Thomas A. Hose

Geotourism in Almeria Province, southeast Spain

Abstract

Southeast Spain has since the 1960s been a destination for mass domestic and foreign with tourists attracted to Andalucia's resort regions of Almeria and Malaga. Attracted to the narrow coastal strip's sandy beaches and associated tourism infrastructure, the often dramatic and varied inland landscapes have until quite recently seldom attracted mass tourists. However, with central and provincial governments' acknowledgement of the need to develop environmentally and economically sustainable forms of tourism, new types of tourist and tourism provision have been sought since the 1990s. Geotourism is one form of such sustainable niche tourism; its development has been supported by a rapidly evolving and emerging range of landscape and wildlife protection measures and promotion. Because of its rich and varied geology, topography and wildlife, subsumed within 'natural landscape', Almeria Province has already developed the basis for considerable geotourism development. In late 2006 the success and national excellence of these measures was recognised with the award of UNESCO Geopark status to the Cabo de Gata-Nijar Natural Park. This paper summarises and analyses geotourism provision in Almeria Province. It also examines the management issues for geotourism in fragile landscapes. Finally, it indicates the role that such provision can play in the broader context of sustainable tourism in Spain's Mediterranean coastlands.

Keywords:
geotourism; sustainable tourism; Almeria; Spain

Introduction

Geotourism is a form of niche (Hose, 2005) and special interest tourism (Hall & Weiler, 1992) and travel (Read, 1980) focussed on tourists travelling to participate in a specific activity in an appropriate location. The native resource alone is insufficient to provide the tourism resource; transport and accommodation infrastructure must be coupled with interpretative provision based upon a sound knowledge and understanding of the resource base and its users, or geotourists. Geotourists are focussed on examining, often spectacular, landscapes and geological materials such as fossils and minerals *in-situ* and in museums. Geotourism can promote and fund the preservation and

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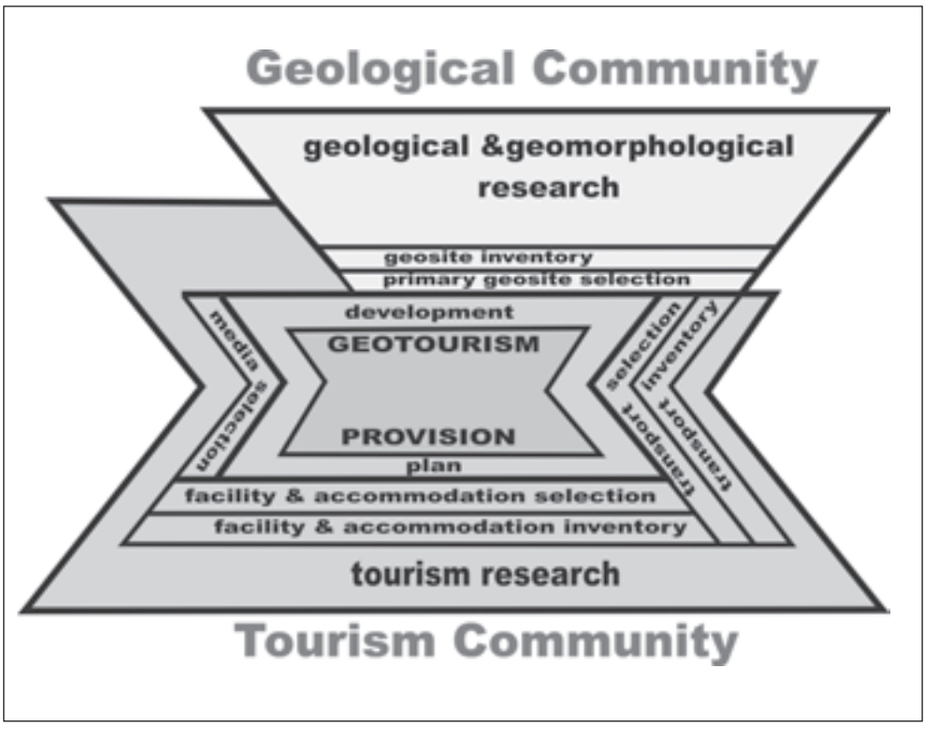
conservation of geosites, that is geoconservation because it generates income and popularises and constituency-builds; it promotes positive interaction between central/regional government agencies responsible for statutory provision, regulation and some funding and the supply-side stakeholders, especially the academic geo-heritage and bio-heritage communities and local government and commercial heritage attraction providers. Geotourism's successful development requires ongoing primary published geo-research, geoconservation, visitor and media evaluation within the framework of sustainable tourism management.

However, even in areas such as the rapidly expanding European Geoparks Network (Zouros, 2006) in which it is especially promoted, there is seemingly limited understanding of geotourism's resource base, antecedents and management requirements. Hence this paper provides this background and develops them through the case-study of Spain's Almeria region, developed from a 2004 geotourism review undertaken for the regional government (Benitez, 2004).

Figure 1
A MODEL OF GEOTOURISM DEVELOPMENT*



* The model draws attention to the major activities and their linear relationships, together with areas of overlapping activity (the thinner lines separate related components and the thicker lines separate different sectors). Tourism research underpins traditional tourism components and should be employed in the selection of primary geosites. The important aspects of media and transport selection to develop sustainable provision are noted. It recognises that two professional 'communities' are involved that need to work towards a common goal. However, it does not consider sustainability since this externally driven to both geological and much tourism research. The process of developing, implementing and evaluating management plans is not covered.

