On a common misconception arising from a flawed reading of *Tableau de la géographie de la France*

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At primary – and sometimes secondary – school, almost all of us will have learned that there are *old mountains*, with round summits that have been eroded away over time (such as those of the Massif Central), and *young mountains* with sharp peaks, typified by the mountain chains of the High Alps. This anthropomorphic image, easily etched into children's memories, has enjoyed remarkable success over the past century, so much so that it provided the inspiration for one of the illustrator Marc Reiser's most famous cartoons.

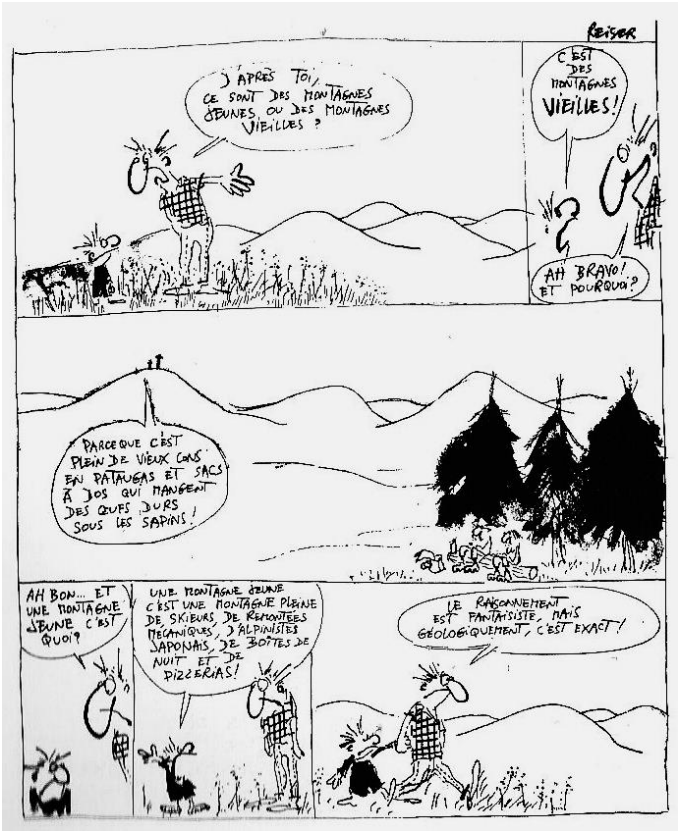


Figure 1: **Le Nouvel Observateur*, 24–30 July 1982.***
– "So, are these young mountains or old mountains?" – "Old mountains!" – "Bravo! And why?" – "Because it's full of old fogies with hiking boots and rucksacks eating hard-boiled eggs under pine trees!" – "Ah, right. So what's a young mountain?" – "A young mountain is full of skiers, ski lifts, Japanese mountaineers, nightclubs and pizzerias!" – "Your reasoning is far-fetched, but sound enough from a geological point of view."

The cartoon is striking and the dialogue amusing, but the conclusion is false. The jaggedness of a mountain range depends on the power and type of erosion acting upon it, which itself depends on the altitude of the mountains, and not on their more or less venerable age. The platform beneath the Massif Central rose up at the same time as the neighbouring Alps and gains in altitude as it approaches them. This is exactly what Paul Vidal de La Blache says when he explains the phenomenon at the end of the extract of the *Tableau de la géographie de la France*[1] presented here.

