PARK HALL COUNTRY PARK: THE PLAY CANYON

EARTH SCIENCE BACKGROUND

The geological and geomorphological story of the NSC area is based on the interpretation of evidence from the rocks and from the landscape, some of which may not be visible in this area. Briefly, this is the story and the evidence for it.

The Carboniferous rocks in the area are underneath the Triassic rocks. They were deposited between about 327 and 290 million years ago. The main rock types are shales, sandstones and coal. These rocks, with the coal indicate a floodplain and delta type environment with large amounts of vegetation growing upon it. This vegetation fell and became buried in stagnant water, and was prevented from decaying away completely, but instead, chemically changing to the carbon-rich beds we call coal. These beds lie 1km northwest of The Central Northern Quarry, which is now called "The Play Canyon". See **Figure 1.**

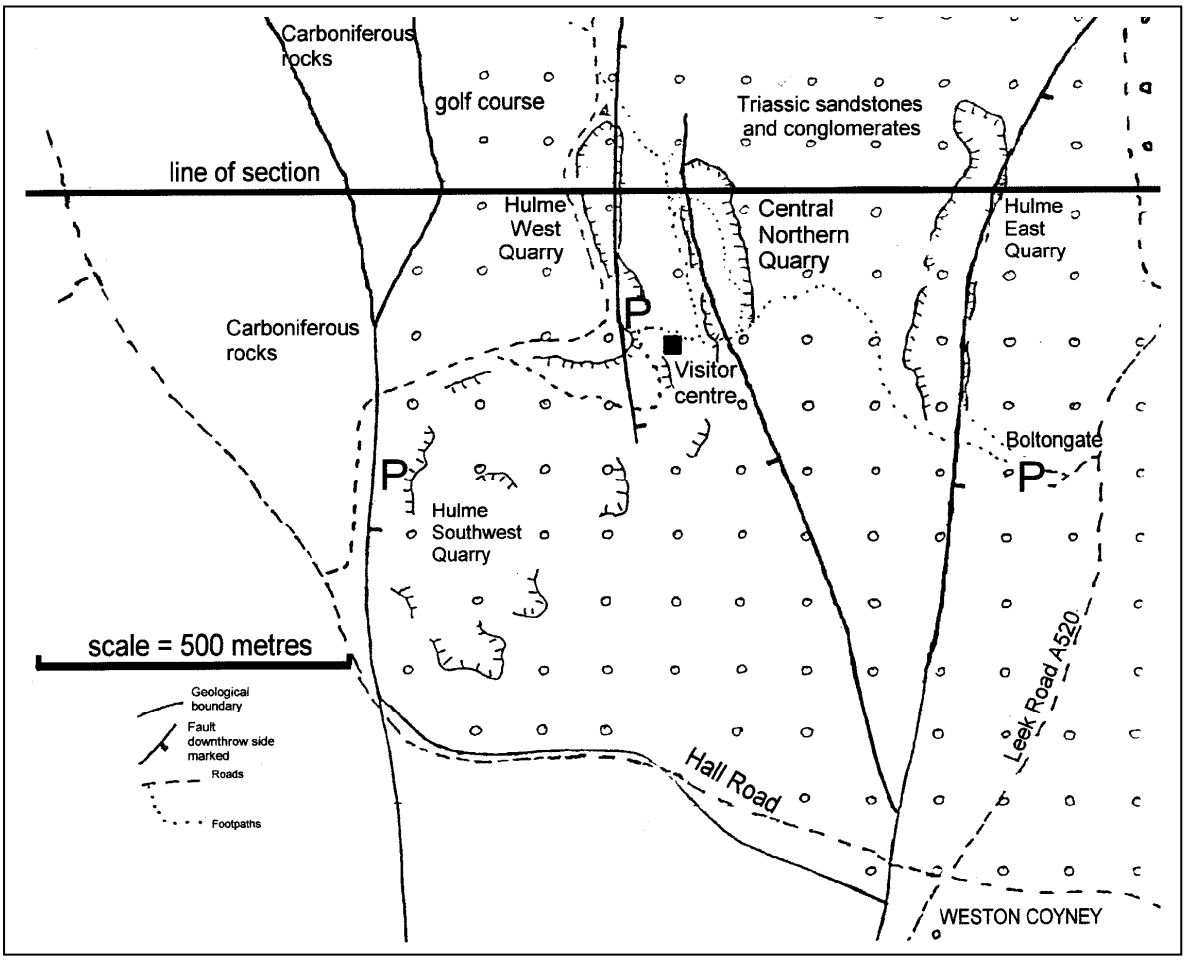

Figure 1. The Quarries at Park Hall

Beds from the Permian period should lie between the Carboniferous rocks and the Triassic rocks, but have either not been deposited, or have been eroded away, leaving a "gap" in the record of more than 45 million years. Instead we have Triassic rocks, deposited about 248 million years ago, on top of a landscape cut into the older Carboniferous rocks underneath, which had been folded and faulted and uplifted to form a land area.

