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THE MEANING OF GEOETHICS

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Summary

This chapter outlines a framework of the issues addressed by geoethics. Starting from an etymological analysis of the word “geoethics”, we identify the cultural basis on which to expand the debate on geoethics, while also proposing for consideration by the scientific community some questions that may guide the development of future research and practice in geosciences.

We attempt to define some fundamental points that, in our opinion, will strengthen geoethics and help its development. The goal of geoethics is to suggest practical solutions and provide useful techniques, and also to promote cultural renewal in how humans perceive and relate to the planet, through greater attention to the protection of life and the richness of the Earth, in all its forms.

As each science does, geoethics should also be able to present an image of the world, pointing out the manner in which it can be conceived, investigated, designed and experienced.

Keywords: geoethics, responsibility, society, etymological analysis, geoscientists oath.

The Birth of Geoethics

For many years the growing impact of people on natural processes has been both recognized and documented. In 1873 the Italian geologist Antonio Stoppani (1824 – 1891) hypothesized and defined the “Anthropozoic Era”, a geological time in which humans appear as a new “geological force”. This is an era dominated by human activities, in many ways similar to the concept of the Anthropocene as defined by Nobel Prize recipient Paul J. Crutzen (Crutzen, 2002). The Anthropocene refers to the time when human activities became capable of modifying the Earth’s ecosystem and dynamics (Ellis and Haff, 2009). The proposal to formally enter the Anthropocene into the Geological Time Scale is still the subject of lively debate

among scientists (Zalasiewicz et al., 2008) and an increasing number of disciplines, such as geoenvironment (Borgomeo, 2012), are orienting their research towards the development of technologies that take into account the impact that interventions by humans (though often necessary) may have on the natural environment (Bohle, 2013).

The historic great technological and industrial development, the exponential growth of population in the last century, and the consequently huge urban expansion have increased the effects of human interference with the geosphere. In addition, the expanding use of land and the increasing demand for natural resources have highlighted the need, not only for the scientific community but for all of society, to consider issues such as environmental sustainability and energy, protection from natural hazards, reduction of pollution and their inevitable repercussions on health and climate change.

It becomes evident that geoscientists, as scholars and experts on these issues affecting our planet, can play a fundamental role in society, thanks to their specific and unique skills, by addressing environmental problems at the local and global scale and helping to find optimal solutions.

Thus, discussing ethics in relation to geosciences (i.e., geoethics) and considering the social implications of geological research and practice has by default become an indispensable requirement for geoscientists (Peppoloni and Di Capua, 2012b). The debate is increasingly broad inside the scientific community and includes specific technical and methodological aspects, as well as theoretical considerations and reflections on the ethical value of geological activities.

The problems that arise from the interaction between humans and nature are complex and may require various approaches and solutions. The possibility of multiple solutions and varied results creates a need for an open and widespread scientific discussion, on how to live on the planet, while respecting natural dynamics and human life. This discussion inevitably raises ethical issues that force us to consider our responsibility in this interaction with nature.

What Is Geoethics?

Geoethics consists of research and reflection on those values upon which to base appropriate behavior and practice where human activities intersect the geosphere (IAPG, 2012; Peppoloni and Di Capua, 2012b). It deals with the ethical, social, and cultural implications of geological research and practice, providing a point of intersection for geosciences, sociology and philosophy (Moores, 1997; Bosi et al., 2008; Peppoloni and Di Capua, 2012b; Peppoloni, 2012a, 2012b).

The field of geosciences is wide. The Earth system is the subject of study, which includes the solid Earth, the hydrosphere, the atmosphere, and the biosphere (GSL, 2014). This implies that

the themes of geoethics are numerous, often interconnected, and include theoretical and practical aspects as well as cultural and operational perspectives.

Geoethics focuses on some of the most important environmental emergencies: it encourages a critical analysis of the use of natural resources, promotes careful management of natural risks, and fosters the proper dissemination of the results of scientific studies, including the development of environmentally friendly technologies (Peppoloni and Di Capua, 2012b), while also extending its principles to planetary protection (Martínez-Frías et al., 2011).

