Church of today, when it takes such intransigent stands on similar issues.) But, even granted the Church's injustice, the book does not advance our understanding of it nor of what lay behind it. Fölsing offers little explanation of the Church's behaviour other than its "lame theology" and its conservative, thick-headed science. Koestler at the other extreme offers little insight into Galileo's motives. Another work, *Galilei und die Kirche oder Das Recht auf Irrtum* by Walter Brandmüller (Verlag Friedrich Pustet, Regensburg, 1982) provides a much needed counterbalance in its examination of the Church's motivation in the Galileo affair. Those who read Fölsing's book should follow it with Brandmüller's in order to complete the picture.

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**PIONEER OF DENDROCHRONOLOGY**


The American astronomer Andrew Ellicott Douglass was born in 1867 and died at 95 in 1962 — in the springtime, when with first buds the trunks of trees begin their annual ring of growth. The analytical study of tree-rings is a tool that Douglass had forged, quite alone, and shaped into a new science: a technique of dating and analysis now commonly used in archaeology, climatology, and the recovery of environmental history. The early successes of dendrochronology, particularly in archaeology, had made his name well known.

In this scientific biography the historian G. E. Webb tells us also of Douglass's career in astronomy, which was long and plain and not so well known. It began in Cambridge, Massachusetts where in 1890 Douglass secured a job as a temporary research assistant at the Harvard College Observatory, on credentials of ambition and a fresh Bachelor of Arts degree from a small college in Hartford, down the road. The same year he seized the opportunity to work alongside William H. Pickering on a three-year astronomical expedition to the Andes, to select a site and lay the foundation stones of the new Harvard Boyden Station at Arequipa, 1½ miles above the sea. On his return to Boston he met the world traveller and man of letters who was to shape and stain his early career. The wealthy Percival Lowell, 39, infatuated with Mars and intrigued by the promise of mountaintop telescopes, needed a rugged advance man to take the train at once to Arizona Territory and there to seek out a suitable site, hire the needed help, and begin the construction of another new observatory; and as quickly as possible. Young Douglass, 27 and fresh back from adventures in Peru, seemed ideally suited for the task.

What followed in six weeks of March and early April of 1894 was a comic opera of a one-man, whirlwind site-survey — made by rail and horse-drawn wagon with a small telescope and a large stack of Western Union Telegraph blanks, the latter to keep his anxious employer advised, in real time, of nightly measures of the skies. After perfunctory stops at Tombstone, Tucson, Phoenix and Prescott,
Douglass (with telegraphed consent from Boston) selected Flagstaff and on 23 April broke ground for the first building of the observatory that today bears Lowell's name.

For the next seven years, while Percival Lowell astounded the world of astronomy with his sightings and his prose, Douglass served him quietly in Flagstaff as observer and site manager — though all the while seeking, without success, to land a job less isolated and beshadowed. In July 1901, however, the career he had struggled to build came crashing to the ground. Lowell, in a fit of anger, 'fired' him, on learning of indiscreet remarks. "His work", Douglass had said of Lowell, "is not credited among astronomers because he devotes his energy to hunting up a few facts in support of some speculation...". He had long known that Lowell was deluding himself and others on the matter of Mars's canals, and felt that Lowell had "a strong literary instinct and no scientific instinct".

Douglass, at 34, was a man without a future. Though he had worked as an astronomer for eleven years he had done nothing of renown. He had no advanced degree. And he soon learned that he was also bereft of scientific friends — for he was branded, rightly or wrongly, as Lowell's man.

Inch by inch, Douglass fought his way back into astronomy, serving two years along the way as an elected probate judge in northern Arizona. By 1906 he had secured a teaching position at the young University of Arizona in Tucson and by 1915 had risen to Dean. In 1923, after a labour of seventeen years, he brought the Steward Observatory to the school. For the rest of his life he remained in astronomy there, though for much of it in unsuccessful searches for greater pastures elsewhere.

In 1901, the year that Lowell cast him down, Douglass took up the hobby that would grow into a far more successful facet of his life. Arizona, where fate had stranded the young New Englander, was the ideal cradle for the birth and early nurture of dendrochronology; and Douglass, an ordinary man, was patient and dogged enough to see it on its way.

In the arid air of the U.S. Southwest trees are of necessity 'sensitive' (as compared to biologically 'complacent') in response to environmental stress. One could see this clearly in the stumps of mountain pines. Fancied by these distinctive patterns of growth Douglass set out to understand them, and through the years assembled long sequences of annual ring-widths in western trees. Along the way he developed the painstaking methods now employed to establish continuous chronologies, and to account for the many subtle factors that complicate their interpretation.

In 1929 the bright light of renown came at last to Douglass when his analyses of wood in ceiling beams from Anasazi ruins allowed him to announce the dates of construction of ancient structures in Chaco Canyon, Mesa Verde and other key, undated sites in Southwest archaeology. He became something of a saint.

In truth, what Douglass gave to archaeology and other fields that use tree-ring data was not discovery but patient technique — for it had long been known that the stems of trees in temperate climates grow in discrete expansions whose dimensions are a measure of root moisture and other growing conditions. Moreover, what led Douglass to his famous hobby and kept his interest there was a naïve and wholly subjective belief in a dominant effect of solar activity on local weather, and hence on tree growth. From the start what Douglass hoped to find in
trunks of trees was a diary of the Sun, and to the end of his life he stubbornly believed that he had succeeded in finding it, if only others would believe him. Henry Norris Russell, to mention one, did not, and criticized Douglass for his apparent lack of objectivity on the matter: he was seeing things that weren't there. Douglass acknowledged that solar cycles were not always present in trees but they were some times and in some places: one needed to know where to look, and how. In the final years of his life, in a manuscript volume left unpublished, Douglass endeavoured to link these will-o'-the-wisp cycles to solar influences that were in turn caused by the clockwork movements of the planets, involving coincidences and shielding of planetary forces on the Sun. It was a desperate, wholly conjectural attempt at a unified explanation — of something that does not exist.

In 1972, ten years after Douglass's death, Valmore LaMarche and Harold Fritts, working at Douglass's Laboratory of Tree-ring Research, settled the matter with a calm and definitive refutation of this aspect of his work — in vol. xxxii, pp. 19-33 of the Tree-ring bulletin that Douglass had started. Using more powerful statistical tests they could find no evidence of eleven-year sunspot cycles in the Southwest tree-ring sequences that Douglass had studied.

Webb seems to have missed this crucial paper. Nor does his black-and-white biography give adequate interpretations of Douglass's work or critical judgements of his accomplishments.

As a 'scientific' biography it misses much of the flavour of the romantic age in which Douglass moved, avoids analysis of his personality, and omits perceptive comment on the character of the man. As such it leaves untold the great dramas of his life: the conflict between lofty aspirations and ordinary abilities; the frustrations of an academic astronomer without an earned degree and of an innocent, tarred with Lowell's brush; the story of a new field of science founded for the wrong reasons; and the ultimate irony of Douglass's later life, in succumbing to the same faults of autosuggestion that he had diagnosed in Lowell not that many years before.

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**BIOGRAPHY OF HARRIOT**


In early seventeenth-century England, the community of learning, like society as a whole, was in the kind of turmoil we, from our more detached viewpoint, might call a "state of transition". Social changes were complex, with the building of tensions that led to the Civil War and the Commonwealth. Position and wealth were increasingly less reliable guarantors of security and safety. Similarly, within the learned community itself, changes were afoot. Long before the execution of Charles I, the so-called "Mathematical Practitioners" were finding the system of