

Final project report

Project ID: 2002/2.07
Title: *Structure of the lithosphere and geodynamics of the Scotia Arc (2002 - 2003)*

Principal investigator: Prof. Giuliano F. Panza
Institution: Department of Earth Science – University of Trieste
Email: panza@units.it

Duration: 2 years
Assigned funding: € 19700 (PEA 2003)

Activities and results

The main aim of the research is the study of the structural properties of the lithosphere and to improve our understanding of the geodynamical properties of the Scotia Sea region.

The methodologies for the complete waveforms inversion, that allow us to define, along profiles, the structural parameters of the lithosphere, have been developed and tested making them compatible with oceanic structural models. Maps, which describe the variations of S-wave velocities with respect to depth, have been obtained by means of the tomographic analysis of the structural models determined along the sampled profiles. Further, a new methodology has been tested, based on ambient noise measurements. Such a methodology consists in computing the cross-correlation of the vertical components of the ambient noise recorded at two different seismic stations. By mean of this procedure the Green function for Rayleigh waves for the medium between the two considered stations is obtained. Its applicability has been verified using signals recorded by two stations of the ASAIN (Antarctic Seismographic Argentinian-Italian Network) in the Scotia Sea region, obtaining the dispersion curve for group velocity, along the path connecting the two stations.

The retrieval of the seismic moment tensor for selected earthquakes, obtained by means of the inversion of complex broad-band wave forms for a set of events recorded both at stations OGS – IAA and IRIS and during the experiments performed at the South Shetland Isles and in Antartica Peninsula (SEPA Project), represents an advanced contribution to the study of the regional and local stress field in the region of the Scotia Sea. This analysis lead to the publication of the paper: Guidarelli, M., and Panza, G.F., 2006. Determination of the seismic moment tensor for local events in the South Shetland Islands and Bransfield Strait, GJI, 167, 684-692.

The research has been carried out in parallel with other research projects related to the study of the Caribbean and central Mediterranean regions, with the aim to perform a systematic comparative analysis of the west – directed subduction zones.

The Scotia Sea region is, in fact, one of the few regions, outside of the Pacific Ocean, characterized by a W-directed subduction. Since, among the non-Pacific W-directed subduction zones, the Scotia Arc is the poorest in terms of available data, the comparative study improves the possibility to interpret the available data. Thus our knowledge on the features of the examined region takes advantage from the results obtained in similar regions, more intensively studied. The detection of some characteristics common to all of the studied regions supports the hypothesis that a similar process of formation could be at the origin of the Scotia Sea, the Caribbean Sea and the Tyrrhenian Sea regions. One of the most promising prospects of the research reported here is the deepening of the analysis of this hypothesis.

Products

A – papers in scientific magazines

1. Guidarelli, M., Russi, M., Placencia Linares, M.P. and Panza, G.F., 2003. The Antarctic Seismographic Argentinean-Italian Network and the Progress in the Study of Structural Properties and Stress Conditions in the Scotia Sea Region. *Terra Antartica Reports*, 9, 25-34.
2. Guidarelli, M., Gonzales, O., Raykova, R., Pinat, T., and Panza, G.F., 2004. The west directed subduction zones outside of the Pacific: Scotia, Caribbean, Tyrrhenian and Carpathians domain, *Bollettino di Geofisica Teorica ed Applicata*, 45, supplement 2 GEOSUR, 36-39.
3. Guidarelli, M., Placencia Linares, M.P., Russi, M., and Panza G.F., 2004. Lithospheric structures and regional seismicity in the Scotia Sea area: a review, *Bollettino di Geofisica Teorica ed Applicata*, 45, supplement 2 GEOSUR, 84-87.
4. Placencia Linares, M.P., Bukchin, B.G., Guidarelli, M., Russi, M., and Panza, G.F., 2004. The 4 August 2003 earthquake recorded by ASAIN network in Antarctica and Tierra del Fuego, *Bollettino di Geofisica Teorica ed Applicata*, 45, supplement 2 GEOSUR, 87-91.
5. Russi, M., Placencia Linares, M.P., Guidarelli, M., 2004. Further developments of the ASAIN network in Antarctica and Tierra del Fuego, *Bollettino di Geofisica Teorica ed Applicata*, 45, supplement 2 GEOSUR, 92-95.

B – book chapters

--

C - proceedings of international conferences

--

D – proceedings of national meetings and conferences

--

E – thematic maps

--

F – patents, prototypes and data bases

--

G – exhibits, organization of conferences, editing and similar

--

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

1. Guidarelli, M., 2004. Models of lithosphere and seismic sources in the Scotia Sea region. Tesi del XVI ciclo del Dottorato di Ricerca in Geofisica della Litosfera e geodinamica, Università di Trieste.
2. Pinat, T., 2005. The Scotia Arc: Theoretical observations on Synthetic Modeling, models of the Litosphere, Tomographic Comparison with other W-Directed Subduction Zones. Tesi del XVII ciclo del Dottorato di Ricerca in Geofisica della Litosfera e geodinamica, Università di Trieste

Research units

Giuliano Francesco Panza
Mariangela Guidarelli
Tommaso Pinat
O'Leary Gonzales Matos
Marino Russi

Date: 18.12.2008

Notes