

1.0 Setting the Scene

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This book takes stock of the field of geoethics. This chapter highlights the purpose of this book, the context for writing it, and the limits to its scope. It sets the scene by introducing the relevance of geoethics, how it relates to professional matters pertaining to the geosciences, and its broader application to other fields of study and interest.

Contemporary geosciences refer to a range of applied and fundamental research fields within and beyond natural sciences, as well as engineering disciplines and related commercial undertakings. Traditionally, the term 'Earth system' refers to the Earth's physical, chemical and biological constituents and the processes and cycles that determine their interaction that transform or transfer matter, energy and information. Over recent centuries, 'geosciences' (or 'Earth sciences') have evolved into a set of basic and applied, scientific and engineering disciplines to study natural systems and human-built systems that intersect with each other.

Within the last decade, geoscientists have shaped the notion 'geoethics' to frame inquiries into two subjects, namely: i) the responsible behaviour of professionals in geosciences and ii) the societal relevance of geosciences. These inquiries (see Peppoloni and Di Capua 2017a) have led to the exploration of the societal, cultural and philosophical contexts and implications of geoscience knowledge, research, practice, education and communication. Thinking about the implications and applications of geoethics, or 'geoethical thinking', can be located within broader societal concerns about the responsible conduct of science and the science-society interface. How individuals such as geoscientists act when exercising their profession, for example, is relevant to the functioning of modern societies (Press 2008).

When arranging the matters that belong to the realm of geoethical thinking, a geoscientist may be inclined to employ as a metaphor a sphere consisting of a core and concentric layers around it. The core would consist of amalgamated general and professional

ethics that applies to geosciences, to their particularities and to individual geoscientists. The first layer around the core would comprise ethical issues that challenge the professional activities of geoscientists. Around this layer, a geo-professional mind may perceive an outer shell of various societal considerations which, like tectonic plates, spread, collide and subduct each other. Evidently, this metaphor has a professional bias, and a philosopher of science may find it annoying. Nevertheless, such a metaphor may assist the reader to follow the lines of thought as they are presented in this book.

Within such a metaphor, the core and the adjacent layer represent the status quo of geoethics (Chapter 2), which might be called ‘enriched geo-professional ethics’. Studying these matters triggers thoughts about the wider relevance of geoethical thinking. Therefore, the two subsequent chapters gather several essays that explore the societal relevance of geosciences, first taking a view which is anchored in daily experiences (Chapter 3) and second, offering a more conceptual overview of some geoethical concepts and applications (Chapter 4). Among the matters addressed are the day-to-day functioning of modern societies that intensively apply geoscience knowledge; governance issues and the quest for normative frameworks within Earth system sciences; the need to embrace participatory practices in geoscience; and how to apply geoscience knowledge to give meaning to human behaviour. Drawing on such reflections opens inquiries about the purpose of geoethics when building what has been termed the ‘human niche’ (Fuentes 2016), that is, the natural space shaped and occupied by humans. These reflections and inquiries enlarge the perimeter of matters that geoethical thinking may include beyond its traditional scope. Consequently, the question arises (Chapter 5) whether this perimeter is getting too comprehensive, so that the notion of geoethics risks no longer being a meaningful concept, either for geoscientists or for citizens. Other concepts such as ‘environmental ethics’ (Hourdequin 2015) or ‘sustainability ethics’

(Becker 2012, Rozzi et al. 2015) may be considered better suited than geoethics to frame some of these matters. Given this concern, the authors have looked for concepts that would be complementary to geoethics or that could describe reflections and inquiries at or beyond the boundaries of geoethical thinking. When studying the interfaces between geosciences, social sciences and humanities (Kagan 2009), for example, a concept such as 'geo-humanities' may be deemed suitable. It seems to be one option (of several) to reflect on insights that, for example, emerge from climate change research or subjects such as anthropogenic global change, geoengineering or the Gaia hypothesis. In closing, the book keeps this question at least partially open, seeking suggestions from constituencies other than geosciences.

