موسسه میراث زمین شناختی خاورمیانه
Geoheritage Institute of the Middle East

Principles of Geotourism

English for GeoTour Guides

Compilation
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موسسه میراث زمین شناختی خاورمیانه
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Principles of Tourism

Tourism may be defined as the processes, activities, and outcomes arising from the relationships and the interaction among tourists, tourism suppliers, host governments, host communities and surrounding environments that are involved in the attracting and hosting of visitors.

Tourism means the temporary short-term movement of people to destinations outside the places where they normally live and work, as well as their activities during their stay at these destinations. (All tourism should have some travel, but not all travel is tourism.)

Tourism comprises the activities of persons travelling to and staying in places outside their unusual environment for less than a year for leisure, business and other purposes.(UNWTO)

Types of tourism according to time period are categorized as short term (up to 3 days) and long term (>7 days). And by its way of organization, tourism could be organized (by travel agency) or individual (Families on their own).

According to place of destination, tourism is divided into two categories: International and Domestic and according to direction of tourist flows tourism is categorized as Incoming (inbound) tourism and Outgoing (outbound) tourism.

Elements of travel are known as distance, length of stay at a destination, residence of traveler, purpose of travel.

Tourism has some main characteristics: perishability, inconsistency, investment and immobility, people-oriented, inseparability, intangibility and inflexibility.

Economic benefits of tourism:

-Provides employment opportunities

-Generates foreign exchange

-Increases incomes

-Increases GDP

-Can be built on existing infrastructure

-Develops an infrastructure that will also help stimulate local ---Commence an industry

-Can be developed with local products and resources

-Diversifies the economy

-Tends to be compatible with other economic activities

-Spreads development

-High multiplier effect

-Increases governmental revenues

Social benefits of tourism

-Broadens educational and cultural horizons

-Improves quality of life

- Higher incomes and improved standards of living

- Environmental protection and improvement

-Provides tourism and recreational facilities that may be used by a local population

Cultural benefits of tourism

-Reinforces preservation of heritage and tradition

-Visitor interest in local culture provides employment for artists, musicians and other performing artists enhancing cultural heritage.

-Breaks down language barriers sociocultural barriers, class barriers, racial barriers, political barriers, and religious barriers

-Creates a favorable worldwide image for a destination

-Promotes a global community

-Promotes international understanding and peace

What is Ecotourism?

Ecotourism has been defined as a form of nature-based tourism in the market place, but it has also been formulated and studied as a sustainable development tool by NGOs, development experts and academics since 1990.
The term ecotourism, therefore, refers on one hand to a concept under a set of principles, and on the other hand to a specific market segment. The international Ecotourism Society (TIES) (Previously known as the Ecotourism Society (TES)) in 1991 produced one of the earliest definitions
Ecotourism is responsible travel to natural areas that conserves the environment and sustains the well-being of local people.
Ecotourism is environmentally responsible travel and visitation to relatively undisturbed natural areas, in order to enjoy and appreciate nature (and any accompanying cultural features – both past and present) that promotes conservation, has low negative visitor impact, and provides for beneficially active socioeconomic involvement of local populations.

Components of Ecotourism

-Contributes to conservation of biodiversity.
-Sustains the well-being of local people.
-Includes an interpretation / learning experience.
-Involves responsible action on the part of tourists and -tourism industry.
-Is delivered primarily to small groups by small-scale businesses.
-requires lowest possible consumption of non-renewable resources.
-stresses, local participation ownership and business opportunities, particularly for rural people.

Principles of Ecotourism

-Minimize the negative impacts on nature and culture that can damage a destination.

-Educate the traveler on the importance of conservation.

-Stress the importance of responsible business, which works cooperatively with local authorities and people to meet local needs and deliver conservation benefits

-Direct revenues to the conservation and management of natural and protected areas.

-Emphasize the need for regional tourism zoning and for visit or management plans designed for either regions or natural areas that are slated to become eco-destinations.

-Emphasize use of environmental and social base – line studies, as well as long-term monitoring programs, to assess and minimize impacts.

-Strive to maximize economic benefit for the host country, local business and communities, particularly people living in and adjacent to natural and protected areas.

-Seek to ensure that tourism development does not exceed the social and environmental limits of acceptable change as determined by researchers in cooperating with local residents.

-Rely on infrastructure that has been developed in harmony with the environment, minimizing use of fossil fuels, conserving local plants and wildlife, and blending with the natural and cultural environment.

Most popular nature based tour activities are: adventure tourism, geotourism and cultural heritage, bird-watching tours, wildlife tours, desert safari, rural tourism, backpacking, extreme tourism, nature photography, wildlife photography, agritourism, river trekking, rafting, scuba diving, caving, whale watching and many other activities.

What is Geotourism

Geotourism sits within a spectrum of definitions;

In our definition of geotourism the “geo” part pertains 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.

At the same time the tourism component of geotourism involves visitation to geosites for the purposes of passive recreation, engaging a sense of wonder, appreciation and learning. In association with this visitation there may be regular tours, specific activities and even the development of accommodation facilities. In addition to this there may be various forms of geosite planning and management in place. We thus posit that geotourism is a distinct subsector of natural area tourism, and not a form of tourism that also includes wider cultural and heritage components or tourism that focuses on wildlife, all of which can be considered as distinct and separate aspects of tourism in their own right.

Geotourism can therefore be mostly conceptualized in three areas: form, process and tourism.

Form represents the existing landscape and its features and materials. Landscapes of geotourism interest include mountain ranges, rift valleys, great escarpments, volcanoes, karst landscapes and arid environments. Within these landscapes there may be characteristic landforms or an array of landforms. For example, within a particular mountain range there may be glacial and fluvial geomorphic features. Moreover, a hierarchy of features of geotourism interest may be identified within a landscape; these may range from individual landforms through to geological materials such as rocks, sediments and fossils.

Process involves geological and geomorphological activity, including volcanic eruptions, the action of running water, and sediments being weathered, liberated and moved from one site (eroded and transported)to another

(deposited). This can readily be appreciated when volcanic activity is observed or where people can see rivers in flood and resent landslide events.

Superimposed on this is the human dimension as reflected in tourism activity. Visitation to geosites may take the form of bus tours, boat trips, scenic flights, self-guided driving, hiking trails, and patronage of viewpoints. Sites selected and developed for geotourism may contain accommodation facilities and attendant infrastructure. Services designed to enhance visitor experience include purpose-built access roads, visitor centers, interpretive geotours and virtual tours, such as can be conducted by an IMAX cinema.

Form (landscapes -> landforms->sediments->rocks->fossils): volcanic landforms, glacial features, fluvial landscapes, Aeolian landforms, karst features, sedimentary environments, coastal landforms, rock outcrops, regolith sections, minerals.

Process (tectonic activity, igneous process, weathering, erosion, deposition): mountain ranges, volcanism, lava flows, weathered profiles, landslides, ice sheets, glaciers, waterfalls, coastal cliffs, river valleys, deltas, mudflats.

Tourism (attractions, accommodation, tours, activities, interpretation, planning and management)

Attractions: Macroscale e.g. grand canyon, USA, Mesoscale e.g. wave rock, AUS, Microscale e.g. fossil beds, UK.

Accommodation: geolodges, georesorts

Tours: scenic flights, organized vehicular guided tours, self-guided tours-drive and/or hiking

Activities: site locally visitor centers, virtual tours.

Interpretation: visitor centers, guided and self-guided trails, pamphlets.

Planning and management: geoconservation, site design for tourism, visitor management.

What is Geosite?

A **geosite** is a site or an “area”, a few square meters to several square kilometers in size, with geological and scientific significance, whose geological characteristics (mineral, structural, geomorphological, physiographic) meet one or several criteria for classifying it as outstanding (valuable, rare, vulnerable, ..).

It is our view that the bulk of geotourism takes place in the natural environment. Geotourism may thus be considered to be a part natural area tourism and ecotourism, but is a specialized form of tourism in that the focus of attention is the geosite. A geosite can be a landscape, a group of landforms, single landforms, a rock outcrop, a fossil bed or a fossil. This approach provides a clear distinction from other forms of tourism that take place in the natural environment, such as visiting natural areas to view wild flowers or animals, or simply for recreating a natural area. In relation to this later point, many people visit sites for a combination of natural values some of which are geological in character. These values include appreciation of scenery, hiking, and bird watching.

Landscapes and some geosites provide for aesthetic values and cultural, historical and adventure tourism, Geological tourism can focus on cultural and historical aspects, such as buildings, constructed from local rocks, and stones and various forms of mining activity. Of particular relevance are mine sites where the impact of geology on people can be readily appreciated. Old mine sites, such as former gold mines, can provide tourism interest relating to the issues surrounding the importance of geology in people’s lives and also to aspects of environmental degradation. There is a crossover into adventure tourism, as many sites of geological interest are also destinations for thrill seekers.

Geosites are also not necessarily confined to natural areas such as national parks and other protected areas; they can also be found in agricultural settings and even in urban environments. Road cuttings may sometimes offer views of impressive rock structures, but such sites may fail to provide for the additional

components that add to visitor experience, such as interpretation, visitor centers, walk trails and a sense of naturalness and wildness.

What is Geointerpretation?

For many people , rocks do not demand the same attention as a living forest or elicit the interest that animals do by virtue of movement, color, sound and interaction .This makes the issue of bringing rocks 'alive' to the visitor a critical aspect of geotourism. Although many landforms are visually impressive, what really matters are accounts of paleo landscape and formation. This requires knowledge and therefore trained interpreters who can deliver the information and inspire the geotourist. As in other forms of natural area tourism, the visitor needs to be left with a sense of wonder and challenged as to where we sit as a species within the timescale of planet earth.

