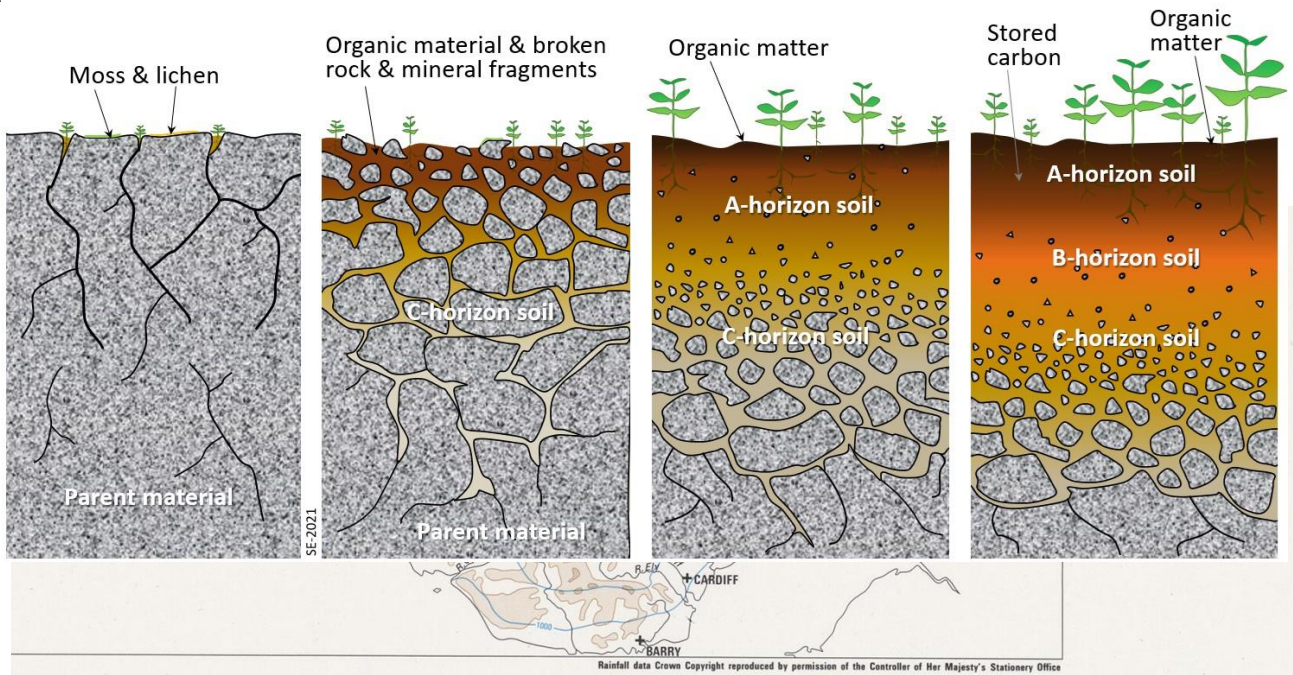
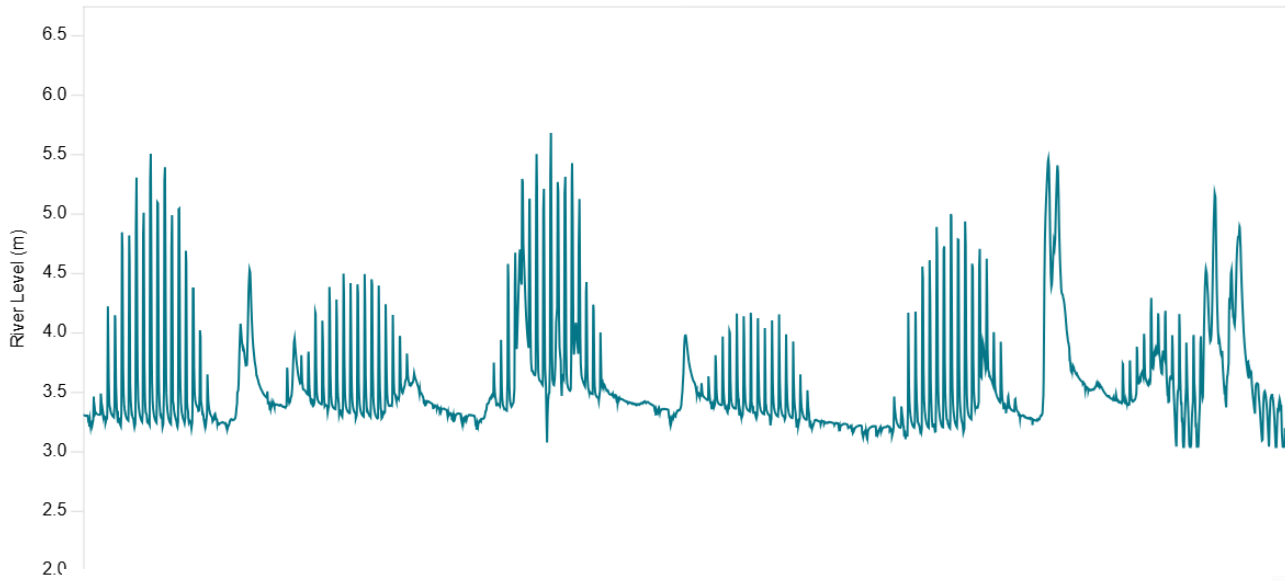
