L’ Étacq - Le Pulec Geology Trail.

Greywacke, Shale- NW granite contact, Minerals & Raised beaches.

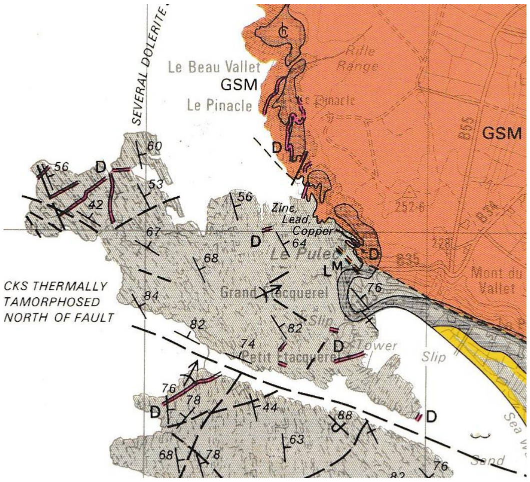

Fig. 1.

Fig. 2.

This is one of the best Trail routes because of the fine variety of features in well-exposed, accessible outcrops, and enables us to start with the first, or oldest rocks, at the base of the succession.

It is located at the northern end of St. Ouën’s Bay **(Fig. 1)** and Le Grand Étacquerel and Le Petit Étacquerel are two prominent coastal land forms at L’Étacq **(Fig. 2),** while Le Pulec is an inlet just north of them. The Trail is along outcrops of the Jersey Shale Formation and the NW granite with associated mineral veins in them, and access is easy.

Here, along with the best exposures of a main part of Jersey’s geological history, the surrounding area, old cliffs, nearby quarries with mineralised areas, and a wave-cut platform to the west and south can also be explored to add more to the story.
There is a wealth of sedimentary structures in the shale formation, which is more of a siltstone - greywacke sequence than a shale one, and there are several contact features with the granite, one of which includes a striking mineral vein. These are exposed in the landforms produced by marine erosion, which include former raised beach or gully features overlain by glacial head and loess.

It is better to start the Trail at L’Étacq, near Le Petit Étacquerel, and study the outcrops along the north side of the Slip du Sein, down to the beach to start with the facts before the interpretation.
Here, there is a sequence of thinly bedded, grey to brown, laminated siltstones, the laminae being light grey, medium-grained sandstones (turbidites or greywackes). The beauty here is in the variety of sedimentary structures which exhibit, cross-bedding, load-casting, attenuation or boudinage and balling **(Figs. 3-6).** Later micro faulting and quartz veing can also be seen.

Fig 3.

Fig. 4.

Fig. 5.

Fig. 6.

Returning to the top of the slipway, cross the road to the small quarry and look at the sole markings of the flute casts in base of the overlying beds **(Fig. 7).**

Fig. 7.

From this quarry, cross the road and go down onto the pebbly beach and walk north to below the small carpark, west of the slipway down into Le Pulec (or Stinky Cove if there's a lot of rotting seaweed in it). About 50m along the beach outcrops of Jersey Shale reveal beautiful ripple-laminated structures on the bedding plane surface **(Fig. 8).** At first site they appear like shallow water beach ripples but cross sections show the cross laminae of turbidity current deposits.

Fig. 8.

Above this in the low outcrop, the beds reveal clear sections of cross-laminated intervals c. 1 - 2cm thick **(Figs. 9, 10).** The cross laminae of coarser sandstone or greywacke, c.1mm thick are very clearly exposed and show current bedding as well as grading.
Other beds with lobate bases, show evidence of scouring as cut-and-fill structures, and of compression to give load casts and to have caused thickening and thinning. Incipient sedimentary dykes can also be seen, as well as later jointing and displacement by small faults. Immediately to the north west, the low cliffs reveal beds dipping landwards to the northeast.


Fig. 9


Fig. 10.

Retrace one's steps or scramble up the low cliff to the small car park. From here, the view across the inlet, Le Pulec, reveals higher beds of the grey Jersey Shale Formation in section, the beds dipping away from you eastwards, and with light coloured veins and thin dykes crossing them **(Fig. 11).** Above are cliffs of the NW granite rising steeply to Les Landes, the flat-topped plateau of northwest Jersey.

The cliffs also extend NW and the junction with the Jersey shale can be seen extending irregularly along the beach rocks of a narrow wave-cut base at low water. Small masses of light brown-yellow granite, like wide dykes, are separated by outcrops of the dark grey shale **(Fig. 12).** Faults and master joints can be easily seen in the cliffs above, marked by caves in several cases.

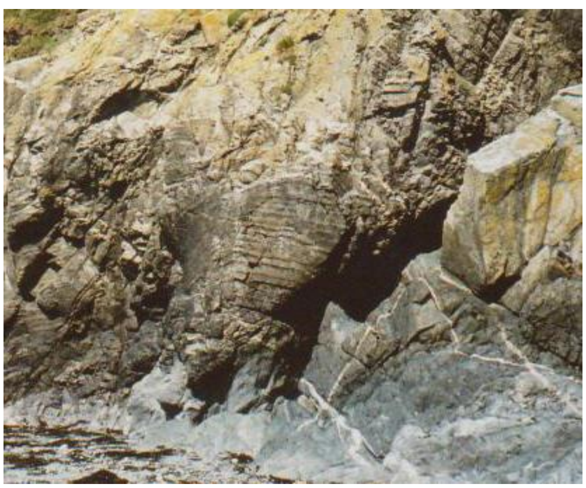
Fig. 11.


