

FOURTH INTERNATIONAL CONFERENCE ON GEOMORPHOLOGY - Italy 1997

Session: Tropical Geomorphology

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**SHORT COMMENT ON STATE OF THE ART
AND PAPERS PRESENTED**

Probably the best presentation is given by M. Thomas in his new book on *Geomorphology in the tropics*, published by Wiley in 1997. Nevertheless there have been published many other books and papers during the decades before by a great number of authors of different countries. The longest tradition, maybe, is documented by French authors concerning especially weathering problems in several francophone African countries. Weathering processes and questions of landform evaluation have been focused by English spoken researchers in several other African countries covering the eastern and partly the western part of the continent, with special interest to Nigeria. Other parts of the world dominated by English spoken geomorphologists are South and South-East Asia and Australia, as well as parts of Latin America. Here, also Spanish and Portuguese spoken scientists are very important. The important role of the Dutch geomorphologists and especially pedologists in Indonesia should be mentioned here as well as the contributions of German researchers representing results from all over the tropical zone.

Tropical geomorphology includes the following main items:

Processes and products of weathering. The weathering processes are the most intensive of all climatic zones of the world with the final result of deep saprolite or bauxite formations. It is necessary to know the complexity of chemical weathering processes as well as the different pathways of the soluted material. Both, the petrographic and climatic factors are of great influence, and it can be interesting to estimate rates of chemical weathering according to various precipitation regimes. A very common problem is the formation

of laterites and duricrusts, and, in special parts of the tropics, silcrete. There are great difficulties to know the water circulation in such weathering profiles and groundwater aquifers which could be used by the local population.

Denudation and erosion processes. At the beginning rainfall, infiltration and runoff processes are to be understood and should be supported, if possible, by experiments. Gully and fluvial erosion are important as well as the quantity of exported material by big rivers and the sedimentation rates of their non-soluted sediments on floodplains and related landforms. Of a similar importance are mass movements processes on slopes. They include soil creep as well as big landslides, which are typical for earthquake-affected mountainous areas. Because of the widespread forest degradation landsliding has become a very common process in the tropics. Therefore, slope stability in the tropics is diminishing dramatically growing to be a big problem for planning authorities.

But not only processes, but also the history of weathering profiles and especially landforms should be focused continuously by researchers. So, the well-known etchplain and inselberg problem should be mentioned at the first place, because it represents relief formation during a long period, starting somewhere in the Tertiary, and probably permanent tropical weathering conditions. There exists different concepts forming a remarkable part of the total literature on the tropics, but etching can be regarded as a problem in permanence and typical for the long-term landform evolution.

From special interest are the features representing the quaternary environmental change, induced by really severe climatic changes. Special landforms and deposits are the so called hillwash sediments and river terraces and stone-lines which are incorporated in thick soil profiles. Other features are valleys without channel (*dambos*, *bas-fonds*) or

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podzolic white sands. As a conclusion it can be said that also quaternary research will remain highly interesting in the future.

A total of fifteen contributions have been presented in the Session «Tropical Geomorphology». Following the decisions of the Organizing Committee, three of them were selected for oral presentation, while the others twelve were showed as posters. They concerned the following five main topics hereafter reported.

GENERAL GEOMORPHOLOGY

Thomas presented orally a communication about *Morphogenesis in lowland equatorial environments: the weathering processes and the origins of «withe sands» in Kalimantan*, carried out in collaboration with Thorp and McAlister over undulating igneous rock terrain (*meias laranjas*) associated with extensive white sands. It has been proved that withe sands are the final product of alternating phases of more or less continuous lessivage under equatorial conditions, as well as of Quaternary seasonal climatic oscillations that have widely affected the inner tropics during the ice advances. The model developed from this study has been compared with other models of soil-landscape evolution in perhumid tropical environments.

Only one poster, presented in French by Queiroz Neto & José Pereira, concerned the *Soil-landforms relationships in the humid tropics*. The results of a general study carried out in the humid regions of Brasil have allowed a better evaluation of the importance of soil science for the study of landforms and, in particular, for the slope dynamics.

REGIONAL GEOMORPHOLOGY

Latroubesse, in collaboration with Rossi & Franzinelli spoke on *Geomorphology of the Pacaas Novos Range, Southwestern Amazonia, Brazil*, underlying the presence of a sequence of slope landforms (detrital talus passing to a pediment) interpreted as a strong evidence of the fact that the morphogenetic systems changed drastically in Amazonia during the Quaternary.

The poster by Blanco Segundo, Hernandez Santana, Magaz Garcia and Diaz Diaz first concerned *The basic principles for the classification of the recent exogenous processes of the Cuban relief*. These principles come from an expeditionary survey for the elaboration of the map of *Recent exogenous processes* included into *Nuevo Atlas Nacional de Cuba*.

