The Classification of Land Forms and Landscapes

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Source: *The Geographical Journal*, Vol. 43, No. 4 (Apr., 1914), pp. 424-427

Published by: geographicalj

Stable URL: <http://www.jstor.org/stable/1778377>

Accessed: 26-01-2016 04:59 UTC

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exploration and mapping, and when that is complete the real work of Geography and Geographical Societies will only begin. The explorer and map-maker only lay down the foundations of the subject; it will remain for generations of geographers to rear thereon a stately structure fitly representing "the kingdoms of this World, and all the glory of them." One of the most effective mediums through which the subject can be promoted, especially in education, is the Geographical Association, with its thousand members, which has done me the honour of electing me its President, for which honour, in conclusion, I again render you thanks.

Mr. Freshfield proposed a vote of thanks to Dr. Keltie for his address, which was seconded by Mr. Mackinder. Mr. W. H. Arden Wood, C.I.E., Principal of La Martinière College, Calcutta, then read a paper on "Personal Experiences of Indian Geography," in which he described the many changes which have taken place in even recent years in the delta and distributaries of the Ganges; the effects of earthquakes, and the movements and characteristics of cyclones.

The Rev. W. J. Barton, of Winchester College, opened a discussion on what should be in a school atlas: he asked for uniformity of scale, or scales of even multiples, showed how he would divide up Europe and other continents, and advocated hemispherical world maps. Mr. Fairgrieve said that a school atlas was insufficient, and that there should be at least *two* school atlases—a more elementary one and a more advanced one. Dr. Unstead desiderated maps for teaching purposes which were printed in an ink which could disappear in three years. Mr. William Stanford (of Messrs. G. W. Bacon & Co.) and Mr. George Philip (of Messrs. G. Philip & Son) pointed out some of the difficulties that a publisher of a school atlas had to face, and Mr. Mackinder spoke strongly against any attempt being made to stereotype atlases, and so teaching. He himself advocated the placing of world maps at the end of an atlas, so that the pupil did not deal with them until he had gained some richness of geographical thought and knowledge about the different parts of the world. A committee would profitably report on such a subject as size of type and treatment which would strain the eyes least, but it would not profitably put books through a sieve with regard to their ideas: the old South Kensington Science and Art Syllabuses were a sufficient warning of that.

Mr. B. C. Wallis, of the Holloway County School, then discussed some difficulties of the teacher of geography, and showed how by pictures and models he tried to make unfamiliar places known to his pupils, and how he applied modelling methods to the construction of solid diagrams to illustrate distribution of density of population, etc.

A full report of the proceedings will be found in the spring number of the *Geographical Teacher*

THE CLASSIFICATION OF LAND FORMS AND LANDSCAPES.

IN a lengthy monograph which forms the greater part of Band 26, Heft 2, *Mitt. Geog. Gesell. in Hamburg*, Professor Passarge makes a commendable effort to meet a long-felt want of systematic geographers. The various classifications of land forms adopted in geographical textbooks are usually admitted to be imperfect and more or less artificial, and although the advantages of possessing a natural genetic classification have been repeatedly pointed out, little or no serious attempt has hitherto been made to provide one. Dr. Passarge, therefore,

has done good service to geography in publishing this essay upon *Physiologische Morphologie*, and it is to be hoped that the attention which he has directed to this important and scientific study may stimulate other experienced workers to renewed activity in the same field.

Prof. Passarge remarks that it ought not to be an impossible task for geographers to set up a natural classification of land forms into orders, families, genera, and species, just as botanists and zoologists have succeeded in establishing a natural classification of plants and animals. In the case of geography, however, the task is rendered much more difficult owing to the fact that species and genera are rarely sharply limited. Land forms everywhere pass into each other, because the forces which produce them rarely act singly, but usually in groups of two or more. New forces also may be added to any group at any stage, while older members of a group may disappear or vary much in intensity; and with every modification of the grouping of the forces, a corresponding modification of the surface forms is produced. An intimate scientific analysis of the various forms must therefore be carried out; and, for purposes of classification, all transitional forms must at first be neglected and attention concentrated upon the forms produced by single forces or by definite groups of forces.

