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Evolution of an interdisciplinary enterprise: the *Journal of Archaeological Science* at 35 years

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ABSTRACT

The *Journal of Archaeological Science* first appeared in 1974 as an explicitly interdisciplinary medium, linking archaeology with the natural sciences, and one that emphasizes methodological innovation. This editorial analysis examines the steady growth of the journal from 400 to 3200 print pages per annum, and from a small to a large, double-column format. The impact factor increased until it became the leading archaeological journal overall. Tracking the published papers according to national origin, manuscripts from the USA began to outpace those from the UK in 1990, and Australia, South Africa and Canada are well represented. After 2000 the influx of papers from non-Anglophone countries also increased rapidly until by 2008 they exceeded those from the UK or USA. A growing interest for archaeological science is suggested in Mediterranean countries such as France, Israel, Spain and Italy. Thematic trends are more difficult to track due to the growing structural complexity of many papers. That said, there is no striking thematic shift, confirming the viability of the inclusive philosophy and diversity of the journal, and its balance between problems and analytical innovation, as applied to significant archaeological issues. Possible editorial responses to changing directions in archaeology are discussed. For all scientific periodicals, the efficacy of the peer-review system today is challenged by the increasing numbers of journals and manuscripts, together with the greater specialization of high-tech methods. This demands greater professional responsibility as well as new solutions.

1. Foundations

The 19th century fascination with archaeology and the natural sciences emerged in response to the Napoleonic *Description de l'Egypte*, giving impetus to geographical and other learned societies willing to support the juxtaposition of new questions and perspectives. The configurations of cross-disciplinary research eventually came into focus with excavation projects such as in the Fayum (Egypt, 1920s), Star Carr (Yorkshire, 1950s), and Jarmo (Iraq, 1950s). These efforts were complemented by a novel emphasis on *ad hoc* field or laboratory study of physical and biological materials, together with a search for objective methods to date the past. More explicit conceptual frameworks followed, in part drawn from earlier writings on history and the environment, as a putative paradigm of archaeological science (Brothwell and Higgs, 1963) or environmental archaeology (Butzer, 1964) became apparent.

Substantial growth during the 1970s is borne out by several books and collected volumes addressing various interfaces between archaeology and the natural sciences. The *Journal of Archaeological Science* was launched by Academic Press in 1974, through the initiative of Don Brothwell and the late Geoffrey Dimbleby, as a pioneering, interdisciplinary periodical. Trained as a physical anthropologist, Brothwell was an expert in paleopathology and prehistoric diets. He is an emeritus professor at York University, and has continued to publish actively. With a background in botany and soil science, Dimbleby was professor of human environment at University College, London, and especially engaged in matters of forest ecology. Both men collaborated actively with archaeologists throughout their careers, and shared a broad vision of archaeological science. They saw the interdisciplinary challenge positively as well as critically.

As announced in the first issue in 1974, the stated goal of the journal was the combination of archaeology with the physical, biological and earth sciences, as well as mathematics. This thematic conception is in many ways analogous to that of *Science in Archaeology* (Brothwell and Higgs, 1963), which had 54 terse but informative, expository chapters on dating methods, environmental history and reconstruction, human osteology and paleopathology, applications of archaeometry, and site prospecting. What began as a modest quarterly, with 400 pages per annum, has

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grown phenomenally to a large-format, double-columned monthly, with 3200 pages in 2008. The basic focus proved quite durable, but it also has evolved significantly, to be reformulated in 1981 as "covering the interaction between the sciences and archaeology, with particular emphasis upon methodological innovation". That is precisely what the journal continues to offer. Articles are overwhelmingly problem-oriented, with methodologies presented in the context of specific case studies.

Successful interdisciplinary journals remain uncommon, so that the unpredictable evolution of the JAS is of some interest. Three graphics were prepared (a) to illustrate the physical growth of the journal and the accompanying changes of the editorial board; (b) to approximate the origin by country of the manuscripts published, and (c) to attempt to identify the trends of papers within different subfields of archaeological science (Figs. 1–3). These themes can be discussed and the methodology underlying the figures explained.

2. Growth of the journal

Fig. 1 records the physical growth of the JAS, as measured by number of annual print pages. It does not, however, quantify the effect of the change of format (in 1994) from a small (A5) page to a larger (A4) one, with double columns – there are 37% more spaces per page with the larger format.