The paper is based upon direct field observation, a critique of geotourism publications, dialogue with Andalusian geologists and conservationists, supplemented by a desktop study; the whole is underpinned by a dedicated on-going from the early 1990s geotourism research programme (Hose, 2003) which was the first attempt to define geotourism's nature and purpose, develop an understanding, and ascertain appropriate approaches to the management and interpretation, of its resource base. The subsequent outcomes were incorporated within the *UNESCO Geoparks Programme Feasibility Study* (Anon, 2000; Patzack & Eder, 1998) initiative which has globally promoted geotourism since 2000. Geotourism provision is enhanced by 'environmental interpretation': *". . . a range of activities carried out by managers of countryside and heritage sites. It can be defined as: 'the art of explaining the meaning and significance of sites visited by the public'."* (Badman, 1994, p.429) whose geotourism role has been reviewed (Hose, 1998; Hose, 2000; Hose, 2006). Its interpretive provision (Hose, 2003), geosite selection criteria and approaches (Hose, 1997; Hose 2003) have already been modelled but there are no published attempts to model its provision processes as this paper requires; consequently a tentative model *(Figure 1)* is herein included.

Geotourism and geoparks: Essential definitions

Geotourism's first definition appeared in a professional interpretation magazine (Hose, 1995) undergoing several revisions to: *"The provision of interpretative facilities and services to promote the value and societal benefit of geological and geomorphological sites and their materials, and to ensure their conservation, for the use of students, tourists and other recreationalists."* (Hose, 2000a, p. 136). It is useful in developing geotourism provision to recognise 'Dedicated Geotourists' as *individuals who purposefully select to visit geosites and exhibits for the purpose of personal educational or intellectual improvement and enjoyment* and 'Casual Geotourists' as *individuals who visit geosites and exhibits primarily for the purpose of pleasure and some limited intellectual stimulation.* Provision for the former is longstanding through field-guides and journal papers. Provision for the latter is relatively recent through populist guides, trails and visitor centres. Their geosites often overlap although their usages and understandings are usually different. Geoconservation and tourism promotion, overtly linked with sustainable tourism, are key geotourism elements. It is useful for management purposes to recognise:

> Primary Geosites with geological/geomorphophological of at least local significance for their scientific, educational or interpretative value that are naturally or artificially generally permanently exposed features within a delimited area. They vary from quarries and natural cliffs to mines and caves and require 'husbandry' rather than strict preservation; much of their value is their access to *in-situ* rocks and their contents, benefitting from limited disturbance, restricted collecting and removal of obscuring debris and vegetation.

and

> Secondary Geosites with some feature(s) and/or item(s) of at least local significance to the history, development, presentation or interpretation of geology or geomorphology within or on a structure. They include museum and library collections, heritage/visitor centres, geoscientists' residences and memorials.

Geoparks usually include both type of geosite. A UNESCO Geopark is:

> *". . . a territory with well-defined limits that has a large enough surface area for it to serve local economic development. The Geopark comprises a number of geological heritage sites of special scientific importance, rarity or beauty; it may not be solely of geological significance but also of archaeological, ecological, historical or cultural value." (Anon, 2000, p. 43).*

UNESCO Geoparks must provide educational facilities and promote research. A European Geopark is: *". . . a territory which combines the protection and promotion of geological heritage with sustainable local development."* (Zouros, 2006, p. 16) with the main characteristics that they: encompass a geo-heritage with enough geosites of sufficient quality (in terms of science, rarity, aesthetics and educational value) to generate tourism interest; have a formal agreement amongst local government authorities on promotion and management strategies, with a sound economic (and with some European Union financial) underpinning, within the boundaries of an area large enough to be economically viable; and formally link to the geopark network to benefit from protection and management measures. Geoparks must actively participate in the economic development of their territory and immediate surroundings by working with locally-based small and medium sized enterprises to develop and promote new products and services, ranging from interpretative provision to souvenir manufacture; equally, leisure-related activities (such as cycling and climbing) can be encouraged so that a geopark's host communties recognise and appreciate the geo-heritage and are actively involved in its cultural and economic regeneration.

Geoconservation and geotourism in Spain

Spain was relatively late in Europe in enacting national legislative nature conservation. The first, the 1975 Natural Areas Act, required the competent authorities to develop inventories of areas protected for nature conservation purposes. This was undertaken under the auspices of the National Nature Conservancy Institute (ICONA) that created the 1976-1977 Inventory of Outstanding Landscapes and subsequently the 1977-1980 Inventory of Natural Open Spaces Warranting Special Protection (Cortes, Barettino & Gallego, 2000). The latter included some geology elements, but its chief focus was biological. Consequently, from 1978 the Geology and Mining Technology Institute of Spain (ITGE) undertook a National Inventory of Geological Interest, initially underpinned by a four-phase project (Elizaga, 1988); however, its progress was very slow and in 1987, after a two-year delay, the work was included within the remit of the 1:50,000 Geological Cartography project. The underpinning sustainable geotourism audit was undertaken by the Spanish Geosites Project, initiated by the International Union of Geological Sciences Geosites Working Group (Wimbledon, 1996a, 1996b, 1998) with UNESCO and European Union (via the LEADER-IIC programme) support; this recognised important geosites, especially as a tourism resource for economic regeneration within a sustainable tourism geoparks' framework (Zouros, 2006), in relation to their physical accessibility and proximity to urban areas. Concomitant with the national some regional inventories were undertaken such as the 1973 *The Geological Heritage of the Autonomous Community of Madrid*, the 1983 *Sites of Geological Interest in the Province of Valencia* and a catalogue and inventory for Andalusia's Malaga Province (Cortes, Barettino & Gallego, 2000).

Although Spain lacks specific geoconservation legislation two laws (1985 Law of the Historic Heritage and 1989 Law of the Conservation of the Wild Flora and Fauna) have some geoconservation relevance. The 1985 Law in Section II, Article 15 notes an: *". . . historical site is place or natural area linked to events or memories of the past, to popular traditions, cultural creations or creations of Nature and the works of mankind that possess an historical, ethnological, palaeontological or anthropological value."* Section V, Articles 41 and 42 refer to: *". . . geological and palaeontological elements relating to the history of mankind and to his origins and background."* and include archaeological excavations: *". . . carried out with a view to describing and researching all kinds of historical and palaeontological remains and geological components relating thereto."* The 1989 Law has two significant geoconservation elements: Article 13: Parks are natural areas that because of the their

beautiful landscapes and geomorphological formations have aesthetic, educational or scientific values meriting conservation; and Article 16: Natural Monuments are those geological formations, palaeontological deposits and other elements of the geosphere that are of special interest due to their uniqueness or the significance of their landscape and scientific worth. It also enables the recognition of National Parks that, although designated by the Spanish Parliament, are jointly managed by the State Administration and the Autonomous Communities within which they are situated.

