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**PHYSICAL SCIENCES OF THE OCEANS**  
**Italian Research activity (1991-1994) report to IAPSO**

INTRODUCTION

Failed the initiative of the Ministry for the Universities and the Scientific and Technological Research (MURST) of giving a unitary framework to national oceanographic activities through the National Plan for Research at Sea (PNRM) (Astraldi et al., 1990), the conditions of oceanographic research did not change substantially from those of the previous years. All the principal institutions operating at sea kept on with their activity according to their own mission and statute, while a National Oceanographic Commission, grouping most of them, acted as a forum where to discuss the principal problems related to this sector.

As in the past years, the National Research Council (CNR), with about 20 among Institutes and working groups covering all the marine disciplines, a new oceanographic ship (R/V Urania) along with some smaller vessels, a meteo-oceanographic buoy permanently moored in the Liguro-Provencal Basin (ODAS), and, as a last, an airplane fully equipped for the environmental research (LARA Project), is the body dedicating major resources to oceanographic research. CNR carries on its own activity both directly financing specific oceanographic projects even involving the Universities, and participating, through its Institutes, to the major international initiatives, mostly those devoted to the Mediterranean Sea. In the considered period, CNR initiated the procedure of creating a National Institute for the Marine Sciences with the aim of establishing a more straight co-ordination among the Institutes working at sea.

Also the Universities carry on oceanographic research in nearly all the marine disciplines. As in the CNR, the research centers are scattered all over the national territory, with some important concentrations in Trieste and Milan (Marine Geology and Geophysics) and Naples (Physical Oceanography). Compared with the previous period, it is worth mentioning a significant contraction of the chairs in Physical Oceanography, that are presently active only in the last University.

The National Committee for the Research and Development of the Nuclear and Alternative Energies (ENEA) has a center in La Spezia (Research Center for the Energy and the Environment) (CRAM) dedicated to oceanographic research. Two main guidelines are followed in this center: climatological studies, mostly dedicated to the Mediterranean Sea and involving modelling and analysis of satellite and climatological data, and the monitoring of marine parameters in critical regions of the national coastal system. CRAM also hosts a CNR Institute working in Physical

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Oceanography, and has at its disposal the most complete oceanographic data bank at the national level, with about 30000 hydrographic stations relative to the Mediterranean Sea.

The Central Institute for the Scientific and Technological Research Applied to the Sea (ICRAM) in Rome is the deputy body for the studies devoted to the assessment of fishing resources and the amelioration of the productive activities, mostly in the coastal regions. ICRAM is also active in other fields related to sea management, such as the sea protection and the scientific support during emergencies.

The Experimental Geophysics Observatory (OGS) in Trieste has a significant oceanographic potential supporting high level activities in physical oceanography and geophysics. OGS manages a hydrographic calibration center operating according to the international standards, an oceanographic ship (R/V *Explora*) mostly devoted to geophysical activity, and an oceanographic data bank storing, among the others, the POEM data set (see also later).

All the considered institutions collaborated to the Research and Experimental Program for the Protection of the Adriatic Sea (PRISMA), starting at the end of the period. Due to a massive tourists presence, the Adriatic Sea has a significant economic reason, and deserves, among all the other basins, a special attention by the national authorities. MURST sponsored this project to study the physical and bio-geochemical mechanisms conditioning the fate of pollutants introduced into the basin by the surrounding rivers, and, definitively, to evaluate the basin response to this anomalous presence.

Another project involving all the national institutions is the National Research Program in Antarctica supported by the Italian Government since 1955, and which foresees an intense activity in Physical Oceanography, Chemical Oceanography and Geophysics (see also later).

The necessary connections with the foreign bodies were maintained through a Committee involving the representatives of the major marine institutions around the Mediterranean. Through this Committee, all the Mediterranean countries belonging to the European Union tried to establish common concerted actions with regard to the principal initiatives concerning this basin. GOOS, living resources and coastal regions were the main topics discussed by the Committee.

## BIBLIOGRAPHY

- AstralDI M., Bregant D. and Colantoni P.; 1990: *Physical Sciences of the Ocean-Italian research activity (1987-1990) report to IAPSO*. *Boll. Geof. Teor. Appl.*, **32**, 371-391.

## PHYSICAL OCEANOGRAPHY

National activities in this sector concerned all the Italian basins and were mostly carried on within the frame of the international initiatives related to the Mediterranean Sea. Among them, POEM (Physical Oceanography of the Eastern Mediterranean, now transformed in POEM-BC (Biology and Chemistry)), and PRIMO (Programma di Ricerca Internazionale sul Mediterraneo Occidentale, having the same acronym in French and Catalan), both sponsored by IOC and CIESM and supported by EEC through MAST II. It must be remarked at this regard that the national participation to the activities of the two projects was encouraged by a contribution of the CNR Physical Committee, which supported a research program complementary with both of them.

POEM activity was mostly dedicated to the Adriatic and the Ionian Seas and it was carried on by OGS along with some Institutes of CNR ("Istituto per la Biologia del Mare, Istituto Talassografico, Istituto per la Pesca Marittima, Istituto per la Fisica dell'Atmosfera and Istituto per lo Studio della Dinamica delle Grandi Masse"). In addition to the traditional hydrographic measurements for the investigation of the principal paths of the Levantine Intermediate Water,

as well as the definition of the principal mesoscale structures inside these basins, the monitoring of the fluxes of water and particles through the Otranto Strait, between the two basins, has been initiated.

PRIMO was carried out through different phases (PRIMO-0 focused in the Liguro-Provencal Basin, and PRIMO-1 dedicated to the central region of the Mediterranean Sea, between Sicily, Sardinia and Tunisia and still in progress), and mostly involved the CNR "Stazione Oceanografica", with the collaboration of the "Istituto Universitario Navale" of Naples. The principal results obtained in this period were the further extension of a current time series collected in the Corsica Channel, between the Liguro-Provencal Basin and the Tyrrhenian Sea (the current time series is now 9 years long), the accurate description of the gyre-scale circulation in the northern Tyrrhenian Sea, and the beginning of the monitoring of the water fluxes in the Sicily Strait and the Sicily-Sardinia passage, in parallel with that of the Corsica Channel and the Otranto Strait.

Besides the observational activity, important modeling efforts were carried out mostly by the "Istituto per le Metodologie Geofisiche Ambientali" of CNR. A primitive equation General Circulation Model was implemented in the Mediterranean Sea with the development of the appropriate air-sea interaction physics at the upper boundary, in order to describe the fluxes of heat, momentum and salt that drive the circulation. The results show the large seasonal cycle of the circulation and its transient characteristics even though the comparison with the climatological data is difficult due to data scarcity.

#### BIBLIOGRAPHY

- Argentini S., Lavagnini A. and Carullo R.; 1991: *Climatological and dynamical aspects of the wind regime in the Strait of Messina*. Il Nuovo Cim., **14C**, 135-144.
- Artale V., Astraldi M., Buffoni G. and Gasparini G.P.; 1994: *Seasonal variability of gyre-scale circulation in the northern Tyrrhenian Sea*. J. Geoph. Res., **99**, 14127-14138.
- Artegiani A., Gacic M., Michelato A., Kovacevic V., Russo A., Paschini E., Scarazzato P. and Smircic A.; 1992: *The Adriatic Sea hydrography and circulation in spring and autumn (1985-1987)*. Deep-Sea Res. II, **40**, 1143-1180.
- Astraldi M. and Gasparini G.P.; 1992: *The seasonal characteristics of the circulation in the north Mediterranean Basin and their relationship with the atmospheric-climatic conditions*. J. Geoph. Res., **97**, 9531-9540.
- Astraldi M., Gasparini G.P. and Sparnocchia S.; 1994: *The seasonal and interannual variability in the Ligurian-Provencal Basin*. In: Seasonal and Interannual Variability of the Western Mediterranean Sea, P.E. La Violette (ed), Coastal and Estuarine Studies, 46, American Geophysical Union, pp. 93-113.
- Astraldi M. and Gasparini G.P.; 1994: *The seasonal characteristics of the circulation in the Tyrrhenian Sea*. In: Seasonal and Interannual Variability of the Mediterranean Sea, P.E. La Violette (ed), Coastal and Estuarine Studies, 46, American Geophysical Union, pp. 115-134.
- Barale V.; 1991: *Sea surface colour in the field of biological oceanography*. Int. J. Rem. Sens., **12**, 781-794.
- Barale V.; 1991: *Marine remote sensing information system (MARSIS): a conceptual design*. Int. J. Rem. Sens., Vol. **12**, 4, 795-802.
- Bergamasco A., Malanotte-Rizzoli P., Thacker W.C. and Long R.B.; 1993: *The seasonal steady circulation of the Eastern Mediterranean determined with the adjoint method*. Deep Sea Res. II, **40**, 6, 1269-1298.
- Bignami F., D'Archino R., Montebello O. and Salusti E.; 1991: *New observations on bottom currents in the Southern Adriatic and Ionian Seas (Eastern Mediterranean Sea)*. Ann. Geoph., **9**, 227-232.
- Bohm E., Marullo S. and Santoleri R.; 1991: *AVHRR visible-IR detection of diurnal warming events in the West Mediterranean Sea*. Int. J. Rem. Sens., **12**, 695-702.
- Borzelli G., Ligi R. and Ferulano E.; 1992: *Surface circulation in the Northern Adriatic Sea as revealed by a drifter experiment*. Il Nuovo Cim., **15C**, 265-274.
- Borzelli G., Marullo S., Ligi R. and Cannizzaro G.; 1994: *Solitary waves in the Gulf of Quarnaro revealed by LANDSAT thematic mapper*. Il Nuovo Cim., **17C**, 143-152.
- Brocchini M., Drago M. and Iovenitti L.; 1994: *The modeling of short waves in shallow waters and in the surf zone*. Il Nuovo Cim., **17C**, 549-564.
- Cavaleri L., Bertotti L. and Lionello P.; 1991: *Wind wave cast in the Mediterranean Sea*. J. Geoph. Res., **96**, 10739-10764.
- Cavaleri L. and Bertotti L.; 1994: *Sensitivity of wave model results to directional resolution*. Il Nuovo Cim., **17C**, 635-644.

- Cessi P.; 1991: *Laminar separation of colliding western boundary currents*. J. Mar. Res., **49**, 697-717.
- Colacino M. and Conte M.; 1993: *Greenhouse effect and pressure patterns in the Mediterranean Basin*. Il Nuovo Cim., **16C**, 67-78.
- Crisciani F. and Mosetti R.; 1991: *Stability criteria independent from the perturbation wave number for forced zonal flows*. J. Phys. Ocean., **21**, 1075-1079.
- Crisciani F., Ferraro S. and Raicich F.; 1992: *Some factors controlling the climatological evolution of the upper-layer sea temperature at Trieste*. Il Nuovo Cim., **15C**, 173-180.
- Crisciani F., Ferraro S. and Raicich F.; 1992: *A semi-empirical model of tracer advection in the Northern Adriatic Sea*. Il Nuovo Cim., **15C**, 307-316.
- Crisciani F., Ferraro S. and Raicich F.; 1993: *Remarks on a pronounced meteorological event in the Northern Adriatic Sea in Spring 1992*. Il Nuovo Cim., **16C**, 83-86.
- Crisciani F., Ferraro S. and Raicich F.; 1994: *Evidence of recent climatic anomalies at Trieste (Italy)*. Clim. Change, **28**, 365-374.
- Crisciani F., Ferraro S. and Raicich F.; 1994: *Interannual variability of the sea level at Trieste*. Il Nuovo Cim., **17C**, 377-384.
- Crisciani F. and Mosetti R.; 1994: *An extension of the Serrin non-linear universal stability criterion to the quasi-geostrophic barotropic fluid dynamics*. Il Nuovo Cim., **17C**, 523-528.
- Crisciani F., Cavallini F. and Mosetti R.; 1994: *Stability of analytical solutions of Stommel-Veronis ocean circulation models*. J. Phys. Ocean., **24**, 155-158.
- Dalu G., Prabhakara C., Pompei A. and Nucciarone J.; 1994: *Rainfall estimation over the ocean from 37 GHz radioametric measurements*. Il Nuovo Cim., **17C**, 349-358.
- De Strobel F. and Gualdesi G.; 1994: *High resolution towed oscillating system*. Sea Technology, **35**, 37-40.
- Fantini M.; 1991: *Baroclinic instability and induced air-sea heat exchange*. Tellus, **43A**, 285-294.
- Ferrari G.M. and Tassan S.; 1992: *Evaluation of the influence of yellow substance absorption in the remote sensing of water quality in the Gulf of Naples: a case study*. Int. J. Rem. Sens., **13**, 2177-2190.
- Fiscella B., Lombardini P.P., Trivero P., Pavese P. and Cappa C.; 1991: *Western Mediterranean wind field deduced from SIR-A SAR images*. Il Nuovo Cim., **14C**, 127-134.
- Fiscella B., Oddenino G., Pavese P. and Trivero P.; 1994: *Comparison between algebraical and numerical solutions on the characteristics equation for ripple motion in the presence of a surface film*. Il Nuovo Cim., **17C**, 209-222.
- Franceschetti G. and Schirinzi G.; 1991: *On SAR focusing of ocean waves*. Int. J. Rem. Sens., **12**, 1947-1962.
- Guymer T.H. and Zecchetto S.; 1991: *Winds derived from Seasat's microwave suite*. Int. J. Rem. Sens., **12**, 1699-1712.
- Khorram S., Cheshire H., Geraci A.L. and La Rosa G.; 1991: *Water quality mapping of Augusta Bay, Italy, from Landsat TM data*. Int. J. Rem. Sens., **12**, 803-808.
- Longo A., Manzo M. and Pierini S.; 1992: *A model for the generation of nonlinear tides in the Strait of Gibraltar*. Ocean. Acta, **15**, 233-243.
- Mainardi F., Tampieri F. and Vitali G.; 1991: *Dissipative effects on internal gravity waves in geophysical fluids*. Il Nuovo Cim., **14C**, 391-400.
- Malanotte-Rizzoli P. and Bergamasco B.: *The wind and thermally driven circulation of the eastern Mediterranean Sea. Part II: the barocline case*. Dyn. Atmos. Oc., **15**, 355-419.
- Manzella G.M.R.; 1994: *The seasonal variability of the water masses and transport through the Strait of Sicily*. In: Seasonal and Interannual Variability of the Western Mediterranean Sea, P.E. La Violette (ed.), Coastal and Estuarine Studies, 46, American Geophysical Union, pp. 33-45.
- Marullo S., Santoleri R. and Bignami F.; 1994: *The surface characteristics of the Tyrrhenian Sea: Historical satellite data analysis*. In: Seasonal and Interannual Variability of the Western Mediterranean Sea, P.E. La Violette (ed.), Coastal and Estuarine Studies, 46, American Geophysical Union, pp. 135-176.
- Masina S. and Pinardi N.; 1991: *Merging of barotropic asymmetric vortices. A case study for gulf stream rings*. Il Nuovo Cim., **14C**, 539-554.
- Masina S. and Pinardi N.; 1994: *Mesoscale data assimilation studies in the Middle Adriatic Sea*. Cont. Shelf Res., **14**, 1293-1310.
- Masina S. and Pinardi N.; 1994: *The halting effect of baroclinicity in vortex merging*. J. Phys. Ocean., **23**, 1618-1637.
- Mattioli F.; 1994: *A variational approach to the derivation of high-order shallow-water equations*. Il Nuovo Cim., **17C**, 175-190.
- Michelato A. and Kovacevic V.; 1991: *Some dynamic features of the flow through the Otranto Strait*. Boll. Oceanol. Teor. Appl., **11**, 39-51.
- Michelato A., Accerboni E. and Berger P.; 1991: *Current meter observation in the eastern and central sectors of the Strait of Magellan*. Boll. Oceanol. Teor. Appl., **11**, 261-271.
- Millot C., Manzella G.M.R. and La Violette P.E.; 1992: *Correction to 'The seasonal variation of water masses content in the Western Mediterranean and its relationship with the inflows through the Straits of Gibraltar and Sicily' by G.M.R. Manzella and P.E. La Violette*. J. Geoph. Res., **97** 17961-17962.
- Moretti M., Sansone E., Spezie G. and De Maio A.; 1993: *Results of investigations in the Sicily Channel (1986-1990)*. Deep Sea Res. II, **40**, 1181-1192.

