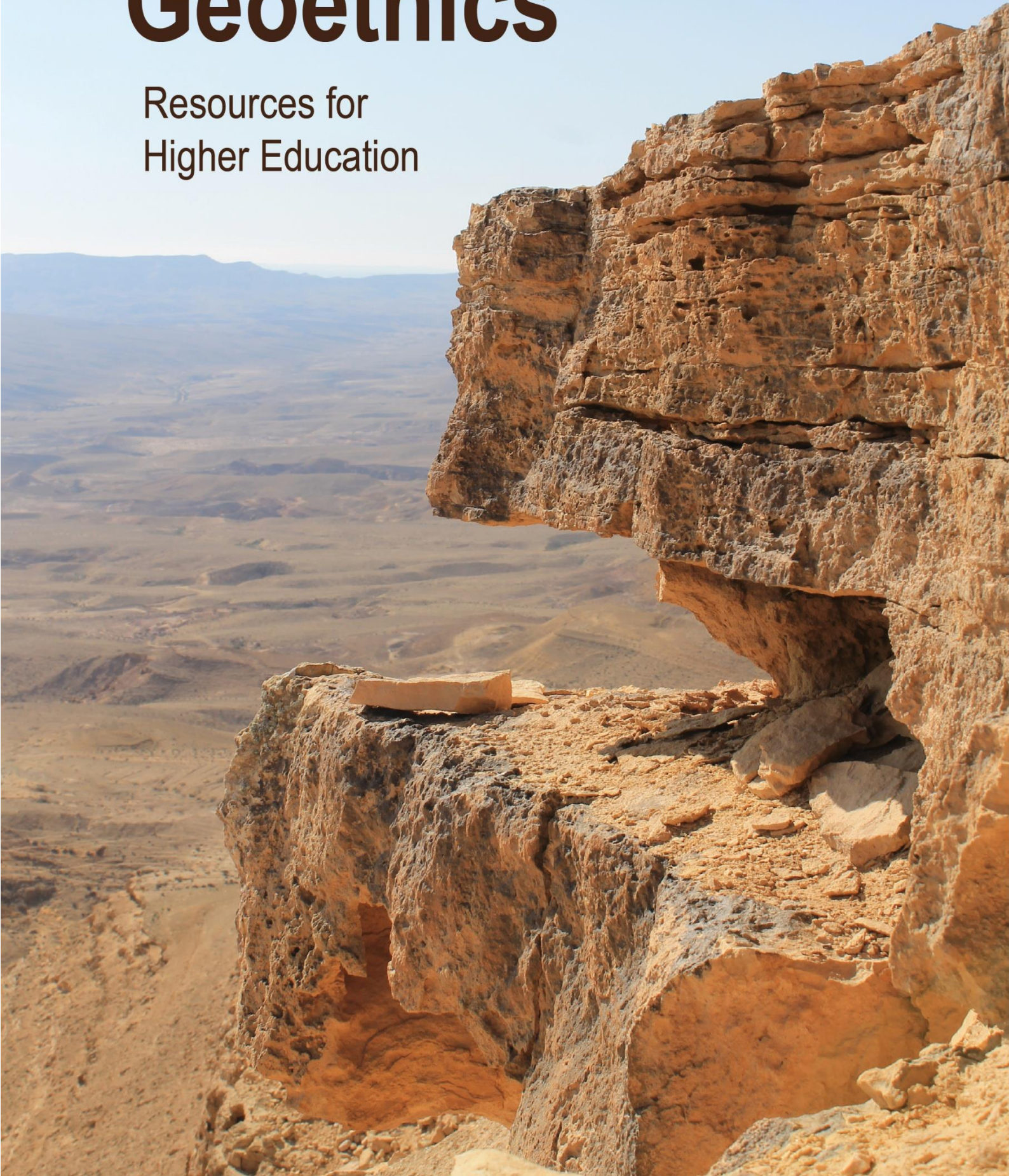


Teaching Geoethics

Resources for
Higher Education





Co-funded by the
Erasmus+ Programme
of the European Union

Teaching Geoethics

Resources for Higher Education

Information about the project

Geoethics Outcomes and Awareness Learning (GOAL)

