

## Multidisciplinary Workshop

Scientific Missions and their Advancement for Overseas Sciences: Past, Present and Future







## 20 December 2021

## Programme

Online conference

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### CONTENTS

Contents	2
Programme	3
Abstract Book	7
	/
Session I	8
Session II	20
Session III	35
Index	47

#### PROGRAMME

- 08.45 9.00 Opening of the "conference room"
- 9.00 9.10 Welcome Address by Patrick VAN DAMME, President of the RAOS, Belgium

#### **Session I**

Chair: Stan HENDRICKX (UHasselt & RAOS member, Belgium) & Philippe GOYENS (Université Libre de Bruxelles, HUDERF & RAOS Hon. Permanent Secretary)

9.10 - 09.35 **Keynote lecture** 

Prof. HENDRICKX Stan, UHasselt & RAOS Member section of Human Sciences Belgian archaeological work in Egypt – History and scientific impact

9.35 - 09.45 Questions & Answer

#### 09.45 - 10.50 Communications by young researchers

### Effects of forest disturbance and regeneration on tree species composition and traits in DR Congo

DEPECKER Jonas, Division of Ecology, Evolution and Biodiversity Conservation, KU Leuven, & Meise Botanic Garden (Belgium)

## Italian aerial photographs of Ethiopia (1935-1941): their recovery and digital archiving for scientific purposes

FRANKL Amaury, Department of Geography, Ghent University & RAOS Member (Belgium)

The significance of collaborations and partnerships with community researchers and institutions in enhancing access and benefit-sharing (ABS): Role of library profession BOUAAMRI Asmaa, Eötvös Loránd University (Hungary)

**Ibeceten, a window into the anuran diversity of the African Cretaceous** LEMIERRE Alfred, Centre de recherche en Paléontologie-CNRS/MNHN/Sorbonnes Université, Bâtiment de Géologie, Paris (France)

## Paul Duvigneaud's botanical missions in Congo (1948-1960): digitization of 1200 slides and field notebooks

MEERTS Pierre, Université Libre de Bruxelles, Herbarium et bibliothèque de botanique africaine, Meise Botanic Garden, Fédération Wallonie-Bruxelles. Service Général de l'Enseignement supérieur et de la Recherche scientifique & RAOS Member

10.50 - 11.25 Coffee break & Poster session

#### Posters

### A new small crocodylian skull from the early Paleocene of Qianshan, Anhui, China reveals an ancient Asian ghost lineage

BOERMAN Sophie, Department of Earth and Environmental Sciences, KU Leuven & Directorate Earth and History of Life, Royal Belgian Institute of Natural Sciences, (Belgium)

*Under The Pole* Scientific Mission to explore Polynesian reefs: differences between photic and mesophotic fish biophonies

RAICK Xavier, Laboratory of Functional and Evolutionary Morphology, Freshwater and Oceanic Science Unit of Research, B6c, University of Liège (Belgium) & Centre de formation et de recherche sur les environnements méditerranéens, Université de Perpignan Via Domitia (France)

#### Spatial planning of global mangrove ecosystems for conservation and fishing

DABALÀ Alvise, Laboratory of Systems Ecology and Resource Management, Département de Biologie des Organismes, Université Libre de Bruxelles & Ecology & Biodiversity, Laboratory of Plant Biology and Nature Management, Biology Department, Vrije Universiteit Brussel - VUB-APNA-WE (Belgium)

A new Chinese partial skeleton revives questions about the multituberculate mammal *Kryptobaatar* 

DEVILLET Ghéreint, Royal Belgian Institute of Natural Sciences, Directorate Earth & History of Life (Belgium)

Effect of Integrated Soil Fertility Management on Hydrophysical Soil Properties and Irrigated Wheat Production in the Upper Blue Nile Basin, Ethiopia

KIDANE ASMAMAW Desale, Department of Environment, Ghent University (Belgium) & Department of Natural Resource Management and Blue Nile Water Institute, Bahir Dar University (Ethiopia)

#### **Session II**

Chair: Philippe MUCHEZ (KULeuven & RAOS Member, Belgium) & Thierry SMITH (Royal Institute for Natural Sciences & RAOS Member, Belgium)

#### 11.25 - 11.50 **Keynote lecture**

Prof. VERHEYEN Erik, Royal Belgian Institute of Natural Sciences & RAOS Member section of Natural and Medical Sciences

Congo2010: A multidisciplinary expedition carried out in partnership with local scientists

11.50 - 12.00 Questions & Answer

#### 12.00 - 13.05 **Communications by young researchers**

Paleoenvironment and paleoclimate of the Maastrichtian-Paleocene shelf seas of Patagonia, Argentina

VELLEKOOP Johan, Department of Earth and Environmental Sciences, KU Leuven & O.D. Earth and History of Life, Royal Belgian Institute of Natural Sciences, (Belgium)

#### Working in and with the North and South: transformative dialogues to decolonize interuniversity collaborations

MERTENS Kewan, Department of Geography, VUB, Brussels (Belgium)

Utilisation d'un SIG pour la caractérisation des paramètres géomorphologiques et hydrologiques des bassins versants de la ville d'Uvira dans la partie Nord-Ouest du lac Tanganyika

NDABAGA Mashauri, Institut Supérieur Pédagogique de Bukavu| Section des Sciences Exactes | Département de Géographie et Gestion de l'Environnement (République Démocratique du Congo)

## Culture to culture: bacterial culture of blood transfusion products, a North-South collaboration

HEROES Anne-Sophie, Institute of Tropical Medicine, Department Clinical Sciences, Antwerp & KU Leuven, Department of Microbiology, Immunology and Transplantation, Leuven (Belgium)

## A crash course on molecular biology/biotechnology laboratory skills: a case study on technology transfer from North to South

KARIUKI Christopher K., Interuniversity Program Molecular Biology (IPMB), Department of Bioengineering Sciences (DBIT), Vrije Universiteit Brussel (Belgium)

#### 13.35 - 14.25 Poster session

#### Posters

## Are endemic *Senegalia* spp. (Fabaceae: Mimosoideae) seeds in the arid tropics potential novel food sources for humans? – Ongoing research summary

SOUNGALO DRABO Moustapha, Research Unit VEG-i-TEC, Faculty of Bioscience Engineering, Ghent University (Belgium) & Laboratory of Applied Biochemistry and Immunology, Department of Biochemistry and Microbiology, University Joseph Ki-Zerbo (Burkina Faso)

The social-spatial construction of industrial workers' identity in early New China ZHANG Yiping, University of Leuven (KU Leuven) (Belgium)

## Quantification and evaluation of the evolution of landscape anthropization in the agglomerations of Southern Katanga from 1979 to 2020

KHOJI MUTEYA Héritier, Ecology, Ecological Restoration and Landscape Unit, Faculty of Agricultural Sciences, University of Lubumbashi (DR Congo) & Biodiversity and Landscape Unit, Gembloux Agro-BioTech, University of Liege, (Belgium)

Appropriation and Co-production of Public Space in "*Barrios Populares*." MÉNDEZ ABAD Xavier, KU Leuven, Faculty of Architecture (Belgium)

# HPTLC guided isolation, identification and characterization of two Iridoids glucosides extracted from root bark of *Vitex madiensis* subsp. *Milanjiensis* (Britten) F.White (Lamiaceae)

MUYUMBA NONGA Welcome, Department of Chemistry-physics, High college training teachers of Lubumbashi (DR Congo); Unit of Therapeutic Chemistry and Pharmacognosy, University of Mons (Belgium) - Laboratory of Pharmacognosy, Faculty of Pharmaceutical Sciences, University of Lubumbashi (RD Congo)

#### The double triangle of cooperative ownership

MURHULA CUBAKA Patrick, Université de Mons (Belgium)

### Improving savannah knowledge of the high Katangan plateaus (South-eastern D.R. Congo) through taxonomical studies

ILUNGA WA ILUNGA Edouard, Herbarium de Lubumbashi & Ecology, Restoration Ecology and Landscape research Unit, Faculty of Agronomy, University of Lubumbashi (DR Congo)

#### **Session III**

Chair: Bart DESSEIN (Ghent University & RAOS Member, Belgium) & Georges VAN GOETHEM (European Commission & RAOS Member, Belgium)

14.25 - 14.50 **Keynote lecture** 

Prof. SMETS Benoit, Natural Hazards Unit, Dpt. of Earth Sciences, Royal Museum for Central Africa, & Cartography & GIS Research Group, Department of Geography, Vrije Universiteit Brussel (Belgium)

## Natural Hazard Risk Assessment in Tropical Africa: Shared Experience in the Western Branch of the East African Rift

14.50 - 15.00 Questions & Answer

#### 15.00 - 16.20 **Communications by young researchers**

**Crystal-record of the formation of the Earth's crust** NAMUR Olivier, Department of Earth and Environmental Sciences, KU Leuven, (Belgium)

**Overseas Scientific Collaborations and their Role for Mirroring Humanitarian Catastrophes** NEGASH Emnet, Department of Geography, Ghent University, Ghent (Belgium) & Institute of Climate and Society, Mekelle University, Mekelle (Ethiopia)

## Barriers, opportunities and options for developing an exploration programme to better estimate plant diversity in south-eastern DR Congo

NGOY SHUTCHA Mylor, Ecologie, Restauration Ecologique et Paysage, Université de Lubumbashi (DR Congo) & Ecologie Végétale et Biogéochimie, Université de Bruxelles, (Belgium)

#### **Women empowerment quid? Reflection on the definitional and measurement consensus** NZANZU Y'Ise Kivalya, Université de Mons (Warocqué School of Economics and Management); E.GE.E (Economie et Gestion de l'Entreprise); CERMi (Centre Européen de Recherche en Microfinance) (Belgium)

#### Archaeology of plastics in Galápagos: studying the recent past to inform the future

PRAET Estelle, University of York, York, Kings Manor and Principals House, Exhibition Square, York (United Kingdom)

## Manufacturing Biodegradable Algae-based plastics in Madagascar through a Triple-Bottom-Line approach

RABEARISON Mihary, Department of Economics and Business Management – Université de Mons (Belgium)

#### 16.20 - 16.50 Coffee break & Poster session

#### Posters

### Linte Syenites (Central region Cameroon): mapping, petrography and potential as industrial minerals

NJIMBOUOMBOUO MOULIOM Soualiou, Université de Liège, Département de Géologie (Belgium) & Université de Yaoundé I, Département des Géosciences (Cameroun)

#### Gouvernance des ressources forestières par les services publics et les Organisations Non Gouvernementales dans la zone rurale de Lubumbashi (Haut-Katanga, République Démocratique du Congo)

N'TAMBWE NGHONDA Dieu-donné, Unité Écologie, Restauration Écologique et Paysage, Faculté des Sciences Agronomiques, Université de Lubumbashi (RD Congo) & Unité Biodiversité et Paysage, Université de Liège - Gembloux Agro-BioTech. (Belgique)

### Mangrove ecosystem services in Northern Sri Lanka: building on community perceptions for mangrove conservation

PERUZZO Sofia, Systems Ecology and Resource Management Research Unit (SERM), Department of Organism Biology, Université Libre de Bruxelles (Belgium)

## The new World-Class Tizert deposit (Anti-Atlas, Morocco): future supply for copper in Europe?

Poor Julien, Department of Geology, Institute of Life-Earth-Environment (ILEE), University of Namur (Belgium)

16.50 - 17.10 Closing remarks by Philippe GOYENS, Honorary Permanent Secretary of the RAOS, Belgium

# **Abstract Book**

# **Session I**

#### Belgian archaeological work in Egypt — History and scientific impact

#### Stan HENDRICKX<sup>1\*</sup>

SUMMARY. — From the early 20<sup>th</sup> century onwards, Belgian Egyptologists were active as archaeologists in Egypt. At first, this was on a limited scale and with the financial help of Belgian industrialists active in Egypt. Only after the discovery of the tomb of Tuthankhamun, causing a strong increase in the interest for archaeology in Egypt, Jean Capart (Royal Museums of Art and History) obtained funding for excavations at Elkab in Upper Egypt. These continue up to the present day, with interruptions for political reasons and funding problems over time. The latter illustrate the modifying aims of scientific research and the impact of the changes in the Belgian political structure.

