A TALE OF TWO EXCURSIONS

by

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Geological, Historical and Environmental Aspects of Gypsum in Derbyshire and Staffordshire

The recent resurgence of interest in geological and historical aspects of the gypsum plaster and alabaster industries began with the almost simultaneous, though quite independent, publication of papers by the writer (Firman, 1984) and J.A. Young (1984). A critical re-examination of each others evidence soon revealed inconsistencies which needed to be resolved and led to the reassessment of both the published and unpublished evidence. Comparative studies of Farey (1811), enclosure documents, and geological maps led to a fuller understanding of the beginnings of nineteenth century gypsum mining (Fig. 1). Furthermore, copies of abandonment plans from the Mines Records Office and Forman's diaries allowed the geographical limits of gypsum mining and quarrying to be defined and dates of closure established (Fig. 2). The resulting paper (Firman and Young, 1986) was the first of a series of cooperative research projects involving the Chellaston History Group and the Geology Department at Nottingham University in effect reviving the close association between Chellaston and Nottingham concerning gypsum which existed in the heyday of the pre-Reformation alabaster industry (Cheetham 1962, 1970).

The practical implication and contemporary environmental relevance of this, hitherto esoteric, research was dramatically emphasised by events following Derbyshire County Council's proposal on 26 November 1987 to instruct the officers, "to investigate the Aston Lane site in detail and to prepare a detailed design and cost for the development of a gypsy site ..." (D.C.C. minute 360/87). Almost immediately the historical evidence of disused gypsum mines underlying the proposed site became of crucial importance and attracted local press and television coverage. The evidence that John Young and I had published the previous year was augmented by a mine plan dated 1860, from the archives of British Gypsum which showed details of underlying pillar-and-stall workings, leaving little doubt that if it had not already subsided there was a danger of subsidence almost anywhere on the proposed site.

Arguably a greater potential hazard arose from the fact that the proposed gypsy site was adjacent to the former Woodlands Brick pit which since its closure had been used for waste disposal. The subsequent report of the County Architect showed that not only was mining subsidence still active but there was a real risk of subsidence arising from fissures which had opened in the sides of the refuse pit (Derbyshire County Council, 1988). Also, as argued by the Chellaston Residents Association and their advisers, there was a strong probability that methane had seeped from the refuse pit into the underlying old gypsum workings. Not surprisingly in view of the high cost of a thorough geotechnical investigation of potential hazards and probable prohibitive costs of filling the underground workings Derbyshire County Council decided on January 28 1988, not to authorise further expenditure.

As a case history exemplifying the relevance of geological and historical researches to contemporary environmental concerns the EMGS Council felt that an evening tour around Chellaston would be an appropriate contribution from the Society to Derby Environmental Week, 1988. On the day, the leaders and their assistants were almost overwhelmed by the sheer weight of numbers in spite of the excursion being divided into dominately historical and geological sections. Moreover, many EMGS members were not able to come on that particular evening in May 1988 and, of those that did, many would have liked to have patronised both sections.

The EMGS Council, therefore, decided to hold another and longer excursion to Chellaston a year later and to extend it to include the geological, historical and environmental aspects of gypsum mining in Staffordshire as well as Derbyshire. The following records the main features of these two multi-faceted excursions.

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Leaders John Young (assisted by other members of the Chellaston History Group) and Ron Firman (assisted by Ros Grum and Colin Bagshaw).

Over 60 people opted for the full walk with a geological rather than historical bias. This in turn was divided into three each following the sequence of features of interest shown on Fig. 2.

The guides outlined the main geological, historical and environmental aspects of gypsum in the Chellaston area emphasising that, although workable gypsum occurs in nodular layers in the upper part of the Triassic red beds in many parts of England and Wales it was Nottinghamshire, South Derbyshire and Staffordshire which, historically, were the main producers of both the fine grained variety used for carving (alabaster) and of plaster grade gypsum, the latter being calcined and used as walling, ceiling and flooring plaster.

