Tower Wood Quarry, Devon

[SX 876 856]

Highlights

This is the main and type locality for the Tower Wood Gravel. This, the older of the two Haldon Gravels facies, represents an in-situ weathering residue of the Chalk which developed locally in early Palaeogene times.

Introduction

About halfway between Exeter and Torquay are the Haldon Hills (Figure 7.1), capped by gravels of predominantly Palaeogene age. Tower Wood Quarry (Figure 7.5) occurs at the extreme northwestern end of Great Haldon at grid reference [SX 8768 8567]. In this small quarry, the Tower Wood Gravel Member represents the residual facies of the 'Haldon Gravels Formation'. Although not presently demonstrable in the quarry, the Tower Wood Gravel rests unconformably on the Upper Greensand (Cretaceous). Whilst the Haldon Gravels have been a subject of considerable interest to both geologists and geographers since the 19th century, the earliest reference to Tower Wood Quarry appears to be in Pickard (1949). More recent descriptions of the locality reflect the detailed study of the Haldon Gravels by Hamblin (1969, 1973a,b, 1974), whilst brief accounts are given in Edwards and Freshney (1982, p. 234) and Selwood *et al.* (1984, p. 128).

Despite a lack of earlier descriptions of Tower Wood Quarry, there is a copious literature on the Haldon Gravels (see Hamblin, 1969, 1973a). Whilst now accepted as being of predominantly Palaeogene age (Hamblin, 1973a), the latter have over the years been dated as Late Cretaceous (Clayden, 1906), equivalent to the Reading Beds (De la Beche, 1839), Bagshot Beds (Reid, 1898b) and Bournemouth Beds (Jukes-Browne, 1907), whilst Green (1941) and Ussher (1878) suggested Miocene and Pleistocene ages respectively. Hamblin (1973a) has argued that the Tower Wood Gravel is certainly pre-Bagshot and probably pre-Reading Beds in age. He conceded that the age cannot be fixed more exactly, arguing that the solution of possibly 200 m of Chalk would have taken a considerable time and may have filled the period from the Maastrichtian to the Thanetian.

Over the years, various opinions have been proposed for the origin of the Haldon Gravels. Marine deposition was suggested by Clayden (1906), Jukes-Browne (1907) and Waters (1960b); Reid (1898b) and Boswell (1923) believed that the gravels were fluvial, whilst a glacial origin was put forward by Ussher (1878). Hamblin (1973a, p. 461) suggested that this dissention reflected failure by earlier workers to perceive that the Haldon Gravels contained more than one member. De la Beche (1839) did, however, recognize that some flints were residual, 'the flints having been let down nearly in places above which they occurred in the chalk', whilst at the same time recognizing that the origin of the gravels was more complex: 'the accumulation of chalk flints... may be referable to more epochs than one', and that the flints are in places 'mixed with rounded pieces of granite, porphyry and other older rocks'.

Description

Tower Wood Quarry comprises a small section in the Tower Wood Gravel, formerly the lialdon Residual Gravel' of Hamblin (1969), for which the quarry is the type locality. Neither the upper nor lower boundaries of the unit have been observed here, although detailed mapping indicates that the gravels rest unconformably on the Upper Greensand (see Edwards and Freshney, 1982, fig. 9.2). Brief descriptions of the section are given in Edwards and Freshney (1982, p. 128).

Lithological succession

A 6 m thickness of flint gravel is exposed, although Edwards and Freshney (1982) suggested the presence of a further 3 m below this which is presently covered by talus. Hamblin (1973a) gave an approximate overall maximum thickness for the member in the area of 8 m.

Sedimentology

The deposit is predominantly an unstratified flint gravel, the clasts being up to 0.3 m in diameter and unabraded. They have, however, been peripherally shattered by Pleistocene frost action. Most now comprise horizontally aligned cores surrounded by small flint chips.

Hamblin (1974) pointed out that for the most part the Tower Wood Gravel has neither abraded flints nor exotic pebbles. Pickard (1949), however, referred to a basal bed with water-worn pebbles of quartz, tourmaline and shale, although Hamblin (1973a) quotes this author as having found quartz and schorl (a quartz-tourmaline rock). The pebbles occur in what Hamblin (1973a, p. 463) describes without specific reference to Tower Wood Quarry as a sandy, flint-free basal bed up to 125 mm thick. This bed was obscured at Tower Wood Quarry when Hamblin was undertaking his work and this continues to be the case at present. In 1990, only about 2 m of gravel were visible in the upper part of the east and south-east faces of the quarry (Edwards, 1991).

Elsewhere in the formation, the matrix between the flint pebbles comprises clay with very little sand. Broader studies of the clay from the Tower Wood Gravel (Hamblin, 1973a) have shown that it typically comprises well-ordered 'china clay' kaolinite, with a little disordered 'ball clay' kaolinite and illite. Some samples, however, show mixtures of well-ordered and disordered kaolinite more characteristic of the overlying Buller's Hill Gravel (Hamblin, 1973b).

