CHAPTER 3
COMPONENTS OF GEOTOURISM

3.1 INTRODUCTION

Chapter Three will explain the concepts of geotope and of geosite, and their selection criteria as the basis on which geotourism are built. Verpaelst's (2004) classification was used to compile a list of geosites in South Africa. The geosites were classified as lithological sites, stratotypes or a type section, geosystems, geological or geomorphological landscapes, caves and grottos, mineral sites, historical mine sites, fossil sites, geological environments that support an ecosystem and meteorite impact sites. Geosite selection criteria means that only a single criterion such as size, accessibility, scientific value, geotourism appeal, educational value, historical significance, cultural, spiritual and social value, economic value, international significance, link with biodiversity and aesthetic quality may be sufficient to recognise the outstanding character of a geological site.

A short overview of some of South Africa's most known and typical geosites and geo-areas follows. They are The Barberton Mountainland, The Witwatersrand Goldfields, Evidence of early life in dolomites in sediments of the Vaalium Era, The Bushveld Complex, The first 'red beds', Diamonds from the deep, Great balls of fire, The Tswaing Meteorite Impact Crater, A continent-wide eruption, Permo-Triassic Area, Cradle of Humankind, Cradle of Humankind, Cango Caves, Kruger National Park and Table Mountain. A comparison of their overseas equivalents will follow their description.

Geodiversity is a very a useful concept for geoconservation and management of abiotic heritage. It is the diversity of minerals, rocks, fossils, soils, landforms and geological processes that constitute the topography, landscape and the underlying structure of the Earth.

Geoheritage refers to the heritage of geology and the various products thereof. Geological heritage (geoheritage) means the heritage of geology and the various products thereof. A new form of tourism, known as geotourism, is being developed in Europe and North America. This includes geology, mineralogy, palaeontology, geosites, present and defunct mines, caves, and collections of geological specimens in museums.

The origins and development of geotourism will be discussed further into this chapter as well as the components (building blocks) of geotourism. The relationship of geotourism to other types of tourism will be demonstrated. It will be shown that without geoconservation, there can be no geotourism.

The World Conservation Union (IUCN) has inventoried and defined six categories of protected areas. A UNESCO World Heritage Site is defined as a specific site, such as a forest, mountain range, lake and desert. The aim of such definition is to catalogue, name, and

preserve sites of outstanding importance, either cultural or natural, to the common heritage of humankind.

A very successful management tool is geo-education through geotourism. The role of interpretation directed at visitors, geoscience education activities, geo-exhibitions and geo-events will be examined. It will be shown how geotourism products may be used at geosites, geological and mining museums, historical mining towns, geological and theme parks. Examples of geotourism products and their utilisation are given.

The use of geosites, old mines, caves, geomuseums, geo-exhibitions, geo-events, geotrails, geoparks geolectures, geoworkshops and geoconferences as part of geotourism will be examined. The chapter will clarify and contextualise the following concepts under investigation: geosites, geoconservation, heritage and geoheritage, geotourism, geoconservation and education through geotourism.

3.2 GEOSITE CONCEPT

Marty, Cavin, Hug, Jordan, Lockley and Meyer (2004:42-43) discuss the geotope and geosite terminology. Geotope was coined following an idea in conservation biology that describes an object of unique and outstanding appearance of biological assemblage, in contrast to the surrounding, as a biotope. Stürm (1994) began to introduce the term geotope in Europe as a distinct part of the geosphere of outstanding geological and geomorphological interest. The term geosite was proposed by Wimbledon (1996), which is more general in scope than geotope, and encompasses any site that contains significant geodiversity. Komoo (1997) introduced the same concept in Malaysia and differentiated it by using the term, "geosite", which is more general in nature and encompasses any site that contains significant geodiversity.

Glitz (2004) says that the "*Akademie der Geowissenschaften zu Hannover e.V.*" started in March 2004 with a competition to determine the 50 most important geotopes in Germany. It was published under the title "*Die bedeutendsten Geotope in Deutschland*". The outstanding geotopes in Germany are represented by important geotopes consisting of a single, a collection or a landscape geotope. Therefore, they are represented by geotopes whose Earth historic events are of exceptional natural interest. This includes the development of life, geological processes in the development of landscapes and geomorphological units or geological attractions. Geotopes are single, small or large evidences in the development of the Earth and of life on them. They represent natural or industrial outcrops of rocks, loose deposits and fossil finding places, minerals, ores, landforms and springs. Geotope collections represent piles of geotopes that are tightly fitted together in a spatial and genetic relation. The objects can be distinguished in an international comparison by the exceptional geoscientific importance, clear view or beauty. They must represent good Earth historical, geological and landscape processes or events or developments Geotope landscapes represent geological and geomorphological attractions with a special peculiarity. These distinguished

and important geotopes must be sustainable in the long term. They must publicly be displayed in a museum, on a learning path or as an identified viewing/inspection object. They could be part or a single feature of a geopark.
(http://www.geoakademie.de/AGH1_of-Dateien/Geotope/WGeotop2_of.htm, http://www.geoakademie.de/AGH1_of-Dateien/Geotope/WGeotop5_of.htm).

Pupienes, Kmita, Kowalski and Mikulėnas (2006:41) believe geotopes are protected, typical or unique geological, geomorphological or geo-ecological important objects in the geosphere that exist as a single object or collection, and that they have significance in science and knowledge. They give information about the Earth's evolution or life on the Earth and are unique and non-renewable. "*It is the most often definition using* (sic) *by geologists, who deal with geological heritage survival. This definition is not steady and strict but the meaning is definite. It helps to add, to the Geotopes database, other objects which are still not protected or to notice their geological value*". A geotope is a delimited area with defined geological attributes or phenomena. It represents a special geological phenomenon or a combination of geological phenomena. All areas on the Earth are a part of one or several geotopes. They are fundamental to biotopes (http://www.sgu.se/hotell/progeo/news/4_2001/e-n.html). Vincent (2004:7) believes that geotopes are spatially defined terrestrial units with outstanding geological or geomorphological qualities that are worthy of protection for future generations. This definition specifically requires that they provide evidence of the geological history of the landscape and its development. Dowling and Newsome (2006:6-9, 12) describe a geosite as a landscape, a group of landforms, a single landform, a rock outcrop, a fossil bed, a fossil, caves, meteorite impact crater, volcano and even a mine site.

In this study, the terms geosite and geotope are used interchangeably.

By using Verpaelst's (2004) classification, a list of geosites in South Africa was compiled and shown below as Table 3.1.

TABLE 3.1 TYPES OF GEOSITES

TYPE OF SITE	DEFINITION	SELECTION CRITERIA	EXAMPLES
LITHOLOGICAL SITES	Outcrops with outstanding value in terms of composition and stratigraphic, phenomeno-logical, petrologic, structural, tectonic or	Scientific value. Refuge for rare species. Vulnerability. Educational value. Palaeo-biodiversity.	Barberton Mountainland. Witwatersrand, Transvaal (Vaalium), Cape, Waterberg and Karoo Sequences. Pilanesberg Complex. Western and Eastern Bushveld Complex. Platinum pipes.

	historical significance.		
STRATOTYPES OR TYPE SECTION	Specific point in a sequence of rocks or sediments that serves as a marker for a unit or a stratigraphic boundary.	Scientific value. Vulnerability. Unique character. International significance. Stratigraphic landmark. Educational value.	Witwatersrand, Transvaal (Vaalium), Cape, Waterberg and Karoo Sequences.
GEOSYSTEMS	Site that contains an assemblage of rock or sediments which, given their character or association, represent a geosystem.	Educational value. Scientific value. Geotourism appeal. Representiveness.	Sections along Barberton, Witwatersrand, Transvaal, Cape and Karoo Sequences. Bushveld Complex. Phalaborwa Complex. Pilanesberg Complex.
GEOLOGICAL OR GEOMORPHO-LOGICAL LANDSCAPES	Site that represents a significant record of the geological history or landscape evolution. It may be a particularly beautiful geological formation, or an example of harmonious development.	Historical significance. Educational value. Scientific value. Vulnerability. Geotourism appeal. Aesthetic quality. Economic value.	Drakensberg escarpment. Cape Folded mountains. Lebombo mountains. Waterberg and Soutpansberg mountains Bushveld Complex. Waterfalls. Pans.
CAVES AND GROTTOS	These are natural openings. Grottos form as a result of	Scientific value. Geotourism appeal. Vulnerability. Educational value. Refuge for rare species.	Cango caves. Sudwala caves. Wonderwerk caves. Kuruman cave/fountain Sterkfontein caves.

	geodynamic processes such as the freeze/ thaw cycle. Caves form because of the dissolution of calcium carbonate.	Economic value. Paleo-biodiversity.	Bloubos cave.
MINERAL SITES	Outcrops that contain several types of minerals of outstanding value in terms of composition and crystallo-graphic, petrologic, aesthetic or historical significance.	Scientific value. Vulnerability. Educational value. Economic value.	Witwatersrand, Barberton and Murchison gold mines. Kimberley, Cullinan and other kimberlite mines. West Coast diamond mines. Alluvial diamond mines. Rustenburg and Eastern Bushveld chrome and platinum mines. Manganese mines. Iron ore mines. Phalaborwa phosphate and copper mine. Richards Bay heavy mineral sands. Industrial sands. Cement Industry.
HISTORICAL MINE SITES	Mine site with recognized historical significance and heritage value, or site with educational and scientific value in terms of mining geology.	Historical significance. Educational value. Scientific value. Vulnerability. Geotourism appeal. Economic value.	All the old gold, diamond and platinum mines. Pilgrim's Rest. Old Blaauwbank visitor mine. Old Kromdraai visitor mine. O'kiep Copper mine.
FOSSIL SITES	Outcrops that contain well-preserved fossils, and that have an	Scientific value. Vulnerability. Educational value. Palaeo-biodiversity. Economic value.	All the Karoo fossil geosites. Sterkfontein caves. Taung. Makapan's cave.

	outstanding value in terms of stratigraphy, palaeobiology, aesthetics, or else represent a specific ecosystem.		Langebaan.
METEORITE IMPACTS	Site that exhibits physiographic and structural elements produced by a meteorite impact on Earth.	Scientific value. Vulnerability. Geotourism appeal. Cultural value. Representiveness. Economic value.	Vredefort. Tswaing. Setlagole. Kalkkop.
GEOLOGICAL ENVIRONMENTS THAT SUPPORTS AN ECOSYSTEM	Site that, given its mineral or geochemical composition, becomes a refuge for rare or threatened species of wildlife or vegetation.	Link with biodiversity. Precious character. Representiveness. Scientific value. Geotourism appeal. Economic value.	St. Lucia lake. Langebaan lagoon. Nylsvlei. Eastern Free State wetlands.

The geosites were classified as:

- Lithological sites
- Stratotypes or a type section
- Geosystems
- Geological or geomorphological landscapes
- Caves and grottos
- Mineral sites
- Historical mine sites
- Fossil sites
- Meteorite impacts
- Geological environment that supports an ecosystem.

The Geological Survey of Quebec (Verpaelst, 2004) uses a list of geosite selection criteria in which only a single criterion may be sufficient to recognise the outstanding character of a geosite:

- Size
- Accessibility
- Scientific value
- Geotourism appeal
- Educational value
- Historical significance
- Cultural, spiritual and social value
- Economic value
- International significance
- Link with biodiversity
- Aesthetic quality
- Representiveness
- Stratigraphic landmark
- Palaeo-biodiversity
- Rare or unique character
- Precious character
- Vulnerability
- Refuge for rare and threatened species.

The definitions and geosite selection criteria were considered, and by applying them, the most typical examples from South Africa were listed.

3.2.1 WORLD HERITAGE SITES

In 1994, the World Conservation Union (IUCN) inventoried and defined six categories of protected areas. These were:

- Ia: Strict nature reserve
- Ib: Wilderness area
- II: National park
- III: Natural monument
- IV: Habitat/species management area
- V: Protected landscape/seascape
- VI: Managed resource protected area.

It should be noted that the definitions of categories linked explicitly to natural features of the Earth references are made, as "*landscape features or rock exposures*" (Ia); "*geological, physiogeographic…features*" (Ib); "*appropriate natural features include…fossil beds*" (III), "*protected landscape and/or seascape"* (V)

(http://www.unep-wcmc.org/protected_areas/categories/eng/index.html).

As adopted in 1972 by the General Assembly of the United Nations Educational Scientific and Cultural Organisation (UNESCO), the Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) has become the world's leading international instrument for the protection and preservation of the most outstanding destinations on Earth. They compiled The World Heritage List (WHL) that ranges from cultural monuments and historic cities through to protected natural areas that span the whole range of tourism destinations and types of tourism, whether business, leisure, youth travel, adventure tourism, eco-tourism or cultural tourism. However, tourism has both positive and negative impacts on cultural and natural heritage. Over-crowding, over-development, pollution or threats to wildlife habitats are some of the associated risks. Nevertheless, tourism also brings much-needed funding, which can be used to help preserve natural and cultural World Heritage Sites (WHS) and empower local communities living and working near those sites. The Protected Areas and the World Heritage Programme forms the basis for World Heritage Sites (http://whc.unesco.org/events/itb/index.htm).

Figure 3.1: Part of the Rammelsberg reduction works,
Rammelsberg World Heritage Site (WHS), Germany

Dallen, Boyd and Boyd (2003:115-119) note that the UNESCO mandate is far-reaching in all aspects of culture, science and education, and that its WHL adds prestige to states, particularly smaller and less affluent nations. In some cases, to have a few WHS even reinforces nationhood and can be a legitimating influence for new governments. UNESCO recognition is also sought for potential financial assistance. Because many countries use it as marketing tool, many more visitor arrivals accrue from it. In 1972, the World Heritage Convention was the primary drive that gave direction to influences in the conservation of the most significant cultural sites. It was followed by the World Heritage Committee whose

primary responsibility is to keep and establish a WHL of cultural and natural properties submitted by countries and considered to be of outstanding universal value. One of the Committee's most important functions is to assist countries with technical assistance in states where resources are insufficient.

The World Heritage Committee has three basic functions:

1. To identify properties, based on states' recommendations, which are to be protected under the Convention, and to inscribe them on the WHL
2. To decide which sites on the WHL should be inscribed on the List of World Heritage in Danger, and
3. To establish how, and under what conditions, the resources in the World Heritage Fund should be used to aid governments in protecting their heritage sites.

Only states that adhere to the Heritage Convention can make nominations to the World Heritage List. A country can nominate a site to the WHL, but it takes a great deal of preparation and a dossier must be submitted for a WHS by the national government accompanied by archival material. Thereafter the Committee will decide whether or not a site merits inclusion in the List. One example was the application by the Sargansenland-Walensee Geopark (Switzerland) to include the "*Glarner Hauptüberschiebung*" (Glarus main thrust) as a WHS. It was turned down at Durban in 2005 because there was not enough preparation done (personal communication, Parks Manager, 2006). Criteria for inclusion in the WHL for natural sites are that the site must:

- Be exceptional examples of major stages in the Earth's natural history, including ongoing geological processes, record of life and geomorphic features
- Exemplify significant ongoing ecological and biological processes, such as those related to marine ecosystems and communities of animals and plants
- Contain natural, phenomena or areas of superlative beauty and aesthetic importance, or
- Contain the most and significant natural habitats for conservation of biological diversity.

The most important aspects are the Sites' superlative characteristics, their high level of representation of places worth protecting and their irreplaceable value to humankind. Management plans must exist for each WHS with regard to entry charges, local tourism business development, the impacts of various visitor types (for example, large tourist groups, visiting scholars, schoolchildren), and potential damage to resources from overcrowding and natural processes. Issues related to information and interpretation, ancillary services (for example, shops, guides, catering) and accessibility must be addressed.

In summary, the key criterion for World Heritage Inscription is that the site has to be of '*outstanding universal value*'. The prestige of inscription encourages heritage preservation by governments and citizens alike, and it may attract financial assistance and technical

support such as heritage conservation projects. Inscription also imposes greater conservation responsibility on the custodian nation, failing which it could be put on the list of World Heritage Sites in danger. Endangered sites are entitled to emergency conservation action by the national and the international community. Once a site has been selected, it is included on the WHL and is protected for future generations against threats of damage caused by natural conditions and human interventions.

The Vredefort Dome and the Greater St. Lucia Wetland (iSimangaliso) are the only World Heritage Sites in South Africa that are based on geology.

