

Pavin, A Rich but Fragmented History (200 AD–2016)

2

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Abstract

“Pavin Stories”, told to the lake’s visitors seeking its wild beauty, were reported throughout the nineteenth century by famous scholars such as Pierre Larousse, an encyclopedist, and Elysée Reclus, a geographer: Pavin had no depth, no fish, could trigger furious storms and no boat could sail on it. Pavin history before 1770 was not established. The Pavin history puzzle, although still incomplete, is re-interpreted here through the grid of sensorial degassing indicators (Table 1.2). It starts with a famous “treasure stone” retrieved from its waters in 1909, actually a pompeian-type millstone probably carved at Pavin during tranquil periods of the lake, when Roman baths were constructed at the Mont-Dore, 6 km away. Literary sources are lacking afterwards but a small early medieval Christian settlement existed at the nearby mountain of Vassivière, some 1.5 km away from Pavin, possibly succeeding an earlier cult (Chap. 3). In 1547 a miracle occurred there and an extra-ordinary explosion with thunder and lightning is witnessed in 1551. Latent Pavin misbehavior is reported from the mid-sixteenth to the mid-seventeenth century: a storm suddenly triggered by a stone thrown into the lake (François de Belleforest, *Cosmographie Universelle*, 1575). These storms, which caused damages to the surrounding valleys, were reported to the King of France during its visit in Auvergne (1566). At the time, the lake, already termed since long ago *lacus pavens* (The Terrible Lake), was avoided by the local people, who feared its permanent summer fog and occasional storms (Jean Banc *La Mémoire retrouvée des merveilles des eaux naturelles* 1605; Godivel II, late 1600s). Belleforest’s description will be copied by other geographers for three hundred years, making Pavin very famous beyond the borders of Auvergne. Another misbehavior event was also witnessed in 1783. However, the highest Auvergne authorities of the time ignored this very clear sudden lake overturn, thereby undermining the validity of the Pavin Stories. A similar event probably occurred in 1936. The “normalization” of Pavin was achieved by the introduction by Lecoq of the first boat (1847) and the first fish (1859), which facilitated its scientific exploration (Chap. 1). Pavin’s fame has remained intact since the early 1900s, but its rich history and wealth of legends (Chap. 3), as well as its unique scientific character, are largely ignored by guidebooks. When Pavin historical descriptions are compared to other lake degassing events (Chap. 1), there is no doubt that several degassing periods and/or events of various intensities were witnessed there in the past.

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“A mountain called Puy de Dome on which there is a big abyss from which escapes ordinarily a big storm of thunder and hail, which damages grains in the valleys” (report made by Auvergne officials to King Charles IX during his visit to Clermont, 30 March 1566, Abel Jouan 1566)

“A short distance from Besse, in Auvergne, there is a mountain on which there is a great lake, so deep that one believes it to be bottomless. As far as one can tell, no spring is feeding it. If one throws a stone into it, soon the thunder rumbles, lightning shine, rain and hail hit your face” (Paul Merula, *Cosmographia*, 1605)

“Pavin is another such place, vaguely famous, on which hundred stupidities have been told. As so few people have visited Auvergne, no wonder that such fables are accredited, particularly when no one rises to fight against them” (Legrand d’Aussy, *Le Voyage en Auvergne* 1788)

2.1 Introduction

Pavin, as called by locals and visitors, is a small round lake on top of an Auvergne mountain. It is unique in France for its long and complex history, being celebrated at least since the sixteenth century by many geographers (see above, Merula’s statement, a Netherland geographer, in 1605). Fears surrounding the lake were already reported by Auvergne Province officials to the king of France, Charles IX in 1566 (see above, report by Abel Jouan, the royal chronicler). These descriptions contrast with the ones naturalists and scientists have made after royal engineer Chevalier’s expedition in 1770 to Pavin (see Sect. 1.4.1). In the late eighteenth century, Pavin was a must-see for a Parisian voyager and writer like Legrand d’Aussy in 1788 (see above) and throughout the XIXth Pavin looked absolutely normal to its visitors. But *Pavin stories* were still told by local people to the growing number of visitors from the nearby Mont D’Or (now Mont Dore) spa. Louis Piesse is one of them and states in 1863: *“There are so many tales about Pavin, or Pavens at it was named by Romans, concerning the thick clouds that were blanketing it, the exhalations that one inhaled on its shore, the stones thrown into the surface waters, that will develop from its depth clouds from which the storm would come, and a perpetual bubbling”*. [As all other original citations in French, this text has been translated by us].

How should such a statement be understood? Was *pavens* the original name of the lake? What are the origins of these phenomena: thick clouds, exhalations, storm, bubbling that were still referred to by local people in the mid-XIXth, while Lecoq was introducing the first trouts to the lake (Chap. 1). Why has this famous Auvergne naturalist ignored the descriptions of Jouan, Merula and all other European

geographers and why did he consider they were not grounded? Throughout the twentieth century, why have the literary and scientific communities ignored the old Pavin descriptions, once reported to authorities by educated witnesses then transformed into *Pavin stories*, transmitted orally over centuries?

The scientific community is now more conscious of, and more interested in past historical and mythological events associated with tsunamis, landslides, volcanic eruptions and their related hazardous places and events, centuries to millenia ago, as well as in how they have been transmitted to other generations through time (*Myths and Geology*, Piccardi and Masse 2007). This approach has been initiated 15 years ago by Italian volcanologists, geochemists, and geologists working on Italian maar-lakes, such as Albano and Monticchio, a very rare lake type only found in volcanic regions which Pavin also belongs to (Chap. 1). They found and endorsed for these volcanic crater lakes a very rich history of past degassing events, reported by the first naturalists working on Monticchio, between 1770 and 1850, and by Latin historians working on Archaic Rome history (see Sects. 1.6.2.1 and 1.6.2.2). This interest for maar-lakes was suddenly triggered by the catastrophic degassing of Lake Nyos (Cameroon) which cost 1700 lives within one night in August 1986 (Sect. 1.6.1).

In Auvergne, the historical research on maar-lakes has not yet been made. In 1986 the study of degassing risk at Pavin (see Chap. 1) did not involve any Human and Social scientists such as archeologists, geographers, historians, folklorists or anthropologists. In contrast, such historical approach had been used in Auvergne for the earthquake risk analysis by Mallot, a historian. Her research in ecclesiastic archives found many unknown important earthquakes (Mallot 1995), that changed the regional risk assessment and lead to the cancellation of a planned nuclear plant in Limagne.

In recent years several catastrophic events related to Pavin have been described by scientists (Chapron et al. 2010, 2012; Chassiot et al. 2016; Chap. 23). These observations suggest that Pavin had not always been as quiet as today: were these events also perceived or recorded by people near the lake, particularly at Vassivière Mountain, a small religious settlement about 1.5 km away, and at Besse, the nearby town, 5 km away?

Our search for the history of Pavin and its surroundings generated a vast and heterogeneous material, largely unknown, misused or unused by previous Pavin historians. Based on this material, the following questions are raised

here: (i) How the extra-ordinary Pavin has been described through centuries, while society's understanding of natural forces and beliefs was evolving, and while the lake state was also modified? (ii) Are these texts sufficiently contextualized, reliable and coherent? (iii) Can these sources be re-interpreted with the grid of sensorial lake degassing descriptors (Table 1.2), (iv) Can we reconstruct the past state of the lake, thus providing contemporary scientists with another set of information?

2.2 Finding Pavin Puzzle Pieces

Pavin's history is a fragmented and incomplete puzzle: some well-known pieces, although linked to Pavin, could not be understood before the description of the degassing process at Nyos in 1986, many pieces have faded and have been gradually forgotten, some pieces were known but not connected to Pavin and finally, some descriptions may be discovered a long time after their initial reporting. Pavin's history analysis was hindered by the fact that Auvergne historians and scientists could not conceive of past degassing events of any kind taking place at Pavin, even after the Nyos degassing evidence. This skeptical attitude was also present in Italy until very recently (Caracausi et al. 2009; Funicello et al. 2010). Assembling Pavin historical puzzle cumulates these difficulties.

The first analysis of Pavin history is published in 1805 by Abbé Delarbre (1795, 1805) in charge of the Clermont Botanical Gardens: as he cannot provide a scientific explanation of any of the *Pavin stories*, he makes his best to disprove all of them, without citing any of his primary sources. This position is followed by Lecoq (1835a), the main Auvergne naturalist of his time (see Sect. 1.4.2). In 1874 a mid-seventeenth century manuscript describing Pavin in details, the Godivel manuscript, is discovered and published (Jaloustre 1884). This description remains undiscussed until today, except by Eusebio and Reynouard (1925), a limnologist and a historian. They try their best to assemble pieces of the Pavin puzzle and make, for the first time, a groundbreaking hypothesis of a major catastrophic event at Pavin during Antiquity. But well respected Auvergne writers such as Pourrat (1935) ignore their analysis and present the *Pavin stories*, generally those reported by Lecoq, mixed with a recent legend, the *Sunken City* of Besse (see Sect. 3.3.1) without proposing any clue. Local historians and geographers (Crécut 1921; Fournier 1971; Charbonnier et al. 2011) either consider all *Pavin stories* as unfounded or simply ignore them.

Some pieces of the Pavin puzzle have been previously described and analysed separately by specialists of each field, e.g. Pelletier (2008) for cartography, Block (2003) for

church misericords, Auserve (2004) for religious history, Fournier (1971) for etymology, Vernière (1899–1900) for the history of past voyagers in Auvergne, Pourrat (1935) for Auvergne culture analysis, Sebillot (1904–1906) and Reyt (2000, 2002), for the analysis of legends and tales. However most of these works have been conducted before the Nyos event and none of these specialists integrated the possibility of catastrophic events due to degassing hypothesis.

Our interpretation of Pavin sources has been recursive, through our multiple iterations (Fig. 1.1), as we were progressing on the characteristics of degassing lakes and discovering the rich body of history and legends surrounding other maar-lakes. A coherent image gradually appeared out of this heterogeneous and incomplete puzzle. This chapter first presents our prime puzzle pieces, i.e. those well identified, reliable, written by educated authors and with complete context (precise date and hour, location, detailed description), in a chronological order from Antiquity to the nineteenth century. Then the history of Pavin, as reported and used by guidebooks, scholars and authorities in the twentieth and twenty-first century, is summarized.

The other Pavin puzzle pieces, i.e. those with less context, unknown authors or unprecised location, legends collected in the nineteenth century, religious sources, featuring dragon and tales of fairies and other fantastic animals and miracles are analysed, in comparison to similar sources found for other European maar-lakes, in the next Chap. 3.

2.3 Pavin's History Highlights

2.3.1 Antiquity: A Pompeian Millstone Retrieved from Pavin Waters in 1909

The Roman presence near Pavin is attested. After the conquest of Gaul by Julius Cesar, Romans have developed intensive agriculture in the fertile Limagne plain, a major granary for Imperial Rome some 40 km north of Pavin. They also established the famous *Mons Aureus* Roman baths – now Mont Dore – on the other side of the eponymic volcanic complex, some 6 h walk north of Pavin across the mountain. Their ruins, containing coins dating from emperors Neron, Augustus and Agrippa, i.e. during the first and second centuries AD (Bertrand 1819; Durand-Lefebvre 1926; Chabrol 1931), were found during the construction of the present-day thermal baths in the early 1800s (Fig. 2.1b). Gallo-Roman poteries have also been found in the 1950s in the Landie Lake, some 15 km, SW of Pavin, at an altitude of 1100 m (J. Bernard, pers. com.). At Pavin a Pompeian millstone has been found a century ago in the lake waters.

This so-called *Pierre au Trésor* (Treasure Stone) is a 250 kg volcanic stone, with cylinder and conical shape,

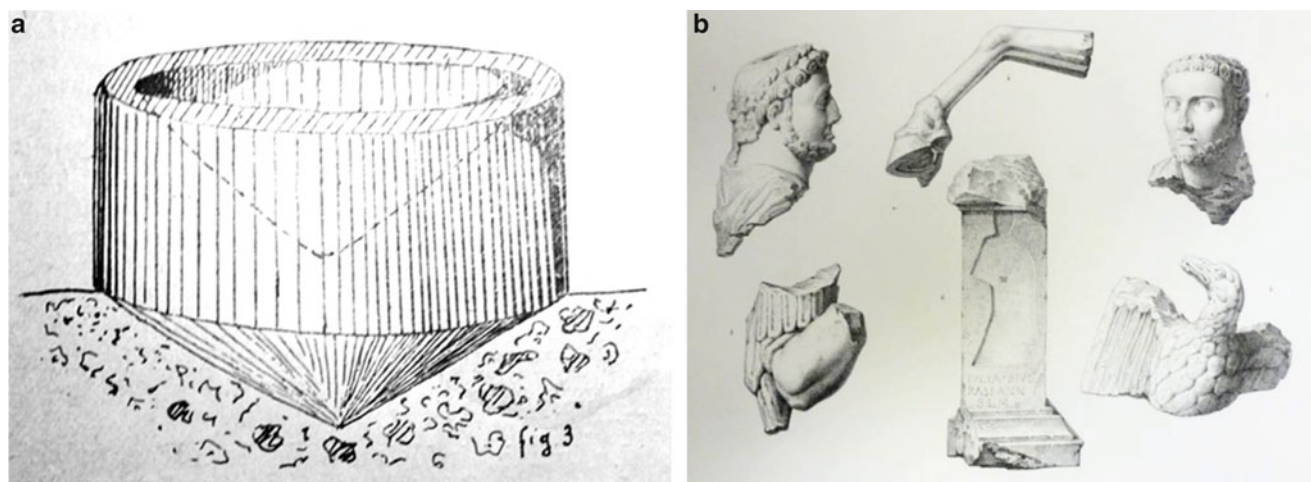


Fig. 2.1 (a) The Treasure Stone retrieved from Pavin lake waters, an unfinished Pompeian millstone, (Reynouard 1909). (b) Archeological Imperial Rome artifacts dated 100 to 300 AD found in the early 1800s

at Mons Aureus Roman baths, now Mont Dore, 10 km from Pavin (Lacour 1850) (BCU library, Clermont-Ferrand)

carved on internal and external side (Fig. 2.1a). It was spotted during the nineteenth century, retrieved from the lake shore in 1909 (Reynouard 1910), brought to Besse that year, then forgotten for 100 years – it was not registered in the archeological inventory – and re-discovered in 2010 (Meybeck 2010). It is now exhibited on the lake shore. Reynouard also mentions few other broken carved stones and concludes they were antique millstones carved from inside Pavin rims. The origin of the stone was confirmed in 2012 by an archaeologist as an unfinished “Pompeian-type meta millstone” (Luc Jaccotey, INRAP pers. com., 2012). Petrographical analyses are currently made to confirm the *in situ* extraction. Until now the dating of the millstone has not been made. Considering its style, a likely hypothesis is that is contemporary of the Mons Aureus settlement.

For Reynouard, a local historian and former Besse mayor, “a small tribe was disseminated near the springs [within the crater]...they were there to extract and carve their millstones...then a cataclysm came: (i) a last eruption from Montchal [the adjacent nearby volcano], (ii) an earthquake or (iii) a dreadful cyclone that would have lifted waters to flood the shore settlements” (Eusebio and Reynouard 1925). He is the first to make the hypothesis of an early human activity at Pavin and to postulate a catastrophic event to explain its interruption. His third proposition, barely conceivable in 1925, has been completely ignored until recently when paleolimnologists found evidence of important sediment slides in Pavin, dated around 600 AD, that could have triggered a sudden catastrophic lake spillover (Chapron et al. 2012; Chassiot et al. 2016). A text from Gregorius of Tours (539–596), the first historian of Christian Gaul, so far not attributed to Pavin, relates a famous pagan lake cult associated to catastrophic storm events (see Chap. 3).

