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## Abbé Paramelle: early excursions and observations in the department of Lot (1818-1827)

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**Abstract.** Abbé Paramelle explored for water on the Causses of the department of Lot beginning in 1818. He was aggrieved by the plight of his parishioners who lived on the limestone plateau and suffered from a severe lack of water for themselves, their farm animals, and their crops. Believing that water could be found nearby, Paramelle began nine years of walking the Causses to find out where the rainwater went. By 1827 he had observed enough terrain to be able to locate water and determine its depth. He submitted a report on his ideas to the government of the department of Lot in 1827, who supported the testing of his theory. Paramelle found water as predicted and his services were soon in high demand. He was released from his parish duties in 1832 and started a career spanning 22 years during which he found water throughout France. His observational method used stratigraphy and geomorphology. He popularized the idea that water was not far below the land surface and that it could be reached without excessive effort. Because he did his early water research on a limestone plateau, he recorded and published important karst observations.

**Keywords:** Causses – groundwater – karst

### 1. Introduction

As a young village priest, Jean-Baptiste Paramelle (Fig. 1) was distressed by his parishioners' lack of water. He was sure that water must be available nearby. He had no reference books to tell him how to find it, so he started walking the land surface looking for it. This article focuses on Paramelle's early years in Lot, where with meager resources and no geologic maps, he challenged himself to find groundwater and succeeded in doing so. After nine years of observation, Paramelle submitted his ideas to the Conseil General of the department of Lot in an 1827 memoir, which is the topic of this article (Paramelle, 1827). The handwritten report resides in the Bibliothèque municipale of Cahors (Fig. 2). Luckily for us, Jacques Audoin of the Spéleo-club de Paris transcribed it in 2010 (Paramelle 2010).



Fig.1. Abbé Jean-Baptiste Paramelle (undated photo). Paramelle family collection.

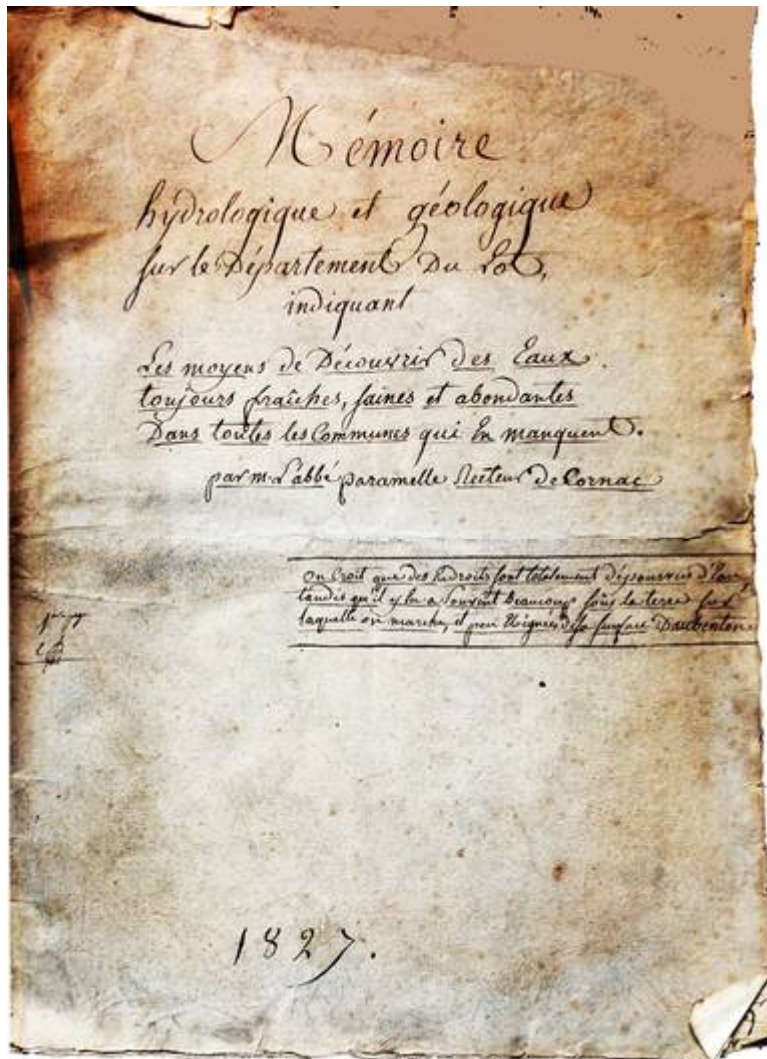


Fig. 2. *Mémoire hydrologique et géologique sur le Département du Lot*, 1827. Page 1. Photo by P. Bobeck

