

The Anthropocene: geology on a human scale

Speaking at the Pontifical Academy of Social Sciences in February 2000, the winner of the 1995 Nobel Prize for chemistry, Paul Crutzen of the Netherlands, surprised his audience by proclaiming the dawn of a new geological era, which he called the Anthropocene. He even dated its inception to a specific year: 1784. The idea that mankind and the planet interact and contribute to shaping landscapes together is the basis of geography, the old academic discipline¹ that studies the face of the Earth. Crutzen was the first to assert that human activity could also affect the globe's most vertically extended movements in its atmosphere or, especially, in its bowels, where change is measured on a scale whose customary unit is one million years. Those are the movements

¹ I am thinking, for example of Strabonius's *Geography*, written around 2,000 years ago. Les Belles Lettres published a bilingual French-Greek edition in 1969.

with which geology, the science of the history of the entire planet — especially its crust — is concerned.

Geological periods (or other units defined by chronostratigraphy) are separated by major events, such as the opening of the seas or oceans or the formation of mountain ranges. In the Earth's history, those events signal times of rupture that typically mark the sometimes sudden transitions between the dynasties of ancient China or Egypt. Geology is inseparable from palaeontology, usually defined as the branch of science concerned with fossil animals and plants.

Saying that hundreds of millennia of life have left their mark on the Earth is therefore commonplace. What is uncommon is to assert that mankind is quickly — namely, in a matter of several generations — transforming not just the Earth's surface, but its very crust. Furthermore, it is exceptional to date the start of that phenomenon to a specific year! Geologists subdivide the most recent period, the Quaternary, into two epochs: the Pleistocene, which began around two million years ago, and the Holocene, which was slightly over 10,000 years ago — yesterday on the geological time scale.

Crutzen's boldness was to claim that mankind plays a key role in the Earth's immediate history, even beyond the thin film of soil, subsoil and atmosphere around it. It was to give a starting point — 1784 — with a precision that is normally meaningless in geology. That is the year James Watt patented his steam engine, which launched the Industrial Revolution and an unbroken

string of technological changes that are not just ongoing to this day, but accelerating before our eyes. One could argue that, in material terms, the human condition as a whole changed very little from the dawn of recorded time until the late 18th century. Technological breakthroughs have continued apace since then. For a long time, they were rightfully considered the driving force of progress. Even before Watt's invention, Diderot's *Encyclopaedia*, the quintessential Enlightenment work, deemed the mechanical arts of vital importance. The progress of science and technology has brought about an unprecedented demographic revolution: the human population soared from 900 million in 1800 to 7.4 billion in 2016. That trend continues, accompanied by revolutionary changes in the patterns of human habitat, with a major shift towards cities and, especially, megacities.

It took two centuries, two world wars and several major economic and social upheavals for the wealthy countries, convinced that the end of world poverty was at hand, to start seriously worrying about the negative effects of what is now called growth. It is no coincidence that, in Europe, environmental movements appeared in early 1960s Germany, less than 20 years after the fall of Nazism. More recently, alter-globalisation movements emerged, identifying the negative aspects of growth with the unwanted effects of "liberal globalisation". The first United Nations Earth Summit took place in 1972 — the same year as the famous Club of Rome report *The Limits to Growth*, whose inspiration was prophetic but whose scientific foundations

were wobbly, if not downright fanciful. The most impressive manifestation of industrial civilisation's negative effects on the "Earth system" is global warming, on which scientists have today reached nearly unanimous agreement — though this does not exclude the possibility that the phenomena observed could also have non-anthropogenic causes. The December 2015 Paris agreement on climate change is promising, although a truly coercive framework for States is obviously still a long way off. It could not have been otherwise, given the state of international relations today. The agreement will not end global warming and the increase of extreme meteorological phenomena, to which we must learn to adapt. It will still take many ordeals and a long global governance learning process before international cooperation bears clearly identifiable fruit in terms of prevention. In the short-term, Trump's election is a discouraging sign. We can expect other signs to follow.

Once again considering Crutzen's idea, climate change is the first indicator of the Anthropocene Era, which is accompanied by many other effects, such as the modification of the biogeochemical cycles of water, nitrogen, phosphate and phosphorus; shifts in erosion and sedimentation processes; changes in the oceans' oxygen content and, consequently, aquatic life; and the reduction of biodiversity. The list goes on. The increasingly spectacular effects on glacial masses have repercussions on volcanic and tectonic activities. It is not absurd to speak of a new geological era, surprising as that may seem at first. True, Crutzen is not a

geologist but a geochemist, and the competent commission for defining the stratigraphic scale has not recognised his proposal. But the key point is that he sought to draw attention to the impacts of human activity that may have greater effects on the planet than those of which we had finally become aware of. He also suggests leads for research whose findings, like that of the IPCC², will gradually shed light on the paths to follow towards global governance in the decades and centuries to come.

² The Intergovernmental Panel on Climate Change (IPCC) is open to all UN member countries.