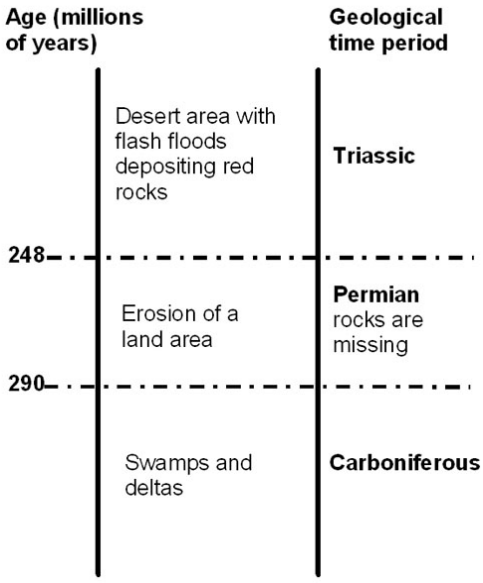

Figure 2. the Geological Column at Park Hall

GEOLOGICAL NOTE:
Geologically, this relationship, where the upper rocks are deposited after a long period of uplift and erosion, is called an **unconformity**. This represents a large gap in the rock record, during which the surface was uplifted, weathered and eroded, before being buried by later rocks. This is the reason why the Permian rocks are missing from this area.
Graphically, this situation can be represented in a column with a gap in it. **See Figure 2.** However, in reality, the Triassic rocks lie directly on top of the Carboniferous rocks, as shown on the section below. See **Figure 3.**
The **surface of unconformity** is underground and cannot be seen in this area, but it is important to realise that the sand and pebbles in the Triassic rocks were previously part of another, older, **Rock Cycle**.
The Earth's surface processes of erosion and deposition constantly recycle materials from previous Rock Cycles into the following one.
Some of the more resistant pebbles at Play Canyon may have been through **several** Rock Cycles.

