Observations on historic and modern Chalk exposures in the Parish of Frampton, West Dorset, UK

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Historical and temporary exposures in the Chalk around Frampton village, West Dorset, UK are described. As well as Chalk, sand and gravel deposits and Clay-With-Flints were found, partly *in situ* and partly as disturbed, downslope solifluction and slip deposits. Use of the rock and soil materials since Roman times to the present day is also described. The way in which the landscape has been modified by human activity is illustrated.

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Introduction

The recording of observations in the present study was prompted by the new build Tunnel House [SY 632 949], in the village of Frampton, in 2003. This involved a deep cut into the hillside north of the A356 road through the village and revealed several unexpected geological features. The late Hugh Prudden advised these observations should be 'written up' preferably with any other relevant information previously obtained. Revisiting sites observed over a period of some 30 years added further information. Long-term residents involved in agriculture provided confirmation and descriptions of original excavations which are no longer visible or had been redeveloped. Tracing the course of a Roman aqueduct to Dorchester provided possible explanations for some observed effects to the hillside south of the village. The railway from Yeovil to Weymouth, running across and through the hillside on the northern side, was responsible for the most obvious change in the landscape.

Frampton lies along the northern edge of the floodplain of the River Frome *c.* 5 miles north-west of the County town of Dorchester. The hamlet of Southover and the area of Frampton Park occupy the southern edge of the floodplain. From 1566 to the 1930s, Frampton was the centre of an eventual 6-7,000 acre estate owned by the Browne family (Miller, 1999) and inherited by the Sheridans for the final 100 years (Fletcher, 1931). The parish has evidence of human occupation of more than 4,000 years with Bronze Age barrows and Iron Age fields (Royal Commission on Historical Monuments, England, 1952). The Romans, a Benedictine Priory, the last of the Browne family, the Sheridan family and a railway all played a part in physically changing the landscape. Smaller excavations, such as two pits south of the river, provided the materials for estate cottages, farmhouses and barns. Modern roads, public and private, made their mark and, like the pits, provided direct information on the geological succession. British Geological Survey maps at scales of 1:50,000 (Sheet 327, Bridport, 2005) and 1:10,000 (SY69SW, 2001)) were a source of valuable information on the observed variations in the chalk. Papers on the fossil sea urchin *Micraster* sp. were also consulted although there is still some difficulty in identifying which *Micraster* species are present (Nichols, 1955; Stokes, 1977; Smith and Batten, 2002). Features in the disturbed chalk in two of the excavations studied are perhaps historical rather than geological in origin. A map showing the location of sites investigated in this study is presented in Figure 1 and the stratigraphy of the Chalk in the Frampton area is described in Table 1.

Investigated sites

Littlewood Farm and environs

The dairy complex at Littlewood Farm [SY 632 942] has been considerably developed over the last 30 years. The floor of a silage pit excavated in the early 1980s revealed a mixture of sands, gravels and occasional clay patches. The sand and gravel was loose and varied in colour. There was no obvious sign of solifluction in the faces of the pit, but periglacial processes might account for this material. During the 1990s a second silage pit and three barns extended the dairy complex further west along the same line. Here, although the floor again comprised sands and gravels (P. Gillam and G. Holmes pers. comm., 2015), the steep back face revealed sedimentary structures more typical of a solifluction flow (Figure 2a). The face was approximately 4 m high with channels up to 1.5 m cut into the chalk which were filled with clay and unsorted, scattered flints. There was no exposure of the gravels beneath the barns. By 1995 a gap had been created between the barns and the back face to allow access from the rear. The gravel from the floor area was excavated and re-deposited up slope and could be seen to be similar to the material observed in the first silage pit. In 2015, extensions to a slurry pit to the east of the complex produced similar material (Figure 2b). The Roman aqueduct was traced along the 85m contour and recorded as 'lost in gravels below Littlewood Farm Dairy' (B. Putnam pers. comm., 1996). Table 2, constructed from a percussion drilling log from a borehole sunk by Saxton Deep Drillers in 1993 in search of a water supply close to the line of the aqueduct, provides details of the subsurface geology at Littlewood Dairy.

Putnam's work on tracing the course of the Roman aqueduct to Dorchester (Putnam, 1998) explained puzzling details in Metlands Valley [SY 626 943] and in the Littlewood farmyard (Figure 3a). The valley has spurs running down the hillsides

