

ANNUAL REPORT ON GEOTRACES ACTIVITIES IN SPAIN

April 1st, 2019 to March 31st, 2020

GEOTRACES related articles

- Alorda-Kleinglass A., García-Orellana J., Rodellas V., Cerdà-Domènech M., Tovar-Sánchez A., Diego-Feliu M., Trezzi G., Sánchez-Quilez D., Sánchez-Vidal A. and Canal M. Remobilization of dissolved metals from a coastal mine tailing deposit driven by groundwater discharge and porewater exchange. *Science of the Total Environment*, 688, 2019, Pages 1359-1372. <https://doi.org/10.1016/j.scitotenv.2019.06.224>. 2019
- Amaya-Vías, David; Tataru, Laurentiu, Herce-Sesa, Belén; López-López, José Antonio, López-Ramírez, Juan Antonio. Metals removal from acid mine drainage (Tinto River, SW Spain) by water gap and air gap membrane distillation. *Journal of Membrane Science*, 582, 20-29.
- Campillo, J.A., Santos-Echeandía, J., Fernández, B., 2019. The hydrological regime of a large Mediterranean river influences the availability of pollutants to mussels at the adjacent marine coastal area: Implications for temporal and spatial trends. *Chemosphere* 237,124492.
- Fernandez-Juarez V., Bennasar-Figueras A., Tovar-Sanchez A. and Agawin N.S.R. The role of iron in P-acquisition mechanisms of the unicellular N₂-fixing cyanobacteria, *Halotheca* sp. PCC 7418, associated with the Mediterranean seagrass *Posidonia oceanica*. *Frontiers in Microbiology*, <https://doi.org/10.3389/fmicb.2019.01903>, 2019
- Fuentealba, M., Latorre, C., Frugone-Álvarez, M., Sarricole, P., Giralt, S., Contreras-Lopez, M., Prego, R., Bernárdez, P., Valero-Garcés, B., 2020. A combined approach to establishing the timing and magnitude of anthropogenic nutrient alteration in a mediterranean coastal lake- watershed system. *Scientific Reports Nature Research* 10:5864 | <https://doi.org/10.1038/s41598-020-62627-2>
- González-Álvarez R., Pinto J., López-López J.A.*, Mendiguchía C., Moreno C. 2020. Selective solvent bar micro-extraction as a single-step approach for the measurement of Cu fractions in seawater. *Analytical and Bioanalytical Chemistry*, 412, pp. 1863-1870.
- Herce-Sesa B., Pirkwieser P., López-López J.A.*, Jirsa F., Moreno C. 2020. Selective liquid phase micro-extraction of metal chloro-complexes from saline waters using ionic liquids. *Journal of Cleaner Production*. 262, 1212145.
- Hopwood, M.J., Santana-González, C., Gallego-Urrea, J., Sánchez, N., Achterberg, E.P., Ardelan, M.V., Gledhill, M., González-Dávila, M., Hoffmann, L., Leiknes, Ø., Santana-Casiano, J.M., Tsagaraki, T.M., Turner, D., 2020. Fe(II) stability in coastal seawater during experiments in Patagonia, Svalbard, and Gran Canaria. *Biogeosciences*, 17(5),1327–1342. <https://doi.org/10.5194/bg-17-1327-2020>
- Laiz, I., Plecha S., Teles-Machado A., González-Ortegón E., Sánchez-Quiles D., Cobelo-García A., Roque-Atienza D., Peliz A., Sánchez-Leal R.F., Tovar-Sánchez A. The role of the Gulf of Cadiz circulation in the redistribution of trace metals between the Atlantic Ocean and the Mediterranean Sea. *Science of the Total Environment*, 719, 134964. DOI: <https://doi.org/10.1016/j.scitotenv.2019.134964>, 2020
- López-Sánchez, D.E., Cobelo-García, A., Rijkenberg, M.J.A., Gerringa, L.J.A., de Baar, H.J.W. 2019. New insights on the dissolved platinum behavior in the Atlantic Ocean. *Chemical Geology*, 511, pp. 204-211. DOI: 10.1016/j.chemgeo.2019.01.003

