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A source-to-sink, multi-proxy provenance study of CRP-1 and AND-2/2A core records: implications for sediment dispersal and ice dynamics models in the West Antarctic Rift System of South Victoria Land in Early Miocene time

Eleonora Strada (1), Fabio Florindo (1), Sonia Sandroni (2), and Franco Maria Talarico (3)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italy (eleonora.strada@ingv.it), (2) Museo Nazionale dell'Antartide, Università di Siena, Italy , (3) Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, Università di Siena, Italy

The study of the lithosphere-cryosphere system interactions in response to climate and tectonic forcings during the Cenozoic long-term cooling and the reconstruction of the past glacial volumes and regimes (ice mountains caps vs ice sheets, warm-based vs polar/cold-based) represents a priority area for recent and current geosciences and climate science research. A unique case-history to investigate these issues is represented by the South Victoria Land sector of the West Antarctic Rift System, where several high-quality sediment drill-cores provide a benchmark for integrating paleoenvironmental information stored in a cumulative ca. 4.8 km-long stratigraphic record of late Eocene to Pleistocene age, with the erosion and exhumation histories recorded in several mountain blocks in the adjacent Transantarctic Mountains (TAM). Previous provenance studies on Victoria Land Basin cores highlight the high value of different provenance tools in the reconstruction of paleoenvironmental variability during the Cenozoic glacial and paleoclimatic evolution in the Ross Embayment in a number of time windows. However, integration of different datasets has been so far very limited, particularly for what concerns correlations of key Cenozoic tectonic and paleoclimatic events across the entire length of the TAM in Victoria Land.
The Cape Roberts Project CRP-1 and the ANDRILL SMS AND2-2A cores, with their correlative core sections, provide the opportunity to reconstruct ice dynamic and paleoenvironmental scenarios at a regional scale, comprising a wide area of the western Ross Sea and the adjacent segment of the TAM in Early Miocene time. Our study includes a tighter data integration of all available provenance/compositional datasets in each core, and new mineralogical data (on both silicate and opaque mineralogy and in different sedimentary grain fractions). The overall new and existing datasets consistently highlight the presence of significant differences in provenance, suggesting that, in the Early Miocene, the Ross Embayement region very likely experienced two contrasting type of ice flow patterns and source-to-sink patterns, with evidence of fluctuating local glaciers with dominant W-E flow lines and proximal sources (max 50-80 km West of the drillsites), alternating at least one time with more extensive ice volumes with dominant S-N flow lines and distal source regions located 150-300 km South of the drillsites.