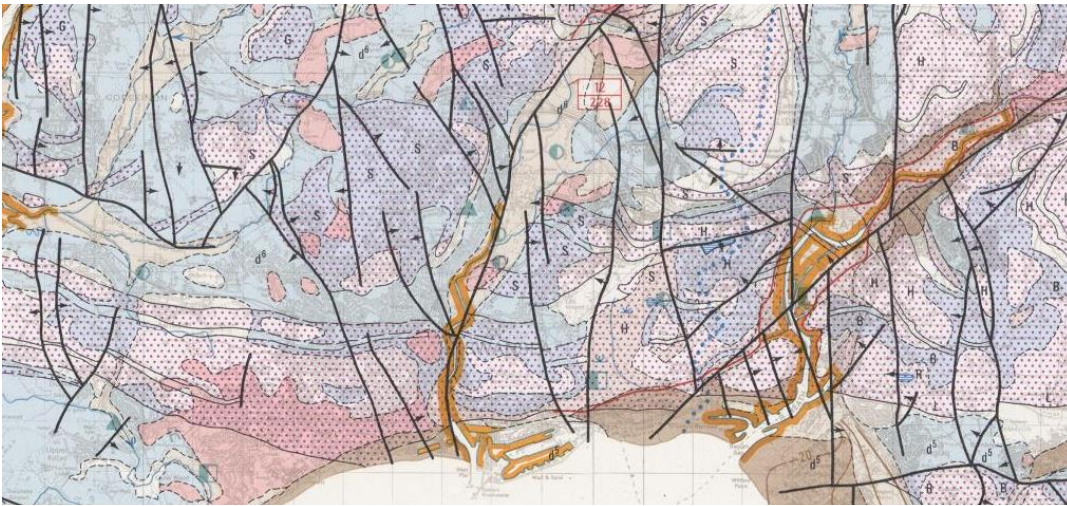


