

# Dating of sediment cores using lead-210

The geochronology of recent sediment materials can be determined by the  $^{210}\text{Pb}$  dating method.

Applications are in the areas of Late Quaternary geochronology, sedimentology and biochronology.

## Capability Selections

- $^{210}\text{Pb}$  dating (by alpha spectrometry)
- $^{210}\text{Pb}$  dating and  $^{137}\text{Cs}$  (by gamma spectrometry)
- $^{137}\text{Cs}$  dating (by gamma spectrometry)

## Pb-210 dating (by alpha spectrometry)

One of the techniques which can be used for  $^{210}\text{Pb}$  dating is alpha spectrometry. The technique uses the decay of excess  $^{210}\text{Pb}$  activity (half-life = 22.3 years) to determine the rate of sediment accumulation. About 5 g of dried sample, from various depths of the sediment core, is required. The samples are processed to prepare  $^{210}\text{Po}$  and  $^{226}\text{Ra}$  alpha sources. The activities of these sources are determined by alpha spectrometry to calculate excess  $^{210}\text{Pb}$  activities.

This technique is more sensitive than gamma spectrometry and is suitable when a small quantity of sample is available for analysis. However the method is destructive and other radionuclides such as  $^{137}\text{Cs}$  will need to be analysed by a different technique such as gamma spectrometry.  $^{137}\text{Cs}$  activities in sediment cores are analysed to verify  $^{210}\text{Pb}$  chronologies.

## Pb-210 dating and Cs-137 (by gamma spectrometry)

$^{210}\text{Pb}$  dating can be undertaken by gamma spectrometry technique. 30-50g of dried sample is required for analysis using a standard gamma spectrometer or 5g using a Well detector. There is no radiochemical processing required with this technique. The samples are simply packed into petri dishes or vials, left to equilibrate for three weeks and then counted on a High Purity Germanium (HP-Ge) gamma spectrometry system. Radionuclides such as  $^{210}\text{Pb}$ ,  $^{226}\text{Ra}$ ,  $^{137}\text{Cs}$ ,  $^7\text{Be}$ ,  $^{228}\text{Ra}$ ,  $^{228}\text{Th}$ ,  $^{238}\text{U}$  and  $^{40}\text{K}$  can be measured simultaneously. This technique is non-destructive.



## Cs-137 dating (by gamma spectrometry)

$^{137}\text{Cs}$  analyses by gamma spectrometry are performed to validate the chronology of sediment cores which had been dated using the  $^{210}\text{Pb}$  method by alpha spectrometry. The depth at which  $^{137}\text{Cs}$  activity is the highest most likely indicates the year 1964. At least 6 samples are required from varying depths to construct the  $^{137}\text{Cs}$  profile. The analysis is usually performed using the Well detector gamma spectrometer, which requires 5g of sample.

Please discuss your proposal with the appropriate ANSTO contact scientist before submitting your proposal as they will assist you in making the correct capability selection.

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