GEOTRAIL

UNESCO obal Geopar

Famenne Ardenne



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Educational, Scientific and Cultural Organization

Eamonno UNESCO Global Geopark



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WHAT IS A GEOPARK ?

WHAT IS A UNESCO GLOBAL GEOPARK ? A LABEL AWARDED BY UNESCO



UNESCO Global Geopark is a label awarded by UNESCO to a single, unified geographical area where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development. At the end of 2019, there were 147 Global Geoparks in 41 countries around the world.

L'UNESCO GLOBAL GEOPARK FAMENNE-ARDENNE

The Geopark encompasses the municipalities of Beauraing, Wellin, Tellin, Rochefort, Nassogne, Marcheen-Famenne, Hotton and Durbuy, all sharing the distinction of being located on the Calestienne, a transitional strip of 910 km2separating the Famenne and the Ardennes, and home to a population of 67,250 inhabitants. The two outstanding geological features of the Geoparkare its Calestienne limestones and their caves (karst systems)as they relate to the geological structure of the region.

The Calestienne

The landscapes found within the Geopark frequently reflect what lies beneath the surface. Among these landscapes, one particular strip stands out: the Calestienne, the common thread of the entire Geopark. This strip, consisting mainly of Givetian limestones, runs from Chimay in the west to Remouchamps in the east. It is bounded to the south by the Ardennes and to the north by the Famenne depression. The term Calestienne may be derived from the German Kalkstein (limestone), or from a prefix referring



A simplified map of the Famenne-Ardenne UNESCO Global Geopark superimposed on a relief map (LIDAR image), highlighting the link between the geology and the geomorphology. Sandstones are more resistant than limestones, which in turn are more resistant than shales, resulting in the relief visible on the map: to the south rise the heights of the Ardennes, ending in a narrow depression scooped out of the Eifelian shales, the limestone strip of the Calestienne standing out in relief (in blue) and to the north the shales of the depression (in brown). (Data sources:"Wallonia Public Service" http://geoportail.wallonie.be).

either to limestone or to heat (plants that grow on limestone are more thermophilic than those that prefer shale soils) – and from the Walloon word Tienne, meaning a high place.

Geological history

1. The geological history of the Geopark begins during the Devonian period (419 to 359 Ma) with the sedimentation of deposits of horizontal layers on the ocean beds.

2. These sediments will gradually become buried under their own accu-

System	Series	Stage	Age Ma
			359
Devonian	Upper	Famennian	372
		Frasnian	383
	Middle	Givetian	388
		Eifelian	202
	Lower	Emsian	100
		Praguian	408
		Lochkovian	411
			419

En géologie, la chronologie se réfère souvent au tableau stratigraphique. Ici un extrait pour le système dévonien (qui fait partie de l'ère paléozoïque). Les étages portent les noms des lieux où ils sont décrits. Le Geopark se situe au cœur de ces lieux importants pour la géologie du Dévonien moyen et supérieur.

mulation and undergo a slow process of transformation into solid rock. The main rocks beneath the Geopark are thus sedimentary: shales, sandstones and limestones.

3. These rocks would later undergo severe deformation, some 320 Ma ago, during the formation of an ancient mountain chain (the Variscan orogeny), the remains of which form the Geopark. This event is what produced the many folds and faults now clearly visible in the landscape, such as the Durbuy anticline. 4. The mountain chain was soon eroded down to a vast flat surface known as a peneplain, which still constitutes the subhorizontal skyline visible throughout Upper Belgium. During the latter part of the Secondary era (Mesozoic) and the early part of the Tertiary (Cenozoic), a warm and humid climate profoundly altered the limestone rocks and formed ghost-rocks, the precursors to caves. In the second part of the Cenozoic, the Ardennes bedrock was uplifted, the river system became incised and caves formed.