2.3.2 Early Antique and Medieval Worship Near Pavin, on the Vassivière Mountain

Before the mid-sixteenth century, our Pavin’s history puzzle pieces are limited to religious history, most likely linked to Pavin, as further discussed in Chap. 3. The nearby Vassivière Mountain, at an altitude of 1350 m, 1.5 km north-west of the lake (Fig. 1.1c) is an early and unexpected human settlement, that can be described as one of the “defortunate” locations, *i.e.* those abandoned by people and left to the forces of nature, where religious settlements were built to help the astray passer-by, as they have been described in the Alps mountains (Reyt 2000, 2002).

According to late nineteenth century historians, an early medieval church was standing on this mountain until 1321, itself possibly located on a pre-Christian wall (Jaloustre 1910). However the wall has not confirmed by contemporary historians nor subject to archeological research, but the ruins of the primitive church were seen when the present pilgrimage chapel was built around 1550 (Jaloustre 1910; Ph. Auserve 2004 and pers.com.). For Jaloustre, Vassivière toponym could originate from celtic words “vas”, temple and “iver”, water. In this location, “a temple built by Celts was dedicated to the Clamouze headwaters deities. People would come here to celebrate feasts. When Christianity took over, the Virgin celebration replaced the one of the Spring water deity. A village became the center of a Christian parish, succeeding to the Gallic dwellings”. This hypothesis could explain the location of this early church on such defortunate mountain, away from all roads and snowbound for 5 months of the year. Gregorius of Tours also mentions an early Christian settlement established after the pagan lake cult, near a mountain lake, however not traditionally attributed to

Pavin but to Lake St. Andéol in the Gévaudan mountains (see further discussion in Chap. 3).

In 1321 the local lord, Bernard de la Tour d’Auvergne, ordered the destruction of the initial Vassivière medieval church, a very rare decision, and authorized the re-use of its stones, on the grounds that profane events were taking place at this location [*“Quam plurima profana in dicto loco comiti et fuisse commissa”*] and granted a very peculiar status to the nearby city of Besse and to its people, an event noted by all historians (Boyer-Vidal 1888; Jaloustre 1910; Auserve 2004). The causes of Vassivière first church destruction and the nature of the profane celebration remain unknown.

Paleolimnology work at Pavin records another major catastrophic event around 1300 AD corresponding to a spillover of the lake with a drop of lake level by 6.5 m, due to the sill erosion (Chapron et al. 2012; Chassiot et al. 2016; Chap. 23). Also, studies on the Couze Pavin talweg sediments show a 9 km-long mudflow originating from the Pavin outlet attributed to this period that could correspond to this catastrophic spillover (Lavina and Del Rosso 2009). The regeneration of some pagan ceremonies at Vassivière, following the 1300 catastrophic event, can be hypothesized. From 1321 to 1550s a statue of the Virgin was left there at a place named locally *Seignadou*, i.e. where people should sign themselves when passing by.

2.3.3 *Lacus pavens* Terrifies the Whole Region Throughout the Sixteenth Century

During the sixteenth century written sources of all kinds on Pavin, actually *lacus pavens*, are numerous. In 1547 the Vassivière Mountain is recognized for a miracle, discussed in the next chapter, soon attributed to the intercession of the Vassivière Virgin, and since that date religious authorities register any evidence of miracles and any odd events in the vicinity of Vassivière, i.e. of Pavin. In 1566, Auvergne authorities complain to King Charles IX of France during his stay in Clermont, about an abyss in mountains, presented as a major hazardous area. In 1575, Pavin is featured in one of the first-ever landscape paintings in France and cosmographer Belleforest describes the marvellous misbehaviour of a lake near Besse (1575). At this period the lake is named *pavens*, the terrifying (Banc 1605). Unusual events at/or near Pavin are highlighted here.

2.3.3.1 The Terrible Explosion Witnessed at Vassivière by Besse People (28 August 1551 Pavin Event)

After 1547, all Vassivière miracles are carefully recorded by the church authorities and kept in the church archives. They are presented in chronological order by Father Michel Coysard (1547–1643), a famous Jesuit lexicographer born

in Besse, then detailed by Dom Cladière, a Benedictan also born in Besse (1688, re-edited in 1837), as well as by many Vassivière historians such as Chaix (1869); Jaloustre (1910) and Pourreyron (1935). Coysard reports a sudden storm that occurred there on 28–29 August 1551, when a mentally sick child was brought to the miraculous statue, the new chapel being under construction:

The air, which was at this moment very calm and tranquil, changed so suddenly that all attendants were astonished: an impetuous wind rose all of a sudden with such violence that they were almost all knocked on the ground, scattering their hats and coats. What put them most in fright and fear is that at the same time the whole air was like ignited by the length of terrible lightning, that occurred without stopping, and by terrible thunder that could be heard around them...this was just the effects of the furiousness of the demon who was being exorcized, as one could smell for a long time after an awful sulfur smell. The weather went back to clear state as it was before, lightning and thunder stopped and the atmosphere went tranquil again.

This violent and very sudden atmospheric event was witnessed by one hundred Besse people. Vicar Boyer, Etienne Desserres, Jean Libinoux, Etienne Ribeyre, Guillaume Lafont, Pierre Blanchier, all witnesses, made a written juridical statement to the religious authorities. These people were standing on the mountain about 1.5 km away from the Pavin, at the same altitude as the crater rim, but not in the direction of the Pavin outlet. This event is very sudden, violent and, probably, unexpected for those who witness it, which explains why it is officially registered.

There is little doubt that this event was actually a violent degassing event of Pavin. Although there is no description of the lake proper, as it cannot be seen from Vassivière, one notes several descriptors of a violent degassing event similar to the one witnessed by the French team at Nyos, few days after the main degassing event or at Monticchio (Table 1.2): the Vassivière event starts during fair weather, then a very violent and sudden wind occurs with “*thunder noise*”, “*ignited atmosphere*”; it terminates abruptly while a “*sulfur stench*” remains. These extra-ordinary atmospheric characteristics were interpreted in 1551 as the presence of the evil being exorcised from the sick child (Don Cladière 1688). Pavin historians, such as Delarbre (1805); Lecoq (1835a); Eusebio and Reynouard (1925), have missed or ignored this event which clearly links Vassivière and Pavin. We also missed it in our preliminary analysis (Meybeck 2010). Other events featured in Vassivière register from 1550 to 1650 present well contextualized events which can be interpreted as loss of consciousness of individuals due to CO₂ intoxications.

2.3.3.2 A Hazardous Abyss, Generating Storm, Thunder and Hail, Presented to Charles IX (1566)

On March 31 1566, Charles IX, touring his kingdom of France with his mother Catherine de Medicis and his brothers

and sister, is hosted at Clermont for 3 days, located at 3-day trip from Pavin. The royal chronicler Abel Jouan (1566) makes a short account of this brief stay in the Auvergne main city in which the king and his followers were informed about “*a mountain, called Puy de Dome, on which there is a big abyss from which escapes ordinarily a big storm of thunder and hail, which damages grains in the valleys*”.

Although Jouan’s description wrongly places the terrible abyss – a lake is not mentioned – on top of the Puy de Dôme, a famous mountain near Clermont, the attribution is most likely at the Mont Dore mountain and concerns Pavin Lake [the Puy de Dôme mountain has no crater], as understood by the very few scholars who reported this text as a legend (Legrand d’Aussy 1788; A. Pourrat 1973). It remained undiscussed by Delarbre and Lecoq who were aware of this famous Royal visit (Jouan’s chronicle is listed as a source on Auvergne history in one of Lecoq’s work). The lake is causing so many damages and fear that the case is brought to the attention of the King and his mother, who is also the ruler of La Tour d’Auvergne and Besse at that time. According to this official complain, Pavin misbehaviour is permanent, damaging grains in the downstream valleys, which could correspond to at least 20 to 30 km downstream. It suggests that lake degassing events associated with storm, thunder and hail as encountered in the 1551 event were common at this period. This description remained largely ignored just like the August 1551 event.

2.3.3.3 Pavin Painted on the First Realistic Landscape Picture in France (1571–1579)

The Queen Mother Catherine de Medicis, and lord of Besse, orders from her royal notary, Antoine Godivel from Besse, a magnificent illuminated manuscript, the royal land register of Besse (Godivel I 1579a) today kept at the Chantilly Castle library. As many members of the Godivel family of Besse have played a role in Pavin’s history, we shall name him Godivel I. One key feature of this unique register is the hand-painted panorama of the Besse countryside (about 40 cm × 80 cm), in which Pavin is represented on the upper right corner, overlooking the town. It can be spotted by its position, its crater-like shape and its cascading outlet reaching the Couze Pavin River. The surface of the lake seems still. The lake is enlarged in this picture considering its actual size (about 400 m in diameter), an indication of its importance. The Vassivière Mountain is marginally represented in the very upper part, identifiable by a small cross. There is no farm featured in the upper Couze Pavin River valley upstream of Besse, which looks very isolated, in contrast to other Besse valleys. It seems that the diminutive pathway from Besse to Vassivière is actually avoiding the lake outlet. The Montchal Mountain, another recent volcano adjacent to Pavin (Fig. 1.2c), is also featured, slightly above the crater lake. The gothic-written illuminated Chantilly manuscript register and

its copy, not illuminated and now kept in the Clermont regional archives (Godivel I 1579b), remained to be checked for the mention of Pavin.

It is without doubt one of the first representation ever made in France of a landscape from an aerial viewpoint (Pelletier-Decitre 2008). It is extremely accurate: the street map of the medieval city of Besse is still the same as today. At the same period, the first accurate map of the kingdom, *La Charte de France*, by François La Guillotière (1575–1590) features the *Vaucivière Mountain* (Vassivière), an indicator of the fame of the new pilgrimage, but not Pavin.

2.3.3.4 Pavin Marvelous Response to a Thrown Stone in Belleforest’s *Cosmographia Universalis* (1575)

In the description of Auvergne made by the cosmographer François de Belleforest (1575), there is still no direct mention of Pavin, nor of Paven, the common spelling until 1800, neither in the index nor in the text; but one finds a “*Lac merveilleux, en haut d’une montagne en Auvergne*” [Marvellous lake located on top of an Auvergne mountain] as well as a “*Marvellous abyss named des Soulcis*” [*Abyme merveilleux nommé des Soulcis*], a small cavity in the nearby lava flow. These sites are less than 1 km away from each other (Fig. 1.2c). The Creux de Soucy, as this cavity is now called, allows to precisely locate the un-named Belleforest’s lake and their description follows the one of Mont d’or famous thermal baths, formerly Mons Aureus (Fig. 2.2).

“...Near this Mont D’or stands the city of Besse, at a half quarter league from which one can see a great lake located nearly on top of a mountain, without a measurable depth and without any water inlet. Actually it is both admirable and terrible to see as, if a stone is thrown into it, it is ascertained that soon thunder, lightning, rainstorm and hail would occur. Not far from this lake there is an abyss named Creux des Soulcis...”

François de Belleforest (1530–1583) is a prolific translator of historical and literature works written in Latin. After having been a royal historiographer for King Henri III, he is commissioned by Parisian publishers Nicolas Chesneau and Michel Sonnius to translate the *Cosmographia Universalis* – i.e. geography – of Sebastian Münster (1488–1552). Münster *Cosmographia* (1565–1566), originally in German, is a very famous work of its time, translated into French, English, Italian and other languages. In his version, Belleforest adds a new and very detailed description of the Kingdom of France and its provinces, in specific chapters that are missing from Münster’s. The Auvergne description by Belleforest is one such addition: it is the most complete description of this province at the time. It has often been misquoted by the very few Auvergne historians referring back to it as “Münster-Belleforest 1575” (e.g. Fournier 1971), and we have reproduced this error (Meybeck 2010). For each new chapter, Belleforest mobilized a set of local informers to whom questionnaires were sent (Simonin

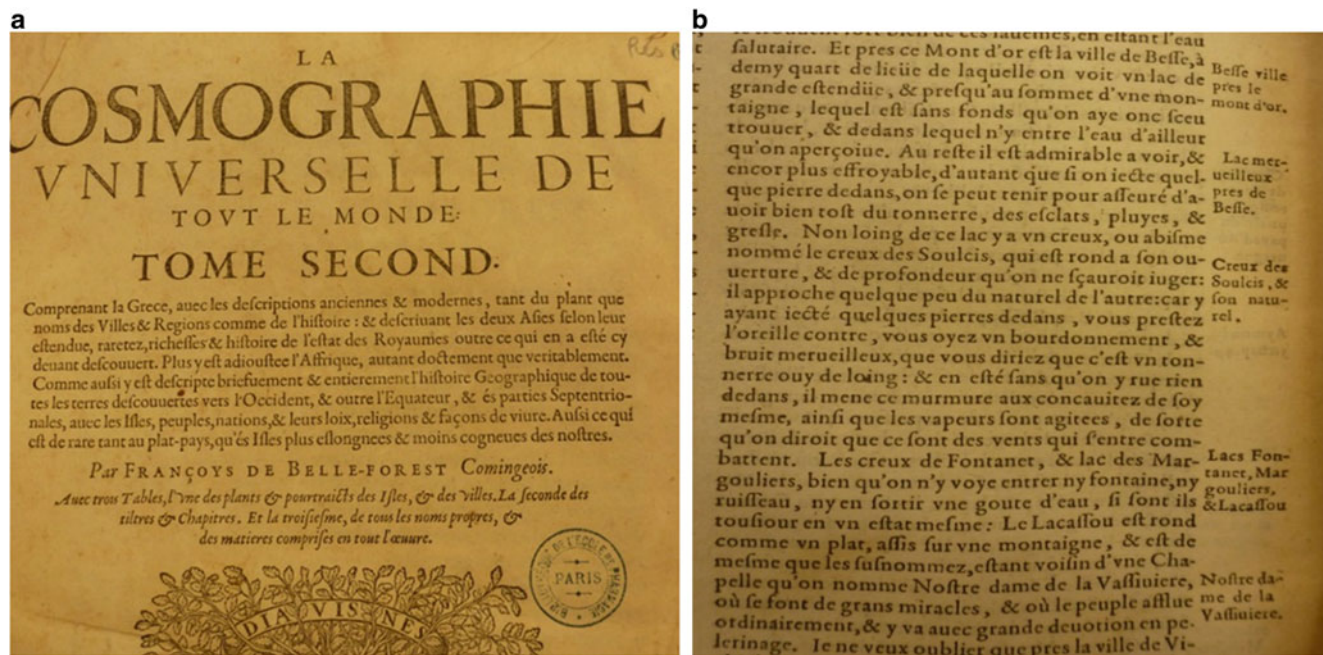


Fig. 2.2 Belleforest's *Cosmographia* (1575) with mention of a “marvellous lake” near Besse where a thrown stone triggers thunder, lightning and storms, and of the nearby Creux de Soucy. It is the first written account of Pavin and Creux de Soucy (Library of the Faculté de pharmacie, Paris)

1992; Deboffe 1995). His cosmography in two volumes is very well organized with a final index of topics and locations featuring about 10 000 entries.

Pavin (44 ha) and “Creux des Soulcis” (10 m², cavity opening) as well as two other nearby ponds less than an acre in size, are featured in this Auvergne description: they are indeed very modest water bodies to be featured in a Universal Geography! Until the nineteenth century, these places were difficult to access and/ or find (Chap. 1). Their description could only have been written first-hand by a local and educated informer who remained unknown. He could be Antoine Godivel the Queen notary who knew this territory so well, as supervisor of the Besse land register, and who could have been an acquaintance of Belleforest at the king's court.

