

Messel Pit Fossil Site Management Plan

1st of November 2009

Table of Contents

Glossary of Terms and Abbreviations	1
Chapter One: Introduction	3
1.1 Vision	3
1.2 Key partners:	4
1.3 The UNESCO World Heritage List	6
Chapter Two: Description and historical background of the site	9
2.1 Geological overview and history of formation	9
2.2 History of raw material production	12
2.3 History of scientific research	14
2.4 History of tourist utilization	15
Chapter Three: Statutory Framework	16
3.1 International conventions and charters	16
3.2 National legal framework	17
3.3 Non-Statutory Framework	20
Chapter Four: Protected Area	20
4.1 Extension of the site	20
4.2 The World Heritage Property of Messel Pit	20
4.3 The buffer zone	21
4.4 Protection of scenic views and industrial remains	21
Chapter Five: Important Values in site management	22
5.1 Statement of significance	22
5.2 Statement of Integrity	23
Chapter Six: Catalogue of measures	24
6.1 Ongoing Measures	24
6.1.1 Maintenance Measures	24
6.1.2 Scientific Research Measures	26

6.1.3 Public Access and Promotion	27
6.2 Projected Measures	28
6.2.1 Landscape Management	28
6.2.2 Scientific Research	28
6.2.3 Public Access and Promotion	28
6.2.4 The Visitor Information Centre (BIZ)	28
Chapter Seven: Challenges and Opportunities	31
7.1 Challenges	31
7.1.1 Tourism pressure	32
7.1.2 Climate change	32
7.1.3 Natural disasters	32
7.2 Opportunities	32
Chapter Eight: Access and Heritage Presentation	32
8.1 Visitor Information	33
8.1.1 Visitor observation platform	33
8.1.2 Info-Point	33
8.1.3 Visitor Information Centre (BIZ)	33
8.1.4 Visitor Services	34
8.2 Information	35
8.2.1 Internet Presence	35
8.2.2 Publications	36
8.3 Networks and International Co-operations	36
Chapter Nine: Resources	36
9.1 Ownership and Administration	36
9.2 Scientific Work and operation (SGN)	37
9.3 Access and Promotion (WGM gGmbH)	38
Chapter Ten: Implementation	38
10.1 Periodic reporting	38
10.2 Reactive monitoring	39
10.3 Quality assurance	40
10.4 Advisory boards and commissions	40

Conclusion	40
List of figures	40
Bibliography	40
Further Reading	42
Appendix	43

Messel Pit Fossil Site

Management Plan (01 November 2009)

Glossary of Terms and Abbreviations

In order to avoid any misunderstandings, the following chart details the German terms and abbreviations and their English equivalents as used within the Messel Pit Fossil Site Management Plan.

BbergG	Bundesbergbaugesetz	Federal Mining Law
BIZ	Besuchersinformationszentrum 'ZEIT UND MESSEL WELTEN'	Visitor Information Centre 'TIME AND MESSEL WORLDS'
HDSchG	Hessisches Denkmalschutzgesetz	Hessian Heritage Protection Act
HLMD	Hessisches Landesmuseum Darmstadt	Hessian State Museum
HMWK	Hessisches Ministerium für Wissenschaft und Kunst	Hessian Ministry of Science and Arts
ICOMOS	Internationaler Rat für Denkmalpflege	International Council on Monuments and Sites
IGD	Institut für Graphische Datenverarbeitung	Institute for Graphical Data Processing
IUCN		International Union for the Conservation of Nature
LfDH	Landesamt für Denkmalpflege Hessen	Hessian State Office for Heritage Protection
NABU	Naturschutzbund Deutschland e.V.	German Society of Nature Conservation
NGO	Nicht-Regierungsorganisation	Non-Governmental-Organization
OP		Operational Guidelines for the Implementation of the World Heritage Convention
SGN	Senckenberg Gesellschaft für Naturforschung	Senckenberg Society for Nature Research
UNESCO		United Nations Educational, Scientific and Cultural Organisation
WGM gGmbH	Welterbe Grube Messel gGmbH	Messel Pit World Heritage Non-Profit Limited
ZAS	Zweckverband Abfallwirtschaft Südhessen	South Hessian Joint Waste Management Authority

Bergaufsicht

Head Mining Office

Bodendenkmal

Historical Landmark

Erbbaurechtsvertrag

Leasehold Agreement (2007)

Museumsverein Messel e.V.	Messel Museum Association
Fossilienmuseum Messel	Messel Museum of Fossils and Local History
Geo-Naturpark Bergstraße-Odenwald	Global Geopark Bergstrasse-Odenwald
Grube Messel Verwaltungsgesellschaft mbH	Society for the Preservation of the Messel Pit Fossil Site
Grundgesetz der Bundesrepublik Deutschland	Fundamental Law of the Federal Republic of Germany
Hauptbetriebsplan 2004-2013	Main Operating Plan 2004-2013
Hauptbetriebsplan Grube Messel 2004-2013	Messel Oil Shale Pit Main Operating Plan
Hessisches Forstamt Dieburg	Hessian Forestry Office Dieburg
Hessisches Gesetz über Naturschutz und Landschaftspflege	Hessian Nature Conservation Act 1980
Oberste Denkmalschutzbehörde	Supreme Authority for Heritage Protection
Untere Denkmalschutzbehörde	Lower Authority for Heritage Protection
Vereinbarung über die Präsentation der Weltnaturerbestätte Grube Messel	Agreement on the Presentation of Messel Pit World Heritage (2005)
Vertrag über die Durchführung paläontologischer Grabungen in der Grube Messel	Agreement on the Conduct of Palaeontological Excavations at the Messel Pit (1992)

Chapter One: Introduction

1.1 Vision

The Messel Pit became known for its rich abundance of fossils in an extraordinary state of conservation as early as the 19th century and remains one of the most important mammal fossil sites until today. The exhaustive fossil record of Messel Pit not only allows the reconstruction of the evolution of early mammals but also gives a unique insight into the biotopes in which they lived. In 1995, in recognition of these outstanding qualities, UNESCO (United Nations Educational, Scientific and Cultural Organisation) inscribed the site onto the World Heritage List. The Messel Pit Fossil Site thereby became Germany's sole exclusively natural World Heritage Site until 2009, when the trans-national natural heritage site "The Wadden Sea" was inscribed into the list.

In order to safeguard the values for which the site was inscribed and to preserve them for future generations, the Messel Pit Site has to be carefully managed. Therefore the vision of the key partners – namely the Hessian Ministry of Science and Arts (HMWK), the Senckenberg Society for Nature Research (SGN) and Messel

Pit World Heritage Non-Profit Limited (WGM gGmbH) – who cooperated for the development of the management plan, is to:

- Protect Messel's outstanding universal value
- Advance scientific research and sustainable tourism
- Provide a key document for the cooperation of stakeholders
- Build local, national and international networks to propagate said vision
- Raise awareness of the problems of the site and to facilitate identification of it for visitors and the local population alike
- Improve the accessibility of the site to make it enjoyable for everybody
- Educate visitors in order to improve understanding of the site's values

1.2 Key Partners

The key partners in the context of the management plan are organisations, who have a direct influence on the management of Messel Pit either by their respective rights or responsibilities.

Hessian Ministry of Science and Arts (HMWK)

The Hessian Ministry of Science and Arts is accountable for professional and legal support and supervision of three of the World Heritage Sites in Hesse. The Ministry represents the interests of the Federal State of Hesse as the sole land owner of the Messel Pit Fossil Site.

Senckenberg Society for Nature Research (SGN)

The Senckenberg Society for Nature Research was founded in 1817 as a private organisation. In 1821, its first museum opened its doors to the public interested in geology, palaeontology, botany and zoology. The SGN has in the meantime acquired a respected reputation worldwide in these scientific fields and the Senckenberg Museum has become one of the largest museums for natural history in Germany. Today, more than 4,000 members contribute generously to the scientific institution and the museum by private donations and individual memberships.

In 1992, the SGN not only took responsibility for the proper scientific utilization of Messel Pit but also the general operation of the site. The Department of Messel Research was set up in 1993 by SGN as part of the Senckenberg Research Institute

with the primary objective of the investigation and reconstruction of the Eocene Lake Messel. SGN operates a field office next to Messel Pit as a base station for the planning and implementation of scientific excavations and the preparation of the findings.

Messel Pit World Heritage Non-Profit Limited (WGM gGmbH)

Messel Pit World Heritage Non-Profit Limited was founded in 2003 as a non-profit organisation under German legislation. Its primary purpose is the presentation of the Site to visitors, including related aspects and activities – such as visitor management and the operation of related facilities – such as the visitor centre. Its shareholders are the State of Hesse, the Senckenberg Society for Nature Research (SGN) and the municipality of Messel. As appointed in the 2005 contract, Messel Pit World Heritage Non-Profit Limited acts as a trustee for the State of Hesse (Please see 3.2 'National Legal Framework', 'Agreements')

1.2 Other partners:

The following organisations are numbered among 'other partners'. Though they are not directly entrusted with the management of the site, most of them have made a contribution to its protection and the scientific exploration in the past. Therefore they are seen as major stakeholders and are consulted and involved in a participatory approach. The most active ones are as follows:

Hessisches Landesmuseum Darmstadt

Louis I, Grand Duke of Hesse, donated his collection of arts and other objects to the public in 1820 and thereby laid the foundation for the later museum. Today, the museum contains two divisions: the division of art history and cultural history and the division of natural history, including geology and palaeontology, mineralogy and zoology. Since the 1970s, Hessisches Landesmuseum Darmstadt has been conducting excavations at the Messel Pit and retrieving a large collection of fossils.

Hessian State Office for Heritage Protection (LfDH)

The Hessian State Office for Heritage Protection is a technical authority and therefore not part of the hierarchy of the administrative authorities. Its responsibilities are the enforcement of heritage protection, the supervision and the consultation of owners of cultural heritage properties in conservation, maintenance and

reconstruction, the compilation of a methodical inventory of cultural heritage properties and the scientific examination of these assets. Additionally, it acts as the advisory body to the Hessian Ministry of Science and Arts and also maintains a palaeontological division.

Messel Museum Association (Museumsverein Messel e.V.)

Messel Museum Association has been operating a museum of fossils found at the site as well as local history since 1978 with the support of the municipality of Messel. Regular meetings between the statutory bodies and Messel Museum Association are held to inform and discuss members about future developments at the site.

Geopark Bergstrasse-Odenwald Association (Geo-Naturpark Bergstraße-Odenwald e.V.)

In 2004, UNESCO assisted in the creation of the Global Geoparks Network, the intention of which is to preserve the geological heritage of a region, to increase the understanding of this heritage among locals and visitors, and to promote tourism and sustainable regional development. The Geopark Bergstrasse-Odenwald Association joined the European Geoparks Network and the UNESCO Global Network in 2002.

