Portelet Bay Geology Trail.

Raised beach, loess & head, dykes & sills, & beach pebbles.

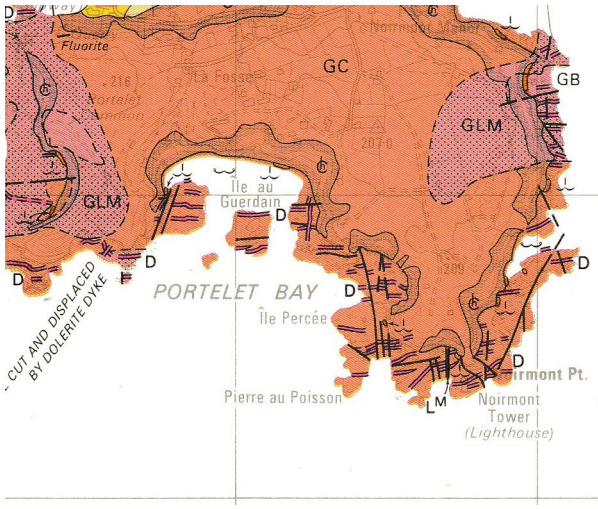

Fig. 1.

Fig. 2.

Portelet Bay (Fig. 1) was revisited because there are other prospects with interesting geological features, sometimes overshadowed by the cliffs with their striking and well-known 8 m raised beach, loess and head. During a previous visit, certain features were either not exposed, visited or recorded so Section members recorded their observations of the other features and Sandra Mahé photographed the sill at the southern end of the bay's western headland, recorded on the IGS map of Jersey Geology (1978).

Looking south from the top of the steps to the beach in Portelet Bay, there is a striking view of the red, coarsely crystalline Corbière granite, the outermost of the three granites forming the SW Igneous Complex. The granite cliffs enclosing the bay extend to the east and west and shelter the central Île au Guerdain (Janvrin's Tomb). The cliffs are steep, fractured by joints, the planes of which often form the sheer cliff faces, and are intruded by dolerite dykes, the erosion of which has left deep gullies cutting into the cliffs (**Fig. 2).**

At first sight, the other geological prospects and features aren't evident, but a small wave-cut platform and notch at base of the western headland and several deep, narrow gullies or clefts to the east seem to indicate a varied geological history, illustrated by those different views or prospects.

These other prospects are indications of several other geological events of which the raised beach, its superficial deposits and the present bay are the most recent.

Fig. 3.

Fig. 4.

Down on the beach, the cliffs at the back are strikingly yellow-brown and composed of a former beach strand c. 50 cm thick, of large, rounded granite pebbles of variable size and various beds of sand, loess and head.

The sequence lies unconformably on an uneven, eroded granite bedrock surface at present day beach level **(Fig. 3)** and the lowest part of the section is a red-brown clay, possibly loess. The raised beach is composed of large, rounded to sub- rounded, pink, coarsely crystalline granite boulders with a low degree of sphericity **(Fig. 4)**. The thickness of the deposit varies around 50cm but thicker 'pockets' also occur **(Fig. 5)**. It dips gently from east to west along the cliff line and rises to the eastern side of the steps.

Fig. 5.

Fig. 6.

It is overlain by a light, red-brown sand, aeolian or marine in origin, weathered and eroded into hollows **(Fig. 6)**. This is in turn is overlain by glacial head with angular fragments, and finally by a yellow, clay-silt (loess, a wind-blown deposit) **(Fig. 7)**, parts of which contain angular granite blocks forming glacial head (a freeze-thaw deposit due to gelifluction).

However, following the projected position east of the steps, no present evidence of raised beach could be found, but thick deposits of loess and head are exposed theoretically equivalent to those deposits further west **(Fig. 8)**.

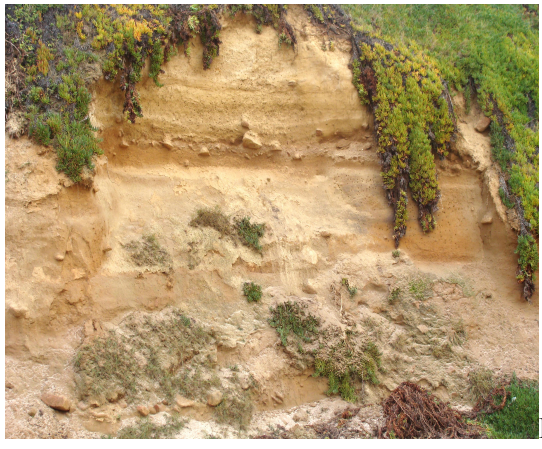

Fig. 7.

Fig. 8.

At the eastern end of the cliff section of thick loess and head, there are exposures of variable thickness, of a bed of rounded pebbles between large angular boulders, resting with a horizontal base on loess which overlies an eroded granite bedrock surface **(Figs. 9, 10).**

Fig. 9.

Fig. 10.

As a tribute to Arthur Mourant, a famous Jersey geologist, his observations made in 1932-3 are included below (Mourant, 1933, p.61);

5. Yellow Clay (loess)……10’ 0” (c. 3.00m)

4. Reddish brown stony clay (head)……...10’ 0” (c. 3.00m)

3. Reddish brown sand…….5’ 0” (c. 1.60m)

2. Large well rounded pebbles…….1’ 6” (c. 0.45m)

1. Reddish brown clay……..2’ 0” (c. 0.60m) Lowest deposit visible..

Respectively, as described by several other authors, the deposits represent glacial period deposition for the lowest deposits, with the 8m raised beach, higher sea-level deposit, representing warmer interglacial conditions. The overlying loess and head deposits represent drier glacial period deposits again, deposited by out-blowing winds and under freeze-thaw conditions respectively.

