ANNUAL REPORT ON GEOTRACES ACTIVITIES IN SLOVENIA

May 1st, 2023 to April 30th, 2024

New GEOTRACES or GEOTRACES relevant scientific results

The results of four relevant topics can be considered:

- Recent studies on mercury contamination reveal significant findings across various environments. In the Isonzo River plain (NE Italy), Hg^0 fluxes from soil surfaces were assessed, showing higher emissions in summer due to increased UV radiation and temperature, with vegetation reducing these fluxes. In the northern Adriatic Sea, despite higher DGM production in heavily contaminated areas, Hg^0 fluxes were comparable across sites, influenced by water turbulence and stagnation. A coordinated assessment of metallic contaminants in seafood highlighted reliable methods for measuring arsenic, cadmium, mercury, and lead, ensuring food safety. Finally, research on hydrothermal venting quantified natural mercury release, emphasizing the predominance of anthropogenic mercury in oceans and the potential impact of emission reduction policies. These studies underscore the need for ongoing monitoring and regulatory efforts to address mercury pollution.

  Further, the studies also addressed metrological issues related to the measurement and analysis of mercury contamination. For instance, the assessment of metallic contaminants in seafood, coordinated by the Government Laboratory in Hong Kong, highlighted the use of advanced techniques like microwave-assisted acid digestion and inductively coupled plasma mass spectrometry (ICP-MS) to ensure accurate measurements. The results were evaluated against supplementary comparison reference values (SCRVs) to ensure consistency and reliability across different laboratories. This approach confirms the measurement capabilities of participating institutes in determining inorganic elements in high-organic-content matrices like seafood, which is crucial for maintaining public health standards. These efforts underscore the importance of metrological accuracy and consistency in environmental monitoring and food safety assessments.

- The levels of metal(loid)s at the beginning of the coastal pelagic food web, providing an insight into accumulation in the suspended particulate matter (SPM) and size-fractionated plankton, were studied in the shallow coastal marine environment of the Gulf of Trieste (northern Adriatic Sea) affected by the metal polluted Isonzo/Soča River as a result of historical Hg, and Pb and Zn mining activities in the hinterland. The study suggests that the Redfield stoichiometric concept is unreliable for coastal marine plankton regarding metal(loid)s. Bioconcentration factors can help establish metal(loid) levels at the base of the food web, providing crucial information for marine organisms consumed by humans.
- Additionally, the study on mucilage events in the Adriatic Sea highlighted the impact of plankton exometabolites and allochthonous material on the formation of macroaggregates, affecting tourism, fisheries, and the coastal economy. Phytoplankton colloidal organic matter was predominantly composed of polysaccharides, contributing mainly to the marine colloidal organic matter pool.
- The study investigates how river inputs affect the carbonate system in the northern Adriatic Sea (NAd), focusing on total alkalinity (AT) and dissolved inorganic carbon (DIC) in seawater. The region receives substantial freshwater input, impacting the carbonate equilibrium and biological processes. The DIC flux is influenced by mineral weathering and biological activity in river basins, though these processes can be altered by anthropogenic activities. The study highlights the importance of quantifying these

disturbances to better understand their impact on the carbonate system and acidification in coastal regions.

New projects and/or funding

- IAEA TC Project INT7022: ***Strengthening Ocean Health for Sustainable Development: A Global Approach using Isotopic and Nuclear Techniques*** started in 2024. The project aims to improve the health of the oceans and achieving the United Nations Sustainable Development Goals (SDGs) SDGs 13, 14, and 17, which relate to the insufficient integrated scientific research at the global level on marine pollution, climate change, ocean acidification, and the carbon cycle.

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

BENEDIK, Ljudmila, ROVAN, Leja, FALNOGA, Ingrid, JERAN, Zvonka, LIPEJ, Lovrenc, PROSEN, Helena, FAGANELI, Jadran. Po-210 in plankton and fish from coastal waters (gulf of Trieste, northern Adriatic Sea). *Marine Chemistry* 2024, 265-266, art. 104425, 8 str. ISSN 0304-4203. DOI: 10.1016/j.marchem.2024.104425.

FLOREANI, Federico, ZAPPELLA, Valeria, FAGANELI, Jadran, COVELLI, Stefano. Gaseous mercury evasion from bare and grass-covered soils contaminated by mining and ore roasting (Isonzo River alluvial plain, Northeastern Italy). *Environmental pollution* 2023, vol. 318, [1]-15. https://doi.org/10.1016/j.envpol.2022.120921, DOI: 10.1016/j.envpol.2022.120921.

FLOREANI, Federico, BARAGO, Nicolò, KLUN, Katja, FAGANELI, Jadran, COVELLI, Stefano. Dissolved gaseous mercury production and sea-air gaseous exchange in impacted coastal environments of the northern Adriatic Sea. *Environmental pollution* 2023, vol. 332, [art.] 121926, [1]-16 str. https://doi.org/10.1016/j.envpol.2023.121926, DOI: 10.1016/j.envpol.2023.121926.