Moreover, geoethics promotes geoeducation, aiming at organizing effective teaching tools (Bezzi, 1999), at developing awareness, values, and responsibility, especially amongst young people. It fosters the development of geoparks (Eder, 2004; Zouros, 2004; McKeever, 2013) and geo-tourism (Newsome and Dowling, 2010; Dowling, 2011), in order to create awareness of the value of a region's geological heritage (Brocx and Semeniuk, 2007; Gray, 2008) and geodiversity (Osborne, 2000). Geoethics also aims at improving the relationships between the scientific community, decision-makers, mass media, and the public (Höppner et al., 2012), highlighting the social role played by geoscientists and their responsibilities; as their choices may have ethical, cultural, and economic repercussions on society (Peppoloni and Di Capua, 2012b; Bickford, 2013).

So, on the one hand geoethics has practical objectives, such as creating references and guidelines that look at providing socio-economic solutions, compatible with a respect for the environment and the protection of humans, nature, and land. On the other hand, it aims at giving a cultural, ethical, and social frame of reference on how to conduct geological research and practice in favor of public welfare (Bickford, 2013); and to give value to geosciences in a cultural sense (Moores, 1997; Peppoloni and Di Capua, 2012b; McKeever, 2013), as part of a group of disciplines capable of suggesting new ways to understand and investigate our planet, and upon which we can base a new relationship between humans and nature.

Issues with the Development of Geoethics

Despite the importance of its themes, the attention given to geoethics is still limited. Only a few geoscientists make explicit reference to geoethics. Outside the scientific community, among the general public, no one even knows of geoethics. Why?

Although the concept of geoethics is increasingly present at many scientific conferences, analyses and debates on the subject have not yet command significant attention. Geoethics does not seem to be accompanied by an adequate research base nor a satisfactory number of scientific publications. Generally, publications on geoethics are still not considered important in the scientific curricula. So, most geoscientists are hesitant to spend time writing on ethical themes.

In short, the issues of geoethics do not easily find space in most respected scientific journals, and this has severely restricted the dissemination of the concept and the development of a

critical stance in the scientific community. Consequently, there are few research projects focused on geoethics, and funds to develop activities and tools on ethical and social aspects in geosciences are scarce.

A wide scientific debate could help geoethics not to have an ideological drift (Peppoloni, 2012a), as in some cases has happened to Bioethics. Bioethics has contributed greatly to the preservation and respect of human dignity. Indeed, its themes are discussed in universities, hospitals, journals, professional organizations, and is firmly established in the public consciousness. At the same time it has raised moral and ideological controversies (Tallacchini, 2003).

The recent publication of a special issue on geoethics (Peppoloni and Di Capua, 2012a), published on a JCR Journal (i.e. included in the Journal Citation Reports by Thomson Reuters: <http://thomsonreuters.com/journal-citation-reports/>), has opened the way for new perspectives in protecting the environment. In recent years, successful sessions on geoethics at national and international meetings have been held (34th IGC in 2012, EGU general assembly in 2012, 2013 and 2014; Geoitalia Congress in 2009, 2011 and 2013; IAEG in 2014) and ongoing editorial projects, like this book, confirm that the discussion on ethics in Earth sciences is becoming an urgent matter within the scientific community.

An Etymological Starting Point: Individual and Social Responsibility

Many geoscientists work with a spirit of service towards society, aware that they have knowledge and skills that are essential and useful for the common good. Nevertheless, a clear reference framework of shared values in geosciences seems to be lacking. These values would consider different cultural and economic contexts and would be a call to responsibility for geoscientists. Moreover, the ethical foundations upon which discussions and actions are based are not sufficiently clear, with the result that geoethics lacks theoretical and practical strength.

An etymological analysis of the word “geoethics” may help to explain the deeper, hidden meaning of the word. Where does the term “geoethics” come from? What are its origins and connotations? What is the history of its development? What is its deeper meaning?

“Geoethics” is the union of the prefix “geo” and the word “ethics”. The prefix “geo” contains a deep and ancient meaning. It refers to “*gaid*”, which means “Earth” in Greek, but its ancient Sumerian base “*ga*” refers more specifically to “home, the dwelling place”. So the Earth is the place where we dwell, where our ancestors dwelt, and where our children will dwell.

