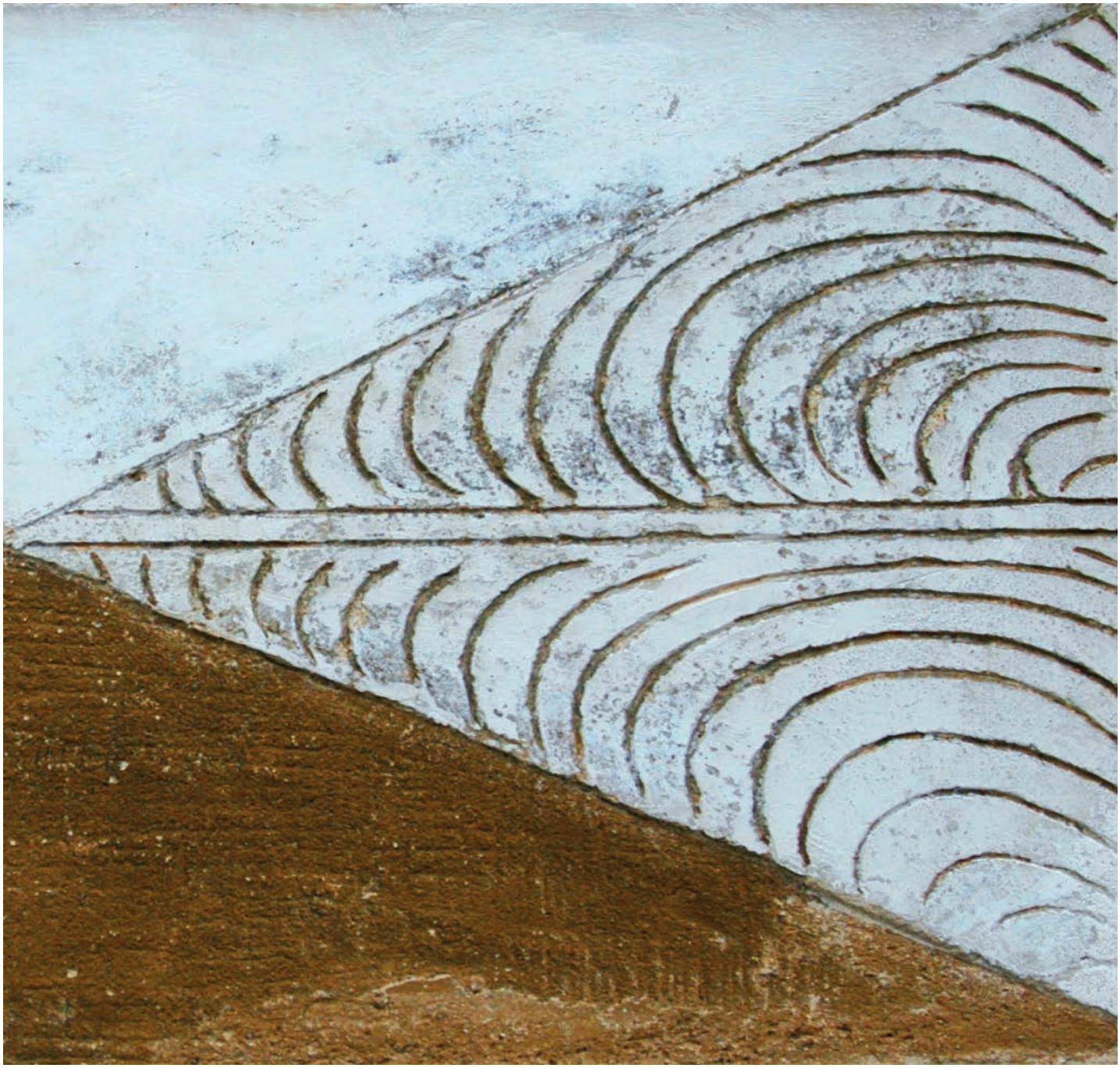
INTERNATIONAL COLLOQUIUM ON GEOARCHAEOLOGY

Landscape Archaeology. Egypt and the Mediterranean World

Cairo, 19TH-21ST September 2010



INTERNATIONAL COLLOQUIUM ON GEOARCHAEOLOGY

LANDSCAPE ARCHAEOLOGY. EGYPT AND THE MEDITERRANEAN WORLD

CAIRO, 19TH-21ST SEPTEMBER 2010

Organised by the Institut français d'archéologie orientale (Ifao)

and by the

Egyptian Geographical Society

in association with the

Centre Européen de Recherche et d'Enseignement des Géosciences de l'Environnement (CEREGE, UMR 6635, CNRS),

and the

Centre Franco-Égyptien d'Étude des Temples de Karnak (CFEETK, USR 3172, CNRS)

under the patronage of the Working Group on Geoarchaeology
of the International Association of Geomorphologists

Programme and abstracts volume
edited by
Yann Tristant and Matthieu Ghilardi

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PROLOGUE

Geoarchaeology can be defined as the multidisciplinary study of environmental and landscape dynamics, linking human occupation and impacts with archaeology. Combining geo- and social sciences, the approach proposes palaeoenvironmental/palaeotopographical reconstructions that can be employed by specialists of prehistory, archaeology and history.

This volume includes 107 abstracts accepted for oral and poster presentations at the international colloquium *Landscape Archaeology: Egypt and the Mediterranean World* held in Cairo, Egypt (September 19-21, 2010). These contributions are grouped into 13 thematic sessions (10 oral sessions and 3 poster sessions) and cover a wide range of geoarchaeological topics dealing with the Mediterranean's different morpho-climatic contexts.

The international colloquium will primarily focus on Egypt, although other Mediterranean contexts will also be considered. Egypt is characterised by a rich plethora of natural landscapes and exceptional archaeology, spanning from prehistory to Modern Times. Within the framework of human-environment interactions, the secondary objective of the colloquium is to throw light on the evolution of the River Nile, a major component of the Egyptian landscape, and its impact on neighboring areas (coasts, flood plains, *wadis* and their tributaries).

We warmly acknowledge the members of the different committees for the evaluation of the 125 abstracts received in total and we would like to express our deep gratitude to the sponsors for their constant support.

Yann Tristant and Matthieu Ghilardi
Organizers of the international colloquium
Landscape Archaeology. Egypt and the Mediterranean World (Cairo, Egypt, September 19-21, 2010)

ORAL SESSIONS

Sunday 19th September

Egyptian Geographical Society

08.00 Reception and registration of the participants

08.30 Welcome address (Zahi Hawass)

08.45 Opening ceremony (Yann Tristant; Matthieu Ghilardi)

09.00 Introduction (Safey Abulezz)

1st Session • Arid landscapes in Egypt / Water in the desert: Life adaption to arid climate conditions

Chair persons: Rudolf Kuper, Olaf Bubenzer

09.30 BRAVARD Jean-Paul, GARCIER Romain, MOSTAFA Ashraf
De l'eau dans un désert : le site d'El Deir à l'Holocène (dépression de Kharga, Égypte)

RIEGER Anna-Katharina, VETTER Thomas, MÖLLER Heike, NICOLAY Alexander, KLAMMER Olaf, FUCHS Markus
The Marmarica-Survey: a geoarchaeological approach to an unknown arid region (NW-Egypt)

BUBENZER Olaf, WURZ Sarah, RITTER Mathias, VAN PEER Philip, KINDERMANN Karin
The Late Pleistocene of the Eastern Desert of Egypt - Geoarchaeological Research

KINDERMANN Karin
Geoarchaeological reconstruction of the mid-Holocene seasonal cycles and mobility patterns on the Abu Muhariq Plateau (Egypt)

LUCARINI Giulio, HAMDAN Mohamed A.
The ancient landscape of Sheikh el Obeiyid (Farafra). The playa and the village: technological and symbolic traits

KOOPMAN Annelies, KLUIVING Sjoerd J.
Geoarchaeological reconstructions of Epipalaeolithic and Neolithic lake shore occupation during dynamic environmental conditions, Northern Fayum Basin, Egypt

WENDRICH Willeke, CAPPERS René, HOLDAWAY Simon
Fayum Landscapes (Egypt): agricultural adaptations during the Neolithic and the Greco-Roman periods

12.00 Transfer by bus to IFAO

12.30 Lunch at IFAO

2nd Session • Coastline evolution in Eastern Mediterranean and in the Black Sea

Chair persons: Kosmas Pavlopoulos, Matthieu Ghilardi

14.00 FOUACHE Éric, LERICOLAIS Gilles
New perspective on the Phanagorian Regression in Black Sea

EVELPIDOU Niki, PAVLOPOULOS Kosmas, VASSILOPOULOS Andreas, TRIANTAFYLLOU Maria, VOUVALIDIS Konstantinos, SYRIDES George
Holocene Palaeogeographical reconstruction of the western part of Naxos island (Greece)

CHABROL Antoine, FOUACHE Éric, LE COEUR Charles, APOSTOLOPOULOS Georges, PAVLOPOULOS Kosmas
The Last-glacial/Interglacial transition in Northern Greece: consequences on physical environments and implications for human populations

GHILARDI Matthieu, CORDIER Stéphane, PSOMIADIS David, DELANGHE-SABATIER Doriane, DEMORY François, PARASCHOU Theodoros, HAMIDI Fatiha, FOUACHE Éric
Reconstructing the Early/Mid-Holocene landscape evolution of the Nea Nikomideia Neolithic settlement (central Macedonia, Greece)

THEODORAKOPOULOU Katerina, PAVLOPOULOS Kosmas, BASSIAKOS Yannis, ZACHARIAS Nikos, ATHANASSAS Constantin
The contribution of geoarchaeological methods to the paleoenvironmental evolution of the coastal area of Istron (N.E Crete) during Holocene

VOUVALIDIS Konstantinos, EVELPIDOU Niki, VASSILOPOULOS Andrea, SYRIDES George, PAVLOPOULOS Kosmas, PARASCHOU Theodoros, TRIANTAFYLLOU Maria
Reconstructing a changing environment between the ancient city of Samos and the Heraion Temple (Samos Island, Greece)

ENGEL Max, BRÜCKNER Helmut, KNIPPING Maria, KRAFT John C., KIDERLEN Moritz
Mid- to late Holocene expansion of Eastern Mediterranean coastal plains: the case study of Akovitika (Greece)

16.30 Coffee break

3rd Session • The Nile Delta and its palaeoenvironmental evolution

Chair persons: Jean-Daniel Stanley, Yann Tristant

17.00 STANLEY Jean-Daniel and GEOARCHAEOLOGICAL PROGRAM GROUP
Elusive pre-Greek Sites on the Nile Delta's coastal margin, Egypt: burial, submergence and role of accomodation space

WORONKO Barbara
Accumulation of aeolian dust within the ancient town of Marea (coastal zone of the South Mediterranean Sea, Egypt)

FLAUX Clément, MARRINER Nick, TORAB Magdy, ROUCHY Jean-Marie, SOULIE-MARSCHE Ingeborg, MORHANGE Christophe
Environmental evolution of the Maryut Lake (Nile Delta) since 3,000 years BP: natural forcings and human impacts

HARTUNG Ulrich
Settlement topography and environmental changes at Tell el-Fara'in/Buto in the Western Nile Delta (Egypt)

TOONEN Willem H.J., TRAMPIER Joshua
The Holocene Nile and Settlement Dynamics in the Western Nile Delta

ASHMAWY ALI Aiman
Tell Basta (Egypt): ancient topography and architecture

FORSTNER-MÜLLER Irene, TRONCHÈRE Hervé, GOIRAN Jean-Philippe, HERBICH Tomasz, SCHWEIZER Christian
Avaris (Egypt) in the second millenium: a study of its landscape

20.30 Cocktail at IFAO

Monday 20th September

French Cultural Centre

4th Session • Geoarchaeology of ancient coastal harbours

Chair persons: Éric Fouache, Jean-Yves Empereur

08.00 GOIRAN Jean-Philippe, MARRINER Nick, CAVERO Julien, MORHANGE Christophe, LE BAILLY Matthieu, ABD EL MAGUIB Mohamed M., CARBONEL Pierre, EMPEREUR Jean-Yves
Palaeoenvironments of the ancient harbours of Alexandria (Egypt): long term evolution and rapid changes

ZYCH Iwona, HERBICH Tomasz, SIDEBOTHAM Steven E.
The urban landscape of the Berenike harbour (Egypt) over time: geophysical research

TRONCHERE Hervé, FLAUX Clément, EL AMOURI Mourad, PETITPA Marie-Christine, under the direction of BOUSSAC Marie-Françoise, CALLOT Yann, GOIRAN Jean-Philippe, MORHANGE Christophe, Torab Magdy
Archaeological and geomorphological evidence for harbour structures at Taposiris, Lake Mareotis, NW Nile delta, Egypt

SALOMON Ferréol, GOIRAN Jean-Philippe, KEAY Simon, BRAVARD Jean-Paul, MILLET Martin, STRUTT Kristian, PAROLI Lidia
The canals of Portus (Tiber delta, Italy): a geoarchaeological approach

MORHANGE Christophe, MARRINER Nick
Ports antiques et paléo-environnements : vers une grammaire géoarchéologique des littoraux méditerranéens ?

10.00 Coffee break

5th Session • Nile River evolution in Southern Egypt and in Nubia

Chair persons: Morgan De Dapper, Safey Abulezz

10.30 FARR Tom G., BLOM Ron G., PAILLOU Philippe
Remote Sensing of the Hydrologic History of Southern Egypt

WOODWARD Jamie C., MACKLIN Mark G., WELSBY Derek A., SPENCER Neal, DULLER Geoff A.T., WILLIAMS Frances, WILLIAMS Martin A. J.
Records of Holocene flooding in the Nile Valley of Northern Sudan

KLOSE Ilka, DE DAPPER Morgan
River Landscapes in the Northwestern Suburbia of Elephantine/Aswan

MÜLLER Wolfgang, DE DAPPER Morgan
The urban landscape of Aswan (Egypt) from the Predynastic period to present times: a geoarchaeological approach

MACKLIN Mark G., WOODWARD Jamie C., WELSBY Derek A., DULLER Geoff A.T., WILLIAMS Frances, WILLIAMS Martin A. J.
Rethinking people river-environment interactions in Sudanese Nubia

CILEK Vaclav, LISA Lenka, SUKOVA Lenka, LISY Pavel, BUSHARA Murtada
Holocene climatic changes and their impact on the landscape and human society behaviour: case study from 6th Nile Cataract, Sudan

12.30 Lunch at IFAO

6th Session • Nile River changes in Upper Egypt
Chair persons: Mansour Boraik, Béatrix Midant-Reynes

14.00 ZIGNANI Pierre, GHILARDI Matthieu
A geoarchaeological approach of Natural hazards in Egypt: the cross contribution of the Pharaonic architecture, the vernacular settlements, and the palaeoenvironmental proxies

GHILARDI Matthieu, TRISTANT Yann, BORAIK Mansour
Nile River evolution in Upper Egypt during the Holocene: environmental implications for the two pharaonic sites of Karnak and Coptos

PAWLIKOWSKI Maciej
Geology and geomorphology as reasons for locating of archaeological sites in Egypt

PIMPAUD Alban-Brice
Une carte archéologique de Thèbes-Ouest (Égypte): élaboration d'un S.I.G. pour la connaissance du paysage naturel et culturel thébain

16.00 Coffee break

7th Session • Geoarchaeological case studies of the memphite area
Chair persons: David Jeffreys, Gihane Zaki

16.30 JEFFREYS David
Tumbling the White Walls: dispelling some myths about the Memphite landscape (Egypt)

ABDEL MONEIM A. Mahmoud
Will the head of the Sphinx (Giza, Egypt) fall down during this century? Geoarchaeological studies around the Sphinx

FAROUK May
A Geographic Information System transportation model in Cemetery En Echelon (Giza, Egypt)

MYSLIWIEC Karol, WELC Fabian, TRZCINSKI Jerzy
Geoarchaeological researches of the Polish Mission in Saqqara, Egypt

BARTA Miroslav, BRUNA Vladimir, CILEK Vaclav, LISA Lenka
Abusir Lake (Egypt): myth and reality

BEBERMEIER Wiebke, ALEXANIAN Nicole, BLASCHTA Dirk, RAMISCH Arne, SEIDLMAYER Stephan Johannes, SCHÜTT Brigitta
Landscape evolution of the necropolis of Dahshur (Egypt)

COLORU Omar, DANELON Nevio, KUKAVICIC Minja, PRANZINI Enzo
The dykes of Memphis (Egypt): rereading classical sources through historical cartography and remote-sensing techniques

20.00 Departure from IFAO for the gala dinner on the Nile

Tuesday 21st September

French Cultural Centre

8th Session • Written sources and toponymy as evidence for landscape evolution

Chair persons: Frank Vermeulen, Christophe Thiers

08.00 BLOUIN Katherine
Représentation et gestion des « accroissements » (προσγενήματα) dans l'Égypte hellénistique et romaine d'après la documentation papyrologique

DHENNIN Sylvain
L'apport de la toponymie à la restitution du tracé de la branche occidentale du Delta du Nil

STRÖMQUIST Lennart, ENGSHEDEN Åke
A geospatial overview of tells vs. settlements in the Northern-Central Delta, Egypt

PEETERS Pierre
À propos de quelques fleuves du Proche-Orient à travers les hiéroglyphes

JIMENEZ VIALAS Helena
Un paysage changeant à l'extrêmité occidentale de la Méditerranée dans l'Antiquité : l'exemple de la Baie d'Algésiras (Espagne)

10.00 Coffee break

9th Session • Environmental response to human and climate changes

Chair persons: Gilles Arnaud-Fassetta, Christophe Morhange

10.30 BERGER Jean-François, BRAVARD Jean-Paul, PURDUE Louise, BENOIT Anne, MOUTON Michel, BRAEMER Franck
Les rivières du bassin de l'Hadramawt à l'Holocène (Yémen) : des preuves d'un fonctionnement tardif

LESPEZ Laurent, LE DREZEN Yann, LOPEZ-SAEZ Jose Antonio, DAVIDSON Robert, TSIRTSONI Zoï
Middle to Late Holocene landscape changes and geoarchaeological implications in the Lower Strymon valley (Greece)

CAROZZA Jean-Michel, PUIG Carole, ODIOT Thierry, VALETTE Philippe
Little Ice Age impacts on fluvial dynamics in the Lower Roussillon coastal plain (Gulf of Lion, Western Mediterranean) and its consequences on Medieval to Modern societies

CASTANET Cyril, DESRUELLES Stéphane, RAGALA Rachid, ARHARBI Rachid, BROUQUIER-REDDE Véronique, LENOIR Éliane
Fluvial landscapes dynamics and societies-environment interactions in the lower Sebou River plain during the Late Holocene (Gharb, Morocco)

BKHAIRI Amor
Approche géoarchéologique et données paléoenvironnementales préliminaires de sites antiques situés dans le bassin versant de l'Oued Hatab (Tunisie centre ouest): enregistrements des deux derniers millénaires

BELLAVIA Valentina, DI PASQUALE Gaetano
First archaeo-anthracological evidence of Juglans regia *in North-West Africa*

PANAGIOTAKOPULU Eva, BUCKLAND Paul
Insects and survival in the desert: archaeoentomological investigations at Kom el Nana, a Byzantine monastery, Middle Egypt

13.00 Lunch at IFAO

10th Session • Human development in a complex landscape
Chair persons: Nabil S. Embabi, Helmut Brückner

14.30 SIART Christoph, GHILARDI Matthieu, FORBRIGER Markus, CORDIER Stéphane
The mountainous karst landscapes of Crete (Greece): Ancient settlement regions of high geoarchaeological interest

GEORGIADIS Mercourios
The landscape characteristics of the Neolithic Settlement Pattern in Central Greece

PARASCHOU Theodoros, GHILARDI Matthieu, PSOMIADIS David
Pyroclastic deposits from the Thera volcano (Greece) and its hazards for the surrounding islands

DOTSIKA Elissavet, POUTOUKIS Dimitrios, TZAVIDOPOULOS Ilias, MANIATIS Yannis, IGNATIADOU Despoina
Isotope contents and origin of water at Pikrolimni Lake: A Natron source in ancient Greece?

SMETANOVA Anna
The geoarchaeological evidence of the Holocene relief transformation in agricultural landscape: the case study of Trnavská pahorkatina Hill Land, Slovakia

KARRAY MOHAMED Raouf
Morphologie et dynamique des paysages le long de la Fossa Regia en Tunisie tellienne

ATHANASSAS Constantin, BASSIAKOS Yannis
Exploring palaeogeographic conditions at two Palaeolithic sites in Pylos, SW Aegean, by means of Optically Stimulated Luminescence dating

JANTY Gwenaëlle, DEL André
Apports d'un S.I.G. pour l'analyse des relations dynamiques du réseau d'irrigation et du patrimoine bâti : le cas de l'oasis de Figuig, Maroc

17.30 Coffee break

18.00 General discussion, synthesis and conclusion

19.00 Closing

POSTER SESSIONS

Sunday 19th September

1st Poster Session (IFAO)

ABDEL MONEIM Mahmoud
Patina of the Prehistoric rock art, in north Africa and their palaeoclimatic implications and cultural contexts

AMR Mohamed Sabry Mahsop
Human impacts on the coastal landforms of the Nile Delta, Egypt

BELLAVIA Valentina, ALLEVATO Emilia, DI PASQUALE Gaetano, PAPI Emauele
First archaeobotanical data from the ancient town of Dionysias (Qasr Qarun, NE Egypt)

DE SCHACHT Tijs, DE DAPPER Morgan, ASADI Ali, UBELMANN Yves, BOUCHARLAT Rémy
Sad-i Didegan: geo-archaeological aspects of an Achaemenid check dam in the hinterland of Pasargadae (Fars, Iran)

DEPREZ Sarah, DE DAPPER Morgan, ALMEIDA Nelson, CARVALHO Joaquim, DE PAEPE Paul, CUNHA Pedro, VAN DAMME Dirk, VANDENBERGHE Dimitri, VERMEULEN Frank
Roman gold exploitation in the Tagus River valley - the Conhal of Arneiro (northeast Alentejo, Portugal): a geoarchaeological case study

ENGEL Max, BRÜCKNER Helmut, FRENZEL Peter, GINAU Andreas, KLASEN Nicole, PINT Anna, PATZKE Martin, HAUSLEITER Arnulf, EICHMANN Ricardo, AL NAJEM Mohamad H., AL SAID Said F.
From lake to sabkha – Palaeoenvironmental studies in the Tayma oasis, NW Saudi Arabia

HERBICH Tomasz
Geophysics applied to the investigation of sacred areas in cities of the Nile Delta (Egypt): the case study of Tell el-Balamun

MOSTAFA Ashraf
Caves of the Nile valley (Egypt): an interaction between man and his environment

MUTRI Giuseppina, HAMDAN Mohamed
Lithic raw material in the Farafra Oasis (Egypt): location, procurement and use from the Middle Stone Age until the Neolithic period

PEREZ LAMBAN Fernando, FANLO LORAS Javier, PICAZO MILLAN Jesús and PEÑA MONNE José Luis
Climatic Change and Slope Formation in Semi-arid Mediterranean Landscapes during the 2.6 ka Event (NE Spain)

SHAWKAT Yahia
The forgotten coast, a 3000 year history of forced migration in the Nile Delta (Egypt)

SCHIESTL Robert
Regional survey Buto (Province of Kafr esh-Sheikh), Western/Central Nile Delta, Egypt

TRISTANT Yann, CAVERO Julien, MIDANT-REYNES Béatrix, MINOTTI Mathilde, RABAUTE Thierry
Geoarchaeological investigations in the Eastern Nile Delta. Preliminary Results of the 'Gezira' A.N.R. Programme

VERON Alain, FLAUX Clément, POIRIER André and MORHANGE Christophe
Middle Bronze Age settlement in the NW Nile delta (Egypt) revealed by pollutant lead

WUNDERLICH Jürgen
The Nile Delta through the Holocene: environmental changes and their geoarchaeological implications

Monday 20th September

2nd Poster Session (IFAO)

AFANE Émilien
L'exploitation des épaves en géoarchéologie : le cas de la Méditerranée orientale du 4e au 11e siècle de notre ère

ALEXANIAN Nicole, BEBERMEIER Wiebke, BLASCHTA Dirk, RAMISCH Arne, SEIDLMAYER Stephan Johannes, SCHÜTT Brigitta
The discovery of the lower causeway of the Bent Pyramid and the reconstruction of the Ancient Landscape at Dahshur (Egypt)

BEALBY Marsia
We journey up the storied Nile; the timeless water seems to smile: Why Nilotic landscapes inspired Minoan Art

BECKERS Brian, SCHÜTT Brigitta
Petra's Engineered Landscape. Age and impact of the terraces surrounding the Nabataean Capital

BERKING Jonas, SCHÜTT Brigitta
Geoarchaeological Survey in Naga, Central-Sudan

BONY Guénaëlle, MORHANGE Christophe, MARRINER Nick, PERINCEK Dogan
Ancient harbours and high energy events signature

CORSI Cristina, DE DAPPER Morgan, VERMEULEN Frank
Surveying the cityscape of Roman Ammaia (Alentejo, Portugal)

EL DIRANI CHEBBO Racha
Tyr et Alexandrie, deux villes d'Alexandre Le Grand

EL GEMAIEY Ghada
The role of environment on civil architecture in Rosetta (Egypt) during the ottoman period: a comparative study with Istanbul (Turkey)

KLOSE Ilka, SEIDLMAYER Stephan J., DE DAPPER Morgan, KELANI Adel
The rock inscriptions of Bigga and Shellal (Aswan, Egypt): archaeological and geoarchaeological approaches

KNITTER Daniel, TOTH Janos, SKUNDRIC Jana, WULF-RHEIDT Ulrike, SCHÜTT Brigitta
Archaeological predictive modeling based on geomorphometric parameters: a case study in the Roman Mediterranean

PERRINEAU Aude, VAN DER WOERD Jérôme, GAUDEMER Yves, LIU-ZENG Jing, PIK Raphaël, TAPPONNIER Paul, THUIZAT Robert, ZENG Rongzhang
Late quaternary climate-driven evolution of the Yellow River in arid northeastern Tibet

TAELMAN Devi, DEPREZ Sarah, VERMEULEN Frank, DE DAPPER Morgan, DE PAEPE Paul
The granite stone of Roman Ammaia (Portugal): a geoarchaeological approach

Tuesday 21st September

3rd Poster Session (IFAO)

BENAZZOUZ BOUKHALFA Karima, DAHLI Mohammed
Le paysage, témoin de l'assise temporelle de la ville

COUTSINAS Nadia, GUY Max
Kouphonisi (Grèce): une étape incontournable entre la Crète et l'Afrique

CURIE Julien, PETIT Christophe, SCHEID John, BEN ABED Aicha, BROISE Henri
Les travertins anthropiques, archives sédimentaires de l'interaction entre l'Homme et son environnement : l'exemple du complexe romain sanctuaire/thermes/source thermale de Jebel Oust (Tunisie)

DAGDOUG Hanene
Influences des Centuriations Romaines sur les dynamiques hydriques et éoliennes en Tunisie centre orientale

FIORENTINO Girolamo, D'ORONZO Cosimo, PRIMAVERA Milena, ORONZO Simone, CALDARA Massimo, MUNTONI Italo M., RADINA Francesca
Climate changes and human/environment interaction in Puglia region (south-east Italy) during the Neolithic

FORBRIGER Markus, SIART Christoph, GHILARDI Matthieu
Use of Terrestrial Laserscanning in Geoarchaeology: a case study on Bronze-Age findings from East and Central Crete (Greece)

GARCÍA DE LA VEGA Alfonso
Découvertes géoarchéologiques et datations absolues pour la reconstitution des paysages méditerranéens

GARCÍA DE LA VEGA Alfonso
Dynamique culturale dans l'évolution des paysages fluviaux méditerranéens

KLEMPE Harald
Identification of river courses and floodplains in the area around the ancient city Tegea, Greece

KOSSMANN Perrine
Le territoire de Latô (Crète, Grèce)

LOGEL Thierry
Dépôts fluviaux, pratiques funéraires et paysage dans la plaine alluviale du Rhin supérieur au cours du 2e et 1e millénaire avant notre ère : Nature, Culture et Société

MATTEUCCI Renato, ROSA Carlo, SEBASTIANI Renato
A Geoarchaeological approach to the study of the city area of Rome, Italy: the changes of the Tiber River course during the Holocene

RASSOUL Hocine, DAHLI Mohamed
Le Sahara, terroir de la Méditerranée

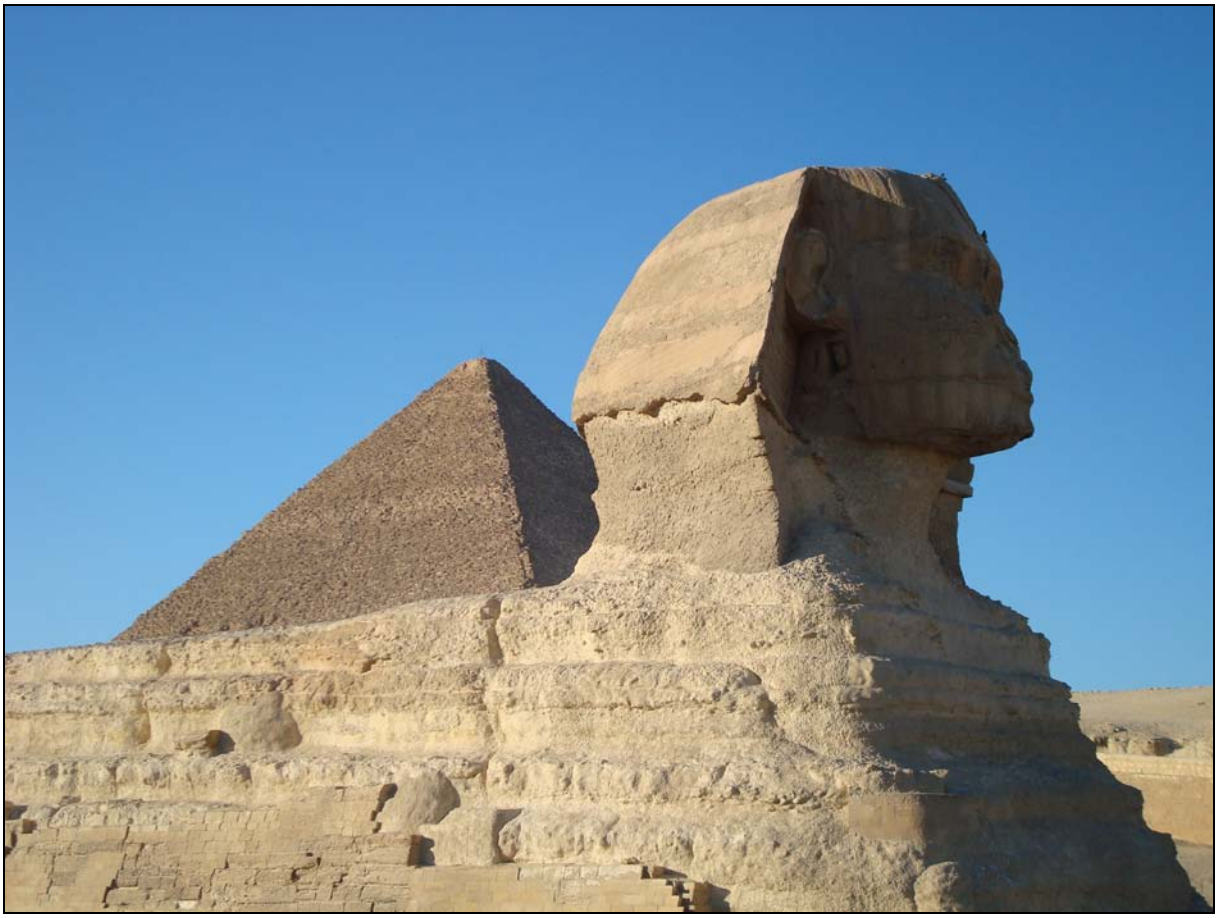
SYRIDES George, AIDONA Eleni, VOUVALIDIS Konstantinos, PAPAKONSTANTINOU Maria-Fotini, PECHLIVANIDOU Sofia
Anthropogenic and natural sedimentary records from the prehistoric settlement of Agia Paraskevi, Lamia, Central Greece

THELY Ludovic
Essai de reconstitution d'un paysage côtier à travers les sources historiques et archéologiques : l'exemple du port Antique de Phalère (Grèce)

VOUVALIDIS Konstantinos, TSOURLOS Panagiotis, SYRIDES George, PAPAKONSTANTINOU Maria-Fotini
The battlefield of Ancient Thermopylae, Central Greece: a geomorphic approach

Tuesday 22nd September (on the morning)

Excursion to the Giza Plateau (by bus)



ABSTRACTS OF ORAL AND POSTER PRESENTATIONS **(by alphabetical order)**

ABDEL MOMEIN A. Mahmoud[1]

Will the head of the Sphinx (Giza, Egypt) fall down during the present century?

