Celebrating 50 years of global initiatives promoting geoconservation and geological heritage

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ABSTRACT

The last five decades have been crucial for the development of geoconservation and for the recognition that some geological features are at risk and need to be properly protected and managed. This recognition is happening at two levels. On one hand, the rise of awareness in certain countries of the importance of geoconservation is pushing international organizations to include this topic in their policies and strategies. On the other hand, this change at the international level is contributing to more countries understanding that they need to integrate geoconservation policies in their statutory systems and create effective measures to guarantee the conservation of geological heritage. This paper presents an overview of the main international efforts made during the last 50 years that have significantly changed the scenario in regard to the place of geoconservation inside the global nature conservation agenda.

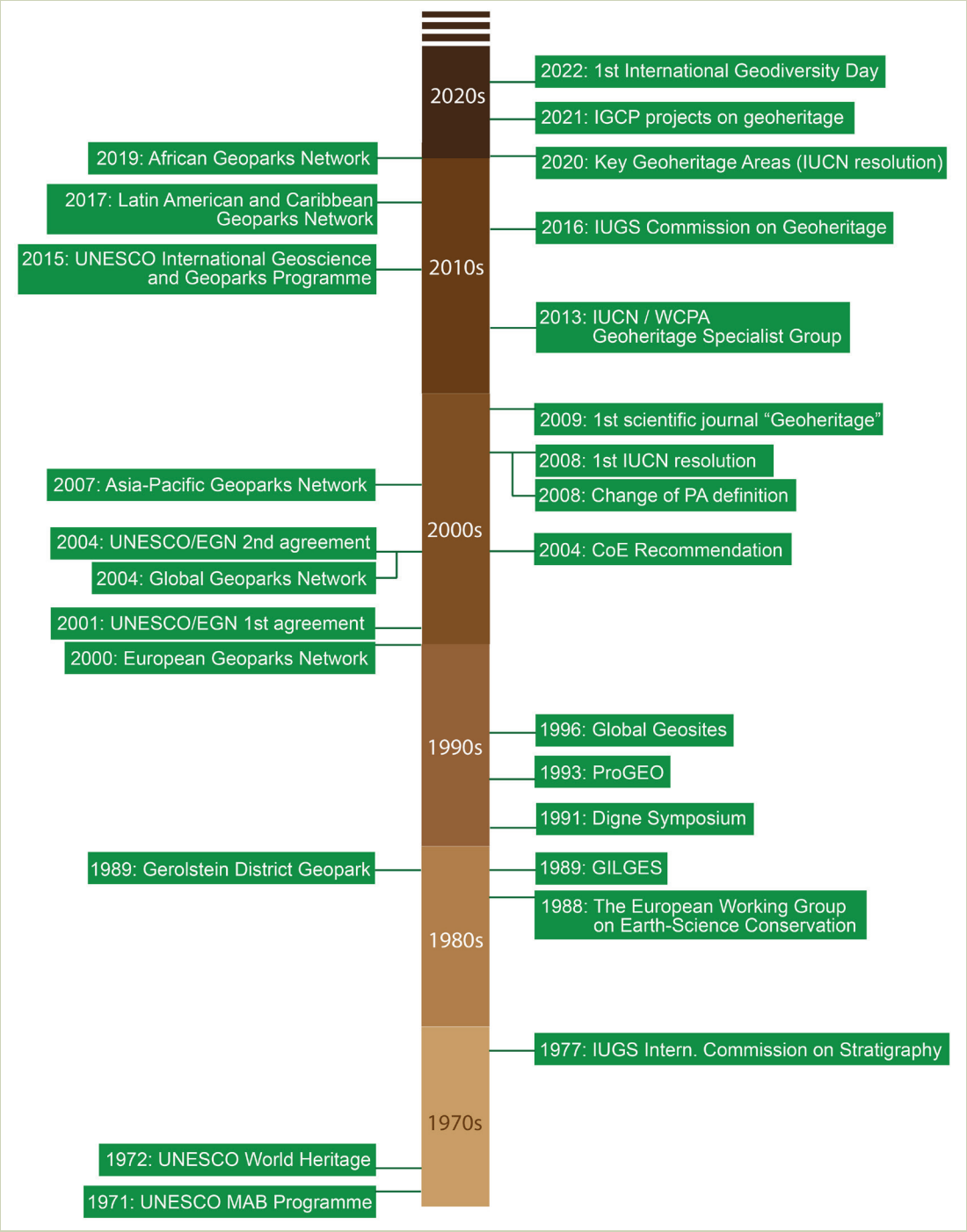
INTRODUCTION

It is common to read in the literature that geoconservation is a new topic in geosciences and in nature conservation policies, but the fact is that the need to protect geological heritage has been discussed at the international level for the last 50 years. Moreover, if we consider initiatives in individual countries, the first actions dedicated to geoheritage protection occurred a few decades earlier. The terms *geoconservation* and *geological heritage*, or *geoheritage* in short, are more recent but the

recognition that exceptional geological features need to be preserved is not new (Burek and Prosser 2008; Larwood et al. 2013).

This paper presents an overview of the most significant initiatives related to geoconservation and geoheritage that have happened at the international level since the 1970s (Figure 1). During this period, the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Union of Geological Sciences (IUGS), and the International Union for Conservation of Nature

Figure 1. Timeline of major international initiatives related to geoconservation and geoheritage.



(IUCN) were the most relevant organizations for the promotion of geoconservation. The activity done under the scope of these bodies was determinative for the development of effective geoconservation actions at the national and local levels. This is clear, for instance, in the increasing number of geological sites properly managed in many countries included in UNESCO's World Heritage List or in UNESCO's Global Geoparks system.

THE 1970s: THE FIRST UNESCO AND IUGS INITIATIVES

