Conservation of monuments and excavated artifacts

Assignment 1 - Discovery Techniques in Archaeology
Green Low Chambered Tomb, Derbyshire
Derbyshire Archaeological Journal Vol85, 1965 (p2-24)

Part A

Green Low Chambered tomb

The site is located overlooking the hamlet of Aldwark, 4 miles west of Matlock, Derbyshire (SK 232/580) (Fig1). As with most of this area the site is resting on carboniferous limestone with highly alkali soils, at a height of 1020ft (Manby. T).

Fig 1

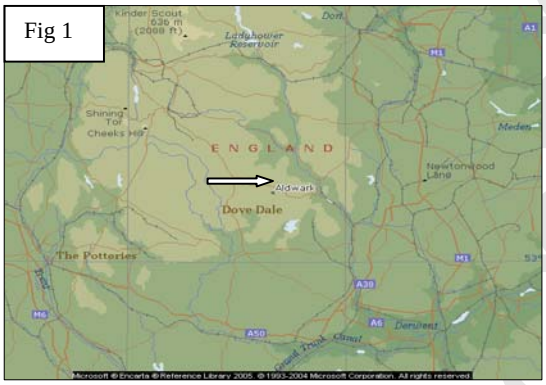


Fig 2

Fig 3

As can be seen from figs 2 and 3, the area is largely rough grass pasture with occasional scattered bushes and scrub. The tomb is situated to the north of the site near a ridge with grass pasture to the south.

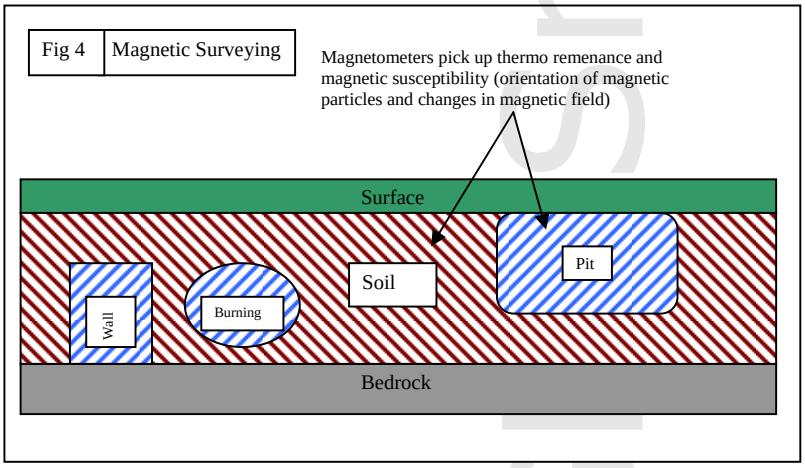
Two other chambered tombs at Harborough Rocks and Minning Low can be seen from the site, and another is situated just ¾ mile to the west at Stoney Low.

The site is one of the lesser known chambered tombs in the Derbyshire area, now without the top stones (fig2) it appears broken and incomplete due to the robbing of stones for walling (Manby. T). Excavations in the past have recorded the tomb in good depth finding one main chamber and access tunnel with, human and animal bone as well as coins, flint and pottery.

The main structure of the tomb is constructed of huge limestone slabs probably from the local area, set into the natural clays underneath. Limestone paving is covering the floor to the tomb and originally was in-filled with brown gravelly soils.

The site was first excavated in 1843 by Thomas Bateman, the top of the tomb at this point was already collapsed so he dug into the structure exposing the main chamber and passage. In 1963/4 the work of excavation was started again by a team of experts, and detailed records can be found of the excavation in the provided article (Derbyshire Archaeological Journal Vol85, 1965). In both cases the method of finding where to dig was largely on a trial and error basis, done more by luck and sight than technology. The extensive trenches across the site also guaranteed finding something, this now days may not have been allowed due to monument restrictions.

