

# Geotourism development in the Azores archipelago (Portugal) as an environmental awareness tool

**Eva Almeida Lima<sup>1,2</sup>, Marisa Machado<sup>2</sup>, João Carlos Nunes<sup>1,2</sup>**

e-mail: valima@azoresgeopark.com, marisamachado@azoresgeopark.pt, jcnunes@uac.pt

<sup>1</sup> Azores University, Geosciences Department, Azores Islands, Portugal

<sup>2</sup> Azores Geopark Association, Azores Islands, Portugal

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## Abstract

The Azores archipelago is distinguished by its unique natural beauty and marine setting. Thanks to its volcanic origin, the region has a very rich and remarkable geodiversity that includes a diversity of landscapes with innumerable craters, volcanic lakes, fumaroles, hot springs, volcanic caves, marine fossil deposits and thermal water springs. The recognition of this valuable geological heritage came with the recent integration of the Azores Geopark into the European and Global Geopark Networks.

The pressure that the increasing development of tourism have been exerting on these geological sites for the last years, and the need to create alternative forms of tourism, which contribute towards the socio-economic development in rural areas, have highlighted the importance of geotourism as a tool to promote and preserve the geological heritage of the Azores. Geotourism has turned to be an important instrument of environmental awareness through the local and foreign people.

## Keywords

Geotourism, Azores archipelago, volcanic islands, geolandscapes, environmental awareness

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## Introduction

The rare nature and its natural and geological heritage are the main ex-libris of the Azores archipelago together with its scenic and aesthetic characteristics and attributes of great attractiveness and a geotouristic potential.

Traditionally, the visitors of this region are looking for the volcanic landscapes and the surrounding sea for mere contemplation, enjoyment or for the practice of different activities in the unique natural environment that the Azores offer. The nature tourism, tourist product defined as strategic for the Azores within the National Strategic Plan for Tourism, is a major one of the main tourist products of the region and is, without doubt, the main component of the Azorean tourist industry (Nunes et al., 2011).

The volcanic landscapes of the Azores are, thus, the main motto of interest and development of geotourism in the archipelago and they present a wide range of possibilities for sustainable use where several activities can be performed and associated tourist products can be developed.

Tourism is one of the sectors with a high development potential in the Azores archipelago. The Azores are in the 3<sup>rd</sup> place in the ranking of the growth of touristic activity in national terms after Algarve and North Portugal (mainland).

According the Azorean Statistics Regional Service (data available on [www.srea.ine.pt](http://www.srea.ine.pt)), in 2012 there were 360,265 tourism arrivals, which correspond to 1,077,420 tourism nights. About half of them are Portuguese tourists (from the mainland or Madeira archipelago) and the other half are foreigners, with the Germans leading this second group, followed by tourists from Finland, the United States of America, Sweden and the Netherlands.

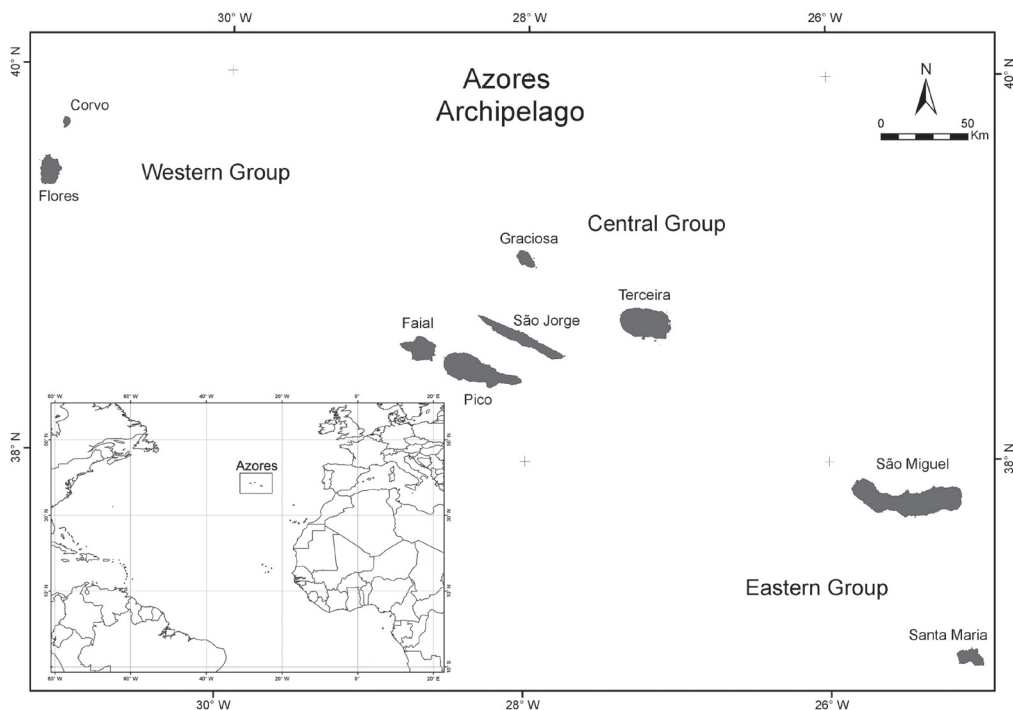
There are presented the natural characteristics of the archipelago that provide the development of geotourism. There are also featured the contributions of the Azores Geopark and partners entities highlighting the opportunity and potential of the development of geotourism in the archipelago has as a tool for environmental awareness