3.2.2 DESCRIPTION OF GEOSITES AND GEO-AREAS IN SOUTH AFRICA

SOUTH AFRICA'S GEOLOGICAL 'TOP TEN' (1999), Reimold (2001:20-23) and Reimold, Whitfield and Wallmach (2006:42-62) all give an overview of the most important geosites in South Africa. Because the geology and geomorphology form the basis of the study, a short overview of some of South Africa's typical places of geological interest (geosites/geo-areas) will be given. A comparison of overseas geosites will follow. The best known top 15 geosites/geo-areas in South Africa could be better described as geological attractions. A short description of the most stunning geosites is given below:

1. **The Barberton Mountainland**
   Within the picturesque mountains of the Barberton area, 3 500 million-year-old rocks preserve evidence of the birth of the continents, some 1 000 million years after the formation of the planet. The largely volcanic 'greenstones' include komatiites (named after the Komati Valley, where they were first identified in 1969). These rocks formed from the hottest-known volcanic lavas (magma temperature about 1 600ºC) ever to have erupted onto the Earth's surface.

2. **The Witwatersrand Goldfields**
   The Witwatersrand Basin is, by far, the world's largest gold deposit, having yielded about 50 000 tons of the precious metal, or a third of all the gold mined so far on Earth. The gold was transported and deposited in conglomerate reefs by high-energy river systems about 2 750 million years ago.

3. **Evidence of early life in dolomites in sediments of the Vaalium Era**
   Silica-rich chert layers in the greenstone belts of eastern South Africa contain traces of the earliest life forms on Earth - blue-green algae dating back to 3 500 million years ago. Large parts of northern and northwest South Africa are covered by dolomites, which preserve the most extensive occurrence of stromatolites in the world. These dome-shaped structures are the fossilised remnants of algal colonies that flourished along the margins of the Transvaal Sea about 2 500 million years ago.

4. **The Bushveld Complex**

   The Bushveld Complex, the world's largest layered igneous complex, is one of the geological wonders of Planet Earth. The Complex is the world's greatest resource of the platinum-group metals, (chromium, vanadium, and titanium), which occur in layers, or 'reefs', extending over hundreds of kilometres. Eighty per cent of the world's platinum, and 75 per cent of the world's chromium, are found here.

5. **The first 'red beds'**

   Sedimentary rocks, known as 'red beds', because of their colour (caused by iron oxides), provide the first evidence for substantial quantities of oxygen in the Earth's atmosphere. The Kalahari Manganese Field, which contains over 50 per cent of the world's manganese reserves, and the large iron-ore deposits at Sishen (Northern Cape Province) and Thabazimbi (Limpopo Province) also owe their origin to the first appearance of free oxygen in the Earth's atmosphere.

6. **Diamonds from the deep**

   Although diamonds have been recovered from alluvial gravels for thousands of years in other parts of the world, their true source was recognised only in 1871 at Kimberley. The diamond-bearing rock, named kimberlite, occurs in narrow pipes that were the feeders to explosive volcanoes. Only a small fraction of the hundreds of pipes found in South Africa contain enough diamonds to warrant mining, but those that are worth exploiting have produced some of the world's largest stones, including the magnificent 3 106-carat Cullinan diamond from the Cullinan Mine (previously known as the Premier Mine) near Pretoria.

7. **Great balls of fire**

   The World's biggest and oldest meteorite impact structure is known as the Vredefort Dome. The Vredefort crater is the largest verified impact crater on Earth. The asteroid is estimated to have been as big as Table Mountain, and its calculated diameter was about 380 km. It hit the Vredefort area approximately 2 023 million years ago. Because granite is exposed in the centre of the structure and because of its shape, the descriptive name of Vredefort Dome was accepted for the area enclosed by the semi-circular range of hills to the north-west. In 2005, the Vredefort Dome was added to the list of UNESCO World Heritage Sites for its geologic interest. Today it is the country's 7th World Heritage Site).

8. **The Tswaing Meteorite Impact Crater**

   Situated about 40 km north-northwest of Pretoria, Tswaing is one of the world's most easily accessible and best-preserved meteorite impact craters. Owing to the presence of volcanic rocks in the vicinity, the structure was previously thought to be volcanic in origin, but investigations of the material filling the crater have shown without a doubt that it marks the site of a meteorite impact (astrobleme) a mere (in geological terms) 220 000 years ago.

9. A continent-wide eruption

The onset of the break-up of the supercontinent Gondwana about 180 million years ago led to a period of spectacular volcanic activity, as molten magma rose through fractures in the Earth's crust and spread across the surface of South Africa. In places, the pile of lava flows approached 2 km in thickness. Remnants of these flood basalts can be seen today in the Drakensberg Mountains.

10. Permo-Triassic Area

Some 240 million years ago, before the break-up of Gondwana, the central parts of South Africa formed a low-lying basin with lush vegetation, where ancestors of the dinosaurs and modern mammals roamed. The Karoo region today is the repository of the most impressive fossil record of these mammal-like reptiles and early dinosaurs, providing palaeontologists around the world with vital clues to the evolution of the dominant life-forms on Earth.

11. Cradle of Humankind

The discovery of a fossilised child's skull at Taung in the 1920s revolutionised the study of palaeo-anthropology. Australopitheticus africanus inhabited South Africa some 2.5 to 3.5 million years ago. There are several world-famous hominid ('Early Man') sites in the Cradle of Humankind, suggesting that southern Africa may have a strong claim to the title "*Cradle of Humankind*".

12. Pilgrim's Rest

The picturesque mining village of Pilgrim's Rest was declared as a National Monument in 1974, and is now a living museum. Mines here were part of the Pilgrim's Rest-Sabie Goldfield, extending from Bourke Luck in the north to Elandsdrift in the south. Pilgirm's Rest was painstakingly restored in its entirety and is now one of the most perfect examples of a restored gold mining town. It is an open-air, and indoor, museum of mining memories, the perfect example of a prospector's town founded during the romantic days of the first gold rush of 1873. More than 155 metric tons (five million ounces) of gold, and a significant amount of silver, have been won from ore deposits in the Pilgrim's Rest Goldfield over more than a century of mining. An appropriate Digging Site Museum was erected at the southern end of the town. The old reduction works is not open to the public, but it could be restored and opened for visitors. A new event created was the "*2005 World Gold Panning Championships*" that was first hosted in Pilgrims Rest from the 17-25 September 2005. It is now an annual national event.

13. Cango Caves

The Cango Caves are one of the world's great natural wonders. They are one of the oldest natural attractions in South Africa, part of which has become the biggest show cave in Africa. The Caves are a subterranean wonder world of great physical beauty.

Within the cave system, there is a fabulous collection of speleothems that form part of the bizarre dripstones formations. There are four cave systems: Cango One, Two, Three and Four of which the last three are not open to the public. The first sequence of caves, Cango One, stretches for 762 metres and was developed and opened for tourists. There are innumerable dripstone formations in the main cambers and antechambers. Some 35 meters from the entrance, there is a 20-meter descent into the largest of the chambers, the Van Zyl's Hall. The highest dripstone, a 12.5-metre column, is in Botha's Hall. It terminates in the Devil's Workshop and Banqueting Hall. The main aesthetic attractions of Cango One, and therefore tourist appeal, of the cave lie in the large size of its chambers, and in the spectacular speleothems. The narrower passages, especially the Devil's Chimney, at the far end of Cango One provides a further attraction for the tourist who enjoys some physical exercises. Unfortunately, physical disturbance, noise and lampenflora have an adverse impact on the cave. The need for geoconservation is being recognised so that future generations of tourist and scientists could also enjoy them. A new museum complex and interpretive centre that blends in with the natural surroundings was opened in 1999.

14. Kruger National Park

Research on the geosites in the Park was done by the author during the last four years. There are excellent examples of migmatites that show how the Earth's crust was formed about 3.5 million years ago. Other examples of geological interest are sedimentary structures and fossils near Punda Maria, the intrusive rocks of the Timbavati Gabbro, the volcanic rocks of the Lebombo Mountains and the weathering products such as the potholes at Red Rocks and the granite kopjes in the southern part, north of Berg-en-Dal camp.

15. Table Mountain

It is a well-known landmark that every tourist notices in Cape Town. The sandstone formation that resembles a table gave rise to the name (http://www.mintek.ac.za/pubs/geobook/Top10.htm; Deep impact – the Vredefort Dome. 2005; http://www.hartrao.ac.za/other/vredefort/vredefort.html; Schutte, 2000a, 2003, 2004a, 2004b, 2006a, 2006b, 2007, Schutte and Whitfield, 2002).

3.2.3 DESCRIPTION OF GEOSITES AND GEO-AREAS OVERSEAS

All tourists that go on an international holiday will often see and experience places of geological interest, and geological landmarks, during their travel. There are numerous geosites in the world such as Yellowstone, Hawaii, Vesuvius, Etna and Pompeii to mention merely a few of the better known examples. World Heritage Sites (WHS) are examples of other geosites like the Jungfrau-Aletsch-Bietschhorn (Switzerland), Messel Pit Fossil Site (Germany), Mount Fuji (Japan), Australian fossil mammal sites of Riversleigh/Naracoorte and Ayres Rock (now called Uluru) (Australia), Los Glaciares (Argentina), Waterton-Glacier International Peace Park (Montana, U.S.A., and Alberta, Canada), Banff National Park

(Canada) and Sagarmatha National Park, including Mt. Everest (Nepal). World Heritage Sites that show mining history are Røros (Norway), the historic centre of the town of Diamantina (Brazil) and the mines of Rammelsberg, with the nearby historic town of Goslar (Germany).

The Galapagos Islands (Ecuador) is a special case because the islands and the surrounding marine reserve have been called a unique '*living museum and showcase of evolution*'. Located at the confluence of three ocean currents; the Galapagos are a 'melting pot' of marine species. The terrestrial area of the site is 766,514ha, comprising almost 97% of the land area of the archipelago where geosites can only be visited when they are accompanied by tourist guides (http://whc.unesco.org/en/285/). Dorset and the East Devon Coast (UK) comprises approximately 155 km of undeveloped coastline and countryside. The cliff exposures along coast provide an almost continuous sequence of rock formations spanning the Mesozoic Era, or some 185 million years of the Earth's history (http://whc.unesco.org/en/282/). Tongariro National Park (New Zealand) has active and extinct volcanoes, a diverse range of ecosystems and some spectacular landscapes (http://whc.unesco.org/en/283). Oman is called the biggest open-air geological museum in the world. The town of Miri (Malaysia) has an impressive geosite exhibition near the road to the airport (http://www.ecomedia-software.com/airport/airport.htm).

Geosites are well-represented in National and World Geoparks overseas (c. f. 4.5.1, 4.5.2).

3.3 GEODIVERSITY

James, James and Clark (2006) believe that "Geodiversity is the link between people, landscape and their culture, and it is the variety of geological environments, phenomena and processes that make those landscapes which provide the framework for life on earth. An understanding and recognition of the importance of geodiversity challenges the more conventional view of geology where it is seen as a destructive science or as a resource to be use". Serrano Cañadas and Ruiz Flaño (2007:390) define geodiversity from a theoretical point of view as "the variability of abiotic nature, including lithological, tectonic, geomorphological, soil, hydrological, topographical elements and physical processes on the land surface and in the seas and oceans, together with systems generated by natural, endogenous and exogenous and human processes, which cover the diversity of particles, elements and sites". Kozłowski (2004, as cited by Serrano Cañadas and Ruiz Flaño, 2007:389-390) believes that geodiversity is the natural variety of the Earth's surface, referring to geological and geomorphological aspects, soils and surface waters, as well as to other systems created as a result of both natural (endogenic and exogenic) processes and human activity.

Geodiversity is a very a useful concept for geoconservation and management of abiotic heritage. The term can be applied to any particular region or country. Abiotic elements must be incorporated into the local policies of sustainable development and the assets of natural

resources. The concept is suitable for a geo-ecological management of natural protected areas. Geodiversity is closely related to the concepts of geoconservation, natural heritage, geoheritage or legal entities like geoparks, protected landscapes, natural monuments or geomorphosites. Geodiversity is the diversity of minerals, rocks (whether 'solid' or 'drift'), fossils, soils, landforms and geological processes that constitute the topography, landscape and the underlying structure of the Earth. The degree of geodiversity depends upon the range of geological and paleontological features relative to the region or area discussed. A relatively higher (richer) geodiversity occurs in areas that are characterised by the presence of many different geological structures, particularly if these belong to differing geological eras. A relatively lower diversity occurs in areas that are characterised by large tracts of similar geological structures, for example the Earth's deserts (http://en.wikipedia.org/wiki/Geodiversity).

The Nordic Council of Ministers prepared a leaflet about geodiversity in 2003 in Swedish. The leaflet was prepared by a group of Earth science professionals established by the Council. The aim of the text was to introduce the term geodiversity into Nordic nature conservation. It is based on the report "*Geodiversitet i nordisk naturvård*" (Geodiversity in Nordic nature management), written in Swedish (ISBN 92-893-0572-2000). It states that geodiversity allows the understanding of variations seen in rocks, superficial deposits and landforms, and in all the geological processes that built up or eroded the Earth's crust. Further, the leaflet points out that there has been far less attention paid to geodiversity, but that geological diversity is a vital pre-requisite for biological diversity. Plants and animals, bedrock and deposits, are elements of the ecosystem. Plants and animals are the living (biotic) elements, while bedrock, deposits, water and wind form the non-living (abiotic) elements. The writers of the leaflet note that while geodiversity is crucial in forming the basis of habitat quality, geodiversity has an impact on land use, economic life and recreation, and therefore, on the fabric of society. They conclude that it is up to everyone to conserve this diversity, and that all activities should take account of the diversity of nature, both biodiversity and geodiversity (http://www.sgu.se/hotell/progeo/pdf/GM_ENG.pdf).

3.3.1 VALUING GEODIVERSITY

Gray (2004:65, 126,-127, 162, 164-165, 168) is of the opinion that it is important to conserve and manage the geodiversity of this planet. Discussing the many values of geodiversity and the reasons for treating the physical basis of our environment with care and respect can achieve this. There are two main types of values in the Earth's physical resources. The first is the economical value of exploiting the resources of the planet, and the second is the cultural or heritage value in protecting the aesthetic and research resources of the physical environment. Other authors expanded the classification into four groups:

- Intrinsic value
- Cultural and aesthetic value
- Economic value

- Research and educational value.

Research and education values are, in many ways, the most important values. The physical environment is a laboratory for future research and this is often the only site that provides a reliable test for geological theories. When physical systems are damaged the ability to undertake further research and teaching regarding those systems may be lost. The study of geological record is of utmost importance when deciphering the history of the Earth over the last 4 600 million years. Therefore, this geological rock record has an enormous value. In all spheres of geology, research plays an important role.

The human impacts on geodiversity are:

- Complete loss of an element of geodiversity
- Partial loss or physical damage
- Fragmentation of interest
- Loss of visibility, or invisibility
- Loss of access
- Interruption of natural processes and off-site impacts
- Pollution
- Visual impact, and
- Underground mining that can have serious effects on the geoscape.

The benefits offered by geodiversity together with the social functions of geodiversity are discussed by Guthrie (2004) and are summarised in Figure 3.2.

There is an ever-increasing pressure on the resources by recreation and tourism, especially in parks, caves systems, dunes and by rock climbing. "*On the other hand, tourism brings people into contact with natural or semi-natural environment and may lead to a, more appreciative public willing to support efforts to reduce the threats and conserve the resource*". Removal of geological specimens is yet another threat to geodiversity. The best way to protect fossils is, in many cases, by placing them in museums. Over-collection of minerals or fossils can lead to the destruction of the site. Strict control is necessary. Even the much-less destructive research and educational activities can damage sites. In Tasmania, special measures are taken to manage coring and the restoration of the core holes. But worldwide, the most important threat to geodiversity is ignorance. "*A lack of survey information, documentation and designation of geoheritage has resulted in loss or degradation of sites and landscapes via inappropriate development in the past and remains a threat in many parts of both the developed and developing* world. *...As a result of this lack of information, geological conservation measures are often lacking, including integration into important land-use planning legislation, policy and practice*". In conclusion, Gray (2004:168) is of the opinion that there should be a greater understanding of the planet's geodiversity, its value, the threats to its existence, and of the importance of geoconservation and management.

