

# Topical Symposia

## **T16.04 - Geoarcheology for climatic changes and catastrophic events in human history**

### **Session 102**

**Monday , August 23 - Room: 12**

## **ORAL**

### ***32<sup>nd</sup> IGC - Florence, 2004***

#### **Abstract title**

PALEOCLIMATE PUNCTUATION OF THE ARCHAEOLOGICAL TEXT: WEST ASIAN SOCIAL RESPONSES TO THE ABRUPT CLIMATE CHANGE EVENTS AT 8.2, 5.2 AND 4.2 KA BP

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#### **Keywords**

abrupt climate change

Holocene

Mesopotamia, Egypt, Indus

archaeology

social adaptations

#### **Abstract**

The post-YD abrupt climate changes, at 8.2, 5.2, and 4.2 kaBP, were of decreasing magnitude and duration. These changes appear in the global paleoclimate proxy record, and are linked temporally and causally with major social alterations visible in the archaeological record---where the archaeological record is sufficiently resolved to permit observation.

Each of these abrupt climate changes reduced precipitation and temperature and increased wind-blown dust. The effects upon fully agricultural societies in the Aegean, Egypt, Mesopotamia, and the Indus Valley were similar in kind, different in degree, at each climate change juncture and in each rain-fed or irrigation agriculture environment. In some cases irrigation agriculture was introduced for the first time. In others, irrigation was not possible and societies either tracked to sustainable irrigation agriculture habitats or collapsed into simpler, low energy-transfer subsistence, i.e., pastoral nomadism.

The sequence of these adaptations to abrupt climate change is the archaeological record, from hunting and gathering to early empires, from the Aegean to the Indus.

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***in session: "T16.04 - Geoarcheology for climatic changes and catastrophic events in human history"***

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

FAULTED TELLS ON THE NORTHERN PART OF THE DEAD SEA FAULT ZONE, TURKEY

### **Authors**

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### **Keywords**

Dead Sea Fault zone

active fault

earthquake

surface rupture

offset tell

### **Abstract**

The Dead Sea Fault Zone (DSFZ) is an active left-lateral fault zone between the Red Sea in south and East Anatolian Fault zone in north. The northern part of the DSFZ extends approximately N-S from the Syrian-Turkish border towards north. Large historical earthquakes occurred on segments of the DSFZ and it has been documented that some of them were associated with surface ruptures.

The environs of the DSFZ are rich in archaeological sites in southern Turkey and age of ancient settlements goes back over the past six thousand years in this area. Considering the seismic activity of the DSFZ in historical times and age of ancient settlements, it is possible that ancient settlements located on the fault zone were displaced by the surface rupture during large historical earthquakes. Geological, geomorphological, archaeoseismic and geophysical studies revealed that the Sicantarla Tell (ancient settlement) and Danaci Tell are located on the fault zone and they are offset a few tens of meters and about 20 m, respectively, by the northern part of the DSFZ in the last six thousands years. The 3 April 1872 earthquake (M=7.2) occurred near the Syrian - Turkish border and the 13 August 1822 earthquake (M=7.4) took place further north. The 1822 and 1872 earthquakes probably contributed about 4-5 m and a few meters to the cumulative offset on the Danaci and Sicantarla tells, respectively. The offset tells provide an estimated slip rate of about 4-5 mm yr<sup>-1</sup> for this part of the DSFZ.

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## 32<sup>nd</sup> IGC - Florence, 2004

### Abstract title

SKELETAL RECORDINGS IN SHELLS AND OTOLITHS: IMPLICATIONS FOR PREINDUSTRIAL HUMAN-CLIMATE INTERACTIONS, SOUTHWEST FLORIDA, USA

### Authors

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### Keywords

paleoclimatology

environmental archaeology

stable isotopes

Sr : Ca ratios

Late Holocene

### Abstract

Skeletal hard parts from archaeological deposits of Pine Island, Florida provide valuable archives of environmental/climate changes and associated human responses. Environmental/climate changes are reconstructed from geochemical variation in accretionary carbonate skeletons, such as shells and otoliths (fish ear bones). Here, we present preliminary geochemical data from aragonitic shells of the southern quahog (*Mercenaria campechiensis*) and otoliths of the hardhead catfish (*Arius felis*) and their potential for preserving seasonality information.

$\delta^{18}\text{O}$ ,  $\delta^{13}\text{C}$ , and Sr:Ca ratios contained in shells of the northern (*M. mercenaria*) and southern quahogs have been used in paleoclimate and paleoecological studies, although these proxies have not yet been calibrated. Early geochemical studies of quahog shells focused on the outer prismatic layer. Because of innovations in microsampling methods, recent studies have focused on the middle cross-lamellar layer, providing high temporal resolution. Do both microstructural layers record similar profiles of  $\delta^{18}\text{O}$ ,  $\delta^{13}\text{C}$ , and Sr:Ca variation? To test this, we collected live clams near Bokeelia, Florida and analyzed the last 2 years of growth. Profiles of  $\delta^{18}\text{O}$  from outer and middle layers are nearly identical.  $\delta^{13}\text{C}$  of the middle layer is more variable and can be offset by as much as +2.4‰ than the outer layer. Sr:Ca ratios from the middle layer can be as much as 0.4 mmol/mol higher than the outer layer. Thus, either microstructural layer can be used to study variation in  $\delta^{18}\text{O}$  because both layers preserve nearly identical profiles. Observed offsets in  $\delta^{13}\text{C}$  and Sr:Ca ratios between microstructural layers can potentially complicate calibration of these geochemical proxies and environmental and climate reconstructions.

$\delta^{18}\text{O}$  of hardhead catfish otoliths was evaluated for its usefulness as a temperature proxy. Values were converted to temperature using the equation reported by Patterson et al. (1993, AGU Monograph 78). Summer temperatures are overestimated and reflect the combined influence of temperature and salinity when catfish inhabit estuarine waters during their reproductive season. *A. felis* migrates into Gulf waters during winter months; therefore, temperature estimates are reasonable for the coldest months of the year. Combining geochemical records from quahog shells and catfish otoliths provides independent archives of climate change and seasonality.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

ENHANCED SOIL EROSION RATES IN THE SOUTHERN MAYA LOWLANDS:  
THE LAGO SALPETEN RECORD, GUATEMALA

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### **Keywords**

soil erosion

Maya

lake sediments

anthropogenic impact

### **Abstract**

Sediments from Lago Salpeten, a small karstic lake in the lowlands of northern Guatemala, reveal dramatically enhanced sedimentation and inferred soil erosion rates coinciding with the period of human occupation by the Maya civilization (~1400BC to ~900AD). This pattern is expressed by a thick stratigraphic unit known as the 'Maya-Clay' characterized by high inorganic detrital content, contrasting sharply with over and underlying organic-rich deposits. It has been hypothesized that the Maya Clay was deposited as a result of anthropogenic deforestation and land-use change.

In this study, we integrated data from several sediment cores with seismic data in order to quantify sediment deposition throughout the basin. Using sediment volumes, physical properties and a precise <sup>14</sup>C-chronology, we established a time series of detrital input into the lake basin, which was then compared with estimates of population density based on several archaeological transects in the same watershed. Assuming a 100% detrital origin for the clay unit, erosion rates increased from <1 t/ha during pre-Maya time to >12 t/ha during the Preclassic Maya Period, when population densities were still relatively low (7-48 people/km<sup>2</sup>). During the Classic Maya period (~250-900AD), erosion rates decreased to about 6 t/ha despite a large increase in population density (up to 248 people/km<sup>2</sup>), indicating a non-linear relationship between population density and soil erosion. Pollen studies show a rapid rise in disturbance taxa already in the early Preclassic, indicating deforestation and land use that might cause rapid removal of the nutrient-rich top soil during initial land clearance. In addition to this anthropogenic impact, clay sedimentation may also be affected by climate change, as nearby circum-Caribbean climate records indicate a regional drying trend beginning at ~1500 BC near the base of the Maya clay unit.

Overall, average annual soil erosion rates during the Maya period were > 5 t/ha over an extended period of more than 2200 years. Because natural soil regeneration is at least an order of magnitude less, a major part of the natural soil profile must have been removed by the end of the Classic Period when the Maya civilization entered a period of rapid demise. Following the Classic Maya collapse, soils were regenerated giving rise to modern profiles, however, population densities in Peten have been increasing again since the 1950s renewing concerns about deforestation and soil loss.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

HUMAN RESPONSES TO CLIMATE CHANGE AROUND AD 1300: A CASE STUDY OF THE SIGATOKA VALLEY, VITI LEVU ISLAND, FIJI (SOUTHWEST PACIFIC)

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### **Keywords**

climate change

sea-level fall

settlement pattern

alluvial charcoal

sand dune formation

### **Abstract**

During the Little Climatic Optimum (or Medieval Warm Period - approximately AD 750-1250 in the tropical Pacific), most island settlements were coastal and their inhabitants depended mainly on coastal, particularly nearshore-intertidal, resources. During the Little Ice Age (approximately AD 1400-1800 in the tropical Pacific), many coastal settlements had been abandoned and people had established smaller fortified mountain-top or cave settlements. The change has been attributed to the AD-1300 Event, a short-lived climatic phenomenon which involved cooling and sea-level fall (and perhaps increased storminess). Sea-level fall in particular drastically reduced the food resources available to coastal dwellers. Validation of this hypothesis comes from several lines of evidence in the Sigatoka Valley, Viti Levu Island, Fiji. The earliest human (Lapita) settlements established in this area were coastal with little evidence of environmental impact inland. Around AD 1300, human movement inland is shown by (1) dates for alluvial charcoals in valley sediment sequences, (2) establishment dates for mountain-top and cave settlements, and (3) dates for the accumulation of a river-mouth sand-dune field.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

CULTURAL ECOSYSTEMS OF THE NEAR URALS TAIGA: AGE, NATURAL AND HUMAN HISTORY

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### **Keywords**

Cultural ecosystem

Holocene vegetation changes

slash-and-burn agriculture

bronze smelting

palynological evidence

### **Abstract**

When and how did man become a geological factor? When and how did natural ecosystems turn into cultural ecosystems? In fact, we get to know that the process had started earlier than we could expect.