## Azores volcanic landscape

The Azores archipelago is a Portuguese autonomous region composed of nine islands, several islets and the surrounding seafloor, located in the Atlantic Ocean between 36° and 41° North Latitude and 24° and 33° West Longitude. It has an administrative area of 2,324 sq. km of land surface and 938,000 sq. km of marine area and it is characterized by the reduced dimension of the islands (between 17 and 745 sq. km), by its dispersion (distributed along approximately 600 km in the Atlantic, between Santa Maria and Corvo islands) and for its distance from the European and American continents (at distances of 1,815 km from mainland Portugal and 2,625 km from Canada). The islands are divided into three groups: the Western Group (Flores and Corvo islands), the Central Group (Terceira, Graciosa, São Jorge, Pico and Faial islands) and the Eastern Group (São Miguel and Santa Maria islands) all of them inhabited (Figure 1). The archipelago has 19 municipalities and 156 parishes with a population of 247,066 inhabitants (year 2011).

The geographic location of the Azores, between the European and American continents, makes this Atlantic territory a true “bridge between two continents”!

**Figure 1** Azores geographic setting



Source: Lima, et al. (2009)

The islands emerge from the seafloor at 2,000 meters deep, associated with the triple junction of the Euroasian, North American and African (or Nubian) lithospheric plates (Nunes, 1991; França, et al., 2003; Garcia-Talavera, 2003), and presenting elements closely linked to the dynamics of the Planet Earth, the volcanism and geotectonic.

The Azores archipelago integrates, together with Madeira, Canary and Cape Verde archipelagos, the biogeographic region of Macaronesia, which means “fortunate islands”.

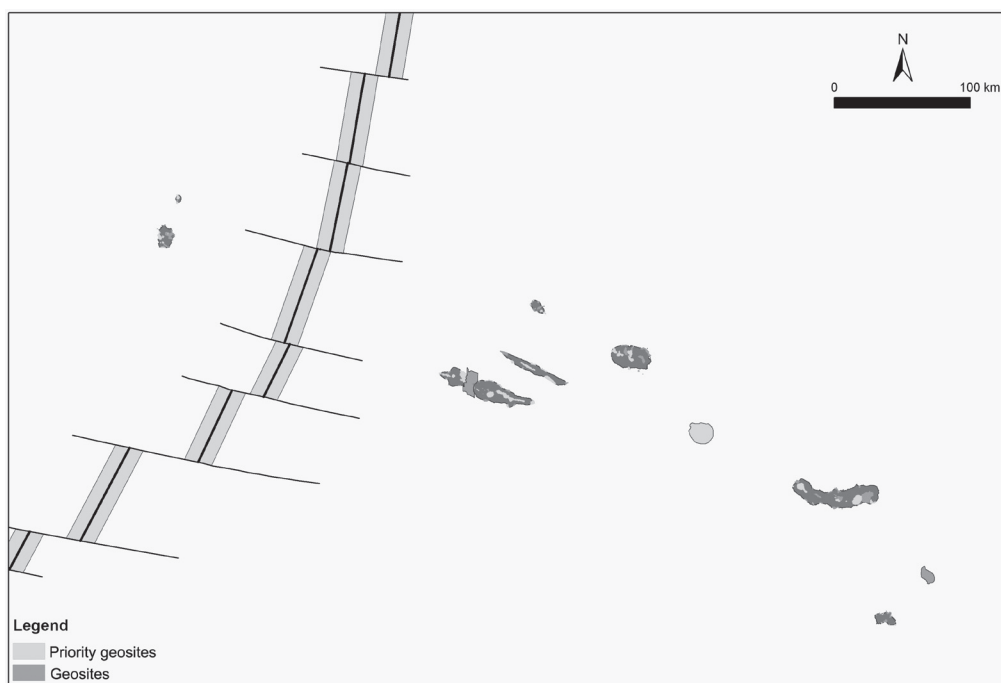
Thanks to its volcanic origin, the archipelago has a very rich and remarkable geodiversity with a wide range of landscapes, forms and structures derived from the types of eruptions, its dynamics and the subsequent actions of weather and erosion (Nunes, 2002). Because of its peculiar geological features and setting, the Azores are a true natural laboratory for volcanic geodiversity (França, et al., 2003).

