PLURALISM IN GEOMORPHOLOGY

KARL W. BUTZER

The University of Chicago

ABSTRACT. Geomorphology as a subfield has had different origins in different countries, with different academic trajectories. The increasing diversification in recent decades has accentuated contrasts between regional schools and complicated the existing problems of departmental affiliations, research funding and publication media. It is argued that geomorphologists accept the pluralism within their subfield and espouse their common interests.

INTRODUCTION

Defined according to its Greek roots, geomorphology refers to the study of the form of the earth. There is little consensus beyond this lowest common denominator since, by deliberate choice or *de facto* use, geomorphology has at different times, in different countries, and at different institutions had a different scope. Despite a certain amount of philosophical or methodological discussion, the many streams of geomorphological study have never been fully rationalized, either within an historical perspective or in terms of the spectrum of contemporary trends. It is generally apparent that modern geomorphological studies range across a wide multidisciplinary plane with geology, soil science, hydrology, geography, and geophysics as coordinates, and including empirical and mathematical-quantitative dimensions. In turn this complexity, indeed pluralism, of the field reflects the multidisciplinary background of geomorphologists both in terms of training and interests.

The purpose of this paper is to explore the roots of pluralism in geomorphology and to attempt an overview of how the field is deployed today. In doing so I have admittedly side-stepped the gargantuan task of documentation, a documentation that would necessarily entail citation of a vast body of literature as well as the indispensable argument by example. However, I trust that my audience will bear with this somewhat personal review, that does not aim to provide a definitive survey of the field such as Dury (1972a) has recently attempted for the 1960's. Instead I come to my fellow geomorphologists and other physical geographers with a plea to allow for diversity, to accept pluralism, and not to obstruct the resurgence of interest in the whole gamut of geomorphological themes by espousing sectarian gospels.

THE ROOTS OF PLURALISM IN GEOMORPHOLOGY

As many, but by no means all, geomorphologists are aware, their subject means something different in each country with its own geomorphological tradition, both in regard to its historical development and presently preferred interests. So, for example, the American school of geomorphology finds its 19th century roots in the empirical observations and theoretical deductions of early workers in the U.S. Geological Survey, primarily J. W. Powell and G. K. Gilbert. Yet its academic and textbook image from 1900-1960 was moulded by W. M. Davis' idiosyncratic application of these basic facts and concepts into a highly individual synthesis. Consequently, Dury (1969) is probably representative of a broader spectrum of English-speaking geomorphologists when he terms the Davisian structure-process-stage approach "classical geomorphology."

By contrast, German geomorphology finds its basic formulations in two texts of the late 19th century. Both of these works, which remain *terra incognita* in the one comprehensive attempt to evaluate the origins of the field (Chorley *et al.*, 1964), reflect geologists who became academic geographers: F. von Richthofen and Albrecht Penck. Richthofen's *Führer für Forschungsreisende* (literally *Guidebook for scientific Travellers*) (1886) and Penck's *Morphologie der Erdoberfläche* (2 vol., 1894) proved instrumental in making geomorphology a permanent branch of geography in continental Europe. Thus neither the Davisian approach (particularly Davis, 1912), nor the counterattack of Walther Penck (1924), ever submerged the more balanced perspectives that were maintained in Central and East European geomorphology. This distinction becomes readily apparent by contrasting texts such as those of

F. Machatschek (1919), A. Hettner (1920), J. Cvijić (1924-26), R. Lehmann (1925), S. Passarge (1929), W. Behrmann (1933), I. S. Ščukin (1933-38), A. Aigner (1936), and O. Maull (1938) with their contemporaries: R. D. Salisbury (1919), C. A. Cotton (1926), S. W. Wooldridge (1937), A. K. Lobeck (1939), P. G. Worcester (1939), and O. D. v. Engeln (1942).

It comes as no surprise that subsequent trends of geomorphology in the English-speaking world and continental Europe did take different directions. In the United States Davisian geomorphologists remained dominant in academic appointments until their subject died a slow death, without issue, much as Douglas Johnson's abortive *Journal of Geomorphology* (1938-42). It remained for another breed of geomorphologists to make possible what might be described as the Hortonian Revolution. The events of the post-1945 period are sufficiently well-known to require no chronicling here, except to note that the spectrum of interests spanned by the work of Stanley Schumm and Luna Leopold has yet to be reflected in a truly general geomorphology text.

