
2 Geological background

In the following review of the bedrock and superficial (Quaternary) geology of Spireslack and Mainhill Wood, information was derived from the published geological maps of the area; BGS 1: 50 000 scale map sheets 23W (Hamilton) and 23E (Lanark), and the geological memoir for Hamilton (Patterson et al., 1998) and Lanarkshire: Central Districts (Geikie A, 1873).

Spireslack and Mainhill Wood SCMs lie within the Central Belt of Scotland, situated between the Highlands to the north and the Southern Uplands to the south (Figure 1). These geographical boundaries are driven by the underlying geology: the Highlands are predominantly composed of metamorphic rocks of Precambrian age, separated from the geological entity of the Midland Valley by the Highland Boundary Fault. The Southern Uplands, predominantly composed of sedimentary rocks of Silurian and Ordovician age, are separated from the Midland Valley by the Southern Upland Fault. The down-faulted region of the Midland Valley (essentially occupying the same area as the Central Belt of Scotland) between these two major faults consists mainly of Carboniferous and Devonian rocks (Figure 1) overlying Lower Palaeozoic rocks.

Carboniferous sedimentary rocks in the Central Belt of Scotland have played a strategic role in industrial development across the region, providing key resources such as coal, ironstone, oil shale, sandstone and limestone, formed when Scotland lay in warm and tropical equatorial latitudes around 358 to 303 million years ago. The Carboniferous rocks exposed at Spireslack and Mainhill Wood SCMs are Viséan to Namurian in age (around 330 to 325 million years old), and in order of oldest to youngest (see (Figure 2)), belong to the Lawmuir Formation of the Strathclyde Group and the Lower Limestone, Limestone Coal, Upper Limestone and Passage formations of the Clackmannan Group (Browne et al., 1999). Typical Carboniferous rock sequences exposed at each site show cycles of environmental change, from shallow tropical seas (recorded in marine limestones and mudstones), to delta development and river channels (recorded in siltstones and sandstones), tropical soil (preserved as rooted seatearth) and finally tropical swamp forest (preserved as coal). Ironstones formed in anoxic conditions in lakes and soils, whilst marine incursions are recorded by marine bands (e.g. the Johnstone Shell Bed and Black Metals Marine Band).

The strata exposed at Spireslack SCM (Figure 3) form the north-western limb of a broad upright north-east trending syncline, and as a result dip moderately steeply at around 30 to 40 degrees towards the south-east in the main void. The rocks here are also displaced in a mostly left-lateral (or sinistral) direction by a number of oblique-slip faults. Palaeogene basaltic dykes intruded these inclined strata at Spireslack SCM around 60 million years ago. In contrast, at Mainhill Wood SCM (Figure 4), the strata are sub-vertically inclined, probably in response to deformation associated with the north-east trending Kennox Fault. The southern limit of coal extraction in the main void at Mainhill Wood SCM is taken at the Kennox Fault, where the Carboniferous strata reveal a complex flower structure formed within the Kennox Fault Zone.

Quaternary deposits consisting of grey-brown glacial till (approximately 2–3 m thick) and dark brown-black peat (< 2 m thick) cover the strata at and around the Spireslack SCM. A reddish- brown 2–3 m thick glacial till overlies the strata at Mainhill Wood SCM. Glacial till was deposited by ice sheets which covered Scotland during the last Ice Age, the last main phase of which ended approximately 10–12 thousand years ago. The colour of the till is often associated with the underlying rock types. As Scotland became warmer, these glacial deposits formed primitive soils allowing vegetation growth which, over time, formed peat. Peat formation is linked to prolonged periods of increased precipitation, where the soil becomes permanently waterlogged and decomposition of plant matter is restricted, allowing thick expanses of peat to form.

Man-made (or made ground) deposits cover both the bedrock and superficial deposits at the two surface coal mines. Whilst Spireslack's earlier phase of mining occurred underground in the 19th/20th century, bell-pits constructed during the late 1700s are visible on the surface at the south of Spireslack. At both Spireslack and Mainhill Wood, tens of metres thick mined waste covers the pre-existing ground surface, related to the late 20th to early 21st century surface mine operations.

