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THE CHANGING LANDSCAPE OF COASTAL WETLANDS IN SOUTHERN CALIFORNIA

Kwan Ming CHAN[1], Xiankun KE[2], Zhanhai LI[2]

[1] *Dept. of Geological Sciences, California State University, Long Beach, USA kmchan@csulb.edu*
[2] *Dept. of Urban and Resources Sciences, Nanjing University, Nanjing 210093, China*

The coastal wetlands of Southern California form a thin rim along the steep coastal mountain and geologically active zones of North America. The geomorphology of these wetlands are affected by the rise of sealevel following the last ice age. Some twenty thousand years age, the sea level was about 130 m below the present shoreline. Over thousand of years, many deep canyons and wide valleys were carved by numerous creeks and rivers. Following the ice age and the rise of sea levels, most of the drowned valleys and canyons became bays or lagoons. The piling up of sands and sediments from creeks created a vast area of beaches, mud flats and marshes. However, with increasing population, less than 10% of the historic wetlands from Mexican border northward to Southern California remain. Over the past century, considerable alteration has occurred and greatly changed the local landscape.

Initially the land is cleared for agriculture. Frequently, farm lands and orchards leave the soil unprotected. Wetland deterioration were accelerated by the poor drainage and artificial fertilization. These cause eutrophication and filling of stream channels in the lower wetlands. In recent years the extensive housing development and harbor construction completely alter the dynamic nature of the wetland system. The most dramatic change is the construction of coastal highways and railways. Many roads run through the entrance of the wetlands and restrict the tidal exchange. Eventually the equilibrium between land and sea of the wetland is upset. The change in the environment has caused alarm to the local residents. Many projects trying to restore the wetlands have gained momentum and generated support from communities.

In the present study of the geomorphology of the coastal wetlands of Southern California, we would provide some current examples and case history of several wetland restoration projects. The cost and the benefit of these projects were evaluated. Their feasibility and applicability to the developing

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CLAY MINERAL ANALYSIS OF YANGTZE DELTA, CHINA: TO INTERPRET LATE QUATERNARY SEA-LEVEL FLUCTUATIONS, CLIMATE CHANGE AND SEDIMENT PROVENANCE

Zhongyuan CHEN[1], Zhanhuan WANG[2]

[1] State key laboratory for estuarine and coastal research East China Normal University Shanghai 200062 China
[2] Department of Geography, East China Normal University, Shanghai, 200062, China Email: Z.Chen@gislab.ecnu.edu.cn

The present study focuses on the temporal distribution of clay mineral in a new, complete type core ZX-1, recovered from the south-central Yangtze delta plain. Result demonstrates that the variation of clay mineral distribution in different Holocene stages is determined by several major physical factors, i.e. sea level fluctuation, climate change, and sediment sources.

Four diagnostic clay mineral suites are recognized from core bottom upward:

1. **Zone I** - kaolinite and illite (late Pleistocene);
2. **Zone II** - kaolinite and chlorite (early Holocene);
3. **Zone III** - illite, smectite, and chlorite (early to mid-Holocene); and
4. **Zone IV** - illite and smectite (late Holocene).

Smectite distribution in core sediment of early Holocene was linked to the rapid sea-level rise, which induced inundation of the current delta plain. Increase in kaolinite content as decrease in smectite, chlorite and illite in late Pleistocene stiff muds reflects a temporary climate warm stage in a general temperate to cold setting. As verified by pollen assemblages, chlorite high in Zone III of early Holocene can correlate to colder temperature and kaolinite high in Zone III of mid-Holocene was possibly associated with a climate warm. Clay mineral distribution also shed light on the late Quaternary sediment provenance of the study area. The terrigenous sediment sources of late Pleistocene and early Holocene were primarily derived from the provincial highlands, west of the study area, and the sediments of late Holocene were proved from the Yangtze basin. The mid-Holocene clay mineral suite indicates sediment input from both the western highlands and the Yangtze sources. This clay mineral study evidences potential usefulness in tracing sediment sources through time, and particularly is of significant value for better understanding the paleoenvironmental implication of the Yangtze delta, where sediment sources is being greatly altered by 3-Gorges dam.

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YANGTZE RIVER SEDIMENTOLOGY PRIOR TO CLOSURE OF 3-GORGES DAM, CHINA

Zhonyuan CHEN, Zhongyang GUO, Yiwen ZHAO, Lin ZHANG and Yunpeng LIU
Department of Geography, East China Normal University, Shanghai, 200062, China, Email: Z.Chen@gislab.ecnu.edu.cn

China's Yangtze river is being dammed at Three Gorges, and this structure will alter the fluvial regime and cause

1. river channel modification below the Dam,
2. reduced freshwater to the lower Yangtze,
3. saltwater incursion into estuarine lowland, and
4. accelerated coastal erosion along shoreline.

Present sediment provenance and dispersal regime will be altered, and before Dam closure it is urgent to acquire a sediment database by sampling along the entire Yangtze drainage basin. The current study (first year) is to focus on the lower Yangtze drainage basin, where one hundred fluvial transects were particularly surveyed by sampling with an interval of 10 km. Together with the sampling, various fluvial morphologies were examined to indicate:

1. lower Yangtze fluvial regime, as presented by braided river channel in 2-4 wide and 10-20 m deep, and with gentle riverbed slop ranging from 0.5-1.0 x 10-5;
2. fluvial topography, including longitudinal bar, gravel shoal and stepped flood plains;
3. rock exposures as mostly marked by pre-Quaternary carbonates and vermiculated red earth of early to middle Pleistocene, meaning
4. prevailed neo-tectonic rise relative to river channel incision during that time;
5. elevated water stage of flood level from 3-5 m above mean sea level in estuary to ~8 m in upstream, as recorded by stepped fluvial banks and marks on rock exposures; and
6. natural hazard, including slide and slumping and mud flow.

In addition, our one-hundred samples indicate that the mean grain size of the lower Yangtze river channel ranges generally from 0.03 to 0.30 mm, and tends to be finning in size downstream towards the estuary. In addition, the mean grain size distribution is closely associated with river channel patterns, indicating that medium to fine sands occur in relative straight river channel and fine sand to clayey silt in curvy river channels, where longitudinal sand bars usually prevail. The above sedimentological database will certainly become the primary "pre-Dam" sediment gauge available for "post-Dam" studies of the Yangtze system.

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THE LARGE-SCALE BEDFORM MOVEMENTS AND THEIR IMPACT EVALUATION IN THE CHANGJIANG ESTUARY DURING THE 1998 DISASTROUS FLOOD IN THE WHOLE CATCHMENT BASIN

Heqin CHENG, Bo SONG, Yuanzhong XUE, Maotian LI
State Key Laboratory of Estuarine & Coastal Research, East China Normal University, 200062, Shanghai, China

A succession of high-resolution large scale bedform movements composed of very fine sand are shown by the high resolution survey records. They are detected by Thermal Depth Recorder, Sonar Side-scan, Endeco Current Meter along two profiles, and Optical Suspended Concentration Meter, Acoustic Suspended Concentration Profiler and D.GPS at one fixed station in the Changjiang Estuary during the last period of 1998 disastrous flood. The scale of bedform and their movement are several times of those detected during the dry season. These results can provide the practical data about the tremendous quantities of bedload transport, which is the mainly ambiguousy long-standing problem resulting in serious shallowing in docks and navigation channels, especially for the present construction of Deep Water Channel in the Changjiang Estuary.

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THE TERNARY PLANATION ENVIRONMENT OF TIBET PLATEAU REFLECTED BY PALAEOKARST AND ITS RELATIVE DEPOSITS

Zhijiu CUI[1], Quanzhou GAO[2]
[1]Department of Geography, Peking University, Beijing, China 100871
[2]Department of Geography, Zhongshan University, Guangzhou, China 510275

Most of karst landforms observed in Tibet plateau originated mainly from the Tertiary underground karst, which were exhumed out with the uplift of the plateau through a long period. The karst processes continued at least in the southern part of the plateau during Pleistocene interglaciations when the climate was relative more humid and warmer. However, some small-scale karst caves were formed by the melting water of the Pleistocene glaciers when climate was relative drier and cooler. The parallel karrens on limestone surface, which depths are not more than 20cm, stemmed from the corrosion in Holocene. The relative deposits of palaeokarst, i.e., red weathering crust, distributed in a remnant form on the main planation surface.

The speleothems found in relict caves reflected the underground cave circumstances of the Tertiary karst process, and twenty fission tracks data of the speleothem calcite demonstrated that the palaeokarst forming period, i.e., the main planation surface forming period, was during 19~7 Ma.B.P.

The relative deposits of the Tertiary palaeokarst, i.e., limestone residual red earth, distribute widely on the main planation surface of the plateau. We analyzed this red earth systematically of its chemical and clay mineral compositions. SiO_2, Al_2O_3 and Fe_2O_3 are the three main components of the red earth. The clay mineral compositions mainly belong to "ilite-kaolinite" type, a few samples are the "kolinite-illite" type. Judged by the silica-allumina ratio and the clay mineral composition, the residual red earth reflected a kind of preliminary laterization process. However, considering the vertical distribution of the chemical weathering degree in the weathering section, the red earth still reflected the humid and warm climate, i.e., a kind of tropical or subtropical climate.

Surface textures of quartz grains in red earth were studied with scanning electrical microscope (SEM). The eroded and deposited features on quartz grain were mainly chemically produced, the mechanically eroded features were secondary. All of those reflected the humid-tropical environment when the red weathering crust and the palaeokarst were formed. The mechanically eroded features are in the majority in surface textures of some samples taken place remarkable movement by various geomorphologic processes which were driven by the uplift of the plateau, those samples such as slope wash and alluvial deposit derived from red earth. As for the evolution pattern in time of the surface textures, much display that the chemically produced features were overlaid by mechanically ones. On the other hand, a few samples display that the mechanically produced features were overlaid by chemically ones. All of those reflect the property of polycycle and complex of the Tibetan environmental evolution since Ternary period.

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TIBETAN FORCING OF ASIAN CIRCULATION CHANGE DURING THE MID-PLEISTOCENE: MPLICATIONS FOR MID-ASIAN DRYING, DESERT FORMATION, DUST-LOESS EXPANSION AND GLOBAL COOLING

Xiaomin FANG, Jijun LI, Lianqing LU, Shenli YANG and Maodu YAN
Department of Geography, Lanzhou University, Lanzhou, Gansu 730000, PR China, Telfax: +86-931-891 3362; E-mail: fangxm@lzu.edu.cn

Chinese arid zone and desert are the result of rising of the Tibetan Plateau and increasing of contrast of land and sea. Dusts are generated in these arid-desert zones and transported by winds outside the zones to their surrounding areas such as the Chinese Loess Plateau and even far East area. Thus, changing and enhancing of air circulation / winds and climate by the rising of the Tibetan Plateau would cause formation of or enhancing dry condition and desert expansion in Asian inland, increasing dust productivity, changing dust-carrying paths and thickening loess deposition. Knowledge of the age and property of loess sequences would bear the chance to understand the past changes of the Asian circulation and climate in relation to the uplift of the Tibetan Plateau.

Eight thickest loess sequences situated on high river terraces on and near the eastern and western Tibetan Plateau have been chosen to represent the beginning of loess, thus the circulation change in those areas, because these loesses have coarser grain size composition than that in the Loess Plateau and are believed to be formed directly under a new circulation system. Paleomagnetic, rock magnetic and soil studies of those sections demonstrate that the loess on the Tibetan Plateau and its immediate adjacent areas began to appear at ca. 1.15-0.9 Ma, and increases its grain size subsequently. These indicate that there was a big air circulation shift around the Mid-Pleistocene which has caused the occurrence of loess in the eastern Tibetan Plateau and West Qinling Mountains and the loess in the northern slope of West Kunlun Mountains. The later has further suggested that the linked dust-supplying area, the Taklimakan desert was probably formed also at the Mid-Pleistocene. Thus, we estimate that the Tibetan Plateau was uplifted to an average elevation of ~3000 m because this height is a theoretical threshold to cause the divergence of the over-flowing westerlies and glaciation of the Plateau which would have resulted in global cooling, very dry condition in Asian inland and the expansion of desert-gobi and its accompanied loess. The continuant rising of the Tibetan Plateau would intensify the above circulation and the feedback system, thus increasing the grain size composition and thickening of the loess.

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MONSOON RAINFALL IN THE SINAN DESERT (EGYPT) DURING THE PHASES OF HIGH-STAND SEAL-LEVEL OF THE MILANKOVITCH GLOBLE-CLIMATE-CYCLES DURING THE LATE QUATERNARY

Gdaliahu GVIRTZMAN
Dept of Geography-Bar Han University, Ramat Gan, Israel

The coastline of southern Sinai Peninsula (Egypt) preserved belt of elevated fossil-reef terraces, up to 35m is fringed by a narrow belt of modern coral reefs. A well above mean sea level, stretches along the coast of southern Sinai. The terraces were mapped, named , dated and published by Gvirtzman, Kronfeld,and Buchbinder (1992, Mar.Geol, 108:29-37), Gvirtzman et al. (1997, Mem. DuBRGM, 89:480-491) and Gvirtzman (1994, Cor. Reefs, 13:203-214). According to these publication, the reefs fringed the coastline and were formed during four periods of high-stand sea-level of the global Milankovitch climatic cycles, namely: isotopic stages 7,5,3, and the older half of 1.

An another study by Klein Loya, Gvirtzman,sdale and Susic (1990, Nature, 345:145-147) these reefs were examined. Bands of alternating high and low density in massive coral species have been used to record their growth history. In the Red Sea,living colonies of the genus Porites deposite low-density skeletal bands during summer and high-density bands during winter. Additionally, yellow-green fluorescence can sometimes be seen in this massive corals, imparted to them by the incorporation of humic material carried by coastal runoff. Annual banding of fluorescent sequences in living scleractinian corals has proved to be useful in the study of terrestrial runoff in the near-shore environment. Here report the finding of similar yellow-green fluorescent bands in fossil Porites from Late Quaternary reef terraces in fluorescent bands in southern Sinai, which are absent from leaving Porites in the nearby living fringing reefs. The periodic sequences of the fluorescenting humics were found to be superimposed on the low-density sub-bands in fossil corals. The interpretation of these observations is an evidence that, during the Late Quaternary reef forming peaks, namely during the isotopic stages 1, 3, 5 and 7, the climate was wetter than the extreme desert condition now prevailing, with a possible summer monsoonal rainfall regime.

In conclusion, the present climate of the global desert belt is extremely dry, winter and summer. During the high-stand sea levels of Late Quaternary, the same belt was wetter, with monsoonal summer rainfall.

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GEOMORPHOLOGIC INVESTIGATIONS IN THE MEDVES AREA, NORTH HUNGARY

Gergely HORVATH
Faculty of Science, Department of Physical Geography, Eotvos Lorand University, Budapest, Hunary, Email: horvathg@gandalf.elte.hu

The variegated Medves Area (160 km^2) lies between the Zagyva, the Tarján-patak and the Bárnai-patak rivers and the Hungarian-Slovak boundary in North Hungary. Due to its natural values a considerable part of the area has been declared to be protected, it is known as Karancs-Medves Landscape Protection Area.

As regards the geology of the area, particularly the typical sequences of the Tertiary era can be studied. Some facies pattern of the stratigraphical formations of sedimentary rocks should be very suitable for pointing out key sections. In various places the special forms of the outcrops of these rocktypes mean landscape-constituent role and have great geomorphologic importance. The "horst-graben-type" geological structure promotes the occurrence of these forms, parallel and perpendicular faults cut the landscape unit, therefore it can be characterised by steeply emerging horst-like hills (e.g. steep sandstone walls with the loaf-like concretions bulging out) and between them narrow trenches and deeply dissected erosional valleys.

In spite of the domination of the sedimentary rocks great part of the area is covered by volcanic rocks. Among them outcrop of Miocene rhyolitic tuff near the village Kazár has great geomorphologic importance forming the only badlands-like landscape of Hungary. The Pliocene basaltic rocks have either stratovolcanic structure or consist of only lavas, forming lavaplateaus, small cones, dykes or necks. Most of these outcrops rise slightly above its surroundings, but there are some basaltic beds with considerable extension, often forming conical shape with steep slopes. Occurance of basaltic columns are also frequent. Some of these outcrops can be seen due to the mining activity, mainly in abandoned mines. At the foot of the hills block fields created mainly by periglacial attrition can often be found.

The anthropogeneous forms are very frequent in the Medves Area, where the change of the natural environment caused by human activity is beyond average degree. Especially the landscape forming effects of the mining of the basalt and the browncoal and that of the related industry and infrastructure changed the surface. Enormous mine dumps, inclined shafts, bogie-tracks, transmission lines, narrow-gauge railway tracks, ropeways, cuts, ramparts, tunnels altered significantly the surface. By now almost all of the mines has been closed, but many of the underground galleries collapsed and therefore depressions occurred on the surface. The biggest change caused by undermining can be seen on the stratovolcanic beds of the Szilvás-kõ, where trench-like deep fissures came into being.

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A LABORATORY STUDY OF WAVE DISSIPATION AND COHESIVE SEDIMENT TRANSPORT

Shixiong HU, Zhaoyin WANG
International Research and Training Center of Erosion and Sediment, P.O.Box 366, Beijing 100044 China

The interaction between the wave and muddy shore plays an important role in the dynamic processes of muddy coasts. The law of cohesive sediment transport under the wave action is very difficult to study because of the complexity of the mud rheology. This paper describes the current status of research into the wave dissipation and cohesive sediment transport, including insight into relations between the mud wash and wave deformation, the cohesive sediment behavior obtained from the laboratory experiment.

The flume experiment was carried out in the oceanic engineering laboratory of the Tianjin University using mud from the Haihe River Mouth. The experiments include the wave dissipation of mud bed with conditions of different mud concentrations, wave heights, wave periods and wave types (regular and irregular wave).

The study on the experiment data is continuing. The initiatory analysis indicate the behavior of the mud is complex and it is very difficult to identify a clearly defined "fluid mud layer", which perhaps improved that to build integrated model of the solidified mud bed, soft mud and fluid mud is a good way to describe the cohesive sediment movement. The comparison among the different muddy bed also shows that the features of mud bed influenced the wave dissipation greatly. The dissipation of wave height increases with the increasing of the mud concentration when the mud concentration is low, however, the dissipation of wave height reduces with the increasing of the mud concentration when the mud concentration is high.

The regular wave dissipation can be expressed as an exponential function, the wavelength increases with the wave dissipation increase. The Law of irregular is similar to that of regular wave.