Mainland Spain has nine national parks including the Parque Nacionale de Donana, in Andalusia. At the regional level these conservation areas have been reinforced by legislation recognising protected Natural Reserves, Natural Monuments and Protected Landscapes. The management of all of these is entrusted to the various autonomous regions' environmental authorities. Significant fossil sites can be protected by the 1985 Law as a cultural resource; their protection is entrusted to the autonomous regions' cultural agencies. Whilst the recognition and enforcement of these protective measures varies in consistency across Spain, in Andalusia considerable support is evident, especially in their promotion through a range of technical and populist wildlife, landscape and geology publications produced under the auspices of TECNA (Tecnologia De La Naturaleza) and the Consejeria De Medio Ambiente of the government of Andalusia which published in 2001 a Declaration on the Conservation of the Geodiversity of Andalusia.

To many tourists, especially those from northern Europe, southern Spain epitomises:

> *". . . summer months, lying on excruciatingly hot sand under an excruciatingly hot sun, with periodic quenchings in the tepid Mediterranean bath. Bliss is finally achieved in the evenings from wine cheaper than water and gaiety of several hundred nightclubs (not all the same night). For those like myself who may find this lifestyle the most boring ever invented there are many geological distractions of great interest . . ." (Moseley, 1990, p. 23).*

There is a perceived need in Spain to: *". . . improve traditional littoral products in order to maintain their appeal and the creation of new products on the grounds of the appearance of the 'new tourism demand'."* (Mir & Baidal, 2001, p. 30). Geotourism provision is an attempt to add diversity to the tourism offer in such classic mass-market (Sun, sea and sand) destinations that are increasingly viewed by academics and tourism policy-makers as unsustainable. Geotourism has to be underpinned, because of the finite and often fragile nature of its resource base, by sustainable management techniques and policies. However, geotourism provision is not isolated from other tourism activities and their associated infrastructure; indeed:

> *"All the components of tourism supply are interrelated with attractions as the core. A coordinated and balanced development of all components is critical because the capacity of the tourism industry is determined by the capacity of the weakest components (the bottleneck). . . . Infrastructure and amenities determine the actual or effective tourism (carrying) capacity while agency and administration normally set the level of the realised capacity in a given period of time." (Liu, 2003, p. 464)*

The 'carrying capacity' concept is central to many sustainable tourism management schemes. However in fragile environments, such as the semi-arid areas of Almeria Province:

> *"There is a clear need to make a distinction between the sustainability of particular tourist product and the sustainability of the environment. . . interest in the two can coincide, especially where the natural environment is the main element of attraction. . .*

The key to sustainability in all cases is that the product offered is maintained in such a way that it satisfies consumer expectations and therefore demand levels are maintained on a long-term basis." (Edwards & Priestley, 1996, p. 196).

The 1980s onwards witnessed significant changes in Spain's landscape from intensive agriculture and tourism development and the consequent increase in groundwater abstraction (Gibbons, 1994, p. 183). Water levels in underground aquifers are a significant cave and karst system, and major geotourism attractions in Almeria Province, environmental control; increased credence needs to be given to issues surrounding geoconservation and the hydro-geological resource. Given Spain's high involvement in mass-market summer tourism, its Government and provincial authorities are keen to extend the timing and nature of tourism, reflecting issues around the summer concentration of tourist arrivals at the driest times. Increasingly, the tourism industry is promoting active, participative outdoor and adventure activities involving the individual in a greater knowledge and understanding of the host environment. Recreational geology promoted through geotourism might well find a niche in such future developments. Maximising tourism revenues and ensuring sustainable development requires the spreading of arrivals across the year through policies to broaden seasonal demand and secure higher spending customers by improving the quality and supply of special interest and niche tourism activities (Valenzuela, 1988); geotourism is demonstrably an aspect of the latter (Hose, 2005) but:

"Steadily expanding visitation to protected areas worldwide increasingly challenges land managers charged with balancing their dual mandates of resource protection and recreation provision. Visitors to protected areas inevitably leave an imprint . . ." (Marion & Read, 2007, p. 5)

Fortunately Spain: *". . . has not been ravaged by generations of geologists, and specimens, especially fossils are to be found in abundance. Overcollecting will quickly reduce the value of many sensitive localities . . ."* (Moseley, 1990, p. 3). The development of geoconservation measures and their incorporation in sustainable tourism strategies is essential to geotourism's viability. Within Almeria Province considerable official support has been given to geoconservation because :

"Geological Heritage should be considered as an additional natural and cultural asset in the socio-economic development in these areas, in the same way as natural resources . . . cultural, archaeological and ethnographic heritage." (Romero in Calaforra, 2003, p. 7)

Case study area: Almeria Province

Almeria in south-east Spain is the easternmost province of Andalusia *(Figure 2)*. Its southern coastal strip is popular with domestic and especially British and German tourists. It is a popular second home and retirement area for British nationals. Almeria town is a venue for, mainly domestic, conferences. Its semi-desert hinterlands were filming locations for many 1970s' 'spaghetti westerns' and their sets are now tourist attractions. Accommodation from budget hostels to luxury hotels is widely available with the smaller inland towns, such as Sorbas, and Tabernas, having the hostels and basic hotels. Sorbas also has a small field study centre. The coastal towns such as Almeria, Carboneras and Mojacar have the upmarket accommodation and cater for large parties. Car and coach hire is generally only available in the main coastal towns. The area's chief gateway and administrative centre is the town of Almeria, (population 160,000) is directly linked to Spain's motorway network and is served by other national roads; it is linked to other European countries via its airport with regular and charter flights from the United Kingdom, as well as internal flights from Barcelona and Madrid.

