



**Building bridges between Earth Scientists worldwide - a way for
promoting peace and strengthening integration:
CAAWG - 8th Conference of the Association of African
Women in Geosciences,
Sibiu, 1-7 October 2016**



ABSTRACTS

Editors: Ezzoura Errami, Antoneta Seghedi

Editura GeoEcoMar

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Editura GeoEcoMar, 2016
București

Descrierea CIP a Bibliotecii Naționale a României

Building bridges between Earth Scientists worldwide - a way for promoting peace and strengthening integration : CAAWG - 8th Conference of the Association of African Women in Geosciences, Sibiu, 1-7 October 2016 : abstracts / ed.: Ezzoura Errami, Antoneta Seghedi. - București : GeoEcoMar, 2016

Conține bibliografie

ISBN 978-606-94282-0-7

I. Conference of the Association of African Women in Geosciences – CAAWG (8 ; 2016 Sibiu)

II. Errami, Ezzoura (ed.)

III. Seghedi, Antoneta (ed.)

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FOREWORD

It was noted that during the geological meetings, the participation of women geoscientists was very limited. In order to encourage them to attend conferences, a decision was taken to form an Association. In 1995, the Association of African Women Geoscientists (AAWG) which believes that the involvement of women in research is a key issue to help Africa solve its socio-economical problems, was created. The main objective of this association is to provide a forum for discussion and dissemination of information and cooperation between women geoscientists, organization and socio-economical stakeholders engaged in African geosciences. AAWG is supporting the development of Earth Scientists in Africa by providing opportunities for networking and promoting the application of geosciences for sustainable development. To meet these challenges, AAWG is organizing numerous activities in and out of the African continent. Biennial International Conferences are being organized to address various challenges that the African continent is facing and to which Earth Sciences could make a contribution.

Building on this, the AAWG decided to hold its first workshop entitled "Gender and environmental concerns among female geoscientists in Africa" in 2000 in Dar Essalam (Tanzania) for the purpose of exchanging ideas, discussing results and encouraging women to present their work at scientific conferences. Consequently, the biannual colloquium of the AAWG was born. Since then, the association is at its eightieth conference. In order to strengthen the collaboration between its African and non African members and also to increase the visibility of the Association, the 8th AAWG Conference is being organized for the first time out of the African continent. To meet these objectives, the 8th conference is entitled *Building bridges between Earth Scientists Worldwide: A Way for Promoting Peace and Strengthening Integration*.

The seventh conference was organized in Namibia in 2014. The sixth conference entitled "Women and Geosciences for African Intergration" was held in Cameroon in 2012. In order to focus on the close relationship between sustainable peace, scientific progress and sustainable development on the African continent, the fifth biannual conference was organized in 2010 in Côte d'Ivoire under the title "Women and Geosciences for Peace". Adding to the scientific sessions, numerous activities were organized during that conference, such as the peace march to pay tribute to Ivorian women who marched for peace in 1949 and to put item on the close relationship between sustainable peace, scientific progress and sustainable development on the African continent. The AAWG participated to the promotion of the International Year of Planet Earth "IYPE" by organizing its fourth conference in 2008 in Cairo (Egypt) under the title "Women and the IYPE". The third conference entitled "Women, Geosciences & Development" was held in El Jadida (Morocco), in 2006. The second colloquium was held in Kampala (Uganda) "Enhancement of Geosciences for Environment Awareness, Poverty Alleviation and Sustainable Development", in 2004. The first colloquium "Women Geoscientists: Past Achievements and Future Challenges" took place in Cape Town (South Africa) in 2002. AAWG is also organizing numerous workshops, roundtables and meetings on and outside the African continent.

The 8th AAWG conference is held in the beautiful city of Sibiu, situated on the southern edge of the Transylvanian basin, in the footwall of the impressive Alpine belt of the South Carpathians. A region with scenic landscapes of mild hills covered by crops, pasture lands or vineyards and

surrounded by the East and South Carpathians and the Apuseni Mountains, Transylvania has unique scenery, traditional villages and occupations. Southern Transylvania is famous for its 18th century Saxon villages with fortified churches, and we'll visit some of them during this conference.

Former capital of the Principality of Transylvania in the 17th, 18th and 19th centuries, Sibiu used to be the center of the Transylvanian Saxons in Romania until World War II. With a first official record in 1191 as Cibinum and known since 1366 as Hermannstadt, Sibiu was an important trade centre in 14th century, with craftsmen divided in 16 guilds. The capital of Sibiu county, Sibiu is one of the most beautiful medieval settlements in Romania, inhabited by Romanian, Hungarian, German and Roma ethnic communities. In 2007, this city with a vibrant cultural life was designated European Capital of Culture, along with Luxembourg.

The conference venue is "Astra Center for heritage" of the Astra National Museum Complex. Located in the beautiful Grove which is now the Dumbrava Forest Natural Park, the Astra Museum of Traditional Folk Civilisation is one of the largest open air museums in SE Europe. Focused on ethnography, it features most significant elements of the Romanian traditional village. We hope the conference participants will take the time to visit the traditional houses and learn more about the Romanian culture.

The main topics of the 8th conference focus on Earth Science and their applications, Environment, Natural Hazards, Medical Geology, Geoheritage, Geotourism & Geoparks, Women and Earth Sciences, Geo-Mining, Geo-Education and Geo-Ethics. These topics are integrated into three days of technical sessions. During the conference, a workshop will take place in the Hațeg Country Dinosaur Geopark, which will be an opportunity for African delegates to enjoy the beautiful landscapes and learn about local geology, local culture and the ways our geological heritage is used for sustainable development of communities.

The three days post-conference field trip will introduce participants to the mai geotectonic units of the Romanian territory: Apuseni Mountains, Transylvanian basin and the South Carpathians, from geology to geoheritage.

This volume includes 87 abstracts sent by authors from 17 African countries – Algeria, Angola, Cameroon, Egypt, Ghana, Ivory Coast, Kenya, Madagascar, Malawi, Morocco, Mozambique, Nigeria, Senegal, South Africa, Togo, Tunisia, Uganda. Other abstracts were received from Romania, France, India, Italy, and United States of America.

Our special thanks go to all those individuals and institutions that supported either morally or financially this conference. We want to thank especially all our sponsors: Agence Universitaire de la Francophonie, IUGS, the National Institute of Marine Geology and Geoecology - GeoEcoMar, Faculty of Geology and Geophysics, University of Bucharest, Astra National Museum Complex, Association GeoD for promoting geodiversity, the Geological Society of Romania, Hațeg Country Dinosaur Geopark, Association Geomedia, Brukenthal Museum. Romanian participants were supported by GeoEcoMar and by projects GeoSust and IDEAS.

On behalf of all our partners and the organizing committee, we wish all participants a pleasant stay in Romania and a fruitful conference.

Ezzoura Errami

Chair of the conference

President

Association of African Women in Geosciences

Antoneta Seghedi

Co-chair of the conference

President

Geological Society of Romania

HUMAN ACTIVITIES, NATURAL HAZARDS AND DISASTER RISK REDUCTION IN PARTS OF NORTHERN NIGERIA

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In Nigeria, like in most part of the world, increase human activities such as deforestation, emission of greenhouse gases, mining and dam constructions generally escalate both natural and human-induced hazards, which have continued to threaten sustainable livelihood across the country. This study examines role of climate change using temperature record (1951-2014) of Kano, Maiduguri, and Sokoto to determine spatiotemporal changes. Shiroro hydrologic record for thirty seven years (1975-2012) were collected and analyzed in addition, hand dug well and bore hole water samples were collected around Kuyi waste dump site to determine the impact on the water quality. The analysis of heavy metal concentrations such as Mg, Pb, Cu, Cr, Ni, Zn, Cd, Na, Mn, Conductivity, Ca, and Cl of ground water sampled was determined using atomic absorption spectrophotometer also; pH meter was used for pH analysis. Furthermore, 300 structured questionnaires were administered to the residents of Gurmana downstream settlement of the dam for the purpose of generating their responses arising from flooding and its related problems.

Table 1. Temperature changes between 1951-1982 and 1983-2014

Stations	Jan. Max	Jan. Min	Jan. Mean	Jan. Range	April Max	April Min	April Mean	April Range
Maiduguri	-0.1	0.2	0.1	-0.3	0.6	1.4	1.0	-0.8
Sokoto	0.2	1.4	0.5	-1.7	0.4	1.5	1.0	-1.5
Kano	-0.6	0.8	0.1	-1.3	0.8	1.2	1.0	-0.4

The result affirmed temperature changes between 1950 - 1981 and 1982 – 2014, it reveals positive changes in April mean, maximum and minimum temperature values of between 0.4 to 1.5°C across the study area (Table 1). The alarming rate of change we are now witnessing in our climate as a result of greenhouse gas emissions is unprecedented in modern records (WMO 2015). The negative changes in range (-0.4 to -1.5) is an indication of warmer temperature as the margin between maximum and minimum temperature is declining. Recent estimates show that for each 1°C rise in average temperature dry land farm profits in Africa will drop by nearly 10% (FAO, 2008).

Similarly, the observed oscillation and positive trend of inflow and outflow from Shiroro reservoir constitute a major and unprecedented shift in stream flow across the riverine communities (Fig.1). Changes in extreme weather and climate events are among the most serious challenges to society faced with living in a changing climate (John *et.al*, 2015). Thus, intensifying seasonal rainfall related hazards that threatens livelihood of the exposed and vulnerable community. Specifically, over 70% of

the riverine community strongly agree that flood poses a great threat to their farmlands also, poverty is major factor intensify vulnerability as about 45% of the population still live in mud houses with thatch roofs.

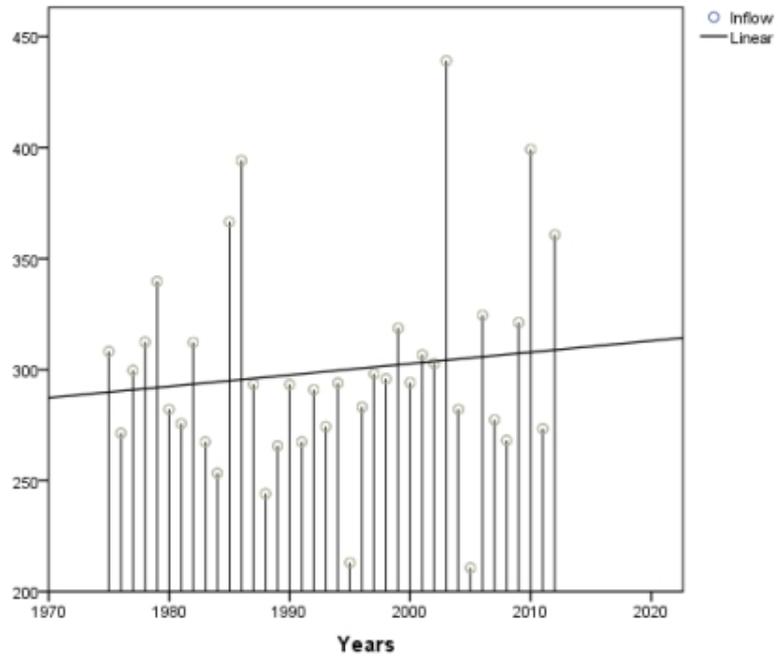


Fig. 1. Variation in time of inflow and outflow in Shiroro reservoir

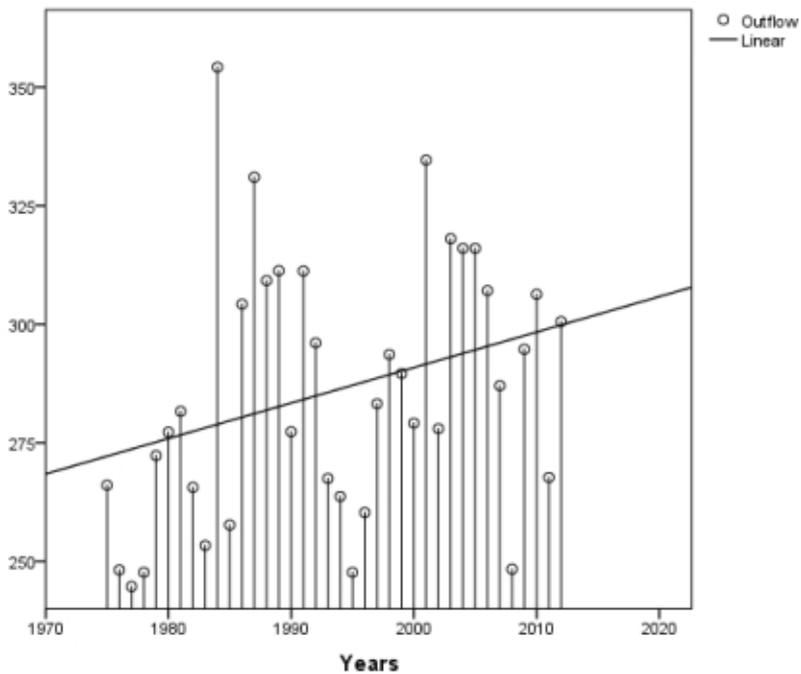


Fig. 2. Variation in time of outflow from Shiroro reservoir

Furthermore, rapid rate of urbanisation in the most cities and towns have continued to aggravate waste management challenges leading to increase concentration of pollutants that pose direct/indirect health threat to women and children. pH values for hand dug well is 6.20 and boreholes are between 6.83 and 7.18, the hand dug well is below SON (2007) standard, Magnesium (Mg) and conductivity is generally above SON (2007) standard value which is 100. Hunter *et al.* (2009) stated that any level of conductivity parameter above this can pose health risk and brain damage.

It's crucial to understand the physical phenomena and human-induced hazards that intensify natural disaster which may cause the loss of life, human life disruption, property damage, socio-economic disruption and environmental degradation. Hence, there is need for systematic development and application of policies, strategies and adoption of best practices to minimize risk, vulnerability and exposure as pathway towards disaster risk reduction.

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UNE VISION POUR LA PROMOTION DU TOURISME DURABLE. CAS DE FOUM CHENNA (SUD-EST MAROCAIN)

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Mots clés: Patrimoine rupestre, géo-écotourisme, éducation, développement durable, Tinzouline

Le Maroc possède de nombreux sites d'art rupestre répartis sur l'ensemble de son territoire. Le site de Foug Chenna est l'un des sites importants du Maroc.

TINZOULINE: PAYSAGE MUET ET PATRIMOINE CULTUREL?

Le site rupestre appelé Foug Chenna est situé à environ 40 km au nord de la ville de Zagora, sur les rives droite et gauche de l'oued Chenna, un affluent de droite de l'oued Drâa, à une altitude comprise entre 1034 et 1060 m. Pour y accéder, on emprunte à partir de village de Tinzouline une piste se dirigeant vers l'ouest, aujourd'hui uniquement fréquentée par les berges et leurs troupeaux

de chèvres et brebis, qui travers un reg de pierres noires. Au km7, après un gué, un sentier se détache sur la gauche: il longe la rive gauche de l'oued et conduit en amont vers les puits, creusé à même le lit torrent, là où le passage est le plus étroit (Foum). C'est en empruntant ce sentier qu'on peut observer les gravures de la rive gauche, tandis que celles de la rive droite sont concentrées presque exclusivement sur les roches à proximité du puits. Une autre petite concentration, inédite, est également située sur la rive gauche de l'oued, à environ 70 mètres à droite du nouveau Centre d'Interprétation construit par le Ministère de la Culture.



Figure1. Les éléments constructifs de site rupestre de Foug Chenna.

Le site comprend plusieurs concentrations. Sur la rive droite, les gravures peu nombreuses, sont regroupées sur quelques blocs et une petite falaise au niveau du puits, orienté Nord-Ouest. La rive gauche a été privilégiée pour la réalisation des dessins, qui couvrent les roches sur une longueur d'environ 800 mètres.

Le patrimoine culturel immatériel composé de savoirs et savoir-faire, les uns accompagnant la vie quotidienne ou les moments forts de la vie communautaire, les autres nécessaires à la transformation des matières premières, à la production d'objets ou d'outils, à leur entretien, à leur utilisation. La vallée de Drâa conserve sa beauté et sa grâce traditionnelle particulièrement pendant le printemps et au début de l'été. Le village de Tinzouline est connu par son souk du lundi, qui se tient à l'intérieur d'une grande enceinte située en haut de village.

EDUCATION AU PUBLIC

En 2012, un groupe de jeunes chercheurs et de citoyens de la région de Zagora a créé une association culturelle faisant partie de la société civile locale dont l'objectif essentiel est la protection

de l'art rupestre de la vallée de Drâa. L'Association s'efforce, malgré ses moyens très limités de sensibiliser les citoyens et les écoliers quant à l'intérêt historique et identitaire de ces manifestations rupestres, gravées ou peintes sous formes de figurations d'une typologie variée, dont notamment les écritures anciennes.

Dans l'aire géographique correspondant à l'espace d'intervention de notre jeune Association, le site de Foum Chenna constitue le pivot central. Le site occupe ainsi une place de première importance eu égard aux innombrables figurations rupestres qu'il renferme. Ces dernières se rapportent notamment aux multiples cavaliers associés aux autres représentations zoomorphes et anthropomorphes, mais surtout, aux nombreuses inscriptions rupestres relatant une tradition scripturaire reflétant les débuts historiques de l'écriture libyque aujourd'hui revitalisée pour transcrire la langue berbère.

La valeur de ce patrimoine, la nécessité de le connaître et de bien le protéger, ne doit pas l'apanage de quelques spécialistes, mais être communiqué à un plus large public. Plutôt, on en est venu à élaborer une problématique plus englobant et dite d'Education Relative au Patrimoine (ERP). L'ERP n'est pas cette approche qui inviterait les élèves à découvrir un patrimoine préexistant et tout organisé et à en déduire des comportements appropriés à son maintien et à sa protection. Elle est plutôt une approche qui invite les élèves à réfléchir sur les façons d'envisager leur rapport à ce que l'on appelle patrimoine et sur les implications qui en découlent, et à élaborer une position avertie à ces sujets.

La transposition d'une telle vision de l'archéologie et de l'ERP dans le domaine éducatif suppose plus qu'un simple remaniement des contenus des programmes ou des techniques d'enseignement. En effet, cette vision est tellement en rupture avec l'imagerie habituelle des milieux d'enseignement, que c'est d'abord sur celle-ci qu'il semble opportun de travailler. Mais un tel travail suppose que l'on dispose d'un certain portrait des représentations et référents qui ont cours dans les milieux éducatifs. C'est donc en vue de contribuer à l'élaboration de ce résumé et compte tenu de notre engagement antérieur d'éducation au public.

Le Centre d'Interprétation de Foum Chenna construit par le Ministère de la Culture, constitué une infrastructure d'accueil, d'information et de sensibilisation des visiteurs. Ce musée présente le patrimoine rupestre marocain, sa richesse et sa diversité. Celle-ci, sera composée de photos, de moulages et d'objets archéologiques. En plus de son principal but: la présentation du patrimoine rupestre marocain, le musée peut également contenir une présentation des particularités ethnographiques de la province de Zagora. Ce musée joue un rôle important dans la sensibilisation du grand public à l'importance de notre patrimoine rupestre, à sa valeur universelle et à la nécessité de le préserver et de sauvegarder. Cette infrastructure permet l'accueil de groupes d'étudiants et d'écoliers nationaux et étrangers en stages organisés ou d'autres activités culturelles à Tinzouline.

Ces éléments de patrimoine naturel et culturel font de la vallée de Drâa l'une des riches vallées du Maroc. En effet, toutes les caractéristiques évoquées plus haut et bien d'autres font de la région un paysage culturel qui mérite reconnu, protégé et proposé pour l'inscription sur la liste du patrimoine mondial. In extenso, les conditions sont réunies et il représente un héritage culturel et architectural de valeur, caractérisé par une architecture de terre commune aux régions présahariennes du Maghreb, des techniques de construction et une typologie du cadre bâti propres aux vallées du Sud du Maroc, une structure spatiale et communautaire articulée autour d'unités d'habitation (kasbahs) agencés selon un mode fortifié.

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PREVALENCE DE L'HYPERTENSION ARTERIELLE CHEZ LES SUJETS D'UNE ZONE D'EXPLOITATION MINIERE AU TOGO: CAS DES PHOSPHATES

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Mots clés: phosphates, métaux lourds, contamination, hypertension artérielle, fréquence cardiaque

Les déchets du traitement des phosphates au Togo renferment des métaux lourds à l'origine de la contamination des sols, l'air, l'eau, la faune et la flore. Ce qui constitue un danger pour la santé des populations travaillant sur le site ou vivant dans la zone. La présente étude a pour but d'établir la corrélation entre l'exposition aux métaux lourds et la prévalence de l'hypertension artérielle chez les sujets exposés. Ainsi, chez 260 sujets (173 employés, 60 riverains de l'usine et 30 sujets témoins) : le régime alimentaire a été déterminé, l'Indice de masse corporelle, la pression artérielle, la fréquence cardiaque mesurés. Les teneurs en métaux lourds (cadmium, plomb, cuivre et nickel) dans le sang déterminées au spectrophotomètre d'absorption atomique.

Les résultats révèlent des valeurs moyennes significativement plus élevées ($p < 0,001$) chez les travailleurs et les riverains de l'usine pour les métaux lourds, la pression artérielle et la fréquence cardiaque. La prévalence de la bioconcentration chez les sujets exposés varie en fonction du degré de contamination par les poussières de phosphate. Elle serait liée soit à la consommation d'aliments contaminés et/ou l'inhalation de l'air pollué, soit à la durée de l'exposition aux métaux lourds.

Les données de cette investigation constituent pour l'épidémiologiste et le géochimiste, de précieuses informations sur le degré de contamination et les risques sanitaires graves chez les employés et les riverains de l'usine. Ce qui devrait permettre la mise en place dans l'usine de

programmes efficaces et des mesures adéquates pour une meilleure protection des employés et une réduction sensible de la pollution des localités riveraines.

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AN APPROACH TO DROUGHT AND DESERTIFICATION IN NIGERIA: A BRIEF EVALUATION OF GOVERNMENT POLICIES

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Key words: deserts, land forms, Nigeria, government policy

The main purpose of this paper is to evaluate current government policies in combating desertification and mitigating the effects of drought in Nigeria.

The review of existing literature, personal observations and interview with residents in the affected areas as well as government officials in charge of programs in combating desertification shows that the failure of current government policies include the top-down approach, inconsistencies of government policies, neglect of indigenous knowledge, use of inappropriate technology, sectoral approach, inadequate funding, and inadequate awareness. Accordingly, we propose that the national policy for drought and desertification should ensure sustainable development based on proper management of human-environment interactions in affected areas. The evaluation method of Nasiru (2007) allows us to analyze the factors responsible for the failure of government policies in combating desertification in Nigeria. So, we suggest that a number of complementary policies, strategies and management approaches be put in place and such must take cognizance of the existing institutional settings and professional groupings as well as the complex historical, social, cultural, and legal considerations.

A rational, holistic, practicable and comprehensive approach for finding solutions to the problems of drought and desertification in Nigeria will be provided.

The finding of the paper shows various weaknesses in the formulation as well as the implementation of some of these programs. These include adoption of the top-down approach that limits consultation between and among the various stakeholders, inconsistency of government policies, neglect of indigenous knowledge (IK), use of inappropriate technology, sectoral approach, inadequate funding, inadequate awareness and rural poverty which compels the people to rely heavily and unsustainably on the environment.

ROLE OF GEOPARKS, GEOTOURISM AND SUSTAINABLE DEVELOPMENT FOR EGYPT

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Egypt has one of the longest histories of any modern country, arising in the tenth millennium BC as one of the world's first nation states. Considered a cradle of civilisation, Ancient Egypt experienced some of the earliest developments of writing, agriculture, urbanisation, organised religion and central government.

With over 93 million inhabitants, Egypt is the most populous country in North Africa and the Arab World. The population density in Egypt is 94 per Km² (243 people per mi²). The great majority of its people live near the banks of the Nile River, an area of about 40,000 square kilometres (15,000 sq mi), where the only arable land is found.

About half of Egypt's residents live in urban areas while the large regions of the Sahara desert, which constitute most of Egypt's territory, are sparsely inhabited. These deserts contain small

communities spread throughout the desert regions of Egypt are clustered around oases, historic trade and transportation routes.

The government has tried with mixed success to encourage migration to newly irrigated land reclaimed from the desert. But, the proportion of the population living in rural areas has continued to decrease as people move to the cities in search of employment and a higher standard of living. However with the Geoparks and Geotourism concepts these areas of geological heritage with international significance and an opportunity to develop cohesive partnerships with common goals between land owners, managers, businesses, tourism interests, and other local organizations will promote and conserve these areas for scientific, which landscapes of these international geological significance are managed with a holistic concept of protection, education and sustainable development representing nearly 15% of Egyptian land.

Communities of these rural areas and deserts like Fayum area, Siwa oasis, saint Katherine, Wadi Allaqi and other places are representing very optimistic opportunities for establishing geoparks across Egypt beside including the involvement of native community which lead to foster socio-economic development that is culturally and environmentally sustainable and geotourism which is a relatively new type of tourism with significant growth potential foster opportunities for sustainable development and poverty alleviation in developing countries across the continent.

EVALUATION OF PHYSICO-CHEMICAL PARAMETERS FOR CYTOTOXIC EFFECTS ON STREAM WATER QUALITY AROUND IBOBO COALMINE, KOGI STATE, NIGERIA

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The Ibobo coal mine is an abandoned mine located in the middle belt of Nigeria and lies in the Ajali Formation within the Anambra Basin. The study was conducted in January 2016 at the peak of the dry season. Ibobo stream 1 and 2 flow into each other and adjoined to flow downward over an unmined coal towards Emewe Efofpa and subsequently joined by Adiele stream. Seven water samples A, B, C, D, E, F and G were taken from Ibobo stream 1, stream 2, mine water, spring water just above the coal mine, Ukpolo upstream and downstream at Emewe Efofpa as well as River Adiele respectively.

Major and trace elements were measured in the water samples collected and subjected to the following analysis; conductometry and electro-analytical techniques for physical parameters; titrimetry and spectrophotometry for anions; and flame atomic absorption spectrophotometry for the cations.

Further study was carried out to evaluate the cytotoxic effects of the water samples A-D on plants and other living organisms using the root meristems of *Allium cepa* (onion) as a case study. The root tips were grown in different concentrations of the water samples while purified water was used as a control. Root tips of onions grown in the water samples and control were harvested between 7.30am and 8.30am for cytological studies. Pre-treatment, fixation, hydrolysis, squashing and staining of cells for the mitotic study were carried out while data was taken on cytological parameters under X400 magnification of the light microscope.

The PH value of the water samples around the mine exhibited average acidity value of 5.66. Lowest electrical conductivity (EC) and total dissolved solids (TDS) values of 0.00 μ s/cm and 8mg/L respectively were recorded at Ibobo stream-1 while Ukpolo upstream indicates the highest values at 0.33 μ s/cm and 237mg/L respectively. Concentrations of EC and TDS in River Ukpolo upstream which flows directly over the un-mined coal increases downstream from 0.09 μ s/cm and 73mg/L into 0.33 μ s/cm and 237mg/L respectively indicating some level of water pollution in the water. Averagely, cationic concentrations of water samples around the area shows $Ca^{2+} > Na^{2+} > K^{+} > Mg$, while the anionic component is in the order of $So_4^{2-} > No_3^{-} > Cl$. The findings indicate that water from these streams (especially stream D) have high mutagenic content.

The average concentrations of Iron(0.344mg/L), Lead(0.024 mg/L), and Cadmium(0.004 mg/L) are higher than the maximum permissible limits of Standard Organisation of Nigeria(SON) and World Health Organisation(WHO) guidelines for domestic and drinking water qualities. The presence of anions and higher concentrations of Fe, Pb, and Cd in the water samples gives a clear indication of dissolution of harmful substances due to coal mining activities. Analysis of variance (ANOVA) result showed that five out of the eleven cytological parameters considered revealed differences across water samples examined in the study. The chromosomal abberations associated with the stream samples are C-mitosis, binucleate cells, sticky chromosomes andvacuolated cells. The highest abberant cells (4) were recorded in Ibobo spring. Thus, the heavy metal pollution in the water is recognized as primary environmental contaminants causing cytotoxic, mutagenic and cancerous (carcinogenic) effects which influence the quality of crops. This will, in turn, have profound consequences for the health as well as the life of animals and human beings in these local communities by way of the food chain. Therefore, for public health awareness, the consumption of water from these streams and also for the purpose of irrigation should be discouraged while safer potable water should be provided for the local communities.

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LE GEOMORPHOSITE DU JBEL AMSITTENE PROVINCE D'ESSAOUIRA, MAROC): DE L'INVENTAIRE A LA VALORISATION

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La province d'Essaouira, à vocation touristique axée surtout sur les zones côtières, dispose d'un patrimoine géologique et géomorphologique riche et varié, qui reste sous-exploité et très peu valorisé.

Dans le cadre de l'inventaire des géosites de cette province, notre travail se portera, dans un premier temps, sur le géomorphosite du Jbel Amsittene qui occupe une position géographique stratégique à cheval entre les bassins d'Essaouira et de Haha. Témoin d'une histoire géologique qui s'étend sur presque 204 Ma, il se caractérise par de nombreux affleurements qui s'échelonnent du Trias au Quaternaire (diapirs salifères triasiques, coupe complète du Jurassique...), des formes singulières (anticlinal, plis, karsts, falaises, grottes) et un contenu paléontologique diversifié (Foraminifères, brachiopodes, algues, bivalves...). Facilement accessible, le Jbel Amsittene est considéré comme le plus haut sommet (915 m) de la province d'Essaouira et domine la zone entière. Il se présente en tant qu'une longue structure anticlinale à cœur salifère, légèrement dissymétrique avec un faible déversement vers le nord. Il est aussi doté d'atouts écologiques qui lui ont valu un double statut de protection à savoir un Site d'Intérêt Biologique et Ecologique (SIBE) et une Réserve de Biosphère de l'Arganeraie (RBA).

Afin d'évaluer le potentiel patrimonial du géomorphosite du Jbel Amsittene, nous avons adopté la méthodologie d'évaluation développée par l'Institut de Géographie de Lausanne (Reynard et al., 2007) qui se base sur la valeur scientifique, définie par quatre critères (la rareté, la représentativité, l'intégrité et la valeur paléogéographique) et les valeurs additionnelles (écologique, esthétique, culturelle et économique). Les scores déterminés montrent que ce géomorphosite dispose d'une

grande valeur scientifique qui rivalise avec sa valeur écologique et esthétique (SIBE, RBA), d'où la nécessité de protéger et de valoriser ce patrimoine géologique au même titre que sa biodiversité et de promouvoir la géodiversité en tant que support de cette biodiversité. D'un autre côté, deux questionnaires ont été conçus et renseignés sur le terrain, respectivement dédiés à la population locale et aux visiteurs potentiels, pour traiter statistiquement les données relatives aux perceptions, aux avis et aux attentes des principaux intéressés.

Les informations recueillies (Démographie, découpage administratif, réseau routier, géologie, sondage...) et les résultats obtenus (géosite primaire, géosite secondaire, scores des valeurs, fragilité, priorité de protection...) sont intégrés et gérés dans une base de données numérique et traités via des outils SIG. Des cartes thématiques sont élaborées dans le but de visualiser les répartitions spatiales des valeurs étudiées et d'avoir une vision plus claire concernant les mesures de protection à prendre et les outils de valorisation à envisager, en harmonie avec les ressources naturelles et l'identité de la population locale.

RECHERCHE DE SUBSTITUT AU CHARBON DE BOIS: OPTIMISATION DE LA CAPACITÉ CALORIFIQUE D'UN COMBUSTIBLE À BASE DE SCIURE DE BOIS ET DE LIANT NATUREL

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Mots clés : Combustible, sciure de bois, liant, capacité calorifique

L'utilisation du bois pour la confection du charbon de bois augmente la déforestation et son traitement dans les scieries produit des déchets industriels. Ces déchets de bois communément appelés sciure de bois polluent l'environnement. Les conséquences générées ont conduit à une étude menée par le laboratoire de Géomatériaux en vue de concevoir un nouveau combustible plus avantageux que le charbon de bois. Ce combustible est élaboré dans le but de lutter contre la pollution de l'environnement, valoriser les déchets industriels et réduire la déforestation. Il est composé de sciure de bois et de liant naturel (l'empois d'amidon).

Au cours de notre étude, différents types d'échantillons ont été confectionnés en faisant varier la teneur en amidon. Trois essais ont été effectués sur ces échantillons : les essais de chute libre, de combustion et d'ébullition d'eau. Les résultats obtenus montrent que la résistance des échantillons à l'essai de chute libre augmente avec la teneur en amidon. Lorsque les échantillons ont une teneur élevée en amidon, ils brûlent plus longtemps. Les échantillons ayant une intensité énergétique élevée

sont ceux de rapport sciure de bois-empois d'amidon 3/7. A ces échantillons nous rajoutons de la matière carbonisée pour renforcer la capacité calorifique. Le résultat montre que les échantillons ont une capacité calorifique élevée.

PETROLEUM POTENTIAL AND TECTONO-SEDIMENTARY ARCHITECTURE OF THE MIDDLE MIOCENE LEVELS IN THE GULF OF HAMMAMET, TUNISIA

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Key words: Gulf of Hammamet, Middle Miocene, petroleum potential, tectonic architecture

The Tunisian offshore is mostly located in the Pelagian Sea. It shows several hydrocarbon reservoirs such as the Serravallian Birsa formation in the Gulf of Hammamet. Many source rocks supply these reservoirs. The most important source rocks are Bou Dabbous and Fahdene formations. Then, the thicker seal rock in this area is the upper Saouaf clays formation.

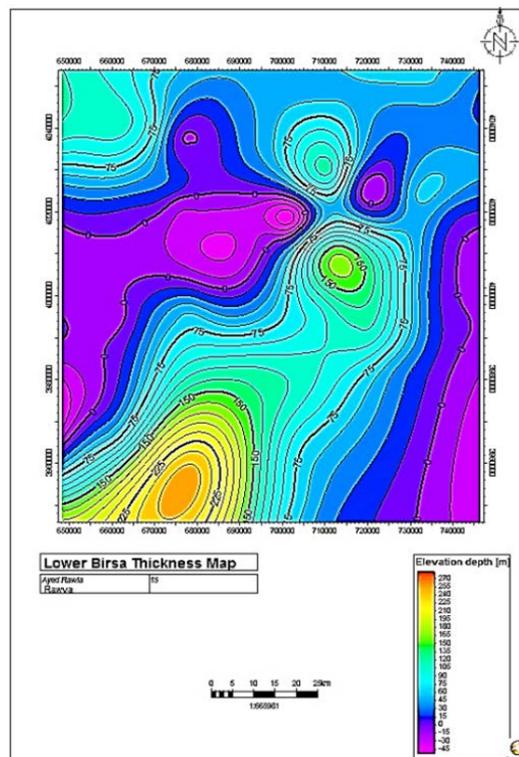


Figure 1. Thickness Maps of lower Birsa formation in the Gulf of Hammamet

Therefore, the Gulf of Hammamet is a prolific province where a complete petroleum system exist and many wells were drilled and had shown hydrocarbon shows. The middle Miocene Birsa reservoir is the most interesting level within the Gulf and especially in the Halk El Manzel block. This reservoir is mainly composed by fluvial to deltaic sand bodies.

An integrated geological study in the Gulf of Hammamet based on well data, loggings, etc., highlighted the spatio-temporal organization of the sedimentary bodies as well as the tectonic architecture of these reservoir levels.

Many thickness, facies variations, unconformities and tectonic inversions characterize the stratigraphic correlations. These tectonic and stratigraphic phenomena had taken part in the genesis of potentially important areas for hydrocarbon exploration.

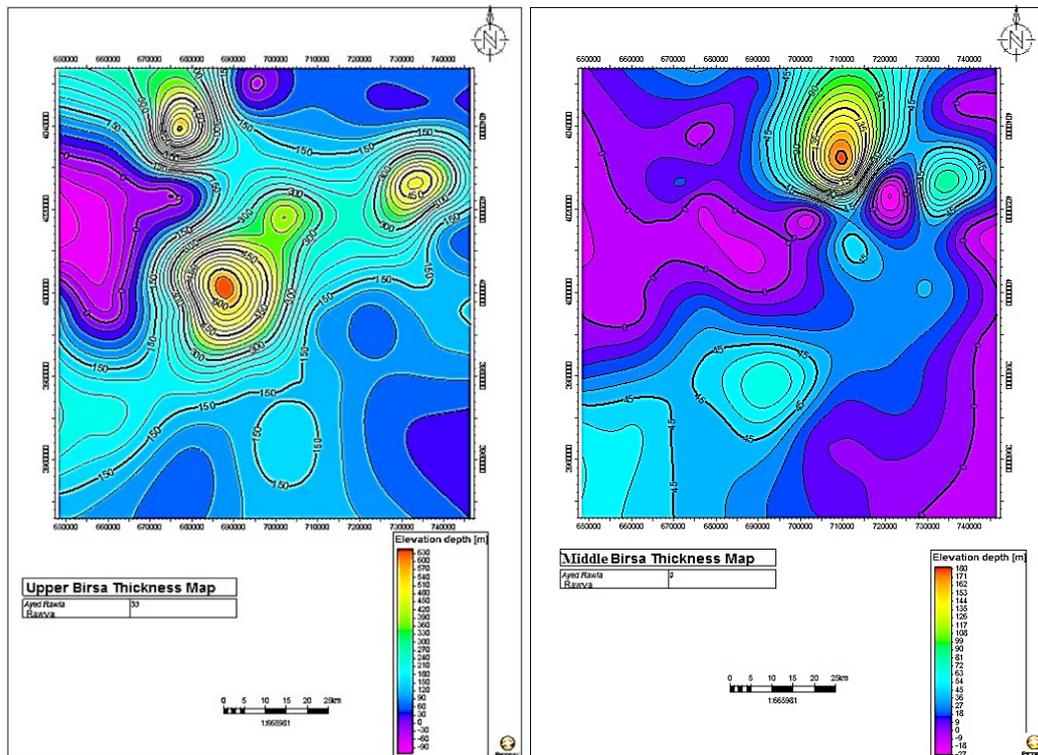


Figure 2. Thickness Maps of middle and upper Birsa formation in the Gulf of Hammamet

A spatial and temporal distribution of genetic parasequences of Birsa reservoir show progradational and retrogradational sequences. A very important facies and thickness variation within these parasequences are recorded. These para-sequences prove the involvement of tectonic and eustatic phenomena during the formation of these series.

These integrated concepts and studies let us improve the stratigraphic architecture predictions of the Birsa sand bodies and to understand the relationship between the sedimentary distribution and the tectonic events.

As a conclusion, the Gulf of Hammamet is an interesting province including all the ingredients of a good petroleum system. The facies distribution model of the middle Miocene Birsa reservoir show the huge importance of this level and encourage the exploration in this area.

VALORISATION ET TRAITEMENT PAR SEPARATION PHYSICO - CHIMIQUE DU MINERAI DE FER DE GARA-DJEBILET, ALGERIE

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Mots-clés : Minerai de fer de Gara-Djebilet, traitement minéralurgique, méthode de séparation physico-chimique, environnement

Le traitement des minerais de fer et son impact sur l'environnement est l'une des priorités de recherche des scientifiques dans le monde. La présence de l'élément nuisible (le phosphore) dans ces minerais métalliques provoque la diminution de la teneur en fer et en particulier la qualité de la résistance de l'acier dans les usines sidérurgiques. Si des mesures de technologie et de sécurité ne sont pas prises en considération, à cet effet l'environnement sera affecté.

L'objectif principal de cette communication est l'application d'une méthodologie de caractérisation physico-chimique du minerai de fer de Gara-Djebilet dont le but de réduire le taux des éléments nuisibles à savoir le phosphore qui est l'élément le plus important. Ce dernier engendre des fissures microscopiques au niveau de la maille cristalline de fer post-fusion, qui peuvent être à l'origine de la diminution de la résistance mécanique de l'acier.