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GIS/REMOTE SENSING TECHNIQUES APPLIED TO DETERMINE THE MOVEMENT OF SUBMARINE SAND RIDGES IN THE SOUTH YELLOW SEA OF CHINA

Haiyu LI
State Pilot Laboratory of Coast & Island Exploitation, Nanjing University, Nanjing 210093,China

Geographical Information Systems (GIS) are powerful tools for the manipulation of spatial objects, and Remote Sensing (RS) data has been used historically to depict and assess ocean environment, and that data can be translated directly into maps, image maps, GIS data layers or text reports. The application of GIS/RS technology to ocean and coast area use has continued to be a major international growth area, with the launching of new high-resolution satellites providing added impetus in last decade. The submarine sand ridges in the South Yellow Sea are located between 32°00N-33°48'N and 120°40'E-122°10'E, off the coastline of Jiangsu Province, China, and the area is about 22470km2. They are the biggest submarine sand ridges in the world, and also have a unique radial shape. Since it is very hard to collect in situ data in this area for the labyrinthine navigation, there are only few of time series of map could be imported to GIS for analysis. So the remotely sensed imagery, e.g. AVHRR, LANDSAT, and RADARSAT imagery, is an important part to determine the recent movement of submarine sand ridges. However, by now, the interface between GIS and remote sensing systems is functional but week. Each side suffers from a lack of critical support of a type that could be provided by the other. For this project the GIS has a continuing need for timely, accurate updates of the various spatial data entities, whereas remote sensing systems could benefit from access to highly accurate ancillary information to extract more useful information from the imagery to determine the movement of sand ridges. There are many things to be considered when performing change detection analyses, especially, processing procedures in GIS and RS are obviously different. This project examine how the submarine sand ridges of South Yellow Sea have changed in an high resolution on both GIS and RS, using TM at 30m and SAR at 12.5m, over the period from 1968 to 1995 - almost thirty years, and predict the change in next 20 years.in this project, the GIS database is managed in ESR's workstation ARC/NFO (version 7.2) software and the remote sensing procedures are supported by ERDAS MAGNE (version 8.2) and PC (version 6.3) software, running on a network of UNX workstations and WNDOWS NT 4.0.

In this project address the technology of GIS and remote sensing and seek to initiate a predictive modeling of the submarine sand ridges by multi-layer feed forward neural networks.

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INTERPRETING THE UPLIFT PROCESSES OF THE QINGHA-TIBET PLATEAU FROM THE COMPARSION OF YECHENG SECTION AND SWALK GROUP

Xiaoze LI[1,2], Guangrong DONG[1,2], Huizhong CHRN[1,2,3], Hongbo ZHENG[3,4], Heling JIN[1,2]
[1]Cold and Arid Regions Environmental and Engineering Research nstitute, Lanzhou, 730000,China
[2]Institute of Desert Research, Chinese Academy of Science, Lanzhou, 730000,China
[3]Xi'an Open Laboratory of Loess and Quaternary Geology, Chinese Academy of Sciences, Xi'an, 710054, China
[4]Department of Geology and Geophysics, West Australian University

Comparative analysis of the Yecheng section at north piedmont of theKunlun Mountain, and the Surai Khola section at south piedmont of theHimalayan Mountain, suggests that the Qinghai-Tibet plateau is dominatedby continuous uplift over the past 10 million years, and the effectivetime scale for dividing the uplift stages is one million years. Theuplift processes of the plateau can be divided into three major stages,namely slow uplift of the entire plateau between 10.0-6.0 Ma.BP;transitional uplift stage between 6.0-2.5 Ma.BP(including medium-velocityuplift of the south part of the plateau and low-velocity uplift of thenorth part of the plateau during 6.0-4.6 Ma.BP; medium-velocity uplift ofthe entire plateau during 4.6-3.5 Ma.BP; and rapid uplift of the northpart of the plateau and medium-velocity uplift of the south part of theplateau during 3.5-2.5 Ma.BP). The entire plateau has been upliftingrapidly since 2.5 Ma.BP. The uplift elevation of the entire plateauexceeded 2000m above sea level by 4.6 Ma.BP and exceeded 3000m above sea level by 2.5 Ma.BP.

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NATURAL EVIRONMENT EVOLUTION OF LOWER REACHES OF FENHE RIVER FOR THE LAST 10,000 YEARS

Zhizheng MA, Junqing HAN
Geography Department , Shanxi Normal University 041004, China

Fenhe River lies in Shanxi province of middle reaches of Yellow River, whose lower reaches is one of the Chinese civilization origins. The research of natural environment evolution of lower reaches of Fenhe River for the last 10,000 years will benefit social economic development in the area and historical civilization in China. The main events reflecting environment evolution of lower reaches of Fenhe River are as follows:

1. **Change of river discharge** According to history, there was ever shipping in Fenhe River. The gully was smooth from Jin to Song Dynasty and intermittent since Ming and Qing Dynasty. Because of calamity and lack of food in Hejin in 1963, the government sent more than 20 ships with 200,000 kg grain from Linfen to Taiyang village in Hejin, today the lower reaches of Fenhe River isn't voyageable. Moreover, it is off and on.
2. **Change of paleolake** According to history, there were almost 10 lakes in lower reaches of Fenhe River. But now they all disappeared. For example, Taizitan was one of vestigial lakes of ancient Sanmen Lake into which divine springs ran. The water in the lake was abundant in Jin Dynasty and dried in Song. While the area was full of reed in Ming and Qing. At the beginning of liberation the area was alkaline lands, and trenches were digged to drain the water away in 1954. Now it has become agricultural model area irrigated by groundwater. There is lacustrine deposits 1 m under surface and groundwater about 3 m beneath it.
3. **Change of groundwater stage** The decline of groundwater stage commonly exists in industrialized cities. But the phenomenon in the remote parts of the Fenhe River relates to the environmental variations. For example, the groundwater stage has lowered by 8 m or so in the place where the famous Taosi Culture lies. The go under water stage of T3 in Jinchengbu has generally dropped by 2-3 m. The annual average discharge of Longzisi Spring has fallen to 4 m3/s from 6 m3/s.
4. **Change of flood water** At the beginning of our civilization flood overflowed in Yao and Shun time. Both Gun and Yu were ordered to harness the flood. In fact, there is the flood verstige in the Taosi Culture layer . Meng Fanxing has described several profiles which were buried after flood eroding. Gaodui is close to Jinchengbu in the west of Fenhe River. The former is lower, belonging to Yangshao Culture. The latter is higher, belonging to Yangshao and Longshan Culture. We recently find that Longshan Culture of Lishan and Guanque exists in loess broken tableland.
5. **Fluviatile geomorgraphy** There apparently exist high, middle and low flood plains in Linfen. Now fixed residency and road strenches are situated in the high flood plains. After Xipang Gully incised alluvial fan during late Pleistocene, 3 little inlaid alluvial fan formed in the new gully, the second of which has complete morphologies and thick deposits.
6. **Paleosoil layers** There are five layers of paleosoil in loess lying on Holocene gravel layer in the right-side escarpment where Sanjiaoliu and Changjiagou Gully meet in Hongtong county. The lower 3 layers are about 0.2 m thick, the black top is the paleosoil having developed on flood plains deposits, and the upper 2 layers are about 0.5-0.6 m thick, which obviously formed in two kinds of environment, and the top layer is loess.

General analysis from the above information: The lower reaches of Fenhe River has experienced 3 climate cycles for the last 10,000 years; it was cold and warm in early Holocene; it was warm in middle Holocene and lasted longer; it was tempered and cool in late Holocene.

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MOUNTAIN GEOMORPHOLOGY OF CENTRAL EUROPE UNDER HUMAN IMPACT

Piotr MIGON

Department of Geography, University of Wroclaw, pl. Uniwersytecki 1, 50-137 Wroclaw, Poland, Email: migon@geogr.uni.wroc.pl

Central European mountain areas constitute a specific type of mountain geomorphology which results primarily from relatively recent (Late Tertiary) modest uplift of planated or hilly relief. Hence, their overall morphology often consists of flattened summit and mid-slope surfaces, deeply incised valleys and steep marginal slopes. The most elevated massifs attain 1400-1600 m a.s.l., c. 100-300 m above the timberline. Those considered in this paper are located in Germany, Czech Republic and Poland and, collectively, are referred to as mid-mountains.

All these mountains bear a long record of human interference, dating back to at least 13-14C, which involved various activities, including prospecting and mining, land clearance for agricultural and industrial purposes, forestry, river channelization, development of transport and tourism, and whose intensity was changing through time. At least three periods of particularly strong imprint of human activities on mountain environments can be recognised and these are 14 to mid-15C, 16 to mid-17C, and from 19C onwards.

Recognition of impact of human activities on geomorphology is based on evidence provided by landforms and by stratigraphic record of the last 500 years or so preserved on slopes and in valleys. Most common man-made landforms are terracettes present on slopes considered too steep to allow for effective agriculture otherwise; they are known up to the altitude of 850-900 m a.s.l. Since the upper boundary of arable land has been significantly lowered in the last 100 years, terracettes are an important witness of past extension of agriculture. More localised are remnants of mining activity, which include mine heaps, quarries, excavations, trial pits and others. In some areas these landforms dominate the landscape and are now subjected to rapid erosion. Another suite of man-made landforms is that resultant from river channelization, which has significantly changed fluvial regimes. Besides, a number of small-scale landforms can be attributed to human impact indirectly, for instance gullies developed in the course of logging and erosional cuttings along mountain tracks. Initial incisions are easily exploited by rainwater and wash and may grow to big gullies a few meters across and deep.

The most obvious stratigraphic evidence of human impact, chiefly that related to changes in land use, is the occurrence of sub-recent alluvial fill. It is a very characteristic time-transgressive sedimentary unit, whose onset of deposition, as determined through C14 dating and archaeological findings, clearly coincides with timing of widespread implementation of agriculture on mountain slopes. Its thickness varies from 0.5-1.0 m in the upper parts of catchments up to 2-4 m along major valleys. This fine-grained sediment records widespread soil erosion and change in the behaviour of mountain rivers. Gravel-bed braided rivers, which existed before 14-15C, have been replaced by single-channel sinuous to meandering rivers with domination of suspended load and intermittent deposition during flood episodes. Fine-grained colluvial deposits with pieces of charcoal are another testimony of accelerated soil erosion, particularly strong on loess-covered slopes. Their thickness locally exceeds 2-3 m.

The main consequence of widespread human impact for geomorphology is increasing exposure to erosion and higher frequency of rapid runoff events, which in turn give rise to floodings. Hence, the rate of geomorphological change is higher now than it used to be in earlier times of the Holocene, although its comprehensive quantitative assessment is yet to be undertaken.

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HUMAN ACTIVITIES AND THE EVOLUTION OF DONGTING LAKE

Duowen MU, Zhongli ZHU
Department of Geography, Peking University, Beijing, 100871, China, Email: dmo@urban.pku.edu.cn

As an important flood and sediment detention lake of Yangtze River, the development of Dongting Lake was not only affected by the geologic process, but also the human activities, especially the lake's evolution and geomorphology features in the past several centuries.

Partitioned off Yangtze River at north bank by Huarong doming, Dongting Lake Basin is surrounded by the mountains. There are four rivers from the mountains and three channels from the Yangtze River flowing into the lake, and then feed into Yangtze River at Chenglingji in the northeast bank. Now the lake consists of 3 sub-lakes like a large "C" letter along the east and south mountains, the center is plain with farmlands divided by dykes.

The earliest description Dongting Lake was in the documents in Han Dynasty (about 200 A.D.). Because most of the Yangtze River's water and sediments was flooding into north Yunmeng Bog, the basin was dominant by river plain but a little flood lake in the northeastern part. With the population increasing and economics roaring, soil erosion was aggravated because of the exploitation of forests and land of the drainage area, embankments were made along the north bank of Yangtze River, and the riverbed was aggraded year by year. Then the Dongting Lake became the main flooding basin of Yangtze River and enlarged gradually till 1825 A.D. in Qing Dynasty.

Controlled by the north embankment of Yangtze River and as a flooding lake, it was full of water in flooding period and little water in low water season. A great deal of sediments deposited in the lake and the lake bed aggraded gradually and the lake retreated from northwest to southeast. The dikes were built and the land was cultivated on the beaches and bars of the lake. Till the late Qing Dynasty the lake reduce to 30% or so. In the fifties to sixties of 20th century, another large-scale dike-building and land-cultivating and land-lake regularization turned the center of the lake into farmland and the south bank into lake, then made the Dongting Lake's layout like a "C". In the west of the basin, some places aggraded 7~8m during the past 40 years. The dikes building and the farmlands protection made the lake water surface and the depositional area smaller, which resulted in channels and lake's water level higher than the farmland, even 10m in some earlier dike-protected farmland. This forms the special suspend lake landscape in Dongting lake. Even the artificial cutoff and dam construction in Yangtze River cause the sediments deposition decreasing, the aggradation tendency of the lake will last for a long time.

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THE DEVELOPMENT OF TERRACES IN QILIANSHAN MOUNTAINS AND THE UPLIFT OF THE TIBETAN PLATEAU

Baotian PAN, Guangjian WU, Jijun LI
Department of Geography, Lanzhou University, Lanzhou, Gansu, 730000, P.R. China

The Tibetan Plateau is the highest, largest, youngest plateau in the world. Its uplift in Cenozoic has important effects on global climatic change. However, different viewpoints existed on the studies of uplift of the Tibetan Plateau. M. Coleman et al. suggested that the Tibetan Plateau got maximum altitude 14 Ma ago. T. Harrison and P. Molnar et al. proposed that the plateau arrived the present altitude 8Ma ago. But Li Jijun et al. thought that intense uplift resulting in the Tibetan Plateau happened in the last 3.6 Ma. M. Searle indicated that the way to resolve difference of viewpoints is dating faults. River terraces in the Tibetan Plateau and its circumference?mainly resulted from tectonic uplift, recorded uplift history of the Tibetan Plateau. Therefore, we think that the best way is dating surfaces such as terraces.

Qilianshan Mountains is located in the margin of the Tibetan Plateau. There are many terraces along the rivers rising in Qilianshan Mountains. Here we discuss terrace development in two rivers. One is from the Shiyang River in East Qilianshan Mountains, another one from The Oil River from the middle Qilianshan Mountains.

The Shiyang River, one of inland rivers in Northwest China, developed a pediment and five terraces. Loess on terraces and pediment is beneficial to dating terraces and pediment. The pediment, 300 m above river, is distributed on the upper part of valley. About 100 m loess deposited on it. The study on magnetic stratigraphy of loess indicated that the pediment is formed 1.4 Ma ago. The fifth terrace, 100 m above river level, covered with 200 m thick loess. The magnetic stratigraphy and paleosol sequence of loess showed that the age of the fifth terrace is about 840 ka. The fourth terrace, 75m above river level, was overlaid with 80m thick loess. S4 at the bottom of the loess profile indicated that the fourth terrace was formed 400 ka ago. The third terrace is 40m above river level and 55m thick loess deposited on it. S2 and a 225±17 ka TL age at the bottom of the loess profile demonstrated that the third terrace was formed 220 ka ago. The second terrace, 30 m above river level, was covered with 30 m thick loess. S1 and a 78±7 ka TL age at the bottom of the loess profile indicated that the age of the second terrace is about 150 ka. The lowest terrace, 15 m above river level, was overlaid with 2 m thick loess. A ^{14}C age of alluvial sediment is 12800±100 a BP, which showed that the first terrace was formed 10 ka ago.

The Oil River, a distributary of The Black River, developed seven terraces. The lower three terraces (T_1, T_2 and T_3) are 25 m, 50 m and 70 m above river level respectively. The upper four terraces (T_4, T_5, T_6 and T_7) are 110 m, 180 m, 270 m and 310 m above river level respectively. According to the ESR date of terrace sediment and magnetic stratigraphy of the relative deposition of terraces, T_4, T_5, T_6 and T_7 were formed 0.15 Ma, 0.8 Ma, 1.1 Ma and 1.8 Ma ago.

Distribution, characteristics, age and formation environment of terraces showed that tectonic uplift is an important factor controlling formation of river terrace in Qilianshan Mountains. Therefore, development history of river terraces in Qilianshan Mountain recorded uplift processes of the Tibetan Plateau, and formation of each terrace represents an event of plateau uplift. Based on age of terraces mentioned above, it is deduced that there were at least uplift events in last 2 Ma in the Tibetan Plateau. They happened 0.01, 0.15, 0.22, 0.4, 0.8, 1.1 and 1.8 Ma ago respectively.

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GEOMORPHOLOGICAL ASSETS: CONCEPTS, METHODS AND EXAMPLES OF SURVEY

Mario PANIZZA

Dip. to Scienze Terra, Universit?Studi Modena e Reggio E., l.go S.Eufemia, 19, 41100 Modena, Italy, E-mail: pit@unimo.it

Some fundamental concepts on geomorphological assets are reviewed and a methodology for their survey and assessment is presented and pointed out. Between the attributes that may confer value to a geomorphological asset, the scientific criterion is based on the perception of the laws that govern its evolution and its importance may be assessed according to four characters: as model of geomorphological evolution, as an object used for educational purposes, as a paleogeomorphological example and as an ecological support. Each of these characters can assume a higher or lower value owing to its rarity, that is, its interest in spatial terms.

The application of these concepts is presented through a case study in the territory of the Province of Modena (northern taly). Finally an attempt to numerically express the scientific importance of geomorphological assets is proposed, in order to weigh them in the process of the Environmental mpact Assessment.

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A SURVEY OF THE DANXIA LANDFORM RESEARCH IN CHINA

Hua PENG

Department of Geography, Zhongshan University, Guangzhou, 510275, China, E-mail: eesph@zsu.edu.cn

Danxia landform belongs to red terrestrial clastic rock landform, which is characterized by its red cliffed scarp. The development of Danxia landform research in China experienced three history stages, i.e.; Prof. Guoda Chen raised initial establishment and taking shape and expanding since the concept "Danxia landform" in 1939. As a new branch of geomorphology, Danxia landform research is now stepping its ripe stage. In 90's, their search enters into an unprecedented grand occasion at the prompting of tourism exploit.

Danxia landform is classified into rock landform system. That the red terrestrial clastic rock being its material base and that steep scarp being its type form are accepted by most of researcher in this field. The constitution of leveled-top and cliffed-scarp and gentle-fool is the type shape of Danxia landform.

In different area, the provincial characteristics of Danxia landform are different from each other due to their geography environment differences.

Danxia landform developed only when the Earth crust reached its specified development stage, e.g., all red beds found on the Earth are not earlier than Mesozoic era. Most of Danxia landform formed on red conglomerate rock, sand-conglomerate rock and sandstone. Meanwhile, red bed hills formed on siltstone and mud stone due to their flexible texture. The regional tectonic pattern, which controlled the distribution of sedimentary basins, is the tectonic base of Danxia landform. Tectonic lines within the basin controlled the distribution pattern and even the shape pattern of Danxia landform mountains. Supper surface of a mountain and tectonic dome of Danxia landform were controlled by the rock occurrences. Crystal movement controlled the development of Danxia landform.

Exogenetic forces influenced the Danxia landform development included alleviation and weathering and gravitation processes, among which the alleviation process is the main force formed the Danxia landform. Alluvial corrosion and weathering created favorable condition for the gravitational eboulement, Danxia landform cliffed scarp is often the eboulement surface or reformed one. Wind erosion and saline weathering are unponderable forces in forming Danxia landform in arid zone. Organism activity is advantageous to weathering in humid zone. Artificial Danxia landform landscape is the product of exploiting stone.

Danxia landform often distributed in weak ecology system areas; however, its tourism development value is often high due to its beautiful landscape and plentiful cultural scenery.

The Danxia landform research is aim at its development principles, taxonomy, landscape quality evaluation and graduation, natural mountains and river culture and human culture scenery, nature resource protection and utilization, and etc. All of which are beneficial to regional economic construction. In recently years, symposium of Danxia landform landscape resource and its tourism development are very active, which make a great contribution to regional tourism development.

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CHANNEL CHANGE DOWNSTREAM FROM TWO DAMS IN THE PACIFIC NORTHWEST, USA

Molly Marie POHL

Department of Geography, San Diego State University, San Diego, CA 92182-4493, Email: mpohl@mail.sdsu.edu

Rivers are one of most dramatically modified elements of the world's natural environment. Many of the world's rivers are affected by dams and water regulation, leading to widespread environmental degradation. More than 75,000 dams fragment the rivers of the United States of America, affecting 98% of our 3.5 million miles of streams. Research evaluating how dams impact river systems has typically focused on the major impacts associated with large dams, yet large dams represent less than 1% of the structures on American rivers.