From the 1970's onwards, universities became the mayor players for Belgian excavations and research in Egypt. Several sites in Middle Egypt were investigated by the Belgian Middle Egypt Prehistoric Project (KU-Leuven). Large scale excavations and recording of monuments are still continuing at Dayr al-Barsha (KULeuven), and in the Theban necropolis (ULB/ULg). International collaboration became increasingly important, as for example in the work at Alexandria of the Musée Royal de Mariemont, collaborating with the Graeco-Roman Museum of Alexandria. Also, less obvious research domains such as rock art attracted attention (RMAH).

Finally, the participation of individual scholars in international projects is to be mentioned. This allowed Belgian researchers to be at the forefront of specific research topics such as archaeozoology, geomorphology and epigraphy. But this depends highly of the personal interest of researchers and can only offer limited guarantees for continuity over time.

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#### Effects of forest disturbance and regeneration on tree species composition and traits in DR Congo

#### Jonas DEPECKER<sup>1,2\*</sup>, Justin Anio ASIMONYIO<sup>3</sup>, Ronald MITEHO<sup>6</sup>, Yves HATANGI<sup>2,6</sup>, Jean-Léon KAMBALE<sup>3</sup>, Lauren VERLEYSEN<sup>1,4</sup>, Piet STOFFELEN<sup>2</sup>, Steven B. JANSSENS<sup>2,5</sup>, Filip VANDELOOK<sup>2</sup> & Olivier HONNAY<sup>1</sup>

KEYWORDS. — Ecology; Ground Survey Data; Congo Basin.

SUMMARY. — Despite their key role in biodiversity conservation, forests of the Congo Basin are increasingly threatened by human activities. Whereas deforestation is very conspicuous, it remains challenging to monitor the impact of forest degradation under a more or less intact canopy. Likewise, the outcomes of forest regeneration following agricultural abandonment remains poorly studied in the Congo Basin. Here, we surveyed 125 vegetation quadrats across (25 m x 25 m) 25 forest inventory plots (125 m x 125 m) in the Yangambi region, and based on historical land-use maps issued by Evrard (1954). We aimed to assess both the impact of anthropogenic disturbance and forest recovery on tree species diversity and tree species traits, community composition, forest structure, as compared to undisturbed old-growth forest. We found that undisturbed old-growth forest harboured more tree individuals, *i.e.* tree abundance was 17.2 % lower (P < 0.05) in disturbed old-growth forests and 24.3 % (P < 0.05) lower in regrowth forests, and particularly individuals with a smaller diameter, as well as species with a higher wood density when compared to both disturbed old-growth and regrowth forest. Moreover, species diversity and evenness were 33.6 % (P < 0.001) and 31.9 % (P < 0.001) higher, respectively, in disturbed old-growth forests as compared to undisturbed old-growth forests. Tree species composition was significantly different between undisturbed old-growth forest and the other two forest categories. Our findings indicate that anthropogenic disturbance results in a degraded forest structure and may reduce the forest's ability to store carbon, based on the found differences in wood density. Whereas species diversity recovered 60 years after agricultural abandonment, species composition remained different from undisturbed old-growth forest. Our study illustrates the need for more extensive vegetation surveys in the Congo Basin in order to quantify the effects of human disturbance under a closed canopy.

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#### Italian aerial photographs of Ethiopia (1935-1941): their recovery and digital archiving for scientific purposes

#### <u>Amaury FRANKL</u><sup>1\*</sup>, Jan NYSSEN<sup>1</sup>, Gezahegne GEBREMESKEL<sup>2</sup>, Gordon PETRIE (deceased)<sup>3</sup>, Biadgilgn DEMISSIE<sup>4</sup>, Steven DE VRIESE<sup>1</sup> & Jeffrey VERBEURGT<sup>1</sup>

#### KEYWORDS. — Photogrammetry; Historical Aerial Photographs; Online Archive; Ethiopia.

SUMMARY. — The aerial photographs acquired during Italian occupation of Ethiopia (1935-1941) have recently been recovered in the framework of overseas collaborations (NYSSEN *et al.* 2016). This unique archive opens new perspectives for change studies as it seems to be the largest set of pre-1940 aerial photographs in Africa (fig. 1). For Ethiopia, the oldest aerial photographs of the country that are known so far were taken in the period 1958-1964. In order to valorise the archive for scientific purposes, Ethiopian and Belgian scientists have spent months in organising and localising the aerial photographs, mainly relying on their knowledge of the Ethiopian landscape. Subsequently, the archive has been availed to the wider scientific community through the Pangaea repository. Additionally, a web interface was created, allowing scientists to visualize the location of relocated aerial photographs, and to select and freely order scenes of interest (NYSSEN *et al.* 2021). So far, the aerial photographs of this collection have been used for research at local scale, addressing changes to rivers, to land use, or to density of soil and water conservation (*e.g.*, FRANKL *et al.* 2019). Here we stress the need for user-friendly digital archives or online interface to make historical aerial photographs accessible to the scientific community.



Fig. 1. — The 1936 oblique aerial photographs showing the 1 km<sup>2</sup> large Chege forest in Tembien (13.656936°N, 39.045330°E).

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## The significance of collaborations and partnerships with community researchers and institutions in enhancing access and benefit-sharing (ABS): Role of library profession

#### Asmaa BOUAAMRI<sup>1\*</sup> & Fredrick OTIKE<sup>1</sup>

KEYWORDS. — Partnership; Collaboration; Sustainable Development Goals; Librarian; Access and Benefit-sharing.

SUMMARY. — This research paper analyzes the significant role of the library profession in collaborations and partnership with community researchers and institutions in Africa while at the same time focusing on implementing the UN 2030 Agenda and sustainable development Goals. It also highlights the importance of welfare of library partnership with development organizations in order to sustain their work. Some key, international and local researchers and their partnership roles with the library profession will also be discussed.

For information to be relevant and useful, establishing collaborations and partnerships with local researchers and institutions, in order to attain community goals and developments, is one of the major keys within the library profession nowadays. For instance, partnering and cooperation with different affiliations permit the sharing of expertise and expand the institutions and organizations such as libraries and universities to a broader access to resources, which enhance the quality of research in any area and supply the academic field with biodiverse multidisciplinary results.

The significance of any scientific research undertaken is always to develop new content and solve problems, however, without proper systems in place there is always a disconnection between research output and research uptake in other words the disconnection between the providers of information and the Users of information.

The paper will also explore and discuss some of the challenges faced by library professionals and researchers, as well as libraries in Africa which come to light in the context of partnerships and collaborations.

The research paper is based on the review of literature in the domain of library profession and partnerships. A thorough review of articles within the recent decade in the context of development also has been carried out.

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#### Ibeceten, a window into the anuran diversity of the African Cretaceous

#### Alfred LEMIERRE<sup>1\*</sup>, Salvador BAILON<sup>2</sup>, Annelise FOLIE<sup>3</sup> & Michel LAURIN<sup>1</sup>

KEYWORDS. — Anura; Pipidae; Cretaceous; Africa; Phylogeny.

SUMMARY. — The Cretaceous is a key period for anurans, as several clades, such as the aquatic Pipidae and the speciose Neobatrachia (~96 % of extant taxa) underwent a rapid and vast diversification. This event is considered to have taken place on Gondwana, as it was breaking apart into several continents, including South America and Africa. Fossiliferous sites from this period from both continents are key to understand how this diversification unravelled. Unfortunately, few cretaceous sites with anuran remains are known from Africa. Among them is the Ibeceten site from the Coniacian-Santonian of Niger. Located in the South-East of Niger, this site has been the subject of several field campaigns during the 1970s by the Muséum national d'Histoire naturelle, Paris. The peculiar pipid Pachycentrata taqueti was described in 1998. However, most of the material remained undescribed. Here we present a thorough study of the anuran material from Ibeceten, which leads to the recognition of a new taxon. New anatomical studies suggest the presence of at least six taxa, although numerous bone fragments remain unattributable. This makes Ibeceten the most diverse anuran fauna of the African fossil record. Half of the identified taxa belong to Pipimorpha (total-group of Pipidae), while another one is an ornamented anuran that resembles the cretaceous neobatrachians from South America. Among the pipids, one new taxon should be erected. Phylogenetic analysis of pipimorphs places two Ibeceten taxa among the pipids. The presence of more than one pipid shows that the clade was already diversified during the early Late Cretaceous, and that the clade might have emerged in Africa, before spreading to South America. In addition, the putative presence of a neobatrachian shows that the clade was already widespread in South America and West Africa.

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#### Paul Duvigneaud's botanical missions in Congo (1948-1960): digitization of 1200 slides and field notebooks

#### Pierre MEERTS<sup>1,2,3\*</sup>

KEYWORDS. — Ecology; Herbarium; Copper Mining; Botanical Exploration; Katanga; Vegetation.
SUMMARY. — Paul Duvigneaud (1913-1991) taught botany at the Université Libre de Bruxelles between 1950 and 1983. He was one of the leaders of scientific ecology in Belgium in the 1960s and 1970s. From 1948 to 1963, his activity was focused on the flora and vegetation of the Democratic Republic of Congo (MEERTS 2014).

