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# Using GIS techniques as valuable tools for the cartographic representation of geosites in the Massif des Bauges UNESCO Global Geopark

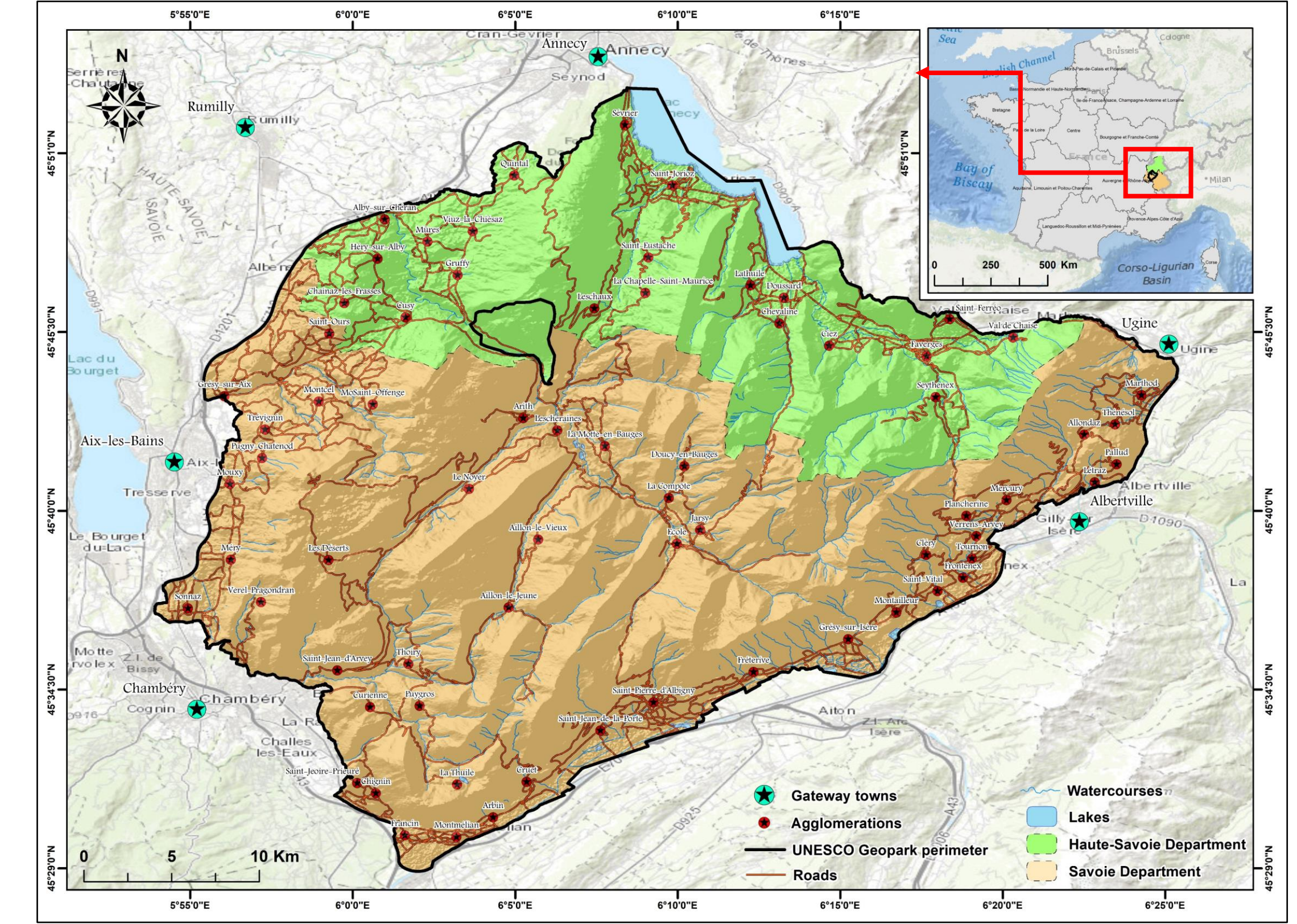
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## Abstract

