

ANNUAL REPORT ON GEOTRACES ACTIVITIES IN SPAIN
JUNE 2013 – JUNE 2014

National committee (under SCOR-Spain)

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We co-organized the GEOTRACES section GA04-S (Mediterranean Sea) on board the R/V Ángeles Alvariño between May 2nd and June 1st 2013. We sampled about 100 depths at 10 stations to analyze a suite of isotopes including $^{231}\text{Pa}/^{230}\text{Th}$, ^{236}U , ^{238}U , Pu isotopes, ^{137}Cs , ^{90}Sr , ^{129}I , ^{234}Th , ^{237}Np , $^{228,226}\text{Ra}$, Nd-isotopes and Deuterium. We also carried out some experiments on ^{210}Pb and ^{210}Po using several techniques to evaluate potential differences between methods. We also deployed ISP (n=6) in order to collect particles to analyze particulate trace metals.

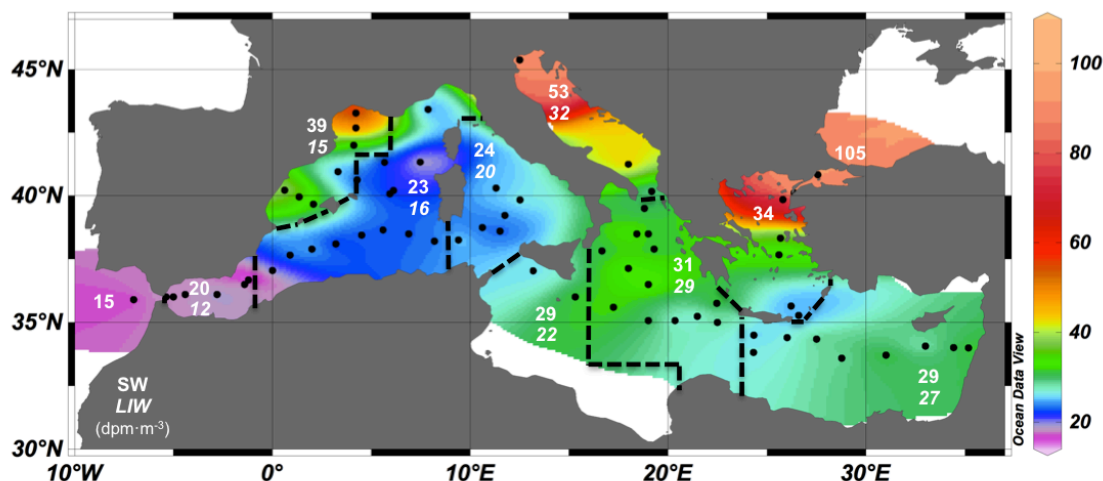


Figure 6. Distribution of ^{228}Ra in the upper MS. The contour plot is based on the ^{228}Ra concentrations measured in SW of the MS. ^{228}Ra inputs from continental margins are revealed from the highest concentrations in coastal areas and the progressive enrichment in ^{228}Ra when surface waters move to the easternmost part of the basin. The average ^{228}Ra concentration in each sub-basin was used to determine the contribution of SGD to the Mediterranean Sea. (Rodellas et al., submitted),

- Participation at a meeting held at ETH-Zurich in March 2013 to coordinate U-236 studies in the frame of GEOTRACES. Samples from the Arctic, Southern Ocean, Atlantic, Mediterranean and Pacific have been collected during the last year to evaluate the usefulness of ^{236}U as tracer of water masses.
- Participation in the French GEOVIDE cruise on May 2014 to undertake an integrated oceanographic transect in the North Atlantic Ocean and Labrador Sea (GEOTRACES GA01 section), collecting samples for artificial (i.e. ^{236}U , Pu isotopes, ^{137}Cs , ^{90}Sr , ^{129}I) and natural (i.e. ^7Be , ^{210}Po and ^{210}Pb) radionuclides.
- Participation in the planning activities of two expeditions lead by Germany in the Arctic Ocean onboard Polarstern in 2015 and 2016.
- Participation at the Mediterranean GEOTRACES workshop that will be held in Barcelona in July 10th, that lead to share data from different labs and determine the contributions from each lab involved in the cruise.