Materials that can be used to assist in interpreting geosites include: books, displays, videos, slide shows, interactive touch panels, models, specimens, computer animations and activities. Although these are extremely useful and in many cases an essential part of presenting geotourism to the visitor, there is no substitute for being in the field. On-site interpretation is very dependent on face to face communication, but selected materials can also be used in the field in order to enhance the interpretive process.

The sight of an almost flat landscape, therefore, particularly requires interpretation of what is being seen and explanation of what it means. Because rocks and landscapes are not alive in the sense that plants and animals are, geotourism is particularly reliant on explanation of origin and meaning . With appropriate interpretation, any landscape, rock outcrop or landform can be made as exciting as spectacular displays of wildflowers or concentrations of wild animals. To be able to understand a geosite makes the experience much more rewarding. Visitors could be asked how the landscape came to look like this, or to take their minds back to the Pre-Cambrian age and imagine a mountain range and the forces that created it.

Such a story could also be further developed with the aid of models and diagrams. Visitors could be led through the environmental changes of the Tertiary period and provoked into considering the origin of lateritic regolith. Clients might be asked to reflect on how we know about geological materials and consider how the evidence is gathered. Grains of sand could be examined under a binocular microscope and visitors allowed to discover shape and color for themselves and, more importantly, consider the 'why?' Such self-discovery based insight activities could then be supported with the viewing of enlarged electron-micrographs of the surfaces of sand grains, thus allowing the geotourist to appreciate fully the story that unfolds from viewing a grain of sand.
The main focus of interpretation, however, will be the main site itself. The ultimate objective is to increase understanding and enhance the enjoyment of the site. By instilling interest via interpretation, appropriate visitor behavior at the site can be achieved. The final desirable outcome should be to encourage appropriate minimal-impact behavior, increase the visitor's awareness of impacts, foster conservation of the site and promote an interest in geoconservation.

What is Geodiversity?

Geodiversity is the variety of earth materials, forms and processes that constitute and shape of the Earth, either the whole or a specific part of it. Relevant materials include minerals, rocks, sediments, fossils, soils and water.

Geodiversity is the process of recognizing and assessing the value of geological features, collections, sites, monuments, artworks, and landscapes and the application of practices for their care, maintenance and management for the long-term benefit of all.

As there is a wide range of biodiversity in the realm of flora and fauna, a rich diversity also exists among the geological features and phenomena. Such

diversity in the types and classes of geological features and phenomena is called geodiversity.

"Geodiversity" can be defined simply as "the natural range (diversity) of geological (rocks, minerals, fossils), geomorphological (land form, physical processes) and soil features. It includes their assemblages, relationships, properties, interpretations and systems".

Geological diversity is illustrated by the 5,000 or so minerals known to exist in the world, some of which are very rare. These diverse minerals, when combined with other factors, such as crystal or particle size, shape, and structure, create thousands of different named rock types. About a million fossil species have been identified, but probably millions more await discovery. There are 19,000 named soil series in the USA alone. Less easily classified are landforms and topography. Some landform names, such as canyons, end moraines, and arches are used widely, but much of the Earth's surface form does not fall neatly into a named landform category. There are also many commonly used names for physical processes, e.g., coastal erosion, landsliding, and glacial abrasion, but, when examined in detail, these processes become increasingly complex. Given the above brief discussion, the conclusion must be that there is as much geodiversity in the world as biodiversity.

Geoparks (History and Philosophy)

A Geopark is an area with particular geological heritage of international significance and a sustainable development strategy involving local communities. A Geopark comprises a number of geological heritage sites of special scientific importance, rarity or beauty. These features are representative of a region's geological history and the events and processes that formed it.

The important geological features within the Geopark area must be accessible to visitors, linked to one another scientifically, thematically, and educationally, and formally protected and managed through a comprehensive plan.
A Geopark must have a sufficiently large surface area to develop a sustainable development strategy. It must have a clear boundary and it must be managed by a clearly defined management structure. It is obvious that huge areas like the Alaxa Geopark in China (68,374 km2) can be considered as very big, and by nature are very difficult to manage and must make a huge effort to demonstrate a coherent image to visitors who may just visit a small part of it.

The Designation of geoparks supports a wide variety of goals: economic development of local communities through geological tourism, allowing public exploration, cooperation in preservation and conservation of our geological heritage, and promoting public knowledge and awareness of the geosciences. These are among the strategic aims of the creators of the network of geoparks.

In pursuit of the goal of stewarding and preserving geosites and geological heritage, initial steps were taken by organizations, groups, and societies such as IGCP, IUGS, ProGeo, Malvern Group, UNESCO's Division of Geosciences and Council of Europe.

The philosophy behind the Geoparks concept was first introduced at the Digne Convention in 1991 as a means to protect and promote geological heritage and sustainable local development through a global network of territories containing geology of outstanding value. In 1997, the Division of Earth Sciences of UNESCO introduced the concept of a UNESCO Geoparks Programme to support national and international endeavors in Earth heritage conservation. In 2000, representatives from four European territories met together to address regional economic development through the protection of geological heritage and the promotion of geotourism. The result of this meeting was the signing of a convention declaring the creation of the European Geoparks Network (EGN).

The next significant step for the EGN was the signing of an official agreement of collaboration with UNESCO in 2001, placing the Network under the auspices of the organzsation. In 2004 the 17 existing European Geoparks joined with eight new Chinese national Geoparks to form a Global Network of National Geoparks under the auspices of UNESCO. This Global Network of National Geoparks has encouraged other countries such as Iran and Brazil to develop Geoparks programmes. By 2007, European Geoparks were distributed across 15 European countries. There are 31 members of the European Geoparks Network, bringing the total number of Global Geoparks to 52. Progress has not always been easy, however, and finding funding to develop the initiative and secure the future of individual Geoparks remains a significant challenge.

A Geopark fosters socio-economic development that is culturally and environmentally sustainable directly effecting on the area by improving human living conditions and the rural environment. A Geopark acts as a quality statement for the region. It gives local people a sense of pride for their region, strengthens public identification with the area, while promoting a better understanding of the area's geological heritage and its importance in history and society today.

The aim of a Geopark is to bring enhanced employment opportunities for the people who live there. These opportunities are being created in association with the conservation of the geological heritage of the Geopark. The establishment of a Geopark stimulates the creation of innovative local enterprises, small business, cottage industries, high quality training courses and new jobs by generating new sources of revenue (e.g. geotourism, geoproducts) while protecting the geo-resources of the Geopark (e.g. encouraging casting instead of sale of fossils). This provides supplementary income for the local population and attracts private capital.

A primary aim of a Geopark is to promote geoscience education within local communities and to visitors by conveying the importance of the Geopark's

geological heritage to students, teachers, local decision-makers, and the public, as well as visitors to the region. New scientific understanding developed through research should be an integral component of the Geopark's education. A Geopark provides education and outreach activities to communicate geoscience and environmental concepts through a variety of methods (such as museums, interpretive/education centers, trails, guided tours, publications, maps, student curricula, public presentations and lectures, and interactive, frequently updated websites).

Global Geotourism Network

Global Network of National Geoparks is a voluntary, co-operative organisation. It has a clearly defined internal structure comprised of a GGN Bureau and experts group and Secretariat.

The main aim of the Network is to support its members to bring sustainable territorial development to the geopark by using that territory's geological heritage, primarily through the development of geotourism. The Network is responsible for the assessment of its members' operation and services in order to promote the "GGN" label as a high quality brand in geotourism geoconservation and local sustainable development.

Geopark management bodies are responsible for the establishment of a management and action plan which should describe its members operation and activities and should refer to the following issues: Earth heritage sites identification and assessment, natural and cultural heritage elements validation, geosite protection and geoconservation, scientific researches, Earth heritage interpretation infrastructure and activities, geotourism infrastructure and activities, environmental education activities and tools, promotional activities, support of local business, monitoring progress, international relationships.

Interesting Geotours and Adventure Geotourism Activities

Geology is the color of nature in all its shapes. From those that prefer hiking over former molten rock, or climb the highest mountains, to those that are tempted to dive to the coral reefs or raft down the roaring gorges, or those again that crawl down the deepest mines or caves, or those that collect the splendor of minerals and the imaginative fossils: The unexpected Earth provides a wealth of opportunities to escape the boring daily routine.

A dramatic and spectacular world tempts one, no matter what session or day, to explore the extra dimension of the geology adventure. Be it when admiring the landscape while traveling by train, car or airplane, or while admiring the wonders of nature when visiting exotic places, or again, when telling tales to the young ones about monsters, big as houses, now extinct. Even when exploring the urban landscape, geology can tell exciting stories of the connection between the natural heritage and the built heritage. Churches and monumental buildings are built with materials from quarries nearby, or from far away, and this can be used as an entrance to local history. Geology is all around us, and nature is still writing its own story.

Caving:

Caving is the recreational hobby of exploring caves. Speleology is the scientific study of caves and the cave environment. The challenges of the hobby depend on the cave being visited , but often include the negotiation of pitches, squeezes, and water. Climbing or crawling is often necessary , and ropes are used extensively.

Desert Safari:

Desert Safari is a form of off-roading, using an off-road vehicle to explore sand dunes. Whilst in some parts of the world, such as the fragile coastal

dunes of Australia, it is illegal, in others such as the Middle East , it is a booming attraction for tourists.