THE COUNTRYSIDE CODE :

- Respectnature, geological heritage, wildlife and plants; do not pick plants, flowers or fruit of any kind.
- Follow the highway code, which applies on country lanes just as much as on the rest of the road network, and obey any prohibitions or restrictions on traffic.
- Use the pavement wherever there is one, otherwise walk on the left-hand side of the road, facing oncoming traffic.
- Make sure you are visible to road-users at all times (wear light-coloured clothing).
- Opt for full-length trousers to ward off ticks.
- Stay on the paths by following and sticking to the permanent or temporary waymarking.
- Scrupulously respect private property: you must obtain the owner's permission before entering.
- When you meet other walkers, remain courteous at all times and be the first to offer a greeting.
- Keep noise to a minimum, to avoid causing nuisance to others.
- Do not startle or disturb grazing animals.
- Keep your dog on a lead and under control.
- Take all your litter home with you.
- Lighting fires is strictly prohibited.





Start/Finish : Car park place Albert 1^{er}, 5580 Rochefort. GPS (WGS84): Latitude : 50.158921° Longitude : 5.223361° Distance/time : 12,7 km – 3h15 Elevation change : 250 m Level : Intermediate

The starting point for this geotrail depends on your choice of transport. Arriving by rail, you will set off from Jemelle station. If you arrive by car, your route will start from the centre of Rochefort, the route described here. The spacious and free car park outside Jemelle station is also another option for car users. Part of the trail follows a RAVeL (dedicated cycling and walking track) and so can easily be accomplished on two wheels. The section between the Rochefort Cave and the Nou Maulin Cave is better suited to mountain bikes

his geotrail starts from the centre of Rochefort and leads to Jemelle via the RAVeL 150 cycle path, along the valley of the Lomme. The valley here follows the limestone strip and is shaped by major karst phenomena. The return to Rochefort is along the left bank of the Lomme, climbing up to the edge of the Gerny plateau and including a suggested detour to visit the Gallo-Roman villa in Malagne.

Leave the car park on Place Albert 1er and turn right onto Rue de Behogne. Make your way across the roundabout and continue along Rue Jacquet for 400 metres. Here is the first of the Famenne-Ardenne Geopark geosites you will encounter along the geotrail. The Château Comtal de Rochefort, or chateau of the Counts of Rochefort, built in the Middle Ages by the Montaigus, the first lords of Rochefort, was to become one of the greatest fortified castles of the Calestienne, and gave its name to the town itself (rocha fortis). The siting of the



The Chateau of the Counts

castle is remarkable in terms of geomorphology. Standing atop a limestone promontory within a loop of the Lomme, close to its peak it levels out into a large and fairly flat area at

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Route of the footpath superimposed on a LIDAR relief map (Wallonia Public Service: http://geoportail. wallonie.be). A LIDAR image reveals the surface of the earth stripped of its vegetation, further highlighting the relief.

an altitude of 230 metres. This area represents the upper terrace of the Lomme, a dominant and much prized position of major strategic importance. It looks out over the Famenne depression to the northwest, the dry valley of Rue Jacquet⁽¹⁾ to the south and east and the Thier des Falizes sink-holes to the west. To the north. the promontory is bounded by a cliff created by differential erosion where limestone meets shales. The castle was besieged on numerous occasions. Later it became a ceremonial palace, then was nationalised, and finally ended its days as an unofficial "quarry", its stones plundered by local residents for their own building needs. A prime historical and archaeological site, it is now open to visitors. More information can be found on the castle's website, www.chateaurochefort. be, under "News".

Continue along Rue Jacquet for 100 metres, then turn left onto Place Lafayette. Next, take Avenue des Tilleuls (a narrow lane, climbing very steeply at the start). On reaching the crossroads, 400 metres later, you will see a deep depression to your left: this is the Val d'Enfer, and opposite you is the en-

¹ Dry valley debouching from the Fontaine Sainte Odile in Hamerenne

ROCHEFORT

trance and visitor centre for the Cave of Lorette.