The objective of this study was to assess how the channel system of the Elwha River of Washington State responded to the construction of two hydroelectric dams of moderate size in the early 1900s. The methodology involved evaluating historical aerial photography of the Elwha River to examine spatial change over time, complemented by a detailed field study of current river system dynamics. While several geomorphic variables responded at different rates to dam installation, the general pattern following dam closure was a simplification of the channel system and the associated riparian community. Finally, the implications of the scientific findings for potential restoration of the Elwha River by dam removal will be discussed. With impending dam removal to 'restore' the damaged ecosystem and fisheries, it is particularly important to evaluate how the dams have changed the Elwha River system and how the river is currently functioning with the structures in place.

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PLAY OF THE INDIAN MONSOON: A GEOGRAPHICAL ANALYSIS

Rana PRATAP
Magdh University, Bodh-Gaya (Bihar), India

To present a geographical analysis of monsoon in general and the ndian monsoon in particular is a irksome task. This is simply because of its uncertainty of its origin, nature, behaviour and mechanism. Although a good number of attempts have been made to explain the characters of the monsoon, still it is difficult to arrive at a consensus finding till the date. This attempt is however, to highlight the various facets of the ndian monsoon which had has exercised a profound influence on ndian life, economy and its culture.

The word, 'monsoon' derives from Arabic mausim, is understood by geographers - as a 'season of rains' occurring between the months of June to September carried by a series of forced cyclonic maritime winds from tropical oceans to the ndian landmasses. It is very popularly known as the S.W.Monsoon or the ndian Summer Monsoon. The 'Pre-monsoon', the 'burst' of monsoon, the play of monsoon and finally the 'retreat' of monsoon are very interesting features. Because of these special characteristics the ndian monsoon differs with the monsoon of the other regions of the world including the monsoons of China, ndo-China, Manchuria and Japan. Actually, the ndian monsoon is the result of a complex - interplay of the three sets of situational factors, i.e. the strong insolation (March to May), the Himalayas and the Northern plains and the penetration of the Peninsular ndia into the ndian ocean. It is better to say that what ndia is to-day is due to the monsoon and what monsoon is, it is due to the ndia. Both are the cause of each other, interlinked and coexistent. It is the Himalayan wall which acts as a formidable barrier between the south and the Central Asia, that generates a region of intensely high temperature and low pressure during onset of summer in and about North-Western portion of the country and creates a situation to attract the South-East Trade Winds to this region. The S.E. Trade Winds coming to the Northern Hemisphere deflects towards the ndian landmasses as "SW Monsoon" and branches off into two streams of, the Arabian Sea and the Bay of Bengal and almost invades the country through-out.

The author observes the ndian monsoon as a monster of undependable character, when happy it comes instantly earlier with heavy and continuous rains, causes havoc of floods - a misery to standing crops and lives. When angry it comes late, gives scanty rains and returns earlier. This causes drought and famine, again devastating impact on lives. Very occasionally a normal monsoon prevails. But after all, the monsoon in ndia is a natural system of life very much required for the survival of ndians and their art, culture and civilization.

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THERMOLUMINESCENCE DATING OF AEOLIANITES FROM LORD HOWE ISLAND, SOUTH WEST WESTERN AUSTRALIA AND NORFOLK ISLAND

David M. PRICE, Brendan P. BROOKE and Colin D. WOODROFFE
School of Geosciences, University of Wollongong, Northfields Avenue, Wollongong NSW 2522, Australia, E-mail: david_price@uow.edu.au

There are differing views as to how the deposition of aeolianites correlates with glacial-interglacial cycles. This study attempts to address this lack of understanding by providing chronological evidence of the timing of the formation of aeolianites at two Australian sites. A third site is also considered but at the time of writing there is limited chronological information available. At the same time the potential of the application of thermoluminescence dating to determine the age of these deposits is also evaluated. The study areas considered are Rottnest Island and the Fremantle coastline in Western Australia, Lord Howe Island in the Tasman Sea off the east coast of Australia and Norfolk Island further east of Lord Howe Island also in the Tasman Sea.

The chronostratigraphy of aeolianite on Lord Howe Island has been comprehensively examined by one of the present authors (Brooke) whereas the depositional chronology of Western Australian aeolianite is only known from previous dating at one or two key sites in the area. At present there is very little known of the timing of the formation of aeolianite upon Norfolk Island although there is a reported age suggesting that aeolianite emplacement took place during the last glacial maximum period at a time of sea level low stand.

In two cases out of the three thermoluminescence has successfully demonstrated that the timing of the emplacement of the aeolianite formations studied is most probably related to source availability. Dune and subordinate marine deposits of Lord Howe Island appear to have been emplaced only during sea level high stands when the platform around the island was flooded and when beach sediments were accumulated around the coast. In contrast the aeolianites found upon Rottnest Island and the adjacent Western Australian coastline appear to have been formed during periods of both high and low sea level indicating a more continuous supply of shallow marine sediments. In the case of Norfolk Island, in a setting similar to that of Lord Howe Island, one might expect aeolianites to have formed during similar times of high sea level. As yet however, due to the lack of suitable crystalline minerals, thermoluminescence has not been successful in determining the timing of the emplacement of the aeolianites found upon the island. An age reported by another researcher, using an alternative dating method, however, suggests deposition during the last glacial maximum. The amount of supporting evidence for aeolianite formation on the island during this low stand sea level period at present is however slim.

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CHARACTERIZATION AND DISTRIBUTION OF MORPHO-SEDIMENTARY UNITS IN BARNEGAT BAY, NEW JERSEY, USA

Norbert P. PSUTY
Institute of Marine and Coastal Sciences, Rutgers-The State University, New Brunswick, New Jersey, U.S.A. 08901, psuty@imcs.rutgers.edu

A systematic sampling of bottom sediments in Barnegat Bay is being undertaken as part of the US Environmental Protection Agency National Estuary Program for this bay. Although the management program is largely focussed on water quality as the basis for maintaining the estuarine natural and cultural resources, sediments and morphology are recognized as a fundamental characteristic of the bay's structure and habitat.

Characterization and distribution of the sediment types within the shallow 272 km2 estuary is a product of the relative contributions from the several source areas derived from the marine and continental components of the estuary. The association of sediment types to the continental margins, the hydrography of the estuary, and the accompanying barrier island geomorphology leads to the identification of discrete morpho-sedimentary groupings. The eastern margin of the bay is the product of alongshore barrier island development with a history of modern as well as relic flood-tide deltaic forms related to former and present inlets, washover forms of various dimensions, and wetland formation. The western side of the estuary has several small micro-estuaries with sequences of fluvial and coastal deposits. There are also remnants of the drowned Pleistocene surface forming the bottom topography. Superimposed on the natural distributions are human-derived manipulations of channels and sediments that have created distinct imprints. Statistical analytic techniques consisting of Principal Component Analysis, factor analysis, and bivariate analysis were used to self-organize the sediment data and contribute to the development of a model of sediment distribution in Barnegat Bay. Unraveling the mix of morphologies and sediment types leads to an understanding of the developmental history of the bay, its evolving spatial organization, and together provides a basis for management of the resources as part of the National Estuary Program Comprehensive Management Plan for Barnegat Bay.

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LATE-HOLOCENE POLLEN RECORDS OF VEGETATIONAL CHANGES FROM DAIYUN MOUNTAINS IN SOUTHEASTERN CHINA

Hong-lie QIU[1] and Kam-biu LIU[2]

[1]Department of Geography & Urban Analysis, California State University, Los Angeles, 5151 State University Drive, Los Angeles, California 90032, U.S.A., hqiu@calstatela.edu

[2]Department of Geography & Anthropology, Louisiana State University, Baton Rouge, Louisiana 70803, U.S.A.

Three dambo sediment profiles from Daiyun Mountains in central Fujian, southeastern China, were used to reconstruct the vegetation and monsoon climate history. These three dambos sites include one from Lianhuachi (Lotus Lake, 25°35'N, 118°9'E) and two from Jiuxianshan (25°40'N, 118°8'E).

Pollen stratigraphies recovered from the three dambos sites indicate that the original vegetation for the region during 4,000-2,500 yr B.P. was a mixed conifer-hardwood forest, a more diverse and productive forest than the pine woodlands of today. A major vegetation change occurred at about 2,500 B.P. when the pollen frequencies of the major tree species (mainly Cryptomeria, Castanopsis, Lithocarpus, Quercus, and Tsuga) were slightly reduced. This vegetation change seems to have occurred mostly at lower elevations because no distinct changes in the sedimentological records of the three dambo cores were detected. The second major vegetation change took place around 1,600 B.P. and was documented in all three pollen stratigraphies as an abrupt decline in the major tree species accompanied by an increase of Pinus, Gramineae, and Dicranopteris. It occurred at a larger scale and reached two of the three catchment basins of the dambo sites under study. Since then the secondary pine woodland has persisted to the present.

Deforestation by human activities is probably the major cause of the documented vegetation changes. The first vegetation change occurred when trees were cut down at lower elevations. The second vegetation change was caused by a more extensive deforestation which reached up to the catchment basins of the two lower dambos sites. This happened during the years between 307 to 420 A.D. when large number of Han Chinese migrated to Fujian Province to escape the wars and political turmoil in North China. This deforestation marked the end of the original mixed conifer-hardwood forest and the initiation of the present-day pine woodlands.

The growth of a mixed conifer-hardwood forest before the formation of dambos in the headwater zones suggests that the climate was probably warmer and/or drier prior to the beginning of the pollen sequences. The onset of cooler/wetter climate after 4,000 yr B.P. was responsible for the initiation of dambo development at the three study sites.

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PROVIDING SEDIMENTS TO RESTORE SUBSIDING COASTAL MARSHES: STRATEGIES FROM THE MISSISSIPPI DELTA PLAIN

Denise J. REED
Dept. Geology & Geophysics, University of New Orleans, New Orleans LA 70148, USA, djreed@uno.edu

Wetland loss in the Mississippi Delta Plain is attributable to alterations in flooding patterns and sediment supply at a number of scales. Contributing factors include the placement of flood control levees along the River itself, isolating the delta plain from its natural source of sediment and freshwater, as well as the smaller scale but very common construction of spoil banks along the extensive network of canals dredged for oil and gas exploration. Opportunities for addressing the results of these changes vary across the delta plain. In some areas within the 'birdsfoot delta' below the flood control levees, artificial 'crevasses' (cuts in the natural river levee) have been created. These have resulted in emergent marsh formation within about 2 years of breaching, with an average land gain of nearly 5 ha yr^{-1}. The cost of each crevasse averaged around US$20,000. Thus these schemes prove cost-effective relative to larger and more complex projects higher on the river where project costs must include the relocation of infrastructure such as roads and railways as well as the engineering challenge of making a controlled breach in major flood control levee. While cost effective, the artificial crevasses represent a technique which has limited application geographically and that creates new habitat in areas remote from hurricane protection levees and human infrastructure where the need for conservation is perhaps greatest. Larger river diversions through controlled structures are under construction and more are planned as the keystone action in a new strategic plan for the provision of sustainable coastal resources in Louisiana.

For sites remote from river distributaries with readily breachable levees, managed dredge material disposal offers an alternative means of increasing wetland elevations. However, sediment recharges need to be carefully managed if they are to have the desired ecological effects. In particular, the thickness of material placement controls the mechanism of vegetative recolonisation. One means of ensuring recolonisation within existing marshes subject to rapid submergence is thin-layer deposition using a spray-dredging technique. The technique has also proved successful in raising the elevation of adjacent shallow pond environments (caused by deterioration of saltmarsh to open water). Thus within the Mississippi delta plain opportunities exist for salt marsh conservation concurrent with continuing industrial and commercial development. While industrial development within the coastal zone caused many problems for coastal salt marshes, increased understanding of salt marsh value and threats to its sustainability mean that not that dredging and development have been halted - rather that dredged material is now used to improve and sustain otherwise degrading habitats.

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RECONSTRUCTION OF THE 30-40 KA B.P. ENHANCED INDIAN MONSOON CLIMATE BASED ON GEOLOGICAL RECORDS FROM THE TIBETAN PLATEAU

Yafeng SHI and Ge YU
Nanjing Institute of Geography and Limnolgy, Nanjing 210008, China

Multi-proxy records from ice caps, lakes and pollen records from the Tibetan Plateau are used to reconstruct the palaeoclimate during the period 30-40 ka B.P. Lake geomorphological and lacustrine sedimentological studies show that numerous high lake level stands and/or freshwater lakes occurred in large areas of western China at this time, almost covering the entire Tibetan Plateau. Today the area contains mostly shallow water and saline-hypersaline water lakes under extremely dry conditions. Pollen-based reconstruction of Tibetan vegetation shows systematic differences from the present; the northern limit of alpine steppe-forests was shifted ca. 400 km and the alpine conifer forest extended ca. 400-800 km beyond their present western limits. Variations in d 18O curves from ice cores from the plateau suggest that the climate was exceptionally warm and wet with temperature 2-4? higher and precipitation 40? to over 100? higher than today. All of the evidence consistently suggests the existence of an exceedingly strong summer monsoon climate over the plateau.

The occurrence of such warm and wet conditions can be attributed to the stronger summer low pressure over the Plateau, which strengthened the influence of the summer monsoon from low latitude oceans. The vigorous evaporation of the tropical ocean surface would also play an important role in promoting the penetration of moisture-rich southwest monsoon over the Tibetan Plateau. These climate patterns with strong summer monsoon circulation during the period 30-40 ka B.P. inflect the 20 ka earth orbital precessional cycle, when the Tibetan Plateau received extraordinary strong solar radiation which thus enlarged the thermodynamical contrast between the plateau and the mid-south part of the Indian Ocean.

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GEOMORPHOLOGY AND GLOBAL ENVIRONMENTAL CHANGE

Olav SLAYMAKER
Department of Geography, University of B.C., Vancouver, B.C. V6T 1Z2, Canada, olav@geog.ubc.ca

Some would claim that all geomorphology is about global environmental change; others are suspicious of the territorial ambitions of Earth systems scientists, who have been largely responsible for the increased awareness of the practical importance of global environmental change over the past couple of decades. regard much geomorphological work as having its primary significance for local scale problems (and no less important for this) and view the emphasis of the Earth systems scientists as an entirely positive reminder to us geomorphologists of the value of examining global scale phenomena.

There are at least two components of global environmental change: systemic and cumulative (Turner et al., 1990). Systemic change refers to global scale changes such as climate change, whereas cumulative change refers to the net world-wide change resulting from many local or intermediate scale changes.

Climate and people drive global environmental change and they are in turn impacted by global environmental change. Climate produces a series of cascading system responses via river hydrology, snow and ice, glaciers, permafrost, flora and fauna, sediment systems, oceans and people. People drive global environmental change by intentional land use and land cover change, damming and diverting of rivers, managing of snowpacks, transferring soil and rock materials of all kinds and building of cities. In this sense, geomorphology is just one of many responses to climatic and anthropogenic processes. Nevertheless, changes in landforms are pervasive over space and through time and many of these changes are global in scale.

The interpretation of global paleoenvironments is undoubtedly the central contribution of geomorphologists to global environmental change in the historical geomorphology tradition. Within the global research agenda, the PAGES project represents the core of this tradition. There are two parts of PAGES, namely PAGES Stream, covering the last 200,000 years and PAGES Stream, covering the last 2,000 years. Functional geomorphologists contribute in two ways:

1. understanding of energy and mass fluxes;
2. interpretation of landform response to climate, hydrology, tectonics and land use.

Applied geomorphologists contribute in three ways:

1. minimising and adjusting to the effects of global environmental change;
2. mitigating natural hazards;
3. the sustainability question.

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THE GEOMORPHIC IMPACTS OF FORESTRY IN B.C.

Olav SLAYMAKER
Department of Geography, University of B.C., Vancouver, B.C. V6T 1Z2, Canada, olav@geog.ubc.ca

British Columbia is a province of 95 million hectares of which 61 million hectares are forest land. BC's forests extend from just south of 49 degrees north to 60 degrees north; from temperate rain forest in humid low elevation coastal areas to arid subalpine forests in continental areas; from semi-desert and savannah forest conditions to boreal.

The Ministry of Forests considers 52 million hectares to be productive forest land or land that is biologically capable of producing commercial timber. When economic viability and environmental sensitivity are considered, about one half of this area is available for timber harvesting. The quality of forest land is highly variable with the most productive forest lands generally found on valley bottoms along the coast and in the interior wet belt.

Because of the variety of ecological conditions, forestry practices vary greatly across the province. In general, forest harvesting increases average runoff and total water yield. Clearcutting increases storm runoff volumes and advances the timing of floods. Small and moderately early autumn storms are most affected. Logging roads increase storm runoff and advance timing of floods. The road layout influences the response. ncreased storm and peakflows result in an increase of erosion and channel scour.

The major sources of sediments are landslides and bank erosion. Maintenance of sediment transfer is important for habitat. Forest landuse increases the sediment production by 2 to 70 times. Road surfaces and sides are most serious; streambank disturbance is serious and debris fans have major significance.

Changes in steep low order streams are readily identified. Detection in larger systems is more difficult. Road building and clear-cutting can alter the timing and magnitude of storm runoff events. These can cause changes in fluvial sediment transport. Land use changes may have more direct effects by making more sediment available for transfer.

Not only is streamflow affected but changes in sediment sources and mobilisation of sediment are superimposed on changes in streamflow. Five landform units are important: hillslopes, gullies, stream channels, riparian zones and valley floors. Primary sediment mobilisation occurs on hillslopes and in gullies; remobilisation occurs from storage zones and along stream channels. Estimates of the rates of mobilisation of sediment are controversial and the precise extent of the acceleration produced by forestry activities is unknown. Coarse sediment, fine sediment and large woody debris should be considered separately. Terrain stability has become an overwhelming concern in forest practice guidelines and recent legislation.

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LUMINESCENCE DATING OF EVOLUTION OF GANGETIC FORELAND BASIN: A SYNTHESIS

P.SRIVASTAVA[1*], B.SINGH[2] and A.K.SINGHVI[1]

[1] *Earth Science Division, Physical Research Laboratory, Ahmedabad- 380 009, India*
[2] *Department of Geology, Lucknow University, Lucknow 261 007*
[*] *pradeep@prl.ernet.in*

Flexing of ndian lithosphere due to the continent-continent collision and thrust fold loading produced Gangetic Foreland Basin during Middle Miocene. Synoptic remote sensing studies enabled delineation of major and minor geomorphic features. Major features include: Upland nterfluve Surface (T_2); Megafan surfaces; River Valley Terrace (T_1); Piedmont fans and Active Flood Plains and minor features comprise Ponds and Alluvial ridges which occur on the upland interfluve surfaces. Major rivers of Gangetic plains are entrenched to more than 20 m. A tectonic and climatic control on the geomorphic evolution via sea-level changes has been hypothesized, however, relative amplitudes and chronology of these processes in shaping the regional geomorphology has not been possible due to paucity of reliable numerical chronology. Limited radiocarbon dates on calcrete and molluscan shells from upland interfluve surfaces and ponds suggest that deposition on upland interfluve continued during 28 - 1 ka BP.

