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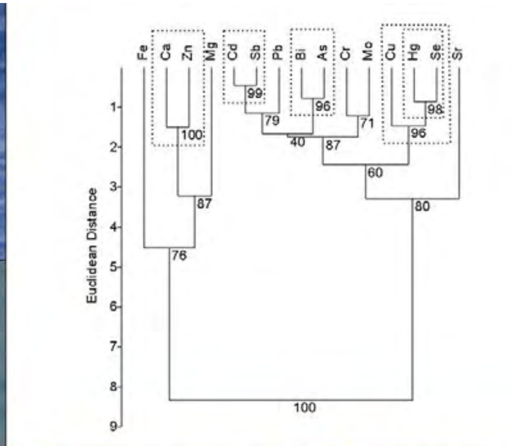
| **A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS:** | | | | | | |
| *See the following pages* | | | | | | |

***Pacyna A.D., Jakubas D., Ausems A.N.M.A., Frankowski M., Polkowska Ż., Wojczulanis-Jakubas K. 2019. Storm petrels as indicators of pelagic seabird exposure to chemical elements in the Antarctic marine ecosystem.*** **Science of the Total Environment *692: 382–392.***

Bioaccumulation and adverse effect of contaminants on biota are undoubtedly some of the most important problems of the 21st century. Birds inhabiting remote areas with sparse anthropogenic pollution can indicate the temporal trends in global contamination. Antarctic is an isolated place, with little human presence. Yet, contaminants may be transported long-distance with air and ocean currents from more urbanized areas, such as South America. Also natural sources like volcanic activity contribute to contaminants upload to the ecosystem.
In this study, we analyzed the concentration of 17 elements in feathers of adults and chicks of two pelagic seabirds – the Wilson's storm petrel *Oceanites oceanicus* and the black-bellied storm petrel *Fregetta tropica* – breeding sympatrically in the maritime Antarctic.
Seabirds' feathers are often used to evaluate birds exposure to contaminants providing a record of contaminant uptake at the time of feather growth and development. Feathers can be collected non-lethally, which is advantageous in terms of ethical and practical aspects. Elemental deposition in feather tissue is species-specific and depends on multiple factors, including diet, age, detoxification abilities and molting pattern. Since adult feathers of studied storm petrels are formed during the non-breeding period away from the breeding grounds but down and body feathers of chicks grow at the breeding sites, we were able to evaluate the birds' exposure to contaminants at various stages of their annual life cycle and in various marine zones. We found that of the two studied species, adult black-bellied storm petrels had significantly higher mercury, selenium and copper than Wilson's storm petrels. We found that Wilson's storm petrel chicks had a significantly different contaminant profile than adults. Arsenic, bismuth and antimony were detected exclusively in the chick feathers, and the Se:Hg molar ratio was higher in chicks than in adults. Our study also suggests considerable maternal transfer of Hg to down feathers in both species.
This data may serve to evaluate variability in contaminant levels in tissues throughout birds' annual cycle. We revealed several differences in elemental concentrations between the two species, as well as differences in exposure between life-cycle stages. These inter-species and inter-age differences are attributed to the various diet compositions and geographic areas of feather growth. We also identified some patterns in concentration of particular elements that suggest a primarily natural origin of most elements. As emissions and global transport of elements such as Hg, Pb and Cd are expected to increase in the future, monitoring studies on seabirds breeding in the Southern Hemisphere may be warning system for global changes and the consequences of elevated emissions into the marine food web.

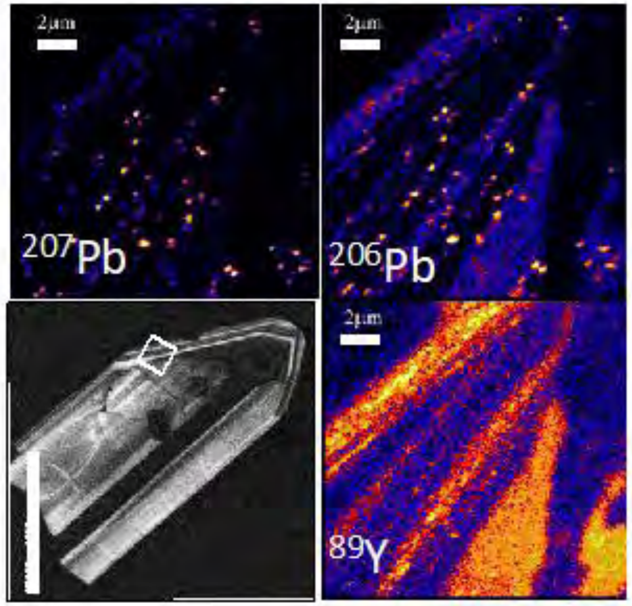



| Method | Element analyzed |
|---|---|
| Inductively Coupled Plasma Mass Spectrometry | Se, Cd, Cr, Cu, As, Fe, Pb, Zn, Bi, Ca, Mg, Mo, Sb, Sr, Ni, Co |
| Thermal Vaporisation Atomic Absorption | Hg |

