Plémont Geology Trail.

Coastal inlets, caves, arches, stacks, reefs...& a Minor Dyke Swarm,

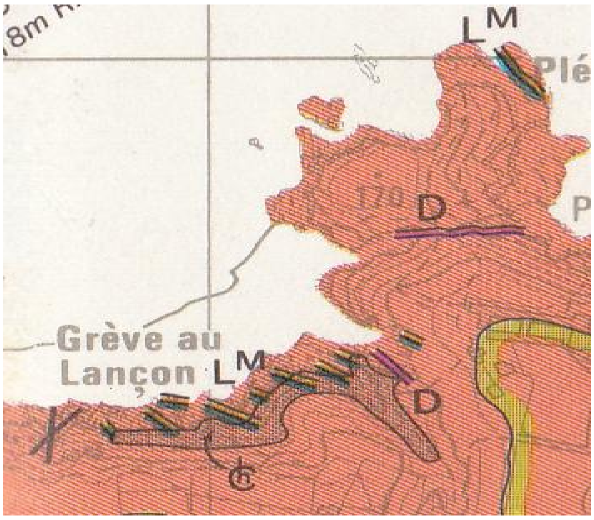

Fig. 1.

La Grève au Lanchon (Lançon en Jèrriais) is a bay to the west of La Tête de Plémont situated on the northwest coast of Jersey in St. Ouën **(Fig. 1).**

It is backed by granite cliffs in which there is a noticeable concentration of mica lamprophyre dykes, 9 in 400m (green, **Fig. 2.** below) with one dolerite, whereas others crop out singly, eg. only two westwards to Gronez, and in very minor numbers c.1 km apart eastwards along the rest of the coast. Additionally, there are veins and xenoliths of several types of rock such as aplite, dolerite (red below) and diorite, faults and many joints and master joints (black lines below). There is also a striking variety of land forms such as caves, inlets, arches, stacks and reefs, caused by differential marine erosion along zones of softer rock in the pink granite.

Fig. 2. (IGS, Jersey, CI sheet 2, 1:25,000, 1982).

The pink-red, well-jointed granite is named the North-west granite, St. Mary's type (Bishop & Bisson, 1989, p. 52), or the Porphyritic Granite, one of four different types making up the North-West Granite Complex (Brown et al. 1990, p. 195).

It is called porphyritic because it contains large zoned and unzoned orthoclase feldspars, in a finer grained groundmass together with scattered black biotite and hornblende crystals.

Inclusions (xenoliths) of dark grey and white speckled diorite of variable size and shape also occur.

Glossary. The following words are used to describe the rock types, land forms and structures.

Aplite. A pink-orange, finely crystalline igneous dyke or vein rock of quartz and feldspar.

Dolerite. A grey, medium crystalline igneous dyke rock rich in iron and magnesium.

Dyke. A wall-like, discordant structure, usually softer, dark grey dolerite, within pink granite.

Fault. A fracture caused by tension or compression which has displaced adjacent rocks.

Granite. A coarsely crystalline pink igneous rock rich in quartz, feldspar and micas.

Joint. A fracture caused by tension in the rocks but without any displacement.

Lamprophyre. A brown, medium crystalline, basic to ultra basic (ultra mafic) igneous, minor intrusive dyke rock with large brown mica crystals; the magma is derived from depth (Gk. lampros = bright; phyro = to mix).

Vein. A narrow, discordant structure of crystals cutting through the country rock.

Xenolith. A different rock type surrounded by the country rock.

The East side Story.

The trail starts east of the bottom of the steps down to the beach called La Grève au Lanchon (sand eel beach) and in the furthest east of two inlets.

Fig. 3.

Fig. 4.

