

# Anthropocene

The notion of the anthropocene appeared and was popularised at the start of this century in an article by the Nobel prize winner Paul Crutzen published in the journal Nature (Crutzen, 2012). The term refers to the most recent period in the Earth's history during which the global environment has been &#8211; or is being - altered by human societies. This notion, increasingly used in environmental sciences, and also in the media and socio-political discourse, (Slaughter, 2012; Bonneuil & Fressoz, 2013) first emerged from the sciences of the &#8211;earth&#8211; and the atmosphere, and then spread to other sciences, from life sciences to the human sciences. Today it is particularly in the area of environmental geography that it is developing (Mathevet & Godet, 2015).

-From a concept developed in the earth sciences...

The term was constructed on the model of the subdivisions in the most recent geological era, the Cenozoic [efn\_note]The Cenozoic, the last geological era

The Cenozoic is the geological era that started with the major biological and environmental crisis of the end of the Cretaceous, 65 million years ago, following the impact of an asteroid on the Yucatan peninsula, Mexico. This resulted in the deposit of a thin layer of iridium in all the sediments of the end of the Cretaceous and the start of the Paleocene. Iridium is a metal that is found in meteorites, but rare on earth. The break at the end of the Mesozoic and the start of the Cenozoic (the Cretaceous-Paleogene boundary) was accompanied by an environmental crisis in which the dinosaurs became extinct and gave way to mammals. The chronology of the Cenozoic comprises successively the Eocene, the Oligocene, the Miocene, the Pliocene, the Pleistocene and finally the Holocene[efn\_note]. For Crutzen the use of this term points to the literal meaning of a geologically marked impact of human activities on the terrestrial environment. The main arguments are the generalised presence of effects on the surface of the globe in the form of increases in chemical elements derived from industrial activities, extending from the ocean depths to the ice caps and the atmosphere (Lorius & Carpentier, 2010; Zalasiewicz et al, 2011) as well as to recent sediments. There is also the increase in levels of CO<sub>2</sub> in the atmosphere (Canadell et al, 2010; Raupach & Canadell, 2010), which accompanies and also explains the rise in temperatures noted since the end of the 20th century according to data published by the Intergovernmental Panel on Climate Change (IPCC) [efn\_note]Levels of CO<sub>2</sub> in the atmosphere

The level of CO<sub>2</sub> in the atmosphere is calculated in ppm (parts per million). In the natural state, and depending on variations in astronomic parameters, it varies from 300 ppm during interglacial warming phases, as was the case 120 000 years ago, to 200 ppm at the time of glaciation maxima, as was the case 20 000 years ago. We are at present in an inter-glacial period, and the level of CO<sub>2</sub> was 300 ppm in 1990. However, in 2014, the level reached at least 400 ppm. Industrial activities and CO<sub>2</sub> emissions from fossil fuels are considered to be responsible for this increase, which is liable to be accompanied by more warming that would naturally occur in an interglacial period. This increase in CO<sub>2</sub> levels is mainly linked to a return to the atmosphere of fossil carbon buried in the lithosphere, as a result of the cumulate consumption of coal and petroleum..[efn\_note]

The notion of the anthropocene also integrates the other environmental changes caused by the impact of human activities, in particular those affecting the &#8211;biosphere&#8211; (Grinewald, 2007). The extinction of species appears to be occurring at a hitherto unparalleled rate, mainly because of the reduction among species enabling biodiversity to be sustained. Mathevet and Godet (2014) have returned to the expression popularised by Leakey and Lewin in 1996, that of the "sixth extinction". Thus more than 45% of the surface of the continents is covered by industrial and agricultural activities and urban areas, reducing habitats and spatial ecological continuums (Fournier, 2015).

-to controversy...

Paradoxically, the term anthropocene was proposed by an atmospheric chemist, and it also has links with the earth sciences: there is a dedicated international working group in the stratigraphic bodies concerned, the Anthropocene Working Group. It is thought that the Earth has today entered a period in its history that is irreversibly determined by the impact of human activities (Crutzen, 2002; Zalasiewicz et al, 2011; Slaughter, 2012). One species of mammal, the human species, has occupied and left a durable imprint on all environments, and the human population will number 10 billion in 2050, without having any predator to fear (Zalasiewicz et al, 2011), but at the same time requiring an ever-greater amount of naturally restricted resources.

However, while the term anthropocene has been adopted by certain scientific institutions, and in particular the British Geological Society, it does not obtain any real consensus. First of all, it is clearly rejected by some geographers whom Mathevet and Godet refer to as proponents of "*ecological negationism*" (2015). These include climate and ecological sceptics, who have received wide media coverage via the book by Lomberg (2004). There is no consensus either across geological institutions (Hamilton & Grinwald, 2015), for two reasons. The issue appears to be that the notion of geological time is upset, with an acceleration and shortening of time required for phenomena that generally take thousands or millions of years in geological history &#8211; one example being the massive extinction of species (Van Dooren, 2014). The reluctance is also linked to the impingement of the human sciences in the area of the sciences of the universe. It is also rooted in a positivist preservation of the fundamental dichotomies of natural and human social sciences.