The recognition of the international relevance of the geological heritage of the territory, its scientific, scenic and educational value, the high number and quality of its geosites and the undoubted importance of its geological heritage, came with the creation of the Azores Geopark, supported with a major effort of the Azores Regional Government to

implement geoconservation and environmental education policies (Costa, et al., 2008; Lima, et al., 2009), and its integration into the European and Global Geopark Networks (EGN and GGN).

The Azores Geopark is based on a network of 121 geosites dispersed by the nine islands and the surrounding seafloor (Figure 2): i) that ensures the representativeness of the geodiversity that characterizes the Azorean territory, ii) that reflects its geological and eruptive histories of about 10 million years, iii) with common conservation and promotion strategies, and iv) based on a decentralized management structure with support in all the islands (Nunes, et al., 2011).

**Figure 2** Azores geosites



Source: Nunes, et al. (2011)

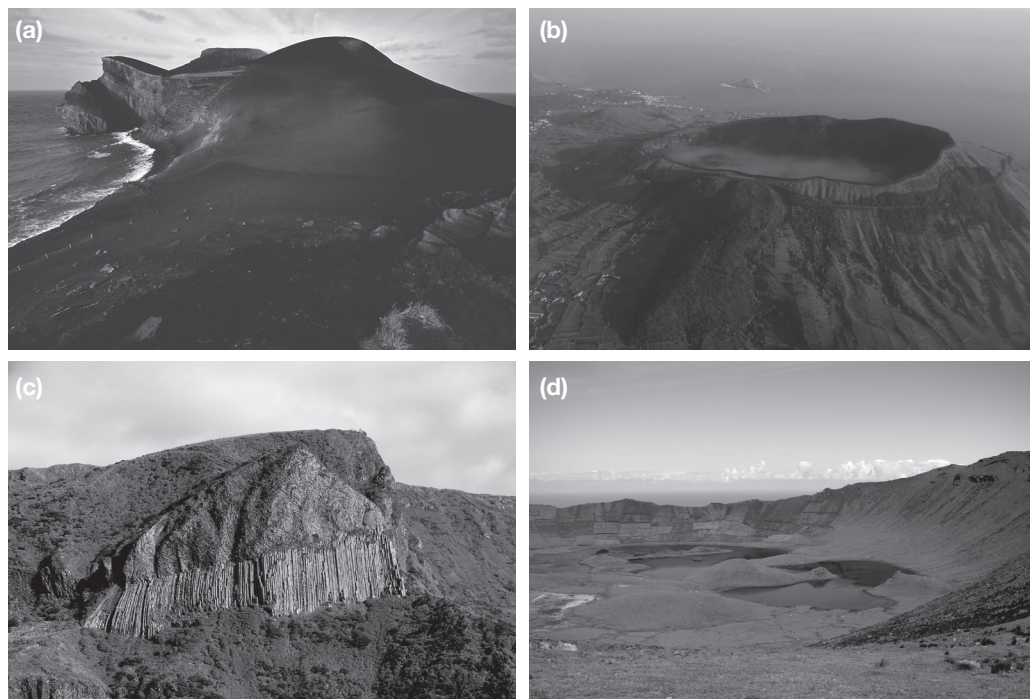
Most of the Azorean geosites are attractive because they are aesthetically appealing and their fantastic and mysterious volcanic phenomena are still active.

