SEGH Society for Environmental Geochemistry and Health Live

2nd SEGH Live online event

Society for Environmental Geochemistry and Health



SEGH Live event schedule & abstracts

Hosted by the British Geological Survey via Zoom webinar

Tuesday 9th February 2021

www.segh.net

Contents

Scientific and Organising Committee

Organising committee

Dr Michael Watts, British Geological Survey

Dr Olivier Humphrey, British Geological Survey

SEGH Organisational Profile

President: Dr Michael Watts, British Geological Survey

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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)

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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.

Where: Zoom webinar, hosted by the British Geological Survey

When: Tuesday the 9th of February, 8:30 – 12:30 (BST)

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 in June 2020 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 was a very interesting meeting with ~40 presentations, 100+ registrants from 35 countries. With the positive feedback from participants we looked forward to a second SEGH Live event on the 9th February 2021 on a smaller scale to cover European/African and Asian time zones, with a separate Americas timezone event planned for later in 2021.

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 inter-disciplinary 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.

We are now in the 50th anniversary year of SEGH in 2021 still facing uncertainty regarding the resumption of physical conferences, but with hope for a return to the postponed conferences in 2021 for Kenya and China late in 2021, albeit in a new format with web streaming to reduce international travel and possibly within border travel for physical participants. In the meantime, the delivery of an online event and ECR training/networking via Zoom has worked well and connected people who would be restricted by resources or time in attending long distance meetings. Bearing in mind growing climate awareness around our daily activities, it is likely that the webinar format of shorter and more regular regional meetings has a role to play in regular communications and perhaps hybrid web/physical meetings via live streaming and interaction. The international conferences have been 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 which must remain at the center of SEGH our future aspirations.

Many thanks to the people that have helped put together the SEGH Live2 programme and offered help in the smooth running of activities.

SEGH Society for Environmental Geochemistry and Health Live

The 2nd online-hosted meeting of the Society for Environmental Geochemistry and Health

Programme

Tuesday the 9th of February 2021, 8:30 – 12:45 (GMT)

Time	Event	Speaker(s)	Chair
Opening session			
08:25 (UK time)	Sign in open		
08:30 – 08:40	Opening remarks and welcome to delegates	**Michael Watts**, SEGH President, Centre for Environmental Geochemistry, British Geological Survey	**British Geological Survey**
Scientific session 1			
08:40 – 08:55 (includes 3 mins question time)	**KEYNOTE:** IMPACT PROCESS OF THE SHALLOW AQUIFER TO REGIONAL ARSENIC ACCUMULATION OF THE UNDERLYING AQUIFER IN A COASTAL AQUIFER	**Maurizio Barbieri** (University of Rome, Italy)	**Michael Watts** (BGS), **Maureene Ondayo** (University of Eldoret), **Olivier Humphrey** (BGS)
08:55 – 09:00	1. FLUORIDE ENRICHMENT IN GROUNDWATER IN THE CENTRAL KENYA RIFT	**Lydia Olaka** (University of Nairobi, Kenya)	
09:00 – 09:05	2. HUMAN HEALTH RISK ASSESSMENT OF CHROMIUM IN DRINKING WATER: A CASE STUDY OF LOUTRAKI BASIN, NORTH EAST PELOPONNESE, GREECE	**Konstantina Pyrgaki** (National and Kapodistrian University of Athens, Greece)	
09:05 – 09:13	3. APPLICATIONS OF CHROMIUM SPECIATION ANALYSIS: CURRENT TRENDS AND FUTURE PERSPECTIVES	**Elliott Hamilton** (British Geological Survey) 8 min ECR Keynote	
09:13 – 09:18	4. ENVIRONMENTAL PESTICIDE AND ITS TOXICITY: A GLOBAL ANXIETY	**Suleiman Usman** (Federal University Dutse, Nigeria)	
09:18 – 09:25	Qs for presenters		
09:25 – 09:30	5. FALLOUT RADIONUCLIDES AS SOIL EROSION TRACERS IN EAST AFRICA	**Sophia Dowell**	

		(British Geological Survey)	
09:30 – 09:38	6. PHYSICAL AND ANTHROPOGENIC FACTORS OF SOIL EROSION, NUTRIENT LEACHING, AND DEPLETION IN EAST WINAM GULF CATCHMENT AND THEIR POTENTIAL HEALTH IMPACTS	**Job Isaboke / Melvine Otieno** (University of Eldoret, Kenya)	
09:38 – 09:43	7. PROFILING CONTAMINATION OF WETLAND SEDIMENTS IN PARTS OF LAGOS, SOUTHWESTERN NIGERIA	**Chukwudi Nwoko** (University of Ibadan, Nigeria)	
09:43 – 09:48	8. OCCURRENCE AND QUANTIFICATION OF AFLATOXIN B1 IN FISH FEEDS IN KISUMU AND UASIN GISHU COUNTY	**Salome Chelimo** (Department of Health Services, Baringo County, Kenya)	
09:48 – 09:55	Qs for presenters		
15 minute (make yourself a) coffee break			
Scientific session 2			
10:10 – 10:25 (includes 3 mins question time)	**KEYNOTE:** SPECIATION OF SPIKED IODINE IN SOLID AND LIQUID PHASE OF FOREST SOIL	**Akira Takeda** (Institute for Environmental Sciences, Japan)	**Michael Watts** (BGS), **Melvine Otieno** (University of Eldoret), **Olivier Humphrey** (BGS)
10:25 – 10:30	9. ANALYSIS OF SPATIAL DISTRIBUTION OF THYROID CANCER AND ITS DYNAMICS AMONG URBAN AND RURAL POPULATION OF THE BRYANSK REGION (RUSSIAN FEDERATION) AFTER THE CHERNOBYL NUCLEAR ACCIDENT	**Elena Korobova** (Russian Academy of Sciences, Russia)	
10:30 – 10:35	10. MINERALOGY, GEOCHEMISTRY, 13C and 16O ISOTOPIC CHARACTERISTICS OF URINARY STONES IN IRAN, A CASE STUDY OF LORESTAN PROVINCE	**Ahad Nazarpour** (Islamic Azad University, Iran)	
10:35– 10:40	11. DENTAL FLUOROSIS AND ORAL HEALTH RISK FACTORS IN THE AFRICAN ESOPHAGEAL CANCER CORRIDOR	**Diana Menya** (Moi University, Kenya)	
10:40– 10:48	12. AN OVERVIEW OF EXPOSURE ASSESSMENT IN THE IARC MONOGRAPHS ON THE IDENTIFICATION OF CARCINOGENIC HAZARDS TO HUMANS	**Daniel Middleton** (IARC-WHO, France) 8 min ECR Keynote	
10:48 – 10:55	Qs for presenters		

