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Currents and trends in the archaeological sciences

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ABSTRACT

Here I use *ISI Web of Knowledge* to build on a recent paper by Butzer (2009) and track current trends in the archaeological sciences. I researched eight thematic keywords replete in the title, abstract, keywords and main body of archaeological science literature for the period 1970–2008. For all keywords investigated a steady rise in archaeological science research is evidenced after 1980, with pronounced growth occurring after 2000. I attribute this pattern to the standardisation of research production and academic evaluation, in addition to the democratisation of new information technologies, notably the Internet. The evolution of 10 leading archaeological science journals was also tracked. Since the 1970s, the bibliometric data show that nine of the ten journals have successfully expanded on an annual basis. I found that the biggest growers (the *Journal of Archaeological Science [JAS]*, the *Journal of Human Evolution* and the *Journal of Anthropological Archaeology*) are all published by *Elsevier*. In 2008, the JAS was ranked first for five of the eight thematic keywords by ISI, underlining the popularity and interdisciplinary scope of the journal. According to the 2008 *Journal Citation Reports*, the JAS ranks second for total citations (4219) in archaeological science and third for its overall impact factor (1.779).

A recent paper by Karl Butzer entitled '*Evolution of an interdisciplinary enterprise*: *the Journal of Archaeological Science at 35 years*' raises a number of interesting points with regards to the journal's growth, success and present position amongst the archaeological science community (Rehren et al., 2008; Butzer, 2009). Using *ISI Web of Knowledge*, I analysed a series of new variables to complement and build on points made in this article. The ISI data reveal a number of patterns and I would like to insist upon the following four points.

1. Development of the archaeological sciences

From its inception as an interpretative paradigm during the 1960–1970s (Brothwell and Pollard, 2001), the ISI database demonstrates that there has been a significant growth in archaeological science literature in general. Within this context, I tracked the evolution of eight archaeological science themes between 1970–2008: *biomolecular archaeology* (31 total hits), *ethnoarchaeology* (210), *experimental archaeology* (219), *geoarchaeology* (275), *historical archaeology* (1093), *marine archaeology* (226), *molecular archaeology* (210) and *zooarchaeology* (263) (Figs. 1 and 2). The searches were applied to all areas of the natural and social sciences, and not restricted uniquely to archaeology journals. It is important to bear in mind that the ISI catalogue is a dynamic database, and new titles are constantly being added. In light of this, the figures discussed here are correct at the time of going to press. With the exception of *biomolecular archaeology*, all of these archaeological science fields emerged during the 1970–1980s, growing steadily after 1990. The keyword *geoarchaeology*, for example, generated 275 hits of which 0 papers are attributed to 1980, 3 to 1990, 10 to 2000 and 57 to 2008. For certain keywords, a number of discrepancies was observed between the *Elsevier Science Direct* and ISI search engines, manifestly arising from how titles are marked and searched in their respective databases.

Have there been any thematic shifts? I found that all fields grew consistently between 1970–2008, the most pronounced average annual growth rates being in *geoarchaeology* (97 %), *historical archaeology* (79 %) and *marine archaeology* (61%). The emergence of interdisciplinary academia and new scientific tools also explains the expansion of certain fields including, for example, *marine* and *biomolecular archaeology*.

2. Explaining the growth

After 2000, I recorded a sharp rise in archaeological science publications (Figs. 1 and 2). How can this be explained? I attribute the trends to two different factors. (i) Without question, **the Internet** has been preponderant in the expansion of archaeological science literature through its vast global network. Not only has it transgressed inward looking national schools of archaeology but it has also standardised evaluation methods (e.g. peer-review), in

