

1st SEGH Live online event

Society for Environmental Geochemistry and Health



SEGH Live event schedule & abstracts



Hosted by the British Geological Survey via Zoom webinar



Monday 29th – Tuesday 30th June 2020

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Scientific and Organising Committee

Organising committee

Dr Michael Watts, British Geological Survey

Dr Olivier Humphrey, British Geological Survey

Dr Daniel Middleton, International Agency for Research on Cancer (IARC)

SEGH Organisational Profile

President: Dr Michael Watts, British Geological Survey

Americas: Mark Button (Canada), Robert Finkelman (USA), Ofelia Morton-Bermea (Mexico)

Europe: Ariadne Argyraki (Greece), Maurizio Barbieri (Italy), Paula Marinho-Reis (Portugal), Daniel Middleton (France), Sanja Potgieter-Vermaak (UK), Keith Torrance (UK),

Asia/Pacific: Taicheng An (China), Xia Huo (China), Ahad Nazarpour (Iran), Kosei Yamaguchi (Japan), Munir Zia (Pakistan)

Africa/Middle East: Belinda Kaninga Kapembwa (Zambia), Akinade Olatunji (Nigeria), Odipo Osano (Kenya), Moatez Tarek (Egypt)

Membership Secretary and Treasurer: Anthea Brown (UK)

Secretary: Gillian Gibson (UK)

Webmaster: Olivier Humphrey (UK)

Past President: Chaosheng Zhang (Ireland)

Conference Information

See General Information at www.segh.net for a copy of the book of abstracts and for recording of Zoom webinar sessions.

Also see @SocEGH for Twitter.

Welcome to SEGH Live

In the current COVID-19 crisis we are all having to adapt to the new situation whilst not knowing when we can return to some sense of normality and what that new 'normal' will be. As we adjust to new ways of working the SEGH international board is working to evolve new ways of interacting with current, (hopefully) new members and encouraging back old friends. The 1st SEGH Live event via Zoom webinar was set-up in response to the COVID-19 crises and need to postpone the Kenya 2020 conference. Many of the speakers were drawn from abstracts submitted to the Kenya meeting and supplemented by additional invited speakers to increase the variety of topics and geographic contributions. Thank you to those speakers who stepped forward to provide the content to what looks like a very interesting programme. Demand for speaking slots was much greater than we had time for and therefore, we are hopeful that a 2nd SEGH Live event could follow later in 2020.

Background for SEGH

As you know, the Society for Environmental Geochemistry and Health (SEGH – www.segh.net) exists to provide a community for researchers and practitioners to exchange ideas for interdisciplinary research with diverse expertise from fields including biology, engineering, geology, hydrology, epidemiology, chemistry, medicine, nutrition and toxicology. SEGH supports a network of Early Career Researchers (ECRs) with a mentorship programme and targeted training at conferences. The ECR group will see renewed efforts to engage this cohort of enthusiastic and bright young researchers over the coming weeks. SEGH also benefits from a cohort of established scientists as a Fellowship group established in 2019 to support the international board, which has sections in Europe, Asia/Pacific, Africa and the Americas. The Fellows are currently discussing a series of review papers to coincide with the 50th anniversary of SEGH in 2021 in SEGH's dedicated journal, Environmental Geochemistry and Health (SpringerNature – IF 3.25, 2018). Other activities in discussion to mark this milestone – the board welcome suggestions from the membership.

SEGH activities normally include an annual international conference, which we target for rotation between the regions, with smaller supported symposia headed by SEGH members to maintain interaction and attract new members. For 2020, two international conferences were planned for Kenya in July and China in November. Due to the current COVID-19 crisis, the Kenya conference has been delayed and moved to June/July 2021. We are hopeful that Nanjing will go ahead in November 2020.

As we approach the 50th anniversary of SEGH in 2021, conferences will likely include a smaller workshop at the University of British Columbia, Canada in August with plans currently in discussion for late 2021 through to 2022. The international conferences are well supported by existing members and newcomers alike, along with contributions from sponsors to the programme. The conferences provide a friendly environment for PhD students and ECRs to mix with established scientists and present their often cutting edge research.

Many thanks to the people that have helped put together this conference programme and offered help in the smooth running of activities.

Programme

Day 1: Monday the 29th of June, 13:00 – 16:30 (BST)

Time	Event	Speaker(s)	Chair
Opening session			
13:00	Sign in open		Zoom hosts
13:30 – 13:40	Opening remarks and welcome to delegates	Dr Michael Watts , SEGH President, Centre for Environmental Geochemistry, British Geological Survey	British Geological Survey
13:40 – 13:50	SEGH ECR activities for the future	Dr Olivier Humphrey	
Scientific session 1 (presentations 1 to 7)			
13:50 – 14:05 (includes 3 mins question time)	KEYNOTE: OPEN WEB MAPPING APPLICATIONS TO VISUALISE AND INTERROGATE ENVIRONMENTAL DATA IN WESTERN KENYA	Severine Cornillon (BGS, UK)	
14:05 – 14:10	OPTIMIZING SOIL FERTILITY MANAGEMENT DECISIONS IN MALI BY REMOTE SENSING	Djembe Dembele (France)	
14:10 – 14:15	PHYSICOCHEMICAL CHARACTERISATION OF ABANDONED GOLD MINE TAILINGS, LEACHATES AND POTENTIAL OF SELECTED INDIGENOUS PLANTS FOR PHYTOEXTRACTION OF INORGANIC CONTAMINANTS	Khumbelo Priscilla Makhado (South Africa)	
14:15 – 14:20	ECOLOGICAL AND HEALTH RISKS ASSOCIATED WITH EMISSIONS OF LEAD IN SOILS, SEDIMENTS, MINE TAILINGS AND PLANTS IN AN ARTISANAL MINING ENVIRONMENT, NORTH-EAST, NIGERIA	Dr Laniyan Temitope (Nigeria)	
14:20 – 14:30	Qs for 10 minute presenters		
14:30 – 14:35	DETERMINATION OF LOW CONCENTRATIONS OF REEs IN RIVER WATER USING ICP-QQQ IN MS/MS MASS-SHIFT MODE	Uwe Noetzel (Agilent Technologies)	
14.35 – 14.40	ENSURING POPULATION SCREENING AFTER EXPOSURE TO ENVIRONMENTAL TOXINS IS WORTHWHILE	Dr Alex Stewart (UK)	