Cultural landscapes in up-to-date taiga zone in the east of the Eastern European Plain appeared since the end of middle Holocene. Ancient Ugro-Finnic peoples settled in river valleys of the Belaya and the Kama. Then, in the middle of the first millennium they developed valleys of the upper Kama and its tributaries, which were located further to the north within up-to-date middle taiga. At the same time the more favorable for agriculture southern lands were left for nomadic cattle breeders from Asia.

Up-to-date nature of the East European Plain is characterized with distinct vegetation and soil latitudinal belts. Recent palynologic evidence shows it has not been always the same. The mixed coniferous and broad-leaved forests reached their fullest flower in the middle Holocene all over the whole plain. Only the far north was occupied mainly with coniferous species, while the far south was covered with mainly broad-leaved forests and steppe meadows.

Active settling at the Black Sea area in the beginning of the middle Holocene resulted in receding of broad-leaved forests to the north at 500 km per less than 3500 years. But how could scanty and primitive tribes really form the existing natural belts? The answer is in techniques used by ancient people. They include bronze smelting, which needs a lot of wood, and slash-and-burn agriculture, which involves much more area than used for annual ploughing up. At least optionality of man impact resulted in supplanting of a number of species, such as coniferous ones in the south and broad-leaved ones in the north.

Thus a continuous steppe belt was formed in the south of the East European plain and it closed down with woodless areas of Asia, where martial nomad cattle-breeders came from. They forced the settled agricultural tribes to the north under the protection of impenetrable forests.

Therefore, developing of taiga region was a forced action of settled tribes in order to protect themselves from martial nomads but it resulted in essential man-caused changes and vegetation cover differentiation of taiga region because of their optional character and slash-and-burn agriculture.

The latitudinal belting resulted not only from climatic differences but mainly under the impact of replicating economy.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

THE IMPACT OF LARGE EXPLOSIVE ERUPTIONS ON ENVIRONMENT AND CLIMATE: CAMPANIAN IGNIMBRITE - THE MOST POWERFUL ERUPTION OF THE LAST 200 KA IN THE MEDITERRANEAN AREA

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### **Keywords**

High-Magnitude Volcanic Eruptions

Campanian Ignimbrite

Degassing of Magma

Paleoclimate

Human Paleoecology

### **Abstract**

Volcanic eruptions variably affect the environment, from regional to global scale. On a planetary scale, they cause a temperature lowering with significant impact on humans. The record of volcanic aerosols in ice cores shows a clear relationship between climate variation and volcanism in the past 110 ka. If volcanoes can affect climate at global scale, they have to interfere with both environment and human life at regional scale. Despite the numerous studies on volcano-climate-human system in prehistoric times, few were focused on the investigation of the environmental change induced by the highest-magnitude eruptions. The catastrophic Campanian Ignimbrite (CI) eruption of the Phlegraean Fields (Italy), one of the largest late Quaternary events, gives a good opportunity to investigate the climate-environmental effects of the volcanic eruptions. Its recent dating at  $39,280 \pm 110$  yr BP draws attention to its occurrence during a time characterized by bio-cultural modifications in western Eurasia. These included the Middle to Upper Palaeolithic transition and the supposed change from Neanderthal to "modern" Homo sapiens anatomy, a subject of continuing investigation and controversy.

A research project on the environmental modification linked to the CI eruption and its effect on human ecosystems in the Mediterranean region and Southern Europe, has been founded. The project is carried out by combining the expertises in disparate fields such as climate dynamics, anthropology, volcanology, geochemistry, paleoclimatology, geology, marine geology. The objectives of the project will be achieved through field work, laboratory experiments and analyses, and modelling. The project is subdivided in distinct but interdependent Research Lines. The integration of the results obtained within each Line will allow to elaborate new hypotheses effects of the high-magnitude explosive eruptions on climate and environment.

The following have also contributed to this work: Barbante C., Università Venezia, Italy; Bozzato S., Università Roma Tor Vergata, Italy; Civetta L., Isaia R., Navarra A., Fogli P.G., Istituto Nazionale Geofisica e Vulcanologia, Italy; Di Canzio E., Università La Sapienza, Roma, Italy; Giaccio B., Istituto Geologia Ambientale e Geoingegneria, CNR, Roma, Italy; Marianelli P., Università Pisa, Italy; Principato S., Università Milano Bicocca, Italy; Turetta C., Istituto Dinamica Processi Ambientali, CNR, Venezia, Italy; Scaillet B., CNRS-ISTO, Orleans, France.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

THE MIDDLE HOLOCENE DRY EVENT IN CENTRAL SAHARA AND SOCIAL RESPONSES OF PREHISTORIC PASTORAL COMMUNITIES.  
THE CASE STUDY OF WADI TANEZZUFT (SW FEZZAN - LIBYAN SAHARA)

### **Authors**

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### **Keywords**

holocene

climatic change

central sahara

pastoral civilization

### **Abstract**

The mountains of the central Sahara (Messak, Acacus, Tassili) and the adjoining lowlands (Erg Uan Kasa, Erg Murzuq, Erg Tetersin and surrounding pediments) was fed by the monsoon during the Early and Middle Holocene.

The whole area was densely inhabited and the Middle Holocene represents the period of the largest spread of pastoral communities. All the physiographic units of the landscape were densely occupied, with different land uses which are clearly reflected in settlement pattern and site typology. A seasonal connection of transhumant pastoralism has been proved between the lacustrine regions in the lowlands and rock-shelters in the mountain ranges. Also marginal areas with lower suitability for pastoral use were exploited as well, probably for hunting activities, as indicated by concentrations of trapping stones.

The onset of dry conditions at about 5000 years bp was abrupt and has dramatic consequences on the the Pastoral communities. The drought caused a strong contraction of wet areas, and only the main course of the Tanezzuft was still active during the third and second millennia BP, originating a wide greening oasis. Consequently, ergs and pediments were abandoned, and transhumant connection with mountain areas became weak: part of Late Pastoral communities concentrated in the Tanezzuft oasis. High concentration of settlements on alluvial soils, changes in stone equipment (large grinding stones, gouges, stone hoes, etc). Micromorphology of buried soils connected to Late Pastoral sites suggest the development of agricultural practices during the third millennium BP.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

COLLAPSE, DETERIORATION OR BLOOMING OF PREHISTORIC HUMAN CULTURES, IN THE LEVANT, PROBABLY WERE DICTATED BY GLOBAL CLIMATIC CHANGES

### **Authors**

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### **Keywords**

PREHISTORY

CLIMATE CHANGES

LATE QUATERNARY

LEVANT

GEOLOGY

### **Abstract**

The "Milankovitch(1941)Orbital Theory" was later reinforced, mainly by dating of coral reefs (Bard et al 1990, Bloom et al 1974, Broecker et al 1968, Mesolella et al 1968, Imbrie and Imbrie 1980, Imbrie 1984, 1985). The  $\delta^{18}O$  in ocean-waters become a new reinforcing arguments for climate change and their ages (Chappell and Shackleton 1986, Prell et al 1986, Martinson et al 1987, Williams et al 1988, Stuiver and Braziunas 1993). The updated new time scale is a result of dated  $\delta^{18}O$  changes. The new Oxygen isotope changes and the older, named and numbered fluctuations of "Marine Stages" were combined as a new approach of marine investigations (Pisias et al 1984, Prell et al 1986, Martinson et al 1987, Williams et al 1988). The new time scale also includes some specific global changes, such the "Younger Dryas Event" and the "Heinrich Events" "(H1..to...H7)" (Broecker 1994, 1995).

The prehistory of the Levant is classified, subdivided, named and dated periods, as follows, though there are some inconsistencies in the time-sequence (After Bar-Yosef 1984, Bar-Yosef and Yevin 1976, Bar-yosef and Gophna 1982, Gophna 1982a, 1982b, 1982c): (1) The "Early Paleolithic", 1-2 million YBP- 91,950 YBP, with the Olduvai Culture. The Ubadiya and Ark-el-Ahmar formations, and their prehistoric content, belong to this phase (Ron et al 2001b). (2) The "Middle Paleolithic", 91,950 - 81,500 YBP, with the Early+Middle Acheulian and the Mousterian cultures. Both, the Ark-el-Ahmar and the Ruhama sites, predate the paleomagnetic Matuyama-Brunhes (=B/M) transition (Ron et al 2001a, 2001b). and they are older than 780,000 YBP. (3) The "Late Paleolithic", 81,500 - 32,950 YBP, with the Levantinian-Ahmatian and the Aurignacian cultures, part of which postdate the Matuyama-Brunhes transition (Ron 2001c). (4) The "Epipaleolithic", 32,950 - 19,000 YBP, with the Late Achulian + Kebarian + Mushabian + Geometric- Kebarian + Negev-Kebarian + Natufian cultures, all of which postdate the B/M transition. (5) The "Prepotery Neolithic", 19,000-7,950 YBP with the Harifian + Hyamian + Sultanian + Tahunian cultures. (6)The "Circamic-Neolithic", 7,950-6,950 YBP. (7)The "Calcolithic (EEC+LEC)", 6,950-5,250 BP, with the Ghasulian culture. (8)The "Early Bronze (BI+BII+BIII)", 5,250-4,100 YBP. (9)The "Intermediate Bronze(IB)", 4,150-3,950 YBP. (10)The "Middle"+"Late" "Bronze Age", 3,950-3,150 YBP. (11)The "Iron", 3,150- 2,537 YBP.

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## . POSTER

### **32<sup>nd</sup> IGC - Florence, 2004**

#### **Abstract title**

ENVIRONMENTAL CHANGES IN WEST TIEN SHAN DURING LATE PLEISTOCENE: INTERPRETATION FROM DEPOSITS OF ARCHAEOLOGICAL SITE OBI-RAHMAT

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#### **Keywords**

Late Pleistocene

pedogenesis

climatic changes

#### **Abstract**

Obi-Rahmat cave is situated in West Tien Shan, 100 km to N-E from Tashkent, Uzbekistan. The whole stratum is saturated with artifacts of Middle(?) - early Late Paleolithic epoch occurring in situ. Studying of pedogenic properties of the deposits permitted to reconstruct soil forming processes, to reveal climatic fluctuations in the region and to restore the direction of environmental changes.