Premising, therefore, that such detailed investigation of individual forms has been completed, Prof. Passarge proceeds to set up two great types of surface forms, Land Forms and Coastal Forms, including respectively all the forms produced within the realm of activity of the two greatest force-groups. The type of Land Forms is then subdivided into two classes, Endogenous and Exogenous Land Forms, representing a primary subdivision into two major force-groups. These classes are further subdivided into orders, or smaller force-groups, and the orders into families, or smallest force-groups. The class of Endogenous Land Forms is thus subdivided into two orders, Tectonic Forms and Volcanic Forms, and the class of Exogenous Land Forms also into two orders, Deposition or Accumulation Forms and Excavation or Removal Forms. The order of Tectonic Forms is then subdivided into the families of Flexure, Fracture, and Fold Forms: the order of Volcanic Forms into the families of Intrusive, Eruptive, and Effusive Forms: the order of Accumulation Forms into various families of Accumulation Forms, due respectively to the action of water, ice, wind, temperature changes, vegetation, animals, and the sea: and the order of Removal Forms into the families of water, ice, and wind-removal forms, and forms arising from disintegration through temperature changes and the action of plants and animals. It will be seen that the content of the various form-families corresponds fairly closely with the phenomena resulting from the activity of the various agents of surface deformation as usually enumerated in text-books.

Prof. Passarge, however, proceeds to point out that the various agents of surface deformation are not single forces but force-groups, and therefore capable of further analysis. Form-families are, therefore, subdivided into genera and sub-genera, corresponding with the sphere of activity of single forces, and these genera and sub-genera are then shown to include a number of species or special forms. For example, the family of Fold-Forms is subdivided into the three genera of (1) symmetrical folded mountains; (2) asymmetrical folded mountains; and (3) overthrust folded mountains, of which saddles, troughs, schuppen, etc., are special forms. The family of Water-Accumulation-Forms is subdivided in the same manner into the genera of (1) mechanical accumulation forms with the sub-genera of stream and rain accumulation forms; (2) chemical accumulation forms; and (3) forms arising through surface creep—the special forms of these genera including alluvial flats, deltas, accumulations of rain wash, sinter cones

and terraces, stalagmites and stalactites, earth and rock flows, land-slips, etc. Again, the family of Water-Removal-Forms is subdivided into two genera: (1) solution forms and (2) erosion forms, the latter with the sub-genera of stream-erosion forms and rain-erosion forms; and the various genera and sub-genera include a variety of special forms such as pipes, dolinas, caverns, V-shaped and flat-bottomed valleys, rock platforms, earth pyramids, etc.

It will be observed that a striking feature of this system of classification is the large number of special or individual monodynamic forms which find a place in it and whose complete genetic history can be stated concisely in tabular form. Take, for example, such diverse forms as rift-valleys, ant-heaps, and mushroom-shaped rocks, which are classified thus:—

Special form	...	...	...	Rift-valley.
Genus	...	...	...	Depressed forms.
Family	...	...	...	Fracture forms.
Order	...	...	...	Tectonic forms.
Class	...	...	...	Endogenous forms.
Type	...	...	...	Land forms.
Special form	...	...	...	Ant heaps.
Genus	...	...	...	Accumulations of land animals.
Family	...	...	...	Animal accumulation forms.
Order	...	...	...	Accumulation forms.
Class	...	...	...	Exogenous forms.
Type	...	...	...	Land forms.
Special form	...	...	...	Mushroom-shaped rocks.
Genus	...	...	...	Mechanical erosion forms.
Family	...	...	...	Wind removal forms.
Order	...	...	...	Removal forms.
Class	...	...	...	Exogenous forms.
Type	...	...	...	Land forms.

