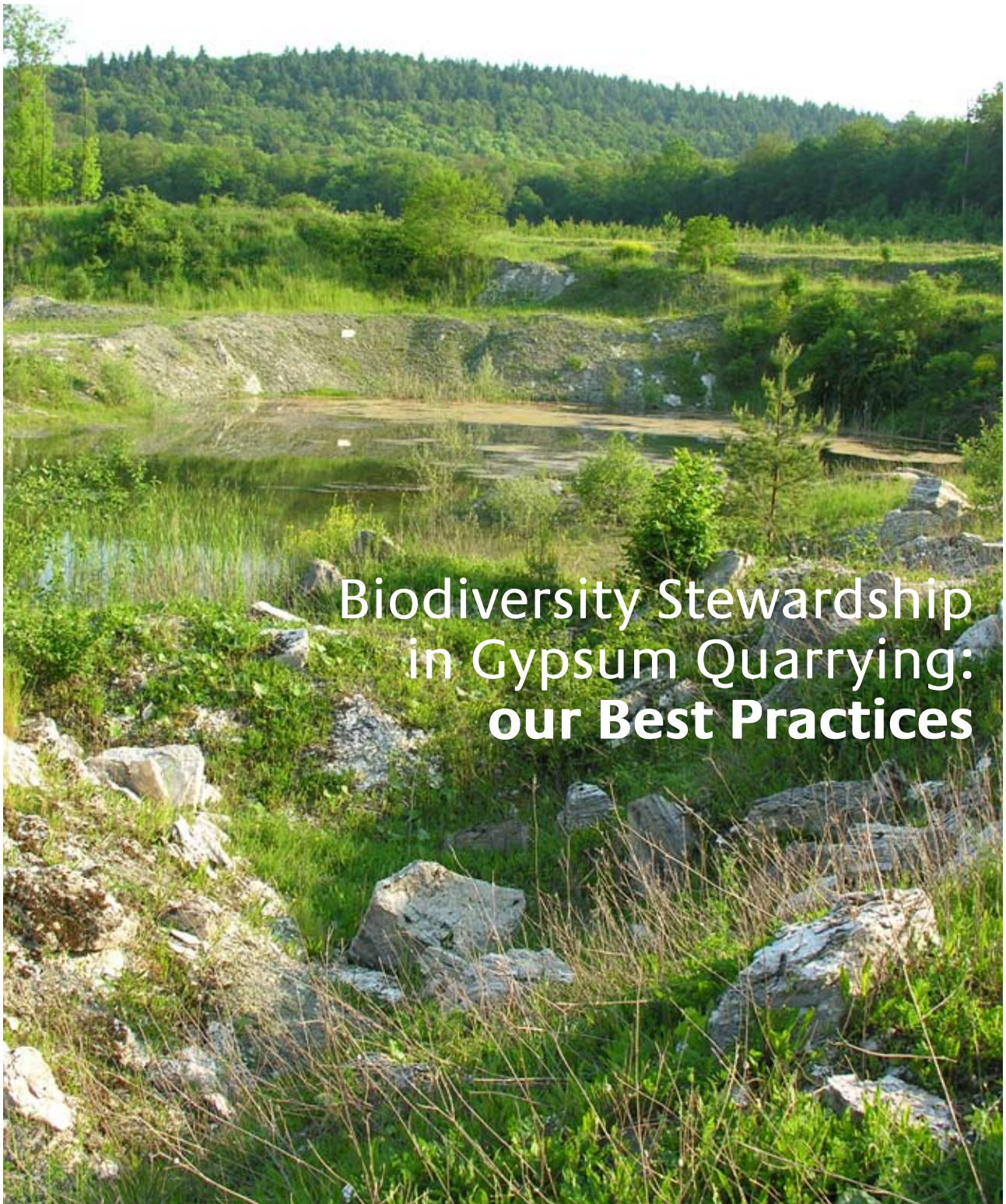
EUROGYPSUM

THE VOICE OF THE EUROPEAN GYPSUM INDUSTRY



# Biodiversity Stewardship in Gypsum Quarrying: **our Best Practices**

# Biodiversity Stewardship in Gypsum Quarrying: **our Best Practices**

# Contents

# Foreword

The beauty of Gypsum is its sustainability throughout the life-cycle of the raw material, from extraction to the end-of-life. Gypsum is an extraordinary and well-known mineral for its splendid chemical properties and endless recyclability.

For many years, The European Gypsum Industry has been addressing the societal life-cycle impacts of its processes, products and systems for enhancing a pleasant, healthy and comfortable environment.

The European Gypsum Industry has thus achieved significant results benefiting the environment and the Society as a whole in extracting in a sustainable way, in rehabilitating quarries, in enhancing biodiversity, in reducing and recycling production and construction gypsum waste.

This brochure describes the best practices implemented throughout Europe for conserving and adding value to the biological eco-systems during and after quarrying.

It also demonstrates that quarrying has a positive environmental impact on the eco-systems providing efficient solutions to the loss of biodiversity and also increasing biological diversity during and after use of the quarry. Adaptation to climate change is thus also in the heart of quarry rehabilitation.

In conclusion, we can say that quarrying can have a positive impact.

**Jean-Pierre Clavel**
President

# Introduction

Gypsum is an industrial and construction mineral eternally recyclable, quarried worldwide and used in an outstanding sustainable way in buildings. Gypsum building materials are used in all construction types (residential, non-residential, new or refurbished), ranging from complex high-tech systems to easy to install products adapted for use by the great public.

The European Gypsum Industry is one of **the few fully integrated industries within the construction products field.** The European Gypsum Industry covers the whole life-cycle of the product. The companies which extract the mineral "Gypsum" also process it and manufacture the value-added products and systems mainly used in construction. Gypsum products are eternally and fully recyclable as they always keep their natural properties after every recycle. Therefore, the gypsum companies strive to effectively recycle the products at the end of their life-cycle (demolition waste).

Industrial processes, from material extraction, product manufacturing through to product disposal, have an adverse impact upon the environment. The European Gypsum Industry aims to reduce environmental stress caused by industry whilst encouraging innovation, resource efficiency and sustained growth. It acknowledges that Industry will continue to operate and expand but it is conscious of its environmental responsibilities to have fewer burdens upon the planet.

**The European Gypsum Industry strives to avoid pollution – material and energy flows with detrimental environmental impact – by:**

- **Increased resource efficiency:** we promote clean production processes without dust; we prevent production waste or recycle it; we recycle construction waste; we implement strict health and safety policies at the workplace for better process efficiency;
- **Material substitution:** the substitute to Natural Gypsum is FGD Gypsum (Flue Gas Desulphurisation Gypsum). The rise in FGD Gypsum production is consequently slowing down the rate at which Natural Gypsum reserves are exploited. FGD Gypsum is generated by coal-fired power stations during the process designed to clean sulphur from the exhaust gases. Gypsum produced by this mean is equivalent to extracted Gypsum and satisfies the same performance and quality standards;
- **Using Gypsum Waste as a resource:** Gypsum is furthermore a raw material which can be eternally recycled to manufacture gypsum-based products (closed-loop recycling);
- **Relying on sound environmental management system:** to maintain and enhance biodiversity during and after quarrying.