Submissions to the JAS were initially all processed in the UK, in cooperation between the editors and Academic Press, and the authors were overwhelmingly based in the UK (81% during 1974–1976). The papers also happened to be concentrated in bioarchaeology (67%), especially palynology and malacology, a British forte. This may have given an incorrect perception that the JAS was a medium to publish UK research on paleoenvironments. The founding editors had hoped for a more active role by archaeometrists, judging by one of the choices for editor (H. Barker) and four of 15 members of the editorial board. But this did not happen. Given the deep recession in the USA at the time, research and university funding had been cut back and libraries were reluctant to subscribe to any new journals, despite the modest original cost of £9.10.

Joan Fujimoto of Academic Press was in charge of the journal and she was unwilling to let the JAS stagnate into a parochial outlet, despite the high quality of its papers and the fact that 10% of the published articles already came from outside the Anglophone realm, especially the Netherlands. During the mid-1970s she invited Karl Butzer to several meetings with the UK editors, to explore ways to broaden international appeal. The outcome was that Butzer was selected to replace Barker as editor, and the US membership on the editorial board was revamped, with four new US-based scientists, including Richard Klein, appointed. A USA submissions office was opened in mid-1977 and manuscripts by archaeologists were welcomed.

A second development was the new USA *Society for Archaeological Sciences* (SAS), a large group of archaeological geologists and archaeometrists, which in 1978–1979 negotiated a special subscription price to the JAS for its members. Some SAS members took advantage of this opportunity, but they had no immediate success in persuading their university libraries to subscribe. With today's electronic dissemination, that would be no problem, but at the time it was. Nonetheless, USA manuscripts began to arrive, so that published USA papers had increased from 5 to 23% between 1974–1976 and 1980–1981.

In 1981 Klein joined the editors and took over handling of USA submissions, and the journal soon began to receive manuscripts on zooarchaeology from USA-based archaeologists. Given this welcoming philosophy, the JAS was gaining momentum and becoming viable. In fact, publication delays were already developing, so that Academic Press decided to increase the number of issues from quarterly to bimonthly in 1983, appointing a new UK editorial team of Robin Dennell, Kevin Edwards, and Susan Limbrey,

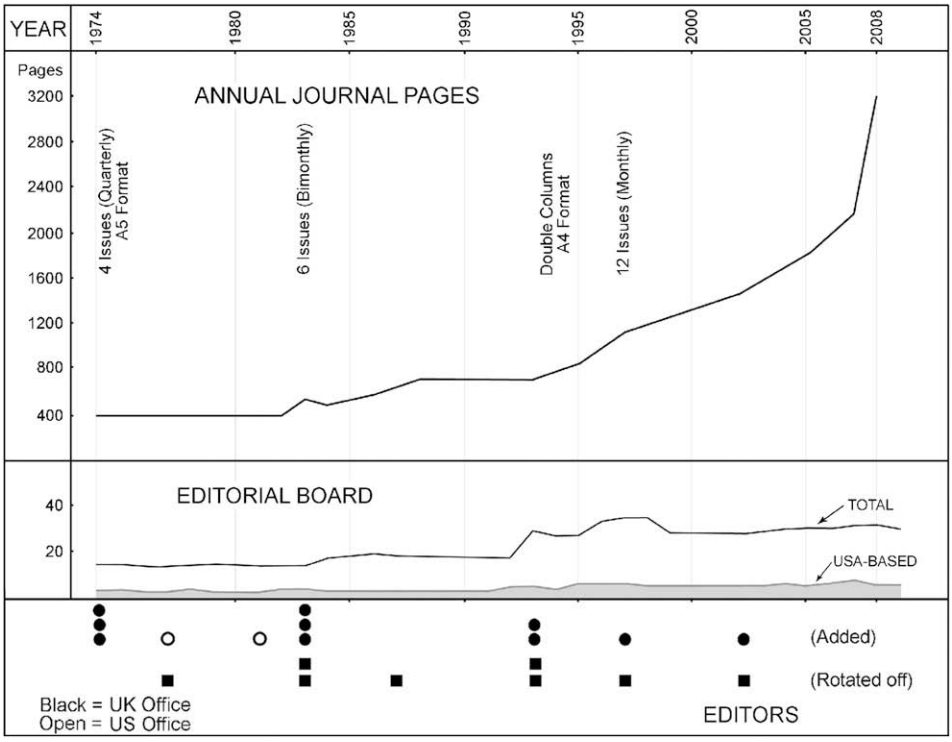

Fig. 1. Growth of the Journal of Archaeological Science in terms of annual print page number. The growth of the editorial board reflected that of the journal.