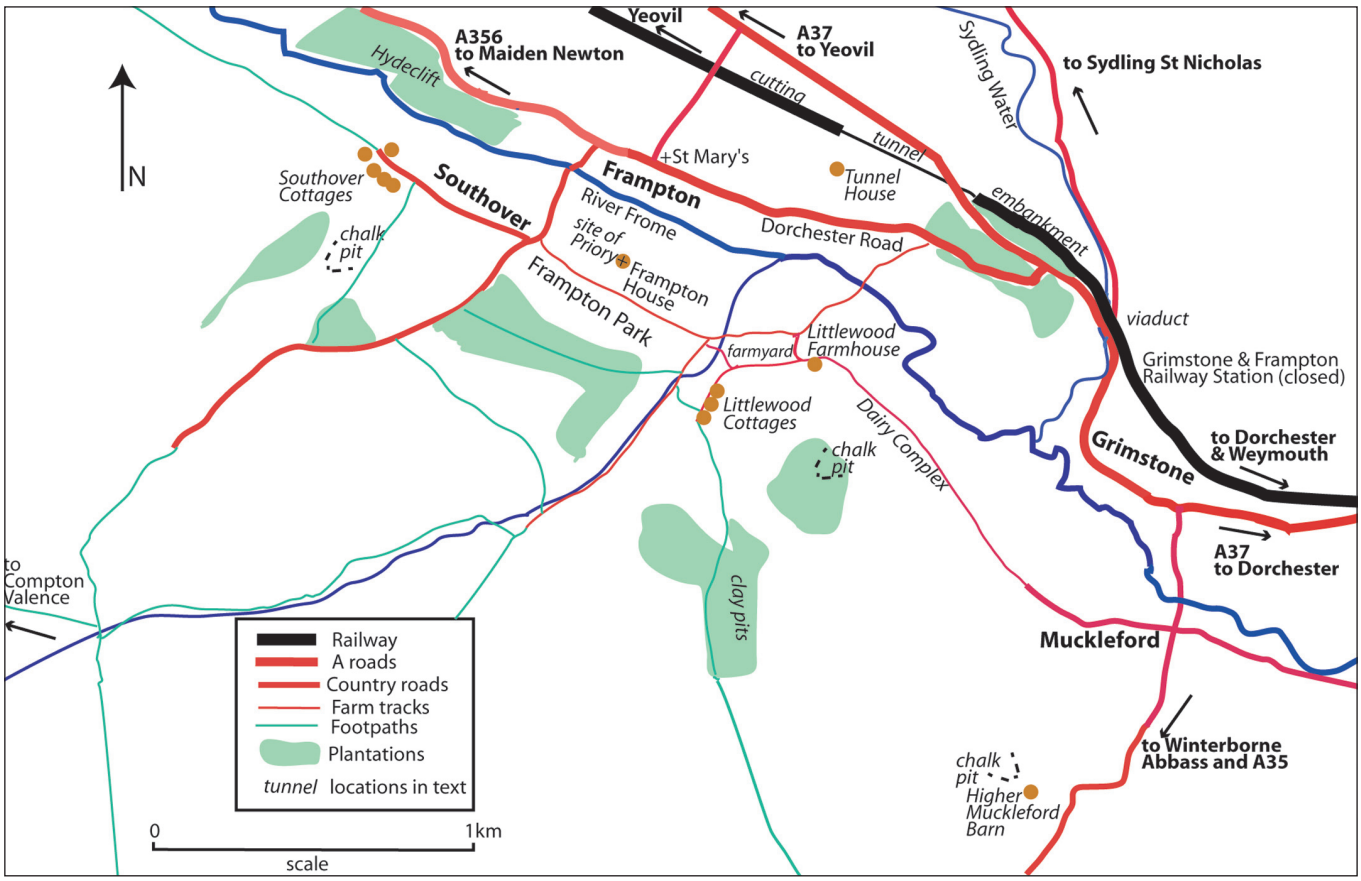

Figure 1. *Map of the Frampton area with locations of the sites mentioned in the text.*

Formation	Fossil Zone
Newhaven	*Offaster pilula*
	Micraster testudinarius
	Uintacrinus socialis
Seaford	*Micraster coranguinum*
Lewes Nodular	*Micraster cortestudinarium*
New Pit	*Terabratulina lata*
	Sternotaxis plana
Holywell Nodular	*Mytiloides labiatus*

Table 1. *Formations in the Chalk of the Frampton area based on information in British Geological Survey (2001) and Smith and Batten (2002).*

Depth (m)	Geology
0.0 - 0.3	Top soil
0.3 - 3.1	Soil/chalk combination
3.1 - 10.5	Chalk medium hard
10.5 - 13.7	Chalk bands of flint
13.7 - 21.0	Chalk massive band of flint
21.0 - 42.6	Chalk bands of flint
42.6 - 45.0	Chalk no flint

Table 2. *The subsurface geology at Littlewood Dairy revealed by a borehole sunk in 1993.*

Figure 2. *(**a**) Clay and unsorted, scattered flints in channels cut into the Chalk exposed at Littlewood Farm. (**b**) Gravel material excavated during the extension to a slurry pit at Littlewood Farm.*