GEOTRACES-related projects/grants

- PROJECT TITLE: Land-sea exchange of trace metals and its importance for marine phytoplankton in an upwelling coast (MITOFITO).
IPs: Manuel Varela and Ricardo Prego.
Funded by the ‘Ministerio de Economía y Competitividad’ of Spain, CTM2011-28792-C02. <http://www.co.ieo.es/proyectos/mitofito/>
- PROJECT TITLE: Carbon export of the upper ocean under diverse ice cover regimes in the Arctic Ocean (CARICE)
IP: Pere Masqué.
Funded by: ‘Ministerio de Ciencia e Innovación’ of Spain, CTM2011-28452.
- PROJECT TITLE: Metal Transport in the Environment (MetTrans).
IP: Don Porcelli (U. Oxford).
Funded by EU FP7-People-2011-ITN, 290336.
- PROJECT TITLE: Iron biogeochemistry in acidified marine environments (ECOFEMA).
IP: J. Magdalena Santana Casiano
Funded by Ministerio de Ciencia e Innovación. CTM2010-19517 (subprograma MAR), 2010-2013.
- PROJECT TITLE: Volcanic eruption at El Hierro island. Sensitivity and recovery of the marine ecosystem (VULCANO).
IP: E. Fraile Nuez (IEO). Researchers: J. Magdalena Santana-Casiano, M. González-Dávila, Milagro Rico (ULPGC).
Funded by Ministerio de Economía y Competitividad. CTM2012-36317, 2012-2013.

GEOTRACES-related articles

- Rodellas V, Garcia-Orellana J, Tovar-Sánchez A, Basterretxea G, López-García JM, Sánchez-Quiles D, Garcia-Solsona E, Masqué P. 2014. Submarine groundwater discharge as a source of nutrients and trace metals in a Mediterranean Bay (Palma Beach, Balearic Islands). *Marine Chemistry* 160, 56 – 66.
- Laglera LM, Santos-Echeandía J, Caprara S and Monticelli D 2013. Quantification of Iron in Seawater at the Low Picomolar Range Based on Optimization of Bromate/Ammonia/Dihydroxynaphthalene System by Catalytic Adsorptive Cathodic Stripping Voltammetry. *Analytical Chemistry* 85, 2486 – 2492.
- Cobelo-García A, Santos-Echeandía J, Lopez-Sanchez DE, Almecija C, Omanovic D. 2014. Improving the Voltammetric Quantification of Ill-Defined Peaks Using Second Derivative Signal Transformation: Example of the Determination of Platinum in Water and Sediments. *Analytical Chemistry* 86, 2308 – 2313.
- Bernárdez P, Ospina-Alvarez N, Caetano M, Prego R. 2013. Fluvial contributions of nutrient salts, dissolved trace elements and organic carbon to the sea by pristine temperate rivers (SW Europe). *Environmental Chemistry*, 10: 42-53.
- Caetano M, Vale C, Anes B, Raimundo J, Drago T, Schimdt S, Nogueira M, Oliveira A, Prego R. 2013. The Condor Seamount at MidAtlantic Ridge as a supplementary source of trace and rare earth elements to the sediments. *Deep-Sea Research II*, 98A: 24-37.
- Prego R, Santos-Echeandía J, Bernárdez P, Cobelo-García A, Varela M. 2013. Trace metals in the NE Atlantic coastal zone of Finisterre (Iberian Peninsula): terrestrial and marine sources and rates of sedimentation. *Journal of Marine Systems*, 126: 69-81.
- Prego R, Caetano M, Ospina-Alvarez N, Raimundo J, Vale C. 2014. Basin-scale contributions of Cr, Ni and Co from Ortegual Complex to the surrounding coastal environment (SW Europe). *Science of the Total Environment* 468-469, 495-504.

