1. Geotourism: definition, characteristics and international perspectives

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INTRODUCTION

Geotourism is tourism based on geological features. Over time it has been variously described as being a type of tourism that is either ‘geological’ or geographical’ in orientation. Whereas the former view was that geotourism was a ‘type’ of tourism in a similar vein to ecotourism, the latter view was wider and encompassed it thereby representing a new ‘approach’ to tourism. Over a decade ago we espoused the former view that geotourism is a niche form of natural area tourism based on geology and landscape (Dowling and Newsome, 2006). Four years later we added to the definition by suggesting the fact that geotourism could be undertaken through either ‘independent visits’ or ‘guided tours’ to geological features (Newsome and Dowling, 2010). We had also broadened the exclusively ‘natural area’ focus of geotourism, in that unlike ecotourism which is restricted to natural areas, geotourism can occur wherever there is interesting geology or geological features. Thus it is now understood that geotourism can take place in urban areas in addition to natural areas, that is, anywhere where geological features can be considered as tourist attractions.

By now the definition of geotourism had expanded to encompass a number of attributes – geology, tourism, geosites, visits and interpretation. The ‘geo’ or geology part of geotourism includes geological features or attributes which are considered worthy of tourist interest. The ‘tourism’ part refers to the conversion of geological features or attributes into tourism resources as ‘geo’ attractions or tours often at designated ‘geosites’. These elements were combined with those central to tourism, that is, geological attractions, in the form of geosites, geological tours, geotours along with geological information presenting specific geoheritage. Geosites can occur in either natural or modified settings such as in rural or urban areas and visits to geological attractions (geo-attractions) could be either independent or on guided tours. The interpretation of geo-attractions occurs through an approach comprising elements of both geology and tourism. The geological elements comprised ‘form’, ‘process’ and ‘time’. These describe the geological tourist attraction of landscape, landform or feature (that is, its form), how it got there or was made (process), and when, or during what period of geological time, it was formed (time).

In this volume we go further again moving away from the view that geotourism is solely a ‘type’ of tourism but adding in elements of the geographic view that geotourism is an ‘approach’ to tourism as well. Thus we now suggest that geotourism could be viewed through multiple lenses along a geological spectrum which has geotourism as a ‘type’ of tourism at one end, and as an ‘approach’ at the other. So let’s see how we have arrived at this view by tracking the history of geotourism through its geological and geographical approaches.

‘GEOLOGICAL APPROACHES’ TO THE DEFINITION OF GEOTOURISM

The first published definition of geotourism as geology-based tourism, defined it as the provision of interpretive and service facilities to enable tourists to acquire knowledge and understanding of the geology and geomorphology of a site (including its contribution to the development of the Earth Sciences) beyond the level of mere aesthetic appreciation (Hose, 1995, 1996). Further refinements were made by Hose (2000, 2008). Geotourism was also described as a niche form of natural area tourism which focused on geosites which range from being small sites such as a rock outcrop or fossil bed, to larger landforms or landscapes (Figure 1.1; Dowling and Newsome, 2006). Put simply geotourism was defined as ‘people going to look at and learn about one or more aspects of geology and geomorphology’ (Joyce, 2006) so the focus was very narrow and solely

Note: This long stretch of coastline on Tongatapu Island is called *Mapu 'A Vaea* (the whistle of Vaea) by the local inhabitants because of the whistling sound emerging from the blowholes as water from the Pacific Ocean crashes into the natural channel on the coral rocks sending water spouts up to 18m in the air, creating one of the most impressive natural spectacles in the Pacific. This natural geological attraction is supported by a large viewing platform complemented by a simple interpretive stone (see bottom right).

Source: Ross Dowling (2015).

Figure 1.1 The blowholes, Tonga

on the viewing of geological features or phenomena. Inherent in these definitions was that geotourism is a vehicle to foster geoconservation, understand geological heritage (geoheritage), and appreciate geological diversity (geodiversity). Taken together the notion is that geotourism as a form of tourism and is congruent with the concept of sustainability.

By 2010 the definition had been broadened to incorporate another aspect of tourism. Here it was added that geotourism could be carried out through either independent visits or guided tours (Newsome and Dowling, 2010). Geotourism was still described as a form of tourism that specifically focuses on geology and landscape. However, it was recognised that unlike ecotourism, which by definition can only take place in natural areas, geotourism can occur in either natural or human modified environments. This definition also embraced the broader aspects of tourism activity in that visitation to geotourism destinations, whether by independent travellers or tour groups, requires transport, access, accommodation and services, trained staff, planning and management. In order to clarify the situation, the following definition was proposed by Newsome and Dowling (2010) which built upon previous ones considered by Hose (1995; 2000; 2008), Dowling and Newsome (2006) and Joyce (2006). Accordingly the definition was:

Geotourism is a form of natural area tourism that specifically focuses on geology and landscape. It promotes tourism to geosites and the conservation of geodiversity and an understanding of earth sciences through appreciation and learning. This is achieved through independent visits to geological features, use of geo-trails and view points, guided tours, geo-activities and patronage of geo-site visitor centres. (Newsome and Dowling, 2010: 4)

Two years later Hose (2012) outlined the historical and theoretical underpinnings of geotourism and approaches to its sustainable management. He suggested that it was underpinned by three key interrelated aspects (the '3G's') of modern geotourism, that is, geoconservation, geohistory and geo-interpretation. Based on this 3G approach, geotourism is then defined as 'The provision of interpretative and service facilities for geosites and geomorphosites and their encompassing topography, together with their associated in situ and ex situ artefacts, to constituency-build for their conservation by generating appreciation, learning and research by and for current and future generations' (Hose and Vasiljević, 2012: 38–39).

By now the 'geological' definition of geotourism viewed it as a niche type of tourism which included a number of key elements including visits to geosites either independently or with organised tour groups (and guides), a conservation element as well as an interpretive component (Dowling 2014a, 2015).

'GEOGRAPHICAL' APPROACHES TO THE DEFINITION OF GEOTOURISM

In the 1990s and 2000s geotourism was being characterised in England and Australia by academic researchers as essentially 'geological' tourism. However, in the United States of America the National Geographic Society was taking a broader 'geographic' stance (Tourtellot, 2000). In research undertaken by the Travel Industry Association of America

for the National Geographic Society, a broader definition of geotourism was expounded (Stokes et al., 2003). It argued that it had identified at least 55.1 million Americans who could be classified as ‘sustainable tourists’ or ‘geotourists’. Geotourism was defined as providing culturally authentic travel experiences that protect and preserve the ecological and cultural environment.

Their view was that geotourism embraced a wider remit than just its geological component, that is, it included a range of niche forms of tourism such as cultural tourism and ecotourism. It stated that ‘geotourism is defined as tourism that sustains or enhances the geographical character of a place – its environment, culture, aesthetics, heritage, and the well-being of its residents’ (National Geographic, n.d.). Here the term environment was taken to include geology, although this was not explicitly stated. The National Geographic definition incorporated the concept of sustainable tourism and, in a similar vein to ecotourism, asserted that tourism revenue should promote conservation, and extended it to culture and history as well, that is, all distinctive assets of a place (Figure 1.2).

The National Geographic Geotourism Charter (National Geographic, n.d.) emphasised sustainable aspects of tourism such as appropriate planning, destination protection, conservation of resources, interactive interpretation, tourist satisfaction and community benefit, and these are aspects of the Charter that have received widespread support. But in terms of geotourism as a particular tourism activity National Geographic stood alone at that time in its definition.

Following this ‘geographic’ approach, a young Swiss geographer at the University of Lausanne, proposed that geotourism was a new form of tourism utilising natural landscapes and based on ‘imagination’ and ‘emotion’ (Pralong, 2006a). He defined geotourism as ‘a multi-interest kind of tourism exploiting natural sites and landscapes containing interesting earth-science features in a didactic and entertaining way’ (Pralong, 2006a: 20). He added that this new form of tourism could be promoted through ‘geomarketing’ which he described as being ‘a kind of image communication that explores the temporal and spatial dimensions of the rocks (e.g. minerals, fossils) and forms (e.g. glaciers, caves) of the Earth’s surface’ (Pralong, 2006a: 20). He concluded that geotourism could be a component of regional economic development generating profitable tourism through the development of geoparks. In his summation Pralong was ahead of his time with his prediction only really coming into reality today.

Following on from this, an International Congress of Geotourism held at Arouca, Portugal in 2011 under the auspices of UNESCO, recognised the need to clarify the concept of geotourism. It adopted the geographic version of the definition, but for the first time included in it the term ‘geology’. A declaration released at the end of the conference stated that ‘geotourism should be defined as tourism which sustains and enhances the identity of a territory, taking into consideration its geology, environment, culture, aesthetics, heritage and the well-being of its residents’ (Arouca Declaration, 2011). In this definition, geological tourism is viewed as one of a multiple number of elements of geotourism. The shift from geotourism as a niche type of tourism to that of an approach to tourism represented a quantum shift for those focusing on purely ‘geological tourism’. Jonathan Tourtellot, National Geographic Fellow and one of the founders of geotourism as geographic tourism, summed up the position at the time. He said:

Notes: Teton Geotourism Center in Driggs, Idaho, invites travellers to ‘See us through the lens of Geotourism, a growing category of travel developed by National Geographic, offering the traveller an ability to experience the culture, heritage, food, art, geology, and music of an area’ (<http://www.tetongeotourism.us>). It was opened on 1 August 2014.