11:00 – 11:05	13. CHEMICAL AND MORPHOLOGICAL CHARACTERISTICS OF HOUSEHOLD DUST	**Martin Gaberšek** (Geological Survey of Slovenia)	
11:05 – 11:10	14. TACKLING AMR ACROSS INDIA	**Kiri Rodgers** (University of the West of Scotland, Scotland)	
11:10 – 11:15	15. HEALTH RISK ASSESSMENT OF LEAD, COPPER AND ZINC IN ROAD DUSTS FROM SHAGAMU, SOUTHWEST NIGERIA	**Nana Benedict Eferhurhobo** (University of Ibadan, Nigeria)	
11:15 – 11:20	16. SPATIOTEMPORAL VARIABILITY OF NITROGEN DIOXIDE (NO_2) POLLUTION IN MANCHESTER (UK) CITY CENTRE (2017-2018)	**Daniel Niepsch** (British Geological Survey)	
11:20 – 11:30	Qs for presenters		
11:30 – 11:35	17. IMMOBILISATION TOXIC OF METALS IN MINING SOIL USING NATURAL CLAY MINERALS: A BATCH STUDY	**Zacharenia Kypritidou** (University of Athens, Greece)	
11:35 – 11:40	18. HUMAN HEALTH RISKS TO METAL EXPOSURE IN ARTISANAL SMALL-SCALE GOLD MINING IN KENYA	**Maureene Ondayo** (University of Eldoret, Kenya)	
11:40 – 11:45	19. HEALTH RISK ASSESSMENT OF HEAVY METALS IN CHILDREN LIVING IN AN ARTISANAL MINING ENVIRONMENT, NORTH EAST, NIGERIA	**Temitope Laniyan** (University of Ibadan, Nigeria)	
11:45 – 11:50	20. SLAG DUSTS FROM KABWE (ZAMBIA): CONTAMINANT MINERALOGY AND ORAL BIOACCESSIBILITY	**Vojtech Ettler** (Charles University, Czech Republic)	
11:50 – 12:00	Qs for presenters		
Closing session			
12:05- 12:15	Wrap up discussion and closing remarks	**Keith Torrance** (University of Strathclyde)	
SEGH Discussion			
	Activities for 50th anniversary	**Michael Watts** (British Geological Survey & SEGH President)	
	ECR network activities	**Ariadne Argyraki** (University of Athens, Greece)	
	Meet the board members and group photo		

KEYNOTE

IMPACT PROCESS OF THE SHALLOW AQUIFER TO REGIONAL ARSENIC ACCUMULATION OF THE UNDERLYING AQUIFER IN A COASTAL AQUIFER

Chiara Sbarbati [1], Maurizio Barbieri [1,*], Alyssa Barron [2], Benjamin Bostick [3], Nicolò Colombani [4], Micòl Mastrocicco [5], Henning Prommer [2,6], Stefania Passaretti [1] Yan Zheng [7] and Marco Petitta [1]

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Abstract: Superlative levels of arsenic (As) in groundwater and sediment often result from industrial pollution, as is the case for a coastal aquifer in Southern Italy, with a fertilizer plant atop. Understanding conditions under which As is mobilized from the sediments, the source of that As, is necessary for developing effective remediation plans. Here, we examine hydrogeological and geochemical factors that affect groundwater As concentrations in a contaminated coastal aquifer. Groundwater has been subject to pump-and-treat at a massive scale for more than 15 years and is still ongoing. Nevertheless, As concentrations (0.01 to 100 mg/L) that are four orders of magnitude more than Italian drinking water standard of 10 µg/L are still present in groundwater collected from about 50 monitoring wells over three years (2011, 2016, and 2018). As geochemical extraction highlighted an elevated presence of As amorphous metal oxides in the sub-oxic contaminated zone. In contrast, in the deeper aquifer zone, iron reduction caused the dissolution of As-bearing phases, acting as secondary sources that continuously release As. The next study's major purpose is to reveal the aquitard's impact process to the regional arsenic accumulation of the underlying aquifer in aquitard– aquifer system from the coastal aquifer, using piezometer water chemistry, sediment chemistry and reactive-transport model. This study's knowledge will offer new insight into groundwater sources and improve local management and protection of groundwater resources.