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23/11/2024

Field Report – Kilvey Hill

Introduction

Kilvey Hill Site Description:

Kilvey Hill is situated to the East of Swansea, acting as part of the border for the river Tawe drainage basin (figure 1). It encloses the Swansea valley, with its elevation at its highest point being 193m (classified as a sub marylin hill). (The Mountain Guide, 2001). It covers roughly 3km² and its vegetation currently consists of mainly conifer woodland, although historically it was made up of deciduous, broadleaf woodland. (Robins, 2023).

It has undergone extensive change, specifically through the industrial history where it was a coal mining site. This has resulted in a unique landform which has in turn led to it being a significant location for study, mainly to analyse the effects of industrialisation / deindustrialisation, and as a site to measure the effects of various environmental pressures. In gaining an understanding of these topics, projected hypotheses can predict future impacts.

During the industrial period, Swansea was known for its copper works which was located at the foot of Kilvey. Slag from this industry was also dumped on the hill. This process resulted in a heavily scarred landscape, on which multiple attempts have been made to cover the bare landscape. (Bernasconi, 2022).

The spot is frequented by dog walkers and the top of the hill is popular for views of Swansea and the Mumbles. For this reason, recent plans for the development of a tourist attraction threaten the ecology of the hill.

Swansea has rich history. Previous to the industrial revolution, it was mainly agricultural, with a much reduced population (roughly 1000 in the mid 16th century, growing to over 100,000 by the end of the 19th century). Swansea port has been a source of income since the 1600s. (Lambert, 2021).

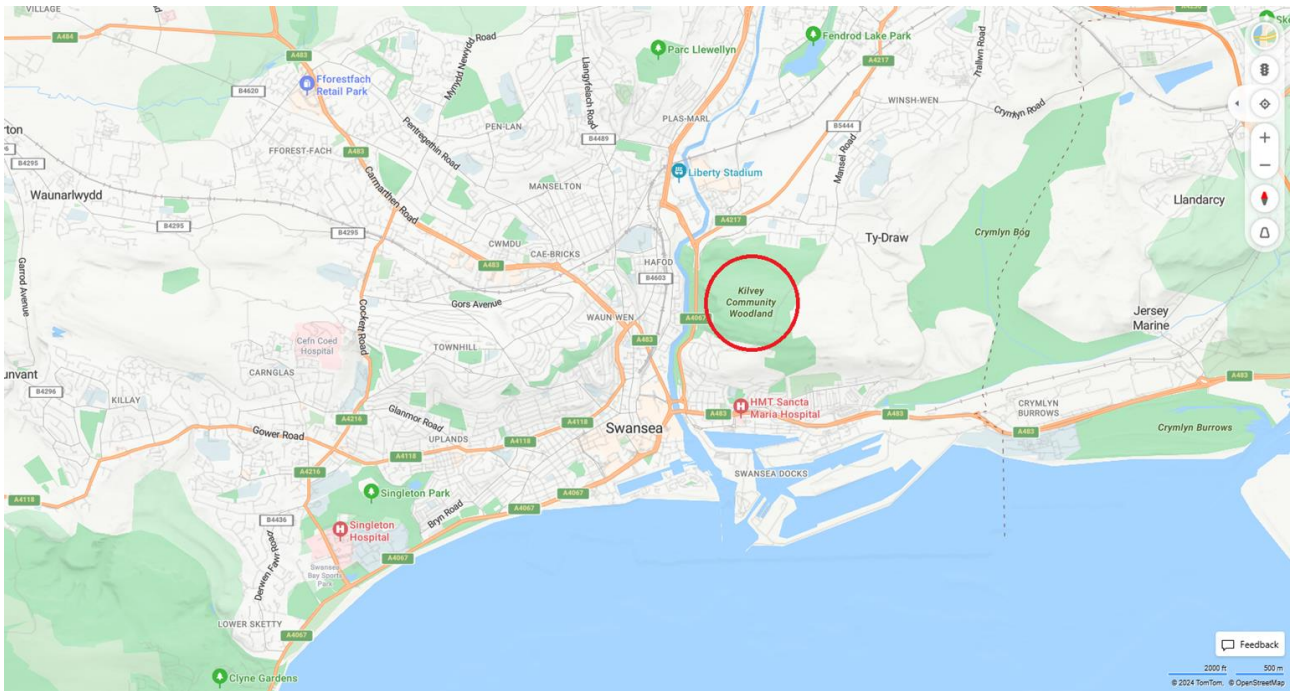


Figure 1 – Map of Kilvey in relation to Swansea Bay (Google Maps, 2024).

