



Strata super strata: the stratigraphy of Thomas Wright of Durham (1711-1786)

Brian K. Tanner

Department of Physics, Durham University, South Road, Durham, DH1 3LE, U.K.

David A. T. Harper

Department of Earth Sciences, Durham University, South Road, Durham, DH1 3LE, U.K.

Correspondence: Brian K. Tanner (b.k.tanner@dur.ac.uk)

ABSTRACT

The stratigraphic ideas found in a late eighteenth-century manuscript of the English cosmologist, Thomas Wright of Durham, are described and discussed in the context of the development of his contemporaries' ideas concerning the age of the Earth and formation of its rock strata. Wright, a convinced Plutonist in his explanation of the volcanic origin of horizontal strata, invoked the earlier concept of vegetative growth of minerals as a way of accounting for inclined strata. Mountains grew from small stones and emerged from the sea, pushing initially horizontal volcanic strata into inclined or vertical orientations. In emerging, they acquired a layer of shells of marine animals, which subsequently were located on the tops of mountains. Through assessment of the degree of petrification, Wright concluded that the age of the Earth was substantially greater than a few thousand years. His thesis that the Solar System represented planets at different stages of evolution through time, Saturn being the youngest and Mercury the oldest, implied to him that at least 10^{12} years was necessary for completion of the cycle from creation to destruction of a planet, including the Earth. Wright's model of the origin and evolution of the Earth was heavily influenced by the writings of Burnet and Whiston, but the stratigraphic ideas were drawn from later debates on the origin of strata and their fossils. The manuscript precedes the publication by James Hutton of observation of unconformities and their implication for the age of the Earth. It provides a fascinating insight into the mind of a second-tier scientist, who nevertheless was party to the ferment of ideas in circulation prior to Hutton's paradigm-changing paper.

Summary

The stratigraphic ideas and models found in an unpublished manuscript by Thomas Wright of Durham (1711-1786) are described and discussed. Horizontal strata were deemed to be volcanic in origin. Vertical strata arose from growth of mountains emerging from water that tilted initially horizontal strata. The work shows the undercurrents of debate in the late eighteenth century prior to the geological revolution of the early nineteenth century.



36

1. Introduction

37 Although something of a polymath, Thomas Wright of Durham¹ (1711–1786) is not presently
38 recognised as having contributed to the science of geology or stratigraphy in the later years of
39 the eighteenth century. The discovery some twenty years ago by the late Michael Hoskin of
40 unpublished notes for a work containing a theory of the origin and evolution of the Earth,
41 together with ideas on the formation of strata and their associated fossils (Hoskin, 2003) is
42 therefore of importance in our understanding of the range of geological thought circulating in
43 the closing decades of the eighteenth century. The manuscript, originally owned by the Bishop
44 of Durham, Shute Barrington (1734–1826) and purchased by Durham University in 2002,
45 forms part of the Thomas Wright Manuscripts collection in Durham University Library.
46 Although available on line, it does not seem to have been previously transcribed, possibly
47 because of the difficulty of reading Wright’s handwriting, and therefore the content is not
48 widely known, if at all. Wright’s work, which can be internally dated from after 1773, provides
49 an interesting insight into the wide range of conflicting ideas being generated as scholars
50 gradually came to realise that the age of the Earth had to be orders of magnitude greater than
51 that deduced from the narrative in the Christian Bible. Like an earlier, but similarly unpublished
52 manuscript by William Hobbs of Weymouth (Porter, 1976), it is an example of the thinking of
53 those in the second tier of intellectual life, of a man who had contact with the foremost scientists
54 of the day, but whose work did not enjoy wide acceptance or circulation. The aim of the present
55 paper is to describe, for the first time, Wright’s stratigraphic ideas and set them in context.

56

57

2. Thomas Wright of Durham

58 Thomas Wright was born in 1711 at the small village of Byers Green in County Durham in the
59 North-East of England (Knight, 2006). His father was described as a yeoman, in that he owned
60 some land, who made his living as a carpenter. Thomas, who by his own admission was “wild
61 and much addicted to sport”, failed to complete his schooling due to a speech impediment and
62 was chiefly taught writing and arithmetic by his sister. At the age of sixteen he was apprenticed
63 to a clockmaker, a tenure that he also did not complete. Largely self-taught, he set up a school
64 of mathematics and navigation in Sunderland before moving to London in 1733, where, under
65 the patronage of the Earl of Scarborough, he was recommended to Roger Gale F.R.S., Treasurer
66 of the Royal Society (Hughes, 1951). Through Gale, Wright was introduced to the Royal
67 Society as an astronomer and navigation expert, and although nominated in 1735, failed to be
68 elected to the Fellowship. For a period of twenty years from 1736, he lived alternately in
69 lodgings in London and in the homes of aristocratic patrons, to whose wives and daughters he
70 taught geometry, astronomy and surveying. During that time, he seems to have developed his
71 interests not only in cosmology but also in architecture (Harris, 1979; McCarthy, 1981), garden
72 design (Preston, 2010) and antiquarianism (Wright, 1748; Buckley, 1909). It was a period in
73 which he published the work for which he is best known, a book entitled *An Original Theory*

¹ Wright referred to himself as ‘Thomas Wright of Durham’ throughout his lifetime, even when not living in the North-East of England. This may have been to distinguish himself from his London contemporary and associate, Thomas Wright (1693–1767) who was ‘Mathematical Instrument Maker’ to King George II. Wright, the instrument maker, subscribed to Thomas Wright of Durham’s *Clavis Pannautici* of 1734 (Wright, 1734).



74 *or New Hypothesis of the Universe* (Wright, 1750). In it he proposed a hierarchical
 75 cosmological scheme of celestial bodies and suggested that the Milky Way would look as it
 76 does if it were composed of a ring or rings of stars, analogous to the rings of Saturn, moving
 77 around a central attractor. That work was credited by Immanuel Kant in stimulating his own
 78 ideas on the formation of the solar system (Kant, 1755; Paneth, 1941).

79 In 1755-6 Wright purchased the family home in Byers Green from his brother (Knight, 2006).
 80 He subsequently demolished it and built a new house to which he moved permanently
 81 sometime after 1762 (Hughes, 1951). In an article written between 1778 and 1783, and
 82 published posthumously in the *Gentleman's Magazine* of 1793, Wright described the house and
 83 his life in retirement as a gentleman scholar (Wright, 1793). He does not seem to have
 84 integrated well with the local gentry; the anonymous author of his obituary² stated that "his
 85 genius was not adapted to the humour of his country neighbours".

86 His papers were left to his natural daughter, who in turn bequeathed them to the University of
 87 Oxford. There is no record of the university accepting them and they do not appear in its mid-
 88 nineteenth century library catalogue. Those that have survived were split up; some of which
 89 were certainly acquired by George Allan of Darlington, County Durham. Almost nothing of
 90 Wright's correspondence has survived. While there is a list, dated November 1766, of
 91 correspondents and the number of letters written to each³, these are primarily to patrons and
 92 pupils and there are no hints as to the identity of those with whom he might have had scientific
 93 discussions. The contents of his library are similarly obscure, which contained, in his own
 94 words, "many books, chiefly of history and sciences."

95 3. Contemporary ideas of the formation of strata

96 As early as the first quarter of the sixteenth century, Leonardo da Vinci (1452-1519) had
 97 described fossiliferous strata in the Italian mountains, but because his work was unpublished,
 98 it was effectively unknown in the mid-eighteenth century (Ferretti *et al.*, 2020; Dominici,
 99 2023). Da Vinci was convinced that the rock layers corresponded to deposits of various types
 100 of mud and that shell beds contained the remains of shellfish that had once been at the bottom
 101 of water (Ferretti *et al.*, 2026); they did not grow in the rock. Rather than there being a single
 102 universal flood as described in the Christian Bible, he attributed the various layers to different
 103 floods, the varying thicknesses arising from differing flood intensities. He recognised the
 104 continuity of strata on either side of river valleys and that the strata preserved a record of the
 105 history of the Earth, not corresponding to a single moment of creation.

106 The attribute of father of stratigraphy has been applied to Nicolaus Steno (1638-1686) who laid
 107 the foundations of ordering the succession of sedimentary rocks chronologically. He too
 108 recognised that fossils were once living organisms and arrived at the tops of mountains through
 109 the uplift of consolidated strata (Dominici, 2021). Importantly, in the context of Wright's
 110 manuscript, he concluded that sedimentary rocks were originally deposited nearly horizontally,
 111 that the youngest layers are at the top, that features cutting a sequence of layers must be younger

² The biographer was probably George Allan of Darlington, who "purchased his collection of prints, mathematical instruments, and other valuable articles" following Wright's death. Allan passed his material to the Newcastle Literary and Philosophical Society, much of which appears to have been destroyed in a fire of 1893 (Paneth, 1950).

³ Wright papers, in 8 volumes, held in the City Library, Newcastle upon Tyne. (Microfilm copies are held at Durham University Library). These papers also contain one disconnected page relevant to stratigraphy.