Backpacking:

(Also tramping or trekking) combines hiking and camping in a single trip. A backpacker hikes into the backcountry to spend one or more nights there, and carries supplies and equipment to satisfy sleeping and eating needs. A backpacking trip must include at least one overnight stay in the wilderness (otherwise it is a day hike). Most backpackers purposely try to avoid impacting on the land through which they travel and there is a saying:

“Leave nothing but footprints; Take nothing but photos”

Extreme Tourism:

Extreme Tourism or shock Tourism is a type of niche tourism involving travel to dangerous places (mountains, jungles, deserts, caves, etc) or participation in dangerous events. Extreme tourism overlaps with extreme sport. The two share the main attraction,’adrenaline rush’ caused by an element of risk.

Nature Photography:

Nature Photography refers to a wide range of photography taken outdoors and devoted to displaying natural elements such as landscapes, wildlife, plants, and close-up of natural scenes and textures. Nature photography tends to put a stronger emphasis on the aesthetic value of the photo rather than other photography genres, such as photojournalism and documentary photography.

River Trekking:

River Trekking is a form of hiking or outdoor adventure activity, and it is a combination of trekking and climbing and sometimes swimming along the river. It involves particular techniques like rock climbing, climbing on wet surface, understanding the geographical features of wet surface, understanding the geographical features of rivers and valleys. Dealing with sudden bad weather and find out possible exits from the river.

Other activities might be as follows

Mountain climbing, Rock climbing, Ice climbing, Mountain skiing, Mountain biking, waterfall rappelling,

Geoconservation

Geoconservation aims to preserve the natural diversity - or 'geodiversity' - of significant geological (bedrock), geomorphological (landform) and soil features and processes, and to maintain natural rates and magnitudes of change in those features and processes. Geoconservation recognises that the non-living components of the natural environment are just as important, for nature conservation, as the living components, and just as much in need of proper management. Indeed, geoconservation is an essential basis for bioconservation, as geodiversity provides the variety of environments and environmental pressures which directly influence biodiversity. The degradation of landforms, soils and waters will adversely impact on the biological species and communities living in or on them. However, geoconservation does not focus solely on the importance of non-living things in conserving biological systems, but is also based on the premise that geodiversity has important conservation values of its own, independent of any role in sustaining living things. It is often argued that there is no need for geoconservation because earth features are generally robust. This is commonly not the case, however. Important geological exposures such as delicate fossil or rare mineral sites are easily destroyed by

inappropriate excavations or uncontrolled collecting. Ongoing land forming processes, for example in cave (karst) and river (fluvial) systems, can easily be degraded by inappropriate disturbances in their water catchment areas. Old vegetated sand dunes can be 'blown out' following disturbance of their thin stabilising soil cover by vegetation clearing, vehicle use or fires. Peat soils can be entirely destroyed by a single bushfire. These examples are just the tip of the iceberg. Indeed, geoconservation often deals with relict or 'fossil' features which are not still forming, so that any degradation is permanent and unsustainable. There is a very good reason for active geoconservation management of such features, arguably greater than bioconservation where things can potentially be're-grown'. If the natural values of bedrock, landform and soil systems are to be retained as part of the broader nature conservation estate, it is essential that land management procedures pay specific attention to the sensitivities which many aspects of geodiversity display.

There is a need to both educate geoconservation and to raise the general level of geodiversity understanding among non-geologists, including the spatial and timescales in which geodiversity operates. This will facilitate successful conservation measures.

If resources are carelessly managed, many will be used up. If used wisely and efficiently, however, renewable resources will last much longer. Through conservation, people can reduce waste and manage natural resources wisely.

Development and conservation can coexist in harmony. When we use the environment in ways that ensure we have resources for the future, it is called sustainable development. There are many different resources we need to conserve in order to live sustainably.

A few examples of appropriate protection, conservation and development measures in relation to geotourism are as follows:

1. Due to the fragile nature of many caves, visitation should be under the supervision of tour guides. Other issues to be taken into account include creating

trails and making visitors use these paths, and the provision of proper electric lighting for visual effects as well as paying attention to the phenomena's changing color because of moss growth effects. Finally explanatory signs, incorporating plans and schematic maps, should be provided.

2. Visiting geological features such as erosion forms and phenomena, mineral springs and travertine cones should be allowed, provided visitors are kept at a minimum distance from the geo-attraction in order to prevent any potential adverse impacts.

3. In order for mountains, valleys and canyons to be developed as geotourism attractions, a thorough study should be carried out before any development occurs. Infrastructure such as footpaths should be constructed in a safe man-ner so as to allow easy tourist access without adverse environmental impacts on the geotourism attractions under observation. The provision of cable cars in such regions could be useful.

4. The use of local and traditional facilities in different geological sites will enhance their attractiveness. This may include sports and/or recreational facil-ities for the tourists - for example, the inclusion of camels in desert regions, visiting local communities, and the provision of easy access to the traditional facilities of life in the same regions. All of these are vital elements of sustainable geotourism development.

The recognition of 'geo' in natural features is the first achievement of geotourism. This should be followed by a study of the direct and indirect economic, scientific and cultural benefits. Finally, research should be undertaken into geotourism's mental and health benefits, which are related to being close to nature.

Geotourism in Germany

Geotourism , under the umbrella of the German Ministry for Education and Research offered a variety of events , such as geosience exhibitions, lectures and fieldtrips , and also led to the establishment of four national geoparks. The initiative was well received by the general public and has highlighted the enormous interest in and awareness of geoscience issues, which needs to be met with appropriate information and education . Geotourism plays a crucial role in this context, as it provides an opportunity to experience geology while at the same time contributing to geoconservation by facilitating a more sustainable use of resources through usage and knowledge.

Geoparks, a fairly recent development focusing in particular on geotopes of regional and national geoscientific importance, can be seen as instruments to coordinate the many stakeholders towards the common purpose of regional sustainable development. In Germany for instance, four National Geoparks were established in 2002-2003; Nationaler Geopark Schwabische Alb, Nationaler Geopark Mecklenburgische Elizeitlandschaft Nationaler Geopark Braunschwiger Land, and Nationaler Geopark Bergstrasse-Odenwald. Geoparks aims to foster regional identity, create greater awareness for local conservation issues through geo-education, and act as a framework for regional sustainable development by bringing together a wide range of stakeholders.

This national Geopark movement is also linked to International Geopark initiatives such as UNESCO Global Network of Geoparks, a program which intends to promote a worldwide network of geoparks as well as the Network of European Geoparks. The latter is a conglomerate of various European geoparks established with the aim of increasing public awareness of geoheritage and geosciences as the foundation for regional sustainable development. This European network initiative, founded in 2001, was initially based on for geoparks in France, Germany, Greece and Spain.

Southwest Germany is characterized by a distinct and diverse landscape, based on over a billion years of geological history. The area can be subdivided into three main landforms. The first is the Upper Rhine Graben in the west, which is bordered by the Black Forest in the east and the Vosges Mountains on the western, French side. The second is the south-western cuesta landscape, gently sloping towards the south east, while the third is the Alpine piedmont.

The formation of the Alps and the subsequent caving in of the upper Rhine Graben caused the uplift of the Black Forest as well as a slope in the surface rock, which led to the formation of the cuesta landscape as the main characteristic geological feature. Except for the Cretaceouse period, the full stratigraphic sequence is presented as heritage of the southwest fascinating geo-history of tectonical and erosive forces. Beside this typical cuestalandscape, the geology of southwest Germany offers rich mineral deposits, with evidence of silver , iron and lead mining in the Black Forest, thermal springs and remnants of volcanic activity. In addition, it has craters caused by meteoroid impacts and fossil-bearingdeposits as well as archaeological evidence of prehistoric activities. Finally, it also has many caves, dolines and springs as a result intense karstification.

This richness, marketed as ‘a one billion year journey of geological history’, provides plentiful geo-objects in southwest Germany. From a geological point of view the most interesting region is the Swabian Alb, which features, for instance, in an area of approximately 6000 km2, a total of 2588 caves registered by the German Speleological Association, making it the region with the highest cave density in German. Many of the southwest resources have been developed into more than 200 diverse geotourism attractions. These include 19 abandoned mines, 32 geoscience museums, 27 geo-trails and 18caves open for visitors, numerous of them featured in the National Geopark Swabian Alb.

Considering the density of its geological and archaeological attractions, the Swabian Alb is unique on a global scale. Thus it comes as no surprise that this region is one of the classic geotourism destinations, already having been visited

in the eighteen century by one of the most famous geotourists, Johann Wolfgang van Goethe. Today, with fifteen caves open to visitors, fourteen geoscientific-technical museums, six archaeological museums, twelve geoscientific and four archaeological interpretation trails, one visitor mine and hundreds of geotopes of side-wide importance, the Swabian Alb is one of the most significant geotourism destinations in Germany and Europe alike and was therefore a pioneer in the German geopark movement.

The founding process of the geopark was initiated by the Network History of the Earth and its subnet, Swabian Alb, Various strategic approaches were employed to facilitate the transfer of know-how from this network to the geopark, amongst them the following:

1- A bottom-up-strategy. The initiation, moderation and promotion of the Round Table Geopark Swabian Alb brought different stakeholders together. Strong support for the geopark idea could be achieved through the participation of a broad spectrum of different stakeholders, ranging from the Association of Quarry Industries to the Association for the protection of Nature and the Environment.

2- A starter project strategy. The joint elaboration and realization of starter projects was important for the creation of a common language between the different stakeholders from academia, tourism, government authorities, private enterprises and nature conservation NGO's . This common language has been one of the most important factors in facilitating effective communication, exchanging know-how and achieving efficient ways of working together on joint projects.