- This poster presents work carried out as part of a PhD thesis comparing geosites management methods in 2 UGG working together: M'Goun (Morocco) and Massif des Bauges (France) Geoparks.
- The ongoing inventory of geosites is one of the conditions for success and for maintaining UGG status. How to integrate the ongoing addition of geosites to the management of the geosites collection grounding a Geopark is the stake of the study, analysing first the strategy used by the Massif des Bauges UGG to manage the increase from 50 initial geosites to 73 current ones. Using GIS and implementing a new database is the solution explored, allowing the creation of new types of maps and integration of the database with various pertinent details such as the date of selection, site classification, management tools employed, and evaluation scores based on the National Geological Heritage Inventory (INPG) methodology in France.
- In a second time, a new GIS database will be created for the M'Goun UNESCO Global Geopark, based on the Bauges model. This database will be used for the proper management of the various geosites of the territory (updating, characterization, and information).
- This example shows the interest in scientific collaboration between Geoparks in terms of experience sharing and technology transfer.

## Study area



The Massif des Bauges covers the entire territory of the communes that have signed up to the Regional Nature Park's charter since 1995, giving it a precise surface area of 856 km<sup>2</sup>, spread over two departments, Savoie (46 communes) and Haute-Savoie (21 communes) in the Auvergne-Rhône-Alpes region.

The administrative boundaries correspond to the natural limits of this homogeneous mountain range. This geographical configuration is accentuated by its adjacency to two substantial lakes, Lac du Bourget to the west and Lac d'Annecy to the northeast, both of which stand as the largest natural lakes in France. It is also geographically bordered by the Isère Valley to the east (Combe Savoie).

In addition, there are six surrounding gateway towns: Chambéry, Aix-les-Bains, Annecy, Albertville, Rumilly, and Ugine. These well-defined boundaries enable coherent, efficient management of the area, considering the region's natural and human characteristics.

## Introduction

Since the establishment of The International Declaration of the Rights of Memory in 1991, there has been a significant increase in scientific research focused on geoheritage and the imperative to preserve it. Since its inception, the preservation of geoheritage has been considered one of the fundamental criteria advocated by the UNESCO Global Geopark label. Moreover, there has been a growing emphasis on continuously inventorying and selecting new geosites. Notably, in the past decade, there has been a remarkable utilization of Geographic Information System (GIS) tools and cartography to produce maps representing geosites and their associated characteristics, facilitating continuous updates and enhancing user interaction with cartographic products.

## Objectif

This poster aims to explore one of the approaches employed by the UNESCO Global Geopark of the Massif des Bauges in its endeavour to maintain its status as a Global Geopark. The strategy involves adding geosites to its repertoire, resulting in a current tally of 73 distinct geosites with unique values. The focus of this poster is primarily on the use of GIS and cartography tools to represent the UNESCO Global Geoparks, the geopartners, and the diverse geosites within the Massif des Bauges Geopark. Additionally, it delves into the creation of a new database for these sites, encompassing various pertinent details such as the date of selection, site classification, management tools employed, and evaluation scores based on the French Geological Heritage Inventory (INPG).

## Methodology

### MCD CREATION

Creating any necessary tables, fields, and relationships in a database management system using JMersie software.

### SQL SCRIPT CREATION

Translating the logical data model into actual SQL statements that define the physical structure of the database: tables, columns, data types, primary keys, foreign keys, indexes, and other database-specific elements.

### WEB ACCESS (PIA)

Deploying PIA Application Front Office on Server for Web Browser Access and Launching New Massif des Bauges Global Geopark Website.