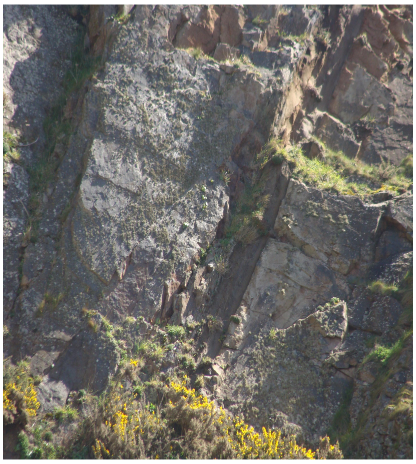

Fig. 5.

The east side is dominated by landforms caused by marine erosion and modified by mechanical and chemical weathering. Well-jointed cliffs **(Fig. 3)** of granite form the eastern wall of the first inlet. Here, nearer the northern part, the pink to brown porphyritic granite contains a large, lozenge-shaped xenolith of dark grey diorite, the edges of which vary from well-defined to ragged and show inclusions of pink feldspar crystals, possibly during assimilation of the older diorite **(Fig. 4).** Similar xenoliths of smaller size and variable shape occur in the granite beach rocks west of the steps (see below).

This first inlet is a wider and longer cove which extends further south due to erosion along a dyke, seemingly a mica lamprophyre (from its colour), and along many joints seen in the back wall **(Fig. 5).**

Returning towards the steps into the second, smaller, narrower inlet, one can see low reefs in the beach, several stacks and two narrow arches, all leading south to a large cave in the back wall. Here, the two arches lead westwards into the third inlet (the first one east of the steps). These features are classic examples of erosion along cross-joints from one inlet to another to produce a cave then an arch.

Fig. 6.

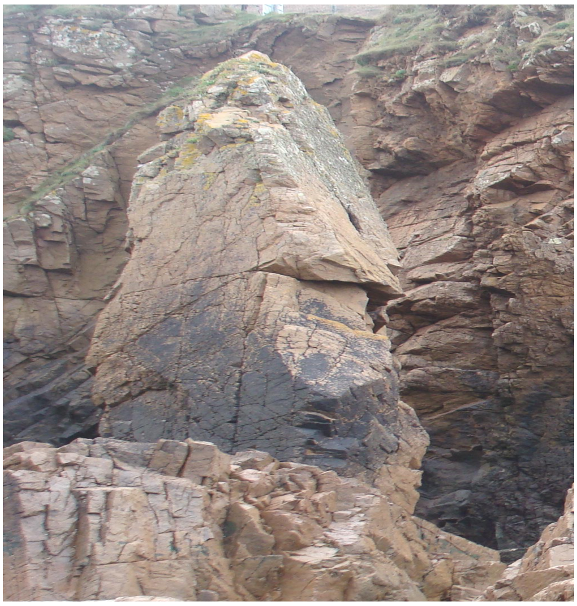

Fig. 7.

The arch (**Fig. 6)** occurs over a long, vertically-sided narrow cleft open at both ends, which has been eroded along a fault zone of softer, crushed rock, leaving an arch of crushed rock Note the darker red, iron-rich vein in the arch and that the shapes of the landforms are controlled by the fracture planes.

The stack, or pinnacle rock **(Fig. 7),** is caused by erosion along vertical joints approximately at right angles to each other, leaving a pinnacle with flat sides which are the joint planes.

The cave at the back has been eroded along a well-weathered mica lamprophyre dyke seen in the granite some metres in front of the cave and in the cliff face above the cave **(Fig. 8 & 9)** which strikes at 170° and cuts across inclined joints, so is therefore later; it also bifurcates in the roof.

These inlets, like the first one, have been eroded along dykes, joints and faults

Fig. 8.

Fig. 9.

Further weathering and stream erosion from above will produce gullies in the land surface. The arch will collapse leaving a stack and a new cliff face. The stacks will then be eroded by wave action and collapse, leaving low reefs. In this way, land is lost by **cliff recession**.

The West Side Story!

The features on the west side are dominated by cliffs and caves which have been eroded along fractures and softer rocks, and by low cliffs and reefs separated by gullies **(Fig. 10)**.

Fig. 10.