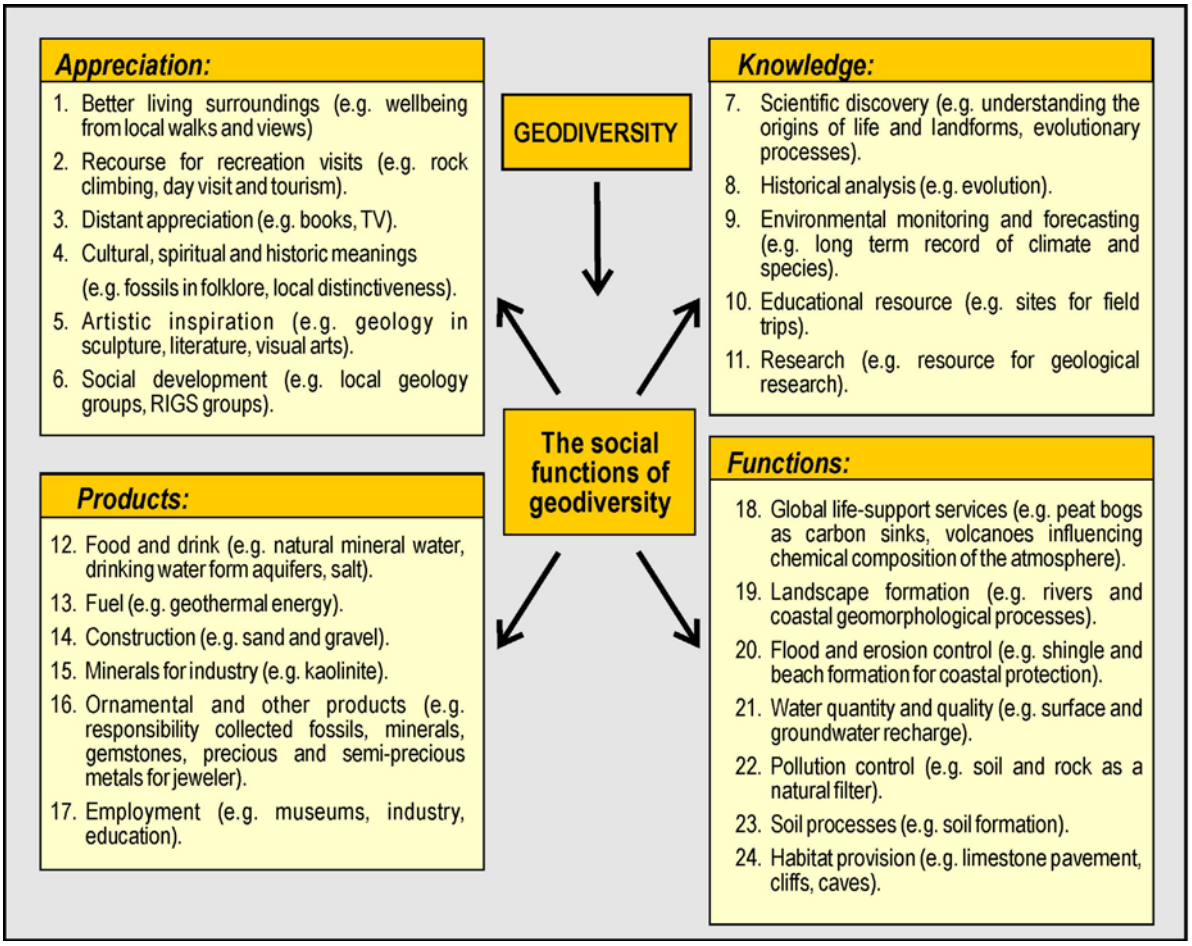

Figure 3.2: The social functions of geodiversity (Guthrie: 2004, adapted from De Groot: 1992, English Nature: 2002 and Gray: 2003) (http://www.geoconservation.com/conference/followup/presentations/guthrie.htm)

3.4 HERITAGE AND GEOHERITAGE

Herbert (1995:1-2) states "*Heritage places are products, or perhaps constructions of history. They owe their distinctiveness to the past. That distinctiveness remains recognizable but is often used and presented in new ways. Much of this presentation is closely related to the growth of leisure and tourism. Heritage places have been part of the round of leisure-time visitors and tourists...Heritage places, leisure and tourism are interrelated, though not necessarily interdependent. Heritage places have autonomous roles as places of formal education, research and conservation. Many people, though probably a minority, visit heritage places in their leisure time as tourists*". Thus, heritage tourism can be regarded as a form of tourism in its own right.

Geological heritage (geoheritage) means the heritage of geology and the various products thereof. Duk, Sumathokina and Gorb (2006:19-20) define geoheritage as "*the system of values embodied in the geologic monuments and objects created by nature that are*

[p]reserved by human generations for human society and its further development". Edwards (1999: iii) states that our geoheritage also contains wealth of other kinds. The diverse rock formations of South Africa span almost the entire range of the geological time scale, and include some of the world's best-preserved and most typical examples. The study of these rocks has enabled scientists to learn much about the Earth's early history and the formation of mineral deposits, and it has also contributed significantly to the understanding of continental drift and the evolution of life on the planet. The country's magnificent and varied scenery that is the result of the interplay between geological processes and climactic factors draws millions of visitors annually from home and abroad, and can be appreciated by the tourist and scientist alike.

3.5 GEOTOURISM

As described earlier, a new form of tourism known as geotourism is being developed in Europe and China where the main emphasis in on geology, while in the USA the geographical viewpoint is followed. Geotourism includes geology, mineralogy, palaeontology, geosites, present and defunct mines, caves, and collections of geological specimens in museums.

3.5.1 ORIGINS AND DEVELOPMENT OF GEOTOURISM

Hallstatt in Austria is the oldest salt mine in the world dating back some 7 000 years (http://www.salzwelten.at/cont/salzwelten/salzwelten_home.aspx). However, Wieliczka Salt Mine is the only site in the world where mining has taken place continuously since the Middle Ages. The Wieliczka Salt Deposit, Poland, belongs to a Miocene salt-bearing formation that originated 15 million years ago. It has been developed on nine levels and its original excavations (longitudinal, traverses, chambers, lakes, as well as lesser and major shafts) stretch for the total of 300 kilometres, reaching a depth of 327 metres. They illustrate all the stages of the development over time of mining technology. The history of the mine is a reflection of this progress of mining technology, development of work organisation and management, and the birth of legislation in industry. Initially, salt was acquired from brine springs and through heating the brine vaporisation of water took place and salt subsequently recovered. Later, a salt deposit was discovered, and its excavation with primitive tools began.

Already in the 14th century, as the site of salt production, it was shown to privileged visitors of the royal court. Later as a vast underground labyrinth of chambers and passages, it was admired for its specific charm and mystery. Towards the end of the 15th century, as historical documents claim, tourist activity began in the mine. Although the groups were small and consisted solely of the elite of the contemporary world, the goal of their visits was to see and to learn. The geosite was unique because it was almost invisible from the surface and could only be seen from the subterranean inside where it displayed its beauty in all its splendour. During the 16th century, the period of Polish humanism, the role of Wieliczka as

a tourist site began to grow as visits to the mine concentrated on the culture and learning, neglecting the organisational aspects. Only members of the upper classes could admire the mining and resultant excavations, and each time the explicit approval of the king was necessary. Even though the mine's authorities saw the tourists as intruders dabbling with the production cycle, this is where geotourism started. In the 16th century, the Wieliczka Salt Mine became one of the largest business enterprises in the then-modern Europe. At present, there exists a well-planned tourist route. Guides are expertly trained employees of the mine (http://whc.unesco.org/sites/32.htm).

3.5.2 DEFINITIONS AND CONCEPTS OF GEOTOURISM

Geotourism has been used mainly by geologists and geographers in the last few years for a new emerging market segment in tourism. Dowling and Newsome (2006:1-2) point out that geotourism is part of a spectrum of definitions. This is shown in Figure 3.3.

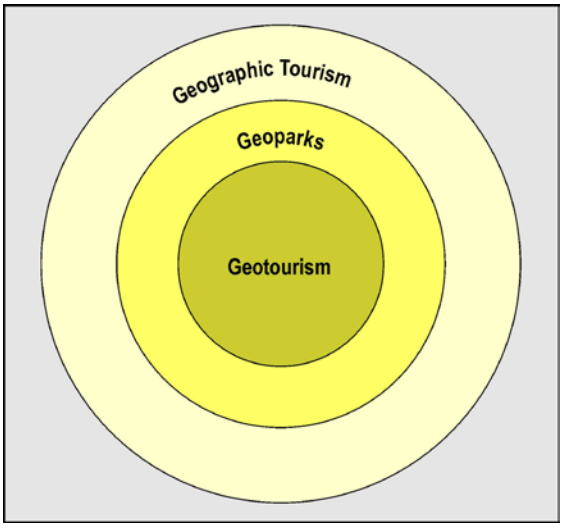

Figure 3.3: The existing spectrum of geotourism (Dowling and Newsome, 2006:1)

Stueve, Cooke and Drew (2002:1) give a broad definition of geotourism from a geographical point of view that encompasses a wider geographical, socio-economic and cultural context under the umbrella of geographic tourism. Frey, Schäfer, Büchel and Patzak (2006:97-114) embrace geotourism at the level of social and community development according to the concept of the geopark.

At the "*3rd International UNESCO-Conference on Geoparks*", Osnabrück, Germany, 22-26 June 2008, Dowling (2008:10-11, 16) defined geotourism as:

"***Geotourism is sustainable tourism with a primary focus on experiencing the earth's geological features in such a way that fosters environmental and cultural understanding, appreciation and conservation, and is locally beneficial***".

In the context of geotourism several definitions were given:

- Geology - is the study of the Earth
- Geoheritage - earth attributes which are valued
- Geoconservation - conserving the Earth's valuable features
- Geosite - a site or place identified for geological tourism development
- Geopark - a geological region developed for tourism
- Geotourism - geological tourism that is sustainable, educative and locally beneficial.

The five 'C's of geotourism are:

1. Creating authentic geotourism product
2. Conserving geoheritage
3. Community building
4. Communicating geo heritage, and
5. Cooperating with a range of stakeholders.

Dowling (2008:20, 25, 51) states that, "*First and foremost, geotourism is a niche form of tourism, that is, it is a type of tourism. As with all modern tourism development, it is grounded in the concept of sustainability. Geotourism should stimulate local socio-economic development through the promotion of a quality geoproducts*". In the case of geoproducts, geotourism can be carried out in natural or urban settings, simply wherever the focus is on the geological environment. If Malaysia is used as an example, geotourism occurs:

- In a World Heritage Area at Mt Kinabalu, Sabah, Borneo
- At a roadside cutting at Miri, Sarawak, Borneo, and
- In the Langkawi Geopark, South East Asia's first.

Saayman (2006:16-17) summarises the principles of geotourism as those that:

- Do not degrade the georesource
- Provide long-term benefits
- Provide fist-hand participatory and enlightening experiences
- Involve education among all parties
- Encourage all-party recognition
- Involve acceptance of the georesource on its own terms, and in recognition of its limits
- Involve understanding and involve partnerships, and
- Promote moral and ethical responsibilities.

In the brochure of the "*Inaugural Global Geotourism Conference 2008*" that was held in the Esplanade Hotel, Fremantle, Western Australia, from 17-20 August 2008, the organisers state that "*Geotourism describes the resources, activities and management of visitor activity centred on rock exposures, landforms and fossils in a wide variety of natural landscapes. The term geotourism is essentially taken to mean 'geological tourism'. It encompasses tourists looking at natural landscapes including the landforms, rocks and processes that*

shaped them over time. The Earth's geological wonders have always fascinated people and are a fundamental part of a culture's identity. Many also form the basis for the establishment of protected areas and World Heritage Sites. From Iguazu Falls to the Grand Canyon, examples abound of outstanding geological features which have attracted visitors from time immemorial. It is not just spectacular landforms either, but also the processes which have shaped the Earth. So tourists also visit sites where glaciers are in action, volcanoes are active, sand dunes are sculpted and rivers are causing erosion. It is the understanding of this 'form - process relationship' that is important in geology, and by extension, geotourism. Through geotourism the relationship is explored and the consequences of geological landforms and activities on our lives are more fully understood" (http://www.promaco.com.au/2008/geotm/). Dowling and Newsome (2006:4-6) conceptualised the nature and scope of geotourism as shown in Figure 3.4.

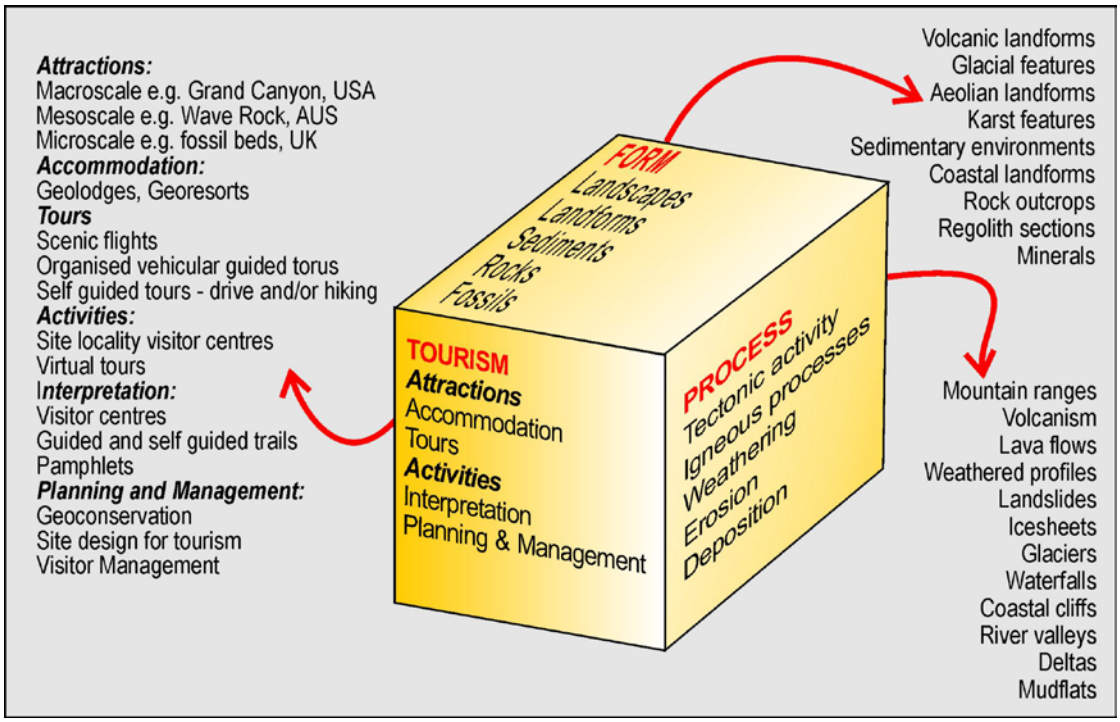

Figure 3.4: The conceptualisation of the nature and the scope of geotourism (Dowling and Newsome, 2006:5)

The three main components are form, process and tourism with its various sub-divisions. Form describes the various geological landforms, rocky outcrops and materials. Landscapes of geotourism interest are mountain ranges, rift valleys, great escarpments, volcanoes, karst landscapes and arid areas. Within a landscape, there may be characteristic landforms or an array of landforms (for example, volcanic, glacial or fluvial geomorphic features). A hierarchy of features of geotourism interest also exists. They may range from individual landforms through to rock outcrops, rock types, sediments, soils and minerals.

Process can be conceptualised in relation to how the dynamic Earth is formed. It involves

geologic and geomorphological activity like volcanic eruptions, the action of running water, sediments that are being weathered, liberated and moved from one site (eroded and transported) to another (deposited).

Superimposed on these is the human dimension that is experienced as tourism activity. Visits to geosites may be in the form of self-guided driving, hiking trails, patronage of viewpoints, bus tours, boat trips and scenic flights. Geosites that are selected and developed for geotourism may have accommodation facilities and attendant infrastructure. Services designed to enhance the visitor experience could be purpose-built access roads, interpretive visitor centres, guided geotourism and virtual tours (IMAX cinema, for example). This three-pronged approach is a very useful concept on which geotourism can be build.

Dowling and Newsome (2006:6-8) explain that the bulk of geotourism takes place in a natural environment. Thus, it may be considered a part of natural area tourism and ecotourism, but it is a specialised form of tourism in that the focus of attention is the geosite. As already discussed, a geosite can be a landscape, a single or group of landforms, a rock outcrop, a fossil bed or a fossil. Using this approach, it is clear that there is a clear distinction from the forms of tourism that take place in the natural environment, such as visiting natural areas to view wild animals or flowers, or for recreation in a natural area. However, many people visit sites for a combination of its natural values, some which may be geological in character. In geotourism, the attention is primarily on geologic phenomena, and the objective of the trip is to visit and view a geological attraction. Where fossils are involved, there is an extension into the early evolutionary processes and the evolution of humans and other vertebrates. Landscapes and a few geosites may provide aesthetic values as well as cultural, historical and adventure tourism. Buildings that are constructed from rocks and stones are important for their cultural and historic aspects. Mine sites can provide an insight into the importance of geology in people's lives and environmental degradation.