In Great Britain, Davisian geomorphology also assumed command, by the 1920's, but fortunately the field work of academic geomorphologists continued to draw heavily on the traditions of Pleistocene geology. The outcome was a more gradual trend of modernization that has produced an interesting blend of geomorphology in both Britain and Australia that includes elements of contemporary processual studies as well as empirical-historical approaches to regional problems.

Scandinavia occupies a special position in these evolving present-day traditions. Davis was never a prominent figure in a region where glacial geomorphology and geology were for many decades a prime focus of interest. Yet already in the 1930's F. Hjulström's fluvial dynamics school at Uppsala had anticipated the work of the U.S. Geological Survey in the 1950's, and the quantitative studies of slope denudation and other contemporary processes, by A. Rapp and others, parallel post-World War II trends in the United States. Equally anomalous has been the situation in South Africa where L. C. King espoused a modified version of Walther Penck's approach to structure-process-stage, and where the mid-1940's saw T. J. Fair's angle measurements of hillslope segments parallel the earliest phases of the quantitative revolution in the United States.

Continental Europe also experienced a revolution in geomorphological thinking. One facet of this revolution has been the infusion of sedimentological work from geology and soil science, first introduced to geomorphology in the Netherlands, France and Germany (C. H. Edelmann, J. P. Bakker, P. Birot, A. Cailleux, J. Tricart, etc.), and now also well established in Belgium, Austria, Czechoslovakia, and Poland. It is probably fair to say that this approach was adopted primarily in response to (i) a growing realization that the soil mantle and weathering are the starting points for most gradational agencies, and (ii) recognition of the interpretive potential of depositional features, in contrast to earlier emphases on erosional forms. This approach has linked geomorphology more closely with soil science, and since it is both empirical and historical, has been primarily applied to Pleistocene environments. It certainly provides a more objective criterion for landscape evolution than the Davisian method.

Systematic and regional geomorphology in continental Europe have been equally affected by application of the environmental approach, the "climatic geomorphology" of the German and French schools. Already in 1926 the Düsseldorf meetings of the German geographers' association (published Breslau 1927) were devoted to the theme of geomorphic processes and erosional landforms as seen in relation to regional variations of climate, vegetation, and soil mantle. The concept itself can be traced back at least as far as V. V. Dokuchayev, at the turn of the century. The 1920's and 30's saw many geographers and geologists contribute raw materials for this new point of orientation, primarily in Germany, Scandinavia and the United States. This international groundwork was employed in the 1940's and 50's to formulate more general theses (J. Budel, H. Wilhelmy, H. Poser in Germany, A. Cailleux, P. Birot and, particularly, J. Tricart in France). "Climatic geomorphology" has rejuvenated the field in France and Germany, providing a uniquely geographical approach to genetic geomorphology. Above all it has served to deemphasize the once dominant role of structural history within the discipline, and structural geology and tectonic theory have since been more logically preempted by geophysicists.

CONTEMPORARY PLURALISM IN GEOMORPHOLOGY

As a result of the multiple origins and separate evolution of schools in geomorphology, at least

four major directions of primary research can be identified:

(1) Quantitative study of geomorphic processes in the field and in the laboratory, leading at higher levels of analysis to the linking of empirical observations and mathematical theory to realize new insights in stream, slope, glacial, and coastal processes. Along the way geomorphologists have profited from new ideas derived from hydrology, physics, meteorology, engineering, and mathematics. Although rates and magnitude-frequency aspects of geomorphic processes and events in general remain inadequately understood, the discipline has—over the last two decades—for the first time been presented with a basic framework of empirical data with which theoretical argumentation must match itself.

(2) Quantitative analysis of landforms—both erosional and depositional, involving slope and other surface measurements in the field, and morphometric studies of individual forms or complex terrain by cartographic, air photo, or field techniques. As a result, new slope models are being developed and a multitude of techniques can now be applied to such variably-scaled phenomena as micro-slopes, drainage-basin geometry, and gross terrain representation. Furthermore it is now possible to at least attempt to relate contemporary processes to specific form characteristics and, at the highest levels of generalization, to consider such problems as entropy and general systems theory. Whatever the pros and cons of increasing application of statistical, topological, modular, or systemic approaches, morphometric work will from now on remain indispensable for synthetic landform analysis.