As you walk down the steps to the beach, there is a deep, vertical-sided inlet on your left which is being eroded by stream action at the back as well as by wave action from the beach. In this inlet immediately west of steps, remnants of a dolerite dyke can still be seen stuck to the eastern wall of the gully at beach level **(Fig. 11)** although none can be seen further into the gully or in the back wall. The dolerite dyke strikes at 125° and only 80-100cm are visible in an 8m wide inlet, and it has a similar strike to that of the mica lamprophyres, except for that in Fig. 13, which is c. WSW.

However, in the back wall under the waterfall, the rock is heavily stained and a mica lamprophyre dyke can be seen which ascends the western wall **(Fig. 12)** and its upper part can be seen on the opposite wall from the steps **(Fig. 13).**

Fig. 11.

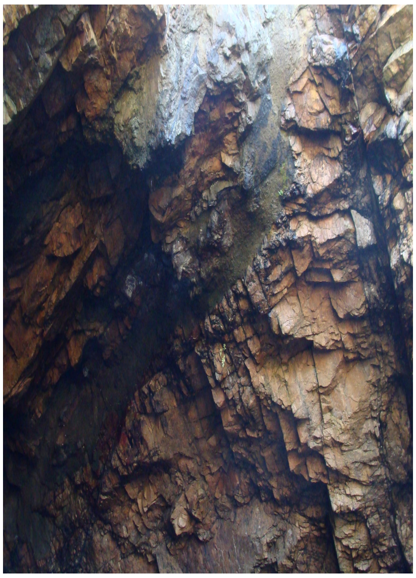

Fig. 12.

Fig. 13.

A cave has been eroded below it, but opposite it, is the second arch which goes through to the inlet east of the steps **(Fig. 14.)**

Fig. 14.

Fig. 15.

Fig. 16.

Meanwhile, in the granite outcrops on the beach, there are areas of dark grey and white speckled diorite some with isolated feldspars indicating partial alteration by the granite. These are inclusions of older rock incorporated by the later granitic magma during its intrusion **(Figs. 15, 16).** They may represent relict parts (xenoliths) of the diorites and gabbros exposed further east at Sorel and Ronez Points. Additionally, in the first cliff outcrop to the west, there are three main directions of the joint planes, not always at right angles to each other; the planes dipping towards the beach could cause potentially dangerous rock-falls.

Fifty metres west, a gully striking SW – NE leads to the first cave and has been produced by erosion along a near vertical master joint plane.

On the east side of the gully are two narrow brown dykes going up through the granite, striking at 125°; these are rarer than dolerite dykes and are mica lamprophyres. The first one, showing displacement, has been faulted, and the second one with chilled margins has been intruded into the colder granite. Alternatively, it is a multiple intrusion, that is, one dyke intruded by another **(Fig. 17, 18).**

Fig. 17.

Fig. 18.

Fig. 19.

Fig. 20.

Further SW towards the cave, the second dyke, a well-jointed, multiple lamprophyre with lenses of granite occurs striking with the same strike **(Fig. 19).** To the west, this dyke continues through the granite **(Fig. 20).**

The first cave in the cliffs has a narrow, high entrance, 2-3m wide, and the front face and initial part of the roof can be easily seen **(Figs. 21, 22)**. It strikes SSW into the cliff (in contrast to the ESE strike of the dykes) and appears to have been eroded along a fault and or master joints as there is no evidence of a dyke.


Fig. 21.


Fig. 22.

In the next cove, the second cave west is a trapezoid-shaped one, and here again, the strike of the cave is different from that of the dykes and it appears to have been eroded along and between a master joint and a fault on the right hand side **(Figs. 23, 24).**


Fig. 23.


Fig. 24.

Four mica lamprophyre dykes crop out in the eastern wall of the gully leading to the second cave. They all have a similar strike to c. 125° and vary in width from 15cm to 1m. They are sinuous in parts and in some cases have bifurcated. They truncate the aplites which show limited displacement as if there has been minimal faulting during intrusion **(Figs. 25 – 29).**

Fig. 25.

Fig. 26.