112 than the strata that they cut, and that there is continuity in the lateral extent of layers of
113 sediment. Mountains arose from the changed orientation of mineral beds and also by deposition
114 of ash and stones by volcanic eruption (Steno, 1671 p.45–47). Both mechanisms implied that
115 mountains had not originally existed at the creation of the Earth. Mountains were created by
116 erosion of lower sedimentary layers, resulting in the inward collapse of the upper layers to form
117 the sides of valleys and inclined strata. The process was repeated through subsequent flooding
118 and sedimentation, and therefore provided a mechanism for Descartes' original idea of
119 mountains arising from collapse of portions of rock (Morello, 2006). Steno's key work
120 containing these ideas, the *Prodromus*, was published in an English translation soon after the
121 initial Latin publication of 1669. Its conclusions were challenged almost immediately (Lister,
122 1671) and they were still being debated in London in the middle of the eighteenth century
123 (Borlace, 1750).

124 By this time, the view of John Woodward (1665–1728) that the strata, and their included fossils,
125 had been deposited during the Mosaic Flood in order of descending density (Woodward, 1695)
126 had been largely discredited by observation. In contrast to the prevailing sedimentary Neptunist
127 theories, in a book published in 1740, Anton Lazzaro Moro (1687–1764) argued for the second
128 mechanism suggested by Steno (Moro, 1740). His concept of Plutonism posited that many
129 rocks, especially igneous rocks, such as basalt and granite, were formed by the solidification
130 of molten material originating within the Earth. Evidence came from emergence of the new
131 island of Neia Kameni off Santorini in 1707. Marine fossils incorporated into these subsea
132 volcanic deposits were raised to their present positions on mountain summits by geological
133 processes rather than by deposition during the biblical flood. It is uncertain as to how widely
134 Moro's proposals were accepted in England until the end of the eighteenth century and it was
135 six years after Moro's self-publication in Venice that the book was brought to the attention of
136 the Fellows of the Royal Society (Zollman, 1746). Indeed, as late as 1767, there is evidence
137 that his work was still obscure and had not gained traction. In that year, Edward King F.R.S.
138 published an explanation for terrestrial fossil shell beds by way of volcanic activity raising the
139 sea beds, displacing the seawater onto the land and causing the biblical Deluge (King, 1767).
140 The ocean and continents were effectively interchanged before and after the Deluge, thereby
141 leaving on land the stratum of shells that had accumulated at the bottom of the sea prior to that
142 event. At the end of the paper, King stated that only after completing it, did he become aware
143 of the suggestion by "Lazzaro Moro, a Venetian author," that the continents were originally
144 raised by subterranean fires.

145 Fossil collections in the sixteenth century formed part of cabinets of curiosity, mainly displayed
146 by the aristocracy of Europe. However, by the late sixteenth century the significance of
147 collections was moving from mere assembles of curiosities to evidence of former life,
148 associated with stratigraphic units and recognition of their part in understanding Earth's history.
149 One of the earliest examples was the Museum Wormianum of Ole Worm (1588–1654) in
150 Copenhagen, where specimens were arranged systematically but within a biblical framework.

151 The earliest British collection to be similarly arranged and catalogued seems to have been that
152 of John Woodward in late seventeenth to early eighteenth-century Cambridge. While display
153 and storage of collections of fossils according to stratigraphical units became common in
154 museums and universities only in the nineteenth century, the mid-eighteenth-century collection
155 of Sir Hans Sloane F.R.S. (1660–1753), which became the foundation of the British Museum,
156 contained classified specimens, minerals, shells and plants and had a global reach.



157
 158 While there is no direct evidence of contact between Sloane and Thomas Wright, they shared
 159 a number of mutual acquaintances including James Theobald (1688–1759)⁴ who himself had
 160 a significant collection of shells and fossils, sold at auction after his death, and with which
 161 Wright would surely have been familiar. Theobald was a strong supporter of Wright from at
 162 least 1742, subscribing to *An Original Theory* (Wright, 1750) and presenting a copy of that
 163 work to the Royal Society on Wright’s behalf in 1750. Between 12 March 1747 and 5 May
 164 1751, Theobald introduced Wright to several meetings of the Royal Society (Appleby, 1996).

165
 166 It was within this context that Wright expanded his interests from astronomy, through
 167 cosmology, to antiquarianism⁵. That interest in the past must also have extended to
 168 participation in the contemporary debates about the structure of the Earth and its chronology.
 169 However, as an autodidact with no training in natural history, Wright will not have been able
 170 to make a significant personal contribution at that time, especially when his interests and work
 171 in architecture and garden design were flourishing (Harris, 1979). It is therefore understandable
 172 that it was not until considerably later, when he had time and space in retirement, that he was
 173 able to reflect on the origin of the Earth and how its characteristic features arose. Wright’s
 174 manuscript may be seen as a remnant of the mid-century debates about the validity of the late
 175 seventeenth century models of the creation and evolution of the Earth, rather than a forerunner
 176 of the new paradigm of James Hutton (1726–1797) (Hutton, 1788). There are no records of
 177 interactions between Wright and other scientists after his retirement to Byers Green, but there
 178 are hints that, during this latter period of his life, he was aware of at least some of the
 179 contemporary publications.

180

181 **4. Summary of Wright’s theory of evolution of the Earth**

182 The documents described by Hoskin (2003), containing Wright’s stratigraphic ideas, comprise
 183 notes for an uncompleted book which is initially titled as ‘A New Theory of the Earth Founded
 184 upon, and more fully Explaining the universal Phenomenon of Earthquakes; Effects of ye
 185 Magnet and Doctrine of Tides. By Tho: Wright of Durham’. The main manuscript⁶, in Wright’s
 186 handwriting, comprises loose sheets grouped in sections within the original box file from Shute
 187 Barrington’s library. The exact page order is not clear, as some pages are un-numbered and
 188 there are several separate numbering sequences. In addition, there is a separate set of further
 189 notes⁷ in the Durham collection, and a couple of pages in Newcastle City Library, that are
 190 evidently associated with the document and which contain important clarification of Wright’s
 191 ideas on stratigraphy contained within the main manuscript.

192 The first few pages contain somewhat unrelated remarks, including some on strata, but these
 193 are then followed by a sub-title page announcing a discussion of “The opinion of the Ancients
 194 naturally sum’d up in the Rational Evedence of their Principal Philosophers as Extracted from

⁴ Theobald was a close friend of Sloane, being a pall-bearer at his funeral and contributor to, and subsequent
 Trustee of, the Sloane Collection (Appleby, 1996).

⁵ Theobald communicated Wright’s only paper published in the Philosophical Transactions of the Royal Society
 (Wright, 1744), which was a description of the earthworks at Buckland Camp near Lymington in Hampshire.

⁶ Thomas Wright Manuscripts WRM.18, held by Durham University Library, Archives and Special Collections.
 Available on line at <https://iif.durham.ac.uk/index.html?manifest=t2m9s161643b> [Accessed 9 September 2026]

⁷ Thomas Wright Manuscripts WRM.18.3. Available on line at
<https://iif.durham.ac.uk/index.html?manifest=t2m9c67wn16k&canvas=t2tdn39x973z>
 [Accessed 9 September 2026]



195 their Theogony and Cosmology concerning Creation” [f.12r]⁸. It is apparent that Wright
 196 discarded this approach, as there is then a new start with a second title page inscribed “New
 197 Philosophy or an Essaye towards accounting for all earthquakes, the magnet and ebbing and
 198 flowing of the sea upon principals of gravity, attraction etc hitherto unattempted by T W”. This
 199 discourse develops in four books, and the second of these, entitled “Process of the mundane
 200 Creation according to the visible oconony and operation and effects of the laws of known
 201 nature”, contains a model for the formation and evolution of the Earth (Tanner and Harper,
 202 2026). Wright’s ideas on stratigraphy emerge within the manuscript as a process of reflection
 203 on the evidence for the validity of his model and his attempts at explaining the origin of
 204 earthquakes in the third book. While Wright explicitly drew on the earlier writings of Whiston
 205 (1696) and Burnet (1719), he was at pains to emphasise the uniqueness of his own proposal,
 206 which underpins his ideas on the formation and development of strata.