In 1948, Paul Duvigneaud carried out what remains, to this day, one of the most successful missions in the history of botanical exploration of the Congo. In nine months, crossing the south of the country from the Atlantic Ocean to the eastern border of Katanga, he studied practically all the major types of vegetation of the southern Democratic Republic of Congo. He thus built up a collection of one hundred thousand herbarium samples. Three other missions of shorter duration in Katanga (1956, 1957 and 1960) have completed this exceptional collection, deposited at the ULB. For each site visited, Duvigneaud took notes describing the landscape, the flora and the vegetation. These notes are accompanied by photos, herbarium samples and soil samples. This material have fuelled Paul Duvigneaud's research for more than fifteen years, resulting in more than fifty publications (DUVIGNEAUD & DENAEYER-DE SMET 1963).

The collection of color slides, rich of more than 1200 views, and the field notebooks, have been digitized thanks to the Plan de préservation et d'exploitation des patrimoines de la Communauté française (Plan Pep's). The collection is especially concerned with the copper-cobalt outcrops of Katanga, where P. Duvigneaud was the first to study the very particular vegetation. Many of the sites photographed by P. Duvigneaud have been deeply altered by mining or have even disappeared completely. P. Duvigneaud's photographs often represent the only testimony of the state of these sites before exploitation. More generally, they also document the state of the vegetation of Upper Katanga before the massive deforestation and urbanization of the last decades.

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#### A new small crocodylian skull from the early Paleocene of Qianshan, Anhui, China reveals an ancient Asian ghost lineage

## Sophie BOERMAN<sup>1,2\*</sup>, Jian YANG<sup>3</sup>, Cheng-Sen LI<sup>3</sup>, Robert P. SPEIJER<sup>1</sup> & Thierry SMITH<sup>2</sup>

#### KEYWORDS. — Paleontology; Phylogenetics; Micro-CT Scanning; China.

SUMMARY. — The Crocodylia include all modern crocodiles, alligators, caimans and gharials, and their extinct relatives. They are an ancient lineage that originated around 70 million years ago. Recently, the field of crocodylian paleontology has experienced a rise in attention from researchers, however, much is still unknown about the early evolution of this group. Our research describes newly discovered fossil material comprised of a small crocodylian skull and associated partial lower jaw of early Paleocene age. It was discovered during a Belgian-Chinese expedition in Qianshan Basin, Anhui Province, China, as part of a bilateral cooperation project between the Royal Belgian Institute of Natural Sciences and the Institute of Botany of the Chinese Academy of Sciences. In the present study, the fossil material is formally described for the first time. Micro-CT scans are made to visualize internal anatomical structures, as well as characters hidden by the sediment. A comprehensive morphological study is executed, revealing that the specimen is a juvenile. It likely constitutes a new species and genus, as it differs from other crocodyloids by several autapomorphies. A phylogenetic analysis based on morphological characteristics reveal that this specimen is the most basal taxon among Crocodyloidea, a group that comprises all species more closely related to modern crocodiles than to modern alligators, caimans, or gharials. Although it is not the oldest crocodyloid ever reported, it is the earliest crocodyloid in Asia. Moreover, its basal phylogenetic position implies that it is part of an ancient ghost lineage of crocodyloids that had already been around in Asia for a longer time. The presence of crocodyloid remains in the Late Cretaceous of North America and the late Paleocene of Europe suggests that crocodyloids may have migrated there from Asia early on in their evolutionary history.

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## *Under The Pole* Scientific Mission to explore Polynesian reefs: differences between photic and mesophotic fish biophonies

# <u>Xavier RAICK</u><sup>1\*</sup>, Lucia DI IORIO<sup>2,3</sup>, David LECCHINI<sup>4,5</sup>, Cédric GERVAISE<sup>3</sup>, Laetitia HÉDOUIN<sup>4,5</sup>, Under The Pole Consortium<sup>6</sup>, Gonzalo PÉREZ-ROSALES BLANCH<sup>4</sup>, Frédéric BERTUCCI<sup>7,1</sup> & Éric PARMENTIER<sup>1</sup>

KEYWORDS. — Coral Reefs; Soundscape; Sounds; French Polynesia; Acoustics.

SUMMARY. — Shallow coral reefs are acoustic hotspots because they are inhabited by many vocal species. However, few is known on the deeper part of coral reefs, known as Mesophotic Coral Ecosystems. The aim of this study is to determine how the acoustic fish biodiversity from Polynesian coral reefs vary depending on the depth and the type of island. The link between benthic cover and both the acoustic  $\alpha$ -diversity and acoustic fish communities was established using data collected at -20, -60 and -120 m in three atolls (Rangiroa, Raroia and Tikehau) and three high islands (Bora Bora, Mangareva and Moorea). More than 45 fish sound types were found and described. However, these sounds were not found at all depths and at all the islands showing the soundscape can be a signature for the different sites. According to the sound types, the number of some sounds increased with depth while the opposite was observed for others. In most of the islands, acoustic  $\alpha$ -diversity fall down between -20 and -60 m but not between -60 and -120 m supporting the existence of a transition zone. A higher acoustic overlap and similarity was found between -60 and -120 m than between -20 and -60 m or between -20 and -120 m. When considering acoustic  $\beta$ -diversity atolls appeared separated from high islands. The diversity was explained mainly by the depth and to a lesser extent by the type of island. The acoustic diversity appeared correlated to benthic cover. A greater variability in the cover at -60 m could increase the reason why a transition fish acoustic community is observed. These results open a potential of Passive Acoustic Monitoring for Mesophotic Coral Ecosystems like it was yet the case with their shallow cousins.

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#### Spatial planning of global mangrove ecosystems for conservation and fishing

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KEYWORDS. — Conservation Planning; Spatial Prioritization; Data Science; Fisheries; Mangroves SUMMARY. — Mangrove forests provide fundamental ecosystem functions, goods and services, including coastal protection, carbon sequestration, aesthetic and recreational benefits. They also support fisheries by providing spawning grounds, shelter and feeding areas for commercial and small-scale species that support local communities, particularly in developing countries (HUTCHISON et al. 2014). Anthropogenic activities – including land conversion and climate change – are threatening the future of these ecosystems. We will develop a climate-smart global network of protected areas to secure the conservation of these habitats, preserving their ecological, social and economic value. To prioritise areas for including in marine protected areas, we use the R package *prioritizr*. The analysis will prioritise areas that simultaneously maximise fishing benefit and maximise conservation outcomes by protecting mangrove plants species and other key ecosystem components. Blue carbon and ecosystem interactions will also be considered, prioritising the selection of areas with high carbon storage and areas with high interaction between mangroves, coral reefs and seagrasses. Furthermore, the selection of mangroves that provide greater coastal protection benefits will be prioritised. The approach developed is novel in that it aims to maximise both fisheries and conservation benefits, rather than the typical approach of minimising conflict between fisheries and conservation as is the common practice. Areas are prioritised based on climate-smart principles, by selecting mangroves that have the ability to migrate landward in response to sea-level rise and by defining larger marine protected areas in regions more impacted by extreme climatic events. The outcomes of this work could inform conservation and sustainable fisheries practices.

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## A new Chinese partial skeleton revives questions about the multituberculate mammal *Kryptobaatar*

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KEYWORDS. — Paleontology; Micro-CT Scan; Phylogeny; Inner Mongolia; China.

SUMMARY. — Multituberculates are an extinct rodent-like order that lived between Late Jurassic and late Eocene, on almost every continent. Due to their extraordinary longevity, their evolutive history is important to understand. One of the most numerous and best-preserved groups is the superfamily Djadochtatherioidea from the Late Cretaceous of the Gobi Desert. All djadochtatherioid genera are monospecific, except *Kryptobaatar*. The large number of *K. dashzevegi* fossils come from Outer Mongolia, while the only two specimens found in Bayan Mandahu, Inner Mongolia, China belong to *K. mandahuensis*. However, a new particularly well-preserved specimen (IMM 99BM-IV/5) found in Bayan Mandahu during the 1990s Sino-Belgian expeditions seems at first sight very close to *K. dashzevegi*.

IMM 99BM-IV/5 consists of a skull associated with cervical and thoracic vertebrae, ribs, shoulder girdle, broken right humerus and an almost complete left forelimb. It is the first specimen for which the hand is described in detail. Based on micro-CT scan and comparison, it appears that IMM 99BM-IV/5 presents morphological characters of both species of *Kryptobaatar*, as well as new characters of its own. Phylogenetic analysis suggests that IMM 99BM-IV/5 has an intermediate position between *K. dashzevegi* and *K. mandahuensis* and could therefore belong to a new species. However, *Kryptobaatar* is paraphyletic in the resulting tree, which raises again questions about intraspecific variability in multituberculates. Since only 13 specimens of *Kryptobaatar* out of the hundreds found have been studied, it is impossible to reliably know if IMM 99BM-IV/5 is included in the variability of *K. dashzevegi* or not. However, it is crucial to know this variability to define whether the genus is monospecific or not.

By comparing *K. mandahuensis* with published specimens, we concluded that it is a valid species. This work also highlighted the lack of knowledge of the variability of the type species *K. dashzevegi*, without which it is impossible to clearly assign IMM 99BM-IV/5. Finally, endemism alone is not the cause of this variability, but the role of paleoenvironment or age is currently unknown.

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#### Effect of Integrated Soil Fertility Management on Hydrophysical Soil Properties and Irrigated Wheat Production in the Upper Blue Nile Basin, Ethiopia

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KEYWORDS. — Grain Yield; Infiltration Capacity; Liming; Manure; Saturated Hydraulic Conductivity; Soil Water Holding Capacity.

SUMMARY. — The effect of combined application of lime, manure and inorganic fertilizer on selected hydrophysical properties of an acid clay Nitisols was assessed in the Koga irrigation scheme, Ethiopia. Five levels of integrated soil fertility management treatments were tested for four consecutive cropping seasons: (i) 0.86 t ha<sup>-1</sup> lime combined with 3 t ha<sup>-1</sup> manure and full-dose inorganic (urea and NPS-B) fertilizer (L3); (*ii*) 1.15 t ha<sup>-1</sup> lime combined with 3 t ha<sup>-1</sup> manure and full-dose inorganic fertilizer (L2); (iii) 1.43 t ha<sup>-1</sup> lime combined with 3 t ha<sup>-1</sup> manure and full-dose inorganic fertilizer (L1); (iv) 3 t ha-1 manure combined with full-dose inorganic fertilizer (M); and (v) full-dose inorganic fertilizer alone (C) as a control. Undisturbed soil samples were collected at 0-10 and 10-20 cm soil depths and analyzed to determine saturated hydraulic conductivity (Ks), soil-water retention characteristics, total porosity and bulk density. Disturbed soil samples were collected at the same depths to analyze soil organic carbon and texture. Infiltration capacity measurements and visual evaluation of soil structural quality were done in the field. The application of L1, L2, L3 and M reduced bulk density compared with the C. The amount of water retained at field capacity (FC) was significantly affected by the treatments in the order of L1 > L2 > M > L3 > and C for both soil depths 0-10 and 10-20 cm. The Ks under plots treated with L1 was 64 % and 37 % higher than that of C for the 0-10 and 10-20 soil depths, respectively. Significantly higher infiltration capacity was found at L1 (0.007 cm min<sup>-1</sup>) followed by L2, L3 and M (0.006 cm min<sup>-1</sup>, 0.006 cm min<sup>-1</sup>, and 0.005 cm min<sup>-1</sup>) compared with C (0.004 cm min<sup>-1</sup>), respectively. Good soil structural quality (Sq) score was identified in L1, L2, L3 and M, whereas in C poor Sq score was found. As compared with C, grain yield was improved by 69 % at L1, 59 % at L2, 53 % at L3, and 44 % at M during 2018 and by 70 % at L1, 58 % at L2, 55 % at L3 and 46 % at M in 2019. In conclusion, the application of organic manure combined with lime and inorganic fertilizer enhanced the infiltration rate, water holding capacity and grain yield more than the inorganic fertilizer application alone. There was also a significant effect of liming as such, with the highest doses showing the best results.

