

Hydroarchaeology: a subject framework

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The editorial in *IJNA* 22.1 offered *Hydroarchaeology* as a generic term to describe the 'subject' in which readers of this journal have an interest. Promoting widespread adoption of the term *Hydroarchaeology* will provide not only the generic term sought by the Editor, but also a subject framework. The term can be assigned a meaning with comprehensive scope which embraces all methods of archaeological investigation, diverse sites in varied environments, and numerous topics of study. *Hydroarchaeology* will therefore be distinct from earlier terms which have drawn their definition from only one such factor: 'underwater archaeology', a method of investigation; 'shipwreck archaeology', a type of site or environment; 'nautical archaeology', a topic of study.

Scientific study depends on nomenclature and classification, and the development of formal, internationally-accepted systems is recognized as an essential foundation. The basic advantage of nomenclature is that it aids understanding during academic debate. Beyond this, it promotes clarity of thought and, thereby, advances intellectual enquiry by setting out a framework which demonstrates the relationship between individual objects of study and the part of those individuals within a perceived whole.

The need to define the relationship of the parts to the whole has been a major motivation in developing terms such as 'intertidal', 'nautical', 'marine', 'maritime', 'riverine', 'ship', 'shipwreck', 'underwater' and 'waterfront' archaeology. The labels were worked as banners to demonstrate that this or that aspect of archaeology was receiving an inadequate proportion of the total available resources. Unfortunately, the success in these campaigns for recognition is double-edged: once an individual part establishes its credibility within the whole of archaeology it becomes increasingly identified as a 'sub-discipline' which implies a separation. This

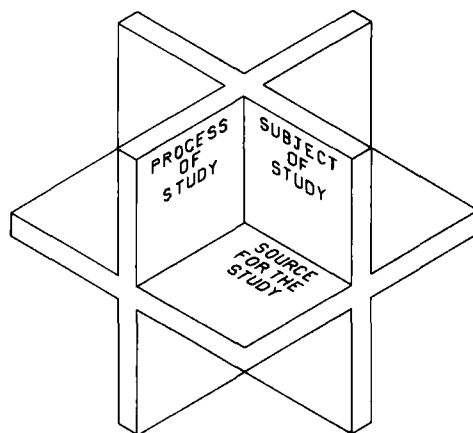


Figure 1. Archaeology comprises three interlocking components.

fragmentation is underlined by the increasing level of specialist technical knowledge which can be achieved in any one aspect of archaeology.

Hydroarchaeology will counterbalance this mental fragmentation by highlighting the composite and organic nature of archaeology. It provides an opportunity for specialists to review their contribution to the whole.

Naturally, the starting point for a definition of *Hydroarchaeology* must be the whole that is *archaeology*. Keith Branigan (1979) sought a no-nonsense definition for the layman and chose to summarise archaeology with:

It embraces the discovery, recording, preservation (where possible) and interpretation of all traces of man and the world in which he lived before the present.

From this broad statement archaeology can be seen to have three components:

1. The *Subject of Study*—man and his world;
2. The *Source for the Study*—all traces of man;
3. The *Process of Study*—discovery through to interpretation.

These components or dimensions of archaeology can be envisaged as three interlocking planes (Fig. 1).

Each dimension, or plane, can be divided into its constituent parts. For example, the *Process of Study* comprises the many techniques employed by archaeologists to extract and manipulate information from the archaeological record which is the *Source for the Study*. A coarse division might identify nine constituent *Processes of Study*:

1. Desk-Top Study
The study of records of past archaeological work, both documentary and artefactual, and use of historical documents.
2. Remote Sensing
Recording aspects of the archaeological record which usually cannot be seen by direct observation—techniques include aerial and infra-red photography, resistivity, magnetometry, radar and seismic surveys.
3. Field Survey
Recording elements of the archaeological record through direct observation.
4. Intrusive Fieldwork
Recording elements of the archaeological record using techniques which extract material or are destructive, e.g., excavation, sampling.
5. Analysis
The retrieval of information from gathered data, employing techniques such as dendro-chronology, pollen analysis, fabric analysis of artefacts.
6. Experiment
The testing of hypotheses using models. This includes computer modelling and the construction of three-dimensional forms, either full-scale (i.e., replicas and reconstructions) or small-scale models.
7. Synthesis
The interpretation of the archaeological resource based on available data and hypotheses.
8. Preservation
Conserving the extant archaeological record depends on management not only of sites and landscapes but of artefactual and documentary archives. Management priorities will rely on raw data (e.g., Sites and Monuments Records) and the evaluations of raw data produced during Synthesis.