14.40– 14.45	GEOPHOBIA: LINKING GEOLOGICAL EVENTS TO ILLOGICAL FEARS	Dr Moatez Tarek (Egypt)	
14:45 – 14:55	Qs for 10 minute presenters		
15 minute (make yourself a) coffee break			
Scientific session 2 (presentations 8 to 14)			
15:10 – 15:25 (includes 3 mins question time)	KEYNOTE: LANDSCAPE CONTROLS ON NUTRIENT STOICHIOMETRY AND LIGHT AVAILABILITY REGULATE LAKE PRIMARY PRODUCTION AT THE MARGIN OF THE GREENLAND ICE SHEET.	Dr Clay Prater (USA)	
15:25 – 15:30	ANTIMONY AND OTHER TRACE ELEMENTS IN BLOOD FROM CHILDREN EXPOSED IN AN ABANDONED METALLURGICAL AREA IN MEXICO	Dr Ofelia Morton-Berma (Mexico)	
15.30 – 15:35	EXPOSURE TO HEAVY METALS FROM GOLD MINE TAILINGS IN SOUTH AFRICA: HEALTH RISKS AND RESEARCH CHALLENGES	Dr Ljubica Zupunski (IARC-WHO, France)	
15:35 – 15:40	RISKY BUSINESS: BIOACCESSIBILITY RISK ASSESSMENTS USING THE CONTINUOUS ON-LINE LEACHING METHOD	Alastair Kierulf (Canada)	
15:40 – 15:50	Qs for 10 minute presenters		
15:50 – 16:05 (includes 3 mins question time)	KEYNOTE: ARE WE IN THE TWILIGHT OF COAL USE AND, IF SO, HOW WILL IT IMPACT HUMAN HEALTH?	Prof Robert Finkelman (USA)	
16:05 – 16:10	FRESHWATER FISH PRODUCTIVITY: DRIVERS, CORRELATES AND MICROPLASTICS	Haley MacLeod (Canada)	
16:10 – 16:15	EFFECT OF NUTRITIONAL CONTENT OF BOTH COMMERCIAL AND NON-COMMERCIAL FEEDS ON AQUACULTURE FISH IN WINAM GULF, LAKE VICTORIA	Melvine Otieno (Kenya)	
16:15 – 16:25	Qs for 10 minute presenters		
Closing session			
16:25 – 16:30	Day 1 wrap up discussion and closing remarks	All delegates	Dr Dan Middleton
Social event			
16:30 onwards	Online Apéro: cameras on, say cheers with your choice of beverage, share anecdotes etc.	All delegates	SEGH Arms

Day 2: Tuesday 30th of June, 09:00 – 12:30 (BST)

Time	Event	Speaker(s)	Chair
Scientific session 1 (presentations 15 to 21)			
09:00 – 09:15 (includes 3 mins questions)	KEYNOTE: BIOGEOCHEMICAL RELEASE OF ARSENIC FROM LAKEBED SEDIMENTS RECEIVING AN ACID MINE DRAINAGE, KUSATSU HOT SPRING, JAPAN: ROLES OF ORGANIC ACIDS AND BACTERIAL SULPHATE REDUCTION	Prof Kosei Yamaguchi (Japan)	
09:15 – 09:20	MANIPULATION OF SOIL FAUNA, TERMITES AND THEIR ALLIES (DECOMPOSITION AGENTS) FOR SUSTAINABLE FOOD PRODUCTION UNDER CLIMATE CHANGE	Momade Mamudo Ibraimo (Mozambique)	
09:20 – 09:25	ASSESSMENT OF HEAVY METALS AND NUTRIENTS STATUS AT A RECLAIMED MINE SITE	Adams Sadick (Ghana)	
09:25 – 09:30	USE OF MULTISTAGE PHYTOREMEDIATION TECHNIQUES IN WASTEWATER TREATMENT	Dr Lucy Luguru Wanjohi (Kenya)	
09:30 – 09:40	Qs for 10 minute presenters		
09:40 – 09:45	ANALYSING TRACE ELEMENTS IN SEDIMENT USING ED-XRF	Marietha du Toit (South Africa)	
09:45 – 09:50	ESSENTIAL AND TOXIC ELEMENTS IN SOIL AND PLANT SAMPLES AND THEIR TRANSFER TO RICE GRAINS OF ITOKIN, SOUTHWESTERN NIGERIA	Dr Akinade Olatunji (Nigeria)	
09:50 – 09:55	IMPACT OF 2, 4, 5 TRICHLOROPHOXY ACETIC ACID ON THE METAMORPHOSIS OF XENOPUS LAEVIS AND THE REMEDIAL CAPACITY OF ASCORBIC ACID	Job Isaboke (Kenya)	
09:55 – 10:05	Qs for 10 minute presenters		
10 minute (make yourself a) coffee break			
Scientific session 2 (presentations 22 to 29)			
10:15 – 10:30 (Includes 3 mins questions)	KEYNOTE: DETERMINATION OF METABOLIC BIOMARKERS OF OCCUPATIONAL EPOSURE TO E-WASTE DISMANTLING POLLUTION	Prof Taicheng An (China)	
10:30 – 10:35	CONTAMINATION AND HEALTH RISK ASSESSMENT OF MERCURY FROM SOIL AT ARTISANAL GOLD MINING AND PROCESSING SITES IN CENTRAL NIGERIA	Dr Mary Odukoya (Nigeria)	

10:35 – 10:40	A SYSTEMATIC REVIEW OF CANCER AMONG PETROLEUM INDUSTRY WORKERS	Dr Felix Onyije (IARC-WHO, France)	
10:40 – 10:45	CANCER RISKS IN AGRICULTURAL WORKERS: FINDINGS FROM AN INTERNATIONAL CONSORTIUM OF AGRICULTURAL COHORT STUDIES (AGRICOH)	Dr Kayo Togawa (IARC-WHO, France)	
10:45 – 10:55	Qs for 10 minute presenters		
10:55 – 11:00	AT THE PERIPHERY OF GAPS: NEEDS ASSESSMENT IN DEFINING LAKE VICTORIA RESOURCE USE FOR MANAGEMENT IMPLICATIONS	Dr Chris Aura (Kenya)	
11:05 – 11:10	HEPATIC POLYCHLORINATED BIPHENYL CONGENERS CONTAMINATION OF SELECTED ITCHTHYOFAUNA (FISH) OF TANA RIVER, KENYA	Collins Ongore (Kenya)	
11:10 – 11:15	DIRECT DETERMINATION OF INORGANIC CARBON TO ACCELERATE, EASE AND SIMPLIFY THE ANALYSIS OF GRAPHITIC CARBON	Tacettin Ozturk (Turkey-Lita Analytical)	
11:15 – 11:20	MULTIELEMENTAL SURVEY AT LAKE VICTORIA BASIN HERALDS ENVIRONMENTAL MANAGEMENT-RELATED NUTRITIONAL DEFICIENCY CRISIS	Prof Odipo Osano (Kenya)	
11:20 – 11:30	Qs for 10 minute presenters		
Closing session			
11:30 – 11:40	Day 2 wrap up discussion and closing remarks	All delegates	Dr Olivier Humphrey
SEGH AGM			
11:40 – 12.30	To include: SEGH developments Meet the International Board Feedback from members ECR-led discussions	All delegates	

Day 1: Monday 29th June

1.

OPEN WEB MAPPING APPLICATIONS TO VISUALISE AND INTERROGATE ENVIRONMENTAL DATA IN WESTERN KENYA: BGS EXAMPLES AND RESOURCES

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Data visualisation and discoverability is key to communicate science to policymakers and the public. Spatial information is getting more and more easy to gather and interpret but has to be visible to enable a better public understanding of the diversity, sensitivity, vulnerability and value of our environment.