- Martin, A. et al., 2020. The oceans' twilight zone must be studied now, before it is too late. *Nature*, 580: 26-28.
- Mas, J.L.M., J.; Villa-Alfageme, M.; Pham, M.K.; Chamizo, E.; Miquel, J.C.; Osvath, I.; Povinec, P.; Eriksson, M., 2020. Analysis of a major Aeolian dust input event and its impact on element fluxes and inventories at the DYFAMED site (Northwestern Mediterranean). *Marine Chemistry*, 223: 103792
- Monteiro, C.E., Correia dos Santos, M., Cobelo-García, A., Brito, P., Caetano, M. 2019. Platinum and rhodium in Tagus estuary, SW Europe: sources and spatial distribution. *Environmental Monitoring and Assessment*, 191 (9), art. no. 579. DOI: 10.1007/s10661-019-7738-z
- Moy, A.D., Palmer, M.R., Howard, W.R., Bijma, J., Cooper, M.J., Calvo, E., Pelejero, C., Gagan, M.K. and Chalk T.B. (2019) Varied contribution of the Southern Ocean to deglacial atmospheric CO₂ rise. *Nature Geoscience* , 12, 1006–1011
- Pérez-Almeida, N., González, A.G., Santana-Casiano, J.M., González-Dávila, M. Iron and copper redox interactions in UV-seawater: A kinetic model approach. *Chemical Geology*, 506, 149-161, 2019. <https://doi.org/10.1016/j.chemgeo.2018.12.041>
- Pirkwieser P., López-López J.A., Schagerl M., Kandioller W., Keppler B.H., Moreno C., Jirsa F. 2020. Heavy metal extraction under environmentally relevant conditions using 3-Hydroxy-2-Naphthoate- based Ionic Liquids: Extraction capabilities vs. acute algal toxicity. *Applied Sciences*. Accepted manuscript 28/04/2020.
- Prego, R., Brito, P., Álvarez-Vázquez, M.A., Caetano, M., 2019. Lanthanides and yttrium in the sediments of the lower Minho River (NW Iberian Peninsula). Imprint of tributaries. *Journal of Soils and Sediments*, 19: 2558-2569.
- Rivera, J., Villa-Alfageme, M., Manjón, G., Hurtado-Bermudez, S., 2019. Comparison and validation of extraction chromatography and solvent extraction methods for determination of ⁹⁰Sr by Cherenkov counting in biological and sediment samples. *Journal of Radioanalytical and Nuclear Chemistry*, 320: 109-122.
- Rivera-Hernández, J.R., Fernández, B., Santos-Echeandia, J., Garrido, S., Morante, M., Santos, P., Albentosa, M., 2019. Biodynamics of mercury in mussel tissues as a function of exposure pathway: natural vs microplastic routes. *Science of the Total Environment*, 674, pp. 412-423.
- Romero-Freire, A., Santos-Echeandía, J., Neira, P., Cobelo-García, A. 2019. Less-studied technology-critical elements (Nb, Ta, Ga, In, Ge, Te) in the marine environment: Review on their concentrations in water and organisms. *Frontiers in Marine Science*, 6 (SEP), art. no. 53. DOI: 10.3389/fmars.2019.00532
- Ruiz S., Claret M., Pascual A., Olita A., Troupin C., Capet A., Tovar-Sánchez A., Allen J.T., Poulain P.-M., Tintoré J., Mahadevan A. Effects of oceanic meso- and submeso-scale frontal processes on the vertical transport of phytoplankton. *Journal of Geophysical Research: Oceans*, <https://doi.org/10.1029/2019JC015034>. 2019
- Samperio-Ramos, G., González-Dávila, M., Santana-Casiano, J. M. Impact on the Fe redox cycling of organic ligands released by *Synechococcus* PCC 7002, under different iron fertilization scenarios. Modeling approach. *Journal of Marine Systems*. 182, 67-78, 2018. <https://doi.org/10.1016/j.jmarsys.2018.01.009>
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- Tilbrook, B., Jewett, E.B., DeGrandpre, M.D., Hernandez-Ayon, J.M., Feely, R.A., Gledhill, D.K., Hansson, L., Isensee, K., Kurz, M.L., Newton, J.A., Siedlecki, S.A., Chai, F., Dupont, S., Graco, M., Calvo, E., Greeley, D., Kapsenberg, L., Lebec, M., Pelejero, C., Schoo, K.L. and Telszewski, M. (2019) An Enhanced Ocean Acidification Observing Network: From People to Technology to Data Synthesis and Information Exchange. *Frontiers in Marine Science*, doi: 10.3389/fmars.2019.00337
- Tovar-Sánchez A., Rodríguez-Romero A., Birthe Zäncker A.E., Fu F., Marañón E., Pérez-Lorenzo M., Bressac M., Wagener T., Triquet S., Siour G., Desboeufs K. and Guieu C. Characterizing the surface microlayer in the Mediterranean Sea: trace metal concentrations and microbial plankton abundance. *Biogeosciences*, 17, 1–16, 2020; <https://doi.org/10.5194/bg-17-1-2020>
- Troupin C., Pascual A., Ruiz S., Olita A., Casas B., Margirier F., Poulain P-M. , Notarstefano G., Torner M., Gabriel Fernández J., Àngel Rújula M., Muñoz C., Alou E., Ruiz I., Tovar-Sánchez A., Allen J.T., Mahadevan A., Tintoré J. The AlborEX dataset: sampling of sub-mesoscale features in the Alboran Sea. *Earth System Science Data*, 11, 129-145, 2019. <https://doi.org/10.5194/essd-11-129-2019>
- Villa-Alfageme, M., Chamizo, E., Kenna, T.C., López-Lora, M., Casacuberta, N., Chang, C., Masqué, P., Christl, M., 2019. Distribution of ²³⁶U in the U.S. GEOTRACES Eastern Pacific Zonal Transect and its use as a water mass tracer. *Chemical Geology*, 517: 44-57.
- Wiedmann, I., Ceballos-Romero, E., Villa-Alfageme, M., Renner, A., Dybwad, C., van der Jagt, H., Svensen, C., Assmy, P., Tataruk, A., Rózanska-Pluta, M., Iversen, M., H., 2020. Arctic Observations Identify Phytoplankton Community Composition as Driver of Particle Sinking Velocity and Carbon Flux Attenuation. *Geophysical Research Letters*, Accepted.

