

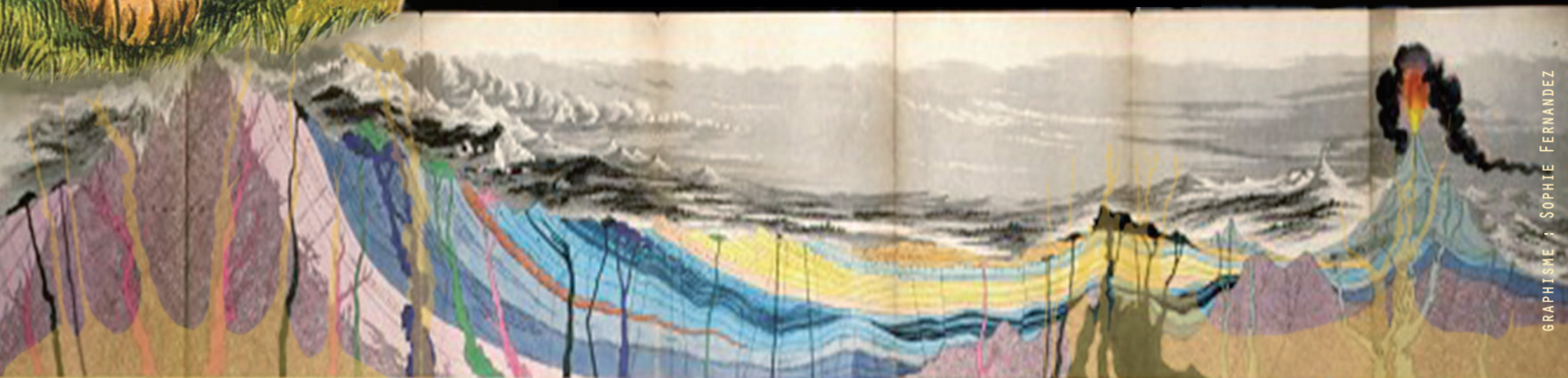


3rd

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2016

YOUNG NATURAL HISTORY SCIENTISTS MEETING

ABSTRACT BOOK



GRAPHISME : SOPHIE FERMANDEZ

YNHM.SCIENCESCONF.ORG

MUSÉUM NATIONAL D'HISTOIRE NATURELLE
LE GRAND AMPHITHÉÂTRE DU MUSÉUM



TIMARCHA





YNHM

The BDEM (Bureau des Etudiants et Doctorants du Muséum), Doc'up, Symbiose6 and Timarcha are pleased to welcome you to the **3rd Young Natural History scientists' Meeting** at the Muséum national d'Histoire naturelle, in Paris. We hope this congress for young researchers will provide you the opportunity to present, possibly for the first time, your research in a relaxed but studious atmosphere. We believe that the YNHM is a great chance for us to have a first congress experience. Our program is varied, covering several aspects of Natural History with a keynote speaker for each session and several oral and poster presentations by young researchers, distributed in six sessions. We thank you for coming so numerous and hope you will enjoy the conference and get opportunities for networking.

Faithfully yours,

The Organizing Committee:

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Acknowledgements

We would like to thank the **Chairpersons** for kindly accepting our invitation to present their session as well as lead the discussion and designating the winners for the oral and poster awards.

Biodiversity Dynamics and Conservation:

Xavier Bonnet is the head master of the Centre d'études biologiques de Chizé (Center of study on biology from Chizé, France). His work focuses mainly on reptiles co-evolution of acquisition systems and management of resources and reproductive strategies in vertebrates. He also works on reptiles conservation

Humanities and Natural Sciences

Margareta Tengberg, is head master of the lab "Archéozoologie-Archéobotanique" of the Muséum National d'Histoire Naturelle. Her research interests are mainly focused on agricultural economies in the Near and Middle Eastern past civilizations and on domestication process of plants.

Systematics, Evolution and Comparative Anatomy

Jean-François Flot, associate professor at the Université Libre de Bruxelles, is interested in molecular systematics and genome evolution in tropical corals, cave amphipods and bdelloid rotifers.

Earth and Planetary Sciences

Gweltaz Maheo, researcher at the Lyon 1 University, is working on lithosphere structure and dynamic.

Evolutionary Ecology

Mathieu Joron is head master of the Genetic and Evolutionary Ecology in the CEFE (Centre d'Écologie Fonctionnelle et Évolutive) in Montpellier.

Methods in natural sciences

Sylvain Gerber is a newly appointed researcher at the MNHN. He is a macroevolutionary biologist, interested in large-scale morphological evolution and in the multiple processes that underlie its dynamics.

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Supporting the sessions:

La société géologique de France (SGF) supporting the Earth and planetary sciences session.

La société française d'écologie (SFE) supporting the Evolutionary ecology session.

La société française de systématique (SFS) supporting the Systematics, evolution and comparative anatomy session.

La société d'anthropologie de Paris supporting the Humanities and Natural sciences session.

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BIODIVERSITY DYNAMICS AND CONSERVATION

Habitat suitability and demography, a time dependent relationship

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The habitat suitability map, that depicts the spatial probability of occurrence of a given species, is assumed to be a relevant spatial predictor of demographic performance. However, recent attempts to link spatial habitat suitability index (HSI) with local demography were halfhearted, including positive, negative and null correlations. One potential explanation for such discrepancy is that the link between HSI and demography can be temporally variable. The ecological processes generating positive or negative correlations between HSI and demographic rates can vary within years because of the phenology of the species or among years because of meteorological fluctuations or climate change. Here, we aimed to disentangle the relationship between HSI and demography in a bird at both inter- and intra-annual scales. Using data collected from a longitudinal nest survey in the Houbara bustard (*Chlamydotis undulata undulata*) in Morocco, we explored whether the HSI computed over the breeding range of the species is related to breeding performance (estimated by the daily nest survival rate), depending on meteorological conditions, and along the breeding season. We found that HSI is negatively related to nest survival early in the breeding season and that this relationship becomes lower along the season and is eventually reversed at the end of the season. Dynamic intraspecific and interspecific interactions along the breeding season, as well as niche variations between the breeding and wintering seasons, may explain this intra-annual shift. Overall, our results point out the complexity of the link between species demography and integrative indices of habitat suitability widely used in ecology, and emphasize the necessity of including temporal dynamics of biotic interactions in models of spatial distribution of species.

Keywords: Habitat suitability, nest survival, biotic interactions, Houbara bustard

Helminth parasites of sparid fishes from Ghar El Melh Lagoon (Tunisia)

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Helminth parasites (Digenea, Cestoda, Nematoda and Acanthocephala) that live in the gut, the body cavity, internal organs, or encysted in muscle of fishes, have been of great interest to ecologists. These parasites can damage the lining wall of the host

and some other organs. In addition, some of them are also transmitted to humans. Hitherto, these organisms still little known in Tunisia hence the importance of this study. Parasitological investigation of 115 sparid fishes (45 *Lithognathus mormyrus* and 70 *Sparus aurata*) from Ghar El Melh Lagoon (Northeast of Tunisia), allowed us to note, for the first time, the presence of six digenean species belonging to three different families: Fellodistomidae (*Proctoeces maculatus*); Lepocreadiidae (*Holorchis pycnopus*) and Opicoelidae (*Macvicaria maillardi*, *Macvicaria mormyri*, *Macvicaria obovata* and *Allopodocotyle pedicellata*) one nematode species belonging to the family of Anisakidae (*Hysterothylacium fabri*) and one cestode (*Tetraphyllidae larvae*). The spatial distribution of helminthes species within the digestive tract of the host showed that, except for *Macvicaria mormyri*, which was limited to the anterior intestine, the other species did not seem to have restricted requirements and colonized two or many parts of the gut. The parasite fauna of *L. mormyrus* was dominated by *H. fabri* (P: 42,22%) and to a lesser degree by *H. pycnopus* (P: 20%), while that of *S. aurata* was dominated by species of the genera *Allopodocotyle* and *Macvicaria*. The diversity of Helminth parasites of sparid fishes in Ghar El Melh Lagoon were compared with the results available both on our coasts and other areas of the Mediterranean Sea.

Keywords: Helminths, teleost fishes, diversity, comparative study, Ghar El Melh Lagoon, Tunis

Preliminary data on *Zostera noltei* meadows and its associated invertebrates in a Southern Mediterranean lagoon

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Zostera noltei Horneman is a small seagrass largely widespread over the coasts of Tunisia. It represents relatively dominant populations in the Northern lagoon of Tunisia. The present work aimed at providing basic information of *Z. noltei* meadows in the Northern lagoon of Tunisia, with (i) mapping meadows along 36 equally spaced and well distributed transects, (ii) measuring the above and below-ground biomass in fixed stations, (iii) the observation of phenological characteristics of the plant and (iv) the study of the associated macrofauna community of *Zostera noltei*. The results show that *Z. noltei* meadows grow over 40% of the total area of the North lagoon of Tunisia. They spread gradually to the Southern part of the lagoon where they are able to survive and to thrive. The total biomass in the lagoon was about 2512 tons of DW in June of 2014. Most of this biomass comes from dense beds. The phenological characteristic analysis shows that the mean density is about 1830 shoots/m², the average length and average width of the leaves are 26.6 cm (SD = 6.9) and 1.8 mm (SD = 0.2), respectively. Depending on the type of cover,

the average number of leaves/shoot is between 3.1 and 4.5 (SD = 0.4). The study of the benthic invertebrates accompanying *Zostera noltei* allowed us to identify 20 faunal species belonging to three zoological groups dominated by molluscs. We can deduce that *Gibbula umbilicalis*, *Gammarus sp* and *Sphaeroma serratum* are the most common species since they are always present in samples (frequency = 100%), they can thus be considered as closely linked to *Zostera noltei* meadows. This study should be extended to other seasons to increase our knowledge on the characteristics and dynamic of *Z. noltei* meadows, which is a crucial step for the assessment of ecological status of the Northern lagoon of Tunis.

Keywords: *Zostera noltei*, Northern Lagoon of Tunis, biomass, mapping, phenology, benthic invertebrates

Morphological identification of the life cycle of *Monorchis parvus* in the gulf of Gabes (southern Tunisia)

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Some species of digeneans belonging to family of Monorchidae (Odhner, 1911) can carry out their life cycles using the bivalve *Cerastoderma glaucum* or *C. edule* as first and second intermediate host; the adult stage parasites some species of sparid fishes. Very few studies have reported the presence of both larval stages (sporocyst, cercariae and metacercariae) of the genus *Monorchis* from the cockle. The aim of the present study was to identify the life cycle of *M. parvus* in the gulf of Gabes. A total of 579 *Cerastoderma glaucum* and 110 fish of the genus *Diplodus* was collected from the Gulf of Gabes (Fishing port of Sfax) and examined in order to detect the presence of developmental stages of *Monorchis parvus*. The morphological examination of the sporocysts containing cercariae and thereafter sporocysts filled with metacercariae collected in the cockle from the gulf of Gabes allowed us to attribute these larvae to the adult stage of *Monorchis parvus* found in *Diplodus annularis*. The larval stages were found in all the flesh of the bivalve except the mantle and the mantle cavity. The adults were harvested either in the pyloric caeca or in the anterior intestine. Prevalence of each developmental stage was calculated. The sporocysts filled with cercariae of *Monorchis parvus* were clearly more frequent (P= 3, 46%) than the sporocysts containing metacercariae (P=0.25%). However, the prevalence of the adults was very low not exceeding 0.02%. Sporocysts invading gonadal tissue and can damage this organ and induce the castration of the host; indeed, the examination of the gonad of the infected bivalves revealed the absence of any sexual cells. It is worth noting that *M. parvus* shows a strong morphological resemblance with *M. monorchis*; hence a further molecular study is necessary to confirm our results.

Keywords: Morphological identification, *Monorchis parvus*, *Cerastoderma glaucum*, *Diplodus annularis*, Southern Tunisia

Disentangling the factors shaping mammal invasion in South-East Australia

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The distribution of introduced species is influenced by both human and natural factors. Understanding the factors that best predict the establishment of invasive species can help us improve the effectiveness of management strategies. We examined the relative importance of anthropogenic and natural factors in shaping the richness of alien mammals across Victoria, New South Wales, and Tasmania. We developed a database of mammal introduction events and occurrence records of exotic mammals for these territories of Australia, beginning in 1775. We used Hierarchical Partitioning on 50 km² grid squares to identify the relative importance of factors in their modern distribution. The strongest predictor for the number of alien mammal species was native mammal richness. This is consistent with the hypothesis that the presence of habitats with high productivity which support more native mammals also enable the establishment of more exotic mammals. In line with this is the second best predictor for alien mammals richness, which is the greenness of an area, as determined the remotely sensed index NDVI. Thus, the establishment of alien species in South-East Australia is best explained by the biotic characteristics of the receiving environment.

Keywords: Alien species richness, hierarchical partitioning, Australia, Native mammals richness

Phenolic composition and biological activities of four Tunisian macrophytes

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Increasing attention is being paid to the search for novel and cheap sources of antioxidant compounds, which would replace synthetic ones. Seaweeds are an excellent source of added value molecules such as phenolics, polysaccharides, proteins, peptides, and pigments. The aim of this study was to assess the antioxidant activity of four macrophytes *Caulerpa prolifera* (Chlorophyta), *Gracilaria gracilis* (Rhodophyta), *Cystoseira barbata* (Ochrophyta) and *Ruppia cirrhosa* (Magnoliophyta) and to determine their phenolic compounds. Acetonic extracts were evaluated using several antioxidant tests including DPPH, Fe-reducing power, and β -carotene bleaching tests. Results showed that *Ruppia cirrhosa* is distinguished from the other studied species by its richness in phenolic compounds (35.43 mg EAG/gMS) and its significant antioxidant activities (total antioxidant activity was 47.8 mg EAG/gDW and IC50 value of DPPH radical scavenging activity was 6.37 μ g/mL). The antimicrobial activity of *Ruppia cirrhosa* was then evaluate against several bacteria and *Candida*. *Ruppia* extract showed appreciable antibacterial properties against human pathogen strains.

The strongest activity was recorded against *Schigella flexenerii* (inhibition zone was 9.33 ± 0.65 mm) and the lowest activity was observed against *Candida tropicalis* (inhibition zone was 1.33 ± 0.65 mm). These findings suggest the interesting potentialities of *R. cirrhosa* as source of valuable molecules for industrial (pharmaceutical, cosmetic and agri-food) purpose.

Keywords: Macrophyte, phenolic compounds, antioxidant, antimicrobial activity

Preliminary data on *Cymodocea nodosa* meadows in a Southern Mediterranean lagoon

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The present work is a contribution to the characterization of *Cymodocea nodosa* (Magnoliophyta, Cymodoceaceae) in the South Lake of Tunis, a Mediterranean coastal lagoon located in the North of Tunisia. In this lagoon, *Cymodocea nodosa* is present in depths < 3m where it can develop either monospecific or mixed stands. It forms an extended dense meadow with coverage nearly 100% at the eastern part and they spread gradually to the west part where they are able to survive and to grow. This study deals with biomass analysis (total, above-ground and below-ground parts) and shoot density of *Cymodocea nodosa* meadow in June 2015. Although, some phenologic parameters were estimated, such as length and width of leaves, number of leaves per shoot and length of rhizomes. For this aim, we adopted a sampling plan composed of 6 parallel transects all along the lagoon. The results show that the mean total biomass in the south lake of Tunis is about $94.7 \text{ g DW/m}^2 \pm 67.5$. Below-ground biomass / above-ground biomass ratio varied from 0.26 to 2.38, showing the highest values in the western of the lagoon. Shoot density oscillated between 80 and 688 shoots/m². This parameter is lower than in other Mediterranean localities. Furthermore, the phenological characteristics analysis shows that the mean length and mean width of the leaves are $29.4 \text{ cm} \pm 5.7$ and $2.8 \text{ mm} \pm 0.2$, respectively. The mean length of the leaves showed a significant positive relationship with depth (Pearson- $r = 0.85$, $p = 0.04$). Indeed, the average number of leaves per shoot fluctuated between 2.9 and 3.8. Finally, the rhizomes reach up to a mean length of $8.6 \text{ m/m}^2 \pm 7.04$ and they have a significant positive relationship with the belowground biomass (Pearson- $r = 0.94$, $p = 0.005$). This compartment has a large capacity to retain sediment favoring its stabilization.

Keywords: *Cymodocea nodosa*, Southern Lagoon of Tunis, biomass, distribution, phenology

Body size response to climate and primary production in common songbirds: a matter of local context

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Body size (BS) is a major determinant of natural history, affecting metabolic rates and species resilience in the face of environmental changes. There is mounting evidence that species experienced BS decline over the last decades: a pattern that was suggested as a response to global climate change. However, the universality of this pattern was questioned, with species exhibiting either declines, increases or no change. The underlying mechanisms of body size change remain poorly understood, and it is not clear whether body size variation is related to changes in ambient temperature or in food availability. Based on long term field biometric data from a national-wide citizen science database (15 years, 248 sites), we tested the reaction norm of juvenile wing length ($n > 38000$) to temperature, rainfall and remotely sensed primary production (NDVI) local anomaly for 41 common songbird across France using generalized linear mixed models. We found the main drivers of BS change to be NDVI, and, to a lesser extent, temperature and temperature variability. Eight species showed a significant effect of NDVI, seven species responded to temperature and eight species responded to temperature variability. However, these effects were slight for most species, and 24 species did not respond to any of the tested variables. We therefore provide no support for a general BS decline as a result of climate change. Our results suggest that BS change is more related to climate-induced changes in habitat quality and food availability rather than temperature per se. However, the main driver of BS change may differ between species. We argue that BS change is dependent on local context, probably affecting a limited number of populations inside the whole range of a species. Further works should test the effect of temperature, temperature variability and food availability, and account for species-specific, and population-specific response.

Keywords: body mass, wing length, climate anomaly, rainfall, temperature, net primary production, food availability, juvenile, citizen science

Effectiveness of nest survey method of Honey bees and Stingless bees to study their diversity according to habitat

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Social bees contribute to pollination of numerous flowers plants, cultivated and wild. Among these bees, there are honey bees and stingless bees which build their nests in different cavities: in trees, in termite mounds or also in the ground. Habitat loss is the main threat for these bees in Africa. Studies on diversity, distribution and abundance of these bees according to habitat are based on trapping or nests survey. We examined the effectiveness of nests survey, in the appreciation of diversity of Apis and Meliponini, in two localities in Gabon (Central Africa). A locality that has suffered deforestation for the establishment of food crops and a forest concession. A trapping was conducted at 30 sites in each locality in order to inventory the species richness. A nests inventory by observation was conducted in 30

transects disposed randomly in each locality. Subsequently, 300 points were positioned randomly. Observation and extensive research of nests were performed to assess the effectiveness of nests detection by observation. Our results showed that forest concession presented the greatest richness; the nest of 27% of species caught in forest concession were observed during the nests survey, while in the disturbed locality, the nest of 40% of the species recorded were inventoried. In disturbed locality, the observation of nests was more effective compared to the forest concession, and the nests of honey bees were the most frequently observed, whatever the locality, compared to stingless bees. The open habitat in the disturbed locality, the size of honey bee colonies, their significant round trips to the nest entrance and their aggressiveness explain the results obtained. Indeed, the activity was lower at the nest entrance of stingless bees and their nests were more difficult to observe. Thus, the efficiency of nests survey depends on the type of habitat and species studied.

Keywords: Honey bees, stingless bees, nests survey, habitat

The establishment of mother-young bonding in red deer females inseminated with sika deer semen: potential insights into embryo transfer and management of interspecific hybrid population

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This study is part of a conservation program for endangered species based on reproductive biotechnologies. To increase the number of offspring from limited numbers of genitors, in vitro production of embryos coupled with embryo transfer on surrogate mothers seem to be a promising possibility. However, it is uncertain that the establishment of early mother-young interactions ensures a proper development of the young. Because of the difficulty of embryo transfer and the occurrence of natural hybridization in some species, we aimed as a first step at characterizing mother-young bond in red deer mothers giving birth to hybrid fawns (sika x red deer). Early interactions were observed by focal and scan sampling during the first 2 hours and the first week following parturition in 3 groups: 17 mother-young red deer dyads, 9 mother-young sika dyads and 9 red deer mothers with their hybrid neonate. At parturition, no difference was found between groups neither in licking nor in nursing behavior of the mother. However, young sika expressed more bouts standing and being licked and were slower to suckle than than the two other groups. Young hybrids stood up sooner than sika and red deer were intermediate. During the first postnatal week, mothers of hybrids were closer and licked more frequently their young. Young hybrids spent more time standing. Suckling did not differ between the three groups. Our study reveals that mother-young behaviors varied only slightly with hybridization, suggesting no major incompatibility for embryo transfer. Mother's age and dominance and fawn's birth mass affected differently behaviors in the hybrid group. Further investigations are then required to explore the effect of early care on young development to weaning according to mother characteristics and validate red deer hind as adequate surrogate mothers for embryo transfer.

Keywords: interspecific hybrids, mother, young relationship, insemination, embryo transfer, red deer, sika deer, individual differences

Diversity of helminth parasites of *Merluccius merluccius* from the gulf of Hammamet (northeastern Tunisia)

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Fish parasites present an essential part of aquatic environments, and knowledge of their biodiversity and their frequency can provide information about the health of these ecosystems exposed to anthropogenic changes. The aim of this study was to identify the helminths of a teleost fish, *Merluccius merluccius*, which presents an important biological resource in marine food webs and a great commercial value in Tunisia and all along Mediterranean coasts. A total of 77 specimens were collected from the gulf of Hammamet (north-eastern Tunisia). Eleven species of helminths parasites were found in the digestive tract of *Merluccius merluccius* for the first time in Tunisia: five species of Digenea (*Robphidollfusium fractum*, *Elstia stossichianum*, *Aporocotyle spinosicanalis*, *Derognes sp.*, *Ectenurus lepidus*), four species of Nematodes (*Anisakis simplex*, *Hysterothylacium fabri*, *H. rigidium* and unidentified larvae) and two species of Cestodes (*Clesthobothrium crassiceps* and a Tetraphyllidae larvae). These parasites were distributed differently within the digestive tract of the host. The analysis of the infra-communities revealed that the majority of host species harbored two parasite species. The helminthofauna of this fish was dominated by nematodes and to a lesser degree by Tetraphyllidae larvae, whereas the other parasites were rare. The diversity of the helminth parasites of *M. merluccius* from the gulf of Hammamet was lower than that of the Gulf of Lion. The report of *Robphidollfusium fractum*, *Elstia stossichianum*, *Derognes sp.*, *Ectenurus lepidus* in *M. merluccius* presents new host records in Tunisia and Mediterranean waters.

Keywords: Helminth parasites, *Merluccius merluccius*, gulf of Hammamet

Effect of vegetation cover on biodiversity and the biological functioning of soils

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The soil fauna is one of the main players in the organic matter degradation process where they get the items they need. The influence of soil conditions on the faunal composition, density or biomass has been addressed in many studies including the influence of vegetation cover. This fauna is therefore a good indicator to inquire about the status of the soil and its variations over time. Different soil invertebrates macro groups taken individually are each very sensitive to conditions in the ground with an-

swers to these changes can vary from one community to another. The eucalyptus plantations represent a replacement for some of their natural habitat to which they can adapt and for other environmental conditions unsuited to their biology. Very surprisingly, we find that in both types of forests, the litter is the least populated area with respectively 3% and 1% of total individuals encountered in cork oak and eucalyptus in. On average, the total density of macrofauna is much lower in cork oak (208 ± 75 individuals / m^2) than under eucalyptus (519 ± 366 individuals / m^2) but the opposite phenomenon is observed for total biomass with heavier individuals found in cork oak (earthworms, beetles ... large). It is thus observed an effect on the density of reforestation and total biomass, which can be explained by the existence of fluctuations in populations of megafauna but also by migration (immigration and emigration) Possible to or from the surrounding community. Thus, under the cork tree density decrease can be explained by migration of fauna to Eucalyptus since in the study area chosen, the proximity between the cork oak plots and those of Eucalyptus reduces climate and geomorphological changes between the plots studied.

Keywords: Macrofauna, biodiversity, bioindicators, eucalyptus, Cork wak

The ontogeny of shell-boring *Octopus* versus *Nautilus* predator-prey interactions

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To complete our picture of predatory boring by *Octopus*, this study focuses on the rate and pattern of *Octopus* predation in pre-adult stages of *Nautilus*, which encompasses the first 15 years of its life. Dry shells from several natural history museum collections were used for this study. In the 555 examined shells, 334 borings were found. For adult *N. pompilius* 136/242 (56.2%) were bored, while for juvenile *N. pompilius* 41/154 (26.6%) were bored. Of the juvenile *Nautilus* 8/52 (15.4%) have multiple borings while 68/179 (38%) of the adult *Nautilus* have multiple borings. One adult *Nautilus* has 6 borings and one juvenile *Nautilus* has 5 borings, both of which set a new record. In adult *Nautilus*, there appears to be no preference to bore on the left or right side of the shell: 129 borings are on the left side (48%) and 140 borings on the right side (52%). In juveniles, though, there is a clear difference in left and right borings. With 47 borings on the left (75.8%) and 15 borings on the right (24.2%) there is a statistical difference. Not just all species of *Nautilus* are attacked by *Octopus*, their predation also has a big impact on all ages.

Keywords: *Nautilus*, *Octopus*, Conservation, Predation, Shell, boring

Cryptic species diversity of Australian smelt (*Retropinna* sp.) fish in different SEQ Rivers revealed by mtDNA analysis

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Two or more morphologically indistinguishable species that are biologically incapable of interbreeding is defined as cryptic species. The Australian smelt (Retropinninae: *Retropinna*) is found in inland and coastal drainages throughout south-eastern Australia. This fish species are known to harbour large numbers of cryptic species. In order to know the genetic diversity smelt fish were collected from three different rivers named Brisbane, Mary and Moloollah rivers of South-East Queensland (SEQ), Australia and Cytb gene of MtDNA has been sequenced. The Mary river population showed high levels of genetic diversity and did not share haplotypes with Brisbane river populations. It was also observed that Moloollah populations group with Mary river populations. It was found that populations from Brisbane and Mary river populations are likely to correspond to two undescribed cryptic species. These results show that evolutionary processes leading to divergence and speciation have been common and reduced connectivity has been occurred among Australian smelt populations. So, it can be said that more comprehensive and large scale sampling in combination with molecular analysis using multiple markers is very much important to explore more cryptic lineages or undescribed genetic species of smelt.

Keywords: Cryptic species, species diversity, mtDNA analysis

The concept of habitat: definitions and implication of an unquestioned paradigm

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Since the beginning of ecology as a science, numerous definitions of the habitat concept were proposed by different authors. Definitions range from a resource based concept of the habitat to ecological niche or vegetation association. The need for a clear definition was stressed by several authors, mainly because habitats are now central in conservation planning. In Europe for example, habitats are key conservation units and are enshrined in environmental legislations since the adoption of the habitats directive in 1992. Quoting Charles S. Elton in 1966, this concept was and still is "one of the chief blind spots of ecology". Through a review of the history of the concept, we analyze the polysemic nature of this term, its evolution and the consequences of the polysemy for biodiversity conservation. First, we advocate that "habitat" should be used carefully and parsimoniously in scientific and legislative literature in order to avoid confusion between terms. Through some examples of terminology, we show how the term "habitat" can lead to misinterpretations that impede the purpose of biodiversity conservation. Second, we focus on habitat quality assessment and argue that "habitat" should remain a species-centered term, describing the location and environmental conditions favoring the growth and reproduction of a given species. We argue that the modeling of species-habitat relationships, combining species distribution models and demographic databases, provides new perspective to

assess habitat quality and bridge the gap between scientists and conservation stakeholders on this issue. Finally, we propose a new framework for testing habitat quality that follows clear and consistent definitions of terminology, and may reduce confusion for lawmakers, media and people.

Keywords: habitats conservation, policy, phytosociology, SDM, history, population

Metazoan parasites of grey mullets (Teleostea: Mugilidae) from Ichkeul Lagoon (Northern Tunisia)

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The mugilids are among the most cosmopolitan teleost fish and they are widely distributed in fresh, brackish and coastal marine waters of the tropical and temperate regions of the world. They are generally considered to be ecologically important and they are a major food resource for human populations in the Mediterranean areas. These fishes are very common in Ichkeul Lagoon (Northern Tunisia) from where a total of 205 specimens of grey mullets (Teleostea: Mugilidae) belonging to five species: *Cheilon labrosus*, *Liza aurata*, *Liza ramada*, *Liza saliens* and *Mugil cephalus*, was collected and examined for metazoan parasites. These latter were searched on the skin, on the fins and in the digestive tract of captured fishes. Twelve species of Metazoan parasites were identified: nine digeneans belonging to three families: Haploporidae, Haplosporididae and Hemiuridae, one isopod that belongs to the family of Cymothoidae and two acanthocephalans taking part of the Neoechinorhynchidae family. *L. ramada* had the largest species richness represented by five digeneans species, one isopod species and one acanthocephalan species. Prevalence, abundance and mean intensity of each parasite species were calculated; the examination of the values of parasitological indexes revealed that digeneans were the most frequent and generally these values increase with host size rise. 75 % of examined fishes were infected with at least one species of parasites. Digeneans in grey mullets were qualified by generalist species as they occupied multiple sites of the digestive tract; however, acanthocephalans were restricted to the anterior intestine. The isopod was found quite fixed to different types of fins. The present results contribute to the enrichment of data on mullet's parasites of Mediterranean lagoons.

