

April 2005

News and Views

Materials witness: Lost in translation

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doi: 10.1038/nmat1360

De rerum natura, by the Roman writer Lucretius, is one of the classic ancient works on the composition of the Universe. Written around 56 BC, it outlines the atomistic philosophy of Epicurus (341-270 BC) and was a major influence on the mechanistic world-view of Cartesians such as Pierre Gassendi in the seventeenth century.

But this book reached the early Enlightenment by the skin of its teeth. In the Middle Ages, Lucretius's atomism was considered anti-Aristotelian – then almost tantamount to heresy – and religious zealots nearly eradicated all copies of his manuscript. It resurfaced only in 1414, and a printed version appeared in 1473.

Many works of the ancient philosophers were less fortunate. The reputation of Pliny the Elder rests on just one seventh of his total oeuvre. For his encyclopaedic *Natural History*, Pliny drew on around 2,000 manuscripts from antiquity, of which very few now survive. Our knowledge of what the ancients knew will forever be woefully incomplete.

John Cisne of Cornell University has developed an original perspective on this decimation of antique manuscripts by comparing it with the growth and extinction of biological populations (*Science* **307**, 1307; 2005). The rationale is that until the explosion of book-making that followed the introduction of printing in the mid-fifteenth century, manuscripts propagated much as organisms do: by spawning copies, generated at the hands of monks.

Cisne's conclusion is somewhat cheering. His calculations, based on Markovian modelling of the 'growth' and 'decay' of manuscripts, suggests that any that survived from antiquity to enter the workshops of the ninth-century Carolingian empire – arguably the 'first Renaissance', when attempts were made to mass-produce the great works of the ancients – had a good chance of persisting until printing began.

Thus, he says, many if not most of the leading technical manuscripts circulating in the early Middle Ages probably exist today. But Cisne's analysis does not reach back into 'antiquity' – that is, before the latter days of the Roman Empire in the third century AD. The surviving fraction of works from this earlier time is evidently far smaller. Why so?

The answer, Cisne, suggests, might lie with a change in material. The principal material used for manuscripts in antiquity was papyrus. It was gradually replaced by parchment or vellum: untanned leather from the skin of a calf or young goat, shaved, stretched and rubbed down to provide a smooth writing surface.

The use of parchment may have begun as early as the third century BC, when the Egyptian ruler Ptolemy Epiphanes banned the export of papyrus in the hope of checking the growth of a library at Pergamum that rivalled his own. Parchment was expensive, but it was a superior and more durable material, and became commonly used by the third century AD.

The import of paper-making technology to the West around the twelfth century, followed by the later appearance of the printing press, are often cited as key factors in the growth of learning. But it seems that another aspect of materials culture may have been one of the earliest drivers of the information revolution.