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# **Session II**

## **Congo2010: A multidisciplinary expedition carried out in partnership with local scientists**

#### Erik VERHEYEN<sup>1,2\*</sup>,

KEYWORDS. — Explorations; International Scientific Collaboration; Capacity Building.

SUMMARY. — Gathering knowledge on biological diversity and the natural environments in which it occurs has traditionally been done through scientific expeditions to explore the diversity of life. Even today, scientific exploration of biodiversity in remote habitats remains important to document biodiversity as it contributes to conserve Earth's biodiversity and to contribute to an improved understanding of the ecological processes that sustain life on Earth.

The 'modern' era of scientific exploration began in the late 17th century. European scientific societies established journals to publish scientific findings based on careful observation and deduction, which led to the establishment of natural history museums in the northern hemisphere. Because doing science requires significant funding and infrastructure, the ability of many former 'colonies' to study their own fauna and flora depends on scientific expertise and financial assistance from Northern Hemisphere partners. This reality contributes to the 'colonial' image of biodiversity and environmental science in the tropical parts of the world and continues to influence contemporary scientific practice in many developing countries. We will argue that decolonizing biodiversity science means not only encouraging Northern hemisphere institutions holding scientific collections to think more about the context in which these items were acquired, but also about how to develop new partnerships that allow them to continue to make important contributions about the diversity of life in hotspots of biodiversity often located in former 'colonies'.

We use the Congo2010 expedition and the projects designed afterwards to argue that the development of equitable international partnerships, that have become mainstream over the last 10-15 years, will lead to a situation where biodiversity and environmental studies in developing countries will gradually become the responsibility of local scientific institutions.

The Congo2010 initiative established a mixed science and development program, funded by DGD and BELSPO, to develop a long-term partnership between scientific organizations from the northern hemisphere and institutional partners in the DR Congo (the University of Kisangani, the Royal Museum for Central Africa, the Royal Belgian Institute of Natural Sciences, and the Botanic Garden Meise). The five-week long scientific expedition Congo2010 (April-May 2010) was carried out by 67 scientists deployed in mixed teams of Congolese scientists and researchers from the northern hemisphere. The specimen collections, environmental samples, and a variety of other data (*e.g.*, anthropology, linguistics, climate, ...) led to a series of jointly conducted studies strengthening local scientists (*i.e.*, master's and doctoral degrees) and to the publication of a wide range of scientific information. In June 2014, the aforementioned consortium also established the "Centre de surveillance de la biodiversité" (CSB), permitting local scientists to store and curate biological reference collections in better working conditions (research facilities, equipment). Subsequent projects provide targeted training programmes to enhance their expertise to formulate advice, and report on biodiversity and environmental matters for the authorities of DR Congo.

In conclusion, hit and run type of projects that extract specimen and data from tropical biodiverse rich regions should be something of the past. Let us all take our responsibility in this matter!

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#### Paleoenvironment and paleoclimate of the Maastrichtian-Paleocene shelf seas of Patagonia, Argentina

#### Johan VELLEKOOP<sup>1,2\*</sup>

KEYWORDS. — Paleontology; Geochemistry; Paleoenvironment; Cretaceous-Paleogene boundary; Patagonia.
 SUMMARY. — During the late Maastrichtian to early Paleocene, Patagonia (Argentina) was characterized by several shallow shelf seas and embayments, connected to the South Atlantic Ocean. These include the shelf sea of the Neuquén Basin and the embayments such as the San Jorge and Cañadón Asfalto basins. The terrestrial and marine successions in these regions demonstrate the biological upheaval across the Cretaceous-Paleogene (K-Pg) boundary (66 Ma) and record the regional paleoenvironmental and paleoclimatic conditions.

In collaboration with local researchers and institutions, several fieldwork campaigns have provided a wealth stratigraphic, sedimentological, paleontological and geochemical information on these successions. The cooperation with local collaborators occurred though informal partnerships, resulting a series of shared publications. Here, a synthesis of these insights in regional ecology, climate and paleoenvironment in the late Maastrichtian to early Paleocene is provided, linking regional changes to global events across this crucial time interval in Earth history.

Biogeographic connections with lower latitude sites in central America and the Tethys Ocean reveal a counterclockwise oceanic circulation along the southwestern margins of South Atlantic Ocean, providing a warm water influx into the Argentinean shelf seas during the late Maastrichtian to early Paleocene. Geochemical, palynological and paleontological studies indicate a humid-warm climate (mean annual temperatures  $> 20^{\circ}$  C) with pronounced seasonality in northern Patagonia and a temperate climate (mean annual temperatures 10-20° C) in southern Patagonia. The shelf seas in this region show strong responses to global climate changes, including an enhanced hydrological cycle and resulting salinity stratification during global warming events such as the Late Maastrichtian Warming Event (LMWE, ~66.4-66.1 Ma). Nevertheless, the regional ecological impact of the LMWE was less severe than that of the K-Pg boundary Chicxulub impact. In the Paleocene, a combination of Andean uplift and eustatic sea level fall resulted in the gradual retreat and eventual disappearance of the Patagonian shelf seas and embayments, closing a unique window into the past.

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#### Working in and with the North and South: transformative dialogues to decolonize inter-university collaborations

#### Kewan MERTENS<sup>1\*</sup>, Adriana MORENO CELY<sup>2</sup> & Viola N. NYAKATO<sup>3</sup>

KEYWORDS. — Post-colonial Research; Geography; Qualitative Analysis of Dialogues; Reflexivity; Global South.

SUMMARY. — We all do our research with the intention to have a positive influence on the world. Often, what drives us is a concern for justice, equality and sustainability. Sometimes with limited success, or at least, that is what we tell ourselves. Unquestioned neo-colonial habits might lead us to engage in research that is further disempowering, rather than empowering, subordinate people in the Global South. This paper aims at highlighting some of these dynamics.

Through the form of weekly interdisciplinary dialogues, we – a white male geographer from Belgium, a black female sociologist from Uganda, and a female post-colonial researcher from Colombia who lives in Belgium – have confronted our own experiences in research with a post-colonial perspective. By looking at the concrete results and outcomes from our own missions and collaborations in the Global South, we identified problems and pathways to enhance the outcomes from these missions. Our work in the Global South covered a wide range of topics including landslide hazard and disasters, agroecology, territorial planning and reproductive health among young adults. We reflected on the capacity of these missions to stimulate fruitful knowledge creation and long-term partnership between the Global North and South. We recorded, transcribed and analyzed our dialogues in order to identify some recognizable patterns which, in our view, should be questioned and changed. As such, we managed to qualify our work from recent missions with a new layer of measures of value, derived from post-co-lonial literature.

Five stories are narrated and linked to four general patterns which allow us to qualify our field missions and data:

(1) unequal ability to choose,

(2) a predominance of interests of Northern partners,

(3) colonial normativity: entrenched norms and habits, and

(4) a tendency to normalize, deny and legitimize unequal power dynamics.

We also highlight how the dialogues conducted in this research have been enriching for each of us in very different ways. The story narrated in this paper illustrates that the decolonization of scientific practice is a slow and uncomfortable, but much-needed process of transformation. Concrete recommendations are formulated towards the end.

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#### Utilisation d'un SIG pour la caractérisation des paramètres géomorphologiques et hydrologiques des bassins versants de la ville d'Uvira dans la partie Nord-Ouest du lac Tanganyika

#### Mashauri NDABAGA<sup>1\*</sup>, Toussaint MUSHAMALIRWA<sup>2</sup> & Aloïse BITAGIRWA<sup>1</sup>

Mots-clés. - Bassin versant; morphologie; hydrologie et SIG.

Résumé. — Les bassins versants de Kalimabenge, Mulongwe et Kavinvira diffèrent sur quelques paramètres, quoi qu'ils possèdent tous des formes allongées avec des indices de compacité Kc strictement supérieurs à 1 et s'étendent sur une direction principale de l'Ouest vers l'Est. La superficie du bassin versant de la Mulongwe est égale à la somme de deux autres bassins; alors que celui de Kalimabenge est deux fois plus vaste que celui de Kavinvira. Ces bassins présentent des morphologies relativement accidentées, avec des pendes très fortes qui vont de 419 m/Km (Mulongwe) à 478 m/Km (Kalimabenge). Ainsi les trois bassins versants appartiennent à la catégorie de relief très fort. Avec une densité de drainage faible (soit de 0.545 km/km<sup>2</sup>) et un coefficient de torrentialité égale à 3.775 km/km<sup>4</sup>, le bassin versant de la Kavinvira présente dans son ensemble un bassin à formation géologique très perméable donc ne présente pas des caractères morphométriques adaptées à l'écoulement par rapport aux deux autres bassins du Sud. Par contre, on remarque que les bassins versants de Kalimabenge et celui de Mulongwe présentent des fréquences plus ou moins faible, ce qui traduit que leurs réseaux hydrographiques présentent une hiérarchisation moyenne ce qui n'est pas le cas pour le bassin versant de Kavinvira. Ces trois rivières se caractérisent par un lit mobile à profil régulier; elles sont entaillées en aval dans les dépôts fluviatiles et les accumulations sont généralement constituées des éléments grossiers.

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## Culture to culture: bacterial culture of blood transfusion products, a North-South collaboration

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KEYWORDS. — Blood Bank Environment; Microbiology; Infection Prevention; Survey; Democratic Republic of the Congo.

SUMMARY. — **Background**: Bacteria may grow in blood transfusion products but the risk remains under-in-vestigated in low-income countries [1].

