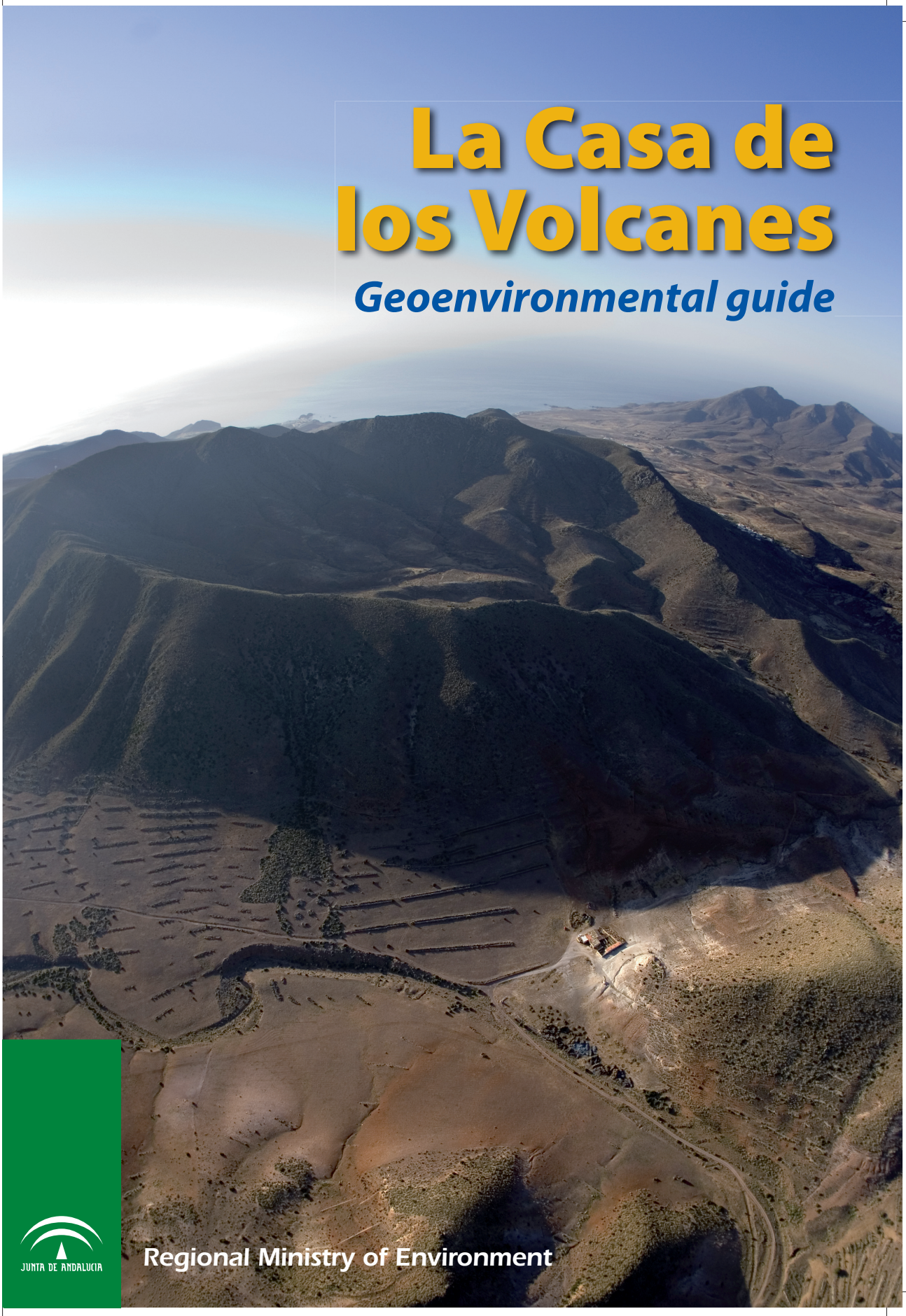
La Casa de los Volcanes

Geoenvironmental guide



JUNTA DE ANDALUCIA

Regional Ministry of Environment

The Cabo de Gata Geopark

In every sense, the Cabo de Gata Geopark comprises a unique site. Even its physical setting deserves to be termed outstanding. These exotic and evocative geological landscapes, clearly reminiscent of Africa, conceal matchless geological information for understanding and interpreting the evolutionary history of the great Mediterranean basin over the last 15 million years. This geological heritage, of such exceptional scientific interest, acquires also a new value when viewed as a cultural resource, a geo-resource fully incorporated to public use in the park. Neither should it be forgotten that this site, given its double status as a European Geopark (and therefore a member of the Global Geoparks Network under the auspices of UNESCO) and as a Biosphere Reserve site, is destined to play a crucial role in the environmental education of this generation and those to come.


Miguel Villalobos

Over the last 15 million years of the Earth's history, most of the land area of Cabo de Gata (and most of the current coastline of Almería) was covered by the Mediterranean Sea. This marine basin, lying over the ancient rocks of the Betic reliefs, saw the deposition of sediments from the erosion of the surrounding mountains. At various times this basin was the site of significant volcanic activity. Once the sea had permanently withdrawn, the


Miguel Villalobos

basin infill (its rocks and sediments) were exposed, wonderfully revealing its history and, by extension, that of the great Mediterranean Basin.


Miguel Villalobos


Miguel Villalobos

The Volcano Learning Museum offers an exceptional geological tour to explore and interpret the landscapes of the Cabo de Gata Geopark. It also helps us to know the particular geological personality of this site within the context of the extraordinary Andalusian geodiversity. Situated in Rodalquilar, the Volcano Learning Museum also offers a necessary tribute to this old mining village, whose gold mines were legendary. Like all such sites, the village had a golden age inevitably followed by the fall of the exhaustion of the mines and their closure. However, nowadays the old installations have been restored in an ambitious project of sustainable development worthy of the most renowned Nature Site of Andalusia. In fact, the old smelter itself has been set aside to house the installations for the first Centre for Geotourism and Geodiversity of Andalusia—the Volcano Learning Museum.