Results of a systematic attempt to provide numerical chronology to the deposition event of sediments in various geomorphic context using Blue-green and nfrared stimulated luminescence techniques are presented here. As discussed below, luminescence ages provide a first order framework to the relationship of major and minor geomorphic features to climate and tectonics.

Samples from the raised Upland interfluve surface, (which reflects an interplay of channel, lacustrine and aeolian processes), were dated across the region. A 20 m thick section at Kalpi on river Yamuna shows (base upward)

1. a cross-bedded gravely unit,
2. 8 m thick fine sand (with remains of the largest Asiatic elephant tusk, Rhino, Bovines and equus) and,
3. top 4 m silt devoid of any fluvial signatures.

Luminescence analysis of this section, bracketed the above mentioned palaeontological and sedimentological evidences of more humid climate to 69 - >32 ka. Sequences on rivers Betwa and Ganges provided similar results and enabled a reasonable inference that deposition of upland interfluve surface began atleast at 80 ka and ended by 10 ka. Local deposition on this surface also took place during Holocene. A northward younging in age of final fluvial activity across the region is also seen. River valley terrace occur in all major rivers, typically ~5 m above the present channel. Present study places activity of meandering rivers with a higher discharge during the Holocene (10-1.5 ka) on these surfaces. Accretion on the narrow, poorly developed youngest Active flood plain began after 1.5 ka. Alluvial ridges occur as geomorphic highs (3-5 m) on upland interfluve surface, comprise grey, cross-bedded fluvial sand at the bottom and reddish brown well sorted aeolian sand at the top. Luminescence ages of 7-6 ka for fluvial sediments (channel activity, humid climate) and 5-4 ka for aeolian sediments (less humid climate) suggest a significant shift in climate during Mid-Holocene, that is also reflected in the aeolian and lacustrine record of Thar desert. Distribution pattern, luminescence dating and sedimentology of Ponds suggest their development due to cessation of fluvial activity on the upland interfluve surface some time during 7-4 ka.

Overall, the geomorphic record of Gangetic basin shows a close correspondence to the Arabian sea record of changes in SW monsoon (water budget). The present 20 m fluvial entrenchment should have been influenced by tectonism and needs further scrutiny. Minor geomorphic features and development of soil in western Gangetic plains bear evidence Late Holocene tectonism.

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ALGAL COMMUNITY AND ITS EFFECT ON STONE FOREST, YUNNAN, CHINA

Youping TIAN[1], Jie ZHANG[1*], Shengfeng L[1], Haosheng BAO[1] and Bingyuan ZHENG[2]
[1] *Department of Urban and Resource, Nanjing University, Nanjing 210093, China*
[2] *Municipal Tourism Administration Bureau, Stone Forest, Shilin, Yunan, China*
[*] *jiezhang@nju.edu.cn*

The well-known Lunan Stone Forest National Park is located at 24°49'N and 103°19'E, 85km southeast of Kunming, provincial capital of Yunnan, China. Lunan Stone Forest covers a total area of some 350km^2. It is not only a great tourist attraction, being acclaimed as "one of the greatest natural wonder in the world", but also of important scientific and aesthetic value. The Lunan Stone forest is referred to in many published papers, but few involves microbe on the surface of carbonate rock there and the relationship of the microbe and formation of Lunnan Stone Forest Landscape.

Based on the field survey and laboratory observation on the microbe on the carbonate rock surface in Lunnan Stone Forest, it is found that microbe, mainly consisted of algae, lichen and fungi, forming a layer generally 0.5-3mm thick, covers nearly all parts of "bare rock" in Lunan Stone Forest. Normally over 90 percent of microbe coating are algae community with species of Chroococales (belong to Cyanophyta, Cyanophyceae, Chroococcales), and secondly species of Rivulariaceae, Scytonemataceae, Nostocaceae (belong to Cyanophyta, Cyanophyceae, Hormogonales), and some species of Chamaesiphonales (belong to Cyanophyta, Cyanophyceae). Over 180 species aerial algae were identified on the surface of limestone and dolomite stone in Lunan Stone forest area, which is probably one of the most systematic identification of aerial algae community on limestone surface.

Meanwhile, the algal genetic effect on the formation of micro relieves and minor relieves of Lunnan Stone Forest landscape were also identified and studied. Cyanophyta, through the boring effects and related stripping effects, lead to the formation of micro and minor relieves on the surface of Stone Forest. These micro and minor forms include scale-like karren and photo-oriented spitkarren on limestone cliffs, round pit, irregular pit on both top and walls of limestone surface. It is also suggested that the algae solution pans and solution troughs. On the other hand, Cyanophyta participate in the formation of tumor-like calcareous tufa on a few parts of surface of Lunnan Stone Forest.

Cyanophyta plays an important role in the formation of beautiful Lunan Stone Forest landscape. It include two aspects as below:

1. Cyanophyta, forming algal coating with biokarst erosional agent, reduces greatly the hardness of surface of carbonate rock, generate a series micro and minor biokarst erosional relieves and promote karst solution process of Lunan Stone Forest landscapes, with directly related forms like karrens in micro and minor scales, and also with meso-scale forms such as pinnacle stone forest, tower stone forest and mushroom stone forest etc. In fact, algal coating even play a critique role in the genetic process of some "free" karren like rillenkarren.
2. Organic coating of Cyanophyta community dyes the surface of Lunan Stone Forest and forms the dyeing strip. When it is rainy with wetted algal coating, the surface colour becomes darker, while it is sunny with drought coating, the surface colour become light. Therefore, surface color of Lunan Stone Forest can be changed while the weather change, which become a unique landscapes attraction enjoyed by visits.

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PALEOTIDAL REGIME AROUND THE CHANGJIANG ESTUARY AT 6KYR B.P.

Katsuto UEHARA[1], Yoshiki SAITO[2] and Kazuaki HORI[3]

[1] Research nstitute for Applied Mechanics, Kyushu University, 6-1 Kasuga Koen, Kasuga, Fukuoka 816-8580, Japan; uehara@riam.kyushu-u.ac.jp [2] Marine Geology Department, Geological Survey of Japan, Tsukuba 305-8567, Japan [3] Graduate School of Science, University of Tokyo, Tokyo 113-0033, Japan

Two-dimensional paleotidal simulations were carried out in order to investigate the influence of large morphological changes that occurred during the postglacial period in the region around the Changjiang estuary on tides and tidal currents of the Yellow/East China Sea. Calculations were made for 6 kyr B.P., which corresponds to period of the maximum postglacial transgression in eastern China. Special consideration was taken to reconstruct the paleotopography around the Changjiang estuary (from lat 31-33°N and long 119 -123°E), which was accomplished by using available borehole datasets. The aim was to remove the effect of the massive sedimentation that obscures the original topographic features in this area. We also simulated the coastline and bathymetry along the Jiangsu coast and Hanzhou Bay for the same reason. Sea level was assumed to be the same with the present level.

At 6 kyr B.P., the M2 tidal currents converge (diverge) from (to) the mouth of the estuary, forming a radial tidal-flow pattern originating from the estuary. Tidal amplitude reached a maximum value in the middle of the estuary and attenuated toward its head. These features agree with the numerical results of Zhu (1999), who estimated paleotides at 7 kyr BP using a different depth elevation model. Tides and tidal currents in the estuary at 6 kyr BP seem to have been stronger than those at present. From the analysis of the tidal-current phase pattern and from some supplemental experiments with changing sea levels, it appears that the emergence of the radial flow pattern of the tidal currents might have been caused by the southward shift of the southern tip of the Yellow Sea amphidromic system that accompanied the postglacial sea-level rise.

Tides and tidal currents within the estuary were dominated by the semi-diurnal components. Closer investigation revealed that their relative contribution varied slightly though systematically among the periods. Ratio of the diurnal (K1 and O1) tides to the semi-diurnal (M2 and S2) ones was systematically lower during 6 kyr B.P., when compared to the modern situation. These changes occurred mostly by the amplitude change of the semi-diurnal tides in the estuarine region.

In the Jiangsu coastal area between lat 32.5°N and 33.5°N, the major direction of the M2 tidal current shifted from a SW-NE to E-W direction during the last 6000 years. This directional change is consistent with a paleocurrent direction estimated for the North Jiangsu region using a geomagnetic analysis (Zhang et al., 1998). The SW-NE flow pattern also appeared when an experiment was carried out using the present-day configuration, except that the sand-ridge system off the Jiangsu coast was removed. This result might indicate a relationship between sand-ridge formation and the directional shift of the tidal current.

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CHANGES OF ASIAN MONSOON SYSTEM AT CA 2.6 MA BP IN CHINA

Jian WANG, Qiaohua HUANG and Zechun LIU
College of Geographical Sciences, Nanjing Normal University, Nanjing 210097, China, jwang@pine.njnu.edu.cn

Based on the numerical simulation results and the geological records of regional environmental evolution and differentiation in China, the changes of the Asian monsoon system at ca 2.6 Ma BP has been analyzed. The analysis shows that, at ca 2.6 Ma BP, the Asian monsoon (including winter monsoon and summer monsoon) was remarkably intensified. The prevailing wind direction of winter (northwest) monsoon in northern China shifted from west-north-westerly to north-westerly and its influencing area extended gradually from Northwest, North and Northeast China to Central, East and South China. However, the influence of southwest monsoon on Northwest China had been weakened. Before 2.6 Ma BP (e.g. in Pliocene), the Tibetan Plateau Region was dominated by subtropical evergreen forests and the Northwest China was not as dry as that today, suggesting that the southwest monsoon could penetrate on and cross over the Tibetan Plateau, and influenced the Northwest China. However, after 2.6 Ma BP, the Northwest China became drier than that before, reflecting the weakening of southwest monsoon influence on the Northwest China. This is the result of the uplift of the Tibetan Plateau to an important critical height (perhaps 2000m), which gave rise to the changes of the Asian monsoon system.

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DEVELOPING PROCESS AND MECHANISM OF TIDAL SAND RIDGES OFF THE COAST OF JIANGSU PROVINCE

Jian WANG[1], Guonian LU[1], Xiaobin XU[2], Hui LIN[3], Zhixiao SONG[4]

[1] *College of Geographical Sciences, Nanjing Normal University, Nanjing 210097, China*
[2] *Jiangsu Teaching College, Nanjing 210024, China*
[3] *Department of geography, Hong Kong Chinese University, Hong Kong*
[4] *Institute for Coast and Sea Engineering, Hehai University, Nanjing 210024, China*

There are many arguments on the causal mechanism of the tidal sand ridges off the coast of Jiangsu province since a long time. It mainly focuses on the dynamics, sand source, initiation age and developing process. Since 1980s, there have been some progresses in these problems, with the investigation on the coasts and the islands, the drilling in the region of coast and continental shelf, and the further development in tidal-system digital simulations of East China Sea. Recently, the authors have analysed sedimentary facies and depositional environment of a coast section composed of 39 cores in middle Jiangsu province coast, and have made digital simulation on the changing process of the tidal current systems in East China Sea for the last 15 000 a years. This paper attempts to discuss the dynamics, sand source, initiation age and developing process of the tidal sand ridges off the coast of Jiangsu province , in terms of the latest analytical data and the results of digital simulations basing on careful analyses of historical literatures. The results show that the main dynamics for the development of the sand ridges are the tidal current systems which convergence off Qianggang and dependence on the location and outline of the coast-line of Jiangsu province and the southern margin of Shandong peninsula. Initiation time of the tidal sand ridges is about 10,000 to 8,000, not 2,000 or 4,000 years BP. Where the sand-ridge-composed material come from is much more complex than it has been thought. In fact, it is the mixture of various sediments in and around the region of the sand ridges with the sands that were and are brought into this region during the development of the sand ridges. Because of the coastline changes since the initiation of the sand ridges, the tidal current system has been experiencing a series of adjustments. Therefore, the sand ridges must have experienced a series of destruction, constructions and adjustments. Sedimentary sequence analysis and tidal-current-system simulations give some evidence to support those changes during the past 10,000 years. The sand exposure region between 30 and 60 m depth in South Yellow Sea has been thought to be the result of erosion by ocean currents. But the ocean currents in South Yellow Sea are too weak to erode the seabed. However, the tidal currents of South Yellow Sea are strong enough to do that. Furthermore, the sand exposure regions in southern Yellow Sea match well with the distribution regions of the sand ridges in 10,000-8,500 years BP and surround the modern sand ridges. Therefore, the exposure of sand area in southern Yellow Sea is the result of erosion by tidal current, not by ocean current.

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KARST CONDUIT FLOW AND ITS HYDRODYNAMIC CHARACTERISTCIS IN HOUZHAI RIVER DRANAGE BASIN IN PUDING, GUIZHOU PROVINCE, CHINA

Lachun WANG[1] and Yongzhan ZHANG[1,2]

[1] *Department of Geo & Ocean Sciences and Department of Urban & Resource Sciences, Nanjing University, Nanjing 210093, China*

[1] *State Pilot Laboratory of Coast & Island Exploitation, Nanjing University, Nanjing210093, China*

The flow moving within subterraneous karst conduits is termed conduit flow. Conduit flow is a special geomorphologic and hydrological phenomenon in karst area. It is a typical indication of dual water-bearing medium and binary structure with extreme specialty and complexity. Being of a rapid response to the heavy rain and with the close relationship to slope flow and fracture flow, conduit flow, mainly as the turbulent flow, always shows the great variety during the different seasons and in distinct karst land mass. The ratio of maximum runoff of conduit flow to minimum one reaches from 10:1 to 1000:1. Thus, underground water hydrodynamics is not suitable for the research of conduit flow. Based on the systemic theory, trace mark technique as a main monitory method is being applied to study the karst hydrological processes, relationship and connection within the underground river system, ratio of the runoff between different conduit flows, contaminants diffusion in karst water and more and more other concerned problems at present time.

Houzhai River drainage basin in Puding, Guizhou province is a large scale test field in the main and broad karst area in southern part of China, where conduit flow is a general reserve and drainage system for underground water. It is a model of mountain karst river basin, with the area of 81 km2, and with two underground reservoirs in its upper stream, which are the ideal sites to draw water for pulse test. Based on the great deal of field investigation and indoor research works during 70s and 80s, pulse tests have been done four times there during 1988 to 1991 in wet and dry seasons. According to the relevant response curves of pulse wave, the connection in this underground river system has been revealed directly. It also shows that water level at each observation site changes from 10 to 1800 mm, with the larger variation in upper stream and at karst windows than in lower reaches and at each exit along subterraneous rivers. By analyzing the lasting time of initial reaction in response curve, the average flow velocity in conduit system is determined within 200-800 m/h, with the less change from flood to dry season, and it is higher in principal conduits and in upper stream area. Meanwhile, the response of water level is always faster than that of gross hardness or electrical conductivity, the later represents the hydrochemistry situation in conduit flow, which shows the difference between wave velocity and flow velocity exactly. Furthermore, while there is full of water in conduit, the difference is even sharper. Then, by measuring the rate of water discharge during pulse tests, reliable divided discharge ratio in each hydrological conduit of sunken system has been got. Combined with detailed field survey in this area, the river system has been exposed finally.

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ANALYSIS OF RESULTS OBTAINED FROM A BBADCP FOR MEASURING SUSPENDED SEDIMENT CONCENTRATION PROFILES IN JIAOZHOU BAY, CHINA

Ya Ping WANG and Shu GAO
Institute of Oceanology, Chinese Academy of Sciences, Qingdao 266071, China

Suspended sediment transport plays an important role in the coastal environment evolution. Thus, the observation of suspended sediments is of interest to coastal scientists, engineers, conservationists and planners, in their activities of harbour construction, land reclamation, coastal protection and coastal zone management. For the past two decades, optical and acoustical techniques have been applied to the measurement of the suspended sediment concentration (SSC) in ocean waters (Proni et al., 1975; Hay and Sheng, 1992; Lynch et al., 1997). Transmissometers and optical back scatters (OBSs) have been developed for point measurements, with some interference to the water column. On the other hand, the acoustic back scatters (ABSs) have an advantage of using a single sensor to obtain SSC profiles without disturbing the water column. Acoustic Doppler Current Profilers (ADCPs), originally designed for measuring three-dimensional current velocities, also have potential to retrieve remote SSC data. The backscatter data form the ADCP i.e. the echo intensity, have been used to measure the SSC by Thevenot and Kraus (1993). They deployed a 2.4 MHz Broad Band ADCP and a transmissometer at a station in the Chesapeake Estuary and found that the ADCP was capable of measuring SSCs with accuracy comparable to the transmissometer, especially when the concentration exceeded 50 mg L^{-1}.

The ADCP is mounted on a vessel moving at a speed of 2-3 ms^{-1} was used to measure the profile of suspended sediment concentrations (SSCs) at the entrance to Jiaozhou Bay, Shandong Peninsula, where the water is characterized by low SSCs (bellow 30 mg L^{-1}), even during spring tides. The echo intensity data produced by the ADCP were regressed against the SSCs collected in situ and derived using the filtration method, in order to establish an algorithm to transfer the acoustic signals (i.e. the echo intensity data) into SSC data. The results show that the calibrated relationship can be used to calculate the SSC, with a relative error of 30%. Therefore, it is feasible to measure the SSC (even if the concentration is low) using the ADCP mounted on a moving vessel. Compared with OBS, ABS and other instruments for SSC measurements, the ADCP represents a potentially powerful tool to retrieve SSC data in continental shelf waters.

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CLAY MINERAL ANALYSIS OF YANGTZE DELTA, CHINA: TO INTERPRET LATE QUATERNARY SEA-LEVEL FLUCTUATIONS, CLIMATE CHANGE AND SEDIMENT PROVENANCE

Zhanghua WANG[1], Zhongyuan CHEN[2] and Jing TAO[3]

[1] *Pilot Laboratory for Urban Remote Sensing and Archaeology, Department of Geography, East China Normal University, Shanghai, 200062, China*
[2] *State Key Laboratory for Estuarine and coastal Research, East China Normal University, 200062, China*
[3] *Department of Geosciences?University of Missouri-Kansas City?Kansas City, M064110-2499, USA*

The present study focuses on the temporal distribution of clay mineral in a new, complete type core ZX-1, recovered from the south-central Yangtze delta plain. Four diagnostic clay mineral suites are recognized from core bottom upward: Zone ; kaolinite and illite (late Pleistocene); Zone ; kaolinite and chlorite (early Holocene); Zone ; illite, smectite, and chlorite (early to mid-Holocene); and Zone V; illite and smectite (late Holocene). Holocene smectite distribution has been linked to the rapid, early Holocene sea-level rise, which induced inundation of the current delta plain. The changes in kaolinite and chlorite composition in early and mid-Holocene were apparently associated with climate oscillation as verified by pollen assemblages. Clay mineral distribution also shed light on the sediment provenance: the terrigenous sediment sources of late Pleistocene and early Holocene were primarily derived from the provincial highlands, west of the study area, and the sediments of late Holocene were basically from the Yangtze sources. The mid-Holocene clay mineral suite indicates sediment input from both the western highlands and the Yangtze sources. This clay mineral study proves potential usefulness in tracing sediment sources through time, and is certainly of significant value for better understanding the paleoenvironmental implication of the Yangtze delta evolution.

