

# THE MUD WALL in ENGLAND at the CLOSE of the VERNACULAR ERA

by *J.R. Harrison*

## A Study in Building Distribution and the Nature of Materials

"Good cob, a good hat and shoes and a good heart last for ever".<sup>1</sup> English studies in the vernacular use of mud walling have generally been confined to the documentation of practice in limited areas and comparative analysis has hardly been attempted. This is the case with the contributions of both S.O. Addey<sup>2</sup> and C.F. Innocent<sup>3</sup>, as also with Clough Williams Ellis's standard work of reference on the subject, 'Cottage Building in Cob, Pisé, Chalk and Clay'.<sup>4</sup> Ellis deals mainly with chalkland, West Country and to a lesser extent East Anglian 'lump' technique. Much space is given over to what is from the standpoint of the student of English vernacular building, the essentially irrelevant French pisé method. More recently, important papers by M.V.J. Seaborne<sup>5</sup> and R.W. Brunskill<sup>6</sup> have covered aspects of Midland and North Western technique and context. In addition, numerous short papers and articles from various hands, often concerning individual buildings, are scattered through the literature. A. Clifton-Taylor in his 'Pattern of English Building' brought some of this material together and his chapter on 'unbaked earth' is a useful summary of the main sources of information then available.<sup>7</sup> J. McCann's very recent 'Clay and Cob Buildings' has added new material in particular about Essex.<sup>8</sup>

It is the aim of this article to carry the argument further, from documentation into the realms of the nature of materials. This approach is implied but hardly ventured upon by Clough Williams-Ellis. Discussion will be about mud walls and walling material. In order to keep the exercise within reasonable bounds, matters of great importance such as finishes and the relationship of walling to roof, to floor structure and to the impervious base-plinth, are generally excluded; these form part of a much more extensive study which is in the process of preparation for publication at some future date.

The 'earthen' wall—the wall of "cob" in the West Country, "clay" in the North and East Anglia, "mud" almost everywhere else—was once as much part of vernacular building practice in England as was the daubed infill panel. The disappearance of the use of the technique, in some places at an early date, is always put down to rising economic expectations or to fashion, or both. But this argument does not account for anomalies such as the very late persistence of cob building in Devon, a persistence that is usually only explained in terms of conservatism.

This article takes a rather different view and considers the mud-wall and the survival of the technique in England from the

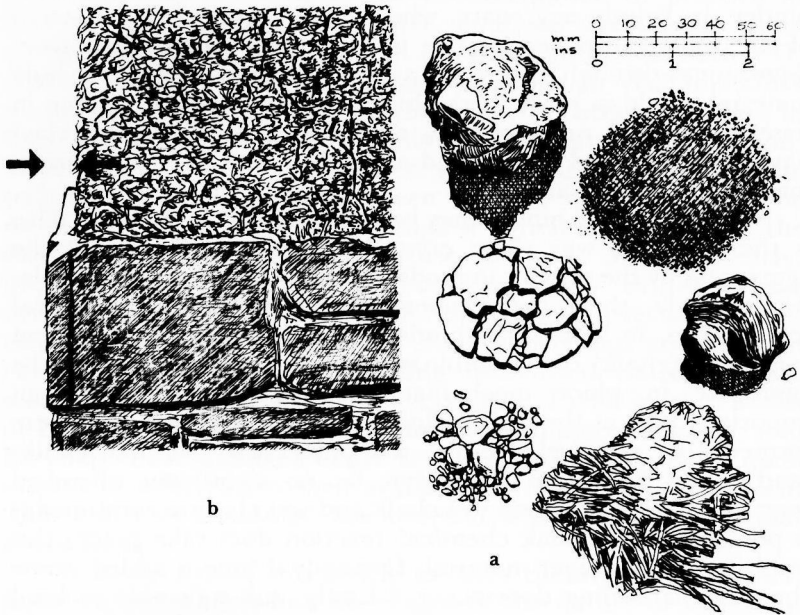
stand-point of the materials involved and from the workman's angle. It tries to show that just as there are good and inferior building stones, so there is good and less good 'mud' and that quality of material had a regional significance so far unexplored.

The minimum constituents for a mud wall built in the traditional wet-mixed and unshuttered way once commonly understood throughout the country were water, aggregate, and binder. In Britain aggregate, which is the inert bulking fraction of the walling mix, can range in individual particle size from large stones through gravel and sand to the finest silts. This bulk material is held in place by the binder which is usually present in lesser quantities; ratios of 80% aggregate to 20% binder (clay) have been recorded in England and this is said to be a common international mix-balance.<sup>9</sup>

Aggregate and binder may bond chemically in the wall. This is the strongest way. The crystal lattice formed around the aggregates by the cement in modern concrete is the best example. Alternatively they may cohere in a weaker, mechanical relationship. In Britain the binder was generally clay or calcium carbonate (chalk) or a combination of the two. Clay holds the aggregate in place mechanically with suction playing an important part at the wall-building stage. Sometimes walls were formed of relatively pure wet-pulverised chalk—"chalk-mud"—and here also there can be no significant chemical reaction. However, where wet chalk and wet clay are combined it is possible that a weak chemical reaction does take place, this resulting in a stronger material. Certainly if lime is added, some chemical hardening does occur.<sup>10</sup> Lastly, sub-soils able to bind chemically because they contain iron are occasionally found in England and are common abroad, as for instance in Africa. Agriculturally poor, these African subsoils are easily made into mud walling.

An understanding of the nature of clay holds the key to an understanding of the mainstream technique. Clay is difficult to use as a binder because it is volumetrically unstable—it expands when wetted and contracts again when dried. Drying contraction in clay causes cracking. Cracks weaken the wall and speed up the processes of weathering and decay. Dealing with potential drying-out shrinkage was thus a major pre-occupation for the builder in wet mud. This problem was circumvented when the quite different pise walling technique was used. Southern French pise walling practice called for the placing of an almost dry clay-based mix in thin layers between shutters. Each successive layer was rammed down hard to give a high level of mechanical cohesion. Since the clay element present was damp rather than thoroughly wetted, shrinkage contraction on drying was reduced to a point where it ceased to be a problem.<sup>11</sup>

The method was not popular in Britain (judging by the evidence of remaining mud buildings) where sub-soils may often have been over-damp to start with. The technique was probably rather too specific and 'scientific' to attract the peasant self-builders who became the mainstay of the tradition here. Wet-built mud walling appears to have been the preferred way.



1 Basic raw materials for clay-based mud: 1 (a) Clockwise, from top left; stone, fine aggregate including sand and silt, dung, staw, pebbles/gravel, clay. On a national basis dung and straw are not invariably present. (From a Cumbrian sample.)

1 (b) Close-up view of the junction between the stone base-plinth and cob walling in a recently erected small building in Devon (builder Mr. A. Howard). The clay in the sub-soil used was rather 'strong' and drying-out caused the cob to shrink inward on the plinth all round the perimeter of the building. The amount of shrinkage is indicated between the two arrows; it averaged between  $\frac{3}{4}$ " and 1". The building measures 8'4" by 13'4" in plan (2.530 m x 4.050 m). The 'strength' of the clay element here is also demonstrated in the pattern of small shrinkage cracks visible in the wall-face. Within established local tradition the use of such a clay 'as it stood' would probably have been avoided. The example demonstrates that even in Devon there are local sub-soils having considerable expansiveness.