In 1968, UNESCO held "The Intergovernmental Conference of Experts on the Scientific Basis for Rational Use and Conservation of the Resources of the Biosphere," later known as the "Biosphere Conference." This conference was the trigger for the preparation and approval in 1971 of the Man and the Biosphere Program (MAB) as an intergovernmental scientific program aiming for the establishment of a scientific basis for the improvement of relationships between people and their environments. Since that time, 727 sites in 131 countries have become members of the World Network of Biosphere Reserves. MAB does not address directly geoheritage, but it is implicit that geodiversity plays a crucial role on the biosphere. More recently, some biosphere reserve managers have recognized the importance of geodiversity and geoheritage and are including these topics in their management plans (Monge-Ganuzas et al. 2018).

Much more relevant for geoconservation was the adoption in 1972 of UNESCO's Convention Concerning the Protection of the World Cultural and Natural Heritage. This convention allows state parties to nominate properties of cultural and/or natural value considered to be of "Outstanding Universal Value" (OUV) for inscription onto the World Heritage List. The aim is to assure permanent protection of properties that have exceptional cultural and/or natural significance. The OUV recognition is based, besides other requirements, on evidence that a certain property fulfills at least one of the ten criteria (six for cultural values and four for natural values). Although criterion viii does not use the term geoheritage, its explanation does not leave any doubts about its direct relation to geological heritage. Sites designated under this criterion must be

> outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features (http://whc.unesco.org/en/criteria/).

In addition to this criterion, there is also criterion vii that can be applied to geoheritage with high scenic value. Sites designated under this criterion must

> contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.

In 1978, three properties were recognized for their geoheritage (among other criteria): the Galápagos Islands (Ecuador), Nahanni National Park (Canada), and Yellowstone National Park (USA). This was the first year that properties were nominated by UNESCO as World Heritage. The first property to be recognized by UNESCO as World Heritage exclusively for its geoheritage was Hawaii Volcanoes National Park (USA) in 1987, 15 years after the establishment of the convention. As of September 2021, 1,154 properties from 167 countries are included in the World Heritage List, 897 due to their cultural value (78%), 218 due to natural value (19%), and 39 with both values (3%). Out of the 218 natural properties, there are 93 properties under criterion viii located in 51 countries. Of these, 21 are sites where geoheritage is the only reason for their recognition as World Heritage. When state parties nominate a certain property, they commit to assure its proper management. So, not only does the World Heritage Convention recognize the importance of geoheritage, it also indirectly assures that this geoheritage is protected and well managed by state parties. Mc Keever and Narbonne (2021) present an updated perspective about the representation of geological sites in the World Heritage List and define 11 geological themes to guide the application of criterion viii and the preparation of new nominations by state parties.