Fig. 12.

The trail continues into the inlet down the slipway cut through the shale beds which reveals their dip and some faults with crushed rock zones on the left side, and other more recent features which can be studied on the way back in keeping with the stratigraphic order of their formation.

If the inlet is relatively clear of seaweed the cliffs and low beach rocks can be easily examined for bedding features and intrusive veins, thin dykes and minerals.

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Near the base of the Jersey Shale sequence there are good exposures of various veins and thin felsite dykes of differing structure and composition, ranging from planar to transgressive and from single to composite with thin and occasional flame-like offshoots.
The junctions are very well defined even of the offshoots.
They vary from grey to grey-pink in colour and from 2 - 4cm wide or thick, and from medium crystalline quartz and feldspar to porphyritic with larger feldspar crystals. The outer, and in some parts, the inner edges of the composite central part are granitic in composition and texture. Two phases of intrusion are visible along with minor faulting **(Figs. 13 - 16).**

Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

The inlet floor is covered with a mixed pebble deposit of shale and granite pebbles with low rock exposures copping out. It is in this area on the western side that a vein of silver, lead and zinc was found and surveyed in the 1800s but found to be uneconomic to mine. At present, some may be found but much is covered by seaweed and shingle.

However, in the beach rocks cropping out in the floor on the eastern side of the inlet among the pebbles, are examples of quartz veins with small, scattered pyrite crystals. The iron pyrite crystals are c. 1mm in size and some are octohedra **(Figs. 17, 18)**. Careful examination may reveal more in other veins.


Fig. 17.


Fig. 18.

Continuing further NW to where the cliffs finish and a low rock platform extends to the main cliff base, scramble onto the platform, and cross to the junction between the shale and the granite which exhibits excellent vein intrusions from the granite (**Fig. 19, 20)** and where the shale has been contact metamorphosed to a hornfels with concentrations of chlorite and minor cordierite and biotite leading to spotted hornfels, north and south of Le Petit Étacquerel. The granite is a coarsely crystalline pink to orange, quartz and orthoclase feldspar garnite with minor biotite and hornblende and many aplite veins.


Fig. 19.


Fig. 20.

This part of the trail will lead you to a narrow gully eroded along a zinc blende vein with the sphalerite set in a gangue of yellow ankerite (Fe Mg limestone). Along the gully the various relationships of the ore mineral to the gangue (uneconomic) mineral are strikingly displayed.
Textures, showing the disposition of the sphalerite and the ankerite, vary from filigree-like to brecciated, and narrow linear sphalerite within and along the edges of the ankerite, and to large and small concentrations **(Figs. 21 - 24).** The nearest exposure to the silver, lead vein on the western side of the gully, shows a quartz gangue within the shale, with dark grey minerals that have not been tested for their type **(Fig. 25).**


Fig. 21.


Fig. 22.


Fig. 23.


Fig. 24.


Fig. 25.

From here, the Trail leads back to the slipway to examine the south side of the cutting where two gullies filled with rounded pebbles are overlain by Pleistocene glacial head and loess, and indicate remnants of raised beaches or raised-beach gullies; a third one occurs in the rocky cliffs on the west side of the inlet.
The pebbles show poor to average size-sorting and are well rounded to sub-spherical and disc-shaped clasts, varying between clast-supported and matrix-supported by a yellow-brown silt to sand groundmass, possibly loessic in part.



Fig. 26.

Fig. 27. **Fig. 28.**

The channels, seemingly gullies eroded in the 8m wave-cut platform (similar to the ones on the foreshore today) vary in width and depth, one being deep and narrow and the others being wider and shallower **(Figs. 26 - 28).** The pebble beds are overlain a thick sequence of angular fragments of shale showing incipient layering. This is considered glacial head formed during freeze-thaw conditions with soil creep or slumping due to gelifluction.

Brief geological history.