The volcanic landscape is the main attraction of the touristic promotion, being the image sold in the touristic campaigns and reflecting the huge geotouristic potential of the archipelago.

## Geotouristic potential

The natural landscapes of the archipelago reflect a high geodiversity, associated with a rich biodiversity with an unquestionable aesthetic beauty, which fascinates local population and visitors, being the starting point for the development of geotourism (Figure 3).

**Figure 3** Azorean geolandscapes: **(a)** - *Capelinhos* volcano (Faial island), **(b)** - *Caldeira* (Graciosa island), **(c)** - *Rocha dos Bordões* (Flores island), **(d)** - *Caldeirão* (Corvo Island)



Source: Azores Geopark

Since the discovery and settlement of the Azores in the middle of the 15<sup>th</sup> century the geolandscapes have been important sources of interest and have attracted several visitors and distinguished naturalists and scientists (Lima, 2007), registered in important documents such as “Saudades da Terra” by Gaspar Frutuoso (1583), a Portuguese priest. It is worth mentioning that Charles Darwin, when aboard the Beagle, visited briefly the Azores in the summer of 1836, taking opportunity to refer the volcanism as an expression of an Atlantic setting (França, et al., 2003).

According to Lima (2007), important steps were taken to initiate the development of geotourism in the archipelago:

- the opening to the public of some volcanic caves, such as Furna do Enxofre in Graciosa island in 1939, the Algar do Carvão in Terceira island in 1968, and more recently,

Furna da Água and Gruta do Natal, also in Terceira island, Gruta do Carvão in São Miguel island, and Gruta das Torres in Pico island, showing part of the volcano speleological heritage of the archipelago;

- the classification of the first geosites, protected as natural reserves in the 1970's (*Pico Mountain* and *Faial Caldera*), and more recently (1990's) others, such as Natural Monuments (e.g. Pedreira do Campo in Santa Maria island, Gruta do Carvão and *Pico das Camarinhas e Ponta da Ferraria* in São Miguel island, and *Gruta das Torres* in Pico island);
- the volcano speleological museum, opened to the public in the 1980's, a property of the Speleological Association Os Montanheiros (Terceira island);
- the ancient footpaths have been used for many years as tourist walking trails and trekking, with the main points of interest - the volcanism, the presence of water (lagoons, streams, waterfalls), flora and fauna and cultural heritage;
- in different places of the archipelago where there are thermal, mineral and carbonated waters, with recognized therapeutic properties, spas (termas in Portuguese) with treatments, either by ingestion or baths, were established. To mention the most important: Termas das Furnas with the first building constructed in the 17th century and Termas da Ferraria and opened in the middle of the 20th century (both in São Miguel island), Termas do Carapacho (Graciosa island) with the nineteenth century building, and Termas do Varadouro (Faial island) opened in the mid20th century;
- the natural conditions create several bathing areas in special places of geological interest as volcanic craters (e.g. Vila Franca islet, near São Miguel island), hydrothermal zones (e.g. Ribeira Quente and Ferraria in São Miguel island, or Carapacho in Graciosa island), natural swimming pools on the volcanic rocks and black sand beaches.

In recent years geotourism has developed in an organized and systematic way in the Azores archipelago. The nine Azorean islands offer a wide range of experiences and emotions that are linked with other values, such as biodiversity, history and cultural heritage, providing the visitors with unforgettable experiences, corresponding to the motto "Come to visit the Azorean volcanoes and enjoy an eruption ... of flavours, smells and experiences!".

This framework has given an opportunity for the creation of local and regional companies which specialized in geotourism, nature tourism, adventure tourism and rural tourism with the development of products and services of the recognized quality that ensures customer satisfaction. Besides promoting geotourism, the Azores Geopark contributes to the promotion and development of traditional activities related to volcanism of the archipelago (e.g. crafts, gastronomy, traditions and customs) and promotes the dissemination of regional resources.

Therefor nowadays visitors can choose from a variety of geotourism-based products, such as geotours, volcanospeleology, rock climbing, mountain climbing, diving, snorkeling, canyoning, coastering, thermal baths, and walking trails that are offered by several specialized geotouristic companies (Figure 4) (Lima, et al., 2012).