In his *Cosmographia*, Belleforest describes only a few lakes, some major European ones such as Léman and Bodan (Geneva and Constance lakes), as well as a few others with remarkable features like the Asphalt Lake (Dead Sea, famous since the Antiquity), a cenote-type pit lake (a dissolution pit in limestone) in Haiti or the seasonal – *i.e.* karstic – lakes in Illyria (today Slovenia and Croatia). All these uncommon lake types indeed exist, and will only be understood centuries after his description. Their mention in the *Cosmographia* demonstrates that Belleforest was well aware of the natural wonders of his time. Furthermore, he did not try to explain them with fantastic stories, legends or miracles: although he is a near-fanatic catholic, he remains respectful of text material (Deboffe 1995). Belleforest's work is attacked, as

soon as it is published, by André Thevet (1516–1590), another cosmographer and competitor (Lestringant 1991), who claims that a true cosmographer should not rely on second-hand material but should instead, be on site (he himself went to South America and Italy). In Thevet's original description of Auvergne, published the same year (1575), Mont d'Or area and Pavin, are not featured although, as a royal historiographer, he could not be ignorant of the complaints made by Auvergne people to Charles IX, as mentioned by Jouan a few years before. Other early cosmographers like Charles Etienne (*Dictionarium Historicum et Geographicum* 1553); Petrus Apianus (1581); and Simeoni (1559) who describes the Limagne Plain, do not feature Pavin: Belleforest's mention of Pavin could be the first one made in a cosmographia.

Considering the previous description of Jouan (1566) and the 1551 event, Belleforest's concise yet detailed location and description of Pavin seems to be quite reliable: the lake is on top of a mountain, it is bottomless and without visible water input. In addition, the description confirms the three Nyos-like violent attributes (Table 1.2): thunder, lightning and storms, already described in 1551, and adds that they can be triggered by a stone thrown into the lake and that they results in hail formation. Whether the stone is a metaphor for a rockslide or should be understood literally remains uncertain. In the second hypothesis, the lake would be close to saturation, until the stone is thrown, as observed by contemporary geochemists at Monoun Lake, in Cameroon (see Sect. 1.6.1). Belleforest also mentions few other *Thrown*

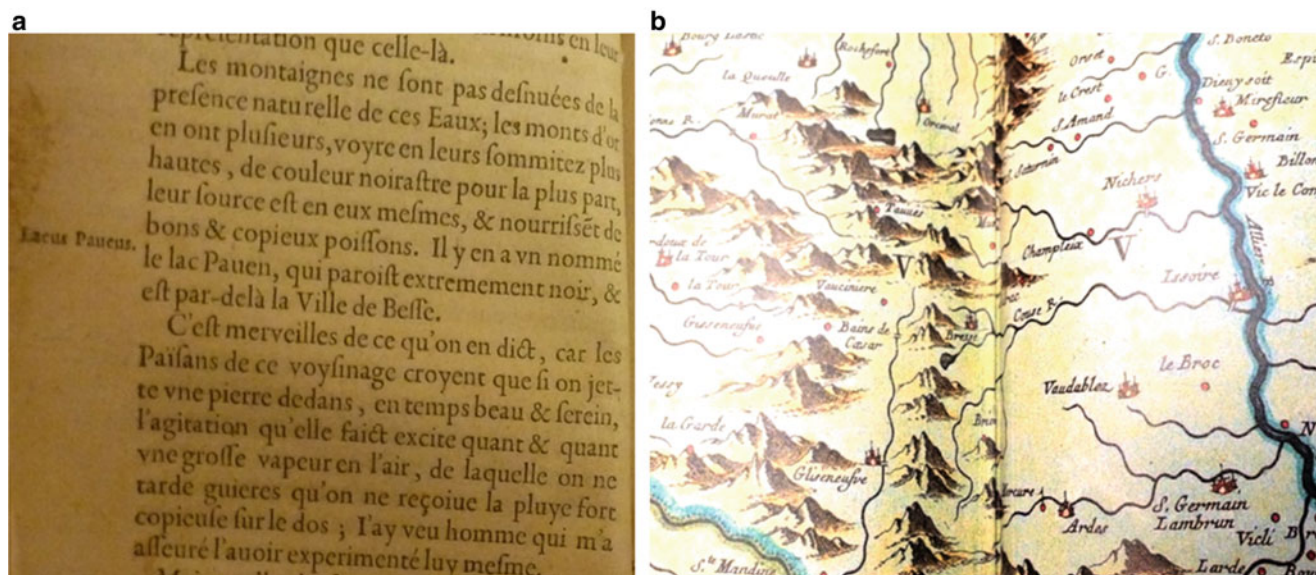


Fig. 2.3 (a) *Lacus pavens*, the terrifying lake, mentioned for the first time by Banc (1605) (BCU library, Clermont-Ferrand). (b) “Paven” Lake is mapped for the first time, although not named, in Amsterdam by Joan Blaeu (1663) in his world atlas featuring also Vassivière mountain

(Vaucinière), Mons Aurus baths (Bains de César, wrongly located), i.e. Mont Dore mountain, and Besse city (Bresse). Other lakes of the region are not featured. The lake is on the N-S watershed divide between Dordogne and Allier

Stone stories in some mountain lakes, in particular in the Canigou Mountain (Pyrenees) during the Middle Age (See a discussion in Chap. 3). However, when considering the 1551 Pavin event, the Jouan's 1566 record and the accurate description of Pavin's area in Belleforest, his account of Pavin seems reliable, even if the *Thrown Stone* part seems to be a stereotypical presentation:

2.3.3.5 *Lacus pavens*, the Terrifying Lake, Is the Original Pavin Name (Banc 1605)

Pavin naming is found for the first time in 1605, in the first census of Auvergne and Bourbonnais thermal waters, by Jean Banc, medical doctor in Moulins (*La Mémoire renouvelée des merveilles des eaux naturelles* 1605). In his general chapter on thermal waters, he starts with two examples of water-related marvels in Auvergne: the first is a *Lacus pavens*, as printed in the column margin (Fig. 2.3a), the second are the famous St. Alyre petrifying springs near Clermont. Banc's description, used here for the first time about Pavin, is presented as such:

There is one lake named the Pauen [Paven] Lake which looks extremely black and is above the town of Besse. It is marvellous, as they say, as the local peasants think that if a stone is thrown into it, when the weather is fair and serene, the resulting agitation excites eventually a big vapour in the air, from which soon one receives an abundant rain on the back. I have seen a man who ensured me that he had experienced this himself.

According to Banc the *Lacus pavens* naming is clear: Paven's means “terrifying” in Latin and its origin is ancient, possibly a legacy from Roman times, which has to be con-

firmed. Roman toponyms remained in use locally until the Middle Age: the center of the Mont d'Or village was still named *Pantheon* in 1420, in relation to the big temple established during the first–second century AD (Durand-Lefebvre 1926).

Banc is considered by hydrothermalism historians as a prime historical source on Auvergne thermal waters and, unlike many seventeenth century geographers, he has visited this province and went to Besse. It is likely, although not expressly stated, that he visited the lake, and his description includes the statement of a trusted local witness. It is therefore probable that this particular characteristic was not just a stereotype added by Belleforest a few years before and borrowed from other lakes. Banc's description is original and clearly independent from the previous ones made in 1551, 1566 and 1575: he does not explicitly mention thunder and lightning, as in Belleforest's text. He describes the frequent degassing, the “big vapour emitted in the air”, which results in “rain”, as the hail triggered by the thrown stone. This process is remarkable as it also happens here when the weather is fair and serene, as during the 1551 event and as suggested by the report to King Charles IX in 1566. It also appears less violent than in previous descriptions.

Following Banc's account, the second time the lake is named, in our Pavin corpus, is in another general work, *Les Rivières de France* by Louis Coulon (1644) as *Pauen* and *Pauin*. We then find *Pauain* (Du Bouchet (1645), *Pavent* (Godivel II, mid-XVIIth) and *Paven* (Jaillot 1715; Cassini 1815; Donnet et al 1820). During the same period, the lake is mapped for the first time in Joan Blaeu's (1598–1673) world

atlas published in Amsterdam (1644), in which the tiny lake is the only one in Auvergne to be featured on the map, another indication of its extra-ordinary fame (Fig. 2.3b). After 1800, the *Pavin* spelling gradually takes over.

The origin of Pavin's name has been, and still is, a subject of much debate among Auvergne specialists which illustrates the entangled analyses of Pavin history. Fournier (1971), a well respected Auvergne historian and etymologist, states: “*I do not know any ancient naming of the lake as Pavin. The first mention of a lake is found in Münster and Belleforest in 1575*” (as we've seen, Münster is not the author of this mention). Fournier also considers that Pavin was first named as such by Chevalier (1770), and then by Dulaure (1788); Legrand d'Aussy (1788); and Delarbre (1805), therefore ignoring Banc and all other previous spellings used. For him, the possible origins of Pavin are (i) *paveo*, meaning “I terrify” in Latin, an hypothesis rapidly ruled out by him, (ii) *pavage* – paving – as there are rocks on the shoreline that mimic paved ground, (iii) *palenc*, a palisade in Occitan language, as some cliffs within the inner crater look like it. Fournier favors this last etymology as Herillier (2011). For Fournier, the *pavens lacus* expression is expressed for the first time in 1921 (Crégut 1921). Crégut found the Pavin description of Briet (1648) with the Trown stone story and mocks those “pleasant etymologists who derive Pavin from lacus pavens”, although Canon Crégut, as Vicar Delarbre in 1805, does not mention who were they. A further research shows that Briet was using André Du Chesne (1614), himself reproducing Belleforest text without quoting him.

Actually, all these possible etymologies had already been mentioned in the mid-1600s manuscript of Godivel II (1650s, see further), but for this scholar from Besse, there is no doubt about the name, “*The lake has always been called Pavent (sic)...It is likely that such denomination is due to the fear and fright generated to all when one looks at it, even everyday of one's life*”.

2.3.4 The Admirable and Terrifying Pavens Gets Famous During the Seventeenth Century

Belleforest's stereotypical *Thrown Stone* story, featuring the stone that trigger thunder, lightning and subsequent storm with hail, will be reproduced for 200 years and more without much modification by many cosmographers, clerks and scholars. Most of them do not mention its origin nor develop an analysis; none of them have visited the lake, as they do not add their personal touch concerning this exceptional phenomenon, but they increase Pavin's fame among scholars, well outside the Auvergne province and the kingdom.

Bessin (1604) is one of the first to reproduce the *Thrown Stone* story, followed by the Dutch geographer Paul Merula

(1558–1607) in his 1605 *Cosmographia*, by André du Chesne (1584–1640) in his *Description of France* (1614), Pierre d'Avity (1573–1635) in his *Cosmographia* (1643), Louis Coulon (1605–1664) in his *Hydrographical Description of France* (1644 and 1654), de La Planche in a manuscript description of French cities (1646), French Jesuit Philippe Briet (1601–1668) in his *Parallela geographiae et novis* (1648) and Louis Moreri (1643–1680) in his *Great dictionary* (1712).

Father Fodéré (1619), an Auvergne clerk, qualifies Pavin as “*admirable and terrible*”; his visit to the lake is unconfirmed. According to Audigier (1720), Athanasius Kircher, the famous German scholar (1601–1680), also mentioned the same description of Pavin. However we failed to find this quotation in Kircher's 40 books, likely to be in his *Mundus Subterraneus* (1664–1678). Most of these mentions of Pavin remain unknown – or voluntarily undisclosed – by Delarbre (1780, 1805); Lecoq and Bouillet 1831; Lecoq (1835a); Eusebio and Reynouard (1925) and Fournier (1971).

2.3.4.1 The Godivel Manuscript, Late Seventeenth Century, Details Permanent and Occasional “Paven” Degassing

The manuscript is uncovered at Besse in 1874 in the Godivel family archives, when the old and famous family lineage terminated in Besse, and published in 1884 by Jaloustre, the Besse historian. The author of the manuscript, a master of Latin and Greek, could be Nicolas Godivel, Besse chatelain and lawyer at the Auvergne Parliament in 1686, according to Cladière (1687); we will name him Godivel II. The text has been written, according to Jaloustre, in the middle of the seventeenth century, maybe at the turn of this century, as *Remarques touchant la Ville de Besse*. Pavin's three-page-long detailed description is an important part of this manuscript. As seen previously Godivel also discuss *Pavent* name. Pavin can be summarized as such:

The lake is one of the most beautiful to be found in Europe. Its depth is thought to be unlimited: some courageous and curious [men] went with a craft in the middle of the lake and let run 313 fathoms of ropes [without reaching the bottom]. The outlet discharge is important even during summer drought. The water is clear and smells like ferrugineous springs in the Pyrenees. Fish has never been seen [in the lake] nor any plant. Birds are rare in the surrounding woods: the reason is that the fog which is seen escaping at any time from the lake keeps them out and makes this place uninhabitable...This place is feared because in summer several exhalations and vapours are emitted and eventually result in clouds and storms that threaten the whole area.

This text is fully coherent with the previous sixteenth century descriptions and it corresponds to different intensities or types of degassing (Table 1.2). The first one is a permanent soft degassing – the fog – when the lake is not frozen, with a sulfur odour and a ferrugineous taste. The absence of fish, birds and even of aquatic vegetation is a noted feature of

Pavin. The second one, which occurs a few times each summer, is characterized by violent exhalations and vapours, with clouds that are threatening the whole area. It corresponds to a sudden, spontaneous and intense degassing, although not as violent as the ones either observed by the Vassivière pilgrims in 1551 or reported by Belleforest, as thunder and lightning are not mentioned here, but is quite similar to Jouan's description (1566) and to Banc's description (1605). It also says that attempts by local courageous people failed to determine the depth of the lake, a finding similar to Belleforest's text. According to Jaloustre (1884) this manuscript is from the second half of the XVIIIth century.

The Godivel manuscript is a major source on Besse history, used by few local historians working on the town's past (Boyer-Vidal 1888; Eusebio and Reynouard 1925; Gomis 2006), ignored by Crégut (1921), unused by Fournier (1971), briefly quoted by a limnologist (Omaly 1968). Before our preliminary work (Meybeck 2010), this manuscript was considered by Eusebio and Reynouard (1925) to be more of a record of legends than a reliable description.

2.3.5 Pavin's State Is Gradually Presented as Normal (Eighteenth Century)

Belleforest's followers are still found during the eighteenth century like Patrick Gordon in his *Geographic Grammar* (1743). Louis de Mailly (1689–1767), in his work on *Nature Principal Wonders* (1723), reports other *Thrown Stone* stories generating dangerous storms for one lake in Germany and one in Switzerland, and states that another lake in Auvergne produces similar effects (see discussion in Chap. 3). It is unlikely that these scholars have visited Pavin. Other scholars are now ignoring Belleforest, as Bruzen de la Martinière (1683–1746) in his *Dictionnaire géographique, historique et critique* (1739–1741), and Piganiol de la Force in his *Nouvelle description de la France* (1754).

Canon Pierre Audigier (1659–1744), often considered as one of the first Auvergne historians, cites both Pavin and Creux de Soucis in his manuscript on Auvergne History (Audigier 1720, only published in 1894, p. 139); it is an early critics of the *Thrown Stone* story:

...Its water is awful to see as its depth is difficult to find...If one makes an effort to shoot a gun, one can hear echos as those made by thunder when it bursts out several times; this lead people to believe that, when a stone is thrown into the lake, in a calm and blue day, the agitation of the water caused by the stone, generates a vapour followed by rain, storms with hail and thunder. Despite the publication of this wonder by our geographers, as well by Father Kircher, based on some authors, it is certain that this does not happen.

It is difficult to check if Audigier himself has visited the lake. His statement confirms a previous opinion by Jesuit de Frétat (1672) on the prime importance of Pavin in Auvergne

and on the failure of the *Thrown Stone* experiment. The thunder is now explained by gunshots echos. The stone and the gunshot experiments will be performed by each visitor to Pavin, particularly when guided by local people, until the end of nineteenth century.

