Activities and results

New geophysical data were collected in the South Shetland Trench to study: the passive subduction of the last PHOenix (PHO) plate remnant, bounded between the Hero and the Schackleton F.Z., and to assess the tectonic expression of the three main segments, interested by bending and roll-back processes. Each of the three segments is characterized by different properties, controlling: lateral variability of the trench, prism morphology, plate tectonic setting, sediment blanketing and deformation of the continental margin. Differences in the stress-strain pattern were expected across the subducting oceanic segments.

We investigated the central part of the subduction zone, crossing the ‘D’ and ‘E’ FZs, the trench and the frontal prism along the Antarctic Peninsula margin. The geophysical dataset is composed by high-resolution multibeam bathymetry, Chirp profiles, gravity and magnetic measurements, reflection and refraction seismic data.

The investigated Multibeam bathymetry is of very good quality and covers 9700 km$^2$. CHIRP profiles amount to 1000 km.

One Multichannel Seismic Profile of 160 km was acquired parallel to the trench with a cable length of 600 m, 48 acquisition channels. The seismic source was composed by two sub-arrays of eight sleeve guns each. Because of compressor’s problems the energy release was not optimal, mainly for the refraction experiment.

Energy on OBSs was not adequate, recording seismic events on too short distances.

The Multibeam and Chirp data image the structures affecting the seafloor, such as: normal faults obliquely oriented, horst and graben structures and volcanic edifices. Normal faults, width and depth of the trench and morphology of the frontal prism are related to the subduction, bending and roll-back of the PHO plate and to inherited structural discontinuities. The results of the seismic reflection data clearly image the sharp crustal discontinuities of the ‘D’ and ‘E’ FZs, highlighting major features and tectonic setting characterizing each of the three investigated oceanic segments.

The results indicate a complex response of the PHO plate as the passive subduction proceeds, due to the increasing importance of the processes at the plate boundaries and to the mechanical coupling variation along the Transform Faults. The integrated analysis of the geophysical data acquired offshore Antarctic Peninsula highlighted new crustal structures affecting the passive subducting PHO plate, that allowed the recognition of the differential passive subduction among the three main segments. The present roll-back and retreat induce a complex stress-strain pattern in the trench and frontal accretionary prism, that drives the oblique fault system and the evolution of the trench, sediment infill and frontal accretionary wedge. The recent activity of the normal faults is also suggested by tectonic features interesting the Explora volcano.

Products

A – papers in scientific magazines

Programma Nazionale di Ricerche in Antartide (PNRA)


B – book chapters

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C - proceedings of international conferences


D – proceedings of national meetings and conferences


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


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

1. PhD program: Subduction of the Phoenix Plate segments beneath the South Shetland Margin (Northern Antarctic Peninsula); the student abandoned the program after 2 years.
2. N. 1 assegno di ricerca alla Dott.ssa Maria Fliomena Loreto (contributo pari ad una annualità c/o INOGS, Trieste).

Research units

U.O. DICA, Trieste University: B. Della Vedova, Julius Fabbri, Michela Giustiniani, R. Nicolich
U.O. INOGS, Trieste: F. Accaino, U. Tinivella, M.F. Loreto

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Notes