Traditional practice used three separate but interlinked approaches to deal with the problem of drying-out shrinkage in wet-built mud walling. Firstly clay content in the raw material could be reduced towards the lowest possible level commensurate with it still fulfilling its function as the matrix within which the bulking aggregates were held. This was done by simply adding extra aggregate to a fixed quantity of the basic raw material. A

second precaution related to moisture content. Water was invariably added during mixing. Its function was to produce an homogeneous and malleable material capable of being formed into a cohering mass on the wall head. Too much water, however, and the clay element in the mix becomes ungovernable. Thus the builders strove to keep water content to the practical minimum. The less water initially present, the less the subsequent drying shrinkage. Thirdly, fibre was added during mixing. Straw was the most commonly used fibre, but there were many alternatives. The presence of straw did not prevent the formation of cracks, but it spread them out, distributing them more or less equally throughout the wall as hair-line fractures alongside each fibre as the clay shrank and drew together. Fibre was added for other reasons also. It was, for instance, used to assist drying-out, to help the material turn over more easily during mixing and to hang on the fork during placing. These were probably the roles it played with chalk-mud. But with clay-based mud, equalisation of shrinkage was its major function.

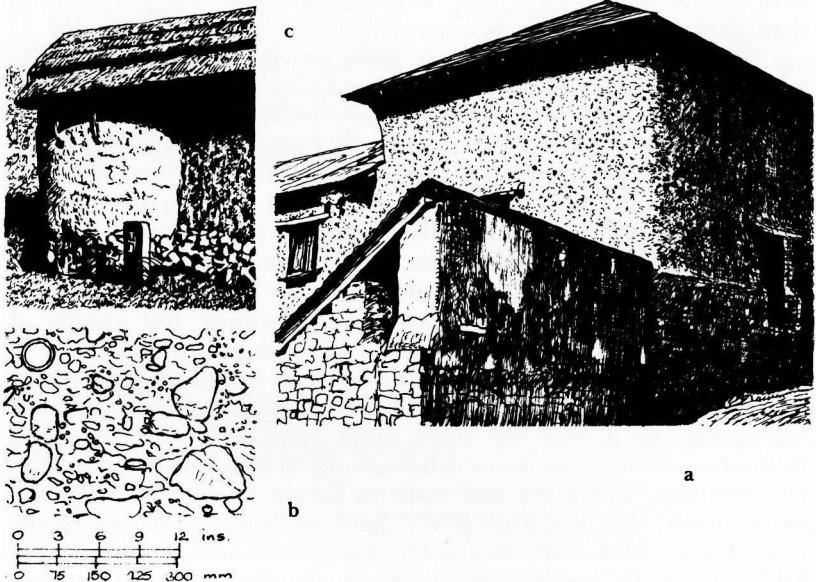
There are many different sorts of clay and the quantity present in any given sub-soil will vary from place to place. Some clays expand more than others when wetted. Those that expand least will be those most likely to produce the least cracking when built into the wall, and to survive best thereafter. Those that suffer a lot of expansion when wet, call for further special precautions during preparation, a fact that the tradition allowed for. In Britain it is probable that only the most 'expansive' of clay sub-soils were unsuited to 'doctoring' by rule of thumb method or by trial and error into some sort of mud walling. But quality of finished product must have varied a great deal.

If we find a wall without any fibre in it, it may have been wet-built using a very 'stable' clay combined with good aggregates, or it may use some other cementing agent such as calcium carbonate or iron carbonate, or it has been built by the pise method. There are cob walls in Devon, clearly built by the wet method, that are fibre-free.<sup>12</sup> Such walling also occurs in the English East Midlands. In the one case the binding agent is very likely a low-hydrating clay-mineral, in the other it is iron naturally present in the sub-soil that holds the mass together.

Just as clay types vary, so do the aggregates in mud walling. In some Cornish<sup>13</sup> and Morayshire<sup>14</sup> work a grading from clay and boulders set in a matrix of mud at the wall base, to a mix containing fine pebble aggregate at the wall head has been traced. Other kinds of mud show an even distribution of aggregate which can on occasion be little more than sand and the odd pebble.<sup>15</sup> Aggregates may be rounded as is the gravel in New Forest work,<sup>16</sup> or flat as is the 'shillet' in cob in parts of Devon and Cornwall, or angular and in a variety of shapes and sizes as is the

stone in the clay-work of the Solway Plain. In its range of aggregates the wet-built method has the advantage over the pise technique which cannot, for instance, accept flat aggregate of the Cornish type.

From a very superficial study of remaining mud walling in England it is clear that some mixes have performed better than others. Performance can be measured in two very obvious ways, through structural stability and through the resistance of the wall-face to weathering. Structural stability can be discounted in the work that survives today as the builders kept generally within large margins of safety. Walls usually fail because of factors other than walling-mix; foundation movement is a typical cause. Corner-bond failure is another common defect found in large sections of the tradition, spanning variations in walling-mix. Weathering resistance however, is a more relevant measure.



**2 Weathering:** 2 (a) A 19th century barn in 'Red' Devon. No sign of render remains on the walls. It is built on a site that is very exposed to the westerlies. Weathering shows as a deep cove under the eaves at the left, at the junction with the lower barn on this side. It has been exacerbated by lack of eaves guttering. It can also be seen at the junction between the high stone plinth and the cob-work at the right hand side of the illustration where there is a door set up into the wall. Everywhere small stones in the cob stand up proud of the general surface.

2 (b) A Churchyard wall in Leicestershire. To the right of the illustration is a well-weathered existing wall on a poor cobble plinth. To the left is a recently rebuilt and un-rendered section which turns the corner; as yet this shows little sign of weathering.

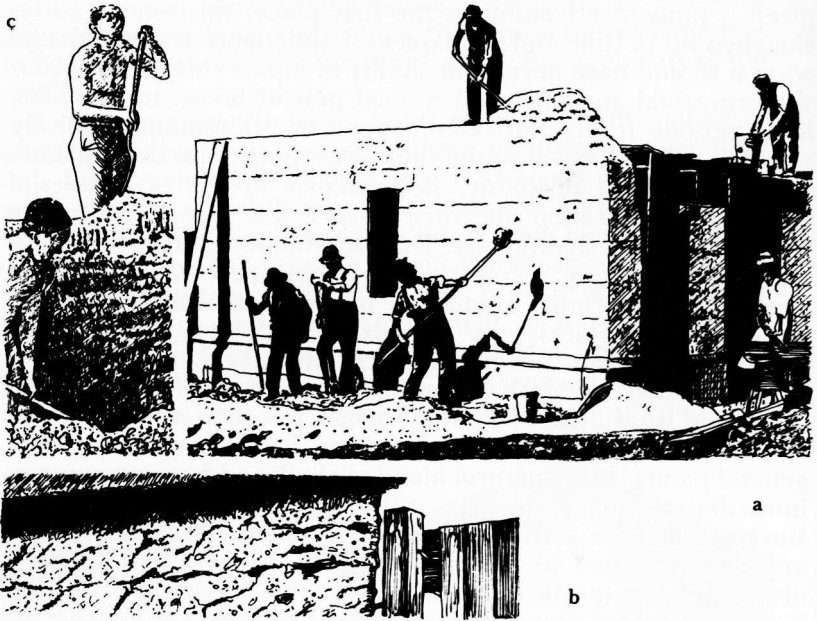
2 (c) Aggregate exposed in the face of a north aspect barn wall in Cumberland. (Camera lens-cap at upper left, for scale.)

