Geomorphologic evolution through cataclinal processes

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Key words: cataclinal, gravitational, integrative theory, clinotropy.

When researching the relief, the term cataclinal is sometimes used, in the sense of processes and forms which appear on the front of the strata in a monoclinal structure (cataclinal valleys, for example). Different than this reductionist approach, in the presented paper the notion of cataclinal (from the Greek words „kata" and „klinos") is endowed with more larger meanings. All the processes acting on a „dislevelement", no matter their origin or their geological structure, are cataclinal. Those processes operate through various mechanisms (extension, substitution, slide motion, dissolution, evorsion etc.) which direct the force vectors into clinotropic sense. In other respect, the mobilizable materials are put into motion descendently on the slope under the gravitation force, noticing that we deal with another material and energetic vectorial sense, of gravitropic essence. The clinotropic and the gravitropic processes act as waves of aggressivity, materialized as points of „insertion" within the preexistent or autocreated dislevelements. In essence, the cataclinal and gravitational processes operate in a singenetic and sinergetic way, fact which lead us toward a unitary theory of the dislevelements modelling, the theory of clinotropy. This theory stipulates that, even if the implied forces are antagonistic (for example way of resistance, motion or readjust), they do not exclude each other, but, on the contrary, acting in contrariety, they work together, which means determined co-operation.

1. Semantic and gnoseologic significations

From the etymologic point of view, cataclinal, deriving from the Greek word kata, means or implies action, force, so energy directed against the slope (klinos). It is not about the origin of the dislevelement or of its inclining level, but about the energy, expressed by a concrete form of action and directed toward the aggradation of that dislevelment (abrupt, or correlation plan). Considering thoroughly the analysis we can notice that the original mentioned word gave birth to many meanings, a lot of term uses appearing through semantic derivations, from the field of natural sciences (physics, chemistry, geology, geography, biology) to that of humanities, reaching even philosophical generalizations. But we shouldn't stop to the simplistic aspect of the interpretation as we usually do, because beyond the "immediate offer", the beauty of the profound thought can hide, often difficult to be found out. In this way, the root of understanding the world as being animated by the two opponent forces yin and yang (strong and weak) (Chuang Tzu, cap. 25, cited by Mac, I., 2002), germinated into a very comprehensive polisemantic thought. Everything is but reduced to the acceptation according to which the existence of things and forces in a certain state is the product of the fight between opposites, which do not exclude each other, but, on the contrary, they assume each other.

The Antagonism has axiomatic value, stipulating that the energy cannot be possible, or at least cannot be noticed by us, without the inherent confrontations it implies. In this way, kata-klinos represents the expression of the fight between the resistance forces, induced in the geographical field as discontinuities by various hard factors (tectonical, petrographical, denudational, man-made), and the need of annihilating the dislevelments by energies

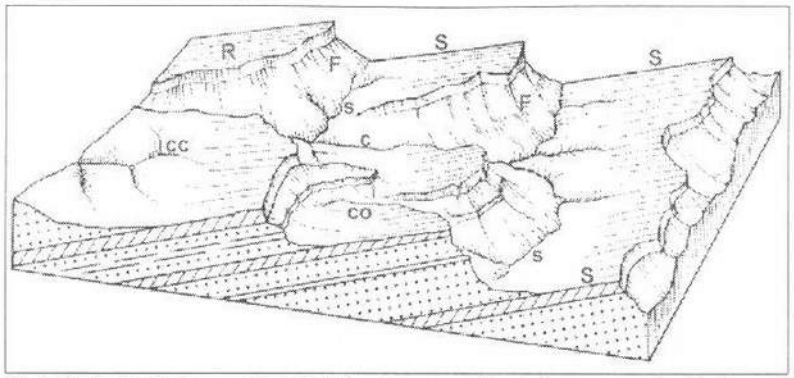


Fig. 1. Terminology in the monoclinal relief of cuesta type, according to the new approach of the theory of clinotropy:
A. The cuesta: F — front, R — reverse, S — structural surface.
B. The valleys: s — subsequent, c — consequent, co — cataclinal obsequent, cc — cataclinal consequent.

directed exactly to them (Brunsden, D., 2001).