207 In common with Burnet, Wright proposed that the initial form of the Earth, created from an
 208 idea in the Divine mind, was all liquid. The elements then separated, forming a core of fire,
 209 surrounded by solid magnetic material giving rise to the Earth’s magnetic field. Over this solid
 210 material lay the water of the abyss and the outer layers of the Earth formed the mineral strata
 211 of earth, initially overlain by ice. After the formation of the Sun, the ice melted, resulting in the
 212 oceans, out of which mountains grew thereby forming continents and islands. Solid land is
 213 continually increasing, and water decreasing, until over time all the water will become earth.
 214 In this period there will be an increasing number of fiery volcanos and eventually the Earth
 215 will be consumed by fire. It will either spiral into the Sun or be destroyed by a comet (Tanner
 216 and Harper, 2026). Wright envisaged that this process occurred for all the planets in sequence,
 217 Saturn being at an early stage of development and Mercury being in the final stages, about to
 218 be burnt up by the Sun. He commented that:

219 The planet Mercury which seems to be in much too sultry a situation for an habitable earth may probably be
 220 in or near these circumstances at present and in like manner possibly all the other planets world after world
 221 may rise into existence in the remote regions of ye system and perpetually [f.65v]

222 In an unpublished⁹ manuscript of a book on cosmology, entitled *Second or singular thoughts*
 223 *upon the theory of the Universe*, he concluded that the process must have taken an extremely
 224 long time. He estimated that

225 This great period of nature cannot be imagind to take up less time than a million of millions of years, in which
 226 as represented in y^e scheme the atmospheres of evry world are continually condensing till all their respective
 227 fluids are absorbed and finally united in y^e Sun (Wright, 1968 pp.72–73)

228 Wright had grappled with the idea of immense distances and huge numbers of stellar systems
 229 in his cosmological thinking in *An Original Theory* (Wright, 1750). In postulating a continual
 230 process of planetary formation in the far reaches of the solar system, followed by a slow inward
 231 spiral towards the Sun, he was extending the concept of such enormous numbers to that of deep
 232 time. Although he did not draw the conclusion, the inclusion of the Earth in the evolutionary
 233 sequence from Saturn to Mercury implied that the age of the Earth was of comparable
 234 magnitude to the 10¹² years that he envisaged for the whole process. Although neither published

⁸ References to WRM.18 are contained in square brackets and give the folio numbers of the on-line manuscript link in footnote 6.

⁹ Until 1968 when Michael Hoskin edited and published the work.



235 nor recognised, this was a major step in the continually emerging idea of deep time that was
 236 taking place throughout the eighteenth century.

237

238 5. Wright's ideas on stratigraphy

239 A key feature of Wright's cosmogeny is "that no extraordinary event shall happen in the
 240 unalterable laws of Providence [f.9v]". Once the laws of Nature had been impressed on the
 241 embryonic Earth by the Divine Mind, all matter must obey them. Therefore, although the Earth
 242 may be subject to catastrophic events, these are entirely subject to, and a result of, the physical
 243 laws that have been and continue to be in operation throughout its existence. While discounting
 244 supernatural events, Wright was not ruling out abrupt changes on short timescales, provided
 245 that they were subject to the over-arching laws of Nature. He was certain that the ruggedness
 246 of the Earth's surface must indicate that, unlike Whiston's belief in a world unchanged since
 247 the Deluge, (Whiston, 1696), a process of change was continually underway. This, he argued
 248 was evidenced by the different strata and the minerals contained within them.

249 The final desolation of the Earth as in consequence of a decay in Nature, it is natural to conclude will be as
 250 water becoming all earth or *terra firma* from originally being all sea or ocean but many accidental catastrophes
 251 may happen before that total consummation as from deluges, conflagrations, plagues, pestilences, famine etc
 252 and that there has been many and great changes upon ye Earth. Terrestrial surface is very broken and from
 253 ye various mines and minerals that comprise it[s] different stratas. [Notes 18.3 f.4v]

254 All these strata were seen as the product of repeated volcanic activity, that happened rapidly,
 255 on a human timescale, as a result of repeated volcanic eruption.

256 All perpendicular or vertical stratas evince its vegetal increase and all its parallel or horizontal strata as clearly
 257 prove its eruptive or volcanic accumulation and now cover the greatest part of ye Earth and in many places
 258 repeatedly so. [f.8r]

259 As a confirmed Plutonist, Wright's ideas follow those of Moro and even though it is unlikely
 260 that he read the original work, there is enough information in Zollman's review (Zollman,
 261 1746), to which he would have had access, to provide the basis of Wright's thought. He seems
 262 to have entirely rejected theories of formation of strata by sedimentation. In particular, he noted
 263 that denser rocks could be found nearest the surface, providing evidence that they must have
 264 been volcanic in origin.

265 It appears that all vertical strata of Earth's stone etc are varied by secretion as in vegetation and that all
 266 horizontal strata especially of different densities and where ye heaviest matter is nearest ye surface is ye
 267 produce of volcanic eruptions but that there then can be no true aboriginal Adamic Earth, now to be anywhere
 268 found as Linn[a]eus affirms is much to be doubted. [Notes 18.3 f.3r]

269 The repeated eruptions, suggested Wright, mean that most of the surface of the Earth was
 270 shaped by this volcanism. Nevertheless, in a rare reference to influences on his thought, he
 271 indicated that this coverage was not universal and he questioned the claim of Linnæus that no
 272 trace remained of the crust that initially formed from the separation of elements after their
 273 creation. A Neptunist, who was convinced that strata formed at the bottom of the sea, Linnæus
 274 had concluded from his geological studies that the present landscape had formed after the
 275 biblical Deluge, as he could find no trace of the flood in the geological formations that he had

276 examined (Nathorst, 1909). Although widely known in multiple editions, it is not clear whether
 277 Wright had read Linnæus' Latin work *Systema Naturae*¹⁰ or was quoting a secondary source.

278 A much clearer primary source is that of the writings of William Hamilton (1730–1803). In
 279 justifying the scope of the volcanism necessary to create all the observed strata, Wright
 280 references the quantities of lava seen in the eruptions of Vesuvius from 1766 onwards and
 281 described by Hamilton in a series of letters to the Royal Society.

282 Such vast quantities of matter are frequently ejected from Vesuvius that all the earth near Naples is said to be
 283 composed of it, *strata super strata* to a considerable depth. See S^r Will^m Hamilton's account of that volcano
 284 etc printed at London 1773. [f.72r]

285 Unusually, there is a clearly identifiable reference in that Hamilton's letters were collected and
 286 published together in 1773 (Hamilton, 1773). In one of the letters, Hamilton remarked that
 287 there was frequently a stratum of soil between material from repeated eruptions and that the
 288 thickness of some of these indicated a substantial time between the volcanic deposits
 289 (Hamilton, 1771). The depth of these deposits, "*strata super strata*", indicated an even longer
 290 period for the whole process. To Wright, all horizontal strata could be explained in terms of
 291 the flow of lava.

292 5.1 "Vegetation" in strata

293 The key to understanding the origin of vertical strata lay in a process which Wright described
 294 as that of "vegetation", a concept in wide circulation in the early modern period to explain the
 295 origin and growth of mineral ores (Luzzini, 2020). This form of spontaneous growth,
 296 explaining the reported regenerative power of some mines, took vegetal growth of plants as an
 297 analogy of how minerals grew and was extremely popular. Seventeenth century British
 298 intellectuals such as John Webster (1610–1682) and Robert Boyle (1627–1691) were important
 299 proponents of this model (Luzzini, 2020). Debates over the veracity of what Luzzini terms
 300 "botanical model" theories concerning the growth of ores and minerals continued well into the
 301 eighteenth century. Johann Henckel, for example, referred in 1722 to minerals and plants as
 302 "siblings", both kingdoms depending on earth for their nourishment (Luzzini, 2025).

303 Wright incorporated such a vegetative process into his theory of Earth's evolution, specifically
 304 referring to it several times in the manuscript.

305 All live stones in quarrys learn naturally to vegetate and grow larger etc and hence hills in the process of time
 306 become mountains and mountains bee rocks. Sand becomes gravel, gravel pibbles etc and hence arises ye
 307 lapedation of valleys and plains. Chalk is strongly suspected to be the last stage of earthly consolidation
 308 without the help of fire [f.55r].

309 This process of the growth of sand into pebbles, etc. explained the origin of mountains in that

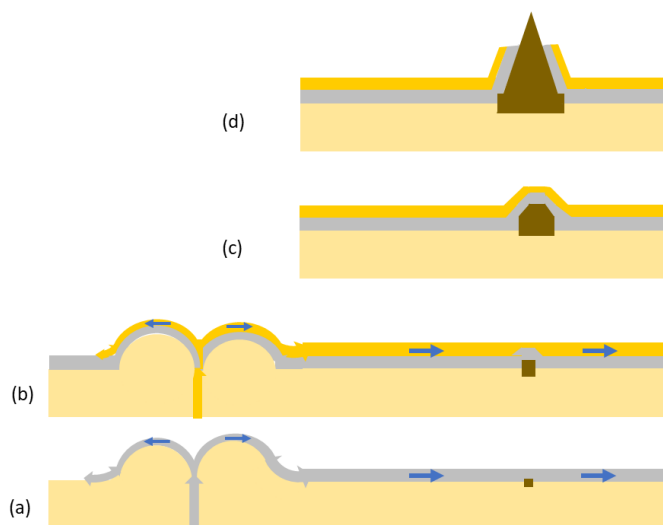
310 All mountains vegetate and grow as rising out of ye water. [f.39v]

311 The vegetative process, by which mountains grew also accounted for inclined strata.

¹⁰ Linnæus stated his view that strata represented a definite succession in the twelfth edition of *Systema Naturae* (Linné, 1768), a concept with which Wright seemed totally content.