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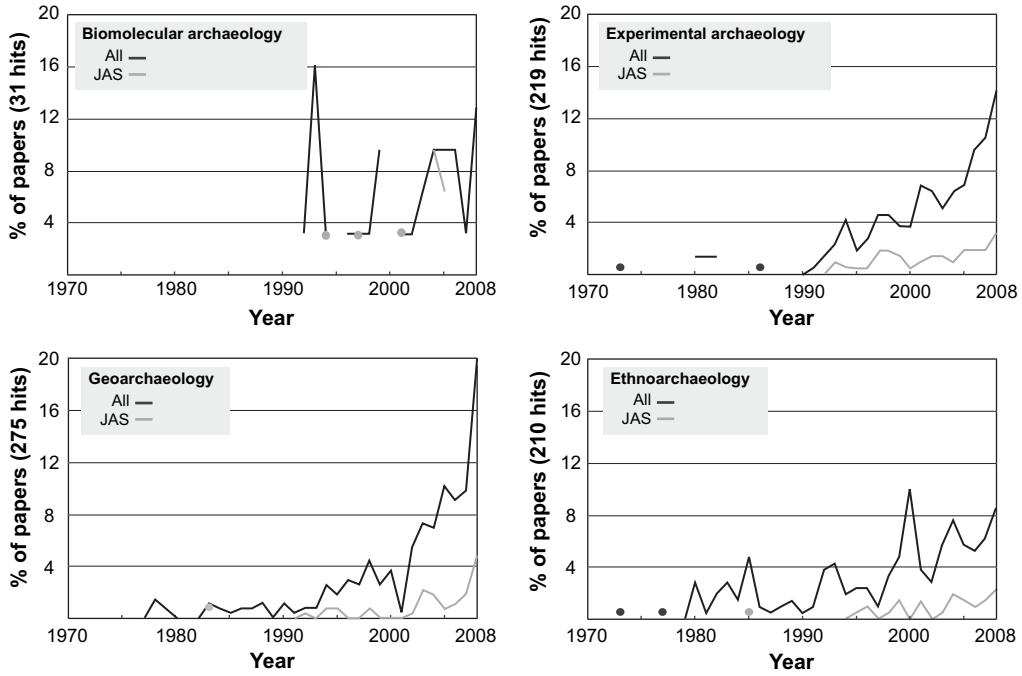

Fig. 1. Growth of four archaeological science themes between 1970 and 2008 (*biomolecular archaeology*, *experimental archaeology*, *geoarchaeology* and *ethnoarchaeology*). The black line denotes all ISI sources whilst the grey line represents JAS only hits. All values are given as a percent of the total hits count. Source: ISI Web of Knowledge.

addition to promoting the more rapid diffusion of newly emerging modes and interpretative paradigms. For example, nearly all of the leading archaeological science journals have now embraced online submission, which has also significantly reduced publication times. At a global level, the Internet has been one of the key drivers in moving archaeological science beyond its Anglophone cradles in Britain and North America, largely since 2000 (Butzer, 2009). Also, unlike traditional archaeology, English has become the *lingua franca* of archaeological science discourse. (ii) **One idea, one article**. Traditionally, archaeologists' favoured medium of scientific diffusion has been the monograph. Today, the *opus magnus* is in decline and shorter papers have emerged as preferred conduits for academic publication, particularly in the archaeological sciences. Current emphasis on citation indices and journal impact factors (e.g. *Journal Citation Reports* impact factor, *Eigenfactor*) to gauge scholarly production has further accentuated this tendency (Ball,

