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Book Review

Alluvial Fans (An Attempt at an Empirical Approach). A.H. Rachocki. Wiley, Chichester, 1981, 172 pp., US $35.00/£14.00.

This book is a monograph on the morphology and evolution of alluvial fans. The author presents in six chapters how processes and form are indivisible factors in geomorphology.

The contents can be subdivided into three main fields of attention: (a) a reviewing part on definitions and terms, covered by the first three chapters; (b) experimental (large-scale) studies in chapter four; and (c) presentation of a statistical model for braided-river systems with a general discussion of the constraints of the modelling and the results of the experiments (chapters 5 and 6).

Chapter 1 is a brief review on the role of processes in geomorphological studies, definitions, terminology and history of research. In chapter 2 the reader is made familiar with the complexity of the studies that have been carried out by various authors on alluvial fans. Richness of terms used to describe fan morphology is made quite clear and the author clings to clarity in using terms throughout his entire book.

Problems of the evolution of alluvial fans are highlighted in chapter 3. In terms of fan morphology, the author refers to deposition of the material, plan shape of a fan, slope angle and radius, influence of climate, dissection of fan surface and braided distributary channels. Description of sediment types and sedimentary structures and how these are distributed within a fan is also part of this chapter. As a whole, the third chapter is a continuation of the reviewing part of the book. The final headings are, logically, introducing into quantitative considerations like accumulation rates, relationships between morphometric characteristics of a fan to its drainage basin, and fundamental theories on fan development.

The observations made on recent fans (man-made) and the large-scale field experiments contained in chapter 4, make this book a unique one. These observations and tests were made in abandoned gravel pits of the Gdansk area, Poland. Initial studies were concentrated on small fans (radii of 15.5, 4.7 and 7.0 m) which had formed in the pits under natural conditions. The observation period extended over three years. Data were gained on sediment types, internal sedimentary structures, interrelationship of proximal and distal sedimentation, and type and manner of sediment supply from the source area to the "mini"-fans.

Alluvial fans in postglacial landscapes of Poland are the field of interest in the second part of this chapter. Morphology and spatial distribution are discussed with respect to source area, place of deposition and lithologies of the respective source areas. I must admit that the photographs included in this part are not always very informative.

Rachocki then focuses on the formation of braided-river systems and the sedimentological features of their stream deposits and their role in creating the fan. Waste material that had been dumped from straining into the abandoned gravel pits revealed a variety of processes that also play a role in natural alluvial fans like sheet-flood action, events connected to rapid flow (i.e. anti-dunes), braided-channel systems, dissection of fan surface, material transport in the form of mud-balls and mud-pellets.

During the observations the author made up his mind to further study fan evolution from initiation to the "mature" stage. Large-scale runs were set up under conditions that involved control of discharge. Experimental fan accretion was the result. The in total nine runs were in part accumulative, i.e. they caused accretion of the fan; partly they were erosional, i.e. they led to dissection of the fan and to changes in plan morphology. The final product of the experiment was a fan of 48.1 m^2 and 6.87-m radius with an obtuse angle of 165°. The process of accumulation, changes in morphology and shape and velocity of spreading was registered after each run by means of a square grid that had been set out before the first run was started. The documentation of the experiment on photographs and line drawings makes this part of the book really unique. They show the birth and maturation of an alluvial fan.

A random walk model for braided-channel development is presented in chapter 5. Similar techniques have been applied by few other authors. The model suggested by Rachocki is comparatively simple. Creation of the pattern, by throwing dice, is described. Threehundred models created by this method served as fundament for drawing basic network models for different steps in pattern evolution. By using these basic patterns questions like re-use of existing channels, degree of system development, shifts in flow distribution and distribution of discharge are tested. The applicability of this technique to other braided-channel systems like in alluvial plain piedmonts and valley sandurs is briefly demonstrated.

In his concluding remarks (chapter 6), the author elucidates the vast importance braided-channel systems have in fan creation. He furthermore makes clear what has been the essence of his contribution to the problem of fan evolution, with special reference to the problem if a fan, at a certain stage, is in equilibrium with its environment.

The book is generally furnished with clear line drawings and very informative photographs. The style of writing is, in the best sense of the word "sober". Rachocki gives numerous useful cross-references and frequently uses citations from the original publication. When reading the text it is a refreshening experience not to be bothered with an excessive review for the mere sake of completeness. The arrangement of chapters is logical and so far no printing errors could be traced. Despite its briefness the book will be of value to both geomorphologists and geologists, especially if they are interested in statistical and conceptual modelling.

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