Peasant mud-work was as often un-rendered as rendered. Even if given a protective coating in the first place, this tended to be sloughed off in time and subsequent maintenance was not always what it should have been. The ability of a particular mud, given the proverbial good hat and a good pair of boots, to stand for long periods in its fair-faced state and to remain relatively resistant to face erosion would thus be a strong point in its favour.

Perhaps less obviously, performance of the raw material during its preparation and then when it was first placed in the wall was of equal significance. For a self-build peasant society this stage was probably of paramount importance. A walling mix needing the minimum amount of preparation and allowing the work to rise as quickly, say as mortared masonry, would be the ideal. The natural mix having such advantages, if taken from beneath a shallow depth of top-soil, would have a lot to offer.

From what little we know, Wichert was such a sub-soil, and it is worth looking at it in some detail in order to make some general points. It is a natural blend of chalk and clay outcropping immediately beneath the topsoil in limited areas of Buckinghamshire and Oxfordshire. Surviving Wichert buildings are closely related to these outcrops. It is likely that this has always been so; for the builders the advantage of mud was lost if it had to be carted any distance. The clay element in Wichert is very expansive. Its strong and potentially destructive drying-out shrinkage and the countering of this by the quantities of more stable chalk present as well as by the ubiquitous straw, is displayed in clearly visible spaced-out vertical cracks that form at quite wide intervals within each course of Wichert. Were the chalk absent, a much closer pattern of deep shrinkage cracks would occur, and to such a degree that the wall would fail structurally regardless of the presence of straw. New Forest mud can sometimes be seen with similar large scale cracking betokening a clay of high expansiveness. In this latter case, the strong shrinkage was countered by the addition of extra aggregate which was carted in from at most, a couple of miles away.<sup>17</sup>

Before building could begin all 'muds' had to be mixed, and mixing time seems to have varied a lot. Compared to Wichert, for instance, the related but less heavily clay-impregnated variety of chalk-mud dug as rubble from shallow pits on the Downlands, may have required more work at preparation stage. In a wet state unadulterated chalk-rubble is very sticky indeed and it probably needed some effort to break it all down to an aggregate size and a consistency giving an acceptable dry-density in the wall.<sup>18</sup> With Wichert the percentage of naturally present clay combined with an already well-reduced and integrated chalk fraction must have facilitated mixing, making the material more immediately malleable than chalk alone, and cutting down preparation time.



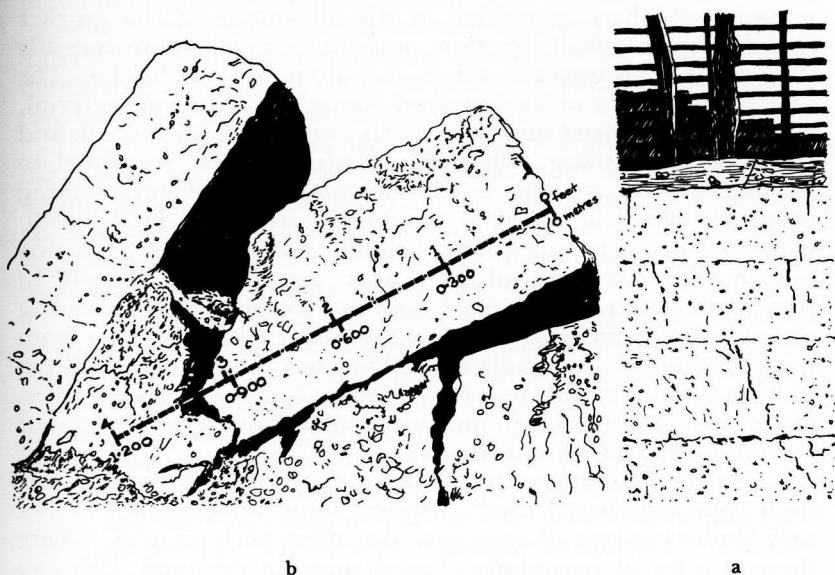
3 Method: 3 (a) Drawing made from a photograph in W.R. Jaggard 'Experimental Cottages. A report of the work of the Department at Amesbury, Wiltshire 'D.S.I.R., H.M.S.O., 1922.

This a chalk-mud wall. The man on the wall-head moves from right to left, backwards, placing the material as he goes. The man immediately below him hands up small amounts of material on the end of his trident or 'prong'. This has an especially long haft expressly intended for passing mud up the wall. The other tridents in use here have hafts of conventional length. However, some form of scaffold will eventually be needed here—the first floor joists probably served the purpose.

3 (b) Close-up of a section of mud wall at Whittlesey in Cambridgeshire. Note the 'scar' lines, intermixed with straw, running diagonally from upper right to lower left between quite shallow lifts. The waller moved from right to left. The example shows that the degree of consolidation of the material could sometimes be minimal.

3 (c) Re-building a chalk-mud wall at Andover in Hampshire in 1983. (Work for Hants. C.C.) The man placing the material has experience of building wet-shuttered cob in Devon. Once again there is minimal consolidation on the wall-head here.

When we turn to 'initial set'—the time taken by the wet material in the wall to become stable (but by no means dry)—the chalk or chalk and clay mixes will usually have had the advantage over simple mud mixes. This was apparently so in the case of Wichert. Walter Rose's comments on the subject<sup>19</sup> are conflicting but a more recent witness confirms that for any decent sized Wichert building successive 2' to 2' 6" high layers or 'lifts' could be superimposed one over the other once the work of course-laying had proceeded right round the wall and had arrived back at its starting point.<sup>20</sup>



**4 Wichert:** 4 (a) An interior view in a building from which the roof had been deliberately stripped. Note the vertical shrinkage cracks at quite wide centres.

4 (b) Collapsed wichert in the same building. Note the size and homogeneity of the great 'blocks' of wichert—these were formed between major shrinkage points. There is no bond between one course and the next; strong side loads cannot therefore be tolerated. In direct compression, however, wichert has considerable strength.

By contrast, to build a clay-based mud wall continuously called for an overall height restriction and special systems of course layering as in Cumberland, or for top class raw material and special skills in the workmen as in Devon. In the latter County continuous wet-mud building in which cob was put up into the wall without shutters and without the normal intermediate rests was sometimes practised. As the wall grew higher, its self-weight caused the mud at the base to bulge out and this surplus was pared away as it formed and passed back up for re-use on the wall head. This probably gave very well compacted mud-work at the wall-base.<sup>21</sup>

Usual clay and chalk based practice involved the 'lifts' already mentioned. Depth of lift varied from between perhaps 6" to 12" and 2'6" or even more, depending on the type of raw material. Lift-lines represent the height above which it was unsafe to proceed for fear of slumping or collapse. Here the work was rested until an initial set sufficiently strong to support the next lift was achieved. A day or two, or some weeks, might pass at this



point depending on weather and the performance of the local material. Wichert, partaking of the advantage of the quicker initial set of its chalk fraction, was thus erected more speedily than many mud-mixes in which clay alone was the binder. The sum of the factors so far described—an easily obtained material, a naturally balanced mix, and a mix containing both chalk and clay—gives a strong indication of why Wichert remained in popular use for so long in Haddenham and the surrounding villages.<sup>22</sup> When it comes to weathering resistance in the wall, however, the picture is rather different and it may suggest one reason why no mud of any great age is now known in Buckinghamshire. Chalk-mud does not survive face-weathering as well as do some of the better clay-based varieties. Seen from this point of view the chalk in Wichert is a disadvantage. But it was not a disadvantage that bothered the builders in recent times at any rate, and the local mud-vernacular shows a wide range of social type and building function.