- Paschini E., Artegiani A. and Pinardi N.; 1993: *The mesoscale eddy field in the Middle Adriatic Sea*. Deep-Sea Res. I, **40**, 1365-1377.
- Picco P.; 1991: *Evaporation and heat exchanges between the sea and the atmosphere in the Gulf of Trieste during 1988*. Il Nuovo Cim., **14**, 335-345.
- Pinardi N. and Navarra A.; 1993: *Baroclinic wind adjustment processes in the Mediterranean Sea*. Deep Sea Res.-II, **40**, 1299-1326.
- Panella S., Michelato A., Perdicaro R., Magazzu' G., Decembrini F., Pontrelli G. and Purini R.; 1994: *The influence of wind forcing and of the changing of Coriolis parameter on the Ross Sea tidal circulation*. Il Nuovo Cim., **16C**, 335-348.
- Robinson A.R., Golnaraghi M., Leslie W.G., Artegiani A., Hecht A., Lazzoni E., Michelato A., Sansone E., Teocharis A. and Unluata U.; 1991: *The eastern Mediterranean general circulation: features, structures and variability*. Dyn. Atmos. Oc., **15**, 215-240.
- Robinson A.R., Malanotte-Rizzoli P., Hecht A., Michelato A., Roether W., Teocharis A., Unluata U., Pinardi N., Artegiani A., Bergamasco A., Bishop J., Brenner S., Christianidis S., Gacic M., Georgopoulos D., Golnaraghi M., Hausmann M., Junghaus H.-G., Lascaratos A., Latif M.A., Leslie W.G., Lozano C.J., Oguz T., Ozsoy E., Papageorgiou E., Paschini E., Rozenroub Z., Sansone E., Scarazzato P., Schlitzer R., Spezie G.C., Tzipermann E., Zodiatis G., Athanassiadou L., Gerdes M. and Osman M.; 1992: *General circulation of the Eastern Mediterranean*. Earth-Science Rev., **32**, 285-309.
- Santoleri R., Marullo S. and Bohm E.; 1991: *An objective analysis scheme for AVHRR imagery*. Int. J. Rem. Sens., **12**, 681-694.
- Santoleri R., Bohm E. and Schiano M.E.; 1994: *The sea surface temperature of the western Mediterranean Sea: historical satellite thermal data*. In: Seasonal and Interannual Variability of the Western Mediterranean Sea, P.E. La Violette (ed.), Coastal and Estuarine Studies, 46, American Geophysical Union, pp. 155-194.
- Sestini G.; 1993: *Global warming, climatic changes and the Mediterranean*. In: Symposium Mediterranean Seas 2000, N.F.R. Della Croce (ed.), Genoa University, pp. 373-393.
- Schiano M.E., Santoleri R., Bignami F., Leonardi R.M., Marullo S. and Bohm E.; 1993: *Air-sea interaction measurements in the west Mediterranean Sea during the Tyrrhenian Eddy Multi-Platform Observation Experiment*. J. Geoph. Res., **98**, 2461-2474.
- Schlitzer R., Roether W., Oester H., Junghans H.G., Hausmann M., Johannsen H., Michelato A.; 1991: *Chlorofluoromethane and Oxygen in the Eastern Mediterranean*. Deep Sea Res., **38**, 1531-1551.
- Sparnocchia S., Manzella G.M.R. and La Violette P.E.; 1994: *The interannual and seasonal variability of the MAW and LIW core properties in the western Mediterranean Sea*. In: Seasonal and Interannual Variability of the Western Mediterranean Sea, P.E. La Violette (ed.), Coastal and Estuarine Studies, 46, American Geophysical Union, pp. 177-194.
- Topliss B.J., Guymer T.H. and Viola A.; 1994: *Radar and infrared measurements of a cold eddy in the Tyrrhenian Sea*. Int. J. Rem. Sens., **15**, 1173-1188.
- Trivero P., Fiscella B., Gomez F. and Pavese P.; 1994: *Wind field deduced from marine SAR images*. Il Nuovo Cim., **17C**, 689-696.
- Zambianchi E. and Griffa A.; 1994: *Effects of finite scales of turbulence on dispersion estimates*. J. Mar. Res., **52**, 129-148.

## CHEMICAL OCEANOGRAPHY

Chemical researches mostly concerned the aspects of marine chemistry rather than those of chemical oceanography. Research, in fact, was principally focused in the study of heavy metals, of pollution and sediments, while the works on nutrients, organic matter, biochemistry were less numerous.

Another feature is the prevalence of the coastal studies over those in the open sea. The Adriatic Sea and the Ionian Basin were the most investigated among all the national basins.

The experimental activity in Antarctica still continued with different research lines devoted both to the coastline around the Italian Base in Terra Nova Bay, and to the open sea, for the study of the distribution of dissolved oxygen and nutrients. Some works were dedicated to the region of the Strait of Magellano. The studies about analytical methodology mostly concerned the presence of heavy-metals, the rare-earth and the organo-metallic compounds.

### Analytical methods

The articles report analytical methods for metal determinations in sea water. Generally, electrochemical or atomic absorption spectrometry methods are proposed.

Several papers proposed the use of HPLC system for organic compounds determination.

## BIBLIOGRAPHY

- Baffi F., Cardinale A.M. and Bruzzone R.; 1992: *Preconcentration of chromium, copper and manganese from sea water on pretreated solid materials for determination by atomic absorption spectrometry*. Anal. Chim. Acta, **270**, 79-86.
- Baffi F., Ianni M.C., Cardinale A.M., Magi E., Frache R. and Ravera M.; 1992: *Study of reversed phase C 18-silica in liquid chromatography for determination of free dissolved aminoacids and copper (II)-aminoacid complexes at the picomoles level in marine matrices*. Analyt. Chim. Acta, **260**, 99-106.
- Capodaglio G., Toscano G., Cescon P., Scarponi G. and Muntau H.; 1994: *Collaborative sampling error assessment of trace metal determination in seawater*. Ann. Chim., (Rome), **84**, 329-345.
- Cardellicchio N., Cavalli S. and Riviello J.M.; 1993: *Determination of cadmium and lead at ug/l levels in aqueous matrices by Chelation Ion Chromatography*. Journal of Chromatography, **640**, 207-216.
- Cardellicchio N., Geraci S., Marra C. and Paterno P.; 1992: *Determination of tributyltin oxide in coastal marine sediments and mussels by electrothermal atomic absorption spectrometry*. Applied Organometallic Chemistry. John Wiley & Sons Ltd., **6**, 241-246.
- Cardellicchio N. and Luzzana M.; 1992: *Il monitoraggio in continuo ed "in situ" del fosforo in acqua di mare*. Atti 22mo Congresso S.I.B.M., Oebalia, vol. XVII-2, 559-561.
- Cardellicchio N., Luzzana M., Marra C., Ragone P., Binelli A., Biasci G., Caramenti G., Panizzuti M. and Tartari G.; 1994: *Sistema automatico multiparametrico per il monitoraggio delle acque da battello*. Atti del Workshop "Il Monitoraggio automatico dell'inquinamento marino: stato dell'arte e prospettive". Taranto, 9-10 aprile 1992, 165-180.
- Crisafi E., Azzaro F., Zappala' G. and Magazzu' G.; 1994: *Integrated automatic systems for oceanographic research: some applications*. Proceedings "Oceans 94" Brest 13-16 September 1994, 1: 455-460.
- Lombardi A.T., Morelli E., Balestreri E. and Seritti A.; 1992: *Reverse phase high performance liquid chromatographic fractionation of marine organic matter* - Environ. Technology, **13**, 1013-1021.
- Mazzucotelli A. and Rivaro P.; 1993: *Study of interferences in spectrochemical behavior of strontium, related to its determination in the shell of marine organisms*. Ann. Chim., **83**, 105-115.
- Mazzucotelli A., Frache R. and De Paz F.; 1991: *Inductively coupled plasma atomic emission and electrothermal atomic absorption spectroscopy of trace amounts of erbium in environmental samples*. Applied Spectroscopy, **45**, 507 - 511.
- Mazzucotelli A., De Paz F., Magi E. and Frache R.; 1992: *Interferences of major elements in the determination of rare earth elements by inductively coupled plasma atomic emission spectroscopy*. Anal. Sci., **8**, 189-193.
- Mazzucotelli A., Vivaldi B., De Paz F. and Magi E.; 1992: *Study of the interferences in the determination of trace amounts of iridium in environmental samples by ETA-AAS and ICP-AES*. Ann. Chim., **82**, 107-120.
- Mazzucotelli A., Frache R., Magi E., Rivaro P. and Gerbino T.; 1992: *Separation and determination of trace amounts of inorganic tin and tributyltin using high pressure liquid chromatography inductively coupled plasma atomic emission spectroscopy*. Ann. Chim., **82**, 379-384.
- Mazzucotelli A., Variengo A., Canesi L., Ponzano E. and Rivaro P.; 1991: *Determination of trace amounts of metalloproteins species in mari-mussels samples by High-Performance Liquid Chromatography with inductively Coupled Plasma Atomic Emission Spectrometric detection*. Analyst, **116**, 605-608.
- Mazzucotelli A., Variengo A., Canesi L., De Paz F., Ponzano E. and Rivaro P.; 1991: *Investigation of organometallics in marine ecosystem by high-performance liquid chromatography with inductively coupled plasma atomic emission spectrometric and electrochemical detection*. Anal. Proc. (London), **28**, 79-80.
- Scarano G., Romei C., Seritti A. and Zirino A.; 1991: *Ethylenediamine in the voltammetric determination of copper in sea water at a rotating mercury film electrode* - Analyt. Chim. Acta, **245**, 177-181.

## Biochemistry

The papers generally report research on humic and metallorganic matter concentration in water organisms and sediments of Mediterranean or Antarctic environments.

## BIBLIOGRAPHY

- Campanella L., Cosma B., Degli Innocenti N., Ferri T., Petronio B.M. and Pupella A.; 1994: *Humic compounds in seawater and marine sediments from Antarctica*. Intern. J. Environ. Anal. Chem., **55**, 61-75.
- Frache R., Mazzucotelli A., Baffi F., Cosma B., Magi E. and Rivaro R.; 1994: *Elementi in tracce e composti organometallici nell'ecosistema marino della Baia di Ross in Antartide*. Atti Convegno "Verso una nuova geografia delle terre polari-Sintesi e prospettive" Roma, 21-22 novembre 1991, Memorie Societa' Geografica Italiana. LI, 313-317.

- Hecq J.H., Goffart A. and Catalano G.; 1991: *An ecosystem approach of the Straits of Magellan, and phytopigments characteristic*. *Memorie di Biologia Marina e di Oceanografia*, **19**, 97-99.
- Marin M., Pivotti L., Campesan G., Turchetto M. and Tallandini M.; 1994: *Effects and fate of sediment-sorbed Linear Alkylbenzene Sulphonate (LAS) on the bivalve mollusc Mytilus galloprovincialis Lmk*. *Water Research*, **28**, 85-90.
- Nasci C., Campesan G., Fossato V.U., Tallandini L. and Turchetto M.; 1991: *Induction of cytochrome P-450 and mixed function oxygenase activity by low concentrations of polychlorobiphenyls in marine fish Zosterisessor ophiocephalus (Pall.)*. *Aquatic toxicology*. **19**, 281-290.
- Selli A., Serrazanetti G.P., Pagnucco C. and Nasci C.; 1993: *Mixed function oxydase system (MFO) in the bivalve mollusc Scapharca inaequalvis*. *The Italian Journal of Biochemistry* **42**, 256 A.
- Sfriso A., Marcomini A., Pavoni B. and Orio A.A.; 1992: *Species composition, Biomass, and net primary production in shallow coastal waters: the Venice Lagoon*. *Bioresource Technology*, **44**, 235-250.

### Geochemistry

The article treats the water geochemistry of the Terranova Bay-Ross Sea.

#### BIBLIOGRAPHY

- Cescon P., Fuoco R. and Papoff P.; 1994: *Trace, alkaline and alkaline-earth elements in sea water samples from Terra Nova Bay- Ross Sea (Antarctica): a three-year period of observation*. *Int. J. Environ. Anal. Chem.* **55**, 91-119.

### Heavy metals

Several articles describe the dissolved and particulate heavy metal distributed in different zones and organisms of the Mediterranean and of Antarctica. Others describe the trace metal distributions in these basins. Finally, one work studies the lead contamination in sea water caused by anthropic effects.

