Suppl. Geogr. Fis. Dinam. Quat.
III, T. 3 (1999), 159-161

FOURTH INTERNATIONAL CONFERENCE ON GEOMORPHOLOGY - Italy 1997
Symposium: Geomorphology and Global Change

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GEOMORPHOLOGY AND GLOBAL CHANGE

Forty-eight papers were contributed to this symposium. Of these, 12 were presented orally and 36 were in the form of posters. Countries of origin of the lead author were: France (6), Italy (5), Russia, UK and USA (4 each), Canada, Germany, Hungary and India (3 each), Poland (2) and one each from Argentina, Brazil, Geographical Society of China Beijing, Ethiopia, Finland, Japan, Malaysia, Morocco, Netherlands, Geological Association of China Taipei and Ukraine.

The substance of the symposium can be summarised under four headings: (i) Global issues (ii) Climatic and hydrologic changes (iii) Human impacts at Holocene time scale and (iv) Human impacts within the past 300 years. It is nevertheless impossible to do justice to the rich research material in such a short overview and we await with interest the completion of manuscripts for publication.

GLOBAL ISSUES

Brinken (Russia) noted that the bulk of the evidence for global sea level change over the past decade suggests lowering of sea level rather than rising sea level as predicted by greenhouse effect calculations. Spencer & *alii* (UK), by contrast, documented a general rise in sea level from 1949 to 1979 and noted sea level variations related to Enso events. They also illustrated a new technique for monitoring sea level change with the aid of «microatolls». Hinton (UK) directed attention to the influence of coastal geomorphology on processes operating in the coastal zone and, in particular, noted the complexity of interpretation of tidal data. Reed (USA) assessed the uncertain effects of hurricanes on microtidal marshes in the subsiding Mississippi Delta plain. Differential habitat response to hurricane impact presents a conundrum for coastal management planning. Cherkashin (Ukraine) made a comprehensive analysis of the past 100 year sea level changes in Odessa Bay in the Black Sea. Badyukova & *alii* (Russia) used coastal dune relief as an indicator of sea level changes around the world. Beach ridge dunes they interpreted as indicators of sea level fall or tectonic uplift; secondary dune ridges indicated sea level rise. Dumas & *alii* (France) identified raised beaches in Calabria ranging from 157 masl (130 ka) to 43 masl (60 ka) and Pirazzoli & *alii* (France) mapped late Holocene emergence, also in Calabria. They found only 1.5 m emergence since 2900 years BP and implicated the compensating effect of glacio- and hydrostatic effects. Harvey & *alii* (UK) described the impact of Quaternary sea level and climate change on coastal alluvial fans in south east Spain. They recognised two sets of fans, one of which was influenced by both sediment supply and sea level change and the other by sediment supply alone. Dragoni & Valigi (Italy) used results from GCMs to predict climatic and hydrologic effects and then used the Fournier (1960) formula to predict specific erosion effects. Kertesz (Hungary), in an extension of the Medalus II project, discussed the environmental implications of aridification. Kadomura (Japan) discussed spatial differentiation of land degradation effects following climate change.

CLIMATIC AND HYDROLOGIC EFFECTS

Folladori & *alii* (Italy) assessed the sensitivity of alpine glaciers to atmospheric warming. They examined more than 1400 glaciers in the Italian Alps covering 607 square kms. Vittorini (Italy) used a Thornthwaite water balance approach in investigating the impact of climate change on badland processes in Tuscany. Huszar & *alii* (Hungary) estimated the impact of climate change on soil water content via an Erosion Productivity Impact Calculation Model. Many of the papers within this theme used lake sediments to interpret environmental change. Most impressively, Anderson & Wells (USA) showed a 40,000 year

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record of lake sediments from Death Valley, California in which a number of high lake stand phases could be identified. Wells & *alii* (USA) reconstructed a late Quatemary history of hydrologic events using geomorphic, sedimentologic, stratigraphic and carbon 14 analyses of alluvial, lacustrine and shoreline deposits in the Mojave Desert. Tikkanen (Finland) examined the detailed sedimentation history since 8,000 BP of a small Finnish lake with careful interpretation of natural and artificial changes in water level. Evans (Canada) explored the question of geomorphic sensitivity via the lake sediment records of four adjacent alpine-subalpine lakes in the Cascade Mountains of British Columbia. Menounos (Canada) examined lacustrine sediments in the alpine Colorado Front Range and identified periods of accelerated debris flow activity during the Holocene. Sayago (Argentina) identified geomorphic indicators of present and former environmental changes in northern Argentina. Kalicki (Poland) discussed Holocene development of the Vistula floodplain via facies analysis, fluvial morphology and dating. Schutt (Germany) reconstructed Holocene paleoenvironments in central Spain by sedimentological analysis of endorheic basins using geochemical and mineralogical analyses of basin sediments. Mazari & Bagati (India) described distinctive landforms associated with soft rock sediments in the north-westem Trans-Himalaya.