THE APPRAISAL OF THE NYAKASURA SPENCOLM GEOSITE: TORO – FORT PORTAL SCENIC AREA, UGANDA

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Uganda, situated in East Africa, occupies an area of 241,000 km² and lies in the heart of the African plateau within the African plate, a continental crust containing Archean Cratons and is crossed by the equator. It has a Tropical-Equatorial climate in addition to a variety of landscapes and other physical features, a unique flora and fauna with a breath-taking beauty which gives her the name of 'Pearl of Africa'. The income per capita is 1300\$ per annum.

The Nyakasura spencolm of stalagmites and stalactites locally referred to as 'Amabere ga Nyina Mwiru' is a geosite within the Nyakasura-Fort Portal scenic area. The geosite is one of the country's most exciting and educative feature. This geosite has been long known and several legends about it written and taught in schools. The site is taken care of by a family of the Rubomboras and are the land owners. From a few to many kilometers around Fort Portal town, Western Uganda are more sites, all beautiful to look at especially when one stands on top of one hill, the Kyeganywa. One can appreciate the land scape, panorama, the calderas, lava domes bearing either water filled or dry craters and various fauna and flora. The sites comprise a potential Fort Portal-Rwenzoris Geopark.

The sites have a foundation on geological, cultural and natural heritage which allow for sustainability through tourism and community involvement. A Geopark approach is a potential developmental remedy to many of our problems of poverty, hunger, economy and development.

The basic underlying appraisal objective is National development of the social and economic aspects. Within the framework of the Uganda Geological Mapping Project under the umbrella of the Finish Geological Survey and the Department of Geological Survey and Mines (Uganda), about 60 sites were visited, and essential information recorded in a more descriptive manner. These comprise the proposed Western Region Geopark. The Park supplies local communities with various wild resourses. It is part of the Rwenzori mountain chain, a world heritage area and which includes Africa's third highest peak. The poster has some attractive views of the Rwenzoris like the Nyakasura Spencolm Geosite for preservation and development.

The stakeholders so far are geologists at the Geological Survey and Mines and those of Makerere University, Uganda. Geoheritage is a subject gaining momentum having interest groups; schools and individuals of different professions approaching it differently but proposed for tourism, such as at www.geographicexplorer.ug.

There is great potential in investigating the feasibility of developing a geosite at a time approach; such as the proposed Nyakasura spencolm Toro-Ndale crater lakes scenic area comprising the proposed Western Region Geopark. To cultivate avenues that can get the Pearl of Africa as a whole or as per the four regions designated as Geoparks. To have a starting point in putting up a National position as to where we stand as country in the Geoscience activities and Geoscience Education at all levels. The Geoparks initiative will supplement to match the Uganda Vision 2040 whose frame work provides plans and strategies to operationalise the Ugandan vision which is "a transformed Ugandan society from a peasant to a modern and prosperous country within 30 years".

PATRIMOINE MINIER DE TIGHZA, MAROC CENTRAL

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Le secteur minier au Maroc constitue une composante essentielle dans l'économie nationale en assurant plus de 35.000 emplois et en participant de 6% dans le PIB. Le district polymétallique de Tighza (anciennement appelé Jebel Aouam) se situe dans la partie orientale du Maroc hercynien central près de la bordure ouest du Causse moyen atlasique, à environ 90 km au Sud de la ville de Meknès et à 7 km de la ville de Mrirt. La mine de Tighza, d'une réserve estimée à plus de 5 000 000 t, est actuellement exploitée par la Compagnie Minière de Touissit. D'une production annuelle de 320 000 t, 25 600 t de concentrés de Pb-Ag, 4 300 t de concentrés de Zn, la mine fait travailler 300 personnes dont 25 cadres.

La région de Tighza est une zone de hautes collines à reliefs modérés (1220 m d'altitude) dont les quartzites du Jbel Aouam constituent un sommet culminant à une altitude de 1496 m. Les crêtes sont grossièrement orientées NE-SW suivant la direction hercynienne. Ces collines sont comprises entre de vastes plateaux, le plateau de Mrirt au Sud-Est et les plateaux de Tanadra et Mçawar à l'ouest et au Nord-Ouest. L'ensemble des terrains est traversé par un réseau hydrographique dont le principal cours d'eau est l'oued Tighza situé au nord selon une direction est-ouest.

Le district de Tighza consiste en deux ensembles magmatiques : (i) un ensemble pré-orogénique formé de metabasaltes situés dans la grande zone de cisaillement de Tighza N100; (ii) un ensemble tardi-orogénique, bien développé dans la région, correspondant à des filons de microgranites, microdiorites, microgranodiorites et rhyolites et quatre intrusions granitiques calco-alcalins, tardi-hercyniens, qui seraient mises en place durant le Westphalo-Stéphanien.

Le district de Tighza est un cas unique au Maroc par la richesse et la diversité de son patrimoine minier qui consiste en une minéralisation polymétallique à Sn-Au-W-As-Sb-Pb-Zn-Ag-Mo-Ba de type filonien. Le district est surtout célèbre pour ses filons hectométriques à Pb-Ag toujours en exploitation. Ces minéralisations sont liées à quatre épisodes de fluides hydrothermaux minéralisateurs:

i) un premier épisode à (Sn-As-Au, W-Au et W-Mo, Sb) est généré à partir des fluides magmatiques. Ces fluides sont contemporains de la mise en place des stocks granitiques et des dykes de microgranites, microdiorites et rhyolites.

ii) un deuxième épisode à antimoine (stibine) caractérisé par la circulation de fluide aqueux qui a engendré la bréchification hydraulique des filons, bien apparente sur terrain, au cours de la phase de relaxation des contraintes varisques.

iii) un troisième épisode tardif hydrothermal à Pb-Zn-Ag lié à la mise en place du réseau de dykes NE-SW permotriasiques pendant une période de distension et d'amincissement crustal qui marque la transition entre la fin de l'orogénèse varisque et la phase de pré-rifting Atlantique.

iv) un dernier épisode est marqué par des venues tardives de barytine.

L'activité minière y est très ancienne. Les premières traces d'exploitation de ces filons remontent au IX^{ème} siècle à l'époque des Idrissides ou l'argent extrait servait à la fabrication de monnaie. Cette

activité minière a probablement connu son apogée au XII-XIII^{ème} siècle. La région abrite un camp fortifié datant du XII^{ème}-XIII^{ème} siècle de 2 200 m de long, muni de tours de garde, des traces d'installations minières et métallurgiques et des zones de grattage (filons exploités en surface). La mine antique d'Aouam (la vieille forteresse d'Ighram Aouassar) fût un important centre minier et métallurgique où les travaux miniers descendaient à plus de 200 m de profondeur. Les haldes laissés par les anciens ont permis d'estimer l'extraction à 166 000 t de métal Pb et 265 t métal d'Ag.

En 1929, la Compagnie Royale Asturienne des Mines (CRAM) a entrepris des travaux d'exploration et d'exploitation, autour du filon Signal (filon à Pb-Zn). La première pépite d'or a été découverte en 1950. En 1954, la Société Minière de Jbel Aouam (SMA) a été créée par la CRAM et le BRPM (actuellement ONHYM) qui a débuté l'exploitation du site en 1955. En 1993, la mine a été mise en veille et la SMA a été liquidée. En 1996, la Compagnie Minière de Tioussit (CMT) a acquis et a développé la mine. En 2003, la CMT a repris ses recherches sur l'or.

L'histoire minière du Maroc Central est essentielle pour comprendre l'histoire de cette région du Maroc. La création de panneaux interprétatifs et le développement de circuits géo-miniers dans la région permettraient sa valorisation et surtout la protection de ce qui reste du patrimoine archéominier. Pour cela, un inventaire détaillé de toutes les composantes patrimoniales liées aux activités minières anciennes et récentes y compris le patrimoine oral et une cartographie de la mine avec les galeries en cours d'exploitation et celles abandonnées s'avèrent nécessaires.

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MARINE PROTECTED AREAS FROM THE ROMANIAN BLACK SEA COAST

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Marine protected areas represent a key component of the integrated management of marine and coastal areas. Although they are often regarded as isolated from the sustainable development of the marine environment, due to their natural capital, MPAs constitute a support for development of socio-economic systems. In these areas, an adequate management can prove that development does

not necessarily mean destruction of nature. Therefore, special efforts should be done in order to find viable solutions for an economic development based on sustainable development of natural resources. Keeping healthy protected areas and exploiting them for commercial, scientific and educational purposes can be achieved only if the human factor involved is aware of their value and rigorously applies the principles of sustainable development.

Each country has the duty to keep and even improve its natural capital, for many reasons: this ensures a healthy environment; it is a duty toward future generations, as unspoiled nature can be the basis of sustainable development; this way it saves rare and endangered species and habitats; the natural capital is an object of study for research and an example for ecological education, both contributing to the improvement of environmental conditions.

The number and surface of protected areas is increasing each year, consequently to increasing economic pressure upon biodiversity, but also of the growing need for natural resources. In 2007, the World Database of Protected Areas – renewed every five years by the World Conservation Monitoring Centre of the United Nations Environment Programme – recorded over 120 000 protected areas, with an area of over 22 million km², representing more than 11,3% from the combined area of national territories. Most are terrestrial protected areas, acknowledging recently that the marine environment is not sufficiently well represented: terrestrial protected areas reached 12.2% of the surface area of the while marine protected areas cover only 5.9% of the sea.

Currently the protection of the natural heritage is ensured through the designation of protected areas: national parks, natural parks, nature reserves, natural monuments, etc. Since 1992, the European Union promotes the development of Natura 2000 network of protected areas, as the main instrument for nature conservation, aimed at EU countries and candidate countries. The Natura 2000 network is based on two EU Directives, the Habitats Directive and the Birds Directive, that regulate the selection and designation of sites and their protection. This network was created to protect not only nature, but also to maintain a long-term natural wealth and resources necessary to ensure sustainable socio-economic development.

The Natura 2000 network covers 24 EU Member States (4 EU Member States have no maritime territory), proving to be a major success. In addition, the Natura 2000 network is complemented by marine protected areas, which were designated in accordance with national legislation. However, despite these successes, the network of marine protected areas in Europe can not yet be considered to be fully coherent nor representative, particularly in the offshore or high seas areas. Significant differences arise between regional seas as areas covered by protected areas. There are also differences in coverage of various types of marine areas. For example, in Europe, 16% of the coastal area is included in marine protected areas. However, beyond 12 nautical miles from shore, only 3% of the EU's seas are protected. This shows that the Natura 2000 network still does not have a representative character.

Considering the increasingly precarious institutional framework of the management of protected areas in Romania, the idea of establishing a National Agency for Natural Protected Areas became a reality in May 2016, after more than 15 years. By setting up this agency, the legal framework for a unified management of all protected natural areas is created, with a unique coordination of the implementation of management plans in order to protect and conserve biodiversity.

Natural protected areas established in Romania represents 23% of the country, the network of marine protected areas covering nine sites of community interest:

- ROSCI0413 The southern lobe of the *Phyllophora* field of Zernov

- ROSCI0311 Viteaz Canyon



The calcareous red algae *Corallina officinalis*



Seahorse *Hippocampus guttulatus* clinging to sea sponge *Halichondria panicea*



Sea grass meadow with *Zostera noltii*



Warty crab (or yellow crab) *Eriphia verrucosa*



Rock shrimp *Palaemon elegans*



Sponge *Dysidea fragilis*

- ROSCI0066 The Danube Delta – marine zone

- ROSCI0197 North Eforie – South Eforie submerged beach
- ROSCI0273 The marine zone at Cape Tuzla
- ROSCI0293 Costinești – 23 August
- ROSCI0094 Underwater sulphurous springs at Mangalia
- ROSCI0269 Vama Veche — 2 Mai
- ROSCI0281 Cape Aurora

Two of the nine marine sites are in the custody of the National Institute of Research - Development of Marine Geology and Geoecology – GeoEcoMar. These are ROSCI 0273 – Marine area from Cape Tuzla and ROSCI 0094 – Underwater sulphurous springs from Mangalia. All the sites are classified in the Black Sea marine biogeographic region.

ROSCI0094 Underwater sulphurous springs from Mangalia contains the highest diversity of marine habitats in Romania and has, overall, the best state of conservation of all marine sites in Romania. In addition, the site contains unique features, making it the most important marine site in Romania. It is the only place in Romania where the habitat 1110-1 Fine sands with *Zostera noltii* meadows, the sea grass growing inside the alveoli formed by existing protection dams. In such bays and in the offshore, 90% of the *Cystoseira barbata* population of Romania is found. Both species are listed in the Red List for the Black Sea at national and regional level. The site also contains a wide variety of animal species considered rare or threatened at national and regional level, such as: *Clibanarius erythropus*, *Calianassa truncata*, *Arenicola marina*.

În the marine site ROSCI0273 marine area from Cape Tuzla, the reefal rocky bottom has the largest expansion to sea and the most varied and rugged terrain in the Romanian sector of the Black Sea. Therefore, the most diverse range of microhabitats of this type are seen here, and consequently a very diverse aquatic fauna and flora occur.

As custodian, GeoEcoMar has the liability to protect and preserve biodiversity, and in particular, the habitats and species of community interest in the protected areas in its custody. To meet the primary goal, the custodian has conducted a series of activities which consisted in the application of measures for long-term maintenance of biodiversity conservation; in organizing educational activities, targeting in particular pre-school children, students and teachers; organization of information and promotion of the site and last but not least, conducting research to determine the current state of the ecosystems within the protected and adjacent areas. The research include underwater observations on the flora and fauna of each site, collectint biological samples (macrophytes, phytoplankton, zooplankton, meiobentos and macrobentos). The results showed a generally favorable conservation status of benthic habitats compared to the eighties and nineties. However, the small number of "favorable conservation status" assessments of species and habitats, as well as the low percentage of fish stocks with "good environmental status" indicates that the current management of Marine Protected Areas is not yet as effective as it could be!

So far, there is no coherent overview on the efficient management of Natura 2000 network in Europe. Considerable efforts are needed to assess whether the Natura 2000 network contributes to achieving the "favorable conservation status" for species and habitats, as well as to a "good environmental status" of the seas in general.

PETROLEUM POTENTIAL AND TECTONO-SEDIMENTARY ARCHITECTURE OF MIDDLE EOCENE RESERVOIR IN KERKENNAH ISLANDS (TUNISIA)

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Key words: Gulf of Gabes, Kerkennah Islands, Middle Eocene, Reineche reservoir, facies modeling, petroleum interest

Kerkennah Islands are located in central eastern Tunisia, specifically in the Gulf of Gabes and belongs to the pelagian platform. Kerkennah Islands are a target for explorers searching for productive stratigraphic levels. It is a prolific hydrocarbon province where several fields were discovered since 1971 and still producing till now. The main production comes from the tertiary petroleum systems. The Gulf of Gabes is a structured mainly by NW-SE trending faults. These extensional faults have led to a structure of tilted basement blocks.

The Middle Eocene Reineche member is a proven reservoir presenting good oil and gas shows and average to good petrophysical evaluation in high zones, in Cercina Oil Field and Chergui gas field.

The Reineche member is subdivided into three units. The lower Reineche is represented by argillaceous limestone and bioclastic limestone. The Middle Reineche is mainly composed of marly intervals and calcareous claystone. The Upper Reineche corresponds to a nummulitic interval. The Reineche reflects a ramp depositional environment.

An integrated geological study, based on multidisciplinary approaches, revealed new evidences of the spatial and temporal organization as well as the tectonic architecture of middle Eocene intervals. Several gaps, thickness variations and unconformities have led to the genesis of potential areas for hydrocarbon explorations. These evidences have been materialized in a new proposed facies distribution model. As part of the exploration activities in Kerkennah Islands, an integrated review of the nomenclatures and subdivisions of the Middle Eocene Reineche has been carried out.

This work encompasses three main phases. The first phase of the study aimed several lithostratigraphic correlations in order to outline the paleogeography, thickness variations and lateral facies transition from deep to inner depositional environments.

The second phase of the study has been devoted to outline the architecture and facies development of the Reineche member. A layering has been performed based on the electrofacies determination from wireline logs and has been improved with a facies association subdivision of the reservoir based on well data (Figure 1).

The last one highlighted the spatial extension, distribution and major transitional zones of each layer. This method has been performed on a 3D grid and is called "Facies modeling".

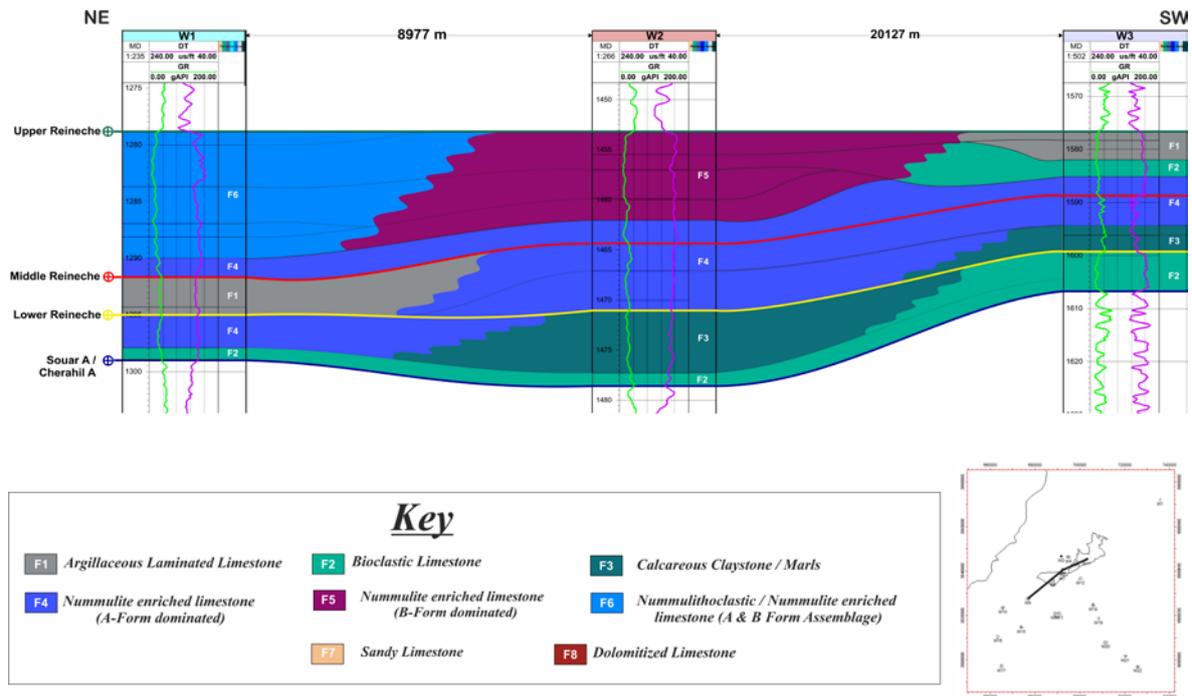


Figure 1. Correlation of Kerkennah electrofacies (NE –SW)

Kerkennah Islands represent a promising area for oil and gas explorations. The Reineche member proves its petroleum potential but has been under-explored within the area. This new proposed facies distribution model brings a crucial motive to rise exploration opportunities for this Lutetian target in Tunisia.

LES MAGNIFIQUES STRUCTURES PAYSAGERES SCULPTEES PAR L'EROSION FLUVIALE DANS LE GEOPARC DU JBEL BANI, TATA-DRAA (MAROC)

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Faisant partie de la chaîne anti-atlasique du Maroc et du géoparc de Jbel Bani Tata-Drâa, la région de Tata occupe la partie orientale de l'Anti-Atlas occidental. Située à l'Est du massif précambrien de Kerdous, elle est limitée au Nord par la boutonnière d'Ighrem, à l'Ouest par la boutonnière de Kerdous et vers l'Est jusqu'au Sud par la plaine du Drâa.

Ce secteur est constitué d'un socle Précambrien, rapporté au Paléo-protérozoïque (orogénèse éburnéenne) et Néoprotérozoïque (orogénèse panafricaine), et d'une couverture sédimentaire qui repose en discordance sur le socle, attribuée au Néoprotérozoïque terminal et au Cambrien, et enfin la couverture paléozoïque structurée pendant l'orogénèse hercynienne. Une longue période d'érosion méso-cénozoïque ensuite a eu lieu dans toute la chaîne anti-atlasique.



Figure 1. La formation limoneuse de l'Oued Akka-Région de Tata, Sud Maroc

Le secteur d'étude est traversé par plusieurs cours d'eaux (Oued Tata, Oued Akka...etc.), qui entaillent les affleurements géologiques tout au long de ses trajets pour enfin se déverser dans l'Oued Drâa.

Les processus d'érosion et d'accumulation génèrent des formes originales qui sculptent ou façonnent le paysage. Ces formes peuvent correspondre à des formes d'érosion qui affectent la roche en place (badlands, cluses, gorges, canyons, paysage karstique...) ou les formations superficielles qui recouvrent la roche en place (Limens...).

Le climat de la région de Tata étant semi-désertique à désertique, c'est-à-dire moins de précipitations, mais lorsqu'ils sont là, ils provoquent le plus souvent des inondations, c'est ainsi que des périodes de crues, accentuent de plus en plus par le biais de l'érosion fluviale, et donc, des formes d'érosion ou des géosites, considérés comme géopatrimoine naturel de la région de Tata.

En plus de l'influence climatique hostile, s'ajoute l'influence lithostratigraphique et tectonique qui joue son rôle aussi conséquent pour faciliter la tâche aux processus de l'érosion fluviale, on cite particulièrement les diaclases.

Ce géopatrimoine naturel de la région de Tata façonné sur une longue période de travail de l'érosion fluviale, doit être tout d'abord exploré, valorisé et préservé, tout en mettant l'accent sur

l'environnement et le développement socio-économique local durable au sein du géoparc de Jbel Bani Tata-Drâa.

IMPACT OF UNDERGROUND MINING ON THE ENVIRONMENT GEOTECHNICAL APPROACH: CASE STUDY FROM ALGERIA

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Keywords: Mines Algeria, analytical and numerical methods, Subsidence, PLAXIS software, Environment

Underground mining of horizontal and slightly inclined deposits leaves large voids "exploited", which could cause subsidence and surface collapses. The problem of these effects and their impact on the environment in general is common to many countries of the world. The mining subsidence and collapses, if they occurred, they result in significant damage: the destruction of mining operations, staff death, cessation of production, negative impact on the soil environment and the basement, etc. The magnitude of these effects depends on several major factors, namely: the geology of the deposit, its lithology and especially its structural aspect, the physical and mechanical properties of the rock mass, the geometry of the mineralized layers, the method of operation and the state of exploited areas. Currently, the state of stability of underground mines can not be measured only by using the analytical and/or numerical methods. In this work, an application has been considered, to study the stability of Chaabet El Hamra and Ain Mimoun underground mines (Algeria).

The two approaches used in this work are the analytical and numerical methods. Numerical simulation is performed using a code of the finite element, application of Plaxis 2D Version 8.2 software. The obtained results have allowed us to quantify the two-dimensional extent of the subsidence basin, to have an acceptable safety factor and to realize a model type of operation in the case of the studied mines.

STUDY OF THE IMPACT OF MINE WASTE ON THE SULFUR CONTAMINATION OF GROUND AND SURFACE WATER AS A RESULT OF ACID MINE DRAINAGE (AMD). CASE OF AIN MIMOUN MINE, ALGERIA

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Key words: Mines Algeria, desulphurization methods, neutralization, Recovery, Environment.

Mining generates major wastes containing sulfur and heavy metals minerals that may be the source of contamination of ground and surface water. The main impact from extraction of the ore a type that affects the quality of water is the phenomenon of acid mine drainage. This is a natural process where acid is produced when the sulfide in the rock is exposed to air and water. This seriously degrades the quality of water, destroys aquatic life and makes water virtually unusable. If security and technology measures are not taken into account for this purpose the environment will be affected.

In this article, an application is considered. It relates to the impact of mining waste on water quality in the Ain Mimoun underground mine (Algeria). The methods used are filtration of mining waste, neutralization by adding lime and recovery of mining waste against oxidation. The results obtained have allowed us to protect the environment against any water contamination in the case of the studied mine.

LES SCIENCES DE LA TERRE DANS L'ENSEIGNEMENT SUPÉRIEUR AU MAROC: UN DÉFI DE GÉO-ÉDUCATION

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Le système LMD installé au Maroc depuis quelques années a permis une nouvelle architecture pédagogique des enseignements des disciplines scientifiques. Ainsi l'enseignement des Sciences de la Terre ne cesse de prendre une place importante en innovation pédagogique et dans les domaines de la recherche scientifique tels que les domaines minier, environnement, eau, climatologie, développement durable, etc.

Aux modules principaux des sciences de la terre qui sont très rattachés aux travaux pratiques et sorties de terrain s'ajoute un socle de disciplines scientifiques fondamentales ainsi que les techniques de communication et l'Informatique.

L'étudiant orienté aux sciences de la terre (3 années) doit suivre 24 Modules comme socle des disciplines fondamentales avant de suivre en 3ème année 9 modules de spécialité et un projet de fin d'étude lui permettant d'approfondir ses connaissances acquises.

Lorsque les disciplines acquises le permettent, l'enseignement des Sciences de la Terre aborde des disciplines transversales basées sur l'observation et le raisonnement scientifique qui offrent à l'étudiant la capacité d'initiative personnelle et autonomie d'interprétation.

PALEOENVIRONMENTAL CHANGES ON THE NORTHWESTERN BLACK SEA SHELF DURING THE LATE PLEISTOCENE – HOLOCENE

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Key words: ostracods and foraminifers sea level fluctuation Black Sea red clay

During Late Pleistocene - Holocene times, the Black Sea basin suffered a major shift from a fresh water environment to a brackish one, which is mirrored in the biotical turnover. In the deeper parts of the Black Sea basin, i.e., below 200 m water depth, Ross and Degens (1974) recorded three stratigraphic units (from young to old): Unit 1 (the microlaminated coccolith ooze, deposited under marine conditions), Unit 2 (the sapropel mud, corresponding to a brackish, anoxic phase), and Unit 3 (the lacustrine lutite deposited during the freshwater or oligohaline stage).

The transition of the Black Sea from an inland lake to a marine basin during the last glacial/deglacial episode is still generating discussion in the scientific community. In this study, high resolution microfaunal analyses coupled with isotopic (carbon and oxygen) and calcium carbonate (CaCO₃) performed on an AMS 14C dated core, 09 SG 13, revealed changes that occur in the Black Sea from the Last Glacial Maximum through the transition to the present day semi-enclosed marine basin. In the core, located on the outermost Romanian Black Sea shelf, two lithological units, respectively the youngest Unit 1 (The Coccolith mud) and the oldest Unit 3 (The Lacustrine lutite), were identified. The Unit 2 (The Sapropel Mud) is missing. In the two lithological units identified, four ecobiozones are distinguished based on changes in microfossil assemblages, which reveal climate shifts and oscillations of salinity. The Last Glacial Maximum period is characterized by stable

conditions recorded by homogenous ostracod assemblages. However, the onset of the Fennoscandian Meltwater Pulses changed drastically the hydrological conditions of the basin, by lowering the salinity and allowing the fresh water ostracods to thrive. These fresh water pulses are mirrored in the sedimentary record by the reddish-brown clay deposition. Following the Late Holocene deposits encountered in this core, i.e. the uppermost 7 cm of the core, stable marine conditions set in. The ostracods and foraminifers that dominate this interval are common in the present-day Black Sea benthic communities, at water salinity around 18‰. Also the occurrence of blooms of the calcareous nannoplankton species *Emiliana huxleyi* suggests stable salinity and temperature conditions for this time interval.

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REE INVESTIGATION OF MOTRU DYKE SYSTEM COMPONENTS (SOUTH CARPATHIANS, ROMANIA)

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A system of calc-alkaline dykes (Motru Dyke Swarm- MDS) penetrates the metamorphic basement of the Danubian Domain on a presumed thermo-tectonic event of pre-Silurian age (Berza & Seghedi, 1975). The metamorphic basement of the Danubian domain (i.e. the lowermost tectonic unit in the South Carpathians Alpine system, that crops out in a large tectonic window), is classically separated in two groups with different origin, lithologic composition and geological history: the Lainici-Paius group of metasedimentary origin and the Dragsan group, a former oceanic island arc (Liegeois et al., 1996). The principal argument of the MDS age is based on their intrusion relation with a particular granitic body (i.e. Frumosu granite, Berza and Seghedi, 1975; Berza et al., 1981) covered by Silurian low-grade metamorphic sediments (e.g. Féménias et al., 2008). The emplacement age assumption is apparently supported by the zircon U-Pb isotopic age dating and monazite chemical dating performed on several MDS components (Câmpeanu et al., 2014). All of the reported datasets lack in ages younger than Silurian, all the zircon and monazite grains being interpreted as inherited. However, some new zircon U-Pb isotopic age data from two MDS components (Câmpeanu et al., 2015), seem to contradict previous assumptions.

The MDS outcrops on a large area in South Carpathians, and is the most important dyke system cutting mainly through the Lainici-Paius group. The other two dyke systems affecting the Danubian basements are Dragsan dyke system and Almaj dyke system (Femenias, 2003). MDS components show heterogeneous geochemical compositions, spanning medium-K, calc-alkaline to shoshonitic series, ranging from basaltic andesites to evolved petrotypes such as rhyolites (49.99-75.04 wt % SiO₂). This subvolcanic complex was linked to a mantle source by Femenias et al., 2008, yet recent studies (Câmpeanu et al., 2014, 2015), propose a mixed mantle and crustal source. The involvement of the crustal component is sustained by the presence of relic zircon and monazite grains, and also by the geochemical interpretation of the trace elements. Additionally, the Sr and Nd isotopes confirm the involvement of a crustal component.

Prospective new REE studies has been carried on five representative samples (rhyolite to dacite) from MDS. The REE distribution reveal a relative enrichment, especially in the LREE part, that confirm the existence of previously enriched source (REE highly variable from 58.85 - 289.35 ppm). The slight positive Eu anomaly, point to the presence of the plagioclase in the source. However, the relic plagioclase together with the relic amphibole was observed. The REE distribution pattern as well as variable and elevated La_N/Yb_N (i.e. 9.7-101) point to involvement of garnet fractionation (e.g. Kay et al., 1991) and possibly amphibole.

All these new data support the previous ideas that the MDS was emplaced in a post-collisional environment from a mixed source with an important crustal participation.

Acknowledgements: study supported by PN-II-ID-PCE-2011-3-0100 Grant, UEFIS-CDI. Access to analytical infrastructure was possible within RIC framework.

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THE ECOTOXICOLOGICAL ASSESSMENT OF BOTTOM FRESHWATER SEDIMENTS COLLECTED FROM VÂLCEA, BĂBENI, IONEȘTI, ZĂVIDENI AND DRĂGĂȘANI RESERVOIRS (ROMANIA), LAKES IMPACTED BY HUMAN-RELATED ACTIVITIES

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GOALS, SCOPE AND BACKGROUND

The investigated aquatic ecosystems it is well known as being affected by the historical, technological development in the Valcea county area, where the chemical industry prevails, especially in the city of Rm. Vâlcea, which is the most industrialized from the county. As well, the Olt River is known to be influenced by the discharges of untreated effluents coming from the Oltchim S. A. Rm. Vâlcea - Chemical Plant (one of the largest chemical producers for Chlor-alkali, Chlorosodics, Polyether Polyols, Propylene Oxide and PVC) situated in Râmnicu Vâlcea, Romania. More specifically, it is about wastewaters containing discharges of mercury (Hg) from the Chlor-alkali electrolysis industry, which affects the aquatic ecosystems considered to be contaminated by historical mercury.

To assess if ecotoxicological effects might be related to the quality status of the sediments impacted by the chemical plant, bottom freshwater sediments were collected (September 2014) at selected locations and analyzed in an integrative approach using the physical-chemical measurements of sediments, as well as two bioassays with benthic invertebrates for ecotoxicological characterization of sediments. Both bio-indicator organisms were chosen based on their common use in the sediment toxicity testing and their occurrence in a wide variety of aquatic environments including freshwater systems of the Northern Hemisphere.

Chironomus riparius is a non-biting midge, which possesses two aquatic growing stages (larvae and pupa) before becoming an aerial adult. Their larvae are known to be sensitive to pollutants such as pesticides and heavy metals including mercury (Hg), too. Mercury contaminated sediments were thus successfully assessed for their toxicity towards benthic communities using *C. riparius*.

Heterocypris incongruens is a sediment-dwelling crustacean with a bivalve carapace of low-Mg calcite, which grows by moulting (eight instars). They are also reported to be sensitive to organic and heavy metal pollution leading to morphological changes of their carapace, a decrease of their growth and their community composition. They are thus very useful organisms to assess sediment toxicity. Both organisms were exposed to the five tested sediments and examined for their mortality and growth rate in order to infer conclusions about their ecotoxicological quality.

METHODS

A) Sampling locations. The Olt River is situated in the South Carpathian Region, being the longest and the main tributary of the Danube River in Romania. Its natural morphology has been strongly modified by the hydro technical works along the Olt River (construction of 19 dams), and its water quality is highly impacted in the Rm. Valcea region, due to the developing number of industries in the evaluated area, notably a Chlor-alkali Process Plant (Oltchim). The bottom freshwater sediments were thus collected in five reservoirs surrounding the industrial platform *i.e.*, Valcea, Babeni, Ionesti, Zavideni and Dragasani using a Ponar-type grab sampler, and maintained at 4°C in the dark until analysis. Valcea reservoir is located upstream the Oltchim platform, relatively farther away from the direct influence of the industrial activities from the Rm. Valcea area, being considered as a reference (control reservoir) in this study. Babeni, Ionesti, Zavideni and Dragasani are situated downstream of the river Olt, relatively directly influenced by the industrial activities that occur in the Rm. Valcea area. To specify that Babeni is the reservoir receiving the direct mercury (Hg) input from the chemical platform.

B) The physical-chemical characteristics of the sediments. Firstly, the bottom freshwater sediments were hand-homogenized and sieved through 2 mm in order to remove large particles and indigenous benthic macro fauna. Then, the sediments were analyzed to determine their pH (unit of pH), the grain size (%) and the total organic matter content (%). The particle size analysis was performed on wet sediments in deionized water with a LS-100 analyzer (Beckman Coulter, Fullerton, CA, USA) to determine the sand, silt and clay fractions. The volume percentage of particles was determined according to their diameter, *i.e.*, Clay ($\Phi < 2 \mu\text{m}$), silt ($2 \mu\text{m} < \Phi < 63 \mu\text{m}$) and fine, coarse sand ($63 \mu\text{m} < \Phi < 1 \text{mm}$). Loss of Ignition (LOI) is a method to quantify the quantity of the total organic matter in sediments (expressed as percentage of dry weight sediment), and was obtained by burning the dehydrated (105°C) sediments at 550°C for two hours. Finally, the total mercury (Hg) content in freeze-dried sediments was measured using an atomic absorption spectrophotometer (Advanced Hg Analyzer; AMA 254, Altec s.r.l., Czech Republic).

C) Ecotoxicological tests. To investigate the ecotoxicological effects on mercury (Hg) on benthic invertebrates, two "direct contact" tests, in which the freshwater indicator organisms were exposed to the whole investigated sediment samples were used, such as: the midge larvae (*Chironomus riparius*) and the sediment-dwelling micro crustacean (*Heterocypris incongruens*). Ultimately, the Chironomid larvae that were used for the experiment were freeze-dried and analyzed for the intracellular mercury (Hg) content ($\mu\text{g/g dw}$).

RESULTS AND DISCUSSION

The physico-chemical characterization of the sediments revealed that the control reservoir (*i.e.*, Vâlcea – not influenced by the discharges of mercury (Hg) from the Chlor-alkali electrolysis industry) and the impacted reservoirs had a similar pH (values varying from 8.1 to 8.3), and were mainly composed of silt (values ranging from 84 % to 93% of the total particle volume). However, the total organic matter content (estimated by LOI method) was found to be lower in sediments from Vâlcea reservoir ($7.8 \pm 0.2\%$) compare to the reservoirs located downstream to the chemical platform, except for Băbeni. Higher Hg concentrations were also found in sediments located downstream the Govora River (higher value of 0.51 mg/kg in Băbeni and Drăgășani reservoirs) than in the control reservoir ($0.13 \pm 0.01 \text{ mg/kg}$). Similar Hg concentrations were measured in Vâlcea sediment in 2006 with values ranging between 0.01 and 0.08 mg/kg. Mercury concentrations in Băbeni reservoir are however lower than those measured in 2006 and 2007, which recorded Hg values between 1.3 and

2.4 mg/kg. The lower concentration measured in the present study further confirms the decrease of Hg in sediment measured at that time using sediment cores. Indeed, a significant decrease of Hg was observed between 1987 and 1999, possibly reflecting the advances in the control of Hg emission by Chlor-alkali plants. However, since 1999, no decrease in Hg was observed despite the decommissioning of one Hg-based product line. The Hg decreasing trend noticed in the present study might, however, now reflect the slowing down of the Oltchim Plant production activities.

The bioassays with *C. riparius* were carried out with larvae in their fourth instar in order to have sufficient amount (material) to measure the Hg bioaccumulation after the sediment exposure. In this 7-day bioassay exposure experiment, sediments from the selected samplings did not cause any larval mortality. In all investigated sediments the biomass of the Chironomides has not declined. An inadequate small length development of the larvae was detected in the tested samples, despite the absence of significant toxic effects. The initial larvae size (0.50 ± 0.09 cm, $n=102$) was however low compared to their expected size of that growing stage, which is probably due to the source of food. Larvae exposed for 7 days to the studied sediments were found to have a similar size, as well as to have comparable Hg content, suggesting that the higher Hg content in sediments of impacted reservoirs might not be bioavailable for the Chironomides; therefore the samples had no detectable effects on larval mortality, in terms of mercury (Hg) bioavailability. The investigated sediments did not induce significant effects on midges, and the concentrations of the mercury (Hg) content in the sediments and the feedback of the midges were not considerably correlated.

The effects of mercury (Hg) on the benthic Ostracod *H. incongruens* through sediment exposure did not reveal significant toxic effects on observed Ostracodes mortalities. The tested samples indicated that no toxicity was observed in the whole sediment assessed with the dwelling microcrustaceans species. The growth rate was also not impacted by a 6-day contact with the studied sediments.

The ecotoxicological effects induced by the environmental samples from the reservoir lakes (considerably influenced by many contamination sources), when were assessed through physical-chemical analyses and bioassays, did not reveal a significant correlation between contamination with mercury (Hg) and toxicity. Within this experiment (2014) the potential mercury (Hg) contamination and the toxicity show that these are not associated at all, suggesting any ecotoxicological concern in these aquatic ecosystems contaminated by historical mercury, neither for the investigated samples, nor for the investigated bio-indicator organisms.

Also, it should be considered, that the present results are in good agreement with a previous study performed in 2007, which did not observe any mortality in *C. riparius* bioassays when the organisms were exposed to Valcea and Babeni sediments containing at that time 0.09 and 1.44 mg/kg of Hg, respectively. In that study, the Chironomides exposed to Băbeni sediments were also found to contain about 1 $\mu\text{g/g}$ dw of Hg. Instead, contrasting results were found with Ostracodes exposed to sediments collected in April 2013. Indeed, about 20% of Ostracodes were found dead when exposed to Băbeni, Ionești and Zăvideni sediments and were also found to have a decrease of about 30% in their growth in Ionești and Zăvideni sediments.

Based on the sediment analyses presented in this study (2014), the investigated aquatic ecosystems cannot be considered to be severely polluted by historical mercury (Hg), despite the past local industrial development in the area. Nevertheless, the both ecotoxicological tests performed in the present study did not reveal any potential toxicity of the tested sediments for the benthic invertebrates.

TECTONIC EVOLUTION AND HYDROCARBON POTENTIAL OF THE TURONIAN-CONIACIAN SERIES IN GULF OF GABES OFFSHORE AREA OF TUNISIA

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Keywords: Tunisia, Tectonic evolution, Turonian-Coniacian, 2D seismic, Hydrocarbon potential

The Gulf of Gabes lies in the Pellagian Province which generally coincides with the offshore shelf area of east-central Tunisia and northern Libya. It is a wide Cenozoic basin developed at the expense of a stable platform and separated from it by the NW-SE platform.