Erasmus+ KA2 – Cooperation for innovation and the exchange of good practices

KA203 – Strategic Partnerships for Higher Education

Project No.: 2017-1-PTO1-KA203-035790, period: 31/12/2017 – 30/08/2020

goal-erasmus.eu

Partnership

University of Porto, Portugal

Kaunas University of Technology, Lithuania

University of Natural Resources and Life Sciences, Austria

University of Zaragoza, Spain

National Institute of Geophysics and Volcanology, Italy

Weizmann Institute of Science, Israel

Authors

Beatriz Azanza, Ron Ben-Shalom, José Brilha, Cristina Calheiros, Alexandra Cardoso, Stefano Corradi, Daniel DeMiguel, Giuseppe Di Capua, Vida Drašutė, Sigita Drašutis, Sérgio Esperancinha, Markus Fiebig, Sebastian Handl, Neringa Kelpšaitė, Guenter Langergraber, Alexandre Lima, Guillermo Meléndez, John Morris, Nir Orion, Silvia Peppoloni, Tiago Ribeiro, Susanne Schneider-Voß, Clara Vasconcelos

Editors

Clara Vasconcelos, Susanne Schneider-Voß, Silvia Peppoloni

Designer

Edita Rudminaitė

ISBN 978-989-746-254-2

DOI 10.24840/978-989-746-254-2

Porto, 2020

How to cite this eBook: Vasconcelos, C., Schneider-Voß, S., & Peppoloni, S. (Eds.) (2020). Teaching geoethics: Resources for higher education. U.Porto Edições.
<https://doi.org/10.24840/978-989-746-254-2>

This project has been funded with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



¹ This license lets you (as other party) remix, tweak, and build upon this work non-commercially, as long as you credit GOAL project partners and license your new creations under the identical terms.

CONTENT

PREFACE	7
INTRODUCTION	8
CHAPTER 1. GEOETHICS SYLLABUS AND EDUCATIONAL RESOURCES FOR HIGHER EDUCATION	12
1 INTRODUCTION	12
2 THE OUTPUTS OF THE GOAL PROJECT	13
2.1 The syllabus	14
2.2 The educational resources	17
3 CONCLUSIONS	17
CHAPTER 2. THE THEORETICAL FRAMEWORK UNDERPINNING GEOETHICAL EDUCATIONAL RESOURCES	20
1 INTRODUCTION	20
2 GOAL'S THEORETICAL FRAMEWORK: FROM EDUCATIONAL THEORY TO GEOETHICS TEACHING AND LEARNING	22
2.1 GOAL'S educational methodology: the geoethical dilemmas underpinning by the	
case-based teaching	24
3 GOAL'S EDUCATIONAL RESOURCES: A WAY TO BRING GEOETHICS INTO GEOSCIENCES'	
CLASSROOMS	26
4 CONCLUSION	27
CHAPTER 3. SOCIAL RESPONSIBILITY AND ETHICAL ATTITUDE ON THE MEDIA	31
1 INTRODUCTION	31
2 SCIENCE COMMUNICATION IN GEOETHICS	33
2.1 Ethical role of communicating geosciences	33
2.2 What media should geoscientists use and how should they use them?	35
3 GEOETHICAL COMMUNICATION IN PRACTICE: GOAL PROJECT	37
3.1 GOAL's website	37
3.2 Educational resources	38
3.3 Video production.....	38
4 CONCLUSIONS	39
CHAPTER 4. THEORETICAL ASPECTS OF GEOETHICS	42
1 INTRODUCTION: THREE FUNDAMENTAL QUESTIONS	42
2 THEORETICAL FRAMEWORK.....	43
2.1 From ethics to geoethics	43
2.2 The four domains and areas of application of geoethics	44
2.3 Key-points of the geoethical thinking	45