312 The various inclination of the different stratas of Earth arise purely from natural [indecipherable] of mountains
 313 and other parts of ye Earth as rising or sinking their several beds by general exhuberation and secretion and
 314 not by ye breaking up of ye mundain shell as supposed by Burnet¹¹ for that vast convulsion of nature, if I may
 315 call it so, would have occasion'd the total desolution of the Earth. Besides, the irregularities of the Earth, such
 316 as mountains and vallies were not occasion'd by the Flood, since mountains are expressly said to have existed
 317 before that dire calamity. [Notes 18.3 not digitised]

318 Figure 1 is a schematic representation of Wright's concept of the growth of inclined strata.
 319 Volcanoes laid down strata that, except in the immediate vicinity of the volcano, were
 320 horizontal (Figs 1(a) and (b)). Within strata, the process of vegetation took place with some
 321 grains of sand growing into mountains and hills (Fig.1(c)). These localised upthrusts resulted
 322 in near vertical strata (Fig 1(d)), a product of the vegetative or secretion process that Wright
 323 believed occurred in all mineral beds, concepts entirely consistent with his evolutionary model
 324 of the Earth.



325

326

327 Figure 1. Schematic diagram of the formation of horizontal and inclined strata
 328 within Wright's thought. (a) A volcano lays down the first horizontal stratum. (b)
 329 Subsequent eruptions result in further strata. The small stone grows vegetatively
 330 into a larger rock. (c) The rock grows into a hill with inclined strata. (d) The hill
 331 grows to a mountain with further inclined, almost vertical, strata.

332

333 All the processes by which strata originated were part of a natural transformation of a world
 334 made of water into one of earth, eventually to be consumed by fire. They were governed by the
 335 unalterable Laws of Nature that had been impressed on the Earth by the Divine Mind during

¹¹ This is a reference to the theory of formation of the Earth of Thomas Burnet, in which the fissuring of an oily crust on the Earth released the waters of the biblical Deluge and the resulting irregularities in the inclined pieces of the fractured crust became the mountains (Burnet, 1719).



336 creation. Through a process of consolidation, there were progressively various types of
 337 minerals formed, the volcanic lava eventually transforming into strata of various kinds.

338 Chalk appears to be ye last visible state of some kind of matter, probable earth. Flints are visible ones of ye
 339 final stages of stone. Gold is manifestly ye last or most perfect state of matter and diamonds are ye last stages
 340 of vitrification. [f.55r]

341 The terms “exhuberation” and “secretion” used in relation to the formation of inclined strata
 342 are not found elsewhere in the manuscript. It is not clear what Wright meant by the former
 343 word, but it may be a synonym for exhalation, a theory of metal ore formation prevalent since
 344 Antiquity. The theory that veins of metal ore arose, not by vegetation, but from the
 345 condensation of vapours or exhalations (*exhalationes minerales*), specifically of sulphur and
 346 mercury, rising through fissures from the depth of the Earth developed from Aristotle’s concept
 347 of mineral exhalations and was widespread during the Middle Ages. Depending on the balance
 348 of wetness and dryness, metal ores or stones could be formed as the vapours condensed due to
 349 coldness. In *A discovery of subterranean treasure*, first published in 1639, Gabriel Plattes
 350 (c.1575–1650) postulated that mountains could have been formed by movement of matter
 351 produced by exhalation vapours (Norris, 2006). The work appeared in another edition in the
 352 late seventeenth century (Plattes, 1679) and was reprinted in a compendium in 1739, so it is
 353 possible that Wright obtained the idea from this source.

354 The term secretion may have been an acknowledgement of competing physical theories
 355 involving water. Such theories were developed both for ore and stone formation (Norris, 2006),
 356 as well as in the production of crystalline spars (Borlace, 1750). By the eighteenth century it
 357 was thought, analogous to the formation of stalactites and stalagmites in limestone caves, that
 358 strata of stone could be formed by the action of water penetrating from the surface, different
 359 types of stone being formed dependent on whether such “vitroline juice” acted on loam or
 360 gravel (Dale, 1707). Indeed, Steno had argued considerably earlier, that crystals grew from an
 361 initial germ by addition of material from surrounding fluid, not by addition within the crystal
 362 through a vegetative process (Menchetti, 2021). In a paper describing a fossilised skeleton of
 363 a large animal that is now identified as a plesiosaur, William Stukeley argued that stone grew
 364 gradually in quarries not by a process of vegetation but by a process of growth through addition
 365 of external material. He said that

366 we cannot be ignorant of stone growing in the quarries gradually, not by any fancied vegetation, tho’ there is
 367 something like it in corals, but generally by apposition of parts to parts, as is notorious in the fluors of
 368 subterraneous grotts and caverns (Stukeley, 1719).

369 Stukeley, with whom Wright corresponded on matters antiquarian, saw growth of stone as an
 370 aspect of a natural process of transformation of minerals whereby clay, sand or earth became
 371 stone or marble and not as any innate tendency towards growth. Wright seems to have had
 372 some acquaintance with aqueous theories, but as is so often the case in his writings, he did not
 373 enquire deeply into detailed mechanisms.

374 The vegetative growth process was also envisaged by Wright as explaining the geographical
 375 location of the great rivers of the Earth. Rather than seeing the greatest valleys cut by the
 376 greatest rivers, he saw the process as being the other way round. The vegetative growth not
 377 only gave rise to increase in solid earth, but in analogy to the growth of trees, he suggested that
 378 cracks and fissures also grew by this process into the great valleys of the mountains. These,



379 associated with the largest vents in the Earth's surface, resulted in the greatest rivers, fed by
 380 water from the abyss. He said:

381 Rivers are formed originally from cracks or fissures in ye Earth's surface occasioned by its vegetative principal naturally
 382 enlarging and making the mountains as the knots and bark of trees are fissurated wider and wider as ye stem increases
 383 and hence the largest rivers are found rising generally thro ye largest vents of Earth.

384 Such as the River de la Plait, the Ganges, the Nile, the Niger, the Oby etc.

385 All which are copiously fed by perpetual springs rising from ye great abyss. [f.78r]

386 Wright was not totally consistent in his thought here, as in the Appendix to *A New Theory* he
 387 followed Halley in calculating that the evaporation from the Mediterranean and Caspian seas
 388 balanced the input to them from their rivers (Halley, 1691; Tanner and Harper, 2026; [f.112v]).

389 **5.2 The role of strata in growth of islands and continents, and the origin of fossil beds on** 390 **mountains**

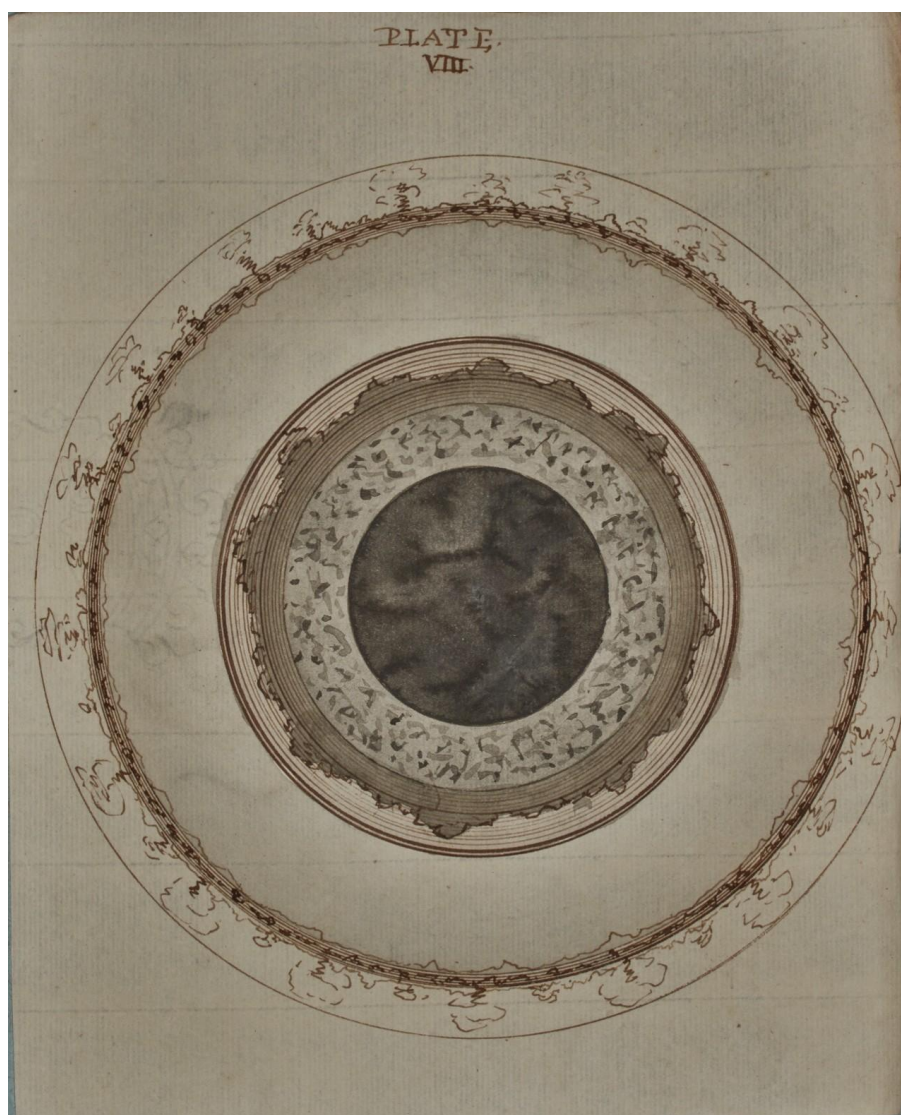
391 Consistent with his general theory that the Earth, once all water, is gradually losing water and
 392 increasing in *terra firma*, the vegetative process provided Wright with a mechanism whereby
 393 islands rose naturally out of the sea and subsequently those islands grew and merged into
 394 continents.