The deposits were divided into 10 zones of pedogenesis, distinguished by pedogenic features and consequently by character of ancient soil forming process. Type of paleopedogenesis was defined and paleoenvironment was reconstruct for each of the zones. Besides if regularities of modern landscapes and altitude sequences of West Tien Shan are taken into account it allows reconstructing mountains landscapes of Obi-Rahmat cave neighborhood for periods of each zone formation.

It was found that the most part of the strata was formed under the effect of serozems formation (~Haplic Calcisols) in arid subtropical landscapes (desert-steppe zone). As this took place precipitation fluctuated slightly and soil subtypes (in a manner like modern dark and ordinary serozems) altered.

Analogues of modern mountain black-cinnamonic soils (~Humic Kastanozems?), formed now in the most mesophilous slope positions under nut and fruit trees, had a significant place in paleopedogenic evolution of the region. Climate of these periods was warm and humid and optimum for humus formation.

The scheme of altitude sequence and the structure of soil cover had also changed in the region of investigations according to climatic changes and regular displacements of altitude zones took place. When analogues of modern dark serozems dominated in the vicinity of the cave the altitude sequence was characterized by the most complexity, and humid (forests, mountain meadows) as well as arid (desert-steppes, light xerophytic forests) landscapes occupied the slopes. Climatic changes both to humidity and to aridity simplified the altitude scheme. For example, when climate was arid and ordinary serozems dominated near the cave, humid landscapes were ousted (mountain brown forest soils, ~Dystric Cambisols, could be found only on the slope tops). And in contrast, when climate was humid, arid landscapes were ousted from altitude sequence, and forest and meadow zones were dominant.

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**in session: "T16.04 - Geoarcheology for climatic changes and catastrophic events in human history"**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

PEDO-ARCHAEOLOGICAL RECORD OF ABRUPT ENVIRONMENTAL CHANGES

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### **Keywords**

paleosols

paleoenvironment

human migration

holocene

archaeology

### **Abstract**

Paleosols buried under kurgans (burial mounds) and hillforts with an age up to 5500 years were studied in the center of the Russian Plain. We also studied soil sequences buried in floodplain sediments. The latter were formed in periods with low flood levels and bear cultural layers from the Neolithic Age up to the modern epoch. In periods of high floods, active alluviation took place and people preferred to settle on high terraces and interfluves. Along with these local human migrations, distant migrations of ancient peoples were connected with changes in the degree of climatic moistening and corresponding shifts in the boundaries of natural zones. This is proved by archaeological data. Thus, ancient cultures of the steppe zone penetrated far to the north within modern forest-steppe and forest biomes in periods of climatic aridization. For example, in a period of climate warming and aridization 4500-3900 BC (calibrated time scale), tribes of the Middle Bonze culture penetrated far to the north and then, after the end of the steppe stage, migrated back to the south. Chernozems under burial mounds left by these tribes differ distinctly from background Gray Forest soils. The stage of climatic cooling and moistening about 800 BC caused the propagation of forests to the south, which stipulated the migration of tribes of the Gorodetskaya forest culture in the same direction, into the Upper Don basin. Paleosols buried under hillforts of this culture attest to the development of Gray Forest soils from Chernozems of the previous stage. In the 1st-3rd centuries AD, during the period of climatic aridization, Sarmat steppe tribes penetrated to the north, within the modern forest-steppe zone, and then migrated back to the south. Paleosols under burial mounds of Sarmatian tribes bear the features attesting to transformation of Gray Forest soils into steppe Chernozems.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

CLIMATE CHANGE AND ANTHROPOCHEMISTRY IN THE PREHISTORIC PERIOD

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### **Keywords**

Anthropochemistry

Archaeology

Paleoenvironment

human migration

### **Abstract**

Under the impact of considerable climate changes, human cultures (populations) can (1) degrade up to complete extinction, (2) adjust to new environmental conditions via corresponding changes in the economy and (3) migrate to new places with more favorable environmental conditions. As a rule, the following cause-and-effect chain is considered as a mechanism of these changes: alteration of temperature and humidity-changes in soil fertility and crop productivity-lack of food for humans and domestic animals and, as a result, one In our report, we consider one more possible mechanism: climate change-changes in chemical composition of soils and waters and, hence, changes in growing conditions of wild and cultural plant species-changes in chemical composition of food products-changes in the health and behavioral reactions of humans and, as a result, possibility of considerable changes in the total social community. The science studying interactions between humans and chemical environment is called anthropochemistry (Alexandrovskaya & Alexandrovskiy, 2003). The state of human populations can also be affected by some other natural factors changing anthropochemical conditions (e.g., volcanic eruptions) and by the inner factor acting in societies, i.e., the invention of new technologies involving new chemical substances

**ACCEPTED as Poster Presentation**

**in session: "T16.04 - Geoarcheology for climatic changes and catastrophic events in human history"**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

THE ATTEMPT OF THE ANALYSIS OF HISTORICAL STRONG EARTHQUAKES PARAMETERS' RELIABILITY ASSESSMENT IN THE TERRITORY OF ARMENIA AND ADJACENT REGIONS

### **Authors**

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1 - National Survey for Seismic Protection of RA

### **Keywords**

historical earthquakes

seismic parameters reliability

parameters root classes

hierarchical scale

### **Abstract**

The Republic of Armenia and adjacent countries are an area of strong and destructive earthquakes. It is conditioned by their location in the Arabian and Eurasian continental collision zone. We have rich data on the strong earthquakes occurred in the region from 6th Century (c.) B.C. to 1988, Spitak, M=7.0, Armenia, as an ancient country that has written language since the 5th (c.) and a high culture of civil engineering, represents a special interest from the point of view of large opportunities to study the historical earthquakes and their influence on the construction culture's historical heritage objects. Armenia is rich in ancient architectural and cultural monuments. Many of them dated to antique times, Middle Ages, were suffered a lot from strong earthquakes and now we have ruins or partly retrofitted buildings of once excellent ancient monuments. Such as: temple Zvartnotc (7th c.), churches Aruche, Taline (7th c.) - it isn't known by which historical earthquake was destroyed-, cloisters Kecharis (11-13th c.-es), 1827, M=6.5, Akhchotcvank (10-13th c.-es), Havutctar (11-13th c.-es), fortress Kaqavaberd (11-13th c.-es), 1679, M=7.0 etc. To another group of rich architectural heritage we can consider the structures which were suffered a little from strong earthquakes and entirely retrofitted after them. Among the second group are heathen temple Garni (1st c.), 1679, M=7.0, the cathedral and cloistral structures of Tatev (9-17th c.-es), 1139, M=7.0; 1407, M=6.5 etc. A part of them now are used as religious structures or cultural monuments (museums, touring objects, exhibition halls etc.). But, nowadays they are under the danger of strong, possibly destroying, seismic influences. The task is set to effectively decrease the seismic risk for preservation of the cultural heritage built in the past. In order to solve it, it is necessary to study the historical seismicity of Armenia. The more complete and authentic the historical information about earthquakes is, the more accurate the definition of a seismic regime of the region, as well as the seismic hazard and risk assessment are. With comparing modern methods (European, Russian) and revising the method elaborated in the NSSP RA in 1996 have been developed the method of the seismic parameters reliability assessments in RA and adjacent territories. The hierarchical scale of the root classes received in the result of this work for each of seismic parameters allows to deepen the degree of reliability assessment of studying for each of basic parameters of each earthquake.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

THE IMPACT OF THE LATE HOLOCENE SOMMA - VESUVIUS ERUPTIONS ON THE LANDSCAPE AND HUMAN ACTIVITIES

### **Authors**

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### **Keywords**

Environmental Geology

Archaeology

Somma-Vesuvius

### **Abstract**

The geomorphological results of a pluridisciplinary geoarchaeological research carried out on the Campanian archaeological sites affected by products of the main explosive eruptions of Somma-Vesuvius are shown in this note. This volcano, still active, rest on the coast in the central part of the Gulf of Naples (Southern Italy). The volcanic area and its surroundings territories has been inhabited since the prehistoric time and many civilities are documented by archaeological findings. It has pointed out the role played by the negative effects of plinian eruptions as cause of landscape morphotopographic alterations with consequent modifications of local geoenvironmental characteristics from which depend the human activities, especially in prehistorical time. The areas close to volcano have undergone the greatest geomorphological modifications and alterations of topographic surface, whereas the distal ones very little. That is also reflected on the time of resumption of the anthropic activities after the destruction caused by the eruption. In the archaeological sites nearest the volcano, infact, the time of resumption is very long (several centuries or thousand years), whereas few years or very soon for the distal sites up to 70 km. The time of resumption depend of the time of restoration of georesources ("environmental histeresys"). In such highly vulnerable territory the ancient civilities were strongly dependent from local georesources, so that their activities and developments were connected to it. The study is based on detailed geomorphological and stratigraphic survey of the area surrounding the archaeological sites. From data analisys emerges that the environmental histeresys is related to the importance of the eruption (plinian or no-plinian), to the distance of the vent and to the cultural level of civilization (as dependent from local georesources). From the research, for the first time, emerges that since the Neolithic/Bronze Age the populations in the vesuvian area has experimented a destiny of destructions and re-occupations: in many archaeological places has been found a complex stratigraphic succession with alternances of anthropic occupation levels (archaeological strata) and catastrophic events such as volcanic eruption products. These data help to think about the man-environment interactions in an area characterized of very strong and active volcanic risk with high frequency of destruction and restoration of georesources.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

GEOARCHAEOLOGICAL EVIDENCES OF RECENT CLIMATIC CHANGES AND CATASTROPHIC EVENTS IN THE NEAPOLITAN URBANISED AREA

### **Authors**

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### **Keywords**

geoarchaeology

climatic change

catastrophic events

Neapolitan Area

### **Abstract**

The geoarchaeological research pointed out that many urban areas have been affected by the same local geological problems during all the historical period.