In the Hegelian logic "light", the case taken into discussion presumes a triple plan of the antagonism application and of the dissymmetry manifestation, as follows:

• The dissymmetry between the horizontal plan and the vertical ones;

• The dissymmetry of the forces regarded as ascendant (abrupt) and descendent (cataclines);

• The dissymmetry of the substance in its evolution, in the sense that any dislevelement will successively deny itself by its own way of directing the forces involved in its evolution and transformations.

We accept here, from the dynamic logic of the contradictory of Stephané Lupasco (1982), that contrariness does not mean contradiction, but determined co-operation. From here will also derive the "catenation" concept, which implies synergic concatenations in a holonic arrangement, meaning facts, elements originating from one another and which do not exclude each other, but on the contrary, they assume each other with the purpose of giving birth to systemic wholes (Mac, I., 1993).

2. Geomorphologic Particularities

In the case of geomorphology, by tradition, a reductionist logic was installed as regarding the cataclinal process.

By relating the form of the linear erosion and especially the processes it implies (rivers, torrents etc.) with the inclination of the strata, the three well-known types of valleys were delimited: *subsequent* - directed perpendicular to the strata inclination, *consequent* — in accordance with the strata inclining and *obsequent* — contrary to the direction of inclination. The typical landform that results is the cuesta. It belongs to the morphostructural associations, its genesis being controlled by passive factors (rock, structure) and active factors (climate, hydrographic system etc.) (Fig. 1).

The geometry of the cuesta is defined by linear elements (discontinuities, edges, intersections of planes); surface elements: **front** (straight, concave, convex, in steps, combined); **reverse**, also met in various configurations (smooth, in steps, waved etc.), **angular elements** (right angles, sharp, simple, multiple etc.). If the surfaces allow fields of action for various linear and areal processes, the other elements act as regulation factors having the function of transfer, extinction and intersection thresholds. Thus, the cuesta, in its whole, is a landform with entropic evolution; its entire dynamics is oriented toward the extinction of its geomorphic potential. Even if in its first phases the shape profile appears in its plenitude on the base of the deepening subsequent valleys which leads to a altitudinal detachment between the planes of vertical framing and increases the vertical equidistance of the front, subsequently, the modeling process is directed toward the installation of reggresivity. The above mentioned facts lead to the fundamental idea according to which the cuesta relief is the expression of two antagonical directions, an ascendant one, when the geometry of the shape appears and a geomorphic potential is sized, and a descendent one, when the geomorphic potential previously created is "consumed" by "kata"- geographical processes. The cuesta dimension and its stage of evolution will express the geomorphic sensitivity. The spatial arrangement of the cuestas in a certain type of landscape may also be interpreted as a response of the modeling systems to variables of control (rock, structure, climate etc.) and state (duration).

The reductionist aspect of the geomorphologic approaches is obvious especially in the case of the cuestas, because the there are considered as cataclinal only those processes, which act on the front of the cuesta, therefore contrary to the strata inclination. A lot of questions arise in this regard, but we will stop to one of them: the torrent going ahead by regressive erosion from the base of the cuesta reverse (the monocline flank) toward the superior plane (the interfluves) is or is not a cataclinal mechanism? Within the large acceptance we give to the cataclinal meaning, the answer is, of course, "yes" (Fig. 1).

3. The Extensive Acceptance

No matter in what way the discontinuities appear in the geomorphologic landscape, the process of counteracting them in the systems evolution should be synthesized in an unitary concept which should constitute a "coagulated" theory on the cataclinal transformations.

The petrographic, structural, morphologic etc. fronts, no matter their location, become field of action for the cataclinal actions. The processes through which the modeling takes place are extremely numerous. From the sheet denudation, sheet-flood, gully erosion, torrentiality to the material mass movements and further to the erosion at the base of the waterfalls or taffoni etc., all these join together and form a large spectrum within which various mechanisms also act (extension, substitution, crioclastism, slide motion, vorticity, dissolution, evorsion etc.).

Persevering in the thinking of the contradictory dynamics, we can't resume by approaching only the cataclinal processes, a reconsideration of what geomorphology intended by gravitational processes being compulsory. Thus, cataclinal and gravitational constitute the contrariety in a modeling system in which, the materials prepared by the cataclinal processes, after some transformations, become outputs which will be redeposit under various forms and will become diluvia, colluviums, alluvia, giving birth in this way to new landforms as: deposition cones, glacises, alluvial beds etc. According as the cataclinal processes feed the system with materials, the gravitational ones takes the function of evacuation, so that new fresh surfaces increase the geomorphic modeling continuity through the same dialectics (Fig. 2).