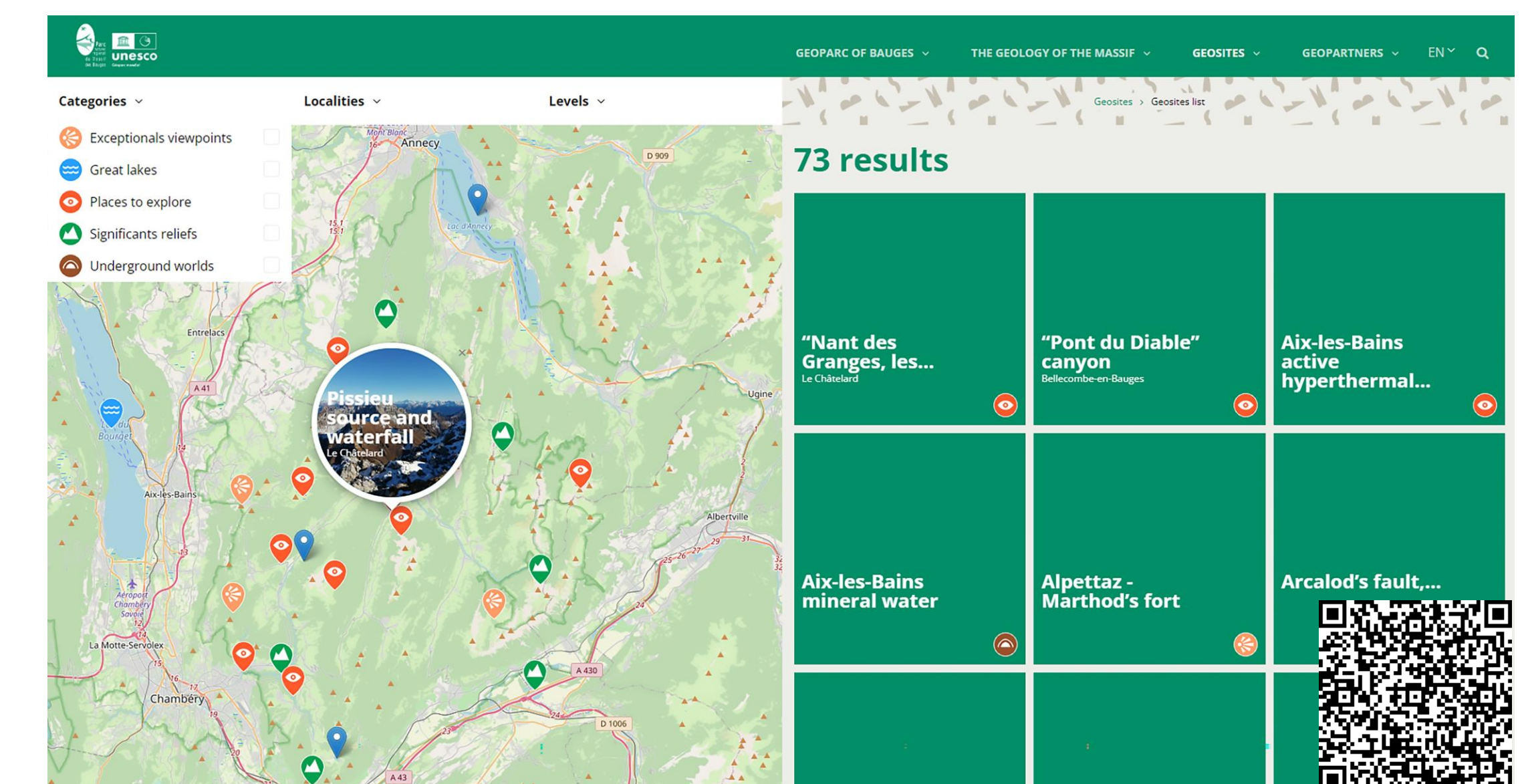
**1 DATA COLLECTION**  
Gathering information pertaining to the Global Geoparks, the geosites and the geopartners within the Geopark and consolidating this data into a single Microsoft Excel file.

**2 MLD CREATION**  
Generating an MLD (Logical Data Model) from the MCD (Conceptual Data Model) using JMersie software by defining entities, attributes, and relationships more precisely. This refinement guarantees a more structured representation of the data.

**4 POSTGRESQL DATABASE**  
Using spatial data management through the PostGIS extension allows us to store various types of geospatial data, and multi-dimensional geometries, directly within the PostgreSQL database.

**6 GEOSITES DATA DISPLAY**  
Displaying data on the newly launched Massif des Bauges Geopark website through interactive online maps.