In this brochure, the European Gypsum Industry describes the best practices it implements in its extraction processes to address biodiversity during and after quarrying. The European Gypsum Industry is also conscious of its responsibility to use natural resources in a sustainable way by:

- Relying on substitutes of Natural Gypsum, mainly FGD Gypsum; and
- Sharply progressing towards the recycling of Gypsum construction and demolition waste.

# Quarrying Gypsum and Increasing Biodiversity

## 1. Quarrying Gypsum in Line with Nature

The mineral Gypsum precipitated some 10-400 million years ago when sea water evaporated. From a chemical point of view, it is Calcium Sulphate Dihydrate ($CaSO4.2H2O$) deposited in sedimentary layers on the sea bed. Under high pressure and temperature or under high salinity Gypsum turns into Anhydrite ($CaSO4$).

In nature, Gypsum and Anhydrite occur as beds or nodular masses up to a few metres thick. Gypsum is mostly formed by the hydration of Anhydrite. The depth of hydration can range from the surface of the deposit down to three hundred metres, depending on temperature and pressure, topography and the structure of the deposit. Anhydrite is often mined in conjunction with Gypsum, but is comparatively limited in its technical applications. The content of calcium sulphate in a sedimentary rock varies from 70% to 100%, the rest being clay and limestone.

Gypsum is extracted from open-cast mines or underground mines using room and pillars mining methods. Gypsum is normally only screened to remove "fine particles" (mainly mudstones), then crushed and finely ground. The extraction process implies an unavoidable impact on the landscape and the natural environment. However, human activity does not necessarily mean loss of biodiversity and danger for eco-systems.

Indeed, without human economic activity, Central Europe would nowadays almost be exclusively covered with forests. This type of habitat is not particularly favouring the uptake of many species as many herbaceous plants cannot live under the leafy canopy of the trees due to the lack of light. Those conditions would also have prevailed at gypsum locations with relatively shallow soils. But as small-scale farming emerged, numerous plant species were able to migrate to the open habitats and the number of species steadily increased. Human activity resulted in a richer biodiversity. No mineral fertilizers and agrochemicals such as pesticides were available at that time. With the uptake of large scale farming and the intensive use of those chemical products, we observed a dramatic decrease in species and biodiversity. As a result of the large supply of nutrients, tall-growing species displaced low growing plants, and common species, also known as ubiquists, displaced rare plants. Human activity in that case meant a loss of biodiversity[1].

The development of a gypsum quarry creates the favorable conditions that provide habitats for photophilic and thermophilic (light and heat demanding) species, orchids, gentians and carnation because "disturbance ecology" can take place in and under:

1. Areas which are exposed to light thanks to the removal of tall-growing vegetation;
2. Oligotrophic soil conditions which are created thanks to the removal of the eutrophicated topsoil;
3. A wide variety of habitats which is obtained as a result of the different shapes of quarries.

## 2. Gypsum Soil Habitats

Gypsum soils spread over 100 million ha around the world. They are confined to arid and semi-arid climates where low precipitation prevents Gypsum from being removed by leaching. Together with the arid conditions, gypsum soils have particularly stressful physical and chemical properties for plant life. Among the adverse physical features are the presence of a hard soil surface crust, which can restrict seedling establishment, the mechanical instability of the soil material due to its lack of plasticity, cohesion and aggregation; and, in certain areas, its low porosity, which might limit the penetration of plant roots.

In semi-arid regions, the low water retention of massive gypsum soils leads to a high infiltration of rainwater, which increases water deficit during drought periods, although in some arid regions gypsum soils have been shown to display higher water availability during drought than adjacent soils. Chemically adverse features of gypsum soils are mainly related to the intense nutritional impoverishment of the soil caused by the exchange of calcium for other ions retained in the soil complex. Such stressful conditions make gypsum soils largely unsuitable for the growth of trees, and thus vegetation is composed mainly of stress-tolerant subshrubs, some scattered shrubs, herbaceous perennials and annual plants. Despite gypsum soils constituting extremely adverse habitats for plant life, they give rise to diversified set of endemic and rare plants in arid and semi-arid regions[1]. Gypsicolous flora, especially the comparatively more restricted endemic taxa, should be conserved after quarrying. Therefore, rehabilitation should aim particularly at the ecological recovery of the original environments.

1. Quarry-Environment 1/2002 Gypsum habitats and biodiversity - Gypsum extraction and nature conservation are compatible, Schmeisky H., Tränkle U., Reimann M.

Up to the beginning of the nineties, refilling, soil shaping for prevention of erosion and recultivation of quarries with regard to the after-use for agriculture and forestry were the basics of quarry restoration. But since then, the surveys showed that abandoned and even active quarries are adequate habitats for rare and endangered animal and plant species. Intensive scientific research provided new elements to enhance biodiversity in gypsum quarries with the results that natural rehabilitation became a standard next to re-cultivation which is still required by law.

## 3. The European Gypsum Industry Biodiversity Stewardship

*«A land ethic, then, reflects the existence of an ecological conscience, and this in turn reflects a conviction of individual responsibility for the health of the land. Health is the capacity of the land for self-renewal. Conservation is our effort to understand and preserve this capacity...»* (Aldo Leopold).

**Stewardship** is both about the conservation status of land, and about a conviction or "ecological conscience" which guides how companies and individuals respond to that land.

**Biodiversity** means "biological diversity" and relates to all life forms – mammals, birds, reptiles, amphibians, fish, insects and other invertebrates, plants, fungi and micro-organisms.

The conservation of biodiversity ("biodiversity conservation") together with the conservation of valued geological exposures and geo-morphological features are the essential building blocks that make up "nature conservation". Conservation involves both the protection and enhancement of existing resources, and the creation of new ones.

Biodiversity is of intrinsic value and should be maintained for its own sake as well as for its life supporting functions. Biodiversity is a vital component of well functioning ecosystems and increases their resilience. It acts as a climate buffer and carbon sink and underpins ecological security. It is a precondition for global economic prosperity and long-term human well-being.

Citizens have a moral responsibility to care for nature and a right to enjoy access to it. This improves mental and physical health and well-being. Nature has practical, cultural, emotional, scientific, recreational and economic significance. These benefits should be better understood and valued.

The European Gypsum Industry commits daily and on the ground to conservation of nature and preservation of biodiversity by bringing constructive solutions to the environmental impacts of quarrying Gypsum.

This biodiversity commitment, where feasible, entails the creation of wildlife habitats on its sites in order to contribute to the conservation of endangered or threatened species, local established species populations, as well as the creation of suitable habitats for previously displaced species. Conservation and biodiversity enhancements also play an important role in preventing additional losses and listing of species. In the field of nature conservation and quarrying, we support rational evaluation over preconception by facilitating comprehensive and sound scientific fundamental and applied research combining ecology and business needs.

The European Gypsum Industry biodiversity commitments also include key local stakeholders to share its strong belief in promoting and restoring biodiversity and habitats with the support of local stakeholders at the European Gypsum Industry operations and/or properties across Europe.

## 4. Ecological Restoration for Biodiversity Enhancement

A common misconception is that active quarries are noisy, dusty and sterile places where native plants and animals are absent. In reality, many quarries provide wildlife havens in areas where biodiversity is otherwise limited by other forms of land-use such as intensive farming. Through careful management, quarries can significantly enhance the biodiversity of an area and provide much needed habitats and refuges for wildlife.