#### BIBLIOGRAPHY

- Baffi F., Cardinale A.M., Soggia F. and Frache R.; 1991: *Heavy metals distribution in suspended matter in coastal and offshore waters in Ross Sea (Antarctica)*. *Ann. Chim. (Rome)*, **91**, 523-531.
- Capodaglio G., Scarponi G., Toscano G. and Cescon P.; 1991: *Cadmium complexation in surface seawater of Terra Nova Bay (Antarctica)*. *Ann. Chim.*, **81**, 279-296.
- Capodaglio G., Scarponi G., and Cescon P.; 1991: *Lead speciation in the Antarctic Ocean*. *Anal. Proceed.*, 76-77.
- Cicero A.M., Baldini M., Mecozzi M., Giani M., Molinaro M.G. and Stacchini P.; 1992: *Indagine sui livelli di cadmio in molluschi cefalopodi dello Jonio*. Risultati preliminari. *Rivista della Societa' Italiana di Scienza dell'Alimentazione*, **21**, 163-170.
- Fabiano M., Danovaro R., Magi E. and Mazzucotelli A.; 1994: *Effects of heavy metals on benthic bacteria in coastal marine sediments: a field results*. *Mar. Pollut. Bull.*, **28**, 18-23.
- Ferrara R. and Maserti B.E.; 1992: *Mercury concentration in the water, particulate matter, plankton and sediment of the Adriatic Sea*. *Mar Chem.*, **38**, 237-249.
- Ferrara R., Maserti B.E., Morelli E., Nannicini L., Scarano G. and Seritti A.; 1993: *Metalli pesanti nelle acque e nella Posidonia oceanica dell'Arcipelago Toscano*. In: "Progetto Mare" - Ricerca sullo stato biologico, chimico e fisico dell'Alto Tirreno. C. Nuccio Ed., Laboratorio di Ecologia, Univ. di Firenze, 45-63.
- Frache R., Baffi F., Soggia F., Cosma B., Magi E., Mazzucotelli C., Bottinelli C. and Ravera M.; 1994: *Ricerche sulla distribuzione di metalli pesanti nelle matrici antartiche abiotiche. Ulteriori risultati*. Atti III Convegno "Impatto Ambientale-Metodologiche Chimiche", Venezia, 10-11 marzo 1994, 90-99.
- Giani M., Gabellini M., Miserocchi S. and Pellegrini D.; 1994: *Caratteristiche granulometriche e contenuto di mercurio, piombo e cromo nei sedimenti della zona di discarica dei materiali dragati nel Porto di Ravenna*. Atti del X Congresso A.I.O.L., 619-631.

- Giordano R., Arata P., Ciaralli L., Rinaldi S., Giani M., Cicero A.M. and Costantini S.; 1991: *Heavy metals in mussels and fish from Italian coastal waters*. Mar. Poll. Bull., **22**, 10-14.
- Guarino S.M., Gambardella C., Cardellicchio N., Marra C. and De Nicola M.; 1994: *Accumulo ed effetti biologici del cadmio e dello zinco*. Atti del Workshop "Il monitoraggio automatico dell'Inquinamento marino: stato dell'arte e prospettive. Taranto, 9-10 aprile 92, 91-102.
- Mazzucotelli A., Soggia F. and Cosma B.; 1991: *Electrothermal atomic absorption interactions among trace and major elements in environmental samples: determination of cadmium in the selective and total dissolution of marine sediments*. Applied Spectroscopy, **45**, 504-507.
- Pellegrini D., Giani M. and Coppolelli P.; 1992: *Mercury and Chromium in organism of the coastal marine area between Po delta and Ravenna harbour*. Rapp. Comm. int. Mer Medit., **33**, 325.
- Tapia J., Frache R., Baffi F. and Mazzucotelli A.; 1992: *Metales pesados en diversas matrices del Rio Biobio y del area marina adyacente*. Atti Semin. Intern. "Pianific. territ. Svil. Salvag. Amb. - Progetto EULA Siena, 7-11 Ottobre 1991, 59-64.

## Nutrients

Several papers report data on nutrient distributions in different areas of the Mediterranean, Magellano Strait, Arctica, and Antarctica.

## BIBLIOGRAPHY

- Azzaro F.; 1993: *Concentrazione di nutrienti nella Rada di Augusta (Sicilia)*. Atti I Workshop "Risorsa mare: un Progetto per il Mezzogiorno. Salvaguardia e valorizzazione delle acque costiere del Salento". 93-108.
- Bianchi F., Boldrin A., Cioce F., Dieckmann G., Kuosa H., Larsson A.M., Nothig E.M., Schelstedt P.I., Socal G. and Syvertsen E.E.; 1992: *Phytoplankton distribution in relation to sea ice, hydrography and nutrients in the northwestern Weddel Sea in early spring 1988 during EPOS*. Polar Biology, **12**, 225-235.
- Bregant D., Allegra A., Azzaro F., Civitaresse G., Crisafi E., La Ferla R., Luchetta A. and Rabitti S.; 1992: *Condizioni idrobiologiche nell'Adriatico meridionale*. Aprile 1990. Atti 9 Congresso A.I.O.L., S. Margherita Ligure, 20-22 Novembre 1990. 25-33
- Bregant D., Azzaro F., Bonaccorso A., Civitaresse G., Crisafi E., La Ferla R., Leonardi M., Luchetta A., Polimeni R. and Raicich F.; 1994: *Condizioni idrobiologiche nell'Adriatico meridionale*. Novembre 1991. Atti X Congresso A.I.O.L. Alassio 4-6 Novembre 1992, 37-46
- Bregant D., Civitaresse G. and Luchetta A.; 1992: *Chemical parameters distribution in the Ionian sea during POEM-06 cruise (October 1991)* Rapp. Comm. int. Mer Medit. **33**, 395.
- Catalano G. and Goffart A.; 1991: *Dissolved oxygen and nutrients in the Strait of Magellano*. Nat. Sc. Comm. Antarctica. Oceanographic cruise february-march 1991. 53-66.
- Catalano G., Benedetti F. and Boldrin A.; 1992: *Le condizioni idrobiologiche a Baia Terra Nova: ossigeno disciolto, nutrienti ed alcuni elementi maggiori nell'estate australe 1987/1988*. Atti 9 Congresso A.I.O.L., S. Margherita Ligure, 20-22 Novembre 1990, 593-604.
- Catalano G., Benedetti F. and Iorio M.; 1991: *Coastal Oceanography from Cape Russel to Campbell Ice Tongue (Terra Nova Bay)*. Dissolved Oxygen, Nutrients, pH, Total Alkalinity and Total Inorganic Carbon distribution. Nat. Sc. Comm. Antarctica. Oceanographic Campaign. 1989-1990, 25-32.
- Catalano G., Benedetti F., Goffart A. and Iorio M.; 1991: *Distribution of dissolved oxygen, pH, Total Alkalinity and nutrients in Southern Ocean and Ross Sea (R/V "Cariboo" 1989-1990)*. Nat. Sc. Comm. Antarctica. Oceanographic Campaign 1989-1990. 11-25.
- Catalano G., Goffart A., Artegiani A. and Paschini E.; 1991: *Oxygen and nutrient distribution related to the thermoaline structure along the Straits of Magellan (February-March, 1991)*. Memorie di Biologia marina e di Oceanografia, **19**, 91-95.
- Catalano G., Povero P. and Benedetti F.; 1994: *Removal of N-NO<sub>3</sub>, P- Po<sub>4</sub> and Si-Si(OH)<sub>4</sub> from the upper layer as a result of primary production induced by pack-ice melting (Ross Sea, Antarctica)* Atti X congresso A.I.O.L.. Alassio, 4-6 Novembre 1992, 643-653.
- Fabiano M., Povero P., Catalano G. and Benedetti F.; 1991: *Hydrological data collected during the biological, chemical and geological sampling in Terra Nova Bay*. Nat. Sc. Comm. Ant. Ocean Campaign. 1989-90. Data report. 35-71.
- Hecq J.H., Magazzu' G., Goffart A., Catalano G., Vannucci S. and Guglielmo L.; 1992: *Distribution of planktonic components related to structure of water masses in the Ross sea during the Vth Italianantide expedition*. Atti 9 Congresso A.I.O.L. S. Margherita Ligure 20-22.11.1990, 665-678.
- Luchetta A., Civitaresse G. and Matishov D.; 1992: *Hydrochemistry*. Berichte zur Polarforschung, **115**, 32-35.



- Sfriso A. and Marcomini A.; 1994: *Gross primary production and nutrient behaviour in a shallow coastal environment*. *Bioresource Technology*, **47**, 59-66.
- Sfriso A., Marcomini A. and Pavoni B.; 1994: *Annual nutrient exchanges between the central lagoon of Venice and northern Adriatic Sea*. *The Science of the Total Environment*, **156**, 77-92.

### Suspended matter

The articles describe the research into suspended matter in Northern Adriatic sea, Weddell Sea and Magellano Strait.

### BIBLIOGRAPHY

- Bak R.P.M., Boldrin A., Nieuwland G. and Rabitti S.; 1992: *Biogenic particles and nano/picoplankton in water masses over the Scotia- Weddell Sea Confluence*. *Antarctica, Polar biology*, **12**, 219-224.
- Boldrin A. and Rabitti S.; 1992: *Suspended matter in the Gulf of Venice (Northern Adriatic Sea): years 1990-1991*. XXXIII Congr. CIESM, Trieste. *Rapp. Comm. Int. Mer. Medit.* **33**, 322.
- Fontolan G. and Panella S.; 1991: *Distribution and chemistry (Fe, Zn, Pb, Cu, Cd and chlorophylla) of suspended particulate matter in the Strait of Magellan: Austral Spring 1989*. *Boll. Oceanol. Teor. Appl.*, **9**, 179-191.

### Pollutants

The articles describe the distribution of several kinds of pollutants in water, organisms, and sediments in different areas of the Mediterranean Sea (Venice lagoon, Sicily, Gulf of Taranto, Ligurian Sea).

### BIBLIOGRAPHY

- Corregiani A., Frascari F., Miserocchi S. and Fontana D.; 1992: *Breakwaters and eutrophication along the Emilia Romagna coast*. *Science of the total Environmental. Supplement*, 277-290.
- Crisafi E.; 1993: *Esperienze di monitoraggio della qualità delle acque della rada di Augusta*. In: Atti I Workshop "Risorsa mare: un Progetto per il Mezzogiorno. Salvaguardia e valorizzazione delle acque costiere del Salento", pp. 75-91.
- Danovaro R., Povero P., Diviaco G., Fabiano M. and Gianì M.; 1994: *Indagine ambientale sull'area marina costiera antistante la piana di Albenga (Liguria occidentale). 2. Sostanza organica particellata e batteri*. *Biol. Mar. Medit.* **1**(1), 57-62.
- Da Ros L., Pepi M., Fossato V.U., Baldi F.; 1992: *Microbiological investigations of the surface water of the Laguna Veneta (North Italy) in relation to light gas-oil biodegradation*. XXXIII Congr. CIESM, Trieste. *Rapp. Comm. Int. Mer. Medit.*, **33**, 364.
- Decembrini F., Azzaro F. and Creazzo S.; 1992: *Primi risultati di monitoraggio automatico con mezzo mobile in acque marine costiere*. Riassunto. "Workshop: il monitoraggio automatico dell'inquinamento marino". Taranto, 9-10 aprile 1992.
- Decembrini F., Azzaro F. and Magazzu' G.; 1993: *Studio delle condizioni trofiche della Rada di Augusta per il monitoraggio automatico dei fenomeni di eutrofizzazione*. Atti I workshop "Risorsa mare: un progetto per il Mezzogiorno. Salvaguardia e valorizzazione delle acque costiere del Salento", 109-127.
- De Domenico L., Crisafi E., Magazzu' G., Puglisi A. and La Rosa A.; 1994: *Monitoring of petroleum hydrocarbon pollution in surface water by a direct comparison of fluorescence spectroscopy and remote sensing techniques*. *Mar. Poll. Bull.*, **28**, 587-591.
- De Nicola M., Cardellicchio N., Gambardella C., Guarino S.M., Marra C.; 1992: *Effects of cadmium on survival, bioaccumulation, histopathology and PGM polymorphism in the marine isopod Idotea baltica*. In "Ecotoxicology of metals in invertebrates". Edited by R. Dallinger and P.S. Rainbow. Lewis Publisher, London 103-116.

- Giani M., Cicero A.M., Savelli F., Bruno M., Donati G., Farina A., Veschetti E. and Volterra L.; 1992: *Marine snow in the Adriatic Sea: a multifactorial study*. Sci tot. Environ. Suppl, 539-549.
- Magazzu' G., Crisafi E.; 1991: *Monitoraggio nella rada di Augusta*. Mediterraneo, **1**, 10-12.
- Loglio G., Degli Innocenti N., Stortini A.M., Orlandi G., Tesei U., Mittner P. and Cini R.; 1991: *Air-sea exchange in Antarctic environment and Snow Microcomponents*. Ann. Chim., **81**, 453-467.
- Maroli L., Pavoni B., Sfriso A. and Raccanelli S.; 1993: *Concentrations of Polychlorinated biphenyls and pesticides in different species of Macroalgae from the Venice lagoon*. Marine Pollution Bulletin, **26**, 553-558.
- Mazzucotelli A., Rivaro P., Magi E. and Frache R.; 1993: *Interferenze nella determinazione di tracce di stagno in campione di origine ambientale marina*. Atti Convegno Naz. Div. Chim. Anal., Pavia, 22-25 settembre 1992, 217.
- Paterno P., Cardellicchio N., Leone G. and Marra C.; 1991: *Mercury and tin distribution in Posidonia O. (L.) Delile meadows into the Taranto Gulf (Italy)*. Oebalia vol, XVII, suppl. 1, 265-277.
- Paterno P., Cardellicchio N., Marra C., Leone G.; 1992: *Distribuzione di elementi metallici (Hg, Cu, Zn, Cd, Pb, Sn) in Posidonia oceanica (L.) Delile del Golfo di Taranto*. Atti del 22 Congresso S.I.B.M., Oebalia, vol. XVII-2, 583-585.
- Piraino S., Cardellicchio N., Caroppo C., Paterno P., Annicchiarico C., Leone G., Marra C., Ragone P. and De Nicola Giudici M.; 1991: *Caratterizzazione ecotossicologica del Golfo di Taranto: crescita in laboratorio di idroidi coloniali e microalgahe*. S.I.T.E./ Atti 12, 221-226.
- Schiavuta E., Mittner P. and Cini R.; 1992: *Meteorological Trigger and Remote Control in a meteoromarine Station for Coastal Sea Pollution Studies*. Workshop "Il Monitoraggio Automatico dell'Inquinamento marino" CNR-SCI - Taranto 9-10 aprile 1992. Cardellicchio, F. Dell'Elba eds., 313-330.
- Sfriso A. and Pavoni B.; 1994: *Macroalgae and phytoplankton competition in the central Venice lagoon*. Environmental Technology, **15**, 1-14.
- Sfriso A., Pavoni B., Marcomini A. and Orio A.A.; 1992: *Macroalgae, Nutrient Cycles, and pollutants in the lagoon of Venice*. Estuaries, **15**, 517-528.
- Sherwin M.R., Van Vleet E.D., Fossato V.U. and Dolci F.; 1993: *Coprostanol (5B-cholestan-3b-ol) in lagoonal sediments and mussels of Venice, Italy*. Marine Pollution Bulletin, **26**, 501-507.
- Tallandini L., Fossato V.U., Campesan G., Pivotti L. and Menetto A.; 1992: *Accumulation of PCBs and induction of cytochrome P-450 and mixed function oxygenase activity in juvenile seabass (Dicentrarchus labrax)*. XXXIII Congr. CIESM, Trieste. Rapp. Comm. Int. Mer Medit. **33**, 178.