Some special forms, such as mushroom-shaped rocks, may be produced independently by different forces, but such cases are readily included within the system, *e.g.*—

Special form	...	...	...	Mushroom-shaped rocks.
Genus	...	...	...	Insolation forms.
Family	...	...	...	Physical disintegration forms.
Order	...	...	...	Excavation forms.
Class	...	...	...	Exogenous forms.
Type	...	...	...	Land forms.

There is, however, a number of common land forms which are the product not of single but of two or more forces acting together, such as fractured folded mountains, composite volcanic cones, river dunes, kames, mangrove swamps, etc. These may conveniently be termed *polydynamic* forms and classified according to the predominant force.

These methods of classification applied so successfully to Land Forms are next extended to the author's second type of surface forms, namely, Coastal Forms. These are subdivided into four classes: (1) Coastal Forms dependent upon adjacent Land Forms; (2) Coastal Forms dependent upon the form of the adjacent sea floor; (3) Coastal Forms of new Accumulation-Lands; (4) Abrasion Coasts. Each class is subdivided into orders, families, genera, and special forms as before, with, however, less success than in the case of Land Forms.

Having thus elaborated a classification of surface forms, which introduces into the study of Geomorphology a systematic precision hitherto unknown, Prof. Passarge boldly attacks the further subject of Landscape Geography, which, up to the present, has been largely neglected by geographers. His analytical treatment of the subject forms a valuable study in the course of which he introduces the terms *consonant*, *dissonant*, *harmonic*, and *disharmonic*, with the object of rendering our conceptions with regard to landscapes more precise. Consonant phenomena are those which are anywhere produced by the same concert of forces, which may vary in intensity amongst themselves, as, for example, the various phases of fluvial erosion. Dissonant phenomena arise when and where a given concert of forces is disturbed by outside influences, as for example where a steppe or desert zone is crossed by a river valley or a desert coast broken by a delta. Harmonic phenomena in landscapes are all those which can be explained as the product of forces now active in the region, while disharmonic phenomena are those which cannot be so explained and which require the postulation of some recent or remote crustal disturbance or climatic change. The classification of landscapes into types, classes, and orders is based upon the classification of land forms previously adopted, and is of quite a tentative character. The author deals mainly with ideal consonant monodynamic landscape forms, while admitting that the great majority of actual landscape forms are polydynamic and frequently dissonant and disharmonic. The monograph closes with two useful chapters on map and landscape analysis.

Prof. Passarge's wide experience of both tropical and temperate countries has especially fitted him for his self-imposed task. Every credit is due to him for his pioneer work in this as in so many other fields, and whether or not his system of classification of land forms and landscapes be ultimately generally accepted, his valuable monograph deserves to be widely and carefully studied. One cannot but think, however, that he would have been well advised to omit many of the references which he makes in a somewhat hypercritical spirit to the writings of Prof. W. M. Davis. Indeed, it is difficult to understand at times why he should indulge in criticism which has little or no relevance to the presentation of his own case. Every teacher, if not every student of geography, knows well both the value and the limitations of Prof. Davis's work, and Prof. Passarge, by his laboured criticism, has achieved nothing but the thankless task of recording common knowledge.

J. D. FALCONER.

REVIEWS.

EUROPE.

'MODERN Russia.' By Gregor Alexinsky. (London: Fisher Unwin. 1913 (date of translation). Pp. 361. 15s.) This book has been translated by Mr. B. Miall, and certain sections are extended in this edition as compared with the French. The work deals almost wholly with Russian political, administrative and social topics and problems, and does this very clearly and systematically. The reader possessing the usual superficial knowledge of Russian conditions will not fail to find all the points in that vast subject which are familiar to him clearly elucidated. The description of the country itself is compressed within the inordinately small compass of four pages. The empire is dealt with simply as a plain, but within this limit a real endeavour is made to establish a connection between physical environment and human conditions.