9. Dissemination

This embraces audiences both within the subject (i.e., academic) and external to it. The external audience may be specific (e.g., a developer requiring evaluation of the impact of his proposals on the archaeological resource) or general (e.g., museum display, interpretation of monuments within the landscape).

These nine constituents of the *Process of Study* can be visualized as a series of parallel planes forming one dimension of *archaeology* (Fig. 2). Every plane will intersect the planes in the other dimensions, that is, the *Subject of Study* and the *Source for the Study*. This demonstrates the potential for any of the techniques in the *Process of Study* to be applied to any part of the archaeological resource in the *Source for the Study* in order to produce information on any topic in the *Subject of Study*. The converse of this maxim is that any *Subject of Study* may draw information from any part of the *Source for the Study*.

Every plane within a dimension can be divided and the resulting planes divided again *ad infinitum*. Ultimately the planes in the *Process of Study* represent specialisms. So, in the Remote Sensing constituent the plane can be divided into separate techniques (e.g., aerial photography, resistivity, magnetometry), which, in turn, could be divided until each plane represents a particular type, or even make and model, of instrument. This total refinement of the planes introduces a complexity to the three-dimensional model of archaeology which will be discussed later.

After establishing the framework of *archaeology* a general definition of *Hydroarchaeology* becomes possible.

Hydroarchaeology is that part of archaeology which is associated with water. The association may be in any dimension, the *Subject of Study*, the *Source for the Study* or the *Process of Study*. The full scope of *Hydroarchaeology* can only be appreciated by examining each dimension.

The *Subject of Study* integral to *Hydroarchaeology* is the *Use of Water*. Six *Uses of Water* have been identified^[1]. They are listed alphabetically rather than in order of merit.

1. Defence

Water is a barrier that can offer security. It is also a means of carrying defence away from the home by means of naval offensives.

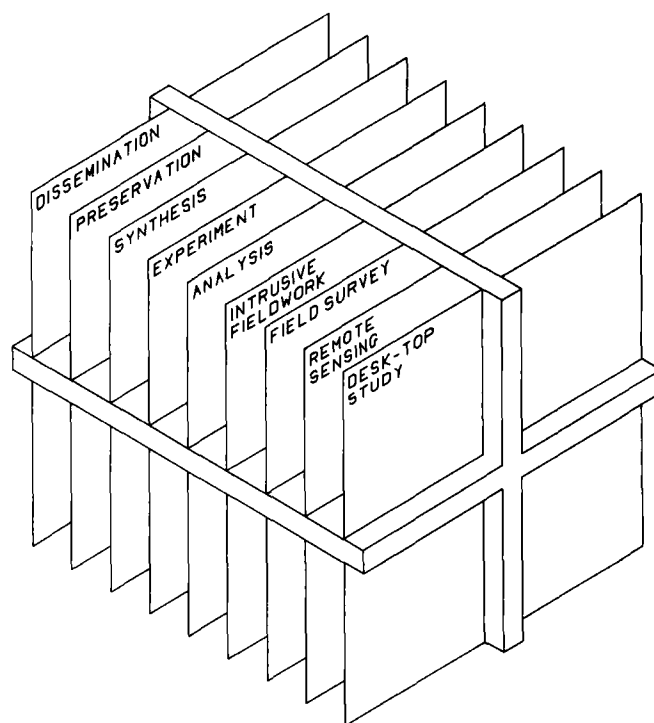


Figure 2. The *Process of Study* component of archaeology may be divided into constituent techniques for gathering and manipulating information from the archaeological record.

2. Extraction

Water supports and contains animal and vegetable resources. Minerals can be extracted from water courses (e.g., gold) and from the seabed (e.g., aggregates and hydrocarbons). It is also a source of energy.