1.3 The UNESCO World Heritage List

The General Conference of UNESCO adopted the Convention concerning the Protection of the World Cultural and Natural Heritage in 1972, which declares that the preservation and protection of cultural and natural properties of outstanding universal value is not limited to a national or regional level. According to the Operational Guidelines¹, “the cultural and natural heritage is among the priceless and irreplaceable assets, not only of each nation, but of humanity as a whole. The loss, through deterioration or disappearance, of any of these most prized assets constitutes an impoverishment of the heritage of all the peoples of the world. Parts of that heritage, because of their exceptional qualities, can be considered to be of 'outstanding universal value' and as such worthy of special protection against the dangers which increasingly threaten them.”

Therefore the Convention of 1972 also stipulated the composition of the World Heritage List, which is managed by the inter-governmental World Heritage Committee and contains sites which are selected in a nomination process. In this process, applying sites have to prove that their respective outstanding universal value as well as meeting the criteria of “authenticity” (for cultural sites) and integrity

(for cultural and natural sites) are met and appropriate means for its protection and management are in place.

According to the 2008 Operational Guidelines for the Implementation of the World Heritage List, the nominated properties have to fulfil at least one of the following criteria.

- *(i) represent a masterpiece of human creative genius;*
- *(ii) exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;*
- *(iii) bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;*
- *(iv) be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;*
- *(v) be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change;*
- *(vi) be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance.²*
- *(vii) contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;*
- *(viii) be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;*
- *(ix) be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;*
- *(x) contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation*

The World Heritage currently (August 2009) includes 890 properties, including 689 cultural, 176 natural and 25 mixed properties from 145 state parties. As of November 2007, 186 state parties have ratified the World Heritage Convention.

According to the Operational Guidelines, the criteria of “authenticity” applies for all sites listed under criteria (i) to (vi) from above and is met when their cultural values “are truthfully and credibly expressed through a variety of attributes including form and design, material and substance, use and function, traditions, techniques and management systems, location and setting, language and other forms of intangible heritage, spirit and feelings and other internal and external factors” (Operational Guidelines 2008, section 82).

The criterion of “integrity” is met, when a property

- a. *“includes all elements necessary to express its outstanding universal value;*
- b. *is of adequate size to ensure the complete representation of the features and processes which convey the property’s significance;*
- c. *suffers from adverse effects of development and/or neglect”*

(Operational Guidelines 2008, section 88).

For properties listed under criteria (vii) to (x), as in the case for Messel, integrity means that “bio-physical processes and landform features should be relatively intact. However, it is recognized that no area is totally pristine and that all natural areas are in a dynamic state, and to some extent involve contact with people. Human activities, including those of traditional societies and local communities, often occur in natural areas. These activities may be consistent with the outstanding universal value of the area where they are ecologically sustainable” (Operational Guidelines 2008, section 90).

The inscription of the Messel Pit Fossil Site

The World Heritage Convention was ratified by the Federal Republic of Germany in 1976 and acceded by the German Democratic Republic in 1988. In 1990, with the unification of both German states, it was agreed in the Unification Treaty that the treaties and agreements to which the Federal Republic of Germany was a contracting party remained in force and that their respective rights and obligations were to be applied to the whole territory of Germany.

The World Heritage Committee on its 19th session in Berlin in 1995 followed its advisory body, the International Union for the Conservation of Nature (IUCN), which opted for Messel’s inclusion in the World Heritage List under criteria (viii) - the former natural criteria (i) - *“considering that the site is of outstanding universal value as the single best site which contributes to the understanding of the Eocene, when mammals became firmly established in all principal land ecosystems. Furthermore, the Committee commended the German Government for their support of the high standards of palaeontological research undertaken.”*

It therefore confirms the justification provided in the nomination document:

*"[Messel Pit] contains examples of the major stages of earth's history and outstanding geological features. Messel Pit fossils are the remains of organisms from the middle Eocene strata dating back 50 million years. The Messel Pit Fossil Site demonstrates a vital and explosive evolution of mammals that mainly occurred during the Eocene. Few high quality sites are known to provide the opportunity to study this process, and at none of these sites are the fossils so outstandingly preserved or their habitats so extensively reconstructible in a wide variety of biotopes. The specimens provide information to decipher the history of the large subphylum of vertebrates. The finds embrace a wide spectrum of diverse Eocene life-forms unequalled by virtually any other site."*⁴

Fossil Sites on the World Heritage List

Messel Pit Fossil Site constituted the third fossil site inscribed in the World Heritage List after

- Dinosaur Provincial Park, Canada, inscribed in 1979
- Australian Fossil Mammal Site, inscribed in 1994.

Four other fossils sites have been inscribed after Messel Pit Fossil Site:

- Fossil Hominid Sites of Sterkfontein, Swartkrans, Kromdraai, and Environs, South Africa in 1999
- Miguasha National Park, Canada in 1999
- Monte St. Giorgio, Italy in 2003
- Wadi Al-Hitan (Whale Valley), Egypt, in 2005
- Joggins Fossil Cliffs, Canada in 2008.

A number of other prominent sites containing fossil sites have also been nominated:

- Grand Canyon National Park, United States of America, in 1978,
- Canadian Rocky Mountain Parks, Canada, in 1984
- Dorset and East Devon Coast, United Kingdom, in 2001.

Chapter Two: Description and historical background of the site

2.1 Geological overview and history of formation

2.1.1 Geological formation of Messel Pit

The Messel Pit owes its existence to complex processes in plate tectonics, which originated in the formation of a rift system in the Dogger period of the Middle Jurassic, some 170 million years ago. This rift system, which later formed the Atlantic Ocean, caused the break-away of the African continent from the supercontinent Pangaea. In the Lower Eocene period, around 53 million years ago, the northward movement of the African Continent led to the collision of the Adriatic Plate with the Eurasian Plate, which initiated the formation of the mountain chain of the Alps. The very same continental drift also caused the depression of the Upper Rhine Graben - a rift system which extends from the Swiss Jura near Basel to the southern edge of the Taunus, north of Frankfurt/Main. In an isostatic response, uplift occurred at the flanks of the rift system and the thinning of the crust allowed magmatic and volcanic activities to occur, resulting in dykes which parallel the Upper Rhine Graben.

The Messel Pit itself is located on an uplifted block of magmatic and metamorphic rocks from the Paleozoic, which are covered by continental sediments and volcanic rocks of the Lower Permian age. Today, the uplifted area is called 'Sprendlinger Horst' and seen as the northernmost extension of the Odenwald. To the west, north and east it is surrounded by areas of depression: the Upper Rhine Graben, the Neu-Isenburger depression and the Hanau-Seligenstädter depression. The same geological strata, which surface at Messel Pit are buried under thick layers of sedimentary and volcanic rocks in the depression areas. In the Upper Rhine Graben, they can only be found at a depth around 1500 metres or more.

The volcanic activities at the flank of the Upper Rhine Graben led to the formation of today's Messel Pit during the Tertiary. Molten rock ascended along a vertical fault line and came in contact with ground water some 100 metres below the surface. The extreme difference in temperature led to the instant evaporation of the ground water, fuelling a so-called "phreatomagmatic explosion" – thereby shattering and ejecting the rocks above the point of contact. As a result, a funnel-shaped crater formed and was partly filled with the ejected bedrock. Rock debris and volcanic ash, also ejected during the explosion, piled up and subsequently formed a low crater wall. Until today, the remains of that crater wall consisting of loose and lightweight materials have completely eroded away. The process of the formation of the Messel Pit was heavily disputed in the past and was only proven as recently as 2001 by geoscientific investigations and drilling.

In the aftermath of the phreatomagmatic explosion, which occurred around 48 million years ago, groundwater filled the 700 metre-wide and 1000 metre-long crater and formed the Messel Pit crater lake. Organic sediments, the remains of algae and bacteria, formed the first strata of the so-called 'Messel Formation', organic sediments which later became known as the "oil shale". At the centre of the Messel Pit, this formation has piled up to a thickness of more than 200 metres and incorporates 1-1.5 million years of sedimentation, the life-span of the Messel Pit crater lake.

During the time the Messel lake was in existence, it was located on the Central European continent, though not far away from the coastline: the shallow bays of the former North Sea stretched as far south as the present-day Central-German Midlands and to the west the sea extended over today's English channel and into the Paris Basin. To the south was the Thetys sea, the ancestor of the modern Mediterranean. If one also takes plate tectonics into account, the position of Messel Pit has since the early Tertiary shifted around 1300 kilometres northward and some distance - which cannot be determined by scientific methods - eastward. So, at its time of existence, the Messel lake was located at a latitude of around 38 degrees of latitude - comparable to the latitude of southern Spain or Sicily today.

2.1.2 The fossils of Messel Pit

Very special conditions had to be fulfilled for fossilization processes to occur at the Messel crater lake, which had a small diameter (around 1.5 kilometres) and comparably great depth of around 300 metres - common characteristics of Maar lakes. These physical characteristics constrained the mixing process of the water which usually occurs in shallower lakes. The disgorged material which formed the crater wall acted as an additional barrier for the inflow of water and air currents.

As a result, nutrients and oxygen were dispersed in life-sustaining amounts only in layers relatively close to the water surface (down to a depth of approximately 20 metres). However, even in the top levels of the water column of the lake, nutrients and oxygen were subject to strong seasonal changes. Sediments from the eroding crater wall were washed into the lake during rainy seasons, while algae bloomed in the dry seasons.

Below the surface, conditions became too hostile for most life-forms to deal with. At the bottom of the lake, only anaerobic bacteria were able to completely decompose the remnants of dead matter and bodies of the life forms from below the water surface. The remains of the anaerobic bacteria, conserved by geological and chemical processes, left a minute imprint of the bodies they decayed - and today form the famous fossils of Messel Pit.

The specific feature which distinguishes Messel Pit World Heritage Site from the great majority of similar fossil sites is due to the extraordinary conditions of conservation of its fossils, which allow a detailed reconstruction of the biotope and the habitats they lived in. Since Messel was located a great distance southward in the early Tertiary in comparison to its present-day location, the climate was similar to subtropical and tropical climates today. As a result, the fauna and flora bear resemblance to those found in similar climate zones at present.