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Sedimentological and mineralogical investigations of the weathering products around the Sphinx monument reveal high concentrations of silt, clay, rounded quartz sand and carbonates near the right and left paws and left back of the statue. This suggests that erosion is more intense at these locations. Petrographical definitions for the selected limestone gravels proved that these are pelbiomicritic to biomicritic. These could be derived from the body of the Sphinx or from the same facies exposed to the west and south of the statue.
X-Ray Diffraction (X.R.D.) analyses of some of the weathering products indicate the predominance of calcite, halite and quartz. Gypsum, dolomite, albite, microcline, diopside, muscovite and anorthite are present in different amounts. High concentration of halite mineral close to the right and left paws of Sphinx in particular could be derived in situ from the thorax beds of middle Eocene which enriched in halite. This leads to accelerate the chemical and mechanical weathering at these sides of the statue. The rate of the weathering of the Sphinx is calculated as 0.066 mm/yr. This could explain how and why did the mass of rock fall down from the right shoulder of the statue during the year 1987.

ABDEL MOMEIN A. Mahmoud[1]

Patina of the Prehistoric rock art, in north Africa and their palaeoclimatic implications and cultural contexts

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Patina is a karstified duricrust or so called desert varnish. It is a thin hard layer or crust formed on the surface of soil. It exists above or on the top of weathered Paleocene limestone or so called Abdalla limestone formation and on the surface of wall of the cave in Farafra Depression. Its colours vary from reddish, blackish to brownish colours. It is typically formed by the accumulation of soluble minerals deposited by mineral-bearing waters that move upward, through joints by capillary action, commonly assisted in arid settings by evaporation. The recent discovery of this cave, the so called El Obeiyed, reveals that Prehistoric societies carved into the rock. Cave enriched in rock arts and scratches at the northwestern side of the plateau during the season of 1996. This season a lot of patinas were identified on the other side of the plateau during the prospection for prehistoric rock arts prospections. In Morroco, wonderful rock arts were sculptured in calcarenites of the Eocene Formation. The types of patinas in Egypt and Morroco on which rock arts were sculptured are looks similar. It indicates the North African area during Prehistoric time was exposed to the same palaeoclimatic condition. Diagenesis of the patina and cultural contexts are discussed.

AFANE Émilien[1]

L'exploitation des épaves en géoarchéologie : le cas de la Méditerranée orientale du 4e au 11e siècle de notre ère

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Notre communication se positionne dans deux axes de recherche : l'archéologie navale et la biogéographie historique. Le sujet est défini géographiquement en Méditerranée orientale, du 4e au 11e siècle ap. J.-C.
C'est à cette période que s'opèrent des innovations techniques et technologiques dans la construction des navires - innovations connues sous l'expression de « *Revoluzione navale* » pour reprendre l'appellation de Giuliano Volpe. Les caractères les plus explicites sont les passages d'une "architecture bordé premier" à une architecture "sur membrure", avec l'introduction généralisée de la voile triangulaire. Ces innovations auraient provoqué des conséquences importantes sur l'économie, la navigation, le commerce maritime, ainsi que sur l'évolution des ressources forestières et des processus de désertification en Méditerranée orientale.
Cette évolution technologique s'accompagne d'un changement d'exploitation et d'approvisionnement des essences de bois, adaptées au nouveau mode architectural des navires dit "sur membrure". Au regard de cette évolution, l'hypothèse d'une diminution des surfaces boisées au Moyen-Orient à la fin de l'Antiquité tardive serait envisageable. Sur ce point, les sources historiques des géographes arabes comme *Al-Içt'akhrî* (4e/10e siècle) ou des textes juridiques comme la *Lex Rhodia* (6e/7e siècle) nous fournissent des indications sur la gestion des territoires et de leurs ressources.
Nos problématiques initiales sont donc de comprendre quelles sont les causes des modifications de la répartition des zones boisées en Méditerranée ? Quels facteurs ont déterminé ces changements ? S'agit-il des conséquences des nouvelles conditions économiques, politiques et technologiques, et/ou s'agit-il du résultat de fluctuations environnementales durant cette période ? De même, existe-t-il un processus de désertification visible dans le bassin oriental de la Méditerranée ?
Le sujet de cette communication s'inscrit dans la continuité des travaux antérieurs en géoarchéologie. Il propose de nouveau protocole d'analyse, notamment par l'utilisation du bois des épaves pour appliquer une transversalité entre les sources géographiques et les sources historiques. Nous tenterons de démontrer que le bois des épaves est l'un des rares objets archéologiques à analyser simultanément les contextes environnementaux, techniques et économiques ; avec respectivement des analyses dendrologiques et xylologiques, une analyse architecturale des navires, une évaluation de la qualité des éléments architecturaux et enfin une étude de la cargaison. Nous pouvons tirer de l'analyse des épaves des données archéobotaniques et des paléoindicateurs qui nous fournissent de précieuses informations sur la diffusion et l'évolution du couvert végétal au Moyen - Orient. Nous pouvons également retracer la filière économique du bois : de l'approvisionnement en forêt jusqu'à son exploitation architecturale.

ALEXANIAN Nicole[1], BEBERMEIER Wiebke[2], BLASCHTA Dirk[1], RAMISCH Arne[2], SEIDLMAYER Stephan Johannes[1], SCHÜTT Brigitta[2]

The discovery of the lower causeway of the Bent Pyramid and the reconstruction of the Ancient Landscape at Dahshur (Egypt)

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The vast necropolis of Dahshur is one of the largest pyramid cemeteries of the Old and Middle Kingdom (2,600 – 1,700 BC). The cemetery is located in the desert, approximately 30 km south of Cairo. The most prominent monuments are the Red Pyramid and the Bent Pyramid, which were erected by King Sneferu and three pyramids of the 12th Dynasty.
The pyramid complex of the Bent Pyramid was excavated by Ahmed Fakhry from 1951 to 1955. From his excavations, the basic layout is known, including the pyramid and its temple as well as a stone-built causeway linking the pyramid precinct to a lower temple. From Fakhry´s plans, it was also evident that a lower causeway, built from mud brick, led up from the valley to the temple. However the course and design of this lower causeway remained unknown until now.
The German Archaeological Institute took up this issue again in 2008. Based on a magnetometric survey, drill core soundings and excavation trenches, it was possible to ascertain the existence of this lower causeway deep below the present surface on the floor of the *wadi* which leads up to the temple. The vaulted causeway is preserved to a height of 3 m. Coming from the temple after 140 m it leads into an U-shaped area by 90 x 145 m which is defined by mudbrick walls. This area is possibly to be interpreted as a harbour basin such as it is known from later pyramid complexes.
Geomorphological and sedimentological investigations made clear that the *wadi* changed its shape fundamentally in historic times. During the Old Kingdom, it was much deeper, approx. 6 m below the present surface, and led up to the site of the lower temple in a steep course. It was not until the period between the Old Kingdom and the Ramesside period that the wadi was levelled to its present shape through aeolian (wind) events. It also became obvious that the appearance of the natural wadi was intensely altered by human impact. The floor levels of the basin will be discussed in the light of floodplain and settlement levels.

AMR Mohamed Sabry Mahsop[1]

Human impacts on the coastal landforms of the Nile Delta, Egypt

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The initial state of the coastal plain of the Nile Delta can be inferred from many data sources such as old topographic maps, historical charts and archeological literatures depict a lesser degree of human impacts since the predynastic period. Recent geomorphological studies concerning the coastal plain of the Nile Delta using TM and MSS Landsat images (1986-2003), aerial photos (1955-1983), and topographic maps (1940, 1967, 1983, 1991) accompanied by field studies revealed that the human impacts greatly varies between slight and sever through the time. Coastal landforms were widely exposed to human modification since the beginning of the 20th century. During the last two decades sever deterioration has been occurred along different sectors of the coastal plain leading to hazardous events which can be summarized as follows:

- Changes of the shoreline accompanied with erosion versus accretion, especially for navigation and property damages.
- Removing of the foredunes that have been quarried and used for establishing resorts.
- Shrinking of the coastal lagoons to be reclaimed for aquaculture.

It is so important to monitor the rapid changes of the coastal dynamic and to put a national strategy for coastal management.

ASHMAWY ALI Aiman[1]

Tell Basta (Egypt): ancient topography and architecture

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This study aims to detail the results of a group of trenches which were dug during the development project of the site of Tell Basta together with some earlier trenches and excavation of the Supreme Council of Antiquities (S.C.A.), the trenches inside the Tell represents; a big trench for the new administrative building, along trench for the site museum and a long trench for the parking place and cafeterias. The trenches to the north of the site include, a very long and deep trench for the modern drainage system for the city of Zagazig, and some other trenches for modern houses, while the southern trenches in the Tell include three deep trenches dug early in 2000 for modern houses, those besides modern SCA excavation covering the whole southern part of the site parallel to the great temple of Bastet.
The results derived from those trenches allow us to reconstruct the landscape and topography of the site, it also helped re-identify the function of one of its buildings namely the so-called palace of the middle kingdom. It shows that the city of Tell Basta like many other delta sites grow on different turtle-backs or *geziras* , it is clear now that the northern part of Tell Basta was a high sand mound which was used as a burial ground for the city from the old kingdom onwards ,while the city itself extended to the south and east of this mound ,the excavations and trenches has proved also the presence of two canals that issue from the Pelusiac Nile branch and run to the north and south of the site ,which agree perfectly with the description of the city by Herodotus . It proved also the presence of a harbor and maybe a sacred lake which was provided by water through an artificial canal which issue from the canal to the south of the site. As for the so-called governor palace, it is clear now that the main entrance should be located to the north and not to the south; since all the other buildings and all the old, middle, and new kingdom tombs around it are located to the north. It was reached through the northern canal of tell Basta. It is suggested also that the building is a mortuary temple since the area was occupied with tombs continuously since the Old Kingdom and the Egyptian were not in a habit of building domestic buildings among the cemeteries, also the stone objects discovered inside the building including statues of the priests of Bastet and a door lintel represents Amenemhet the 3rd during the sed-festival proves it is a temple rather than a palace.

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Exploring palaeogeographic conditions at two Palaeolithic sites in Pylos, SW Aegean, Greece, by means of Optically Stimulated Luminescence dating

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This paper employs Optically Stimulated Luminescence (O.S.L.) dating on sediments associated with two archaeological sites located in Messenia, southwestern Greece, to reconstruct Pleistocene chronology and palaeogeography. The coastal areas of Messenia exhibit evidence of hominid exploitation during the Middle Palaeolithic period. Archaeological surveys have located at least two sites on preserved Pleistocene fossilised dune and beach deposits that stretch along the modern shoreline. Chipped stone assemblages were identified eroding out of palaeosols incorporated into the dunes. But the two assemblages do not share obvious technological characteristics. The assemblage from one site contains artefacts that typologically can be assigned to the Levallois Mousterian, which is associated in the Balkans with *Homo sapiens Neanderthalensis*. The lithic assemblage from the other site lacks distinct typological features and hence is more difficult to assign to a chronological period.

Global sea-level underwent dramatic fluctations throughout the Pleistocene. This has been well documented in the marine isotopic record. Fortunately, a well-preserved sedimentary record of eustacy throughout the Quaternary exists in Pylos. Within this framework of environmental change, Palaeolithic sites, which are presently coastal, might have not been as such during stages of sea-level change during the Pleistocene. Palaeolithic exploitation strategies would have been significantly restrained by such geological processes, encouraging hominids to adapt to new distributions of resources. But the current lack of absolute dates for the Pleistocene restrains the chronological correlation between anthropogenic strata and Late Quaternary geologic events.

O.S.L. dating directly dates the time of sediment deposition. Previous efforts to date the artifact-bearing sediments at these sites were unsuccessful. Nevertheless, recent developments in O.S.L. dating procedures such as the Single Aliquot Regenerated Dose (S.A.R.) protocol and the Thermally Transferred O.S.L. (T.T.-O.SL.) method can sufficiently overcome the complications encountered earlier. Using new O.S.L. dating methods, we attempt to connect traces of hominid activity, as preserved in the Pleistocene sediment facies, with climatic stadials/interstadials of the later Pleistocene derived from already published oceanic isotopic curves (Oxygen Isotope Stages). Ultimately, these data will permit the successful reconstruction of certain phases of Pleistocene regional palaeogeography.

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Abusir Lake (Egypt): myths and reality

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Abusir is one of the famous pyramid fields from the Old Kingdom Egypt and it is located some 30 km south of Cairo. It is known, above all, as a burial place of several 5th Dynasty kings. Its southern part, Abusir South, was in Ancient times an entrance part to the cemeteries of Saqqara and Abusir. The geological background of the site was formed mainly during the Eocene-Pliocene and the Pleistocene, and represented by what is known as tafla and by sands with gravels cemented together by lithification, respectively. The site of Abusir is situated at the northern tip of the so called Abusir Lake which has traditionally been supposed to exist here in antiquity and being used for ancient Egyptian funeral processions. But, what are the sedimentary and geomorphological evidence for the existence of Abusir Lake? How the Lake functioned during the Old Kingdom Period? There are known historical photographs and drawings of the area of Abusir Lake, while covered by water surface. It is obvious that long ramps were connecting the area of the lake with the cemeteries of Abusir and Saqqara. There is ample historial evidence indicating that there existed at least seasonal lake in the area. This situation is reflected through proxy data from contemporary Old Kingdom tombs, title "priest of Heqet" of high officials that were buried in the area and some others. Similar evidence may be also found during the Late Period.

In 2005 Czech expedition excavated four squares at the edge of the Abusir Lake. The surface of those squares was at the altitude of 20 meters above the sea level. The water table was found at a depth of 18 m.a.s.l. In the same depth were preserved gravels with tilled pavement constructed on it. According to the associated pottery finds, the pavement may be tentatively dated to the Third Dynasty. One can see fluvial destruction of that pavement and fluvial sands deposited above the pavement. The uppermost part of the best preserved and less influenced square A is composed of very fine aeolian sands with organic matter rich fine grained layers. Minimally two phases of erosion were described in the section of the square A, which explain quite a small amount of the material covering the Old Kingdom pavement.

The question is why the water table in this area is so high while the water surface of Nile River is at the altitude of 12-13.5 meters? Were the fluctuations of Abusir Lake connected with the Nile River fluctuations? This fact has to be connected with the background geology and with the function of the local hydrological system. Usually, the depressions in the foreland of escarpments, often in combination with tectonic faults as well as pans within or at the end of paleodrainage systems generated in Tertiary are reliable to be supplied with a water surplus of pouched water table. The area of Abusir Lake was one of those examples, supplied by the underground pouched water table, which was probably responding favourably to the Nile River fluctuations. So during the Nile river fluctuations the area was "flooded" but not necessarily connected with Nile River. Current geological conditions, especially the water permeability of regional bedrock have to be taken into the account to be able to apply further modelling and understanding of the function of this hydrological system.

BEALBY Marsia[1]

We journey up the storied Nile; the timeless water seems to smile: Why Nilotic landscapes inspired Minoan Art*

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In Egyptian artistic terminology, a Nilotic landscape is a riverine scene with abundant plant and animal life, much of which is native to Egypt. Painted depictions of the Nile have been attested to Egypt since the Predynastic Period. However, the wild beauty of Nilotic iconography has always exceeded the borders of this country and its culture. So far, numerous scholars have approached various artistic aspects of Egyptian Nilotic representations in the Second Millennium BC, and how these have influenced the iconography and thematology of Minoan frescoes on Crete and Thera. This study will not only refer to painting influences in frescoes; it will expand on other finds, providing examples of Minoan decorative elements, pendants, seals, etc., in which the impact of the Nilotic flora and fauna is explicit. Most importantly; throughout the discussion of the evidence, the research seeks to explore the reasons why the Minoans were so keen on receiving artistic inspiration from the landscape of the river Nile.

**The rhyme in the title is taken from the poem 'Along the Nile' by Henry Abbey (1842-1911)*

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Landscape evolution of the necropolis of Dahshur (Egypt)

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The necropolis of Dahshur is located at the eastern fringe of the Western Desert close to the flood plain of the Nile River, approximately 30 km south of Cairo. The necropolis is dominated by ancient monuments, first of all the Bent Pyramid, the Red Pyramid (both Old Kingdom) and the Pyramid of Amenemhat the 3rd (Middle Kingdom). The present landscape is characterized by an escarpment orientated N-S, parallel to the Nile valley, in which tributaries incised.
The research history of the necropolis of Dahshur dates back to the late 19th century and focused on its meaning as a sanctuary. Since 2001, several auger corings were conducted along the margin of the Nile floodplain and in the channel-beds of its tributaries to locate the pyramid town of the Red Pyramid and to trace the causeway of the Bend Pyramid down the valley. Beside the localisation of the northern pyramid town, the core profiles show that the relief of the necropolis underlay significant changes since ancient times. These changes were driven by two main processes: accumulation of Nile alluvial deposits and deposition of aeolian sands, the latter mainly in the *wadi* beds.
The aim of the geoarchaeological project presented here is to study the landscape evolution of the necropolis of Dahshur. A special focus is set on the time slice of the Old Kingdom. In doing so, we analyse the structure of the drainage network of the pyramid plateau and compare it with the drainage network characteristics of the adjacent catchments. As input parameter of this Geographic Information System (G.I.S.)-based analysis a digital elevation model based on the 1:5000 topographic map is used. The analysis of the catchment parameters shows that significant differences exist between catchments located in the pyramid area in comparison to adjacent catchments and *wadi*-systems. Hereby, we will combine the morphometric data with geomorphological, archaeologicical and sedimentological field data and present evidence that the relief of the pyramid area can be hardly explained taking into account only fluvial processes or processes like gully erosion or soil erosion. For the area of the pyramid plateau a direct anthropogenic relief forming influence has to be considered.

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Petra's Engineered Landscape. Age and impact of the terraces surrounding the Nabataean Capital

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Virtually every feasible square meter of the diverse landscape of the Petra region in Jordan has been terraced, channelized, in some way modified for irrigation or agricultural purposes. However little is known about the chronology, development and dynamics of this cultural landscape. This study (ongoing fieldwork from 2009) presents the first results of radiocarbon dating and stratigraphic and sedimentological investigations of terrace fills in this area. Emphasize is given to the specific problems of dating terraces and the impact of the arid land reclamation and sedentarization on landscape stability and soil processes. Radiocarbon dates of charcoal from the terrace fills range from 963 ± 39 cal BC to 1118 ± 57 cal AD in the Wadi Beida catchment next to Petra and 79 ± 32 cal AD to 183 ± 70 cal AD within a terrace fill near the Wadi Musa - Wadi Araba confluence. Results of current laboratory analysis of the related sediments will reveal if those dates coincidence with geomorphological indications of human occupation.

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First archaeobotanical data from the ancient town of *Dionysias* (Qasr Qarun, NE Egypt)

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The second season of the "*Dionysias* Archaeological Project", conducted by the University of Siena in collaboration with the Egyptian Antiquities Service, started in 2010 with the main goal of investigating new archaeological sources in the Fayum region (NE Egypt).
The aim of the present contribution is to add knowledge to the reconstruction of the ancient environment, with a particular focus on the origin and kind of the natural resources used in the Ptolemaic town, its relation with the Qarun Lake and the possible location of irrigation channels.
The Fayum is one of the depressions of the western desert, being connected to the Nile Valley through the Bahr Yusuf channel, it is a part of the Nile region. The whole Fayum area measures 1700 km^2, its climate is dry, with high temperature and evaporation values, low humidity, and almost no rainfalls (14 mm/yr). The average temperatures range from 29.5° and 14.5° C.
The ancient town of *Dionysias*, later named Qasr Qarun, was located near the western edge of Lake Qarun (the modern name of Moesis Lake) in the Fayum region. The town was discovered by a Franco-Swiss archaeological team during the 1940s and 1950s. An epigraphic survey was conducted in 1976 and since then it has been the object of several restoration projects. The site is located 4 km to the W of the salted lake of Qarun, between 0 and 3 m a.s.l.. It is now in a full desert context, to the W of the Bahr Qarun irrigation channel, created in the 1900s in order to make the surrounding soils suitable for cultivation, as they were probably in the past. In fact, it is known that the Qarun was a freshwater lake, which surely favoured the development of a vegetation cover around the town of *Dionysias* under a more humid climate. The history and historical geography of the town of *Dionysias* and its environment, during the time period from the foundation by the Ptolemaics until the abandonment (6^{th} century AD), is still rather unknown. The only existing building is the temple devoted to the crocodile Sobek god, built in limestone blocks and probably dated to the Ptolemaic epoch (from the 3^{th} to the 2^{th} century BC), even if never investigated in detail. The town of *Dionysias*, spreading towards the north and south of the temple, is mostly in ruins a part from a few structures that are worth mentioning. In particular, in the northern sector of the town, a few oil presses are found, some of which of big dimensions and with an internal chamber conceived for the pressing and for the oil-water separation. The analysed wood and charcoal samples were collected in the Sobek temple (wood fragments from the northern chapel and from the door of the northern stairs) and in a decantation basin (some charcoals).

BELLAVIA Valentina[1], DI PASQUALE Gaetano[2]

First archaeo-anthracological evidence of *Juglans regia* in North-West Africa

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The archaeological excavations directed by the University of Siena, in cooperation with the "Institut National des Sciences de l'Archeologie et du Patrimoine" of Rabat, from 1999 to 2006, in the site of *Thamusida* (Moroccan Atlantic coast), allowed to discover the history of its development essentially between the 6th century BC and the 7th century AD. The charcoals of *Juglans regia* were found in layers dated to the period comprised between the 3rd century BC and the 1st century AD. The only palaeobotanic data of *Juglans regia* in North Africa relate to the pollen analyses by Reille and Ben Tiba (Western Rif; High Central Atlas; High Eastern Atlas; Medium Atlas Morocco; Kroumirie, Tunisia), by Ballouche (Eastern Morocco), and by Roubet in Algeria (Grotte Capellette, Aurès).
However *Junglans regia* appears in low amount in most recent times, suggesting its human origin. On the basis of such pollen data, the presence of walnut in Northern Africa was traditionally believed a men introduction. According to Quezel (2003), walnut spread nowadays only in few areas of Morocco (Rif and High Atlas) as the wild state of ancient cultivations. Only Ballouche (1991) suggests an indigenous origin of *Juglans regia* since in the pollen profile from Moyenne Moulaia walnut is present in the first and medium Holocene. Our anthracological data could rework the history of *Juglans regia* in North Africa, strongly suggesting an autoctonous provenance of this *taxon.* The ongoing ^{14}C dating of charcoals will provide more detailed information on the chronological setting.

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Le paysage, témoin de l'assise temporelle de la ville

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L'émergence de nouvelles références essentiellement qualitatives dans le développement urbain orientées vers des préoccupations de type environnemental s'exprime par la reconnaissance du paysage en tant qu'élément qualificateur de l'espace. Ce dernier contribue à l'affirmation de l'identité d'un territoire à appréhender, tant en termes de matérialité que de vécu. L'approche du paysage se traduit par de nombreuses recherches qui impliquent un regard pluridisciplinaire permettant de cerner d'une manière globale les relations complexes de l'homme avec son environnement à partir des données historiques, naturelles et de la mémoire du lieu. Il s'agit de lieux dotés de sens, de paysages nés de l'interaction entre l'homme et son milieu dont la valeur patrimoniale émane des représentations et significations que lui attribuent les habitants.

Cette présentation suggère des dimensions essentielles du paysage tant concrètes que subjectives. Dans le cas présenté ces dimensions sont imbriquées et indissociables. En effet le paysage de Bejaia résulte de l'imbrication des éléments naturels, de la diversité des temps d'expressions architecturales qui témoignent d'une des occupations humaines les plus reculées et d'une évolution par stratification et apports successifs des différentes civilisations méditerranéennes qui ont façonné son territoire depuis les Phéniciens jusqu'à la colonisation la plus récente. L'interprétation du paysage de Bejaia permet de rendre compte de sa singularité par rapport au milieu dans lequel il s'insère.

Nous proposons l'identification et la qualification patrimoniale de ce paysage à partir des vestiges soulignant la présence des différentes phases du développement urbain de la ville et de la mémoire collective qui tend à ne plus exister. La lecture de ce paysage nous renseigne sur l'aménagement ancien qui l'a produit, sur son adaptation aux caractéristiques naturelles, sur la topographie d'un site exceptionnel et sur la pérennité visuelle et fonctionnelle qu'entretiennent la ville et ses habitants depuis des millénaires avec des composantes paysagères majeures comme la mer, l'arrière pays montagneux et la vallée dans laquelle serpente la rivière de la Soummam. Elle fournit des éléments de compréhension de sa physionomie actuelle et des informations sur les significations et les valeurs à sauvegarder qui sont essentielles pour orienter son évolution ultérieure vers le qualitatif.

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Les rivières du bassin de l'Hadramawt à l'Holocène (Yémen) : des preuves d'un fonctionnement tardif

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Un travail de terrain a été réalisé dans le bassin versant de l'Hadramawt au Yémen (2004-2005) dans le but de documenter l'évolution de la dynamique et des formes fluviales des *wadis* Masila, Washa (aval), Erda, Sabia, Thawda, Dbl, Khun, Khudari et Sokhora et de mieux caractériser les forçages anthropiques récents associés à la pratique de l'irrigation et à la mise en place des « anthrosols ». Le cadre chronologique s'étend de la fin de la dernière période glaciaire, correspondant à un hyper-aride dans la péninsule arabique, à l'Actuel. Les schistes et les calcaires Paléocènes (Formation d'Umm-ar-Rhaduma) donnent les escarpements sommitaux des vallées incisées en canyons. Les schistes, marnes, et gypses de la Formation de Jeza (Eocène) couronnent les interfluves. Ces sédiments ont alimenté le remplissage des *wadis*, via le ruissellement et l'action éolienne. Dans l'axe des vallées affluentes du *wadi* Masilah, les lits actuels fonctionnent comme des oueds à charge de fond caillouteuse. Les études régionales antérieures (paléohydrologie, pollens, spéléothèmes) ont mis en évidence à l'échelle régionale la césure entre un Holocène ancien/moyen humide (8000-3500 av. JC), associé à un positionnement plus septentrional de la zone de convergence intertropicale (ITCZ) renforçant la circulation de la mousson indienne humide sur l'Arabie méridionale, et un Holocène moyen-récent aride, marqué par quelques pulsions plus humides, associé au retrait vers le sud de cette même ITCZ. Dans la péninsule arabique, les lacs disparaissent entre 4000 et 3500 av. J.C., attestant de bilans hydriques nettement déficitaires. Les sociétés d'agriculteurs des basses terres développent des stratégies adaptatives comme l'irrigation pour rester dans leur territoire, sans doute dès la fin du 3^{e} millénaire. Le débat sur les modalités et les rythmes du changement climatique majeur de l'Holocène moyen apparaît encore contradictoire (abrupt ou progressif ?) car les données continentales bien datées sont encore trop peu nombreuses et souvent très disloquées par les dynamiques érosives de l'Holocène récent. Des écoulements fluviaux assez réguliers semblent cependant perdurer dans l'Hadramawt au-delà de la rupture holocène moyen et de l'assèchement des lacs arabiques. Ils impliqueraient un régime pluviométrique encore partiellement alimenté par la mousson indienne.
Les apports de notre étude sont les suivants :

- Les loess carbonatés déposés à la fin du Pléistocène ont été entraînés par le ruissellement dans les fonds de vallées lors d'épisodes humides de l'Holocène : il en subsiste des lambeaux de formations sablo-limoneuses à paléosols, d'une puissance de 3 à 24 m selon les éléments du système fluvial.
- L'exhaussement accéléré des plaines alluviales s'amorce autour de 5000 av. J.C., au Néolithique, au cours du second optimum humide de l'Holocène.