3. Leisure

Water is a medium for leisure activities. Its aesthetic value can also be a factor in the location and design of dwellings.

4. Life Source

Water is essential for human consumption and its use can have religious significance. Its regulation not only provides for life through activities such as agriculture, but prevents its destructive powers rendering land useless or causing loss of life.

5. Transport

Water provides for exploration, migration and trade, both legal and illegal.

6. Waste Disposal

Water is used to carry away waste products and bodies of water are used as dumping areas for waste.

These *Uses of Water* have required specialist technology and expertise. There are three groups of tools:

1. Vessels.

Movable units which either float on the water (rafts, boats, ships) or in the water (submarines). This includes floating plants, such as cranes and jack-up oil rigs.

2. Static Installations

Structures which operate in one location to *Use the Water*, or to contain it, such as flood defences or drainage ditches. The structures may be built off-site, for example, mulberry harbours or oil rigs.

3. Hydro-communities

Communities whose relationship with water has led to the development of specialist skills in *Using Water*. The communities may be linked to water geographically or economically. The concept of the Maritime Cultural Landscape recognizes the importance of understanding these relationships^[2].

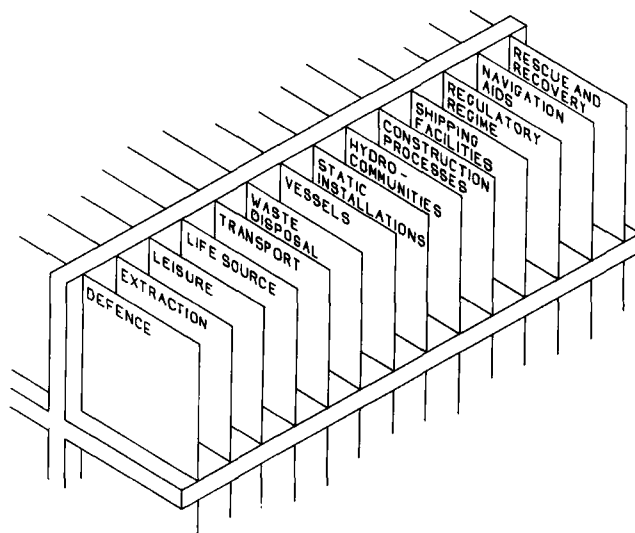


Figure 3. The *Use of Water* is the *Subject of Study* in *Hydroarchaeology*. The group of topics into which it divides can be called the *Hydrostory*.

In addition to the tools there is a wide range of supporting activities which facilitate the *Use of Water*.

1. Construction Processes

These include not only ship- and boatbuilding, marine engineering and civil engineering, but also manufacturing of subsidiary components and equipment. For example, iron works which produce large ship components, such as stern-posts, and manufacturers of materials or equipment, such as nails, ropes, sails, blocks, pumps.

2. Shipping Facilities

This includes port or dock services, such as berthing and cargo-handling facilities, and the conservancy of harbours and waterways.

3. Regulatory Regimes

The *Uses of Water* are regulated, and have been regulated, by a plethora of organizations. Their records are a rich source of documentary evidence in *Hydroarchaeology*.

4. Navigation Aids

This includes the exploration and charting of the sea and inland waterways, and the development of navigational techniques, instruments and systems (e.g., hyperbolic), and the maintenance of seamarks.

5. Rescue and Recovery

This includes rescue services which cover those engaged in *Using Water* and the

salvage of vessels or other equipment lost in water.

The *Subject of Study* in *Hydroarchaeology* can be coarsely divided into 14 constituent planes to represent the *Uses of Water* and the *Tools and Facilitating Activities* (Fig. 3). The Appendix provides an indication of the range of topics into which these planes can be subdivided. The sum of these planes as the *Subject of Study* in *Hydroarchaeology* can be called the *Hydrostory*.