Figure 2
SPAIN, ALMERIA PROVINCE LOCATION MAP

It has a combined bus and railway station – trains make the journey to Granada in just over two hours and direct services are also available to Madrid. Buses run to Grenada, Barcelona, Malaga and Valencia.

Economically Almeria Province has traditionally relied upon fishing, farming and mining (especially for iron, lead, gold, silver, gypsum and fine marble) and associated processing activities such as Nijar's ceramics industry. Since the 1960s tourism has been a growing economic activity. For tourists the area offers, as well as typical mass tourism activities, cycling, hiking, off-road driving, climbing, sailing and windsurfing.

The area is opening up to walkers, especially in the cooler months. However, its climate - western Europe's driest - is a limiting factor for tourism and farming. Mean annual precipitation is less than 300mm, most of which falls in the autumn and winter months as brief high-intensity storms, producing hot dry summers when temperatures reach 40° C., whilst winter temperatures fall to 15° C. and frost is generally confined to the sierras. The spring and autumn months are the most suitable periods for strenuous outdoor activities. The summer is best suited to sight-seeing and the established Spanish beach tourism offering. Almeria Province's burgeoning prosperity has come at a price because of its climate, for the: *". . . the hydrogeological demands for agricultural use considerably exceed the natural resources that are available, so that as a consequence, it has motivated a growing social sensitivity and demands for solutions to this problem."* (Megia, 2003, p. 5).

Such hydrogeological issues are exacerbated by the demands of the summer tourism industry; less obvious is the impact of water abstraction on the gypsum karst areas for which there is now recognition that: *". . . semi-arid zones, are declared to be one of the regions of greatest environmental and ecological importance in Europe . . . To all this can be added the exceptional geological value placed on these arid landscapes."* (Megia, 2003, p. 5).

Geotourism in Almeria Province

Given Spanish geotourism provision is concentrated on areas of palaeontological (especially dinosaur), karstic, or volcanic interest (Calaforra & Fernández-Cortés, 2006), Almeria Province is rich in the last two. Nature conservation within Almeria Province initially focused on biodiversity, due:

> *". . . perhaps, to our anthropocentric outlook, which unconsciously favours our preferences for living beings over the mineral world. Fortunately, this perception has changed over the last decade and the value of geological resources are now being recognised, as assets that form an inseparable part of the natural and cultural heritage of the countryside; in short, of the history of the Earth and the evolution of life itself." (Botella in Calaforra, 2003, p. 5)*

The Province's major geotourism attractions and areas *(Figure 3)* are all within an hour's drive of Almeria town:

1. Cabo de Gata-Nijar (volcanic) Natural Park – 30km east of Almeria with rugged coastal scenery formed from volcanic rocks *(Figure 4)*;
2. Sorbas Gypsum Karst Natural Park – 45km north-east of Almeria with arid limestone scarps and caves *(Figure 5)*;
3. Tabernas Desert Natural Park – 25km north of Almeria *(Figure 6)* and marketed as 'mini-Hollywood' *(Figure 7)* because of the ex-film sets used as tourist attractions;
4. The coastal belt, including the salt pans of Acosta and Cabo de Gata – immediately east and west of Almeria.

Figure 3
ALMERIA GEOSITES LOCATION MAP

Figure 4
CABO DE GATAR-NIJAR NATURAL PARK*

* The panel on the left clearly sets out the restrictions on activities within the Park, whilst that on the right describes and explains the volcanic rocks of the headland in the middle distance.

Figure 5
SORBAS GYPSUM KARST NATURAL PARK**

** The sparse scrub vegetation is indicative of the limited surface water. Old gypsum mine working and their spoil heaps can be seen to the left of the modern road bridge.

Figure 6
TABERNAS NATURAL PARK**

** The hills covered with sparse vegetation and the seasonally dry river bed, with trees such as the date palm, are typical of this semi-desert or 'bad-lands' area; the similarity to the southern United States and northern Mexico were well exploited from the 1960s for the filming of 'westerns'.

Figure 7
MINI-HOLLYWOOD NEAR TABERNAS*

* This cinema studio has some of the film sets, now used for re-enactments, employed in making 'westerns' and a small zoo.

Figure 8
RODALQUILAR GOLD MINES*

* The extensive but derelict gold mines and the treatment plants (such as the circular settling tanks in the middle of the view) require considerable restoration to make them safe for casual geotourists. There are several information panels around the site.

Figure 9
SORBAS MUSEUM PANEL**

** The panel outside the museum explains the formation of the karst landscape; its roof provides some limited shade from the heat of the Sun.

The Cabo de Gatar is noted for rugged coastal scenery and is popular with walkers and mountain bikers; the high quality of its geotourism provision was recognised in September 2006 with the award of UNESCO Geopark status. Cabo de Gatar has Spain's only gold mines at Rodalquilar *(Figure 8)*, a potential new tourist attraction; the end-nineteenth century discovery of gold was only exploited in the mid-twentieth century when large-scale underground mining was undertaken; a town of 1400 inhabitants that supported the mine until its 1966 closure has virtually disappeared, with its remaining 75 inhabitants involved in farming and tourism, including a camping ground. The derelict state of the underground mines and the treatment works, coupled with their isolated location, suggests a show mine development is unlikely without the emplacement of sustainable transport; it does have limited interpretative provision with on-site information panels and a study centre with accommodation might well the best option for future development. The gypsum karst area has several show caves and visitor centres, the most popular, especially with coach parties, being at Sorbas *(Figure 9; Figure 10)*.

Figure 10
SORBAS MUSEUM GALLERY*

* One of the museum's galleries; the wall panels describe the areas plants and their adaptions to the harsh environment whilst the model in the foreground shows a section through the gypsum karst with its caverns and sinkholes.