Plant fossils are well represented in Messel Pit - the Senckenberg Research Institute lists over 20,000 catalogued specimens - usually in the form of seeds, pollen grains,

leaves, fruits and algae, whereas wooden remains are rarely conserved. Many of the preserved ferns or tree species are either extinct or related to species found in the tropics of Central America and Asia.⁵

Insects - with their abundance and functions vital for almost every terrestrial ecosystem - are a good indicator of the ecosystems they live in. In total, close to 15,000 specimens of insects have been found in Messel, with beetles, constituting the largest group, totally about 60 per cent of all insects. While land-based insects seemed to dominate the insect fossils of Messel pit, recent studies of fish excrement have shown that water-living insects were equally abundant. The majority of the fossilized insect species is related to today's species. Spectacular fossils, like giant ants with a wingspan of up to 16 centimetres are rarely found.⁶

The adaptations of fish species - the ability to directly breathe air and to re-absorb materials from their scale margins - indicate a sometimes hostile environment. The most common fish species was *Atractosteus trausi*, a member of an archaic group of fishes remarkable for their strong skull bones and *Cyclurus kehreri*, a relative of the bowfins of eastern North America. All fish species found in Messel were predators.⁷

Only five species of amphibians have been found in Messel, in particular salamander and frog species. Surprisingly, maybe due to the inferior water quality, aquatic frogs are very rare, whereas terrestrial toad/frog species (anurans) are more common.

Three of the modern four orders of reptiles have been found at Messel: snakes and lizards, turtles and crocodiles, among them the first crocodile remains were discovered in 1877. Noteworthy again is the extraordinary condition of preservation of most of the reptiles - with complete skeletons of fragile bones as in the case of snakes like *Palaeopython fischeri* and three-dimensionally preserved remains of reproductive organs of turtles. These cold-blooded animals also act as climate indicators which show that the average temperature must have been higher than today.

The birds, as well as the most iconic fossils of Messel Pit, the mammals, are represented by a wide variety of species. Most of these either belong to archaic, now extinct groups or are early predecessors of today's species, therefore bearing testimony to the rapid evolution of these classes until today. Again, the extraordinary quality of the fossils (including such fine structures as feathers, hair and soft body tissues such as wing membranes, stomach and intestinal contents) allow researchers to make conclusions that go far beyond the mere morphology of these animals. Some of these include the reconstruction of movements, reproduction, feeding patterns and other important discoveries.

2.2 History of raw material production:

The identification of small amounts of bog iron ore in the middle of the 19th century in the area of today's Messel Pit led to the discovery of Messel brown coal and in turn oil shale. The mining company "Messel Union" (Gewerkschaft Messel) was originally founded by the banker Cäsar Straus in order to exploit the oil shale.

The brown coal (oil shale) found, however, was unsuitable for use as fuel. That being said, its components were extracted in a process of low-temperature carbonization and then sold. An appropriate technology for the extraction process had to be invented, in which a representative of the company, the 28-year-old chemist Dr. Adolf Spiegel, played a leading role. The oil shale was extracted from an open-cast mine, broken down and then carbonized by distilling it at a temperature of about 500 C. At first, the furnaces caused problems with the process which led to a difficult economic situation for the young company in the 1890s. After the problems were resolved, new products could be launched and the output of crude oil increased. At first, the main products were tar and paraffin, which were used in the production of candles. At the beginning of the 20th century gasoline, diesel and fuel oil became the company's main products and ammonium sulphate (fertilizer), coke, and from the 1920s onwards electrode coke, formed the most important by-products.

When the Messel furnaces were introduced in 1900, production increased dramatically. During World War I, the production of engine fuel became an important asset for the company. In light of the economic regression after the war, Messel Pit joined the company "Riebeck'sche Montanwerke" in Halle, Saxony, which also operated brown coal carbonization plants. In 1918, the entrepreneur Hugo Stinnes took over the company and its name was altered to "Hugo Stinnes-Riebeck Montan- und Ölwerke AG". After his death in 1924, the company became part of the IG-Farben Chemical Company. In the following decades until 1945, the modernization of the Messel Pit factory continued: a new boiler house was built, more excavators were purchased and the refinery was re-equipped. Ultimately, 32 furnaces were in operation.

During the Second World War, the company became important for the supply of raw materials but nevertheless, in spite of great efforts, production fell. At the end of the war, on March 24th and 25th, 1945, the factory was bombed twice from the air. Although the mine itself, the factory buildings and the plant were not actually damaged, the supply lines were hit by gunfire and the electricity supply was cut off. This meant that the carbonizing furnaces could not be discharged and, as a result became deformed.

After the end of the war, the Messel factory was handed over to the Americans who became responsible for the administration of the business, which was run under the name "Messel Paraffin and Petroleum, U.S. Administration". The most important parts of the plant were quickly repaired and production was started up again, which was made possible with the help of the Marshall Plan. Conveyor belts replaced the

old carts, both for transporting shale and removing waste. In spite of all this, the days of producing crude oil from oil shale were numbered. New sources of oil were discovered in 1952, which meant that production at Messel became increasingly uneconomic and less important.

On January 1st, 1954, the ownership of the works was returned to German hands. The economic situation, however, became more critical: on top of competition from crude petroleum, the company was confronted with social charges, environmental impositions and technical problems in open-cast mining. On top of that, the work force started to move into “cleaner” professions. In 1959, the Ytong Company, which began by making bricks from the slag-heaps, took over the mineral oil works. In March 1962, the carbonizing furnaces, the heart of the company, were shut down. Ytong continued to mine oil shale for the production of energy until 1972, when the pit was finally closed altogether. ⁸

2.3 History of scientific research

The first fossils were found in Messel Pit as early as 1870 while workers were searching for brown coal. These first finds belonged to the order of crocodiles and were described by Ludwig in 1877. At the end of the 19th century, additional finds were published, containing several species of freshwater-fish, remains of turtles, a bird skeleton and imprints of leaves. In the following decades, the director of the mining company, Dr. Spiegel, himself a natural scientist with a broad range of interests – collected and salvaged fossil remains which were discovered in the progress of the mining operations. He thereby laid the foundations for later scientific research by collecting an increasing number of finds, including remains of plants, insects, turtles, bats and equines. In 1911, Oskar Haupt, the custodian of the Geological-Palaeontological division of Hessisches Landesmuseum Darmstadt identified the geological age of this fossil site while researching the equines of Messel. His dating of the site to the Middle Eocene is still valid in principle today.

When the mining of the oil shale by hand was replaced by mechanization in the 1920s, the number and quality of new findings decreased. Despite of this, the plant management was able to obtain numerous new fossils. In 1966 and 1967, Hessisches Landesmuseum Darmstadt found some rare objects, including a skeleton of a frog and the skull of another amphibian in the course of planned excavations.

When the mining stopped, a 'hole' was left that extended approximately 1000 metres from north to south and 700 metres from east to west. Up to that point in time, the public had paid little attention to the Messel Pit. However, it soon became better known, since the increased opportunity to search for fossils, combined with improved preparation techniques available, now meant that spectacular finds could easily be made accessible to the public. Plans to turn the former quarry into a rubbish-dump also gained it public recognition. A 20-year long struggle began, involving highly

motivated citizens and scientists, to save this unique fossil site. From 1975 onwards, regular scientific digs were organized and conducted by Hessisches Landesmuseum Darmstadt, the Senckenberg Research Institute and other scientific institutes, which reported many sensational finds.

The movement organized by the citizens and the community of Messel became stronger and more active and the people were finally successful in their bid to save Messel Fossil Pit. The plans to construct a waste disposal site, initiated by the Head Mining Office in Wiesbaden, were declared to be illegal by the Court of Administration in Kassel on November 23rd, 1988. The legal dispute was ended after an appeal, the costs of which were taken over by the Federal State of Hesse, who also purchased the site from the South Hessian Joint Waste Management Authority for approximately 16.7 million Euros.

2.4 History of tourist utilization

In the beginning of the 1970s, as new methods for conserving the rapidly deteriorating oil shale were developed and the interest of a broader public in fossil remains increased, Messel became well-known to private collectors of fossils. When one such collector had excavated the fossil of the predecessor of the modern tapir and supposedly earned a huge amount of money by selling it, this created a kind of gold-rush for fossils. By the end of 1974, Messel Pit had to be closed to the public by the Mining Head Office for security reasons.

However, when the plans of the South Hessian Joint Waste Management Authority to turn Messel Pit into a waste disposal site became known, this led to a public outcry by scientists and concerned private citizens. During the struggle for the safeguarding of Messel's fossils, the site not only gained publicity in scientific circles, but also to the general public. In 1981 and 2000, for example, articles about Messel were published in "Geo"-magazine, a nationwide magazine for popular science. The very threat of Messel's destruction as a fossil site not only increased its profile on a national level, but internationally as well.

A number of exhibitions in Senckenberg Museum, Hessisches Landesmuseum Darmstadt and Messel Museum of Fossils and Local History additionally promoted Messel Pit, so that not only the exhibits, but also the site in which they were found, gained recognition.

Despite the difficulties of turning a former mining site into a safe location for visitors, a viewing platform was installed at the border of Messel Pit in 1997, which provides a view of Messel Pit to visitors, especially to those, who cannot take part in guided tours due to physical problems. With continuing growth of public interest and an increase of visitation, Messel's prominence as a tourist destination will grow further.

It is the belief of the key partners that this increase in tourist numbers is not in opposition, but rather in accordance with the World Heritage Convention, under the provision that a sustainable visitor management is developed, as detailed in this management plan. In addition, the current visitor numbers, of around 25,000 a year, are quite low in comparison to other World Heritage Sites and the planned increase of visitor will be largely limited to the area of the new visitor centre. The number of those actually descending into Messel Pit will also increase moderately due to improved facilities for visitors.

The construction of the visitor centre and the planned increase in visitor numbers has a considerable effect on a number of management issues, such as visitor safety (please see also Chapter 8). Since the only way to descend into Messel Pit is by guided tours, which are limited to a number of a maximum of about 50 participants each, visitors can be closely supervised so that the increase in their numbers is currently not seen to have detrimental effects on the integrity of the site. Currently, eight guided tours can take place simultaneously, so that the maximum number of visitors at a time is limited to around 400 people.

In order to safeguard the integrity of Messel Pit in future, all effects of increased visitation will be closely monitored in the course of periodic reporting (please see 10.1).

Detailed plans for the visitor information centre are given under 6.2.4. and 8.1.3.

Chapter Three: Statutory Framework

3.1 International conventions and charters

The World Heritage Convention

The Convention concerning the Protection of the World Cultural and Natural Heritage was adopted in 1972 by the member states of UNESCO. In this convention, the signatory state parties recognized their duty of ensuring the identification, protection, conservation, presentation and transmission to future generations of their respective cultural and natural heritage.

In 1976, the World Heritage Committee was founded which was made up of – an international committee elected by the general assembly of UNESCO by its member states. Additionally, the World Heritage Fund was established and the Operational Guidelines were adopted by the World Heritage Committee in June 1977. Within the last few decades, these guidelines were updated on a regular basis to reflect the changes in heritage protection and management. The most recent version of the Operational Guidelines was published in January 2008. The guidelines require that each nominated property should have an appropriate management plan or management system and which specifies the elements which should be considered

in such a plan – thereby setting a framework which is binding for the Messel Pit Fossil Site Management Plan.