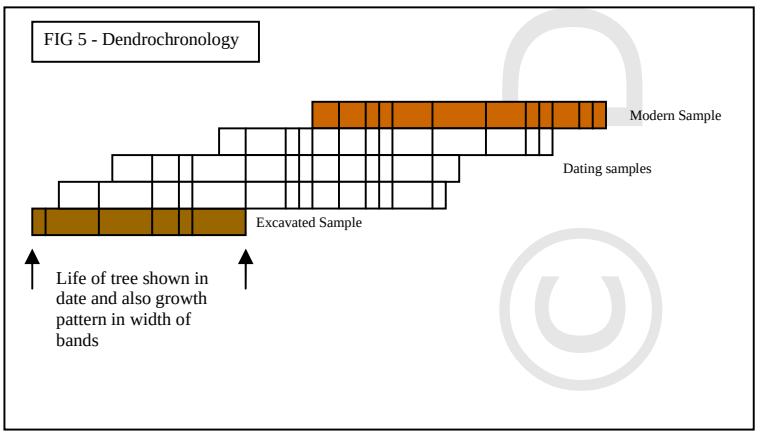
The first step using modern dating techniques I believe on this site would be to use satellite or aerial imagery such as fig3 to analyze the topography and general features of the area. Although not visible on this photograph better and more detailed imagery is easily available. The AVHRR (Advanced Very High Resolution Radiometer) system used on the NOAA (National Oceanic and Atmospheric Administration satellite) or the MODIS (Moderate Resolution Imaging Spectrometer) used on the US based TERRA and AQUA satellites would be good for larger features. For a smaller area the popular LandSat system or SPOT (satellite pour l'observation de la terre) could give sufficient resolution (Mather. P). By looking for crop marks, shadow marks and soil marking new undiscovered areas to the site may be seen, thermal or infrared imagery is also sometimes useful especially where vegetation is sparse. But the analysis of the site in relation to the other tombs in the area and the topography may give more information to why it was built in the area. This could be enhanced by the use of a micro-topographic survey of the tomb area to show slight variations in the land indicating buried structures (Barker. P).
Due to the shallow soils, clay and underlying rocks near to the surface resistivity surveys will be difficult to do without getting misleading readings, because of this the best survey is a magnetic survey. These record variations in natural background magnetism (magnetic susceptibility – fig4) caused by burning, digging, walls, road building etc: and then using computers data can be put on a graph or map to show the overall site readings (Grant. J et al). By using this method and relevant equipment (proton magnetometer, proton gradiometer, fluxgate gradiometer) anomalies can be picked out. The fluxgate gradiometer for this site would be ideal as the equipment takes continuous readings rather than spot making it quicker and easier to undertake and interpret. It is also less affected by wires, electrical storms and possible natural variations (Barker. P). The method of sampling is simple, the handheld device is simply walked over the site in straight lines (strips) and the readings can then be fed into a computer for analysis.



Due to the presence of metallic objects at the site (roman coins) I would recommend the use of metal detectors to check the surrounding area and spoil as the excavation progresses. If available the more advanced 'Pulse induction meter' should be used as this can give early warning of metallic objects in burials, especially important considering the tombs previous use.
If the presence of unexcavated voids (such as this site prior to excavation) is possible the ground penetrating radar (GPR) system should be adopted to get an internal plan of voids prior to excavation. When put into a computer this system can be enhanced to show subtle changes of shapes/materials, often indication disturbance of some kind such as a burial pit.
No one of these systems can tell you the whole story of the site and only by using them in conjunction with not only each other but with traditional excavation techniques can a true picture be formed, this should then be analyzed and scrutinized against other historical records and data. It must be remembered that the technology can tell you where something is, but not what it is, what it was used for and its significance. These aspects are as much a mystery today as it was in 1964 or even 1843 for the first excavations.