Geopark tourism and its impacts

Almeria Province's principal and best developed geotourism attraction is the Cabo de Gata.- Nijar Natural Park (covering 45,663ha), a 30km long coastal strip with an associated landscape and natural history seen nowhere else in Europe and very similar to that of north Africa. It was designated by UNESCO in 1987 as a biosphere reserve of some 38,000 hectares of land and 12,000 hectares of marine reserve, the latter to prevent commercial over-fishing, because of its extraordinary wealth of wildlife, including many rare and endemic xeromorphytic plants and endangered animals.

It was also designated a special protected zone for birds in 2000. Some 1,000 plant and 1,1000 bird and animal species are recorded (Williams, 2004). Amongst these are the dwarf fan palm, used for the park's symbol. The Salinas (salt pans) support wetland birds such as flamingos, herons, storks, cranes, avocets, curlews and oystercatchers. In the spring and autumn it is major stopping-off point on the migration route between Europe and Africa. It is an over-wintering area for wildfowl. Thus, it is a year-round bird watching area. The park has some 15 reptile species. Its offshore waters have 260 species of seaweed and support many species of crustaceans, molluscs and fish. Its coast has witnessed the re-introduction, after its demise in 1974, of one of the Mediterranean's most endangered marine mammals, the monk-seal. This varied seasonal biodiversity makes the area attractive to naturalist throughout the year, with geology activities best pursued in the cooler months. This biodiversity is consequent upon the area's arid climate and coastal location creating a large semi-desert area, bordered by arid steppes with dry river beds, coastal dunes, beaches, steep cliffs, saltmarshes and saltpans. The mountain range of Cabo de Gata is Spain's largest volcanic rock formation with sharp peaks and crags that fall steeply to the sea creating jagged 100m high cliffs. The coast is noted for its white sandy beaches and large sand dunes, together with salt pans that run parallel to the coast separated by a 400m-wide sand bar. The Cabo de Gata was designated as a European Geopark in 2001.

The Park's extensive sandy beach is adjacent to the road between Cabo de Gata and Almadrava de Montelva that is sometimes blocked off just east of the Cabo de Gata peninsula to restrict tourist numbers. Much of the coast is also only accessible on foot, via well-marked trails, especially the Cabo de Gata headland to San José (taking in beautiful beaches such as Monsul, where some scenes for the film *"Lawrence of Arabia"* were shot, with its huge sand dunes) and Las Negras to Agua Amarga sections. The coastal villages of San Miguel de Cabo de Gata, San Jose, Las Negras, Los Escullos, La Isleta del Moro, Agua Amarga, are adjacent to generally uncrowded beaches. With a population of less than 5,000 inhabitants, it annually hosts 500,000+ tourists. It has a visitor centre at Los Amoladeras, between Retamar and San Miguel de Cabo de Gata with an exhibition on its volcanic geology and natural history. There are also information points at Las Sirenas on the southernmost tip of Cabo de Gata, in La Isleta and at the Punta de los Muertos. Additionally, the main stops and viewpoints have colourful information panels.

Cave tourism and its impacts

Around one fifth of Spain's land area is karstic and Almeria Province is noted for its unique gypsum karst. Both old gypsum mines and natural limestone caves have been opened as tourist attractions since the mid-nineteenth century. It provides:

> *". . . a pioneering example of how geo-resources can become an asset within the socio-economic development of rural areas, which benefits from the possibilities offered by environmental legislation. The challenge tackled within this Protected Natural Space of Andalusia illustrates this assertion and confirms that the picture is beginning to change." (Romero in Calaforra, 2003, p. 7).*

There is already (Cigna, 1993; Hoyos, Soler, Canaveras, Sanch-Moral & Sanz-.Rubio, 1998; Huppert, Burri, Porti & Cigna, 1993) a wealth of understanding of how show caves are impacted by tourist development, especially visitors (Pulido-Bosch, Martin-Rosales, Lopez-Chicano, Rodriguez-Navarro, & Vallejos, 1997) and how they can be monitored and managed for geotourism (Calaforra & Sánche-Martos, 1996). Show caves are negatively impacted by changes in the local water regime and by their visitors and the services (such as lighting in terms of both light and the heat generated by

traditional bulb-based systems) provided for them resulting in the ingress and spread of numerous micro-flora and fauna. A recent study (Calaforra & Fernadez-Cortez, 2002) of Almeria Province's unexploited gypsum karst caves noted these threats. The degradation can be related to the nature of the visitor regime in terms of frequency, duration and numbers, coupled with the lighting regime and specific cave characteristics. However: *"The application of inefficient conservation measures and the lack of an analysis of the cave environment are the main causes of negative impacts within the caves."* (Calaforra & Fernadez-Cortez, 2002, p. 119). This indicates that cave management to achieve sustainable outcomes, both environmental and economic, is still a poorly understood and applied process in the tourism industry. Whilst the ultimate goal might well be considered as sustainable ecotourism or geoconservation subsumed with geotourism it should be noted that:

> *"Ecotourism activities require monitoring and assessing in order to facilitate more comprehensive decision-making . . . Ideally monitoring would be undertaken before opening the cave to tourists. This also means that the visitor regime can be adapted if a change is observed relative to the conditions existing before tourism." (Calaforra & Fernadez-Cortez, 2002, p. 119).*

A monitoring system, initially designed to study the changes consequent upon the beginning of tourism activities, has been installed in the Sorbas gypsum caves (Calaforra, Fernandez-Cortes & Gazquez-Parra, 2004); through employing custom designed hardware and software it monitors carbon dioxide concentration, temperature, relative humidity and visitors with the data broadcast to a base station at the University of Almería from where the information is published on the internet, enabling a real-time overview of the cave's microclimate in relation to visitor ingress and its recovery following their departure. Various measures are available to mitigate degradation. The most radical are complete or temporary closure to visitors. Alternatively, parts of the cave system can be closed and visitor numbers can be reduced. These are measures that seek to present them as sustainable ecotourism attractions in the form of show caves. Such attractions require benchmark auditing prior to their opening and subsequent monitoring and assessment to facilitate their sustainable management. The latter implies that visitor regime will be modified as required to ensure that the show cave environment is maintained more or less at the quality prior to opening; further it suggests that a cave's behaviour under natural conditions can be separated from that induced by human influence because the effects of external conditions on the cave system can be analysed following modifications required for their presentation. However, the majority of published studies are on caves that have long been opened to visitors and the true benchmark situation can only be deduced, such as for the two show caves near Malaga:

- The Nerja Cave, discovered in 1959, shown from 1962 and averaging 500,000 annual visitors, has only since 1993 had the visitor impact monitored and the management strategy moved away from maximising visitor numbers and revenues (Duran, Carrasco & Rivas, 1999).
- The Ardales Cave, discovered in 1821, shown from the mid-nineteenth century, is noteworthy for its archaeological interest (Paleolithic and later rock paintings and carvings) but only now are visitors restricted to once a week for small guided parties to minimise their impact (Vallejo & Duran, 1999).

Despite the shortcomings of these various studies they have introduced numerical concepts helpful in the management of show caves as sustainable ecotourism attractions, such as 'visitor capacity' (Andrieux, 1988; Cigna 1993; Hoyos *et al.*, 1998) and visitor 'carrying capacity' (Huppert *et a*l, 1993). The Sorbas Gypsum Karst Natural Area was

examined from an environmental economics perspective (Contreras & Calaforra, 2002) via a contingent valuation study in Sorbas town; this gave a value of 279.350 $/year for tourist use of the Gypsum Karst Natural Site in its current state, whilst the value supposing zero usage decreased to 41.340 $/year, suggesting that the Area's future involves its development as a sustainable tourist resource; further, 60% of respondents would accept reduced gypsum exploitation in favour of geoconservation.

Promoting Almeria Province's geotourism

Published accounts of Spain's geology and geomorphology are very technical; The Geological Society's English text (Gibbons & Moreno, 2002) is not particularly useful to geotourists because its approach is stratigraphic, unlike Spain's Geological Survey's Spanish text (Vera, 2004) that adopts a regional approach and includes a CD-ROM rich in additional material and images. Likewise the Spanish geomorphology text (Elorza, 1994) adopts a useful regional approach. However, the major shortcoming, especially for casual geotourists, is the lack of dedicated geological identification guides, especially for fossils for which probably the best available and national guide (Martinez, 1988) is some twenty years old. Almeria Province's geotourism potential was explored and promoted by a major regional conference (1as Jornadas Tecnicas Sobre Conservacion Y Uso Sostenible De La Geodiversidad De Andalucia) held in Almeria in May 2004. The promotion of geotourism in Province has benefited from a spate of publications produced under the auspices of the Technologia de la Naturaleza, SL (TECNA); the major of these (Megia, 2003) is a full-colour illustrated soemwhat technical guide to the desert and semi-desert areas, especially around Sorbas, meeting the needs of dedicated geotourists. Two major texts in Spanish outlined Andalusia's geodiversity and geoconservation strategy (Anon, 2001) and inventoried its natural monuments (Anon, 2003a) together with a tourist guide to its natural parks (Anon, 2003b). The first was supported by a technical DVD *Inventario, Diagnostico Y Valoracion De La Geodiversidad En Andalucia* and a populist DVD *Patrimonio Geologico De Andalucia* produced by TECNA in 2004 and 2003 respectively. The second was supported by a CD-ROM in 2003 also produced by TECNA. Two videos *Desertos De Almeria: Paisajes Geologicos Exceptionales* and *Karts En Yesos De Sorbas: Un munda subterranao entre el dessierto y el humedal* were produced by TECNA in 2004. These complement similar offerings from some of the geo-attractions such as the *La Cueva del Gato and Las Cuevas de Sorbas* DVD published in 2004. A bilingual guide (Calafora, 2003) to Sorbas Gypsum Karst of Sorbas was published by the Conserjeria de Medio Ambiente in 2003 and meets the needs of dedicated geotourists. A range of populist booklets and leaflets in Spanish were also published in the early 2000s by Conserjeria de Medio Ambiente meeting the needs of casual geotourists; these included a combined map and guide to the Cabo de Gata-Nijar and the Sorbas karst. The area has also attracted publications for the dedicated geotourists such as research papers (Martin, Braga, Aquirre, & Betzler, 2004) and field-guides (Mather, Martin, Harvey & Braga, 2001).

Conclusion

Overall, the superb exposures of rocks and landforms and accessible underground features, coupled with the sparseness of macro-vegetation, make Almeria Province ideal for the informal study of the relationships between geology and geomorphology in aesthetically appealing landscapes – the very essence of geotourism. However, given the fragile nature of the major primary geosites, geotourism environments such as the Cabo de Gata-Nijar and the Sorbas gypsum karst areas, measures are required, and some are already in place, to restrict the timing and volume of visitor ingress. Given the model earlier presented for successful geotourism provision, the adherence to the majority of steps is evident, but noteworthy exceptions, especially in relation to the secondary

geosites, are those of 'visitor studies and 'media evaluation'. This implies, from studies outside of Spain (Hose, 2003) that much of the especially populist geotourism provision might well be misfocused. Although a detailed analysis and critique of Almeria Province's geotourism interpretative provision is beyond the scope of this paper, informal observation by the author indicates that the misfocus is much less than elsewhere in Europe, but this is clearly requires a fuller investigation. However, the widespread availability of Spanish and English Language texts and multi-media materials, is benefiting Almeria Province's geotourism promotion to both dedicated and casual geotourists; the former already visit the area in increasing numbers and the latter are being encouraged through the inclusion of geotourism activities within general tourism offerings and the widespread availability of populist publications. However, the economic impact of this provision has not been fully assessed, although it has been considered for the Sorbas gypsum karst (Contreras & Calaforra, 2002) and this clearly, with the Cabo De Gata-Nijar Geopark's economic objectives, requires examination; it could provide one of western Europe's best such case studies. Geotourism provision in Almeria Province has developed rapidly with some measure of success, in terms of geosites' designation, protection, interpretation and promotion that would now benefit from further evaluation and subsequent feedback to the competent funding authorities.