Meetings

- Briggs N., S. Henson , M. Villa-Alfageme , H. Claustre , F. Carvalho and S. L. Carolin Giering. Consistent Increase in Particle Sinking Velocity with Depth Found across >30 High-Latitude Phytoplankton Blooms using Biogeochemical Argo. Ocean Science Meeting 2020. San Diego, USA. 16th-21st February 2020. Oral.
- Buesseler K., P.W. Boyd, S. Henson, I. Kriest, G. Saba, D. Siegel, M. Villa-Alfageme, L. Memery, R. The Joint Exploration of the Twilight Zone Ocean Network (JETZON). Sanders Ocean Science Meeting 2020. San Diego, USA. 16th-21st February 2020. Town-Hall Presentation.
- Chamizo, E., Casacuberta, N., Lopez-Lora, M., Christl, M., Kenna, T., Villa-Alfageme, M., Masque, P., 2019. Presence of ²³⁶U and ²³³U in the Canada Basin from the US GEOTRACES expedition in 2015, Goldschmidt 2019, Barcelona.
- Ceballos-Romero E., K. Buesseler, C.García-Prieto and M. Villa-Alfageme. Revisiting 45 years of Th data: a comprehensive global oceanic database. Ocean Science Meeting 2020. San Diego, USA. 16th-21st February 2020. Poster
- David Amaya Vías; Tataru, Laurentiu; Belén Herce Sesa; José Antonio López-López, Juan Antonio López Ramírez. Application of membrane distillation for metal removal in acid mine drainage. 8th Edition of International Conference and Exhibition on Separation Techniques. Dublín, Ireland, 29/07/2019. Oral communication.
- de Soto F., E. Ceballos-Romero , M. H. Iversen and M.Villa-Alfageme. A comparative study of the particle size spectra for Arctic, North Atlantic and Southern Ocean spring

blooms: implications for POC export and sinking velocity. Ocean Science Meeting 2020. San Diego, USA. 16th-21st February 2020. Poster

- Santos-Echeandía J., Brito, P., Caetano, M., 2019. A comparison between DGT-ICPMS and polarographic methods for dissolved metal determination in estuarine and coastal waters. 6th Conference on Diffusive Gradients in Thin Films 2019. University of Natural Resources and Life Sciences, Vienna (BOKU), Austria. Oral presentation.
- Santos-Echeandía, J., Belando M.D., Álvarez-Rogel J., Tercero C., Otero-Pérez X.L., Bernardeau-Esteller J., García-Muñoz R., Ramos A., Ruiz, J.M., 2019. An extreme eutrophication event in a spanish coastal lagoon (MAR MENOR, se spAIN): THE ROLE OF BENTHIC FLUXES. International Estuarine Biogeochemistry Symposium Vigo (Spain), 4-5th June 2019. Oral presentation.
- Santos-Echeandía J., Belando, M.D., Bernardeau-Esteller, J., García-Muñoz, R., Ramos, A., Ruiz, J.M., 2019. THE AQUATIC PLANT cymoDOCEA NODOSA AS A TRACER OF TRACE METAL ANTHROPOGENIC INPUTS TO THE MAR MENOR COASTAL LAGOON (SE SPAIN). International Estuarine Biogeochemistry Symposium Vigo (Spain), 4-5th June 2019. Poster presentation.
- Villa-Alfageme M. , M.H. Iversen , N. Briggs , K. Pabortsava , E. Ceballos-Romero, F.C. de Soto and S.L. Carolin Giering. Evaluation of particle sinking velocities near South Georgia using four independent approaches. Ocean Science Meeting 2020. San Diego, USA. 16th-21st February 2020. Oral
- Villa-Alfageme, M., Ceballos-Romero, E., Giering, S., de Soto, F., 2019. Particle Sinking Velocities distribution from the Arctic to the Southern Ocean: Patterns and implications, IMBER, Brest, France.