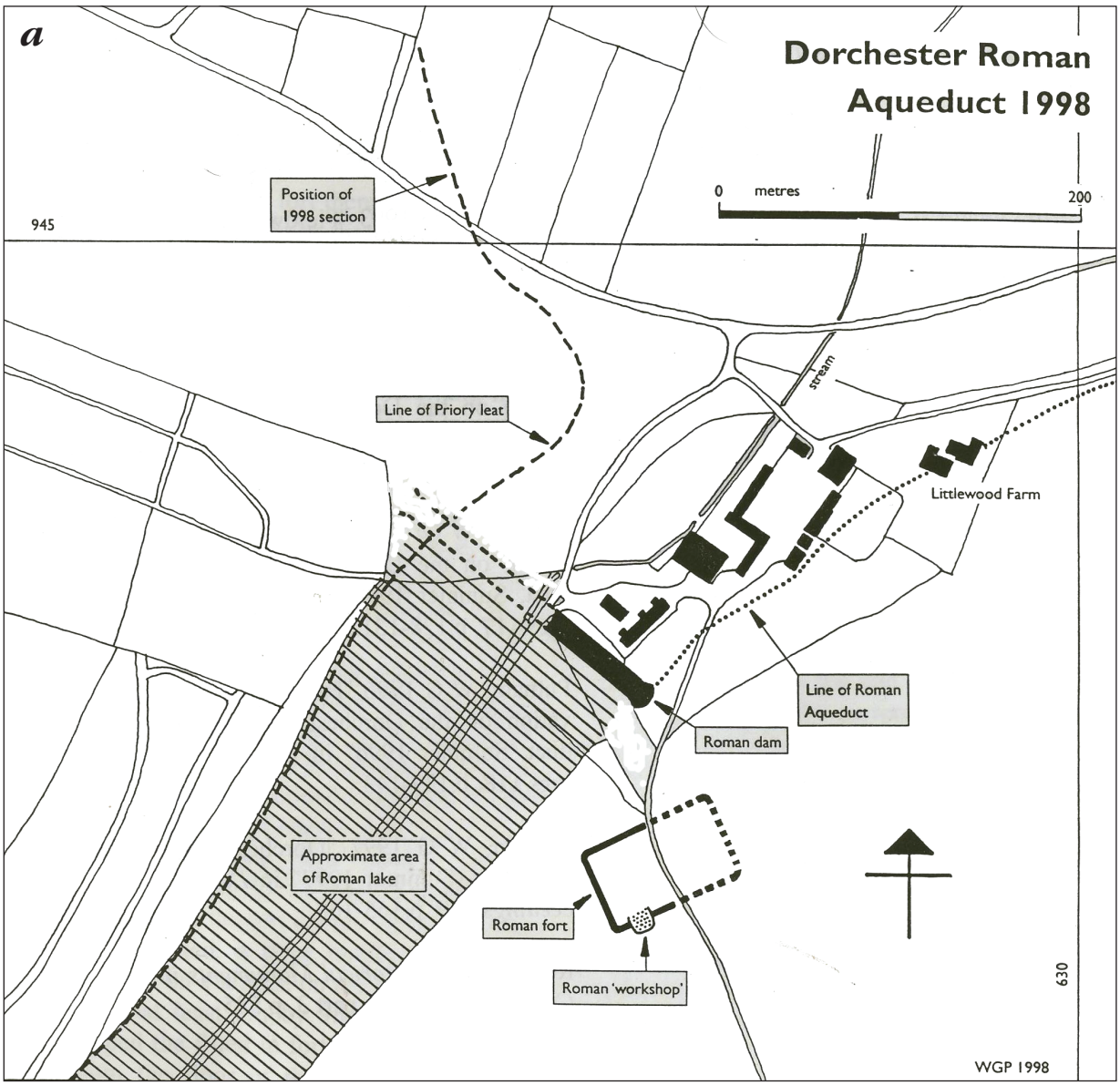

Figure 3. *(**a**) Map of the aqueduct (copyright and reproduced courtesy of B. Putnam). (**b**) Water trough at Hampton Hill Barton. (**c**) Pit in Clay-With-Flints possibly dug in Roman times.*

which cease abruptly in small cliffs a few metres above the floor. Putnam found the first sluice for the aqueduct in the chalk several metres up the eastern side of the valley close to Littlewood cottages. The small stream in the valley, the source of which is 4 km away in the Greensand of Compton Valence, had to have been dammed to raise water levels sufficiently to reach the sluice. It is possible that the Romans straightened the sides of the valley both to provide material to build the dam and also to increase the valley's water-holding capacity. The earth dam, some 4 m high and 100 m maximum width across the valley, was proved when the foundation was found.

