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Comments on what the Romans knew about Alpine Landforms and Processes

Delphine Acolat

EDITOR'S NOTE

Translation: A.C. Wickens.

- 1 Historians of military events (Titus Livius 1st cent. B.C., Quintus Curtius, Tacitus 1st cent. A.D., Ammianus Marcellinus 4th cent. A.D.), poets (Silius Italicus), encyclopaedists and chorographers such as Strabo, Pliny the Elder, Pomponius Mela, Seneca (1st cent.) provided Roman World literary authors with material for limited descriptions of certain geomorphologic elements and phenomena particular to high range mountains. Did these authors however, attempt to use specific terminology, try to analyse and understand the causes and mechanisms of such formations or events? Their descriptions of alpine realities and of phenomena observed leave us today with no evidence of the exact meaning of the terminology used. In this instance, during Antiquity, both Latin and Greek used generic terms rendering us unable to determine their actual geographic knowledge or lack of, and likewise, to establish whether methodical effort and reflection were put into interpreting unrecognised scenery.

Were glaciers and crevasses known to the Romans?

- 2 The desolate landscape, the inaccessible solitude terrified the tired soldier. He had reached the end of the world. Wherever he looked, in awe, he saw desert, with no trace of civilisation¹. Quintus Curtius' description of an alpine glacier renders well a scene of "desolation", "desert", a frightening, repelling place where life cannot be sustained. It is a description typical of the landscape at the high altitude level of eternal snow. The author

rightly insists on the aspect "end of the world" of high mountains. Just snow and rock. As authors of the Roman World mention ice landscapes, one wonders if they actually had a true perception of glaciers and the risks they implied: crevasses. The Alps count numerous glaciers, and the itineraries most commonly used by the Romans across the Alps from Gaul to Italy were precisely such iced environments with seracs and remarkable moraines (such as The Grand St Bernard and the Brenner Pass). And yet, no specific term is used to designate them². Therefore, when, in texts pertaining to alpine glaciers, authors refer to "astounding traps in the terrain" (*locorum fraude*³) we are left with an interpretation problem.

- 3 In Greek, when Plutarch relates the crossing of the Alps by the Cimbri: *pagôn kai chionos batheias*, we come across an ambiguous expression⁴. The actual notion of depth, of hollow, even of thickness, is essential to a description of high mountains accurately evoking alpine glaciers. In the same context in Latin, two words exist meaning "fracture" and "cavity". "*Hiatus*", used by Silius Italicus easily describes the collapse of a snow bridge: "*The snow loosens, opening a crevasse engulfing men*"⁵. Then "*lacuna*", used by Ammianus Marcellinus, insisting on the danger of what he describes as a hole "*hidden by accumulated snow*"⁶ which is the reality of a crevasse⁷.
- 4 Again, in the same context of high mountains, two other examples strangely describe what resembles the physical reality of a crevasse. Quintus Curtius uses a periphrasis "*a kind of cave*", *uelat fouea* and *fossa*⁸. These caves are very deep and insidious, therefore dangerous. According to Quintus Curtius, rescuing those who fell was extremely difficult, which is precisely the case of crevasses with the permanent risk of collapse of both sides and edges under the weight of men, engulfing them in the fall: *They sank into kind of pits that engulfed them and when fellow soldiers tried to pull them out, they dragged their rescuers in more often than they were pulled out*⁹.
- 5 Another quote, by Ammianus Marcellinus, is also puzzling, for he seems to me astute in his description¹⁰ of a "flat" glacier in the Gallic Alps, with crevasses that, as he says, "engulf" travellers "in their treacherous ice"¹¹. In this context of danger and ice¹², it seems unlikely that we are dealing with "valleys" as defined in today's modern language. "*Vallis*" can be translated as "hole" or "hollow" and adjectives *patulae* and *perfida* convey accurately the image of the trap a crevasse constitutes when hidden by a bridge of snow or when its iced edges collapse under the weight of a man.
- 6 As we can see, the presentation of these treacherous "holes" or "hollows" is that of danger, which remains predominant in the description of this environment of ice. In a typically Roman utilitarian and prophylactic perspective, which in itself justifies the quotation of high mountain characteristics, Ammianus Marcellinus notes an alpine technique that ensures safe winter travel through snowy terrain and prevents falls into crevasses or precipices: *It is for this reason that people who know the area well plant wooden poles in the secure spots, forming a continuous line that safely guides the traveller. If these poles become buried under snow or are knocked down by a mountain stream, it is then difficult to follow these paths, even with local people to show you the way*¹³. We note here the association of a technical practice (beacons of a kind) and the use of indigenous guides.

