

## ANNUAL REPORT ON GEOTRACES ACTIVITIES IN SPAIN

May 1st, 2016 to April 30th, 2017

### ***GEOTRACES related articles***

- Abdou, M., Schäfer, J., Cobelo-Garcia, A., Neira, P., Petit, J.C.J., Auger, D., Chiffoleau, J.-F., Blanc, G., 2016. Past and present platinum contamination of a major European fluvial-estuarine system: insights from river sediments and estuarine oysters. *Marine Chemistry*, 185: 104-110.
- Almécija, C., Cobelo-Garcia, A., Santos-Echeandía, J., M., Caetano, M., 2016. Platinum in salt marsh sediments: behavior and plant uptake. *Marine Chemistry*, 185: 91-103.
- Almécija, C., Cobelo-Garcia, A., Santos-Echeandía, J., 2016. Improvement of the ultra-trace voltammetric determination of Rh in environmental samples using signal transformation. *Talanta*, 146: 737-743.
- Álvarez-Vázquez, M.A., Prego, R., Ospina-Alvarez, N., Caetano, M., Bernárdez, P., Doval, M., Filgueiras, A.V., Vale, C., 2016. Anthropogenic changes in the fluxes to estuaries: wastewater discharges compared with river loads in small rias. *Estuarine, Coastal and Shelf Science*, 179: 112-123.
- Caetano, M., Raimundoa, J., Nogueira, M., Santos, M., Mil-Homens, M., Prego, R., Vale, C., 2016. Defining benchmark values for nutrients under the water Framework directive: Application in twelve portuguese estuaries. *Marine Chemistry*, 185: 27-37.
- Castrillejo M, Casacuberta N, Christl M, Garcia-Orellana J, Vockenhuber C, Synal H-A, Masqué P. 2017. Anthropogenic <sup>236</sup>U and <sup>129</sup>I in the Mediterranean Sea: first comprehensive distribution and constrain of their sources. *Science of the Total Environment* 593-594, 745 – 759.
- Charette M., Lamb P., Lohan M.C., Kwon E.Y., Hatje V., Jeandel C., Shiler A.N., Cutter G.A., Thomas A., Boyd P.W., Homoky W.B., Milne A., Thomas H., Andresson P., Porcelli D., Tanaka T., Geibert W., Dehairs F., Garcia-Orellana J. 2016. Coastal ocean and shelf-sea biogeochemical cycling of trace elements and isotopes: lessons learned from GEOTRACES. *Philosophical Transactions A* 374.
- Cerdà-Domènech M, Rodellas V, Folch A, Garcia-Orellana J. Constraining the temporal variation of Ra isotopes and Rn in the groundwater endmember: Implications on the derived SGD estimates. *Science of the Total Environment*, Accepted
- Mazarrasa I., Marbà N., Garcia-Orellana J., Masqué P., Arias-Ortiz A., Duarte C.M. Carbon burial in *Posidonia oceánica* meadows. *Limnology & Oceanography*. Accepted
- Mazarrasa I., Marbà N., Garcia-Orellana J., Masqué P., Arias-Ortiz A., Duarte C.M. Sources of organic carbon to *Posidonia oceanica* sediment stocks. *Limnology & Oceanography*. Accepted
- Martínez Soto M.C., Tovar- Sánchez A., Sánchez-Quiles D., Rodellas V., Garcia-Orellana J., Basterretxea G. 2016. Seasonal variation and sources of dissolved trace metal in Maó Harbor, Minorca Island. *Science of the Total Environment* 565, 191 – 199.
- Masferrer E, Garcia-Orellana J, Gonzalez A. 2016. El programa de investigación internacional GEOTRACES. *Okeanos* 3