395 We may conclude in general indeed that as all the firm land we now see everywhere was once sea, so all the
 396 residual oceans may at length become land and [f.60r] and [*sic*] when every fluid is absorbed, ordained for ye
 397 natural nurishment and support of all animals and plants the desolation of the world may fully be expected and
 398 as it was originated in water it may be consummated in earth or a solid orb of *terra firma*. For as the connection
 399 or union of many islands produced continents, so the conjunction of larger continents must complete ye solid
 400 shell [f.60v]

401 It was a remarkably coherent theory, as the merging of islands into continents was just an earlier
 402 step in the merging of continents into a state where no oceans were left, the remaining water
 403 being only in springs and lakes. It is a theory not dissimilar to current ideas on continental
 404 accretion. Figure 2 is Plate 8 of the manuscript, described in Wright's text as

405 Plate VIII. [which] represents the Earth in a universal state of conflagration arising from the general content
 406 of an infinite number of volcanoes with the greatest part of subterraneous matter sunk down to ye surface of
 407 its terrella' [f.64v].¹²

¹² The breaking off of material from the inside of the crust and its subsequent falling towards the surface of the inner magnetic terrella was the origin of earthquakes in the model. It was almost identical to that of Burnet (1719).



408

409 Figure 2. Wright's caption reads 'Plate ye VIII. The Earth in its last stages of vegetation or in
 410 a universal state or *terra firma* interspers'd with lakes only and water'd by fountains and
 411 rivers' [f.2v] [Reproduced by permission of Durham University Library and Collections].

412

413 This concept was also consistent with the observations of ancient shore lines in high mountains,
 414 first identified by Linnæus, which seemed to indicate that water levels must have been much
 415 higher in the past than at present. While some naturalists interpreted such features as evidence
 416 for the biblical Deluge, Linnæus contested this conclusion (Nathorst, 1909 p.742).

417 Like many of his contemporaries, Wright wrestled with the conflict between observation and
 418 the Genesis account of a universal flood that wiped out all living things except for single pairs



of each species saved within Noah's ark. For example, Wright's namesake, Edward Wright strongly argued that the presence of pelagic or open-ocean fossil shells in strata near to the surface proved that they must have been transported to their present location in a catastrophic event not inconsistent with the biblical narrative (Wright, 1755). Thomas Wright, however, took the view that such marine fossil deposits on the tops of mountains were not proof of a universal flood, but rather that they equally supported his model of mountains rising from the sea in a steady natural progression.

From the earliest accounts of the origin of the Earth, it evidently appears that the primary mundain mass must or may have been all water and that shells and fish bones etc being found upon ye tops of ye highest mountains is no positive proof of a universal deluge but rather evinces that many if not all of those mountains as originally vegetating rose by degrees and emerged from the bottom of ye abyss and out of the oceans. Look'd upon in this light we may well conclude that those first appearances must have been sands and as such from the breaking of circumnambient waves [Newcastle City Library documents]

Unfortunately, the text breaks off abruptly at this point. The conclusion that the islands emerging from the sea must initially have been covered in sand¹³ is intriguing and the reader is left pondering what result Wright envisaged through the action of the waves. It would appear that he saw such sandy islands as differing from rocky islands, and particularly some rocky islands to whose formation we now attribute submarine volcanic activity. He argued that:

All rocky islands now are generally no other than the mountainous parts of sunk continents as remaining above water. Such are ye Azores, Ladrones and Cape Verds and like in time will be ye Andes and ye Alps etc. The Cannaries being manifestly part of Mount Atlas cut off from the rest and the antil[ies] in america a part of ye *terra firma*. But continents were at first no other than islands generated out of sea as lands and afterwards in process of time clothed with soil and plants. [f.78v]

Rather than being the product of ancient volcanic eruptions, such mountainous archipelagos were envisaged to be the tips of mountains on continents that had sunk under their own weight. This is not quite the same concept as found in an earlier comment in the manuscript, that:

Such particular changes we must attribute to earthquakes, inundations, eruptions etc of which new mountains, new islands, new lakes and new seas are of natural effects. All high and rocky islands in ye oceans manifestly being no more than the tops of the summits of craggy mountains [f.61r].

There is evident uncertainty in Wright's narrative about the origin of these island clusters. He definitely regarded volcanic activity as being a natural process for mountain creation on land in addition to, and in combination with, the slower vegetative process. Importantly, he recognised that the creation of a new island through volcanic eruption could be very fast and that island and mountain creation processes were alike. He recalled that within living memory

Many new mountains are raised from the eruptions of volcanos only, such as Mont[e] de N[u]ovo near Naples etc. Many new islands also have been raised out of ye sea, particularly in ye Mediterranean as Procida and Ischia, Thera¹⁴ and Thorosia and Kammeni¹⁵ and no doubt Delos and Lemnos had ye same original tho' all our like accounts of them are only found in fables. [f.72r]

However, because of his belief in a vegetative process as the origin of mountains and the gradual reduction in the amount of water in the Earth, he envisaged that islands such as the Azores would eventually become like the Alps or Andes as the ocean retreated. Although he

¹³ The word is underlined by Wright, suggesting perhaps that a novel idea had occurred to him.

¹⁴ Santorini

¹⁵ Nea Kameni. Major eruptions took place in 1707-1712, a new island appearing overnight off Santorini in May 1707 (Grenet 2024).



speculated that the Aegean islands Delos and Lemnos might have been formed through submarine volcanic activity in the manner suggested by Moro, he did not extend this idea to the Atlantic Ocean islands. It may have been inconceivable to him that, far out into the Atlantic Ocean, an island mountain could build up to a height necessary to protrude above the surface through sequential underwater eruptions.

5.3 The age of the Earth and the origin of fossiliferous strata

The debate about the age of the Earth was continual throughout the eighteenth century, and Thomas Wright will have been aware of the growing evidence that the age of the Earth was much greater than the six millennia determined by Bishop Ussher from the Christian Biblical narrative. While the seminal work of Hutton appeared only after Wright's death (Hutton 1788) an appreciation of Deep Time on a scale previously unimaginable was developing throughout Wright's lifetime. It is unlikely that Wright will have been aware of, or seen as relevant, Buffon's published estimate of the age of the Earth as nearly 100,000 years, based on experiments following Newton (Newton 1729 p.422) which involved the cooling of various sizes of iron sphere (LeClerc, 1774).¹⁶ Unlike that of Buffon, who envisaged planets as being formed from liquid material displaced from the Sun through collisions with comets, Wright's model did not involve the cooling of such a molten mass of material.

Wright's evidence for concern over the accepted age of the Earth came in part from his observations of fossiliferous strata.

The surprising phenomenon of fossels as found in their mineral beds particularly that of the shell vein'd marble¹⁷ etc is an evident demonstration that a much longer duration of time than that of a few thousand years since ye flood appears to be necessary towards their perfect formation in their present state of petrification. [f.55v]

Wright was certainly not the first to have concluded that the process of petrification must have taken much longer than 6,000 years, despite such ideas still being regarded by influential theologians as contrary to acceptable belief. In a series of 1688 lectures, partly on the basis of observations on the Isle of Wight, Robert Hooke had concluded that the strata in which he found fossil shells must once have been covered by water. From detailed microscopic inspection, he deduced that the fossils had once been part of living animals (Drake 2007). However, the duration of the Flood as specified in the Book of Genesis was insufficient to result in the observed level of petrification (Hooke 1705). In the mid-eighteenth century, Moreton Gilks was still cautious in suggesting, from observations of petrification in the mineral-rich waters in the Peak District, that a period of 60,000 years rather than 6,000 years might be more appropriate for the age of the Earth (Gilks 1740). As late as 1785, James Douglas, after concluding from examination of a fossil nut that the earth had to have been created in six expanses of time rather than six days, found it necessary immediately to suggest that Moses used the concept of a solar day rather than an expanse of time as a pedagogic device (Douglas 1785).

¹⁶ Assuming a date of 1773 for Wright's manuscript, it will have just preceded Buffon's 1774 publication of cooling experiments on cannon balls of various sizes, (Poirier, 2017), from which he concluded that it had taken 96,670 years and 132 days (LeClerc, 1774, p.223) for the Earth to reach ambient temperature.

¹⁷ This may well have been the mineral known locally as 'Frosterley Marble'. It is a black limestone containing coral fossils from the Carboniferous Period, found in the North Pennines of County Durham. Polished pillars, made from this material and displaying these fossils very clearly, can be found in the region including many in Durham Cathedral and the palace chapel at Bishop Auckland, places well known to Wright.