1.1 Context and Purpose of Geoethical Inquiries

As sketched above, geosciences address the functioning of the Earth system as well as the use of non-living resources. Likewise, geosciences are instrumental in understanding and handling anthropogenic global change. Moreover, within this perspective, each geoscientist must reflect on whether their professional conduct in each instance is scientifically and technically sound, compliant with norms, and justified vis-à-vis citizens. Geoethical thinking attempts to tackle such questions.

1.1.1 Looking Inward

Over recent years, the applied geoscience professions have steadily strengthened their professional ethical frameworks, for example by means of accreditation processes for an individual qualifying as a chartered geologist, who adheres to a professional standard characterised by an elevated level of knowledge, skills and experience and is bound by a code

of professional conduct (Peppoloni et al. 2015, Wyss and Peppoloni 2015, Abbot 2017a, Abbott 2017b, Gundersen 2017a, Mogk 2017). These efforts cut across various fields of geoscience research and practice, such as engineering geology, geohazards and geo-resources (Bobrowsky et al 2017, Di Capua and Peppoloni 2014, Neuberg 2015, Nickless 2017, Nurmi 2017, Peppoloni and Di Capua 2018), although they do not yet cover the full breadth and complexity of the Earth sciences (Bohle and Ellis 2017). Discussions about ethics and responsible scientific practice in other parts of the Earth sciences in, for example, global change research or sustainability ethics, have informed the development of geoethics, although specific deliberations are only in their initial stages. Hence, geoethical inquiry has touched on a limited number of subjects so far.

The word geoethics (often spelled differently) has emerged spontaneously in various geoscience contexts with variable meanings, such as to provide guidelines for mapping geographical data (Harley 1990, DiBiase et al. 2012) or as a political notion that is used to describe geo-citizenry (Stoddard and Cornwell 2003). Against this background, the notion geoethics has been established recently in some applied geoscience communities (Bobrowsky et al. 2017). It has evolved with specific relevance to the scholarly and practical domains of these communities. The L'Aquila trials¹, held after the earthquakes that caused 300 deaths in Central Italy in 2009 (Cocco et al. 2015), intensified the discussions (Mucciarelli 2015). In addition, because of geoscientists being exposed to the wide range of social circumstances under which they execute their professions, the emergence of geoethics has been advanced (Wyss and Peppoloni 2015, Bobrowsky et al. 2017, Gill and Bullough 2017, Stewart and Gill 2017).

¹ <http://www.sciencemag.org/news/2015/11/italy-s-supreme-court-clears-l-aquila-earthquake-scientists-good>

Demonstrably, the international Earth sciences community has felt a need to strengthen professional ethical frameworks (Peppoloni and Di Capua 2015, Peppoloni and Di Capua 2016, Gundersen 2017a, Mogk 2017). Following the initial debates concerning ethics in geosciences, a distinctive meaning of geoethics has emerged since the 34th International Geological Congress (Brisbane, Australia, 2012). The 'Cape Town Statement on Geoethics' (Di Capua et al. 2017) was published in 2016 by the International Association for Promoting Geoethics². It frames geoethics as a kind of 'enriched geo-professional virtue ethics' that aims to contribute towards a cultural shift in society that advocates for more responsible interaction with the Earth system. This setting marks a departure from earlier approaches to geoethical thinking (e.g. Martínez-Frías et al. 2011) which by their structure, approach and content qualify as belonging to the corpus of environmental ethics and related schools of thought (Hourdequin 2015). There is a tension as to whether geoethics should be anchored within the field of environmental ethics, or whether to pursue it as something distinctly different that builds on the foundation of professional ethics of applied geosciences. The question also arises as to how to interact with other ethical domains as, for example, the field of research ethics that defines the guidelines for conducting responsible science (United Nations 2013). Recently, when considering the peculiar societal and cultural settings in which geoscientists exercise their professions, some scholars have begun to enrich and diversify the notion of geoethics. Their thinking has evolved beyond specific professional ethics. In the last decade it has resulted in a substantial corpus of contributions as demonstrated by Bobrowsky et al. (2017) and Peppoloni and Di Capua (2017a).