STATISTICS

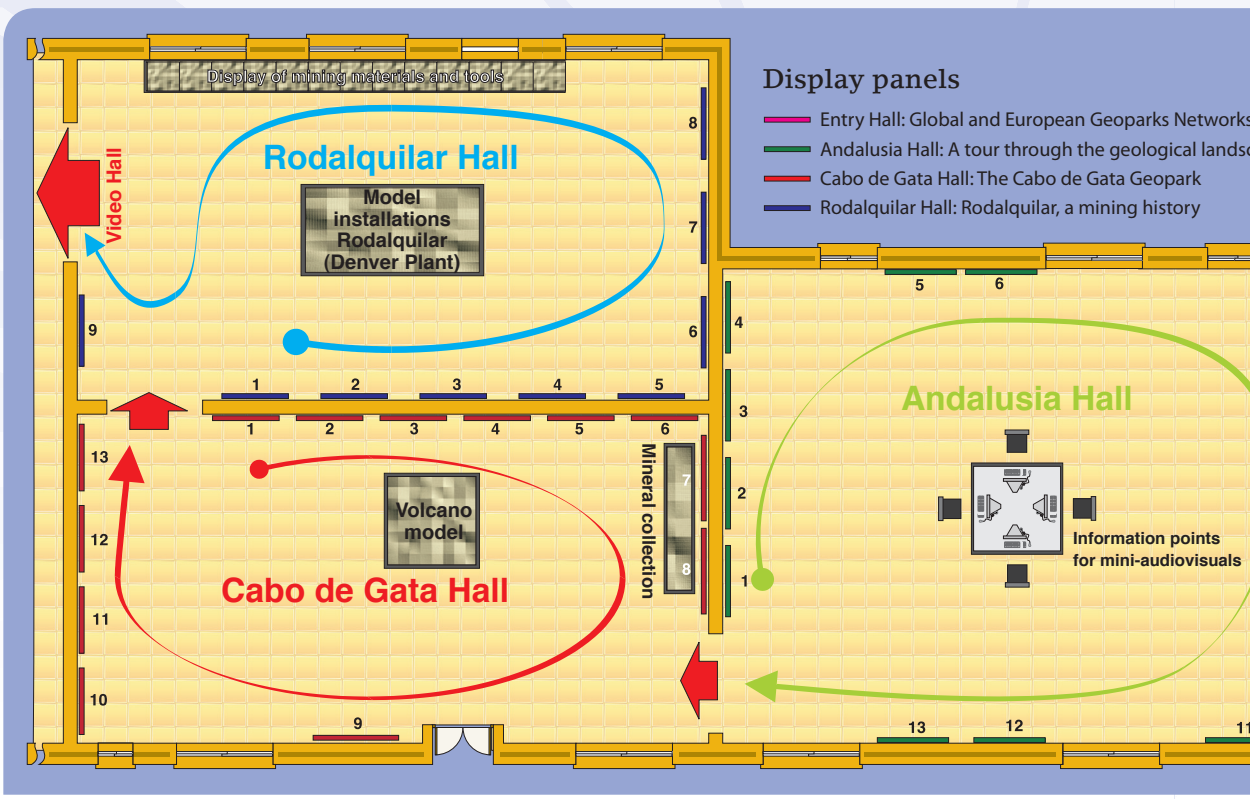
Province:	Almería
Municipalities:	Almería, Carboneras, and Níjar
Geographic location:	southeastern end of Almería province
Coordinates:	36º 51′ N; 2º 6′ W
Population:	5,220 inhabitants, spread out over 27 villages
Area:	49,512 ha, of which 12,012 ha are submarine
Elevation:	–60 m (seafloor) to 562 masl (La Serrata, Sierra de Cabrera)
Average annual temperature:	18ºC
Average annual precipitation:	200 mm
Best time to visit:	all year round
Main items of geological interest:	A mountain chain of volcanic origin, fossil marine reefs, beaches, ranks of dunes, fossil marine terraces, marine seafloors, and more.
Most important classifications:	Sea and Land Nature Park 1987 Special Protection Area for Birds 1989 Biosphere Reserve 1997 Specially Protected Area of Significance to the Mediterranean (ZEPIM) 2001 European Geopark 2001
Administered by:	Ministry for the Environment. Regional Government of Andalusia

The Volcano Learning Museum: Centre for Geotourism and Learning on Geodiversity in Andalusia

The Volcano Learning Museum has five halls set up to illustrate geoconservation of the Earth´s Memories.

Entry Hall

The entry hall in the centre, also doing duty as reception and information, has four display panels that enlighten the visitor on the concepts of geodiversity, cultural georesources, geological heritage, and geoconservation. Thus, emphasis is placed on the role that geodiversity can and should play in local strategies for sustainable rural development. More specifically, such new terms as geotourism, geoproducts, and others are introduced. These concepts are the basis of the development strategies supported by the programmes of global geoparks and European geoparks.



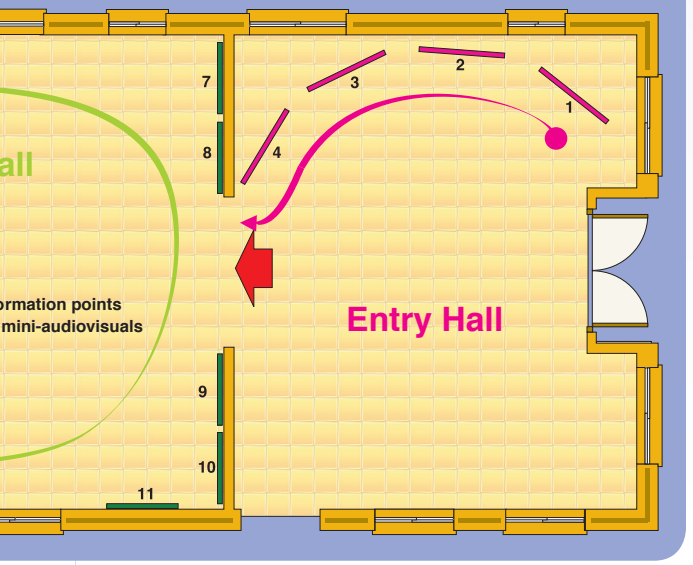
Andalusia Hall

The thirteen panels in this hall draw us into the most characteristic and most valuable geological landscapes of Andalusia. These sites range from the Atlantic marshes to the deserts and volcanoes of Almería, from the beaches and sea-cliffs of Cádiz to the high glacier-carved peaks of Sierra Nevada, from the karst landscape of the Mediterranean Subbetic middle mountain to the rolling hills of the Guadalquivir River valley, from the palaeontological records of primitive Jurassic marine fauna of the Subbetic limestones to the records of higher vertebrates in the Quaternary basins of Guadix, Baza, and Orce.

Associated with each panel is a sample of some of the rock types most representative of each geological landscape, thereby comprising a small rock 'library' illustrative of the petrological diversity of Andalusia.

There are also four spots (one equipped for the handicapped) set up with various multimedia programmes at which the visitor can get a closer view of Andalusian geodiversity by choosing from among twelve mini-audiovisual shows, each one three to four minutes long.

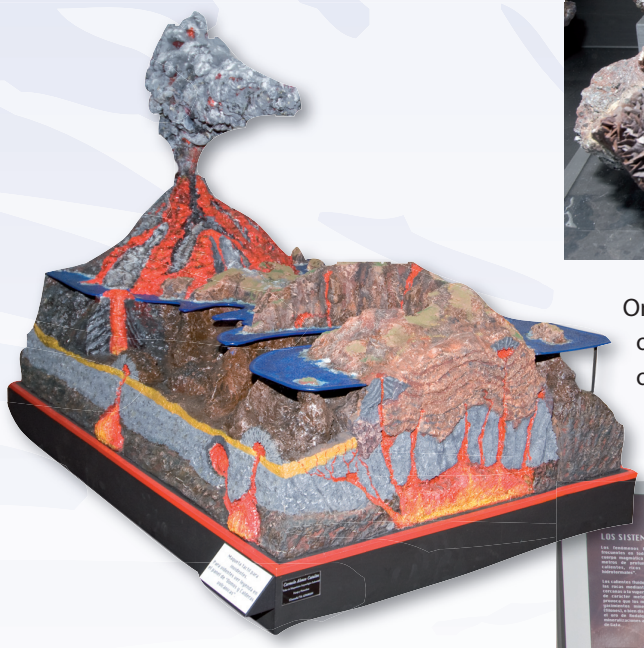
Geoparks Networks
e geological landscapes of Andalusia
ata Geopark
ning history



Cabo de Gata Hall

Thirteen panels interpret the geological history of the Geopark and its surroundings, the origin and evolution of the Volcanic Complex of Cabo de Gata, and the most noteworthy elements of the Quaternary period of the coastal plain of Cabo de Gata. All this is placed in the context of the palaeogeographic and geological evolution of Almería Bay, particularly as regards the salt lagoons, the fossilized and active dune fields, and the Tyrrhenean fossil marine terraces.

Next to each panel is a sample of rock representative of each geological landscape, thus comprising a small rock 'library' with the most characteristic rock types of the Cabo de Gata Geopark.



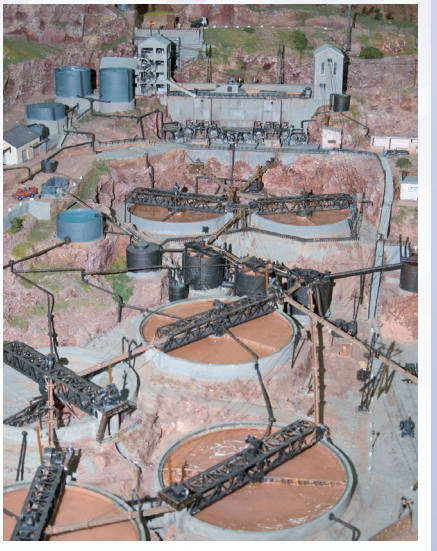
One display associated with the explanation of hydrothermal mineralization processes of the volcanic massif shows a sample of the main minerals found in Cabo de Gata.