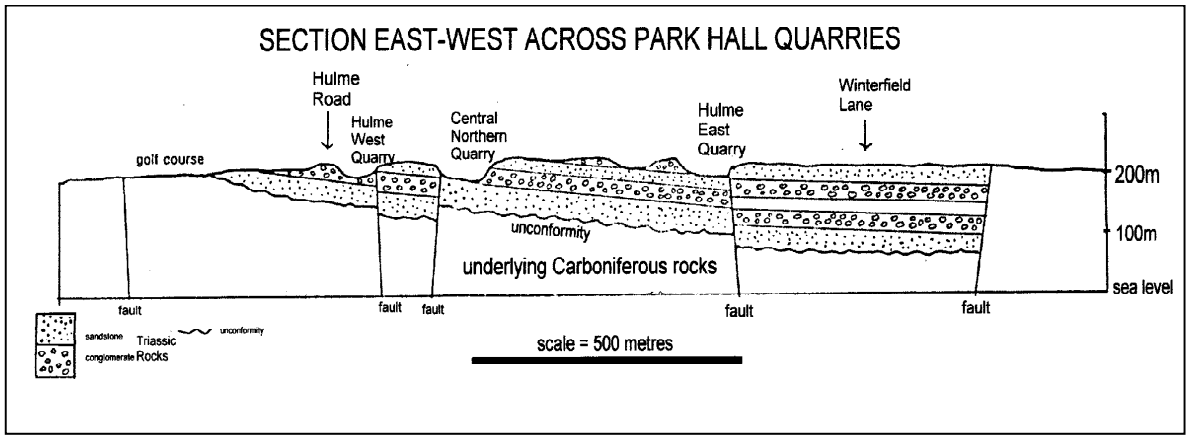

Figure 3. Section Across the Park Hall Quarries.

This Triassic landscape was in an arid, hot-desert environment, as suggested by the lack of preserved fossil material, and the red colouring of rocks by iron oxides, as happens in Colorado and central Australia today. The paler areas of colour represent spots where the iron oxide has been reduced, probably by the decomposition of vegetable matter buried in the sediments. England is thought (from palaeomagnetic evidence) to have been on a latitude of about 13 degrees north of the equator in Triassic times. Footprints from Cheadle (but not here) show that dinosaurs walked on these sediments before they were cemented into rock.

The rocks exposed in The Play Canyon show similar characteristics to braided river deposits of the present day, being cross bedded pebbly, to sandy rocks, suggesting rapidly varying current strengths.

Such rivers are formed by flash floods in modern deserts. In the channels, where the current was faster, coarse grained deposits formed, between sand bars, whilst in quieter pools finer material was deposited. The cross bedding dips northwards and north-northeast-wards suggesting these rivers flowed from the south in this area, bringing large amounts of sand and pebbles with them. Likely sources of the different pebble types also lie to the south and southwest.

Since their deposition, these Triassic rocks have been loosely cemented together, uplifted, and tilted gently towards the east. Some pebbles show signs of fracturing under great pressure from adjacent pebbles as this tilting occurred. This suggests they were deposited in contact with one another, and that, here, the sand was washed into the spaces between the pebbles as the current slackened later. Some fractured pebbles have been re-cemented before present day uplift and erosion. In the overlying, more sandy rock, the pebbles are clearly deposited at the same time as the sand, in which they are buried without touching each other.

As well as uplift and tilting, these rocks have also been affected by tensional forces that produced the normal faults in the area.

The rocks now have signs that they have been weathered and eroded by rain water and frost, as they are gullied and show scree slopes that have formed since the end of quarrying activities in the 1970s. Soil formation on these sandy rocks has led to brown podsols, which support a vegetation of gorse, birch and broom.

The map, **Figure 3**, below summarises the main features of The Play Canyon.

The economic use of this area began in the seventeenth century when the natural heathland was cleared for agriculture. During the industrial revolution several collieries were dug around Hulme, some even taking coal from below the Triassic rocks. The sands and conglomerates of the Triassic outcrop were worked for some building stone, but also sand and gravel. From 1939 to 1970, and especially when the M1 motorway was constructed in the 1960s, sand and gravel extraction was an important activity in this area, with the quarries becoming abandoned in the 1970s and infilled by quarry waste and industrial and household rubbish. The City of Stoke on Trent, Staffordshire County Council, the Countryside Commission and the Department for the Environment reclaimed the area, which won an award in 1978.

EARTH SCIENCE PRINCIPLES

In this area it is possible to demonstrate the following Earth Science principles.

1) **The Principle of Superposition**: in a bedded sequence of strata, the oldest layers were deposited first, and are found below the younger layers, which were deposited later.

2) **The Principle of Included Fragments:** A rock which contains fragments of other rocks, must be younger than those other rocks, and formed after erosion and deposition of the fragments of the older rock.

3) **The Principle of Cross-Cutting Relationships:** Structures, like faults and joints, which cut through rocks must be later, and therefore, younger than the structures they cross cut. They must also be older than the ones that cut across them.