Geotourism can be developed at the landscape scale such as the Grand Canyon, USA. There may also be visits made to road cuttings and quarries to see how the Earth was formed. In South Africa, the Karoo fossils are a focus of attention. Visitors can view fossils *in situ* and see other geological and geomorphological features in the area. In this example, the fossils are found in clayey and sandy sediments of the Karoo Supergroup. These sedimentary rocks show impressions of leaves that are preserved, in tracks and burrows, shells and skeletons of reptiles. In conclusion, it could be claimed that ”*Geotourism is an option for all countries and all parts of the world*”.

Dowling (2008:37-39, 51) believes that understanding geotourism has the implication that:

- Geotourism has a strong educative component in which geoscientific knowledge is communicated to the public
- This may be accomplished through protected and interpreted geosites, museums, information centres, trails, guided tours, school class excursions, popular literature, maps, educational materials and displays, seminars

- The study of geotourism also fosters scientific geological and landscape research.

By appreciating geotourism, the following is achieved:

- The fostering of a connection with the earth such that people begin to feel part of the earth's abiotic landscape, in much the same way as they are attracted to its biotic components.
- The interactive interpretation and education that involves both the tourist (guest), as well as the local people and community (host).

Geoconservation principles are:

- To conserve significant geological features and explore and demonstrate methods for excellence in conservation
- To allow for the fact that certain geological features or landforms should not be allowed to be developed as tourism products because of the high value they have as natural attributes.

Emerging partnerships characteristics are that:

- Geotourism is a natural advocate of partnerships
- All partnerships have a number of common elements including a shared vision, shared risks and shared benefits
- Such partnerships can take many different forms including amongst industry, government and non government organisations
- Community participation is the essence of most partnerships.

Frey, Schäfer, Büchel and Patzak (2006:97-98) use Frey's definition of 1998 as follows: "*Geotourism means interdisciplinary cooperation within an economic success-orientated and fast-moving discipline that speaks its own language. Geotourism is a new occupational and business sector. The main tasks of geotourism are transfer and communication of geoscientific knowledge and ideas to the general public*." Thus, they suggest that geotourism is based on the interaction between politics, geoscience, universities and the tourist industry. A regional value and sustainable use achieves a quasi-balance by using the potential of the landscape and its established infrastructure. The sustainable protection and safeguarding of the geoheritage of a region is the principle behind geotouristic activities. The above-mentioned actions were very successfully applied in the Volcano Eifel Geopark in Germany by bringing geoscientists and politicians together in addition to the effective marketing of the geopark.

Pforr and Megerle (2006: 118, 120-121) state that geotourism "*embraces the identification of geo-objects, landscape marketing and interpretation of the geoheritage of a region in a sustainable manner*". Collaboration, co-ordination, effective communication and transfer of know-how are necessary to achieve sustainability outcomes. Geotourism is also a vehicle to promote geoconservation in a sustainable management regime. There is also a symbiotic

relationship between tourism and geoconservation and its potential to contribute to the sustainable development of a region. Geotourism should be consistent with the principles of sustainable development, balancing economic, ecological and social aspects as an integrated whole. It should be viewed as part of a holistic management approach to the broad field of geological and landscape history, including its interconnectedness with fauna and flora, the cultivated landscape, and present use. Pforr et al. (2006: 121) conclude that "*Sustainability and environmental education are seen as integral parts*".

At the Second International Conference on Environmental, Cultural, Economic and Social Sustainability in Hanoi and HaLong Bay, Vietnam, James, James and Clark (2006) stated that that geotourism was an extension of activity - or nature-based tourism, where landscapes and geological objects and processes were integral to the tourism experience, and were also linked politically, socially and economically to the sustainable development of an area of special geoscientific interest.

The principles of geodiversity, geoconservation and geotourism are most ably demonstrated and realized in the UNESCO-supported Global Geopark Network that is currently expanding across the planet. In Australia, there is an understanding, knowledge and interest in sites of geological interest such as the Great Barrier Reef, the Uluru monolith or the Flinders Ranges. Such areas as these are potential locations for geoparks in the future.

Dowling (2008:52) state that the future development of geotourism's includes:

- Refining the definition of 'geotourism
- Empowering local people
- Emphasising quality products and service
- Marketing the 'Geopark' brand
- Introducing guide certification
- Recognising geotourism potential
- Minimising impacts through planning
- Recognising the importance of interpretation.

In conclusion, Dowling (2008:69) believes that:

- 'Geotourism' is the new ecotourism
- Geotourism will continue to grow rapidly and gain an even greater share of mainstream tourism
- Its growth is predicated on environmental sensitivity, community well-being and local economic benefits.

Van Tonder and Wallmach (2001:4) states that "*Geotourism is a major facet of special interest and educational tourism and focuses on the natural resources by means of which the natural history, geology, palaeontology, ecology, prehistory and cultural heritage of an area can be interpreted presented in a multi-disciplinary way to people of differing levels of*

knowledge. Geotourism seeks to combine conventional tourism with learning through the development of thematic itineraries and the experts to provide information and context through interaction with clients. Although special interest tourism is one of the fastest growing tourism markets in oversees countries". Mieczkowski (1995:459) sees educational tourism as a component of alternative tourism. Thus, geotourism is not a major facet of special interest and educational tourism as postulated by Van Tonder and Wallmach (2001:4) above. To arrive at this conclusion, however, a sufficiently informed background of tourism and tourism literature to define geotourism precisely must be postulated. Specialist interest tourism can be for any discipline, not only geotourism. Van Tonder and Wallmach (2001:4) also include prehistory and cultural heritage as part of geotourism.

The researcher agrees with Mieczkowski (1995:464-465) when he says that, "*I do not accept the inclusion of human made elements in ecotourism*". Because archaeological, historical and anthropological resources are man-made, they are not included in the definition of ecotourism by Mieczkowski. Thus, the same will apply to geotourism, that prehistory and cultural heritage are not part of geotourism. In this study, the author agrees that geology should form the basis for geotourism. The tourism component of geotourism involves visitation to geosites for the purposes of passive recreation, engaging in a sense of wonder, appreciation and learning. Thus, geotourism is a distinct sub-sector of natural area tourism. South Africa is emerging as a very popular tourism destination and geotourism is the newest addition. Mining tourism will be included in the definition of geotourism in the country.

According to Reimold (1999:10-11) a potential new branch of ecotourism is geotourism. Yet this is not true because geotourism is a new branch of tourism. The importance of geology with regard to conservation is emphasised. Reimold (2001:20-23) discusses geotourism in South Africa in an article: "*Tourism … Ecotourism …Geotourism! A case for a new national tourism strategy*" in Geobulletin. However, a clear definition and explanation of tourism, ecotourism and geotourism is not given. It is only mentioned that the term ecotourism is focusing on and capitalisation from the environment and is targeting the tourist, whilst, at the same time sustaining the environment. This is a completely wrong statement because the economic and social dimensions of sustainability are not being described. Another point is that there is no explanation of the relation between tourism, ecotourism and geotourism. From the title, it may be assumed that ecotourism is the result of tourism and that geotourism is the result of ecotourism. Again, this is untrue because ecotourism is essentially 'green' tourism, while geotourism comprise elements of ecotourism as well as mining components, geoheritage, geological museums and geomorphology.

Mining heritage tourism is also part of geotourism. The theme parks of Gold Reef City, Kimberley Diamond Theme Park and the newly announced Platinum Park all have a central theme of mining. Numerous examples of mining heritage are presented in World Heritage Sites and mining museums in Europe, Canada, USA and Australia. A detailed research of all the tourism literature was undertaken to form a sound understanding and background of all the principles and concepts. The geology of the relevant geosites was also studied.

Comparing various forms of tourism and applying it to geosites could establish the link between geology and geotourism established from the literature. Thus, a new form of tourism, known as geotourism, is developing in Europe and North America. Geotourism includes geology, geomorphology (including waterfalls), mineralogy, palaeontology, geosites, present and defunct mines, caves, collections of geological specimens in museums and open-air museums.

From Internet research, it was established that geotourism is built on the following pillars:

- Geological outcrops
- Geomorphology
- Caves
- Visitor mines
- Museums with geological exhibitions
- Geoscientific institutions for research
- Heritage/visitor's centres
- Geologists' residences (when they have a collection of rocks/minerals)
- Commemorative plaques/monuments.

Geological outcrops and geomorphology is one of the pillars of geotourism; but at the same time, they are also part of ecotourism. This is the only part of ecotourism that overlaps with geotourism. Therefore, they can both be classified as forming part of nature-based tourism. From the above-mentioned discussion, it will be noted that only geological outcrops and geomorphology form part of ecotourism as well as of geotourism. There are also mining and mining heritage components in geotourism (Gold Reef City, Cullinan, Kimberley and Pilgrim's Rest). To arrive at a workable definition of geotourism, a starting point will be part of the geotourism mission statement for the Geotourism Interest Group (GIG) of the Geological Society of South Africa (GSSA): "*South Africa's fascinating geological formations span almost the entire range of the Earth's history, including some of the world's best known, well-preserved, most stunning and typical examples…unique and diverse rock formations and landscapes*". The researcher (adapted to Schutte: 2000b) proposes that:

"***Geotourism is a conglomerate of all the geosciences elements. It includes geology, geomorphology, mineralogy, palaeontology, geophysics, geosites, present and defunct mines, collections of geological specimens in museums, other geological museums, geology in protected areas, World Heritage sites and open-air geological museums. It should be appreciated and used by visitors, tourists, scholars and students and the way the geological sites were formed***".

Smit (2003:20-58) describes the geotourism supply and possible geotourism development in South Africa. This was the first attempt to complete proper geotourism research in South Africa.

Mendelsohn and Potgieter (1986:10-124) prepared a guide to the most important geosites of the Central Witwatersrand gold fields for the centenary commemoration of the discovery of gold on the Witwatersrand in 1886, at the Annual Congress of GSSA. In the publication a short history of the Witwatersrand Goldfield, a guide to the geology of the Johannesburg area and a description of Crown Mines, the first South African gold mining giant, are given. It is followed by a description of the geosites and a geological map, as well as a list of 100 places of cultural, historical, architectural and natural values. This was the first publication of its kind in the country. Toens (1995:1-72) subsequently compiled the "*South African National Geological Site and Monuments*" report for GSSA. However, it was never implemented.

Viljoen and Reimold (1999:1-193) describe some of the most typical geosites of South Africa's geoheritage. Their work is a guide to, and explanation of, some of the country's most outstanding and 'representative' geological features and geosites, as well as of the country's mining history. They draw the public's attention to geology, in such a way that the non-specialist can understand this often overlooked, but crucial, aspect of our natural heritage. It is also valuable for teachers of Earth Sciences and related fields, such as geography, and it contains a widely useable field guide and glossary. The themes of environmental awareness, tourism, education and science were linked for the first time to emphasise the needs for protection and for conservation of these treasures, for their aesthetic and historical value as well as for scientific and educational reasons.

Poster presentations to link tourism and geology were held at the Geocongress 2000, held in Stellenbosch during July 2000. They represented many different subjects. The authors presented different viewpoints of geotourism. In fact, eight authors presented nine different themes. These were:

- Geology and ecotourism in the Barberton Mountain Land, South Africa and Swaziland (Anhaeusser:3-4)
- The geology of some building stones in the Cape peninsula (Cole:12)
- Geoconservation in South Africa (Reimold:60-61)
- Geotourism in the Western Cape: of plinths and plaques (Rogers:63-64)
- Geoconservation in East Africa (Schlüter:66-67)
- The Kruger National Park: a challenge for geotourism (Schutte:67-68)
- A possible application of Conjoint Value Analysis (CVA) in the Kruger National Park with regard to geotourism (Schutte:68-69)
- Turbidites and tourists (Wickens:92)
- Geotourism in South Africa: opportunities and challenges (Wilhelm:92-93).

Four pre-congress excursions were planned for the Geocongress 2000:

1. Geology and Eco-tourism - Cape Fold Belt, break-up of Gondwana landscape evolution (29th June-2nd July 2000).
2. Terroir: The influence of geological factors on wine (3rd July 2000).
3. Geology and scenery of the Cape Peninsula (3rd July 2000).

4. Building Stones of Cape Town (5th July 2000).

At the Geocongress 2000, a workshop including a two-day (12 hours) hands-on course, "*Quality-Appraisal of Diamonds*"**,** outlining the factors that contribute to the ultimate value of a diamonds, took place from the 2-3 July 2000. Participants were given the opportunity to handle cut diamonds of varying size, colour and proportions, and evaluate them in terms of internationally accepted norms. Brochures were prepared by geoscientists of the Belleville Branch of the Council for Geoscience (CGS) of the 11 geosites of the Western Cape and the brochures were available at the Congress. This was a new development to describe the geology of a geosite for the nonprofessional, and for geological excursions.

Grünert (2000:1-176) wrote the first tourist guide to geology, "*Namibia fascination of geology. A travel handbook*". It was intended for visitors to explain the geology and the geological evolution of Namibia in a very simple and understandable way. The rest of the chapters describe the geosites in various regions of the country. "*The roadside geology of Namibia*" was published by Schneider (2004:1-294). The following year, McCarthy and Rubidge (2005) published "*The story of Earth and life. A Southern African perspective on a 4.6-billion-year history*". This was the first popular text explaining southern African geological and paleontological history and was comprehensively illustrated with explanatory diagrams, and full colour photographs. It was a compilation of two one-day sessions of lectures at the University of the Witwatersrand in 2001 and 2002. A very informative book by Norman and Whitfield (2006:1-320) "*Geological journeys. A traveller's guide to South Africa's rocks and landforms*" explains the structure of the earth, plate tectonics, the geological timescale, classification of minerals and rocks and then gives a short geological history of the country. Eighteen routes to geosites along the main roads in South Africa are described and explained to the visitor in a very simple way with pictures and maps. Viljoen and Moore (2007:1-30) compiled "*A guide to the geology of Madikwe Game Reserve*", where twelve geosites are briefly described.

After Geocongress 2000, the Geotourism Interest Group (GIG), a subgroup of the Environmental, Conservation and Archives committee of GSSA, was officially formed on 31 October 2000. Latterly, it functions as "*The Conservation and Geotourism Committee of GSSA*". A geodatabase that should be completed by the Council for Geoscience (CGS) will form the basis for future research and information. So far, only the database that is managed by the Council for Geosciences materialised in 2007. A document, in which the concept of geotourism, opportunities and awareness, goals, and in which a vision and mission statement was outlined, was presented by Schutte (2000b).

Whitfield (2001:65-71) visited several historic sites in and around Johannesburg such as George Harrison Park where gold was discovered in 1868, Langlaagte Deep Village and the old headgear and inclined shaft on the original Robison mine. All the sites were neglected, and needed to be conserved and promoted. The question was asked how geotourism could save these mining heritage sites, and what the role of following institutions should be:

- Mining houses
- Chamber of mines of South Africa
- South African Heritage Agency
- Gauteng Tourism Authority
- Johannesburg Metropolitan Tourism Association.

Something must be done to conserve geological and mining heritage before it is too late, and at the same time, to educate the public. The main aims of GIG (now The Conservation and Geotourism Committee of GSSA) are to:

- Promote awareness of local and national heritage resources
- Compile and manage a database of natural heritage sites
- Assist in training of educators in Earth science at an introductory level
- Set and maintain standards for basic geological education for guides and teachers
- Establish a network of interested parties to accomplish these goals
- Generate funding to drive and accelerate the above processes
- Provide ongoing funding to maintain geosites/attractions until they are self-supporting.

Whitfield (2001:71) concludes, "*The time has come for all South Africans with an interest in the mining industry to add their support [for] the conservation and promotion of our dwindling mining heritage. One way to this is to support the GSSA's geotourism initiative. In addition, many unprotected geosites need to be identified and brought to the attention of the relevant local government and conservation authorities*".

3.5.3 THE GEOGRAPHICAL VIEWPOINT OF GEOTOURISM

Tourtelott (2002:2) define 'geotourism' as:

"***Tourism that sustains or enhances the geographical character of the place being visited - its environment, culture, aesthetics, heritage, and also the well being of its residents***".

At the joint NGT/TIA press conference held 13 March 2002 in New York Tourtellot explained the new concept of geotourism and the "*geographical character*" as a unifying umbrella was stressed. Geotourism is referred to as "*sustainable tourism on st*eroids" - it sustains, but it can also enhance. In the geotourism definition are several additional principles:

- Geotourism must provide an enjoyable, enriching experience for visitors
- Accordingly, it calls for visitors to receive high-quality information about the place, appealingly presented – 'interpretation' in the trade
- Geotourism requires the involvement of host communities, and that includes discovering and presenting that interpretive information. This can be exciting stuff.

