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ORAL PRESENTATIONS

Geochemistry, Petrogenesis and tectonic setting of Mesoarchean mafic and felsic magmatic rocks in the “Sangmelima granite-greenstone belt”, Ntem Complex (South Cameroon)

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KEYWORDS. — TTG; Zircon U–Pb ages; Subduction-related zone.

SUMMARY. — Systematic studies of the magmatic record of mantle and crustal origin in Archean granite-greenstone terranes is crucial for understanding the petrogenetic and geotectonic processes that generated the early continental crust, mainly composed of TTG (tonalite-thronjmeite-granodiorite) lithologies. New LA-ICP-MS U-Pb zircon ages combined to a geochemical study have been obtained on Mesoarchean mafic and felsic rocks from the Sangmelima, in the northern part of the Archean Ntem Complex, South Cameroon. Zircon U-Pb dating for the TTG gneisses indicates protolith emplacement around 3155 ± 32 Ma, evidencing an early Mesoarchean magmatic activity that includes TTG plutonism in the Ntem Complex. The potassic granites were emplaced at $\sim 2752 \pm 61$ Ma and $\sim 2722 \pm 2$ Ma. Those lithologies are crosscut by gabbro-norite and dolerite dykes that are tholeiitic in composition. However, the doleritic dykes are more enriched in both compatible and incompatible elements and have higher $(La/Yb)_N$ ratios than the gabbro-norite. Both exhibit low Nb–Ta values, likely indicative of crustal contamination. In contrast, charnockites and TTG rocks are calc-alkaline, with strong LREE enrichment and HREE depletion, similar geochemical features comparable to those of Cordilleran-type granitoids which formed in magmatic arcs, suggesting that they were derived from partial melting of mafic to intermediate igneous rocks that might have been thickened in a “hot subduction” process or the root of an oceanic plateau. They show negative Nb and Ta, but positive Zr and Hf anomalies, suggesting melting of a deep source with rutile eclogite and garnet amphibolite \pm plagioclase in the residue. The high-K granite has high SiO_2 (> 68 wt. %), and $K_2O + Na_2O$ (8.04–9.78 wt.%) contents and is enriched in LREE. These geochemical characteristics suggest an origin from partial melting of the older TTG gneisses, possibly in an extensional setting. Based on the occurrence and difference in composition of the mafic and felsic igneous rocks, it is suggested that the Ntem Complex was produced in a Mesoarchean subduction-related zone. Melting was possibly triggered by the upwelling of asthenospheric mantle resulting from the rollback of the subducted oceanic lithosphere. At ~ 2752 – 2500 Ma, the tectonic environment changed from compression to extension, related to the emplacement of the dykes.

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Impacts of the hydropower-controlled Tana-Beles interbasin water transfer on downstream rural livelihoods (northwest Ethiopia)

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KEYWORDS. — Hydroelectricity; River pattern adjustments; Commercial farms; Development induced displacement and resettlement; Livelihood strategies.

SUMMARY. — Despite public awareness of unintended impacts (1980s) and well-developed international standards (2000s), downstream impacts of large hydropower projects still very often are not properly assessed. Impacts of (hydropower-regulated) interbasin water transfers (IBWTs) are considered self-evidently positive, although they can have far-reaching consequences for hydrogeomorphological systems and consequently river-dependent communities. In this study, the downstream direct and indirect impacts of the Ethiopian Tana-Beles hydropower-regulated IBWT are evaluated in an interdisciplinary way. The components of the framework of rural livelihoods (Scoones, 2009) are considered and changing contexts, resources' availabilities and livelihood strategies are analysed. Mixed methods are applied, combining hydrogeomorphological field observations, GIS analyses, scientific literature, policy documents, and semi-structured interviews with local people and local to federal Authorities. Results show that the IBWT drastically increased the Beles river's discharge (+ 92 m³ s⁻¹; *2 in rainy season and *12 in dry season 100 km downstream of the water release) and introduced dangerous situations for local communities (over 250 people drowned in the river). River bank erosion resulted in the uncompensated loss of farmland (163 ha) and the establishment of largescale commercial farms increased the pressure on land and led to the impoverishment of displaced communities (4310 households). The project was implemented top-down, without any transparency, benefit sharing or compensation for external costs. This stresses the importance of downstream interdisciplinary impact assessments and highlights the need for decent in-depth ex post-analyses of hydropower projects. Environmental impact assessments should be taken seriously and cannot be considered a formality. In Ethiopia and in many developing countries, the hydropower industry is booming. Although dams and IBWTs can be the best solution for water-related problems in specific contexts, national development goals should not be at the expense of rural livelihoods.

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Functional diversity of associated fishes with the Peruvian anchovy (*Engraulis ringens*) during “El Niño costero” in 2017

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KEYWORDS — Functional traits; Humboldt Current System; Pelagic fisheries.

SUMMARY — Peruvian anchovy, *Engraulis ringens*, is the most important fishery resource of Peru (Ministerio de la Producción, 2015) and the integrated assessment of the biodiversity of associated fishes to this resource, with an ecosystem approach, is crucial for the sustainability of this fishery (FAO, 1997). The assessment of functional diversity; by describing functional traits, functional groups and calculating indexes allows us to assess the biodiversity in an integrated analysis. It also gives us the possibility to know the functionality of the species in the ecosystem (Chapin III et al. 2000, Martin-Lopez et al. 2007). The aim of this research is assessing the functional diversity of the associated pelagic fish's community with the Peruvian anchovy (*E. ringens*) along the Peruvian coast. The fishes were collected during the phenomenon called “El Niño Costero” – the third most intense over the past hundred years in Peru (Comisión multisectorial encargada del estudio nacional del fenómeno "El Niño" (ENFEN), 2017).

2198 individuals belonging to 53 species were analyzed. They were grouped into 11 functional groups, which were established based on the similarity of 15 selected functional traits, which are related to functional characteristics as food type and morphological characteristics. The type of teeth, which is one amongst the morphological characters, was observed and photographed under the microscope. Some functional traits were according to the type of life history, such as a type of reproductive strategy and type of migration. The Rao index was calculated for the first time in Peru with the FDiversity program: divergence, fairness, and functional richness. The values obtained did not show significant differences between north-center and south regions. Furthermore, the taxonomic diversity indexes (Margalef, Pielou, Shannon-Wiener and Simpson indexes) calculated by PRIMER v6, also did not show significant differences along the Peruvian coast. Two individuals of the species, *Lagocephalus lagocephalus*, were found at the north (-9.2236°S, -79.4678°W) and at the center (-11.8272°S, -78.0138°W) of the Peruvian coast, out of its normal distribution (from California to Galapagos islands) (Fischer et al., 1995). This tropical species was not registered before for Peru and shows us the influence of “El Niño Costero” on the distribution of marine species.

This research is the first specific analysis with an exhaustive identification up to the species level of the associated fishes of the Peruvian anchovy fishery. It is also the first analysis of functional diversity in the marine environment and especially the associated fishes of a fishery, through the analysis of functional groups and the calculation of functional diversity indexes. The results provide detailed characteristics to identify easily and to group the fish species into functional groups in future evaluation of the *E. ringens* fishery. In this way, the results of the present research and the future ones will contribute to identify possible change in the species composition and how this can influence the ecological features distinctive of the Humboldt Current System.

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In the trail of spurious lineages: Antenor Firmin and the emergence of an anthropological anti-racist Afro-Caribbean thought

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KEYWORDS. — History of anthropology; Counterhegemonic narratives; Anthropologies of the South.

SUMMARY. — For the Haitian anthropologist Michel-Rolph-Trouillot (2003), anthropology offers access to alternative visions to the standard of humanity that places economic growth as the supreme value, responsabilizing us for assuming that this humanity from which anthropology itself tells its history is not the most respectful of the planet, neither the most precise or the most practical, nor the most beautiful, nor even the most optimistic.

Taking this epistemological attitude seriously implies that anthropology rethinks and re-designs its curricula, its guidelines, requiring the suppression of a colonialist logic, which captures the production of knowledge (Césaire, 1950).

Defending an anthropology implicated in the world (as opposed to applied to), as an ontological commitment of that, Tim Ingold (2014) defines the discipline as a practice of education, which transforms the person of the anthropologist and shapes the anthropology that he/she does.

What happens when the anthropologists come from those groups that used to be "anthropological subjects"? It is proposed here an alternative composition of the theoretical-ethnographic frameworks of anthropology, outlining a narrative in which Afro-Caribbean - especially Haitian - anthropologists, such as Antenor Firmin, Jean Price-Mars, Jacques Romain, engage, in direct dialogue with canonical authors such as Alfred Métraux and Melville Herskovits, in debates dear to the development of discipline, subverting its garden of Eden by the introduction of spurious lineages (Haraway, 1991).

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Evaluation of mangroves as a sink for mercury at Matang Mangrove Forest Reserve, Malaysia

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KEYWORDS. — Mercury pollution; Mangrove forest; Charcoal; Rhizophora; Mollusks.

SUMMARY. — Mercury (Hg) is one of the most hazardous heavy metals due to its toxicity, high mobility and long persistence in the environment (Pirrone et al., 2010). At Matang Mangrove Forest Reserve (MMFR) the impact of charcoal industries, along with increased human activities in the vicinity are believed to raise the pollution and importantly, the Hg presence to risk both environment and humans. The limitations such as no regular monitoring on pollution and very few scientific studies on Hg at MMFR makes the present study highly relevant.

Samples collected from ten sites in June and July 2018 included: leaves (four stages – young, mature, senescent and decomposing), bark and roots of the dominant species *Rhizophora apiculata* (Blume) for up- and midstream sampling sites, and of *Rhizophora mucronata* (Lamk.) for two downstream locations; sediments from both the river bank and the inside of the forest; gastropods of the species *Cassidula aurisfelis* (Bruguere) and cockles of the species *Anadara granosa* (Lamk.). Sample preparation was done by freeze-drying and grinding the samples to fine powder with mortar and pestle. The concentration of Hg in each sample was detected using a mercury analyzer MA3000 (Nippon Instruments Corporation, Japan). All the results presented are unpublished as the interpretation of the results is still in progress.

Among the plant tissues, Hg was found mostly in the leaves, indicating a major influence of atmospheric deposition. The concentration of Hg in other plant tissues (*i.e.* bark and roots) was close to zero or under the detection limit of the mercury analyzer. Mercury within the four types of leaves was in the order of decomposing leaves > senescent leaves > mature leaves > young leaves.

Calculation of the geo-accumulation index from sediment data shows that all sites can be considered as unpolluted, indicating that there is little to no impact on Hg pollution from the human activities upstream. Thus, our results show that the management of the MMFR for charcoal production is not positively influencing Hg increase in the environment.

Cockles had Hg concentration below the permissible limit for seafood equal to 0.5 mg/Kg on fresh weight basis (EC regulation no. 466/2001), thus indicating a safe consumption for the local people.

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Valorisation of soils from Kinshasa and Kongo Central regions (Democratic Republic of Congo) for raw earth bricks

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KEYWORDS. — Soil deposits; Compressed Earth Blocks; Stabilization.

SUMMARY. — Soil is a building material widely used in Kinshasa and Kongo Central regions. Its exploitation is generally artisanal. Soils extracted are largely used for the manufacture of wood-fired bricks, with consequent deforestation problems (Mango-Itulamy, 2015). In order to limit the production energy cost and to produce a sustainable building material, the use of raw earth bricks seems to be a solution. Six areas containing important soil deposits have been selected: Kinshasa, Mbanza Ngungu, Kasangulu, Nkamba, Kwilu Ngongo, and Lukala. Soils of these 6 zones were sampled and used to make raw earth bricks.

Field missions consisted in prospecting for soil deposits and representative sampling. Laboratory analyses covered the characterization of soils samples by particle size distribution, plasticity, and mineralogy. The next step was the production of Compressed Earth Bricks (CEBs) which were characterized by their mechanical and hygrometric properties. All these tests were done in the Geotechnology Laboratory and in the Argiles, Géochimie et environnements sédimentaires Laboratory of the University of Liège. An improvement in compressive strength and durability (resistance over time) is obtained with the addition of sand, bagasse and sand-cement. The treatment with 7.5% bagasse results in a satisfactory dry strength, however, the resistance after 6 cycles of wetting-drying is altered by 25%. The treatment with 50% sand and 6% cement gives also a satisfactory dry strength. The resistance decreases by 2% after 6 cycles of wetting-drying, and thus remains higher than in the other mixtures.

Raw earth bricks are an alternative solution to the housing problem in the Kinshasa and Kongo Central regions. However, projects of sensitization must be carried out with local populations which continue to consider the raw earth as "material of the poor man" and do not yet consider the use of raw earth bricks.

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Navigating unsteady flows: 'blood work' and transnational partnerships in Kikwit's health sector

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KEYWORDS. — Medical anthropology; DR Congo; Blood transfusion; Ebola; Global health.

SUMMARY. — Blood is a life-giving force whose flow is often critical in Kikwit, DR Congo, a secondary city of more than 1.2 million inhabitants situated in the interior of the vast country. A constant demand for transfusions exists, yet benevolent donors are scarce and blood banks face not only supply shortages but also infrastructural precarity that jeopardizes the safekeeping of their stock. Kikwit lacks basic infrastructure (e.g. fixed line electricity or water), but features a high density of medical technologies, in part due to more than a century of (international) medical and techno-scientific intervention dating back to early 20th-century sleeping sickness control programs.

Against the backdrop of the town's severe 1995 Ebola outbreak and its legacy (Kibari N'sanga & Mulala, 2011), blood flows hold particularly important material and symbolic weight in the city. A central actor facilitating these flows is the provincial centre for blood transfusion, CPTS (*Centre Provincial de Transfusion Sanguine*). Their 'blood work' takes them well beyond the laboratory to many sites across the city, from Evangelical churches for post-Mass blood donation drives, to clinics and hospital operating theatres for urgent transfusions. CPTS faces numerous barriers in ensuring the availability and accessibility of blood for those in need, as they struggle with high demand, significant resource constraints, and suspicion or fear of their work.

By tracing some of the flows of both blood itself and of related medical technologies—along with the frictions or blockages that arise in 'blood work' in Kikwit—this paper explores the material and symbolic particularities of these circulations throughout the city and its spaces of care. It also discusses the transfusion of (foreign) biomedical technologies and expertise into the local health system, given the deep involvement and ongoing importance of transnational partnerships in the material provisioning of both CPTS and the region's health facilities, as elsewhere in Africa (Dilger, Kane, & Langwick, 2012; Geissler, 2015).

Based on 14 months of anthropological fieldwork in Kikwit, including participant observation, apprenticeship, and interviews with patients, health workers, NGO staff, technicians, spiritual leaders, community members, and non-biomedical healers, this paper speaks to the broader ambiguities and contingencies involved in the transfer of medical technologies and the networks through which they flow. In exploring the implications and dynamics of the often turbulent and unsteady flow of these resources, it offers ethnographic insight into how local actors cope with their dependence on flows that lack continuity, and how they strategically search for new flows to tap into when existing circulatory systems are impeded or run dry. Ultimately, it argues that in a context of uncertainty and the absence of a stable and responsive state, transnational partnerships have the potential to transform healthcare at the local level, but also produce considerable ambivalence, anxiety, and new aspirations for those who must negotiate these highly uneven relationships and unsteady flows of resources.

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Silurian Succession from North Africa (Algeria) – A Review for a New Era of Hydrocarbon Exploration

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KEYWORDS. — Tassili n'Ajjer plateau; Black shales; Clay minerals; Thermal history.

SUMMARY. — The diagenetic grade and thermal history of the widespread graptolitic Silurian Oued Imihrou black shales (Llandoveryan in age) and the overlying sandstone levels of the Atafaitafa Formation (late Llandoveryan to Wenlockian) from the Tassili n'Ajjer plateau have been investigated by integrating a variety datasets, such as illite crystallinity, graptolite-derived organic matter reflectance, source-rock maturity and illite K–Ar ages. Combination of X-ray diffraction and petrographic examinations allowed to confirm the occurrence of three distinct minerals of authigenic origin, i.e. kaolinite, illite and ferroan chlorite, within the Silurian succession. These clay minerals, as well as pyrite and quartz overgrowths were neofomed at different times during diagenetic-to-hydrothermal conditions and conversion-precipitation reactions. Furthermore, formation processes of these minerals are found to be broadly controlled by the stratigraphical level, lithology of the host rocks and the paleogeographical location of the studied outcrop sections from the eastern- and western-Tassili n'Ajjer plateau (Djouder et al., 2018).

The illite crystallinity (i.e. Crystallinity index standards or CIS-calibrated *IC* values range between 1.58 to 0.38 $\Delta^{\circ}2\theta$), paleotemperature estimates (~113–190°C) and graptolite reflectance (vitrinite reflectance equivalent, 0.65–1.5% VR_{eqv}) correspond to low grade diagenesis/anchi-metamorphic illite crystallization conditions and to the oil-to-wet gas hydrocarbon generation zone. A paleothermal gradient towards the west is clearly present. This higher thermal maturity of the most western part of the Tassili ($T_{max}=466\text{--}483^{\circ}\text{C}$) is intimately linked to the migration of hot fluids, notably along N-S lineaments mega-shear zones in the Hoggar Shield. The latter were repeatedly reactivated during the Phanerozoic orogenies and rifting phases.

K–Ar dating results on at least two generations of authigenic, micrometric illite-type crystals document periods of fluid flow and, therefore, allow to reconstruct the timing of the fault reactivations within the Tassili n'Ajjer plateau at the northern Hoggar Shield. Illite ages of about 335 ± 8 Ma indicate an epithermal event, which corresponds to the timing of the early Hercynian tectono-thermal activity in the region, probably accompanied by the first hydrocarbon generation (i.e. Carboniferous age 'Visean'). In contrast, illite ages at 238 ± 11 Ma (Mid-Upper Triassic) and at 204 ± 6 to 179 ± 4 Ma (Early Jurassic) can be attributed to high temperature fluid flow and kerogen maturation of the Oued Imihrou black shales, following Tethys rifting and the later opening of the Central Atlantic Magmatic Province, respectively.

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Economic comparison of sustainable alternative fuel technologies for green shipping

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KEYWORDS. — Alternative fuels; LNG propulsion; Scrubber system; Marine diesel oil; ECA zones; Maritime cost; Chain cost.

SUMMARY. — International maritime shipping is affected by new legislations from IMO during the last years in order to reduce the pollutions such as sulphur oxides and nitrogen oxides globally and within Emission Control Area (ECA) zones strictly (Trozzi, 2010; McGill et al., 2015). In order to respect the regulations, several alternative fuel options are available such as Liquefied Natural Gas (LNG), Compact Natural Gas (CNG), Marine Diesel Oil (MDO), Liquefied Petroleum Gas (LPG) and etc. and some technologies such as scrubber systems. (Aronietis et al., 2014; McGill et al., 2015; Stevens et al., 2015; Žaglinskis et al., 2018). In this research, among all the solutions, marine diesel oil, LNG propulsion, and scrubber system technology are considered and examined economically through two main research objectives; ‘evaluation of total maritime cost from shipowner point of view’ and ‘evaluation of generalized chain cost’. To do so, ‘TPR Chain Cost Model’ developed by the University of Antwerp is applied that includes both maritime, port and land transport costs. In the model, the total cost is assessed by considering different engine types and by making changes with respect to the engines by scrubbers that are installed for specific chains, operational as well as including external. In addition, generalized chain cost is calculated from a selected point of origin in the US and Europe, via a predefined container loop to a destination point in China. Moreover, various routes through various ports on both the US and European sides are simulated, including the use of various ship types with different engine types which allow using different fuels in ECA zones and out of ECA zones. The calculations allow deriving the best economic solutions for specific routes, from an operational point of view. The results display the importance of fuel price on the final conclusion. The outcomes of this research are valuable for shipping companies, shippers, freight forwarders, etc. as well as for governments that have to devise and implement policies.