Avalanches and rockfalls

- 7 Both avalanches and rockfalls are characteristic phenomenon of steep slopes. On every occasion, they constitute a sudden fall of snow or rock from an overhanging summit. The idea, common to both phenomenon, of a violent and disastrous slide explains the choice of the word *ruina*¹⁴ in Latin. Silius Italicus distinguishes between the rock falls and an avalanche. An avalanche, being of course a mass of loosened snow, is identifiable by the notation of humidity: *And the avalanche thundering down from the summit buried the squadrons in a humid mass...*¹⁵ the rock fall is clearly defined and described as the side of the mountain coming down in large blocks: *On the Alps' summits when a whole side of the mountain detaches itself, the blocks fall from high above, ripping apart with tremendous noise, the flank of the mountain*¹⁶. An excellent description: the preterit *reuulsa* evokes the tearing away of rock, then the conjugated verb *scindunt* repeats the notion of tearing and adds that of cutting into the rock. Silius Italicus mainly insists, along with that of noise, on the horrific and dangerous aspect of such unpredictable phenomenon, a natural catastrophe creating an "obstacle"¹⁷ to passage and against which man is powerless. Titus Livius, for his part, is more interested in the consequences than in the phenomenon itself. He relates a "landslide" (*lapsus terrae*) a more general term, meaning in fact a rockfall. He describes with great accuracy the terrain's configuration (a steep slope) conducive to this kind of event. *The terrain, already very steep at the start, became abrupt as a result of a recent slide to a depth of at least a thousand feet. (...) Hannibal was told that the whole side of the mountain having fallen, they could not go any further*¹⁸. The consequence of such falling rocks is clearly stated: the terrain has become more abrupt (Titus Livius says in this instance *recta saxa*¹⁹), a huge rock has fallen from a height of 265 m (an incredulous height, a probable hyperbolic statement) and is blocking their way.
- 8 These examples indicate that the Roman authors had, at times, observed these phenomenon, but had made no attempt to understand their origin or what exactly caused them to happen. All that remains is a description of the phenomenon itself and eventually of its consequences. Strabo is the only one having produced the most accurate and surprising assessment of what corresponds to an avalanche, maybe even of what is scientifically called today a "wind induced avalanche"²⁰. After having described the process of "sliding", characteristic of an avalanche as mentioned above, Strabo distinguishes clearly the formation stages of these "hardened layers of snow" (a hardening which brings him to talk of ice). It is clear that he means an accumulation of successive layers of snow. This accumulation of hardened snow and the separation of the above layers from those beneath is a perfect description of an avalanche. An avalanche is triggered when the weight of the upper layer is too important: it slides off the layer underneath. Strabo's description is so precise, virtually scientific, since he gives us the components of the phenomenon, its structural pattern, stages of development, and two possibilities of outcome (stability followed by melting or avalanche). The writer again insists on its dangerous aspects, since, he states "one cannot avoid it" and as for its amplitude "it can engulf whole convoys".

