5. Methods

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The Magnesian Limestone Project required the collation, assessment and analysis of four main types of archaeological data comprising aerial photography, geophysical survey, excavation, and stray finds from fieldwalking/metal detecting events. The mapping of aerial photographs and the recording were undertaken by a small team of aerial investigators employed by Archaeological Services WYAS and based alongside English Heritage's Aerial Survey and Investigation (AerSI) (North) team in York between March 2005 and May 2006. The original Magnesian Limestone Project required new AP mapping over an area of 575km^2, 23 OS map quarter sheets (5x5 km). In December 2005 a project variation extended the study area to encompass the eastern part of South Yorkshire and parts of North Nottinghamshire and an additional mapping requirement of 225km^2, 9 OS map quarter sheets. This work was completed in December 2006. Data for the geophysics, excavations and finds events were collated and processed by a researcher and GIS officer based at Archaeological Services WYAS between March 2005 and March 2007.

All archaeological events were entered onto a Microsoft Access® project database and georeferenced and digitised as individual layers for geophysics, excavation and finds within MapInfo® GIS software. Some material relevant to the study area was not suitable for incorporation within the GIS system. A proportion of grey literature reports did not contain figures or provided insufficient or inaccurate detail preventing accurate special referencing. The result is that approximately one quarter of database entries could not be georeferenced and are only represented on GIS layers with a dot symbol. Aerial photographic data were supplied in native Autodesk AutoCAD® dxf format and imported into MapInfo® with all line style and colour conventions maintained. Report figures were produced from Adobe Illustrator® and/or MapInfo®. A list of all conventions used in the figures is presented in Figure 7.0.

Comprehensive project methodologies (Roberts *et al*. 2004; Deegan 2006) form part of the data archive provided to the regional Historic Environment Records and Sites and Monuments Records.

Aerial Photograph Mapping

The aerial photograph data have been sourced from parts of three existing National Mapping Programme (NMP) projects and one specifically commissioned for this task: the Nottinghamshire NMP, the Vale of York NMP and the Lower Wharfedale NMP projects and the Magnesian Limestone in South and West Yorkshire AP mapping project (Fig. 5.0). All four projects were undertaken to the standards of English Heritage's National Mapping Programme but it should be noted that these standards have been elevated and developed over time so the earliest of these, the project for Nottinghamshire, has a quite different end-product to the results from the latest.

In line with the specification of the NMP, all cropmark, soilmark and earthwork archaeological features, dating from the Neolithic through to the end of the Cold War, were mapped and recorded (RCHM(E) 1997). Certain post-medieval and modern features were excluded; in particular, upstanding or levelled field boundaries that were depicted on the Ordnance Survey First Edition or later maps were not mapped. Similarly widespread, small-scale stone quarries were omitted although small limestone quarries that were associated with limekilns were mapped. Larger-scale quarries were recorded, their presence being particularly significant when in close proximity to other archaeological features. As this project focuses on later prehistoric and Roman archaeology, later features, such as medieval ridge and furrow, have been excluded from the main theme of this report.

Oblique and vertical photographs in the two national collections of aerial photographs, one held by the NMR in Swindon and the other by the Unit for Landscape Modelling, University of Cambridge, were consulted. In addition oblique photographs held by the West Yorkshire HER, South Yorkshire SMR and North Yorkshire HER were also examined, along with information from selected published and grey literature.

There were two strands to the NMP recording strategy. The main strand was the creation of new, or the enhancement of existing, monument records in the National Monument Record database (AMIE). The NMP-generated entries or enhancements for each monument or monument group in this database hold the key locational information, the monument types present and their dating, the nature of the evidence, a

free text description of the monument or monument group, the source of record information and administrative details such as concordance with SMR/HER records, record authorship, and links to events and archives. To assist in the management and interrogation of the actual map data in the Autodesk Map® environment and ultimately in English Heritage's GIS, a summary of some of the database information is attached as metadata to each individual mapped feature.

Aggregates Data

Active quarry data were initially obtained from the British Geological Survey web site and verified at the offices of the BGS in Nottingham, where historical quarry data were consulted. Further information was obtained from local authority Minerals Local Plans and Unitary Development Plans. Local authority on-line maps were consulted for planning extents, where available, and web-based aerial photography was employed to verify active areas. Commercial data on quarry production were obtained from Cameron and Bartlett *et al*. (2005).

Geophysical Survey and Excavation Mapping

A variety of local and national government organisations, commercial companies and universities were contacted as part of the data-gathering process. Organisations that responded are listed in Appendix 1. Geophysics data were digitised from a suitably scaled copy of grey-scale report figures and excavation data from site or trench plans. Geophysical anomalies, including both probable and possible archaeological features, were mapped in accordance with the actual widths of the magnetic/resistance anomalies (although it is recognised that the geophysical response may be disproportionate to the size of the feature concerned). In circumstances where a geophysical survey or excavation had taken place, but produced no relevant archaeological results, just the outline of the survey/trench area was digitised. The data were layered and colour coded to differentiate between limits of survey/excavation, probable/possible archaeological geophysics feature and extent of archaeological feature (Figure 7.0).

Archaeological Finds Data

Fieldwalking, and in some cases, metal detecting, for artefacts is employed regularly in mitigation strategies on aggregates sites, but its effectiveness has yet to be assessed. The inclusion of such data within the project is an important component in potentially dating

unexcavated cropmarks and geophysical survey sites, and also in reviewing the effectiveness of its role in the different mitigation strategies employed.

Data from organised fieldwalking events as well as spot find data from chance finds or metal detecting were obtained from regional museums and the Portable Antiquities Scheme database (Appendix 1). Only prehistoric, Roman and early medieval (pre-Norman) material is recorded on GIS layers. Finds from organised fieldwalking events have been given a single database entry and plotted within MapInfo, where geographic information was available. The locations of spot finds have only been included in the study if a provenance to at least an 8-figure grid reference has been available. Find event data are shown on the GIS as symbols, colour-coded by period.

Database Structure

The database forms part of the project archive and its structure is based on the Event – Monument – Source data model, compliant with the basic Monument Inventory Data Standard (MIDAS). All the key fields meet the requirements of the HER Basic Compliance Specification v0.2 (English Heritage/ALGAO 2002).

The database comprises a number of related tables linked by a unique Primary Reference Number. The fields used include basic background information for each event relating to the site, the event and information source. Certain fields, such as site type, period, evidence, event, and source were completed using standard terms from RCHME wordlists and data thesauri to ensure accuracy, consistency and compatibility of information with existing HER/SMR data sets. The Primary Reference Number for each database record appears in the metadata of related MapInfo® layers for easy cross-reference.