

FORUM: SCIENCE IN TRANSLATION

Antonio Stoppani's 'Anthropozoic' in the context of the Anthropocene

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Abstract

The figure of Antonio Stoppani (1824–91), an Italian priest, geologist and patriot, has re-emerged in the last decade thanks to discussions gravitating around the 'Anthropocene' – a term used to designate a proposed geological time unit defined and characterized by the mark left by anthropogenic activities on geological records. Among these discussions, Stoppani is often considered a precursor for popularizing the term 'Anthropozoic', which he used to describe and characterize the latest 'era' of Earth's geological time. His writings, largely unknown to an international audience before the 'Anthropocene saga', have been particularly in the spotlight after Valeria Federighi translated excerpts of his main geological work, *Corso di Geologia*, originally published in three volumes between 1871 and 1873. In the first edition of *Corso di Geologia*, namely *Note ad un Corso Annuale di Geologia*, or simply *Note*, published between 1865 and 1870, Stoppani characterized the Anthropozoic in stratigraphic terms. In particular, Chapter 15 of the second volume of *Note* (1867) represents the first stratigraphic characterization that the author provides of the Anthropozoic. Our contribution here brings, for the first time, a translation of Chapter 15 to a broader international audience, accompanied by a critical commentary elucidating the broader social, political, religious and scientific context wherein the notion of Anthropozoic emerged in Stoppani's writings. The text of the original document and its translation can be found in the supplementary material tab at <https://doi.org/10.1017/S0007087422000590>.

Antonio Stoppani and Chapter 15 of *Note ad un Corso Annuale di Geologia*

A recent proposal to formalize an Anthropocene Epoch on the Geologic Time Scale has ignited widespread multidisciplinary debates. This proposal – the Anthropocene hypothesis – has been advanced by the Anthropocene Working Group (AWG) of the Subcommission of Quaternary Stratigraphy. The hypothesis holds that a discernible stratigraphic signature of anthropogenic origins may be used to end the Holocene and mark the beginning of a new geological unit (the Anthropocene) at approximately 1950 CE.¹ The proposal has been attracting multidisciplinary interest, merging into an experimental and explorative field of research that scholars are now labelling 'Anthropocene studies'.

¹ Jan Zalasiewicz, Colin N. Waters, Mark Williams and Colin P. Summerhayes, *The Anthropocene as a Geological Time Unit: A Guide to the Scientific Evidence and Current Debate*, Cambridge: Cambridge University Press, 2018.

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One of the many research trajectories born out of this new field has been the reconstruction of the genealogy of the Anthropocene concept.² Researchers have been scouting for similar conceptual antecedents in the history of scientific thought, a debate that is somewhat polarized between ‘continuists’ and ‘discontinuists’ as to whether or not the Anthropocene was anticipated by earlier attempts to locate humans in the context of stratigraphic and geologic time. On the one hand, continuists argue that the concept of Anthropocene has semantic precursors that anticipate its core meaning. On the other hand, discontinuists believe that this semantic continuity is unwarranted, in that the Anthropocene grounds into a completely new theoretical framework developed in the womb of earth system science and absolute geochronology.

How does the figure of Antonio Stoppani enter this debate? Antonio Stoppani (1824–91) was an Italian priest, scientist and patriot born in Lecco who made important scientific and cultural contributions to Italian geology and what we would now consider to be citizen science.³ International interest in Stoppani and his writings has been ignited amidst debates surrounding the genealogy of the Anthropocene, especially in conjunction with the Anthropozoic – a term and geological unit defined, characterized and used by Stoppani in his geological writings. Stoppani’s first stratigraphic description of the Anthropozoic appears in Chapter 15 of his 1867 geology manual *Note ad un Corso Annuale di Geologia*, entitled ‘Neozoic Epoch. Anthropozoic formations’. The value of a commented translation of this chapter, which we present here, is at least threefold.

First, the chapter represents an extremely valuable historical source in reconstructing the history of Italian and European geology. Stoppani was a central figure in the establishment of the first Italian geological survey, and in the popularization of earth science in academic as well as popular culture. However, knowledge of Stoppani’s *oeuvre* remains largely confined to an Italian-speaking audience. As of 2022, only Valeria Federighi’s translation of excerpts from *Corso di Geologia* exists, this being Stoppani’s major geological work published in three volumes between 1871 and 1873. This translation is particularly valuable in framing Stoppani’s broader considerations on humanity’s place in the natural world, and we strongly encourage readers to familiarize themselves with the translated excerpts while approaching our translation.⁴ However, Chapter 15 of *Note*, which is our focus here, provides a more detailed stratigraphic description of the Anthropozoic that is absent from Federighi’s selected excerpts.

Second, this chapter allows Anthropocene researchers entangled in the genealogical dilemma to further address Stoppani’s characterization of the Anthropozoic, particularly with reference to semantic continuity with the Anthropocene. Genealogical discussions over the currently proposed epoch have developed without thoroughly contextualizing Stoppani’s definition and characterization of the Anthropozoic. While the Anthropozoic was already being used by authors in Great Britain such as Thomas Jenkyn or Samuel Haughton, or by the German zoologist Ernst Haeckel, Stoppani has been the first (and

² For an overview of the genealogical research on the Anthropocene see Eva Horn and Hans Bergthaller, *The Anthropocene: Key Issues for the Humanities*, Milton Park: Routledge, 2019, Chapter 3. See also the seminal article from Will Steffen, Jacques Grinevald, Paul Crutzen and John McNeill, ‘The Anthropocene: conceptual and historical perspectives’, *Philosophical Transactions of the Royal Society A* (2011) 369(1938), pp. 842–67.