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Sewage-derived resort runoff threatens coral reefs? A pilot isotopic assessment of nitrogen at Pulau Redang, Malaysia

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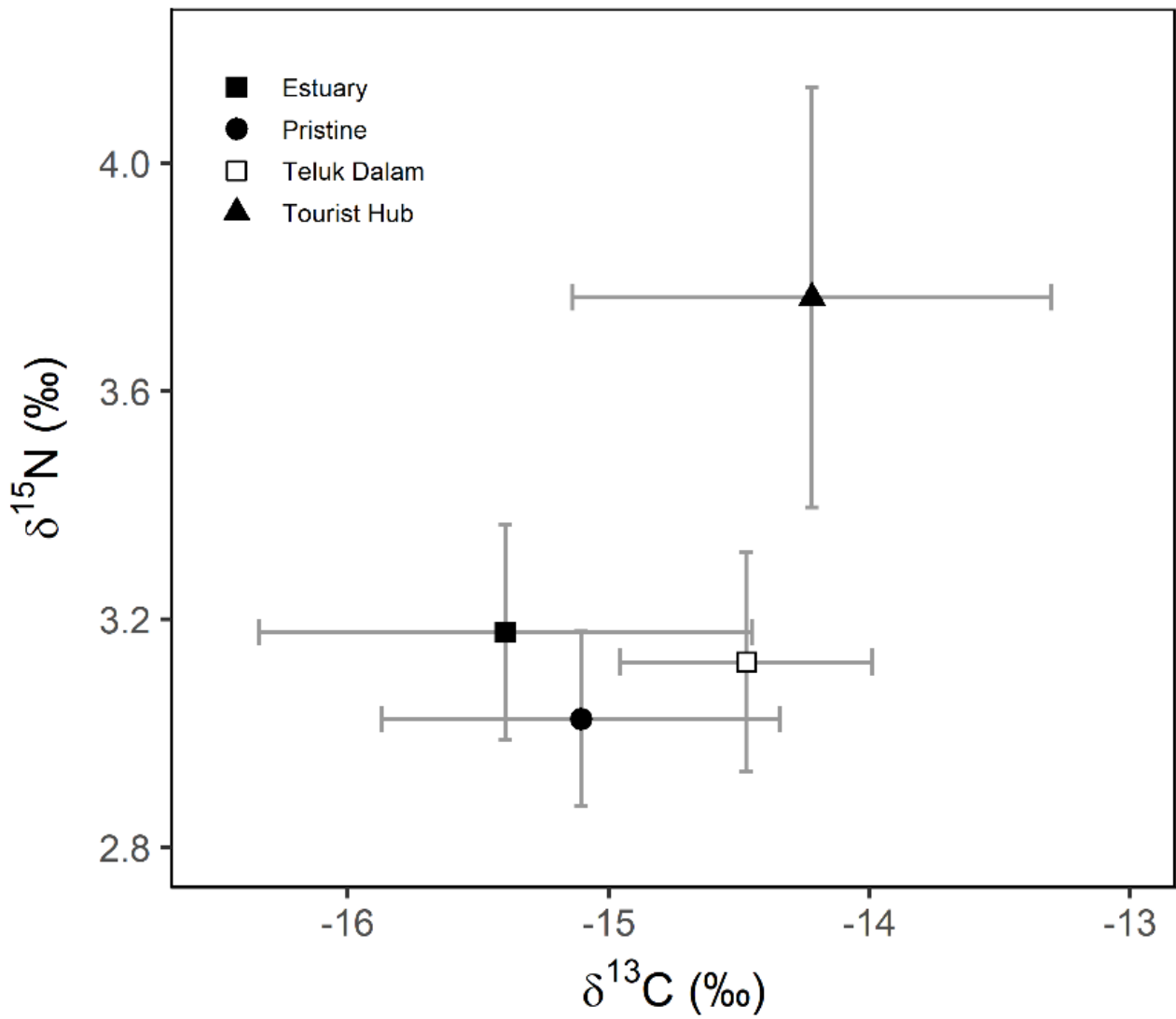
KEYWORDS. — Marine parks; Resilience; Tourism development; Diversity; Water quality.

SUMMARY. — In the Anthropocene coral reefs are threatened by a host of global and local stressors. In the past two decades development of island tourism at Pulau Redang, Peninsular Malaysia, has increased the annual number of visitors by an order of magnitude, from 22,725 visitors in 1995 to 184,043 visitors in 2017 (Data Source: Department of Marine Parks Terengganu, 2017). Sewage-derived nutrient enrichment has emerged as a potential ecosystem scale threat to coral reefs around this island (1). Here, the spatial extent of sewage-derived nutrient sources across Redang is assessed using stable isotopic techniques to measure $\delta^{15}\text{N}$ in competitive macroalgae (*Lobophora* spp.), corallivorous gastropods (*Drupella* spp.), and branching corals (*Acropora* spp.), representing nutrient uptake over multiple temporal scales (2). Combining $\delta^{15}\text{N}$ with conventional benthic reef monitoring data, we then test the relationship between $\delta^{15}\text{N}$ and coral reef community composition with a multivariate approach on all 55 benthic cover types, and a univariate approach on community structure indices and major benthic group coverage. We show that *Acropora* has the best potential as a bioindicator of pollution at Redang. Significantly higher enrichment of *Acropora* $\delta^{15}\text{N}$ was identified in the tourist hub on the east coast ($3.85\text{‰} \pm 0.18\text{ SE}$), where septic tanks and eutrophic waste-water outflows are potential nutrient sources, compared to pristine reefs on the uninhabited northern and western sides ($3.02\text{‰} \pm 0.04\text{ SE}$). Regional *Acropora* $\delta^{15}\text{N}$ was significantly correlated to regional variance of cover type richness, Shannon diversity index, and Simpson dominance index; coexistence of coral-dominated reefs alongside degraded zoanthid barrens was only found in the tourist hub region. In Terengganu there is a need for better cooperation between state and marine park Authorities to ensure that tourism-derived nutrient enrichment does not cause reef degradation. Determining the ecological impact caused by nutrient enrichment is an important first step in the long-term sustainable development of tourism on the now-booming Terengganu islands.

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The relationship between $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ of *Acropora* from each geographical area. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ are expressed as mean \pm standard deviation of each geographical area.

Albian-Cenomanian exhumation of the southwest Amazonian Craton, Colombia

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& Johan DE GRAVE¹

KEYWORDS. — Tectonics; Thermal history; Apatite Fission Track dating; Intracontinental deformation.

SUMMARY. — Samples from the Rio Negro-Juruena tectonic province located in east Colombia are analysed for LA-ICP-MS based apatite fission track – U/Pb double-dating. Low temperature thermochronological research is scarce in east Colombia, due to the poor accessibility of the Amazonia basin, and is limited to the Cordilleran mountain belts. Apatite U-Pb ages from our study area indicate cooling below 300-500°C caused by possible regional metamorphism during the Mesoproterozoic (~1.4 Ga) and agree with the model proposed by Cordani *et al.* (2016).

The apatite fission track pooled ages are Mesozoic in age and concentrate around the Cenomanian – Albian. Mean track lengths ranging from 10.4 to 13.1 µm indicate different cooling histories and clearly displays an increase in mean track length for the samples of Albian-Cenomanian AFT age. This means that basement cooling between the 60°-120°C isotherm was gradually increasing from the early Cretaceous to the end of the early Cretaceous (Albian). An Albian-Cenomanian unconformity has been described in the sedimentary basins of NW South America (Jaimes and de Freitas, 2006), however, scarce evidence of this tectonic event is found in the Cordilleran mountains, due to overprinting of Cenozoic events related to Andean mountain building phases. The Albian-Cenomanian cooling of basement rocks has been overlooked by researchers (Jaimes and de Freitas, 2006) and most likely misinterpreted as partially reset zircon fission track ages (Amaya *et al.*, 2017). Late Albian uplift of around 3.5 km is also found in the Precambrian Garzon Massif in the Eastern Cordilleran mountains (Van der Wiel, 1991). Currently, it is not yet clear which role the opening of the South Atlantic Ocean during late Albian played in this story of intracontinental deformation, if any.

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Intraspecific covariation of wood and leaf traits in a tropical rainforest species

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KEYWORDS. — *Pericopsis elata*; Trait-based ecology; Water deficit; Tradeoff; Tropical forest.

SUMMARY. — Climate changes will have different impacts on different species within a community. Some species will be favoured, others will decline. The typical response depends on species' traits, understood as any morphological, biochemical, physiological or phenological characteristic measurable at the individual level (Violle *et al.*, 2007). Prediction of forest changes depends therefore on a sound knowledge of the traits of the species. In this respect, correlative and empirical studies have identified direct and indirect links between plant traits and parameters such as growth, reproduction and survival (Wright *et al.*, 2007). Others have focused on the distribution of traits to model plant communities (Sedio *et al.*, 2012). In most of these studies, plant traits were studied separately according to whether they are related to leaf or wood tissue neglecting the possible coordination between these two groups of plant traits. The few studies available have shown only modest relationships based on a limited number of traits and neglecting intraspecific variability. To fill this gap of knowledge, we measured wood and leaf traits on twigs from different height location within the crown of five (5) individuals of *Pericopsis elata* (Harms) Meeuwen (Fabaceae), a tropical rainforest tree species. Trees were selected within a single population growing in the northern part (0°30'N - 0°10'S and 25°00' - 25°35'E) of Democratic Republic of the Congo (DRC). All traits varied between and within individuals. The sample location height was found to be the driving factor of the within individual trait variation. In a gradient from the base to the top of the crown, theoretical specific hydraulic conductivity and specific leaf area decreased while the stomatal density and the maximum stomatal conductance increased. This result was found to be a response to water deficits occurring upward. However, the ways wood and leaf traits of an individual tree react to this water deficit also vary from one individual to another suggesting a varying response to changing environmental conditions. The height location gradient of trait variation found in this study acts also on plant tradeoffs so far as it modifies trait associations. For example, the relationship between vessel size and vessel density was negative at low sample location height but fairly positive at high sample location height. This change would be an adjustment to decrease the risk of xylem cavitation in twigs at top of the canopy. We also found that the negative relationship between stomatal density and leaf size becomes weaker with increasing sample location height. This change means that the water deficit experienced by leaves at the tree top increase with tree height and becomes severe for very tall tree. Also, the positive relationship between specific leaf area and conduit tapering decreased with sample location height suggesting that the effect of a proper xylem tapering to the accumulation of biomass is more pronounced at high sample location height. These observations suggest the usefulness of modeling these relationships for large datasets.

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**Genetic population structure of the blue sea star *Linckia laevigata*
in the western and central Indo-Pacific realms**

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& Marc KOCHZIUS¹

KEYWORDS. — Population genetics; Connectivity; Gene flow; Invertebrate; Genetic diversity.

SUMMARY. — Connectivity, also known as gene flow, is the degree of linkage between local populations through dispersal. Depending on the mobility of the organism, dispersal could occur during the adult phase (for a mobile organism), but also during the juvenile phase, or during the larval phase. In the marine context, larval dispersal could be facilitated by sea currents. Moreover, the occurrence of islands can play as a stepping stone model for dispersal. However, there are many factors that can prevent dispersal and limit the connectivity (e.g. geographic distance, geographic isolation, complex sea current -e.g. eddies, seasonal currents...-, humanly induced form of barrier, or others). The understanding of such phenomenon is key for conservation since it provides information about the resilience capability of the targeted species. In fact, the knowledge of gene flow patterns can support conservation management to be more efficient by understanding recolonization and recruitment capabilities, thus, it helps to comprehend the resilience potential of a disturbed area.

To assess the genetic diversity and population structure of the blue sea star *Linckia laevigata* from the Western Indian Ocean (WIO) and Indo-Malay Archipelago (IMA), 594 individual sea stars were sequenced from the COI gene and 592 were genotyped using 10 microsatellites loci. 13 sample sites in the WIO and 27 sample sites in the IMA has been considered and suggest a significant differentiation (AMOVA results: $F_{st} = 0.05$, $p \leq 0.01$; $\phi_{st} = 0.14$, $p \leq 0.01$). After testing several hypotheses with a hierarchical AMOVA, results suggest a higher and significant fixation index by using only two group which are the WIO and the IMA ($F_{ct} = 0.08$, $p \leq 0.01$; $\phi_{ct} = 0.24$, $p \leq 0.01$). But some structuring is also observed in these two regions. In the WIO, both markers suggest the following grouping: (1) Kenya, (2) Zanzibar, (3) southern Mozambique, and (4) all other sites in the WIO ($F_{ct} = 0.08$, $p \leq 0.01$; $\phi_{ct} = 0.24$, $p \leq 0.01$). In the IMA, the grouping consists of (1) Western Pacific, (2) Eastern Indian Ocean, and (3) all other sites of the IMA.

In the WIO, the complex oceanography is likely responsible for the observed genetic structure whereas it is more likely the geological history of the region combined with geographical distance in the IMA.

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Development of novel herbal formulation: An approach for Conservation of Useful Endangered Medicinal Plant species

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KEYWORDS. — Biodiversity; *Gymnema sylvestre*; Microparticulated formulation; Diabetes.

SUMMARY. — The International Union for Conservation of Nature (IUCN) has estimated that one-third of the global plant species are under threat; many plant species are becoming extinct, endangered, threatened or vulnerable. According to the IUCN Species Survival Commission (2007), *Gymnema sylvestre* is vulnerable to be endangered and needs to be prioritized for long-term conservation (B. Subbaiyan et. al, 2014). *G. sylvestre* is an important Indian traditional herbal medicine. It possesses number of biological and pharmacological activities: antimicrobial, anti-hyperlipidemic, hepatoprotective and anticancer. It has also been used for several years for the treatment of diabetes and marketed globally as single or multi-herb formulation (Ashutosh Kumar Verma et al, 2016). Japan, the United States of America, Singapore, Australia, and Germany are the fastest growing importers of *G.sylvestre* from India. The increase in rate of importation by Japan, the United States of America and Singapore is 56.7%, 19.2% and 11.7%, respectively. The Indian custom export database released a report indicating an export value of US\$ 613.300 (<https://indiaexportdata.voleba.com/products/india/gymnema-sylvestre-exports-data.html>). This plant has been over-exploited due to its enormous requirement for the pharmaceutical industry. Effective steps are required to preserve this plant species from extinction and to ensure greater availability of raw material.

The purpose of the present study was to encapsulate *G. Sylvestre* extract in a micro-particulate drug delivery system in order to reduce the dose of the drug.

Methods: The formulation was prepared by inotropic gelation technique using sodium alginate as a polymer and calcium chloride as a cross linking agent. The shape and surface morphology of the formulation was revealed by optical and scanning electron microscopy (SEM). The optimized formulation was screened for drug entrapment, efficiency of the constituents, as well as other parameters such as drug release, particle size, and stability studies.

Results: Particle size of microspheres was found to be in the range of 19.49 – 23.83 µm. SEM showed almost spherical particles with rough surface. The DSC and FT-IR studies indicated no drug-polymer interaction. Pharmacological evaluation: Antidiabetic efficacy was evaluated in an alloxan-induced diabetic rat model by oral administration of formulation for 28 days. Administration of the formulation reduced blood glucose levels and increased anti-hyperglycemic activity compared to the parent extract. The microencapsulated formulation reduced the dose required to produce a similar antidiabetic activity as the parent extract by about 50%.

This study reveals the advantages of novel formulation of *G. Sylvestre* and the potential of a microparticulate delivery system for improving the efficacy of *G. sylvestre* extracts as antidiabetic medicine. This reduction in dose may substantially save plant material.

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Mechanism for fractionation of Ta-Nb, Sn and W in granite-related metallogenic systems based on observations from the Karagwe-Ankole Belt of Central Africa

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KEYWORDS. — Economic geology; Rare-metal; Pegmatite; Quartz vein; Rwanda.

SUMMARY. — Tantalum, niobium, tin and tungsten mineralization occurs worldwide in close proximity to fractionated peraluminous leucogranites. In the Mesoproterozoic Karagwe-Ankole orogenic belt (KAB) of Central-Africa numerous early-Neoproterozoic rare-metal deposits formed as primary mineralization in hydrothermal quartz veins, magmatic lithium-cesium-tantalum family pegmatites and associated intra-pegmatitic greisens. These deposits are on a belt-scale related to ilmenite-series, peraluminous, S-type leucogranites, which are generally defined in the KAB as the Kibara Sn-granite generation with an intrusion age of $\sim 986 \pm 10$ Ma (SHRIMP U-Pb on zircon; Tack *et al.*, 2010).

This study gives an overview of the petro- and metallogenic processes of Nb-Ta-Sn-W granite-related ore deposits, as they occur in the Rwandese part of the KAB, and provides a general overview of the geochemical mechanisms behind the formation of pegmatite- and quartz vein-hosted deposits and the distribution and enrichment of the ore elements Nb, Ta, Sn and W in the different metallogenic subsystems (i.e. granites, pegmatites or veins). Moreover, the observed close spatio-temporally association between leucogranites, pegmatites and quartz veins is assessed in terms of a direct genetic link between the mineralization and the felsic magmatism. Based on this review and element distribution calculations, an integrated orthomagmatic metallogenic model for Nb-Ta-Sn-W mineralization in the KAB is demonstrated. Rayleigh-type fractional crystallization acted as the main mechanism by which pegmatitic magmas differentiate from a parental leucogranitic melt and by which incompatible elements Nb, Ta, Sn and W are enriched. However, early aqueous fluid immiscibility has been identified to occur during differentiation of this B-rich, F-poor melt system, which greatly effects W depletion in the melt by preferential partitioning of W into the mobile fluid phase. Sn retains dominantly in the melt phase and becomes, by high degrees of fractional crystallization, enriched in late-stage magmatic fluids. Element-specific melt-fluid-crystal fractionation together with element-specific and lithological-controlled precipitation conditions are the key enrichment processes and are all responsible for the decoupling of Nb-Ta, Sn and W and their subsequent precipitation in pegmatite, hydrothermal quartz vein and greisen deposits. This formation model for the KAB system can form a major tool in the exploration for granite-related ore deposits in general.

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Micro crédit et entrepreneuriat féminin durable à Lubumbashi /RD Congo

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MOTS-CLÉS. — Micro crédit; IMF; Entrepreneuriat féminin durable; Lubumbashi; RD Congo.

RÉSUMÉ. — Il est courant de lire, dans la littérature de l'entrepreneuriat féminin que le non accès au financement constitue l'obstacle majeur à l'entrepreneuriat des femmes. A un moment où de nombreuses femmes à travers le monde font face à de graves difficultés pour satisfaire leur besoin financier, à Lubumbashi en (RD Congo), les Institutions de Micro Finance (IMF) offrent une alternative en proposant aux femmes une gamme de services micro financiers notamment le micro crédit en vue de promouvoir l'entrepreneuriat féminin. En plus d'une solution contre la pauvreté, le microcrédit devient une solution contre le chômage des femmes. Le microcrédit permet-il pour autant la promotion de l'entrepreneuriat féminin ?

Sur les 8.030 femmes ayant bénéficié des micro crédits au cours de l'année 2011 jusqu'à la fin de l'année 2016 (période de l'enquête) seulement 306 femmes (soit 3,81%) sont encore en activité. Ce constat a soulevé des interrogations.

Dans cette thèse, nous avons identifié le profil des femmes bénéficiaires des micro crédits qui sont toujours en activité d'une part et les contraintes auxquelles les femmes en arrêt d'activité ont été confrontées. Cette étude a conduit à mettre en lumière les facteurs qui influencent l'entrepreneuriat des femmes de façon durable.

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Late Quaternary History of Meru Volcano, Tanzania: spatial links between volcanic geology and fluoride contamination

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KEYWORDS. — Stratigraphy; Pyroclastic density current; Plinian-style; Debris avalanche; Chronology.

SUMMARY. — Reconstructing the eruption history of volcanoes provides key information for the future volcanic activity and hazard assessment at different time scales. The majority of active African volcanoes remains poorly documented in terms of eruptive history and their interactions with society. Meru is an active stratovolcano in the eastern branch of the East African Rift system, near the city of Arusha, with its last eruption in 1910. Earlier studies suggested that the volcanic geology of Meru is dominated by debris avalanche deposits as well as major pyroclastic formations indicative of Plinian-style eruptions. The stratigraphy, petrology, spatial extent and chronology of these pyroclastic deposits have, however, not been systematically documented. Similarly, the impacts that might have been caused by these deposits are not well characterized. Yet the surface and ground water around Meru are heavily contaminated by fluoride sourced from the volcanic rocks, leading to dental and skeletal fluorosis among the local population.

This study presents the first evaluation of the most recent eruptive history of Meru, based on detailed field stratigraphic logging and mapping of pyroclastic deposits. The western flank of Meru volcano is characterized by pyroclastic fall and pyroclastic density current deposits. We documented >4.5m-thick pumice fall deposits separated by thick ash tuffs and in some places, palaeosols. The main pumice fall deposits are interpreted to represent the fallout from two explosive events. The most recent of these explosive events produced the thickest and most widespread pumice which can be traced up to 25km distance from the volcano, whereas the deposits of the first event are preserved only in few localities. Although they resulted from major Plinian-style eruptions, these deposits are not found on the eastern side of the volcano where the landscape has been reshaped by a Holocene debris avalanche. The different geological formations in the area appear to have a first-order control on the spatial distribution of fluoride contamination, posing persistent health problems to the local communities.