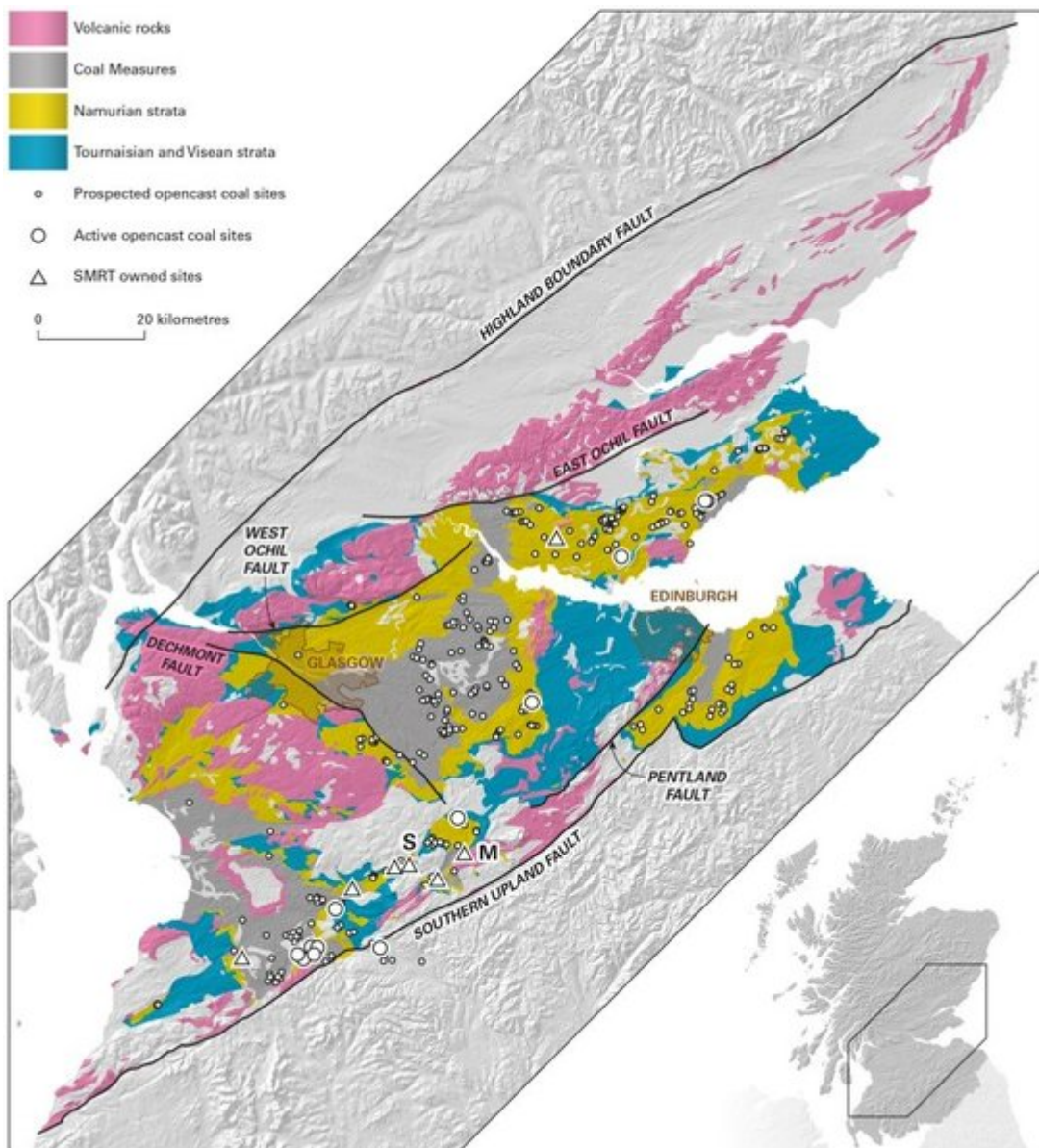
(Figure 1) Generalised Carboniferous geology of the Midland Valley of Scotland, showing the major faults that bound the Midland Valley. The map also shows the locations of prospected and active surface coal mines in Carboniferous strata. Sites owned by the Scottish Mines Restoration Trust (SMRT) are also indicated, with the locations of Spireslack (S) and Mainhill Wood (M) SCMs highlighted.

(Figure 2) Stratigraphical framework for coal-bearing strata at Mainhill Wood and Spireslack SCMs. The key coal units and lithological markers referred to in this audit are highlighted in the more detailed columns.