³ Stoppani’s life and works are thoroughly discussed in Elena Zanoni, *Scienza, patria e religione: Antonio Stoppani e la cultura italiana dell’Ottocento*, Milan: FrancoAngeli, 2014. For an English summary of his contributions to science see Stefania Lucchesi, ‘Geosciences at the service of society: the path traced by Antonio Stoppani’, *Annals of Geophysics* (2017) 60(7), pp. 1–7.

⁴ Valeria Federighi, ‘The Anthropozoic Era: excerpts from Corso di Geologia’, *SCAPEGOAT* (2013) 5, pp. 346–53. The translation is also available at https://geologicnow.punctumbooks.com/2_Turpin+Federighi.php (accessed 17 June 2022).

perhaps most cited) author reemerging in genealogical discussions over the Anthropocene. Therefore his description of the Anthropozoic deserves particular attention.⁵

Third, the chapter is a testimony to the nineteenth-century multidisciplinary approach to reconstructing the most recent geochronology of the Earth. Stoppani's stratigraphic writings connect significant palaeontological, archaeological and geological research in the Alps during the mid-nineteenth century,⁶ granting insights into his awareness and relationship with international (primarily European, but also North American) scientific and humanistic research. Unavoidably, his scientific contributions witness the development of ties between Italian and European historical sciences in the nineteenth century.

In summary, then, this commentary first reconstructs the (re-)emergence of Stoppani's figure in recent Anthropocene debates, focusing on those recent publications that elevated his figure to the international scale. Then, the focus shifts to the meaning and importance of Chapter 15 of *Note*, emphasizing the intellectual background and context wherein the idea of Anthropozoic emerged. The last section provides technical remarks on the translation.

Stoppani in Anthropocene literature

The term 'Anthropocene' was coined by Nobel laureate Paul Crutzen as a spur-of-the-moment neologism in a panel held during the 15th Scientific Committee meeting of the International Geosphere–Biosphere Programme in Cuernavaca, Mexico, in late February 2000. The term quickly gained momentum, and a few months later Crutzen published with marine biologist Eugene Stoermer (who had been using the term independently during his classes) a seminal article entitled "The 'Anthropocene'" on the *IGBP Newsletter*.

The two scientists advanced that, considering the unprecedented and ever-increasing impact of anthropogenic activities at least since the Industrial Revolution, 'it seems to us more than appropriate to emphasise the central role of mankind in geology and ecology by proposing to use the term "anthropocene" for the current geological epoch'.⁷ They recognized that the idea of a human-characterized epoch has many antecedents in geological thought – Stoppani's Anthropozoic being one among them. Specifically, the authors quote Stoppani through Chapter 1 of the 1986 edited volume *Sustainable Development of the Biosphere*, where the Italian geologist is mentioned in passing in note 18: 'Stoppani, writing at the same time as Marsh, argued that man constituted a new geological force, and designated ours as the "anthropozoic era"'.⁸ Indeed, Marsh's *Man and Nature* is mentioned by Crutzen and Stoermer in their *IGBP Newsletter* article, further corroborating the hypothesis that Marsh – a much more popular figure in international scientific and humanistic literature than Stoppani – kick-started Stoppani's visibility at the inception of the Anthropocene's recent conceptual history.

Crutzen remained a cardinal figure in the survival, spread and evolution of the Anthropocene concept through time. In 2002, he published in *Nature* his influential paper 'Geology of mankind', where he further stressed, that 'Mankind's growing influence on the environment was recognized as long ago as 1873 when the Italian geologist

⁵ See Simon L. Lewis and Mark A. Maslin, 'Defining the Anthropocene', *Nature* (2015) 519(7542), pp. 171–80; and Valentí Rull, 'The Anthropozoic era revisited', *Lethaia* (2020) 54(3), pp. 289–99, for a list of past figures who used the term 'Anthropozoic'.

⁶ See Mott T. Greene, *Geology in the Nineteenth Century*, London: Cornell University Press, 1982.

⁷ Paul Crutzen and Eugene Stoermer, 'The "Anthropocene"', *IGBP Newsletter* (2020) 41, p. 17.

⁸ William C. Clark, 'Sustainable development of the biosphere: themes for a research program', in William Clark and Robert E. Munn (eds.), *Sustainable Development of the Biosphere*, Cambridge: Cambridge University Press, 1983, pp. 5–48, 43.

Antonio Stoppani spoke about a “new telluric force which in power and universality may be compared to the greater forces of Earth,” referring to the “anthropozoic era”.⁹ The *Nature* article had a major impact in increasing the term’s visibility and popularity and spreading it among disciplinary domains and fields of knowledge. By 2006, geologists from the Geological Society of London Stratigraphy Commission began considering the term on stratigraphic grounds.¹⁰ Thereafter, an Anthropocene Working Group was formed under the Subcommittee of Quaternary Stratigraphy in the summer of 2009 to determine whether an Anthropocene unit could see formal ratification on the Geologic Time Scale and International Chronostratigraphic Chart.