**Objective**: The present PhD project assessed the bacterial contamination rates of blood products in the Democratic Republic of the Congo (DRC). Methods: The PhD was set up as a sandwich North-South collaboration embedding a Belgian candidate (abstract's first author) in a research team in Kinshasa. Over the period 2017-2020, she conducted six field visits corresponding to 12 months while integrated in the bacteriology unit of Institut National de Recherche Biomédicale, Kinshasa. The team set up collaborations with the National Program of Blood Transfusion and three sentinel hospitals, drafted and submitted study protocols to the DRC ethical committee and recruited Congolese researchers as co-investigators. In total, they assessed 2,959 blood products by bacterial culture, as well as > 500 samples of blood bank air, surfaces, disinfectants and blood donor's skin. They organized two focus-group discussions and a survey (247 participants) about safe blood bank practices.

**Results**: In a heavily contaminated blood bank environment (harbouring Gram-negative pathogens), product contamination rate remained relatively low (1.4 %) and limited to low-virulent skin and environmental bacteria [2]. Blood bank staff adhered well to transfusion safety standards but lacked understanding of the microbiological principles behind the guidelines. Research findings were diffused via seminars and jointly attended conferences in DRC and Europe. Logistical, administrative and regulatory hurdles were overcome thanks to institutional collaboration and short communication lines between research teams and supervisors. Mutual assets were cultural experiences and competence; teleconference tools were welcomed as valuable adjuncts but could not substitute in person work on site. The PhD project meanwhile has incited a sandwich DRC South-North PhD in infection control.

**Conclusion**: we experienced that integration in a South team was conducive to field studies and promoted mutual exchanges and contextualization of research overseas.

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#### A crash course on molecular biology/biotechnology laboratory skills: a case study on technology transfer from North to South

#### Christopher K. KARIUKI<sup>1,2,3\*</sup>, Steven ODONGO<sup>4</sup>, Serge MUYLDERMANS<sup>1</sup>, Edilbert VAN DRIESSCHE<sup>1</sup>, Sonia BEECKMANS<sup>1</sup> & Geert ANGENON<sup>1</sup>

KEYWORDS. — Biotechnology; Capacity Building; Hands-on Training; Knowledge Exchange; Fourth Industrial Revolution; East Africa.

SUMMARY. — Biotechnology is one of the key Science, Technology, Engineering and Mathematics (STEM) technologies expected to leverage the inclusion of the developing sub-Saharan countries in the fourth industrial revolution (4IR). However, inadequate knowledge and skills limit the practice of biotechnology in this region. While few institutions of higher learning in sub-Saharan Africa can provide basic theoretical knowledge, and as well possess the basic infrastructure for molecular biology and biotechnology, they have inadequate capacity for practical lessons. This results in a critical lack of skills amongst their graduates.

This situation motivated the Interuniversity Program Molecular Biology (IPMB) hands-on training workshops in the following locations within East Africa (Institute of Primate Research, Nairobi, Kenya, Sokoine University for Agriculture, Morogoro, Tanzania and Makerere University, Kampala, Uganda). All the locations selected were assessed to have the basic molecular biology facilities for the training to occur. The training team comprised the authors of the work in addition to select members from the institutions involved. The training course was adapted from a 2-week practical course offered to IPMB First Year Master's students within the department of Bioengineering at Vrije Universiteit Brussels. Funding was provided by the VLIR-UOS Global Minds from the VUB. Despite high application rates, facility limitations only allowed a total of 123 participants (53 Kenyans, 32 Tanzanians and 38 Ugandans), comprising females (n=60) and males (n=63), to be selected and trained. Forty-five of the 123 course participants responded to post-hoc satisfaction surveys. All the respondents were satisfied with the course, testified to have acquired new knowledge and skills and were satisfied with the training facilities to varying degrees. One hundred percent (100 %) of the respondents would recommend the course.

Given the need and interest exhibited for these trainings, we highly recommend that the organization of this type of workshops be continued in order to expand the knowledge and practice of biotechnology in developing countries.

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## Are endemic *Senegalia* spp. (Fabaceae: Mimosoideae) seeds in the arid tropics potential novel food sources for humans? – Ongoing research summary

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KEYWORDS. — Food Security; Biodiversity; Traditional Knowledge; Drought-prone Regions.

SUMMARY. — Future food security is tied to the preservation of food biodiversity and the mitigation of climate change. However, conventional farming practices are associated with food biodiversity loss and severe negative ecological impacts. Furthermore, the 2017 Shenzhen Declaration pointed out that traditional knowledge about plants and nature that supported food security in the past is alarmingly disappearing and there is an urgent calls for actions to document and protect them. For instance, *Senegalia* spp. *sensu stricto* has been identified as a segregate of *Acacia sensu lato* at Vienna International Botanical Congress, 2005. Approximately 217 endemic species thrive in drought-prone regions of Africa, America and Asia, where they can help alleviate food shortages.

This review aimed to inventory edible *Senegalia* seeds and document their food potentials. Google Scholar, Web of Science, JSTOR, CABI abstracts, Kew/SEPASAL, and ResearchGate have been thoroughly consulted using keywords acacia, senegalia, mimosaceae, seed, wild legume, usage, value, food, feed, nutrition, edible, composition, and phytochemistry. It is concluded that *Senegalia* spp. have high seed yield (up to 3 kg/tree/year) and have been sporadically consumed as famine-emergency foods. Although the food use of most *Senegalia* spp. were hardly traced back, *Senegalia macrostachya* and S. *senegal* whole-seed foods are claimed healthy for humans, protecting against imbalanced nutrition, diabetes, gastrointestinal disorders and cardiovascular diseases and have become delicacies in Burkina Faso and Rajasthan (north-western India). The investigation indicates that most *Senegalia* spp. seeds are likely safe for human consumption and in general poor in glycemic carbohydrate but rich in dietary proteins (20-40), fat (1-10) and fibers (10-20) (g /100 g dm). Yet, most *Senegalia* spp. seeds exhibit hard-to-cook defects (*i.e.*, long cooking time and unpalatable seed coat), leading to the need for the development of improved processing options. This research showed that *Senegalia* seeds provide edible biomass that can contribute to food diversification, healthy diets, food security, and biodiversity conservation.

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#### The social-spatial construction of industrial workers' identity in early New China

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KEYWORDS. — Architectural History; Fieldwork Research; Literature Review; Social-spatial Perspective; China.

SUMMARY. — In 1949, the foundation of New China, the Chinese Communist Party rolled out the socialist system towards a nationwide development. Facing the after-war ruins, industrialization was one of the primary tasks for the new regime. In alliance with the Sino-Soviet Treaty of Friendship, Alliance and Mutual Assistance, the Soviet Union aided China to realize 156 key industrial projects (DONG & WU, 2004). Similar to USSR, factories were not only workplace for production, but the embodiment of the new national identity and political system, and thus were also responsible for the livelihood of the workers. The workers' village – as a Chinese adapted model of the Soviet communal housing – became the most unique social and spatial practice in this period. A workers' village is a residential area close to the factory. Constructed according to communist standards, it was a crucial model for the novel community life in synchronization with the ideology of the new state (YANG, 2009; 2017).

This research focuses on workers' village and their living space, and tries to answer three questions: (1) How was the identity of this worker group constructed/molded, and how was the USSR-typology adapted to the new China? (2) From the socio-spatial perspective, how was the living space collectively regulated and institutionalized? By reviewing the history of that period of time, and fieldwork of the workers' housings, several routes of identity construction and social control approaches of the workers' living space surfaced. (3) In the last part, this paper concludes by looking to the present situation of some workers' villages and the residents. What did the workers' identity and their housings experience since the collapse of state-owned enterprises after the China's opening-up policy in 1978?

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#### Quantification and evaluation of the evolution of landscape anthropization in the agglomerations of Southern Katanga from 1979 to 2020

#### <u>Héritier KHOJI MUTEYA</u><sup>1,2\*</sup>, Dieu-Donné N'TAMBWE NGHONDA<sup>1,2</sup>, François MALAISSE<sup>2</sup>, Salomon WASELIN<sup>2,3</sup>, Kouagou Raoul SAMBIÉNI<sup>4</sup>, Jean-François BASTIN<sup>2</sup>, Yannick Useni SIKUZANI<sup>1</sup> & Jan BOGAERT<sup>2,4</sup>

KEYWORDS. — Mining; Urbanization; Dendro-Energy; Miombo; Remote Sensing/GIS.

SUMMARY. — In Southern Katanga (DR Congo), mining activities lead to various anthropogenic effects such as deforestation and unplanned (peri-) urbanization. This study aims to quantify the anthropization of landscapes around the agglomerations of Southern Katanga (Lubumbashi, Likasi, Fungurume and Kolwezi) through the analysis of area evolution, with a view to assessing, in a tropical mining context, the applicability of the natural landscape evolutionary sequence model of BOGAERT et al. (2014), based on natural landscapes being replaced by anthropogenic landscapes, first dominated by agricultural production, then land occupations reflecting urban development. The mapping approach coupled with the landscape analysis revealed that the forest cover that dominated the landscape has lost more than 50 % of its area in 41 years around the settlements of southern Katanga to agricultural and energy production, but also to urbanization. These anthropogenic disturbances of the landscape, amplified between 2000 and 2020, are clearly more significant in the Kolwezi area, which has seen a 69.7 % regression in its natural cover, compared to 62 % for Lubumbashi, 56.7 % for Fungurume and 52.9 % for Likasi. Nevertheless, all these agglomerations are at a stage where patches of land use materializing agriculture and energy exploitation currently dominate the landscape, along with a steadily increasing urban spatial expansion. Our results confirm the suitability of the BOGAERT et al. (2014) model to the tropical context and highlight the urgency of implementing a land-use plan and alternatives regarding the use of charcoal as the main energy source in order to decrease the pressure on natural ecosystems. This study highlights the dynamics of land use in southern Katanga to boost the national policy on natural resources in order to allow present and future generations to benefit from them.

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#### Appropriation and Co-production of Public Space in "Barrios Populares."

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KEYWORDS. — Urban Design; Public Space; Participatory Methods; Co-production; Guayaquil.

SUMMARY. — Current urban conditions of inequalities and fragmentation exacerbate the tensions and contestation about the production of public space in cities worldwide. Informally developed urban areas remain places extreme challenging for developing policies and projects. As urban interventions are still based on conventional space and knowledge production schemes, they tend to overlook local narratives, inhabitants knowledge, and everyday socio-spatial practices. The gap between the idealised spaces and the actual socio-spatial dynamics also manifests in public space design in historically neglected urban areas. Often, there is a mismatch between institutional expectations and the ways inhabitants appropriate designed spaces. Alternative epistemologies considering the local practices and collaboration with local actors are essential to address these challenges.

The cooperation between academia and local actors can constitute an essential platform for steering new collaborative and situated practices. Drawing from an ongoing doctoral investigation and the experience of the project SURLab – a consortium of three universities from Belgium and Ecuador, local communities and local government – the presentation focuses on the relevance and challenges of exploring the appropriation of public space in *barrios populares* in Guayaquil, Ecuador. It argues that academic initiatives like SURLab - based on co-production and participatory design methods- enable the inclusion of diverse local actors' perspectives and promote fruitful interactions. Therefore, it can potentially feed a new landscape of urban research encouraging collective production of knowledge and engagement with the local practices and spaces.