- Rial, D., Santos-Echeandía, J., Álvarez-Salgado, X.A., Jordi, A., Tovar-Sánchez, A., Bellas, J. 2016. Toxicity of seabird guano to sea urchin embryos and interaction with Cu and Pb. *Chemosphere* 145: 384-393.
- Rodellas V., Garcia-Orellana J., Trezzi G., Masqué P., Stieglitz T.C., Bokuniewicz H., Cochran K.J. and Berdalet E. 2017. Using the radium quartet to distinguish sources of submarine groundwater discharge: fresh groundwater vs seawater recirculation through sediments. *Geochimica et Cosmochimica Acta* 196, 58 – 73.
- Tovar-Sánchez A, Basterretxea G., Ben Omar M., Jordi A., Sánchez-Quiles D., Makhani M., Mouna D., Muya C., Anglès C. Nutrients, trace metals and B-vitamins composition of the lower Moulouya River: a major North African river discharging in the Mediterranean Sea. *Estuarine, Coastal and Shelf Science*, 176, pp 47-57, 2016 DOI: 10.1016/j.ecss.2016.04.006
- Trezzi, G. , Garcia-Orellana, J. , Rodellas, V., Santos-Echeandia, J., Tovar-Sánchez, A., Garcia-Solsona, E., Masqué, P. 2016. Submarine groundwater discharge: A significant source of dissolved trace metals to the North Western Mediterranean Sea. *Marine Chemistry* 186: 90-100.
- Trezzi, G., Garcia-Orellana, J., Santos-Echeandia, J., Rodellas, V., Garcia-Solsona, E., Garcia-Fernandez, G, Masqué, P.. 2016. The influence of a metal-enriched mining waste deposit on submarine groundwater discharge to the coastal sea. *Marine Chemistry* 178: 35-45.
- Trezzi G., Garcia-Orellana J, Rodellas V, Masqué P, Garcia-Solsona E, Andersson P. 2017. Assessing the role of submarine groundwater discharge as a source of Sr to the Mediterranean Sea. *Geochimica et Cosmochimica Acta* 200, 42 – 54.

### ***Cruises***

In the frame of the Spanish national research project MEGOCA (MINECO CTM2014-59244-C3-3-R, IP: A. Tovar-Sánchez), 10 oceanographic campaigns have been carried out in the Gulf of Cádiz (October 2014; December 2014; March 2015; September 2015; November 2015; March 2016; June 2016; September 2016; December 2016). [Fig. 17]. Surficial seawater for trace metals analysis (Ag, Cd, Co, Cu, Fe, Mo, Ni, Pb, V, Zn) were collected in all campaigns.



**Figure 17.** Stations location of 10 campaigns in the Gulf of Cádiz (Pink dots: October 2014; Green dots: December 2014; Purple dots: March 2015; Yellow dots: September 2015; Cyan dots: November 2015; white squares: March, June, September and December 2016; Mediterranean (red squares: September 2015).

### **GEOTRACES related projects**

#### National and Regional:

- Title: Study of trace metal contents in the Golf of Cádiz: influence of Guadiana, Tinto, Odiel and Guadalquivir rivers.

IP: Antonio Tovar Sánchez (ICMAN-CSIC)

Founded by: MINECO CTM2014-59244-C3-3-R.

Period: 1/1/2015 - 31/12/2017

- Title: Recuperação e impactos dos elementos de terras raras provenientes de atividades humanas (REEuse).

IP: Dr. Miguel Caetano (IPMA, Portugal) and Dr. Ricardo Prego as Foreign Scientific Consultant (IIM, CSIC)

Founded by: Ministerio da Educação e Ciência (Portugal) PTDC/QEQ-EPR/1249/2014

Period: 1/6/2016 – 31/5/2018

- Title: SCORE: Sediments and cold water Corals to address key questions of the Oceans in the past: two case-study Regions and one Experiment.

IP: Carles Pelejero

Founded by: Ministerio de Economía y Competitividad.

Period: 2016-2018

- Title: Nuevos REtos en la investigación de cañones submarinos: Indicadores del Estado ambiental y Variabilidad espacio-temporal – El papel de los temporales (NUREIEV).

IP: Miquel Canals (U. of Barcelona).

Funded by: Ministerio de Economía y Competitividad, CTM2013-44598-R.

- Title: MEzcla y DISpersión en el TRANsporte de Energia y Solutos (MeDistraes).

IP: Jesus Carrera y Maaten W Saaltink.

