



# Accessible Geoparks in Iberia: a Challenge to Promote Geotourism and Education for Sustainable Development

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## Abstract

This work aims at providing an overview regarding accessibility conditions for people with functional diversity among the 15 UNESCO Global Geoparks (UGGs) located in the Iberian Peninsula—4 in Portugal and 11 in Spain—from the point of view of a disabled user wishing to visit a geopark. Website information and a questionnaire composed of closed and multiple choice questions directly administrated to the geopark managers were used aiming at inquiring about facilities provided to people requiring adapted access conditions, including mobility, vision, hearing and cognitive dimensions of access both under the aim of geotourism activities or in the frame of educational programmes. Results show that Iberian UGGs display several facilities for the development of geotourism and education that meet the needs of people with functional diversity. Accessibility facilities to receive people with physical impairments are common, but sensory and communication access facilities are scarce. Geoparks' websites generally lack information concerning facilities for special groups, and the web design does not meet the needs of people that have difficulties with written word and speech. The constraints on implementation of programmes aimed at disabled visitors can be partially overcome if geoparks' leaders seek to integrate partners that currently develop activities for persons with disabilities. Geodivulgar (an innovation project from the Complutense University) and Science without Barriers (an association; Ciencia sin Barreras in Spanish) are pioneer initiatives for the outreach of geology among people with functional diversity in Spain, which currently develops activities and resources that can be of great help to enlarge the geoparks' offer about geotouristic tours and/or educational programmes for disabled visitors. The acquired experience at the Basque Coast UGG can be of great help for other partners of the UGG Network to fully fulfil their roles as agents of sustainable development through geotourism and education for all.

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## Introduction

The 2030 Agenda for Sustainable Development refers to the relevance of empowering people who are vulnerable, i.e., all children, youth, persons with disabilities (of whom more than 80% live in poverty), people living with HIV/AIDS, older persons, indigenous peoples, refugees and internally displaced persons and migrants; it also emphasizes the need of providing inclusive and equitable quality education at all levels—early childhood, primary, secondary, tertiary, technical and vocational training—and for all the people, irrespective of sex, age, race or ethnicity, and persons with disabilities, migrants, indigenous peoples, children and youth, especially those in vulnerable situations, who should have access to lifelong learning opportunities that help them to acquire the

knowledge and skills needed to exploit opportunities and to participate fully in society. It also recognizes that social and economic development depends on the sustainable management of our planet's natural resources, which can be achieved through the promotion of sustainable tourism (UN 2015).

The United Nations 70th General Assembly has designated 2017 as the International Year of Sustainable Tourism for Development “recognizing that well-designed and well-managed tourism can make a significant contribution to the three dimensions of sustainable development” (UN 2016, p. 1). The initiative is framed on the 17 goals to end poverty, protect the planet and ensure prosperity for all over the next 15 years, and was adopted by the General Assembly of the United Nations on September 2015 (UN 2015).

The geological heritage represents a precious resource linked to the geodiversity of a territory and which can be exploited, like other geological resources, for the scientific, educational and tourism purposes (Eder and Patzak 2004; McKeever and Zouros 2005; Ruban 2017 among others). As pointed by Dowling (2011, p. 2) “Geotourism is sustainable tourism with a primary focus on experiencing the earth's geological features in a way that fosters environmental and cultural understanding, appreciation and conservation, and is locally beneficial”. The same author considers that authentic geotourism is based on five key principles: It is geologically based (that is, based on the earth's heritage), sustainable (i.e., economically viable, community enhancing and fosters geoconservation), educative (achieved through gointerpretation), locally beneficial and it generates tourist satisfaction. Taking this wide perspective into account, non-formal (and also informal) education can be viewed as geotouristic activities, and formal education can use geoparks as an educational resource, leading to enhance geoconservation awareness (Henriques et al. 2012).

The UNESCO Global Geoparks (UGGs) are “single, unified geographical areas where sites and landscapes of international geological significance are managed with a holistic concept of protection, education and sustainable development” (UNESCO 2016, p. 3). Education for all at all levels is at the core of the UGG concept, which must contain geology of international significance independently evaluated by scientific professionals, that is used as a sustainable economic asset for the people who live there, such as through the development of responsible tourism (IGCP 2012). Like educational activities, a sustainable development plan including geoeeducational programmes is required for the people who live in an area aspiring to become a UGG, being sustainable tourism a current form to achieve it through, for example, the development of walking or cycling trails, training of local people to act as guides and creation of innovative local enterprises for accommodation and other services, while the geological resources of the area are protected (Dowling 2009; Henriques and Brilha 2017 and references therein).

In this work, it is intended to analyse how Iberian UGGs accomplish their role in promoting sustainable development through geotourism and education, taking people with functional diversity into account, i.e., persons who have the potential to access the same functioning as other people but in a different way—often through the use of technical components and technological resources (Romañach and Lobato 2005; Toboso 2011).

In order to develop an accessible tourism destination, the European Network for Accessible Tourism highlights the importance of research and educational institutes in the production of knowledge and the development of training and education in support of tourism accessibility; it also identifies three key barriers which prevent a tourist destination from becoming increasingly accessible: infrastructure and physical barriers, financial barriers and knowledge and information barriers, the last one to be addressed by using case studies and best practices of successful destinations (UNWTO 2016; Ambrose et al. 2017).

As so, the content of the available information on the websites of the Iberian UGGs was analysed in order to determine the accessibility facilities that they provide through that medium for persons with disabilities; this information was complemented by data collected from surveys carried out with geopark managers during July, 2017 to September, 2017.

