
Stable Pit, Bradgate Park (Charnwood Forest)

[SK 5340 1000]

J.N. Carney

Introduction

The Stable Pit is a disused quarry situated within the Bradgate Park Precambrian GCR site (Figure 2.8), the geology of which is described by Sutherland *et al.* (1987, 1994) and reviewed in Chapter 2. It provides virtually the only suitable exposures of quartzose sandstone beds developed in the Stable Pit Member, which in turn belongs to the Brand Hills Formation of the Brand Group, Charnian Supergroup (Moseley and Ford, 1985). A further section in Deer Park Spinney, 680 m to the north-east, is at the time of writing overgrown (Worssam and Old, 1988). This site, along with that at 'The Brand', is of prime importance for demonstrating the sedimentology of strata that are now thought to be of Lower Cambrian age (e.g. McIlroy *et al.*, 1998, and see introduction to 'The Brand' site report). It is the type section for the Stable Pit Member (Moseley and Ford, 1985), although the quartzose sandstones seen here are of an unusual facies, in that they differ considerably from the wacke-type turbiditic sandstones representing the top of the member at 'The Brand' site. The uniqueness of these sandstones in the Charnian context was commented on by Watts (1947, p. 52); they are indeed more reminiscent of lithologies in the Hartshill Sandstone Formation, at the base of the Lower Cambrian sequence in Nuneaton (Brasier *et al.*, 1978).

Description

The principal exposures on the northern side of the Stable Pit (Figure 9.1) are in grey- to pink-weathering, medium-grained, quartz-rich sandstones (quartz arenites), which are extremely compact and 'glassy' on fresh surfaces, and form good crags (Figure 9.2). Bedding traces are best seen on joint surfaces orientated north-south; they are rather faint, and defined by c. 20 mm-thick layers of darker grey sandstone, which in one place outline vertically stacked, unidirectional cosets of low-angle planar cross-bedding, the foresets dipping to the north-west.

A structure trending roughly east-west, parallel to the local cleavage, is inferred to occupy the area of non-exposure in the centre of the site because the beds next seen to the south side are vertical to steeply south-dipping (50–60°) in a faulted zone about 8 m wide. The sequence here is heterolithic; it includes a thick bed of slaty mudstone with thin (20–30 mm) layers of quartzose sandstone, passing northwards into alternating mudstone and sandstone beds, and thence to mainly sandstone with rafts or discontinuous lenses of mudstone. The thin quartzose sandstone layers within the mudstones have been described as possible clastic dykes (Moseley, 1979; Worssam and Old, 1988), but Sutherland *et al.* (1987) question whether they may also be sedimentary intercalations, the explanation favoured here.

A sub-vertical dyke of fine-grained, altered diorite, just over 1 m wide, is intruded into sandstones along the base of the face forming the north-western side of the quarry (Figure 9.2). Its east-west trend appears structurally controlled since it is parallel to the local cleavage strike, and to quartz veins traversing the host rocks. The dyke is also sub-parallel to prominent strike-slip shear zones that give rise to sub-horizontal slickenside lineations in sandstones on the northern side of the quarry.

Interpretation

The Stable Pit sandstones form part of a highly distinctive but rather restricted facies within the Brand Hills Formation. The significance of these lithologies lies in their grey, glassy and obviously quartzose character, and is underlined by the fact that in terms of composition and petrography they compare best with Lower Cambrian strata of the Hartshill Sandstone Formation exposed at Nuneaton (McIlroy *et al.*, 1998). The occurrence of cosets showing tabular cross-bedding is particularly reminiscent of the Park Hill Member at Nuneaton (e.g. Brasier *et al.*, 1978; Carney, 1995),