1.
FLUORIDE ENRICHMENT IN GROUNDWATER IN THE CENTRAL KENYA RIFT

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Groundwater in volcanic areas can exhibit high fluoride levels becoming a major public health concern. In order to meet the UN SDG goal 6 on water security, knowledge of the sources and processes of fluoride enrichment are required to help mapping hotspots and develop interventions. The study was carried out within the Naivasha catchment (Kenya) to understand the genesis, enrichment and seasonal variations of fluoride in the groundwater. Rocks, rain, surface and groundwater sources were sampled for hydrogeochemical and isotopic investigations, the data was statistically and geospatially analyzed. Results show that water sources have a large range fluoride concentrations between 0.02–75 mg/L. With 73% exceeding the WHO limit (1.5 mg/L) in both dry and wet seasons. The F^- concentrations in rivers are lower (0.2–9.2 mg/L) than in groundwater (0.09 to 43.6 mg/L). The higher concentrations are found in the rift floor. Fluoride base levels in the volcanic rocks are very high (3750 and 6000 ppm) in minerals such as cordierite and muscovite while secondary minerals like illite and kaolinite have lower remnant fluoride (1000 ppm). Thus, F^- enrichment in regional groundwater is mainly due to a) rock alteration, through long residence times and natural discharge and/or enhanced leakages of deep seated geothermal water reservoirs, b) secondary concentration fortification of natural reservoirs through evaporation, through reduced recharge and/or enhanced abstraction and c) through additional enrichment of fluoride after volcanic emissions. The findings are useful to help improve water management in Naivasha as well as similar active rift setting environments.

2.

HUMAN HEALTH RISK ASSESSMENT OF CHROMIUM IN DRINKING WATER: A CASE STUDY OF LOUTRAKI BASIN, NORTH EAST PELOPONNESE, GREECE

K. Pyrgaki[1]*, A. Argyraki[1], E. Kelepertzis[1], F. Botsou[2], E. Dassenakis[2] and D. Dermatas[3]

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The present study aims to evaluate the human health risk of Cr(VI) via oral exposure to contaminated drinking water. Groundwater samples from Loutraki basin in Northeast Peloponnese, Greece were studied. Non-carcinogenic and carcinogenic health risks were calculated for both adult and children groups. Within such a framework a total of 28 groundwater samples were collected during the wet and dry season of 2017 and 2018 from wells and boreholes distributed in the study area and analysed for alkalinity, Ca^{2+}, Mg^{2+}, Na^{2+}, K^{+}, dissolved organic carbon, Cl^{-}, NO_3^{-}, NO_2^{-}, NH_4^{+}, SO_4^{2-}, As, Cd, Cr, Cr(VI), Cu, Fe, B, Co, Al, Si, Mn, Ni, Pb and V. The assessment was based on a deterministic approach with respect to health risk formula proposed by the United States Environmental Protection Agency. Two major indices,i.e. chronic daily intake (CDI, mg/kg/day) and hazard quotient (HQ) were calculated while the cancer risk was calculated by multiplying the CDI with the corresponding cancer slope factor. In this method, a single value is assigned for each input parameter in the health risk equation and a single risk level is calculated for each sample, accordingly. Even though there is a high uncertainty associated with the assigned parameters, this approach is widely used at a screening-level to help establish the range of possible outcomes. The results show that there is a need to further examine the potential health risks by implementing more in-depth analysis through probabilistic risk assessment and epidemiological studies.

3.

APPLICATIONS OF CHROMIUM SPECIATION ANALYSIS: CURRENT TRENDS AND FUTURE PERSPECTIVES

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The field of elemental speciation has seen rapid progress over the past 20 years, and can now be considered a routine technique in the toolkit of the analytical chemist to quantify classes of elemental species in a variety of environmental and biological samples. This is largely due to advances in analytical instrumentation, bringing with it lower detection limits and near-complete removal of interfering chemical analytes to streamline sample preparation, increase sample throughput and reduce operating costs. The analysis of essential and toxic elemental species is now a fundamental component in a range of research areas, including food and beverage safety, occupational exposure assessment, and the efficacy of phytofortification schemes to improve the nutritional status of staple crops.

This presentation focuses on chromium (Cr), an element whose species exhibit significantly different toxicity, environmental mobility and bioavailability. Trivalent chromium (Cr^{III}) is an essential micronutrient for glucose and lipid metabolism, whereas hexavalent chromium (Cr^{VI}) is toxic and a recognised carcinogen through inhalation. The speciation analysis of Cr^{III} and Cr^{VI} in water and agricultural soil- two of the most commonly studied sample types- are detailed, alongside important methodological considerations to ensure accurate data for these different matrices without affecting species integrity during sample preparation, separation and detection. The future perspectives for chromium speciation are presented, including field-based separation methods and online hyphenation with passive sampling techniques (microdialysis) to begin addressing the remaining challenges for elemental speciation analysis, such as species stability and interconversions following sampling, and sample clean-up for compatibility with instrumentation.

4.

ENVIRONMENTAL PESTICIDE AND ITS TOXICITY: *A GLOBAL ANXIETY*

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It should be acknowledged that pesticides have offered many benefits to various components of agricultural including soil, crop, animal, fishery, forestry and wildlife. What are these pesticides? Answer to this type of question must be link to the general concept and the origin of the word 'pesticide'. This word is believed to have originated from two terms namely '***pest***' and '***cide***'. In a common term, pest is a name used to define any plant or animal or soil organism which is detrimental or harmful to all agronomic and other agricultural production components whereas, the term '*cide'* is a Latin word that means 'to kill' or 'to destroy'. The unethical use of pesticide chemicals can lead to broad environmental contaminations, and are harmful to both human and biological organisms due to complex toxicity contained in the formulation of pesticides. This toxicity can be explained into two forms namely acute and chronic toxicity. Acute toxicity is the ability of a chemical pesticide to cause harmful effects in human or biological organism within a very short period after inhalation or contact, whereas chronic toxicity is the ability of a chemical pesticide to cause adverse health effects which follows from long-term exposure to a chemical. Generally, out of over 10 million cases of toxicity effect, more than 50% are accidental and happened probably due to lack of awareness and proper use of protective clothes during the spray process. This entails that pesticides are poisons and can be hazardous when mis-used in the farm or garden, and could lead to various environmental damage, which will in turn affect water body, soil body, forest body and overall ecosystem.

