Calibrating Site U1541 XRF Elemental Data Using Sediment Digests and ICP-MS.

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Elemental proxies, such as iron, titanium, and excess barium, in marine sediments, can constrain past variations in nutrient inputs, dust inputs, and biological carbon export over a variety of climate conditions. X-ray fluorescence (XRF) scanning is a valuable paleoceanographic tool for generating elemental proxy records because it can generate high-resolution basic intensity data in many samples in a timely fashion compared to other techniques, but XRF intensity data needs to be calibrated by further lab analysis in order to compute absolute elemental concentrations and ratios for comparison across study locations. Here we present XRF calibrations and calibrated basic concentration data for IODP Site U1541 from the Pacific Southern Ocean. Site U1541 is important because it records the sensitivity of the Pacific Southern Ocean to changes in continental dust deposition, where increases in iron delivered by continental dust may lead to increases in biological activity and the export of carbon dioxide from the atmosphere to the ocean. We used a sediment digest to fully dissolve 50 bulk sediment samples to a clear liquid form and measured a suite of elemental concentrations (including iron, titanium, aluminum, calcium, and barium) using an inductively coupled plasma mass spectrometer (ICP-MS). We then use the linear relationships observed between the ICP-MS elemental concentration and XRF intensity data in the same sample depths to compute element-specific calibration curves and calibrate XRF concentration records throughout the core. Our calibrated XRF records can then be used to examine changes in dust deposition at Site U1541 over the past 8 million years.