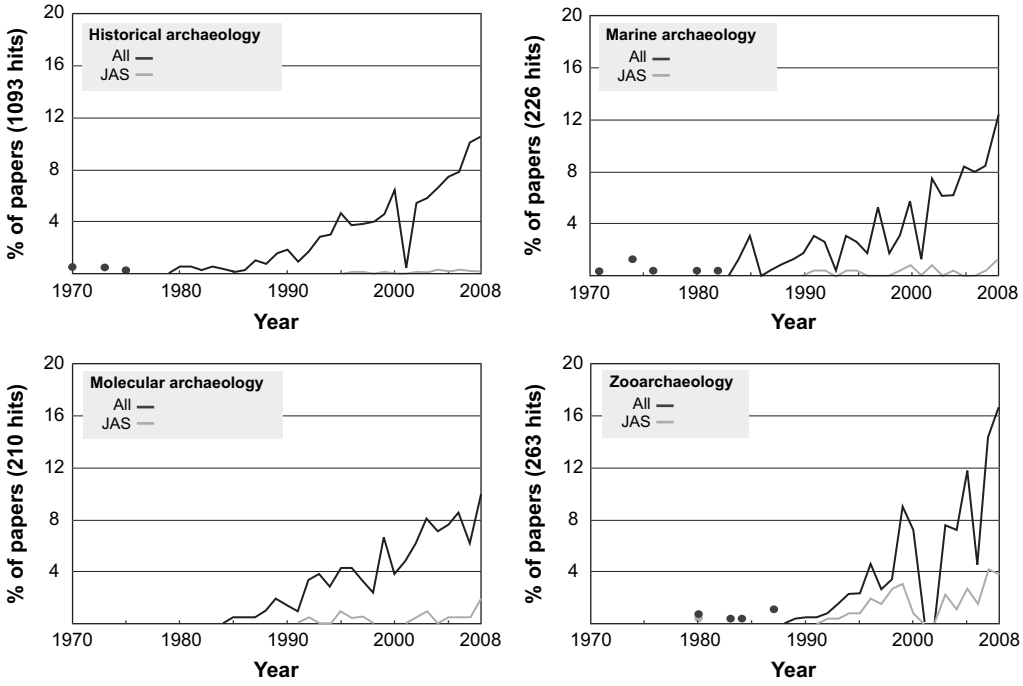

Fig. 2. Growth of the themes *historical archaeology*, *marine archaeology*, *molecular archaeology* and *zooarchaeology* between 1970 and 2008. Source: ISI Web of Knowledge.

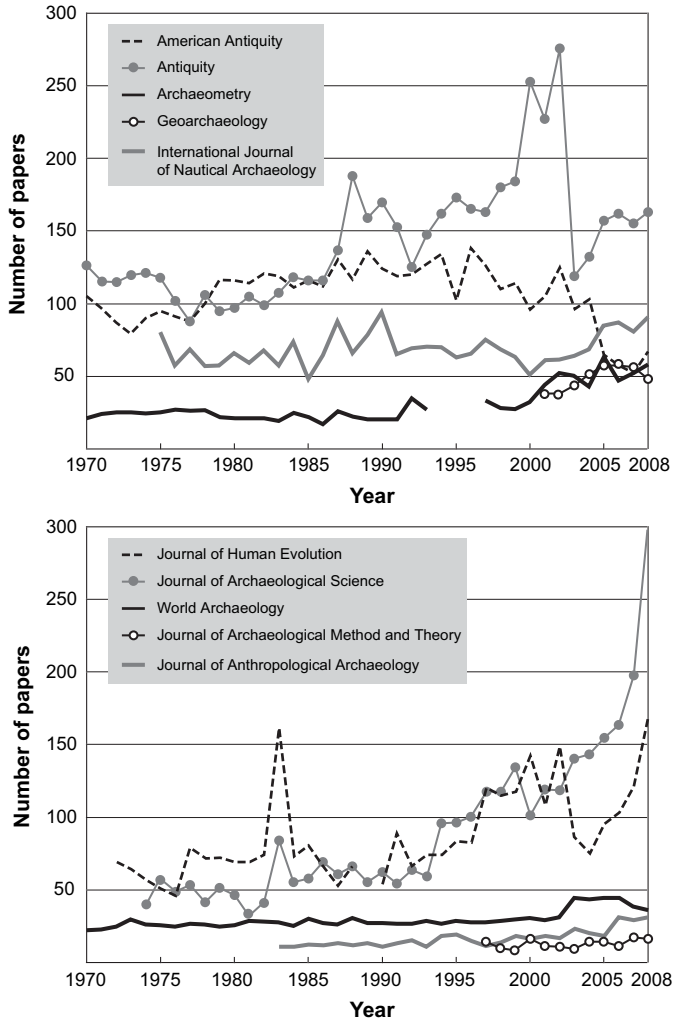

Fig. 3. Evolution of ten archaeological science journals between 1970–2008, represented by the number of papers published. Source: ISI Web of Knowledge.

2005; Garfield, 2006). To keep pace with these trends, many of the most successful archaeological science journals have expanded their publication space. For example, the JAS has adapted its format on no less than five separate occasions since its inception in 1974 (see Butzer, 2009, Fig. 1).

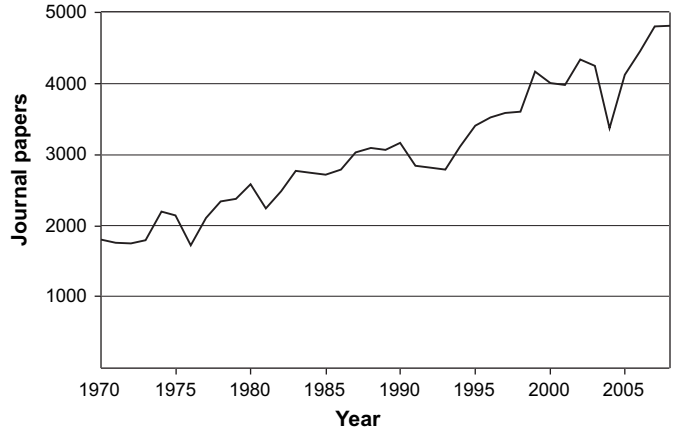

Fig. 4. Growth of anthropological literature since 1970, as evidenced by ISI ('anthropology' comprises 61 journal titles in the 2008 JCR).