## The geosites:



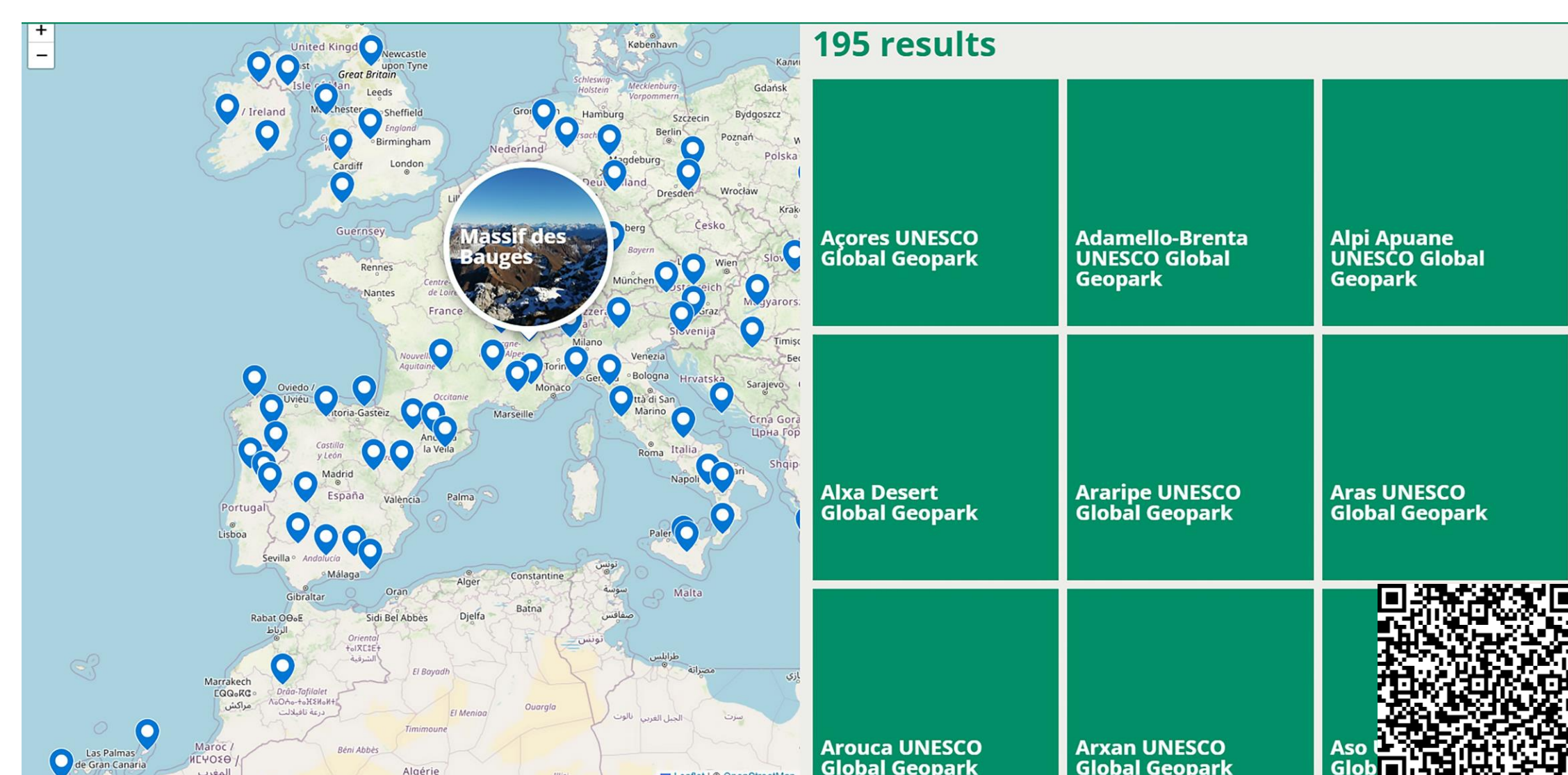
An interactive map has been developed, encompassing 73 geosites within the geopark based on the latest inventory. These sites are classified into five distinct categories: Exceptional Viewpoints (9), Great Lakes (2), Exploration Destinations (40), Significant Landforms (18), and Subterranean Realms (6). The map also indicates the respective communes containing each geosite, along with the available modes of access (accessible to experts or the general public).

Efforts are ongoing to incorporate additional information into the map's dataset, including the extent and nature of development, the current condition of each geosite, contact details for the designated geosite representative, and evaluation scores derived from the French Geological Heritage Inventory (INPG).