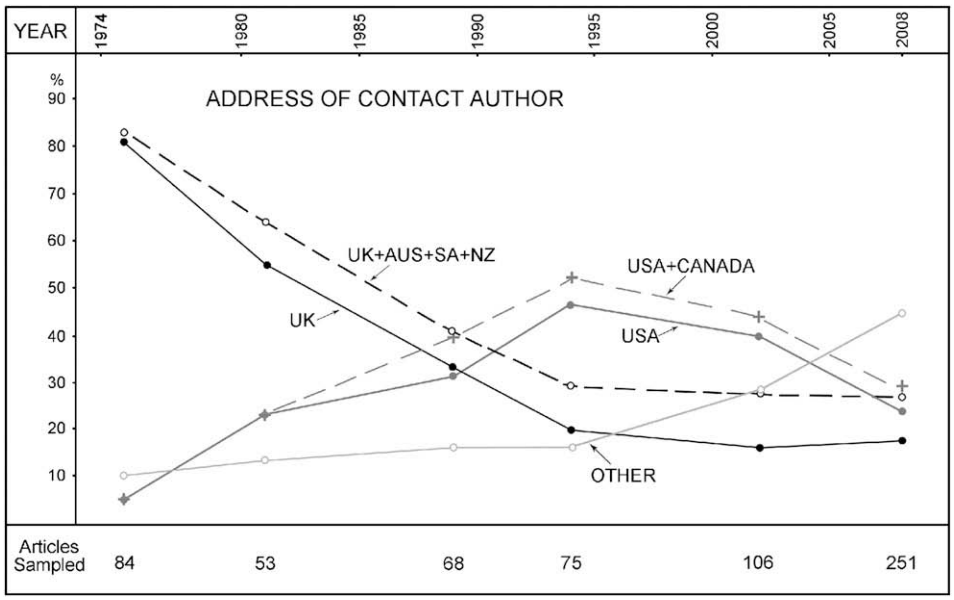

Fig. 2. National origin of published papers, based on the institutional address of contact or corresponding author. Aus, Australia; SA, South Africa; NZ, New Zealand. For the samples used and identification of Other, see text.

thus increasing the number of editors to five. Although it took until 1986 to actively increase the published pages to 600, the journal now was an established interdisciplinary medium, with a growing influx of high-quality submissions.

There were further rotations of the UK editors in 1994, when David Gilbertson and Julian Henderson replaced Edwards and Limbrey, or again in 1997 as John Grattan joined and Gilbertson rotated off, and in 2003 when Thilo Rehren came aboard in place of Henderson. The editorial board was substantially enlarged, but not its USA representation. "Space" in the journal was increasing rapidly, yet still not keeping up with the influx of manuscripts. The switch from Academic Press to the Elsevier imprint in 2003 did not affect the journal visibly, but a new rationalization of the publishing process had begun.

For all intents and purposes, the journal now has 11 times the "space" that it did during the mid-1970s. In spite of this rapid growth, the "impact factor" of the JAS increased steadily from 0.819 to 1.439 (in 2007), as a verdict on its quality and relevance. Indeed, by 2004 the JAS had pulled ahead of the *Journal of Anthropological Archaeology*, *American Antiquity*, *Archaeometry*, as well as *Geoarchaeology*, to become the leading archaeological journal overall.

3. National origin of manuscripts

With editorial offices in both the UK and USA, and communities of scientists split accordingly, it is informative to now examine the composition of the journal's authors. In view of multiple authors becoming the rule, the institutional address of the "contact" or "corresponding" author was selected to identify country of origin for manuscripts published. A sampling procedure was necessary to extract reasonably representative information from over 2500 papers (viz., 3 years centered on 1975; 2 years for 1980–1981; eight arbitrarily picked issues centered on 1989; six numbers for 1994; and complete single years for 2002 and 2008). These added up to 637 articles, or almost a quarter of the total.