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References

Andrieux, C. (1988). Influence de Fhomme sur l'environnement climatique souterrain. In *Actes de Journées Félix Tromba vol. 1* (pp. 96-122). Moulis (Ariége), France.

Anon (2000). *UNESCO Geoparks Programme Feasibility Study*. Paris: UNESCO.

Anon (2001). *Propuesta de Estrategia Andaluza de Consevacion de la Geodiversidad*. Granada: Conserjeria de Medio Ambiente, Junta de Andalucia.

Anon (2003a). *Monumentos Naturales De Andalucia*. Granada: Conserjeria de Medio Ambiente, Junta de Andalucia.

Anon (2003b). *Parques Naturales De Andalucia Guia del Viaejero*. Granada: Conserjeria de Medio Ambiente, Junta de Andalucia.

Badman, T. (1994). Interpreting Earth science sites for the public. In D. O'Halloran, C. Green, M. Harley, M. Stanley, & J. Knill (eds.), *Geological and Landscape Conservation* (pp. 429-432). London: The Geological Society.

Botella, F. C. (2003). Preface. In J. M. Calaforra, (2003) *The Gypsum Karst of Sorbas* (p. 5). Calle Mayor: Conserjeria de Medio Ambiente, Junta de Andalucia.

Calaforra, J. M. & Fernández-Cortés, A. (2006). Geotourism in Spain: resources and environmental management. In R. Dowling, & D. Newsome (eds.), *Geotourism, Sustainability, Impacts and Opportunities* (pp. 199-220). Oxford: Elsevier.

Calaforra, J. M. & Sánche-Martos, F. (1996). An example of environmental monitoring programme of a cave before its possible tourist use: "Cueva del Agua" (Granada, Spain). In A. Arrigo Cigna (ed.), *Proceedings of the International Symposium Show Caves and Environmental Monitoring* (pp. 251-259). Cuneo, Italy..

Calaforra, J. M. (2003). *The Gypsum Karst of Sorbas*. Calle Mayor: Conserjeria de Medio Ambiente, Junta de Andalucia.

Calaforra, J. M., Fernández-Cortés, A & Gázquez-Parra, J. (2004). Low-cost telemetry monitoring of the cave environment: Sorbas gypsum karst, Spain. Vol 31(1), 37 – 41.

Calaforra, M. J. & Fernandez-Cortes, A. (2002). Cave Management: What to do Before Making Suitable a Tourist Cave; paper to the 4th Samcheok International cave symposium: The Sustainable management of Cave: Academic and Policy Implications (pp. 118-127). Gangwon, Korea, 10th July 2002 and published in their proceedings.

Cigna, A. (1993). Environmental management of tourist caves. The examples of Grotta di Castellana and Grotta Grande del Vento, Italy. *Environmental Geology*, 21, 173-180.

Contreras, S. & Calaforra, J. M. (2002). Valoracion contingente del patrimonio karstico: el caso del karts en yesos de Sorbas (Almeria). In F. Carrasco, J. J. Duran, & B. Andreo, (eds.), *Karst and Environment (*pp. 350-368). Nerja: Fundación Cueva de Nerja.

Cortes, A. G., Barettino. D. & Gallego, E. (2000). Inventory And Cataloguing Of Spain's Geological Heritage, An Histrorical Review And Proposals For The Future. In D. Barretino, W. A. P. Wimbledon, & E. Gallego, (eds.), *Geological Heritage: Its Conservation and Management* (pp. 47-67). Madrid: Sociedad Geologica de Espana/Instituto Technologico GeoMinero de Espana/ProGEO.

Duran, J. J., Carrasco, F. & Rivas, A. (1999). Management Of The Underground Geological Patrimony: Tourism And Research; The Example of the Nerja Cave (Malaga, Spain). In D. Barettino, M. Vallejo, & E. Gallego (eds.), *Towards the Balanced Management of the Geological Heritage in the New Millenium* (pp. 367-373). Madrid: Sociedad Geologica de Espana/Instituto Technologico GeoMinero de Espana/ProGEO.

Edwards, J. A. & Priestley, G. K. (1996). European Perspectives on Sustainable Tourism. In G. K. Priestly, J. A. Edwards, & H. Coccossis (eds.), *Sustainable Tourism? European Experiences* (pp.189-198). Wallingford: CAB International.

Elizaga, E. (1988). Georrecursos Culturales. In Anon, *Geologia Ambiente* (pp. 85-100). Madrid. Instituto de Tecnologico GeoMinero de Espana.

Elorza, M. G. (ed.) (1994). *Geomorfologia De Espana*. Madrid: Editorial Rueda.

Gibbons, B. (1994). *A Guide to the National Parks and Other Wild Places of Britain and Europe*. London: New Holland.

Gibbons, W. & Moreno, T. (eds.) (2002). *The Geology of Spain*. London: The Geological Society.

Hall, C. M. & Weiler, B. (1992). What's Special About Special Interest Tourism. In B. Weiler, & C. M. Hall (eds.), *Special Interest Tourism* (pp. 1-14). London: Belhaven Press.

Hose, T. A. (1995). Selling the Story of Britain's Stone, *Environmental Interpretation*, 10, 2, 16-17.

Hose, T. A. (1997). Geotourism - Selling the earth to Europe. In P. G. Marinos, G. C. Koukis, G. C. Tsiambaos, & G. C. Stourness (eds.), *Engineering Geology and the Environment* (pp. 2955-2960). Rotterdam: A.A.Balkema.

Hose, T. A. (1998). Mountains of Fire from the Present to the Past – Effectively Communicating the Wonder of Geology to Visitors. *Geologica Balcania*, 28, (3-4), 77- 85.