Reference

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5.

FALLOUT RADIONUCLIDES AS SOIL EROSION TRACERS IN EAST AFRICA

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Fertile soil is an essential resource; however, a large proportion of the world's soils are degraded to some extent. This concern is notably greater within tropical environments as they can experience extreme wet/dry weather patterns, driving rain and wind soil erosion. As a large proportion of this degradation is a direct result of poor land management practices or vegetation clearance, there is a need for reliable quantitative data detailing rates of soil erosion, in areas which are at high risk of degradation. Fallout radionuclides (FRN) offer an alternative way to quantify soil erosion without the need for expensive long-term monitoring techniques. FRN methods are based on the comparison between the activity per unit area of a representative reference site, with that at a given sampling site. By using the assumption that the loss of radionuclide at a reference site is only due to radioactive decay, soil erosion can be calculated from the loss of radionuclide at the site under investigation. This research has the potential to guide future investigations into the extent of soil erosion in east Africa according to different land management and clearance scale. This can then allow for targeted mitigation planning for sustainable soil conservation measures to be put into place, working towards the prevention and limitation of future land degradation.

6.

PHYSICAL AND ANTHROPOGENIC FACTORS OF SOIL EROSION, NUTRIENT LEACHING, AND DEPLETION IN EAST WINAM GULF CATCHMENT AND THEIR POTENTIAL HEALTH IMPACTS

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The catchment of East Winam Gulf of Lake Victoria including basins of Kibos, Sondu Miriu, and Nyando rivers contributes 25% volume of water into the Kenyan part of the lake and supports livelihood of 40 million riparian and agricultural communities (Density: 250 people.km-2). The evolving land use practices in this basin has resulted in rapid soil erosion, depletion and leaching of nutrients, siltation, and eutrophication of the lake. The implication of this on health of the inhabitants is not well-understood.

Preliminary studies, part of an ongoing large-scale study funded by The Royal Society, have been made to identify the possible causes of soil erosion, leaching, depletion, and dynamics of their transfer from the river catchment into the lake. The steep slopes of Nandi Hills are experiencing increasing land clearance. The bareland exposes the topsoil to natural forces; such as rainfall and wind. The major practices that are observed to expose soils to erosion were: farming on steep slopes (up to 60 degrees), inadequate mitigation measures to safeguard the soils, overstocking of livestock, land clearance or inappropriate land preparation techniques, and deforestation. Additionally, broken banks were common with part of the crop washed into the rivers due to farming too close to the rivers. Further, rampant deforestation worsens the situation and these may have contributed to the current disaster of uncontrolled rise of the levels of the lake. Increased nutrient loads into the lake may have resulted in the eutrophication and uncontrolled growth of macrophytes especially Water Hyacinth, and importantly altered the lake's ecosystem.

7.

PROFILING CONTAMINATION OF WETLAND SEDIMENTS IN PARTS OF LAGOS, SOUTHWESTERN NIGERIA

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Prominent industrial, commercial and agricultural activities that define Lagos have been globally identified as potential sources of contamination in the environment. This study assessed wetland sediments from parts of Lagos, Nigeria, to determine the spatial distribution of Potentially Toxic Elements (PTEs) in the area and ascertain the extent of contamination by the PTEs and their sources.

Core wetland sediments were collected from seven locations within the study area using 30cm long High-Density Polyvinyl Chloride core barrels. The sediments were subdivided at 5cm interval, air dried, disaggregated and sieved. The resultant sub samples were digested and analyzed for their elemental composition using ICP-MS. Metal Ratio, Modified Contamination Degree, Geo-accumulation Index (I_{geo}) and Pollution Load Index (PLI) were employed in assessing the environmental quality of the sediments.

The results from elemental analysis revealed a range of concentration for Cu, Pb, Zn, Co, Mn, As, U, Cd, Cr across the depth profile of 0-30cm. The Metal Ratio ranged from > 1 to > 6 while the I_{geo} varied from < 0 to > 2, indicating moderate to high contamination of the sediments by the PTEs. The PLI values were generally above 1 for all the sites investigated indicating that they have all deteriorated in quality. Inferred sources of the metals are from non-sustainable waste management system, industrial and agricultural activities within the catchment of the study area.

Keywords: Wetland sediments, Contamination, Potentially toxic elements

8.

OCCURRENCE AND QUANTIFICATION OF AFLATOXIN B1 IN FISH FEEDS IN KISUMU AND UASIN GISHU COUNTY

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Mycotoxins are toxic compounds produced by fungi as secondary metabolites. Their level of occurrence has gained global concern, especially in the aquaculture industry because mycotoxins have shown to be persistent in fish flesh, causing a serious threat to animal welfare and human health. Communities should be aware of the dangers of Aflatoxin so that such knowledge will enable them to handle fish feeds appropriately. This study aimed at establishing contributing factors leading to mycotoxin contamination among farmers and fish feed traders on their effects, and possible management strategies. A questionnaire and an observation check list were used to collect data. A Cross-sectional exploratory study was employed; both qualitative and quantitative data was collected. Snowball technique was used to identify the respondents. The data was analysed using Statistical Package for Social Sciences (SPSS) version 24, Binary logistic regression was used to determine associations and descriptive statistics were used to analyse data.