Fig. 1. — Collective Mapping session in Santiaguito Roldós, Guayaquil.

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#### HPTLC guided isolation, identification and characterization of two Iridoids glucosides extracted from root bark of *Vitex madiensis* subsp. *Milanjiensis* (Britten) F.White (Lamiaceae)

<u>Welcome MUYUMBA NONGA</u><sup>1\*</sup>, Amuri Salvius BAKARI<sup>3</sup>, Claudio PALMIERI<sup>2</sup>, Joseph KAHUMBA BYANGA<sup>3</sup>, Jean-Baptiste LUMBU SIMBI<sup>4</sup>, Irène SEMAY<sup>5</sup>, Pascal GERBAUX<sup>5</sup>, Edouard NGOY KIHUYA<sup>1</sup>, Amandine NACHTERGAEL<sup>2</sup> & Pierre DUEZ<sup>2</sup>

KEYWORDS. — Iridoids; HPTLC; Vitex madiensis subsp. milanjiensis; Aucubin; Agnuside.

SUMMARY. — The Lamiaceae family is one of the important sources of iridoids which are considered as chemotaxonomic markers of the genus *Vitex* (Dos SANTOS *et al.* 2001). *Vitex madiensis* subsp. *milanjiensis*, locally known as Mufutu, is used in DR Congo for the treatment of diseases such as anemia, asthma, diabetes and diarrhea (AMURI *et al.* 2017). The aim of the present work was to isolate and characterize iridoids in the methanolic extract of the root bark.

Isolation was performed using flash chromatography (FC) guided by high-performance thin-layer chromatography (HPTLC); structural characterization was based on nuclear magnetic resonance (<sup>1</sup>H and <sup>13</sup>C NMR, <sup>1</sup>H-<sup>1</sup>H COSY, HSQC, HMBC and NOESY) and liquid chromatography coupled with tandem mass spectrometry (LC-MS/MS) (MAHRAN *et al.* 2020). HPTLC was performed using the semi-automated equipment from Camag and FC on the PuriFlash<sup>®</sup>215 from Interchim. The structures of isolated compounds were elucidated as agnuside (1.08 %) (1) and aucubin (3.24 %) (2). These two compounds are iridoid glycosides (figure 1).



Fig 1. — (A et B) HPTLC plate (20 cm×10 cm), silica gel 60 F254. Mobile phase, (A) dichloromethane - methanol (70: 30, v/v); (B) dichloromethane - methanol – 32 % ammonia solution (60: 38: 2, v/v/v); derivatization with a vanillin-sulfuric acid reagent and visualization under white light. Structures of agnuside (1) and aucubin (2).

Given the wide range of biological properties attributed to iridoids (antibacterial, anti-inflammatory), these compounds could explain some of the reported traditional uses of *V. madiensis* subsp. *milanjiensis*.

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#### The double triangle of cooperative ownership

#### Patrick MURHULA CUBAKA<sup>1\*</sup>

KEYWORDS. — Ownership; Cooperative; Members; Formal Ownership; Real Ownership; Psychological Ownership.

SUMMARY. — Members of cooperatives are simultaneously clients and owners (ENJOLRAS 2000). As owners, cooperative members should access to information, participate in decision making, have a share in the profits, etc. (CORNFORTH 2004). However, in financial cooperatives, the mechanisms for accessing members' rights are not well defined and, in the context of developing countries, financial cooperatives' members are less educated and may lack necessary skills to fulfil the owners' duties. Having ownership rights therefore does not make members to be the real owners of cooperatives. This study thus aims to better explore the meaning of ownership in financial cooperatives by conceptualizing this type of ownership through the introduction of the construct of "double triangle of cooperative ownership".

Based on a qualitative approach using the grounded theory method and conducted in the Democratic Republic of Congo, our findings show that ownership is a multidimensional concept with three main dimensions: formal ownership, psychological ownership and real ownership. These dimensions were designed as the first triangle of cooperative ownership. The practice of ownership within each dimension revealed three specific characteristics of cooperative ownership in credit and saving cooperatives (SACCOS): desired ownership, learnt ownership and induced ownership. These features were conceptualised as the second triangle of cooperative ownership. The practice of cooperative ownership thus suggests that SACCOs should leave it up to each member to choose whether or not to become a formal owner. Furthermore, it is up to SACCOs to make members aware of their roles and teach them to behave like real owners. The ownership feelings and the real involvement of members in cooperatives will therefore be a result of the cooperative ownership learning process. Cooperative ownership must thus be analysed under the six facets of ownership classified in two large blocks labelled as "the double triangle of cooperative ownership must thus be analysed under the six facets of ownership classified in two large blocks labelled as "the double triangle of cooperative ownership".

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#### Improving savannah knowledge of the high Katangan plateaus (South-eastern D.R. Congo) through taxonomical studies

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KEYWORDS. — Plant Taxonomy; Savannah Exploration; Local Capacities; Upper-Katanga.

SUMMARY. — Savannahs are important ecosystems for humanity but are also a vital component of tropical ecosystems. Many people depend on it as pasture for their cattle, arable land for crop cultivation, and hunting ground. In south-eastern D.R. Congo, savannahs appear under miombo tree cover, islands like copper-cobalt outcrops, but also and more remarkable on the high plateaus, encompassing the two National Parks (NP) of the region (Kundelungu and Upemba). Except for savannahs occurring on the Katangese copperbelt (KCB), which was subjected to numerous studies since Duvigneaud in the 1950s and recently through the project REMEDLU (2005-2010), other types of savannahs unfortunately have been insufficiently explored. Knowledge on phytogeography and taxonomy is very poor, and so are the evolutionary aspects in relation to ecological conditions. Considering that the KCB occupies an area estimated at  $300 \times 50 \text{ km}^2$ , one can realise how deep the gap in the knowledge of the remaining savannahs from the Upper-Katanga is. This situation is of great concern when considering the pressures that are currently being exerted on these savannahs (agriculture, medicinal plant demand, mining, urbanisation, etc.) in a context of global change. Recently, local interest for these ecosystems has been revived, but it is unfortunately hampered by a real deficit in local capacities. The current facilities of the herbaria of Lubumbashi (LSHI) and Kipopo (KIP) are no longer sufficient to support the improvement of taxonomic knowledge.

The project aims to increase taxonomic knowledge on the biodiversity of the savannahs in the Upper Katanga and to advocate for their conservation. Specifically, the project aims to (a) increase knowledge of plant diversity in savannahs, particularly in the Upemba and Kundelungu NPs, through intensive explorations, ii) enhance human capacities in taxonomy, iii) strengthen the capacities of LSHI and KIP herbaria, and iv) create a Centre for Central African Savannah Research.

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# **Session III**

#### Natural Hazard Risk Assessment in Tropical Africa: Shared Experience in the Western Branch of the East African Rift

#### <u>Benoît SMETS</u><sup>1,2\*</sup>, Olivier DEWITTE<sup>1</sup>, Mohamed LAGHMOUCH<sup>1</sup>, Caroline MICHELLIER<sup>1</sup> & François KERVYN<sup>1</sup>

KEYWORDS. — Natural Hazards; Risk Assessment; Geomatics; Scientific Cooperation; East African Rift. SUMMARY. — In some regions of Africa, the combination of population growth, urban sprawling, human-induced transformation of the land and socio-political instabilities, together with the potential influence of climate change, tends to significantly increase disaster risks related to natural hazards. A better understanding of the underlying natural and anthropogenic processes that lead to these disasters is therefore of uppermost importance. Over the last decades, the Royal Museum for Central Africa (RMCA), together with several partner institutions from Belgium and abroad, has worked to better understand natural hazards of geophysical/hydrological origin and associated vulnerability in Central Africa, with a specific focus on the western branch of the East African Rift. Through scientific research, long-term local partnerships and institutional strengthening by raising capacity building and awareness, the RMCA has contributed to noteworthy improvements in processes understanding, yet providing useful information and tools to various stakeholders. This is illustrated for instance by recent studies that provided key information on landslides and volcanism. Together with a partner institution in Luxembourg, and in partnership with African institutions, the tectonic and volcanic activity of the region can nowadays be more precisely studied and monitored thanks to the development of the first permanent regional seismic and GNSS networks. In collaboration with the concerned civil protections and African scientists, vulnerability assessments have been performed and citizen observer networks have been developed. In order to make the benefits of these actions sustainable, particular attention is paid to the appropriation, by local partner institutions, of the developed tools and methods. Training courses are organized locally and grants are awarded for internships and PhDs in Belgium. This long-term approach will also involve the implementation of a inter-university master's degree in DR Congo and Burundi. This presentation aims to introduce this holistic approach and the challenge of disaster risk reduction in and with Africa.

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#### Crystal-record of the formation of the Earth's crust

#### Olivier NAMUR<sup>1\*</sup>

KEYWORDS. — Volcano; Crystal; Geochemistry; Experiments; Thermodynamics.

SUMMARY. — The Earth's continental and oceanic crusts are mostly formed by accumulation of volcanic products. Understanding crustal formation therefore requires accurate constrain on where and how magma forms in the Earth's interior and migrates towards the surface. The mechanisms of formation and the structure of the deep magmatic crustal units on Earth are however not well understood. We do not yet know where mantle-de-rived magmas chemically change during differentiation in the crust and the timescales of these processes. We also do not accurately know the mineralogy and structure of deep crustal units. However, an extremely useful but poorly appreciated way to decipher the large-scale lithological variability of the crust, the mechanisms of magma differentiation and to estimate mass transfer in the crust is to use crystal fragments commonly brought to the surface during eruptions. They represent pieces of crustal rocks that witnessed deep magmatic processes. They are therefore a unique opportunity to determine the mineralogy and chemistry of frozen parts of subvolcanic magma chambers, inaccessible otherwise.

In this study, we use the crystal record of various active or extinct volcanoes (Azores, Shatsky Rise, Nyiragongo, Nyamulagira, Calbuco) to understand the mechanisms of crust formation in various geodynamic settings: oceanic plumes, continental rifts, subduction zones. We combine high-temperature, low- to high-pressure experiments in laboratory with textural and geochemical analyses of lavas from volcanoes to investigate the deep plumbing systems and magma storage conditions of the volcanoes. Altogether, this project will improve our understanding of the lithological and geochemical variability of the Earth's crust and will add to the current understanding of magma chamber solidification. Our work and especially the field missions is performed in close collaboration with local scientists from the geological survey of the Azores, Sernageomin (Chile), GVO (DR Congo). In DR Congo, our work also contributes to the training of local scientists both in Congo and in Belgium through MSc and PhD theses.