During late Cretaceous, extensive shallow water carbonate platforms were developed over a large part of the Gulf of Gabes. The development of this carbonate platform was especially controlled by the inherited substratum structuration. The present study is based on subsurface data and was initiated with the aim to reconstitute the tectono-sedimentary evolution of Turonian-Coniacian series, to bring out the major structural elements that have dislocated the sedimentary substratum and to highlight the remaining hydrocarbon potential of the Ashtart sub-basin to guide the future exploration activities.

The overview of the lithostratigraphic succession of the study area using mud logging data and wireline log lead to homogenize all the stratigraphic formations as well as the Turonian-Coniacian target. Thus, the drilled wells used, crossed a lithostratigraphic series ranging from Plio-Quaternary to upper Cretaceous. Several lateral thickness and facies changes were highlighted through different directions of regional correlation well lines.

Moreover, several stratigraphic correlations lines of Cretaceous intervals flattened with the Santonian discordance (Datum) and facies map allowed us to follow the special distribution of facies and thickness of Douleb and Bireno objective. Indeed, the Turonian-Coniacian lithostratigraphic sequences show a main lateral facies evolution from the SW to the NE seen at different scales.

The interpretation of 2D seismic reflection lines are used to determine the structural configuration of the basin. Isochron and Isobath maps drawn for both tops of Douleb and Bireno carbonates horizons show that during the Turonian-Coniacian time, the structure of study area was especially controlled by NW-SE extensional faults network development, strike slip and NE-SW minor normal faults system. The structural pattern resulting from the NW-SE compartmentation is governed mainly by tilted blocks, horsts, grabens and puzzling structures.

Thus, this study allowed us to bring out the best area of interest where all favorable conditions, to the generation and hydrocarbons accumulation, are met in Tunisia.

LE GISEMENT DE TALC DU NKOBO (SIROUA, ANTI-ATLAS CENTRAL, MAROC)

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Le gisement de Talc unique et important par sa taille au Maroc, se situe dans la région de Nkob dans le massif du Siroua de l'Anti-Atlas Central partie nord du craton ouest africain à 100 Km au SW de la ville de Ouarzazate. Il apparaît au contact des dolomies, shales, grès et quartzites avec des dykes et des sills de dolérites formant la série de marge passive du Groupe de Taghdout, affectées par l'orogénèse panafricaine, correspondant au break-up de la marge nord du craton Ouest Africain. Cette série fortement écaillée se trouve prise dans une zone de déformation panafricaine polyphasée décro-chevauchante ayant joué dans les conditions de facies schiste vert-amphibolite. Au Talc du Nkob viennent s'ajouter d'autres minéralisations importantes situées dans le Massif de Siroua comme l'argent de la mine de Zgounder et l'Or de Tafrent.

Le Talc friable à grains très fins, affleure en bandes blanchâtres d'épaisseur centimétrique à métrique alternant avec les bancs métriques de dolomies. Ces dernières sont de couleur rouge mais deviennent verdâtres avec l'apparition du Talc. Elles sont recristallisées en marbre, en association avec des niveaux de lentilles de gabbros et/ou des serpentinites du complexe ophiolitique panafricain du Siroua de l'Anti-Atlas. Le gisement est aussi limité dans sa partie sud occidentale par le granite de Mzil ainsi que des schistes et des micaschistes à l'Est.

Les variétés de Talc sont nombreuses et diffèrent selon les types de massifs et de la roche mère, donnant plusieurs hypothèses valables pour sa formation. Il y a dépôt à partir d'une roche mère magnésienne de nature carbonatée (dolomie) transformée sous l'effet d'une métasomatose siliceuse ; ou à partir d'une roche mère ultrabasique comme les serpentinites sous l'effet de venues massives de CO₂ (carbonisation) ; et aussi par transformation de roches siliceuses (granite, quartzite...) sous l'effet de métasomatose magnésienne. L'ensemble de ces conditions qui pourraient être à l'origine de cette minéralisation en Talc sont présentes dans la région de Nkob.

Pour pouvoir déterminer l'origine du Talc de Nkob, et réaliser un modèle structural détaillé et métallogénique du gisement, plusieurs études sont en cours, et d'autres sont envisagées aussi bien sur la minéralisation talqueuse et sur les roches plutoniques qui y sont associées. Il s'agit d'une cartographie et d'une étude structurale, pour définir la géométrie du gisement de son encaissant; une étude pétrographique, géochimique, thermométrique et minéralogique pour caractériser les zones stériles et minéralisées.

L'objectif est de réaliser un modèle structural détaillé du gisement sur la base des observations de terrain et des images satellitaires permettant de mettre en évidence les objets structuraux lieux des circulations de fluides minéralisateurs, et aussi de réaliser un modèle métallogénique du gisement caractérisant les sources de fluides et de chaleur et les cellules de circulation hydrothermale et mettant en avant les paramètres qui contrôlent la localisation des minéralisations exploitables de talc.

De nouveaux éclaircissements sur la formation et la concentration du Talc de la région seront apportés, ainsi qu'une comparaison avec d'autres gisements de même type de minerais ; ainsi que la détermination de l'architecture de mise en place des plutons associés par la méthode d'Anisotropie de Susceptibilité Magnétique (ASM). Sur le plan économique, d'importantes indications sur la qualité économique et probablement concurrentielle de ce gisement de la région de Nkob seront envisagées.

GEOLOGICAL AND GEOMORPHOLOGIC ITINERARY – AN ALTERNATIVE APPROACH OF URBAN TOURISM IN SIBIU

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Given the increase in the level of awareness and information of the tourists, the guides' and the specialists' mission in this area becomes ever more difficult. The fact that a growing segment of the population has the possibility to travel, makes the formulation of the communication messages used to attract and surprise them, ever more challenging and difficult.

The current paper suggests urban geotourism as an alternative form of tourism, meant to complete the cultural and religious one which are already happening in Sibiu. In this paper we will present a geotouristic route as which will include cultural and architectural sights, which will also be presented from a geological and geomorphologic perspective. This direction aims at the diversification of the presentation of the cultural-historical objectives, which ought to satisfy the motivations and the requirements of specialized category of tourists and not only. Another objective is to present and to increase the awareness of the geotouristic elements of the urban space, as well as to highlight certain geological and geomorphologic elements which are to be appreciated from a touristic point of view through educational, scientific or recreational tourism. Tourism can also offer geological information that either adds on to the cultural information, reinforces already known facts or presents geology's practical, everyday side. One way to educate, to spread geological information is through tourism, regardless the age of those who practice it. This paper refers to a form of urban tourism, namely geotourism.

Urban geotourism comes to complete the other forms of tourism with information related to the rock that was used in the architectural elements of the cultural and religious sights, their collection

site, the degradation processes that have affected them, the vulnerabilities related to the internal composition of the rock and the local topoclimate, and the geomorphologic context of the city of Sibiu location and development.

The natural circumstances have represented and keep on being positive factors in the socio-human and economic development and evolution of Sibiu. The Upper Town has several towers, genuine belvedere points, from which observations can be made on the geographic space of the depression where Sibiu is located. We will then focus on the fact that the landscape elements enable the development of the settlement since their morphologic characteristics can be easily transposed to the built on areas of the city: the ancient nuclei of the settlements of Sibiu, Gușterița, Turnișor are placed on the almost horizontal surfaces of the terraces of the Cibin river bay. Furthermore, the landscape represents the factor that enabled and later on guided the spatial evolution of the city. The quite recent and current historical transformations will also be dealt with, since they are significant and determined by the spatial and functional evolution of the city. This approach of the touristic sights in the city can represent a way to access knowledge and to set the grounds for a geological and geographical education, in which school, in all its forms of education, museums and local administration – through its department of touristic promotion – all play an important role in the organization of research programmes and practical activities for students and pupils.

LA RÉGION DES PLATEAUX DU TOGO, UN GÉOPARC POTENTIEL

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Mots clés: Patrimoine géologique, régions des plateaux, environnement, géotourisme, géoparc, développement durable.

La région des plateaux, située dans la partie septentrionale du territoire togolais (Fig. 1), est caractérisée par une suite de reliefs montagneux et de plateaux avec les monts aux altitudes les plus élevées. Elle représente l'une des plus belles régions touristiques du Togo, attractive par son climat doux de montagne, sa biodiversité (forêts humides, forêts classées), ses pics, cascades et par la beauté de ses paysages. Elle possède de nombreux sites géologiques et géomorphologiques remarquables, dont le Mont Agou, le plus haut sommet du Togo qui culmine à 986 m (Photo 1). Malgré l'importante géodiversité qui caractérise cette région, les héritages géologiques sont jusqu'ici peu valorisés.

Ce travail vise à inventorier et sélectionner les géosites remarquables de la Région des Plateaux du Togo en vue de leur valorisation dans le cadre de la création de géoparcs au Togo.



Figure. 1. Localisation de la Région des plateaux



Photo 1. Vue panoramique du Mont Agou (986 m)

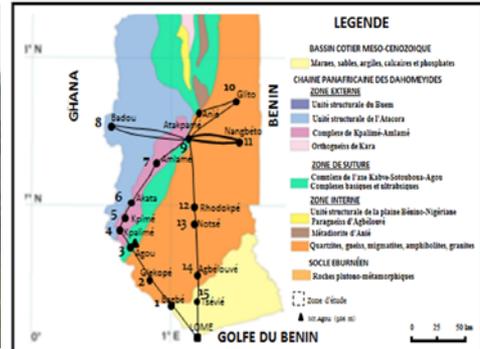


Figure 2. Géotour potentiel dans la zone d'étude

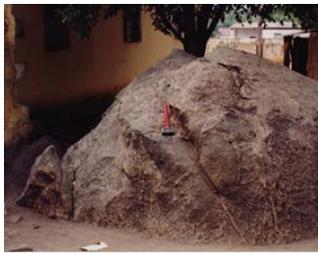


Photo 2. Les granitoïdes de Kpalimé



Photo 3. Les éclogites des monts Lato

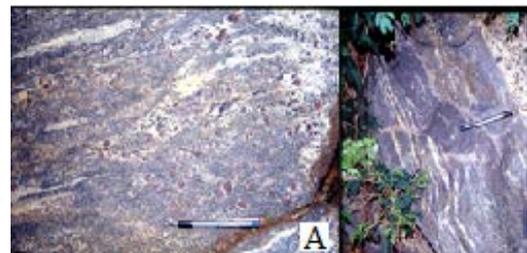


Photo 4. Les granulites du Mont Agou



Photo 5. Activité pédagogique sur le Mont Agou



Photo 6. Les migmatites de Kpédomé



Photo 7. Grès de bordure (Contact socle-bassin côtier)



Photo 8. Géomorphosite Plateau de Badou



Photo 9. Géomorphosite Cascade de Kpimé



Photo 10. Patrimoine historique: Le Château Vial

Le patrimoine géologique de cette région est d'une importance capitale car les géohéritages sont d'intérêt scientifique et pédagogique, à caractère régional et international. Ils offrent l'opportunité d'étudier à la fois deux évènements orogéniques majeurs, l'orogénèse éburnéenne (2100-1600 ± 50 Ma), et l'orogénèse panafricaine (650 ± 50 Ma) qui a permis l'édification des chaînes dites panafricaines en Afrique (Dahomeyides, Hoggar) et au Brésil. La région des plateaux représente l'unique endroit dans les Dahomeyides où affleurent des écloğites issues de la subduction du paléoo-céan panafricain. Plusieurs géosites remarquables (Fig. 2) ont été sélectionnés dans le cadre de ce travail en fonction de leur appartenance aux grandes unités structurales géologiques du Togo. Ce sont, d'ouest en est : les quartzites ornementales de Kpimé et d'Akata, les granitoïdes de Kpalimé-Amlamé (photo 2), les écloğites des monts Lato (photo 3) les granulites du massif Agou (photos 4 et 5), les migmatites de Kpédomé (photo 6) ; les granites d'anatexie de Rodokpé, les orthogneiss d'Agbélouvé, les granites de Glito et d'autres sites dont la zone de contact socle panafricain - bassin sédimentaire côtier méso-cénozoïque (Photo 7) et plusieurs géomorphosites (Photos 8-9).

Le géotour proposé (Fig. 2) comprend une quinzaine de géotopes qui permettent de raconter l'histoire géologique de la zone étudiée. A cela s'ajoute un riche patrimoine touristique qui intègre les composantes naturelles, culturelles, historiques (Photo 10) actuellement exploitées à des fins écotouristiques (château Viale, grottes aux chauves-souris, cascades, barrages, forêts humides, champs de café et cacao, produits artisanaux, marchés aux fruits tropicaux, etc...).

L'intégration des géotopes sélectionnés aux circuits touristiques existants offre l'opportunité de développer le géotourisme qui permettra une meilleure valorisation de l'ensemble des patrimoines de la région. La gestion efficace d'une telle activité géotouristique deviendra un puissant outil de développement socio-économique et un moyen de sensibiliser les populations locales sur l'importance des géohéritages, la protection de l'environnement et la géoconservation.

L'ensemble de ces richesses naturelles, géologiques, culturelles et historiques associé aux nombreux sites d'hébergement fait de la Région des Plateaux un géoparc potentiel.

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EFFET DE L'INOCULATION DES MICROORGANISMES SYMBIOTIQUES SUR LA CROISSANCE D'*Acacia mangium* CULTIVE SUR DE LA FIBRE DE COCO

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Acacia mangium est capable de croître même sur les sols les plus pauvres et de former des associations symbiotiques avec les microorganismes. La plupart de ces microorganismes sont apportés au sol (sol stérile ou sol de décharge) via des inoculations. La quasi-totalité des études faites montrent un seul type de substrat de culture potentiel, pour cette plante c'est à dire le sol. Cependant, malgré l'existence de plusieurs substrats de culture très peu d'études mentionnent l'effet de l'inoculation des microorganismes, sur la croissance d'*Acacia mangium* cultivé sur un substrat de culture autre que le sol. Le but donc de cette étude menée sous serre est de montrer l'effet de l'inoculation des microorganismes symbiotiques, sur la croissance d'*Acacia mangium* cultivé sur de la fibre de coco.

Pour ce faire, nous avons d'abord procédé à des traitements et Pré germination de graine d'*Acacia mangium*, ensuite au repiquage des plantules dans les sachets en polyéthylène, enfin à l'inoculation des plantules à partir des microorganismes symbiotiques. Nos résultats ont révélés après un mois de culture que la hauteur moyenne des plants d'*Acacia mangium*, cultivé sur de la fibre de coco était comprise entre 7 et 11 cm. Nous avons aussi observé des nodulations dans tous les cinq traitements (Ta, T, M, R, MR) mais ces nodules étaient beaucoup plus significatif chez M (63) contre 16 ; 56 ; 47 et 63 respectivement chez Ta ; T ; R et RM. Par ailleurs nous avons également déterminé la biomasse aérienne et racinaire et la teneur en N et P des feuilles. Toutefois il serait important d'étudier la croissance et l'effet de l'inoculation des microorganismes symbiotiques sur *Acacia mangium* cultivé sur un substrat composé à la fois de la fibre de coco et du sol afin de mieux appréhender le meilleur substrat pour une telle espèce végétale.

IDENTIFICATION DES CORPS SEDIMENTAIRES PAR LA SISMIQUE REFLEXION DANS LA MARGE OUEST DE LA CÔTE D'IVOIRE

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Mots-clés: Côte d'Ivoire, pièges stratigraphiques, post albien, sismique réflexion

Ces travaux ont pour but de mettre en évidence des corps sédimentaires ou pièges stratigraphiques qui potentiellement peuvent contenir des hydrocarbures dans les formations post albiennes du bassin sédimentaire ivoirien (marge de San Pedro).

La découverte de nouveaux réservoirs notamment des pièges stratigraphiques, dans la partie Ouest du bassin ivoirien, très peu connu, est un défi majeur pour la recherche pétrolière en Côte d'Ivoire.

Essentiellement basée sur l'interprétation de profils sismiques 2D, la démarche adoptée pour l'obtention des résultats est la suivante :

- l'identification des séquences sismiques (cartographie des toits des grandes coupures stratigraphiques et analyse des caractères de réflexion au sein de ces coupures stratigraphiques en vue de se prononcer sur la nature éventuelle des sédiments qui les constituent).
- l'identification de corps sédimentaires (analyse des faciès sismiques au sein de ces séquences).

Ainsi cinq (5) séquences sédimentaires ont été identifiées sur les profils sismiques et les corps mis en évidence sont :

- des chenaux d'érosion orientés suivant les directions NE-SW et NW-SE ;
- des lentilles et des biseaux mis en place à la faveur des discordances.

En somme, la mise en place de ces corps sédimentaires identifiés dans les séries post-albiennes, est liée à l'histoire du bassin sédimentaire ivoirien. Ils correspondent aux pièges stratigraphiques présentant ainsi un grand intérêt pour l'exploration pétrolière.

SOIL CONTAMINATION BY DUST IN ZEIDA ABANDONED MINE (HIGH MOULOUYA, MOROCCO)

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Keywords: Mining waste, contaminated dust, heavy metals, aeolian erosion, remote sensing

The Pb-Zn abandoned mine of Zeida is located in the eastern part of Morocco. During 14 years of its activity (1972-1985), the mine produced 140 000 t/y ore and generated huge quantities of tailings considered as a major source of water and soil contamination by heavy metals. The tailings were deposited to the north of the processing plant in three huge dams spreading over an area of 100 ha. These mining wastes are subject to mass erosion by the floods of the Moulouya river and by the intensive aeolian action which disseminate polluted dust over large distances. In the prevailing E-W wind direction, 26 top soil (uppermost 5 cm) samples have been taken over a 1.6 km transect in order to learn more about the air-born soil contamination gradient. Geochemical analyses of soils show high contents of Si, K, Sr and Al near the mining waste dam and a steady decrease away from the dam due to the distribution of impoundment material (Quartz and K-Fd). Conversely, the increase in Mg, Fe and Ca content in soils can be linked to pedochemical background. Heavy metals can be arranged in two groups according to their chemical behavior. Lead and arsenic show high concentrations close to the dam (200 to 2 600 mg/kg) which decrease with the distance. The very similar gradients of some chemical element contents such as As, Pb and Sb with the distance are probably due to the transport of these elements in a common mineral phase, most likely galena and cerussite. Results confirm the significance of wind-blown toxic element contamination in the semi-arid climate that can even reach the nearby urban areas.

In order to find the correlation between oxides and heavy metals and As, and to understand the assemblage of these elements transported on common phases by different carriers, an PCA statistical analysis was applied and confirmed by the HAC.

On basis of the mineralogy of tailings, maps of eolian dispersion of tailings minerals (barite, orthoclase, galena, wulfenite) were performed by remote sensing using multi-spectral bands of Landsat 8 (OLI).

INFLUENCE DES FIBRES DE COCO ET DE PAILLE DE RIZ SUR LA QUALITE DES MORTIERS ARGILE-CIMENT

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Mots clés : mortier, fibres de coco, pailles de riz, résistance mécanique, maçonnerie bloc/mortier

La redécouverte des constructions en terre se heurte aux difficultés de définition d'un mortier assurant une bonne adhérence entre blocs de terre et mortier. Ainsi, des fibres végétales en occurrence les fibres de coco et la paille de riz, ont été ajoutées à des mortiers d'argile - ciment pour cerner leur influence sur les propriétés des mortiers.

Pour atteindre cet objectif, divers mortiers d'argiles stabilisées avec 5 % de ciment et différentes teneurs (0,2 ; 0,4 ; 0,6 ; et 0,8 %) et longueurs (10 mm, 20 mm, 30 mm et 40 mm) de fibres ont été élaborés. Des essais de caractérisation sur les mortiers à l'état frais et à l'état durcis ainsi que les maçonneries bloc/mortier ont été réalisés. Les résultats obtenus montrent que l'ajout de fibres améliore la consistance des mortiers et réduit le retrait au séchage. De plus, leur résistance mécanique augmente avec la teneur des fibres mais chute avec la longueur. En outre, la longueur optimale pour avoir une bonne adhérence mortier de fibres et bloc est comprise entre 10 et 20 mm avec une teneur de 0,6 %.

ADAKITIC SIGNATURE AND ITS SIGNIFICANCE FOR THE MID-CRETACEOUS MAGMATISM ALONG THE SIBIŞEL SHEAR ZONE – SOUTH CARPATHIANS, ROMANIA

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Mid-Cretaceous trondhjemites and granodiorites (MCTG) forming a swarm of over 270 sills, dikes and small intrusions occur along the Sibisel Shear Zone at north Getic basement of the South Carpathians (Sebeş-Cibin Mountains). The rocks are Na₂O-rich (4.5-7%), peraluminous with few metaluminous exceptions, of both I and S types characteristics. Variable Sr (113-900 ppm), low HREE (Yb of 0.05-0.46 ppm), low Y (3-16 ppm) contents – hence medium-high Sr/Y and medium (La/Yb)_N ratios and small to no Eu anomalies approximate *the adakitic signature*, partly overlapping the main

characteristics of the high silica adakites (HSA). The differences from real adakites relate to lower #Mg (16-46), Ni (<6.5 ppm) and Cr (<35 ppm) contents similar to those formed in the thick lower crust or from pure slab melts at low angle subduction. The trace elements behavior suggests that the MCTG rocks crystallized from partial melts of garnet-bearing rocks (with variable garnet in rocks of mainly amphibolite type) from the mafic crust, slight continental crust input evidenced. Particular hypabissal texture characteristics and the presence of corroded hornblende and primary epidote in the porphyritic trondhjemites and muscovite in the granodioritic bodies indicate crystallizing conditions of deep-seated emplacement and rapid ascend.

The ubiquitous presence of inherited zircon crystals in the U-Pb dated samples and the Sr-Nd isotopes values [$Sr_{i(105\text{ Ma})}$ of 0.7040-0.7045 and $\epsilon_{Nd(105\text{ Ma})}$ of (-2.26) to (+1.22)] confirm contamination with old detrital/continental crust. U-Pb ages on zircon crystals of 105.18 ± 0.48 Ma (Dobrescu et al., 2010) are close to $^{40}\text{Ar}/^{39}\text{Ar}$ cooling ages at 109.3-108.4 Ma on K-bearing minerals (Dobrescu & Smith, 2000) and coincide with the supposed timing of the Ceahlău-Severin ocean subduction/collision event. Besides, the rapid convergence and shallow subduction followed by tectonic underplating beneath Dacia (Ducea & Roban, 2016) to have occurred at mid-Cretaceous time, fit well with the *adakitic signature* of the MCTG rocks as an igneous consequence and the herein significance of the Sibisel Shear Zone.

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CARACTERISATION SISMIQUE DES SYSTEMES TURBIDITIQUES POST-ALBIENS POUR LA RECHERCHE DES PROSPECTS PETROLIERS DANS LA PARTIE EST DU BASSIN SEDIMENTAIRE IVOIRIEN

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Mots-clés: lobes, chenaux-levées, sismique, post-albien, submarine fan, Côte d'Ivoire

Les turbidites désignent un groupe de roches sédimentaires qui sont le produit d'un écoulement de sédiments détritiques du haut vers le bas d'un talus continental sous marin (ou lacustre). Une fois consolidées, ces roches présentent des séquences répétitives caractéristiques des flyschs. La

dynamique des écoulements gravitaires est par conséquent les modalités de construction et d'évolution de L'architecture de ce complexe sédimentaire appelé appareils systèmes turbiditiques.

L'information sismique sera utilisée pour identifier les systèmes turbiditiques en définissant leurs caractéristiques du point de vu sismique dans le bassin sédimentaire ivoirien.

Ce travail est basé sur l'analyse et l'interprétation de données acoustiques de 3462 kilomètres de Lignes sismiques 2D, des données de logs de diagraphies différées ont permis d'avoir une idée sur la lithologie des corps sédimentaires. L'établissement des cartes isochrone, d'isovitesse, d'isopaques et d'isobathes nous servira de donner des indications sur les structures géologiques du sous-sol et la reconnaissance des corps sédimentaires. L'analyse des configurations, d'amplitude, de fréquence et la continuité des réflecteurs, mais aussi la vitesse d'intervalle conduira aux faciès simiques des séquences sédimentaires a permis de mettre en évidence le fonctionnement sédimentaire des différents systèmes en lien avec les conditions environnementales de dépôt. Ce travail va nous proposer un model 3D d'évolution d'éventails profonds pour mieux comprendre la distribution des réservoirs, pour une meilleure connaissance des systèmes turbiditiques en stratigraphie, sédimentologie marine.

ELABORATION D'UNE DATABASE HYDROGEOLOGIQUE POUR UNE GESTION INTEGREE DES EAUS SOUTERRAINES DE LA REGION DE ABDA, MAROC

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Mots clés: HyGéoDataBase, SIG, aquifère, gestion des ressources hydriques

Devant l'augmentation continue de la demande en eau, le recours aux eaux souterraines devient une nécessité dans la région de Abda caractérisée par un climat aride à semi-aride. Face à cette situation il est devenu nécessaire d'entreprendre une réactualisation des données pour une meilleure compréhension du fonctionnement hydrodynamique des différents systèmes aquifères et une réévaluation des potentialités en eau, en vue d'une gestion optimale des ressources hydriques.

L'élaboration d'une base de données hydrogéologique (HyGéoDataBase) à référence spatiale pour cette région est réalisée en utilisant une grande masse de données venant de divers sources et origines. L'harmonisation et la structuration de ces données dans l'HyGéoDataBase facilite leurs utilisations. Le SIG élaboré offre la possibilité de description des organisations spatiales suivant des modèles qui peuvent évoluer avec le progrès des connaissances dans le domaine de la planification et de la gestion des ressources en eaux de la zone d'étude.

L'analyse, le traitement et le croisement des données géologique, hydrogéologiques et climatiques montrent que la région de Abda dispose de niveaux hydrogéologiques. Les cartes

piézométriques et les coupes hydro-stratigraphiques élaborés montrent des communications latérales entre ces différents niveaux aquifères.

GÉOSITES ET GÉOMORPHOSITES DE LA VALLÉE D'AIT BOU GUEMMEZ (HAUT ATLAS CENTRAL, MAROC)

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Mots clés: géosites, patrimoine géologique, géodiversité, paléobiodiversité

Le Haut Atlas Central Marocain est célèbre pour sa richesse en patrimoine naturel, y compris le patrimoine géologique. La conservation, la gestion et la mise en valeur de ce patrimoine se fait par l'identification de sites d'intérêts géologiques et géomorphologiques. Les géosites constituent ainsi l'application directe de la notion de patrimoine géologique. Un géosite est un site qui possède une importance d'un point de vue géologique et qui répond à des critères d'exception (précieux, rare, vulnérable ou menacé, UNESCO, 2000).

La vallée d'Ait Bou Guemmez située au cœur de la chaîne haut atlasique central à 65 km au sud de la province d'Azilal constitue une zone privilégiée par sa biodiversité et sa géodiversité, la beauté de ses paysages, ses géosites d'intérêt pédagogique, scientifique et touristique de grande importance sont un atout qu'on peut notamment exploiter à travers leur préservation et leur valorisation dans le but d'assurer un développement socio-économique durable de la région.

Elle recouvre un bassin sédimentaire centré sur l'extrémité Ouest du bassin haut atlasique à remplissage sédimentaire Jurassique dans lequel sept géosites ont été choisis pour leur intérêt stratigraphiques, sédimentologique, paléontologique (pistes de pas de dinosaures), floristique, archéologique et paysager. Parmi eux, trois présentent un intérêt géomorphologique majeur: panorama sur les dépressions, formes de plissement et de dislocation spectaculaires taillées dans les sédiments, etc.

Cette convergence des facteurs de géodiversité (formes de reliefs, dépôts sédimentaires, mosaïques de sols et de paléosols, gisements de minireux), de biodiversité (avec une faune et une flore souvent endémiques) et de paléobiodiversité (assemblages faunistiques et floristiques fossiles) ont fait une région à patrimoine naturel d'une exceptionnelle richesse à l'échelle nationale et internationale.

BUILDING BRIDGES BETWEEN EARTH SCIENTISTS WORLDWIDE: A WAY FOR PROMOTING PEACE AND STRENGTHENING INTEGRATION

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Geosciences could provide the needed information to support African countries to work out strategies and policies to tackle these challenges. All Earth Sciences professional organizations, associations and networks working on the continent should ensure that the needed information related to various socio-economic aspects of African societies are available to local populations and decisions makers in an easily accessible form. By adopting such a strategy, we will strengthen our organizations, encourage new members to join us, find additional funding resources, take new initiatives and catalyze the ongoing activities.

Research and cooperation are the driven forces towards sustainable development. To meet these challenges and to increase the level of knowledge worldwide, the international scientific communities should join their efforts to strengthen their partnerships and collaborations. They should also adopt a strong and positive spirit, integrity and respect of diversity in order to maximize the impact of the outcome of the common initiatives on local sustainable development.

The African Association of Women in Geosciences (AAWG) is an example of engaged organizations working on the continent. AAWG, created in 1995 in Nairobi (Kenya), aims initially to encourage women geoscientists to participate in Earth Sciences related conferences and to inform and become involved in gender issues related Earth Sciences. After 13 years of its existence, the Association changes its vision by focusing on promoting Earth Sciences for society through women geoscientists and promoting women geoscientists through Earth sciences related activities. It aims also through its activities and actions to highlight the role of international and regional exchange and collaboration in promoting peace and strengthening integration. The association is serving as a platform to share ideas, exchange information on experiences, best practices, new developments and trends in technologies and methodologies in various areas of geosciences. As we believe that such synergy will benefit to the sustainable socio-economic development of Africa, AAWG is striving to encourage linkages between regional, continental and international initiatives. International scientific events (conferences, workshops...) help to strengthen communication and collaborations between potential partners and foster strong mutual exchange and understanding of research outcomes.

Building on this, AAWG decided to hold its first workshop entitled "Gender and environmental concerns among female geoscientists in Africa" in 2000 in Dar Essalam (Tanzania) for the purpose of exchanging ideas, discussing results and encouraging women to present their work at scientific conferences. Consequently, the biannual colloquium of the AAWG was born. Since then, the association is at its eightieth conference entitled "*building bridges between Earth Scientists worldwide: a way for promoting peace and strengthening integration*" **to be held in Sibiu, October 1-7 2016. This conference, organized for the first time outside the African continent, is the beginning of a long process that aims to strengthen south-north collaboration.** AAWG is also organizing

numerous workshops, roundtables and meetings on and outside the African continent.

Africa consists of a rich geoheritage which is still not well investigated. National inventories are limited to few initiatives in a handful of countries often as part of geoheritage research activities conducted by universities and/or geological surveys. Compared to other regions of the world, Africa is still delayed in instituting geoheritage inventories and protection and addressing the economic use of their geoheritage. The link of geoheritage to local socio-economic sustainable development through the promotion of geotourism within geoparks will help to increase the awareness of local populations and decision makers about the necessity to use sustainably their geoheritage assets in economic and social dynamics. In the absence of national legislations that allows the inventory, the conservation and the economic use of geological sites, the creation of geoparks in Africa could be an opportunity to establish local inventories and to protect the geoheritage through the education of local populations and/or the institution of local laws.

In order to help to improve this situation, we initiated in 2009, the African Geoparks Network (AGN) that had been officially launched during our fifth conference entitled "*Women and Geosciences for Peace*" organized in 2010 in Grand Bassan (Cote d'Ivoire). The AGN aims to identify and make an inventory of the geological sites of outstanding value in Africa; to promote and increase the awareness among policy makers and the general public in Africa, particularly local communities about the necessity of the protection and the valorization of African geological heritage through the creation of geoparks for a sustainable local development; and to build the capacity of local population in the field of geoheritage through a strong networking and the organization of conferences, seminars, symposia, training courses and workshops.

According to AGN, a geopark is an area where the geoheritage and all heritage components should be used as a tool to *i*) improve the infrastructure of rural areas through the development of geotourism by building roads, creating and improving accommodation, supplying remote areas with electricity and drinking water, creating adequate spaces to sell local products, including the development of museums and cultural/information centres; *ii*) enhance human development; and *iii*) promote sustainable peace in all regions of Africa.

Geoparks, like other managed areas, should be used as a space to promote sustainable peace. Local communities should use their territories and become more involved in their development and their protection, and thus benefit directly from the revenues generated by activities conducted, such as geotourism. Encouraging the creation of trans-boundary Geoparks in Africa will help address conflicts by empowering local communities from different countries to work together in managing their natural resources, and to accept and manage their differences and diversity. In the African context, geoheritage could be used as a tool to reinforce social integration.

Trans-boundary Geoparks like any other managed areas could play a key role to highlight the opportunities for African countries to trade goods, services and investments across borders, they could help to remove barriers to trade in Africa and reinforce African socio-economic integration.

Geoparks could be also used as an area to promote best practices in mining and carrying governance, such as rehabilitation and economic utilisation of the geotouristic potential of the abandoned mines and carries.

The first international Conference on Geoparks in Africa and Middle East entitled "Aspiring Geoparks in Africa and in the Arab World" was organized, in 2011 in El Jadida (Morocco). As a follow up of the conference, the AGN and the AAWG in collaboration with other stakeholders are organizing many workshops and field trips to promote geoheritage for society through the African continent and

to build the capacity of local populations. The second conference was organized in 2014 in Dakar (Senegal).

To reach their objectives, AAWG and AGN proclaimed in 2013, the **20th March** as a "*Day for Earth Sciences in Africa and the Middle East, DESAME*". This initiative which is supported by numerous national and international organizations and institutions, aims to promote Earth Sciences for Society and to increase the awareness about the role that Earth Scientists could play to help to build a peaceful, healthier and wealthier continent. The DESAME, that is being celebrated each year, is at its fourth edition.

By doing that, AAWG, AGN and their national and international partners are contributing to build strong and sustainable bridges between Earth Scientists worldwide and continue to promote the major role that sustainable development could play in establishing a sustainable peace on the continent.

RÔLE DES LÉGENDES ET DES DÉBATS SCIENTIFIQUES VULGARISÉS DANS LA PROMOTION D'UNE SITE GÉOPATRIMONIAL: CAS DES LACS ISLI ET TISLIT, HAUT-ATLAS, MAROC

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Les lacs Isli et Tislit sont deux merveilles de la nature situés près du village d'Imilchil, dans les montagnes du Haut-Atlas central du Maroc. Le lac Isli, situé à 9 km au NE village Imilchil, est un des larges et profond lacs d'Afrique du Nord avec une surface de 2.55 km² et une profondeur de 92 m. Situé à 8 km à l'ouest du lac Isli, le lac Tislit est plus petit avec une surface de 1.3 km² et une profondeur de 16 m. Ces deux lacs sont bien connus des touristes qui traversent les Atlas en empruntant la route pittoresque de Beni Mellal à Tinghir. Ces deux lacs ont aussi un intérêt culturel important, tant sur le plan ethnographique que sur le plan scientifique, en particulier géologique. Nous souhaitons montrer ici combien la combinaison de ces angles de vue peut favoriser la promotion d'un site géopatrimonial.

Le grand public, simple amateur de la nature et des légendes populaires, est séduit par le lac Tislit, bordé de plages et de roseaux, paisible et d'un bleu clair, puis s'en va découvrir plus à l'est par une courte piste le lac Isli. Or celui-ci lui offre une image toute différente, d'une profondeur de 92 m, ses eaux bleues sombres, ses rives abruptes, son contour circulaire, semblent emplir un gouffre. Pourquoi une opposition si frappante entre ces faux-jumeaux?

Une très belle légende populaire l'explique ainsi. Les Aït Ibrahim et les Aït Yâaza, deux factions de la tribu des Aït Hdidou, étaient en perpétuelle guerre les uns contre les autres. Selon la légende, une jeune fille de la tribu des Aït Yâaza était amoureuse d'un jeune homme de la tribu des Aït

Ibrahim. Juliette et Roméo du Haut-Atlas, les amoureux rencontrèrent le même destin que les célèbres amants de Vérone : mourir sans avoir pu s'aimer à loisir et à se marier. Mais avant cette fin tragique, les pleurs des deux amoureux avaient donné naissance aux lacs Isli (le fiancé) et Tislit (la fiancée en langue berbère). Leurs parents, repentis, décidèrent que leurs garçons et leurs filles seraient libres de choisir leurs partenaires au cours d'une fête annuelle des fiançailles. C'est le "Moussem d'Imilchil", festival très connu à l'échelle nationale et internationale, et qui attire de plus en plus de touristes et génère d'importants revenus pour les populations locales.

Cependant l'origine de ces deux lacs, et surtout celle d'Isli, s'est trouvée récemment au cœur d'une véritable polémique scientifique qui a défrayé la presse nationale avant de passer dans les revues astrophysiques et géologiques internationales. Les journaux du Maroc se sont fait l'écho en 2012 d'une information scientifique divulguée par des géologues universitaires: les lacs jumeaux Isli et Tislit seraient un cas exceptionnel de doubles cratères d'impact liés à la chute d'une météorite, de ca 100 m de diamètre, dédoublée lors de sa pénétration dans l'atmosphère terrestre, il y a environ 40.000 ans. Quelques mois après, juin 2013, l'origine cosmique des deux lacs était formellement publiée dans un article scientifique (Ibhi et *al.*, 2013). Articles de presse et article scientifique furent reçus avec scepticisme par la communauté des géologues, et cette interprétation mal fondée fut rapidement rejetée par les spécialistes des météorites (Châabout et *al.*, 2013). Dans la même année, les géoscientifiques qui prêchent la théorie cosmique restreignent son champ d'application au seul lac Isli (Nachit et *al.*, 2013; Ibhi et Nachit, 2013). Le lac Tislit redevenait un lac banal, tandis que son faux-jumeau était rattaché aux météorites ferreuses découvertes près d'Agoudal 20 km plus au sud (Chennaoui-Aoudjehane et *al.*, 2013; Sadilenko et *al.*, 2013).

Un autre groupe de géoscientifiques a rejeté l'origine cosmique du lac Isli (Ibhouh et *al.*, 2014) en proposant une origine tectonique contrôlée par des failles de décrochement pendant le Miocène ou le Plio-Quaternaire, entre 10 Ma et environ 1 Ma, période correspondant au serrage maximum de la chaîne Atlasique marocaine. La morphologie particulière du fond du lac en forme de gouffre résulte de la dissolution des calcaires jurassiques sous-jacents ; il s'agit d'un phénomène karstique qui s'est développé pendant les périodes pluviales du Quaternaire en profitant de la fracturation tectonique des calcaires. Des dizaines de lacs du Haut-Atlas et du Moyen-Atlas ont une origine analogue, à la fois tectonique et karstique (Hinaje et Aït Brahim, 2002; Rhoujjati et *al.*, 2012).

Qui faut-il croire ? La réponse n'est pas le but de cet article mais c'est le débat qui nous intéresse. La controverse scientifique entre l'origine cosmique ou tectonique d'abord des deux lacs et puis du lac Isli a permis d'attirer l'attention aussi bien des scientifiques que du grand public. La légende populaire sur l'origine des lacs Isli et Tislit qui nous rappelle les tensions éternelles entre amour et communautarisme associé à la controverse scientifique sur leurs origines viennent renforcer l'intérêt géopatrimonial de ce site très réputé grâce au festival d'Imilchil, dit Moussem des fiançailles, qui a acquis une renommée internationale.

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ENREGISTREMENT SEQUENTIEL DU CENOMANO-TURONIEN SUR LA TRANSVERSALE AGADIR-GOULMIMA, MAROC

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Mots clés: Agadir, analyse séquentielle, Goulmima, Infra-cénomaniens, Ouarzazate

Six coupes ont été levées sur une transversale Ouest-Est entre Ouarzazate et Goulmima, entre le Haut-Atlas et l'Anti-Atlas. Les dépôts dits "infra-cénomaniens", à caractère principalement fluviatile partout, sont transgressifs soit sur le socle précambrien au Sud ou sur des séries mixtes, marines et fluviatiles, d'âge mésozoïque au Nord. Dans tout le secteur, cette série fluviatile "infra-cénomaniens" mal datée est transgressée par des carbonates peu profonds mis en place au tout début de l'anomalie géochimique en $\delta^{13}\text{C}$ qui caractérise le passage Cénomaniens/Turonien. Les dépôts du Turonien Inférieur sont transgressifs et marins partout.