The generalisation that chalk-mud “weathered more quickly than good clay-based mud” requires some qualification as not only binder but type of aggregate also affect performance. Where there is a lot of irregularly shaped stone in the mud, this can accelerate decay of the wall-face. In clay walling made from the drift subsoils of the Solway Plain, individual stones within the wall, some as large as tennis balls, become loosened at the face through rain and frost action. They fall away leaving surface pits and erosion develops further in these, to the detriment of the building. All the same, unroofed clay walls survive in the region, as in many other parts of England, for a surprisingly long time. Some of the best aggregate in English mud-work is the shillet of Devon and Cornwall. These flat slately fragments which were either present naturally or were carted in, were well suited to the building process and seem to perform well at the wall face. In some parts of the region they are combined with low-hydrating clays. The resulting cob can be among the most hardwearing mud in Britain. Because the particular clays used probably lacked the malleable quality of more expansive varieties the preparation of this type of grey or buff cob may have been assisted by overwintering—exposing the raw material to winter rain and frost to help break it down—as with brick-earths. The practice is well documented among cob builders in Devon.<sup>23</sup> By contrast, subsoils from adjoining deposits in the county—the ‘Red Devon’ areas—were in all likelihood simply prepared. In the wall though, they are not as erosion resistant, the quantities of soft sand which they contain being easily washed down.<sup>24</sup> As with the sand in lime mortars, sharper sands in clay walling bind better than soft varieties.

Sand is in fact the major bulking element common to clay-

based mud work throughout Britain. This not only because it is a common element in sub-soils but also because its small grain size makes for good compaction—dry-density—in the wall. With it, reasonable compaction could be achieved with the minimum of physical effort on the part of the builders.

The smallest scale of aggregate, silt, is a good pore-filler but can hardly be said to cohere mechanically at all. This makes it highly vulnerable to rain wash. There is also the possibility, with an excess of silt, of shear-failure and collapse under load, a factor suggesting that a better use for it may be in armature supported mud-walling such as wattle-and-daub.

The techniques of the chalk-based tradition have already been touched on and to complete the picture two other regional traditions—both based on the use of clay as binder—will be described and discussed. Before doing this, however, some general notes on the major remnants of the practice as it survived in England into the early 19th century will be useful.

Mud in Britain was drawn from three main sources—the chalk and the true chalk-marls, the true sedimentary clays, and the drift deposits. Other types of superficial deposit were also used but the drift sub-soils, by reason of their sheer extent, were the major superficial source. As far as chalk-based practice is concerned, the method must once have been commonplace over the open chalklands. One 19th century reference indicates that in the 18th century it may even have been in use as far north as the Yorkshire Wolds.<sup>25</sup> Much chalk-mud survives on Salisbury Plain almost all of it recent. However it may be that in other chalkland areas where flint could easily be gathered from the surface of the fields rather than having to be quarried from pits, mud fell out of use early.<sup>26</sup> Certainly flint is today the exclusive 'poor' vernacular material of east Hampshire and into Sussex. In the chalk districts that remained well-wooded, chalk-mud could not have competed although it would always have been difficult to beat for jobs like boundary walling.

In the case of the natural chalk and clay mixes of the chalk escarpment-foot from Dorset to Cambridgeshire, Wichert survived in use because of its unusual natural advantages and because of particular local circumstance. In south Cambridgeshire and neighbouring Hertfordshire, the economical early 19th century Improvers took another good local source and turned it into very serviceable mud-brick.<sup>27</sup> Apart from these concentrations a sprinkling of mud and chalk-mud walling could still be found thirty five years ago in most of the Counties through which the escarpment passes.<sup>28</sup>

For the sedimentary clays, the West Country was the main stronghold of the method. This is not really surprising as national levels of susceptibility to shrinkage and expansion in clay

sediments are at their lowest in that region with, conversely, the most 'volatile' clays being found in eastern England.<sup>29</sup> It is suggested here that the area of the region covered by the Culm Measures and the Devonian Slates and Shales was the longstanding heartland of the technique in the West, supplying top grade material over a wide area. All aspects of the tradition except, on present evidence, the Cumbrian/Dumfriesshire method, were recently known in Devon. Both unshuttered (free-piled) and shuttered (locally 'boxed') systems of erecting wet walling were employed in the County in the last century.<sup>30</sup> 'As-found' material was used wherever possible but mix-balancing was also standard practice. Cob-brick comes to light now and then in partitions.<sup>31</sup>

Fully load-bearing cob survives in Devon from an early period—cruck feet were raised up into the walls of farm houses there in the 15th century.<sup>32</sup> This confidence in the material shows again in the common arrangement of chimney-flues constructed entirely of cob as far as the roof level. Cob in Devon always had a wide range of rural user and was employed for most building purposes. The survival of the method there was far from being a purely cultural matter. There are good reasons for considering that the quality of the local mud gave it practical advantages that outweighed both the national preference for the timber frame, and the straight evolutionary move to stone walling, and secured its use in the countryside of the West over a very long time.

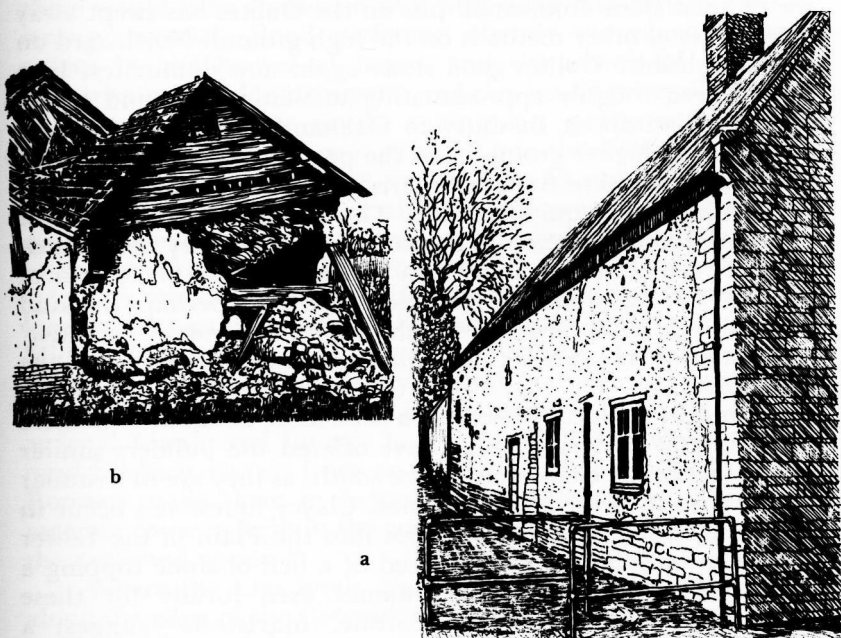
The mud-work of Somerset may be considered as the most northerly point to which the western tradition shrank when its more general use contracted and it is of course closely linked to that of Devon.<sup>33</sup> Along the southern coastlands eastward from Devon, the chalk and the clays, showing varying degrees of expansiveness, recently carried the method as far as the New Forest.<sup>34</sup> The East Midlands, a second and less extensive clay-based heartland zone, is one of the two areas to be discussed in more detail later.