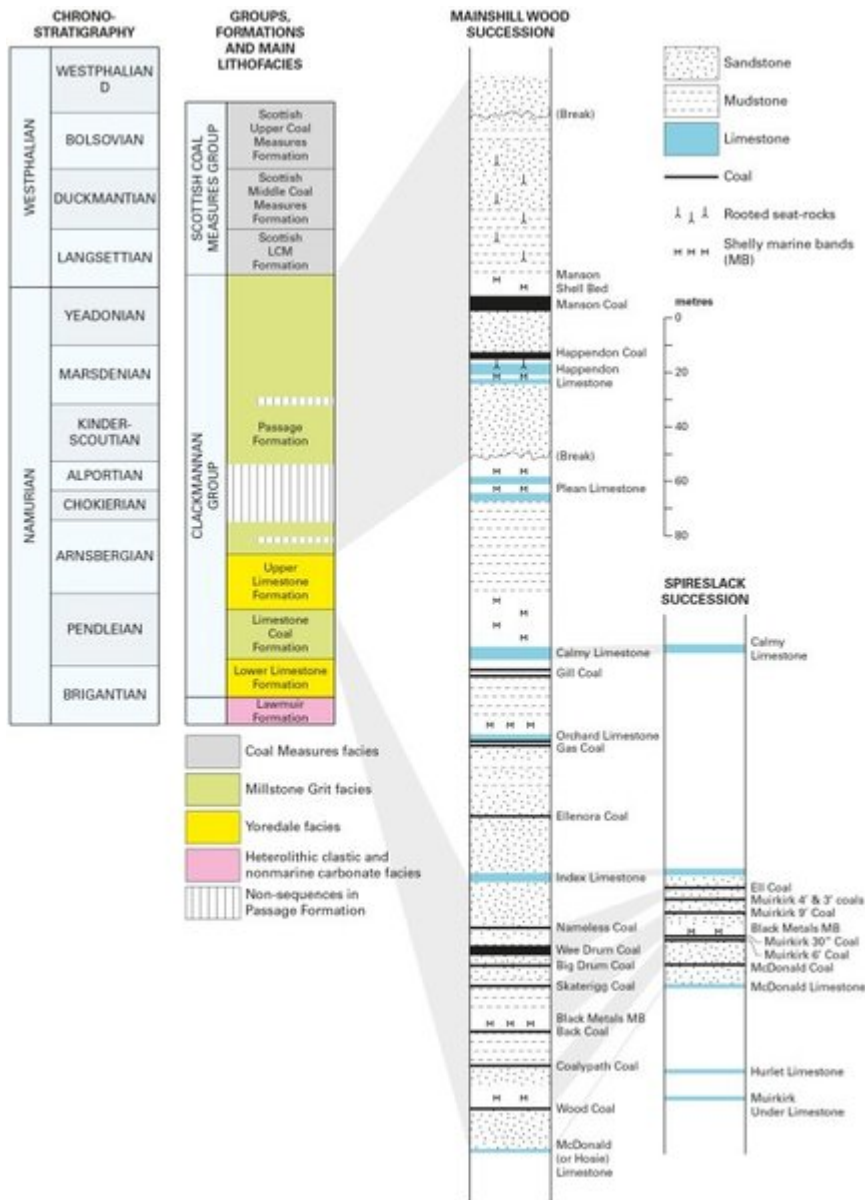
(Figure 3) 1:50 000-scale geological map within the Spireslack SCM site area. The oldest rocks within the site are exposed at the far east of the site boundary, and are sandstones belonging to the Swanshaw Formation (Devonian in age). These rocks are separated from the Carboniferous rocks by a major north-trending fault. The Carboniferous strata have been folded into a broad north-easterly syncline across the site, with the strata offset by many faults with a dominant north to north-northeasterly trend.

(Figure 4) 1:50 000-scale geological map within the Mainhill Wood SCM site area. The oldest rocks within the site belong to the Devonian age Biggar Volcanic Formation, situated to the south of the Kennox Fault in the southern portion of the site. The Carboniferous strata lie to the north of the Kennox Fault where they are sub-vertically arranged. The rocks become younger towards the north.