A three-dimensional model for the blind reproduces the volcanic environment of Cabo de Gata some eight million years ago, together with two of its most typical forms—domes and calderas.

Rodalquilar Hall

This hall contains nine panels displaying aspects regarding the historical importance of the mining district of Cabo de Gata, the mining history of alunite in the 16th century, of lead and silver in the 19th century, up to the last and more modern metal-mining processes developed in the Denver Plant for gold extraction. Special attention is paid to the mining history of Rodalquilar, from its heights to its fall, as well as to the crisis and general impact of mining on the natural environment of Almería. Finally, there is a draft of the project for reusing the ancient mining installations of Rodalquilar in the context of the current management of the Nature Park.

The hall also displays a large-scale model of the Denver Plant, showing the extraction process used for gold and the function of each of its sections.



Audiovisual Hall

The Audiovisual Hall has a video that runs for 20 minutes on "Reading in the Stones," which offers a view of the scientific and cultural richness of Andalusian geodiversity and the role it is called upon to play as a source of resources or assets of great cultural value in the strategies of tourism development in the rural environment of Andalusia.

Geoparks

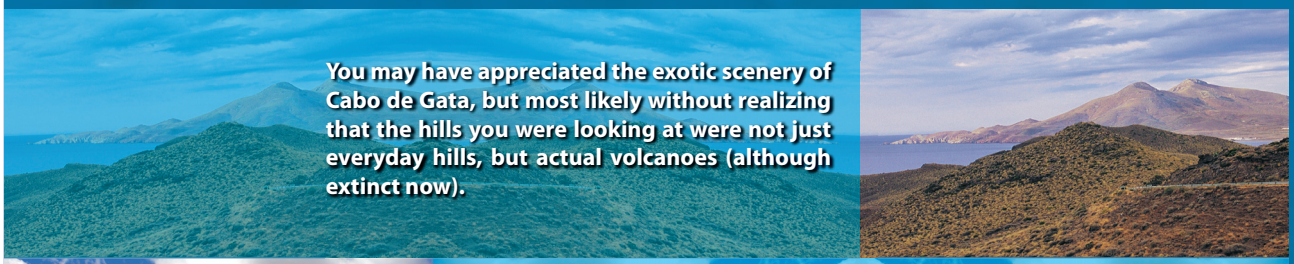
Entry Hall

A close-up of our Geodiversity

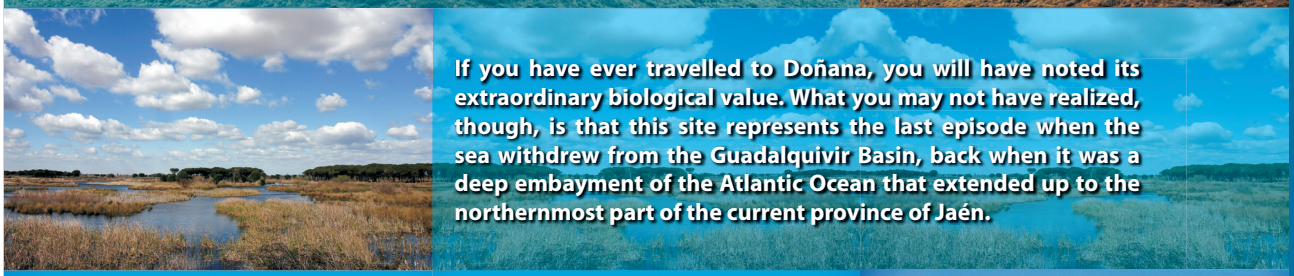
We actually see geodiversity all around us every day, without being aware of it. The natural landscapes surrounding us, and which we enjoy daily, are different from each other due to the geological elements comprising them—the rocks, deposits, and soils of each such setting are distinct just as are the geological processes modelling them and giving each terrain its own personality. In fact, all unknowing, we accommodate our lifestyles to the opportunites and resources that geodiversity offers us.

Within each cultural landscape there is always a different geological setting, and in its features are written the history of its evolution. These scenes of great beauty are there for our enjoyment during our leisure time, but they are also sites of tremendous educational and scientific value for learning about the evolution of the planet Earth and about our own evolution.

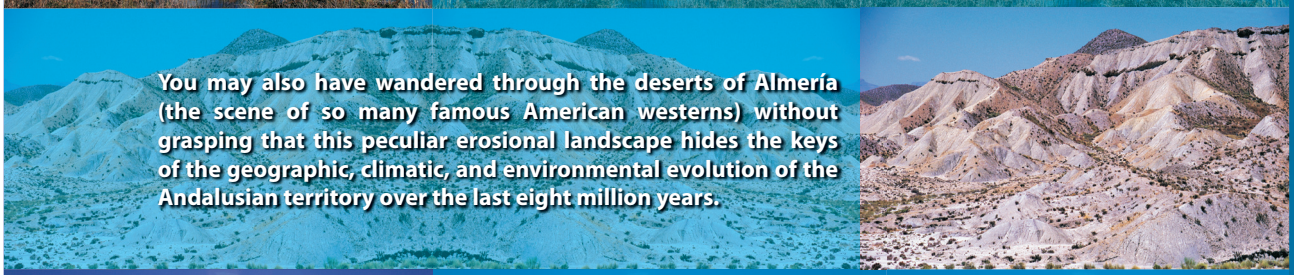
UNESCO GLOBAL GEOPARKS NETWORK



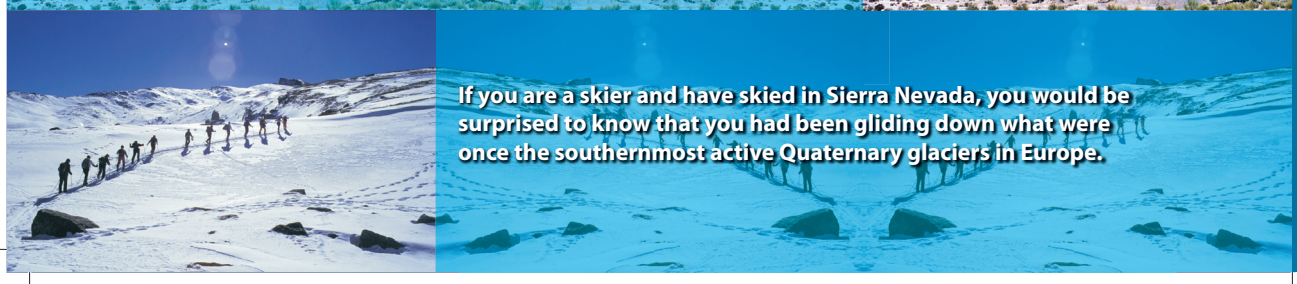
You may have appreciated the exotic scenery of Cabo de Gata, but most likely without realizing that the hills you were looking at were not just everyday hills, but actual volcanoes (although extinct now).



If you have ever travelled to Doñana, you will have noted its extraordinary biological value. What you may not have realized, though, is that this site represents the last episode when the sea withdrew from the Guadalquivir Basin, back when it was a deep embayment of the Atlantic Ocean that extended up to the northernmost part of the current province of Jaén.



You may also have wandered through the deserts of Almería (the scene of so many famous American westerns) without grasping that this peculiar erosional landscape hides the keys of the geographic, climatic, and environmental evolution of the Andalusian territory over the last eight million years.



If you are a skier and have skied in Sierra Nevada, you would be surprised to know that you had been gliding down what were once the southernmost active Quaternary glaciers in Europe.