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COASTAL PLAN EVOLUTION INDICATED BY SANDY BARRIER SYSTEM IN SOUTHERN HAINAN ISLAND, CHINA

Ying WANG[1], Peter MARTINI[2], Dakui ZHU[1], Wenwu TANG[1] and Yongzhan ZHANG[1]

[1] *State Pilot Laboratory of Coast and Island Exploitation and Dept. of Geo and Ocean Sciences, Nanjing University, Nanjing, China, wangying@nju.edu.cn*

[2] *Department of Land Resource Science, University of Guelph, Guelph, ON, Canada, pmartini@uoguelph.ca*

Hainan Island is located in the marginal, relatively shallow, tectonically stable part of the South China Sea, which is bounded to the south by the ndonesian plate collision zone and to the west by the subaqueous extension of the Red River strike-slip fault zone. The island is composed of various rocks, primarily Paleozoic to Mesozoic granite and metamorphic rocks to the centre and south, Mesozoic to Cenozoic basaltic rocks to the north, and thin cover of Quaternary sediments mainly to the northeast and east. It is dissected by several morphotectonic lineaments (major faults), some very old, others recent directed NE-SW and E-W. During the last two millions years or so, an interplay between neotectonic forces and climatic changes (glaciations) was responsible for the change in relative sea level of about 120 -150 m.

The southern area of Hainan Island is characterized by a shallow offshore area, a promontory-and-embayment coastline, and relatively narrow sandy coastal plains bounded by terraced bedrock hills and backed by mostly granite mountains. The steep slopes of the mountains are associated with a major east-wet trending fault. The sandy costal plains have evolved as response to the various Pleistocene transgressions and regressions. Their component sand was derived from the intense weathering of the granite under subtropical to tropical climate, transported to sea by seasonally flooding streams. It was reworked by monsoon (mainly south and southeast) waves in a generally micro-tidal setting, and it was redistributed by local cellular marine currents into a series of coastal bars separated by sandy lagoons. In general, there is very little clay preserved in the coastal plains. Remnants of pre-Pleistocene, highly indented shorelines occur as terraces on the hills at different elevations ranging from 80 m to 40 m. Lower, more recent terraces at 20, 10 and 5 m asl record the development of the coast during Late Pleistocene and Holocene. In the coastal plains, where best exposed in the Sanya region, there are up to eight to nine costal bars, from small residual inland uplifted ones around promontories of hills to the recent extensive (approximately 10-15 Km long and 5-600 m wide) more recent bars that occur along the present shore. The most recent bar has wells sorted, loose medium light gray quartzose sand, generally showing well developed structures, such as plane bedding and cross bedding. The sand of the older bars becomes progressively more weathered (reddish in colour) with development of some interstitial fines and light cement, and the internal structure becomes apparently massive. The internal architecture of the more recent bars can be readily defined using Ground Penetrating Radar (GPR). This shows that the bars have developed over bedrock, reefal platforms or beachrock. Their deeper horizons have characteristic lexeme-like GPR facies of shoreface to coastal sand, and their top parts are characterized by locally well developed, stacked, seaward prograding 3-4 m thick cross beds. Where not stripped by human activities, aeolian dunes generally cap them. The total sand thickness of the bars reaches up to 8-10 m.

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RIVER-SEA INTERACTION AND COASTAL OCEAN SANDY RIDGES EVOLUTION: EXAMPLES FROM SOUTH YELLOW SEA

Ying WANG and Dakui ZHU
State Pilot Laboratory of Coast & Island Exploitation, Nanjing University, Nanjing 210093, China, wangying@nju.edu.cn

Sand Ridges are distributed widely along the coastal ocean of China seas especially in the Yellow Sea area, such as finger-shaped ridges off west side of Bohai strait, three ranks of sand ridges off Liu Gu River mouth in the Bohai Sea; sand ridge field off Yalu River mouth and the north end of Yellow Sea; sand ridges field off Hanjiang River mouth of Korea in the east side of Yellow Sea; radiative pattern sand ridges field off west coast of the south Yellow Sea, residual Sandy ridges of the outer continental shelf of East China Sea; and finger shaped sand ridges off west side off west side of Qiongzhou Strait in the South China Sea. There are Larger Sandy bodies developed in the area with abounded sandy deposits and predominant tidal dynamics in the inner continental shelf environment (Off, 1963, Collins, 1995). The semi-closed Yellow Sea is located in the mid latitude zone, there, the progressive tidal waves of the pacific are transferring towards the north Yellow Sea and reflected by Shandong Peninsular, thus, the reflected waves meet and converge with the continuing progressive tidal waves to form movable "standing wave" (Zhang Dongsheng, 1998). As a result, the largest tidal ranges up to 9.28m and the strong tidal currents developed in the area. The transgressive tidal dynamics of the Holocene time Perform on the coastal Sandy deposits, accumulated by the ancient Changjiang River and others during lower sea level of late Pleistocene time, to evolve the larger Sandy ridge fields. Tidal dynamics in China seas are strengthened by the convergence processes either in the embayed of north Yellow Sea or by reflected waves, and also through the narrow sea strait effict.

Tidal sandy ridges are the larger sediment bodies in the continental shelf environment, the bodies preserve the geological history records of Sea level changes, land-sea environment changes and the shelf evolution. It is a kind of new land and navigation channel resources and biological habitat. Thus, it has great scientifical and utilizable value for study. Following is the example from South Yellow Sea.

The South Yellow Sea sand ridge field is located offshore of the north Jiangsu Coast of China in a radiative fan pattern. The length of the sand ridge field is 199.6km from north to south, and 140.0km in width from east to west. It consists of more than 70 sand ridges and tidal channels in the water depth from 0 to 25 m. The total area encompasses 22470 km^2, of which 3782 km^2 is above 0 meter.

Fine sands and silts, originated from old Changjiang River sediment during late Pleistocene period, are major sediment components of the sand ridge field. Late Holocene sand strata have well-preserved liminal bedding with more clay particles reflecting the influence from the Yellow River. Present, silt and clayey materials are supplied both by Changjiang River sediments and the abundoned Yellow River delta.

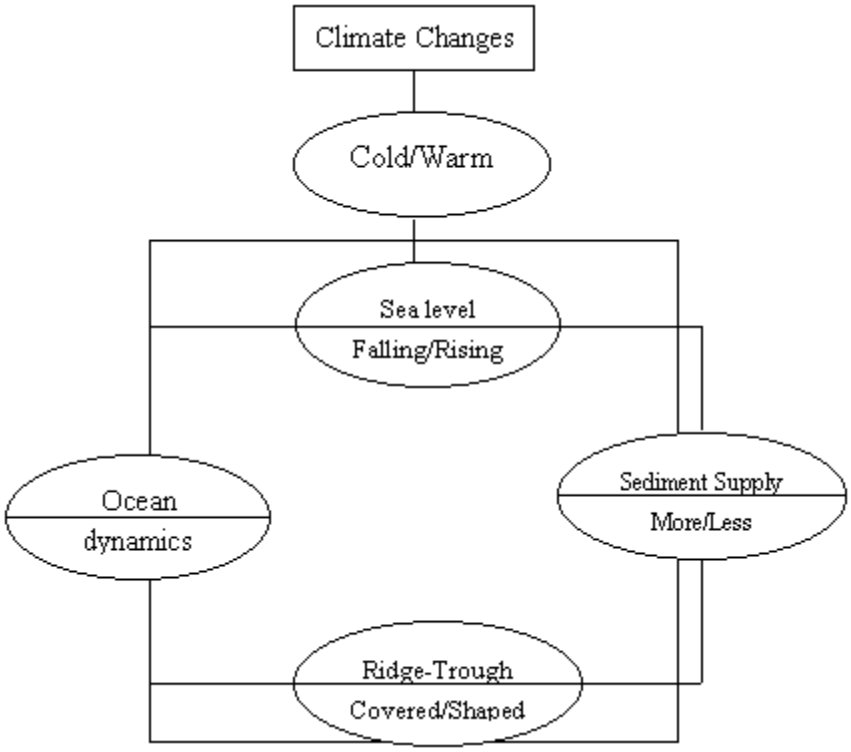
The radiative sand ridge field consists of essentially three genetic types according to seismic profiles and sediment core data.

1. Reformed old river depositional bodies in the center and southern parts, consisted of late Pleistocene sand ridges and superimposed by Holocene sediments.
2. Radiative current ridges in the northeast formed during early and middle Holocene.
3. Eroded-depositional sandy bodies in the northern part, outer part and small ridges out of the large one formed mainly during Holocene time.

The tidal channels have also three types.

1. The tidal channel developed along the old river valley (Changjiang), which were formed during the end of late Pleistocene to the present.
2. Patrimonial valley types were mature valleys or depressions during the end of the Pleistocene or early Holocene.
3. The tidal current erosional trough, formed during the late part of middle Holocene transgression.

Several times of the ridge-trough imposed records have been seen in the seismic profiles, all indicated the developing process of the sand ridges has a periodic nature. That is, the period of sediment accumulation by rivers started during 30 ka B.P. of cold epoch while low sea level of -20m, at that time the accent Changjiang River was entered Yellow Sea from Haian-Libao in the north Jiangsu provenance. Then, the erosional formation period by tidal currents during warm epoch of Holocene transgression, such as, several erosional boundaries preserved in the strata of sandy ridges may indicate the transgression of sea level rising during 10 ka B.P. and 8.0 ka B.P. of the initial and early Holocene time; 6-5 ka B.P. of mid-Holocene high sea level, and the latest erosional period of 1 ka B.P. sea level. Thus, the river-sea interactive process in this area is closely related with the climate change, the rising and falling of the sea level is the key agent to free the coast zone land-sea dynamic interactive processes. It can be summarized as "transgression-dynamic-sedimentation" process pattern.



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COASTAL DUNE ROCKS IN CHINA

Wei WANG and Zheng WU
Geography Department of South China Normal University, wangw@scnu.edu.cn

1. Field characteristics

Coastal dune rocks in China are aeolian sand cemented by calcium carbonate under subaerial conditions, distributing on tropical and subtropical coasts of South China. The northernmost location of the dune rock is found on the coast of Fujian Province and the southernmost in Shidao of Xisha Archipelago. Dune rocks are founded in the areas where coastal dunes are fully developed. However, only the top layers of the dunes closed to shorelines can be cemented into rocks, inland extent distance of which is no more than 500 m. Two types of dune rocks can be identified: (1) the rocks developing in patches on seaside slopes of coastal hills at elevations from 2 meters to more then 80 meters above seal level; (2) the sand being cemented on the top of coastal dunes and sand bars on coastal plains. The topset strata of the dun rocks are in form of flat deddings, laminae of which are parallel to each other with small dip angles. The foresets are planar cross-bedded strata on a large scale with high dip angles of 32°-40° generally pointing in one direction. The foresets are cut by the topsets at top or extend continuously up to the flat topsets.

2. Depositional characteristics of dune rocks

The coastal dun rocks are composed of find and medium, well or moderately sorted quartz grains and bio-detritus (mainly shell fragments). Contents of the bio-detritus are different from place to place, ranging from 10 to 40 percent. The rocks have very high percentage of porosity (>20%). Shape of the quartz grains in the dune rocks varys from sub-rounded to sub-angular with worn and rounded edges. However, some grains contained in samples taken from coastal hills have sharp edges, fresh and flat fractures without any traces made by abrasion. Grain surface is characterized by textures formed in aeolian environment such as dish-shaped depressions, meniscus depressions, upturned plates, pitted surfaces and worn particle shape. They also keep surface textures formed under water such as V-shaped depressions, triangular solution pits and conchoidal fractures. The features of the cements are the followings:

1. pore spaces filled with granular low-Mg calcite mosaic;
2. menicus cements between grains or gravitational cements beneath grains;
3. quartz grains or shell fragments cemented by columnar or microlitic calcite cements, and the size of the crystals increasing towards the centre of the pores where several generations of the crystals can be found;
4. the moulds of the pre-existing fragments or some times micrite envelops filled by columnar low-Mg calcite.

Contents of Sr and Mg are very low in the dun rocks.

3. Formation of dune rocks and their ages

Ages of the most coastal dune rocks in China is no more than 5000 years, with an exception of the dune rocks in Shidao of Xisha Archipelago, the age of which is 25000 B.P.. So that the coastal dune rocks in China formed especially during the period of late Holocene times (3000-1000B.P.), when the monsoon climate in China has been fully established. High temperature with distinct dry and wet seasons together with more than 10 percent biogenic fragments in coastal dunes provides a suitable environment for the coastal dunes to be cemented into dune rocks, sources of which were from beach sand and hill side detritus. Pore water between the sand in the dunes closed to shorelines contains certain amount of $CaCO_3$ resulting from soaking of wave sprays or leaching of biogenic fragments by rain. After evaporation

taking place on the surface of the dunes, the pore water becomes over-saturated and then low-Mg calcite precipitate. The upper layers of the coastal dunes near shorelines are thus cemented into dune rocks.

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THE COURSE OF URBANIZATON INFLUENCES THE LANDFORM FUNCTION AND THE LAND DEVELOPMENT RESEARCH: EXAMPLE FROM ZHAOQING, GUANGDONG, CHINA

Chunhai WU
Guangdong Guangning TV University, Guangning County, Guangdong 526300, China

Since 1990s in the course of modernization, with the change of social economic constructure, the population of villages in Zhaoqing city which lies in the edge region of north-west of Zhujiang triangle continent has moved to cities and towns. The labor force of villages has changed from the primary industry to the secondary and teriary industry. The population of society accepted the city culture having steadily increased and the city efficiency having steadily improved speeds up the course of urbanization.

In the course of urbanization, xome parts of countryside districts in Zhaoqing city have change into cities and towns districts. Because of the basical installation of city and the construction of region sights, those lead the land resources of non-agricultural modernization to the openning uses. The terrain such as plain, hillock, mountain, river valley etc. And the landform such as karst, diluvium, riverbed, flood land etc. Have been transformed which have become the essential function of city and the use of installation of cities and towns population. The objective achievements show the course of urbanization rapidly.

In the course of urbanization in Zhaoqing city the influence of the landform function forced by people has been brought the positive effect surly, but the programs run away or surpass previously. Some parts of the land resources aren't developed. We shouldn't overlook the influence of environment. The course of urbanization must be arranged in order and regularly. The rapid of urbanization and the improvement of city efficiency can't be ignored the character of areas, the landform function and the land resources.

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CHRONOLOGICAL AND STRATIGRAPHICAL STUDIES OF THE "OLD RED SAND" ON COASTS OF SOUTH CHINA

Zheng WU and Wei WANG
Geography Department of South China Normal University, wangw@scnu.edu.cn

The "old red sand" is aeolian deposits of Pleistocene ages widely distributed on the coasts of southern China. There are still arguments about the exact time when the "old red sand" deposited and how many stages can be classified during the deposition period. In recent two years, detail studies were made on the "old red sand" along the coasts of west Guangdong and south Fujian, China. The sediment strata and ages of the "old red sand" were determined on some typical sections by field investigations, magnetic stratigraphy and earth chemistry, as well as thermoluminescenc (TL), electron spin resonance (ESR) and carbon-14 (^{14}C) dating techniques.

1. Depositional characteristics in sections

The sections of the "old red sand" can be founded in outcrops on roadsides or in gullies in dissected platforms formed by the "old red sand". The thickness of the "old red sand" varies in places. In general, it is about 3-5 m in thickness and some could be over 10 m. The field investigations show that "old red sand" mainly consists of fine and medium sand with a certain content of very fine sand and clay. Some of them, lying upon weathering crusts on hill slopes, contain small portion of coarse sands and fine pebbles washed from the slopes by heavy rains. Most of the "old red sand" has massive structures with no bedding and very few sections have high angle cross bedding or wedge cross bedding.

2. Stratum classification

It is difficult to classify strata of the "old red sand" by biostratigraphy due to that almost no spore-pollen or other microfossil can be found in it. So that the color, grain size, interfaces found in the sections, contents of Fe_2O_3 and magnetic susceptibility, in association with dating techniques, were used as standards to divide the strata.

The typical sections can be composed of two similar layers vertically, each of which has two units according to colors, degree of cementation of the sediments, contents of Fe_2O_3 and magnetic features. The upper unit is red, brown red or light brown red in color while the lower one dull yellow orange, yellow orange or light yellow orange. The cementation of the upper unit is better then that of the lower one. The thickness of the upper unit ranges from several ten-cm to several meters and that of the lower one is quite different everywhere. No clear boundary is found between the two units. The color changes gradually from red to yellow downwards in each layer. However, the interface between the base of the yellow unit in the upper layer and the top of the underlying red one in the lower layer can be clearly identified

3. Age of the deposits

32 dating samples taken from the "old red sand" in this study and 15 ones from published literatures show that the "old red sand" deposited during the period of time from 55400a.B.P.to 9000a.B.P., indicating that they were the aeolian deposits in middle and late Pleistoncene times. Most of the ages concentrate into two periods of 56-42Ka and 30-10Ka, denoting stronger aeolian activities in these times in which the "old red sand" in the period of 30-10Ka developed on the largest scale and had the widest distribution, induced by dryer and colder climate, more powerful winter monsoon and stronger aeolian activities in the later Wurm glacier sub-stage (Q_3^3).

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A MODIFIED CONCEPTUAL MODEL FOR PREDICTNG THE TENDENCY OF ALLUIVAL CHANNEL ADJUSTMENT INDUCED BY HUMAN ACTVITIES

Jiongxin XU
Institute of Geographical Sciences and Resources, Chinese Academy of Sciences, Beijing 100101, China, xujxin@mx.cei.gov.cn

In the 1960s, S.A. Schumm proposed a set of conceptual relations to predict river channel adjustment. These relations take into consideration runoff and sediment load variables only; when channel boundary materials are changed considerably during adjustment, it is likely that these relations would not work well. After a discussion about some limitations of Schumm's conceptual model, this study introduces the channel boundary material as an independent variable, and thereby establishes a conceptual model.

This model can be used to predict the tendency of downstream and upstream channel adjustment after reservoir construction, and particularly to explain the complex behavior of channel adjustment at a relatively long time scale. Although this model is qualitative, it proposes a framework or a line of thinking for further physically based simulation modeling. This conceptual model has been tested by data from the Hanjiang River and the laboratory model river, and also applied in the navigation channel training practice.

The suggested conceptual model is flexible in application, and may be used in rivers with various physico-geographical settings. For example, when the bed material is fine and selective scour is less marked or duration of the clear water scour is short, and the direction of channel adjustment can be predicted by the first stage of this model; in fact this is just Schumm's model. f the bed material coarsening is pronounced, the re-shaping of point-bars is also appreciable, then the channel adjustment may rapidly enter the second and the third stages. The complex behavior of channel adjustment can be explained satisfactorily.

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WATER LEVEL CHARACTERISTICS OF SWAN LAKE TIDAL INLET SYSTEM, RONG CHENG BAY, SHANDONG PENINSULA

Yun-chuan Xue Jian-jun Jia Shu Gao
Institute of Oceanology, Chinese Academy of Sciences, Qingdao 266071

Two tidal water level data sets, each with a length of 29 days, were obtained from the Swan Lake using a self-recording tide gauge (Model WLR-7 and WLR-8) during November-December, 1998 and August-September, 1999, respectively. Harmonic analysis of the data was undertaken with the method developed by the Proudman Oceanographic Laboratory. The results show that the monthly-average water level in winter is 0.34 m lower than in summer. The tides in the Swan Lake are of a mixed type, which is dominated by semidiural tides, and there exist phase lags in the main constituents between winter and summer. Further, shallow water overtides are significant, in comparison with the main constituents; non-tidal constituents (caused by storms, etc.) in winter are more remarked than in summer. The differences in the tides between winter and summer described above may be caused by atmospheric factors.