However, the World Heritage Convention has not been separately implemented in German law. It was seen that the Convention is not necessary to enforce since there is already appropriate German legislation which protects natural and cultural heritage.

With a growing number of fossil sites applying for World Heritage nomination, an evaluation adapted for fossil sites had to be developed to better judge the qualities of outstanding universal value of these sites. The International Union for the Conservation of Nature (IUCN) developed during the nomination process of Miguasha Provincial Park in 1994 its IUCN Fossil Sites Evaluation Checklist, consisting of ten questions every newly nominated site has to fulfil (please see 5.1). The checklist was published in IUCN Evaluation of Nominations of Natural and Mixed Properties to the World Heritage List.

Fossil sites all over the world usually are seen to be part of natural heritage. Unlike other nature reserves, as for example national parks, their purpose of existence is not to protect parts of an ecosystem or a specific species but to gain an understanding of the evolutionary development of life forms from the past. This places fossil sites in scientific methods in the realm of archaeological sites, which are considered cultural heritage. Possibly due to this in-between-status, no international convention or charter concerning the protection and management of fossil sites as separate entities exists. The development of such a convention or charter, which might be an adaptation of the ICOMOS Charter for the Protection and Management of Archaeological Heritage, remains subject to future development.

3.2 National legal framework

Under Article 30 of the Fundamental Law of the Federal Republic of Germany (German Constitution of 1949), the exercise of governmental powers and the discharge of governmental functions are incumbent on the Federal States in so far as the constitution does not otherwise prescribe or permit. There is no overriding or constitutional provision in cultural matters. The power to legislate on cultural matters, including the protection of the national heritage is vested in the Federal States under their “cultural sovereignty”.

In the Federal State of Hesse, heritage protection and conservation are distributed to various authorities with differing fields of responsibility. In respect to heritage protection, the Hessian Ministry of Science and Arts holds supreme authority for

heritage protection (Oberste Denkmalschutzbehörde). The lower authorities for heritage protection (Untere Denkmalschutzbehörden) are located in counties and communities whose main responsibility is to provide administrative decisions concerning heritage protection. Both types of authorities are counselled by heritage advisory committees. The Hessian State Office for Heritage Protection (LfDH) is provides scientific advice in questions adhering to heritage protection.

Legislation

The following legislation affects the management of Messel Pit Fossil Site:

- Hessian Heritage Protection Act (HDSchG) of 1 October 1974 with amendment of 5 September 1986

Due to a special feature under the HDSchG (section 19), the oil shale in Messel Pit is considered to be a historical monument (Bodendenkmal), which is defined as containing or representing “movable or non-movable objects, being evidence, remnants or traces of human, **animal or plant life**, which stem from eras and cultures, for which excavations and findings are the main sources of knowledge.” According to that definition, there is no clear separation between cultural and natural heritage; historical landmarks can be part of both categories.

- Mining Act of the German Federal Government of 13 August 1980

Most recently amended on 9 December 2006, this act defines the terms of conditions, under which mining activities in Germany must be conducted and under which former mining sites have to be operated (as is the case for Messel Pit). The Mining Act mainly details the safety of the site by prescribing the composition of operating plans for (former) mining sites in intervals of a decade as a prerequisite. Currently the Messel Oil Shale Pit Main Operating Plan for 2004 -2013, which includes detailed and specific regulations for the operation of Messel Pit, is in force.

- Hessian Nature Conservation Act of 1980, most recently amended 2006

This act sets the legal framework for nature conservation in the Federal State of Hesse. It also incorporates the 'Nature 2000' guidelines of the European Union, which were adopted in 1992 and designed to protect the most seriously endangered species and habitats across Europe. The act defines which levels of interference – by agriculture, forestry-use or fishery – are acceptable for specific areas and strictly limits exemptions of this law.

Agreements

The preferred method to set legal obligations, which are mainly concerned with questions of ownership and responsibilities, comprises agreements, subject to public law and usually contain one or more public bodies as contractors. Four agreements adhere to the management of the site:

- Agreement of 26 June 1992 on the Conduct of Paleontological Excavations in Messel Pit between the Hessian Ministry of Science and Arts (HMWK) and the Senckenberg Society for Nature Research (SGN). This agreement details the following main aspects: the mode of operation and scientific standards for excavations and the constitution, composition and fields of responsibility of a scientific advisory board (please see 6.1.2). Most importantly, the operation of Messel Pit Fossil Site is assigned to the Senckenberg Society for Nature Research in compliance with existing laws and regulations.
- Agreement of 17 December 1992 on the Scientific and Cultural Use of the Messel Pit Fossil Site. This contract includes the foundation of the Society for the Preservation of the Messel Pit Fossil Site (Grube Messel Verwaltungsgesellschaft mbH)
- Agreement of 28 February 2003 on the re-structuring of the “Society for the Preservation of the Messel Pit Fossil Site” into “Messel Pit World Heritage Non-Profit Limited” (WGM gGmbH) between Hessian Ministry of Science and Arts (HMWK), Senckenberg Society for Nature Research (SGN) and the municipality of Messel. WGM gGmbH is constituted by three shareholders: the State of Hesse (65%), SGN (25%) and the municipality of Messel (10%). WGM gGmbH’s main responsibility consists of the presentation of the site to the public, including the operation and maintenance of a visitor centre and a viewing platform, the regulation of public access, and the participation in approval procedures concerning the scientific use and the prevention of hazards.⁹
- Agreement on the Public Presentation of Messel Pit Fossil Site of 2005, between the State of Hesse and Messel Pit World Heritage Non-Profit Limited (WGM gGmbH): The State of Hesse transfers all rights which are a result of its ownership of Messel Pit, particularly the rights for public access and the public presentation of Messel Pit, to WGM gGmbH. Furthermore, the State of Hesse assigns its authority, as detailed in the agreement on the “Scientific and Cultural Use of the Messel Pit Fossil Site” of 1992 to WGM gGmbH as trustee.
- Leasehold Agreement of 16 November 2007, accredited in December 2008, between the Hessian Ministry of Science and Arts (HMWK) and the South Hessian Joint Waste Management Authority (ZAS) concerning the construction of a visitor centre. The land, on which the visitor centre will be erected, is property of the publicly owned local joint waste management authority. The Federal State of Hesse is in the process of paying the agreed

amount to the owner; the lease period extends over 99 years. (please see Chapter Four and Appendix 1)

3.3 Non-Statutory Framework

Guidelines as published by the World Heritage Centre in the series “World Heritage Papers” have been consulted in the preparation of the management of Messel Pit World Heritage Site, specifically the World Heritage Paper No. 23 “Enhancing our Heritage Toolkit - assessing management effectiveness for natural World Heritage Sites”.

Chapter Four: Protected Area

4.1 Extension of the site

Messel Pit is located in a forested region in between of the towns of Darmstadt, Dieburg and Langen, about 20 kilometres south-east of Frankfurt/Main, which is approximately eight kilometres north-east of Darmstadt and about two kilometres south of the village of Messel. After almost a century of mining activities, in which a considerable amount of oil-shale was extracted, the former open-cast mine covers an area of 1.5 square kilometres, extending approximately 1000 metres to the north and south and 700 metres in an east-west direction, as well as reaching down to a maximum depth of approximately 70 metres. The area is fenced in by a perimeter enclosure to prevent trespassing. Currently there are two entrance ways to Messel Pit: the winding road which was built in connection with Messel's formerly planned function as a waste disposal site in the 1980s, and an additional entrance east of the pit which is intended to facilitate access to Messel Pit in the future.

4.2 The World Heritage Property of Messel Pit

The geological formation of oil shale at the bottom of Messel Pit contains fossil remains which are examples of a major stage of earth's history and an outstanding geological feature. This geological formation contains the remains of organisms from the middle Eocene strata dating back 50 million years which has been recognized as the asset which classifies the Messel Fossil Pit as a World heritage site as described in the nomination document and accepted as such by the World Heritage Committee. Only parts of this geological formation are accessible on the surface while most of it lies deep underground.

4.3 The buffer zone

When Messel Pit Fossil Site applied for World Heritage nomination in 1994, the Operational Guidelines did not yet foresee the delineation of a buffer zone, in which the conservation and protection of a World Heritage property is particularly enforced. With newer amendments to the Operational Guidelines, such an appropriate buffer zone is now required for inscription on the World Heritage List. According to current standards, a protected area in the form of a buffer zone should feature the following criteria:

"For the purposes of effective protection of the nominated property, a buffer zone is an area surrounding the nominated property which has complementary legal and/or customary restrictions placed on its use and development to give an added layer of protection to the property. This should include the immediate setting of the nominated property, important views and other areas or attributes that are functionally important as a support to the property and its protection. The area constituting the buffer zone should be determined in each case through appropriate mechanisms."

(Operational Guidelines 2008, section 104).

A perimeter fence was put up which surrounds the whole former mining site and which is under surveillance by foot patrols. These measures have intercepted illegal trespassing and illegal excavations. This fencing-off has proven to be very effective in the protection of those parts of the world heritage site which are accessible on the surface. The buffer zone of Messel Fossil Pit World heritage site is therefore clearly defined by the perimeter fence.

In the 2006 periodic reporting "State of Conservation of World Heritage Properties in Europe" - the protection arrangements of Messel Pit were considered to be highly effective.

4.4 Protection of scenic views and industrial remains

It is also the intention of the key partners to ensure that the scenic views of Messel Pit are not too severely affected by the extensive industrial sites surrounding the World Heritage Site and indeed Messel itself.

An important view of Messel is provided by the viewing platform. At times, visitors on the platform, looking in a northerly direction may distinguish another waste rock pile behind the waste-heap of aerated cement blocks, which are remains of the former industrial use of Messel Pit and in the meantime have become a valuable biotope for snakes and lizards. The former pile consists of demolition waste, which is owned by a company processing it in the vicinity of Messel. The key partners seek to encourage the lowering of this dump beyond the line of visibility to avoid potential visual impairment of Messel Pit by communicating with the Community of Messel.

Chapter Five: Important Values in Site Management

5.1 Statement of significance

In management plans for World Heritage Sites, the term of “outstanding universal value” is of utmost importance for the protection and management of such as site. According to the Operational Guidelines, “outstanding universal value means cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity”. Therefore this chapter focuses on the outstanding qualities set out below.