This work will, therefore, contribute to our understanding of both the potential future volcanic hazards at Meru but also the long-term hydrological and societal impacts of young volcanic deposits in an active continental rift setting.

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Alchimie lexico syntaxique: problématique d'une connotation à profusion

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MOTS-CLÉS. — Alchimie lexicale; Hybridation; Connotation à profusion; Déstructuration; Désémantisation.

RÉSUMÉ: — Dans le matériel qu'offre le système général de la langue, l'utilisateur tient compte non seulement de la conscience qu'il a de ce système, mais aussi du milieu socio-culturel du destinataire de l'énoncé. Alain Mabanckou conçoit l'écriture dans cette perspective dans quatre de ces romans : *African Psycho*, *Verre Cassé*, *Mémoires de porc-épic* et *Black Bazar*. L'insertion des mots des langues congolaises dans la langue française et la perversion sémantique des syntagmes du français, loin de paraître comme une entorse à la langue classique rigoureuse, participent de l'esthétique de l'écriture romanesque de Mabanckou. Cette pratique nous semble aboutir au fait de la désémantisation puis de la réémantisation dûment pensée et recréée par l'écrivain congolais. Cela crée un jeu de glissement sémantique qui confère à ces mots et tournures de nouvelles acceptions adaptées aux réalités et aux besoins d'expression. C'est dans cette perspective que Gassama suggère : « l'emploi de certains termes de langues africaines obéit au besoin, pour l'auteur, de traduire en français l'idée sans la déformer »¹. Car ces mots du terroir et expressions hexagonales sont « en effet, dans nos langues, intraduisibles en français »². De cette situation, peut découler deux constats.

Le premier laisse apparaître que l'intrusion des mots des langues congolaises dans la chaîne phrastique française semble justifier le désir de suppléer un déficit sémantique dont l'auteur peine à trouver le mot juste dans la langue d'arrivée.

Le deuxième laisse entrevoir un phénomène presque contraire qui consiste à faire adhérer des tours de l'expression française dans la dynamique sémantique de la pratique linguistique populaire congolaise. De cette alchimie, paraît naître une profusion connotative pouvant être relevée dans la trame de l'écriture « mabanckouenne ». Dans cette perspective, Jean-Alexis Mfoutou, abordant la problématique du glissement sémantique, fait constater qu'en « zone frontière où les variations sémantiques des mots déjà existants en français recouvrent un sens nouveau sans changer de forme, on fait du nouveau avec de l'ancien »³. Puisque, renchérit-il : « Le français au Congo est une langue qui bouge. Son lexique est en évolution permanente »⁴. Mabanckou crée son style en télescopant les mots du terroir recréés au français classique conservateur

Les perversions sémantiques relevées dans le texte de Mabanckou foisonnent. Elles sont davantage répandues quand il s'agit de les appréhender au double plan lexico-métaphorique. C'est ce qui semble d'ailleurs expliquer la récurrence de la présence la métaphore sexuelle, qui paraît être un code par lequel l'écrivain congolais dévoile un phonème social jusqu'ici resté tabou, mais sans réellement le dire : l'écrivain nous donne à voir une diversité d'images conçues au travers de certaines représentations comme les instruments de travail, le matériel mécanique, les fruits de jardin et les éléments de la nature, le tout gravitant autour de la symbolique sexuelle. De cette hybridation des lexico-sémantiques des langues congolaises avec la langue française semble naître une écriture romanesque rénovée, décomplexée, enrichie de part en part de l'apport mutuel des charges expressives et sémantique. Julien Barret y voit une : « casquette à l'envers, c'est créer son style en se démarquant de la norme »⁵. Aussi, la langue française mérite-t-elle d'être « détournée pour en faire jaillir les effets inédits »⁶, affirme Julien Barret. Les textes romanesques de Mabanckou s'inscrivent dans le sillage du français francophone « qui sait manier les formes pour créer des noms et des verbes (...) avec l'invention sémantique »⁷, suggère Bernard Cerquiglini.

¹ Makhily Gassama cité par Paul Nzete, *Les langues africaines dans l'œuvre romanesque d'Henri Lopes*, p. 54

² Ibid, p. 54

³ Jean Alexis Mfoutou, *Histoire du français au Congo-Brazzaville. Chance et défi de la francophonie*, Paris, Harmattan, 2012 p. 152

⁴ Ibid. p. 83

⁵ Julien Barret, *Tu parles bien la France, Essai sur la langue française d'aujourd'hui* p. 53

⁶ Ibid. p. 49

⁷ Ibid. p. 109

Isolation and Production Efficiency of Novel Bioplastic-synthesising Bacteria from Redang and Bidong Islands, Malaysia

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KEYWORDS. — Biotechnology; Pollution; Plastic; Sustainability; Gas Chromatography; Marine Biology.

SUMMARY. — The ability of some microorganisms to synthesize plastic-like materials has received much attention from academia and industry over the past 30 years, due to the environmental problems caused by industrial plastic pollution and solid waste disposal (Kumar Sudesh *et al.*, 2010). Biodegradable plastic is a worldwide alternative to synthetic plastic, but its usage is limited because production costs are over 3 times that of industrial plastic (Castilho *et al.*, 2009). Polyhydroxyalkanoate (PHA) is a type of biodegradable plastic produced by some bacteria strains under specific environmental conditions of nutrients and carbon (Lee *et al.*, 1999). We aim to isolate and identify novel bacteria strains responsible for producing this polymer (PHA) from marine sediments and coastal soils on the previously unstudied islands of Bidong and Redang in Terengganu, Malaysia. The main cost and limitation of biodegradable plastic production is the expensive carbon source growth media (Chaudhry *et al.*, 2011). Therefore, after isolation, we tested PHA production ability of microorganisms grown on 6 different renewable carbon sources, glucose, fructose, sucrose, sweetwater, glycerol and glycerin pitch, to find the cheapest and most suitable carbon source for producing PHA. Glycerin pitch would be the sustainable option as it is an industrial waste product. Gas Chromatography was used for polymer characterization (Braunegg *et al.* 1978), while PCR purification and sequencing will be used to identify bacterial strains responsible for PHA production (Giovannoni *et al.*, 1990). Five potential PHA producing bacterial strains cultured on all carbon sources except glycerol were detected from both islands. Preliminary analysis of Gas Chromatography identified the easily degraded SCL-PHA as well as the more durable MCL-PHA. These results can contribute to the ongoing search for PHA producing bacteria strains that may produce alternatives to conventional plastic and could enhance bioplastic industry by reducing production costs, and thus reducing synthetic plastic usage and its negative impact to the environment.

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The karst phenomena of the Boukadir region (Chlef-Algeria) and their potential risks

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KEYWORDS. — Limestones; Messinian; Collapse; Inventory; Weathering; Fault.

SUMMARY. — There are many karstic areas around the Mediterranean basin including in Algeria. In northwestern Algeria, in Boukadir, different forms of karstic dissolutions are outcropping along the northern foot of the Ouarsenis mountain range composed of lithothamnium limestones of the Upper Miocene. About 1400m north of this calcareous mountain front, a large collapse sinkhole occurred in the Chelif Basin on June, 16th 1988 (Ourabia & Bennallal, 1989). It broke the national road RN4 that connects the Capital Algiers to the large city of Oran. Despite this large event and visible karstic dissolutions, Boukadir has not yet been classified among the karstic areas of Algeria.

In this study, we re-evaluate the karstic risk in Boukadir by using rainfall data over the last 50 years, field work, remote sensing data, geological maps (Brives, A., 1911), drilling, stratigraphic sections, geological cross-sections and petrographic analyses. We first examine the climatic conditions that prevailed during the unique occurrence of the collapse sinkhole, then we re-evaluate the geological and structural context and finally we made an inventory of the dissolution forms.

The climate analysis shows a rain deficit the year before the collapse sinkhole. Regarding the geological context, the 80 to 150 m thick Lithothamnium platform is typical of the HST-T2 phase of the Messinian that occurred 5.9 Ma ago; the calcareous sediments rest upon Upper Miocene Marine blue marl, and are overlain in the Chelif Basin by the Marine Zanclean marl (~ 5.3 Ma) (Cornée J-J & al. 2004), and younger Pleistocene continental and Quaternary alluvial sediments. The structural data highlight that the carbonate platform has varying dip from east to west in the foothills and is affected by faulting. The major left-lateral Relizane Strike-slip Fault that runs parallel to the piedmont offsets vertically the platform. Other secondary faults running parallel to the Relizane Fault also deform the carbonate platform. The outcropping limestone shows different dissolving karstic forms. The most frequent ones are interstratal dissolutions along bedding surfaces in river valleys. We observe only two large sinkholes filling by clay in study area.

Dissolution characteristics documented in the calcareous piedmont cannot explain the size of the 1988 sinkhole. We infer that this large structure must be related to the fault network of Relizane Fault zone located near the sinkhole. In conclusion, the karst risk is limited to the covered karst in front of the outcropping limestone Ouranasis that is faulted; it defines a 2 km wide band in the Chelif.

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Apport des *Self-Organizing Maps* dans la caractérisation hydrochimique des nappes alluviales en zone de socle cristallin

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MOTS-CLÉS. — Statistiques multivariées; Hydrolyse des silicates; Irrigation; Aquifère.

RÉSUMÉ. — Les ressources en eau constituent une denrée rare dans les régions semi-arides en zone de socle. Les eaux de surfaces y sont les plus exploitées pour les activités agricoles mais celles-ci, sous l'influence de la forte évaporation, tarissent de façon précaire entraînant des pertes financières pour les exploitants. Les nappes alluviales avoisinant ces eaux constituent une alternative pour «sauver» les investissements et doivent être caractérisées tant sur le plan quantitatif que qualitatif (Petit, 2004).

La présente étude, sur base de l'analyse et de l'interprétation des données physico-chimiques issues de trois campagnes de prélèvements (en hautes eaux et en basses eaux) dans environs 36 ouvrages de stockage et de captage d'eau de la nappe alluviale de Mogtédou au Burkina Faso. Elle apporte une contribution pour une meilleure connaissance de ces nappes aquifères avec l'utilisation la méthode des *Self-Organizing Maps* (SOMs) introduite par Kohonen (1982).

Contrairement aux méthodes traditionnelles de statistique multivariée, le SOM est une méthode d'analyse statistique non linéaire et non biaisée, basée sur l'application d'algorithmes permettant de visualiser les relations de similarités dans un ensemble d'éléments, de les regrouper et de détecter les relations non linéaires entre eux (Kohonen, 2014; Peeters & Dassargues, 2006). L'algorithme utilisé par le SOM est construit sur le modèle d'un réseau neuronal artificiel (ANN) non-linéaire et non-hiérarchique (Iwashita, 2017; Wu *et al.*, 2017).

L'application de cette méthode dans la caractérisation hydrochimique des eaux de la nappe alluviale de Mogtédou montre que les paramètres physico-chimiques ces eaux varient en fonction des saisons et sont aussi fortement influencés par les activités anthropiques ainsi que par la dynamique des eaux de surface. Les corrélations entre les différents éléments ont permis également de conclure à une minéralisation contrôlée par l'interaction eau-roche, notamment l'hydrolyse des minéraux silicatés. En général, ces eaux sont de bonne qualité pour l'irrigation de complément mais des pollutions ponctuelles observées peuvent contaminer l'aquifère qui est surtout exploité pour l'approvisionnement en eau potable. Une réglementation -voir une limitation de l'utilisation de certains produits chimiques (pesticides, engrais et herbicides etc.) dans l'agriculture- est nécessaire afin de préserver la qualité de ces ressources.

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Impact of an invasive seagrass on the diet of juvenile queen conch (*Lobatus gigas*) in the Caribbean

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KEYWORDS. — *Halophila stipulacea*; Invasive species; Stable isotope; Mollusca; *Lobatus gigas*; Queen conch; Diet.

SUMMARY. — Seagrass meadows in the Caribbean are important nursery habitats for many organisms, including the iconic queen conch (*Lobatus gigas*). Since 2002 the seagrass species *Halophila stipulacea* is rapidly expanding throughout the Caribbean and is found to have a negative effect on native seagrasses (Willette & Ambrose, 2009). The trophic consequences of the invasion for juvenile queen conch are unspecified. Therefore, the aim of the present study was to investigate the diet of juvenile queen conch in native, mixed and invasive seagrass meadows at the islands of St Barthélemy, St Maarten and St Eustatius. Diet was examined by collecting tissue samples of queen conch and food sources (seagrass detritus, seagrass epiphytes, sediment organic matter, microbial mats and macroalgae), which were analysed using stable isotopes composition of nitrogen and carbon. The proportions of food sources to the diet were calculated by Bayesian stable isotope mixing models with the R package 'simmr' (Parnell, 2016). A large variation was found in stable isotope signatures in queen conch among the three islands. The main diet of juvenile queen conch in the three habitats consisted of surface sediment organic matter. Whereas juvenile queen conch in invasive habitat completely depended on sediment related food sources (surface sediment organic matter and microbial mats), specimens in the native seagrass meadow fed on a more diverse diet that also consisted of native seagrass detritus and macroalgae. Seagrass detritus of the invasive *Halophila stipulacea* only contributed minor proportions to the nutrition in invasive and mixed seagrass meadows. In none of the three habitats a change of diet proportionate to the shell size was found. The mixing of different food items in more diverse native habitats may increase fitness of juvenile queen conch. Consequently, monitoring and adopting measures to downscale the rapid spread of the invasive seagrass should be aspired, especially for long known juvenile queen conch nursery grounds.

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POSTERS

Estimation of forest biomass in Bulgan province using Remotely sensed data

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KEYWORDS. — Forest biomass; NDVI; Remote sensing.

SUMMARY. — Information on forest volume, forest coverage and biomass is important for developing global perspectives about CO₂ concentration changes. Forest biomass cannot be directly measured from space yet, but remotely sensed greenness can be used to estimate biomass on decadal and long-time scales in regions of distinct seasonality, as in the north. The objective of this study is to estimate forest biomass and forest change in the Bulgan province using remotely sensed technique. Landsat images were used to validate forest coverage. Ground truth data was collected in July 2018 and September 2018 for forest coverage and biomass measurements. This study suggests that the estimation of biomass based on remotely sensed data could be detected over a range of land cover change processes for global biomass change studies.

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Risque d'inondation, « aménagement » urbain et déguerpissement comme réponse. L'histoire sans fin de Douala

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MOTS-CLÉS. — Historique des inondations; Vulnérabilité; Exposition; Déplacements forcés; Cameroun.

RÉSUMÉ. — Comme pour beaucoup de villes en Afrique (OZER & PERRIN, 2014), les inondations constituent le risque le plus important dans la ville de Douala, le problème de leur gestion se pose désormais avec acuité dans un contexte d'aménagement urbain. Cette étude se présente comme une contribution à l'analyse de la dynamique spatio-temporelle des inondations ainsi que des différentes stratégies d'aménagement urbain. La méthodologie de recherche exploitée repose essentiellement sur deux approches d'analyse. Une approche d'analyse systémique permettant de mettre en exergue les relations entre les populations et leurs milieux de vie et une approche géohistorique basée sur l'analyse d'articles de presse (Cameroun Tribune de 1980 à 2018) permettant la constitution d'une base de données sur les inondations passées.

Les résultats montrent que les premières inondations enregistrées remontent à 1984 et qu'elles se poursuivent aujourd'hui avec une fréquence et des conséquences de plus en plus importantes. De 1980 à 2018, Douala a enregistré 29 inondations documentées occasionnant 49 pertes en vies humaines, 71 blessés, 90923 sinistrés et 547 recasés. De 1980 à 1990, trois inondations ont été recensées avec une seule perte en vie humaine alors que la seule période 2010-2018 a connu 13 inondations occasionnant 29 décès. Par ailleurs, la pluviométrie, paramètre principal à l'origine des inondations à Douala n'ayant pas augmenté, la composante majeure de la fréquence du risque résiderait dans l'aggravation de la vulnérabilité, conséquence d'une conquête anarchique de l'espace urbain et des politiques d'aménagement mal/pas adaptées. La superficie urbaine de Douala est successivement passée de 800 ha, 4800 ha, 17850 ha à 33450 ha respectivement en 1960, 1980, 2000 et 2017. Cette extension urbaine conduit à une spatialisation voire à un transfert du risque du centre vers la périphérie.

Parallèlement, la fréquence des inondations a amené les autorités à mettre en place des opérations de déguerpissement en vue de la libération des emprises des cours d'eau et des espaces verts (notamment la mangrove). De 1993 à 2018, la ville a enregistré 16 cas de déguerpissements recensés occasionnant le déplacement d'environ 17812 ménages. La taille moyenne des ménages à Douala étant estimée à 5 personnes, on estime à environ 89060 le nombre de personnes privées de logement; soit la taille de tout un quartier de Douala effacé de la carte de la ville. Le nombre de pertes directes en vies humaines durant les opérations de déguerpissement s'élève à 23 personnes. Ces déguerpissements, opérés dans un contexte où les personnes déguerpies sont complètement dépossédées de leurs biens, sans indemnisation ni processus de recasement, ne sont pas sans conséquences tant sur les vies des populations que sur les zones d'estuaires faciles à conquérir. De ce fait, une bonne partie de la population déguerpie dans la ville de Douala en réponse aux inondations se réinstalle dans les zones d'acquisition facile de la terre ou des « espaces submergés ». Ce faisant, comme ailleurs en Afrique (CHOKPON et al., 2018; GEMENNE et al., 2017), les autorités participent à une reconstruction du risque.

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Dynamique littorale à Cotonou (1955-2018) et efficacité des ouvrages de protection de la côte

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MOTS-CLÉS. — Trait de côte; Cartographie; Ouvrage de protection; Vulnérabilité.

RÉSUMÉ. — En Afrique de l'Ouest, la vulnérabilité aux risques côtiers est particulièrement élevée. Les littoraux ouest africains subissent globalement un processus érosif important pouvant être impressionnant par endroit avec des reculs moyens qui dépassent les 10 mètres par an (OZER et *al.*, 2017). A Cotonou (Bénin), l'érosion côtière a engendré un coût social considérable (GEMENNE et *al.*, 2017) et a atteint une telle ampleur que la zone à l'est de la ville et est souvent qualifiée de « hot spot » pour les projets béninois et ouest africains de protection du littoral (DOSSOU & GLEHOUEYOU-DOSSOU, 2007).

Cette étude vise à: (i) cartographier la dynamique du trait de côte à Cotonou avant et après la construction des principaux ouvrages de protection de la côte est entre 2013 et 2017 et évaluer les variations de superficies associées ; (ii) évaluer les taux de variation du cordon littoral et l'impact des ouvrages sur ces taux ; et (iii) analyser les perceptions des populations sur la dynamique de leur vulnérabilité.

Les traits de côte ont été extraits de l'analyse des photographies aériennes de 1955 et des images satellitaires à très haute résolution disponibles sur *Google Earth* pour les années 2002, 2013 et 2017. Ils ont ensuite été combinés en une géodatabase pour leur traitement. La ligne de référence utilisée est la ligne de pleine mer. Le logiciel ArcGIS Desktop 10.3 a été utilisé pour la réalisation des cartes et son extension DSAS v4.3 a permis le calcul statistique des vitesses d'érosion et des taux d'évolution à partir des différents traits de côte extraits. DSAS crée des transects qui viennent couper les différents traits de côtes. Il mesure ensuite les distances entre les points d'intersection des transects et des traits de côte (EPR), calcule les taux d'évolution (LRR) le long de chaque transect et restitue les résultats sous forme de tables.

Pour estimer la vulnérabilité des populations telles qu'elles-mêmes la perçoivent, une enquête de terrain réalisée à l'est du port de Cotonou nous a permis d'apprécier notamment leurs perceptions sur l'efficacité des ouvrages de protection des côtes.