One of geotourism's benefits to host communities, then, is the pride that comes with deeper knowledge of your own home's natural and cultural heritage

- Another community benefit, of course, is financial. It can come from providing geographically appropriate tourist goods and services. It can come from employment that includes avenues for career advancement, and
- To sustain those benefits indefinitely, host communities must practice good destination stewardship. That means adopting policies that protect the locale's environment and heritage, and it means managing tourism to achieve maximum benefit with minimum disruption. Geotourism accepts, therefore, that in some situations limits on tourist traffic may be necessary to avoid the loved-to-death syndrome.

In summary, then:

- Geotourism is environmentally responsible, committed to conserving resources and maintaining biodiversity
- Geotourism is culturally responsible, committed to respecting local sensibilities and building on local heritage
- In addition, while geotourism is incompatible with loss of natural or cultural diversity, it does not seek to stop the clock and preserve a destination in amber. What it does seek to preserve is geographical diversity, the distinctiveness of a locale. Sameness is a tourism-killer. A strip mall of nationally identical franchises afloat on a river of asphalt has no place in geotourism. Who will travel to see that?

In Appendix I: Adapted from the joint NGT/TIA press conference held 13 March 2002 in New York, Tourtelott gave the first description of geotourism in an article "*About tourism*" saying "S*ustainable tourism, like a doctor's code of ethics, means, "First, do no harm". It is basic to good destination stewardship*". Characteristics of geotourism are:

- Geotourism is environmentally responsible, committed to conserving resources and maintaining biodiversity
- Sustainable tourism does not abuse its product - the destination. It seeks to avoid the 'loved to death' syndrome. Businesses and other stakeholders anticipate development pressures and apply limits and management techniques that sustain natural habitats, heritage sites, scenic appeal, and local culture
- It conserves resources. Environmentally aware travellers favour businesses that minimize pollution, waste, energy consumption, water usage, landscaping chemicals, and unnecessary night time lighting
- It respects local culture and tradition. Foreign visitors learn about and observe local etiquette, including using at least a few courtesy words in the local language. Residents learn how to deal with foreign expectations that may differ from their own
- It aims for quality, not quantity. Communities measure tourism success not by sheer numbers of visitors, but by length of stay, distribution of money spent, and quality of experience.

Geotourism adds to these principles by building on geographical character – the 'sense of place' - to create a type of tourism that emphasizes the distinctiveness of its locale, beneficial to visitor and resident alike. Geotourism is defined as tourism that supports the geographical character of a place - its environment, culture, heritage, aesthetics and the well-being of its citizens and so:

- **Geotourism is synergistic**. All the elements of geographical character together create a tourist experience that is richer than the sum of its parts, appealing to visitors with diverse interests
- **It involves the community**. Local small businesses and civic groups work together to promote and provide a distinctive, authentic visitor experience
- **It informs both visitors and hosts**. Residents discover their own heritage and how the ordinary and familiar may be of interest to outsiders. As local people develop pride and skill in showing off their locale, tourists get more out of their visit
- **It benefits residents economically**. Travel businesses do their best to use the local workforce, services, and products and supplies. When the community understands the beneficial role of geotourism, it becomes an incentive for wise destination stewardship
- **It supports integrity of place**. Destination-savvy travellers seek out businesses that emphasize the character of the locale. Tourism revenues in turn raise local perceived value of those assets
- **It means great trips**. Satisfied, excited visitors bring new knowledge home and send friends off to experience the same thing - which provides continuing business for the destination.

(www.nationalgeographic.com/ travel/sustainable/sustainable.htm).

National Geographic Traveller (NGT) in the USA sponsored a landmark study, The Geotourism Study in 2002. Stueve, Cooke and Drew (2002:1-22) of The Research Department of the Travel Industry Association of America (TIA) in Washington, D.C. were responsible for its preparation. The first large-scale national study of the current and potential consumer market for geotourism was examined. It examined the travel habits and attitudes of the 55 million Americans now classified as 'sustainable' or 'geotourists'. The term 'geotourism' is closely related, but is concerned instead with preserving a destination's geographic character - the entire combination of natural and human attributes that make one place distinct from another. Geotourism encompasses both cultural *and* environmental concerns regarding travel, as well as the local impact tourism has upon communities and their individual economies and lifestyles.

'Geotourists' are high-income, frequent travellers who have a well above-average interest in environmentally oriented travel and prefer travel experiences that are culturally and socially oriented with travel patterns. The Geotourism Study segments American travellers into eight distinct market segments or profiles from the 154 million Americans who have taken at least one trip in the past three years. It was done according to their demographic-, travel- and

geotourism profiles. The report shows that three segments of travellers can indeed be called "*geotourists*" - those who are quite conscious of the environment and are inclined to seek culture and unique experiences when they travel. These segments not only represent millions of travellers, the segments are quite lucrative for the travel industry. The findings are summarised in Figure 3.5
(www.tia.org/Pubs/GeotourismPhaseFinal.PDF).

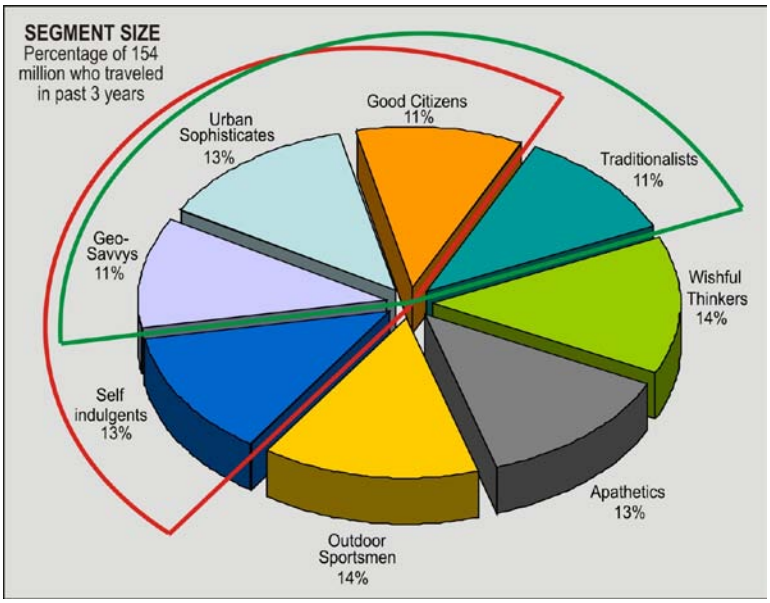

Figure 3.5: The eight traveller segments (Tourtelott, 2005:58)
(http://odin.dep.no/filarkiv/246728/Jonathan_Tourtellot_red_i_National_Geographic_traveller.pdf)

Cooke (2002:7) in "*Appendix 2: Geotourism Study Executive Summary*" (www.world-tourism.org/sustainable/ IYE/quebec/cd/statmnts/pdfs/tousae.pdf:7-8) states that three segments tend to have some 'empathy' and care for the environment and could probably the 'geotourist'. These segments share high income and educational levels, and a high incidence of travel, yet possess somewhat unique geotourism profiles. It includes inter-alia the following:

- 'Good citizens' are older, with about half of them 55 years of age. They show strong involvement in a variety of community activities, as well as heightened levels of cultural and environmental awareness and sensitivity, as manifested by behaviors in their local areas.
- 'Urban sophisticates' are more oriented to large city destinations and the cultural opportunities they provide
- 'Geo-savvys' are distinguished by their above average interest in environmentally-oriented travel

'Geo-Savvys' and 'Urban Sophisticates' show a distinct preference for culturally and

socially-related travel. They both share an intellectual curiosity as reflected in their well-above average tendencies to participate in a number of educationally and culturally-oriented activities in their local communities. They both also share more highly developed social consciences, engaging in pro-environment behaviors at home and more actively supporting environmental and cultural organizations through donations of time and money than the other segments. Lastly they tend to be dominated by Baby Boomers.

The three next segments are viewed as good potential geotourism markets. These are the:

- 'Traditionals' are older than 'Good Citizens'; and not as inclined to travel as other segments
- 'Wishful Thinkers', are at the other end of the age spectrum dominated by members of Generation X and Y
- 'Apathetics' are more likely to be 'Baby Boomers'.

Like 'Good Citizens', the 'Traditionals' segment is an older demographic group, not as inclined to travel as many of the other segments. 'Wishful Thinkers' are at the other end of the age spectrum, dominated by members of Generation X and Y, while 'Apathetics' are more likely to be Baby Boomers.

Two of these groups, the 'Traditionals' and 'Apathetics', are conservative in their travel choices, looking for predictability, and the high levels of cleanliness, safety and security. 'Wishful Thinkers' wish they could travel more than they do now and want to be very busy and active when they do. They are looking to be entertained and to have fun when they travel. None of these three groups seems particularly interested in culturally-oriented travel or cultural activities in their local areas. They also tend to be less environmentally-oriented, both when they travel and at home, although 'Wishful Thinkers' do show some interest in outdoor-related travel.

Generation X is a term used in the USA to refer to a generational cohort of children born after the baby boom ended and usually prior to the 1980s (http://en.wikipedia.org/wiki/Generation_X). Generation Y is also known as The Millennial Generation, is a term used to describe the demographic cohort following Generation X. Its members are often referred to as "*Millennials*" or "*Echo Boomers*". There are no precise dates for when Generation Y starts and ends. Most commentators use dates from the early 1980s to early 1990s. Members of Generation Y are primarily the offspring of the Baby Boom Generation (http://en.wikipedia.org/wiki/Generation_Y).

The last two segments are:

- 'Outdoor sportsmen'
- 'Self-indulgents' are looking specifically for those upscale travel experiences.

These two groups tend to be at opposite ends of the spectrum in terms of income and travel preferences, but both are largely centered in the Baby Boom generation, age 34 to 54, with a

large percentage of younger adults under age 35 included, as well. 'Outdoor Sportsmen' of whom 61 percent are men like to travel especially to the countryside, remote locales and into the wilderness. They enjoy outdoor activities, especially hunting and fishing. They say they value a clean unpolluted environment, but are well-below average in their tendencies to support organizations and efforts to preserve and protect the environment. 'Outdoor Sportsmen' are the least likely of all segments to seek upscale travel experiences and to engage in culturally-oriented activities either at home or while travelling.

'Self-Indulgents', on the other hand, are looking specifically for those upscale travel experiences. They see travel as a way to get away from the demands of home and work and want to have fun and be entertained, similar to the 'Wishful Thinkers'. They are generally below average in their interest in culturally or environmentally-oriented travel and community based activities. But what really distinguishes 'Self-Indulgents' from other segments is their general lack of cultural and environmental awareness and sensitivity and, in some cases even, their negative cultural and environment attitudes. They are the least likely of all the segments to actively engage in activities such as supporting certain companies because of their pro environment or social policies, or to donate money to or volunteer time for a variety of organisations which support environmental and cultural programs, for example.

The findings expand the concept of sustainability as it relates to cultural heritage tourism. While sustainable tourism generally refers to the impact of mass-market tourism on the ecological environment, geotourism goes a step further to encompass the preservation of a destination's culture, heritage, aesthetics and environment, as well as the vitality of the community's lifestyles and economy. According to Cooke (2002, as cited in www.nasaa-arts.org/artworks/geotourism.shtml), the study shows that a destination's unique characteristics are what primarily attract those consumers who make the most trips, spend the most money and produce the greatest volume of visitors overall. From the above, geotourism is to large extent geographically orientated, not geologically. Tourtelott (2005: 1-111) amply illustrates the concept in a power point presentation (http://odin.dep.no/filarkiv/246728/Jonathan_Tourtellot_red_i_National_Geographic_traveller.pdf).

Finally, the principles of geotourism were endorsed as a strategy for gateway regions and adjacent wilderness areas and wild lands. Participants were urged to collaborate to adapt geotourism principles to the specific needs of gateway regions and those participants were encouraged to join in an alliance to help implement the geotourism approach worldwide.

3.5.4 THE RELATIONSHIPS OF GEOTOURISM TO OTHER TYPES OF TOURISM

Mieczkowski (1995:464-466) is of the opinion that ecotourism overlaps with several types of tourism, such as educational, scientific, adventure and agritourism. By examining the

relation between alternative tourism and ecotourism in Mieczkowski's model, the author proposes that geotourism, together with cultural, educational, scientific, adventure and agritourism, is also part of alternative tourism, as is shown in Figure 3.6.

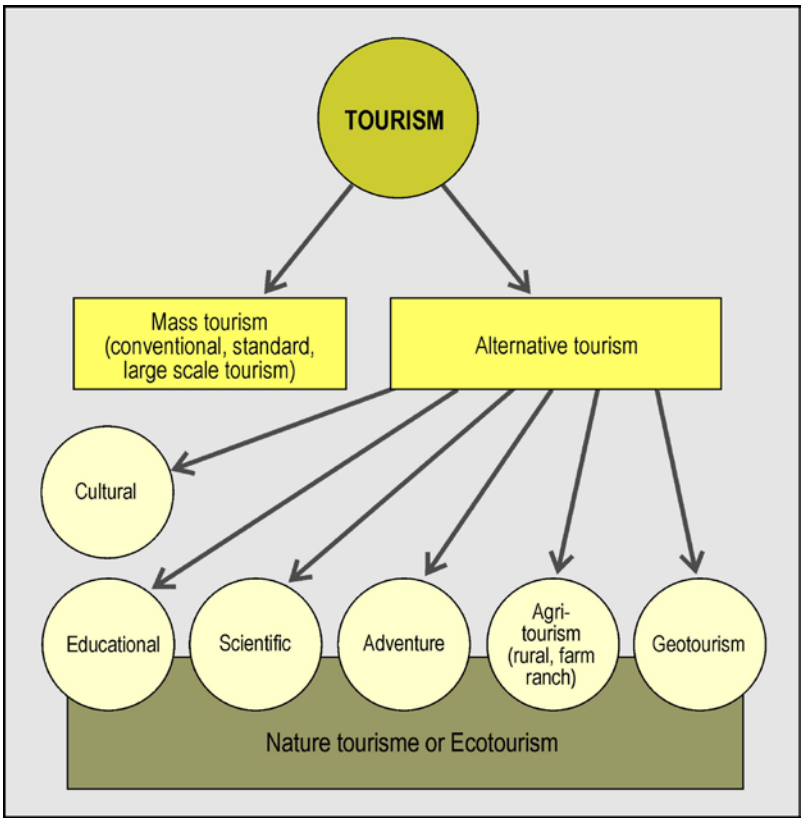

Figure 3.6: Alternative tourism (Adapted by the researcher: 2008, to Mieczkowski, 1995:459)

Weaver (2006:39-40) depicts a typology of candidate subtypes based on the extent to which they are defined by their relative orientation toward attractions, accommodations or motivations as a triangle by their relative orientation towards one of the three criteria, while several combine attraction and motivation. The subtypes may vary to the extent to which they are marketed as alternative tourism by their relevant organisations, because some of them occur both as alternative and mass tourism (for example, ecotourism and historical re-enactments). Geotourism would be near the attraction corner. At present, it is more orientated towards the attraction itself, as shown in Figure 3.7.

A range of special interest tourism categories could include regional, cultural, heritage, rural, educational, cycle, aboriginal cultures and indigenous, travelling for health, environmental, wine and food, cruise, festivals and events and seniors tourism. These categories overlap in many cases (http://www.bized.co.uk/educators/16-19/tourism/special/presentation/special1.ppt).