Messel Pit Fossil Site was inscribed into the World Heritage List at the 19th session of the World Heritage Committee in Berlin in 1995. Previously, in May 1995, an IUCN expert mission had visited the site to evaluate the outstanding qualities of Messel Pit with the help of a detailed Fossil Site evaluation checklist IUCN had developed the previous year (please see 3.1). The checklist provides ten questions developed by IUCN in order to give some indicative measures of significance. The complete checklist can be viewed under

http://whc.unesco.org/archive/advisory_body_evaluation/698.pdf

The evaluation followed the opinion of the nomination document:

“The oil shale Messel Pit provides the single best site which contributes to the Eocene understanding of the middle part of Eocene period. Messel is also exceptional in the quality of preservation, quantity and diversity of fossils. While most fossil vertebrate remains yield only fragments of bone material, Messel offers fully articulated skeletons and the outline of the entire body as well as feathers, hairs and stomach contents. Significant scientific discoveries have and are being made at Messel including studies of the evolution of echolocation in exceptionally well-preserved fossil bats and vital new data on the evolution of the horse. The fossils found here are providing a unique insight into an early stage of mammal evolution when many of the basic steps in diversification were being achieved. But mammals were not the only component of the fauna - birds, reptiles, fish, insects and plant remains all contribute to an extraordinary fossil assemblage. Clearly criterion (I) – the later criterion (viii) – as given in the justification section of the nomination summary is met.”

5.2 Statement of Integrity

Considering the industrial use of Messel Pit, the category of 'integrity' is not easily applicable for Messel Pit. A somewhat paradoxical situation arises, since fossils of Messel Pit owe their very discovery to these early mining activities.

According to the Operational Guidelines, “*properties proposed under criteria (viii) should contain all or most of the key interrelated and interdependent elements in their natural relationships.*” Under these aspects, the extraordinary state of conservation of Messel's fossils, which not only allows for the reconstruction of the morphology of the preserved fauna and flora, but also for that of their environment, the condition of integrity is met to an exemplary degree.

In comparison to other fossil sites the IUCN report concludes:

“In terms of fossil localities which provide a window into the Eocene Age, Messel is the best and most productive example discovered to date. The most obvious comparison would be the brown coal fossil assemblages notably that of Geiseltal, also in Germany, but this site has not received the scientific attention that Messel has. There are some very important localities in Egypt, notably Fayum, which have yielded significant Eocene vertebrates including early primates and whales but Messel is still judged as pre-eminent in terms of richness. The nomination document also notes the Monte Bolca site in Italy which is not as diverse as well as the Green River formation in the western USA which does not offer the quality of specimen preservation that Messel does.”

In contrast to other fossil sites that are marine in origin – for example the deferred Devonian fish site at Miguasha – and thus widespread, Messel can be considered as the single best 'classic' locality 'snapshot' of life as it was in the Eocene. It has been identified as one of the four most significant fossil sites in the world by several senior palaeontologists and by the biologist David Attenborough. At this point in time it can reasonably be claimed that it is the 'best property of its type'.”

5.3 Conclusion

Messel Pit is adequately safeguarded today and it is clear that the Hessian Government has a serious commitment to its long-term maintenance as a site of scientific importance. Controls on excavation are in place and its disturbances to the oil shale are very limited. Although a vast amount of material has been taken from the site during former mining activities – approximately 20 million tons of rock in a century of mining activities – the volume of fossil-bearing oil shale sediments is still massive and far from being depleted.

The actions detailed in the following chapters will show the incorporation of the management objectives as predetermined by said sources.

Chapter Six: Catalogue of measures

In order to achieve comprehensive results regarding the effectiveness of this paper it is indispensable to give a detailed account of the measures which are taken and those which are projected. Every action shall be undertaken with careful accuracy, present no endangerment for the outstanding universal value (please see 1.2 and 5.1) of the Messel Fossil Pit Site and be implemented according to the legal frameworks (please see 3.2). Within the Messel Fossil Pit, three main categories of ongoing and projected measures can be distinguished:

- Maintenance (represented by the Federal State of Hesse and SGN)
- Scientific Research (represented by SGN)
- Public Relations (represented by WGM gGmbH)

These categories are divided into ongoing and projected measures:

6.1 Ongoing Measures:

6.1.1 Maintenance Measures

Although mining activities in the Messel Pit stopped in 1972, the Federal Mining Law is still to be applied since it also covers regulations for unused former mining sites. Therefore scientific excavations and safety measures are liable to the Federal Mining Law which also imposes the obligation of a main operating plan (section 55). The current main operation plan usually has a validity of a decade and has to be renewed subsequently.

In 1992 an agreement about the liability of the Federal Mining Law in the Messel Pit (as open pit) was concluded between the HMWK and the SGN (please see 3.2).

According to this agreement SGN is responsible for the open pit, e.g. the preparation of the main operating plan, it also is in charge of the water drainage, the slope reinforcement, the protection against trespassers and the former North-East Dump.

Section 21 of the Hessian Heritage Protection Act provides that the research in Messel oil shale has been liable to investigation authorisations since 1986. The research permits are given by the Office of Heritage Protection and are valid for a one year excavation period.

The SGN conducts extensive investigations and measurements on a regular basis according to the mining regulations of the Federal Mining Law. The ongoing palaeontological research and excavations within the area of the oil shale are being undertaken in accordance with the report of the 19th session of the World Heritage Committee.

Further measures undertaken include:

- In 1980, 2001 and 2004 core hole drilling took place in order to examine the geology of the soil layers of the Messel Pit (please see Section 2.3).
- Thirty inclinometers (please see Appendix 1) monitor the stability of slopes. In case of landslides, necessary steps are undertaken under the supervision of SGN. Another inclinometer drilling has been conducted in 2009.
- The drainage of the area of Messel Fossil Pit Site is done by means of installations constructed by ZAS, the landowner of public access area. The groundwater and rainwater that gathers on the pit floor is pumped away in order to stabilize the slopes of the pit.
- The water levels in the Messel Pit were defined in agreement with the nature conservation organisations and with the Hessian Office for Heritage Protection and appointed to the height of the 6th bed. To avoid the collection of water and the fluctuation of the water-level two additional water pumps have been set up to pump out accumulating rainwater (please see Appendix 1).
- In case of emergency or special activities, a backup generator is available.
- When the site was declared a World Heritage Site in 1995, a perimeter fence was erected. The fence is comprised of seven drive gates and six entry gates, which are accessible only by authorised personnel. Furthermore, there are three internal gates within the site. Visitors can only access the site with a guided tour via the entrance gate, near the information point. The SGN is in charge of the maintenance of the fence.
- The site and perimeter are kept under surveillance by foot patrols to prevent trespassing.
- The fence construction is also subject to conditions of the German Society of Nature Conservation (NABU) which ensures that wildlife in the Messel Pit is not hindered by the fence and initiated some opening for the trespassing of boars and rabbits.
- In order to control wildlife in the Messel Pit HMWK licensed hunter for the Messel Pit (and the former North-East Dump).
- Regular uprooting of plants is inevitable to ensure the accessibility for and safety of visitors and personnel.

In order to ensure the maintenance of the geological site and the sustainability of ongoing scientific research it is important to prevent regularly renaturation and uncontrolled growth.

The SGN plans to list the animal and plant species which can be found in the area of Messel Fossil Pit site.

6.1.2 Scientific Research

Regarding **excavations** at the World Heritage Site, different layers of protection apply. The buffer zone has been categorized into five so-called “geoscientific priority areas”, which ensure that scientific excavations are kept within reasonable limits and particular care is taken to protect the more valuable strata of the oil shale. The categories are as follows:

- Category I: Scientific excavations have to be strictly limited in scope.
- Category II: Scientific excavations are harmless, provided they are carried out in a sensitive way
- Category III: Preliminary surveys prior to scientific excavations have to clarify a listing under Categories I and II
- Category IV: Scientific excavations not possible (covered by deposits)
- Category V: Unsuitable for scientific exploration (not worthwhile for excavations)

Strict minimum requirements as detailed in the “Agreement on the Conduct of Paleontological Excavations in Messel Pit” have to be fulfilled by any institution engaged in scientific field-research within the WH site. The agreement details the following principal aspects: licensing, scientific purpose, documentation, inventory and storage of the findings. With the protection of Messel as a cultural and natural site, the focus in scientific excavations has shifted from extensive rescue excavations which focused on iconic species to small-scale and more accurate excavations attempting to reconstruct the whole biotope of the former Messel Lake.

- Scientific excavations by SGN, HLMD and other institutions, take place every year from spring to autumn. The excavations are undertaken by permanent excavation teams as well as excavation trainees who are mostly students.
- Ongoing scientific excavations are strictly controlled according to their quality
- In co-operation with the mining authority, the SGN surveys the stability of the slopes which is essential for the safety of visitors, personnel and the excavation teams. The excavations are implemented according to the “System of rules for paleontological excavations in the Messel Pit Fossil Site”.
- The fossils are conserved in large part according to the so-called transfer method
- After the elaborated preparation the fossils found are included in the public collections of the excavating institutions, so they can be scientifically researched, published and presented.

In connection to the meeting of the scientific advisory board of Messel Pit and in order to ensure communication amongst scientists, SGN invites colleagues who are interested or involved in Messel Pit research to the “Working meeting Messel Pit”¹⁶ which takes place annually for about 25 to 30 participants, to be detailed in Section 10.4.

In the 2006 periodic report, “State of Conservation of World Heritage Properties in Europe”, the protection arrangements of Messel Pit were considered to be highly effective.

6.1.3 Public Access and Promotion (compare 8.2)

Public Relations are one of the key issues for the management of World Heritage sites. The number of visitors to the site, the amount of tourism revenues, the behaviour, interest and understanding of visitors are all directly connected to the quality of public relations work. At the Fossil Pit, it is mainly Messel Pit World Heritage Non-Profit Limited (WGM gGmbH) which is in charge of the following important tasks:

- Responsible for the active marketing of the site. This non-profit organisation is the main contact for communicating with the public and in charge of the development of presentation concepts and the transfer of scientific findings. Moreover, it develops and provides information material such as print media (flyers and programmes) to the public (as seen in Section 1.1).
- Administrates an internet presence: the official homepage of the Messel Fossil Pit is www.grube-messel.de
- Coordinates and controls the quality and implementation of the various guided tours into the Messel Pit Site (for more details, see Section 8.1.4).
- Engages in fund-raising and in finding sponsors.

Since 2005, an info-station – the seat of WGM gGmbH – has been located next to the site entrance. Here, WGM gGmbH runs a visitor shop, offers guided tours, provides informational material and presents an animated film on the emergence of the Messel Fossil Pit.

Since 1997, a visitor observation platform with text panels about the history and the development of the Messel Pit has been on site and open to the public 24 hours a day. Since 2004, the observation platform has had 212,000 visitors.

The tasks of WGM gGmbH will be completed in close co-operation with other scientific institutions; for instance the Hessisches Landesmuseum Darmstadt, the Messel Museum Association and further co-operation partners at the municipal, regional, national and international level.

6.2 Projected Measures

6.2.1 Landscape Management

In the future, landscape management measures will be undertaken to prevent the Messel pit from becoming overgrown with vegetation.