Geoconservation: the Global Geoparks Network

The UNESCO Earth Sciences division, in one more of the initiatives developed globally for nature conservation, has set in motion an ambitious project to identify, protect, and sustainably use nature sites with relevant geological characteristics. This is known as the GEOPARKS PROGRAMME, created in 2004.

A Geopark is a protected area recognised by UNESCO as enclosing geological features and characteristics of special interest due to their educational or scientific significance, their rarity, and their beauty. These geological features are also representative of the geological history of a region and allow the evolution of its landscapes to be determined and interpreted.

A Geopark must be managed, under the auspices of UNESCO, by a national or regional environmental authority and have three essential aims.


MEYC Banco imágenes

1. Encourage scientific research


Lisa McManus

2. Promote environmental education (Marble Arch Caves & Cuilgagh Mountain Park - North Ireland)


www.resgeol04.org

3. Enable the sustainable economic development of the local territory (Reserve Geologique de Haute Provence - France)

A decade of experience in the administration of Geoparks has shown that the correctly managed geodiversity and geological heritage of a nature site can and should generate employment, advance new trends in rural tourism (GEOTOURISM), and promote local markets for innovative craftwork of interest to tourists and related to geology (GEOPRODUCTS).

The Global Geoparks Network

This network is in continual growth on five continents. In 2007, 52 Geoparks comprised the Global Network.

AUSTRIA
Eisenwurzen
Kamptal

BRAZIL
Araripe

CHINA
Danxiashan
Huangshan
Lushan
Shilin
Songshan
Wudalianchi
Yuntaishan
Zhangjiajie
Hexingten
Taining
Xingwen
Yandangshan
Fangshan
Funiushan
Jingpohu
Leiqiong
Taishan
Wangwushan

CROATIA
Papuk Geopark

CZECH REPUBLIC
Bohemian Paradise

FRANCE
Haute Provence
Luberon

GERMANY
Bergstrasse-Odenwald
Terra Vita
Vulkaneifel
Harz Braunschweiger
Mecklenburg
Swabian Albs

GREECE
Lesvos
Psiloritis

IRAN
Qeshm Island

IRELAND
Copper Coast

ITALY
Madonie
Parco del Beigua
Geological and Mining Park of Sardinia

MALAYSIA
Langkawi Geopark

NORWAY
Gea-Norvegica

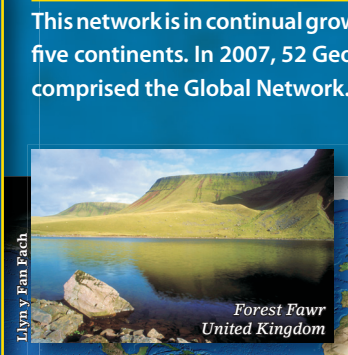
PORTUGAL
Naturtejo

RUMANIA
Hateg Country

SPAIN
Maestrazgo
Cabo de Gata
Sobrarbe
Subbéticas

UNITED KINGDOM
Abberley and Malvern Hills
Marble Arch & Cuilcagh
North Pennines
Fforest Fawr
North West Highlands
Lochaber Geopark

July 2007


Llyn y Fan Fach

Forest Fawr United Kingdom


Beijing Office

Xingwen China


Martin Ha,denteufel

Vulkaneifel Germany

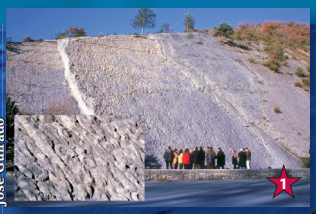

Sandro Mezzolani

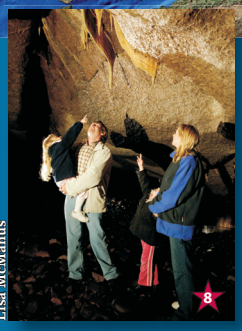
Geological and Mining Park of Sardinia Italy

The European Geoparks Network

The European Geoparks Network was created in June 2000 on the Island of Lesvos (Greece) by four member states of the European Union (France, Germany, Greece, and Spain) in the context of a LEADER II-C Programme (a programme offering European financial support to socioeconomic development in rural areas). The motivation behind it was to put into practice and exchange experiences on sustainable development in territories of great geological value based on use of those sites. The European Geoparks Network was incorporated, still as a discrete entity, in the Global Geoparks Network of UNESCO when the latter was created in 2004.

- Preserves geodiversity and geological heritage of great scientific and educational value.
- Oversees the protection and conservation of its geological heritage.
- Promotes strategies for sustainable development based on touristic use of its geological heritage.
- Shares development tools, strategies, and experiences with the other geoparks in the network.





1 Reserve Geologique de Haute-Provence - France
2 Vulkaneifel Geopark - Germany
3 Petrified Forest of Lesvos - Greece
4 Parque Cultural Maestrazgo - Spain
5 Psiloritis Natural Park - Greece
6 Terra Vita Naturepark - Germany
7 Copper Coast Geopark - Ireland
8 Marble Arch Caves & Cuilcagh Mountain Park – Northern Ireland (UK)
9 Madonie Geopark - Italy
10 Kultupark Kamptal - Austria
11 Eisenwurzen, Naturpark Steirische - Austria
12 Bergstrasse-Odenwald Geopark - Germany
13 North Pennines A.O.N.B. European Geopark – United Kingdom
14 Abberlev and Malvern Hills Geopark – United Kingdom
15 Luberon, Parc Naturel Regional - France
16 North West Highlands Geopark – United Kingdom
17 Swabian Alb Geopark – Germany
18 Harz Braunschweiger Land Ostfalen Geopark – Germany
19 Mecklenburg Ice Age Park – Germany
20 Hateg Country Dinosaurs Geopark - Rumania
21 Ente Parco del Beigua - Italy
22 Fforest Fawr Geopark – United Kingdom
23 Bohemian Paradise – Czech Republic
24 Parque Natural de Cabo de Gata-Níjar – Spain
25 Naturtejo Geopark - Portugal
26 Parque Natural Sierras Subbéticas – Spain
27 Sobrarbe Geopark – Spain
28 Gea Norvegica – Norway
29 Papuk Geopark - Croatia
30 Geological and Mining Park of Sardinia - Italy
31 Lochaber Geopark - Scotland (UK)

July 2007

Andalusian Geoparks

The Cabo de Gata–Níjar Nature Park had the privilege of being the first Andalusian nature site incorporated into the European Geoparks Network. The incorporation took place at the II Meeting for European Geoparks held on the Island of Lesvos (Greece) in October, 2001.

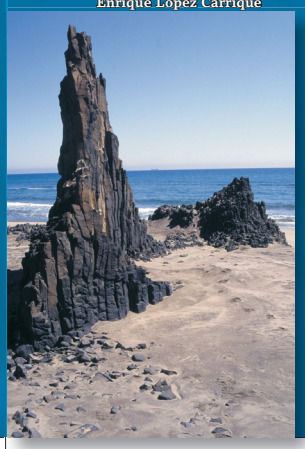
In September 2006, at the II International UNESCO Conference on Geoparks, held in Belfast (Northern Ireland), the Subbética Cordobesa Nature Park also became part of the exclusive club of the European Geoparks Network, and hence also of the Global Geoparks Network.

That moment was the culmination of a process that began in the year 2000 with a joint INTERREG project between Andalusia and the French region of Provence-Côte d'Azur; it was then consolidated on the occasion of the I Meetings on the Conservation and Sustainable Use of Geodiversity in Andalusia, held in Almería in 2004. In the intervening period, various activities and courses took place. In particular, the International Conference on Geotourism was held in Rodalquilar in 2001. All these events paved the way for the inclusion of the first two Andalusian Nature Parks in the European and Global Geoparks Networks.

1 Cabo de Gata-Níjar Nature Park


José Bayo Valdivia

The Cabo de Gata-Níjar Nature Park is a true open-air nature museum for recognising and learning about the fascinating world of volcanic phenomena. A stroll around Cabo de Gata is a walk back in time through the history of the last 15 million years of geological, geographic, and environmental evolution in the Mediterranean Basin.