Arriving at the point when the clinotrope materials surpass the capacity, and respectively, the gravitational evacuation ability, a morph genetic balance is reached, and the system (of the slope, torrent or river) tends to a stationary equilibrium which could be expressed by the "0" value of the geomorphic balance. The former landforms enter a "sleepy" state, new energetic manifestations and the dynamics restarting being possible on other "floors" or other directions.

It is crystal clear that, in the case of the slope for example, its systems continue to exist just because the contradiction between clinotropy and gravitropy exist (equiplane and gravitational homogenization). The energetic dynamism of the slope should comprise

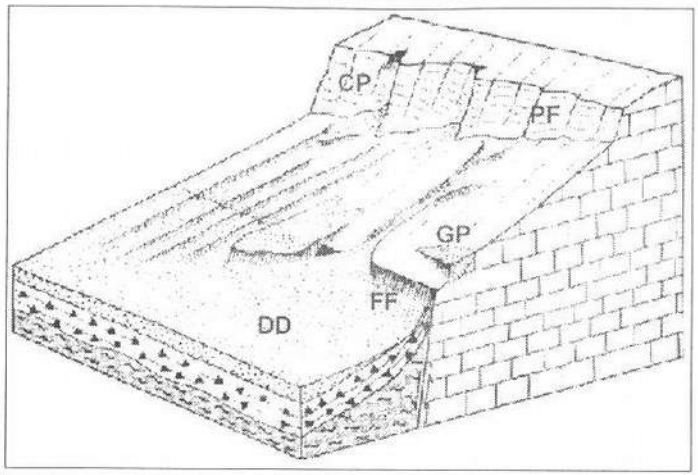
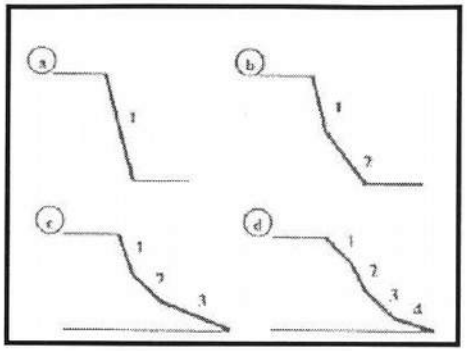


Fig. 2. The synergic action of the cataclinal (CP) and gravitational (GP) processes on a petrographic front (PF) and on a fault front (FF). At the slope base accumulations of detritus deposits (DD).

both the contradictory and the homogenization forces. The slope profile, in the diversity or restrictivity of its morphological and functional units (Fig. 3 a, b, c) can be thus considered as the expression of the fight between clinotropy and gravitropy.

The theory of clinotropy, based on the cataclinal processes and on the catenic correlations, may be included in what the contemporary geomorphic thinking consider as the concept of the sin-geomorphologic development. It is absolutely compulsory that the whole matter to be evaluated from the point of view of the time and space dimension of the aggressivity waves which are materialized as morphologic toposequences, meaning erosion levels under the form of morphologic and functional slope units. In an extremely elementary way, an isolated hill appears as an ensemble of "neuralgic" insertions (stroke points and actions), that is nucleons, which will further develop into the "origin" of the geomorphologic transformations planes. Joint in an unitary co-operation, the cataclinal and gravitational forces and processes compose a clinotropic motion of down slope wearing form, which vary depending on the climate, litology and structure.

a.



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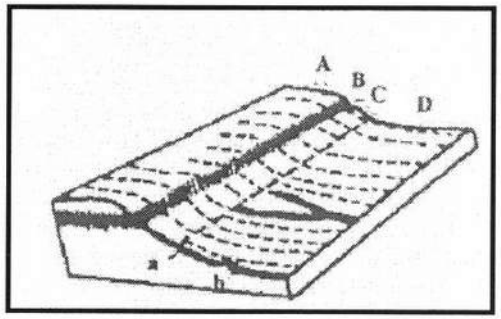

c.