The British Geological Survey (BGS) has a wide range of spatial datasets and is known for publishing as many as possible under open access solutions like map viewers and mobile apps (e.g. GeoIndex, UKSO, iGeology or mySoil). UKSO (UK Soil Observatory, www.ukso.org) is an online portal of UK soils data gathered from nine research bodies, including BGS. It provides easy access to fully described datasets allowing everyone to work with the latest UK soil research outputs. By making soils information widely accessible, UKSO aims to advance scientific understanding and inform business for a sustainable and environmentally friendly future.

With the same objectives in mind, BGS is developing a web mapping application for data collected across counties in Western Kenya. The aim is to disseminate environmental information and predictions (e.g. soil chemistry, pH), based on samples collected during fieldwork campaigns as part of an Official Development Assistance (ODA) Programme in collaboration with Kenyan partners and stakeholders. The web-based application is intended as an easy to use tool to inform local authorities, policymakers (e.g. extension services for public health, agriculture) and farmers about soils to improve human welfare and future economic development. Here we present the initial concept and working web-based model for testing with stakeholders.

2.

OPTIMIZING SOIL FERTILITY MANAGEMENT DECISION IN MALY BY REMOTE SENSING AND GIS

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One of the major constraints of agriculture in Mali is the low soil fertility and its decline from year to year. Understanding soil variability is significant for agriculture soil planning and management. Soil test is also a widely accepted methodology in nutrient management. However, its applicability is curtailed in Mali due to the high cost of implementation. Thus, soil fertility maps could be used as a soil fertility management decision support tool. In the current study, Remote Sensing, Geographic Information System and laboratory analysis were used to identify soil fertility status. Stratified randomized sampling was performed using landsat images and visual interpretation. 52 points were sampled on 1,157ha, at a depth of 0 to 20 cm and analysed to determine the clay, sand and silt content of the soil as well as the soil pH, C, N, P and K. The combined use of visual interpretation, kriging and thematic analysis function of ArcGIS allowed determining clay, sand and silt spatial distribution. Soil texture triangle was used to identify the textural classes. Ordinary Kriging method was used to analyse the spatial variability of soil pH, C, N, P and K. Soil clay content was low (1.22 - 12%), soil sandy was high (47-85%), soil pH was from extremely to moderate acidic (4.7- 6.1). Carbon, Nitrogen, Phosphorus and Potassium were below the critical levels, ranging from negligible to 0.4%; negligible to 0.03%; 2.22 to 5.5 mg/kg and from 0.01 to 0.07 cmol/kg respectively. The overall current soil status was poor.

3.

PHYSICOCHEMICAL CHARACTERISATION OF ABANDONED GOLD MINE TAILINGS, LEACHATES AND POTENTIAL OF SELECTED INDIGENOUS PLANTS FOR PHYTOEXTRACTION

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Abandoned gold mine tailings often generate acidic leachates which contain high concentration of inorganic contaminants that have the potential to contaminate surface and groundwater. This study evaluates physicochemical properties of the mine tailings and leachates flowing from the abandoned gold mine tailings in Johannesburg, South Africa, as well as the potential of indigenous plant species to bioaccumulate inorganic contaminants. The pH, salinity, electrical conductivity, total dissolved solids and redox potential of the leachates were found to be ranging between 3.31-5.21, 2.1-3.023 psu, 174-5 517 mS/cm, 1,903-2,175 ppt, and 3.86-220.3 mV respectively, which is the nature of mine water. The concentration of dominant inorganic species such as Fe, Al and Mn were found to be ranging from 149.9-333.7, 8.7-37.5 and 9.38-24.03 mg/L, respectively. The mine tailings were mainly composed of SiO₂ (47.32-75.59 mg/L), MgO (0.55-15.10 mg/L), Al₂O₃ (3.93-9.63 mg/L) and Fe₂O₃ (2.07-5.95 mg/L). The concentration of Al, Mn, Zn, Cu and As in *Cortaderia selloana* plants were ranging from 28.58-727.80 mg/L, 14.90-196.96 mg/L, 18.97-144.85 mg/L, 4.67-19.89 mg/L, 0.33-2.91 mg/L respectively, indicating that it is a hyperaccumulator of inorganic contaminants and it has the potential for use in phytoextraction of inorganic species from mine water and mine tailings.

4.

ECOLOGICAL AND HEALTH RISKS ASSOCIATED WITH EMISSION OF LEAD IN SOILS, SEDIMENTS, MINE TAILINGS AND PLANTS IN AN ARTISANAL MINING ENVIRONMENT, NORTHEAST, NIGERIA

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Artisanal mining has become a major challenge in the environment due to emission of toxic metals that persists in the atmosphere causing severe diseases and eventual death. The study assessed ecological and health risk associated to lead emission from gold mining in Arufu, northeast, Nigeria. Fifty-sixty (56) samples (30 soils, 10 stream sediments, 6 rocks, 5 mine tailings and 5 plants) were collected in areas close to mining excavation. All samples were air-dried and pulverized while rock samples was crushed and pulverized. Samples were analysed using High Performance Liquid Chromatography-Inductively Coupled Plasma-Mass Spectrometry (HPLC-ICP-MS). The mean concentration of Pb in soils, sediments, tailings, rocks and plants are: 1,100 mg/kg, 15,800 mg/kg, 110 mg/kg, 12,756 mg/kg, 7,105 mg/kg and 50 mg/kg respectively. Minerals present in the soils are quartz, muscovite, microcline, and anatase while in stream sediments minerals present are quartz, rutile, maagnesite, calcite, anatase, and microcline and those in tailings are quartz, cerrusite, fluorite, muscovite and kaolinite. Intense-extreme weathering with intermediate to extreme mineralogical transformation was observed. Bioaccumulation factor showed metal mobility from soil to plant. Ecological risk assessment revealed that Pb poses threat to environment. Pollution load index (PLI) revealed all samples to be highly polluted with Pb due to mining. Mining and geogenic activities contribute significantly to the contamination of media in the area. Lead in the samples poses both carcinogenic and non-carcinogenic health diseases. It is recommended from this study that artisanal mining in the area should be regularly monitored to forestall future epidemic.

Keywords: Ecological, Health Risk, Lead, Geogenic

5.

DETERMINATION OF LOW CONCENTRATION REEs IN RIVER WATER USING ICP-QQQ in MS/MS MASS-SHIFT MODE

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Rare earth elements (REEs) also known as lanthanides are widely used in high-technology products. However, there are environmental and health concerns associated with the mining, processing, use, and disposal of REEs. Quick, reliable, and sensitive methods are needed to measure these emerging pollutants. With its high sensitivity and advanced interference removal capability, ICP-MS/MS is suitable for the direct analysis of REEs at ultra-trace level in environmental water.

6.

ENSURING POPULATION SCREENING AFTER EXPOSURE TO ENVIRONMENTAL TOXINS WORTHWHILE

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Following exposure to environmental toxins, the idea of screening the population for disease or disease markers may be considered. Such population screening differs from environmental screening and an epidemiological survey. It is a cross-sectional review of a defined community to find latent cases or biomarkers of disease that indicate the possibility of disease development.

Over the past 50+ years, criteria for population screening programs have been developed for many conditions, including infections, neonatal disorders, pregnancy issues and cancers. Screening after environmental exposures has received remarkably little attention from the public health community.