### a. Spain – Sorbas, Almeria

| | |
|---|---|
| **Company** | Saint-Gobain Placo Ibérica S.A. |
| **Objective** | Ecologic restoration |
| **Context** | Quarry is located in area LIC |
| **Solution** | Ecologic restoration of 32 ha |
| **Result** | Annual monitoring shows possibility of protection and preservation of gypsum flora |
| **Local Partner(s)** | Yes |
| **Area Sensitivity** | Natura 2000 areas |

Organic material add

Final of restoration

Fine Stock, January 2006

Sterile Stock, January 2006

## Dump lands

### b. Spain – Sorbas, Almeria (Algypsa)

| | |
|---|---|
| **Company** | Lafarge Almeria Gypsum S.A. Algypsa, Concession Hornos Ibericos III |
| **Objective** | The restoration of the Lafarge Sorbas gypsum quarry does not only address the visual impact but also the biological impact.<br><br>Although the cicatrising potential of gypsophytes is already well known, not all the species are able to recolonise worked out quarries. Lafarge Sorbas quarry is favouring an ecological restoration based on the knowledge of the species spectrum on site, by avoiding alien species in order to reach the goal of the biodiversity enhancement |
| **Context** | The gypsum outcrop has a vascular flora with a high variety of exclusive species restricted to this kind of substrates (gypsophytes). In addition to vascular plants, there are some rarities on gypsum soils like lichens and bryophytes. The role of cryptogammic crust is almost unrivalled in other world eco-systems and, consequently, it is not surprising that they cover up to 90% of the soil, especially crystalline gypsum substrate. This is probably one of the most remarkable features of the Lafarge Sorbas quarry: the variety of its vegetal cover |
| **Solution** | Usual artificial rehabilitation results in much altered vegetal communities. This is avoided in Lafarge Sorbas quarry rehabilitation programme.<br><br>The preservation of the gypsum flora deserves priority protective strategy, so all the seeds, plantations and cuttings come from species originally from the quarry itself to avoid the risk of introducing alien species into the outcrop. The restoration of the quarry encompasses the complete system, with all relevant process and components. Thus we must bear in mind that this quarry is a mosaic habitat and that all species must be used, especially those peculiar to the gypsum outcrop and among these, those most vulnerable |
| **Result** | Works have started in January 2009. 200,000 $m^3$ of soil have been moved to create slopes from 7.5% to 27%. The used material is Gypsum (production sterile and original topsoil from the site). Over 3,000 holes and drains have already been made and several hundred plants planted and watered.<br><br>Seeds and plants picking is organised on the site according to a calendar covering the seeds ripening from April to December. A nursery, able to produce 80,000 plants a year, has been erected in collaboration with Exploitation Rio de Aguas (ERA) and the University of Almeria. This Nursery is located 30 km away from the site in order to take advantage of quality water in required quantities. Plants production is in an ongoing process based on three procedures: plants, seeds, propagation by cuttings, again all of them collected in the quarry itself |
| **Local Partner(s)** | Exploitation Rio de Aguas (F. Torralba) – Plant Biology and Ecology Department, University of Almeria (Prof J.F. Mota) - Biointegra |
| **Area Sensitivity** | The site is located within the Lugares de Importancia Comunitaria “Sierra Cabrera” (Natura 2000 Area) |

Aerial view of land moving and slope preparation – June 2009

Aerial view of land moving and slope preparation – June 2009

Holes making for planting – April 2009

Top soil add – April 2009

Top soil improvement - April 2009


Site entry with panel showing the ongoing project and partners


Seeds collection (picked on site)

Planting and watering (first summer)

Plants and seeds nursery

## 5. Equilibrating the Eco-system by Generating Diversified Biotopes in Gypsum Quarries

In order to evaluate the overall stress of gypsum quarrying on the environment, we need to consider that human activity has influenced the appearance of landscapes fundamentally since farming and settlement began. Even landscapes which appear as untouched nature can often be traced back to cultivation and the conservation of these sites will depend on human use.

Although industrial development may cause environmental negative impacts, more often gypsum quarrying creates new and diverse habitats. This is, for example, true in regions where intensive agriculture or population density has put pressure on nature, and where animals and vegetal species seek refuge in former quarries and even in well-managed quarries.

To a certain extent, quarries compensate for the disappearance of the original habitats, generating diversified biotopes for rare species of amphibians, reptiles, insects, birds, flowers and plants.

### a. Germany – Markt Nordheim, Northern Bavaria

| | |
|---|---|
| **Company** | Knauf Gips KG |
| **Objective** | Planning and quarrying in an agricultural area to connect different existing biotopes/ gypsum steppe |
| **Context** | Quarry covered by Natura 2000 during work |
| **Solution** | Technical restoration and forming morphology step by step followed by partly succession or hay sawing |
| **Result** | Different wet and dry biotope types: up to 20 red listed plant and animal species. 10 years monitoring from 2008 assigned each 2 years |
| **Local Partner(s)** | LBV e.V. Bavaria/landscape conservation organisation/regional environmental authorities |
| **Area Sensitivity** | Project situated between several protected biotopes and nature protected area adding value to the environment inside larger Natura 2000 area |

## Re-natured gypsum quarries in the north of Bavaria

The gypsum quarries of Markt Nordheim and Markt Bibart are part of the European protected area network Natura 2000

## Markt Nordheim

Planning and working quarry in an agricultural area to connect different existing biotopes/gypsum steppe

Backfilling, technical restoration and forming morphology step by step. The project is situated between several protected biotope and nature

**The results are different types of wet and dry biotopes...**

**... with up to 20 red listed plant and animal species**

**b. Germany – Markt Bibart, Northern Bavaria**

| | |
|---|---|
| **Company** | Knauf Gips KG |
| **Objective** | Implementation of different types of biotopes in a 4 ha quarry site without overburden badefill : wetlands, rainfall ponds, rocky talus and walls, dry plateaus, etc. |
| **Context** | Quarry covered by Natura 2000 after closing down |
| **Solution** | Technical restoration and forming morphology followed by succession |
| **Result** | Monitoring after 8 years shows more than 15 plant and animal species that are red listed |
| **Local Partner(s)** | - LBV e.V. Bavaria<br>- Community<br>- Forest Authorities<br>- Landscape Conservation Organisation<br>- Ecological consultant |
| **Area Sensitivity** | Located inside protected wood types of Natura 2000 – quarry area reaches high biodiversity value in the meantime – interaction with wood habitats |

2001 – Implementation of different types of biotopes in a 4 ha quarry site. Quarry covered by Natura 2000 after closing down

2003 – Located inside protected wood types of Natura 2000

2006 – In interaction with wood habitats the quarry area reaches high biodiversity in the meantime

2008 - Monitoring after 8 years shows more than 15 plants and animals species in the red list of endangered species