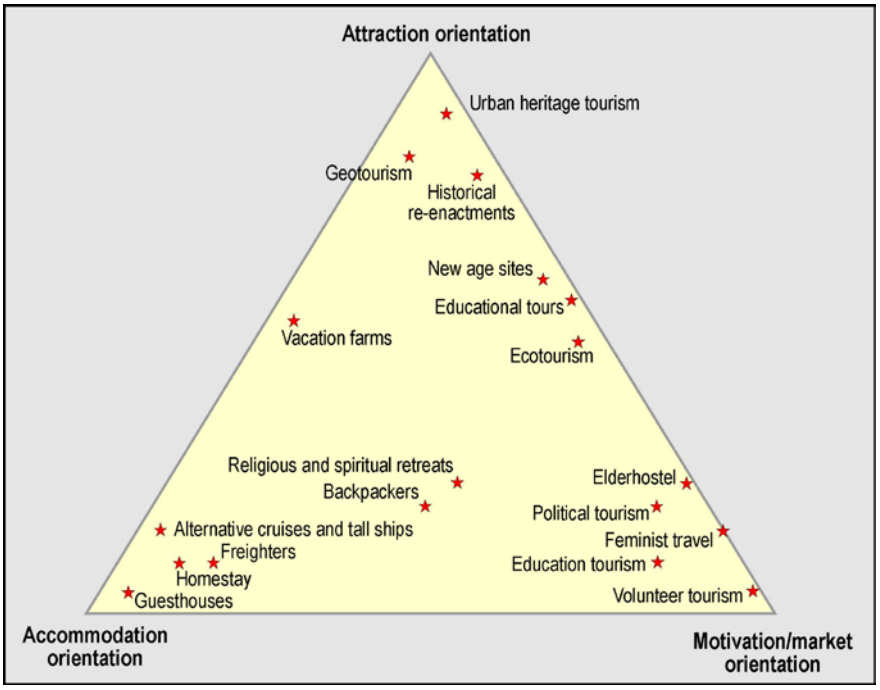

Figure 3.7: Various types of alternative tourism
(Adapted by the researcher: 2008, from Weaver, 2006:40)

Tourism New South Wales describes nature-based tourism. 'Nature tourism' is not a term commonly used by visitors, but instead it is a term of value to the tourism industry in the context of visitor desires, experiences and activities. *"In its broadest sense, nature in tourism involves experiencing natural places, typically through outdoor activities that are sustainable in terms of their impact on the environment*". It ranges from active to passive and includes everything from bush walking and adventure tourism experiences to sightseeing, scenic driving, beach experiences and wildlife viewing. A visitor may combine several of these in the one trip. Nature-based experiences are intimately linked to all other aspects of the visitor's total experience of a destination, such as food, culture, relaxation, health, escape, family needs, accommodation and transport. They complement each other and together form the basis of a visitor's overall satisfaction with their holiday and include the benefits of nature (for example, relaxation). Nature in tourism embraces what is commonly termed 'nature tourism' and its various subsets and the wider visitor benefits provided by nature. Nature is crucial to the experience or it may enhance the experience. The elements of nature tourism are shown in Figure 3.8.

Simpson (2003) believes that nature tourism in the UK occurs in natural settings with the added emphasis of fostering understanding and conservation of the natural environment. Activities are wildlife, birds, cycling, walking, horse riding, heritage, organized trails, forest parks and nature reserves, camping, footpaths/bridleways, fishing, quad bikes, painting, and passive activities like rest, relaxation and picnics. Soft adventure activities commonly require a moderate level of physical involvement by participants and are less physically challenging

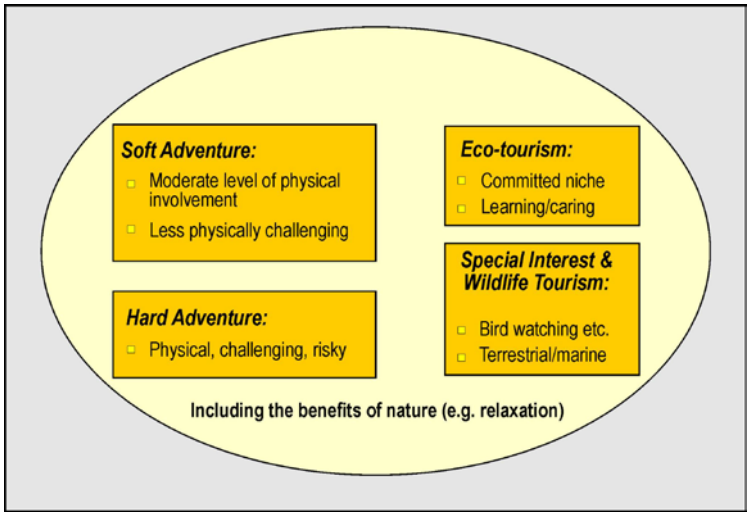

Figure 3.8: Elements of nature tourism (Tourism New South Wales) (www.corporate.tourism.nsw.gov.au/Sites/.../2_defining_nature_tourism.pdf:4).

than hard activities. These soft activities can include hiking/bushwalking, mountain biking/bicycling, camping, horseback riding, orienteering, walking tours, wildlife spotting, whale watching, river and lake canoeing and fishing. Hard adventure activities conversely commonly involve a higher level of physical or rugged involvement or a potentially greater personal challenge for participants, while the risk factor can also increase. Hard adventure activities with a nature basis or need include caving, scuba-diving, trekking, white water rafting, kayaking, rock and mountain climbing, cross-country skiing, safaris, surfing, windsurfing, ballooning and ocean sailing (www.openspace.eca.ac.uk/costE33/ppt/MurraySimpsonPresentation.ppt).

In the South Australian Tourism Plan 2003-2008, it is stated that ecotourism is a part of nature-based tourism that involves education and interpretation of the natural environment and is managed to be ecologically sustainable. Figure 3.9 shows the difference between sustainable tourism, nature-based tourism and ecotourism.

At the International Ecotourism Conference held at Cairns, Australia, during October 2002, some of the definitions of ecotourism were given as follows:

- Ecotourism encompasses a spectrum of nature-based activities that foster visitor appreciation and understanding of natural and cultural heritage. These activities are managed to be ecologically, economically and socially sustainable. Research is showing that ecotourists are now demanding that their travels encompass a 'learning experience' and 'deep appreciation' of how local communities live within their ecological systems.
- Ecotourism is responsible travel that promotes the conservation of nature and sustains the well-being of local people. It must be exciting, educational and ethical.
- Ecotourism is a specialty segment of nature tourism.

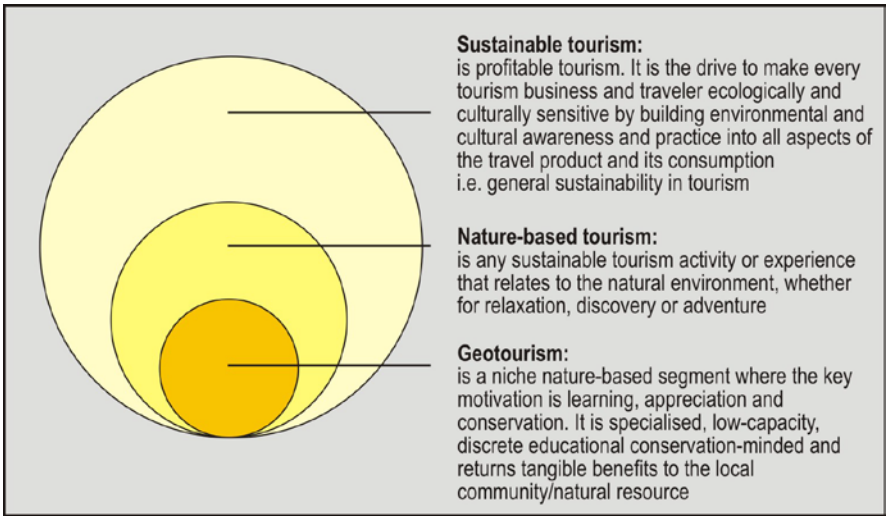

Figure 3.9: The relationship between sustainable tourism, nature-based tourism and geotourism (adapted by the researcher for geotourism 2009) (http://server-au.imrworldwide.com/cgi-bin/b?cg=documentdownloads&ci=sa-corporate&tu=http://www.tourism.sa.gov.au/tourism/plan/TourismPlan2003_2008.pdf:17).

Despite the many varying definitions developed since the word ecotourism was phrased in the mid-1980, some notable consistencies remain with most definitions describing ecotourism as:

- Nature based
- Ecologically sustainable
- Contributing to conservation and local communities
- Involving education and interpretation of the natural environment. (www.joondalup.wa.gov.au/BUcouncilsupport/agenmin/Agenda/2002/Attach5brf101202.pdf)

Strasdas (2001:6) believes that ecotourism is a form of responsible awareness journey in natural areas where the nature experience is the focus. Ecotourism minimises negative ecological and socio-cultural effects, adds to the financing of protected areas or nature conservation measures and creates income possibilities for the local population. Indirect ecotourism should increase the nature acceptance of the relevant community actors. Weaver (2006:91-194, 205-206) states that ecotourism involves an emphasis on nature-based attractions, educational interactions with these attractions and management practices that make every reasonable effort to achieve environmentally and socio-culturally sustainable outcomes. An intensive study of ecotourism by Strasdas in 2001 (http://www.tourism-watch.de/dt/24dt/24.praxis/index.html) was made as demonstrated by four case studies in the biosphere reserve of Calamul, Mexico, the sea protection area at Cancún, Belize, the Rio Bravo Conservation and Management Area (RBCMA) and the Toledo Ecotourism Association. Ecotourism was studied, not as a sustainable tourism strategy, but as a niche in

the tourism market. Nevertheless, even as a niche, it could have a considerable importance that will contribute to nature conservation and rural areas, especially in developing countries. The problem of ecological and socio-cultural accommodation in ecotourism was proven less important. It is more difficult to implement socio-economic and nature political aims because of the:

- Financing of protected areas
- Creation of local income
- Acceptance of nature conservation.

This is also true for well and less developed regions. In spite of criticism, the demanding concept of ecotourism can be achieved. The problem could be implemented as follows:

- All those involved must work together
- All stakeholders from the environmental sector must come from the developmental, political spectrum on the one side, and from the tourism sector on the other.

(http://www.tourism-watch.de/dt/24dt/24.praxis/index.html).

At the "*Ökotourismus in Berggebieten – eine Herausforderung für nachhaltige Entwicklung*" Conference held at St. Johann/Pongau and Werfenweng, Salzburg, Austria, during 12-15 September 2001, ecotourism in the context of sustainable development was discussed. It was seen as a concept to conserve natural landscapes. In overseas destinations in Europe, it was regarded as a niche product by tourism enterprises. Consensus was reached that ecotourism should be developed in an ecological, social and economic manner. During planning and implementation, the efficient and balanced participation of those concerned, especially the local people, must be considered. When these aims are achieved, ecotourism could then be realised as an instrument for economic development.
(http://www.bmwa.gv.at/NR/rdonlyres/72CEB215-87FE-42FA-8F2F-21607163F67F/1795/StJohannSchlussdok.pdf).

Buckley (2003:76) believes that the defining characteristics of ecotourism fall into two categories, those of environmental inputs and those of environmental outputs. The inputs are the natural and associated cultural features in a particular geographic location that serve as attractions for tourists. The outputs are the net costs or benefits for the natural and social environment. Ecotourism can hence be viewed as geotourism with a positive triple bottom line. There are several advantages to this view as:

- It clarifies the meaning of ecotourism without redefining it
- It bypasses the service components that are common to tourism in general, not distinctive to ecotourism
- It treats environmental management and interpretation as means, not ends in themselves
- It requires an accurate accounting of environmental and social, as well as financial, costs together with the benefits
- It differentiates ecotourism from tourism products with a mere veneer of green

- The tourism products and organisations that are generally viewed as the world's best practices in ecotourism comply with this definition.

Heritage tourism is defined in the guide "*Successful Tourism at Heritage places*: *A guide for tourism operators*, heritage managers and communities" as: "*Activities and services which provide international and domestic visitors with the opportunity to experience, understand and enjoy the special values of Australia's heritage*" (www.ahc.gov.au/explore/tourism/guide/pdf/guide.pdf). Heritage tourism values in Australia are depicted in Figure 3.10.

Dallen *et al.* (2003:62-69, 84-85) is of the opinion that 1) heritage tourism has witnessed a phenomenal growth as of late; and 2) heritage tourism demand can be viewed from different perspectives, including:

- Current or use demand
- Option demand (visiting the future)
- Existence demand (intrinsic value that is placed on heritage that is not actually consumed)
- Bequest demand (heritage being passed to future generations
- Latent demand and demand can be viewed according to the source.

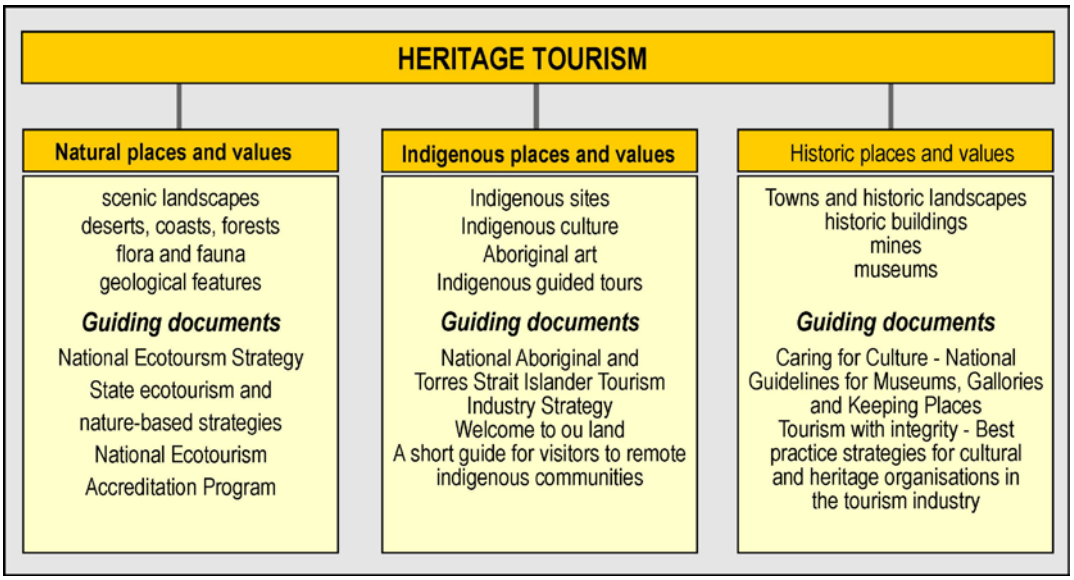

Figure 3.10: Heritage tourism values in Australia (www.ahc.gov.au/explore/tourism/guide/pdf/guide.pdf: 4).

Visitor characteristics

Heritage tourists can be distinguished by their demographic (level of education, gender, age, income level and employment types), geographic origins (closely related to the scale of attraction visited) and psychographic (tendency to be more allocentric in type) characteristics.

Motivations that drive tourists to visit heritage places

As for demand, the focus should be on understanding unmet demand and how to turn this into actual use and so overcome obstacles preventing visitors visiting the heritage site. Above all tourists are regarded as interested in gaining an overall experience in places they visit.

Wildlife tourism can be both eco- and animal-friendly tourism in both captive and wild environments. It has experienced a dramatic and rapid growth in recent years worldwide. Wildlife tourism, in its simplest sense, is watching wild animals in their natural habitat. Wildlife tourism in a wider sense is also a multi-million dollar industry offering customized tour packages and safaris (http://en.wikipedia.org/wiki/Wildlife_tourism).

3.6 GEOCONSERVATION

Without geoconservation, there will not be any geotourism. According to Hose (2006:222-223), geoconservation was defined by himself in 2003 as "*The dynamic preservation and maintenance of geosites, together with geological and geomorphological collections, materials and documentation*". Hose is of the opinion that much of the value of geosites lies in the availability of, and accesses to, *in situ* rock specimens that benefit from limited disturbance, restricted collecting and removal of soil/debris. When geoconservation measures are linked to tourism promotion, they are key geotourism elements. Geoconservation (http://www.geoconservation.com/index.htm) involves recognising, protecting and managing sites and landscapes identified as important for their fossils, minerals, rocks, processes or landforms. "*Geodiversity conservation (synonymous with Earth Heritage Conservation) is a much wider term designed to encompass the conservation of geological and geomorphological processes, i.e. rocks, fossils and minerals and landforms, but also museum specimens, building stone, buildings, archives, maps and data*".

At a meeting in Strasbourg, France, on 5 May 2004 the Committee of Ministers of the Council of Europe adopted the "*Recommendation Rec (2004)3 on Conservation of the Geological Heritage and Areas of Special Geological Interest*". The philosophy and practice of geological and geomorphological conservation are explained in Appendix 1 where it is stated that geology and geomorphology describe the history and form of the planet. They help to understand Earth's history in terms of how the face of the planet has changed over time, by means of the evidence in rocks, sediments, fossils and minerals that reveal past climates, environments, mountain construction, and the movement of continents. The history of life itself is also revealed; how it began and evolved, how new species appeared and how species became extinct. Geomorphology interprets the present landforms such as deserts, glaciers, coastlines and others, and the conditions under which they were formed. It also provides a record of the recent past and current processes operating on the planet. Rocks, minerals and fossils show the history of the planet together with the history of life itself. They are evidence of the passage of geological time that reveals the changes shaping the Earth's surface over millions of years. These archives make it possible to understand the way the planet looks today, and for the diversity of its fauna and flora. Despite their apparent

permanence, geosites, minerals and fossils are vulnerable and are a non-renewable heritage that belongs to humanity.