Chellaston's reputation as a centre both for the production of large blocks of alabaster, weighing commonly 4–6 tons, and for carving these into fine tombs was well established by at least the early fifteenth century. Chellaston probably produced alabaster before this and almost certainly production continued well into the seventeenth century. Unfortunately documentary and other historical evidence is sparse and disconcertingly discontinuous. Similarly although gypsum plaster was used as early as the late thirteenth century the earliest record of it having been produced at Chellaston is 1538 (Young, 1984). Although details are scarce it is reasonable to suppose that the medieval gypsum workings were situated where gypsum occurred close to the surface (ie close to the outcrop) where not hidden by glacial deposits (see Fig. 1).

Dr Firman commented that, in contrast, the nineteenth century revival of alabaster and the expansion of plaster industry at Chellaston is comparatively well documented. Abandonment plans, of variable quality, exist for all major underground workings, Forman's unpublished diaries have provided valuable information about surface working and Bernard Smith in 1919 published a detailed account of the geology of the Leys Alabaster quarry. Geological Survey officers collated geological information available to them, (Sherlock and Smith, 1915 & 1917) (Sherlock and Hollingworth, 1938). Sarjeant (1962, 1963) also reviewed the literature on gypsum in

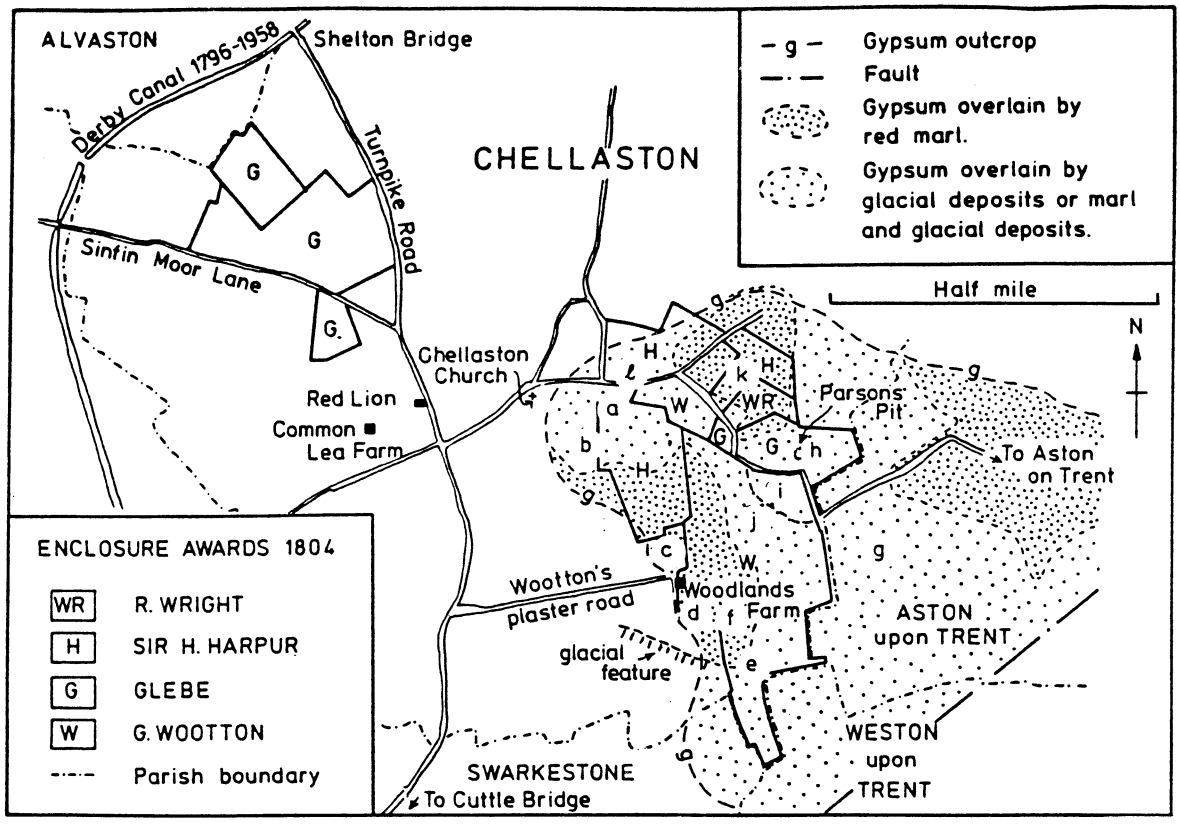

Fig. 1. Enclosure awards of 1804 in relation to geology. The unshaded area is underlain by strata below the main gypsum seam. Glacial deposits are shown only where they overlie gypsiferous strata. Geological boundaries are based on Geological Survey mapping revised by R.J.F.

Derbyshire and added some original observations on the quarries as they were in the early 1960's. More recently the historical and geological evidence has been reassessed by the Leaders (R. J. Firman and J. A. Young 1986). Figs. 1 and 2, which were used as hand-outs, represented up-dated versions of the maps which appeared in that paper.

Although gypsum is no longer worked in Derbyshire partially restored quarries pose important environmental problems. For example much of the area the party was about to explore is prone to subsidence: there are potential hazards resulting from gases such as methane and carbon dioxide diffusing into the old mines from landfill sites: because of its solubility gypsum may cause problems to housing and roads (eg. the proposed southern Derby by-pass) even where it has not been mined and harmful leachate may get into the old mines and hence into ground-water where dumping (as at Duddle Pit) is directly above mine works.

Geologists (Ron Firman, Ros Grum and Colin Bagshaw) then guided their respective parties around the area looking particularly at the following (cf. Fig. 2):