The term “ethics” was defined by Aristotle (384/383 B.C. – 322 B.C.) as the investigation of and reflection on the operational behavior of humans. It identifies that part of philosophy that deals with the problem of human action (Dizionario di filosofia, 1988).

The etymological analysis of the word “ethics” is complex: ethics is derived from the Greek “*ἔθος*” (*ēthos*), which means “habit, custom”. This noun has the same origin as “*ἔθωα*”

(*eiōtha*), a Greek perfect form meaning “I am accustomed to, I have the habit of, I am familiar with” (Liddell and Scott, 1996).

Words such as “accustomed” and “familiar” imply a sense of belonging to a community, either a family or a larger social group. But what determines familiarity and therefore a habit of behavior? This can be traced back to the Semitic root “*edum*” meaning “experience, to be experienced in”.

In other words, I experience something (an event, a circumstance), I acquire knowledge, and I familiarize myself with this event. From now on I am expert enough to be able to choose the behavior or custom most suitable to a particular circumstance or event.

But the meaning of the word “ethics” is more than this: ethics is traced also to the Greek “ἦθος” (*ēthos*), which refers more specifically to the characteristics or habits of the individual, one’s personal characteristics (Liddell and Scott, 1996). Both these nouns (*ēthos* and *ēthos*) derive from the same root “*sweth-*” (compare to lat. “*suesco*”, “I use”, Ernout and Meillet, 1994), but the second term, probably more recent than the first, could be evidence of that moment in human history when a person, who belonged to a community, became capable of perceiving himself/herself as an individual. So, the word “ethics” could have a dual meaning: one related to the social sphere and one to the individual sphere.

The same origin can be also observed going back from Greek to the Accadian language: starting from the Accadian base “*esdu*”, ethics means “social foundation, social discipline”, and in a wider sense “assurance of continuity”. Again we meet the social dimension, the reference of the word “ethics” to the community (Semerano, 2007).

However, from the Accadian base “*betu*” comes the meaning of “home, dwelling, shelter”. As such it can refer to something more personal, intimate, and deep in every human being. Moreover, from the Accadian base “*ettu*”, the word ethics assumes the meaning of “character, distinguishing marks of an individual, characteristic of a person: again the individual sphere” (Semerano, 2007).

Therefore, “ethics” in origin relates to what is common, when individuals perceive themselves only as a part of a community. But at a certain point in human history an evolutionary cultural leap takes place and inside the community appears the individual, the self in relation to oneself.

In summary, it seems that a double meaning can be given to the word ethics: on the one hand it contains a sense of belonging to a social dimension; on the other it expresses the personal, the individual.

It follows that ethics concerns both the common sphere, the interactions between individuals belonging to a social organization, and the personal sphere, what distinguishes an individual. Ethics means “to be part of”, and at the same time “to belong to oneself”. These two existential conditions (social and individual) unexpectedly coexist in the word ethics.

By analogy, these considerations can be extended to geoethics, coming to define it on the one hand as an investigation of and reflection on the behavior of humans towards the geosphere, and on the other hand as the analysis of the relationship between the geologist who acts and his/her own action, his/her own work. The etymological analysis of the word “geoethics” calls geoscientists to an intrinsic responsibility for their own activities.

Responsibility of Geoscientists

Based on the above considerations, to see if one’s behavior as a geologist is ethical, it is not sufficient to refer to the social sphere. One also has to refer to his/her own person, and clarify to himself/herself the ethical value of his/her activities.

Thus, the in-depth meaning of the word “geoethics” calls upon geoscientists to face the responsibility of ethical behavior at both a social and individual level. These two dimensions are strictly linked. In fact, an ethical attitude within an individual is reflected in his/her social behavior.

But of what does the responsibility of the geologist consist? And what motivations are needed to encourage geoscientists to practice Earth sciences in an ethical manner? The ethical commitment of geoscientists is the research and defense of truth, and a commitment to advancement of knowledge and life-long learning (individual dimension). Ethical obligations arise from the possession of specific knowledge that has practical consequences for the public. Geoscientists are an active and responsible part of society. They should be at the service of the common good, taking care of the Earth system and promoting the awareness of every citizen’s responsibility (social dimension).

A key question we must tackle is: Are geoscientists well-equipped to undertake the responsibility of discovering the best solutions through the application of scientific methods, while promoting professionalism and research integrity, in a world in which our increasing interconnectedness promises increasingly complex problems and consequently the adoption of complex solutions?