Further west along the beach, other prospects are revealed. There are many boulders of different sizes and of different rock types. The granite boulders reveal several different textures also found within the granite cliffs further west. There are those with fine to coarse crystalline textures and porphyritic textures **(Figs. 11, 12)**, and those showing variable concentrations of minerals which produce pegmatite textures **(Fig 13**). All of these show the varied modes of crystallisation during the cooling of the granite.

Fig. 11.

Fig.12

Fig. 13.

Fig. 14.

In addition, grey shale pebbles show some of their sedimentary and tectonic history in the shape of possible slumped laminae and quartz vein minor folds **(Fig. 14)**.

Unexpectedly, there are also well-rounded pebbles of black and white speckled diorite, some with pink feldspars, grey and white porphyritic andesite, grey quartz - feldspar porphyries and maroon spherulitic rhyolites, some with very small white crenulated spherulites.

The nearest outcrops of similar diorite and andesite occur around Elizabeth Castle and immediately west of St. Helier respectively while outcrops of the porphyritic andesite occur in the quarries just to the north.

However, the nearest outcrops of the maroon types of spherultic rhyolites crop out on the east coast at the northern end of Anne Port Bay at La Crête Point (Nichols & Hill, 2004, p.23) and north of Archirondel Tower to Le Malade at the southern end of St. Catherine's Bay. Rare examples have also been found by the author in the raised beach deposits in the second bay south of La Cotte de St. Brelade on the west side of Portelet Common headland

In terms of provenance, does this mean that these different pebbles from the east and south coasts have been transported and abraded by tidal currents and longshore drift driven by south-easterly winds during the sea-level rise over the last 10,000 years…leaving aside the possibilities of jettisoned ballast.

Yet another prospect is revealed among the granite bedrock which crops out through the sand further west near the end of the beach, and towards the back of this area there are two narrow, c.1m wide dykes of grey dolerite rock, one of which bifurcates to form a third. They strike c. E -W and seem to have been unrecorded, possibly because they were formerly covered by sand **(Fig. 15).**

Fig. 15

Fig. 16.

At the western end of the beach, past the houses, the yellow cliffs curve south and are covered by green netting to stabilise the deposits and vegetation, but a partly broken section reveals thicknesses of angular blocks of granite forming head, and of yellow loess overlying a basal, thin strand of pebbles of granite and minor grey shale, and dolerite, from the dykes or sills which form

the western part of the central raised beach **(Fig. 16).** Here, the raised beach section varies in thickness, related or controlled by the uneven nature of the granite bedrock. Some of the exposures are well cemented in parts **(Figs. 17, 18)**.

Fig. 17.

Fig. 18.

Yet another prospect is gained by climbing carefully up onto the wave-cut platform which extends southwards below the former quarries in the western cliffs. Here, there is a horizontal, grey-green dolerite sill, 30 - 60cm thick, partly forming the wave cut groove (notch) where it has been eroded faster than the granite **(Fig. 19)**. About half way along, it has been cut and downthrown by an E -W dolerite dyke along a vertical fault **(Fig. 20)**. Other dykes also occur, eroded to form gullies and clefts, and looking back, eastwards across the bay, other narrow, vertical-sided, black gullies and clefts can be seen striking into the pink granite on the south side of l'Île au Guerdain and in the eastern cliffs in Fig. 1**.**

Fig. 19

Fig. 20

During an associated visit, our Chairman successfully located and photographed the dolerite sill at the base of the headland **(Fig. 21)**, recorded on the IGS map but not previously published; she was unable to collect a sample due to the height of the tide.

Fig. 21.

Above the sill, the last prospect here is of the old quarries which reveal that the granite varies in texture and colour. In parts, there are porphyritic granites with large feldspar crystals in a finely crystalline groundmass **(Fig. 22)** and in others, more uniform textures or clusters of black biotite mica crystals **(Fig. 23),** a sample of which was collected by our Chairman for our rock database, and pegmatitic patches of milky quartz **(Fig. 24).** Similar varieties of granite and textures occur in the sea walls at La Haule and Millbrook and seem likely to have come from these quarries as they are nearer than those at La Rosière

Fig. 22.

Fig. 23.

Fig. 24.

Brief Geological History.

During the Lower Palaeozoic, the Porphyritic granite (c.550 Ma) and the Aplite/microgranite (c.527 Ma) of the SW granite in the area described, 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). The adjacent Corbière granite was then intruded (c. 483Ma) and more andesites erupted, while during the same period (but later than 483Ma) there was intrusion of the dolerite sills then later, the dykes of the Main Dyke Swarm along E-W strikes. Intrusion of the NW granite, occurred below, during the eruption of the rhyolites and the uplift and erosion and deposition of the Rozel Conglomerate (c. 477 – 426 Ma).
The folding and intrusion occurred during a period from c. 700 – 425 Ma, ie. c. 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 the Pleistocene there were several periods of higher sea level during interglacial times when raised beaches were formed and the raised beach deposits in Portelet Bay are representatives of the 8m one. These were interspersed with periods of loess and head deposition during intervening glacial times, the deposits in the present littoral zone were 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 present day features, for example, the tombolo spit linking the beach to l'Île au Guerdain.

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