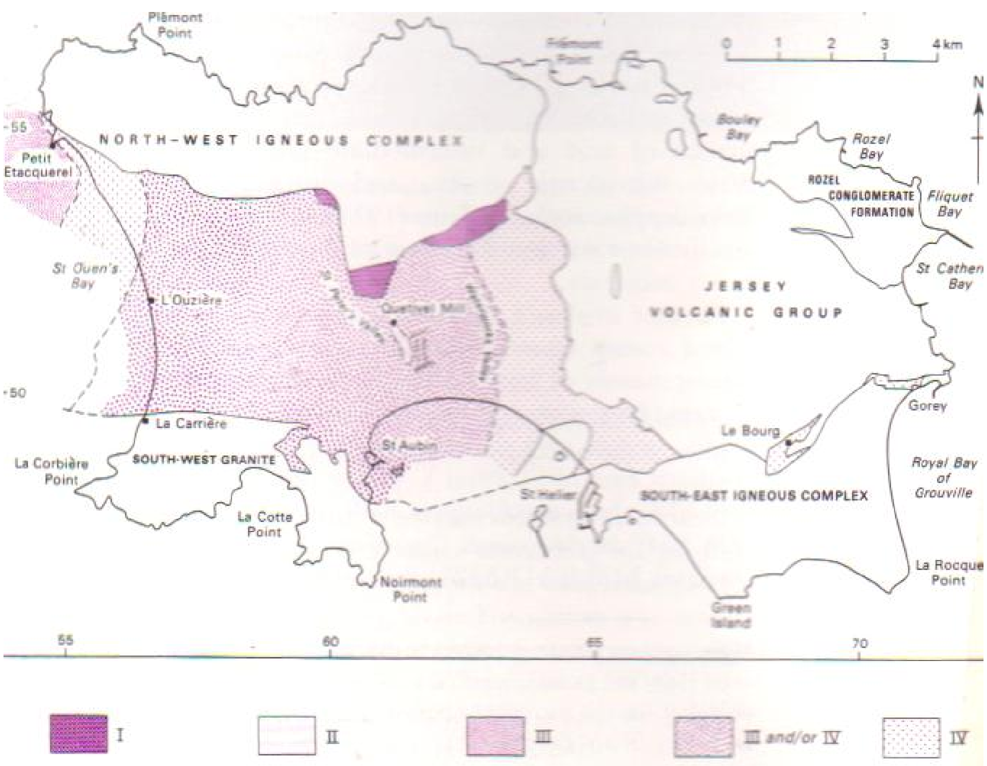

Fig. 29. Sketch map of the facies variation in the Jersey Shale Formation (Bishop & Bisson, 1989, p. 8).

The rocks of the Jersey Shale Formation have been mapped in detail and more recently have been

divided into four facies within a deltaic (submarine fan) environment by analogy with the work of several researchers (Bishop & Bisson, 1989, p. 8 - 10, who quote the work of others, see References). On the key below, **outcrop I** indicates conglomerates; **outcrop II** indicates a limited exposure of medium to fine-grained sandstones (in St. Peter's Valley), both being channel deposits; **outcrop III** indicates ripple-laminated fine-grained sandstones, and fine-medium turbidity current sandstones with several sedimentary structures **west of the Trail area at Petit Étacquerel** (op. cit. p. 8), while **outcrop III and/or IV**, is the central area of fine to medium- grained sandstone with sedimentary structures such as ripple laminations, and flute casts in the northern and central parts of St. Ouën's Bay; and **outcrop IV around the trail area and on the eastern edge**, has the most important associations of ripple laminations, cross-stratification and grading; these are parts of mid to outer fan deposits.
Palaeocurrent directions are generally northwards but also easterly & south easterly in **Assoc. II,** and the shales young towards the east where they are overlain disconformably by a sequence of andesites and rhyolites. However, a southerly flow is shown for proximal turbidites **(Fig. 30)** by Dupret et al. (1990, map on p.125).

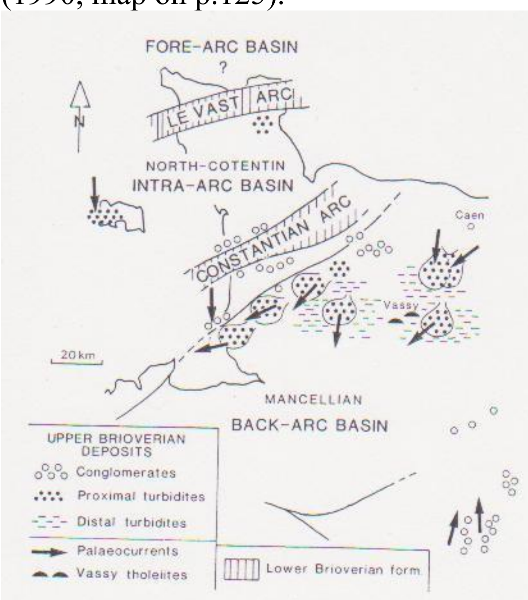

Fig. 7. Upper Brioverian palaeogeographical map with sediment types and palaeocurrent directions.

Fig. 30.

No fossils have yet been found but they are dated as Precambrian, c. 700 Ma old.
and have been folded at four different times with fold axes and plunging folds being exposed in several places south of L'Étacq, and later faulting produced varied displacements, the largest being along La Bouque Fault just to the south.
Volcanic activity occurred in the east followed by uplift and erosion to produce the Rozel Conglomerate.
The area was then intruded by the NW granite dated at c. 475 Ma and this gave rise to the mineralisation. The area then underwent a very long period of erosion which produced the extensive wave-cut platform to the west and the fossil stacks of L'Étacq and St. Ouën's Bay to the south.

The last changes in sea level brought about by the Ice Age glaciations finally came to an end after producing the 8m wave-cut platforms and the raised beaches during advances, and the loess - head deposits during the retreats seen in the last part of the Trail.

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