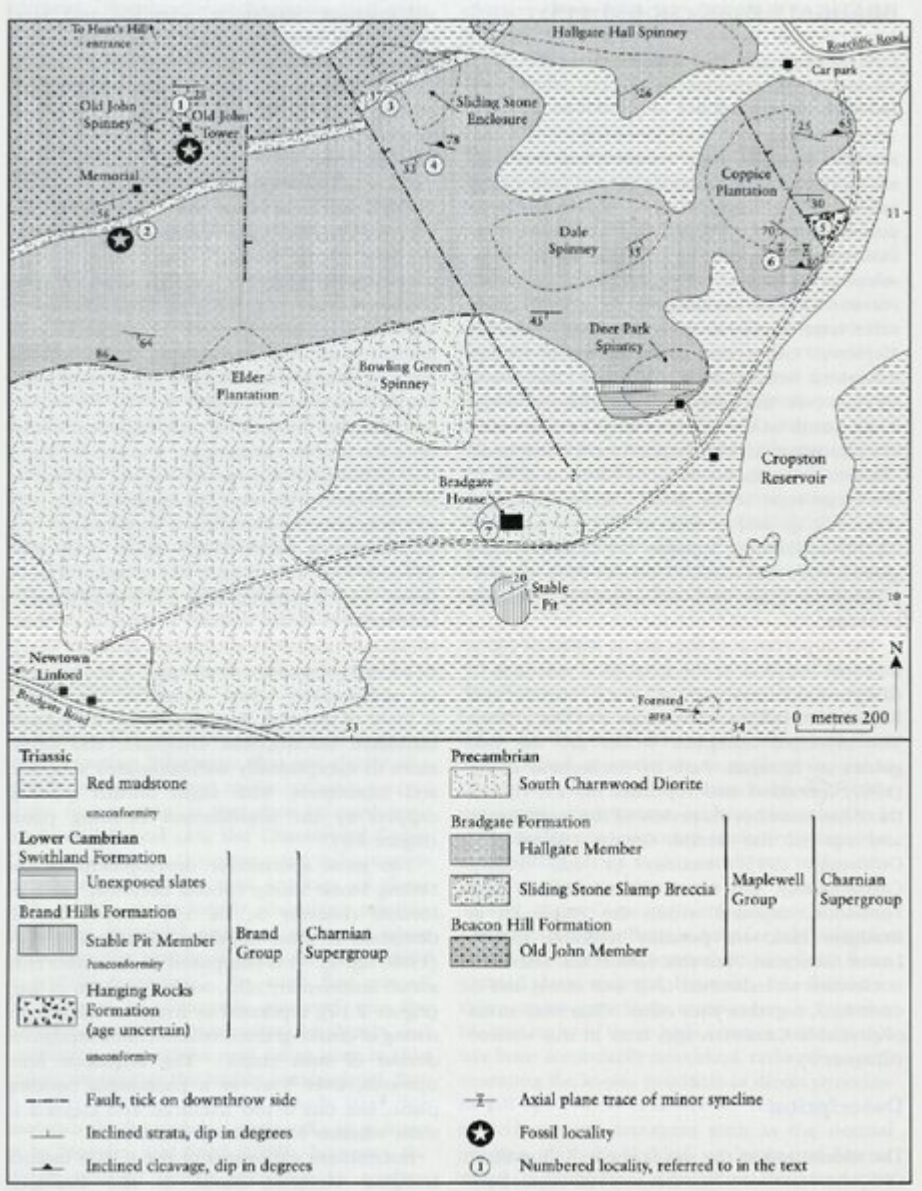
deposited in tidally influenced, nearshore marine environments during the transgression of the sea across the eroded Precambrian landmass. The heterolithic part of the Stable Pit sequence could represent a transition into the mudstone-rich Swithland Formation, in which case the quartzose sandstones could be lateral equivalents of the wacke-type sandstones underlying the Swithland Formation at 'The Brand'. Alternatively, and perhaps more plausibly in view of the comparisons noted with the Park Hill Member, the muddy beds might simply represent periods of reduced arenaceous supply, perhaps during a marine flooding event. The possibility that the quartzose sandstone facies may occupy the lower part of the local Brand Hills Formation sequence is to some extent supported by an occurrence of the supposedly underlying Hanging Rocks Conglomerate Formation in Bradgate Park, although this occurs 1.2 km to the north-east (Figure 2.8).

The age of the dyke seen at the site is not known. It had been regarded as Precambrian, but if the Stable Pit strata are indeed Cambrian, then it may have been emplaced during the same late Ordovician magmatic event that gave rise to the Mountsorrel granodiorite complex, located to the east of Charnwood Forest (e.g. Le Bas, 1972).