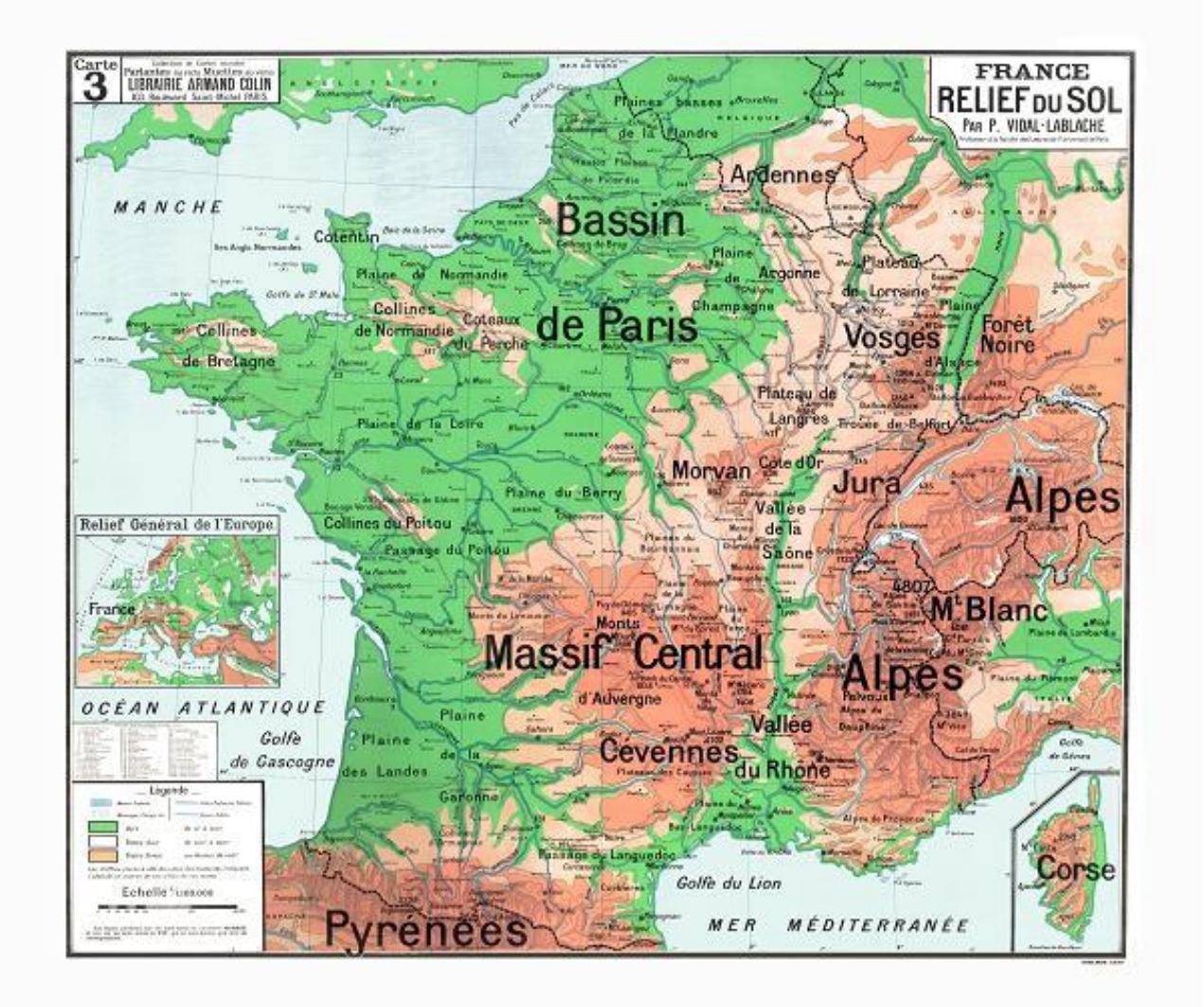
> *An awakening of orogenic forces contemporaneous to the Alpine convulsions rejuvenated part of the Massif. Thus whole swathes of the structure, dislocated once again, were raised up; some, such as Mont Lozère, to an altitude of up to 1700 m.*

***Figure 2:* Mont Lozère, the highest peak in the Cévennes**
(southerly view from the Aubrac plateau) (WikiCommons auteur Jmp48)

Why, then, is Mont Lozère so commonly (but incorrectly) considered an ancient mountain formed in the Palaeozoic era? The same question can be asked of the Vosges, whose gently rounded summits – the famous *ballons* – indicate gradual subsidence since the Hercynian orogeny. The main reasons for this misunderstanding are probably – and paradoxically – contained within the text

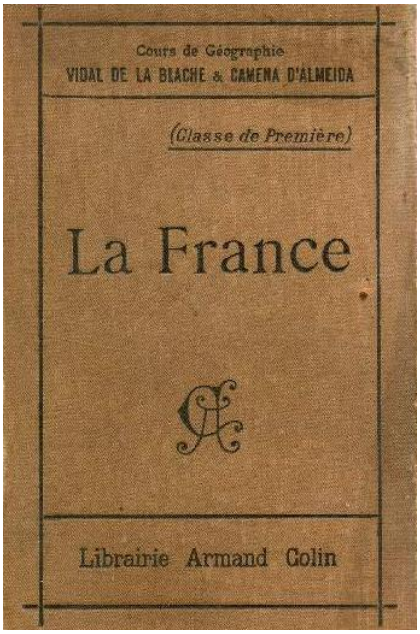
1. *Tableau de la géographie de la France*, p. 248–250, ed. 1908.