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- Rigaud S, Puigcorb  V, Camara-Mor P, Casacuberta N, Roca-Mart  M, Garcia-Orellana J, Benitez-Nelson CR, Masque P and Church T. 2013. A methods assessment and recommendations for improving calculations and reducing uncertainties in the determination of ^{210}Po and ^{210}Pb activities in seawater. *Limnology and Oceanography Methods* 11, 561-571.
- Casacuberta N, Masqu  P, Garcia-Orellana J, Garcia-Tenorio R and Buesseler KO (2013) ^{90}Sr and ^{89}Sr in seawater off Japan as a consequence of the Fukushima Dai-ichi nuclear accident. *Biogeosciences* 10, 3649-3659.
- Casacuberta N, Christl M, Lachner J, Rutgers van der Loeff M, Masqu  P, Arno Synal H. A first transect of U-236 in the North Atlantic Ocean. *Geochimica et Cosmochimica Acta* 133, 34 – 46.
- Garcia-Solsona E, Jeandel J, Labatut M, Lacan L, Vance D, Chavagnac V, Pradoux C. 2014. Rare earth elements and Nd isotopes tracing water mass mixing and particle-seawater interactions in the SE Atlantic. *Geochimica et Cosmochimica Acta*, Volume 125, 351-372.
- M. Rico, A. L pez, J. M. Santana-Casiano, A. G. Gonz lez, M. Gonz lez-D vila. Variability of the phenolic profile in *Phaeodactylum tricornutum* diatom growing under copper and iron stress. *Limnol. Oceanogr.* 58, 144-152, 2013.
- N. P rez-Almeida, M. Gonz lez-D vila, J. M. Santana-Casiano, A. G. Gonz lez, M. Su rez de Tangil. Oxidation of Cu(I) in seawater at low oxygen concentrations. *Environ. Sci. Technol.* 47, 1239-1247, 2013.
- J. M. Santana-Casiano, M. Gonz lez-D vila, E. Fraile-Nuez, D. de Armas, A. G. Gonz lez, J. F. Dom nguez-Yanes and J. Esc nez. The natural ocean acidification and fertilization event caused by the submarine eruption of El Hierro. *Scientific Reports* 3, 1140 DOI: 10.1038/srep01140, 2013.
- J. M. Santana-Casiano, M. Gonz lez-D vila, A. G. Gonz lez, M. Rico, A. L pez, A. Martel. Characterization of phenolic exudates from *Phaeodactylum tricornutum* and their effects on the chemistry of Fe(II)–Fe(III). *Mar. Chem.* 158, 10-16, 2014
- Garcia-Orellana J, Cochran JK, Bokuniewicz H, Daniel JWR, Rodellas V, Heilburn C. Evaluation of ^{224}Ra as a SGD tracer in Long Island Sound (NY). Accepted in *Geochimica et Cosmochimica Acta*, in press
- Rodellas V, Garcia-Orellana J, Masqu  P, Feldman M, Weinstein Y Submarine Groundwater Discharge: a major source of nutrients to the Mediterranean Sea. Submitted MEPS.