We reviewed the classical public health criteria for the development of a screening programme. We then applied them to three situations where requests for screening might be made: an arsenic contaminated golf course, radiation exposure and lead exposure.

There is often little to be gained from instigating a population screening program after environmental contamination. Too little is known about the progression of resulting disease, the necessary tests, the design and implementation of a relevant programme, or the treatment possibilities, to run a productive and helpful population screening programme following most environmental exposures. The exception appears to be reassurance monitoring after a radiation release, where policy, reassurance and decontamination may be more important than case finding.

Integrating high-quality environmental and public health approaches in a combined environmental-public health risk assessment is a more appropriate means of responding to the realities and anxieties of pollution exposure.

7.

GEOPHOBIAS: LINKING GEOLGICAL EVENTS TO ILLOGICAL FEARS

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As phobia is an unreasonable sort of fear that can cause avoidance and panic, we can create a new terminology in terms of psychogeology, which is Geophobias.

Geophobias can be defined as the phobias related to earth materials and geologic events including fear of dirt, dust, water, coins, jewelry, earthquakes, volcanoes, waves, heights and fear of being in small caves, so all of these phobias can be classified under the category of phobias related to geology.

In this Presentation, we will present how geology could play a role in the treatment of these phobias and how we can use amazing geosites to show the other attractive side of the geology.

We suggest a new approach for phobias treatment – the geopsychological approach – by setting a treatment program to form a new response to the fear object or event and replace feelings of fear with feelings of astonishment and amazement.

Key words: Psycho-geology, Claustrophobia, Seismophobia, Geo-phobias.

8.

LANDSCAPE CONTROLS ON NUTRIENT STOICHIOMETRY AND LIGHT AVAILABILITY REGULATE LAKE PRIMARY PRODUCTION AT THE MARGIN OF THE GREENLAND ICE SHEET.

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Global change is rapidly altering the physical environment and geochemical processes in paraglacial areas near the Greenland ice sheet. These complex physiochemical changes combine to structure biological communities and govern ecological dynamics in this region, which can feed back to affect the global climate by altering nutrient cycling and storage in biogeochemical processing hotspots such as lakes. To gain a better understanding of how these ecosystems will respond in the future, this study examined recent (<10 yr) and long-term (1000 yr) shifts in autotrophic production across environmental gradients in SW Greenland.

Temperature and light availability increased with distance from the ice sheet along with dissolved organic carbon (DOC) concentrations and total nitrogen:total phosphorus (TN:TP) ratios in contemporary lake waters. These changes were correlated with diatom production shifts measured as biogenic silica accumulation rates (BSiAR), total primary production ($\delta^{13}\text{C}$) and diatom abundance in algal communities (BSi:C ratios), indicating that regional autotrophic production is controlled by microbial competition and competitive displacement of algal groups across physiochemical gradients. Production was uniformly low across lakes prior to the 1750's but has increased exponentially 1.5-3x since this period. Unlike contemporary patterns however, historical production changes were more strongly related to alleviation of macronutrient limitation from localized and long-range atmospheric N and P deposition.

Overall, these results suggest that biological responses to regional climate and biogeochemical forcing could serve as negative-feedbacks to global change dynamics, but predicting these responses requires detailed spatially and temporally resolved consideration of mechanisms responsible for local-scale changes in autotrophic communities.

9.

ANTIMONY AND OTHER TRACE ELEMENTS IN BLOOD FROM CHILDREN EXPOSED IN AN ABANDONED METALLURGICAL AREA IN MEXICO

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Several metallurgical facilities were established in Cedral (Mexico), in order to process silver ores.

This study aimed to assess the exposure of children to antimony and other metals present in the residues of the metallurgical activities in order to identify possible sources and exposure routes.

A sampling campaign was conducted, focused in the main media to that the children can be exposed: dust, particulate matter (PM_{<2.5}µm) and mineral residues. For human metal exposure, 51 blood samples were obtained from children in ages between 3 and 12 years old.

Results show high concentrations in tailing samples of Fe, Mn, Sb and Cu and less concentrated but still significative amounts of As and Cd.

Comparing metal concentrations in dust samples with data for dust samples collected in other urban areas, it highlights a significant enrichment of As, Cd and Sb.

The assess of metal concentration in PM_{2.5} allows to recognize the high enrichment of Mn, Sb, Cd and Cu. Metal concentration in PM_{2.5} were compared with minimal risk levels values (MRL) of the ATSDR, showing that the metal fraction proportion corresponding to PM_{2.5} of Sb, Cd and Mn exceeds the limits recommended for chronic exposure to the atmospheric environment.

Blood metal content was compared with cutoff values used by Cusick et al. (2018), as pediatric reference values, and found that Cd, Sb, Cr and As surpass this values 11.3, 10.9, 3.5 and 1.8 times respectively.

10.

EXPOSURE TO HEAVY METALS FROM GOLD MINE TAILINGS IN SOUTH AFRICA: HEALTH RISKS AND RESEARCH CHALLENGES

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Impact of gold mining activities on human health and environment has been a serious concern in South Africa for many years. Mining operations resulted in significant pollution of residential environments with the risk of people's exposure to toxic and carcinogenic metals, including uranium, lead, mercury, cadmium and arsenic. Substantial quantities of mine tailings were deposited in densely populated urban areas posing a potential health hazard to the millions of residents of nearby communities. Main population exposure pathways include inhalation of tailing dust, ingestion of mining wastes through hand-to-mouth activity of children and geophagia. To date, few epidemiological studies have been conducted in South Africa on association between environmental exposure to heavy metals from mining wastes and health effects, including cancer, in residents near the tailings.

Section of Environment and Radiation, International Agency for Research on Cancer (IARC/WHO) collaborates with South African scientists to set up a long-term multidisciplinary cancer research of protracted exposure to heavy metals and uranium in this under-studied population. High residential and workplace mobility of the population and potential disease under-registration are among the main study challenges. In a pilot study, uranium concentrations were determined in a total of 70 composite hair samples collected from barber shops from originally 1332 individuals. Concentrations ranged from

31 µg/kg to 2524 µg/kg, with a mean of 192 µg/kg, suggesting elevated exposures in international comparisons.

Study findings would strengthen our knowledge on health effects after prolonged exposure to heavy metals, and could guide public health policies in the contaminated areas.

11.

RISKY BUSINESS: BIOACCESSIBILITY RISK ASSESSMENTS USING THE CONTINUOUS ON-LINE LEACHING METHOD

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When soil is contaminated, the risk to those that may be exposed to the soil must be assessed. In human health risk assessments an important tool is the investigation into the bioaccessibility of a contaminant. Bioaccessibility studies look at the amount of a contaminant that is made available for absorption into the bloodstream and can be performed using artificial matrices in vitro. Bioaccessibility studies are faster and cheaper than other methods and do not require animal subjects [1]. Drawing from the techniques of flow injection and chromatographic separation, the Continuous On-line Leaching Method (COLM) provides an alternative to conventional batch bioaccessibility methods. Each artificial gastrointestinal matrix is sequentially pumped through a mini-column containing the sample and sent directly to the detector. Leaching time is significantly less than in batch methods, as results for three gastrointestinal matrices (saliva, gastric, and intestinal) are obtained in only 25 minutes (instead of over 5 hours with some batch methods). The COLM has been used in bioaccessibility studies on rice, corn bran, bread, and wheat [2-5]. However, it has not been directly standardized or validated against an accredited method. This work presents a comparison of the COLM with the Unified BARGE Method (UBM) [6]. Comparison of the two methods shows good agreement especially in the gastric and stomach phases, where the majority of elements are leached out. Overall, percent bioaccessible fractions (%BAFs) are low, but within agreement of each other. Future work will refine the COLM and compare it to other bioaccessibility methods for more streamlined bioaccessibility analysis in future risk assessments.