In this cove, the first and second dykes show the bifurcation and sinuosity **(Figs. 25, 26)** while the third mica lamprophyre dyke on the eastern side curves SE round to S in its upper part, and possibly shows multiple intrusive phases **(Fig. 27).** In its lower part, the dyke bifurcates and attenuates following a joint at the base **(Fig. 28).**

Fig. 27.

Fig. 28.

The fourth **(Fig. 29)** is similar to the first two and clearly bisects two orange aplites

However, in the third cove towards the main cliff line with overhangs rather than caves, a wide gully strikes back E and from this a side gully strikes south to the cliff line. On the eastern wall of this gully is another lamprophyre dyke striking in a similar direction to the others **(Fig. 30).**

Fig. 29.

Fig. 30.

The orange dykes are aplites (also called micrograntes), acid intrusions of finely crystalline equigranular quartz and feldspar, noticeable because of their colour, strike and dip, and their age. They are rich in iron oxide and have a light selvage at the junction with the granite. They strike both sub-parallel to **(Fig. 31, 32),** and across the basic dykes which bisect them, and are either vertical or inclined, dipping to the east. They intrude the granite but are themselves cut and sometimes displaced by the dolerites and lamprophyres **(Fig. 33)**, and are therefore older than the latter.

Fig. 31.

Fig. 32.

Fig. 33.

Finally, climbing the steps from the beach, binoculars are needed to examine an exposure of head above a dyke at the top of the inlet cliff to the west in which among angular fragments there may be some rounded ones which may represent part of a raised beach **(Figs. 34, 35),** while to the NE, perched in the cliffs there may be an 18m a sea cave **(Fig. 36).**

Fig. 34. **Fig. 35.**

Fig. 36.

Brief Geological History.

During Lower Palaeozoic times, the various granites of the NW granite formed as follows, the Porphyritic granite (c. 465 Ma) formed first and was followed by the Coarse Granite (c. 438 Ma) and the Mont Mado microgranite or Red Granite (c. 426 Ma); they were intruded below the

Precambrian Jersey Shale Formation after its deposition, uplift and folding, and during the eruption of the andesites forming the lower part of the Volcanic series (c. 522 – 477 Ma).
These granites are younger than the adjacent South-west granites (c. 550 - 483 Ma) with which they are shown to be connected (Bishop & Bisson, 1989, p. 101-2), and younger than the 483 Ma age for the dolerite dykes of the Main Dyke Swarm intruded along E-W strikes on the south coast. The aplite dykes were then intruded cutting cleanly through the granite.

The N-S dolerite dykes were intruded, possibly at the same time as the N-S tear-faulting and they cut the earlier E-W dykes. The mica lamprophyre dykes with their variable strike of NE at Gorey to NW at Plémont are younger again and were intruded last, as seen by their cross-cutting relationships with the dolerite dykes.
Intrusion of the NW granites also occurred during the eruption of the rhyolites and the uplift, erosion and deposition of the Rozel Conglomerate (c. 477 – 426 Ma).
The folding and intrusion during the Precambrian and Lower Palaeozoic occurred during a period from c. 700 – 425 Ma, ie. during 275 Ma from the Precambrian to Silurian, a long period known as the Cadomian Orogeny (Brown et al, 1990, p. 181 et seq.).
This seems to have been followed by a long period of erosion, during the Upper Palaeozoic and Mesozoic, which removed the country rock and revealed the granites, until Tertiary limestones were deposited around the island during Eocene times.
During the Pleistocene there were several periods of higher sea level during interglacial times when raised beaches were formed, the 30m one being the oldest; other raised beaches deposits occur at 8m and 18m. These were interspersed with periods of loess and head deposition on the eroded granite bedrock, as seen at the top of the cliffs in this area, during intervening glacial times. The deposits in the present littoral zone, described above, being produced during the last glacial period before the present sea rise. The present climatic regimes and weather, which control the present weathering, marine and fluvial erosion and deposition, have produced the springs and the beach sands illustrated above.

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