Seasonal floods and torrential erosion

- 9 Antiquity writers knew of and described the violence of precipitation, cold, freezing and snow falls specific to mountainous climate. It is logical that they had knowledge of the direct consequences these waters flowing down the mountains would have. A torrent is by definition an irregular body of water, and the word *torrens* exists in Latin, evoking impetuosity. It carries water which can become "wild" after a storm, seasonal rain or melting snow. These impact on the regularity of its flow. Today, we talk about snow retention, a deficiency in the river discharge during the cold season, when precipitations in the form of snow instead of rain accumulate and fill the streams later on.
- 10 Precipitation regimen change in mountainous areas was well known in Ancient Times. Strabo, for example, states that the river Po was periodically "filled", in other words fed by rain and snow²¹. He alerts the reader of the consequences in plain areas of torrential floods in the mountains, giving precise data of the phenomenon as well as the critical timing of spring rainfalls in addition to melting snow. He names Aristobule as a reference, since he witnessed this type of flood in Paropamisus, in India²². Torrential floods are not typical of this region in India, but local monsoon rains are. Strabon explains that *torrential rains originating in the Alps are responsible for the damage caused by water, lasting sometimes until summer, as a result of snow melting*²³. In Greek, the substantive *cheimarroi*, meaning "torrential through-flow" is proof of the explanation given by ancient authors: it is derived from an adjective with the exact meaning "made bigger or formed by storm or winter rain". The adjective itself is composed of the verb "to flow" (*reô*) and the noun *cheima*, conveying the idea of bad stormy weather or of cold season. In a wider sense, it can mean "torrent" with the connotation of violence and rising waters. Pliny the Elder uses *torrentior* for the river Pô²⁴. Writers of Roman period therefore, had most accurately established the rapport between seasonal rain, melting of snow and increase in the regimen of torrents, proof of their diligent observation of mountainous streams at different times of year. When torrent waters rise, rain downpours gather fast eroding mountain slopes. The natural force and speed of the torrent's water are increased by the slope's declivity. This process of erosion of the slopes was easily observed during heavy downpours. To illustrate this, there is a second Greek word we can translate as "torrent": *charadra*, a furrow caused by a stream of water. Many words derive from this noun, all linked to erosion (literally "furrowing" or "digging") of the mountain by a torrent. Any body of water with the characteristics of a torrent "will dig its bed as a ravine": a *potamos charadrôdês*²⁵. Quintus Curtius, in Latin, talks about rapid and violent torrents "digging caves": *ingens uorago, concursu cauata torrentium*²⁶.
- 11 Other than gullying, Romans perceive erosion also as the ripping by the tractive force of flowing water of vegetation and rock debris from mountain slopes. As water rushes down, heavy debris (trees, blocks of rock) increase its force. Seneca describes these floods due to snow melting combined with torrential rain²⁷, giving great detail of the destruction the torrent can cause as it carries with tremendous force debris ripped from the mountain side: *the current washing away the slopes, charged with rocks ripped away from the side of the mountain*²⁸. The notion of debris being ripped out (*rapit, disiectas*) and carried (*ferens secum*) by the force of water (*deuolutus, rotat*)²⁹ is well rendered. Seneca uses appropriate vocabulary to describe the phenomenon of erosion, especially when it comes to the destructive force of water.