The *Physical features and hydrology of the Pantanal de Nhecolândia (Brasil)* was the subject of the poster presented in French by Fernandes, Queiroz Neto, Lucati & Capellari. By means of Landsat TM images 5 different land units have been identified there, on the basis of the vegetation types, frequency and distribution of flood events, frequency and distribution of particular fluvial landforms as *corixos, baias, vazantes, cordilheiras* and *lagoas*.

The only Italian author in this session, Sansò, reported on *The ancient landforms of the Apulia region (Southern Italy)*. Now a typical Mediterranean country, Apulian landscape reveals in several stretches the occurrence of landforms developed during the Tertiary, when the climate was there characterized by a tropical regime. In particular, some pre-Quaternary paleo-surfaces, the most common being etchplains, have been identified on Gargano promontory, Murge Alte and Salento peninsula.

Coltrinari studied the *Karstic-type forms and landscape evolution in Taubaté basin (San Paulo, Brazil)*, comparing a quasi-original situation in the 40's (as given by aerophotos) with a present-day one. As a result, she observed that some of these karstic-like depression in the sample area evolve by vertical removal of soluble material favoured by lithological or tectonic discontinuities.

SLOPE DYNAMICS

A poster presented by Kegang Wu, concerned *Runoff and sediment response of badland gully to rainfall in Southern China*. In the Deqine County of Guandong Province, chosen as representative, there are 61 gullies per sqKm, on average. A watershed of 0.9 sqKm has been equipped and monitored in order to determine the response of gully to rainfall events. Among other results, it has been found that, although the runoff occurred in the gullies only during rainfall, the threshold precipitation required to initiate runoff and erosion is very low.

Again on the subject of gully landforms, De Oliveira reported on *Regressive alcove, gully head extension and gully integration in the Southeastern Brazilian Plateau*. He proposed a conceptual model for gully erosion evolution that conceives the existence, on the same hillslope, of two different types of vertical erosion channels: one connected to the main drainage net, and another disconnected. With time, both of them may integrate each other; besides, overland flow and subsurface flow tend to reach a synergetic interaction, giving origin to a complex gully with a characteristic retreating head, named regressive alcove.

ENVIRONMENTAL AND APPLIED GEOMORPHOLOGY

Jeje presented orally a communication on *Land use changes and sediment yield in parts of Central Western Nigeria*. The research was based on the selection of 12 third order basins, homogeneous for geology and relief, but not for land use: 6 of them area forested (55-81% coverage) and the others cultivated for rice production (56-89% coverage).

Machado, Perez Gonzalez & Benito deal with the *Erosion processes and land degradation episodes during last 3,000 years at the Axum Region (Tigray, Northern Ethiopia)*, as a result of the interaction between a continuative agricultural land use (over 2,000 years) and climatic variability during Holocene. The research has been carried out by means of stratigraphical, pedological and geo-

archaeological studies of some profiles in tributary infilled valleys, where sequences of coarse material are interbedded with buried soils. Three main land degradational phases have been identified: a) first human influence on the land, due to iron-tipped plow (2250 ± 190 yr BP); b) decline of the Axumite kingdom; c) XVIII-XIX cent. More recently, a sudden increase of erosional phenomena was due to large-scale deforestation in the years 1936-1939 as well as a consequence of the changes on land tenure produced after the 1975 rural reform.

Ruse & Peart selected 10 sites in Hong Kong, in order to evaluate the *Spatial variability of ^{137}Cs fallout*. They also evaluated the ability of the soil to fix ^{137}Cs and the ability of geomorphic processes to move it, and tested a sampling methodology, such as the number of samples needed to make an accurate assessment of total inputs.

In an equipped small catchment (3.5 sqKm) situated in the secondary rainforest of Tijuca (Rio de Janeiro), Silveira & Coelho Netto evaluated the *Hydrogeochemical basin responses to rainfall inputs in a tropical mountain environment*. Besides measuring rainfall and discharge at the outlet, rainfall, throughfall and water below the litter were collected to evaluate the chemical input. As a general result, the basin showed a quick hydrological and geochemical response to rainfall.

QUANTITATIVE GEOMORPHOLOGY AND MODELLING

Another small watershed has been chosen by Lopezblanco, Galicia-Sarmiento & Garcia-Oliva to analyze the *Hierarchical analysis of relief features in a tropical deciduous forest ecosystem in Mexico*, according to 4 levels: total watershed, facing slope orientation, altitudinal ranks segmented by faults, hillslope units.

Last, but not least, Fernandes & Santi illustrated a poster on *The convex hilltops of Southeastern Brazil and the question of dynamic equilibrium: insights from hillslope curvature and numerical modelling*. The study, based on a detailed field survey in three different areas inside the State of Rio de Janeiro, characterized the ratio between the incision rate and the diffusion coefficient for these areas.

As a general conclusion, we can affirm that at Bologna Conference the researchers involved in Tropical Geomorphology, most of them from Brasil, have focused their activity on quantifying the magnitude of some geomorphic processes, as those resulting from accelerated erosion (i.e. gullies producing badlands). It seemed to us that in the Tropics, even better than in temperate climates, geomorphology is becoming a basic science for the study of the environment.