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Exploring sediment dynamics from source to sink in Australia's large river basins using cosmogenic ^{14}C, ^{10}Be, and ^{26}Al

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The relatively short half-life of ^{14}C, namely, 5730 years, means that, compared to the other cosmogenic nuclides, it is substantially more sensitive to short term variations in process rates. Both the erosion of steep mountains and the dynamics of sediment transport, storage and recycling occur over timescales that are too short to be detectable by the cosmogenic nuclides that are currently used routinely, namely ^{10}Be and ^{26}Al. In situ ^{14}C on the other hand is ideally suited for these short timescales, and used in combination with ^{10}Be and ^{26}Al, it will allow for rapid fluctuations in process rates and/or the relatively short timescales that characterise sediment transfer and storage to be measured accurately. The above make in situ ^{14}C an important addition to the cosmogenic radionuclide toolkit.

We present results of in situ cosmogenic ^{14}C system blank and calibration sample measurements obtained with the recently established ANSTO/UOW in situ ^{14}C extraction system. The ^{14}C extraction scheme follows the design of the University of Cologne, which exploits the phase transformation of quartz to crystobalite to quantitatively extract the carbon as CO_2. Offline high-temperature furnace extraction allows a relative rapid sample throughput and can accommodate samples ranging between 0.5 to 4 grams of clean quartz. Following extraction and isolation, the CO_2 gas is graphitised using a micro-furnace and then measured using AMS similarly to routine small radiocarbon samples.

We also present results of ^{14}C, ^{10}Be, and ^{26}Al analyses from sediment samples collected from two of Australia's largest river systems: the Murray-Darling and the Lake Eyre basins. We use the downstream changes in the ratios of the three radionuclides in samples collected at key locations along the rivers to quantify sediment mixing and sediment storage times in the two basins. Substantial $^{26}Al/^{10}Be$ 'burial' signal is observed in both Lake Eyre and downstream Murray and Darling samples, while in situ ^{14}C suggests complex burial-exposure histories in these samples.