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Microplastic pollution and its effects on aquatic and terrestrial ecosystems

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Dr Anish Kumar Warriier

Fellowships/Awards/Honors

2022	<ul style="list-style-type: none"> Received a medal and a certificate from the Ministry of Earth Sciences, Government of India for participating as a member of the scientific team (summer) at the 39th Indian Scientific Expedition to Antarctica during November-December 2019.
2021	<ul style="list-style-type: none"> Award for Research Publications-2021 by the Vision Group on Science & Technology, Government of Karnataka.
2020	<ul style="list-style-type: none"> Certificate of Contribution for the valuable contribution and outstanding performance as a member of the Scientific Committee of the 3rd Conference of the Arabian Journal of Geosciences (CAJG), held online, 2-5 November 2020. GeoHost Award (airfare and local hospitality) to participate in the 36th International Geological Congress, New Delhi, India during March 2-8, 2020.
2019	<ul style="list-style-type: none"> Awarded Faculty Scholarship under the National Scholarship Programme by the Government of the Slovak Republic (Not availed).
2018	<ul style="list-style-type: none"> Tinker-Muse Prize Travel Award sponsored by the TINKER FOUNDATION, USA, to participate in the POLAR2018 conference, Davos, Switzerland, during June 19-23, 2018. Awarded the Research Grant for Faculty/Scientist (RGS/F) by the Vision Group of Science & Technology, Govt. of Karnataka (July 2018).
2017	<ul style="list-style-type: none"> PAGES-IPO Travel Award to participate in the 5th PAGES OSM held at Zaragoza, Spain during May 9-13, 2017.
2015	<ul style="list-style-type: none"> K.K. MENON AWARD IN SEDIMENTOLOGY, Geological Society of India.
2015	<ul style="list-style-type: none"> Received a certificate from the Ministry of Earth Sciences, Government of India for participating as a member of the scientific team (summer) at the 34th Indian Scientific Expedition to Antarctica during December 2014-April 2015.
2014	<ul style="list-style-type: none"> Received a certificate from the Ministry of Earth Sciences, Government of India for participating as a member of the scientific team (summer) at the 33rd Indian Scientific Expedition to Antarctica during December 2013-April 2014.
2013	<ul style="list-style-type: none"> Received a certificate from the Ministry of Earth Sciences, Government of India for participating as a member of the scientific team (summer) at the 32nd Indian Scientific Expedition to Antarctica during January-April 2013.
2008	<ul style="list-style-type: none"> SENIOR RESEARCH FELLOWSHIP (DIRECT) awarded by the Council of Scientific and Industrial Research (CSIR), Government of India.
2006	<ul style="list-style-type: none"> YOUNG SEDIMENTOLOGIST AWARD awarded by the Indian Association of Sedimentologists.
2006	<ul style="list-style-type: none"> SENIOR RESEARCH FELLOWSHIP awarded by the Indian Space Research Organization, Government of India.
2004	<ul style="list-style-type: none"> JUNIOR RESEARCH FELLOWSHIP awarded by the Indian Space Research Organization, Government of India.

Membership of Professional Bodies

2021	Member , Association of Quaternary Researchers (AoQR)
2014 – 2022	Secretary , International Geoscience Education Organization (IGEO).
2006 onwards	Life Member , Indian Association of Sedimentologists

Editorial Responsibilities

2020	Review Editor , Editorial Board of Marine Pollution (specialty section of <i>Frontiers in Marine Science</i> and <i>Frontiers in Environmental Science</i>)
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Publications (Research)

Keerthi, K., George, S.D., Joju G.S., **Warrier, A.K.**, Chidangil, S., Unnikrishnan, V.K. (2022). *Optimization of different sampling approaches in liquid LIBS analysis for environmental applications. Journal of Analytical Atomic Spectrometry (Impact factor: 4.351; Q1) <https://doi.org/10.1039/D2JA00202G>*

Rizwan Khaleel, Gokul Valsan, Nelson Rangel-Buitrago, **Warrier, A.K.** (2022). *Hidden problems in geological heritage sites: The microplastic issue on Saint Mary's Island, India, Southeast Arabian Sea. Marine Pollution Bulletin (Impact factor: 7.001; Q1) <https://doi.org/10.1016/j.marpolbul.2022.114043>*

Mahesh, B.S., D'Mello, C.N., Nair, A., **Warrier, A.K.**, Rahul Mohan (2022). *Environmental Changes and Geomorphological Factors Influencing the Sediment Flux to a Coastal Lake Spanning the Deglacial- Early Holocene Period in East Antarctica. Journal of the Geological Society of India (Impact factor: 1.466; Q2) <https://doi.org/10.1007/s12594-022-xxxx-x>*