The *Source for the Study* of the *Hydrostory* may be defined as the whole of the archaeological resource, because, as is represented by the intersecting planes of the two dimensions, it has already been recognized that any *Subject of Study* may draw information from any part of the *Source for the Study*. However, it is possible to identify elements of the *Source for the Study* with greater potential to yield high levels of information which is pertinent to *Subjects of Study* within *Hydrostory*. For example, when looking at Transport, the survey or excavation of a waterfront site with wharves and quayside storage facilities, whose size and design will relate to cargo-handling requirements, has greater potential to indicate the volume of trade than either the evidence of cargo from a single shipwreck site or the results of calculations based on distributions of traded wares gleaned from a

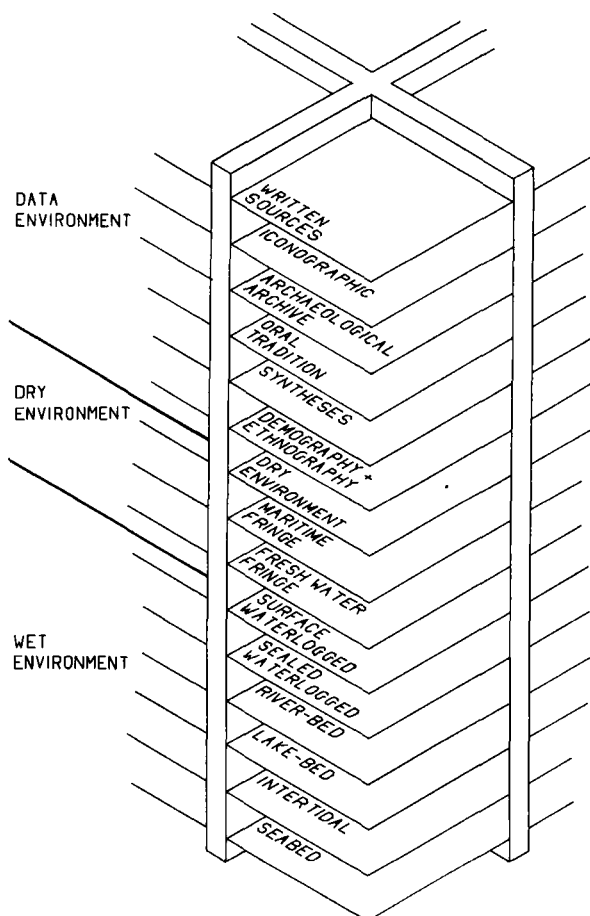


Figure 4. The archaeological resource is the *Source for the Study* and can be divided into different environments.

miscellany of inland sites which represent the point of consumption for imports.

However, division of the *Source for the Study* on the basis of site types will be of little value for two reasons. Firstly, site types are a function of the *Subject of Study* and to enumerate the totality of sites it would be necessary to identify all the *Subjects of Study* in the whole of *archaeology*. Secondly, any limitation of the *Source for the Study* to 'sites' overlooks the importance of aspects such as written, iconographic and oral evidence.

The *Source for the Study* is best considered as a series of environments in which traces of man may survive. The most coarse division would provide two planes: the *Data Environment* and the *Physical Environment*. When viewed in the plane represented by the *Source for the*

Study, *Hydroarchaeology*, by definition, must be concerned with archaeological information drawn from that part of the *Physical Environment* which is associated with water. This gives a division into the *Dry* and *Wet Environment*.

The *Data Environment* can be coarsely divided into the following planes:

1. Written Sources
Primary documents including maps and charts.
2. Iconographic Sources
Pictures represented in any medium.
3. Archaeological Archive
4. Oral Tradition
5. Historical and Archaeological Syntheses
Secondary works interpreting primary sources.
6. Demography and Ethnography

The *Physical Environment* can also be divided:

7. The Dry Environment

There are multitude of sub-divisions of this environment but, given the focus of this paper, these will not all be explored. Attention should be drawn to two spatially defined environments.

- 7.1. Maritime Fringe (i.e., coastal and estuarine area);
- 7.2. Fresh Water Fringe (i.e., river corridors and lake surrounds).

The *Wet Environment* can be divided into:

8. Surface Waterlogged (e.g., bog, marsh)
9. Sealed Waterlogged (e.g., buried peat layers)
10. River-bed (i.e., beneath flowing fresh water, including man-made canals)
11. Lake-bed (i.e., beneath enclosed fresh water including man-made lakes)
12. Intertidal
13. Seabed

While *Hydroarchaeology* viewed within the plane of the *Source for the Study* is confined largely to the *Wet Environment*, consideration from the plane of the *Subject of Study* and the *Process of Study* will show its interaction with a broader range of environments. Thus, information on the *Subjects of Study* covered by the *Hydrostory* may be found in all environments. This reflects the fact that the *Use of Water* has an impact far beyond the communities which are in immediate contact with the lakes, rivers and sea. In addition, changes in sea-level and the courses of rivers mean that sites once intimately connected with rivers or the sea may now be firmly in the *Dry Environment*.