After the mid-1700s, Auvergne naturalists fiercely deny the Belleforest's description and its repetition by seventeenth century geographers, which they now consider to be *Pavin stories* since they are unable to observe any of the former Pavin attributes when they visit the lake. The first disproof of these "stories" relates to Pavin's bottomless reputation.

2.3.5.1 Finding Paven Depth, a Major Challenge (1672–1770)

Pavin is thought to be bottomless. This is not the least of its many mysteries. In 1672, Amable de Frétat, a Jesuit, draws the first accurate map of the Pavin area. He considers *Paven* as the VIIIth wonder of Auvergne in a list of XIII, which he briefly develops in the margin of his map. There he notes that the lake water is very beautiful and clear and "*it is not true that when throwing a stone one triggers a great vapour and thunder as reported by some authors. The lake is 60 fathom deep*" [110 m]. This is the first disproof of Belleforest's statement by a scholar and a visitor to the lake who is the first to mention the *Thrown Stone* experiment. Frétat does not provide any other detail on Pavin's state, nor does he mentions how he has measured the depth. A permanent soft degassing in 1672, as stated in the Godivel II manuscript, cannot be totally ruled out as Frétat only refutes the *Thrown Stone* effect.

On March 9 1726, another Godivel from Besse (Godivel III) failed to find Pavin depth while the lake is frozen, but measures for the first time its length and width: 1000×927 geometric steps (five feet), which probably required a sustained effort by several people (Legrand d'Aussy 1788; Delarbre 1805). In 1760 Domeiron, a voyager, visits Pavin but also fails to generate a storm while throwing a stone (La Porte et al. 1790). However Auvergne historians do not mention de Frétat's work: the first successful sounding of Pavin [96 m] is attributed instead to Chevalier in 1770 (Delarbre 1805). It can be considered as the first scientific approach on Pavin (see Sect. 1.4.1).and will be a major disproof of Pavin stories. Few years after Chevalier's expedition another misbehavior event is witnessed at Pavin but will remain ignored for 200 years.

2.3.6 A Sudden, Unexpected and Moderate Degassing Event (21 August 1783 Pavin Event)

This remarkable and non-violent event is witnessed and published by Besse chatelain Godivel (Godivel IV, grand son of Godivel III). It took place after Chevalier's expedition.

Godivel IV, who knew Pavin very well, found his observation worth publishing, and only a week later sent a two-page “letter to the editor” to the *Feuille Hebdomadaire de la Haute et Basse Auvergne*, a new pre-revolutionary weekly magazine. The abridged version follows:

Paven Lake, at half league from Besse, is one of Auvergne marvels. It represents a terrible gorge in a mountain...Its water has always been very clear, never clouded by rains nor by storms or inlets, which are invisible. The outlet discharge is very stable and could work a watermill. On August 21 [1783], on a very clear day I have crossed this stream at eight in the morning to go to Vassivière. When going back at four in the evening with three priests, a deacon and my son, scholar in philosophy, I found the outlet water very turbid and yellowish...My son climbed to the lake, some 150 toises [180 m] from there, and found the lake surface completely troubled, carrying a sort of yellowish silt [limon glutineux]. He took the water in his hand and when this substance dried it produced on his hand some pimples with a slight pain that lasted some time. The same day the land keeper came to tell me: “Sir, there is something extraordinary in Paven which I have never seen, the water is boiling everywhere but there is no wind, it is yellowish and even rusty in some places”. The day after, I called my farmer Gelac who stays close to the lake. He told me that the water had been dirty two or three times this summer, in the evening...I suppose that there has been inside the lake some slide, so important that such volume of water was clouded and infected by some venomous material...

This important text on Pavin is much contextualized, with the exact date as well as named witnesses. One notes once more the initial spelling of the lake, the celebration of Pavin as a wonder of Auvergne, as in Fréat’s list (1672), and the latent fear (*a terrible gorge in the mountain*). At the time, the path from Besse to Vassivière avoids the lake outlet and is located on the opposite side of the valley. The witnesses immediately notice Pavin’s abnormal behaviour, a sudden change of colour and nature in lake’s water. It is very different and much less violent than previous descriptions of degassing at Pavin (the atmospheric event of 1551 or the descriptions made by Belleforest, Banc and Godivel II). Godivel details: (i) a colour change, from very clear water to yellowish, sometimes rusty, (ii) a modification of the nature of the waters which look silty, (iii) the phenomenon occurred suddenly, within a few hours, between morning and afternoon, (iv) the whole lake surface is affected, (v) this abnormal behaviour had been observed by a third witness several times during the summer of 1783, (vi) it was associated with the whole lake boiling in the land keeper testimony, (vii) the water is slightly corrosive and can cause skin disease. All these observations have been made by scientists in other degassing maar-lakes (Table 1.2).

Godivel IV’s observation of this phenomenon is very factual and detailed, it includes a rational explanation: he attributes this event to an internal slide, a processus that had actually occurred several times at Pavin, as made evident today by sedimentologists (Chapron et al. 2010, 2012; Chassiot et al. 2016). Considering a probable meromictic nature of Pavin maar-lake at that time, *i.e.* the permanent

occurrence of an anoxic bottom water layer (see Chap. 1), these changes of water colour and aspect are likely due to rollovers of lake deep waters with precipitation of iron hydroxide when mixed with oxygenated surface waters. Such hydro-dynamic process is also invoked for the Albano maar-lake in Italy (Ellwood et al. 2009; Funicello et al. 2010).

The journal in which Godivel IV is publishing is the first news magazine in Auvergne. It aims to be read by nobles, bourgeois and ecclesiastic and has a section devoted to “Arts and science”. In her analysis of this journal, Labarre (1977) is indexing this sudden modification of the river as a “pollution in Vassivière stream”. Despite its definitive scientific value, this description, made outside of the academic world, will remain ignored until...1987! It is unquoted by contemporary Auvergne authorities (Chabrol 1786) and naturalists (Delarbre 1795, 1805; Lecoq 1835a), by limnologists and historians (Eusebio and Reynouard 1925; Fournier 1971), only to be mentioned for the first time by journalists working on Pavin’s history after the Nyos event (see further). It remained to this day un-analysed by historians, volcanologists and limnologists. In a 1877 manuscript one finds a possible veiled reference to this event by Jean-Baptiste Bouillet, a noted archaeologist and former co-author of Lecoq, who mentions that during the year of the Calabria earthquake in 1783 (now scaled 7.0 on the Richter scale), *the waters of Pavin turned red during 3 weeks*. However this earthquake occurred in February and March: could the destabilization of Pavin sediments have occurred some months later and triggered a rollover?

This soft degassing is by many aspects similar to that of Lake Monticchio, observed between 1800 and 1840 including the corrosive nature of Pavin’s waters, similar to the “vitriol-like” water taken from Monticchio’s deep waters by Tata in 1777 (see Sect. 1.6.2.2). This event is also omitted in the following statement by Chabrol.

2.3.6.1 An Official Statement Denies Pavin Marvels (Chabrol 1786)

Guillaume-Michel Chabrol (1714–1792), a King’s state councillor, establishes in 1786 the Auvergne register of local rights, a remarkable work – 858p with multiple indexes – and a major historical resource for this province. All villages are listed one by one with the history of their owners’ rights, sometimes as far back as the thirteenth century. It is likely that Chabrol has been to Besse and he curiously starts this legal register for this town by a detailed description of Pavin, warning local people and visitors about *Pavin’s stories*, which he then disprooves one by one. It is actually one of the most complete lists of Pavin’s marvels:

The town of Besse is near the Monts-Dors: there is a very large community of priests and this town is famous for its devotion to the Virgin, the image of which stays in summer at Vassivière and the winter at Besse...There is in Besse territory a lake named the

Pavin and the Creux de Soucy about which some marvellous events are reported [outside Auvergne], which have nothing remarkable, except that this lake has no fish; the depth is fifty-seven fathoms but the stones thrown into it do not raise any storm, nor hail nor thunder as it has been written by many geographers; guns shot ashore have no other effects than the repetition of various echoes, and there is no smoke nor hot exhalations; the lake water does not generate any bad effect when in contact with it; it has been wrongly said that it was bottomless; there is no external input of water but there is a small outlet because of internal springs. It is told that waters from the Creux de Soucy are communicating with it. It may or may not be so but there is no interest in this.

This looks like an official statement from Auvergne authorities to end the reporting of Pavin's stories. Chabrol does not mention chatelain Godivel's publication of the odd event at Pavin, 3 years prior, even though his veiled reference to the corrosive nature of Pavin's water suggests that Chabrol knows this description, or that it has been reported to him.

2.3.6.2 Pavin Is at Last Visited by Naturalists (1770–1820)

In the second half of the eighteenth century, interest in natural sciences is developing, particularly in the Auvergne Mountains where so many geological, botanical and hydrological curiosities remain to be discovered and studied for their picturesque and scientific values (Babeau 1928). The successful expedition of Chevalier in 1770 has piqued the attention of many naturalists: Monnet, an hydrologist and a chemist, Delarbre, the Clermont botanist, Dulaure and Legrand d'Aussy, historians and writers, Montlosier and Lacoste de Plaisance, volcanologists, Desmarests, geographer and geologist or La Porte, a traveler. These visitors to Pavin do not observe any of the lake's characteristics described by so many authors during the previous centuries, and they ignore Godivel IV's recent publication. These naturalists are not equipped to extend Chevalier's scientific investigations in 1770. None of them attempts to take a sample of surface and deep water for a chemical analysis, as done in 1777 by Tata at the Monticchio Lakes in Naples kingdom (Sect. 1.6.2.2). Likewise, they do not try to make a thermal profile as done by de Saussure in Lake Geneva (see Chap. 1). They are usually coming from the Bains du Mont d'Or village, to day Mont Dore, across the mountain and are guided by local people who continue to tell their stories about the lake, despite Chabrol's recommendation. Guides carry guns to perform the "Pavin experiment" in front of visitors, reproducing the thunder effect with the shooting echo and throwing stones into the lake, without success. In contrast with the stereotypical seventeenth century repetitions of the *Thrown Stone* story, these new descriptions are nows detailed, personalized and generally combined with those of Creux de Soucy. Only some of them are reported here.

A.G. Monnet, a royal mines inspector, comes twice to Auvergne to evaluate its hydro-thermal capacities. He makes a geological and hydrological description of Pavin (1788). He celebrates *Paven*, the Auvergne wonder and the nearby Vassivière pilgrimage, so respected by local people, recognizes Pavin as a volcanic crater and takes note of its paved-liked banks, which, according to him, could be the origin of its name. He attributes the absence of fish to the coldness of the waters, a hypothesis also made by many visitors after him. He does not mention other *Pavin stories*.

Legrand d'Aussy (1737–1800), an historian and a naturalist, member of the Academy, describes Pavin in ten pages in his *Voyage en Auvergne* (1788). He is quite smitten: "*maybe the most beautiful lake in Europe, for sure the most singular*". He then disproves the old tales one by one: (i) he sees some fish [there are no big fish, only few roaches and bleaks are present in Pavin before 1859], (ii) he carries pistols and experiments with the gunshot echos, (iii) he throws a stone... nothing happens. However he is fascinated by Pavin's mysteries and would like to dive into the deep waters to unveil its multiple secrets. As he is not born in Auvergne, his work is much criticized by local scholars such as Delarbre, but for others, his work is considered as the most relevant description of this province.

Antoine Delarbre (1724–1807), the vicar of Clermont's cathedral and founder of the Clermont Botanical Gardens, visits Pavin for the first time in 1777 with his friends Ozy and Monnier, a naturalist and a pharmacist (Vernière 1899). His first report on Pavin is in an unpublished manuscript (1795); it is followed by his presentation of Auvergne (1805). He holds the most skeptical attitude about *Pavin's stories*, which he vaguely presents and then disproves one by one. He does not mention Jouan, Belleforest, Fodéré or chatelain Godivel and labels all geographers of the seventeenth century as "*compilers who made together an arrangement to tell old stories that lack nothing but the truth*". Therefore he does not mention any of them in his 1805 version, but quotes Moeri 1712 and Gordon 1748 in his 1795 manuscript! For him the sound produced by cracking ice can be similar to thunder, thus explaining this legend (even though all thunder noise accounts are reported for the summer season). Delarbre also observed "*some fish*" in the lake and as far as he is concerned, this is the ultimate proof of the lack of grounds of all other *Pavin stories*.

Volcanology pioneers' only concerns are the origins of Pavin and its neighbour, the Montchal volcano. For the most prominent among them, Montlosier (1755–1838), Pavin does not originate from a *roasting eruption* [with lava flow emission] but from a *pulverulent eruption* due to the action of water or air (1789).

Lacoste de Plaisance (1755–1828) reports in 1803: "*very close to Puy de Montchal, [in French mont-chaud, brûlant – scorching mountain – a denomination so expressive which is*

a proof that those who named it must have seen this volcano burning. Such a name would never have been given to a mountain that would not burn], there is a lake named Pavin, which should owe its existence to a volcanic explosion". Lacoste is the only one to place such importance on Montchal's toponymy, the crater adjacent to Pavin. He follows Montlosier regarding Pavin's origin, a position also endorsed by Poulett-Scrope (1866). However, the origin of the lake remains in debate until 1900: Julien (1869, in Vimont 1874) favours a glacial origin, which explains the great depth of Pavin, followed by a damming of the glacial valley by the Montchal volcano; Glangeaud proposes a collapse of the Pavin volcano after its eruption (in Boule et al. 1901). The history of volcanology of the Pavin area is fully developed in Chap. 5.

Dulaure (1755–1835) publishes his *Description of France* in six volumes in 1788. Born in Auvergne, he visited Pavin and has been hearing about its stories for a long time. In his section on Auvergne, he makes a balanced analysis of past Pavin descriptions. He is one of the few to reproduce the statements of Jouan (1566) and Fodéré (1619). Then, based on his visit to Pavin and on the findings of Chevalier, he strongly challenges the "marvellous phenomenon" these authors have described. For him the *Thrown Stone* story is probably due to the remembrance of a former volcanic explosion, which could explain that the lake's name derives from *pavens*, the terrifying.

Until now, Delarbre has been considered as the main historical source on Pavin, although he seems more biased than Dulaure or Legrand d'Aussy. After Delarbre's publication in 1805, all of Pavin visitors, like Lecoq and Bouillet 1831; Lecoq (1835a) will share his opinion.

2.3.7 The Attractive and Repulsive Dual Nature of Pavin Throughout the Nineteenth Century

During the nineteenth century, Pavin is fully normalized, mostly by Henri Lecoq who introduces the first large fish (char and salmon) in the lake (1859), which serves as the ultimate proof to dispel all of Pavin's marvellous effects. On the other side, he reports in details what he calls the *Pavin stories*, which he heard from his guides, thus ironically promoting these tales throughout the nineteenth century. Excursions from Mont Dore to Pavin are becoming a must-do and dozens of elaborate Pavin descriptions, with new romantic overtones, are recorded in the travel memoirs of the wealthy people coming to the Mont Dore spas. Some of them are famous writers and they choose Pavin as a central component in their novels and short stories, as Scribe and Assolant. After Lecoq's death in 1871, Clermont scientists start to study Pavin with their specialized equipment and will not pay any attention to the old stories.

2.3.7.1 Romantic Visitors Celebrate the Latent Fears of Pavin and Its Unique Atmosphere

At the beginning of the XIXth century geographers still report Belleforest's description (Prudhomme, 1807). Pre-romantic writers celebrating France's natural wonders are very impressed by the scenery and by the volcanic origin of Pavin. Depping (1811) spends three pages on Pavin:

"...It is one of the most beautiful and most singular lakes of our country and should be added to the beautiful monuments enriched by nature on the land of Auvergne ...At times when the volcano was in action, there was in its crown an indentation through which the liquid and fluid substances were vomited... The shore of the lake forms a kind of horizontal bench which is covered by lavas rocks placed jointly, as would be a natural pavement..." Depping also suggests that "the study of deep waters would reveal many singularities", a statement probably borrowed from Legrand d'Aussy.