- 12 The effort to analyse and observe in detail the different elements of the process of hydraulic charge linked to declivity is obvious. Finally, we owe Silius Italicus for the most explicit description of torrential erosion affecting mountain slopes. Not only does he speak of "ripping out" but more subtly of "wearing away" by the action of water: *The river Durance, taking its source in the Alps, carries with astounding clamour ash trees and debris ripped away from the mountain side, a roaring noise as the current rushes by*³⁰. With the Durance, we find all the specific elements of a torrent, as we have studied them: eddies and water falls (*uoluens, spumanti uertice*), roaring noise (*sonitu, latrantibus undis*, virtually sounding like a dog's bark), irregular flow (*translato cursu*), seasonal flooding (*imbre fuso*), trees uprooted (*auulsas ornos*), and particularly the notion of "wear and tear" of the mountain (*adesi montis*) and of "debris" of all sizes, carried by water (*fragmina*).
- 13 However, despite the precision of description and accurateness of remarks on the torrential flow of the Durance, it was not the author's true objective to make a scientific analysis of the process and determine mountain specificities. All was meant to emphasise the danger this type of stream represents and to add to the dramatisation of his recounting of Hannibal and his army crossing of the Alps. The phenomenon of erosion was perceived more as a "trap" planted by nature against man (*fallacia*), as are also, the physical realities of high mountains. The author's work is not meant as a study of geography using a specific method. However, the exactitude of the description reveals sound knowledge of the phenomenon. In Ancient Times there was great interest in the path and the nature of mountain streams, for they modify the make-up of landscapes. As a result, a mountainous landscape was shown as tormented, gullied, subjected to aggression by the same water so beneficial and indispensable in the plains, and more than anything else as an unstable place, full of horrendous surprises. To protect the roads built along the side of the mountain from damage done by running waters, Roman engineers "cut" into the natural slope, creating side banks to compensate an inclination in the downslope portion, with materials dug from the upslope portion (Chevallier, 1997).

To estimate rather than measure: the misappreciation of altitude and the relativity of judgement

- 14 Judging (or estimating) the height of a mountain was merely an approximation in Ancient Times. It was done in relation to the immediate environment. Dealing with a range of mountains is far more difficult. Pliny gives an excellent example when he asserts that Mount Viso is "one of the highest summits of the Alps": *Vesuli montis celsissimum in cacumes Alpium*³¹. Mount Viso is part of the range but its' height is incorrectly assessed, influenced by that of neighbouring summits with which it is compared. It is wrongly considered the highest mountain of the Alps at 3841 m, when in fact the Mont Blanc culminates at 4810 m. It is considered the highest since its characteristic pyramidal mass rises to dominate surrounding mountains and especially the plain of River Po. For the Roman observer located in the plain near Torino³², it rightly does appear to be the highest of the Cottian Alps and therefore was hastily thought as the highest of the whole range. Summits of more than 3800 m are numerous in the Alps, but went unnoticed as such in Ancient Time, for they do not stand out in relation to their immediate environment (as don't summits of 4000 m by the Mont Blanc or in the Swiss Alps). The best proof of such indifference is that these mountains were not named. Mount Viso is a remarkable exception, because of its' impressive height it received a name: *Vesulus*, justified by the

visual impression it creates. The impression is easily demonstrated when looking at a photo of Mount Viso and surroundings, taken from the plain of Turin (See photo 1).

Photo1. Mount Viso and surroundings, taken from the plain of Turin.



- 15 Mount Viso stands out and its' height is estimated particularly "huge". Situated at the far end of the Alps, on the Italian side, the mountain does not blend in with other summits of the same importance; on the contrary, it stands out, dominating all in the area. It can be seen from Piedmont, furthermore, from afar.
- 16 The assessment of height remains quite vague and varies according to the reference mark chosen. At best, when an attempt is made to have a "scientific" measure, it is based on the length of time taken to cross the range, not on its' altitude. Strabo relates information given by Posidonius who had crossed the Alps at Montgenèvre. Strabo mentions the height of a summit in Medulla Territory as being 100 stadiums (approximately 18,5 km³³). He is not quoting altitude but distance, that of going up or coming down Montgenèvre Pass, considered a summit because, in fact, it is the highest point reached by the Romans when crossing from Gaul to Italy. Again, the attempt to have a precise figure is dictated not by a geographical reality but by usefulness: an estimation of how to facilitate the crossing of the Alps.

Conclusion

- 17 Phenomena specific to altitude and mountain climate obviously did interest the Romans, because they conditioned their ability to penetrate this type of terrain, to identify the time of year when passage was not possible (or at least not recommended), to assess the difficulty of needed transformations, in other words to determine how potentially useful these somewhat hostile areas could be. Assessment criteria of risk based on vegetation,

freezing, the presence of rock, enabled them to define and gain knowledge of certain morphologies typical of high mountains, of which the Alps are the paradigm.