A particular geoenvironmental problem is represented by the bradyseismic movements that affected all the Neapolitan urbanized surface coastal area; in fact the roman buildings are usually found some meters (5-7) below sea level. The last bradyseismic uplift happened in the Phlaegrean Phields in the period eighteen eighty three- eighteen eighty five affecting an area densely populated around Napoli and also the western part of Napoli. The urban area of Napoli, from Roman Period to the end of Middle Ages, was affected by three bradyseismic movements that lowered the roman soil of eight-ten meters maximum. The bradyseismic movements are correlatable with the cyclical climatic variations. The soil uplift happened during the warm-arid period named "Roman Greenhouse Effect" and "Crusades Greenhouse Effect"; the soil surface lowered during the cold-humid periods named "Dark Age Little Ice Age" and "Little Ice Age". According to this ciclicity we think that in the near future the Phlaegrean Area will be affected by another soil uplift. The Buildings existing in the Phlaegrean Area are not structured to resist to the bradyseismic soil deformations characterized by anomalous expansion.

Original researches evidenced that not well known Intraplinian Vesuvian eruptions alimanted a lot of debris flows at the base of the calcareous mountains surrounding the Campanian Plane; in fact we found ten-fifteen meters of resedimented pyroclastic sediments and soils covering the roman anthropized surface (for example in Castellammare di Stabia, Sarno).

The stratigraphic recostructions evidenced that all the ancient towns built in the alluvial plains areas where affected by contemporaneous catastrophic flooding. We recognised three regional flood period. The first happened between the sixth and forth century Before Christ and we named it "Archaic Little Ice Age"; the second happened between the sixth and eight century A. D. and is named "Dark Age Little Ice Age"; the third happened between the sixteenth and eighteenth century A. D. and is named "Little Ice Age".

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

ANCIENT PEOPLING AND GEOMORPHOLOGICAL EVOLUTION IN THE ALLUVIAL PLAIN BETWEEN FAENZA AND RAVENNA (EMILIA ROMAGNA, ITALY)

### **Authors**

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### **Keywords**

Po Plain

Holocene

Continental stratigraphy

Geoarchaeology

Palaeohydrography

### **Abstract**

In the plain between Faenza, which is placed near the external front of the northern Apennines, and Ravenna, by the southern border of the Po delta, several archaeological sites have been found, since the past years. Generally, they are covered with a wide blanket, made by fine alluvial sediments by Santerno, Senio and Lamone rivers, at a depth included between few decimetres and more than ten metres.

This alluvial plain is characterised, on the surface, by an extremely regular territorial organisation, which is called cenuriatio and dates back to Roman times, that parcels the fields in squares of nearby 710 square meters. It was probably set out and started at the beginning of the II century B.C., after the tracing of the via Aemilia (187 a.C.), which was assumed as its main axis (decumanus maximus).

A typical example of this territorial layout is evident in the surroundings of Lugo, where a Roman surface at a medium depth of 4/5m is associated, surprisingly, to an extremely well preserved centuriatio.

In this study, through the analysis of the present micromorphology, the main archaeological stratigraphies concerning Roman and Medieval layers, and a wide consideration of soils, it has been possible to critically consider the current hypothesis of ancient topography, in order to better reconstruct the diachronic evolution, both natural and anthropic, of this alluvial landscape during historical times.

Moreover, considering that the geoarchaeological analysis has shown particular aspects of interaction between the natural evolution and the ancient peopling, we want to underline the potential of using the depths of Medieval levels (VIII-XII century B.C.), in addition to the ones of Roman times (already used as basis of Unità di Modena; see Carta Geologica d'Italia 1999, Carta Geologica d'Italia alla scala 1:50.000 - Note Illustrative, Foglio 223, Ravenna, ed. A. Amorosi, Roma), in order to better understand the chronostratigraphy of historical alluvial deposits of the Po Valley.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

GEOARCHEOLOGY OF CATASTROPHIC EVENTS AND CLIMATIC CHANGES IN ITALY DURING THE LATE HOLOCENE

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### **Keywords**

Geomorphology

Climate changes

Geoarcheology

Italy

### **Abstract**

The AIGEO Working Group on " PHYSICAL GEOGRAPHICAL AND GEOMORPHOLOGICAL CONTRIBUTION TO ARCHEOLOGICAL RESEARCH" was founded about two years ago to carry out researches on the topic of geoenvironmental changes caused by catastrophic events and significant climatic oscillations, those of short term in particular, and on the effects they had on ancient cultures. Current climatic changes are causing clear alterations in the most sensitive areas. Similar changes of higher strength in the historical and prehistoric past, certainly caused even more marked and sometimes catastrophic effects on our territory affecting life to such an extent, that sometimes it was necessary to modify human activity for a better exploitation of the new situation. Man himself, in his turn, was able to become a morphogenetic agent in his environment owing to the available technology. Understanding relationship between man and his environment in the past may help steering us into a more sustainable future development.

The present studies concern:

- Changes in land use caused by the development of deltas: the cases of the Tiber, Ombrone and Crati rivers over the last 6,000 years;
- Volcanic eruptions and changes in land and human activity in the Somma-Vesuvio region;
- Flooding in the Po Plain in late antiquity: the cases of Modena and western Emilia;
- Aridity crises and depopulation of the Apulian Tavoliere and Apulia in Late Neolithic times;
- Landslides and evolution of Alpine settlement;
- Archeological evidence of catastrophic events in Sardinia;
- The sea-level rise and the changes of human activity in Sardinia during Roman times;
- Record of catastrophic events and climatic trend in dendrochronological series;
- Effects of catastrophic events and rapid climatic changes along the Ligurian coast (Genoa);
- Man impact and degradation of the Late Holocene slopes in the southern - central Marche;
- Historical hydrographic changes in the Romagna plain: the case of Faenza.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

GEOARCHAEOLOGICAL EVIDENCES FROM THE PONTELUNGO AVENUE DIGGING OF ALBENGA - SV

### **Authors**

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### **Keywords**

Albenga

Geoarchaeology

ancient Roman site

flood events

### **Abstract**

Albenga, which historical town correspond to the ancient Roman site of Albingaunum, has always been a town subject to flood events that have bound, in past times, its topographical development.

The excavations carried out in 1999 to adjust the City sewer system, allowed to get new and interesting data to reconstruct the ancient topography and the paleoenvironment to the North area of Albenga.

The excavation, supervised by the Soprintendenza Archeologica della Liguria, made possible to determine the up to today uncertain ancient road network to the North of Albingaunum.

Consequently, it is now also possible to recognize how, in the course of ages, the area's topography was strongly conditioned by the closeness of the terminal segment of the Centa river which flows to the South of the town since the half of the XIII Century; the obtained data are consistent with the delta model developed by Le Blanc in 1972.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

LATE HOLOCENE CATASTROPHIC FLOODS IN THE ARNO RIVER BASIN (TUSCANY, CENTRAL ITALY): FLOODPLAIN GEOARCHAEOLOGICAL ARCHIVES AND THEIR IMPLICATIONS FOR RAPID CLIMATE CHANGE AND HYDRAULIC HAZARDS

### **Authors**

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### **Keywords**

GEOARCHAEOLOGY

LATE HOLOCENE

CATASTROPHIC FLOOD

ARNO RIVER

### **Abstract**

Recently discovered Etruscan and Roman remains in the shallow subsoil of the Arno River floodplain (Central Tuscany, Italy) tell a story of catastrophic hydro-climatic events occurred between 3,000 and 1,500 years ago. Two sites are of particular significance due to their location in different reaches of the Arno River; the upstream one, Gonfienti site, is located on the eastern side of the mid Arno River Valley within the Firenze-Prato-Pistoia Plio-Quaternary basin, the downstream one is in lower Arno River valley, Pisa-S.Rossore site, within the onshore portion of the Viareggio Basin, a northern Tyrrhenian Neogene-Quaternary basin. The Gonfienti site concerns a relatively wide Etruscan settlement founded at the confluence of the Marina Creek into the Arno River plain and few km from the Calvana Mount, a ridge made of early Cainozoic marls and limestone. The Pisa-S.Rossore site is characterized by the remains of a fluvial harbour, settled by the Etruscans but largely exploited by the Romans, consisting of 16 well-preserved ships and thousands of items related to their cargos. The stratigraphy and the sedimentary facies development is quite different in the two sites. At Gonfienti the Etruscan town is buried below 1-1,5 m thick alluvial-slope deposits consisting of three distinct sandy-silty beds with floating pebbles and brick clasts, interpreted as mudflow deposits, overlain by recent alluvial laminated sand and silt. At Pisa-S.Rossore the ships and their cargos are buried below 5 m thick post-Roman and Modern alluvial muds and debris and are encased within medium-coarse sands arranged in sets of planar inclined beds dominantly dipping to NW, separated by thin (dm-thick) silty-clayey beds. These deposits are interpreted to results from catastrophic crevassing of the Arno River which between the 2nd century BC and the 5th century AD destroyed the harbour and the moored ships located in an abandoned river channel. The flood-flows generated sandy lobes whereas muds draping the lobes accumulated during interflood periods. A calibrated radiocarbon chronology makes possible to compare and partially correlate the Gonfienti and Pisa-S.Rossore stratigraphies and facies successions in order to trace high-magnitude hydroclimatic events across a relatively wide region. These lines of evidence are of particular interest for the: 1) forecasting of high-frequency climatic changes; 2) understanding of hydraulic hazard dynamic in a densely populated floodbasin.