- Une crise hydrologique majeure est perçue dans les bassins tributaires du Masila : le Sokhora et le Dbl, en amont de Makaynun, autour de 2800 av. J.C. Elle concerne également le *wadi* Masila alors marqué par une aggradation verticale sableuse sur plusieurs mètres. Ce phénomène pourrait illustrer en Arabie méridionale un évènement détritique déjà perçu dans les lacs et les fonds des océans à l'échelle du Proche et du Moyen Orient, associé à l'affirmation de l'aridité.
- À la fin de la période de sédimentation fine, une phase de ravinement par une nappe grossière a été repérée quasiment partout. Sa mise en place inaugure le déblaiement des formations fines dans la plupart des vallées étudiées, et le début d'un cycle d'enfoncement des oueds jusqu'à la situation actuelle.
- Sur le site de Makaynun, l'hydraulique d'irrigation a été installée sur le remblaiement fin préexistant au dépôt des limons d'irrigation dès la fin du second millénaire av. J.-C. Des installations hydrauliques antérieures au 2^{e} siècle av. J.C. sont également observées dans la partie aval du *wadi* Erda. Le véritable forçage anthropique sur l'alluvionnement fin des fonds de vallées (« anthrosols ») apparait surtout prépondérant à partir du début du 1er millénaire avant J.C. (expansion de la culture sudarabique). Les enregistrements pédosédimentaires antérieurs seraient avant tout sous contrôle climatique. L'impact de l'aléa hydrologique sur la gestion hydraulique sudarabique est perçu à plusieurs reprises par l'envahissement des réseaux par des nappes sablo-graveleuses destructrices. La confrontation des données sur la gestion hydraulique et les territoires agraires de Makaynun avec les données géoarchéologiques documentant leur histoire temporelle et les oscillations paléohydrologiques permettra l'élaboration d'un modèle relationnel de co-évolution entre la société sud-arabique et son environnement.

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Geoarchaeological survey in Naga, Central Sudan

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The site of Naga is located in the semi-arid region along the fringe of the north-eastern Sahel and the eastern Sahara desert, and actually the archaeological excavation is under progress. The remains of this Meroitic city are located in central Sudan, 150 km north of Karthoum and 50 km south of the Nile River. During its heydays the city has been a highly developed central place, with a high population and an economic culmination from about 300 BCE to 300 CE. Naga is the target of archaeological research since several decades and since 2008 of geoscientific investigations.
The recent climate conditions are characterised by an insufficient precipitation/runoff ratio for a perennial discharge in the *wadi*. One goal of the project is therefore to answer the question: how the water supply of the city was organised? Was there a higher water availability in ancient times due to a different climatic setting in the region - or were the inhabitants able to compensated the water deficit by using high sophisticated water harvesting techniques?
To distinguish between these possibilities different geomorphological and hydrological methods, coupled with geophysical- as well as high precision terrain data, were applied and moreover the analysis of sedimentary records and a broad analysis of modern climate and hydrological data was performed. The results are used as input for high resolution modelling of the (palaeo-) drainage and landscape-evolution. We will present the preliminary results of geomorphic evidence of the investigated archives, as well as geomorphic processes.
Altogether palaeoenvironmental reconstructions provide crucial information for archaeological purposes, as they play a key role for answering questions about living conditions and natural resources.

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Approche géoarchéologique et données paléoenvironnementales préliminaires de sites antiques situés dans le bassin versant de l'Oued Hatab (Tunisie centre ouest) : enregistrements des deux derniers millénaires

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Situé au centre ouest de la Tunisie, le bassin versant de l'Oued Hatab couvre une superficie de 2200 km^2, il est positionné entre les trois anciennes villes romaines de *Sufetula,* d'*Ammeadara* et de *Thelepte* et abrite dans son cours moyen la ville de *Ciluim*. La prospection géoarchéologique associée à l'exploitation de l'Atlas archéologique de la Tunisie a permis de relever la richesse archéologique de cette région où de nombreux ouvrages de différentes périodes (romaine, vandale et byzantine) sont encore visibles. L'ensemble de ces structures témoigne de l'importante de l'occupation du sol et des aménagements qui y furent entrepris : construction de barrages, de citernes, d'aqueducs, d'huileries, de villages, etc. Ces installations coïncident avec de profondes transformations dans la politique impériale vis-à-vis de l'Afrique proconsulaire, en particulier dans les régions méridionales et occidentales.
L'étude morpho-stratigraphique de certains sites archéologiques permet d'établir une première chrono-stratigraphie des formes et des dépôts accumulés antérieurement et/ou postérieurement à l'occupation des sites étudiés. Nos recherches révèlent des positions stratigraphiques variées qui témoignent d'une dynamique sédimentaire et fluviale très active de l'Oued Hatab et de ses affluents : les modifications climatiques holocènes et les changements radicaux de l'occupation du sol sont ici avancés pour expliquer ces phénomènes d'alluvionnement. L'approche géoarchéologique fondée sur une approche interdisciplinaire nous a permis de reconstituer l'évolution des paysages (paléo-topographie, et paléo-hydrographie) et de retracer les modes d'occupation du sol de certains sites archéologiques. En complément, les données sédimentologiques, pétrographiques et pédologiques ainsi que les datations de céramiques et les datations par le radiocarbone indiquent une tendance générale vers l'installation d'un climat semi-aride avec une sédimentation forcée par des crues violentes et à charge solide importante, entrecoupée par des phases d'incision permettant l'emboîtement des formes fluviales et la ramification croissante du réseau hydrographique.
Le développement du chevelu hydrographique constitue aujourd'hui une menace sérieuse pour ce patrimoine archéologique puisque l'érosion hydrique affecte plusieurs sites situés sur les rives de l'Oued Hatab.

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Représentation et gestion des « accroissements » (προσγενήματα) dans l'Égypte hellénistique et romaine d'après la documentation papyrologique

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De l'Antiquité à la construction du haut barrage d'Assouan, la crue annuelle du Nil contribua à faire de la vallée et du delta du même nom des environnements fluviaux très dynamiques. En plus de fluctuer au rythme de l'inondation annuelle, le paysage égyptien était l'objet de dynamiques sédimentaires constantes qui, bien que d'amplitude variable en fonction des crues et des lieux, n'en contribuaient pas moins à faire des rivages du Nil des environnements fondamentalement mouvants.

À cet égard, la terminologie agro-fiscale en vigueur aux époques hellénistique et romaine montre comment les contribuables autant que l'État étaient conscients de l'instabilité des rives du Nil et de ses défluents et soucieux de gérer les risques leur étant associés. Ainsi les papyrus grecs de cette époque font-ils notamment état d'une catégorie de terres déplacées nommées « accroissements » (προσγενήματα). À partir de l'analyse de l'ensemble des sources relatives à ce type de terre riveraine, la présente contribution s'interrogera sur leur signification du point de vue de la mise en valeur des particularités riveraines nilotiques ainsi que de la gestion de ces environnements à risque.

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Ancient harbours and high energy events signature

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The study of sedimentary records in harbour basins allows ancient palaeoenvironments to be reconstructed. In the field of "factual geology", ancient harbours are particularly conducive in recording extreme environmental events. Although the sedimentary record of these phenomena does not constitute the major part of the sedimentary deposits, they are, nevertheless, common in the stratigraphic column. Their recording and preservation depends on depositional conditions, sedimentary formation, process magnitudes and the preservation potential of these deposits during time. Harbour basins are generally confined and protected areas. They are located in low-energy environments like coves, estuaries or lagoons, and/or in semi-artificial environments resulting from human activities. In these conditions, extreme natural events are very well preserved because they contrast with fine-grained harbour sediments. Here, we discuss two types of high-energy events: tsunamis and storms. These two events result from different phenomena; storms result from meteorological phenomenon whilst tsunamis are triggered by tectonic, volcanic or gravitational causes. These two events, however, are recorded in the sedimentary record in a similar manner.
Sedimentological, malacological and chronological results from two harbour sites (Fréjus, Var, France; Istanbul, Turkey), attesting to at least one high-energy event, will be presented. Fréjus' Roman harbour is located on the distal margin of a Holocene ria. The study of three cores taken in the harbour basin has facilitated the palaeoenvironmental reconstruction of this site. A core deriving from the middle of the basin and situated in the access channel presents a coarse sediment layer in the fine-grained harbour facies. On the basis of bio-sedimentological analyses, this sediment unit has been interpreted as a high-energy event, perhaps a storm. In Istanbul, Theodose's the 1st harbour, also called "Yenikapi" was been built in 390 AD on the Marmara coast. The eastern Mediterranean Sea is an active tectonic region that has witnessed many seismic events and tsunamis. The archaeological excavation of "Yenikapi" harbour has elucidated the stratigraphy of this site. Harbour facies constitute fine-grained sediments typical of a protected port. A tsunamigenic sediment layer dated to 553 AD using ceramics and radiocarbon dates covers this facies. According to historical sources, an earthquake was recorded in 553 AD on the Marmara coast.

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De l'eau dans un désert : le site d'El Deir à l'Holocène (dépression de Kharga, Égypte)

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Une recherche interdisciplinaire a débuté en 2008 dans les environs du site d'El Deir situé au nord-ouest de la dépression de Kharga en Égypte. La contribution géographique à cette recherche vise à comprendre les conditions naturelles de l'alimentation en eau sur le rebord ouest du plateau qui s'étend entre la Dépression et la vallée du Nil, sur le tracé d'une importante route d'axe ouest-est. Cette région du désert occidental égyptien reçoit actuellement moins de 5 mm d'eau en moyenne annuelle. Une question scientifique importante est celle de l'alimentation en eau de cette micro-région depuis 4500 ^{14}C yr BP, c'est-à-dire depuis le passage du Pluvial Holocène à l'hyperaridité, les secteurs favorables étant réduits à quelques oasis disposant d'aménagements hydriques au sein de la dépression (Ain Manawir, Tell Douch, par exemple). La démarche de recherche a combiné le recours à l'imagerie satellitale à haute résolution (SPOT) et aux levés de terrain. La géomorphologie structurale, les surfaces d'érosion emboîtées et les formes karstiques ont fait l'objet de travaux antérieurs (secteur d'El Rufuf notamment). La recherche en cours précise ces données à grande échelle. Un Système d'Information Géographique est mis en place pour traiter l'ensemble des données en cours de recueil.

Les deux premières missions de terrain réalisées ont apporté les éléments suivants :

- La caractérisation de la topographie et de la structure, notamment la mise en évidence de plusieurs phases tectoniques datées de la fin du Crétacé et du Tertiaire (plis et failles).
- La caractérisation des formes d'érosion par pédimentation et déflation, l'ensemble conduisant à la cartographie de la mosaïque d'unités de territoire homogènes.
- La localisation précise des sources artésiennes, déjà connues par la littérature. Ces sources sont liées aux remontées de l'eau souterraine contenue dans le grand aquifère des grès de Nubie qui a lentement épuisé ses capacités artésiennes après le Pluvial. Ce secteur est caractérisé par la présence de sources artésiennes qui ont été exploitées par des forages du début jusqu'au milieu du 20^{e} siècle.
- La délimitation et de premiers résultats sur le fonctionnement d'une playa de piémont (caractérisée par un écoulement holocène et par des dépôts limono-sableux d'origine fluvio-éolienne).

La compréhension du fonctionnement artésien depuis la fin du Pluvial holocène est un des objectifs de ce programme de recherche qui concerne plusieurs périodes d'occupation du territoire.

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The Late Pleistocene of the Eastern Desert of Egypt - Geoarchaeological Research

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The talk at first introduces the project ´Out of Africa – Late Pleistocene Rock Shelter Stratigraphies and Palaeoenvironments in Northeast Africa` as part of the German Collaborative Research Centre 806 ´Our Way to Europe: Culture-Environment Interaction and Human Mobility in the Late Quaternary` (www.sfb806.de) that started in the year 2009.
Understanding the movement of modern humans through and out of Africa from the centre of origin in Northeastern Africa is a major research issue in palaeo-sciences. The primary movement of modern humans out of Africa must have occurred before 90 000 years ago, as the earliest modern human remains outside Africa have been found in the Levant, at Qafzeh and Skhul and date to 90 000 years ago. The 'Northern Dispersal Route' through Egypt to the Levant has been identified a likely route Out of Africa and is the focus of our research project. It is thought that the habitat expansion that accompanied the interglacial period of OIS 5e relaxed ecological constraints to such a degree that the movement of modern humans through the Eastern Desert of Egypt towards the Levant became feasible.
The archaeological evidence shows that there was a population expansion in northeastern Africa in OIS 5e. However, except for some marine records (Red Sea, Arabian Sea) and a few sites in the western desert, there is a lack of precise terrestrial dating evidence and scant information about regional climatic changes. Archaeological sites dating to OIS 6 are rare, but Middle Stone Age or Middle Palaeolithic stone tool assemblages that date to OIS 5 occur in notable densities in the Nile Valley, Western and Eastern Desert. These stone tool assemblages have been classified as the 'Nubian complex' industry and are typified by the Levallois production system, small bifacial foliates, and Nubian points. Most of the sites discovered in the Nile Valley and the Eastern Desert are open air special task sites, e.g. for quarrying chert cobbles. Living sites in this time range are rare, but close to Quseir in the Eastern Desert, such a site, Sodmein Cave, occurs. Sodmein Cave preserves stratified deposit of more than 4 meters dating to the Late Pleistocene. The lowermost levels at Sodmein Cave are associated with the Nubian complex and have been dated by thermoluminescence to 118 ± 8 ka. Although the hypothesis is widely accepted that dispersal processes in the Late Pleistocene was strongly influenced by the environmental and climatic conditions, the geo-archives for environmental and climatic conditions have not been integrated with the archaeo-archives of behavior at the Last interglacial because of a lack of sites with suitable stratigraphies. Sodmein Cave, researched by the Belgian colleagues Moeyersons, Vermeersch and Van Peer, provides an ideal opportunity for the integration of the archaeo- and geo-archives within a stratified context. A geoarchaeological approach will be followed in which methods like stone tool technological analysis; digital elevation models and GIS-based analysis are combined in an effort to understand the role that the topography and

palaeoenvironment of the Northern Dispersal Route could have played in the dispersal of modern humans out of Africa.

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Little Ice Age impacts on fluvial dynamics in the Lower Roussillon coastal plain (Gulf of Lion, Western Mediterranean) and its consequences on Medieval to Modern societies

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During the last Millennium, the lower Mediterranean alluvial plains experiment major hydrological, sedimentological and geomorphological changes as recorded by abundant literature.In particular, the period comprised between the middle of the 12th century AD to the middle of the 19th c. AD corresponds to a period of high sedimentation rate, drainage reorganization – lobe avulsion and fluvial metamorphosis around the Gulf of Lion.
Hereby, we propose to discuss the possible relationship with a climatic control for such changes, with a special reference to small coastal Pyrenean Rivers (Agly, Têt, Réart and Tech Rivers). High chronological resolution based on both radiocarbon and archaeological dating let us to propose a relation with rapid climate shifts associated with the Little Ice Age period.
In the Gulf of Lion, Little Ice Age effects on the fluvial system seem to be early, *i.e*. initiating during the second part of the 12th c. AD, generally considered as a period of transition between Medieval Climatic Optimum and Little Ice Age. A first period of general aggradation occurs during the beginning of the 13th to the 15th c. AD. Major changes are recorded during the second part of the 16th c. AD to the beginning of the 19th c. AD. This period could be considered as the "sever phase" of this climatic and environmental crisis. Since the 1920s, rivers rapidly incise they course into the valley floor, marking the end of this major step in the building process of the deltaic alluvial plain.
The timing and processes are compatible with a secular to infra-secular climatic control, associated with Little Ice Age cooling phases documented in the western Mediterranean area.

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Fluvial landscapes dynamics and societies-environment interactions in the lower Sebou River plain during the Late Holocene (Gharb, Morocco)

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This study focuses on, 1/ responses of fluvial environments to climatic and anthropogenic changes, during the Late Holocene, 2/ edification processes of lower alluvial plains, and 3/, societies-environment interactions in alluvial contexts. These interdisciplinary works are integrated in the A.N.R. program "Eau Maghreb" and French-Moroccan cooperation (I.N.S.A.P. and other Moroccan organisms).
The sector of study is the lower plain of the *Sebou River* named *Gharb plain* (length: 80 km; width: 45 km). Hydrosedimentary flows come from a watershed (40 000 km^2) extending partly on *Rif Mountains* and *Middle Atlas Mountains* (Northern Morocco). The flow regimen of the *Sebou River* is under Mediterranean influences. During the last century, it induced floods of high frequency, magnitude and spreading in the *Gharb plain*.
Methodological developments join a fluvial geoarchaeology approach. Morpho-sedimentary archives are studied in and out archaeological sites. An integrated and multiscale approach is based on crossed studies: geomatics [D.E.M. analysis (S.R.T.M. data), remote sensing (Landsat, SPOT), G.I.S.], morpho-stratigraphy and sedimentology (organic matter, silicates and oxides, carbonates rates; grain size deposits; magnetic susceptibility; accumulation rates of mineral matter), archaeology (surveys and excavations) and chrono-stratigraphy (relative chronology, radiocarbon datings). Palaeohydrographical and palaeohydrological evolutions were reconstructed.
First results reveal a strong potential of the morpho-sedimentary archives for reconstructions of Holocene hydrogeomorphological and landscapes dynamics (voluminous alluvial store, dilated sedimentary series, organo-mineral deposits, strong facies variability). The plain is structured as a mosaic of heterochronous sedimentary bodies. During the Late Holocene, its construction was associated with levees developments and avulsions of *Sebou River* and *Beth River*, and with backswamps alluviation. During historical times, strong vertical and lateral aggradations are observed at the level of *Sebou River* levees (significant alluviation and numerous meander cut-off). The impact of past hydro-sedimentary dynamics on the current heterogeneity of archaeological potential is discussed. A strong spatio-temporal variability of fluvial activity and landscapes was contemporary of pre-Roman, Roman and Islamic settlements. Episodes of lower fluvial activity, leading development of alluvial soils, alternated with episodes of higher fluvial activity, leading overbank fine deposits aggradation. Mass accumulation rates of mineral matter were very strong during historical periods. The impacts of climatic and anthropogenic driving factors, associated with autocyclic dynamics, are discussed. Settlement dynamics in the lower Sebou River plain by roman societies is set against fluvial landscapes dynamics.

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The Last-glacial/Interglacial transition in Northern Greece: consequences on physical environments and implications for human populations

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Across the Mediterranean Basin, the glacial-interglacial transition (15,000-6,000 cal. BP) is the transition from hunter-gatherer societies of the Upper Paleolithic and Mesolithic Final companies to Neolithic farmers. In Epirus (northwestern Greece), the lack of archaeological sites is obvious for this period: only two cave sites have yielded Upper Paleolithic occupations and one open air site was dated to the Mesolithic. During the Lateglacial and the Holocene, climate fluctuations have caused major palaeogeographic changes on the coastline evolution and the river dynamics. The prehistoric remains in a continental environment cannot be easily found: they were either destroyed by marine erosion during the post-glacial fast sea-level rise, or they were buried by sediment accumulation. The study we are conducting, as part of a PhD in geoarchaeology, tries to better understand the response of the deltaic areas in northwestern Greece.
Our study focuses on two specific areas: the delta formed by the Thyamis River (also called Kalamas R.), and the inlet between the island of Corfu and the mainland. The first was not yet investigated for palaeoenvironmental reconstructions. Likewise, archaeological research in the watershed is lacking. The second study area is of paramount importance to understand the impact of the post-glacial rebound on the prehistoric and archaeological maps: initial investigation indicates that this space was occupied by a lake that ceased to function around 10,000 BP. The paper presents preliminary results on the paleogeographic evolution of the delta Thyamis. In June 2009, combined measures of Electrical Resistivity Tomography (E.R.T.), seismic refraction and Ground Penetrating Radar (G.P.R.) profiles have established the thickness of the Holocene sedimentation: around/circa 15 meters at the upstream of the delta. To better understand the prehistoric and historical evolution of this space, a first series of 8 cores was conducted in conjunction with the geophysical investigations. Preliminary results of sediment analyses and microfauna identifications allow us a first reconstruction of the delta that still needs to be dated. Two cores of reference allow us to calculate rates of sedimentation. The results will be compared with against the existing data from Greece and Italy and particular attention will be paid to present the advantages of expanding this type of study across the lower valley of Thyamis.

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Holocene climatic changes and their impact on the landscape and human society behaviour: case study from 6th Nile Cataract, Sudan

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In 2009, the Czech Institute of Egyptology, Charles University in Prague, and the Institute of Geology, Academy of Sciences of the Czech Republic, carried out a geoarchaeological research in the area of Sabaloka and the 6th Nile Cataract. The objective of the research was to attain better understanding of the history of the Nile, climatic changes in the Holocene, and their impact both on the landscape and the human society.
One of the main tasks of the geoarchaeological research was to study the sedimentological record of the Nile alluvial zone. The area included in the study covers approximately 25 km of the Nile banks within the Sabaloka gorge and by the 6th Cataract. The alluvial plain within the gorge is generally 5 m above the water level and at some places extends over tens of meters. The first stage of the research is supposed to provide a general idea about the degree of deposition and erosion within the Sabaloka gorge, about the age and possible climatic record hidden in the alluvial deposits, and the degree of anthropogenic influence. In addition to the sedimentological research, the area of Sabaloka was studied also from the point of view of raw materials distribution and extraction and previous occupation. As for the raw materials, the area represents an important centre from which raw materials were acquired mostly for the production of Palaeolithic, Mesolithic, Neolithic and younger artefacts. The amphibolitic granitoids of the basement complex were often used as grinding stones, but the main local materials are the silicified sandstones up to 100 m thick at the plateau of Jebel Rauwiyan and the microgranites, trachytes and vitreous volcanics of the Ring complex, which were extracted at a number of sites mostly from Lower to Late Palaeolithic.
The archaeological record of the area seems to be dominated by a chain of "terraced villages" (habitation structures on man-made terraces) of Post-Meroitic or later date that are interconnected by a network of routes. In some cases, the villages are located on the places of earlier, most often prehistoric sites. Other types of sites observed during the survey include cemeteries, isolated graves, stone features, occupation scatters, stone quarries, and buildings (fortresses) of various ages.
A number of environmental and archaeological methods (including dating, sedimentological research, micromorphology, phytolith analyses, palynology, archaeological prospection and mapping) were applied in the geoarchaeological research at Sabaloka. Preliminary results of the research will be presented in this paper.

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The dykes of Memphis (Egypt): rereading classical sources through historical cartography and remote-sensing techniques

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The present paper arises from an interdisciplinary teamwork research that assembles philological, archaeological and geographical competences. It consists of a preliminary study on the presence of ancient hydraulic works, resulting from the analysis of historical cartography and satellite imagery of Middle Egypt and, in particular, around the ancient city of Memphis. At first glance, the complexity and the extent of this system suggest to reconsider our understanding of ancient hydraulic engineering and rural economy in dynastic Egypt. Evidence of the existence of seasonal basins called Bahr Batn, mentioned by the members of the French mission (1798-1799) and withdrawn in eighteenth-century cartography was found. In addition long and transverse dykes that bordered these ancient basins, still in use until Muhammad Ali's land reform, were traced. Their functioning was already described by early scholars, but a precise idea of the real extent of this system lacked. The application of remote-sensing techniques integrated using historical cartography allowed the mapping of most of the dykes' network.
In particular, this study focuses on two of these barrages: the Great Dyke of Hawd Magrur Qushayshah (about 6 km in length), which bounded the southern limit of the Memphite *nomos*, and the dyke–basin system of Birkat al Malik at Dahshur (4 km), that could be identified with the Memphite dyke described by Greek writers and, according to tradition, attributed to the legendary king Menes.
Remote-sensing data processed consist of several panchromatic images from the Corona satellite (US military declassified data), multispectral Landsat datasets (L1 M.S.S., L5 TM, L7 ETM) covering time interval from 1973 to 2003 and multispectral ALI EO-1 satellite images from 2003 and 2004. This dataset provided a large overview of changes recently occurred in this area. As an example, the Corona satellite imagery (1963-1966) has been used to map a portion of the dykes' network and at the same time has been employed to highlight topographical features that nowadays have almost totally disappeared, obliterated by modern urban sprawl, such as basins, banks and channels.
The fact that the evidences deriving from the analysis of remote-sensing data cannot be directly dated could be overcome by considering their relationship to known historical entities, such as ancient *kawms*, pyramid complexes and other archaeological features. In the light of these evidences, ancient records such as inscriptions, classical accounts and papyri concerning the restoration of these works could acquire more significance and reliability. Nevertheless it is important to remark the preliminary nature of this work whose results must be verified by means of ground surveys.

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Surveying the cityscape of Roman *Ammaia* (Alentejo, Portugal)

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Simultaneous with the on-going archaeological excavations of the Roman town site of *Ammaia* in Southern Portugal, a group of researchers of the universities of Ghent, Évora and Cassino has, during these past years, been doing a geo-archaeological and topographic survey of this ancient city and its territory. A combination of fieldwalking, geomorphological analysis and the study of aerial photographs has allowed to reconstruct almost completely the circuit of the city walls, to identify several elements of the Roman street pattern, to suggest a plausible hypothesis for the location of the major roads connecting the town to its hinterland, to locate several possible buildings and infrastructures in the suburban area (e.g. theatre, aqueducts) and to suggest the identification of several funerary monuments along the roads entering the urban area. Integrating the survey evidence with stratigraphic data from the excavations it was also possible to approach questions about the taphonomy of the site and in particular its erosion history.
In April 2009 a European project, called "RADIO-PAST", was launched within the Marie Curie framework "Industry-Academia Partnerships and Pathways" (http://www.radiopast.eu/). This project aims to join resources and different skills to tackle each possible aspect connected with "non-destructive" approaches to complex archaeological sites. The research consortium has chosen an "open laboratory for research and experimentation" in and around the abandoned Roman site of *Ammaia* and aims to further elaborate the first geo-archaeological campaigns on this site. With as one of the prime objectives the scientifically correct, high resolution and digital reconstruction of the cityscape of a Roman town, the RADIO-PAST team is currently applying an integrated methodology. This involves a wide range of field survey techniques, such as geomorphologic, pedological and topographic survey, geophysical prospection, vertical aerial photography interpretation, high resolution LIDAR scanning and innovative low altitude aerial photography, as well as new strategies for data processing, modelling, 3D visualisation and site presentation. The results obtained so far give reason to believe that the full intra mural town plan can be revealed and understood in its ancient landscape setting, limiting the necessity for grand scale and costly excavation procedures, but at the same time allowing a 3D view of the townscape and opening perspectives on a sustainable touristic exploitation and cultural valorization of a complex site.

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Kouphonisi (Grèce) : une étape incontournable entre la Crète et l'Afrique

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À l'extrémité orientale de la Crète, la cité d'Itanos fait l'objet, depuis 1994, d'un programme d'exploration de la ville et de son territoire, sous la direction de l'École française d'Athènes et de l'Institut d'études méditerranéennes de Réthymnon (Crète). La situation particulière de la cité implique qu'elle soit naturellement tournée vers la mer et qu'elle entretienne des rapports privilégiés avec l'Égypte. À l'époque hellénistique, lorsque la cité est menacée par sa voisine Praisos, entre 270 et 260 av. J.-C., une garnison lagide est installée, qui est maintenue jusqu'à la mort de Ptolémée VI Philometor en 145 av. J.-C.
Alors que le territoire d'Itanos occupe le nord de l'extrémité orientale de la Crète, la petite île de Kouphonisi, située au sud, fait partie des possessions de la cité. Au milieu du 2e siècle av. J.-C., elle se trouve au coeur d'une querelle territoriale entre Itanos et sa nouvelle voisine Hiérapytna, qui revendique également sa possession. Cet îlot aujourd'hui désertique a connu un développement important aux époques hellénistique et romaine. Son importance stratégique est soulignée par l'implantation d'une seconde garnison lagide.
L'île, par sa situation géographique, occupe une place privilégiée dans les relations entre la Crète et la Cyrénaïque ou l'Égypte. Une étude des vents et des courants permet de montrer un certain degré d'exclusivité par Kouphonisi dans le trafic entre la Crète orientale et la Cyrénaïque. En effet, si en été le *meltem* facilite les relations Nord-Sud, le retour vers la Crète est une longue route passant nécessairement par la côte levantine et Rhodes. Mais à l'automne, grâce au « tourbillon d'Hiérapetra », une route directe est disponible qui aboutit seulement à Kouphonisi, ce qui expliquerait l'acharnement des Itaniens à conserver ce minuscule territoire éloigné.
Par ailleurs, on étudie une implantation humaine dans un milieu actuellement hostile mais qui ne l'a pas toujours été. L'île possède une plaine centrale cultivable où la gestion de l'eau peut être retracée grâce à un aqueduc et des citernes qui sont conservés ; le plateau qui porte le temple au sud de l'île montre de nombreuses structures liées à l'agriculture, murets et aires de battage. Un peu à l'Ouest du temple une vaste zone d'habitat a été rapidement parcourue. En l'absence d'une prospection détaillée au sol, l'analyse de photographies aériennes a amélioré notre connaissance de l'île.