The drift deposits of Northern England and East Anglia were the third main materials source. By the early 19th century, those of the North continued to supply only the builders of the coastal plains of the Isle of Man,<sup>35</sup> Lancashire,<sup>36</sup> Cumberland,<sup>37</sup> and Holderness in East Yorkshire.<sup>38</sup> But the technique had been known not long before in Cleveland,<sup>39</sup> Northumberland and Durham.<sup>40</sup>

In East Anglia and bordering counties, buildings in mud, chalk-mud, and mud-brick made from both sources, can still be seen in many places from the boulder clays of northern Bedfordshire<sup>41</sup> to those of Suffolk and from similar glacial clays west of Norwich to as far south in Essex as the fringes of north London.<sup>42</sup> Mud-brick in this region all seems to be of late 18th

century or later date, although it has been claimed that this particular method is old established locally. The genesis and fine detail of this tradition are a study in themselves and space precludes discussion here. It is sufficient to note that although the clay in drift deposits is often of a highly shrinking sort, the relatively easy availability of chalk through much of the region gave the opportunity of offsetting its more extreme effects.<sup>43</sup> Mix-balancing with chalk as both bulking and part binding agent seems often to have been used.<sup>44</sup> A shortage of good quality alternative building material must have been a powerful influence on the survival of mud and chalk-mud walling techniques locally. With the arrival of the Improvers mud-brick seems to have come into extensive use for cheap building.

To conclude, and to demonstrate the flexibility of English sub-soils from the mud-waller's viewpoint, two now widely separated and localised traditions will be described — those of the East Midlands and of the Cumbrian Solway Plain. The former



**5 Northamptonshire and Norfolk:** 5 (a) Northamptonshire. A flank wall, at right angles to the street, built in mud; the gable facing the street is of stone. The mud was once rendered.

Combinations of stone and mud are very common in the area and demonstrate the relative stability of some local sub-soils.

5 (b) Norfolk; Collapse. Part of a 19th century 'model' farmstead being rapidly, and deliberately, despatched whence it came. Note the continuity of the section of mud wall still standing within the gable end. Its configuration suggests that a continuous building technique of some kind was used here, possibly between boards.

drew on a range of sedimentary raw materials while the latter was a purely drift derived method.

The recent heartland of Midland tradition ran from around Northampton to Leicester, with straggling surviving buildings reported as far to the west as Warwick and eastward to Rutland.<sup>45</sup> In fact 19th century walling survives today even further to the east at Whittlesey on the Fen edge. Nearby the poet Clare was familiar enough with buildings using the technique around his home village of Helpstone; this was in the early 19th century and all such work is now lost. The region thus indicated extends from some of the higher limestones out onto the clays of the Midland Plain and also in the other direction to the clays of the Fen margin. Clearly mud once marched with stone here, and not so long ago either. Built evidence suggests that the influence of local drift deposits through the area can be discounted.

An important aspect of the Midland tradition is its relationship to the limestones. To the south, in the Cotswolds the use of good stone from small pits on the Oolites has swept away most traces of other methods on the high ground. Northward on the Lincolnshire Oolites good stone again now dominates. In a central area roughly approximating to that where mud is still evident, from about Banbury to Oakham, a mixture of strata make up the higher ground. For the peasant builder the quality of stone varied here from one parish to another and brick only became important quite recently. The increasing significance of iron in the sub-soil becomes apparent from Banbury northward. It can be seen in the change from buff to brown in the colour of the local stone as well as in the fields. These are perhaps the kind of circumstances where one might expect the more 'primitive' vernacular techniques such as building in mud to survive on the stonelands.

Considering local geology in a little more detail the extensive Lias Clays of the region may have offered the builders similar advantages to the chalk-marl to the south, as they are in a similar relationship to overlying limestones. Clayey limestones occur in the Upper Lias Clays and well out into the Plain in the Lower Lias. The Middle Lias is composed of a bed of stone topping a thick bed of silty clay. The names used locally for these formations—cementstone, ironstone, marlstone—suggest a material with potential for the builder. Walling based on these sources seems to have been stable, although still needing the addition of fibre, and wears well in the wall.

Above the Lias Beds is the Inferior Oolite and the Northampton Sands of this formation produced an iron-carbonate bound sand-based walling that was the most flexible regional mud of all—a mud that required no fibre when wet-mixed. This useful material must have established the method

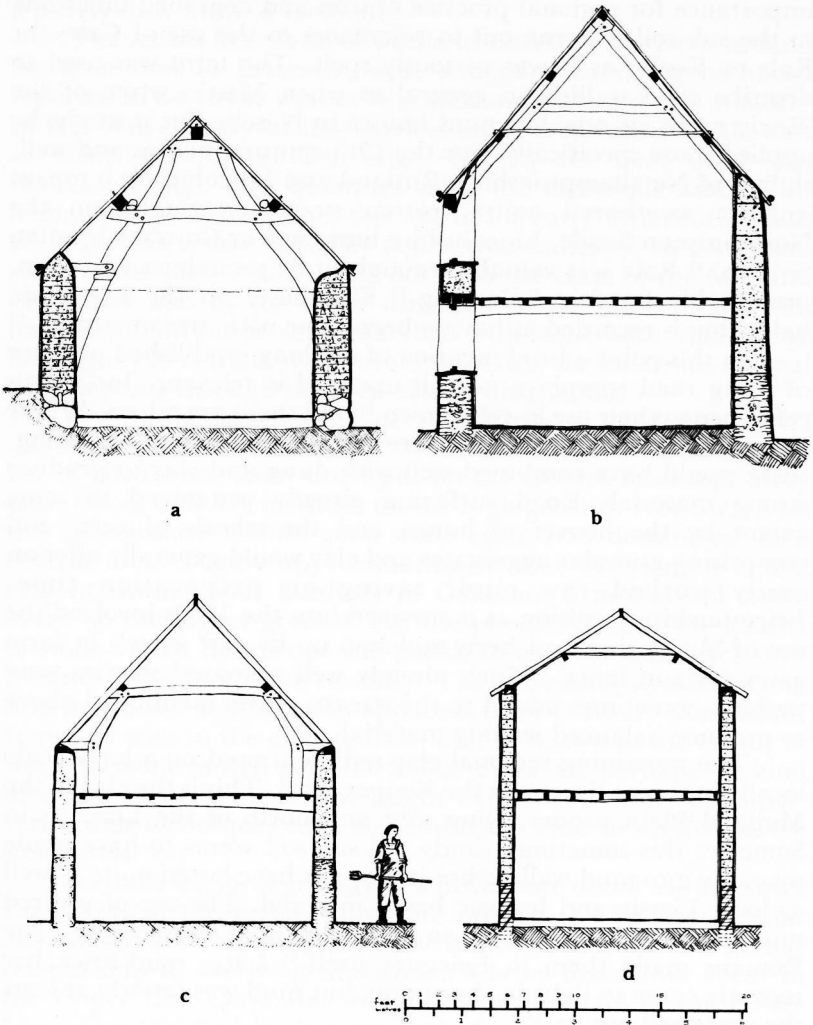
very strongly for some classes of building locally.<sup>46</sup> The importance for regional practice of iron and degraded limestone in the sub-soil is borne out in references to the use of Cale—or Kale or Keale, as it was variously spelt. The term was used to describe mud walling in general as when Mastin wrote of the 'Kealy earth' of now lost mud houses in Naseby,<sup>47</sup> or it might be applied more specifically. For the 19th century masons and well-sinkers of Northamptonshire, Rutland and Lincolnshire it meant 'surface weathered oolite, rotten stone ... usually on the Northampton Sands, Lincolnshire limestone or Cornbrash; often reddish'.<sup>48</sup> Kale was valuable enough to be sometimes carted-in, presumably for mix balancing.<sup>49</sup> Elsewhere, on the Lias, mix balancing is recorded as having been done with 'stream gravel'.<sup>50</sup>