3- A promoter strategy. The coordination of the geopark-network has been man-aged through the same methods and techniques as tested in the Network History of the Earth. In short, the network moderator has to act as a network promoter. One of the network's most important tasks, therefore , has been the promotion of various win-win scenarios to the different partners; otherwise the enthusiasm of stakeholders to implement the geopark might have waned fairly quickly.

Geotourism in China

China's national Geoparks are natural parks that are dominated by special, rare, graceful, and/or beautiful geological heritage. When integrated with local historic and cultural relics, they have great scientific value . The bases for the establishment of a geopark are the geological landscape, scientific involvement, cultural features and social development. Rather than a single geological heritage, the geopark is trying to systematically and scientifically to integrate regional geological heritage with local ecosystems, It aims to protect the geological heritage by providing a place for scientific education, by geological popularization and by ecological tourism. The aim of geopark is to unite its geological heritage protection with the development of the local economy.

China is vast in territory and complex in geological and geometric features. Many of the world's rarest and unique geological landscapes have been created during the earth's history. So far 44 National Geoparks have been established in China, and many important areas are geological heritage are now protected.

Geoparks have been created in a range of categories including stratigraphic, paleontological, structural geology, geological-geomorphic, glacial, volcanic, hydrogeological, engineering and geological disaster.

Stratigraphic heritage:

Fuping National Geopark, Hebei: The major geological heritage is the type section and Archaean Longquanguan Formation. The controlling geological setting is the pediment fault system and fault-block mountain masses and the relevant natural conditions are waterfalls and warm springs.

Songshan National Geopark, Henan; The controlling geological setting is the differential elevation brought about by block movement on the North China Platform. The relevant natural conditions are steep cliffs, perilous peaks and dense forest .

Jixian National Geopark , Tianjin. The major geological heritage is the Mid-Upper Proterzonic section, yielding rich fossils, especially the macroscopic

algae earlier than 1.7 Ga. The controlling geological setting is the old gentle stratigraphic section on the North China Platform, and the relevant natural condition is carbonate peak cluster landform.

Palaeontological heritage:

Chengjiang National Geopark, Yunnan. The major geological heritage is the Early Cambrian (0.53 GA) explosive bio multiplication and synchronous emergence of tons of biological groups and species. The controlling geological setting is a stable neritic environment, and the relevant natural conditions are the hills and rift lakes.

Bagonshan National Geopark, Anhui. The major geological heritage is the Huainan biota and late early Cambrian stratigraphic sections. The controlling geological setting is the southern edge of the North China Platform, close to the Yangtze Platform, and the relevant natural condition is the juncture of the north and south climatic zones of China.

Liujiaxia Dinosaur National Geopark, Gansu. The major geological heritage is the excavated dinosaurian tracksites, with the largest one over 1 m in diameter. The cotrolling geological setting is the Mesozoic inland lake in the western North China Platform; The relevant natural conditions are valleys in the upper reach of the yellow River.

Structural geology heritage:

Baotianman National Geoark, Henan. The major geological heritage is the traces of tectonic and metamorphic processes; the controlling geological setting is central orogenic belt of continental China. The relevant natural conditions are biodiversity and dense vegetation at the juncture of the north and south climatic zones of China.

Geological-geomorphic heritage:

These geoparks are based on different landforms: Danxia landform, Yardang landform, Carbonate karst caves, Carbonate peak forest landform, Marble peak forest landform, Quartzose sandstone peak forest landform, and Granite peak forest landform.

***Dunhuang Mountain National Geopark, Gansu*.** The major geological heritage is the wind-eroded landform, with curiously shaped landscapes derived from the physical erosion of loosely cemented mid-Oligocene fluvial-lacustrine deposition. There are strange winds at night. The controlling geological setting is the fluvial-lacustrine deposition in a Cenozoic fault depression basin in the northeast of the Tarim massif, and the relevant natural condition is the desert landscape with stretches of black desert lacquer.(yardang landform)

Glacial geological heritage:

Glacial geological vestiges include both fossil and modern glaciers.

Fossil glaciers: Lushan Mountain National Geopark, Jiangxi. The major geological heritage is the Quaternary glacial vestiges and their naming places, complete sections, old stratigraphic sections of southern China, and the fault-block mountain . *The* controlling setting is the old continental nucleus of the South China Para platform, and Cenozoic differential elevation and subsidence in the fault-block movement. The relevant natural conditions are the Lushan Mountain, Poyang Lake and Yangtze River.

Modern glaciers: Hailougou Natinal Geopark, Sichuan. The major geological heritage is the 29-km long modern glacier on the east of the Gongga Mountains. The lowest ice tongue goes down to 2750 m above sea level, with many warm spring sites. The controlling geological setting is the juncture of the western edge of the Yangtze Platform and the folded belt of the Kangdian Hengduan Mountains, They were strongly uplifted in the Cenozoic era. The relevant natural condition is the co-existence of vast primeval forest, glacier and warm springs.

Volcanic geological heritage:

Tengchong Volcano Natinal Geopark, Yunnan. The major geological heritage is the modern volcanic landforms, geothermal springs and various hot spring sinters; the controlling geological setting is the folded belt of Kangdian Hengduan Mountains and intensive neotectonism. The relevant natural conditions are the low hills, spring lakes and thick vegetation. The main humanistic characteristics are the ancient border city, customs and practices of ethnic minorities.

Hydrogeological heritage:

Hukou Waterfall National Geopark on the Yellow River. The Hukou Waterfall is the greatest waterfall on the mainstream of the Yellow River; the major geological heritage is the narrow and deep gorges, with retrogressive erosion. The controlling geological setting is a series of joints formed by the influence of the Indo-sinian movement controlling the river erosion on the North China Platform. The relevant natural conditions are the Yellow River valley, lateral erosion and loess landforms.

Engineering geological heritage

Daduhe Valley National Geopark , Sichuan. The major geological heritage is the Daduhe river valley, the narrow gorges and lane-like valleys of its tributaries, the Dawa Mountain and Quaternary glacier. There is also the Cheng-Kun Railways cutting through the valleys, with bridges linking to culverts and caves to tunnels. The controlling geological setting is the north-south trending Sichuan0-Yunnan structural fault, with intense effects of neotectonism on the western edge of the Yangtze Platform. The relevant natural conditions are the moderate and low mountains, deep valleys and dense forest.

Geological disaster heritage

The heritage of geological disasters includes both earthquake-included collapse and large-scale landslides.

Geotourism in Australia

The geology of Australia is diverse, unique and remarkable. The diversity is related to the complexity of Rock types, mineral deposits and fossils, and the uniqueness is related to its geological evolution, from the earliest beginnings with the formation of the ancient cratons that form the basis for the present-day continent, to the relatively recent break up of Gondwanaland. The subsequent drift of the island continent northwards, through a range of climatic zones and geographic locations, has resulted in a unique flora and fauna, as isolation served to protect the diversity that was captured at the moment of break-up. The landscapes of Australia range from mountains to valleys, deserts to coasts, and its very variety is a reflection of the rocks that make up its foundations.

Australia's rocks are remarkable for a number of reasons. They cover the range of geological eras, representing geological time from some of the oldest rocks on the planet, in the ancient continental fragments of western Australia, through to the relatively recent and well-presented remains of the mega fauna at Naracoorte Caves, where the forerunners of Australia's unique marsupial fauna, the giant kangaroo, are fossilized.

The Earth's three major groups of rocks -igneous, metamorphic and sedimentary – are all represented in Australia. In addition, the major geological eras are represented, as evidenced by the diversity and evolutionary history of the landscape in the rocks of northwest Western Australia.

Geotourism sites

Australia is well endowed with a number of outstanding geological sites that underpin the country's geotourism. Some examples include the Great Barrier Reef, Uluru, Shark Bay, Wave Rock, the Remarkable Rocks, the Naracoorte Caves, Sydney Harbor, the Blue mountains, tessellated pavement and volcanic landforms.

Great Barrier Reef

The Great Barrier Reef is one of the wonders of the natural world. It is world Heritage listed, and is one of Australia's and the world's premier holiday destinations. It is a beautiful and awe-inspiring feature, visible from space. Home of countless marine species, the reef is the largest complex of coral in the world, stretching for approximately 2000 km along the coast of Queensland, forming a natural breakwater. It is separated from the mainland by shallow lagoonal seas that range in width from 16 to161 km. in some places the reef is more than 122m thick. The Great Barrier Reef system is the largest UNESCO world Heritage Are, covering more than 300000 square kilometers.

The corals that make up the various reefs and cays, and provide the basis for the great variety of sea and animal life, consist of individual coral polyps- tiny living creatures that join together to form colonies. Each polyp is a tiny jelly-like blob crowned by tentacles, and looks like an anemone but much smaller. There are many different types of coral; some are slow growing and live to be hundreds of years old while others are faster growing. The colors of coral are created by algae and only live coral is colored.

Uluru

Uluru, previously known as Ayers Rock, the world's largest monolith and Kata Tjuta, A series of 36 dome-like rock formations, are remarkable geological and landform features set in a contrasting, relatively flat, sand-plain environment 450 km southwest of Alice Springs. Undoubtedly Uluru is Australia's most well-known and well-recognized icon. It is a geological landform more correctly known as an Inselberg. The rock formation of kata Tjuta stands up to 546m high and covers an area of 3500 hectares and, like Uluru, produces an incredible light show at sunset, with crimsons turning to rusts, and pinks to mauves.

Tourists come to Uluru to witness the color changes, particularly at sunrise and sunset. Australians come in their thousands, as it epitomizes 'the outback' experience, and most tourists marvel at the contrast of this single isolated

monolith that towers above the vast inland plains of the central Australian deserts.