Increasing interest in the Anthropocene as a geological time unit pushed academics to research the term’s genealogy. In 2011, Paul Crutzen co-authored with historians John McNeill and Jacques Grinevald, and former IGBP executive director Will Steffen, a seminal paper entitled ‘The Anthropocene: conceptual and historical perspectives’. As the title hints, the authors investigate conceptual precursors that seemingly anticipated the Anthropocene concept in terms of foreseeing the geological agency of humans, arguing that ‘the idea of an epoch of the natural history of the Earth, driven by humankind, notably “civilised Man”, is not completely new’.¹¹ In the article, Stoppani is briefly mentioned, jointly with Marsh, in connection to Crutzen’s original article, where Stoppani first (re)appeared. Once again, it seems that Marsh indirectly contributed to resurfacing Stoppani’s writings. However, there is no evidence that Marsh and Stoppani, despite living at the same time and sharing an interest in geological research, ever met, or exchanged letters.

In 2012, translated excerpts from Stoppani’s three-volume *Corso di Geologia* (1871–3) were reproduced as a book chapter in the edited volume *Making the Geologic Now* by philosopher Etienne Turpin and architect Valeria Federighi.¹² The translation was also reproduced the next year as a journal article on *SCAPEGOAT*. The excerpts are from Chapter 31 (‘First Stone Age or Archeolitic Epoch. First period of the Anthropozoic Era’) of the second volume of *Corso di Geologia*. The excerpts emphasize the unprecedented geological agency of humans: ‘The creation of man constitutes the introduction into nature of a new element with a strength by no means known to ancient worlds’. Humans are, according to the Italian priest and geologist, ‘a new element, a new telluric force that for its strength and universality does not pale in the face of the greatest forces of the globe’.¹³ Just as geologists read the geological history of the Earth through rocks and strata, one ‘can already count a series of strata, where you can read the history of human generations’.¹⁴ This type of narrative, swivelling between the acknowledgement of the grandeur of human agency and the scientific characterization of such agency, makes Stoppani’s writing very close to the overtone implicit in the Anthropocene concept, defined by stratigraphic criteria, but also epitomizing the indelible footprint of human activities – a new telluric force. To an extent, this narrative style inevitably inspired scholars to

⁹ Paul Crutzen, ‘Geology of Mankind’, *Nature* (2002) 415, p. 23.

¹⁰ On the reception of the Anthropocene in stratigraphic research see Jan Zalasiewicz *et al.*, ‘Are we now living in the Anthropocene?’, *GSA Today* (2008) 18(2), pp. 4–8; and Jan Zalasiewicz, Colin Waters, Mark Williams, Colin Summerhayes and Phil Gibbard, ‘The geological Anthropocene: born in the Burlington House’, *Geoscientist* (2018) 27(11), pp. 16–19.

¹¹ Steffen *et al.*, *op. cit.* (2), p. 843.

¹² Etienne Turpin and Valeria Federighi, ‘A new element, a new force, a new input: Antonio Stoppani’s Anthropozoic’, in Elizabeth Ellsworth and Jamie Kruse (eds.), *Making the Geologic Now: Responses to Material Conditions of Contemporary Life*, Santa Barbara: Punctum Books, 2012, pp. 34–41; Federighi, *op. cit.* (4).

¹³ Turpin and Federighi, *op. cit.* (12), p. 36.

¹⁴ Turpin and Federighi, *op. cit.* (12), p. 38.

consider semantic continuities between the present notion of Anthropocene and past geological terms such as Stoppani's Anthropozoic.

Federighi's translation has been crucial in Anthropocene research, enabling access to anglophone readers to a forgotten piece of scientific literature of great historical value in bearing witness to early acknowledgement of the impact of humans as a geological agent. The translation has undoubtedly served as a bridge (and the only one existing so far) between Stoppani's geological thought and the international history of science and the Anthropocene studies audiences.

Many authors have engaged with the genealogy of the Anthropocene concept.¹⁵ While genealogical research has had undeniable historical and philosophical value, some scholars – the 'discontinuists' – criticized this type of endeavour, suggesting that at its core it undermines the theoretical, historical and geological singularity that the Anthropocene represents both as a concept and as a proposed unit of geological time. For instance, philosopher Clive Hamilton and science historian Jacques Grinevald have argued that 'the effect of finding historical precedents is, inadvertently or otherwise, to deflate the Anthropocene concept, reading the Earth's future into its past and diminishing its significance and novelty as just another manifestation of a long line of thinking'.¹⁶ The authors argue that none of the proposed conceptual precursors, including the 'Anthropozoic', are in fact antecedents to the Anthropocene, in that this is grounded in an utterly unprecedented theoretical framework – that of earth system science.¹⁷

Stoppani's 'Anthropozoic' is also directly tackled by Hamilton and Grinevald. They observe that Stoppani's 'religious and stratigraphical perspectives were at one', and that his proposal, like those of his contemporaries, 'described the impact of human activity on "the face of the Earth" rather than on the planet Earth as an evolving complex system'.¹⁸ The novel framework of earth system science separates, according to the authors, the Anthropocene from any supposed precursor – including the Anthropozoic.