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12.

ARE WE IN THE TWILIGHT OF COAL USE AND, IF SO, HOW WILL IT IMPACT HUMAN HEALTH?

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The answer to this question is: it depends. If you live in North America and Western Europe then the answer is: yes and the health impacts should be significant. If you live in China, India, or Russia, the answer is: not yet and the health impacts should be significant. The significance in these two regions is diametrically opposite each other. In the United States, coal consumption in the last 12 years has declined from 1,045,140 million short tons in 2007 to 539,420 million short tons in 2019, a decrease of almost 50%. During that period the number of electric power coal generators has declined from 1,470 to 738 accounting for 21% of capacity. An even more dramatic decrease in coal use has occurred in Western Europe. This significant reduction in coal use and the concomitant closure of coal mines and coal-burning power plants will result in substantially cleaner air, reductions in respiratory problems such as asthma, less heart disease and hospitalizations, etc. as well as a reduction in occupational health problems such as silicosis and Coal Workers Pneumoconiosis (Black Lung Disease). However, in China, India, and Russia and in several other Asian countries some projections indicate an increase in coal production and use. In some situations the coal is burned in old, polluting power plants. In addition, millions of people in these regions still burn coal in their homes resulting in maximal exposure to the pollutants such as arsenic, selenium, fluorine, and mercury released from coal combustion. In these regions the health impacts of coal use could worsen.

13.

FRESHWATER FISH PRODUCTIVITY: DRIVERS, CORRELATES, AND MICROPLASTICS

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It is understood that fish production is one of the most effective metrics for assessing fish populations and aquatic ecosystem health. However, extensive effort and monetary expense required to calculate production has prevented the use of these estimates in fundamental energy-biomass flow studies and trophic ecology, and importantly has resulted in a lack of empirical knowledge of correlates and drivers of production. Using extensive long-term datasets (>60 years) from IISD-Experimental Lakes Area of disturbed and undisturbed freshwater fish populations and the environments that support them, spatiotemporal correlates and drivers of fish production are being evaluated to develop time- and cost-effective indicators, while answering questions around fundamental ecosystem functions. Further, fish production as an indicator of freshwater health is being evaluated through assessing the impact of emerging aquatic contaminants on the productivity potential of freshwater fish using microplastics as a model. Initial results indicate phosphorus is a driver of fish production with variable Lake Trout (*Salvelinus namaycush*) production over time that increased 3-fold during a whole-lake experiment (2003-2007) before rapidly returning to pre-manipulation levels upon cessation of nutrient inputs. This work will provide a valuable starting point for improving our understanding of freshwater fish productivity and the ecosystems that support them, while providing useful tools to inform industry, management, and conservation practices.

14.

NUTRITIONAL CONTENT OF BOTH COMMERCIAL FEEDS AND NON-COMMERCIAL FEEDS ON AQUACULTURE FISH IN WINAM GULF, LAKE VICTORIA.

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Feeds are critical to success of aquaculture on Lake Victoria. Feeds could be derived in situ from plants and animals within the ecosystem of Lake Victoria or externally such as commercial feeds. The net effect of input from outside could increase eutrophication in the lake while feeds derived from fauna and flora from the lake may not impact negatively. The nutritional values of feeds and the potentials of feeds derived from outside and from flora and fauna within the ecosystem of the lake is compared. The consequence of nutritional level from the different sources on the quality of fish product is estimated. The commercial and non-commercial feeds samples are digested using acid digest process. The trace elements; selenium, zinc, cobalt, iron (essential elements) and lead, mercury, cadmium (toxic elements) are analyzed through inductively-coupled plasma mass spectrometer (ICP-MS; Agilent 7500cx). The potentials of sustainable production of aquaculture especially caged culture from Lake Victoria is presented taking into account the optimal ratios of use of both commercial feeds and feed derived from natural or in situ that could be sustainable, economically and environmentally. Our study presents an environmentally sustainable means of solving food insecurity among the rapidly growing human population that suffers malnutrition, hunger, joblessness and diseases.

Day 2. Tuesday 30th June

15.

BIOGEOCHEMICAL RELEASE OF ARSENIC FROM LAKEBED SEDIMENTS RECEIVING AN ACID MINE DRAINAGE, KUSATSU HOT SPRING, JAPAN: ROLES OF ORGANIC ACIDS AND BACTERIAL SULFATE REDUCTION

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Originating from the Kusatsu-Shirane volcanic district in the central Japan, the Yukawa River is acidic (pH = ~2) and rich in sulfate because of natural oxidation of sulfide in its source hot spring area. For nearly fifty years, the river water has been neutralized by adding pulverized CaCO₃ in suspension at its mid-downstream. The Shinaki Dam was constructed to precipitate and store the treated sediments for assurance of water quality. However, because the sediments have been filling the dam, they are dredged and transported to nearby mountains for dumping by local government. Those sediments are expected to contain significant amount of As, because of its high concentration in the river water (up to 10 mg/L) and co-precipitation with Fe(OH)₃ produced by increase in pH from ~2 to ~5 upon neutralization.

Because As would cause serious environmental and health problems, chemical stability of the As-rich dumped sediments needs to be guaranteed; however, environmental acids such as acid rain and organic acids and microbial processes such as bacterial sulfate reduction (BSR) in anaerobic environments would enhance dissolution of Fe(OH)₃ to release adsorbed As. It is therefore important to investigate the stability of the dumped sediments. We performed a series of laboratory experiments to quantitatively assess the extent of As release (1) by leaching the sediments with various reagent-grade organic acids (acetic, oxalic, formic, and citric acids) and natural organic acids and (2) upon bacterial sulfate reduction. We found that almost all As adsorbed onto the Fe(OH)₃ in the sediments was released by leaching within three days (formic and oxalic acids were the most effective media for As liberation), and that an appreciable amount of As was released upon BSR (through reductive dissolution of As-rich Fe(OH)₃). This study has important implications for storing As-contaminated sediments for water quality assurance.

16.

MANIPULATION OF SOIL FAUNA, TERMITES AND THEIR ALLIES (DECOMPOSITION AGENTS) FOR SUSTAINABLE FOOD PRODUCTION UNDER CLIMATE CHANGE

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The speed at which crop residues are degraded by termites and their allies at the Nampula agronomic post, city of Nampula, Mozambique is very high. Organic materials when thrown to the soil, including the cuttings that demarcate the test plots do not escape the aggressiveness of these insects. The review aims to provide an initial basis for the practical work that has been done, but it has never been concluded whether the clay mounds made by them has part of the carbon consumed immediately or perhaps the methods of carbon analysis do not evaluate fresh carbon. In short, the determination of the recent carbon incorporated by these insects is very important. This will enable the assessment of their contribution to carbon sequestration in real time. It is common for producers to use termite mounds for agricultural production, proving to be the most fertile place than the soils around them. Hence the importance of this study for our rural communities.

