

ANNUAL REPORT ON GEOTRACES ACTIVITIES IN MEXICO

May 1st, 2021 to April 30th, 2022

New GEOTRACES or GEOTRACES relevant scientific results

The results presented are from an impacted area of the Gulf of Mexico and a protected area on the Pacific Mexican region in front of Baja California peninsula.

- **Gulf of Mexico.** Surface water samples from the Yucatan shelf presented Cd concentrations similar to those reported internationally for non-polluted coastal and marine waters. V concentrations, on the other hand, fall within the range of anthropogenically polluted waters (25% of the sampling sites). In the study area, the probable sources of V could be: (1) carbonate sediments leaching V into the water column and co-transported with fine sediments resuspending as a result of the complex hydrodynamics in the area or, (2) accidental spills from cargo ships transporting oil between the Atlantic and the Gulf of Mexico. Significant spatial and temporal differences were found for both metals; therefore, a regional interval concentration is suggested for V from 1.28 to 1.84 $\mu\text{g L}^{-1}$ and Cd from 0.003 to 0.09 $\mu\text{g L}^{-1}$. These differences could primarily be the result of the observed hydrology and hydrodynamics created by the Yucatan current, submarine groundwater discharges and upwelling.
From: Arcega-Cabrera et al. (2021).
- **Pacific (protected area).** Surficial sediment quality in the Ojo de Liebre Lagoon (OLL), Mexico, was evaluated via five geochemical indices. Results indicate that concentrations of the elements Ag, As, Cu, Fe, Mn, Mo, Ni, Sb, U, V and Zn do not exert adverse biological effects in this ecosystem. However, minor enrichment was observed for Ba (mean \pm SD: 1.09 \pm 0.17) and Co (1.57 \pm 0.22) and was moderately severe for Cd (9.3 \pm 2.0), possibly due to natural processes. The adverse effect index was >1 only for Hg, suggesting that concentrations of this element are sufficiently high (0.40 to 1.13 nmol g^{-1}) to potentially elicit adverse effects on local organisms in contact with sediments. This result is particularly important for grey whales (*Eschrichtius robustus*), given that they ingest large quantities of benthic organisms during their seasonal stay in the OLL.
From: Valdivieso-Ojeda et al. (2021).

New projects and/or funding

- Biological response of phytoplankton community to iron and vitamin B12 and their implication to the formation and persistence of Harmful Algal Blooms in Mexican coastal waters. Multidisciplinary project financed by CONACyT. PI: Dr. Mary Carmen Ruiz de la Torre (2017 - 2022).

New GEOTRACES or GEOTRACES-relevant publications (published or in press)

- Arcega-Cabrera, F., Gold-Bouchot, G., Lamas-Cosío, E. et al. 2021. Spatial and Temporal Variations of Vanadium and Cadmium in Surface Water from the Yucatan Shelf. *Bulletin of Environmental Contamination and Toxicology* 108, 43–48. <https://doi.org/10.1007/s00128-021-03234-3>
- Cervantes-Díaz, G.Y., Hernández-Ayón, J.M., Zirino, A., Herzka, S.Z., Camacho-Ibar, V., Norzagaray, O., Barbero, L., Montes, I., Sudre, J., Delgado, J.A. 2022. Understanding upper water mass dynamics in the Gulf of Mexico by linking physical and biogeochemical features. *Journal of Marine Systems*, 225, 103647. <https://doi.org/10.1016/j.jmarsys.2021.103647>.
- Dótor-Almazán A., Gold-Bouchot G., Lamas-Cosío E., Huerta-Diaz M.A., Ceja-Moreno V., Ocegüera-Vargas I., Zapata-Pérez O., Arcega-Cabrera F. 2022. Spatial and temporal distribution of trace metals in shallow marine sediments of the Yucatan Shelf, Gulf of Mexico. *Bulletin of Environmental Contamination and Toxicology* 108, 3-8. doi: 10.1007/s00128-021-03170-2.
- Dótor-Almazán A., Gold-Bouchot G., Lamas-Cosío E., Huerta-Diaz M.A., Ceja-Moreno V., Ocegüera-Vargas I., Zapata-Pérez O., Arcega-Cabrera F. 2022. Vanadium and cadmium in shallow marine sediments: Spatial and temporal behavior in the Tamaulipas Continental Platform, Gulf of Mexico, Mexico. *Bulletin of Environmental Contamination and Toxicology* 108, 30-36. doi: 10.1007/s00128-021-03213-8.
- Hernández-Sánchez, O.G., Camacho-Ibar, V.F., Fernández-Álamo, M.A., Herzka, S.Z. 2022. Nitrogen sources (NO_3^- vs N_2 fixation) inferred from bulk $\delta^{15}\text{N}$ values of zooplankton from the deep water region of the Gulf of Mexico. *Journal of Plankton Research*, 44, 48-87. <https://doi.org/10.1093/plankt/fbab089>
- Lee-Sánchez, E., Camacho-Ibar, V.F., Velásquez-Aristizábal, J.A., Valencia-Gasti, J.A., Samperio-Ramos, G. 2022. Impacts of mesoscale eddies on the nitrate distribution in the deep-water region of the Gulf of Mexico. *Journal of Marine Systems*, 229, 103721. <https://doi.org/10.1016/j.jmarsys.2022.103721>.
- Olimón-Andalón V, Valdés-Flores J, Ley-Quiñonez CP, Zavala-Norzagaray AA, Aguirre AA, León-Sicairos N, Velázquez-Román J, Flores-Villaseñor H, Acosta-Smith E, Sosa-Cornejo I, Valdez-Flores M, Hart CE, Canizalez-Román A. 2021. Essential and trace metals in a post-nesting olive ridley turtles (*Lepidochelys olivacea*) in Ceuta beach, Sinaloa, Mexico. *Environmental Science and Pollution Research International*, 28(23):29998-30006. doi: 10.1007/s11356-021-12819-8.
- Valdivieso-Ojeda J.A., Huerta-Diaz M.A., Delgadillo-Hinojosa F., Otero X.L., Arenas-Islas D. and García-Orozco J. (2021) Sediment trace metal levels in the Ojo de Liebre Lagoonal Complex (Baja California, Mexico), a marine wildlife protected area. *Mar. Pollut. Bull.* **165**, 112097. DOI: 10.1016/j.marpolbul.2021.112097. ISSN Impreso: 0025326X, ISSN Electrónico: 0025326X.
- Velásquez-Aristizábal, J.A. Camacho-Ibar, V.F., Durazo, R., Valencia-Gasti, J.A., Lee-Sánchez, E., Trasviña-Castro, A. 2022. Nitracentric/Hydrographic classification and prediction of nitrate profiles for oceanographic stations under the influence of mesoscale eddies in the Gulf of Mexico. *Frontiers in Marine Science*, 9, 827574 doi: 10.3389/fmars.2022.827574

Completed GEOTRACES PhD or Master

- Gutiérrez, R.A. 2022. Spatial and temporal variability of dissolved manganese in Todos Santos Bay (summer 2008 - spring 2009). MSc thesis Oceanografía Costera - Universidad Autónoma de Baja California. 94 pp
- Naranjo-Ortiz, D.A. 2022. Spatial and temporal distribution of nickel and cadmium in relation to the abundance of *Synechococcus* spp. and *Prochlorococcus* spp. in the Mexican region of the Gulf of Mexico. MSc thesis, CICESE. 177 pp

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