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## **32<sup>nd</sup> IGC - Florence, 2004**

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LATE HOLOCENE CATASTROPHIC FLOODS IN THE ARNO RIVER BASIN (TUSCANY, CENTRAL ITALY): FLOODPLAIN GEOARCHAEOLOGICAL ARCHIVES AND THEIR IMPLICATIONS FOR RAPID CLIMATE CHANGE AND HYDRAULIC HAZARDS

### **Authors**

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

PALAEOFLOOD EVIDENCE FROM A LATER UPPER PLEISTOCENE KARSTIC ROCK SHELTER RECORD ON THE UPPER JARAMA VALLEY (CENTRAL RANGE, SPAIN)

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### **Keywords**

Palaeoflood,

Rock shelter

Karst

Late Upper Pleistocene

Spanish Central Range

### **Abstract**

The Upper Jarama Valley (Valdesotos, Guadalajara, Spain) is located on the southern slope of the eastern part of the Spanish Central Range. In this area the valley cuts and runs through a narrow strip of carbonated rocks (Upper Cretaceous) tilted towards the SW and affected by a strong karstification. This karstic system is spanned by Jarama River, creating a karstic canyon with many caves and rock shelters in the cliffs of both banks. One of this rock shelters, Jarama VI, is located on the left bank of the Jarama River, in the middle of a hillside, 20 m above the river, and is partially filled up. The lithostratigraphic sequence, which spans from the altered substratum limestone, presents five levels from bottom to top, and begins with a sterile level originated on the stratum alteration (level 4). A cold autochthonous clastic deposit follows it with a human occupation of the Middle Paleolithic (level 3). The upper part of the level was affected by a strong erosion due to a huge palaeoflood, which caused the sedimentation of a sandy series (sublevel 2.3) that ends in flood silts (sublevel 2.2). Both sediments shows many sinsedimentary and postdepositional fluvial structures of a great quality, as parallel laminations, planar and furrowed crossed laminations, stream ripples, fluid escape structures, convolute lamination, roots traces, etc.

Charcoals have yielded the date Beta-56639 32.600 + 1.860 BP. These typically fluvial deposits -overflowing and flood plain facies- have their origin in a fluvial palaeosuperflood (Kirianova and Rudoy, 1996; Sheffer et al., 2003). At the top part of this level and inside the rock shelter there are clastic intercalations (sub-level 2.1) plenty of Mousterian artefacts with the radiocarbon date Beta-56638 29.500 + 2.700 BP. An stratigraphic hiatus due to erosion processes separates level 2 and level 1. Level 1 has a cold autochthonous clastic nature containing many human occupation remains from Early Upper Paleolithic age. Although these remains could be dated indirectly with Beta-56640 23.380 + 500 BP. The sequence is sealed by a stalagmitic crust (level 0). The 14C dates from Jarama VI locate the palaeoflood in the chronostratigraphic scale. Therefore, both dates Beta-56639 32.600 + 1.860 BP and Beta-56638 29.500 + 2.700 BP let placed the upper part of level 2 somewhere on the Later Upper Pleistocene, between the isotopic stages 3 and 2 (Shackleton and Opdyke, 1973).

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

RHINE'S FLOODS DURING ROMAN ANTIQUITY. GEOARCHAEOLOGY OF THE OEDENBURG GALLO-ROMAN SITE (BIESHEIM-KUNHEIM, HAUT-RHIN DEPT., FRANCE)

### **Authors**

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### **Keywords**

Geoarchaeology

Flood deposits

Rhine

Gallo-Roman period

Dendrochronology

### **Abstract**

The archaeological site of Oedenburg takes place in the Alsatian Rhine's floodplain.

This place, located across Rhine's channels, was dedicated not only to civilian activities (vicus from the 1st to the 4th century AD) but also to military settlement (1st and 4th century). As a result, Oedenburg was related to the Upper Rhine Roman Empire's 'Limes' (Roman boundary) during the first century AD and the fourth century AD.

In order to better understand relationships between alluvial environment and the roman occupation a geoarchaeological approach has been performed.

A micro-topographic land survey and ortho-correction of aerial photos have been realised, over the study area, and associated with spatial distribution of thousands of archaeological artefacts discovered during several field prospecting.

This approach highlights the evolution of human occupation and gives us estimation of the end of some channels activity.

Large scale excavations and cross-sections analysis made possible to recognise evidences of several floods in a small channel during roman period (from the middle of the 1st century AD to the beginning of the 2nd century AD).

Minute dating of roman artefacts discovered in this small lateral Rhine channel led to constrain accurately chronology of the observed flood deposits as sterile, homogenous and continuous fine sand sheets interlayered with archaeological levels.

Moreover, the good preservation of wood-artefacts allowed us to study growing anomalies (with the help of dendrochronology and  $\delta^{13}C$  analysis of some trees found in archaeological context). These growing anomalies are probably due to an hydrological stress affecting the alluvial forest.

These geoarchaeological observations and dendrochronological datas allowed us to focus on floods at the end of 1st century AD (93 AD) that have affected a part of the Rhine floodplain, but don't seem to have modified significantly the human occupation.

**ACCEPTED as Poster Presentation**

**in session: "T16.04 - Geoarcheology for climatic changes and catastrophic events in human history"**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

ARCHAEOFAUNA AS A PALAEOENVIRONMENTAL PROXY : CHARACTERISATION OF REFUGES FOR NEOLITHIC SETTLEMENT AFTER THE RAPID PULSES OF ARIDITY OF THE LATE HOLOCENE

### **Authors**

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### **Keywords**

Palaeoenvironmental reconstruction

bovid ecology

refuges

western Africa

Holocene

### **Abstract**

Understanding the human presence in a given location and landscape requires an in-depth knowledge of the environmental setting. Due to strong wind deflation in arid zones, many archaeological sites lack environmental proxies, such as plants remnants, micro-organisms or sediments. This study proposes a method of environmental calibration based on archaeozoological remains, such as mammals species hunted or exploited by human.

Modern distribution of bovid species is recorded from the specialised literature, and matched with African vegetation classes (Global Land Cover Characteristics Database of the United States Geological Survey). For each species, an "environmental interval" is calculated from all its occurrences in the vegetation classes. The faunal list of a Neolithic site gives an association of those environmental intervals, and the calibration is obtained by keeping their maximal intersection.

This actualistic approach assumes some similarities between modern and past fauna and ecosystems. The originality of the study is to use only species occurrences without quantification, in order to avoid the distortions due to the poor archaeological material preservation in arid zones. The application of the method on modern data provides significant results to within about one vegetation class and defines the limit of the method (modern data influenced by human activities, bovid endemism).

A corpus of archaeozoological data is compiled for western Africa during Holocene. The calibration shows that tree cover was well developed locally, around refuges governed by edaphic characteristics (palaeolakes, wadi, floodplains, reliefs,...), when the global climate became drier.

It provides complementary data comparable to previous qualitative (pollens) and quantitative (models) reconstructions of Holocene vegetation in western Africa, at a different scale. This explains the patterns of archaeological settlement, the potential of human adaptation against the rapid pulses of aridity recorded around 5000-4500 BP and 2000 BP and also the place where cultural innovations and exchanges, and social mutation occurred at the end of the Neolithic.

**ACCEPTED as Poster Presentation**

**in session: "T16.04 - Geoarcheology for climatic changes and catastrophic events in human history"**

# General Symposia

## G03.12 - Rapid and catastrophic geological changes and societal response

### Session 125

Monday , August 23 - Room: 6

## ORAL

### *32<sup>nd</sup> IGC - Florence, 2004*

#### **Abstract title**

SOCIAL AND CULTURAL CONSEQUENCES TO A LATE HOLOCENE ERUPTION IN CENTRAL MEXICO

#### **Authors**

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#### **Keywords**

Popocatépetl

migration

Mexico

religion

volcanism

#### **Abstract**

Volcanic disasters often have been invoked as prime movers in the culture history of ancient Mexico. They have been used to explain massive population movements that led to the emergence of the great city of Teotihuacan in the central highlands and the Early Classic florescence in the Mayan area. In this paper we explore both the geological and archaeological records in order to provide insights on the variable nature of human responses to a major volcanic event of the Popocatépetl volcano in central Mexico that took place 2000 years ago. We suggest that the population implosion experienced by some emerging highland cities in the first century of the common era was due not only to the immediate consequences of the volcanic event itself but also to an acceleration of social processes already underway. As people had to deal with "the allocation of blame and the allocation of resources" in the aftermath of the eruption, religious responses may have been highly adaptive as people became ensnared in ensuing conflicts. A better understanding of the relationship between human populations and volcanoes permits a more realistic assessment of the social and cultural significance of eruptive phenomena in the Prehispanic period.

**ACCEPTED as Key Lecture**

**in session: "G03.12 - Rapid and catastrophic geological changes and societal response"**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

THE END OF NORSE GREENLAND:  
A NATURAL CATASTROPHY OR GRADUAL ATTRITION?

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### **Keywords**

Norse

Greenland

fossil flies

archaeoentomology

### **Abstract**

The disappearance of the Norse from Greenland during the 14C in the Western settlement and the 15th C in the Eastern, has always been a topic for discussion. It is often put forward as a classic example of the impact of climatic deterioration on farmers who were reluctant to modify their subsistence base. However without the dead left in the farms, the archaeological data are not conclusive and the palaeoenvironmental data now emerging only seems to add to the confusion. In particular, fossil fly data from two farms from the Western Greenland provide very precise information about the different phases of occupation of the farms. The use of fossil fly puparia in environmental reconstruction is a very sensitive tool that can pick up many of the activities inside the farms, abandonment period and occasionally the reasons for desertion. The contrasting pictures of everyday life from the farms GUS and V54 that have been produced on the basis of their fly faunas, add more clues to the interpretation of the end of Norse Greenland. Was it a natural catastrophe that evacuated the Western Settlement in Greenland at 1350 AD, three centuries after primary occupation or just a non viable place was abandoned by its inhabitants?

**ACCEPTED as Oral Presentation**

**in session: "G03.12 - Rapid and catastrophic geological changes and societal response"**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

EARLY BYZANTINE SEISMIC EVENT RECORDED IN MANYAS-ULUBAT LAKE SEDIMENT (N-W TURKEY) AND ARBORICULTURE COLLAPSE

### **Authors**

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### **Keywords**

Turkey  
earthquake  
arboriculture collapse  
Roman-Byzantine period  
lakes

### **Abstract**

Lakes Manyas and Ulubat (N-W Turkey) are located on strands of the North Anatolian Fault. Written records of past earthquakes reveal a devastating cluster in the Early Byzantine Tectonic Paroxysm (EBTP) from the fourth to the sixth century. The Beysehir Occupation Phase (BOP, c. 3300 yr BC - AD 200-800) is a cultural phase seen in palynological diagrams of S-W Turkey. It is marked by a rich arboriculture as well as pastoralism. The end of the BOP is relatively sudden and dramatic in palaeoenvironmental terms and coincides with changes in people distribution and lifestyles. Similar collapses of arboriculture have been observed in diagrams from Greece and the Dead Sea.