A septic tank was installed in a deep clay layer between Littlewood cottages and the stream in the 1980s. Downstream, there was a pronounced rise in the ground which ran across the valley. A metre-deep excavation upstream of the rise in 1996 again revealed the clay layer in the floor of the valley, which was very fine and contained some microscopic chalk foraminifera. Such fine clay was indicative of deposition in still water which, in this open-ended valley, was most likely to be behind a dam. A narrow trench was excavated across the rise and the compressed chalk and flint core of the dam, some 3 m below the present ground level, was exposed. The earth dam and the wooden aqueduct (Putnam, 1998) would have needed a large volume of clay to waterproof the structures.

In 1985, a shallow brick-lined pit in the plantation above Littlewood farmyard was investigated. A pipeline in the pit led to a water trough in the walled enclosure of Hampton Hill Barton on the 150 m contour [SY 626 935] (Figure 3b). The enclosure appears on an Ordnance Survey 1:10,560 scale map dated 1903 and had presumably been used as animal winter quarters with water supplied from the man-made 'dew pond'. There are other much deeper pits in the plantation (Figure 3c) along the ridge to the south of Littlewood Farm. These are in the Clay-With-Flints (British Geological Survey, 2005) and lie along an ancient trackway which led directly to Littlewood farmyard and the site of the dam. It seems likely that this was the source of the clay needed by the Romans and also provided flints for the core. Plans to measure the volume produced from the pits could not be implemented.

Putnam extended his research area to reveal that the Benedictine friars, using a similar system to the Romans, had later utilised the western edge of the valley lake to provide a water source for the Priory. The Browne family built a mansion on the site of the Priory in 1704 (Royal Commission on Historical Monuments, England, 1952) so there are no remains. Recycled material from the Priory, however, can still be seen in Frampton. The Romans possibly also used the soil and chalk from the eastern side of the present farmyard at Littlewood Farm [SY 626 945] where there is a low walled cliff along most of its length. That area was the province of both the Benedictine Priory (14th Century) and the Frampton Estate (16th Century) (Miller. 1999) and is still in use so may have been further modified since the Roman times.

Construction of a tennis court in the steep hillside south of Littlewood Farmhouse [SY 629 947] in the 1980s revealed disturbed 'powdered' chalk. Conical echinoids (*Echinocorys* sp.) (Figure 4a) were found, but the majority were damaged. There were also a number of brachiopods (*Gibbithyris* sp.) (Figure 4b). Putnam's work showed that the Roman aqueduct followed the 85 m contour through this area, so there is a possibility that the considerable disturbance was archaeological rather than geological. The cottages at Littlewood Farm [SY 627 944] were built of chalk block in 1881. The date was ascertained by a penny found under the pavers during renovation in 1989. The only chalk pit in the vicinity is the one in the hillside south of Littlewood Dairy so that seemed likely to be the source. One of the blocks examined during the renovations contained a *Micraster* sp. (possibly from the upper part of the *M.coranguinum* Zone) (Figure 5a). Breaking the block to remove it revealed a small coral (*Parasmilia granulata*?) (A. Brokenshire pers. comm., 1998) (Figure 5b), as well as a cast of a small Rhynchonellid brachiopod complete with burrow (E. Etches pers. comm., 1998) (Figure 5c).

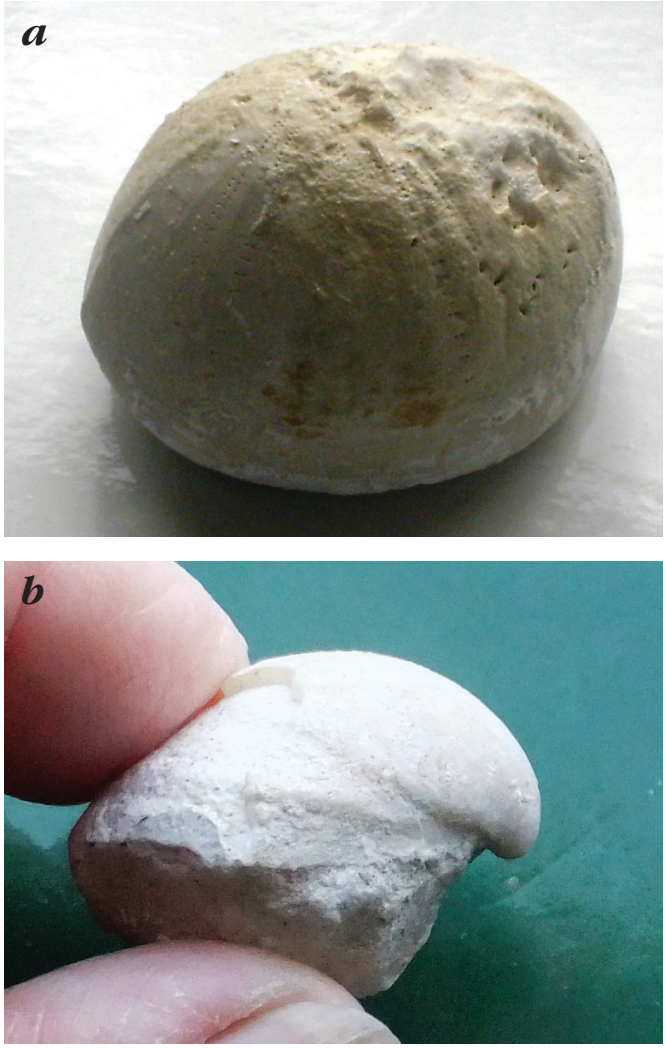

Figure 4. *Fossil finds from near Littlewood Farmhouse.* ***(a)*** Echinocorys *sp. (length 55mm, width 45mm, height 35mm).* ***(b)*** Gibbithyris *sp.*