Aiming at assisting Iberian UGGs to promote geotourism as an inclusive activity open to all persons, as well as to implement strategies and provide resources to support geoeeducation for all, a pioneer activity developed on June 2015 will be described in detail: a fieldtrip for a group of people with deaf blindness lacking geological educational background. The experience took place at the Basque Coast UGG in Zumaya, Northern Spain, facilitated by the IAGD (International Association for Geoscience Diversity) partnered association “Ciencia sin Barreras” (Science without Barriers). This field trip was sponsored by the Geological Society, the University Complutense project “Geodivulgar”, and individual donations (Gomez-Heras and Garcia-Frank 2016). This experience can serve as inspiration model for the development of analogous initiatives in other geoparks, thus contributing to allow the direct and indirect fruition of geological sites which are of high scientific relevance or particularly evocative (Panizza and Piacente 2008).

## Geoparks of the Iberia: Accessibility Conditions for People with Functional Diversity

Around 80 million EU citizens are to a greater or lesser extent affected by a disability. As a result of demographic aging, this figure is expected to increase to 120 million by 2020 (AP 2017).

The general demand for accessibility in Europe alone exceeded 120 million people in 2005, more than 27% of the European population at the time. It is estimated that by the end of 2025, this demand will reach an approximated 160 million people (Bowtell 2015). The senior segment is growing significantly, and by 2050, it is expected that all regions of the world except Africa will have nearly a quarter or more of their populations at ages 60 and above (UN 2017). Accessibility is a prerequisite for these people to be able to participate and play an active role in society, including travel and tourism.

Tourism is a strategic activity for Portugal, being its largest export activity, accounting for 15.3% of exports of goods and services (AP 2017). The direct contribution of travel and tourism to GDP was EUR11.9bn (USD13.3bn), 6.4% of total GDP in 2016 and is forecast to rise by 2.8% in 2017, and to rise by 2.2% pa, from 2017 to 2027, to EUR15.1bn (USD16.9bn), 7.3% of total GDP in 2027 (WT&TC 2017a).

In Spain, leisure travel spending (inbound and domestic) generated 86.9% of direct travel and tourism GDP in 2014 (EUR96.5bn); the direct contribution of travel and tourism to GDP was EUR57.1bn (USD63.7bn), 5.1% of total GDP in 2016 and is forecast to rise by 3.5% in 2017, and to rise by 2.0% pa, from 2017 to 2027, to EUR72.1bn (USD80.5bn), 5.5% of total GDP in 2027 (WT&TC 2015, 2017b).

Accessible tourism is a form of tourism that involves collaborative processes between stakeholders that enables people with access requirements, including mobility, vision, hearing and cognitive dimensions of access, to function independently and with equity and dignity through the delivery of universally designed tourism products, services and environments (Michopoulou et al. 2015). It must not be envisaged as “a separate kind of tourism with its own types of venues and attractions; rather, it should be part of every tourism destination, so that cultural venues, leisure and sport, shopping, and other tourist activities are accessible for all visitors” (Ambrose et al. 2017, p. 14).

Among the European Union, there are about 313,286 suppliers with accessible tourism potential being the UK, France, Spain and Italy, the countries with more than 10,000 suppliers of accessible tourism (AP 2017).

Iberian UGGs (15 in total) are scattered within Portuguese (4) and Spanish (11) territories, representing important tourist destinations for a wide range of geotourists from visitors with no or low motivation to visit geosites to those aware or interested in geological tourism (Hurtado et al. 2014). Located in Southern Europe Iberian, UGGs can be attractive all the year and desirable for all the people (Fig. 1). It remains to be seen whether these geoparks are prepared to face the big challenge of making this niche of tourism accessible to everyone.

## Accessibility Conditions Based on Website Information

Website information about accessibility conditions in the Iberian UGGs was analysed, taking available data regarding geotourism activities and educational programmes into account (Table 1).