La comparaison de ces coupes avec celles d'une autre transversale Ouest-Est dans le bassin d'Agadir (Essafroui et *al.*, 2015) a permis de mettre en évidence une partie orientale à polarité téthysienne et une partie occidentale (bassin d'Agadir) à polarité atlantique. Une hétérogénéité est remarquée au Cénomaniens supérieur ; Sur la partie amont du bassin d'Agadir, les faciès mixtes, marins et fluviatiles, sont transgressés par des dépôts entièrement marins de façon plus précoce que sur la partie orientale. Cette tendance transgressive est ensuite interrompue, côté atlantique, par des régressions forcées au Cénomaniens terminal, alors qu'on constate au contraire une tendance transgressive généralisée au même moment sur la partie orientale. Les dépôts du Turonien inférieur sont transgressifs et marins partout. Cette hétérogénéité est interprétée comme le résultat d'un

mouvement de surrection uniquement sur le secteur d'Agadir (l'expression locale d'une petite pulsation tectonique), qui interrompt brusquement le mouvement transgressif amorcé juste avant.

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THE GEOLOGICAL, PALEONTOLOGICAL AND ARCHAEOLOGICAL HERITAGE OF DRÂA-TAFILALET REGION, MOROCCO

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The Drâa-Tafilalet region enclose a wide-ranging geological and archaeological heritage. The large number of paleontological specimens such as Trilobites, Orthoceras the Goniatices, Crinoids, Fish, Crocodiles, Dinosaurs and fossil wood, reflects the diversity of geological heritage in this area. The geosites, corresponding to stratotypes, faults, folds, sedimentary structures, biostromes and old mines, are numerous and diverse, reflecting a variety of sedimentary paleo-environments, tectonic and magmatic events that have occurred in the region. The archaeological diversity is the result of a long history of anthropic activity in the area.

Nevertheless, this geocultural heritage is little valued and poorly preserved. This situation causes the deterioration of this heritage following the intense exploitation. In addition, juridical and technical deficiencies do not allow protecting this heritage. Therefore, in order to enhance and preserve this national heritage that have scientific, educational and geotouristic important value, a set of requirements should be taken into consideration, *i*) Elaboration of juridical regulation for the preservation of this heritage especially rare specimens; *ii*) Creation of geologic, paleontologic and archaeological museums; *iii*) Inventory, identify, and georeference the various geosites and archaeological sites, and integrate them into geotouristic tours.

A DEBRIS-FLOW CASE-HISTORY IN PODU SECU FORMATION FROM TARCĂU NAPPE IN THE BUZĂU VALLEY, EASTERN CARPATHIANS, ROMANIA

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Key words: Eastern Carpathians, internal Moldavides, debris-flow deposits, Podu Secu Formation, sedimentological remarks

In the structural development as imbricated folds structures of the Paleogene-Miocene Formations belonging to the Tarcău nappe from Eastern Carpathian Bend zone, one of the geological landmark can be considered the breccia deposit that repeats with increasing thickness from the inside to outside, revealing clear characters of debris-flow deposit. In the paper were determined several adjacent descriptive facies, which then used as interpretative facies allows genetic sedimentological remarks on the whole ensemble of Tarcău Unit.

GEOLOGICAL-GEOTECHNICAL-ECOLOGICAL ASSESSMENT OF THE CURRENT FRAMEWORK OF THE ANTHROPOMORPHIC SALINE LAKE FROM BĂILE TELEGA, PRAHOVA COUNTY, ROMANIA

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Key words: Badenian, Cosmina Breccia, Telega salt diapir, landslides, salt exokarst, management of anthropo-saline lakes

The paper is a summary of the geological, hydrogeological, geotechnical information on the environment of anthropomorphic saline lake from Baile Telega (Prahova county) as well as the conditions for further exploitation as spa cure. Baile Telega Lake is a salt water accumulation in the ceiling void collapse of an old salt mining exploitation with bell shape, developed into a massive salt diapir.

L'EXTRACTION DES DIAMANTS EN DÉPÔTS SECONDAIRES EN ANGOLA

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L'exploration du diamant en Angola a commencé en 1912. Lorsque en 4 de Novembre, deux géologues de la compagnie Formière ont trouvé sept petits diamants dans le nord de l'Angola, dans la province de Lunda Norte. A ce moment, les dépôts ont été exploités au delà de la frontière, au Congo belge. On a pensé qu'ils pourraient également être trouvés en Angola, qui était le cas.

L'extraction de diamants en Angola est généralement réalisée en deux principaux types de dépôts: primaires et secondaires.

Angola contient trois types de gisements de diamants, "placers" alluviales quaternaires, "paleoplacers" du Crétacé tardif et kimberlites. Les gisements de diamants alluviaux du Quaternaire sont les premières qui ont été découverts dans la province de Lunda-Nord.



Figure 1. Exploration du kimberlite Catoca



Figure 2. Exploration du Dépôt de Formation Calonda

Parmi les dépôts secondaires sont connus: les «placers», le alluviale quaternaire, et "paléoplacers" Crétacé tardif. Dans les dépôts alluviaux, les diamants se produisent dans les lits des rivières, des marais, des vallées, des terrasses et des collines et sont dérivées de la formation Calonda / Cuango. Ils peuvent également être dérivés du kimberlite le plus proche.

Jusqu'à présent, l'histoire des mines de diamants en Angola est encore liée aux dépôts alluviaux, mais les symptômes ont tendance à changer étant donné l'émergence de projets d'exploration de kimberlites.

Le processus d'obtention des diamants extraits des dépôts alluviaux est établi en deux étapes: d'abord, le minerai qui est le matériau de diamant est soumis à des processus de concentration de hydrogravítica - obtenir le concentré, qui est éliminé la plupart des minéraux les plus légers qui accompagnent le diamant; i.e lavage et classification pour obtenir le appelé grain.



Figure 3. Laverait Du Milieu Dense



Figure 4. Laverait de Pré - Traitement

Dans la deuxième étape, le matériau est soumis à une calibrage granulométrique où la classe intermédiaire résultant est envoyé à la séparation gravimétrique. Ces derniers sont obtenus si un rebut et un concentré. Le concentre est transféré à la station de sélection où l'opération finale est le "hachage" qui est, le tri manuel des diamants.

Actuellement, les dépôts secondaires représentent environ 25% de la production totale de diamants en Angola. Les diamants des gisements alluvionnaires de l' Angola sont de haute qualité et se situent entre 80-90% de jaune.

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THE PERFORMANCE OF *ACACIA XANTHOPHLOEA*, *SCHINUS MOLLE*, *CASUARINA EQUISETIFOLIA* AND *GRAVELLIA ROBUSTA* IN THE REHABILITATION OF A LIMESTONE QUARRY AT EAST AFRICAN PORTLAND CEMENT FACTORY, ATHI RIVER, KENYA

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Key words: mining, rehabilitation, tree species, limestone quarry

Limestone remains the most exploited and crucial industrial mineral worldwide, hence mining activities within limestone quarries will imminently prevail. Quarrying for limestone is an economic necessity that is not only hazardous to human but also one that invariably has deleterious effect on the environment. Information on the performance of trees species is important as plants are key in the revegetation of exhausted quarries.

A comparison of field performance of *Acacia xanthophloea*, *Schinus molle*, *Casuarina equisetifolia* and *Gravellia robusta* was made in an exhausted limestone quarry, in a semi-arid area, in Athi River, Kenya. The exhausted quarry was backfilled with the mine waste material and then leveled. Four blocks each 25 m x 25 m, were established at the quarry site for tree planting and control, using the Randomised Complete Block Design (RCBD).

Six months old seedlings of each species produced in a nursery were transplanted in the plots. The sequence of planting the four species was varied from block to block. One block was left unplanted for the control. Growth performances were estimated by measuring; tree height, diameter at the stem base (BD), and diameter at breast height (DBH). Seedling height (cm) and stem diameter (cm) were measured immediately after planting, and thereafter measurements were recorded every two weeks for a period of two years. To avoid border effect, the height and diameter of the middle 10 trees of each species, in each block were measured, as these were less susceptible to external influence. The tree height from ground level to tip of the youngest leaf was determined using a tape measure. A Vernier calliper was used to measure basal stem diameter 1 cm above the soil surface. A line was painted on the trunk, to ensure repeat measurements are made at the same point for the diameter.

To maintain consistency during data collection, a similar method was used for measurements of diameter at breast height (1m above soil). This commenced at the beginning of year II of planting when most trees had attained a height of at least 1.3 m. Diameter at breast height was measured immediately below a branch if this occurred at a height of 1 m.

The study revealed that the time-species interaction was significant ($p < 0.001$), indicating continuous tree growth for all the species. The tree species performance was varied. *C. equisetifolia* recorded the highest growth increments for the; height (525.3 cm), BD (7.42 cm) and DBH (4.94 cm) and the highest growth rates for; tree height (14.24 cm/month), BD (0.23 cm/month) and DBH (0.14

cm/month), indicating superior performance. This was followed by *A. xanthophloea* and *S. molle*. *Gravellia robusta* showed poor performance and recorded the lowest growth rates; tree height (1.35 cm/month), BD (0.017 cm/month) and DBH (0.023 cm/month). These results also indicated that there is species-specific response that may be due to different water- and nutrient-use strategies and growth patterns.

From the study, *C. equisetifolia* has the best growth performance followed by *A. xanthophloea*. The two species are therefore recommended to be used in the rehabilitation of limestone quarries in similar semi-arid conditions.

ETRE FEMME, ETUDIANTE OU ENSEIGNANTE CHERCHEUR EN ALGERIE : UN DEFI AU QUOTIDIEN

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L'Algérie est un pays d'Afrique du Nord qui fait partie du Maghreb. Avec une superficie de 2 381 741 km², c'est le plus grand pays bordant la Méditerranée. Le sol algérien renferme de nombreuses richesses. Le pays est un important producteur et exportateur de gaz naturel et de pétrole et dispose d'importantes réserves minières.

Je suis une femme, je suis géologue et je vis dans ce beau pays. En me basant sur les statistiques je pense être une privilégiée. L'Algérie fait partie des pays les plus touchés par l'analphabétisme dans le monde arabe. Depuis l'indépendance, en 1962, des efforts gigantesques ont été investi dans l'éducation scolaire, cependant en 2014, le taux d'analphabètes est de 14%, dont les 2/3 sont des femmes. Malgré une très nette évolution dans la scolarisation des filles, dans le domaine du travail, la population féminine occupée ne représente que 19% de la population totale occupée (Fig. 1).

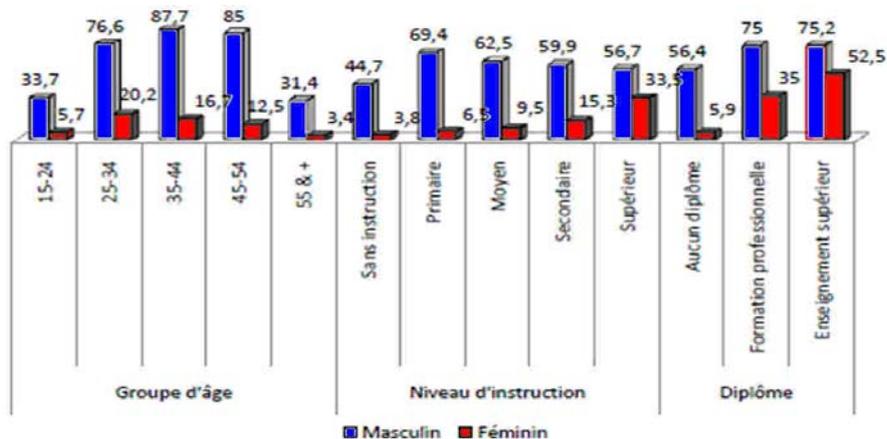


Figure 1. Taux d'emploi selon le sexe, le groupe d'âge, le niveau d'instruction et le diplôme (en %)

La société Algérienne est totalement dominée par les hommes et être une femme et de surcroît géologue est un handicap nécessitant un combat de tous les jours. L'université algérienne offre à ses enseignants un plan de carrière jalonné de difficultés.

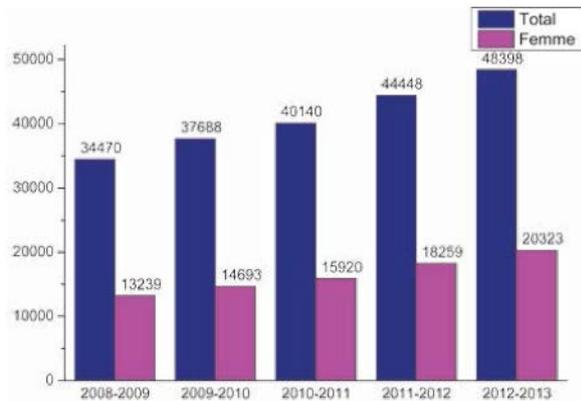


Figure 2 a. Évolution des enseignantes universitaires

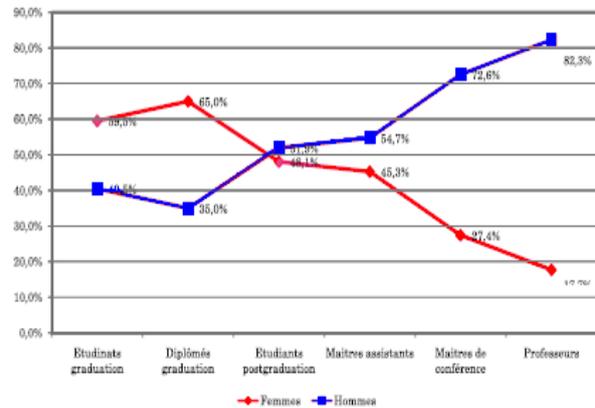


Figure 2 b. Pourcentage d'hommes et femmes aux différents niveaux universitaires en 2010

La progression des femmes est moins significative que celle des hommes (Fig. 2a). On remarque même une nette tendance négative dans l'évolution des femmes (étudiantes et enseignantes). En graduation (licence) la progression des étudiantes est plus marquée (65%) que celle des étudiants (35%), cette tendance s'inverse en post-graduation (Master et Doctorat) (Fig. 2b). On constate une diminution drastique du taux d'enseignantes (toutes spécialités confondues) dans l'évolution de carrière universitaire (Fig. 2b). En 2010 seul 27% des femmes ont le grade de Maître de conférence et uniquement 17.7% ont le grade de professeur (Fig. 2b).

Tableau 1. Nombre d'étudiants inscrits en 2015 (par filière)

DOMAINES		NOMBRE
Sciences et techniques		1261
Sciences de la nature et de vie		1071
Mathématiques - informatique		315
Sciences Economiques de Gestion et Commerciales		1106
Sciences de la Matière		552
Sciences Humaines et Sociales	S.H.	806
	S.S.	314
STAPS		222
Droit		406
Sciences politiques		22
Langue et Littérature Arabes		205
Langue et Littérature Françaises		287
Langue et Littérature Anglaises		371
Italien		184
Métallurgie (R.N.)		178
Genie minier		169
Géologie et Environnement (R.N.)		59
Géologie		46
Architecture		149
Total		8443

La géologie est un domaine masculin par excellence, la femme y représente moins de 1%. En Algérie il y'a moins de 0.1% de femmes géologues qui travaillent directement dans la recherche et prospection minière. La majorité des femmes occupent des postes dans des laboratoires de géologie ou sont enseignantes en géologie dans des lycées et les universités.

La filière géologie est un cas particulier. En 2015 le nombre total d'étudiants (filles et garçons) inscrits dans la filière géologie est de 105 sur un total de 8443 bacheliers (toutes spécialités confondues), seuls 46 bacheliers se sont inscrits dans la spécialité géologie (Tableau1).

Sur les 46 étudiants inscrits en géologie, 41% sont des filles et 15% d'entre-elles ont réellement été orientées en géologie (choix 1 sur la liste de vœux). Pour 85% des étudiantes en géologie, cette spécialité correspond au 5^{ème} ou 6^{ème} choix et dans certains cas même au derniers choix (10^{ème}).

Malgré les efforts fournis par l'Etat Algérien pour la promotion de la femme dans la société, dans le domaine du travail et de dans celui de l'éducation (tout secteurs), son évolution est lente. Dans le domaine scientifique et particulièrement en géologie sa progression est infime.

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Section 01. Statistiques 2015: www.univ-annaba.dz

TECHNIQUE OF MEASURING P-WAVE STRESS

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Key words: modeling; stress strain, parameters of blast, rock failure

The destruction of rock by explosive has been studied by many investigators. This process involved different properties of the rock mass. In this work the physical and dynamic properties has been determined and the results are shown.

A cement mortar blocks weighing 1 ton has been studied and the results from a single shot experiment instrumented are given. Results from static and dynamic materials testing of the cement mortar are also given. The method used has been determined and compared.

GEOEDUCATION AND GEOTOURISM – IMPORTANT TOOLS FOR GEOCONSERVATION: THE CASE OF BUZĂU LAND ASPIRING GEOPARK, ROMANIA

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Keywords: geoconservation, geoeducation, geotourism, aspiring geopark

Buzău Land is an Aspiring Geopark that is located at the Carpathian Bend Area (Romania), very close to Vrancea seismic zone, covers an area of about 1040 km² and comprises 18 mayoralities. The aspiring geopark is famous for its unique geological features and beautiful landforms that include: natural gas fires, called “Living fires”, salt caves, muddy volcanoes, amber deposits, fresh water lakes on salt diapirs (found on a Natura 2000 site), but also for the rare species of plants and animals (*Euscorpius carpathicus*, *Reticulitermes lucifugus*) and the diversity of cultural heritage. Buzău Land Geopark is also rich in palaeontological sites. Sarmatian *Mastras* assemblages, *Teleost* fish, cetaceans (*Cetotherium* sp.) and other vertebrate remains are frequent in thick sandstone and blackish shale deposits and give the area a particular scientific significance.

The purpose of this paper is to illustrate that geoeducation and geotourism are very important tools for geoconservation. Various educational programs and geotourism issues will be proposed in order to promote the concept of geopark and the geological heritage from this area. Only by geoeducation and by promoting the geotourism, visitors and local communities become aware of the value of the geological sites and fossil record.

It is very important to develop several educational activities related with the intangible cultural heritage of the area that stimulates visitors’ ideas (especially with kids or students) regarding the natural and cultural resources of the geopark.

Outdoor activities, together with tours around the most important geological and cultural sites and thematic camps for children and students can be held inside the geopark. In addition, educational materials such as brochures, flyers were already done. Another possibility of promoting the geological heritage, could be by creating information centres and points, interpretive panels, and through the construction of small museums into the area, permanent or temporary exhibitions (there was already built an interpretive centre in Mânzălești commune in 2015). Will be necessary involving local authorities and communities in these activities.

Geotourism will promote Buzău Land Geopark as a sustainable destination through some thematic trails around the most important geosites.

Acknowledgements: Part of the research leading to these results has received funding from EEA Financial Mecanism 2009 - 2014 under the GeoSust project contract no 22 SEE/30.06.2014

UN ÂGE À 1710 MA DANS LE MAGMATISME BASIQUE DU GROUPE DE TAGHDOUT DANS LA BOUTONNIÈRE D'IGHREM: UNE NOUVELLE LITHOSTRATIGRAPHIE DU PROTÉROZOÏQUE DE L'ANTI-ATLAS, MAROC

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Un âge préliminaire U-Pb sur Baddeleyite de 1750 Ma obtenu sur un sill de la série de Taghdout dans la région d'Ighrem suggère que la série, communément attribuée au Cryogénien, est d'âge Mésoprotérozoïque. Sur la base de cette nouvelle datation nous proposons un nouveau découpage et une nouvelle lithostratigraphie du Protérozoïque de l'AntiAtlas.

Le domaine Paléo-Mésoprotérozoïque, dans l'Anti-Atlas Sud Occidental, est formé d'un socle paléoprotérozoïque et sa couverture mésoprotérozoïque. Le socle est représenté par des séries silicoclastiques faiblement métamorphisées et intrudées par des granitoïdes dans les boutonnières de Bas Draa, Tagragra d'Akka, Zenaga et Iguerda. Le Mésoprotérozoïque est représenté par la série des calcaires et des quartzites du **Groupe de Taghdout** dans les boutonnières de Zenaga, Tizi-N'Taghatine, Agadir Melloul, Iguerda, Ighrem, Ait Abdallah, Kerdous and Bas-Draa. Les séries sédimentaires de Tachdamt-Bleïda, décrites à Bou-Azzer et datées à 788 Ma (Clauer, 1974), sont considérées comme des séries pré-orogéniques de l'orogénèse Panafricaine. Cependant, après l'âge que nous présentons dans ce travail, ces séries ne peuvent plus être considérées comme l'équivalent distal des roches du Groupe de Taghdout.

Le domaine Panafricain (Anti-Atlas central), représenté par les boutonnières de Bou Azzer et de Sirwa. Ce domaine correspond à l'orogénèse panafricaine S.S. et comporte la série de Tachdamt-Bleïda (788 Ma, d'après Clauer, 1974), les complexes ophiolitiques de Bou Azzer et de Sirwa et l'arc magmatique associé.

Le domaine Post-panafricain (Anti-Atlas Nord-oriental) comporte essentiellement les séries d'âge néoprotérozoïque supérieur (d'après Liégeois et al. 2006, in Walsh 2012 et Abati, 2010). Les

séries de Saghro seraient plus récentes que le Groupe de Taghdout et doivent être corrélées aux séries d'Anezi dans l'Anti-Atlas Sud Occidental et de Tidilline and Bou Salda dans l'Anti-Atlas central.

L'histoire commune des trois domaines commence après leur juxtaposition au début de l'Ediacarien. Elle se poursuit par une intense activité magmatique de type postcollisionnel généralisée à toute la chaîne de l'Anti-Atlas. Représenté par les roches du Groupe de Ouarzazate, ce magmatisme serait le résultat d'une montée asthénosphérique (Hefferan et al, 2014) dans un contexte semblable à celui des plumes ou induit par une délamination lithosphérique postcollisionnelle.

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AN OVERVIEW OF DROUGHT AND HEAT-INDUCED TREE MORTALITY REVEALS EMERGING CLIMATE CHANGE RISKS FOR THE FOREST. CASE STUDY FROM NORTHERN NIGERIA

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Keywords: Climate change, drought effects, forest mortality, global patterns

Increases in the frequency, duration, and/or severity of drought and heat stress associated with climate change could fundamentally alter the composition, structure, and biogeography of forests in many regions. The main concern is the potential increases in tree mortality rate associated with climate-induced physiological stress and interactions with other climate-mediated processes such as insect outbreaks and wildfire. Despite this risk, existing projections of tree mortality are based on models that lack functionally realistic mortality mechanisms, and there has been no attempt to track observations of climate-driven tree mortality globally. Here we present the assessment of recent tree mortality attributed to drought and heat stress.

Although episodic mortality occurs in the absence of climate change, studies compiled here suggest that at least some of the world's forested ecosystems already may be responding to climate change and raise concern that forests may become increasingly vulnerable to higher background tree

mortality rates in response to future warming and drought, even in environments that are not normally considered water-limited. This further suggests risks to ecosystem services, including the loss of sequestered forest carbon and associated atmospheric feedbacks.

Our review also identifies key information gaps and scientific uncertainties that currently hinder our ability to predict tree mortality in response to climate change and emphasizes the need for a coordinated observation system. Overall, our review reveals the potential for amplified tree mortality due to drought and heat in forests worldwide.

SEEING THE UNSEEN: GEOTECTONIC BRIDGE BETWEEN AFRICA AND EUROPE ON SEISMIC TOMOGRAPHY IMAGERY

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INTRODUCTION

Seismic tomography is a geophysical technique to illustrate very deep geological structures mainly located within the lithosphere and the upper mantle. It usually uses seismic signals provided by earthquakes and recorded in seismological observatories or seismic stations. In areas characterized by low natural seismicity recordings of large explosions (military or geophysical experiments, blasts in quarries) are also used.

Seismic velocity anomalies are computed in a 3D volume at regional or continental scale, being referenced to an in-depth velocity model. The anomalies intensity and sign are given as percentage of the reference velocity model at each depth and colors code (blue - positive anomalies; red - negative anomalies). When a reference velocity model is not fitting the whole studied area, the velocity anomalies are given in km/s.

The depth till where the velocity anomalies are computed and illustrated on maps or sections is chosen upon the main targeted geological structures, in most cases ranging between 200km and 1000km.

Seismic tomography results at regional and continental scales may be usually interpreted for illustrating:

a) past or ongoing subduction zones, old cratons and metamorphic shields, large frozen magma chambers and large accumulations of oceanic lithosphere, all in blue (positive seismic anomaly);

b) thick sedimentary basins situated at different crustal depths, active volcanic areas with hot and viscous magma chambers, upwelling asthenosphere, all in red (negative seismic anomaly).

CONTINENTAL-SCALE SEISMIC TOMOGRAPHY STUDIES

The seismic velocity map presented in Figure 1 (Geyko et al., 2001) covers Europe, parts of Africa and Asia, the lack of a well fitted continental velocity model preventing the computation of velocity anomalies in the tomographical sense.

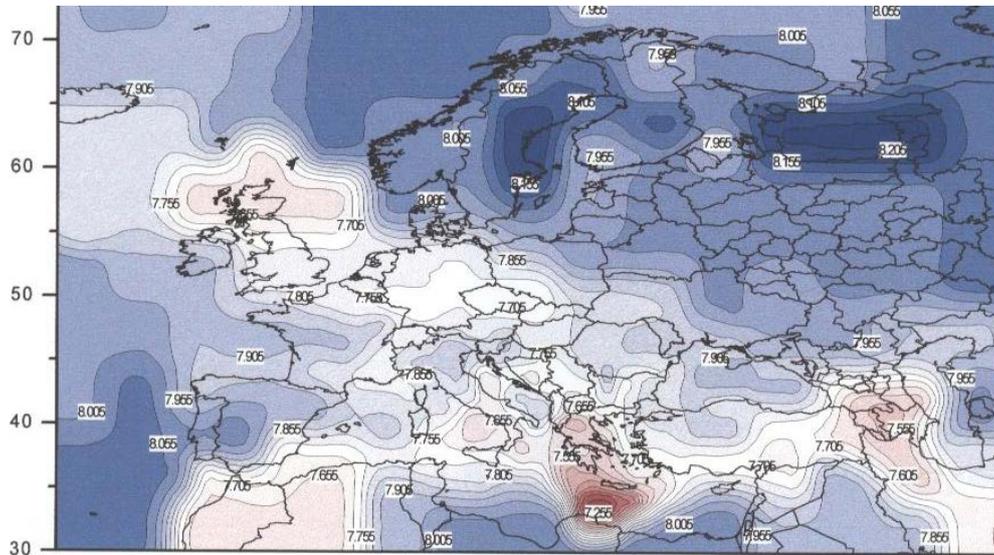


Figure 1. Seismic tomography map of north Africa, the Mediterranean sea and Europe at Moho depth (Geyko et al., 2001).

The large variability of the seismic velocity at Moho depth, ranging from 7.2km/s and 8.2km/s, revealed a very complex and interesting low seismic velocity area, trending WNW-ESE, between Africa and Europe. It may be determined regionally by asthenosphere updoming in a geodynamically mobile zone located between cratons and metamorphic shields, and locally, by active subduction and volcanic processes.

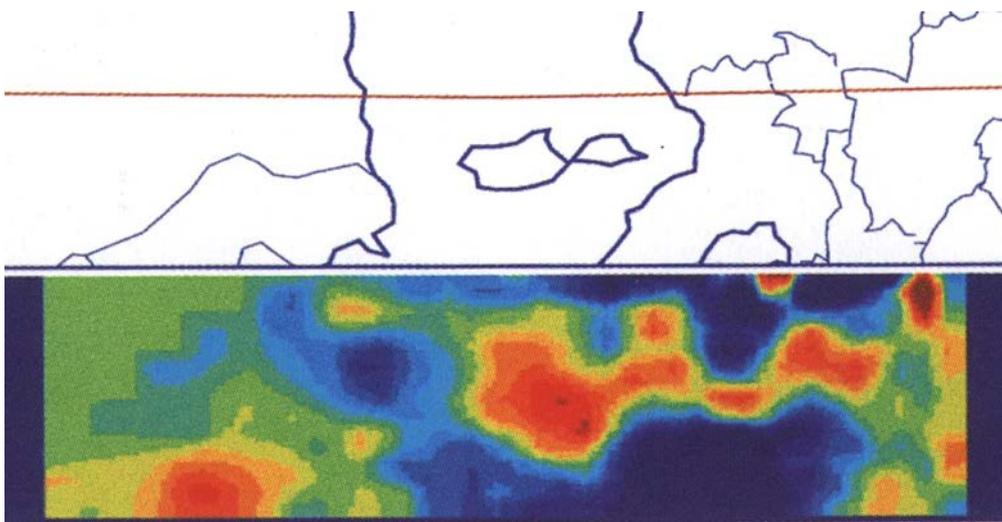


Figure 2. Seismic tomography section stretching from northern Africa (Algeria) to western Europe (Germany). After Piromallo and Morelli (1997).

The tomographic study published by Piromallo and Morelli (1997), dedicated to the Mediterranean sea region, nicely depicted geotectonic relationships between Africa and Europe up to 700km depth (Figure 2). At the northernmost part of Africa a high velocity structure dipping northward may be interpreted as a remnant of an once active subduction zone, which transferred at that time huge quantities of oceanic lithosphere into the large blue “oceanic lithosphere graveyard”, deeply located between 400km and 700km. Above the red colored almost horizontal low seismic velocity structure, which can be associated with hot and more viscous asthenospheric matter, traces of other subduction processes may be interpreted, the blue vertically dipping structure beneath the Alps being associated with the Apulian plate of African affinity, presently in collision with Europe.

The vertical red structure shown toward the northern limit of the seismic tomography section may be interpreted as a deeply enrooted volcanic structure, possibly associated with the Neogene volcanism in the Rhine graben area. The northward displacement of a segment of this magmatic structure, due to deeply located geodynamic movements, might explain the extinction of the volcanic processes. However, the intense negative anomaly (dark red color) developed till 100km depth, may represent the signature of a large magmatic chamber where magma is not entirely frozen and possibly, the volcanism is not totally extinct.

CONCLUSIONS

The analysed seismic tomography data revealed an regional elongated WNW-ESE low seismic velocity zone at subcrustal depths, mainly situated between Africa and Europe, overlapping a large accumulation of oceanic lithosphere located between 400km and 700km depth.

The regional low seismic velocity zone is interpreted to be associated with updoming asthenosphere, dislocated by old subduction processes and the accumulation of the large “oceanic lithosphere graveyard”.

Remnants of past subduction zones or active ones at the contact between the African and Eurasian plates are interpreted on the seismic tomography sections as dipping positive velocity anomalies (blue) structures. Good examples are those situated beneath the Mediterranean sea and beneath the Alps.

Recent or active volcanism processes, associated with low seismic velocity zones (red), are interpreted on the Aegean Arc, southern Italy and Sicily, or within the Rhine graben.

Acknowledgements. Claudia Piromallo and Valentin Geyko are thanked for kindly offering published and unpublished seismic tomography data, as well as for fruitful discussions.

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DANUBIUS-RI, INTERNATIONAL CENTER FOR ADVANCED STUDIES ON RIVER-SEA-SYSTEMS

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DANUBIUS-RI is a major initiative developing a Pan-European Research Infrastructure dedicated to the integrated study of European river – sea systems and the opportunities and risks they present to society. It will be the platform for the European research community to take a world-leading role in interdisciplinary studies focused on integrated management at the scale of entire river-sea systems, as means to obtain sustainability. DANUBIUS-RI components are spread over Europe. It will comprise a Hub and Data Centre in Romania, a Technology Transfer Office in Ireland, and Supersites and Nodes across Europe. The Hub will provide leadership, coordination, and key scientific, educational and analytical capabilities.

The DANUBIUS-RI supersites are locations of high scientific importance where observation, research and modelling will be focused. These Supersites range from relatively pristine sites – such as in the Danube Delta – to areas highly impacted by human activity – such as in the Thames Estuary and the Venice lagoon. Other Supersites will cover the middle and upper parts of the Danube, in Hungary and Austria, and other European river-sea systems. All the data collected will be processed in the DANUBIUS-RI Nodes. These will be existing centres of expertise in observation, analysis, modelling, and social and economic sciences. Initially the leadership of the nodes will be based in the United Kingdom, Germany, Italy and the Netherlands, but with linked laboratories across Europe to increase capability and capacity of the key research disciplines.

There is an explanation for the complexity of this interdisciplinary research infrastructure. Traditional scientific vision, whether discipline-specific or with separate freshwater and marine disciplines, has not managed to provide sustainable solutions for the many problems. The importance of this approach is shown by the recognition of DANUBIUS-RI as a new project on the 2016 Roadmap of the European Strategy Forum on Research Infrastructures, ESFRI, and as flagship project for the European Union Strategy for the Danube Region.

NÉCESSITÉ D'UN RÉSEAU DE SURVEILLANCE DE LA QUALITÉ DES EAUX SOUTERRAINES DANS LA VILLE DE DOUALA (CAMEROUN)

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INTRODUCTION

Environ 90% du trafic portuaire, 75% de la production industrielle, près de 3 millions d'habitants sont concentrés à Douala, capitale économique du Cameroun (Fig. 1). Comme toutes les villes portuaires, Douala se caractérise par un développement rapide des banlieues.



Douala reçoit annuellement environ 4.000 mm de pluie. Malgré ces conditions naturellement favorables, l'accès à l'eau potable et à l'assainissement se révèle être un défi pour les services publics. Plus 40% des citoyens utilisent des puits traditionnels.

RÉSULTATS

Il a déjà été établi que, ces puits peu profonds sont pollués et cette pollution semble s'étendre. Dans les quartiers à habitats spontanés, une personne sur deux souffre de maladies d'origine hydrique; par exemple, des cas de choléra sont observés dans certains quartiers. Par ailleurs, les eaux souterraines sont recherchées par la quasi-totalité des industries situées dans la ville.

Plus de 500 forages sont en service mais il y a un bon nombre non identifiés étant donné qu'il n'existe aucune base de données fiable sur le recensement exhaustif des ouvrages. Les aquifères sont ainsi exploités sans aucun suivi spatio-temporelle, quantitative et qualitative. C'est dans ce contexte qu'un programme d'acquisition de connaissances hydrogéologiques sur la ville de Douala et ses environs est en cours depuis une quinzaine d'années.

Les investigations géologique, géophysique, physico-chimique et isotopique (^{18}O , ^2H , ^3H , ^{14}C) effectuées montrent une grande complexité et hétérogénéité du système aquifère du bassin sédimentaire de Douala. Les eaux sont naturellement très faiblement minéralisées. Les fortes minéralisations observées sont liées à la pollution et sont observées dans la nappe superficielle (Fig. 2) et de plus en plus dans des niveaux sous-jacents à certains endroits.

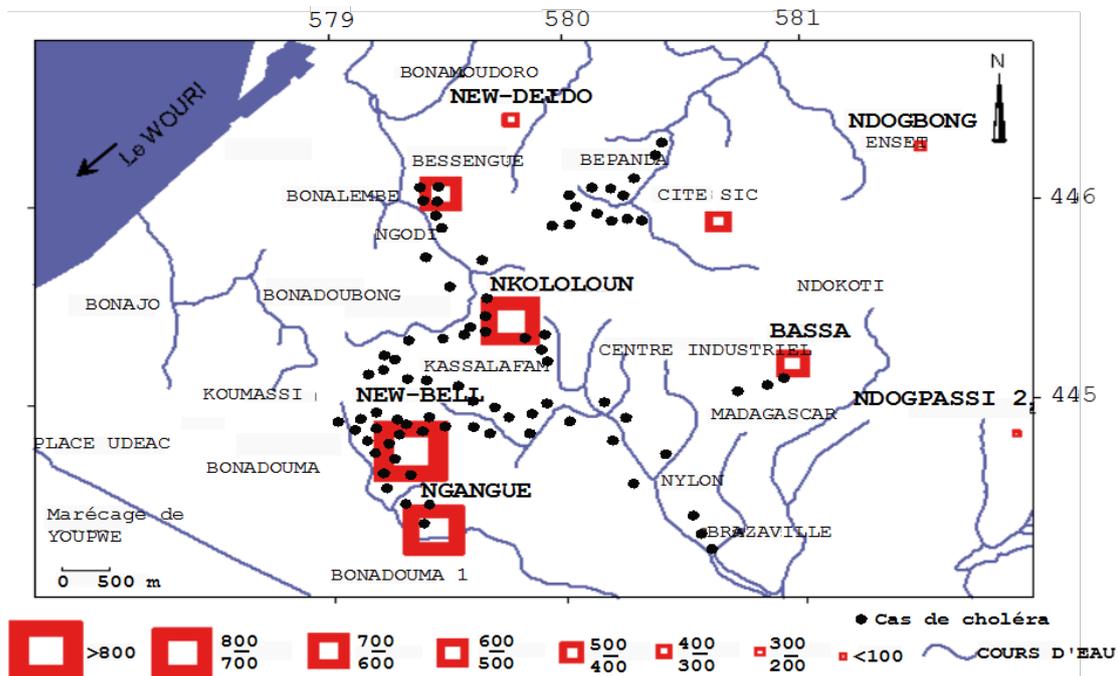


Figure 2. Conductivité de la nappe superficielle et zone de cholera

L'existence de plusieurs nappes qui semblent connectés par endroits a pu ainsi être mise en évidence. Il est probable que l'augmentation du nombre de forage favorise l'interconnexion des couches aquifères et intensifie les zones de contamination.

CONCLUSION

A l'échelle nationale, la prise de conscience sur la nécessité de protéger les nappes de la pollution existe. Malheureusement, les actions de nombreux intervenants dans le secteur ne sont pas coordonnées. La recherche dans le domaine manque de soutien financier et de ressource humaine. Par conséquent, les connaissances sont insuffisantes pour déterminer la meilleure stratégie de gestion intégrée des ressources en eau souterraine. D'une région à l'autre, le problème peut varier, mais tout le pays fait face aux mêmes maux. Avec l'avènement de la décentralisation, le gouvernement du Cameroun a transféré par le décret n °. 2015/1373 / PM du 8 Juin 2015, la protection des ressources en eaux souterraines et des eaux de surface aux conseils municipaux. Il est absolument nécessaire voire impératif d'établir des programmes de suivi quantitatifs et qualitatifs, par l'installation de réseaux de surveillance piézométrique, afin de mieux comprendre l'état des ressources en eau souterraine, d'identifier les causes de leur dégradation, dans le but de guider et d'évaluer les actions à mettre en œuvre afin d'assurer ou de maintenir leur bon état qualitatif.

MESURE DES DISCONTINUITES DU MASSIF ET DE LA PERFORMANCE DU TIR EN VUE DE L'OPTIMISATION DU PLAN DE TIR

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Mots clés : optimisation, massif rocheux, plan de tir, discontinuités, granulométrie, projection stéréographique, paramètres géométriques.

La capacité de l'ingénieur de pouvoir mesurer et prédire la granulométrie issue de tir est la manière la plus efficace et la plus raisonnable pour juger les résultats d'un tir. Les quatre paramètres principaux à tenir en compte pour estimer la fragmentation issue d'un tir, selon les résultats des travaux de plusieurs chercheurs sont les propriétés de la roche, les propriétés de l'explosif, les paramètres géométriques du plan de tir et la géométrie du gradin. Cependant les propriétés de l'explosif, la géométrie du tir et du gradin peuvent être maîtrisées par le concepteur. Par contre les propriétés de la roche sont incontrôlables à cause de l'anisotropie du massif rocheux. Ce qui influe négativement sur les modèles de fragmentation des roches à l'explosif.