Interpretation and evaluation

The Tower Wood Gravel, at its type locality Tower Wood Quarry and elsewhere, sheds light on the weathering and denudation affecting an area to the west of the Hampshire Basin in early Palaeogene times.

Gravel provenance

Despite a variety of origins for the Haldon Gravels suggested by earlier workers (see discussion of Buller's Hill Quarry), it now seems that the composition of the Tower Wood Gravel indicates its formation as a residual deposit derived from a former cover of Chalk, the nearest outlier of which is today almost 25 km to the east. It follows from the nature of the gravel (in particular its silicified fossils) that this cover included flinty Upper or Senonian Chalk. Derived fossils from the Haldon Gravels as a whole include material from as high as the *Belemnitella mucronata* Zone (Edmonds *et al.,* 1975, p. 75).

By contrast, the exotic clasts in the sandy pebble bed at the bottom of the Tower Wood Gravel may represent the basal conglomerate associated with a westerly transgressive early Chalk sea. As yet, there is no proof that any pre-Senonian (non-flint-bearing) Chalk was ever present here, but Hamblin (1973a) has suggested that this pebbly sand represents the residuum of the flint-free Lower Chalk. It remains apparent, however, that the Tower Wood Gravel (together with the remainder of the Haldon Gravels) is all that remains of a former Upper Cretaceous cover some 200–300 m in thickness.

The origin of the clay matrix is less clear than that of the flints themselves. Hamblin (1973a, 1973b) stressed that the Tower Wood Gravel was quite unlike the 'Clay with Flints' and explained this by a variety of factors, including a different climatic regime, altitude of formation and the relative position of the water table.

He believed that the well-ordered kaolinite present in a number of samples could not have been derived form the Chalk, but came from a hydrothermal kaolinite source probably in the area of the Dartmoor Granite a few miles to the west. This suggestion is supported by the presence of a granite-derived heavy mineral suite associated with the clay matrix. Since the gravel has an intact framework (i.e. closely packed clasts), it seems likely that the clay was introduced post-depositionally by downward infiltration. Where the matrix of the Tower Wood Gravel contains a mixture of well-ordered and disordered kaolinite, downward eluviation from the overlying Buller's Hill Gravel may provide an

explanation (Hamblin, 1973b).

Palaeoclimatic implications

Hamblin considered that the weathering of the Chalk that gave rise to the Tower Wood Gravel had occurred under savannah conditions rather than those of tropical rain forest (cf. Chandler, 1964), arguing that kaolinite characterized savannah soils. Whilst this was disputed by Green (1974), it is compatible with the findings of Isaac (1979). He concluded that the Peak Hill Gravels of the Sidmouth area (also unabraded flints in a matrix of kaolinite) and the Tower Wood Gravels had a common origin in the lateritic weathering of the Chalk, but that the presence of silcretes in the former provided evidence for dry conditions for at least some of the time. Edwards and Freshney (1982) have suggested that the Orleigh Court Gravel of North Devon (first described by Rogers and Simpson, 1937) may be a residual deposit of probably Palaeocene age and hence comparable with the Tower Wood Gravel. However, Edmonds *et al.* (1975) suggested that the former might be a Pliocene beach deposit.