Photos – Top left: the Teton Range forms part of the Rocky Mountains in North America. Most of the east side of the range is within Grand Teton National Park. Top right: Teton Geotourism Center is located in the small town of Driggs, Idaho. Lower left: volunteers help to run the centre which embraces the wider National Geographic approach to geotourism. Lower right: thus the centre interprets the region’s geology and landforms first then interprets its plants and animals and history, past and present.

Source: Ross Dowling (2016).

Figure 1.2 Teton Geotourism Center, Idaho, USA

The dual geotourism concepts, of course, remain, but their relationship is now clearly established. After all, geologists have devoted careers to geological geotourism. One of them, Ross Dowling, of Perth Australia, first suggested to me the ‘type’ versus ‘approach’ distinction between the two concepts. I think he’s right. If I may steal and adapt a page from Einstein’s theories of Special and General Relativity, we could think of ‘special’ and ‘general’ geotourism. Special geotourism is just that: a specialty focused on geological features. General geotourism is a strategy for protecting, showcasing, and enhancing all the distinctive assets of a destination. (Tourtellot, 2011)

GEOLOGICAL VERSUS GEOGRAPHICAL APPROACHES

The major difference between the ‘geological’ and ‘geographical’ versions of geotourism’s definition is that the former focuses on geotourism as a ‘form’ or ‘type’ of tourism whereas the latter views geotourism more as an ‘approach’ to tourism, somewhat akin to sustainable tourism. Neither view is mutually exclusive as geotourism (from a ‘geological’ perspective), naturally encompasses the geotourism principles as espoused by National Geographic. This is in exactly the same way that ecotourism (a form of tourism) not only incorporates sustainable tourism principles, but in fact should be a best practice exemplar of it. In essence the National Geographic view of geotourism seems to simply be the application of sustainable tourism principles combined with the element of an area’s ‘sense of place’. Thus the best way forward is to view geotourism both as a **form** of tourism as well as an **approach** to it, but one that firmly ties itself first to the geologic nature of an area’s ‘sense of place’. Such tourism development generates benefits for conservation (especially geoconservation), appreciation (through geoheritage interpretation), and the economy.

GEOTOURISM’S INTERPRETIVE ELEMENTS

Essential to the development of geotourism is the understanding of the identity or character of a region or territory. To achieve this, geotourism is viewed as being based on the idea that the environment is made up of **A**biotic, **B**iotic and **C**ultural components. This ‘**ABC**’ approach comprises the *Abiotic* elements of geology and climate, the *Biotic* elements of animals (fauna) and plants (flora), and *Cultural* or human components, both past and present (Dowling, 2013). Geotourism argues that to fully understand and appreciate the environment we must know about the Abiotic elements of geology and climate first, as these determine the Biotic elements of animals and plants which live there. By extension, the combination of the Abiotic and Biotic components of the environment, determine the Cultural Landscape of how people have lived in the area in the past, as well as how they live there today, in the present (Figure 1.3).

The essence of geotourism is its geological base comprising plate tectonics, fossils and the evolution of life. It also embraces the understanding of geology interpreted through its components of **Form** (landforms and landscape), **Process** (how the landforms originated) and **Time** (when and how long these processes occurred). This forms the basis of a more holistic understanding of the environment and its component parts and thus provides the resident or tourist with a greater connection to the environment in which they live or are visiting.

Thus, when interpreting geotourism it is important that its geological (Abiotic) element is described in such a way that it informs the visitor about the area’s plant and animal (Biotic) elements, and then taken together, the information from both the Abiotic and Biotic parts is used to explain how people have lived there in the past and/or today (Cultural elements). Inherent in this interpretation is that the geology will be clearly and easily explained according to its form, process and time.

Notes: Devils Tower is a laccolithic butte composed of igneous rock in part of the Black Hills, northeastern Wyoming. It rises dramatically 386m above the Belle Fourche River, standing 265m from summit to base. The summit is 1,559m above sea level. It was the first declared a United States National Monument established in 1906 by President Theodore Roosevelt. It is visited by approximately 400,000 people per annum.

Photos – Top left: Devils Tower taken from the roadside. Top right: this photo of the tower was taken from within the visitor centre. Lower left: interpretive panel within the centre describing its geological origins in ‘How the tower was formed’. Lower right: a great example of geotourism linking geology with the wider context of people in a panel ‘What does the tower mean to people?’ which explains its cultural significance to the Lakota Indians.

Source: Top left: Wendy Dowling; all others, Ross Dowling (2016).

Figure 1.3 Devils Tower, Wyoming, USA

GEOTOURISM'S DEFINITIONAL SPECTRUM

In the very first sentence of our first book *Geotourism* we stated ‘Geotourism sits within a spectrum of definitions’ (Newsome and Dowling, 2006: 3). We then illustrated this spectrum approach with some examples from other contributions within that book. For example, Frey et al. (2006) embrace geotourism at the level of social and community development according to the concept of the geopark. However, in our then definition of geotourism the ‘geo’ part pertained to geology and geomorphology and the natural resources of landscape, landforms, fossil beds, rocks and minerals with an emphasis on appreciating the processes that are creating and created such features.

It is now clear that geotourism may be viewed as either a type of tourism (that is, geological tourism) or an approach to tourism (which is more geographic in orientation). Thus, one way of characterising it is to see it sitting astride a spectrum of possibilities (Table 1.1). At the geological end of the spectrum its focus is on traditional geological tourism, that is, the tourism of geology and landscape (Newsome and Dowling, 2010). At the other end of the spectrum it embraces a wider geographic stance in which it still has its geological foundation which is utilised to inform a geosite's biotic and cultural elements.

A definition of geotourism which encapsulates this spectrum of possibilities is:

Geotourism is tourism of geology and landscape usually undertaken at geosites. It fosters conservation of geological attributes (geoconservation) as well as understanding of geoheritage and geodiversity (through appropriate interpretation). At a higher level the geological knowledge imparted at a geosite may be used to inform its biotic and cultural features so that a more holistic view of the environment can be gained. This should then lead to a more enhanced understanding and appreciation of the world built from its geological foundations.

Table 1.1 The geotourism spectrum

The Environment	Abiotic	Biotic	Cultural
	Geology & Landforms Climate	Animals – (Fauna) Plants – (Flora)	People: Past & Present
Tourism	Geological Tourism Climate dependent tourism e.g. Summer resorts or Winter Skiing	Nature Based Tourism Wildlife Tourism Ecotourism Wildflower Tourism	Cultural Tourism Heritage Tourism Indigenous Tourism
Geotourism	A Type of Tourism Here geotourism is viewed exclusively as ‘geological’ tourism	An Approach to Tourism Here it is viewed more broadly through a ‘geographical’ lens, still based on its ‘geological’ foundation, but also informing an area’s Biotic and Cultural elements	
The Geotourism Spectrum	A Type (or Form) of Tourism	Geotourism Viewed As	An Approach to Tourism

THE SCOPE AND CONTENT OF GEOTOURISM

Geotourism has a number of characteristics. They are that it is geologically based, promotes geoconservation, fosters geo-education through geo-interpretation, and contributes to an area or region's sustainable development through economic and social benefits. The recognition and identification of geosites is essential in order to draw up an inventory of geotourism resources. It is important to note that geotourism can take place in a range of settings that include urban environments, peri-urban locations, quarries and mine sites, agricultural land, remote natural areas and protected areas such as national parks, nature reserves and national monuments.

Geotourism is tourism that fosters the protection of geoheritage. This is frequently achieved via promotion and communication of knowledge about geology and geomorphology (Figure 1.4). The latter point again serves to illustrate the vital importance of education and interpretation in geotourism. Increased awareness raised through geotourism can play a significant role in gaining support from various sectors to initiate and continue to work on geoconservation projects. Conserving geosites especially when subject to high levels of tourism is dependent upon informed management pertaining to site access (roads, trails), managing visitor numbers, site development (site hardening, viewing areas, signage and interpretive panels) and monitoring for signs of degradation. Sustainability is also framed in economic terms and the sustainability of tourism businesses is dependent on well-protected and managed sites that yield high levels of visitor satisfaction.

Notes: Jusangjeolli cliff is a spectacular series of basaltic columnar joints (rock pillars) at Seogwipo on the southern coast of Jeju Island, South Korea. It is similar to the Giant's Causeway in Northern Ireland.

Photos – Left: the rock pillars. Right: the panels here are excellent representatives of sound geological interpretation. The information is simple, easy to understand, and written in four languages, Korean, Chinese, Japanese and English. The display follows the cardinal rule for such presentations in that it includes one-third text, one-third illustrations (diagrams and/or photos) and one-third space. Too often such interpretive panels are written by geologists presenting detailed geological information in text which covers most of the panel leaving geotourist's *eyes to glaze over* with information overload. The key is to leave the visitor wanting more information so leaving a web address which does this is a good way of ensuring that even the most enquiring visitor can obtain the relevant detail if they so wish.

Source: Ross Dowling (2014a).