You are now standing on the plateau of Notre Dame de Lorette, a mainly horizontal area that is simply an extension of the area on which the chateau stands, across the Rue de Jaquet valley. Seen from above, the plateau features a number of deep hollows. When not man-made in origin (shell holes, excavation), such hollows are often caused by the underlying limestone dissolving and the land sinking to form these depressions, known as sink-holes or dolines. They are also surface clues to the probable existence of underground caves. What you see before you here are the morphological forms typical of a karst landscape. The Cave of Lorette or Rochefort Cave is run on a rather unusual pattern, as a tourist attraction but also as a place of scientific research that then communicates its results to the public. This makes it one of the major geosites within the Geopark. The Cave of Lorette extends over six kilometres of galleries beneath the plateau, some of which are open to visitors, while others are used as an underground laboratory. The location of this laboratory was chosen following the discovery of an active fault within the cave that is altering the shape of certain galleries or very gradually crushing blocks of stone and concretions. The laboratory focuses its studies on geophysics (studying faults, seismology and gravimetry) and hydrogeology (studying how water percolates through rock).

Useful information: Karst is a term that refers to all the surface and underground features resulting from the erosion of largely carbonate rocks: hollow depressions (sink-holes or dolines), dry valleys, river swallow holes (adugeoirs and chantoirs), major springs re-emerging from under the earth (resurgences), and caves and caverns (grottes, gouffres) of all shapes and sizes. The term itself derives from the eponymous region of Carso or Kras, a limestone plateau located for the most part in Slovenia but also extending into Italy and Croatia. A fluvial terrace (fluviatile) is a flattish ledge along one or both sides of a valley forming the bed of a former watercourse into which the water has sunk. A terrace may also be alluvial, created by the deposition of sediments, or flattened out by the erosion of either a rocky bed (strath terrace), or of an earlier

Although an underground river once ran through the cave, most of the galleries are now dry. Small underground rivers and lakes can still be found in some places, however, proof that the Cave of Lorette is connected to a much larger system, much of which is still to be discovered: the Lomme-Wamme underground sys-tem. These two rivers flow down from the Ardenne but when they reach the limestone, they follow the limestone strip rather than cutting perpendic-ularly across it, as the Lesse does at the Caves of Han Acrit course of the strip, the Lomme and the Wamme both gradually disappear underground, giving rise to a highly complex underground flow,

mostly heading in the same direction as surface flows. The waters emerge once again at the Eprave resurgence. At the Nou Maulin Cave, this flow cuts across the surface meander encircling the town of Rochefort.

Follow Avenue de Tilleuls to the Chapel of Notre-Dame de Lorette and its Calvary cross. From behind the cross. admire the view from the Notre-Dame de Lorette lookout point.



A glimpse of the Lomme-Wamme underground system discovered in the "wild" section of the Cave of Lorette (photo: Gaëtan Rochez).

Suggestion: Cave of Lorette A visit of the cave takes an hour and a half, descending 60 metres to the lowest point of the cave where a river runs over massively eroded rocks. You will see a number of galleries typical of the system. The visitor centre also has a screening room where the "Videokarst" film explains the current scientific research being undertaken in the cave, but also gives you a glimpse into galleries otherwise inaccessible. The guides' building features a miniexhibition on the seismological research carried out here. More information available is at: https://grottedeloretterochefort.

The N.D. de Lorette lookout point offers a magnificent panorama over the Lomme valley, from which you can just make out the industrial buildings of the Lhoist quarries in the distance. The main focus here, however, is the course of the Lomme itself. Clearly, here it is following the limestone strip very closely, with both sides of the valley similar in appearance and fairly steep. Between the two slopes lies a vast horizontal area, the alluvial plain of the Lomme, through which the river snakes. Note that the course of the Lomme has been altered on numerous occasions by the hand of man, particularly during the building of the railway. The alluvial plain is made up of pebbles and fine sediments. At high water, the valley will flood, performing its natural function of accommodating the flood-



The N.D. de Lorette lookout point.

waters. It will be no surprise that this area is designated a floodplain by the Wallonia Public Service (SPW).