Waldschläger, K., Brückner, M., Carney Almroth, B., Hackney, C., Adyel, T., Alimi, S. O. Belontz, S., Cowger, W., Doyle, D., Gray, A., Kane, I., Kooi, M., Kramer, M., Lechthaler, S., Michie, L., Nordam, T., Pohl, F., Russell, C., Thit, A., Umar, W., Valero, D., Varrani, A., **Warrier, A.K.**, Woodall, C.L., Wu, N. *Learning from natural sediments to tackle microplastics challenges: a multidisciplinary perspective. Earth- Science Reviews, v. 228, 104021 (Impact factor: 12.038; Q1) <https://doi.org/10.1016/j.earscirev.2022.104021>*

Warrier, A.K., Bhavani, K., Amrutha, K., Dhanasree J., Gokul V., Prashansa, A. *Seasonal Variations in the Abundance and Distribution of Anthropogenic Particles in the Surface Waters of a Southern Indian Lake. Chemosphere, v. 300, 134556 (IF: 8.943; Q1) <https://doi.org/10.1016/j.chemosphere.2022.134556>*

Sandeep, K., Shankar, R. and **Warrier, A.K.** (2022). A Late Holocene record of variations in the chemical weathering intensity and pedogenesis in a lake catchment from southern India. *Aquatic Geochemistry, v. 28, pp. 27-42 (Impact factor: 1.813; Q2) <https://doi.org/10.1007/s10498-021-09402-5>*

Sandeep, K., Shankar, R., **Warrier, A.K.**, Aravind, G.H. (2022) *The geochemical and pedogenic signatures of Shantisagara lake sediments, southern India: Implications for weathering,*

terrigenous influx and provenance during the Holocene. **Geological Journal**, v.57(5), pp. 1925-1937. (**Impact factor:** 2.128; **Q2**) <https://doi.org/10.1002/gj.4388>

Nishitha, D., Amrith, V.N., Arun, K., **Warrier, A.K.**, Udayashankar, H.N., Balakrishna, K. (2022) *Study of trace metal contamination and ecological risk assessment in the sediments of a tropical river estuary, Southwestern India.* **Environmental Monitoring and Assessment**, v. 194:94 (**IF:** 3.307; **Q2**) <https://doi.org/10.1007/s10661-021-09728-1>

Warrier, A.K., Mahesh, B.S., Joju, G.S., Yamuna Sali A.S. and Mohan, R. (2022). *A Synthesis of Glacial-Interglacial Paleoenvironmental Records from Lake Sediments of Schirmacher Oasis, East Antarctica.* In: N. Khare (ed.), *Assessing the Antarctic Environment from a Climate Change Perspective*, Earth and Environmental Sciences Library, https://doi.org/10.1007/978-3-030-87078-2_8

Amrutha, K., **Warrier, A.K.**, Sandeep, K., Jyothinath, A., Ananthapadmanabha, A.L. and Shankar, R. (2021). *Environmental Magnetic Properties of Lateritic Soils from Southwestern India.* **Eurasian Soil Science**, v. 54(2), pp. 238-248 (**Impact factor:** 1.374; **Q2**) <https://doi.org/10.1134/S1064229321020022>

Warrier, A.K., Joju, G.S., Amrutha, K., Yamuna Sali, A.S., Mahesh, B.S. and Mohan, R. (2021). *Magnetic properties of surface sediments in Schirmacher Oasis, East Antarctica: Spatial distribution and controlling factors.* **Journal of Soils and Sediments**, v. 21, pp. 1206- 1221 (**Impact factor:** 3.536; **Q1**) DOI: 10.1007/s11368-020-02824-8

Warrier, A.K., Mahesh, B.S., Joju, G.S. and Mohan, R. (2021). *How strong was pedogenesis in Schirmacher Oasis during the Late Quaternary?* **Polar Science**, v. 30, 100636 (**Impact factor:** 2.355; **Q2**) <https://doi.org/10.1016/j.polar.2021.100636>

Warrier, A.K., Mahesh, B.S., Mohan, R. and Shankar, R. (2021). *A 43- ka mineral magnetic record of environmental variations from lacustrine sediments of Schirmacher Oasis, East Antarctica.* **Catena**, v. 202, 105300 (**Impact factor:** 6.367; **Q1**) <https://doi.org/10.1016/j.catena.2021.105300>