NATIONAL CURRICULUM LINKS

In this area it is possible to:

1) Recognise, sort and compare rocks types (sandstone, shale and sandstone) [Science]
2) Collect evidence relating to the formation of sedimentary rock layers. [Science]
3) Use instruments in the field to collect data: tape measure, compass, clinometer, and plot them on maps. [Science]
4) Explore the ideas of sustainable development explored through environmental and resource issues [Geography].

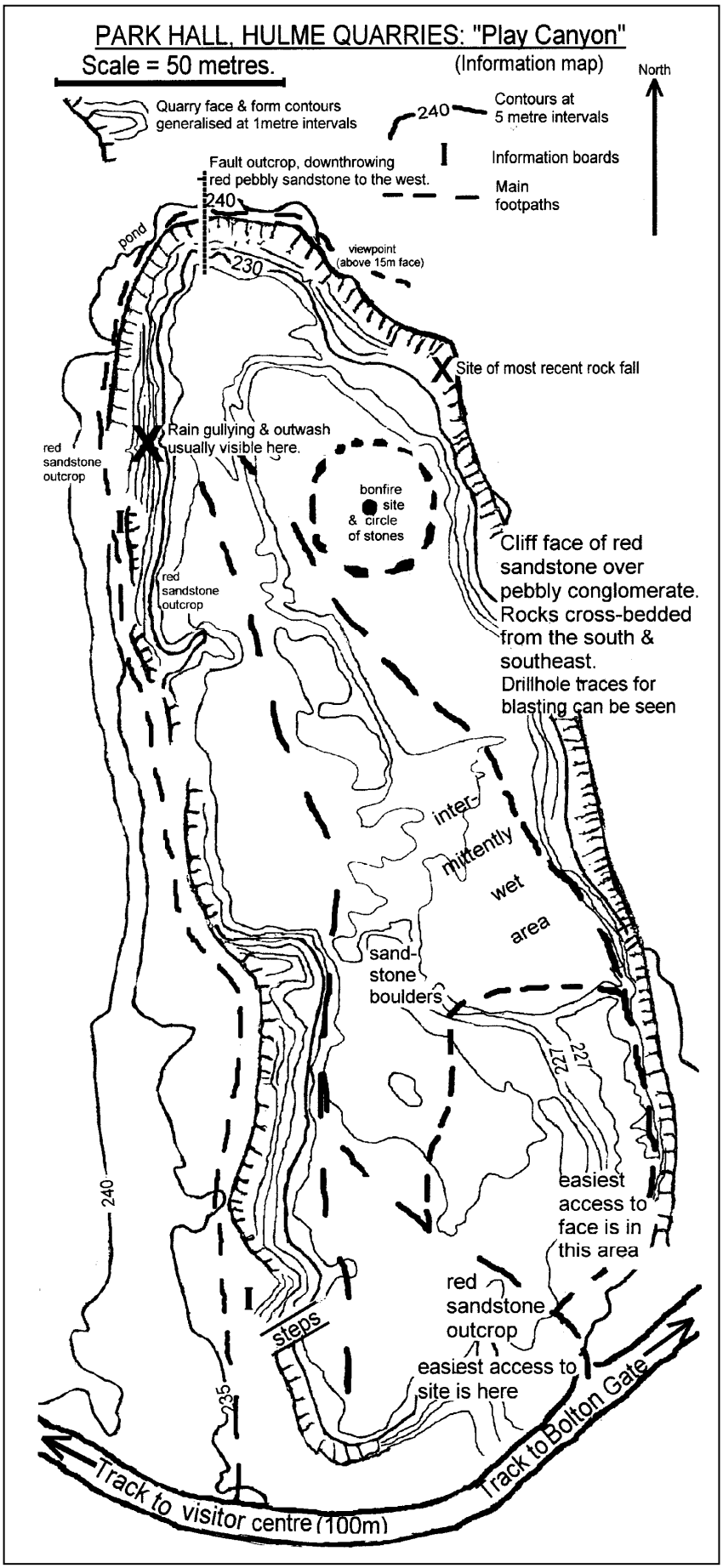

Figure 3.
Main Features of "Play Canyon".