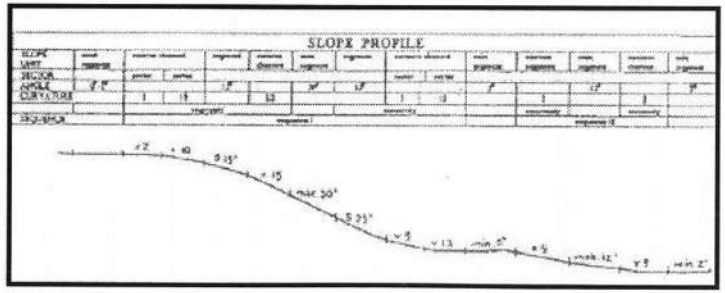

Fig. 3. a. Morphological units of the slope: a — abrupt, b — two units, c — three units, d — four units
b. The elements of the slope according to L. King conception (1953): A — waxing slope, B — free face, C — debris slope, D — waning slope.
c. Slopes terminology (according to Young, 1964).

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Consideraţii asupra rolului geomorfologiei aplicate în planificarea teritoriului

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Cuvinte-cheie: geomorfologie aplicată, obiective, planificarea teritoriului, poliţia mediului

On the role of the applied geomorphology in the territorial planning. Applied geomorphology may be defined as the application of geomorphic understanding to the analysis and solution of problems concerning land occupancy, resources exploitation, environmental management and planing. Applications of geomorphology can be divided broadly into two classes: 1) Man as a geomorphic agent, in terms of his inadvertent and plannned effects on geomorphic processes and forms; 2) Geomorphology as an aid to resource evaluation, engineering construction and planning. Objectives of applied geomorphology are: the identification of landforms, the description, the explanation of their origin, the postdiction and prediction of change. For each objectif more examples are discussed.

„Cercetarea ta să aducă omenirii foloase economice, sociale şi culturale."
Mario Bunge, 1984

Ca şi în cazul altor ştiinţe, dezvoltarea şi progresele cunoaşterii în geomorfologie, precum şi unele necesităţi impuse de evoluţia civilizaţiei, au determinat o permanentă aprofundare, uneori pe domenii extrem de înguste, a abordării fenomenelor referitoare la relief. Aceasta a condus la individualizarea unor direcţii de ştiinţă, astfel încât, în momentul de faţă, fără nici o exagerare, putem spune că *geomorfologia* a devenit un sistem de ştiinţe, derivat dintr-o structurare firească a cunoaşterii reliefului. *Geomorfologia aplicată* reprezintă acel domeniu al geomorfologiei care, prin elaborarea unor predicţii cu privire la dinamica reliefului, prin prezentarea potenţialului geomorfologic al unui teritoriu dat — de la elementele de geometrie ale reliefului până la cele de stabilitate şi hazard în apariţia şi dezvoltarea unor procese — se implică în rezolvarea unor situaţii social-economice. Este o ramură consacrată de şcoala de la Strasbourg (creată de Jean Tricart). Realitatea este că în mai toate ţările lumii în care geomorfologia a cunoscut o emancipare după al II-lea război mondial, o asemenea ramură s-a impus prin natura lucrurilor.

Se cuvine însă o precizare ce trebuie bine subliniată, şi anume: nu puţini dintre cei care vin sub incidenţa necesităţii de a implica geomorfologia în soluţionarea problemelor menţionate în definiţia obiectului geomorfologiei aplicate reduc evaluarea factorului relief la descrierea geometriei lui. Or, aceasta este sarcina topografiei, de care geomorfologia se distinge ca ştiinţă aplicativă şi genetică a formelor de relief, în timp ce topografia se limitează la descrierea pur geometrică, respectiv, la relevanţa cu exactitate a fizionomiei terenului şi elementele sau obiectivele de pe el: păduri, râuri, drumuri, construcţii de altă natură ş.a. Firește, toată această bază topografică este foarte necesară, dar nu suplineşte partea explicativă şi genetică, partea de cunoaştere a dinamicii formelor de relief. Doar evenimentele deosebite, de multe ori denumite catastrofice, i-au pus pe practicienii la care ne-am referit în situaţia de a considera că relieful nu este numai topografie. În consecinţă, geomorfologia şi-a câştigat statutul de disciplină aplicativă, tocmai prin caracteristicile genetic şi istorist intrinsece în explicarea reliefului, deci prin posibilităţile