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Les travertins anthropiques, archives sédimentaires de l'interaction entre l'Homme et son environnement : l'exemple du complexe romain sanctuaire/thermes/source thermale de Jebel Oust (Tunisie)

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Les travertins préservés sur le site archéologique de Jebel Oust (Tunisie) présente un intérêt majeur dans le cadre d'une étude géoarchéologique. Le site, situé à environ 30 km au sud de Tunis, comprend une zone cultuelle, implantée directement à l'aplomb d'une cavité hydrothermale, un édifice thermal alimenté par l'eau de la source antique par le biais d'un aqueduc, et une zone de résidence accolée aux thermes. Le substrat calcaire de la région rend les eaux de source saturées en carbonates, créant ainsi des dépôts superficiels de type travertineux. L'exploitation de la source de Jebel Oust par les Romains a ainsi généré la formation de travertins carbonatés dans l'ensemble des structures archéologiques dans lesquelles elle circulait, depuis la cavité hydrothermale, probablement aménagée par les romains lors de la construction du deuxième état du sanctuaire au 2^{e} siècle ap. J.-C., jusqu'en aval au niveau du complexe thermal. Nous proposons ici de démontrer l'influence de l'Homme sur la formation de ces travertins et sa gestion du fonctionnement hydrologique d'une source d'eau chaude.

La caractérisation physico-chimique de ces travertins anthropiques a permis de définir plusieurs faciès, correspondant à des environnements de dépôt différents. D'un aspect très lité dans le remplissage sédimentaire de l'aqueduc, nous passons à une certaine diversité de faciès dans les thermes. En effet, si dans certaines piscines, les dépôts sont extrêmement laminés, ils présentent dans quelques salles servant de bassins de refroidissement un faciès sans lamination particulière, mais avec une cristallisation radiale des carbonates. Enfin, un travertin à lamines oranges est interprété comme la fin du fonctionnement thermal en tant que tel, lorsque l'eau n'est plus gérée mais continue à circuler dans l'édifice.

En outre, l'analyse des isotopes stables de l'oxygène et du carbone, ainsi que l'analyse des teneurs en éléments majeurs et traces des travertins permettent d'apporter certaines informations quant à la nature de l'eau thermale antique, et de proposer des reconstitutions de la température des différents bains utilisés par les romains.

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Influences des Centuriations Romaines sur les dynamiques hydriques et éoliennes en Tunisie centre orientale

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Les paysages tunisiens sont profondément marqués par d'imposants héritages archéologiques parmi lesquels on trouve les traces des Centuriations romaines. Ces dernières structurent le paysage et ont une influence géomorphologique par leurs conséquences sur les dynamiques hydriques et éoliennes dans un milieu semi aride.
En Tunisie centre orientale, le cadastre romain est particulièrement visible. Malgré les effets de plus de quinze siècles d'occupation agricole, ses traces marquent encore certains traits du paysage tunisien et offrent un riche registre non encore décrypté en matière de paléogéographie et d'évolution des environnements au cours des temps historiques. Ce cadastre a de notoires effets paysagers structurants, mais ses expressions physiques sont très discrètes sinon imperceptibles sur le terrain. Une étude de cas en Tunisie centre orientale permet de dégager l'influence de ce cadastre sur les actions hydriques et éoliennes. Celles-ci se traduisent sur les Centuriations romaines, par des formes et des dispositions révélatrices en termes géoarchéologiques à l'exemple des mosaïques culturales, des amorces de ravines et galeries de suffosion orientées, les distributions contrôlées des aires d'éolisation.
L'originalité de ce travail est de montrer l'interaction entre des dynamiques géomorphologiques et les orientations du cadastre, mais aussi de proposer au moyen de la géomorphologie, une nouvelle approche de localisation des Centuriations romaines, en se fondant sur des données simples et en l'étayant par l'analyse des documents aériens multi dates, des cartes à thématiques variées, des images de synthèse Google Earth, des prises de vue au sol ainsi que de l'Atlas des Centuriations romaines de la Tunisie.

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Sad-i Didegan: geo-archaeological aspects of an Achaemenid check dam in the hinterland of Pasargadae (Fars, Iran)

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In recent years, non-intrusive intra-site research as well as emergency excavations in the larger area of Pasargadae have considerably complemented our comprehension of this "empty" Achaemenid capital and its supposedly semi-nomadic surroundings. Further off-site evidence of infrastructural investment in the region and the existence of a proper rural countryside is supplied by a set of five monumental Achaemenid check dams, all located in the smaller valley beds and highland plains surrounding the palatial centre.
Out of the different dam-sites under review by the joint French-Iranian project at Pasargadae, the case study of Sad-i Didegan, one of the best preserved dams is presented. The site is that of an earth and boulder built gravity dam, measuring up to 70 m in width, 130 m in length and 21 m in height, equipped with an ashlar built canal at the base of the dam. Constructed on the course of a perennial river, the Sad-i Didegan dam functioned as a seasonal check-dam to prevent downstream flooding and violent erratic flash floods. Main focus is on both the archaeological and geomorphological characteristics of the site. Special attention is focused on the crucial elements of site location and the mapped pre-dam geomorphologic situation, allowing a full appraisal of the main monument's construction fashion and date, its sourcing material and the invested labour expense. Finally, both the hydrological and sedimentological impacts of the site during its functioning and post-failure period are evaluated.

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Roman gold exploitation in the Tagus River valley - the *Conhal* of Arneiro (northeast Alentejo, Portugal): a geoarchaeological case study

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Results of geaorchaeological research conducted in the ancient territory of the Roman town of *Ammaia*, located in the northeastern Alentejo region (central eastern Portugal) are here presented. Focus is placed on the Roman exploitation of gold on a site named *Conhal*, situated on the left bank of the Tagus (Tejo) River in the extreme north of Ammaia's territory. The research consists of three major parts: (1) identification of anthropogenic landforms, (2) their interpretation in order to explain their role in the gold mining process, and (3) the dating of the exploitation. In order to tackle these research questions, it was vital to apply and integrate a range of methods, techniques and knowledge base from different (sub)disciplines: archaeological survey and excavation, classical literature study, geomorphology, sedimentology, geochronology (O.S.L.-dating), numismatics, malacology, palaeontology, G.I.S.-modelling, etc.

This type of integrated study of a Roman gold mining area can be considered the first one in the Portuguese Tagus River valley to be published. It proves that large volumes of terrace coarse fluvial deposits were systematically exploited here during Roman Imperial times. This moreover occurred on an industrial scale, i.e. by one of the earliest forms of hydraulic mining. Over a surface area of 0.6 km², the topography was lowered by 10-15 metres, corresponding to a processed volume of 6-9 x 10^6 m³ auriferous sediment. The gold extraction left behind a radically modified landscape, which has largely been preserved up to the present-day. The authors hope that the presented study is a stimulus towards more research on other, not yet investigated or yet unknown, ancient industrial landscapes in this resource-rich area, and towards the protection and preservation of these important heritage sites.

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L'apport de la toponymie à la restitution du tracé de la branche occidentale du Delta du Nil (Égypte)

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La branche la plus occidentale du Nil, vecteur de circulation des provinces occidentales du Delta, a contribué à l'importance économique de la zone, à partir du Nouvel Empire, notamment par le développement de l'activité vinicole, ainsi que l'attestent les nombreuses « étiquettes de jarres ». Elle est également un axe ayant joué un rôle politique majeur aux époques tardives, permettant la circulation des armées d'Apriès, d'Amasis et d'Inarôs. À l'époque gréco-romaine, elle est le lien direct entre Memphis et Alexandrie, comme le montrent les papyrus mais aussi les récits des auteurs classiques.
Le corpus des « inscriptions géographiques », recouvrant les soubassements des temples égyptiens, comporte des processions qualifiées d'« hydrologiques » (ainsi la procession ornant le soubassement du portique du temple de Séthi I à Gourna). Celles-ci apportent des informations essentielles pour la restitution de l'hydronymie et de l'organisation géographique du Delta, à condition d'être complétées par d'autres sources, en l'espèce les documents d'origine locale. Dans le Delta occidental, cette documentation laisse trace de plusieurs dénominations majeures, « le fleuve de l'Ouest », « le Grand fleuve » et l'« Eau de Ptah », ainsi que de nombreux canaux secondaires. Le réexamen de certaines sources et la vision en longue diachronie permettent d'apporter quelques précisions nouvelles sur l'hydrographie de cette partie du Delta.
Cette communication vise donc dans un premier temps à déterminer les différents noms qu'a pu porter la branche la plus occidentale du Delta du Nil, depuis le Nouvel Empire jusqu'à l'époque romaine, en observant les sources variées et en déterminant les différents éléments marquant son bassin. Ce réexamen permet notamment de montrer que l'« Eau de Ptah » est un surnom religieux du « Fleuve de l'Ouest », donné au Nouvel Empire et ne survivant guère à celui-ci, et correspondant à un tracé plus occidental que l'actuelle branche de Rosette. L'« Eau de Ptah » correspond en effet, *a minima*, à un tracé conduisant de Memphis aux environs d'Imaou, et dont on trouve peut-être encore la trace dans la toponymie hellénistique et romaine, dans le nom de Mômemphis. Il s'agit également de déceler, dans la toponymie locale, les éléments permettant d'apporter des précisions sur son tracé (vignobles, liaisons avec des canaux secondaires, passage à proximité de villes localisées par l'épigraphie, etc.). Pour terminer, l'observation des itinéraires fluviaux consignés sur les papyrus grecs permettra de confirmer le tracé approximatif de la branche la plus occidentale du Nil jusqu'au 3^{e} s. av. J.-C.

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Isotope contents and origin of water at Pikrolimni Lake: A Natron source in ancient Greece?

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One of the basic and essential materials used in antiquity for the production of raw glass was natron (Na_2CO_3 - soda). The only sources of natron known to exist up to now are in Egypt and it was therefore assumed that natron was imported for glass making in the Aegean. However, Pliny mentioned that "at Clitae in Macedonia it is found in abundance the best, called soda of Chalestra, white and pure…". Moreover, the amount and the purity of glass objects that are found in Roman and later times in Macedonia are vast and this makes the possibility for a source of natron in Greece plausible. A possible location known to produce a white deposit in Macedonia is the basin of the lake Pikrolimni in the area of Kilkis where a spa and installations for mud baths exist. The lake is located 20 km to the NW of the town of Thessaloniki (in the region of Macedonia, Northern Greece). The geochemical conditions that are responsible for the formation of "chalastraion nitron" in the basin of Lake Pikrolimni were investigated. Pikrolimni is a saline lake that is characterized by alkaline brines. Water samples were collected from a spring and a borehole in the thermal spa of Pikrolimni, as well as brine samples were collected from the lake for isotopic analysis. This study shows in total that the conditions that are responsible for the formation of soda seem to be present in the basin of Lake Pikrolimni and confirm Pliny's description.

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Tyr et Alexandrie, deux villes sous Alexandre Le Grand

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En s'appuyant sur les concepts de la géographie définis par Jacques Lévy et Michel Lussault dans leur dictionnaire de la géographie et de l'espace des sociétés, les présentes recherches proposent une comparaison de deux villes arabo-méditerranéennes : Tyr au Liban et Alexandrie en Égypte. Notre recherche confronte les paysages urbains de ces deux villes tout en les considérant comme lieux de médiation (de relation de la société à son environnement). Il apparaît nécessaire d'associer les notions d'espace politique, social, architectural et urbanistique avec les notions de paysage. Ces notions de paysage basées sur la théorie du paysage comme définie par Pierre Donadieu, Yves Luginbühl et Alain Roger. La relation entre l'usager de l'espace de Tyr et d'Alexandrie et leur écoumène sera déterminée, ce qu'Augustin Berque propose de nommer « médiance ». À travers plusieurs périodes de l'histoire, ces deux civilisations ont partagé des destins communs ainsi que des destins divergents. On leur associe souvent le nom d'Alexandre Le Grand qui assiégea Tyr puis reconquit l'Égypte et donna son nom à Alexandrie. Ces deux îles transformées en presqu'îles avec le temps renferment des sites classés par l'Unesco comme patrimoine mondiale.
Elles sont, tour à tour, passées sous domination grecque, romaine, byzantine, perse et arabe. En premier lieu, sera retracé brièvement leur passé lointain qui est toujours présent à travers les vestiges archéologiques ainsi que dans des mythes. Que reste-il de ces vestiges et de ces mythes ? Quel rôle ont joué les orientalistes (les récits et les tableaux) dans l'invention de l'imaginaire de ces deux villes? Cette question sera traitée dans une approche culturaliste de la notion du paysage. La deuxième partie sera consacrée au contexte actuel de ces deux villes, quel rôle a l'une et l'autre dans le paysage méditerranéen. On s'intéresse aussi aux espace ouverts de Tyr et d'Alexandrie, les jardins, les corniches… quel espace public offre-t-elles ? Un espace homogène ou un espace de mixité ? Quelles activités s'y pratiquent ? Pour quels usagers ? Sera évoquée la variété des populations aux niveaux religieux à Alexandrie et à Tyr ainsi que le brassage culturel qu'elles ont subit.
La méthode de travail est basée sur la lecture minutieuse des travaux de chercheurs comme Robert Ilbert et Jean-Charles Depaule, ainsi que des orientalistes du 19^{e} siècle. L'analyse des transformations des deux villes est envisagée à travers l'observation des changements des plans et des paysages urbains des deux villes.

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The role of environment on civil architecture in Rosetta (Egypt) during the ottoman period: a comparative study with Istanbul (Turkey)

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This study is about the effective of environment on the façade form in the civil architecture in Rosetta" palaces and houses" at the ottoman period, and the role it played in choosing materials used in building or decorating those façades. This study will also focus on the civil architecture located on the banks of the river Nile, on the coast, or in their vicinities. Moreover, it will examine its role in role to forming and decorating those facades, in addition to its effect in distributing the interior units, which are affected by several factors, such as the desire of the founder, and the availability of a place to build them, close to river Nile.
Due to the similarities between Rosetta and Istanbul, which are both located on the mouths of a river (Nile and Bopsorus), overlooking the coasts of Mediterranean and Marmora Sea, we decided to compare the architectural façades of palaces and houses of both cities, aiming at examining the role of the environment in designing and decorating these façades. Moreover, the study will try to find the similarities and differences between the architectural elements of the facades of both places.

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Mid- to late Holocene expansion of Eastern Mediterranean coastal plains: the case study of Akovitika (Greece)

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The Eastern Mediterranean delta plains represent areas of major geomorphic and ecological changes which are controlled primarily by eustatic sea level rise, human impact on the environment, neotectonics and climate fluctuations. In many nearshore alluvial realms the relevance of shoreline mobility and altered sediment fluxes for decision making in antiquity and the rise and fall of famous cities has been studied in detail. The Messenian plain in the SW Peloponnese, Greece, was chosen for a local palaeogeographic case study since the discovery of a Protogeometric sanctuary inside the alluvial plain strongly required well-founded scenarios of landscape change in order to explain its life cycle and its cultural contexts. Previous efforts, though providing informative data, have a relatively low spatial resolution, i.e. a small number of sediment cores are distributed over the entire alluvial plain.
Eighteen sediment cores from inside and the proximate surroundings of the Protogeometric Poseidon Sanctuary of Akovitika as well as a broad spectrum of palaeoecological data (AAS, $CaCO_3$, LOI, orthophosphate, pH, electric conductivity, microfauna, molluscs, pollen, X.R.D.) and chronostratigraphical indicators (^{14}C, datable ceramic fragments) provide the basis for scenarios of landscape change. The stratigraphical pattern reflects the maximum marine transgression around 5,000 BP when the coastline was shifted up to 3 km inland in the centre of the coastal plain and c. 800 m at Akovitika. Subsequent delta growth and expansion of the low-lying alluvial province was triggered by decelerated sea-level rise and increased hinterland erosion due to intensified land use. During the Protogeometric Dark Ages (950-875 BC) the Poseidon Sanctuary was founded at the SE margin of the coastal plain in a slightly elevated position on a fossil beach protecting the site from seasonal inundation. According to stratigraphical analyses, seaward shoreline migration and corresponding expansion of swamps as well as gradual leveling of the ridge-and-swale topography resulted in increasingly hostile conditions and the abandonment of the sanctuary site around 380-350 BC. Further topics of this paper are implications of new local pollen spectra and a discussion of a local relative sea level curve.

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From lake to sabkha – Palaeoenvironmental studies in the Tayma oasis, NW Saudi Arabia

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This paper contains initial results and interpretation of palaeoenvironmental investigations from an oasis site on the NW Arabian Peninsula. North of the oasis, a sabkha – defined as a sediment-filled intra-plateau basin with a flat surface – provides a valuable geoarchive for late Quaternary landscape reconstruction. The study is part of a long-term, multidisciplinary research project of the German Archaeological Institute (DAI), the General Commission for Tourism and Antiquities, Kingdom of Saudi Arabia and the King Saud University of Riyadh aiming at deciphering the rich cultural heritage of Tayma and its broader area.
Palaeoenvironmental interpretations are based on an extended set of vibracores and a multi-proxy approach. The thanatocœnosis of fine-grained organic-rich sediment units in the lowermost core sections indicates the presence of a large perennial lake associated to the pan-Arabian pluvial phase in early Holocene times. Lacustrine conditions persisted at least until the 7th mill. BP when cattle-breeding nomads inhabited the Tayma region. In order to evaluate whether the lake once had an economic value or served fortification purposes we present current data concerning its siltation process in space and time.

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Holocene Palaeogeographical reconstruction of the western part of Naxos island (Greece)

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The study area is located in the western coastal part of Naxos island, situated in the Cycladic plateau. It consists of concaved beach zones separated from small headlands. The embayments were frequently exposed, and their communication with the sea was not perennial.

In this study the tracing of the diachronic palaeo-shoreline shift due to the sea level change and its effect to the palaeo-environment in the western part of Naxos Island is attempted. Sea level changes along with local conditions have been studied and the palaeogeographical evolution during the Upper Holocene has been verified.

In order to project a curve of sea level rise that will contribute to the reconstruction of the shoreline of the western part of Naxos, 7 boreholes have been taken into account along with geomorphological, paleontological, sedimentological investigation and radiocarbon datings.

The constructed sea level curve of Naxos indicates a sea level rise 0.77 mm yr^{-1} the last 6000 years and it seems that there is a correlation with the one predicted by the glacio-hydro-isostatic model. During upper Holocene the coastal area was wider with many active lagoons and embayment changing from shallow marine environment to coastal environment frequently alternating to brackish mesohaline one.

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A Geographic Information System transportation model in Cemetery En Echelon (Giza, Egypt)

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No man made streets or routes are known in the cemeteries of the Giza plateau (Egypt) either because their existence was not recognized in the course of archaeological excavations, or because the records of such features are still unpublished. Within the limits of our current knowledge, it could be assumed that the road network in the Giza cemetery consisted of natural routes which were created by the constant passage of men and animals which compacted the ground and clearly marked the way. The tracks of those routes would have been bordered by the existing buildings in the occupied areas of the cemetery.
The present paper is concerned with modeling a network of routes for the Giza plateau with a G.I.S. software, concentrating our analysis on the area of Cemetery En Echelon. Even long before the evolution of the modern location theory, the preliminary evaluation of the economics of energy consumption must have played a central role in decisions concerning choosing the location of tombs. Energy consumption during tomb construction included the quarrying of materials, the costs for transportation and the effort expenditure related to the digging of substructure and the building of superstructure. The present research focuses thus on analyzing the cost and energy consumption associated with the transportation of stone from an optimal quarry in Giza plateau to the construction sites in Cemetery En Echelon**.**

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Remote Sensing of the Hydrologic History of Southern Egypt

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The region of the Gilf Kebir in southeastern Egypt has never been thoroughly mapped in terms of the landforms and subsurface signs of past climates conducive to human occupation. As part of NASA's Space Archaeology program, we are generating new maps of the paleohydrology, topography, geomorphology, and surficial deposits of the area and developing GIS-based models which use the data to pinpoint past resources and travel pathways. The maps we are generating will constitute a unique resource for exploration for archeological sites in the Gilf Kebir and other regions of N Africa as well as other applications in hydrology, ecology, geomorphology, and tourism.

That the Sahara was favorable for human habitation at times has long been known. With the remarkable paleo-landscape revealed by the L-band (25 cm) Shuttle Imaging Radar-A in 1981, it became clear that ancient humans concentrated along integrated drainage systems dubbed "radar rivers" by Jack McCauley and his colleagues. However SIR-A and subsequent long-wavelength radar coverage was limited and regional understanding of the drainage network has remained elusive. A complete map of the buried channels of the region could also prove useful for development of water resources in southern Egypt and northern Sudan.

We are mapping the area with three sensors optimized for mapping and characterizing arid regions: The Japanese PALSAR L-band imaging radar, NASA's S.R.T.M., and ASTER. Together these sensors allow characterization of surface and subsurface landforms formed and modified by former wetter climates. A mosaic of PALSAR images uses as a base the topographic map produced by the Shuttle Radar Topography Mission, flown in 2000. S.R.T.M. also produced C-band images, similar to those being produced by Europe's ERS and Envisat and Canada's Radarsat satellites which, despite their shorter wavelength (5.5 cm) and thus decreased penetration capability, have been used for mapping buried Sahara drainages. An advantage of the S.R.T.M. C-band images is that they are inherently registered to the topographic data and provide full, mosaicked coverage. A global hydrologic net, Hydrosheds, has been generated from the S.R.T.M. D.E.M. and released by the U.S.G.S. Some of the drainage lines in this data set are related to the ancient river valleys, indicating some surficial manifestation of their presence. This could be due to incomplete burial, sagging of the mantling sediment, or a small amount of penetration of the S.R.T.M. C-band radar signals. A third data set, visible-near infrared to thermal IR images from ASTER and Landsat TM, is being used for mapping surficial landforms and vegetation. These wavelengths are sensitive to surface composition including rock types, weathering phenomena, and soil types. We are using ASTER to map the spectral signatures of calcium carbonate, travertine, playa clays, and other signs of springs and lakes found throughout the area.

**Part of this work was done under contract with NASA*

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Climate changes and Human/Environment interaction in Puglia Region (South-East Italy) During the Neolithic

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Man/environment interactions represent a crucial point in the understanding of the cultural and social dynamics, particularly during the Neolithic period. A number of studies have been carried out aiming at this goal, paying attention on several connected aspects (such as settlement pattern, palaeoeconomy, palaeoenvironment, palaeoeconomy etc.) also taking into account their effects on a wide temporal scale.
The Apulia (south-east Italy) is a region projecting in to the Adriatic and Ionian seas. The coastal area borders a variety of hinterland landscapes such as the Gargano headland, a calcareous mountainous area which maximum elevation reaches 1,000 m, the flat Tavoliere (the second largest Italian plain) and the calcareous Murge hills. Due its complex landscape, enclosed in a relatively small area, the Apulia region could offer the rare opportunity to connect, across the time, various environmental features to different exploitation modes.
The research aim is to define the main man/environment/climate interactions during the Neolithic period (6,500 - 4,000 BC) on the basis of available palaeoclimatical palaeoenvironmental, palaeoeconomical and archeological evidence. For this purpose a multidisciplinary approach has been applied, comparing the results obtained through the analysis of a number of natural deposits (off-shore and off-site data) with archaeobotanical investigation (performed on seed/fruit remains) carried out on Neolithic settlements. The results allow us to define the main climate and microclimate features for the examined period; in particular we identify a fluctuation of temperature and rainfall during the second half of the 5th millennium BC. Human response to the environment instability has been discussed in terms of settlements pattern modifications and attainment of specific economical strategies.

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Environmental evolution of the Maryut Lake (Nile Delta) since 3,000 years BP: natural forcings and human impacts

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Our research project aims at understanding how the Maryut Lake has evolved during the past 3,000 years, linked to both human impacts, and variations in Nile discharge and deltaic mobility. This study was funded by the A.N.R. (Agence Nationale de la Recherche) research program Paleomed.

Maryut Lake is a shallow coastal waterbody situated on the north-western margin of the Nile delta. It is 50 km long and lies behind a consolidated sandstone ridge locally referred to as kurkar. Known as Mareotis Lake during antiquity, it was used as a waterway to travel up to 70 km south-west of Alexandria and 50 km south-eastward, or to the Nile Canopic branch via a system of man-made canals.

New sedimentological and archaeological evidence allow us to refine the historical environmental evolution of Maryut Lake. Fifteen stratigraphic sections and an additional five corings, between 1 and 2.5m depth, have been described and correlated. From one selected sedimentary sequence, we used macro and microfauna associations, charophyte remains and mineralogical identification to assess environmental changes in the lake. Ten radiocarbon datings provide a chronological framework.

Before the 10th century BC, the Maryut basin was a lagoon connected to both the Mediterranean Sea and to the Nile. From the 10th century BC to the 8th century AD no sedimentary archives could be found, although extensive topographic and archaeological evidence allow us to reconstruct the basin's contour, its connections to the Nile and lake-level changes during antiquity. A sediment hiatus suggests reworking, possibly linked to human impacts, as the gap corresponds to the most intensive occupation of the whole Mareotis area. After the 9th century AD, sediments record the fluctuating water budget of Maryut Lake, changing from a large brackish lagoon with varying freshwater inputs to a coastal sebkha. Travelers who visited Alexandria from the 15th to the 18th centuries AD have also described similar landscapes. These environmental changes are associated with the infilling of the Canopic branch of the Nile and of the canals feeding the Maryut Lake. Archaeological data suggests that Alexandria's countryside was practically abandoned after the 8th century AD. The interaction between land occupation and Maryut Lake environmental changes has yet to be precisely established.

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Use of Terrestrial LaserScanning (T.L.S.) in geoarchaeology: a case study on Bronze-Age findings from East and Central Crete (Greece)

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Terrestrial Laserscanning (T.L.S.) is increasingly attracting archaeological interest because of its manifold application possibilities, such as digital and non-destructive analysis of cultural heritage and documentation of excavation activities. However, most studies focus on the mere object without considering the link to the surrounding environment. Regarding geoarchaeology, these particular interactions between man and ecosystem are of utmost relevance as they allow for reconstructing ancient landscapes. The paper aims at presenting a new approach for combining digital datasets, archaeological remains and geomorphological information in order to unravel a paleaoenvironmental scenario.
The mountainous karst areas of Crete (Psiloritis and Dikti), along with their sediment-filled depressions, are of special interest in this context, since they represent favorable locations for land use and economic exploitation (agriculture, horticulture, stock breeding). Even though both regions share a long term settlement history dating back to the second millennium BC. (e.g. Bronze-Age villas of Zominthos and Lato, peak sanctuaries, necropolises) only few studies have been conducted here so far due to the remoteness and the isolated location.
Potential geoarchaeological applications of T.L.S. are presented, showing the versatile advantages for surveying anthropogenic remains like walls or drainage systems while taking account of karst morphology and topography at the same time (morphometry of dolines and uvalas, vegetation structure). The subsequent transfer and use of this digital elevation data in G.I.S. analyses allows to derive topographical parameters like slope, aspect or surface drainage patterns, which give additional insights into the spatial characteristics of corresponding locations and might help reveal the reasons for ancient settlement and land use.
All on-site investigations are based on one of the latest 'time-of-flight'-scanners (Riegl VZ-400) with online waveform processing technology. Shadowing effects due to vegetation cover can easily be eliminated by postprocessing. In contrast to conventional scanners, the fullwave format provides a larger amount of terrain information. In addition to other prospecting techniques applied in geoarchaeological studies (e.g. geophysics, sedimentological analyses), T.L.S. may contribute essentially to a comprehensive reconstruction of former landscape processes at the human-environmental interface. Some of these promising prospects will therefore be presented and discussed.

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Avaris (Egypt) in the second millenium: a study of its landscape

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The landscape of Tell el-Dab'a/Avaris as it now appears to the modern viewer is very different from the primeval landscape. Nowadays completely flat, it was then a system of turtlebacks – *geziras* – with eroded depressions between them. Most of these topographic features are no longer visible due to agricultural levelling and modern irrigation engineering. Thus for any archaeological work, the ancient landscape has to be reconstructed. Pivotal studies on this subject were carried out by Manfred Bietak and Josef Dorner, the latter study using auger coring. Since 1999 a geophysical survey (magnetometry) has been realized and this has proved a breakthrough in understanding the topography of the city Avaris. Recently a project was initiated with the University of Lyon to investigate possible harbours.
The results of both the geophysical work and the investigation of the harbours are presented in this paper.

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New perspective on the Phanagorian Regression in Black Sea

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The concept of Phanagorian regression, supposed to correspond to a phase of low sea level situated around 5-5.5 m below the current sea level is dated circa 500 BC. The assumption of this event appeared for the first time in the Taman peninsula and was inferred from archeological and paleogeographical researches conducted around the Greek colonies of the Cimmerian Bosporus and in particular of the Phanagoria site. Underwater and oceanographical prospection revealed the presence of a large number of submerged Greek relics of the classic era, associated with a continental morphology submerged before this period. Identification through core analysis and ^{14}C dating of fossil coastal bars to the west and to the south of the Taman peninsula show that contemporary coastal bars may correspond to sea levels modified by up to 6 m vertical around 500 y BC. This confirms that the apparent sea level changes are tectonically induced on the Taman peninsula. These tectonic movements are initiated by the release of gas from mud volcanoes inherited along anticline axes. Other observations around the Black Sea confirm that areas of submerged archaeological sites or where the Holocene high stand is located above present day sea level correspond to areas where high subsidence or tectonic activities have taken place. Oceanographic research carried out over the last decades in the Black Sea have established that since the Black Sea reconnected with the Mediterranean Sea (at the latest 7,500 y BP), these two marine bodies have been in equilibrium. This leads us to question the existence of the Phanagorian regression as well as the following transgression.