(3) Quantitative and qualitative study of sediments, involving field observation of extent, depth, and character of surficial deposits and soils, and their subsequent laboratory analysis. The labyrinthine discussions of historical landscape evolution in the older literature were focused primarily on complex erosional forms that commonly reflected long periods of time with changing constellations of geomorphic forces. Alternatively, it is commonly possible to link erosional features with correlative deposits or paleosols and so to narrow down the possibilities to a more tangible medium of study. Palynological studies and a host of other biological and geochemical techniques have greatly assisted in refining such assessments of past depositional environments.

(4) Systematic, regional studies of complex landform evolution through time and in the wake of environmental change. This, perhaps the most traditional and basic of pursuits in geomorphology, has been revitalized and redirected through the impetus of innovation in processual studies, morphometry, and sedimentology. Beyond the scope of such standard topics as glaciation and sea-level changes, the "climatic geomorphology" approach has drawn attention to the many other changes corollary to glaciation, to such themes as landform development in low latitudes, to forms and paleosols that appear to have been inherited from the Tertiary period, and to problems of paleo-environmental reconstruction in general. Isotopic dating by radiocarbon, potassium-argon, and uranium isotopes has provided realistic temporal parameters and given new insights as to rate of complex landform evolution. This all is, of course, a far cry from the Davisian pseudo-historical "stage" approach to landform evolution.

Apart from these four basic directions of contemporary geomorphological research, it is imperative to mention the increasing scope of applied geomorphology not only to the engineering, construction, and military trades, but also to such themes as the impacts of urbanization, floodplain hazard studies, resource evaluation, environmental protection, and environmental archeology.

Although this broad spectrum of primary and applied interests lends to geomorphology a level of diversity comparable to that of the broad neighboring fields of geology and geography in which it finds its roots. Yet geomorphology does not even now have the scope of a major field, such as geology, and is perhaps best described as a specialized subdiscipline. Add to this the multidisciplinary nature of many of the techniques employed and goals sought, and it becomes apparent that geomorphology has unusual methodological problems. At this point it has in fact become a typical enterprise of the post-World War II era, crossing traditional academic boundaries with the same stimulus, if not success as Early Man studies, nuclear physics, and micro-biology.

PARTICULARISM IN GEOMORPHOLOGY

A great many advantages can be cited for a multi-/interdisciplinary field of endeavor, not the least of which are the multiple currents of work and thought that are bound to generate exceptionally productive hybrids in both analytical and synthetical approaches. But the potential negative

aspects of fragmentation and particularism are nonetheless real and deserve some reflection.

(a) Disciplinary particularism has a long history in geomorphology. Prior to about 1870 the origins of geomorphology are inextricably interwoven with the evolving field of geology and the severing of the umbilical cord has fortunately never been complete. Yet although geomorphology has traditionally been a tool rather than a goal of geology, uneasy "political" relationships have continued to prevail at the level of academic appointments, governmental agency jurisdiction, research funding, and publication media. Whether temporarily or permanently adopted into academic geography, geomorphology has everywhere had its ups and downs in terms of departmental emphasis as well as in points of research funding and publication problems.

(b) Directional particularism is an equally venerable but unfortunate, internal problem of geomorphology. The academic intolerance of Davis and his followers between World Wars I and II has become proverbial and can still be readily savored in the editorial policies implicit in the defunct *Journal of Geomorphology*. Rather less whimsical are the real tensions that continue to be generated among the various preferred interests within the subject. Geomorphology, like geology, has had more than its share of forceful, evangelistic personalities who have espoused partisan interests with vehemence. In part, related symptoms have been reflected in the increasing number of rationalizations concerning the role of geomorphology and "landform geography" within orthodox geography curricula (see Zakrzewska, 1967; Falcon, 1971; Clayton, 1971; Dury, 1972b). And in part, too, they have caused severe grief to students whose dissertation projects were rejected by overly-orthodox funding agencies, or whose research came under fire by dissertation committees or book reviewers on account of approach and philosophy rather than content and originality.