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#### Overseas Scientific Collaborations and their Role for Mirroring Humanitarian Catastrophes

#### Emnet NEGASH<sup>1\*</sup>, Sofie ANNYS<sup>1</sup>, Biadgilgn DEMISSIE<sup>1,3</sup> & Jan NYSSEN<sup>1</sup>

KEYWORDS. — Conflict; Scientific Collaboration; Humanitarian Situation; Tigray; Ethiopia.

SUMMARY. — Conflict has deep historical roots in the horn of Africa, particularly in Ethiopia. Such conflicts often go hand in hand with humanitarian catastrophes including famine and mass-displacement (ANNYS *et al.* 2021). The Tigray region of Ethiopia has experienced such conflict induced catastrophes in the 1984/85 (DECKERS *et al.* 2020), and now again (NYSSEN *et al.* 2021a).

The current conflict has resulted in world's worst humanitarian-catastrophe in a decade. In an attempt to report the humanitarian situation, researchers have partially succeeded bypassing the communication-blackout. This was made possible because of the long-standing collaboration between Flemish Universities and Mekelle University, through which many Ethiopians studied in Belgium and many Belgian researchers did research in Ethiopia.

Besides, during the history of academic collaboration, Belgian researchers showed strong commitment towards communities in Ethiopia, engaging as far as disentangling unnoticed profound agricultural policy biases (NYSSEN *et al.* 2017). This has equipped researchers an opportunity to establish vast field knowledge and community integration enabling field data collection in wartime.

Here, we show how such overseas scientific collaborations were important in mirroring the dire humanitarian situation since the devastating conflict started in November 2020. It has resulted in an internationally recognized atlas documenting the tragic humanitarian situation including 260 massacre incidents, public services interrupted, 2.1 million displaced living in grim conditions, at least 400,000 people in famine conditions, and agricultural production declined by over half further threatening to compound hunger crisis (ANNYS *et al.* 2021; ASFAHA *et al.* 2021; NYSSEN *et al.* 2021a, 2021b, 2021c).

These scientific outputs served as reference points for various UN, EU and US humanitarian and human-rights organizations, and worlds major media-outlets. Hence, overseas scientific collaborations not only responds to research questions, but also serve as a reference-point informing the general public and diplomatic-circles working towards cessation of hostilities and improved humanitarian situation.

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#### Barriers, opportunities and options for developing an exploration programme to better estimate plant diversity in south-eastern DR Congo

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KEYWORDS. — Biodiversity; Assessment; Networking; Haut-Katanga; Lualaba.

SUMMARY. — Scientific explorations carried out during the colonial period are currently the main sources of knowledge on the plant diversity of the DRC. Nevertheless, they were mainly focused on areas of economic interest which are located around the large cities. Because little has been recorded since independence, there is an urgent need to fill the knowledge gap through new explorations. A good example comes from the recent explorations of the ichthyofauna in the Upemba National Park (KATEMO MANDA 2020) with 42 new fish species (six of which have been fully described and published) discovered and new habitats described in five years. The plant diversity to be discovered would be great, especially when considering that the south-east of the DRC is known to be a regional centre of endemism (WHITE 1993). This lack of knowledge concerns the level of vegetation, plant communities and species.

The fieldwork carried out the last decade argues for the setting up and execution of an ambitious exploration programme to better estimate the biodiversity in south-eastern DRC in a context of biodiversity erosion. In our study, the main barriers to exploration have been identified. They mainly concern the lack of interest, and the limited capacities of local research institutions. The opportunities are identified and options for solutions are proposed. These are based on a better mainstreaming of biodiversity in various sectors, a revival of interest in the region's biodiversity and the financial support from the private sector. The development of well-equipped local infrastructure, the training of local experts and the development of an international collaboration network are major prerequisites for the success of future explorations. Some practical recommendations are provided and discussed. They include the use of the funds coming from the biodiversity offsets and the assessments of ecosystem services in protected areas.

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#### Women empowerment quid? Reflection on the definitional and measurement consensus

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KEYWORDS. — Women Empowerment; Definition; Measurement Approach.

SUMMARY. — The transformation of power relations and the empowerment of less privileged social groups has become a major concept in contemporary development discourses (CHESTON & KUHN 2002; CALVÈS 2009); and more specifically, women empowerment is considered a key indication in this research mainstream (CALVÈS 2009).

Despite the relevance of the concept in the current literature, women empowerment suffers from the lack of an unanimous understanding among scholars. Given the definitional diversity and complexity associated with this concept (IBRAHIM & ALKIRE 2007), measuring and tracking levels of women empowerment has raised sound methodological concerns.

According to IBRAHIM & ALKIRE (2007) ambiguity on the way women empowerment is measured need to be clarified. For instance, it is still unclear whether indicators should measure the power women are empowered with or the power women value; should indicators be comparable across contexts and time; should indicators measure women empowerment at the individual, collective or institutional level; should indicators measure collective women empowerment based on individual-level data; should indicators measure the level of women empowerment or the dynamic processes of change; who should measure empowerment, women or third parties, and how to proceed; etc.

In line with what precedes, it is agreed that there still a need for rigorous method to efficiently measure and monitor women empowerment. "In the absence of such measures, it is difficult for any stakeholder to be confident that their efforts to empower women are succeeding" (MALHOTRA *et al.* 2002, p.3). Furthermore, ALI & HATTA (2012 p. 112) argue that "it is even more worrying to trust claims that a given stakeholder is succeeding in empowering women".

Taking a stand in this research mainstream, based on the meta-analysis method, the present paper aims at reflecting on the complex and diversified definitions and measurement methods around the concept of women empowerment and then provide a related consensual definition and measurement methodological approach.

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#### Archaeology of plastics in Galápagos: studying the recent past to inform the future

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KEYWORDS. — Contemporary Archaeology; Citizen Science; Galapagos; Plastic Pollution.

SUMMARY. — Plastics are the material culture crystalizing our obsession for the "here and now" through its disposability and ephemerality (GONZÁLEZ-RUIBAL 2018). Its resilience turns it inevitably in a diagnostic artefact of the Anthropocene found in most archaeological contexts. The impacts of plastic pollution on the environment and on human health are known but we lack informed decisions understanding the issue thoroughly to avoid plastic entering the sea in the first place. We here present how applied contemporary archaeology can contribute to the understanding of plastic pollution and can help implementing solutions.

Our case study focuses on Galapagos, a UNESCO site whose wildlife is unique in the world yet is threatened by plastic pollution with at least 27 vertebrates directly impacted by it (JONES *et al.* 2021). On land and underwater archaeology can both contribute to the understanding of plastic pollution in the Galapagos. The use of archaeological methods will aim at understanding the types, weathering, and occurrence of plastic artefacts on Galapagos shores.

In addition to the use of archaeological techniques to analyse artefacts, the research will benefit from citizen science (CS) data that actively contributes to the monitoring of plastic pollution. The CS project "Garbology" (Basurología in Spanish), in collaboration with the Galapagos Conservation Trust, gathers pictures of plastic objects taken by citizen scientists on Galapagos beaches which are then uploaded and analysed by other citizen scientists answering the following questions: What is it for? What is it made of? Where is it from? How old is it? Who made it? Who used it? Why is it there? This approach does not only focus on material properties as the answers to the last two questions reflect upon the behaviors that led to their arrival into the sea, which can be better understood through theories from behavioral archaeologists such as SCHIFFER (2010) and RATHJE & MURPHY (2001). The scientific results offering a better understanding of origins and causes of plastic pollution through archaeological research and CS will be enhanced in policies limiting plastic pollution and disseminated in knowledge exchange between citizen scientists, policy-makers and researchers.

This presentation is an opportunity to emphasize the relevance of archaeological research to inform decisions that will impact our future. This monitoring identifying plastic sources also provides a necessary step in understanding the extent to which (il)legal fishing activities contribute to plastic pollution in Galapagos and how to limit it, which is revealing as the decision to extend the Galapagos Marine Reserve -where industrial fishing is not allowed- has just been made public during COP26.

By contributing to the understanding of plastic pollution, this multi-disciplinary research will contribute to the 4-year Plastic Free Galapagos programme by exemplifying the efficient inclusion of Citizen Science in archaeological projects. Creating knowledge about plastic pollution through citizen science and archaeology also emphasises the importance of collaborative methods to contribute to the creation of scientific data from overseas countries. Outcomes of the CS and archaeological research will prove the successful exchange of scientific data on plastic pollution in Galapagos and will enable the creation of tailored policies limiting its presence on the shores of the archipelago.

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#### Manufacturing Biodegradable Algae-based plastics in Madagascar through a Triple-Bottom-Line approach

#### Mihary RABEARISON<sup>1\*</sup>

KEYWORDS. — Bioplastics; Algae; Triple Bottom Line; Life Cycle Sustainability Assessment; Social Life Cycle Assessment.

SUMMARY. — The Triple-Bottom-Line (TBL) approach describes how corporations should not only focus on the economic value, but also on the environmental and social values that they add – or destroy (ELKINGTON 1999).

In 2010, despite the fierce global debate over the past three decades about sustainability, 8 million metric tons of plastic waste still went into the ocean (JAMBECK *et al.* 2015). However, it harms marine biodiversity and to some extent declines the normal reproduction level of marine animals, mostly fishes.

For the time being, fishing is still among the main sources of income for coastal communities in Africa. Thus, the need to undertake alternative and environmentally friendly income-generating activities (IGA) is now imperative as their livelihood starts to slump.

In this sense, this research will contribute to enhance literature on triple bottom line approach (economic-social-environment) applied in the field of aquaculture entrepreneurship as well as in bioplastic industries.

In doing so, Carrageenan mainly extracted from Kappaphycus Alvarezï alga mixed with Polybutylene Adipate Terephtalate will give bioplastics expected to degrade faster. The main objective is to create a new sustainable value chain of bioplastics where integrated seaweed farming, carried out by farmers of coastal communities in the South West region of Madagascar, will provide an alternative IGA to fishing. Moreover, valorizing their algae production gets its market out of a monopsony. Afterwards, the final output aims to reduce global downstream plastic waste for the sake of marine biodiversity.

In order to elaborate its business model and to reach an optimum profitability with the best scenarios of formulation, the implementation of the social life cycle assessment method (S-LCA) informs on the potential social and socio-economic impacts of the bioplastic throughout the extraction and processing of raw materials; manufacturing; distribution; use and biodegradation. Furthermore, it emphasizes social issues to be considered among stakeholders (workers, consumers, local community, society, value chain actors). The life cycle assessment method (LCA) informs on the environmental potential impacts of the output (SPIERLING *et al.* 2018) and its contribution to SDGs (SDG9; SDG12, SDG17) and the Carbone capture potential of seaweed farming (COP26 – nature based solutions).