Lake Manyas has provided an 11 m-long sediment record which revealed two seismites: at the bottom of the sequence (11 m, between 2290 and 2030 calibrated years BC) and at c. 4 m. The nearby 7 m-long Ulubat sequence shows a hiatus near the bottom of the core. The 4 m event of Manyas and the bottom event of Ulubat date of c. AD 400. Historical documents indicate local seismic events at AD 460 at Cyzicus and at AD 368 at Germe. Those are most likely responsible for the event; unless it was caused by a more regional earthquake with a large felt area: the Marmara seism at AD 447 or the eastern Mediterranean seism at AD 365. In both lakes, in addition to dramatic local changes in water quality, aquatic vegetation and sediment, the regional terrestrial vegetation (extending outside of the drainage basin of lakes Manyas-Ulubat) is similarly affected. The shift from a Quercus forest and arboriculture to Pinus woodland never reverses.

It is clear that events of a similar type were rare (1 or 2 in c. 4100 years) and that the effect of the earthquake was long-lasting. The crucial element is the permanent change in terrestrial vegetation in both sites. In conclusion, although one single earthquake could not have influenced the whole of western Turkey (and some neighbouring countries), there is a strong possibility that the end of the BOP in various places is linked to individual earthquakes. This occurred with the unfavourable background of an increasing rainfall deficit over the same time period, i. e. the end of the Roman period and the early Byzantine one. A civilisation, that is under stress because of a climatic deterioration, may not be able to survive the additional effects of a cluster of earthquakes.

**ACCEPTED as Oral Presentation**

**in session: "G03.12 - Rapid and catastrophic geological changes and societal response"**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

CYCLICAL CLIMATIC CHANGES AND ENVIRONMENTAL CRISES IN THE MEDITERRANEAN AREA (2500 BP-PRESENT DAY)

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### **Keywords**

climatic change

cyclicity

environmental crises

Mediterranean Area

### **Abstract**

The Mediterranean area acts as a boundary zone between humid and desert zones and is highly sensitive to variations in climate and environment. Indeed, shifts in the climate bands towards north or south by only a few degrees of latitude may result in dramatic changes in soil surface conditions.

The main result achieved through geoenvironmental research is the identification of cyclicity (period of about 1000 years) of the major climate and environmental changes that have resulted in 100 to 200 year environmental crises. Paleoenvironmental, paleoclimatic and geoarchaeological data show that the Mediterranean area was chiefly affected by environmental conditions similar to those of the present day (Ortolani and Pagliuca, 1993).

There is clearly a close correlation between climatic and environmental changes and solar activity. Prolonged solar activity maxima coincide with warm "greenhouse effect" periods and repeated solar activity minima coincide with cold periods, such as the Little Ice Ages. The history of mankind and the environment in the last few millennia highlights progressive, cyclical climatic and environmental changes that consistently occur in multacentennial periods.

During periods in which the temperature increased by 1-2 °C, "greenhouse effect" environmental conditions similar to those expected in the near future were established and coastal zones were affected by desertification up to about latitude 42° N (Roman "Greenhouse Effect", 100-300 A.D.; Crusades "Greenhouse Effect", 1100-1270 A.D.).

During temperature decreases, the areas of alluvial plains subject to human impact and settlements were affected by an accumulation of huge volumes of sediments (Archaic Little Ice Age, 500-300 B.C.; Dark Age Little Ice Age, 500-750 A.D.; Little Ice Age, 1500-1830 A.D.); this resulted in aggradation and progradation of the coastlines. During the transition periods from humid to warm-arid and at the beginning of cold-humid climatic variations, other significant geoenvironmental variations (hydrologic and geomorphological instability) occurred concurrently with the marked increase in rainfall that took place after warm periods.

**ACCEPTED as Oral Presentation**

**in session: "G03.12 - Rapid and catastrophic geological changes and societal response"**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

THE LOESS EARTHQUAKE LANDSLIDE  
IN HAIYUAN COUNTY, NINGXIA

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### **Keywords**

the Haiyuan EarthquakeLoess landslide

microstructure

Magnifying effect

site soil reaction.

### **Abstract**

On the 16th of December 1920, the strong earthquake occurred in Haiyuan County of Ningxia, China, which resulted in intense surface deformation around the breakdown belt and the extreme earthquake country. The large-scale failures and loess seismic landslides occurred over 600 times. Forty-one earthquake barrier lakes took shape, the destruction area whose intensity is above eight degrees amounts to  $50 \times 10^3 \text{ km}^2$ . This paper focuses on the mechanism of loess seismic landslide, researching from the microstructure property of the late Pleistocene loess in the landslide-attacked region and the coupling effect between earthquake waves and site soil.

The late Pleistocene loess reveals loosen structure and porous property. The concrete research is done into microstructure property is done in respect of the loess's arrangement mode of grain shape, pore feature, state of binding materials and structure type. Those special properties affect and control the extent and the destruction area. The magnifying and basin effect of earthquake waves are caused from special topography and geomorphologic. So the mechanism of large-scale loess seismic landslide is connected with thicker burden soil, the microstructure of loess, topography factor, and basin effect. All of above lead to large-scale seismic loess landslides and make the disaster condition of earthquake worsened than other types of site soil. The paper also provides control methods.

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### **ACCEPTED as Oral Presentation**

**in session: "G03.12 - Rapid and catastrophic geological changes and societal response"**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

TUNGUSKA GAS CATASTROPHE AS PREVENTION OF POSSIBLE MAN-MADE EXPLOSIONS

### **Authors**

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### **Keywords**

gas

explosive

catastrophe

### **Abstract**

The Tunguska meteorite explosion that took place in Siberia in the summer 1908 has been drawing explorers' attention for nearly a century. So far the version that the explosion resulted from the collision of Earth and a cosmic body has been widely covered in the scientific literature and media. However, even a general idea of the explosion site geology and interpretation of some paradoxes, which cannot be explained by space hypotheses, provide arguments to conceive that the explosion was caused by the ignition of a jet of helium-containing hydrocarbon gases which were released into the atmosphere at breaking down a high-head gas reservoir seal. The idea was presented at different scientific meetings and published in the city of Tomsk in 2002. It was positively spoken of in a number of European countries.

This version of the Tunguska explosion makes geologists pay attention to the problem of the safe existence of three European cities located close to large man-made fuel gas storages. An estimated billions cu m of gas being at 100 atm pressure is 10 times more energetic than the Tunguska explosive power (Timofeev, 1998). Many European cities and capitals are situated in seismic zones or within influence of large crust fractures. In case of an increase in tectonic activity there will be major earthquakes followed by ground shifts and building destructions. In such situations gas storage seal failure may happen. Events may start to be developed under the scenario of the Tunguska explosion having the same effect as 500 nuclear bombs, which were dropped over Hiroshima. It is obvious, that their consequences will be very tragic.

In this connection it is urgent to study "the Tunguska meteorite" phenomenon as a result of combustion gas explosion. Using it as an example, Nature itself tenders to study dangerous phenomena and find out what causes them. At the explosion epicenter it is necessary to fulfil a complex of modern geological and geophysical studies. To do this would require a special Interstate Fund. It may unite geologists from the countries interested in the problem and help them to establish plausible reasons of the Tunguska catastrophe and study physical features of that subnuclear natural explosion.

**ACCEPTED as Oral Presentation**

**in session: "G03.12 - Rapid and catastrophic geological changes and societal response"**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

NATURAL HAZARD AND RISK MAPS FOR EUROPEAN REGIONS

### **Authors**

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### **Keywords**

Natural hazard

Hazard risk

Spatial Planning

Risk classification

Structural funds

### **Abstract**

This abstract summarizes some results of the European Spatial Planning Observation Network's project 1.3.1, focusing on natural hazards. Europe experiences different natural hazards and risks that have various effects on the development of its regions. In order to facilitate risk mitigation through planning processes, relevant hazards are filtered. This abstract focuses on the typologisation of risks and hazards, as well as on the risk profile of regions (hazard potential and vulnerability). The aim is to better understand risks, facilitate targeted responses and policies, and to point out comparable situations across Europe. The starting point for the typologisation of hazards is a risk classification and characterization scheme upon the relevance of risk types in the context of spatial planning: 1) a low probability of occurrence and a high extent of damage and 2) an unknown probability of occurrence and high extent of damage. A so-called spatial filter addresses the spatial relevance of each hazard. The natural hazards that are relevant on a spatial planning level are thus: Floods, droughts, storm surges, landslides, earthquakes and volcanic eruptions. The spatial character of a hazard can either be defined by spatial effects that might occur in case of a disaster or by the possibility of spatial planning responses. On the basis of the selection of hazards a typology of regions is developed, according to their hazard and risk profile. The integration of the vulnerability of a region (damage potential, coping capacity) allows distinguishing between those regions that are mainly hazardous areas and those that are risky areas. These synthetic risk profiles are then presented in a cartographic form as risk maps of the European regions on NUTS 3 level (administrative boundaries). The obtained information can be of great value for spatial planning and development, e.g. the risk profile of regions can influence the targets of investments and could thus be an important background for structural funding. For more information, please see: <http://www.gsf.fi/projects/espon>.

**ACCEPTED as Oral Presentation**

**in session: "G03.12 - Rapid and catastrophic geological changes and societal response"**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

TO THE MATTER ON GEOLOGICAL CATASTROPHES AND  
DISASTERS - STATE AND WAYS TO SOLVE THE PROBLEM

### **Authors**

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### **Keywords**

catastrophe

disaster

exogenic geological processes

geological hazard

### **Abstract**

1. A special place among natural disasters belongs to catastrophic endogenic and exogenic geological processes - earthquakes, volcanic activity, landslides, glacial avalanches, mudflows, erosion, and their paragenetic complexes.