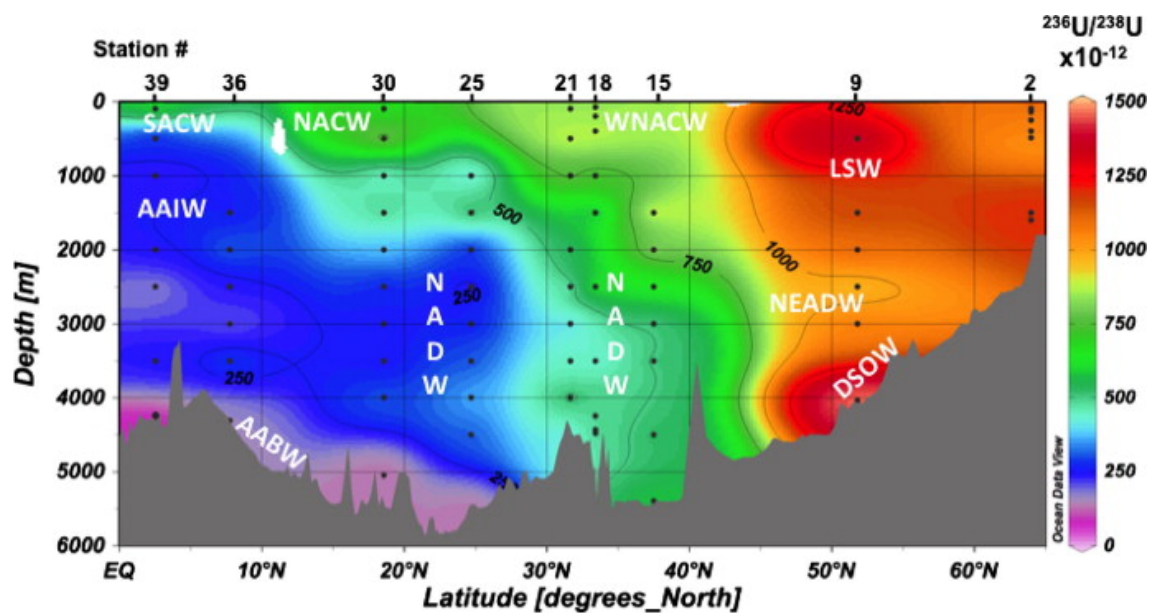


Figure 7. Distribution of $^{236}\text{U}/^{238}\text{U}$ in the North Atlantic Ocean. $^{236}\text{U}/^{238}\text{U}$ ratios are in correspondence to the different water masses in the region. Casacuberta et al., 2014.

Contributions to conferences

- 12th International Estuarine Biogeochemistry Symposium (IEBS2013). <http://www.iebs2013.org/> Plymouth University, 30th June - 4th July 2013.
- Grenier, M., E. Garcia Solsona, N. Lemaître, T. Trull, and C. Jeandel. Rare Earth Element concentration and neodymium isotopic compositions of seawater around the Kerguelen Plateau: Tracing Land-to-Ocean sources and ocean circulation. Ocean Sciences Meeting, Hawaii, 23-28 February 2014.
- Trimborn, Hoppe CJM, Norman L, Santos-Echeandia J, Laglera LM, Hassler C. The availability and the source of iron modulate ocean acidification effects in antarctic phytoplankton. DUST 2014: International Conference on Atmospheric Dust. Castellana Marina, Italy. 01-06/06/2014
- Cobelo-García A, Prego R, Santos-Echeandia J, Doval MD, Varela M. Seasonal Patterns of Nutrients and Bioactive Trace Elements in the North Atlantic Upwelling System (NW Iberian Peninsula). 12th International Estuarine Biogeochemistry Symposium (IEBS2013) Plymouth University, 30th June - 4th July 2013.
- Kenna, T. and Masqué, P. (2014). Anthropogenic radionuclides in the Atlantic Ocean. ICRER 2014 - Third International Conference on Radioecology and Environmental Radioactivity. Barcelona (Spain). 7-12 September 2014.
- Buesseler, K.O., Black, E., Pike, S., T. Kenna and Masqué, P. (2014). Plutonium isotopes in the ocean off Japan after Fukushima. ICRER 2014 - Third International Conference on Radioecology and Environmental Radioactivity. Barcelona (Spain). 7-12 September 2014.
- Casacuberta, N., Christl, M., Lachner, J., Rutgers van der Loeff, M., Masqué, P., Vockenhuber, C., Walther, C. and Synal, H.-A. (2014). ^{236}U , ^{129}I and Pu-isotopes as oceanographic tracers in the Arctic and Atlantic Oceans. AMS-13, Aix-en-Provence (France), 24-29 August 2014.
- Castrillejo, M., Casacuberta, N., Masqué, P., Breier, C., Pike, S. and Buesseler, K.O. (2014). Reassessment of ^{90}Sr in the Pacific Ocean and the coast off Japan derived from the Fukushima Dai-ichi nuclear accident. ICRER 2014 - Third International Conference on Radioecology and Environmental Radioactivity. Barcelona (Spain). 7-12 September 2014.
- Jung, K.T., Maderich, V., Bezhenar, R., de With, G., Qiao, F., Casacuberta, N. and Masqué, P. (2014). ^{90}Sr dispersion and fate in the Northwestern Pacific and adjacent seas:

