

Final project report

<i>Project ID</i>	2002/3.12
<i>Title</i>	<i>Subduction of the LAsT Poenix Plate Segments beneath the South Shetland, Antartic Peninsula (SLAPPSS)</i>
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<i>Duration</i>	3 years
<i>Assigned funding</i>	44.700,00 Euros

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 km². 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

1. Loreto M.F., B. Della Vedova, F. Accaino, U. Tinivella and D. Accetella, 2006. Shallow geological structures of the South Shetland Trench, Antarctic Peninsula. *Ofioliti*, 31 (2), 151-159.

Programma Nazionale di Ricerche in Antartide (PNRA)

2. Tinivella U., Accaino F. and Della Vedova B., 2007. Gas hydrates and active mud volcanism on the South Shetland continental margin, Antarctic Peninsula. *Geo-Marine Res. Letters*. DOI 10.1007/s00367-007-0093-z, 1-10.

B – book chapters

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C - proceedings of international conferences

1. Della Vedova B., Accaino F., Loreto M.F., Tinivella U., 2007, Passive subduction of the Phoenix plate remnant at the South Shetland trench, Antarctic Peninsula. U.S: Geological Survey and the National Academies; Proceedings of the 10th ISAES X, edited by A.K. Cooper and C.R. Raymond et al., USGS Open-File Report 2007-1047, EA084, 1-4.
2. Tinivella U., Accaino F., Della Vedova B. and Geletti R., 2004. Gas hydrates and active fluid outflow NE of the South Shetland Islands, Antarctic Peninsula. GEOSUR Meeting, Buenos Aires, Dec. 2004.

D – proceedings of national meetings and conferences

1. Tinivella U., Accaino F. e Della Vedova B., 2004. Progetto BSR: risultati preliminari della campagna geofisica al largo delle isole Shetland Meridionali. Riassunti estesi del 23° Convegno Nazionale GNGTS, Roma, 489-491
2. Della Vedova B., Accaino F., Tinivella U., Loreto M.F., and D. Accetella, 2005. Subduction of the last Phoenix segments beneath the South Shetland margin, northern Antarctic Peninsula (SLAPPSS Project): preliminary results. Presented at FIST 2005, Spoleto 21-23 September, 2005.
3. Loreto M.F., Tinivella U., Accaino F., Della Vedova B. and N. Zanette, 2005. New geophysical measurements detect mud volcanoes and active fluid outflow from gas hydrate reservoirs, west of Elephant Is. (Antarctic Peninsula). Presented at FIST 2005, Spoleto 21-23 September, 2005.
4. Loreto M.F., B. Della Vedova, F. Accaino, U. Tinivella and D. Accetella, High resolution images along the subducting oceanic plate (Antarctic Peninsula), 2006. Presentazione al Convegno Nazionale del GNGTS, Roma 28-30 Novembre 2006.

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

1. Della Vedova B., U. Tinivella, F. Accaino, 2004. Risultati preliminari di fine campagna: Progetto SLAPPSS. Report PNRA, DICA Università di Trieste.
2. Loreto M.F., B. Della Vedova, F. Accaino, U. Tinivella and D. Accetella, 2007. Passive subduction of the Phoenix Plate Remnant by seismic and morpho-bathymetry data analysis, Antarctic Peninsula. OGS Research Report: 2008-70-GDL 18 REDS (16 pp.)

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

Date: 21 November 2008

Notes

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