Les résultats montrent, après une érosion très importante à l'est du port (jusqu'à 12 m par an de 1955 à 2013), une relative stabilité du segment de côte depuis la construction des épis en 2013. Par contre, à l'ouest, l'accrétion continue, favorisée notamment par les mesures d'agrandissement du port autonome. Aussi, les perceptions des riverains en lien avec l'efficacité des ouvrages présentent une bonne corrélation spatiale avec les variations obtenues avec la cartographie. En outre, il a été noté que la majorité estime que leur vulnérabilité vient désormais moins de l'aléa d'érosion que des stratégies adoptées par les autorités pour la gestion de cet aléa.

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Etude des conditions de développement durable d'une filière de gazéification de la biomasse agricole au Burkina Faso

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MOTS-CLÉS. — Gazéification; Développement durable; Biomasse agricole; Burkina Faso.

RÉSUMÉ. — Les populations rurales de l'Afrique de l'Ouest dépendent quasi exclusivement de la ressource bois comme source d'énergie pour la cuisson des aliments et pour la transformation agroalimentaire. Cet usage associé à la fourniture des villes en combustible induisent une pression sur le gisement bois. Parallèlement, les activités agricoles génèrent d'énormes quantités de résidus cultureux (tiges de coton, balle de riz, etc.) sous-exploités. Ces résidus présentent un potentiel énergétique important qui pourrait contribuer au développement rural. Contrairement au bois, ils sont difficiles à exploiter directement. La gazéification constitue une solution innovante permettant de transformer ces résidus en énergie thermique flexible. Les quelques rares installations existantes au Burkina Faso, sont basées sur des technologies importées peu maîtrisées localement et difficiles à entretenir par les bénéficiaires. Ceci constitue un verrou important pour le développement de cette voie de valorisation énergétique des déchets agricoles. La présente recherche vise à identifier les conditions de développer durablement une filière de gazéification au Burkina Faso. Elle se basera d'abord sur la théorie de la sociologie de la traduction pour analyser les facteurs de blocage et de motivation de l'adoption de la technologie. Puis les méthodes d'analyse structurelle et fonctionnelle permettront d'évaluer les performances des différentes composantes constitutives de la chaîne de valeur de la filière de production d'énergie renouvelable par gazéification de biomasse agricole. Les méthodes d'analyse de cycle de vie environnementale et sociale seront utilisées pour évaluer la durabilité de la filière de gazéification. Les modèles d'aide à la décision seront également utilisés pour soutenir la filière. Les données seront collectées à l'aide de guide d'entretien et de questionnaire auprès des acteurs potentiels connaissant la technologie de gazéification. Au terme de l'étude, les principaux facteurs socio-économiques et environnementaux de blocage de l'adoption de la gazéification au Burkina Faso, de même que la taille des gisements de sous-produits agricoles économiquement mobilisables seront connus. Les indicateurs sociaux de durabilité de la filière de gazéification de biomasse et un modèle d'aide à la décision seront également proposés.

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Enjeu foncier et développement des cultures horticoles en Afrique de l'Est. Etude de cas du fruit de la passion au Burundi, Kenya et au Rwanda

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MOTS-CLÉS. — Foncier; Fruit de la passion; Compétition entre cultures; Achat de terre.

RÉSUMÉ: — La terre arable, considérée comme abondante en Afrique subsaharienne (Deininger et al., 2011) constitue une ressource rare en Afrique de l'Est comme c'est le cas au Burundi et au Rwanda où la superficie moyenne par ménage est respectivement estimée à environ 0,5 ha (ISTEEBU, 2015 ; MINAGRI, 2013). La terre agricole est devenue un objet marchand (Chauveau et al. 2006 ; Colin, Ayouz 2006), un capital fixe (Brossier et al., 1997), et le développement de nouvelles cultures dans un contexte de pression foncière comme c'est le cas en Afrique de l'Est ne fera qu'augmenter sa valeur marchande (Paré 2003, Chauveau et al. 2006). Cet article montre que l'implantation d'une nouvelle spéculation comme le fruit de la passion au Burundi peut accentuer la marchandisation de la terre et en conséquence augmenter le nombre des ménages sans terre avec des risques des conflits et d'insécurité alimentaire. Des enquêtes ont été réalisées auprès de 171 agriculteurs (60 au Burundi, 51 au Kenya et 60 au Rwanda) et ont porté sur le choix d'assolement, la superficie occupée par chaque culture, etc. Les résultats montrent qu'au Burundi 21 % de terres occupées par le fruit de la passion ont été achetées contre 33 % au Kenya et 41 % au Rwanda. Ceci montre que le mode d'accès à la terre par achat est une pratique de plus en plus courante dans les trois pays. Cela confirme ce qui avait déjà été observé au Rwanda par certains auteurs (André et Platteau, 1998 ; Blarel, 1994) mais aussi au Kenya (Migot- Adholla et al., 1994). L'adoption du fruit de la passion a entraîné une compétition des cultures en ce qui concerne l'espace cultivé. C'est presque la majorité des terres qu'occupe le fruit de la passion qui était sous culture au Kenya (95%), au Rwanda (64%) et seulement 18% au Burundi. Par conséquent, les cultures vivrières (haricot, maïs, etc.) ou industrielles (caféier, etc) sont abandonnées au profit du fruit de la passion et cela suite au manque de terres arables (Kisare, 2011). Les politiques de modernisation de l'agriculture et développement des cultures plus orientées vers le marché prônées par les gouvernements en Afrique de l'Est produisent, dans ce cas, des effets inattendus et devraient intégrer les questions foncières sous ces multiples dimensions.

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Characterization of Gullies and Landslides in Shafe Catchment, Southern Ethiopia

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KEYWORDS. — Gully erosion; Landslide; Gully density; Sub-catchments.

SUMMARY. — Gully erosion is a process whereby runoff water concentrates over short periods and removes the soil, sometimes to considerable depths (Poesen *et al.*, 2003). Landslides include a range of processes by which slope material is displaced under the force of gravity (Hungri *et al.*, 2014). Gullies and landslides play an essential role in landscape evolution and can be responsible for production of large amount of sediments. Gully and landslide inventory maps are useful to investigate the distribution, types, and the landscape characteristics associated with these processes in a catchment. Such inventories can thereafter serve as a preliminary step toward gully and landslide susceptibility modelling and estimation of long-term sediment production.

Here we focus on a catchment in the southern part of the Ethiopian rift system, draining to Lake Abaya. Despite the rapid sedimentation of the lake, the spatial distribution and contribution of landslides and gullies to the sediment budgets of rift border catchments are poorly known. Therefore, the main aim of this research is to characterize the type and distribution of gullies and landslides in Shafe catchment, which covers an area of 153 km². For production of inventory maps, Google Earth imagery, field surveys, high-resolution satellite images and aerial photographs of 1965/66 and 1975, acquired by Ethiopian Geo-spatial information agency were used. For field validation and comparison with different parts of the catchment, the catchment has been divided into 23 sub-catchments. More than 3200 gullies and 60 landslides were mapped (and 100 and 20 validated in the field respectively). According to the classification of Solomon (2009), 51% of the sub-catchments are characterized by extremely high gully density, 20% are severe to very severe, 15 % moderate to severe, with only 13% of the total catchment area being little to moderately affected by gully erosion. More than 70% of the catchment has a gully density greater than 10m/ha. The landslides are much less frequent than the gullies. The largest ones are developed on a few slopes and seem quite old, therefore not affecting directly current sediment budget, and are probably of natural origin. They could however favour the occurrence of gullies (further step of the research). The recent landslides usually are of limited size and are concentrated along the rivers. Note that some large gullies, once initiated, clearly evolve through landsliding. Our detailed inventory and characterization of these processes in the Shafé catchment is a first step towards understanding the natural and anthropic factors favouring their occurrence, and a first contribution to the long term objective of favouring sustainable land management practices preserving soils and reducing sediment delivery to Lake Abaya.

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Assessing perception and adaptation to socio-ecological changes in rural Africa : first results from a case study in Cameroon

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KEYWORDS. — Geography; Risk; Climate Change; Socio-Ecological approach; Perception; Resilience; Cameroon.

SUMMARY. — West-Africa is affected by global changes, particularly by demographical and economical transformations and climate change modifying rainfall spatio-temporal structures. This situation is specifically affecting rural areas. In western Cameroon, land use has evolved and diversified since the 1980s: coffee cultivation, followed by eucalyptus, and recently an increase in gardening (Uwizeyimana, 2009). This is observed throughout West and Central Africa in response to demographic change and the integration of agriculture into the market economy, resulting in the colonization of available land, from summits to low-land along rivers (Tchatchouang, 2015). Western Cameroon is located in a transient rainfall regime, between a humid tropical monsoon climate in the south and a tropical humid mountain climate in the north (Tsalefac *et al.*, 2003). This effect is due to the topography of the region which extends from sea level to the highlands above 1500m. Climate changes come here in addition to the various natural hazards observed for decades: floods, landslides, weather hazards, land-use conflicts. The changes and risks that affect rural dynamics and migration are very complex: changes in rainfall, natural hazards and social risks are closely linked together. The work focus here on West Cameroon, because it is still a low documented area in comparison to other Africans regions like Sahel or East Africa.

To understand interactions between environment and society, this research in geography is based on a transdisciplinary approach. The objective is to define and evaluate how rural societies in western Cameroon perceive and, in particular, adapt to socio-environmental changes and risks. The presentation will show the preliminary results of the study focalized on a rural community (Kekem), which present a social, economic and agricultural diversity (mountainous agroforestry, lowland gardening, livestock farming). The research uses a mixed-method approach. Quantitative surveys (n=94) are used to evaluate the perception of changes and risks from people, and factors influencing this perception. We also used qualitative interviews to highlight adaptations strategies used to cope risks and changes.

Key findings from the village of Kekem suggest that most households perceive a change of the beginning of the rainy season, which occurred earlier in recent years. Compared to the rainfall data collected in Bafang (20 km), this perception is correct. The percentage of people perceiving this rainfall trend is close to other results observed in Africa, as in Ethiopia (Habtemariam *et al.*, 2016). There is also an increase in some natural hazards, whether landslides or floods, and land-use conflict. Surveys show that exposure and perception of risk depend mainly on social factors, as shown by farmers' better perception of rainfall evolution and the exposure of migrants to floods due to the location of their fields in lowlands. In the surveyed community, we observed that coping strategies are closely linked to migration. Migration to cities is a solution often chosen by households that face multiple environmental problems. Conversely, return migration is at the origin of grouping farmers into cooperatives aimed at reducing economic risks, especially for cocoa and coffee production.

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Spatial dynamic of forest within the Katangese Copper Belt (DR Congo)

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KEYWORDS. — Forest dynamic; Spatial dynamics; Remote sensing; Landscape Ecology; Anthropization; Mesh.

SUMMARY. — The Katangese Copper Belt (K.C.B.) zone is experiencing profound changes, including the destruction of forest ecosystems linked to a synergy of anthropogenic activities, such as mining activities, charcoal production or slash-and-burned agriculture and exacerbated by the socio-economic conditions and by population growth. The main objective of this research was to quantify the dynamics of forest ecosystems in the K.C.B., assuming that structural changes in land cover are due to the various anthropogenic activities. Based on satellite remote sensing, Geographic Information Systems (GIS) and landscape ecology concepts, land cover dynamics was assessed using a multiscale approach ranging from the Lubumbashi plain to the K.C.B. Six Landsat 5 TM, 7 ETM+ and 8 OLI scenes was used on three dates (1990, 2002 and 2015) to generate three mosaics of images covering K.C.B., while the Lubumbashi plain was represented by Landsat scenes of 2001, 2005 and 2011. After a supervised classification of the images and validation by fieldwork, forest patterns were characterized using spatial indices, including area, mean area, patch number, dominance, dispersion, rate of evolution and perimeter metrics. Bibliographic research on the deforestation patterns around Lubumbashi showed that a remote sensing approach is better suited for quantification of forest dynamics; it consequently revealed the presence of remnant forest patches around the main agglomerations. More forest disturbances are observed in the plain of Lubumbashi and the forest hence acts as a provider of space for other types of land cover. The landscape matrix is reversed in favor of non-woody land cover classes. Forest ecosystem transformations seem governed by a synergy of human activities. Using remote sensing data, dissection was identified as the dominant spatial transformation process in K.C.B. At the local level (10 km x 10 km), deforestation was dominated by fragmentation and dissection while reforestation was characterized by attrition and creation. The temporal dynamics of landscape configuration and composition have shown a continuous anthropization of forest ecosystems; forest patches are increasingly dispersed. Simulation of the dynamics at 2050 by means of a first-order Markov chain has shown that the forests will regress in all study areas. This study showed that the forest ecosystems of K.C.B. were characterized by high spatial dynamics, caused by Man, and which menace the survival of populations dependent on them. Through this multiscale approach, our contribution helps to establish the rational and fundamental scientific foundations for the conservation and management of forest ecosystems necessary for the preservation of biodiversity.

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Intestinal parasites in children of Cochabamba - Bolivia

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KEYWORDS. — Neglected tropical diseases; Environment; Helminths; Protozoans.

SUMMARY. — A high percentage of the population of Latin America lives with intestinal parasitic infections, neglected tropical diseases that frequently are not treated. Intestinal parasitism is associated with nutritional diseases such as anaemia, a malabsorption syndrome, or poor weight gain (PAHO, 2011). Nevertheless, information about the epidemiological situation of parasitism in countries like Bolivia is scarce. Huge environmental differences are encountered in Bolivia, depending on altitude, humidity or temperature (Mollinedo S., 2006). These environmental conditions play an important role in the prevalence of certain parasites (Torgerson P.R., 2015).

The main objective of this study was to know the current situation of parasitic infections among children under twelve years old from different geographical areas of the department of Cochabamba – Bolivia and to identify areas with populations at higher risk for these infections. This information is essential to propose and evaluate eradication policies in the field.

We retrospectively analysed the laboratory reports of four second line hospitals of different areas (high valley, low valley, semi-tropical and tropical areas) and the third line hospital of the department in the city of Cochabamba. Results of all stool examinations performed between 2011 and 2015 in children under twelve years old were collected. Stool samples containing *Entamoeba histolytica*, *Giardia lamblia*, *Ascaris lumbricoides*, *Ancylostomas*, *Trichuris trichiura*, *Strongyloides stercoralis*, *Taenia solium*, *Enterobius vermicularis* and *Hymonolepis nana* were considered positive.

We gathered the results of 23221 stool examinations. The median age was one year; 89 % of children were less than five years old. The main diagnostic method was simple examination (97%). Pathogenic parasites were found in 31 % of samples. *Entamoeba histolytica* and *Giardia lamblia* were the 2 most prevalent parasites in all areas. Helminths were found in only 19% of positive samples. *Ascaris lumbricoides* is the most prevalent helminth. Parasitic infections are more frequent in the tropical area. Helminths are quite exclusively found in the tropical area where their prevalence is comparable to the prevalence of protozoans.

We confirm that parasitic infections in children are still highly prevalent in Bolivia despite efforts to reduce the burden in the last ten years (Mollinedo S., 2006). Distribution of parasites differs depending on the ecological environment. Protozoan infections are the major problem while the prevalence of helminths is decreasing (Carreon M. & Martinez C., 1987). The most vulnerable population is still concentrated in tropical areas where the risk of parasitic infection is increased due to the environmental conditions. Social conditions of the population are also more precarious in this area (PAHO, 2011).

Our results will enable the planning of more efficient policies to control parasitic diseases.

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Characterisation and geodynamic context of the Sn-W granite intrusions in the Karagwe-Ankole belt in the Great Lake area

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KEYWORDS. — Geochemistry; U-Pb dating; Magmatism; Rwanda.

SUMMARY. — The Karagwe-Ankole belt is a Mesoproterozoic orogenic belt stretching from Uganda, over Rwanda and Burundi to the Democratic Republic of Congo. Together with the Kibara belt, this fold-and-thrust separates the Archean-Paleoproterozoic Congo craton from the Archean-Paleoproterozoic Bangwuele and Tanzania blocks. It is intruded by two magmatic events: one at ~1375Ma (G1-G3) and the other at ~1000Ma (G4) (Kokonyangi et al., 2006). The cause of the intrusion of the ~1375Ma granitoid bodies is strongly debated and several contradicting models are proposed to explain this event (Klerckx et al., 1987; Fernandez-Alonso et al., 1995; Kokonyangi et al., 2006; Debruyne et al., 2015). The ~1000Ma granites are associated with rare element ore deposits, such as cassiterite, columbite-tantalite (coltan), wolframite, monazite,..., occurring as primary mineralisation in pegmatites, greisen or vein-type deposits. Several studies have been performed to understand these deposits (Dewaele et al., 2010; Hulsbosch et al., 2014). Therefore, the formation and the characterisation of the primary mineralisation are relatively well known for this area. The geodynamic context of the parental granites, on the other hand, is not well constrained. Some suggest that these granites are intruded due to far field stresses caused by the Irumide orogeny (Fernandez-Alonso et al., 2012), while others consider an E-W directed convergence, causing a full scale orogeny (Kogelenberg and Kisters, 2014).

Identification of the younger granite generation in the field is proposed based on the absence of any foliation development (Mucchez et al. 2016), since there emplacement is considered to be late- to post-tectonic. This method is, however, not straightforward if there is no direct visible link with mineralisation in the field. Different granite generations occur crosscutting each other. In the present research, we will attempt to characterise the parental granites associated with rare metal mineralisation by geochemical and mineralogical analyses. By means of discrimination diagrams, spider diagrams and Harker diagrams, criteria will be proposed to identify the fertile ~1000Ma granites. Different granitoids from Rwanda have been selected from the rock collection at the Royal Museum of Central Africa based on the absence of foliation, and subsequently analysed for their major and trace elements. Historically dated granitoids from different parts of the Karagwe-Ankole belt have been analysed as reference samples for the younger granite generation. In a next step of the research, the samples will be dated using zircon U-Pb age dating by using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) in order to confirm the chemical and petrographic distinction between the different granitoid generations.

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Modelling gully erosion and its impact on catchment sediment yields at the continental scale

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KEYWORDS. — Soil erosion; Spatial modelling; Africa; Data compilation; Gully density.

SUMMARY. — In many regions of the world, gully erosion is a dominant land degradation process, threatening available soil and water resources. The process is typically associated with a plethora of problems, including the direct loss of soil and land, water reservoir capacity losses, increased flooding risks, decreased crop yields, decreased water quality, damage to infrastructure and casualties (Poesen *et al.*, 2003). Understanding and quantifying gully erosion (GE) rates and their contribution to catchment sediment yields (SY) is not only of fundamental scientific importance, but also necessary for the development of strategies that allow to prevent and mitigate the many negative impacts of GE.

Nonetheless, our ability to simulate and predict GE remains currently very limited, especially at the continental scale. This contribution presents the concept of a starting PhD research that aims to bridge this gap by developing a first spatially explicit and process-oriented model that simulates average GE rates at the continental scale, building on recently obtained insights, model concepts and databases.

In a first phase, a model will be developed that can simulate the density of gully heads across Africa using a database of mapped gully heads which was recently constructed. The database already consists of more than 1000 sites across Africa (Figure) where the exact location of all gully heads was manually mapped by trained experts, using high resolution aerial photos available in Google Earth. This resulted in a unique database of more than 31 000 mapped gully heads across Africa which will be used to calibrate and validate the model.

In a second phase, this gully density model will be coupled to a recently proposed model simulating the expansion rate of individual gully heads (Vanmaercke *et al.*, 2016). The integration of these two models will result in the very first assessment of gully erosion rates at a continental scale (at decadal timescales).

In a last phase, the simulated gully erosion rates of Africa will be confronted with a database on measured SYs for more than 600 catchments (Vanmaercke *et al.*, 2014). From this, a first quantification of the overall importance of GE for SYs will be acquired. By combining our gully erosion model with an existing erosion and sediment transport model, a first quantification of the direct effect of gullies on SY (by providing sediments) and their indirect effect (by altering the sediment connectivity of the catchment) will be obtained.



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Added Value of Regional versus Global Landslide Susceptibility: the Western Branch of the East African Rift

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KEYWORDS. — Landslides; Susceptibility analysis; Statistical modelling; Google Earth; Africa.