we are considering here. The publication in question has long been a staple of geography teaching in teachers' training colleges in France. Vidal-Lablache maps – the aristocratic particle was dropped – were long used to decorate provincial French classrooms, while textbooks jointly written by the founder of modern French geography and Pierre Camena d'Almeida[2] have been read by generations of *lycée* students. How, then, did their explanations – which are accurate, if a little simplistic and lacking the mathematical precision now expected of science – give rise to such misguided ideas?



***Figures 3 and 3a:* Vidal-Lablache Relief Map, Librairie Armand Colin** *(Photo from the blog Jelidee). The top-left title block states that the map "speaks on one side [and is] silent overleaf". (Below)* **Cours de géographie Vidal de La Blache – Camena d'Almeida** *(for* première *(Year 12/Grade 11) students) (ed. 1909)*

2. P. Vidal de La Blache and P. Camena d'Almeida. *Cours de géographie à l'usage de l'enseignement secondaire*. Programmes de 1902... A. Colin, 1902–1904.



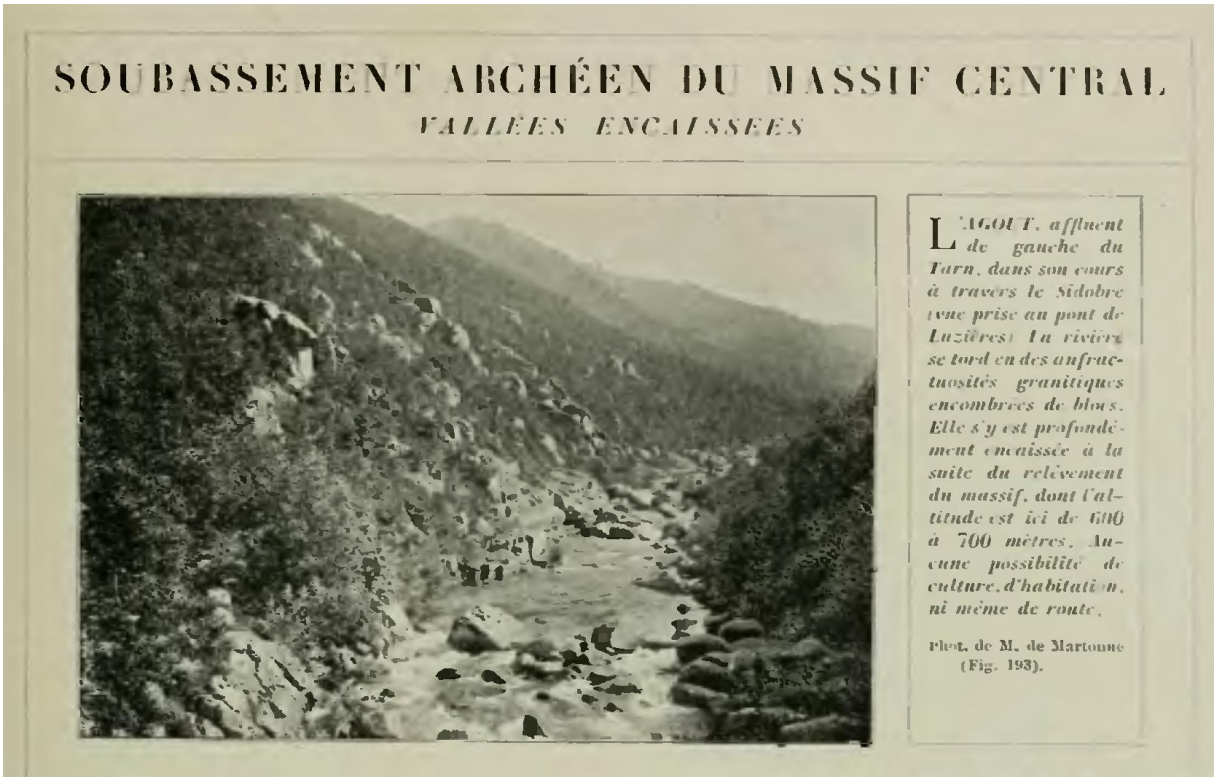
On the face of it, Vidal de La Blache's eloquence is not to blame. And yet his elegant penmanship, word choice and taste for the grandiose led him to formulate ideas in ways that could be misconstrued by readers unfamiliar with the burgeoning science he had founded. From the start, he takes pains to evoke the splendour of the scenery:

> *The Massif Central has been recognised as one of the most important rings in a long series of related massifs. Between the Vosges and the Armorique, it forms an interrupted but visible chain that criss-crossed western Europe in the primary eras. Shaped by the accidents of various ages, it is a partially destroyed mass where vast fault blocks have thrust into one another; it is an – admittedly enormous – fragment of Archaean rocks.*

This scenic evocation magnifies the spatial, pan-European scope of the phenomenon, expressed by terms such as *vast fault blocks* and *enormous fragments*. The temporal *mise en abyme* plunges the reader into the seeming infinitude of the earth's ages and foregrounds the notion of chronological depth: the syntax emphasises the terms *primary eras* and *Archaean rocks*.[3] The text itself should not be taken out of context. At the turn of the 20th century grandiloquence was still synonymous with literary style, and the desire to prove the great length of geological eras was still a very modern one. Indeed, not long before, lively debates had pitted supporters of a literal reading of the Bible

3. The Archaean (3.8–2.5 billion years (Ga) ago) was a geological period during the Precambrian.

against scientists such as the American geographer William Morris Davis,[4] who deemed this impossible.


SOUBASSEMENT ARCHÉEN DU MASSIF CENTRAL

VALLÉES ENCAISSÉES

L'AGOUT, affluent de gauche du Tarn, dans son cours à travers le Sidobre (vue prise au pont de Luzières). La rivière se tord en des anfractuosités granitiques encombrées de blocs. Elle s'y est profondément encaissée à la suite du relèvement du massif, dont l'altitude est ici de 600 à 700 mètres. Aucune possibilité de culture, d'habitation, ni même de route.

Phot. de M. de Martonne (Fig. 193).

***Figure 4:* "Archaean subsidence of the Massif Central", illustration to go with a table just after p. 250.** *The caption states: "The Agoût, a tributary of the River Tarn […] twists through granite crevices […]. Tightly enclosed after the upthrust of the massif, it is shown here at an altitude of 600 to 700 metres. Agriculture, human habitation and road-building are all out of the question."*
(Photo by Emmanuel de Martonne, Vidal de La Blache's son-in-law)

Nevertheless, the remainder of the text is unintentionally clumsy. The facts are clear for Paul Vidal de La Blache; they are rather less so for his readers. He writes:

> *Furthermore, it* [the Massif Central] *lacks the unity which Bohemia, that other fragment of this ancient massif, owes to the existence of a single channel through which the watercourses run. The streams of the Massif Central disperse to all four corners of the horizon.*

The notion of an *ancient massif*, which denotes mountains that had existed in the Palaeozoic but had been reduced to flattened subsoil by the beginning of the Mesozoic, coexists here with the expression *Massif Central*, which had already been popularised by Élisée Reclus. For Reclus – and for Vidal – the Massif

4. William Morris Davis (Philadelphia, 1850–Pasadena, 1934) was a geomorphologist and admirer of Charles Darwin.

Central was a distinct geographic entity, one which now dominated the regions surrounding it.

> *It is a whole in which the similarities outweigh the differences. This whole (around 80,000 km²) covers one sixth of France. It reaches Lyon, neighbours Toulouse and stretches towards Bordeaux and Bourges.*

However, for the lay reader, the adjectives *central* and *ancient* describe the same object: the massif. The problem is that the geologists Dufrénoy and Élie de Beaumont (1841) used the term to designate a compacted platform, while Vidal (1903) used it to designate a type of relief that disperses bodies of water to the river basins of the Seine, the Loire, the Garonne and the Rhône. It is hardly surprising, then, that this explanation gave rise to a long-lived misunderstanding, even though, in reality, the permanence of landscapes results from the type of rock from which they are formed and not the date at which the uplift occurred.

> *It is the nature of the rocks that produces the same appearance. Composed of gneiss and mica-schist, the Archaean bedrock broadens into wide plateaux.*

The misunderstanding deepens from this point on: the differential erosion of rocks with varying degrees of resistance, in more recent periods, is not clearly dissociated from the conditions in which the rocks were created. In the space of a single sentence, lithology (physical characteristics of rocks) and morphology (types of relief) are placed on equal footing.