Keywords: termites; carbon, analysis

17.

ASSESSMENT OF HEAVY METALS AND NUTRIENTS STATUS AT RECLAIMED MINE SITE

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A research was conducted at the reclaimed mine site of Tarkwa Goldfields Limited, Ghana to assess the current heavy metal and nutrients status of the study area. A total of 50 soil samples were collected from the site and transported to the laboratory for analysis of Fe, Cu, Pb, Mn, Zn, Hg, Cd, As, Cr and pH, Organic matter, N, P and exchangeable bases (Ca, Mg, Na, K), using standard methods. The results showed that Soil fertility level of the study sites is low as indicated by the Effective Cation Exchange Capacity levels. The soils are also light textured. It is therefore recommended that for sustainable crop production soil management practices that promote accumulation of organic matter such as cover cropping, soil and water conservation, application of inorganic fertilizers and organic manure is followed. Levels of heavy metal contents in soil samples were generally below the maximum allowable limits. Sources of these pollutants could be identified and reduced to the barest levels which will not put the human health at risk.

18.

USE OF MULTISTAGE PHYTOREMEDIATION TECHNIQUE IN WASTEWATER TREATMENT

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Efficient treatment of wastewater before discharge into ecosystems is a requirement to safeguard public and environment health. Adoption of green technology in wastewater treatment is paramount. This study was carried out to investigate the efficiency of multistage technique in phytoremediation of wastewater. The experimental set up was a four-stage treatment system. It comprised of four columns with different arrangements of macrophytes which included *Ceratophyllum demersum*, *Typha latifolia*, *Nymphaea* Sp. and *Azolla pinnata*. Wastewater was sampled and put in four, twenty litres pre-sterilized plastic containers and allowed to flow to plastic troughs each containing the experimental plants from stage 1 to stage 4 with a retention time of 5 days. Water indicator parameters, nutrients and heavy metals in the wastewater were analysed at the beginning of the treatment process and from each trough in each column at the end of the retention time of 5 days for a period of 20 days to determine the changes in the levels of the parameters investigated. Means of mentioned parameters were calculated and analyzed using ANOVA and significant means separated using Tukey's test at 5% level. Removal efficiency of the investigated parameters was calculated and the range was as follows; TDS 79.13-82.27%, pH 14.12-16.67%, conductivity 66.92-71.48%, turbidity 67.97-80.54%, faecal coliforms 100%, faecal streptococcus 100%, phosphates 93.72-100%, nitrates 89.79-100% Cd 83.40-100%, Cu 83.39-88.60%, Ni 100%, Co 100%, Pb 100%, Mn 100%, Zn 100% and Fe 88.60-95.77%. Multistage technique was found to be efficient in wastewater treatment hence recommended for remediation of wastewater.

19.

ANALYSING TRACE ELEMENTS IN SEDIMENT USING ED-XRF.

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Multi-elemental analysis of sediment samples for bio-geochemistry applications represents a critical task for spectrometric instruments.

Users in science routinely use such spectrometric analysis on materials of widely varying composition. Energy-dispersive X-ray fluorescence (ED-XRF) instruments are often preferred for this work. ED-XRF methodology is an accepted technique for elemental analyses of sediment. So, these instruments' stability and ease of use let them excel at critical tasks from rapid screening analysis to precise elemental determination. They provide fast, precise, accurate, and economical solutions for analysis of major, minor, and trace elements in these and similar applications.

This presentation covers the use of one such instrument to analyse trace elements in samples of geological materials with focus on the analysis of sediment, prepared as pressed powder pellets. Using polarization, band-pass filter, and direct excitation technologies, it proved a powerful analytical tool to satisfy the needs of high precision and low detection limits.

Very high spectral resolution and exceptionally low limits of detection (LODs) were reported for most elements tested. Calibration based on well-characterized samples showed very good correlation for a wide range of elements

The SPECTRO XEPOS performed with high repeatability and excellent precision, so that sample preparation and statistical counting formed the major part of any errors produced. And depending on a given application's range of elements and the required precision of analytical results, the analyser's design allowed measurement time to be optimized.

20.

ESSENTIAL AND TOXIC ELEMENTS IN SOIL AND PLANT SAMPLES AND THEIR TRANSFER TO RICE GRAINS OF ITOKIN, SOUTHWESTERN NIGERIA

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There is limited information on the nutrition quality of rice consumed and farmed in Nigeria. This research work was undertaken to determine the levels of nine essential elements: Ca, P, Zn, Mn, Co, Mg, Fe, Mo and Cu, three toxic elements: As, Cd and Pb in rice cultivated in Itoikin, Southwest Nigeria.

Elemental composition of locally farmed rice grains, rice field soils and rice plant samples from selected rice fields in the study area were determined using Inductively Coupled Plasma Mass Spectrophotometry (ICP-MS). The pH of the soil samples was determined. The Estimated Daily Intake (EDI) of toxic and essential elements compared to Provisional Tolerable Daily Intake (PTDI) for toxic elements and the Dietary Reference Intakes (DRI) for essential elements were calculated to determine the nutritional value of rice grain.

The pH value ranged from 4.01-4.47 indicating the acidic nature of the soil. The concentration (mg/kg) of selected essential elements in the soil were Mg, 620-996; P, 268-449; S, 149-206; K, 6383-8015; Cu, 9.0-11.9; Zn, 29.4-43.30; Ca, 200-563; Fe, 14219-23871; Mn, 477-2130; while the PTEs were As, 0.5-1.2; Cd, Bdl.-0.1; Pb, 19.3-44.8 and Se, 0.31-0.63. The element concentration in the plant samples were Mg, 1117-273; P, 524-3427; K, 7073-29026; Ca, 1047-5412; Fe, 196-5741; Mn, 354-994; As, 0.01-0.8; Cd, 0.1-0.4; Pb, 1.6-6.1; Cu, 9.8-45.4; Zn, 43.46-144.4 and Se, 0.44-0.22. The soil quality compared very well with several agricultural soil quality except for As and Cr which were above the USEPA guidelines. Transfer factor was calculated to determine the uptake of elements by plants from the soil the transfer factor was in the order of Ca>S>P>Cd>Zn>K>Mg>Cu>Mn>As>Cr>Mo>Fe>Pb for the rice field. The study showed that the soils were not polluted comparing to the standard set by USA, UK, Canada, Tanzania, Australia, Germany and China except for Arsenic and Chromium using the USA standard and also heavy metals were likely to be taken up by plants due to the pH of the soil which ranged from acidic to slightly alkaline. Based on the nutritional assessment, this research also revealed that the Itoikin rice is rich in Molybdenum, Copper and Manganese but not particularly rich in Calcium, Phosphorus and Selenium.

21.