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Découvertes géoarchéologiques et datations absolues pour la reconstitution des paysages méditerranéens

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Cette étude porte sur l'interfluve entre deux bassins fluviaux situés au centre de la Péninsule Ibérique : ceux du Duero et du Tajo. Il comprend le plateau de Sierra de Pela, où plusieurs dépôts travertineux ont été identifiés. L'analyse de ces accumulations carbonatées permet d'acquérir des données plus précises sur les différentes alternances climatiques quaternaires et d'émettre des hypothèses quant aux dynamiques d'occupation. Les Romains ont érigé une triple enclave stratégique près de l'interfluve concerné, située au nord du Sistema Central espagnol : Clunia, Numancia et Tiermes. Les vestiges archéologiques de la cité romaine de Termancia se situent sur un rocher de grès d'âge triasique, auparavant habité par le peuple Celtibère. Les Romains y ont érigé plusieurs travaux d'ingénierie hydraulique afin de doter la ville d'un système d'approvisionnement et de distribution des eaux.

Le propos de cette étude est de déterminer l'âge des dépôts carbonatés, par le biais de techniques de thermoluminescence, afin de mettre en relief le lien entre l'existence de ces dépôts sur le terrain et la présence des premiers groupes humains dans ce paysage. La datation absolue semble confirmer que la source de Pedro nourrit l'aqueduc romain de la cité de Tiermes. Les résultats des analyses permettent d'identifier deux épisodes dans le processus de bioconstruction des tuffs en Sierra de Pela. Les trois dépôts les plus anciens montrent des valeurs d'environ 40 ka, c'est-à-dire, une phase climatique tardiglaciaire du pléistocène supérieur, dans laquelle aucun reste humain n'a été trouvé. Les trois dépôts les plus récents sont datés entre 18 et 13 ka correspondant ainsi au pléistocène supérieur. Ils peuvent être mis en relation avec les premières occupations néolithiques.

En conclusion, les travaux d'ingénierie hydraulique qui persistent dans le paysage et les analyses polliniques effectués dans ce secteur montrent une pression anthropique intense sur l'équilibre des écosystèmes de la Sierra de Pela et en particulier sur certains taxons arborescents (*Pinus sylvestris*) à l'époque romaine.

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Dynamique culturale dans l'évolution des paysages fluviaux méditerranéens

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Cette présentation propose de caractériser les unités de relief des différents paysages fluviaux de Méditerranée, en les mettant en relation avec les nombreuses phases d'occupation historiques. Les principaux éléments géographiques sont analysés, notamment ceux qui ont donné forme à l'évolution anthropique de ces paysages et à sa dynamique culturelle. Dans la plupart des établissements humains l'eau a été le facteur commun d'installation des premiers groupes humains et de développement des cultures. Ces transformations du terrain ont déterminé une adaptation culturelle particulière et, par conséquence, ont défini un genre de paysage précis.

Les restes archéologiques des sites romains qui jalonnent encore la Méditerranée sont souvent rattachés aux sources, d'où le fait qu'ils soient associés aux géosystèmes karstiques. L'Epire romain démontrait une connaissance précise de l'emplacement et de l'importance des sources. Les aqueducs, les citernes et les thermes représentent quelques-uns des bâtiments les plus emblématiques et remarquables de Ségovie, de Mérida et de Tolède en Espagne, de Nîmes et de Lyon en France, de Rome et de Pompéi en Italie, d'Haidra et de Dougga en Tunisie, et enfin de Phaeselis et de Termessos en Turquie.

Depuis le Haut Moyen Âge, la culture arabe méditerranéenne a donné un nouvel élan à l'agriculture, notamment, à l'irrigation des cultures. Depuis le 13^{e} siècle, l'exploitation des sources de la nappe phréatique de Chott El-Djerid et de Nefzaoua a rendu possible l'irrigation des terrains des propriétés dans les palmiers de Tozeur (Tunisie). Pareillement, les oasis du Djebel en-Nebeg, établissements à Midès, Tamerza et Chebika (Tunisie), sont autant d'enclaves qui correspondent à un ancien bastion romain, dont les sources, l'*oued* et le canyon soulignent l'identité de ce paysage de montagne.

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The landscape characteristics of the Neolithic settlement pattern in Central Greece

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The research on settlement patterns and landscape in Neolithic Greece is largely concentrated around Thessaly, a region well excavated and studied. Beyond that few surveys have provided a restricted image of the settlement pattern within their boundaries and mainly in the Peloponnese. This paper aims at synthesizing all the available evidence from Central Greece, providing a diachronic analysis of their development and change. The recent results of the Boiotia survey will also be added and discussed, allowing a broader understanding of the close relationship between landscape and settlement pattern in a wider framework. Central Greece consists of varied geographical characteristics and a broken topography, which form the basis of this analysis. Through this study different patterns emerge with landscape elements such as mountains, caves, valleys, lakes, rivers and coastal areas, playing a prominent role. Additionally, they allow a better understanding of the Neolithic socio-economic conditions and how they changed through time. The picture that will emerge from Central Greece will be compared and contrasted with other contemporary settlement patterns in regions such as Thessaly and the Peloponnese. Hence, broader trends, regional phenomena and older hypotheses will be assessed and highlighted, providing a better comprehension of the relationship between the Neolithic settlement pattern and landscape in Central Greece.

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Nile River evolution in Upper Egypt during the Holocene: environmental implications for the two pharaonic sites of Karnak and Coptos

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This paper aims to detail the results of an original geoarchaeological study, led in Upper Egypt, in the western part of the Karnak Temple and the Ancient Coptos settlement. The geoarchaeological approach applied here helps to better understand the Nile River dynamics in the close vicinity of the two pharaonic sites, 35km apart. Our investigation focused on the jetty discovered by the archaeologists of the Supreme Council of Antiquities in front of Karnak Temple (under the local supervision of Dr. Mansour Boraik) and on the remains of Ancient Coptos (under the authority of Dr. Laure Pantalacci, Ifao).
The methods comprise the study of several stratigraphic profiles and of thirty manual auger boreholes (up to a maximum depth of 5.50m) and percussion drillings (only undertaken at the Karnak Temple, to a maximum depth of 25m below the surface, circa 70 m above mean sea level). Sedimentological analyses which include grain-size distribution (sieving method employed, from 20 to 2000 µm in mesh size) and ~~a~~ magnetic susceptibility study of the different sediments help to identify the Nile River deposits and to reveal the ferromagnetic content of the sediments (200 samples were analysed). In doing so, it was possible to characterise the Nile River deposits and to identify the presence of aeolian deposits (associated to wadi fans) in the lower part of the boreholes in both the Karnak and Coptos sites. The data also clearly indicate the later continuous occupation of Nile River in the neighbourhood of the sites. Fluvial dynamics characterized by flood events, sandy accretions and large Nile silts/clay deposits are presented and discussed here for later palaeoenvironmental reconstruction.
The accurate levelling of the different profiles and boreholes, with the help of a topographic survey, allow us to recover long sedimentological sequences and to correlate the different sedimentary units. Finally, in order to obtain a chronostratigraphic sequence, radiocarbon dates were obtained from charcoal/ash samples (analyses undertaken at the laboratory of radiocarbon dating of Ifao, Cairo, Egypt). The construction of a Geographic Information System (G.I.S.) including the borehole results and the integration of S.R.T.M. data (Shuttle Radar Topography Mission) with the superimposition of False Colour Composition of a LANDSAT ETM+ image helped to obtain a spatial interpretation of the results.

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Reconstructing the Early/Mid-Holocene landscape evolution of the Nea Nikomideia Neolithic settlement (Central Macedonia, Greece)

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The site of Nea Nikomideia is located in the western part of the Thessaloniki Plain. It is one of the oldest Neolithic settlements in Northern Greece and in the Balkan Peninsula since it was early occupied by farmers circa 8,500 years ago. Important excavations have been conducted in the 1960s by English archaeologists from Cambridge and Harvard Universities. They revealed two main phases of occupation (second half of the 7th millennium BC and late Neolithic) with a major hiatus during the first half of the 6th millennium. The study also concluded that the settlement was probably located on the early Neolithic palaeoshoreline. Later, different interpretations have been proposed, including the presence of a lake close to the site at the beginning of its occupation. However these assumptions have never been demonstrated, due to the lack of geoarchaeological researches focusing on palaeoenvironemental reconstruction and landscape evolution in the close vicinity of the Neolithic site.

To clarify this, six cores from the western/central parts of the actual Thessaloniki Plain have been drilled and later analyzed for palaeoenvironmental studies. The characterisation of the different facies was based on micro faunal identification, sedimentological analyses (grain size LASER and magnetic susceptibility measurements) and geochemical analyses (loss on ignition and carbonate content). Stable isotopes analyses together with X-Ray Diffraction (X.R.D.) measurements performed on carbonate samples helped to identify the environmental settings of deposition of the sediments close to the Neolithic site. Finally, a series of 14 new ^{14}C dating allowed the obtention of a fine chronostratigraphy and a reconstruction of the landscape evolution during the Neolithic occupation of the western part of the Thessaloniki Plain and since that period. The results for the historical period generally fit well with the previous research carried out in the area.

However, this reconstruction shows that an important lake developed at Nea Nikomedeia in the Late Glacial/early Holocene/ period. Evidences for frequent marine intrusions around the 6th-5th millennium BC suggest that shallow marine turning to lagoonal conditions subsequently occurred during the middle Holocene. The abandon of the site during the 6th millennium BC is discussed and related to the presence of brackish water. Due to the general context of deltaic progradation in the whole Thessaloniki Plain, the sea then regressed continuously towards the east, and a lake developed during the late Holocene. The ^{14}C results finally suggest that a large dry phase affected the lake development from 2,000 to 1,600 cal. BC. A new lake only reoccupied the western part of the plain in the early 1800s until it was dried during the 1920s for agricultural purposes.

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Palaeoenvironments of the ancient harbours of Alexandria (Egypt): long term evolution and rapid changes

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Alexandria's eastern bay covers a surface area of ~2.5 km², naturally sheltered to the north by Pharos Island and to the east by the cape of Lochias. The ancient harbour presently lies drowned 6 m below M.S.L. attesting to significant R.S.L. variations during the past few millennia. Drowned cyclopean blocks near the northwestern entrance of the port have been attributed to the city's famous lighthouse. Using sediment cores, geoarchaeological research since 1998 has centred on attempting to explain the reasons behind the demise of Alexandria's maritime façade. Here we combine multidisciplinary datasets to reconstruct 6,000 years of R.S.L. variations and put into evidence geological traces of a catastrophic tsunami event centred on the 8th century AD. We demonstrate that the high energy generated during this hydrodynamic event is at the origin of five diagnostic signatures.

(1) Abrupt lithostratigraphical changes. The ancient harbour stratigraphy comprises fine-grained sediments (90%) from the 4th c. BC to the 9th c AD. After that, the sedimentary facies manifest a sudden and unconformable coarsening in the lithostratigraphy. The coarse sediment fraction represents more than 65% of the sediment texture.

(2) Sudden biostratigraphical variation. The biological fraction comprises two stocks: (a) broken fragments of *Cladocora caespitosa* (25%) deriving from coralline colonies outside the harbour, and the debris of molluscan tests (15%); and (b) reworked shells in incoherent taphonomic condition (60%). Chaotic juxtaposition of molluscan assemblages from 11 biocenoses translates sediment mixing and significant imports from subtidal waters and shows a disrupted coastal ecosystem.

(3) Quartz S.E.M. exoscopy show clear high energy shocks. A tsunami quartz grain typology has been developed using recent analogues. The shock traces observed include: multiple parallel cleavages (14%), compression and deformation features (8%), radiating fan-shaped gouges and scratches (37%), high strain-rate shock waves (8%) and fractures (33%).

(4) Chronological discrepancies. ^{14}C datings undertaken on the tsunami layer show incoherent aging of the strata, namely due to high-energy waves reworking sub-fossil shell stocks (dated circa 4,400 to 3,400 BP).

(5) The paleoparasitological study, based on the morphological characteristics of parasitic intestinal helminth eggs, shows an increase in parasite biodiversity, from two up to eight species, after the coarse deposit. This sudden increase is essentially characterized by the emergence of anthropozoonosis and an increase in faecal peril parasites. These species attest to deterioration in health and hygienic conditions, consistent with empirical observations of recent hydrodynamic events.

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Settlement topography and environmental changes at Tell el-Fara'in/Buto in the Western Nile Delta (Egypt)

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Buto (modern Tell el-Fara'in) is situated in the floodplain of the Western Nile Delta, ca. 30 km south of the modern shoreline of the Mediterranean, and 10 km west of the modern course of the Rosetta branch of the Nile. The site covers an area of almost 1 km^2. Surveys and excavations carried out during the last decade by the German Archaeological Institute Cairo and the University of Poitiers yielded a plenty of information concerning the settlement history of Buto and allow first insights into the complexity of the occupation of the site and environmental changes.
Buto was first settled in the early 4^{th} millennium BC and developed continiously until the late Old Kingdom. Subsequently, Buto was abandoned for more than 1500 years and resettled not until the late 8^{th} century BC During the Saite period, and in Hellenistic/Roman times, Buto seems to have been a flourishing town until settlement activities deceased in early medieval times.
The presentation will focus on the results of a survey compassing geomagnetic measurements and auger corings. The investigations cover an area of ca. 25 ha and comprise more than 130 drillings. Especially the combination of both methods turned out to be helpful for the understanding of the topography of the site and the development of the settlement. The results obtained by both methods shed light on different aspects of the topography and complement each other. The systematic arrangement of the drillings in a 80 x 40 m grid allows not only to establish series of sections through the settlement mound but supplements the magnetic map also by a third dimension and provides additional information concerning the dating of the structures visible on the map. *Vice versa*, by means of the map the location of each drilling can be checked in respect to its positioning within structures or other archaeological contexts not visible on the surface. This possibility alleviates the interpretation of the result of drilling considerably.
Although the survey is not yet finished and much more research in future is needed - preliminary results of the development of the topography and the history of the site can be presented.

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Geophysics applied to the investigation of sacred areas in cities of the Nile Delta (Egypt): the case study of Tell el-Balamun

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The great temple enclosure in Tell el-Balamun was excavated in 1991-2008 by a British Museum expedition (directed by A.J. Spencer) following sporadic digging in the early 20th cent. The research has resulted in the tracing of the plans of the temple of Amun (erected in the New Kingdom, rebuilt in the Late Period) and the temples of Psamtik the 1st and Nectanebo the 1st, as well as the layout of a citadel in the southern corner of the enclosure (all of Late Dynastic date). Ptolemaic architecture was discovered in the northeastern part of the complex and Late Period burials located north of the Amun temple. The 30th Dynasty outer enclosure wall was traced thanks to surface vestiges of the foundations; the size of the enclosure was determined at 450 by 400 m. The less well preserved wall of the 26th Dynasty was mapped in effect of the excavations.

The size of the complex, precluding extensive excavations of the area inside the enclosure wall, prompted the use of geophysical methods of prospection. The magnetic method was chosen for the survey, its effectiveness having been proven in the past ten years on sites in the Nile Delta. The principal building material used at Tell el-Balamun was brick of Nile silt, which is characterized by high magnetic susceptibility signals.

Magnetic mapping provided a clear overall image of already excavated structures as well as of a number of unknown structures, also in areas that were considered as well investigated so far: a foundation-pit for an unknown temple, a bark-station in front of the Nectanebo temple (apparently the sole surviving stone building in Balamun), colonnade foundation behind the entrance pylon in the temple of Psamtik the 1st and structures seemingly lining the sides of a processional way leading to the temple, a gate in the inner wall. In the area where digging uncovered Ptolemaic vestiges (in the northeastern part of the enclosure), the magnetic map has provided data for the reconstruction of the street grid in this district.

The mapping has also contributed to verifying the line of the outer enclosure wall. The image of the northeastern and northwestern wall sections reflects the method of construction consisting of separate, projecting and recessed, panels of brickwork. In places where erosion has obliterated the wall entirely (the southeastern section), the map evinces the presence of casemate-type buildings probably from the Saite Period.

The magnetic survey has also pinpointed areas of industrial activity inside the enclosure, for example, concentrations of furnaces at the back of the Nectanebo temple, in the northern corner of the enclosure and between the southwestern sections of the 26th and 30th Dynasty enclosure walls. At some points the magnetic map revealed evidence of structures on multiple levels, as, for example, in the building described as the Fort Annexe. The presence of the later structure proved far simpler to detect by magnetic mapping than through actual excavation.

The magnetic survey was run between 2005-2010 as a joint project of the British Museum and the Polish Centre of Mediterranean Archaeology of the University of Warsaw.

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Apports d'un S.I.G. pour l'analyse des relations dynamiques du réseau d'irrigation et du patrimoine bâti : le cas de l'oasis de Figuig, Maroc

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Figuig est une oasis de l'extrême sud-est marocain, située à la frontière algérienne. Elle est constituée d'un noyau urbain éclaté en 7 *ksour* (Laâbidate, Lamaïz, Hammam Foukani, Hammam Tahtani, Loudaghir, Ouled Slimane et Zenaga). L'oasis possède une histoire ancienne due à sa position de relais stratégique sur les anciens axes du commerce caravanier transsaharien. A une époque comprise entre les 11^{e} et 13^{e} siècles, son rayonnement culturel, scientifique et économique dépassait l'échelle régionale. Sa position frontalière constituait un carrefour à la fois géographique, culturel, commercial, ce qui faisait d'elle une plaque tournante d'un point de vue social et économique. Lieu de refuge, l'oasis de Figuig a connu des vagues successives de peuplement par des populations d'origines géographiques et ethniques variées (nomades, berbères, andalous, africains ou juifs) qui font la richesse et la diversité de son patrimoine.
Afin de sauvegarder et de préserver ce patrimoine confronté à une dégradation de son architecture et de son environnement, la Municipalité de Figuig souhaite demander le classement de l'oasis sur la liste du patrimoine mondial de l'humanité de l'U.N.E.S.C.O. C'est pour accompagner cette démarche que depuis plusieurs années des équipes de l'Université Denis Diderot et de l'École Nationale Supérieure Architecture Paris Val de Seine, coordonnées par le Professeur J.P. Vallat, se sont succédé sur le site pour effectuer des études et relevés architecturaux, archéologiques, environnementaux et paysagers.
L'existence et la survie de l'oasis de Figuig sont déterminées par son réseau d'irrigation et les palmeraies qu'il alimente. Ce réseau est constitué par un ensemble relié de sources, de foggaras, de bassins et de canaux, au travers desquels l'eau circule de manière gravitaire. La compréhension de son fonctionnement, de son évolution, tant en qualité qu'en quantité, et de son impact sur les cultures, a nécessité de mettre en place sa description au sein d'un système d'information géographique.
À l'analyse ce réseau n'est pas un ensemble cohérent, issu d'une gestion économe, raisonnée et solidaire de cette ressource rare. Il est constitué d'un entrelacs de réseaux indépendants, juxtaposés (les "croisements" de canaux par des ponts ou aqueducs sont fréquents) dont la complexité raconte l'histoire des luttes et dominations entre les différents groupes sociaux de l'oasis. Ces groupes sociaux sont basés sur une logique d'intégration verticale qui associe un ksar et son groupe d'habitants, la palmeraie dont il maîtrise le foncier, sa culture et la partie du réseau d'irrigation (sources, foggaras, bassins, canaux) qui lui est propre.
Fortement structurante, la géographie de ces réseaux est déterminante pour la compréhension actuelle et passée de l'oasis. Pour mieux mettre en évidence et analyser ces interactions il apparu "naturel" de regrouper les autres informations relevées (habitat ancien, trame viaire des ksour, relevés architecturaux, édifices remarquables et traces archéologiques de *ksour* abandonnés) dans la même Système d'Information Géographique (S.I.G.). La communication proposée présentera la démarche, les cheminements méthodologiques et techniques suivis pour cette mise en place ainsi que les premiers éléments conclusifs qui peuvent en être issus.

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Tumbling the White Walls: dispelling some myths about the Memphite landscape (Egypt)

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Ideas on the environment of the Memphite region have altered dramatically in recent years and are still changing and developing. Discussions (sometimes heated) of floodplain level, river location, and the human response to environmental and climate change have generally taken place in the form of small working groups, exchange visits and walkabouts between interested professionals in the area, but the issues are gaining wider prominence and are equally applicable to other parts of the Nile valley and adjacent regions. The present paper proposes to detail a more integrated approach for reconstructing the past Nile environment.

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Un paysage changeant à l'extrêmité occidentale de la Méditerranée dans l'Antiquité : l'exemple de la Baie d'Algésiras (Espagne)

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Situé entre l'Afrique et l'Europe, le Détroit de Gibraltar et plus particulièrement la baie d'Algésiras sont des sites intéressants pour l'étude des dynamiques historiques et la compréhension des relations homme-milieu en contexte littoral. Le triat de côte a fortement évolué au cours des derniers siècles en raison notamment d'une activité sismique évidente. Á cet égard on est tenté, à une autre échelle et malgré les distances, d'établir une comparaison avec l'Égypte. Ce sont deux régions présentant des richesses archéologique et historique majeures. Les paysages se caractérisent par de forts contrastes, un même dualisme « rive-désert / rive-montagne » et d'importants changements géographiques. En ce qui concerne le Détroit de Gibraltar, le cadre physique contraignant (chaîne de montagnes escarpées), l'altitude des sommets et leur proximité à la côte ont concentré le développement de l'agriculture et le peuplement sur les rives des fleuves principaux. L'étude du Détroit de Gibraltar est donc essentielle pour l'histoire de la Méditerranée occidentale et des relations historiques entre l'Afrique et l'Europe. En effet, depuis la baie d'Algésiras, il est possible de contrôler la communication entre les continents ainsi que le passage de la Méditerranée vers l'Atlantique. En conséquence, cette baie a toujours eu une importance stratégique et démographique qui a été justement la cause principale des hauts niveaux d'urbanisation et d'industrialisation actuels. Toutes ces particularités font de cette baie un exemple représentatif pour l'étude du Détroit de Gibraltar et des paysages côtières du sud de l'Espagne. C'est pour cette raison que l'on présente ici une étude multidisciplinaire qui est l'objet d'une thèse de Doctorat. Pour une reconstruction de la géographie antique, notre approche se fonde sur de nouvelles recherches géoarchéologiques. Elles incluent l'analyse des sources littéraires qui

mentionnent les *Colonnes d'Hercule* et l'étude diachronique de documents cartographiques. Nous disposons également des résultats des fouilles archéologiques menées dans la ville punique et hispano-romaine de *Carteia* (San Roque) et autour du sanctuaire phénico-punique de Gorham's Cave (Gibraltar) ainsi que plus de 160 interventions d'archéologie préventive cataloguées aux archives de la *Delegación de Cultura* de Cadix. Notre travail permet d'ores et déjà d'établir une première carte archéologique à partir de nombreux travaux déjà effectués.

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Morphologie et dynamique des paysages le long de la *Fossa Regia* en Tunisie tellienne

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De Thabraca (nord-ouest de la Tunisie tellienne) située sur la rive africaine de la Méditerranée occidentale, à Thaenea (sud-est de la Tunisie steppique) largement ouverte sur la rive ouest de la Méditerranée orientale, les restes de la *Fossa Regia* sont observables sur près de 400 km. Cette limite territoriale fut édictée par Scipion Émilien vers 146 av. J.C. à la suite de la chute de Carthage ; elle démarque les terres - et dépendances du royaume vaincu - conquises par les romains de celles laissées aux regards des rois numides alliés. La *Fossa Regia* est matérialisée dans le paysage par des ouvrages divers (fossés simples ou multiples, murets, places fortes et lieux fortifiés, etc.) profitant au passage de lignes et de discontinuités physiographiques (crêtes, barres, escarpements, axes de drainage, aires inondables, *sebkhas*, etc.). Conçue comme démarque et ligne de contrôle, mais fonctionnant davantage en frange de transition ou de communication entre deux peuplements, cette limite a été revisitée, deux siècles plus tard, sous Vespasien lors d'une campagne de bornage.
Difficile à établir par les seules prospections archéologiques, avec un tracé incertain au nord-ouest comme au sud-est, le tronçon central entre l'Oued Medjerda et la Dorsale tunisienne en est communément arrêté grâce à des bornes au sommet de Jbel Cheïd, un diapir encore en montée. Dans ce secteur central, de part et d'autre de la *Fossa Regia*, les paysages, les dynamiques environnementales, les organisations spatiales et les signatures agraires et/ou rurales recèlent quelques nuances et différences détectées par l'intégration dans un Système d'Information Géographique (S.I.G.) de documents établis à différentes dates (1909, 1930, 1948, 1963, 1975, 2000, 2010) et d'origine diverse (documents cartographiques, photographiques et imagiers).
Les résultats obtenus grâce à l'application de l'approche géomorphologique, jusque là peu ou prou utilisée et, étayés par l'analyse des documents et données, confortent pour ce secteur le tracé établi par les travaux anciens. Ils permettent d'appréhender la nature et les relations des composantes géoarchologiques de ce *discontinuum* territorial. Ce travail propose *in fine* d'appliquer cette approche géomorphologique et géodynamique pour initier, en préalable, les prolongements potentiels du tracé et des traces de la *Fossa regia*, soit vers le nord, soit vers le sud.

KINDERMANN Karin[1, 2]

Geoarchaeological reconstruction of the mid-Holocene seasonal cycles and mobility patterns on the Abu Muhariq Plateau (Egypt)

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Between 1995 and 2002 interdisciplinary geoarchaeological surveys were carried out by the Collaborative Research Centre 389 "ACACIA" (University of Cologne, Germany) on the Abu Muhariq Plateau, between the Nile Valley and the bow of the Western Desert oases. Up to that time this desert region, which is the central area of the Egyptian Limestone Plateau, has received hardly any attention in the archaeological exploration. The focus of our research concentrated on the prehistory of two areas, firstly on Djara, and secondly on Abu Gerara.
At Djara more than 240 prehistoric sites were documented, from which the greatest share fall in between 6,500 to 5,200 cal. BC and mirror the maximum of the occupation phase in this area. Such a concentration of prehistoric sites points to locally favorable conditions in Djara in contrast to the surrounding high plain areas. On the southern part of the Abu Muhariq Plateau the research area of Abu Gerara is situated 100 km north of the Dakhla escarpment. There a geo-archaeological survey produced more than 100 archaeological sites, most of which date to the same occupation phase.
For both research areas a reconstruction of the past human environment was realized which enables us to recognize conditions of human adaptations as well as changes in those conditions that have provoked adjustment. Contrary to the study area of Djara, in which only two larger landscape units exist, Abu Gerara is characterized by numerous small-scale and varying landscape units. In this presentation the probable models of seasonal subsistence-cycles and mobility patterns should be presented and discussed comparatively.

KLEMPE Harald[1]

Identification of river courses and floodplains in the area around the ancient city Tegea, Greece

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Tegea is an ancient city from Peloponnese (Greece) founded circa 600 years BC. Nowadays no river is flowing through the former city area. The Tegea plain has a general slope less than 1° and is surrounded by hills and mountains making large watersheds. The present-day Sarantapatomos River consists of a channel with stone and gravel bars and sand at the flanks. The channel is constrained by small levees and is running along the top edge of the floodplain. This channel and floodplain model has been applied to the Tegea plain and ancient river courses and floodplains have been identified by map contour analysis and Geographic information System (G.I.S.) spatial analysis methods. The locations of the former channels have been verified by cross sections in a sand pit and excavations, by sound drillings performed down to the bottom of the sediments, and by profiles from Ground Penetrating Radar (G.P.R.). The age of the different floodplains are clarified by recorded findings from the ground surface. At least four river courses with three avulsions have been identified around the ancient city. The Tegea city was probably founded on a floodplain made in Prehistoric time and the rivers in Archaic and Classical time was running both west and east of the city.

KLOSE Ilka[1], DE DAPPER Morgan[2]

River Landscapes in the Northwestern Suburbia of Elephantine/Aswan

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An overview is presented of the preliminary results of a geoarchaeological survey in Gharb Aswan, carried out by the German Archaeological Institute Cairo in cooperation with the Aswan – Kom Ombo Survey Project, between 2007 and 2009.
Gharb Aswan is a collective term for an agglomeration of several small villages located on the west bank of the Nile, a few km north of Aswan, featuring a narrow strip of agricultural land on inundation silt. Hence the survey area is defined by the territory of the Nubian villages and their associated agricultural land. Neither have been subject of an intensive geomorphological or archaeological surveys before. The area under study stretches approximately 7 km along the river's shore, and reaches some 1.5 km inland, up to the steep rise of the rocky hills of the Western Desert.
Geopolitically this countryside belongs to the urban hinterland of the ancient town of Elephantine/Aswan, the center of the region since Early Dynastic times. Much is known about the ancient town of Elephantine and its environmental conditions, daily life, and spatial distribution of the society during a time spanning 5,000 years BP; yet little is known of the surrounding areas. The living conditions, geomorphologic outline, environmental changes, settlement patterns, such as the separate estates, mansions of the elites or scattered huts for the population up to the reconstruction of the landscape of the dead is by far not established; this is clearly illustrated by the discovery within the survey of a mastaba tomb at the foot of the Qubbet El-Hawa.
The survey was performed by archaeological and geomorphological surface observations combined with an exploration of the near-surface geology by core-drillings. Altogether, 160 single cores were drilled, some up to a depth of 10m. To ensure a complete covering of the area, drillings were arranged in a systematic pattern: parallel cross sections, separated by an optimal distance of 250m and running from the hillside towards the river. In the rocky hinterland of Gharb Aswan several quarries of granite or sandstone are located and a few cemeteries are based there. Nowadays the landscape is completely anthropogenic: the slope towards the river is overbuilt with houses and the floodplain is profoundly remodeled by modern agricultural practices, such as an intricate irrigation scheme; a situation which obviously hinders the survey. Some of the fluvial sediments were deposited during the "Wild Nile"-stage, which can be situated around 15,000 years BP, during the Late-Pleistocene; the bulk however was deposited in the last 10,000 years, during the Holocene. The latter consists of very thick layers of dark compact silt up to 10m thick with varying differences in the consistency of the layers. Ceramics found in the sediments testify to the human presence and serve as a *terminus post quem*; they are a useful dating element in sediments otherwise difficult to date. The artefacts include sherds of pottery belonging to the Naqqada, Dynastic, Roman and Medieval Periods. Based on the preliminary results a landscape reconstruction during different seasons and in various historical periods is made. Furthermore an assessment of the agricultural potential of the region through time is questioned. Finally, a discussion on the localization of the town of Contra Syene, which is only known from written sources, is initiated.