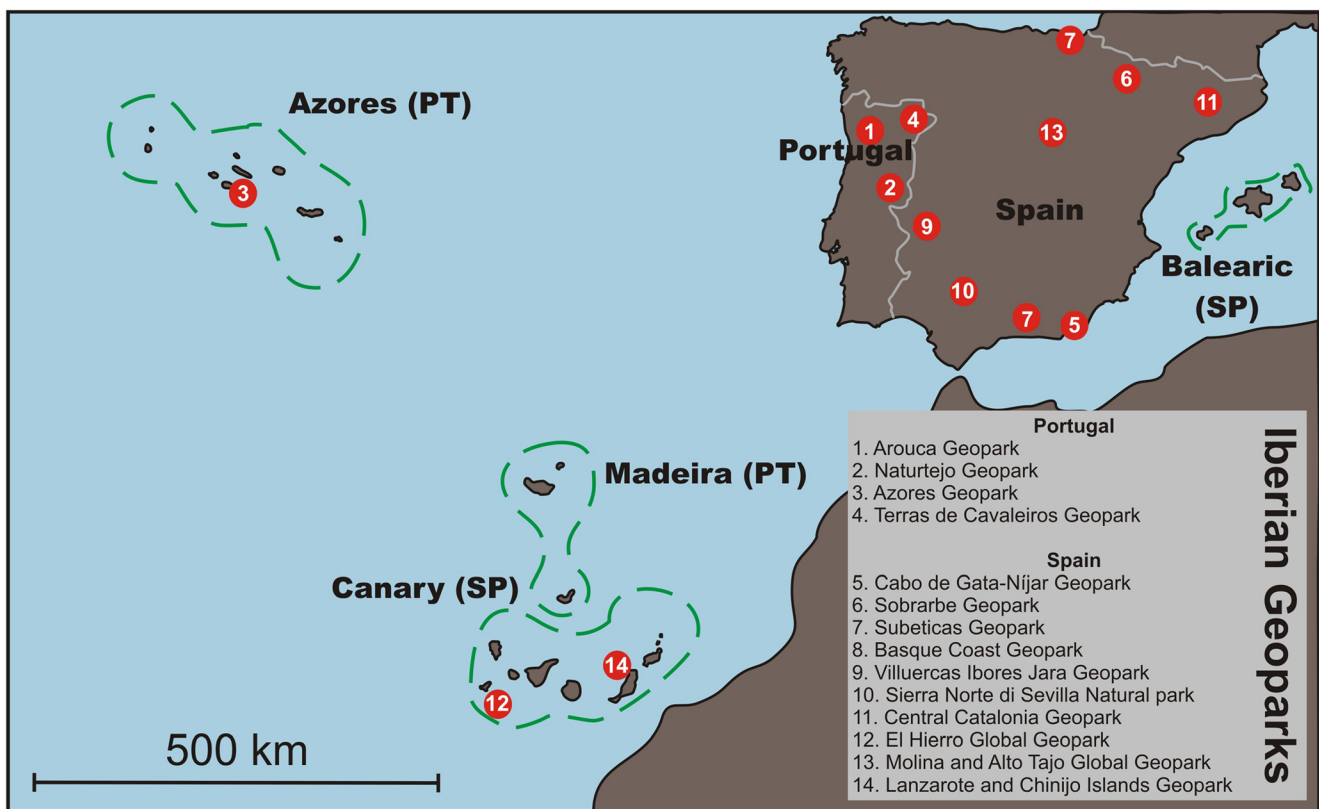
Among the 15 analysed websites, only the Villuercas-Ibores-Jara UGG, located in the southeast of the province of Cáceres (in Extremadura, Spain), displays online information regarding facilities to receive people with special needs: parking for disabled at the tourism office of Guadalupe and accessibilities for people with reduced mobility at Museo Geominero de Logrosán and at several interpretation centres (Cueva Castañar de Ibor, ZEPA Sierra de Villuercas, Arqueología Comarcal and Hornos de la Calera).

However, although information concerning facilities for special groups is not online, many Iberian UGGs display accessibilities for disabled people, such as blind, deaf and handicapped (Henriques 2015; Figs. 2, 3, 4, 5 and 6); others assume the commitment to create conditions to receive people with special needs, as well as seniors and children, and provide a range of activities able to meet the needs of each one (Lima et al. 2013).

The web design used to create the official websites of the analysed geoparks does not generally meet the needs of people that have difficulties with written word and speech. Special care must be taken when designing any official website, since a common accessibility barrier begins with the website design and web tools. For avoiding this, there are free sites that provide specific tools for the analysis of accessibility of websites (e.g., TAW 2017). Nevertheless, there are some common errors that can be easily solved, like the use of alternative text in each image (so that a person with visual impairment can access to the image information if he/she uses a screen reader; otherwise, that information is inaccessible) or the use of transcriptions in videos for people that cannot hear. Making a text more readable is something as simple as using larger font types, spacing and line width. This, together with adequate contrast between text and background colours, allows seeing the content better and makes texts more readable for many people. There are organizations that help with this specific focus, developing strategies, resources or guidelines in order to improve the web and make them accessible for people with functional diversity (e.g., WAI 2017).

## Accessibility Conditions Based on Data Collected from Surveys

A questionnaire was directly administrated to the 15 geopark managers during July, 2017, using the official email (Table 1), written in Portuguese for the Portuguese geoparks and in



**Fig. 1** Location of the 15 UNESCO Global Geoparks established in the Iberia. PT Portugal, SP Spain

Spanish for the Spanish geoparks, in order to facilitate the participation. In September, 2017, a print copy was directly provided to geoparks' managers attending the 14th European Geoparks Conference held in September 2017 at the Azores Geopark (Portugal). The questionnaire was directly and intentionally applied, and it was composed of closed questions and multiple choice questions ([Supplementary Electronic Material](#)).

It included five groups of questions inquiring about the accessibility conditions of the geopark for special groups, both under the aim of geotourism activities or in the frame of educational programmes. The questionnaire was based on Darcy's (1998) approach on facility design, which can be split into three dimensions: (1) physical access, which involves people with physical impairments using wheelchairs or walking aids; (2) sensory access, for example, tactile markings, signs and labels, hearing augmentation systems and audio cues for lifts and lights; and (3) communication access, which involves people that have difficulties with written word and speech.

The five groups of closed questions aim at inquiring (1) how many geosites in the Iberian UGGs display accessibility facilities to receive people with special needs, (2) how many museums and/or interpretative centres of the Iberian UGGs display accessibility conditions to receive people