An Ethical Commitment: The Geoscientist’s Promise

The well-being and survival of humankind depends on the Earth’s habitability and resources. Thus, the health of the Earth system (solid Earth, biosphere, hydrosphere, atmosphere) must be of the utmost importance to society. It is evident that some modifications of Earth system processes, that are potentially damaging for humankind, can be and are being induced by humans, through actions that do not respect our planet’s natural processes and equilibrium. Problems such as the over-imprinting on the Earth’s surface, the overexploitation of natural resources (some of which are not renewable) and the excessive growth of the population require an urgent transition to a sustainable world to ensure the survival of future generations. The

social role of geoscientists is therefore important and their activities must be ethical. A correct and scientifically sound approach can mitigate, or at least help to avoid, many of the serious consequences that continuously arise through the irresponsible use of land. The ethical obligation of geoscientists includes bringing their knowledge to the public, to raise social awareness on environmental problems, to propose prudent choices to decision-makers, and to report misguided actions. In this way, they can contribute to the conservation of the geosphere and its habitability for future generations.

The ethical obligations of modern geoscientists involve the following:

- Proper land/environment use and management. The ethics of sustainable land management must prevail, regardless of the type of commissioned project and the short-term economic interests of the client.
- Respect of truth and science. Respect for scientific truth based on updated evidence (including the recognition of data uncertainty, or of limited knowledge) and rigorous adherence to the scientific method is a must in the professional activities of geoscientists.
- Promotion of awareness of citizens' responsibilities, through effective communication and adequate education, especially of young people.
- Commitment to advancing knowledge and life-long learning. Appreciation of the expertise of geoscientists by the public is a necessary condition in the promotion of efficient action in both the scientific and professional community. For this reason, as for physicians, the education of geologists has to be life-long. Ethical training should be introduced into the university curriculum.

How can geoscientists, especially those with little experience, be best assisted in their acquisition of a clear and binding awareness of their ethical responsibility in the geosciences? In the context of a publicly growing demand for ethical behavior by those who have the ability to intervene in the public domain and act for the public benefit, the explicit acceptance of ethical responsibility by geoscientists can have the following effects:

- Increasing awareness of the social role of geoscientists, including their expertise and contributions, to strengthen their sense of belonging to professional and scientific communities.
- Fostering awareness of geoscientists within society in general and especially recognition of their social mission, essential for the public benefit, and, consequently, of their specific and unique role.
- Stimulation of cultural growth at the individual and community levels, exploitation of research, and implementation of scientific and professional skills.

For geoscientists, cultural and practical preparation has to take on an ethical dimension, starting at the university level. Through their individual commitment, young geoscientists can assume the need for continued cultural education as an ethical duty.

The explicit and conscious assumption of ethical obligations by geoscientists appears opportune and useful (Ellis and Haff, 2009; Matteucci et al., 2012). Some have suggested that the acceptance of ethical obligations may be facilitated by following the model of the Hippocratic oath of physicians (the formula in the sidebar was proposed by the Italian Commission of Geoethics, in 2012, during the 34th IGC in Brisbane). The oath is based on the three fundamental pillars of geoethics proposed by Peppoloni and Di Capua (2012b). These three pillars form the basis of geoscientist's ethical obligations: awareness of one's responsibility, appreciation of the value of geological culture, and intellectual honesty.

Outlook and Strategies for the Future

Geoscientists who are more aware of their role in society and of their ethical duties towards the geosphere will be able to provide a new perspective to geosciences and to build a new vision of how to understand the planet, encouraging the pursuit of the following aims:

- Raising the level of integrity of geoscientists, with the implementation of principles such as intellectual honesty, responsibility, self-criticism, cooperation and fair comparison.
- Dissemination of scientific culture in society and the involvement of the public in the idea of a geological heritage to be shared and protected.
- Creation of a new model of social and economic development, based on economic principles of sustainability and eco-friendliness.
- Protection of life and Earth in all its forms.