As shown, this surge of interest in past instances of geological reflexivity has placed Stoppani's notion of the Anthropozoic under the spotlight over the past two decades. Nevertheless, a critical and contextualized translation of his work, and specifically of his stratigraphic understanding of the Anthropozoic, is still absent in the international historical, philosophical and Anthropocene-oriented research landscape.

Stratigraphy and philosophy of the Anthropozoic

How, then, does Stoppani define and characterize the 'Anthropozoic'?

As anticipated, Stoppani's first characterization of the 'Anthropozoic' epoch is detailed in *Note ad un Corso Annuale di Geologia* (or simply *Note*), specifically in Chapter 15 of the second volume, 'Geologia Stratigrafica' (1867). *Note* represents the first edition of the later revised and renamed *Corso di Geologia* – a more familiar text in Anthropocene literature and the source of Federighi's translated excerpts. Each chapter of *Note* is divided into numbered sections, and Chapter 15 includes sections 442 to 484. The chapter provides a

¹⁵ For instance, Lewis and Maslin, *op. cit.* (5); Horn and Bergthaller, *op. cit.* (2), Chapter 3; Jaia Syvitski, 'Anthropocene: an epoch of our making', *Global Change* (2012) 78, pp. 12–15; Christophe Bonneuil and Jean-Baptiste Fressoz, *The Shock of the Anthropocene: The Earth, History, and Us*, trans. David Fernbach, New York: Verso, 2016.

¹⁶ Clive Hamilton and Jacques Grinevald, 'Was the Anthropocene anticipated?', *Anthropocene Review* (2015) 2(1), pp. 59–72, 62.

¹⁷ To the novelty of earth system science, one could also add the revolution in stratigraphy and geochronology that followed from the adoption of absolute dating techniques during the first half of the twentieth century.

¹⁸ Hamilton and Grinevald, *op. cit.* (16), pp. 63–4.

stratigraphy of the Neozoic and those ‘anthropozoic formations’ that characterize its latest strata.¹⁹ The term ‘Neozoic’, roughly identifying with the present Quaternary Period, has now fallen into disuse in geological classification.²⁰ In Stoppani’s account, it represents the most recent time unit, one that includes the ‘anthropozoic group’. The chapter is particularly valuable because it provides the very first detailed stratigraphic and geochronological characterization of the Anthropozoic by the Italian naturalist.

Early in the chapter, Stoppani confesses that ‘the Anthropozoic soil is located more in the domain of *earth dynamics* rather than geology’, yet a thorough description of the Anthropozoic does not appear in his first volume of *Note*, which is, indeed, dedicated to earth dynamics (*dinamica terrestre*). Post-Tertiary soils are the starting point in defining the Anthropozoic, and include ‘all formations that attest in any way to the presence of humans on earth, or that are contemporary (hence equivalent) to these formations’.²¹ In section 443, Anthropozoic formations are then given stratigraphic, mineralogical and palaeontological characterization (with ‘man’ being the ‘most characteristic fossil’). Representing the most recent series of the Neozoic, Stoppani includes also ‘history and therefore archaeology’, which, despite going ‘quickly astray in the depths of time’, are complementary to stratigraphy and palaeontology in defining the recent Anthropozoic age.²² Indeed, most of the remaining sections deal with archaeological questions, and are located within an archaeological time framework (Stone Age, Bronze Age, and Iron Age), concerning the chronology of pile dwellings and middens in the European, American and Asian contexts.

Understanding Chapter 15 requires understanding the context of Stoppani’s *oeuvre* and thought. *Note* was written to make up for the lack of a textbook suitable for teaching students, as a sort of summary of the oral lessons he had held at the Istituto Tecnico Superiore in Milan. The work, therefore, aimed at disseminating scientific literacy and citizen science throughout Italy – a goal to which Stoppani was fully committed throughout his whole scientific career.

Following the introductory section of *Note*, the naturalist indicates the main interpretive keys of his scientific practice: he fully embraces the gradualist and uniformitarian hypotheses of James Hutton (1726–97) and Charles Lyell (1797–1875) according to which the explanation of physical–geological changes should not be sought in sudden catastrophes but in a slow and constant mechanical action.²³ As is well known, between the end of the eighteenth century and the first half of the nineteenth, first James Hutton and then later Charles Lyell had both contributed significantly to the affirmation of the idea that the present represents the key to understanding the past. Both geologists believed that the Earth’s surface was shaped by physical–geological processes of a non-catastrophic nature. Consequently, the great changes undergone by the globe must necessarily have

¹⁹ In *Corso di Geologia*, Stoppani declares that he has introduced several changes from *Note*, amending several erroneous or inaccurate points, elucidating his arguments more thoroughly, and integrating his analysis with a greater number of notes and figures. *Corso di Geologia*, too, quickly sold out. Stoppani, according to his nephew Cornelio, wanted to make a third edition, but was unable to do so due to his many commitments. Angelo Maria Cornelio, *Vita di Antonio Stoppani*, Turin: Unione Tipografica Editrice, 1898, p. 121. This would instead be published as Antonio Stoppani and Alessandro Malladra, *Corso di Geologia*, Milan: Bernardoni e Rebeschini, 1900–4.