Impacts of 2, 4, 5 Trichlorophenoxy Acetic Acid on the Metamorphosis of *Xenopus laevis* and The Remedial Capacity of Ascorbic Acid

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Background Since the green revolution, the use of the herbicide has accelerated in controlling the weeds due to the less cost used and less labor. Though, the excess use of herbicides causes toxicity to floras and the residual effect led to environmental hazards by polluting soil, water, and air. Through the food chain, the hazard has progressed into animals hence health hazards. In the 1940s the synthetic auxin that is chlorophenoxy acetic acid herbicide was developed that was used to defoliate broad-leafed plants that is “2,4,5-trichlorophenoxy acetic acid”. Esters of ascorbic acid acts as antioxidants with some substrates by shielding double bonds and scavenging oxygen and also depresses the oxidation state of most of the metals.

Methods The impact of 2, 4, 5 T in animals (*Xenopus laevis*) was tested then reversed using the antioxidant ascorbic acid. Stage 51 of the tadpoles were exposed to LC50 concentration of 2, 4, 5,-T with different concentrations of ascorbic acid to quantify its capability for 21 days. The observational endpoints were hind limb length, snout to vent length (SVL), developmental stages, wet weight, teratogenicity and daily observations of mortality.

Results and Discussion High concentrations of ascorbic acid (40-80mg/l) reduced the mortality rate compared to low concentrations. Despite reducing mortality compared to the control of 2, 4, 5 T in high concentration it accelerates development in low concentration that is 20mg/l to 40mg/l with a significant value of 0.038. Weight of the tadpoles was higher (80mg/l) in the high concentration of ascorbic acid as compared to toxicant control. Few abnormalities were experienced which are wavy tail malformation- stunted tail with waves, severe abdominal edema and abnormal gut coiling.

Conclusion From the results there was a metamorphosis impact remedy by ascorbic acid.

22.

DETERMINATION OF METABOLIC BIOMARKERS OF OCCUPATIONAL EXPOSURE TO E-WASTE DISMANTLING POLLUTION

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As numerous studies reported, humans are exposed to various pollutants through respiration, diet, and dermal contact. Among these, phenolic compounds have drawn extensive attention due to their negative effects on human health. In our recent study, a method for simultaneous determination of multiple classes of phenolic compounds (including triclosan (TCS), tetrabromobisphenol A (TBBPA), 19 brominated phenols (BRPs), 5 hydroxyl polybrominated diphenyl ethers (OH-PBDEs), and 12 hydroxyl polycyclic aromatic hydrocarbons (OH-PAHs)) in human urine has been developed to fulfill the global analysis of urine samples from a population exposed to multi-pollutants, and to identify potential biomarkers for occupational exposure to extensive e-waste dismantling activities based on a case study. Finally, the method was successfully applied to screen the potential urinary biomarker for population exposure to multi-pollutants from e-waste recycling areas, where OH-PAHs and TCS were the ubiquitous compounds in human urine. While 3,4-diBRP, 2,4,5-triBRP, 2,3,4,6-tetraBRP and 2'-OH-BDE-28 were firstly tentatively detected in human urine from e-waste dismantling area. Especially, 3,4-diBRP, 2,3,4,6-tetraBRP and 2'-OH-BDE-28 were only detected in urine samples from e-waste dismantling workers, which should be considered as the urinary biomarker for occupational exposure. This developed method will support a more comprehensive health risk assessment for human exposure to multi-pollutants.

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23.

CONTAMINATION AND HEALTH RISK ASSESSMENT OF MERCURY FROM SOIL WITHIN ARTISANAL GOLD MINING AND PROCESSING SITES, NIGER, CENTRAL PART OF NIGERIA

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In this research, ore samples, agric soil and mine wastes were taken within artisanal gold mine and processing sites in Niger, central part of Nigeria to determine the level of Hg contamination in the environment and the health risk assessment. The ranges of mercury in mg/kg for ore, agric soil and mine wastes were 0.03-5.9, 0.002-5.57 and 0.19-20.99 with mean values which followed the order of mine wastes > agric soil > ore respectively. 100%, 90% and 62.5% of samples taken from mine wastes, agric soil and ore respectively were above crustal average values. The values of different contamination indices calculated showed different level of Hg contamination in the study area with mine wastes associated with high level of contamination. The results of non-carcinogenic health risk index (HI) of Hg calculated for children and adults in the study area were (7.42 and 4.45), (2.19 and 1.26) and (1.49 and 1.19) and followed the decreasing order of mine wastes > agric soil > ore respectively. All the values were higher than safe level (=1) and therefore showed that Hg posed serious non carcinogenic health risk index for both adults and children exposed to the soil in the study area. Concentration of bio-accessible Hg calculated in the stomach extract were higher than those in the stomach + intestine extract and ranges between 0.002 -0.502 and 0.006 -0.061 with mean values of 0.063 and 0.017 respectively. The bio-accessible fraction (BAF) for Hg varies between -5.54% to 13.3% with average of 3.71% thus, fall within low mobility.

24.

A SYSTEMATIC REVIEW OF CANCER AMONG PETROLEUM INDUSTRY WORKERS

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Petroleum extraction and refining are sources of potential exposure to carcinogens of workers and residents living close to those industries. This systematic review and meta-analysis is aimed at evaluating the cancer risk in workers employed in petroleum industries. Relevant studies were identified and retrieved through PubMed, Web of Science databases and lists of references. Extracted mortality and incidence studies and their respective 95% CIs were analysed using the metan command on log scale for random-effects meta-analysis. Out of 35 studies, 54% were conducted in North America, 26% from Europe. Asia, Australia and South America had 6%, 11% and 3% of the studies respectively, none from Africa. Five out of 25 reviewed cancers showed elevated effect sizes, i.e. mesothelioma mortality studies 2.02 (95% CI =1.62-2.53), multiple myeloma incidence studies 1.64 (95% CI 1.11-2.43), melanoma incidence studies of 1.34(95% CI= 1.06-1.70), prostate incidence studies 1.13 (95% CI 1.05-1.22) and urinary bladder incidence studies 1.25(95% CI= 1.09-1.43). Mesothelioma, multiple myeloma, melanoma and prostate cancer are similar to previous studies while cancer of the urinary bladder has not been reported in previous reviews. Improved exposure assessment in forthcoming studies is necessary to be able to rule out an increased risk of other cancers.

Keywords: Systematic Review; Meta-Analysis; Petroleum Industry; Occupational Exposure; Environmental Pollution; Neoplasms

25.