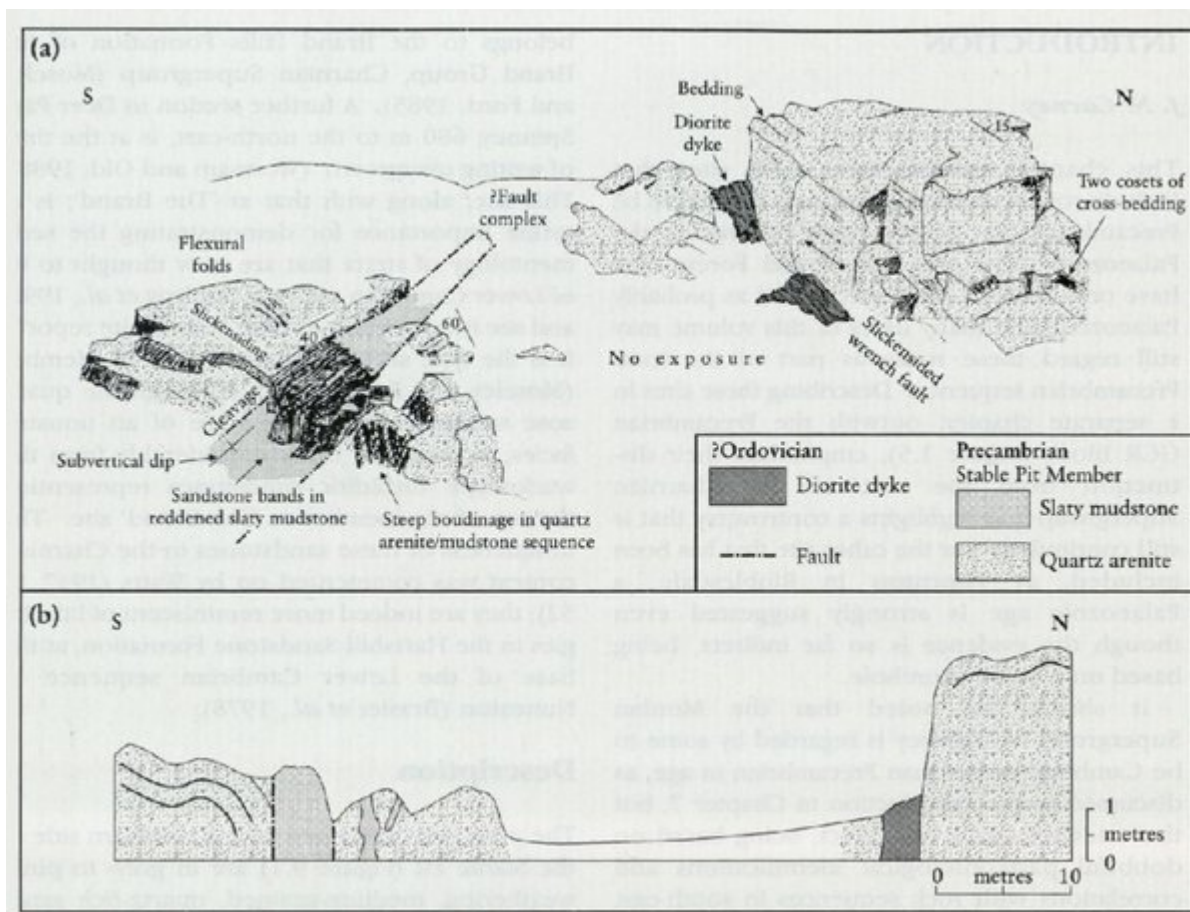
Conclusions

The Stable Pit site offers highly accessible sections in the Stable Pit Member, which has long been considered a unique lithology in Charnwood Forest. Its significance is reinforced by the fact that, on the basis of local correlations, this member is now regarded as part of a Lower Cambrian rather than a Precambrian sequence. Intriguing questions arise over why the Stable Pit Member in its type locality should be so different to the turbidite-facies wackes, assigned to the same unit, at 'The Brand'. For the time being the quartzose sandstones at the Stable Pit are regarded as representative of deposits that were considerably reworked, and 'cleaned' of many unstable constituents, during the early Cambrian marine transgression across the Avalonian landmass (Figure 1.2). In these respects, they are more similar to certain units of the Lower Cambrian Hartshill Sandstone Formation of Nuneaton, than to the rest of the Brand Group. The occurrence of a dyke is another noteworthy feature of this exposure.