Consequently, there is no need to define site types which are specific to *Hydroarchaeology* because such classification is a function of the interaction between the planes in different dimensions. It can be seen that the plane in the *Subject of Study* which represents Vessels intersects all planes in the *Source for the Study*. This reflects the fact that traces of ships and boats have been discovered in all environments: documentary, iconographic, dry (ship burials on sand, or ships within reclaimed land), intertidal and in fresh and salt water.

However, *Hydroarchaeology*, by definition that part of archaeology associated with water, includes not only site types appropriate to

the *Hydrostory* but all site types (i.e., sites, landscapes, finds) in the *Wet Environment*. *Hydroarchaeology* is thus intimately connected with *Subjects of Study* outside the *Hydrostory*. For example, the Langdon Bay, Dover Bronze-Age hoard is definitely part of *Hydroarchaeology* by virtue of its location in the *Wet Environment*. However, it cannot be conclusively termed part of the *Hydrostory* as the site of a vessel lost at sea since there is the possibility that its deposition is a function of coastal erosion. It may however be considered part of the *Hydrostory* for its evidence of transport between the Bronze-Age continent and southern Britain, or as evidence of a coastal community. Thus its presence may be seen in planes of more than one dimension of *Hydroarchaeology*.

The last dimension of *Hydroarchaeology* is the *Process of Study*. All of the constituent planes identified in Fig. 1 for archaeology as a whole can be used in *Hydroarchaeology*. However, some of the techniques into which they divide are exclusive to investigation of the archaeological resource in the *Wet Environment*. These are the specific preserve of *Hydroarchaeology*: for example, the use of diving for field survey and excavation, or seismic survey equipment specific to the marine environment, or techniques for recovering and conserving waterlogged wood.

In addition, some specialist studies within the division called Analysis have particular significance for *Hydroarchaeology*. The study of sea-level change, for example, contributes primarily to understanding of sites either in the present *Wet Environment* (the part of the *Source for the Study* which is automatically within *Hydroarchaeology*) or in the past *Wet Environment*, which are part of the *Hydrostory* and therefore within *Hydroarchaeology*.

The total division of the planes in each of the three dimensions can initially appear to conflict with the notion that all planes are intersecting. A plane in the *Process of Study* which is specific to *Hydroarchaeology*, representing, for example, the use of SCUBA or an echo-sounder, would not seem to have any point of junction, in reality, with a plane in the *Source for the Study* representing, say, chalk downlands. However, they each share a relationship with the planes in the dimension of the *Subject of Study*. In the case of the Langdon Bay bronzes, investigated using SCUBA, and sites on chalk where continental

pottery has been found, a link can be made by consideration of Bronze-Age water-transport, which would be a plane in the *Subject of Study*.

Consequently, no two specialisms in archaeology, however apparently remote, can be thought unrelated. *Hydroarchaeology* is not a

sub-discipline but an integral part of the three-dimensional composite whole of *archaeology*. The greater the diversity of specialists, whether in archaeological techniques, in specific elements of the archaeological resource, or in particular fields of study, the richer *Hydroarchaeology* will become.

Notes

- [1] The list of *Uses of Water, Tools and Facilitating Activities* has been developed from a subject list in Gale (1992) which was devised as a classification for maritime history.
- [2] The importance of the Maritime Cultural Landscape as a central concept in archaeology has recently been highlighted by Westerdahl (1992).
- [3] Divisions of modern shipping into function groups can be found in analyses of today's industry (Alderton, 1980).

References

- Alderton, P. M., 1980, *Sea Transport Operation and Economics*. London.
 Branigan, K., 1973, *Archaeology Explained*. London.
 Gale, A., 1992, *Catching The Tide. The Status and Future of Maritime Collections in the North East*. North of England Museum Service, Newcastle.
 Westerdahl, C., 1992, The Maritime Cultural Landscape. *IJNA*, 21: 5–14.