²⁰ Although the term seems still to be used in Chinese and Italian geological literature.

²¹ Antonio Stoppani, *Note ad un Corso Annuale di Geologia. II. Geologia Stratigrafica*, Milan: Bernardoni, 1867, p. 168 (see translation).

²² Stoppani, *op. cit.* (21), pp. 168–9.

²³ Antonio Stoppani, *Note ad un Corso Annuale di Geologia. I. Dinamica Terrestre*, Milan: Bernardoni e Brigola, 1871, pp. 5–7.

occurred gradually and relentlessly within an enormously large timescale.²⁴ Lyell is quoted repeatedly in *Note*, clearly indicating the value that Stoppani found in his works, in particular the *Manual of Elementary Geology* and, obviously, the *Principles of Geology*. In a letter sent to Giuseppe Gagliardi, a Rosminian dedicated to the study of natural sciences, on 10 January 1863, Stoppani emphasized that ‘in the two works of Lyell [there is] a true equivalent of all the ancient and modern theoretical or elementary books’. Thanks to these ‘two works of great profit, and great delight’, a scholar could say that he was fully aware of ‘the agenda in geological science’.²⁵ Stoppani was therefore well acquainted with Lyell’s scientific contributions. Indeed, the publication of the manuals dedicated to geological disciplines – first of all Stoppani’s *Corso di Geologia* – provided an important contribution to the affirmation of Lyellian ideas in Italy.²⁶

The first volume of *Note* (and likewise in *Corso di Geologia*) is dedicated to earth dynamics, the second deals with stratigraphic geology, and the third with endogenous geology. As mentioned, it is on the second volume of the work that attention needs to be focused. Here Stoppani reviews, starting with the most recent, the different geological epochs – Neozoic, Cenozoic, Mesozoic, Paleozoic and Azoic. It is within the Neozoic Epoch, within Quaternary terrains, that he characterizes for the first time the ‘Anthropozoic’, further distinguishing between a *historic* and a *prehistoric* epoch.²⁷ In *Corso di Geologia* the term ‘epoch’ is replaced with the term ‘era’ and the Anthropozoic is characterized as an era itself – although geochronological terms were then much less formally defined than today.

Stoppani’s main point of reference in this section of the work is once again Lyell’s *Elements of Geology*, which is now joined by the *Manual of Geology* (1861) by James Dwight Dana (1813–95), one of the leading figures of US geology in the nineteenth century. If in *Note* Stoppani adopts a classification of geological eras of a topological nature, ‘which mirrored the process of discovery and didactically seemed more effective’,²⁸ in *Corso di Geologia* he passes to a chronological classification, the same adopted by Dana in his *Manual*. Lyell and Dana are among the main points of reference of his theory and scientific practice. Lyell had proposed, in 1830, to call the current period ‘Recent epoch’ based on the end of the last glaciation, the contemporary appearance – this was the belief of the time – of human beings, and the advent of civilizations; Dana spoke of the most recent geological period as an ‘Age of Mind’ and ‘Era of Man’.²⁹

Stoppani’s Anthropozoic wasn’t just a purely stratigraphic concept – as also shown by Federighi’s translation. In fact, his characterization of the Anthropozoic emerged from a deeply articulated philosophy of nature. As Lewis and Maslin recently observed, there are three main reasons behind the emergence of the idea of human-defined geological time units since the end of the eighteenth century: (1) the evidence that human actions have changed environmental conditions, (2) religious beliefs and (3) the expected future impact

²⁴ Martin J. Rudwick, *Worlds before Adam: The Reconstruction of Geohistory in the Age of Reform*, Chicago: The University of Chicago Press, 2008; Rudwick, *Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution*, Chicago: The University of Chicago Press, 2005; David R. Oldroyd, *Thinking about the Earth: A History of Ideas in Geology*, London: Athlone, 1996.

²⁵ Letter, Stoppani to G. Gagliardi, Milan, 10 January 1863, Archivio Storico dell’Istituto della Carità, Stresa, A. G. 139, n. 18–19.

²⁶ Mauro Cremaschi, ‘Il ruolo delle scienze della terra nella formazione dell’archeologia preistorica’, in Maria Bernabò Brea, Angela Mutti (eds.), ‘... Le terramare si scavano per concimare i prati ...’: *La nascita dell’archeologia preistorica a Parma nel dibattito culturale della seconda metà dell’Ottocento*, Parma: Artegrafica Silva, 1994, pp. 21–30, 26.

²⁷ Stoppani, op. cit. (21). In *Corso di Geologia* he will speak of ‘eras’, distinguishing between Azoic, Protozoic, Palaeozoic, Mesozoic, Cenozoic, Neozoic and Anthropozoic.

²⁸ Giovanni Landucci, *L’occhio e la mente: Scienze e filosofia nell’Italia del secondo Ottocento*, Florence: Olschki, 1987, p. 43.