A total of 62 respondents were interviewed, results indicates that little more women farmers 28 (45.2 %) participated in the interview than men 34 (54.8 %). Most of the respondents, 53.2 % attained secondary 24.2% and 11.3% tertiary education in both the counties. Among the respondents who have heard of mycotoxins, a quarter (OR: 1.003) of them have heard of Aflatoxins only. Maize 49.7% with a mean of (±14.2) was the primary ingredient. Out of the 62 samples, 19.4% (±1.33; SD 0.592) were contaminated with FB1, with majority of the contaminated feeds 66.7% (±0.25; SD 0.44) were from Kisumu County. Traders were 0.006 times likely to have better knowledge on Aflatoxin than farmers. Results from the findings have shown that education hold a positive and significant correlation with level of knowledge and occurrence, from those who attained secondary (OR 1.078: CI 0.736-1.580) and college (OR 1.050: CI 0.594-1.856). Some of the storage practices were found to influence exposure of the feeds to growth of fungi and mycotoxin contamination. Hence, there is need for more sensitization and training targeting farmers and traders. Additionally, there is need for a heightened surveillance programme to monitor local ingredients, finished feeds and storage processes.

Keywords; Aquaculture; Fumonisin; Fish feeds; Mycotoxins; Kisumu; Uasin Gishu

KEYNOTE

SPECIATION OF SPIKED IODINE IN SOLID AND LIQUID PHASE OF FOREST SOIL

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Understanding about chemical forms of iodine added in soil is important for predicting the behaviour of radioiodine in the terrestrial environment or iodine biofortification strategies. In this study, soil samples were spiked with iodine (as iodide or iodate), and the chemical forms of iodine were investigated in both the soils and their water extracts.

Surface soils from O- and A-horizon and a subsurface soil from C-horizon were collected from a coniferous forest. Soil samples spiked with NaI or $NaIO_3$ and incubated at room temperature for 1 or 14 d. The chemical forms of iodine both in the soils and their water-extracts were analyzed by X-ray absorption near-edge spectroscopy and a high-performance liquid chromatography, respectively.

In surface soil and its extracts, inorganic iodine was found to have been transformed to organically bound forms after incubation for 14 d, resulting in a decrease in the amount of water-extractable iodine in the soil. In contrast, in subsurface soil, which had low organic matter content, the predominant chemical form of iodine after incubation did not differ from that in the spiked soil, and the amount of water-extractable iodine did not decrease noticeably. These results suggest that atmospheric I^- and IO_3^- deposited on the forest floor would be rapidly converted to insoluble organic form by reaction with soil organic materials.

This study was performed under a contract with the government of Aomori Prefecture, Japan.

9.

ANALYSIS OF SPATIAL DISTRIBUTION OF THYROID CANCER AND ITS DYNAMICS AMONG URBAN AND RURAL POPULATION OF THE BRYANSK REGION (RUSSIAN FEDERATION) AFTER THE CHERNOBYL NUCLEAR ACCIDENT

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Distribution of thyroid cancer cases among population of urban and rural areas in different countries in the last 30 years was analysed. Thyroid cancer (THYC) cases among rural population of the USA was 14% lower than among urban residents. Similar tendency was observed in Canada, e.g. in province Ontario noted for domination of urban population (85% of the total) there were 3932 cases per 100,000 women versus 4.3 cases in Yukon (60% of urban residents). In Bryansk region, most affected by the Chernobyl accident and marked by higher growing of the number of THYC cases, compared with other regions of Russia, the trend appeared to be the same, except for the most contaminated western regions where the disease level was higher in the regional centers. The latter can be explained by the countermeasures taken. Mortality rates appeared higher in rural settlements only in the first 10 years after the accident that was likely caused by higher consumption of forest products and lower level of medical aid. In our opinion, the higher incidence of thyroid cancer among urban residents may be caused by geochemical factors: 1) higher industrial contamination of urban areas, and 2) disruption of natural diets and inadequate treating of some chemical elements in diets as toxic. We consider the identified tendencies worthy of a more detailed study from a geochemical point of view and believe that the results obtained will help improve the quality of life.

The study was partly funded by RFBR and BRFBR, project number 20-55-00012.

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10.

MINERALOGY, GEOCHEMISTRY, 13C AND 16O ISOTOPIC CHARACTERISTICS OF URINARY STONES IN IRAN, A CASE STUDY OF LORESTAN PROVINCE

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Owing to the importance of urinary stones as one of the biominerals in the human body, it is necessary to investigate their chemical composition and mineralogy. In this matter, a mineralogical study using of X-ray diffraction and scanning electron microscopy (SEM) indicated that urinary stones in Lorestan Province were divided into 5 groups of calcium oxalate, urate, cysteine, phosphate and mixed stones (Whewellite, uric acid, phosphate). In this regard, the microscopic studies revealed that Whewellite was the most important mineral phase among various phases. In the following, the major and rare elements of each group were determined by inductively coupled plasma- mass spectrometry (ICP-MS) and X-ray fluorescence analysis. The obtained results demonstrated that Ca was founded the most abundant element in urinary stones. In the analysis results of the major oxides, compared to other major oxides, CaO had the highest frequency in urinary stones. The reason was due to the role of calcium in most of the basic functions in cell metabolism. The average values of isotope ^{13}C and ^{16}O in the studied urinary stones were obtained -33.71 and -20.57, respectively. Overall, the values of ^{13}C isotope in urinary stones were lower than those in the similar stones and human hard tissues in other countries.