Keywords: Parasites, grey mullets, Ichkeul lagoon

Comparative study of the production of two species of cephalopods (*Octopus vulgaris* and *Sepia officinalis*) landed by trawlers Sfax (Gulf of Gabes, Tunisia)

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Both Cephalopods, the common octopus *Octopus vulgaris* and cuttlefish *Sepia officinalis* are among the most species landed by

trawlers in the Sfax region. These species have a great commercial value. In this work we study the average monthly production of each species and the annual production of these species for the past ten years. On the data base from surveys in the offshore port of Sfax, we could also determine and monitor for each species the average production output by trawler and the seasons. Annual production shows that trawl contributions have increased in recent years. The average monthly output shows that the trawlers are variable inputs for the common octopus, cuttlefish while for the production evolves in the same way with a significant amount in the winter and a remarkable decrease in summer. Monthly monitoring of the average production per boat per trip for each species reveals that the production trawl common octopus and the cuttlefish is important in winter as in summer, intake is low especially for octopus.

Keywords: Cephalopods, *Octopus vulgaris*, *Sepia officinalis*, trawlers, production, Species, cuttlefish

Environmental impact of pesticides use in traditional fishing in Sub-Saharan Africa: case of Deuk rural municipality in Cameroon

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Deuk municipality created the 25 August 1995 is situated in the department Mbam-et-Inoubou in the central province of Cameroon, separated to the east by Ngoro; In the North by Ngambe tikar; in the South by Bafia and to the west by Masmangam. The number of councilors at the municipality is 25 Advisors. With an area of 1555 km², a density of 7.71 inhabitants / km², the Population is 12,000 hbs. The potentiality of the zone is the availability of fertile soils; the presence a vast river system; an abundance of forestry and fishery resources. And concerning fishing activities, populations use pesticides to catch fish. So what are impact on aquatic life? And what can be the environmental effect? And to try to solve this question, ideas on the effects of these pollutants on the environment and health are to be considered. These pollutants when introduced into environments affect them by attacking the flora and fauna and thus reduce the state of biodiversity. They also have an influence on human health and may cause after some complications on the health of users. In Deuk, women who use pesticides for fishing said that they have remark some changes when you eat the fish and even on the aspect river flora year after year. So how it work? When they are fishing, they diluted pollutant in water and revert to the river. After that, the fish are in a state of paralysis spontaneous and they come on the surface of the river because they can't swim anymore. So how can the pollutant use in fishing change or affect the environment and aquatic life?

La peche industrielle au cameroun, joseph Laure, 1969

The municipality development plan, 2014. www.cvuc.cm www.fao.org www.statistics-cameroon.or

www.minepia.gov.cm

Keywords: fishing, pollutant, environment, aquatic life.

The spatial dynamics of gilthead bream (*Sparus aurata*) in UK waters

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With species range shifts and expansions due to climate change it is important to identify potential new target species for UK fisheries and aquaculture, and understand the effects these species have on local ecosystems. The gilthead bream *Sparus aurata* is one of the most sought after warm-temperate marine fish species in Europe, and is currently the most prolifically farmed fish in the Mediterranean. The rise of sea surface water temperature is thought to be responsible for an apparent recent range expansion of gilthead bream into the English Channel and Celtic Sea, and with further climate warming this species is likely to expand its range further along the British coast. Currently little is known about the *S. aurata* population in the UK but adult fish are common in the spring/summer months, and juveniles have been observed in recent years. In this investigation, a range of techniques (tagging, stable isotope analysis, diet analysis, modelling) will be used to determine: What is the rate of range expansion? What is the population size and age structure? Are they seasonal migrants? What prey species does it eat at different ages? To what extent is it a self sustaining population? The findings will be of importance to and benefit both commercial and recreational fisheries, the related coastal tourism sector and conservationists managing the long term sustainability of inshore fisheries.

Keywords: climate, species distribution, conservation, management, marine, fisheries

Preliminary research: Mitigating the impact of the tropical tuna purse seine fisheries on Silky sharks (*Carcharhinus falciformis*): small scale behavioral analyses and future improvements in the protocol for video data acquisition in the purse seine net

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Sharks are top predators in marine ecosystems. Due to their low fecundity and late maturity, they are considered among the most vulnerable species to human exploitation. Silky sharks (*Carcharhinus falciformis*) figure among the most frequent shark species that are accidentally caught in the purse seine tropical tuna fisheries worldwide. Juveniles are commonly attracted by floating objects together with tropical tuna aggregations. Possible mitigation measures that reduce the bycatch of silky sharks have been considered, among which the possibility to attract them out of the purse seine net. This research has been the first step towards assessing the key stimuli that may be employed in such conservation measures, by studying the behavior of silky sharks in the purse seine net at a fine scale. We analyzed the videos filmed in the net during three scientific cruises conducted

in the Pacific Ocean in the period 2012-2014. We found indications of different behavioral patterns of silky sharks in the net that may guide future developments of mitigation measures. Swimming speed and distance between individuals in a group were found constant throughout all the cruises. Also, the results showed a bimodal distribution of group sizes that suggests that social interactions may play an important role in the spatial distribution of silky sharks. Other analyzed categories, like the attraction to the net, have shown a certain disparity among years, possibly caused by the difference in sample sizes or bias while filming. What is certain is that there was a need for an established protocol for video data collection which the scientists would follow in the years to come. To this purpose, we developed a protocol as a set of step-by-step advice that could be applied in the future cruises in order to standardize the data collection procedure.

Keywords: Purse seine fisheries, silky sharks, bycatch mitigation, shark behavior.

An indicator of the pollination service at a local scale based on crop pollinator dependence

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The development of new farming methods since the 60s, such as increased mechanization, monoculture systems, higher level of inputs (i.e. water, chemical fertilizers, pesticides), and selection of high-yield varieties have increased agricultural productivity (Tilman et al. 2002). However, one major downside of agricultural intensification is a loss of biodiversity in agroecosystems, among which pollinators (Biesmeijer et al. 2006; Potts et al. 2010; Garibaldi et al. 2011). Nowadays, 35 % of global crop production for human food derive from crops that depend to some extent on pollination services (Klein et al. 2007) and 3-8 % of world crop production could be lost in the absence of pollinators (Aizen et al. 2009). Deguines et al. (2014) found that benefits of agricultural intensification decrease with increasing pollinator dependence, to the extent that intensification failed to increase yield of pollinator-dependant crops and decreased stability of yield over time. As a consequence, benefits from agricultural intensification may be offset by reductions in pollination services. At present, there is no consensus about an indicator of pollination service to measure accurately this phenomenon. In this study, we focus on the changes in mean yield of the major crops in France according to their dependence on insect pollinators and try to undertake a country-wide assessment of the effectiveness of crop pollination. We analyze a dataset composed of more than 50 major crops produced between 1989 and 2014, at a departmental scale. Using the relationship between standardized crop yield and crop pollinator dependence, we calculate an indicator of the effectiveness of crop pollination in each department. This indicator is used to map pollination efficiency, a central ecosystem service, for the first time in France.

Keywords: agriculture, crop pollinator dependence, changes in mean

yield over time, departmental scale

Trajectory of biodiversity indices in exploited tropical forests

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The multiple services of tropical forests make a crucial issue of their sustainable management. Because many economic, social and environmental stakes rely on the diversity of tree species it is essential to fully understand its role for the functioning of ecosystems and forecast its dynamics. The attention can particularly be drawn on the exploitation of tropical forests and its impact on stands in order to design truly sustainable management. The main idea would be to explicit post-logging cycles of biodiversity and adjust the techniques and logging plans to ensure a long term maintenance of biodiversity. The first step is to design an adapted mathematical framework to measure biodiversity indices. The measure of biodiversity is an intricate issue because they must account for various aspects like species number, equitability and similarity. Besides they must remain practical enough to apply to various context. First the point is to identify the best indices to capture ecosystems' complexity and design adequate bias corrections. The second point is to investigate phylogenetic and functional diversity that account for species dissimilarity and represent additional facets of stands diversity. The third point is to design this framework to integrate biodiversity aspects into forests dynamics models and provide a workable tool to anticipate the impact of logging and refine sustainable forest management. For each step technical questions have to be tackled like dealing with determination uncertainty of forest inventories, managing the functional traits variability and validating the models with real datasets. Those are provided by datas from Paracou experimental station in French Guiana where stands underwent logging treatments of various intensities and have been regularly inventoried since.

Keywords: Biodiversity Indices, Logging Impact, Dynamic Models, Phylogenetic and Functional Diversity

Richness, diversity and threatened taxa patterns and conservation of bryophytes in headwater streams

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Bryophytes are a major component of freshwater diversity, playing a vital role in headwater streams, highly vulnerable ecosystems subjected to intense human pressures. However, efforts to conserve fluvial bryophyte diversity are often lacking or ineffective. In this context, our main objectives were to determine the most important environmental variables affecting community structural patterns of bryophytes across scales and

identify priority fluvial areas for bryophyte and habitat conservation, through the development of an Index of Fluvial Botanical and Hydrogeomorphological Singularity (IFBHS). For this purpose, a total of 187 river segments and 835 microhabitats were sampled in headwater streams of northwest and center-west Portugal, mostly within Natura 2000 Sites and National Protected Areas. Partial least squares regressions were performed to analyze which environmental parameters relate to the most rich and diverse bryophyte communities. At the segment scale, bryophyte community richness, diversity and threatened taxa occurrence were positively affected by increasing hydrogeomorphological quality, in particular by the heterogeneity of morphodynamic habitats, flow type and water discharge. At the microhabitat scale, high current velocities constituted a physical constraint to bryophyte assemblages. The identified areas are of special conservation significance, since they encompass high levels of bryophyte endemisms and red-listed species, as well as unique fluvial microhabitats. These results confirm previous assessments of the role of physical habitat in shaping biological communities. Heterogeneous fluvial environments, characterized by an array of substrate sizes and flow regimes, promoted bryophyte richness and diversity, given the greater availability of ecological niches that could be potentially occupied. Our study highlighted the relevance of hydrogeomorphological features to bryophyte communities in headwater streams subjected to different levels of human pressure and drew attention to the need to establish an adequate strategy for bryophyte conservation.

Keywords: fluvial conservation, headwaters, threatened bryophytes, hydrogeomorphology

Cat litter made from macroalgae

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This work is a study of an upgrader project of a green macroalgae *Chaetomorpha linum* in the production of cat litters. The North Lake of Tunis presents a favorable environment for the proliferation of large biomasses of *Chaetomorpha linum* during an average period of 5 months/year. In the context of the control of water quality, the excesses of biomass of *Chaetomorpha linum* are evacuated out of the lake to avoid eutrophication. The availability of important biomasses of this macroalgae (13,680 tons of wet mass in spring 2015) and the physicochemical properties of this macroalgae especially its water retention capacity and its antibacterial activity has enabled us to enhance the alga *Chaetomorpha linum* and test its use after a few treatments as additives to cat litter. The tests were conclusive. Their addition to the litter of cats has increased their durability and their efficiencies to capture moisture. In addition, marine odors have permeated the mixtures litter-filamentous algae. All these results have encouraged us to initiate an economic study which showed the feasibility and relevance of the establishment of a project for manufacturing litter to basis of *Chaetomorpha linum*. However, further research is needed to limit the costs of operations for washing and drying and develop other forms of marketing of the algae that are in high demand especially in the European market (plates of algae, granules, food supplements for pets etc.). We

are confident that our project for manufacturing litter made from *Chaetomorpha linum* is attainable.

Keywords: *Chaetomorpha linum*, Northern Lake of Tunis, biomass, litter, macroalgae, valorization.

Diversity-stability relationships: from theory to natural communities

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The diversity-stability relationship is one of the most debated topics in ecology, but mostly using theoretical or experimental approaches. Theoretical and experimental studies showed a positive effect of diversity on temporal stability and highlighted three main mechanisms potentially involved such as the overyielding effect, the variance effect and the covariance effect. Regarding the effect of diversity on population stabilities, studies found positive and negative relationships. However, the composition of natural communities is not random but depends on both local environmental conditions and perturbations. Here we analyzed the temporal stability over 8 years of 131 local butterfly community abundances spread all over France. We integrated data about landscape composition and habitat quality to represent environmental perturbations. Our results indicate that habitat degradation affects both the species richness and the phylogenetic diversity of butterfly communities which in turn affect community stability but via different mechanisms. Urbanization affected negatively community abundance and species richness, instead of woodland area had a positive effect on species richness and phylogenetic diversity. Then species richness increases stability directly and phylogenetic diversity increases community stability via a decrease in population synchrony. Interestingly, we also found that the temporal stability at the population level also increases in richer communities. A finding that contrasts with experimental and theoretical results carried out on plant communities. Thus two distinct mechanisms appear to drive the stability of natural butterfly communities: a portfolio effect where more species induces a stronger statistical averaging of the population dynamic and a response diversity effect where more distantly related species tend to respond more differently to environmental fluctuations. The higher stability of populations might also contribute to the higher stability at community level and show differences in the diversity-stability relationship between plant and animal communities.

Keywords: Diversity, stability, communities, butterflies, landscape

The drivers of the plant communities at the base of the alignment trees in a district of Paris (France)

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At the age that the cities became the place of life for half of human on planet, it is important to understand the factors which support the urban biodiversity to give the best preconization of management. The tree bases occupy a very reduced surface, but present in great number and arranged not randomly in space. They could play an important ecological part in the urban context which offers a limited favorable spaces to the development of a spontaneous flora. The purpose of this study was to understand which are the factors influencing the composition of species which are harbored by tree bases in this district. We thus analyzed the data of floristic inventories of the flora growing at the base of 1474 trees in 26 streets in 2014 located in the district of Bercy. Our results indicate that the species richness and composition depended on tree bases characteristics, its equipments, tree species and distance to green spaces. The characteristics of the district and street, and the biological characteristics of the plants such as the longevity of the seeds in the soil and species' strategy type could be the main drivers of the distribution of the species among the tree bases. This study showed that the tree bases are favorable habitats for a certain number of species and could be considered as corridors between more important green spaces like the parks or the gardens.

Keywords: Tree bases, district of Bercy, spontaneous flora, Paris, biological characteristics of plants, tree bases characteristics

Wind constraints on the thermoregulation of high mountain lizards

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Thermal biology of lizards affects their overall physiological performance. Thus, it is crucial to study how abiotic constraints influence thermoregulation. We studied the influence of wind speed on thermoregulation in an endangered mountain lizard of the Pyrenees (*Iberolacerta aurelioi*). Therefore, we compared two populations of lizards: one living in a sheltered rocky area, and the other living in a mountain ridge, exposed to strong winds. The preferred temperature range (PTR) of lizards, which reflects thermal physiology, is similar in both areas, and it is typical of a cold-specialist. Although the thermal physiology of lizards and the structure of the habitat are similar, the highest wind speed in the exposed area entails a significant decrease in the effectiveness thermoregulation, dropping from 0.83 to 0.74. Moreover, the cooling effect of wind in lizards is potentiated as wind speed increases, by means of the added cooling effect of substrates. Our results also have conservation implications related to climate change. Mountain lizards are cold-specialist, which make them highly vulnerable to global warming. Phenotypic plasticity and evolution of their thermal physiology seems not able to adapt to the rapid warming, and mountain lizards lack the chance to migrate to colder areas. Thus, a possible solution

to help preserving these species would be to search for cold refugia in mountains. Hence, although wind constraints thermoregulation of lizards under current climatic conditions, it may be valuable to identify cold refugia for conservation of mountain ectotherms in the present day scenario of global warming.

Keywords: wind, abiotic constraints, thermoregulation, climate change, lizard, mountains

Tracking down *Dendrocryphaea lamyana*: establishing the environmental context and distribution of a vulnerable bryophyte in Europe through collections and time

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First described in 1836 in Limoges - France, *Dendrocryphaea lamyana* (Mont.) P.Rao is a threatened bryophyte species at the European level. Listed as Vulnerable on the Welsh Red-list and Near-Threatened in Great Britain, it receives special protection in several countries. Locally distributed in west and south Europe (south Britain, France, Portugal, Spain and Italy), and most likely erroneously cited in Switzerland and North Africa, it has been considered either as a euatlantic, atlantic, subatlantic, oceanic-submediterranean-montane or a southern-atlantic temperate species. These classifications have in common the distribution trends of this species towards the Atlantic Ocean territories. Through time, bryologists and collectors have described this taxon as requiring very restricted fluvial ecological conditions, which translated into an equally restricted distribution. As more data is comprehensively gathered and chronologically classified, we observe the enlargement of its bioclimatic and hydrogeologic niche definition, and consequently, open the discussion of its, so far, vulnerable status. In the present work, we have identified and gathered point occurrences from range-wide herbarium specimens and field observations and explored the most important parameters that allow the detailed description of species macro- and meso-ecology. Occurrence points were compiled to explore the European suitability area for this species and to establish its overall distribution by the application of environmental niche modelling techniques. By gathering all the available information on this taxon we hope to identify probable sampling gaps of this species in Europe and to obtain a present potential distribution range of the species at the European level that could guide future field surveys. Furthermore, we aim to

superimpose the species occurrence with macroclimatic and hydrologic variables to better understand species ecology. Additionally, we aim to discuss and propose an updated conservation status in Europe considering the results of this work and the present integrity of European fluvial scenarios.

Keywords: conservation status, environmental niche modelling, freshwater

Morphological drivers of trophic cascades

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Understanding the ecological consequences of human activities has become a central issue in ecology. A large number of studies have shown that anthropogenic biodiversity loss is not random, but is biased against large vertebrate consumers at the top of trophic networks, and results in trophic cascades in all of the world major biomes. Moreover, recent studies have demonstrated that anthropogenic perturbations also induce rapid change in morphological traits (in particular rapid body-downsizing) which may be pivotal to ecological functioning, in fact this rapid change could also impact trophic cascades. However, studies interested in the effects of biodiversity loss are mostly focused on the presence-dependent effects of predators without taking into account the morphology-dependent effects. In our experimental study, we have specifically quantified the respective contributions of predator presence and morphological traits (body size and shape) to the strength of a fish-induced trophic cascade. We varied both the presence and the morphological traits of a small freshwater fish (medaka, *Oryzias latipes*) in a food chain including herbivorous zooplankton and phytoplankton and we compared the resulting trophic cascade. Our results show that the strength of size-dependent effects of fish may dominate the strength of their presence-dependent effects in the trophic cascade. Therefore, our study suggests that accounting for rapid anthropogenic body-downsizing is necessary to predict and manage the consequences of biodiversity loss, and further advocates for a better integration of trait-dependent interactions into classical ecological theory.

Keywords: traits, mediated interactions, body size, body shape, trophic cascade, medaka

Urban pressures consequences on communities and behaviors of earthworms

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Urban environmental pressures affect ecological and evolutionary dynamics. Indeed urbanization influences community's structure and ecosystem functioning, and several animals adapt their behavior to this particular habitat. The urbanization effect on communities and behaviors of earthworms, an engineer species making many ecosystem services, are poorly known. In this study, we sampled more than twenty sites in Île de France, allowing us to assess the urban environment's impacts on communities and two behavioral traits: above ground moves and capacity to burrow large galleries in earthworms. Abundance and biomass decrease with urbanization, moreover they also diminish going towards west just as species richness. This may imply the existence of a longitudinal soil quality gradient. Earthworms show a temporal stability in inter-individual differences of behavior, which may be similar to personality in the common species *Allolobophora chlorotica*. Furthermore, urbanization influence earthworms behavior, indeed urban earthworms make less above ground displacements but burrow larger galleries than rural ones, which may be explained by a trade-off between these two traits.

Keywords: urbanization, earthworms, community, above ground moves, burrows

Gradients and drivers of Amazonian tree bark and leaf litter beetle diversity

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Insect species richness in tropical rainforests is in focus but the forest habitat compartment tree bark is poorly studied, especially for hyper-diverse orders like Coleoptera. This study contributes to closing this gap. In order to detect diversity patterns, drivers and gradients of Coleoptera assemblages, tree bark was sampled by barkspray method in a lowland rainforest in French Guiana. 160 tree trunks on 16 plots were sampled in 2011 and 11 plots (110 trees) were resampled in 2014 in the Réserve Naturelle Les Nouragues. Additionally, the litter fauna was sampled in 2014 on seven plots (70 samples) at each respective tree base. The Coleoptera were analyzed according to their spatial beta diversity, using similarity indices and correspondence analysis techniques (CA, CCA). 2224 beetle individuals out of 577 morphospecies and 50 families were counted in this study. 354 morphospecies and 1377 individuals were found in bark samples and 241 morphospecies and 847 individuals in litter samples. 1080 morphospecies were predicted (Chao2) for the bark and 545 morphospecies for the litter, showing no saturation and indicating that litter beetle diversity was lower and more predictable than the corresponding tree bark fauna. Tree bark turned out to harbor

a distinct fauna, with only 18 overlapping morphospecies with the litter which is only 3%. Thus, the tree bark represents an own compartment in a forest ecosystem and is not just a continuation of the nearby litter stratum. Furthermore, the litter fauna was more homogeneously spread over the study area than was the bark fauna, which was more stochastically distributed over the trunks. It can be concluded that under island biogeographical aspects, tree trunks are "islands in a sea of litter".

Keywords: Coleoptera diversity, Bark beetle communities, Litter beetle communities, Tropical insect ecology, Beta diversity, Diversity gradients, Diversity drivers

One invasive fish and two new parasites

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The penetration of Red Sea organisms into the Mediterranean Sea through the Suez Canal is probably the most dramatic marine bio-invasion since the Pleistocene. While the invasion of free living organisms receive great attention, their accompanying parasites receive very little of it. In our research we examined the parasites of native and alien fishes. The invasive blotchfin dragonet *Callionymus filamentosus* was first recorded about 60 years ago off the Israeli shore. Today it is considered as one of the most abundant fish species on shallow sandy bottom along the Israeli Mediterranean coast. During the study, two novel parasites were found on *C. filamentosus*: (1) an unusual microsporidian infection found only in female gonads, described as a novel genus and species, *Obruspora papernae*, and (2) an ectoparasitic copepod infecting the gills of both males and females. Prevalence and intensity of *O. papernae* infection were high throughout most of the year. Over 80% of the females had visible microsporidian xenomas in their ovaries, many of them heavily infected and completely overtaken by xenomas. Neither *C. filamentosus* males nor copepods from the gills of males showed any presence of *O. papernae* infection. However, DNA traces of the microsporidia were found in the tissues of both. The timeline of appearance of both parasites was determined from preserved specimens of *C. filamentosus* deposited in the fish collections of the Steinhardt National Natural History Museum, Tel Aviv University, and the Hebrew University Zoological Museum, Jerusalem. Establishment of the two parasites in the Mediterranean took place 40 years after their host, with the parasitic copepod first to appear and the microsporidium following several years later. Our findings suggest a potential role of the parasitic copepod in the life cycle of the microsporidia and the eventual co-invasion of the host fish along with two of its native parasites.

Keywords: Marine bio invasion, Parasites, Co invasion, Invasive fish

Performances of a hybrid constructed wetlands for domestic wastewater treatment in Moroccan rural area

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Actually, most of rural areas of Morocco are suffering from pollution, and the potential illness caused by untreated wastewater discharged in the environment. Sanitation in this region, where technical and financial resources are usually limited, has a negative impact on the quality of life of the rural population. In order to solve this problem, a number of alternative technologies have been developed as a hybrid constructed wetlands (HCW), which are adapted to the needs of these areas. The experiment was set up in small rural community named Tidili. The wastewater treatment plant was composed of three vertical-subsurface flow wetlands (VF), 130 m² each, working in parallel. Thereafter, followed by two horizontal-subsurface flow wetland (HF) connected also in parallel (88 m² each). The two units were planted with *Phragmites australis* at a density of 4 plants/m². Several water quality parameters including pH, BOD5, COD, TSS, TKN and TP, and fecal bacteria's number in both raw and treated wastewaters were monitored during one year. Wastewater samples were collected fortnightly at the inlet of the storage tank and at the outlet of both the VF and HF stages from April 2014 to March 2015. The main removal percentages of SS, BOD5, COD, TN and TP were respectively 95, 91, 88, 63 and 63%. In addition, the Log10 removal for total coliforms, fecal coliforms and fecal streptococci were 4.42, 4.30 and 3.91 Log unit respectively. Based on the obtained results, the hybrid constructed wetland technology is a successful method for rural region and provides good purification performance in terms of removal of organic matter, nutrients and indicator bacteria fecal contamination. Thus, it can be concluded that hybrid constructed wetlands could be considered as a low cost technology adapted to Moroccan rural areas for domestic wastewater treatment.

Keywords: hybrid constructed wetlands, domestic wastewater, organic load, nutrients, bacterial load, Moroccan rural areas

Conservation strategies of two endemic Italian species of carnivorous plants

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The Apuan Alps represent an hotspot for biodiversity since it hosts more than a third of Italian floral heritage. Recently two new species, belonging to Lentibulariaceae family, have been described: *Pinguicula apuana* Casper & Ansaldo (2009) and *Pinguicula mariae* Casper (2009). They were both proclaimed endangered since endemic and subjected to illegal over-collection, moreover they inhabit natural priority habitat 7220* (Natura 2000) characterized by an excessive human pressure. For this purpose monitoring campaigns and ex situ conservation are a powerful tools for the implementation of environmental preservation strategy. The aim of this work was to improve in situ monitoring program of *P. apuana* and *P. mariae* and define a standard protocol for their in vitro seeds germination. Monitor-

ing data carried out in the vegetative period of the two species, have demonstrated that they have a very restricted distribution area with isolated populations, especially for *P. mariae*. Regarding in vitro studies, changes in seeds germination percentage were investigated varying Murashige & Skoog medium (MS) concentration and Gibberellic Acid (GA3) concentration and kind of treatment. The GA3 was given in two concentrations (250-500 mg/L) and two type of applications (direct on culture medium or 24h seeds presoaks), whereas MS was absent or ½, ¼ concentrated. The highest germination rate was obtained for seeds presoaks for 24h in 250 mg/L GA3 using ¼ MS (90,64±5,03%) and free MS (82,53±1,83%), respectively for *P. apuana* and *P. mariae*. After germination some seedlings were grown in vitro and subsequently acclimatized to ex vitro conditions. With this study it was possible to obtain data about the conservation status of *P. mariae* and *P. apuana*. Moreover, throughout the description of an efficient protocol to get material for in vivo germplasm collection it will be possible to have plants for future replenish of natural declining populations.

Keywords: Conservation, In vitro culture, Germination, Carnivorous plants

Are land uses and soil properties determining Termite and Ant Communities in the Colombian Llanos?

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Ants and termites, as soil engineers, provide many ecosystem services that can be important for the sustainability of agriculture. The aim of this study was to evaluate the impact of land use on ant and termite communities in Colombian savanna landscapes, and to assess whether this impact is associated with modification of soil properties. Ants and termites were collected in five different agricultural systems across of Colombian Llanos: 1) annual crops (maize, soy and rice), 2) rubber plantations, 3) oil palm plantations, 4) improved pastures and 5) semi-natural savannas. A total of 91 ant and 16 termite species were collected. Multivariate analysis revealed that termite communities significantly differed among land uses but not among regions. Ant communities differed between regions and land uses. Three groups of land use can be distinguished: one formed by semi-natural savannas and improved pastures, the second by oil palm plantations and annual crops and the third by rubber plantations. General linear models applied separately to each species found 19 significant associations with soil properties, land uses or regions for 15 ant species and 14 significant relationships for 6 termite species. Taken together, there is a strong association between land uses and ant or termite communities and this influence is likely due to changes in ant and termite habitats resulting from agricultural practices such as tillage, fertilization, and lime addition. Our results suggest that annual crops are the most detrimental land use for termites and ants, because their communities are highly sensitive to the vegetation cover and agricultural practices such as tillage. Maintaining a high diversity of soil engineers and the ecosystem services they provide, probably depends on the maintenance of native ecosystems in the landscape and the adoption of practices that reduce impacts on

soil engineers when native ecosystems have been transformed into agricultural systems.

Keywords: Soil engineers, perennial crops, annual crops, soil physical and chemical properties, agriculture

Humans, Elephants and Birds in Zambian Mopane

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Habitat structure, diversity, complexity, scale and type are some of the key factors that determine diversity of species in nature. Mopane woodland, which is also a key part of the bigger Miombo ecoregion in the Southern Africa is considered by many as biodiversity poor landcover. But, also many believe that Mopane like the Miombo is understudied. There are some studies that take in account biodiversity and biodiversity change in Mopane, but to clearly understand about biodiversity significance of mopane woodland and to assess impact of changes in mopane structure and cover on its biodiversity, we require more investigations. We investigated drivers of change in habitat structure and how it affects richness and composition of Avian species in the mopane landscape of Zambia. In the Zambian mopane woodland, the human and elephant are the major drivers of change. While cutting of stems by humans result in higher stocking density but of smaller size class, debarking by elephants resulted in lower stocking density consisting of more bigger sized trees. This results in trait filtration, functional divergence and difference in species composition while alpha diversity remains the same in both landscapes.