Shark Bay

The spectacular 1500km coastline of Shark Bay is made up of a series of east-west peninsulas and islands which separate inlets and bays from each other and the Indian Ocean. There are three distinct landscape types: The Gascoyne-Wooramel province, which comprises the coastal strip along the eastern coast of the bay and consists of a low-lying plain backed by a limestone escarpment; the Peron province, which comprises the Nanga/Peron peninsulas; and the Faure Island/sill, which comprises undulating sandy plains with gypsum pans or birridas, and ancient interdune depressions filled with gypsum.

A significant feature of the Bay is the change in salinities from oceanic in the northern and western parts of the bay through meta-haline to hyper saline in Hameline Pool and Lharidon Bight.

Shark Bay is a complete ecosystem containing many important and fascinating features including the Wooramel Sea grass Bank, the Faure Sill and ecosystems dominated by benthic microbial communities which flourish in the hyper saline embayments. The discovery of stromatolites at Hamelin Pool was a major factor in Shark Bay being declared a World Heritage Area, and has helped to unravel the history of life on Earth.

Sydney Harbor

Sydney Harbor is an example of a major drowned river valley system referred to as a ria. This feature shows the bays and headlands topography that typifies flooded river valleys, and explains the reason behind the construction of that other Australian icon, the Harbor Bridge.

The rocks around the shores of Sydney Harbor are mostly sandstone and shale formed during the Triassic Period(about 220 million years ago). At that time, Australia was part of the Gondwana super-continent and the Sydney region was

a large fresh water lake. This was slowly filled in by deposits of sand, mud, silt, and pebbles washed in by large rivers. Over the millions of years that followed, these sediments were gradually overlain by others. They were compressed into sandstone, mudstone and shale. These formations were later raised by earth movements, starting in the Jurassic period (200 million years ago). During this time great cracks formed and molten lava rose up through the rocks to form volcanic vents; these then cooled and hardened to form dykes of basalt. Remains of basalt dykes can still be found around Bradleys Head, north head and Nielsen Park. Two to twelve million years ago, the Sydney plateau was uplifted by movements in the Earth's crust. The Parramatta River and its tributaries flowed across this plateau, gradually cutting deep v-shaped valleys into it and leaving narrow sandstone ridges behind. About 6000 years ago, when the sea rose to its present level, the Parramatta River valley was drowned and Sydney Harbor, with its coastline of inlets and headlands, came into being.

Geotourism in Malaysia

As in many other countries in the world, Malaysian Borneo (which includes the East Malaysian states of Sabah and Sarawak) inherited many geological features through its long(more than 200 million years) and complex geological history. Some of them are rarely found in other parts of the world, and are already declared as World Heritage. Examples include the intrusive rocks of Mount Kinabalu in Sabah and the limestone complex of Muluin Sarawak. While this geological heritage has long been popular with tourists, its main attractions have been mostly limited to aesthetic and recreational values. Scientific values are often ignored or not included at all as part of the attraction . one of the reasons for this is the lack of scientific information related to a particular site that can be easily understood by the public.

The presence of outstanding geological features and landscapes generally contributes to the conservation of a particular area in Malaysian Borneo. In

Sabah, several important geological attractions are located within protected areas. The remnants of the Mount Kinabalu granitic intrusion in Ranau District and Mount Maria volcanic cone in Tawau District contributed to the establishment of the Kinabalu Park in1964 and Tawau Hills Park in 1979, respectively. The presence of an active mud volcano in the island of Pulau Tiga in the district of Kuala Penyu has become a key attraction to visitors, prompting the government to gazette the whole island as a national park in 1978. The occurrence of a circular sedimentary basin in central Sabah prompted the state government to gazzete Maliau Basin Conservation Area as a protection Forest Reserve in 1997.

In Sarawak, the presence of limestone caves, limestone pinnacles waterfalls, coastlines and beaches have contributed to the establishment of several national parks. Bako National Park, Sarawak's oldest park, established in 1957, as well as Semilijau National Park, open in 1995, are both well known for their picturesque coastlines, where constant erosion caused by waves at the base of cliffs has carved and created many sea arches and sea stacks. Niah National Park and Gunung Mulu National Park are well known for their karst topography, a distinct landscape where vast limestone terrain is carved out by river and ground water. Gigantic caves and cave sysems, some of the largest in the world, are found in both parks. Waterfalls and pools constitute some of the key attractions at Lambir National Park and Gunung Gading National Park.

Panar Laban plain

The small plain, where the main camping ground is located, lies at a height of between 3500 and 3700 m above sea level. The different rock types of the Mt Kinabalu pluton, comprising hornblende adamellite, porphyritic adamellite and aplite veins, can be seen here. Glacial deposits, called tilloid, also occur. The scour effects of glacial erosion can be observed here.

Poring hotspring

The hot spring occurs near Poring, a small village lying southeast at the edge of the park at a height of about 500m above sea level. The hot spring can reach to a temperature up to 60 degree C, and is thought to be associated with the magmatic activities have a higher heat flow than the earth's average – in other words, the heat sources are to the ground surface. Thus, percolating groundwater has a greater chance of being heated, and stored as hot water. Faults or fractures may have acted as conduits for the heated water to flow out to the surface at Poring.

Tiger Hill volcanic cone

An ancient volcanic cone occurs on Tiger Hill in the district of Tawau. Quarrying on the hillside has exposed the impressive internal structure of the volcanic cone. The exposed cone, about 25m high and 100m wide, shows at least four episodes of deposition of volcanic ash and scoria bombs the site is visited regularly for field excursions by local geology students.

Maliau Basin waterfalls

Maliau Basin, located in Tawau, forms an almost circular amphitheater, about 25km across and sharply defined on all sides by steep slopes or cliffs reaching over 1700m high. The basin is underlain by sedimentary of gently inclined beds of sandstone and mudstone. The basin formed as a result of subsidence due to extension tectonics in this region.

Geotourism resources of Iran

Iran has a rich culture and civilization as well as an outstanding natural environment. Its natural and cultural diversity specifications have caused it to be listed as one of the top ten tourist countries in the world (Francesco Frangialli, Secretary General of the World Tourism Organization, 2004), and its archaeological, cultural and natural attractions form an excellent basis for developing geotourism. For years its geological features have been studied by researchers from around the world. The country has been labelled a 'geologists' paradise' or 'the 1.5-million-km2 geological museum'. While Iran has a great range of geological phenomena, geotourism is just emerging and taking its first devel-opmental steps. This chapter presents general information about Iran's geology and places where it occurs, as well as some examples of geotourism products. However, it is clear that the future development of geotourism requires comprehensive planning.

Iran

Iran is a large Middle Eastern country bounded by the Caspian Sea in the north and the Persian Gulf in the south (Figure 5.1). The 500-km northern coastline and the 1500-km southern one are both formed by water boundaries, while there are numerous lakes throughout the country. Iran also shares borders with Iraq, Turkey, Armenia, Azerbaijan, Turkmenistan, Afghanistan and Pakistan. It has an area of more than 1500 000 km2 and a population of over 65 million people. In the north it is bounded by the Alborz (sometimes shown as Elburz) Mountains, with the Zagros Mountains in the west. Together they cover half the country, while the remainder comprises forests and fertile plains. The highest point in Iran is Mount Damavand (5671 m) and its lowest part is the Caspian coast, 28 m lower than sea level.

Iran lies in the temperate zone but, owing to its large latitude and altitude ranges, the difference between temperatures in various parts of the country at the same time is often as much as 40°C. This is due to the existence of its

mountain ranges and vast desert lands, both of which have a big influence on the climatic conditions of the country. The geographical features of Iran include high peaks, vast deserts and Kavirs, large rivers and permanent glaciers.

Geology

Iran belongs to the Alpine-Himalayan orogenic belt, extending from the Atlantic to the Pacific Ocean. It separates the two regions of Eurasia in the north and Gondwana in the south. The political boundaries of Iran approximate the orogenic belt between the Arabian-African unit in the south and the Asian block in the north. Due to the closure of an ocean located between these blocks around 65 million years ago, the main geological features of the Iranian region were estab-lished. two huge mountain ranges, the east-west trending Alborz Mountains and the northwest-southeast trending Zagros Mountains, are the most important ones and dominate the tectonic and stratigraphic features of the country. Central Iran, bearing the Iranian basement and the Makran Plain, and the East Iranian region, both have interesting geological records. Together they have created a mountainous region which covers about 50 per cent of the country's area.

The oldest rock unit, which forms the basement of Iran, is exposed in Central Iran. The Pan-African orogeny is a significant event in Iran's geological history, and formed the Iranian basement. Outcrops occur in Alborz, and include pre-cambrian Kahar and Soltanieh formations. The main orogenic phases of the Palaeozoic Era have not influenced the Iranian region as much as in other areas in Europe and North America.: However, during the Middle to Late Triassic Period an important compression phase affected the Iranian region, resulting in the closure of a Late Palaeozoic ocean situated between Iran and Toran. In the Early Tertiary Period, the Laramide orogeny in the Iranian region was marked by the closure of the sea between the Iranian and Arabian plates during the Late Cretaceous Period and the Early Palaeocene Epoch. This north-

east trending movement led to the uplift of the Zagros Mountains, which are still rising today.

The Lower to Middle Eocene Epoch was a period of extensive volcanism in most of Iran. Volcanism occurred in the Uromiyeh-Dokhtar zone as a long volcanic-plutonic part of the Zagros Orogeny. It started during the Cretaceous Period and reached its peak during the Eocene Epoch of the Tertiary Period. The tectonism leading to the present physiography of Iran occurred during the Alpine Orogeny, which started in the Late Tertiary Period and continues to the present time.