Controversies within the environmentalist community that agree to the notion of the anthropocene are found concerning the date of the start of this new era. Crutzen (2002) suggested origins in the industrial era, at the start of the 19th century, with the arrival of massive consumption of coal: it is this date that appears to receive some consensus. In more recent publications, some researchers consider that since humans are responsible for environmental change, the changes occurred progressively and on an increasing scale, thus leading to a distinction between a paleo-anthropocene and a recent anthropocene linked to the industrial revolution (Foley et al, 2013). For Hamilton and Grinwald (2015) there is clearly a moment of entry into a new age, corresponding to a global, radical shift to a system oriented by human activities. Thus these authors propose that the nuclear tests of 1945 mark the start of the anthropocene. The issue under discussion is that relating to the geological and paleo-environmental markers that could demonstrate whether there was a clear break between two geological periods, as has now been shown for the transition from the Mesozoic to the Cenozoic, in particular with the iridium layer in the contact zone between the two sedimentary levels.

Finally, a critical, deconstructivist approach to the genesis of the notion of the anthropocene among historians of the sciences (Bonneuil & Fressoz, 2013) shows that scientists in the area of physics, chemistry and earth sciences have adopted a posture aiming for a form of power, that of the status of experts able to weigh on political decisions. In reality, for Bonneuil and Fressez, there was indeed an "*anthropocene event*" corresponding to an environmental change for which political and economic players are responsible, and it would be a mistake to expect the collective guilt of humanity to take on this shift under the authority of experts. According to these two authors, to apprehend the anthropocene we need to refrain from placing all trust in the epic narrative of a redemption by science alone; scientists should be integrated into society and their conclusions discussed item by item, rather than giving way to a "*geocracy*" of technical and economic solutions to manage the Earth. The anthropocene, they conclude, is too important an issue to be left to scientists alone.

see also: Geochronology

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## Bibliographie

References:

-Anthropocene Working Group :

<http://quaternary.stratigraphy.org/workinggroups/anthropocene/>

-Bonneuil C. et Fressoz J-B., 2013. L'autre histoire de l'Anthropocène &#8211; L'Événement Anthropocène ? La Terre, l'histoire ? et nous ? Paris, Seuil, 304p.

-Canadell J.G., Ciais P., Dhakal S., Dolma H., Friedlingstein P., Gurney K.R., Held A., Jackson R.B., Le Quéré C., Malone E.L., Ojima D.S., Patwardhan A., Peters G.P., Raupach M.R., 2010. Interactions of the carbon cycle, human activity and the climate system : a research portfolio, Current Opinion in Environmental Sustainability 2 : 301-311

-Crutzen P.J., 2002. Geology of mankind, Nature, 415 : 23

-Foley S.F., Gronenhorn D., Andreae M.O., Kadereit J.W., Esper J., Scholtz D., Pöschel U., Jacob D.E., Schäfer B.R., Schreg R.,

- Vitell A., Jordan D., Lelieveld J., Weller C.G., Alt K.W., Gauzinski-Windheuser S., Bruhn K-C., Tost H., Sirocko F., Crutzen P.J., 2013. The Paleanthropocene &#8211; The beginnings for anthropogenic environmental change. *Anthropocene* 3 : 83-88
- Fournier J. 2015. Géographie et Écologie du paysage. In : R.Mathevet et L.Godet coordonnateurs : Géographie de la conservation Paris, L'Harmattan, 229-242
- Grinevald J., 2007. La biosphère de l'Anthropocène. Genève, Georg Editeur, 293p.
- Hamilton C. et Grinevald J., 2015. Was the Anthropocene anticipated ? *The anthropocene review*, 1-14 DOI : 10.1177/20530196114567155
- Leakey R. et Lewin R., 1996. The sixth extinction. Patterns of life and the future of humankind, Anchor Books, New York, 288p
- Lomborg B., 2004. L'écologiste sceptique. Le véritable état de la planète.Paris, Le Cherche Midi, 748p.
- Lorius C. et Carpentier L., 2010. Voyage dans l'Anthropocène. Cette nouvelle ère dont nous sommes les héros, Arles, Actes Sud, coll. « Babel », 2010
- Mathevet R. et Godet L. (coordonnateurs), 2015. Géographie de la conservation Paris, L'Harmattan, 397p.
- Raupach M.R. and Canadell J.G., 2010. Carbon and the Anthropocene. *Current Opinion in Environmental Sustainability* 2 : 210-218
- Slaughter R.A., 2012. Welcome to the anthropocene, *Futures* 44 : 119-126
- Van Dooren T., 2014. Flight ways : life and loss at the edge of extinction. New York, Columbia University Press, 193p.
- Zalasiewicz J., Williams M., Fortey R., Smith A., Barry T., Angela L Coe, Paul R Bown, Peter F Rawson, Andrew Gale, Philip Gibbard, F John Gregory, Mark W Hounslow, Andrew C Kerr, Paul Pearson, Robert Knox, John Powell, Colin Waters, John Marshall, Michael Oates, Philip Stone, 2011. Stratigraphy of the Anthropocene. *Philosophical Transactions of the Royal Society - Series A : Mathematical, Physical and Engineering Sciences*, 369 (1938) : 1036-1055