- 18 Mountains constitute an environment where mechanical actions are aggressive with widely spread effects. Any time something specific was noted, that put forth the harshness of the milieu, it was to observe a useful practice of the mountain population or to find a technical procedure to counteract danger. These were given names, somewhat vague in application, no specific vocabulary was created that would apply only to mountainous terrain. Despite certain efforts towards precision in their analyses and descriptions, there is no true interest in the geographical reality of mountains, only in their possible concrete exploitation.

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NOTES

1. Q.C., V, 6, 12: "locorumque squalor et solitudines inuiae militem terrebant, humanarum rerum terminos se uidere credentem. Omnia uasta, atque sine ullo humani cultus uestigio attoniti intuebantur".
2. The word "glacier" with its definition only appears in the 18th century; the first accurate description of these "piles" or "rivers of ice" recognised as such dates from the 16th century.
3. Q.C., V, 5, 1.
4. Plut. The life of Marius, 24. The Belles Lettres edition translates in French: "piles of ice and snow" but in my opinion the notion of depth rendered by *batheias* is too easily left aside.
5. Sil.It., Punic War, III, 520-521: "(...) Haurit hiatu/ nix resoluta uiros (...)".
6. I consider here that F. Galletier's translation, published by Belles Lettres, adroitly avoids the problem of the crevasse, by stating "ravines hidden by snow drifts". The word *lacuna* does not mean "ravine" but just "hole". Yet, there is a definite difference in size and meaning in French for these two words. Even E. Gaffiot suggests "crevasse for this passage"...
7. Sil. It., XV, 10, 4: (...) *lacunas pruinarum congerie latebrosas* (...) "crevices hidden by the accumulation of snow".
8. Q.C., V, 5, 1 : *praealtae praecipitesque fossae*, "very deep and steep pits". It is to be noted that the term *fossa* can be used in the context of mountains in a very different way. Tacitus gives us an example when he evokes Nero's project of digging a sort of canal/tunnel (*fossa*) through the mountains overlooking the region of Lake Avernus (Tac., Ann., 15, 42, 2).
9. Q.C., V, 4, 18 : *quippe uelut in foueas delati hauriebantur et, cum a commilitonibus adleuantur, trahebant magis adiuuantes, quam sequebantur*.
10. I am deliberately shifting from F. Galletier's translation in the Belles Lettres edition : "the wide valleys, where flat surfaces are unsafe because of ice, occasionally engulf travellers".
11. Amm., XV, 10, 5: *Patulae ualles per spatia plana glacie perfidae uorant non nunquam transeuntes*: "Those who cross wide open spaces occasionally fall into gaping holes, tricked by ice cover".
12. It is common for mountain descriptions in Greek and Roman texts.
13. Amm., XV, 10, 5: *Ob quae locorum callidi eminentes ligneos stilos per cautiora loca defigunt, ut eorum series uiatorem ducat innoxium ; qui si niuibus operati latuerint aut montanis defluentibus riuis euersi, calles agrestibus praeuiis difficile peruaduntur*.
14. Tac., Histories, IV, 22, 4 actually compares the fall of Roman enemies surrendering their side of the mountain to an avalanche or a rock slide using the term *ruina* : *deturbati ruinae modo praecipantur*.
15. Sil., III, 521-522: (...) *altoque e culmine praecipites/humentis turmas operit delapsa ruina*.
16. Sil., I, 370-373: (...) *Alpibus altis/aeriae rupes, scopulorum mole reuulsa,/haud aliter scindunt resonanti fragmine montem*.

