

Relief

The relief of a region can be defined, as a first approximation, as the different forms, or the salient and hollow volumes that make it up - "a family of topographical forms" in the phrase of De Martonne. However, while relief is a geographical object that has been widely studied, analysed and interpreted by generations of specialists, explorers and geographers, it has not often been precisely "defined". This is probably because the notion of relief includes one of the most obvious irregularities of the earth's surface, altitude, the third dimension of geographical space, which is the most conspicuous, and hence seems not to require lengthy consideration. Relief is obvious, and geodesic measures bear this out. It is common to see works at the end of the 19th century and in the early 20th century starting with the study of the different aspects of relief - "formes du terrain" (de la Noë and de Margerie, 1888), the "dessin géographique" (Lapparent, 1896), of the "relief du sol" (Martonne, 1905) (roughly, forms of the terrain, geographical layout, relief of the ground), this being generally accompanied by a reminder of the methods of measurement and topographical representation.

Etymologically the word relief comes from the vernacular Latin *relevium*, from classical Latin *relevare* which referred to the action of raising or raising again, with derived meanings in English (feeling relief, relieving pressure, relief worker etc), and also in French, among which the term for topographical surveying. With the development of the arts and sciences in the 19th century it became an architectural term (low relief or *bas-relief*, for instance). The development of cartography brought topographical and military usages (De la Noë for instance was at once a topographer and a lieutenant-colonel when he published his work on the "forms of terrain"). In French the word also refers, in addition to differences in altitude across different parts of the earth's surface, to the height of a work of fortifications above the terrain on which it is constructed, and in the navy to the height of a vessel above the water level.

With the development of geology and physical geography in the second half of the 19th century, rather than mere "drawings" by topographers, we find references to the "relief of the earth's crust" and "shape" (*le modèle*, De Lapparent 1882, now termed "landform" in English), showing that the issue was no longer to describe, but to explain. Finally, relief came to be apprehended as the result of different processes, as in the phrase "the expression of structures, dynamic forces and the history of the planet" (Peulvast & Vanney, 2002). This also required integration of the time-spans required for these "forces" ("internal and external", Reclus, 1868) to develop "families of topographical forms" (Martonne, 1905, time that was thereafter expressed in millions and hundreds of millions of years. This is very far removed from landscape as apprehended by Vidal de la Blache, spaces as they have been developed by different societies, or environment shaped over generational time. This was the start of "geomorphogenics" (Lawson, in De Lapparent, 1896), and "geomorphology", a notion created by English-language academics under Davis, McGee, or Gilbert. This is defined as the science that studies relief forms (both terrestrial and, by extension, that of the planets as they become accessible). This apprehension of very long time spans does not really suit the geographer, it is more a matter for geologists. It was these time spans that were constantly put forward in the 19th century to counter religious dogma. Geo-morphologists for their part focused more on analysis of the surface of the globe and superficial processes, relating this first and foremost to physical geography, and then to the sciences of the "environment".

The definition of relief is complex because it requires reference to several parameters. It is indeed at once the expression of altitude, of slope, and of form, while at the same time reflecting the relationships that exist between these different elements. There is a Chinese proverb that expresses this very well: if there were no mountain, the plains would not be seen. Indeed, associating relief solely with high altitude zones is reductive, even if slope, shape and altitude are most prominent in "mountain" ranges. All portions of the terrestrial surface have relief. The different types of relief result from the geodynamics of the globe (rheological behaviour of the earth's crust and lower layers, lithospheric plate tectonics generating thrust, uplift, "volcanoes", earthquakes etc.) and from external geodynamic processes (river erosion, glacial erosion, chemical processes etc). It is the sum of all these processes that enables an understanding of what should be attributed to one or other type of geodynamic, what relates to primitive forms and what to derived forms. Present-day reconstitutions of paleo-climates, the quantification of different processes, and the understanding of time scales in the elaboration of forms and formations, all provide insight into the history and origins of characteristics we can observe today.

The many aspects of the study of relief has led researchers, and in particular geographers, to make a series of distinctions. These are found in classic manuals, but sometimes too easily forgotten today.

• The distinction between relief and landform. The term landform refers to a particular aspect of the surface of the volumes or forms making up relief. A shape such as a dissymmetrical talus can occur between flat surfaces and steep slopes, or between slightly undulating surfaces and more progressive slope changes – in either case the relief feature is the same, but the landforms are

different.

• The distinction between purely descriptive terms, and terms that refer to explicative processes and to morphogenesis models. Descriptive terms are generally fairly precise, and obtain a consensus. There is usually more debate and uncertainty about explicative terms. Habitually it has been words from common language that have been used, giving them more restricted and precise meaning, in reference to a particular explicative model. There is a considerable arbitrary component in this manner of operating, so that debate can arise. (Thus in English the word "combe" refers, according to the OED, to "a short valley or hollow on a hillside or coastline, especially in southern England" while the geological term is given as "a dry valley in a chalk or limestone escarpment", while there is also a mention of a link with the Welsh "cwm" or valley. In French the word "combe" also has a general meaning of a small valley, but is used more specifically in geology to mean a valley running along an anticlinal axis). Hence terms can be somewhat ambiguous and appear non-specific. However the "manufacture" of these terms in reference to their roots is a useful aspect, which tends to support this practice.

Slopes are possibly the most eloquent expression of relief. Combined with altitude they generate bioclimatic levels (and the corresponding drops in mean temperature). Slopes, on account of their configuration, produce topographic and/or ecosystem boundaries limiting the diffusion of innovations (disease, animal and plant species, humans etc). Thus slope systems are studied today in a globalising, systemic approach, so as to gain better understanding the chain of geomorphological processes and events, from natural vagaries upstream (precipitation, snowfalls, volcanic eruptions etc) to downstream vulnerabilities and «risks» (flooding, landslides, lahars etc.). This is all the more crucial because slope areas are frequently inhabited and developed by human societies.

See also: " earth"

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