Final project report

Project ID	2002/4.12
Title	**Cenozoic rift-related sedimentary processes:** a tool to reconstruct paleoclimatic, environmental and tectonic evolution of the Ross Sea area, Antarctica
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Duration	2 years
Assigned funding	41.000,00 Euro

Activities and results

This study allowed to reconstruct the relationship between sedimentation diagenesis, and the related syntectonic features in the sedimentary successions drilled along the Antarctic continental margin, in the Ross Sea Area.
1500 m of sedimentary successions drilled during te Cape Roberts Project were relogged in order to revise all the macrostrructures. Samples from cores CRP-1, CRP-2 and CRP-3 were characterized in terms of microstructures, mineral-fills, microtextures. Detailed microanalyses on this sections/chips using LC, CL, SEM, EDS were performed. A comphrensive dataset permitted to discriminate 4 paragenesis related to different stress regime, on the basis of the different calcite microfabrics interpreted as related to different tectonic control:

- Microsparite-sparite: occurs as infills in most veins. Under CL, calcite crystals have a uniform brightness suggesting a homogeneous composition. -Drusy calcite fills small cavities, often associated with sparite and/or elongated crystals. -Elongated calcite is also common as vein infills formed either by wide (up to 50 μm) fibers growing from the vein wall toward the vein center, often associated with sparite/drusy sparite, or by straight fibers growing across the vein (no median line).
- Fibrous calcite consisting of micrometric acicular crystals were recorded only in a few veins. Under CL calcite fibers show irregular crystal boundaries and different brightness (bright to dull) maybe due to solid inclusions.

Geochemical investigations performed on all the vein samples showed that the different carbonate microfabrics always consist of low-Mg low-Fe calcite and do not show any differences in terms of composition.
We therefore correlated the microtextural, compositional, microstructural data to reconstruct a tentative paragenesis of the different calcite microfabric and to clarify a possible tectonic control on sedimentation and cementation, as follows:
Paragenesis 1: single stage of calcite precipitation consisting of microsparite as infills of micrometric veins (hairlines) or sparite occuring as equant crystals as infills of centimetric veins suggesting no tectonic control during sedimentation/cementation.
Paragenesis 2: A first stage of microsparite and/or sparite precipitation followed by syntectonic fibrous calcite is interpreted as partially tectonic controlled.
Paragenesis 3: A first stage of microsparite and/or sparite precipitation followed by a second stage of syntectonic elongated crystals, then formation of drusy calcite is due to a active tectonic control.
This multidisciplinary study showed that the different paragenesis of the analysed CRP Cenozoic records are consistent with the regional stress regime interpreted as rift-related.
This study therefore highlighted that an accurate investigation of the different paragenesis of calcite veins is a useful new tool to interpret the regional setting during sedimentation of drilled sedimentary successions.

Products

A – papers in scientific magazines

1. Aghib F. S., Moretti Foggia F. & Cita M. B., 2003. "Aspetti sedimentologici, petrografici e composizionali della successione sedimentaria Cenozoica del pozzo CRP-3, Cape Roberts, Mare di Ross, Antartide." Istituto Lombardo (Rend. Sc.) B 135, 101-130, Milano.
2. Aghib F. S., Fielding C. R. & Frank T. D., 2003. "Diagenesis of the Cenozoic sedimentary succession from the CRP-3 core, Ross Sea, Antarctica." Terra Antartica, v. 10(1), 27-37, Siena.
3. Bellanca A., Aghib F.S., Neri R. & Sabatino N., 2005. "Bulk carbonate isotope stratigraphy from CRP-3 core (Victoria land Basin, Antarctica): evidence for Eocene-Oligocene paleoclimatic evolution". Global and Planetary Change, 45, 237-247, Amsterdam.
4. Giorgetti G., Aghib F.S., K. J. T. Livi, A.-C. Gaillot & Wilson T., 2007. "Newly-formed phyllosilicates in sediments and basement rocks from CRP-3 core (Antarctica): An electron microscopy study. Clay Minerals, 42, 21-43, London.

B – book chapters

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C - proceedings of international conferences

1. **32 IGC, Firenze, Agosto 2004:** Aghib F.S. & Wilson T.J. "Authigenic smectites from the Cenozoic record and basement rocks of the CRP-3 core, Ross Sea (Antarctica)".
2. **AGU San Francisco, CA, Dicembre 2005:** Aghib F.S., Giorgetti G., Livi K. J. T., Gaillot A.-C. "Syntectonic Growth of Clays in Veins, Victoria Land Rift Basin, Antarctica: An Electron Microscopy Study".
3. **EGU Vienna, Aprile 2007:** Aghib F.S., G. Giorgetti & T.J. Wilson. "Syntectonic carbonate cementation in veins. Evidences from the Cenozoic sedimentary successions drilled at Cape Roberts, Victoria Land Basin, Antarctica"
4. **ISAES X Santa Barbara, CA, Agosto 2007:** Giorgetti G., F.S. Aghib, T. J. Wilson & C. Millan. "Authigenic clay minerals in rock matrices and fractures from CRP-2 and CRP-3 cores (Antarctica)".

D – proceedings of national meetings and conferences

FIST-Geoitalia, Spoleto, Settembre 2005:

1. Aghib F.S. "Cenozoic Rift-related sediment processes: a tool to pleoclimatic and tectonic histories, Ross Sea Region, Antarctica. State of the art and future plans".
2. Galeotti S., Aghib F.S., Barrett P., Bellanca A., Brinkhuis H., Harwood D., Setti M., Sprovieri M., Talarico F. M., Villa G. "Integrated stratigraphy of lower Oligocene glacimarine cycles in the CRP-3 core (Victoria Land Basin, Antarctica)".

E – thematic maps

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F – patents, prototypes and data bases

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G – exhibits, organization of conferences, editing and similar

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H - formation (PhD thesis, research fellowships, etc.)

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Research units

Università di Milano - Dipartimento di Scienze della Terra:
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CNR-IDPA (Istituto per la Dinamica dei Processi Ambientali), Milano:
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Date:

Notes