1.1.2 Looking Outward

² <http://www.geoethics.org/ctsg>

Against the background of past efforts, a more systematic trans-/multi-disciplinary interaction should be undertaken to define specific considerations that can strengthen and further the aims and relevance of geoethics. Hence, current geoethical thinking should seek exposure to a broader academic, professional and societal audience, in and beyond social and natural sciences. Such exposure should trigger trans-/multi-disciplinary dialogues to reflect on geosciences (including self-reflection within geosciences), to unearth philosophical and social roots in the history of geosciences, or to evaluate the societal relevance of geosciences and their responsible conduct. Interactions with disciplines based in the social sciences and humanities should be fostered to draw on their conceptual depth and methods of inquiry into ethical and societal issues. Interdisciplinary dialogue can also expose the challenges that geoscientists face in contemporary societies as they reflect on how to respond to anthropogenic global change.

Hence, this book offers some insights into geoethics to communities beyond its traditional audiences, as well as seeking to further discussions about geoethical thinking within geoscience professions. Likewise, the book should widen the scholarly community that is interested in gaining deeper insights into geoethical thinking. It should also facilitate the development of research agendas for the coming years, which are likely to go beyond the matters that the notion geoethics has initially encompassed.

In presenting the state-of-debates about developing geoethics, this book can be read with three areas of inquiry in mind:

1) Taking a professional focus: what are the ethical issues that are relevant to an individual geoscientist³?

2) Taking a societal focus: what are the wider considerations that evolve from considering professional ethics, especially when contemplating the place of geosciences and geoscientists in contemporary societies which operate i) under the conditions of anthropogenic global change, ii) in the context of the quest for sustainable and responsible development, and iii) with the aim of improving societal resilience?

3) What, under these two operational perspectives (professional and societal focus), is the core of geoethics and 'geoethical thinking' in geosciences; and what aspects can be stimulated to engage more general considerations?

As indicated above, tackling these research questions triggers reflections as to whether to utilise notions such as geo-humanities (Sörlin 2012, Castree et al. 2014, Hawkins et al. 2015, Holm et al. 2015) or geosophy. The latter notion may be used as initially coined by Wright (1947) or may be derived from reflections presented by Shaw (2017). Whatever notion may complement that of geoethics, it should encapsulate concepts and matters that go beyond geo-professional ethical issues to avoid using geoethics as a catch-all term. Several concerns drive such a reflection. First, geoscientists must acknowledge that their work shapes the intersections of human activities and the Earth system. Second, the insights of professional ethicists about the ethics, for example, of climate change (Hulme 2009, Hulme 2011, Hulme

³ The notion geoscientist refers to any categories of expert in geosciences (researchers, chartered and other applied professionals, teachers); for example, in the sense of "Geoscientists are stewards or caretakers of Earth's resources and environment. They work to understand natural processes on Earth..." (see: <https://www.bucknell.edu/academics/arts-and-sciences-college-of/academic-departments-and-programs/geology-and-environmental-geosciences/what-is-a-geoscientist>)

2014, Victor 2008, Victor 2015) and the environment (Hourdequin 2015) raise concerns in frameworks other than in professional ethics. Third, the humanities and social sciences offer insights as to how to situate geoscientists and their professions in different societal contexts (Douglas 2009, Castree 2017, Douglas 2017). Active dialogue and exchange between the geosciences, humanities and social sciences could result in new conceptual frameworks and guidelines for practical engagement (Barry et al. 2008, Paul 2018).