Figure 1.4 Jusangjeolli cliff, Jeju Island, South Korea

Geotourism always includes information about the geological and broader environment so that the (geo)tourist learns about the site or setting that they are visiting. Geo-education comprises the specific interpretive aspects of geotourism consisting of the development of specific pre-visit and on-site pamphlets; viewpoint and geosite panel design and location; self-guiding trails (supported by books, printed guides, marked points and panels; Figure 1.4); geological gardens; guided tours (e.g. cave tours, guided fossil collecting) and interpretive/visitor centres (audio-visual content, interactive displays, collections of rocks, lectures and film shows). A key aspect is the availability and expertise of geo-guides, something that is dependent upon funding and training opportunities. Thus the interpretive component is a central part of geotourism and visitors will always rate their experiences higher if they have learned something about the landscape and geology they are visiting. Suitably attractive and detailed information at geosites and good tour guiding is therefore essential.

Finally, geotourism should always be locally beneficial. Such benefits include the employment of local people as guides and staff to service geotourism activities and facilities. The accommodation sector has the potential to contribute to local communities through employment opportunities, events, retail and the provision of services. Geotourism development may, however, depend on outsiders for approvals and expertise. Dowling (2009) notes that stakeholders in geotourism can include investors, government planners, environmental groups and universities.

INTERNATIONAL PERSPECTIVES

The way in which geotourism is viewed is different according to a range of perspectives. These include different political and governance approaches, societal models, funding methods, conservation approaches and visitor pressures. An international perspective allows us to appreciate specific settings and situations. In this sense, we are able to learn from each other and the international geopark movement is a good example of how specialists from different countries exchange ideas. Moreover, geographically different geo-attractions have their own particular issues. A major consideration for the future will be dealing with heavy visitor demand and contrasting visitor attitudes. For example, Indonesia and China have large domestic tourism pressure on natural sites such as waterfalls, volcanic areas and places with high scenic values. The sunrise at Mt Bromo in Java is one such place that is now experiencing site degradation and high levels of congestion. Furthermore, geo-attractions in some countries may be starved of funding or have to rely on external (international donations) in order to manage visitor pressures. There may be insufficient funding for geoconservation and the provision of interpretive facilities in some countries. Where funding is available the sheer pressure of domestic tourism combined with international visitation may lead to a large site management footprint (Newsome et al., 2012). Some countries may be able to police and enforce breaches of site protection rules while management agencies in other countries are unable to do so!

Different scales and intensities of visitation and differing visitor attitudes in combination with contrasting funding and site management scenarios make a broad international perspective of utmost importance in understanding the full gamut of geotourism.

A GROWING LITERATURE

Geotourism is now being researched and developed around the world as illustrated in the literature review in this volume by Ruban (Chapter 6). It has come a long way since the term was first coined by Hose (1995) and in the intervening 23 years much has been written on the subject. For example, a number of books on the subject have been compiled (Table 1.2) by Dowling and Newsome (2006), Newsome and Dowling (2010), Dowling and Newsome (2010) and others. In addition, many international conferences have been held on the subject including the *Inaugural Global Geotourism Conference* held in Australia in 2008 (Dowling and Newsome, 2008); the *Second Global Geotourism Conference* (Malaysia, 2010); *Third Global Geotourism Conference* (Sultanate of Oman, 2011); *European Geoparks Conference on Geotourism* (Portugal, 2011), *Asia Pacific Geotourism Conference* (Hong Kong, China, 2013). Other more specialised conferences have taken place on geotourism. A recent example was the *Caves and Karst Symposium: Understanding, conservation and geotourism* held in Voguë, France in March 2018. Finally several papers have been written reviewing the geotourism literature including from a 'geographic' perspective (Ruban, 2015) as well as a 'systematic' standpoint (Ólafsdóttir and Tverijonaite, 2018).

Underpinning all of the above has been an explosion of academic literature on the subject. The first journal to be dedicated to geotourism is *GeoTurystyka* (Geotourism) which was launched in 2005 (www.geoturystyka.pl). It is published by the AGH University of Science and Technology, in Krakow Poland. Whilst most of the contributions are about Poland and written in Polish, a number of articles are in English and are global in scope. A new journal, the *GeoJournal of Tourism and Geosites*, published in Romania (<http://gtg.webhost.uoradea.ro>) was started in 2008 and one year later the journal *Geoheritage* (<https://link.springer.com/journal/12371>) was launched. This has included a large number of papers on geotourism and has published a 'Special Issue' on the topic (Hose, 2012). The *Czech Journal of Tourism* is a peer-reviewed scientific journal (<http://www.czechjournaloftourism.cz>) which has published two Special Issues on geotourism (Paskova, 2013, 2017). Papers concerned with geotourism also appear in the new journal *Geoconservation Research* sourced in Iran.

In recent years contributions have been made on a range of topics pertaining to geotourism (Dowling, 2010b, 2011). These include the fostering of conservation (geoconservation) and geoheritage; assessing its potential and/or devising plans for sustainable development at either specific geosites or in regional settings; delivering economic and social outcomes for geoparks and geotrails; understanding geotourists and developing urban geotourism. Finally, the development of geotourism has given rise to a number of related 'geo' activities such as 'geo-art' and 'geo-trekking'.

A principal characteristic of geotourism is that it fosters conservation of its geological resources through geoconservation (Larwood and Durham, 2005; Newsome and Dowling, 2018); other regions where geotourism has been developed to foster conservation include a number of areas in China, for example, Luochuan Loess National Park (Dong et al., 2014); Arxan-Chaihe Volcano Area, Inner Mongolia (Wang et al., 2014); and Hong Kong (Wang et al., 2015). It has also been utilised as a conservation tool in the Azores archipelago, Portugal (Lima et al., 2013). In some related parks and other areas, geotourism is being used to promote geoheritage. They include the geologic park of Aliaga, Spain (Escorihuela and Dowling, 2015); the US Fossil Parks (Clary and Wandersee, 2014);

Table 1.2 *Books, journals and conferences on geotourism*

Year	Title	Editors / Authors	Context
BOOKS			
2006	<i>Geotourism</i>	Dowling & Newsome	Introductory text
2008	<i>Geotourism</i>	Dowling & Newsome	Conference proceedings
2008	<i>Geotourism in Ethiopia</i>	Asfawossen, Demissie & Mogessie	Mainly about building materials
2010	<i>Geotourism: The Tourism of Geology and Landscape</i>	Newsome & Dowling	Furthering knowledge from 2006 book
2010	<i>Global Geotourism Perspectives</i>	Dowling & Newsome	International case studies
2010	<i>Volcano and Geothermal Tourism</i>	Erfurt-Cooper & Cooper	Volcano tourism
2011	<i>Geotourism: A Variety of Aspects</i>	Ślómka	A global overview including geosites and mining heritage
2012	<i>The Catalogue of Geotourist Sites</i>	Ślómka	A comprehensive overview of geosites in Poland
2012	<i>Geoparks and Geotourism</i>	Farsani et al.	Geotourism in geoparks
2012	<i>Geotourism: Toward a Better Understanding of Motivations for a Geotourism Experience</i>	Allan	Allan's PhD dissertation
2013	<i>Geodiversity: Valuing and Conserving Abiotic Nature</i>	Gray	A focus on geoconservation with some geotourism cases
2014	<i>Volcanic Tourist Destinations</i>	Erfurt-Cooper	Volcano tourism
2015	<i>The Principles of Geotourism</i>	Chen, Lu & Ng	Chinese Earth Sciences
2014	<i>Geoheritage, Geoparks & Geotourism</i>	Eder, Bobrowsky & Martínez-Frias	A pictorial account
2016	<i>Understanding Ethiopia: Geology and Scenery</i>	Williams	A GeoGuide to Ethiopia
2016	<i>Geoheritage and Geotourism</i>	Hose	A European perspective
2017	<i>GeoBritannica: Geological Landscapes and the British Peoples</i>	Leeder & Lawlor	How Britain's geology has been utilised by society
2018	<i>Geoheritage: Assessment, Protection & Management</i>	Reynard & Brilha	Includes some geotourism perspectives
2018	<i>Handbook of Geotourism</i>	Dowling & Newsome	A global overview
JOURNALS		WEBSITE	
1994	<i>Earth Heritage</i>	www.earthheritage.org.uk	Dedicated to geological and landscape conservation
2005	<i>GeoTurystyka / Geotourism</i>	www.geoturystyka.pl	Polish with some English content
2008	<i>GeoJournal of Tourism and Geosites</i>	http://gtg.webhost.uoradea.ro/	Published in Romania
2009	<i>Geoheritage</i>	www.geoheritage.com	The European Association for the Conservation of the Geological Heritage
2018	<i>Geoconservation Research</i>	http://gcr.khuisf.ac.ir	Published in Iran
MAJOR CONFERENCES			WHERE
2008	Inaugural Global Geotourism Conference		Perth, Australia
2010	Second Global Geotourism Conference		Sarawak, Malaysia
2011	First International Workshop on Geotourism and Geoparks		Perth, Australia
2011	Third Global Geotourism Conference		Muscat, Oman
2011	European Geoparks Network Conference on Geotourism		Arouca, Portugal
2013	Asia Pacific Geotourism Conference		Hong Kong, China
2018	Second International Workshop on Geotourism and Geoparks		Perth, Australia

Sheringham Park, England (Daniels and Veale, 2015); a region in southeastern Serbia (Began et al., 2017); and in the Galapagos Islands, Ecuador (Kelley and Salazar, 2017).