(c) National particularism, although certainly not new or unique to our subdiscipline, is perhaps the least apparent. The particularism of national schools can perhaps be best seen in published dissertation work. By this criterion, doctoral research on geomorphological themes in the United States and Canada has been noticeably distinct over the past several decades, with the Canadian approach showing strong elements common to contemporary work in Britain and Australia, as well as influences of unmistakably French origin. It goes only one step further to state that the development, role, and contributions of geomorphology in France or Germany remain yet to be appreciated in English-language digests of a subdiscipline that has never been an Anglo-Saxon prerogative. The most recent example of such uncomprehension is Stoddart's (1969) review of "climatic geomorphology" which adequately served to put to rest the simplistic notions of climate and process derived by some from an early paper by Peltier (1950). However, Stoddart confines his analysis to dissecting the general writings and programmatic statements of a few geomorphologists whose substantive work is far from facile, without grasping the scope of the vast body of relevant, problem-directed research that was distilled into the one representative study of environmental geomorphology, the five-volume *Traité de Géomorphologie* of J. Tricart and A. Cailleux (1955-62) (see also Holzner and Weaver, 1965, for a bibliographic selection to 1964). Although the growing number of text translations, most unfortunately mediocre or poor, will serve to alleviate the problem, the language barrier will continue to remain for the many substantive papers that continue to appear in a myriad of journals.

But why bemoan potential or real problems at a time when geomorphology is enjoying a recrudescence in North American universities, and particularly in departments of geography or environmental studies? Because there is a genuine problem of communication and understanding that must be overcome if related research is to be carried out under optimal conditions and assimilated into a broader and more viable field.

(i) Academic geomorphology *is* dangerously fragmented between geology and geography departments, and further isolated by rival national societies with their own annual meetings. Almost everywhere geomorphology is represented by no more than a single individual, commonly appointed primarily to teach mass courses in elementary physical geography or general geology, and few departments have any intellectual commitment to the subject itself. Geomorphology papers play a noticeably adjunct role at peripheral sessions at the meetings of both geological and geographical fraternities. Sometimes such sessions do not even provide the critical mass for effective interchange, a chronic situation for most geomorphologists who normally work in some degree or other of isolation at their own institutions.

(ii) Publications *are* a serious problem. Geo-

morphological papers are scattered over an incredible array of topical and regional journals, with only two specialized journals—the *Zeitschrift für Geomorphologie,* with an international clientele, in Germany, the less cosmopolitan *Révue de Géomorphologie dynamique* in France, and the newer *Geomorfologia* in the U.S.S.R. Despite the invaluable assistance offered by Keith Clayton's *Geo-Abstracts "A"* since 1960, even now the scatter is so great that some papers in out-of-the-way journals take two and three years to find their way into the review box, if at all. This imposes special problems on scholars and is particularly difficult for students. It also leads to undesirable pressures in non-geomorphological journals whose editorial policies or referees have marginal commitments to a peripheral subfield, and where format may be unsuitable, priorities low, publishing delays inevitable and above all, space so tight that over-condensation becomes a serious problem.

(iii) Research funding poses a special dilemma. Geomorphology has in the past, for example, been supported by NSF programs or sections as diverse as geography, geology, oceanography, and anthropology, without, however, being central to the core-interests of any one of these fields. Commitments have accordingly varied over the years and recent cut-backs have fallen most heavily on interdisciplinary subjects. Both here and in other funding agencies, geomorphological projects can still run afoul of the jaundiced eye of geologist referees and, regrettably, too, on occasion, of the methodological particularism of more proximal colleagues.

In conclusion, it is to be hoped that geomorphologists will close ranks to strengthen the subject and to ensure optimal opportunities for themselves and especially for their students in terms of job opportunities, publication media, and research support. Only by realizing and appreciating the pluralism of our subfield can we hope to overcome the unfortunate particularistic tendencies that hamper communication and closer collaboration. Diversity is a source of strength but it can only be so when pluralism is accepted and tolerated. It is in this sense that geomorphologists must continue to expand their mental horizons so that communication remains both possible and desirable. Hopefully, a growing sense of identity will, then, make it feasible to achieve fuller recognition for our corporate interests.

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