> *On the contrary, a craggier relief can be seen in part of the Forez mountains. This is due to the presence of porphyry, which erupted across the Forez, Beaujolais and Morvan mountains during the primary era.*

While these eruptions at the end of the Palaeozoic naturally created new landforms, geologically speaking these did not last very long. The solid porphyries contained within fragile rocks were extracted during a period of more recent and general upheaval. The current relief is not the direct result of very old eruptions, as an attentive reading of the passage clearly shows. However, to grasp this the reader has to be familiar with geomorphological facts. This was not true of most readers in 1903. Indeed, the text had initially been conceived as an introduction to Ernest Lavisse's monumental history of France, published in instalments between 1903 and 1922. The text's initial readers were therefore historians. Though the latter would have been unfamiliar with the concepts of

physical geography, they no doubt believed that their well-rounded education,[5] as it was understood in the 19th century, gave them direct intellectual access to the text. Yet by the *Belle Époque*, a period in which knowledge became extremely specialised, this was no longer the case. Intellectual specialisation occurred in both the so-called hard sciences and in the human sciences, which we will not insult by calling soft. The ideal of being both physicist and chemist, grammarian and linguist, historian and geographer became increasingly unobtainable – though few intellectuals of the time were aware of this fact. They had an excuse. These similar but distinct disciplines had long been taught in pairs, as indeed they often still are until the *baccalauréat*. Add to this the fact that historians often taught – indeed teach – both history and geography, and it isn't hard to imagine how a misreading of this paragraph, or of the text as a whole, could take hold.

By this stage, the succession of inaccurate readings of the text impedes understanding of the explanations that follow:

> *But these peaks are worn, blunted, and reduced to a gentle gradient: they bear the marks of the erosion undergone during the extremely long period in which most of the Massif remained exposed.*

In a reader now convinced of the venerable old age of the Massif Central, this sentence seems to confirm that the present-day situation was produced by a progressive and slow subsidence of the Hercyian reliefs. Everything is a question of scale. Despite those "Alpine convulsions", this is nonetheless a "gentle gradient". As the geomorphologist Henri Baulig (1877–1962) later pointed out,[6] the central plateau running across France is subsiding very gradually from its eastern summit towards its Atlantic fringe. The altitude of the cross-country motorway that runs from Mont Pilat (Loire) to Limoges falls by just under a kilometre every 300 km: the slope (3 in 1000) is barely visible to the eye. It was easy, then, for the hasty reader to mistake this flat land for the worn remnants of Palaeozoic mountains. Admittedly, we go on to read that the latter were more or less reduced to sea level, or even partially submerged by the sea.

> *This general subsidence was so great that when the sea flooded the Parisian basin all the way down to the south of Paris, lakes formed over part of the Massif.*

5. [Translator's note] The French article refers here to the notion of the *honnête homme,* the cultivated and socially adept gentleman amateur.
6. *Le plateau central de la France et sa bordure méditerranéenne, étude morphologique*, thesis, Armand Colin, 1928, 590 p.

But the damage is already done, and most readers have doubtless wandered astray by the time Vidal de La Blache concludes the story of this great landform.

> *These lacustrine vestiges can still be found today, but they are carved out, broken up and raised to varying heights. It was only after they were deposited that an awakening of orogenic forces, contemporaneous with the Alpine convulsions, rejuvenated the relief of part of the Massif.*

The misunderstanding is exacerbated by the use of the term *rejuvenate*. This anthropomorphic expression taken from an article by William Morris Davis[7] is extremely unfortunate here, in that it introduces the idea of a preceding ageing process when, in fact, the event should be considered exclusively within the context of the Palaeozoic morphogenesis that led to the formation of the reliefs. Lastly, Vidal de La Blache's concludes by asserting that volcanism – which he associates with Alpine accidents and extends to the present day – occurred over an *immense period*. This simply entrenches the idea of the phenomenal ancientness of the Massif Central in the reader's no doubt uninformed mind. Given that volcanism is common to the whole surface of the Hercynian platforms, the mistake had considerable geographical scope, making it more deplorable still. But let's not blame Vidal de La Blache. If he had been able to quantify the great episodes of upheaval in spans of millions of years – in addition to correctly describing the sequence in which they occurred – his writings, and those of others, would have been less prone to misinterpretation. Yet this was not in his power and, even today, the exercise can still prove delicate. Of course, we are now able to date rocks using radiochronology, but this is not the same thing as dating the age of the reliefs, in the same way that a sculpture does not have the same age as the marble from which it is sculpted. Furthermore, surprisingly old landforms can survive on the surface of the earth. This is especially true of areas characterised by historically weak vertical motions of the earth's crust, or areas affected by uplifts with such a slight radius of curvature that it limits the dissecting properties of the very gently sloping rivers. But that is another story…

