

SLIC – When it is Good it's Very Very Good and When it is Bad, it's Horrid

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Short-Lived Isotopic Chronologies using ^{210}Pb and ^{137}Cs to assess surface processes has come into common use over the last four decades. Although produced by different processes, both become attached to sediment in a similar manner. ^{210}Pb chronologies are based on mathematical models relating the decrease in activity with depth. ^{137}Cs , a solely anthropogenic radioisotope, did not come into wide use until the late 1960's when it was recognized that atmospheric nuclear testing had produced significant concentrations. ^{137}Cs chronologies are primarily based on the identification of the 1963/64 activity peak.

Most of the chronologic studies rely on one of these isotopes. Unfortunately, this does not supply enough information needed. The activity of an isotope may be affected by factors such as: sediment source(s), episodic or event-related deposition and post-depositional disturbance. Therefore, basic knowledge of the depositional controls is necessary in order to interpret sediment isotopic profiles. For example, in a core off the Bonnet Carré spill-way in Lake Pontchartrain, the ^{210}Pb profile using the isotopic age models yielded a date of greater than 100 years at 70cm depth. However, ^{137}Cs was present below this horizon. Since ^{137}Cs did not exist prior to 1954, its presence in the lower portion of the core negates the date obtained using ^{210}Pb . Upon further analysis of the core, it was determined that the ^{210}Pb profile was an artifact of the chaotic flow regime during the opening of the spill way. A similar situation was found in the northern Everglades. In this case, the ^{210}Pb started out low at the surface, rose to a peak mid-core then decreased with logarithmic decay. A standard explanation for this profile would be that the upper portion of the core had been physically or biologically disturbed. The ^{137}Cs distribution showed no indication of disturbance and dated the change in ^{210}Pb at approximately 1960. The ^{210}Pb peak occurred at transition from a saw-grass dominated to a cattail dominated marsh. As the cattail peat accumulated at a higher rate, the lower concentration of ^{210}Pb was attributed to the dilution of the isotopes due to the vegetative changes. These and like examples demonstrate the importance in using both isotopes coupling with knowledge of the sedimentary dynamics to properly ascertain a valid chronology.