References



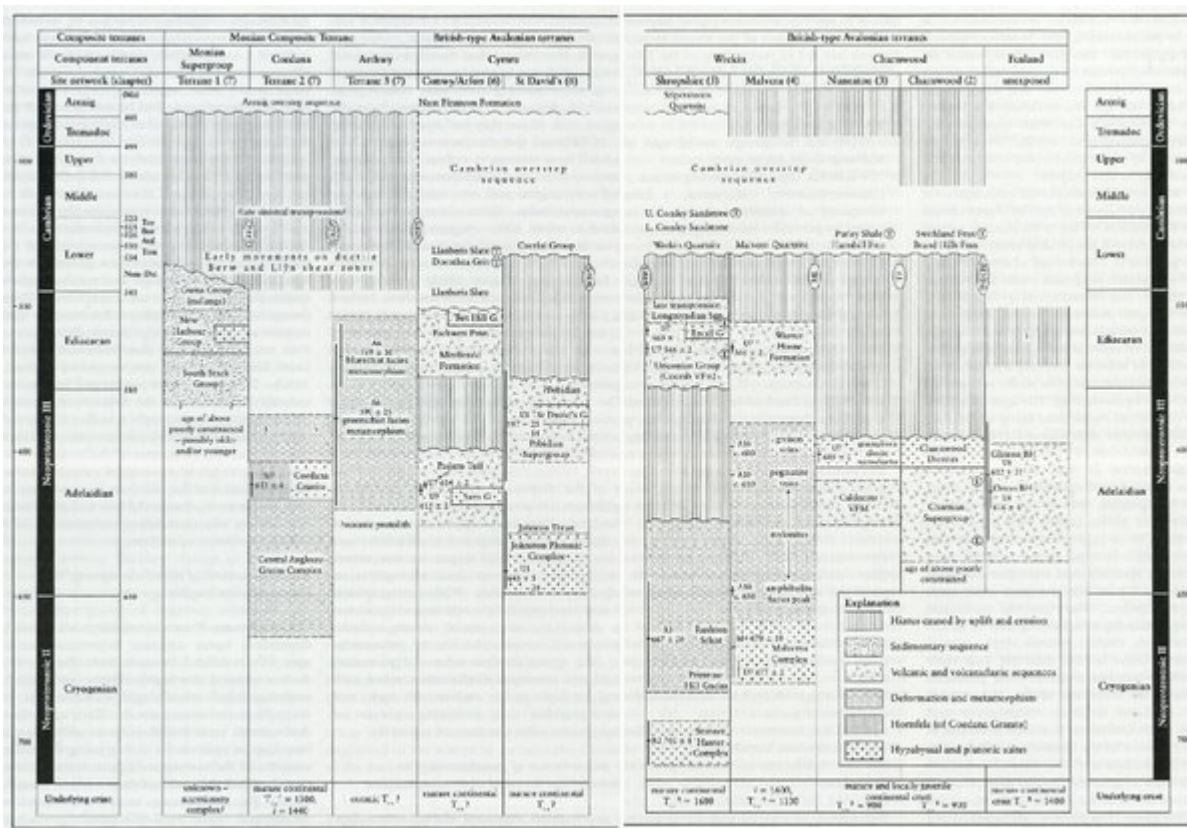
(Figure 2.8) Geological map of the Bradgate Park site, adapted from Sutherland et al., (1994) and Kelk and Old (1982).



(Figure 9.1) Geological sketch of the Stable Pit site (after Sutherland et al., 1994)



(Figure 9.2) The Stable Pit, Bradgate Park viewed north-eastwards. The prominent crags at the far side of the exposure are in quartzose sandstones of the the Stable Pit Member, Brand Hills Formation. The rocks in the foreground are part of a heterolithic, sandstone-mudstone facies. (Photo: J.N. Carney.)



(Figure 1.2) Correlation chart for the late Neoproterozoic history of southern Britain. Key: A, $^{40}\text{Ar}-^{39}\text{Ar}$ age; M, U-Pb monazite age; R, Rb-Sr whole-rock isochron age; U, U-Pb zircon age; T_{DM} , Depleted mantle Sm-Nd age; i, inherited zircons. Key to faunas; (E) Ediacaran fossils; (T) Teichichnus trace fossils. Key to horizontal boundaries; continuous line, conformable stratigraphy; wavy line, unconformity; dashed T line, tectonic contact; dashed line, nature of contact uncertain. Terrane boundaries: BSZ, Berw Shear Zone; CASZ, Central Anglesey Shear Zone; LTFZ, Llyn Traffwl Fault Zone; ML, Malvern Lineament; MSFS, Menai Strait Fault System; ?NECBF, postulated NE Charnwood Boundary Fault; TF, Thringstone Fault; WBFS, Pontesford Lineament of Welsh Borderland Fault System. Literature sources: 1, Patchett and Jocelyn (1979); 2, Patchett et al., (1980); 3, Beckinsale et al., (1984); 4, Thorpe et al., (1984); 5, Davies et al., (1985); 6, Dallmeyer and Gibbons (1987); 7, Tucker and Pharaoh (1991); 8, Noble et al., (1993); 9, Horák et al., (1996); 10, Strachan et al., (1996). Stratigraphical data for Lower Cambrian sequence, and fossil occurrences after McIlroy et al., (1998): nem-Dal, Nemakit-Daldynian; Tom, Tommotian; Atd, Atdabanian; Bot, Botomian; Toy, Toyonian.