Jean-Charles Nodier (1780–1844), Isidore Taylor (1789–1879) and Alphonse De Cailleux (1788–1876) describe Auvergne in 1829 in their *Voyages pittoresques et romantiques dans l'ancienne France* in 23 volumes, published from 1820 to 1878. This monumental work, the first of its kind, celebrates the archeological and picturesque patrimony of France. Their volume on Auvergne is fully illustrated by splendid pre-romantic engraving, including the earliest Pavin engraving (Fig. 2.4). They dedicate many eulogistic pages to Pavin that can be abridged as such:

Pavin is the ruin of a volcano and the location of one of the most famous wonder as told by the people...Here a stone thrown by an imprudent person...would generate, from the deep, thunder clouds that vomit a storm...Often thick clouds and hot exhalations would spread on its shore...The hands of the voyager refreshed [in the lake] would be covered by swellings and pimples as if they were burned...Its name, Pavens, imposed by the Romans, tells well that it was a threat in this area.

Nodier has a background in Natural Sciences and baron Taylor has personally experienced active volcanism during previous visits to Vesuvius and Etna, qualities so far rarely found in visitors to the Pavin. Most of this description is related to what they heard from local guides, either from Mont Dore or from Besse: thick clouds and hot exhalations are explicitly mentioned and the *Thrown Stone* story triggering thunder and storms is reported once more. The mention of the skin disease, swelling and pimples, is identical to the one reported by Godivel IV in 1783. Nodier also links the Vassivière pilgrimage to a latent fear of atmospheric phenomena at Besse (see Chap. 3) and concludes: "there is always a positive and undisputable truth behind all popular superstitions, for the one who knows how to find it".

In the 1820s, the new road between La Tour d'Auvergne and Besse is established in the Couze Pavin valley, according to maps by Desmarest (1798–1828) and Maury (1844). Before that period, the road avoids the Pavin valley and is located on the plateau, some kilometers further south, near



Fig. 2.4 First Pavin drawing, with a marked romantic vision (Nodier et al, *Voyages pittoresques et romantiques dans l'ancienne France*, 1829) featuring a marked outlet incision (Author's collection)

the Creux de Soucy (Fig. 1.2c). At this period only few geographers only mention Pavin as a “natural curiosity” (Kilian and Piquet 1823)

Throughout the nineteenth century, Pavin will be high on the list of excursions to be taken from the Mont Dore area, first by foot or on mule, and much later by car. Famous writers are coming to Pavin, spreading its fame, and sometimes they include it as a major component in their novels, as Gibory (1840) in *La Vierge aux œillets*, Scribe (1791–1861) in his *Roi de Carreau* (1843), George Sand (1859). The most famous author is Guy de Maupassant (1850–1893) who places *Humble Drame*, a short-story, at the Sancy Mountain and creates a very attractive vision of Pavin “so clear and so blue...so charming that one would like to live in a hut in the wood dominating this crater where cold and tranquil water is resting” (Maupassant 1883). The last novelist to feature a major scene at Pavin is Paul Bourget (1852–1935) in the *Démon de midi* (Bourget 1914).

2.3.7.2 The Sunken Castle of Pavin Featured in a Novel (*Le Puy de Montchalm*, Assolant, 1875)

One of the novels featuring Pavin, *Le Puy de Montchalm* by Assolant (1875), counts among the many origins of the legend of the *Sunken City*. The author places the action at Pavin in 1665, a dark period of Auvergne history when nobles were

behaving like ruffians. A big castle is featured on the lake shore: “the lake is subject to terrible storms and the former volcano crater seems to still breathe and moves like a wild animal” (p.24), “local people say the lake is the inferno gate and that if a stone was thrown a storm would occur, lifting the lake and the devil would appear at the lake surface” (p.184). The owners of the castle, feasting and behaving badly, terrify the entire region, but there is a happy ending when the whole castle is sunk into the lake, troublemakers and all. The city sunk into a lake for its trespassing is a recurrent theme in lake legends and many interpretations can be given (see Chap. 3). As regards to Pavin, the sunken city story does not appear, in the analysed texts, before the end of the nineteenth century.

2.3.7.3 Pavin Stories Normalized by Lecoq (1831–1870)

Henri Lecoq (1802–1871) is the most famous Auvergne scientist of his time, being a botanist, a geologist and a hydrologist (see Sect. 1.4.2). When he visits Pavin for the first time in 1831 with his companion Jean-Baptiste Bouillet, a mineralogist, he reports a “charming picture, made even more majestic by an absolute silence” (Lecoq and Bouillet 1831). His illustrated account of his visit shows the near absence of vegetation within the crater, the pristine and impressive state of the rims and of the outlet (Fig. 2.5) (Lecoq 1835a, b). He



Fig. 2.5 Lecoq's drawing of Pavin in pristine state (1835b) showing the "terrible gorge" described by chatelain Godivel in 1783 and the explosive nature of the crater. The access to the lake is from the left rim

of the cascading outlet. The Montchal volcano, not vegetated, is topping the Pavin explosion crater. The barns are not in the Couze Pavin talweg but on its North side. (Musée Lecoq, Clermont-Ferrand)

mentions all the dreadful stories, still told by his local guides despite Chabrol's official warning: the lake has no depth, no fish, a stone thrown "*makes the water boil and generates a storm*"...; there is "*no boat, no wherry comes across these deep waters, no one would dare to linger on the liquid plain for there is in the middle a whirl that would swallow the careless*" (the Whirl and Storm legend, Eusebio and Reynouard 1925). He labels these as "*absurd tales and legends invented by fear and transmitted by credulity*". Some key characteristics of lake degassing (Table 1.2) are once more present in this list, with the addition of a lack of floatability that fully explains the absence of boats. Lecoq's mention of boiling waters could be related to the summer 1783 event described by chatelain Godivel, not mentioned by him.

The lack of boats on the lake will at last be resolved in 1844: Lecoq himself manages to have one constructed near the lake and he uses it several times for his observations. The lack of fish – excepted two small species – comes to an end in 1859 when he successfully introduces into Pavin thousands of chars and salmon juveniles – obtained from a new fish-breeding technique of which he is a pioneer (see Sect. 1.4.2). The fish introduction convinces the local people of the stupidity of their tales, chars are sent to all restaurants of the region and fishing soon becomes an attraction for the Mont Dore visitors who are now securely sailing the lake on few small boats. Lecoq confirms Chabrol and Delarbre's rebuttals of *Pavin stories* such as: the origins of its waters are not mysterious any more as springs have been found by

Chevalier in 1770; thunder is caused by echos and/or by ice cracking in winter etc (Lecoq 1835a).

Lecoq has not deciphered the complex history of Pavin. Although he is familiar with the works of Belleforest and Banc, and of Jouan's chronicle, which are listed among his references on Auvergne, he does not refer to them, nor to Godivel IV's letter to the editor of the *Feuille d'Auvergne* in 1783, which was also ignored by Chabrol and Delarbre. Finally it must be stated that he could not be aware of the Godivel II manuscript, only discovered in 1874, nor compare Pavin to Nyos descriptions. Every time Lecoq comes to Pavin, the lake seems normal. His attitude is in contrast with the one of his contemporary colleagues from Naples, Tenore and Gussone (1838) and Palmeri and Sachi (1852), who could conceive of extra-ordinary events in active volcanic areas and described the degassing of the Monticchio Lakes, which occurred two decades before their visit, on the basis of testimonies and previous observations (see Sect. 1.6.2.2). We ignore if Lecoq was aware of the descriptions of Monticchio degassing made by Naples scientists between 1777 and 1850s.

Lecoq's attitude about Pavin stories is shared by his companion, Jean Baptiste Bouillet, a mineralogist and archaeologist: "*A thousand tales have been made about this lake; many prodigies are attributed to it that we will refrain to report here*" (Guide du voyageur à Clermont-Ferrand 1836). This statement illustrates the position of all nineteenth and twentieth century naturalists.

2.3.7.4 Pavin Stories Diffusion in Guidebooks, Larousse Dictionary and Reclus Textbooks

Very early in the nineteenth century the *Thrown Stone* story by Belleforest is still mentioned in most Auvergne and Mont Dore guidebooks and travel accounts (Taillandier 1826; Stuart-Costello 1841). Then Lecoq's reporting gets a prominent place among scholars and guidebooks authors, thus promoting the centuries-old Pavin's stories and drawing again the attention to the lake throughout the second half of the XIXth. After Lecoq and Rico have opened Pavin to visitors and introduced fish (see Sect. 1.4.2), Pavin becomes very popular and no one truly believes in those marvels any longer.

Adolphe Joanne (1813–1881), a geographer and initiator of a famous guidebook series, is one of the first to quote of Lecoq, upon his visit Pavin: “*none of the local people, says M. Lecoq (Description de l’Auvergne) would dare to venture on this liquid plain. A whirl exists in the middle that swallows the unfortunate who would lead his boat there. A stone, even thrown from far so as to reach the abyss, would make the water boil and produce a storm. The sounding lead melts in the middle of the lake and its depth has no limits*”... and remarks “*an elegant boat sails on Pavin waters, despite the terrible legends told in this country*”. (Joanne 1867). In the 1894 version of the guide Pavin terrible stories will just be evoked.

Pierre Larousse (1817–1875), the famous encyclopaedist, in turn includes Pavin in the first edition of his *Grand Dictionnaire Universel* (1866–1877) using Joanne's citation: “*Pavin Lake, says M. Joanne, played a great role in Auvergne legends: it was enough, he was told, to throw a stone into it to trigger terrible storms, therefore its name Pavin (pavens, frightening)*”.

The *Thrown Stone* story is also found in Cosse (1857) who links the ancestral fear – *pavens* – with the remembrance of past volcanic eruption, Piette (1863); Nadeau (1863); Labesse and Pierret (1892); Tardieu (1888). Many visitors are still performing the “Pavin experiments” with guns and stones (Chaumette 1857; Cosse 1857; Clugnet and Alvin 1877; Bouillet 1878). In other guidebooks the Pavin's stories become less detailed, the existence of “terrifying tales” is only just mentioned and then finally dropped (Neulat 1846; Chabory 1894; Bouillet 1878; Joanne 1881; Lacroix de Marlès 1884; Larive-Fleury 1889).

Elysée Reclus (1830–1905), the prominent French geographer, makes this statement in volume II of his *Géographie Universelle* (1885):

“Pavin was much feared in the old times and, according to the tradition also found in the Aubrac plateau and in mountainous regions, it was believed that marvelous events would generate storms: a simple stone into the water would be enough to call for a storm. However, nowadays it is trans-

formed into trout fisheries and it has lost its terrifying character. Once judged bottomless, it is in fact more concave than any other Auvergne lakes, as the sounding line touches its center at only 94 m”. Reclus is also referring to the description made by Gregorius of Tours of an Aubrac lake, that could be re-attributed to Pavin as discussed in Chap. 3. His brother Onésime Reclus (1837–1916), another noted geographer, also mentions the *Thrown Stone* story in his works on France's geography (1888, 1899).

Jean Ajalbert (1863–1947), a famous writer and critic, gives one of the last romantic descriptions of Pavin: “*terror lake, tragic horror, fantastic vision, gloomy lake, inferno lake*”. His illustration does not promote this vision (Fig. 2.6) but this photo-engraving shows landslide scar within the crater rim, opposite the outlet. In his book on Auvergne, a whole chapter is dedicated to Pavin where he mixes for the first time the *Thrown Stone* story, the *Whirl* story coined by Lecoq and a *Sunken City* story (Ajaltbert 1896). Meanwhile, the town council of Besse modifies the lake outlet, which is shifted by few meters to the NE, and the lake level is lowered by 4 m to its current level. The modern technology almost arrives at Pavin: a project, promoted by the Besse town council and supported by the Onésime Reclus (1886), of using the lake for water resource and hydropower – 3 to 4 m³/s diversion particularly during the summer drought – is well underway (Reynouard 1909). Fortunately, the project, which would have generated marked water levels fluctuations, is abandoned. In 1909 the circular pathways around the terrible lake is achieved with the financial help of the Touring Club de France and tourists now have unrestricted access to Pavin.

A few years after Lecoq died in 1871, botanists and zoologists from the Clermont Faculty of Sciences initiate the first flora and fauna inventories of the Auvergne lakes (see Sect. 1.4.3). They now have a boat and use Rico's cabin by the lakeshore (Fig. 2.7). They do not mention the old Pavin's tales, as recommended by Bouillet. Amédée Berthoule, the mayor of Besse and a recognized specialist of fish introduction, does not report Lecoq's Pavin stories but is the first to evoke a sunken city (Berthoule 1890, 1896), a new legend at Pavin which will have a great success in the next century.

2.4 Pavin's Representation in the Twentieth and Twenty-First Centuries

After the turn of the nineteenth century, Pavin begins to be considered a major asset in the development of “climatic” and automobile tourism for the Besse area (Fig. 2.7). The first Auvergne scientific guidebook, published with major local scientists such as the geologist Philippe Glangeaud (Boule et al. 1901), does not mention the *Pavin stories*. They are however still present in many others, like one by Cany

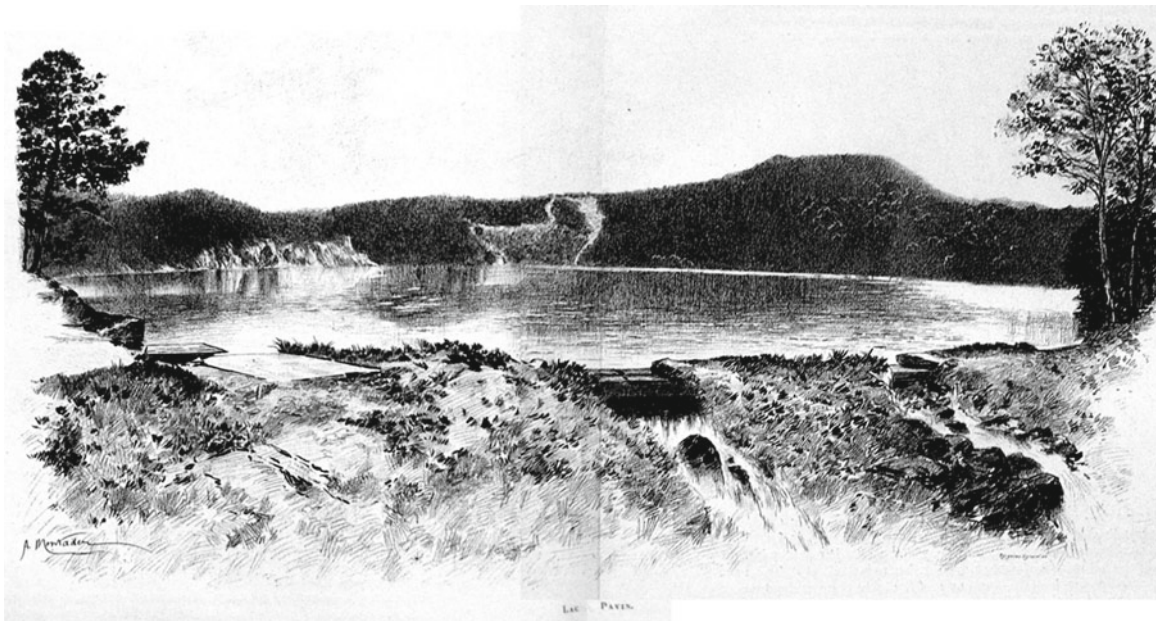


Fig. 2.6 Pavin and its new regulated outlet in 1896 (in Ajaibert 1896). Scars due to possible landslide within the crater rim are visible, opposite the outlet (Author's collection)