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- Masqué, P., Casacuberta, N., Pike, S., Castrillejo, M. and Buesseler, K.O. (2014). Evolution of Cs-137 , Cs-134 and Sr-90 in the Pacific Ocean derived from the Fukushima Dai-ichi nuclear accident. 2014 Ocean Sciences Meeting. Honolulu (USA), 23-28 February 2014.
- Kenna, T.C. and Masqué, P. (2014). Anthropogenic radionuclides in the Atlantic Ocean: results from U.S. GEOTRACES North Atlantic zonal transect GA03. 2014 Ocean Sciences Meeting. Honolulu (USA), 23-28 February 2014.
- Casacuberta, N., Christl, M., Vockenhuber, C., Walther C., Rutgers van der Loeff, M., Masqué, P. and Synal, H.-A. (2014). Distribution of ^{236}U , ^{129}I and $^{240}\text{Pu}/^{239}\text{Pu}$ ratios in Arctic Ocean waters. 2014 Ocean Sciences Meeting. Honolulu (USA), 23-28 February 2014.
- Jonkers, L., Zahn, R., Masque, P., Thomas, A., Henderson, G., Abouchami, W., François, R. and Bickert, T. (2013). Water mass influence on sedimentary Pa/Th: insights from a paired Pa/Th and neodymium isotope record from the South Atlantic. 11th International Conference on Paleoceanography. Sitges-Barcelona (Spain). 1-6 September, 2013.
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- Roca-Martí, M., Puigcorbé, V., Masqué, P., Rutgers van der Loeff, M., Stimac, I., Iversen, M., Strass, V.; Klass, C., Wolf-Gladrow, D. (2013). Impact of eddy structures and the polar front region on carbon export fluxes in the water column of the Southern Ocean. ASLO 2013 Aquatic Sciences Meeting. New Orleans (USA), 17-22 February 2013.
- Rodellas, V., Garcia-Orellana, J., Feldman, M., Masqué, P. and Weinstein, Y. (2013). Submarine Groundwater Discharge into the entire Mediterranean Sea. 40 CIESM Congress. Marseille (France). 28 October-1 November 2013.
- Casacuberta, N., Christl, M., Lachner, J., Rutgers van der Loeff, M., Masqué, P. and Synal, H.-A. (2013). The first comprehensive dataset of ^{236}U in the North Atlantic Ocean. Goldschmidt 2013. Florence (Italy). 25-30 August 2013.
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- M. González-Dávila, J. M. Santana-Casiano, A. González, M. Rico, A. López. Characterization of phenolic exudates from *Phaeodactylum tricornutum* and their effects on the chemistry of Fe(II)-Fe(III). Gordon Research Conference. Chemical Oceanography. University of New England, Biddeford, ME, August 4-9, 2013
- J. M. Santana-Casiano, M. González-Dávila, E. Fraile-Nuez The natural ocean acidification and fertilization event caused by the submarine eruption of El Hierro. Gordon Research Conference. Chemical Oceanography. University of New England, Biddeford, ME, August 4-9, 2013
- M. González-Dávila, J. M. Santana-Casiano, A. G. González, N. Pérez-Almeida. The effect of Copper in the oxidation of Fe(II) in seawater. Goldschmidt Conference. Florence, Italy, August 25-30. 2013

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- E. Fraile-Nuez, J. M. Santana-Casiano, M. González-Dávila. The submarine volcano eruption at the island of El Hierro: physical-chemical perturbation and biological response. AGU Fall meeting. San Francisco, USA, December, 9-13, 2013
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