Kilvey Evolution

Geologic Formation:

The geology of the Swansea district is mostly comprised of carboniferous rock (aside from a small portion of the Gower which is Devonian). This term refers to a mix of layers of limestone, sandstone and shale formed roughly 300 million years ago. The name is derived from the abundance of coal stored in the rock, owing to the large quantity of dead organic material at the period. Kilvey hill is set specifically on Westphalian rock (late carboniferous). (Scottish Geology Trust, 2024).

As shown in figure 2, geology across south Wales tends to get younger as you go further South, with the older, Silurian and Ordovician rock to the north. This displays the underlying, large-scale formation processes in the landscape, e.g. tectonic processes such as folding. Glacier action has also played a large role many hills and mountains formation, many key indications of these are left behind in landscapes such as glaciated valleys. This is particularly prevalent in the Brecon Beacons in places like Cwm Llwyd. (Fiona Fyfe Associates, 2012). Whilst Kilvey shares some features with the BBNP, due to it being younger, it also contains many differences – particularly in the composition of the rock.

Various weathering processes have also effected the formation of Kilvey, particularly due to its proximity to the sea. These include mainly mechanical and chemical weathering processes as a result of prolonged rainfall on exposed ground. Biological weathering has also shaped the landscape, particularly from certain plant species and flora in general. Some more minor processes have also contributed such as thermal stress and freeze thaw. (Met Office, 2016).

Swansea's weather in general aligns with most coastal regions in South Wales. It is temperate, characterised by strong winds and heavy rainfall, due mainly to high exposure to the Atlantic ocean.

