

EGU23-9728, updated on 03 Jul 2023

<https://doi.org/10.5194/egusphere-egu23-9728>

EGU General Assembly 2023

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Inventory of ice-rafted clasts and sediment constituents that pertain to dynamic ice-margin processes and biological productivity, Amundsen Sea region, Antarctica

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Marine sediments, obtained from cores and captures from deep sea and continental shelf sites of West Antarctica, contain rich records of latest Miocene to Present glacial and deglacial processes and conditions at the margin of the West Antarctic ice sheet (WAIS). The materials we are investigating were recovered from a) Resolution Drift on the Amundsen Sea continental rise (water depths >3900m), b) the continental shelf in the Amundsen Sea, Wrigley Gulf, and Sultzberger Bay (water depths <1000m). Resolution Drift cores were drilled by IODP Expedition 379 (Gohl et al., doi:10.14379/iodp.proc.379.2021) in sediments dominated by compacted clay and silty clay, with conglomeratic intervals of ice-rafted detritus (IRD) and downslope deposits. The shelf sediments were recovered by piston core, trigger core, and Smith McIntyre Grab (SMG) during USA research cruises of the R/VIB *IBR* (1999, 2000, 2007) and USCGC *Healy* (1983). The shelf samples are non-compacted clay, containing abundant cobbles, pebbles and biogenic fragments.

Our research focuses upon rock clasts, detrital apatite and zircon, felsic volcanic tephra, and micro-manganese nodules separated from marine and glaciomarine clay. The rock clasts and detrital minerals represent samples of continental crust that we characterise according to rock type, petrology, geochemistry, and geo-thermochronology [U-Pb, (U-Th)/He, and fission track methods]. These characteristics illuminate solid Earth processes, including the development of subglacial topography. We compared clasts' petrology and age data to the exposed onshore geology and thermochronology of bedrock, and determined that ≥90% of clasts likely originated in West Antarctica. Therefore the materials can be used to assign roughness, erodibility, and heat production factors for subglacial bedrock, which constitute boundary conditions used by ice sheet modelers.

Rhyolite ash and fragments provide new evidence for explosive eruptions (dated ca. 2.55 to 2.92 Ma; feldspar ⁴⁰Ar/³⁹Ar) delivered to sea as airfall, IRD, and possible subglacial water transport. Silicic eruptions produce ash and aerosols that may screen solar energy, and provide bio-available nutrients that produce phytoplankton blooms leading to sequestration of carbon. The rhyolite dates coincide with the end of a Pliocene warm period recorded in IODP379 cores (Gille-Petzoldt et

al., 10.3389/feart.2022.976703). Our work in progress seeks to obtain higher resolution geochronology in order to determine whether silicic continental volcanism occurred in response to ice unloading due to deglaciation (cf. Lin et al., 10.5194/cp-18-485-2022) and whether erupted products contributed to latest Pliocene significant cooling and WAIS re-glaciation.

Another distinctive sediment constituent is micro-manganese nodules of unusual form. Whereas typical micro-MN nodules are dark, formed of concentric layers, this form is pale in color, 'barbell' shaped, and transparent in transmitted light. Scanning electron microscopy shows these to be microcrystalline Mn-oxide with embedded grains of quartz and feldspar, which likely served as seed material. Mn-oxides form by authigenesis at/near the seafloor surface, requiring high oxygen concentrations in the bottom water and low sedimentation rates, generally associated with the end of glacials/during interglacials (Hillenbrand et al. 2021, 10.1029/2021GL093103). Work is in progress to determine whether Mn oxides formed through passive accretion upon seed grains or microbially-mediated precipitation from Mn-oxyhydroxides or colloids, of possible relevance for coastal carbon budgets.