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GRAIN SIZE CHARACTERISTICS OF THE INTERTIDAL ZONE, NORTHERN YELLOW RIVER DELTA, CHINA

Yun-chuan XUE[1] Yan-hong YIN[2] Shu GAO[1]
[1]Institute of Oceanology, Chinese Academy of Sciences, Qingdao 266071, China, shugao@ms.qdio.ac.cn
[2]Institute of Marine Geology, MLNR, Qingdao 266071, China

Intertidal flats represent an important deposition environment and there is a close relationship between the hydrodynamic and sedimentary conditions and the evolution pattern of the coastal profile characteristics. In the present contribution, we report the coastal profile characteristics of two transections in the northern Yellow River Delta (i.e. the Yellow River mouth area from 1964 to 1976). Levelling of the profiles and sampling in 100 m interval were carried out along the profiles. The Profile P1 is 1175 m in length (along which 13 surficial sediment samples were collected) and Profile P2 is 2250 m in length (23 samples collected). We analyzed these samples with a Cilas 940L laser particle size analyzer) and computed their grain size parameters (i.e. mean grain size, sorting coefficient, skewnness and kurtosis).The result shows that from the mean high water level (MHWL) to the mean low water level (MLWL) the sediment becomes coarser and better-sorted. The skewness is decreased, whilst the kurtosis is relatively stable. These observations indicate that the sediment has a unified source. The general characteristics described above are consistent with those of the Jiangsu intertidal flat. Along both profiles there are significant changes in the grain size parameters in the places where small wave-eroded cliffs are present. Likewise, along Profile P2 the grain size parameters change rapidly at a distinct elevation; this pattern differs from that of Profile P1 where grain size parameters changes are not well correlated with the elevation. Such a difference may result from the difference in the intertidal zone width.

In addition, over the northern part of the Yellow River delta, the grain size distribution patterns show some temporal variations from the early 1980s to the present time following the shift of the Yellow River mouth towards the south in 1976. This may be a response to wave action. Furthermore, spatial changes in grain size from MHWL to MLWL observed in the study area may be a result of different hydrodynamic processes from those observed elsewhere. For instance, on the Jiangsu coast, the spatial variations in sediment size over the intertidal flat are caused by hydraulic sorting mainly by tidal currents, but at the Yellow River delta the changes are largely due to wave modifications.

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^{137}Cs TRACING OF LACRUSTRINE SEDIMENTS IN THE DALIAN LAKE, QINGHAI PROVINCE, CHINA

Ping YAN[1, 2], Guangrong DONG[2] and Zhibao DONG[2]

[1]Key Laboratory of Environmental Change and Natural Disaster, the Ministry of Education of China, Beijing Normal University, Beijing 100875, China

[2]Cold and Arid Regions Environmental and Engineering Research nstitute, Chinese Academy of Sciences, Lanzhou 730000, China

By analyzing the ^{137}Cs and grain-size samples, along with the results of field investigation and some other relevant materials, the total amounts of ^{137}Cs deposition by wind and water in the Dalian Lake of Gonghe Basin, Qinghai Province is defined. The vertical profile of ^{137}Cs in the lacustrine sediments has exhibited three ^{137}Cs activity peaks and one valley: the maximum peak corresponds to the global ^{137}Cs fallout in 1963; the two secondary peaks correspond to the leakage of the Chernobyl reactor in 1986 and complete desiccation of the lake in 1994 respectively; while the valley corresponds to aeolian deposition caused by the extensive reclamation in late 1980s and early 1990s. The ^{137}Cs dating was used to evaluate the average sedimentation rate of Dalian Lake since 1963, Consequently, the deposition processes are divided into three stages: two slow deposition of 1963-1986 and 1994-1998, and one rapid deposition during 1986-1994. This preliminary study reveals that the ^{137}Cs has the same tracing potential indicating the environmental changes and human interference in the arid and semiarid regions as in the humid region.

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GEOMORPHOLOGICAL FEATURES OF TROUGHS IN THE THREE GORGES CHANNEL OF THE CHANGJIANG RIVER, CHINA

Dayuan YANG[1], Xiankun KE[1], Lufu ZHOU[1], Xusheng LI[1], Deji CHEN[2], Tianmin YANG[2], Guofu XUE[2]

[1]Department of Geo & Ocean Sciences, Nanjing University, Nanjing 210093, China
[2]Exploration Bureau, Hydraulics Committee of the Changjiang River, Wuhan, China

With construction of the Three Gorges Dam in the Changjiang River, some deep-digging engineering was carried on the base of the river beds at site of the Three Gorges Dam, so that two of deepest troughs (No. 76 and No. 77) were exposed and show completely the landforms. Thanks the huge engineering, we have first time to observe Changjiang trough bottoms and have good evidences to study the geomorphology of the troughs. This paper is to document the No. 76 and No. 77 troughs of the Changjiang River and use the morphology to study geomorphological development of troughs.

The observation data was obtained by channel-depth map in the scale of 1:5000, in which the data were regularly measured between November of 1978 and May 1979 along the river channel and the map was printed in May 1980. The map reveals that there are more than 90 troughs at the Three Gorges channel in the Changjiang River, which the troughs are all over 40 m deep below the lowest river level along the longitude sections. Sum of the trough's length take 45% of the total length of the river channel. Troughs of No.76 and No. 77 are located at the site of the Three Gorges Dam. The deepest base of the river bed is at the elevation of 10.6 m a.s.l., while the deepest bottom of the deep-tough is at the elevation of -10.7 m a.s.l.

The troughs have geomorphological features as follows:

1. The trough with vertical and steep walls
   This trough is located in the Sandouping channel with 400 m wide in the river level, 325 m wider in the shallow channel of less than 30 m deep, but ca 40 m wide in the deep trough of more than 40 m deep. The trough profile section shows its U-shaped with vertical walls in the two sides.
2. Left side of trough wall, which was experienced by strongly abrasion processes
   There are numerous of abrading galleys on the vertical walls of the river troughs. He abrading galleys indicate the directions of water currents. The depths of galleys are normally several decades of centimeter, but a few reaches to more than a half of meter. We also found many narrow galleys along the fissures of the granite rocks. Some surfaces of the granite rock become flower-shaped, indicating the surface experienced gravel-abrasion under the whirling currents.
3. The top of trough face, which was experienced by strongly hitting and abrading erosions
   Some walls of the trough are very smooth, suggesting that these experienced strongly abrasion on the rock fissure faces. On the top of rock, there are a great of huge rock fragments. We found many hitting holes on the rock surface with several centimeters in the diameter.
4. Right side of trough wall with vertical abrading galleys and grounding hollows
   It suggests the trough experienced current down-cutting processes. A great of cone rocks left on the trough base, indicating an undergoing abrasion processes so that the base rock can keep its sharp shapes.
5. Left side of trough wall with opened-cracks and colluvial lump
   It suggests that the week tectonic sites are easier developed trough walls than the hard rocks.
6. The deepest base of the trough with grounding hollow
   The hollow is -5 m deep on the trough base, while a deeper hole formed on the -10 deep below the trough base. The hollows were developed under the eddy-current abrasions with rocky gravels.

According to morphology of the trough, we attempted to interpret causes of the trough in geomorphology as the following:

1. The troughs were formed by fluvial down-cutting erosion along tectonic cracks, when the river bed was moved to the current trough site and stood over there stablely .
2. Deep-cutting points are normally located at the deepest base (i.e. deep hollow or deep pond) of the trough, when intensive tectonic broken zone with joint-points of cross-broken and longitude fissures focus on.
3. When fluvial down-cutting occurred in Changjiang bed, jet current (particular eddy current) would be carried lots of pebbles and eroded on the bottom of the river bed, leading to trough deepening, such as scouring landforms on the right and left walls of the troughs. Meanwhile, water current with gravels and pebbles is of hitting, abrading, grounding processes in vertical walls.
4. After trough deepening, the released fracture on trough bank would induced more opened cracks happened. This process would increase more rocky walls broken and full down.

In order to estimate ages of the trough, a few of samples from sediments in the trough bottoms were radiocarbon-dated. Two of the earliest dates are at 33,800±1600 yr B.P. (No. 9924) and 38,200±2400 yr B.P. (No. 9923), suggesting that the trough was formed at least between 35,000-40,000 yr B.P. Recent study has reconstructed that there was much warmer period between 30,000-40,000 yr B.P. than the present day (Shi et al., 1999), when the temperature was 2-4^{o}C higher and 40 percent of precipitation than today. High rainfalls would create frequently floods and high velocity of fluvial in the river channel and river valley, leading to various intensive erosion processes of striking, abrading and under-cutting, and finally forming troughs up to 80m deep in the Changjiang River.

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LANDSCAPE EVOLUTION AND PALAEOCLIMATE IN THE DESERTS OF WESTERN CHINA: WITH A SPECIAL REFERENCE TO BADAIN JARAN AND TAKLAMAKAN

Xiaoping YANG
Institute of Geology and Geophysics, Chinese Academy of Sciences, P.O.Box 9825, Peking 100029, China, xpyang@public2.east.cn.net

The deserts in western China are significant repositories of information needed for global circulation modeling. In the framework of past global change studies, these deserts service as one of the key regions for the reconstructing late Quaternary Asian monsoon fluctuations. Recent investigation reveals that the influences of the westerlies, similar as Asian monsoons, have undergone considerable variation during the late Quaternary as well. Field observations, air photos and satellite imageries show that the aerodynamic relief and desert plains are the predominant types of the geomorphological landscapes both in the Badain Jaran Desert and in the Takalamakan Desert. The aerodynamic relief, characterized by the wind-caved surface forms, is represented mainly by the dune fields. On the edge of the dune fields there are sand and gravel desert plains which extend for approximately one thousand square kilometers. In the low section of both desert areas there are ancient lakebeds which are now undergoing strong deflation. Two types of such lakebeds can be distinguished through the vegetation and surface materials:

a) historical lake surface shrinkage;
b) prehistoric lake surface shrinkage.

Due to strong deflation Yardangs have been formed in the old lake basins. On megadunes of the Badain Jaran Desert, four cemented surfaces of palaeo-dunes were observed, which are representatives of relatively moister environment. The chronological data show that four periods of more humid environment occurred in the past 30 000 years. The stabilization of dunes in a large region and the existence of many palaeo-lakes and lacustrine terraces confirm the periodic fluctuations of climate even in the extremely arid region. It implies that the influence intensity of westerlies and Asian monsoons changed in the Chinese deserts, and the periods of higher precipitation took place even in the times close to the last glacial maximum. The studies indicate that the Badain Jaran Desert reacts more sensitively to the monsoon fluctuation than the Takalamakan.

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COMPARISON OF PALEOCLIMATIC CHARACTERISTICS BETWEEN MONSOON AND WESTERLY AREAS, CHINA

Wei YE
Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences, Urumqi 830011, China

Yili area is located in the west of Xinjiang, China and is an intermontane basin of Tianshan, which is surrounded by the mountains in the north, south and east and adjacent to Central Asia deserts in the west. Controlling by the westerly year and year out, the modern climate is different from the monsoon area where the maximum precipitation occurs in summer. The season precipitation of Yili area is relatively equal to each other and the percentage of precipitation in winter is higher than that of monsoon area. As a part of the Central Asia loess zone, the loess in Yili area is not only widespread, but the sequence is successive and the deposition rate is high. The loess record from Yili area shows that the climatic change during the last glaciation responds to that of global, but it shown some regional speciality.

1. Loess record from Yili area
   According to the loess record, same as the Loess Plateau, the climate of Yili area during the last glaciation was of instability. In the Zeketai section of Yili area eleven stronger wind events (14.0, 20.0, 23.9, 25.5, 33.0, 36.7, 47.5, 52.0, 58.0, 61.5, 67.0 ka BP) were recorded, some of which respond to the Heinrich events that happened in the North Atlantic. All of the interstadials on millennial-centennial scale that were documented by the Greenland ice core during the last glaciation have been identified in the loess record from Yili area except for the S5. Compared the loess record from Yili area with those from the north and west of the Loess Plateau (the Yuanbao section and Lijiayuan section), it can be found that the trend of climatic change was uniform at the three different areas. All of them are similar to the mode of ice volume change. However the loess record from Yili area show a similarity to the Greenland to certain degree between S3-S12. In addition to, the transitions from the warm to the cold periods were dramatic, whereas the variations from cold to warm periods were fluctuant.
2. Comparison the climate of Yili area since the last glaciation with those of other areas of China
   Comparing the climate since the last glaciation with other areas, it can be found that there are some differences between the monsoon and westerly areas. First, on the whole the climate of Yili area during the last glaciation was dry, but was fluctuant. The assemblage of humidity and temperature was very complex. The last glacial loess in Yili area includes three units: two loess units brackets a poorly developed paleosol unit and respond to three marine isotope stages (MS2-4) respectively. The study shows that during the early stadial stage (MS4) the content of the particle less than 10mm decreased (34.8%, the percentage of Artimisia was higher than the Chenopodiaceae, the concentration of carbonate was relatively low (17.4%), and the $^{87}Sr/^{86}Sr$ ratios were high (0.7131-0.7135), which approach to those of the last interglacial paleosol (0.7133-0.7137). All of these imply that the westerly was strong and the humidity was relatively high. Compared with the early stadial stage, the late stadial stage (MS2) was relatively dry. This is supported by previous studies on paleoglaciation and ice core from Qinghai and Tibet Plateau and some pollen evidences from the west part of the Loess Plateau. The interstadial stage, westerly was relatively weaker, pedogenisis was prevailing and formed poorly developed paleosols. The percentage of Artimisia was lower than the Chenopodiaceae, the concentration of carbonate was relatively high (19.7%), and the $^{87}Sr/^{86}Sr$ ratios were low (0.7122-0.7130), which even are lower than that of the loess to accumulated at the early stadial stage. However the evidences from the concentration of carbonate and composition of the strontium isotope show that at the end of the interstadial stage the climate became to be relatively wet. In a sharp contrast to the model that cold matches dry and warm matches wet at the east and central part of the Loess Plateau, the climatic change of Yili area during the last glaciation show its complexity. Second, the deposition rate of dust during the early cold stage was higher than that of the late cold stage in the Yili area, while the maximum rate of dust deposition at the Loess Plateau occurred at the last

maximum glaciation. Third, the maximum of last glacial occurred at 18 ka BP in the Loess Plateau and it usually responds to the global cooling when the temperature was low and the wind was strong. This was supported by the results of climate modeling. The record from Yili area shows that the strongest wind event occurred at 24 ka BP instead of the 18 ka BP, which is consistent with the results from the aeolian dust deposits in the Pacific Ocean. Last, based on the variation of the grain size, it can be concluded that the westerly was getting to decrease since the deglaciation, but the dust accumulation was going on until late Holocene. High concentration of carbonate, low ratio of $^{87}Sr/^{86}Sr$ and no soil to be developed imply that the climate was dry during the early and middle Holocene that was similar to the other areas of Northern Xinjiang and Central Asia. Since the late Holocene the climate was relatively wet and the soil was developed. On the contrary, the climate of middle Holocene was characterized by the warm and humid in the monsoon area.

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THE EFFECT ON FLOOD DISASTERS BY CHANGING CLIMATE IN THE MIDDLE AND LOWER REACHES OF THE CHANGJIANG (YANGTZE) RIVER

Guangming YU
Xianning Normal College, Xianning City, Hubei Province 437005, China, qu98@public.xn.hb.cn

The middle and lower reaches of the Changjiang (Yangtze) River are the heavy disastrous region of flood and waterlogged damages in China. The flood and waterlogged damages are resulted from the conjugate evolution between the natural environment systems and the human social systems. The change of climate system is the direct leading factor to cause flood and waterlogged damages. The factor evolution of environment geology is the background condition to form the flood and waterlogged damages. The ENSO event and monsoon anomaly are the trigger mechanism of flood and waterlogged damages, and the precipitation course and river hydrological features in the flood season are the main signs of flood and waterlogged damages.

The change of climate system is the leading factor of flood and waterlogged damages in the middle and lower reaches of the Changejiang River, and this change is seriously influenced from the external forcing. In the middle and lower reaches of the Changjiang River, the external forcing is displayed as ENSO events, accumulated snow in the Qinghai-Xizang plateau, the mid-latitude air-sea interaction, and hydrological cycle of land-atmosphere system. The direction of climate change is influenced by the intensity of external forcing. It is confirmed as follows as you know:

1. the ENSO events are connected with the variability of the Summer Monsoon over Asia, the summer rainfall in China, and summer flood in the middle and lower reaches of the Changjiang River,
2. the accumulated snow in the Qinghai-Xizang Plateau is correlated with the run-off main area for Changjiang River,
3. the atmospheric circulation is responded to the SSTA. Under the external forcing, some changes of the internal course of atmospheric dynamics will take places such as the low-frequency oscillation (LFO), the monsoon anomaly in Asia, and the anomaly of atmospheric circulation in East Asia. The disastrous rainstorm is followed the changes.

The regional environmental, hydrologic and geological conditions are the background factors to form flood and waterlogged damages. The flood course and features are effected by the features of river system and riverbed, as well as soil moisture. And then the regional disastrous condition is also determined by those factors in some case. With the consideration of high rational level, it maybe is one of basic factors to result on the change of climate system that human activities change the lower surface of

atmosphere. The condition of environmental destruction and the validity of flood regulation will result on the loss condition of the disasters directly.

In this paper, the relationship of conjugate evolution between the climate change and the flood disasters in the middle and lower reaches of the Changjiang River are analyzed in the case of 1998 flood disasters in the Changjiang River Valley.

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ECOLOGICAL PROBLEMS IN THE SUBTROPICAL KARST OF SOUTH CHINA

Daoxian YUAN
The Institute of Karst Geology, Guilin, Guangxi, 541004, dxyuan@mailbox.gxnu.edu.cn

An overview of world karst indicates that most karst environmental problems, especially rock desertification, occur mainly in tropical and subtropical karst terrains. Population pressure and some malpractices in land use have intensified the processes of rock desertification. in Guizhou Province, the rate of rock desertification in karst areas was as high as 933 km^2 per year in the 1980s, although in recent years, many projects to deal with this fragile environment in south China have been implemented. Measures such as harnessing underground streams, ecological rehabilitation, and comprehensive development in the poorest karst regions of south China have been proved to be successful. However, ecological conditions there vary from place to place as a result of geological,climatic, and topographic differences. Consequently, more research and improved management are necessary for better planning and more effective implementation of rehabilitation measures.

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CHANGES IN LAND SURFACE CONDITIONS TO UNDERSTAND EVOLUTIONS OF ASIAN PALAEOMONSOON CLIMATE FOR THE LAST 40 KA B.P.

Ge YU, Bin XUE, Jian LU
Nanjing Institute of Geography and Limnology, Chinese Academy of Science, Nanjing 210008, China

The present studies focus on three key time phases in the mid-Holocene (6ka B.P.), the Last Glacial Maximum (21ka B.P.) and the mega-interstadial of last glacial period (30-40 ka B.P.), in which the climate conditions were remarkably different from the present. Lots of paleoenvironmental studies have suggested that there have been dramatic changes in the strength and extent of the Asian monsoon in response to changes not only in insolation and glaciation, but also large feedback from changes in land surface boundary conditions. According to geological data in pollen and lake records in this study, reconstructions of climate during the three can provide benchmarks for identification of the climate signals in response to changes in insolation, glacial and land surface boundary conditions for evolution of Asian palaeomonsoons, and for the validation of climate model simulations to understand the mechanisms of the climate changes.