Part B
Artifact Dating

The dating of pottery is an interesting subject relying as much on the interpretation of physical features as the use of complex technologies (Orton et al, 1999). The first step to obtaining a date and possible source is to visually analyze the sample in terms of colour, texture, finishes, measurements, shape and composition. This simple method is best for obtaining a rough guide line date during an excavation by comparing your sample to already known dated pieces. For full compositional analysis an electron micro-probe could be used, although this is expensive and can only tell you the composition of the artifact not a date of firing.
Many methods of pottery dating exist such as the Instrumental Neutron Activation Analysis (INAA) and optical image spectrometry, (Hughes et al, 1994) but most of these are inaccurate, inconclusive or not easily available. The most highly regarded technique is that of Thermo-luminescence dating, this involves the heating of a crushed pottery sample to 500°C at which point light is given off. This light is caused by the radioactive impurities in the pot, (Potassium, Uranium, Thorium) this can then be recorded and as the light given off is proportional to the time since firing an accurate date can be established. The method does have some problems such as the pots individual sensitivity to radiation and the need for soil analysis, but generally a date of with ± 5-10% can be achieved (Aithen, 1974).
The Dating of bone can be done in numerous ways the first method known as analytical dating simply measures the amounts of fluorine, uranium, and nitrogen within the bone which can then give a relative dating. Amino acid dating is similar to analytical but measures the conversion of the amino acids after death, these are both only relative dating methods though and are also largely affected by the chemical content of the soil and contamination is a common problem (Aithen, 1974). Absolute dating methods such as the electron spin resonance (ESR) and Uranium series methods could be used but the most common method is Radio Carbon Dating (Microsoft, 2004). This involves the measuring of carbon 14 content within an object, with a half-life of 5730 years a maximum date of around 50,000yrs can be obtained (Aithen, 1974). For bones an absolute date can be obtained showing the time of death for the person, but only if sufficient quantitiy is available for analysis. This method though can be easily contaminated by modern carbon so care should be taken to ensure the correct interpretation of results.
Wood can also be analyzed under the Radiocarbon method giving accurate dates to within a few years. Smaller samples are needed for wood than bone meaning it can be completed on very small objects (Mays, 2000) ideal in a modern archaeological excavation. There is a problem with this method in that it can tell you when a tree died (cut down) not when it was first used, the process of seasoning which for a whole tree could take years means the date can be quite inaccurate. The use of other types of evidence should be used such as pottery dating if available to get a better idea of when a site was in full scale use. Dendrochronology (the study of tree rings) is a common and accurate technique for dating trees. The rings of a tree are sampled in cross section and then compared to other trees of the same species growing in the same place until a start date can be achieved (fig5). This method is dependant on the knowledge of which species of tree the sample is



from and where it was likely to be growing, often for a more accurate dating Radiocarbon dating would also be done.
Volcanic implements could be dated using the Potassium-Argon method, this method records the amount of potassium 40 that has decayed into argon since the rock was last molten (last eruption). Using this method objects can be dated back to their last period of heating, due to the slow conversion of potassium 40 to argon dates of around 10,000yrs are the minimum possible. This method has one main problem and that is that it can tell you when an object was last intensely heated, NOT when it was last used by somebody. Other evidence from an excavation should be used in conjunction with this method to truly date when a volcanic tool was used. If the object is volcanic glass the Obsidian Dating method could be used, as with Potassium-argon it is not fully accurate but nether the less an important process. Volcanic glass by its nature absorbs water slowly, this is done in a chemical manner so natural water content in soils, rivers or oceans will not affect it. When hydrated the glass forms bands, these can be measured and a calculation can then tell when the object was laid down as a solid (last eruption) (Aithen, 1974).
With all modern archaeology some of these methods or the many others available will be used to estimate the age of excavated artifacts, in most cases only certain objects will be tested in this way and relative dates based on ground layers (i.e. deeper down = older) given to the rest. This is not a less professional way of analysis but a more economically viable option, so long as the recording is done in a detailed and careful manner it should allow for reinterpretation of results in the future and possible retesting of objects.

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Bibliography of figures

Fig 1 = Microsoft Encarta Reference Library 2005, Microsoft, USA [CD-ROM]
Fig 2 = www.megalithic.co.uk [accessed 4/11/04]
Fig 3 = www.multimap.co.uk [accessed 4/11/04]
Fig 4 = Author
Fig 5 = Author