KLOSE Ilka[1], SEIDLMAYER Stephan J.[1], DE DAPPER Morgan[2], KELANI ADEL[3]

The rock inscriptions of Bigga and Shellal (Aswan, Egypt): archaeological and geoarchaeological approaches

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The presented study is located in the southernmost part of the 1st Nile Cataract, a region where a large granite barrier allowed people to fix political borders. Nowadays the former natural entity of the cataract is divided by the Old Aswan Dam; the southern part of the area is known today as the 'small reservoir lake'. Most parts of the rocky landscape where the inscriptions are located are still above the water line and thus accessible, but in contrast most of the former associated cultural- and agricultural land is inundated.
The study involves a survey and the research itself. The survey provides the documentation, resumption and collation of the rock art, inscriptions and graffiti of the region Shellal and the island Bigga. The research focuses on the chronology, spatialisation and prosopography of the documented items, as well as on questions concerning their environment and setting from the geomorphological point of view.
As the rock inscriptions have become permanent and unmovable fixtures in the landscapes, and they remained constant while their surroundings and audience changed and developed over time, focus is placed (1) on the original context in which the rock-inscriptions were embedded, as well as on (2) the motivation to create these inscriptions and (3) the evolution of their perception through times. Since the archaeological context, especially in this region, is elusive or not detectable it is crucial for an assessment to trace the patterns and models that the rock-inscriptions, graffiti or drawings follow and to determine their interconnection with the environment.
Until now rock inscriptions were mostly studied from the point of view of linguistics; the geoarchaeological approach, focusing on geomorphology and assessment of the potential and limitations of the physical environment, is a quite recent methodology. To pinpoint where/when/how real and imagined spaces cross and crisscross each other, is the main aim of this new approach. As a result, taking the rock inscriptions as the probably most fixed constant, a visualisation of both - experienced real places and not map-able imagined spaces of statements/movements from societies/individuals or scenes and settings -, will be realised.

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Archaelogical predictive modeling based on geomorphometric parameters: a case study in the Roman Mediterranean

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Archaeological predictive models are used to predict the location of archaeological sites or materials in a region, based either on observed patterns or on assumptions about human behavior. The binary overlay method is applied to investigate settlement patterns in the surroundings of the late ancient imperial palace Felix Romuliana in Eastern Serbia. The investigation is based on an archaeological settlement database containing 53 settlements dated from four different cultural epochs, which span a chronological frame from Bronze Age to Middle Ages.
The predictive model focuses on geomorphometric parameters derived from a Digital Elevation Model (D.E.M.) to find favored settlement features concerning the geomorphological locality. While digital elevation models are available for the entire world, this approach is characterized by its universal applicability, requiring only elevation data and an archaeological site database. Based on test-statistics important parameters of settlement locations are determined from the geomorphometric parameters and integrated in the model. The derivation of parameters and the model calculation is done using different Geographic Information Systems. Test statistics are applied to find parameters that influence settlement locations. This results in maps for every discrete cultural epoch.
The model is applied with and without distances to recent perennial streams. It is shown that this sensitive parameter is not needed to create a well performing model. In general, gently sloped and curved areas as well as plane terrace levels are favored locations for settlements. The calculated model quality is good, proving the prediction of the known locations. A verification and assumption about the real predictive power is not possible until future investigation is carried out in the field.

KOOPMAN Annelies[1], KLUIVING Sjoerd J.[1]

Geoarchaeological reconstructions of Epipalaeolithic and Neolithic lake shore occupation during dynamic environmental conditions, Northern Fayum Basin, Egypt

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The Fayum Basin (Egypt), a circular depression formed in the limestone plateau of the Western Desert, Egypt, has undergone several major environmental changes during the Holocene. These changes can be evaluated from ancient lake sediments deposited throughout the northern Fayum desert, by high floodwaters of the River Nile. Remnant of the high palaeo-lakes is the modern, terminal Lake Qarun, with a present surface-water level of 43-45 m below sea level. The presence of an extensive lake attracted prehistoric hunter-gatherers and semi-sedentary settlers to the northern Fayum region, who roamed and occupied its resourceful, but dynamic palaeo-shores. This geoarchaeological study investigates the sedimentary record at an Epipalaeolithic and Neolithic site, known as E29H1.
Objectives are to document agents and processes of sediment deposition, depositional environments and environmental change, before, during, and after the occupation of the prehistoric site, as well as to reconstruct palaeo-lake levels and shores. Additional aim is to investigate and evaluate the links between the very dense surface scatters of lithics and bones with many hearths, and the litho-types associated with them. Purpose is to provide a contextual framework for the study of the (surface) archaeological record at this deflated location.
Geoarchaeological fieldwork was performed during one month (Nov.-Dec.2008), and involved the study of vertical sections of irrigation ditches and bulldozer scars, as well as a hand augering research. Analytical studies were performed on grain size- and Thermal Gravimetric Analysis (T.G.A.). Four cross sections provide a lithostratigraphic reconstruction of the study area, positioned directly through dense surface artefact scatters, including several radiocarbon dated hearths.
Four main terrestrial sedimentary environments have been recognized in the study area, a lacustrine (deep-, and lake margin facies), a deltaic (delta-top facies), a fluvial (i.e. wadi facies), and an aeolian depositional environment. The frequent vertical and lateral changes in depositional facies indicate the existence of a dynamic environment, which may be related to the shifting of shorelines by changes in lake level. The fragmented sedimentary record also reflects the high rates of erosion and deflation in this area. The recurrence of muddy lithostratigraphical units, often with significant amounts of charred plant material, may reflect the intentional burning of near-shore vegetation. Very dense surface artefact clusters have been associated with the presence of remaining parts of beach-ridges along the former lake shores. Furthermore, a large hearth with chunks of charred wood dating 7,305BP ±25 (6,225-6,085 cal BCE: E29H1/148), may be situated within palaeo-deltaic sediments. So far, all reconstructions point to the positive correlation between inferred dry depositional conditions and associated cultural activities.

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Le territoire de Latô (Crète, Grèce)

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L'étude du territoire de l'antique cité de Latô peut s'appuyer sur un dossier exceptionnel de trois documents épigraphiques de la seconde moitié du 2e siècle avant J.-C. émanant de la cité, qui mentionnent des frontières précises, et même une délimitation complète du territoire, suivant les éléments du relief. L'existence de tels textes, ainsi que les fouilles de la première moitié du 20e siècle à Latô et au sanctuaire de Sta Lenika, ont donné lieu à plusieurs tentatives de reconstruction du tracé de la frontière du 2e siècle av. J.-C., fondées principalement sur la documentation épigraphique. Cependant, aucune des précédentes recherches ne s'est attachée à reconstruire l'occupation spatiale du territoire de Latô dans son ensemble, ni à l'époque hellénistique, ni aux périodes antérieures ou postérieures, alors que les travaux sur les territoires dans le monde grec se sont largement développés depuis les années 1960-70. C'est à ces lacunes que le projet en cours cherche à remédier, en associant à l'étude des textes des recherches de terrain, qui sont désormais fondamentales pour faire progresser nos connaissances, et par là, mieux comprendre la dynamique spatiale de cette cité.
Ce poster permettra de présenter les résultats de deux opérations de terrain menées au printemps 2010 dans le cadre du programme de l'École française d'Athènes et dont le but est de compléter la carte archéologique du territoire de Latô: une campagne de prospection extensive, dont l'objectif est de localiser avec précision les sites déjà connus, et de repérer des sites inédits ; une campagne complémentaire de prospection intensive avec ramassage du matériel de surface dans la zone-frontière entre Latô et Dréros, afin de repérer des différences significatives d'organisation et d'occupation du territoire entre les deux cités, dans le but de préciser le plus possible la position de la frontière et d'étudier l'occupation de la chôra.

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Middle to Late Holocene landscape changes and geoarchaeological implications in the Lower Strymon valley (Greece)

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The "Balkans 4000" research program focused on the settlement in Northern Greece and in the Balkans during the 4th millennium BC (Dir. Z. Tsirtsoni) and gives support to develop palaeoenvironmental and geoarcheological investigations in the floodplain and wetland environments of Northeastern Macedonia, Greece. The Holocene palaeogeographic changes in the lower Strymon valley, a major river of the Balkan Peninsula, have been investigated using a combination of facies interpretation from borehole cores, ^{14}C dating, and pollen and fire signal analyses.
From the Neolithic, the depositional history reveals a palaeogeographic evolution of the lower valley that may be divided into five major periods. The changes observed are compared to other fluvial systems in the Aegean and Balkanic areas and the results are discussed in regards of the climatic changes testified at a regional scale and archaeological data available. The discussion on the landscape changes and their geoarchaeological implications is focused on short and well defined chronological windows: 4th millennium BC; 2,500-2,000 BC; 500 BC-150 AD; 750-1,000 AD; 1,500-1,800 AD.

LOGEL Thierry[1, 2]

Dépôts fluviaux, pratiques funéraires et paysages dans la plaine alluviale du Rhin supérieur au cours des 2e et 1er millénaires avant notre ère : Nature, Culture et Société

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À partir de l'étude systématique des dépôts fluviaux (c'est-à-dire des objets métalliques de l'âge du Bronze jusqu'au Moyen Âge abandonnés de manière volontaire dans les cours d'eau) mis au jour dans la zone alluviale du Rhin (Alsace, Bade), nous avons pu constater des transformations constantes et significatives du tracé du fleuve, mais également identifier de nombreux passages à gués. En effet, ces dépôts de métal sont disposés de manière simultanée sur les deux rives du fleuve à proximité de formes marquantes du paysage, confluences de rivières ou falaises. Ils attestent des contacts entre les deux rives dès l'âge du Bronze. La relation entre ces axes de passage et des pratiques cultuelles est soulignée de surcroit par la présence de tertres funéraires à proximité. Les sociétés protohistoriques ont édifiés des tertres dans des espaces naturels impropres à l'activité agricole et l'habitat, en bordure de cours d'eau ou d'autres voies de passages. Ces sociétés semblent donc procéder à un classement et à une interprétation symbolique du paysage sur un mode binaire (vivant/mort), qui rappelle la division Humain/Non humain de l'anthropologie sociale.
Les deux principales cultures matérielles de la région sont localisées au sud et au nord de Strasbourg. Ce site est établi en zone alluviale, à l'extrémité d'une avancée de la terrasse würm, à la confluence des affluents du Rhin et concentre de nombreux dépôts fluviaux. Aucun tertre ni habitat n'y a été signalé. Le site apparaît comme un gué sur le fleuve, mais également comme un espace de passage entre les deux cultures matérielles du nord et du sud.
L'identification des dépôts fluviaux, associée à une lecture structurale et spatiale systématique des nécropoles tumulaires dans leur contexte environnemental, contribue à définir un paysage original de l'Alsace/Bade au cours de la Protohistoire. C'est dans ce cadre géographique et topographique que ces sociétés ont façonné leurs mentalités, leurs pensées, leurs pratiques sociales, voire leurs rapports politiques. Ainsi, les vestiges archéologiques ne se présentent plus seulement comme des faits empiriques, isolés et uniques, mais se rattachent à un système de pensée élaboré qui tisse avec le paysage la structure de la conception du monde de ces sociétés de la Protohistoire.

LUCARINI Giulio[1], HAMDAN Mohamed A.[2]

The ancient landscape of Sheikh el Obeiyid (Farafra, Egypt). The playa and the village: technological and symbolic traits

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It is nowadays clear that the Early Holocene hunter-gatherer groups of the Eastern Sahara were characterised by remarkable sedentism and economic complexity. Research carried out in the Egyptian Oases region has shed new light on this model showing its prospective development. As a consequence of the double rain regime which characterised the areas of the Egyptian Western Desert during the Middle Holocene (from 6,000 to 4,800 BCE), the Farafra Oasis underwent a number of occupations which, iterated at short intervals, caused the formation of semi-sedentary settlements near ephemeral lake basins. The economy of these sites, which can be considered as real villages, was based on the exploitation of wild plants; the raising of small mammals (such as sheep and goat) and the hunting of wild animals.
This has been further corroborated by the Italian Archaeological Mission in the Farafra Oasis thanks to the recent research carried out in the Sheikh El Obeiyid territory (located in the upper course of the Wadi El Obeiyid). In this context a wide occupation area dating back to the Middle Holocene has been found. It is a real settlement system which develops at different heights along the slope of the Northern Plateau from the bottom of the wadi up to the top of the plateau itself. At the bottom the landscape is characterised by the wide Bir el Obeiyid playa basin, which is still fed by a perennial spring and which certainly housed a wide lake during the Holocene moist episodes. In the middle there are terraces, namely erosion surfaces, showing traces of an intense occupation. Among these, the Italian research team has recently detected a slab structure village characterised by thirty limestone features which have provided important insight on building techniques. Two of these structures, which are in the shape of a tumulus with an inner corridor, had an undebatable symbolic value. On the top of the plateau there is a cone-shaped hill surmounted by a karstic tower-like rock, which, given its peculiar aspect, must have been indubitably considered as a landmark by the human groups that inhabited the region. The large sites characterised by limestone slab structures found in the Farafra Oasis, together with the similar sandstone samples found in Dakhla, Kharga and in more peripheral areas, namely the Gilf Kebir, not only show that several human groups settled in the Western Desert for quite a large span of the Middle Holocene, but that they were also developing a certain social complexity.

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Rethinking people river-environment interactions in Sudanese Nubia

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Joint archaeological and geomorphological research within an 80 km-long reach of the Nile Valley in northern Sudan, centred on the town of Dongola, has identified several former river courses along which are located many hundreds of archaeological sites, the majority of which date to the Kerma Period (c. 2,500 to 1,500 BC).

What distinguishes our geoarchaeological investigations from similar studies elsewhere in the Nile Valley, and also from those in Mesopotamia and in the Indus Valley, is the luminescence dating of river channel and floodplain sediments that adjoin archaeological sites. This has enabled changes in settlement patterns to be precisely matched with independently dated phases of river activity, including those periods when channels ceased to flow. Contrary to much previous research on early agricultural societies dependent on floodwater farming in the Nile Valley and other parts of the Old World, the Kerma culture continued to flourish during the environmental crisis centred at around 2,000 BC – with the number of settlements actually increasing in the period from 2,050 to 1,750 BC. The Kerma culture ended around 500 years later, coinciding with a major anabranch of the River Nile becoming inactive shortly before 1,400 BC.

The continuity and success of the Kerma agriculturists in the Dongola reach was associated with a favourable combination of local alluvial landforms and hydrology that persisted for about 1000 years. These conditions included a network of anabranching river channels with well developed levees, which conveyed moderate-sized seasonal flows ideally suited to support floodwater farming on an extensive scale, in some instances, more than 12 km to the east of the present course of the River Nile. However, when flows stopped >400 km^2 of formerly irrigated farmland in the northern Dongola reach alone would have become unusable, perhaps in a matter of years. This undoubtedly would have had a catastrophic impact on local farming communities and the urban centres they supplied. Indeed, this area was only very recently brought back into agricultural production in the second half of the 20^{th} century with the introduction of diesel-powered groundwater pumps. While possible causal links between cultural and climate changes in the Nile Valley have been proposed, the results of this study indicate that the nature and dynamics of *local* alluvial environments are likely to have been a critical factor in determining whether climatic fluctuations and associated changes in hydrology represented an opportunity or a hazard for riparian communities and floodwater farmers.

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A Geoarchaeological approach to the study of the city area of Rome, Italy: the changes of the Tiber River course during the Holocene

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The city of Rome, with its nearly 3,000-year history, is located in the lower Tiber River valley. The final course of the river, about 25 km NE before the mouth in the Tyrrhenian Sea crosses the urban area. Human occupation since Prehistory and the existence of a city from 6th century BC, in this area, have an influence both on the natural evolution of the river ecosystems and on the human settlement along the river itself.
A geoarchaeological approach to the study of the changes of the river course during the last millennia focuses the attention on the dynamic relation between man and the river element. In particular, a geoarchaeological investigation is being carried out in two crucial areas of the river valley within the city: Milvio bridge-Flaminio and Testaccio-via Ostiense (the ancient river harbour)-Valco S. Paolo.
Multitemporal airphoto intepretation, the analysis of historical and modern cartography as well as of older archaeological and geological data, geomorphologic and geophysics along with new geoarchaeological investigations allows for the reconstruction of the river course changes in these important areas of the city.
The study involved new investigations in the Flaminio area, where the river begin to cross the urban area, until the great archaeological excavation (one hectare inside the historical city) of Nuovo Mercato di Testaccio (New municipal market of the Testaccio quarter), located behind the ancient river harbour on the left bank southwest of the Aventino hill. A great quantity of core drillings related to archaeological investigations were drilled in several parts of the alluvial plain and specifically in Ostiense area, immediately situated outside the 3rd century AD Aurelian walls.
The possibility to directly analyse several boreholes drilled for geoarchaeological purposes, well dispatched from some specific points along the Tiber river urban floodplain, the correlation of these data with the archaeological ones, allowed a reconstruction of a typical geological cross-section for the urban course of the Tiber with lithological facies well correlated to the depositional environment and the archaeological record.
A reconstruction of the landscape evolution over the Holocene, and until the modern times, has been attempted, and may constitute a useful instrument to guide city planning activities in relation with cultural heritage management.

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Ports antiques et paléo-environnements. Vers une grammaire géoarchéologique des littoraux méditerranéens ?

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Les premières approches globales de l'étude des paléo-environnements d'un port antique en Méditerranée ont été effectuées à Marseille, après la seconde guerre mondiale, sous la direction de F. Benoit, dans le quartier détruit au Nord du Vieux Port. Une équipe pluridisciplinaire s'était alors formée comprenant un sédimentologue, un malacologue et un botaniste. Malheureusement, la plupart des résultats sont restés inédits ou ont été dispersés. En revanche, cette approche moderne de l'étude des sites littoraux archéologiques s'est largement développée à partir des années 70.
Depuis une vingtaine d'années, des équipes d'archéologues (dépendant principalement du laboratoire d'archéologie du Centre Camille Jullian, du Centre d'études Alexandrines, de l'Ecole Française de Rome et du Centre Jean Bérard, mais surtout de l'INRAP (Institut National de Recherches Archéologiques Préventives) et de géomorphologues de différents laboratoires travaillent en commun sur l'histoire paléo-environnementale des ports antiques de Méditerranée. Lors de notre communication, nous aborderons cinq questions principales:

(1) Question de la localisation des bassins portuaires que ce soit par l'analyse d'image ou l'étude géo-électrique des milieux comme à Cumes (Campanie) ou en Grèce antique.
(2) Question de la variation relative du niveau de la mer, avec les cas des ports de Marseille et de Pouzzoles (Campanie).
(3) Question de la mobilité du trait de côte et des impacts du détritisme en présentant quelques résultats récents obtenus sur le port romain de Fréjus dans la basse vallée de l'Argens (Var), à Chypre ou au Liban.
(4) Question des risques naturels (évènements de haute énergie, mobilité co-sismique…) avec le cas du port de Tipaza (Algérie) et de la côte du Liban et les mégablocs déposés par plusieurs tsunamis.
(5) Question de la diversité et de la chronologie des impacts d'origine anthropique. Ces impacts ont été appréhendés par la mise en oeuvre d'indicateurs multiples. Dans l'histoire de l'occupation humaine des rivages de Méditerranée, la fondation des ports antiques correspond à un moment important, celui ou les paysages littoraux vont cesser d'évoluer uniquement de façon naturelle mais connaître une artificialisation et une urbanisation sans précédent. Ces milieux ont donc enregistré dans leurs archives bio-sédimentaires des degrés d'artificialisation et des types d'impact, qui correspondent à des logiques d'organisation de l'espace différentes au cours des temps historiques. A titre d'illustration, nous présenterons quelques résultats récents obtenus le long des rives du Mariout (Égypte) et au Liban.

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Caves of the Nile valley (Egypt): an interaction between man and his environment

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The present study reveals the morphological characteristics of the caves on the sides of the Nile Valley in Assiut (Egypt), and how the relationship between man and the caves in this area provides a good example of the interaction between man and his environment over time.
It has been shown that there are two types of caves. The first is the caves which naturally originated as a result of the karst process. The second is the caves which are man-made. Each of these two types has different morphological characteristics. Each of them has also reflected a different functional importance over time. Natural caves constituted a shelter for the early Egyptian man who left the desert for the Nile Valley with the advent of the arid periods "the first great change". The second type of cave was dug on the sides of the Nile Valley and was used as tombs or temples starting from the Pharaonic times till the Coptic era. The Ancient Egyptians abandoned natural caves because they were fully aware that protection inside caves did not meet their aspirations towards the building of a great civilization and that the Nile River became the most important attraction "the second great change." They resorted to digging caves on the sides of the Nile Valley not to settle and take shelter but to use them as tombs for their dead or as temples.
The study explains why artificial caves were used instead of the natural caves which were abandoned since the time of the Pharaohs. They realized that natural caves were not suitable from the geological and geomorphological perspective because they originated at weakness sites along faults and joints, something which was reflected in the highly accurate choice of the sites of the artificial caves, most of which were generally far away from the weakness sites. These caves were also dug for other purposes, some of which had to do with protection, some had to do with the engineering design appropriate for the new functions of the caves, and others had to do with the high technical and cultural level at that time.
Therefore, tracing the characteristics and functional importance of the caves in the Nile Valley over time sheds light on great changes in the history of the relationship between man and his environment.

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The urban landscape of Aswan (Egypt) from the Predynastic period to present times: a geoarchaeological approach

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The Swiss Institute for Architectural and Archaeological Research on Ancient Egypt in Cairo has been conducting excavations in the modern town of Aswan in a joint mission with the Supreme Council of Antiquities (S.C.A.) Aswan since 2000. The project is directed by Cornelius von Pilgrim and Mohamed El-Bialy. The geomorphological survey is conducted by Morgan De Dapper of Ghent University.

Throughout its long existence Aswan, Graeco-Roman Syene and Pharaonic *Swnw* played a major role as the land-based counterpart to Elephantine. While the town on the island was the cultic and administrative centre (at least until Late-Antiquity), Aswan figured as a checkpoint for the traffic bypassing the non navigable first cataract. Recent excavations gave reason to the assumption that Aswan played that role throughout Egyptian history. While scattered evidence of human activity and settlement from the Old and Middle Kingdom was found in several of the salvage excavations undertaken in the modern town, the archaeological record from the Late Period onwards is much more consistent. The fortified garrison town, well attested in archives dating to the Persian period from Elephantine Island and encountered in several excavations in Aswan, probably already existed during the 26th Dynasty. The Graeco-Roman town of Syene represented a first apex in urban development. From the early 2nd century BC onwards the town started to grow over the restricted limits of the prior periods and became a proper tensely built up town in the Roman Imperial and Late Roman Periods. In the Early Islamic period Aswan became a city second in size and importance only to Cairo due to its function as a central waypoint for the pilgrims travelling from all over Northern Africa to Mecca.

Major natural factors in the Cataract region are the River Nile and the granite-landscape. The Nile was both excluding and attracting habitation. While the huge and often catastrophic differences between the minimal and maximal water-levels during high and low flood limited the amount of suitable locations for whole year settlement, the river was on the other hand the most important line of transport and communication. As both the pre-eminent resource of the region, the highly regarded local syenite, a pink granite, and the river Nile at the same time limited and attracted human activity, it is crucial to localize the exact course of the river and its branches and thus to reconstruct the ancient topography that is now covered by several metres of mostly anthropogenic deposits.

The geoarchaeological survey in Aswan is a crucial element within the urban-archaeological project of the Swiss-Egyptian Mission and is a good example for the fruitful cooperation of the geomorphological and archaeological disciplines, both with respect to the planning/preparation and the interpretation of excavations.

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Lithic raw material in the Farafra Oasis (Egypt): location, procurement and use from the Middle Stone Age until the Neolithic period

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During the last fieldwork, on December 2009, the italian mission at the Oasis of Farafra (Egypt), directed by Barbara Barich (Sapienza, University of Rome) started a new research project. The aim of the project is the identification and description of lithic outcrops of raw materials used by people from the Pleistocene until the Early and Middle Holocene. The first phase of this research interested the areas of Hidden Valley-Plateau and Sheikh el Obeiyid. A series of surveys were carried out, in order to identify the raw material outcrops and different lithic samples were collected. These samples will be subjected to detailed petrographic analysis at the Cairo University, but macroscopic analysis allowed a preliminary classification of the raw materials. A special attention was paid on the presence of clear evidence of exploitation of the outcrops by human groups, such as the workshop for the production of lithic artefacts. These findings have emerged in most cases, such as in the case of a silcrete outcrop on the Hidden Valley Plateau. The techno-typological features of the lithic artefacts found in this site indicate an exploitation of the quarry around 100.000 BP this year, in an advanced phase of the local Middle Stone Age (M.S.A.). The presence of artefacts near the outcrops is the clearest indicator of an effective exploitation of the source and therefore represents an important economic factor in the analysis of raw materials and resource exploitation by human groups in different periods.
Until now various formations of chert have been identified (silcrete, chalcedony, silicified mudstone, alveoline) all related to the karstic nature of the Farafra region. The preliminary analysis allowed us to underlines that:
- Middle Stone Age artefacts are formed mainly from quartzite and siliceous sandstone. These rocks occur as channel fill sediments of the Tarawan chalk. They are recorded in two localities: the sandstone of the first one seems very suitable for grinding stones. Some of these artefacts are also formed form flint.
- Neolithic artefacts are formed from three different sources, these are:
  a- chert, which is available as nodules and bands in the Eocene Farafra limestone exposed at the topmost part of the plateau also probably as boulders and gravel in the bottom of the basin.
  b - Silcrete is a silicone oxide occuring as a dark brown crust that covers horizontal plains located to the north of Sheik El Obeiyid Village.
- Silicified mudstone, developing as thin beds, up to 5 m thick, included in Ain Dalla Formation.

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Geoarchaeological researches of the Polish Mission in Saqqara, Egypt

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Geoarchaeological and geomorphological studies of the ancient necropolis situated just west of the Step Pyramid complex in Saqqara have been carried out by the Polish Mission (Polish Centre of Mediterranean Archaeology, University of Warsaw, Poland), concurrently with excavation and conservation work, since 1998. The aim was to analyze and to determine the relations between the funerary structures discovered in this area and the geological and geomorphological structure of the region. The results have provided grounds for a reconstruction of the morphogenetic and paleoclimatic processes which have shaped the landscape in the territory of the cemetery and have directly impacted its development in successive historical periods and especially the Old Kingdom.
The geoarchaeological research has focused on a section of the necropolis between the eastern edge of the so-called *Dry Moat* and the stone foundation of the Step Pyramid's enclosure wall. Analyses of sediment accumulations in the cross sections, on the ground surface and in the fill of the uncovered funerary structures has supplied data for reconstructing changes in the climate at the beginning and in the terminal Old Kingdom period. Of particular importance were the lithostratigraphic analyses of layers from the Late Old Kingdom and the First Intermediate Period. Measurements and field observations, combined with an analysis of the archaeological discoveries, have made a theoretical reconstruction of the original topography of the region possible. It can be demonstrated that an open quarry operated in the first half of the Third Dynasty in the region immediately west of the Step Pyramid complex, supplying limestone blocks for the funerary complex of Netjerykhet, which was then under construction. Once the stone-procuring operations had ceased, the artificial terraces of the quarry proved to be a very convenient location for further building activities. A suitable landscape and easy availability of building material must have promoted the decision to use the terraces west of the Step Pyramid as a necropolis during the 6th Dynasty.
Plans are under way for an interdisciplinary project extending the scope of geoarchaeological research to central Saqqara. The project will aim at correlating the data with the results of similar research carried out on other archaeological sites in Egypt.

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Insects and survival in the desert: archaeoentomological investigations at Kom el Nana Byzantine monastery, Middle Egypt

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The desiccating environment of the Egyptian desert leads to the preservation of fossil insects. Recent palaeoenvironmental work at the Byzantine monastery at Kom el Nana, built over part of the New Kingdom city at Amarna, has provided new insights into how the community survived. Away from the Nile and outside artificially irrigated areas, the landscape of Middle Egypt today is dominated by desert, and in the past, any settlement had to rely upon imported commodities. Modern agriculture has had serious impact upon the archaeology of sites on the desert fringe, and the remains of the monastery have been damaged as a result of the construction of irrigation channels and with the rising water table, organic sediments no longer survive. The results from the archaeoentomological research show that the landscape around Kom el Nana was very different from today. The insect faunal remains include a suite of pests of stored products, and elements which imply the proximity of fruit trees and water. The possibility of the use of irrigation by the monks, either by drawing water from a well or by channels from the Nile, is discussed in light of the palaeoecological evidence.