**Figure 4** Geotouristic activities: **(a)** - Geotour in *Barreiro da Malbusca* (Santa Maria island), **(b)** - nature photography on the central volcanic ridge (São Jorge island), **(c)** – Walking trail on *Pico Alto* volcano (Terceira island), **(d)** – Guided tour on *Gruta das Torres* lava tube (Pico island)



Source: Azores Geopark

The geotourism strategies in the Azores Geopark are supported by the exploitation, maximization and organization of the existing services and tourist infrastructures, making profit from the available resources and enhancing joint synergies. For this purpose, partnerships with several stakeholders have been set up, such as with the associations responsible for promoting the Azores as a tourist destination and for the qualification of the tourism offer in the region (e.g. the Tourism Association of the Azores and the Regional Association of Tourism-ART). This is done by bearing in mind that the implementation of geotourism requires proper planning to consolidate and develop itself with guarantees of success (Nunes, et al., 2011).

The global strategy of sustainable tourism in the Azores has been successful and its implementation has been recognized. The archipelago is identified as one of the main active volcanic and geothermal touristic destinations of the world (Erfurt-Cooper, 2011), as it is evidenced by several national and international prizes and rewards. In 2007, the National Geographic Traveler magazine considered the archipelago as the second best island in the world for sustainable tourism. In 2008, the publisher Lonely Planet described the region as one of the best destinations worldwide and in 2010 the Forbes magazine distinguished the Azores as “One of the world’s most unique travel

destinations“. In this same year, the Sete Cidades Lake and the Volcanic Landscape of Pico Island were considered two of the „7 Natural Wonders of Portugal“, by public voting integrated in the initiative of the New Seven Wonders Portugal. In the year of 2011, those prizes contained the following classification: (i) the Azores as one of ten best destinations worldwide for summer, given by the National Geographic Traveler; (ii) the walking trail of the Vineyards of Criação Velha, in Pico island, as one of the eight best trails of the World, determined by the Boots n ALL; (iii) Furnas, in São Miguel island, as one of the five more appealing volcanic areas in the world, labelled by the World Travel Guide; (iv) Pico island, as one of the five best secret islands in the world, awarded by the BBC Travel; (v) the Association of the Azorean Municipalities received the Prize “Geoconservation 2011“, attributed by ProGEO Portugal; and (vi) the Faial Island Natural Park received the EDEN Prize, and was confirmed by the European Commission as the first European Destination of Excellence in Portugal (Nunes et al., 2011). In 2013 the archipelago won the QualityCoast Gold Award, an international award for the best sustainable tourism destination.

## Man and the volcanoes

Also since the early days of the Azores settlement, the Azorean people have had a strong connection with “their” volcanoes, living through several volcanic eruptions and experiencing many earthquakes.

Therefore, the culture is closely linked with volcanoes, specifically in festivities and architecture. Given the strong Catholic faith of the inhabitants and the lack of scientific knowledge about these catastrophic natural events, the Azoreans created religious events in order to “calm down the wrath of God”, such as processions and pilgrimages. In addition, it is possible to see old manor houses, monasteries, churches and fortresses built from the rocks of each island, and the stone walls that divide some rural terrains help to understand the local history, as well as their toponymy. There are also places and ruins that which eyewitness the occurrence of natural geological phenomena, such as volcanic eruptions and earthquakes (Nunes, et al., 2011) (Figure 5).

The volcanoes and man’s relationship is also imprinted in some ancestral and traditional practices of the local population which are also of high tourist interest, such as the usufruct of the secondary manifestations of volcanism, existing in several islands with a high potential in the health and well-being of this tourism area, taking an advantage of baths in thermal waters of the recognized therapeutic properties, the intake of carbonated and mineral waters and the use of mud as peloides thanks to their medicinal properties. The gastronomy cooked in the steam of the fumarolic field of the Furnas Lake typifies another typical geo-product of the Azores (i.e. the famous Azorean dish *Cozido das Furnas*) (Nunes, et al., 2011; Viveiros, et al., 2012) (Figure 6).



**Figure 5** Culture elements linked with the volcanoes: **(a)**- religious procession (São Miguel island), **(b)** – ornamental rocks in the regional architecture (Santa Maria island), **(c)** – *Ribeirinha* lighthouse ruins from the 1998 earthquake (Faial island)



Source: Azores Geopark

Also in the literature the Azoreans volcanoes and geologic processes are not forgotten, with his exponent in the famous Azorean poem by José Ferreira, “*Ilhas de Bruma*”, where he wrote “(...) It’s running into my veins black basalt / At the hearth the blazing of the fumaroles / The immense sea fills my soul / And I have green, so much green showing my hope (...)”. This poem became a song, and it is now the Azores Geopark anthem.