Funded by: Ministerio de Economía y Competitividad. CGL2013-48869-C2-2-R

Period: 2014-2016.

#### European:

- Title: COST Action. Network On Technology-Critical Elements: From Environmental Processes To Human Health Threats. <http://www.costnotice.net/>

IP: A. Cobelo García (IIM - CSIC)

Founded by: European Union (H2020)

Period: 2015 - 2019

- Title: MED-SGD: Submarine Groundwater Discharge, a hidden source of chemical compounds at the land-ocean interface

IP: Pieter Van Beek (University of Toulouse).

Funded by: French ANR (Agence Nationale de la Recherche) - ANR-15-CE01-0004-01

#### ***PhD theses***

- Student: Maria de la Fuente García

Title: Marine Carbon Cycle Evolution in the Eastern Equatorial Pacific over the Last Deglaciation". Universidad de Las Palmas de Gran Canaria e Instituto de Ciencias del Mar.

Date of defense: November 2016

- Student: Giada Trezzi.

Title: Assessing the significance of submarine groundwater discharge as source of trace metals and Sr to the Mediterranean Sea.

Advidors: Jordi Garcia-Orellana and Pere Masqué. Universitat Autònoma de Barcelona.

Date of defense: 29/07/2016.

#### ***Meetings***

- Álvarez-Vázquez M.A., Prego R., Caetano M., De Uña-Álvarez E. River-ria fluxes of dissolved trace elements: pristine versus anthropogenic disturbed contributions. Oral. Valle, C. et al. (Ed.) 2016. Libro de Resúmenes. XVIII Seminario Ibérico de Química Marina. Universidad de Alicante, Alicante. 114 pp. ISBN pendiente, pp. 14-16.
- Bernárdez P., Prego R., Alvarez-Vazquez M.A., Ospina-Álvarez N., Santos-Echeandía J., Filgueiras Ana V. (2016). Lithogenic sources, composition and intra-annual variability of suspended organic matter and particulate metals supplied from pristine rivers to the Western Cantabrian Sea (Bay of Biscay, SW Europe). En: "Changing Ecosystems: Natural versus Anthropogenic Effects" XV International Symposium on Oceanography of the Bay of Biscay (ISOBAY 15): Programme and abstracts. Servicio Editorial de la Universidad del País Vasco. Depósito legal BI-865-2016, p. 136.
- Brito P., Caçador I., Prego R., Mil-Homens M., Caetano M. Distribution of rare earth elements in estuarine sediments from the Tagus Estuary (Portugal): Evidence of anthropogenic contamination. Poster. Valle, C. et al. (Ed.) 2016. Libro de Resúmenes.

XVIII Seminario Ibérico de Química Marina. Universidad de Alicante, Alicante. 114 pp. ISBN pendiente, pp. 28-29.

- Cobelo-García, A., Neira, P., Santos-Echeandía, J., Besada, V., Bellas, J. Time-series (1991-2014) trends of technology-critical elements accumulation in mussels from an urban coastal area (Vigo Ria, NW Iberian Peninsula). Oral. 32nd International Conference on Environmental Geochemistry and Health. Université Libre de Bruxelles (Belgique), 4-8 Julio 2016
- Cobelo-García A., Moran P., Almécija C., Caballero P. Historical record of trace elements (1983-2007) in scales from Atlantic salmon (*Salmo salar*): study of past metal contamination from a copper mine (Ulla river and estuary, NW Iberian Peninsula). Oral. XVIII Seminario Ibérico de Química Marina. Universidad de Alicante. Alicante, 20-22 July 2016.
- Cobelo-García A., Tovar-Sánchez A. Dissolved rare earth elements in estuarine and coastal waters of the Gulf of Cadiz (South Spain). Workshop on Environmental Concentrations, Cycling and Modeling of Technology Critical Elements. Rehovot (Israel), 18-19 Enero 2017. (Póster presentation).
- de la Fuente, M., Calvo, E., Skinner, L., Pelejero, C., Müller, W., Evans, D., Povea, P. and Cacho, I. (2016) The evolution of deep ocean chemistry in the Eastern Equatorial Pacific over the last deglaciation. 12th International Conference on Paleoceanography, 28 August - 2 September, Utrecht, The Netherlands
- Pelejero, C., Sherrell, R.M., Fuertes, S., Kozdon, R., López-Sanz, A., Gagnon, A.C. and Calvo, E. (2016) Experimental proxy calibration in cold water corals. 12th International Conference on Paleoceanography, 28 August - 2 September, Utrecht, The Netherlands
- Tovar-Sánchez A., Sánchez-Quiles D., Roque D., Cobelo A., Laiz I., Sánchez R., Bruno M. Distribution and transport of dissolved trace metals in the Gulf of Cádiz, Spain. XVIII SIQM, Alicante: 20-22 July, 2016, Spain (Poster communication).
- A. Tovar-Sánchez, M. C. Martínez-Soto, D. Sánchez-Quiles, J. García-Orellana, A. Jordi, M. A. Huerta-Díaz, G. Basterretxea. Historical record and sources of metals in core sediments from Maó Harbour, Minorca, Spain. XVIII SIQM, Alicante: 20-22 July, 2016, Spain (Poster communication).