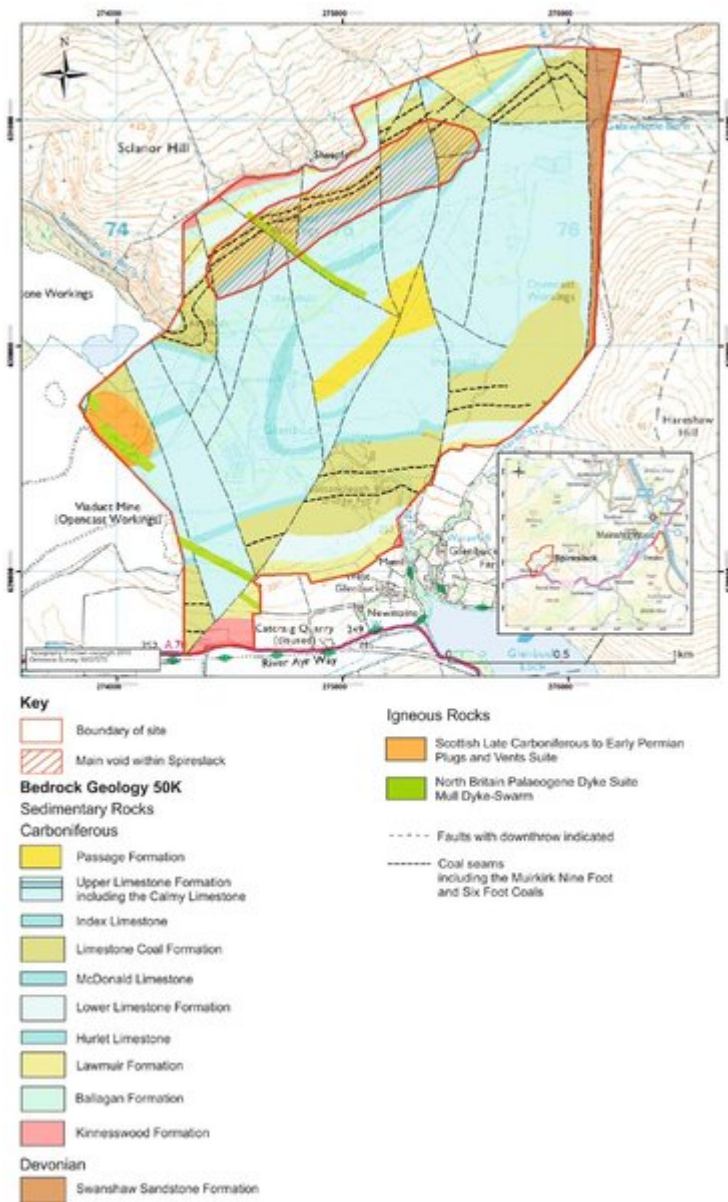
References



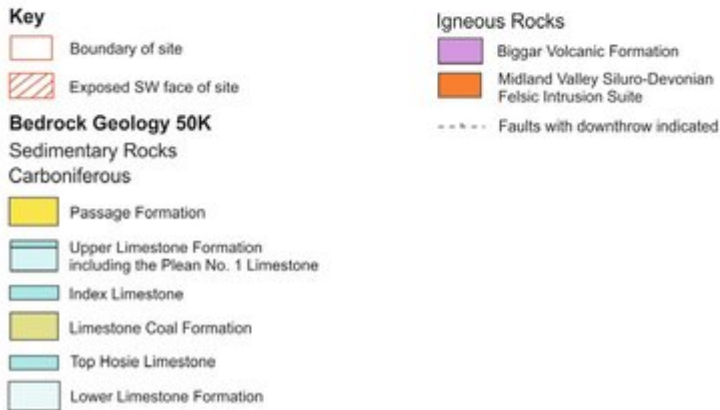
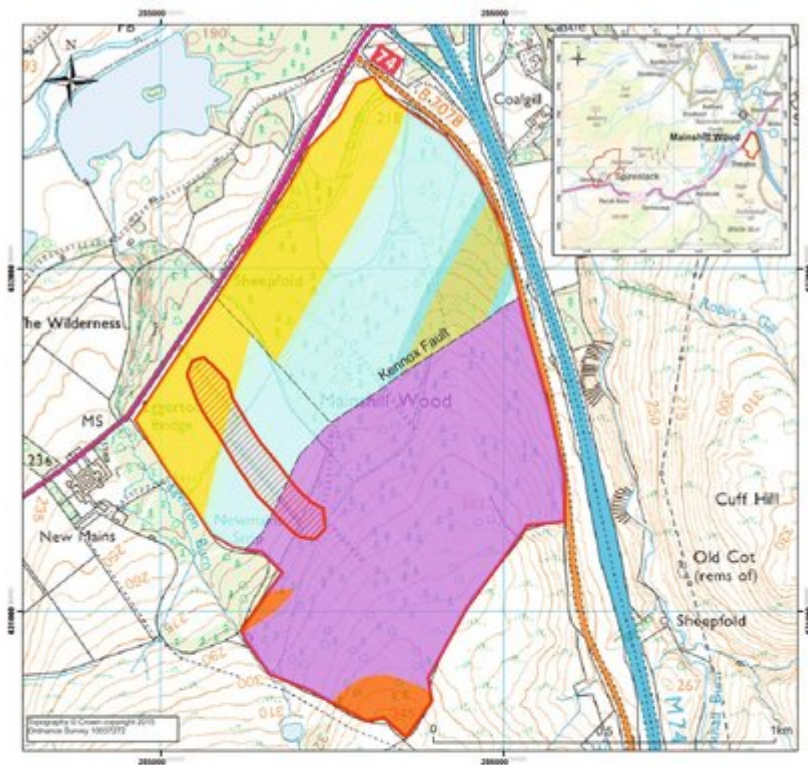
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