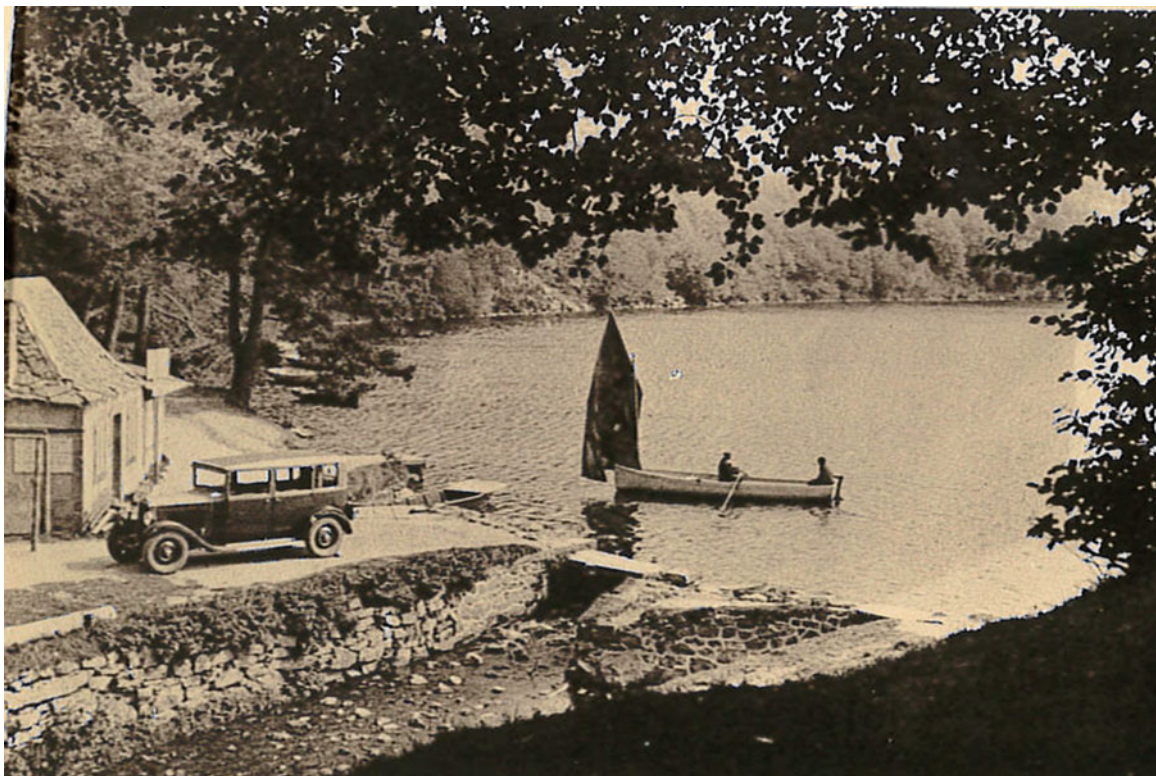


Fig. 2.7 Pavin Lake in the 1930s after the excavation of the outlet. The Rico's fisherman cabin is now used by limnologists. (G.D'O Post card, author's collection)

et al. (1916) in which Bruyant, the prominent Clermont limnologist, also highlights the major limnological features of Pavin. This is a rare example of the involvement of scientists in the Pavin mediation, until the 2011 exhibition established by city of Besse at the lake outlet. Several more targeted guidebooks on Pavin and /or Besse are published. The first one written by Abbé Blot (1924) explores the rich architectural heritage of Besse and briefly describes the first excursion around Pavin on the new pedestrian pathway set up in 1909. He too, does not include the *Pavin stories*. The second one, produced by Eusebio, the director of the Besse limnology station, and Reynouard, a local historian and former Besse mayor (1925), is the first to be entirely devoted to Pavin. It synthesizes the current research on the lake and presents the first thermal regime figure and a bathymetric map (see Sect. 1.4.3 and Fig. 1.5).

Reynouard also makes an in-depth analysis of Pavin's history and legends and is the first to clearly recognize that the *Sunken City* legend, probably promoted by local authorities, is recent and rooted in both Assolant's novel, Lecoq's Whirl and Storm legend and Berthoulet's new naming of Pavin as the "Dead Sea of Auvergne" (see Sect. 3.3.1). He reports the Whirl and Storm legend, but he does not have any clues to base an interpretation on. His historical references do not go beyond Chevalier's sounding (1770) as reported by Delarbre, his major historical source on Pavin. Despite the limitations of historical sources, due partly to Delarbre and Lecoq who withhold information, Reynouard makes an in-depth analysis: he is the first to describe the *Treasure Stone* (Fig. 2.1), placing its origin some time during the Roman era, and to formulate the hypothesis that catastrophic events at Pavin could have stopped the production of these Antique millstones. His intuition remained unnoticed until recently (Meybeck 2010).

2.4.1 A Sudden and Moderate Degassing Event? (June 1936 Pavin Event)

Another eye-witnessed Pavin misbehavior event occurs in 1936, but is only reported in 1986 when local newspapers are asking scientists about the possibility of Nyos-like degassing in Pavin (see 1.8). The witness, Paul Joanny, an otoned pharmacist in Clermont, is questioned by the media about what he saw at Pavin (Joanny 1986 and 1987):

"In June 1936, I was fifteen...I went fishing at the lake for crayfish...and I left my heavy catch in a fish trap. When I came back the morning after, Pavin was fully coloured, from yellow to orange with streaks of blue...One fisherman named Bocard came by and told me he already saw this one or twice. We lifted the grids [that have been put at the outlet before 1890, see Figs. 2.6 and 2.7] but the escaping water looked like spongy mud ..." He also identifies the special smell of the mud as "colloidal sulfur, used in arsenic analysis". During our interview in

August 2011, Joanny spoke of *"a yellowish thick foam, a gelatinous mass with a strong sulfur smell, floating on half of the lake, the water itself did not change colour: it was the yellow-orange deposit that did so"*.

During the scientific controversy in 1986–87 surrounding a potential Nyos-like event at Pavin the degassing interpretation of this event was put aside by Clermont hydrobiologists in the local press (La Montagne, 1987a), suggesting a planktonic bloom (*Anabaena* blooms have been reported by Wurtz 1945) or a pollen rain but in no case a foam of sulfur at the surface. The statement of the scientists is highlighted in one of the rare guidebooks mentioning degassing risks at Pavin (Cassan 1998). Joanny is also the first one to mention the Pavin event reported by chatelain Godivel in 1783, passed on to him in 1986 by a well-informed reader of *La Montagne*, the local daily newspaper.

Although there is no explicit mention by Joanny of degassing, the likelihood is high: the suddenness, the sulfur smell, the whole-lake change, the multiple occurrences during summer, the nature of the materials, the night-time sudden occurrence which does not fit with a plankton bloom, all allow to attribute this event to another rollover of the deep waters, a process associated with precipitation of ferric hydroxide, manganese hydroxide and colloidal sulfur, hence some degassing (see Table 1.2). Also, the 1783 and 1936 events are indeed very similar: Pavin may completely change its aspect within a few hours, waters turn yellow, orange or rusty, with traces of blue, the same kind of fluffy or spongy material is found. In both cases these are well-contextualized events and witnesses mention repeated occurrences over the summer. Evidence of the 1783 and 1936 events are now found in sedimentary archives of Pavin (Chassiot et al. 2016)

2.4.2 Guidebooks and Textbooks Ignore Scientific Findings at Pavin (1925–2011)

After 1925 different attitudes about Pavin can be found in guidebooks. All of them report the lake's altitude, depth and size, and highlight its wonderful setting and its fish yield, while its limnological characteristics, which make Pavin unique in France and even in Europe (see Sect. 1.3), are very seldom put forward. Boule et al. (1901); Cany et al. (1916); Eusebio and Reynouard (1925); Olivier (1954); and Cassan (1998) are among the rare authors who provide some details on the exceptional nature of the lake, progressively unveiled by scientists since 1880.

In contrast, the terrible *Pavin stories* or legends are very often mentioned, generally supported by the lake etymology, largely chosen as *pavens*=frightening. Many guidebooks and authors mix the *Whirl and Storm* legend, the *Thrown Stone* legend and the *Sunken City* legend (Cany 1916; Pourrat

1935; Guide Michelin 1954; CNSGR 1974; Chamina 1989; 1996; Burel and Debaisieux 1995, Guide du Routard 2010). The tourism industry favours the new *Sunken City* legend, the only one presented by Vazeille (1957), by Graveline and Debaisieux (1984), and by the Office de Tourisme de Besse (2012), probably a more appropriate story for the development of mass tourism at Pavin. Other guidebooks completely ignore all *Pavin stories*, such as the Guides Bleus (Montmarché 1924) and Guide Michelin (1937), Olivier (1954) or Balme (1954), a stark contrast with the position of Joanny and Larousse a 100 years ago.

The absence of any mention of Pavin's rich history and popular fear accounts is striking in most geography textbooks about Auvergne (Semonsous 1949; Balme 1954; De La Torre 1979; Hureau 1978; Tournilhac and Aleil 1988; Bonnaud 1995; Charbonnier et al. 2011). These scholars no longer mention the Pavin's stories, except for Jamot (1983) who has a very critical tone: "*with these legends, the irrational world is opened into the earth's depth*". The Auvergne Volcanoes Natural Park issues a brochure on all Auvergne lakes (PNRVA 2004), in which Pavin scientific peculiarities are vaguely mentioned, and legends labeled as being "*extracted from the Bible and Auvergne's transposition of the Sodom and Gomorrah myth*", a statement based on the analysis of the recent *Sunken City* legend by Reyt (2000, 2002).

Until very recently, limnologists and other scientists working on Pavin were not aware of its rich and complex history, which only became a matter of interest in the last 10 years. Attention to the *Thrown Stone* story was drawn for the first time by the hydrogeologist Del Rosso (2009a, b) in the local press and during a presentation on Pavin's legends at the very end of the Besse Meeting on Pavin and Meromictic Lakes, held in 2009 (see 1.8). He also placed emphasis on the possibility of active volcanism during the Middle Ages, not observed so far by volcanologists, on the basis of other legends. His plea for the scientific value of the Pavin's legends was strongly denied at that meeting by other scientists, based on the sole *Sunken City* tale. Very few recent guidebooks mention the degassing risk at Pavin and their ironic tone suggests that this question should not be seriously addressed: Cassan's guidebook (1998) minimizes the degassing risks and gives the floor to Pavin itself: "*these persistent legends irritates me very much*", and *Eruptions*, a volcanological magazine, titles a scientific paper as such: "*Is Nyos monster hiding in Pavin's bottom?*" (Michard 2010).

However this attitude is changing: the city of Besse has now recognized the scientific, historical and cultural values of Pavin which are presented since 2012 in a permanent exhibition at the lake outlet with the full cooperation of Pavin scientists. Some very recent guidebooks are now integrating a new vision of Pavin, with the recent scientific findings (Burel and Debaisieux 1995; Plane 2011). Also, the new

findings made on Pavin paleolimnology (Chapron et al. 2010, 2012; Chassiot et al. 2016), confirm our preliminary analysis (Meybeck 2010), and are broking through the reluctance of the scientific community regarding past degassing events at Pavin for the first time,

2.5 Conclusions

2.5.1 Why Is Pavin's History So Difficult?

The first difficulty was to go beyond Delarbre's 1805 analysis, which was biased, deliberately (?), ignoring Jouan (1566), Belleforest (1575), Banc (1605), and chatelain Godivel (1783) observations and truncating all references to "compilers". This made it very difficult to go beyond Chevalier's sounding of 1770.

The second difficulty lies in the late discovery of some key source materials: 1884 for the mid-seventeenth century Godivel II manuscript and 1987 for the descriptions of the 1783 and 1936 events.

The third difficulty is the lack of scientific awareness of degassing until 1986: this very rare behaviour popped out suddenly that year among the contemporary scientific community. Therefore, the bizarre descriptions made by the sixteenth century scholars could not be understood by any naturalist of their time nor for centuries thereafter. Although detailed degassing observations had been made from 1778 to 1840 at Monticchio by Naples scientists, they remained unknown to the volcanologists and limnologists of the twentieth century, even in Italy.

The fourth difficulty is the lack of interdisciplinary approach. For instance, in Auvergne, the scientific community was barely aware of Lecoq's *Pavin stories* or, if those were known (Omaly 1968), their historical roots were not given, resulting in Lecoq's opinion being unquestioned: everybody believed they were groundless tales and legends. Some historians such as Reynouard (1925) for Pavin, and Jaloustre (1910) for the adjacent Vassivière pilgrimage site, sensed very old relations between ancient human settlements, ancient cults and possible catastrophic lake events but not Blot (1910). However when questions of past degassing risks at Pavin were raised in 1986, their hypotheses were not revised by historians, geographers or archeologists (e.g. Auserve 2004, 2013). These disciplines were not mobilized by the Risk commissariat at the time and did not express concern about this topic..

The fifth difficulty is re-assessing known texts: in this perspective we had to create a set of sensory degassing descriptors using other lakes in Africa and Europe where degassing had been observed or recently disclosed (Table 1.2). This approach is once more used in Chap. 3 for the re-analysis of

several other enigmatic descriptions, fantastical stories and legends, adding a new set of past Pavin information.

Finally, we found that, throughout the nineteenth and twentieth centuries, the past historical descriptions of Pavin, such as the very official report to King Charles IX mentioned by Jouan (1566), have been ignored or completely entangled with local stories told by guides and with the recent forged legend, the *Sunken City* tale of the early 1900s. This forged legend, well analysed by Reyt (2000, 2002), has been favoured by regional authorities, well ahead of Lecoq's *Pavin stories* (PNRVA 2004), so that grounded and un-grounded Pavin stories were totally mixed.

2.5.2 The Pavin Name

The debate on Pavin's name, started by Godivel II (mid-seventeenth century) and which has been recently reactivated (Fournier 1971; Herillier 2011) seems irrelevant. We found that, in contradiction to Fournier's statement, the original name of the lake is Paven, itself derived from *Lacus pavens*, terrifying lake, as mentioned as early as 1605 by Jean Banc. Paven was officially used until Cassini's map in 1815. The past degassing character of Pavin and its related misbehaviours can fully explain this traditional naming. One question arises: why give a Latin toponym to a local place in Auvergne? We know that millstones workers have already settled by the lake in Antiquity, probably when the great thermal baths of Mont Dore (Mons Aureus) were established at the Ist and IInd centuries and that other Latin toponyms such as *Pantheon* have lasted until the fifteenth century in Mont Dore. If the lake had already been identified by local population as a possible threat during that period, a latin denomination would then be possible, particularly when considering the very ancient fear of Romans for another similar maar-lake near Rome, Lake Albano (Chap. 3). Another hypothesis would be that *Lacus pavens* is much more recent, a name given by Middle Age or Renaissance scholars who were writing in Latin although, according to Godivel II manuscript – mid-1600s, the lake has “always” been called in such a way.

2.5.3 Historical Evolution of Pavin's Fame and Recognition

Considering their limited size and poor accessibility (located at 1300 m altitude, no road until the 1820s) Pavin Lake – 44 ha – and adjacent Creux de Soucy cavity- 10 m²-, had an outstanding recognition since the sixteenth century in official reports, local, provincial or national. Both Pavin and Soucy are found among the lists of wonders or curiosities worthy of mention in many universal geography works, from

Belleforest's cosmographia in 1575, to Larousse (1866–1877) and Recluz (1885), a recognition today largely ignored. In 1566, provincial authorities are officially complaining to the King of France during his visit in Auvergne about Pavin misbehaviour that damages crops and the terrifying lake is figured in the Queen Mother land register in 1575, which makes it one of the first lakes to be represented in a landscape figure.