499
500 In retirement in the North East of England, where fossiliferous limestones and marls are
501 common, Wright will doubtless have reflected on these debates whilst trying to reconcile his
502 model for the formation of the Earth with his understanding of the Scriptures. He did not accept
503 the literal truth of the Genesis narrative and indeed referred to the biblical text in such a manner
504 that:

505
506 We are not to expect a perfect philosophical account in a discourse addapted only to vulgar notions and the
507 most common capacities; and besides in the Patriarchal Ages, the insurmountable prejudices of the plane flat
508 form of ye Earth and ye totale ignorance of its being a spherical body made it both dangerous and improper
509 [f.35v]. This theory of the Mosaic creation will not be found to differ much from that of the Phoenicians,
510 Babylonians and Egyptians excepting only the very essential circumstance of introducing a Divine Nature
511 [f.36r].
512

513 In the section headings for the incomplete Book IV of the present manuscript, there is also the
514 suggestion that no certain account of the universal flood has come down to us and that what
515 can be known is founded in fable [f.93v].

516 Wright's theory for the development of strata provided a simple explanation as to how marine
517 fossils were to be found high in mountains.

518 But an aboriginal flood will obviate all objections of this nature for if the universal *terra firma* was originally
519 generated out of the seas, shells and fossels of all kinds must naturally be found upon ev'ry mountain. [f.56v]

520 As the Earth was originally all ocean, and mountains grew out of that body of water, the
521 accumulated shells would naturally be raised onto the highest mountains. It was a much simpler
522 explanation than that of Halley, who had proposed that the shock of a comet or other closely
523 passing astronomical body might have reversed the Poles and rotation direction of the Earth,
524 the resulting catastrophic flow of water depositing shells onto high mountains (Halley, 1724).

525 It was not just the presence of fossils that indicated to Wright that the Earth was of very great
526 age. The variety and number of strata, which he perceived to have been initially produced by
527 the spread of volcanic lava, convinced him that their production through natural processes
528 required huge, inconceivable, amounts of time.

529 The various and many amazing strata of Earth and the more astonishing production of mountains which no
530 universal Flood tho' of an ages dimension could ever have effected are all sufficient proofs of the inconceivable
531 amounts of time the Earth must have existed and notwithstanding we cannot reach the original or penetrate
532 the powerful laws of nature by which it subsists yet we see sufficiently enough to convince us of an infinite
533 Providence [Notes 18/3 f.2r]

534 Wright did not see the concept of an inconceivable amount of time since the creation of the
535 world as an impediment to a belief in a universal Divine Providence. Indeed, he regarded it
536 quite the opposite, as convincing evidence of the existence for a benign power that "provides
537 for all nature according to justice wisdom and virtue" [f.39r]. The providentially established
538 laws of nature controlled the evolution and development of the Earth and these laws were
539 unalterable. If his model was correct and the present epoch represented an equilibrium between
540 water and earth, then because there had not been a perceptible change in the orbit of the Earth
541 about the Sun in historical time, Wright concluded that this provided further proof that the
542 evolutionary process too must be imperceptibly slow.



543 For as ye Earth and its surrounding atmosphere will always [f.9r] have the same undiminished quantity of
544 matter in it till finally absorbed in the Sun, one great object of nature must be to pursue that just equilibrium
545 in the solids and fluids of the Earth that no extraordinary event shall happen in the unalterable laws of
546 Providence but such transmutation as preordained to answer the various periods of time and ye constitution
547 and disposition of human nature and as the Earth having preserved ye same velocity and momentum without
548 ye least perceptible def[i]minution since ye beginning of our time this progression must be very slow. [f.9v]

549 Nevertheless, although convinced of what we now refer to as Deep Time, Wright was clear that
550 his arguments did not lead to a value for the extent of the duration of the Earth, nor to definite
551 proof of the future destruction of the Earth by fire.

552 But all this neither prove or evince the duration of the Earth's existence and the many ages of its subsistence
553 thro' an illimitable length of time, then any tendency towards its desolation, this not only possible but probable
554 event can only be gathered from celestial observations and now begins to appear in several prosthaphaeresis
555 of the Earth and Moon's motion as continually approaching to ye ye [sic] Sun but of this I shall say much
556 more in another place. [f.72v]

557 The true tests of his hypotheses would come from astronomical observations and he claimed
558 that there were contemporary measurements that suggested that the Earth was indeed gradually
559 approaching the Sun¹⁸. Sadly, his promise to say more elsewhere was not realised.

560

561 6. Final reflections

562 As an autodidact whose papers have been dispersed or lost, it is difficult to place Thomas
563 Wright's ideas in the context of contemporary debates over the origin and significance of fossils
564 and strata. There is no hint that he had any involvement in Scottish Enlightenment circles and
565 there is no record of his continued interaction with the London cognoscenti following his
566 retirement to County Durham.¹⁹ The neat handwriting and careful narrative of *Second of*
567 *singular thoughts* suggests that he had prepared this manuscript for possible publication at
568 about the time of writing of *A new theory*, but the absence of subscribers and failure to publish
569 *Second of singular thoughts* suggests that he had lost touch with mainstream thinkers by this
570 time. Nevertheless, the existence of twelve carefully drawn plates definitely indicate that he
571 had publication of *A new theory* very much in mind.

572 As suggested earlier, it is likely that *A new theory* is based on ideas that he had formed during
573 the latter part of his life in the south of England up to the later 1750s. His ideas on the origin
574 and nature of strata, while ingenious in their explanation, do not significantly advance a debate
575 that seemed to have temporarily stalled. The absence of papers relating to the origin of strata
576 in the *Philosophical Transactions of the Royal Society* in the period 1750-1780 perhaps reflects
577 this impasse. Wright's theory of the evolution of the Earth has interesting parallels with that of
578 Buffon, which appeared in *Les époques de la nature*, in 1778 as a supplement to his *Histoire*
579 *naturelle générale et particulière* and published separately in Paris in 1780 (Leclerc, 1780;
580 Harper and Tanner, 2026). Buffon, proposed that the Earth is in a process of continual

¹⁸ We now know that the Earth gradually getting further from the Sun over time, primarily due to loss of mass from the Sun from nuclear fusion processes and ejection of material in the solar wind.

¹⁹ When chided by Elizabeth Vane in 1777 for neglecting his long-time friend, the Bluestocking Elizabeth Carter, Wright claimed that he had not 'been in London for many years'. Nevertheless, he was still travelling, as Vane also notes that he had gone to visit the Duchess of Beaufort, presumably at her home in Stoke Park, near Bristol. (Letter from Elizabeth Vane (d.1789) to Elizabeth Carter (1717-1806), dated 27th Aug 1777, Raby Castle Archives MR 6, No.3, Staindrop, County Durham, U.K.)



development through a series of seven distinct stages or epochs through the cooling of a molten mass to an eventual frozen sphere. Despite attempting to present his ideas as compatible with an allegorical reading of Genesis, he was forced to retract many of his concepts in the face of intense criticism from theologians (Roger, 1997). It was not until the recognition of unconformities, such as that identified by Hutton at Siccar Point in the south of Scotland (see Harper, 2024; Ferretti, *et al.*, 2026), that the evidence for the existence of Deep Time became overwhelming (Hutton, 1788). Wright's ideas, alongside those of Buffon, sit between two sets of evidence from the strata, namely that strata represent a historical record of the Earth's development and that the time over which this occurred was unimaginably long.

7. Conclusions

Although seemingly having no influence of the development of late eighteenth-century concepts of stratigraphy, Wright's work illustrates the way in which ideas were being adapted by lesser-known scientists and philosophers in order to account for the phenomena that challenged contemporary thought. His unique and curious views provide a fascinating example of how a hidden raft of unsuccessful propositions and arguments by relatively unknown thinkers contributed to the crisis in consistency prior to the critical shift in the understanding of time in the Earth Sciences at the end of the eighteenth century. Wright's work represents a node in this web of thought during what, within the structure of Thomas Kuhn's analysis, was a crisis in normal science that led through a paradigm shift to a scientific revolution (Kuhn, 1996). Thomas Wright had neither the resources nor the training to make a bold unifying step in resolving his conflicting ideas but he certainly recognised the anomalies within contemporary models that both his theory and the observational evidence presented. His belief in a benign Divine Presence that had established immutable Laws of Nature reconciled the existence of environmental catastrophes with overall good for mankind. While unwilling to be drawn into debate over the timescale of creation, his recognition that the Biblical narrative was not literal and was written within the context of the philosophical worldview of its time meant that he was prepared to interpret the stratigraphy of the Earth's surface as evidence of its long existence and the product of processes continuing at the present. He almost reached a concept of Deep Time, referring to an "illimitable length" or "inconceivable amount" of time for which the Earth had existed. That he never brought *A new theory* to a state ready for publication may have been an unwillingness to confront the controversy that his ideas would have generated, or perhaps disillusionment in failure to publish *Second or singular thoughts*. Like much of Wright's life and work, it remains an enigma.