1.2 Locating Contemporary Geoethical Thinking

This section presents the current state of inquiry into geoethical thinking from four viewpoints. The first point of view situates geoethics within adjacent fields of ethical inquiries (e.g. environmental ethics). The second view traces the history of the term geoethics with precursors (e.g. Lynn 2000), albeit without attempting an exegesis. The third view regards the subjects of the current debates, namely professional behaviour and ‘geoethical thinking’, in a broader sense. The fourth view lists some debates in which geoethics engages only marginally so far.

1.2.1 Neighbouring Fields

Over the last decade, the experiences of the geoscientists and practitioners who have explored the meanings of geoethics have determined the choice of topics and themes that were included to shape debates around the development of geoethics. Hence, debates happened 'by constituency' by means of a bottom-up approach and have been driven on a case-by-case basis by the practical matters that needed to be tackled. Examples are debates on the design and application of professional codes (Gundersen and Townsend 2015, Abbott

2017b), the conception of training events (Druguet et al. 2013, Mogk et al. 2017) and the need to reach out to the public (Peppoloni and Di Capua 2012, Stewart and Nield 2013). So far, these bottom-up processes have attracted only a few contributions by few scholars who focus on philosophical aspects of geoethics (Pievani 2012, Pievani 2015, Potthast 2015, Pözlner 2017). Also, the scholarly debates of theoretical ethicists and philosophers of science have had little influence on shaping geoethical thinking. Notwithstanding this limitation, geoscientists engaged with these topics have benefited from some discussions with ethicists, philosophers of science and sociologists. One example is the wording of a formal definition of ‘Geoethics’ (Peppoloni and Di Capua 2015a) that will be introduced towards the end of this chapter.

The status that the emerging field of geoethics may gain is dependent on the extent to which there is professional cooperation among disciplines and constituencies. Within that context, some might worry that applying a rigorous philosophical methodology might render the development of geoethics devoid of practical meaning, hindering fellow geoscientists’ acceptance of it, whereas viewed from an operational geoscience perspective attracting them is important. Others might consider that although substantial progress could be made by shaping geoethics from a bottom-up mode, regular interaction with neighbouring fields of scholarly inquiry is now much needed.

Neighbouring relations with geoethics come in different shades and hues. Geoethics has not yet turned to big ticket matters like climate change or geoengineering, exceptions apart in the grey literature. Inquiries into ethics have a well-developed place within these subjects (Rayner et al. 2013 for the ‘Oxford Principles’, or Lawrence et al. 2018, Box 1), which could be taken up from a geoethics perspective. Similarly, observations that pertain to metaphysical subjects in geosciences like the Gaia hypothesis have not been studied. Also,

inquiries into ethical matters that are already being undertaken, for example, in hydrology or marine research (Linton and Budds 2014, Campbell et al. 2016, Barbier et al. 2018) could easily be taken up as part of geoethics. In summary, geoscientists who are interested in geoethics will find within geosciences several disciplines that offer opportunities for further inquiry.

Beyond matters pertaining to geosciences, fields of ethical inquiry that neighbour geoethics come in three configurations: The first configuration is by subject matter, for example, environmental ethics. The second configuration is by cognitive content, for example, research integrity or responsible science; both notions refer to the complicated matter of science-society interactions and have a strong focus on internal interactions within the sciences. The third configuration is by methodology, prompting consideration of general inquiries into ethics or the application of scientific methods.

Until now, geoscientists inquiring into geoethics have explored only some parts of the above. Understandably, most have considered their primary task to anchor geoethics in their research communities and daily practices. Notwithstanding this primary focus, a thorough awareness of essential efforts in neighbouring fields of inquiry is paramount for the methodological development of geoethics.

Possibly the best-explored relationship between geoethics and adjacent fields of ethical inquiries concern issues relating to research integrity (Mayer 2015), and public outreach and communication about natural and technological hazards and risks (Stewart and Nield 2013, Bohle 2015, Marone and Peppoloni 2017, Meller et al. 2018). Related to these are reflections about the Geoethical Promise of geoscientists and training needs (Matteucci et al. 2014, Riede et al. 2016a, Peppoloni and Di Capua 2017a). Exceptions apart (Stewart and Lewis 2017), inquiries about hazards and risks often seem to fall short in exploring insights

into science-society interactions from a geoscience perspective (Allenby and Sarewitz 2011, Cairney 2016), as has been done more systematically for climate research (Hulme 2009, Kowarsch 2016).

