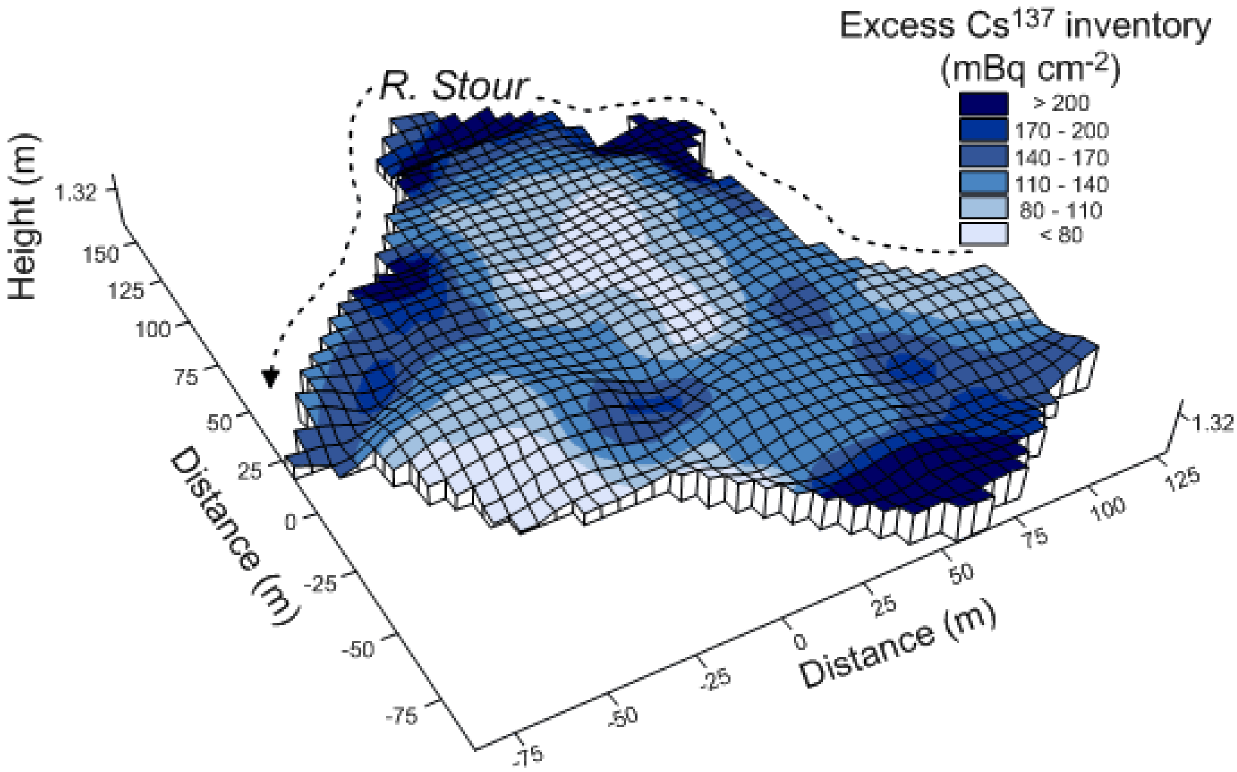


Fig. 4.55.1: Topography and excess ^{137}Cs inventory as a function of surface sediment size, less than 63 μm (modified from Walling and He [400]).

4.55.3 Caesium isotopes in geochronology

Nuclear fission of ^{235}U (or other **fissionable** materials) yields ^{137}Cs as a product. Although ^{137}Cs is not naturally present in the environment, it can be collected from nuclear reactor processing and then used as an environmental tracer. ^{137}Cs adheres tightly to porous sediments and will follow the movement of the sediment. By exposing sediments to ^{137}Cs and allowing this combination to move dynamically, **gamma ray** spectrometry can then be used to measure the activity of ^{137}Cs and monitor the movement of the radioactive sediments [401-403].

^{137}Cs dating of sediments not older than 60 years is useful in natural and artificial lakes and other environments because of its widespread production and release during atmospheric nuclear weapons testing, which began in the late 1940s, plus subsequent releases, such as during the accident at the Chernobyl nuclear reactor in April 1986. The ^{137}Cs concentration profile in a sediment core can be matched with the historical record of ^{137}Cs release to determine the approximate age profile of the sediment [403, 404].

4.55.4 Caesium isotopes in industry

High-energy gamma rays from ^{137}Cs serve as food irradiation devices to remove bacteria and other harmful microorganisms (living single celled organisms such as virus, algae and fungus) from food. Although ^{137}Cs is not used commercially for large-scale food irradiation, it has been proposed that it can be used this way. Gamma rays from the radioactive ^{137}Cs destroy the **DNA** of organisms to enable foods to last longer (i.e. irradiation of fruits and vegetables stops the ripening process) and be contamination free [405, 406].