(*a*) *Pit Close Car Park*. Here the main gypsum seam was extracted from about 6m below the present ground surface. Since this seam dipped gently SE and since the land also rose eastward the overburden increased as opencast workings expanded E and SE. They were finally abandoned about 1880 when the overburden was c 12m. Some areas of Pit Close has been restored but some, topographically, are much as they were in 1880. Examples of the Keuper Marl (now called Mercia Mudstone) in which the main gypsum seam and minor beds above it occurred were examined *en route* to (*b*).

(*b*) *The probable site of medieval alabaster workings*. The footpath from Pit Close Lane to Woodlands follows in part an old tramway which served the Pit Close workings. West of this lies the probable site of shallow medieval diggings for alabaster. Little could be seen other than irregularities in the fields but it was noted that foundations, dug for the new houses, revealed gypsum thus confirming the essential correctness of the geological map.

(*c*) Near *Woodlands* and at *Woodlands Farm* itself several boulders of gypsum (coarsestone) demonstrated its essential nodular structure. The thickest seam was up to 18ft and itself nodular in form but as these samples showed, each huge nodule (colloquially described as a pillar) is made up of numerous smaller nodules of gypsum squashed together. At Woodlands, Wootton's Plaster Road which served the Chellaston Old Plaster Mine and from which crushed gypsum was taken to a kiln, plaster works and wharf at Shelton Bridge, was noted as was the topographic feature formed by glacial deposits. This probably precluded further southward exploration for gypsum in medieval times.

(*d*) *Two glacial erratics* of Carboniferous Limestone, one of which exhibits striae, provided evidence of southward movement of ice during the Ice Age.

(*e*) *The enigmatic brick lined shaft* near the top of the hill in the adjacent field aroused great interest. It is not on the abandonment plans of the Chellaston Old Plaster Mine, dated 1878, but is on the 1887 edition of the OS 6″ map. Moreover, it is south of any known mine workings. Mine plans show a 'sand-fault' 'or dirt fault' along the south east margin of the gypsum mines hereabouts which probably represents an infilled sub-glacial channel. All headings which attempted to explore this area were abortive and this shaft may have been to ventilate one such exploratory heading. If so it is surprising that it is not shown on the abandonment plans. Alternatively it may have been a later venture, after the mine closed, for which no mine plans exist. The parties then walked down the hill again to (*f*) were a large *pestle* formerly used for the crushing gypsum is partly hidden at the edge of the world. Further upslope an old collapsed shaft with gypsum boulders around it was examined. Although shown on the mine plans no details are given. Presumably it was a winding shaft. The walk continued NE to (*g*) the site of *Aston Glebe (California) Mine* observing *en route*, soils derived from glacial deposits with many pebbles apparently from the Bunter Pebble Beds (now part of the Sherwood Sandstone Group). Areas of old subsidence resulting from collapse of the underlying 'pillar-and-stall' workings were also observed. Some of the old mine buildings had survived although the main offices were currently being demolished.