Mountainous features

Mountains cover half of Iran's area, and because of this they are among the most important tourist attractions in the country. There are 1500 mountains,higher than 3000 m and 600 peaks higher than 4000 m in Iran. Particular mountains which hold significance for geotourism include Mounts Damavand, Alamkuh, Sabalan and Taftan. Mount Damavand is a young volcano that formed in the late Tertiary and early Quaternary Periods. Its 5671-m summit is the highest peak in the Middle East, and it is considered to be one of the world's highest conical peaks. It is located in the north of Iran near the capital, Tehran. In addition to natural tourism and sporting attractions, the mountain displays some geological features and related phenomena of relevance to geotourism. They include its basalt columns, permanent glaciers and hot mineral water springs, as well as a wide var-iety of volcanic features. One of its most significant features is the possibility of direct observation and accessibility to its internal basement. The deep valley, which is located on its northeast sector, provides opportunities for geotourism as well as volcanological research.

Mount Alamkuh (4850m), Iran's second highest peak, is located in northern Iran. The mountain is a huge granite mass which has led to the metamorphism of its surrounding layers. There are over 200 mountains in this region with peaks higher than 4000 m. Its main tourist attraction is a vertical cliff which is

500 m high with a base at an elevation of 4300 m. It attracts lots of professional rock climbers from Iran and other countries around the world every year. Another outstanding feature of the mountain are its large glaciers, which are up to 5 km long.

Mount Sabalan (4815m), a volcano located in the northwest, is Iran's third highest mountain. Three important phenomena distinguish it for tourism: a crater lake, a valley and a mineral spring. On the highest point of the mountain lies a scenic freshwater lake, one of the highest in the world. It was formed during the final volcanic phase, and is the result of the volcanic dome's downward collapse. The lake is approximately 7000 square meters in area, and it is between 25 and 35 m deep. The surface of this lake is usually covered with ice throughout the year, and only in summer time does the ice turn to water. To the north of the mountain, lies the long and deep Shirvandarreh Valley, which has a wide variety of scenic landscapes. It has been formed as the result of flood erosion in pyroclastics and tephra. A range of scenic landforms occurs, including erosion and conglomerate columns as well as a variety of other structures. The valley's profile and its walls show well-beddings in pyroclastics. Surrounding the mountain there is a concentration of hot -water mineral springs. They are traditionally used in the northern region for bathing and water therapy, and in the Sarein Region, in the south, some modern facilities have been built for therapeutic use.

With more than 50000 visitors per year, tourism is growing rapidly in the region. This has created a demand for visitor accommodation, facilities and services. Located on the western side of the mountain, in the Meshkin-Shahr region, is Iran's hottest mineral spring, the temperature of which rises to 86°C. An interesting point here is that there is another cold spring just a few meters away where temperature hovers around 0°C. In the same region, geothermal energy is being developed.

Mount Taftan (4100 m), in southeast Iran, is the country's only semi-active vol-cano. There are some traces of volcanic activity on the peak and its surroundings, including sulphur fumaroles. The mountain can be accessed by a

main road and it has two hiking trails toward the peak, by which approximately 2000 tourists climb to the top each year.

In northwest Iran a diversity of volcanoes and small craters have formed the Sahand mountainous region, among which the highest peak is 3600 m. The set of craters in the area has its own unique features, including Lake Uromiyeh.

Canyons

There are three large canyons in different parts of the country. In the southeast of Fars Province, a 4-km long spiral canyon has its origin through tectonic activity, karst and erosion, and in some places it is over 300 m deep. In the north of the Alborz Mountain range, facing the Caspian Sea, there is one other large canyon, which is covered in dense forest. The depth of this canyon is between 350 and 400 m, and its formation is through intense flood erosion at a time of mountain uplift. In the southeast region, a long canyon has been created in weak formations from flood and storm erosion. Due to large anticlines and calcareous formations there are many canyons and narrow capes in the southern regions of Zagros, of which the most beautiful examples are in Fars Province.

Landslides

The world's largest landslide occurred in the west of Iran at the foot of Mount Kabirkuh. The huge sliding mass traversed a distance of 50 km, and it is so large that it covers the area of a standard topographic (1:50000 map). The complete shape of this landslide can only be observed from the air, as from land the whole scope of the slide cannot be fully comprehended. At the foot of Kabirkuh, and also in other areas in the Zagros mountain range, there are many landslides of different dimensions.

Volcanic features

As well as the large number of volcanic mountains in Iran, there are also several other features related to volcanoes or igneous activity. They include lava flows, lava rivers, basaltic columns, craters and volcanic villages.

Lava flows

Pahoehoe lava flows are fluid basaltic flows. They flow very fast because of their low viscosity. They are not thick, generally being less than 1 m deep. As a pahoe-hoe flow moves it develops a thin, glassy crust, which is moulded into billowy surfaces resembling coils of rope - hence they are often referred to as ropey lava. The other major type of lava flow is called an aa flow. These are generally slow moving, and are usually between 3 and 10 m deep. The surface of the flow cools and forms a crust while the interior remains molten. As it continues to move, the hardened crust is broken into a jumbled mass of angular blocks and clinkers (Hamblin, 1992).

In northwest Iran, at Maku City, there is a large area covered by pahoehoe and aa flows. These flows are partly the result of the Mt Ararat volcanic eruption, but are also due to magma rising up to the surface through faults and fractures and then flowing across a vast plain. Mt Ararat is located in Turkey on the border of northwest Iran, but most of its basaltic lava flows toward Maku in Iran. In this region another flow has exposed light and porous basaltic rocks. These are formed when gas within the fluid interior of the flow migrates upward. Although Maku is the best site to view these lava features, they also occur in other locations around the Damavand and Sabalan volcanoes.

Lava rivers

The basaltic flows of Mount Ararat have created another particular phenomenon in the Maku area; a river of lava. During the eruption the lava flowed down a val-ley, and afterwards water erosion carved a channel inside the cooled lava and rebuilt the river's bed. The walls of this valley are dark and glossy, and the

flow of the river down it creates a scenic vista. The river resembles a large black snake, and its local name is Zangmar ('black snake' in Persian).

Basaltic columns

Hexagonal columns of basalt occur in many parts of Iran. The most important and interesting ones are located near Maku City, Ploor Town in northern Iran (this is related to the Damavand Volcano), and Birjand City in the east. The columns are usually formed by contraction when lava cools, with their long axis being approximately perpendicular to the cooling surface (Bates and Jackson, 1982). The Maku columns are situated along a valley and are approximately 50m high with sharp joints and clear surfaces. The Damavand columns are widely spread along the eastern side of the mountain, and are not arranged in the same way as those in Maku. Sarbisheh (Birjand) is another typical example of these columns.

Craters

Iran has a number of volcanic craters, including a set in the Rayen region that comprises fourteen craters of oval and circular shapes. The largest has an open-ing with a diameter of 1200m and a depth of more than 300m. It is considered that these craters are not volcanic but meteoric in origin, and considerable research is being undertaken to establish their true origins.

In the Ghorveh region, a set of craters includes some in the shape of a set of rosary beads. In the area there are many pumice and volcanic foam mines as well as volcanic bombs. The biggest bomb is 3 m long with a diameter of 1 m, and is perfectly spindle-shaped.

Volcanic villages

The two villages of Kandovan (northwest Iran) and Meymand (southeast Iran) comprise houses cut into the volcanic rocks. Kandovan is located at the foot of Mount Sahand, where the shelters have been dug out of hardened ashes or

lahar beds .The houses have been carved into the steep slopes of the mountain and are now supplied by electricity, running water and a wastewater system. Some have two stories with staircases inside, and all are still inhabited.

Meymand village is located at the foot of Mt Mozahem, and it is approximately 2000 years old. Here the house walls are built of volcanic conglomerate and hard-ened ashes. The carved structures include a mosque (which is the largest opening), a school, a public bath, and a structure that seems to have been used as a fire temple. The Meymand Village differs from that of Kandovan; the area is not so steep, and also the houses are no longer inhabited.

Water features

These include numerous lakes, waterfalls and mineral springs.

Lakes

There are many lakes in Iran, which have different sources and characteristics. The most important is the Caspian Sea, which forms the 500-km long northern boundary of the country. It is the largest lake in the world (436 000 km2) and is one of the remnants of the old Sea of Paratethys. Because of its size and unique characteristics, the lake is considered to be a sea (Shahrabi, 1994).

Along the coast are large deltas which originate from the mouths of rivers flowing down from the Alborz Mountains. On the north coast lies the Anzali lagoon, which has a special place in environmental geology in relation to its land-forms, plants and migratory bird species.

The Gorgan Gulf lies on the far eastern coast of the Sea. The strip-like peninsula of Miankaaleh separates it from the Caspian Sea and has made it similar to a half-closed small basin. This Gulf enjoys special research importance due to issues related to its deposition, submarine flows and streams. Being a protected area in Iran, the peninsula has great potential for geotourism development.

Lake Uromiyeh is Iran's largest lake (5000 km2) with super-saturated salt water. Salt crystals cover the shallow coastal parts of the lake, and it is home to the

unique Arthemia crustacean. The 'ooze lands' in the coastal part of the lake are of special interest to the many health tourists who travel to the area for therapy for skin diseases and arthritic pain. A few other islands provide scenic attractions on the lake.