17. Sil., III, 540: importuna locorum.
18. Livius, XXI, 36, 2-3: Natura locus iam ante praeceps recenti lapsu terrae in pedum mille admodum altitudinem abruptus erat. (...) Muntiatur rupem inuiam esse.
19. Livius, XXI, 36, 1: "steep face rocks".
20. Str., IV, 6 6 : "It is impossible to avoid these enormous sheets of ice sliding from high above capable of carrying away a whole convoy, precipitating it into the abyss off the roadside. In effect, numerous plaques of ice <of frozen snow> accumulate on top of each other creating piles of hardened snow. The top layers always tend to detach themselves from those underneath before melting in the sun".
21. Str., V, 1 5: "<The Po> is a very large river, its waters frequently swollen by rain and snow".
22. Str., XV, 1 17: "< Aristobule says> mountains have snow in the winter; at the beginning of spring, rain starts to fall, becoming heavier and heavier; pushed by summery winds, the rain falls non-stop, day and night, until the rise of Arcturus; then the rivers, with waters swollen by snow and heavy rain, flood the plains".
23. Str., IV, 1, 12.
24. Pliny, III, 117-119.
25. Str., XI, 3, 4.
26. Q.C., V, 4 23: "An enormous cave, dug by the rush of torrents".
27. Sen., Naturales Quaestiones, III, 27, 7: deuolutus torrens altissimis montibus rapit siluas male haerentes et saxa resolutis remissa compagibus rotat (...). "A torrent rushing down the mountain with great force, uproots already unstable forests, rolling loosened rocks".
28. Sen., QN, III, 27 9 : Danuuius iuga ipsa sollicitat ferens secum madefacta montium latera rupesque disiectas (...).
29. Today we talk about "load".
30. Sil., III, 469 sq : (...) Namque Alpibus ortus,/ auulsas ornos et adesi fragmina montis/ cum sonitu uoluens, fertur latrantibus undis/ ac uada translato mutat fallacia cursu,/ non pediti fidus, patulis non puppibus aequus/ et tunc, imbre recens fuso, correpta sub armis/ corpora multa uirum spumanti uertice torquens : "The river Durance, taking its source in the Alps, carries with astounding clamour ash trees and debris ripped away from the mountain side, roaring as the current rushes by, changing the place of it's bed, making it difficult to find a ford for crossing: uncertain for the simple soldier on foot, impossible for large embarkations; rain having swollen its waters, it snatched a great number of men along with their weapons, carrying them away in it's frothy eddies...".
31. Pliny, III, 117.
32. Pliny was born at Como, Italia.
33. Str., IV, 6 5: "It is said that their steepest ascension was of 100 stadiums and that it was the same on the des-cent to Italy's borders".

ABSTRACTS

During Antiquity times there existed little specific vocabulary pertaining to mountainous relief. Did Romans know what glaciers, crevasses, avalanches, rock falls, seasonal torrential erosion were? Could they estimate the height of the Alps? The phenomenon and dangers of alpine

geomorphology were described by Greek and Latin authors of the Roman World mostly to warn the traveller of its consequences, in an attempt to ensure safe passage.

Le vocabulaire géographique spécifique au relief montagnard n'existe pas ou peu dans l'Antiquité. Les Romains connaissaient-ils pour autant les glaciers, les crevasses, les avalanches, les éboulements de rochers, les érosions torrentielles saisonnières ? Savaient-ils chiffrer la hauteur des Alpes ? Si les auteurs grecs et latins du monde romain décrivent un processus ou un danger géomorphologique alpin, c'est surtout pour ses conséquences sur le voyageur, dans la perspective utilitaire du passage.

INDEX

Mots-clés: Alpes, antiquité, avalanche, connaissance scientifique, érosion, glacier, relief alpin

Geographical index: Cottian Alps, Gaul, Mount Viso, River Po

Keywords: alpine landforms and processes, Alps, antiquity, avalanche, erosion, glacier, knowledge

AUTHOR

DELPHINE ACOLAT

Université de Bretagne Occidentale, Brest.

acolat@gmail.com