At this point a brief mention of the long-established practice of using road scrapings as wall material is relevant. Innocent's reference to their use is well known,<sup>51</sup> and there are others. Where forms of crushed limestone were employed as road surfacing, these would have combined well with dung and clay to produce strong material. Road surfacing already pre-mixed to some extent by the hooves of horses and the wheels of carts and comprising granular aggregates and clay would generally offer an easily worked raw mud, saving on preparation time. Leicestershire tradition as it survived into the 1960s involved the use of 'slurry that had been mulched up by cart wheels in farm gateways and lanes'.<sup>52</sup> Such already well prepared slurries were perhaps sometimes added to the stream gravel mentioned above to produce balanced walling material.

The remaining regional clay-sediment used on a large scale locally in recent times was the Keuper Marl. This is the clay of the Midland Plain proper, lying west and north of the Lias. As in Somerset this sometimes sandy red sub-soil seems to have made up easily into mud walling but it may not have lasted quite as well as local Liassic and Jurassic based material. The use of unfired mud-bricks is known from an early date in Leicestershire—the Romans made them in Leicester itself.<sup>53</sup> Later mud-brick has recently come to light in the county but mud was latterly at least the preferred option.<sup>54</sup>

Where the Lias levels are less widespread, as to the south along the edge of the Cotswolds, there is today little sign of mud walling either on them or on the adjacent Keuper Marl. It is suggested that the survival of the method on the red Marls of the East Midlands may be evidence of a contraction towards a heartland of better raw material. In this case the better raw material was of course that derived from the locally extensive Liassic and Jurassic formations.

To the north of Leicester mud buildings are still found on the Keuper Marl as it passes via the Vale of Belvoir into



**6** Some examples of mud walling from different parts of England: 6 (a) Northern 'clay' derived from the drift deposits of the Solway Plain. 6 (b) West Country 'cob' derived from the Permian Marl. 6 (c) Buckinghamshire 'wichert' derived from the Portland Beds. 6 (d) East Anglian 'lump' derived in this case from the 'chalk-marl'.

Nottinghamshire.<sup>55</sup> The method probably extended from here into Lincolnshire not too long ago. In the latter county mud seems once to have been a standard option for the builders but not much is recorded about its distribution there. Ancient ways of making walls have been shown to survive in Lincolnshire and more research might pay dividends.<sup>56</sup> The usual assumptions about raw material and performance would apply. As with parts of Leicestershire the until recently 'underdeveloped' nature of agriculture and shortage of good alternative building materials in parts of the County will have contributed to the survival of the practice there. Lincolnshire mud is the only remaining connection between the traditions of the Midlands and those of the North. The link is made across the Humber to the boulder clays of Holderness.

The mention of northern boulder clay brings us to the last substantial tradition to be discussed. In its consistent use, almost to the end, of the cruck or cruck-derived frame and in the mode of wall-building adopted, Cumbrian work as a whole is now unique in England.<sup>57</sup> With its clearly defined modern geographical and geological limits it parallels the present state of such materials as Wichert. However it continued in use into the early 19th century for rather different reasons. It is the classic example of the perpetuation of the technique due to the lack of suitable alternatives. Within the Solway Plain good stone lay too far away for ease of transport and improvement did not clear the ground as it did in Scotland. 19th century re-building, from convenient local supplies of stone, brought the loss of most of the built-evidence of the related tradition in the equivalent parts of Dumfriesshire, over the Solway Firth.<sup>58</sup> It is now through the countryside of the Solway Plain that the most obvious signs of the method are to be seen but it is clear that its use was common also in the small towns of the area.

In this part of northern Cumberland, then, the material was used because there was little choice. The glacial drift of the Plain is too deep and too extensive for other mass-walling material—apart from awkwardly shaped cobbles—to be economic. Brick was a late arrival although eventually it did succeed in supplanting mud. The preference for the mud wall as against the daubed panel could perhaps be put down to a shortage of timber but this is a supposition that cannot be pursued in detail. Whatever the background to the survival of the technique here there is no doubt that what remains today demonstrates that non-calcareous drift sub-soils could be coaxed into producing substantial and long-lasting walling. Although northern drift sub-soils usually contain expansive clays the effect of these, as has already been noted, can often be checked by the large quantities of aggregate present. The drift of the Solway



Plain may even have been useable 'as found'. It is a moot point as to how much this, or similar, methods were once used in the North. It is likely that wherever sub-soils of the right sort were extensive enough—usually on the lower lands although even in the upland valleys good materials sources are to be found—they will have been part of the vernacular builder's vocabulary.

The alternative local name for the clay walls of the Plain is 'dung wall'<sup>59</sup> and this draws attention to a particular feature of the technique. Adding dung to the mix was very much a part of national clay-based walling practice. There is insufficient space here to discuss the detail of the various advantages of the use of dung. However in the case of the Cumbrian drift material it may have acted, among other things, to facilitate mixing. This would be so where the overall percentage of clay present was on the low side. In modern useage the dung—added, one assumes, pretty wet—would be termed a plasticiser.

The Cumbrian and Dumfriesshire method of wall building has been very well documented and described and although it is hard to believe it there is no doubt that a great deal of substantial clay walling in the region was put up very quickly indeed. Evidence for the usual national practice of erecting the mud in staged lifts, each of some depth, is found in the area but far more common are walls constructed throughout of much thinner courses that from a distance look not unlike irregular brickwork. These courses are in fact continuous layers of wet-mixed mud separated by beds of straw. Such straw beds occur in other regions (they are another detail of the tradition that must await discussion elsewhere) but rarely so consistently, at such close vertical centres. The theory here put forward is that these thin lifts, within beds of straw which run right through the wall thickness, were the instrument by which stability during continuous construction was achieved. As the wall rose so surplus water would be drawn and squeezed out at each level of straw-bed on the principle of the cider press. The sheer accumulating self-weight of the wall would stabilise the lower levels. As with the majority of other vernacular mud walling this work was free-built without shuttering, and the sides were pared back on completion.<sup>60</sup>

For the student of vernacular building the remains of this now isolated tradition are of great importance, as are their rather different equivalents on the Fylde Plain and in Lincolnshire. They embody building practices and systems both of walling and roofing and demonstrate attitudes to materials and the use of the dwelling, that are now largely vanished from many other parts of England. Every year the number of 'clay dabbins' on the Solway Plain continues to decline just as when Ronald Brunskill surveyed the area over 25 years ago. The remnant ought to be properly

investigated and secured before it is too late; we will otherwise lose a unique chance of looking into the minds of builders with a different set of priorities from those whose work survives in the high craft tradition of the South Country.<sup>61</sup>