### ***Teaching***

- Máster Universitario en Oceanografía. Reactividad Química en los Océanos  
Professor: Dr. Antonio Tovar-Sánchez  
Facultad de Ciencias del Mar, Universidad de Cádiz (España).  
Academic years: 2015-16

- Máster Universitario en Oceanografía. Reactividad Química en los Océanos  
Professor: Dr. Antonio Cobelo García  
Facultad de Ciencias del Mar, Universidade de Vigo (España).  
Academic years: 2015-16

- Tovar-Sánchez A. *The role of the sea surface microlayer in the biogeochemical cycles of trace elements*. Ponencia - Seminario Postgrado y Oceanografía. Universidad Autónoma de Baja California. 31 de Agosto de 2016. Ensenada. México



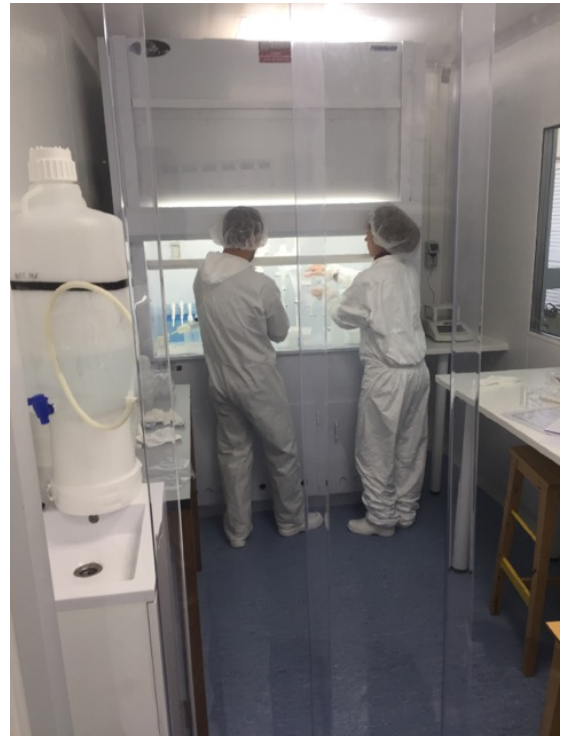
### *Other activities*

- Acquisition of an autonomous rosette equipped with ultra clean bottles (PVDF and POM), hydrographic sensors (pressure and temperature) and an electro-hydraulic bottle firing module. Configuration of the system is made via a wireless network through a graphic interface on a remote device. The system is designed with closed-Inyection: bottles keep closed during deployment and are activated to suction water at the target depths selected in the configuration.

The rosette is operated by a portable electric winch equipped with a drum and cable guide system made of POM and 600 m of Kevlar rope.



- New Clean room. The Institute of Marine Sciences of Andalusia (ICMAN –CSIC) has included a Clean Room as a new facility for environmental studies involving trace elements analysis.



Submitted by Antonio Tovar-Sánchez (a.tovar@csic.es).