### Isotopes

The articles listed below deal with radioisotope distribution in the Adriatic sea, with emphasis on Carbon 13 and 14, and Cesium 137.

### BIBLIOGRAPHY

- Calderoni G., Frignani M., Langone L., Petrone V. and Ravaioli M.; 1992: *The distribution of <sup>14</sup>C and <sup>13</sup>C in the organic fraction of coastal sediments from Northern Adriatic Sea*. Rapp. Comm. int mer Medit., **33**, 380.
- Frignani M. and Langone L.; 1991: *Accumulation rates and <sup>137</sup>Cs distribution in sediments off the Po River delta and the Emilia-Romagna Coast (northwestern Adriatic Sea, Italy)*. Continental Shelf Research, **11**, 525-542.

### Sediments

The articles give the distribution of several parameters (pollutants, nutrients, heavy metals, trace elements, clay minerals, organic matter) in sea sediments in different areas of the Mediterranean Sea and Antarctica.

## BIBLIOGRAPHY

- Barbanti A., Bergamini M.C., Frascari F., Miserocchi S., Ratta M. and Rosso G.; 1992: *Early diagenesis and nutrient benthic fluxes in an area South of Po River Delta Northern Adriatic Sea, Italy*. Rapp. Comm. int. Mer Medit., **33**, 321.
- Barbanti A., Bergamini M.C., Frascari F., Miserocchi S. and Rosso G.; 1994: *Critical aspects of sedimentary phosphorus chemical fractionation*. J. Environ. Qua., **23**, 1093-1102.
- Barbanti A., Ceccherelli V.U., Frascari F., Reggiani G. and Rosso G.; 1992: *Nutrient regeneration processes in bottom sediments in a Po delta lagoon (Italy) and the role of bioturbation in determining the fluxes at the sediment-water interface*. Hydrobiologia, **228**, 1-21.
- Boldrin A., Juracic M., Menegazzo Vitturi L., Rabitti S. and Rampazzo G.; 1992: *Sedimentation of riverborne material in a shallow shelf area: Adige River, Adriatic Sea, Marine Geology*, **103**, 473-485.
- Cicero A.M., Divacco G., Ausili A., Di Muccio A., Giani M., Mecozzi M. and Morlino R.; 1994: *Indagine ambientale sull'area marina costiera antistante la piana di Albenga (Liguria occidentale). 1: Finalita', generalita' ambientali e livelli di composti organofosforati nei sedimenti*. Biol. Mar. Medit., **1** (1), 47-56.
- Cosma B., Frache R., Mazzucotelli A. and Soggia F.; 1991: *Trace metals in sediments from Terranova Bay - Ross Sea, Antarctica*. Ann. Chim. (Roma), **81**, 371-382.
- Cosma B., Soggia F., Abemoschi M.L. and Frache R.; 1994: *Determination of trace metals in Antarctic sediments from Terranova bay - Ross Sea*. Intern. J. Environ. Anal. Chem., **55**, 121-128.
- Frache R. - *Trace metal distribution in particulate matter and sediments in Ross Sea (Antarctica)*. Proc. "Environmental Impact Chemical Methodologies", Second Meeting Venice, 26-28 May, 1992.
- Gabellini M., Pellegrini D., Giani M., Spagnoli F. and Zanoli S.; 1994: *Dati preliminari sulle variazioni dei caratteri granulometrici dell'area di scarico dei materiali dragati dal porto di Livorno*. Atti del X Congresso A.I.O.L., 367 - 374.
- Giani M., Gabellini M., Miserocchi S. and Pellegrini D.; 1994: *Caratteristiche granulometriche e contenuto di mercurio, piombo e cromo nei sedimenti della zona di discarica dei materiali dragati nel porto di Ravenna*. Atti X Congresso A.I.O.L.. Alassio 4-6 Novembre 1992, 619-631.
- Giordani P., Hammond D.E., Berelson W.M., Poletti R., Rabbi E. and Lucchini F.; 1994: *Sediment diagenesis and its effect on nutrient cycling in NW Adriatic Sea*. Atti X Congresso A.I.O.L., 4-6 Novembre 1992, 525-527.
- Giordani P., Hammond D.E., Berelson W.M., Montanari G., Poletti R., Milandri A., Frignani M., Langone L., Ravaioli M., Rovatti G. and Rabbi E.; 1992: *Benthic fluxes and nutrient budgets for sediments in the Northern Adriatic Sea: burial and recycling efficiencies*. Science of the Total Environment. Supplement. 251-275.
- Miserocchi S., Langone L. and Guerzoni S.; 1993: *The fate of Hg contaminated sediments of the Ravenna lagoon (Italy): final burial or potential remobilization*. Wat. Sci. Tech., **28**, 343-358.
- Mecozzi M., Amici M., Gesumundo C. and Giani M.; 1994: *Variabilita' stagionale dei nutrienti presenti nei sedimenti dell'Adriatico settentrionale*. Acqua-Aria, **5**, 1-5.
- Mecozzi M., Gesumundo C., Amici M. and Giani M.; 1992: *Total P and extractable Si in superficial sediments of Northern Adriatic Sea*. Rapp. Comm. Int. Mer Medit., **33**, 325.
- Petronio B.M., Cosma B., Mazzucotelli A. and Rivaro P.; 1993: *A multimethod approach to study humic compounds and metal speciation in marine sediment samples*. Intern. J. Environ. Anal. Chem., **54**, 45-56.
- Price N.B., Mowbray S. and Giordani P.; 1994: *Sedimentation and heavy metal input changes on the northwest adriatic sea shelf; a consequence of anthropogenic activity*. Atti X Congresso A.I.O.L.. Alassio, 4-6 Novembre 1992, 23-33.

## Speciation and complexing capacity

The articles describe studies on speciation and the complexing capacity of copper, mercury, and lead in several geographic areas.

## BIBLIOGRAPHY

- Capodaglio G., Toscano G., Scarponi G. and Cescon P.; 1994: *Copper complexation in surface seawater of Terra Nova Bay (Antarctica)*. Int. J. Environ. Anal. Chem., **55**, 129-148.
- Cardellicchio N., Ragone P., Annichiarico C. and Marra C.; 1993: *Speciation of organotin compounds in environmental samples by GC-MS Selected Ion Monitoring*. Oebalia, **19** suppl., 573-580.
- Palmisano F., Zambonin P.G. and Cardellicchio N.; 1993: *Speciation and simultaneous determination of mercury species in dolphin liver by liquid chromatography with on-line cold vapor atomic absorption spectrometry*. Analytical Chemistry, **346**, 648-652.

- Scarano G. and Bramanti E.; 1993: *Voltammetric behaviour of marine hydrophobic copper complexes: effect of adsorption processes at mercury electrode*. Anal. Chim. Acta, **277**, 137-144.
- Scarano G. and Morelli E.; 1993: *A voltammetric study of copper-ion binding to the cell surface of the marine alga *Phaeodactylum tricornutum**. Chemical Speciation and Bioavailability, **5**, 129-134.
- Scarano G., Bramanti E. and Zirino A.; 1992: *Determination of copper complexation in seawater by a ligand competition technique with voltammetric measurement of the labile metal fraction*. Anal. Chim Acta, **264**, 153-162.
- Seritti A., Morelli E., Nannicini L., Giambelluca A. and Scarano G.; 1994: *Fluorescence emission characteristics of naturally occurring organic matter in relation to metal complexation studies*. Sci. Tot. Environ., **148**, 73-81.

### Organic matter

The papers describe studies on different aspects of organic matter distribution in sea water.

### BIBLIOGRAPHY

- Buttino I., Filippi M. and Cardellicchio N.; 1991: *Tossicità dei composti fenolici nell'ambiente marino*. Acqua Aria, **9**, 853-861.
- Cardellicchio N., Palma A., Montemurro N. and Ragone P.; 1994: *Humic and fulvic acids in marine sediments in the Ionian sea (Italy): Proceedings of the 6th International Meeting "Humic Substances in the Global Environment and implications in human health*. Eds. N. Senesi and T.M. Miano, Elsevier, 819-824.
- Lombardi A.T., Seritti A. and Morelli E.; 1994: *Marine dissolved organic matter. Fractionation by RP-HPLC*. In: *Humic substances in the global environment and implications on human health - Proceedings VI Int. Meeting of the IHSS, Monopoli (Bari), Italy, Sept., 20-25, 1992*. N. Senesi and T.M. Miano (Eds.), Elsevier, 851-856.
- Morelli E., Puntoni F. and Seritti A.; 1993: *Fluorescence characteristics of reverse phase HPLC fractionated marine organic matter*. Environ. Technol., **14**, 941-948.
- Seritti A., Morelli E., Nannicini L. and Del Vecchio R.; 1994: *Production of hydrophobic organic matter by the marine diatom *Phaeodactylum tricornutum**. Chemosphere, **28**, 117-129.

### Miscellaneous

The papers describe particular studies on different areas of the Mediterranean Sea, Magellan Strait, and Antarctica.

### BIBLIOGRAPHY

- Acri F., Alberighi L., Bastianini M., Bertaggia R., Bianchi F., Cavalloni B., Cioce F., Dal Pos R., Piergallini R., Socal G. e Trevisan M.; 1991: *Qualità delle acque marine di balneazione nella Regione Veneto (D.P.R. 8/6/82 N. 470 e legge 15/7/88 n. 271). Distribuzione dei parametri idrologici, dei nutrienti disciolti e della biomassa fitoplanctonica (1989)*. In: Regione Veneto, Piano per il rilevamento delle caratteristiche qualitative e quantitative dei corpi idrici della Regione Veneto. Qualità delle acque marine di balneazione nella Regione Veneto. Anni 1988-1990. Vol. II, 177-278.
- Acri F., Alberighi L., Bastianini M., Bertaggia R., Bianchi F., Cioce F., Cavalloni B., Cassiani L., Lombardo I., Stoppelli N., Socal G. e Trevisan M.; 1991: *Qualità delle acque marine di balneazione nella Regione Veneto (D.P.R. 8/6/82 N. 470 e legge 5/4/90 n. 71, art. 15). Distribuzione dei parametri idrologici, dei nutrienti disciolti e della biomassa fitoplanctonica (1990)*. In: Regione Veneto, Piano per il rilevamento delle caratteristiche qualitative e quantitative dei corpi idrici della Regione Veneto. Qualità delle acque marine di balneazione nella Regione Veneto. Anni 1988-1990. Vol. II, 279-416.
- Alberighi L., Bertaggia R., Berti L., Bianchi F., Cioce F., Da Ros L., Pellizzato M. e Socal G.; 1991: *Qualità delle acque marine di balneazione nella Regione Veneto (D.P.R. 8/6/82 n. 470 e legge 25/6/85 n. 322). Distribuzione dell'idrologia, dei nutrienti disciolti e della clorofilla a (1985-1986-1987)*. In: Regione Veneto, Piano per il rilevamento delle caratteristiche qualitative e quantitative dei corpi idrici della Regione Veneto. Qualità delle acque marine di balneazione nella Regione Veneto. Anni 1988-1990. Vol. I, 271-339.

- Alberighi L., Bertaggia R., Berti L., Bianchi F., Ciocce F., Piergallini G., Socal G. e Trevisan M.; 1991: *Qualità delle acque marine di balneazione nella Regione Veneto (D.P.R. 8/6/82 n. 470 e legge 15/7/88 n. 271). Distribuzione dei parametri idrologici, dei nutrienti disciolti e della biomassa fitoplanctonica (1988)*. In: Regione del Veneto, Piano per il rilevamento delle caratteristiche qualitative e quantitative dei corpi idrici della Regione Veneto. Qualità delle acque marine di balneazione nella regione Veneto. Anni 1988-1990. Vol. II, 91-176.
- Boldrin A. and Rabitti S.; 1992: *Oceanografia biologica del mare di Weddell orientale (EPOS Leg 3)*. Atti 9 Congresso A.I.O.L., 697-707.
- Cardellicchio N., Annichiarico C., Leone G., Marra C., Paterno P., Piraino S. e Ragone P.; 1991: *I Mari di Taranto: problematiche di impatto ambientale*. S.I.T.E./Atti 12, 769-775.
- Caroppo C., Cardellicchio N. e Cavallo R.A.; 1994: *Ciclo annuale del fitoplancton nei Mari di Taranto: influenza della qualità delle acque*. Biologia Marina Mediterranea, **1**, 201-206.
- Cini R., Desideri P.G., Mittner P., Pantani F. and Piccardi G.; 1991: *A meteomarine station for the study of the role played by the air-sea exchange and transport of micropollutant via marine aerosol*. Congresso dei Gruppi Interdivisionali della Società Chimica Italiana. Chianciano Terme (SI) 6-11 Ottobre 1991. Atti vol. II, **528**.
- Frache R., Mazzucotelli A. e Baffi F.; 1991: *Chimica oceanografica nel golfo di Arauco*. Atti Sem. Intern. "Pianific. Territ. Svil. Salvag. Amb. - Progetto EULA" Siena, 7-11 ottobre 1991, 129-134.
- Mittner P., Ceccato D., Del Maschio S., Cini R. and Giostra U.; 1991: *Multielemental characterization of aerosol at Terra Nova Bay. Preliminary results on the fine component during the 1990-1991 Austral Summer*. Ann. Chim. Rome, **81**, 605-613.
- Panella S., Magazzù G. and Decembrini F.; 1991: *Photosynthetic pigments in the Strait of Magellan (November 1989, April 1991)*. Memorie di Biologia Marina e di Oceanografia. N.S. - **19**, 135-140.
- Panella S., Michelato A., Perdicaro R., Magazzù G., Decembrini F. and Scarazzato P.; 1991: *A preliminary contribution to understanding the hydrological characteristics of the Strait of Magellan: Austral Spring 1989*. Boll. Ocean. Teor. Appl. **9**, 107-126.
- Rabitti S., Bianchi F., Boldrin A., Da Ros L., Paschini E., Socal G. and Totti C.; 1992: *Observations on some biological properties in the upper layer of the Ionian Sea (POEM06 Cruise, October 1991)*, Rapp. Comm. int. Mer Medit., **33**, 397.

## MARINE GEOSCIENCES

In the period we consider (1991-94), Italian Earth-scientists have carried out a wide activity notwithstanding the lack of an unitary national plan, and the growing difficulties in getting grants for the expensive marine research. In addition, we have to point out that only the major research centers succeeded in managing ships and great projects, while the smaller groups (especially from the Universities) have been often obliged to reduce their contributions. Many subjects have nevertheless been approached: some of them are the natural continuation of previous research lines, while some others are completely new projects.