FAGANELI, Jadran, FALNOGA, Ingrid, KLUN, Katja, MAZEJ, Darja, MOZETIČ, Patricija, ZULIANI, Tea, KOVAČ, Nives. Metal(loid)s in suspended particulate matter and plankton from coastal waters (Gulf of Trieste, northern Adriatic Sea). *Journal of soils and sediments* 2023, vol. 23, iss. 12, str. 4085-4097,. https://link.springer.com/article/10.1007/s11368-023-03519-6#article-info, DOI: 10.1007/s11368-023-03519-6.

KOVAČ, Nives, VIERS, Jerome, FAGANELI, Jadran, BAJT, Oliver, POKROVSKY, Oleg S. Elemental composition of plankton exometabolites (Mucous Macroaggregates): control by biogenic and lithogenic components. *Metabolites*. 2023, vol. 13, no. 6, str. 1-15, ilustr. ISSN 2218-1989. https://www.mdpi.com/2218-1989/13/6/726, DOI: 10.3390/metabo13060726.

KLUN, Katja, ŠKET, Primož, BERAN, Alfred, FALNOGA, Ingrid, FAGANELI, Jadran. Composition of colloidal organic matter in phytoplankton exudates. *Water* 2023, vol. 15, iss. 1, str. 1-10. https://doi.org/10.3390/w15010111, DOI: 10.3390/w15010111.

CHUN-WAI TSE, Kevin, FUNG, Wai-hong, KHAN, Mala, RIQUELME, Soraya Sandoval, VERA, Javier, CRISTANCHO, Ronald, JAĆIMOVIĆ, Radojko, HORVAT, Milena, MAZEJ, Darja, ALILOVIĆ, Adna, ZULIANI, Tea, et al. APMP.QM-S19: Toxic elements in seafood. *Metrologia* 2024, vol. 61, no. 1a, 33 str. ISSN 1681-7575. DOI: 10.1088/0026-1394/61/1A/08001.

TORRES-RODRIGUEZ, Natalia, HORVAT, Milena, HEIMBÜRGER-BOAVIDA, Lars-Eric, et al. Mercury fluxes from hydrothermal venting at mid-ocean ridges constrained by measurements. *Nature geoscience* 2024, str. 51–57. https://www.nature.com/articles/s41561-023-01341-w, DOI: 10.1038/s41561-023-01341-w.

KLEINDIENST, Alina, ŽIVKOVIĆ, Igor, TESSIER, Emmanuel, KOENIG, Alkuin Maximilian, HEIMBÜRGER-BOAVIDA, Lars-Eric, HORVAT, Milena, AMOROUX, David. Assessing comparability and uncertainty of analytical methods for methylated mercury species in

seawater. *Analytica chimica acta* 2023, vol. 1278, [art no.] 341735, 1-11. https://www.sciencedirect.com/science/article/pii/S000326702300956X?via%3Dihub, DOI: 10.1016/j.aca.2023.341735.

GIANI, Michele, OGRINC, Nives, TAMŠE, Samo, COZZI, Stefano. Elevated river inputs of the total alkalinity and dissolved inorganic carbon in the Northern Adriatic Sea. *Water*. 2023, vol. 15, no 5, str. 894-1-894-22. DOI: 10.3390/w15050894.

Special issue publication

OGRINC, Nives, GIANI, Michele, FAGANELI, Jadran. Editorial: the changing carbonate systems in coastal, estuarine, shelf areas and marginal seas. *Frontiers in marine science*. 2023, vol. 10, [art. no.] 1325363, 1-3. https://www.frontiersin.org/articles/10.3389/fmars.2023.1325363/full, DOI: 10.3389/fmars.2023.1325363.

OGRINC, Nives, FAGANELI, Jadran. Preface to the special issue of the 15th International Symposium on the Interactions Between Sediments and Water. *Journal of soils and sediments* 2023, vol. 23, iss. 12, [article no.] 1325363, str. 4081-408. https://link.springer.com/article/10.1007/s11368-023-03681-x, DOI: 10.1007/s11368-023-03681-x.

GEOTRACES presentations in international conferences

FAGANELI, Jadran, KOGOVŠEK, Tjaša, MAZEJ, Darja, MALEJ, Alenka, FALNOGA, Ingrid. Mercury in the coastal pelagic food web: phytoplankton, zooplankton and jellyfish. V: EGU General Assembly 2024: Vienna, Austria & online, 14-19 April 2024. Göttingen: EGU - European Geosciences Union. 2024, 1 spletni vir. https://meetingorganizer.copernicus.org/EGU24/EGU24-15021.html, DOI: 10.5194/egusphere-egu24-22463.

RELITTI, Federica, OGRINC, Nives, ESPOSITO, Veronica, GAMBI, Maria Cristina, POTOČNIK, Doris, GIANI, Michele, DE VITTOR, Cinzia. Stable isotope values of the seagrass Posidonia oceanica in Panarea hydrothermal vents = Isotopi stabili della fanerogama marina Posidonia oceanica nei sistemi idrotermali di Panarea. Biologia marina mediterranea, 52° Congresso della Società Italiana di Biologia Marina, 12-15 Giugno 2023, Messina. 2024, vol. 28, no. 1, str. 5-8, ilustr. ISSN 1123-4245.

Submitted by prof. dr. Nives Ogrinc (nives.ogrinc@ijs.si)