Many regions have also been assessed for their potential for geotourism. They are being developed for a range of differing geosites including caves, glaciers and volcanoes. Early contributions to cave tourism focused on the environmental impacts of visitors. These included a case study from the Grotto Grande del Vento, Aracena, Spain (Pulido-Bosch et al., 1997) and another from the caves of the Dordogne Region, France (Baker and Genty, 1998). The motivations of cave tourists have been investigated in South Korea (Kim et al., 2008) and the issues associated with ‘mass’ geotourism have been described for the tourist caves in the Nam Ou Valley, Lao PDR (Kiernan, 2013).

There is a scoping review of glacier tourism (Welling et al., 2015) with case studies from the Franz Josef Glacier, New Zealand (Purdie, 2013; Purdie et al., 2015). There are also two major books on volcano tourism with case studies from around the world (Erfurt-Cooper and Cooper, 2010; Erfurt-Cooper, 2014). Specific examples of volcano tourism include Iceland (Dowling, 2010a); Reunion Island in the Indian Ocean (Dowling and Margueritte, 2014); Galápagos, Ecuador (Dowling, 2014b) as well as the geothermal fields in the Central North Island, New Zealand (Pijet-Migoń and Migoń, 2015). An extension of the above is ‘landscape tourism’ which integrates landscapes and geotourism. This is illustrated by a case study of the Bucegi Mountains, Romania (Neches and Erdeli, 2014) and when landforms are viewed as sacred sites (Kiernan, 2015). An overview of caves and geotourism suggests that ‘caves offer the purest form of geotourism: a journey through the Earth itself, involving close encounters with enveloping rocks’ (Brick, 2017: 197).

Two early examples of utilising geotourism for regional development included northern Vietnam (Pajak et al., 2006) and the Vredefort Dome, South Africa (Gibson and Blom, 2008). More recently areas assessed for their geotourism potential include the Vizovicka vrchovina highland, Czech Republic (Kubalíková and Kirchner, 2016); and Uganda (Schumann et al., 2015).

A number of assessment models have been proposed as reviewed by Brilha (2016). They include a systems model approach which was applied to the Taining and Longhushan geoparks in China as well as to Zion National Park in the United States of America (Ren et al., 2013); geoheritage as the basis for assessing geotourism development in the Jeli District, Kelantan, Malaysia (Adriansyah et al., 2015); a geo-ecological information system (GEIS) approach developed in India (Kumar and Deshmukh, 2015); and a proposed geosite assessment model (GAM) applied in the Srem Loess Plateau, Serbia (Višnić et al., 2016). Assessment through the application of Geographic Information Systems (GIS) has been applied to the Kayseri Yahyali, Turkey (Akhbaşında and Bulut, 2014) and to Rottnest Island, Australia (Rutherford et al., 2015). Assessment of specific geosites has been reviewed by (Kubalíková, 2013; Migoń and Pijet-Migoń, 2017), a new approach to geosite inventory has been tested in the Villuercas-Ibores-Jar Geopark, Extremadura, Spain (Fernández et al., 2014) and geotourism has been re-interpreted as an approach to study landscape–tourism interactions (Stoffelen and Vanneste, 2015).

Beyond assessment, geotourism has been used as a vehicle to generate sustainable regional development in many areas (Dowling, 2009, 2013). This is illustrated in the many chapters of this book. Specific regions and/or countries where geotourism has been proposed include the Almeria Province, southeast Spain (Hose, 2007); Hawaii,

USA (King, 2010); The Sultanate of Oman (Lawrence, 2010); Mt Kinabalu, Sabah, Malaysia (Tongkul, 2010); Mauritius (Johnson et al., 2010); the Kutch region, Gujarat, India (Swarna et al., 2013); the Lubelskie Province, southeastern Poland (Zgłobicki and Baran-Zgłobicka, 2013); China (Zhang et al., 2013); Malaysia (Ghani et al., 2013); Iceland (Ólafsdóttir and Dowling, 2014); the Idanre Hills, Nigeria (Anifowose and Kolawole, 2014); Western Australia (Pforr and Dowling, 2008; Pforr et al., 2014); in eight Chinese geoparks (Ng, 2015); Philippines (Aquino et al., 2017); Zonguldak, Turkey (Citiroglu et al., 2017); Waldviertel, Austria (Migoń, Różycka and Michniewicz, 2017); Serbia (Began et al., 2017), Australia and New Zealand (Dowling and Pforr, 2017) and in southern Egypt (Sallam et al., 2018). Community attitudes to geotourism development have been examined in Iran (Shahhoseini et al., 2017) and Poland (Różycka and Migoń, 2018).

Little has been written about the economic value of geotourism. An early contribution was on the economic contribution of geotourism in a German geopark (Härtling and Meier, 2010). However, a recent economic review of the Irish geoscience sector provides some indication of its contribution (IIEC, 2017). In Ireland tourism has grown rapidly in recent years and rose to 19 million in 2016. Major attractions in the country are its landscapes and heritage thus making it a significant geotourism and geoheritage destination. This development is supported by Geological Survey, Ireland (GSI) through their Irish Geoheritage Programme including the development of UNESCO Global Geoparks. GSI manages the Irish Geopark Forum which provides funding for geologists within existing and aspiring Geoparks. GSI also collaborates in major European Union project initiatives on geotourism. The report finds that the geoheritage and geotourism sector is a major contributor to the Irish economy, with total revenues (visitor expenditures) directly attributable to this sub-sector amounting to over €370 million (2016), while the sector directly contributes almost €240 million to the Irish economy. It supports 8,767 full time equivalent jobs as well as €415 million in gross value added and over €660 million in output (Table 1.3; IIEC, 2017). Research undertaken in the UK found that the UNESCO label added approximately £2.69 million to the UK economy per annum for each UNESCO geopark (UK National Commission for UNESCO, 2016).

Geotourism is the driver of geoparks. An early contribution took place in Germany at an international workshop held at Karlsruhe in 2006 on Geopark and Geotourism Research (Vogt and Mergerle, 2006). A number of contributions were made on the links between geotourism and geoparks including the range of market segments (Pralong, 2006b); the importance of understanding and presenting the landscape not only in geological terms but also for its historic and cultural characteristics (Morrissey, 2006);

Table 1.3 The economic value of geotourism in Ireland, 2012–2016 (€ million)

Revenue	2012	2013	2014	2015	2016
Top Fee-Paying Sites	17.0	19.7	22.8	28.2	33.6
Top Free Sites	1.2	2.4	5.2	6.8	7.3
Hiking & Cross Country Walking	149.8	189.8	225.1	286.3	329.8
Total Revenue	167.9	211.9	253.1	321.3	370.7
Gross Value Added	108.6	137.0	163.6	207.7	239.6

Source: Indecon International Economic Consultants (IIEC, 2017).

and geotourism and geopark research in South Africa (Schutte, 2006a, 2006b). At the conclusion of the workshop a position paper was released in six languages underscoring the importance of geotourism and geoparks and establishing a research agenda for the future. Two years later the same links were being fostered in a paper illustrating links between the two in a number of countries (Dowling, 2008). Recent contributions have emphasised geopark contribution to sustainability by fostering economic sustainable development through the promotion of geotourism (e.g. Henriques and Brilha, 2017).

Geotourism is also key reason why geoparks and geotrails are established. Today geotourism has helped geoparks become vehicles to power sustainable development in hundreds of regions around the world (Farsani et al., 2014a; UNESCO, 2016). Examples include the national geopark Ries, Southern Germany (Stoffler et al., 2008); Beigua UNESCO Global Geopark, Italy (Burlando et al., 2009); Lesvos Petrified Geopark, Greece (Zouros, 2010); Caoling Geopark, Yunlin County, Taiwan (Lee, 2013) and Stonehammer UNESCO Global Geopark, Canada (Miller and Buhay, 2014).

Examples of specific geotrails include Perth, Western Australia (Norrish et al., 2014); Cilento Vallo di Diano Geopark, southern Italy (Santangelo et al., 2015) and The Ichnite Route of Soria, Spain (Castanera et al., 2017). Allied to the above is the importance of guiding. Recent research has examined the role of geopark guides in enhancing geotourism (Choi, 2013); the willingness of visitors to pay for accredited guides in Hong Kong, China (Cheung, 2016); the role of the geotour guide in Earth Science Education (Escorihuela, 2017) and the use of GeoGuide application technology in transferring knowledge and making it usable for tourists (Pica et al., 2017).