Code availability: Not appropriate

Data availability: The related Thomas Wright manuscripts are available at <https://iif.durham.ac.uk/index.html?manifest=t2m9s161643b> and <https://iif.durham.ac.uk/index.html?manifest=t2m9c67wn16k&canvas=t2dn39x973z>

Contributions of authors.

Tanner transcribed and edited Thomas Wright's manuscript and wrote the first draft of the paper. Harper contributed notes and information on eighteenth-century stratigraphy and in discussion with Tanner developed the framework of the paper. Both authors contributed to later drafts.



623

624 **Conflict of Interest**

625 The authors declare that they have no conflicts of interest.

626

627

References

628 Anonymous, probably George Allan of Darlington: A sketch of the character of Mr Thomas
629 Wright, late of Byer's-Green Lodge, in the County of Durham, *The Gentleman's Magazine*,
630 63, 9–12, <https://archive.org/details/s2492id1330026/page/n17/mode/2up>, 1793.

631 Appleby, J. H.: James Theobald, F. R. S. (1688–1759), merchant and natural historian, *Notes*
632 *Rec. Roy. Soc. Lond.*, 50, 179–189, <https://doi.org/10.1098/rsnr.1996.0020>, 1996.

633 Borlace, W.: An enquiry into the original state and properties of spar and sparry productions
634 particularly, the spars, or crystals found in the Cornish mines called Cornish Diamonds. In a
635 letter to Emanuel Mendez da Costa Esq. F.R.S. from the Rev. Mr. Wm. Borlace, *Phil. Trans.*
636 *Roy. Soc. Lond.*, 46, 250–277, <https://doi.org/10.1098/rstl.1749.0049>, 1749.

637 Buckley, J.: The Journal of Thomas Wright. Author of *Louthiana*, *J. County Louth Archaeol.*
638 *Soc.*, 2, 165–185, <https://doi.org/10.2307/27727872>, 1909.

639 Burnet, T.: The sacred theory of the Earth, 4th Edition, J. Hooke, London,
640 <https://archive.org/details/sacredtheoryofea01burn/page/n123/mode/2up?view=theater>, 1719.

641
642 Dale, S.: A letter from Mr. Samuel Dale to Mr. Edward Lhwyd, Keeper of the Ashmolean
643 Repository in Oxford, concerning Harwich Cliff, and the fossil shells there, *Phil. Trans. Roy.*
644 *Soc. Lond.*, 24, 1568–1578, <https://doi.org/10.1098/rstl.1704.0013>, 1704.

645 Dominici, S.: A man with a master plan: Steno's observations on Earth's history, *Substantia*,
646 5(1) Supplement, 59–75, <https://doi.org/10.36253/Substantia-1278>, 2021.

647 Dominici, S.: The Volterra cliff in the mind of philosophers, savants and geologists (1282–
648 1830) in: *Geology's Significant Sites and their Contributions to Geoheritage*, edited by:
649 Clary, R. M., Pyle, E. J., Andrews, W. M., Geological Society Special Publications, 543,
650 London, <https://doi.org/10.1144/SP543-2022-230>, 2023.

651 Douglas, J.: A dissertation on the antiquity of the Earth read at the Royal Society, 12th May
652 1785, George Nicol, London, 38–41,
653 <https://play.google.com/books/reader?id=ZoNU87jgtccC&pg=GBS.RA1-PA41&hl=en>, 1785.

654 Drake, E. T.: The geological observations of Robert Hooke (1635–1703) on the Isle of Wight,
655 in: *Four Centuries of Geological Travel: The Search for Knowledge on Foot, Bicycle, Sledge*
656 *and Camel*, edited by: Wyse Jackson, P. N., Geological Society Special Publications 287,
657 London, 19–30, <https://doi.org/10.1144/SP287.3>, 2007.

658 Ferretti, A., Vezzani, F., Balini, M.; Leonardo da Vinci (1452–1519) and the birth of
659 stratigraphy. *Newsl. Stratigr.* 53, 1–17, <https://doi.org/10.1127/nos/2019/0564>, 2020.



- 660 Ferretti, A., Balini, M., Harper, D. A. T., Servais, T.: Cutting Time in slices, *Palaeogeog.*,
 661 *Palaeoclim.*, *Palaeoecol.*, 683, 113433, <https://doi.org/10.1016/j.palaeo.2025.113433>, 2026
- 662 Gilks, M.: A letter from Mr. Moreton Gilks, F. R. S. to Dr. Mortimer, Sec. R. S. giving some
 663 account of the petrefactions near Matlock Baths in Derbyshire; with his conjectures
 664 concerning petrefaction in general, *Phil. Trans. Roy. Soc. Lond.*, 41, 352–356,
 665 <https://doi.org/10.1098/rstl.1739.0059>, 1740.
- 666 Grenet, M.: Santorini: When an Island was Born. University of Toulouse II, from a lecture at
 667 the University of Geneva in November 2024, [https://www.tovima.com/stories/santorini-](https://www.tovima.com/stories/santorini-when-an-island-was-born/)
 668 [when-an-island-was-born/](https://www.tovima.com/stories/santorini-when-an-island-was-born/), (last access: 10 September 2026), 2024.
- 669 Halley, E.: An account of the circulation of the watry vapours of the sea, and of the cause of
 670 springs, presented to the Royal Society, *Phil. Trans. Roy. Soc. Lond.*, 17, 468–473,
 671 <https://doi.org/10.1098/rstl.1686.0084>, 1691.
- 672 Halley, E.: Some considerations about the cause of the universal Deluge, laid before the
 673 Royal Society, on the 12th of December 1694, *Phil. Trans. Roy. Soc. Lond.*, 33, 118–123,
 674 <https://doi.org/10.1098/rstl.1724.0023>, 1724.
- 675 Hamilton, W.: Remarks upon the nature of the soil of Naples, and its neighbourhood; in a
 676 letter from the Honourable William Hamilton, His Majesty's Envoy Extraordinary at Naples,
 677 to Mathew Maty, M. D. Sec. R. S., *Phil. Trans. Roy. Soc. Lond.*, 61, 1–47,
 678 <https://doi.org/10.1098/rstl.1771.0001>, 1771.
- 679 Hamilton, W.: Observations on Mount Vesuvius, Mount Etna, and other Volcanos: in a Series
 680 of Letters, addressed to the Royal Society, 2nd. Edition, Printed for T. Cadell in The Strand,
 681 London, <https://wellcomecollection.org/works/c9k7abhe>, 1773.
- 682 Harper, David A. T.: The importance of fossils and their collections in the development of
 683 modern stratigraphy, *Earth Sci. Hist.*, 43, 286–302, [https://doi.org/10.17704/1944-6187-](https://doi.org/10.17704/1944-6187-43.2.286)
 684 [43.2.286](https://doi.org/10.17704/1944-6187-43.2.286), 2024
- 685 Harris, E.: Thomas Wright. Arbours and Grottos: a facsimile of the two parts of Universal
 686 Architecture (1755 & 1758) with a catalogue of Wright's works in architecture and garden
 687 design, Scholar Press, London, ISBN 10 859675157, 1979.
- 688 Hoskin, M.: Discovery of Thomas Wright's A New Theory of the Earth, *J. Hist. Astron.*, 34,
 689 94, <https://doi.org/10.1177/002182860303400108>, 2003
- 690 Hughes, E.: The early journal of Thomas Wright of Durham, *Ann. Sci.*, 7, 1–24,
 691 <https://doi.org/10.1080/00033795100202151>, 1951.
- 692 Hutton, J.: Theory of the Earth; or an investigation of the laws observable in the composition,
 693 dissolution, and restoration of land upon the globe, *Trans. Roy. Soc. Edinburgh*, 1, 209–304,
 694 <https://doi.org/10.1017/S0080456800029227>, 1788.
- 695 Kant, I.: Universal Natural History and Theory of the Heavens, Johnston, I. trans. 2008,
 696 Richer Resources Publications, Arlington, <https://web.viu.ca/johnstoi/kant/kant2e.htm>, 1755.
- 697 King, E.: An attempt to account for the universal deluge, *Phil. Trans. Roy. Soc. Lond.*, 57,
 698 44–57, <https://doi.org/10.1098/rstl.1767.0005>, 1767.