6.2.2 Scientific Research Measures

For 2009, a password protected “Research Portal”¹⁸ is envisaged where scientists can introduce their projects on Messel Pit. This Portal is restricted to scientists who have registered with the SGN and received a personal password. This project aims to facilitate information exchange about research projects on Messel Pit. The Portal will be accessible at www.senckenberg.de

6.2.3 Public Access and Promotion

Due to difficulties experienced by visitors in finding their way to the information station, and therefore the entrance to the site, it is necessary to improve the current situation of signage to the Messel Pit. Due to complicated legal responsibilities, national, regional and municipal consultants need to co-operate in terms of developing the existing infrastructure in order to make approaching to the site easier. Such particulars would include a wider regional integration of the Messel Fossil Pit site and an improvement on the site’s relationship to other institutions such as the Messel Museum and the museums in Darmstadt and Frankfurt/Main (Please see Section 1.2). The main objective of World Heritage Messel Pit is to establish the visitor communication and information centre “ZEIT UND MESSEL WELTEN” (see below) in the vicinity of the Messel Fossil Pit. In conjunction with the development of the visitor centre, new parking areas and visitor facilities will be constructed, including the extension of the access road.

6.2.4 The Visitor Information Centre (BIZ)

When this management plan comes into force, the Visitor Information Centre “Time and Messel Worlds” (ZEIT UND MESSEL WELTEN) will still be under construction, as its inauguration is projected for 2010..²⁰ On 17 December 2008, the foundation stone was laid in the vicinity of Messel Fossil Pit. Once complete, it will offer an interactive and attractive exhibition about the topics about the site. The centre will also offer possibilities to explain the authenticity of the site to the public. To meet the scope of visitor requirements to the centre, WGM gGmbH will follow through with the following measures²¹:

²¹:

- Provide an information station at the site
- Operate a visitor shop with World Heritage relevant articles and merchandise, which respond to the needs of consumers and clients

- Develop and implement tourist products for a wide range of visitors and facilitate access to the Messel Pit and to the Visitor Information Centre by means of:
 - Development of relevant forms of media and their practical realisation (public relations, exhibitions, lectures, further education methods, internship possibilities, brochures, internet access, etc.)
 - Creation of a European communication and co-operation network with the perspective of international expansion
 - Medium-term and long-term acquisition of sponsors
- Establishment and protection of the brand “Messel Pit” for the “Time and Messel Worlds” exhibit in a European context
- Establishment and extension of best practices in "Customer proximity and natural scientific transfer qualities for the general public" amongst the European World Heritage Sites.
- Sustainable maintenance of the Messel Fossil Pit and creation of sustainable values.
- Protection of resources
- Development of a didactic approach for the mediation of the Messel Pit World Heritage Site and integration of sustainable socio-economic aspects for touristic marketing.
- Development of an appropriate World Heritage approach to communication, as well as high quality sustainable value creation to enable visitors to take part in the didactic programme.
- Conception and realisation of projects in co-operation with local and international partners.

Description of design²²:

The projected building for the Visitor Information Centre will be composed of several rooms which will span from north to south between monolithic shear walls which consist of pale faced concrete. This design imitates the basic idea of the stratifications of the oil shale and provides the visitor with the impression of wandering through different layers of earth. Construction units from west to east are light-weight walls or consist of metal and glass and divide particular spatial units which form the outer façade and thereby supporting the structure of the shear walls. The ceilings consist of reinforced concrete with a filigree design, which highlights the building's rough appearance. Only the two western layers of the one-story building consist of an upper floor, and only part of the building will include a basement.

The external dimensions of the building are 71 meters in length by 34.40 metres in width, and the building's layer structure is influenced strongly by jutties and offsets

which result in a base area of 1223 square metres. The total area of the Visitor Information Centre will extend over 32.000 square metres.

An inner courtyard of a base area of 80 square metres is integrated and bordered by exhibition rooms on three sides, and by a cinema and event hall on one side.

Integration into the World Heritage Site:

The parking places for the Visitor Information Centre are located behind a wall on the left of the main access road to the southwest of the site. Bus parking is hidden behind a tree row. Because of this, the impression of visitors to the site who come by foot, bicycle or tour bus is not disturbed by parked vehicles. The south facade of the Visitor Information Centre continues along the existing retaining wall and is flush with its height, thereby symbolically alluding to the previous development of the site's industrial history.

The different layers of the building point north with the extension of one layer breaking through a grove and serving as an observation deck of the Messel Pit. The roof scape, like the exhibition rooms, is also structured into stripes by shear walls. The roof construction is flat and is extensively covered with plants and grass. Merely one stripe serves as an accessible surface and is connected with the retaining wall by means of a platform.

The exterior area consists of three units: the "Garden of Times" which will be free of charge; the theme garden, which is directly attached to the exhibition and the "Garden of Worlds".

Interior and exhibition space:

Outside the building, visitors are directed to the entryway to the "Trail of Questions". This path is the starting point for every visitor to the site, and is useful in introducing the main topics of the exhibition.

The light and broad foyer offers an initial orientation to disburse the streams of visitors and structures the building into the public space and the exhibition space.

The exhibition starts with the cinema and a wide waiting room. The following exhibit is about volcanism and located in a darkroom to intensify the impression of this topic.

In the next room drilling cores and further objects are exhibited along the right wall. A model of an elongated drilling core is integrated into the floor.

Diffused light announces the transition to the theme gardens. From there the visitor comes back to the building into a very high light-flooded room where the topic of rain forest and its different horizontal layers are exhibited.

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Adjacent to this area, the visitor accesses the next layer which exhibits evolution and geo-diversity. Big openings enable the outside view on the original edge of the pit and its succession forest. Passing by a room where the dissection of fossils is demonstrated, the visitors enters the treasure chamber. This room is inlaid in between the concrete walls in order to highlight the characteristics of the exhibits. By means of a flexible wall, the treasure chamber can be connected to the cinema.

The circuit ends with an exhibition in the foyer about the history of industrial development at the site.

Chapter Seven: Challenges and Opportunities

7.1 Challenges

7.1.1 Tourism pressure

With a growing number of visitors, tourism pressure will also increase in the future and could possibly lead to a degradation of the site in the case of unrestricted access.

However, since the increase will be largely due to the new visitor centre, which is located in the vicinity of the site. The number of visitors descending into Messel Pit is supposed to increase only moderately and could be strictly enforced, since visitors are only granted access while participating in guided tours, which have to be booked in advance. Adverse effects could therefore only occur due to inappropriate management decisions.

7.1.2 Climate change

Climate change could possibly affect Messel Pit Fossil Site, provided that heavy rain falls in a short time period, as detailed below, become more frequent. Currently forecasts estimating the effects of climate change indicate a possible increase of such events in future.

7.1.3 Natural disasters

Heavy rainfall in short periods can cause sliding of the slopes. A measurement system has been installed which is constantly monitoring the stability of slopes, especially at Messel's single entrance for visitors, the road leading to the bottom of Messel Pit. Additionally, research has been undertaken for the evaluation of a

possible increase in slides in the future and to propose ad-hoc measures when such an event occurs.

7.2 Opportunities

All of the issues identified as opportunities possess an inherent threat, either through a withdrawal or absence of sensitive management strategies, or through an unbalanced attitude or preference of the different interests of the stakeholders. However, all policies for the mitigation of risks can be seen as an opportunity to enhance or add to the quality of the site.

New developments at the site, like the planned visitor centre, enhance the presentation of the outstanding universal value of Messel Pit to the public. By exhibiting famous examples of Messel fossils within the new building, the key partners seek to overcome the actual main weakness of the site. So far, examples and replicas of famous fossils were not visible at the site itself but could only be seen in museums, like the Senckenberg Museum in Frankfurt am Main and the Hessisches Landesmuseum in Darmstadt.

Chapter Eight: Access and Heritage Presentation

The interpretation and presentation²³ of a world heritage site is one of the main responsibilities for a site's management team. Tourism signifies the biggest challenge and possibility for a site. It covers various aspects like heritage awareness, education, promotion, public relations among others.

Therefore the challenge is to show and offer the uniqueness of the site within a clear frame and structure to the public.

8.1 Visitor Information

8.1.1 Visitor observation platform:

In 1997, a visitor observation platform (Please see Appendix 1) was opened close to the main entrance to the site. There, panels provide printed information about the history, development and significance of the Messel Fossil Pit. The platform is accessible 24 hours a day.

8.1.2 Info-Point:

On 28 September 2005 the Information Station – the seat of WGM gGmbH - opened to the public. A visitor shop and a small exhibition currently provide the necessary space for visitor management until the projected Visitor Information Centre will more appropriately meet the needs of the Messel Pit.

8.1.3 Visitor Information Centre (BIZ) (compare 6.2.4):

The initial operation of the Visitor Communication and Information Centre “Time and Messel Worlds” is projected for September 2010. It will provide a bigger visitor capacity of an envisioned 100.000 visitors annually, temporary exhibitions of fossils on loan from other museums, as well as exhibits dedicated to volcanism, climate, evolution, Geo-diversity, and landscape.

Vision

Messel Pit's complexity derives from its historical development, its value as a tourist destination, as well as its character as an archive of time dating to 47 million years ago. On this basis, it can be defined as a treasure chest of “Time and Messel Worlds”. It is the sustainable aim of WGM gGmbH to further develop and to establish the brand Messel Pit beyond local, national and European levels, and to position it internationally.

The Messel Pit enables the visitor to learn about new facets of life on earth, and to exchange this knowledge with people from all over the world.

The World Heritage Site Messel Fossil Pit is predestined to serve the public as a transfer, information, and communication centre with the following highlights:

- A diversity of topics
- A relevant scientific singularity with fascinating aesthetics in shape and colours
- A high social image
- A consistent rate of annual visitors
- The potential to explore topics aimed at connecting people
- The dedication of the Hessian State to the conservation of the Messel Pit World Heritage Site
- Integrating service based preconditions with a consideration in planning and realization of a building complex with gardens

Approach

With the presentation of Case studies and working methods as well as the highlighting of objects, the allure of the Messel Pit serves to communicate natural sciences to the visitor. By means of these topics, bridges are built to other continents and cultures and new worlds are opening up. Respect and fascination of the GEO-Nature of the world are aspects which open new perspectives to the visitors.

This is considered an appropriate World Heritage approach which demonstrates a part of UNESCO's pedagogy.

For this educational approach WGM gGmbH developed a strategy with the following basics for a young target group:

- Learning to observe
- Exploring and researching
- Gathering experiences
- Combining and constructing
- Being creative
- Realising and exchanging experiences
- Communicating experiences
- Producing enjoyment in the spot light

8.1.4 Visitor Services

World Heritage Messel Pit also coordinates and offers a considerable number of guided tours into the Messel Fossil Pit. WGM gGmbH operates according to German mining laws, hence, safety regulations need to be followed. The site provides safety instructions to all visitors, such as obligatory use of safe footwear for all visitors to the site which can be borrowed from the information centre. Furthermore, the personnel advise individuals on which type of guided tour would be appropriate according to their physical conditions. Accordingly, WGM gGmbH suggests to book and consult the staff by telephone or email prior to a visit.