Mahesh, B.S., **Warrier, A.K.**, Nair, A., Fernandes, R. and Mohan, R. (2021). *Evolutionary inferences from the sedimentary deposits of Lake LH73, Larsemann Hills, East Antarctica.* **Catena**, v. 203, 105341 (**Impact factor:** 6.367; **Q1**) <https://doi.org/10.1016/j.catena.2021.105341>

Cheryl A. Noronha-D Mello, Nair, A., Mahesh, B.S., **Warrier, A.K.**, Mohan, R. and Kurian, S. (2021). *Glacial-Holocene climate-driven shifts in lacustrine and terrestrial environments: Rock magnetic and geochemical evidence from an East Antarctic Mochou Lake.* **Palaeogeography Palaeoclimatology Palaeoecology**, v. 576,110505 (**Impact factor:** 3.565; **Q1**) <https://doi.org/10.1016/j.palaeo.2021.110505>

Mahesh, B.S., Nair, A., Ghadi, P., **Warrier, A.K.** and Mohan, R. (2021). *Holocene sedimentology in an isolation basin in the Larsemann Hills, East Antarctica.* **Polar Science**, v.30, 100729 (**Impact factor:** 2.355; **Q2**), <https://doi.org/10.1016/j.polar.2021.100729>

Amrutha, K., Vishnu, U., Sachin, S. and **Warrier, A.K.** (2021). *Current State of Microplastics Research in SAARC Countries – A review.* In: S. S. Muthu (ed.), *Microplastic Pollution, Sustainable Textiles: Production, Processing, Manufacturing & Chemistry*, Springer, Singapore https://doi.org/10.1007/978-981-16-0297-9_2

Chandran, T., Vishnu, U. and **Warrier, A.K.** (2021). *Microplastics in Dentistry – A review.* In: S. S. Muthu (ed.), *Microplastic Pollution, Sustainable Textiles: Production, Processing,*

Amrutha, K. and **Warrier, A.K.** (2020). *The first report on the source- to-sink characterization of microplastic pollution from a riverine environment in tropical India*. **Science of the Total Environment**, v. 739, 140377, <https://doi.org/10.1016/j.scitotenv.2020.140377> (**Impact factor: 10.753; Q1**)

Sandeep, K., Shankar, R., **Warrier, A.K.**, Yadava, M.G., Ramesh, R. and Jani, R.A. (2019). *Late Holocene palaeovegetational and environmental changes inferred from organic geochemical proxies in sediments from Pookot Lake, southern India*. **Arabian Journal of Geosciences**, v. 12:643, pp. 1-14. (**Impact factor: 1.827; Q2**)

Shetye, S.S., Mohan, R., Patil, S., Jawak, S., Nair, A., **Warrier, A.K.**, Badnal, M. and Shirodkar, R. (2019). *Hidden biogeochemical anonymities under Antarctic fast ice*. **Regional Studies in Marine Science**, v. 31: 100789, pp. 1-6. (**Impact factor: 2.166; Q2**)

Mahesh, B.S., **Warrier, A.K.**, Mohan, R. and Tiwari, M. (2019). *Impact of Antarctic climate during the Late Quaternary: Records from Zub Lake sedimentary archives from Schirmacher Hills, East Antarctica*. **Palaeogeography Palaeoclimatology Palaeoecology**, v. 514, pp. 398-406. (**Impact factor: 3.565; Q1**)

Mahesh, B.S., Nair, A., **Warrier, A.K.**, Avadhani, A., Mohan, R. and Tiwari, M. (2018). *Paleolimnological records of regime shifts from marine-to-lacustrine system in a coastal Antarctic lake in response to post-glacial isostatic uplift*. **Current Science**, v. 115(9), pp. 1679-1683. (**Impact factor: 1.169; Q2**)

Warrier, A.K., Sandeep, K. and Shankar, R. (2017). *Climatic Periodicities recorded in a Lake Sediment Magnetic Susceptibility Data: Further Evidence for Solar Forcing on the Indian Summer Monsoon*. **Geoscience Frontiers**, v. 8(6), pp. 1349-1355. (**Impact factor: 7.483; Q1**)

Mahesh, B.S., **Warrier, A.K.**, Mohan, R., Tiwari, M., Roy, R., Ravindra, R. and Asthana, R. (2017). *Response of Sandy Lake in Schirmacher Oasis, East Antarctica to the glacial-interglacial climate shift*. **Journal of Paleolimnology**, v. 58, pp. 275-289. (**Impact factor: 2.265; Q2**)