Keywords: Urinary stones, Calcium oxalate, X-ray diffraction, Trace elements, Carbon

isotope

11.

DENTAL FLUOROSIS AND ORAL HEALTH RISK FACTORS IN THE AFRICAN ESOPHAGEAL CANCER CORRIDOR

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There are no studies of oral health in relation to esophageal cancer in Africa or of East Africa's endemic dental fluorosis, an irreversible enamel hypo-mineralisation due to early-life excessive fluoride intake.

During 2014-2018 we conducted a case-control study of squamous cell esophageal cancer in Eldoret, western Kenya. Odds ratio (AORs; 95% CI) were adjusted for design factrors, such as tobacco, alcohol, ethnicity, education, oral hygiene and missing/decayed teeth. Esophageal cancer cases (N = 430) had poorer oral health and hygiene than controls (N = 440). Compared to no dental fluorosis, moderate/severe fluorosis which affected 44% of cases, had a crude OR of 20.8 (11.6, 37.4) and on full adjustment was associated with 9.4 fold (4.6, 19.1) increased risk, whilst mild fluorosis (43% of cases) had an AOR of 2.3 (1.3, 4.0). The prevalance of oral leukoplakia and tooth loss.decay increased fluorosis severity and increased cancer risks associated with moderate/severe fluorosis were particularly strong in individuals with the more tooth loss/decay. Using a mswaki stick (AOR = 1.7 (1.0, 2.9)) rather than a commercial tooth brushand infrequent tooth brushing also independently increased risk. Geographic variations showed that areas of high esophageal cancer incidence and those of high groundwater fluoride levels have remarkably similar locations across Eastern Africa.

In conclusion, poor oral health in combination with, or as a result of, high-altitude susceptibility to hydro-geologically influenced dental fluorosis may underlie the striking co-location of Africa's esophageal cancer corridor with the Rift Valley. The findings call for heightened research into primary prevention opportunities of this highly fatal but common cancer.

12.

AN OVERVIEW OF EXPOSURE ASSESSMENT IN THE IARC MONOGRAPHS ON THE IDENTIFICATION OF CARCINOGENIC HAZARDS TO HUMANS

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The Monographs Programme of the International Agency for Research on Cancer (IARC) conducts cancer hazard evaluations to identify environmental factors that are carcinogenic to humans, informing public health policies and cancer prevention strategies worldwide. Using a rigorous evidence synthesis approach carried out by Working Groups of impartial international experts, the IARC Monographs entail comprehensive systematic reviews of multiple streams of evidence to assign a variety of chemicals, complex mixtures, occupational exposures, physical agents, biological agents, and lifestyle factors to one of four classifications: Group 1 – carcinogenic to humans (121 agents), Group 2A – probably carcinogenic to humans (89 agents), Group 2B possibly carcinogenic to humans (315 agents) and Group 3 – Not classifiable (497 agents). The evidence streams informing Monographs evaluations are epidemiological studies of cancer in humans (Subgroup 2), animal cancer bioassays (Subgroup 3), and mechanistic studies (Subgroup 4). These streams are supported by a review of human exposure characterisation (Subgroup 1) which includes a critical appraisal of exposure assessment methods used in human studies reviewed by Subgroups 2 & 4. This presentation will provide a background and overview of the IARC Monographs programme, with special emphasis on the work of Subgroup 1: Exposure Characterisation.

13.

CHEMICAL AND MORPHOLOGICAL CHARACTERISTICS OF HOUSEHOLD DUST

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A detailed study of the household dust characteristics was done in the town of Maribor, Slovenia. Sampling was done by collecting vacuum cleaner bags. Participating residents completed a questionnaire about their lifestyle, habits and the characteristics of their apartments. The chemical composition (determined by ICP-MS, following aqua regia digestion) differs considerably from one apartment to another. This is most probably a result of the different habits and activities of the residents as well as the specific characteristics of the apartments. Compared to street and attic dust, household dust stands out with the highest medians of Ag, Au, Ba, K and Na. The selected household dust samples were analysed using SEM/EDS. The mineral composition was assessed using surface EDS analysis. On average, 50% of the sample surface is covered with C-rich particles (organic matter). A high level of organic matter is typical for this type of dust. The predominant mineral groups are silicates (24%) and carbonates (17%; calcite predominates over dolomite). Detailed study of the particles with potentially toxic elements allowed us to determine some of their indoor anthropogenic sources. The irregularly shaped Ba-Zn-S-O and Ba-S-O particles most likely originate from the degradation of white wall paint, where barite and lithopone (a mixture of barium sulphate and zinc sulphide) are used as white pigments. We have discovered spherical Fe-Ce-La-O particles in apartments where residents smoke frequently. Their occurrence coincides with the highest total Ce and La levels. These spheres originate from the use of lighters.

Additional information about household dust characteristics and their comparison with soil, street and attic dust are given in the following article:

Gaberšek, M., Gosar, M. 2021. *Towards a holistic approach to the geochemistry of solid inorganic particles in the urban environment*. Sci. Total Environ. 763, 13 pp., doi: https://doi.org/10.1016/j.scitotenv.2020.144214

14.

TACKLING AMR ACROSS INDIA

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The direct impacts of anthropogenic pollution are widely known public and environmental health concerns, and details on the indirect impact of these are starting to emerge, for example affecting the environmental microbiome, and potentially enhancing the prevalence on antimicrobial resistance (AMR) globally.