***Lyon I., Kusiak M.A., Wirth R., Whitehouse M.J., Dunkley D.J., Wilde S.A., Schaumlöffel D., Malherbe J., Moore K.L. 2019. Pb nanospheres in ancient zircon yield model ages for zircon formation and Pb mobilization.*** **Scientific Reports** ***9: 13702.***

Geochronology is crucial to the understanding of geological processes. Secondary Ion Mass Spectrometry (SIMS), which uses micro to sub-micron scale ion beams to analyze zircon ($ZrSiO_4$) crystals from rock samples, has become the dominant method for dating rocks that have undergone complex or multiple thermal events. Zircon contains trace amounts of three Pb-producing radionuclides: $^{238}U \rightarrow ^{206}Pb$, $^{235}U \rightarrow ^{207}Pb$ and $^{232}Th \rightarrow ^{208}Pb$. If the U-Pb and Th-Pb isotopic systems have not been disturbed, then there should be agreement between ages calculated from these parent-daughter pairs. However, U-Pb systematics of many zircon grains are disturbed by geological processes such as metamorphism, fluid infiltration and weathering, causing mobilization of radiogenic Pb. Work on Archean zircon grains from the Napier Complex in east Antarctica led to the discovery that Pb mobilized on the nano-scale can form atomic clusters and metallic Pb nanospheres in zircon. It was concluded that ultrahigh temperature event at ca. 2.5 Ga caused Pb mobilization.

Utilizing nanoSIMS, we were able to analyse Pb nanospheres separately and calculate model ages for host zircon and Nanosphere Model Ages (NMAs) for individual Pb nanospheres. Ages calculated by this new method are consistent with the timing of original zircon formation and last major metamorphic event in the Napier Complex. Our new NMA method for separately analyzing individual Pb nanospheres, as well as radiogenic Pb in the host zircon, is widely applicable in zircon geochronology.




NanoSIMS imaging showing relative intensities of $^{207}Pb$, $^{206}Pb$ and $^{89}Y$ together with cathodoluminescence image of zircon grain. White box indicate area mapped by NanoSIMS.

***Wójcik K.A., Bialik R.J., Osińska M., Figielski M. 2019. Investigation of sediment-rich glacial meltwater plumes using a high-resolution multispectral sensor mounted on an unmanned aerial Vehicle.* Water *11: 2405.***

The article presents the first results obtained from research conducted with the innovative use of drones in the glacial area of Antarctica during austral summer 2019. It is part of a project on the analysis of water turbidity and concentration of suspended matter in the surface layer supplied from South Shetland glaciers in remote sensing approach. Its purpose is to confront the results obtained from recording images during drone flights with a multispectral camera with in situ measurements of water turbidity. During research Parrot Sequoia+, multispectral camera on a Parrot Bluegrass drone registered four spectral bands (green, red, red edge (RE), and near-infrared (NIR)) to identify glacial outflow zones and determined the meltwater turbidity values in waters in front of Ecology, Zalewski, Krak glaciers and Dera Icefall, on King George Island. This process was supported by a Red-Green-Blue color model from a Zenmuse X5 camera on an Inspire 2 quadcopter drone. Additional surface water turbidity measurements were carried out using a Yellow Springs Instruments probe EXO2. From this research, it was apparent that for mapping low-turbidity and medium-turbidity waters, a red spectral band should be used, since it is insensitive to possible surface ice phenomena and registers the presence of both red and white sediments. High-turbidity plumes should be identified through the NIR band. Strong correlation coefficients between the reflectance at particular bands and turbidity values readings (RGreen = 0.85, RRed = 0.85, REdge = 0.84 and RNIR = 0.83) shown that multispectral mapping using Unmanned Aerial Vehicles (UAVs) can be successfully used even in the harsh climate of Antarctica. In addition, high resolution images allow observations of small-scale phenomena that cannot be observed on satellite images, for example ice phenomena, varied color of sediment. Thanks to this, UAV image analysis can be a complementary part of analyses based on traditional remote sensing methods. Lastly, the movement of water masses in Admiralty Bay is briefly discussed and supported by the results from EXO2 measurements.