Behind the chapel, you will see a narrow dirt path going down the hill. Follow this path for 300 metres. When you reach the bottom, turn left.

You are now standing outside the entrance to the Trou Maulin, which gives access to a complex network of galleries extending over more than 1,600 metres. You can enter the first 20 metres of the entrance gallery with just a hand-torch (any further would require the presence of a qualified guide). The left wall of the entrance features a series of asymmetric spoon-shaped hollows. These structures or "chisel marks" are the sign of a turbulent current and indicate the direction of flow. It is also apparent that the gallery actually descends beneath below the level of the surface river. Speleologists have found the level of the water table some fifteen metres beneath the bed of the Lomme. Opposite the entrance, a dyke separates the river from the cave, otherwise the Lomme would disappear completely into the cave. The construction of the dyke, and the paving of the bed of the river, were



Chisel marks showing the direction of water flow (from left to right).



The Nou Maulin cave entrance in flood season.

carried out by the local authorities in the last century. The aim was to keep the course of the river above ground as it flowed through the village, for sanitation purposes and as a source of power for its mills.

Take the stony path that leads back up to the village. When you reach the top, turn right and cross the bridge. Go around the roundabout on the right and then immediately take the RAVeL path opposite you (alongside the shop).

RAVeL line 150 or the Lesse line is a now disused railway line built in 1880 to link the town of Rochefort to Jemelle, a station of some importance on the Brussels-Luxembourg line. The Compagnie de l'État Belge gradually extended the line, in stages, towards Dinant, completing the project in 1898. During the Second World War, the local Resistance blew up the bridges over the Lesse at Vignée and Villers-sur-Lesse. Rail operator SNCB brought the line back into service in 1950. In 1978, the last cabotage freight train drew into Jemelle station. By 1985, the last of the tracks had been ripped up, to be replaced by the RAVeL cycling and walking path we know today. A railway line, of course, needs to be as straight and horizontal as possible, which means building tunnels, bridges, cuttings and embankments. As the geotrail follows this part of RAV-

eL line 150 to its terminus at Jemelle station, one section runs through a cutting through the rock almost 10 metres in depth. It is one of the finest cross-sections in the whole Geopark for studying Mid-Devonian geology (Givetian and Eifelian stages, i.e. from 393 to 383 million years ago).

Cross the Lomme via the metal bridge. 500 metres on, you will see on your right, looking down from the RAVeL, a large cave entrance, often concealed by plants in the growing season.

The entrance to the Pré-au-Tonneau Cave on the left bank of the Lomme is marked by an impressively large entrance, leading to a perpendicular gallery running east to west. It was created by the collapse of the rock wall separating the valley from the gallery that runs parallel to it. This was one of the main sink-holes on the Lomme, before the construction of a railway embankment in 1880 created a separation between the two. When the flow of water in the Lomme is powerful enough, the sinkholes upstream of the cave become active and feed into the gallery to the left of the entrance. The river continues its course to the right of the entrance before disappearing some 50 metres further on into a siphon.

Continue to follow the RAVeL, which leaves the Lomme valley to follow a tributary, the Fond des Valennes stream. 400 metres further on, take the bridge across the stream.



The RAVeL making its way through a cutting revealing Eifelian clastic rocks.

To the left of the RAVeL rises a steep-sided hill. On the summit of this spur is a flat area of over 1.5 hectares, created by erosion, on which stand the ruined fortifications of the "Vieux-Château" or the "Fayt Oppidum", dated to the Middle Ages.



Station and Lhoist works.

As the RAVeL continues, the limestone gradually gives way to clastic rocks: siltstone and sandstone. After crossing a second bridge, the trail now leaves behind the Fond des Valennes stream. The RAVeL now continues through an 800-metre long cutting, exposing along its length dark-coloured sandstone-type rocks, before emerging back into the Lomme valley with Jemelle station a little further on.