The most promising interface of geoethics with adjacent fields is probably the relation to the field of environmental ethics. Some fundamental principles of environmental ethics (Hourdequin 2015) are profoundly relevant for geoethical research, such as the application of the precautionary principle, considering a utilitarian approach versus issues relating to environmental justice, reflecting on generic values of beings and features, or studying how to make value judgements in circumstances of uncertainty. Seen from such perspectives, some scholars may even argue that geoethics is (or should be) a part of environmental ethics. Nevertheless, a possible distinction has recently become evident for justifying and developing geoethical thinking (Bobrowsky et al. 2017, Peppoloni and Di Capua 2017a). The core of environmental ethics is concern for the relationship between humans and other living beings, specifically beings that feel pain and exhibit traits of consciousness. Geoethics, on the other hand, does not explicitly include a focus on the relationships between humans and other living beings, although one of the precursor authors (Lynn 1998a, Lynn 1998b, Lynn 2000) who used the notion 'geoethics' did not apply this distinction. Geoethics, as discussed in this book, would qualify within environmental ethics as a virtue ethics (Bohle 2018). Virtue ethics is one of several ethical framings used in environmental ethics. Within geoethics, it refers to the 'virtue ethics of an individual agent' (e.g. geoscientist), as distinct from (but not necessarily in contradiction with), for example, approaches that apply utilitarian ethics as a societal norm.

Beyond observations on the distinction of geoethics from environmental ethics, it is to consider that the application of professional geoscience expertise in modern societies is closely linked with that of engineering professions. This linkage brings into the scope of

geoethics a set of concerns that some scholars would wish to treat as sustainability ethics, with an emphasis on the functioning of societies.

To summarise, any debate regarding the delineation of geoethics from environmental ethics or sustainability ethics can be seen as a question of degree and professional affinity. The delineation partly seems a matter of convenience. For the following discussions, the core of geoethics refers to the 'virtue ethics of an individual agent' applied with the purpose to guide behaviours and practices of the individual agent. The following chapters will delineate an operational perimeter for the kinds of agents and actions that comprise the sphere of geoethics.

Compared to the question of how to relate geoethics and environmental or sustainability ethics, the question of how to assimilate into geoethics those inquiries into ethics taking place within any field of geosciences, should not be an issue of professional affinity. Such assimilation has happened only to a limited degree, either due to lack of opportunities, resources and time or due to the thematic specialisation of the interested scholars. It will be challenging to explore the interface of geoethics with climate research, mainly because of the volume of relevant contributions and its societal implications, not least when considering the subject of geoengineering (climate engineering). Nevertheless, it seems fruitful to exploit that interface at least to gain deeper insights into the processes that shape science-society interactions (Kowarsch 2016), which in turn would find application in exploring the context and concerns of geoethics in the perspective of anthropogenic global change.

1.2.2 Early Reflections About Geoethics

Discussions about the ethics of science and research intensified around the turn of the century, as the example of physical sciences illustrates (Leys 1952, Kirby and Houle 2004, Whitbeck 2004). Hence, when exploring the societal context, implications and obligations of the geosciences, it is mainly the efforts undertaken during the last decade that are analysed in this book. Notwithstanding emphasis on recent efforts, the early sense-giving of geoethics-like thinking provides a further context for discussions. References may be found from the mid-nineteenth century (see Lucchesi 2017 about the work of Antonio Stoppani, 1824-1891) to the twenty-first century (Bobrowsky et al. 2017). The 'land ethic' of Aldo Leopold (1887–1948) should also be mentioned (Leopold 1949). At the turn of the last century, Lynn (2000, p.1) wrote of the need to *"recover ethics as part of the geographic tradition and begin justifying a distinctly geographic account of how we ought to live; all through a distinct perspective on moral understanding I call geoethics."*