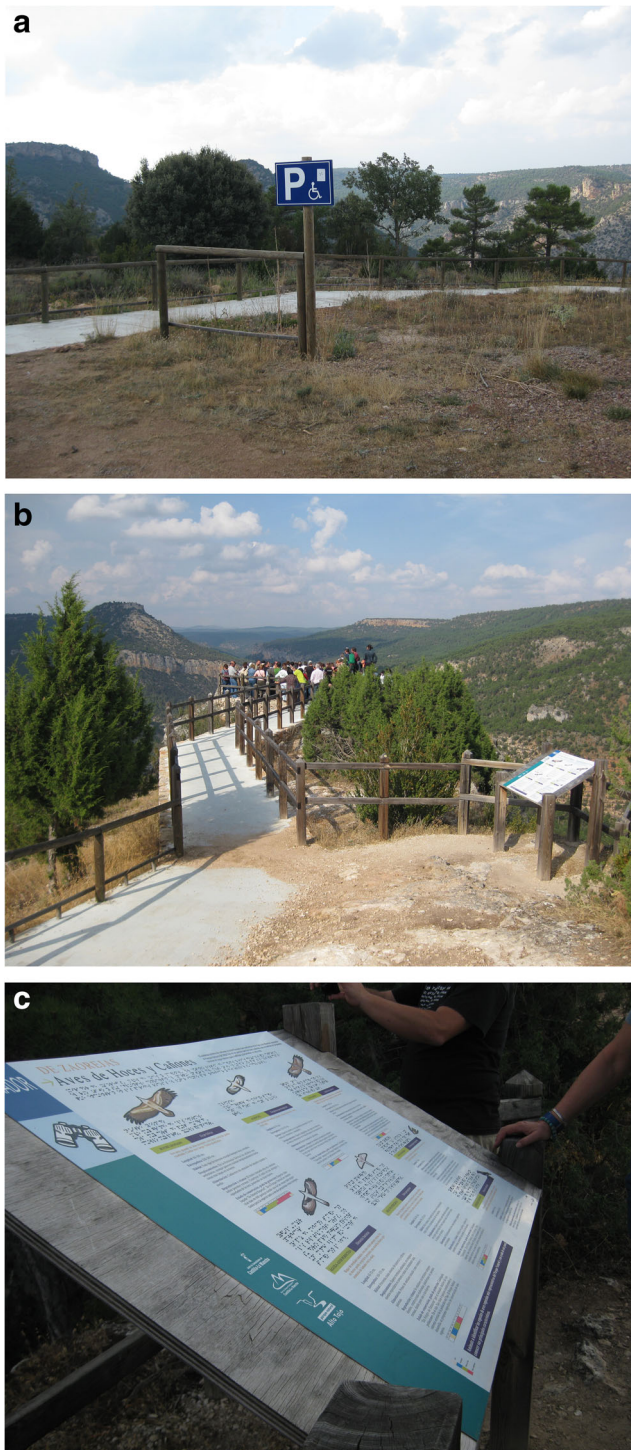
with special needs, (3) if Iberian UGGs offer geotouristic tours and/or educational programmes for disabled visitors and (4) what kind of support the Iberian UGGs need to adapt facilities and activities to meet the special needs of visitors.

Of the 15 geoparks contacted, only two Portuguese and two Spanish geoparks replied the questionnaire. The four respondents claim to display accessibility facilities to receive people with special needs in a percentage between 3 and 98% of their geosites and between 60 and 100% of their interpretation centres. Regarding the type of accessibility displayed in the geoparks, two of them display audio and video records in their official websites. People with physical impairments using wheelchairs or walking aids have facilities from 2 to 100% of the geosites included in the surveyed geoparks, and only one of them claim to display accessibility facilities to receive blind people in one of their geosites. This percentage rises to 75% when questioned about sensory accessibilities displayed by museums or interpretation centres, which include audio-guides and Braille panels. Regarding the geoparks' offer about geotouristic tours and/or educational programmes for disabled visitors, one provides stimulating geotouristic and educational activities of the five senses, another displays geotours with specialized guides and the other two refer that they have not yet had time to implement such initiatives.

**Table 1** The Iberian UNESCO Global Geoparks: name, location, official website and electronic contact

Geopark	Country	Website	Contact
Cabo da Gata	Spain	<a href="http://www.juntadeandalucia.es/medioambiente/cabodegata-nijargeopark">http://www.juntadeandalucia.es/medioambiente/cabodegata-nijargeopark</a>	I-pn.cabodegata.capma@juntadeandalucia.es
Naturejo	Portugal	<a href="http://www.naturejo.com/">http://www.naturejo.com/</a>	geral@naturejo.com
Sierras Subbéticas	Spain	<a href="http://www.juntadeandalucia.es/medioambiente/site/portalweb/menuitem.7e1cf46ddf59b227a9ebe205510e1ca/?vgnextoid=c4107d976ba95210VgnVCM2000000624e50aRCRD&amp;vgnextchannel=8ac0ee9b421f4310VgnVCM20000000624e50aRCRD">http://www.juntadeandalucia.es/medioambiente/site/portalweb/menuitem.7e1cf46ddf59b227a9ebe205510e1ca/?vgnextoid=c4107d976ba95210VgnVCM2000000624e50aRCRD&amp;vgnextchannel=8ac0ee9b421f4310VgnVCM20000000624e50aRCRD</a>	pn.subbeticas.cma@juntadeandalucia.es
Sobrarbe	Spain	<a href="http://www.geoparquepirineos.com/">http://www.geoparquepirineos.com/</a>	gerencia@sobrarbe.com
Arouca	Portugal	<a href="http://aroucageopark.pt/pt/">http://aroucageopark.pt/pt/</a>	geral@geoparquearouca.com
Basque Coast	Spain	<a href="http://geoparkea.com/en/">http://geoparkea.com/en/</a>	geogarapen@geogarapen.com
Sierra Norte de Sevilla	Spain	<a href="http://www.juntadeandalucia.es/medioambiente/site/portalweb/menuitem.7e1cf46ddf59b227a9ebe205510e1ca/?vgnextoid=a2572de842555310VgnVCM1000001325e50aRCRD&amp;vgnextchannel=b2798c09651f4310VgnVCM1000001325e50aRCRD">http://www.juntadeandalucia.es/medioambiente/site/portalweb/menuitem.7e1cf46ddf59b227a9ebe205510e1ca/?vgnextoid=a2572de842555310VgnVCM1000001325e50aRCRD&amp;vgnextchannel=b2798c09651f4310VgnVCM1000001325e50aRCRD</a>	pn.sierranorte.cma@juntadeandalucia.es
Villuercas-Ibores-Jara	Spain	<a href="http://www.geoparqueviluercas.es/galleries/en-plena-sierra/">http://www.geoparqueviluercas.es/galleries/en-plena-sierra/</a>	josemaria.barrera@oad1.es
Central Catalonia	Spain	<a href="http://www.geoparc.cat/es/">http://www.geoparc.cat/es/</a>	info@geoparc.cat
Azores	Portugal	<a href="http://www.azoresgeopark.com/?lang=EN">http://www.azoresgeopark.com/?lang=EN</a>	info@azoresgeopark.com
Molina and Alto Tajo	Spain	<a href="http://www.geoparque Molina.es/">http://www.geoparque Molina.es/</a>	Monaste1@gmail.com
El Hierro	Spain	<a href="http://elhierrogeoparque.es/">http://elhierrogeoparque.es/</a>	cespinosa@el-hierro.org
Lands of Knights	Portugal	<a href="http://geoparkterrasdecavaleiros.net/">http://geoparkterrasdecavaleiros.net/</a>	geral@geoparkterrasdecavaleiros.com
Lanzarote and Chinijo Islands	Spain	<a href="http://www.geoparque lanzarote.org/geoparque-lanzarote-y-archipiélago-chinijo/">http://www.geoparque lanzarote.org/geoparque-lanzarote-y-archipiélago-chinijo/</a>	geoparque@cabilododelanzarote.com
Las Loras	Spain	<a href="http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/unesco-global-geoparks/list-of-unesco-global-geoparks/spain/las-loras/">http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/unesco-global-geoparks/list-of-unesco-global-geoparks/spain/las-loras/</a>	info.geoloras@gmail.com