### c. Germany – Bavaria

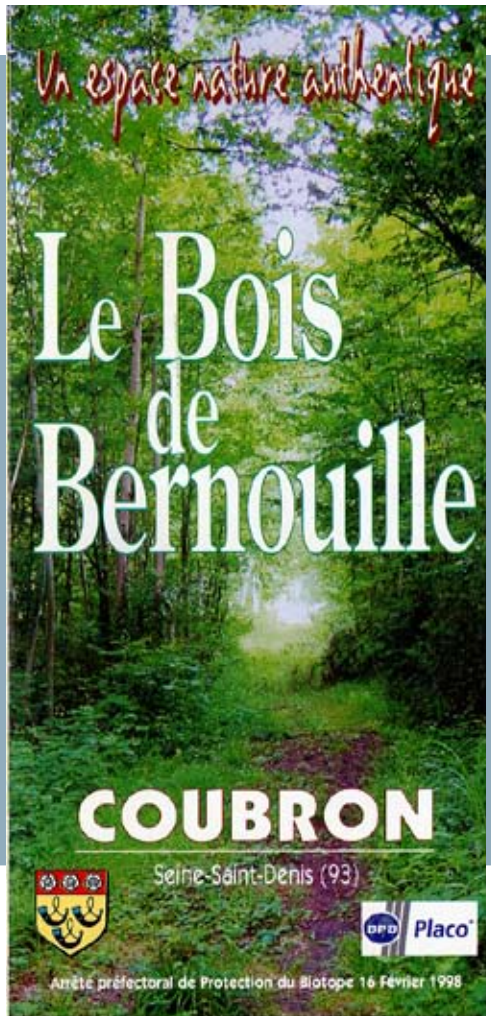
| | |
|---|---|
| **Company** | Knauf Gips KG |
| **Objective** | Biodiversity check in more than 30 gypsum quarries in Northern Bavaria |
| **Context** | Compliance with local land use plans by rehabilitation of gypsum quarries |
| **Solution** | Gypsum quarries that have been rehabilitated by succession |
| **Result** | "Man-made" high biodiversity fulfilling criteria to be included into nature protection areas |
| **Local Partner(s)** | - Knauf Gips KG<br>- Landesbund für Vogelschutz/Bayern<br>- Landschaftspflegeverband<br>- Private persons locally active in nature protection<br>- Büro für Naturschutz und Landschaftsökologie, Thüngersheim |
| **Area Sensitivity** | Some of the gypsum quarries studied have been already integrated into the Natura 2000 network. For the future an extension of protected areas by including additional abandoned quarries is foreseen because of the high value of biodiversity found in those areas |

Centaurium erythraea

Rana esculenta

### d. France – Bois de Bernouille, Seine-Saint-Denis

| | |
|---|---|
| **Company:** | Placoplatre, Saint-Gobain Group |
| **Objective** | Preserve and develop the humid environments within the Bernouille forest that are rich in rare batrachians species |
| **Context** | According to the very rich environmental value an open cut mining was considered too impacting and underground mining was chosen |
| **Solution** | An agreement with local communities and environmental associations was signed in 1997. The company funded tracks, observation points and documentation for public visits. Since 1997 the company has provided annual funds to preserve the humid sites |
| **Result** | The humid environments are preserved while frequently visited |
| **Local Partner(s)** | Local community and environmental associations |
| **Area Sensitivity** | The area is preserved by a biotope protection regulation and two years ago was declared Natura 2000 |



## 6. Preserving Natural Assets in Gypsum Quarries during and after Use

### a. Austria – Puchberg, Schneeberg

Cultural landscape and nature conservation are in many cases compatible. The planning of a new extraction site requires a precise and balanced consideration of environment and economy, thereby building value for society at large. As the extraction process is temporary, the final condition of the site is an essential part of the planning process as shown below.

| | |
|---|---|
| **Company** | Saint-Gobain Rigips Austria Ges.m.b.H. |
| **Objective** | Protection of red listed flowers |
| **Context** | Quarry is located in area with red list flowers within Natura 2000 areas |
| **Solution** | Transplantation of lawn; restore typical countryside with artificial hills and dips |
| **Result** | Annual monitoring shows possibility of protection and preservation of flora |
| **Area Sensitivity** | Natura 2000 area |

### b. Germany – Gipshütte, Hartershofen

Many rare and endangered animal plant species depend on secondary habitats as their original habitats became scarce in the landscape. Anthropogenic habitat, such as quarries, can harbour high biodiversity and provide substitute for natural habitats. Quarries can show a wide variety of habitat types for specialised species.

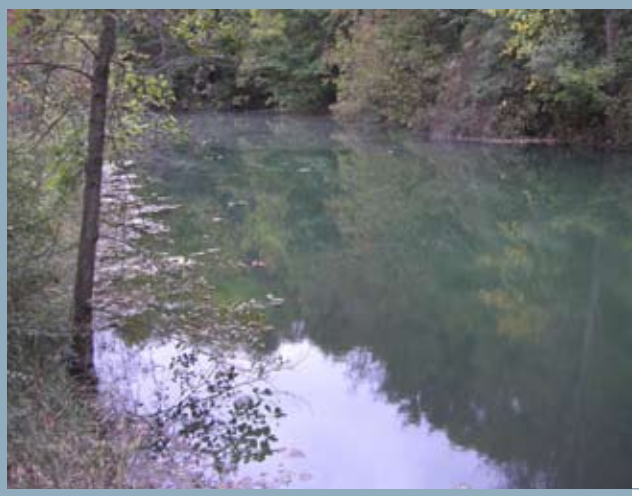
| | |
|---|---|
| **Company** | Lafarge Gips GmbH |
| **Objective** | Protection of the yellow-bellied toad (Gelbbauchunke) and crested newt (Kammolch), protected species |
| **Context** | The Gipshütte quarry is in a Natura 2000 protected area |
| **Solution** | The operation of the quarry is stopped during the spawning season of the frog, which feels very good in this karstic area |
| **Result** | Best conditions are definitively maintained for the frogs' development and breed |
| **Area Sensitivity** | Natura 2000 area |

Transplantation of lawn


**The Gipshütte quarry is in Natura 2000 protected area and an area of protection of the yellow body frog**

View from the bottom of the quarry of last area worked

Waste board used for rehabilitation of soil in the quarry



Settlement basin

### c. Italy – Monte Tondo, Borgo Rivola, Ravenna (Bats)

A quarry represents a mosaic of different habitat types. The spectrum ranges from open waters with wetland vegetation at the floor level up to exposed, xeric sites at the steep rocky slopes.

Much of the land needed for quarrying is in reality only borrowed – and the quarrying industry works hard to ensure that the loan is repaid with interest.

| | |
|---|---|
| **Company** | Saint-Gobain PPC Italia S.p.A. |
| **Objective** | Bats colony's protection |
| **Context** | Extension area and old mining tunnels under open pit quarry within Natura 2000 areas |
| **Solution** | Partial closing of old tunnel entrance and bat boards installation in the woods for quarry extension; underground climate habitat assessments, bats survey and periodical monitoring |
| **Result** | 6 bats species use of old mine tunnels as karst environment alternative; reproductions and increasing of the bats populations; 3000 specimens colony |
| **Local Partner(s)** | Local environment association |
| **Area Sensitivity** | Natura 2000 areas. Bats species are: Rhinolophus ferrumequinum, R. hipposideros, R. Euryale, Myotis myotis, M. blythii and Mniopteurus schereibersii |

Bats colony protection in old tunnels and for extension quarrying

Open pit quarry = 62,000 sqm
- 13 km (in 4 levels) of mine tunnels
- bats use of mine tunnels
- 25 bat boards in the woods

### d. France – Lantosque, Alpes maritimes

For quarrying businesses, biodiversity work means good business practice. It helps to secure licenses to operate from official authorities as well as the local communities in which quarries are located. There are potential cost savings to be gained by thinking ahead and planning for biodiversity. Biodiversity is also a useful means of engaging these communities in the industry and helping to strike a balance between social, economic and environmental needs of sustainable development.