Lake Gahar is an excellent example of a lake formed as the result of a landslide. It is located in the OshtoranKuh mountain range, and resembles a glacial lake. The lake is 2.5 km long and 500 m wide, and is fed by the streams and springs flowing down from the mountain range. It was formed by a large landslide (with a volume of about 20000000 m3) blocking the mouth of the valley and making a natural dam. The gradual collection of water behind this dam has led to the formation of the lake. Some rivers flow from this lake, giving an indication of its large volume of water.

Waterfalls

Most of Iran's waterfalls are in the Zagros and Alborz mountain ranges. The highest waterfall (80m) occurs in Lorestan Province. However, the Bisheh, Shevie (Talezang) and Margoon waterfalls also attract many visitors and are important ecotourism destinations.

Mineral springs

There are over 400 mineral and hot-water springs in Iran. These springs are divided into four groups depending on their average temperature: subthermal, hypothermal, homothermal and hyperthermal. There are different ideas regard-ing the spring's sources of heat, but most are related to magmatic sources. The springs occur mostly in volcanic areas or areas with geodynamic activity. Their compositions are different, but usually include carbonate, sulphur, sodium and iron compounds (Shahbeyg, 1993). The majority and also the most important mineral and hot-water springs in Iran are in Azarbayjan, Ardabil and Tehran Provinces.

The hottest mineral spring is located in the Meshkin Shahr region at the foot of Mount Sabalan volcano, and its temperature rises to 86°C. Since the spring is 2200m above sea level, the water temperature is near boiling point. There is one other spring in central Iran, on the margin of Kavir, whose temperature rises to 75°C. Iran's hot springs form key attractions for Iranian and international tourists. Other areas that have hot-water springs include the Sarein region (south of Mount Sabalan), Larijan (East of Mount Damavand), Geno (in southern Iran) and Ramsar (northern Iran). There are some interesting formations in the area of the springs, which produce travertine deposits. These include cone shapes, shield-like shapes, travertine terraces and strip-like spiral walls of different colours.

In the Azarshahr region, near Mount Sahand, there is a collection of these for-mations, including conical and shield-like forms, which are the remnants of old springs. Also, several active springs along a fault have turned this region into a 'Travertine Park'. The colours of the deposits are varied, and include yellow and shades of brown caused by different combinations of iron in the spring waters. In the Salmas region, on the northwest border, there is another colourful collection of these springs, which have created many white or milky-coloured travertine terraces. Inactive springs in the forms of circles and hollow hemispheres have turned the region's surface into a lunar landscape.

In the Damavand and Larijan regions there are many springs comprised of sulphur. They have traditionally been used for many years, and have led to tourism prosperity in the region. The travertine deposits have created a variety of interesting shapes on the natural features of the region, as well as on the leaves and branches of the shrubs and bushes, thus making the whole region a geot-ourist's wonderland.

Other features

There are a range of other landforms with geotourism potential in Iran (e.g. see Case study 5.1). They include mud volcanoes, salt domes, caves, sinkholes, deserts and chimney rocks (erosion columns).

Mud volcanoes

There are two mud volcanic regions in Iran: in Chahbahar region near the Oman Sea, and in the surroundings of Bandar-e-Tourkmen, near the Caspian Sea. Chahbahar's numerous mud volcanoes are the bigger and more active, and it is believed that their formation is related to geodynamic movement and uplift. The mud volcanoes on the margin of the Caspian Sea are more related to oil and gas fields, and in the region smells of crude oil. Their mud is less viscous, and because of this their bubbles blow out quickly. In the Caspian Sea some large mud volcanoes have been reported where the mud has erupted above the sea surface. However, the duration of their activity has been brief, although they probably continue to be mildly active under the water.

Salt domes

There are over 200 active and inactive salt domes of various sizes concentrated in the southern part of the country. In central Iran and south of Alborz there is also a considerable number of these domes. These large masses of salt have risen upwards due to their difference in weight from surrounding rocks, and where their crust has reached the surface of the earth they have formed large hills and mountains. This mass has led to a change of position in the surrounding formations, thus altering the region's morphology. Through dissolution after rain, some minerals that accompany salt (such as calcite, hematite and sulphur) remain in the vicinity, forming dense deposits.

In the southern Zagros Mountains there is an extremely scenic area due to the folding and formation of salt domes. These have been formed as a result of the pressures put on the Iranian Plate by the Arabian Plate. The salt domes also

out-crop in three islands in The Persian Gulf on Qeshm, Larak and Hormoz Islands. The latter is entirely a salt dome, with many interesting landforms due to a variety of rocks and ores having been brought up to the island's surface by the salt mass. These have given the Hormoz Island a colorful appearance, representing an outdoor museum of lithology and mineralogy. In parts of the dome that are in direct contact with the sea, vertical walls have been formed. Extraction of ruddle (red ochre) has turned the southern part of the island reddish, and this red hue stretches out over a large part of the surrounding sea.

In the south of the Semnan Province, at the northern margin of the Great Kavir Desert, there is a collection of about 40 salt domes which are considered to be the best in the world (Jackson, 1990).

Case study 5.1: The Takht·e·Soleyman Complex, Iran

Takht-e- Soleyman is a UNESCO-listed World Heritage site which Includes a natural lake, a collection, of ancient buildings, the Draqon Stone (Sang-e-Ezhdeha) and Zendan-e-Soieyman Mountain (figure5.3). The oldest buildings date back to the first milennium BC. and the most important one is the Azargoshab Fire Temple which, based an historical records, is considered to be Zoroaster's birthplace. The lake is in fact a large perennial travertine Spring taking its water from deep below the earth's surface. It has an oval shape with diameter of up to 115 m and a depth of between 50 and 70 m. Travertine deposits have made a large plate, 20 m high, around the lake, on which ancient buildings are situated, and the lake is located in its center. The water flows downward through a few streams and has led to the formation of a structure that is wiled Sang-e Ezhdeha. This is a long, spiral wall made of early travertine deposits, and it has gradually increased to its current height of 1.5 m.

Around the main site there are other hot water and travertine springs, some of which are used for bathing and water therapy by both local people and tourists. There is another phenomenon in this complex, 2 km away from the main site, named Zendan-e-Soleyman, which is a cone-shaped mountain. This is the

remnant of a former large travertine spring, and a rupture in the walls (the result of a fault) has been created by water drainage from the lake now becoming inactive. The view of the inner side of the hollow mountain gives rise to the mountain called Zendan-e-Soleyrnan (Prison Mountain)

Caves

There is a wide variety of caves in Iran, including calcareous (karst), salt, ancient and human-made caves. The calcareous caves are in diverse forms of multi-storied, river, lake and well caves. Examples include:

1.The Kataleh Khor Cave. Located about 150 km from Zanjan city, Kataleh Khor Cave is the longest and most scenic in Iran. Its formations date back to the Oligo-Miocene Epoch. About 3000m of this cave's route has had walkways installed, and these are illuminated for tourists. The reception and accommodation facilities are well developed, and it has a diversity of simple and compound stalactites and stalagmites, mushroom-like calcareous columns, deposits, strip-like formations, calcareous bodies and a variety of other scenic phenomena. So far three floors of this cave have been discovered, and a vast area (20 km in length) has been explored. However, not all of the cave has yet been discovered.

2. Alisadr Cave. Iran's largest lake cave is located in the vicinity of Hamadan city. The cave is 2.5 km long, with the depth of water reaching 8 m in some parts. The lake water is pellucid and fresh, and the cave contains many cavero-neous phenomena including a range of colourful stalactites. It has excellent reception facilities, and tourists explore the cave by pedal boat and on foot.The presence of nearby accommodation adds to this established geotourism product, which is a major natural attraction.

3- Karaftoo Cave. Located between Takab and Divandareh cities, Karaftoo Cave is Iran's biggest ancient cave. This four-storey cave was created in limestone formations dating back to the Oligo-Miocene Epoch. Some parts of this cave have also been excavated by humans, and based on archaeological

excavations, as well as signs and objects discovered in the cave, researchers believe that the history of its inhabitation dates back to Arsacides' period (250 BC). At other times in the past the cave has been the residence and place of worship for different tribes. A wide array of hand tools in the cave is related to the pre-historic period, which suggests that early humans lived in the cave. One of the most scenic parts of the cave is the roof of the fourth floor, which is reminiscent of a theatre ceiling. There, some bowl-like holes and convex (lens-like) protrusions cover the surface of the roof, displaying a beautiful morphology. These holes are the result of karst erosion in the limestone formations.

Sinkholes

The largest doline or sinkhole occurs in the Rafsanjan Region, Kerman Province. This sinkhole is like a gigantic funnel, with the diameter of its entrance being 60 m. It is of an unknown depth as, so far, measurement has not been possible. The hole was formed by uncontrolled overuse of underground waters in the region. This created a hollow space in a fragile rock formation, and hence the weight of the upper layers led to their sudden collapse into the space beneath. Among other karst sinkholes there are interesting examples in eastern Alborz and also in the surroundings of Hamedan city (near the Alisadr Cave region).

Kavirs and deserts

Desert areas and kavirs cover about 25 per cent of Iran's area. These regions have a collection of all the geomorphologic phenomena related to deserts. Iran's two great deserts are Lut Kavir and Great Kavir. Lut Kavir is a vast, relatively

unexplored region in the eastern part of central Iran. It includes three of the world's unique phenomena (Ahmadi, 1998):

1. Ghourd - the world's highest sand pyramids, which are huge sand dunes 2000 m long and 500 m high
2. Yardang or Kalut - an area 150 km long, 70 km wide and 80 m high, which comprises long, deep moats (ditches) created by storms and floods
3. The hottest point in the world, as recorded by satellite images (Kardavani, 2003).