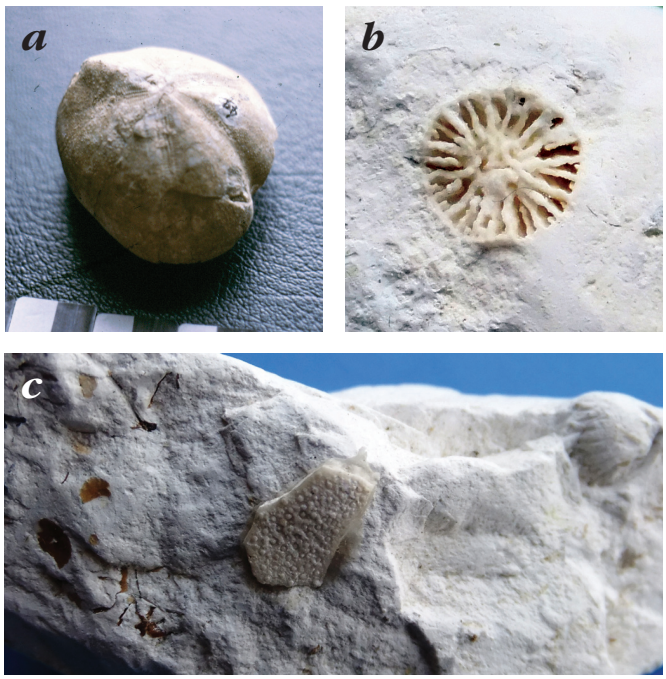

Figure 5. *Fossil finds in a Chalk block during renovation of Littlewood Cottages.* ***(a)*** Micraster *sp.* ***(b)*** *Coral (diameter 5 mm).* ***(c)*** *Rhynchonellid brachiopod and burrow.*

A pit near Higher Muckleford Barn [SY 637 929] was first excavated in 2005 (P. Gillam pers. comm.) (Figure 6a) to supply material for Littlewood Farm field roads. No fossils have been found to date but the area was mapped as being on the boundary of the Newhaven and Seaford Chalk (British Geological Survey, 2001). The chalk is fine and soft with a very white texture. There are occasional white skinned flints with black centres. Exposure of the pit face to weathering over a 10-year period has worn blocks of chalk to a rounded shape (Figure 6b).

Figure 6. *A pit near Higher Muckleford Barn.* (***a***) *Freshly excavated faces in 2005.* (***b***) *A face in 2014 showing rounding of Chalk blocks by weathering.*

A37 and A356 road works

The A37 Dorchester to Yeovil road runs north of the village, and has been remodelled extensively over the years. In 1985 a section was lowered at Grimstone [SY 645 937] east of and just outside the Frampton Parish boundary (P. Hanham pers. comm., 2015), which revealed channels possibly containing river gravels that have been cut into the chalk (Geological Survey of Great Britain, 1940, 1976) (Figure 7a). A new driveway from the A37 into Hyde Crook House, north of Frampton [SY 627 962], temporarily exposed a geological feature (Figure 7b) in the 1990s for which there have been several different explanations, but is likely to have originated as a small fissure in the Seaford Chalk (British Geological Survey, 2001) that has been widened by water and frost and later filled with sediment.

Pavement construction along the A365 in the village of Frampton [SY 626 950] in 2003 involved a considerable amount of earth movement (Figure 7c) which has created an artificial feature that resembles a natural river terrace.

Harry's Wood (Hydeclift Plantation)

Harry's Wood, a 4-acre strip of woodland [SY 623 953] that was originally part of the Frampton Estate, was previously inaccessible as private land but in 1999 was purchased by a local resident and his wife (H. Grenville. pers. comm.) and given to Frampton as a nature reserve. During the wardship of the Frampton Estate by the Benedictine Priory and the Browne family there were many changes in the Park and the village of Frampton, but apart from the development of a water supply to the Priory, they were mainly concerned with buildings of various kinds, so had little impact on the landscape.