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#### Linte Syenites (Central region Cameroon): mapping, petrography and potential as industrial minerals

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KEYWORDS. — Syenite; Feldspar; Petrography; Beneficiation; Ceramic and Glass Applications.

SUMMARY. — Syenites constitute a natural resource of industrial minerals like feldspar that may contribute to the development of African countries. In this study, we investigate the Ina syenites from the Central Region of Cameroon that constitute a syntectonic and intrusive batholith of 1000 km<sup>2</sup> within the granitic basement (northern batholith of Linté syenites). The grey to dark coloured rocks consists of feldspar phenocrysts within a fine ferromagnesian matrix. The aim of this study is to characterise and evaluate the potential of feldspars as industrial minerals, particularly as a flux product for the ceramic and glass industry. Petrographic analyses were carried out in combination with mineralogical and geochemical analyses. Petrographic analysis, through observation of thin sections, reveals a grainy to grainy porphyroid texture. Large orthoclase crystals have malgachitic texture since ferromagnesian minerals are present in them. Plagioclases are either zoned or show polysynthetic twinning. Most of ferromagnesian minerals are present in the feldspathic matrix. Powder X-ray diffraction patterns reveal the presence of orthoclase, microcline, albite, biotite, quartz, amphiboles and pyroxenes. Chemical analysis by X-ray fluoresence reveals that alongside silica, there is a significant proportion of fluxing agents (K<sub>2</sub>O and Na<sub>2</sub>O). Alumina (Al<sub>2</sub>O<sub>2</sub>), iron (Fe<sub>2</sub>O<sub>2</sub>) and titanium (TiO<sub>2</sub>) oxides are considered noxious for any use in ceramic and glass products. These characterization results allow to refine the pre-treatment method of the material and therefore optimize their recovery. These pre-treatment methods are grinding and enrichment by magnetic separation and flotation. Thermal analysis of the enriched material will be performed at different temperatures (1050, 1100, 1150 and 1200 ° C) to determine the optimum temperature of the appearance of the vitreous phase. In addition to thermal analysis, various tests will be carried out to assess the industrial application of these feldspars.

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#### Gouvernance des ressources forestières par les services publics et les Organisations Non Gouvernementales dans la zone rurale de Lubumbashi (Haut-Katanga, République Démocratique du Congo)

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Mots-clés. — Politique forestière; Forêt claire de miombo; Déforestation; Administration publique; Agence de développement.

Résumé. — La non appropriation par les communautés locales des programmes visant la gestion durable des forêts et la sous-utilisation de leur capacité à contribuer à cette gestion, limitent l'atténuation du processus de déforestation. Cette étude a examiné la gouvernance des ressources forestières par les services publics et les organisations non gouvernementales (ONG) à travers des enquêtes semi-structurées menées à Lubumbashi et dans cinq villages aux alentours.

Les résultats révèlent une faible collaboration entre la communauté locale et les ONG/services publics. Par conséquent, si l'éloignement des forêts et la raréfaction des Produits Forestiers Non Ligneux sont perçus comme les principaux problèmes dans les villages étudiés, les actions des ONG ne portent quelquefois que sur le reboisement alors que les services publics ne se focalisent que sur le recouvrement des taxes. La communauté locale, peu encadrée et qui a une perception mitigée vis-à-vis des actions menées, est rarement associée aux activités des ONG et des services publics, qui peinent à exécuter leurs activités en raison des limitations budgétaires.

#### Tableau 1

Niveau de planification, d'exécution et d'évaluation des activités de gestion de la forêt claire par les Organisations Non Gouvernementales (ONG) et les Services Publics (SP) et fréquence de participation (Fpart) de la communauté locale (CL) aux activités. -: non organisée; ×: rarement organisée; ××: très souvent organisée; \*: très faible; \*\*: faible; -: nul; n: taille d'échantillon d'enquêtés dans la communauté locale (Source: Focus group avec les agents ONG/SP et enquêtes au sein de la CL personnels).

	Planification		Exécution		Evaluation	
Domaines d'intervention	ONG	SP	ONG	SP	ONG	SP
Reboisement	××	×	××	×	××	×
Agriculture durable	×	×	×	×	×	×
Prospection	×	×	×	×	×	×
Recouvrement des taxes	-	×	-	××	-	××
Gestion et Exploitation des forêts	×	×	×	×	×	×
Contrôle Forestier	-	×	-	×	-	×
Participation de la CL aux activités						
F <sub>part</sub> (% ; n =150)	25,5	4,4	27,5	1,5	15,7	0

Il importe d'améliorer la gouvernance de la forêt claire à travers un encadrement et une intégration des communautés locales.

Ces recherches s'ajoutent sur les connaissances existantes et contribuant à l'amélioration des connaissances relatives à l'exploitation durable des forêts claires du miombo aujourd'hui surexploitée pour le bois énergie.

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#### Mangrove ecosystem services in Northern Sri Lanka: building on community perceptions for mangrove conservation

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KEYWORDS. — Mangroves; Social-Ecological-Systems; Questionnaire Surveys; Community-Based Management; Northern Indian Ocean.

SUMMARY. — Mangrove forests provide key ecological processes which support the livelihoods of local communities and beyond, through the provision of a diverse set of ecosystem goods and services (DAHDOUH-GUEBAS *et al.* 2021).

In recent years, mangroves in Northern Sri Lanka have been exposed to increasing anthropogenic stressors that led to their degradation (KARUNATHILAKE 2003). Additionally, three decades of civil war and a destructive tsunami in 2004 contributed to worsen the state of the mangrove forest, and threaten the livelihood of the communities living in proximity of this ecosystem (DAHDOUH-GUEBAS *et al.* 2021). With this study, we investigated the most important mangrove goods and services that local communities benefit from, and derived possible mangrove forest management solutions.

We collected data from: (*i*) a stakeholder questionnaire, to investigate the well-being of the population, which include social, material and health concerns (WHITE 2010); (*ii*) an ethnobiological survey, to assess the mangrove forest's goods and services used by the local population and their perception of the mangrove forest.

We found that the degree of dependence of the local population to the mangrove ecosystem varies among the respondents, with a majority placing high importance on wood consumption and fish nursery. Moreover, the local communities have a general positive perception of the mangrove ecosystem, especially related to coastal protection and tourism attraction; they expressed willingness to be involved in conservation projects but also showed a low understanding of regulations and legal enforcement. Therefore, we investigated the roles of authorities in mangrove management and conservation on the Jaffna peninsula. A Delphi survey (to identify expert opinions) and a Q methodology (to map perceptions) are currently being performed in the area. These data combined with bibliography will allow us to gain deeper insights of the local mangrove social-ecological system, and to lay the basis for collaborative, multi-actor conservation initiatives.

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#### The new World-Class Tizert deposit (Anti-Atlas, Morocco): future supply for copper in Europe?

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KEYWORDS. — Acid Neutralization; Geology; Oxidation; Supergene Ores; Weathering.

SUMMARY. — Since the 2000s, the increasing request for metals in new technologies restarted the interest in new ore deposits. In this context, exploration of supergene ores has been carried out in many countries, including Morocco. Supergene deposits form near the surface of the Earth, associated to oxidizing conditions and meteoric fluids, as a result of modifications of hypogene ores (primary sulfides), which are only stable under reducing conditions at shallow depth. This study, in collaboration with the Managem Group (Morocco), aims to complete our knowledge of the mineralization, initiated by OUMMOUCH *et al.* (2017), in order to start the exploitation of the deposit.

The giant Cu Tizert deposit is considered as the largest copper deposit in the western Anti-Atlas and resources are estimated to 57 Mt @ 1.03 % Cu and 23g/t Ag (OUMMOUCH *et al.* 2017). The deposit is characterized by Cu mineralization mainly carried by malachite, chalcocite, covellite, bornite and chalcopyrite; azurite is not observed. The host rocks are mostly limestones/dolomites (Lower Limestone/Tamjout Dolomite Formation) and sandstones/siltstones (Basal Series) of the Ediacaran/Cambrian transition (540 Ma). The secondary/supergene enrichment is most likely related to episodes of uplift/doming (last event took place since 30 Ma) which triggered the exhumation of the primary/hypogene mineralization (chalcopyrite, pyrite, galena, bornite I and chalcocite I) generating their oxidation and the release of acidic fluids ( $H_2SO_4$ ) and of Cu ions. The precipitation of secondary sulfides, carbonates and Fe-oxyhydroxides was only possible by partial or total neutralization of this acidic fluids. Tizert is characterized by an abundance of Cu carbonates (saprolite or "green oxide zone") because of the rapid neutralization of acidic meteoric water by the carbonate host rocks (mostly Tamjout Dolomite Formation) and chlorite in the sandstones/siltstones of the Basal Series. Secondary sulfides (cementation zone) such as covellite, chalcocite II and bornite II are much less present as they require lower pH and more reducing conditions.

Overall, the mineralization is relatively homogeneous in the entire deposit (*i.e.* the malachite present in the "green oxide zone"), which could be a major advantage for potential mining, compete with other world-class Cu deposits and supply some copper to Europe.

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### INDEX

#### В

В		MERHULA CUBAKA, Patrick	33
BOERMAN, Sophie	15	MERTENS, Kewan MUVUMBA NONGA Welcome	25 31
BOUAAMRI, Asmaa	12		51
D		Ν	
DABALÀ Alvise	17	NAMUR, Olivier	37
DEPECKER Ionas	10	NDABAGA, Mashauri	24
DEVILLET Ghéreint	18	NEGASH, Emnet	38
DRABO Moustanha Soungalo	27	NGOY SHUTCHA, Mylor	39
DRADO, Moustaplia Souligato	21	NJIMBOUOMBOUO MOULIOM, Soualiou	43
F		N'TAMBWE NGHONDA, Dieu-donné	44
		NZANZU, Y'Ise Kivalya	40
FRANKL Amaury	11	Р	
Н		DEDUZZO Sofia	15
UENDDICKY CL	0	POOT Julian	45
HENDRICKA, Stan	9	DD AET Estalla	40
HEROES, Anne-Sophie	25	I KALI, Estene	41
Ι		R	
ILUNGA WA ILUNGA, Edouard	34	RABEARISON, Mihary	42
		RAICK, Xavier	16
K		G	
KADIIIKI Christopher K	26	8	
KHOII MUTEVA Héritier	20	SMETS Benoît	36
KIDANE ASMAMAW Desale	10		50
RIDANE ASMAMAW, Desale	17	V	
L		VELLEKOOD Johan	22
LEMIENDE ALC. 1	12	VEDHEVEN Erik	22
LEMIERRE, Alfred	13	VERHETEN, EIK	21
Μ		Z	
MEERTS. Pierre	14	ZHANG, Yiping	28
MÉNDEZ ABAD, Xavier	30		
· · · · · · · · · · · · · · · · · · ·			

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