The tour programme is done annually and according to the physical conditions of the visitors, their level of interest and their time capacity, the Messel Pit provides a variety of guided tours from 1 April to 1 November.

The guided tours range between one and three hours and are designed to meet different needs, such as walking or hiking tours, excavation impressions, nature tours, children expeditions, family tours, and children birthdays.

Additionally, further training of teachers is offered and tours for schools, kindergartens or groups can be booked as required.

QR-Code-Technology (Mobile-Tagging)

With the on-site installation of a new technology, the so-called “QR-code” or “Mobile Tagging” in 2007, visitors are provided with another way to obtain information about the industrial history of the site. This technology uses two-dimensional bar codes which are meant to be read and inputted by the camera of a mobile phone. These barcodes then serve as a hyperlink to additional online information. The QR-Code-Technology is aiming to awaken interest in the target group of young visitors.

8.2 Information

8.2.1 Internet Presence

The official internet presence www.grube-messel.de²⁵ of the World Heritage Messel Pit is supervised by WGM gGmbH. Online information about the Messel Pit is also provided at:

www.worldheritagesite.org/sites/messelpit.html, www.unesco.org/en/list/720 (World Heritage list).

The SGN is envisaging an Online Research Portal (Please see Section 6.2.2).

8.2.2 Publications

In order to satisfy the various interests of visitors to the site and the information station WGM gGmbH strives to offer a variety of reading material, including: publications, flyers, site maps, programmes, guided tours offers and posters are available in the information station, via internet and with co-operating partners.

8.3 Networks and International Co-operations

To achieve a high level of awareness, WGM gGmbH seeks to establish an international network of communication and co-operation.

Immediate co-operation partners include:

- World Heritage Sites in Hesse: Abbey and Altenmünster of Lorsch, Frontiers of the Roman Empire and Upper Middle Rhine Valley
- Municipality of Messel, Museum for fossils and local history Messel
- Hessisches Landesmuseum Darmstadt
- Senckenberg Society for Nature Research (SGN) and Senckenberg Museum
- Deutsche UNESCO Welterbestätten e.V.
- Regional service providers – gastronomy, hotels, regional touristic services

- European Geopark Bergstrasse-Odenwald – member of the UNESCO Global Geoparks Network
- International Cooperation for Palaeontological Research

The Messel Fossil Pit Site is the northern entrance gate to the Global Geopark Bergstrasse-Odenwald which unites a scenic and historic landscape of about 500 million years of geology. In addition to the Messel Fossil Pit, this Global Geopark cooperates with several partners such as the World Heritage site Abbey and Altenmünster of Lorsch. It is also a member of Global Geoparks Network which is considered as the highest commendation for a unique landscape and its use for tourism and which is supported by UNESCO.

Chapter Nine: Resources

9.1 Ownership and Administration

The State of Hesse is the legal owner of the Messel Fossil Pit and therefore owned by the public. The administration is jointly managed by the Senckenberg Society for Nature Research (SGN) and Messel Pit World Heritage Non-Profit Limited (WGM gGmbH). WGM gGmbH is also jointly owned by the Federal State of Hesse. The Messel Fossil Pit is administrated separately from the federal state's budget.

Finances²⁸

Hessian State benefits for the Messel Pit: 162,500 Euros annually

German Federal State and Hessian State benefits for Senckenberg:

Each 7,553,250 Euros annually

9.2 Scientific Work and operation (SGN)

The SGN conducts maintenance and conservation work on behalf of the Federal State of Hesse according to the Agreement of 26 June 1992 on the Conduct of Palaeontological Excavations in Messel Pit between the Hessian State and Senckenberg Society for Nature Research (SNG). To support operation of Messel Pit and research activities the SNG keeps a satellite research station in Messel.

Finances²⁹

Operation of the Pit and waste water treatment plant: 380,000 Euros

Security measures and slope reinforcement: 80,000 Euros

Maintenance of ways and roads: 10,000 Euros

Excavation: 12,000 Euros

Fossil treatment and Messel Pit Laboratory: 10,000 Euros

Operation of the research station in Messel: 14,000 Euros

Personnel costs for the research station in Messel: Not available at this time

Personnel:

Currently the SGN provides five scientific researchers, one preparer and six technical assistants for the Messel Pit.

9.3 Access and Promotion (WGM gGmbH)

Finances:

Since 2005, the shareholders have provided a maximum of 250,000 Euros annually for business operations (depending on the yearly decision by the State of Hesse). According to the “non-profit organisation form” revenues need to be generated.

In the 2009 financial year, an allocation of an additional 100,000 Euros for the operation of the projected Visitor Information Centre has been provided. Its operation is estimated at about 900,000 Euros per year, which will need to be generated mostly by the revenue of entrance fees and guided tours.

Personnel:

Starting in 2009, the staff of WGM gGmbH consists of six full-time positions, two seasonal positions for a period of seven months, plus one short-term position is foreseen.

For the operation of the centre, at least eight full-time positions for the service counter area including guided tours are estimated.

Chapter Ten: Implementation

The key partners are aware that the management of a World Heritage site is an ongoing process which has to be sustainable. Thus, it is important to monitor and to evaluate the implementation of the Management Plan. This is to ensure that the Messel Pit Fossil Site and its values are being effectively preserved, and that the applied strategies are responding to changing conditions. Regular monitoring and evaluation are therefore critical points in assessing the effectiveness of conservation treatments and in determining the needs for maintenance or repair. These management tools provide the necessary information for the revision of the plan, and for the continuous update of strategies and methods.

10.1 Periodic reporting

According to Article 29 of the World Heritage Convention in connection with Chapter V of the Operational Guidelines, the submission of periodic reports by the State Parties is required every six years. Periodic Reporting serves four main purposes:

- a. *“To provide an assessment of the application of the World Heritage Convention by the State Party;*
- b. *To provide an assessment as to whether the outstanding universal value of the properties inscribed on the World Heritage List is being maintained over time;*
- c. *To provide up-dated information about the World Heritage properties to record the changing circumstances and state of conservation of the properties;*
- d. *To provide a mechanism for regional co-operation and exchange of information and experiences between States Parties concerning the implementation of the Convention and World Heritage conservation”.*³¹

Periodic reporting for the World Heritage Site Messel Fossil Pit was last undertaken in 2006 by the World Heritage Committee.³² The periodic reporting document “State of Conservation of World Heritage Properties in Europe”³³ provides general information about the actual state of the Messel Fossil Pit, draws conclusions, highlights the strengths of and the threats to the site, and also sheds light on projected and recommended future actions. The main examples of the outcome were:

- The staffing situation of visitor management and visitor facilities at the Messel Fossil Pit needs improvement, e.g. the operation of a Visitor Information Centre
- Need for awareness raising
- Reactive monitoring reports were not available
- The current management system is highly effective³⁴

10.2 Reactive monitoring

In General

According to section 172 of the OP 2008, “the World Heritage Centre is to be informed of extraordinary circumstances and work which may affect the state of conservation of the World Heritage site within the framework of a reactive monitoring programme. All procedures prompted by reporting through official channels or by third party information related to action in and on World Heritage sites fall under reactive monitoring³⁵

Reactive Monitoring is the reporting by the Secretariat, other sectors of UNESCO and the Advisory Bodies to the Committee on the state of conservation of specific World Heritage properties that are under threat³⁷.

Messel Fossil Pit

Until today there has not been a reason given to conduct reactive monitoring for the Messel Fossil Pit. The scientific council is open for comments and the local population is included in decision making.

10.3 Quality assurance³⁸

For every World Heritage site "technically competent planning and procedures are critical for quality assurance and measures"³⁹. This implies that all procedures need to be "documented and monitored in detail." This is done by the key partners.

10.4 Advisory boards and commissions

The UNESCO - “Recommendation concerning the Protection, at National Level, of the Cultural and National Heritage” recommends co-operation with advisory boards for advice on and preparation with measures that may affect the heritage of a site. This is done by the scientific advisory board (Please see Section 6.1.2). This advisory board includes experts and representatives of organizations devoted to conservation of the property, as well as representatives of participating administrative bodies (For further information, see Appendix 3).

The Mining Authority is to be regularly informed about the investigation authorisations according to monument rights, and receives maps from the Hessian Federal State Office for Heritage Protection about the fixed excavation spots.

The following figure identifies the relations and co-operations between the particular advisory boards, commissions and stakeholders. A continuous and detailed report of the scientific excavations of the previous year is a precondition for the continuation of the distribution of licences for excavations.

Conclusion

List of figures

Bibliography

- Abteilung Archäologische und Paläontologische Denkmalpflege im Landesamt für Denkmalpflege Hessen, Archäologische Gesellschaft Hessen e. V. (eds.) 2001, 'Fossilien aus der Grube Messel', *Ausgrabungen und Funde in einer UNESCO-Welterbe-Stätte im Kreis Darmstadt-Dieburg*, Paläontologische Denkmäler in Hessen 12, Wiesbaden. (Thomas Keller)
- DABau Hessen 2007, "Grube Messel. Errichtung eines Besucher- und Informationszentrums", *Allgemeine Entwurfsbeschreibung*, ES-/EW-Bau 02.03.2007. (erhalten durch Frau Karin Dierkes, HMWK)
- European Geoparks Network et al. (eds.) 2001, European Geoparks Network, *European Geoparks Magazine*, issue 1, November, Eifel Tourismus (ET) GmbH, Prüm.
- European Geoparks Networks et al. (eds.) 2005, European Geoparks Network, *European Geoparks Magazine*, issue 2, Promoline S.A..
- Harms, F. J. et al. 1999, 'Erläuterungen zur Grube Messel bei Darmstadt Südhessen', *Schriftenreihe der Deutschen Geologischen Gesellschaft*, Hft. 8, Sonderdruck, Kleine Senckenberg-Reihe Nr. 31, Hannover.
- Hessisches Landesamt für Bodenforschung (ed.) 1999, 'Welterbe Grube Messel', *Karte zur Verbreitung der Messel-Formation (Mitteloazän) und der Tiefenlage der Basis des Deckgebirges (Miozän, Pliozän und Quartär) am Ostrand des Sprendlinger Horstes*, Hessisches Landesvermessungsamt, Wiesbaden. (Franz-Jürgen Harms)
- Hessisches Landesmuseum Darmstadt (ed.) 2001, 'Die Sammlung Behnke und der Ameisenbär *Eurotamandua joresi*', *Herausragende Fossilien-Funde der Grube Messel*, Offset Druck, Rostock. (Autor: Norbert Micklich)
- Hessisches Landesmuseum Darmstadt (ed.) 2007, 'Fossile Schätze aus dem UNESCO-Weltnaturerbe-Denkmal Grube Messel', *Begleitbuch zur Ausstellung Messel on Tour*, Harold Vits, Mannheim. (Wissenschaftliche Redaktion: Dr. Gabriele Gruber; Dr. Norbert Micklich)
- Hessisches Ministerium für Wissenschaft und Kunst (ed.) 2000, 'Fenster zur Urzeit', *Grube Messel – Weltnaturerbe in Hessen*, April, 2. überarbeitete und ergänzte Auflage, Bernecker Mediagruppe, Melsungen.