The IUGS's International Commission on Stratigraphy has been identifying Global Boundary Stratotype Section and Points (GSSPs) since 1977. These are the best localities worldwide to serve as standards for the divisions of Earth's time scale. Each locality is selected after a detailed scientific analysis made by experts working under one of the 17 subcommissions. In September 2021, there are 75

GSSPs ratified by IUGS, each one corresponding to a geosite of top international scientific significance (https://stratigraphy.org/gssps/). New GSSPs are still under evaluation.

THE 1980s: THE DAWN OF INTERNATIONAL INVENTORIES

We have to wait until the last years of the 1980s to see further advances in international activity related to geoconservation. In 1988, the European Working Group on Earth Science Conservation was created. It was an outcome of the first international workshop on the topic, held at Leersum, The Netherlands. It brought together 12 geoconservationists from Austria, Denmark, Finland, Great Britain, Ireland, Norway, and The Netherlands (Black 1991). Two more workshops were held in 1989 at Bregenz, Austria, and in 1990 at Lom, Norway, with participants also from Belgium, France, and Switzerland.

This was also the decade where the word *geopark* was used for the first time (Frey 2012). In 1989, Gerolstein District Geopark (Germany) was established with three main aims: (i) protect geosites, particularly fossil sites; (ii) foster geotourism; and (iii) promote local economic development. This geopark was created by the Eifelverein, a large outdoors group, after the development in 1986 of a first set of geotourism activities. Gerolstein District Geopark was enlarged in 2000 to become Vulkaneifel Geopark, one of the four founding members of the European Geoparks Network that are presented below.

The difficulty of getting more geological sites represented in the World Heritage List highlighted the lack of an international inventory of sites with high relevance. Therefore, in December 1989 during the 13th session of UNESCO's World Heritage Committee, a first version of a "global indicative list of geological and fossil sites which have the potential to meet World Heritage criteria" (UNESCO 1989) was presented. This initiative was the result of a request made by the World Heritage Bureau (during the 12th session in June 1988) in which it was stated that IUCN (which is responsible for reviewing nominations of natural areas) "needed specialist advice to evaluate properties nominated under natural criterion (i) (the earth's evolutionary history) or criterion (ii) (ongoing geological processes)." This preliminary Global Indicative List of Geological Sites (GILGES) was prepared by J.W. Cowie (chair of the IUGS Commission on Stratigraphy), taking into account mainly the integrity criterion. The list was circulated to more than 150 experts worldwide for their comments in order to achieve a final version to be approved by the bureau at the 14th session of the World Heritage Committee in June 1990. The aim was that "on the basis of this list, State Parties will be invited to nominate sites thereon and IUCN will have the possibility of consulting with IGCP [UNESCO's International Geoscience Program] and the IUGS for their evaluation." This work was the output of the Working Group on Geological and Palaeobiological Sites or Geotopes, a joint cooperative project constituted by the World Heritage Secretariat of the Division of Ecological Sciences of UNESCO, IUGS, IGCP, and IUCN.

THE 1990s: THE GATHERING OF A COMMUNITY

This decade starts with the continuation of the initiatives related to GILGES. During the 14th session of the bureau (June 1990) it was decided to organize a meeting in October 1990 with a task force of experts mainly from Africa, Asia, and Latin America, because it was recognized that the preliminary list was unbalanced with a higher representation of sites from Europe and Australia, and also because many of the 150 geologists queried did not answer at that time (UNESCO 1990). References to GILGES slowly disappeared from UNESCO documents after 1990. It seems that the efforts made by the geological community at that time changed from the preparation of a such a list to more comprehensive work in order to promote an update to the criteria to nominate geological sites as World Heritage. In fact, at its 17th session (June 1993) the bureau decided to include the proposals presented by the Working Group on Geological and Palaeobiological Sites or Geotopes in the World Heritage Guidelines.

