British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL
Arolwg Daearegol Prydain
CYNGOR YMCHWILYR AMGYLCHEDD NATURIOL

Artificial Ground: Where Geologists and Archaeologists Share Territory

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1. Introduction

Prior to the commencement of construction projects, detailed ground investigations needs to be carried out. One aspect of this work is the desk study but the extent of existing information about a site varies from location to location. Since mankind came into existence we have been dramatically altering the shape of the landscape & directly influencing the near-surface in ways not seen in nature. Never has this been more evident than in the years following the Industrial Revolution. Anthropogenically altered ground has different behavioural properties to natural ground & thus it is crucial that known deposits are mapped &, where possible, these deposits are classified in as much detail as practicable. Mapping artificial ground in this way reduces the prospect of unforeseen ground conditions, de-risks investment & allows engineering geologists to plan better site investigations. The past is the key to the present, thus a greater understanding of the spread & nature of anthropogenically altered ground provides archaeologists & historians with a wealth of information on human patterns of settlement, as well as allowing geotechnical & civil engineers to plan the future better.

2. Roles & Responsibilities

- Geological surveys are responsible for mapping artificial ground on geological maps
- Artificial ground is not well represented due to lack of information & the changing nature of deposits, & thickness & composition are generally not recorded
- Different groups & organisations have different information on artificial ground - geological surveys do not always have all the data
- Archaeologists have very detailed knowledge of the near subsurface & terrain
- Archaeologists record finds & define the extent of sites but do not map artificial ground

3. The Newport Case Study

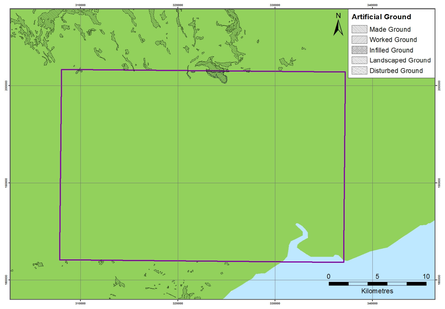

Fig. 1. Extent of the Newport map sheet in purple shows little artificial ground previously mapped. DiGMap 1:50,000 British Geological Survey © NERC. Contains Ordnance Survey data © Crown Copyright & database rights 2018.

- The 'Newport map sheet' was lacking artificial ground & needed updating
- The project was time limited so quick wins needed
- Existing information on artificial ground held by Newport City Council & the Glamorgan Gwent Archaeological Trust (GGAT)
- BGS contacted the council & the trust to avoid 'doubling up'
- The archaeologists had first hand experience of the ground
- Archaeologists' GIS-based database (HER) used to supplement pre-existing methods of mapping

4. Available Resources

- Historical maps
- Aerial photographs
- LiDAR
- Digital Elevation Models
- Borehole logs
- Historical sources
- Archaeological excavation
- Archaeological finds (datable)
- Reports from previous digs
- Borehole logs

Local Authority data - in this case study Newport City Council provided access to over 5,000 borehole records submitted to the council as part of the planning application process.

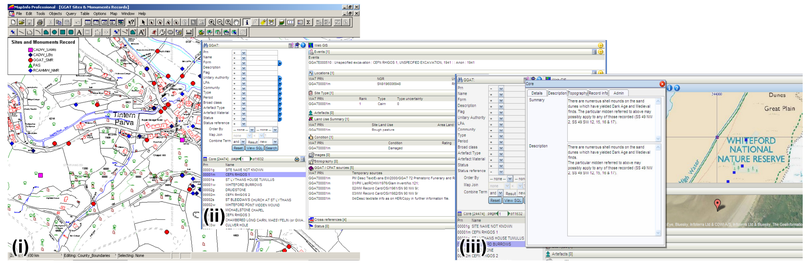

Fig. 2. Extracts from GGAT's Historic Environment Record (HER). Polygons & points show data availability (i) & are linked to a database showing the types of records for a site (ii). These can be previewed (iii) or downloaded as whole reports. Polygons show site extent. © GGAT HER Charitable Trust, 2018 (& in part © Crown, 2018).

5. Artificial Ground Mapping

- Artificial ground mapping & site development history from traditional sources, mainly historical topographic maps & aerial photographs but in conjunction with HER polygons for speed
- Mapping checked against existing borehole records & new data donated by the council
- Additional data from the HER included polygons, boreholes & deposit descriptions
- New artificial ground polygons mapped in GIS & attributed with data source & information on the nature of the deposit made much more possible by the inclusion of archaeological data
- The HER provided additional information where BGS datasets did not show artificial ground
- Use of the HER made mapping faster, saving staff time, & avoided duplication of effort
- Using the HER made it possible to attribute the mapped polygons with detailed information about the deposits far better than could be done using traditional data sources alone

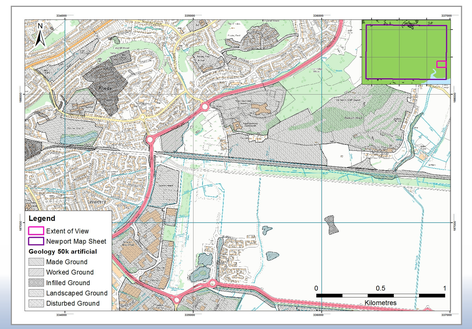

Fig. 3. Selected area of the Newport map sheet showing the new mapped artificial ground. DiGMap 1:50,000 British Geological Survey © NERC. Contains Ordnance Survey data © Crown Copyright & database rights 2018.

6. 3D Modelling

BGS produces 3D geological models from cross-sections using borehole & mapping data. The example in Figure 4 is currently under development for the map sheet adjacent to Newport. Unit volumes can be calculated by extrapolating the data between the sections. It is planned that the final version of this model will be attributed with geotechnical data & material properties. Newport may also be modelled when the 2D mapping is complete. With details on the nature of artificial ground, this model could be of use to site developers & civil engineers.

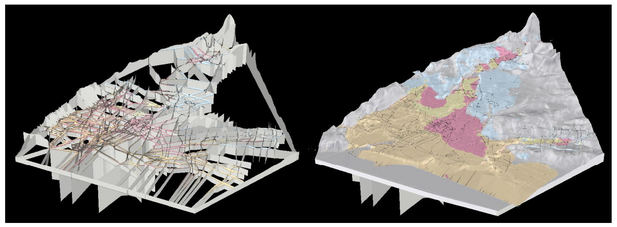

Fig. 4. Extracts from a 3D geological model produced in GSI3D for the Cardiff map sheet. Models are built from fence diagrams & 'envelopes' of units can be generated.

7. Next Steps

- Completion of the Newport map sheet
- Fully attributed polygons
- 3D model of artificial ground in collaboration with GGAT & Swansea University

8. Key Findings

- Archaeologists have a lot more direct contact with artificial ground than geologists
- Through planning permission procedure archaeologists often get access to site investigation data that geological surveys do not automatically get
- Geologists can make use of this information in their mapping to extend coverage & detail
- Collaboration could yield attributed 3D artificial ground/archaeological cover models
- Collaboration has IPR & contracts issues, & it can be difficult to engage with partners
- Funding issues can arise between partners & trust can be a problem
- Newport is an example of where collaboration has worked well
- Archaeologists are often not on geologists' radar but they have a lot of shared interests
- BGS gained new data from GGAT but also introduced them to more BGS resources
- Collaboration leads to joined up thinking which increases data quantity & quality, benefits stakeholders & de-risks sustainable development of the near- & sub-surface
- Collaboration agreements give confidence to partners over IPR

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