Belleforest's 1575 Pavin description – the thrown stone that triggers thunder, lightning and storms – was then reproduced by many French, Netherland, German, English geographers in the next 300 years. The cosmographer probably obtained it from one of his many informers and, considering the level of details given on the Creux de Soucy area, there is little doubt that his informer is both local and well educated. Such stereotypical lake description has been used before (see Chap. 3). However this marvellous process at Pavin is most likely true, as other reliable, non-stereotypical and independent descriptions made at the same period, depict similar Pavin misbehaviour (Vassivière pilgrims in 1551, Jouan in 1566; Banc 1605). In the mid-seventeenth century the Godivel II manuscript, unpublished until 1884, gives another very detailed account of Pavin from a local and reliable witness.

The fame of Pavin seems to then slow down and become more regional. Jesuit cartographer de Fréat (1672) refutes the *Thrown Stone* effect for the first time. Royal civil engineer Chevalier makes a successful sounding in 1770, after many previous failed attempts, an achievement considered by all as the first for Pavin despite de Fréat's earlier depth estimate. This sounding largely contributes to the normalization of the lake by the naturalists and voyagers of the Enlightenment's era who now flock to the lake. After 1770, as they visit Pavin, they throw a stone, nothing happens: Belleforest's description is refuted by naturalists who are now accessing to Pavin.

But stories continue to be told by local guides, despite the efforts made by the highest political, ecclesiastic and scientific authorities (Chabrol 1786; Delarbre 1795; Lecoq and Bouillet 1831; Lecoq 1835a): for local people Pavin is still bottomless, devoid of a water inlet, without fish, connected with the Creux de Soucy; its waters can cause pimples on the skin after contact; there is a whirl in the middle so that no boat can sail on it, it had exhalations and, from time to time, violent events.

Throughout the nineteenth century, these *Pavin stories* are widely quoted in Auvergne or Mont Dore guidebooks and used by novelists coming to the Mont Dore spa resulting in a second period of fame for Pavin beyond Auvergne's borders. After Lecoq's normalization of Pavin through the introduction of boats and fish in 1859, the stories are gradually presented as legends and the *Sunken City*, a new legend, appears and is finalized in the 1900s (Chap. 3).

Today the lake receives 200 000 annual visitors and is still lauded, through guidebooks and other touristic material, for its excellent fish and its nice circular pathway around the shore where one can see the devil's chair and a sketch of the city of Besse, sunk into the lake for its trespassing. Pavin's rich history and recent degassing controversy (see Sect. 1.8) remain absent from geography textbooks (Charbonnier et al. 2011). However the general attitude about Pavin is now changing. Plane's guidebook (2011) is the first one to mention the uniqueness of Pavin's deep waters as well as the seriousness with which its degassing risks are now taken. The town of Besse is now offering visitors to Pavin a remarkable permanent exhibit on the lake, its surroundings and Creux de Soucy, and on the most recent scientific results. Belleforest and Lecoq's descriptions are presented in panel on the legends. The recent findings on past catastrophic spillover events near 600 AD and 1300 AD by paleolimnologists and geologists (Chapron et al. 2012; Chassiot et al. 2016; chapter 23) confirm that past Pavin spillover events have occurred. They probably will change the attitude of the many Pavin actors (historians, scientists, tourism industry representatives, risk-management authorities and the media).

2.5.4 Past Pavin Degassing Events and Past Pavin State

There are at least three accounts of sudden Pavin's misbehaviour events of various intensities at Pavin, reported by Vassivière pilgrims in 1551, Godivel IV in 1783 and Joanny in 1936. They are fully contextualized with an exact date, identification and position of witnesses as well as detailed descriptions. They come from local and educated people from Besse who voluntarily record what they have experienced. None of them are apparently aware of the previous events. All witnesses are familiar with Pavin and are common visitors to this area. As such they are more prone to notice disorders that can either be missed by occasional visitors or left un-reported by uneducated local people. For instance, the 1783 events that have occurred several times during this summer remained un-reported until they were mentioned on August 21 to chatelain Godivel, a jurist. In addition to these events, other descriptions of Pavin's state at the sixteenth–seventeenth centuries feature extended degassing periods of various types and intensity (Jouan 1566; Belleforest 1575; Banc 1605; Godivel II manuscript, 1650s). The occasional visits to Pavin by outside visitors such as de Frêtat (1672), Chevalier (1770) and their many followers provide information on the state of the lake the day of their visit: with the exception of the 1783 and 1936 event, none report unusual Pavin behavior after mid-seventeenth century. But witnesses of possible occasional Pavin disorders – so

marvelous- may have withheld their observations as for the 1936 event, only disclosed in 1986.

There are many other sources about Pavin, although so far un-attributed to the terrifying lake, such as local religious history and iconography, a fantastical dragon story published in 1632 in Paris and pagan times' dragons and fairies legends collected during the nineteenth century. They are fully detailed and discussed in the next chapter in comparison with similar myths, legends and beliefs found in other European maar-lakes. Even if they are less contextualized and can be hypothetical, they still enrich our analysis of Pavin's history and confirm the latent fear surrounding the lake since pagan times, *i.e.* before the fourth-fifth centuries.

Acknowledgments for chapters 1 and 2 are combined with those of chapter 3.

References

- Ajalbert J (1896) *L'Auvergne. Ancienne maison Quentin*, Paris, 362 pp
- Apianus Petrus (1581) *Cosmographie, description des quatre parties du monde*
- Assollant A (1875) *Le Puy de Montchalm*. Librairie de la société des gens de lettres, Paris, 370 pp
- Audigier P (chanoine) (1720) *Histoire d'Auvergne, tome I. Projet de l'Histoire d'Auvergne*. Manuscript published in 1894, Louis Bellet, Clermont Ferrand, 139 pp
- Auserve Ph (2004) *Histoire du pèlerinage de N-D de Vassivière*, Impr. de A. Dumont, Clermont-Ferrand, 46 pp
- Auserve Ph (2013) *Pers Com.*
- Babeau A (1928) *Les Voyageurs en France depuis la Renaissance jusqu'à la Révolution*, Alfred Mane Tours, 294 pp [Re-édition Slatkine, Geneva, 1970]
- Balme P (1954) *A travers le département du Puy-de-Dôme*. Coll. Le Tourisme en Auvergne, De Bussac, Clermont-Ferrand, 184 pp
- Banc J (1605) *La Mémoire retrouvée des merveilles des eaux naturelles en faveur de nos Nymphes Françaises et des maladies qui ont recours à leurs emplois salutaires*. L Pierre Sevestre, Paris (BCIU library, Clermont-Ferrand)
- Bar E (1907) *Guide pratique Le Mont-Dore, La Bourboule, Saint-Nectaire*. Guides Pol, 112 pp
- Belleforest (de) F (1575) *Cosmographie Universelle*, 3 volumes, Nicolas Chesneau, imprimeur-libraire, Paris. Vol 2, 1127 pp (Bibliothèque Sainte Geneviève-Sorbonne, Paris, réserve, cote RXVIB 3=321-1)
- Berthoule A (1890) *Les Lacs d'Auvergne. Orographie, faune naturelle, faune introduite*. Revue Société Nationale d'Acclimatation, Paris, 136 pp
- Berthoule A (1896) *Les Lacs de Besse-en-Chandesse*. In: *L'Auvergne. IV Congrès Int. Hydroclimatologie Géologie*, Clermont-Ferrand
- Bertrand M (1819) *Mémoire sur l'Etablissement Thermal du Mont-d'Or et les Antiquités qu'on vient d'y trouver*. Librairie Landriot, Clermont-Ferrand, 47 pp
- Blaeu Johan (1663) *Atlas Major. Province d'Auvergne*, Amsterdam
- Block E (2003) *Corpus of Medieval Misericords, France, XIII-XIVth*, Brepols, Turnhout, 444 pp
- Blot A (1910) *Histoire du pèlerinage de Vassivière*. A. Dumont Clermont-Ferrand, 157 pp
- Blot J, abbé (1924) *L'Eglise de Besse. Monument historique. Guide Illustré*, 63 pp

- Bonnaud P (1995) Vivre sur nos volcans. Des appellations plus ou moins contrôlées. In: *Volcanisme et Volcans d'Auvergne, Parc Naturel Régional des Volcans d'Auvergne (PNRVA)*, La Dépêche scientifique du parc n°8-9: 36–37
- Bouchet (du) (1645) Carte d'Auvergne (map) (BCIU library, Clermont-Ferrand)
- Bouillet JB (1836) Guide du voyageur à Clermont-Ferrand et des localités les plus remarquables au départ du Puy-de-Dôme. Auguste Veyssat, Clermont-Ferrand, 355 pp
- Bouillet J (1877) Description historique [de Besse], Clermont-Ferrand, University Library (BCIU), Manuscrit, 40 f, Ms 977-fo: 39–40
- Bouillet M.N (1878) Dictionnaire Universel d'histoire et de géographie, 26e édition, Hachette, 2054pp
- Boule M, Ronchon G, Glangeaud Ph, Vernière A (1901) Le Puy-de-Dôme et Vichy. Guide du Touriste, du Naturaliste et de l'Archéologue
- Bourget P (1914) Le démon de midi. Published in: *La Petite Illustration*, 1921, 2 volumes, Plon-Nourrit. vol 1, 251pp
- Boyer-Vidal A (1888) Besse et Vassivière. Notice historique. Imprimerie clermontoise, Clermont-Ferrand, 50 pp, appendices. Réédition ACVAM 2005, 72 pp
- Briet (1648) *Parallela Geographia Veteris et Novae*, tome 1, chap 7, [in Cregut, 1921]
- Bruzen de la Martinière A-A (1739–1741) Le Grand dictionnaire géographique, historique et critique. Paris, 6 volumes
- Burel J, Debaisieux F (1995) Les Volcans du Mont-Dore, du Cézalier et de l'Artense. Ed. Debaisieux, 64pp
- Cany G, Percepied E, Perpère E (1916) Séjour et promenades au Mont Dore et à la Bourboule. Guide des baigneurs, touristes, naturalistes (Collab. Ph Gangeaud, C Bruyant, préface A Lacroix), 394 pp
- Caracausi A, Nuccio PM, Favara R, Nicolosi M, Paternoster M (2009) Gas hazard assessment at the Monticchio crater lakes of Mount Vulture, a volcano in Southern Italy. *Terra Nova* 21(2):83–87
- Cassan P (1998) Le lac Pavin. Office National des Forêts, Aulnat, 48 pp
- Cassini (César François Cassini de Thury) (1815) Feuille Brioude-Issoire, Carte de France, n°53
- Chabory F (1894) Guide complet du promeneur au Mont-Dore et à la Bourboule suivi du Guide du Baigneur aux eaux du Mont-Dore
- Chabrol (1786) Coutumes locales de la Haute et Basse Auvergne. Index des paroisses, index des seigneurs et propriétaires (tome IV), Martin Déguette, Paris, 858 pp
- Chabrol E (1931) L'Auvergne thermale à l'époque gallo-romaine. Ed. L'Auvergne littéraire, 31pp
- Chaix LA (abbé) 1869 Histoire de Notre-Dame de Vassivière depuis ses origines jusqu'à nos jours, Clermont-Ferrand, 359p
- Chamina (1989) Balades à pied en Auvergne, Massif du Sancy et Artense, Chamina, Clermont-Ferrand, 127pp
- Chamina (1996) Lacs et volcans d'Auvergne, 226 pp
- Chapron E, Alberic P, Jezequel D, Ledoux G, Massault M (2010) Les Archives sédimentaires de l'histoire du lac Pavin. *Rev Sci Nat Auvergne* 74–75:57–66
- Chapron E, Ledoux G, Simmoneau A, Alberic P, Saint-Onge G, Lajeunesse P, Boivin P, Desmet M (2012) New evidence of Holocene mass wasting events in recent volcanic lakes from the French Massif Central (lakes Pavin, Montcineyre and Chauvet) and implications for natural hazards. 5th international symposium on submarine mass movements and their consequences, Kyoto. Chap.23: 256–264
- Charbonnier P et al (2011) Le Puy-de-Dôme. Série de géographie régionale, Christine Bonneton éditeur, 320pp
- Chassiot L, Chapron E, Di Giovanni C, Alberic P, Lajeunesse P, Lehours A-C, Meybeck M (2016) Extreme events in maar lake Pavin sedimentary record: implication for natural hazards assessment in the French Massif Central. *Quat Sci Rev* 141:9–25
- Chaumette EJ, abbé (1857) Souvenirs de voyage ou les vacances en Auvergne, Itinéraire du Puy-de-Dôme, 375pp
- Chevalier (1770) Rapport du sondage au Pavin du 28 septembre. In: Delarbre A (abbé), 1805. Notice sur l'Auvergne et en particulier sur la ville de Clermont. Clermont-Ferrand, 256pp
- Cladière Jean-Joseph (1688 ou 1687) L'histoire de la Sainte Chapelle de Vassivière près du Mont-d'Or en Auvergne Célèbre par les miracles que Dieu y fait continuellement par l'intercession de sa très-pure et glorieuse Mère Par un religieux Bénédictin de la congrégation de St Maur. Damien Boujon, Clermont. Re-imprimé 1837, Clermont Ferrand
- Clugnet L, Dr Alvin (1877) Nouveau guide du baigneur et du touriste au Mont-Dore, 203 pp
- CNSGR (1974) Topoguide du GR 30. Comité national des sentiers de grande randonnée
- Cosse Etienne-Joseph (1857) Souvenirs de voyage ou Les vacances en Auvergne: Itinéraire du Puy-de-Dôme
- Coulon L (1644) Les Rivières de France ou description géographique et historique du cours et du débordement des fleuves, rivières, fontaines, lacs et étangs qui arrosent les provinces du Royaume de France, François Clousier, Paris, 442pp
- Coulon L (1654) Le Fidèle conducteur pour les voyages de France, d'Angleterre, d'Allemagne et d'Espagne. Gervais Clouzier, Paris, 239 pp
- Crégut R (chanoine) (1921) En feuilletant les vieux livres. *Bull. Hist. Sci. Auvergne*, 120pp
- D'Avity Pierre (1643) Le monde ou la description de ses quatre parties. Tome 2: L'Europe avec tous ses empires, royaumes, états et républiques, 521 pp
- Deboffe P (1995) François de Belleforest. Assoc. Autour de F. de Belleforest, Samatan, 224pp
- Delarbre A (1795) Notes et observations sur les volcans, puits, mines et fontaines d'Auvergne. Manuscrit Ms 716, University Library (BCIU), Clermont-Ferrand
- Delarbre A (abbé) (1805) Notice sur l'Auvergne et en particulier sur la ville de Clermont. Clermont-Ferrand, 256pp
- Del Rosso T (2009) Les Légendes du Pavin. Oral communication. Int. workshop Pavin and other meromictic lakes, May 14–17, 2009, Besse
- Del Rosso T (2009) (printemps-été). Interview with Marc Gachon, La Galipote: 37–38
- Depping GB (1811) Les Merveilles et beautés de la nature en France. P Blanchard, Paris, 634 pp
- Desmarest N (1798–1828) Lacs volcaniques. In: *Dictionnaire de géographie physique*, vol 5: 687–688: lacs volcaniques
- Donnet FL (1820s) Carte du Département du Puy de Dôme. Bibliothèque Universitaire Clermont-Ferrand (CA 10 070)
- Du Chesne André (1614) Les Antiquités et recherches des villes, châteaux et places les plus remarquables de France, 2ème édition, Jean Petit-Pas, Paris, 1025pp
- Dulaure Jacques Antoine (1784) Description des principaux lieux de France. Part V. Auvergne
- Durand-Lefebvre M (1926) Les Vestiges antiques et le culte des sources au Mont-Dore. Le Puy, 64 pp, ill
- Ellwood NTW, Albertano P, Galvez R, Funicello R, Mosello R (2009) Water chemistry and trophic evaluation of Lake Albano (Central Italy): a four-year water monitoring study. *J. Limnology*, DOI: <http://dx.doi.org/10.4081/jlimnol.2009.288>
- Etienne Charles (1553) *Dictionarium Historicum et Geographicum*
- Eusebio A, Reynouard J (1925) Le lac Pavin et le Creux de Soucy. Station limnologique de Besse, Besse, 55pp
- Fodéré Jacques (1619) Narration historique et topographique des convents de l'Ordre de Saint-François et monastère Sainte-Claire, Lyon. Edited by Abbé Randamme, 1861, Mémoires Académie de Clermont, Ferdinand Thibaut, Clermont-Ferrand, 160pp
- Fournier PF (1971) Le Nom du lac Pavin. Essai d'étymologie. *Bull hist Sci Auvergne* 85(631):159–164
- Frétat (de) Aimable (1672) Carte de la Haute et Basse Auvergne (map)