Walking down the lane various environmental problems were observed notably the still active subsidence and the continued dumping in Duddle Pit (which for security reasons could only be viewed from afar) with its associated potential problems of leachate and/or gases entering the old mines. Joining the road at (*h*) the site of *Parson's Pit* and subsidence hollows associated with Chellaston Glebe Mine were indicated by the leaders.

Since access to the *proposed gypsy site* (i) was not possible Dr Firman outlined the potential problems. These arose chiefly because the narrow site overlies old gypsum mines and overlooks a disused brick quarry currently used for waste disposal. During the ensuing discussion members expressed surprise that it should ever have been proposed as a caravan site since all the facts were easily available and hazards such as unstable quarry walls, mining subsidence and methane infiltration should have been foreseen. Moreover, the problems should have been investigated during the geotechnical survey which should have preceded the development of the land-fill site. Dr Firman replied that the problems, both environmental and political, experienced by Chellaston residents are by no means uncommon. Disused quarries are common features of areas of past mining and provide tempting sites for the disposal of both domestic waste, which nowadays contained much putrefactable material, and industrial wastes. He hoped examples such as Loscoe and now Chellaston, would serve to emphasise the importance of thorough historical, geological and geotechnical investigations before waste disposal began. Also, appropriate precautions to prevent diffusion of gases and leachate and close monitoring during and after tipping were essential.

From the entrace to the *land-fill site* (*j*) the party were able to gain some idea of its size and to observe that after 4 months methane was still being burnt off. After examining rain pitted boulders of gypsum near the entrance the party returned to Chellaston in the gathering gloom noting in passing Forman's old quarries south of the road and old, possibly mediaval, diggings north of the road at *Chellaston Covert* (*k*). Houses are now built on the infilled site of *Leys Quarry* (*l*) so no evidence could be seen of gypsum hereabouts.

Most of the party then returned to the Pit Close Lane Car Park but some continued to the church to be rewarded by the end of John Young's talk and a glimpse of some of his contemporary alabaster carvings which adorn the church.