### Geology and geodynamics of the Mediterranean area

For this argument many seismic profiles from the Seas around Italy and data from sampling have been newly interpreted, according to modern concepts. The new studies concern the southern Adriatic Sea (Apulian foreland), the Sicilian-Tunisian platform, the evaluation of the Sardinia-Corsica rotation, and the Plio-Quaternary tectonic subsidence of the Tyrrhenian Sea. Of special interest is the Project CROP (Progetto Strategico Crosta Profonda), still in progress, devoted to achieve new information on the deep structure of Italy and the surrounding seas.

## BIBLIOGRAPHY

- Agate M., Catalano R., Infuso S., Lucido M., Mirabile L. and Sulli A.; 1993: *Structural evolution of the northern Sicily continental margin during the Plio-Pleistocene*. In: Geological development of the Sicilian-Tunisian Platform, M. D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 25-30.

- Aiello G.; 1992: *Analisi sismostratigrafica del margine apulo nell'offshore delle Murge settentrionali*. *Giornale di Geologia*, **54** (1), 3-18.
- Aiello G. and Alteriis G.; 1993: *Il margine adriatico della Puglia: fisiografia ed evoluzione terziaria*. *Mem. Soc. Geol. It.*, **47** (1991), 25, 197-212.
- Argnani A. and Trincardi F.; 1991: *Paola slope basin: evidence of regional contraction on the eastern Tyrrhenian Margin*. *Geology of Oceans, Terrasini*, 14-16 Maggio 1991. *Mem. Soc. Geol. It.*, **44**, 93-105.
- Argnani A. and Trincardi F.; 1992: *Shallow thrusting in the Gela foredeep basin: an example of gravity-driven shortening*. *Mem. Soc. Geol. It.*, **45**, 605-606.
- Argnani A.; 1993: *Neogene Basins in the Strait of Sicily (Central Mediterranean): tectonic settings and geodynamic implications*. In: E. Boschi, E. Mantovani, A. Morelli Eds., "Recent Evolution and Seismicity of the Mediterranean Region"; NATO-ASI Serie C, **402**, 173-187.
- Argnani A.; 1993: *Neogene tectonics of the Strait of Sicily*. In: Geological development of the Sicilian-Tunisian Platform. M. D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 55-60.
- Argnani A., Favali P., Frugoni F., Gasperini M., Ligi M., Marani M., Mattiotti G. and Mele G.; 1993: *Foreland deformational pattern in the southern Adriatic Sea*. *Annali di Geofisica*, XXXVI, **2**, 229-247.
- Argnani A. and Trincardi F.; 1993: *Growth of a slope ridge and its control on sedimentation: Paola Slope Basin (Eastern Tyrrhenian Margin)*. *Sedimentation and Tectonics in Extensional, Oblique-slip and compressional settings*. Memec and Steel, IAS Special Publ. **20**, 467-480.
- Bartole R., Bocchino F., Gandino A. and La Torre P.; 1991: *Neogene-Quaternary magmatism in the Gaeta Gulf, East Tyrrhenian margin, from seismic and aeromagnetic interpretation*. *Terra Abstracts, Strasbourg*, 3/1, **373**.
- Bartole R., Torelli L., Mattei G., Peis D. and Brancolini G.; 1991: *Assetto stratigrafico strutturale del Tirreno Settentrionale: stato dell'arte*. In: *Studi Geologici Camerti*, vol. spec. 1991/1: Studi preliminari all'acquisizione dati del profilo CROP 03, 115-140.
- Bartole R.; 1994: *The North Tyrrhenian-Northern Apennines post-collisional system: constraints for a geodynamics model*. *Terra Nova*, **6**, 24.
- Bowles F.A. and Fleischer P.; 1993: *Outcropping pre-Pleistocene strata in the Strait of Sicily*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 135-140.
- Caiti A., Fiori S., Guidi G., Michelozzi E. and Zimmer W.X.; 1993: *Shallow sediment shear structure at three sites in the Sicilian-Tunisian Platform*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 141-146.
- Camerlenghi A., Cita M.B., Hieke W. and Ricchiuto T.; 1992: *Geological evidence for mud diapirism on the Mediterranean Ridge accretionary complex*. *Earth and Planetary Science Letters*, **109**, 493-504.
- Camerlenghi A. and Erba E.; 1992: *Extreme deep-sea environment of the Eastern Mediterranean anoxic basins: The state of the art*. *Riv. It. Pal. Strat.*, **97**, 695-708.
- Camerlenghi A., Della Vedova B., Pellis G., Polonia A., Rebesco M. and Rebez A.; 1993: *The Mediterranean Ridge in the Eastern Mediterranean*. *Atti XI Convegno Annuale G.N.G.T.S.*, Roma, 553-568.
- Catalano R., Di Stefano P., Nigro F. and Vitale F.P.; 1993: *Sicily mainland and its offshore: A structural comparison*. In: Geological development of the Sicilian-Tunisian Platform, M. D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 19-24.
- Catalano R., Infuso S. and Sulli A.; 1993: *The Pelagian foreland and its northward foredeep. Plio-Pleistocene structural evolution*. In: Geological development of the Sicilian-Tunisian Platform, M. D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 37-42.
- Catalano R., Infuso S., Milia A. and Sulli A.; 1993: *The submerged Sicilian-Maghrebian chain along the Sardinia Channel-Sicily Strait belt*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 43-48.
- Cermak V., Balling N., Della Vedova B., Lucazeau F., Pasquale V., Pellis G., Shultz R. and Verdoya M.; 1992: *The European Geotraverse: Heat flow density*. In: Blundell D., Freeman R. and St. Mueller Eds., *A continental revealed, The European Geotraverse. Atlas of compiled data*, 49-57, Cambridge University Press.
- Channel J.E.T., Oldow J. and D'Argenio B.; 1990: *Paleomagnetically determined rotations in West Sicilian fold and thrust belt*. *Tectonics*, **9** (4), 641-660.
- Cita M.B. and Camerlenghi A.; 1993: *The Mediterranean Ridge as an accretionary prism in a collision context*. *Boll. Soc. Geol. It.*, **45**, 463-480.
- Coltorti M., Galassi B., Siena F. and Savelli C.; 1993: *The igneous floor of the Marsili deep basins (South Tyrrhenian Sea): mode and magmatic characters of the oceanization*. *Ofoliti*, **18/2**, 171-176.
- De Alteriis G. and Aiello G.; 1993: *Stratigraphy and tectonics offshore of Puglia (Italy, Southern Adriatic Sea)*. *Marine Geology*, **113**, 239-253.
- Della Vedova B., Marson I., Panza G.F. and Suhaldoc P.; 1991: *Upper mantle properties of the Tuscan-Tyrrhenian area: a key for understanding the recent tectonic evolution of the Italian region*. *Tectonophysics*, **195**, 311-318.
- Della Vedova B., Mongelli F., Pellis G., Squarci S., Tuffi L. and Zito G.; 1991: *Heat flow map of Italy*. Scale 1:2.500.000, National Research Council, Int. Institute for Geothermal Research, Pisa, SELCA, Firenze.
- Della Vedova B., Mongelli F., Pellis G. and Zito G.; 1993: *Campo regionale del flusso di calore nel Tirreno*. *Atti X Convegno Annuale G.N.G.T.S.*, Roma, 817-826.

- Della Vedova B., Pellis G., Crisci G. and Barca D.; 1993: *Regime termico e processi magmatici nel Tirreno Meridionale*. Atti XI Convegno Annuale G.N.G.T.S., Roma, 601-612.
- De Voogd B., Nicolich R., Olivet J.L., Fanucci F., Burrus J. and CROP-ECORS Working Group; 1991: *First deep seismic reflection transect from Gulf of Lions to Sardinia (ECORSCROP profiles in western Mediterranean)*. In: Meissner R., Brown L., Duerbaum H.J., Franke W., Fuchs K. and Seifert F. Eds., *Continental Lithosphere: Deep seismic reflections*. AGU Geodynamic, **22**, 265-274.
- Fanucci F., Eva C., Cattaneo M., Firpo M. and Piccazzo M.; 1991: *Tettonica e morfogenesi olocenica in Mar Ligure*. Mem. Soc. Geol. It., **42**, 221-227.
- Fanucci F., Firpo M., Piccazzo M., Lembo P., Pantaleone N.A. and Sacchi L.; 1992: *Morphostructural features and evolution of the Ligurian Sea*. Miscellanea IV: 29th International Geological Congress, Kyoto 24 agosto-3 settembre 1992. Servizio Geologico Nazionale. Istituto Poligrafico e Zecca dello Stato, Roma, IV, 29-44.
- Fanucci F., Firpo M., Morelli D. and Piccazzo M.; 1994: *Il Mar Ligure: origine e storia di un bacino mediterraneo*. In "Studi geografici in onore di Domenico Ruocco", a cura di F. Citarella, Loffredo Editore, Napoli, 117-130.
- Ferrucci F., Gaudiosi G., Hirn A. and Nicolich R.; 1991: *Jonian Basin and Calabrian arc: new elements by DSS data*. Tectonophysics, **195**, 411-419.
- Gabbianelli G., Romagnoli C., Rossi P.L. and Calanchi N.; 1993: *Marine geology of the Panarea-Stromboli area (Aeolian Archipelago)*. Acta Volcanologica, **3**, 11-20.
- Gamberi F. and Argani A.; 1993: *Seismostratigraphic analysis of the Neogene basins superposed on the Maghrebien orogen west of the Egadi Islands: Preliminary results*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 61-64.
- Gardiner W., Grasso M. and Sedgeley D.; 1993: *Plio-Pleistocene stratigraphy and fault movement of the Malta Platform*. In: Geological development of the Sicilian-Tunisian Platform, M. D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 111-116.
- Grasso M.; 1993: *Pleistocene structures at the Ionian Side of the Hyblean Plateau (SE Sicily): Implications for the tectonic evolution of the Malta Escarpment*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 49-54.
- Grasso M., Mazzoldi G. and Torelli L.; 1993: *Structural and stratigraphic framework of the Tunisian shelf surrounding the islands of Lampedusa and Lampedusa (Pelagian Sea)*. In: Geological development of the Sicilian-Tunisian Platform, M. D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 65-70.
- Mongelli F., Zito G., Della Vedova B., Pellis G., Squarci P. and Taffi L.; 1991: *Geothermal Regime of Italy and Surrounding Seas*. In: Cerm V. and Rybach L. Eds., *Terrestrial Heat Flow and the Structure of the Lithosphere (Exploration of the deep continental crust)*, Springer-Verlag, 381-394.
- Pedley M., Debono G. and Yeaman M.; 1993: *Mesozoic structuring and volcanics along the Pelagian-Ionian boundary: A prelude to foundering of the Ionian Basin*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 81-86.
- Pellis G. and Della Vedova B.; 1993: *Modellistica termica transiente nel mediterraneo Centrale*. Atti X Convegno Annuale G.N.G.T.S., Roma, 827-840.
- Sartori R., Colalongo M.L., Gabbianelli G., Bonazzi C., Carbone S., Curzi P. V., Evangelisti D., Grasso M., Rossi S., Lentini F. and Selli L.; 1992: *Note stratigrafiche e tettoniche sul Rise di Messina (Ionio nord-occidentale)*. Giornale di Geologia, **53/2**, 1-16.
- Savelli C. and Schreider A.A.; 1991: *The opening processes in the deep Tyrrhenian basins of Marsili and Vavilov as deduced from magnetic and chronological evidence of their igneous crust*. Tectonophysics, **190**, 119-131.
- Savelli C.; 1992: *Il riftung del vulcano Marsili (Mar Tirreno): aspetti morfo-tettonici osservati da bordo del sottomarino "MIR 2"*. Giornale di Geologia, **3**, 54, 2, 215-227.
- Savelli C. and Gasparotto G.; 1993: *Natura ed evoluzione del vulcanismo del Monte Marsili (retro-arco Eoliano, Mar Tirreno)*. Plinius, **10**, 231-233.
- Savelli C. and Gasparotto G.; 1994: *Calc-alkaline magmatism and rifting of the deep-water volcano of Marsili (Aeolian back-arc, Tyrrhenian Sea)*. Marine Geology, **119**, 137-157.
- Senatore M.R., Normark W.R., Pescatore T. and Rossi S.; 1992: *Structural framework of the Gulf of Taranto (Ionian Sea)*. Mem. Soc. Geol. It., **41**, 533-539.
- Serri G.; 1991: *Neogene-Quaternary magmatism of the Tyrrhenian region: characterization of the magma sources and geodynamic implications*. Mem. Soc. Geol. It., **41** (1990), 219-242.
- Todesco M. and Vigliotti L.; 1993: *When did Sardinia Rotate? Statistical evaluation of the paleomagnetic data*. Annali di Geofisica, **36**, 119-134.
- Torelli L., Tricart P., Zitellini N., Argani A., Bouhel I., Brancolini G., De Cillia C., De Santis L. and Peis D.; 1992: *Une section sismique profonde de la chaine Maghrebides-Apennins, du bassin tyrrhenien à la plateforme pelagienne (Mediterranee centrale)*. Comp. Rendue Acad. Sci. Paris, **315**, II, 617-622.
- Torelli L., Zitellini N., Argani A., Brancolini G., De Cillia C., Peis D. and Tricart P.; 1993: *Sezione geologica crostale dall'Avampese Pelagiano al bacino di Retroarco Tirrenico (Mediterraneo Centrale)*. Mem. Soc. Geol. It., **47**, 385-399.
- Tramontana M.; 1992: *Strike-slip tectonics in the Puglia Shelf between Gargano Promontory and Monopoli (South Adriatic Sea)*. Rapp. Comm. Int. Mer Medit., **33**, 153.

- Tramontana M., Bartole R., Mazzoli S., Wezel F.C. and Savelli D.; 1992: *Proseguimento delle facies carbonatiche bacinali mesozoiche dell'Appennino centrale sul margine Campano-Laziale (Mar Tirreno)*. Mem. Soc. Geol. It., **41** (1988), 507-518.
- Tramontana M., Lucantoni G. and Anibaldi A.; 1994: *Riattivazione di faglie giurassiche nella evoluzione terziaria dell'avampaese apulo tra il Promontorio del Gargano e Brindisi (Mare Adriatico meridionale)*. 77 Riunione Estiva-Congresso Nazionale Soc. Geol. It., Bari 26-28 settembre 1994, Abstract, 152-153.
- Tricart P., Torelli L., Brancolini G., Croce M., De Santis L., Peis D. and Zitellini N.; 1991: *Derives d'arcs insulaires et dynamique mediterraneenne suivant le transect Sardaigue Afrique*. C.R. Acad. Sci. Paris, **313**, II, 801-806.
- Tricart P., Torelli L., Boullin J.P., Rekhiss F., Argnani A., Brancolini G., De Santis L., Peis D. and Zitellini N.; 1993: *Structure and Neogene dynamics of the northern Tunisia margin*. In: Geological development of the Sicilian-Tunisian Platform, M. D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 71-76.
- Yastrebov V.S., Savelli C., Sborshchikov I. and Schreider A.A.; 1992: *On the oceanic crust of the Tyrrhenian Sea: present knowledge and open problems*. Mem. Soc. Geol. It., **41**, 547-556.