²⁹ Lewis and Maslin, op. cit. (5), pp. 172–3.

of human activity on Earth as a consequence of a period of rapid industrialization, strong exploitation of natural resources and colonization of the globe.³⁰ The second motivation was certainly decisive in Stoppani's thought, although brief moments of environmental consciousness appear too in his writings.

In his best-seller *Il Bel Paese* Stoppani outlines a fundamental concept of his thought: the Linnaean idea of the 'economy of nature', in which it is possible to discern the roots of ecological sciences – a separate disciplinary field emerging only at the beginning of the twentieth century. Nature is understood by Linnaeus as a hierarchical system in perfect balance, in which each created being is destined to play a specific role within the natural world, as a function of maintaining the equilibrium of the overall system at the top of which are situated humans. Every mineral, every plant and every animal was created in relation with the other natural elements.³¹

Stoppani develops this idea, which in turn referred to the concepts of seventeenth-to eighteenth-century natural theology, speaking of 'telluric economy' in some public conferences held in 1873 at the Salone dei Giardini Pubblici in Milan, then published in the book *Acqua ed aria*.³² In this work Stoppani tackles the theme of water on a theoretical, geological and ecological level, investigating the geodynamic mechanisms that guarantee the preservation of the purity of an element which, together with air, is essential for the balance of the natural system and the perpetuation of life on Earth. The work drew on a long tradition of thought that since the seventeenth century has tried to analyse the factors of geodynamic equilibrium of the planet. However, during the eighteenth century, the hypotheses concerning the hydrological cycle were added to those relating to the process of formation and degradation of continents, generating the model of the hydrogeological cycle that we find in Stoppani's pages.

The general connection existing between the phenomena of nature takes the form of an 'infinitely multiple circles that unfold and return to themselves indefectibly' to prevent the return to original chaos and to guarantee to human beings, the supreme purpose of the entirety of creation, the order they need for their survival and progress. In Stoppani's writings, we can rediscover the Huttonian image of an Earth as a wonderful machine built by a benevolent 'Author of nature' to ensure the habitability of the globe for life and human progress. He fully accepted Hutton's vision of the 'telluric economy', which he also embraced in one of its most controversial aspects, namely the cyclical nature of its mechanisms.³³

From his perspective as a man of science with deeply Catholic convictions, Stoppani conceived the natural system as created to welcome the supreme creature; that is, the human being.³⁴ Stoppani argues that 'the Earth without man is nonsense', and precisely this still fully anthropocentric vision limits the scope of the ecological sensitivity expressed by the scientist's geological philosophy.³⁵ Even without anachronistically claiming an ecological awareness that will emerge only in the following century, it can be observed that, by the 1850s, the American philosopher and naturalist Henry David Thoreau (1817–62) had not only questioned the static models of the economy of nature of Linnaeus in the light of the emerging evolutionary theories, but also called attention

³⁰ Simon L. Lewis and Mark A. Maslin, *The Human Planet: How We Created the Anthropocene*, London: Penguin Books, 2018, Chapter 1.

³¹ Antonello La Vergata, *L'evoluzione biologica: da Linneo a Darwin 1735-1871*, Turin: Loescher, 1979, p. 56.

³² Antonio Stoppani, *Acqua ed aria ossia La purezza del mare e dell'atmosfera fin dai primordi del mondo animato*, Milan: Hoepli, 1882.

³³ Rudwick, *Bursting the Limits of Time*, op. cit. (24), pp. 172.

³⁴ Stoppani, op. cit. (32), p. 5.

³⁵ Stoppani, op. cit. (32), p. 12.

to the destructive power of the human being.³⁶ In the same period, another significant American cultural figure, the writer and philosopher George B. Emerson (1797–1881), had drawn attention to the extent of the environmental transformations brought about by human progress, denouncing how the unjustified destruction of wooded areas endangered animals and ecological balance, as well as the very basis of human economy.³⁷

In truth, in an article of 1873 entitled *L'uomo e il suo impero sulla terra*,³⁸ Stoppani had defined humans as a 'thief of the world' and had timidly allowed conservationist concerns to emerge ('Which will be when all Europe is worked like England, and the whole world like Europe?'). However, he concluded by stressing that the Earth was destined for humans and their progress, to become 'a seal of the power of man, and man a seal of the power of God'.³⁹ The same philosophy expressed in this article is reiterated by Stoppani more broadly in Federighi's translated excerpts of the *Corso di Geologia* – the excerpts behind Stoppani's rediscovered popularity in the present day. Chapter 31 of the second volume of this work is, in fact, partly dedicated to showing how much human presence has affected the three kingdoms of nature (inorganic matter, plants and animals). Looking primarily at the European context, Stoppani shows how 'effective and absolute' is the empire that humans exercise over the mineral, plant and animal world (of which humans are part but in a privileged ontological position). This set of beliefs stands behind Stoppani's proclamation of a new geological era: 'it is in this sense, precisely, that I do not hesitate in proclaiming the Anthropozoic era', an era where humans represent 'a new element with a strength by no means known to ancient worlds'.⁴⁰