| | |
|---|---|
| **Company** | Lafarge Platres |
| **Objective** | Protect the Iberis Linifolia |
| **Context** | Presence of a protected species in the quarry |
| **Solution** | Setting of a protection all around the plants watching on the dust all around the area |
| **Result** | The species are maintained |

Protection field of the Iberis Linifolia in the quarry area

### e. United Kingdom – Gypsum Way, Gotham

*"The preservation of biodiversity is not just a job for governments. International and non-governmental organisations, the private sector and each and every individual have a role to play in changing entrenched outlooks and ending destructive patterns of behaviour" (Kofi Annan, UN Secretary General on the 2003 International Day of Biological Diversity).*

| | |
|---|---|
| **Company** | British Gypsum, Saint-Gobain Group |
| **Objective** | Promote wildlife and nature conservation along the road verges of Gypsum Way, Gotham UK |
| **Context** | The company was approached by a local wildlife group (Notts Wildlife Trust) regarding habitat management and possible assistance. Prior to this there was no planned management and habitats were lost due to over mowing! |
| **Solution** | A simple management programme was developed in conjunction with the local wildlife group with approval of "The Wildlife Trust" and local authority (responsible for highway maintenance) |
| **Result** | Increased botanical interest adjacent former gypsum sites and next to local primary school. Species promoted include: small mammals (such as harvest mice), amphibians, birds and insects such as butterflies. Blue Butterfly plaques are present showing scheme in place |
| **Local Partner(s)** | Nottinghamshire Wildlife Trust |
| **Area Sensitivity** | Considered local interest. Benefits: promotion using "Blue Butterfly scheme" plaques |


### f. Spain – Guixers, Catalunia

Specific management objectives in the planning, design and implementation of quarry restoration will not necessarily create a high habitat quality in each case. In situations where restoration is driven by specific objectives, like slope stabilisation and erosion control, the opportunities for minor changes in design and management can avoid the impact on valuable, well-developed plant communities, and corresponding modifications will enhance nature conservation.

| | |
|---|---|
| **Company** | Knauf GmbH Guixers |
| **Objective** | Restoration of a gypsum quarry situated in the pre-Pyrenees |
| **Context** | Areas with problems concerning soil erosion |
| **Solution** | Technical restoration and forming morphology vertical to direction of slope to prevent soil erosion and sowing wild flower seed |
| **Result** | Slopes of high variability, especially high biodiversity due to amphibian population |
| **Local Partner(s)** | - Authority<br>- Local consultants |
| **Area Sensitivity** | No – In former time, only agricultural use. High worth now by "disturbance ecology" |

1999: St. Feliu quarry (Eocene – gypsum) in work

2008: situation 3 years after final restoration

After quarrying a specific soil design...


... and sowing of a grass and wild flower seed mixture – will prevent soil erosion

Birdsfoot trefoil

Viper's bugloss...

... and many amphibian species, such as Iberian Green Frog, Common Toad an Natterjack Toad populate permanent in temporary stagnant waters inside restored quarry area

## 7. Enhancing Mitigation of Climate Change and Nature Conservation in Gypsum Quarries after Use

Climate change is a growing concern to society. It already has a perceptible impact on biodiversity and notably on the geographical range, phenomenology, behaviour and genetic diversity of organisms. Climate change also exacerbates other threats to biodiversity, such as habitat fragmentation and biological invasions.

Historically, nature conservation practices have mainly relied on traditions. However, the context is changing. Human activities are exerting more and more pressure on the natural environment. In addition to habitat destruction and fragmentation, invasive species, pollution and over-exploitation, climate change now adds to the list of drivers of biodiversity loss. Particularly worrying is the fact that climate change combines and can exacerbate the effects of other threats to biodiversity. For example, species might not be able to adapt their ranges to track changing climatic conditions in a fragmented landscape or invasive alien species might find new opportunities under changing climate.

The establishment of vegetation can be initiated by planting of native trees and bushes as well as by seeding of native grasses and wild flowers. The success will be visible after predictable periods when the soil is covered by a closed vegetation, if appropriate materials are used depending on climate and sun exposure. However, directed restoration techniques are only indispensable if rapid vegetation development is required. The structural diversity can be advanced by chapping of the surface with overburden for the creation of a physical form that provides conditions favourable for the establishment of a diverse plant community. Enriching structural elements are rubble, screes and rocky slopes as well as temporary and permanent waters. These structures are habitats for numerous plant and animal species and underline the importance of quarries for the natural balance of eco-systems.

### a. France – Cormeilles, Val d'Oise

| | |
|---|---|
| **Company** | Placoplatre, Saint-Gobain Group |
| **Objective** | Rehabilitation of 110 hectares by developing various environments and generating biodiversity. The site will be after rehabilitation opened to public |
| **Context** | Gypsum mining has been operated since the 19th century and is still going on. According to the high stripping ratio the moving pit represents 15 million of cubic meters and is 100 m deep |
| **Solution** | About 8 million of cubic meters of earth moving materials were brought from outside to get the final profile. More than 70,000 trees were planted. Creeks and ponds were created to manage the water flows and let install humid areas |
| **Result** | A very scenic landscape was created including a marvelous view of Paris city. Various environments were generated and biodiversity growing with, for example, a dynamic colonisation by rare orchids |
| **Local Partner(s)** | Local community and environmental associations.<br>Through a global agreement about 50 hectares were already given to the Region Community and the remaining surfaces will be progressively given |

A view of Paris city

More than 70,000 trees were planted

**b. France – Coubron-Vaujours, Seine-Saint-Denis**

| | |
|---|---|
| **Company** | Placoplatre, Saint-Gobain Group |
| **Objective** | Rehabilitation of 120 hectares of historical open cut mining operation. Develop various environments and generate a biodiversity |
| **Context** | Gypsum mining operated since early 20th century by previous companies has let a wide area of pits and dumps |
| **Solution** | Ten years ago a global rehabilitation plan was designed. About 6 millions of cubic meters of earth moving materials were brought from outside to get the final profile. About 70,000 trees were planted within and wide area devoted to grass settled. Creeks and ponds were created to manage the water flows and let install humid areas |
| **Result** | A very scenic landscape was created and various environments led to a rich biodiversity development that should now be maintained |
| **Local Partner(s)** | Local Community and environmental associations |
| **Area Sensitivity** | The area is next to a Natura 2000 site |