6ka: Both the temperature field from available palaeo-GCMs (Joussaume et al., 1998) and the forest vegetation patterns from BOME model (Prentice et al., 1998) are consistent with a theory that a lower-than present winter insolation anomaly in the early and mid-Holocene (Berger, 1988) would produce a lower-than present winter temperature. Winter temperature (DJF) anomaly between 6ka and 0ka simulated by Palaeo-climate models of UGAPM (Dong et al., 1996) and CCM (Kutzback et al., 1998) shows that, 6ka winter temperature in China were 2°C colder in UGAMP model and 2-4°C in CCM model than the present. The palaeoclimate-driven biome models show the mid-Holocene forest vegetation zones was shifted southwards in China (Harrison et al., 1998; Kutzback et al., 1998). However, these are neither consistent with geological interpretations of vegetation changes (Yu et al., 1998) nor with reconstruction of winter temperature during the mid-Holocene that reconstructed a high-than-present winter temperature (Yu and Qin, 1997). These differences in changeable directions at least raise the questions: Are there regional differences in the Asian monsoon regions? What are climate mechanics behind the vegetation patterns?

Vegetation feedback in high latitudes through decrease in albedo of land surface simulated by climate-biome models (Foley et al., 1994; TEMPO, 1996) and through increase of CO2 in coupled ocean-atmosphere model (Manabe and Stouffer, 1994). These models have provided prediction at 6ka when there was a warmer-than present high latitude land in Eurasia and north America, which changeable amplitudes in temperature are much higher than changes directly driven from orbital-induced insolation. These Changes in land surface in high latitudes may have offset the direct affects of the orbital-forcing on winter temperature in the mid-low latitudes of Asian monsoon regions (e.g. Wang, 1999).

The winter monsoon patterns in the mid-Holocene from geological evidence are consistent with this interpretation. Changes in the land surface such as disappearance of icesheet in northern Europe (Bjorck, 1995), reduction of the permafrost areas in Siberia and north China (Zhou et al., 1991), and increases in taiga vegetation covering in high latitudes (Texier et al., 1997), would decrease the cold high pressure in northern Asian continent in the mid-Holocene. This can lead to a weaker winter monsoon than the present, consequently an occurrence of warm winter with a less-decreased temperature. This hypothesis is waiting for confirmation by palaeoclimate and biome models. Thus the land surface feedback has paid important role in climate changes in Asian monsoon regions.

21ka: Palaeoclimate models simulated more positive mean annual P-E in western North America and in the Mediterranean region (e.g. Dong et al., 1996; Kutzbach et al, 1998) which reflect the dominance of glacial anticyclonic

conditions and a southward shift of the westerlies. Otherwise, P-E was generally less than today across most continents of the world from the tropical to the high latitudes. Indian monsoon and Pacific monsoon were weakened in the east and the south Asia, leading to less precipitation over the regions.

Lakes from eastern and southern China are consistent with the modelling results. However, very wet conditions from Tibet and inland Xinjiang (Yu et al., 2000) can not find any clues consistent with these modelling experiments. To argue the positive water balance of high lake level is resulted from more rainfalls and less evaporation, we compared with recent research products on glacier changes from Tibet. There occurred synchronous changes in water balance by lake and ice balance by glaciers in LGM Tibet and Xinjiang. When there were presence of high lake level/ large lake areas, glaciers in Tibet and Xinjiang were increased in their maximum volumes (Li et al., 1998). This implies that the high lake level in the region was not due to mountainous glaciers melt water. Pollen-based reconstruction show the very cold conditions at LGM can not provide evidence there was enough good thermal condition to melt large ice or snow at LGM.

Thus we provide interpretations for the LGM wet conditions in western China:
(1) Quaternary ice sheets of the Northern Hemisphere developed its maximum extend and consequently existence of persisting strong glacial anticyclone, leading to the southward displacement of the westerly.
(2) The presence of ice sheets in high northern latitudes in the western Eurasian, and the presence of much large areas of permafrost than today from Russian Far East to northern China, would favor a stronger cold high pressure in northern Asian continent, leading to a stronger winter monsoon. This could barred the westerly that was difficult to penetrated into higher latitudes than the displacement of the present.
(3) Much lower sea level than today in LGM and large land areas exposed in modern continental shelf in the East Asia, eastern, produced a weakened land-sea contrast and reduced summer monsoons of the South Asia and East Asia. This could be resulted in an around-year dominance of the westerly in the mid-latitudes across Eurasia continents. These suggest the wetter conditions over Tibet and Xinjiang linked with southern Europe, Near East and Central Asia was major resulted from increased precipitation by moisture transportation from dominance of the westerly. Continental cooling during the LGM produced evaporation conditions much lower than today. The significant decrease in evaporation may help to explain the wetter conditions over the Tibetan Plateau and Xinjiang inland.

30-40 ka: The period of 30-40 ka B.P. corresponds to the later phase of the marine oxygen isotope of Stage 3. According to reconstruction from the deep sea cores (mbrie et al., 1984), Antarctic Vostok ice core (Lorius et al., 1991) and Greenland GRP ice core (Fabre et al., 1995), the global temperature was generally lower at the Stage 3 than the last interglacial period (Stage 5) and also lower than the post-glacial Holocene (Stage 1), but slightly higher than the early last glacial (Stage 4) and late last glacial (Stage 2). However, our recent palaeoclimate studies showed that Tibetan Plateau climate during the period of 30-40 ka B.P. was exceptionally warm and humid, which the increased temperature were roughly equivalent to the last interglacial of Stage 5.

The lake-level and pollen records consistently indicated that during that period the climate of western China was exceptionally warm and humid that had reached the interglacial climate regime. It was estimated that the annual mean temperature at that time was 2-4°C higher than the present by isotope?18O variations in Guliya ice cap (Yao et al., 1994; 1997). There occurred numerous large freshwater lakes and their water surfaces were 30-200 m above present level. There were also large freshwater lakes occurred in the today's desert regions, such as Qaidam Basin, Tengger Desert and Badain Jaren Desert. The conifer forest in the Tibet extended ca. 400-800 km beyond their present western limits. The precipitation was estimated ca 400 mm more than today.

These evidences strongly infer a very strong summer monsoon event in the late Stage 3. We provided a hypothesis to interpret the changes in climate during the 30-40 ka. As the precessional anomaly was much stronger in the low latitudes than that in high-latitude region during the late Stage 3, the Tibetan Plateau heat low would be formed by the strong heating effect of the Plateau not only induced the ndian southwest monsoon to the inner Plateau, but also induced the extension of southeast airflow from the Pacific Ocean towards the northwest inland, thus leading to a relatively wet climate in the arid region. Meanwhile, the evaporation of the tropic and subtropical ndian Ocean surface was strengthened due to increased heat input, resulting in enhanced the cross-equatorial airflow moving towards the Northern Hemisphere and much intensified ndian southwest monsoon, which carried large amount of moisture to ndia and Tibet Plateau.

We are developing the palaeoclimate modelling to test these hypotheses.

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INVESTIGATIONS OF MICROBIAL ORIGIN OF KARST CORROSION OF SOILS DEPENDING ON DIFFERENT TEMPERATURES

Laszlo ZAMBO, Gergely HORVATH
Eotvos Lorand University, Budapest, Hungary H-1083, horvathg@gandalf.elte.hu

There is a broad agreement among researchers that the acids accumulating in soils and controlling the solution of carbonates - including the predominant CO2 - can be mostly derived from three groups of processes:

1. root respiration of higher plants;
2. decomposition of soil organic matter by microorganisms (microbiota);
3. other decomposition processes not associated with microbial activities.

We performed studies of corrosion on small samples.

The objective of the investigation was to allow the comparison of solution effects by absorbing the entire carbonate solution capacity originating in the soil. Limestone solution capacity is expressed by the concentration of dissolved carbonate (milligrams) or by the equivalent amount of CO2.

Model investigations covered the 4 most common karst soils (originating from the Aggtelek Karst region, Northeast Hungary) in the temperate and subtropical climatic belts:

a. black rendzina
b. brown rendzina
c. humous red-brown eath
d. relict red clay soil.

For each soil type 4 models involved the original microbiota and these models served to measure natural solution capacity. On the other hand, in four models for each soil type the soil was sterilised and here solution capacity without microbial action could be determined.

The solution capacity derived from microbial action was almost an order magnitude higher under rendzinas (in original samples) than the solution capacity not due to microbial sources (sterile samples). Under clay soils this effect is only half as intensive.

Solution capacity expressed by total dissolved carbonate content shows distinct values, characteristic for the individual soil types.

In each soil types studied, the solution caused by microbial activities manifold exceeds the rate of solution resulting from temperature factor but there is a manifest dropping trend from rendzinas to clays.

The elaborated method seems to be suitable to carry out the investigation under different climates. Through the alteration of conditions, further aspects of the soil effect can be revealed.

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GRANITE CHEMCAL WEATHERNG FEATURES OF RIVERBED WTHIN THREE GOREGE REACHES OF THE YANGTZE RIVER

ZHANG Liping[1,2], YANG Dayuan[2], CHEN Deji[3], XUE Guofu[3], ZHOU Fulu1[1,2], ZHANG Zhenke[2]

1 State Pilot Laboratory of Coast and Island Exploitation;
2. Department of Urban and Resources Science Nanjing University 210093;
3. Hydraulic Committee of Changjiang Wuhan 430010

Keywords: riverbed granite, chemical weathering, transferring and concentration

Up to now, the research on the origin of granite, the process of granite weathering and the features of regolith have been done and a large number of academic thesis and works have been published, but the research on the process and features of weathering of riverbed granite have hardly been done. In the early days of 1999, clearing up sediment and regolith on the foundation of dam in Three Gorges of Yangtze River, granite riverbed were exposed which offered a good opportunity for researchers to research riverbed granite weathering features. The chemical weathering features of riverbed granite are main researched in this paper.

1.Sample collection. The ways of sample collection were divided into:* between upper cofferdam and lower cofferdam, the 22 samples were equidistantly collected along riverbed two sides on a horizontal elevation of 28m; ?in lower 100m of dam location,the 50 samples were collected along NE45(direction cross section of river valley, dividing different 3 elevation(riverbed, flood plain, valley slope) and 6 typical columnars section.

2. Samples treatment and analysis. All chemical composition of granite samples were analyzed by X rays fluorescent slice. Further, weathering ratio, chemical element transferring ratio, the coefficient of average dripping and washing, the intensity of weathering, SiO2/Al2O3, Al2O3/Fe2O3, (CaO+MgO)/Al2O3, K2O+Na2O/Al2O3 and so on were calculated in greater detail.

3. Results analysis. The desilication rate of riverbed granite with 7.1% is > valley slope granite with 2.5% and < flood plain granite with 9.7%. Al2O3/Fe2O3, is in order of riverbed granite >flood plain granite > valley slope granite. ? (CaO+MgO)/Al2O3 of riverbed granite is the greatest of three landforms position. The dissolved and lossed rate of K2O and Na2O of riverbed granite with 0.71% is > valley slope granite with 0.67% and < flood plain granite with 1%. The increase rate of R2O3/(RO+R2O) of riverbed granite with 0.57% is the lowest of three landforms position. … absolute weathering intensity of riverbed granite is the greatest of three landforms position.The relative weathering intensity of riverbed granite with 7% is > valley slope granite with 3.75% and < flood plain with 7.78%.

4.Discussion. In flowing water environment for long term, chemical reaction (hydration, hydrolysis, solution, oxidation etc.) and the transferring rate of easy solution mineral of riverbed granite are faster than valley slope granite. But, because regolith of granite are eroded by flowing water and are not dissolved further, riverbed granite weathering is in the early stage condition of chemical weathering. In the period, K+ and Na+ are displace with H+ and are washed away as flowing water, and CaO and MgO are relatively concentrated. The other reasons is that CO2 is much littler and carbonic acidization is more slight in riverbed granite than in valley slope regolith.

In a word, the chemical weathering process of riverbed granite is different from that valley slope and flood plain granite in many aspects.

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WELCOME INTERNATIONAL MOUNTAIN YEAR OF 2002

Qingsong ZHANG

Institute of Geography, Chinese Academy of Sciences, Beijing, China, 100101, qszhang@public2.east.cn.net, qszhang@mimi.cnc.ac.cn

Account 27% of total lands on earth, mountain regions are the water towers, very rich in natural, cultural and tourism resources, as well as bio-diversity. However, social and economic conditions in mountain regions are being underdeveloped and the residents are relatively poor. Therefore, sustainable mountain development is recognized as an urgent common strategy to the mankind and has been paid a great attention by the international communities. United Nations proclaimed in 1998 the year 2002 as the nternational Year of Mountains and invited the FAO as the lead agency for the year.

Mountain regions in China account 2/3 of total area, with great deal of potential industrial and agricultural resources, relatively low in economic development, fragile in geo-ecological environment and suffering multiplied natural hazards. Mountain development in China is most important at present and in future. Major target and problem of sustainable mountain development in China are of how to coordinate the accelerating economic development and protection of geo-ecosystems.

Chinese scientists paid a great attention to the research in mountain regions and have made a significant approaches in past 20 years in many aspects, such as in the integrated study on the Tibetan Plateau, mountain hazards and control, soil loss and control, slope use and protection, regional planning and nature conservation etc. Which provide a great contribution to sustainable mountain development in China.

Major approaches and planed works in mountain regions are reviewed, and some suggestions related to welcome the nternational Year of 2002 are raised in this paper.

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VARIATIONS OF SOUTHWEST MONSOON RECORDED IN ERHAI LAKE SEDIMENT DURNG THE PAST 8 ka YEARS

Zhenke ZHANG, Dayuan YANG
Department of Geo. & Ocean, Nanjing University, Nanjing , PRC 210093

Wang Sumin Wu Ruijin
Nanjing Institute of Geography and Limnology, Chinese Academy of Sciences, 210008

Keywords Lake sediments, Southwest monsoon, Erhai Lake, Southwest China

Based on the multi-environmental proxies of high-resolution lacustrine records from Erhai Lake, Yunnan Province, Southwest China. The sequence of climate evolution in the past 8ka years in Erhai Lake records has been reconstructed. The results indicate that the climate evolution in the past 8ka years includes nine stages coinciding with lake level fluctuations. Comparisons of relative regional environmental records indicate that the climate evolution reduced from Erhai lake sediments are mainly controlled by the strong-weak transitions and the temporal -spatial changes of southwest monsoon in Southwest China. Before 5.9kaBP, the climate was inclined to warm-temperate condition corresponding with the intensifying of solar radiation and monsoon circulation in northern- sphere. The multi-environmental proxies of lacustrine sediment from Erhai Lake show that in warm or temperate-dry stages southwest monsoon was weak and summer monsoon in East Asian was enhanced. On the contrary ,n the conditions of temperate(warm)-wet stages southwest monsoon was strong and summer monsoon in East Asian was weak in the conditions of temperate(warm)-wet stages.There were three cold events in the records from Erhai Lake sediment: 7.2kaBP, 5.3kaBP and 3.7 kaBP. The cold-dry or wet stages were affected by the intensification of winter monsoon in Asian.

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MODERN COASTAL EROSION AND COASTAL LANDFORM CONVERSATION IN SHANDONG PENNISULA, CHINA

Zhenke ZHANG, Dayuan YANG, Ying WANG
Department of Geo. and Ocean. Sciences, Nanjing University, Nanjing, China 210093

1. Introduction

Shandong peninsula is located in North China and surrounded by Bohai Sea and Yellow Sea with the coastline more than 3000 km. There are two types of coast-plain coast and harbor bay coast. During the past decades the coastal erosion along Shandong Peninsula was obviously aggravated by the interaction of human activities and coastal dynamic forces. Modern coastal erosion has severe effects on the development of marine economy, coastal environment and coastal landforms.

2. Modern coastal erosion and its results

2.1 Modern coastal erosion
Based on the field investigation and collected related data, modern coastal erosion along Shandong Peninsula have three features as follows:
(1) Widespreading coastal erosion and high erosion rate
Along the coast of Yellow River Delta, the coastal erosion near to the abandoned river mouth is obvious in spite of the sedimentation and regression at the present river mouth. From 1855AD, the "new land " was formed at a average rate of 23.5 km^2/a because of the sedimentation in front of the Yellow River mouth, and at the same time the erosion took place along the coast near to the abandoned river mouth. For example, about 330 km^2 land was lost during 1949-1976 and along Shenxiangou river mouth there was 2.8 km transgression in the period of 1961-1964 at the average erosion rate of 930 m/a.

From Zimai River mouth to Bailang River mouth along Laizhou Bay, the coastline was erode with 200-300 m transgression at a average rate 6-10 m/a during the past 30 years. From Jiaolai River mouth to Hutouya, the average erosion rate was 68-100 m/a with the 1.5-2.0 km transgression during the period of 1954-1976.

The harbor bay coast along Shandong Peninsula is the main type of coast. The sandy beaches have undergone severe erosion in the past 30 years with the average rate of 2 m/a.

(2) Obviously seasonal changes of coastal erosion
The most severe coastal erosion along Shandong Peninsula is directly affected by wind surges and typhoon surges. So the changes of coastal erosion have obvious seasonal characteristics. During the summer season the typhoon surges can cause great damage for the coastal area and rapid coastal erosion. For example, the coastal erosion along Shandong Peninsula during No9216 typhoon in 1992 is shown in Tab.1

Tab.1 Coastal erosion along Shandong Peninsula during No.9216 typhoon*

Whole coast area	Longkou&Penlai	Rizhao Haiyang&Rushan	Qingdao
Coastal erosion widespread& transgression 145.3ha land losed	2-10 m	4-6 m 8-10 m	20-40 m

Economic lose 43.5×10^{8}yuan Dead person 76

* Coastal erosion & transgression refer to the sandy beaches

(3) ntensifying coastal erosion caused by human activities
During the past decades, many dams intercepted the sand to the sea and the runoff mostly used for industry and agriculture as well as the exploitation on sandy beaches along Shandong Peninsula increased rapidly. All above caused a total sand loss at 2×107 t/a, which intensified the coastal erosion during the condition of wind surges and typhoon surges.

2.2 Results of coastal erosion
The results of coastal erosion in Shandong Peninsula include:

1. the loss of land resources;
2. the damage of coastal forest;
3. the destroy of coastal building and sea walls;
4. the ground water pollution because of the intruding sea water;
5. the loss of potential tourist resources;
6. the damage of coastal sea-farming;
7. the loss of some coastal environment benefiting for the marine creatures.

3 Conversation coastal landforms

Various coastal landforms provide important natural environment for coastal bio-diversity, and usually coastal landforms such as the sand beaches and pebble beaches have the function for coastal tourism. The coastal erosion will destroy the coastal environment and beaches. In Shandong Peninsula the coastal tourism is flourishing and is one of the key aspects for economic development in 21th century. There are many cases of coastal erosion which are harm to the coastal tourism. So the conversation of coastal landforms is urgent for the government and the public in the coastal area along Shandong Peninsula. The countermeasures for protecting coastal landforms are shown as follows:

3.1 Based on scientific investigations, To determine the coastal areas which is most urgent to protection.

3.2 To adopt a series measures to control the coastal erosion along Shandong Peninsula. mplementing beach nourishment and engineering renovation suitable to

local coastal conditions.

3.3 For the purpose of avoiding irrational exploitation of coastal resources, to educate the public especially the local government officials with perfect knowledge of marine engineering and coastal landforms.