**Fig. 2** Facilities provided to people with special needs at the Zaroejas viewpoint (Molina and Alto Tajo UNESCO Global Geopark). **a** Informative panel indicating the existence of a trail equipped for disabled people. **b** Ramp access to the viewpoint. **c** Interpretative panel with Braille information

Geoparks' managers were asked about what kind of support they need to adapt facilities and activities to meet the special needs of visitors using multiple choice questions. Of



**Fig. 3** Facilities provided to people with special needs at the Elorriaga viewpoint (Basque Coast UNESCO Global Geopark). **a** Informative panel indicating the distance to the belvedere. **b** Disabled people can rest during the trail leading to the belvedere



**Fig. 4** Facilities provided to people with special needs at the Ribeira Seca Fountain geosite (Azores UNESCO Global Geopark). The use of transparent glass around the fountain facilitates observation for people with wheelchairs





**Fig. 5** Facilities provided to people with special needs in a viewpoint located at the Regional Route 1-1 (Azores UNESCO Global Geopark). The installation of ramps in the parking facilitates the access to people with wheelchairs



**Fig. 6** Facilities provided to people with special needs at the Arouca UNESCO Global Geopark. **a** Adequate trails to access the Pedras Boroas do Junqueiro geosite facilitates its use to people with wheelchairs (photo by Arouca Geopark). **b** Access by lift to the Arouca Weather Radar geosite, where the use transparent glass around the Radar Tower facilitates observation of the Castanheira Coast for people with wheelchairs (photo by Alexandra Paz)

the four geoparks, three assume that the geopark is searched by people with special needs, and half of them consider being technically impossible to adapt the geosites to people with sensory difficulties (blind, mute or deaf). They all complain about the lack of economic resources to carry out accessibility infrastructures (ramps, elevators, etc.), but three complain about the lack of human and economic resources for different purposes: to guide visits to geosites and to implement educational activities for people with cognitive difficulties, to produce alternative digital resources (Braille and sign language) and to acquire and maintain a trained assistance dog to assist a visually impaired (“guide dog”), hearing impaired (“deaf dog”) or with a motor, mental or organic disability (“service dog”).

The rate of questionnaire responses was very low (27%), and it is sure that Iberian UGGs display much more accessibilities than what can be concluded from the analysed data. And the managers’ awareness about all these inclusiveness issues is certainly higher than the results reflected by the questionnaire responses. In a similar survey regarding the role played by geoparks in improving the economy of local populations, the rate of questionnaire responses was also very low (39%; Farsani et al. 2011). Difficulties in convincing geoparks’ representatives to participate in this type of research may be related to the huge amount of requests to which they are permanently subject. They daily face great challenges in order to maintain the quality standards that the UNESCO Global Geoparks Network requires, being the lack of economic and human resources a permanent difficulty for the implementation of any action in the geopark.

Specific tasks like the production of alternative resources in Braille or the training of an assistance dog require specialized actions performed by experts. The Portuguese Agency for Tourism runs since 2016 the “All for All Programme” aiming at providing awareness, training and knowledge for organizations and enterprises about “Tourism for All”, and at supporting projects to improve accessibility of infrastructures, equipment and tourism resources (TP 2017). The integration of partners that currently develop activities for persons with disabilities—e.g., ACAPO, the National Organization of Portuguese blind people (<http://www.acapo.pt/>), or ONCE, the National Organization of Spanish blind people (<http://www.once.es/new>)—within the geoparks’ action plans can help overcome the systemic lack of economic resources and expertise (Mineiro 2017). The dissemination of good practices of accessibilities targeting people with functional diversity among other geoparks can also contribute to enlarge the relevance of UGGs in the promotion of sustainable tourism. In fact, the Global Geoparks Network “is a dynamic network where members are committed to work together, exchange ideas of best practice, and join in common projects to raise the quality standards of all products and practices of a UNESCO Global Geopark” (GGN 2017).