The semantic combination of the prefix 'geo-' and the term 'ethics' has been used to refer to quite different concepts (Stoddard and Cornwell 2003), and hence the word 'geoethics' has found a variety of meanings. Lynn's (2000) generic approach to geoethics of 'how we ought to live' has led him to consider relations of humans and animals, which contrasts with other approaches. Considering human activities in a geoscience context easily leads to a range of philosophical reflections, which might often be situated in environmental ethics (for instance, advocacy of the precautionary principle) or considered metaphysical concepts (such as the Gaia hypothesis) (Weston 1987, Kleinhans et al. 2012, Lucchesi and Giardino 2012, Peppoloni and Di Capua 2012, Bobrowsky 2013, Almeida and Vasconcelos 2015).

Geographers have discussed the ethics of geography since the 1990s (Cutchin 2002) using the term geoethics when referring to ethical issues that are related to mapping (Harley 1990, Harley 1990, Harley 1991, Crampton 1995, Brennetot 2010, Brennetot 2011, Sánchez Guitián 2013). Otherwise, presidents of the Geological Society of America have discussed ethical issues at the society-geosciences interface without using the term geoethics (Zen 1993, Moores 1997). In addition, some scholars have used the notion 'geoethics' (see references in Martínez-Frías et al. 2011, Peppoloni and Di Capua 2015a, Peppoloni and Di Capua 2015b) when other scholars would prefer the term sustainability ethics or environmental ethics for such matters (Shearman 1990, Miller and Kirk 1992, Proctor 1998, Sparrow 1999, Becker 2012).

1.2.3 Core and Peripheral Matters

The notion 'enriched professional ethics' may denote the core of geoethics to put the behaviour of the agent at the centre of our thinking. In the first instance, this agent is the geoscientist. The philosophy of ethics describes such an approach as virtue ethics. Other approaches to ethics are possible: for example, a utilitarian approach (Auster et al. 2009); a model that seeks a generic value of the environment (Cherkashin and Sklyanova 2016); or ethics of justice (Kunnas 2012, Ott 2014, Kopnina 2014). When the agent is made a central feature of the approach to ethical issues, then considering agency provides a conceptual means with which a distinction can be drawn between different approaches to ethics. A focus on the individual - that is, the human agent - belongs to the core of geoethics.

In seeking to clarify the specific content of geoethics, etymological analysis of the term has brought to the fore notions of 'home', 'dwelling place' and 'individual and social

responsibility' (explored further in Chapter 2). Such considerations relate well to an actor-centric approach projected towards a world outside the self. Exploring the etymology of the word 'geoethics' and the concepts that underpin its roots thus foster a deeper understanding of its meaning.

Martínez-Frias (2008, p. 1) describes geoethics as

" ... a key discipline in the field of Earth and Planetary Sciences, which involves scientific, technological, methodological and social-cultural aspects (e.g. sustainability, development, museology), but also the necessity of considering appropriate protocols, scientific integrity issues and a code of good practice, regarding the study of the abiotic world. Studies on planetary geology (sensu lato) and astrobiology also require a geoethical approach".

Such a description aims to be all-embracing regarding the subjects of geoethics although, for example, it does not include reflection and guidance relating to objects and methodologies of inquiry into ethical issues. In addition, it locates geoethics firmly within environmental ethics.