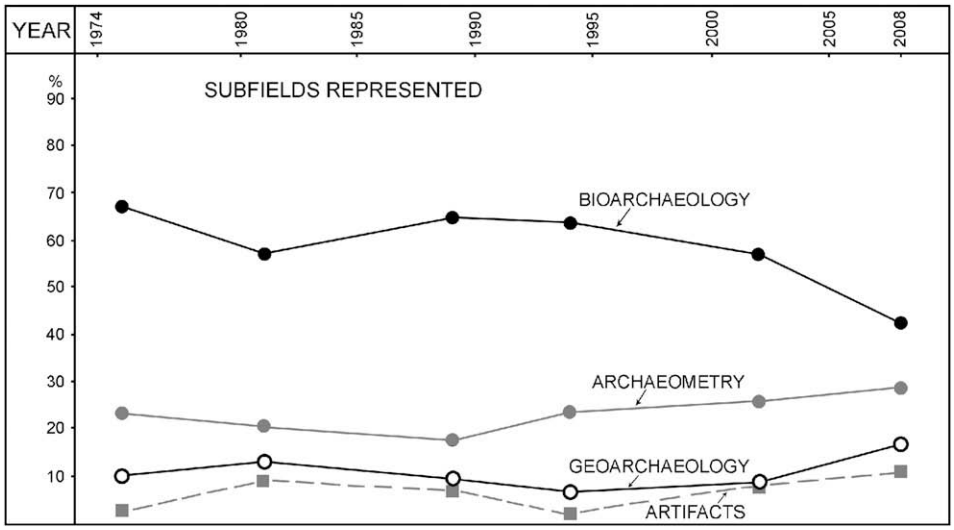

Fig. 3. Stability of the analytical subfields represented in published JAS papers. See text in regard to classification.

The countries of origin were classified as UK, Australia–South Africa–New Zealand (as a group), the USA, Canada, and "Other". Such a simplification allows the intelligible graphic representation given in Fig. 2, with a more specific tally given in Table 1.

Although the lower range of numbers is prone to greater misrepresentation, as a result of random temporal variability, the data do offer a useful overview of which countries have contributed submissions over the longer view or, most recently, for 2008.

The most striking feature of Fig. 2 is that while the proportion of UK papers declined from 81 to 20% during the first 20 years, their actual number has remained fairly steady. This probably reflects the "founder" legacy, in addition to the swelling of contributions from other countries. At the same time there has been strong growth from the USA (from 5 to 47% during the same period). But this shift had not yet become apparent in the composition of the editorial board – 19 members from the UK in early 2009, but only five from the USA.

The strong representation of Australia, South Africa, and Canada is notable. It demonstrates continuing close ties between research institutions in these Anglophone countries, as well as the vitality of the archaeological sciences represented.

The surprise of Fig. 2 is the abrupt increase in submission from other countries towards 2008, from 28 to 45% of the total. The change is international, accompanied by a marked relative decline of papers from the USA (40 to 24%). The increase comes primarily from Israel, France, Spain and Italy. It is still too early to interpret this transformation, or to know whether it will continue. But it may well indicate a growing interest for archaeological science in the Mediterranean countries. For example, during the summer of 2008 a geoarchaeology conference in Greece, emphasizing classical archaeology, attracted some 600 papers. If sustained, this trend could indicate a sea change in interdisciplinary collaboration.

4. Thematic change?

It is difficult to synthesize the thematic evolution of the JAS – exactly because the subject matter is interdisciplinary to begin with, and increasingly incorporates several research components, ultimately directed to a higher order of results. Even with a simpler paper structure, broad categories must be identified, at the risk of subjective labeling. Ideally, a very complex and laborious computerized analysis would need to be applied to over 2500 articles. Since that is not about to happen in the near future, a first approximation must suffice, to illustrate what the JAS publishes and how this may or may not have changed.

Table 1
National origin of manuscripts.

Country	Sum of all six samples	2008 sample only
UK	186	44
USA	174	59
Aus–SA–NZ	58	24
Canada	34	12
Israel	24	17
France	23	16
Spain	21	15
Germany	13	5
Italy	11	11
Greece	11	7
Sweden	9	6
Demark	7	4
Japan	7	1
Netherlands	6	2
Belgium	6	2
Argentina	5	4

Accordingly, four major subfields are identified below (see Fig. 3), as a basis for further discussion:

(1) Bioarchaeology, the most intricate and also largest subfield, can be envisaged as emphasizing archaeobotany, palynology, phytoliths and zooarchaeology, as informative procedures in environmental reconstruction, microstratigraphy, or broader interpretation of archaeological residues and bone taphonomy. There also appears to be a continuum to matters of diet and stable isotopes, organic residues and osteology, and a wide range of paleopathological studies, in part medical or forensic. It might well be argued that "bioarchaeology" as here described should be subdivided into several categories.
(2) Geoarchaeology addresses archaeological problems by means of earth-science techniques. Approaches must be adapted to different kinds of archaeological sites and are grounded in microstratigraphy, microdepositional environments, and site formation or post-depositional processes, employing techniques such as sedimentology and soil properties or soil micromorphology (see Butzer, 2008). Also usefully included here are GIS and soil prospecting, although they still represent a comparatively minor component.
(3) Archaeometry emphasizes identification, provenance or production studies in archaeometallurgy, geoceramics, glass, or chemometrics, with diversifying high-tech methods (Rehren and Pernicka, 2008; Killick and Young, 1997). Dating techniques, mathematical approaches, and computerized simulations can also be grouped here.
(4) Artifact studies, beyond "materials" or traditional classification, may deal with tool production and modification, microdistributions, or use, e.g., via microwear patterns and organic residues.