SUMMARY. — Throughout the world, landslides are recognized as a severe natural hazard, inflicting significant damage to infrastructure and causing several thousands of casualties per year, predominantly in developing countries (Burns, 2015; Froude and Petley, 2018; Walker and Shiels, 2013). Despite these facts, there is no detailed information on landslide distributions in more than 99% of the earth's land surface (Guzzetti *et al.*, 2012) and global or continental landslide susceptibility (LSS) models are frequently the only available data for most areas. However, these models are quite basic with no process differentiation, built from spatial datasets (covariates) of coarse resolution, and not validated in most regions. Their reliability for regional-scale studies can, therefore, be questioned. A solution for a reliable regional assessment is frequently found in the computing of a data-driven model derived from a comprehensive landslide inventory. However, building up a regional LSS assessment can be very challenging and time-consuming, especially in low-capacity and data-scarce regions where there is no comprehensive landslide inventory or accurate covariates at hand. This is particularly the case in tropical Africa where the construction of landslide inventories is impeded by high land reclamation, poor field accessibility, and a lack of high-resolution remote sensing imagery (Monsieurs *et al.*, 2017).

The objective of this research is to assess the added value of data-driven approaches at the regional level. The focus is on the Western Branch of the East African Rift (WEAR), a data-scarce landslide prone tropical environment where the impact on society is high. From Google Earth imagery, we compiled a landslide database of more than 6600 occurrences where process differentiation is considered. Moreover, we constructed a new, higher-resolution lithology map and use a state of the art regional Peak Ground Acceleration assessment (Delvaux *et al.*, 2017). From our regional LSS analysis, we derived three conclusions: (1) the regional LSS models score significantly better than global and continental models such as those of Stanley and Kirschbaum (2017) and Broeckx *et al.* (2018). (2) We show that the added value of a comprehensive landslide inventory and process differentiation is higher than that of higher-resolution covariates. (3) Using an inventory of more than 500 occurrences only increases the predictive performance marginally; showing that there is an 'optimum model complexity' and a trade-off between data collection and model reliability. The outcomes of this research are relevant not only for the understanding of the processes at play in the WEAR, but also bring methodological insights with regard to regional LSS issues in general.

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Questioning causes and drivers of slope instability in a tropical context – insights from the Ikoma Landslide (DR Congo)

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KEYWORDS. — Landslide mechanisms and triggers; Hillslope evolution; Weathering; UAV; Historical Aerial Photographs.

SUMMARY. — Understanding the role of landslides in landscape systems and evolution and their associated hazards relies on accurate process characterisation. This ideally requires knowledge on the timing of slope deformation episodes as it allows understanding the link between slope instability and environmental drivers, such as seismicity and climate. However, for many regions, especially in tropical environments where rapid vegetation growth and low-capacity data collection policy is commonplace, such information remains rare. Here we focus on a large deep-seated landslide in the landslide-prone and data-scarce Kivu rift, in eastern DR Congo. This landslide, developed in weathered basalt and regolith, shows obvious deformation features at its surface, indicating large deformations during recent years. High-resolution topography, historical aerial photographs, satellite imagery and careful field investigations are used to detail the landslide mechanisms and investigate failure development over the last decades. By confronting rainfall time series and major earthquake sequences to the different deformation episodes, we show that the relation between instability triggers and slope failure is not straightforward; e.g., the largest instability occurred at the end of a dry season during a period of relatively low seismicity. Instead of direct influence of external triggers, we suggest that some phases of instability may ultimately be caused by the intrinsic evolution of the hillslope associated with strength degradation of the slope material through time. Our results question the relative weight of the commonly recognized causes and drivers of slope instability in this area. Analysis of landslide processes provided here should help improve the evaluation of landslide hazard and mitigation in the area, but also across other regions where similar environmental conditions are met.

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DNA methylation polymorphism of the *Karma* element in clonal oil palm (*Elaeis guineensis* Jacq.)

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KEYWORDS. — Oil palm; Tissue culture; Somaclonal variation; Epigenetics; DNA methylation.

SUMMARY. — The *mantled* floral phenotype of oil palm arises from *in vitro* somatic embryogenesis protocols and results in an apparent feminization of male floral organs [1]. As a result, this somaclonal variation has a detrimental effect on palm oil production and research efforts are directed towards detecting its occurrence as early as possible during the tissue culture process so that off-type regenerant material can be eliminated [2].

Previous studies have found that the *EgDEF1* gene responsible for stamen identity undergoes alternative splicing between normal and *mantled* inflorescences [3] and that this differential splicing is correlated with hypomethylation of an intronic transposable element, *Karma*, in variant tissues [4]. Although these discoveries have greatly improved our understanding of the origin of the phenotype that is visible in reproductive tissues of the adult clonal oil palm, it is still unclear that they could be useful in the perspective of an early discrimination of the variation in *in vitro*-propagated tissues.

We therefore used bisulfite sequencing in order to assess *Karma* DNA methylation in embryogenic suspension lines that had been generated through the re-cloning of clonal oil palm of normal and *mantled* phenotypes, respectively, and in the corresponding regenerant plantlets. We find that the deficit in *Karma* methylation is present in the different *mantled*-derived materials, with variations depending on both the duration of the multiplication phase and the nature of the tissues. We discuss the implications regarding the elaboration of a detection test.

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Le projet PHYTOKAT à Lubumbashi (R.D. Congo): Conditions pour l'intégration de la médecine traditionnelle aux soins de santé modernes: caractérisation, validation biologique et culture ex situ de plantes médicinales

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KEYWORDS. — Plantes médicinales; Médecine traditionnelle; Ressources génétiques; Pharmacognosie.

SUMMARY. — La R.D. Congo reste confrontée à de multiples problèmes de santé. L'accès à la médecine conventionnelle est limité ; la médecine traditionnelle est la principale, souvent la seule, alternative de soins et l'Organisation mondiale de la Santé prône sa reconnaissance et sa modernisation pour les soins de santé primaires (Anonyme 2013). Le projet pilote PHYTOKAT, financé par l'ARES, vise à établir les bases indispensables pour progresser dans cette voie au Katanga:

- les conditions pour l'introduction des pratiques traditionnelles en médecine moderne seront évaluées (qualité des intervenants, des diagnostics; qualité, efficacité, sécurité des traitements);
- de nombreuses plantes de la pharmacopée traditionnelle ont été recensées au Katanga; certains usages traditionnels ont pu être validés par l'identification de composés actifs. Le projet propose d'approfondir l'étude botanique, pharmacologique, chimique et agronomique de ces espèces;
- dans le contexte de l'érosion régionale de la diversité végétale, les prélèvements excessifs sur certaines espèces médicinales vulnérables pourraient représenter une menace sérieuse, menant à leur disparition; une stratégie de conservation est urgente et nécessite un état des lieux de leur répartition actuelle.

Ce projet permettra la réalisation de 5 thèses de doctorat, orientées vers les sciences biomédicales et agronomiques. Le projet contribuera à corriger une des faiblesses identifiées par l'Analyse Contextuelle Commune (Anonyme 2015) pour le domaine environnement/ressources naturelles : *"Manque d'information, de connaissances et de sensibilisation chez les décideurs et les communautés locales sur les bienfaits de la biodiversité liés au développement"*.

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Etude des mécanismes de la thermosensibilité différentielle du déterminisme du sexe de différentes souches béninoises de tilapia

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MOTS-CLÉS. — Tilapia; Thermosensibilité; Déterminisme sexuel; Souches.

RÉSUMÉ. — *Oreochromis niloticus* est l'espèce de tilapia la plus élevée dans le monde compte tenu de ses caractéristiques très intéressantes pour l'aquaculture. Un des principaux avantages de cette espèce est le dimorphisme sexuel de croissance en faveur des mâles qui grossissent jusqu'à 50% en plus que les femelles. Différents procédés sont mis en place pour produire des populations monosexes mâles chez les tilapias : le sexage manuel, l'hybridation, le contrôle du sexe par utilisation de mâles YY, les inversions sexuelles par administration d'hormones et la masculinisation par les hautes températures. Les deux premières méthodes ont été progressivement abandonnées au profit de l'inversion sexuelle par administration massive d'androgènes (généralement la 17 α -méthyltestostérone) qui représente aujourd'hui la technique la plus largement utilisée en aquaculture bien qu'elle présente des risques environnementaux et de santé publique importants. Dès lors, la méthode alternative utilisant les hautes températures est une technique intéressante. La présente étude a pour objectif d'une part de comparer la thermosensibilité du déterminisme sexuel chez différentes souches de tilapias collectées au Bénin et d'autre part d'investiguer les mécanismes par lesquels les hautes températures influencent le déterminisme et la différenciation du sexe chez les tilapias.

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Population genetics and phylogeography of African Fruit Bats involved in ecology of Filoviridae (Ebola virus, Marburg virus) in West, Central and Southern Africa

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KEYWORDS. — Ebola; Outbreak; Disease; Phylogenetics; Chiroptera.

SUMMARY. — For several decades, the Filoviridae family including Ebola virus (EBV) and Marburg virus (MARV) has been responsible for many haemorrhagic fever outbreaks in humans and great apes, mainly in Central Africa (Rougeron et al. 2015). Since 2005, several studies have shown that certain African fruit bat species might be potentially susceptible to transmit pathogens, including filovirus, between geographically distant African regions (Olival et al., 2014; Richteret et al. 2008). This would maybe explain the massive epidemic, which occurred in Western Africa in 2014-2016. However, very little information exists on the exact distribution of these species, on their taxonomy, as well as on the mobility and on the existing contacts between their populations. This study aims to better understand the biology of these species through two objectives. The first one will be to improve our knowledge on the taxonomy of bat species living in the region of Central, Western and Southern Africa through a molecular phylogeny approach basis of nuclear markers and the complete mitochondrial genome sequencing. The phylogenetic methods used will give a better understanding on the evolution and the species distribution of this group in sub-Saharan Africa. It will also provide important information for a better understanding of the patterns of pathogens' circulation among fruit bat species. The second objective will be to understand the spatial dynamics related to the migratory behaviour of these species through a study of the relationships existing between the populations of five frugivorous species (*Hypsignathus monstrosus*, *Epomops franqueti*, *Epomops buettikoferi*, *Eidolon helvum* and *Lissonycteris angolensis*), throughout Western, Central and Southern Africa and which were found to be positive for the Zaïre strain Ebolavirus. Population genetics studies will be achieved by single-nucleotide polymorphism obtained by genotyping by sequencing method. Our research will give a better knowledge on mobility of these species as well as on their genetic structures and population relationships. This information will be also essential to identify networks of contacts between bat populations and communities as well as interactions between humans and bats, in order to estimate risks of transfer of filoviruses among African regions. This project is integrated in the EU funded EBO-SURSY project supervised by the World Organization for Animal Health (OIE) aiming to better understand the problematic of Ebola in Africa.

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The impact of human activities on the diversity and structure of trematode communities in planorbid snails in western Ugandan crater lakes

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KEYWORDS. — Biodiversity; Parasite ecology; Gastropod; Trematode; Community ecology.

SUMMARY. — Biodiversity loss caused by human activities threatens the capacity of ecosystems worldwide to provide essential ecological services (Hautier et al. 2015). Hence, ecological research is increasingly directed at understanding the consequences of anthropogenic disturbances for biodiversity. Parasitic organisms have so far been largely overlooked in these efforts, although parasitism is the most common feeding strategy on Earth (Dobson et al. 2008). One group of parasites with high societal relevance are the trematodes, flatworms utilizing snails as intermediate hosts to infect vertebrate species, including humans, as final host (Toledo 2016). Trematodes cause important human diseases such as schistosomiasis, a neglected tropical disease affecting more than 200 million people (Gryseels et al. 2006). Here we aim to document the ecological patterns and processes that shape the local and regional diversity of trematodes transmitted by *Bulinus* and *Biomphalaria* snails in two clusters of crater lakes in western Uganda. These crater lakes experience a varying degree of anthropogenic disturbance, forming natural replicates to test the impact of both natural and anthropogenic factors on trematode diversity within and among lakes. Currently, however, it remains difficult to directly detect and identify trematode infections in snails. Therefore we are developing a multiplexing and pooling technique (Bybee et al., 2011) for genotyping by deep amplicon sequencing. This method allows to simultaneously amplify genetic loci for the host and its parasites from the same sample, thus enabling the analysis of the infra-communities of trematodes over large populations of snails. Additionally, it increases the genomic coverage for both taxa and thus the power to infer population genetic structure and diversity of trematode communities within and across lakes.

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'AM I SOLD?'
Bangladeshi Female Workers' Diaspora in the Middle East

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KEYWORDS. — Female Workers; Bangladesh; Middle East; Migration; Wellbeing.

SUMMARY. — This research aims to explore the impacts of female labour migration on women's well-being in a Muslim majority country like Bangladesh. Bangladesh, being a highly patriarchal and male dominated country is a very interesting case to analyse the issue of well-being of women through international migration. Focusing on the cases of Bangladeshi returned female domestic workers from the Middle East, the research analyses the dynamics and factors influencing behind the decision of migration and also the challenges women face both during their stay abroad and after their return. The study is based on qualitative data collected through in-depth semi structured interviews, focus group discussions, and key informants' interview. Observations and textual analysis are also carried out to support data obtained from the major tools of data collection. The study is grounded on Amartya Sen's (2001) concept of well-being in terms of capability and Martha Nussbaum's (1999; 2003) further interpretation of this concept and applied to analyse how and to what extent international migration ensures well-being of female migrants. The first part of the findings of this study unveils the global demand of female workers, state policy to promote female labour migration. Besides, poverty, unemployment, discrimination of women in the labour market in terms of salary and other facilities also encourage them to search for alternative options and thereby opt for migration. The second part of the research explores the challenges of migrant domestic workers during their stay in different countries of the Middle East. Deprivation from meeting the basic needs, excessive work load, seldom communication with home, and sexual and physical exploitation make their stays more challenging and problematic.

The research concludes that the understanding of the consequence of female migration in relation to achieving well-being is not always straightforward, rather it is relative. The well-being of the migrants depends on many factors including legal provision of respective countries, job agreement and culture of the destination countries, nature of the employer(s), socio-economic situation, personal motivation, and adaptation capability. Despite many challenges and difficulties, the study identifies some positive transformations among the migrants in terms of practicing agency in attaining further well-being. Thinking optimistically, these changes re-generate the 'means of realized well-being' after their returns.

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Représentations de la famille et émergence des troubles émotionnels chez les adolescents congolais de Lubumbashi

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MOTS-CLÉS. — Jeunes; Dépression; Anxiété; Histoire.

RÉSUMÉ — Les troubles émotionnels tels que la dépression et l'anxiété sont reconnus dans la population adolescente et font l'objet de recherches épidémiologiques, psycho-cliniques et psychomédicales. Des modèles conceptuels ainsi que des modèles d'intervention ont été développés dans le monde occidental. Peu d'études à ce jour ont été menées en Afrique. Le contexte socio-politico-économique, culturel et religieux en RD Congo est très perturbé depuis plus de 20 ans. La population en général en est la victime. Ce contexte pourrait bien expliquer et être à la base de troubles émotionnels et de santé mentale - anxiété et dépression - des adolescents congolais. En effet, en raison des réalités vécues, la famille congolaise se fragilise et sa représentation auprès de ses différents membres se modifie. Ceci est plus particulièrement le cas parmi les sujets en croissance (enfants et adolescents).

Notre étude vise à mieux appréhender la question des troubles émotionnels dans la population adolescente de Lubumbashi (12 à 17 ans) et à dégager des modèles étiologiques propres au contexte de la ville, en lien avec les contextes familiaux et l'attachement parental. Nous souhaitons reconnaître les facteurs les plus déterminants dans le processus d'émergence de l'anxiété et de la dépression.

Nos enquêtes menées auprès de 1051 adolescents (460 filles et 561 garçons) au cours des années 2015, 2016 et 2017 nous permettent de constater que l'histoire de la famille ou le récit de vie de la famille est au centre de la représentation. Quatre profils types de famille ont été identifiés. Nous constatons également que l'attachement parental est en lien indirect avec l'émergence de la dépression, mais par contre en lien direct avec l'anxiété. Par ailleurs, il existe une comorbidité entre la dépression et l'anxiété dont les taux de prévalence se présentent de la manière suivante chez les adolescents de Lubumbashi : dépression (18,74% de dépression modérée et 18,17% de dépression sévère) et anxiété (25,31% d'anxiété moyenne et 2,85% d'anxiété élevée).

Cette étude a permis de mettre en lumière le noyau central et les facteurs périphériques qui influencent la représentation de la famille et d'identifier les différents facteurs identitaires, scolaires, familiaux et sociodémographiques corrélés avec la dépression et l'anxiété parmi les adolescents de Lubumbashi. Cette information permettra de développer des modèles étiologiques et à terme des stratégies thérapeutiques.

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Investigating the land use/land cover changes in the Omo basin and their subsequent effects on the Omo delta

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KEYWORDS. — Post Classification Comparison; Lake Turkana; River Delta.

SUMMARY. — The Omo delta, is a huge wetland on Lake Turkana at the border between Ethiopia and Kenya. Remote sensing images show that the size of the delta has been fluctuating over time.

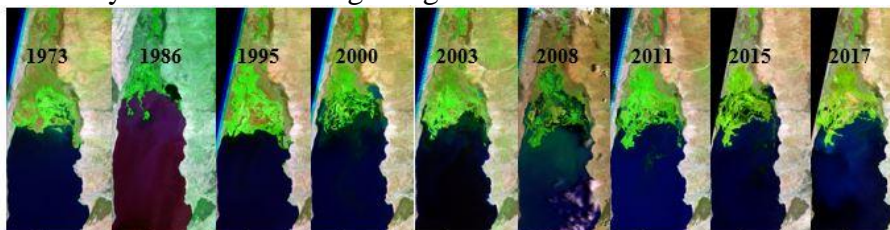


Figure 1: Spatial fluctuation of the Omo delta from 1973 to 2017 as shown on satellite imagery.
Source: (<https://earthshots.usgs.gov/earthshots/Lake-Turkana>. Accessed last on 19.08.2017).

The growth of the delta (Fig. 1) can be viewed: (i) positively, as presenting unique opportunities for people, fauna and flora (Butzer 1970) or (ii) negatively, as a result of Lake Turkana recession due to human activities and/or climate change in the Omo basin (Avery 2010). Remote sensing and GIS techniques were used to quantify the Omo delta extent in 2003 and 2008. A three-fold investigation of possible causes that led to changes in the areal extent of the Omo delta between 2003 and 2008 was carried out. The possible causes evaluated were: lake level variations, rainfall changes and land use/land cover changes. A Post-classification comparison method (Pontius *et al.* 2004), which utilises a two-way cross-tabulation matrix was employed for change detection analysis of land use/land cover and rainfall. A relationship between the spatial distribution of land use/land cover categories and rainfall was also sought. Between 2003 and 2008, the delta grew by 213 km², yet in 2003 the lake level was on average 0.78 m higher than in 2008. Therefore, the hypothesis proposed by (Haack 1996) that an increase in the delta size could be attributed to reduced lake levels was rejected. Further, the annual rainfall received in the Omo basin was found to be generally similar in the two years. There was, however, a marked change in the rainfall distribution pattern with a larger area of the Omo basin receiving higher amounts of rainfall in 2008 than in 2003. Additionally, there was a significant total change in land use/land cover categories with the transitioning of land use/land cover category shrubland to cropland accounting for 70.5% of the total swap change. In conclusion, the increased area of the Omo delta between 2003 and 2008 cannot be attributed to a decrease in lake levels and is most likely due to increased sediment load in the Omo river which is mainly deposited at the river mouth (delta).

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Dynamics of the spread of cholera epidemics in the Democratic Republic of the Congo: environmental, climatic and human factors

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KEYWORDS. — El Niño; Conflicts; Access to WASH; Transport networks; Population displacements.

SUMMARY. — Cholera still affects at least 47 countries across the world, resulting in an estimated 2.9 million cases and 95,000 deaths per year worldwide (Ali *et al.*, 2015). The Democratic Republic of the Congo (DRC) accounts for 7% of the cases and 4% of the population at risk worldwide (Ali *et al.*, 2015). The eastern DRC, where cholera's hotspots are located, reports outbreaks annually while the remaining regions are sporadically affected. A recent mapping of the burden of cholera in sub-Saharan Africa has suggested a detailed analysis of local epidemiology to understand local dynamics (Lessler *et al.*, 2018).

Thus, the present study aims to determine the spatial and temporal dynamics of cholera epidemics spreading and to analyze their underlying determinants. We hypothesized that environmental, climatic and human factors are involved in the observed dynamics of cholera's spread.