During the late 1790s to early 1800s, the then squire, Francis Browne, planned a grand approach to his residence [SY 626 947] in Frampton Park. The River Frome ran through the middle of his demesne and the meanders hindered the view from the bridges which cross it at both ends (Figures 8a and b). Straightening the river left a high chalk cliff which runs almost the whole length of Harry's Wood. Occasional clearing of the overgrowth reveals the chalk face (Figure 8c). Plentiful flints can be observed both in the chalk face and loose in the scree slope at its base. Occasional tree falls indicate the underlying geology is the Holywell Nodular Chalk Formation (British Geological Survey 2001, 2005). Extensive searching of the visible face and any fallen material has not revealed any fossil finds.

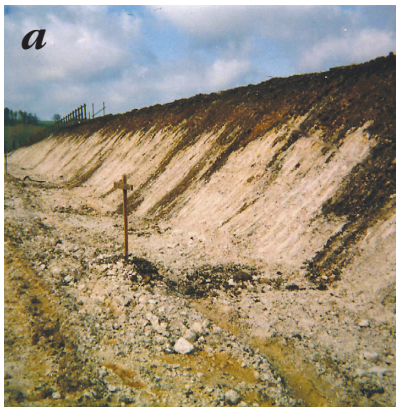

Figure 7. (***a***) *Improvements to the A37 at Grimstone.* (***b***) *A possible dissolution feature exposed on a new driveway to Hyde Crook House.* (***c***) *Earth movement for pavement construction along the A365 in Frampton.*

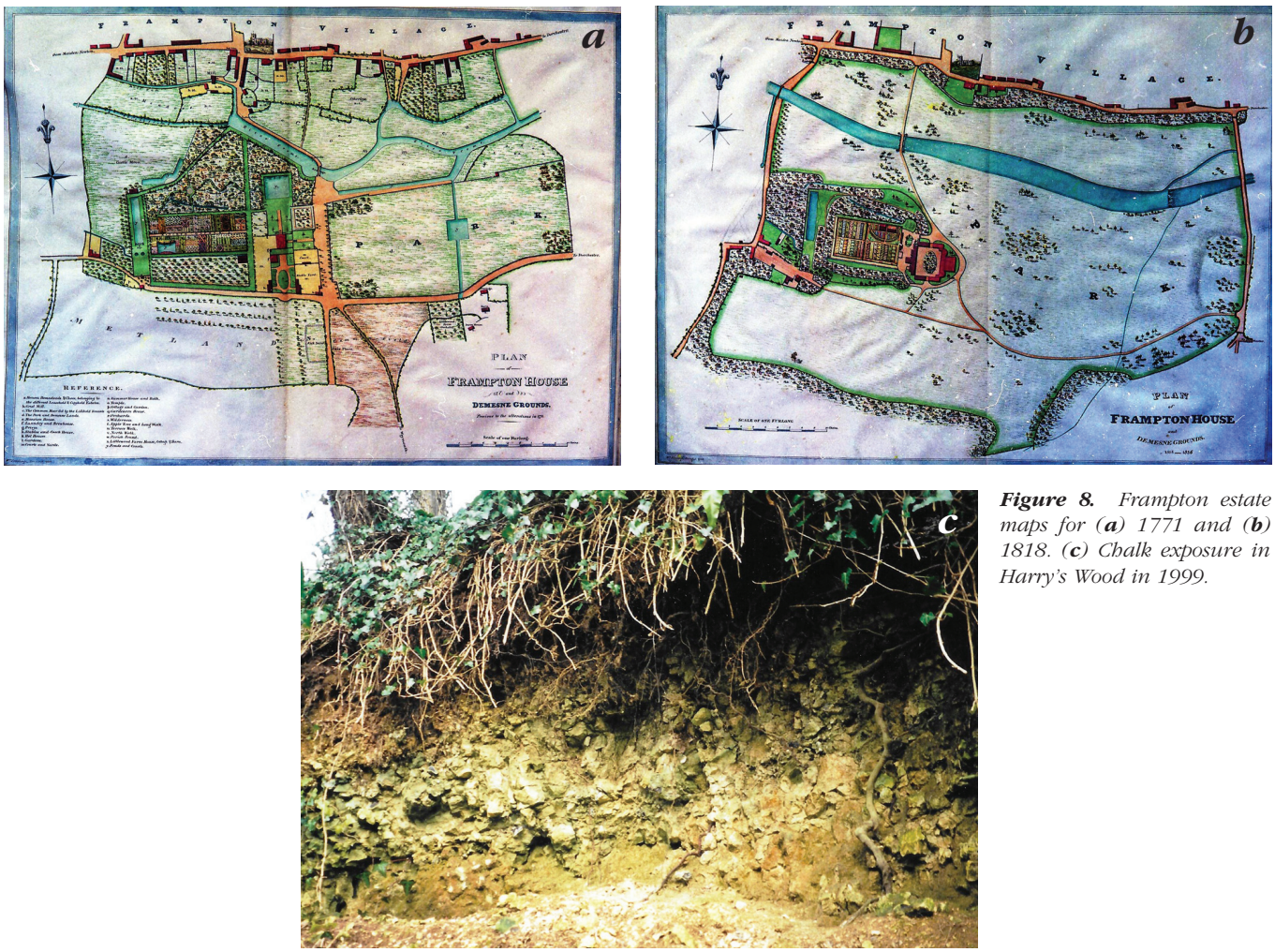

Figure 8. *Frampton estate maps for (**a**) 1771 and (**b**) 1818. (**c**) Chalk exposure in Harry's Wood in 1999.*