In November 1993, a report by J.W. Cowie finally brought some light to the work done during the previous years. This report presents about 300 sites worldwide that have "sufficient global universal outstanding value" to qualify as World Heritage. Cowie cautioned that this updated GILGES "is not definitive and must be subject to revision" and "is an open-ended list and its improvement can be made by deletions as well as additions" (Cowie 1993). Besides the recommendations to IUCN concerning World Heritage and the preparation of GILGES, the Working Group on Geological and Palaeobiological Sites or Geotopes was also engaged in setting up a

"New Global Database of Geological Sites (IUGS GEOSITES)" in the IUGS secretariat in Trondheim, Norway.

Based on the GILGES experience, in 1996 IUGS (under the auspices of UNESCO) created the Global Geosites Project, aiming to develop an inventory of geosites with worldwide scientific importance, run by the Global Geosites Working Group (GGWG). However, this project was closed by IUGS in 2003 without achieving its main goals.

Meanwhile, two other events must be underlined in the history of the first half of the 1990s, both related to the European Working Group on Earth Science Conservation mentioned above. After the first meetings organized by this working group, the 1st International Symposium on the Conservation of the Geological Heritage, held in Digne-les-Bains,France, in 1991, constituted a landmark on geoconservation and was a sign of a prospering international community. This working group evolved in 1993 to become ProGEO–The European Association for the Conservation of the Geological Heritage, a decision approved in its first General Assembly held in Mitwitz-Cologne, Germany. ProGEO was the first non-governmental organization (NGO) fully dedicated to the promotion of geoheritage and geoconservation, based on the work done in European countries by its national groups. In spite of the closing of the IUGS Global Geosites Project mentioned above, ProGEO kept working in European countries using the methods and principles set for Global Geosites (Wimbledon and Smith-Meyer 2012).

THE 2000s: THE GEOPARKS' BOOM

This decade is characterized by the popularization of the geopark concept and its spreading around the world. In 2000, the Geological Reserve of Haute-Provence (France), the Petrified Forest of Lesvos (Greece), the Geopark Vulkaneifel (Germany), and the Maestrazgo Cultural Park (Spain) jointly created the European Geoparks Network (EGN). In 2001, a formal agreement was signed between EGN and UNESCO's Division of Earth Sciences, whereby UNESCO gave the network its endorsement. A new Global Geoparks Network (GGN) was created by UNESCO in 2004, grouping the 17 European geoparks with eight Chinese geoparks selected from the Chinese Network of National Geoparks already existent at that time. A second agreement that year (the Madonie Declaration) confirmed that the EGN geoparks were integrated into the new global network without the need of further procedures (Henriques and Brilha 2017 and references therein). Some years later (2007), a second regional geoparks network was created in the Asia-Pacific region. As of September 2021, there are 169 geoparks in GGN, located in 44 countries worldwide. This increase corresponds to a yearly average of eight new geoparks being integrated into GGN, which is a remarkable growth and sign of excellent acceptance of the geopark concept by state parties and by their local communities.

During the 2000s, two other transnational organizations started to develop geoconservation activities. In 2004, the Committee of Ministers of the Council of Europe approved the Recommendation Rec(2004)3 on Conservation of the Geological Heritage and Areas of Special Geological Interest. The aim was to strengthen cooperation with international organizations, scientific institutions, and NGOs in the field of geoheritage, and their participation in geoconservation programs. Unfortunately, this was the only known geoheritage-related initiative from the Council of Europe, and even an assessment of its impact planned for 2009 was never made public.