HUMAN IMPACTS AT LATE-GLACIAL AND HOLOCENE TIME-SCALES

A large number of papers within this theme used geoarcheological techniques to good effect. Chen & Stanley (Geographical Society of China, Beijing) discussed a 10,000 year history of the Yangtse Delta and its response to Holocene sea level rise. Kadereit & Lang (Germany) made geoarcheological investigations of colluvial sediments in the loess covered Kraichgau Hills in southern Germany to interpret Holocene landscape evolution. Pastre & *alii* (France) summarised a complex interdisciplinary project on the morphosedimentary evolution of the Paris Basin river valleys during Late and Post-Glacial periods. Cubizolle & Valadas (France) explained the Holocene evolution of the Dore valley in the French Massif Central with the aid of geomorphic analysis, historical research and carbon 14 dating. Mausbacher & Igl (Germany) identified the influence of climate change and human impact on sediment flux during Late Glacial and Holocene periods in central Germany. Berakhi & *alii* (Ethiopia) made a geomorphologic-stratigraphic investigation of Holocene climate change and human impacts in the highlands of northem Ethiopia. Dikareva (Russia) analysed the effects of irrigation in central Asia since the fourth millennium BC on valleys and ancient deltas. Lespez (France) carried out geoarcheological investigations on an alluvial cone in eastern Macedonia and concluded that maximum aggradation since the middle Neolithic occurred between the eighth and eighteenth centuries AD. Fouache & *alii* (France) used a geoarcheological approach to reconstruct the influence of climatic and anthropic factors in Albanian landscape evolution since the Iron Age. Giorgi (Italy) discussed the morphological evolution of the Bolognese Plain over the last 3,000 years with the aid of DEMs, archeological, historical, cartographic and soils data. Brown & Rhodes (UK) studied valley fill sediments in Etruria, central Italy and established the roles of climate and land use since the Roman period. Klimek (Poland) demonstrated human impacts on the evolution of the upper Oder in Upper Silesia since 1000 AD.

HUMAN IMPACTS WITHIN THE LAST 300 YEARS

Geczi & *alii* (Hungary) explored the relationship between aridification and human activity in south eastern Hungary. Golosov & Larionov (Russia) discussed badland development in three broad contexts: alpine, steppe and mining regions. Jackson & Nordstrom (USA) examined the effects of human action on the physical evolution of the shoreline of New Jersey. Ciabatti & *alii* (Italy) investigated littoral changes in Emilia Romagna over the period 1970-1995. Bandyopadhyay (India) described the history of the reclamation of an island in the Hugli estuary since 1811 AD. Chang (Geological Association of China, Taipei) reported a 300-year history of fluvial and coastal interaction on the Tsengwen Plain, Taiwan. Stam (Netherlands) investigated the response of the Meuse River to climate and land use changes over the last 200 years. Modelling of the relationship is being attempted. Lai & Malandi (Malaysia) studied four watersheds with varying proportions of logged area and concluded that logging increases the export of particulate organic matter relative to undisturbed watersheds. Coelho Netto & *alii* (Brazil) documented geohydroecological responses to human induced changes in the National Tijuca Park near Rio de Janeiro over the past 20 years. Qarro & Ouahid (Morocco) identified overgrazing and vegetation clearing as the two most important factors in changing vegetation dynamics over a 29 year period (1963-1991) in the central plateau of Morocco. Rawat & Rawat (India) have established a research programme of careful monitoring of geomorphic processes in the central Himalayas in order to make recommendations for guidelines and strategies for sustainable development of water and land resources.

SUMMARY

If we accept the distinction between systemic and cumulative aspects of global change (Turner & *alii*, 1990) then the 24 papers under Sections 1 and 2 above can be considered to be systemic or attempts to establish global system-wide generalisations. The 23 papers under Sections 3 and 4 dealt with cumulative impacts and are more site or

region specific. In his state-of-the-art lecture, Slaymaker (Canada) gave an overview of the relationship between global environmental change, physical geography and earth system science and suggested a vital role for geomorphology, namely the quantitive assessment of the sensitivity and resilience of geomorphic systems to climatic and anthropogenic change. All paper contributions to the Symposium S1 can be interpreted as contributions to the understanding of geomorphic resilience and sensitivity but only a minority of the papers addressed the issue directly and quantitatively. Geomorphology has come a long way towards making its contribution central in the global change debate but, if this Symposium is indicative, we still have more work to do(a) in clarifying that role for our own geomorphic community and (b) in communicating that role to our earth and environmental science peers. Acknowledgement is hereby made of the efforts of Morner & Douglas who were the authors of the original vision of this Symposium.

REFERENCE

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