Keywords: Mopane woodland, Elephants, Humans, Birds, Biodiversity: Functional diversity

Beyond MSY: Trading off yield and resilience in harvested predator-prey communities

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The overexploitation of many marine ecosystems points out to the need of a consistent ecosystem-based management, able to trade-off between various ecosystem services. As of today, the most common fisheries management target is the maximum sustainable yield (MSY), that aims at maximizing catches. Yet its relevance to harvested multispecies communities with ecological interactions is still in question. In particular, its effect on other ecosystem services such as resilience remains uncertain. Here we assess the consequences of MSY on the sustainability, resilience and yield of a predator-prey community. While harvesting prey at MSY always implies to cull the predator species, harvesting predator at MSY is always sustainable. Yet if this strategy brings the predator population to low levels, it can lead to resilience losses. Under certain conditions, maximizing the

total catches of prey and predator species can also be sustainable. In that case, a prey-oriented harvest will bring higher yields and lower resilience than a predator-oriented harvest. To go beyond MSY, we use a multi-objective optimization approach. We find a general trade-off between a high-yield low-resilience prey-oriented harvest and a low-yield high-resilience predator-oriented harvest. This suggests that a balanced harvesting could be the best-suited strategy to trade-off between multiple ecosystem services in multispecies trophic communities.

Keywords: Maximum sustainable yield, predator, prey community, resilience, multi, objective optimization, Pareto frontier, balanced harvesting

Consequences of pollinator extinctions on the loss of plant evolutionary history

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Predictions about future biodiversity state that high proportions of species could go extinct in the following centuries. Among well-known groups, 32% of the world's amphibians, 25% of mammals and 13% of birds are threatened with extinction. But those alarming predictions are probably underestimated because they are biased towards a few taxa and they do not consider coextinction events. Species are related through complex networks of interactions such as competition, predation and mutualism, and the extinction of a given species could increase the vulnerability of its partners and cause extinction cascades. Coextinctions are probably not random in the tree of life and could conduct to the loss of large amounts of unique evolutionary history. Yet secondary extinctions were seldom considered to assess the loss of evolutionary history or relied on too simplistic topological models. Thanks to a new method which accounts for both the complexity of interaction networks and for the phylogenetic complementarities among species, we assessed how much plant phylogenetic diversity could be lost subsequent to the local extinction of pollinator species in Europe. Our results showed that the loss of specialist pollinator species, which tend to be more vulnerable to extinctions, could remove high amounts of phylogenetic diversity because they interact with evolutionary unique plant species. Moreover some pollinator groups interact with evolutionary close plant species presumably because those plants are ecologically similar due to their common ancestry. The extinction of those groups would thus remove deep branches in the European plant phylogeny. Through this study, we recommend to consider coextinctions and phylogenetic diversity in order to measure and predict the consequences of species loss on biodiversity. We believe our method is efficient for that purpose and should be applied to all types of interaction networks such as trophic, competition and mutualistic networks.

Keywords: Coextinctions, phylogenetic diversity, pollinators, interaction networks

Landscape analysis of genetic diversity and structure of Andean bears across Ecuador

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The Andean bear (*Tremarctos ornatus*) is the only bear in South America and the only living member of its genus. Habitat fragmentation is one of the main threats for the species and information on functional connectivity does not exist. Documenting the degree of fragmentation among the more spatially continuous habitat areas and determining linkage zones across the Tropical Andes is of high priority. Molecular data is advantageous because DNA is inherited from one organism to its offspring, which allows determining historical and current patterns of population connectivity distributed across the landscape. Our research focused on evaluating functional connectivity among Andean bear populations by conducting genetic analysis of mitochondrial DNA (mtDNA) and nuclear DNA (nDNA). Our research objectives were: (1) to generate information on the current state of fragmentation of Andean bears in Ecuador and (2) to determine genetic diversity, structure and phylogeography for Andean bears. Field and molecular methods based on non-invasive sampling of hair and feces were developed during the course of this study. In order to obtain information on intra-specific phylogeography, four primers were designed to amplify the control region of the Andean bear mitochondrial DNA. Due to the endangered status and elusive behavior of this species, this methodology has proven crucial to study wild Andean bears in tropical ecosystems. This data represents new information for the species and the methodology has been adopted by many bear researchers. Our genetic dataset comprises information from free range and captive Andean bears collected across Ecuador during years 2000 to 2010. Results show that there is gene flow among bear populations in the Northeast of the Andes Mountains, but not between other areas. We found 6 different haplotypes within the bear populations across the country. This research is crucial for determining patterns of functional connectivity and priorities for Andean bear conservation.

Keywords: Andean bears, *Tremarctos ornatus*, conservation genetics, DNA, non, invasive sampling, tropical ecosystems, Ecuador

Arrested Succession in Costa Rican Lowland Secondary Rainforest through a *Dicranopteris pectinata* Understory

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The slopes of La Gamba in the Golfo Dulce region in South

West Costa Rica form a patchwork of regenerating lowland secondary rainforest sites in different stages of succession. Certain sites, however, are dominated by a pervasive understory of the pan-tropical fern *Dicranopteris pectinata*. This fern is known to form dense recalcitrant layers which arrest natural succession through a range of interference mechanisms. This research project aimed at verifying whether the *D. pectinata* understory effectively arrests succession in the La Gamba region and by which mechanisms it succeeds in doing so. An arrest in above and below-ground succession was assumed by hypothesizing a minimal development in a range of variables. We hypothesized that a fast lateral growth, an accumulation of litter, and an allelopathic effect due to phenolic substances were the main reasons for *D. pectinata* dominance and arrested succession. Furthermore, we checked whether a pervasive understory layer can also have beneficiary effects on the local soil. For this purpose, soil and vegetation analyses were executed on a chronosequence of *D. pectinata* dominance in a range of sites. In-situ seedling and greenhouse experiments were used to determine the importance of allelopathy in restricting the regenerative capacity of the local vegetation. Understory removal experiments determined the regeneration rate and influence on the soil of *D. pectinata* stands. The analysis proved the understory to be an effective barrier to seedling establishment and vegetation regeneration and the main cause for an arrest in above- and below-ground succession. Characteristics contributing to understory dominance were its high biomass; fast lateral growth; strong aboveground competition and large litter layer. The understory's allelopathic effect, however, was of no importance. This research project provides an extensive overview of the ways by which a *D. pectinata* understory arrests succession and of the effects this has on the local vegetation.

Keywords: arrested succession, invasive species, *Dicranopteris pectinata*, understory, reforestation

Growth and flowering of rose geranium (*Pelargonium capitatum*) plants under salt stress

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Pelargonium capitatum is a low shrub mainly used for its essential oil. Young rose geranium plants were grown in pots and watered with solutions containing 25, 50 and 75 mM NaCl. The control was sprinkled with running tap water. Different parameters were studied: plant height, number of leaves per plant, number of inflorescences and number of flowers per inflorescence. The results showed that salt stress affects both vegetative growth and flowering of plants. In fact, the plant height and the number of leaves per plant decreased in presence of NaCl especially for the highest concentration (75 mM) for which the number of leaves represented only 22% of the control. The plants flowering was also affected by salt and the number of inflorescences and the number of flowers per inflorescence fell as NaCl concentration increases.

Keywords: Growth, flowering, *Pelargonium capitatum*, salt, stress.

HUMANITIES AND NATURAL SCIENCES

Ditsong Natural History Museums; Drivers of Conservation, Nation Building and Tourism

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DITSONG National Museum of South Africa was formerly known as the Transvaal Museum founded on December 1st, 1892. It is now an amalgamation of eight national museums. The museum is situated in Johannesburg, Gauteng Province, and the only natural history museum in Johannesburg. Since its establishment, it has documented South Africa's collection of hominid fossils, fauna as Mrs Ples, fossils skeleton, mounted specimens of fish, amphibians, mammals and reptiles. Natural History Museums are imperatives / provides for the collection, conservation, preservation and restoration of national heritage assets and undertakes appropriate research to the public through exhibitions and educational programmes, thereby contributing to nation building and tourism; as a shift towards an emerging South African museology. Museums are very crucial to the development of the nation. Hirzy (2003) reiterate that museum as institutions are pertinent to understanding, appreciating the natural world, and the history of civilization. The purpose of this research is to explore the history of the DITSONG Natural history museum prior to its amalgamation. The paper discuss the roles of museum role in nation building, conservation, nation building and tourism from historical analysis to contemporary trend. This is a sequential exploratory study in that used a mixed methods approach (quantitative and qualitative) to explore museum models in South Africa in line with the SPECTRUM standard, the museum collections management standard developed in 1994 by the UK. With few interviews from directors and curators of museum. Preliminary data found out that intricacies such as legislation, scarce support from the state budget and museum workers are stifling the growth of museums.

Keywords: Museums, Ditsong, Conservation

Human Subsistence Strategies and Environment in Late Pleistocene-Early Holocene Eastern Java: Evidence from Braholo Cave

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The climatic shifts during the Pleistocene-Holocene transition in Island Southeast Asia resulted in dramatic changes in landscape configurations which are presumed to have greatly impacted vertebrate community composition and in turn human subsistence economies. Zooarchaeological investigations in the region have provided information on how ancient foraging communities responded to these changes. However the complete picture remains to be elucidated. In this paper we present preliminary results of an ongoing analysis of faunal remains recovered

from Braholo Cave in Eastern Java. We observed an overwhelming predominance of arboreal and semi-arboreal fauna most notably the Javan langur in the Late Pleistocene and Early-Mid Holocene deposits of the cave. In contrast earlier cave deposits were dominated by animal taxa generally associated with open environments such as bovids and cervids. This reflects forest expansion at the onset of the Holocene, albeit it also suggests deliberate targeting of specific taxa. The wide range of terrestrial, arboreal and aquatic taxa from various ecological niches suggests that the humans that inhabited the site subsisted on a mosaic of environments. It also hints on their intimate knowledge of these environments and the presence of different hunting technologies. Zooarchaeological parameters such as mortality profiles and body part representation allowed us to describe certain aspects of these hunting technologies. We also present preliminary results of an ongoing dental mesowear and microwear analyses of cervid and bovid specimens from the assemblage. Our results provide unique insights on subsistence strategies of prehistoric foraging communities and the environment they encountered in Java during a key period of human history.

Keywords: zooarchaeology, southeast asia, java, holocene, pleistocene, subsistence

The Atlantic crossing Sacred Trees: Ethnoarchaeology at maroon community (Vila Bela/MT-Brasil)

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This communication is about master's research results developed between 2008 and 2012, under the PPGArq-MAE / USP, at Vila Bela, in the Boqueirão Maroon Community, located in the state of Mato Grosso, Alto Vale do Guaporé and among African-Brazilian religious communities at São Paulo and Mato Grosso. The ethnoarchaeology studies and maroon landscape focused on the allocation of symbolic significance to certain plants, especially the tree by its mnemonic potential. We have considered not only the important role of plants in the Afro-Brazilian religions, but their distinctive and mnemonic potential as well, able to bring up reminiscences in this afro-descendant group and its memory. Data collected in the systemic context were used for the interpretation of the archeological site, in order to broaden the diachronic variation of the analysis. We were able to trace back to part of the family background of some members of this community, in addition to part of their ancient past, for some of the data obtained led to their African roots. We conclude that there are trees which bear a symbolic, both inside the studied "terreiros", in accordance with the Afro-Brazilian religion literature, and also significance to the way of thinking of the community in the Boqueirão community.

Keywords: ethnoarchaeology, landscape, African diaspora, maroon community, symbolic plants

The contribution of the nineteenth century fossil fauna collections to the debate of first *Homo sapiens* dispersion in South America

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Homo sapiens dispersion and its impact in the paleoenvironment is one of the most studies subjects in archaeology. Americas suppose a special case since it is a landscape free from previous Hominini interventions. This had implied novel contacts with native fauna groups that developed in isolation in this continent such as Xenarthras and Notoungulata among others. From a paleoecological perspective, our specie would have been a new predator in this continent, producing modifications and/or amplification in the hunting-scavenging niche. This would have helped to the dispersion of our specie in this new paleoenvironment. In order to get deep into this problematic taphonomic and archaeozoological studies are being realized in different Pampean (Argentina) nineteenth century collections, housed in Argentinean and European museums. Since they were extracted with a different procedure that nowadays standards, they can have potential useful information. Thus biological intervention and pathological deficiencies are being registered in different species such as Mylodontidae, Glyptodontidae, *Megatherium americanum*, or *Macrauchenia patachonica* among others. They can inform about anthropic and carnivore's exploitation that could have left marks in the bones. These biological marks allow inferring if new relationships, like predation and/or competition would have been developed among humans and native fauna. On the other side, the presence of pathologies helps to contextualize this information, to know the age profile of the sample and if the animals suffered any stress or trauma in life. This type of research over nineteenth century collections not only allows revalorizing these old fossil assemblages, but also, to contribute with new data to current debates about our behaviour in the past.

Keywords: Collections, Taphonomy, American peopling, Fauna

Defining the experience of nature: Evidence from a large sample of French respondents

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Much research effort has been done to explore the effects of natural areas on human health, well-being and environmental concern. However, with urbanization, biodiversity crises and western way of life, the opportunities to experience nature rarely, and the growing disconnection of people from nature jeopardizes global conservation efforts. It is therefore extremely important to know which kind of nature are mostly preferred and used by individuals, before building sustainable conservation managements. We present results on nature connectedness and habits of 4639 French adults, based on the exploration of questionnaires from complementary data sets: 1126 students, 1172 adults from a virtual game community, 446 zoo visitors, 342 Facebook respondents and 1553 persons who "adopted" an animal through a zoo. We explored the type and frequency of natural areas they visit mostly, the place they have grown up, and their connectedness with nature, i.e. the extent to which an individual feels being part of the natural environment. We built an index assessing place ownership for each quoted natural place, to measure to what extent the respondents mentioned a specific place (e.g. a particular forest) or remained general (e.g. forests). Although we found very different quoted natural areas, five were mostly quoted. This result was consistent between the five groups, despite the large differences in the targeted samples. Rurality of place of childhood and connectedness with nature negatively impact place ownership, whereas a positive impact was found for frequency of visits of natural areas and age of respondents. These results clarify the relationship between past, present experiences of nature and sense of connectedness with nature. Finally, consequences of these results in terms of landscape management and education are examined.

Keywords: connectedness to nature, experience of nature, natural areas, extinction of experience of nature

Technical behaviour during the Gravettian in their palaeoecological framework

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Over the past, the cultural homogeneity of Gravettian has been questioned with suggestions that there may be technocomplex variability at a regional scale leading to the following question: What is the cultural, chronological and functional significance from the different features observed? Our work concerns the second part of the Gravettian period, which didn't benefit from recent global studies. The aim is to better characterizing these cultural sub-stages, to understand their regional variability and the constraints linked to the environmental context. Selected sites are located in the Southwest of France and belong to various ecological environments. The focus concerns various aspects. First, a technological study is intended to understand the mobility of the Gravettian. Next, the study is interested in lithic projectiles, often considered as cultural marker. Part of composite tools, they entail many technical constraints, which suggests

a significant artefacts standardisation. Lithic projectiles are usually distinguished by their fixation, especially between different techno-complex, morphology and types. These differences are they linked with different cultural traditions, socio-cultural changes or hunting behaviour defined by a type of hunted animals and environment? In Gravettian, from 30 to 22 ka BP with different environments and animals, similar projectiles are used. A reflection on the importance of cultural tradition and on adaptation with different environmental constraint is suggests. Then, environments contexts of the sites are analysed. They could imply changes with technical systems. Finally, the focus is on the question of the sites functions by integrating all the available archaeological data (archaeozoology, archaeobotanic). This presentation shows some first results which were developed in my master 2 and beginning of my PhD. The aim is to contribute to understand the technical and hunting behaviour of the Gravettian people. With the approaches of environmental context, we will test the relation between human/environment and the stones industries.

Keywords: Gravettian, lithic projectiles, environment, technology, traceology

The idea of “nature” in modern conservation biology

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Natural sciences stand at the crossroad between quantitative sciences and humanities, and are largely based upon abstracts concepts and metaphors that are used to put names on complex entities. At the core of the discipline lies the idea of “nature”: even if this word appears as a very common and clear notion, it still lacks any scientific definition despite its wide use in scientific works. However, an extensive study of dictionaries from 5 different European languages ranging from latin to contemporary languages finds that this term has undergone massive changes in meaning during its history and has currently 4 very different and conflicting definitions. We name these meanings as follows : the christian/romantic definition, the cartesian definition, the vitalist definition, and the essentialist definition. None of them appears more legitimate than the other, and they are always given in different orders between sources. At the same time, all of these uses of the word “nature” can be found in contemporary scientific works, though authors rarely make explicit which meaning of the term they are using. In this study, we try to provide standard definitions and epistemological context for each of these meanings of the word “nature”, and investigate how misunderstandings in the use of this word may have fed many important controversies in the field of conservation biology. On the other hand, as such semantic diversity can also be a chance, we then try to see what opportunities can emerge from these conflicting visions in terms of conservation scenarios and culturally-accurate adaptive management.

Keywords: Nature, conservation, natural history, environmental philosophy, semantics

Investigation of an ancient prehistoric collection in the Muséum National d’Histoire Naturelle: the mesolithic cemetery of Tévéc (Morbihan, France)

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In 1928, Marthe and Saint-Just Péquart discovered an exceptional cemetery dated from the late Mesolithic on the island of Tévéc. Their discovery constitutes outstanding documentation for the understanding of funeral practices during this period in Brittany. The collection gathers a rich variety of material (human bones, fauna, artefacts, literature and archives) that has been split among five museums. It has been partly retained since the beginning of the 20th century at the Institut de Paléontologie Humaine (IPH), in association with the Muséum National d’Histoire Naturelle (MNHN), in Paris. This collection illustrates the issues related to old collections: deprived of context and fractionated. Before any new study, it required to reconstitute its history by cross-examining inventories, publications and material. This cross-sourced process allowed us to propose an updated review of this collection at the IPH and a reflection on the influence of archaeological methods and scientific theories in the creation of a collection in the beginning of the 20th century. Indeed, this analysis revealed an important gap between the archaeological methods used by the Péquart and the anthropological study that followed. The Péquart were the first to view burials in their globality (the funerary architecture, the dead and the artefacts) as meaningful. But the anthropologists of the MNHN, Marcellin Boule and Henri-Victor Vallois, were only concerned with human bones and looked for morphometric characteristics in order to identify the “race” of the Tévéc population. This communication will question the importance of the history of sciences to understand issues related to old collections in an historic institution such as the MNHN. It will also evaluate the shift brought by the Péquart in the definition of prehistoric burials and try to answer this question: today, how is it possible to propose a new study of funeral practices from the documentation they left us?

Keywords: Prehistory, Mesolithic, History of science, History of collections, Archaeology of death

Agricultural Intensification: a Threat to Native Microbial Diversity?

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Unimproved, botanically-rich grasslands are cultural landscapes, created by thousands of years of human management, yet over 97% of these have been lost to agricultural intensification and urbanism in the UK alone. Microbial diversity may also be lost in this process, yet it is unclear how changes in land use and management affect the levels of ‘good’ and ‘bad’ microbiota. This has ramifications for agriculture, conserva-

tion, and potentially even bioprospecting. Based on fieldwork at 36 sites (unimproved, conservation, and improved grasslands as well as sites converted to rapeseed and poppy cultivation) throughout Oxfordshire, England, this paper will discuss how changes in management and land use affect microbial diversity. To establish the microbial taxa at each site, Illumina sequencing of the bacterial 16S and fungal ITS regions was used, microbiota were divided into five functional groups (Plant-Growth-Promoting Rhizobia, Beneficial Fungi, Decomposers, Bacterial and Fungal Pathogens), and this data was analyzed using multivariate analysis. Unimproved grasslands and those under arable reversion (conservation) had overlapping microbial communities while those from improved grasslands, rapeseed and poppy fields were similar. Bacterial and fungal diversity was highest in the unimproved grasslands. Although, beneficial microbiota were ubiquitous, agriculturally improved fields had higher rates of plant, human and livestock pathogens. This paper proposes that the microbial resources from unimproved grasslands could be actively used within agricultural development. For example, inocula from unimproved grasslands could be used to 'restore' degraded soils, protect crops against pathogens, and increase crop productivity. At the same time, more research on the rarer taxa within these soils might lead to new bioproducts, from fungi useful in the conversion of lignocellulosic biomass to bioenergy to novel antibiotics. This has implications for agricultural and biodiversity policies in the UK as well as the northern Europe, where biologically-diverse, unimproved grasslands are also quickly disappearing.

Keywords: microbial diversity, cultural landscapes, grasslands, soil pathogens, bioprospecting

Archaeobotanical Analysis in the Amazon Basin: evaluating management and domestication across de Holocene at the shellmound Monte Castelo (Rondônia State, Brazil)

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The anthropogenic landscape of the Amazon Basin has been created by a dialectical relationship between humans and plants. Far from being a pristine forest, its biodiversity, fertility and resilience are influenced by the presence of inhabitants since c. 14.000 B.P. It represents, thus, a palimpsest of histories marked by continuities and changes in climatic and environmental conditions, and in the development of different technologies and management strategies. This presentation concerns in re-evaluate the role and importance of agriculture and plant domestication process, from a case study dating from the Holocene in the Southwest Amazonia, through plant macroremains analysis. It is being developed in the graduate project "Archaeobotanical and Socioeconomic Change in the Amazon: 8.000 years of management in the Shellmound Monte Castelo", at the Laboratory of Archaeology of the Tropics (USP). This shellmound is located in the Guaporé basin, in a ecotone defined by a transition between the flooded savanna and dry land habitats. The area presents the oldest dates to the occupation of the Amazon, and is composed of a linguistic and ethnic mosaic which is accompanied by a variety of site type. It is the region of prob-

able origin of the Tupi language and domestication of staples among indigenous societies, such as peach palm (*Bactris gasipae*) and cassava (*Manihot esculenta*), besides Anthropogenic Dark Earths initial formations. Monte Castelo is one of the few sites known to the early Holocene in the region with an uninterrupted occupation between 8.000 and 800 BP, so throughout the dry period in the Middle Holocene, which is related to a significant decrease humidity and consequent abundance of resource. The research identified an ancient ceramic production - usually related to an emergency food production system - named Bacabal phase, with c. 4000 BP, related to the presence of maize (*Zea mays*) and other palm specimens.

Keywords: Archaeology of the Amazon, Archaeobotanic, Agriculture, Plant Domestication

Elucidation of Ancient Asian Papermaking Processes through the Characterization of Their Botanical Resources using Py-GC/MS

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Botanical resources play a vital role in the process of human evolution and the development of human society. It was widely used as food, tools, weapons, medicine and clothes. Apparently, botanical remains from ancient time bears archaeological and/or anthropological information which provide great insight into the interpretation of archaeological context, interaction between human society and natural resources. Paper, as a botanical based writing material, may appear late in the history, but its influences on human society were too profound to be overlooked. But when it comes to the study of ancient Asian papers from the perspective of botanical resource utilization, it is challenging as the link between ancient papers and botanical materials was lost during the papermaking process. For a long time, Hertzberg staining and microscopy was the dominant way to identify the botanical fibers as well as the provenance of ancient papers. Effective as it is, the drawbacks are obvious because the identification of fibers from their morphological features are somehow experience-dependent. Basically, the secret of ancient Asian papermaking lies in the nature of cellulosic botanical fibers and/or the mucilaginous solution extracted from certain plants. An analytical protocol is developed by the mean of Pyrolysis-GC/MS to identify the chemical fingerprints that might have varied chronologically and geographically. Analysis is currently conducted on reference papers samples made from different types of plants. It is demonstrated that the presence of specific triterpenoids and phytosterol compounds can be correlated to the composition of the fibers. The method is currently applied for the identification of museum artefacts. The traceable chemical information of the ongoing experiments may have promising academic values in gaining in-depth understanding of the botanical material evolved in the early stage of papermaking and reveal the origin and spread of papermaking.

Keywords: botanical resources, ancient Asian papermaking, Pyrolysis GC/MS, chemical fingerprints, triterpenoids, phytosterol

Museums and Reconstruction of Nigerian History: A Case Study of Benin National

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Undoubtedly, the role national Museum is enormous and visible in most countries. The star attractions are the brasses from Benin City, which get their own gallery. The Nok Terracottas are also well represented. Another gallery dedicated to traditional symbols of power contains carved ivory and a royal host of crowns. A less fortunate symbol of power is the bullet-riddled car in which Former President of Nigeria, Murtala Mohammed was assassinated in 1976. This museum also operates a non-profit crafts centre, which stocks a good range of batik cloth, woodcarvings and textiles at fixed prices. There's a fine range of intricately decorated calabashes from across Nigeria. The paper examines the significant the museum has played in re-writing the Nigerian past. Preliminary data shows that the museum is not been utilized. The paper recommends re-training of staff and more awareness should be created.

Keywords: Benin, Museum

National Commissions for Museums and Monuments in Nigeria: Any Relevance for Standard?

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Museums are public institutions with the mission of collecting, preserving ,exhibiting and educating about artifacts amongst others. It is on this premise that they are guided and regulated by code of ethics, local, state and international convention as well as accreditation scheme. The needs for museums to be regulated have become crucial amidst operating in complex and dynamic environment in contemporary world. These regulation and accreditation schemes are beneficial to museum operation in terms of the management and preservation of museum collections and the need for museums to be at par with current trend in museology. Museums in Nigeria are not immune to these concepts. The National Commissions for Museums and Monuments in Nigeria manages and oversees about forty-six museums and outlets, as well as two UNESCO World Heritage Sites, the Sukur Landscape and Oshogbo Sacred Grove spread across Nigeria. With this in view, the paper examines the roles of the Nigeria National Commissions for Museums and Monuments in regulating museums operations and standards and, the extent to which Nigeria museums are keeping up with international code of ethics. The paper discusses also the traditional didactic approach adopted by other museums in developed countries at comparative level with museums in Nigeria. Based on a sequential exploratory study that combined a mixed methods approach (quantitative and qualitative) to explore how staff of the National Commissions for Museums and Monuments in Nigeria perceive to what extent Nigeria museums have standards comparatively to those in developed countries. The paper argues that while museums in developed countries have visible regulatory organizations and standards regulating them, Nigeria museum are still struggling

to keep up the pace. The research findings reveal that there is lacuna in Nigeria museums accreditation scheme and legislations on museums operations in Nigeria.

Keywords: Archeological site, Nigeria Museum, Standard, Code of ethic

Hunting and breeding at Bienne lake: New aspects from Neolithic sites at Sutz-Lattrigen bay, western Switzerland

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With its Neolithic age wetland sites, Switzerland offers an incomparable source of information on prehistory dwellings. The exceptional preservation of wooden construction elements allow an exact dating of the sites as well more into understanding the settlement evolution. Sutz-Lattrigen bay at Bienne Lake offers a clear sight into the economy lake dwelling sites in Switzerland. An Archaeozoological research on three Neolithic bone assemblages is running with the aim of understanding the environment, ecology and economy of these Neolithic sites. The hypotheses put forwards that the breeding activities observed in all the sites are probably attributable to topographical conditions within the effect of climatic features. A comparison of the archaeozoological data show that the assemblages located on the flat side of the lake contain higher proportions of domestic animals than those situated on the steep side and the clever change in the herd management during the Horgen period is based ultimately on economic imperatives.

Keywords: archaeozoology, neolithic, pile dwellings

Social responsibility of mining company and Sustainable Development in Guinea

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Demand for mineral commodities has increased in the world and this leads to discover new reserves worldwide; thus that the Republic of Guinea has become a destination for mining giants since the turn of the century. Guinea is endowed with rich and diverse renewable and non-renewable natural resources, but largely under-exploited until now. Social and environmental issues relating to mining impacts remains a real concern in Guinea. With one of the world's most important bauxite concentrations, yet Guinea remains among the poorest country in the world.

Keywords: Societal, Responsibility, Mining, Guinea, Sustainable development

Archaeological collections of Rochereil Cave: new study of the ornamentation of barbed points (harpoons)

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The Rochereil Cave was discovered in 1906 and has been classified as 'Monument Historique' in 1952, thanks to the amount and quality of archaeological remains. The most recent excavation, made by Doctor Paul-Emile Jude, has been realized from 1936 to 1939 but the objects were collected without a real stratigraphic context, a common method at that time. We have therefore little information about the stratigraphy of the site, but it is possible to estimate the period of occupation by comparing the style of some pieces. For Doctor Jude, there were only two occupation periods on the site: Magdalenian and Azilian (late Upper Palaeolithic). More recently, another period of occupation was found (Laborian), throughout the new study of the collections. The series extracted from the 1930's excavation are preserved in the 'Musée National de Préhistoire' (Les Eyzies de Tayac, Dordogne), since January 2015. Collections extracted from this cave are very exceptional in term of conservation and diversity of objects, and were studied in the frame of a PCR ('Projet Collectif de Recherche') supervised by Patrick Paillet. They are constituted of some bone industries and lithic equipment. A part of my work was dedicated to the study of Magdalenian barbed points (sometimes called 'harpoons'). First, they have been measured and described and their figurative ornamentations were thoroughly studied, as their presence on Magdalenian barbed points is very rare. The location of these ornamentations on the objects is rather uncommon compared to other objects from nearby sites ('La Madeleine', 'Lauferie-Basse', etc.) and detailed drawings were made. Moreover, rhombic motives containing horizontal striations are exclusive to Rochereil Cave, which make it unique.