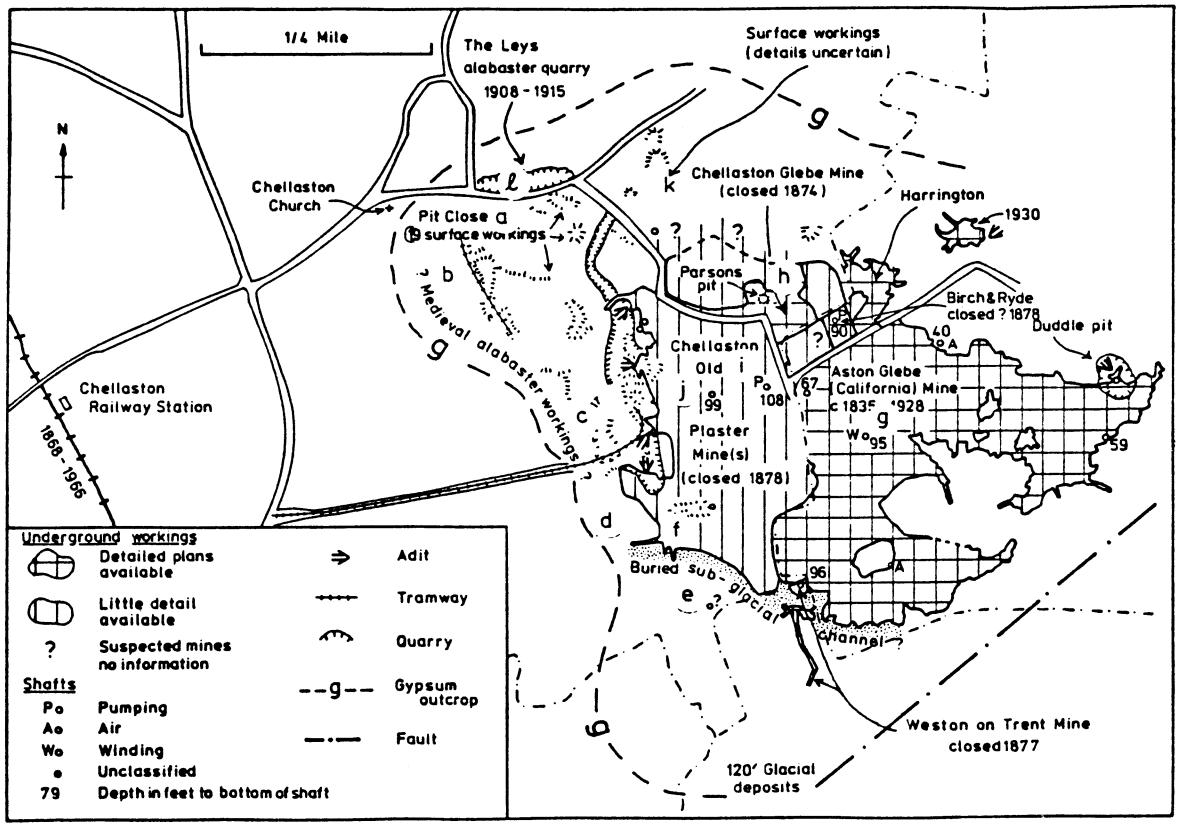

Fig. 2. Principal underground and surface workings for gypsum based on the 1887 6 inch O.S. map, Smith, 1919 and plans of abandoned mines in the Mines Records Office, Liverpool. Note the adit entrances to Chellastom Old Plaster Mine appear to have been from the Woodlands Brick and Tile quarry the outline of which, as depicted on the 1887 O.S. map, is shown on this figure. After the mines closed this quarry was greatly enlarged eastward eventually closing in 1977 by which time, over most of the area, all the strata overlying the Chellaston Old Plaster Mine had been removed.

Tutbury and Chellaston Saturday 13 May 1989. Leaders Ron Firman and John Young assisted by Colin Bagshaw and Ian Sutton.

Forty-six members and friends attended what turned out to be a pleasantly warm day with a few showers in the afternoon. Mercifully all the showers occurred when members were listening to a lecture in Chellaston Church.

Appropriately the excursion began by examining the oldest known example of the use of gypsum in England in the Norman west door of St Mary's Church, Tutbury where the second innermost order consists of elaborate carvings in alabaster. Not only is this the earliest known use of alabaster (1160–1170) but it is the only example of its external use to have survived virtually intact. An exterior roundel has been noted at Rolleston (Firman, 1984) but is so deeply weathered as to be unrecognisable. Probably here at Tutbury the outer orders of the arch protected the carvings from undue weathering. The vicar kindly demonstrated that in spite of the grime which encrusted these 800 year old carvings it was possible to see that they were made of the 'streaky-bacon' type of alabaster and not the purer varieties favoured in the fourteenth and fifteenth centuries. The leader explained that for centuries gypsum had been principally used for alabaster and plaster and because of the comparative rarity of alabaster grade gypsum it seems likely that the chief use of gypsum, even in the Middle Ages, was for plaster of Paris. However, especially in the Midlands, references to plaster were rare in spite of the earliest known commission in England being at Nottingham Castle in 1252 (Salzman, 1952).

The party then examined the other unusual uses of gypsum at St Mary's namely the squared blocks of gypsum in the footings of the church and the remains of an alabaster coffin in the church. Unfortunately neither could be dated although both were thought to be medieval. Some debate ensued about whether the coffin (now in pieces and not easily examinable) could have been a grave rather than a coffin. Evidence could, however, be seen that, although water worn, the gypsum had been shaped externally as well as internally and when excavated from the churchyard in 1972 it was certainly coffin shaped.

