Why I study Earth sciences

Edoardo Borgomeo

South Kensington Campus, Imperial College London, London, UK

Article history
Received December 20, 2011; accepted March 3, 2012.
Subject classification:
Anthropocene, Geoengineering, Student, Environmental change.

ABSTRACT

I present here the reasons why I chose to pursue a University degree in Earth sciences. Although this topic might at first seem unrelated to geoethics, it is somehow connected to it. I will show how my decision to study Earth sciences was influenced by geoethical considerations, even though I did not consider them as such when I made my decision. My choice is explained using four representative words: 'wonder', 'environment', 'system' and 'Anthropocene'. The idea of Anthropocene is discussed in detail because of its relevance to geoethics.

1. Introduction

The reasons that led me to choose a University degree in Earth sciences can be briefly explained with four representative words: 'wonder', 'environment', 'system' and 'Anthropocene'.

The first word is 'wonder'. This is perhaps the most common motivation among Earth sciences students, and it is linked to the fascination that humans feel for natural phenomena, such as volcanic eruptions, earthquakes, and other representations of the natural world, of mountains or oceans. In my personal experience, the Dolomites (Figure 1) were the place where this wonder first materialized.

The second word is 'environment'. This is a vague word, often used to mean many different things. Initially, I was interested in environmental issues in a very generic way, and I read about climate change, air pollution, and natural hazards. The more I read about the environment, the more I realized that Earth sciences are the factor common to all environmental problems. The word environment was fundamental in shaping my decision, because it focused my attention on the Earth sciences as a way of understanding environmental problems.

The third word is 'system', and this mainly refers to the general research method of Earth sciences (i.e. from rock to processes). Once I became interested in Earth sciences and environmental problems, I started to find out more about the activities and methods of geoscientists. Above all, the methods fascinated me, because geoscientists always try to group observations together to provide a general, comprehensive explanation of natural phenomena. I started to appreciate the skill that geoscientists have: starting from simple analytical observations (e.g. looking at a rock specimen), they can provide an explanation for the rock formation and its geological history, and they can then integrate various pieces of evidence to construct a general theory to explain the Earth as a system.

The fourth word, 'Anthropocene', deserves a slightly longer explanation.

2. The Anthropocene

The International Commission on Stratigraphy has recently created a new working group whose task is to solve a rather unusual problem: the stratigraphic significance of the Anthropocene [Zalasiewicz et al. 2008]. The term 'Anthropocene' was first proposed in 2002 by the chemist Paul Crutzen to describe a new geological epoch denoted and characterized by human activity [Crutzen 2002]. The possibility of a geological epoch, or even of an era dominated by human activities, had already been hypothesized in the late 19th century by Antonio Stoppani [1873], an Italian geologist, who defined an 'Anthropozoic Era', which began when humans entered the history of the Earth for the first time. In Stoppani's time these ideas were criticized by the geological community [Zalasiewicz et al. 2010], because it appeared nonsensical to even compare human history to the limitlessness of geological time. In recent years, the reality of climate change and of the major changes that human activities are imposing on our Planet has raised new interest in the Anthropocene (Figure 2).

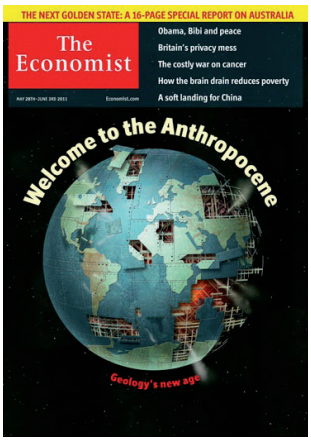
3. Geoethics and the implications of the Anthropocene

The increasing awareness and interest in the Anthropocene in the geological community is only partly due to the stratigraphic debate on where to place the Holocene–Anthropocene boundary. Regardless of the terminology used, the concept of the Anthropocene interests geologists, and the public in general, as a metaphor of global en-

Figure 1. Mount Antelao in the Dolomites, as seen from the town of S. Vito di Cadore (from Wikipedia). Bottom left: **Figure 2.** May 2011 cover of The Economist, showing the increasing attention that the public is paying to the Anthropocene. The involvement of public opinion provides an important contribution to the debate, although sometimes it can obscure or twist the scientific evidence. Bottom right: **Figure 3.** Front cover of the 2009 Royal Society Report on 'Geoengineering the Climate'.