Cholera notification data from the Ministry of Health, based on the World Health Organization standard case definition, were collected at a weekly time scale from 2000 through 2017. Environmental variables (the proportion of the population with access to improved drinking water and to improved sanitation, population density, distance to a main river, a main road, a railway station and/or a harbor) and climatic variables (rainfall, temperature, and El Niño warm events years) were and will be collected using the methods developed by Moore and colleagues (Moore *et al.*, 2017). The data on armed conflicts and population displacements were extracted respectively from <http://www.acleddata.com/data/> and <http://www.ehtools.org/data/>. Generalized Linear Models will statistically analyze the epidemiological association between dynamics of the spread of cholera epidemics and environmental, climatic and human factors.

Using Binomial Regression Models, a preliminary analysis showed that El Niño warm events were a predictor of cholera epidemics spreading out of eastern endemic provinces (Odds ratio [OR] 3.3, 95% confidence interval [CI] 1.86-5.93). It implies that we may be able to provide an epidemiological tool to forecast the risk of cholera in the DRC.

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Etude par télédétection de la dynamique du couvert forestier du village Banango dans le territoire d'Ubundu (Tshopo, RDC)

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MOTS-CLÉS. — Banango; Défrichement; Occupation du sol; Sentinel-2.

RÉSUMÉ. — L'étude par télédétection de la dynamique du couvert forestier a été conduite dans le terroir villageois de Banango dans la province de la Tshopo en République Démocratique du Congo avec comme objectif d'évaluer la tendance évolutive du couvert forestier en zone agro-forestière, mais aussi décrire la dynamique d'ouverture des champs dans une année culturale qui, au niveau local, conduit à la fragmentation et à la perte de la couverture forestière (Treuhft *et al.*, 2004; Bonnet *et al.*, 2011; Colomina and Molina 2014; Tankoano *et al.*, 2015). Pour rendre possible cette étude, les images Sentinel-2 prises au cours d'une année culturale (décembre, janvier, mars et juin) ont été analysées et les enquêtes socio-économiques sur la nature des pressions exercées par la population sur le couvert forestier dans cette zone ont été également complétées. Deux approches ont été utilisées notamment, (1) la classification non supervisée pour la discrimination des zones de sols nus (défriche et route/village) et (2) la classification Random Forest pour prédire la dynamique d'occupation du sol (Lang *et al.*, 2007; Sako *et al.*, 2013; Dibi *et al.*, 2016).

L'examen de la dynamique du couvert forestier autour du village Banango de 2005 à 2016 évaluée à travers les images Landsat révèle une régression des formations forestières au profit des formations anthropiques. Le taux annuel de déforestation entre 2005 et 2016 est de -1.38%. Les principales causes du recul de la couverture forestière sont l'accroissement démographique, l'agriculture, le prélèvement du bois énergie, la carbonisation et la réouverture de la route Kisangani-Ubundu et celle de la voie ferrée. L'analyse de l'ouverture de champs dans une année a montré qu'à Banango, le maximum des champs sont ouverts au mois de juin.

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L'auteur en représentation.
Une étude du corps de l'écrivain dans les autofictions fantastiques
de Valeria Luiselli, Mario Bellatin, Alan Pauls et César Aira

Nicolas LICATA¹

MOTS-CLÉS. — Littérature; Mexique; Argentine; Corps; *Ethos*.

RÉSUMÉ. — Ce poster vise à fournir une vision d'ensemble de l'investigation qui se trouve au cœur de notre thèse de doctorat. Proust, Vargas Llosa, Bolaño, Doubrovsky, de nombreux écrivains se sont exposés sous leur propre nom comme les narrateurs et personnages de récits autofictionnels afin de raconter, non sans ambiguïté, divers épisodes de leur propre vie. Ce genre littéraire, dont Vincent Colonna (2004) a recensé quatre types — autofictions spéculaire, biographique, intrusive et fantastique —, a connu lors du siècle dernier un véritable *boom*, en France (Gasparini 2008) et en Espagne (Alberca 2007) mais aussi en Amérique hispanique. Notre objectif est d'en appréhender la modalité fantastique telle qu'elle se présente chez quatre écrivains hispano-américains contemporains. Plus spécifiquement, notre recherche porte sur la représentation dont le corps de l'auteur fait l'objet à l'intérieur desdits romans.

Les trois aspects de notre investigation que nous souhaitons mettre en relief à l'occasion du prochain Young Researchers' Overseas Day sont :

(1) Une lecture attentive des principaux théoriciens du fantastique, à l'instar de Caillois (1965), Todorov (1970) et Roas (2011), mène à constater que les autofictions désignées comme telles exploreraient en réalité d'autres modalités littéraires ;

(2) une étude systématique de quatre de ces autofictions — *Los ingravidos* (2011) et *El gran vidrio* (2007), des romanciers mexicains Valeria Luiselli et Mario Bellatin, ainsi que *Cómo me hice monja* (1993) et *Wasabi* (1994), des écrivains argentins Alan Pauls et César Aira — permet de conclure que la valeur (Le Breton 1992) des nombreuses altérations corporelles autour desquelles celles-ci s'articulent n'est en rien négative ; au contraire, la maladie, le handicap, la mort, et toutes sortes de perturbations somatiques surnaturelles (kyste démesuré, dédoublement, évanescence), s'y associent plutôt aux notions positives de lucidité, de créativité et de pouvoir ;

(3) on peut légitimement s'interroger sur la raison, ou du moins l'intérêt, d'une pareille représentation dans la fiction des troubles du corps de l'écrivain. De même que pour l'autobiographe, la question de la présentation de soi est, pour l'auteur d'une autofiction, cruciale. En adoptant le point de vue de la sociologie de la littérature, celui des travaux menés par Maingueneau (2004) et Jérôme Meizoz (2011) notamment, il n'est pas invraisemblable de penser qu'il s'agit pour l'auteur d'un levier, d'un moyen lui permettant de produire et de contrôler une certaine image de lui-même.

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Cartographie par télédétection de l'évolution du couvert forestier de la Réserve Forestière de Yoko de 1976 à 2015

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MOTS-CLÉS. — Logiciel SIG open source; Défrichement; Yoko; Tshopo; République Démocratique du Congo.

RÉSUMÉ. — Depuis plusieurs décennies, l'analyse par télédétection de l'évolution du couvert forestier en Afrique centrale est surtout réalisée pour des grandes étendues. Etant donné le rôle fondamental de la forêt dans la régulation de l'équilibre climatique, la meilleure analyse devrait se faire sur des petites étendues. La présente étude rentre dans le contexte d'évaluation de la prise de conscience du changement climatique en cours et de la protection de la biodiversité à une échelle locale en République Démocratique du Congo. Cette étude vise la cartographie de l'évolution du couvert forestier de la Réserve Forestière de Yoko de 1976 à 2015, tout en évaluant les difficultés liées à l'utilisation exclusive des logiciels open source. Elle vise également l'analyse de la dynamique du défrichement. Pour ce faire, la classification non-supervisée a été utilisée pour les images antérieures à 2015 et celle supervisée pour l'image de 2015. Les résultats ont montré trois phases d'évolution du couvert forestier. Au cours de la première allant de 1976 à 1986, le couvert avait progressé de 88,38 % à 95,93 %. A cette époque, la forêt était coupée pour alimenter les locomotives de la Société Nationale des Chemins de Fer du Congo en bois-énergie. Ensuite, la superficie forestière était restée presque inchangée pendant la deuxième phase jusqu'au début des années 2000. Enfin, la troisième phase avait commencé à cette date avec un nouveau moteur de déforestation : l'agriculture itinérante sur brûlis. Au cours de cette dernière phase, la superficie forestière était passée de 94,68 % à 79,68 % soit 15% de perte. En ce qui concerne le défrichement, il se fait avec rotation des champs. Les espaces défrichés se localisent encore près des voies de communication. On note par ailleurs que les paysans sont motivés à installer des champs à l'intérieur de la réserve par manque de sols riches en dehors. Il a été également noté qu'aucune difficulté n'est attribuable à l'utilisation exclusive des logiciels open source en ce qui concerne ce genre d'études. Somme toute, cette étude a révélé que la forêt primaire de la Réserve Forestière de Yoko est actuellement en train de régresser au profit de forêts dégradées et de jachères.

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Methodology for the design of climate responsive houses for optimized thermal comfort in Quetta, Pakistan

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KEYWORDS. — Thermal comfort; Building simulation; Resource efficiency; Design strategies; Design interventions

SUMMARY. — Household sector in Pakistan consumes more than half of the energy [1]. Quetta is the capital and the largest city of Balochistan province, Pakistan. The city is facing several problems including increasing population, and shortage of energy. The existing houses are not providing optimum thermal comfort to the residents. The residents are using mechanical methods for achieving comfort in their houses which increases the usage and the demand of energy. There is a strong need to develop and adopt the climate responsive strategies in order to achieve thermal comfort by using minimum energy and reducing the environmental impact. The aim of this PhD is to develop climate responsive strategies for the improvement of indoor thermal comfort in houses at Quetta, Pakistan by providing low cost, energy efficient and locally acceptable solutions. This PhD is divided in 5 workpackages: WP1 focuses on characterization of the existing housing in Quetta, in WP2 the common type(s) of houses are further analyzed in terms of indoor climate, comfort, building materials and living habits of the residents; in WP3 representative benchmarking models will be selected for the building simulation and parametric analysis; WP4 focuses on the development of methodology for the improvement of indoor thermal comfort; and in WP5 the developed methodology will be validated by discussion and interviews with the residents and the future inhabitants.

A housing survey was conducted in the first phase of this PhD to get insights and identify the main characteristics of the existing housing stock in Quetta. In total 215 houses were surveyed in 32 residential areas of Quetta by filling in survey questionnaire, drawing sketches and taking pictures [2] [3]. In a second phase, indoor temperature and humidity was monitored in 10 houses. In 5 houses monitoring was done for 4 weeks (2 weeks in summer and 2 weeks in winter) to calculate the extreme temperatures. While in the rest of the 5 houses monitoring was continued for the whole year to monitor extreme temperatures as well as seasonal differences [4]. Benchmarking selection will be done, and selected models will be simulated for the improvement of indoor thermal comfort by adopting various strategies and scenarios such as change of orientation, ventilation schemes, design interventions and building materials, etc. The study will provide the basis for the improvement of thermal comfort in housing at Quetta. Similar strategies can be later adopted in other parts of Pakistan.

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Epigenetic Cu-Zn (Pb) mineralization at the Kyaundji deposit hosted in the Kundelungu Group (northern part of the Tenke-Fungurume region, DR Congo)

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KEYWORDS. — Copper-zinc deposit; Hypogene and supergene mineralization; Lufilian arc.

SUMMARY. — The Tenke-Fungurume mining district, located in the central part of the Lufilian arc in the Democratic Republic of Congo, forms a world-class Cu-Co ore district. Mineralization is mainly situated in the Mines Subgroup, with however some occurrences in both the Nguba and Kundelungu groups (Schuh et al., 2012; Mambwe et al., 2017). In the northern part of the district, i.e. at Kyaundji and close to the Katanga foreland (eg. Plateau de Bianco), Cu-Zn (Pb) mineralization is hosted in the Lusele Formation (dolomite, shale, dolomitic shale and sandy shale) at the base of Kundelungu Group. The location of the mineralization is controlled by faulting, the presence of a tectonic breccia and microkarst development in the dolomitic lithologies. A mineral sulfide zonation is observed in these fractures and the micro-karsts. The primary sulfide mineralogy consists of pyrite, chalcopyrite, bornite, sphalerite and galena. Euhedral pyrite also occurs disseminated in the host rock. The supergene mineralization contains azurite, chrysocolla, covellite, malachite, smithsonite and pseudomalachite. Both the hypogene sulfides and the supergene Cu-Zn minerals are overgrown by carbonate minerals. A microthermometric study of the fluid inclusions in these carbonate minerals will allow to deduce the precipitation conditions of the minerals and the evolution of the mineralizing fluids. The timing of the Cu-Zn (Pb) sulfide mineralization is interpreted to postdate the Lufilian orogeny, as is the case for the world-class Kipushi Cu-Zn-Pb ore deposit (Chabu, 1990).

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Fluid trapping processes at the Shangoluwe Cu ore deposit (Katanga Supergroup, DRC)

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KEYWORDS. — Cu mineralization; Breccia; Fluid inclusion microthermometry; Lufilian arc.

SUMMARY. — The Shangoluwe Cu deposit is located in the Kambove region in the central part of the Lufilian arc. It forms a major Neoproterozoic Cu vein-type ore deposit hosted in the Kundelungu Group. The mineralization was controlled by the lithology of the host-rock (a sedimentary breccia) and tectonic deformation (Mambwe et al., 2017). This deformation was related to Lufilian extensional collapse and post-Lufilian transpressional inversion (Kipata et al., 2013). The brittle tectonic evolution of the Katangan Supergroup was documented previously by Kampunzu and Cailteux (1999) and Kipata et al. (2013). The latter authors distinguished 8 brittle stages in the Lufilian arc. A microthermometric study of fluid inclusions in gangue minerals which formed during brittle tectonics stages 5 (arc-parallel extension) and 6 (transpressional inversion) was carried out. This study shows a wide range of the homogenization temperatures between 30° and 250°C and salinity between 4 - 36 eq. wt.% NaCl. The preliminary data also show high salinity fluid inclusions (26-36 eq. wt% NaCl) with a wide range in temperatures (100 – 250°C) in brittle stage 5. Brittle stage 6 contains inclusions with a homogenization temperature between 30 and 80°C, i.e. around 50°C, but with a wide range in salinity (4 – 22 eq. wt% NaCl). The data from both brittle stages thus indicates cooling and mixing between an original high salinity fluid and a younger low saline fluid. The high salinity fluid has been observed in several previous studies and forms a basinal brine which was already present in the deeper subsurface during maximum burial and early tectonic deformation (El Desouky et al., 2009). These results will be compared with new fluid inclusion data from other-deposits in the Katanga Supergroup, especially in the Nguba and Kundelungu groups which are still poorly investigated along the Lufilian arc compared to the mineralization in the Roan Group (El Desouky et al., 2009).

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Abundance of giant clams (*Tridacna* sp.) on protected versus unprotected coral reefs in the Western Indian Ocean

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KEYWORDS. — Density; Community analysis; Mitochondrial DNA; DNA barcoding.

SUMMARY. — Giant clams have an ecological significance in coral reef ecosystems. Worldwide a decline in abundances can be noticed due to habitat degradation and fishing pressure. Despite the presence of many marine protected areas, densities of giant clams remain low. The objective of this study is to investigate if the abundance of giant clams in marine protected areas is higher than in unprotected areas of the Western Indian Ocean (WIO). The results show no significant difference in abundance. Cluster analysis based on abundances of *Tridacna* sp. in the WIO showed a biogeographic pattern. Moreover, this study aims to use 16S sequences for the genetic identification of *Tridacna cf. squamosina* from the WIO. Phylogenetic analysis shows that *Tridacna cf. squamosina* from the WIO forms a closely related sister clade to the *T. squamosina* clade from the Red Sea. There is either a divergent population of *T. squamosina* in the WIO or a new species closely related to *T. squamosina* that exists in the WIO. In the future, an integrated taxonomy approach is needed to be able to confirm the presence of *T. squamosina* in the Western Indian Ocean and the Red Sea.

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Characterization of drying and impact of pretreatment on color and piperin content of Kampot peppers (*Piper nigrum L.*) in Cambodia

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KEYWORDS. — HPLC; Geographical indication; Bioactive compounds.

SUMMARY. — *Piper nigrum L.* is known as the king of spice because of its pharmaceutical properties linked to the presence of bioactive compounds including vitamin C, phenolic compound, and piperine that are known as anti-oxidants, anti-diarrhea, anti-inflammatory, and also reduce lung cancer (Nair, 2004; Ahmad *et al.*, 2012). In Cambodia, pepper plantation has been reported as early as the 13th century. Nowadays, pepper is planted across the whole country. However, peppers from the Kampot province, at the south west of the country, is the most known in the world. Its quality was recognized during French colonization in which pepper was the main crop exported from the region to European countries. Due to this reputation, Kampot pepper was registered as a Protected Geographical Indication (GI) product in Cambodia in 2010 and in EU in 2016. Four types of Kampot peppers can be found: green, black, white, and red peppers. Interestingly, those peppers are not from different varieties, but differ in transformation and harvesting period. Green pepper is collected while still young, black pepper is produced when they are old enough (yellow-green), red pepper is harvested while they are ripen, and white pepper originates from red peppers by removing their skin (MCC & MAFFC, 2009). Red, black and white peppers are dried products.

Drying is a dehydration technique commonly used to extend shelf life and reduce transportation weight of agricultural products. It is considered as a complicated technique since it combines complex mass and heat transport phenomena (Mayor & Sereno, 2004). In Cambodia, open sun drying is routinely used to preserve the agricultural crops. This traditional technique provides undesired pepper quality due to physical and microbiological contamination during drying. Therefore, new approaches for the drying have to be investigated. A key step in such a development is the characterization of the pepper drying operation.

The main objectives of this study are to define the drying behaviors of Kampot pepper by applying different drying temperature and air flow rate, to study on the impact of pretreatment on color and piperin content of Kampot red peppers and finally applying an empirical model. Two different drying conditions were designed. Firstly, fresh Kampot peppers were dried in a lab scale hot air tunnel dryer at 45°C and 55°C with different air flow rates of 0.5 m/s and 0.35 m/s without and with pretreatment for 1 minute. Secondly, Kampot red peppers were oven-dried at 55°C and 65°C without and with pretreatment for 5, 10, and 15 minutes respectively.

The piperin content was determined by HPLC (High Performance Liquid Chromatography) and the color was analyzed by Chroma meter. The results showed that higher drying temperatures allow faster drying, as expected, with the apparition of external mass transfer limitation at high temperature. The shrinkage of pepper grains seems to be different at drying temperatures of 45°C and 55°C. Pretreatment such as blanching by boiling in water had an interesting impact on drying kinetics and color especially on red peppers. Drying and pretreatment had only a slight impact on piperin content. This limited impact seems to be explained by the location of this molecule mainly in the inner core of pepper grain. A simple empirical model, i.e. Newton's model, can offer an appropriate fitting to Kampot drying kinetic. Further phenomenological modeling is required, particularly the correlation between drying kinetic and its quality.

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Long-term moisture analysis using Remotely sensed data in Mongolia

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KEYWORDS. — Soil moisture; Satellite; *In-situ*; Moisture index; PET.

SUMMARY. — The purpose of this research work is to estimate long-term soil moisture content in central part of Mongolia. The soil moisture (SM) content is one of the most important environmental variables in relation to land surface climatology, hydrology and ecology. Climate is changing in the global spotlight and Mongolia is a hotspot of climate change especially temperature rises and drought frequencies increased. Mongolia has six different natural zones which are high mountain, taiga forest, mountain forest steppe, steppe, desert steppe and desert. The amount of moisture is decreasing north to south. In my previous study, the annual evaporation is 150~250 mm in the steppe zone and over 150 mm in desert steppe and deserted zones. The study area includes seven provinces which are situated in the central part of Mongolia. It is situated between 589 and 2788 masl and contains thirty-eight climate stations. In the long-term analysis, satellite-derived products can provide moisture contents. For the interpolation, we interpolated precipitation data into raster imagery from May to August for the 2000-2013 over Mongolia using 127 climate stations. The potential evapotranspiration (PET) was estimated from MODIS data. The Normalized Difference Vegetation Index (NDVI) was calculated using the near infrared (NIR) and the visible red (RED) bands from the SPOT data during the growing season (May to August) for 2000-2013. The method of Mathew Tybersky (2008) used to derive from precipitation and PET. For the accuracy, we used NDVI and climate station data. The results of the long-term soil moisture maps were compared with the NDVI data. The relationship between moisture of June and NDVI of July is determined 0.68, moisture of July and NDVI of August is determined 0.80. The amount of moisture (May-July) was compared with NDVI of August correlation coefficient was 0.75 and the relationship between amount of moisture (June-July) and NDVI of August was determined 0.79. According the results that moisture of previous months directly affected to growth of vegetation which as next months. In the future, we will apply the model all over the Mongolian natural zones. We used SM measurements from climate station in different depths for the validation of estimated SMC. Then we estimated relationship between estimated SMC and NDVI during the study period. SM monitoring is important for Mongolian agricultural development.

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**The overseas regions and the European Union: historical context, rationale and dynamics
within the scope of the institutional conception of European identity**

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KEYWORDS. — EU membership; Colonies; French DROMs.