Arriving in Jemelle is something of a shock: in a few dozen metres, the terrain changes from nature and rocks to an entirely man-made setting: railway tracks, workshops (abandoned) and the SNCB station. The backdrop consists of (disused) quarry walls and the industrial plant of the quicklime works still operated by the Lhoist group.



Former SNCB workshop.

Keen photographers will find plenty of opportunities here, in the disused part of the station, for fascinating shots of old railway installations, unique in the Calestienne.

Cross the station car park and go along Rue des Marchandises. At the end of the street, cross the main road (Rue de Ninove) and you will find on your left the Centre for Rail and Stone, a Famenne-Ardenne UNESCO Global Geopark partner.

The railway, along with limestone quarrying, both played a part in Jemelle's rise to prosperity towards the turn of the 19th century. Midway between Brussels and Luxembourg, Jemelle became a nerve centre for rail equipment servicing and maintenance, and attracted large numbers of workers during the first half of the 20th century. This prosperity also had its downside, however. During the Second World War, on 10 May 1940, Jemelle was also the first railway station to be bombed. It was to honour the memory of the region's railways that the non-profit organisation "Fous du Rail" succeeded in 2000 in transforming the former civic centre into Centre for Rail and Stone (Centre du Rail et de la Pierre), a museum extending over three floors, containing an outstanding collection of tools and objects from the heyday of rail.

Suggestion: Centre for Rail and Stone

Open daily except Friday from 1 April to 31 October, from 1 pm to 5 pm. The Centre retraces the history of the railway, the organisation of Belgium's railways, and even the design and mechanics of the rolling stock of the period, as well as a fascinating insight into the various jobs and professions involved in operating the railways. A special area is set aside for the Compagnie Internationale des Wagons-lits, including a life-sized carriage complete with all the fine marquetry work, and the silverware and fine china enjoyed by passengers on these iconic trains. In the basement of the building, another area is dedicated to the railway workers' Resistance movement during the Second World War, recording how the workers sabotaged and disrupted the invader's plans. Yet another area is set aside for the rain economic resource: its geology. This section focuses on how limestone is extracted and the process of manufacturing quicklime and its derivatives. The local geology is represented in a collection of rocks, fossils and minerals.





Centre for Rail and Stone.

Leaving the Centre for Rail and Stone, take the main street on your left for 40 metres and then take the next left into Rue des Carrières (before the tunnel under the railway line). At the end of this street, turn to your left on Rue de la Wamme, which runs alongside the river Wamme.

From here, you will see a cliff rising on the other side of the Wamme. This marks an historic spot for the village, the former On limestone quarry, which began operating in the 19th century, to serve the construction of the Brussels-Luxembourg railway line (1850). A number of different owners operated the quarry prior to its acquisition by L. Lhoist in 1924, who expanded and modernised the plant. Since his day, the quarry is no longer used to produce limestone, but houses the lime kilns vital to the production of quicklime from limestone. Every years, 400,000 tonnes of quicklime are shipped out by truck or freight train, mainly to clients in the steel industry or for use in environmental protection. The On-Jemelle site employs 105 people directly. The kilns are supplied with Frasnian limestone from the Boverie guarry on the other flank of the Calestienne to the north.

Carry on along Rue de la Wamme to the Turn right to: Rue de Gerny on you steeply at its start). Carry on au. street for 850 metres to the N836 Ro-chefort-Marche main road. Cross (with care) and take the road opposite (Rue de l'Observatoire). After 150 metres turn off onto the dirt track on your " and follow this for 500 metres t the crossroads with Rue de Ninove.

You will find yourself at the highest point of a flattened area. From Rue de Ninove onwards, you will have passed by a number of disused quarries (not always easy to spot, as they are fenced off). Were you to continue northwards, you would come to the

Boverie guarry, mentioned above. Geologically speaking, you would still be treading Calestienne limestone all the way from the On quarry to the Boverie. Along most of its length, the Calestienne is a strip less than a mile wide. Here, however, it is at its widest at 4 km, as a result of a geological anticline: this is the Gerny plateau, or Gerny anticline, which stretches eastwards from Rochefort as far as Hargimont. This slightly rolling limestone plateau was covered by windborne silt loam deposits ideal for crop-growing.