There is a constant interaction of human society with geology and geomorphology in many ways, through the exploitation of mineral resources, reshaping the landscape by industrial or agricultural activity, and through the development of infrastructure links. By quarrying, mining and the cutting of new roads, these activities reveal geological or geomorphological information of scientific, educational or cultural value. In other ways, these very activities destroy the information just as they reveal it. The armouring and obscuring of rock sections and the infilling of old quarries with waste are examples of destructive activities.

Protecting the geoheritage is the objective of geoconservation that is being actively promoted in Europe through a number of programs and through the activities of many individuals. The programs that promote geoconservation seek to identify geosites/areas, educate the public about their value and to develop management plans or strategies that will not only protect but also enhance this value. There is a need to increase awareness of the importance of geoconservation to allow it to rank alongside, and fully support, biological conservation. Opportunities already exist to work towards these aims at a European level, via the Council of Europe and the involvement of member states, and through the various inter-governmental and non-governmental international organisations operating within Europe, such as UNESCO, the International Union of Geological Sciences (IUGS), and the World Conservation Union (IUCN) (www.jncc.gov.uk/pdf/councilofeurope1.pdf).

According to Verpaelst (2004), two reasons for protecting geosites as part of geoheritage are:

1. To ensure the protection and preservation of geological diversity, meaning all the different geological elements found …, which may be threatened by natural disasters or by human intervention
2. To increase public awareness of the geological cycle, and to better understand all of its components.

In South Africa, very little has been done in this respect, and yet the principles of geoconservation can be applied very successfully here. At the Vredefort Dome, at the Cradle of Humankind (COH) and at the Greater St. Lucia Wetlands (iSimangaliso), the first attempts were made to protect geoheritage.

So far, the emphasis on valuing our natural environment has been dominated by biological values. Pemberton (2001:1-7) is of the opinion that geoconservation or the conservation of geodiversity needs to be promoted and taken more seriously because these values will assist in communicating the fascinating history of the earth to the large majority of people who find the explanation of geological history truly daunting. Biologists and other natural scientists widely accepted the need for nature conservation. Nature conservation agencies and governments in Australia and overseas tend to emphasise the need for the conservation of biodiversity, while they virtually ignore the geological foundation on which it is built and

from which it has evolved. This is because of a lack of pressure on the part of earth scientists who are not trained in conservation theory and have had very little input into the development of conservation strategies and policies, particularly with regard to geoconservation. Most earth scientists are trained for, and employed in, the extractive and mining industries, and to be involved in conservation could be seen to be contrary to the goals of the profession by some.

Indeed it may be thought that to conserve geodiversity may be more important than biodiversity because mostly rare or threatened species can be propagated or bred in captivity. Many geological features have formed under conditions climatic or geological that are now inactive. They represent essentially relic or 'fossil' features that, once disturbed, will never recover or will be removed forever. In the case of biodiversity, there would be enormous concern. If mankind cannot afford to lose biodiversity then a very strong case to conserve geodiversity could be made. Ecosystems depend entirely on their non-living parts like the bedrock, landforms, soils or related processes. Geological features thus also have their own values irrespective of their relationships with biodiversity. Hence, there would simply be no biodiversity without geodiversity. The story of the Earth's natural diversity, the links between geodiversity and biodiversity, and how they have evolved, needs to be explained to visitors and tourists. This is a strong need to improve communication regarding the Earth's processes. National Parks and other natural areas are the best places to do this.

Pemberton (2001:1) concludes, "*the links between geodiversity and biodiversity would assist people to value the non-living environment. This would facilitate a greater appreciation of natural diversity and provide a pathway for the public better to understand the complexities and wonders of our geological history. Concentrating on communicating our attitudes, philosophies and practices to the wider community may not be the only approach. We should try to nurture a respect and appreciation of the earth's evolution and its building blocks*" (http://www.dpiwe.tas.gov.au/inter.nsf/Attachments/SJON-57W5Z5/$FILE/geocon_abstract.pdf, www.tasmaniaoutdoors.com/infosheets/Geoconservation%20Principles.pdf).

Doyle (2003:19) notes that most people associate the concept of fragility and the endangering of a resource as one that is almost exclusive biological. Because of the increased awareness of green issues, there is a corresponding awareness of the need to protect living species, and habitats (the protection of the African elephant and Amazonian rainforest are good examples). Unfortunately geological features are often built over and, all too often, destroyed. Doyle (2003:19) continues, "*Geoconservation, sometimes called Earth heritage conservation, is a relatively new concept. It means conserving the Earth's geological and geomorphological features for the same reasons that habitats are conserved, namely that they have intrinsic value in their own right; that they are of value in scientific research, education and training; and that they are of aesthetic value, often within a cultural framework. Today it is common to refer to the concept of geodiversity to match that of*

biodiversity; geodiversity recognizes the variety and depth of the geological resource and express its richness to the layperson".

Wimbledon (1999:1-7) gives a short introduction of efforts by the International Union of Geosciences (IUGS) concerning the conservation of geosites. A debate has been taking place for the last ten years over the possibilities of inclusion of geological sites in global conservation schemes and in the World Heritage List. The strongest proponents of this school of thought came from Europe. At the ProGEO, IUGS- and UNESCO-organised workshops, the construction of interrelated global and national inventories were discussed. A number of workshops were held all over the world. It was stressed, "*Sadly, many geoscientists fail to see the fundamental supportive role of geosite conservation. Its role is to keep available the vital site resource that our community needs for future research, as well as for education and training. In essence, it's a simple principle: no sites, no science. Geoconservation is essential to maintaining the best of our geoscience heritage*". Doyle further admits that geologists are not good at 'selling' geo(morpho)logy, for it is mistakenly thought that biological sites are always more vulnerable to change or threat than are geoscience sites. Yet, many geological and geomorphological monuments are of finite extent because they cannot accommodate development nor retain their intrinsic value, and they are non-renewable. Thus, neglect may threaten the best geoscience sites.
GEOSITES was started by IUGS in 1996 and works through regional working groups. It is a project to involve the geological community in geoconservation with the aim of providing a factual basis (inventory and data set) to support any national or international initiative to protect the geological resource, which is the basic resource for research and education. The intention is to redress the imbalances in conservation. The aims are not exclusive but are designed to mesh with and support national and geocommunity initiatives. Most importantly, it offers a uniform methodology for site comparisons and justification.

James, James and Clark (2006) also stress that, as a global community, an understanding of the use of land for mining, quarrying and the development of the built environment is fundamentally related to the underlying rocks, soils and landforms. This component of the natural world and the biological, archaeological, historical and cultural equivalents must be protected and conserved for the enjoyment and education of future generations. They believe that geoheritage must be conserved not only for its utilitarian value, but also for its beauty, aesthetic and intrinsic importance. By doing this, the global geoconservation movement would be rapidly expanded in order to achieve its rightful status as a key component of the overall worldwide conservation strategy.

Gray (2004:175) believes that conservation is a human response to perceived threats to features regarded as having value and "it is the embodiment of an environmentally sophisticated society that it acts to avoid losses and protect what is vulnerable to damage". International organisations, governments or local bodies have a large variety of ways to attempt to protect areas of geological or geomorphological importance. How conservation has been, and can be, implemented is a very important issue. There are enough ideas to

implement, but there must be the political motivation and adequate resources to apply the implementation.

Several conclusions about valuing and conserving geodiversity are noted by Gray (2004:367):

- The Earth has not only a huge biodiversity, but also an enormous geodiversity, and this diversity is of value both intrinsically and in utilitarian ways that are barely appreciated by human beings
- Not all of the geodiversity of the planet needs to be conserved, only those elements that are seen as being significant for one or more of their values. This proportion of total geodiversity is known as the geoheritage
- There are significant threats to this geoheritage from a variety of human activities either directly or through influencing the rates of operation of earth surface processes. Different aspects of geodiversity vary in their sensitivity and vulnerability to different types of threats
- Protection of geoheritage is a complex task involving decisions on sites to be included, boundary identification, site documentation monitoring and enforcement. Most countries now agree that the aim of geoconservation should be maintaining a representative sample of a country's or area's geodiversity. While there are significant efforts at protection and management at the international level and in several nations, sub-nations and regions, some countries have barely begun the process of geoconservation
- But even this is unlikely to be sufficient to protect geodiversity, and so a number of approaches are being used to assess and conserve the wider geodiversity resource and to make decision makers and the public aware of this geoheritage, for as Hillel (1991: 9) has put it "*we cannot protect what we do not understand*"
- Geoconservation needs to be established as an independent subject in its own right and to be integrated with wildlife conservation in a more holistic approach to nature conservation, and even beyond that, to develop comprehensive and sustainable land use management and natural resource strategies.

According to Gray (Crofts, 2001, as cited by Gray, 2004:367), the following six principles for sustaining the Earth's resources are:

- Accept that natural change is inevitable.
- Work with natural functions and processes.
- Manage natural systems within the limits of their capacity.
- Manage natural systems in a spatially integrated manner.
- Use non-renewable Earth resources wisely and sparingly at a rate that does not restrict future options; and
- Use renewable resources within their regeneration capacity.

These principles represent the basis for a future strategy for sustaining geodiversity and so ought to be embedded in each country's nature conservation strategy.

Dowling and Newsome (2006:254) conclude that it is imperative to protect the georesource base: "*However, where resources are deemed appropriate for geotourism development, then the resource needs to be fully understood – especially concerning its conservation. Thus it is paramount that geoconservation is fully resourced so that the interface between conservation and tourism can be understood, for without this understanding the promise of geotourism will not be reached*".

3.6.1 ISSUES IN INTERNATIONAL GEOCONSERVATION

Gray (2004:257-262) believes that the major issues in international geoconservation are:

- **Diversity of systems**: Biodiversity dominates conservation worldwide. Systems of protected areas and nature conservation vary around the world. Some geoconservation is being done in the UK (Dorset coast), Australia (Uluru), New Zealand (Tongariro), USA (Yellowstone, Grand Canyon) and Europe (Eifel Geopark, Rammelsberg WHS. Much more need to be done for geodiversity conservation – it should be the standard objective of nature conservation.
- **Site selection methods**: Countries with geoconservation site networks have different means of site selection. Literature reviews, panels of experts for consensus judgements have been used. Ideally, systematic surveys or national inventories of the geodiversity resource should be established as a basis for selecting sites, but there are few examples of this approach
- **Site selection criteria**: Early criteria used were research value, rarity, vulnerability to threat and representativeness. Significance, outstanding features and earth science interest's level of detail are other critical points
- **Duplication or replication**? To avoid duplication, some countries select only one example of the different types of feature. Replication provides some security against the complete loss of a particular aspect of geodiversity. With fewer examples of a type of feature that exists, it is than more important than ever to protect a higher proportion of the samples of the type and so the case for replication is stronger in the case of features that are highly sensitive, that support biodiversity or that are poorly understood. It also allows having representatives of particular types of feature in different parts of the country, thereby supporting local geodiversity
- **Values**: Sites can offer value in more than one way
- **Scope**: Many systems could be both static or dynamic.
- **Significance**: Sites may be graded for significance according to international, national or local importance.
- **Site management and enforcement**: Management of geosites varies greatly. Sometimes reliance is placed on significance of the protected area and related legislation. Academic scientists are less good at practical site management. Fencing

around a petrified tree in Yellowstone National Park is used to protect it from souvenir hunters. At the Craters of the Moon National Monument, Idaho, USA, signage is used to discourage collecting and to discourage off-track access. In other places paths, boardwalks and related signage are used to restrict visitor access to sensitive areas. The best solution would be in education in the belief that voluntary restraint will restrict damage to sites.

- **International agreements**: Stürm (1994) argued that an International Agreement would be useful in promoting and supporting the implementation of the geotope concept within national planning systems. This type of agreement would cover the following issues:
  - The definition of the spatial unit (geotope)
  - The creation of an international inventory of important geotopes (including criteria and procedures for selection)
  - The obligation of countries to integrate geoconservation into their planning policies and legislation including the designation of geotope areas; to take account of geoconservation at all stages of their plan making and approval processes at all administrative levels, and to establish an inventory of geotopes of national and regional importance; and
  - The establishment in each country of a statutory body that would supervise, sustain and provide the implementation of the geotope concept.

In conclusion, Gray (2004:262) says that, "*Despite the diversity of geoconservation systems and networks currently in use, many countries and organizations now agree that the aim of geoconservation should be to maintain the rage of earth science features within their borders…[and] that they aim to conserve a representative selection of the geodiversity of their country*".

The "*Recommendation Rec (2004)3 on Conservation of the Geological Heritage and Areas of Special Geological Interest*" in Strasbourg, France, on 5 May 2004, was the first time that an activity of guidelines on the conservation of the geoheritage was launched on a world-wide scale at this level.

The explicitly philosophy of the recommendation was to join the forces of all role players and stakeholders involved. Issues related to in this agenda of geoconservation included:

- The philosophy and practice of geological and geomorphological conservation Existing conservation programs
- The IUGS geosites project
- European geoparks
- World Heritage Convention
- The management of areas of special geological interest and of legislation for protecting areas of special geological interest and moveable geological heritage

- Developing information and education programs to promote action in the field of geological heritage conservation
- Strengthening co-operation with international organisations, scientific institutions and NGOs in the field

(www.jncc.gov.uk/pdf/councilofeurope1.pdf).

The Committee of Ministers of the Council of Europe made the following statement (Recommendation Rec (2004)3):

- Recalling the United Nations' Millennium Declaration, in particular the assertion of the fundamental value of "respect for nature" in the management of all living species and natural resources
- Recalling that geological heritage constitutes a natural heritage of scientific, cultural, aesthetic, landscape, economic and intrinsic values, which needs to be preserved and handed down to future generations
- Recognising the important role of geological and geomorphological conservation in maintaining the character of many European landscapes
- Recognising that the conservation and management of geological heritage need to be integrated by governments in their national goals and programs.
- Noting that some areas of geological importance will deteriorate if they are not taken into account in planning and development policies
- Aware of the need to promote the conservation and appropriate management of the geological heritage of Europe, in particular areas of special geological interest
- Considering the philosophy and practice of geological and geomorphological conservation (see Appendix 1 to this recommendation)
- Recognising the need to strengthen the regional co-operation in Europe in the field of geological heritage conservation, recommends that governments of member states:
  - Identify in their territories areas of special geological interest, the preservation and management of which may contribute to the protection and enrichment of national and European geological heritage; in this context, take into account existing organisations and current geological conservation programs (see Appendix 2 to this recommendation)
  - Develop national strategies and guidelines for the protection and management of areas of special geological interest embodying the principles of inventory development, site classification, database development, site condition monitoring and tourist and visitor management, to ensure sustainable use of areas of geological interest through appropriate management
  - Reinforce existing legal instruments or develop new ones, to protect areas of special geological interest and moveable items of geological heritage, making full use of existing international conventions
  - Support information and education programs to promote action in the field of geological heritage conservation

- Strengthen co-operation with international organisations, scientific institutions and NGOs in the field of geoheritage conservation
- Allocate adequate financial resources to support the initiatives proposed above
- Report to the Council of Europe on the implementation of this recommendation five years after its adoption, so that an assessment of its impact may be carried out.

Appendix 2 describes existing conservation programs and criteria in the selection of areas of special geological importance. Common elements taken into account by national programs when listing sites are:

- The extent to which an area or site represents an important geological phenomenon.
- The scientific value of the area
- The pedagogical value of the area
- Rarity of geological/geomorphological phenomena within the area
- Degree of disturbance and potential threats
- Size of the area.

In the "*Recommendation Rec (2004)3 on Conservation of the Geological Heritage and Areas of Special Geological Interest*", Appendix 5 spelled out the recommended information and education programs to promote action in the field of geoheritage conservation. It was suggested that Governments of member states should promote action in these fields by identifying and utilising opportunities to develop and support information and education programs, both within their own jurisdictions and regionally, acting via the Council of Europe and other relevant international or European organisations.

According to the Aarhus Convention, access to information and public participation in environmental decision-making is now understood to be an important part of sustainable development. The importance of educational activities through programs aimed at well-defined target groups is recognised by the Council of Europe. The objectives of these programs are to raise awareness and develop partnerships for the conservation and enhancement of natural and cultural heritage. The Working Group on Geological Heritage emphasised in this recommendation that the geoheritage of Europe is an important and integral part of the region's natural heritage. The concepts of geological and geomorphological conservation are less publicised than are those relating to the conservation of biodiversity or the protection of landscapes.