Image of sediment plume on water surface due to glacial meltwater influx, registered by Zenmuse X5 camera mounted on Inspire 2 drone.

PUBLICATION LIST FOR 2019

**Life sciences**

*Sea birds and pinnipeds*

1. Ausems ANMA, Wojczulanis-Jakubas K, Jakubas D. 2019. Differences in tail feather growth rate in storm-petrels breeding in the Northern and Southern hemisphere: a ptilochronological approach. *PeerJ* 7: e7807.
2. Hinke J.T., Santos M.M., Korczak-Abshire M., Milinevsky G., Watters G.M. 2019. Individual variation in migratory movements of chinstrap penguins leads to widespread occupancy of ice-free winter habitats over the continental shelf and deep ocean basins of the Southern Ocean. *PLoS ONE* 14: e0226207.
3. Korczak-Abshire M., Zmarz A., Rodzewicz M., Dąbski M., Kycko M., Chwedorzewska K.J. 2019. Study of fauna population changes on Penguin Island and Turret Point Oasis (King George Island, Antarctica) using an unmanned aerial vehicle. *Polar Biology* 42: 217-224.
4. Michielsen R.J., Ausems A.N.M.A., Jakubas D., Petlicki M., Plenzler J., Shamoun-Baranes J., Jakubas K.W. 2019. Nest characteristics determine nest microclimate and affect breeding output in an antarctic seabird, the wilson's storm-petrel. *PLoS ONE* 14: 1–23.
5. Pacyna A.D., Jakubas D., Ausems A.N.M.A., Frankowski M., Polkowska Ż., Wojczulanis-Jakubas K. 2019. Storm petrels as indicators of pelagic seabird exposure to chemical elements in the Antarctic marine ecosystem. *Science of the Total Environment* 692: 382–392.
6. Wojczulanis-Jakubas K, Plenzler J, Jakubas D. 2019. Indications of contagious behaviours in the southern elephant seal: an observational study. *Behaviour* 156: 59–77.

*Terrestial plats*

7. Androsiuk P., Koc J., Chwedorzewska K.J., Górecki R., Giełwanowska I. 2019. Retrotransposon-based genetic variation of *Poa annua* populations from contrasting climate conditions. *PeerJ* 7: e6888.
8. Atala C. Pertierra L.R., Aragon P., Carrasco-Urra F., Lavin P., Gallardo-Cerda J., Ricote-Martinez N., Torres-Diaz C., Molina-Montenegro M.A. 2019. Positive interactions among native and invasive vascular plants in Antarctica: assessing the "nurse effect" at different spatial scales. *Biological Invasions* 21: 2819–2836.
9. Dulska J, Wasilewski J., Androsiuk P., Kellmann-Sopyła W., Głowacka K., Górecki R., Chwedorzewska K.J., Gielwanowska I., 2019. The effect of sodium fluoride on seeds germination and morphophysiological changes in the seedlings of the Antarctic species *Colobanthus quitensis* (Kunth) Bartl. and the Subantarctic species *Colobanthus apetalus* (Labill.) Druce. *Polish Polar Research* 40: 255–272.
10. Galera H., Rudak A., Czyż E.A., Chwedorzewska K.J., Znój A., Wódkiewicz M. 2019. The role of the soil seed store in the survival of an invasive population of *Poa annua* at Point Thomas Oasis, King George Island, maritime Antarctica. *Global Ecology and Conservation* 19: e00679.
11. Miryuta N., Smykla J., Parnikoza I. 2019. Algorithm for the United Quality Latent Index of the plant adaptability and its

application in monitoring of *Deschampsia antarctica* È. Desv. populations. *Ukrainian Antarctic Journal* 18: 152–168.

12. Molina-Montenegro M.A., Bergstrom D.M., Chwedorzewska K.J., Convey P., Chown S.L. 2019. Increasing impacts by Antarctica's most widespread invasive plant species as result of direct competition with native vascular plants. *Neobiota* 51: 19–40
13. Rudak A., Wódkiewicz M., Znój A., Chwedorzewska K.J., Galera H. 2019. Plastic biomass allocation as a trait increasing the invasiveness of annual bluegrass (*Poa annua* L.) in Antarctica. *Polar Biology* 42: 149–157.