Southover

The hamlet of Southover [SY 622 948] lies west of Frampton Park and along a millstream which used to work a corn and a timber mill and also feed the lakes within the demesne. Several of the cottages are built of chalk block and flint (Figure 9a) and date from the 17th Century (T. Musk pers. comm., 2015; Royal Commission on Historical Monuments, England, 1952). They lie immediately below the steep hillside to the south in which a chalk pit is still marked on both Ordnance Survey and geology maps. A description of the pit from a long-term resident (R. Green pers. comm., 2014) matched almost exactly the one given for the quarry above Littlewood Dairy. It has been partly infilled in recent years so the floor and the face are no longer visible. It does, however, lie on the boundary between New Pit and the Lewes Nodular Chalk formations (British Geological Survey, 2001) which is associated with a marked change of slope across the width of the field. *Micraster precursor* has been recorded as being found, and a hand-sized sample of the Lewes Nodular Chalk has an unidentified encrusting porifera (T. Holmes pers. comm.) on its surface (Figure 9b).

The cottages, which date to the mid to late 18th Century, appear to be built from blocks of Lewes Nodular formation, which are hard, nodular and porcellaneous with flint bands. New Pit Chalk, which is white and firm, had been used in a barn (Figure 9c) that has since been incorporated into a housing development.

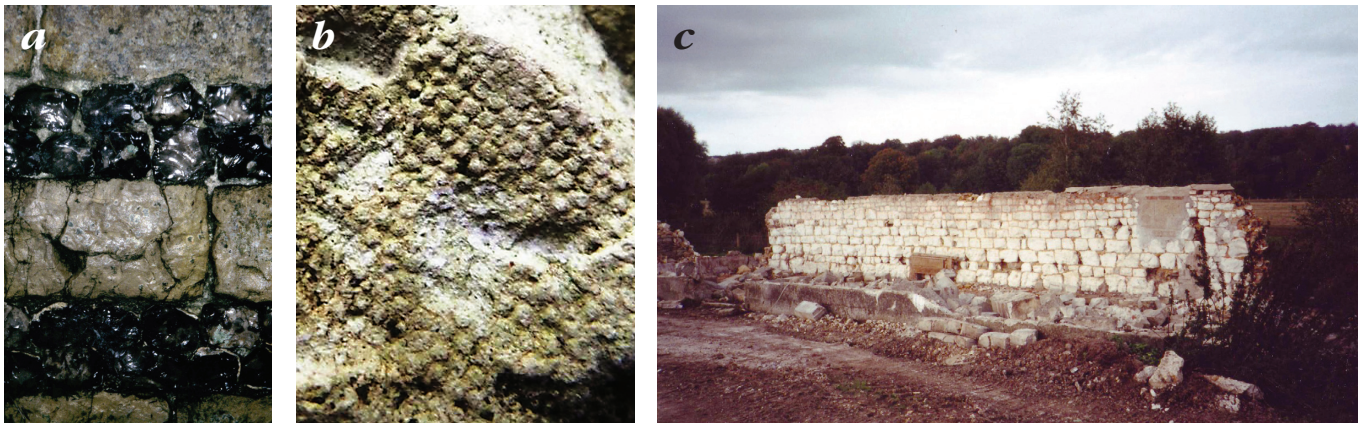

Figure 9. *(**a**) Chalk and flint cottage wall at Southover. (**b**) Encrusting porifera on a sample of Lewes Nodular Chalk. (**c**) Wall of Long Barn at Southover in 1996 made from blocks of New Pit Chalk. Photograph courtesy of R. Green.*

Brunel's Railway (British Rail) Yeovil to Weymouth

Isambard Kingdom Brunel's Great Western railway was built through Frampton in the 1850s. In the village it comprises a deep cutting and a 600-yard tunnel (Maggs, 1982) (Figure 10a). There is a short length of embankment at the Dorchester end of the tunnel leading to the viaduct across the Sydling valley entrance (Figure 10b). A further longer length of embankment leads to 'Grimstone & Frampton', a long defunct station. The overall length of the feature is *c.* 2 km and it traverses the Holywell Nodular, New Pit and Lewes Nodular Chalk formations (British Geological Survey, 2001). An agreement with the Sheridan family that the railway would not be visible from the Sheridan mansion in the Park (Sheridan, 1990) has led to considerable modification of the landscape.