Furthermore, the map utilizes various spatial elements such as **Points**, **Lines**, and **Polygons** to effectively represent the diverse geosites.

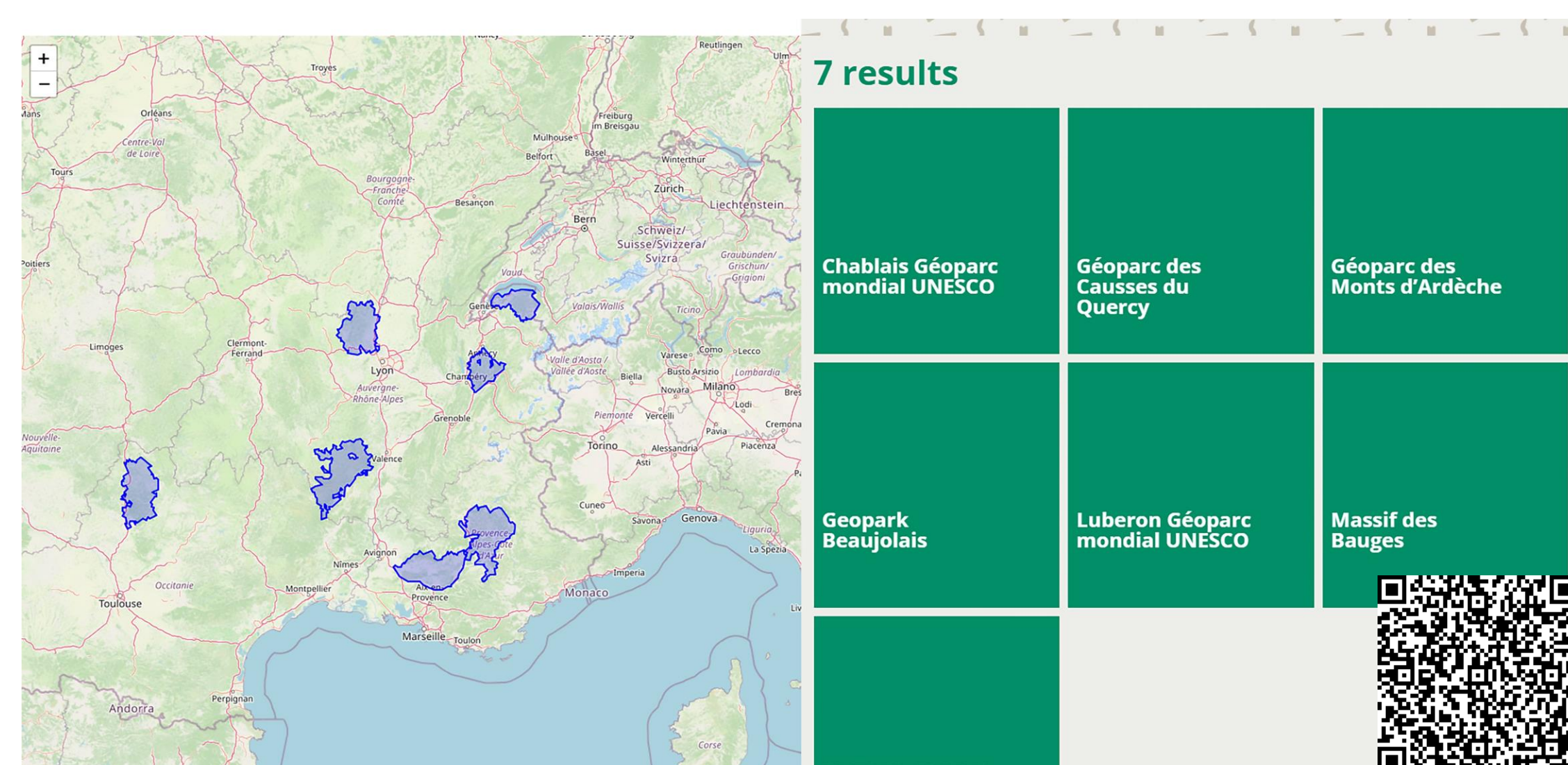