SUMMARY. — European identity is the first condition for a State to be considered eligible to EU membership. Indeed, Article 49 of the Treaty on the European Union, which regulates the application process for EU membership, enshrines that a State must be 'European', without specifying the meaning(s) attached to such a qualifier. Various interpretations were provided by the EU institutions in the course of enlargements and membership requests. One of these interpretations is illustrated by the integration, or full assimilation, of some overseas regions into the EU because they have retained ties with one of the EU Member States. Despite their remoted geographical position, these regions were indeed integrated – and not merely associated – in the same capacity as the metropolitan regions, which means that the general provisions of the Treaties apply to these overseas regions. In spite of the fact that this specific option has existed since the Treaty of Rome, different legal provisions for integration have applied to these regions, depending on their status within and ties with the motherland.

This poster will provide an overview of the history of the integration of overseas regions into the EEC/EU, as well as the rationale and the dynamics (financial, geopolitical, 'colonial', ...) behind this process, by relying on a few illustrative cases, such as the French overseas regions (Guadeloupe, Mayotte, Réunion ...) and the former integrated Algeria and Greenland. The poster will also display the respective legal integration framework of these cases and the possibility to change their integration/association status enabled by Article 227 TFEU.

By presenting the various aspects surrounding the relationship between the overseas regions and the European Union, the poster intends to highlight the historical (colonial) interpretation of European identity and how these regions have eventually become part of the institutional conception of European identity.

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Floods and rainfall variability: Analysis of trends of extreme rainfall events observed in 40 Algerian stations

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KEYWORDS. — Climate; Floods; Rainfall indices; Extreme events.

SUMMARY. — According to the Köppen-Geiger classification, Algeria is characterized by two major types of climate. From north to south - and with several levels - it goes from a temperate type to a dry type. Precipitation is subject to high spatial and temporal variability and can cause catastrophic floods (Nouri et al., 2016). In 2015 alone, we recorded more than 130 floods across the country. In order to understand the cause of these floods, we present an analysis of long-term daily rainfall series through eight rainfall indices (de Longueville et al., 2016).

- General indices: the annual total precipitation (TOTR), the number of wet days per year (DR) and the simple day intensity index (SDII) ;

- Extreme rainfall event indices: the annual maximum rainfall recorded during one day (Rx1d), the number of heavy rainfall days (RR10) and very heavy rainfall days (RR20), the 90th, 95th and 99th percentiles to determine heavy, intense and extreme rainfall (R90p, R95p and R99p).

To do this, we use the time series of 40 rainfall stations distributed heterogeneously over the Algerian territory. These series have been made available by the National Agency of Hydraulic Resources. The database contains daily rainfall information taken since 1872 for some stations, until 2016 for the most recent ones. This information is analysed to detect possible changes in the rainfall regime over time, as well as to verify the hypothesis that extreme rainfall events that can cause flooding increase both in frequency and intensity.

Considering the climate change issue, we were expecting for higher frequency of extreme event, but the results of our long term analysis (47 years) show that there is no significant trend. Which leads us to another prospecting topic to define the increase of the extreme floods in Algeria: the land use (subject treated separately).

For the first time, this global analysis is applied on a daily rainfall data, measured and compared to a database dedicated to disastrous floods.

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Ecologie et conservation des plantes médicinales dans la région de Lubumbashi

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MOTS-CLÉS. — Variabilité morphologique; Niche écologique; chémotype; Lubumbashi.

RÉSUMÉ. — Les plantes médicinales restent très utilisées en médecine traditionnelle en Afrique centrale. Pourtant, la variation morphologique importante existant au sein des espèces peut rendre l'identification problématique et permet aussi de soupçonner une variation phytochimique. Dans la région de Lubumbashi (Haut-Katanga, R D. Congo), la déforestation rapide représente un risque pour l'approvisionnement en plantes médicinales. L'impact de la pression anthropique sur la conservation de leurs populations doit être évalué d'urgence.

Les études ethnobotaniques réalisées dans cette région ont démontré que les espèces du genre *Vitex* (Lamiaceae) sont très utilisées en médecine traditionnelle (Okombe et al., 2014 ; Bakari *et al.*, 2017). Le nombre important d'espèces au sein de ce genre, et leur variabilité, contribuent aux difficultés d'identification rapportées par les différents acteurs de la filière des plantes médicinales (Hounpkévi et al., 2016).

Notre thèse de doctorat, réalisée dans le cadre du projet PHYTOKAT, vise à améliorer la connaissance botanique et écologique des espèces du genre *Vitex* dans une région soumise à une pression anthropique forte. Spécifiquement, nos objectifs sont les suivants :

1. Evaluer l'abondance des espèces et l'état de conservation de leurs populations en fonction de l'état de dégradation du paysage ;
2. Caractériser la niche écologique des espèces dans la Plaine de Lubumbashi ;
3. Caractériser la variation morphologique existant au sein des espèces, afin d'orienter la recherche de chémotype aux propriétés pharmacologiques différentes ;
4. Proposer des critères d'identification micro-morphologiques des espèces, afin d'améliorer le contrôle de qualité des produits mis sur le marché.

Les résultats préliminaires suggèrent que deux espèces de *Vitex* de la Plaine de Lubumbashi (*V. madiensis* et *V. mombassae*) ont leur optimum écologique dans des peuplements légèrement savanisés. L'étude micromorphologique suggère que la morphologie des poils permettra une identification des espèces sur base de fragments de feuilles. Il existe aussi une variation intraspécifique de la morphologie foliaire qui permet de soupçonner l'existence d'une variation phytochimique et donc, des propriétés pharmacologiques.

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Domestication et production en culture de plantes médicinales du Katanga

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MOTS-CLÉS — Médecine traditionnelle; Diversité génétique; Variation populationnelle; Métabolites secondaires.

RÉSUMÉ — Les plantes médicinales ligneuses (PM) constituent l'un des principaux produits écosystémiques fournis par la forêt claire du Haut-Katanga (R.D. Congo). La déforestation rapide dans cette région fait que les espèces de plantes les plus importantes, parmi lesquelles les PM, sont en régression. Dans le même temps, la demande en PM augmente avec la croissance démographique, car plus de 80% de la population utilise les plantes pour se soigner. Dans ce contexte, la domestication des PM apparaît comme un moyen efficace pour garantir l'approvisionnement en produits de ces espèces et de diminuer la pression sur les populations sauvages (Mwandja, 2018).

Toutefois, la domestication étant un processus évolutif, peut également entraîner la perte de la diversité génétique, affecter la production des métabolites secondaires et limiter ainsi son utilisation future (Mapongmetsem et al., 2017). C'est pourquoi, des études génétiques et phytochimiques devraient compléter toute initiative relative à la domestication des PM, afin de déterminer les facteurs responsables de la variabilité ainsi que le gène responsable de l'adaptabilité.

Les études ethnobotaniques réalisées dans le Haut-Katanga ont démontré que les espèces du genre *Vitex* (Lamiaceae) sont très utilisées en médecine traditionnelle (Okombe et al., 2014 ; Bakari et al., 2017).

Notre thèse de doctorat, réalisé dans le cadre du projet PHYTOKAT, vise à explorer les possibilités de domestication d'une sélection de PM, principalement du genre *Vitex* (Lamiaceae). Nos objectifs sont : 1) de maîtriser la multiplication et la mise en culture de ces plantes par bouturage ou semis ; 2) de constituer une collection d'accessions diversifiées représentatives de la diversité existant dans le Haut-Katanga ; 3) de caractériser la variation existant dans ces collections (traits morphologiques et phytochimiques) ; 4) d'examiner l'influence des conditions de culture sur la production de métabolites d'intérêt.

Les résultats préliminaires obtenus montrent qu'il est possible de reproduire ces espèces par bouturage de tiges : 55% du taux de reprise pour *Vitex mombassae*, 30,7% pour *V. doniana*, 21,4% avec *V. madiensis* et 16% avec *V. fischeri*. Les expérimentations sont en cours pour améliorer les connaissances sur la phytotechnie de ces espèces en testant le semis, le bouturage des racines, la culture *in vitro* ainsi que les études sur leur diversité mycorhizienne. Les études phytochimiques et génétiques interviendront deux ans après transplantation.

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Risk perception of socio-natural hazards among gold miners in Itogon, Benguet

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KEYWORDS. — Mining; Disasters; Landslides.

SUMMARY. — The Philippines is prone to natural hazards. With its population exceeding 100 million, the country has been ranked among the top countries with the most number of people affected by disasters in the last 20 years (CRED-UNISDR, 2015). The poster describes how artisanal and small-scale gold miners in Itogon, Benguet live alongside the risks of socio-natural hazards in an area that is naturally prone to landslides and has been the site of large- and small-scale gold mining activities for more than a century. Artisanal and small-scale gold mining (ASGM) is often associated with hazardous working conditions, the use of hazardous chemicals such as mercury and cyanide, child labor, and its negative impact on the environment. However, ASGM continues to be an important source of livelihood among indigenous people and migrant miners in the area.

In September 2018, one of the mining communities in Itogon was affected by a big landslide, resulting in the death of more than 70 residents. A survey on risk perception of socio-natural hazards was conducted by the Author in the area prior to the landslide event. The survey revealed that while the miners' risk perception of landslides is high, the need to make a living is their primary concern. The poster presents various aspects of risk perception used in the survey to highlight the importance of perception studies in communicating risks and in encouraging participation in disaster risk reduction activities among communities living in areas susceptible to socio-natural hazards.

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Socio-economy of the small-scale fishing in the Burundian waters of Lake Tanganyika at Mvugo and Muguruka

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KEYWORDS. — Catch; Fishing effort; Investment; Profitability; Clupeids of Tanganyika.

SUMMARY. — The study on the socioeconomic and environmental dynamics of the small-scale fishing in Burundi was made in the Northwest part of the Lake Tanganyika in the province of Makamba, Municipality of Nyanza-lake, in the landing sites of Muguruka and Mvugo, from March till July 2013. The first objective is to update the information about the fishermen, their associations, the machines used in both selected beaches, as well as to compare the present catches with previous ones. A second objective is to estimate the cost and the income of the active, motorized and nonmotorized units, in order to assess their profitability. *Stolothrissa tanganyicae* (adults and young) and young *Lates stappersii* dominated in captures with respectively 68% and 26.7% at Muguruka, vs. 81.5% and 16.7% at Mvugo. As for the catch by a unit of effort (CPUE), the study estimates the CPUE of the unit Appolo at 152 kg/night, 80 kg/night for the motorized catamaran and 50 kg/night for the nonmotorized catamaran. After-sales service of the products of fishing, the estimated net profit (PNE) per artisanal fishing unit is the US \$ 8,300 ± 222 with a net annual income per fisherman of about the US \$ 691 for the non-motorized catamaran. for the motorized catamaran, this profit amounts to 4,380 ± 654 US \$ with a net annual income per fisherman of 274 US \$. On the other hand, the estimated net profit (PNE) of the Appolo unit is 11,670 ± 2,500 US \$ with a salary cost per fisherman of 645 \$ US. Catches of fish in Lake Tanganyika depend mainly on changes in fishing practices or fishing effort. Thus, since the 1990s, the most common observation is that CPUE has decreased for all artisanal fishing units (Sarvala et al., 2006, Van der Knaap et al., 2014). This is also observed in the northern part of the lake, both on the western side of Uvira and Congolese Fizi (Mushagalusa et al., 2015) and on the Burundian side in Mvugo and Muguruka. Thus, based on the results of this study, non-motorized fishing units are more profitable in the near-shore area. As for Apollo units fishing offshore in the pelagic zone, catches are much higher but their profitability is not much higher than non-motorized units. As a result, the number of non-motorized, motorized and trimaran Appolo catamarans decreased by 59%, 20%, and 64% respectively compared to the 2011 framework survey.

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Phytolith Stock of a 26-yr Volcanic Ash Soil in Tarlac, Philippines

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KEYWORDS. — Volcanic glass; Rice; Mt. Pinatubo ash; Silicon; Amorphous silica.

SUMMARY. — Volcanic ash soils derived from pyroclastic materials are deposited by explosive eruptions. As such, their geographical distribution closely matches that of active volcanoes. Owing to their excellent fertility, volcanic ash soils support productive agriculture in many parts of the world. In Southeast Asia, including the Philippines and Indonesia, they are used for cash crop production such as rice, sugarcane and banana. However, these regions are also prone to frequent volcanic ash deposition. When the ash deposit is thick enough, complete burial of the surface soil may occur and a new soil will eventually form upon weathering and organic matter accumulation in the fresh ash. The impact that soil burial by ash tephra has on the biogeochemical cycles of key elements such as C and Si in the soil-plant system is not well known. This study focuses on Si in a rice-cultivated area affected by the 1991 Plinian eruption of Mt. Pinatubo in the Philippines. Silicon is not an essential element but its presence has been shown to improve rice resistance to biotic and abiotic stresses. Rice is a well-known accumulator of Si in phytolith (BSi) form. Here we assessed the phytolith (BSi) stocks in the modern soil that has been developing from the fresh dacitic ash deposited in 1991, and in the older (~800 yrs) volcanic ash soil that was buried by this deposit.

BSi was extracted through densimetric separation using a heavy liquid (Na-polytungstate) from the soil's silt-size fraction. Volcanic glass (GSi), ASi present in ash deposits, having similar density (~ 2.3 g cm⁻³) as BSi, was also extracted using this method. The estimated percentage abundance of BSi and GSi were based on abundance per surface unit expressed in percent and qualitatively rated using AFCOR (Abundant, Common, Frequent, Occasional, Rare) description. The average ASi [BSi + GSi] stocks of the surface soil, ash, and buried soil horizons were 47, 11 and 294 g m⁻².

Phytolith assemblages of the surface soils have frequent to abundant total BSi (rice + other grasses) [2.0-4.4 %] with rare to occasional occurrence of rice BSi [0.12-0.8 %] and frequent to abundant GSi [2.3-4.4 %]. Buried soils were dominated mainly with total BSi [4.4-5.0 %], with occasional rice BSi [0.6-1.5 %] that is 70% higher than the surface soil, and with rare to occasional GSi [0.1-0.9 %].

Knowing that the modern soil has received rice straw biomass for the past 12 years, we determined the rate of BSi accumulation on the surface (newly developed) soil of the 26-yr old ash deposit. We also computed the theoretical BSi stock of the ash-buried soil. Using mass balance equation, the predicted rice BSi accumulation in the modern soil was 10 times higher than the measured value. The rice BSi stock of the ash-buried soil was also higher by a magnitude of 5 from the actual BSi extracted. The results suggest that accumulation of BSi in a young volcanic ash soil being lower than the predicted value either incurred losses via leaching and dissolution or Si uptake by rice is low in ash-affected soils resulting to lower BSi recycled into the soil.

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Dynamique paysagère de l'urbanisation de la ville de Kinshasa (Congo, République Démocratique) entre 1995 et 2010

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MOTS-CLÉS. — Paysage; Etalement Urbain; Transformation Spatiale; Espaces Verts.

RÉSUMÉ. — La nécessité de caractériser la dynamique d'urbanisation connaît un intérêt croissant dans le cadre des recherches pour le développement urbain durable (Mesev, 2003). Les études menées sur l'étalement urbain de la ville de Kinshasa, la capitale de la République Démocratique du Congo (RDC) sont encore peu nombreuses (Tshibangu *et al.*, 1997 ; Kayembe wa Kayembe *et al.*, 2009). De plus, elles abordent peu les mécanismes et processus de transformations spatiales liés à l'urbanisation en cours. La présente étude a consisté à l'analyse des transformations spatiales en cours dans le paysage de la ville. Elle s'appuie sur la théorie de la croissance urbaine basée sur l'hypothèse de diffusion-coalescence du bâti (Dietzel *et al.*, 2005). L'étude se base ainsi sur l'hypothèse que (i) le paysage tend à l'homogénéisation avec une dominance croissante de la classe du bâti; (ii) cette dernière est la plus stable et (iii) les processus spatiaux en cours sont préjudiciables aux zones vertes. Notre démarche s'est basée sur le traitement de deux images satellitaires SPOT de 1995 et 2010 couplé à l'emploi d'indices de structure spatiale pour déterminer la composition du paysage ; la matrice de transition pour l'analyse des conversions d'occupation du sol et à l'analyse des processus de transformation à travers l'arbre de décision de Bogaert *et al.* (2004). Ce dernier consiste en une clé dichotomique basée sur la comparaison entre les deux années étudiées du nombre, de l'aire et du périmètre des taches constituant chaque classe d'occupation du sol.

Nos résultats montrent que le paysage de Kinshasa s'homogénéise au profit de la classe du bâti qui est, en toute conséquence, la classe la plus stable. La croissance urbaine de la ville se fait donc par un double phénomène d'extension et de densification du bâti. De plus, nous observons que la dynamique d'urbanisation est concentrée dans un rayon d'au moins 13 km à partir du centre-ville et qu'elle consiste en l'aggrégation du bâti au détriment des zones vertes (forêt, savane, marécage et eau) et en la savanisation du réservoir forestier de l'arrière-ville. Garantir la qualité environnementale de la ville dans ce contexte de croissance urbaine impose donc d'optimiser et de rationaliser l'utilisation de l'espace et des ressources naturelles intra-urbains et périurbains à travers une approche plus respectueuse de la nature.

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Growing in a world of physiological drought by using foliar water uptake: the mangrove *Avicennia marina*'s secret

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KEYWORDS. — Drought; Foliar water uptake; Plant-water relations; Deuterium tracing; Climate change.

SUMMARY. — Mangrove forests constitute a diverse group of evergreen trees, shrubs and ferns functioning as stabilizers for riverbanks and coastlines, food and wood providers both for animals and people and protectors of more inland areas against storm surges. Due to their exceptional location, these forests are known to have an abundance of water at the root-level. However, due to the high salinity, this water is not readily available for these forests and even induces physiological drought. This partly explains why the latitudinal distribution of mangroves coincides with the geographical limits of arid regions, suggesting that the distribution of mangroves is more limited by precipitation and aridity rather than air temperature. This hypothesis has been confirmed by recent research that indicated the direct uptake of canopy rainwater (foliar water uptake; FWU) which caused turgor-driven growth spurts in full grown *Avicennia marina* trees, a widely distributed mangrove species. It was clear that diameter growth of this species in the absence of rainfall events was negligible, thus illustrating the importance of precipitation events for this species. FWU has been intensively studied for full grown trees of different species from the tropics, however, the importance of this plant trait on seedlings has been widely neglected. As such, FWU was investigated for *A. marina* seedlings by using both dendrometers and sap flow sensors as well as deuterium tracing. It was found that the effect of FWU on the turgor-driven growth was even larger for seedlings compared to full grown trees. Even more, by performing a deuterium tracing experiment it was clear that the water taken up by FWU was redistributed to the stem and directly correlated with the observed turgor-driven diameter growth. These results indicate that FWU is an essential trait for the growth of *A. marina* seedlings and possibly even their establishment, thus indicating that the distribution of mangrove species might be more affected by the upcoming climate change driven changes in precipitation patterns than previously thought.

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Host Control on Symbiont Proliferation

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KEYWORDS. — Symbiosis; Dynamin; Cnidarians; Cell division; Zooxanthellae.

SUMMARY. — ABSTRACT: —The theory of 'symbiogenesis' provides an explanation for the evolution of plastids and mitochondria in eukaryotes through engulfment of prokaryotes. The proteins required for the division of these organelles are nuclear-encoded and thus are being controlled by the 'host'. Studies in *Arabidopsis thaliana*¹ and *Toxoplasma gondii*² have suggested an involvement of host-derived GTPase, dynamin, in the regulation of symbiont division.

Photosynthetic dinoflagellates in the genus *Symbiodinium* exist as endosymbionts within a series of membranes of both host and symbiont origin in the gastrodermis of various cnidarian taxa. The growth rate of the endosymbionts is higher in culture than within the host (*in hospite*)³. If not controlled, the symbionts would probably overgrow the host cells. A dynamin-regulated mechanism employed by the host for the control over symbiont proliferation was suggested by us. Dynamin is a membrane-remodelling GTPase employed by the cell in process of membrane fission.

This study aimed at examining whether dynamin genes show differential levels of expression in symbiotic versus aposymbiotic anemones (*Exaiptasia pallida*).

The documented distribution of this species is around the coast of U.S., throughout Caribbean Sea and the Gulf of Mexico⁴. But it is a known aquarium pest and an upcoming model system for sea anemones⁵. Real-time polymerase chain reaction was used to quantitate dynamin expression. The diel mitotic index was estimated for the endosymbiont (*Symbiodinium minutum* type B₁) in culture and *in hospite* to assess variation in the division patterns.