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Pyroclastic deposits from the Thera volcano (Greece) and its hazards for the surrounding islands

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There is a growing body of literature on the fact that many square meters areas around huge volcanoes contain great amount of pyroclastic materials. Furthermore, the sequence of pyroclastic sediments (lava fragments, pumice and ash) has been observed up to 60km away from the island volcanoes and has travelled beyond the level of the sea as a pyroclastic flow or pyroclastic surge. This study will seek to illustrate if and how the pyroclastic deposits that occur around the nearest islands of the Thera volcano (Santorini Island) which is connected with the 3.6 ka BP eruption, is related to the collapse of Mediterranean civilizations.
The island of Anafi which is nearest to Santorini Island (20km) has been the recipient of a big amount of ash and pumice sediments. Studies illustrate that there are 10 different sites of ash and pumice layers in Anafi which have thickness of less than 1 meter. Interestingly enough, one of them represents thickness of more than 3 meters. On the other hand, pumice and ash

layers, have been observed in Sikinos island, which is very close (35km) to Thera island. Moreover, when sedimentological, geochemical and geomorphological characteristics of these layers have been analysed in comparison with Thera's pyroclastic materials they indicate a close correlation. Finally, in this study we try to discover if human presence was influenced by the pyroclastic flow and the general implication of pyroclastic flow hazards. Last but not least, we can argue that human presence in Anafi Island is probably connected with the Minoan civilization which developed in south Aegean during the same period.

PAWLIKOWSKI Maciej[1]

Geology and geomorphology as reasons for locating archaeological sites in Egypt

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Geological investigations of archaeological sites were conducted from 1979 in a vast area from Upper Egypt up to the Delta (Hierakonpolis, Armant, Qurna – Deir el-Bahari, el-Tarif, Fayum – Qasr el-Sagha, Tell el-Farkha). Hereby, we present the main results. Important data were acquired and helped to perform correlation of sediments between described sites and we propose a reconstruction of palaeoenvironment and climate conditions for the transition Late Neolithic–Early Dynastic.

1. Hierakonpolis Geological and mineralogical investigations showed that the site is located on an old and dry delta of a *wadi* fading into the Nile from the Western Desert.

2. Armant. The scrutiny of archaeological and geological documents confirms very hot and dry climatic stage at the end of Neolithic and beginning of Dynastic in this part of the Nile Valley.

3. Qurna - Deir el-Bahari. Investigation of the area and local geological profiles highlight a phase of hot and dry climate between Neolithic and Dynastic.

4. El-Tarif. The presence of the Tarifien culture over gravels of older pediment at the phase of sedimentation of aeolian sands and silts confirms a very dry phase of climate. This phase could explain the location of the Tarifien occupation at the edge of the Nile flood plain.

5. Fayum – Qasr el-Sagha. The examination of oscillation of the shore of the Moeris Lake and geological profiles confirmed again that at the end of Neolithic climate was very dry.

6. Delta – Tell el-Farcha. The examination of the site showed that sediments are a result of interference of natural and anthropogenic activity. Because of natural morphology of the site (*gezira*) one can see there phases of important Nile sedimentation (grey silts) deposited over sands of *gezira* and on the other hand, deposition of anthropogenic material over the Nile silts at moments when the Nile level was low.

The performed investigation as well as correlation of geological profiles along the Nile valley confirm very dry climatic phase between Neolithic and Early Dynastic in a period of circa 300-400 years. This very dry climatic phase caused a reduction of the Nile floods and probably forced societies to change their life organization, being the main reason for transition between Late Neolithic and Early Dynastic.

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PEETERS Pierre[1]

À propos de quelques fleuves du Proche-Orient à travers les hiéroglyphes

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Il est indéniable que le Nil a joué un rôle majeur dans le mode d'appréhension de l'environnement et dans la construction identitaire des habitants de la vallée. En tant que « colonne vertébrale » du territoire égyptien, le Nil en demeure le poumon indispensable à la survie des populations qui en tirent profit. Aussi, l'homme dû s'adapter aux fréquentes inondations, façonnant ainsi des comportements humains tout à fait spécifiques. Dans la relation particulière que l'homme a tissée, dès la plus haute Antiquité, avec le paysage fluvial, le Nil a véritablement marqué ce dernier dans les rapports qu'il entretient avec son environnement.
Dans notre intervention, nous proposons d'étudier les évidences issues des sources hiéroglyphiques du 2nd millénaire av. J.-C., entre les habitants de la Vallée du Nil et le paysage syro-libanais dont le réseau hydrographique est bien plus dense que celui de l'Égypte. Notre attention se portera davantage sur les fleuves Oronte et Euphrate, les seuls à avoir véritablement marqués les consciences égyptiennes. Notre étude, basée sur une réflexion menée depuis plusieurs années déjà, s'inscrit dans une période chronologique qui est celle du Nouvel Empire égyptien (1550-1070 av. J.-C.). Nous nous pencherons davantage sur les campagnes militaires menées en Syrie notamment par les pharaons Touthmosis III et Ramsès II et leurs rencontres avec les fleuves précédemment mentionnés seront abordées. Les moyens logistiques qui permirent à ces derniers de franchir sans heurt ou de naviguer sur ces fleuves seront étudiés et les conséquences de cet environnement fluvial si différent, sur les consciences égyptiennes seront également envisagées. Comment appréhender et gérer un paysage neuf tout en étant si éloigné de la vallée du Nil ? Comment relater les faits ? Entre exagération délibérée à des fins de propagande politique et militaire, et réalité parfois trop lisse des faits, les sources égyptiennes trahissent constamment cette relation unique que les habitants du Nil ont toujours entretenue avec la réalité des fleuves.

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Climatic Change and Slope Formation in Semi-arid Mediterranean Landscapes during the 2.6 ka Event (NE Spain)

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In the Ebro Basin and the Iberian Ranges (NE Spain) there are many slopes with regular concave profiles which were formed during the Upper Pleistocene and Holocene as a result of erosion at the edges of hills and platforms. Today they are typically shaped as talus flatiron as a result of the escarpment retreat but it is their formation during the Bronze and Iron Ages which is of special interest because of their particular geomorphological characteristics and their relationship with patterns of human settlement. During this stage in their formation the slope accumulations were modelled by solifluction and gravity processes that led to a total coverage of the slopes, from their upper sections down to the nearby valley bottoms. These processes have been described in different locations of the Ebro Basin.

In the semi-arid central Ebro Basin, distinctive geomorphological features and archaeological evidence from the slopes of Cerro de la Gorra de la Visera (María de Huerva) and Peña Enroque (Muel) have recently been mapped and analysed. According to the Bronze Age pottery included in their deposits and to a chronology obtained from radiocarbon dating of charcoals recovered from their bases, the slopes are associated humid and cool climatic conditions in the transition between the Subboreal and the Subatlantic. In general terms they can be related to the 2.6 ka event and with the Bond event 2. Their subsequent intense erosion was caused by a combination of warm climate and anthropogenic impact on the covering vegetation which led to severe incision processes. This erosion took place mainly in the south- and east-oriented slopes, which were almost entirely removed in some cases, while those slopes with a northern aspect are much better preserved because of their lower insolation and evaporation levels. In turn these levels have encouraged the presence of denser vegetation which has protected their surfaces.

This small-scale climate event therefore has tremendous importance for the geomorphology and archaeology of the western Mediterranean. It caused a change in the dominant slope processes: the sedimentary regularization of the former erosive shapes and the recovery of vegetation. The particular environmental conditions it created would never occur again during the later Holocene. The later Subatlantic conditions in the western Mediterranean are characterized by dryer climatic environments which lead to clearer vegetation and therefore to weaker surface protection against anthropogenic impact. From an archaeological perspective this climatic event and the related deforestation and desertification process are correlated to the evolution of the Bronze Age and the cultural transition which points the beginning of the Iron Age.

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Late quaternary climate-driven evolution of the Yellow River in arid northeastern Tibet

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The Yellow River and the Nile River are two of the ten longest rivers on Earth, with lengths of more than 5,000 km. Their present morphology is the result of a long term evolution, determined by their geological setting and climatic changes in arid areas.
In northeastern Tibet, the Yellow River crosses central Asian desertic landscapes. Their morphology is evolving very rapidly in the wake of the Tibetan Plateau uplift. In northeastern Tibet, the plaetau is made of wide and flat basins separated by young mountain ranges. In particular, several basins at an elevation of 3,200 m are interpreted as a regional paleo base-level. It testifies of an old phase of basin filling by sediments coming from surrounding mountain ranges. It also highlights possible past connections between these different basins, different from the actual. Nowadays, some basins are internally drained and partially occupied by lakes, while others are crossed and drained by the Yellow River. During the late Quaternary, lakes and river levels fluctuated following landscape morphology changes and climatic events, but their respective timing is unclear. Determining ages of geomorphic landforms is thus crucial to understand the landscape evolution. Studies from different teams recovered evidence of upper Palaeolithic human occupation in the Qinghai Basin. However, the lake level in this basin seems to be now at its highest level since MIS 3 and would have consequently flooded early human occupation traces. On the contrary, our study of the adjacent Gonghe basin shows that this basin is drained progressively since MIS 6.
Our investigations show that a set of seven main 50 km-wide terraces were carved by the Yellow River in the more than 1,000 m-thick sediment filling of the basin. Two terrace levels were dated with cosmogenic isotopes (^{10}Be and ^{26}Al) and yield ages of ~200 ka and 106 ka (assuming no erosion). At the exit of the basin, the river carved deep gorges across Waliguan Mountains, which acted as a temporary barrier of the river course, explaining the formation of the successive terrace levels. Two strath terraces located above the gorges yield ^{10}Be ages of 74 ± 15 and 90 ± 15 ka and suggest maximum incision rate of 4 mm/yr. Terraces were likely formed during deglaciation periods. Unexpectedly low $N^{26}Al/N^{10}Be$ ratios show that sediment remobilization played a major role in this region. The results indicate recent and rapid changes in river drainage evolution in northeastern Tibet, and a strong imbrication, of fluvial dynamic, tectonics and climate in shaping the northeastern edge of the Tibetan plateau.

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Une carte archéologique de Thèbes-Ouest (Égypte): élaboration d'un S.I.G. pour la connaissance du paysage naturel et culturel thébain

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Occupant près de cinq mille hectares, la zone archéologique de Thèbes-Ouest recèle un nombre considérable de sites patrimoniaux, depuis les gisements du Paléolithique jusqu'aux maisons de fouilles du début du 20e siècle, insérés dans un paysage résultant d'une importante dynamique naturelle et anthropique, entre désert libyque et vallée du Nil. Afin de doter les différentes institutions égyptiennes d'un outil permettant de favoriser la gestion et la mise en valeur de cette région inscrite au patrimoine mondial de l'U.N.E.S.C.O., le département S.I.G. (Système d'Information Géographique) du Conseil Suprême des Antiquités de l'Égypte a entrepris, en coopération avec le Ministère français des Affaires Etrangères et Européennes, d'en réaliser une carte archéologique synthétique et actualisable.
La documentation utile à l'établissement de cette carte – en perpétuelle constitution depuis les débuts de l'égyptologie – se révèle riche et disparate. D'époques et d'échelles diverses, les cartes et plans ont recours à des projections et à des normes graphiques variées. Les photographies d'archive, terrestres ou aériennes, rendent compte de la topographie ancienne et offrent un intéressant précédent à l'emploi de l'imagerie satellite comme référentiel cartographique. Enfin, l'abondante littérature, souvent inégale et contradictoire, apporte un complément indispensable à la qualification des entités archéologiques représentées. Cette disparité des sources pose de nombreuses questions, tant du point de vue de la normalisation des informations que de leur utilisation au sein d'un système documentaire unifié dépassant la simple approche graphique.
Pour relever ces défis et satisfaire les objectifs d'utilisation finale de la carte, un S.I.G. s'appuyant sur les logiciels ESRI ArcGIS™ et Microsoft Access™ est en cours d'élaboration depuis 2008. Chaque structure archéologique mentionnée dans la littérature est susceptible d'être enregistrée dans une base de données regroupant les informations principales (datation, typologie, état de conservation, bibliographie, documentation graphique associée, etc.) et est géolocalisée sous la forme d'une entité géographique élémentaire. Cette première approche est complétée par des représentations plus élaborées précisant le rendu graphique des vestiges, l'emprise des zones fouillées ou figurant des informations d'ordre topographique (isohypses, anciens sentiers, cours d'eau).
L'emploi conjoint de la géomatique et des bases de données, en plus de permettre la production de cartes thématiques, ouvre ainsi de nouveaux horizons tant en terme de traitement et d'analyse (modélisations de la paléo-topographie, des facteurs de co-visibilité et des coûts), de prospective (étude paléo-environnementale sur la mobilité du Nil), qu'en terme de partage et de publication des données favorisant la compréhension des processus de formation du paysage et d'installation humaine à Thèbes-Ouest.

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Le Sahara, terroir de la Méditerranée

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Le nombre exceptionnel de monuments funéraires ainsi que la diversité de leur expression et forme architecturale, recensés jusqu'à présent en Afrique du Nord et plus particulièrement en Algérie, nous renseignent sur le dynamisme et les mouvements que connut et connait cette rive Sud de la Méditerranée. Mais, d'où émane toute cette richesse ?
Sachant que le Sahara fut une région humide, les hommes ayant occupé ces vastes contrées nous ont laissé des traces impérissables qui se résument en grande partie à l'art rupestre, immortalisant de ce fait sur la pierre leurs croyances et pratiques du quotidien, ajouté à cela les monuments érigés en mémoire à leurs défunts. Notre intérêt dans ce présent travail sera porté sur les monuments funéraires à enclos (en trou de serrure) et les bazinas, dont l'usage à perdurer jusqu'à l'avènement de l'Islam (Tombeaux de Tihinan-Tamanrasset au 4^{e} siècle après J.-C).
Face à l'aridité du climat qui caractérisa le Sahara à partir de l'Holocène récent, les populations locales furent contraintes à d'importantes migrations vers les territoires plus humides. L'interaction de ces émigrés avec d'autres peuplements et/ou civilisations donnât alors naissance à de nouvelles conceptions architecturales pour les monuments dédiés aux morts. Les Mausolés dits « royaux », Madracen aux Aurès et tombeau de la chrétienne à Tipaza, présentent des permanences architecturales avec les monuments préhistoriques et protohistoriques du Sahara.
Les Mausolés berbères du Nord algérien ne sont t-ils pas finalement une synthèse d'une survivance du Sud et d'un contexte méditerranéen pluriel?

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The Marmarica-Survey: a geoarchaeological approach to an unknown arid region (NW-Egypt)

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At the northern fringe of the Libyan Desert, between the Mediterranean coast and the Qattara Depression, between Nile Valley and Kyrenaika, stretches the Marmarica. In this semiarid to arid region little is known of inhabitants and their life-strategies in antiquity apart from single cities along the coast. Recent research basing on hydrological, pedological and archaeological surveys and analyses revealed considerably rich anthropogenic remains in the eastern part of the Marmarica. The data allow to reconstruct patterns of settlements and uses in an ancient arid landscape. Despite the scarce natural resources of water and soil substantial areas on the tableland and in the *wadi* were terraced and thus could be cultivated. In close connection to these fields – some of them in use since the late Bronze Age – lie numerous settlements dating to the greco-roman period. A pottery production from Ptolemaic to roman times too large to cover only the local demand testifies that surplus agriculture and exports were possible in the steppic zone.
Changing land use and life styles can be observed from north (sedentary) to south (nomadic). Soil-water-management, soil qualities are studied by pedological and hydrological analysis. The agricultural systems are partly reconstructed on the base of remote sensing data (Quickbird, LANDSAT TM). The chronology of sedimentation was fixed by Optically Stimulated Luminescence (O.S.L.)-dating. Soil layers accumulated by human measures reveal a use of the landscape for cultivation since the 2nd millenium BC. A later main phase of intensive settlement activity and agricultural use can be dated in Greco-Roman Times mostly by ceramic finds.
The research in the Eastern Marmarica shows the economical possibilities of the arid zone across a broad chronological frame. Since quality and quantity of the remains are problematic a geoarchaeological approach is the only useful way to learn about the history and life strategies in the arid landscape of Marmarica.

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The canals of Portus (Tiber delta, Italy): a geoarchaeological approach

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Navigable canals in Antiquity are a subject that has been little studied by archaeologists or by geoarchaeologists. In fact, in current landscapes, canals filled up by sedimentation are difficult to precisely locate. Around the Mediterranean Sea, many canals mentioned by ancient authors have not been found yet (*Fossae Marianae*…). Fortunately, the archaeological area around the most important harbour of the Roman Empire is known by old aerial photographs, and even more by extensive geomagnetics surveys that have been conducted by the archaeological team of the *British School at Rome* for several years. By bringing archeological, geophysical and geoarchaeological points of views together, we have set up a strategy to determine the number of canals that really existed during the Roman Empire.
Claudian basin (mid 1st c. AD) seems to have had two entries by the sea: but how was Portus connected to Rome? There are two possibilities: by land, of course, but most importantly by waterway. In this paper, we will focus on waterway transport systems: How were the connections between Portus and the Tiber made? How many canals are attested? What are their characteristics (depth)? How did they get filled?
A series of sedimentary cores were drilled in order to determine the palaeoenvironmental conditions of sedimentation in the canals. After the results, two types of canal have been identified: the *Canale di Comunicazione Traverso* (CT1) and the *Canale Romano* (CN1, CN2 and CN3). A multi-proxy analysis was performed on the cores, including grain-size analysis, magnetic susceptibility measurements, bioindicators analyses. Each canal presents different contexts of sedimentation: (1) marine influence and (2) fluvial influence. A great surprise was to discover the bedload of the ancient Tiber at the bottom of the *Canale Romano*. It is a unit composed by very coarse sands that was found between 6 and 7.50 m in depth below the topographic zero level. The sedimentary environments of ancient canals can be considered as indirect pictures of the rivers from which they derive. In this context, the combination of a study of these sediments with a classical study of fluvial geoarchaeology (on the channel of the Tiber) seems to open large possibilities of research.

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In 2010 a new project was initiated by the German Archaeological Institute in Cairo, in order to investigate the region of Buto (Tell el-Farain, province of Kafr esh-Sheikh). Due to its importance in antiquity as a religious and an administrative center, Buto is the key site of the western/central Delta. No less is its archaeological importance, as it is the only site in the region, for which, as a result of the investigations by the German Archaeological Institute Cairo, the settlement history spanning four millennia has become clear and the ancient landscape surrounding the site is better understood. However, very little is known about its hinterland and the interaction between the center (Buto) and its region. For example, the absence at Buto of layers associated with settlements of the late 3rd and the entire 2nd millennium pose basic questions about the settlement history of the whole region. If the settlement at Buto was abandoned during this period, did the settlement shift to another site, or was there abandonment on a regional scale? In order to address these and other questions, a survey with a regional approach was chosen.
The survey focuses on a region east of Buto, approximately 12 x 14 km large. A host of sites, identified from satellite images and maps, are investigated, many for the first time. These sites are documented, mapped and surface pottery collected. A selected range of sites are investigated by a coring program in order to understand both the natural sediment sequences and the settlement history of the tell. The goal is to understand, in the *longue durée*, the changes in the ancient landscape and the shifting settlement patterns, and the connection between these phenomena.

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The forgotten coast, a 3000 year history of forced migration in the Nile Delta (Egypt)

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In light of more widespread awareness as to the increasingly fragile state of the Nile Delta with severe coastal erosion, soil salinization and the highly possible impending rise of sea levels, voices from a wide array of disciplines such as agriculture, engineering, environment and archaeology are starting to be raised on what to do to save it. However, what do we really know about the character and the history of this place that was once an entire country in its own right, and the people that shaped its culture and worked its land.

Even though there has been much research on the various aspects of the morphing delta, it has been rare to find them all together and related to one another in one body of work. Like most river deltas, the Nile Delta has been constantly changing over its 7,000 year life, and inevitably affecting the people that settled its land, settle being a relative term. Generations of these people have, over the course of 3,000 years, faced migrating and decaying branches, tsunamis, earthquakes, river inundation, sea inundation, and sinking land, but have somehow managed not just to survive, but to thrive and create one of history's more wondrous civilisations.

The essay follows the lives of the people of the delta through the environmental events that history recorded as well as those inferred from archaeological and geological evidence, from Pre-dynastic through Ancient Egyptian, Greco-Roman, Muslim and then Modern times. It is also worthy to point out how some of the environmental shifts happened as possible aftermaths of manmade interventions into the environment of the delta, 2,000 years before the contemporary era began to ponder the idea.

Today with the livelihood of millions directly at the risk of losing the land they live on, while the lives of millions more will be severely affected by the loss of precious arable land, it's time we try to learn from the past so as to make better decisions for our future. By understanding more about how societies adapted to and informed their environment, we would be better prepared to plan and adapt to the current as well as the future challenges that face the Nile Delta.

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The mountainous karst landscapes of Crete (Greece): Ancient settlement regions of high geoarchaeological interest

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Karst landscapes respectively their geomorphologic landforms (e.g. dolines and poljes) are increasingly attracting the interest of interdisciplinary research, most notably regarding palaeoenvironmental, historical and geoarchaeological investigations. In this context, Crete has barely been focused on, even though its location at the interface between Europe, Asia Minor, the Middle East and Africa, which makes it a special nucleus and a geographical link of cultures and exchange, ideally qualifies for unravelling past environmental and sociocultural changes. For this reason, sediment-filled karst depressions in the remote mountainous areas of Crete are of special interest since they represent terrestrial proxy-data sources that can yield promising records for the analysis of the Holocene landscape evolution. However, as shown by other studies from the Mediterranean, karst terrains are highly complex and unpredictable sites and therefore almost always require a multi-method approach in order to investigate.

This paper aims at analysing the structure, function and sedimentary records of dolines and uvalas in Central and Eastern Crete (Psiloritis and Dikti mountains), presenting their great value for geoarchaeological research and showing new methodological potentials for their investigation, which may be transferred to other sites in the Mediterranean. Most notably because of the long settlement history of these regions, dating back to the second millennium B.C., past human-environmental interactions and corresponding landscape changes can ideally be investigated here. Among others, archaeologists unearthed two Bronze Age settlements (Zominthos, Lato) which points to a dense population and intense exploitation of the landscape during Minoan times (Neopalatial period, ~1,650-1,500 BC). However, the abrupt abandonment and the disappearance of human occupation around 1,150 BC pose the question for the reasons and controlling variables of this exodus.

To unravel this drastic change, sediment-filled karst depressions are investigated with a comprehensive set of techniques, such as Terrestrial Laser Scanning (T.L.S.), remote sensing, G.I.S.-processing and 3D visualisation, geophysical prospecting (electrical resistivity tomography, seismic refraction tomography), sediment coring and mineralogical analysis (X.R.D., dating, S.E.M. and E.P.M.A. examination, magnetic susceptibility). Several depressions from different areas of Central and East Crete with different altitudinal, petrographical and geomorphological characteristics are studied for comparability purposes (plateau of Zominthos, Embriskos, Lato, Katharo).

According to the results, the hollows represent dynamic systems with simultaneous flux and storage of sediment. Their subsurface structure exhibits typical features of buried karst systems, having heterogeneous and undulating bedrock topography, which is in sharp contrast to the rather smooth surface relief. However, the thickness of the predominantly colluvial-type fills occasionally amounts to more than 20 m, while soil formation is almost absent. Potential buried archaeological remnants (wall remains, subsurface drainage channels) can be

presumed within the loose overburden. The sediments must have been eroded from the surrounding hills and deposited downslope during times of stronger geomorphodynamic activity. As it is known from archaeological findings, Minoan people already used dolines for farming and stock breeding, since the depressions represent favourable areas for agricultural purposes. Mineralogical analyses furthermore reveal the existence of windblown minerals (North Africa) within the sediment column as well as volcanogenic particles at the base of the borings (~10 m below surface), which can only be attributed to the Minoan eruption of Thera (~1,620 BC) and thus point to the young age of the fills. This fact constitutes a novelty for Crete, where igneous minerals from the 3.6 ka event have only been found at lower altitudes in coast-proximate regions.
Despite their remote location, karst hollows in Crete must be regarded as important sediment traps, which are in close connection with supra-regional processes in the Eastern Mediterranean. As ancient relics of settlement are closely related to these dolines, they allow investigating the landscape history with regard to both man and his natural environment. For this reason, the paper aims at demonstrating the qualification of doline fills as valuable geo-archives, especially in coast-distal and mountainous regions without limnic or fluvial deposits.

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The geoarchaeological evidence of the Holocene relief transformation in agricultural landscape: the case study of Trnavská pahorkatina Hill Land, Slovakia

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The loessic hilly lands situated in Danube Lowland are characterised by favourable climatic conditions, soft-modelled relief and fertile soils. They have been changed by human agricultural activities since the late Mesolithic. The transformation of natural geosystems to agricultural landscape influenced the intensity, spatial and temporal variability of geomorphological processes, mainly water, wind and tillage erosion. Their reaction to variable environmental factors such as land use and climate has brought transformation of relief. The research was based on the study of bio-geoarchives in 1st order catchment of dry valley in Trnavská pahorkatkina Hill Land. Several findings since Paleolithic to modern times proved long-term human influence. Polycultural archaeological locality was discovered in filled gully. It proved the settlement in the Bronze Age and its erosion in following period. Agricultural activities caused the change of geomorphological conditions. Comparisons of reconstructed original and present-day relief showed its lowering and smoothing, infilling of local depression on slopes and the movement of valley bottom. Original leached Chernozems were transformed to typical Chernozems with secondary carbonates, or eroded up to Calcaric Regozems. The archaeological findings and geoarchaeological reconstructions contributed to understanding of human-landscape interactions.

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Elusive pre-Greek sites on the Nile Delta's coastal margin, Egypt: burial, submergence and accomodation space

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Egypt's Nile's delta was occupied in Predynastic time as recorded by archaeological exploration, and most such sites lie between the delta's southern apex and its central-to-northern delta sector. However, extensive areas of the northernmost plain, from about 20-30 km south of the Mediterranean coastline to the adjacent submerged Nile Shelf, form an integral part of the Nile Delta margin where sectors have been either incompletely explored or remain an almost unknown frontier. Some areas of this northern now-subaerial delta were at times during the Holocene covered by the sea, while offshore now-submerged sectors of the margin include terrains once subaerially exposed and accessible to humans during late Pleistocene-early Holocene low-stands. The northern Nile region, mostly <1 m above m.s.l. and comprising ~30% of present delta land area, remains a challenge for geoarchaeologists studying pre-Greek sites. Most of the arcuate ~220 km-long delta margin has a thick cover of Holocene sediment that locally reaches a thickness to ~50 m, and is associated with a shallow water table. Thus, other than in koms and small relief features such as geziras, traces of early human activity are difficult to detect and excavate on land, and such exploratory efforts are even more arduous offshore.

Exploration of the margin during the past 25 years by our Smithsonian Geoarchaeological Group, in close collaboration with colleagues in Egypt and Europe, involved coring and geophysical surveys on land and offshore. The stratigraphy of Holocene sections, based on hundreds of radiocarbon-dated core samples, has been defined at >100 localities. Studies have emphasized petrology, biofacies (fauna, pollen) analyses and geochemistry. Paleogeographic maps show marked changes over time resulting from climate and other factors that induced shifts in Nile sediment dispersal, sea-level fluctuations, and coastline shifts on the delta margin. Subsidence, the most important component affecting this region, resulted from sediment compaction, isostatic loading and deep-seated readjustment (faulting and other) of the thick delta sediment sequence at depth, and tectonic instability along the delta's eastern and western desert borders.

Climatically-controlled factors, but especially subsidence of the delta plain, account for lateral variability of River Nile silt deposition and total thickness. We can best account for this marked variability of Holocene sediment by lateral variations in *accommodation space, that is, the 3-dimensional configuration of the surface on which the lower delta plain received its depositional fill*. The thickest Holocene sediment sequences accumulated in areas where the basal depositional surface has been the most depressed, including ones that in Holocene time subsided considerably in the Manzala region and at the Damietta and Rosetta promentories. Offshore, thickened sediment sections occur in areas of recently subsided sectors, such as Abu Qir Bay and Alexandria harbours. Average rates of subsidence range from 1.0 to >5.0 mm/yr (excluding sea-level rise). Examples of pre-Greek sites presented at this conference are now buried and/or submerged in 6 areas, including those discovered in the NE delta, Burullus Lagoon (2), Abu Qir Bay (2), and Alexandria's Eastern Harbour.

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A geospatial overview of tells vs. settlements in the Northern-Central Delta, Egypt

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The governorate of Kafr el-Sheikh (the area around Lake Burullos) contains 64 tells registered by the Supreme Council of Antiquities (S.C.A.). Still, they represent only a small portion of the ancient settlements of that area. A more complete picture appears if one combines all available information regarding the presence of tells through an overlay analysis based on ancient maps starting from the "*Carte topographique de l'Égypte*" of the French expedition until recent satellite imagery of different resolution (i.e. Landsat ETM (30 m), aster (15 m), Spot (10 m), Ikonos (4 m)). For the spatial analysis a number of modern villages whose non-Arabic names indicate that they predate the domination of Arabic (no later than 9th c. AD) have been added. The latter sites are in most cases not associated with any finds, mainly because they are built upon the ancient settlement.

Through our researches, a total of nearly 300 ancient settlements can be located within the study area. Since the northern part of the governorate has been extensively settled only in the Late Ptolemaic-Roman times and again abandoned in the early Islamic period as a result of environmental change and civil warfare (the Bashmuric revolts), the distribution of presumed ancient settlements can be considered a relatively synchronous pattern. Because of the preference of levees along river branches and canals for settlement, observing the location of sites helps to find past waterways.

We wish to show in this paper an example of how geospatial analysis can be complemented with research concerning toponyms in order to reconstruct landscapes of the past. Toponyms formed during stage 1 (ca. pre-1,500 BC) all lie above the 2 metre contour, whereas names presumed to have been formed later have a more varied distribution.