As such, we embark on an extensive research project in which we aim to develop a greater understanding on the impact of antibiotic and industrial pollution on the environmental microbiology across India. By focusing on Common Effluent Treatment Plants (CETPs) across India, this project aims to monitor the prevalence of AMR in sediments, slurries and water by investigating four key hypothesis:

1. AMR in bacteria is driven by a combination of anthropogenic factors and this influences potential reservoirs for infections and also complex microbial communities in the environment
2. The use of novel, optical and electrochemical sensing systems deployed in the CETP system will determine levels of antimicrobials presence in waste and provide an effective monitoring system for environmental release of these compounds.
3. Photocatalytic processing will remove antibiotic residues and kill AMR bacteria already in the effluent and minimising risk of AMR development in the waterways.
4. The attainment of a detailed AMR map and effective monitoring systems from this project will engage authorities and industry to support each other in waste water management and create effective regulations and policies

15.

HEALTH RISK ASSESSMENT OF LEAD, COPPER AND ZINC IN ROAD DUSTS FROM SHAGAMU, SOUTHWEST NIGERIA

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Shagamu is a popular transit city in southwest Nigeria with a population of about 300,000 people and it is home to one of the oldest Cement Works in Nigeria. The presence of the Cement Works; the city's strategic location between three commercial hubs, (Lagos, Ibadan and Benin City), and the city's rapidly increasing urbanization rate render the city's environmental media such as road dusts and soils susceptible to contamination and quality impairment from Potentially Harmful Elements (PHEs).

Thirty road dusts samples were collected from along major roads within the city of Shagamu, sieved using a <63 microns nylon sieve and analysed for Lead, Copper and Zinc using ICPMS. The Health Risk Assessment for the three PHEs was assessed based on the USEPA's health risk assessment model for non-carcinogenic effects in both children and adults.

The concentration of Lead ranged from 18-66ppm, Copper 8-106ppm, and Zinc 39-429 ppm, most of the samples exceeded the average crustal values for Lead and Zinc (ACV=Lead:7ppm, Zinc:16ppm). The Health risk assessment for children and Adults showed that the main exposure route was through oral ingestion compared to dermal and nasal exposure routes.

The HI values for kids (Lead=1.79E-01, Copper=1.05E-1, Zinc=5.08E-01), and Adults (Lead=0.0192, Copper=0.0102, Zinc=0.0521), all less than 1, revealed that both the children and adults were not exposed to any immediate non-carcinogenic health risk, however continuous monitoring is recommended so as to be able to detect if conditions change later in the future.

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16.

SPATIOTEMPORAL VARIABILITTY OF NITROGEN DIOXIDE (NO_2) POLLUTION IN MANCHESTER (UK) CITY CENTRE (2017-2018)

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Nitrogen dioxide (NO_2) is linked to poor air quality and severe human health impacts, e.g. respiratory and cardiovascular diseases and is estimated to contribute to approximately 23,500 premature deaths annually in the UK[1,2]. Automated air quality monitoring stations continuously record pollutants in urban environments but are restricted in number, only record air quality proximal to their location and cannot document variability of airborne pollutants at finer spatial scales. Passive sampling devices (e.g. Palmes-type diffusion tubes[3]) can be used as an alternative inexpensive method to assess the spatial and temporal variability of air quality in greater detail.

Passive diffusion tubes were used to investigate spatiotemporal variability of NO_2 concentrations across the City of Manchester (UK), by sampling 45 locations over a 12-months period (1,080 individual NO_2 measurements). Elevated NO_2 concentrations, exceeding the EU/UK limit value of 40 µg m^{-3} were recorded throughout the deployment period (N=278; 26% of individual measurements), particularly during colder months and across a wider area of Manchester's city centre. Of 45 sampling locations 16% showed elevated NO_2 (>40µg m^{-3}) for at least 6 months of deployment. Vehicular emissions were identified as a major cause of NO_2 pollution, with urban factors (e.g. surrounding building heights) also influencing NO_2 dispersion and distribution.

This study demonstrates the importance of high spatial coverage to ensure appropriate monitoring of NO_2 concentrations across urban environments, especially for areas not covered by continuous air quality monitoring stations. Thus, the limited number of automated monitoring stations potentially underestimate the problem of NO_2 pollution across urban areas and subsequent human health risks.

1 DEFRA and PHE, *Air Quality A Briefing for Directors of Public Health*, 2017.

2 The Royal College of Physicians, *Every breathe we take: the lifelong impact of air pollution - Report of a working party*, London, 2016.

3 E. D. Palmes, A. F. Gunnison, J. DiMattio and C. Tomczyk, Personal sampler for nitrogen dioxide, *Am. Ind. Hyg. Assoc. J.*, 1976, **37**, 570–577.

17.

IMMOBILISATION TOXIC OF METALS IN MINING SOIL USING NATURAL CLAY MINERALS: A BATCH STUDY

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The interactions that occur in the solid-solution interface are controlling the retention of potentially toxic elements (PTEs) by the clay surfaces in clay-amended contaminated soil. In this study, natural Fe-Mg clay minerals, namely a palygorskite-rich (AH), a smectite-rich (SM) and a mixed palygorskite/smectite-rich (MH) clay were used as amendments of a contaminated mining soil. A pot experiment was set up where clay minerals were mixed at different proportions with mining soil from the sulfide ore mining village of Stratoni, north Greece. Total concentrations in soil had averages of 131 mg kg^{-1} Cu, 555 mg kg^{-1} Pb, 332 mg kg^{-1} Zn, 2.0 mg kg^{-1} Cd, 130 mg kg^{-1} As and 24.6 mg kg^{-1} Sb. The effectiveness of clay amendments was evaluated by comparing water-leachable metal concentrations of treated and untreated soil after a four-week period of repeated cycles of wetting and mixing. All clays in a mixing proportion of 7% reduced leachable concentrations of the elements in comparison to the original soil. The corresponding reduction of the water-leachable fraction was as high as 61% for Cu, 87% for Pb, 55% for Zn, 57% for Cd, 56% for As and 49% for Sb. Soil pH was raised from 4.5 up to 8.0 during the experiment. The stabilisation of PTEs in the mining soil was achieved by a combination of ion-exchange, surface complexation and precipitation of metals onto the clay surface, especially in the case of the mixed clay material, where different clay phases with different physicochemical properties coexist.