In contrast to the above, Peppoloni and Di Capua proposed⁴ in 2012 that:

"Geoethics consists of research and reflection on the values which underpin appropriate behaviours and practices, wherever human activities interact with the Earth system. Geoethics deals with the ethical, social and cultural implications of geoscience education, research and practice, and with the social role and responsibility of geoscientists in conducting their activities." (Peppoloni and Di Capua 2015a p. 4-5, Peppoloni and Di Capua 2017a p. 2)

⁴ <http://www.geoethics.org>

Such a delineation of the meaning of geoethics, for example, clearly specifies what objects and subjects are to be included in a definition of geoethics and provides orientation with regards to its spheres of application. The inherent significance of this definition is illustrated by subsequent scholarly enquiries into whether and how to develop a kind of ‘Hippocratic oath’ for geosciences (Rotblat 1999, Riede et al. 2016a, Bohle and Ellis 2017), such as the Geoethical Promise (Matteucci et al. 2014), again discussed further in chapter 2. Likewise, the definition by Peppoloni and Di Capua (2015a, 2017a) positions geoethics meaningfully to engage with broader issues at the society-science interface.

Currently, the bulk of peer-reviewed publications on geoethics has interpreted the expression 'appropriate behaviours and practices, wherever human activities interact with the Earth system' as focusing on geoscientists within their professional and societal sphere. Such focusing of the interpretation is possible, while the potential of the wording is wider and more powerful: namely to include other human agents who interact with the Earth system. Explicitly, when considering anthropogenic global change, limiting the application of geoethics to actions of geoscientists may be too restrictive. A broader interpretation reflects the reality that geoethical engagement concerns any human agent who shapes production systems and consumption patterns, which in turn interact with the Earth system.

However, if it is intended to consolidate 'enriched geo-professional ethics' into an operational tool within geosciences, then such a broader interpretation of geoethics may refer to matters that are too peripheral to geoscience professions. Consequently, to address them, a concept may be needed that is complementary to geoethics. Hence, the discussions that are presented in this book shall help to draw a perimeter around the matters that are subsumed under the notion ‘geoethics’.

1.2.4 Ethical Debates Beyond Geoethical Inquiries

Inquiries into ethical principles and guidelines form a growing activity within geoscience scholarship and practice, and geoethical thinking is part of it. To close this chapter, the following paragraphs characterise some matters that geoethical thinking should tackle soon.

Geoethics could bridge several ethical questions and dilemmas within geosciences which relate, for example, to climate change (Gardiner 2004), hydrology (Linton and Budds 2014), meteorology (Schwab and von Storch 2018), the marine environment (Duarte 2014) or geoengineering (Brown and Schmidt 2014). However, these inquiries currently do not coincide. Furthermore, ethical inquiry in geosciences often links to broader ethical subjects, such as research ethics, value judgements in circumstances of uncertainty, or environmental justice. Consequently, scholars may overlook commonalities across geosciences that should enrich their inquiries. The example of 'geoengineering', for instance, poses a major ethical dilemma (Corner and Pidgeon 2010, Rayner et al. 2013, Lövbrand et al. 2015, Schmidt et al. 2016). While scholars inquiring into geoethics have contributed little to this debate, it would be an object par excellence to which to apply the Geoethical Promise. Likewise, geoethical argumentation may focus more on governance issues and historical experiences (Banerjee 2011, Gordijn and ten Have 2012, Bodansky 2013, Biermann 2014, Rozzi et al. 2015). In a similar sense, discussions about applying geoscience knowledge relate to reflections about the ethics of engineering (El-Zein et al. 2008, Ramírez and Seco 2012, Diekmann and Peterson 2013), as metaphorically reflected by Langmuir and Broecker (2012) in the title of their book on the evolution of Earth, "*How to build a habitable Planet?*"

Finally, inquiry about the 'ethics of geosciences' happens in various geoscience communities, although normally not referring to the actor-centric perspective of 'geoethics'.

Nevertheless, such a perspective seems attractive, at least for most domains of applied research. Consequently, it has been suggested to extend the scope of the Geoethical Promise to include applied Earth system sciences (Bohle and Ellis 2017). Subsequently, it could be explored how geoethics can reach out to any other ethical debate in Earth sciences. Geoethics could progressively enter into any debate wherever human activities interact with the Earth system; at least within the professional sphere of Earth system sciences.