## 2. Biography

Paramelle was born in 1790 in Felzins, in the department of Lot (Fig. 3). He attended the seminary in Cahors and was ordained there in 1815. He was assigned to Saint-Jean Lespinasse parish in 1818, and became rector in Cornac in the 1820s (Fig. 3). After submitting the 1827 report, receiving a grant to test his ideas, and showing his ideas to be successful, requests for his services multiplied rapidly. The young priest began a career as a hydroscope. In 1832, he was released from parish responsibilities. He then began his water-finding travels throughout France, which continued until 1854 when he could

no longer ride a horse. By his own account, between 1832 and 1854, Paramelle explored 40 of France's departments, evaluated 30,000 sites, and indicated water at 10,275 sites with a 90% success rate. In 1854, Paramelle retired to Saint-Céré and wrote *The Art of Finding Springs*, which was published in 1856. This book, which was based on the 1827 report, included additional observations and methods he developed throughout his later career. The book was a how-to manual for the public; it became a best seller that was reprinted six times. The last edition appeared in 1926. The book was translated into German in 1856 and Spanish in 1863. The English translation appeared in 2019 (Bobeck, 2019). Paramelle died in Saint-Céré in 1875.

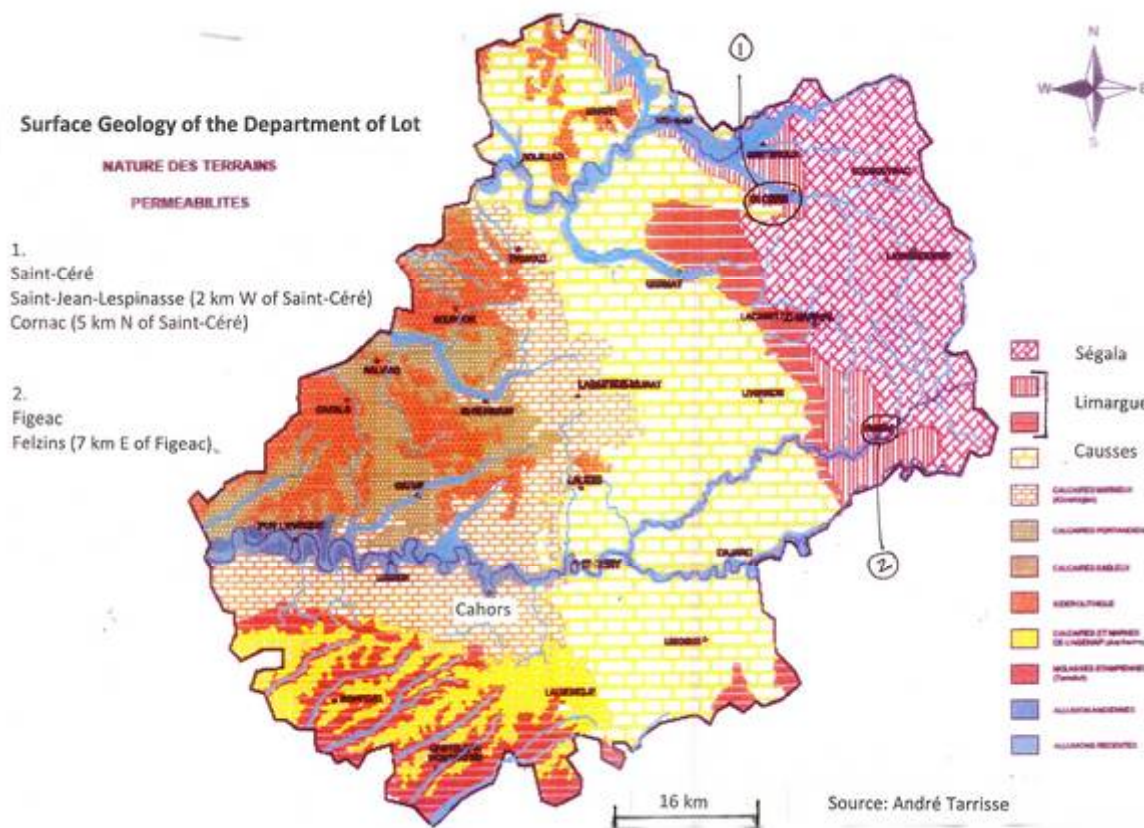


Figure 3. Geologic map of the Department of Lot.

### 3. Paramelle's observational method

Paramelle's parishes were situated on the Causse, a limestone plateau located in the central part of the department of Lot, where surface water is scarce (Fig. 3). Paramelle had grown up in the eastern part of the department of Lot, where the surface is impermeable clay and schist (Limargue and Ségala). Paramelle had childhood memories of streams and abundant surface water. He also knew that the same amount of rain fell on his childhood home and his parishes. Paramelle observed that streams that cross the Ségala and the Limargue are quick to disappear where they flow westward onto the Causse. In a passage that many geologists can relate to, that is, looking at a feature and not realizing its significance, Paramelle recounts how he walked the Causse for nine years before

recognizing that disseminated dolines on the Causse surface convey water to the subsurface (Fig. 4).

Paramelle sought to increase his geologic knowledge by reading. Throughout his career he amassed a library of 3000 volumes by such authors as Brongniart, d'Orbigny, d'Aubuisson des Voisins, and de La Bèche (in translation). Presumably by the early 1820s farmers had observed water flow into limestone, but this information may not have been published and the concept of karst was not known outside of Eastern Europe.