Iran's vast deserts also contain wide ergs with a variety of sand deposits, such as Seif, Barkhan, Yardang, sand pyramids (Ghourd), sand channels and Nebka in a variety of different forms. Vast clay and saline lands as well as salt polygons are other ubiquitous features of its deserts (Zomorrodian, 2003).

Chimney rocks (erosion columns)

Erosion in conglomerate beds, which alternate with soft layers of clay and marl or hard layers of sandstone, creates interesting landforms. Where there are verti-cal joints, the result of this heterogeneous erosion is the formation of columns or wall-like column ranges. The top columns have a huge rock or a remaining part of a layer, and are usually called chimney rocks In the Mahneshan region there is a collection of these columns with the different forms and sizes that appear predominantly in Pliocene conglomerates. Locally the columns are called Sang-e-Adam (Adam's Rock) because of their physical similarity to a human profile with a large head, narrow neck and cylindrical body. Besides Mahneshan, formations such as this can be viewed in several other parts of Iran in the southeast, along the southern coast and on Qeshm Island.

Qeshm Island

Qeshm Island is located in southern Iran in the Persian Gulf. It is 120 km long, and has an average width of 20 km. The island is part of the Zagros Mountains, and it is the largest island in the Persian Gulf. From the point of view of natural phenomena, the island enjoys a special status. Harra mangroves are located in the northern part of the island, and form the habitat for many rare and endangered species of plants and animals. On the southern part, there is a large sea-turtle nesting habitat. The island's phenomena have been recorded as part of UNESCO's Man and the Biosphere (MAB) Program. There is also a wide variety of gelogical phenomena on Qeshm Island. These include a range of landforms.

The Kharbas coastal caves have been formed in clay and marl beds. Originally they were formed as the result of wave action, and they are deep and interconnected. They have been extended by humans, and were probably used by the ancient residents of the island as a shelter against enemy attacks.

Across the whole of the island there is a wide variety of landforms created by erosion. An example of a scenic vista caused by erosion is found at Darreh-e-Setarehha (the Valley of Stars) on the southern side of the island. Due to the variety of geological formations in the area, especially a limy sandstone whose amount of calcite varies in different parts, the erosion has created many heterogeneous and dissimilar forms. There is a main valley with some tributaries where columns, strip-like walls and arches are abundant, and other landforms create an unusual picturesque landscape. The valley is an ideal place for the study of different types of erosion. The Qeshm Roof is a high plateau that stretches along the north-central area of the island. It is predominantly made up of limestone, and is more resistant to erosion than its surrounding formations. The short-term growth of plants after rainfall creates novel scenery in this hot and dry region.

The Chahkuh valley and a similar one nearby have U-shaped profiles. The mouth of the Chahkuh Valley is wide and surrounded by high walls, but its width

gradually decreases until it becomes very narrow. The walls are very high and there is little light. Water erosion and dissolution have created long and deep clefts in the shape of concave, spoon-like spherical holes. At the mouth of the valley there are some shallow wells, forming a place for the rain to be stored, and because of the hot and dry weather the stored fresh water has a high value. It seems that this valley and similar vallies nearby are related to a large anticline, which has played a key role in the formation of the Namakdan salt dome. This dome, in the southern part of the island, has created various phenomena, and has had a big influence in shaping the morphology of the area, largely through its deposits of iron compounds such as hematite and oligist. The walls of this mountain are rough and jagged, and consist of a variety of stones and ores. In part of the mountain there is a salt cave, which has been formed as the result of salt dissolution. The cave is about 200m long, with cavernous phenomena such as saline stalactites and columns. Beside the cave there is a spring of saturated salty water, which deposits salt and hematite in its path and has formed a red and white strip in the area. Other phenomena on the south coast include vast and flat coastal lowlands covered in long ripple marks with bright, thin particles of oligist. In addition there is a rocky coastline and colourful coral reefs.

Conclusion

Iran has many geological wonders and considerable geotourism potential. While, according to the Iran Tourism Organization, over a million tourists visited Iran in 2002, only a small number of these visitors is attracted by the country's natural phenomena, due to absence of adequate information. However, the existence of the geological phenomena described in this chapter makes a strong argument for developing geotourism in Iran. From the point of view of both general and specialized visitors, such tourism would have the capacity to attract large numbers of tourists. To achieve such an aim, there is an urgent

need to undertake a comprehensive geotourism development plan. This should include:

1. Preparing a scientific inventory of geological attractions.
2. Reporting on each particular phenomenon in order to classify and rank them from the point of view of 'value' and 'importance', as well as compiling infor-mation for each site based on the existing data.
3. Formally registering each site in the list of the country's national sites.
4. Ensuring appropriate protection and conservation of the sites to prevent any kind of harm and/or loss resulting from civil, economic and other human activities - i.e. minimizing any adverse impacts of local people's activities.
5. Establishing an organizational plan for sustainable geotourism development under the total supervision of the country's official authorities, namely the Geological Survey of Iran (GSI) and the Environment Protection Organization (EPO).
6. Registering the country's geotourism sites as geoparks and introducing specific limits included in the definition of a geopark by UNESCO in order to acquire support by this organization. While nature-based tourism has enjoyed a long history, geotourism is a new and specialized branch of tourism, not only in Iran but also throughout the world. Its establishment may lead to some initial resistance in justifying its related benefits and advantages to governmental authorities or the private sector, as it is difficult to provide the budgets to develop and advance the industry. There is also another problem that can be observed mostly in developing countries; that is, the lack of protection and conservation of geological phenomena. However, writing books and papers and holding meetings and conferences in this regard can contribute to the introduction of this new branch of tourism and its related values.

GLOSSARY

Aeolian	بادی
Algae	جلبک
Arid	خشک و بیابانی
Bay	خلیج کوچک
Biodiversity	تنوع زیستی
Caving	غارنوردی
Cay	تخته سنگ ساحلی
Conglomerate	کنگلومرا (نوعی سنگ رسوبی)
Conserve	نگهداری کردن
Crater	دهانه آتش فشان
Cultural heritage	میراث فرهنگی
Deposit	نهشتن
Destination	مقصد
Drift	یخرفت
Dune	ریگ روان
Ecotourism	اکوتورسیم، طبیعت گردی
Erode	فرسائیدن
Eruption	فوران
Escarpment	پرتگاه
Excavation	کاوش – حفاری
Extinct	نایاب
Fault	گسل
Fluvial	آبرفتی
Fossil	سنگواره
Fragment	قطعات-تکه‌ها
GDP(Gross Domestic Product)	تولید ناخالص داخلی
Geoconservation	حفظ و نگهداری پدیده‌های زمین شناختی
Geodiversity	گوناگونی پدیده‌های زمین شناختی
Geointerpretation	تفسیر پدیده‌های زمین شناختی
Geolodge	پانسیون‌های زمین شناسی
Geomorphological	زمین ریخت شناسی
Geosite	ژئو سایت
Geotourism	ژئوتوریسم، زمین گردشگری
Glacial	یخچالی
Gorge	گلوگاه , دره تنگ
Host	میزبان
Ice sheets	لایه‌های یخ
Immobility	غیر منقول
Impacts	اثرات
Inconsistency	ناپایداری
Inflexibility	غیر قابل انعطاف بودن
Infrastructure	زیرساخت
Inseparability	تفکیک ناپذیری
Intangibility	ناملموسی

GLOSSARY

Interpretation	تفسیر	Piedmont	کوه پایه‌ای
Karst	کارست	Pitch	شیب
Landform	بوم ریخت (لندفرم)	Quarry	حفاری
Landscape	چشم انداز	Rafting	قایقرانی در آب‌های خروشان
Landslide	زمین لغزش	Recreational	تفریحی
Lateritic regolith	رگولیت لاتریتی	Regolith section	مقطع رگولیت
Lava flows	جریان گدازه ها	Relic	بقایا-آثار
Leisure	فراغت	Remnant	بقایا
Liberate	تجزیه کردن	Renewable	تجدید پذیر
Metamorphism	دگرگونی	Retrogressive	برگشت کننده,-پسرو
Meteoroid	شهاب سنگ	Revenues	درآمدها
Mineral	کانی	Rift valleys	دره‌های کافتی(ریفتی)
Molten	گداخته	River trekking	رودخانه نوردی
Monolith	تک سنگ	Rock	سنگ
Morain	سنگ و خاکی که در اثر توده یخ غلتان جابجا شود	Rust	زنگار زدن
Mudflat	پهنه‌های گلی	Salinity	میزان شروع
Outcrops	رخنمون	Scenic flight	پروازهایی با هدف بازدید
Patronage	حفاظت	Scuba diving	غواصی
Peat	کود گیاهی	Sediment	رسوبات
Peninsula	شبه جزیره	Specimen	نمونه های واقعی
Perishability	فنا پذیری	Speleology	غار شناسی
Physiographic	وابسته به جغرافیایی طبیعی	Subsidence	فرونشست

GLOSSARY

Sustain	حفاظت کردن
Tectonic	زمین ساخت
Tentacle	شاخک
Transport	جابجایی
Vehicular	همراه با وسایل نقلیه
Viewpoint	چشم انداز
Volcano	آتشفشان
Weathered	هوازدگی
Weathered profile	چهره‌های هوازدگی

IGCP: International Geoscience Programme

IUGS: International Union of G eological Sciences

ProGeo: The European Association for the Conservation of the geological heritage.

NGO(non-governmental organization) سازمان‌های مردم نهاد

UNESCO: United Nations Educational , Scientific and Cultural Organization