## The Geodivulgar Project and the Science without Barriers Association

Various practices demonstrate the value of science outreach directed to people with disabilities (especially to people with intense learning difficulties and those who have undergone some sort of educational marginalization; see UNICEF 2010). Based on past experiences, these activities are not only a learning tool but also a way of improving learners' self-image and, therefore, their quality of life (e.g., García-Frank et al. 2014a; Gomez-Heras et al. 2014). Moreover, they show how to implement simple and low-cost adaptations fostering inclusive outreach and education practices focused on science and technology issues, as presently required to increase scientific literacy among any citizen.

### Geodivulgar: Geology and Society (Geología y Sociedad)

Geodivulgar is a pioneer project for the outreach of geology among people with functional diversity in Spain. It is an innovation project of the University Complutense of Madrid (UCM, Spain), chosen among the best of its respective annual competitive calls since 2013. Different partners configure its working groups, which include university lecturers, graduate and postgraduate students and technical staff from the UCM. Besides, some of the members of Geodivulgar belong to other universities and research institutions within Iberia, such as the University Autónoma of Madrid (Spain), University of Alcalá (Spain), University of Coimbra (Portugal), Consejo Superior de Investigaciones Científicas (Spain) or Instituto Geológico y Minero de España (Spain), among others.

The project was launched in 2012, when a group of geologists noticing the need of dissemination of Earth Sciences among the society has achieved different goals in relation to promote geological activities covering various collectives. Some of those actions were focused on pre-graduate students (geological workshops, donation of educational materials) and other to general public (geo-routes, story and illustration contests related to geological issues, Geolodays). However, according to the projects' motto "Geology for everybody", the group began to promote also activities for people with functional diversity. The first activities were integrative rather than inclusive (see García-Frank et al. 2014a, b, 2016; Gomez-Heras et al. 2014), but the later recorded an increase during the last year (e.g., García-Frank et al. 2017; SGE 2017; Table 2).

### The Non-Profit Association Science without Barriers (Ciencia sin Barreras)

This association was founded in 2014 by a group of scientists and professionals related to disability seeking to promote inclusive learning and science literacy among people with

disabilities, in line with the motto "Science for everybody". Since much of them were members of the Geodivulgar project, the first actions were almost all related uniquely with geological workshops. Now, several groups integrate the different disciplines, and Geodivulgar is the representation of Earth Sciences within the association. The activities organized so far have been done on a volunteer basis. The association's volunteers include, in addition to scientists, psychologists, social workers, university students and others, who bring their own expertise. The association follows mainly three lines of work: organization of activities (either specifically targeted to people with functional diversity—integration approach or open to everybody—inclusion approach); talks, lectures and educational research; and self-training and training of volunteers. In 2016, the association was recognized as one of the 98 innovative practices and policies with a focus on inclusive education and information and communication technologies considered as worldwide role models in their field by the project "Zero Project". The Zero Project is an international initiative that focuses on the rights of persons with disabilities globally, which seeks to identify the status quo of the implementation of the United Nations Convention on the Rights of Person with Disabilities (ZP 2017).

Finally, it must be highlighted that the association is a meeting point among outreach professionals and functional diversity public organizations. This allows having permanent relationships with important foundations covering different collectives (i.e., ONCE, the National Organization of Spanish blind people) and consents to programme activities with important scientific agencies such as the Geological Society (Gomez-Heras and García-Frank 2016), the European Geosciences Union (Gomez-Heras et al. 2017) or the European Space Agency (Gálvez et al. 2017).

### Examples of Inclusive Best Practices from the Projects in the Basque Coast UNESCO Global Geopark

In June 2015, a group of geologists from Geodivulgar and Science without Barriers projects organized a fieldtrip to the Basque Coast UNESCO Global Geopark (Northern Spain) which was attended by persons with and without deaf blindness and with no geological educational background. There were four working groups composed by one deafblind person and a participant without deaf blindness, who were accompanied by a mediator and a geology disseminator.

Appropriate science education strategies were developed for people with deaf blindness based on current know-how on science education mobilizing knowledge inherent to the earth sciences. This activity, as well as previous ones, was prepared and designed with expert mediators, who are professionals related to deaf blindness, in order to guide the scientists with regard to the learning strategies and specific needs of the attendees.