Therefore, the purpose of any geoconservation information and education program should be parallel to that described above, and should complement informational or educational initiatives designed to raise awareness of landscape and biodiversity issues. Geoconservation in all its forms and features and all its scientific, social and economic aspects represents an important part of the European common heritage. It is directly relevant to biodiversity

conservation and to landscape protection, and the proposed program should emphasise integration with these other conservation and protection programs (www.jncc.gov.uk/pdf/councilofeurope1.pdf).

3.6.2 GEOCONSERVATION IN SOUTH AFRICA

Reimold (1999:469-483) described geoconservation in Southern Africa. He noted a wealth of outstanding geological sites although pro-active geoconservation on the African continent had not featured very prominently to that date. Reimold further intimated that, in the interest of science, education and tourism, both unique and typical geosites needed to be identified, catalogued and prioritised with their protection being the aim if such identification . Further he notes that geoconservation aimed to identify and protect Earth science related heritage for protection and conservation prior to its destruction or degradation. He gave the following as reasons why geoconservation is important:

- It is part of general environmental protection, which would extend to all terrains and to all aspects of the surface of this planet
- Education relies on well-preserved natural instruction sites. (How can one teach geology when the best examples of geomorphological features and typical geological type sections (stratotypes) are no longer accessible for demonstration?)
- Scientific use demands protection of this heritage, for future examination, for comparison with new discoveries and for renewed scrutiny of previous hypothesis and dogma
- Many African countries already discovered the bonus that comes with the protection of natural sites, as ecotourism and tourism provide much needed revenue.

Figure 3.11: Old washing machine, Big Hole, Kimberley.
In the background some of the diamond sorting tables can be seen

At the time Reimold wrote, little had been done conserve geoheritage in South Africa except in the Vredefort Dome, at the Cradle of Humankind (COH), in the Greater St. Lucia

Wetlands, and the mining towns of Johannesburg, Pilgrim's, Rest, Cullinan and Kimberley. It was suggested that the most important geosites in the country should be protected and that a national geosites database should be developed. The database was started only in 2005 and is administered by the Council for Geoscience (CGS) in Pretoria.

Figure 3.12: Old mining equipment, Big Hole, Kimberley

Figure 3.13: Mining equipment, Big Hole, Kimberley

In an e-mail communication, Whitfield (2004) made the following comment: "*South Africa does not have a history of formal geological conservation. Indeed, at present it is a barely recognized aspect of geoscience. Our first step must be to start with the fundamentals - the sites or places of geological importance or significance – and to create an inventory of geosites, and to classify them in terms of agreed criteria*". The Geoconservation and Geotourism Committee of the Geological Society of South Africa (GSSA) started the geosite program in 2005, in collaboration with the Council for Geoscience (CGS), and yet all of the

above-mentioned international geoconservation principles and programs above should be applied in South Africa.

Figure 3.14: Coco pans with kimberlite diamond ore, Big Hole, Kimberley

3.7 EDUCATION THROUGH GEOTOURISM

In other parts of the world, a tremendous effort is made to use geotourism for geo-educational purposes. Geosites, old mines, caves, geomuseums, geo-exhibitions, geotrails and geoparks are all used for the visual learning experience. Geolectures, geoworkshops, geoconferences and geocongresses, as well as leaflets, books, videos, CD-ROM's and websites, are very important forms of communication. The most critical aspect is interpretation for visitors and tourists. Geology cannot be explained to the nonprofessional as it would be to other geoscientists (http://gfx.vulcania.com/UserFiles/File/espaces/scolaires/ressources_themes/guide_enseignants/le_dossier_pedago.pdf). Geotourism does not stop at geology, but also includes industrial archaeology (for example, Kimberley) and mining. Where possible, these experiences should be learned from and the learning applied in South Africa.

One of the best examples where museums are used for educational purposes is at Vulcania Park 15 km west from Clermond-Ferrand, France. It is a unique man-made volcanological museum park with the motto, "*L'aventure de la terre*" (Adventure of the Earth). When the main building of Vulcania is entered, an exceptional natural setting is entered, that of another universe, a volcanic environment. The Great Crater, 35 m in depth that shows 30 000 years of lava eruptions, is a feature.

The mysticism and real force of volcanism such as cloud sand flames of a real volcanic eruption can be experienced by descending progressively down the crater. The building consists of several stories (levels) where all aspects of volcanism are displayed as well as

volcanic rock samples, simulations and film shows. The benefits for agriculture, building industry and mineral deposits are explained. In the open space outside the main building, there are two open-air geological gardens where geotrails can be experienced (VULCANIA. L'AVENTURE DE LA TERRE. DOSSIER PÉDAGOGIQUE. GUIDE POUR LES ENSEIGNANTS. 2006: http://gfx.vulcania.com/UserFiles/File/espaces/scolaires/ressources_themes/guide_enseignants/le_dossier_pedago.pdf). This museum is to a certain extent similar to Maropeng because the main goal is to educate people. In Vulcania the emphasis is on geology and at Maropeng it is on evolution.

Figure 3.15: The Vulcania Museum that resembles a volcano, Clermond Ferrand, France (http://gfx.vulcania.com/UserFiles/File/espaces/scolaires/ressources_themes/guide_enseignants/le_dossier_pedago.pdf)

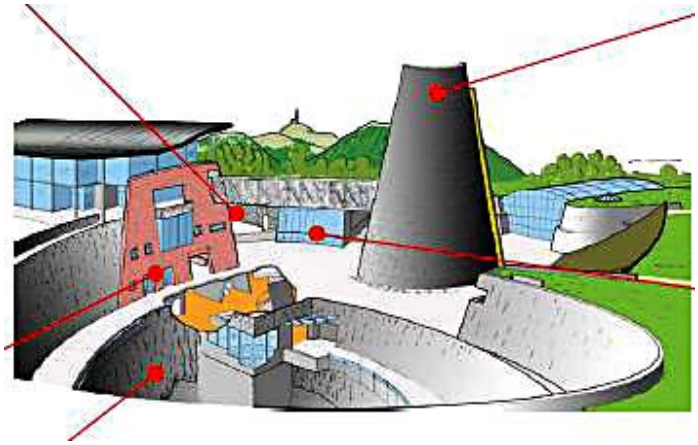

Figure 3.16: Diagram explaining The Vulcania Museum, Clermond Ferrand, France. There are also several underground levels with various volcanic displays (http://gfx.vulcania.com/UserFiles/File/espaces/scolaires/ressources_themes/guide_enseignants/le_dossier_pedago.pdf)

At the Big Pit Mining Museum in Blaenafon, South Wales, the mine was developed into a tourist attraction to revitalise the area and to advance the education of the public in the history of the coal mining industry in Wales. A museum (both underground and on surface) at the colliery demonstrates past and contemporary mining methods. After gold was discovered in Alaska (USA), in the Klondike area, a mining town developed. At present, it is managed as the Klondike Gold Rush National Historical Park, a unit of the US National Park System. Another example is the mining town of Val d'Ór in Quebec, Canada. At Hannans North in Kalgoorlie-Boulder, Western Australia the tourist mine, established on the original mine site, provides a glimpse into 100 years of mining history. Visitors can be taken on an underground tour, but it far exceeds one's own Gold Reef City's underground experience. Displays and exhibits are housed in buildings transferred from various old mine sites. The tourist mine has also one of the largest and best displays of historic mining equipment in Australia.

In South Africa, Johannesburg, Barberton, Pilgrim's Rest, Cullinan and Kimberley are all former mining towns. The African Gold Zone, Africa's first internationally competitive gold jewellery manufacturing facility, was recently established on the Rand Refinery property at Germiston. Much more should be done to promote and develop geotourism in these places. Educational aspects to be considered could include geoscience educational activities, curriculum guidelines for geotourism management education, museums at geosites, geotrails, open-air geological museums, information centres, guided excursions, exhibitions and formal education.

Wight (1993:54-66) analysed, on the basis of sustainable tourism, guidelines that have been developed by The Ecotourism Society and by The Ecotourism Association of Australia. Principles on which the geotourism experience should be constructed (adapted by the researcher (2008) in Rátz, 1996: 1-5) should take into account the following criteria:

- Do not degrade the georesource. It should be developed in an environmentally friendly manner
- Provide long-term benefits to the georesource, the local community and industry (benefits may be conservation, scientific, social, cultural, or economic)
- Provide first-hand participatory and enlightening experiences
- Involve education among all parties - local communities, government, non-governmental organisations, industry and tourists before, during and after the trip).
- Encourage all-party recognition of the intrinsic values of the georesource
- Involve acceptance of the georesource on its own terms, and in recognition of its limits, which involves supply-orientated management
- Involve understanding and involve partnerships between many players, which could include government, non-governmental organisations, industry, geoscientists, and locals (both before and during operations)
- Promote moral and ethical responsibilities and behaviours towards the natural and cultural environment by all players.

3.7.1 GEOSCIENCE EDUCATION ACTIVITIES

Wandersee and Clary (2005) report that three US public fossil parks (in Ohio, New York and Iowa) have embraced educational missions and allowed the public to collect and actually to keep the fossils they found. The new parks moved beyond exhibiting fossils to allowing the park visitor to have a direct, tangible and authentic geobiological field experience, typically culminating in the visitor's identification and ownership of a small number of personally collected fossils. A site-based, qualitative, comparative geoscience educational analysis of the strengths and weaknesses of the first three parks was presented at the 2004 International Geological Congress. A fossil park design model for others contemplating the establishment or instructional use of such parks was subsequently developed. Today there are five specially developed, public fossil parks in the US. All are owned and operated by city or county governments, or by non-profit organizations. Each considers its primary mission to advance geoscience education.

Figure 3.18: Explanation of cave formation, Tumulus Building Exhibition Centre, Cradle of Humankind (COH)

An on-site, multiple case study research was conducted on the two newest US fossil parks. Both are located in small towns: Trammel Fossil Park in Sharonville, Ohio (population 13,000), and Fossil Beds Park in Fossil, Oregon (population 430). The former site is Ordovician in age, with four fossiliferous marine formations. The latter is an Oligocene lakebed and contains approximately 35 species of identified plant fossils. The focus in both case studies was on identifying the steps of successful fossil park development that lead to a sound informal geoscience education program, based on principles of active, meaningful and mindful learning. It was found that each town had developed a collaborative, community-driven, pedagogically innovative, field-based geotourism venue. Each was noteworthy in specific ways for its geoscience education potential as an outdoor teaching laboratory. The results of actual fossil collecting and interpretation at each site and evaluating the opportunities was to discover common fossils and to learn geobiology in the field. The

study's findings outline the steps of educational program development and support underlying each park. While one site utilises a very effective interpretive signage system that aims to be self-teaching, the other employs a helpful on-site geological interpreter.

In one place, following the collapse of the timber industry, the town's entire economic recovery plan is now predicated on geotourism and geoscience education activities centred on its fossil park. In the other, the fossil park has become the enticing geoscience jewel of the town's park system. The two different fossil park program development approaches (for example, Wheeler County Oregon's Palaeo Project and Sharonville's university-city-local developer collaboration) could be replicated at other appropriate fossil sites. Fossil parks can offer scientific experiences to the public that contribute to the nation's scientific literacy.

A very informative site by Andrew Alden to inform the public about geology is available on the Internet (http://www.arc.govt.nz/volcanic). Various geological topics and articles (rock identification tables, minerals, geological maps, geological evolution, plate tectonics, earthquakes, volcanoes, mineral deposits, caves, fossils, sedimentary and metamorphic rocks, etc.), geotours and safaris, and even space geology can be downloaded.
Pemberton (2001) believes that to assist with the communication of the fascinating history of the Earth to the large majority of people, who find deep study truly daunting, the links between geodiversity and biodiversity should be emphasised. It would assist people to value the non-living environment. It would also facilitate a greater appreciation of natural diversity and provide a pathway for the public better to understand the complexities and wonders of geological history. Concentrating on communicating a geo-historian's attitudes, philosophies and practices to the wider community may not be the only approach, for the nurturing of a respect and appreciation of the earth's evolution and its building blocks should be attempted. The story of natural diversity, the links between geodiversity and biodiversity and how it has all evolved, needs to be explained to visitors. This would be a powerful way of improving communications regarding the earth sciences. The best places to do this would undoubtedly be in National Parks and other natural areas.

3.7.2 GEOLOGICAL MUSEUMS

A collection is a number of mineral, fossil or rock samples with aesthetic, historical or scientific value, or that is particularly rare (Verpaelst: 2004). Museums mostly display collections and these are primarily used for educational purposes and regular visitors are scholars, students, tourists and the public. In setting up an exhibition all details from the conceptualisation stage, designing and lighting to the final execution thereof must be taken into account. The accessibility to a museum collection is also the accessibility to the information associated with it. Education includes topics such as issues of interpretation, outreach programs, non-formal education and an understanding of the importance of these to the target audience. Visitor surveys show children to be a special category of target audience. When a new museum is planned, attention should be given to the museum architecture: museum types (building, theme or size types) and the design process of museums (location

and new/old building). Later architectural adaptation and expansion in museums is also necessary.

Jakubowski (2004) is of the opinion that natural history museums gather valuable collections. He believes that they play an important role in the protection of geoheritage and that this role is inherently associated with the fundamental mission of museums concerning the protection of natural and cultural heritage. For the purpose of methodology, two categories of the inanimate nature monuments are distinguished:

1. Immovable geoheritage (immobile monuments of inanimate nature) that cannot be removed from the surrounding environment and should be protected *in situ*
2. Movable geoheritage (mobile monuments of inanimate nature) protected *ex situ*, that is, within a museum.

There are scientific and didactic criteria of the valuation of the main types of museum collections constituting the movable part of the geoheritage. A new tendency in active preservation of geosites is indicated. It consists of the use of *in situ* museum techniques of conservation, exposition and of the construction of special museum pavilions and protective halls. Geological museums are found all over the globe. They have a very important role because minerals, rock specimens and fossils are being preserved and displayed in them. After collection, all the specimens are documented manually, perhaps digitally, and will then form part of the collections.

3.8 CONCLUSION

The chapter first looked at new concepts such as geotopes and geosites and their selection criteria as the basis on which geotourism are built. Geosites are features such as a landscape, a group of landforms, a single landform, a rock outcrop, a fossil bed, a fossil, caves, meteorite impact crater, volcano and even a mine site. A list of geosites in South Africa was compiled and they were classified according to various criteria as well as their selection criteria. A short overview of some of South Africa's most known and typical geosites and geo-areas was given, as well as a comparison with geosites in the rest of the world.

Geodiversity, geoheritage, World Heritage Sites, geoparks and the UNESCO World and European Geoparks Network were discussed and explained with examples in the rest of the world. A description of the better known and important geosites and geo-areas in South Africa was given. A comparison with geosites and geo-areas overseas followed. A World Heritage Inscription means that the site has to be of ‘outstanding universal value’. A UNESCO World Heritage Site is a specific site can be nominated for the international World Heritage program. Geodiversity is a simpler term that is used for the geoconservation and management of abiotic heritage. It consists of the diversity of minerals, rocks, fossils, soils, landforms and geological processes that constitute the topography, landscape and the underlying structure of the Earth.

The origin and concepts of geotourism was firstly described from the definition of geotourism that is used in Europe, China and the rest of the world. The second one is the geographical concept that is used in the US. During the discussion of geotourism, it became clear that is a relationship with other types of tourism, that is, eco-, soft and hard adventure-, special interest-, wildlife-, heritage-, mining heritage, responsible- and successful tourism. In some cases, an overlap exits because mining heritage tourism is part of geotourism but not of ecotourism.

It was pointed out that, without geoconservation, there will be no geotourism. The World Conservation Union (IUCN) defined and subsequently inventoried six categories of protected areas. The World Heritage List ranging from cultural monuments to historic cities, to protected natural areas that span the whole range of tourism destinations, and different types of tourism were described. Geoconservation is a new concept that is practiced with great success in the rest of the world. The "*Recommendation Rec (2004)3 on Conservation of the Geological Heritage and Areas of Special Geological Interest*" of Strasbourg, France, 5th May 2004 was an effort by the European Union where the conservation of the geoheritage on a world-wide scale was discussed.

In 1872, Yellowstone became the world's first designated National Park. The literature-review also indicated that pro-active geoconservation in South Africa has not featured very prominently to date. Thus, in the interest of science, education and tourism, unique and typical geosites need to be identified, catalogued and prioritised with the aim being their protection. The National Geosites Database started only in 2005, and is administered by the Council for Geoscience (CGS) in Pretoria.