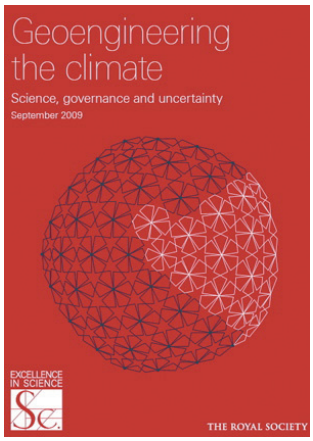
vironmental change. It is a perfect metaphor to represent the present time in which the history of the planet and the history of humankind have become intertwined. Natural processes and forces have always influenced human history to an extent, but the reverse had never taken place, until now: human processes can now operate at the same scale as natural processes. As Zalasiewicz et al. [2010] remarked, the fate of one depends on the fate of the other.

For centuries, geology was a science that was never concerned with human activities; however, now, in the Anthropocene, geologists are starting to recognize the importance of humankind as a primary geological factor. It is now known that humans are changing the Earth climate system. However, it is not just the climate system that is being affected by human activities: there are many other changes induced by human activities that are happening on a global scale. For instance, the changes in the nitrogen cycle, or the observed increases in the rate of extinction of biological species. Geology needs to change to a science that is capable of modeling and describing the interactions between natural forces and human drivers. The Anthropocene requires a change in perspective, or what Kant would have called a "Copernican Revolution": anthropogenic drivers need to be considered as endogenous to the Earth system.



In the Anthropocene, scientists in general, and geologists in particular, will need to study and understand how the Earth system functions, and also how human activities fit into this system. In this scenario, geoethics will be an essential tool in the geologist's toolbox, aiding the interpretation of human activities, and also, and perhaps more importantly, guiding the geologists in the communication of their results to the wider public in an accessible, yet scientific, way.

It is the very real existence of the Anthropocene problem that makes geoethics relevant nowadays, because it is during the Anthropocene that humans have for the first time become able to change geological environments on a planetary scale. Bioethical issues really became relevant with the advent of technological advances that made humans capable of consciously changing the basic conditions of biology. In the Anthropocene the problem appears to be similar: technology has put humankind in a position where it can consciously determine the fate of its environment and its components. If it is 'up to us', then decisions on, for instance, carbon emissions reduction or land use, which can have global effects, need to be weighted up according to geoethical principles; i.e. principles that consider the application of new technologies and policies from a geological point of view.



In the Anthropocene humankind is 'in the driver's seat', able to intentionally and consciously change the Earth climate and environment. Some have suggested taking this even further, by developing a new science, geoengineering (Figure 3), where the overarching aim would be the engineering of the components of the Earth system to reduce the greenhouse effect. This type of science and research cannot overlook ethical considerations. Again, to force the comparison with bioethics, it can be said that geoengineering is a cure, a treatment for the sick planet, the Earth. As bioethics is

concerned with the morality of the technological innovations applied to medical treatments, so geoethics is concerned with the morality of technologies, and more in general, of human activities that have a planetary impact.

4. Conclusions

My decision to study Earth sciences was influenced by geoethics, although I did not consider my motivations as geoethical at the time. These geoethical considerations did not come from any 'environmentalist' 'save-the-World' commitment, but rather from a more realistic and selfish view of the world, that takes the management and protection of the Earth as a commitment to protect and perpetuate humanity. For any Earth scientists who want to think about the ethical implications of Earth sciences, it is perhaps a useful and interesting exercise to go back to their early years and reflect on the reasons that led them to choose this area of science. By doing so, many Earth scientists will perhaps find that part of their motivation was indeed geoethical. Indeed, the discussion on geoethics needs to start from the personal experience of each geologist.

References

Crutzen, P. J. (2002). Geology of mankind, Nature, 415, 23.

Stoppani, A. (1873). Corso di Geologia, vol. II, G. Bernardoni and E.G. Brigola (eds.), Milan.

Zalasiewicz, J., M. Williams, A. Smith, T.L. Barry, P.R. Bown, P. Rawson, P. Brenchley, D. Cantrill, A.E. Coe, A. Gale, P.L. Gibbard, F. J. Gregory, M. Hounslow, A. Kerr, P. Pearson, R. Knox, P. Powell, C. Waters, J. Marshall, M. Oates, P. Rawson and P. Stone (2008). Are we now living in the Anthropocene?, GSA Today, 18 (2), 4-8.

Zalasiewicz, J., M. Williams, W. Steffen and P. J. Crutzen (2010). The new world of the Anthropocene, Environm. Sci. Technol., 44, 2228-2231.

Corresponding author: Edoardo Borgomeo,
South Kensington Campus, Imperial College London, London, UK;
email: edoardo.borgomeo08@imperial.ac.uk.