<u>*Other terrestrial microorganisms*</u>

14. Romaniuk K., Styczynski M., Decewicz P., Buraczewska O., Uhrynowski W., Fondi M., Wolosiewicz M., Szuplewska M., Dziewit L. 2019. Diversity and horizontal transfer of Antarctic *Pseudomonas* spp. Plasmids. *Genes* 10: 850.
15. Zawierucha Z., Buda J., Fontaneto D., Ambrosini R., Franzetti A., Wierzgoń M., Bogdziewicz M. 2019. Fine-scale spatial heterogeneity of invertebrates within cryoconite holes. *Aquatic Ecology* 53: 179–190.

<u>*Marine biology*</u>

16. Cecchetto M., Lombardi C., Canese S., Cocito S., Kuklinski P., Mazzoli C., Schiaparelli S. 2019. The Bryozoa collection of the Italian National Antarctic Museum, with an updated checklist from Terra Nova Bay, Ross Sea. *ZooKeys* 812: 1–22.
17. Majewski W., Stolarski J., Bart P.J. 2019. Two rare pustulose/sponose morphotypes of benthic foraminifera from eastern Ross Sea. *Journal of Foraminiferal Research* 49: 405–422.
18. Potocka M., Kidawa A., Panasiuk A., Bielecka L., Wawrzynek-Borejko J., Patuła W., Wójcik K.A., Plenzler J., Janecki T., Bialik R.J. 2019. The effect of glacier recession on benthic and pelagic communities: Case study in Herve Cove, Antarctica. *Journal of Marine Science and Engineering* 7: 285.
19. Ronowicz M., Pena Cantero AL., Mercado Casares M, Kuklinski P., Soto Angel J. 2019. Assessing patterns of diversity, bathymetry and distribution at the poles using Hydrozoa (Cnidaria) as a model group. *Hydrobiologia* 833: 25–51.
20. Vause B., Morley S., Fonseca V., Jażdżewska A. Ashton G., Barnes D. Giebner H., Clark M., Peck L. 2019. Spatial and temporal dynamics of Antarctic shallow soft-bottom benthic communities: Ecological drivers under climate change. *BMC Ecology* 19: 27.

**Geosciences**

<u>*Archean geology*</u>

21. Harley S.L., Kelly N.M., Kusiak M.A. 2019. Chapter 35 - Ancient Antarctica: The Archean of the East Antarctic Shield, in: Van Kranendonk, M.J., Bennett, V.C., Hoffmann, J.E. (Eds.) *Earth's Oldest Rocks* (Second Edition). Elsevier, pp. 865-897.
22. Lyon I., Kusiak M.A., Wirth R., Whitehouse M.J., Dunkley D.J., Wilde S.A., Schaumlöffel D., Malherbe J., Moore K.L. 2019. Pb nanospheres in ancient zircon yield model ages for zircon formation and Pb mobilization. *Scientific Reports* 9: 13702.

<u>*Penguin paleontology*</u>


23. Acosta Hospitaleche C., Jadwiszczak P., Clarke J.A., Cenizo M. 2019. The fossil record of birds from the James Ross Basin, West Antarctica. *Advances in Polar Science* 30: 251–273.
24. Jadwiszczak P., Mörs T. 2019. First partial skeleton of *Delphinornis larseni* Wiman, 1905, a slender-footed penguin from the Eocene of Antarctic Peninsula. *Palaeontologia Electronica* 22: 1–31.
25. Jadwiszczak P., Rothschild B.M. 2019 The first evidence of an infectious disease in early penguins, *Historical Biology* 2019, 31: 177–180.