Keywords: Rochereil, cave, collection, barbed point, ornamentation, archaeological, Magdalenian, Dordogne

Mixtures of endocrine disruptors affect thyroid hormone signaling during embryogenesis

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Thyroid hormones (TH) are crucial for early embryogenesis (Fini et al. 2012) and brain maturation (Bernal 2007). TH disruption (THD) by genetic and/or environmental factors during brain development can cause irreversible neurological defects. Nowadays humans are exposed to myriads of chemicals including thyroid disrupting chemicals (TDCs). TH disruption

during pregnancy by chemicals such as polychlorinated bisphenols (PCBs) and flame-retardants cause neurological impairment (Stewart et al. 2008). Mostly chemicals are studied individually for their effect on hormonal signaling. Only few studies addressed their combined effects and moreover the consequences of exposure during brain development. We examined the separate and combined effects of different chemicals as present in urine or serum of pregnant women (Woodruff et al., 2011). Effects of the chemicals, individually or as three different mixtures (Growth, Neurodevelopment, Amniotic) were assessed on thyroid hormone signaling using a line of transgenic thyroid hormone reporter *Xenopus* embryos (Fini et al, 2007). Nine chemicals and the three mixtures clearly showed thyroid disrupting effects. Other batches of tadpoles were exposed from NF45 for 3 days in order to quantify endogenous gene expression. Gene expression of deiodinases and thyroid hormone related genes are altered by the exposure to the three mixtures. The Amniotic mixture strongly modifies mature beta tubulin and mbp transcripts which reveal mature neurons or oligodendrocytes expression. Finally using immunohistochemistry we showed, after exposure to different concentrations of mixture A, a high induction of Histone H3 phosphorylation, usually used as a proliferation marker. We also studied mature neuron and oligodendrocyte populations with specific antibodies in developing brain. Taken together these results show that the mixture of endocrine disruptors applied during embryonic brain development, at physiologically relevant concentrations, affects thyroid hormone signaling and therefore normal brain development.

Keywords: Thyroid hormone signaling

Characterization of consanguinity evolution in the population of Sidi Djilali (North western of Algeria)

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The practice of consanguinity has declined remarkably in most developed countries. However, within many populations of the developing world, marriages between biological relatives remain common. This is especially true in the isolated populations as Sidi Djilali tribe. In the aim to understand the situation and the evolution of this practice in the rural population of Sidi Djilali. The investigation was carried out in 2015 into a sample of 150 people of Sidi Djilali in North-western of Algeria. The results indicate that in recent decades the prevalence of inbreeding is decreasing with 50% in this region, from 85% (in 2005) to 43% (in 2015) of marriages are consanguineous, over 63.5% of which are between first cousins in current study. The analysis of data concerning the social correlates revealed that several economic, socio-cultural and demographic factors seem to be associated to the choice of this type of marriage, such as socioeconomic status, low level of education especially among women, age early marriage, habitat type and the degree of parental involvement in the choice of future spouses.

Keywords: Sidi Djilali, Inbreeding marriage, Endogamy, Rural population, kinship, Motivations, Tradition

Hunting and breeding at Bienne lake: New aspects from Neolithic sites at Sutz-Lattrigen bay, western Switzerland

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With its Neolithic age wetland sites, Switzerland offers an incomparable source of information on prehistory dwellings. The exceptional preservation of wooden construction elements allow an exact dating of the sites as well more into understanding the settlement evolution. Sutz-Lattrigen bay at Bienne Lake offers a clear sight into the economy lake dwelling sites in Switzerland. An Archaeozoological research on three Neolithic bone assemblages is running with the aim of understanding the environment, ecology and economy of these Neolithic sites. The hypotheses put forwards that the breeding activities observed in all the sites are probably attributable to topographical conditions within the effect of climatic features. A comparison of the archaeozoological data show that the assemblages located on the flat side of the lake contain higher proportions of domestic animals than those situated on the steep side and the clever change in the herd management during the Horgen period is based ultimately on economic imperatives.

Keywords: archaeozoology, neolithic, pile dwellings

Human dispersal and inbreeding avoidance in Central Asia

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The reproduction between closely related individuals, or inbreeding, decreases genetic diversity and increases the number of homozygous sites within the genome of each individual. This can reveal recessive deleterious alleles associated with several genetic diseases, decrease fertility and impede the adaptive ability of individuals. In humans, two strategies can limit inbreeding. First, individuals can migrate out of their native group and mate inside a new group, which is called geographic exogamy. Second, in the absence of dispersal, individuals can mate according to specific matrimonial rules, for example forbidding closely related mating. In Central Asia, multiple human populations with different levels of geographic exogamy and contrasted social organization cohabit. It therefore represents an interesting opportunity to confront these strategies. For this study, we developed a pluri-disciplinary approach to investigate the prevalence of inbreeding avoidance strategies in relation with dispersal among Central Asian populations. We collected both ethnological and genetic data from 18 populations from Uzbekistan, Tajikistan, Kyrgyzstan, Siberia and Mongolia. Specifically, high-density genotyping data (> 200,000 markers) was

performed in 369 men and 177 women, and detailed questionnaires were collected. This allowed us to estimate genetic inbreeding of each individual (based on runs of homozygosity, or ROH, longer than 1500kb) as well as the geographical exogamy of each couple (measured as the distance between the place of birth of mates). We found that the proportion of exogamous couples (> 20km between birth places) was highly variable between populations, with populations that were entirely endogamous (0%) and others that were mainly exogamous (72%). Furthermore, we found different patterns of inbreeding (based on ROH length and number) between populations that have different social organization.

Keywords: Dispersal, Inbreeding avoidance, Human, Central Asia

Earthen mounds of southern Brazil: chronology and settlement

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This work aims to discuss the radiocarbon chronology of archaeological sites known as Cerritos, Aterros or Earthen mounds, commonly found at the Pampa biome, among the low lands of Brazil, Uruguay and Argentina. The Pontal da Barra settlement is located at Patos lake, in southern Brazil and is a testimony of the long-term occupation of the indigenous groups in swamp and wet environments. The chronology was based on charcoal from hearths and fish otolith from *Micropogonias furnieri* and *Pogonias cromis* species, which live in the seashore up to 100 m deep, in sandy or muddy bottom. In order to account for reservoir corrections, we have used a phase model in the OxCal software with an undetermined offset ranging from -800 to 800 ¹⁴C yrs. Since there could be mixing of material from different archaeological context we have considered a simple phase for each site containing all the respective dates. The model allowed determining the local reservoir offset DR in -300 ±140 ¹⁴C yrs disclosing a possible freshwater influence. The modelled dates range from 2700 to 900 ¹⁴C cal BP with highest probability densities between 1800 and 1200 ¹⁴C cal BP. From the comparison of dating from each mound they seem to have been occupied simultaneously as opposed to previous interpretation of the mounds as isolated occupations, with little demography of hunter-gatherers groups, and denotes a complex and synchronic village occupied by groups of perhaps hundreds of individuals. In this period, the significance of the Pontal da Barra has shifted from a fish camp eventually occupied to an important part of the territory of the mound builders of Patos lake with permanent settlement correlated to functionally diverse structures in a systematic and well planned occupation.

Keywords: Earthen mound, Brazil, radiocarbon dating, Cerrito, chronology

The Bear in Roman Switzerland

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The bear is the largest predator on the European continent. For thousands of years there's been a close relationship between humans and the animal. Impressive cave paintings from Chauvet-Grotto in France, dating back to the period 30 000 BC, portray not only the Palaeolithic fauna, but the extinct cave bear *Ursus spelaeus* as well. How dangerous a bear hunting has been, narrate 12 000-year-old skeletons of brown bear *Ursus arctos* and Cro-Magnon-Man discovered in Grotto du Bichon in Switzerland, where the hunter as his pray lost their lives. The bear was probably not systematically hunted by humans because it was perceived as dangerous, powerful and mighty creature. This belief led to bear canines being used as neck pendants, which were worn by the Palaeolithic hunter-gatherer cultures. In the Roman Age bear retained its status of a dangerous large carnivore. Mosaics depicting scenes of an animal baiting at amphitheatres, called venatio, show the bear as a frequent actor. How large the bear population in Roman Switzerland and generally in Central Europe were, is still unknown. However, it is certain that bear has been systematically ousted because of extensive landscape changes made by humans. Three almost complete brown bear skeletons were discovered in a well, which was given up and filled between 200-250 AD. This well is situated in the lower town of the Roman city Augusta Raurica. The discarded bears show clear traces associated with the use of their fur. In addition, in the most preserved skeleton can be seen an evidence of captivity, which is presented by unspecific pathology around the snout and sawed canines. This spectacular finding is unique on the territory of Switzerland and provides a possible direct link to the participation of bears in the famous and popular roman games venatio in Augusta Raurica.

Keywords: Bear, *Ursus arctos*, Switzerland, Roman Age, amphitheatre, venatio, Augusta Raurica, captivity

Architectural Designs and Intellectual Exploration; A case of Obafemi Awolowo University

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Natural History Museum was established at the Obafemi Awolowo University in 1971, starting as an autonomous unit with plants and animals collection from the zoology Department. Since then, it has been one of the leading natural museums in West Africa, besides, the Institut Fundamental Afrique Noir in Senegal. The museum is housed temporarily in one of the buildings of the Faculty of Agricultural complex since its establishment. The museum is a repository of animal and plant life, contributes to research and knowledge because researchers and students visits the museum for research and learning purposes. Its importance cannot be overlooked, as contemporary University museums are expected to contribute to university mission, as teaching, research function and intellectual development. Its role as a repository of plants and animals, is also crucial especially with the issues of deforestation and urbanization leading to the extinction of some of these biota. However, due to paucity of funds, the museum was merged with the Department of Archaeology. The Leventis Foundation helped with funding in order to address the issue of space, this is based on the premise that the

Leventis Foundation has been key in conservation efforts worldwide. On completion, it was agreed that the museum would be named after the Foundation. With this in mind, the study discuss the growth of University natural history museum, its objectives and arrangement. Much emphasis was dwelt on the extent to which museums objective have been achieved; how museum arrangements and designs affect learning. Limitations and challenges of Universities museums in Nigeria were also discussed and a set of five recommendations proposed for increasing the effectiveness of university museums in the research and teaching purpose.

Keywords: Architectural Designs: Intellectual Exploration

Linking archaeology and palaeontology: tracing Pleistocene humans' activities through the analysis of (mega)faunal remains from the Vienna area, Austria

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The municipal area of Austria's capital extends over 414 km² and its geological surface is covered mainly by Pleistocene and Holocene river sediments of the Danube and its local tributaries and loess. Especially the western part, on the southern side of the Danube, is characterised by a system of Pliocene and Pleistocene terraces. Fossils have been observed and archived since more than 550 years. Findings were discovered in the course of construction works, road foundations, sand and loess mining, or through digging fortification trenches. At least some of the discovered bones found their way into official collections. Only very little is known about the prehistoric human presence – considering the over-regional view of palaeoanthropology which suggests migration “corridors” along the Danube from eastern to western Europe since the immigration of early humans more than 0.5 Ma ago. Therefore, the Austrian Academy of Sciences has initiated a detailed survey of the archived finds and a digital database as well as GIS project have been created collecting all available information from Pleistocene faunal remains and human artefacts from the Vienna municipal area. Any existing information about the archived specimens including species, location of discovery, stratigraphic setting, context, etc. is collected. The project is operated by the Quaternary Archaeology research group and it involves the University of Vienna, the Natural History Museum, local museums and private collections. The aim

is the detection of human presence during the Pleistocene, indicated by possible interaction with animals and their remains examining the hypothesis of humans as accumulation agent of bone assemblages. At present our database comprises more than 300 specimens and establishes a basis to encourage future efforts like improving dating and closer cooperation between different research institutions in Vienna.

Keywords: (Mega)fauna, Pleistocene, Mammoth, Archaeozoology, Vienna

Geese eggs and other animal remains from a late Roman, rural cemetery in the hinterland of Mogontiacum/Mainz (Germany)

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In 2001 archaeologists excavated a late Roman, rural cemetery at Ober-Olm near Mogontiacum/Mainz (Germany). Apart from pottery, glass and other objects, they recovered from four graves numerous remains of animals buried along with the deceased. New zooarchaeological analysis of the faunal material sheds light not only on the range of species represented in the inhumation burials (pigs, piglets, pigeons, chicken, geese and some others), but also on the basic function of most of these animals – in general they seem to have been placed there as food. Strong indication for this assumption is the fact that a substantial number of bones was discovered on plates and in bowls. Other evidence is given by the fauna skeletons themselves: With one interesting exception, all birds are missing their feet (and sometimes their head) while showing correlating cutting marks on their remaining, largely complete skeletons. This clearly reflects a preparation for cooking, similar to boiling fowl or roast chicken today. What remains unknown, however, are the thoughts and beliefs that led people to put food in the graves of their dead. Besides not all discovered animal remains can be explained that easily. Mysterious are also two geese eggs from a woman's burial. By closer analysis of those particular remains – including the question if they belong to already incubated or even hatched eggs – it will be tried to provide new perspectives concerning the interpretation of faunal grave goods.

Keywords: archaeology, late roman times, necropolis, rural, grave goods, geese, eggshell, animal remains, food

Gamers like it green: Virtual Biophilia-like experience in a Virtual Universe

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In the modern era of urban human development, the occidental way of life has increased a separation between humans and nature, together with a delegation of our sensory and cognitive abilities to technologies. For example, we delegate our senses of direction to GPS and other GoogleMap, our memory to search engines, and we make all calculations not mentally but with our cell phone! We can also choose virtual social interaction over physical social networking, using chat, video/audio/e-mails, and online video games. Relationship to Nature is no exception to this and today, technology has begun to change human's long-standing experiences with nature: through videos and documentaries, we travel, discover magnificent windows opened onto wilderness, landscapes, places and species we would not be able to reach and see otherwise. Videogames contribute to this phenomenon. In this study, we focused on how players relate to Nature in the world's number one online role-playing game, the World of Warcraft (WoW, millions of players throughout the world). We proposed an on-line questionnaire to 1200 French-speaking gamers to assess their motivations to play, their relations to nature in the real life and their preferred landscapes in the virtual environment. We combined their answers to ecological descriptions of these virtual tridimensional environments. We showed that players prefer virtual areas displaying an important amount of green vegetation, but that this preference is not related to their nature connection, nor to their motivation to play, which is mostly escaping from their daily life, mostly urban. We discuss these results in terms of virtual biophilia, i.e., an attraction to virtual landscapes that are healthy and full of vegetation landscapes, when it is no longer possible to reach such landscapes in real life.

Keywords: Human, nature relationship, virtual nature, Biophilia, Conservation Psychology

SYSTEMATICS, EVOLUTION AND COMPARATIVE ANATOMY

Taxonomic and phylogenetic relationship of mentha species collected from Mansehra region Pakistan using morphological and molecular markers

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The genus *Mentha* includes perennial herbs, generally cultivated for their essential oils used for medicinal and aromatic purposes. The number of species in the genus *Mentha* has been a matter of confusion due to high polymorphism in morphology and great diversity in essential oil composition. Previously the *Mentha* collections have been classified on morphological traits in Pakistan. This study is the first documented report of using molecular as well as numerical techniques for dissecting *Mentha* specimens collected from mansehra region of Pakistan. *Mentha* specimens collected from Kunhar River catchment of Mansehra region were analysed through numerical and molecular markers. For numerical analysis twenty two micro and macromorphological traits were studied. Dendrogram analysis of morphological traits assorted the 25 *Mentha* collections into 4 groups viz. Group-A, B, C and D. Group-A showed 98% similarity (*M. longifolia*). Group-B showed 98% similarity (*M. spicata*). Group-C showed 92% similarity (*M. arvensis*). Group-D showed 89% similarity (*M. royleana*). Molecular analyses were carried out through 50 RAPD primers. Primers amplification revealed that high level of genetic diversity (0-100%) existed among the *Mentha* collections. Dendrogram analyses based upon the genetic distance estimates conferred the cluster analysis of the morphological traits. It was found that population's No. 8 and 9, collected from Kaghan and Mahandri, were most distantly related as compared to population No. 10 and 20 collected from Balakot and Darmundi, respectively. Furthermore, the variations among populations of *M. royleana* need further elaboration through additional molecular and anatomical markers for establishing their exact taxonomic status to varietal level.

Keywords: Dendrogram, DNA, *Mentha*, PCR, RAPD, Trait

3D reconstructions of endocranial structures in stegocephalians; preliminary implications in phylogeny and paleobiology

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The phylogeny of stegocephalians (ancient tetrapods) remains problematic: three different hypotheses on the origin(s) of lissamphibians within stegocephalians are still debated. Most of the characters used in these phylogenies are extracted from the skull roof, the palatal region and/or the postcranial skeleton: a

few endocranial characters have been taken into account. However, endocranial structures of stegocephalians are known in some fossil specimens exceptionally well preserved. In other vertebrate groups (e.g., mammals, dinosaurs), endocranial characters have also been showed to be phylogenetically informative. A 3D cranial exploration of exquisite stegocephalians (a capitosaurian temnospondyl and a chroniosuchian) has been therefore investigated thanks to a micro-CT scan: it leads to new anatomical data which were not directly observable before, such as bony conducts, a detailed connection between stapes and palate, or the "delta-groove" a newly describe structure. These new data allow to reconstruct the endocranium region and to hypothesize the vascular and hearing systems of these stegocephalians. They will be also used in a global matrix in order to try to solve, thanks to new observed and compared characters, the debate on the stegocephalian phylogeny and the origin(s) of lissamphibiens.

Keywords: stegocephalian, 3D reconstruction, endocranium, phylogeny, paleobiology

Zschokkella trachini n. sp. infecting the gallbladder of the greater weever *Trachinus draco* (L.) off Tunisia: Morphology and phylogeny characterisation

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A new Myxosporea *Zschokkella trachini* n. sp., infecting the gallbladder of *Trachinus draco* Linnaeus, 1758, was collected from Tunisian coasts, is described using microscopic and molecular studies. This is the first record of *Zschokkella* species parasite of *T. draco* in Tunisian waters. Plasmodia and mature spores were observed floating free in the bile. Plasmodia are polysporic with variable size and shape. Mature spores are subspherical in frontal view, sub-ovoid in sutural view, measuring 14.4-16 μm in length and 9-10.8 μm in width/thickness. Two equal spherical polar capsules with 3.6-4.5 μm in diameter, were located separately at the spore's extremities. Suture ligne was clearly visible and slightly curved. Each spore was composed of 7 to 8 elevated surface ridges. Based on a 1658-pb-long alignment used in the sequence identity matrix, the 18S rDNA of *Zschokkella auratis* (KC849425), and *Zschokkella candia* (KF575322, KF575323) is the two most similar species to *Zschokkella trachini* n. sp. with 94 % nucleotide identity. The phylogenetic analysis revealed that *Z. trachini* n. sp. clusters within the clade of freshwater gallbladder parasites consisting of *Zschokkella* and *Myxidium spp.* originating from different fish hosts.

Keywords: Myxosporea, *Zschokkella trachini* n. sp., *Trachinus draco*, gallbladder, morphology, phylogeny, Tunisia

Molecular systematics of two Mediterranean blenniid species from the genus *Salaria* (Perciformes, Blenniidae): *Salaria basilisca* and *S. pavo*

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The genus *Salaria* (Perciformes, Blenniidae) is represented on the Tunisian coast by two species *Salaria basilisca* and *S. pavo*. *Salaria basilisca* (Valenciennes, 1836) is an endemic species of the Mediterranean Sea, associated to seagrass beds and showing a very fragmented distribution (Tunisian coasts, Toulon, Sardaigne and Genoa). Conversely, *S. pavo* (Risso, 1810) is widespread in the atlanto-Mediterranean region. It occurs both on rocky marine habitats and coastal lagoons, in the intertidal or in the first meters of the subtidal (Heymer, 1985). However, in the light of the recent discovery of a noteworthy cryptic diversity among the freshwater populations of the genus *Salaria*, we aimed to characterize genetically some Mediterranean populations of these two species and to study the phylogenetic relationships between them. The phylogenetic relationships of *Salaria pavo* and *S. basilisca* were thus investigated through the amplification and sequencing of three mtDNA markers 12S (433 pb), 16S (604 pb) and Dloop (475 pb). Samples were collected from Tunisian coasts and one from Thau lagoon (France). Including some freshwater blenny *S. fluviatilis* as an outgroup. Both distance-based and Bayesian trees showed largely congruent topologies, where the investigated *Salaria* specimens cluster in clades lacking any geographical or morphological structure. Accordingly, no support is given for the monophyly of *S. pavo* and *S. basilisca*, which are thus indistinguishable based on the implemented molecular markers. This unexpected result can be interpreted through two mutually-exclusive hypotheses: the first is the fact that we can have a single species with two distinct morphotypes and the second is the lack of mitochondrial divergence between these closely related and possibly recently-diverged blenniid species. Further analyses are currently underway in order to better understand this unexpected decoupling between the observed morphological and molecular diversity patterns.

Keywords: *Salaria*, Blenny, Tunisia, Mediterranean, molecular marker.

Correlation between Hox code and vertebral morphology in archosaurs

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The vital importance of the axial column for vertebrate life is clear, because its key functions, the protection of the neural chord and providing a balance between stability and mobility,

have remained the same in a huge variety of taxa. However, vertebrae show considerable variation in number and shape across the axial column, resulting in varying degrees of axial regionalization. Nevertheless, functionally equivalent master control genes mediate the embryonic development of the axial column in animals as different as mouse and chicken. The combined expression of Hox genes is a requirement to establish specific vertebral morphologies, indicating that the morphological variation across taxa is likely due to modifications in the pattern of gene expression. In archosaurs, Hox codes have been established for birds, but not yet fully for the crocodylian lineage. First, we analyzed the Hox gene expression in the axial column of the Nile crocodile. Second, by using geometric morphometrics, the present study shows a correlation between Hox code and quantifiable vertebral morphology in living archosaurs, in which the boundaries between morphological subgroups of vertebrae can be linked to anterior Hox gene expression limits. Our findings reveal homologous units of vertebrae in modern archosaurs, each with their specific Hox gene pattern. Based on these results, we used the morphological pattern as a proxy to reconstruct the underlying Hox code in fossil taxa where the genetic information is not available. This allows us for the first time to rigorously hypothesize the genetic complexity of an extinct archosaur, the sauropodomorph dinosaur *Plateosaurus*. By connecting the morphological patterns to developmental processes, inference of the genetic changes that underlie the evolutionary modifications of the axial column appears feasible. This is not only an important case study, but will lead to a better understanding of the origin of morphological disparity in archosaur vertebral columns.

Keywords: axial skeleton, evolution, sauropodomorph dinosaurs, regulatory genes, phenotypic variation

Inter and intra specific morphological variation in two species of *Phorcus* genus (Risso, 1826) along the rocky coasts of Tunisia

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This work is a morphological comparison of two species: *Phorcus turbinatus* (Born, 1778) and *Phorcus articulatus* (Lamarck, 1822), performed at 31 stations along the rocky coasts of Tunisia during spring 2013. Geometric morphometry was performed to realize canonical analysis of variance (CVA) and deformation grid. *P. turbinatus* was often encountered in the interstices at the mediolittoral of exposed stations whereas *P. articulatus* was mainly concentrated at the infralittoral of quiet habitats. The CVA in *P. turbinatus* (16 stations) showed that samples from the northern coasts deviate from those of the South. This projection also suggested that samples from the Gulf of Tunis are stretched toward the positive side of the axis 2 and those from the Gulf of Hammamet are secluded to its negative side. As for the samples of Cap Bon, they are overlapping with the two sets. Furthermore, CVA in *P. articulatus* (9 stations) revealed overlapping sets from the Gulf of Tunis and Cap Bon and stretched samples from the Gulf of Gabes. Moreover, the comparison of the mor-

phometry of the two species, suggested a morphological divergence with some overlap. *P. articulatus*' samples are extended on the positive side of the axis 1 while those of *P. turbinatus* are drawn to its negative part. The deformation grid revealed that *P. articulatus* has a more conical shell than *P. turbinatus*. The intra-specific morphological plasticity could be attributed to many factors according to the stations namely continental shelf extent; tidal influence; population sizes and capacities of resistance to waves snatching. Furthermore, the difference between the species' habitats seems to generate a dissimilarity of adaptive strategies against predation. Indeed, *P. turbinatus* escapes predators in shelters whereas *P. articulatus* is more exposed (infralittoral) which requires a higher shell to remove the animal in the upper whorls out of the reach of predators.

Keywords: *Phorcus*, rocky coastline, geometric morphometry

Diversity and evolution of tandem DNA repeats in primate centromeres

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α -satellite DNA is the major nucleotide component of primate centromeres. This superfamily is composed of tandemly repeated sequences of about 170 bp in length which have diversified to some extent and thus cluster in different families of α -satellite sequences. Limitations of α -satellite sequence availability in non-human primates and difficulties of tandem DNA repeat assembly are two major constraints to study this diversity and understand the evolutionary dynamics of α -satellite DNA. To overcome these problems, we propose a new approach called SAT-Seq (Satellite sequencing) which combines enzymatic isolation, high throughput sequencing and in silico analyzes of α -satellite monomeric and dimeric sequences. This method allowed the characterization of six distinct families of α -satellite sequences in two species from the tribe *Cercopithecini*, the Sun-tailed and Crowned monkeys, bringing out an unknown intra and interspecific diversity of the α -satellite component in this clade. A highly specific fluorescence in situ hybridization approach was perfected to visualize these families on chromosomes and analyze their specific genomic distribution pattern to propose an evolutionary scenario for α -satellite DNA in *Cercopithecini*. These results introduce SAT-Seq as an efficient approach to get comprehensive insights into α -satellite DNA diversity and evolution, and could be extended to the study of other satellite superfamilies in primate as in non-primate taxa.

Keywords: Genome evolution, Satellite DNA diversity, Gene or DNA sequence families, Centromeres, Primates, High throughput sequencing

Ontogenetic development and intraspecific variability of bone microstructure in the king penguin, with considerations for paleoecological inferences

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Birds have colonized various ecological niches during their evolutionary history. Besides the acquisition of flight, several lineages independently adapted to the aquatic environment and developed swimming and diving capabilities. Over the past years, numerous papers focused on the diversity of long bone microstructure in aquatic birds. Some studies attempted to reconstruct the evolution of aquatic adaptations in a given lineage, based on the bone microstructure of fossil taxa, without referring to a comparative set of modern taxa. These works often drew ecological deductions from one or two limb bones of a single specimen. However, the ecological signal contained in bone microstructure is known to vary between skeletal elements. Bone microstructure can also be affected by other factors (besides lifestyle), which have often been overlooked in paleoecological reconstructions. Studies on intraspecific variability, as well as bone microstructural development during ontogenesis are rare in the field of comparative bone histology. However, such works are essential for the choice of standard parameters for bone structural analyses and for drawing rigorous paleobiological inferences. In the present study, we sampled limb bones of hatching, juvenile and adult specimens of the king penguin (*Aptenodytes patagonicus*), in order to assess the extent and the causes of limb bone microstructural variability during ontogenesis. Histomorphometric observations reveal that, for a given skeletal element, the microstructure and the compactness vary greatly during ontogenesis. The limb bones undergo an intense remodeling episode during the juvenile molt. Moreover, these bones show different developmental patterns during the individual's life. Finally, for a given long bone, even adult specimens exhibit variability in compactness. This work is intended to constitute a comparative basis for the histological study of extinct sphenisciforms (and other diving birds), and thus provide a better framework for paleobiological and ecological reconstructions.

Keywords: Spheniscidae, long bones, aquatic adaptations, osteosclerosis, compactness

Microanatomical diversity of amniote ribs: an exploratory study

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Bone microanatomical diversity in extant and extinct tetrapods has been extensively studied with increasingly sophisticated quantitative methods, in order to assess its ecological, biomechanical and phylogenetic significances. The vast majority of

previous works was conducted on the appendicular skeleton, and a strong relationship has been found between limb bone microanatomy and habitat preferences. Few comparative studies focused on the microanatomy of the axial skeleton and its ecological signal. Here, we propose the first exploratory study of the microanatomical diversity of amniote ribs. Our comparative sample comprises 155 species of extant amniotes and encompasses the taxonomic, ecological, and body size diversity of this group. We standardized our sampling location to the midshaft of mid-dorsal ribs. Transverse sections were obtained from classical petrographic methods, as well as from X-ray microtomography. Most of the microanatomical and size characters of the ribs display a phylogenetic signal, an expected result also observed in amniote limb bones and vertebrae. We found a significant relationship between rib cortical thickness, global compactness and lifestyle. As for the vertebrae, the development of the spongiosa in the medullary region seems to be strongly correlated with size. Even though an ecological signal was found in the inner structure of the ribs sampled, additional work is needed to document the intra-specific variability of the rib microanatomy along the rib cage and within a single element.

