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A Penn State biology professor with a passion for old prints and maps says he has found a new way to date centuries-old books by using a technique similar to what scientists use to study mutations.

By Genaro C. Armas: First published by Associated Press

The so-called "print clock" technique incorporates some complicated statistical formulas. But professor Blair Hedges says much of his analysis on 16th and 17th century books and prints was conducted by simply counting the number of discrepancies such as "line breaks" on the same pages in the different editions of a book. An example of a line break would be a faded line in a drawing that may have been bolder in an earlier edition of a book.

Many experts say breaks or fading may be due to wear and tear during print runs. Hedges says his analysis shows the breaks occur at a constant rate over time, irrespective of print runs, which, in turn, could help scientists and rare book aficionados alike determine when an undated item was printed. Pinpointing an age on an undated item could affect the value or historical significance of an old book, said David Szewczyk, a partner at Philadelphia Rare Books and Manuscripts and a member of the Antiquarian Booksellers' Association of America. Hedges' study was published in an article published Tuesday night by the *Proceedings of the Royal Society A: Mathematical, Physical, and Engineering Sciences*, a British research journal.

"It looks like a sensible and scientific approach to an old problem," said Szewczyk, who had not read the complete study. Generally, experts try to estimate ages of undated materials from the 16th and 17th centuries by researching items like fonts, the type of paper, a printer's watermark or bibliographies.

Hedges said he became interested in finding another method after coming across some old maps and prints while doing research in the Caribbean a couple years ago. The "print clock" technique, Hedges said, is similar to molecular-clock techniques used to time genetic mutations, which is a key tool for dating genetic material in much of his biological research. Hedges, who paid for his own research, looked at prints made from woodblock and copper plates. For the woodblock plates, he studied 23 copies of Bordone's *Isolario*, an atlas containing maps of islands, spanning the first three editions, printed in 1528, 1534, 1547 and a fourth undated edition.

On average, successive editions of books typically had more line breaks than earlier editions. For instance, Hedges found that fourth-edition books had about 550 line breaks, compared with about 300 in third-edition books. "If all the damage was from the printing, then the last copy of the third edition would have had about the same number as the earliest copy of the next edition," he said Tuesday. Typically, plates were put away in between print runs.

It is in storage where Hedges said the woodblocks may deteriorate, which eventually cause more line breaks to show up during printing. That deterioration, on average, caused about 10 more line breaks each year, which would be evident in each successive edition of the *Isolario*. As a result, he estimated that the undated edition was printed in 1565. In the study, Hedges likened the deterioration process to the "random radioactive decay of geologic clocks and the random genetic mutations of molecular evolutionary clocks."

He conducted the same analysis on the printer's logo or mark found in each of the 23 books. That mark would have been printed on a woodblock different from the one used on the rest of the book, though Hedges said he also arrived at the 1565 date. Similar study was conducted on 16th and 17th century prints made from copper plates, and Hedges found, through analyzing the width of lines on



the page, that the plates deteriorated 1 to 2 micrometers per year due to corrosion. The rate is similar to known rates for the atmospheric corrosion of copper, Hedges said.

While more study was needed to determine if the theory could be applied to different types of prints and time periods, "Compared with current methods of dating, such as the use of watermarks, the print clock has the advantage of dating the print and, in some cases, the original artwork (e.g. woodblocks), rather than the paper," Hedges wrote.....**THE END**

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