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Tectonic/climatic control on sediment provenance in the Cape Roberts Project core record (southern Victoria Land, Antarctica): A pulsing late Oligocene/early Miocene signal from south revealed by detrital thermochronology

V. Olivetti (1), M. L. Balestrieri (2), F. Rossetti (1), and F. M. Talarico (3)

(1) Department of Earth Sciences, University of Roma Tre, Roma, Italy (volivetti@uniroma3.it), (2) CNR-IGG, Università degli Studi di Firenze, Florence, Italy., (3) Department of Earth Sciences, University of Siena, Italy.

The Mesozoic-Cenozoic West Antarctic Rift System (WARS) is one of the largest intracontinental rift on Earth. The Transantarctic Mountains (TAM) form its western shoulder, marking the boundary between the East and West Antarctica. The rifting evolution is commonly considered polyphase and involves an Early Cretaceous phase linked to the Gondwana break-up followed by a major Cenozoic one, starting at c. 50-40 Ma. This Cenozoic episode corresponds to the major uplift/denudation phase of the TAM, which occurred concurrently with transition from orthogonal to oblique rifting. The Cenozoic rift reorganization occurred concurrently with a major change in the global climate system and a global reorganization of plate motions. This area thus provide an outstanding natural laboratory for studying a range of geological problems that involve feedback relationships between tectonics and climate. A key to address the tectonic/climate feedback relations is to look on apparent synchronicity in erosion signal between different segments, and to compare these with well-dated regional and global climatic events. However, due to the paucity of Cenozoic rock sequences exposed along the TAM front, a few information is available about the neotectonics of the rift and rift-flank uplift system. The direct physical record of the tectonic/climate history of the WARS recovered by core drillings along the western margin of the Ross sea (DSDP, CIROS, Cape Roberts and ANDRILL projects) provides an invaluable tool to address this issue. Twenty-three samples distributed throughout the entire composite drill-cored stratigraphic succession of Cape Roberts were analyzed. Age probability plots of eighteen detrital samples with depositional ages between 34 Ma and the Pliocene were decomposed into statistically significant age populations or peaks using binomial peak-fitting. Moreover, three granitic pebbles, one dolerite clast and one sample of Beacon sandstones have been dated. From detrital samples, three peaks are detected reflecting different bedrock provenance areas. Two peaks older than 40 Ma (P2 and P3) are compatible with thermochronological data from TAM bedrock that underwent a stepwise denudation in Cretaceous times. A Peak younger than 40 Ma (P1) has been detected occasionally, recording the signal of a source area exhumed during late Oligocene /early Miocene with a constant denudation rate of 0.4 mm/yr (constant lag-time up-section), but absent in the onshore portion of the proximal TAM. Indeed, when compared with AFT data from ANDRILL cores, the relatively young P1 ages, suggest that part of sediments in the Cape Robert Rift basin have a provenance from source regions probably located far away in the south (i.e. Skelton-Byrd glaciers region) where bedrock experienced compatible thermal histories. This provenance would imply glacial systems with main flow patterns from south to the north, therefore orthogonal to the orientation of present-day drainage. We thus infer that the post-Eocene glacial and erosional history of the TAM front was significantly controlled by the N-S-trending transtensional regime that affected the western Ross Sea margin during transition from orthogonal to oblique rifting in the region. The appearance and disappearance of P1 along the drill-cored stratigraphic succession seems to be linked to the oscillation in the extent of the ice sheet.