### Sedimentary processes

These studies include: depositional models within a sequence stratigraphic framework, Quaternary detailed bio-stratigraphy, the definition of interactions between tectonics and depositional systems and models for the coastal zone evolution.

### BIBLIOGRAPHY

- Argnani A., Artoni A., Ori G.G. and Roveri M.; 1992: *L'avanfossa centro-adriatica: stili strutturali e sedimentazione*. Studi Geologici Camerti, **1**, 371-381.
- Argnani A. and Trincardi F.; 1992: *Growth of a slope ridge and its control on sedimentation: Paola Slope Basin (Eastern Tyrrhenian Margin)*. IAS, Special Publ. **15**.
- Biasini G., Borsetti A.M., Cati F., Gabbianelli G. and Jorissen F.J.; 1991: *Southern Adriatic Ad/91 Cruise. Preliminary seismic and biostratigraphical results*. Giornale di Geologia, **52/2**, 77-90.
- Bonardi M. and Marabini F.; 1991: *Paleoenvironments in the lagoon of Venice*. Birbal Sahni Paleobotanical conference, Lucknow (India), 20-22 Nov. '91. Proceedings.
- Bonardi M. and Marabini F.; 1993: *Environmental evolution in the Lagoon of Venice, Italy*. Geophytology, **23/1**, 159-165.
- Bowles F.A., Lambert D.N. and Richardson M.D.; 1993: *Sediment patterns within the trough separating the Tunisian and Sicilian Platforms*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 129-134.
- Brambati A., Ciabatti M., Fanzutti G.P. and Marabini F.; 1991: *A new sedimentological textural map of the south Adriatic Sea*. Sixth meeting of the European Union of Geosciences, Strasburgo 24-28 Marzo 1991, Proceedings.
- Brambati A. and De Muro S.; 1992: *Dynamics of the bar and trough zone between Capo Testa e Punta di li Francesi (northern Sardinia)*. Boll. Oceanol. Teor. Appl., X, **2-3-4**, 165-179.
- Brizzolari E., Chiocci F.L., Orlando L. and Sacchi L.; 1991: *Pleistocene evolution of the Tuscan shelf from Piombino headland to S.Vincenzo (Tyrrhenian sea, Italy)*. Giornale di Geologia, **53** (2), 3, 11-30.
- Budillon F., Pescatore T.S. and Senatore M.R.; 1994: *Cicli deposizionali del Pleistocene superiore-Olocene sulla piattaforma continentale del Golfo di Salerno (Tirreno meridionale)*. Boll. Soc. Geol. It., **113**, 303-316.
- Casali O., Castelli G.F., Fontana M. and Marabini F.; 1991: *The safeguard of the coastal environment: a possibility of a preventive action against the erosive phenomena*. 7th Coastal zone 91. Long Beach (USA) 8-12 Luglio 1991, Paper n. 48. Proceedings.
- Catalano R., Di Stefano E., Lo Cicero G., Infuso S., Vail P.R. and Vitale F.P.; 1993: *Basin analysis and sequence stratigraphy of the Plio-Pleistocene of Sicily*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 99-104.
- Catani G., Tunis G. and Lenardon G.; 1993: *One year of surveys along a transect of emerged and intertidal beach (Valle Vecchia, northern Adriatic Sea)*. Boll. Oceanol. Teor. Appl., X, **2-3-4**.
- Coccioni R., Bellagamba M., Di Leo R., Savelli D. and Tramontana M.; 1992: *Latest Pleistocene-Holocene Paleoclimatic record and sea level changes in the central Adriatic Sea: Foraminiferal evidence from core A85-10*. Il Quaternario, **5/2**, 147-162.
- Colantoni P., Tramontana M. and Alberini C.; 1991: *Central Adriatic Sea: an example of a fore-deep system filled by sedimentary prograding clino-forms*. Terra abstract, **3**, 1, 356.



- Colantoni P., Asioli A., Borsetti A.M., Capotondi L. and Vergnaud- Grazzini C.; 1992: *Subsidenza tardo-Pleistocenica ed Olocenica nel Medio Adriatico evidenziata dalla geofisica e da ricostruzioni paleoambientali*. Mem. Soc. Geol. It., **42**, 1989, 209-220.
- Colantoni P., Gennesseaux M., Vanney J.R., Ulzega A., Melegari G. and Trombetta A.; 1992: *Processi dinamici del canyon sottomarino di Gioia Tauro (Mare Tirreno)*. Giornale di Geologia, **3**, 54/2, 209-223.
- Colantoni P., Tramontana M. and Alberini C.; 1993: *Some notes on recent turbiditic sedimentation in the Pantelleria Basin (Sicily Channel)*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 147-152.
- Corradi N., Setti M. and Tucci S.; 1992: *Distribuzione dei minerali argillosi nei sedimenti della piattaforma continentale compresa tra Sestri Levante e la Spezia*. Atti IX Congr. Ass. It. Ocean. Limnol., S. Margherita Ligure 20-23/11/90, 315-324.
- Corradi N., Setti M., Tucci S. and Ferrari M.; 1994: *Distribuzione dei minerali argillosi nei sedimenti della piattaforma continentale compresa tra Capo Mortola ed Alassio (Liguria Occidentale)*. Atti X Ass. It. Ocean. Limnol., Alassio, 4-6 Novembre 1992, 575-585.
- Correggiari A., Roveri M. and Trincardi F.; 1991: *Forced Regressions, Depositional Regressions and Sediment Failure of Late-Quaternary Progradational Units (Southeast Adriatic Sea)*. Continental Margins: Sedimentation, Tectonics, Eustasy, Climate. Portland Oregon, 15-18 Agosto 1991. SEPM first annual meeting.
- Correggiari A., Roveri M. and Trincardi F.; 1992: *Regressioni forzate, regressioni deposizionali e fenomeni di instabilità in unità progradazionali tardo-quaternarie (Adriatico Centrale)*. Giornale di Geologia, **3**, 54/1, 19-36.
- Del Bono G.L., Guennoc P., Lembo P., Pantaleone N.A., Sacchi L. and Ventura R.; 1991: *Tipologia dei fondali marini sulla piattaforma continentale dell'Isola di Marettimo*. Boll. Serv. Geol. d'Italia, vol. CX.
- Di Stefano E., Infuso S. and Scarantino S.; 1993: *Plio-Pleistocene sequence stratigraphy of south western off-shore Sicily from well logs and seismic sections in a high resolution calcareous plankton biostratigraphic framework*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 105-110.
- Fanucci F., Pineda V. and Amore C.; 1992: *Characteristics and dynamics of the coast of the Arauco Gulf (Central Chile)*. I Seminario sulla dinamica e i caratteri geoambientali degli spazi costieri. Alassio 3-4 ottobre 1991. Boll. Ocean. Teor. Appl., X, **3**, 265-271.
- Fanucci F. and Pineda V.; 1992: *El canon submarino del Bio Bio y su importancia en la dinamica ambiental del Golfo de Arauco*. Monografía Científicas del Proyecto internacional: "Gestión de los recursos hídricos de la cuenca del Río Bio Bio y del área marina costera adyacente" vol. IV. O. Parra y F. Faranda Ed. Min Aff. Esteri-Roma; Min. Plan. y Coop.-Santiago.
- Field M.E. and Trincardi F.; 1991: *Regressive coastal deposits on quaternary continental shelves: preservation and legacy*. SEPM, **46**, 107-122.
- Field M.E. and Trincardi F.; 1991: *From highstand to lowstand: formation and preservation of distinctive sediments facies on Quaternary shelves*. Nuna Conference on High-Resolution Sequences Stratigraphy, 23-30 Agosto 1991. Proceedings of Resolution Sequence Stratigraphy, pp. 19.
- Hamano Y., Krumsieck A.O., Vighiotti L. and Wipperfurth J.; 1992: *Plio-Pleistocene magnetostratigraphy of sediment cores from the Japan Sea*. Proc. ODP Sci. Results, 127-128, part 2, 969-982.
- Hoang C.T. and Taviani M.; 1991: *Stratigraphic and tectonic implications of Uranium-series-dated coral reefs from uplifted Red sea islands*. Quaternary Research, **35**, 264-273.
- Jorissen F.J., Asioli A., Borsetti A.M., Capotondi L., De Visser J.P., Hilgen F.J., Rohling E.J., Van Der Borg K., Vergnaud-Grazzini C. and Zachariasse W.J.; 1993: *Late Quaternary central Mediterranean biochronology*. Mar. Micropal., **21**, 169-189.
- Marabini F., Veggiani A., Qing Yumshan and Cang Shuxi; 1992: *The climatic changes and the coastal environment*. Marine Geology and Quaternary Geology, **12**, 27-40.
- Marabini F. and Veggiani; 1993: *Evolutional trend of the coastal zone and influence of the climatic fluctuations*. In: P.M. Grifman, J.A. Fawcett, Eds., "International Perspectives on Coastal Ocean Space Utilization", Sea Grant, University of Southern California, Los Angeles, 459-474.
- Marani M., Argnani A., Roveri M. and Trincardi F.; 1993: *Sediment drifts and submarine erosional surfaces in Central Mediterranean: evidence of bottom current activity*. Sedimentary Geology Special Issue, Stow and J.C. Faugeres, Conturites and Bottom Currents, **82**, 207-220.
- Marocco R.; 1991: *Evoluzione tardopleistocenica-olocenica del delta del F. Tagliamento e delle Lagune di Marano e Grado (Colfo di Trieste)*. Il Quaternario, **4/1b**, 223-232.
- Max M.D., Kristensen A. and Michelozzi E.; 1993: *Small-scale Plio-Quaternary sequence stratigraphy and shallow geology of the west-central Malta Plateau*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 117-122.
- Molinaroli E., Guerzoni S. and Rampazzo G.; 1993: *Contribution of Saharan dust to the Central Mediterranean Basin*. In: M.J. Johnsson, A. Basu Eds., "Processes Controlling the composition of Clastic Sediments". Geol. Soc. of America Special Paper, **284**, 303-317.
- Pasini G., Colalongo M.L., Curzi P.V. and Taviani M.; 1993: *Analisi paleoecologica degli ambienti tardo-quaternari del Dosso Gallignani (Adriatico centro-meridionale) mediante lo studio paleontologico di carote*. Boll. Soc. Paleont. Ital., **32** (1), 113-130.

- Pineda V., Fanucci F. and Di Geronimo I.; 1991: *Sedimentologia y tanatocenosis del Golfo de Arauco*. Congr. Geol. Chileno, 5-9 agosto 1991. Actas Vol. 1.
- Pineda V., Fanucci F. and Di Geronimo I.; 1991: *Distribucion de las facies texturales y materia organica de los sedimentos del Golfo de Arauco*. Seminario Inter. "Gestion ambiental de los recursos hidricos Continentales y marinos y Planificacion Teritorial" Talcahuano-VIII Region Chile, sept. 1991.
- Pugliese N. and Stanley D.J.; 1991: *Ostracoda, depositional environments and late Quaternary evolution of the eastern Nile Delta, Egypt*. Il Quaternario, **4/2**, 275-302.
- Sartori R., Colalongo M.L., Gabbianelli G., Bonazzi C., Carbone F., Curzi P., Evangelisti D., Grasso M., Lentini F., Rossi L. and Selli L.; 1991: *Note stratigrafiche e tettoniche sul Rise di Messina (Mar Ionio nord-occidentale)*. Giornale di Geologia, **53/2**, 49-64.
- Taviani M., Bouchet, Metivier, Fontugne and Delibrias; 1991: *Intermediate steps of southwards faunal shifts testified by last glacial submerged thanatocoenoses in the Atlantic Ocean*. Paleo-3, **86**, 331-338.
- Tomadin L., Curzi P.V. and Landuzzi V.; 1991: *Fluvial pelitic supplies from the Apennines to the Adriatic sea: IV- Clay minerals from the Musone River as natural tracers in the nearshore sediments*. Proc. 7th EUROCLAY Conf., Dresden 1991, **3**, 1081-1085.
- Tomadin L. and Laduzzi V.; 1991: *Origin and differentiation of clay minerals in pelagic sediments and sapropels of the Bannock Basin (Eastern Mediterranean)*. In : M.B. Cita, G.J. de Lange and E. Olausson (eds.), Anoxic Basins and Sapropel Deposition in the Eastern Mediteranean: Past and Present. Marine Geology, **100**, (Spec. Sect.), 35-43.
- Tomadin L. and Laduzzi V.; 1993: *Fluvial pelitic supplies from the Apennines to the Adriatic Sea: III-Imprinting and seasonal variation of the clay minerals trasported by the Chianti River*. 11th Conference on Clay Mineralogy and Petrology, C. Budejovice 1990, 225-235.
- Tonarelli B., Turgutcan F., Max M.D. and Akal T.; 1993: *Shallow sediment composition at four localities on the Sicilian-Tunisian Platform*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 123-128.
- Trincardi F. and Field M.E.; 1991: *Geometry, lateral variation and preservation of downlapping regressive shelf deposit: eastern Tyrrhenian sea margin, Italy*. Journal of sedimentary petrology, **61**, 5, 775-790.
- Trincardi F. and Field M.E.; 1991: *Deposition and preservation of late Pleistocene regressive shelf deposits: eastern Tyrrhenian Sea Margin, Italy*. Nuna Conference on High Resolution Sequence Stratigraphy, 23-30 Agosto 1991. Proceedings of Resolution Sequence Stratigraphy, 53-55.
- Trincardi F. and Field M.E.; 1992: *Collapse and flow of lowstand shelf-margin deposits: an example from the Eastern Tyrrhenian, Italy*. Marine Geology, **105**, 77-94.
- Trincardi F., Correggiari A. and Roveri M.; 1994: *Late Quaternary trasgressive erosion and deposition in a modern epicontinental shelf: the Adriatic Semienclosed Basin*. Geo-Marine Letters, **14**, 41-51.
- Tucci S., Piccazzo M., Firpo M. and Corradi N.; 1992: *Interaction entre morphologie et dynamique de depot des sediments: quelques cas en Ligurie*. Actes du Colloque International sur l'ecologie et la protection du littoral Mediterranean. Commission RAMOGE, Monte-Carlo 23-24 Octobre 1992.

## Geomorphology

Some contributions deal with the morphological aspects of the Mediterranean margins; among these, special interesting studies were carried out by diving on rocky shallow seabeds and in marine caves in order to define climatic fluctuations and reconstruct sea-level changes.