18.

HUMAN HEALTH RISKS TO METAL EXPOSURE IN ARTISANAL SMALL-SCALE GOLD MINING IN KENYA

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Artisanal and small-scale gold mining (ASGM) create polluted sites associated with high-dose toxic exposures to communities. The study assumes a high potentially toxic elements (PTEs) burden of the environment and local population in Kakamega and Vihiga Counties, Kenya. From February 2020, element concentrations have been determined in environmental (soil, sediments and water) samples pending interior house dust, fish and staple food crops grown locally and personal inhaled air. The local population's internal PTEs burden and the extent of possible negative health impacts will be examined by administering questionnaires to 195 volunteers. Human (hair, nails and urine) samples will be analysed for PTEs. Additionally, the local communities' and ASGM workers' knowledge, attitude and practices on PTEs exposures resulting from ASGM and related poisoning will be examined. Oral, lung, gastric and blood plasma bioavailability of the PTEs will be investigated using simulated fluids and comparisons made.

The efficiency and safety of available ASGM mitigation technologies, which minimise PTEs exposure and increase gold recovery, will be tested after which ASGM workers and the general public will be educated and trained accordingly. Study data will be appropriately analyzed and the burden of disease as a result of ASGM in the study area generated. Part of results indicate high pollution of soils, water and sediments (n=178) with As, Pb, Hg, Cd, Cr and Ni concentrations exceeding the WHO standards. The study will characterize the environmental health problem resulting from unregulated ASGM and demonstrate the need for coordinated efforts for intervention, including policy, in Kenya.

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19.

HEALTH RISK ASSESSMENT OF HEAVY METALS IN CHILDREN LIVING IN AN ARTISANAL MINING ENVIRONMENT, NORTHEAST, NIGERIA

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Heavy metal exposure from artisanal mining pose environmental health risks to children in Nigeria. This study assessed the health hazards associated with Gold mining practices in Anka, Northwest, Nigeria.
Forty (twenty nails and twenty hairs) samples were collected from ten boys and ten girls (average 8 years) with soil (S); stream sediment (SS) and groundwater (GW) samples. Concentration of Heavy metals (HM; Cr, Ni, Cu, Zn, As, Cd, and Pb) in all the samples was determined using HPLC Agilent 7700 series inductively coupled plasma-mass spectrometry.

Chromium (0.06),Pb (0.58) and As (0.44) in groundwater were higher than the WHO limits. Arsenic, Cr and Pb in soil and stream sediment, As (S-0.64; SS-15.46), Cr(S-42.55; SS-111.82), Pb (S-131.76; SS-2234.02) were higher than USEPA limits. Concentration of HM in Boys' and Girls' hair was: Cu (14.47 vs 38.66), Zn (88.08 vs 155.66) and As (0.26 vs 0.36). Moreover, concentrations of HM in Boys' and Girls' nail were: Cu (34.61 vs 19.02); Zn (140.37 vs 42.82) and As (0.36 vs 0.22).Higher concentration of HM were recorded in Girls' hair than Boys; however, Boys had higher HM in their nails than Girls.
Artisanal mining may contribute to the high levels of heavy metals observed in the children and other environmental media which pose non-cancer risks to the children. A Government regulation of the activities of the miners in addition to enforcement of existing relevant laws and effective health education will go a long way in saving the lives of the children and the environment.

KEYWORDS: Health risk; Carcinogenic and Non-carcinogenic; Heavy-Metals; Children

20.

SLAG DUSTS FROM KABWE (ZAMBIA): CONTAMINANT MINERALOGY AND ORAL BIOACCESSIBILITY

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The former Pb-Zn mining town of Kabwe in central Zambia is ranked amongst the worst polluted areas both in Africa and in the world. The fine dust particles from various slags deposited in Kabwe represent a health risk for the local population. We combined a detailed multi-method mineralogical investigation with oral bioaccessibility testing in simulated gastric fluid to evaluate the risk related to the incidental dust ingestion. The slag dust fractions contain up to 2610 mg/kg V, 6.3 wt.% Pb and 19 wt.% Zn. The metals are mainly bound in a slag glass and secondary phases, which formed during the slag weathering or were windblown from nearby tailing stockpiles (carbonates, Fe and Mn oxides, phosphates, vanadates). The bioaccessible fractions (BAFs) are rather high for all the main contaminants: Pb (24-96%), V (21-100%) and Zn (54-81%). The results indicate the potential risks related to the incidental slag dust ingestion. Even when a conservative value of the dust daily intake (100 mg/day) is considered, the daily contaminant intake significantly exceeds the tolerable daily intake limits, especially for Pb>>V>Zn. At higher ingestion rates, other minor contaminants (As, Cd) also become a health risk, especially for children. The slag heaps in Kabwe should be fenced to prevent local people entering and should be covered to limit the dust dispersion. The Czech Science

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