**Figure 6** Examples of secondary volcanism usufruct: **(a)**- thermal baths at *Caldeira Velha* (São Miguel island), **(b)** – drinking thermal and mineralized waters (São Miguel island), **(c)** – cooking at Furnas volcano (São Miguel island)



Source: Azores Geopark

## Challenges of the Azorean geotourism

The volcanic landscape is the main promotional icon of the archipelago and for the development of geotourism and it offers a wide range of possibilities for sustainable use, where several activities can be performed and associated with different touristic products. The main challenge to this form of tourism is to keep the balance between the management of the touristic operations and the implementation of geoconservation policies (Lima, et al., 2009). The pressure that the increasing development of tourism have been exerting on some geosites over time, and the need to create alternative forms of tourism which contribute towards the socio-economic development in rural areas, have highlighted the importance to protect and promote the geological heritage of the Azores (Viveiros, et al., 2012).

Other important task is the information about the geosites, geolandscapes and geological manifestations through several information and explanatory resources (Figure 7) as a form to discover and understand some secrets of the Earth that are particularly represented in the Azorean geosites; to notice the geological phenomena that gave rise



to the sites that are visited and valued 'recognize the importance of the natural heritage, its fragility and need for preservation to maintain their natural evolution and ecological balance' and thus, to contribute to the passage of this legacy for future generations and visitors, in accordance with the definition of geotourism made by Hose (1995). In fact, the need of knowledge makes information an effective tool to provide information in accessible language; it has an important role in the increased interest in geology and geoconservation, and to promote their touristic disclosure and a better environmental awareness and education (Lima, et al., 2009).

**Figure 7** Interpretative resources: **(a)** - explanatory panel of *Gruta das Torres* Visitors Center (Pico island), **(b)** - *Capelinhos* volcano Interpretation Center (Faial island), **(c)** - outdoor information panel (Pico island)



Source: Azores Geopark

Being an active volcanic archipelago, there is another obvious challenge in the development of geotourism in the region, health and safety issues with a significant risk factor which is often underestimated (Erfurt-Cooper, 2011). The visitors are knowingly approaching potentially dangerous areas. Therefore, it is necessary to work on the risk prevention by building physical barriers and signs or through information and alerts to visitors to raise awareness about a potential dangerous environment, without decreasing the visitor number. In the Azores the principal hazards to a geotourist are thermal burns from hot springs, fumaroles and other degassing vents, or intoxication by inhalation of volcanic gases, in addition to the risks of any outdoor activity (Figure 8).

**Figure 8** Geotourists in *Caldeira Velha* fumarolic field (São Miguel island)



Source: Azores Geopark

A point of differentiation of the Azores is the enjoyment of the coastal and submarine geosites through coasteering and diving to observe the geomorphology and submarine hydrothermal fields in some shallow geosites.

Another big challenge is to make this niche of tourism accessible to everyone. There are some good examples of inclusive tourism in the archipelago, such as adapted facilities and activities, but it is necessary to generalize them. It is therefore necessary to create conditions to receive people with special needs, such as blind, deaf, handicapped, as well as for seniors and children, and provide a range of activities able to meet the needs of each one, and help to develop their physical and intellectual abilities. It is essential and a priority to create conditions for accessibility and improve the existing ones in order to promote geotourism as an inclusive activity open to all persons.

The Azorean weather sometimes is a constraint and a challenge to the tourist experience, even being just a nature tourist. Thus, there is another challenge which requires having some alternative activities and products in case of unfavourable weather conditions. In the archipelago those alternatives already exist, such as visits to volcanic cavities, the environmental interpretation centres and science centres, for example.

#### Contributions of the Azores Geopark

The rich geodiversity, complemented by natural and cultural heritage, and together with the existing infrastructures (e.g. viewpoints and visitors, interpretation and science centres) provide good conditions for the development and creation of new touristic products.

It is important to note that the Azores Geopark, as an archipelagic territory, does not offer geotouristic services directly to the public, but works through the partners (tourism companies, interpretation and visitors centres, rural accommodation, and restaurants).