It is therefore not surprising that Stoppani thought of defining the most recent geological era as 'Anthropozoic'. Furthermore, the concern to reconcile science and faith was a constant presence in his cultural commitment. In the preface of the *Studii geologici della Lombardia* – his first monograph – the author observed that 'faith, immobile on its divine foundations, welcomes sciences as friends, supports them, illuminates them, but does not invoke them as auxiliaries, nor fear them as enemies'. In a subsequent note, he supported the possibility of drawing 'arguments confirming the revelation' from geology. He acknowledged that the Noachian Flood itself was 'evidently confirmed by a rich series of geological data'. However, he specified, 'the facts that could be cited to confirm the deluge are currently the most disputable for science'. Consequently, 'before geologists agree on their origin and nature, it would be dangerous to take them as evidence of revelation'.⁴¹

These statements seem to reveal an attempt by Stoppani to use science and its discoveries as a tool to strengthen faith and support the truthfulness of revelation. A little further on, however, he specified that 'the principle of revelation ... stands by itself independently of the sciences, and the sciences, in turn, are essentially unable to obtain for Reason the possession of those principles of which Reason is instead blessed as a spontaneous offer of the Supreme Body'. Nevertheless, the sciences – he added – lead us to contemplate the 'divine Potestate'.⁴² Stoppani therefore seems works from the assumption that faith and science are fully autonomous. The latter, however, has an important role in deepening the knowledge of God through the contemplation and study of the natural world.

³⁶ Donald Worster, *Storia delle idee ecologiche*, Bologna: Il Mulino, 1994, pp. 89–99.

³⁷ Worster, op. cit. (36), pp. 99–102.

³⁸ Antonio Stoppani, 'L'uomo e il suo impero sulla terra', *Prime letture* (1873) 4, pp. 124–8.

³⁹ Stoppani, op. cit. (38).

⁴⁰ Federighi, op. cit. (4), p. 348. Cf. Antonio Stoppani, *Corso di Geologia. II. Geologia Stratigrafica*, Milan: Bernardoni e Brigola, 1873, pp. 737–40.

⁴¹ Antonio Stoppani, *Studii geologici e paleontologici sulla Lombardia*, Milan: Turati, 1857, pp. xv–xvi.

⁴² Stoppani, op. cit. (41), p. xi.

In *Lo studio della natura come elemento educativo*, Stoppani developed these ideas further and expressed the thesis of a 'sentiment of Nature, or rather the feeling of God in Nature', that 'makes God himself ... visible, palpable, perceptible to all the senses'.⁴³ This idea had already been expressed in 1873 when he defined geology as a 'new Revelation'. Stoppani thought that simple contemplation of Nature was not enough to understand God and the design he had impressed on it. In addition to a 'spontaneous and irresistible sentiment' stimulated by each sensory phenomenon, there is another sentiment that can only flow through reflection, observation and a careful study of these phenomena.⁴⁴ This provides a clear sense of the importance that Stoppani attributed to studying and teaching the natural sciences.

In *Note* (and its following editions) there is some minor reference to the idea of science as a tool for strengthening faith in God. In the conclusions of the work, Stoppani abandons the more technical themes and develops a reflection on the cognitive limits of the discipline – limits that induce the scientist to go further to reach the boundaries of time, just as astronomy tries to reach the boundaries of space:

Will human science come one day to dismiss its matches with the human intelligence that yearns to know the first why? Will it one day come to resolve the great questions of origins? ... The more the boundaries of science expand, the more the ends of knowledge drift apart ... Thus, from what most induces us to be proud, the idea of our nothingness arises more and more naked, and the feeling of the greatness of Him ... grows.⁴⁵

The fact that Stoppani recalled on some occasions the theme of harmony between science and Holy Scripture certainly weighed in the evaluation of *Note* by his contemporaries. Despite confirming his belief that science should not adapt its results to the claims of the Bible, he is particularly cautious in dealing with the subject of the antiquity of the human being, a caution reiterated in *Corso di Geologia*. Stoppani, who limits his arguments to Europe, believed it absurd to speak of a 'Tertiary man'; that is, the idea that humans extended all the way back to what was once considered the Tertiary, considering this a 'violation of all the principles of geology and palaeontology'.⁴⁶ Up to that moment, European stratigraphy and palaeontology had not detected traces of the human presence of great antiquity and it was unlikely, in his opinion, that new discoveries would bring further elements of information. Therefore Stoppani concluded by supporting the correspondence, restricted to the European research context, between the archaeolithic human being and the primitive human being, who appeared after the Ice Age.⁴⁷ In private correspondence, he was even more emphatic, by affirming that man was 'the very new one who appeared on Earth', refusing to accept that there was 'a human relic or a human industry that exceeds or even reaches the age of 4000 years'.⁴⁸ As with many religious scientists of the time, the main goal remained to separate *Homo sapiens* from other animals and place it at the pinnacle of life on Earth.⁴⁹

⁴³ Antonio Stoppani, 'Lo studio della natura come elemento educativo', *Gli studi in Italia* (November–December 1878) 1, pp. 752–92, 791.

⁴⁴ Stoppani, op. cit. (32), p. xviii.

⁴⁵ Antonio Stoppani, *Note ad un Corso Annuale di Geologia. III. Geologia Endografica*, Milan: Bernardoni, 1870, p. 454.

⁴⁶ Stoppani, op. cit. (40), p. 743.