Il existe plusieurs méthodes d'évaluation, actuellement les ingénieurs de l'exploitation minière emploient le modèle Kuznetsov-Rammler développé par Cunningham en 1987 pour prévoir la distribution de grandeurs de roche résultant du tir. Le but de notre travail consiste à mesurer numériquement le degré de fragmentation de tas de roches abattues à l'aide de la technologie d'analyse d'image dans les conditions d'exploitation d'une carrière à ciel ouvert ; à comparer les granulométries obtenues à celles ciblées ; et caractériser adéquatement le massif rocheux par la méthode des traverses afin de déterminer l'azimut et le pendage du plan des principales

discontinuités à l'aide de la technique de projection stéréographique. Cela permettra de réajuster les paramètres actuels du tir à l'aide du modèle de conception minière du système Delpat 3, les résultats ont montrées que pour obtenir des paramètres rationnels, la hauteur du gradin doit être diminuée et un plan de tir avec les paramètres adéquat a été proposé.

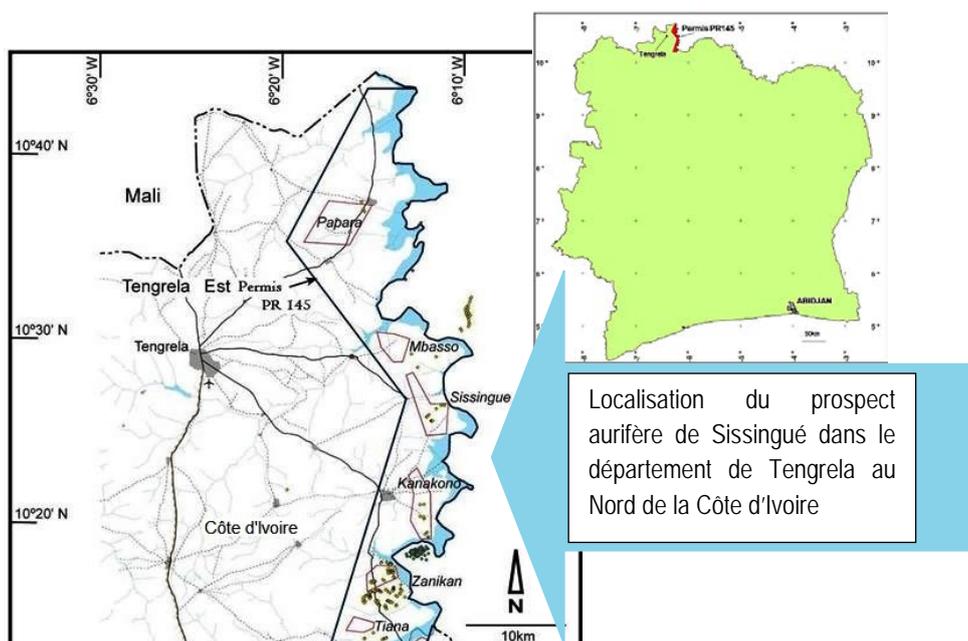
MINERALISATION AURIFERE DANS LE COULOIR DE CISAILLEMENT SYAMA-BOUNDIALI: CAS DE SISSENGUE (TENGRELA, NORD DE LA CÔTE D'IVOIRE)

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Mots clés : minéralisation, or, couloir de cisaillement, Sissingué, Tengrela

Le prospect aurifère de Sissingué se situe dans le nord de la Côte d'Ivoire dans le couloir de cisaillement Syama-Boundiali, dans la branche nord-sud du sillon de la Bagoé. La géologie de ce prospect est composée selon l'étude pétrographique, de deux unités lithologiques : l'une constituée de métasédiments, de métaconglomérats, de metasandstone et de metasilt et l'autre intrusive composée de granite, de micro granites porphyriques et de granodiorites.



Les études de télédétection montrent que le couloir de cisaillement Syama - Boundiali est orienté selon la direction NNE-SSW. Cependant l'orientation de la minéralisation à Sissingué est NNW- SSE contraire à la direction du couloir de cisaillement.

Sur les carottes, différentes structures ont été identifiées, elles ne montrent pas d'orientation particulière.

Concernant la minéralisation, l'or sous forme de pépite a été observé à l'œil nu dans les veines de quartz et dans les formations plutoniques intrusives. Lorsque nous avons réalisé des diagrammes de teneur en fonction de la lithologie, nos analyses ont montré que la minéralisation est disséminée et filonienne et que l'altération hydrothermale (séricitation, carbonatation et silicification) a favorisée cette minéralisation. Les sulfures associés à l'or sont la pyrite, l'arsénopyrite et la chalcopryrite. La paragenèse associée à l'or serait à arsénopyrite, pyrite, chalcopryrite, quartz, séricite et carbonate.

CARACTERISATION ET VALORISATION DU PATRIMOINE GEOLOGIQUE ET TOURISTIQUE (GEOTOURISTIQUE) DE LA REGION DES DIX-HUIT MONTAGNES DANS LA PARTIE OUEST DE LA CÔTE D'IVOIRE

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Mots clés: Fleurons, tourisme, substratum géologique, Liberianides, paysage pittoresque, cascades, musée minéralogique, téléphérique

La région de l'Ouest dans les hauteurs est l'un des **fleurons** du **tourisme** en Côte d'Ivoire. Son **substratum géologique** est constitué de plusieurs formations où on peut reconnaître un complexe plissé Liberianides.

L'originalité de la Région Ouest tient à son paysage de montagne. On y note les reliefs les plus vigoureux du pays. Plusieurs hauteurs créent un **paysage pittoresque** qui rompt avec la platitude de l'ensemble du pays. Les eaux qui proviennent de ses hauteurs alimentent un réseau hydrographique très dense souvent entre coupé et reliés par des **cascades** impressionnantes telle la cascade de la ville Man 100m de dénivelée la cascade du village de Zéadepleu environ 200 m de dénivelée et qui est une source d'approvisionnement en eau de la société de distribution d'eau de la ville.

La région s'identifie donc comme secteur stratégique de développement du tourisme. La vocation touristique de la région est marquée par une infrastructure hôtelière de qualité, elle est également réputée pour la richesse de ses chants et danses traditionnelles, de ses masques et rites. Le culte des **masques** est la principale **tradition** d'où découlent de nombreux rites d'initiation telle la circoncision, des danses célèbres comme le Tematé, Floly, échassiers jongleur ou danseurs aux

couteaux, des jeux populaires à savoir la course des masques et des architectures comme les cases rondes à toiture conique qui retiennent l'intérêt des touristes. Le visiteur a également l'occasion d'apprécier les fabuleux ponts de lianes dont la réalisation reste encore inexploitée et la Singes sacrés de la forêt de Gbèpleu.

Par la construction de Musée des Mines et de la Géologie dénommé **musé minéralogique** de Man, et la création de chemin de fer aérien ou **téléphérique**, permettrons à tout visiteur perché sur ces hauteurs d'apprécier la diversité et la richesse géologique ainsi que la splendeur du relief de cette région.

ETUDE STATISTIQUE DES PARAMÈTRES DES ANOMALIES CONDUCTRICES ET CONCEPTION D'UN MODÈLE DE DÉBIT DE FORAGE EN MILIEU DU SOCLE : CAS DES RÉGIONS DU BELIER, IFOU, GBEKE (RÉGION CENTRE DE CÔTE D'IVOIRE) ET BAGOUE (RÉGION NORD DU CÔTE D'IVOIRE)

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Mots-clés : anomalies géophysique, débit, forage, Côte d'Ivoire

Au cours de ces dernières décennies, et dû à la succession des crises et au changement climatique, l'accès à l'eau potable dans nos pays d'Afrique et plus précisément en Côte d'Ivoire est devenu un enjeu crucial. Aujourd'hui, l'approvisionnement en eau dans la majeure partie des territoires dans différents pays d'Afrique est basée sur la recherche d'un réservoir souterrain en milieu du socle (aquifère fissuré) (Fig. 1).

En Côte d'Ivoire, les différents forages offerts à la population rurale dans 24 villages des régions du BELIER, IFOU, GBEKE et BAGOUE, n'ont pas été fructueux à long termes (Biemi, 1992).

Ces forages ont été victimes d'un dépérissement de la nappe et/ou du mauvais choix dans son implantation malgré l'utilisation de la prospection géophysique (Cieh, 2001). L'intérêt était de concevoir un modèle, via l'étude des paramètres des anomalies conductrices (Sombo et al., 2011) qui pourrait à la fois quantifier le réservoir souterrain avant forage, de définir avec précision l'anomalie idéale et de prévoir un débit théorique de forage afin de réduire le nombre de forages négatifs lors des prochaines campagnes.

L'utilisation des méthodes géophysiques de trainé électrique, de sondages électriques couplés à l'analyse en composantes principales (ACP) et multiples (ACM) ont définis nos résultats.

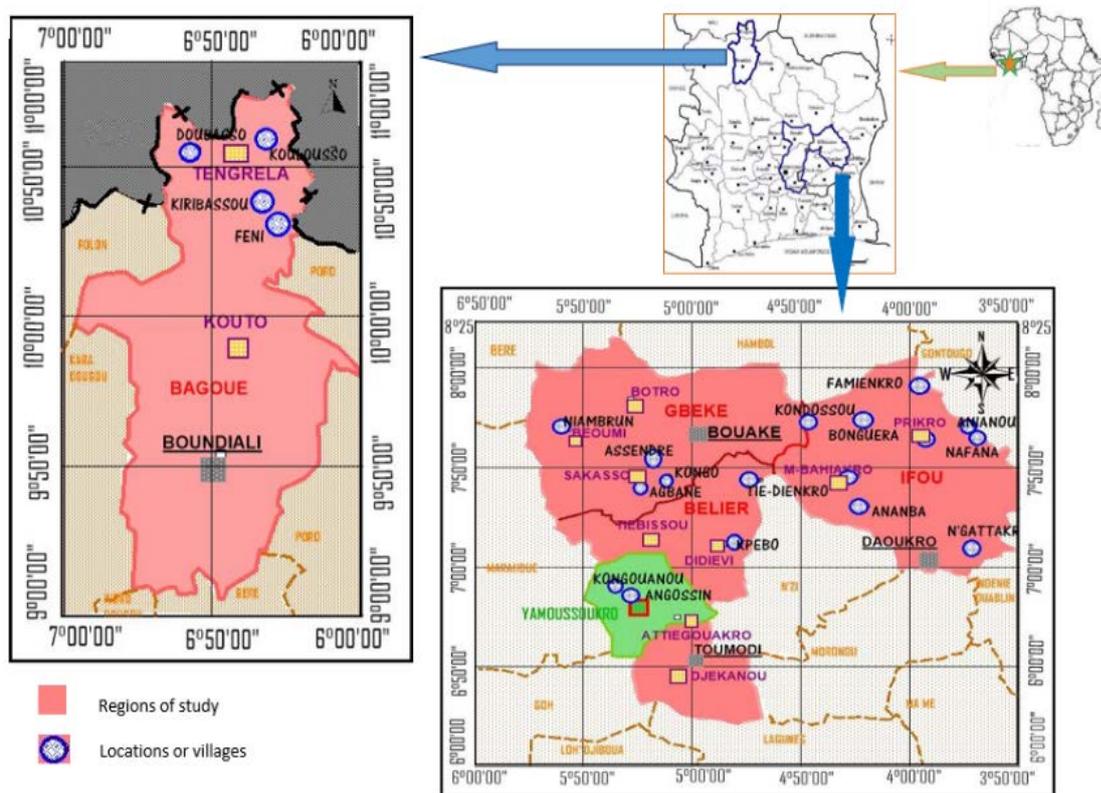


Figure 1. Localisation des forages pour l'eau

Ainsi, l'analyse comparative réalisée avec les débits et les différents paramètres à savoir la forme, le type, la puissance (P), l'amplitude (A), la profondeur de l'anomalie, et le degré de fracturation de la roche (IF) (Dieng et al., 2004), a permis de proposer les anomalies productives et de concevoir un modèle de débit qui va aider désormais à choisir les sites de forage. Après le test d'efficacité, le modèle théorique de débit (QT) élaboré sur 24 localités, a monté un taux de succès de 66.67% (16 localités) pour lequel le débit calculé avant l'implantation du forage était le même que le débit trouvé après forage.

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BATHYMETRY OF LAKES AND RESERVOIRS WITH GPR

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Silting within all man-made reservoirs can be a major problem because of a lower potential water storage. Exploring a lake's bathymetry with electromagnetic techniques is one way to identify the magnitude of sediment accumulation in these reservoirs. In this study, the bathymetry and sediment accumulation of Walker Lake, Pennsylvania were explored with ground penetrating radar (GPR) using either a 400 or 100 MHz antenna, depending on the depth of the lake.

The assembled apparatus herein included two GPR antennas placed in an inflatable boat towed by another boat powered by an electrical trolling motor. A total of eighteen crossings were performed along the entire length of the lake and a new integrated method using multiple processing software was applied to generate three-dimensional and contoured surfaces of bathymetry, sediment accumulation, and the original 1971 basin topography prior to the construction of Walker Lake Dam.

The bathymetry, volume of sediment, and its accumulation rate were estimated. The lake depth was found to vary between a few centimeters near the inlet to 9 m nearer the dam. Deposition of sediment takes place mainly near the inlet to the lake and along the old channel of Middle Creek. The sedimentation gradually decreases toward the dam, ranging between 0 and 1.85 m in terms of bulk sediment volume.

THE STRATOTYPES OF THE DACIAN AND ROMANIAN EASTERN PARATETHYS STAGES FROM THE BUZĂU LAND GEOPARK, ROMANIA

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In the outer part of the Eastern Carpathians, i.e. their southern foreland, there are good exposures of the Upper Miocene and Pliocene successions. Specifically, in the area belonging to the Buzău Land Geopark, the stratotypes of two Pliocene regional stages of the Eastern Paratethys, namely Dacian and Romanian, are located. In terms of global stages, the Dacian and the Romanian cover almost the whole Pliocene (i.e., the Zanclean, Piacenzian and Gelasian stages), except the lower

part of the Zanclean (Snell et al., 2006; Piller et al., 2007). Since the Oligocene, the present-day Romanian territory was included within the Central Paratethyan domain, while starting with the Late Miocene, interval characterized by the isolation of basins with restricted circulation, it became part of the Eastern Paratethys.

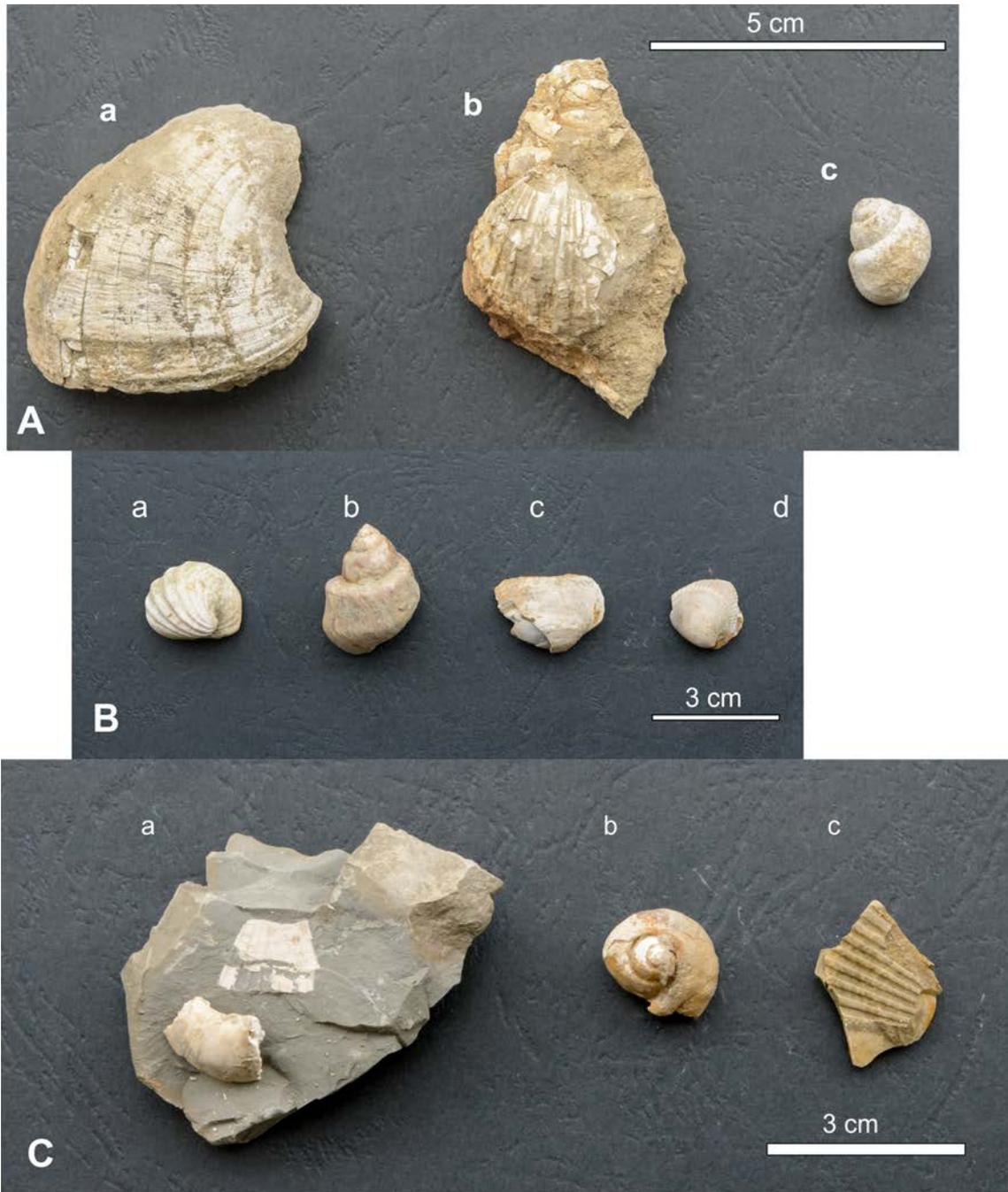


Figure 1. Pliocene bivalves identified in the BLG area. **A:** Lowest Dacian faunas from Câmpulungeanca Valley: a – *Stylodacna* sp.; b – *Zamphiridacna zamphiri*; c – *Viviparus* aff. *heberti*. **B:** Dacian fossils from the Slănicul de Buzău Valley. a – *Prosodacna (Psilodon) haueri* Cobălcescu; b – *Viviparus cucestiensis* Lubenescu; c – *Psilunio?* sp.; d – *Prosodacnomya* sp; **C:** Romanian bivalves from the Slănicul de Buzău Valley. a – *Unio* sp. (fragments); b – *Valvata (Cincinna)* sp.; c – *Limnocardium* sp.

Since the Middle Miocene, the territory of the Buzău Land Geopark was included in the Dacian Basin, that refers to the area extending from the foreland of the Southern Carpathians (towards W) up to the southern part of the Eastern Carpathians (towards E) and the present course of the Lower Danube (at the S), being almost entirely comprises on the Romanian territory (Jipa, Olariu, 2013).

At the stratotype, in the Slănicul de Buzau Valley, the Dacian stage reaches a stratigraphical thickness of around 500 m. The base of the Dacian, i.e. the Pontian/Dacian boundary, is marked by the occurrence of bivalve assemblages with *Pachydacna*, *Parapachydacna*, *Stylodacna* and *Zamphiridacna* species. The lower part of the Dacian stage, i.e. the Getian substage, mainly contain species of the *Prosodacna*, *Stylodacna*, *Limnocardium*, *Phyllocardium*, *Viviparus*, *Pachydacna*, *Zamphiridacna*, *Dacicardium*, *Pseudocatillus* and *Dreissena* genera.

The upper part of the Dacian stage, namely the Parscovian substage, is characterized by the presence of *Prosodacna haueri*, *Stylodacna heberti*, *Viviparus rumanus*, *Prosodacna (Psilodon) conversus*, *Limnodacna rumana*, *Dacicardium rumanum* and *Viviparus heberti* (Fig. 1). Lithologically, at the holostratotype of the Dacian exposed in the Dogari village, the uppermost Pontian is mainly composed of grey, greenish and yellowish clays, interbedded with thin cm sandstones. The sandstones beds became more numerous and thicker towards the top of the Pontian. The lithology yielded no significant change within the lower Dacian, except of the occurrence of reddish clays and the higher frequency of thin cm coquinas

The top of the Dacian stage, i.e. the Dacian/Romanian boundary, is pointed out by the dominance of the unionids in the mollusk assemblages. Typical bivalve assemblages of the Romanian stage contain endemic macrofaunas in the Eastern Paratethyan realm, such as *Jazkoa sturzae*, *Psilunio slanicensis*, *Prosodacnomya sturi* and *Viviparus bifarcinatus* (Fig. 1).

The lithology of the Romanian at the holostratotype, in the Slănicul de Buzau basin, is characterized, as for the upper part of the subjacent stage, the Dacian, by the presence of sands and yellowish clays, interbedded with sandstones. Within the lower Romanian, the coal intercalations become thicker and more numerous. The macrofaunas indicate an overall transition from a brackish paleoenvironment towards a fresh water one during the Romanian.

Aknowledgements. The research leading to these results has received funding from EEA Financial Mecanism 2009-2014, under the GeoSust Project, Contract no 22 SEE/30.06.2014.

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EVALUATION OF THE NATIONAL CULTURE OF MOZAMBIQUE AND ITS INFLUENCE ON THE ORGANIZATIONAL CULTURE OF THE MULTINATIONAL OIL COMPANY OPERATING IN THE COUNTRY

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Key Words: culture, society, organization, hydrocarbons

The coexistence of cultures both in companies and in the organizations is imperative in the age of globalization however there are several cases where cultural differences are the cause of violence and wars. Paradoxically in organizations, corporate culture when well designed and interpreted is the asset to the success of the organizations. The aim of this study was to evaluate the National culture of Mozambican society and its influence on organizational culture in multinational working in the Petroleum sector in Mozambique.

We surveyed 61 individuals of which 35 responded to inquiries about National culture and 26 in surveys on organizational culture. There were approached different entities, from ordinary citizens to the companies managers. Particularly for the sample on the assessment of the National culture, respondents had to be Mozambican citizens living in Mozambique and have to be 18 years old. For the assessment of the organizational culture, it was appropriate that the respondents were employees and managers of some multinational oil companies operating in Mozambique, aged greater than or equal to 18 years and certainly without distinction of nationality. Although the sample size is small, i.e, less than 50 individuals (which may cast doubt on its interpretation), the data quality is good. These show a relatively invariant amplitude and frequency possibly motivated by the fact that companies in the oil industry, having to operate according to internationally accepted norms and standards. The data were entered into an Excel database and imported to the statistical analysis program SPSS for processing and analysis.

The surveys for the assessment of organizational culture were spread over 5 multinational companies. About 5 people from each of the companies covered in surveys namely two senior managers and three technical staff. It should be noted that these entities have asked not to refer to the organizations' in this research work. The study suggests that there is a certain coexistence trend of the societal culture and the organizational culture. This trend may have motivation in the fact that both multinational and society have to realize that mineral resources are exhaustible and therefore must be developed in a sustainable way, which is only possible with the integration of all stakeholders in the process.

LONG-TERM PERFORMANCE OF THE DISPERSED ALKALINE SUBSTRATE TECHNOLOGY: PILOT STUDY IN EMALAHLENI, MPUMALANGA, SOUTH AFRICA

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Keywords: Dispersed alkaline substrate, passive treatment, acid mine water

Environmental concerns associated with abandoned coal mining sites in the Highveld coalfields have demonstrated the need to develop remediation technologies that are practicable, efficient, cost effective and environmentally friendly in a wide range of physical settings.

Traditional passive treatment technologies on the other hand have proved to be efficient in treating acid mine water with low concentrations of heavy metals and acidity, they have also proved to have limitations such as loss of reactivity through armouring of the limestone which prevents the limestone from reacting with the AMD and causing clogging in the systems.

To overcome these problems the Dispersed alkaline substrate (DAS) system was constructed for the Douglas colliery site. The mine water from the abandoned Douglas colliery underground workings is characterized by pH levels of 2.5 to 3, acidity of 1900-2300 mg/L (as CaCO₃), 250-330 mg/L of the total iron, 1000-2000 mg/L SO₄²⁻, 100-200 mg/L Al, 3-5 mg/L Zn.

The DAS at Douglas is composed of coarse wood chips mixed with a fine grained alkaline material (e.g. limestone or Magnesia). The wood chips allows permeability to minimize clogging and small grain sizes of the fine limestone which provides a large reactive surface area making it to be consumed before it is coated by precipitates.

The system was operated at low flow rates in order to achieve longer residence time in the reactive tanks. This consumed the acidity and lowered the metal concentrations in the water treated.

STRUCTURAL STUDY OF THE PRIOPCEA HILL – THE NATURE OF MAJOR FAULTS IN THE WESTERN PART OF THE NORTH DOBROGEA OROGEN, ROMANIA

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INTRODUCTION

The Cimmerian fold-and-thrust belt of North Dobrogea is a narrow orogenic belt located between the Scythian and Moesian Platforms. The tectonic boundaries are represented by crustal faults, Sfântu Gheorghe and Peceneaga-Camena Faults. North Dobrogea comprises the western Măcin zone, exposing largely the pre-Alpine basement and the eastern Tulcea zone, dominated by Triassic-Jurassic outcrops; these two zones are separated by the NW trending Luncavita-Consul Fault. Both zones have a more complicated internal structure, interpretations varying from low-angle nappes to high-angle thrusts. Previous studies showed that several strike-slip faults affect the Pre-Alpine basement in the Măcin zone, but the importance of wrenching for the achievement of the Cimmerian structure still needs to be proved through detailed structural studies. The Cimmerian structures were truncated by erosion before being overstepped by the Late Cretaceous post-tectonic cover (Babadag Basin).

The Priopcea Hill consists of black limestones, shales and black argillites with thin sandstones interbeds, ascribed to the Silurian, quartzite and phyllites with a Cambrian depositional age suggested by detrital zircons (Balintoni et al., 2010) and an amphibolite-dominated member of the Megina Group. The tectonic contacts between the Silurian deposits, the quartzites and amphibolites in the Priopcea hill are interpreted either as result of steep faulting (Mirăuță, 1966), or of Hercynian thrusting (Seghedi et al., 1988).

The paper presents the results of structural mapping, microstructural and petrographic studies in the Priopcea Hill, aiming to decipher the deformational mechanisms responsible for the structure of this key area in understanding the structure of the Măcin zone.

METHODOLOGY

Detailed mapping of structural elements: foliation, lineation, fracture planes has been performed with sampling. 84 oriented samples were collected and cut for thin sections on one plane or two perpendicular planes (along schistosity and lineation XOY and perpendicular on schistosity and parallel with lineation XOZ). The optical study of the thin sections was performed in transmitted light, comprising the determination of mineralogical and petrological assemblages and the identification of the deformational microstructures.

RESULTS

In the SW part of the hill, the Priopcea quartzite, part of the Boclugea Series, thrusts over the mudstone of the Cerna Formation ascribed to the Silurian. In the NE part, the amphibolite of Megina Series thrusts over the quartzite.

Contact between Cerna Formation – Priopcea Quartzite

The fault is oriented SW/75° - 85°. In the SE part. The fault dip reaches 90°. Inconsistency of the dip direction suggests the contact is folded.

The Silurian shale of Cerna Formation with thin intercalations of fine sandstone is folded on the clivage plane and the bedding plane became the schistosity plane. The black limestone of the Silurian succession contains kinematic indicators: σ clasts of quartz showing the deformational direction NE – SW, the same like the hinges of the kink folds found in the shales.

In general, samples from the Priopcea Quartzite show the superposition of multiple generations of deformation. The first one is the plastic deformation represented by the deformational lamellae and undulose extinction of quartz grains. These are indicators of a ductile domain characterized by high temperatures for quartz > 250°C. Also, we can see the crystallization through subgranular rotation, occurring probably in the early part of the deformational phase. The second phase of deformation is cataclastic. It is characterised by a lower temperature, so the mechanical response is brittle and is re-equilibrated by the dynamic recrystallization of quartz grains.

Contact between Priopcea Quartzite – Megina Series

The fault is oriented NW – SE with a dipping angle varying between 60° - 75°. Lineation has been measured with an orientation SE – NW and a dip azimuth between 30° - 40°. The slickenlines are characterised by an orientation of 282° - 286°/5° - 15°.

The deformation in amphibolites is ductile and generally recorded by the kinematic indicators like σ clasts and kink bands. Late transformations are visible in the paragenesis sequence: calcite and epidote.

CONCLUSIONS

Multiple stages of folding have been observed in the study area. The first one has the fold axis parallel to the lineation and it is considered synchronous with the deformation. The second phase of folding has the fold axis oriented almost perpendicular on the previous one and it is of lower intensity.

The tectonic contact between the amphibolite and the quartzite is oriented NW – SE/ 60-75°. The fault is parallel with the foliation, indicating a reactivation in a brittle regime of a pre-existing anisotropy. The slickenlines are parallel to the lineation, oriented ~116°/30-40°. The deformation is compressional towards NW.

The contact between the Priopcea Quartzite and the Cerna Formation is oriented NW – SE/ 75-85°. The lineation in the quartzite is parallel with the slickenlines, oriented 284°/ 5-15°. The relative movement between the units suggests similar compressional behaviour towards NW.

The dip azimuth of faults and the sub-horizontal slickenlines observed at the boundary of the petrographic units in Priopcea Hill suggest the faults to have a stronger horizontal component of deformation compared to the vertical one, implying a strike slip character.

Acknowledgements. This research was funded by the Geological Society of Romania and NRD GeoEcoMar during the campaigns of collecting data in the field and by the University of Bucharest through the Scholarship of Scientific Performance obtained by Andreea Mârza.

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GEOLOGICAL AND PALEONTOLOGICAL HERITAGE OF ROMANIA. CASE STUDY: THE GEOPARKS OF THE CARPATHIANS

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The Romanian Carpathians exposes sediments covering the last 500,000 million years, enclosing rich fossil assemblages, both in the Eastern and Southern Carpathian regions, as well as in the Apuseni Mountains. One of the richest geological and paleontological patrimonies is situated at the southern end of the Eastern Carpathians (Fig. 1), in the Buzău Land Geopark (BLG), where rocks covering more than 70 million years (Late Cretaceous up to Quaternary interval) crop out. Notably, in this Geopark, the oil and gas exploitation is active since the end of the 19th Century, as the Paleogene and Neogene rocks contain important hydrocarbon reserves.

The most significant geological heritage of the BLG comprises the Mud Volcanoes, ones of the few known in Europe, and also the amber deposits, spectacular concretions in Miocene sandstones showing strange shapes, mineral springs, along with the salt diapirs ('The Salt Mountain') and caves, as well as karsts hosting numerous depressions in which lakes and swamps have formed.

The Mud Volcanoes (Fig. 2), placed in the BLG territory are the most representative site of this kind in Romania. The occurrence of this phenomenon is linked, as in other regions of the world, to an intense diapirism; the mud migrates to the surface from the Middle Miocene deposits situated at a depth of around 3,000 m, through the faulted limbs of an anticline. Various sizes and shapes were

evidenced on over 100 structures occurring in the Mud Volcanoes sites of the BLG (Brustur et al., 2015).

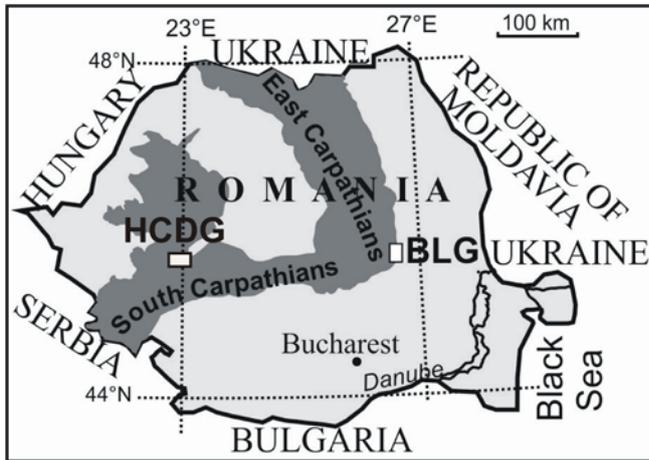


Figure 1. Location of the two geoparks in the Romanian Carpathians, BLG- Buzău Land Geopark and HCDG – Hațeg Country Dinosaur Geopark, enclosing a significant geological and palentological heritage.

Besides, in the Geopark area, the Neogene outcrops are of a broad scientific significance, as they exposed the holostratotypes of two Pliocene and Pleistocene Eastern Paratethyan stages, namely the Dacian and Romanian. As for many stages of the Paratethyan domain, the boundary between the Pontian/Dacian and the Dacian/Romanian stages were defined based on bioevents recorded in the mollusc group of organisms. At the end of the Late Pontian the genera *Lunadacna*, *Luxuridacna* and *Pteradacna* disappeared. The boundary between the lower Dacian and the upper Dacian is marked by the first occurrence of the bivalves *Zamphiridacna zamphiri* and *Prosodacna (Psilodon) stefanescui euphrosinae* (Papaianopol et al., 2003; Macaieț et al., *in press*).



Figure 2. The Mud Volcanoes from Berca, namely Păcelele Mici (Photo: Gabriel Ion, August 2014).

Notably, the outer (eastern) region of the BLG territory, where the Dacian and Romanian stages have been firstly described, has been included, since Late Neogene times, within the Dacian Basin. This was an elongated depression at the foot of the Carpathians, extending more than 500 km from the NE to the SW, where it connected with the Balkan Mountains (Jipa, Olariu, 2013). Endemic

macrofaunas occurred as results of the isolation and lowering salinity in this semi-isolated Eastern Paratethyan basin.

Another significant part of the geological and paleontological Romanian heritage is exposed towards the western part of the Southern Carpathians, where the UNESCO Hațeg Country Dinosaur Geopark (HCDG) is situated (Fig. 1). This geopark is world wide famous for its uppermost Cretaceous dinosaur remains, mostly containing dwarf endemic taxa that have lived in a restricted setting, i.e., an island (Nopcsa, 1914; Grigorescu, 2010). Along with the dinosaur fossils, other Cretaceous vertebrate remains, as well as primitive mammals, were discovered in the HCDG territory.

In this geopark, the geological and paleontological heritage includes not only continental sites, but marine sites as well. The Lower Cretaceous reefal limestones are followed by a continental deposition (bauxite), within the Albian. The first Upper Cretaceous marine sedimentation, an infralittoral one (Melinte-Dobrinescu, 2010), occurs in this area within the Early Cenomanian, when coquinas mainly composed of *Actaeonella* are present (Fig. 3), along with rich rudist assemblages, followed by marlstones enclosing rich faunas, i.e. ammonites and inoceramids. While in the eastern part of the Hațeg basin a dominant shelf deposition took place, in the western part thick turbiditic successions, indicative for a deep-marine paleosetting, are exposed.



Figure 3. Cenomanian coquinas with *Actaeonella* in the NW part of the Hațeg basin, Ohaba-Ponor region (Photo Andrei Briceag, 2010).

The entire Upper Cretaceous sedimentation of the Hațeg basin could be assigned to the Gosau facies of the Alpine area, such as the Northern Calcareous Alps (Wagreich and Decker, 2001), being one of the very few sites located in the Carpathian bend where this facies may be encountered.

Acknowledgments. The studies leading to this paper have been financed by the Project PN2 IDEAS Code UEFISCDI 0162/2011 and by the Collaborative Project Romania-Norway SEE GeoSust No. 22/2014.

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A GEOLOGICAL ITINERARY THROUGH THE METALIFERI MOUNTAINS, ROMANIA

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This work represents only a first step in a broader research aiming to connect the geology, the geodiversity and the geoheritage of the Apuseni Mountains (Western Romania).

The geology of the Apuseni Mountains area has been studied for more than two centuries and still presents a high interest for scientists.

Known worldwide for their mineral deposits, the Metaliferi Mountains (southern part of the Apuseni Mountains) have been the subject of study for a considerable number of researchers (hundreds of published papers) (e.g. Ghițulescu and Socolescu, 1941; Ianovici et al., 1969; Bleahu et al., 1976; Udubașa et al., 1992; Pécskay et al., 1995; Bojar and Walter, 2006, Seghedi and Downes, 2011, etc.).

The aim of this work is: a) to highlight the area of the Metaliferi Mountains as an important geological heritage; b) to propose a geological itinerary during of which the visitors can learn about the geology of this part of Romania and also about the history of mining activities in this area. Besides, mining in Metaliferi Mountains dates back to Roman and even pre-Roman times.

The proposed itinerary connects nine sites/stops: 1) Citadell Hill (Deva); 2) Măgura Uroiului Hill (Simeria); 3) Săcărâmb village (Certejul de Sus); 4) Măgura Hill/ Crăciunești Gorge (Băița); 5) Dealul Mare Hill (Vălișoara); 6) Gold Museum (Brad); 7) Vulcan Mountain (Buceș); 8) Detunatele (Bucium); 9) Mining Museum (Roșia Montana). The itinerary develops for about 170 km; all the stops are easily accessible.

The itinerary has been chosen by taking into account both the values of the sites and the beauty of the area. Each of the above mentioned sites had one or more of the following values: scientific, educational, cultural, historical, and touristic/ recreational values.

The visitors have the opportunity to see and/or learn about: a) geology (Neogene volcanism and associated mineralisation; Quaternary volcanism; Mesozoic ophiolitic and sedimentary rocks); b) world-famous minerals and type localities; d) geological monuments and natural reserves; f) geoheritage; g) in situ and ex situ geodiversity sites; h) mining history and heritage, etc.

The goal of organising of this itinerary is to explain to visitors the geological richness of the Metaliferi Mountains. The itinerary, well documented and presented, can be interesting to both a general public and academic geologists and could be considered as an itinerary with geotourism potential.

The sites that form the stops along the proposed itinerary represent a minor part of the geodiversity and geoheritage of Metaliferi Mountains. In order to point out the geoheritage importance of these mountains, a lot of work needs to be done: inventory and characterization of geosites, assessment of geodiversity, geoheritage evaluation, geoconservation strategies, etc.

This work has been financially supported as part of the Research Projects No. 16 06 02 01/2016 and No. PN 16 06 03 04/2016 financed by Romanian Authority for Scientific Research, Development and Innovation.

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GEOLOGIE DES FORMATIONS BIRIMIENNES DE LA REGION DE TENGRELA EN RELATION AVEC LA MINERALISATION AURIFERE DE SISSINGUE (NORD DE LA COTE D'IVOIRE)

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Située sur le sillon Syama-Boundiali, au nord de la Côte d'Ivoire, Tengréla est l'une des régions les moins étudiées du pays. Par l'absence des travaux de recherche scientifiques antérieurs, les travaux de recherches minières de la société Occidental gold ont été un appui important car le climat de cette région est très chaud et sec avec une très intense altération météorique. Ce qui rendait difficiles les levés géologiques et la caractérisation de la minéralisation aurifère sur la base d'affleurements.

Nos travaux consistaient à des études lithostructurale détaillée et métallogénique sur le terrain et en laboratoire de certains échantillons de roches carottées, de quelques affleurements et certaines pierres volantes du permis P145 et P146 du projet Tengréla. Ces études ont contribué à une meilleure connaissance du gisement de Sissingué.