Some of Paramelle's observations stem from reports of local residents and farmers. Many of Paramelle's observations appear obvious to today's reader. Paramelle was able to link these obvious

facts such as water flowing downward on a hillslope, to that same water flowing into a surface stream, which, in Paramelle's observation, is always underlain by a subsurface stream, and thus groundwater. Given that this superposition of streams was common on the Causses, where streams disappear into

the subsurface and then spring forth downstream into the course of the surface stream, Paramelle took this phenomenon as a universal. This idea may seem quaint to us, but in Paramelle's time, water was thought to flow primarily through natural underground conduits.



Fig. 4. Photograph of doline near Rocamadour. Photo by P. Bobeck.

#### 4. Paramelle's question n°1: where is the water?

Paramelle eventually understood that limestone allows rainfall to penetrate and noted that water does not evaporate underground, allowing for accumulation of large amounts of water in the subsurface. He noted that water forms both surface and subsurface streams as it flows downslope. He claimed that every surface stream, dry or not, is underlain by an underground stream. In the department of Lot, streams such as the L'Ouyse disappear into the subsurface and reappear downgradient as resurgent springs.

Paramelle observed that disseminated dolines on the Causses surface convey water to the subsurface to form underground streams that flow downward, unseen, and often issue as springs at the base of cliffs.

The department of Lot has three large river basins, separated by crests (watershed boundaries): the Dordogne, the Lot, and the Céré. Obviously, rain that falls on slopes flows downgradient into rivers, so Paramelle's sound basic advice is to look for water in valleys. He notes that many people build their houses on a high point and plan to obtain water adjacent to the house, but he points out that water is found in valleys. Paramelle categorized valleys as primary and secondary. A wide valley will collect more water than a narrow one, and the amount of water present can be estimated by considering the size of the valley. He explains where to dig in a wide valley to intercept an underground stream.

Paramelle also noted interrupted vs continuous valleys. Interrupted valleys occur on the Causses; minor barriers can cross dry valleys, thereby hiding a valley trace, and he describes how to find the val-

ley trace within the barrier. The importance of the valley trace is that the dry valley overlies the underground stream, thus, the groundwater.

### 5. Paramelle's question n°2: how deep is the water?

Having established that water can be found at the base of cliffs, under dry streams, and in wide valleys, Paramelle set out to determine the depth to water. In the 1820s, depth to water was critical, given the lack of power drilling tools. His determination of water depth was simple. For surface water that flows into disseminated dolines on a plateau and issues as a spring at the base of a cliff, the water depth is intermediate between the plateau elevation and the elevation of the base of the cliff. The slope of the hill and its underlying water can be calculated and a person can determine roughly the point where the water is closest to the surface. Paramelle provided a model for making a level to measure slope.

He suggested a method for finding water that flows between an unknown doline and a river. If the water flows on the valley surface before entering the river, a person can determine the amount of flowing water by the angle at which the water approaches the river. Paramelle explained which direction to follow to walk up the slope and describes landmarks to guide the water seeker to the doline. This exercise provides the elevations of the river and doline, and the water seeker can identify the location where the water is likely to be closest to the land surface.

Surface streams (flowing or not) in shallow valleys have underlying underground streams and the water in both streams follows equal slopes. As stated above, Paramelle explains where to dig in a wide valley to encounter groundwater. Paramelle suggests using depths of nearby wells, if available, to determine groundwater depth.

### 6. Paramelle's Legacy

Paramelle's 1827 report was a major advance in water-finding knowledge. He singlehandedly popularized the idea of groundwater as an inexpensive, easily obtainable resource. He showed the public that water was not far beneath the surface and made it possible for many individuals, farmers, and communities to tap into clean groundwater for themselves and their animals. Paramelle demystified the process of finding water.

Unbeknownst to Paramelle, as he was looking for water on a limestone plateau, he made important contributions to the study of karst. Taisne and Choppy (*Karstologia*, 1987) enumerate Paramelle's ideas that became central to karst as follows: a) lines of dolines are frequent features in dry valleys, b) a surface valley usually overlies a subsurface stream, and c) the sinkhole-resurgence connection is a general phenomenon.

As Paramelle travelled, observed, and made more discoveries between 1832 and 1854, his successes were widely publicized in newspapers. Henry Darcy, the engineer known as the father of quantitative hydrogeology, cites his contemporary Paramelle three times in Darcy's 1856 *The Public Fountains of the City of Dijon*. He praises Paramelle's knowledge and his success in supplying so many communities with clean, abundant, and free water (Darcy, 1856).

Paramelle's 1856 book (Paramelle, 1856), the outgrowth of his 1827 report, was used for finding water in the department of Lot as late as the 1970s, according to Andre Tarrisse, retired hydrogeologist of the department of Lot (Tarrisse, personal communication, 2015). In the 1970s water utilities began using geophysical techniques to find larger quantities of water but prior to that, Paramelle's observational method had been the primary guidance on finding water for more than 100 years.

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