Sandeep, K., Shankar, R., **Warrier, A.K.**, Yadava, M.G., Ramesh, R., Jani, R.A., Zhou, W. and Xuefeng, L. (2017). *A multi-proxy lake sediment record of Indian summer monsoon variability during the Holocene in Southern India*. **Palaeogeography Palaeoclimatology Palaeoecology**, v. 476, pp. 1-14. (**Impact factor: 3.565; Q1**)

Warrier, A.K., Mahesh, B.S. and Mohan, R. (2017). *Lake Sediment Studies in ice-free regions of East Antarctica – An Indian Perspective*. Special Volume on Polar Sciences, **Proceedings of the Indian National Science Academy**, v. 83(2), pp. 289-297. (**Impact factor: NA**)

Sandeep, K., Shankar, R., **Warrier, A.K.** and Balsam, W. (2017) *Diffuse Reflectance Spectroscopy of a Tropical Southern Indian Lake Sediment Core: A Window to Environmental Change*. **Episodes – Journal of International Geoscience**, v. 40(1), pp. 47-56. (**Impact factor: 2.439; Q2**)

Shankar, R., Orion, N., King, C., **Warrier, A.K.**, Narahari, A.M. and Swamy, S.G.S. (2017). *Teacher training workshops in India*. **Current Science**, v. 112(6), pp. 1090-1093. (**Impact factor: 1.169; Q2**)

Shankar, R., Orion, N., King, C., **Warrier, A.K.**, Narahari, A.M. and Swamy, S.G.S. (2017). *Teacher Training Workshops in India – A Report*. **Journal of the Geological Society of India**, v. 89, pp. 217-219. (**Impact factor: 1.466; Q2**)

Shankar, R., Orion, N., King, C., **Warrier, A.K.**, Narahari, A.M. and Swamy, S.G.S. (2017).

Teacher Training Workshops in India – A Report. **Episodes**, v. 40(1), pp. 90-93. (*Impact factor: 2.439; Q2*)

Warrier, A.K., Pednekar, H., Mahesh, B.S., Mohan, R. and Gazi, S. (2016). Sediment grain size and surface textural observations of quartz grains in late quaternary lacustrine sediments from Schirmacher Oasis, East Antarctica: paleoenvironmental significance. **Polar Science**, v. 10(1), pp. 89-100. (*Impact factor: 2.355; Q2*)

Avinash, K., Kurian, J., **Warrier, A.K.**, Shankar, R., Vineesh, T.C. and Ravindra, R. (2016). *Sedimentary sources and processes in the eastern Arabian Sea: Insights from environmental magnetism, geochemistry and clay mineralogy*. **Geoscience Frontiers**, v. 7(2), pp. 253-264. (*Impact factor: 7.483; Q1*)

Mahesh, B.S., **Warrier, A.K.**, Mohan, R., Tiwari, M., Anila, B., Aswathi, C., Asthana, R. and Ravindra, R. (2015). *Response of Long Lake sediments to Antarctic climate: A perspective gained from sedimentary organic geochemistry and particle size analysis*. **Polar Science**, v. 9(4), pp.359-367. (*Impact factor: 2.355; Q2*)

Bhattacharyya, A., Sandeep, K., Misra, S., Shankar, R., **Warrier, A.K.**, Weijian, Z. and Zuefeng, L. (2015). *Vegetational and Climatic Variations during the past 3100 years in Southern India: Evidence from Pollen, Magnetic Susceptibility and Particle Size Data*. **Environmental Earth Sciences**, v. 74, pp.3559-3572. (*Impact factor: 3.119; Q1*)

Sandeep, K., Shankar, R., **Warrier, A.K.**, Weijian, Z. and Xuefeng, L. (2015). *The environmental magnetic record of palaeoenvironmental variations during the past 3100 years: A possible solar influence?* **Journal of Applied Geophysics**, v. 118, pp. 24-36. (*Impact factor: 1.845; Q2*)

Warrier, A.K., Mahesh, B.S., Mohan, R., Shankar, R., Asthana, R. and Ravindra, R. (2014). *Glacial-Interglacial Variations from Lake Sediments of Schirmacher Oasis, East Antarctica: First Report from Environmental Magnetism*. **Palaeogeography Palaeoclimatology Palaeoecology**, v. 412, pp. 249-260. (*Impact factor: 3.565; Q1*)

Pandarinath, K., Shankar, R., Torres-Alvarado, I.S. and **Warrier, A.K.** (2014). *Magnetic susceptibility of volcanic rocks in geothermal areas: application potential in geothermal exploration studies for identification of rocks and zones of hydrothermal alteration*. **Arabian Journal of Geosciences**, v. 7(7), pp. 2851-2860. (*Impact factor: 1.827; Q2*)