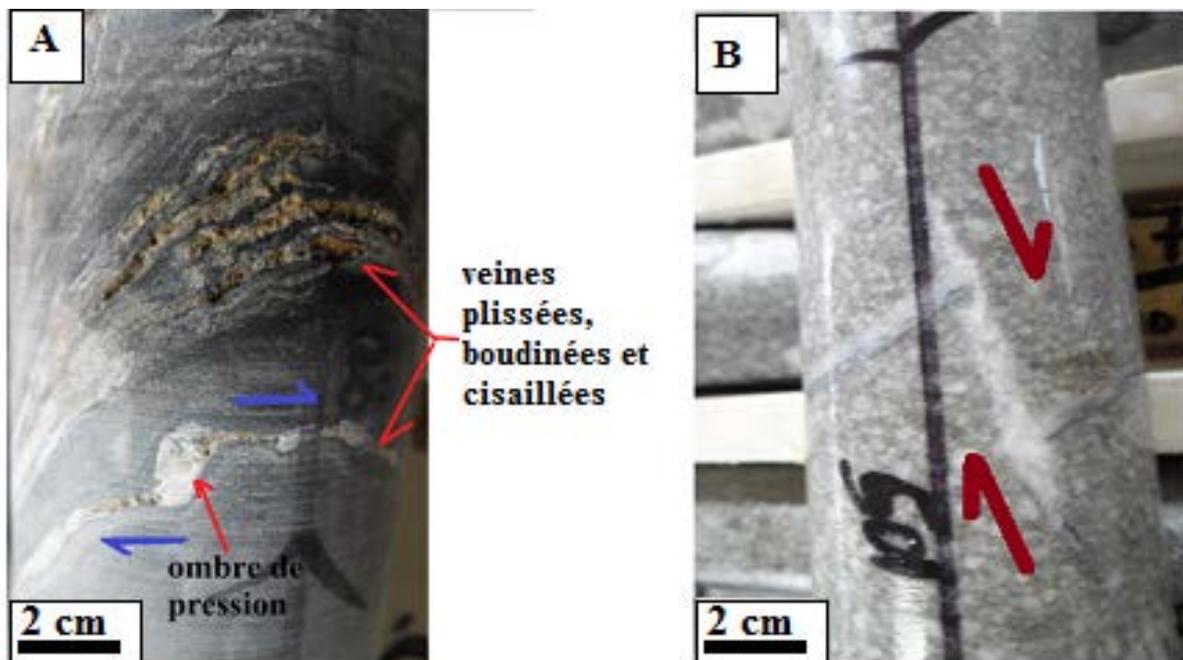


Figure 1. Aspects macroscopiques des métasédiments, des microgranites porphyriques et des structures observées sur les carottes de sondage de Sissingué (55° vers le SSW). A-Microplis de veines de quartz, cisillées et boudinées avec des ombres de pression dans un métagrès. B-Décalage dextre d'une veine par une autre dans un microgranite porphyrique.

A l'issue de ces travaux, plusieurs faciès lithologiques correspondant à ceux du Birimien ont été déterminés. Nous remarquons une prédominance de métasédiments dans toute la région (Fig. 1A), essentiellement constitués de métaconglomérats, de métaagrès, de métasilts et de schistes graphitiques, intrudés par des formations magmatiques. Ces dernières sont constituées essentiellement de granite, microgranite, dykes felsiques (microgranites porphyriques) au niveau de Sissingué (Fig. 1B), et de roches mafiques dont les microgabbros quartziques à Papara. Les microgranites et les microgranites porphyriques sont les principales formations qui abritent la minéralisation de Sissingué.

La minéralogie des microgranites est constituée de quelques rares phénocristaux de quartz dans une matrice fine composée de quartz corrodés, de plagioclase, de muscovite lamellaire avec un agrégat fibreux de séricite, des carbonates et des minéraux opaques. Celle des microgranites porphyriques est constituée essentiellement de quartz, de phénocristaux d'orthose et de plagioclase, de calcite, de séricite en petites paillettes allongées et des minéraux opaques. La paragenèse métallifère est composée d'or inclus dans des sulfures généralement automorphes (pyrite et arsénopyrite qui dominent la chalcopryrite, la pyrrhotite et galène) et de l'or natif.

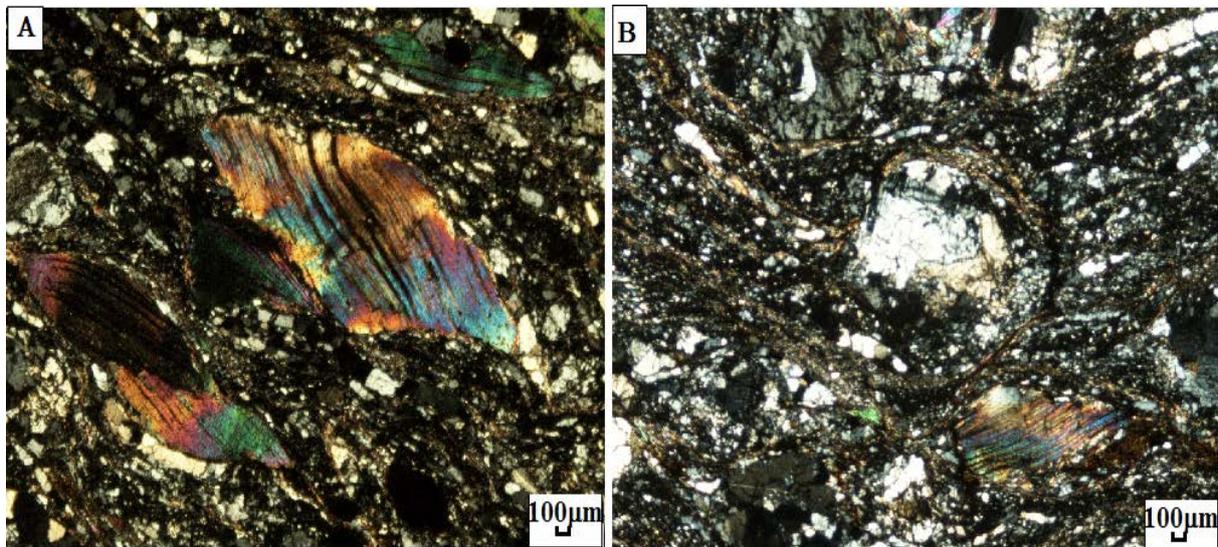


Figure 2. Aspects microscopiques des structures observées. A, Structure ceillée et muscovites losangiques à clivages déformés dans le gneiss en lumière polarisée; B, Ombre de pression, grains de quartz cisailés dans le gneiss en lumière polarisée.

La paragenèse métallifère est composée d'or inclus dans des sulfures généralement automorphes (pyrite et arsénopyrite qui dominent la chalcopryrite, la pyrrhotite et galène) et de l'or natif.

L'analyse structurale des formations nous a permis de répertorier un nombre élevé de structures que sont les failles, les réseaux de fractures, les plis, les ombre de pression, les décalages de veines, les boudins, les structures mylonitiques, les microboudins, les foliations, les veines ondulés ou non, les minéraux étirés et les joints. Elles sont majoritairement orientées dans deux directions principales NNE-SSW NNW-SSE et parfois NE-SW qui correspondent aux directions du Birimien. On peut déduire que notre zone d'étude est localisée dans une shear zone (couloir de cisaillement) montrant une tectonique souple et cassante (Fig. 1A; Fig. 2). La déformation souple serait à l'origine des roches métamorphiques identifiées à Tindara, au sud-ouest de Sissingué. Elles se présentent sous deux faciès : le gneiss gris à biotite et le gneiss rose à muscovite (Fig. 2A; Fig. 2B) présentant une structure

mylonitique avec des minéraux ocellés (muscovite losangique, quartz en mosaïque équant ou amygdalaire, feldspath), et des minéraux étirés (muscovite et biotite en fines paillettes allongées et orientées).

La minéralisation du gisement de Sissingué apparait étroitement liée à la lithologie et à l'hydrothermalisme. Ce gisement est de type disséminé et filonien, montrant un contrôle lithologique et structural. L'or s'accompagne régulièrement de séricitisation, de silicification et de sulfures (pyrite et arsénopyrite). La pyrite est porteuse d'or lorsqu'elle est fine.

Le gisement de Sissingué, tout comme les gisements de Syama, Tongon et Aféma, a été contrôlé par un grand couloir de cisaillement.

ZONING PATTERNS IN METAMORPHIC GARNETS, LEAOTA MASSIF, SOUTH CARPATHIANS, ROMANIA

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Garnet porphyroblasts play a critical role in metamorphic rocks study, considering their remarkable property of recording and preserving in their chemical composition both P-T conditions and the timing of their metamorphic evolution. Moreover, garnet is common in metamorphic rocks and persists over a large range of temperature and pressure, permitting its use in diverse tectonic settings.

The distribution of elements within single garnet grains from metamorphic rocks is a valuable tool to evaluate their metamorphic history. Major element zoning results mostly from varying physical parameters during mineral growth leading to simple or very intricate zoning patterns of the garnet crystals. Secondary overprints during retrograde metamorphism may cause additional changes which are evident at crystal rims. Various zonation patterns of Ca, Fe, Mg and Mn are indices of time-lines in porphyroblastic garnets. The zonation of Mn marks various growth stages very well, sometimes indicating complex growth histories dominated by multiple nucleation and coalescence, but also interrupted by partial resorption (e.g. Săbău *et al.*, 2006). Chemical variations of Ca, Fe and Mg in garnet during prograde metamorphism define time-lines other than those of Mn which decreases, highlighting the stages of porphyroblastic growth. In particular, the Ca/Mn, Mg/Mn and Mg/Fe ratios are useful in late growth stages, when low Mn contents and radial gradients do not allow a satisfactory resolution of Mn time-lines (Săbău *et al.*, 2006). These ratio-based time-lines further substantiate the potential of Mn time-lines in revealing non-concentric porphyroblastic growth. This is important in order to correctly relate garnet growth stages to stable mineral assemblages, a prerequisite for a reliable derivation of the metamorphic history of rocks in a wide variety of geological settings.

The compositions and chemical zoning of garnets from the Leaota Massif (South Carpathians) were investigated in order to highlight the internal structure of garnet porphyroblasts and accurately

determine the growth sections and retrograde zones from compositional maps, with a key role for deriving a reliable P-T-t path of their forming and evolution. The Leaota Massif consists of a flat-lying sequence of five structurally concordant units (Fig. 1) displaying mutual and partly internal lithologic and metamorphic contrasts (e.g. Negulescu & Săbău, 2015). Garnet is omnipresent in all the basement units, displaying distinct compositions and zoning patterns associated with specific P-T-(t) conditions and evolutions of the host rocks.

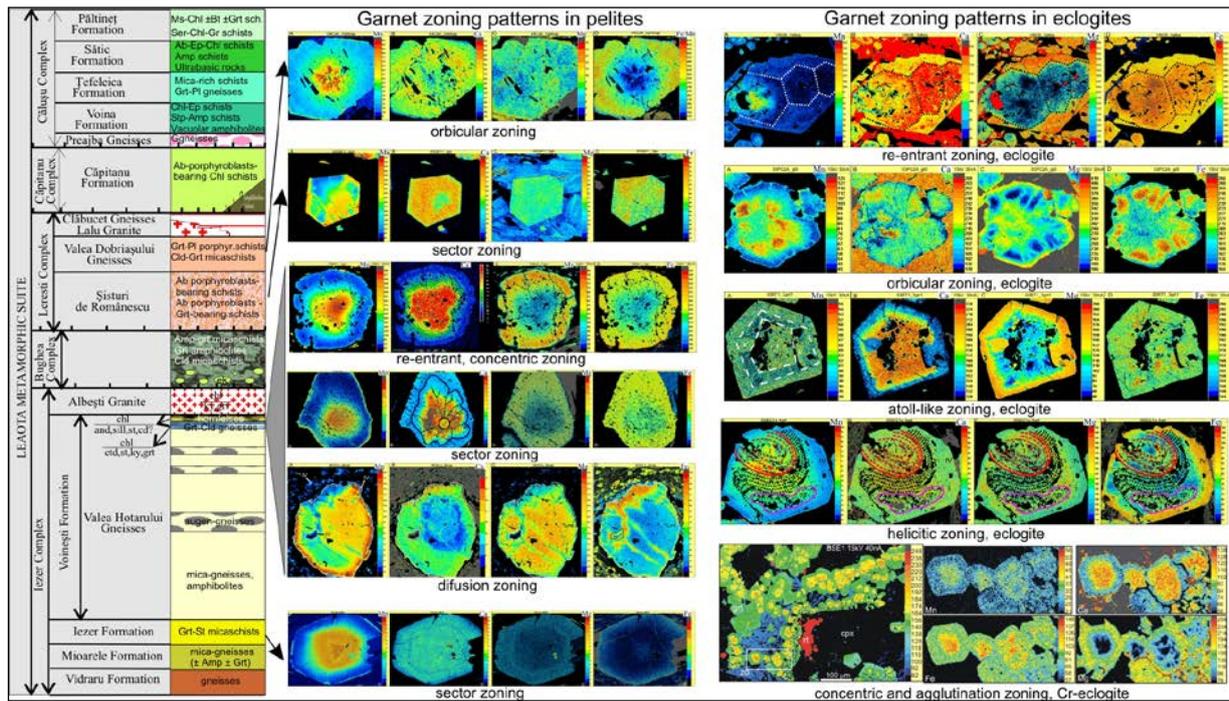


Figure 1. The lithologic units of the Leaota Massif and garnet zoning patterns in pelitic rocks and eclogites

The compositions of garnets from metapelite rocks of the lezer, Bughea, Lerești and Călușu Complexes are plotted on ternary Mg-Ca-Fe, Mg-Mn-Fe and Mg-(Ca+Mn)-Fe diagrams (Fig. 2) showing distinctive populations and evolution paths for each unit. Garnets from the Țefeleica Formation (Călușu Complex) are characterised by the highest Ca and Mn compositions. Garnets from the micaschists of the Bughea Complex and gneisses of the upper part of the Voinești Formation (sample 05Tb1) display the highest magnesian compositions. Garnets from the Româneșcu schists (Lerești Complex) are Mg-richer than garnets from the Valea Dobriășului gneisses of the same complex and Mn-richer than garnets from the Bughea and Lezer Complexes.

The evolution paths of garnets have been inferred from core-to-rim chemical line-profiles and vary from typical prograde paths (e.g. Bughea Complex) to complex evolutions (e.g. Ri6, Voinești Formation). The most complex evolution was recorded by the garnets from kyanite mylonitic gneisses (sample 05Tb1) during polymetamorphic evolution of the upper part of the lezer Complex (Negulescu et al., 2015). The kyanite-garnet mylonitic gneisses are made up of large garnet porphyroclasts (05Tb1-gt-large, Fig. 2) embedded in a strongly deformed matrix of small garnets (05Tb1-gt-small, Fig. 2) - white mica - kyanite - epidote - plagioclase - biotite - amphibole - quartz - rutile - ilmenite. Rare clinopyroxene inclusions were identified in the small garnets. The small garnets are poorer in Mn and Fe, and richer in Ca and Mg than large porphyroclastic garnets.

The distribution of the main cations in the garnets from pelitic rocks belonging to different units (Fig. 2) characterise a prograde zonation, sometimes displaying coalescence features or simple agglutination of some idiomorphic nuclei overgrown in single crystals by thick rims. Some garnets from the Româneşcu Schist, Iezer and Voineşti Formation display sector zoning indicative of a fast growth. The garnets from eclogites (Bughea Complex) disclose simple to intricate prograde zoning, indicating its complex growth histories dominated by multiple nucleation and coalescence (Fig. 1).

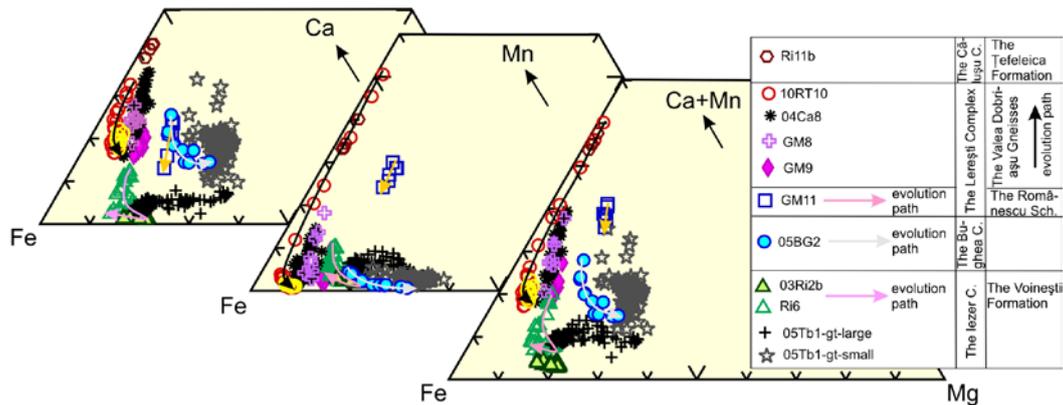


Figure 2. Chemical compositions and evolution paths of garnets from pelitic rocks (Leaota Massif).

It is generally agreed upon that garnet is a valuable tool for inferring depths, temperatures, and durations of metamorphism, metasomatism, or deformation (e.g. Caddick, Kohn, 2013). A good example is the kyanite-garnet mylonitic gneisses from the upper part of the Voineşti Formation (Leaota Massif) where textural relationships, garnet compositions and monazite data relate the large garnet porphyroclasts to an old 539 ± 27 Ma medium grade metamorphic event, and mineralogical and textural reworking during syn-metamorphic Variscan (346 ± 14 Ma) tectonic loading, corresponding to the small garnet - phengite - kyanite - pyroxene - rutile high-pressure mineral assemblage (Negulescu et al., 2015).

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CAUSES OF ENVIRONMENT DEGRADATION IN GHANA AND PREVENTIVE MEASURES PROPOSED

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Environmental degradation in West Africa, specifically in Ghana, is caused by several factors. The main causes and preventive measures are presented below.

Run off water. In Ghana we experience two main seasons, the dry season and rainfall. During rainfalls, the poorly constructed and choked gutters, and the undredged river beds and river banks, make the surface run off water and the river beds overflow their banks. In effect, this destroys many assets such as roads, buildings, kills both humans and domestic animals, after they've been washed away. It also increases the rate of unemployment and homelessness. At times, the stagnant water causes breed of mosquitos that cause malaria sickness.

Preventive measures proposed : the government should pay more attention to this issue, provide excavators to remove materials from river channels and river beds. Then again, there should be a communal labour, so that the community people themselves can dig choked gutters to remove debris that prevents the flow of the running water.

Soil erosion is the process of carrying away the top layer of the soil, due to both human activities and natural causes. This affects crop production and many a times it also pollutes water bodies. This yield low agricultural productivity, since the soil nutrients are washed away.

Preventive measures. The community should construct terraces, especially at places that have steep and gentle slopes, in order to improve cultivation.

Pollution is an undesirable state of the environment which contaminates the air, water bodies and the land as a whole. There are several types of pollution including air pollution, sound pollution, thermal pollution, water pollution, land pollution, etc. Africa is mostly affected by water, land and air pollution. Water pollution by humans is caused by defecation along the river banks and excrements are washed away into the river whenever the river overflows its banks. This causes waterborne diseases such as bilharziasis. Some fishermen also apply chlorofluorocarbons (CFC) and dichlorodiphenyltrichloroethane (DDT) in order to catch fish, poisoning the water. Air pollution is caused by factories, which also discharge poisonous gases into the air which leads to lung diseases. Land pollution occurs as many farmers also apply unprescribed chemicals and fake fertilizers to their farmlands.

Preventive measures. The government must educate people to curtail from polluting the environment.

Deforestation occurs as people (such as farmers, road, mining and building contractors), hew or cut down the trees to destroy the environment. This affects the inhabitants directly and indirectly. It is scientifically proven that cutting down trees reduces the amount of rainfall in an area. When trees along the riverbanks are destroyed, the water level also reduces, due to evaporation. It is well known that when the last tree dies, the last human also dies, because trees discharge the oxygen which we inhale.

Preventive measures should include education and carrying on afforestation exercises.

Landslides. They form by sliding of large mass of dirt, including disintegration of rocks fragments, which are washed down from hills and slopes, due to various reasons, including human activities. This way the land or hilly slopes get destroyed. This is a frequent phenomenon mostly in the hilly areas in some parts of the eastern region of Ghana.

Preventive measures. Tap rooted trees must be planted in those areas and activities of deforestation must stop. Afforestation ought to be practiced and terraces must be built to combat the slides.

The main factors mentioned above represent both natural causes and human activities, due to inadequate education, fragile governmental policy, lack of technical-know-how, etc. Meanwhile, it can be safely concluded with a degree of certainty, that well organized communal labour in each community, as well as improvement on education, research work, advocacy and policy by the government, will help curb environmental degradation.

WESTERN BLACK SEA BASIN: HAZARDS, EFFECTS AND THEIR MONITORING

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Limited by active fault systems and showing a high regional seismicity, the Black Sea basin represents a suitable area for the occurrence of natural hazards. Earthquakes, which usually accompany areas with active tectonic activity represent the main triggering of the tsunami waves, submarine landslides or large scale gas seepages.

Other known natural hazards of the western Black Sea, shelf and coastal areas, are caused mainly by the impact of global climate changes, which can generate exceptional marine storms, tornadoes, meteotsunamis, involving sea level rises, all of these implying an accelerated erosion and damages for the coastal area. These natural hazards are significant either by themselves or being part of the cause – effect chain.

Classical triggering mechanisms of the tsunami-type natural hazard are present in the Black Sea. Recent and historical data, collected on natural hazards, show that the Black Sea basin is highly productive and can generate important seismic events only for a seismic magnitude higher than 6.7 degrees on Richter scale. Although some areas, like the northern coast of Turkey, the Crimean coast (Ukraine) or the western Black Sea coast are subject to a higher risk than other localities, researchers have suggested that the entire Black Sea coast should be considered as a possible tsunami target. The submarine landslides are well strained, especially in the NW part of the basin, rare or exceptional

events, like large-scale gas-hydrates seepages, being present mainly on the continental slope area. Crustal movements, sediment compaction and eustasy of the Black Sea basin and around area represent other elements important in the appearance and evolution of the geohazards, with impact to the Romanian - Bulgarian Black Sea coast.

Considering the mentioned multiple natural causes an early-warning system (EUXINUS) and an on-line geodynamic network (GeoPontica) were implemented by Romania and Bulgaria, using a cross border cooperation project.

EUXINUS network represents a complex automatic marine measurement equipment, consisting of 5 gauges installed in key points of the Western Black Sea area, at water depth up to 90 m, and one shallow water gauge, as component of a coastal wave station, operating in Mangalia area (Romania), close to the Romanian – Bulgarian border. These 5 fully automatic stations, 3 in the Romanian territorial waters and other 2 in the Bulgarian area, are provided with real-time bidirectional data communication capabilities and managed from on-shore, by two National Data Centres located in Romania (GeoEcoMar, Constanta Branch) and Bulgaria (IO-BAS Headquarters, Varna).

The equipments provides meteorological information, physical – chemical data related to the water column (water current amplitude, water current direction, conductivity, temperature, pressure, oxygen concentration, turbidity, chlorophyll) and an underwater tsunami module, equipped with a high resolution pressure sensor and temperature sensor, provides data related to the possible tsunami waves appearance.

A common Romanian – Bulgarian database comprises all the information needed in the process of elaboration and issue of an early-warning notification to the public authorities specialized in the civil protection, and assessment of evolution of a marine hazard situation.

Using the international cooperation opportunities, EUXINUS is integrated in different European networks as JRC (Ispra, Italy), Horizon 2020 EMSODEV Project, EMSO-ERIC research infrastructure of the ESFRI and developed large collaboration with various national and international research institutions, universities and public administrations.

HEAVY MINERAL DEPOSITS FROM PETITE COTE, SENEGAL

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Heavy minerals deposits from Senegal have an economic interest since 1990. The present paper intends to analyze heavy mineral deposits of the coast of Senegal in terms of grain size, morphometric and mineralogical point of view, with the aim to determine the economic potential of these deposits.

Petite Côte, the study area, is located in West Africa, in the southwestern part of Senegal and covers 1599 km². This place belongs to Senegalo - Mauritanian sedimentary basin and formed as a result of the fluvial activity on the Somone, Casamance, Saloum, Gambia and Senegal rivers and the activity of marine currents, which transports sedimentary material from the Precambrian basement area, characterized by granite, granodiorite, andesite, basalt and shale. Investigated area is crossed by the Saloum river which builds deltas where the river meets the ocean, and brings 665,000 tons of sediments per year. The heavy minerals deposits from south - eastern Senegal are recent accumulations of heavy minerals (Holocene) and they represent one of the largest deposits of this type.

A number of 112 samples were collected from drilling carried out from each meter and were analysed after minerals separation with sodium and lithium polytungstate liquid which have a density of 3.0 g/cm³. Then the analysis were based on the granulometric, morphometric and mineralogical studies.

The particle size of the sand placers was measured by laser granulometry with a HORIBA LA-950 device, which use the principle of laser light diffraction on the surface of the particles. Morphometric study of samples represent a statistical examination of a large number of grains. Determination of the roundness parameter and sphericity parameter was performed by visual comparator after Krumbein and Sloss. For the last one study had made 28 polished sections, that have been analyzed with AXIO IMAGER - Carl Zeiss microscope, that work with transmitted and reflected light. The microscope was equipped with a digital camera image acquisition and image processing software Axio Vision.

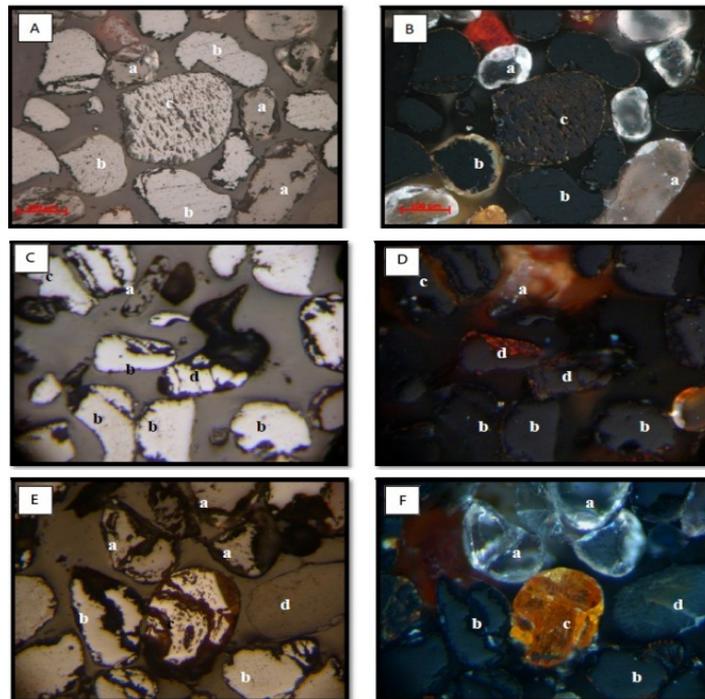


Figure 1. A (normal polarizers) and B (cross polarizers): a - zircon, b - ilmenite, c - exsolution of ilmenite and rutil; C (normal polarizers) and D (cross polarizers): a - zircon, b - ilmenite, c - lepidocrocite with internal reflection, d - ilmenite with rutil wreaths; E (normal polarizers) and F (cross polarizers): a, zircon, b, ilmenite, c, goethite, d, hematite.

Grain size distribution is homogeneous in all analyzed samples. The median values range between 1,862 and 1,968 Φ units, which suggests that the main fraction is medium sand having an

unimodal character and are moderate to good sorted. Cumulative curve suggest that sediments and heavy minerals in this area are transported by saltation, which indicates that the waves action has the ability to wash sedimentary material, to removal very fine fraction and rolling the particles and sort the sediment grains by size and composition so as to form placer deposits. This distribution suggests proximity to the shore area.

Morphometric analysis focused on the grain shape and extent of their contour, which varies according to the mineralogy species. The minerals determined presents different shape and contours. Garnet (spersartite), rutile, ilmenite, magnetite, has isometric - spheroidal shapes and very well rounded contours. Staurolite, goethite, kyanite and zircon, has prismatic or columnar cylindrical shapes and various contours of angular (staurolite) to very well-rounded (zircon). Tourmaline crystals and anatase presents some planar - discoidal shapes and various contours of sub angular (anatase) to very well-rounded (tourmaline). Morphometric analysis revealed that the granules have spheroidal - isometric forms, rounded and sub rounded contours, which indicates a long transport in a fluvial environment, where the level of rolling increases with the velocity of the flow or continuous running of the granules in the marine environment due to the wave action.

Mineralogical investigation analysis revealed the following mineral species: ilmenite, rutile, goethite, zircon, tourmaline, magnetite, lepidocrocite, garnet, hematite, anatase and highly resistant minerals such staurolite and kyanite. The percentages distribution of identified mineral differ on each meter drilled with dominance of ilmenite in the first two meters, with a maximum concentration of 23 %, followed by rutile and goethite. Zircon and leucoxene show low concentration that range between 0,40% and 3,25 %. The garnet, titanite and lepidocrocite minerals are founded in small quantities (Figure 1). The most common mineralogical features observed in analysed fraction were: pleochroism in yellow-green tones and compositional zoning and inclusion of rutile on zircon crystals; rutile and zircon wreaths around of ilmenite crystals and also ilmenite contains exsolution of rutile (Figure 1 - A(c) and B (c)); the magnetite usually contains a further exsolution of hematite; internal reflection with red – yellow collar at the lepidocrocite, visible on polished section (Figure 1 - C and D). Distribution of mineral species present two trends: Saloum delta barriers are rich in rutile, while beach barriers are richer in goethite. All other heavy minerals, shows a homogeneous distribution parallel to the shoreline

Correlating morphometric information with the particle size and geology of the area results that heavy minerals of sands analyzed are transported by the network of rivers from the south-western part of Senegal, in a beach area, and then sands are washed and sorted by ocean waves and redistributed in litoral placers form the beach deposits.

Acknowledgements. We wish to thank for support to Company SC. Prospectiuni SA and to the Department of Mineralogy of the Faculty of Geology and Geophysics, University of Bucharest.

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MIOCENE PALAEOBOTANICAL HERITAGE OF THE OLTENIA PROVINCE, SOUTH ROMANIA

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The most representative Sarmatian sites with macroplant remains (primarily leaves) from the Dacian Basin (southern Romania) have been investigated. These fossiliferous sites are represented by the Morilor Valley flora, the Ciocadia flora, the Slătioara flora, the Râmestî Valley flora, and the Săcelu flora.

The composition of the Sarmatian paleofloras indicates a stronger floristic variability and mixtures of plants from habitats so widely different that explanation is difficult. Brown algae like *Cystoseirites partschi*, *Cystoseirites flagelliformis*, *Bifurcaria palaeobifurcata*, *Ascophyllum palaeonodosum* are often found in some of these floras. A single rhodophytae thallus of *Ceramium* sp. was recognized from the Morilor Valley site. As a rare presence we notice fertile and sterile stems of *Equisetum* in the Slătioara and Morilor Valley outcrops. From the Morilor Valley and Ciocadia paleofloras are documented fern remains that belong to Osmundaceae and Schizaeaceae (*Osmunda pardschlugiana* and *Lygodium gaudini*). The inedite presence of the relict *Eostangeria* cf. *ruzinciana* in the Ciocadia flora increase the distribution areal of this taxa. Taxodiaceae family is well represented in the composition of Sarmatian floras by *Glyptostrobus europaeus*, *Sequoia abietina* and *Taxodium dubium*. *Tetraclinis salicornioides* (Cupressaceae) was frequently found as twigs and seeds. *Pinus* was found in abundance as seeds, needles, inflorescences and cones. *Magnolia*, *Laurus*, *Daphnogene* and *Persea* are floristic elements which habitual generate the under-canopy layer of the Sarmatian forests. *Matudaea menzelii*, an Oligocene relict hamamelidacean, was found in the Sarmatian deposits of Morilor Valley and rise numerous questions about its paleoecological demands and migration routes.

In the mesophytic associations, Ulmaceae (*Ulmus*, *Zelkova*, *Cedrelospermum*), Fagaceae (*Fagus*, *Castanea*, *Quercus*) and Juglandaceae (*Juglans*, *Carya*, *Pterocarya* and *Engelhardia*) predominate. These elements fall in the category of vegetation called subtropical Evergreen Broad-leaved Forest. Also, the Fabaceae family, is highly represented by the genera *Robinia*, *Podocarpium* and *Leguminosites* (riparian and/or sclerophyllous elements). Betulaceae (*Betula*, *Alnus*, *Carpinus*) are often found as leaves and fruits. The Aceraceae family is represented by numerous impresions of samaras (five morphotypes) and leaves. Rare monocotyledons, as *Potamogeton*, *Phragmites*, *Typha* indicate few pond-like habitats or near vicinity with some swamp forests.

GEOETHICS: A NEW PERSPECTIVE FOR GEOSCIENCES

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²IAPG – International Association for promoting Geoethics

In recent years, the need to develop an ethical reflection on the values that are at the basis of geoscience research and practice has arisen powerfully. Studying the Earth system, managing the land, geo-engineering the environment, exploiting its geo-resources, and altering natural processes are actions that involve great responsibilities towards oneself, colleagues, society and the environment, of which perhaps we, as geoscientists, are not sufficiently aware.

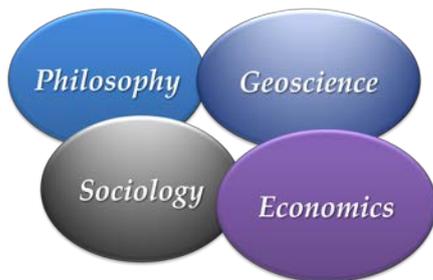


Figure 1. Geoethics as a point of intersection between Geosciences, Philosophy, Sociology and Economics.

Since, the effects of human interference with the geosphere have increased enormously compared to the past, geoscientists, as scholars and experts of problems that affect our planet, are faced with the need to consider in an ethical perspective issues such as the sustainable use of geo-resources, protection against natural hazards, pollution control and its inevitable repercussions on human health, and climate change adaptation.

So, in order to find ethically sound solutions to the current global challenges, we need scientific advances in the field of geosciences to take into proper consideration the ethical and social aspects involved. Geoethics was born to define a framework in which geoscientists can find new references for thinking and managing the Earth.

Starting from the definition of ethics by the Greek philosopher Aristotle (384–322 BC), the International Association for Promoting Geoethics (IAPG: <http://www.geoethics.org>) has defined Geoethics as the research and reflection on the values which underpin appropriate behaviours and practices, wherever human activities interact with the geosphere (Peppoloni, Di Capua, 2015). Geoethics deals with the ethical, social and cultural implications of Earth Sciences education, research and practice, and with the social role and responsibility of geoscientists in conducting such activities (Wyss, Peppoloni, 2015). It represents the point of intersection between Geosciences, Philosophy, Sociology and Economics (Fig. 1). Its objective is to identify shared values on which to base documents (code of ethics and conduct, research integrity statements), procedures (protocols) and operational strategies (best practices), taking into account the different social and cultural contexts and the existing economic and political realities.

The framework of the emerging field of Geoethics is wide and includes both theoretical and practical aspects. Among its topics, aspects concerning gender, racial, religious discriminations and harassments cannot be forgotten: they are of specific interest for Geoethics when they affect the freedom of acting by geoscience researchers and practitioners, while conducting their activities, since people who are not free could be not able to act in an ethical way.

Geoethics rediscovers and widens the cultural horizon of geoscience knowledge, by orienting scientists and society in the choice of a responsible behavior towards the Earth system. Geoethics recognizes that human beings are a geological force, capable of acting on natural environments, and in virtue of this prerogative assigns them an ethical responsibility that comes from the consciousness of being a modifier of the environment. Only becoming fully aware of this responsibility, geoscientists and citizens can work while respecting the biotic and abiotic components of **the Earth**.



Figure 2. IAPG logo.

The IAPG (Fig. 2) was founded on August 2012 during the 34th International Geological Congress (IGC) in Brisbane (Australia), with the goal to unite geoscientists all over the world and to raise their awareness of the ethical, social and cultural repercussions of their activities. The IAPG is an international, multidisciplinary and scientific platform, born to encourage studies and the discussion on ethical problems and dilemmas in Earth Sciences, to promote geoethical themes through scientific publications and conferences, to strengthen the research base on Geoethics, and to focus on case studies as models for the development of effective and operative strategies. The IAPG is legally recognized as a not-for-profit organization. It is a non-governmental, non-political, non-party institution, at all times free from racial, gender, religious or national prejudices. Its network continues to grow with more than 1150 members in 105 countries, including 23 national sections. The IAPG lives exclusively through donations and personal funds of its members.

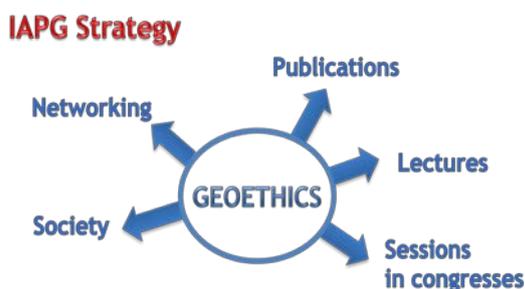


Figure 3. IAPG strategy for promoting geoethics.

The results achieved since inception have been recognized by numerous international organizations. In particular, IAPG has obtained the status of affiliated organization by the International Union of Geological Sciences (IUGS), the American Geosciences Institute (AGI), the Geological Society of America (GSA), the Geological Society of London (GSL), and the Geoscience Information in Africa (GIRAF) Network. The IAPG has also enlarged its official relationships through

agreements of collaboration with other organizations, such as the American Geophysical Union (AGU), the International Association for Engineering Geology and the Environment (IAEG), the EuroGeoSurveys (EGS), the European Federation of Geologists (EFG), the Association of Environmental & Engineering Geologists (AEG), the International Geoscience Education Organisation (IGEO), the African Association of Women in Geosciences (AAWG), and others.

In its strategy (Fig. 3), the IAPG considers publications as an indispensable activity to strengthen geoethics from a scientific point of view. Several articles and books on Geoethics with a peer-review process were published by its members from 2012 up to today (Peppoloni, Di Capua, 2012, 2015, 2016; Lollino et al., 2014; Matteucci et al., 2014; Peppoloni et al., 2015; Wyss, Peppoloni, 2015). Moreover, the IAPG organizes sessions/symposia on geoethics in national and international congresses, thus encouraging a wide participation of the scientific community in the discussion on geoethical topics. Finally, several activities are developed to popularize geoethics into society.

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THE OLIGOCENE FLORA FROM URICANI COAL MINE, PETROȘANI BASIN, ROMANIA

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The Petroșani Basin is a typical Oligocene – Miocene intramontaneous basin located in the South Carpathians. It has a SW–NE orientation and is 48-km long; its width is varying between 10 km (to the eastern part) and 2 km (to the western part), and it overlays the Danubian and Getic basements. The Oligocene sequences are filling the basin, their thickness ranging between 300 and 500 m. They consist of clays, marls, bituminous shales, microconglomerates and limestones, including 22 coal beds.

The essential feature of the Petroșani Basin is the occurrence of thick coal seams and the remains of a rich, 28 million years old ecosystem. *The studied material was collected from Uricani coal mine, from the „Lower Productive Horizon” or Horizon no. 2, Chattian in age (Upper Oligocene), and from Uricani coal waste dumps.* The Lower Productive Horizon, also described as the Dâlja–Uricani Formation, includes several coal seams and crops out in several areas (Buia et al., 2014). *Collecting fossil plants from underground mining horizons represents a unique method for detailed understanding of coal bearing formations in a three-dimensional approach (Popa, 2011).*

The plant remains are represented by a large number of species, most specimens belonging to the Family Lauraceae. The fossil flora is very well preserved, some of the leaves preserving their cuticles. The fossil plants from Uricani coal mine, Petroșani Basin, are described, illustrated and discussed based on leaf impressions. The associated macroflora of Uricani coal mine comprises various leaf species of *Daphnogene*, *Laurophyllum*, *Ocotea*, *Smilax* and *Alnus*. Most of the studied woody plants are mesophytic, like Lauraceae (narrow-leaved *Daphnogene*, *Laurophyllum*), but the affinities of the plant remains from Uricani coalfield have not been clarified yet. Nonetheless, the taxonomic composition of the studied flora from Uricani coal mine points to a semi-tropical climate. The overall character of the depositional conditions of Petroșani Basin best fits a flatland with surrounding uplands, within a typical intramontaneous depression.

The fossil flora of the Petroșani Basin was first cited by Stur (1863). Pop (1975) contributed with a study on the geology of the Uricani mining field, with special emphasis on coalbeds. A paleobotanical overview of the plant remains from Petroșani Basin related to coal deposits was also published by Givulescu (1996).

This paper refers to the Oligocene fossil flora of Uricani coalfield, as a part of the Petroșani Basin and to the reconstruction of its paleoenvironment.