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Anthropogenic and natural sedimentary records from the Agia Paraskevi Prehistoric settlement, Lamia, Central Greece

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The prehistoric settlement of Agia Paraskevi was founded during the Neolithic period (~6,000 BC) on a headland extending into a shallow sheltered marine bay. A slow but continuous siltation, by the Sperchios River, affected the area diachronically. Until the late Neolithic period (4,500 – 3,500 BC) the area was a shallow marine – lagoonal environment, that was restricted and gradually turned into a freshwater marsh (Helladic period ~2,500 BC). Marshes extended along the whole area until the previous century. Today the remnants of the prehistoric settlement are situated on the northern margin of the low flat alluvial plain of the Sperchios River 5 km east of the city of Lamia and ~5 km away from the present coastline.
In this research, data derived from a detailed stratigraphical analysis of the anthropogenic and natural deposits are compared with magnetic susceptibility measurements performed on 107 selected samples from 3 boreholes indicating different depositional palaeoenvironments (terrestrial, marine, marshy). A Bartington MS2B meter equipment at low (0.46kHz) and high (4.6kHz) frequency, was used for the measurements. Selected cores are:

- MAG-1 (8m depth) drilled in the centre of the prehistoric settlement, traced the thickness of the anthropogenic (archaeological) strata. High values of magnetic susceptibility are recorded in these sediments, indicating that the whole core is affected by human occupation.
- PAR-2 (7m depth) drilled eastwards of the settlement into the former marine bay, penetrated shallow marine fine-grained sediments, while upwards marshy sediments were found. Low values of magnetic susceptibility are recorded suggestive of the natural source of these sediments.
- MAG-2 (8m depth) drilled in the north edge of the settlement, investigated the interface between anthropogenic strata (upper part) and Holocene natural sediments (lower part). The variation of the magnetic susceptibility indicates the limits of the influence exerted by human occupation.

Anthropogenic sediments can positively be distinguished from natural ones due to higher values of magnetic susceptibility, especially layers of destruction containing burnt material and charcoal. Two layers of destruction in MAG-1 (1.39–1.41m, 1.88–1.92m) are clearly depicted, while in MAG-2 the transitional zone between anthropogenic and coastal marine sediments is situated at a depth of 4.30-4.50m.

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Pitaranha, a Granite Quarryscape in the Hinterland of Roman Ammaia (Alentejo, Portugal)

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The geoarchaeological research project conducted in and around the Roman town of Ammaia (Portugal) aims to investigate the relationship between a provincial inland urban site and its territory. One of the main examined facets includes the study of the provenance and the exploitation mechanisms of the raw granite building material of the site. In a region where intensive stone use for constructional purposes was very limited until the advent of the Roman culture, the study offers important new perspectives on the Romanization processes in this part of the Roman Empire.

The first phase of the research consisted in mapping the stone use in Ammaia. This allowed to define granite and marble as the main natural building stone. Simultaneously, the geologic and geomorphologic setting of the site and its territory was examined in detail. Samples from both the granite of the Ammaian buildings and the granite in the territory were macroscopically analyzed and possible source areas of the granite were selected. Intensive field survey in these areas revealed several ancient granite extraction sites. The granite of the sites was petrographically analyzed and the results were compared with those of the Ammaia granite. Subsequently the suitability of the different quarries for providing an entire Roman town with the necessary raw building material was tested. This method excluded all quarry sites except for one: the quarry of Pitaranha.

The granite quarry was further studied from a geomorphologic and archaeologic point of view, in order to gain insight into the used extraction methods, the spatial and temporal organization of the site. The rather irregular opencast quarry is implanted on the western slope of semi-circular hill and consists of a large number of smaller extraction fronts. The extraction method extensively took advantage of the existing joint planes of the granite rock in order to facilitate the quarrying.

A final important topic in the study of the stone supply of Roman Ammaia was the transport of the raw granite stone material from the Pitaranha quarry to the urban site. An analysis of aerial photographs and of the topography of the terrain allowed to conclude that the valley of the Sever river functioned as the main corridor for the transport of the granite building blocks towards Ammaia.

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Essai de reconstitution d'un paysage côtier à travers les sources historiques : étude géoarchéologique du port antique de Phalère (Grèce)

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Phalère, le premier port d'Athènes (Grèce) avant l'aménagement des trois bassins du Pirée à l'époque classique, représente un cas d'étude singulier pour tenter de reconstituer l'évolution des paysages côtiers pendant l'Antiquité. Cet essai est fondé sur une approche pluridisciplinaire qui associe à l'étude de la documentation antique (littérature et inscriptions grecques) des observations consignées à des époques plus récentes (récits de voyageurs) ainsi que des données géoarchéologiques.

Le premier objectif vise à affiner la localisation du dème antique dont les vestiges ont disparu avec la forte poussée d'urbanisation de la ville moderne. Les sources antiques n'apparaissent le plus souvent que comme de maigres notations incidentes sur l'emplacement des infrastructures, qu'il est cependant indispensable de confronter au matériel archéologique mis au jour depuis le début du 20^{e} siècle autour de l'actuelle église saint Georges. La toponymie moderne, associée aux récits de voyageurs de l'époque moderne ainsi qu'aux cartes dressées par l'amirauté britannique aux 18^{e} et 19^{e} siècles, permet d'éluder les erreurs d'interprétation fréquemment présentées dans les ouvrages de topographie antique. Enfin, chercher à délimiter les limites du dème conduit à interroger plus largement la notion de confins dans la Grèce ancienne, sensible à Phalère depuis la découverte d'un important cimetière au nord-ouest de la plaine du Céphise lors des fouilles de 1915.

La reconstitution de l'organisation spatiale doit se poursuivre par l'étude des terroirs agricoles, bien que les paysages aient enregistré une mutation radicale dans la seconde moitié du 20^{e} siècle (remembrements fonciers, déviation du cours de l'Ilissos). Les éléments de la topographie se conjuguent toutefois aisément avec la documentation littéraire et posent la question de l'étymologie du nom *Phalère*. L'exploitation des terroirs nous est relativement bien connue : à l'endroit du dème, il s'agissait d'un paysage boisé où l'on pratiquait essentiellement la viticulture. Pour apprécier la valeur foncière des terrains, indice de la qualité des productions agricoles, l'on dispose d'un petit ensemble d'inscriptions sur lesquelles sont parfois indiqués les prix des terrains. L'étude de la topographie du littoral, enfin, est indispensable pour déterminer les raisons qui ont poussé les Athéniens à préférer la baie de Phalère au Pirée : l'absence de formation du cordon littoral, conjuguée à un témoignage de Strabon, donne à penser que le Pirée était à l'époque archaïque une île.

Dans un troisième temps, les indices dont nous disposons permettent prudemment de reconstituer la ligne de rivage. Les hypothèses anciennes ont d'abord mis le déplacement du rivage en relation avec l'importance des mouvements tectoniques, ce qui apparaît aujourd'hui comme peu décisif au vu de la stabilité relative de la zone géodynamique dans laquelle se situe Phalère et le Pirée. Seuls les résultats fournis par les prospections menées au printemps et à l'automne 2005, portant notamment sur l'étude des *beachrocks* submergés permettent de suggérer des hypothèses sur l'élévation du niveau marin dans l'Antiquité. La question en suspens, à laquelle doit tenter de répondre l'historien, est donc celle de l'impact que les variations eustatiques, ainsi que la transgression de la ligne de rivage ont eu sur l'abandon du port de Phalère au profit du Pirée.

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The contribution of geoarchaeological methods to the paleoenvironmental evolution of the coastal area of Istron (N.E Crete) during Holocene

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The coastal area of Istron is located in the west-central part of the Mirabello Gulf, eastern Crete. There are indications of human installations from the Neolithic to the Roman period, proving the continuous human activity in this area.
Several geoarchaeological methods were employed, to provide information on the paleoenvironmental evolution of the area during the Holocene. Detailed fieldwork and sampling by drilling cores along the coastal area, provided samples for further analytical studies. The identification of the stratigraphy and the distinction of sedimentological units gave evidence for landscape evolution of the coastal area. Micropaleontological (identification of ostracods, benthic foraminifera) and pollen analyses on deposited sediments along with 29 datings performed by O.S.L. method and radiocarbon (A.M.S.), revealed the paleoenvironmental conditions prevailed since the onset of the Holocene.
Changes of sedimentation rates determined by dating and sedimentological analyses, were also correlated with holocene climatic phases. The warm and wet period of 7,600-6,400 BP and 5,200-4,200BP, identified on marine sediments in the Aegean Sea and eastern Mediterranean, was determined to our sedimentological record. The study of sea-land interactions during the last seven millennia in relation to the eustatic sea level oscillations and the regional neotectonic regime, provided new data for sea level changes and local tectonics. The results of field work and analyses provide insight for paleoenvironmental evolution of the area, emphasizing the importance of geoarchaeological techniques.

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The Holocene Nile and Settlement Dynamics in the Western Nile Delta

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The floodplain area to the southwest of the relict Canopic Nile provided the opportunity to explore sedimentary processes that dynamically shaped the region's cultural and natural landscape during the Holocene. As part of the Western Delta Landscape Project, we integrated information on the distribution of settlements in space and time with regional geomorphological development in an effort to explore the palaeoenvironment and cultural landscape from the New Kingdom to the Late Roman period (1,535 BCE – 650 BCE).
One striking result is the discovery of several former Nile distributaries: deltaic Nile channels that probably branched off the Rosetta or Canopic Nile near the present town of Kom Hamada. The distributaries have served as the freshwater source for downstream Lake Maryut (formerly, Lake Mareotis). Drawing together observations of regional geomorphology from historical cartography and satellite imagery, the project initiated a targeted program of drill coring in order to explore hypothetical channels in the region between the ancient settlements of Kom el-Hisn and Kom el-Abqa'in. Lithologic information was used to validate hypothesized channel features. It was concluded that the channels are part of a meandering river system that is located in the distal floodplain area between the Canopic Nile and the Delta fringe and carried a minor portion of the Nile discharge. The river system shows a series of bifurcations and confluences over its length, showing evidence for avulsion and abandonment of channels during the several millennia of existence. Based solely on historical cartography and satellite imagery, we were also able to recognize a former distributary near Kom Firin.
Information from coring transects across archaeological sites and nearby channels suggests that settlement placement correlates strongly with the position of fluvial features of similar age. Settlements were typically founded on natural levee deposits in the direct vicinity of an active fluvial branch. Systematic surface collection of ceramics at several sites indicates the channel system to have been active during the Pharaonic and Classical eras. It shows the region to have witnessed increased occupation over time, with ongoing fluvial-deltaic sedimentation. In particular, the economic centers of Naukratis and Alexandria likely played an important role in stimulating human presence in the region as these channels tied the settlements to the larger Mediterranean world.

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Geoarchaeological investigations in the Eastern Nile Delta, Egypt: preliminary results of the 'Gezira' A.N.R. Programme

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Deltaic environment is inherently hostile to humans (floods, lagoons, swamps, mosquitoes). It has long been believed none human occupancy was possible in the Nile Delta before Pharaonic times when a minimum of technology made it suitable for human living. However, the geological and archaeological research conducted during the past two decades have shown that the current conditions that form (have formed?) the Delta as we know it today were actually in place by the 6th millennium BC. Therefore, it is possible that human occupancy and agrarian activity could have existed during prehistoric times.
On behalf of the French National Research Agency, the aim of the Gezira programme (ANR-08-BLAN-0312-02) is to study the interactions between people and their environment during phases of the formation of the Egyptian state. In an ecosystem that naturally fluctuates, what kind of occupation models is characteristic from the Early Neolithic to the Early Dynastic Period? What changes did this transformation implied on the landscape and the society? Which traces did the new forms of power emerging at the end of the millennium leave? And how did this situation impact on the management of the environment?
Besides conventional techniques, the Gezira programme also considers new geographical techniques, such as remote sensing analysis and Geographical Information Systems, which offer not only new possibilities for archaeological research, but also allow researchers to supply answers to the crucial problems of the interactions between humans and the environment. It will be more particularly shown how satellite imagery can help identifying and locating sites of potential archaeological interest.

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Archaeological and geomorphological evidence for harbour structures at Taposiris, Lake Mareotis, NW Nile delta, Egypt

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Lake Mareotis (Egypt) is believed to have been most active during the Greco-Roman period. It was used as a waterway for the Alexandrian region's trade system. Present research is looking to better understand the chronology and function of Taposiris' lakeshore structures, hypothesized to have controlled Lake Mareotis' traffic west of Alexandria. Taposiris is an ancient city situated on the northern shore of Lake Mareotis, 45km west of Alexandria. It was built upon a consolidated sandstone ridge, separating the lake from the sea. Taposiris' waterfront presents a well-preserved example of a closed harbour. Our study aims to reconstruct the main phases for the evolution of the shoreline, which has resulted from interactions between the city's development and environmental conditions.

A topographical survey has defined the main geomorphological features of Taposiris' shores. A spit of land divides the lake's shore into two marshy plains. This irregular shoreline does not open onto the lake. Southwards, a straight causeway, running from the spit up to 1700 m eastwards, closed the area. A deepened channel was dug along it. Its westward outlet provides a narrow entrance into the closed harbor system.

In addition, six cores of 7m deep were drilled in the present-day silted port area (located in the basin, the nearby lake, and the channel linking them) and show several phases of sediment accumulation, dated from the Pleistocene substratum to the harbor abandonment layer. Sedimentary, biological and chemical analyses were conducted in order to discriminate the harbor from the natural lake environment: the impact of anthropization can be perceived through the alteration of natural processes. Archaeological and sedimentological investigations reveal that the causeway and the channel were part of the same system. It was installed within a previous Hellenistic quarter, during the 2nd century AD. These major works completely modified the ancient shoreline, which should have been indented during Hellenistic times.

Eastwards, a jetty 230m long and perpendicular to the shoreline closes the harbor basin. There is currently a 100m-wide opening between the jetty and the causeway's eastern outlet. Excavations in the area highlight a fish farming system flanking the jetty. The structure was abandoned in the first half of the 7th century. On land, the wall of the barbarians, crossing the sandstone ridge and another causeway probably barred traffic roads both on land and through the waterway. But there is still no evidence to suggest that these features, together with the closed harbor, were part of the same system.

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Middle Bronze Age settlement in the NW Nile delta revealed by pollutant lead

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Lead has proven to be an efficient tracer of past and present human activities and pollution dispersion in lacustrine and marine coastal regions owing to its specific isotopic imprints from anthropogenic and natural crustal sources.
We have developed its use to evidence (1) the onset and growing of Antique Mediterranean harbors (Marseilles, Alexandria, Tyr) and (2) early Bronze Age settlements. Our previous investigations in Alexandria bay sediments strongly suggested pre-Hellenistic settlements during the Egyptian Old Kingdom (around 2,700-2,200 BC and possibly 3,800-3,500 BC).
In order to corroborate and extend this finding, we have analyzed lead concentration and corresponding isotope ratios from radiocarbon-dated sediments collected in Lake Maryut, about 10km south of Alexandria. Our new isotopic data evidence the presence of pollutant lead around 3,800-4,000 BC and 3,200-3,600 BC in this lake basin, reinforcing and extending evidences for a pre-Hellenistic settlement in the NW Nile delta region. To date, no archaeological data has elucidated human occupation in the area before Alexandria was founded in 331 yr cal. BC even so sparse historical data evoke indirectly the presence of human occupation in Maryut countryside. However, ongoing studies are conducted on the Nile Canopic branch to check whether this pollution is purely of local origin or could derive at least partially from allochtonous sources, transported with Nile sediments.

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Reconstructing a changing environment between the ancient city of Samos and the Heraion Temple (Samos Island, Greece)

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This paper is an attempt to reconstruct the Holocene geomorphological evolution of the Kambos coastal - alluvial plain, situated in the southern part of the island of Samos, between the ancient city of Samos (contemporary city of Pythagorio) and the temple of Hera (Heraion). The present-day morphology of the site area is shaped by the fluvial action of Mavratza Torrent forming an extensive alluvial fan in the northern part of the plain, while further southwards a drained freshwater marsh close to the sea exists. Heraion is located about 6km westwards of the ancient city. The habitation of the site area started approximately in the 11th century BC and has been constant to this day. Samos city enjoyed its greatest prosperity in the 6th century BC, under the leadership of the tyrant Polycrates.

To reconstruct the geomorphological changes of the plain, a detailed geomorphological survey in combination with stratigraphical and palaeontological techniques was applied. In addition, a drilling project of two vibracores was carried out. The chronostratigraphy of the cores was determined by two ^{14}C A.M.S. radiocarbon datings undertaken on *in situ* bivalves. The evaluation of the data gives rise to the following time-scenario concerning the geomorphological evolution of the area. Long before 2,700 BC, the area was covered by fluvial sediments originating from the nearby torrents to the north. Predominance of sandy fraction and a low percentage of silty-clayey material may indicate a process that removed the fine material. Absence also of coarse clastics (pebbles, cobbles) indicates restricted fluvial transportation and subsequently a low gradual relief.

By ~2,700 BC the area had already been flooded by sea-level rise and a shallow lagoon with a sandy bottom was formed. The lagoon continued to exist for a further ~2,000 years, progressively becoming muddy; it was restricted and gradually transformed into a marsh. This marsh endured until the final decades of the previous century before it was drained. The aforementioned results strongly encourage the idea that the paved road connecting the ancient city to the temple in the 6th century BC must have been situated more inland, avoiding the coastal lagoon.

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The battlefield of Ancient Thermopylae, Central Greece: a geomorphic approach

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The Battle of Thermopylae, which took place on a narrow strip of land in the "middle gate" of the Thermopylae Pass (Malian Gulf, Central Greece), is one of the most famous battles in European and world history. Recent geoarchaeological research has shown that the battleground was not a narrow passage between the land and the sea. Between the two there was a freshwater marsh supplied with large quantities of warm water coming from the thermal springs. Since the era of the battle, the high accumulation rates of travertine deposits in the marsh created layers with a total thickness of approximately 13 meters in the last 2,500 years. Today the battlefield is a small hill with an elevation of 10m running beside waterways with continuous travertine deposition.

In this work an attempt is being made to undertake a geomorphological approach of the battlefield in Ancient Thermopylae between the mountain foothills and the marshy area where the final stage of the battle took place. A detailed geomorphological survey took place in the site area of the battlefield and all the field data were interpreted with the help of a G.I.S. For the 3D representation of the ancient morphology, geomorphological data supported by high resolution topographic measurements were combined with the stratigraphical data derived from Electrical Resistivity Tomography (E.R.T.) profiles and drillings.

The technique of electrical resistivity tomography was applied to provide geological, tectonic and lithological information regarding the surveyed area and correlate the results with the findings of the geomorphological, morphotectonic and stratigraphical studies. Several E.R.T. sections were measured mostly crossing the main geomorphological features in an attempt to map both the bedrock as well as the other geological formations. The data were collected using the pole-dipole array and lines had various lengths exceeding 100m with depth of investigation at approximately 25m. The 2D E.R.T. survey maps the subsurface resistivity both in lateral and vertical directions. The interpreted data produce resistivity images which directly correlate to the existing geological data.

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Fayum Landscapes (Egypt): agricultural adaptations during the Neolithic and the Greco-Roman periods

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The Fayum depression, located approximately 60 miles southwest of Cairo, is the region where the first evidence of domesticated wheat and barley in Egypt was found. The agricultural importance in the Neolithic, was echoed in the Greco-Roman periods when the Fayum region was developed on a grant scale to feed the populus of Rome, and the present, where agricultural expansion forms the greatest threat to the remains of the Neolithic landscape. This contribution outlines the recent results of a cooperative survey and excavation project from UCLA, Rijksuniversiteit Groningen and the University of Auckland. The research team considers the Fayum as an agricultural landscape, using climate reconstruction in tandem with tracing land formation, potential areas of agricultural fields and the location and nature of processing sites and equipment. The landscape reconstruction is for a great part dependent on a combination of geoarchaeological research and the reconstruction of agricultural methods. The analysis of threshing remains in the mud bricks of Karanis, for instance, provide information on growing circumstances, field location and harvesting methods through the study of weeds that have been harvested with the crops. For the Neolithic the research focus has been on determining whether our evidence for agricultural methods indicate whether early agriculture was part of a sedentary or mobile way of life. The most important indicators, such as flint cortex ration, site distribution, site size and characteristics, botanical and faunal composition, and the seeming absence of cemeteries are contradictory. The first results point, however, at a relatively short period of agricultural exploitation in the Fayum (approximately 500 years), using agricultural methods which could not readily be adapted to the Nile Valley.

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Records of Holocene flooding in the Nile Valley of Northern Sudan

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This paper sets out the long-term palaeohydrological context for the Nile Valley in Northern Sudan and presents some new high resolution flood records. Recent geomorphological research in the Northern Dongola Reach and at Amara West (upstream and downstream of the Third Cataract, respectively) has identified fluvial landforms and sediments that provide a record of river history for much of the Holocene. This work has been conducted in collaboration with archaeological surveys and excavations of the fluvial landscapes of Northern Sudan and as part of an international effort to reconstruct the environmental history of the Nile basin over the last 30,000 years. Much of the existing data on hydrological change in the eastern Sahara has been derived from lake sediments and associated palaeoecological records.

Over several field seasons, we have recorded the fluvial stratigraphic record in the region generating data that have been used to supplement and refine interpretations of the archaeological record. Strontium isotope measurements from discrete Nile flood units in palaeochannel fills have allowed us to establish the source, and help constrain the age, of the flood sediments. These data have been compared directly with the continuous strontium isotope record from the Nile Delta. Using thin sections produced from resin-impregnated sediment blocks, we have examined the microstratigraphic features of discrete Nile flood units during key periods of environmental change. New exposures on the eastern margin of the valley floor in the Northern Dongola Reach (>15 km from the modern Nile) record the activity of local wadis and alluvial fans and yield a valuable record of local hydrological changes in this part of the Nile Valley.

A detailed chronology of Holocene river behaviour and flooding episodes has been assembled using Optically Stimulated Luminescence (O.S.L.) supplemented by A.M.S. radiocarbon dating. This paper integrates these datasets and explores some of the archaeological implications. Together, these approaches have yielded important new insights into the dynamics of the Holocene Nile that will be of interest to all those working on the sedimentary and archaeological records downstream in Egypt, and in the marine record in the Eastern Mediterranean.

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Accumulation of aeolian dust within the ancient town of Marea (coastal zone of the South Mediterranean Sea, Egypt)

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The ruins of the Marea ancient town are located on the southern shore of Maryut Lake (also called in ancient times Mareotis), 45 km to the southwest of Alexandria, Egypt. Marea was a very important trade, religious and agricultural centre in the period of 5th-7th century AD. The area, occupied by a town in the past, is of a diversified relief. Local hills are built of sandstones constituted by calcified dunes that accumulated during the last glaciation. The hills are separated by flat depressions of an irregular shape. The uppermost layer in the depressions covering loam and sand sediments is made up of structureless silt of 1.2-1.5 m thick. Analysis of the deposits suggests that in many places they are not disturbed despite the dynamic town development. The following analyses of the sediments were conducted: grain-size distribution, calcium carbonate and humus content, micromorphology of the surface of quartz grains of sand and silt fraction under a Scanning Electron Microscope (S.E.M.), clay minerals, geochemistry, thin-section, and dating by O.S.L. method.
Results of O.S.L. dating method indicate that the filling of the depressions with silt deposits started probably about 2,450±138 years BP, and that it is correlated with dust deposition. The rate of the dust accumulation was about 0.49 mm/year. However, diversified humus content in the deposits suggests that it was not a permanent process. The accumulation took place during intensive dust storms. The sediments in the depressions are fine to medium silt (7-23 μm), with bi-modal particle size distribution likely caused by both the local and the regional origin of the material. Micromorphological analysis of the surface of sand and silt quartz grains in SEM shows the deposits are dominated by two types of grains: fresh and sharp, and crusted by amorphous silica. The sources of the accumulated material could be from the bottoms of desiccated lakes, beach and sea bank deposits and deposits carried by the Nile River. Geochemical ratios (Mg/Ca, Fe/Mn and Na/K) distinguished in the deposits of the depressions show that the beginning of the dust accumulation took place during environmental conditions more humid than the contemporary ones. Later, the drier conditions stabilized. The driest period is assumed to occur around the 14th-15th c. AD, when the higher supply of dust to the depressions was observed. However, the depressions remained much wetter than the surrounding hills, and therefore, many of them were neither cultivated nor built up. Thin section analysis of fauna occurrence confirmed this observation. Finally, the highest concentration of trace elements (Cu, Zn and Pb) in the samples correlates well with the period of Marea prosperity.

WUNDERLICH Jürgen[1]

The Nile Delta through the Holocene: environmental changes and their geoarchaeological implications

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The poster presents results of palaeoenvironmental and geoarchaeological studies conducted in the northern Nile Delta in the 1980s. The research focused on the archaeological sites of Tell el Fara'in/Buto south of Lake Burullus and Minshat Abu Omar in the eastern Nile Delta. The aim was to provide information about changes in the deltaic fluvial system and the coast line during the Holocene, and the effects on the occupation of the northern Nile Delta.
These aims were achieved by evaluating historical topographic maps and satellite images, vibro-coring and analysing samples, as well as geoelectric profiling and obtaining radiocarbon dates.
The results of the field work indicate that the Holocene sediment sequence mainly consists of clay and silt with intercalations of sand indicating the migration of river channels. Peat layers represent phases with a prevalence of brackish environments and reduced sedimentation of clastic sediments. The Holocene sediments cover Pleistocene sands and gravels which had been dissected by Nile branches during the regression of the last glacial maximum. In the early Holocene the surface of the sand deposits formed suitable areas for early settlement until the post-glacial sea level rise and increased sedimentation of Nile mud caused the retreat to the highest sand mounds (turtle backs) and to levees along the Nile branches.
The changing environmental conditions throughout the Holocene were of crucial importance for the settlement pattern and the continuity of settlements within the Nile Delta. Our results concerning changes of the deltaic fluvial system and the coast line will be presented and discussed against a background of recent studies of the effects of climate and environmental changes in Egypt and neighboring regions.

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A geoarchaeological approach of Natural hazards in Egypt: the cross contribution of the Pharaonic architecture, the vernacular settlements, and the palaeoenvironmental proxies

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It is difficult to escape texts when studies are focusing on the Pharaonic Egypt. However most of the texts have a religious or ideological background which gives a "formal" and "official" point of view. Usually, one is expecting that archaeology is associated with systematic excavations and subsequently bring us facts and objects which can support or complete the abundant written sources. Although the "Book of the Temple", at the present stage of research, denotes in a form of chart some functional elements of the building composition, no real architectural treatises or learning documents have been preserved. Special studies of historic (or vernacular) architecture and researches on the environment give major evidences of natural hazards in terms of solutions, destructions or landscape evolutions. In some cases, they may also provide information beyond our current fundamental knowledge, and offer new critical information to our modern community, such as the evidence of recurrent and important seismic activity during Pharaonic Times. According to the physical model of the tectonic plates, one can argue that the ancient and significant seismic activity could be repetitive and could occur again in the Egyptian Nile Valley area. Heavy rainfalls due to climate changes well attested over the last millennia and major flood events from the Nile River were also integrated by the architects when building the religious structures. Here we propose to correlate several proxies such as the palaeoenvironmental changes affecting the sites during the dynastic period, the seismic events, the architectural concepts in order to attest the acceptance by local societies of the natural hazards when building temples.

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The urban landscape of the Berenike harbor (Egypt) over time: geophysical research

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Geophysical research at the harbor of Berenike was applied originally to investigate an area considered by the excavators, S.E. Sidebotham and W.Z. Wendrich, as the prospective location of the remains of a Ptolemaic harbor district. The first season of fieldwork in 1999 has been followed now by three consecutive campaigns (2008-2010), during which some 9.5 ha of the site have been surveyed (about 50% of the site). The results, combined with an analysis of satellite images and earlier geological research (conducted by J.A. Harrell), have provided grounds for formulating new ideas regarding the interpretation and the reconstruction of the urban landscape of this "harbor town". Archaeological testing of these theories is in progress.

Magnetic prospection of the harbor basin, believed to lie within a crescent-shaped ridge seen in both the topographic survey and satellite images has revealed long parallel anomalies following the shape of this feature; these are interpreted as indicative of a receding shoreline as the basin slowly silted up. Two structures observed in the middle of the harbor basin have been found to be surrounded by a magnetically "quiet" area, which most likely reflects a part of the harbor which remained under water until the end of occupation. In all likelihood the structures in question were erected on either a low island or a dredge heap at the port entrance. The emerging archaeological picture is that of reversed stratigraphy in the spatial sense, the earliest occupation from the 1st and 2nd centuries AD being located at the top of the harbor to the north, the latest from the 4th through 6th c. AD standing much lower and at the southern end of the basin.

Magnetic mapping has also provided clues about the nature of the shoreline in the eastern part of the harbor basin where the ruins of the town can already be discerned on the ground surface. The anomalies recorded in this area demonstrate that the architecture may have come right down to the water. Moreover, the clarity of the readings is such that not only can the plans of individual buildings and the streets separating them be read, but it is even possible to discern doorways between particular units. Completed prospection of the terrain extending west of the harbor, where the few features visible on the ground surface are not indicative of any architectural remains, has mapped anomalies that can be interpreted as the corners of a homogeneous architectural complex measuring roughly 50-55 m (E-W) by 70 m (N-S). Archaeological testing to date has left no doubt that this enclosure is of Ptolemaic date and that it should be connected with the industrial and shipbuilding or ship-repair capacities of the port.

Ideas have also been propounded, based on magnetic mapping and analysis of satellite images, concerning the overall makeup of the district lying north of the harbor basin and connecting the Ptolemaic industrial part with the town that sprung up around the temple of Sarapis in the east.

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