**Physical Sciences**


26. Abubakar M., Habib N.M.S.A., Manogaran M., Yasid N.A., Alias S.A., Ahmad S.A., Smykla J., Hassan M.A., Shukor M.Y.A. 2019. Response surface-based optimization of the biodegradation of a simulated vegetable oily ballast wastewater under temperate conditions using the antarctic bacterium *Rhodococcus erythropolis* ADL36. *Desalination and Water Treatment* 144: 129–137.
27. Tiegs S., Costello D.M., Isken M.W., Woodward G., McIntyre P.B., Gessner M.O., Chauvet E., Griffiths N.A., Flecker A.S., Acuña V., Albariño R., Allen D.C., Alonso C., Andino P., Arango C., Aroviita J., Barbosa M.V.M., Barmuta L.A., Baxter C., Bell T.D.C., Bellinger B., Boyero L., Brown L.E., Bruder A., Bruesewitz D.A., Burdon F., Callisto M., Canhoto C., Capps K.A., Castillo M.M., Clapcott J., Colas F., Colón-Gaud C., Cornut J., Crespo-Pérez V., Cross W.F., Culp J., Danger M., Dangles O., de Eyto E., Derry A.A., Díaz Villanueva V., Douglas M.M., Elosegi A., Encalada A.C., Entrekin S., Espinosa R., Ethaiya D., Ferreira V., Ferriol C., Flanagan K.M., Fleituch T., Frainer Barbosa A., Friberg N., Frost P.C., Garcia E.A., García L., García Soto P.E., Ghate S., Giling D.P., Gilmer A., Gonçalves Jr J.F., Gonzales R.K., Graça M.A.S., Grace M., Grossart H.P.F., Guérold F., Gulis V., Hepp L.U., Higgins S., Hishi T., Huddart J., Hudson J., Imberger S., Iñiguez-Armijos C., Iwata T., Janetski D.J., Jennings E., Kandikere Ramaiah S., Kirkwood A.E., Koning A.A., Kosten S., Kuehn K.A., Laudon H., Leavitt P.R., Lemes da Silva A.L., Leroux S., LeRoy C.J., Lisi P.J., MacKenzie R., Marcarelli A.M., Masese F.O., McKie B.G., Medeiros A., Meissner K., Miliša M., Mishra S., Miyake Y., Moerke A., Mombrikotb S., Mooney R., Moulton T., Muotka T., Negishi J., Neres-Lima V., Nieminen M.L., Nimptsch J., Ondruch J., Paavola R., Pardo I., Patrick C.J., Peeters E.T.H.M., Pozo J., Pringle C.M., Prussian A., Quenta E., Quesada A., Reid B., Richardson J.S., Rigosi A., Rincón J., Risnoveanu G., Robinson C.T., Rodríguez-Gallego L., Royer T.V., Rusak J.A., Santamans A.C., Selmeczy G.B., Shah J.J.F., Simiyu G., Skuja A., Smykla J., Sponseller R., Stoler A., Swan C., Szlag D., Teixeira-de Mello F., Tonkin J.D., Uusheimo S., Veach A.M., Vilbaste S., Vought L.B.-M., Wang C.-P., Webster J.R., Wilson P.B., Woelfl S., Xenopoulos M.A., Yates A.G., Yoshimura C., Yule C., Zhang Y., Zwart J.A. 2019. Global patterns and drivers of ecosystem functioning in rivers and riparian zones. *Science Advances* 5: eaav0486.
28. Saruni N.H., Razak S.A., Habib S., Ahmad S.A., Alias S.A., Johari W.L.W., Smykla J., Yasid N.A. 2019. Comparative screening methods for the detection of biosurfactant-producing

capability of Antarctic hydrocarbon-degrading *Pseudomonas* sp. *Journal of Environmental Microbiology and Toxicology* 7: 44–47.

29. Kuklinski P., Wicikowski L., Koper M., Grala T., Leniec-Koper H., Barasiński M., Talar M., Kamiński I., Kibart R., Małecki W. 2019. Offshore surface waters of Antarctica are free of microplastics, as revealed by a circum-Antarctic study. *Marine Pollution Bulletin* 149: 110573.
30. Plenzler J., Budzik T., Puczko D., Bialik R.J. 2019. Climatic conditions at Arctowski Station (King George Island, West Antarctica) in 2013–2017 against the background of regional changes. *Polish Polar Research* 40: 1–27.
31. Szopinska M., Szuminska D., Bialik R.J., Dymerski T., Rosenberg E., Polkowska Z. 2019. Determination of polycyclic aromatic hydrocarbons (PAHs) and other organic pollutants in freshwaters on the western shore of Admiralty Bay (King George Island, Maritime Antarctica). *Environmental Science and Pollution Research* 26: 18143–18161.
32. Wójcik K.A., Bialik R.J., Osińska M., Figielski M. 2019. Investigation of sediment-rich glacial meltwater plumes using a high-resolution multispectral sensor mounted on an unmanned aerial Vehicle. *Water* 11: 2405.
33. Potapowicz J., Szumińska D., Szopińska M., Polkowska Ż. 2019. The influence of global climate change on the environmental fate of anthropogenic pollution released from the permafrost Part I. Case study of Antarctica. *Science of the Total Environment* 651: 1534–1548.