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OPTICAL DIFFERENCES OF HEAVY MINERALS FROM MBODIENE – NGALOU AREA (WEST AFRICA) AND LOWER DANUBE BASIN (ROMANIA)

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INTRODUCTION

Heavy minerals are constituents of siliciclastic sediments with a density higher than 2,89g/cm³. Usually they occur in sediments as main minerals, like garnets, amphiboles, pyroxenes or micas, or accessory phases as zircon, rutile, tourmaline, staurolite, monazite. Alluvial deposits containing economic or potentially economic concentrations of heavy minerals are traditionally referred to as “placer deposits”. The main targeted „products” are zircon, ilmenite, rutile, tourmaline and leucoxene. Igneous and metamorphic rocks are a major source of the heavy minerals along with other old detritus that accumulated heavy minerals in coastal sands or fluvial settings. Heavy minerals are widely used for sediment provenance dispersal and correlation studies in both modern and ancient sediments.

The study areas are represented by two sedimentary basins. One of the studied deposit is formed due to the contribution of several rivers and by the activity of marine currents (Saloum-Gambia Delta and adjacent beach). Mbodiene - Ngalous, the study area, is located in West Africa - Petite Côte, in the southwestern part of Senegal, belongs to senegalo - mauritanian sedimentary basin and formed as a result of the fluvial activity on the Somone, Casamance, Saloum, Gambia and Senegal rivers and the

activity of marine currents (Diara, 1999), which transports sedimentary material from the Precambrian basement area (Roger et al., 2009), characterized by granite, granodiorite, andesite, basalt and shale. The other basin is formed by the activity of the Danube River and a number of tributaries that transport sediments mainly from some metamorphic basement rocks of the South Carpathians, also dated as Precambrian (micaschists, gneisses, amphibolites, eclogites) (Săbău, 2000). The Danube Delta is located on the north-western coast of the Black Sea and is also important for its heavy-mineral deposits in grinds and branches formed since the Upper Pleistocene (Panin et al., 1983), which is an area also targeted for sampling. A few decades ago, some beach deposits near Vadu village (southern area of Danube Delta) represented an important heavy-mineral placer that was fully exploited until the 90s.

From Saloum Delta and the adjacent beaches, a number of 50 samples were collected from drilling carried out from each meter and were analyzed following minerals separation with sodium and lithium polytungstate liquid. The particle size of the sand placers was measured by laser diffractometry (HORIBA LA-950). Morphometric study of samples represent a statistical examination of a large number of grains. Determination of the roundness parameter and sphericity parameter was performed by visual comparator after Krumbein and Sloss (1951). For the last study 28 polished sections were made, that have been analyzed with AXIO IMAGER - Carl Zeiss microscope.

The sampling sites from the Danube River and its delta were selected at the mouth of several main tributaries of the Danube River (Argeş, Olt, Topolnița, Cerna), two samples from the Danube main channel at km 789 and mile 54 and two samples from the Danube Delta distributaries Tulcea and Chilia. A total of 8 samples were taken for heavy-mineral extraction using sodium and lithium polytungstate liquid. After mineral extraction optical analysis for the degree of roundness was performed and granulometry studies were made with a sieving set. Other parallel granulometry data was acquired with a laser diffractometer (MASTERSIZER 2000 E, Hydro 2000 MU). For optical determination of the minerals polished sections were made, studied at a Zeiss Axiolab A1 microscope.

MBODIENE – NGALOU AREA

On the west african coast the grain size distribution is homogeneous in all analyzed samples. The median values range between 1,862 and 1,968 Φ units which suggests that the main fraction is medium sand having an unimodal character and moderate to good sorting. Cumulative curve suggests that sediments and heavy minerals in this area are transported by saltation, which indicates that the wave action has the ability to wash sedimentary material, remove very fine fraction, roll the particles and sort the sediment grains by size and composition, so as to form placer deposits. This distribution suggests proximity to the shore area.

Morphometric analysis focused on the grain shape and extent of their contour, which varies according to the mineral species. The minerals determined presents different shape and contours. Garnet, rutile, ilmenite and magnetite show very well rounded contours. Staurolite, goethite, kyanite and zircon have various contours, from angular (staurolite) to very well-rounded (zircon). Tourmaline and anatase crystals present various contours, from subangular (anatase) to very well-rounded (tourmaline). Morphometric analysis revealed that the granules have rounded and subrounded contours, which indicates a long transport in a fluvial environment where the level of rolling increases with the velocity of the flow, or continuous running of the granules in the marine environment due to the wave action.

Mineralogical investigation analysis for Mbodiene – Ngalou area revealed the following mineral species: ilmenite, rutile, goethite, zircon, tourmaline, magnetite, lepidocrocite, garnet, hematite, anatase, staurolite and kyanite. The percentages distribution of identified minerals differ on each meter drilled, with dominance of ilmenite in the first two meters with a maximum concentration of 23 %, followed by rutile and goethite. Zircon and leucoxene show low concentration that ranges between 0,40% and 3,25 %. Garnet, titanite and lepidocrocite minerals are found in small quantities. Distribution of mineral species shows two trends: Saloum Delta barriers are rich in rutile, while beach barriers are richer in goethite. All other heavy minerals shows a homogeneous distribution parallel to the shoreline.

Correlation of the morphometric information with the particle size and the geology of the area indicates that heavy minerals of analyzed sands are transported by the network of rivers from the south-western part of Senegal into a beach area, and subsequently sands are washed and sorted by ocean waves and redistributed in littoral placers from the beach deposits.

LOWER DANUBE BASIN

Danube's modern deposits consisting of variable percentage of gravel, sand, silt and clay, indicate very different values of environmental energetic conditions (median values from -2,57 to 4,57 Φ units). The values of textural parameters of Danube's channel reveal a weak and very weak sorting, although normal for the fluvial environment; the velocity of the Danube is relatively low, excepting the western part of the Lower Danube, the Iron Gates area. Through grading analysis, standard deviation proves that the Danube sediments are usually poorly and very poorly sorted, asymmetry is positive, meaning that the presence of very fine fraction and the velocity of the Danube is relatively low, excepting the western part of the Lower Danube, the Iron Gates area. Along with the grading analysis, the speed and depths of the water suggest that in the Danube Delta and at the mouths of Cerna and Argeş tributaries smaller fractions (less than 0.250mm) were preferably sedimented. The coarse material is more certain to be found in Danube's main channel and in Topolnița and Olt tributaries.

Mineralogical and morphometric studies revealed two main assemblages. One is represented by garnet (~33% max. concentration) – amphibole (~30%) – epidote (~27%) – kyanite (~11%). The granules display a subrounded to subangular morphology, that indicates a narrow distance to the source area, most likely the Getic-Supragetic metamorphic units of the South Carpathians. The second assemblage consists of chlorite (20% in the Danube Delta, less in the Danube), biotite (2%) and green amphibole typical for greenschists. Having a low physical and chemical resistance as mineral species, chlorite and biotite granules are well rounded to subrounded, despite the near possible source like metamorphic units from Dobrogea or South Carpathians. Although most of the granules identified preserve a subangular contour that indicates a short distance transport, some of the ZTR minerals with very high physical and chemical resistance show a high degree of rolling.

More relevant mineralogical remarks could be observed at the surface of granules from Danube Delta versus Gambia Delta, which implies environmental conditions of sediment accumulation in two different climates. The similar age of the source rock of mineral particles from the Danube and Gambia Rivers, along with the relatively similar degree of angularity, might be correlated with the total length from the source to the final deposition in deltas or beaches.

Acknowledgements. We wish to thank for support to the National Institute for Research and Development – GeoEcoMar, SC. Prospecțiuni SA and the Department of Mineralogy of the Faculty of Geology and Geophysics, University of Bucharest.

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IMPACT OF MINING ACTIVITIES ON WOMEN: A CASE STUDY OF THE MINING ACTIVITIES IN JOS PLATEAU, NIGERIA

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Nigeria is endowed with abundant natural georesources of important international economic value, including gold, salt, limestone, coal, phosphate, natural gas, gemstone, iron ore, cobalt, tin, etc.

Mining is a major economic activity in Jos plateau. The mining of Tin has been largely responsible for the profound changes in the landscape and in the social and economic structure of the Jos Plateau over the last 100 years. In Barkin Ladi, Jos North and Jos South Local Government Areas of Plateau State, women are mostly involved in the mining activities for petty gains. These women are exposed to danger daily in order to make ends meet. This includes the inhalation of dust, exposure to noise pollution which adversely affects their hearing ability and visual pollution which leads to eye problems, collapse of mining caves, children at times drown in the ponds created by miners. Mining has a number of adverse impacts on the natural environment, society, cultural heritage, health and safety of the women who are involved in mining activities.

Women living within these mining areas benefit directly from the existence of the mining activities as they are involved in artesian mining. This artesian mining has the potential to release harmful substances into the soil, air, and water. Other impacts include water contamination (surface and ground), landscape degradation, pollution (noise, dust and visual), and loss of biodiversity, destruction of vegetation, and erosion of soil.

Mineral deposits should be a source of wealth for local communities and as such, much need to be done to mitigate the impacts especially on women and children.

LES GÉOSITES/GÉOMORPHOSITES DANS LE PARC NATIONAL ISALO, MADAGASCAR, POUR UNE VALORISATION GÉOTOURISTIQUE

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Key words : Patrimoine géologique- géosites/ Géomorphosites- Geotourism- Parc National Isalo

Le tourisme représente un des facteurs de développement économique. Confronté au défi de la durabilité, le tourisme doit prendre en compte la protection du patrimoine et des ressources naturelles. Véritable merveille faisant partie du patrimoine naturel, le patrimoine géologique de Madagascar cache de multitudes trésors des fois masqués sous la couverture végétale ou complètement inconnus voire même détériorés par cette simple ignorance et par conséquent, restent négligés et mal compris par le grand public.

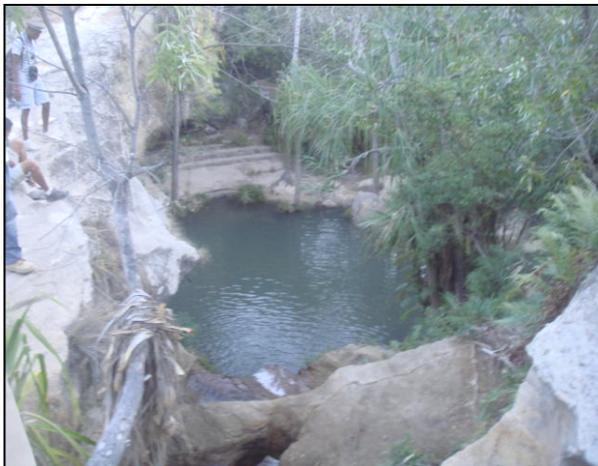


Figure 1. Piscine naturelle du parc Isalo

Pour faire valoir ce patrimoine, le présent article a pour objectif de promouvoir les géosites/Géomorphosites qui devraient fournir une source de valeur ajoutée et de renforcement de la notoriété de l'attractivité d'une destination touristique. Une proposition de système de localisation et de promotion de géosites et géomorphosites présents dans le parc national de l'Isalo permet de favoriser des sites attractifs par ses intérêts géologiques.

ESTIMATION OF CLOUD EFFECT ON SOLAR IRRADIANCE FOR SOME SELECTED STATIONS IN NIGERIA

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Key words: solar irradiance, clear-day, blocking effect, Nigeria, Day number, sunshine hour

INTRODUCTION

Solar radiation is the fundamental source of energy that drives the Earth's climate. It sustains life. The variability of this output certainly affects our planet. In the last two decades, an enormous advance in the understanding of the variability of the solar irradiance has been achieved. Due to the high demand for solar power generation and a corresponding inadequate solar radiation data, the prediction of the in-coming solar energy from the Sun requires more attention.

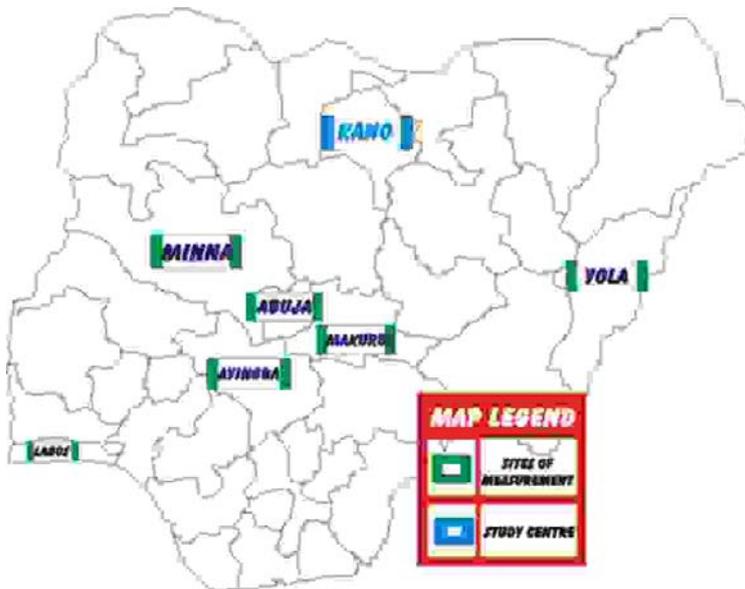


Figure 1. Map of Nigeria

Table 1. The Six Stations, geographic location and duration of data

	Station	Latitude	Longitude	Duration	
				from	To
1	Abuja	8.9957°	7.16825°	2007	2012
2	Ayingba	7.4840°	7.1874°	2010	2013
3	Lagos	6.5193°	3.3920°	2007	2008
4	Makurdi	7.7226°	8.5562°	2008	2011
5	Minna	9.6597°	6.5268°	2008	2011
6	Yola	9.1967°	12.4995°	2009	2013

In this paper, measured solar irradiances are sourced from six different locations through the Centre for Atmospheric Research, which is based in Ayingba, Kogi State of Nigeria. The centre is under the auspices of the National Space Research and Development Agency, Abuja, Nigeria. Clear-day solar irradiance equations are used to estimate the solar irradiances of the six selected locations. The blocking effects of the clouds are estimated for each location from the measured and the calculated solar irradiances.

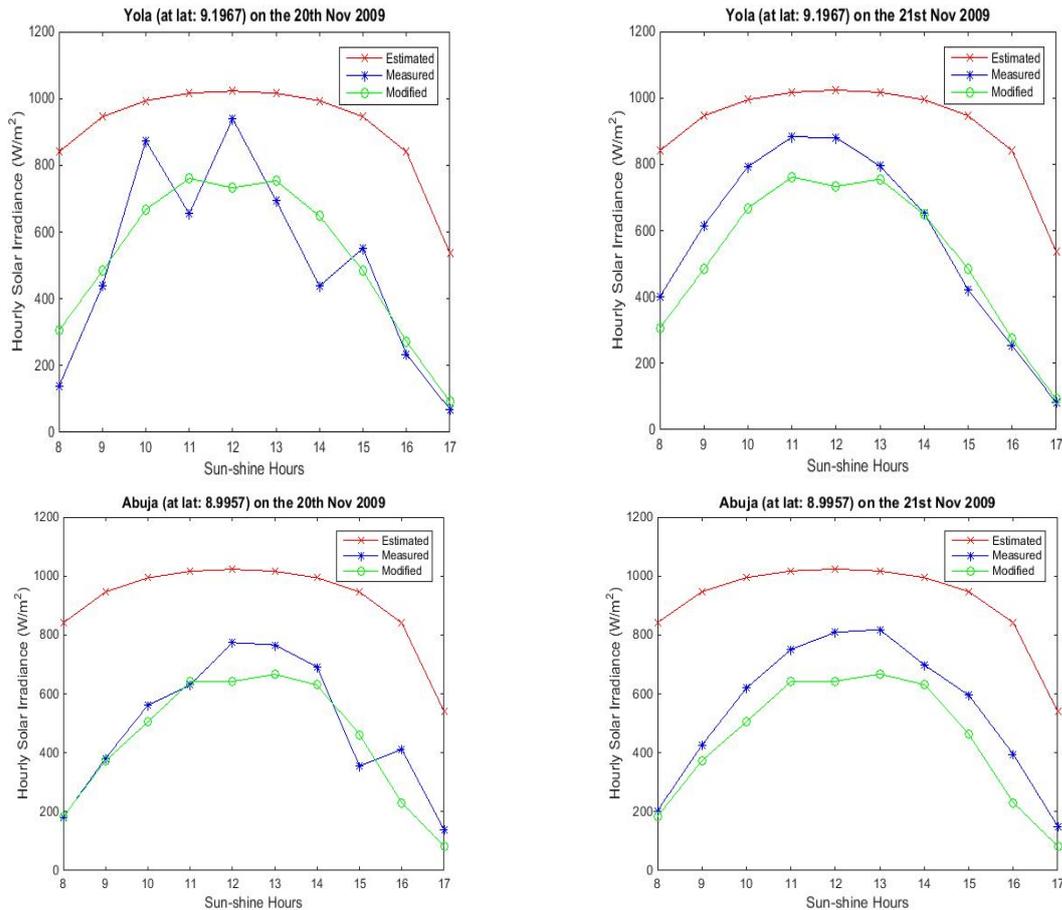


Figure 2. Graphs for two of the six stations studied, showing the effect of cloud on solar irradiance.

METHODOLOGY

For the correction and validation data, the experimental location is Mussa Mosque in the Old Campus of Bayero University, Kano (located at Latitude: 11.9785, Longitude: 8.4783). The experiment involved measurement of solar irradiance during the sunshine hours using a Pyrheliometer (510 Solar Meter), which measures the incident solar radiation (Direct radiation) in W/m² and the readings were taken at hourly intervals from 08.00hours to 17.00 hours each day during the four days the experiment lasted. For the measured data, these were procured from six different locations through the Centre for Atmospheric Research, National Space Research and Development Agency, Federal Ministry of Science and Technology, Anyigba, Nigeria. From each of the six stations, a 5minutes interval of data for the direct solar irradiance was obtained throughout.

RESULTS

The four graphs are for two of the six stations studied. The graphs show the effect of cloud on the solar irradiance. The modified is the solar irradiance obtained from subtracting cloud effect from the long term measured values at the stations.

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ECOSTRATIGRAPHIE DES MILIEUX LITTORAUX DU MESSINIEN D'AFRIQUE DU NORD

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avec

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L'histoire du Messinien est aujourd'hui déchiffrée à la lueur des nombreuses données biostratigraphiques, magnétostratigraphiques, cyclostratigraphiques et téphrochronologiques disponibles. Les modèles proposés pour expliquer les divers aspects de la fameuse Crise de Salinité du Messinien peuvent être maintenant discutés en fonction d'un canevas temporel beaucoup mieux contraint qu'à l'époque des plus vives controverses. Cependant, des problèmes se posent encore lorsque ces données ne peuvent être directement utilisées, surtout en ce qui concerne les domaines littoraux et, notamment, les plates-formes carbonatées. Des indicateurs écostratigraphiques s'avèrent alors des compléments presque indispensables. Les travaux menés au Maroc, en Algérie et en Tunisie, permettent d'apporter des informations précieuses sur ces indicateurs.

Le Messinien (-7,2 à -5,3 Ma) est caractérisé par nombre de phénomènes paléocéanographiques dont la traduction se retrouve dans les changements et l'évolution des peuplements marins. Dans ce cadre, si les microfaunes et microflores du Messinien ont été assez bien étudiées, en revanche peu de travaux ont été consacrés à l'évolution des peuplements de macrofaune des fonds méditerranéens. Il s'agit donc de recenser ces peuplements de manière globale afin de suivre les modifications survenues dans leur structure et leur composition. Des variations dans la composition des faunes littorales sont ainsi très sensibles aussi bien avant le début de la crise, estimée aux alentours de -5,96 Ma, que durant la crise marquée par la généralisation des dépôts à caractère évaporitique, l'instauration des environnements de type « lagoon » et l'abaissement du niveau marin méditerranéen :

- présence des marqueurs d'eaux froides dans les populations de diatomées ;
- évolution de la composition et disparition de la faune de coraux constructeurs ;
- architecture des constructions coralliennes à *Porites* ;
- « bloom » et disparition des peuplements à *Halimeda* ;
- disparition des grands foraminifères ;
- appauvrissement des assemblages de gastéropodes ;
- disparition de certaines mégafaunes de mollusques, des térébratulidés, des clypeastréidés, des bryozoaires... ;
- association coraux-stromatolites ;
- généralisation des constructions à microbialites (stromatolites, thrombolites) ;
- développement des faunes saumâtres caractéristiques du faciès lagoon-mare...

La compilation des informations paléontologiques permet de disposer d'un outil écostratigraphique fiable particulièrement bien adapté au cas du Messinien. Cet outil a été appliqué à titre de modèle dans le cas des grands panneaux de dépôts messiniens disloqués et déplacés observés récemment à la marge nord du bassin du Chelif (monts des Dahra). Plusieurs des événements précités ont ainsi pu être identifiés et permettent de reconstituer un véritable système de plate-forme, jusqu'alors totalement méconnu, dont l'évolution faciologique et paléontologique s'avère tout à fait similaire à ceux représentés dans l'ensemble de la Méditerranée à cette époque. Par ailleurs, la découverte de formations stromatolitiques conséquentes dans le Messinien de Tunisie amène à mieux inscrire cette région dans l'évolution biosédimentologique du Messinien.

Cette histoire des peuplements littoraux méditerranéens est désormais ainsi bien définie. Elle est également inscrite dans plusieurs affleurements exceptionnellement démonstratifs, certains vraiment uniques dans les pays concernés. Une réflexion serait à mener afin de préserver et faire connaître au mieux ces précieux témoignages que l'urbanisation ou les éléments naturels (érosion, écroulements) risquent de faire disparaître.

LA MICROPALÉONTOLOGIE AU FÉMININ: UNE VIE DE RECHERCHE

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L'investissement d'une vie de recherche dans le domaine de la micropaléontologie ne peut résulter que d'une vocation, tôt exprimée dans le choix du cursus universitaire. Une fois acquis les précieux diplômes qui sont la clé d'entrée dans l'univers de la recherche, des options et des opportunités qui se présentent orientent à la fois une vie professionnelle et une vie personnelle. Dans ce cadre, la rencontre avec les paysages, la géologie et les collaborations avec des collègues d'Afrique du Nord a constitué un jalon important dans mon parcours de chercheur.

La vie microscopique du passé révélée par des fossiles, dont l'observation passe par un patient et souvent ingrat travail d'observation au microscope, est un enchantement renouvelé. La diversité des formes, la beauté parfois extraordinaire des microfossiles ont toujours eu une correspondance avec une perception toute personnelle des objets à étudier. Il est tentant de penser qu'il s'agit là d'une empathie féminine pour les merveilles miniatures de la nature conduisant à une approche à la fois très rigoureuse et sensible de la géologie.

L'étude des diatomées, ces algues microscopiques qui sont de véritables bijoux à squelette siliceux, m'a permis d'aborder des thèmes de recherche et de tenter de résoudre des problèmes scientifiques souvent passionnants, parfois totalement inattendus. Ce sont les assemblages de diatomées qui m'ont permis de démontrer, dans les dépôts du Miocène moyen de Roumanie, que l'influence marine était encore présente en Paratéthys à cette époque. Ce sont aussi les assemblages de diatomées qui indiquent nettement que la mer Méditerranée était en pleine connexion avec l'Atlantique jusqu'aux premiers moments de la fameuse « Crise de Salinité », comme peuvent en témoigner les diatomites largement répandus en Algérie et au Maroc où mes travaux en collaboration ont pu me mener. Mais une vie de recherche n'est jamais, et sans doute ne doit jamais être, linéaire. La découverte totalement improbable puis la description de diatomées marines planctoniques englobées dans l'ambre du Crétacé m'ont conduit à m'intéresser au monde microscopique de l'ambre et donc à toute une vie se développant ou piégée dans la résine originelle et figée par la suite dans l'ambre. Ces allers-retours entre objets d'étude et problématiques très variés ne peuvent qu'apporter des trésors de connaissance qu'il faut absolument transmettre à la fois à travers les publications spécialisées et l'enseignement, mais aussi auprès du public le plus large pour rendre au mieux l'importance de la recherche au féminin.

LOCAL STAKEHOLDER'S ENGAGEMENT IN DEVELOPING MANAGEMENT PLANS FOR THE RAZELM-SINOE LAGOON SYSTEM, ROMANIA

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The Razelm-Sinoe Lagoon System, situated in the NW part of the Black Sea, integrated part of Danube Delta Biosphere Reserve, is interconnected with the Danube Delta and the wider Danube basin. This interconnection involves water and sediments exchanges, with direct impacts on physical and chemical parameters, which, in their turn, influences the whole ecosystem, biodiversity included (as all the waters feeding the lagoon system are coming from the Danube River via its delta).

During the past century, the system has been subject to major changes due to human interventions. These changes resulted into a complete change of the Lagoon specific ecosystems compared to its pristine state. Throughout a series of hydro-technical interventions, the Lagoon System has been transformed into a fresh water reservoir, to be used for agriculture and fresh water aquaculture, considered at that time much more viable economically.

Inevitably, the result of these anthropic interventions (hydro-technical, economical, touristic, etc.), most of them abusive and uncontrolled, affected the indigenous species by destroying the spawning areas, altering the system's hydrology by closing the connections with the sea and increasing the water and sediment discharge from the Danube, and concentrating the pollutants inside the sediments.

In order to identify the proper solutions, management plans have to be developed exclusively for Razelm-Sinoe Lagoon System, giving a special attention to climate change and anthropic changes faced by the Lagoon System. The management plans developed until now have covered the entire area of Danube Delta Biosphere Reserve, fact that made impossible finding the proper solution for some characteristic problems that only the Lagoon System is facing.

A different approach to this situation was brought by the FP7 ARCH Project (Architecture and roadmap to manage multiple pressures on lagoons), financed by the EU Commission. The ARCH Project aims to develop participative methodologies in collaboration with policy makers, local authorities and stakeholders, to manage the multiple problems affecting the lagoons (estuarine coastal areas) by taking into consideration the climate change and anthropic interventions. The Razelm-Sinoe Lagoon System was one of the case study areas where the participative methodology (active engagement of local stakeholders) was developed and tested. By applying an active engagement, but not only, the ARCH project managed to get together researchers, professors, local authorities representatives, fishermen, NGO's, the Environmental Protection Agency Constanța, the Danube Delta Biosphere Reserve Administration, professional associations, students, etc.

The ARCH process started with developing the State-of-the-lagoon report, representing the foundation for initiating the discussions with local authorities. The State-of-the-lagoon report

contains a detailed site analysis including the identification of environmental and socio-economic indicators and forecasts of the potential impact of climate change. The material was distributed to the participants of the first series of workshops that reviewed the state of the lagoon and also to factors that contributed to environment's degradation. Due to the fact that the Razelm-Sinoe Lagoon System covers two counties spread on the territory of 11 local authorities, the first workshop was divided in two parts. The first step of the first workshop was organized with the representatives of the 11 authorities who agreed to elect two members to represent them. In the second part, the results of the State of the Lagoon Report were presented to the representatives of the local communities, NGO's, scientific communities, etc.

The results of the first workshop represented the starting point for the second workshop "The future of the lagoon", where we have developed "Future Scenarios" and also the "Vision for sustainable development" – How do we want RSLs to look like in 2035. The third workshop started by presenting the "Vision for sustainable development" and grouping the ideas for developing the "Roadmap" in order to define clear measures, responsables, funding type and time horizon. The outcomes (deliverables, lessons learned, know-how transfer, etc.) from the project, represented the base for initiating discussions between the involved parties, in order to identify the best approach for improving the state of the lagoon and solving the multiple problems faced by the lagoon system.

The results of the ARCH project were presented at the Multiplier Seminar, attended by the participants of the previous workshops (local municipalities, research institutes, fishermen, NGO's, etc.), but also Representatives of the Danube Delta Biosphere Reserve Administration and the Ministry of the Environment, as well as the project coordinators. The outcomes and lessons learned thought the project – adjusting the methodology, tackling the sensitive situations, the specificity of each case – will be transposed into a "Guide for lagoon managers".

THE TRANSYLVANIAN DINOSAUR MUSEUM AND THE EUROPEAN JOURNEY OF A DWARF SAUROPOD

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Key words: paleontological heritage, dwarf dinosaurs, paleoart, education

In January 2014, a 10 years old dream to reconstruct the dwarf dinosaurs that lived in the Late Cretaceous on the Hațeg Island took a new form and concept, that of the Transylvanian Dinosaur Museum. The museum concept involves the reconstruction of the all the dwarf dinosaurs discovered so far, as well as their world of other reptiles and mammals, vegetation and environment, using modern step-in dioramas. The main partners in this project are two Romanian NGOs, Association

GeoD for promoting geodiversity and Association Geomedia, together with Cooley & Co., a Canadian company from Calgary, owned by dinosaur sculptor Brian Cooley and his wife, artist Mary Ann Wilson. The partnership was soon enlarged to include the National Institute of Marine Geology and Geoecology – GeoEcoMar, the Geological Society of Romania and the town hall of General Berthelot commune in Hațeg Country.

The museum is designed as a future center for education, interpretation and geoconservation of the unique paleontological heritage of the Hațeg Country Dinosaur Geopark – a UNESCO Geopark included in the European Geoparks Network and in the Global Geoparks Network.



Figure 1. *Balaur bondoc*, clay model with paper wings in the studio of dinosaur sculptor Brian Cooley. This is now an exhibit in the exhibition „Griffins, dragons and dinosaurs” at the Information Center of Hațeg Country Dinosaur Geoparc in Hațeg town.

By March 2014, two dwarf dinosaurs were reconstructed in Canada for the museum. *Magyarosaurus dacus*, the largest sauropod from Hațeg, was cast using an existing mold of a juvenile *Alamosaurus*, which was slightly altered. Two types of osteoderms were created by Brian Cooley using the papers of Csiki (1999) and Curry Rogers (2005). The rhabdodontid ornithomimid *Zalmoxes robustus* was made using the cast of the first dwarf dinosaur reconstructed in 2008 by Brian Cooley for the National Museum of Geology. This reconstruction was based on skeletal elements described in the paper of Weishampel et al. (2003). Then Brian started to work on *Balaur bondoc*, the meat eating dwarf theropod, known from a post-cranial skeleton (Csiki et al., 2010) (Fig. 1). It was not enough time to create a mold for *Balaur*, as it was needed in Hațeg by the end of June, for a permanent exhibition.

As the museum project was not funded, the partners tried to find various solutions to cover the costs of the models and their transportation to Romania. The *Balaur* sculpture was sponsored by GeoEcoMar. The model was cut into three pieces and the sculptor brought it to Bucharest in his luggage, to spare shipping costs. The sculpture was reassembled in a makeshift studio at the Science and Art Center of the Geopark from General Berthelot, where turkey and rooster feathers were glued one by one to the model, operation that took two weeks to finish. By the end of June 2014, Balaur

was ready to take its place in the exhibition „Griffins, dragons and dinosaurs”, in a dedicated room at the Information Center of the Hațeg Country Dinosaur Geopark.

Zalmoxes was shipped to Germany, then transported by truck to Romania, arriving home in July. Its shipment costs were supported by the Geological Society of Romania. But the big event of the year was the journey of *Magyarosaurus* through Europe, on a trailer of GeoEcoMar, accompanied by the sculptor itself, his wife and two daughters. Anna Cooley, Brian’s elder daughter, came accompanied by her crew to film the entire adventure.

For bringing *Magyarosaurus* home, Brian Cooley submitted the project „A Transylvanian Dwarf Dinosaur Needs a Ride Home” to the Kickstarter fundraising platform. A movie about the making of *Magyarosaurus* was posted on <https://www.kickstarter.com/projects/1318817492/a-transylvanian-dwarf-dinosaur-needs-a-ride-home/description>.

Launched on May 1, 2014, and supported by 127 backers, by May 31 the Kickstarter project was funded, raising 25,673 Canadian dollars. During May-July 2014, 22 updates were posted on the blog created by Brian Cooley for this project, www.dinoroadtrip.wordpress.com. A logo (Fig. 3), a website and a facebook page were created for the Transylvanian Dinosaur Museum (<https://www.facebook.com/Transylvania-Dinosaur-Museum-140392742798090/?fref=ts>), with the intent to present step by step the journey of the sauropod.



Figure 2. The logo of the kickstarter project „A Transylvanian Dwarf Dinosaur Needs a Ride Home”



Figure 3. The logo of the Transylvanian Dinosaur Museum

Magyarosaurus boarded a ship in Montreal on June 3rd and arrived to Rotterdam on July 1. However, due to internal procedures at the customs, the sculpture was released in Antwerpen only on July 11, when it was ready for its European journey. In Europe, *Magyarosaurus* travelled through Bruxelles to Paris, then visited the famous Messel Pit UNESCO fossil site in Germany. In Hungary, the sauropod visited the Bakony-Balaton UNESCO Global Geopark, where a conference on Transylvanian dwarf dinosaurs was presented to the public by Hungarian dinosaur specialist Attila Ósi. Then the dwarf dinosaur travelled to Budapest to visit the Geological Museum of Budapest, which still houses the Institute of Geology and Geophysics of Hungary, directed in the beginning of the 20th century by Ferencz Nopcsa, the discoverer of *Magyarosaurus*.

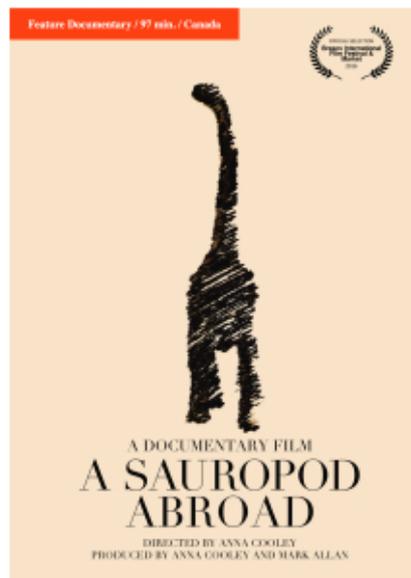
The journey through Romania included several localities connected to the Hațeg country dinosaurs. In other localities, like Budila, Castelu and Potlogi, *Magyarosaurus* was introduced to communities suggested by Association Ovidiu.ro, an NGO in Romania strongly involved in education. The dinosaur party travelled east, from Deva to Brașov, then along the Buzău valley to the mud

volcanoes Pâclele Mici near Berca, and further to Măcin, Tulcea and Ilgani in Dobrogea. From the Danube Delta the Magyarosaurus party travelled south to the sea shore. In Constanța the sauropod visited the R/V Mare Nigrum and took a bath in the Black Sea, spending the night at the headquarters of GeoEcoMar. GeoEcoMar was sponsor of the Kickstart campaign, offering to the highest bidder a cruise on the Black Sea during a scientific expedition on R/V Mare Nigrum.

From Constanța the journey continued to Bucharest, where *Magyarosaurus* spent the night at GeoEcoMar headquarters. Then the sauropod visited the University of Bucharest (the administrator of the Hațeg Country Dinosaur Geopark) and the Faculty of Geology and Geophysics, as its Paleontology Museum hosts numerous dwarf dinosaur bones. Once the sauropod entered Romania, its journey was much easier to control and promote, so it was well reflected in the media, both at TV and in the newspapers.

The journey of the dinosaur sculpture *Magyarosaurus dacus* from Canada to Romania, a story of emotion and humor, shot into a documentary and released this spring, was already selected and awarded at two film festivals. The documentary „A Sauropod abroad”, shot by a Canadian team and directed by Anna Cooley, daughter of Brian Cooley and Mary Ann Wilson, won the honour of best feature documentary at the Brașov International Film Festival and Market, while at the Hollywood Boulevard Film Festival 2016, it has been honoured with the "Best Woman Filmmaker" award. The opening in Romania, on September 3, 2016, was dedicated to the loving memory of Gheorghe (Gigi) Oaie, director of GeoEcoMar gone too soon, this July, one of the most important supporters of this project and of the Hațeg Geopark.

SATURDAY – SEPTEMBER 3



A SAUROPOD ABROAD (2016)
 Feature Documentary – 97 min. –
 Canada
 Directed by Anna Cooley

Figure 4. Poster of the documentary about the journey of Magyarosaurus, directed by Anna Cooley, at the Brașov International Film Festival & Market.

There is still a lot of work to do in order to reconstruct all the dwarf dinosaurs and their lost world. It involves research, fundraising, promotion and educational activities. The reconstructions

themselves need time, as a museum quality dinosaur model takes months from concept to sculpture and requires the hard work and attention to detail of many people, from scientists to paleoartists, painters, fiber glass specialists and technicians. The partners involved in the Transylvanian Dinosaur Museum project are working step by step to bring to life the dwarf dinosaurs and the animals that lived in their shadow: turtles, snakes, lizards, primitive crocs, frogs, small rodents and fishes. Only this way a visit to the museum can be a travel in time back to the Cretaceous.

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ACTIVE FAULT SYSTEMS IN THE MOESIAN PLATFORM, ROMANIA, AS INTERPRETED ON SEISMICITY AND GRAVITY DATA

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INTRODUCTION

The Moesian Platform is a major structural unit of the Carpathians and Balkans foreland, considered a stable part of the European continent and the Balkan Peninsula (Milev & Vassileva, 2007), but still place of an active seismicity, with some very strong earthquakes recordings (Oncescu

et al., 1999 updated, www.emsc-csem.org, 2016). The seismic activity within the Moesian Platform is the manifestation of its contemporary geodynamics, earthquakes being an indicator of active faulting.

Analysis of regional seismicity data available from ROMPLUS Earthquake Catalogue (Oncescu et al., 1999 updated) and EMSC Earthquake Catalogue (www.emsc-csem.org, 2016), integrated with published gravity data (Bouguer, residual, gravity stripping anomalies), offers the possibility to interpret active fault systems within the Moesian Platform and build the grounds for a much more comprehensive understanding of seismic risk in this region.

REGIONAL SEISMICITY DATA

The regional distribution of epicenters recorded within the Moesian Platform (Fig. 1) illustrates a seismicity limit along the Arges River, showing a more intense seismic activity eastward as compared to the western part of the platform. There are scattered seismic events on the entire eastern compartment, with some local clusters of earthquakes, while the western compartment appears to be more stable from the seismicity point of view, with recordings mainly along the borders of the platform (e.g., Pericarpathian Fault, North Prebalkan Fault) or scattered in the North-Bulgarian Uplift.

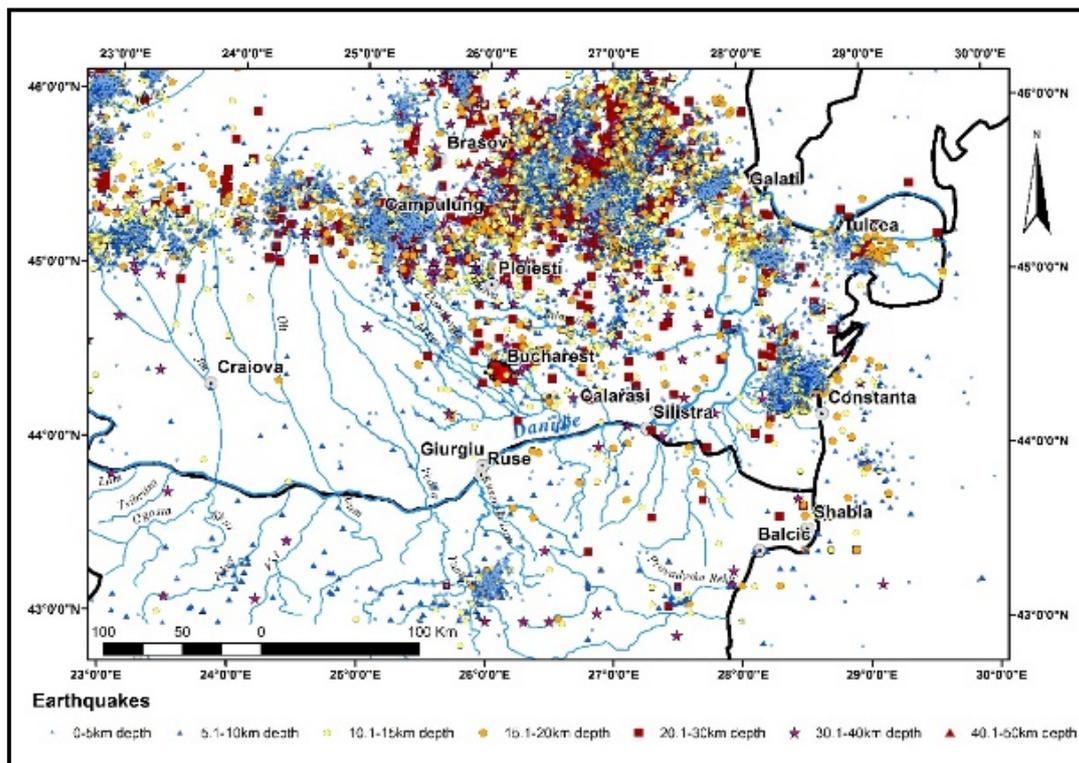


Figure 1. Regional distribution of epicenters recorded within the Moesian Platform

The crustal seismic activity is low to moderate magnitude, only exceptionally exceeding M_w 6. In front of Bulgarian Black Sea coast (Mangalia – Shabla / Cape Kaliacra) recordings show an active seismicity, generating the strongest earthquakes within the Moesian Platform. The strongest earthquake recorded in this area was 7.2 M_w , 14 km depth (1901/03/31).