**Table 2** Activities promoted by the Science without Barriers Association under the aim of the Geodivulgar Project

Date	Action	Website/podcast	Remarks
May 22, 2017	Radio programme “Marca España” in Radio Exterior	<a href="http://mvod.lvl.rtve.es/resources/TE_SMARCAE/mp3/0/0/1495446466800.mp3">http://mvod.lvl.rtve.es/resources/TE_SMARCAE/mp3/0/0/1495446466800.mp3</a>	Title: La geología más popular. Interview: 2017 Madrid Geoloday chronicle. Audio podcast (from 4:05” to 28:23”; Spanish)
May 09, 2017	Television announcement of the Madrid Geoloday 2017 in the news. TV Channel: La 1	<a href="http://rtve.es/v/4013322">http://rtve.es/v/4013322</a>	Voucher of ONCE; Spanish Lottery supported by the National Organization of Spanish blind people referring to the 2017 Madrid Geoloday Video (Spanish)
May 06, 2017	Video Geoloday of Madrid made by the association Ciencia sin Barreras	<a href="https://youtu.be/XKsu6O9JizY">https://youtu.be/XKsu6O9JizY</a>	Video (English subtitled)
2016	Short documentary “Geología sin Barreras” (Geology without barriers) made by the association Ciencia sin Barreras. Fieldtrip to the geopark of the Basque Coast in Zumaia (Northern Spain)	<a href="https://www.youtube.com/watch?v=UofKRblfptY">https://www.youtube.com/watch?v=UofKRblfptY</a> <a href="https://www.youtube.com/watch?v=wMeFCwqbY3Y">https://www.youtube.com/watch?v=wMeFCwqbY3Y</a>	Video (Spanish Original soundtrack with Spanish subtitles and Spanish sign language)
September 02, 2015	Radio programme “Hoy empieza todo con Marta Echeverría” in Radio 3	<a href="https://www.youtube.com/watch?v=i2uWUBsY3Ow">https://www.youtube.com/watch?v=i2uWUBsY3Ow</a> <a href="http://www.rtve.es/alacarta/audios/hoy-empieza-todo-con-marta-echeverria/hoy-empieza-todo-marta-echeverria-cronica-fresca-ciencia-sin-barreras-02-09-15/3266466/">http://www.rtve.es/alacarta/audios/hoy-empieza-todo-con-marta-echeverria/hoy-empieza-todo-marta-echeverria-cronica-fresca-ciencia-sin-barreras-02-09-15/3266466/</a>	Video (Spanish subtitled) Title: Crónica a la fresca: Ciencia sin barreras (Spanish)
June 27, 2015	TV programme “En lengua de signos” in La2 de TVE	<a href="https://www.youtube.com/watch?v=AV2lrcydc4g">https://www.youtube.com/watch?v=AV2lrcydc4g</a>	Title: Excursión Geológica a Zumaia.
June 26, 2015	Conference. Confronting Barriers to inclusion: opening the gate to accessible fieldwork. The Geological Society of London.	<a href="https://www.youtube.com/watch?v=QokJruAtmg0">https://www.youtube.com/watch?v=QokJruAtmg0</a>	Video (English)
October 12, 2013	TV programme “En lengua de signos” in La2 of TVE	<a href="https://www.youtube.com/watch?v=jhsRD-pLXF8">https://www.youtube.com/watch?v=jhsRD-pLXF8</a>	Title: Geology workshop for deafblind people (made September 06, 2013) (Spanish)

Previous successful activities adapted to people with deaf blindness have been developed by Geodivulgar and Science without Barriers projects (see García-Frank et al. 2014b, 2016; Gomez-Heras et al. 2014). They included fieldtrips to palaeontological sites (Somosaguas, Madrid, see Navalpotro et al. 2015), and tactile workshops with fossils, rocks and minerals, demonstrating the high potential of geology for being successfully taught through sensory activities, which allow acquiring abstract concepts to people with disabilities (García-Frank et al. 2016). Also, a stratigraphy fieldtrip adapted to people with visual impairment was twice prepared and carried in Riba de Santiuste (Guadalajara, see Gomez-Heras et al. 2017).

Since most of the Geodivulgar and Science without Barriers activities are destined to people with functional diversity, aspects related to the tailoring of multi-sensory teaching materials are crucial: Universal design of materials make activities suitable for all public, including people with functional diversity (Fesharaki et al. 2016; Gomez-Heras et al. 2017). As so, the fieldtrip was preceded by a workshop in the Algorri interpretation centre, conducted by resources especially created for the activity aiming at the participants' cognitive, geographical and psychological preparation for the fieldtrip (Orion 1993).

In the case of people with visual deficits, all the concepts that are to be told must be supported with tactile material, with remarkable density, odour or flavours, so that these senses can compensate for the sight deficit (Fesharaki et al. 2016). Examples of some adaptations include the use of three-dimensional maps for spatial orientation, or samples of endogenous rocks slightly heated as a starting point for the explanation of the internal heat of the Earth, plate tectonics and the rock cycle (Gomez-Heras et al. 2014). Figure 7 shows the simulation of how a turbidity forms, with the help of different temperature flows, in order that deafblind people can sense the arrival of the sediments.



**Fig. 7** Activities prior to the fieldtrip to the Basque Coast UNESCO Global Geopark (Northern Spain) carried out on June, 2015: tactile material used to enable the reconstruction of a turbidite flow using different temperature fluids

The fieldtrip was performed through a careful selection of easily reach outcrops of the Zumaya flysch due to the mobility restrictions of the participants. There, abstract concepts were explained through supporting tactile material (rubber bands for explaining folding and stratigraphy concepts and fossils and rocks in the outcrop) enabling attendants to overcome cognitive, social and methodological barriers (Figs. 7, 8 and 9), thus reducing the “novelty space”, as defined by Orion (1989).

After that, an evaluation was made (questionnaires, structured interview, etc.) to highlight the strengths and weaknesses of the activities, from both educational and social perspectives. It should be noted that the questions have to be easily understandable (very precise and direct), due to the difficult communication routine that has to be performed and involved scientific-mediator-deafblind person interactions. The answers have shown that all participants in the fieldtrip (both with and without deaf blindness) reached to some extent the expected learning outcomes, namely understanding concepts such as sedimentation, species evolution and extinction, geological time and sedimentary succession, and recognizing the tactile aspect of strata and sedimentary structures (Figs. 8 and 9). A short documentary on this experience was made, widely available to raise awareness on the need of making geology accessible to people with disabilities but also as a guide of how to replicate a fieldtrip experience and face these challenges when designing new activities with people with deaf blindness in other places (Table 2).

This event had an impact on the media. It was broadcast in the national TV programme “En lengua de signos” (“In sign language”), and a documentary film was made and showed in the Zero Project Conference and in the Cineforum of the General Assembly of the European Geosciences Union, (Vienna, February and April, 2016, respectively) (Table 2).