Given the amount and variety of uses, both at St Mary's and in Tutbury castle, and several documentary references to gypsum at Tutbury, Dr Firman argued that there must have been a local outcrop (Firman, 1984). This was supported by the vicar who stated that gypsum was frequently found when digging in the churchyard.

Leaving Tutbury about 11.30 am the party proceeded by coach to Hanbury passing Fauld Mine; now the only alabaster producer in the country (a minute proportion of its total gypsum output). This gypsum mine was claimed, in 1985/6, to be the largest in the UK then producing approximately 250,000 tonnes of gypsum per year for plaster and about 400,000 tonnes of a mixture of gypsum (35%) anhydrite (35%) and marl which was sold to cement manufacturers (Anon ? 1985).

At Hanbury the party divided into two, one half led by Colin Bagshaw, and the other by Ron Firman and Ian Sutton. Since many members were familiar with the opencast workings in East Nottinghamshire the leaders took the opportunity to emphasise the difference between the 'Newark' and 'Tutbury' gypsum. Whereas the 'Newark Gypsum' consisted of several relatively thin seams which could be profitably worked opencast the 'Tutbury Gypsum' of W. Notts., Chellaston and Staffs., consisted essentially of one thick (average 2.4 m) workable seam which cropped out near the base of steep escarpments and nowadays had to be mined from adits. Thinner seams above the 'Tutbury Gypsum' may have been formerly worked as was the main seam by 'pitting' parallel to the outcrop. Because of its solubility even the thickest gypsum seams were wholly or partially dissolved at the supposed outcrop. The groups then examined some of these old surface workings which here were well upslope from the estimated outcrop and probably extracted alabaster from 5 to 7 m below the surface. Further down dip at deeper levels alabaster grade gypsum tends to be replaced by coarser, more granular, plaster grade gypsum and at deeper levels still anhydrite is frequent particularly in the cores of the gypsum masses, thus explaining the large current output of mixed anhydrite and gypsum from Fauld Mine.

The two groups then walked up the hill, one to the church and the other to view the 1944 explosion crater. The church is a veritable museum of alabaster both ancient and modern. The oldest, disputedly of John de Hanbury (died 1303) is, if the attribution is correct, by far the oldest alabaster tomb in England but even so there is a gap of about 130–140 years between the external carvings at Tutbury and this tomb. Moreover, alabaster did not become widely used for church monuments until after the mid-fourteenth century (Firman, 1984), some 200 years after the Tutbury carvings. It was, however, in the late sixteenth and early seventeenth centuries that alabaster tombs became most common and widespread but paradoxically this boom is the least well documented. Hanbury is a good example in that although it houses six alabasters from this period only one was described by Pevsner as being made of alabaster. In addition part of the nave floor and the chancel arch (? 1862) is alabaster. After examining the variety of styles and uses of local alabaster in the church Dr Firman's party walked along the foot-path from the pub to the explosion crater meeting Colin Bagshaw's apparently shell shocked party, half way.

Said to be the biggest man made explosion crater in Europe even after 45 years this is still an impressive feature. Since it happened in wartime (Nov 27 1944) facts are hard to come by and even the number of fatalities is disputed. In the Hanbury Church pamphlet 62 deaths are recorded, 68 in a Weekend Guardian article (Rogers 1989), 70 in an exhibit at Tutbury Castle and 80 is given as the official death toll in the Fauld Mine guide (Anon ? 1985)! What is clear is that during the war the disused parts of Peter Ford's gypsum mine, between Fauld and Hanbury, were used for storing bombs by the RAF and, for whatever reason, all or part of the high explosive was detonated, estimates varying between 4,000 to 5,000 tons. Upper Castle Hayes farm, directly above the explosion, was completely destroyed as were its human and animal inhabitants. Photographs show substantial damage to the pub, village hall, and other buildings in Hanbury about a kilometre to the West. Similarly to the north, Fauld gypsum works were severely damaged. Reports claim that houses were damaged within a 16 km radius so clearly mapping gypsum on the basis of its presence in topsoils must take into account the widespread distribution of gypsum (and bombs?) due to this explosion.