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ON THE BOGEOMORPHOLOGY OF CORAL REEFS: A CASE STUDY ON REEF FLAT OF SHANYA FRNGNG REEFS, HANAN ISLAND

Qiaomin ZHANG
South China Sea nstitute of Oceanology, Chinese Academy of Sciences, Guangzhou 510301, P.R.China, qmzhang@ns.scsio.ac.cn

Keywords coral reefs reef flat sea level change biogeomorphology Hainan Island

1. INTRODUCTION

Coastal (dynamic) geomorphology study focuses the three main modern processes: dynamic, sedimentary and geomorphologic, and their interaction and combination. Study for coastal biogeomorphology in biological coast (mainly with mangroves and coral reefs) should add indispensable fourth coastal biological process. The coastal biogeomorphologic process is one of the main responses of the coastal ecosystem to the global changes, and has been emphasized in Focus 2 of the Land-Ocean nteraction in the Coastal Zone (LOICZ) of the Global Changes. Coral reefs are the most typical growing landform, even though with minor dynamic modification, and become the best research objective for biogeomorphology study. This research takes the reef flat of fringing reefs in Shanya of Hainan Island as case study. We would like to get better understanding of characteristics of biogeomorphologic process of coral reefs and their response to environmental changes, like sea level change, and some ideas about management and conservation of coral reefs from this research.

2. THE STUDY AREA

Shanya fringing reefs in southern coast of Hainan Island is one of the best development fringing reefs in Hainan Island of China and became the National Coral Reefs Natural Protective Area in 1990. The study area is on the west coast (Luhuitao) and the east coast (Xiaodonghai) of Luhuitao tombolo based on raised coral reefs. Many research works about this area have done. They found the 4-5m highest sea level in 5000-6000a.BP forming raised coral reefs and that is important background for reef flat development in this area. Hermatypic coral taxa composition consists of 12 family, 24 genus, 83 species (ZOU Relin,1975) and 10 family,21 genus, 58 species (YU Dengpan,1995). Some species have been disappeared during the past 20 years. Dominant taxa are Porites lutea, Goniastrea aspera, Platygyra crosslandi in importance order. Wave climate is depends on monsoon and typhoon. The winter NE wind and waves is longer and stronger than the summer S wind and waves. Typhoon and storm waves occur in July-Nov. The tide is irregular diurnal type, the mean tidal range 0.9m and largest one 2.14m. Annual mean surface sea water temperature is 26.4* and Jan. mean temperature 22.5*. Sea water salinity is 29.9-34.2‰. Sea water transparency is about 10m.

3. THE MATERALS AND METHODS

6 transects were set up, 5 of which on the Luhuitao and 1 on Xiaodonghai. The survey items along each transect include biological community structure (corals, algae, sea grass etc); hydrodynamics (tide level, wave, etc); sedimentation (sediments, etc) and geomorphology (leveling, etc). We can exactly determine the relationship between reef flat and tidal levels using leveling survey data and tide observation data

4. RESULTS AND DSCUTON

4.1. Up limit of tidal elevation for living flat coral are 15-20cm above Theoretical Lowest Tide (Chart Datum in China and 90cm below the Mean Sea Level in Shanya waters) on Luhuitao leeward and low wave energy coast, and 37cm above Theoretical Lowest Tide on Xiaodonghai windward and high wave energy coast. These tidal elevations are controlling factor for reef flat up-growing and that is theoretical bases for reef flat as an indicator for sea level change.

4.2. On Luhuitao leeward and low wave energy coast the reef flats are with gentle sloping profile about 2‰ grade and

with spreading weathered original head corals, that means it is a growing form responding to falling sea level. This accords with exist of mid-Holocene highest sea level.

4.3. On Xiaodonghai windward and high wave energy coast the reef flats are with higher and horizontal profile and with wave spreading reef blocks. Two reasons for its deference from that on Luhuitao. Both storm wave spreading reef block and a litter higher up limit of living flat corals make the outer flat higher then that on Luhuitao. This is a growing form responding to falling sea level but with modification of high wave energy.

4.4. In atolls of Nansha Islands some reef flats have a lower (about 20cm above Theoretical Lowest Tide which is 100cm below the Mean Sea Level in Nansha waters) and horizontal profile with spread living corals. These reef flats are growing form responding to stable sea level.

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HOW ACCURATE IS THE CURRENT CHRONOLOGY OF LOESS-BASED PALAEOCLIMATE RECORDS IN CHINA

L.P. ZHOU[1], and N.J. SHACKLETON[2]

1 Department of Geography, Peking University, Beijing 100871, China
2 The Godwin Laboratory, Department of Earth Sciences, University of Cambridge, Pembroke Street, Cambridge CB2 3SA, UK

Recent studies have shown that loess records in China display similar patterns of climate variability as those observed in polar ice cores and deep sea sediments. While great effort has been made to correlate loess with other records, a major problem is outstanding: the accuracy of the loess chronology. This is a crucial issue in the loess-based palaeoclimatology on both the glacial-interglacial timescale and the millennial-scale. It also has implications for the understanding of the landform evolution in the loess regions. Here we discuss the accuracy for two methods which have been widely used in dating loess sequences: palaeomagnetism and luminescence.

The Matuyama/Brunhes Boundary (MBB) has been an important time marker in loess stratigraphy. While there is a striking similarity in the overall pattern between the magnetic susceptibility of the loess from the Loess Plateau in China and the oxygen isotope record of the deep sea sediments, the MBB is found at very different stratigraphic positions: its occurrence in a loess unit, which represents a glacial climate, is in contrast to its placement in the marine record in Oxygen Isotope Stage 19, an interglacial stage. This has given rise to significant uncertainty in the chronology of the loess-based palaeoclimate records and has impeded the stratigraphic correlation between continental and marine sequences. We have recently suggested that the measured positions of the geomagnetic polarity boundaries in loess are misleading due to the displaced ('delayed') acquisition of magnetic remanence. The 'lock-in' depth in loess could range between a few tens and over 300 cm depending on the process of remanence acquisition in loess, which is linked to the development of the loess structure. The apparent 'time lead' is of a few thousand to over 30,000 years. This means that the age for the level where the MBB is measured, i.e. mid-L8, is older than 795 ky. The 25,000-40,000-year difference from the previously published age estimate for the same level needs to be explained before we make palaeoclimatic interpretation of the loess records. We suggest that the chronology of the Chinese aeolian sequence (loess and red clay) should be re-evaluated with respect to the true age of the measured palaeomagnetic boundaries. Our remanence acquisition model predicts that similar displacement is likely to affect records of the reversals or excursions in loess and red clay of all ages and in most of the cases the age shift will be over 10,000 years.

To date palaeoclimate events within the last 50,000 years, luminescence method offers a most promising means. However, previous studies mostly employ thermoluminescence techniques which probe signals from mixed minerals. This presents an intrinsiclimitation on the accuracy of the published TL dates. We have recently tested a series of new protocols of dating loess by photon-stimulated luminescence. For well-bleached samples, we are able to obtain paleodose estimates with uncertainty as low as 2%. While such a high precision is readily obtainable, the accuracy of the method is more difficult to test due to the lack of suitable material for applications of other independent, more reliable dating methods.

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ROLE OF CLIMATE IN THE RISE AND FALL OF NEOLITHIC CULTURES ON THE YANGTZE DELTA*

Cheng ZHU, Shiyong YU, Qiang ZHANG
(Department of City & Resources Sciences of Nanjing University, Nanjing 210093, P. R. China) First author's, zhucheng@nju.edu.cn

Keywords: Maqiao culture site, Cultural interruption, Holocene climate variation, the Yangtze Delta, P. R. China

Climatic changes in the Yangtze Delta played an important role in emergence, persistence and collapse of civilization. Archaeological excavations in the region over many years demonstrated that there are several layers of fine sand or organic mud that interrupt the consecutive culture strata in a number of Neolithic culture sites. Continuous biostratigraphical and sedimentological records from Maqiao cultural site, Shanghai, suggest that the fine sand and organic mud units resulted from expansion of water bodies both by sea-level fluctuation and increased flooding during cold and humid episodes in Holocene climate. The vacancy of human settlement from 7240 yr B.P. to 5320 yr B.P. in the region was mainly caused by higher sea-level due to warm and humid climate. The Neolithic cultures developed under the conditions of lower and more stable sea-level as well as warmer and more arid climate between about 4410 yr B.P. and 3250 yr B.P. A flood-induced lake expansion interrupted the civilization in the region at about 4200 yr B.P. Later, higher water tables and expansion of lakes between 3250 yr B.P. and A.D.618 under cold and moist climate temporarily terminated settlement on the delta. Later, during the Tang Dynasty, beginning at about A.D.618, the region again became suitable for human settlement under conditions of more favorable climate and lower water tables.

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SOUTHERN HAINAN ISLAND, CHINA: LANDSCAPE AND LANDUSE

Dakui ZHU[1], Ying WANG[1], Peter MARTINI[2], Yongzhan ZHANG[1],

1. State Pilot Laboratory of Coast and Island Exploitation and Dept. of Geo and Ocean Sciences, Nanjing University, Nanjing, China (wangying@nju.edu.cn);
2. Department of Land Resource Science, University of Guelph, Guelph, ON, Canada (pmartini@uoguelph.ca)

Keywords: tropical island, coastal zone, landuse, tourism, agriculture

In the last two to three decades China has undergone rapid modern development in every field, including infrastructures, industries, tourist facilities, and agriculture. The Hainan Province, which is the largest maritime one of the country, has fully participated in this revival with mixed experiences. Hainan Island is the largest island of this province. The narrow, shallow Quiongzhou Strait separates it from the mainland. It is located in the tropical region, subjected to a monsoon regime modified by typhoon activities. The island can geologically, geomorphologically and climatically be subdivided into a northeastern-eastern generally wet lowland, a western lowland dry because of orographic effects, a central mountainous region locally affected by cold winter spells, and a southern hilly country with well defined wet and dry seasons. The island is geologically stable, generally experiencing only minor earthquakes (the last major earthquake of magnitude 8, occurred in 1605), and its coast is affected by relatively low tides, frequent typhoons (5 per year on average for the last half a century), but, to living memory, not by tsunami. The landscape and generally mild to hot climate make the southern region of the island ideal for agricultural and tourism development. A narrow shoreface and few scattered islands with reef development occur in the near offshore zone. Rocky promontories alternating with sandy embayments characterize the inshore zone. Relatively narrow costal plains have formed in these embayments, which are backed by terraced foothills and steeply sloped high mountains. The principal landuse of this landscape is as follows.

AREA	MAN LANDUSE	SECONDARY
High mountains	natural, plantations (rubber, pepper)	agriculture, tourism
Steep mountain slopes	natural	-
Hills and terraces	plantations (rubbers, eucalyptus)	agriculture
Bars	traditional villages, roads, railways, towns)	agriculture
Lagoons	agriculture (traditional, cash crop)	salterns, natural
Shoreline	natural, recreational	aquaculture
Shoreface	natural, recreational	aquaculture, fishing

slands	natural	agriculture, recreational
Offshore	fishing	petroleum

Potential tourism development exists everywhere, for various activities. These include aquatic activities on the islands and shores, resort areas in some embayments, communal activities in towns and high-density hotel areas, ecotourism in the hills and mountains, cultural tourism related to traditional activities and native peoples in the coastal plains and parts of the hills and mountains.

Hainan Island has experienced an economic boom periods in the late 1980s early 1990s, followed by an economic busts due to econo-political reasons. The boom period led to some development, particularly along the coastal sandy bars near Sanya where basic environmental, ecological principles were disregarded. All this has given away to the present sensible, more gradual development that follows principles of informed, ecological-sensitive planning. This includes intense, necessary activities in towns such as Sanya, planned resort development such as in Yalong Bay, cash crops agriculture and limited controlled aquaculture in coastal areas.

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SEDIMENTS VARIATION AND THEIR ENVIRONMENTAL SIGNIFICANCE IN SOUTH HONGSHAN LAKE, WEST KUNLUN MOUNTAINS SINCE 150 YR AGO

ZHU Li-ping[1], CHEN Ling[1], LI Bing-yuan[1], LI Jian-guo[2]
1. Institute of Geographical Sciences and Natural Resources, CAS, Beijing 100101, P. R. China;
2. Nanjing nstitute of Geology and Paleontology, CAS, Nanjing 210008, P. R. China

Due to the connection between geological records and instrument-recorded materials, the environmental changes during the past 2000 years has been already an important time window in the global changes, in which short span and high resolution records are especially significant because they are the base for comparison of environmental changes. Among the multiple methods for detecting past global changes, lake deposits and their environmental significance are still not substitutable. In particular, as there are rigorous natural condition, poor population and wide areas, shortage of climatic changes derived from historical records and tree-rings as well as less disturbance of human beings on the Tibetan Plateau, lakes and their environmental significance are apparently important.

South Hongshan Lake is situated at 35°10'N 80°04'E which is in the Tianshuihai area of west Kunlun Mountains, northwestern Tibetan Plateau. With the average elevation of 4800-5100 m asl, it is very cold-dry in this area. The annual mean precipitation is 23.8 mm, the annual mean temperature is -7.7°C while that in July is only 6.0°C. The lake is a 3.35 km^2 close lake and mainly supplied by snow and ice thawy water. It is intensively retreated in recent years and the average salinity reaches 9.4g/l. With the more than 5 meters of average water depth and rich sullage in the lake bottom, this lake provided better materials for the study of its modern sedimentary environment and reconstruction of past environmental changes.

Past environmental records are mainly inferred by the study of core SHC-2. It is a 1.07 m long lake core which was taken on the aquatic platform by piston sampler in 1998. The sample site is 5 m deep of the water depth and 100 m far to the lake bank. The average sedimentary rate is 0.72 mm/yr determined by radioactive isotope ^{210}PB, and the attenuation of ^{137}Cs also tested the veracity of this data. Thus, a 150-yr continuous sedimentary sequence was obtained. For capturing the effective environmental proxy indexes to detect past environmental changes, grain-size, total organic carbon (TOC), total nitrogen (TN) $CaCO_3$ and part of trace elements were analyzed.

TOC represent the lake biomass in some degree, and reflect the cold and warm condition of the lake. Grain-size distribution is the result of water dynamical changes, it indicates the water depth and thus reflects the lake water quantity. Due to the dry condition of the depositing of $CaCO_3$, its contents may reflect the dry and humid condition in the lake drainage basin. In trace elements, Fe^{3+} is transformed from Fe^2 during oxidation circumstance which is generally caused by the increasing of water content and temperature under the natural condition. The increasing of its contents may indicate the enhancement of hot and wet degree. TN generally reflect the nutritional degree of the lake.

The contents variation of TOC, grain-size, $CaCO_3$ and Fe^{3+} showed that the lake experienced alternate changes of water dynamical and cold-warm conditions during the past 150 years. Though the contents of TOC is not high (less than 3%) under the rigorous natural condition, the tendency of its variation obviously appeared the low value in the later half of 19th century, the end of 1920s, 1950s and 1980s, the high values are in the beginning of 20th century, the end of 1930s and the beginning of 1970s. They represent the corresponding cold period and warm period respectively. Corresponded to the high values of the TOC content, the mean grain-size diameters were significantly fine and indicated the increasing of lake water quantity except those in the end of 1930s. The content variation of Fe^{3+} was well corresponded to that of TOC and represented the changes of water-heat condition during the sedimentary period. However, the

vibration amplitude is not very clear due to the complexity of lake deposits. With the over 50% in the total content of deposits, the content of $CaCO_3$ appeared clear changes in the former half of 20th century. It was increased corresponded to the low value of TOC in 1920s while decreased corresponded to the high value in the end of 1930s. However, these changes were not clear in the other time section. The content of TN was very low (less than 0.25%) and had not notable fluctuation in the total lake core. This may indicate the poor nutrition of the lake and reflect the rigorous ecological environment in this area.

The environmental records in SHC-2 core is well coincided with that of Guliya ice records in the same area. There is better corresponding relation between TOC in SHC-2 core and $Q^{18}O$ in Guliya ice core before 1960s. The similar variations also appeared in the grain-size distribution and Fe^3 profiles, they all showed the cold period in the later half of 19th century, the end of 1920s and 1950s, and the warm period in the beginning of 19th century and the end of 1930s. In spite of the same variation tendency between them, the changing amplitude is very different after 1960s. It may be caused by the increasing of human activities in this area. The environmental sequence of SHC-2 core also showed the relativity to the snow accumulation of Guliya glacier, but the later lagged about 20 years behind the former in the time scale. Although the changes of snow accumulation lagged 50 years behind that of temperature in Guliya by obtained results, it is not such in the sequence of this lake. Because it is mainly supplied by ice and snow thawy water, the largest quantities of water and the most humid period of the lake rested on the thawing rate during the increasing period of temperature, and is not synchronal to the peak of snow accumulation. This may be the cause of the different sluggish time of the most humid period between that from the ice core and that from the lake core. However, temperature is the main dominant factor and have well synchronization to those reflected from the ice core and the lake core.

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BENTHIC FORAMINIFERAL RECORD IN THE NORTHWESTERN INDIAN OCEAN OF QINGHAI-XIZANG PLATEAU UPLIFT*

Xiaodong ZHU
Department of Geo- and Ocean Sciences, Nanjing University, Nanjing 210093, China, xdzhu@public1.ptt.js.cn

One of the most remarkable and profound past global changes during the Quaternary and Tertiary was the uplift of the Tibetan Plateau and the consequent set of Indian Ocean-Asia monsoon climate system. That is a multi-sphere interactive process originated from lithosphere plate tectonic movement, transferred to atmosphere and hydrosphere. This process was well recorded in the northwestern Arabian Sea. Previous work usually focused on the Tertiary record and used planktonic indicators (e.g., Prell WL, Niitsuma N et al., 1991). However, benthic fauna is also fairly good proxy indicator to be explored because they can not only reflect the sea surface condition, but also is unique record of bottom environment.

Much of the Arabian Sea is characterized by a narrow continental shelf bordered by an extremely steep continental slop. The western Arabian Sea currently is characterized by intense summer monsoonal upwelling that induces high primary productivity and distinctive assemblages.

The benthic foraminiferal fauna were sampled in 32 Recent coretop sediment samples covering a water depth from 247 to 1474 m during the regional survey cruise RC27-04.

Characteristics of benthic foraminiferal fauna are: (1) high abundance (large standing stocks); (2) high species dominance and low diversity; (3) relatively small, thin shelled specimens; (4) particular test morphology and ornaments that are adaptations to opportunistic infaunal mode of life; (5) more than 90% of tests are stained or filled by pyrite; (6) dominated by a relatively small number of opportunistic species, mainly species belonging to genera such as Bolivina, Bulimina, Buliminella, Cassidulina, Chilostomenella, Ehrenbergina, Globobulimina, Uvigerina, etc. Benthic foraminiferal record in Hole 723B of ODP Leg 117 reveals that the Indian summer monsoon and upwelling were intensified 9 ky, 18 ky, 50 ky , 100 ky , 200 ky and 240 ky, 340, 440 ky, 480 ky, 600 ky and 700 ky ago. These benthic foraminiferal records are highly coherent with record of eolian detritus flux from deserts and highlands of adjacent lands, and grain size of lithogenic component in the sediments deposited on the western Arabian Sea continental shelf. Compared to the Tertiary, the Quaternary monsoon/upwelling/OMZ conditions revealed by benthic foraminiferal record were more intense, which implies the increasing in global changes effect from the uplift of the Tibetan Plateau.

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