Appendix

Hydrostory

The following list is not intended to be exhaustive but to provide an indication of the range of *Subjects of Study* within *Hydroarchaeology*.

Defence

- Dwellings
 - Island (natural/man-made)
 - Stilts or other supports
 - Promontory (coastal/lake/river meander)
 - Moated
- Coastal
 - Signal stations
 - Forts
 - Beach (i.e. anti-landing)
 - Harbour entrances (e.g., chains and booms)
- Naval Operations

Extraction

- Animal
 - Whaling
- Fishing
 - Fixed Instruments (e.g., weirs, fixed nets)
 - Drift Nets
 - Movable Drag Nets (e.g., trawling)
 - Baited Traps (e.g., pots, hand and long-lines)
 - Man-power Instruments (e.g., spears, mussel rakes)
 - Farming

Vegetable

- Seaweed
 - Fertilizer production
 - Foodstuffs
 - Kelp burning

Mineral

- Salt Making
- Chemical use of seawater (e.g., reduction of limestone to magnesite)
- Aggregates
- Hydrocarbons
- Gold panning

Kinetic

- Cooling processes
- Direct power (e.g., water and tide mills)
- Indirect power (electricity generation by river/wave)

Land Reclamation

Leisure

- Shore-based
 - Fishing
 - Model boating
 - Scenic setting for other activities
 - Spas
- Waterborne
 - Canoeing
 - Diving
 - Fishing
 - Motor cruising
 - Power boating

- Rowing
- Sailing
- Surfing
- Swimming
- Water skiing
- Wind surfing

Life source

- Human Consumption
 - Drinking
 - Food preparation
 - Sanitation
 - Religious ritual
- Food Production
 - Irrigation
 - Anti-flood measures

This section includes consideration of water (e.g., rainfall, flood patterns) on demographic phenomena.

Transport

- Exploration
- Migration
- Trade (including smuggling)
 - Inland
 - Coastal
 - Oceanic
- Travel
 - Domestic
 - Foreign

Waste disposal—industrial, military and domestic

- Dumping (from land and using ships)
- Piping
- Ship waste
- Ship ballast

Vessels

For the model of Hydroarchaeology developed in this paper a classification of vessels by function is most appropriate^[3].

Static installations

- Aqueducts
- Canals and canalized waterways
- Dams
- Docks
- Dry Docks
- Flood Relief Works
- Groynes
- Locks
- Piers

- Mills
- Pumps (irrigation, etc.)
- Weirs
- Sea and Flood Defences
- Slipways

Hydro-communities

The relationship of communities to the sea through occupations, economic dependence, etc.

Construction processes

- Vessels
 - Boatbuilders
 - Shipbuilders
 - Individual trades
 - Marine Engineers
 - Ship Repairers
 - Subsidiary
 - Blockmakers
 - Iron/steel foundries
 - Pumpmakers
 - Ropemakers
 - Sailmakers
 - Timber suppliers
- Static installations
 - Civil Engineers

Shipping facilities

- Conservancy
- Dredging
- Health provision
- Lights
- Docks, etc.
 - Berthing (e.g., docks, wharves)
 - Cargo Handling (e.g., cranes, conveyors, drops, etc.)
 - Storage (warehousing, etc.)
 - Transport Networks.

Regulatory regimes

The *Use of Water*, like all activities, has attracted regulation. This section is concerned with the regulating organizations. Today in Britain, for example, the multitude of agencies include: Trinity House (lighthouses and navigation buoys, etc.), Coastguards (rescue services), Ministry of Agriculture, Food and Forestry (fisheries, dumping, etc.), Crown Commissioners (mineral extraction), National Rivers Authority (inland waterways and flood defences).

Navigation aids

Navigation Techniques

Hydrographic Surveying

Charts

Navigational Instruments (sextant to radar)

Navigation Systems (Decca stations, satellites, etc.)

Communications

Seamarks

Lighthouses and vessels

Leading Marks

Rescue and recovery

Lifeboat Organization

Life-saving Equipment (ship to shore) and organizations

Salvage