Advances in Accelerator Mass Spectrometry: Gas-Filled-Magnet

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The measurement of radionuclides by accelerator mass spectrometry (AMS) allows the quantitative study of depositional and erosional processes. Although AMS techniques have been in routine use for about three decades the technique is still improving. These advances are enabling both more precise measurements of commonly-measured radionuclides as well as new capabilities for additional nuclides. We have recently begun routine use of a gas-filled-magnet (GFM) detector system at PRIME Lab. This instrumentation has significantly improved the measurement capability for ^{10}Be, ^{26}Al, ^{36}Cl, and ^{41}Ca.

Although the AMS technique is capable of rejecting the vast majority of interferences that could compromise a measurement, pure isobars can make AMS measurements difficult. Many of the commonly run radionuclides are accompanied by an isobar (^{10}B, ^{26}Mg, ^{36}S, ^{41}K). The GFM suppresses these isobars by placing them on a different trajectory within the vacuum chamber of a dipole magnet, preventing them from entering the *dE/dx* detector. This produces lower backgrounds, which in turn improves detection sensitivity. The most dramatic improvement is for the AMS measurement of ^{26}Al. Most AMS laboratories inject Al^- since Mg^- does not form a negative ion. AlO^- currents are ~ 10 times higher, but MgO^- is likewise formed and cannot be resolved with standard *dE/dx* techniques. The low Al currents have always limited the precision, and accordingly, the applicability ^{26}Al measurements. The compromised ^{26}Al measurement is especially problematic for those studies employing the ^{10}Be-^{26}Al pair, *e.g.* burial dating. With the GFM we are now able to inject AlO^-, which has a current comparable to BeO^-, and the precision of the ^{26}Al measurements is essentially equivalent to that of ^{10}Be measurements.

Although we have only recently implemented the GFM it is already impacting multiple scientific investigations. We anticipate the development of new measurement capabilities that will likewise impact geoscience investigations.