And in one respect this argument can be extended into the other 'heartland' areas of English mud building. In Cumberland the fragile visual evidence of ancient practice awaits closer investigation. But in Devon and the Midlands and perhaps in the chalklands too—all with their ever declining stock of mud buildings—the oral lore of the tradition still lives on. Those who have worked with the material or who knew others who once did so, are still to be found. They can give many more insights into detailed practice than have been offered here. They should be sought out before their contribution is lost for ever.<sup>62</sup>

## NOTES AND REFERENCES

1. 'Gie un a gude hat and pair of butes, an' ee'l last for ever' is the better known rendering. I am grateful to Devon County Library Service for the alternative and more realistic reference.
2. S.O. Addey and J. Summerson, *The Evolution of the English House*, 2nd edition 1933, E.P. reprint 1975. See pp. 61-65 for the well known description of 19th century mud houses in Holderness.
3. C.F. Innocent, *The Development of English Building Construction*, Cambridge 1916. See Chapter X 'Walls (continued)' where the mud wall is described alongside the various daubing techniques. In terms of basic material the two methods are of course closely related.
4. Clough Williams-Ellis, *Cottage Building in Cob, Pise, Chalk and Clay* Country Life, second edition 1920.
5. M.V.J. Seaborne 'Cob Cottages in Northamptonshire', *Northamptonshire Past and Present*, 1964, Vol. III no. 5 pp. 215-228. See also, by the same author, 'Cob Cottages in Northamptonshire—a postscript.' *N.P. & P.*, 1965-1966, Vol. III no. 6, pp. 283-284.
6. R.W. Brunskill 'The Clay Houses of Cumberland' TAMS., New series Vol. 10. 1962 pp. 57-80.
7. A. Clifton-Taylor 'The Pattern of English Building' 1972, Chapter 11 pp. 287-293.
8. J. McCann, *Clay and Cob Buildings*, Aylesbury 1983.
9. For Devon see the analysis quoted in Clough Williams-Ellis, *Cottage Building in Cob, Pise, Chalk and Clay*, Country Life, second ed. 1920, p. 36. Advice on mix-balances internationally from R. Hughes.
10. See J.R. Coad, 'Lime-stabilised soil building blocks', *Building Research and Practice*, March/April 1979 pp. 80-88. This documents experiments carried out with two African 'soils'. One, a tropical lateritic soil showed very marked strength improvement when lime was added. The other, a brown soil having an appearance similar to an English 'clay', also showed strength gain, but less so.
11. For the best recent summary of the Pise method see Craterre *Construire en Terre*, Paris 1979. This includes a useful bibliography.
12. Information from John Deal, A.R.I.B.A.
13. For the general Cornish background and a little on construction see V.M. & F.J. Chesher, *The Cornishman's House*, Truro 1968, particularly p. 41 and 99.
14. B. Walker, *Clay Buildings in North East Scotland*, Scottish Vernacular Buildings Working Group, Dundee and Edinburgh, 1977. p. 18.
15. As for instance in a cob dovecote in Durligh, Somerset, described by R.F. Taylor in *Somerset Archeological and Natural History Journal*, 112 (1968), pp. 101-103.

- Here evidence suggested that the nesting holes were cut out of the mud wall after erection. Robert Taylor commented 'This technique of cutting the nesting holes accounts for the absence of stones in the cob...'
16. For a thorough exploration of this important local tradition see J.F. James, *Vernacular Architecture in the New Forest*, Hampshire Field Club, New Forest Section, Annual Report 1977. pp. 20-25.
  17. Information from J.F. James.
  18. See R. Whitlock *The Folklore of Wiltshire*, 1980, p. 87, where it is stated that it took an hour or two to get the material to the right consistency for wall-building. This may be an exaggeration but the implication that considerable effort was needed is no doubt true.
  19. Walter Rose, *The Village Carpenter*, Cambridge 1937. The description on pages 101-102 implies swift construction. Elsewhere—in the Appendix to Harman's *Buckingham Dialect* 1929, p. 166—he suggests that the drying period between lifts could be relatively lengthy. Here he writes that, weather permitting, a wall 7'6" high could take a fortnight to erect, and that this was considered quick. (It is interesting to note in passing that 'Buckinghamshire Dialect' gives the local word for a lift as "berry". It is perhaps possible that this term derives from the Anglo-Saxon for a 'mound', an apt description of a lift of Wichert before paring-down.)
  20. Walter Rose's view of erection time is contrasted here with that of Mr. J. Nelms, an established second generation builder in Haddenham. In a conversation recorded on 4th June, 1976 he stated that 'in an average barn building (the mud) usually set in time for the next layer to procede without delay'. I am indebted to Mr. M.R.G. Andrew, Assistant Conservation Officer, Buckinghamshire County Council, for this and the previous reference.
  21. In the mid 1960s the architect John Deal, working with a team of architectural students near Dunsford in Devon, used continuous construction. However in this case the mud wall was only free-built on one side. The other side of the wall was contained behind a permanent shuttering of stonework. As the cob wall rose it bulged at the base in the way described and was beaten back and pared away as necessary.  
The contrasting quick set of chalk-mud is confirmed in a Department of Scientific and Industrial Research paper edited by the Architect W.R. Jaggard, *Experimental Cottages. A report of the work of the Department at Amesbury, Wiltshire*, H.M.S.O. 1922. Here, under the description of the traditional 'Winterslow' method it is noted that the 'lift is carried right round the building and by the time the waller has returned to his starting point, the mud is sufficiently solid for him to commence upon the next course'. p. 18.
  22. These points emerged as a result of discussion and correspondence with Mr. M.R.G. Andrew of Bucks. County Council.
  23. B.W. Oliver, 'The Devonshire Cottage', *Transactions of the Devonshire Association*, Vol. 18, 1949, p. 37. Overwintering might be done in the corner of a field (not too far from the building site), in which bullocks were penned over the material with liberal amounts of straw as in the normal yard. The result, in the spring, was ready-mixed cob. I am grateful to Mr. R. Stanes for this information.
  24. This is also the view of two independent experts—John Deal A.R.I.B.A. and Mr. J. Morgan, Devon plasterer and builder specialising in the rehabilitation of cob buildings.
  25. Wold cottages in the 18th century—H. Woodcock, *Piety Among the Peasantry*, 1889. 'The cottages were mud walled and thatched roofed about six feet high; I am grateful to Mrs. V. Neave for this reference.
  26. This theory arose out of discussion with Mr. G. Pearson of Hampshire County Council Architects Department. Mr. Pearson's Architectural Association Dissertation 'Chalk: its use as a structural building material in the County of Hampshire' April 1982, includes a valuable survey of distribution of remaining chalk-mud building in the County as well as information on technique etc.
  27. At an earlier period 'mud' was used to wall round churchyards in this area. It is still to be seen in a few places in the county.
  28. References by village in Murray's *Berkshire Architectural Guide* ed. J. Betjeman and J. Piper, London 1949; for the Vale of Pewsey see G. Grigson, *An English Farmhouse* London 1948; for Dorset see references in R.C.H.M. volume for Central Dorset, to cob below the chalk escarpment and even westward across the clay Vale on the Limestone.