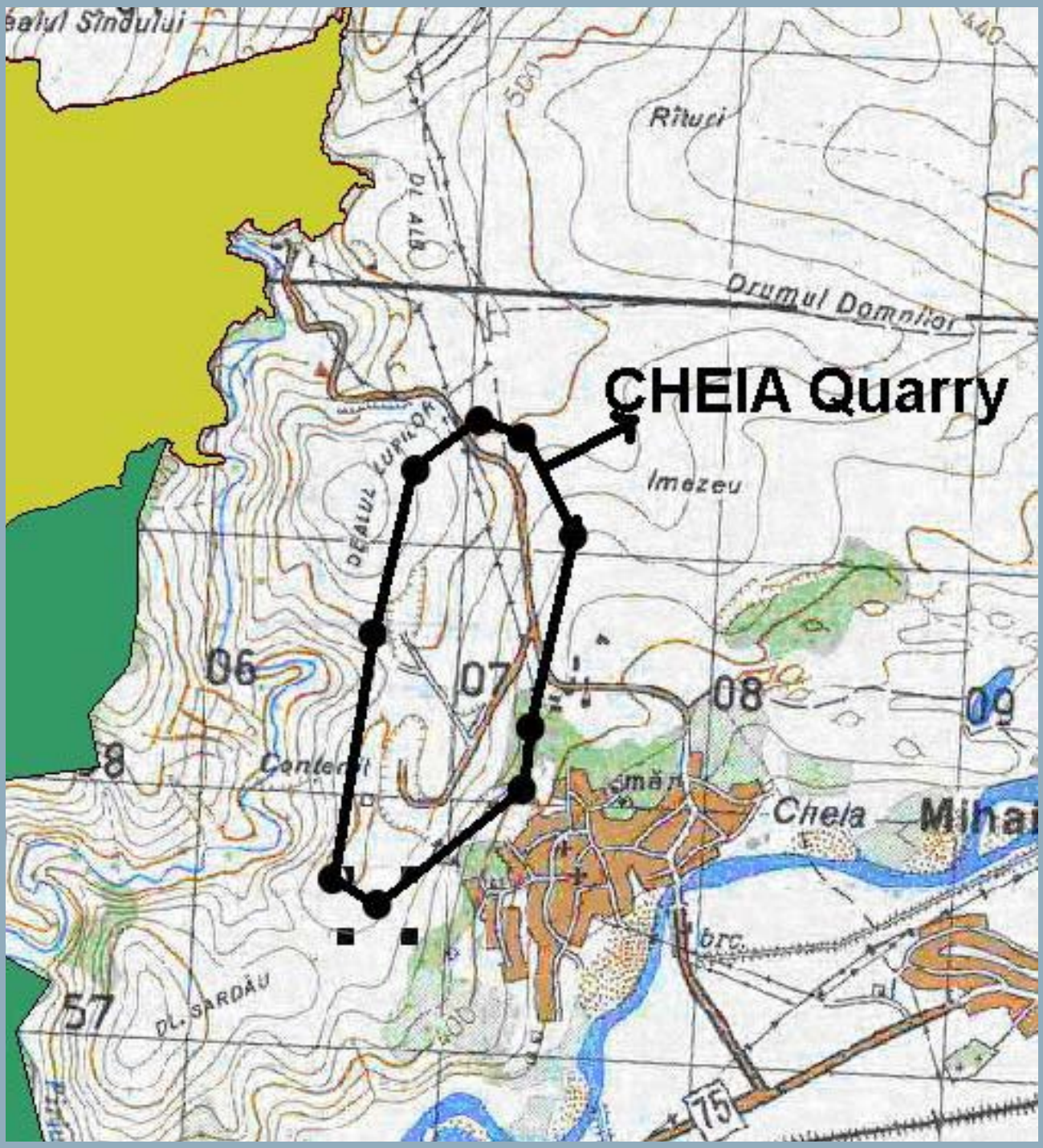
A view of Coubron Vaujours quarry rehabilitated

### c. Romania – Cluj County, Turda city

| | |
|---|---|
| **Company** | Rigips Romania SRL, Saint-Gobain Group |
| **Objective** | Reintroducing on the natural circuit of old quarry dumps. Start date: November 2008. Evaluating the impact on the birds population from Natura 2000 protected area ROSPA 0088 |
| **Context** | The objective is a part of the environment re-establishment project for the gypsum Cheia Quarry and is as well a part of the impact assessment needed in the permitting procedure |
| **Solution** | Forestation of an area of 1,3 ha and expert study |
| **Result** | The success of the forestation shall be evaluated during the autumn in 2009.<br>After 10 years, the aims of this project will be achieved, i.e.:<br>- reducing the visual impact of the quarry in the protected areas<br>- re-establishing the ecological equilibrium of the area<br>Quarry activities do not significantly affect the bird species from the Natura 2000 protected area ROSPA 0088 |
| **Local Partner(s)** | - Silvicultural authorities of Cluj County<br>- Biodiversity experts licensed by the Environmental Ministry |

## Environment re-establishing

**Objective 1:** Environment re-establishing
- Quarry area: 100,09 ha
- Actual extraction area: approx. 10 ha
- Re-establishing by forestation area: 1,3 ha
- Bedded species: Robinia Pseudacacia, Pinus Nigra, Gleditsia Triacanthos, Eleagnus Angustifolia



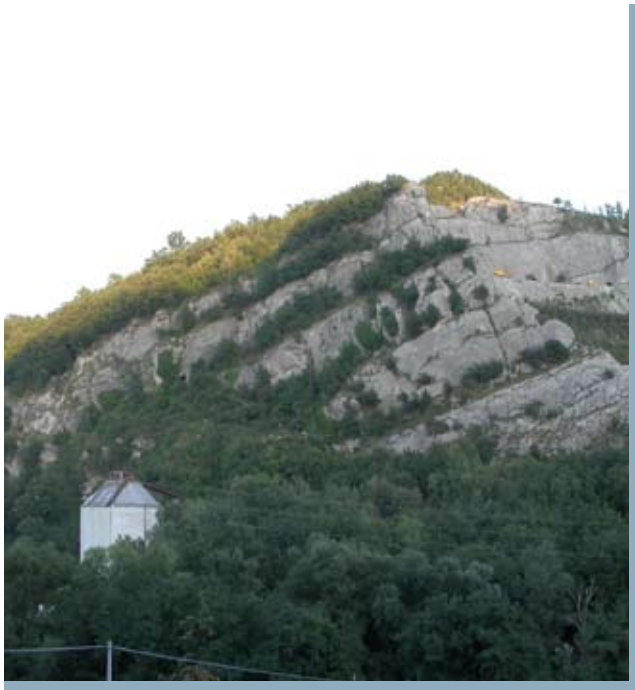

**Objective 2:** Evaluating the impact on the bird population from Natura 2000 protected area ROSPA 0088

## 8. Promotion of Cultural Heritage within Preserved Eco-systems

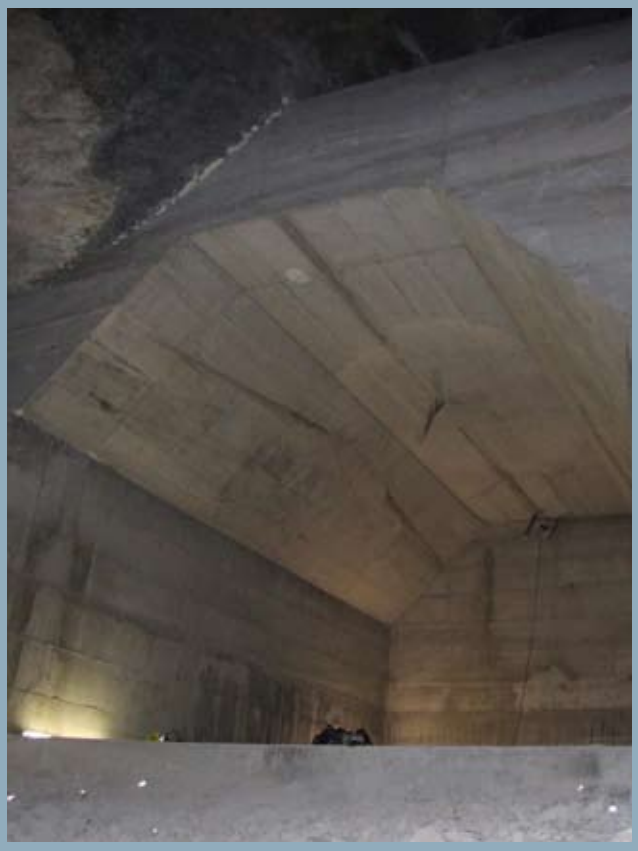
Some of the most exciting archaeological discoveries of our age have been made as a direct result of quarrying. The industry contributed in funding to ensure that archaeologists have every opportunity to uncover the secrets of the past or to make accessible to the great public the cultural heritage of Europe.