Warrier, A.K., Shankar, R., Manjunatha, B.R. and Harshavardhana, B.G. (2014). *Mineral magnetism of atmospheric dust over southwest coast of India: Impact of Anthropogenic Activities and Implications to Public Health*. **Journal of Applied Geophysics**, v. 104, pp.1-9. (*Impact factor: 1.845; Q2*)

Warrier, A.K., Shankar, R. and Sandeep, K. (2014) Sedimentological and carbonate data evidence for lake level variations during the past 3700 years from a Southern Indian lake. **Palaeogeography Palaeoclimatology Palaeoecology**, v. 397, pp. 52-60. (*Impact factor: 3.565; Q1*)

Sandeep, K., **Warrier, A.K.**, Harshavardhana, B.G. and Shankar, R. (2012). *Rock magnetic investigations of surface and sub-surface soil samples from five lake catchments in tropical Southern India*. **International Journal of Environmental Research**, v. 6(1), pp. 1-18. (*Impact factor: 3.229; Q2*)

Warrier, A.K., Sandeep, K., Harshavardhana, B.G., Shankar, R., Pappu, S., Kumar, A., Prabhu, C.N. and Gunnell, Y. (2011). *A rock magnetic record of Pleistocene rainfall variations at the Palaeolithic site of Attirampakkam, Southeastern India*. **Journal of Archaeological Science**, v.

38(12), pp. 3681-3693. (*Impact factor: 3.508; Q1*)

Warrier, A. K. and Shankar, R. (2009). *Geochemical evidence for the use of magnetic susceptibility as a paleorainfall proxy in the tropics*. **Chemical Geology**, v. 365 (3-4), pp. 553-562. (*Impact factor: 4.685; Q1*)

Warrier, A. K. (2006). *Can Magnetic susceptibility be used as a proxy for paleomonsoon in Tropical regions?* **Journal of the Indian Association of Sedimentologists**, v. 25 (1 & 2), pp. 93-104. (*Impact factor: N.A.*)

Shankar, R., Prabhu, C. N, **Warrier, A. K.**, Vijay Kumar, G. T., and Sekar, B. (2006) *A Multi-Decadal Rock Magnetic Record of Indian Monsoon During the Past 3,700 Years from a Tropical Indian Tank*. **Journal of the Geological Society of India**, v. 68, pp. 447-459. (*Impact factor: 1.466; Q2*)

Research Projects:

2022	<p>Title: Understanding the Fluxes of Microplastics in the Coastal Ecosystems of major Rivers of India.</p> <p>Duration: Three years (Ref No.: CRG/2021/004725 dated 24.06.2022).</p> <p>Amount: Rs. 46,74,620/-</p> <p>Funder: Science and Engineering Research Board, Department of Science and Technology, GoI.</p> <p>PI: Dr Anish Kumar Warrie (MAHE)</p> <p>Co-PI's: Dr Priya M D'Costa (Goa University); Dr Kanu Shil (Assam Down Town University).</p> <p>Status: Ongoing</p>
2019	<p>Title: Paleoweathering and paleoenvironmental changes recorded in lake sediments of Schirmacher Oasis and Larsemann Hills, East Antarctica: a multi-proxy approach.</p> <p>Duration: Three years (Ref No.: NCPOR/2019/PACER-POP/ES- 02 dated July 5, 2019).</p> <p>Amount: Rs. 21,24,000/-</p> <p>Funder: ESSO-NCPOR, Ministry of Earth Sciences, GoI. PI: Dr Anish Kumar Warrier</p> <p>Co-PI's: Dr K Balakrishna (MIT); Dr Rahul Mohan (NCPOR); Dr Mahesh Badanal (NCPOR).</p> <p>Status: Ongoing</p>
2018-19	<p>Title: High-resolution record of rainfall variations during the Holocene from lake-bed sediments of Karnataka.</p> <p>Duration: One year (Ref No.: NO/VGST/GRD-697/2017-18/2018- 19/515 dated February 2, 2019).</p> <p>Amount: Rs. 5, 00, 000/-</p> <p>Funder: VGST, Government of Karnataka.</p> <p>PI: Dr Anish Kumar Warrier</p> <p>Status: Completed</p>

Instrumental Facilities to conduct microplastics research:

- 1). Manta Trawl Net (100-microns mesh) with a flow meter
- 2). Niskin Water sampler
- 3). Advanced stereo zoom microscopes with camera (Nikon and Zeiss)