The pursuit of these objectives can be done concretely through the following tools and actions:

- Codes of ethical conduct for geological research and practice (TGGGP, 2013).
- Guidelines for best practice, and eco-friendly and sustainable technologies in different fields (geo-resources, geo-hazards, communication, etc.).
- Action protocols for the proper management of the relationship between geoscientists and decision-makers (Hays and Shearer, 1981; IAVCEI, 1999; UNDRO, 1991; Jordan, 2013; Dolce and Di Bucci, this volume).
- Regulatory framework of legal liability for geoscientists engaged in activities that have an impact on society.
- Easy access to and friendly use of the data and results of public research, and quality control of information and results.
- Constant and authoritative support of geoscientists for politicians and decision-makers.
- Qualified presence in media spaces (both traditional and new), and strengthening of cooperation with mass media operators (Di Capua and Peppoloni, 2009; Marone et al., this volume).

- Strengthening and exchange of knowledge and experience between the world of professionals and researchers, transfer of advanced knowledge to industry and authorities, and collaboration in the training of technicians.
- Support for both theoretical and practical innovations, which attempt to renew the way we approach and manage environmental problems and natural resources, from the perspective of sustainability for future generations (Lambert et. al., 2013).
- Attention to the uniqueness of each region and to its historical, cultural, and environmental characteristics, respecting the bio/geo-diversity of each environment, and using cross-disciplinary methods including consulting with experts in related fields.
- Innovative and diversified tools for geoeducation, based on exchange of experience among educators and users, to stimulate an active approach to scientific learning and a possible direct involvement in activities of social interest.
- Educational campaigns to teach people appropriate behavior in the management of energy, and water, and in the area of protection from natural hazards.
- Working groups and networks for international collaboration that actively work to develop the debate on ethical issues in Earth science, to introduce geoethics in the teaching of university courses and to include the principles of ethics and research integrity in the management and implementation of national and international research projects that have large environmental and social impact.
- Development of research activities, without being overconfident in the results, by checking the information sources, by verifying the compatibility of results with the observations, and by following defined integrity criteria (Mayer and Steneck, 2011), as expressed in the Singapore (2010) and Montreal (2013) Statements.

Conclusions: Questions for a Public Debate on Geoethics

Science does not claim to solve all problems of society, but it has value especially when it is aware of its limits (Peppoloni, 2012b). In any case, science, and in particular geosciences, can play a key role in supporting society by providing useful tools to mitigate the impact of human activities on the geosphere and to deal with the environmental challenges that face humanity. Geoscientists can help society to define a framework of values on which to base the study and implementation of procedures and tools for the benefit of the public.

The following basic questions may be useful to clarify some fundamental steps to be taken in the development of Geoethics to render our actions effective:

- How do we articulate an ethical criterion for geoscientists?
- How can the freedom of research be combined with the principle of sustainability?

- Where should the line be drawn between preservation and economic development of the geosphere, especially in low-income countries?
- How can the relationships between geoscientists, media, politicians, and citizens be made more fruitful, particularly in relation to protection from natural hazards?
- What communication and educational strategies should be adopted to transfer the value of the geosciences to society?

The development of geoethics, not only as a critical attitude toward the relationship between humans and the geosphere, but also as a genuine scientific discipline, will be possible only if geoscientists are able to give convincing answers to these questions. Geoscientists have an important historical responsibility in the third millennium: to demonstrate that geological knowledge is really a benefit to mankind and in particular for future generations.

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SIDEBAR:

The geoscientist's Promise

- *I promise I will practice geosciences being fully aware of the involved social implications and I will do my best for the protection of the geosphere for the benefit of mankind.*
- *I know my responsibilities towards society, future generations, and the environment for a sustainable development.*
- *In my job I will put the interest of society at large in the first place.*
- *I will never misuse my geological knowledge, not even under constraint.*
- *I will always be ready to provide my professional expertise in case of urgent need.*
- *I will continue to improve my geological knowledge lifelong and I will always maintain my intellectual honesty at work, being aware of the limits of my capabilities and possibilities.*
- *I will act to foster progress in geosciences, the dissemination of geological knowledge and the spreading of a geoethical approach to the management of land and geological resources.*
- *I will honor my promise that my work as a geoscientist or certified geologist, will be fully respectful of Earth processes.*

I promise

Source: Formula proposed by the Italian Commission of Geoethics (Matteucci et al., 2014).