IUCN was established in 1948 but, with the exception of its involvement with the World Heritage Convention and its criterion viii, no other activity to promote geoheritage or geoconservation was ever made during the union's first 60 years. This long absence of activity focused on geoheritage can be partially understood by the lack of members with expertise during that period. Two actions were taken in 2008 to remedy this situation. First, the World Commission on Protected Areas, in reviewing its Guidelines on Protected Areas Management, adopted a new definition of a protected area:

> A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. (Dudley 2008).

The use of the term *nature* rather than *biodiversity*, which had been used in the previous definition, was

a breakthrough in IUCN to recognize abiotic and as well as biotic features and processes. Second, and in order to trigger the activity inside IUCN, the Commission on Geological Heritage of the Geological Society of Spain became a full IUCN member in March 2008. Soon after, two other geo-related organisations joined as members: The Spanish Society for the Defence of Geological and Mining Heritage and ProGEO. Since that time these three members have joined to present motions to the IUCN General Assemblies that, when approved, have been converted into IUCN resolutions (Table 1).

Besides these resolutions, many others have included amendments proposed by these three organizations, in order to make explicit references to geodiversity and geoheritage, when appropriate.

The 2000s closed with a very relevant initiative to strengthen the recognition of geoconservation by the global scientific community. The ProGEO scientific journal *Geoheritage* began publication in 2009. As of September 2021, almost 600 high-quality papers covering all continents have been published in *Geoheritage*, totaling about 73,000 downloads just in 2020.

THE 2010s: INSTITUTIONAL REINFORCEMENT OF GEOHERITAGE

This decade is characterized by the strengthening of geoheritage under the institutional point of view. In 2015 UNESCO approved the International Geoscience and Geoparks Program (IGGP), an umbrella initiative comprising two activities: the already existent International Geosciences Program (IGCP) and the newly revised UNESCO Global Geoparks (https://en.unesco.org/international-geoscience-and-geoparks-programme). After the first attempt in 2001 to create a geopark program, it was now possible to include the geopark concept in the strategies and objectives of UNESCO, giving geoparks a higher international visibility. A UNESCO Global Geopark is a new label aiming to create a "mechanism of international cooperation by which areas of geological heritage of international value, through a bottom-up approach to conserving that heritage, support each other to engage with local communities to promote awareness of that heritage and adopt a sustainable approach to the development of the area." Two new regional geoparks networks were soon established: the Latin American and Caribbean Network (2017) and the African Network (2019).

On the IUCN side, 2013 was the year of the establishment of the Geoheritage Specialist Group (GSG) under the World Commission on Protected Areas (WCPA). IUCN has six commissions that are constituted by scientists and experts providing know-how and policy advice on conservation and sustainable development. WCPA is one of these commissions. WCPA's specialist groups are established to bring together commission members who can provide ongoing specialist expertise and leadership in topics that are IUCN priorities. GSG offers geoconservation expertise to the IUCN community and to the general society. The publication of guidelines to promote geoconservation in protected and conserved areas, included in the IUCN's Best Practice Protected Area Guidelines Series, is one of GSG's recent outcomes (Crofts et al. 2020).

To conclude the analysis of the 2010s, it is necessary to refer a new development under IUGS, the most relevant geoscientific organization in the globe. IUGS is organized into seven scientific commissions, one of them being the International Geoheritage Commission, established in 2016. The creation of this scientific commission is one more evidence of the rising recognition of geoconservation topics within the international geoscientific community.

Table 1. IUCN resolutions at the World Conservation Congress (WCC) directly related to geodiversity and geoconservation (including those passed in 2021).

WCC	Resolution no.	Title
2008, Barcelona	040	Conservation of geodiversity and geological heritage
2012, Jeju	048	Valuing and conserving geoheritage within the IUCN Programme 2013–2016
2016, Honolulu	083	Conservation of moveable geological heritage
2021, Marseille	074	Geoheritage and protected areas
2021, Marseille	088	Conservation of the natural diversity and natural heritage in mining environments

FINAL CONSIDERATIONS

After this overview of the last half-century of geoconservation initiatives with global impact, it is important to underline three recent activities that are still in their early stages but have high potential to be included in a future history of the 2020s.