## BIBLIOGRAPHY

- Alessio M., Allegri L., Antonioli F., Belluomini G., Ferranti L., Impronta S., Manfra L. and Proposito A.; 1992: *Risultati preliminari relativi alla datazione di speleotemi sommersi nelle fasce costiere del Tirreno centrale*. Giornale di Geologia, **3**, 54/2, 165-193.
- Alvisi M., Barbieri F., Bruni R., Cinelli F., Colantoni P., Grandi G.F. and Maltoni P.; 1994: *La Grotta Azzurra di Capo Palinuro (Salerno)*. In: Grotte Marine d'Italia. M. Alvisi, P. Colantoni e P. Forti, Eds. Memorie dell'Istituto Italiano di Speleologia, **6**, II, 51-56.
- Alvisi M., Barbieri F. and Colantoni P.; 1994: *Le grotte marine di Capo Palinuro*. In: Grotte Marine d'Italia. M. Alvisi, P. Colantoni e P. Forti, Eds. Memorie dell'Istituto Italiano di Speleologia, **6**, II, 143-181.
- Alvisi M., Bianchi C.N. and Colantoni P.; 1994: *Le grotte sommerse dello Scoglio della Cappa (Isola del Giglio)*. In: Grotte Marine d'Italia. M. Alvisi, P. Colantoni e P. Forti, Eds. Memorie dell'Istituto Italiano di Speleologia, **6**, II, 25-30.

- Alvisi M. and Bruni R.; 1994: *Le grotte Marine del promontorio dell'Argentario (Grosseto)*. In: Grotte Marine d'Italia. M. Alvisi, P. Colantoni e P. Forti, Eds. Memorie dell'Istituto Italiano di Speleologia, **6**, II, 31-35.
- Alvisi M. and Bruni R.; 1994: *Le grotte marine dell'isola di Giannutri (Grosseto)*. In: Grotte Marine d'Italia. M. Alvisi, P. Colantoni e P. Forti, Eds. Memorie dell'Istituto Italiano di Speleologia, **6**, II, 37-43.
- Alvisi M., Bruni R. and Forti P.; 1994: *Ricerche speleomarine a Capu di Monte Santu (Sardegna)*. In: Grotte Marine d'Italia. M. Alvisi, P. Colantoni e P. Forti, Eds. Memorie dell'Istituto Italiano di Speleologia, **6**, II, 45-50.
- Alvisi M., Colantoni P., Gargiulo E. and Gargiulo R.; 1994: *Le grotte marine dell'Isola di Dino (Calabria)*. In: Grotte Marine d'Italia. M. Alvisi, P. Colantoni e P. Forti, Eds. Memorie dell'Istituto Italiano di Speleologia, **6**, II, 183-191.
- Antonoli F. and Ferranti L.; 1992: *Geomorfologia costiera e subacquea e considerazioni paleoclimatiche sul settore copreso tra S. Maria Navarrese e Punta Goloritz (Golfo di Orosei, Sardegna)*. Giornale di Geologia, **3**, 54/2, 65-89.
- Antonoli A. and Ferranti L.; 1994: *La grotta sommersa di Cala dell'Alabastro (S. Felice Circeo)*. In: Grotte Marine d'Italia. M. Alvisi, P. Colantoni e P. Forti, Eds. Memorie dell'Istituto Italiano di Speleologia, **6**, II, 131-136.
- Antonoli A., Ferranti L. and Mucedda M.; 1994: *Osservazioni geomorfologiche e paleoclimatiche nella Crotta delle Alghe (Capo Caccia, Sardegna)*. In: Grotte Marine d'Italia. M. Alvisi, P. Colantoni e P. Forti, Eds. Memorie dell'Istituto Italiano di Speleologia, **6**, II, 137-142.
- Antonoli F., Ascione A., Cinque A., Ferranti L. and Romano P.; 1994: *Coastal and underwater geomorphology of Capo Palinuro area. GEOSUB '94, International Meeting on Underwater Geology, Guidebook to the field-sea trip. Palinuro (SA-Italy)*.
- Brambati A. and De Muro S.; 1992: *Notes on the Geomorphological map of the area between Capo Testa and Punta di li Francesi (northern Sardinia)*. Boll. Oceanol. Teor. Appl., **10**, 133-147.
- Brambati A. and De Muro S.; 1992: *Submerged coastlines in the sector between Capo Testa and Punta di li Francesi (northern Sardinia)*. Geomorphological and Sedimentological aspects. Boll. Oceanol. Teor. Appl., **10**, 149-164.
- Cinque A. and Putignano M.L.; 1992: *Geomorphology of the continental shelf around the Sorrento Peninsula (Southern Italy)*. Giornale di Geologia, **3**, 54/2, 115-125.
- Colantoni P., Lembo P., Pantaleone N.A., Sacchi L. and Spanio F.; 1993: *Morpho-lithological map (1:50.000) of the Egadi Islands shelf (western Sicily)*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 87-92.
- Colantoni P., Ligi M., Morsiani P., and Penitenti P.; 1993: *Morphology and Recent sedimentary evolution of the western Sicilian Continental Shelf*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 93-98.
- Colantoni P., Gamba R. and Alvisi M.; 1994: *Le grotte marine dell'isola di Ustica (Palermo)*. In: Grotte Marine d'Italia. M. Alvisi, P. Colantoni e P. Forti, Eds. Memorie dell'Istituto Italiano di Speleologia, **6**, II, 57-70.
- Diviaco G. and Serena F.; 1994: *Le grotte del Bue Marino dell'isola di Gorgona*. In: Grotte Marine d'Italia. M. Alvisi, P. Colantoni e P. Forti Eds. Memorie dell'Istituto Italiano di Speleologia, **6**, II, 17-23.
- Fanucci F., Eva C., Cattaneo M., Firpo M. and Piccazzo M.; 1991: *Tettonica e morfogenesi olocenica in Mar Ligure*. Atti Convegno "Morfogenesi e stratigrafia dell'Olocene", Bari 28-30 maggio 1989. Mem. Soc. Geol. It.
- Firpo M., Piccazzo M., Bonci M.C., Ivaldi R. and Poggi F.; 1994: *Il delta sommerso del Fiume Centa (Albenga): caratteristiche morfologiche e stratigrafiche*. Atti X Congr. Ass. It. Ocean. Limnol., Allassio, 4-6 Novembre 1992, 587-602.
- Gabbianelli G., Romagnoli C., Rossi P.L., Calanchi N. and Lucchini F.; 1991: *Morphology and tectonics of the Vulcano complex (Aeolian Is., South Tyrrhenian Sea)*. Acta Volcanologica, **1**, 135-141.
- Orr P. and Pasquini C.; 1992: *Rilevamento geomorfologico sottomarino della riserva marina di Tavolara e di Capo Coda Cavallo (Sardegna nord-orientale)*. Giornale di Geologia, **3**, 54/2, 49-63.
- Orr P., Melegari G. and Badalini M.; 1993: *Geomorphological observations of the sea bed between Cape Bon and Cape Feto (Strait of Sicily)*. In: Geological development of the Sicilian-Tunisian Platform, M.D. Max and P. Colantoni Eds., UNESCO reports in marine science, **58**, 153-160.
- Reitano G.; 1992: *Rilevamento geomorfologico subacqueo del litorale compreso tra Punta Priola e la borgata Arenella, a nord di Palermo (Sicilia nord-occidentale)*. Giornale di Geologia, **3**, 54/2, 103-114.
- Romagnoli C., Kokelaar P., Rossi P.L. and Sodi A.; 1993: *The submarine extension of Sciara del Fuoco feature (Stromboli Isl.): morphological characterization*. Acta Volcanologica, **3**, 91-98.
- Romano P. and Sgrosso A.; 1992: *L'evoluzione geomorfologica della grotta subacquea dell'Isca (Penisola sorrentina, Campania)*. Giornale di Geologia, **3**, 54/2, 151-163.
- Serena F. and Diviaco G.; 1994: *La "Grotta du Bue Marinu" dell'Isola di Capraia (286 T/Li)*. In: Grotte Marine d'Italia. M. Alvisi, P. Colantoni e P. Forti Eds. Memorie dell'Istituto Italiano di Speleologia, **6**, II, 125-129.
- Tocaceli R.M.; 1992: *Principali elementi morfostrutturali del tratto di costa sommerso tra Sapri e la foce del Fiume Noce (Golfo di Policastro)*. Giornale di Geologia, **3**, 54/2, 91-101.

### Environmental geology and study of the present depositional processes

This topic deals with the assessment of the environmental conditions through the measure of the nutrient and organic matter fluxes at the sediment-water interface, the role of bioturbation, resuspension and diffusion, and pollution through rivers and the atmosphere.

#### BIBLIOGRAPHY

- Barbanti A., Ceccarelli V.U., Frascari F., Reggiani G. and Rosso G.; 1992: *Nutrient regeneration processes in bottom sediments in a Po delta lagoon (Italy) and the role of bioturbation in determining the fluxes at the sediment-water interface*. *Hydrobiologia*, **228**, 1-21.
- Barbanti A., Ceccarelli V.U., Frascari F., Rosso G. and Reggiani G.; 1992: *Nutrient release from sediments and role of bioturbation in the Goro Lagoon (Italy)*. *Science of the Total Environment*, Suppl., 475-488.
- Barbanti A., Frascari F., Paltrinieri D. and Rosso G.; 1992: *Transport of nutrients in rivers: investigations on the river Po (Italy)*. *Science of the Total Environment*, Suppl., 337-344.
- Correggiari A., Frascari F., Miserocchi S. and Fontana F.; 1992: *Breakwaters and eutrophication along the Emilia-Romagna coast*. *Science of the Total Environment*, Suppl., 277-290.
- Cruciani L., Falsconi L., Guerzoni S., Quarantotto G. and Rampazzo G.; 1992: *Six years (1985-1990) of suspended particulate matter (SPM) and precipitation data at Messina Station, Italy: relationships between dust transport and rain chemistry*. MAP Technical Reports, Series 64, UNEP, Athens 1992.
- Frascari F., Rosso G., Bortoluzzi G., Barbanti A., Bonvicini Pagliai A., Crema R., Castelli A., Mauri M., Zunarelli A., Orlando C., Prevedelli D., Ceffa L. and Ratti S.; 1992: *Environmental impact of water based drilling muds and cuttings in a northern Adriatic Sea site*. *Bulletin de l'Institut Océanographique*, Monaco, n. speciale 11, 305-324.
- Frignani M. and Langone L.; 1991: *Accumulation rates and <sup>137</sup>Cs distribution in sediments of the Po River delta and the Emilia-Romagna coast (northwestern Adriatic Sea, Italy)*. *Continental Shelf Research*, **11**, 8, 525-542.
- Guerzoni S., Landuzzi W., Lenaz R., Quarantotto G., Rampazzo G., Molinaroli E., Turetta C., Visin F., Cesari G. and Cristini S.; 1993: *Fluxes of soluble and insoluble metals and nutrients from the atmosphere to the central Mediterranean Sea*. In: J.M. Martin, H. Barth Eds., "EROS 2000", CEC Water Pollution Research report, **30**, 253-260.
- Miserocchi S., Langone L. and Guerzoni S.; 1993: *The fate of Hg contaminated sediments of the Ravenna Lagoon (Italy): final burial or potential remobilization*. *Water Science and Technology*, **28** (8-9), 349-358.
- Molinari E., Guerzoni S. and Rampazzo G.; 1993: *Contribution of Saharan desert to the Central Mediterranean Basin*. *Geol. Soc. of America*, Spec. Paper **284**, 303-312.
- Viel M., Barbanti A., Langone L., Buffoni G., Paltrinieri D. and Rosso G.; 1991: *Nutrient profiles in the pore water of a deltaic lagoon: methodological consideration and evaluation of benthic fluxes*. *Est. Coast. Shelf Science*, **33**, 361-382.

### Geology and geodynamics of extra-Mediterranean areas

The investigation was concentrated in two main regions: a) the oceanic ridges and fracture zones, and b) the seas around Antarctica. As to first topic the contributions derive from ODP and the special surveys in the Atlantic and Pacific Oceans, while the second one deals with the results of the P.N.A. (National Program for Antarctic Research) that is still continuing. Important oceanographic cruises were carried out in the Strait of Magellan to gather some elements for an initial solution to the problem of the structure of the water bodies and to advance hypotheses on the origin, source and transport of the sediments.

#### BIBLIOGRAPHY

##### a) Oceanic ridges and fracture zones

- Auzende J.M., Bonatti E. et al.; 1993: *The MAR-Vema F.Z. intersection surveyed by deep submersible Nautile*. *Terra Research*, **2**, 68-73.