Enrique López Carrique


José Guirado

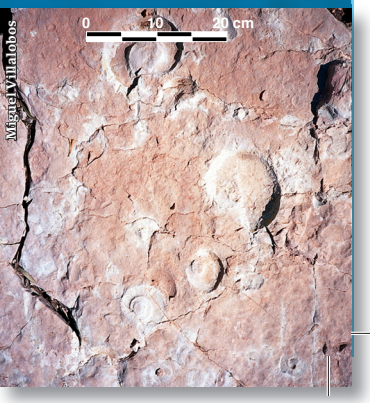

J. M. Fernández Soler

2 Subbética Cordobesa Nature Park


Miguel Villalobos


ARIPEN

The Subbética Cordobesa Nature Park offers (and also conceals) other geological treasures. This site presents one of the most beautiful landscapes representative of the characteristic karst environment of the Andalusian middle mountain, peppered with caves and pits, poljes and dolines, karren and other whimsical solution forms in limestone. The park contains unequaled palaeontological richness, especially of the ammonite fossil group, ancient shelled predecessors of squids. This location is a global reference level for ammonites.



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Geoparks

UNESCO GLOBAL GEOPARKS NETWORK

Geodiversity in Andalusia

The kindgom of dunes and marshes on the Atlantic

The Huelva Coastline


Héctor Garrido

Tinto and Odiel tidal marshes

On the coast of Huelva, littoral activity works on the soft sedimentary infill of the Guadalquivir Basin. It is therefore one of the most geomorphologically dynamic areas on the Iberian Peninsula. As a consequence, there is a whole slew of landforms produced by this littoral landshaping: beaches, seacliffs, dune fields, sand bars, sandspits, and, especially, extensive estuaries and marshes where both fluvial and littoral processes model the terrain.


Miguel Villalobos

Rompido sandspit


A. Rodríguez Ramírez

Doñana dune ranks

The beaches and seacliffs of Cádiz

Between the Guadalquivir and the Betic Cordillera


Miguel Villalobos

Conil seacliffs and beaches

Between the mouth of the Guadalquivir River and the Cape of Trafalgar, littoral dynamics have contoured the infill materials of the Guadalquivir Basin, producing a low coastline sprinkled with inlets, beaches, seacliffs, marine terraces, tombolos, sandspits, ranks of dunes, and marshes. At Carnero Point and Getares Bay, the littoral dynamics have shaped terraces and seacliffs of singular beauty out of thick, monotonous turbidite sequences (also termed flysch and consisting in alternating layers of hard sandstone beds with soft marl beds).


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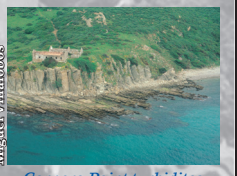
La Barrosa seacliffs


Miguel Villalobos

Carnero Point turbidites

Water landscapes

The Subbetic Karst


Miguel Villalobos

Torcal de Antequera. Málaga

The great limestone mountain chain ranging all the way from the Sierra de Grazalema (in the northern part of the province of Cádiz) to Sierra Gorda (in the western part of the province of Granada) contains the most stunning karst landscapes of Andalusia. Along this huge Subbetic axis are such emblematic karst massifs as those of Grazalema, Ubrique, Endrinal, Líbar, Blanquilla, Torcal de Antequera, and Sierra Gorda. These Jurassic and Cretaceous limestones are very vulnerable, as all carbonates are, to dissolution by water. Over the slow march of thousands, hundreds of thousands, and sometimes millions of years, rain, snow, and underground water thus become natural sculptors of impossible-looking stone landscapes.


Miguel Villalobos

Republicano Polje. Cádiz


Miguel Villalobos

Sierra Gorda doline field. Granada


Roberto Travesí
High peaks of Sierra Nevada

The Southernmost Glaciers of Europe

Sierra Nevada

Sierra Nevada, the rooftop of the Iberian Peninsula, has been shaped by one of the most implacable sculptors in nature—ice. Here were the southernmost Quaternary glaciers of Europe. Around the high peaks there developed very large, spoon-shaped cirques and snow-filled hollows. There are magnificent examples in the valleys of Lanjarón, San Juan, Valdeinfierno, La Caldera, Goterón, Vacares, Valdecasillas, Veleta, Río Seco, and Dílar, among others. The cirques grade into typically U-shaped glacial valleys. In the transitional area from cirque to valley, nearly always marked by a break in gradient, can be seen the erosional traces of the ice, such as striations and grooves. Excellent examples are visible in Río Seco and Siete Lagunas.


Ana B. Pérez
Roches moutonnées


CETURSA
Upper Corral del Veleta

Natural deserts

Almería


Enrique López Cantique
Tabernas Desert

In the first stages of its formation, the Betic Cordillera formed an extensive archipelago, with the first large land masses surrounded by sea. On the coasts of this ancient sea, and between the land masses, small sedimentary basins formed that became filled with sediments from the erosion of the surrounding land. One of these basins is the modern-day Tabernas, in Almería. After the withdrawal of the sea, occasional but torrential rainfall on the soft sediments of the Tabernas Basin have produced a system of fluvial washes. They are normally dry, but during heavy storms they sweep down huge amounts of water and sediments. The result is a spectacular and striking erosional subdesert landscape, practically unique in Europe.


Miguel Villalobos
Cerro Alfaro


Miguel Villalobos
Badlands

Extinct volcanoes and fossil reefs

Cabo de Gata


José Bayo Valdivia
Los Genoveses Inlet

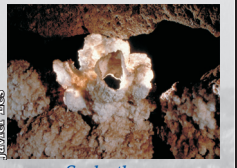
The volcanic ranges of Cabo de Gata consist of a small emerged portion of a wide area of lava beds currently underwater in the Mediterranean Sea in the zone of Alborán. The volcanic activity took place between 15 to 7.5 million years ago (during the late Miocene), in a geological period when the sea flooded vast coastal territories of Almería that are now emerged. In this marine environment, and in part due to the weakness of several large tectonic faults, deep-seated magma flowed to the surface and generated numerous volcanic edifices, mostly submarine. This unusual geological configuration enabled the formation of a unique geological landscape that is now emerged, showing the picturesque shapes and colours of its rocks.


Enrique López Cantique
Punta Baja volcanic domes

Geoparks

Javier Lees

Galleries



Javier Lees

Speleothems

Underground gypsum labyrinths
Sorbas

Javier Lees

Gypsum crystals carpeting the walls of halls and galleries

The Sorbas basin is an intermontane basin of considerable geologic interest in the study and understanding of the geographic and environmental changes along the Mediterranean coast in the last 8 million years.

At the end of the Miocene (about 6 million years ago, during the Messinian), a generalized process of desiccation in the Mediterranean Basin led to the then-marine Sorbas basin becoming nearly completely isolated, with a consequent shallowing and considerable evaporation. Under these conditions, the basin precipitated out a gypsum packet nearly 100 metres thick—the Sorbas gypsum beds. After the sea withdrew, the highly soluble gypsums were exposed to the air and the effects of rainwater, which gradually dissolved them. Thus began the formation of one of the most important gypsum karsts in the world based on its size, uniqueness, and beauty.

Miguel Villalobos

Guadix Basin fluvial deposits

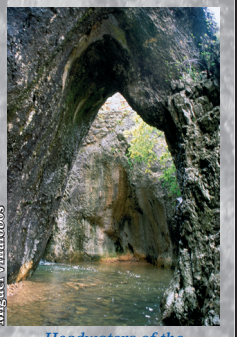
Traces of our direct ancestors
The High Plateau of Granada

What we now know as the high plateau of Granada, the counties of Guadix and Baza, is in truth the top of the sedimentary infill of an intermontane basin. From the Miocene to the present day, it has evolved from a marine basin (connected to the Mediterranean through the current Almanzora corridor), to an extensive endorrheic lake, and finally to an emerged area whose drainage system flows into the Atlantic basin of the Guadalquivir.

