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High-resolution heavy mineral analysis of marine sediments in the Ross Sea, Antarctica

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In Antarctica, ocean currents and ice sheet dynamics affect sediments, their erosion, transport and deposition, and the sedimentological record represents a precious natural archive of the past climate. The study of the mineralogical composition of modern sediments can be conducted by applying the most modern techniques of preparation and analysis of individual grains. The sediments studied were collected from a box-core (BC-08) within the PNRA ODYSSEA project, near the U1523 IODP site and considered as a valid present analogue of the site itself. The sampling site is on the edge of the Iselin Bank, under the influence of the Antarctic Slope Current, and records both along-slope circulation and inputs from the continent. Heavy minerals were concentrated in the 5-500 microns grain size window and the entire suite of heavy minerals was quantified. A specific protocol for silt and sand was applied separating heavy grains, calculating the percentage of minerals with density greater than 2.90 g/cm^3, in different samples and describing the suite of minerals as a proxy of the source rocks in an interval of time from 14.000 yrs. BP to modern sediments. Combining optical microscopy and Raman spectroscopy, a high-resolution study of different species and varieties in groups of minerals was achieved, allowing a more detailed characterization of different magmatic and metamorphic sources. During point counting, the surficial texture of each single grain was described, highlighting how corrosion features in polar environments are common and could be used as an independent proxy identifying tendencies and changes in climate effects on sediments through time. Clinopyroxenes are the best candidate to record the degree of corrosion, due to their crystalline structure and chemical instability in the geological record. From Late Pleistocene to the Holocene, a clear trend and increasing in the weathering indices suggest a direct link with warming and production of brines, involved in the chemical dissolution of unstable silicates in sediments. The amount of sediment used was small, between 8-13 g. The percentage of heavy minerals in the 7 samples analysed remains almost constant throughout the time interval considered, varying between 2.2 and 2.7%, with the lowest

amount in the most recent time. The pyroxene corrosion index varies through time, from 29% at the depth of 10-11 cm and it increases regularly up to 50% in the most recent sample, indicating a progressive effect of dissolution of unstable minerals in modern sediments. The mineralogical composition is characterized by a wide range of 35 minerals, associated with magmatic (pyroxenes and olivine) and metamorphic (amphiboles, epidote, garnet) source rocks around the Ross Sea. Detailed study of mineralogical assemblages in silt to medium sand represents a new tool for quantitatively demonstrating the effects of climate change recorded by sediments.