The main contribution of the geopark to the development of the geotourism in the archipelago is its practice in producing information and support materials or actions in order to give support to those who make the activities. However, other aspects were also taken into account, such as the promotion of circulation between the different islands (that present complementary geolandscapes and traditions); an increase in the length of stay (also increasing the revenues to local businesses), and suggest a variety of exciting activities and capability to develop with all weather conditions (as it has been mentioned before, the weather is an important factor in oceanic islands).

The products made by the Azores Geopark include (Viveiros, et al., 2012; Machado, et al., 2013) (Figure 9):

- i) “Geosites Charts” per island, with the areas and information about each geosite and also about some support facilities in the island;
- ii) “Azores geosites leaflet”, with a simple map, identification and photos of the geosites of the archipelago;
- ii) “Thematic routes”, including the Volcanic Caves Route (to “discover the subterranean world of the islands”, valuing the volcanic caves and associated visitors centres), the Belvederes Route (to “discover the Azores volcanic landscapes by car”, valuing the numerous belvederes and panoramic points that exist in all islands of the archipelago, easily accessible, superbly located and with support facilities), the Walking Trails (“discover the Azores geosites on foot”, enhancing the Regional Network of Walking trails with about 100 different options), the Science and Interpretation Centres Route (“to learn and explain the Azorean volcanic phenomena”, valuing 25 science, interpretation and visitors centres existing in all the islands), the Thermal Route (to “discover and enjoy the power of the Azores volcanism”, taking an advantage of the benefits in terms of health and well-being of the thermal waters and mud) and Urban Routes (to “discover the geology of my village/town” that allow local population and visitors to see and learn about the rocks in buildings and monuments and to understand the geology of urban areas);
- iii) “Azores Geotouristic Guide”, to support travellers and tourists that visit the islands, but also to assist the tourism companies to promote their products and services. It

- includes suggestions of places to visit (with an explanation of the geological characteristics and geotouristic potential), leisure activities, and other useful information;
- iv) “Geotours in rural areas” to give rise or improve the local socioeconomic activity in this places, socially depressed; this work has been develop in cooperation with the Local Development Associations (such as ARDE) and with Technical/professional schools (through internships and some final course works);
  - v) “Recycling courses” for the touristic companies staff about the geotourism activities of each island, being a continuous work initiated on the “2011 Meeting of Touristic Activities – Geotourism”, co-organized by the Azores Geopark and Regional Association of Tourism;
  - vi) “Geotourism workshops” targeted at students of technical/professional tourism courses;
  - vii) an “Azores Geopark Passport” is being develop to be launched next season in order to promote the thematic routes and travelling between the islands and the partners of the geopark;
  - viii) a “Geotourist conduct” was defined and disseminated through various tools;
  - viii) and several local products have been recognized as geoproducts of the Azores; this is the case of the wines “Terras de Lava”, “Basalto”, “Magma” or “Pedras Brancas” and the “Cozido das Furnas”, a typical dish cooked in the ground with natural volcano steam.

In addition, visitors can choose from a great variety of geotourism-based products, such as geotours, volcanospeleology, rock climbing, mountain climbing, diving, snorkelling, canyoning, thermal baths, and walking trails that are offered by various tourism companies.

It is important to mention that it is currently a test phase of a monitoring geosites methodology which is going to be applied in the mostly visited places (e.g. belvederes, other viewpoints, or local places where leisure activities can be performed) for the verification of site conditions, their natural evolution and effects of anthropogenic pressure. In addition, this methodology should also help to give an accurate answer when maintenance or changes of the management rules of the site are needed.