2. In Russia and adjacent countries the geological processes show activation - earth-quakes in Armenia, Georgia, Turkey, Russia (Altai), Iran; catastrophic landslide-avalanches and erosion-mudflows in 2002 in North Caucasus, including the Karmadon canyon; floods and the related erosion-accumulative processes of 2002-2003 in West Europe, and so on.

3. The developed countries have ever-growing territories developed and, as a result, ever-increasing anthropogenic loads upon the geological environment, and ever larger territories affected by negative processes, making environmental, social and economic consequences more and more sizable. These are numerous human victims, billions dollars of losses annually.

4. The existing practice of struggle with natural disasters lies in liquidation of their consequences. No planned, preventive and prophylactic measures are undertaken, the cost of which is many times lower than expenses for liquidation, let alone the cost of human lives, social, economic and political consequences of "missed" catastrophes.

5. Geological catastrophes have a regular and avoidless character. Their consequences are determined not only by a type and scales of geological manifestation, but more by being ready to counteract and prevent them, protect people and economic structures.

6. It is impermissible to develop territories affected by negative processes and having a high seismicity without reliable engineering-geological substantiation. Such territories need a geoenvironmental control and strict legal regulation of their use. They must have a special status.

7. Different-type (long-, short-term, operative and regional) predictions of geological processes are necessary. The theoretical grounds and methods of predicting are developed (VSEGINGEO, Russia).

8. It is necessary to work out concepts and federal programs of struggle with geological hazards. They should include regional investigations and special territory zoning, monitoring, preparation of predictions and recommendations, normative, regulatory and methodical support of works.

**ACCEPTED as Oral Presentation**

**in session: "G03.12 - Rapid and catastrophic geological changes and societal response"**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

IMPACT OF TROPICAL CYCLONE HETA, JANUARY 2004, IN THE SOUTH PACIFIC

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### **Keywords**

tropical cyclone

Heta

South Pacific

impacts

### **Abstract**

Tropical cyclones are annual events which affect the insular tropical Pacific, causing devastation along their path. Previous studies by the author have shown that since 1939, over 350 cyclones have adversely impacted the South Pacific. The most recent, Heta, developed from a tropical depression on 1 January 2004 and into a full-blown cyclone on 4 January, causing a national disaster on Niue. On approaching Niue at 05:20UTC, 5 January 2004, the local pressure was 915hPa, with the feature moving southeast at 15 knots, with average winds of 115 knots and gusts of over 160 knots. At about 01:00UTC, 6 January 2004, the eye of the feature was located just 30km west of Niue. The regional meteorological observation centre at Nadi, Fiji Islands indicates that maximum gusts were in excess of 200 knots, before the local Niue weather station was devastated. Storms wind and very high seas were within areas of 50 nautical miles from the eye, with gale force winds and high seas within an area of 180 nautical miles from the eye of the event. The cyclone was a Category 5, the highest category in the existing hurricane-cyclone rating system. Niue with a population of 1500 and area of 259 square kilometres and maximum height above sea level of 65m was significantly damaged. The capital, Alofi, was flattened, after 40m high waves run-up more than 30m high carbonate cliffs, and more than 100m inland, with 200 people left homeless, one dead and many injured, many houses destroyed, fuel supplies damaged, power and telecommunication lines damaged, water supplies affected, air travel disrupted, commercial buildings destroyed, with 90% of the island's infrastructure and agriculture destroyed. So far, records show that more than 4000 homes on American Samoa were destroyed. The Cook Islands, about 500km to the Southwest of the cyclone's path was battered by huge swells, with coastal flooding, damage and disruption of private and commercial activities. Tonga and Samoa was also adversely affected by large waves and gusty winds.

**ACCEPTED as Oral Presentation**

**in session: "G03.12 - Rapid and catastrophic geological changes and societal response"**

**POSTER**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

IMPACT OF THE OIL FIELD DEVELOPMENT ON ENVIRONMENT: GEOTHEMAL STUDY

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### **Keywords**

environment

temperature

pollution

catastrophic changes

### **Abstract**

Studies of temperature and temperature gradient measurements have been applied to environment problems. By use of the geothermal observations, we studied two problems. One of them the discovery of man made pollutants of the environment during exploitation of oil-gas resources and the other the location of places polluted by the drainage waters. We made measurements in deep wells of the East European platform and other regions. Impact of the oil field development is expressed not only in pollution of the environment by petroleum products, but in so called thermal pollution. Our experiments in wells have revealed temperature anomalies due to the oil-gas field development. They are observed in the subsurface layers in many wells because natural variations in temperature gradient are very small as compared to the technical ones. Large prominent "thermal pollution" of the environment and underground waters arises during the water and stream injection. Temperature anomalies in some wells are evidence for a drainage water flowing in overlying layers not intended for injection. "Thermal pollution" can spread up to the Earth's surface. Experimental data suggest that revealed thermal pollution may be responsible for unreversible processes: changing of the upper layer ecosystem near the Earth's surface cause undesirable consequences for climate, flora and fauna.

**ACCEPTED as Poster Presentation**

**in session: "G03.12 - Rapid and catastrophic geological changes and societal response"**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

GEOECOLOGICAL CHANGING OF THE BOWELS WHICH IS CONNECTED WITH PROCESS OF OIL AND GAS EXTRACTION

### **Authors**

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### **Keywords**

man-induced factor

bowels

geoecological problems

### **Abstract**

From year to year the intensity of human influence on the lithosphere is growing, not only far but wide as well. Hydrocarbons are extracted from the higher depth, while the depth of wells being drilled increases.

Human activity on natural resources development comparable with the geological factors affects.

Geological problems emerging as a result of fuel and power resources development, generally are due to surface contamination whereas oil and gas fields are affected by the great man-induced factors even within deep layers.

Under these conditions the natural state of the latter is disturbed while the composition and properties of rocks and formation fluids changes.

Even drilling of a single well may result in disturbance of natural resources balance let alone the scale of extraction and fluid injection.

Technogenic affect not only distorts the natural conditions of bowels but actually is responsible for its new unbalanced state.

In these conditions harmful influence appears to be not so much the penetration itself of drilling equipment as the subsequent use of these wells for different technological aims, such as: underground explosions, injection of sewages with chemical production waste or various acids with the applications of methods of leaching.

Technogenic stress are frequently the course of local earthquakes, horizontal rock displacement, surface fracturing, permafrost melting, fluids seepages, technogenic pools formations, caving-ins, landslides, as well as ground subsidence, that have been marked in many countries all over the world.

Thus, the intensity of the technogenic processes, concentration and frequency of their emergence is considerably higher than those the same processes accruing in nature.

Nowadays man can not prevent a lot of dangerous geological phenomena and processes and cease production and use of natural gas.

However while developing natural resources one should predict the probable ecological damage aimed at adopting necessary and sufficient measures minimizing or eliminating unfavorable consequences.

**ACCEPTED as Poster Presentation**

**in session: "G03.12 - Rapid and catastrophic geological changes and societal response"**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

EFFECT OF GLOBAL WARMING ON THE LITHOSPHERE

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### **Keywords**

global warming

lithosphere

Euler's theorem

MOR

Ice Age

### **Abstract**

Discussions of global warming (GW) have usually focused on its effects on the atmosphere and the hydrosphere, but not on the lithosphere. A new "Geological Map of the Ocean Floor" (GMOF) recently released by the Granton Institute of Technology facilitates the analysis of the effects of GW on the structure of the Earth's crust.

If GW continues at its current rate, the remaining ice sheets in Antarctica and Greenland will melt. The recent fracture of the Larsen B Ice Shelf and Thwaites Ice Tongue only strengthen this point.

The Antarctic and Greenland ice sheets contain approximately  $33 \times 10^6$  km<sup>3</sup> of ice, which will add an additional  $30 \times 10^{15}$  kg of water to the oceans if melted. Hence, GW could result in a measurable load redistribution on all plates: The Pacific plate will be further loaded by  $8 \times 10^{15}$  kg, African by  $2.4 \times 10^{15}$  kg, Eurasian by  $2.2 \times 10^{15}$  kg, and so on. Oppositely, The Antarctic plate and Greenland will be relieved of  $26 \times 10^{15}$  kg and  $2.7 \times 10^{15}$  kg respectively.

This load shift will lead to major isostatic readjustments of all plates, with the most significant effects along fracture zones and plate boundaries. To project the likely consequences of future plates' load changes due to deglaciation, we examine the origin of existing irregular displacements along MOR centers.

The current explanation for spreading centers displacements refers only to Euler's theorem, which describes the geometry of shell rotation but does not reveal the source of such displacements; it does not adequately describe whatsoever, the cause of the process's dynamics and its causal forces.

The modified GMOF suggests an alternative interpretation of spreading centers displacements: a powerful process, such as the movement of the lithosphere caused such displacements. It also suggests that these displacements occurred after the Pliocene-Quaternary oceanic floor was formed, which is supported by the fact that the Quaternary displacements coincide with the end of the last Ice Age, where approximately  $50 \times 10^6$  km<sup>3</sup> of ice was released from the ice caps. The ensuing shift in the isostatic equilibrium at that time, could have yielded global lithosphere shifts and, as a result, created the powerful forces causing the displacements of MOR centers.

If GW will continue, it will likely cause the oceanic crust to revert to a state approximately that of the pre-glacial mid-Miocene. Geologically, it will accelerate the end of the Holocene and the onset of the post-Holocene Epoch.

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**in session: "G03.12 - Rapid and catastrophic geological changes and societal response"**

## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

THE NORTH EURASIA FLOOD AS ARCTIDA'S DESTRUCTION CONSEQUENCE

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### **Keywords**

super flooding

jökulhlaups

Arctida

### **Abstract**

The existence of the previous Floods is confirmed by relief features of North Eurasia connected with huge water flow effects on the earth surface (Grosswald, 1999). Calculations show the total volume of the last super flooding, that crossed southern and central Russia, could reach 1 million km<sup>3</sup>.