- Funiciello R, Giordano G, De Rita D, Carapezza M-L, Barberi F (2002) L'Attività recente del cratere del Lago Albano di Castelgandolfo. *Rend Fis Acc Linei* 9:113–143
- Funiciello R, Giordano G, De Rita D (2003) The Albano maar-lake (Colli Albani Volcano, Italy): recent volcanic activity and evidence of pre-Roman Age catastrophic lahars events. *J Volcanol Geotherm Res* 123:43–61
- Funiciello R, Heiken G, De Benedetti A-A, Giordano G (2010) Volcanic activity of the Lake Albano maar in Roman history and mythology. In: Funiciello R, Giordano G (eds) the Colli Albano Volcano, Geol. Soc; London, Special. Publ. IAVCEI
- Gibory Ferdinand (pseudonym Saint-Sard) (1840) *La Vierge aux œillets*. Hyppolite Souverain, Paris
- Godivel Antoine (Godivel I) (1579a) “Terrier pour la Royne mère du Roy, de sa terre, ville et mandement de Besse, faict par Antoine Godivel, notaire royal en la dite ville”. In –f°, 30 ff.lim.et 529 ff chiffrés, Manuscript, Bibliothèque du Musée Condé, Chantilly
- Godivel Antoine (Godivel I) (1579b) Terrier de Besse-en-Chandesse. Manuscrit, Non-illustrated copy of the Terrier de Catherine de Médicis. Archives Régionales, Clermont-Ferrand, 1 E 0154
- Godivel II (1650) “Remarques touchant la Ville de Besse”. In: Le Beffroi de Besse, Jaloustre, 1884. *Mém. Acad. Sci., Belles-Lettres et Arts*, Clermont-Ferrand
- Godivel III (subdélégué) (1726) Sondage infructueux du 7 mars 1726. In: Legrand d'Aussy (1788)
- Godivel IV (Chatelain) (1783) Lettre ouverte au Rédacteur de la feuille. Feuille Hebdomadaire de la Haute et Basse Auvergne, contenant ce qui peut intéresser cette province (Chabrit M ed.), Antoine Delcros imprimeur, Clermont-Ferrand, 27 septembre 1783, p 152
- Gomis S (2006) Les « enfants prêtres » des paroisses d'Auvergne. XVIe-XVIIIe siècles, Presses Universitaires Blaise Pascal, Clermont-Ferrand
- Gordon P (1748) Grammaire historique, 16ème edition traduite de l'anglais, Durand, Paris (quoted by Delarbre, 1795)
- Graveline F, Debaisieux F (1984) Les Volcans d'Auvergne et du Velay, Solar, 62pp
- Gregorius from Tours (Florentius Georgius Gregorius) (c 600) Histoire de France. Les Sept livres des miracles. La Gloire des confesseurs, VII, II, traduction Gérard Pradalié
- Guide du Routard (2010) Guide du Routard, Auvergne
- Guide Michelin (1937) Guide Michelin d'Auvergne
- Guide Michelin (1954) Guide vert du pneu Michelin d'Auvergne, 118 pp
- Herillier C (2011) Déetectives au pays des mots. Christian et Marie Jeanne Hérliller (Interview). In: L'eau d'Auvergne: 164–169
- Hureau J (1978) L'Auvergne, le massif central d'aujourd'hui. Edition Jeune Afrique, 237pp
- Jaillet (1715) La Province d'Auvergne (map) (BCU library, Clermont-Ferrand)
- Jaloustre E (1884) Le Beffroi de Besse. *Mém. Acad. Sci., Belles-Lettres et Arts*, Clermont-Ferrand (BMIU, Clermont A34 425)
- Jaloustre E (1910) Histoire du pèlerinage de Notre-Dame de Vassivière. Impr.Dumont, Clermont-Ferrand, 150pp
- Jamot C (1983) Le Tourisme. In: Brossolette P (dir.), Les Monts d'Auvergne. Privat, 471 pp
- Joanne A (1865) Itinéraire général de la France. Deuxième partie, Auvergne, Dauphiné, Provence. Hachette, 863 pp
- Joanne A (1881) Le Mont D'Or et les eaux minérales d'Auvergne, 200 pp
- Joanne A (1894) Le Mont-Dore, La Bourboule, etc. Guides Joanne
- Joanny P (1986) De l'eau qui sent (parfois) le soufre, La Montagne, 2 septembre 1986
- Joanny P (1987) Un Pharmacien clermontois raconte un souvenir de jeunesse. Interview de J Gandebeuf. Le Républicain Lorrain, Janvier 1987
- Jouan Abel (1566) Recueil et discours du voyage du Roy Charles IX, Charles Etienne, imprimeur du Roy, Paris
- Kircher A (1678) *Mundus subterraneus*
- Kilian A-J, Piquet Ch (1823–1833) Dictionnaire géographique universel, Paris
- Labarre S (1977) La Feuille hebdomadaire pour la Province d'Auvergne, Mémoires Institut d'Histoire de Clermont-Ferrand, 137 pp, annexes
- Labesse E-D, Pierret H (1892) Notre pays de France. En cheminant (Auvergne). Ducrocq, Paris, 246 pp
- Lacoste de Plaisance (Abbé) (1803) Observations sur les volcans de l'Auvergne. Clermont, 1 vol
- Lacroix de Marlès, Jules (1884) Merveilles et phénomènes de la nature
- La Guillotière François (1575–1590) La Charte de France
- La Planche (de) Pierre (1640–1646) Description des villes de France. Manuscrit appartenant à M Meurtey de Tupigny. Quoted in: P Duval (1667) La France sous le Roy Louis XIV: 176
- La Porte (de) J (1790) Le Voyageur françois ou la connaissance de l'ancien et du nouveau monde. Tome XXXI, Lettre CDXII (Laporte, Fontenay, Domeiron, 1760. Le Voyageur Français), Vincent, Paris, vol 32: 19–23
- Larive, Fleury (1889) Dictionnaire français illustré des mots et des choses, Tome 2, G Chamerot
- Larousse P (1866–1877) Grand dictionnaire universel du XIXème siècle, français, historique, géographique, mythologique, bibliographique, littéraire, artistique, scientifique, etc., Paris, Tome 12, 1560 pp
- La Torre (de) M (1979) L'Auvergne. Le Guide de la France, Berger Levrault, 193 pp
- Lauras-Pourrat A (1973) Guide de l'Auvergne mystérieuse. Tchou, Paris
- Lavina P, Del Rosso T (2009) New geological findings in Pavin area, Oral communication, Symposium Pavin and other meromictic lakes, Besse-en-Chandesse, May 2009
- Lecoq H, Bouillet J-B (1831) Itinéraire du Département du Puy-de-Dôme, 178 pp
- Lecoq H (1835a) Description de l'Auvergne. Le Mont d'Or et ses environs. J-B Baillère, Paris, 437pp
- Lecoq H (1835b) L'Auvergne pittoresque. Atlas colorié. Le Mont-Dore et ses environs. Seize vues coloriées b. Chaillon, Paris
- Legrand d'Aussy P JB (1788) Voyage en Auvergne. E. Onfroy, Paris, 555pp
- Lestringant F (1991) André Thevet, cosmographe des derniers Valois. Genève, Droz, Travaux humanisme et Renaissance n° 251, 430
- Mailly (de) L (1723) Principales Merveilles de la Nature où l'on traite de la substance de la terre, de la mer, des fleuves, lacs, rivières, montagnes, rochers, etc. avec un précis des choses les plus rares et les plus curieuses qui s'y voient. Rouen, 330 pp
- Mallot F (1995) Les tremblements de terre en Basse-Auvergne aux XV et XVIème siècles. Histoire de l'Auvergne, CREA, Université Blaise Pascal, Clermont-ferrand, pp 86–90
- Maupassant G (1883) Humble drame, Gil Blas. Re-edited by La Pléiade édition, Gallimard, 1974
- Maury (1844) Carte du Puy de Dôme (map) (BCU library, Clermont-Ferrand)
- Merula P (1605) Cosmographia, caput X, In: B. Thalès, Voyage dans la Vieille France par Jodocus Sincerus(1614), 1859, Paris, 362 pp
- Meybeck M (2010) Le Pavin et ses voisins, histoire d'un patrimoine européen unique. *Rev Sci Nat Auvergne* 74–75:7–44
- Michard G (2010) Le Monstre du lac Nyos se cache t-il dans le Pavin ?, Eruptions
- Monmarché M, Doré R (1924, 1931, 1936) Auvergne et Centre. Guide Bleu. Hachette, 596pp
- Monnet AG (1788) Voyages minéralogiques faits en Auvergne dans les années 1772, 1784 et Observations sur la Physique, sur l'Histoire Naturelle et sur les Arts. Tome XXXII: 179–199

- Montlosier (de Reynaud de) (1789) Essai sur la théorie des volcans d'Auvergne. Re-published in 1802, 184 pp
- Moreri (1712) Grand dictionnaire géographique (Quoted by Delarbre 1795)
- Münster S (1565–1566) Cosmographie Universelle, 1430 pp (Paris faculté de pharmacie library)
- Nadeau L (1863) Voyage en Auvergne (département du Puy-de-Dôme), Dentu, Paris. (re-edited: La Tour Gile)
- Nodier Ch, Taylor JD, De Cailleux J (1829) Voyages pittoresques et romantiques dans l'ancienne France (ré-édition 1987, Presse du Languedoc, Montpellier Tome 1, 110 pp)
- Olivier L (1954) Saint Nectaire, Besse, Murols, les lacs Montdoriers. De Bussac, Clermont-Ferrand, 64pp
- Omalry N (1968) Le lac Pavin, historique et hydrobiologie. Rev Sci Nat Auvergne 34:7–31
- Palmeri L, Scacchi A (1852) Della regione vulcanica del Monte Vulture. Gaetano Mobile, Naples, 160pp
- Pelletier-Decitre M (2008) De Ptolémée à la Guillotière (XV-XVIème siècles). Des cartes pour la France, pourquoi, comment. Comité des Travaux Historiques et Géographiques, Paris
- Piccardi L, Masse WB (eds) (2007) Myths and geology. Geol. Soc. London Special Public 273: 51–59
- Piesse L (1863) Guide des eaux thermales du Mont Dore. Guides Joanne, L Hachette, Paris, 220pp
- Piganiol de la Force (1754) Nouvelle description de la France (Tome XI, chap XXII, Description de l'Auvergne), 571 pp
- Plane J-Th (2011) Massif du Sancy. Les 15 plus belles balades et randonnées. Rando Editions, 56 pp
- PNRVA (éd.) (2004) Les Lacs des volcans d'Auvergne. Parc Naturel Régional des Volcans d'Auvergne
- Poulet-Scroppe G (1866) Géologie et volcans éteints du centre de la France. Thibaud, Clermont, 261 pp
- Pourrat H (1935) Au fort de l'Auvergne. Arthaud, 170pp
- Pourreyron C (Chanoine) (1935) Le Culte de Notre-Dame au diocèse de Clermont en Auvergne. Bost, Nancy, 303 pp
- Prudhomme LM (1804) Dictionnaire universel de la France. Laporte, Paris 5 vol
- Sand (George) (1859) Voyages en Auvergne. 1827-1859-1873. Editions Paleo, 168 pp
- Reclus E (1885) Géographie universelle, Vol II, France. Hachette, Paris, 1017 pp
- Reclus O (1886) France, Algérie, colonies. Hachette. Paris, 802 pp
- Reclus O (1899) Le plus beau royaume sous le soleil, Brodart, Paris, 861 pp
- Reynouard J (1909) Besse, autrefois, aujourd'hui ? Ann. Stat. Limnologie Besse-en-Chandesse, tome I:1 –14
- Reynouard J (1910) La Légende du Pavin. La Montagne d'Auvergne, 28 Aug 1910: 1–4
- Reyt P (2000) Les Dragons de la crue. Cahiers de Géographie du Québec 44(122):127–145
- Reyt P (2002) Nous et les autres : l'égalité face au risque. Cahiers de Géographie du Québec 46(127):7–24
- Scribe Eugène (1848) Le Roi de carreau, de Vigny (quoted by Eusebio and Reynouard, 1925)
- Sébillot Paul (1904–1906) Les Eaux douces. In: Folklore de France, Ré-Ed. 1983, Imago, Paris, 304 pp
- Semonous J (1949) L'Auvergne, sa géographie, son histoire. Charles-Lavauzelle, Paris, 256 pp
- Shanklin E (1989) Exploding lakes and maleficent water in Grassfield legends and myths. J Volcanol Geotherm Res 39:233–246
- Shanklin E (2007) Exploding lakes, myths and reality, an African case study. In: Piccardi L, Masse WB (eds) Myth and geology. Geol Soc London Spec Pub vol 273: 165–176
- Simonin M (1983) Les Elites chorographiques ou la Description de la France dans la chorographie universelle de Belleforest. In: Voyager à la Renaissance, Edit: Jean Gérard et J CH Margolin, Colloque de Tours: 433–441
- Simonin M (1992) Vivre de sa plume au XVIème siècle ou La Carrière de François de Belleforest, Droz, Genève, 328 pp
- Stuart-Costello L (1841) Voyage en Auvergne, dans le Velay et en Bourbonnais fait en 1841. Ré-édition 1945, De Bussac, Clermont-Ferrand, 237pp
- Taillandier (1826) Résumé de l'Histoire d'Auvergne par un Auvergnat. Lecointe et Durey, Paris, 554pp
- Tardieu A (1888) Puy-de-Dôme, Guide complet illustré, Monographies des villes et villages de France, Ré-édition Res. Universis 1993, 329pp
- Tata D (1778) Lettera sul Monte Vulture a sua eccellenza il signor D. Guglielmo Hamilton. Stamperia Simoniana, Napoli, 62pp
- Taylor J, Nodier C, de Cailleux A (1829) Voyages pittoresques et romantiques dans l'ancienne France. 3, Auvergne. 1829, Didot, Paris
- Tenore et Gussone (1838) Peregrinazioni effettuate nelle state del 1838 dai Signore Tenore e Gussone. In: Principato Citeriore e di Basilica). Edité en 1995 par A Ciarallo et L Capaldo Viaggio al Vulture, Edition Osanna Venosa, 157 pp
- Thevet A (1575) Cosmographie universelle. Tome II Europe (Paris Faculté de pharmacie library)
- Tournilhac B, Aleil PF (1988) Besse. In: Histoire des communes du Puy-de-Dôme, Arrondissement d'Issoire: 97–106
- Vazeille A (1957) La Tour d'Auvergne et sa région. Le Tourisme en Auvergne n° 28, De Bussac, Clermont-Ferrand, 64 pp
- Vernière A (1900) Les voyageurs et les naturalistes dans l'Auvergne et dans le Velay. Typ. et lit. G. Mont-Louis
- Vimont E (1874) Les Lacs Pavin, de la Montcineyre et de la Godivelle. Annuaire du Club Alpin Français. Paris
- Wurtz A (1945) Recherches écologiques sur les lacs, tourbières et étangs d'Auvergne. Ann Stat Centr Hydrobiol Appliquée 1:89–166