2.4	The values of geoethics	46
2.5	Codes of ethics and ethics of responsibility	47
2.6	Intellectual freedom as fundamental prerequisite for geoethics	47
2.7	Ethical issues and dilemmas	47
2.8	Why do we have to act (geo)ethically? Geoethics as an advantage	49
2.9	Teaching geoethics	49
2.10	Resources	49
3	CONCLUSIONS: MAIN CHARACTERISTICS OF GEOETHICS	52
CHAPTER 5. GEOETHICS AND GEOHERITAGE		57
1	GEODIVERSITY, GEOHERITAGE AND GEOCONSERVATION	57
1.1	Background and main concepts	57
1.2	Why do we need geoconservation?	61
2	PALAEONTOLOGICAL HERITAGE	61
2.1	Generalities about fossils and palaeontological heritage	61
2.2	Management of palaeontological heritage	62
3	GEOETHICAL ISSUES RELATED WITH GEOHERITAGE	65
3.1	Illegal collecting of geological specimens (fossils, minerals, meteorites)	65
3.2	Smuggling of geological specimens versus economic revenue of deprived communities	65
3.3	Selling of fossil replicas: fakery or handcraft	66
3.4	Mining and development works: a threat or an opportunity	67
3.5	Mineral and fossil shows: an educational occasion or an incentive for smuggling of geological specimens	67
3.6	Location of vulnerable geosites: reveal or keep secret?	68
3.7	Artificialization of show caves: a way to promote visitation or a loss of value	69
CHAPTER 6. GEOETHICS AND GEORESOURCES		73
1	PUBLIC AWARENESS OF THE IMPORTANCE OF RESOURCES IN SOCIETY	73
2	CLARITY AND TRANSPARENCY IN MEDIA DISSEMINATION (REGULATED SCIENCE COMMUNICATION) TO WELL-INFORM CITIZENS	74
3	THE RELEVANCE OF WELL-INFORMED CONSENT FROM THE CITIZENS TO USE THE SITE FOR MINING	75
4	SOCIAL RESPONSIBILITY BEFORE, DURING AND AFTER A MINING PROCESS	77
5	REQUIRED GEOETHICAL PROCEDURES IN THE MINING SITE	78
6	REGULATION AND STANDARDS OPERATION PROCEDURES INTERNATIONALLY RECOGNIZED IN MINING	80

7	HEALTHY AND SAFETY IN WORKABLE MINING AREAS.....	80
8	CONCLUSION	81
CHAPTER 7. GEOETHICS AND WATER MANAGEMENT		84
1	INTRODUCTION	84
2	INTERLINKAGES AND INTERDEPENDENCIES OF THE SUSTAINABLE DEVELOPMENT GOALS.....	85
3	RELATION OF WATER RESOURCES, LAND USE AND CLIMATE.....	86
4	EFFECTS OF HYDROPOWER PLANTS ON RIVER ECOSYSTEMS.....	88
5	PERSONAL CONSUMPTION AND PUBLIC AWARENES	92
6	CONCLUSIONS	93
CHAPTER 8. GEOETHICS AND GEORISKS		97
1	INTRODUCTION: GEOSCIENTISTS AS SOCIAL ACTORS.....	98
2	DEFINING RISK.....	98
3	GEOETHICAL VALUES FOR BUILDING A DISASTER RISK REDUCTION STRATEGY	99
4	GEORISK REDUCTION AS A SOCIETAL CHALLENGE: ROLES AND RESPONSIBILITIES OF ACTORS INVOLVED	100
5	CITIZEN SCIENCE.....	101
5.1	General concepts.....	101
5.2	An example of citizen science: citizen seismology.....	101
6	ETHICAL ISSUES IN RISK COMMUNICATION FROM A SOCIOLOGICAL POINT OF VIEW	104
6.1	A historic perspective.....	104
6.2	Key-points in risk communication.....	104
6.3	Fundamental characteristics of risk communication	105
6.4	Turning ethical principles in principled practices.....	105
7	DEFINING THE ACCEPTABLE LEVEL OF RISK FOR CIVIL PROTECTION PURPOSES	105
7.1	The acceptable level of risk: a political decision	105
8	HOW GEOSCIENTISTS CAN SUPPORT SOCIETY IN THE DEFENCE AGAINST GEORISKS..	106
8.1	Key-points in georisks from a geoethical perspective.....	106
9	CONCLUSION: CONSEQUENCES OF A SOCIETY UNPREPARED	107
10	RESOURCES.....	108
10.1	Video-pill: “geoethics and geological risks”	108
CHAPTER 9. GEOETHICS IN FIELD-TRIPS: A GLOBAL GEOETHICS PERSPECTIVE		111
1	INTRODUCTION	111
1.1	The meaning of learning and the outdoor learning environment	112
2	FIELD-TRIPS AND THE GOAL EDUCATIONAL APPROACH.....	115