Keywords: Axial skeleton, virtual sections, comparative analysis, lifestyle adaptation, body size, bone microstructure, compactness

New palaeobiogeographical investigations on stoneflies

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The 16 recognized extant stonefly families of the hexapod order Plecoptera are characterized by a primarily vicariant global distribution. As indicated by the names, the suborders Antartoperlaria and Arctoperlaria refer to the distributions in the southern and northern hemispheres, respectively. With a few exceptions (e.g. the occurrence of Perlidae and Notonemouridae – Arctoperlaria – in the southern hemisphere), this distribution pattern makes the group suitable for historical biogeographical investigations. It has been proposed that the Arctoperlaria and Antartoperlaria diverged during the Jurassic period. The main impediments to resolve stimulating evolutionary questions are the problematic taxonomic assignment of fossil species and a weakly constrained phylogenetic framework on the other. In the last years, we have carried out a number of descriptions and revisions of Paleozoic and Mesozoic species of this order. In this presentation, we summarize recent progress, including a new investigation of the affinities of *Sinosharperla zhai* and the description of the first fossil Pteronarcyidae (based on a series of ca. a dozen of specimens). Further steps of the project, including the description of amber material, and the elaboration of a timetree, will be outlined.

Keywords: biogeography, insect, Plecoptera, fossil

Development and evolutionary history of the coelacanth lung

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Coelacanths are a group of sarcopterygians fishes known from the Devonian to the Recent. Although anatomically well studied, the extant coelacanth *Latimeria* still hides some key features, such as its lung. Based on X-ray tomographies of a unique ontogenetic series, direct observations on partial dissections and on histological material we recently studied the development and evolutionary history of the coelacanth lung. We do confirm the presence of a lung in extant coelacanths and describe its allometric growth relative to the associated fatty organ. Furthermore, we suggest the development of the latter for buoyancy control as a deep-waters adaptation. Among our results, we present for the first time evidences of hard but flexible plates around the vestigial lung of *Latimeria chalumnae* and discuss their possible homology with the calcified plates of fossil coelacanths.

Keywords: coelacanth, lung, ontogeny, deep water

Patterns and dynamics of diversification of the genus *Cardiodactylus* (Orthoptera, Grylloidea, Eneopterinae) in Southeast Asia

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The genus *Cardiodactylus* is a speciose clade (more than 80 described species) diversified from Southeast Asia to many archipelagos in the South-West Pacific, showing a high contrast species distribution: a few species in the genus such as *Cardiodactylus novaeguineae* (Haan, 1842) are largely distributed in most of the island, while the others are found only in very limited areas. Their contrasting distribution patterns suggest that *Cardiodactylus* may constitute a valuable model to address questions about patterns of endemism, species diversification and island biogeography, as suggested by previous studies focusing on the cricket fauna of New Caledonia. Now i will evaluate different models of diversification and estimate the dynamics of lineage radiation within *Cardiodactylus* by utilizing molecular phylogenetic approaches and secondary calibration points to estimate lineage ages and using dispersal-extinction-cladogenesis model and paleogeographical information in the Southeast Asia to reconstruct ancestral geographical distributions. By understanding the evolution of *Cardiodactylus*, we attempt to identify the main processes acting on insular insect diversity and the causes of its origin and maintenance.

Keywords: diversification, biogeography, *Cardiodactylus*

What can we learn from the study of the locomotor development of non-human catarrhines about the evolutionary pathway toward habitual bipedalism?

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Through individual development, a dependent infant becomes an autonomous adult. This developmental pathway is not necessarily a straight line as demonstrated in primates. Extant catarrhines exhibit various developmental patterns that may conduct toward very specialized (habitual) locomotor modes, such as brachiation (gibbons), bipedalism (humans) and quadrupedalism (baboons and macaques), as well as more diversified positional repertoires (chimpanzees and orangutans). Regarding these developmental pathways, and according to biomechanical principles which stipulate that gaits and limbs of animals are designed to favor locomotor optimization in a specific ecological context, infants are likely to represent a "primary shape" on which locomotor development will work. In this context, we conducted an integrative research project on captive baboons, at the boundary between behavior and biomechanics, and focusing on an early stage of development. We investigated specifically the relationships between changes in the distribution of the mass and the changes in the posturo-locomotor repertoire, i.e., the manner in which they move quadrupedally, bipedally, and behave. Our results show that the global body design of baboons is governed by changes in the functional demands involved in the development of the locomotor profile. Nevertheless, despite transitioning toward locomotor autonomy, the shape of fore- and hindlimbs appear to be optimized very early for quadrupedal walking. These findings, when replaced in the socio-ecological environment of baboons, reveal the adaptive value of this morphological conformation: infant baboons are autonomous very early, therefore they must be able to locomote efficiently on the ground in order to keep following their group. Furthermore, we observe that the coordination of limb movements increases which improves quadrupedal walking but also other modes such as bipedalism. In an evolutionary anthropological perspective, our results suggest that habitual bipedal walking in hominins might have not been exclusive of other modes of displacements such as quadrupedalism, at least during infancy.

Keywords: Development, Locomotion, Morphology, Bipedalism, Human evolution, Primate model

Photogrammetry for 3D digitizing bones of mounted skeletons – potential and limits

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Since the late twentieth century, new technologies have provided powerful ways to digitize biological structures in three dimensions (3D). Among those, photogrammetry is a low cost and non-destructive method, though as old as photography, but which has only been common since the 90's and the development of digital camera. Recent studies have demonstrated that it can be used for objects of all sizes, and that the reconstructions of isolated elements can be of as high quality as those obtained with laser scanners. Here we wanted to test the performance of photogrammetry for the quantitative analysis of mounted specimens in museum exhibitions. Indeed, access to material can be an issue in comparative anatomy and, especially, in paleontology. This is notably the case for large, impressive specimens. We performed reconstructions based on acquisitions done under various conditions and also tested the reconstruction performance of two software. The resulting 3D models were then compared to a reference object corresponding to the bone of interest digitized with a cutting-edge surface scanner. Our results show that photogrammetry enables quality reconstruction of the almost entire surface of the bone of interest, except contacts with braces (caused by mounting) or other bones. Photogrammetry appears thus as a reliable method perfectly suited to study large specimens exposed in museum gallery.

Keywords: photogrammetry, paleontology, 3D, model, digitization, mounted skeletons

Morphological and molecular characterization of *Ceratomyxa scorpeii* n. sp. (Myxozoa: Ceratomyxidae) infecting the gallbladder of the Black Scorpion fish *Scorpena porcus* (L.) from Tunisia

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During a parasitological survey from July 2014 until August 2015, a total of 256 specimens of Black Scorpionfish *Scorpena porcus* (L.) were caught from two localities Bizerte and Mahdia, Western Mediterranean sea. A new coelozoic Myxosporean species *Ceratomyxa scorpeii* n. sp. was collected from the bile and the gallbladder of *Scorpena porcus*. This new species was compared morphologically and molecularly with previously described *Ceratomyxa* species using morphological and molecular characteristics using the 18S rDNA sequencing. Spores are crescent-shaped with two unequal shell valves, with rounded ends. Spores are (7.2-8) μm in length and (21.6-44) μm in thickness. Polar capsules are equal in size, sub-spherical in shape (3-3.2) μm in length and 2 μm in width. The structure and dimensions of *Ceratomyxa scorpeii* n. sp. differ from the previously described *Ceratomyxa* spp. Furthermore, the 18S rDNA sequence, based on 1811 bp of our new species showed 97 to 98% genetic similarity to the *Ceratomyxa* species described from *Sparus aurata* (JF820292, JF820293) and *Diplodus annularis* (JF820291). On the phylogenetic tree *Ceratomyxa scorpeii* n. sp. cluster with all *Ceratomyxa* marine species. The position clearly shows the formation of a Mediterranean group of five

coelozoic *Ceratomyxa* spp.

Keywords: Myxozoa, *Ceratomyxa scorpeii* n. sp., gallbladder, morphology, 18S rDNA, *Scorpaena porcus*, Tunisia

Resurrecting a forgotten species: the case of *Filago longilanata* (Gnaphalieae, Asteraceae)

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Filago longilanata (Maire & Wilczek) Greuter is a species distributed in the semidesertic regions of Morocco. It is characterized by an annual life cycle, capitula in subglobose clusters, receptacular paleae 15-20 arranged helicoidally, aristate, achenes homomorphic with short-clavate twin hairs. This species was described by Maire and Wilczek in 1934 under the name *Evax longilanata* Maire & Wilczek based on a collection from Tinfift (Mequinez-Tafilalet, Morocco). After an exhaustive review of more than 16000 sheets lodged in 31 herbaria, only a single specimen preserved at the Herbarium in Montpellier (MPU008138) can be determined unequivocally as *F. longilanata*. In this work, two new localities for *F. longilanata* are given, Tissint and Amerzgane, which are located relatively far from the until now only known one (i.e. 170 km and 190 km far, respectively). In addition, the phylogenetic relationships of this unusual taxon were studied using sequences of ITS and ETS (nuclear ribosomal DNA). Interestingly this species is included in the "Filago desertorum clade", which is composed of species that grow mainly in arid (sometimes halophytic) places. A new comprehensive description for *F. longilanata* is provided, enhancing a previous one by Maire and Wilczek with additional diagnostic characters for the species (mainly carpologic characters). According to the phylogenetic results an identification key for the species of the "Filago desertorum clade", including *F. longilanata* is provided. Finally and based on our data, the conservation status of *F. longilanata* is evaluated. In accordance with IUCN criteria B12ac this species should be considered Endangered (EN).

Keywords: *Filago longilanata*, Gnaphalieae, Taxonomy, Conservation, Resurrected species

Towards better taxonomic classification of Continental African *Angraecum* species from section *Conchoglossum* and *Afrangraecum* (Orchidaceae)

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Taxonomy of *Angraecum*, one of the most diverse angraecoid orchid genus, has considerably changed over time. New insights from recent molecular studies questioned the monophyly of the

genus and called for morphological studies to support a new taxonomy. The main goal of this work was therefore to test whether the current sectional delimitation of two morphologically related sections, *Conchoglossum* and *Afrangraecum*, are accurate. In order to do so, species delimitation of the 23 members of these two sections needed to be elucidated. Based on morphological observations of 36 characters and multivariate analyses, we identified 5 potentially new taxa and 19 validly published species within the 109 specimens studied. *A. lisowskianum* is synonymised with *A. curvipes* and *A. modicum* with *A. angustum*. The complex of *A. affine* and *A. multinominatum* was not solved since some individuals presented intermediate characteristics, but there is indication of possible geographical structure, with *A. multinominatum* being a more Western species. Question of two cryptic species (*A. cultriforme*, *A. stolzii*) remains open. Relevance of the discriminative characters used in the literature for the two sections was verified. Significant inflorescence features proved to be discriminant between sections except in two species. The thickness of the inflorescence was proposed for sectional delimitation. Results also showed that *A. claessensii* and *A. firthii* are distant from the other studied species showing a subtrilobed lip and a determinate inflorescence. This combination of characters seems unique for the genus *Angraecum*. This gives enough support to recognize a new section or a new genus to accommodate these two species. Evidences from this study contributed clarifying the discrimination of the related sections within the polyphyletic genus *Angraecum*, and revealed the need to publish at least one new genus or a section and five new taxa.

Keywords: Taxonomic revision, Multivariate analysis, Morphometric study, Angraecoid, Orchid, Africa, Species delimitation, Sectional reorganization

Swift like an arrow: fast-start predation in actinopterygian fishes evaluated by CFD

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Diversity and disparity of Osteichthyes (bony fishes) increased during the Late Permian and Triassic, when ecosystems of Palaeozoic type were successively replaced by more modern-like communities. Actinopterygians occupied many new ecologic niches including small-sized primary consumers, durophagous invertebrate feeders, or high-level predators. Among the predators, the non-neopterygian Saurichthyidae were the first actinopterygians supposedly specialized on a new hunting technique: the fast-start predation. Fast-start predation aims at catching mobile prey by a quick, target-oriented lunge out of rest or slow movement. The success of the lunge depends on prey detection and orientation of the predator, its locomotor performance, and prey response. It is therefore crucial that the predator reduces the time of the interaction with prey and remains undiscovered by it as long as possible. Prey fishes can react to both visual and hydrodynamic signals caused by approaching predators. We tested the anatomical adaptation of *Saurichthys* for fast-start predation by comparing its hydrody-

dynamic properties with several recent actinopterygian fast-start predators. These fishes share an elongate body shape with long heads and posteriorly placed unpaired fins, indicating optimization towards acceleration. The generalist rainbow trout was used as a control example. Placing 3D models of these fishes in a digital flow channel, we determined the pressure and velocity distribution in the current and over the fish body using CFD (Computational Fluid Dynamics). Parameters such as the drag coefficient or the influence of a moving fish on surrounding water, expressed as area of disturbed flow, were derived from these data. *Saurichthys* is characterized by a small area of flow disturbance, similar to the recent *Lepisosteus* and *Belone*. Low drag coefficients of these fishes enable them to maintain high speeds at the end of the acceleration phase. These values provide the base for successful fast-start predation. The acceleration mechanism shall be investigated in forthcoming studies.

Keywords: *Saurichthys*, hydrodynamics, locomotion, predator, prey interaction

A molecular approach to visualize the role of repetitive DNA in spatial organization of eukaryotic genomes

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DNA repeats are abundant in eukaryotic genomes, representing in most species more than a half of the total DNA content. Based on their distribution in linear genomes, repeats are classified as tandem or dispersed, with tandem repeats being organized as "head-to-tails" arrays, while dispersed repeats are distributed as individual copies in the genome. Because most of them do not encode proteins, repetitive elements have been for a long time regarded as "junk" DNA. However, evidences have challenged this view, assigning several functional roles to these repeats such as driving reproductive isolation and speciation, gene recombination and regulation, and chromatin organization. Moreover, studies have shown that repeats of the same family tend to colocalize in the nucleus, even if dispersed in the linear genome. This phenomenon has been observed in different eukaryotes such as fungi, plants, mammals, and is referred as "repeat pairing". Through their physical interaction, repeats could drive movements of the entire genome and indirectly influence gene regulation. If many studies suggest the existence of repeat pairing, the molecular mechanisms behind it remain to be clarified. Our project consists in establishing an experimental approach that will allow us to probe repeat pairing and to test hypotheses about the molecular mechanisms driving it. To that goal, we developed a strategy to introduce artificial tandemly repeated DNA arrays in the budding yeast genome, in two different chromosomes. We will soon be able to test the interaction of the inserted blocks of tandem repeats in the nuclear space by Hi-C, first with the exact same repeats inserted in two different chromosomes, then with decreased homology degrees between the two blocks, in order to investigate the role of homology sequence in repeat pairing. We will also test if "chromatin homol-

ogy" could drive repeat pairing, or the need of RNA or protein intermediates.

Keywords: DNA repeats, budding yeast, genome organization, repeat pairing, chromatin

Combining transcriptomic with exon capture to resolve the deep phylogeny within suborder of Caridea shrimps

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Caridean shrimps are the second most diversified infraorder of Decapoda. There are more than 3,200 described species, living from polar to tropical regions. This group contains both model and commercial species, explaining the great interest of scientists. During the past decade, several studies tried to resolve the phylogeny of this group. Because of biased taxon sampling, and/or lack of resolution of the molecular markers the phylogeny of the Caridea remains unresolved. The MNHN possesses important collections, and can provide a large amount of material. Using these collections, Aznar-Cormano et al., 2015 attempted to solve the phylogeny of Caridea combining five genes and a hierarchical sampling of taxa based on the current classification of Caridea. This study sampled 28 of the 38 families of Caridea, of which 21 families were represented by at least 2 different species. This phylogenetic analysis supports the validity of most families but didn't resolve relationships among Caridea families. New phylogenomic approaches were recently developed to resolve such deep phylogenies. Our study is based on two recent papers on the class of Ophiuroidea. O'Hara et al., 2014 used an analysis of 60 transcriptomes to determine a set of 425 genes. These 425 genes were then sequenced for 380 species using an exon capture method (Hugall et al., 2015). Following this approach, we expect that extending the molecular marker sampling will provide a better deep nodes resolution within the sub-order Caridea. We sequenced the transcriptome of eight specimens belonging to eight different families of Caridea. The assembly were performed with Trinity. Then, we looked for the 425 genes from the Ophiuroidea study within the 8 transcriptomes using BLAST method. Selected markers will be used for designing probes to perform an exon capture for the whole sampling of Aznar-Cormano et al., 2015.

Keywords: Caridea, exon capture, transcriptomic, phylogeny

Neuroanatomical asymmetries of the central sulcus (CS) in relation to handedness in baboons. An anatomical MRI study in 90 *Papio anubis*

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Handedness and its relationship to brain anatomical asymmetries are prominent manifestations of hemispheric specialization in the human brain. On that account, many studies investigate the origins of human handedness and hemispheric specialization in studying handedness in nonhuman primates. Handedness for complex manipulative bimanual coordination in chimpanzees has been associated to structural asymmetries within the motor cortex, at the central sulcus (CS), namely the motor hand area but not with homologs of language areas. This evidence attributes the origins of handedness to increased motor skills beyond asymmetries in language area. Studies on handedness in a large comparative approach including both apes and monkeys can be of great importance, in respect to the phylogenetic origins of cerebral specialization for manual control. In the present study, we investigate the anatomical asymmetries regarding depth and surface area of the CS in 90 baboons (*Papio anubis*) from in vivo anatomical magnetic resonance imaging (MRI) scans that have been previously collected at the Center IRMf (INT, Marseille). The post-processing of the MRI scans was performed on a free distributed sulcus-based morphometry software (BrainVisa), which allows the extraction of the sulci and their anatomical characteristics. The anatomical findings have been correlated with behavioral data on handedness for the TUBE task, since studies have shown the presence of population level right-handedness in baboons for this task. The behavioral data have been previously collected in order to assess handedness on baboon for bimanual actions at the Station de Primatologie CNRS (France). The main results indicate the presence of CS depth asymmetry at the hemisphere contralateral to the preferred hand of the baboons for the TUBE task. The present neuroanatomical correlate of manual preference is an argument in favor of a continuity in manual laterality in humans a baboons, that perhaps goes back to a common ancestor 30-40 Mya.

Keywords: central sulcus— baboons— handedness— asymmetry

Mysteries in the phylogeny of early tetrapods, and their evolutionary implications

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‘Nothing makes sense in biology except in the light of evolution’, and ‘nothing makes sense in evolution without a phylogeny’ – a robust phylogeny is necessary to test hypotheses

about the evolution of individual characters or about evolutionary trends. The current textbook’ tetrapod phylogeny has been taken for granted by recent research into such problems, but parts of it are shakier than they seem. Some widely held evolutionary hypotheses may therefore be without foundation. Based on an improved data set for phylogenetic analysis, new characters and new fossils, I present open questions and their implications for such problems as terrestrialization. *Ichthyostega* is less closely related to the tetrapod crown-group than *Acanthostega* and may represent a very early origin of a seal-/mudskipper-like lifestyle independent of terrestrial tetrapods. Anthracosauria (Embolomeri) may lie more rootward than Temnospondyli; this part of the tree, which may contain the origin(s?) of an amphibious lifestyle for adults, is difficult to unravel because of the conflicting distribution of certain characters, including some with implications for lifestyles like the tail fin skeleton (now known in an anthracosaur) or evidence of internal gills (widespread even in temnospondyls). Lepospondyli’ is most likely closer to Amniota than Seymouriamorpha is; Amniota may plesiomorphically have a temporal fenestra, and its early phylogeny is not quite clear. *Casineria* is indistinguishable from *Caerorhachis*, thus involved in temnospondyl – not amniote – origins. A ‘istopoda, a snake-like clade traditionally classified as ‘lepospondyls’, apparently belongs far rootward on the tetrapod stem and contains another separate origin of terrestriality. ‘Microsauria’, and especially ‘Nectridea’, need to be revisited in detail. Finally, the origin of Lissamphibia (the extant amphibians: frogs, salamanders, caecilians) is a very controversial topic. I find Lissamphibia among the ‘lepospondyls’, next to the brachystelechid ‘microsaurs’, the eel-like lysorophians and maybe the ‘nectridean’ Scincosaurus, rather than belonging to the amphibamid temnospondyls.

Keywords: Tetrapoda, Amphibia, Lissamphibia, Amniota, phylogeny, phylogenetic analysis, Paleozoic, terrestriality, internal gills, review

Assesment of otolith shape in discrimination and characterization of Soleidae species (Pleuronectiformes) from Tunisian coasts

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Soleidae species are of great economic importance and have biological interests due to the existence of an evolving hybrid zone between *Solea aegyptiaca* and *Solea senegalensis* in the northern Tunisian coast. Moreover, identifying Soleidae species could be subject to ambiguity. Shape analysis of otoliths of several Soleidae species collected along the Tunisian coasts were carried out to study the variation within and between species in order to characterize and discriminate among them. Samples were collected in various environments like coastal lagoons (Bizerte, Ghar El Melhand gulf of Tunis) as well as other marine sites (Tabarka, Sfax, Kerkennah and Zarzis). The otolith shape was described by fifteen harmonics from elliptic Fourier descriptors of the left and right otoliths which have been considered separately. Out of the eight collected species (*Solea solea* (Quensel, 1806); *Solea aegyptiaca* Chabanaud, 1927; *Solea senegalensis* Kaup, 1858; *Pegusa impar*

(Bennett, 1831); *Pegusa lascaris* (Risso, 1810); *Synapturichthys kleini* (Risso, 1827); *Microchirus azevia* (Capello, 1867); *Dicologlossa cuneata* (Moreau, 1881)), two were sampled for the first time along the Tunisian coasts: *Microchirus azevia* and *Dicologlossa cuneata*. Multivariate analysis showed the discrimination between the different collected species mainly with right otolith and the grouping of phylogenetically close genus. Moreover, discrimination between *Pegusa impar* samples collected from different environments was established. Analyzing shape variation of otoliths inside and outside the hybrid zone between *Solea aegyptiaca* and *Solea senegalensis* had shown an overlap of samples of each species without the intermediate otolith shape. However, some individuals in the contact zone, from *Solea aegyptiaca* species, were assigned to *Solea senegalensis* samples and reciprocally.

Keywords: Soleidae, Tunisian coasts, otolith shape, elliptic Fourier analysis

New insights on the evolution and taxonomy of the diploid-polyploid complex *Veronica* subsection *Pentasepalae*

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The diploid-polyploid complex *Veronica* subsection *Pentasepalae* is a good model to study the role of hybridization and polyploidy in the origin and evolution of plant species given that these events have played an important role in the recent diversification of the group. The complex is composed of c. 22 closely related perennial species distributed in Eurasia and North Africa, with an important diversification center in the Balkan Peninsula. We used amplified fragment polymorphisms (AFLPs) on more than 200 individuals to try to shed light on the taxonomy of this intricate complex and to elucidate the role that these evolutionary processes have played in the history of the group. Overall, the comparison of our AFLP data with the previous studies based on morphological, molecular and cytological data showed high degree of congruence. Thus, while the monophyly of most of the previously described taxa was confirmed, the existence of some previously undetected divergent lineages suggests that cryptic speciation is taking place in the group. The lack of genetic divergence between diploid- and tetraploid individuals in a particular population of *V. orbiculata* suggests an autopolyploidy origin of the latter. The placement in the NeighborNet analyses and PCoA of the morphologically intermediate populations named "*V. jacquinii-orbiculata*" suggests that interspecific hybridization is also occurring nowadays in the group. Our results confirm that AFLPs are a useful tool to identify hybridization and polyploidization events, which are identified as the main evolutionary forces stimulating speciation in *Veronica* subsection *Pentasepalae*.

Keywords: AFLPs, species delimitation, hybridization, autopolyploidy, *Veronica*

Haplotype diversity and structure in a diploid-tetraploid complex: the case of *Odontites vernus* (Bellardi) Dumort. (Tribe Rhinanthaeae, Orobanchaceae) in the Iberian Peninsula

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The genus *Odontites* Ludw. comprises ca. 26 root hemiparasitic species distributed mainly around the Mediterranean. Most of the species show limited distribution areas in the Iberian Peninsula and North Africa. The *Odontites vernus* group (three species) is the most widespread of the genus occupying the temperate regions of Eurasia with one population in North Morocco. One species from this complex i.e., *Odontites vernus* s.l. (sensu lato), includes diploid and tetraploid individuals. Although based on morphological characters *O. vernus* seems to be very variable in the Iberian Peninsula, only two subspecies have been generally accepted, which are in correspondence with the cytotypes observed. Ploidy level was estimated in 301 individuals from 100 sampling sites using Flow Cytometry. We found 129 diploids, 169 tetraploids and 3 individuals of unknown ploidy. Additionally, two cpDNA regions (rps16 intron and trnK-rps16) were sequenced in the same individuals. A network of twenty haplotypes was obtained using TCS software. The diploid cytotype is the only one detected in the southern part of the Iberian Peninsula, but in the central and northern parts both cytotypes are present almost in sympatry. Additionally, we found two sampling sites where different cytotypes co-occur. Two well defined groups of haplotypes were found, that mostly correspond with ploidy levels, i.e., 75% of the samples within Haplogroup A are diploids, while 79% are tetraploids within Haplogroup B. These frequent combinations of cyto- and haplotype are spatially randomly distributed, but the less common combinations (tetraploids within Haplogroup A, and diploids within Haplogroup B) are located mainly in the Pyrenees and Galicia. This complex distribution pattern could be related with glacial refugia during Pleistocene climatic cycles and subsequent post-glacial expansions, and/or adaptation to new environments via polyploidization, creating a biodiversity hotch-potch where converge native and exotic (from other European refugia) cyto- and haplotypes.

Keywords: Cytotypes, Haplotypes, Iberian Peninsula, *Odontites vernus*, Orobanchaceae

Quaternary skulls of the saiga from Eastern Europe and Siberia. *Saiga borealis* versus *Saiga tatarica* – one species or two?

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During the Pleistocene, the saiga, a nomadic, non-territorial, herding species, inhabited vast areas of Eurasia and North America; its distribution was at its maximum extent in the last glaciation. Now, it is restricted to a few isolated populations in Central Asia. Two main forms of saiga were recognised: *Saiga borealis* and *S. tatarica*. The former became extinct at the beginning of Holocene, the latter has survived since the Pleistocene to the present. They are regarded either as two species or as two subspecies of *S. tatarica*. Our comparison of skull and horn measurements of many Eurasian specimens, including literature data, revealed significant differences between these taxa. *S. borealis* was larger than *S. tatarica* in terms of some cranial measurements, whereas *S. tatarica* was characterised by a greater diameter of horn core base. However, the distinction involved only a few metric features and the ranges of all the analysed measurements overlapped at least partially, indicating that the two taxa may not be true species. Our analyses also showed that the skull of *S. tatarica* had become smaller since the Pleistocene in terms of several measurements, which was probably associated with the climate and palaeogeographical changes at the end of the last glaciation and a decrease in the population size. We found significant differences between the various geographical subgroups of *S. borealis* and *S. tatarica* only in some measurements. The observed dissimilarities between *S. borealis* and *S. tatarica* correspond most probably to subspecies level and may have resulted from a biogeographical differentiation of the saiga populations in the Pleistocene.

Keywords: *Saiga tatarica*, *Saiga borealis*, skull

The new Rudist phylogeny (Bivalvia, Hippuritida)

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Rudists (order Hippuritida) are Heterodont Bivalves close to the Megalodontidae. They appear in upper Jurassic and spread all around the Thetys in warm shallow seas, to become completely eradicated at the Cretaceous/Paleogene boundary. This group develop completely original morphologies – probably due to a shell uncoiling – which make them recognizable at first glance. A strong development of the myocardinal apparatus constituted of a hinge (teeth and sockets for the teeth) and myophores (insertion point of the adductor muscles), the loss of a ligament and the presence of canals in the shell that can adopt a very large diversity of morphs are some examples of morphological events which occurs in rudists. Finally, their increasing development during Cretaceous had the result to be – with the debris of their shells – the major contributors of the edification of carbonate platforms of these times. Here I present a new phylogeny based on representatives of each family – from Diceratidae to Hippuritidae – to resolve the early nodes of the Rudist phylogeny. I point out the weaknesses of the unique pre-

vious phylogeny (Skelton and Smith, 2000) on the formalization of homology hypotheses, and I propose a completely new set of morphological descriptors, and therefore characters, based on comparative anatomy with a decomposition of traditional "morphological wholes" (as hinge) into independent characters (i.e. anterior tooth, central tooth socket). Accessory cavities are also an example of "trash character" that is redefined. I show that the previous unique character "pallial canals" can be decomposed to point four different origins. The results are presented in three-taxon analysis, a cladistic method that uses a new formalization of homologies directly in trees, and without matrix. The cladistic analysis leads to a single most parsimonious tree (RI=0,87) computed with LisBeth 1.3 (Zaragüeta-Bagils et al., 2012).