Hose, T.A. (2000). Geological Interpretation and Geoconservation Promotion for Tourists. In D. Barretino, W. A. P. Wimbledon, & E. Gallego (eds.), *Geological Heritage: Its Conservation and Management* (pp.127-146). Madrid: Sociedad Geologica de Espana/Instituto Technologico GeoMinero de Espana/ProGEO.

Hose, T. A. (2003). *Geotourism in England: a two-region case study analysis*. Unpublished PhD thesis. Birmingham: Department of Ancient History and Archaeology, University of Birmingham.

Hose, T. A. (2005). Geo-Tourism – Appreciating the deep side of landscapes. In M. Novelli (ed.), *Niche Tourism: contemporary issues, trends and cases* (pp. 27-37). Oxford: Elsevier.

Hose, T. A. (2006). Geotourism and Interpretation in Dowling, R. & Newsome, D. (eds.) *Geotourism, Sustainability, Impacts and Opportunities* (pp. 221-241). Oxford: Elsevier.

Hoyos, M., Soler, V., Cañaveras, J. C., Sánch -Moral, S. & Sanz-Rubio. E. (1998). Microclimatic characterization of a karstic cave: human impact on microenvironmental parameters of a prehistoric rock art cave (Candamo Cave, northern Spain). *Environmental Geology, 3,* 231-242.

Huppert, G., Burri, E., Forti, P. & Cigna, A. (1993). Effects of tourist development on caves and karst. *Catena Supplement*, 25, 251-268.

Liu, Z. (2003). Sustainable Tourism Development: A Critique. *Journal of Sustainable Toiurism*,11(6), 459 - 475.

Marion, J. L. & Reid, S. E. (2007). Minimising Visitor Impacts to Protected Areas: The Efficacy of Low Impact Education Programmes. *Journal of Sustainable Tourism*, 15(1), 5 -27.

Martin, J. M., Braga, J. C., Aguirre, J. & Betzler, C. (2004). Contrasting models of temperate carbonate sedimentation in a small Mediterranean embayment: the Pliocene Carboneras Basin, SE Spain. *Journal of the Geological Society of London*, 161, 387-399.

Martinez, N. L. (ed) (1988). *Guia de Campo de los Fosiles de Espana* (3rd ed.). Madrid: Piramide.

Mather, A. E., Martin, J. M., Harvey, A. M. & Braga, J. C. (eds.) (2001). *A Field Guide to the Neogene Sedimentary Basins of the Almeria Province, SE Spain*. Oxford: Blackwell.

Megia, M. (ed.) (2003). *Geology of the Arid Zone of Almeria South East Spain: An educational field guide*. Granada: Technologia de la Naturaleza, SL (TECNA).

Megia, M.V. (ed) (2003). *Geology of the Arid Zone of Almeria: an educational field guide*. Granada: TECNA.

Mir, V. M. M. & Baidal, J. A. I. (2001). Towards a sustained competitiveness of Spanish Tourism. In Y. Apostopouls, P. Loukissas, & L. Leontdou (eds.), *Mediterranean Tourism: Facets of socioeconomic development and cultural change* (pp. 17-38). London: Routledge.

Pulido-Bosch, A., Martin-Rosales, W., López-Chicano, M., Rodríguez-Navarro, C. M. & Vallejos, A. (1997). Human impact in a tourist karstic cave (Aracena, Spain). *Environmental Geology*, 31, 142-149.

Read, S. E. (1980). A prime force in the expansion of tourism in the next decade: special interest travel. In D. E. Hawkins, E. L. Shafer, & J. M. Rovelstad (eds.), *Tourism Marketing and Management Issues* (pp. 193-202). Washington D.C.: George Washington University.

Romero, J. D. (2003). Forward. In J. M. Calaforra, *The Gypsum Karst of Sorbas* (p. 7). Calle Mayor: Conserjeria de Medio Ambiente, Junta de Andalucia.

Valenzuela, M. (1988). Spain: The Phenomenon of Mass Tourism. In A. Williams, & G. Shaw (eds), *Tourism and Economic Development: Western European Experiences*. London: Belhaven.

Vallejo, M. & Duran, J. J. (1999). Serrezuela de Carractraca (Malaga, Southern Spain): An Small Spot With A Diverse Geological Heritage in Barettino, D., Vallejo, M. & Gallego, E. (eds.), *Towards the Balanced Management of the Geological Heritage in the New Millenium* (pp. 374-377). Madrid: Sociedad Geologica de Espana/Instituto Technologico GeoMinero de Espana/ProGEO.

Vera, J. A. (ed.) (2004). *Geologia de Espana*. Madrid: Sociedad Geologica De Espana & Instituto Geologico y Minero de Espana.

Williams, J. (2004). Natural Parks – Almeria Province: Cabo De Gata-Nijar Natural Park. Retreived January 15, 2007, from: Almeria www files\Cabo de Gata-Nijar Natural Park, CdG Flora and Fauna of Andalucía, Southern Spain.htm

Wimbledon, W. A. (1996a). National site selection, a stop on the road to a European Geosites list. *Geologica Balcania*, 26(1),5-27.

Wimbledon, W. A. (1996b). GEOSITES - a new conservation initiative, *Episodes*, 19, 87-88.

Wimbledon, W. A. (1998). A European geosites inventory: GEOSITE – an International Union of Geological Sciences initiative to conserve our geological heritage. In D. Barettino, J. J. Duran, & J. Lopez (eds.), *Comunicaciones de la IV Reunion Internacional de Patrimomio Geologico* (pp. 15-18). Madrid: Sociedad Geologica de Espana.

Zouros, N. (2006). The European Geopark Network: Geological Heritage Protection And Local Development – A Tool For Geotourism Development in Europe. In C. Fassoulas, Z. Skoula, & D. Pattakos (eds.), *4th European Geoparks Meeting – Proceedings Volume* (pp. 15-24).

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