Central to geotourism is the geotourist. Studies have investigated visitor motivations of cave tourists in South Korea (Kim et al., 2008); tourists to Australian geosites (Mao et al., 2009) and place attachment and the desert tourist experience, the case of Wadi Rum, Jordan (Allan, 2016). A typology of visitors to geosites has been suggested (Grant, 2010) and another model aimed at identifying geotourists (Hurtado et al., 2014). Other studies seeking to understand the visitor experience have been undertaken in: the Flinders Ranges, South Australia (Kim and Brown, 2012); Australia and Jordan (Allan, 2012); Crystal Cave, Yanchep National Park, Western Australia (Allan et al., 2015) and Hong Kong, China (Fung and Jim, 2015). Geotourist values have been investigated in the Vistula River Gap, Poland (Warowna et al., 2016); an analysis has been undertaken of push and pull motives for geotourists visiting the Mount Pinatubo volcano in the Philippines (Aquino et al., 2017); and the prediction of tourists' behaviour intention towards geotours has been trialled in Egypt (Soliman and Abou-Shouk, 2017). Interpretation is a central plank of geotourism (Farsani et al., 2014b) and traditional crafts have been suggested as a tool for geo-education in geotourism (Farsani et al., 2017).

As noted earlier, geotourism is not confined to natural areas and it can occur wherever there is the possibility of geology being developed as a tourist attraction. Thus it can occur in human modified areas such as cities and towns. Examples of urban geotourism include Hong Kong, China (Ng et al., 2010); Turin, Italy (Borghi et al., 2014); São Paulo City, Brazil (Del Lama et al., 2015); Mexico City, Mexico (Palacio-Prieto, 2015) and Bojnord City, Iran (Kharazian, 2015).

The development of geotourism has given rise to a number of related 'geo' activities. These include 'Geo-art' in Norway (Erikstad, 2009; Rangnes, 2013); a 'geo-bakery', Portugal (Geraldès and Ferreira, 2009); 'geo-climbing', Spain (García-Rodríguez and

Fernández-Escalante, 2017); and ‘geo-trekking’, Indonesia (Brahmantyo, 2013). In addition ‘geo-medicine’ is described as the link between geotourism and medical geology and the health benefits of geotourism in natural healing areas, as well as the development of related products, which is being investigated in Cape Verde (Rocha and Ferreira da Silva, 2014). Finally the term ‘geowatching’ has been introduced to describe the activity of observing geological objects and phenomena without damaging them (Garofano, 2015).

OUTLINE OF THE BOOK

This Handbook has been compiled to bring together much of the latest thinking about and information on geotourism as it has developed over the past two decades. It comprises 36 chapters written by 54 authors from 21 countries around the world. These include – Australia, Brazil, Canada, Czech Republic, England, Ethiopia, Germany, Italy, Japan, Jordan, Malaysia, Malta, Namibia, New Zealand, the Philippines, Poland, Portugal, Russia, Scotland, South Korea and the USA.

It covers a range of topics, includes numerous examples and case studies, and essentially adds to our knowledge of geotourism that is rapidly growing globally. It describes how there are a range of views about geotourism, explores it in relation to society and sustainability, presents a number of ways it is being used for geoheritage interpretation and education, examines how it is contributing to geoparks, and showcases a number of ways in which it is being used to develop destinations around the world. The book is divided into six parts. After a comprehensive introduction Part I – *Geology and Tourism* comprises six chapters which examine the links between the geology and tourism from a variety of standpoints. These include how tourism professionals can present geology and geological information; explanations of geology’s key terms of geodiversity, geoheritage and geoconservation; the relationship between geotourism and the cultural landscape; geotourists; the application of geographic information systems in geotourism; and finally, a targeted literature review of geotourism.

Part II – *Geotourism, Society and Sustainability* comprises five chapters. These include public–private partnerships for sustainable development in the Philippines; the significance of show caves in Italy; the issues of management, including risk, of geotourism in volcanic regions, caves and glaciers; and the potential contribution of geotourism in Africa. Part III – *Geotourism in Urban Areas* comprises three chapters which profile examples from Australia, USA and Brazil. Part IV – *Interpretation and Education Strategies* brings together a range of views on the presentation of geotourism in public settings. The five chapters in this section include contributions on geotourism interpretation and education as well as examples of geoliteracy in geoscience education (USA); ‘The day of geosites’ (Germany), and the importance of stories (Australia).

Part V – *Geotourism’s Contribution to Geoparks* presents how geotourism is contributing to the development of ten geoparks on four continents – Europe, Asia, North America and South America. Geotourism is the engine which drives geoparks generating funds to foster community well-being and conservation outcomes. The final part of the book Part VI – *Case Studies in Geotourism*, showcases how geotourism is being used as a development tool around the world in many different geological environments. It comprises five chapters from an array of countries in numerous continents including Malta, the Czech

Republic, Namibia, the Philippines, and New Zealand. The final chapter of the book (Chapter 36) provides an overview of the state of geotourism in the world today and future directions for research.

REFERENCES

- Adriansyah, D., Busu, I., Eva, H. and Muqtada, M. (2015) Geoheritage as the basis for geotourism development: A case study in Jeli District, Kelantan, Malaysia. *GeoJournal of Tourism and Geosites* 15(1): 25–43.
- Akhbaşında, M. and Bulut, Y. (2014) Analysis of terrains suitable for tourism and recreation by using geographic information system (GIS). *Environmental Monitoring Assessment* 186: 5711–5719.
- Allan, M. (2012) *Geotourism: Toward a Better Understanding of Motivations for a Geotourism Experience: A Self-Determination Theory Perspective*. Saarbrücken, Germany: LAP Lambert Academic Publishing.
- Allan, M. (2016) Place attachment and tourist experience in the context of Desert Tourism: The case of Wadi Rum. *Czech Journal of Tourism* 5(1): 35–52.
- Allan, M., Dowling, R.K. and Sanders, D. (2015) The motivations for visiting geosites: The case of Crystal Cave, Western Australia. *GeoJournal of Tourism and Geosites* IX 2(16): 141–152.
- Anifowose, A.Y.B. and Kolawole, F. (2014) Appraisal of the geotourism potentials of the Idanre Hills, Nigeria. *Geoheritage* 6(3): 193–203.
- Aquino, R.S., Schänzel, H.A. and Hyde, K.F. (2017) Analysing push and pull motives for volcano tourism at Mount Pinatubo, Philippines. *Geoheritage* online, DOI 10.1007/s12371-017-0254-z.
- Arouca Declaration (2011) *Arouca Declaration on Geotourism*, 12 November, Portugal, www.europeangeoparks.org/?p=223 (accessed 4 May 2018).
- Asfawossen, A., Demissie, M. and Mogessie, A. (2008) *Geotourism in Ethiopia: Archaeological and Ancient Cities, Religious and Cultural Centres*. Addis Ababa: Shama Books.
- Baker, A. and Genty, D. (1998) Environmental pressures on conserving cave speleothems: Effects of changing surface land use and increased cave tourism. *Journal of Environmental Management* 53: 65–175.
- Began, M., Višnić, T., Djokić, M. and Vasiljević, D.A. (2017) Interpretation possibilities of geoheritage in southeastern Serbia: Gorge and canyon study. *Geoheritage* 9: 237–249.
- Borghi, A., D'Atri, A., Martire, L., Castelli, D., Costa, E., Dino, G., Favero Longo, S.E., Ferrando, S., Gallo, L.M., Giardino, M., Groppo, C., Piervittori, R., Rolfo, F., Rosetti, P. and Vagelli, G. (2014) Fragments of the Western Alpine Chain as historic ornamental stones in Turin (Italy): Enhancement of urban geological heritage through geotourism. *Geoheritage* 6: 41–55.
- Brahmantyo, B. (2013) *Geotourism in Indonesian Perspective*. Paper presented at the HAGI-IAGI Joint Convention, Medan, Indonesia, 28–31 October.
- Brick, G. (2017) *Caves and Geotourism*. Proceedings of the 17th International Congress of Speleology, Vol. 2 (pp. 197–198). Sydney: Union Internationale de Spéléologie.
- Brilha, J. (2016) Inventory and quantitative assessment of geosites and geodiversity sites: A review. *Geoheritage* 8: 119–134.
- Burlando, M., Firpo, M., Queirolo, C. and Vacchi, M. (2009) A new strategy to promote sustainable tourism in Beigua Geopark (Italy). In C.N. de Carvalho and J. Rodrigues (eds) *New challenges with Geotourism* (p. 54). Proceedings of the VIII European Geoparks Conference, Idanha-a-Nova, Portugal, 14–16 September.
- Castanera, D., Pascual, C., Ignacio Canudo, J. and Luis Barco, J. (2017) Bringing together research, geoconservation and reaching a broad public in the form of a geotourism project: The Ichnite Route of Soria (Spain). *Geoheritage* online. DOI 10.1007/s12371-017-0249-9.
- Chen, A., Lu, Y. and Ng, Y.C.Y. (2015) *The Principles of Geotourism*. Berlin Heidelberg: Springer and the Science Press Beijing.
- Cheung, L.T.O. (2016) The effect of geopark visitors' travel motivations on their willingness to pay for accredited geo-guided tours. *Geoheritage* 8: 201–209.
- Choi, C. (2013) The role of geopark guides in enhancing geotourism: the recommended geopark guide system in Hong Kong. Paper presented at the Third Asia Pacific Geoparks Network Symposium, *For the Innovation of the APGN*. Jeju Island, South Korea, 7–13 September.
- Clary, R.M. and Wandersee, J.H. (2014) Lessons from US fossil parks for effective informal science education. *Geoheritage* 6: 241–256.
- Citiroglu, H.K., Isik, S. and Pulat, O. (2017) Utilizing the geological diversity for sustainable regional development, a case study: Zonguldak (NW Turkey). *Geoheritage* 9: 211–223.
- Daniels, S. and Veale, L. (2015) Revealing Repton: Bringing landscape to life at Sheringham Park. *Landscape Research* 40(1): 5–22.