Table 1
Top journals for eight archaeological science themes.

Rank		Papers	
	Keyword 'biomolecular archaeology'		% of total papers (31)
1	**Journal of Archaeological Science**	**9**	**29**
2	World Archaeology	5	16.1
3	Animal Genetics	2	6.5
4	Science	2	6.5
5	Acupuncture & Electro-Therapeutics Research	1	3.2
	Keyword 'ethnoarchaeology'		% of total papers (210)
1	**Journal of Archaeological Science**	**29**	**13.8**
2	American Antiquity	23	11
3	Journal of Archaeological Method and Theory	16	7.6
4	Antiquity	15	7.1
5	Journal of Anthropological Archaeology	14	6.7
	Keyword 'experimental archaeology'		% of total papers (222)
1	**Journal of Archaeological Science**	**46**	**20.7**
2	American Antiquity	11	5
3	World Archaeology	11	5
4	Journal of Human Evolution	10	4.5
5	International Journal of Nautical Archaeology	9	4
	Keyword 'geoarchaeology'		% of total papers (275)
1	**Journal of Archaeological Science**	**43**	**15.6**
2	Geoarchaeology	29	10.5
3	Geomorphology	18	6.5
4	American Antiquity	11	4
5	Plains Anthropologist	11	4
	Keyword 'historical archaeology'		% of total papers (1106)
1	Historical Archaeology	174	15.7
2	American Antiquity	61	5.5
3	World Archaeology	38	3.4
4	American Anthropologist	32	2.9
5	Antiquity	31	2.8
6	**Journal of Archaeological Science**	**18**	**1.6**
	Keyword 'marine archaeology'		% of total papers (231)
1	International Journal of Nautical Archaeology	19	8.2
2	**Journal of Archaeological Science**	**14**	**6.1**
3	World Archaeology	9	3.9
4	Antiquity	7	3
5	American Antiquity	6	2.6
	Keyword 'molecular archaeology'		% of total papers (210)
1	PNAS	15	7.1
2	**Journal of Archaeological Science**	**14**	**6.7**
3	American Journal of Human Genetics	7	3.3
4	American Journal of Physical Anthropology	6	2.9
5	Analytical Chemistry	6	2.9
	Keyword 'zooarchaeology'		% of total papers (263)
1	**Journal of Archaeological Science**	**73**	**27.8**
2	International Journal of Osteoarchaeology	19	7.2
3	Journal of Human Evolution	15	5.7
4	Journal of Anthropological Archaeology	14	5.3
5	American Antiquity	13	4.9

Bold denotes the *JAS*. Source: ISI Web of Knowledge.

I also tracked the evolution of ten leading archaeological science journals since 1970. The analysis recorded the number of papers published per journal (as catalogued by ISI) but did not include a count of the total number of pages. With the exception of *American Antiquity*, there has been a general increase in the number of papers published annually by the leading archaeological science journals (Fig. 3). The biggest growers have been the JAS (9.3 % per annum average) - which has expanded its format from the original 400 pages in 1974 to 3200 pages in 2008 – the *Journal of Anthropological*

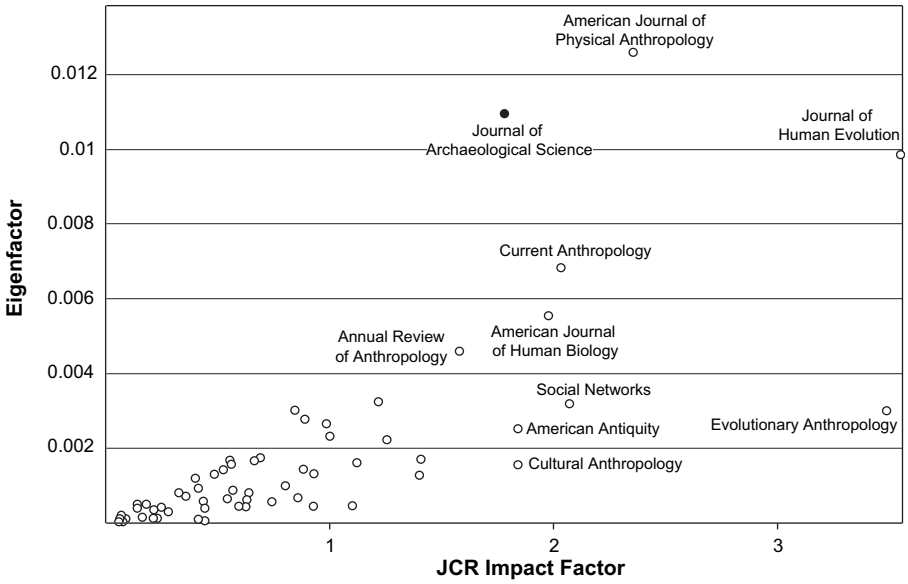

Fig. 5. Scatter plot of 2008 JCR impact factor vs. Eigenfactor values for anthropology journals. The black dot denotes the JAS.