**Fig. 8** Activities developed during the fieldtrip to the Basque Coast UNESCO Global Geopark (Northern Spain) carried out on June, 2015: recognition of ichnofossils of the flysch succession outcropping at Zumaya



**Fig. 9** Activities developed during the fieldtrip to the Basque Coast UNESCO Global Geopark (Northern Spain) carried out on June, 2015: description of the landscape by a specialized guide

This fieldtrip to the Basque Coast UNESCO Global Geopark, and the activities prior to the fieldtrip, represents one of the feasible pathways of enlarging opportunities of public understanding of geosciences to people with severe sensorial disabilities, thus contributing to enrich the role of geoparks as educational resources for sustainable development (Eder and Patzak 2004; Henriques et al. 2011, 2012). Our proposal is to encourage the effective inclusion when designing activities in geoparks. Similar fieldtrips can be easily made taking into account the principles of universal design in order that everybody enjoy the activities and get a meaningful learning.

## Conclusions and Implications

The World Health Organization estimates that 15% of the global populations, roughly one billion people, live with some form of disability (UNWTO 2016). The European Network for Accessible Tourism estimates that there are about 127 million Europeans with some specific need during their tourist trip; moreover, as these tourists tend to travel together, the number may increase significantly, being this kind of demand usually related to high level of customer loyalty to destinations and with the preference for the low season (TP 2014).

An analysis of the accessible tourism market size shows that 70% of the population demanding accessibility have both the financial as well as the physical capabilities to travel, generating potential revenues of €88.6 billion by 2025 (Bowtell 2015). Taking Europe as an example, the accessible tourism market has been estimated at approximately 27% of the total population and 12% of the tourism market; as so, facilitating travel for people with disabilities is therefore not only a human rights imperative but also an exceptional business opportunity (UNWTO 2016). Member states have started to legislate on accessibility independently, increasing regulatory

fragmentation; however, the Accessibility Act under discussion in the European Commission, will help dismantle barriers between member states due to different national accessibility requirements that are emerging, and will provide the establishment of European-wide functional requirements (EU 2018a).

Due to its geographical position, Iberia is a particularly attractive tourist destination for both operators and users. Favourable weather conditions and the existence of large protected areas, coupled with suitable infrastructure, can make Iberia a preferred destination for the growing market of accessible tourism. The geoparks should follow this perspective, especially since they are part of a network that carries the UNESCO brand, an organization that highlights geotourism as an essential tool for promoting sustainable development.

Iberian UGGs display several facilities for the development of geotourism and education that meet the needs of people with functional diversity. Accessibility facilities to receive people with physical impairments, especially in interpretation centres and museums, are particularly relevant, but sensory and communication access facilities are yet quite scarce.

In conclusion, accessibility conditions for disabled people among the analysed data do not fully fulfil the needs of visitors with special needs, despite the fact that some of their managers have identified good examples of inclusive tourism in their territories that they hope to generalize in the future (Lima et al. 2013). Geoparks' websites lack information concerning facilities for special groups, and website design does not meet the needs of people that have difficulties with written word and speech. Adapting geoparks to persons with functional diversity requires technical components and technological resources that many geoparks cannot afford. However, some of these difficulties can be easily overcome by using specific tools available online that help to improve the geoparks' official websites.

The difficulties pointed out by geoparks' managers regarding the implementation of geotouristic tours and/or educational programmes for disabled visitors can also be partially overcome if geoparks' managing structure seeks to integrate partners and/or to network with organizations that currently develop activities for people with functional diversity. The Geodivulgar project, a pioneer initiative for the outreach of geology among people with functional diversity in Spain, currently develops activities and resources that can be of great help to enlarge the geoparks' offer about geotouristic tours and/or educational programmes for disabled visitors.

People with physical impairments can visit many of the surveyed geosites and the majority of interpretation centres and museums, as accessibility to the public and private built environment is regulated by different legal instruments both in Portugal and Spain (ANED 2013). Trail networks equipped for disabled persons as those adopted at Beigua Geopark, located in the north-west of Italy (Burlando et al. 2011), represents one of the measures to make geoparks accessible to all,



thus meeting the obligations deriving from the UN Convention on the Rights of Persons with Disabilities, the first human rights convention to which the EU has become a party (EU 2018b).

Conditions to receive people with sensory and communication requirements involve other kinds of approaches, namely accessibility audits and facility improvement, adaptive outdoor recreation equipment design, community and volunteer engagement, staff diversity training and support and partnerships with agencies serving people with disabilities. The Push to Open Nature programme at Alberta Parks (Canada) is a successful example currently used to represent such approach (UNWTO 2016). The production of alternative digital resources (Braille and sign language), besides the acquisition and maintenance of trained assistance, can be too costly for the geoparks' budget. Such difficulties can be overcome if geoparks implement some partnership with outreach professionals and functional diversity public organizations. The association Science without Barriers, together with the Geodivulgar Innovative Project of the University Complutense of Madrid (Spain), runs a long-term innovative educational programme on scientific dissemination for people with functional diversity, which offers once or twice per year adapted fieldtrips, thus contributing to promote geotourism for everyone. Some of the former experiences were fieldtrips to Riba de Santiuste (Guadalajara, Spain) with ONCE associates and fieldtrips to the Basque Coast UGG and to Somosaguas palaeontological site (Madrid) for deafblind people. The activities developed and the acquired experience can be of great help for other geoparks within the UNESCO Global Geoparks Network, allowing them to fully fulfil their roles as agents of sustainable development through geotourism and education, and taking special groups into account.

The results obtained with the present research relate to a study case, and cannot, as such, be extrapolated to other geoparks and/or contexts, unless if other researchers or readers will recognize their utility (Cohen et al. 2010). So, and in spite of the fact that the UGGs are different from a country to another, the research design and the Geodivulgar project experience may be useful for inspiring other researches to assess accessibility conditions provided by geoparks to meet the needs of people with special needs, and to create conditions to receive them, as well as to provide a range of activities able to contribute for the development of their physical and intellectual abilities.

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