Tick-tock there is a clock in my rock – 30 years of counting atoms with Accelerator Mass Spectrometry

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Abstract

Accelerator Mass Spectrometry is recognized as one of the most significant advances in analytical isotope research of the 20th century. Since the 1980's its impact in science and technology has been immeasurable. In all subjects related to the study of planet Earth, geologic and biologic, past and present, outcomes facilitated by the unprecedented sensitivity afforded by AMS have resulted in paradigm shifts of prevailing concepts and models. The art of in-situ produced terrestrial cosmogenic radionuclides (specifically ^{10}Be, ^{14}C, ^{26}Al, and ^{36}Cl) was borne out of AMS methodologies developed in the study of precious lunar and meteoritic samples to unravel their formation, distribution and exposure histories. As a result, measurement of miniscule concentrations of cosmogenic radioisotopes produced in the atmosphere, or within the shallow lithosphere in a myriad of natural archives has enabled scientists to quantify the spatial and temporal evolution of climatic and environmental processes which has shaped our planet.

Enabling these advances were commensurate revolutions in AMS technology with the continual drive to reduce complexity, accelerator size and costs. Equivalent AMS performance for ^{14}C, ^{10}Be and ^{26}Al is now possible on dedicated accelerator systems operating at 0.5MV - a considerable step down in size from the shared 10MV nuclear research laboratories of the past. Increased performance in ion detection, background suppression, efficiency, and innovative ion-source developments, together with fully computerised and remote operations afforded by new generation AMS systems has led to ever-increasing sample throughput and improved sensitivity. Together with continual improvements in global production rate calibration, scaling and modelling, a spectrum of diverse applications to "date events, changes in climatic conditions and trace processes across the landscape" has now become part of the researcher's toolbox which augers well for future years of exciting discoveries. This talk will present a brief 35-year overview of key advances since the time of the first terrestrial in-situ ^{10}Be, ^{26}Al and ^{36}Cl measurements were published in 1986.