Archaeology (6.7 %) and the *Journal of Human Evolution* (4.7 %). Significantly these three titles are all published by *Elsevier*, one of the first publishing houses to fully embrace new information technologies at all levels of the publication process, be it online submission and production, or the development of globally accessible platforms of diffusion (*Science Direct*).

These trends are all set against a general expansion of archaeological literature in general. The JAS is listed in the 'anthropology' section of the JCR social sciences report, which contains a total of 61 journals. Fig. 4 plots the overall growth of anthropological literature, as represented by these 61 journals, expanding from 1805 papers in 1970 to 4805 papers in 2008, growth of 62.4 %.

3. How does the JAS fair against other archaeological journals?

For the year 2008, I reran ISI searches to source papers for the eight archaeological fields outlined above (Table 1). For five of the keywords (*biomolecular archaeology*, *ethnoarchaeology*, *experimental archaeology*, *geoarchaeology* and *zooarchaeology*) the JAS was first, ranking second for two keywords (*marine* and *molecular archaeology*) and sixth for *historical archaeology*. It was the only journal to consistently rank in the top six for all of the investigated keywords, underlining both the publication's popularity and its interdisciplinary scope. According to the 2008 *Journal Citation Reports* (JCR), the *Journal of Archaeological Science* ranks 9/61 in 'anthropology' for its impact factor (1.779) and third for total citations (4219). For archaeology, it ranks in third behind the *Journal of Human Evolution* (impact factor: 3.55) and *American Antiquity* (impact factor: 1.841) and second for total citations behind the *Journal of Human Evolution* (total citations: 4519). Fig. 5 plots JCR impact factors against Eigenfactor values for the JCR category 'anthropology' and further underlines the overall importance of the JAS in this field.

4. The JAS and different archaeological periods

I also ran searches for 18 different chronological windows, to discriminate the JAS's popularity with different archaeological audiences. Runs were performed for 1970–2008, for both the physical and social sciences, before restricting searches to archaeology only. For 16 of the 18 time periods investigated, the JAS ranked in the top five of archaeology journals, figuring in the top three on no less than 12 occasions (Table 2). It also faired very well in searches of all ISI catalogued titles. The JAS proved most popular for the prehistoric periods, where arguably much of the archaeological sciences' early *raison d'être* first derived. This reflects the relative scarcity of archaeological artefacts for these periods, and the role of archaeological science in developing new research avenues (Brothwell and Pollard, 2001; Miskovsky, 2002).

In sum, much of the JAS's success can be attributed to its broad interdisciplinary appeal and the awareness of its editors to adapt the journal's format to emerging interpretative paradigms, new scientific tools and the rapidly changing face of academic publication. Its inclusion in the globally recognised *Elsevier Science Direct*

Table 2
The JAS's ISI ranking for different archaeological periods.

Period	Rank *JAS* (archaeology titles only)	Rank *JAS* 1970–2008 (all *ISI* titles)
Archaic	8/184	8/188
Bronze Age	3/125	3/653
Byzantine	1/26	2/188
Chalcolithic	1/37	1/104
Copper Age	11/13	19/27
Early Modern Period	2/51	30/1352
Hellenistic	5/40	35/480
Holocene	3/234	20/1243
Iron Age	3/108	8/3367
Islamic	4/18	12/273
Late Glacial	5/47	30/317
Mesolithic	2/51	2/198
Middle Ages	2/92	209/6649
Neolithic	2/120	3/742
Palaeolithic	2/37	3/206
Pleistocene	1/194	21/1520
Pliocene	3/73	172/835
Roman	4/138	24/3797

Source: ISI Web of Knowledge

platform has also been preponderant in its recent growth. For example, since joining *Elsevier* in 2003, the JAS has improved its JCR impact factor every year (2004 = 1.186; 2005 = 1.316; 2006 = 1.322; 2007 = 1.439; 2008 = 1.779), underscoring the journal's success as a leading forum for archaeological science.

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