- Del Lama, E.A., de La Corte Bacci, D., Martins, L., da Glória Motta Garcia, M. and Dehira, L.K. (2015) Urban geotourism and the old centre of São Paulo City, Brazil. *Geoheritage* 7: 147–164.
- Dong, H., Song, Y., Chen, T., Zhao, J. and Yu, L. (2014) Geoconservation and geotourism in Luochuan Loess National Geopark, China. *Quaternary International* 334–335: 40–51.
- Dowling, R.K. (2008) The emergence of geotourism and geoparks. *Journal of Tourism* 9(2): 227–236.
- Dowling, R.K. (2009) Geotourism's contribution to local and regional development. In C. de Carvalho and J. Rodrigues (eds) *Geotourism and Local Development* (pp. 15–37). Camar municipal de Idanha-a-Nova, Portugal.
- Dowling, R.K. (2010a) Emerging volcano and geothermal related tourism in Iceland. In P. Erfurt-Cooper and M. Cooper (eds) *Volcano and Geothermal Tourism: Sustainable Geo-resources for Leisure and Recreation* (pp. 209–220). London: Earthscan.
- Dowling, R.K. (2010b) Geotourism's emerging global footprint. *Interaction, Journal of the Geography Teachers' Association of Victoria* 38(2): 19–23.
- Dowling, R.K. (2011) Geotourism's global growth. *Geoheritage* 3: 1–13.
- Dowling, R.K. (2012) Conference report: The third Global Geotourism Conference, 30 October to 1 November 2011, Sultanate of Oman. *Geoheritage* 4(3): 221–223.
- Dowling, R.K. (2013) Global geotourism: An emerging form of sustainable tourism. *Czech Journal of Tourism* 2(2): 59–79.
- Dowling, R.K. (2014a) Geotourism. In J. Jafari and H. Xiao (eds) *Encyclopedia of Tourism*. Berlin: Springer. DOI <https://doi.org/10.1007/978-3-319-01669-6>.
- Dowling, R.K. (2014b) Galápagos: An emerging volcano tourism destination. In P. Erfurt-Cooper (ed.) *Volcanic Tourist Destinations* (pp. 193–200). Heidelberg: Springer.
- Dowling, R.K. (2015) Geopark. In C. Cater, B. Garrod and T. Low (eds) *The Encyclopedia of Sustainable Tourism* (pp. 230–231). Oxford: CABI.
- Dowling, R.K. and Margueritte, J. (2014) Reunion Island: A volcanic showcase. In P. Erfurt-Cooper (ed.) *Volcanic Tourist Destinations* (pp. 325–336). Heidelberg: Springer.
- Dowling, R.K. and Newsome, D. (eds) (2006) *Geotourism*. Oxford: Elsevier Butterworth Heinemann.
- Dowling, R.K. and Newsome, D. (eds) (2008) *Geotourism*. Proceedings of the Inaugural Global Geotourism Conference, 'Discover the Earth Beneath our Feet', 17–20 August, Fremantle, Western Australia, pp.478. Perth: Promaco Conventions Pty Ltd.
- Dowling, R.K. and Newsome, D. (eds) (2010) *Global Geotourism Perspectives*. Oxford: Goodfellow Publishers.
- Dowling, R.K. and Pforr, C. (2017) Geotourismus in Australien und Neuseeland. In C. Pforr and D. Reiser (eds) *Tourismus in Australien und Neuseeland* (pp. 206–223). Berlin: De Gruyter, Oldenbourg.
- Eder, W., Bobrowsky, P.T. and Martínez-Frías, J. (2014) *Geoheritage, Geoparks and Geotourism*. Berlin Heidelberg: Springer.
- Erfurt-Cooper, P. (ed.) (2014) *Volcanic Tourist Destinations*. Heidelberg, Springer.
- Erfurt-Cooper, P. and Cooper, M. (eds) (2010) *Volcano and Geothermal Tourism: Sustainable Geo-resources for Leisure and Recreation*. London: Earthscan.
- Erikstad, L. (2009) Geo-art. *ProGEO News* 3: 1.
- Escorihuela, J. (2017) The role of the geotouristic guide in Earth Science education: Towards a more critical society of land management. *Geoheritage* online DOI 10.1007/s12371-017-0236-1.
- Escorihuela, J. and Dowling, R.K. (2015) Analysis of the geotouristic activity in the geologic park of Aliaga, Spain: Progress, threats and challenges for the future. *Geoheritage* 7: 299–306.
- Farsani, N.T., Coelho, C.O.A. and Costa, C.M.M. (2014a) Analysis of network activities in geoparks as geotourism destinations. *International Journal of Tourism Research* 16: 1–10.
- Farsani, N.T., Coelho, C.O.A., Costa, C.M.M. and Amrikazemi, A. (2014b) Geo-knowledge management and geoconservation via geoparks and geotourism. *Geoheritage* 6, 185–192.
- Farsani, N.T., Coelho, C., Costa, C. and Neto de Carvalho, C.N. (2012) *Geoparks and Geotourism: New Approaches to Sustainability for the 21st Century*. Boca Raton, Florida, USA: Brown Walker Press.
- Farsani, N.T., Mortazavi, M., Bahrami, A., Kalantary, R. and Bizhaem, F.K. (2017) Traditional crafts: A tool for geo-education in geotourism. *Geoheritage* 9: 577–584.
- Fernández, M.P., Timón, D.L. and Marín, R.G. (2014) Geosites inventory in the geopark Villuercas-Ibores-Jara (Extremadura, Spain): A proposal for a new classification. *Geoheritage* 6: 17–27.
- Frey, M.-L., Schafer, K., Buchel, G. and Patzak, M. (2006) Geoparks: A regional, European and global policy. In R.K. Dowling and D. Newsome (eds) *Geotourism* (pp. 95–117). Oxford: Elsevier Butterworth Heinemann.
- Fung, C.K.W. and Jim, C.Y. (2015) Unraveling Hong Kong Geopark experience with visitor-employed photography method. *Applied Geography* 62: 301–313.
- García-Rodríguez, M. and Fernández-Escalante, E. (2017) Geoclimbing and environmental education: The value of La Pedriza Granite Massif in the Sierra de Guadarrama National Park, Spain. *Geoheritage* 9: 141. <https://doi.org/10.1007/s12371-016-0187-y>.
- Garofano, M. (2015) Geowatching, a term for the popularisation of geological heritage. *Geoheritage* 7: 25–32.