- Auzende J.M., Gracia Mont E., Bendel V., Lafoy Y., Lagabrielle Y., De Alteriis G. and Tanahashi M.; 1994: *A possible triple junction at 14 degrees 50'S on the North Fiji Basin Ridge (Southwest Pacific)?* Marine Geology, **16**, 25-35.
- Bonatti E., Raznitsin Y., Bortoluzzi G., Budillon F., De Alteriis G., Gasperini L., Gasperini M., Giaquinto G., Ligi M., Lodolo E., Mazarovich A., Peyve A., Sacchi M., Skolotnev S., Trofimov V., Turko N., Zacharov M., Auzende J.M., Mamaloukas-Frangoulis V. and Searle R.C.; 1991: *Geological studies of the eastern part of the Romanche transform (equatorial Atlantic); a first report.* Giornale di Geologia, **53** (2), 31-48.
- Bonatti E., Daniele D. and Peyve A.; 1993: *Peridotites from the Chain Fracture Zone in the Equatorial Atlantic: a preliminary report.* Acta Volcanologica, **2**, 65-71.
- Bonatti E., Peyve A., Kepezhinskas P., Kurentsova N., Seyler M., Skolotnev S. and Udintsev G.; 1993: *Upper mantle heterogeneity below the Mid-Atlantic Ridge, 0 degrees-15 degrees N.* Jour. Geophys. Res., **97/B4**, 4461-4476.
- Bonatti E., Seyler M. and Sushevskaia N.; 1993: *A cold suboceanic mantle belt at the Earth's Equator.* Science, **261**, 315-320.
- Bonatti E.; 1994: *The Earth's Mantle below the Oceans.* Scientific American, March 1994, 26-33.
- Cannat M., Bonatti E. et al.; 1993: *A geological cross section of the Vema Fracture Zone transverse ridge, Atlantic Ocean.* Jour. Geodynamics, **13**, 97-118.
- De Alteriis G., Ruellan E., Auzende J.M., Bendel V., Gracia Mont E., Lagabrielle Y., Ondreas H., Huchon P. and Tanahashi M.; 1993: *Propagating rifts in the North Fiji Basin (Southwest Pacific).* Geology, **21**, 583-586.
- Gasperini M.; 1993: *Global forces on the lithosphere.* Journal of Geodynamics, **17**, 3, 121-132.
- Lagabrielle Y., Mamaloukas-Frangoulis V., Cannat M., Auzende J.M., Honnores J., Melvev C. and Bonatti E.; 1993: *Vema fracture zone (central Atlantic): tectonic and magmatic evolution of the median ridge and the eastern ridge-transform intersection domain.* Jour. Geophys. Res., **97**, B12, 17, 331-17, 351.
- Lodolo E., Coren F. and Christoffel D.A.; 1992: *Geophysical study of the South-West Pacific in the vicinity of the Macquarie Triple Junction.* Eos Transaction, American Geophysical Union, 73 (25), Western-Pacific Geophysical Meeting Suppl., **68**.
- Mamaloukas V., Bonatti E. et al.; 1993: *In situ study of the eastern ridge-transform intersection of the Vema F.Z.* Tectonophysics, **190**, 55-71.
- Marshak S., Bonatti E., Brueckner H. and Paulsen T.; 1993: *Fracture-zone tectonics at Zabargad Island, Red Sea (Egypt).* Tectonophysics, **216**, 379-385.
- Ondreas H., Ruellan E., Auzende J.M., Bendel V., De Alteriis G., Gracia Mont E. and Tanahashi M.; 1994: *Variabilité morphostructurale a l'échelle kilométrique de la dorsale du Bassin Nord-Fidjien: Exploration in situ du segment compris entre 18 degrees 50' S et 19 degrees S.* Compts Rendu de l'Academie de Science de Paris, **316**, III, 115-122.
- Rossi S., Westall F. and Mascle J.; 1991: *The geomorphology of the Southwest Guinea Margin: Tectonic, volcanic, mass movement and bottom current influences.* Marine Geology, **105**, 225-240.
- Sartori R., Torelli L., Zitellini N., Peis D. and Lodolo E.; 1994: *Eastern segment of the Azores-Gibraltar line (central-eastern Atlantic): An oceanic plate boundary with diffuse compressional deformations.* Geology, **22/6**, 555-558.
- Serri G., Spadea P., Beccaluva L., Civetta L., Coltorti M., Dostal J., Sajona F., Vaccaro C. and Zeda O.; 1991: *Petrology of the igneous rocks from the Celebes Sea.* Proceedings of the O.D.P., Scientific Results, **124**, 271-296.
- Spadea P., Beccaluva L., Civetta L., Coltorti M., Dostal J., Sajona F., Serri G., Vaccaro C. and Zeda O.; 1991: *Petrology of the basic igneous rocks from the Sulu Sea.* Proceedings of the O.D.P., Scientific Results, **124**, 251-269.
- Spadea P., Beccaluva L., Coltorti M., Serri G., Vaccaro C. and Zeda O.; 1992: *Petrology of the igneous rocks from the sea floor of the Sulu and Celebes Sea.* Ofioliti, **17/1**, 79-93.
- Torii M., Hayashida A., Vigliotti L. and Wipern J.; 1992: *Rock magnetic properties of sediments from Site 797, Japan Sea.* In: Tamaki K., Allan J., McWilliams M. et al. Proc. ODP Sci. Results, 127-128, part 2, 947-957.
- Vigliotti L.; 1992: *Magnetic properties and paleomagnetism, of volcanic rocks and interlayered sediments from the Japan Sea (ODP Leg 127).* Proc. ODP Sci. Results, 127-128, part 2, 933-945.
- Vigliotti L. et al.; 1992: *Biostratigraphic and biochronologic synthesis of Legs 127 and 128: Sea of Japan.* Proc. ODP Sci. Results, 127-128, part 2, 1218-1219.
- Westall F., Rossi S. and Mascle J.; 1993: *Current controlled sedimentation in the Equatorial Atlantic: examples from the southern margin of the Guinea Plateau and the Romanche Fracture Zone.* Sedimentary Geology, **82**, 157-171.

## b) Seas around Antarctica

- Anderson, Reid and Taviani M.; 1991: *Compositional and geochemical characteristics of recent biogenic carbonates from the Ross Sea (Antarctica).* Mem. Soc. Geol. It., XLVI, 561-562.
- Boehm G., Brancolini G., Fais S., Snidarcing A. and Vesnaver A.; 1993: *Integrated interpretation of geophysical anomalies in the Western Ross Sea-Antarctica.* Boll. Geof. Teor. Appl., **35**, 119-132.

- Bozzo, Ghezzi, Simeoni and Taviani M.; 1991: *The magnetic susceptibility of Ross Sea Continental shelf surficial sediments (Antarctica)*. Mem. Soc. Geol. It., XLVI, 563-570.
- Brambati A. and Colantoni P.; 1991: *Preliminary report on a seismic survey in the Strait of Magellan*. Boll. Ocean. Teor. Appl., **9**, 99-106.
- Brambati A., Fontolan G. and Simeoni U.; 1991: *Recent sediments and sedimentological processes in the Strait of Magellan*. Boll. Oceanol. Teor. Appl., **9**, 217-260.
- Brambati A., Colizza E., De Muro S., Di Grande A., Fontolan G. and Simeoni U.; 1993: *Geomorphological map of the coastal area of the Strait of Magellan between Punta Dungeness and Bahía Inutil (Chile)*. Proc. III International Geomorphology Conference, Hamilton 23-29 Agosto 1993.
- Brambati A., Ceccaroni L., D'Onofrio S., Fanzutti G.P., Finocchiaro F., Frignani M., Langone L., Melis R. and Ravaoli M.; 1994: *Paleoenvironmental inferences from the Core ANTA 91-30 (Drygalski Basin-Ross Sea, Antarctica)*. Terra Antarctica, **1/2**, 335-337.
- Brancolini G., Gantar C., Lodolo E. and Marchetti A.; 1991: *Acquisition, processing and preliminary results of the 1988/89 Antarctic Geophysical survey*. Mem. Soc. Geol. It., **46**, 543-560.
- Brancolini G., Fais S., Gantar G., Lodolo E. and Zanolla C.; 1993: *Geophysical study of the Ross Sea (Antarctica): two integrated sections*. Boll. Geof. Teor. Appl., **35**, 107-118.
- Brancolini G., Bartek L., Cooper A. and Mirabile L.; 1994: *Acoustic Stratigraphy of Victoria Land Basin-Ross Sea Antarctica*. Terra Antarctica, **1/2**, 339-340.
- Brancolini G., Casula G., De Cillia C., Manzella A., Polonia A., Rebesco M. and Seriani G.; 1994: *Seismic modeling of two depositional systems*. Annali di Geofisica, **37**, 899-913.
- Brancolini G. and Davey F.; 1994: *The Cenozoic Sedimentary Geology of the Ross Sea (A review)*. Terra Antarctica, **1/2**, 325-328.
- Brancolini G., De Santis L., Busetti M. and Cooper A.; 1994: *Structural evolution across a section south of the Drygalski ice tongue (Victoria Land Basin)*. In: Landscape evolution in the Ross Sea Area, Antarctica van der Wateren A.M. Vebers & F. Tessensohn Eds., Haarlem, 69-76.
- Buonocore B., Mirabile L., Severino V. and Giorgetti F.; 1994: *Sidescan sonar survey, an investigation of some marks on the Joides Basin seafloor (Ross Sea)*. Terra Antarctica, **1**, 111-114.
- Busetti M., Camerlenghi A., Carta A., Lodolo E. and Sauli C.; 1993: *The Ross sea (Antarctica) review of the geological and geophysical exploration*. Boll. Geof. Teor. Appl., **35**, 245-263.
- Busetti M., De Santis L., Kavun M. and Zayatz I.; 1993: *Seismic sequences of the Ross Sea continental margin*. Boll. Geof. Teor. Appl., **35**, 133-152.
- Busetti M., Brancolini G. and De Santis L.; 1994: *Seismic sequences analysis from the Ross Shelf*. Terra Antarctica, **1**, 130-133.
- Busetti M. and Cooper A.K.; 1994: *Possible ages and origins of unconformity U6 in the Ross Sea, Antarctica*. Terra Antarctica, **2**, 341-344.
- Busetti M., Zayatz P.I. and Ross Sea Working Group; 1994: *Distribution of seismic unit in the Ross Sea, Antarctica*. Terra Antarctica, **2**, 345-348.
- Camerlenghi A., Brancolini G. and Rebesco M.; 1993: *Caratteristiche Sismiche del Margine Pacifico della Penisola Antartica a sud della zona di frattura Shackleton*. IV Meeting Scienze della Terra in Antartide.
- Camerlenghi A., Boehm G., Della Vedova B., Lodolo E., Pellis G. and Vesnaver A.; 1994: *Seismic reflection tomography and thermal implications of a gas hydrate Bottom Simulating Reflector (BSR) on the South Shetland margin (Antarctic Peninsula)*. Terra Antarctica, **1**, 295-296.
- Colizza E.; 1991: *Preliminary report on coastal morphology and sea-bottom sediments of the Canales Beagles, Ballenero, Brecknock, Cockburn and Magdalena*. Boll. Ocean. Teor. Appl., **9**, 273-279.
- Cooper A.K., Brancolini G., Behrendt J.C., Davey F.J. and Barrett P.J.; 1994: *A record of Cenozoic Tectonism Throughout the Ross Sea, and possible controls on the glacial record*. Terra Antarctica, **1**, 353-356.
- Cooper A.K., Brancolini G., Hinz K., Traube V. and Zayatz I.; 1994: *Evidence of Cenozoic Tectonics in sedimentary record of the Ross Sea continental margin*. In: Landscape evolution in the Ross sea area, Antarctica. van der Wateren A.M. Vebers & F. Tessensohn Eds., Haarlem, 77-84.
- Coren F., Giorgetti F., Pescatore T. and Senatore M.R.; 1993: *Le successioni sedimentarie della Baia di terra Nova-Bacino Drygalski (Mare di Ross-Antartide): interpretazione di profili sismici ad alta mochanale*. Giornale di Geologia, **55/1**, **3**, 155-163.
- Della Vedova B., Pellis G., Lower L.A. and Brancolini G.; 1991: *Heat flow and tectonics of the Western Ross Sea*. Recent Progress in Antarctic Earth Science, Proceeding of the Sixth International Symposium on Antarctic Earth Science. Yoshida Y., Kaminuma K., Shiraishi K. Eds., Tokyo, 627-637.
- Della Vedova B., Pellis G., Ramigni M., Lower L.A. and Brancolini G.; 1993: *Flusso di calore e tettonica recente nel Victoria Basin (Mare di Ross)*. Atti X Convegno Annuale G.N.G.T.S., Roma, 841-856.
- Della Vedova B., Pellis G. and Brancolini G.; 1994: *The ACRUP-1 experiment 1993/94: deep crustal investigation across the Transantarctic Mountains and the adjacent Ross Sea depression (Antarctica)*. Terra Antarctica, **1**, 363-366.
- Della Vedova B., Gantar C. and Zanolla C.; 1994: *Crustal structure in the Ross Sea area, Antarctica*. Terra Antarctica, **1**, 121-122.

- Della Vedova B., Pellis G. and Gruppo di Ricerca ACRUP-1; 1994: *Il Progetto ACRUP-1 per lo studio delle strutture crostali alla transizione tra il Mare di Ross Occidentale e la Catena Transantartica*. Atti XII Convegno Annuale G.N.G.T.S., Roma, **20**.
- Della Vedova B., Ramigni M. and Brancolini G.; 1994: *Cenozoic tectonic activity and thermal regime of the Victoria Land Basin (Ross Sea Antarctica)*. Terra Antarctica, **1**, 125-127.
- Della Vedova B., Pellis G., Brancolini G. & The ACRUP-1 Research Group; 1994: *The ACRUP-1 Experiment 1993/94: Deep crustal investigation across the Transantarctic Mountains and the adjacent Ross Sea depression (Antarctica)*. Terra Antarctica, **1**, 363-365.
- De Santis L., Anderson J.B., Ship S.S., Brancolini G. and Zayatz I.; 1994: *Integration of high and intermediate resolution seismic data sets with MCS data to examine the glacial record of Eastern Basin (Ross Sea)*. Terra Antarctica, **1**, 359-362.
- De Santis L., Brancolini G. and Busetti M.; 1994: *Structural evolution of the Victoria Land Basin south of the Drygalsky ice tongue (Western Ross Sea)*. Terra Antarctica, **1**, 107-110.
- Fanucci F., Firpo M. and Piccazzo M.; 1994: *Lineamenti geologici del Mare di Ross: recenti risultati delle ricerche di geologia marina in Antartide*. Atti del Convegno "Verso una nuova geografia delle terre polari: sintesi e prospettive". Roma, 21-22 Novembre 1991. Mem. Soc. Geog. It., LI, 277-289.
- Fontolan G. and Panella S.; 1991: *Distribution and chemistry (Fe, Zn, Pb, Cu, Cd, Chlorophyll a) of suspended particulate matter in Strait of Magellan: Austral Spring 1989*. Boll. Oceanol. Teor. Appl., **9**, 179-191.
- Lodolo E., Camerlenghi A. and Brancolini G.; 1994: *A bottom simulating reflector on the South Shetland margin, Antarctic Peninsula*. Antarctic Science, **5**, 207-210.
- Lodolo E. and Coren F.; 1994: *The western most Pacific Antarctic plate boundary in the vicinity of the Mequarie Triple Junction*. Terra Antarctica, **1**, 158-161.
- Marchetti A., Baroni C., Brancolini G., Lodolo E., Ombrelli G. and Stefanon A.; 1993: *Sea bottom morphologies of the Ross Sea area*. Boll. Geof. Teor. Appl., **35**, 203-218.
- Mosca R. and Fontolan G.; 1991: *Preliminary results on major, minor and trace elements chemistry of surficial sediments in the Strait of Magellan*. Boll. Oceanog. Teor. Appl., **9**, 287-291.
- Russi M., Freber J., Costa G., Nieto D. and Panza G.; 1993: *Analysis of digital waveforms recorded at the seismographic station Esperanza*. Terra Antarctica, **1**, 162-166.
- Simeoni U., Fanzutti G.P. and Bonadiman C.; 1991: *Morphometric features of plebbles in a polar environment (Northern Victoria Land, Antarctica)*. Boll. Oceanol. Teor. Appl., **9**, 353-365.
- Simeoni U., Ghezzi G., Bozzo E. and Fontolan G.; 1991: *Magnetic susceptibility of surficial sediments from the Strait of Magellan*. Boll. Oceanol. Teor. Appl., **9**, 203-215.
- Spezie G., Tucci S., Budillon G., Corradi N., Piccazzo M., Fanucci F., Firpo M., Mirabile L. and Ferrari M.; 1993: *Water masses characteristics, sediment dispersal and seismic stratigraphy in the continental margin of the Ross Sea (Antarctica)*. Annali Facoltà Scienze Nautiche, Istituto Universitario Navale, Napoli, LX.
- Taviani M., Reld D. and Anderson J.; 1993: *Skeletal and isotopic composition and paleoclimatic significance of late pleistocene carbonates, Ross Sea, Antarctica*. Journal of Sedimentary Petrology, **63**, 84-90.