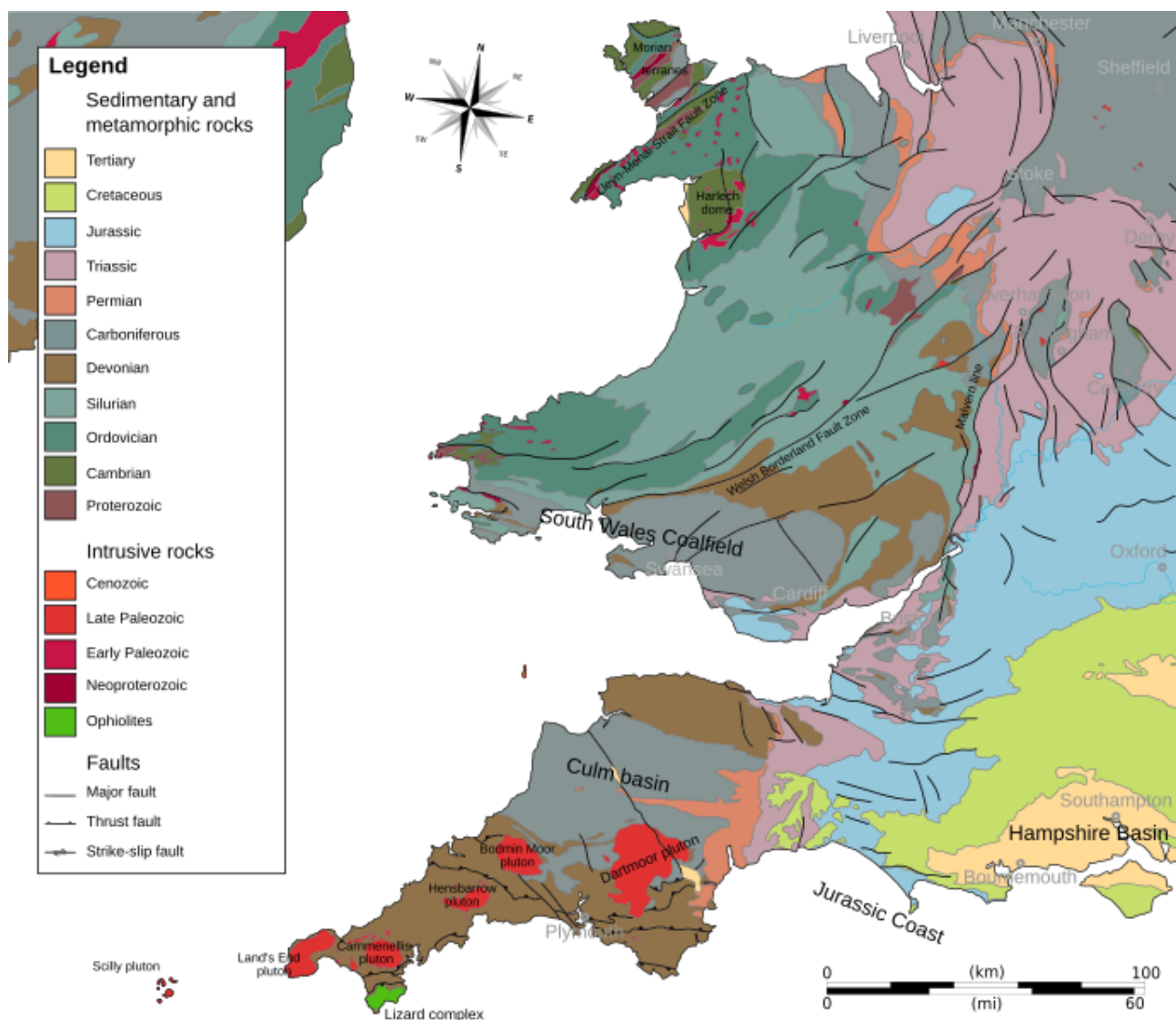


Figure 2 – Wales geology (Wikipedia Contributors, 2009).



Glaciation History:



Whilst there is debate about the exact extent of ice coverage over South Wales, the vast majority of sources agree that Swansea was previously a glaciated landscape in the LGP. Many features of glaciation still exist in South Wales, Craig y Llyn displays two glacial cirques on its northern flanks (figure 5). (Evans, 1999).

Figure 5 – Cirques in Wales (Evans, 1999)

The role of glaciation in the formation of Kilvey is difficult to quantify, owing largely to aggressive land use in the 19th century, which has changed the landscape significantly. In addition to this, there are few maps or illustrations which are available from before the 1800s. This has helped to conceal the history of Kilvey.

Hydrogeology:

Figure 6a + 6b – Swansea hydrogeology (BGS, 2024)

Figure 6c – Swansea relief and rainfall (BGS, 2024)

As seen earlier, the bedrock on Kilvey is made up of carboniferous sediments, mainly limestone. Limestone aquifers have high fracture permeability, producing relatively rapid groundwater flow. Recent developments on Kilvey have led to increased groundwater flow from factors such as increased infiltration (caused by loss the change in vegetation as well as the soil loss). This accelerates the leeching of sediments and nutrients from the hill, along with any contaminants it may contain. Overall this results in a more rapid discharge of water into the river Tawe, which is illustrated in erratic pattern shown in figure 7.

Figure 7 – River level at Morfa (NRW, 2024)

Anthropogenic Influence:

South Wales has experienced industrial development since the 19th century – Swansea itself being the largest producer of copper in the world (known as Copperopolis). Between the years 1770 and 1840, Swansea was

producing up to 40% of the world's supply of copper. Kilvey hill in particular, was used as a dump site for both coal and copper slag (the waste product generated from smelting ores). (Bernasconi, 2022). Whilst this industry supported Swansea's economy, the impacts on local biodiversity were devastating, particularly for Kilvey.