## Results

### The UNESCO Global Geoparks:



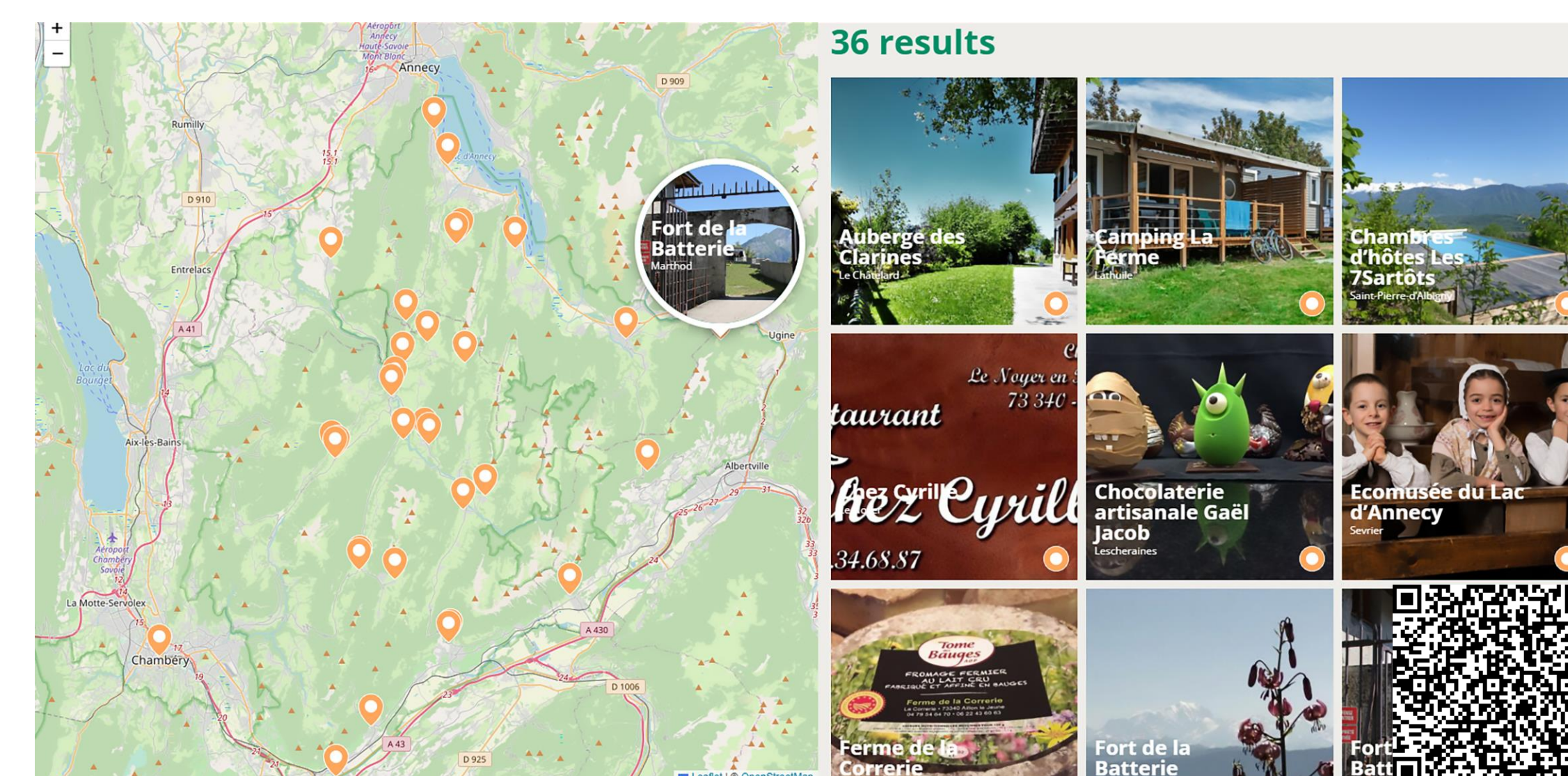
A comprehensive interactive map has been made available, showcasing a total of 195 Global Geoparks spread across 48 countries worldwide.