Keywords: Hippuritida, Rudists, 3ta, cladistics, homology, canals, myophores

Intraspecific morphological variation of the middle ear in the European badger, *Meles meles* (Carnivora: Mustelidae)

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Hearing is the process through which the ears (outer, middle, inner) detect and perceive sounds. Many studies dealt with the anatomical structure of the mammalian middle ear and its functional implications. The middle ear is defined by the auditory bulla, a resonance cavity right after the tympanic membrane, and the ossicles bones linking this membrane to the inner ear. Considering that the morphological variation of such structures is unknown, and that these previous studies focused on few individuals, we argue that the interpretation of informations given by the anatomy is open to question/needs to be better supported. Thus, we aim to provide a quantitative analysis of the intraspecific variation of this structure, focusing on the auditory bulla, relative to the interspecific variation. For that purpose, we focused on the mustelids, as a quite generalist taxon, and more specifically on the European badger, *Meles meles*. Our study includes two steps. We first checked that the volume of the bulla relatively to the length of the skull does not vary more in a species than between species. Second we tried to group our individuals according to a few available measures and managed to cluster badgers together (21 skulls in our sample) but clustering species for which we only had two or three skulls did not give any satisfying result. We conclude that the middle ear varies effectively less intraspecifically than interspecifically. However, we believe that using only a few anatomical measurements to describe the auditory bulla requires more specimens and/or geometric morphometrics analyses.

Keywords: Auditory bulla, multidimensional scaling, Mammalia, 3D, segmentation, interspecific variation

Theropod Dinosaurs from Thailand and Southeast Asia: A Review with Newly Found Specimens

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Non-avian theropods in Southeast Asia are found mainly from northeastern Thailand with one bizarre theropod from Lao PDR and one recent report from Malaysia. They are found in the Late Jurassic or the Early Cretaceous (Phu Kradung Formation) and the Early Cretaceous (Sao Khua, Khok Kruat, and "Grès supérieurs" Formations). Until now, thirteen non-avian theropods have been discovered. They consist of several theropod groups. There are two sinraptorids from the Phu Kradung Formation of Thailand. It consists of a lower leg (left tibia) of a sinraptorid and cranial and postcranial elements of another as-yet-undescribed sinraptorid. Seven non-avian theropods from the Sao Khua Formation of Thailand: a small-bodied compsognathid; a spinosaurid *Siamosaurus*; postcranial skeleton of an ostrich-mimic dinosaur *Kinnareemimus*; partial maxilla of a carcharodontosaurid; an avetheropod *Siamotyrannus* with the new study suggests it is not a tyrannosauroid but could be a basal coelurosaur or a sinraptorid; a new megaraptoran (PW A1-2) looks similar to *Fukuiraptor* from Japan and *Australovenator* from Australia; and a new, as-yet-undescribed theropod (PW9B) possibly a neovenatorid or a coelurosaur. Two theropods from the Early Cretaceous Khok Kruat Formation of Thailand: an undescribed partial postcranial skeleton of a spinosaurid and an undescribed partial skull, teeth, and postcranial skeleton of a carcharodontosaurian. One spinosaurid from Laos: *Ichthyovenator* from "Grès supérieurs" Formation which equivalent to Khok Kruat Formation of Thailand. And the spinosaurid teeth which were recently reported from the late Early Cretaceous of Malay Peninsula. The discovery of theropod faunas from Thailand and Southeast Asia will continue to yield new data on theropod evolution and palaeobiogeography in the Late Jurassic to the Early Cretaceous of Southeast Asia and in the global scale.

Keywords: theropod, Southeast Asia, Thailand, Early Cretaceous, palaeobiogeography

Study of the morphological variability of the semicircular canals of proboscideans using 3D landmarks

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The Proboscidea - the group that includes extant elephants - is one of the most peculiar mammalian order to have ever lived. This taxon is extremely well-documented with more than 170 known fossil species and it displays an original locomotor behavior as well as curious auditory performances (they are able to hear and produce infra-sounds). Both of these features are controlled by the inner ear which is a complex organ contained in the petrosal bone. With the development of the CT scanning methods and their application in the field of paleontology,

the inner ear morphology is more and more studied and often used to create new phylogenetic characters. The primary objective of this project was to study the inter- and intra-specific morphologic variability of the inner ear of proboscideans. To do so, petrosal bones of extant and extinct proboscideans have been CT-scanned and their inner ears have been segmented and landmarked in order to use 3D geometric morphometrics methods. Results show that it is possible to discriminate elephantimorphs from other proboscideans based on the morphology of the semicircular canals. A particular common trait of these taxa seems to be a relatively small size of the lateral semicircular canal. Among elephantimorphs it is also possible to discriminate the Elephantidae family (which contains for instance mammoths and extant elephants). One of the characters that seem to influence the grouping of the Elephantidae is the proportion of the crus commune which is shorter in this group. Nevertheless these preliminary results on semicircular canals do not allow us to discriminate proboscideans at a lower taxonomic level using 3D landmarks. The same method will be tested on the cochlear morphology in order to try to resolve this issue, even though this region is missing on several fossil petrosal bones.

Keywords: Proboscidea, elephants, inner ear, CT scan, 3D geometric morphometrics

Study of the small mammals of Bronze Age layers from Arenaza I Cave (Galdames, Bizkaia, North of Iberian Peninsula)

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The study of the small mammals from the uppermost layers (*ca.* 3695-4414 cal BP) from Arenaza I Cave (Galdames, Bizkaia, North of Iberian Peninsula) is reported in this work. This cave is developed in Lower Cretaceous limestones at 190 meters above actual sea level. First archaeological intervention began in 1972, documenting a stratigraphic sequence from the Upper Magdalenian to the late Bronze Age, with sporadic late Roman occupations. Nevertheless, the small vertebrate assemblage presented here comes from the excavations carried out between 1991 and 1993, from layers 8 to 10 of the Q15 quadrant. At least, 14 taxa have been identified, nine belonging to the Order Rodentia and five to Order Eulipotyphla. Palaeoecological data obtained for the three layers indicate a clear predominance of deciduous forest landscape in cave's surrounding area during the Bronze Age, being the layer 9 when it was most extended. Therefore it was probably at that time when the most humid conditions and mild temperatures took place.

Keywords: Small mammals, Holocene, Bronze Age, Cantabrian Range, Palaeoecology

The upper molar topography of a fossil European colobine monkey

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Colobine monkeys have been historically described as specialized folivores, to the point of being dubbed “leaf-eater monkeys”. However, reports on both their behavior and dental metrics lead researchers to ascribe them a more contrasted diet. In particular, several species seem to be dedicated seasonal seed eaters. They use the lophs on their post-canine teeth to crack open the hard endocarp that can protect the seed. This raises the following question: did the colobines first relied on their molars to eat leaves, and secondarily developed an “exaptation” to durophagy, or were their molars originally selected to deal with hard food and happened to be reliable leaf-eating tools? In this work, we use 3D dental topography to investigate the diet of a fossil colobine monkey, *Mesopithecus*. This primate dwelt in central to southern Europe and up to the Middle Orient, from the Late Miocene to the Early Pliocene. We compare the upper second molars of fossils retrieved in Pikermi, Greece, with the teeth of several extant cercopithecids from Asia and Africa characterizing a wide range of diets. Classical topometrics were used, such as relief index, occlusal complexity, relative enamel thickness and Dirichlet normal energy. Furthermore, we characterized the diet of the comparative sample taxa using alternative, mechanically pertinent dietary categories developed in a precedent work. Following this approach, we adopted multilevel categories such as “hard, brittle food cracking” in place of uninformative categories such as “frugivory”. Results show that *Mesopithecus* was not as adapted to durophagy as previously thought. Its dental morphology resembles other “tough food shearing” cercopithecids, e.g. folivore ones. Therefore, the consumption of hard food items attested by other methods, such as dental microwear analysis, might result from the seasonal consumption of mechanically challenging items, e.g. tubers or seeds.

Keywords: Primates, Diet, Food mechanical properties, Dental morphology

Phosphotriton sigei, a new salamander from the Phosphorites du Quercy: tomography and phylogeny

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Extinct species are a significant component of the diversity of life and are essential to fully understand its past and extant organisation. However, some rare fossil specimens can be con-

sidered as even more important, for their exceptional preservation, which often retain an impressive quantity of anatomical information, such as bones in connection and soft parts. Only recently could most of these specimens be studied, thanks to modern X-ray imaging technologies like CT scanners or synchrotrons, since they enable access to a high level of detail. Here, we will present results obtained through phase contrast x-ray synchrotron tomography on a recently studied exceptionally preserved specimen of salamander. It is a 41-34 million years old natural mummy that was discovered in the late 19th century in the ‘Phosphorites du Quercy’ (south western France) but never studied. This particular specimen would have been impossible to study, beyond its external anatomy, without CT scanning. The imaging reveals the whole preserved skeleton, as well as some soft organs, like the alimentary canal, nerves, and a probable lung. The stomachal content is also preserved and indicates that this salamander ate a frog, which is very unusual. These discoveries yield clues about the lifestyle of this animal and its systematic position. Anatomical comparisons with other species indicate that it is a new taxon, that we named *Phosphotriton sigei*. The phylogenetic analysis showed that *P. sigei* is very probably on the stem of Salamandridae, the most speciose clade of urodeles in Eurasia. This position was obtained from a parsimony analysis of an existing morphological and molecular data matrix of 32 species. 45 characters of the 326 morphological characters were coded for this new taxon. *P. sigei* shares with Salamandridae at least four synapomorphies whose position is unambiguous, such as the presence of sacral ribs.

Keywords: tomography, urodele, fossil, phylogeny, synchrotron, Salamandridae, mummy, Phosphorites du Quercy, Eocene, anatomy

The impact of geographic parameters on the fluctuations of the taxonomic and morphological diversification rates: The case of insular Murinae Rodents

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Taxonomic and morphological diversity is driven by evolutionary mechanisms such as speciation, extinction and adaptation. On islands, these mechanisms are related to biogeographical parameters. According to island biogeography theory, it is expected that isolation, surface as well as altitude have an impact on island lineage diversification, although it was never tested from phylogenies. To quantify this effect, we implemented a large-scaled macroevolutionary study on the hyperdiverse Murine clade in the Indo-Pacific archipelago. To obtain an estimate of Murine evolutionary history, we inferred an exhaustive dated molecular phylogeny, which was subsequently linked with a large ecomorphological and geographical database. Our results demonstrated that Murine diversification rates follow a diversity-dependent model, a process in which the ecological niche filling limits the diversity through time. An exception was recognised with the *Rattus* division, whose numerous colonization events accelerated significantly the diversification rate. Fur-

thermore, several clades seem to have taken advantage of an ecological opportunity and show a strong acceleration of the morphological diversification (*Rattus* species from Sahul and Indo-Pacific shrew-rats). In order to assess the impact of geographical parameters on diversification, we compared diversification rate values with geographic data using both linear and quadratic regressions. We were able to show that strong isolation allows a reduced competition, and, as a result, a higher taxonomic diversification. Instead, surface does not seem to play a role on the taxonomic diversification, but has a positive effect on the morphological one. Finally, the environment at mid-altitudes accelerates significantly diversification.

Keywords: insular biogeography, Rodents, Indo, Pacific, macroevolution, radiation

Exploring the global population of the giant squid (*Architeuthis dux*) using mitochondrial genomes and nuclear genetic markers

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The giant squid, *Architeuthis dux* (Steenstrup 1857), is one of the largest molluscs in existence, and a very charismatic figure in myths and popular culture, yet its biology has remained largely unknown. We initially published a population genetic study on the giant squid using 44 mitochondrial genomes in 2013. The results of this study were intriguing, suggesting only a single species with very low genetic diversity across the globe, but they also left questions to be answered regarding the structure and dynamics of the population, and how accurate a reflection of the true population history we could believe the mitochondrial data to be. We are now completing a follow up study on the same sample set, using several thousand genetic markers obtained by a RADseq approach, in an attempt to increase the phylogenetic resolution of the data. More specifically, we analysed 32 individuals of giant squid with a world-wide distribution using the Genotyping-By-Sequencing pipeline available at the Genomic Diversity Facility at Cornell University, and used the data to once more look for population structure across the large geographic range of this species.

Keywords: Molecular ecology, evolution, population genetics, genomics, giant squid

EARTH AND PLANETARY SCIENCES

The Lower Devonian flora of Mezquita de Loscos (NE Spain, Iberian Peninsula)Borja Cascales-Miñana¹, Gerrienne, Philippe¹¹ PPP, Département de Géologie, Université de Liège, Allée du 6 Août, B18 Sart Tilman, B4000 Liège, Belgium

The plant fossil record of the Lower Devonian (419-393 Ma) in the Iberian Peninsula is represented by poorly preserved remains with controversial taxonomic affinities. However, this record is key to palaeogeographic interpretations because of the relative position of the Peninsula between Laurussia and Gondwana during the early radiation of plants. The Lower Devonian flora of Mezquita de Loscos (Teruel Province, Spain) probably represents the best documented Iberian plant fossil record of early Devonian times. Indeed, a solid plant megafossil evidence (e.g., *Taeniocrada*-like remains, *Hostinella sp.* and a branching system of a basal euphyllophyte) as well as a rich spore diversity (e.g., *Ambitisporites*, *Aneurospora*, *Brochotriletes*, *Cheilospora*, *Emphanisporites*, *Gneudnaspore* and *Retusotriletes*) have been discovered. In this communication, recent new findings from this outcrop belonging to the Nogueras Formation (Lochkovian-Pragian) are presented. New evidence consists of a highly diversity palynoflora with more than 20 genera (> 70% of them being new for the formation), as well as of a new Lower Devonian plant currently under study with unexpected phylogenetic relationships within the early land plants. Acknowledgements: This study is supported by (1) a Marie Curie COFUND Postdoctoral Fellowship from the University of Liege (grant number: 600405) and by (2) an ULg grant 'Fonds Spéciaux pour la recherche' - crédit classique C-12/32.

Keywords: Gondwana, Nogueras Formation, Teruel Province, phylogeny, plant megafossils, dispersed spores.

Characterization of Hydrogeological functioning of the western part of the Haouz plain of Marrakech using geological, geophysical and hydrogeological dataIbtissam Chouikri¹, Abdennabi El Mandour¹ Université Cadi Ayyad, Marrakech, Morocco

The Western Haouz plain and the Mejjate plain constitute a vast alluvial plain of about 2800 km². The area is located between 30 and 80 km south-west of Marrakech city and it is characterized by a semi-arid climate. The morphology of the plain is known by a flat topography, monotone and it is drained by three wadis; Nfis wadi, Assif El Mal wadi and Chichaoua wadi. The compilation of Geological, Geophysical and hydrogeological data shows that the Western Haouz plain is divided into two parts, it is a synclinal form separated by Marmouta horst and Guemassa horst. In the southern part, the Mejjate syncline is subsiding and shows a several formations from the shales of the Paleozoic to the alluvium of the quaternary. In the northern part, the syncline is less developed and it is formed by the

conglomerates of the Mio-Pliocene and the alluvium of the Quaternary. The gravity map established shows positive anomalies due to the outcrop of the basement, and negative anomalies in the subsiding basins. Hydrogeologically, the geometry of the reservoirs and the groundwater circulation are controlled by geology (Rifts, flexure, anticline and syncline). The southern part of the plain between the Marmouta anticline and the piedmont of the High Atlas Mountains shows two aquifers; the unconfined aquifer housed in thick formations of Quaternary and Mio-Pliocene; and the confined aquifer housed in dolomitic limestones of the Cenomanian-Turonian. The confined aquifer is fed at the northern flank of the High Atlas showing karst morphology and high cliff of limestone slab of the Turonian. The outlet of the deep confined aquifer is shown by Abainou source with a variation between 300 and 600 l/s south of the Marmouta anticline and constitutes a barrier for the deep waters flow circulations.

Keywords: Morocco, western Haouz, hydrogeology, gravimetry, structural geology, aquifer.

Sea-ice influence on carbon and silicon biogeochemical cycles in the Southern OceanIvia Closset¹, Damien Cardinal, Arnaud Dapoigny, Louis Girard, Guillaume Massé¹ LOCEAN, Université Pierre et Marie Curie [UPMC] - Paris VI, France

Polar sea ice plays a fundamental role in the regulation of global climate, particularly by the formation of dense waters as observed on the continental shelf of Adélie Land (Southern Ocean). There, diatoms are major primary producers and key exporters of organic matter and silica. Their impact on carbon (C) and silicon (Si) cycles in this zone has great implications on the global ocean biogeochemistry. As they fractionate C and Si isotopes during their growth, their isotopic compositions ($\delta^{13}\text{C}$ and $\delta^{30}\text{Si}$) were closely linked to the primary production (PP) and the degree of silicic acid utilization in surface waters. Sediment trap samples from mooring deployed there showed a massive sedimentation event in January that represent more than 90% of the total annual sedimentation and is probably linked to the PP in the Mertz Polynya area. The main variation of $\delta^{30}\text{Si}$ occurred during this short event (from 0.2 to 0.5‰). This flux was composed by a mix between isotopically heavy sea-ice diatoms ($\delta^{30}\text{Si}$ from 0.41 to 0.86‰) and light planktonic diatoms ($\delta^{30}\text{Si}$ from -0.93 to -0.06‰) as measured in the mixed-layer, ML, above the mooring) whose contribution to the flux varies along the season. Comparison of Si and C fluxes and stocks in the ML with their respective isotopic signatures provides key information concerning nutrient dynamics and coupling in surface water, and how well the isotopic signature of exported opal is preserved from the euphotic zone to the underlying sediments.

Keywords: Southern Ocean, silicon isotopes, sea, ice, diatoms, nutrients

Hydrogeochemical groundwater characterization of Plain Ghis Nekor. Northern Morocco Oriental

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¹ Morocco

The Watershed of the Ghis Nekor is bounded to the north by the Mediterranean Sea on almost 260 km of coastline, to the west by the Atlantic about 140 km to the south by the Sebou Basin and East in the basin of the Moulouya. The Plain Ghis-Nekor is an intra-mountain valley occupied by a fill consisting of heterogeneous alluvial sands, gravels and conglomerates of Pliocene-Quaternary and Actuel. The plain belongs to 90% in Nekor, the Ghis intervening only in the northwest end. The plain has an average slope of S and N is in the form of depression; usually it is surrounded by schist and sandstone flysch, waterproof together, except in the northwest sector where appear carbonatées formations Dorsal Bokoya limestone massif, and the northeastern area where outcrop vulcanites plioquaternaires Ras Tarf. The geochemical analysis shows the abundance of sulfate ions over other major present in samples of groundwater. The most of the sampling points in the plain of Nekor Rhis-show conductivity values above the limit for drinking water according to the Spanish standards (2500 microseconds / cm). The pH values are at least neutral and the average temperature is about 20°C.

Geology and mineralogy data from the Roc Blanc Ag-Pb-Zn deposit (Jebilet massif, Variscan Belt, Morocco)

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The Roc Blanc deposit is located 20 km north of Marrakech city of the Variscan Jebilet Massif, in western Morocco. It is a 200 000 tons Ag, with average grades of 557 g/t Ag, 0.8% Pb and 1.01% Zn. The Roc Blanc vein-type Ag-Pb-Zn deposit is hosted within spotted schists and metamorphic rocks of late Visean-Namurian. The main veins are discontinuous along N10°E to N150°E direction. The veins are 0.3-0.5 m thick and their lengths reach up to 2000 m. Ore occurs in banded veins and breccias and as stockworks, with gangue composed dominantly of quartz, chlorite, sericite and carbonate minerals. Textural relationships indicate two main hydrothermal stages, the first stage is characterised by a Zn-Cu-Pb polymetallic mineralisation and the second stage by precipitation of Ag, Pb and Sb-bearing minerals, marked by assemblages of quartz-chlorite-sericite and carbonate. Silver minerals occur in veins as argenterous tetrahedrite, ullmannite, owyheeite, miargyrite, pyrrhgyrite, polybasite, argentite, and native silver. They commonly exist as inclusions in galena, chalcopyrite, and other sulfides. Sometimes, they occur as filling microfractures in sulfides and quartz. The studied mineralization may genetically related to the Tabouchent-Bramram granodiorite pluton. Although the implication of the metamorphic basement into the genesis of this mineralization should be also taken into consideration.

Keywords: Ag, Pb, Zn, Sb, Roc Blanc, Vein, Hercynian, Morocco.

Les niveaux à pillow-lavas et sédimentaires des successions basaltiques de la Province Magmatique de l'Atlantique Central (CAMP) du Haut-Atlas de Marrakech, Maroc : Faciès, Morphologie, Structures internes et Morphométrie

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The study of the physical volcanology (morphology and internal structure) of lava flows of the Central High Atlas (regions of A'it-Ouir, Jbel Imzar and Oued Lhar or Herissane) has revealed the existence of four volcanic formations. These formations are common in the literature by the name of: lower formation, intermediate formation, upper formation and recurrent formation, which correspond to four fields of lava flows. These fields are constituted by several lava flows. They are separated by levels of sedimentary red clay or carbonates. The mains types of flows recognised are: compound pahoehoe or simple flows, breccia basis flows, pillow lavas and prised flows. The morphometric study of pillow lavas levels for intermediate and upper formations of the CAMP in the regions of Jbel Imzar, and Oued Lhar or Herissane shows that the pillow lavas of the current study especially of A'it-Ouir and Herissane have larger sizes by report to the pillow of Jbel Imzar. The analysis of clays by the method of X-ray diffraction has highlighted the presence of illite, mica, phengite, celadonite, talc and low quantity of quartz, hematite, feldspar and calcite, as well as two couples of irregular stratabound (Chlorite- Smectite/ Chlorite-Mica). The fibrous minerals such as Sepiolite and Palygorskite have not been detected. The peperites in the region of Herissane (Central High-Atlas) have provided an excellent overview regarding the factors favoring the interaction of magma-sediment, this are the product of a mixture of sediment consolidated or poorly consolidated to low permeability with magma of low viscosity.

Keywords: Central Atlantic Magmatic Provinces (CAMP), Central High, Atlas, Pillow, lava, physical volcanology, morphometry, peperites, clay mineral, palynology.

Contribution of GIS in the evaluation of quality of soil perimeter Issen plain Souss Massa, Morocco

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The study of the quality of soils in irrigated areas is necessary for measuring the sustainability of the production system. Indeed this quality assessment is based on the physicochemical characterization of their parameters and knowledge of their spatial distribution and evolution over time, in order to achieve sustainable agricultural development strategies. The present work is to make a diagnosis of the current situation of soil quality that prevails in the scope of Issen plain of Souss Massa. It was based on three seasons of 52 soil sampling points spread across the plain studied for two years (2013-2014). The test results show that the analyzed soils are fairly basic with a predominance of isohumic soil sierozems, and that 15% of soils are at risk of soil salinity. Furthermore 60% of soils are moderately organic matter levels, they are also characterized by a high concentration at the level of phosphorus contents and potassium assimilated. Then a thematic mapping for each parameter was determined using a Geographic Information System (GIS).

Keywords: Perimeter Issen, Plain Souss Massa, Soil, Quality, GIS

Simulation of daily events- based of rainfall–runoff modelling in a semi arid area in central Morocco

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A spatially distributed hydrological model, dedicated to flood simulation. Rainfall–runoff models can be very useful for flood forecasting and prediction. The objective of this paper was to analyze, on a relatively large sample of daily flood events. Estimation of model parameters requires data concerning topography, soil properties, vegetation and land use. The initial conditions of soil moisture are indeed a key factor for daily flood modelling in the Mediterranean region. Three parameters are calibrated for the entire catchment using 27 flood events that occurred between 2005 and 2009. Results of this sensitivity analysis with a criterion based on the Nash efficiency coefficient and other coefficients are used to calibrate the model. This study was done in the Ourika catchment (503 km²) located in the Mediterranean zone of central Morocco. The model was found satisfactory to reproduce the runoff and the temporal evolution of floods, even with limited rainfall data. The classification of events by their seasonal distribution, can improve the performance of the model. So they suggest some regional heterogeneity of responses catchment. This same approach could be implemented in other catchments of this region for operational purposes.

Keywords: Simulation, events, rainfall–runoff, semi arid area

Analysis of charcoals from soils in Amazonia by anthracological identification and radiocarbon dating

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The Amazon region offers a wide variety of biodiversity and microclimates. In order to better understand the evolution of such environment, past remains need to be analyzed by all possible means. In this context, the study of natural and anthropogenic fires can give information on climate changes, biodiversity or even human intervention on land management. In this work, we associate the anthracological analysis of charcoal fragments to their radiocarbon dating by Accelerator Mass Spectrometry. A total of 34 charcoal samples were identified and 14 were dated from soil samples collected in the Brazilian Amazon. Of the 20 groups of charcoal fragments identified by the anthracological method, 9 contained more than one taxonomic type and Fabaceae, Combretaceae and Sapotaceae families achieved the highest frequencies. Regarding the dating results, some ages showed a considerable range among different species. Significant variations were observed for two fragments of the same sampling spot presenting dates of 6876 ± 41 and 1950 ± 31 ¹⁴C yr BP. On the other hand, some samples resulted in up to 5 different species with statistically similar dating results. These findings disclose the importance of the association of anthracological identification to radiocarbon dating to achieve more accurate and robust results.

Keywords: Fires, Taxonomic type, ¹⁴C, Accelerator Mass Spectrometry

Hydrochemical and statistical characterization of groundwater in Western Haouz (Morocco)

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Western Haouz is a vast alluvial area covering 2800 km² and located thirty kilometers westwards from the Marrakech city. It is bounded to the north by the Tensift wadi, to the south by the western High Atlas massif, to the east by the Nfis wadi and to the west by the Chichaoua wadi. This study aimed to physico-chemical characterization and classification of groundwater, by analyzing: characteristics ratios of major elements, Piper diagram, Shoeller Berlaloff Classification, correlation matrix, and Principal Component Analysis (PCA). The results of empirical, graphical and multivariate statistical investigations permitted characterization of groundwater in the western Haouz, identification of various chemical facies and contributed to the classification of different types of groundwater (springs, boreholes, Khetaras and wells). Using multivariate techniques in combination with empirical and graphical techniques, classifies groundwater in two groups. Water facies of the first group (Khetaras, boreholes, wells and springs) is Cl-SO₄-Ca-Mg, while the

second group (wells) is characterized by $\text{HCO}_3\text{-Ca-Mg}$ facies.

Keywords: Hydrochemistry, statistics, groundwater, Wester Haouz, Morocco

Mineralogical and geochemical characteristics of carbonate-hosted Cu, Pb, Zn, (Ag,Au) ore deposit at Amensif (Western High Atlas, Morocco)

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The Amensif Cu–Pb–Zn–Ag–(Au) deposit is located on the northern flank of the western High Atlas Mountains, Morocco. This carbonate-replacement deposit occurs predominantly in Lower Cambrian carbonates along a major detachment fault that separates the Basal unit from the Upper unit. Orebodies are mainly massive replacements of carbonate strata, although sulphides also occur in veins. Silicification, chloritization, local skarn formation and sulphidation are the most important hydrothermal alteration features observed. The mineralogy is dominated by base metal sulphides with subordinate sulphosalts of Ag, Bi, Sb, Pb, and Au. The ore consists of chalcopyrite, pyrite, galena, sphalerite, arsenopyrite, tetrahedrite, tennantite, and Bi–Ag–Sb–Cu–Pb–Te sulphosalts (matildite, schirmerite, native bismuth, bismuthinite, freibergite, hedleyite, and krupkaite), anglesite, covellite, malachite, and azurite. Silver commonly occurs as Ag–Bi–Sb–Pb sulphosalts intimately associated within galena. SEM analyses confirm the occurrence of invisible gold within sulphides. Although SEM analysis of auriferous sulphides indicates the presence of gold in sufficient quantities to explain the bulk gold concentrations; native gold has not been detected in our polished sections. Gangue minerals include predominantly chlorite, epidote, tremolite, calcite, Mn-dolomite, saddle dolomite, quartz, sericite, with minor andradite and vesuvianite. The presence of a bismuth association at the Amensif deposit is typical, and was effective in scavenging gold and silver. Lead isotope compositions of galena sampled from two regions in western High Atlas (Amensif and Tighardine) show a wide range in $^{206}\text{Pb}/^{204}\text{Pb}$ (18.053–18.324), $^{207}\text{Pb}/^{204}\text{Pb}$ (15.534–15.577) and $^{208}\text{Pb}/^{204}\text{Pb}$ (37.780–37.986). The Pb isotope signature suggests that Pb–Cu–Zn minerals were leached from the older reservoir of the Cambro–Ordovician volcano-sedimentary rocks during the Permian granite event. The Amensif deposit is a typical example of a distal skarn, and is compatible with a model for polymetallic carbonate-replacement type mineralization.

Keywords: Carbonate, replacement, Ag–Bi–Te sulphosalts, Base, metal sulphides, Lead isotope, Amensif, Western High Atlas, Morocco

Geological Study of Western Tarouni area of the Bou Azzer Cobalt-Nickel-Arsenic District (Central Anti-Atlas, Morocco)

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The Tarouni deposit belongs to the district of Bou Azzer–El Graara (central Anti-Atlas, Morocco) which is distinguished by cobalt arsenide mineralization generally located in serpentine diorite-quartz interface IIP and/or serpentines-volcanic and volcano-clastic rocks PIII. The western mining center (Tarouni West deposit) is very promising by the presence of a multitude of carbonates in structures, quartz- carbonate and concentrations of metallic elements such as Ag–Au–Cu–Ni–Co Pb– Zn.