Should we simply overlook this – admittedly rather innocuous – aberration in French geography teaching? That would prove difficult, because the aberration has been sustained by the education system for a century, and is still part of the country's core of "common knowledge".

7. "The geographical cycle", *Geographical Journal*, 1899, vol. 14 : 481–504.

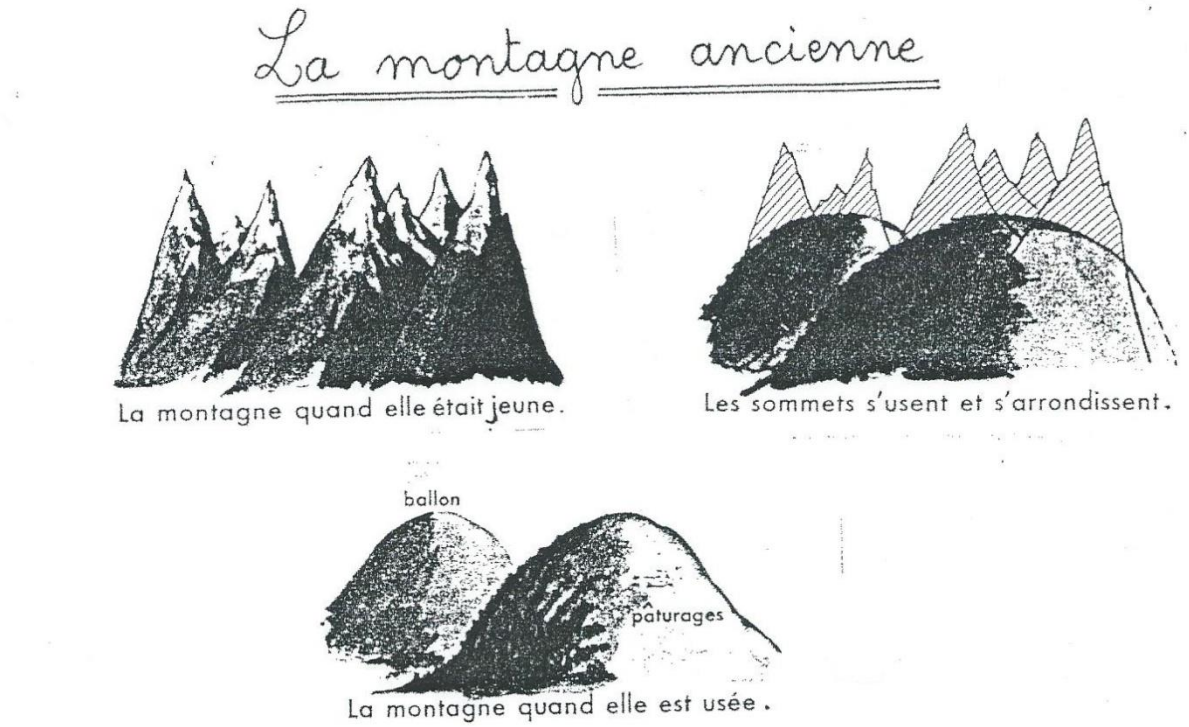


Figure 5: ***(Incorrect) pupil worksheet recently distributed by a primary schoolteacher.*** *Clockwise from left: – The mountain when it was young. – The peaks are worn down and become round. – The mountain once worn down.*

What we need to consider, then, is why this scientific error has proved so tenacious, especially as most teachers have not read the *Tableau de la géographie de la France*. The first possible explanation is that this inaccurate reading is an extremely simple one: it is easy to understand, especially in childhood, because it evokes the ages of life. Even if pupils had a choice between the flawed tale and the correct explanation, they would prefer the most common-sense option – and I speak from experience, having taught for many years in lower primary classes. The law of minimum intellectual effort could be at work here. Yet this law is in greater evidence among adults – for example, those at risk of converting religious extremism on the basis of pseudoscience – than it is among children, who have less preconceived ideas. For children, however, appearance can easily be taken as evidence and therefore reality – even when it is not. Since erosion is a result of the passage of time (which is partially true), it is tempting to conclude that higher mountains are the result of more recent uplift – and therefore younger – while "blunter" mountains are necessarily old (which is false). What's more, when the error is passed on by an authority figure, i.e. a schoolteacher, and thereby gains credence, it is taken as a given and becomes extremely difficult to dislodge.