2.1	The Higher education common teaching approach.....	115
2.2	The unique role of field-trips within the geosciences Higher education	115
2.3	Global examples of integrating geoethics aspects into field-trips.....	116
3	CONCLUSION.....	131
CHAPTER 10. CONCLUSION AND OUTLOOK.....		134
1	CONCLUSION.....	134
2	OUTLOOK.....	135
INDEX.....		138
APPENDIX 1: GOAL Geoethics syllabus		141
APPENDIX 2 :Introduction to geoethics: definition, concepts, and application		148
APPENDIX 3: Geoethics and geological risks.....		152
APPENDIX 4: Earth system nexus human interaction:		156
a geoethical perspective		156
APPENDIX 5: Can we dare say modern society does not need mineral raw materials?.....		161
APPENDIX 6: Good practices in the promotion of geoethical values in a UNESCO Global Geopark.....		173
APPENDIX 7: A geoethical conflict in “Lo Hueco” fossil site”		177
APPENDIX 8: Geoethical aspects of hydropower plants		182
APPENDIX 9: Water: a geoethical perspective on one of humanities most valuable resource		187
APPENDIX 10: Geoethics in education: from theory to practice		192

APPENDIX 6: GOOD PRACTICES IN THE PROMOTION OF GEOETHICAL VALUES IN A UNESCO GLOBAL GEOPARK



Co-funded by the
Erasmus+ Programme
of the European Union



GOAL EDUCATIONAL RESOURCE

AUTHOR	José Brilha (University of Minho, Portugal)
TITLE OF THE CASE	Good practices in the promotion of geoethical values in a UNESCO Global Geopark
SHORT CASE DESCRIPTION	In the Arouca's UNESCO Global Geopark (Northern Portugal) mining activities and geoconservation co-exist and together promote sustainable use of geoheritage with benefits either to local communities and to the international scientific community.
KEYWORDS	Fossils; Geoheritage; Geotourism; Sustainability.
PRIOR KNOWLEDGE	Fossil; Geodiversity; Geoheritage; Geotourism; Global geopark.
AIM	Develop awareness of geoparks as key territories with innovative strategies fully engaged with geoethical principles.
OBJECTIVES	<ul style="list-style-type: none"> • To recognize the three main pillars of a geopark strategy - geoconservation, education, and geotourism. • To explain that the value of geoheritage is based on sound scientific knowledge produced by the geoscientific community. • To defend the need for a good balance between the exploitation of geological resources and preservation of geoheritage. • To list natural and anthropic threats that can jeopardize geoheritage. • To recognize that mining may affect negatively geoheritage and, at the same time, could be a way to reveal new important geological features. • To explain the importance to communicate geological knowledge in a way to be understood in general terms by laypeople. • To defend the need for effective management of fossils avoiding illegal selling and smuggling. • To illustrate the role of local communities in the conservation of geoheritage raising the sense of land belonging in the inhabitants due to their natural heritage. • To relate the geopark concept with specific UN Sustainable Development Goals.

CASE

A “Global Geopark” is an official label given by UNESCO since 2015 to territories that have successfully proved to comply with the geopark principles, integrating a Global Network that has already 147 members in 40 countries (data as of 2019). The Arouca Geopark in Northern Portugal, presently a UNESCO Global Geopark, was established in 2009 (Fig.1).



Fig. 1 – Location of Arouca UNESCO Global Geopark in Portugal.

The inventory of geoheritage revealed the existence of about 40 geosites in an area of 330 square kilometers. Some of these geosites have international scientific value, one of the necessary requisites for UNESCO recognition.

The Valerio’s quarry is one of these geosites with high scientific relevance. It is a slate quarry operating accordingly with the Portuguese legislation and where layers of Ordovician slate offer magnificent exemplars of giant trilobites. Trilobites are fossils of extinct marine animals, usually with a few centimeters long. However, in this quarry and due to conditions not yet fully understood by paleontologists, these trilobites may reach 50 cm long (Fig.2).



Fig. 2 – Trilobites in the center’s exhibition.