Keywords: Tarouni, district of Bou Azzer–El Graara, central Anti Atlas, Morocco, cobalt and arsenide mineralization

Ifni lake the highest natural mountain lake of Morocco: Morphometric and environmental characterization using geographic information system (High Atlas Mountains, Morocco -North of Africa)

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National park of Toubkal, is located in the high Moroccan Atlas Mountains sheltering the highest summits in Morocco with 4167 elevation, this park characterized by very important ecosystem and water resources .The Ifni lake is a part of this park with an elevation of 2320 meter ,is the highest lake in Morocco, which constitutes a specific environnement , lithologie and biodiversity .The water of Ifni lake is very fresh and cold ,this lake considered one of water tower in this region. The sub watershed Ifni lake is small with 18 km² in surface and 17 km in perimeter, and geologically the lithology is very hard with volcanic rocks .So, to understand the physical environnement and different process of watershed of the Ifni lake, we determinate the morphometric parameters of the catchment area using Geographic information system (GIS),topographic map and digital elevation model (DEM). The morphometric analysis in the study area show that the Ifni lake watershed characterized by a high elevations 4141 m maximum and 2282 m minimum and greater slops . The absence of vegetation in the Ifni lake watershed hard geology and the relief these factors influence the erosion problem in this area. Consequently, the morphology of Ifni lake will change with time .We must conserve the Ifni lake, biodiversity and ecosystem in this region.

Keywords: Environnement, biodiversity, water resources, GIS, Ifni lake

First look on biogenic silica and its associated processes in Indian estuaries along contrasted seasonal climate

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Si, a specific nutrient needed by diatoms and its availability relative to other nutrients determines the phytoplankton composition in estuarine and coastal ecosystem. Climate and land use are the major processes that alter the nutrient supply in the estuaries, affecting the ecosystem health and biogeochemical cycles. Indian estuaries are monsoonal estuaries, receive 80% of annual water discharge during monsoon period with contrasted seasonal biogeochemical processes. Here we present the first study of biogenic silica (BSi) distribution (a proxy of diatoms and phytoliths abundance) and its relationship with other biogeochemical parameters (including dissolved silicon, DSi) in 26 and 18 Indian tropical estuaries during monsoon and non-monsoon period respectively. During non-monsoon period, non-conservative behavior of DSi along the salinity gradient was observed with $Si:N > 1$ in all estuaries indicating that Si is non-limiting. The good correlation between diatoms pigments and BSi contents in eastern estuaries ($r=0.66$, $p < 0.001$) indicates the major role of diatoms at this season. In contrast, during monsoon period, conservative like behavior and higher DSi concentration associated with higher discharge was observed along the salinity gradient. Higher BSi concentration when compared to non-monsoon and good correlation with total suspended material ($r=0.67$, $p < 0.001$) indicate the supply of land derived plant material in to the estuaries. The detailed associated biogeochemical processes will be studied via statistical tools and discussed during the session as an attempt to classify the estuaries according to their behavior with respect to Si cycle. **Keywords:** Biogenic silica, tropical estuaries

Stratigraphic and micropalaeontological (benthic Foraminifera) analysis of middle-upper Miocene sequences from southern Ecuador

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To shed some light on the controversial debate of the influx of marine waters during the Miocene in southern Ecuador, in this work is presented a stratigraphic and micropalaeontological (benthic Foraminifera) study of selected sections from the Loja, Malacatos-Vilcabamba, and Catamayo-Gonzanamá Basins. The benthic Foraminifera assemblage is composed of several species from marginal marine and open-water environments: *Bathysiphon sp.*, *Reophax cf. fusiformis* (Williamson, 1858), *Haplophragmoides? sp.*, *Jadammina sp.*, *Uvigerina sp.*, *Anomalina cf. grosserugosa* (Gümbel, 1868), *Ammonia sp. aff. Ammonia tepida* (Cushman, 1926), and Rotalidae indet. The facies associations, together with the presence of these benthic Foraminifera species, verify the influence of marine waters and the sporadic development of marginal marine conditions in this area during certain periods of the middle-late Miocene

Keywords: benthic Foraminifera, stratigraphy, middle-upper Miocene, marine influence, southern Ecuador, palaeoecology

The contribution of geospatial information for sediments yield modeling of N'FIS watershed (High Atlas Mountains of Marrakech, Morocco)

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Morocco faces a challenge in terms of water resources management over the last years, in terms of quantity and quality. The study of water resources at watershed scale is widely adopted as approach to manage, assess and simulate these important natural resources. This work define our demands to know the specificities of the water cycle overlooked a modeling tool continuous model, distributed and physically based SWAT. The catchment has an approximate drainage area of 1686 km² at the dam Lalla Takerkoust whose watershed coincides with the downstream limit of active runoff areas and a mean annual precipitation 700 mm. The hydrology is characterized by to annual time step, seasonal and monthly basis. This is related to rainfall and their irregularities contributions. The flows peak of the N'Fis wadi are important in spring and winter. The summer is a dry season and low flows from base flow provided by groundwater and eventually melt of snow. The SWAT model can open up new perspectives regarding the changes on water resources, in terms of both quantity and quality. This work aims to measure the adaptability of this model to the selected area in order to generalize the model to the whole N'fis watershed. The daily runoff and sediment event data from 2001-2009 were used in this study; data from 2001-2006 were used for calibration and 2007-2009 for validation. The calibration of SWAT model was successfully done with 0.65 as value of Nash coefficient used commonly to evaluate the model performance. The calibrated model was then used to estimate the hydrological balance sheet of the N'fis watershed to model the intermediate contribution of the reservoirs situated in the watershed. The SWAT model performed well in capturing the trend of sediment load, while the model tended to estimate sediment load during the calibration and validation

Keywords: Modeling, SWAT, GIS, Water balance, Sediment yield

New insights into the fossil record of the mangrove palm *Nypa*: a taphonomic study from the Iberian Peninsula

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New fossil fruits pertaining to the mangrove palm genus *Nypa* Steck. (Arecaceae, Arecales) were collected from a recently discovered plant-bearing assemblage in Northeastern Ebro basin (Arguis, Huesca Province, Spain). This new assemblage (Bartonian in age) consists of nine specimens of fossil *Nypa* fruits and one monocotyledon leaf fragment. Over half of these fossil fruits are nearly-complete (i.e. with preserved mesocarps) while the other represent endocarps. The type of remain preserved (fruits or endocarps), presence of abrasion, Teredo borings and sedimentary facies provide criteria to infer contrasting lengths of transport (drifting). We have estimated the approximate floating time by measuring the length of Teredo borings and comparing it to their growth rates. Thus, evidence suggests that the specimens of Teredinids were very young and not mature in the endocarps, while the specimens were mainly mature and adults in the fruits. Results revealed that the endocarps had a floating time much shorter than the fruits. The sinking of the endocarps to the seafloor started after upon separation of mesocarp from the endocarp. According to evidence, we think that the total floatation time of the endocarps after separation could have lasted between 20-30 days. Conversely, evidence suggests that the fruits were floating three times more than endocarps (i.e., three months approx.). Furthermore, the discovery of *Nypa* fruits suggests a tropical-subtropical climate in the collecting area, as well as the presence of a coastal environment and littoral forests during deposition. Acknowledgements: This study has been partially supported by a Marie Curie COFUND Postdoctoral Fellowship from the University of Liege (grant number: 600405).

Keywords: Mangrove, Prepyrenean External Sierras, Palm, Iberian Peninsula, Arecaceae

Variation de composition chimique et évolution subsolidus des phases minérales des péridotites et pyroxénites du massif ultrabasique des Béni Bousera (Rif interne, Maroc)

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Le massif ultrabasique des Béni Bousera affleure au Nord du Maroc dans le Rif Interne. Ce dernier renferme trois faciès de lherzolites : Les lherzolites à spinelle, les harzburgites à spinelle les dunites à spinelle et/ou à grenat. Des bancs des pyroxénites plus au moins continues sont associés à l'ensemble des lherzolites. Les lherzolites présentent des textures variables allant des textures à gros grains au centre du massif vers des textures mosaïques en contact avec l'encaissant tout en passant par des textures porphyroclastiques.

La composition chimique des minéraux des lherzolites et pyroxénites associées est largement variable, traduisant l'évolution subsolidus affectant ces minéraux toute en soulignant l'action de la fusion partielle ayant affecté le massif durant son évolution lithosphérique. Ces variations chimiques ont générés la présence d'une zonation due à la répartition des éléments chimiques tels Al, Cr, Ti, Fe, et Mg au sein d'un même cristal tout en partant de son cœur vers sa bordure.

Ainsi dans la famille des pyroxènes, on distingue une augmentation de la teneur en Al du cœur du cristal vers sa bordure, con-

tre une chute de la teneur en Cr du cœur du cristal vers sa bordure. De même nous soulignons la nature du zonage des teneurs des éléments (Fe, Mg), (Cr, Al) dans le couple des minéraux en équilibre Ol-Sp et Opx-Sp. Ceci ce fait en réponse l'action de rééquilibrage de subsolidus accompagnant une chute de température.

Keywords: Rif interne, massif ultrabasique des Béni Bousera, lherzolites, pyroxénites, subsolidus.

Using the soil water balance for evaluation of deep percolation in drip/ flood irrigated citrus orchards in the Haouz plain (Tensift Basin, Morocco)

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In the semi-arid Haouz plain, located in the central Morocco, agriculture still uses tremendous amount of water and consumes about 85% of the available water resources. Therefore, accurate management of irrigation water is important to avoid both the water lost by direct soil evaporation and by deep percolation (DP) below the plant root zone. Estimating or measuring water demand (evapotranspiration) has been investigated by many studies in the Haouz plain, but DP has not been quantified yet in this area. It is one of the most important hydrological challenges in analyzing irrigation efficiency and understanding the potential contribution of irrigation returns to groundwater. Direct measurements of DP are difficult in both time and space. Therefore DP from irrigation is often indirectly estimated using the water balance equation. In this work, an orange site with drip irrigation technique was studied. DP was estimated by the water balance and then compared with the direct measurements of a flux-meter installed beneath the root zone. The results showed that the variation of DP is the product of the combination of three factors: water supply, evapotranspiration and the changes in the soil water storage, recording an average value of DP (about 15 mm/week) when the precipitation was absent. Unlike, when there is a heavy rainfall the DP value is greater than (40 mm/week). The direct method (flux-meter) is used to validate the calculated DP, an overestimation of this parameter is recorded using water balance equation because this method does not consider the rainfall interception and runoff during the heavy precipitations.

Keywords: Deep percolation, semi, arid region, irrigation return, precipitation, evapotranspiration, water balance, flux, meter

Radiocarbon marine reservoir corrections on the Brazilian coast and their implications to the considered region

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Knowledge of the radiocarbon marine reservoir effect (MRE) is essential to allow accurate radiocarbon dating of marine material. This effect can vary greatly over time and space, which makes its quantification a complex task. There are available data for many locations around the world but these data are not equally distributed and some regions are poorly understood. In order to support radiocarbon research on the Southwest Atlantic (SWA) coast, we continue to improve estimates of ΔR corrections for the Brazilian coast (Alves et al., 2015a,b; Carvalho et al., 2015; Macario et al., 2015). For this work, we are radiocarbon dating pre-bomb known-age shells from the malacological collection of the Zoology Museum of the Universidade de São Paulo (MZUSP). The conventional radiocarbon ages of the shells are being determined independently at the Radiocarbon Laboratory of the Universidade Federal Fluminense (LAC-UFF), in Brazil, and at the Oxford Radiocarbon Accelerator Unit (ORAU) of the University of Oxford, in the United Kingdom. Results will be compared and correlations between the MRE calculated and the marine conditions of the considered region will be made.

Alves, E. et al. 2015. Radiocarbon reservoir corrections on the Brazilian coast from pre-bomb marine shells. *Quaternary Geochronology* 29, 30-35.

Alves, E. et al. Marine reservoir corrections on the Southeastern coast of Brazil: paired samples from the Saquarema Shellmound. *Radiocarbon* (in press).

Carvalho, C. et al. 2015. Potential use of archaeological snail shells for the calculation of local marine reservoir effect. *Radiocarbon* 57, 459-467.

Macario, K. et al. 2015. Marine reservoir effect on the Southeastern coast of Brazil: results from the Tarioba shellmound paired samples. *Journal of Environmental Radioactivity* 143, 9-14.

Keywords: radiocarbon dating, ocean dynamics, shells, mollusca

The Devonian palynology of the Iberian Peninsula: current state and future goals

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This communication aims to reflect the current state of the studies carried out in the Iberian Peninsula about the Devonian palynostratigraphy. From this, we pretend to reflect the discontinuous (and timely) development that they have had over the last 60 years. Classically, the datation of macroflora deposits have been done according to stratigraphic correlations of equivalent sea levels, whose time assignment has been made on the basis of marine microfossils as e.g. conodonts and/or ostracods. However, recent results from the Iberian Peninsula have shown that these levels have sufficient pollen records to be dated by palynostratigraphy. Three are mainly the regions that have developed most of the studies: (1) Ossa-Morena in Portugal, (2) the Cantabrian Zone -north of the Palencia province- and (3) the Aragonese branch of the Iberian range. These studies demonstrate (1) the importance of this region and (2) represent an inter-

esting starting point to understanding the process of geotectonic reconstruction, which together with plant megafossil data, allow accurate paleoenvironmental reconstructions. According to this, we propose here the re-study of the known plant-bearing fossil sites from a palinological viewpoint, as well as the sampling of the previously described levels, but which age is only based on the marine invertebrate fossil evidence. A readjustment of the regional biozonation is discussed. Acknowledgements: B.C-M. is supported by a Marie Curie COFUND Postdoctoral Fellowship from the University of Liege (grant number: 600405)

Keywords: Devonian, Iberian Peninsula, Palynology, Marine invertebrate, Stratigraphic correlation

SEM study on well-preserved fossil soft tissues to identify physical biomarkers of biofilm decomposing activities

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Microbial activity is the most important factor of decay and decomposing of organic tissues. It is actually assumed obvious, by uniformitarianism, even can be found on fossilized specimens. Recent studies recognized association of microbes, biofilm, as major cause of decay of organic tissues in marine environments. Just after death, symbiotic microbes, initiate the firsts decomposing stages, sharing EPS increasing resistance and speeding up chemical decay. The aim of this study is to identify physical biomarkers of these activities by SEM analyses. The analyses were performed in Bologna on abdominal, cartilage and dermic tissues samples collected from Bolca shark exposed at Museo Geologico Giovanni Capellini, *Galeorhinus cuvierii*. These observations allowed to identify diverse pattern of fungal morphologies. Preliminary results allow to discriminate morphologies that share similarities with those described in the literature including (1) twisted strains (*ca.* 200 μ m in length) which at one end lays on ctenoid dermal scales while the other end enter right in the substratum; (2) branched filaments (less than 1 μ m in diameter for more than 100 μ m in length) in the stomach and intestine contents, and 3. spherules (*ca.* 2 μ m) and casts of spherules from pelvic cartilages.

Keywords: SEM, fossil, decomposing biofilm, fungi, hyphae

Physico chemical assessment of groundwater pollution and soil quality in agricultural zone: the case of Agafay Farm-Western Haouz, Morocco

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The irrigated perimeter of the Haouz plain is one of the largest in Morocco with 310000 Ha with intense agricultural practices

based on irrigation. Besides, recent studies have shown that the aquifer is characterized by an overall average to low sensitivity and vulnerability (Sinan, 2003). Based on that, this study represents an analysis of current situation of the soil quality and the water irrigation in an irrigated area (Agafay Farms), located in the western part of Haouz at 35 km SW of Marrakech. The purpose of this study is mainly based on the analysis of physical-chemical parameters of soil and aquifer, the variation of these parameters and their impact on the type of rootstock and the variation of pollutants through the different soil horizons. The physico-chemical analysis of the soil revealed that the condition of the soil quality is not very alarming, with relatively low organic matter content, the soil is characterized by a light texture, showing a dominance of the sand fraction. The pH has an alkaline trend. The study of the vertical organic material distribution, the electrical conductivity, orthophosphates and nitrates in soils, showed in general a decrease in amounts of these elements with depth except for pH, and total limestone, which shows an increase with soil profile depth. The analysis of 30 samples covering the study site shows that all groundwater for agricultural use, are characterized by moderately high salinity. A regular monitoring and rationalization of water use (N'fis dam waters, river water and groundwater), is necessary for sustainable exploitation in these irrigated areas.

Keywords: Groundwater, soil, farm, physico, chemical quality, agricultural intensification

Morphological variations of peacock wrasse (*Symphodus tinca*) populations along the Tunisian coast

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Species of Labridae family constitute an important component of the Atlanto-Mediterranean ichthyofauna. They represent, despite of their low market value, an essential link of the trophic chain in coastal environments. They contribute indirectly but significantly in the halieutic production of fishes with an important economic value. *Symphodus tinca* (Linnaeus, 1758) is one of Labridae species which show a short pelagic phase (9-13 days). Adults are benthic, they spawn in inshore waters and remain within spawning grounds. Furthermore, the Tunisian coasts occupy a strategic position in the Mediterranean Sea. They are opened to the western basin by the North-eastern facade and to the eastern basin via the South-eastern sector. The morphological variation of seven samples of peacock wrasse collected along the Tunisian coasts were studied using a geometric morphometric approach. Models of body-shape variation in geographic space into a sequential hermaphrodite marine species were explored basing on procrustes superposition method. The coordinates in the space of 22 landmarks of 210 adults were used to define the morphological data. A discriminant analysis was performed and showed significant differences between two groups. The first one was formed of North-eastern samples (Sidi Rayes and Bizerta), belonging to the Western Mediterranean basin. The second group was constituted of South-eastern samples (Mahdia, Sfax, Skhira, Kerkennah Island and El Kef) belonging to the Eastern Mediterranean basin. The

morphological differences highlighted were linked to the body height. This divergence in body-shape seems to reflect the heterogeneity of cabled environments. They can, also, be the consequences of eventual genetic differences in *Symphodus tinca* species along the Tunisian coasts. In fact, the Siculo-Tunisian strait, acting as a physical barrier, added to the eco-biological characteristic of this species (duration of the larval stage, sedentary), can lead to limited gene flow.

Keywords: *Symphodus tinca*, geometric morphometric, Tunisian coasts, Siculo, Tunisian strait

Knowledge of water potentials in Bleida region by the method of the Magnetic resonance sounding

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Morocco's water resources are facing challenges of rarefaction. Our study area, which is the Bleida region belonging to the but-tonhole Bou Azzer in the Anti-Atlas, is not immune to this phenomenon. Indeed, the climate is semi-arid and water resources both ground and surface are so limited, on the one hand, due to the fractured nature of the terrain and on the other hand due to the progressive succession of drought years. Facing this problem, a knowledge of water potential should be conducted to require the development of an adequate exploitation plan at this region. This knowledge is only possible through a non destructive geophysical method which is magnetic resonance sounding (MRS). The fractured aquifer of Bleida is not well studied, it is true that it was the subject of several geophysical studies, but his characterization was up for mining purposes. This study purpose the application of magnetic resonance sounding to provide answers to the questions relating to the issue of water resources. Its aims the identification of areas favorable for the establishment of productive hydraulic drilling. To this goal, eight surveys of magnetic resonance sounding were conducted at two sites, separated by 290 meters, to the intersection between the faults, the results of this recognition are:

- The first site showed a saturation of up to 14% in the first eight meters, explained by the drained water from the dam. Saturation decreases further by going in depth.
- The second site showed a maximum of 6% saturation levels ranging between 50 meters and 71 meters.

Both sites investigated are separated by a river show the same degree of saturation in the same levels. Finally we were able to raise the reliability of the RMP method in presence of the boundary conditions of its use by correlating the results of surveys with existing boreholes.

Keywords: Anti, Atlas, Hydrogeology, Magnetic resonance sounding, water resources, water potentials, saturation

Keywords: SEM, fossil, decomposing biofilm, fungi, hyphae

First bird footprints from the lower Miocene Lerín Formation (Ebro Basin, Iberian Peninsula): ichnotaxonomy and palaeoecology

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In this work it is described a new tracksite with bird footprints, found in the Bardenas Reales de Navarra Natural Park (Navarre, Spain). The footprints are preserved in four sandstone blocks of the Lerín Formation from the northwest sector of the Ebro Basin. These are the first bird fossil footprints discovered in this Formation. According to the magnetostratigraphic data, the age of these blocks is 20.4 Ma (Agenian, lower Miocene). The footprints are large (more than 100 mm), mesaxonic, tridactyl, with a prominent central pad impression and with the digit impressions not jointed proximally. These features allow classifying them as *Uvaichnites riojana*, which is related with trackmakers belonging to Gruidae family. This ichnotaxon has been cited previously in other locality of northwest sector of the Ebro Basin (Cenicero, La Rioja), and some footprints found in China are very similar to this ichnotype. These three localities with bird footprints affined with *Uvaichnites* are related to a specific age, latest Oligocene-earliest Miocene (from ~23 to 19.9 Ma), and have been found in similar continental environments, alluvial and deltaic systems.

Keywords: bird fossil footprints, *Uvaichnites riojana*, early Miocene, Lerín Formation, Ebro Basin, avian diversity

The structural study of mineralization in the southern part of the north orebody of the polymetallic Hajjar deposit (Morocco)

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In the southern part of the northeast of the Hajjar orebody, we report orientations of the various mineralized lenses intercepted by core drilling carried out in the area. Based on lithostructural

studies of samples, the mineralization is hosted in metapelites of Visean age, with hydrothermal alteration at the base marked by abundant chlorite. The orebody is located at the northeast part of a sinistral system of Hercynian structures. These structures are locally cut by older faults. The mineralization is parallel with stratification and has a very low dip to the northeast. This alignment shows that the depositional paleo-environment was very stable and consequently was a favorable zone for mineralization. It is recommended to conduct exploration northeast of the E-W orientation in order to evaluate the extent of mineralization and further mining operations.

Keywords: Hajjar mine, massive sulphide, eastern Meseta, Morocco

Contribution of mountain streamflow to the groundwater recharge in Piedmont alluvial plain: the Rheraya Wadi case study (Marrakech, Morocco)

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The Haouz basin, located in the Central Morocco, is composed of two parts: the Haouz plain which contains the Marrakech city in the north and the High-Atlas mountains culminating at 4165 m in the South. The plain, covering a surface of 6000 km², has a semi-arid climate characterized by low rainfall (126-250 mm/year) and high evaporative demand (126-1400 mm/year). The High-Atlas mountains receive more important precipitation either as rain or snow falls and encompasses the drainage basins of several intermittent streamflows (wadis) that cross the plain from south to north. Therefore within the Haouz basin the water resources have two main components: the wadis fed by mountain rain and snow fall, and groundwater contained in the alluvial deposits of the plain. The mountains, constituted mainly by impermeable material, generate flash floods. When reaching the piedmont alluvial plain, the more important floods flow onto the floodplains and are partially derived for traditional irrigation. The seepage losses in this area might be an important source of groundwater recharge. The present study aims to evaluate these losses along the Rheraya, one of the main wadis of the Haouz basin. This is performed in several steps: (1) Conceptual modeling of the wadi's flows at a daily basis; (2) Several sampling campaigns of groundwater, surface water and rainfall, for hydrochemical and stable isotopes analyses. The sampling was performed along the Rheraya wadi from the mountain valley to the piedmont, and from sites within the irrigation area. Results of the hydrologic conceptual modeling allow assessment of the role of the snow melt in the hydrological functioning of the Rheraya wadi. In order to estimate the Rheraya streamflow losses to groundwater.

Keywords: Groundwater, Recharge, Piedmont alluvial plain, hydrochemical, Haouz.

EVOLUTIONARY ECOLOGY

Insight from shell proteome: biomineralization to adaptationJaison Arivalagan^{1,2}, Sophie Berland¹, Arul Marie²

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Although the bivalve shells are composed of more than 95% calcium carbonate, the shell matrix proteins (SMPs) (1-5%) embedded in the shells play a vital role in nucleating, arranging and shaping these calcium carbonate crystals. From earlier today, many SMPs were identified from different species and their possible roles in biomineralization were discussed. Our previous study in *Mya truncata* shell revealed SMP's roles beyond shell formation i.e. immunity, cell signaling and etc. (Arivalagan J et al, 2015). In this work SMPs from shells of *Mya truncata*, *Crasostrea gigas*, *Mytilus edulis* and *Pecten maximus* were identified and compared. Interestingly, like *M. truncata* SMPs, other three bivalve shells also possessed SMPs with diverse functions beyond biomineralization :

- domains ruling for calcification mechanism remained common in all four models (e.g. carbonic anhydrase, chitin binding, tyrosinase), which may be classified as evolutionary sustained control proteins in calcium carbonate calcifying systems regardless of the crystalline lattice.
- domains homologous to EGF, WAP and FN3 were shared among the species, which had either complete or partly calcite microstructure in their shells and were absent in aragonitic shells. *M. truncata*, the most early divergent branch among the four models shared only very few domains with the other three species, those are closer on the evolutionary scale.
- most of the species-specific domains are related to immunity or cell signaling which may imply adaptive response to different threatening environment, predators and pathogens of the species.

The shells of the four model species exhibit the same trend in having different class of SMPs. But the difference in the proteins constituting each class may have relevance to plasticity and can be attribute to adaptation by these organisms to their environment.

Keywords: Biomineralization, Shell Matrix Proteins, Biological Control, Functional domains, Evolution, Adaptation

The stasis that wasn't: Adaptive evolution goes against phenotypic selection in a wild rodent populationTimothée Bonnet¹, Erik Postma¹

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Natural and sexual selection almost universally favour larger individuals, and body size is typically highly heritable. Nevertheless, while species tend to get larger over geological timescales, conclusive evidence of a contemporary evolutionary response to selection remains elusive for wild animal populations for body size or any other fitness-related quantitative trait for that matter. Here we apply a comprehensive analytical framework to long-term individual-based data from a wild rodent population, showing that despite phenotypic selection for being heavier, animals have evolved to become lighter, and that this change is adaptive. We show the positive selection on mass to be driven by a non-heritable trait related to both mass and fitness, while the evolutionary change toward smaller individuals is an adaptive response to viability selection occurring during ontogeny. This response is associated with a climatic shift which reduced the length of the snow-free season. While we show that models based solely on estimates of phenotypic selection may thus be overly simplistic and not predictive of the rate and direction of evolution, natural populations can show a rapid and adaptive but easily missed evolutionary response. Therefore, contemporary adaptive evolution may be more common than is often believed.

Keywords: Climate, Evolution, Fitness, Rodent, Selection, Stasis, Wild population

Relative importance of ornaments on mating success and paternity in Collared FlycatchersAnais Edme¹, Milos Krist²

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Extra-pair copulation is a common behavior for monogamous birds. Males gain a fitness advantage by gaining extra-pair offspring without expending resources on paternal care. The advantage for females, if any, is less obvious and still debated. Due to differential reproductive investment, females are generally very choosy of their social partners and we expect they may be also choosy for extra-pair males. Usually, females use secondary sexual ornaments to compare and select the best social and extra-pair partners. To evaluate female choice of both social and extra-pair partners, we modified the size of the forehead patch, a secondary sexual ornament, in the collared flycatchers (*Ficedula albicollis*). We expected that females would prefer males with an increased ornament, to males with a reduced ornament, as both social and extra-pair mates. In contrast with these expectations, our results do not indicate that the size of the patch influences either paternity or extra-pair paternity.

Keywords: extra, pair paternity, selection, genetic benefits

Scent-marking behaviour in a solitary and non-territorial species in the Pyrenees: the brown bear, *Ursus arctos*

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Scent-marking behaviour is a relevant indirect communication strategy for large carnivore species using large area at low population density. Scent-marking behaviour is not species-specific but rather adaptive to social organization and environment. Thus, several hypotheses for the functions of this behaviour have been put forward such as territory defence and mate attraction, which have been mostly studied in rodents and in social and territorial species. Besides studies on the giant pandas, there are few studies about the functions of scent-marking behaviour in free-ranging solitary and non-territorial species. The brown bear, *Ursus arctos*, a solitary and non-territorial species with a polygamous mating system and a hierarchical organization, faces conservation problems in the Pyrenees (France and Spain) with a minimum of 31 individuals detected in 2014. The study was made on camera-traps' series of videos and pictures facing rubbing trees from 2010 to 2014. Three hypotheses were evaluated for the functions of scent-marking behaviour in brown bears: 1) Attraction of mates by self-advertisement, 2) Communication of dominance and competitor assessment, 3) Comfort. The analysis was conducted through multimodel inference with generalized linear mixed models. Thus, scent-marking communication strategy in the Pyrenean brown bear population seems to be mostly aimed at intra-sexual competition. Intra-male communication would be aimed at guarding females during the mating season and at settling agonistic interactions during the non-mating season. Intra-female communication might be aimed at settling home ranges mostly during the non-breeding season. In further studies, it will be important to correct models with the home range sizes of bears, known to show seasonal variations as well.

Keywords: brown bear, carnivores, scent marking, communication, conservation behaviour

Does greater specific-leaf-area plasticity help plants to maintain a high performance when shaded?