Cut and fill is a standard procedure in road and railway construction. The cut removed enormous amounts of chalk from the western end and more was moved to construct the tunnel. Some of the material was used to narrow the Sydling St Nicholas valley (P. Cox pers. comm) which merges with the Frome valley at Grimstone, and the rest continued the embankment beyond the viaduct. D. Wyatt, writing in the *Frampton Village News* in 1969 gave the following description: "*...the high embankment for which the debris from the tunnel had been used, was almost complete and work had begun on the station…the stones for the viaduct, all cut by hand and carefully numbered, had been stacked on the site under the direction of Isambard Kingdom Brunel and the master mason*".

The viaduct (Figure 10b) is built of random size natural stone blocks and the alms houses in Frampton, built in the 1860s (P. Cox pers. comm., 2003), seem to be of the same rock formation. There are a few possibly Portland fossils in the structure and there are small bivalve fossils in an exterior but sheltered alms house wall.

In the 1990s, the northern side of the cutting, running through Lewes Nodular Chalk, slipped and dropped chalk on the line between the Church Lane bridge and the tunnel (Figure 10c). An investigation of the debris found a *Micraster* sp. (probably from *M. cortestudinarium* group) (Figure 10d) in the spill section.

Tunnel House, Dorchester Road, Frampton

The Tunnel House [SY 632 948] excavation was approximately 40 m into and across a very steep hillside with a back face height of 4 m. The work was photographed over the course of 18 months. As the surfaces weathered apparent slickensides were revealed on the east face (Figures 11a and b). Although fractured and in varying depth into the face, the slip marks covered almost the whole length of the east face at an angle of approximately 2° rising from south to north. There

Figure 10. *Brunel's Railway in Frampton.* ***(a)*** *Cutting and tunnel.* ***(b)*** *Viaduct and embankment.* ***(c)*** *Chalk slip in cutting.* ***(d)*** Micraster *sp. found in spill from slip.*

Figure 11. *Tunnel House excavation.* (***a***) *East face in 2003.* (***b***) *Slickensides on east face.* (***c***) *Hard cemented glauconitic chalk at base overlain by fractured chalk. Specimens of* (***d***) Micraster *sp. and* (***e***) *Spondylos spinosus found in the excavation.* (***f***) *West end of back face developed in Clay-With-Flints.*

were also a few fainter marks which appeared to be at an angle of some 50-60° and running west-east across the south-north marks. These slickensides are likely related to a fault line on the east side of the Tunnel House excavation which runs north-west through the railway tunnel and is shown on the older geological maps of the area (Bridport Drift, 1940 and Solid, 1976).

A 1.5 m high band of hard cemented glauconitic chalk (depth below ground not known), was visible at the base of the excavation and may represent a hardground (Figure 11c). It first appeared in the east face approximately 30 metres into the hillside and was present across 30 metres of the back face. There were less defined 'slickensides' on the back face at angles of 45-55° rising to the east mainly on the cemented strata but were also on the fractured chalk above it. A clear boundary was evident between the cemented layer and the fractured chalk above (Figure 11c) which contained fractured bivalves including *Inoceramus* sp. and numerous damaged *Micraster* sp. firmly embedded in chalk. A thin seam of grey flint ran horizontally 0.5 m from the top of the face and above that there were fine specimens of *Micraster* sp. (Figure 11d) and a few almost complete bivalves (*Spondylus spinosus*) (Figure 11e). The west face was developed in Clay-With-Flints (Figure 11f).

Discussion and conclusions

Some areas of the Frampton landscape have undoubtedly been changed by human interference, including the environs of Littlewood Farm by the Roman dam and aqueduct construction, although it is not immediately apparent. Brunel's railway is a more dramatic intervention. Excavated material from the tunnel was used to infill the Sydling valley according to local information. The material from the cutting may have moved downslope toward where Tunnel House now stands. Frampton was part of a stop line during the threat of invasion in World War II and there are anomalies in the west wall at Tunnel House which might be explained by those activities. Investigations into the construction of the railway will continue, aided by the discovery that Brunel's papers are at Bristol University (J. Elton, pers. comm. 2015).

There have been many other excavations in the parish of Frampton since the 1980s which range from a large commercial site [SY 630 955], agricultural and new house-building in Southover and Frampton, a walkers' car park [SY 619 945] and small extensions to dwellings along Dorchester Road in Frampton. Clay pits along the chalk ridge south towards Winterbourne Abbas, which remained puzzling and unexplained for many years, are likely related to the use of this material by the Romans.

The present study was based mainly on curiosity-led observations and on a personal interest not only in geology but also local archaeology and history. Although relying on casual recording over a 15-year period, the observations of temporary exposures may provide a useful record. Information gathered on the human impacts on the landscape around the village of Frampton has also proved a useful basis for local fieldtrips and 'Frampton Fossil' displays at local events have aroused local interest and prompted the receipt of further information from many sources.

Acknowledgements

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