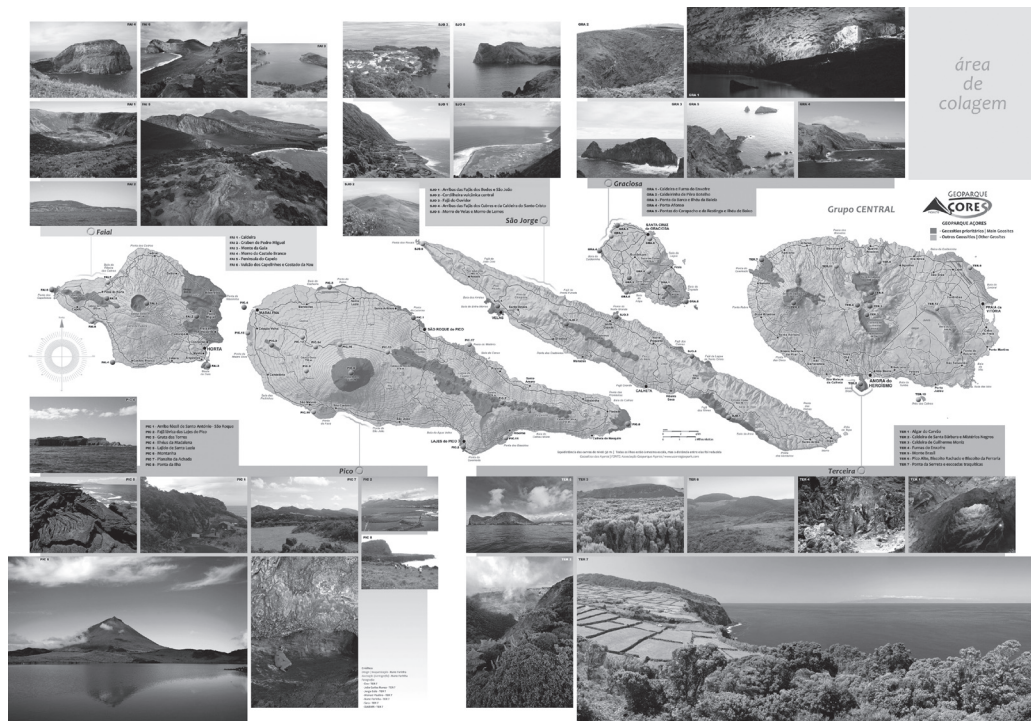
## Conclusion

Geotourism can be considered as an anthropocentric perspective of the use of the geological heritage and geodiversity. This captivating and promising activity involves learning, exploration and discovery, being also an appealing way of environmental awareness that spread wide through the general public (local and foreign).

Volcanic and geothermal landforms are obviously attractive destinations for geotourism where the special geodiversity offer an extensive range of outdoor direct contact with the volcanic structures and the emotions that they provide, and with including the opportunity for education about geoheritage as well as an insight into their significant value for regional culture, religion and history.



**Figure 9** Geotouristic products developed by the Azores Geopark: **(a)** – Azores geosites leaflet, **(b)** – Geotourism workshop fieldtrip at Furnas volcano (São Miguel island)



Source: Azores Geopark

In recent years, the Azores Tourism has defined a strategy that includes geotourism as one of the main vectors thanks to the great geological potential of the Azores. The implementation of the Azores Geopark in the archipelago has become an important support for the development of geotourism, and for disclosure and awareness of the importance of the geolandscapes (integrated on the geological heritage, or not) and geoconservation issues, as well as emphasizing the importance of the abiotic part of nature as a basis to all the ecological systems, even to human activities. The creation of various tourism companies, restaurants and accommodations that offer products and services specialized in geotourism also helped to earn its space and marked its strong position in the Azorean nature tourism.

In the Azores archipelago the basic work has been done (e.g. identification and analysis of the geological heritage and geodiversity). As mentioned above, since early days the region has presented appealing characteristics, several ancestral activities and conditions for the practice of geotourism.

The Azores as a nature touristic destination should be built up on the experiences and emotions that tourists can experience and witness. The feedback from geotourists (locals and foreigners, has been positive; they express their satisfaction with the quality of the geosites or geolandscapes sites visited and the available variety of activities, products and services. Also from the tourism stakeholders (companies, environmental interpretation centers, and other partners) there have been requests for cooperation and support to some activities or staff training, resulting in the new partnerships and in the development of new geotouristic products.

With the notion that there are always some issues to improve, it is intended in the near future to: i) work on more assertive communication of the Azorean Geotourism; ii) promote and enhance the quality of the services and products; iii) and work on the consolidation of the archipelago as a nature destination, involving in an articulated and committed way public entities, private sector and the general population.

In order to maintain and improve the quality of geotourism, it is necessary to make this dynamic and accessible to all public by the promoting of a strategy that promotes and safeguards the geological heritage, through a monitoring network of the geosites. Moreover, it is also fundamental to stimulate the geotourists for the environmental awareness so that they can acquire the concern to respect the geosites characteristics and to maintain the geosites visited. It is up to today's geotourists to think about the geotourists of tomorrow.

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