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GEOMORPHOLOGICAL HAZARDS: CHARACTERISTICS AND HUMAN RESPONSE

Geomorphological hazards may be defined as those events or processes, natural or man-induced, that cause a change in earth-surface characteristics detrimental to Man and his activities. They form a sub-set of the broader range of *natural hazards* that represent a world problem of growing importance, in which the cost to mankind is measured in billions of dollars annually. Man's sensitivity to all types of hazard is increasing as world population rises, as technological advances and economic development place ever-greater demands on the environment and its resources, and as societies and economies grow in complexity, thus becoming more vulnerable to disasters. The recurrence of violent earthquakes, volcanic eruptions, catastrophic floods and droughts serves to heighten human awareness of these potential threats and of the need for protection against them. In developed countries, natural disasters may usually be contained and absorbed within the economic and social fabric of the region; but in developing countries they can be a most serious threat to economic advancement, sometimes affecting the economy of the whole nation.

On our dynamic planet there are, of course, areas that are more subject to natural catastrophes than others, areas where endogenic forces are more active, where hillslopes are more unstable, or where certain climatic phenomena are more extreme. In recent decades, human activities have also brought about great changes in the environment, often for the worse. In areas characterised by a precarious morpho-climatic equilibrium, Man himself has sometimes triggered off disastrous events or increased their effects, witness the results of deforestation, of river diversion, or of unsuitable land-use practices.

The specific field of geomorphological hazards represents, in reality, a wide spectrum of physical phenomena and processes, ranging from the sudden and rapid to the slow

and long-lasting; from the intense to the diffuse, and the predictable to the unpredictable. A classification in terms of dominant process is given in table 1, together with some approximate qualifications in respect of the degree of catastrophism, predictability and possible control. The term «geomorphological» is used in a broad sense, as it is in this volume of papers, to include geophysical and hydrological phenomena that cause earth-surface changes.

Several international organisations and programmes are today concerned with the scientific investigation of geomorphological hazards. Some are involved with one particular type of hazard, such as the Japan Landslide Society or the World Landslide Inventory of the International Geotechnical Society. Others have a more general remit, but one that is concerned with a specific area, such as the Centre Européen pour les Risques Géomorphologiques. At the world level, the International Geographical Union set up in 1988 a *Study Group on Rapid Geomorphological Hazards*. This body, under the chairmanship of Prof. C. Embleton of London University, was partly formed from the union of three previous Working Groups that coordinated the meetings at which the papers in this volume were presented. (These were the Working Groups on Geomorphological Survey and Mapping, the Geomorphology of River and Coastal Plains, and Morphotectonics). The three groups met in Italy (Firenze - Modena - Padova) from 28 May to 4 June 1988 at a meeting sponsored by the *International Geographical Union* and by the *International Council of Scientific Unions*, with a special grant from C.N.R. (*National Council for Scientific Research in Italy*) and several universities and public institutions in Italy.

The papers contained in this volume cover a range of geomorphological hazards. They were compiled by twenty-three authors from nine countries, and the areas of study include parts of Europe, south-east Asia, Africa, the Soviet Union and the Middle East. *Mass movements* as a threat to Man and his activities provide the focus of interest in three papers, dealing with the collapse of river bluffs along the Danube in Hungary (LOCZY, BALOGH & RINGER), the

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