Continue along the path for 750 metres as it follows the ridgeline, until you come to a tarmac road. Turn left and follow the road for 1,200 metres



Aerial view of the remains of the main building of the Malagne villa.

to a crossroads, followed immediately. by another. Keep left and follow Rue du Coirbois for 500 metres. On your right, you will find the Malagne villa (Jemelle).

Malagne is an outstanding example of a Gallo-Roman rural estate that stands on the edge of the Calestienne, on a hill overlooking the Lomme valley to the south and an outpost of the Famenne depression to the northwest. The limestone plateau of Gerny stretches to the northeast. This strategic position offered its early inhabitants a south-facing aspect on the boundary between the

Suggestion:

limestones and schists of the Devonian Period (385 million years ago). In common with the rest of the Gerny plateau, the loamy/stony soil, rich in limestone or schist, was ideal for growing crops. As with so many ancient sites, Malagne owes its location not to chance but to a combination of advantageous geological and topographic features. The Malagne villa in Jemelle is the Geopark's only sizeable landed estate, and was built in the middle of the 1st century AD; the ancient site is now a centre for learning, tourism and experimental archaeology (lime kiln).

Malagne, the Rochefort Archaeopark, a Geopark partner. Take time out to explore this superb geosite, with its remarkable wealth of historical and archaeological interest. Here you will also learn more about how the Romans and Gauls once lived, what they ate, the jobs they did, the crops they grew and the animals they raised. The site is open every day in July and August, and at weekends, on public holidays and during school holidays (from spring to autumn half-term holidays included). More information available on https://www.malagne.be/

Now retrace your steps and walk back down Rue du Coirbois. Back at the crossroads, turn right onto Rue de la Martinette. After 450 metres, take Rue Louis Banneux on the left. After 250 metres, take a sharp right turn and walk alongside the Lomme for 450 metres. When you come to the stone bridge, turn left across it and then follow Rue de Behogne for 480 metres. Pass the church and, a little further on, you will find your final stopping point on your left, opposite the cultural centre.

You have now arrived at the last geosite on this trail: the little tourist train (https://www.rochefort. be/ loisirs/tourisme/attractions/ Train-Touristique). A one-hour ride will (re) introduce you to Rochefort's her. .

itage, both natural (the panoramic view from the Rond du Roi, the Lorette sink-hole) and historical (the Chateau of the Counts, the Lorette chapel, Malagne), with the help of an audio commentary in two languages. Afterwards, continue along Rue de Behogne for 500 metres to rejoin your car in the Place Albert 1er car park on your right.

Reference :

Frebutte, C. (dir.), 2014. Coup d'œil sur 25 années de recherches archéologiques à Rochefort, de 1989 à 2014. Namur, IPW, 228 p.

Quinif, Y. et coll. 2017. Hommes et Paysages. 43 Itinéraires des grottes et du calcaire, de Rochefort à Han-Sur-Lesse. ISBN : 978-2-9600712-6-9 Van De Poel, B. 1968. Géologie et Géomorphologie de la Région du Parc National de Lesse et Lomme (Han-sur-Lesse – Rochefort). Publication de l'asbl Ardenne et Gaume – monographie n°1.

Tourist information

Syndicat d'Initiative de Rochefort Rue de Behogne, 5 à 5580 Rochefort(B) T. : +32(0)84/21 25 37 – courriel : infos@rochefort-tourisme.be Maison du Tourisme Famenne-Ardenne Place de l'Étang, 15 à 6900 Marche-en-Famenne (B) T. : +32(0)84/34.53.27 – courriel : info@famenneardenne.be WEB : www.famenneardenne.be

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