⁴⁷ Landucci, op. cit. (28), pp. 67–8.

⁴⁸ Letter, A. Stoppani to G.B. Bulgarini, Biblioteca Marucelliana, Florence, Carteggio G.B. Bulgarini, C.Bu.152.

⁴⁹ Lewis and Maslin, op. cit. (5), p. 173.

His analysis of evolutionary theories was also affected by his religious position. Like many palaeontologists of the time, in his attempt to tackle the hypothesis of the transformation of species, which he defines as ‘the negation of physiology and palaeontology’, Stoppani rejects the incompleteness of the palaeontological documentation supposed by Darwin to explain the lack of fossil evidence relating to all intermediate species and leans on some phenomena that contradicted, in his opinion, the perfect seriation of the organic world.⁵⁰ Stoppani was convinced that evolution was considered by Darwin and Darwinists to be a progressive and constant phenomenon, devoid of irregularities, which forced the organic world to advance uniformly, as if it were a homogeneous complex constrained to respond evenly to natural laws. From this perspective, any irregularity in the development of organisms over time could be transformed into a refutation of the theory.⁵¹

Despite the religious assumptions that were certainly the basis of his treatment of these issues, Stoppani tried to keep the discussion of Darwinian hypotheses on a strictly scientific level. Moreover, he did not further develop these ideas on evolutionism, neither in palaeontological works nor in ethical-literary writings. His opposition to the Darwinian theory was limited to brief ironic hints mainly centred on the problem of the origin of human beings. In particular, it is significant that in *Corso di Geologia* Stoppani removed the appendix where he had originally dealt with these issues in *Note*. It is possible that lacking precise arguments with which to challenge a generally accepted theory, Stoppani preferred to avoid dealing with Darwin’s theory directly.⁵² Notably, Stoppani’s position evolved further during the 1880s to the point of theorizing the complete independence of scientific from religious discourse.⁵³

In *Corso di Geologia* Stoppani proposed an even more in-depth characterization of the ‘Anthropozoic’, to which he dedicated three long chapters (31, 32, 33). In particular, he clearly defined humans as ‘a new element with a strength by no means known to ancient worlds ... A new telluric force, which, due to its power and universality, does not pale in the face of the major forces of the globe’.⁵⁴ This has become a particularly popular and successful statement that has granted Stoppani a special place in the context of Anthropocene research. Despite this, it remains essential to be aware of the specific ways in which he first characterized the ‘Anthropozoic’ contained in Chapter 15 of the second volume of *Note*, and to bear in mind the potential role played by his religious belief in the use of this term.

Translators’ notes

The translation (by Eugenio Luciano) to which this commentary is linked has attempted to remain faithful to the original narrative and rhetorical style of the author as well as to his abundant prose. However, paraphrasing was necessary to render the text meaningful and legible for the English audience. This meant readapting the language to modern English, transforming the punctuation (e.g. em dashes), and most of all breaking down excessively long sentences typical of the Italian narrative style. Nevertheless, an exception applies for

⁵⁰ Stoppani, op. cit. (21), p. 202; above all, the simultaneous appearance of all types of invertebrates at the beginning of the Cambrian was one of the greatest strengths of anti-evolutionists. Giovanni Pinna, ‘Antonio Stoppani e l’evoluzione’, in Gian Luigi Daccò (ed.), *Antonio Stoppani tra scienza e letteratura, Materiali: Monografie periodiche dei Musei Civici di Lecco* (1991) 1, pp. 95–106, 71–94, 82–4.

⁵¹ Pinna, op. cit. (50), pp. 82–3.

⁵² Zanoni, op. cit. (3), pp. 132–4.

⁵³ See the following works: Antonio Stoppani, *Il dogma e le scienze positive*, Milan: Dumolard, 1884, 1886; Stoppani, *Gl’intransigenti alla stregua dei fatti vecchi, nuovi e nuovissimi*, Milan: Dumolard, 1886; Stoppani, *L’Exameron*, 2 vols., Turin: Unione tipografico editrice, 1893–4.

⁵⁴ Federighi, op. cit. (4), p. 348. Cf. Stoppani, op. cit. (40), p. 732.

the capitalization of geological unit terms, including the Anthropozoic, which Stoppani does not capitalize – we left these terms uncapitalized. Orthographic errors or printing typos in the original text are not rendered in English. Stoppani's language is also the language of the nineteenth-century *man* of science, meaning that his prose is deeply gendered. This aspect is left untouched to remain faithful to the historical and social context surrounding science writing in Italy during the second half of the nineteenth century. Additionally, the translation is accompanied by footnoted insights over the constellation of scientists, scholars and locations mentioned by Stoppani along with the text. These insights are very basic, sometimes limited to the full name, birth and death, and occupation of figures mentioned by Stoppani. Indeed, each person, location or textbook mentioned by the Stoppani could easily be explored independently, but such work detours from the primary scope of this attempt. However, we felt that these insights were necessary to frame the broader social, geographic and scientific context from which Stoppani's notion of 'Anthropozoic' emerged.

Supplementary material. The translation on which this article is based can be found under the 'supplementary materials' tab at <https://doi.org/10.1017/S0007087422000590>

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