- Geraldes, J. and Ferreira, R. (2009) Tourism 'tectonics' and geo-bakery. In C.N. De Carvalho and J. Rodrigues (eds) *New Challenges With Geotourism* (pp. 100–103). Proceedings of the VIII European Geoparks Conference, Idanha-a-Nova, Portugal, 14–16 September.
- Ghani, K.A., Leman, M.S. and Komoo, I. (2013) Sustainable tourism and geoparks. Paper presented at the Third Asia Pacific Geoparks Network Symposium, *For the Innovation of the APGN*. Jeju Island, South Korea, 7–13 September.
- Gibson, R.L. and Blom, M. (2008) *Geotourism Potential of the Vredefort Dome, South Africa: Challenges, Opportunities, Progress and Recommendations* (3112pdf). Large Meteorite Impacts and Planetary Evolution IV Conference, held Vredefort Dome, 17–21 August.
- Grant, C. (2010) *Towards a Typology of Visitors to Geosites*. Paper presented at the Second Global Geotourism Conference, 'Making Unique Landforms Understandable'. Mulu, Sarawak, Malaysia, 17–20 April.
- Gray, M. (2013) *Geodiversity: Valuing and Conserving Abiotic Nature* (2nd edn). Chichester: Wiley Blackwell.
- Härtling, J. and Meier, I. (2010) Economic effects of geotourism in Geopark TERRA.vita, Northern Germany. *The George Wright Forum* 27(1): 29–39.
- Henriques, M.H. and Brilha, J. (2017) UNESCO Global Geoparks: A strategy towards global understanding and sustainability. *Episodes (Journal of International Geoscience)* 40(4): 349–355.
- Hose, T.A. (1995) Selling the story of Britain's stone. *Environmental Interpretation* 10(2): 16–17.
- Hose, T.A. (1996) Geotourism, or can tourists become casual rock hounds? In M.R. Bennett, P. Doyle, J.G. Larwood and C.D. Prosser (eds) *Geology on your Doorstep* (pp. 207–228). Geological Society.
- Hose, T.A. (2000) European geotourism: geological interpretation and geoconservation promotion for tourists. In D. Barretino, W.A.P. Wimbledon and E. Gallego (eds) *Geological Heritage: Its Conservation and Management* (pp. 127–146). Madrid: Instituto Tecnológico GeoMinero de Espana.
- Hose, T.A. (2007) Geotourism in Almeria Province, southeast Spain. *Tourism Interdisciplinary Journal* 55(3): 259–276.
- Hose, T.A. (2008) Towards a history of Geotourism: Definitions, antecedents and the future. In C.V. Burek and C.D. Prosser (eds) *The History of Geoconservation* (pp. 37–60). London: The Geological Society.
- Hose, T.A. (2012) Editorial: Geotourism and geoconservation. *Geoheritage* 4: 1–5.
- Hose, T. A. (2016) *Geoheritage and Geotourism: A European Perspective*. Woodbridge, UK: The Boydell Press.
- Hose, T.A. and Vasiljević, D.A. (2012) Defining the nature and purpose of modern geotourism with particular reference to the United Kingdom and South-East Europe. *Geoheritage* 4: 25–43.
- Hurtado, H., Dowling, R.K. and Sanders, D. (2014) An exploratory study to develop a geotourism typology model. *International Journal of Tourism Research* 16(6): 608–613.
- IIEC (2017) *An Economic Review of the Irish Geoscience Sector*. A Report prepared for the Geological Survey Ireland by Indecon International Economic Consultants, pp.91. Dublin: IIEC.
- Johnson, C.P., Sheth, H.C. and Ollier, C.D. (2010) Geological attractions for tourists in Mauritius. In R.K. Dowling and D. Newsome (eds) *Global Geotourism Perspectives* (pp. 80–92). Oxford: Goodfellow Publishers.
- Joyce, B. (2006) *Geomorphological sites and the new geotourism in Australia*. <http://web.earthsci.unimelb.edu.au/Joyce/heritage/geotourismReviewwebj.htm> (accessed 4 May 2018).
- Kelley, D. and Salazar, R. (2017) Geosites in the Galapagos Islands used for geology education programs. *Geoheritage* 9: 351. <https://doi.org/10.1007/s12371-016-0190-3>.
- Kharazian, P. (2015) Assessment of geo-tourism structure in Bojnourd city sustainable tourism development. *European Journal of Sustainable Development* 4(2): 175–184.
- Kiernan, K. (2013) The nature conservation, geotourism and poverty reduction nexus in developing countries: A case study from the Lao PDR. *Geoheritage* 5: 208–225.
- Kiernan, K. (2015) Landforms as sacred places: Implications for geodiversity and geoheritage. *Geoheritage* 7: 177–193.
- Kim, A.K. and Brown, G. (2012) Understanding tourist perspectives on geotourism experience: Implications for destination development. *Tourism Review International* 16: 24–57.
- Kim, S.S., Kim, M., Park, J. and Guo, Y. (2008) Cave tourism: Characteristics, motivations to visit, and the segmentation of their behaviour. *Asia Pacific Journal of Tourism Research* 13(3): 299–318.
- King, L.M. (2010) Geotourism in the Hawaiian islands. In D. Newsome and R.K. Dowling (eds), *Geotourism: The Tourism of Geology and Landscape* (pp. 114–125). Oxford: Goodfellow Publishers.
- Kubalíková, L. (2013) Geomorphosite assessment for geotourism purposes. *Czech Journal of Tourism* 2(2), 80–104.
- Kubalíková, L. and Kirchner, K. (2016) Geosite and geomorphosite assessment as tool for geoconservation and geotourism purposes: A case study from Vizovická vrchovina Highland (Eastern Part of the Czech Republic). *Geoheritage* 8: 5–14.
- Kumar, A. and Deshmukh, B. (2015) A review on 'Geo-ecological Studies': An interdisciplinary approach for evaluation and sustainable management of 'Geo-ecosystems'. *Journal Geological Society of India* 86: 605–612.
- Larwood, J. and Durham, E. (2005) Involving people in geodiversity. Publication compiled after the *Earth Heritage: World Heritage Conference* held in September, Wareham, Dorset, UK.

- Lawrence, A. (2010) Geotourism in the Sultanate of Oman. In R.K. Dowling and D. Newsome (eds) *Global Geotourism Perspectives* (pp. 93–112). Oxford: Goodfellow Publishers.
- Lee, C.-T. (2013) Geodiversity and geotourism development in Caoling Geopark, Yunlin County, Taiwan. Paper presented at the Third Asia Pacific Geoparks Network Symposium, *For the Innovation of the APGN*. Jeju Island, South Korea, 7–13 September.
- Leeder, M. and Lawlor, J. (2017) *GeoBritannica: Geological Landscapes and the British Peoples*. Edinburgh: Dunedin Academic Press.
- Lima, E.A., Machado, M. and Nunes, J.C. (2013) Geotourism development in the Azores archipelago (Portugal) as an environmental awareness tool. *Czech Journal of Tourism* 2(2): 126–142.
- Mao, I., Robinson, A.M. and Dowling, R.K. (2009) Potential geotourists: An Australian case study. *Journal of Tourism* 10(1): 71–80.
- Migoń, P. and Pijet-Migoń, E. (2017) Viewpoint geosites: Values, conservation and management issues. *Proceedings of the Geologists' Association* 128: 511–522.
- Migoń, P., Różycka, M. and Michniewicz, A. (2017) Conservation and geotourism perspectives at granite geoheritage site of Waldviertel, Austria. *Geoheritage* online DOI 10.1007/s12371-017-0219-2.
- Miller, R.F. and Buhay, D.N. (2014) Turning a forgotten geological heritage into a geological park: Developing Stonehammer Geopark. *Geoheritage* 6: 29–39.
- Morrissey, C. (2006) Thesen zur integration historischer landschaftspotenziale in geotourismus und geopark-konzepte – Kurzfassung des beitrags. In J. Vogt and A. Megerle (eds) *Geopark and Geotourism Research: Results of the International Workshop at Karlsruhe 2006* (pp. 57–58). Frickenhausen: Regional Science Research No. 31, University of Karlsruhe.
- National Geographic (n.d.) About geotourism, <https://www.nationalgeographic.com/maps/geotourism/about/> (accessed 2005).
- Necheş, I.-M. and Erdeli, G. (2014) Geolandscapes and geotourism: Integrating nature and culture in the Bucegi Mountains of Romania. *Landscape Research* 40(4): 486–509.
- Newsome, D. and Dowling, R.K. (eds) (2010) *Geotourism: The Tourism of Geology and Landscape*. Oxford: Goodfellow Publishers.
- Newsome, D. and Dowling, R.K. (2018) Geoheritage and geotourism. In E. Reynard and J. Brilha (eds) *Geoheritage: Assessment, Protection and Management* (pp. 305–321). Berlin: Elsevier.
- Newsome, D., Dowling, R.K. and Leung, Y.-F. (2012) The nature and management of geotourism: A case study of two established iconic geotourism destinations. *Tourism Management Perspectives* 2–3: 19–27.
- Ng, Y. (2015) *Geoparks: A Global Approach to Promote Sustainable Tourism for Local Communities*. Paper presented at the Global Asia Pacific Conference, *Expanding Ecotourism Horizons*, held on Rottneest Island, Perth, Western Australia, 17–19 November.
- Ng, Y., Fung, L.W. and Newsome, D. (2010) Hong Kong geopark: Uncovering the geology of a metropolis. In R.K. Dowling and D. Newsome (eds) *Global Geotourism Perspectives* (pp. 179–191). Oxford: Goodfellow Publishers.
- Norrish, L., Sanders, D. and Dowling, R.K. (2014) Geotourism product development and stakeholder perceptions: A case study of a proposed geotrail in Perth, Western Australia. *Journal of Ecotourism* 13(1): 52–63.
- Ólafsdóttir, R. and Dowling, R.K. (2014) Geotourism and geoparks: A tool for geoconservation and rural development in vulnerable volcanic environments: A case study from Iceland. *Geoheritage* 6(1): 71–87.
- Ólafsdóttir, R. and Tverijonaite, E. (2018) Geotourism: A systematic literature review. *Geosciences* 8, 234. DOI 10.3390/geosciences8070234.
- Pająk, J., Krobicki, M., Golonka, J., Słomka, T., Van Giang, N. and Zuchiewicz, W. (2006) Attractions of inanimate nature of the northern Vietnam as a basis for tourism development. *Geotourism* 2: 167–172.
- Palacio-Prieto, J. (2015) Geoheritage within cities: Urban geosites in Mexico City. *Geoheritage* 7: 365–373.
- Paskova, M. (2013) Editorial: Special Issue on Geotourism. *Czech Journal of Tourism* 2(2).
- Paskova, M. (2017) Editorial: Special Issue on Geotourism. *Czech Journal of Tourism* 6(2).
- Pförr, C. and Dowling, R.K. (2008) *The Potential for Geotourism Development in Western Australia: A Scoping Study*. Presented at Geotour 2008 – ‘Geotourism and Mining Heritage’, Krakow, Poland, 26–28 June.
- Pförr, C., Dowling, R.K. and Newsome, D. (2014) Geotourism: A sustainable development alternative for remote locations in Western Australia? In M. Brueckner, A. Durey, R. Mayes and C. Pförr (eds) *Resource Curse or Cure? On the Sustainability of Development in Western Australia* (pp. 153–162). Heidelberg: Springer.
- Pica, A., Reynard, E., Grangier, L., Kaiser, C., Ghiraldi, L., Perotti, L. and Del Monte, M. (2017) GeoGuides, urban geotourism offer powered by Mobile Application Technology. *Geoheritage* online. DOI 10.1007/s12371-017-0237-0.
- Pijet-Migoń, E. and Migoń, P. (2015) Geothermal fields of New Zealand in tourism industry – the case of complementary assets and competitive products. *Geotourism* 3–4: 42–43, 3–24.
- Pralong, J.-P. (2006a) Geotourism: A new form of tourism utilising natural landscapes and based on imagination and emotion. *Tourism Review* 61(3): 20–25.