### a. Italy – Monte Tondo, Borgo Rivola, Ravenna (Re Tiberio)

| | |
|---|---|
| **Company** | Saint-Gobain PPC Italia S.p.A. |
| **Objective** | "Re Tiberio" cave recovering |
| **Context** | Rehabilitate gypsum caves inside quarry pertinence area (quarry shafts, conveyors and crushing chambers) within Natura 2000 areas and archeological sites |
| **Solution** | Put caves in safety and under monitoring programme; contract/agreement with local municipality to develop a museum and tourist visits |
| **Result** | Implement founds for archeological excavations and museum within the cave; preserve archeological and karts habitats; sustainable improvement of quarrying activity with archeological site; public community and authorities positive opinion |
| **Local Partner(s)** | - Riolo Terme Municipality<br>- Ravenna Province<br>- Emilia-Romagna Region<br>- Regional Archeological Supervisor Agency |
| **Area Sensitivity** | Natura 2000 areas (bats and karst) and archeological sites |



**The "Tana del Re Tiberio" is a natural gypsum cave with bronze age finds and bats habitats. The karst system is long 4,500 meters and the final karsic part (last 60 meters) of the caves are famous for archeological aspects**



**After years of cave recess to visitors for safety reasons, recently the property has put in safety conditions the cave with a static consolidation work under Re Tiberio cave and monitoring programme is in place to allow other future safety archeological excavations and visits**

**b. Italy – Monte Tondo, Borgo Rivola, Ravenna (Karst)**

| | |
|---|---|
| **Company** | Saint-Gobain PPC Italia S.p.A. |
| **Objective** | Carry out gypsum karst systems scientific studies |
| **Context** | Rehabilitate gypsum caves near open pit quarry and inside quarry pertinence area (quarry shafts, conveyors and crushing chambers) within Natura 2000 areas and archeological sites |
| **Solution** | PhD's; hydrogeology-geological-speleo-logical studies; caves assessments and survey |
| **Result** | Mineralogical, regional structural and speleo-genesis findings as contribution to scientific research in gypsum deposits |
| **Local Partner(s)** | University of Pavia Earth Science Depart-ment |
| **Area Sensitivity** | Natura 2000 areas (bats and karst) |

The last 60 meters of the caves because tourist interest have been given for 99 years as free availability to local Municipality to implement with public and private founds the "Re Tiberio Cave Museum" and other archeological excavations, and manage tourist visits with the intent to recover and promote the local area

## 9. Restoration of Quarries in Line with Water Protection, a Way to Mitigate Climate Change

### a. UK – Robertsbridge

| | |
|---|---|
| **Company** | British Gypsum, Saint-Gobain Group |
| **Objective** | To open up the culverted River Line enhancing habitat for wildlife and preventing possible pollution of the water course from the adjacent landfill |
| **Context** | The River Line was running in a 1km steel culvert underneath the on-site landfill. The landfill has been closed and capped for a number of years but was historically used for depositing gypsum production waste producing high-sulphate leachate and there were concerns with regards to the integrity of the culvert |
| **Solution** | Divert the River Line around boundary of landfill opening it up over most of its length |
| **Result** | Significant enhancement of wildlife habitat – notably more birds in the area |
| **Local Partner(s)** | Environment Agency |
| **Area Sensitivity** | The site is situated in an area of outstanding natural beauty and there are two sites of special scientific interest in the close vicinity of the project area |

River line 1

River line 2

### b. France – Carresse, Pyrénées Atlantiques

| | |
|---|---|
| **Company:** | Lafarge Plâtres France |
| **Objective** | Quarrying taking into account a river classified in Natura 2000 area |
| **Context** | The river goes through the quarry |
| **Solution** | Specific impact assessment study has been carried out. A protection band was foreseen before the quarry started |
| **Local Partner(s)** | Regional Direction of the Environment |
| **Area sensitivity** | Natura 2000 N° FR 7200791 |

# Conclusions

The variety of life on Earth, its biological diversity is commonly referred to as biodiversity. The number of species of plants, animals and micro-organisms, the enormous diversity of genes in these species, the different eco-systems on the planet such as deserts, rainforests and coral reefs are all part of a biologically diverse Earth. Appropriate conservation and sustainable development strategies attempt to recognise this as being integral to any approach. Almost all cultures have in some way or form recognised the importance that nature and its biological diversity has had upon them and the need to maintain it.

Greater biodiversity makes species[3] and systems[4] more resilient, while loss of biodiversity weakens them, making them more vulnerable to extinction. If a large proportion of the biosphere is invested in only a small number of species (such as humans and their associated domesticated/cultivated species), this will result in an inherently unstable system.

The biodiversity interactions and functions within eco-systems have developed and evolved over countless years. Changes that have occurred ever so slowly over time have allowed for adaptation of species and eco-system survival. But catastrophic and rapid changes can have a disastrous effect on eco-systems and biodiversity of species. Among these are natural events such as volcanic eruptions, floods, tsunamis and hurricanes. Other disruption and destruction of the natural environment and biodiversity occur through rapid and harmful human activities.

A rapidly growing concern is the impact of climate change on biodiversity. Indeed, climate change could lead to a shift in eco-systems pole-ward and upward. In tropic savannah, a move into former forest areas could occur as a well as changes in services provided by eco-systems (provisioning, water regulation, climate regulation).

Biodiversity is connected to climate change mitigation in three ways:

> Biodiversity can contribute to adaptation;

> Each climate change measure does not automatically contribute to biodiversity conservation and eco-system services maintenance (i.e. bio-fuel crop production, afforestation of biodiversity habitats);

> The biodiversity conservation sector itself needs to adapt.

We are thus faced with the challenge of finding solutions for both combating climate change and halting biodiversity loss.

The main goal to win this challenge is to preserve eco-system and ecological integrity by:

> Maintaining numerous and therefore genetically viable populations of native species within large enough, non-contaminated habitats;

> Maintaining life-supporting processes in eco-systems which maintain eco-systems (and which are expressed by the term eco-systems services)[5].

Acting in this way, biodiversity and climate change will co-benefit bearing in mind that "Biodiversity needs to be an integrated part of the general mitigation and adaptation efforts"[6] and that we cannot halt biodiversity loss without addressing climate change, as it is equally impossible to tackle climate change without addressing biodiversity loss.

The biodiversity's response to climate change will be revealed through a vast effort of time, talent and knowledge.

In front of these challenges facing our Society, the European Gypsum Industry is conscious of its responsibility to go further towards an eco-system approach, thereby contributing to shaping our customers' total quality of life – not merely in the products that we supply, but also in ensuring that we do not in the process degrade other aspects of society. Through our products and solutions, we aim to create a world that is aesthetically pleasing, biologically stable and economically productive. However, we also know that we are a small drop in an ocean.....