Its spectacular erosional subdesert landscape has hidden riches that speak not only of the geographic evolution of the Betic Cordillera, but also of our own evolution. A wide variety of sites of interest in terms of palaeontology, geoarchaeology, and palaeoecology (particularly in the locality of Orce) allow a reconstruction of the landscape as it was hundreds of thousands of years ago, probably quite similar to the modern-day African savanna.

Alfonso Arribas Herrera

Clearing dirt at a dig. Granada



Miguel Villalobos

Headwaters of the Guadalquivir River. Sierra de Cazorla. Jaén

The birth of our great rivers
Sierras de Cazorla, Segura, and Las Villas and the Sierra de Castril

Miguel Villalobos

Las Truchas Creek. Jaén

The steep Prebetic reliefs of the Sierras of Cazorla, Segura, Las Villas, and of Castril comprise a dividing line of waters draining towards the Mediterranean (Segura River) and those draining towards the Atlantic (Guadalquivir River). The geographic position and jagged topography here favour precipitation, with a yearly average of over 1500 mm. These reliefs are therefore one of the rainiest belts in the southern part of the peninsula. The permeable nature of the dominant geological formations, limestones and dolostones, combined with its high rainfall, means that almost all the features of this nature site revolve around this natural element—WATER.


Miguel Villalobos
Despeñaperros. Jaén

The panoramas of the old meseta

Sierra Morena

The third of the great Andalusian geological units, together with the Betic Cordillera and the Guadalquivir Basin, is the Hercynian Massif of the Meseta, the remains of an ancient continent already emerged 320 million years ago, long before the Betic Cordillera formed. The reliefs of this meseta comprise the Sierra Morena, nearly mythical to the Andalusians. This mountain range extends down through the southern section of Andalusia from Jaén in the east all the way to Huelva in the west. These are old metamorphic rocks, highly folded, deformed, fractured, and scoured by time; the landscapes here are much less abrupt than in the young Betic Cordillera, but are no less interesting.


Miguel Villalobos
Cerro del Hierro karst. Sevilla


Miguel Villalobos
Graptolites

Palaeontological treasures

Sierras Subbéticas de Jaén y Córdoba


Miguel Villalobos
Nava Polje. Córdoba

The Subbetic limestone moutain ranges of southern Jaén and Córdoba also offer lovely karst landscapes, as well another geological feature of great interest—their palaeontological contents. These limestone rocks formed from lime muds, a result of the accumulation of the shells and skeletons of animals on the seafloor from 200 to 25 million years ago. Some of these shells were fossilized in the geological record of the rock, turning them into an exceptionally interesting 'journal' for understanding the environmental and ecological conditions of these prehistoric sea bottoms and of their evolution over time. They are a treasure house of information.


Miguel Villalobos
Ammonite limestones of the Cañada del Hornillo. Córdoba


J. M. Tavera
Ammonites


Miguel Villalobos
Guadalquivir River valley. Sevilla

The rolling hills of the Grande River

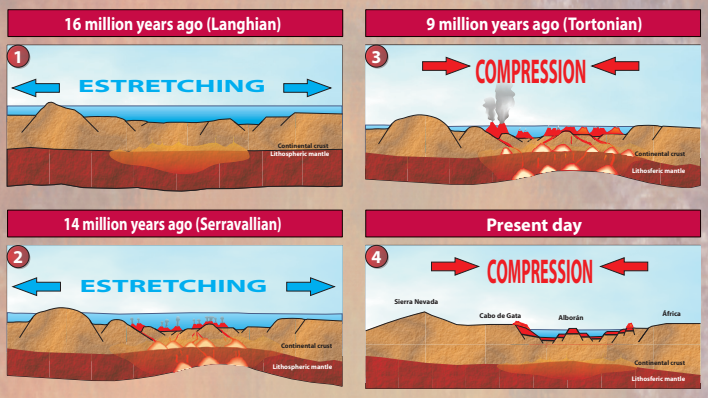
Guadalquivir

The current Guadalquivir Basin has its origins in a young (on a geological scale) marine basin that opened during the Neogene, about 20 million years ago, between two mountain chains—the old Sierra Morena to the north and the young, rising Betic Cordillera to the south. Over those 20 million years, the marine basin accumulated substantial sediments from the erosion of these two great reliefs on its margins. As the sea withdrew, rainwater began to trace the fluvial system, searching for its natural course from the land to the Atlantic and eroding, on the way, the soft infill sediments of the young basin. The result is a landscape with neverending forms characteristic of its fluvial shaping.


Miguel Villalobos
Setefilla mesa. Sevilla


Miguel Villalobos
Cliffs of Arcos de la Frontera. Cádiz

The Cabo de Gata Geopark



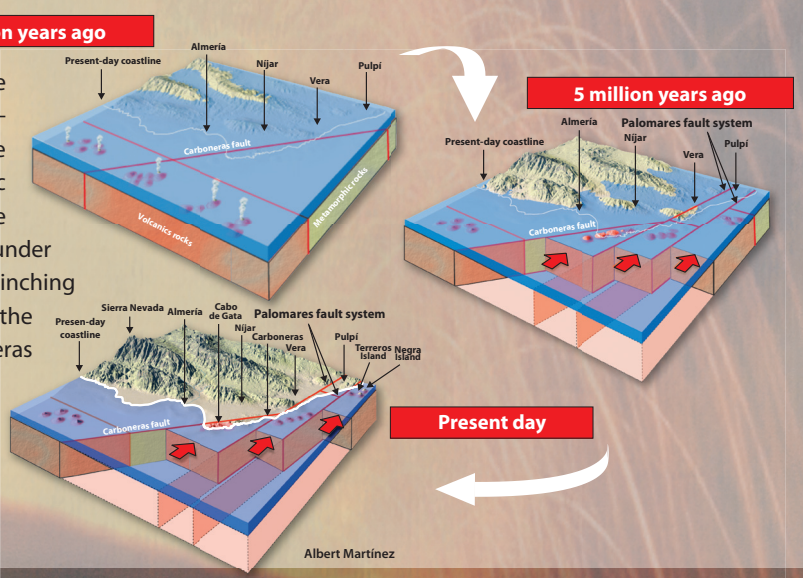
The volcanic origins of Cabo de Gata

The rocks comprising the Cabo de Gata range are quite unusual in that they are volcanic magmatic rocks. They are also very different from the metamorphic rocks of the surrounding Betic ranges and from the sedimentary rocks of the coastal depressions in the region. This difference is due to their eventful geological history, dating back at least 15 million years, when magmatic activity began in the Alborán Sea. In fact, the volcanic rocks of Cabo de Gata comprise a small emerged portion of a huge area of lava flows that extends far out under the sea.

Displacement of the Cabo de Gata volcanic complex

In Cabo de Gata there were actually two volcanic episodes or periods of volcanic activity with quite different evolutions. In fact, the rocks from the First Episode did not even form at their current site, but under the Alborán Sea, far from where they are found today. Only the rocks of the Second Volcanic Episode formed at the location (or very close by) where they can be seen now. Between these two volcanic cycles there was a very long period of volcanic inactivity typified by the quiet deposition of marine sediments on the seafloors of the basin.

The first and oldest of the two volcanic cycles began around 15 million years ago and continued up until about 9 million years ago, during which time there were various volcanic episodes. The volcanoes occupied most of the seafloors of the Alborán Sea, and therefore the volcanic rocks formed in underwater conditions of scarce explosiveness. As the volcanic episodes of this initial cycle took place, the entire crust under the Alborán Sea was slowly inching northeastwards as a result of the activity of the large Carboneras fault.