### The French Geoparks:

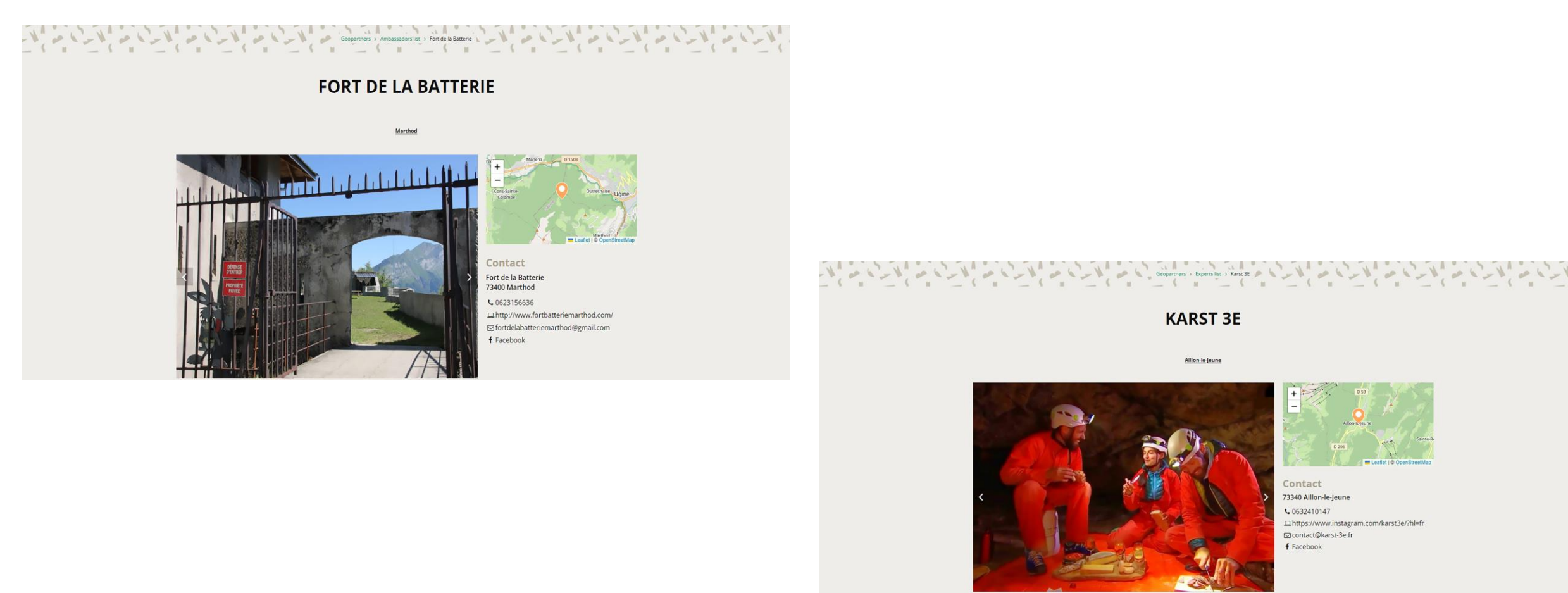


A user-friendly map has been supplied, encompassing all seven of France's global geoparks, each distinctly outlined along their perimeters.

### The geopartners:



The geopartners have been categorized into two groups: one map encompasses ambassadors (to be guided through the massif's geotourism offer), totalling 36 geopartners, while the other incorporates experts (to be accompanied in the field by a professional: geosciences, specific activities), totalling 10 geopartners. Both maps feature dedicated databases for each category, comprising descriptions of the geopartners, their respective locations, and contact information such as phone numbers, email, official websites, and social media links, and access methods.



## Conclusion

This poster highlights the enduring enthusiasm for scientific cooperation among UNESCO Global Geoparks, focusing on the exchange of experiences and the transfer of technology. The process commences with the creation of a fresh database for the geosites and geopartners within the Massif des Bauges Geopark in France. Subsequently, this endeavour will extend to the establishment of a similar database for the M'Goun Geopark in Morocco.

One of the key objectives of the UNESCO label is to make this information accessible to the public. This initiative serves as a form of mediation and a platform for sharing insights from various stakeholders both within and beyond the local territory.