IUCN Resolution 074, passed at the 2021 World Conservation Congress (Table 1), requests the IUCN director general and WCPA to "support the development of a detailed study envisaging the establishment of a future IUCN initiative on Key Geoheritage Areas, as a complement to the existing Key Biodiversity Areas programme, in order to protect geoheritage sites of global conservation significance and move towards more integrated nature conservation." Presently, IUCN members and GSG are defining the methods, criteria, standards, and governance to be applied to Key Geoheritage Areas. This initiative can be a game-changer not only on the selection of the most important geoheritage at the international level, but also on the mobilization of national and local administrations, together with local communities for its conservation.

IGCP, together with IUGS, has supported collaborative research projects since 1972, under five topics: earth resources, global change, geohazards, hydrogeology, and geodynamic. For the very first time, a new special topic, geoheritage for sustainable development, was available as part of the 2020 call for proposals, and six new projects were approved under this theme. These new projects constitute excellent opportunities to further develop geoconservation (in a broad sense) across the globe.

The third ongoing initiative is based on a proposal made by the international geoscientific community to UNESCO for the establishment of an International Geodiversity Day (Brilha et al. 2021). This proposal was approved by the 211th session of UNESCO's executive board (21 April 2021) and a final decision to approve it was made in November 2021, during the 41st session of UNESCO's General Conference. So 6 October 2022 will go down in history as the first commemoration of International Geodiversity Day—an excellent opportunity each year to call the attention of the society to all aspects related to geodiversity, geoheritage, and geosciences in general.

The analysis here presented of the accomplishments achieved in the last 50 years suggests that there is a long way still to go. The work that started in 2008 inside IUCN needs to be strengthened because this organization has the capacity to influence national governments to implement new nature conservation policies. The very recent conversion of ProGEO from a European to an international organization might also help to raise awareness of national authorities in each country for the need to develop geoconservation strategies in a sound and definitive way.

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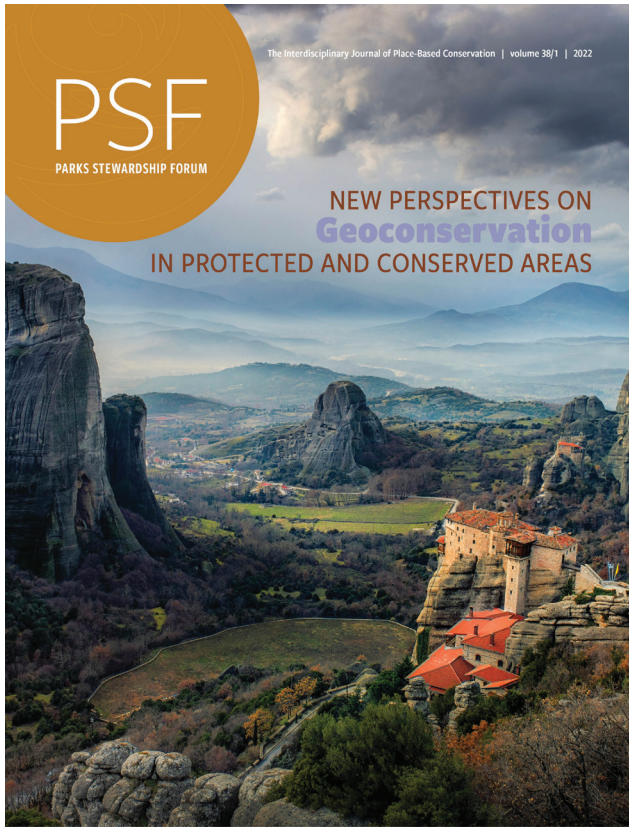

On the cover of this issue
The precipitous rock spires of Meteora World Heritage Site in Greece have a complex geological history. Over the centuries a number of Eastern Orthodox monasteries were built atop them, and today's World Heritage Site recognizes this cultural history as part of the overall geoheritage. | STATHIS FLOROS