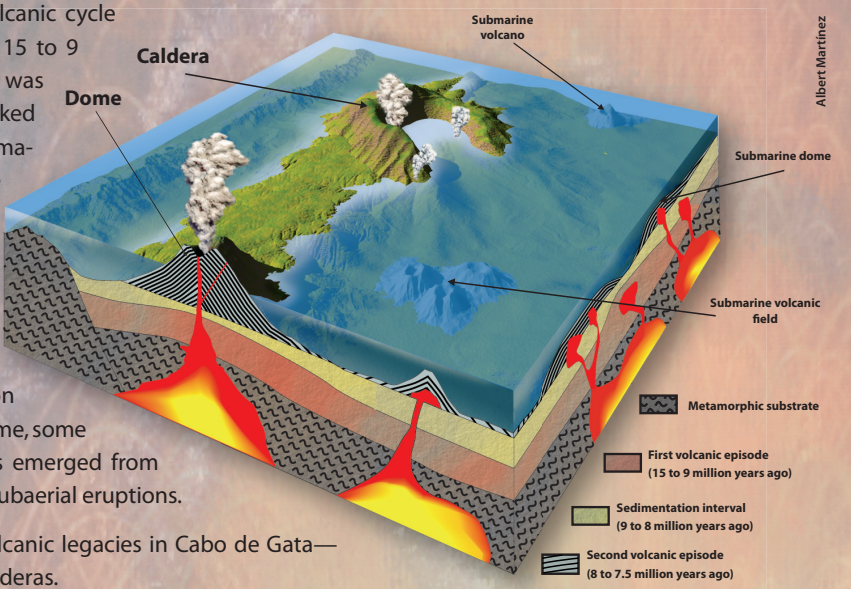


Volcanic domes and calderas of Cabo de Gata

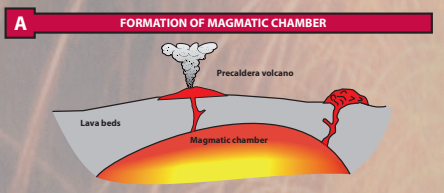
After the first great volcanic cycle in Cabo de Gata from 15 to 9 million years ago, there was a period of quiet marked by the deposition of marine sediments on the volcanic seabeds.

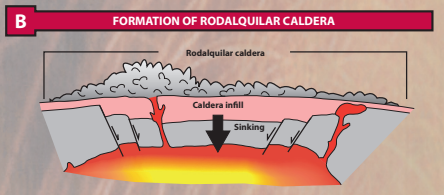
Subsequently, a second volcanic cycle began about 8 million years ago and lasted until around 7.5 million years ago. During this time, some of the volcanic edifices emerged from the sea and produced subaerial eruptions.

There are two main volcanic legacies in Cabo de Gata—volcanic domes and calderas.



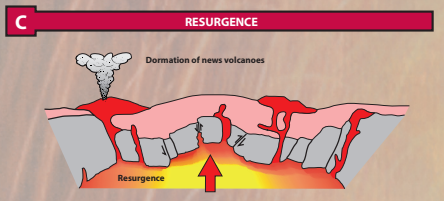
The volcanic caldera of Rodalquilar

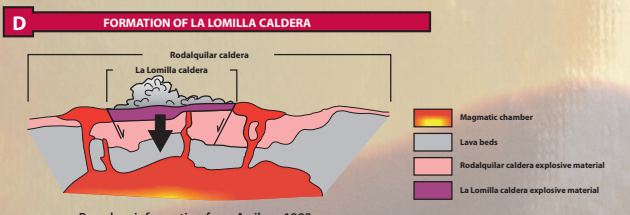




Although volcanism in Cabo de Gata was mostly submarine and relatively peaceful, those few volcanic edifices that emerged as islands had phases of much greater explosiveness, sometimes associated with the formation of volcanic calderas. The largest of these currently emerged is the volcanic caldera of Rodalquilar.

This caldera is an oval shape eight kilometres long E-W and four kilometres wide N-S. It formed 11 million years ago over older lava flows. A resurgence of activity after the formation of the Rodalquilar caldera resulted in a smaller secondary caldera forming inside the main one, called Caldera de La Lomilla.



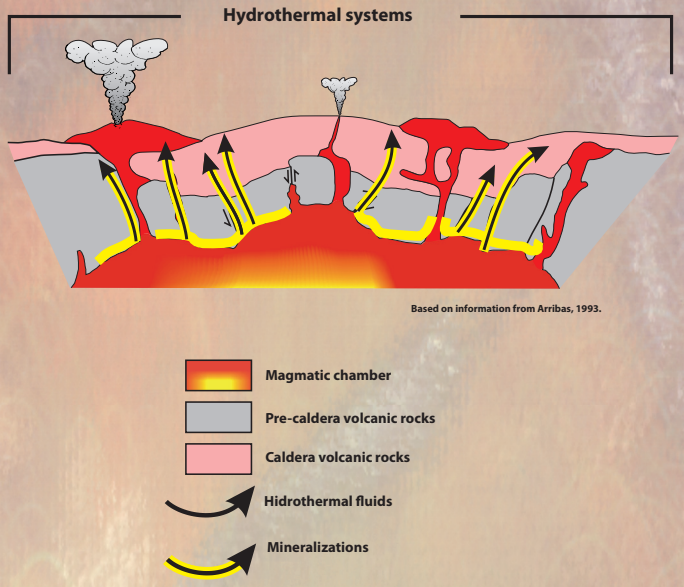


Based on information from Arribas, 1993

Hydrothermal mineral deposits

Hydrothermal systems

Hydrothermal phenomena are common processes in all volcanic areas. When a body of magma cools hundred or even thousands of metres deep, it emits extremely hot gases and fluids that are rich in minerals (termed hydrothermal fluids).



Hydrothermal fluids ascend through rocks via fissures up to zones closer to the surface, where they mix with cold meteoric waters (rainwaters). The consequent cooling causes the dissolved metals to precipitate, generating mineral deposits in cracks and fissures (veins) or dispersed throughout the rock itself. Thus was formed the Rodalquilar gold, in addition to most of the mineral deposits associated to the Volcanic Complex of Cabo de Gata.

Mineral deposits

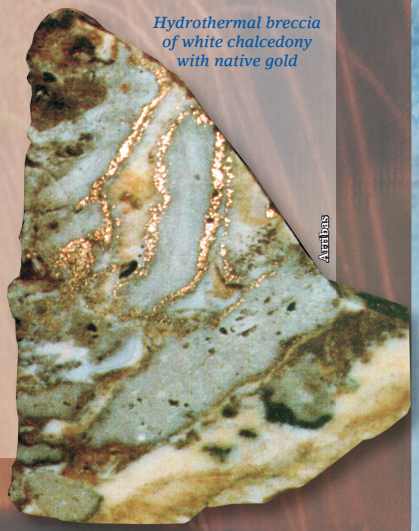
Related to the hydrothermal products, in Cabo de Gata various hydrothermal deposits have been exploited: alunite, lead and zinc sulfates (sometimes with associated copper, silver, and gold), manganese, gold, semiprecious stones (agate and amethyst), and bentonites (still mined).