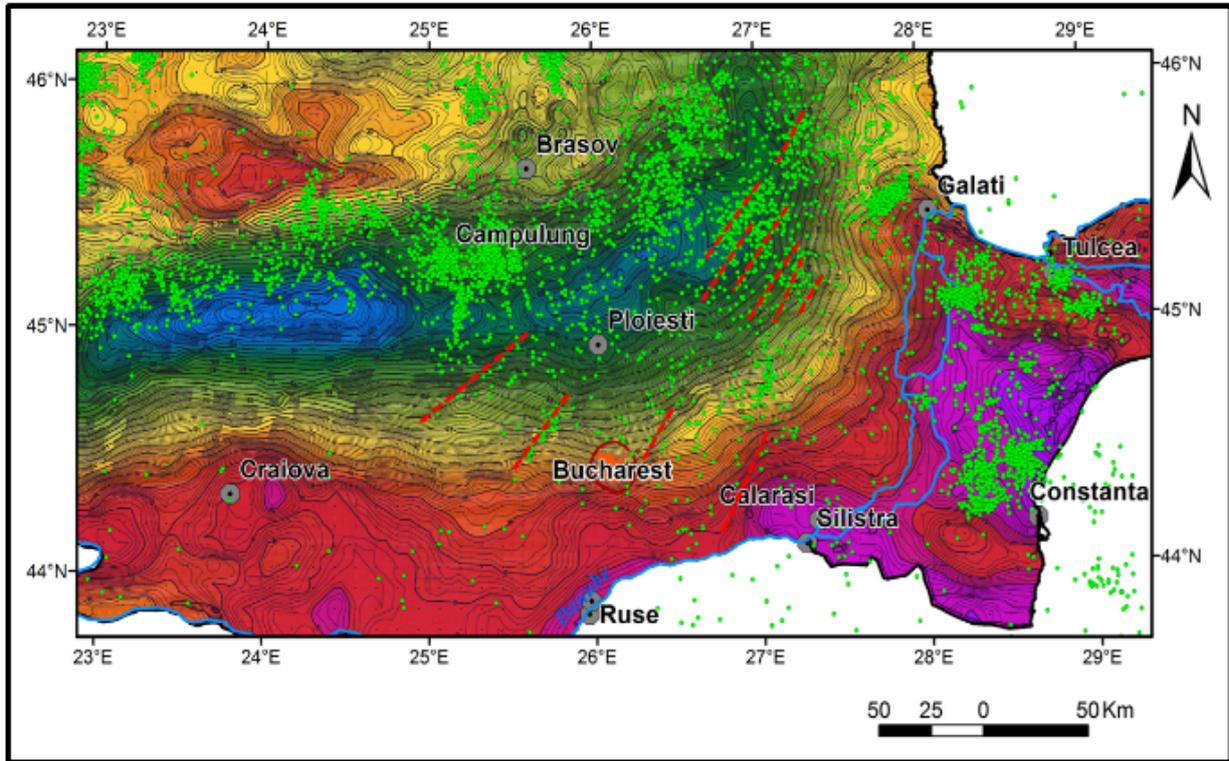


Figure 2. Regional distribution of 0 – 10 km depth seismic events (green dots) on the Bouguer Gravity Map of Romania built on mean values (Ioane, Ion, 1992). Red dashed lines mark interpreted active faults.

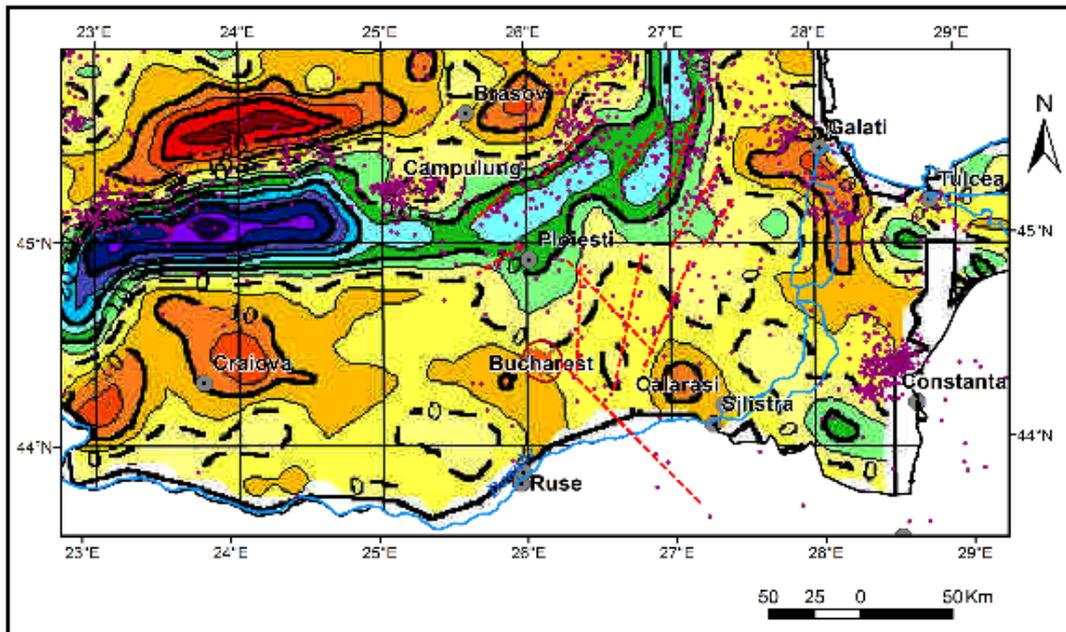


Figure 3. Regional distribution of 10 – 15 km depth seismic events (purple dots) on the Gravity Residual Map of Romania (Ioane, Ion, 2005). Red dashed lines mark interpreted active faults.

GRAVITY DATA

Several NE – SW trending lineaments with gravity variations depicted on the Bouguer Gravity Map of Romania built on mean values (Ioane & Ion, 1992), considered to be due to significant density inhomogeneities at the sedimentary cover / crystalline basement discontinuity depths (Ioane et al., 2014), are well correlated with earthquake epicenters and interpreted as active faults (Fig. 2). A clear epicenters lineament is displayed 20 km NW of Bucharest city, main seismic events recorded in 2007 and 2008, at depths up to 10 km. Also in front of Vrancea area there are several NE – SW trending epicenters lineaments, some of them preserved from near-surface to crustal depths.

The Gravity Residual Map of Romania (Ioane, Atanasiu, 2000) illustrates, by significant gravity variations, at the crystalline basement level, depressionary and uplifted tectonic structures within the Moesian Platform. A NW–SE graben structure, with active seismicity, is interpreted in the central part of the Moesian Platform, eastward-delineated by the Intramoesian Fault and Silistra-Călărași uplifted tectonic block (Fig. 3).

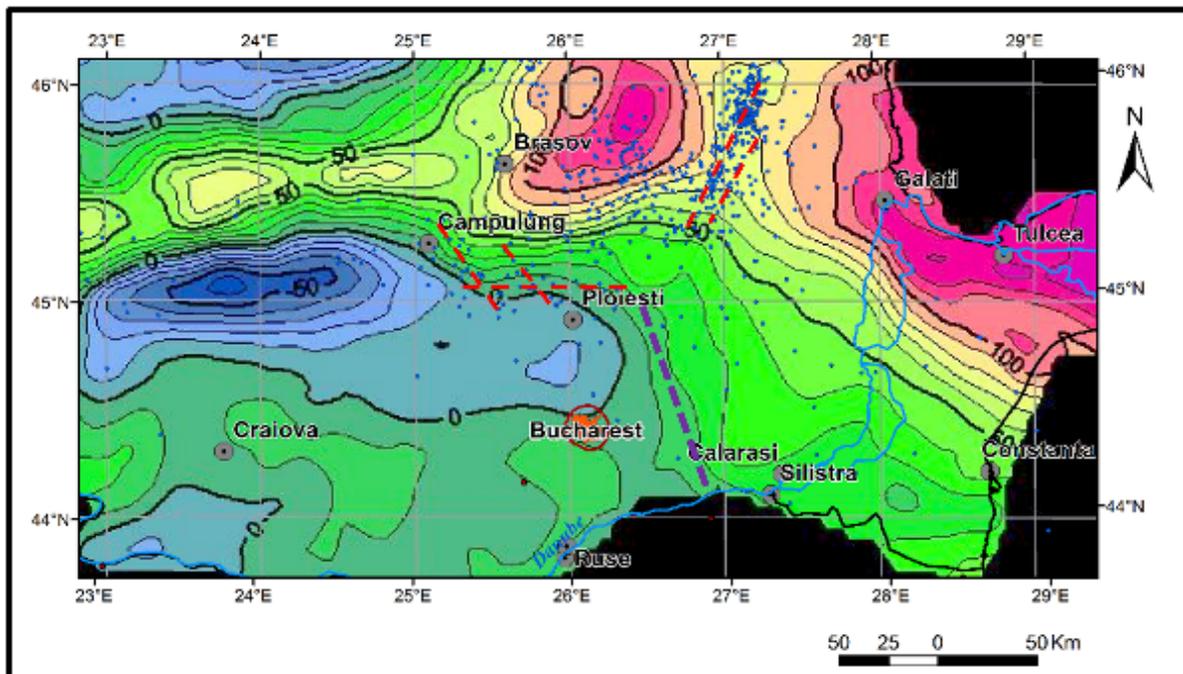


Figure 4. Regional distribution of 30-40 km depth seismic events (blue dots) on the Gravity stripping Map of Romania (Ioane & Ion, 2005). Red dashed lines mark interpreted active faults. Purple dashed lines marks the interpreted path of the Intramoesian Fault (after Ioane & Caragea, 2015; Caragea & Ioane, 2015).

The Gravity Stripping Map of Romania (Fig. 4) displays two different gravity regimes beneath the Moho discontinuity in the Romanian central part of the Moesian Platform, interpreted as determined by the continuation of the Intramoesian Fault at lithospheric depths, the eastern compartment being denser than the western one (Ioane & Caragea, 2015). No seismicity is correlated with this tectonic structure at this depth. However, a similar E–W gravity lineament north of Ploiesti city, correlates with a 30–40 km depth earthquakes cluster.

CONCLUSIONS

Several NE–SW trending lineaments depicted on the Bouguer Gravity Map of Romania built on mean values (Ioane & Ion, 1992), correlate with earthquake epicenters and are interpreted as active faults.

The Gravity Residual Map of Romania illustrates by significant gravity variations at the crystalline basement level, a NW–SE graben structure in the central part of the Moesian Platform, eastward-delineated by the Intramoesian Fault, with active seismicity at 10–15 km depth.

The Gravity Stripped Map of Romania suggests a large density contrast beneath the Moho discontinuity in the Romanian central part of the Moesian Platform, along the direction of the Intramoesian Fault. It may represent the in-depth continuation of the Intramoesian Fault as tectonic contact at lithospheric depths.

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WAVELET TRANSFORM FOR SPECTRAL ANALYSIS OF SURFACE WAVE

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Key words: MASW, SASW, Wavelet Transform, Spectral analysis

Wavelet transform for multichannel surface wave is a method to overcome the limitations of conventional seismic signal analysis for noise reduction for surface wave analysis regarding multichannel and wavelet transform. Seismic surface wave method is a familiar non-destructive seismic test to reveal the soil profile in geotechnical engineering. The spectral analysis surface wave method, using two receivers, is constrained due to interferences of other signals and various types of noises. Applications of surface wave analysis for geotechnical and engineering geology include: determination of pavement system profiles including the surface layer, base and subgrade materials; determination of soil velocity profiles needed for earthquake and dynamic loading analysis; determination of abutment depths of bridges; condition assessments of concrete liners in tunnels, and other structural concrete conditions; shear wave velocity, depth to and shape of bedrock and soil stiffness estimates, etc.

The MASW method uses Rayleigh waves to estimate the soil stiffness profile of a site. A method for transforming seismic surface waves into depth profiles of dynamic properties of the soil such as the soil shear modulus or wave velocity or wave attenuation. During a seismic survey, a large amount of the energy generated by a source does not travel vertically as body waves in the earth to reflectors and then return to the geophones, but rather travels horizontally through the shallow near surface of the earth from the source to the geophones. These strong surface waves (ground roll) can overlap the weaker reflections. Energy (signal) of interest are the deeper body waves from reflectors, for prospecting hydrocarbon reservoirs, and the body waves are obscured by overlapping surface waves. Fashionable for subsurface imaging is differences between body waves and surface waves (relative velocities and frequencies), spatial variability of surface wave velocities. Limitation of imaging are due to incomplete separation between the velocities and frequencies of surface waves and body waves.

Multichannel Analysis of Surface Waves (MASW) method is one of the Seismic Survey methods evaluating the elastic condition (stiffness) of the ground for geotechnical engineering purposes. MASW first measures seismic surface waves generated from various types of seismic sources (sledge hammer) analyzes the propagation velocities of those surface waves, and then finally deduces shear-wave velocity (V_s) variations below the surveyed area that is most responsible for the analyzed propagation velocity pattern of surface waves. Shear-wave velocity (V_s) is one of the elastic constants and closely related to Young's modulus. Under most circumstances, V_s is a direct indicator of the ground strength (stiffness) and therefore commonly used to derive load-bearing capacity.

The Spectral Analysis of Surface Waves (SASW) method is applied to soil sites to measure the in-place shear wave velocity profile of soil and rock without requiring a borehole. In general, the method uses the dispersive characteristics of surface waves to determine the variation of the shear

wave velocity (stiffness) of layered systems with depth. Once the shear wave velocity profiles are determined, shear and Young's moduli of the materials can be estimated through the use of simple mathematical equations. The shear wave velocity profiles (shear wave velocity versus depth) are determined from the experimental dispersion curves (surface wave velocity versus wavelength) obtained from SASW measurements through a process called forward modeling or through an inversion process. The SASW method can be performed on any material provided there is an accessible surface for receiver attachments and source impacting.

DESIGN OF A BLASTING SYSTEM

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Key words: dynamic properties, model blasting, borehole, stress wave, static properties

A method for model scale blasting in sandstone blocks with weight of 96 kg has been used for measuring the pressure in the oil filled borehole.

The dynamic and static properties of the sandstone are also given. The instrumented tests in such blocks using pressure gauges, was useful for measuring the peak p-wave stress at the position of the oil filled borehole after the blast.

EVALUATION DES FACTEURS DE RISQUE CARDIOVASCULAIRE DANS LES ETHNIES ISOLATS DE LA CHAINE DES MONTAGNES DE L'ATAKORA AU TOGO

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Mots Clés: Adélé, Ogo, isolat, MCV, chaîne de l'Atakora

Les maladies cardiovasculaires (MCV) constituent actuellement la première cause majeure d'incapacité et de mortalité prématurée dans le monde. On estime que plus de 30% de la mortalité

mondiale sont imputables aux MCV et plus de 80% de ces décès surviennent dans les pays en développement. En Afrique subsaharienne, la transition épidémiologique est parallèlement associée à l'augmentation rapide des MCV et de leurs facteurs de risque, surtout dans les populations urbaines. Sur le plan métabolique, les MCV résultent souvent du développement de l'athérosclérose sous l'influence de différents facteurs dont les plus importants sont l'hypertension artérielle (HTA), les dyslipidémies, le diabète, l'obésité, l'hérédité.

Au Togo, il existe encore des ethnies (Adélé, Ntribou, Ogo..) considérées comme des relatifs isolats. L'épidémiologie des MCV est inconnue dans ces ethnies isolats. Cette étude a pour but d'évaluer l'influence de l'environnement géographique sur le risque athérogène chez les 250 Adélé et 360 Ogo adultes des deux sexes considérés comme des relatifs isolats et vivant en région montagneuse et forestière à plus de 700m d'altitude.

Les résultats montrent que les valeurs de l'IMC observées chez les Adélé et les Ogo sont voisines ($21,30 \pm 3,13$ et $20 \pm 3,66$). Celles de la tension artérielle sont normales chez la plupart des sujets par rapport aux valeurs de référence (PAS < 120 mm Hg / PAD < 80 mm Hg). Les sujets ne présentent pas d'hyperglycémie (glycémie = $105,82 \pm 27$ mg/dl et $109,97 \pm 36$ mg/dl).

Les concentrations moyennes du cholestérol total ($1,87 \pm 0,52$ g/l; $1,62 \pm 0,39$) et des tryglicérides ($0,94 \pm 0,44$ et $1,14 \pm 0,82$ g/l) chez les Adélé et les Ogo montrent que ces derniers présentent une hypertriglycéridémie. Cependant leurs indices d'athérogénicité (C-LDL/C-HDL) (Adélé 2,25 et Ogo 2,77) révèlent que le risque athérogène n'est pas élevé dans ces ethnies. L'enclavement géographique (montagnes et forêts) des sujets de l'étude leur permet d'effectuer beaucoup d'activité physique et d'avoir une alimentation saine. Ce qui diminue les risques de maladies cardiovasculaires.

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MINERALOGY AND METAMORPHIC CONDITIONS OF SILLIMANITE GNEISSES FROM LAINICI-PĂIUȘ GROUP (BÂLTA VALLEY, SOUTH CARPATHIANS, ROMANIA)

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This study approaches the metamorphic conditions of Lainici-Păiuș group from the Danubian Domain, Southern Carpathians (Romania). The analyses are carried on some gneiss samples from the Bâlta Valley (Vâlcan Mountains, Southern Carpathians) through mineralogical and petrological observations using Optical Microscopy and EPMA.

The Alpine architecture of the Southern Carpathians is defined by three major structural units, the Getic and the Danubian domains, sutured by the Severinide ophiolitic complex. These units originate in different continental margins and were brought together during the Alpine Orogeny (e.g. Săndulescu, 1984; Balintoni, 1997).

The lowermost major unit in this Alpine system is the Danubian Domain. It is composed of two series of smaller Alpine tectonic units, called the Lower and the Upper Danubian units, separated by an Intradanian thrust (Berza et al., 1984). These units share a heterogeneous pre-Alpine basement that consists of metamorphic rocks divided in two series: the Drăgșan and the Lainici-Păiuș series. Lithologies defined mainly by amphibolites and gneisses as main constituents of the Drăgșan series, are considered a former oceanic island arc (Legeois et al., 1996) subjected to medium pressure/medium temperature metamorphism. The Lainici-Păiuș series is a medium pressure/high temperature metasedimentary assemblage (Seghedi et al., 2005), dominated by quartzites, marbles and varieties of gneisses and amphibolites.

Numerous granitoid intrusions are characteristic to both series, with ages ranging from the Upper Neoproterozoic for some (e.g. Legeois et al., 1996, Balintoni et al., 2012), to the Later Paleozoic for most of them (e.g. Balica et al., 2007, Balintoni et al., 2011).

In the southeast of the Retezat and in the Vâlcan Mountains, the Lainici-Păiuș series was divided in two complexes: (i) the upper carbonatic-graphitose complex, with crystalline limestones and

various types of gneisses, and (ii) the quartzitic complex, dominated by quartzites with marble, gneiss and amphibolite intercalations.

From a mineralogical point of view, our gneiss samples contain an abundant association of aluminous minerals which indicate its metasedimentary (pelitic) origin. Interestingly all of the three aluminum silicate polymorphs are present (sillimanite-andalusite-kyanite), alongside almandine, cordierite, biotite and possibly corundum. Cordierite has sillimanite and garnet inclusions, sillimanite also forms quasi-parallel aggregates (fibrolite?), while biotite usually is present in the foliation plane and forms clusters of crystals with chaotic orientation in the foliation plane, sometimes with a different mineral in the middle. Three Ti minerals were identified alongside in the studied samples, titanite (CaTiSiO₅), rutile (TiO₂) and ilmenite (FeTiO₃), but they do not show a uniform distribution. Other identified minerals are quartz, feldspar, monazite, zircon and epidote.

The rough estimates for the metamorphic conditions are 5-6 kbar at 600-650°C (based on the almandine-cordierite-sillimanite-quartz assemblage), but further study is required to evaluate the specific conditions of the metamorphism these rocks were subjected to. One possibility is the use of the Fe-Mg exchange vector as a geothermobarometer (Spear, 1993), mainly in the cordierite-garnet system (but biotite could also be used), while another option is the characterization of metamorphism using successive mineral equilibria.

It is very likely that the minerals found in our samples to belong to several mineral equilibrium associations. The minerals sillimanite-andalusite-kyanite may have formed during a clockwise loop around the triple point on the P-T diagram (Whitney, 2002), with kyanite being the first, then followed by sillimanite and after that andalusite. The garnet and sillimanite inclusions in cordierite suggest that garnet formed before cordierite (therefore the evolution of the system is closer to a medium than to a low P-T type), while the presence of K feldspar may suggest peak temperatures close to the beginning of the granulite facies, around 600 °C (Miyashiro, 1994).

We propose the following succession of mineral equilibria and processes along the discussed path (based partly on Spear, 1993): (i) the first metamorphic mineral that appears is kyanite (+muscovite and quartz); (ii) garnet and possibly staurolite (+quartz and muscovite); (iii) kyanite grows, staurolite is consumed and biotite appears (+quartz and muscovite); (iv) sillimanite appears and muscovite may disappear (+quartz and biotite); (v) cordierite appears after sillimanite (when the pressure reaches lower levels); (vi) andalusite is the last mineral that forms.

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INTERPRETATION AND LOCAL COMMUNITIES – IN BUZĂU LAND GEOPARK, ASPIRING AT THE STATUS OF UNESCO GLOBAL GEOPARK

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Key words: geoparks, geoconservation, interpretation, local community

Geoparks aim to be the framework for geoconservation: protection, conservation and sustainable development of a territory and the most important asset in this joint forces is the local community from that territory.

Regarding geoconservation, the fundamental issue, besides protection, is valuing or interpretation of the geological heritage. As we know, geological heritage is the part of geodiversity that can be valorized in a Geopark, like processes from Earth's history, elements that marked climate change etc. Interpretation of the geological heritage opens the geoscience door to visitors that don't have much knowledge in terms of geology, geography, geophysics. The interpreter "translates" scientific information to a common language with very well known facts by everyone. The role of interpretation is to evoke the scientific information, not to tell it, but to put it in a story that will appeal to the visitors previous knowledge. Also the interpretation should engage and provoke the visitor and should be referring at the whole picture, not a single element. For example, a good interpretation doesn't aim only to an element of geological heritage, but to the paleo-environment, or for example in Buzau Land Geopark one of the values of geodiversity (the cultural value) is enhanced. When speaking about mud volcanoes, we also tell the story from the local community about them, (cultural heritage) or the amber stone also found in Buzau Land Geopark that has also a

mythical meaning – the godparents used to put a piece of amber in the newborn’s cradle for good luck.

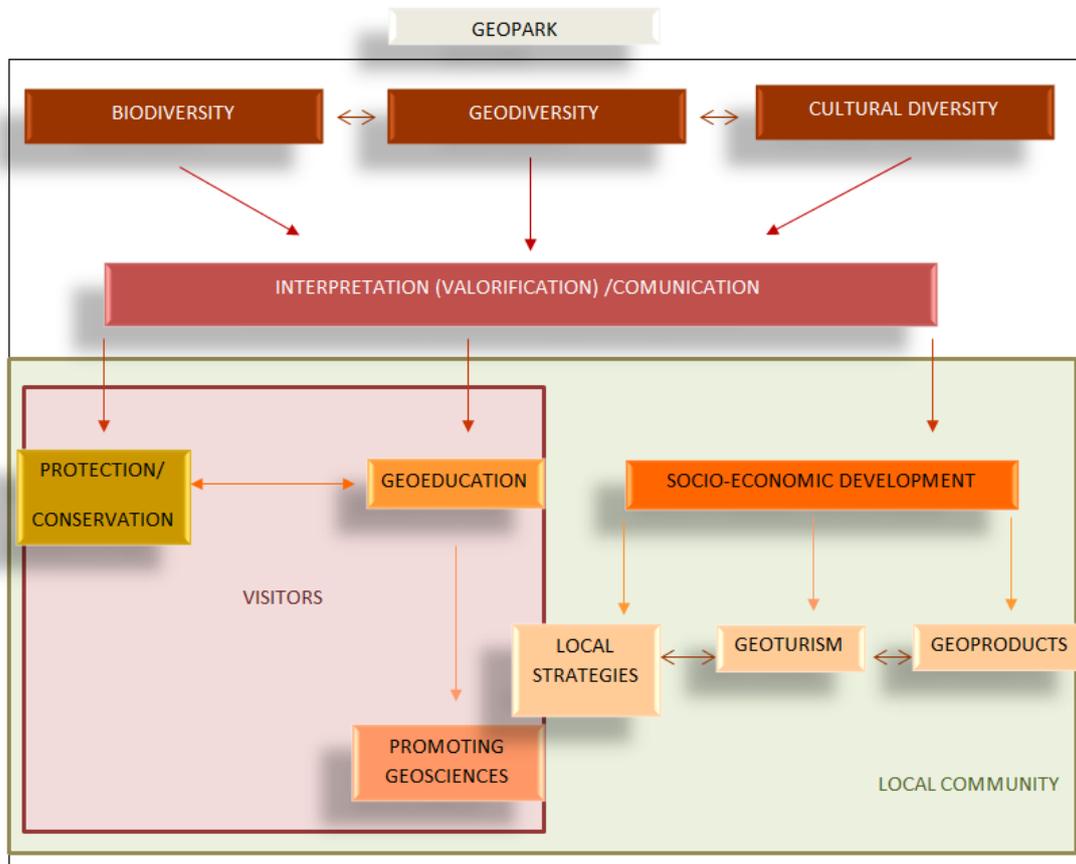


Figure 1. Interpretation in the context of Geopark

Fig. 1 shows that interpretation and communication are the methods by which natural and cultural heritage (the resources) can be used in a sustainable manner for education and socio-economic development, protecting those resources in the same time.

As previously shown, the local community is the main factor in this sustainable way of living and development. The Geopark is on their territory and it belongs to them, is a part of their identity. This is the first role of interpretation, to show the local communities this side of their identity, their connection to Earth, that is a part of their lives, occupations, stories, folklore and myths. When they understand that, an enhancement of their pride of place will occur and the locals will take action for protecting what is THEIRS and will include geological heritage in their local strategies for development: geotourism, geo-products, geo-museums. Interpretation is also the way to educate young visitors maybe for a carrier in Geosciences or only to understand more about geological processes and be able to protect them.

In Buzau Land Geopark, aspiring at the role of UNESCO Global Geopark , this connection with the local community has been accomplished through the research conducted in GeoSust project, financed by grant no. 22 SEE/30.06.2014. The local communities embraced the concept of Geopark and geoconservation through interpretation and gave the Geopark’s team three places to arrange interpretation points (Mânzălești – *The Museum Time of Man* on the traditional and natural life of

the local community. The local community donated also all the exhibits in the museum, empowering their community and being part of the Geopark's development; Lopătari – *7 Stories Museum*, to be opened in June 2016 ; Bozioru – museum of photography *Buzau Land Future and Present*, to be opened in 2016; Mânzălești – larger museum with many rooms – 2 of them dedicated to one of the main geological heritage elements there : salt, diapirism, the traditional way of collecting and using salt, also experiments and interactive exhibitions). Also, a local entrepreneur offered a place for a museum dedicated to *Real Volcanoes and Mud Volcanoes*.

Concluding, interpretation is the method to connect natural and cultural resources to the local communities and their sustainable development, enhancement of their identity and pride of place.

Acknowledgements: A part of the research included in this paper is financed by EEA Financial Mechanism 2009-2014, GeoSust program, no. 22 SEE/30.06.2014.

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ANALYSIS OF FACTORS INFLUENCING THE ROCK BLASTING

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Keywords: Breakage; modelling; discontinuities; rock mass, the line of least resistance

A model scale study has been carried out to evaluate the effect of joints on rock blasting. Three selected burdens were done on six different joint orientations. The different joint orientation angles were rotating in anticlockwise direction from the floor of the bench in a plane perpendicular to the

free face. The volume of the models 0.025 m^3 with a bench height of 0.05 m was prepared by binding sandstone slabs of 0.025 m thickness with an adhesive. The dynamic and static properties of sandstone are given.

The crater of the bench and the fragmentation were predominantly influenced by the position of charge with respect to the joint orientation. Severe toes were noticed in models with vertical joints and with joints dipping away from the face. Over breaks were observed in horizontally bedded models and in models with joints dipping towards the free face. The size of the broken fragments has been analyzed.

HOW LOCAL PEOPLE IN MALAWI HAVE BENEFITED FROM GRAPHITE OCCURRENCE

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Malawi is endowed with a number of rocks that can greatly boost the economy of the country as well as enhance the living standards of the people. Such stones have been used since time immemorial and have been used by the previous generation. Graphite, one of the minerals associated with rocks in the central region is one of the rocks that aid in development.

There are two main areas of Graphite mineralization that were identified in the pre-independence era, Chimutu and Katengeza prospects which are the premium Graphite prospects in Malawi. The majority of the lease area is underlain by a variety of Proterozoic Gneiss and Schist. Our forefathers have used Graphite to smoothen and provide a shiny appearance to the floors of their houses as well as to add flavor to the walls of their houses in the villages. That is how Graphite has been perceived by the local people in Malawi, as a building material. Among the locals, Graphite is commonly known as “Mwala wa Mtsiro” which means mud-stone used in floor smearing and it is women who usually exploit it to adorn their homes.

Although Graphite is still used in floor making, most Malawians have graduated to the use of cement and tiles which are both a product of stones for development. Several villages in Malawi have maintained that culture of using Graphite for their households. Currently, graphite is a strategic mineral in high demand, with advanced technological applications. Such being the case, Graphite from Malawi contributes to such advancement in technology and development.

LA CHUTE DE DINDIFÉLO (SÉNÉGAL ORIENTAL, AFRIQUE DE L'OUEST), UN GÉOSITE À VALEUR SCIENTIFIQUE, PÉDAGOGIQUE ET SOCIO-CULTUREL

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La chute de Dindifélo, située au Sud-Est du Sénégal à 1,5 km du village, reçoit ses eaux de sources de résurgence situées sur le plateau de Dandé, en territoire guinéen. Ces eaux forment au pied de la falaise une mare (les roches sont très glissantes), qui se déverse dans un affluent de la Gambie, le Thiokoye, par un petit ruisseau à écoulement superficiel sur 1100 m puis souterrain. Autour de cette mare règne un microclimat caractérisé par une humidité relative élevée et une température relativement basse. Ce microclimat a permis l'installation d'une flore ligneuse diversifiée à prédominance forestière (Goudiaby *et al.*, 2001). L'étude des diatomées menée dans différents types d'habitats (aussi bien aquatiques qu'aérien) liés à cette chute a permis d'inventorier 62 espèces appartenant à 28 genres (Sow *et al.*, 2013). L'escalade comme sport pourrait être développé sur les flancs des collines et tout près de ce joyau.

La communauté rurale de Dindifélo, située non loin du parc national de Niokolokoba, abrite une faune et une flore très diversifiée. Cette faune renferme une grande variété de primates parmi lesquels une population de chimpanzés parfois peu agressifs suivis par l'Institut Jane Goodall depuis 2008, des phacochères, des reptiles... Pour préserver la biodiversité et assurer le développement durable la zone a été érigée par l'état du Sénégal en Réserve Communautaire de Dindifélo depuis 2010. Elle est dotée d'un centre d'accueil et visitée pour ses 8 sites naturels merveilleux, sa végétation et ses animaux. Pour la promotion du tourisme 3 campements à décor local (cages) tous gérés par les jeunes du village sont construits : le « Campement villageois », « Africa Cascade » et le « campement Dogon ». Le village de Dindifélo reçoit tous les dimanches l'un des marchés hebdomadaires les plus importants de la région de Kédougou.

Ce site est devenu, depuis quelques années, un lieu touristique avec des activités culturelles riches et diversifiées. Les moments ou les visites sont plus fréquentes sont les vacances, les fêtes de Noël et de Pâques pour les locaux et les mois d'août et septembre pour les touristes. Il reçoit également des visites pédagogiques de nombreux établissements scolaires venant des régions de Kédougou et Tambacounda. Il accueille chaque année les écoles de terrain des étudiants en Géologie sédimentaire. Les visites sont payantes : 100 à 500 frs pour les sénégalais et 1000 à 3000 pour les touristes.

Du point de vue géologique, les dépôts de la falaise appartiennent à la Formation de Dindifello d'âge néoprotérozoïque (Deynoux *et al.*, 1992 ; Youm, 2012), subdivisée en deux membres : un membre inférieur constitué de grès à lamines de pélites mauves, et un membre supérieur constitué de grès ruiniformes. Cette formation repose en discordance sur les grès, pélites calcaires et conglomérats à stromatolithes et à roches basiques qui affleurent 1km plus à l'Ouest où ils sont

surmontés par des formations fluvio-glaciaires montrant l'existence d'une ancienne période glaciaire dans la zone.

Le site de Dindiférou, de par son caractère naturel avec des micro-écosystèmes diversifiés, la variété de ses roches, sa faune et sa flore, les activités socio-économiques qui y sont menées, mérite d'être érigé en géosite protégé et valorisé.

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LE BASSIN MESO A NEOPROTEROZOÏQUE DE MADINA KOUTA (SENEGAL ORIENTAL): REVISION LITHOSTRATIGRAPHIQUE

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Situé à cheval entre le Sénégal oriental dans l'actuelle région de Kédougou et la Guinée Conakry, le bassin de Madina Kouta est un prolongement du bassin de Taoudéni, qui est un bassin intracratonique post-birimien d'âge méso-néoprotérozoïque à paléozoïque (Delors et al., 2010) formé durant la phase distensive dans une marge passive (Villeneuve, 1989). Le bassin s'étend sur une superficie de 30 000 km² au NE de la Guinée Conakry, sur une mince bande d'environ 115 km de long sur 10 km de large au maximum à la frontière sénégal-guinéo-malienne entre Pélel Kindessa à l'Ouest et Guémédji au Sud (Deynoux *et al.*, 1993). Le bassin de Madina Kouta est limité au Nord par la boutonnière de Kédougou-Kéniéba, au sud par la dorsale de Man, à l'Est par le bassin de Taoudéni et à l'Ouest par les chaînes des Bassarides et des Rockellides.

Le bassin correspond à la couverture du Craton Ouest Africain et est subdivisé en deux supergroupes : le supergroupe 1 ou de Ségou-Madina Kouta d'âge Méso à Néoprotérozoïque subdivisé en deux groupes, le groupe de Ségou et le groupe de Madina Kouta (Delors et al., 2010) et le supergroupe 2 ou des Mauritanides d'âge Néoprotérozoïque subdivisé en 4 groupes, Walidiala, Mali, Soukouta et Boundou (Deynoux, 1992, Shields et al., 2007). Notre étude lithostratigraphique et sédimentologique basée sur une trentaine de logs lithostratigraphiques montre que le groupe de Ségou d'une épaisseur qui varie de 200 m à 350 m est formé par des conglomérats de base à éléments du socle (Mésoprotérozoïque, Delors et al., 2010), des dépôts pélitico-grésocalcaires de la

formation de Pélel et des grès à stratifications entrecroisées, rides de courant et fentes de retrait de la formation de Dindifello. Ces dépôts correspondent à une évolution d'un cycle sédimentaire dans une marge passive en distension en 3 stades, un stade de distension avec un conglomérat de base à éléments de démentellement du socle comblant les paléovallées, rejoignant ainsi l'idée du rifting (Villeneuve, 1989), un stade de l'accentuation de l'extension donnant des dépôts de plateforme puis des dépôts de milieu plus profond, avec beaucoup de fracturations, des slumps de petite taille ainsi que roches volcaniques témoins d'une distension du craton birrimien, et un stade de progradation avec une sédimentation silico-clastique (grès de Dindifello), progradation d'un système fluviatile, sous l'influence des vagues (Deynoux, 1992), dans une plaine margino-littorale.

Le supergroupe 2 ou les Mauritanides débute par des diamictites (groupe de Walidiala) d'âge Marinoan (Deynoux, 1980, Delors et al., 2010) discordantes sur la formation de Pélel dans le secteur de Pélel-Tanagué ou sur le socle vers les villages de Pelloungue-Walidiala. Elles constituent un repère sur toute la couverture du craton ouest africain et comprend une alternance de conglomérat à matrice silto-gréso-carbonatée et de siltites laminées à dropstones intercalées de niveaux gréseux à HCS assimilés à des turbidites distales coiffée de barres d'arénites quartzzeuses plurimétriques à galets centimétriques. Les arénites quartzzeuses sont surmontées par deux niveaux conglomératiques séparés par des grès et siltites (Groupe de Soukouta) dans un environnement à affinité fluviatile. La position stratigraphique de ce Groupe est fortement discutée : entre les groupes de Walidiala et de Mali (Delors et al., 2010), équivalent du Groupe de Walidiala (Fullgraf et al., 2010), antérieur au Groupe de Walidiala (Villeneuve, 2005). La transgression rapide qui a suivi la fin de la glaciation « Marinoan » a permis le dépôt de dolomies calcaires (cap dolostone), de silexites à faciès de jasper et de pélites, siltites et grauwackes (Groupe de Mali) surmontés de grès rougeâtres en bancs épais séparés par des interbancs argileux (Groupe de Boundou). Les corrélations faites montrent que le bassin s'approfondissait vers le sud.

ETUDE NANNOSTRATIGRAPHIQUE DES FORMATIONS DE LA LIMITE K/PG DU BASSIN SEDIMENTAIRE OFFSHORE DE CÔTE D'IVOIRE, AFRIQUE DE L'OUEST

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Mots clés : Nannofossiles, biozonation, Paléocène, Maastrichtien, Bassin offshore

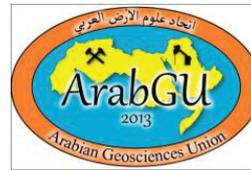
L'étude des nannofossiles calcaires de l'intervalle 1061– 1445 m du Puits ZNB-1X situé au large d'Abidjan, dans la partie « offshore » du bassin sédimentaire de Côte d'Ivoire a révélé une nannoflore de faible diversité spécifique. Elle a permis d'identifier le Selandien (Paléocène moyen) caractérisé

par la présence des espèces que sont *Toweiuscelandianus*, *Toweiuscrassus*, *Cruciplacolithusprimus*, *Toweiusrotondus*, le Danien (Paléocène inférieur) grâce à l'association composée de *Cruciplacolithusprimus*, *Neochiastozygusmodestus*, *Toweiuscrassus*, tandis que le Maastrichtien a été rélevé par l'assemblage constitué des espèces, *Miculamurus*, *Cribrosphaeraehrenbergii*, *Retecapsacrenulata*, *Archangelskiella maastrichtiana*, *Quadrumssissinghi*, *Micula concava*. Cette étude met en évidence le passage K/Pg avec trois étages à savoir le Selandien (Paléocène moyen), Danien (Paléocène inférieur) et le Maastrichtien. Cette biozonation de nannofossiles appuyée par les données lithologiques et calcimétriques suggère un environnement de dépôt de plate forme continentale interne.

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ISBN 978-606-94282-0-7