Beyond the inherent limitations of any classification, and considering the particular preferences of practitioners, methodologies are evolving so rapidly that there may be a danger of overemphasizing batteries of analytical techniques – at the expense of addressing significant archaeological problems. Given such caveats, Fig. 3 seems to suggest that the JAS continues to adhere to the basic vision and logic of its founding editors.

5. The JAS today

The successful formula that has sustained the accelerating growth of the journal appears to be its inclusive philosophy, its balance between problems and analytical innovation, and its *de facto* role as an interactive forum between the sciences and archaeology. Many of the contributors as well as the editorial board members identify themselves as archaeologists, or at least work within departments of archaeology or anthropology. The editors, past and present, include several bridge-building geographers, and share a genuine interest in the challenge of significant archaeological issues. Most articles give a context and discuss broader implications, drawing a diversity of readers.

Downloading statistics for the last 4 years supports such inferences. For example, seven papers published since 2000 have been downloaded well over a thousand times, some actively continuing to be so. These include themes such as "Folsom point design and adaptation" (Ahler and Geib, 2000); "Sego lilies and prehistoric foragers" (Smith et al., 2001); "North American overkill" (Grayson and Meltzer, 2003); "Environmental history in the Mediterranean world" (Butzer, 2005); "The social bond between dogs and people" (Morey, 2006); "Rethinking Easter Island's ecological catastrophe" (Hunt, 2007); "Prehistoric population history (Late Glacial to Late Neolithic, in temperate Europe)" (Shennan and Edinborough,

2007); or "Methods of soil P analysis in archaeology" (Holliday and Gartner, 2007). Computer searches for keywords evidently are important for dissemination as well as the fiscal viability of a journal.

The JAS receives its share of manuscripts, so that competition with other established media is not about volume. It is about attracting the most interesting or innovative articles, the ones to which a discriminating readership is drawn. Two possible competitors, *Archaeometry* and *Geoarchaeology*, have recently been revamped so as to appeal to archaeological audiences. The *Journal of Human Evolution*, which has its pick of research in palaeoanthropology, may draw off some geoarchaeological and taphonomic components, particularly in regard to Pleistocene evolutionary studies. Other journals, such as *Quaternary Science Reviews* or *Quaternary Research*, have a little overlap with the JAS but less general appeal for archaeologists. But given the growing number of other, expanding journals, with intersecting clienteles, the field could be described as basically unstable, so that unexpected rearrangements are possible.

There are no grounds for complacency, since the number of manuscripts with significant archaeological applications is finite. The editors of the JAS need to periodically reevaluate their strategies to maintain a balance between high-tech methods and broadly interesting archaeological issues, at a time when their constituencies are fluid.

In effect, the editors are proactive, now directly encouraging submissions from high-profile researchers as well as from younger practitioners in poorly represented but active subfields. For example, geoarchaeology in the UK is flourishing, as a result of fresh funding sources, and initiatives might be taken to bring in new authors. Even in the USA, geoarchaeology is receiving more attention by geomorphologists. A special issue of top-flight contributions to current research in paleoanthropology would be widely welcomed. Further steps to attract papers on long-term environmental degradation or world-systems "collapse" would also be prudent, because archaeological interest is turning to younger time ranges. Finally, it would be advantageous to appoint new members to the editorial board from non-Anglophone countries who might also be asked to report briefly on regional conferences or research directions at their institutions.

6. The peer-review crisis

A closing comment about competent refereeing is called for, in the context of increasing technological refinement. The peer-review system has recently drawn the attention of a key member of the British Academy as well as the Editor of Science, in part with respect to potential conflicts in regard to environmental change. But at the moment the search for unbiased reviewers is less of a problem for the JAS than is the shortage of qualified or willing referees. All quality journals experience the same problem today, given the growth of the number of publication outlets and in research productivity with an expanding professional body, which places exponentialy greater demands on reviewers' and editors' time. Quality control is essential to the survival of print journals. Further, potential reviewers must recognize that they are in good measure responsible for the quality of "their" journals. Yet all too many leaders in their fields are declining to participate in the peer-review system: they should therefore anticipate the consequences, specifically that impact indices for their key journals will erode.

Flexible solutions are called for, beginning with greater communication among managing editors, "regular" reviewers, editorial board members, and outside advisers too. The idea would be to identify a larger pool of potential reviewers, especially those with expertise in evolving high-tech methods. This could and should bring many more, early- to mid-career scientists into the process. Some journals are considering a new category of tactful and fully informed subeditors, to select and correspond with referees for specialized subfields, so as to ease the burden of overworked editors.

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