CANCER RISKS IN AGRICULTURAL WORKERS: FINDINGS FROM AN INTERNATIONAL CONSORTIUM OF AGRICULTURAL COHORT STUDIES (AGRICOH)

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AGRICOH is an international consortium which currently consists of 28 agricultural cohorts (<https://agricoh.iarc.fr/>). The consortium aims to facilitate collaboration and pooling of data across existing cohorts to examine agricultural exposures in relation to various health outcomes including cancer. Since its establishment in 2010, the AGRICOH Cancer Subgroup has studied cancer incidence in eight cohorts as well as animal farming and pesticides in relation to non-Hodgkin lymphoid malignancies (NHL) in three large prospective cohort studies. The study of associations between pesticides and NHL included a total of 2,430 cases, allowing for subtype-specific analyses of chronic lymphocytic leukaemia/small lymphocytic lymphoma (CLL/SLL), diffuse large B-cell lymphoma (DLBCL), multiple myeloma/plasma-cell leukaemia, and follicular lymphoma. The methods used to assess pesticide exposure varied across cohorts. One of the cohorts used self-reported ever application of specific active ingredients, and the other two cohorts used self-reported history of crops cultivated combined with country-specific crop-exposure-matrices (CEM). Among 33 active ingredients studied, the results showed a moderately elevated risk for ever use of organophosphate insecticide terbufos (NHL overall), pyrethroid insecticide deltamethrin (CLL/SLL) and organophosphorus herbicide glyphosate (DLBCL) compared to never use of those pesticides. This initial analysis of ever/never exposure had some limitations, such as high correlations resulting from the use of CEM. To improve the exposure assessment, use of additional parameters of exposure, including probability, frequency, intensity, and timing/duration is being considered and to be applied to future analyses of NHL and other cancers, e.g. prostate and breast, within AGRICOH.

26.

AT THE PERIPHERY OF GAPS: NEEDS ASSESSMENT IN DEFINING LAKE VICTORIA RESOURCE USE FOR MANAGEMENT IMPLICATIONS

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Needs assessment is a critical component to make informed policy, development, planning, and resource management decisions. However, strategic gaps in technical, capacity, and institutional frameworks inhibit the creation of consistent and relevant information and data for use in a given resource. This current paper highlights the Lake Victoria needs assessment in order to provide a means for stakeholders to categorize gaps and challenges identified, and facilitate the application of these findings by linking the gaps to balancing science and governance for the sustainable use of the existing resources. The needs assessment herein are characterized by the use of indigenous knowledge, existing data, literature and personal communication from Lake Victoria experts. The study notes the low quality or lack of information regarding the status and significance of lacustrine forces and mitigation measures of Lake Victoria resource use to understand the severity and magnitude expected. The process of collectively developing a consistent and flexible Regional Lake Victoria Monitoring System (RLVMS) will allow the creation of a unified pool of data that can be shared across agencies and countries. Such an RLVMS will also allow for consistent change analysis to be performed going into the future. The needs assessments highlighted herein recommends appropriate behavior change techniques for each underlying determinant, facilitated communication and understanding of the identified issues to a broader audience for sustainability of the lake ecosystem.

27.

HEPATIC POLYCHLORINATED BIPHENYL CONGENERS CONTAMINATION OF SELECTED ITCHTHYOFAUNA OF TANA RIVER, KENYA

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Tana River system is highly vulnerable to contamination, posed by its position and the extent of its drainage basin. This study assessed the Polychlorinated biphenyl (PCB) contamination of resident itchthyofauna and established the PCB congeners and their trends, indicating the river's environmental health. Thirty-four (34) liver specimen from *Oreochromis spilurus* and *Clarias gariepinus* were analyzed following standard methods of extraction and quantitation to obtain the concentrations on each specimen as congeners and total PCB using GC-MSD. The concentrations in fish showed declining trends downstream, with Masinga dam recording the highest mean (\pm SD) among *Clarias gariepinus* of Total PCBs = 674 ± 228 ng g⁻¹ and *Oreochromis spirulus spirulus* of Total PCBs = 392 ± 176 ng g⁻¹. Similar patterns exhibited in Kamburu dam, where Total PCBs for *Clarias gariepinus* were 252 ± 194 ng g⁻¹ and *Oreochromis spirulus spirulus* of 110 ± 88 ng g⁻¹, while at Kipini delta the mean Total PCB were 390 ± 157 ng g⁻¹ and 169 ± 71 ng g⁻¹ for *Clarias gariepinus* and *Oreochromis spirulus spirulus*, respectively. Hence, the accumulation potential of PCB residues in the fishes or their presence in different sites is not congener specific. The prominence of PCBs 28, 52 and 155 at all sites indicate either their high environmental presence or relative ease of accumulation and recalcitrance in fish tissues. Further studies on the environmental presence of the PCBs in other media and investigations on the current sources and pathways in the Tana and connected systems would aid in prevention of leakage into receiving environments.

28.

DIRECT DETERMINATION OF INORGANIC CARBON TO ACCELERATE, EASE AND SIMPLIFY THE ANALYSIS OF GRAPHITIC CARBON

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Graphite and diamond are the allotropes of carbon that occurs naturally. Graphite has become an indispensable industrial raw material of today's technology with the development of technology in the world. There are 3 main types of carbon fraction in graphite; organic carbon (OC), inorganic/ carbonate carbon (IC) and graphitic/elemental carbon (Gg or EC). Determination of graphitic carbon (Cg) is essential for the evaluation of graphite deposit. Graphitic carbon determination includes time-consuming, labour intensive and cumbersome experimental steps such as acid leaching, organic carbon removal (calcination), analysis residual carbon by combustion. The complete workflow takes approximately 8 hours in a laboratory. The rate determining (slowest) step for the determination of graphitic carbon is acid leaching.

In this work, a faster and automated alternative method is proposed as replacement of acid leaching step to decrease overall time required for the determination of graphitic carbon. In proposed method inorganic carbon in graphite is determined by NDIR detector after mixing of acid and sample. The proposed method yields consistent results when compared to classical method.

29.

MULTI ELEMENTAL SURVEY AT LAKE VICTORIA BASIN HERALDS ENVIRONMENTAL MANAGEMENT-RELATED NUTRITIONAL DEFICIENCY CRISIS

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Background: The intractable nutritional insufficiency in the developing nations is exacerbated by emerging anthropogenic activities on the landscapes and poor land management that leads to soil erosion, acidification, nutrient leaching and loss of organic matter. Recent rapid ecological changes in lake Victoria to a highly eutrophic water body provide evidence of the drastic changes in the catchment. Physical and chemical conditions (eg pH and organic matter content) influence the dynamics of soil – plant transfer of nutritional elements or mobilization of Potentially Toxic Elements (PTE).

Methods: A multi-elemental baseline survey on key foodstuff was carried out on the basin of Winam Gulf of lake Victoria. Open source Maps.Me® software for mobile telephones was leveraged to ensure even spatial spread of 380 sampling stations across the basin. Samples of soil, water, and food crops were analyzed by ICP-MS for 58 elements, including the essential minerals calcium(Ca), copper (Cu), iron (Fe), magnesium(Mg), selenium (Se) and zinc (Zn). The physicochemical (pH, conductivity, acidity) parameters of soil and/or water was conducted in situ. The calcareous status and total carbon was determined and related to the concentrations of the elements in the different food plants. Based on integrated Food Balance Sheet from the East African region per capita daily intake of the microelements and exposure to PTE were estimated.

Findings: This study revealed significant risk of deficiency for Se, Zn, Ca, I, of up to 100% and PTE concentrations exceeded European guideline values (e.g. Cr >100mg/kg in 23% of soils) for many elements. Increased acidity and non-calcareous status impacted negatively on the levels of essential elements (eg Selenium).

Interpretations: The hitherto unknown hidden hunger arising from low supply of dietary micronutrients may already be impacting negatively on health among the study population and an understanding of associated anthropogenic factors would assist in designing appropriate interventions for this crisis.



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