Workshops

- Santos-Echeandía, J., 2019. Interaction of mercury with microplastics and potential transfer to marine organisms. Workshop on Emerging contaminants. University of the Balearic Islands (Spain), 30th September- 3rd October. Red Temática de Excelencia (Net4Sea, www.net4sea.es) financiada por el Ministerio de Ciencia, Innovación y Universidades (CTM2017-90890-REDT).

International meetings – Working Groups

- Santos-Echeandía, J., 2019. The Meeting of the Ecosystem Approach Correspondence Group on Pollution Monitoring of the Mediterranean Sea. Podgorica, Montenegro, 2-4 April 2019.

GEOTRACES related projects

- - Development of highly efficient microsampling systems for the direct determination of trace elements in aquatic ecosystems. Ministry of Science, Innovation and Universities. PI: Carlos Moreno Aguilar. 2019-2022. Budget: 70,840 EUR.
- NET4SEA: Scientific network of risk analysis and exposure to emerging pollutants in the marine environment. Thematic Network of Excellence (NET4SEA) has been granted by the Ministry of Science, Innovation and Universities-Spanish State Research Agency (CTM2017-90890-REDT, MCIU-AEI/FEDER, UE). www.net4sea.es. Participant Institutions: University of the Balearic Oslands, Spanish Institute of Oceanography,

University of Vigo, University of the Basque Country, Intecmar, University of Cadiz and University of Santiago de Compostela.

- FEDER funds. Call 2014-2020 Regional Government. AMS and radiometrically determined radionuclides as tracers of natural processes in the Arctic and Southern Oceans. From: 01/02/2020 to: 31/01/2022. 80 000 €.
- IAEA (United Nations). Anthropogenic ²³⁶U, ¹²⁹I and natural ²¹⁰Po, ²³⁴Th radionuclides as tracers of Oceanography studies in the coordinated Research Project: Behaviour and Effects of Natural and Anthropogenic Radionuclides in the Marine Environment and their use as Tracers for Oceanography Studies. From: 01/06/2017 to: 31/05/2021.
- Effects of ocean acidification, temperature and organic matter on Fe(II) persistence in the Atlantic Ocean. Ministerio de Economía y Competitividad. CTM2017-83476-P (2018-2020) IP: J. Magdalena Santana Casiano, Melchor González Dávila
- Our common future ocean in the Earth system – quantifying coupled cycles of carbon, oxygen, and nutrients for determining and achieving safe operating spaces with respect to tipping points. COMFORT. UE. H2020. Grant Agreement number: 820989 (2019-2022).QUIMA-ULPGC Group 12.

PhD Thesis

- Belén Herce. Ionic liquids as a sustainable alternative in the liquid microextraction of trace metals in natural waters using capillary systems (Líquidos iónicos como alternativa sostenible en la microextracción líquida de metales traza en aguas naturales mediante sistemas capilares). University of Cádiz. December 2019

Master Thesis

- Helena Guerra Alcaide. Eventos de deposiciones secas de aerosoles en el oeste del Mediterráneo: caracterización y respuesta del fitoplancton. Supervisor: A Tovar-Sanchez
Master: Chemical Oceanography, University of Cadiz.
Cádiz, 16 Decembre-2019
- Hortensia Holgado. Mercury in the marine ecosystem. Supervisor: A Tovar-Sanchez
Master: Chemical Oceanography, University of Cadiz.
Cádiz, 23 September-2019

Teaching

- Master's Degree in Oceanography. Chemical Reactivity of the Oceans
Professor: Dr. Antonio Tovar-Sánchez
Facultad de Ciencias del Mar, University of Cádiz and University of Las Palmas de Gran Canaria (Spain). Academic years: 2019-20
- Emerging Metallic Pollutants. Marine Environment and Resources. Erasmus Mundus Master, Professor: Dr. Cobelo-García A.
Plentzia Marine Station, Universidad del País Vasco (Spain)

Cruises

- MEJ2019 campaign. Annual monitoring campaign for the evaluation of the environmental status and pollution degree of the Spanish Mediterranean coastal waters

using mussels (*Mytilus galloprovincialis*) as bioindicator organisms. (11th May-18th June). ESMARES2C5A2 project funded by the Ministry of Ecological Transition.

Other activities

- GEOTRACES Summer School-2019 took place in Cádiz from September 23rd to 28th, 2019, on board the School Ship Intermares A- 41, in collaboration with the Ministry of Defense and the General Secretary of Fisheries of the Ministry of Agriculture, Fisheries and Food of the Government of Spain.

Contributors to the report

- José A. López-López; Eva Calvo; Carles Pelejero; Juan Santos-Echeandía; Ricardo Prego; Antonio Cobelo; María Villa-Alfageme; J. Magdalena Santana-Casiano; Melchor González-Dávila; Antonio Tovar-Sánchez

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