29. See R.M.S. Perrin, *The Clay Mineralogy of British Sediments*, Mineralogical Society (Clay Minerals Group) London 1971; B.W. Avery & P. Bullock, *Minerology of Clayey Soils in Relation to Soil Classification*, Soil Survey, Harpenden, 1977; B.R.E. Digest, *Low-rise buildings on shrinkable clay-soils, Part I*, D.O.E./H.M.S.O. 1980.
30. One method of climbing-shuttering—the same as that used for Pise—is described in C.H. Laycock, 'The Old Devon Farmhouse', *Transactions of the Devonshire Association 1920* (Vol. 52) p. 180. Shuttering in one form or another may well have been used in Devon long before this. Latterly it was known among the squatter communities of the New Forest; see *Innocent op. cit.* p. 135. The tradition of its former use still lingers in the area (information from J.F. James).
31. Particularly good examples have been found by Mr. J. Uglov in Thorverton. For the general point I am indebted to Mr. C. Hulland of Bampton.
32. See C. Hulland 'Devonshire Farmhouses Part V: some Medieval Houses in North and Mid-Devon' *Trans. Devonshire Assoc. for the Advmt. of Science*, 112 pp. 127-170, December 1980, partic. pages 155-156.
33. I am grateful to Mr. M. Batt for first bringing to my attention the rough correspondence of the spread of remaining Somerset mud-work to the local extent of the Keuper Marl.
34. The clay sub-soils of the New Forest are expansive when compared to some of those of the West but they become still more unreliable and therefore difficult to use eastward from Southampton.
35. Latterly at least the Island had little woodland. Mud was used in company with sod on the boulder clays of the northern lowlands. There was much here that was reminiscent of recent Scots and Irish practice. M. Killip, *Manx traditional houses, furnishings and household goods*, Scottish Society for Northern Studies, 1977, 10, pp. 3-16, is the standard reference. A.W. Moore, *Folklore of the Isle of Man*, Man and London 1891 pp. ii-v is an earlier source. Innocent, of course, had been here too.
36. Personal communications from R.C. Watson and R.F. Taylor. See also R.C. Watson and E.M. McClintock, *Traditional Houses of the Fylde*, Centre for North West Regional Studies, University of Lancaster, Occasional paper no. 6. Chapter II; and R.F. Taylor, 'Three cruck buildings in Lancashire and Cheshire—1, Pudding Pie Nook, Wrea Green', *Historical Society of Lancashire and Cheshire*, Vol. 117, 1966, pp. 33-47.
37. R.W. Brunskill 'The Clay Houses of Cumberland', *TAMS New Series* Vol. 10. 1962, pp. 57-80.
38. S.O. Addey and J. Summerson, *The Evolution of the English House*, second ed. 1933, E.P. Reprint 1975. Henry Best of Elmswell mentions the material in 1641. Further documentary information kindly supplied by Mrs. V. Neave.
39. Captain Cook was born in a mud-walled cottage at Marton just outside what is now Middlesborough. See A. Kippis, *The Life of Captain James Cook*, 1788.
40. For Northumberland see T. Bewick, *A Memoir of Thomas Bewick, Written by Himself*, 1862. New Ed. Oxford, 1975, p. 30—'... the "Lodge" (or earth built Hovel) close by my fathers Pit...'; see also T.H. Turner & J.H. Parker, 'Domestic Architecture in England', II, (1853) pp. 200-201.
41. At Melchbourne in North Bedfordshire there is a long terrace of estate cottages built of mud. It is claimed that this is amongst the earliest estate housing in the County, appearing to date from early 17th century. See P. Bigmore, *Bedfordshire and Huntingdonshire Landscape*, 1979, pp. 144-145.
42. A small mud barn still stood at Theobalds Park Farm in Hertfordshire in 1979-80. Information from R. Hughes.
43. Chalk underlies much of the drift in East Anglia as well as being itself an important constituent of the drift.
44. See for instance the description of Essex practice in 1843, by the Rev. Coppinger-Hill, quoted by J. McCann in his 'Clay and Cob Buildings' *op. cit.*, pp. 3 and 4.
45. See Seaborne 'Cob cottages in Northamptonshire' *op. cit.* for the basic distribution map (1964). Further discoveries have since been made but the area of main concentration remains as shown.
46. The author first raised the possibility that iron in the sub-soil was relevant to mud wall construction in parts of Northamptonshire at the meeting of the I.C.O.M.O.S. 'Committee on the Conservation of Buildings Constructed of Soil' held in London in October 1979. R. Hughes subsequently analysed local material and found this to be the case.

47. Rev. J. Mastin, *The History and Antiquities of Naseby*, Cambridge 1792, pp. 6-9.
48. W.J. Arkell and S.I. Tomkiewic, *English Rock Terms*, Oxford 1953. See under Kale pp. 64-65.
49. One of M.V.J. Seaborne's correspondents quotes from 'Stocks' book on "Market Harborough Parish Records 1531 to 1837". At Sutton in 1712 payment is recorded for "71 loads of Cale"...'. Seaborne, 'Cob Cottages in Northamptonshire—a postscript.' *op. cit.* p. 284.
50. Information kindly supplied by David Smith from notes taken in the mid 1960s of conversations with two Leicestershire workmen who had built and repaired mud walling locally.
51. Innocent 'The Development of English Building Construction' *op. cit.* p. 135.
52. Information supplied by David Smith as ref. 50 above.
53. See N. Davy, *A History of Building Materials*, London 1961, Plate XIII opposite p. 52.
54. Further information from David Smith.
55. With regard to new discoveries in this area I am grateful to J. Samuels for a sight of his 1979 draft of a contribution to the *Transactions of the Thoroton Society* 'Mud walls in Flintham and Thoroton, Notts.'
56. I am grateful to David Roberts for supplying information on former practice in the County.
57. The system of framing was of course once extensively used in the North but there are no other remaining concentrations of equal density, unless on the Fylde. It is now clear that the system once extended over the Border and through Scotland. The tradition was no respecter of national boundaries.
58. A very few clay buildings survive in Dumfriesshire. I am grateful to G. Stell for advice on the reasons for the loss of the evidence in south west Scotland.
59. Information from Brian Sinclair, second generation Cumbrian builder.
60. This was clear from observation when inspecting the fair-faced mud compartment wall abutting a cross-passage, above ceiling level, in a Cumbrian clay farmhouse. This wall had been untouched and possibly unseen from the day it was built. It was noted that all the projecting staw ends in the wall (and there were a great many) were bent downwards in the same direction. This can only mean that the face was pared-down from above, either by the use of a mattock type tool at the face or by means of a spade. Shuttering would have caused the straw ends to lie in all directions.
61. A relatively detailed survey was carried out at Lamonby Farm, Burgh by Sands, Cumberland, during its recent rehabilitation and conversion. It is hoped to present the results of this survey at some future date.
62. Contrary to the view expressed in a recent television programme, Mr. A. Howard from the hamlet of Morchard Road near Crediton is far from being the only remaining link with the old tradition. Such claims underestimate the tenacity of the old rural culture in regions like the south west. This does not of course in any way devalue the importance of Mr. Howard's unique continuing contribution.

## ACKNOWLEDGEMENTS

The author would like to express his gratitude to the following for their interest and for their invaluable assistance, advice and criticism; Martin Andrew, Dr. Ronald Brunskill, John Deal, Brian Giggins, Alfred Howard, Charles Hulland, Jude James, John McCann, Jim Morgan, Mrs. Vanessa Neave, Gordon Pearson, David Smith, Robert Taylor and John Uglow also the many other individuals and members of the Vernacular Architecture Group who agreed to meet or to correspond. Lastly I wish to thank Richard Hughes for pointing me in the direction of the 'nature of clay'.