Morphogenetic system

A whole formed by the combination of different erosion agents present in a place and playing a role in the genesis of landforms.

The first term was defined by A. Cholley in 1938 in lectures, and in 1950 in Morphologie structurale et morphologie climatique, Annales de GÃ©ographie, the second by J. Tricart in 1962. They mark the first appearance of truly systemic reasoning in geography. The emergence of these two very closely related concepts in geomorphologic thinking was the result of the progress of research carried out in the fifties in and outside the temperate zone, which led to a critique of the notion of so-called normal erosion, attributed in the first and final analysis to the action of running waters, according to the works of W. Davis and H. Baulig. Geomorphologists then became aware of the fact that, on the one hand it was necessary to invoke several processes and inter-combined factors in order to explain the attack on rocks and the genesis of relief forms (hectometre and higher scales) and of micro-relief forms (decametre and lower scales), from disintegration by frost to transport and deposit by waters and by wind; and that, on the other hand, the combination of processes at work, and their relative weight, varied according to the places, periods and scales under consideration. As these processes are notably governed by variations in temperature and by the action of waters on slopes whose protection by vegetation also depends on temperatures and available water, i.e., on the characteristic elements of climates, erosion systems and morphogenetic systems have been distributed among a few main types closely linked with main zone climates that J. Tricart called morphoclimatic systems. Geomorphologists of the sixties divided the Earth's surface into main morphoclimatic zone systems, which were the supports and fundamental components of a zone geography illustrated by publications of P. Rognon and X. de Planhol, S. Daveau and O. Ribeiro, G. Viers, M. BenchÃ©trit, J. Cabot, F. Durand-DastÃ¨s.

Subsequent research has shown, however, that the forms of relief and micro-relief of a portion of the Earth's surface cannot be explained solely by the physical and biochemical processes currently at work. The climates and their components, temperatures, precipitation, winds, vegetal cover, water flows and soils have in the course of time undergone significant modifications, which have altered, strengthened or moderated the processes of disintegration and decomposition of rocks and of the transport and deposit of the products of erosion. Whenever these modifications are reflected in a sudden intensification of the attack on slopes and a significant transformation of the shapes of the ground surface, micro-relief or relief, the existing morphogenetic system is destroyed and replaced by another one; this process is described as a morphoclimatic crisis or erosion crisis. Thus the quaternary era went through a succession of several morphoclimatic crises provoked by an intensification of cold and frost in the polar and temperate regions (so-called ice ages) or an intensification of drought in the subtropical and tropical regions (so-called inter-pluvial periods). A morphogenetic crisis may also be provoked by a local or general upheaval, by a lowering of the base level that restarts linear erosion linked to watercourses, or by the clearing of slopes by a society (a crisis of anthropogenic erosion). Morphogenetic crises correspond to the phases of rhexistasy (from rhexein, to break) described by the pedologist H. Ehrard ("La genÃ¨se des sols en tant que phÃ©nomÃ¨ne gÃ©ologique", Masson, 1956). During these phases, previous biopedological balances are broken, as disappearance of the vegetation cover entails the disappearance of the soils and brings about a sudden attack on the slopes by running waters and by frost, which produce coarse detrital materials. On the other hand, during the phases of biostasy (from bios, life), more temperate temperatures and sufficient humidity permit the growth of a dense vegetation, and the formation of more or less thick soils which limit the attack on slopes and the production of coarse detrital materials. Forms of relief and micro-relief and correlative deposits witness the succession of these morphogenetic systems.

A fully systemic approach now leads to the integration of human societies, their actions and their concrete marks on their physical surroundings, into the morphogenetic systems. On the one hand, societies must take into account in their projects and actions a number of more or less severe risks presented by the morphogenetic systems and their components. The essential distinction is between slopes with weakly active morphogenesis, called stable slopes, and those marked by a strong intensity in the processes of rock disintegration, of land shifts or of the deposit of alluvial or colluvium material, leading to unstable slopes. On the other hand, the activities of societies modify the action of physical agents and of biological processes in the spaces they use or develop, and modify their relative impact on the morphogenetic systems, which become anthropogenic systems. If some thresholds are exceeded, vegetation disappears, rocks are more likely to disintegrate, and a morphogenetic crisis may occur, as in France on the deforested slopes of the Alps in the nineteenth century, or in the high valleys of the mountains of the Maghreb, put into cultivation after 1860 when the Berber tribes lost their lowlands, which had been confiscated by the French settlers, and had to withdraw from the high slopes. Specialists then debate about the respective roles of the spontaneous evolution of climates and vegetation, and of societies, in the transformation of local and regional morphogenetic systems .

See also : anthropization, erosion, system, environment

Bibliographie

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