- 699 Knight, D.: Thomas Wright (1711–1786), Oxford Dictionary of National Biography, Oxford
700 University Press, Oxford, <https://doi.org/10.1093/ref:odnb/30060>, 2006.
- 701 Kuhn, T.: The structure of scientific revolutions, 3rd. ed., University of Chicago Press, Chicago,
702 <https://doi.org/10.7208/chicago/9780226458106.001.0001>, 1996.
- 703 Leclerc, G.–L., Comte de Buffon: Histoire générale et particulière, Tome 6, L'imprimerie
704 royale, Paris, 204–224., <https://doi.org/10.5962/bhl.title.124163>, 1774.
- 705 Leclerc, G.–L., Comte de Buffon.: Les époques de la nature, L'imprimerie royale, Paris, 1780
706 and Leclerc, G.–L.: *The epochs of nature*, Zalasiewicz, J., Milon, A.–S., Zalasiewicz, M.
707 (trans. eds.), University of Chicago Press, Chicago, ISBN 13 9780226395432, 2018.
- 708 Linné, C.: Systema naturæ per regna tria naturæ, secundum classes, ordines, genera, species,
709 cum characteribus & differentiis, tomus III, Salvius, Stockholm, 1–236,
710 <https://doi.org/10.5962/bhl.title.37256>, 1768.
- 711 Lister, M. A.: Letter of Mr. Martin Lister, written at York August 25 1671 confirming the
712 Observation in N^o 74. about musk scented insects adding some notes upon D. Swammerdam's
713 book of insects and on that of M. Steno concerning petrify'd shells, Phil. Trans. Roy. Soc.
714 Lond., 6, 2281–2284, <https://doi.org/10.1098/rstl.1671.0050>, 1671.
- 715 Luzzini, F.: Sounding the depths of Providence: Mineral (re)generation and human-
716 environment interaction in the Early Modern period, Earth Sci. Hist., 39, 389–408,
717 <https://doi.org/10.17704/1944-6187-39.2.389>, 2020.
- 718 Luzzini, F.: Harvesting Underground: (re)generative theories and vegetal analogies in the
719 early modern debate on mineral ores (I), Notes Rec. Roy. Soc. Lond., 79, Issue 4
720 <https://doi.org/10.1098/rsnr.2023.0032>, 2025.
- 721 McCarthy, M.: Thomas Wright's Designs for Gothic Garden buildings, J. Garden Hist. 1,
722 239–252, <https://doi.org/10.1080/01445170.1981.10412374>, 1981.
- 723 Menchetti, S.: How do Crystals Grow? Steno's Approach, Substantia, 5(1) Suppl., 77–87,
724 <https://doi.org/10.36253/Substantia-1279>, 2021.
- 725 Morello, N.: Steno, the fossils, the rocks and the calendar of the Earth, in: The origins of
726 Geology in Italy, edited by Battista Vai, G., Glen, W., Caldwell, E., Geological Society of
727 America, Boulder CO, 81–93, [https://doi.org/10.1130/2006.2411\(06\)](https://doi.org/10.1130/2006.2411(06)), 2006.
- 728 Moro, A. L.: De Crostacei ed altri marini corpi che se trovano su' monti, Venice,
729 https://books.google.it/books?id=KiQJanHrFFoC&hl=it&source=gbs_navlinks_s, 1740.
- 730 Narthorst, A.G.: Carl von Linné as a geologist, Annual Rpt. of the Smithsonian Inst. 1908.
731 Washington: Government Printing Office, 711–743, [https://library.si.edu/digital-](https://library.si.edu/digital-library/book/annualreportofbo1908smitfo)
732 [library/book/annualreportofbo1908smitfo](https://library.si.edu/digital-library/book/annualreportofbo1908smitfo), 1909.
- 733 Newton, I.: Mathematical Principles of Natural Philosophy, translated by Motte, A.,
734 Benjamin Motte, London, <https://books.google.co.uk/books?id=b3RgvRUi2FsC>, 1729.
735 Modern edition: Newton, I.: The Principia, translated by Andrew Motte, Prometheus Books,
736 Amherst, ISBN 978-0879759803, 1995.



- 737 Norris, J. A.: The mineral exhalation theory of metallogenesis in pre-Modern mineral science,
 738 *Ambix*, 53, 43–65, <https://doi.org/10.1179/174582306X93183>, 2006.
- 739 Paneth, F. A.: Thomas Wright of Durham, *Endeavour*, 9, 117–125,
 740 https://archive.org/details/sim_endeavour_1950-07_9_35/page/116/mode/2up?view=theater,
 741 1950.
- 742 Paneth, F. A.: Thomas Wright of Durham and Immanuel Kant, *The Observatory*, 64, 71–82,
 743 <https://ui.adsabs.harvard.edu/scan/manifest/1941Obs....64...71P>, 1941.
- 744 Plattes, G.: A Discovery of Subterranean Treasure, Peter Parker, London, 1679: Plattes, G.: A
 745 Discovery of Subterranean Treasure, Gale Ecco Print Editions, ISBN 13 9781385800485, 2018
- 746 Poirier, J-P.: About the age of the Earth, *Comptes Rend. Geosci.*, 349, 223–225,
 747 <https://doi.org/10.1016/j.crte.2017.08.002>, 2017
- 748 Porter, R.: William Hobbs of Weymouth and his The Earth Generated and Anatomised
 749 (?1715), *J. Soc. Bibliography of Natural History* 7, 333–341,
 750 <https://doi.org/10.3366/jsbnh.1976.7.4.333>, 1976.
- 751 Preston, J.: A polymath in Arcadia, *Garden History*, 38, 159–176,
 752 <https://www.jstor.org/stable/41411752>, 2010.
- 753 Roger, J.: Buffon: A life in natural history, translated by: Bonnefoi, S. L. and edited by Pearce
 754 Willams, L., Cornell University Press, Ithaca, ISBN 10 0801429188, 1997.
- 755 Steno, N.: The prodromus to a dissertation concerning solids naturally contained within
 756 solids. Laying a foundation for the rendering a rational accompt bot of the frame and the
 757 several changes of the masse of the Earth, as also of the various productions in the same.
 758 Englished by H[enry] O[ldenburg], Winter, London, <https://doi.org/10.5962/bhl.title.145115>,
 759 1671.
- 760 Stukeley, W.: An account of the impression of the almost entire sceleton of a large animal in a
 761 very hard stone, lately presented the Royal Society, from Nottinghamshire, *Phil. Trans. Roy.*
 762 *Soc. Lond.*, 30, 963–968, <https://doi.org/10.1098/rstl.1717.0053>, 1719.
- 763 Tanner, B. K. and Harper, D.A.T.: The creation and evolution of the Earth, as described in
 764 Thomas Wright of Durham’s “A New Theory of the Earth”, *Earth Sci. Hist.*, 45, accepted,
 765 <https://durham-repository.worktribe.com/output/5856731>, 2026.
- 766 Whiston, W.: A new theory of the Earth, Benjamin Tooke, London,
 767 https://archive.org/details/b30324361_0002/page/n11/mode/2up, 1696.
- 768 Woodward, J.: An essay toward a natural history of the earth, and terrestrial bodies, especially
 769 minerals: As also of the sea, rivers, and springs. With an account of the universal deluge, and
 770 of the effects that it had upon the earth, Richard Wilkin: London,
 771 <https://archive.org/details/essaytowardnatur00wood/page/n5/mode/2up>, 1695.
- 772 Wright, E.: An account of Orthoceratites: in a letter from Edward Wright M.D. to Mr. Peter
 773 Collinson F.R.S., *Phil. Trans. Roy. Soc. Lond.*, 49, 672–682,
 774 <https://doi.org/10.1098/rstl.1755.0106>, 1755.



- 775 Wright, T.: *Clavis Pannautici*, Huggonson, London,
 776 <https://iif.durham.ac.uk/index.html?manifest=t1m41687h91q&canvas=t1tns064g56v>, 1734.
- 777 Wright, T.: A Letter from Mr. Tho. Wright to James Theobald, Esq; F.R.S. concerning Two
 778 ancient Camps in Hampshire, *Phil. Trans. Roy. Soc. Lond.*, 43, 273–275,
 779 <https://doi.org/10.1098/rstl.1744.0060>, 1744.
- 780 Wright, T.: *Louthiana: or an introduction to the antiquities of Ireland.*, Faden, London,
 781 <https://wellcomecollection.org/works/k9d749nr/items>, 1748.
- 782 Wright, T.: *An Original Theory or New Hypothesis of the Universe*, Chappelle, London,
 783 [https://publicdomainreview.org/collection/an-original-theory-or-new-hypothesis-of-the-](https://publicdomainreview.org/collection/an-original-theory-or-new-hypothesis-of-the-universe/)
 784 [universe/](https://publicdomainreview.org/collection/an-original-theory-or-new-hypothesis-of-the-universe/), 1750. Reprinted: Thomas Wright, *An original theory or new hypothesis of the*
 785 *universe*, Cambridge University Press, Cambridge,
 786 <https://doi.org/10.1017/CBO9781107447370>, 2015.
- 787 Wright, T.: Mr Wright's description of his villa at Byer's-Green, *The Gentleman's Magazine*,
 788 63, 213–216, <https://archive.org/details/s2492id1330026/page/212/mode/2up>, 1793.
- 789 Wright, T.: *Second or singular thoughts upon the theory of the universe*, edited by: Hoskin,
 790 M., Dawsons, London, ISBN 13 9780712902212, 1968.
- 791 Zollman, P. H.: An extract, by Philip Henry Zollman, Esq; F. R. S. of a philosophical account
 792 of a new opinion concerning the origin of petrifications found in the earth, which has been
 793 hitherto ascribed to the universal deluge; as contained in an Italian book, intituled, *De*
 794 *Crostacei ed altri marini corpi che se trovano su' monti*, di Anton Lazzaro Moro, Venice 1740,
 795 *Phil. Trans. Roy. Soc. Lond.*, 44, 163–166, <https://doi.org/10.1098/rstl.1746.0032>, 1746.
- 796