Due to the abundance of coal (located in the coalfields area – figure 1), Kilvey hill has had a long history of mining which has led to soil loss in the locality. This has also had adverse effects on the ecology of Kilvey hill, and has been particularly detrimental to water quality (figure 1a). Water testing has revealed high concentrations of heavy metals in the drainage off Kilvey. (Barclay, 2011). This indicates an unhealthy ecosystem which is also contaminating the lower section of the river Tawe.

Removal of the vegetation during the industrial era left the landscape bare with very little remaining tree cover. Vegetation on Kilvey now is predominantly made up of foreign conifer forest, planted as a knee-jerk reaction in the 1960s. More recently, the woodlands of Ynys Mond have been recently converted to a more fitting broadleaf woodland in keeping with the native environment – this reforestation has been broadly successful when compared to Kilvey's. Plans have been made by Natural Resources Wales to potentially transition Kilvey's woodland back to a broadleaf environment in order to promote biodiversity and ecosystem health. This is reflected in their forest resource plan which is essentially based on Ynys Mond. (Natural Resources Wales, 2022).

Other features of the NRW resource plan include:

- Encouraging species diversity by planting appropriate tree species on the hill.
- Upgrading infrastructure to ensure equal access for the general public (this includes the development and maintenance of walking routes).
- The development of heathland on the tip of Kilvey to encourage non-woodland species.

Environmental Conservation Challenges

In terms of implications for sustainable land management, perhaps the most significant challenge is accounting for soil loss – soil takes hundreds of years for just a few inches to generate. Since the 19th century, there have

been multiple attempts to restore a healthy ecosystem to Kilvey. These began with the fairly rudimentary attempts (planting trees on the hill which included many non-native species). More recent schemes have progressed to include tree species which are resistant to the high levels of heavy metals in the water. Scots Pine (*Pinus sylvestris*) is notable for being particularly successful in the restoration process. (Çomaklı and Bingöl, 2021). Despite this success, to fully transition of Kilvey back to its natural state would take hundreds of years. As it stands, the current ecosystem is severely lacking in biodiversity, meaning its fragile and susceptible to threats such as disease.

Trees such as scots pine play a large role in the conservation effort, sequestering carbon from the atmosphere, breaking down minerals to aid in the formation of soil and locking up dangerous heavy metals such as lead and zinc. Unfortunately, the flora that is present on Kilvey is stunted (figure 1b). (Robins, 2023). This is due to the contaminated water sources, as well as the relatively low small quantity of soil (although over time this is expected to recover, with a larger diversity of species). Flora currently present could therefore be seen as a form of foundation species (figure 1c).



Figure 1a – Contaminated water source, north-west side (Author, 2024)



Figure 1b – Example of stunted Scots Pine (*Pinus sylvestris*) (Author, 2024)

Figure 1c – Soil formation (Earle, n.d.).

As of now, land use on Kilvey currently consists of a community based woodland which is supported and managed by the Swansea council and NRW, backed by a group of volunteers. (Natural Resources Wales, 2022).

Projections for future land use are centred around the tourism industry, with recent development plans to convert Kilvey hill into a cable car and zipline attraction (Skyline project). Although the project is controversial amongst stakeholders, Skyline's chief executive Geoff McDonald is proposing a potential £84 million profit for the local economy. (Thomas, 2024).

The Skyline project brings many complications to the conservation and management of Kilvey. Balancing the social and economic needs of the community require careful consideration. For this reason, it is of great importance that the implications of such a project are understood (i.e. quantified) to limit any negative impacts, particularly as Swansea is currently deprived of green spaces.

Other, forms of land use on Kilvey involve vandal activities such as littering and arson which in 2019, resulted in a large area (more than two hectares) of land being burnt. (Howard and Clements, 2019). These activities effectively stall the recovery of the ecosystem on the hill and contribute to pollution. Managing this is difficult due to the large number of public footpaths and bridleway's on the hill, presenting many different conservation challenges. The most common activity occurring on the hill is dog walking.

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