Two super flows, which took place in different time, are reconstructed. The Flood could occur repeatedly during the last twenty thousand years. The more ancient of them was directed from the Kara Sea along the Urals to the Caspian Sea, and the younger one began at the Laptev Sea and went from the Lena mouth to the Aral Sea. The estimation of reliable existence of such super flows in the past requires that the main question be solved: how could they form? Glacier dammed lakes and outburst floods known as jökulhlaups can give an answer. But there appears a question: how could dammed lakes form in the Arctic Regions?

To get answers it is necessary to take into account the following. 1. The Arctic Ocean is crossed by mid-oceanic ridge Gakkel which fixes a modern rifting zone (volcanism in Iceland is connected with it). Evidence indicates that submarine Lomonosov and Mendeleev ridges could be in the surface about 10 thousand years ago (Neyman, 1984). Probably, in Late Pleistocene in the subarctic area there could be a vast land - Arctida, and in the place of Podvodnikov, Nansen-Amundsen and Canadian basins there could be large seas. 2. Ice shelves (their parts remained in the European Arctic Regions) were able to isolate the seas with a continuous ice dam. 3. During glaciations the World ocean level decreased by 100 and more meters, and there appeared an altitude gradient between the ocean and glacier dammed seas. Thus, in the subarctic area there could exist prerequisites to the formation of huge sea jökulhlaups.

The Nansen-Amundsen basin to which the sources of both super flows are traced is a likely place where they originated. This part of the modern ocean is the deepest. It is situated in the seismically active zone of the rift. It was close to it at Holocene boundary where Arctida subsidence occurred. The rift became more active. As a result Arctida sank. The ice dam surrounding the sea was broken, and a giant water flow flooded the vast territories of Eurasia.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

NATURAL ENVIRONMENT AND HUMAN SETTLEMENTS IN THE GUBBIO AREA (CENTRAL ITALY)

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### **Keywords**

climate deterioration

debris flow

alluvial fan

settlement

### **Abstract**

Gubbio is a small town located in Central Italy in an area bordered to the east by the Apennine chain and to the west by the Tiber River. The town is placed on the eastern side of a narrow tectonic depression, the Gubbio basin. Most of the geomorphological features of the valley are the result of the tectonic activity and the stream flow dynamics.

Steep escarpments composed of Mesozoic-Tertiary limestones and marly limestones border the valley to the north-east, whereas smoother slopes consisting of Tertiary marly-arenaceous rocks are on the western side. The climate deterioration and environmental degradation, which have characterized climate changeability since the end of the Pleistocene, triggered erosional processes on the surrounding reliefs and accumulation events in the valley and favoured the formation of debris flow deposits and an array of coalesced alluvial fan complexes on the eastern side of the basin.

The alluvial events, which have been present in the area since the medium-upper Paleolithic, controlled and influenced the diffusion and the distribution of the settlements.

The fieldwork on the outcropping lithological types and the geomorphological studies on the Gubbio area have allowed to recognition of various depositional complexes linked to the Camignano, Cavarello and Zappacenero streams, although only the structural features of the Cavarello complex could lead us to suppose the formation of debris flow deposits during its flooding phases.

The subsequent more favourable climate conditions led the Middle-Upper Paleolithic hominids to use the land, settling especially the well-drained zones next to the water-courses, such as terraces or the edges of the alluvial fans.

The Neolithic settlements took place next to the streams, superimposed on the Paleolithic ones during the improvement of the climate started at the end of the wurmian ice age.

The settlements of the Bronze Age, and even more the late Bronze Age, moved towards topographically relieved zones because they were more comfortable and safer during seasons of flooding and degradation of the slopes.

The last alluvial fan events happened during the little Arcaic Ice Age and little High Middle Ages Ice Age, triggered by heavy and long-lasting rainfalls. During the same climate season, the Umbrian Age settlements came down towards the valley settled the safest sites on the slopes between areas exposed to erosional and depositional processes.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

THE NEGATIVE IMPACTS UPON THE ENVIRONMENTAL ASPECTS IN TAIZ CITY AND SURROUNDINGS, YEMEN

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### **Keywords**

Pollution - Floods

Sewage water

Degradation

Deterioration

Environment

### **Abstract**

The rapid increase in population and constructions in the area of study caused huge losses in the areas as incredible increase in the associated environmental problems. The negative environmental impacts are proportional to the number of people and include water pollution, soil erosion, human wastes concentration, mass wasting and erosion of asphalt roads.

The demands of the different resources as fuels, land, clean environment and fresh water increases with population and industrial growth. Therefore, the environmental degradation is the inevitable result of these demands in addition to floods, mass wasting and other geologic hazards which effected on people and constructions.

In this study I throw light on the expected environmental impacts resulted from ill-planned development, domestic wastes or other forms of private and public mismanagement.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

THE ENVIRONMENTAL GEOLOGICAL PROBLEMS, THE MOST IMPORTANT OBSTACLES FOR SUSTAINABLE DEVELOPMENT PROGRAMMS IN IRAN

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### **Keywords**

Environmental geology

Geohazards

Pollution

Sustainable development

### **Abstract**

During the reconstruction period, which started in 1988, the huge construction projects such as dams, tunnels, highways, mining and industries complex have been done. Unfortunately, these projects have been done without any consideration of geological environment. Long and steep trenches in toe of slopes and also extra loading above them are the examples of improper treatment of ground for construction projects. Vast destruction of natural drainage patterns is another example which was accompanied by consequent negative effects, and created the most important problems of the environmental geological conditions of Iran and its sustainable development. These negative effects can be divided into three groups as follow:

-Devastation of the environments, ecosystem and also plants cover including forests.

-Intensive increase of occurrences of natural disasters and geohazards such as flooding, mass movements, subsidence, collapse, scouring, etc...

On the basis of the statistical data, since last two decades, there were only two provinces were subjected to floods, but today, two third of Iran is suffering from flooding after each precipitation period. The Masuleh flood (2000) is an example in which 80 people were killed in few minutes.

In Iran, mass movements with variety of shape, speed rate, type, etc. are frequent. Statistically Iran also has experienced several fatal landslide events.

Iran also is situated on the Himalaya earthquake belt and has experienced large earthquakes, both historical and instrumental.

-Pollution of water, soil and weather are the important negative effects of improper treatment of ground. It seems that the pollution can be more dangerous than the earthquake for people. Release of waste waters from residential, mines and industrial complexes into the natural environment is the major cause of environmental pollution.

Because of the relationship between occurrence of geohazards and sustainable development, current years, several national programs, both for geohazard reduction and cleaning of natural environments, are defined and carried out by the Geological Survey of Iran (GSI), among them include:

-Geohazard reduction and disasters management, including landslide mitigation.

-Waste disposal site selection, particularly in the coastal plane, with high level underground water.

-Land-use and urban geological mapping for urban planning and regional development.

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## **32<sup>nd</sup> IGC - Florence, 2004**

### **Abstract title**

- 1.THE GEOLOGICAL ENVIRONMENT OF OLYMPIC PARK IN BEIJING
- 2.THE FORECAST SYSTEM OF MUD-ROCK FLOW IN BEIJING

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### **Keywords**

Beijing

Olympic park

geological environment

mud-rock

geological disaster forecast system

### **Abstract**

#### 1.The Geological Environment of Olympic Park in Beijing

Based on survey and research on the geographic and geological character around the Olympic park, systematic analyses on the geological environment, which include earthquake, active fault especially Huanzhauang-Gaoliying fault and Nankou-Sunhe fault, ground settlement and sand liquefaction, have been made. Aiming at the goal of the layout, we discussed the protection measurement that should be taken during the stadium construction and provide the background backup to ensure all facilities and services meet the demands for holding the Olympic Games.

#### 2.The Forecast System of Mud-rock Flow in Beijing

On the base of systematic analyses of the feature of mud-rock flow in Beijing, the mathematical statistics, correlative and systematic analysis have been taken to make the quantitative and quasi- quantitative prediction for degree of danger caused by mud-rock flow. At the same time, we discussed the damage and the evolitional patterns of mud-rock flow in Beijing. According to the result, we provide the scheme for constructing geological disaster forecast system to make sure the protection from mud-rock flow more reasonable and the damage minima in Beijing.

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### **Abstract title**

HUMAN INDUCED ENVIRONMENTAL CHANGES IN BOTTOM SEDIMENTS DURING THE PAST 100 YEARS IN KITANADA BAY, EHIME PREFECTURE, JAPAN

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### **Keywords**

Bottom sediments

contents of elements

grain size composition

fish culture

### **Abstract**

During the past 50 years, marine environments in Japan have been changed by human activities, particularly by fish farming. This study is chiefly focussed on the impact of fish farming on marine environment in Kitanada bay as a model for other applicable areas. Present sea bottom environment is shown in distribution pattern of grain size and element contents of surface sediments. The distribution pattern of grain size shows that coarser sediments are distributed around the bay mouth and becomes finer toward the bay interior. Tidal current is faster around the bay mouth and it decreases its velocity toward the interior. This result suggests that hydrodynamic environment in inner Kitanada bay is stagnant. Contents of total organic carbon, total nitrogen and total sulfur are high around fish farming cages in the north. Recently, much organic substances are supplied into fish cages. Bottom environment has become strongly reductive due to the supply of much organic substance in combination with stagnant hydrodynamic environment. Environmental changes during the past 100 years show the impact of fish farming on bottom environment. Total organic carbon and total nitrogen concentrations in sediment cores increase toward the top from 1970's when fish farming started in this bay. Kitanada bay has become eutrophic due to fish farming. At the same time, grain size profiles show decrease toward the bottom surface in the northern part and increase in the southern and bay mouth area. These results suggest that the hydrodynamic environment has been changed by the setting up of fish cages. In the northern area, hydrodynamic environment has become more stagnant by the setting of fish cages which somewhat resist tidal current. In the southern and bay mouth area where no fish cages are observed, tidal current has become faster. As a result, sea water exchange has become more active, and bottom environment has become more weakly reductive. Fish farming in this bay is one of the main reason for eutrophication. Hydrodynamics and bottom environment have been greatly changed by fish farming.

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