- Pralong, J-P. (2006b) Research approaches concerning the guiding image of 'Protection through use' in geoparks and geotouristic destinations. In J. Vogt and A. Megerle (eds) *Geopark and Geotourism Research: Results of the International Workshop at Karlsruhe 2006* (pp. 51–55). Frickenhausen: Regional Science Research No. 31, University of Karlsruhe.
- Pulido-Bosch, A., Martín-Rosales, W., López-Chicano, M., Rodríguez-Navarro, C.M. and Vallejos, A. (1997) Human impact in a tourist karstic cave (Aracena, Spain). *Environmental Geology* 31(3–4): 142–149.
- Purdie, H. (2013) Glacier retreat and tourism: Insights from New Zealand. *Mountain Research and Development* 33(4): 463–472.
- Purdie, H., Gomez, C. and Espiner, S. (2015) Glacier recession and the changing rockfall hazard: Implications for glacier tourism. *New Zealand Geographer* 71(3): 189–202.
- Rangnes, K. (2013) Communicating geological heritage through art – a cooperative project between geologists, artists and schools. Paper presented at the Third Asia Pacific Geoparks Network Symposium, *For the Innovation of the APGN*. Jeju Island, South Korea, 7–13 September.
- Ren, G., Simonson, L. and Pan, Z. (2013) Interpretation of geoheritage for geotourism – a comparison of Chinese geopark and national parks in the United States. *Czech Journal of Tourism* 2(2): 105–125.
- Reynard, E. and Brilha, J. (eds) (2018) *Geoheritage: Assessment, Protection and Management*. Berlin: Elsevier
- Rocha, F. and Ferreira da Silva, E. (2014) Geotourism, medical geology and local development: Cape Verde case study. *Journal of African Earth Sciences* 99: 735–742.
- Różycka, M. and Migoń, P. (2018) Customer-oriented evaluation of geoheritage: on the example of volcanic geosites in the West Sudetes, SW Poland. *Geoheritage* 10: 23. <https://doi.org/10.1007/s12371-017-0217-4>.
- Ruban, D.A. (2015), Geotourism: A geographical review of the literature. *Tourism Management Perspectives* 15: 1–15.
- Rutherford, J., Kobryn, H. and Newsome, D. (2015) A case study in the evaluation of geotourism ashotspot. *Current Issues in Tourism* 18(3): 267–285.
- Sallam, E.S., Ponedelnik, A.A., Tiess, G., Yashalova, N.N. and Ruban, D.A. (2018) The geological heritage of the Kurkur-Dungul area in southern Egypt. *Journal of African Earth Sciences* 137: 103–115.
- Santangelo, N., Romano, P. and Santo, A. (2015) Geo-itineraries in the Cilento Vallo di Diano Geopark: A tool for tourism development in Southern Italy. *Geoheritage* 7: 319–335.
- Schumann, A., Muwanga, A., Lehto, T., Staudt, M., Schlüter, T., Kato, V. and Namboya, A. (2015) Ugandan geosites. *Geology Today* 31(2): 59–67.
- Schutte, I.C. (2006a) Geotourism and geopark research in South Africa. In J. Vogt and A. Megerle (eds) *Geopark and Geotourism Research: Results of the International Workshop at Karlsruhe 2006* (pp. 59–64). Frickenhausen: Regional Science Research No. 31, University of Karlsruhe.
- Schutte, I.C. (2006b) Guidelines for the sustainable development of geotourism in South Africa. In J. Vogt and A. Megerle (eds) *Geopark and Geotourism Research: Results of the International Workshop at Karlsruhe 2006* (pp. 65–69). Frickenhausen: Regional Science Research No. 31, University of Karlsruhe.
- Shahhoseini, H., Modabberi, S. and Shahabi, M. (2017), Study of factors influencing the attitude of local people toward geotourism development in Qeshm National Geopark, Iran. *Geoheritage* 9(1), 35–48. <https://doi.org/10.1007/s12371-015-0171-y>.
- Słomka, T. (2011) *Geotourism: A Variety of Aspects*. Kraków, Poland: AGH University of Science and Technology.
- Słomka, T. (2012) *The Catalogue of Geotourist Sites: In Nature Reserves and Monuments*. Kraków, Poland: AGH University of Science and Technology.
- Soliman, M.S.A. and Abou-Shouk, M.A. (2017) Predicting behavioural intention of international tourists towards geotours. *Geoheritage* online. DOI 10.1007/s12371-016-0200-5.
- Stoffelen, A. and Vanneste, D. (2015) An integrative geotourism approach: Bridging conflicts in tourism landscape research. *Tourism Geographies* 17(4): 544–560.
- Stoffler, D., Posges, G. and Barfield, R. (2008) *Development of Geotourism in the National Geopark Ries, Southern Germany* (3070pdf). Large Meteorite Impacts and Planetary Evolution IV Conference, held Vredefort Dome, 17–21 August.
- Stokes, A., Cook, S. and Drew, D. (2003) *Geotourism: The New Trend in Travel*. The Travel Industry Association of America (TIA) and National Geographic Traveler. Washington, DC: National Geographic.
- Swarna, K., Biswas, S.K. and Harinarayana, T. (2013) Development of geotourism in Kutch Region, Gujarat, India: An innovative approach. *Journal of Environmental Protection* 4: 1360–1372.
- Tongkul, F. (2010) Geotourism in Malaysia: Mount Kinabalu, Sabah. In R.K. Dowling and D. Newsome (eds) *Global Geotourism Perspectives* (pp. 113–123). Oxford: Goodfellow Publishers.
- Tourtellot, J.B. (2000) *Geotourism for Your Community*. National Geographic Drafts, p.2. Washington, DC: National Geographic.
- Tourtellot, J.B (2011) *UNESCO's Geoparks 'Clarifies' geotourism*. Posted 16 November. <https://voices.national-geographic.org/2011/11/16/unescos-geoparks-embrace-geotourism> (accessed 4 May 2018).

- UK National Commission for UNESCO (2016) *Wider Value of UNESCO to the UK 2014–2015*. London: UK National Commission for UNESCO. https://www.unesco.org.uk/wp-content/uploads/2016/02/UK-National-Commission-for-UNESCO_Wider-Value-of-UNESCO-to-the-UK_UK-Organisations_January-2016.pdf (accessed 3 June 2018).
- UNESCO (2016) *UNESCO Global Geoparks*. Paris: Division of Ecological and Earth Sciences – United Nations Educational, Scientific and Cultural Organization.
- Višnić, T., Spasojević, B. and Vujičić, M. (2016) The potential for geotourism development on the Srem Loess Plateau based on a preliminary geosite assessment model (GAM). *Geoheritage* 8: 173–180.
- Vogt, J. and Megerle, A. (eds) (2006) *Geopark and Geotourism Research: Results of the International Workshop at Karlsruhe 2006*. Frickenhausen: Regional Science Research No. 31, University of Karlsruhe.
- Wang, L., Tian, M. and Wang, L. (2015) Geodiversity, geoconservation and geotourism in Hong Kong Global Geopark of China. *Proceedings of the Geologists' Association* 126: 426–437.
- Wang, L., Tian, M., Wen, X., Zhao, L., Song, J., Sun, M., Wang, H., Lan, Y. and Sun, M. (2014) Geoconservation and geotourism in Arxan-Chaihe Volcano Area, Inner Mongolia, China. *Quaternary International* 349: 384–391.
- Warowna, J., Zglobicki, W., Kołodynska-Gawrysiak, R., Gajek, G., Gawrysiak, L. and Telecka, M. (2016) Geotourist values of loess geoheritage within the planned Geopark Małopolska Vistula River Gap, E Poland. *Quaternary International* 399: 46–57.
- Welling, J.T., Þorvarður, Á. and Ólafsdóttir, R. (2015) Glacier tourism: A scoping review. *Tourism Geographies* 17(5): 635–662.
- Williams, F.M. (2016) *Understanding Ethiopia: Geology and Scenery*. Berlin Heidelberg: Springer.
- Zglobicki, W. and Baran-Zglobicka, B. (2013) Geomorphological heritage as a tourist attraction. A case study in Lubelskie Province, SE Poland. *Geoheritage* 5: 137–149.
- Zhang, J., Tian, M., Wu, F. and Mei, X. (2013) Discussion of key points of geopark construction and development in China. Paper presented at the Third Asia Pacific Geoparks Network Symposium, *For the Innovation of the APGN*. Jeju Island, South Korea, 7–13 September.
- Zouros, N. (2010) Geotourism in Greece: A case of the Lesvos Petrified Geopark. In R.K. Dowling and D. Newsome (eds) *Global Geotourism Perspectives* (pp. 215–229). Oxford: Goodfellow Publishers.