- Interessengemeinschaft zur Erhaltung der Fossilienfundstätte Grube Messel e. V. (ed.) 2003, 'Die Grube Messel für Kinder und andere Forscher', Druckerei Lockay, Reinheim. (Text: Anita Bagus; Gestaltung und Illustrationen: Julia Drinnenberg)
 - IUCN 1995, 'World Heritage Nomination', *IUCN Summary*, www.unesco.org, (homepage of UNESCO), accessed on 07. January 2009,
<http://whc.unesco.org/archive/advisory_body_evaluation/720.pdf>.
 - IUCN 2008, 'Natural World Heritage Nominations', *A Resource Manual for Practitioners*, Number Four, World Heritage Convention, www.iucn.org (Homepage of IUCN), retrieved 05. January 2009,
<<http://cmsdata.iucn.org/downloads/nominations.pdf>>.
 - Raab, Manfred 1996, 'Bildokumentation zur Industriegeschichte der Grube Messel', *Schriftenreihe zur Grube Messel*, Hft. 2, Roether Druck, Darmstadt.
 - Strutz, Wolfgang, Steininger, Fritz F. Prof. Dr. (eds.) 2004, 'Natur und Museum', *Bericht der Senckenbergischen Naturforschenden Gesellschaft*, März, Bd. 134, Hft. 3, Friedrich Bischoff Druckerei GmbH, Frankfurt am Main.
- UNESCO 1996, 'Convention concerning the protection of the World Cultural and Natural Heritage', *World Heritage Committee Nineteenth session, Berlin, Germany, 4-9 December 1995*, Report, [WHC-95/CONF.203/16, 31. January, retrieved 07. January 2009](http://whc.unesco.org/archive/whc95conf2031631january),
<<http://whc.unesco.org/archive/repcom95.htm#720>>.
- UNESCO 2008, 'Guidelines and Criteria for National Geoparks seeking UNESCO's assistance to join the Global Geoparks Networks', *Global Geoparks Network*, www.unesco.org (Homepage of UNESCO), retrieved 20. January 2009,
<<http://www.unesco.org/science/earth/geoparks/2008guidelinesJuneendorsed.pdf>>.
 - UNESCO 2008, 'Operational Guidelines for the Implementation of the World Heritage Convention' WHC. 08/01, www.unesco.org (Homepage of UNESCO), retrieved 06. January 2009,
<<http://whc.unesco.org/archive/opguide08-en.pdf>>.
 - Welterbe Grube Messel gGmbH 2008, 'Programmbudget 2009 der Welterbe Grube Messel gGmbH', Stand: 10. Juni 2008. (erhalten durch Frau Dr. Frey, Welterbe Grube Messel gGmbH)
 - Welterbe Grube Messel gGmbH 2009, 'Weltnaturerbe Grube Messel – Zeit und Messel Welten', *Erlebnisprogramme und Informationen 2009*, [Brochure, Druckerei Hoffmann, Messel](http://www.welterbe-grube-messel.de).

Further Reading

- Keller, T., Frey, E., Heil, R., Rietschel, S., Schaal, S. & Schmitz, M. 1991. Ein Regelwerk für paläontologische Grabungen in der Grube Messel. Paläontologische Zeitschrift 65, 221-224
- Morlo, M., Schaal, S., Mayr, G. & Seiffert, C. 2004. An annotated taxonomic list of the Middle Eocene (MP11) Vertebrata of Messel. Courier Forschungsinstitut Senckenberg 252, 95-108.
- Schaal, S. 2004 Aktuelle Übersichtskarte zur Betriebs- und Grabungsplanung in der Fossilienfundstelle Grube Messel Courier Forschungsinstitut Senckenberg 252, 207-210
- Schaal, S. Schneider, U. (Hrsg.) 1995. Chronik der Grube Messel. Verlag Kempkes, 35075 Gladenbach.
- Wedmann, S. 2005. Annotated taxon-list of the invertebrate animals from the Eocene fossil site Grube Messel near Darmstadt, Germany. Courier Forschungsinstitut Senckenberg 255, 103-110.
- Wilde, V. 2004. Aktuelle Übersicht zur Flora aus dem mitteleozänen "Ölschiefer" der Grube Messel bei Darmstadt (Hessen, Deutschland). Courier Forschungsinstitut Senckenberg 252, 109-114.

Appendices

Appendix 1: *Übersichtskarte zur Betriebs- und Grabungsplanung der Fossilienfundstätte Grube Messel*

Appendix 2: Scientific research Cooperation Partners of SGN

Appendix 3: Supervisory committee 'Scientific Advisory Board'

ANNEX 2 (please see also 8.3):

To ensure a high level of scientific research, scientists from SGN who do research on Messel cooperate with scientists of a wide range of national and international institutions, e. g. :

Fossil flora from Messel:

Royal Holloway University of London, University of Florida, Universität Göttingen, Universität Tübingen, Universität Prag

Fossil vertebrates from Messel:

University of Michigan, Ann Arbor, USA; TU Clausthal; Uni Göttingen; University of Oslo, Norwegen; Universität Bonn, Hessisches Landesmuseum Darmstadt, Landesamt für Denkmalpflege Hessen, Generaldirektion Kulturelles Erbe Rheinland-Pfalz

Geology, geophysics, geochemistry etc:

Uni Jena, Uni Bonn; HLUG, Wiesbaden; GGA, Hannover; Uni Frankfurt; Uni Göttingen; Uni Halle-Wittenberg; Uni Freiburg; Hessisches Landesmuseum Darmstadt, Uni Würzburg

Extant fauna from messel:

Arbeitsgemeinschaft Hessischer Lepidopterologen; Arbeitsgemeinschaft Hessischer Coleopterologen; Arbeitsgemeinschaft Hessischer Hymenopterologen

Fossil invertebrates from Messel:

Hessisches Landesmuseum Darmstadt; Moscow State University, Russia; National Museum Praha, Czech Republic; Institute of Biology and Soil Sciences, Vladivostok, Russia; Uni Kansas, USA; Uni Bonn; Australian National Insect Collection; Uni Göttingen

ANNEX 3 (please see also 10.4)

Supervisory Committee 'Scientific Advisory Board'

Composition:

Unabhängiger Fachwissenschaftler (Ausland)

Unabhängiger Fachwissenschaftler (In- oder Ausland)

Vertreter der Senckenbergischen Naturforschenden Gesellschaft (SGN)

Vertreter der für Denkmalschutz zuständigen obersten Landesbehörde

Vertreter der IG Messel

Vertreter der für Denkmalpflege zuständigen Landesbehörde

Vertreter eines in Messel grabenden Instituts

Vertreter der Paläontologischen Gesellschaft

Vertreter des Landesmuseums Darmstadt

Vertreter der Deutschen Forschungsgemeinschaft

Vertreter eines in Messel grabenden Instituts

Ständige Gäste

[1](http://whc.unesco.org/en/guidelines/)Operational Guidelines 2008, accessible on: <http://whc.unesco.org/en/guidelines/>

[2](#) The Committee considers that this criterion should preferably be used in conjunction with other criteria

[3](#) March 2009

[4](http://www.unep-wcmc.org/sites/wh/messel.html)IUCN summary Messel Pit Fossil Site, accessible on : <http://www.unep-wcmc.org/sites/wh/messel.html>

[5](#)Wilde, V., The green Eocene, in: Vernissage, Messel Pit Fossil Site, Heidelberg, 2005.

[6](#)Wedmann, S., Petrified Flyweights, in Vernissage, Messel Pit Fossil Site, Heidelberg, 2005.

[7](#)Micklich N, Environmental Informants of Lake Messel, in: Vernissage, Messel Pit Fossil Site, Heidelberg, 2005.

[8](#)Dieser Abschnitt ist übernommen aus: Höllwarth, M., History of the Messel Pit, in: Window to primeval times, Wiesbaden, 2000.

[9](#)The Agreement of 28 February 2003 has replaced the Agreement of 17 December 1992 on the Scientific and Cultural Use of the Messel Pit Fossil Site. The contract included the foundation of the Society for the Preservation of the Messel Pit Fossil Site (Grube Messel Verwaltungsgesellschaft mbH).

[10](http://whc.unesco.org/archive/periodicreporting/EUR/cycle01/section2/720-summary.pdf)<http://whc.unesco.org/archive/periodicreporting/EUR/cycle01/section2/720-summary.pdf>

[11](#)cf. UNESCO 1996, WHC 95/CONF 203/16

[12](http://whc.unesco.org/archive/advisory_body_evaluation/720.pdf)http://whc.unesco.org/archive/advisory_body_evaluation/720.pdf

[13](#)IUCN 1995, p. 11

[14](#)Keller, T, Frey, E, Heil, R, Rietschel, S, Schaal, S & Schmitz, M 1991: 'Ein Regelwerk für paläontologische Grabungen in der Grube Messel', *Paläontologische Zeitschrift* 65, pp 221-224.

[15](#)Compare HMWK 2000 (ed.): 'Fenster zur Urzeit'

[16](#)'Arbeitstreffen Grube Messel'

[18](#)'Forscherportal'

[19](#)(Kunden-/Kommunikations- und Informations-Zentrum "ZEIT & MESSEL WELTEN")

[20](#) Welterbe Grube Messel gGmbH 2009, p. 3

[21](#) cf. Welterbe Grube Messel gGmbH 2008

[22](#)DABau Hessen 2007, ES-/EW-Bau 02.03.2007

[23](#)cf. Ringbeck, 44

[24](#)cf. Feldkamp, Vogel

[25](#)In German language

[26](#) Some print media for the planned Visitor Information Centre is under preparation.

[27](#)cf. Welterbe Grube Messel gGmbH 2009, p. 29

[28](#)Date: 2008

[29](#)Date: 2008

[30](#) cf. Feldkamp, Vogel

[31](#)Operational Guidelines 2008, § 201

[32](#) cf. <http://whc.unesco.org/archive/periodicreporting/EUR/cycle01/section2/720-summary.pdf>

[33](#) (Cycle 1) Section II Summary

[34](#) (Cycle 1) Section II Summary

[35](#) Ringbeck, p. 38 et seq.

[36](#)Operational Guidelines 2008, par. 170

[37](#)Operational Guidelines 2008, par. 169

[38](#)Erarbeitung mit Frau Dr. Frey

[39](#) Ringbeck, p. 40