3 A group of related and similar living organisms that can interbreed among their own species and produce fertile offspring.
4 All the living organisms and all the non-living components of a given area interacting as a whole functional unit.
5 Green-Week 2009, slides presentation, "The potential of co-benefit approaches: contributing to both combating climate change and halting biodiversity loss", J. Plesnik, Agency for Nature Conservation and Landscape Protection of the Czech Republic, Prague.
6 Aarhus Conference, Beyond Kyoto, 2009.

## References

1. Tierwelt in Gipssteinbrüchen, BV Gips e.V., June 2006.

2. Gypsum quarries in Southern Europe – A partnership between man and nature in the Mediterranean regions, Knauf, October 2006.

3. Good Environmental Practice in the European Extractive Industry: a Reference Guide, with example from the Industrial Minerals and Gypsum Industries, published by Eurogypsum and IMA-Europe, Belgium, 2001.

4. Gypsicolous flora, conservation and restoration of quarries in the southeast of the Iberian Peninsula, J.F. Mota*, A.J. Sola, M.L. Jiménez-Sánchez, F.J. Pérez-García and M.E. Merlo, Kluwer, 2004.

5. Betreiber von Steinbrüchen sichern den Lebensraum von Uhus, BV Gips e.V., January 2007.

6. Gipstagebaue in Nordbayern und biologische Vielfalt, M. Reimann, A. Burghardt, AEM-Akad. Geowiss. Geotechn., 26 6375, Hannover, 2008.

7. Plants Living on Gypsum: Beyond the Specialist Model Sara Palacio*, A. Escudero, G.I. Montserrat-Martí, M. Maestro, R. Milla and M.J. Albert, January 2007.

8. Quarry – Environment 1/2002 Gypsum extraction and nature conservation are compatible, H. Schmeisky, U. Tränkle, M. Reimann.

9. Development of Natural Vegetation in Gypsum Quarries, Prof. Dr. H. Schmeisky, University of Kassel, presentation at the Eurogypsum Congress in Den Haag, 1998.

10. Die Naturschutzfachliche Bedeutung nordbayerischer Gipssteinbrüche im Kontext von Natura 2000, Knauf 2006.

11. Green-Week 2009, slides presentation: “The potential of co-benefit approaches: contributing to both combating climate change and halting biodiversity loss”, J. Plesnik, Agency for Nature Conservation and Landscape Protection of the Czech Republic, Prague.

# Members' list

### AUSTRIA

WKO – Fachverband Steine-Keramik
Wiedener Haupstrasse 63
Postfach 329, A-1045 Wien
Tel: (43-590) 900 3531
Fax: (43-1) 505 62 40
steine@wko.at
www.baustoffindustrie.at

### BELGIUM AND LUXEMBURG

ABLG – Association Belgo-Luxembourgeoise de Gypse /
BLVG – Belgisch Luxemburgse Gips Vereniging
Sint Jansweg 9, BE-91930 Kallo
(Belgium)
Tel: (32-3) 360 25 52
Fax: (32-3) 360 25 53
blgv.ablg@gyproc.be

### FRANCE

SNIP – Syndicat National des Industries du Plâtre
3, Rue Alfred Roll, F-75017 Paris
Tel: (33-1) 44 01 47 75
Fax: (33-1) 40 54 03 28
jmguihaume@lesindustriesduplatre.org
www.lesindustriesduplatre.org

### GERMANY

Bundesverband der Gipsindustrie e.V.
Birkenweg 13, D-64295 Darmstadt
Tel: (49-6151) 366 820
Fax: (49-6151) 366 8222
info@gips.de
www.gips.de

### ITALY

CAGEMA – Associazione dell'Industria Italiana delle Calce, del Gesso e delle Malte
Piazza G. Marconi 25,
I-00144 Roma
Tel: (39-06) 5421 0198
Fax: (39-06) 5921 533
rricci@cagema.it
www.cagema.net

### NORDIC COUNTRIES (SWEDEN, NORWAY, DENMARK, FINLAND)

NGF – Nordisk Gipspladeforening
Confederation of Danish Industries
H.C. Andersens Boulevard 18,
DK-1787 Copenhagen V
Tel: (45-33) 77 33 77
Fax: (45-33) 77 39 80
jn@di.dk

### POLAND

PSG – Polskie Stowarzyszenie Gipsu
Mokotowska 4/6,
PL-00-641 Warsaw
Tel: (48-22) 825 28 23
Fax: (48-22) 606 259 460
sekretarz@polskigips.org
www.polskigips.org

### SPAIN

Atedy – Asociación Técnica y Empresarial del Yeso
C/ San Bernardo 22, 1°,
E-28015 Madrid
Tel: (34-91) 532 63 54
Fax: (34-91) 532 94 78
gerencia@atedy.es
www.atedy.es

### THE NETHERLANDS

NBVG – Nederlandse Branche-vereniging Gips
Muntstraat 1, NL-3512 ET Utrecht
Tel: (31-6) 538 131 30
Fax: (31-30) 236 40 08
h.schinkel@wxs.nl
www.nbvg.nl

### TURKEY

Türkiye alçi üreticileri dernegi / Association of Turkish Gypsum Producers
Cinnah Caddesi 71/15
T-Cankaya Ankara
Tel: (90-312) 441 40 97
Fax: (90-312) 442 07 32
alcider@superonline.com

**UNITED KINGDOM & IRELAND**

GPDA – The Gyspum Products Development Association
PO Box 35084, UK-London NW14XE
Tel: (44-207) 935 85 32
Fax: (44-700) 606 59 50
admin@gpda.com
www.gpda.com

## EXTRAORDINARY AND ASSOCIATE MEMBERS

Eteria « 5E » A. E.
Kolokostroni 42, GR-Patras, Greece
Tel: (30-2610) 277 361
Fax: (30-2610) 224 725

Orbond Gypsum Industries Ltd
1C, Yony Netanyahu St.,
Il-Yehuda 60250, Israel
Tel: (972-3) 634 28 53
Fax: (972-3) 634 28 94
shayer@orbond.co.il
www.orbond.co.il

Peletico Ltd
P.O. Box 1326
CY-1506 Nicosia, Cyprus
Tel: (357) 248 22 65
Fax: (357) 248 17 47
peletico@peletico.com
www.peletico.com

Sival
Rua Rodrigues Cordeiro 34,
P-2400 Leira, Portugal
Tel: (351-244) 815 054
Fax: (351-244) 815 063
www.guianet.pt/profile/sival.gessos

United Gypsum Company
P.O. Box 29323, SA-Riyadh 11457 Saudi Arabia
Tel: (966) 1 208 10 08
Fax: (966) 1 208 10 08
newgypsum@hotmail.com

Published by Eurogypsum.

This brochure is for information use only. Eurogypsum assumes no responsibility for any errors or inaccuracies that may appear. No part of this brochure may be reproduced in any form without the prior written permission of Eurogypsum.

All rights reserved.

Photos by courtesy of: Knauf, Lafarge Gypsum, Saint-Gobain Gyproc.

Design et production : www.chriscom.eu

EUROGYPSUM
THE VOICE OF THE EUROPEAN GYPSUM INDUSTRY

GYPSUM
RECYCLABLE
FOR EVER
PLASTER