	<p>These are the longest trilobite fossils in the world, which makes these fossils a geoheritage with international scientific value. Usually, quarrying is considered a major threat to geoheritage. However, Valerio's quarry geosite is a good example to show that mining and geoconservation are not impossible to co-exist. The owner of the quarry has developed a deep knowledge and fascination about trilobites, and he collects all fossils that appear during the normal quarrying operation. These fossils are properly collected and stored, studied by paleontologists and the main exemplars are available to be appreciated by the general public and students in the interpretative center that was built specifically for this aim by the quarry company.</p> <p>This interpretative center is, quite obviously, a certified partner of the Arouca UNESCO Global Geopark. Valerio's quarry geosite constitutes a best-practice case showing that with proper management it is possible to have quarrying and geoconservation in the same place. This is particularly relevant because not only the exploitation of a mineral resource is important for the local economy but also because the scientific, educative and touristic use of geoheritage is assured, also bringing benefits for the local community.</p>
<p>QUESTIONS</p>	<ol style="list-style-type: none"> 1. What is a geopark? 2. How many geoparks exist in the world? 3. Why geoparks are innovative land-use planning tools? 4. Why mining is usually considered a threat to geoheritage? 5. How can geoconservation be assured if society needs to exploit tons of geological resources every day? 6. How is it possible to have mining inside a geopark? 7. How can mining contribute positively to geoconservation? 8. What is the consequence for the local community to have a mining and geoconservation in the same place? 9. Describe the impacts of illegal selling and smuggling of fossils and minerals. 10. Relate the best-practices identified in the Arouca UNESCO Global Geopark with specific UN Sustainable Development Goals. 11. Explain how geoparks can be considered a showcase of geoethical values in practice.
<p>PROCEDURE</p>	<ol style="list-style-type: none"> 1. Setup work groups of students and hand out one paper mentioned in the references to each group. After some minutes, each group has to present the main ideas of the paper to the classmates. 2. Presentation of the PowerPoint slides by the teacher: https://goalerasmus.eu/wp-content/uploads/2019/12/PP_Arouca.pdf 3. The teacher should promote questioning and write in the board the main questions raised. 4. The same work groups have to search for relevant information in order to be able to present possible answers to the questions. 5. Final discussion promoted by the teacher in order to clarify the main topics presented as aims.

	<p>Important links:</p> <ul style="list-style-type: none">□ Arouca UNESCO Global Geopark: http://www.aroucageopark.pt/en/□ UNESCO Global Geoparks: http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/unesco-global-geoparks/□ UNESCO Global Geoparks: celebrating earth heritage, sustaining local communities: https://unesdoc.unesco.org/ark:/48223/pf0000243650□ UN Sustainable Development Goals: https://www.un.org/sustainabledevelopment
REFERENCES	<p>Brilha, J. (2014). Concept of geoconservation. In G. Tiess, T. Majumder & P. Cameron (Eds.), <i>Encyclopedia of Mineral and Energy Policy</i>. Berlin: Springer. (access here)</p> <p>Brilha, J. (2014). Mining and geoconservation. In G. Tiess, T. Majumder & P. Cameron (Eds.), <i>Encyclopedia of Mineral and Energy Policy</i>. Berlin: Springer. (access here)</p> <p>Giardino, M., Lucchesi, S., Alessandra, M., Edoardo, D. & Tullio, B. (2017). Geodiversity and Geoethics: added values for UNESCO Geoparks. <i>Geophysical Research Abstracts</i>, 19, EGU2017-9486. (access here)</p> <p>Henriques, M.H. & Brilha, J. (2017). UNESCO Global Geoparks: a strategy towards global understanding and sustainability. <i>Episodes</i>, 40(4), 349-355. doi:10.18814/epiiugs/2017/v40i4/017036 (access here)</p> <p>Page, K. (2018). Fossils, Heritage and Conservation: Managing Demands on a Precious Resource. In E. Reynard & J. Brilha (Eds.), <i>Geoheritage: Assessment, Protection, and Management</i> (pp. 107-128), Amsterdam: Elsevier. (access here)</p> <p>Sá, A., Silva, E. & Vasconcelos, C. (2015). Geoparks and Geoethics: a fruitful alliance to guarantee the wholesome development of geoparks in the world. In K. Saari, J. Saarinen & M. Saastamoinen (Eds.), <i>Responsible Use of Natural and Cultural Heritage</i> (p.84), Rokua: Humanpolis Oy/Rokua Geopark. (access here)</p>