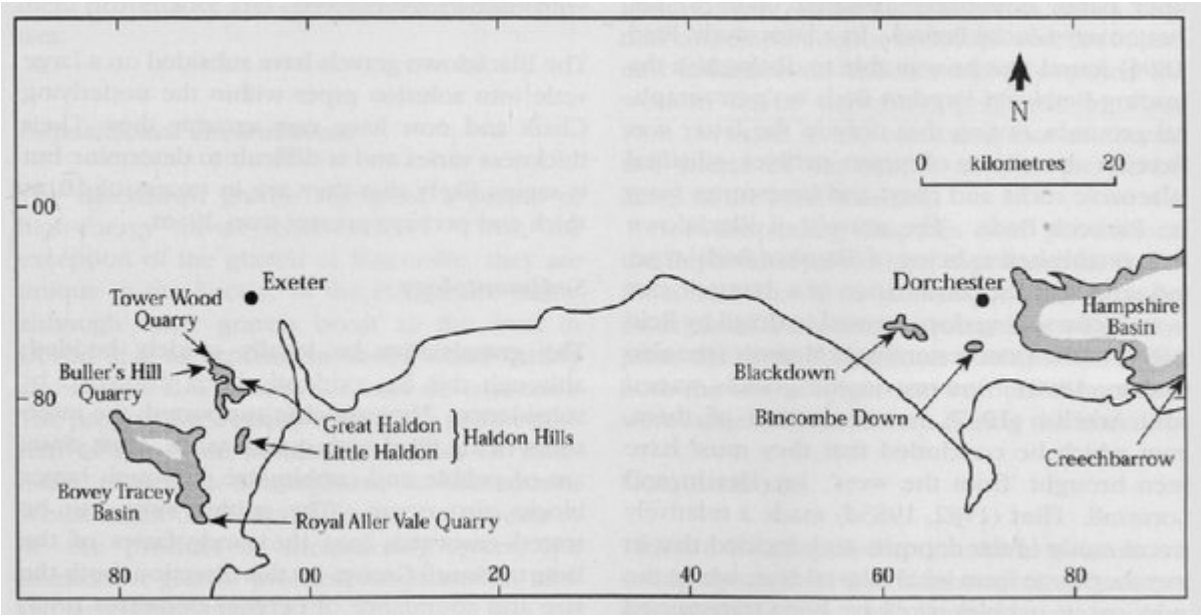
Occurrence elsewhere

That the Tower Wood Gravel (and hence the Chalk cover) originally extended further westwards is supported by the occurrence of unworn flint nodules in solution pipes in Middle Devonian limestone, exposed in the Newton Abbot Bypass, which Brunsden *et al.* (1976) considered as having a Chalk weathering residue origin comparable to the Tower Wood Gravel.

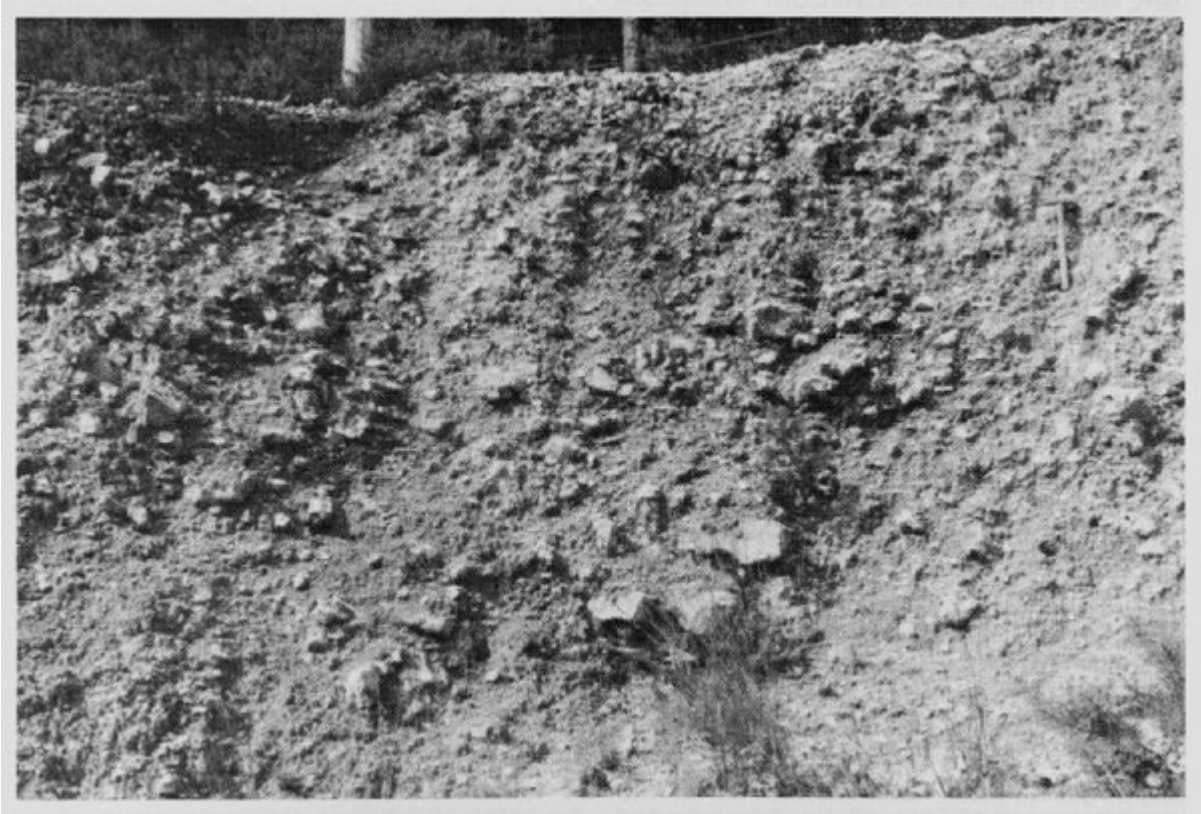
Conclusions

Tower Wood Quarry comprises the type locality for the Tower Wood Gravel and is one of very few localities where this formation may be observed. The gravel exposed in this section represents an in-situ weathering residue of the Chalk which formerly extended further west than at the present time. Its kaolinitic interclast matrix appears to have been derived from hydrochemically altered granite to the west. The section reflects the denudation of a land mass which lay to the west of what is now the Hampshire Basin. Climatically, it has been interpreted as representing savannah conditions in this area during early Palaeogene times.

References



(Figure 7.1) Map to show the distribution of Palaeogene outliers in Dorset and Devon.



(Figure 7.5) Tower Wood Quarry, Great Haldon, Devon. The Tower Wood Gravel, a residual flint gravel formed by solution of the chalk in situ. Photograph taken in 1970, reproduced by courtesy of the British Geological Survey (BGS photograph A11556).