Little evidence of scattered gypsum was seen when walking downhill from the pub. Small pieces of gypsum in farm gateways to improve drainage could well have been raked from the fields but could equally well have been brought from the mines. Similarly swampy depressions, apparently due to mining subsidence, could have resulted from weakening of pillars in pillar-and-stall workings due either to the 1944 blast or to natural processes or both. In and around the crater itself, however, the party observed abundant evidence of explosive activity, subsidence and landslipping but found it difficult to distinguish original features from subsequent geomorphological modifications. Large gypsum boulders are plentiful around the ruins and on the sides of the crater: a vertical face on the SE wall of the crater probably represents the back wall of a large rotational shear contemporaneous with or subsequent to the two original explosions. As shown on the OS map the present hole is approximately circular and about 300 m in diameter. Given that most of the slopes are now at or near their angle of rest the floor cannot be deeper than about 70 m although the original crater could have been deeper and filled in by collapsing crater walls. Although not as large as implied by some reports (eg Rogers, 1989), the party was nevertheless most impressed by what remains an awe inspiring sight.

Both groups then returned by bus for a late lunch at Tutbury, some members taking advantage of the hour available to visit Tutbury Castle when it opened at 2.00 pm. As in St Mary's, gypsum blocks are incorporated into the Triassic sandstone walls and squared blocks are used in the foundation of the North Tower. Apart from this presumably local gypsum, most of the sandstone came either from Winshill near Burton-upon-Trent or Repton. Members visiting the castle were also able to see the small exhibition which included photographs of the explosion crater and associated damage.

At Chellaston the party was welcomed at the church with tea and biscuits and treated to an illustrated lecture by John Young. After briefly outlining the probable history of the church he concentrated on the alabaster industry emphasising Chellaston's great reputation for fine quality, the 'trademark' of the Chellaston angel and the close commercial links with Nottingham during the Middle Ages. Chellaston's contribution to the late Tudor and Jacobean boom in alabaster tombs remains enigmatic but John's researches have documented much of the Victorian revival. He illustrated this with slides of the details of carvings in St George's Chapel, Windsor, and Mackworth Church amongst other places and, based on his own experience as a sculptor, gave a fascinating insight into the planning and execution of these works of art. His suggestion that many may have been initially modelled in clay, during planning, raises interesting geological questions about the source or sources of suitable modelling clays. Certainly Chellaston had clays which could be pressed into service for such purposes but it occurred to the writer that it was Nottingham which had the greater variety of clays in its immediate neighbourhood. Could this be one reason why Nottingham became a major centre of the alabaster trade in the Middle Ages? Clearly more research is needed into this aspect. Finally, John brought us back to the twentieth century by showing us examples of his work which adorns the church thus proving that the art of alabaster carving is not dead.

With the showers finishing with the lecture, the field excursion resumed with a partial repeat of the 1988 walk. Time did not permit the party to get beyond (*f*) where unfortunately the millstone grit pestle had been removed. One noteable new feature was a recent 2–3 m circular subsidence with fresh near vertical c 1 m walls. The underlying mine closed in 1878 so considerably more than 100 years has elapsed before this particular subsidence feature occurred. The previous year the only indication had been particularly swampy ground. Whether this subsidence was induced by changes in the hydrology caused by the infilling of the land-fill site was debated but not resolved as was the question of whether the striae on the limestone glacial erratic at (*d*) were due to ice action or acquired when the farmer dragged the boulders out of the field. The party noted that methane was apparently still being burnt off the land-fill site.

Discussion of the implications were terminated by one member's remark that if there was one thing worse than an old mine full of methane it was a mine half full of methane! With this remark the party opted to return to the coach having had a surfeit of gypsum from the twelfth to the twentieth centuries.

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