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It is frequently assumed that phenotypic plasticity can be very advantageous for plants, because it may increase environmental tolerance. This should, however, only hold for plastic responses

that are adaptive, i.e. increase fitness. Numerous studies have shown shade-induced increases in specific leaf area (SLA), and there is wide consensus that this plastic response has to be adaptive. However, it is not known whether this is really the case. In order to identify whether SLA plasticity does increase shade tolerance (i.e. maintenance of high biomass) of plant species, we employed a meta-analytical approach. Across 280 species and 467 individual studies from 32 publications and two unpublished experiments, plants increased their SLA by 55.36% on average when shaded, while they decreased their biomass by 59.93%. In contrast to our expectation of a positive relationship between SLA plasticity and maintenance of plant's biomass, our results indicated that species with greater SLA plasticity were less able to maintain biomass under shade. However, species with a high SLA under high-light control conditions showed a significantly greater ability to maintain biomass under shade overall. This implies that plasticity in the ability of plants to capture more light under low-light conditions by increasing SLA does not contribute to shade tolerance of plant species. Therefore, we argue that some of the plastic changes that are frequently thought to be adaptive might simply reflect passive responses to the environment, or result as by-products of adaptive plastic responses in other traits.

Keywords: Adaptive, Functional traits, Phenotypic plasticity, Shade environment, Shade tolerance, Specific leaf area

Sensorial adaptations in deep hydrothermal shrimp : comparison of sensory abilities of hydrothermal shrimp *Mirocaris fortunata* and coastal species *Palaemon elegans*

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Deep hydrothermal vent constitute habitats spread along oceanic ridges, with particular physico-chemical conditions, and are colonized by an endemic fauna which depends on hydrothermal fluid emissions for its trophic inputs. The sensory faculties of hydrothermal species may play a major role in their life cycle, dispersion, maintenance and long-term evolution, but were overall little studied.

Alvinocarididae shrimp are abundant on mid-Atlantic ridge hydrothermal sites, and the processes involved in the detection of the environment in absence of light, in order to locate food, fluid emissions or for colonization of new sites, are still unknown. A potential attractant commonly accepted is the chemical composition of the hydrothermal fluid. In decapods, the chemoreceptor neurons located in the antennules are responsible for the primarily mediate responses to odorant chemicals. We investigate the chemosensory abilities of the hydrothermal shrimp *Mirocaris fortunata*, in relation with its special habitat, via a multidisciplinary approach, with morphology, behavior, electrophysiology and molecular biology studies. Behavior experiments allow to determine the detection capacities of environmental stimuli such as fluid components. An additional approach in electrophysiology aims at testing which odorant stimuli are detected by the chemoreceptor neurons in the antennules. Finally we use molec-

ular biology to identify and locate chemoreceptors in sensorial organs. The related coastal shrimp *Palaemon elegans* is used for comparison, to discuss eventual adaptations of hydrothermal shrimp, for the optimization of the methods, and to better understand olfaction in shrimp among Crustaceans.

Keywords: deep sea, hydrothermal shrimp, coastal shrimp, chemoreception, olfaction, electroantennography

The inprints of continental drift and evolutionary convergence on the composition and functional structure of mammal biodiversity worldwide

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The complex structure of present-day geographical distribution of species and lineages has long fascinated naturalists. These distributions are considered to be shaped by present climatic conditions but also historical legacies. Here, we investigate the impact of these two processes on the distribution of extant mammal lineages by decomposing regional species compositions along a phylogenetic scale. While climate appears to better explain composition of recent lineages (e.g. species), geography better predicts deep lineage composition (e.g. genus or families). This could suggest that historical biogeography impacts the distribution of deep lineages while environment selects for finer differences. We further show that the impact of geography on the distribution of deep lineages (e.g. genus or families) is shaped by historical proximity between landmasses rather than present landmass configuration. In particular, Australia harbors a very unique fauna at all phylogenetic scales because it has been isolated over the course of the Cenozoic. We may expect this fauna to show extensive evolutionary convergence if natural selection has been an important process for mammals evolution. By comparing observed functional traits diversity with evolutionary neutral expectations, we show that this Australian fauna harbors extraordinary levels of evolutionary convergences at the scale of entire biotas.

Keywords: phylogenetic diversity, dispersal, vicariance, mammals

Variability in foraging behaviour of red-footed boobies throughout their range

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Tropical waters are known to be less productive than temperate and polar waters, with an heterogeneous distribution of resources. Due to these conditions, marine predators may use particular foraging strategies to minimize costs associated with more dispersed resources and low-quality foraging area. Here we study the foraging behaviour of a pan-tropical seabird, the red-footed booby, in relation to the environment. Adults from 5 different sites were fitted with GPS tags during the incubation stage, leading to a total of 202 tracks from 125 birds. Each track was clustered in 4 behaviours, depending on the speed and the turn between each location, using the EMbC algorithm (Garriga et al., 2015). A potential link between the chlorophyll concentration (a classical proxy of the water productivity) and areas where the birds were intensively foraging was also investigated. We show that red-footed boobies use different global foraging strategies according to the site, with daily trips in some sites and long trips with nights at sea in others. However, they seem to all have the same behaviour distribution during the day, and also at finer scale during intensive foraging. Finally, no clear link between prospected zones and chlorophyll concentration was found. Since that the chlorophyll concentration doesn't seem sufficient to explain the foraging behaviour, an alternative hypothesis could be the inter-specific and intra-specific competition which differs greatly among studied islands.

Keywords: seabird, tropical, foraging, behaviour, gps, spatial, red footed booby

Combining stable isotopes and tooth microwear to reconstruct feeding ecology : preliminary results for a living population of wild mandrills

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Diet composition depends on numerous biotic and abiotic factors such as seasonality or feeding strategies. Although those factors are much studied on living species, they are difficult to decipher on extinct ones because we only have access to indirect information coming from inert material (bones or hairs). Ratios of stable isotopes retrieved from biological tissues and tooth microwear are often used as proxies of feeding ecology. Indeed, they provide individual information about the relative proportion

of C3- and C4- plants ($\delta^{13}\text{C}$), trophic level ($\delta^{15}\text{N}$) and food abrasiveness (dental microwear). They also correspond to different time scales: hair growing period corresponds to a monthly diet; blood plasma gives a snapshot of food items consumed during the last 1-2 weeks. Besides, information retrieved from dental microwear turnover seem to be different regarding the tooth surface analysed (occlusal versus buccal), indicating diet over the past days to months. This study focuses on a wild population of mandrills (*Mandrillus sphinx*), currently living at the Lékédi Park in Gabon, combining stable isotopes and tooth microwear analyses. Hair and blood samples along with in vivo dental molds have been collected during annual captures that occurred in 2012-2014. We show effects of both individual and environmental variables on these diet proxies. Seasonal changes are visible on isotope signatures of hairs and blood plasma, but also in buccal enamel. Moreover, individual age and hierarchical position are suggested to affect feeding preferences and/or access to food resources. These results underline the need to consider environmental data in a paleontological context before inferring a diet to extinct species. They also comfort the interest of combining different proxies for feeding ecology, to get information at different time scales. Ratios of stable isotopes and microwear patterns are promising tools for diet reconstruction of living species when behavior is challenged by field constraints.

Keywords: feeding ecology, mandrill, stable isotopes, tooth microwear, Gabon

Can sex prevent extinction?

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An organism faced with extinction can adapt to conditions lethal to ancestors, which is termed “Evolutionary rescue”. A recent study indicates that sex increases a chance for survival in a gradually deteriorating environment, but will the effect be the same if the change becomes too severe? We are performing a selection experiment with a unicellular alga by manipulating the rate of environmental deterioration (increasing salt concentration) and mode of reproduction (asexual and sexual populations) in order to address this question. The results to date show that mean growth of sexual lines decreases slower compared to asexual lines, and the effect of sex becomes more advantageous as the rate of environmental deterioration increases.

Keywords: Evolutionary rescue sex environment deterioration

From public to private goods: the interplay between ecology and the evolution of siderophore production

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dom

Microbes often live in dense communities: the way they modify their local environment is likely to affect the growth of neighbouring cells, that can be clones or belong to other strains. Such environmental modification can occur through basic metabolism, as in the consumption of a shared resource - inducing exploitative competition, or by increasing the availability of a limiting resource, such as iron. In the context of iron limitation, some bacteria can release siderophores, which bind the otherwise insoluble iron. Siderophore production is an example of microbial cooperation: they are costly to produce and once released, they can be captured by all cells in the vicinity given they possess the adequate receptor. Hence the production of siderophores has been extensively studied in the field of microbial sociobiology. However, there is still a debate regarding the status of siderophores, that can be both cooperative and competitive depending on the ecological context. In this theoretical study, we explore the interplay between the evolution of siderophore production and the ecology of microbes, more specifically the strain diversity, iron availability, resource supply. We consider siderophores on a continuum from public to private goods. We first set siderophore production as constitutive, then study its regulation as part or iron homeostasis. We show that siderophore production highly depends on the ecology of microbes, and link our results to different experimental studies.

Keywords: microbial ecology, evolution of cooperation, competition, siderophores, regulation

Parasites affect the ecological coexistence and stability of predator-prey species, as well as the evolution of predator foraging

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Parasitism is known to play an important role in the dynamics of ecological networks and to be very frequent in all networks. Nevertheless, consequences for the structure and stability of natural communities are still unclear. In this study, we explore how parasitism may affect the ecological dynamics in a two-prey-one-predator module, as well as the evolution of predator foraging strategies. We show that the effects of parasitism on trophic dynamics depend how parasites affect the life history and interaction traits. We distinguish virulent parasite (effects on the basic growth rate of the infected prey) from parasite that manipulate their host (thereby increasing the trophic interaction, i.e. increasing the vulnerability to the predation). Considering evolution of predator diet, we constrain it by a trade-off (concave or convex) between the two prey. Virulent parasites infecting prey species reduce coexistence while manipulative parasites promote it. Stability of ecological dynamics is often reduced. Allowing for the evolution of the predator foraging frequently facilitates system coexistence. Nevertheless, the trophic structure observed at evolutionary equilibrium varies greatly depend-

ing on the type and intensity of parasitism. We either obtain a specialist predator or observe a diversification of predator strategies, leading to the coexistence of two specialist predators (each predator preys on each prey). Generalists may only be obtained in the case of concave trade-offs. Finally, we discuss how these qualitative results, in term of ecology (structure and stability) and evolution (predator foraging strategy) will be testable by an experimental approach.

Keywords: Ecoevolutionary model, adaptive foraging, parasitism, coexistence, resilience

High mutual sexual selection affects survival in bird communities

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Natural and sexual selection have an antagonistic effect. Indeed, sexual selection can result in the evolution of exaggerated costly sexual advertisements which could be deleterious regarding to the natural selection. It has been shown that individuals in population under strong sexual selection pressure show increasing predation and parasitism risk. Promislow et al (1992) showed that dichromatic species (for which sexual selection is supposed to be stronger) had lower survival rate than monochromatic. Thus, sexual selection may be susceptible to influence extinction rate whose understanding is a major goal in conservation. Doherty and coworkers (2003) have tested the prediction that local extinction rates should be higher for species in populations with intense sexual selection. Despite an interesting progress on the issue, one strong limitation of this study as well as most of the past works comes from the fact that sexual selection has traditionally been considered to act mostly on males. Here, we wondered whether species with high intensity of sexual selection had more probabilities to locally become extinct and if consider mutual selection between males and females could affect the results. We estimated local extinction probabilities (one per species in order to consider phylogeny) for 106 species of birds living in 5 states of the USA by patch occupancy models thanks to 20 years of presence/absence data collected by the BBS (breeding bird survey). We tested if extinction probabilities were correlated with sexual selection intensity estimators. We founded that interaction between sexual selection intensity and geographic range of the species (inside or edge) explicated local extinction probabilities for males and females. In particular, we founded that dichromatic species had significantly higher chances of becoming locally extinct compared with monochromatic birds. Results were similar between males and females and suggested that females are under selection pressure as well as males.

Keywords: extinction, dichromatism, sexual advertisements, population dynamic, site occupancy

Cytotype distribution patterns in the diploid-polyploid complex *Veronica* subsect. *Pentasepalae*: evidences of ecological differentiation?

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Hybridization and polyploidization are important evolutionary mechanisms in angiosperms. Although several studies have been focused on the causes and consequences of genome duplication, little is known about the influence that ecological conditions may have on the distribution of cytotypes. Alpine and arctic floras have been reported to have high frequencies of polyploids and therefore polyploids are considered to be more frequent at higher latitudes and altitudes. However, this has never been tested in a group of closely related species at a European scale. Here, we want to evaluate the relationships between environmental conditions and the distribution of cytotypes of the diploid-polyploid complex *Veronica* subsect. *Pentasepalae*. Flow cytometry combined with confirmatory chromosome counts was used to determine ploidy levels in 207 populations from 16 species belonging to *Veronica* subsect. *Pentasepalae* (664 individuals), across a range of more than 3 million km². Environmental variables related to temperature, precipitation, slope, soil, vegetation, sun radiation and human footprint were obtained for each sample locality. Ecological differentiation among ploidy levels was tested by performing univariate and multivariate analyses. Diploids are preferentially distributed at low latitudes (S Europe), where precipitation is lower during the warmest and driest quarter and temperature is higher than at high latitudes. A relationship with the Mediterranean region and areas of low vegetation coverage has been found. Conversely, octoploids are more frequent at high latitudes (N Europe), where precipitation is higher during the warmest and driest quarter and temperature is lower than at low latitudes. They occur in the alpine and continental regions and in areas of high vegetation coverage. Hexaploids are distributed in E Europe, in areas where the temperature seasonality is higher and the isothermality is lower than in those occupied by other cytotypes. A relationship with the continental region and areas of high vegetation coverage has also been found.

Keywords: Cytotype distribution, ecological differentiation, Europe, flow cytometry, ploidy level, polyploidy, *Veronica* subsect. *Pentasepalae*

Landscape change promotes population differentiation at a small geographic scale

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Landscape change can expose individuals to rapidly changing conditions, and thus may accelerate phenotypic divergence among populations. However, the spatial scale at which phenotypic change can occur remains poorly understood. Here, we used a 5-year (2008-2012) database to examine morphological differentiation and site fidelity of red-necked nightjars (*Caprimulgus ruficollis*) breeding in two nearby (10 km) habitats subjected to contrasting management practices: a mosaic landscape of cattle-grazed pastures and tree plantations and a protected reserve where human access and activities are restricted. We also quantified the potential foraging opportunities for nightjars at both sites, measured by aerial prey abundance, availability of foraging habitats and their proximity to nesting sites. Nightjars were not randomly distributed with respect to morphology. Breeding birds from the managed area were significantly larger (keel length) than those from the natural reserve, whereas there were no differences in wing or tail length. No individual (out of 1,130 captures overall) moved between habitats over the study period, indicating strong site fidelity. Food availability was similar in both habitats, but the availability of foraging sites and their proximity to nesting sites were found to be highest in the managed property, which likely translated into enhanced access to food in the latter area. Taken together, our results suggest that landscape change underlines the observed fine-scale variation in nightjar morphology, since the increased proximity between foraging and nesting sites in the managed area leads to increased food intake and growth rates of nestlings and, as a result, they likely attain larger adult sizes in relation to those in the natural site. High site fidelity probably contributes to maintain the body-size differences between the two habitats. These results come on top recent studies highlighting the role of habitat alteration by humans in promoting population differentiation, even at very small spatial scales.

Keywords: Human, induced environmental change, Morphology, Phenotypic divergence, Philopatry, Population differentiation

Inference by exclusion in Red-tailed Black cockatoo (*Calyptrorhynchus banksii*)

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Inference by exclusion is the ability to select a given option by excluding all others. Over the past decade, this ability has been studied in many non-human species, including avians. As inference by exclusion is considered cognitively challenging, testing has mainly been conducted in birds known for their intel-

ligence, such as corvids and parrots, but disparate results have been found between the species. Several hypotheses have arisen to explain those differences, including discussions of differing levels of intelligence and evolutionary theories that relate to the higher success of those species that catch their food. The "adaptive specialization hypothesis" proposes that the ability to reason by exclusion may have only evolved in food-catching avian species, such as corvids. However, recent studies with parrots suggest that the differences observed between corvids and parrots may be due to the details of the methodology employed. To provide more comparison elements, this study investigated exclusion performances in Red-tailed Black cockatoos (*Calyptrorhynchus banksii*). Cockatoos were tasked with finding a food item hidden in one of the two experimenter's hands. In order to test if cockatoos were able to choose by exclusion, three test subjects were first presented with the contents of a) both hands, b) no hands, c) the baited hand only or d) the empty hand only. All subjects succeeded at retrieving the reward regardless of whether they were given full or partial information about the food location. Subjects chose at random when they were not given any information about the food location (the "no hand opened" condition). These results support the hypothesis that Red-tailed Black cockatoos are able to perform inference by exclusion, and suggest that previous differences observed between corvids and parrots are methodology dependent.

Keywords: animal behaviour, cognition, avian cognition, inference by exclusion, cockatoo

Costly cognitive processes in a context of low food availability: Link between body condition and cognitive performances in a primate under acute caloric restriction

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Cognitive abilities are defined as an organism's aptitude at perceiving, memorizing and using information extracted from the characteristics of its environment. In the context of a rapid decrease in food availability, individuals have to maintain costly cognitive abilities to adapt under low energy intakes. In this study, we tested the impact of a 40% caloric restriction on the cognitive abilities of the grey mouse lemur (*Microcebus murinus*). Twenty-eight male mouse lemurs were allocated to two groups. Fourteen control animals (CTL) fed with 105kJ/day and fourteen restricted animals (CR) receiving 40% less food (63kJ/day) than the CTL. The animals were fed according to their treatment for 19 days. Before treatment, we assessed their baseline spatial and associative learning capacities as well as their resting metabolic rate and locomotor skills. After 14 days of treatment, we tested the same components as well as their long-term memory. Our results showed that CR individuals had lower learning abilities following restriction (success rate for session 1 learning: $44.1 \pm 16.8\%$, success rate for session 2

learning task: $27 \pm 18.7\%$), whereas long-term memory and spatial learning capacities were not affected. However, body mass loss was linked to CR individuals' memory test performances, as the individuals losing the more weight were the unsuccessful ones. The negative impact of CR on learning occurred with improved locomotor capacities and a higher rest-

ing metabolic rate. Our data suggest that in the context of food shortage, learning and memory capacities could be a limiting parameter in the adaptation to a changing environment.

Keywords: Caloric restriction, cognition, learning, memory, body mass loss

METHODS IN NATURAL SCIENCES

Repeatability of evolution in evolutionary experiments

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In recent years evolutionary experiments have advanced our understanding of adaptation. Here we present systematic literature review of one of the general patterns concerning this essential evolutionary process: repeatability. We searched the literature for articles describing evolutionary experiments (tracing evolutionary processes in populations introduced to novel environments) and analyzing the impact of three major factors shaping evolution:

- Adaptation – the influence of selection implemented in the experiment, measured as change in the studied traits in response to selection imposed by novel environmental conditions.
- History – the impact of population's past on present evolutionary process, measured by differences in evolutionary outcomes between lines genetically different at the onset of the experiment.
- Chance – the influence of random effects (random occurrence of mutations, genetic drift), measured by comparing evolutionary outcomes between replicates.

Based on our findings so far, most articles report evolutionary experiments conducted on unicellular organisms; new food sources and thermal stress are most often used novel environment types; and fitness, metabolic phenotypes, growth rates, mutation-bearing genes, nucleotide changes are often investigated traits. Repeatability can thus be quantified on different levels. A general pattern can be found that along with decreasing organization level, repeatability decreases. We found that relative roles of adaptation, history and chance depends on additional factors, which include: strength of selection, population & genome size (as these affect sensitivity to stochastic events), type of trait (and its correlation with fitness), type of novel environment (as type of stress affects the number of possible evolutionary solutions), adaptive landscape, target gene, pleiotropy, epistasis. Repeatability measurements are not uniform; in reviewed articles are implemented either some particular indices or more descriptive approach, thus, there is a need to summarize these outcomes.

Keywords: experimental evolution, repeatability of evolution, parallel evolution, adaptation, chance, history

New digital identification tools for natural history

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Identification keys have been used in natural science since the 18th Century. These tools are still crucial for today studies in taxonomy, ecology, conservation and evolutionary biology. The building of identification keys evolved in synergy with the improvement of knowledge in natural sciences and the development of new technologies in human societies. Here we present identification keys in a historical perspective. Traditionally, the keys are dichotomous with a series of identification steps that form a single identification path for a given taxon. Nowadays are developed interactive identification keys that can be used via websites or mobile apps (tablets and smartphones). These tools are innovative and precious for use on and out of the field, by different types of users: researchers and experts, natural environment managers, general public, students and their teachers for educational approaches. We will briefly present some innovative tools such as the Xper3 software, which is used in numerous citizen science programs. We will talk about novel research works that involve the making of digital keys developed with Xper3 using both morphological and ecological traits. We will focus on aquatic insect taxa of the Paris Basin: Odonata (dragonflies and damselflies), Ephemeroptera (mayflies) and Plecoptera (stoneflies). Aquatic insects are determinant taxa in terms of biodiversity assessment and ecosystem conservation.

Keywords: Identification key, Digital tool, Xper3, Citizen science, Biodiversity, Conservation biology, Aquatic insects

Winter – Not Spring - Climate Drives Annual Adult Survival in Common Passerines: a Country-Wide, Multi-Species Modeling Exercise

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Climatic fluctuations affect the demography of animal populations, generating changes in population size, phenology, distribution and community. However, few studies have identified the underlying demographic processes. For short-lived species, like passerine birds, are these changes generated by changes in adult survival or in fecundity and recruitment? This study tests for an effect of climatic conditions (spring/winter) on annual, local adult survival at large spatial (a country, 252 sites), temporal (25years) and biological (25 species) scales.

The Constant-Effort-Site ringing has allowed the collection of capture-mark-recapture data for 100.000 adult individuals since 1989, over France, thus documenting annual, local survival rates of the most common passerine birds. We specifically developed a set of multi-year, multi-species, multi-site Bayesian models describing variations in local survival and recapture probabilities. This method allows for a statistically powerful hierarchical assessment (global versus species-specific) of the effects of climate variables on this survival. A major part (74%) of between-year variations in survival rate was common to all species, whereas only 26% of temporal variation was species-specific. Although changing spring climate is commonly invoked as a cause of population size fluctuations, spring climatic anomalies (mean precipitation/temperature for March-August) don't impact adult survival: only 1% of between-year variation of species survival is explained by spring climatic anomalies. However, for sedentary birds winter climatic anomalies (North-Atlantic-Oscillation) had a significant, quadratic effect on adult survival, birds surviving less during intermediate years than during more extreme years. For migratory birds, we don't detect an effect of winter climatic anomalies (Sahel-Rainfall). We will analyze the life history traits (migration, habitat, thermal range) that could explain a different sensitivity of species to winter climate anomalies. We conclude that changes in population sizes for passerine birds are unlikely to be the consequences of climate-driven local mortality in spring but could be induced by other demographic parameters, like fecundity.

Keywords: Bayesian approach, capture, recapture, climate anomaly, constant effort sites scheme, passerine, seasons, survival

Examining Bronze Age cattle DNA from the site Savognin-Padnal (Switzerland)

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In my master's thesis I examine the genetic diversity of mitochondrial DNA in Bronze Age cattle from the alpine region of Savognin-Padnal (CH). Out of 22 teeth, which were already morphometrical analyzed, DNA could be detected in 18 teeth (success rate 82%). The biostatistical research has shown that the cattle from the settlement Savognin-Padnal were not as homogeneous as suspected from the current state of research. Further, the chronological analysis of the genetic data revealed a gradual decrease of the genetic diversity over the Bronze Age. Equally remarkable is the existence of a special genetic haplogroup in one of the samples from Padnal, which is unusual for Central and Western Europe. This so-called T2 haplogroup is common in the Middle East, Eastern Europe and in the Balkans. In Central and Western Europe it has only been found in individual cases. The earliest occurrence so far in Switzerland came from the Roman Era. The results from Savognin-Padnal are being compared with the archaeogenetic data of Bronze Age cattle from parallel sites in South-Tirol, with other European findings and present-day cattle. The aim is to investigate Bronze Age cattle husbandry from a genetic perspective.

Keywords: aDNA, mtDNA, archaeogenetics, Bronze Age, cattle, Savognin, Padnal

The influence of green fluorescent protein on fitness of the nematode *Caenorhabditis elegans*

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The green fluorescent protein (GFP) is widely used in biology as marker molecule. *Caenorhabditis elegans* is one of many animals of which strains with GFP expression have been created and used in ecological and evolutionary studies as tester strains. For example, in experimental evolution, ancestral lines with introgressed GFP can be directly compared against their descendants. However, there is knowledge gap about the influence of GFP expression on fitness. Since protein production is costly for cells, we can expect that the expression of an additional protein will affect the energetic budget of organisms and in consequence – their fitness. In this project we examine the effects of GFP expression on fitness of *C.elegans*. We introgressed GFP gene from three transgenic strains (differing in genomic location of GFP and in effect – in its expression patterns) into five inbred lines derived from a widely used laboratory strain (N2). Thus, from each of the five inbred lines we obtained a set of 4 lines differing in whether and where they express GFP, but otherwise having the same genetic background. Then we assayed the lifetime reproductive success of individuals from all lines. We showed that expression of GFP causes reduction in fitness of the nematode *C.elegans*. Despite of differently located expression of GFP in our strains their influence on fitness turned out to be homogeneous. These results will have important consequences for further usage of GFP tester strains. Furthermore, we conducted an experiment designed to determine invasive fitness. Replicate invasion experiments are set up, whereby 2 invading individuals without GFP expression are introduced into populations carrying GFP. The number of invaders counted in consecutive generations, together with the number of extinctions, is then used in computer simulations to estimate growth rate relative to resident genotype and determines the probability of a successful invasion.

Keywords: *Caenorhabditis elegans*, fitness, green fluorescent protein (GFP), invasion experiment, tester strain

A general comparative phylogenetic framework for coevolving traits and coevolving lineages

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Models of phenotypic evolution for continuous characters have been described since the 90's in a phylogenetic context. The widely used models of "random genetic drift", "directional selection" or "stabilizing selection" rely on different sets of stochastic differential equations running on a species tree, which can be used to analyze the mode and tempo of trait evolution given a phylogeny and associated phenotypes. These approaches have however mainly focused on cases where lineages evolve independently from one another, thus restraining our understanding of coevolution. Here, we present a very general approach to incorporate species interactions into models of phenotypic evolution, and provide an associated standard protocol to derive the probabilistic distribution of traits at the tips of the phylogenetic tree. This comprehensive framework encapsulates all previously used models of phenotypic macro-evolution, including the recent model of Nuismer & Harmon (Ecology Letters, 2014) in which species phenotypes are either attracted by or repulsed from the mean phenotype in the community. It is intended to serve as a general framework that allows researchers to build biologically realistic models for studying trait evolution among interacting species. We illustrate this potential with two new models. In the first one, geographical information can be taken into account by considering that only sympatric species interact together. In the second one, we show how scenarios of coevolution between two distinct clades, such as host-parasite or plant-pollinator coevolution, can be analyzed, provided we know the interaction network between species.

Keywords: comparative phylogenetics, trait evolution, coevolution, modeling framework

Parasites affect the ecological coexistence and stability of predator-prey species, as well as the evolution of predator foraging

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The understanding of how food-webs work and how they manage to persist along time has been being one of the main questions in ecology for decades. A lot of progress have been done, especially this last decade, and many mechanisms have been identified to promote food-web stability. But most of recent studies largely ignore one fundamental process of ecosystem

functioning : nutrients are recycled by decomposers and flow again in the food-web regarding on two paths : the green and the brown food-web. Our objective is to add the well documented process of nutrient recycling in food-web modelling to test the consequences of such an important process in ecosystem's stability. Food webs are here modelled by a set of ordinary differential equations which represents a size structured food web containing scores of interacting species. The simplest representation of nutrient recycling is implemented in such a model: nutrient are excreted either as mineral nutrient or as detritus decomposed at a fixed rate. The importance of nutrient recycling and its effects are also compared with the effects of nutrient enrichment. The main result of this study is that nutrient recycling only acts as an additional source of nutrient and not as a bottom-up effect increasing primary productivity when the top-down control applied by consumers is strong. This is due to the stability of recycling: even if species abundance varies a lot along time, the amount of recycled nutrient stays constant.

Keywords: Food web, nutrient recycling, stability, nutrient enrichment, size structured food web, detritus

Dogs of ancient Eskimos (archaeozoological study in Chukotka)

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Dog remains (bones and hairs) from three ancient (cal BC 300 – cal 1600 AD) Eskimo settlements were analyzed. The sites are situated on the northeastern seacoast of Chukotka (the far east of Russia). Archaeozoological methods were used along with morphometry, ancient mtDNA and fine structure of hairs. Dogs were common cohabitants of humans at all three sites: dog bones comprise 2-10% of all identified mammal bones. Withers heights of dogs changed significantly through time. The average withers height slumps in the second half of the first millennium of our Era; along with that, the haplotype variability increases, mostly due to Asian haplotypes. After that, we recognize the appearance of sled dogs, which presumably had not been used for sledding at Chukotka before VIII century. The evidence of religious significance of dogs for humans, e.g. ritual burials, occur after the beginning of the 2nd millennium as well. All the obtained results: reduction in size, increase of haplotype variability, ritual burials and probably appearance of dog traction – are likely to be linked between each other and may be caused by some common event. Probably, some cultural changes, which were inspired, for example, with the arrival of new-comer people, which took a place sometime in the beginning of the 2nd millennium.

Keywords: dogs, Eskimo, Arctic, Chukchi

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