Fragments of a pedagogical experience

The scope of this problem dawned on the author of these lines on one particular occasion. A primary schoolteacher had enrolled at the university to take first-year classes in geomorphology. To begin with, it was difficult to get her to accept the reality of scientific fact (which contradicted her preconceptions): that is, the actual stages in the morphogenesis of the Vosges and the Massif Central. After acknowledging this fact she dropped out of class, upset at the idea of having to reassess such a dearly held conviction, one she had always taught to her pupils. Perhaps she did not wish to find herself faced with other pedagogical dilemmas.

In a second case, a student preparing to take the geography *agrégation*,[8] who had "drawn" medium-altitude mountains as his oral subject, had no qualms about discussing the (rather low-altitude) Armorican Massif in his presentation, under the heading *ancient massifs*.

Wikipedia, often more inspired, doesn't do much better here. The French version of the online encyclopaedia states: "Although it rarely reaches an altitude of 400 metres (416 metres at Mont des Avaloirs, 413 metres at Signal d'Écouves, Orne), due to its soils and its craggy landscapes it should be classified among the mountainous massifs."[9] If mountains were simply the product of siliceous soils and modest escarpments, every geographic classification would have to be reassessed…

Understanding the text proved difficult enough for teachers; it must have been more challenging still for general readers who simply wished to learn more about the geography of France. In that respect, Vidal de La Blache's eloquence and the remarkable quality of his descriptions were helpful. But – and the paradox is surprising – this easy readability may have led readers to gloss over the text and the true depth of its thought. This is not to say that Vidal de La Blache would have been easier to understand if his writing had been inelegant. But a century on, his text shows just how editorially cautious one must be when writing about science.

8. [Translator's note] A competitive exam allowing successful candidates to teach in secondary schools and universities.
9. Wikipédia page on the Armorican Massif, consulted on 4 December 2013.

Is it possible to make falsehoods out of truth? The answer, alas, is yes. The lesson we can draw from the section of the *Tableau* dealing with the Massif Central remains relevant even today. In this particular case, the risks posed by an incorrect reading are not particularly great. Neither the author, whom I admire, nor his readers, whom I do not blame, set out to distort the facts or profit from doing so. But every passing day proves that ambiguous writing or an intentionally biased reading of the most important scientific texts can pave the way to the worst excesses. Let's not forget that.

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(December 2013)

(Translated by Helen Tomlinson, published December 2014)

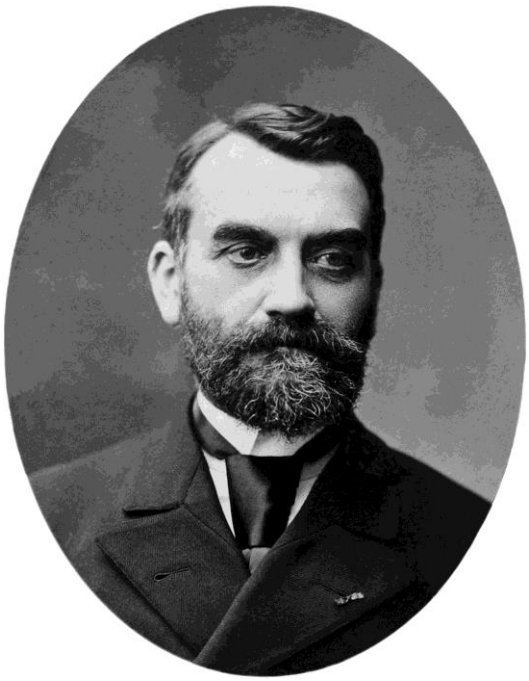

Figure 6: ***Paul Vidal de La Blache*** *(Image Wikimedia Commons – Source Gallica)*