



Figure 4. A small lab technician prepares to chisel artefacts from a mock concretion with a radiograph as a guide. (Photo: courtesy of the Austin Children's Museum.)

story and involves children in multi-disciplinary learning activities as they become engaged in the archaeologists' detective work of piecing together history.

The value of presenting to children the lessons of archaeology is manifest. The Austin Children's Museum exhibit on the 1554 flota wrecks is an excellent example of this kind of effort. We urge our colleagues to keep in mind this avenue for reaching the public.

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Replicas, reconstructions and floating hypotheses

In a review of Frank Welsh's *Building the Trireme*, Christer Westerdahl (1992) has questioned whether a 'scientifically based reconstruction' can be made of a ship type for which there is documentary, iconographic and comparative evidence, but no physical remains. There are indeed problems in attempting such an under-

taking; but there are comparable, although not identical, problems in building a 'replica' of an excavated vessel, such as that of the 3rd/4th century BC Kyrenia ship, which Westerdahl evidently considers can be more readily justified than can a 'reconstruction' of a 5th century BC Athenian trireme.

These replica/reconstruction projects are examples of the two general classes of research in experimental boat archaeology:

- (i) 'Copies' or 'replicas' are built of specific ancient boats, using excavated remains as the primary evidence. In addition to the *Kyrenia* ship, other examples of this class are the Danish replicas of *Skuldelev 3* and *5*, and the German replicas of the *Bremen* cog.
- (ii) 'Reconstructions' or 'simulations' are built of some ancient type, known primarily from written and iconographic sources. In addition to the trireme, other examples may be found in the published work of Heyerdahl (1978) and of Severin (1978, 1982, 1985, 1987).

There is no intrinsic reason why either of these two methods should be better than the other: they are both valid research techniques and entirely reasonable ways of investigating the past, providing that in each case the research is undertaken with scientific rigour and appropriate techniques. Which of the two methods is used is determined by the nature of the surviving evidence.

The authenticity of the vessels designed and built by both these methods and what, if anything, they can tell us about the past depends, as with all archaeological experiments, on:

- (a) The quality of the data (excavated, documentary, etc.).
- (b) The rigour of the arguments for transforming those data into a hypothesis or hypotheses of the full form and structure of the original vessel (in scale drawings or models).
- (c) The appropriateness of the techniques used to turn such a hypothesis into a full-scale vessel, in effect a 'floating hypothesis'.
- (d) The rigour, relevance and effectiveness of the trials programme to measure and otherwise evaluate performance and operational limitations.
- (e) The full and widespread publication of the experiment so that it can be critically appraised.

It is impossible to assess many of the boat archaeological experiments that have been undertaken because they have not been adequately published. The *Kyrenia* ship replica is

certainly based on a 'well executed and well published excavation of the highest scientific standards' as Westerdahl (1992: 85) has argued, but the way that this excavated evidence (incomplete, fragmented, distorted and leaving much to be deduced) was transformed into a complete ship *Kyrenia 2* and how her sea trials were undertaken have not yet been published in the necessary detail. The reason why *Kyrenia 2* has received 'far less attention', to quote Westerdahl again, is that no one outside the experimental team is able to judge the authenticity of this replica or the value of the trials and their relevance to the study of 4th/3rd century BC boat-building and seafaring. Some of the well-known replicas from northern Europe may be similarly 'in limbo' owing to less-than-comprehensive publication.

Whatever may be the faults of the Trireme Trust, it cannot be accused of inadequate publication: to the books listed by Westerdahl (1992: 84) may be added Coates (1988/9; 1989; 1990; 1991) and Coates & Morrison (1987). Moreover, detailed building drawings are available (Morrison & Coates, 1986: 228). Anyone who has studied these publications and drawings can assess the Trireme Trust's claims that their experiment was valid, their reconstruction authentic and that their trials throw light upon nautical affairs in the 5th century BC Aegean. Furthermore, conferences were organized by the Trust at Greenwich before building (Coates & McGrail, 1984) and at Oxford after three seasons of trials (Shaw, forthcoming), at which the principal exponents of the Trireme hypothesis were criticized and questioned about their sources and techniques.

It is right that projects claiming to be involved in experimental archaeology should be criticized, if only because to date we have learned little about early boat-building and seafaring from the many replicas/reconstructions that have been built: a cost-effectiveness of almost zero. It is questionable whether most of them can be considered as scientific experiments, which is what they should be if there are to be worthwhile results (McGrail, 1990). Many of these projects appear to be aimed at 'learning about oneself' rather than learning about the past, or were motivated by national prestige, historic nostalgia or commercial success—such aims may be fine in themselves, but the related

projects cannot claim to be archaeological experiments unless they have an over-riding archaeological aim (McGrail, 1986).

Hypotheses must be investigated and tested by experiment, a process which lies at the foundation of all sciences. As Westerdahl states (1992: 84), 'we never know what we should have known beforehand'. And after testing, the research must be published so that it may be criticized. The Trireme Trust's arguments, both evidential and physical, are, as is proper, open to criticism and with hindsight it is possible to suggest that certain theoretical and practical aspects of their research might have been tackled in a different way: for example, more emphasis might have been placed on evaluating several hypotheses by theoretical and other means before the Trust became committed to one hypothesis, and perhaps more time given to sailing trials. Nevertheless, I consider that the Trust's approach to research, building and trials has been rigorous and that they have undertaken an extremely valuable archaeological

experiment. This is my view; others who have read the Trust's publication or taken part in the trials may come to different conclusions, but it is upon such detailed evaluations of the Trust's arguments and practices that criticism should be based, not on any general belief that physical remains are the only basis for formulating hypotheses about ancient ships.

The Trireme Trust is now, I understand, re-evaluating its hypotheses concerning certain particulars of the 5th century BC Athenian trireme, and in due course will present a re-appraisal for public discussion. Perhaps builders of other replicas and reconstructions could now follow the Trust's example and publish their experiments in full. Only by widespread discussion of actual experiments will this important aspect of maritime archaeology realize its proper potential.

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