This study is a part of a discovery-study aimed at unravelling the basis of host-control on its symbionts.

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Trophic strategies of reef-building corals under contrasted environmental conditions of East Asian Seas

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KEYWORDS. — Oceanography; Corals; Trophic plasticity; Stable isotopes; Taiwan.

SUMMARY. — Most reef-building corals can derive nutrition either autotrophically or heterotrophically, which allows them to use diverse trophic pathways (HOULBRÈQUE & FERRIER-PAGÈS, 2009; MUSCATINE, 1980). Therefore, when facing environmental changes, these organisms are expected to demonstrate an intrinsic ability to acclimatise through trophic plasticity. Despite the ecological importance of these corals, our understanding of their trophic strategies is currently impaired by a lack of rigorous research approaches; a failure to consider the intraspecific variability of coral species and an oversimplification of the proxies of heterotrophic habits (e.g. corallite diameter) (MADIN et al., 2016). In order to understand how trophic plasticity could allow them to acclimatise, this study proposed to assess the trophic plasticity of morphologically contrasted coral species (e.g. *Stylophora pistillata*, *Porites* sp, *Isopora palifera*). We determined the stable isotope ratios of carbon and nitrogen in the coral host tissues and algal symbionts and compared these in corals inhabiting areas around Taiwan characterised by contrasted temperature (from high to low latitudes) and light levels (from shallow to mesophotic waters). For each area, we evaluated the intraspecific trophic variability by estimating and comparing coral isotopic niches as a proxy for trophic niches. Our results on *Stylophora pistillata* revealed no overlap of the isotopic niches for the host and symbiont from different locations (unpublished data), suggesting that these coral colonies are supported by different core resources. Moreover, the isotopic niche of higher latitude coral colonies was larger than those from the lower latitudes (unpublished data), highlighting a certain trophic plasticity that may be related to more variable environmental conditions in the higher latitudes. Analyses of additional species and locations will provide essential insights into the trophic strategies of reef-building corals and how these species might adjust their nutrition in response to environmental changes.

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Les modifications environnementales provoquent-elles des processus migratoires dans l'Ouest du Cameroun ? Exemple de la commune de Kékem

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MOTS-CLÉS. — Changements environnementaux; Récupération des terres; Conflits; Migrations.

RÉSUMÉ. — Dans un contexte où les ressources naturelles constituent la base des moyens de subsistance et de la sécurité alimentaire, la dégradation de l'environnement impacte de façon complexe la vulnérabilité des populations et ses capacités de résilience. Affectés par les mêmes évolutions climatiques et environnementales, la vulnérabilité et la probabilité de migrer des individus/ménages sont influencées par leur dépendance aux ressources naturelles, leur statut socio-économique, et leurs caractéristiques démographiques (GEMENNE et *al.*, 2017). Cette étude part des crises environnementales observées dans la commune de Kékem (Ouest du Cameroun), et des fortes migrations agricoles qui ont précédé, pour s'interroger sur les réponses actuelles des populations aux dits changements. Ce travail a pour objectif de mesurer l'impact des changements environnementaux sur les émigrations dénombrées, ainsi que celui des immigrations passées sur les dégradations environnementales observées dans la commune. Les entretiens menés auprès de 93 ménages et 10 personnes ressources révèlent que Kékem connaît depuis une vingtaine d'années des changements environnementaux continus, en partie dus à certaines activités des populations migrantes dans la commune. Les terres agricoles perdues à la suite des changements environnementaux sont à l'origine de l'augmentation de la valeur des terres et, conséquemment, de la récupération des terres prêtées aux migrants, notamment les moins riches. L'une des réponses des ménages aux problèmes susmentionnés est la migration de certains membres vers les grandes villes. Il ressort également un fort contraste entre les groupes de migrants. Ceux ayant un réseau familial à l'arrivée ont – au même titre que les sédentaires – accès aux terres agricoles. A contrario, les migrants sans réseau familial à Kékem ont des difficultés d'accès aux habitats appropriés et aux terres agricoles et de pouvoir conserver les terres.

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Biais conceptuel et méthodologique dans l'estimation des surfaces déboisées autour de la ville de Lubumbashi (Haut-Katanga, République Démocratique du Congo)

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MOTS-CLÉS. — Forêt claire de miombo; Anthropisation; Rayon de déforestation; Charbon de bois; Télédétection.

RÉSUMÉ. — La forêt claire de type miombo, le « miombo woodland » des auteurs anglo-saxons, est un type de végétation largement distribué en Afrique zambézienne où il fournit des produits forestiers, ligneux ou non, à des millions d'habitants. En RD Congo, il couvre près de 23 % de la surface forestière totale et reste le type de forêt le plus dominant (>50 %) dans l'ex-province du Katanga (Kabulu et al., 2008; Potapov et al., 2012). Autour de la ville de Lubumbashi, les causes de la régression de sa couverture, soutenues par la croissance démographique rapide, sont principalement : (i) le développement agricole, (ii) la production de charbon de bois, (iii) l'expansion de la ville et (iv) les activités minières. Les perturbations engendrées par cette déforestation seraient responsables du raccourcissement de la durée des pluies (Sanga-Ngoie & Fukuyama, 1996; Assani, 1999), d'une malnutrition persistante dans le milieu rural (Malaisse, 1997) et de la perte de biodiversité (Barima et al., 2011; Vranken et al., 2011). L'ampleur inquiétante de ces conséquences a conduit plusieurs chercheurs à quantifier la déforestation autour de Lubumbashi à travers le concept de « rayon de déforestation ». Nous présentons une méta-analyse des études ayant circonscrit le rayon de déforestation autour de Lubumbashi. Ce rayon, utilisé à la fois pour exprimer la superficie (zone circulaire), l'intensité et l'ampleur (distance à la ville) de la déforestation, a été déterminé à travers les observations de la production de charbon de bois *in situ* et la télédétection. Les observations effectuées dans les villages des producteurs de charbon de bois expriment le rayon de déforestation à travers la distance qui les sépare de la ville, ce qui reflète plutôt l'ampleur de la déforestation. Ces estimations de distances, qui n'augmentent pas nécessairement avec le temps comme attendu par ailleurs, varient selon les auteurs, les années d'observation et les distances des villages visités par rapport à la ville; en plus, souvent elles ne considèrent pas les taches de miombo peu accessibles situées entre les villages à proximité de Lubumbashi. Les études *in situ* ignorent les taches de miombo proches de la ville, et semblent donc surévaluer l'ampleur de la déforestation. A partir de cette approche, des projections de la suppression complète du miombo ont été réalisées (Assani, 1999). Force est de constater que les difficultés d'accès et la privatisation de certaines concessions font que des taches de miombo subsistent sur des courtes distances à la ville et le seront jusqu'à l'horizon 2050 (Vranken et al., 2011). Par contre, les études basées sur la télédétection surestiment parfois ce rayon, mais aussi la résistance des taches de miombo, en ignorant leur taux de dégradation, sur des courtes distances à la ville. Malaisse & Binzangi (1985) ont considéré que les taches de miombo qui subsistent sur des courtes distances à la ville, et identifiées par télédétection comme telles, correspondent plutôt aux savanes secondaires que Kabulu et al. (2008) ont identifié comme des complexes de forêt claire et savanes boisées. Il en résulte que ces deux approches ne sont pas cohérentes ou compatibles dans l'étude de l'importance de la déforestation autour de la ville de Lubumbashi en raison de la variabilité des protocoles méthodologiques au sein de chaque approche, mais aussi entre les approches. Ces observations empêchent le développement d'une politique appropriée de conservation et d'exploitation durable de l'écosystème en question. Par conséquent, une harmonisation des approches utilisées en termes méthodologique et conceptuel s'impose. Elle pourrait former le point départ d'une relecture rétrospective critique des estimations historiques de la déforestation et de la dégradation du miombo, afin d'interpréter correctement les dynamiques spatio-temporelles de cet écosystème unique et crucial pour la population katangaise.

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Connectivity of the big blue octopus (*Octopus cyanea*, Gray 1849) between the eastern and western coast of Madagascar

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KEYWORDS. — Genetic connectivity; Mitochondrial DNA; Dispersal; Fishery.

SUMMARY. — Among the coastal communities in Madagascar the fishery for *Octopus cyanea* in coral reefs is one of the three most important activities in term of economic value. This economic exploitation of *O. cyanea* has increased the local value of the fishery and transformed a formerly traditional fishery predestined to local consumption into an export-driven fishery. This dramatic increase of fishery raised rates of exploitation and concerns over sustainability. A way to protect this species against overfishing and manage vulnerable marine ecosystems is to introduce marine protected areas (MPAs). An important factor that should be considered when implying MPA networks is gene flow among populations along the coast of Madagascar. *Octopus cyanea* is fished mostly in shallow reefs among the coast, where it is vulnerable and an easy prey for fishers. It is only when female individuals reach maturity that they migrate from shallow reef into deeper subtidal areas for spawning. The planktonic larvae move into the water column for one to two months, and dispersal is thought to be wide ranging. Larvae are thought to travel up to several hundred kilometres with ocean currents. These findings predict a high connectivity among different populations of *O. cyanea*. Connectivity can be determined using genetic markers such as mitochondrial DNA and microsatellites.

The aim of this study is to provide an answer on the following questions: Is there gene flow between populations on the west and east coast of Madagascar?

The population genetic structure of *O. cyanea* will be studied in order to investigate connectivity among populations. Cytochrome C oxidase subunit-1 (COI) will be used as DNA marker. DNA barcoding will be used to confirm the identification of *O. cyanea* individuals in the samples. Samples from five different sites from the west, north and east coast of Madagascar will be analysed. Samples from the western and eastern coast will be compared with each other and with the samples from the northern coast of the island. In total 88 tissue samples of individuals of *Octopus cyanea* were collected at five different sites. They were preserved in at least 95% ethanol. DNA was extracted using a E.Z.N.A.® Tissue DNA kit. PCR will be conducted using universal primer and COI will be used to analyse the genetic difference between the specimens found on each side of the island.

It is expected that the result of this study will provide baseline data for the conservation and management of *O. cyanea*. Based on 590 base pairs of the COI fragment, 21 haplotypes could be defined. Two haplotypes were shared among sample sites. Population expansion was confirmed through moderate haplotype diversity, low nucleotide diversity and the demographic history analysis. The analysis of molecular variances revealed significant genetic differentiation among populations ($\phi_{st} = 0.25$, $P \leq 0.01$). Restricted gene flow between the eastern and western coast could be a consequence of the complex oceanography in the Western Indian Ocean (WIO).

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Hydrothermal fluid circulation in the Karagwe-Ankole Belt (Central Africa) during the Neoproterozoic

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KEYWORDS. — Ar-Ar & Rb-Sr age dating; Phyllosilicate geochronology; Mesoproterozoic orogenic belt; Neoproterozoic fluid flow.

SUMMARY. — The Mesoproterozoic orogenic Karagwe-Ankole Belt covers the countries of Burundi, Rwanda and parts of Uganda, Tanzania and the D.R. Congo. The metasediments of this belt are intruded by two S-type granite generations, respectively at ~1375 and 986 Ma (Tack *et al.*, 2010). At the end of the Neoproterozoic (~550 Ma), the Karagwe-Ankole Belt was incorporated in the Gondwana supercontinent during the East-African Orogeny.

Step-heating Ar-Ar and in-situ LA-ICP-MS Rb-Sr analyses on phyllosilicates allow to constrain the timing of deformation and metamorphic events. These analyses were conducted on several biotite and muscovite samples from the Gitarama-Gatumba region (West Rwanda), an area representative for the Western Domain of the Karagwe-Ankole Belt. The Ar-Ar ages (n=3) vary between 625 and 567 Ma. Two groups can be distinguished in the Rb-Sr results (n=10). The oldest group of phyllosilicates has a late Mesoproterozoic to early Neoproterozoic age (1100 – 885 Ma), while the youngest group shows a late Neoproterozoic to Cambrian age (620 – 495 Ma).

As the second granite generation in the Karagwe-Ankole Belt shows no petrographical evidence of deformation or metamorphism, all younger ages obtained reflect secondary processes. The oldest Rb-Sr age group (early Neoproterozoic) is most likely linked to regional cooling or pervasive metasomatism following the second granite intrusions at 986 Ma. The Ar-Ar ages indicate that, by 625 Ma, the temperatures in the Gitarama-Gatumba area had dropped below 350-300 °C, the closure temperature of Ar in biotite. However, phyllosilicate recrystallization and concurrent partial isotopic resetting took place till the end of the Cambrian, as demonstrated by multiple samples. The Ar-Ar age spectra and the Rb and Sr isotopic signatures show this partial resetting was the consequence of hydrothermal activity by a host rock-buffered, saline, alkali-rich fluid. The circulation of this fluid affected the phyllosilicates in the Western Domain of the Karagwe-Ankole Belt from shortly prior to the assembly of Gondwana in the east (around 550 Ma) until a syn- to post-amalgamation stage.

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DNA barcoding and genetic population structure of two commercially important octopus species in the Western Indian Ocean

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KEYWORDS. — Connectivity; Gene flow; Fisheries; *Octopus cyanea*; *Octopus vulgaris*.

SUMMARY. — Artisanal octopus fishing is a very important activity for the livelihood and local economy of many communities along Africa's east coast and islands in the Western Indian Ocean (WIO) (Guard & Mgaya, 2002; Humber *et al.*, 2006; Sauer *et al.*, 2011). In the recent past, these traditional fisheries have grown tremendously, with raising concern over the sustainability (Guard & Mgaya, 2002; Humber *et al.*, 2006). Therefore, management actions need to be taken, such as the implementation of Marine Protected Areas (MPAs). Connectivity among populations through larval dispersal is a crucial factor which should be taken into account when designing MPA networks, since it influences population genetic structure, as well as the ability to persist and recover from stressors, like overfishing (Palumbi, 2003).

In order to investigate gene flow patterns and genetic population structure of the two commercially most important octopus species in the WIO, *Octopus cyanea* and *Octopus vulgaris*, a section of the mitochondrial cytochrome C oxidase subunit 1 (COI) gene was analysed from 288 octopus individuals from Madagascar, Kenya, Tanzania and South Africa.

Five different species were identified with DNA Barcoding. The presence of *Octopus oliveri* and *Callistoctopus luteus* in the WIO was never recorded before. For *O. cyanea* (n = 229, 563 bp), 22 haplotypes were found, with one dominant haplotype present at all sampling sites. Analysis of molecular variance (AMOVA) revealed a shallow but significant genetic population structure among all sites ($\phi_{ST} = 0.025$, $P = 0.02$), with significant genetic differentiation among: (1) northern Kenya, (2) southern Kenya, Tanzania, North Madagascar and West Madagascar, (3) Southwest Madagascar and (4) East Madagascar ($\phi_{CT} = 0.035$, $P = 0.017$). Limited gene flow may be explained by the direction and strength of ocean currents, preventing larval dispersal. For *O. vulgaris* (n = 43, 526 bp), ten haplotypes were identified, belonging to two haplogroups. A significant genetic population structure was found among all sites ($\phi_{ST} = 0.57$, $P \leq 0.01$). Restricted gene flow was detected between South Africa and Madagascar, with Durban as potential transition zone. Furthermore, a significant correlation between genetic and geographical distances was found, indicating that geographic distance is one of the main factors restricting gene flow.

The results of this study suggest that four (*O. cyanea*) and two (*O. vulgaris*) regions should be considered as separate management units in the area.

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Tectonic evolution of the Araçuaí – West Congo orogen and the opening of the South Atlantic

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KEYWORDS. — Tectonics; Reactivation; Denudation; Thermochronology; Passive margins.

SUMMARY. — Passive margins represent the transition from the continental to the oceanic lithosphere and, within the Wilson continent cycle, form the phase between rifting and subduction, ending in continental collision. As their name suggests, passive margins were assumed to be tectonically quiet, passively sitting on the plate after drift, until subduction would set. Around the world, two main types of continental passive margins can be found: non-elevated passive margins, with a gradual increase in elevation towards the continental interior; and elevated passive margins (EPM), with a major escarpment towards higher elevation close to the coastal plain. Research within the last decade revealed that the morphology of EPMs took form (long) after continent break-up, indicating tectonic activity at these “passive” margins. It is however still unclear what the mechanism is behind this post-breakup tectonic activity, and whether low-lying margins were once elevated (e.g. Green *et al.*, 2018). Some studies point out the importance of inherited structures, such as faults, in the reactivation of the passive margins (e.g. Cogné *et al.*, 2012).

The Araçuaí–West Congo orogen (AWCO) formed inside a southern embayment of the São Francisco–Congo craton (SFCC) as a result of the Brasiliano–Pan African orogeny (600–500 Ma), in a process described as nutcracker tectonics. The AWCO was thus confined by the SFCC in all directions but the south, rendering it into a unique structural setting. With the opening of the South Atlantic, due to the break-up of Gondwana during the Early Cretaceous (*c.* 130 Ma), the AWCO was divided into two counterparts: the West Congo Belt (WCB) on the African continent (D.R. Congo, Congo Brazzaville, Gabon, Angola), and the Araçuaí orogen in South America (Brazil) (Pedrosa-Soares *et al.*, 2008). Both evolved into passive margins with distinctly different morphology, the Araçuaí side being an EPM and the WCB being a low-lying margin.

The apatite fission track (AFT) method is a low-temperature thermochronometer based on the spontaneous fission decay of ²³⁸U. This fission creates a damage trail (fission track) inside the crystal lattice, which is shortened at temperatures between 60°C and 120°C and totally annealed over 120°C (Wagner & Van den haute, 1962). Fission track analysis thus provides us with information on the cooling age and time-temperature paths of samples within the upper crust.

For this research we analysed samples from both sides of the South Atlantic with the AFT method. We here present results from the Brazilian margin and the first results from the D.R. Congo. The Brazilian EPM displays cooling ages ranging between 70 and 90 Ma, with long track lengths, indicating an exhumation event after break-up. This can be attributed to stress or plume-related activity. The Congolese margin however does not show this signal, but instead has ages of 100 to 130 Ma, with shorter track lengths and a larger standard deviation. This indicates a slower exhumation, which is probably related to the erosion of the rift shoulders. From the current, limited AFT dataset, no recent tectonic reactivation could be inferred for the passive margin in the D.R. Congo.

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Petrographic study of gold mineralization in the Karagwe-Ankole belt (Byumba, Rwanda)

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KEYWORDS. — Gold; Geology; Karagwe-Ankole belt; Petrography; Rwanda.

SUMMARY. — The Mesoproterozoic metasedimentary rocks of the Central African Karagwe-Ankole belt (KAB) are known for hosting important mineral resources, which include the metals Ta, Nb, Sn, W, Li and Au (Fernandez-Alonso et al., 2012). In this important metallogenic province Nb-Ta-Sn-W mineralization is linked to syn-to post orogenic early-Neoproterozoic leucogranites (Hulsbosch, et al., 2016). Mineralization of Central African gold has been linked to fold-and-thrust belt formation (Koegelenberg et al., 2016). However, detailed knowledge of the metallogenic source, evolution and age of the gold mineralization in the KAB is still missing (Pohl et al., 2013). The metallogenic study of KAB gold occurrences thus forms an excellent opportunity to investigate the contribution of magmatic, metamorphic and water-rock interaction processes related to mineralization in an orogenic belt.

For this petrographic study boreholes originating from the Byumba gold deposit (Rwanda) were logged and sampled. The aim of the study is to determine the relationship between the different vein generations and the tectonic evolution and to determine the controlling factors on the gold distribution. Lithologically, the deposit is comprised of deformed metasediments which host multiple pyrite and quartz vein generations. Early quartz vein generations are pre- and syn-folding. A distinct phase of shearing post-dates the folding and cleavage development, characterized by silicification and intense chloritization. Shear-related quartz veins developed parallel to the cleavage, are also occasionally boudinaged and show a sigmoidal geometry. The earliest generation of shear veins contains quartz, chlorite and sericite, and is crosscut by a generation consisting of quartz and Fe-rich carbonate. Early anhedral pyrite generations often contain chalcopyrite inclusions, while later pyrite generations are more euhedral and associated with pyrrhotite. Many of the later pyrite generations are related to folding and shearing and the associated veining. Primary gold mineralization is associated with chloritized shear veins, but gold is also observed at the lithological contact between sandstone and shale laminations. A late secondary gold enrichment phase is identified by association of high ore grades with oxidation/reduction zone boundaries.

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