J.M. Fernández

Hard-rock mining of alunite


Miguel Villalobos

Close-up of a vein of alunite and jarosite

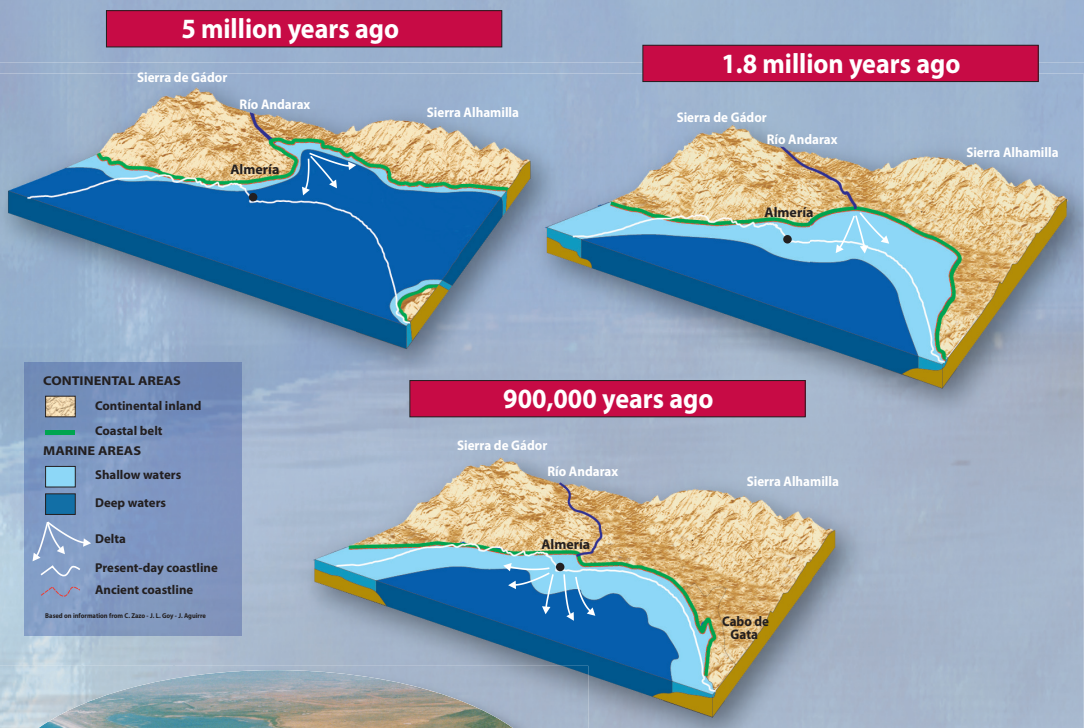

Arribas

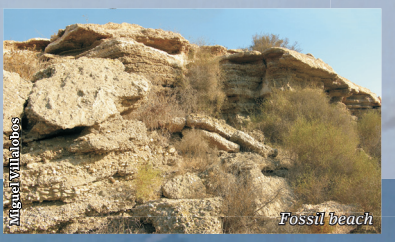
Hydrothermal breccia of white chalcedony with native gold

Almería Bay

In addition to the volcanic range of Cabo de Gata, the park has another large geological and topographic land area—its coastal plain. This plain is also of great geological value, both educationally and scientifically. The coastal plain of Cabo de Gata, in the southern sector of the park, forms part of the easternmost land of Almería Bay. For most of the last 5.2 million years, it was a huge marine sedimentary basin in which were deposited materials eroded from the surrounding land.

The sea has undergone frequent rises and falls in level, but has gradually retreated to its current position. Upon its withdrawal, the sea left exposed the sediments filling the basin. These sediments were undeformed, almost brand-new, with abundant fossil remains of animals and flora that unveil the recent history covering the last 5 million years of the Mediterranean Basin.



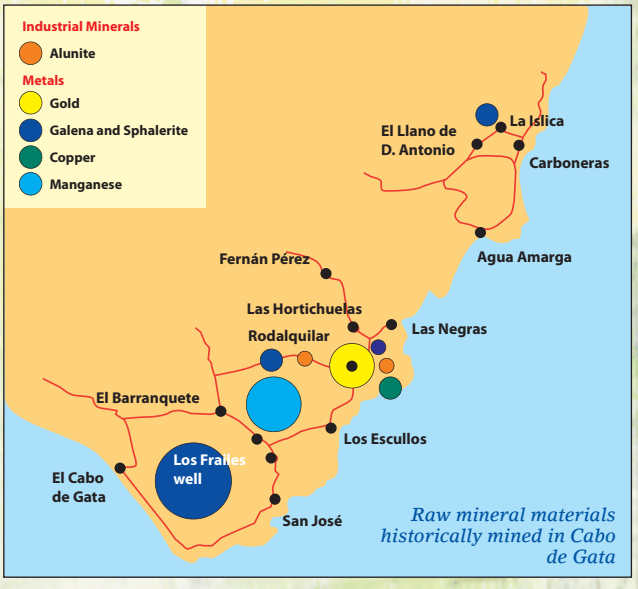


Rodalquilar: A Mining History

The Copper Age, 2.500 B.C.E. — **16th C.**

The Sierra de Cabo de Gata: 5,000 years of mining history

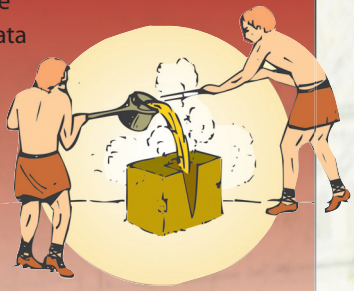
The volcanic mountain range of Cabo de Gata has been a generous source of mineral raw materials ever since the Copper Age. At different stages of its past, this region has been one of the most significant mining districts of the Iberian Peninsula. Five broad periods can be distinguished in the mining history of Cabo de Gata.

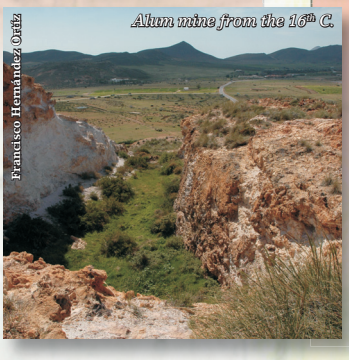


Raw mineral materials historically mined in Cabo de Gata

2,500 B.C.E.

Mining activity in the Sierra de Cabo de Gata goes back to the Copper Age. In the area of Barronal and Rodalquilar, basic tools and mining tools dating from 2,500 B.C.E. have been found.





16th Century

Alunite is first documented as being mined here in the 16th century. It was mined to obtain alum, used as a mordant (a dye-fixer in textiles) in the textile industry of the period. The European textiles market of the time was controlled by such illustrious personages as the Pope, the Medici family, and the Spanish royal family. The influence of the Cabo de Gata alums on that market last for around a century.

17th C.	18th C.	19th C.	20th C.

17th-18th C.

During the 17th and 18th centuries, mining activity in Cabo de Gata decreased due to the arrival of raw mineral materials from the colonies in the Americas, although it did not completely disappear. Mining continued in amethysts and other semiprecious stones.


Francisco Hernández Ortiz
Amethyst vein

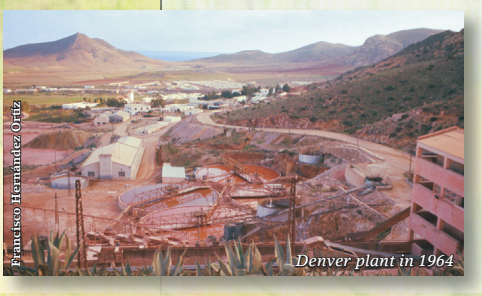
19th Century

In the 19th century, interest in the Cabo de Gata mines was reborn. Intensive mining of lead and silver began, with lesser amounts of copper and zinc. The mining installation clustered in two areas of the current park: around San José and in Rodalquilar.


Francisco Hernández Ortiz
Ruins of the Alemanes Nuevos smelter

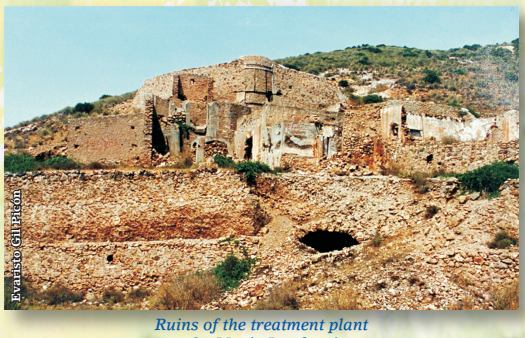
20th Century

In the 20th century, lead mining in Cabo de Gata begins to disappear. However, the coincidental discovery of gold convulsed the social and economic structures of the province of Almería, in addition to the national mining scene.

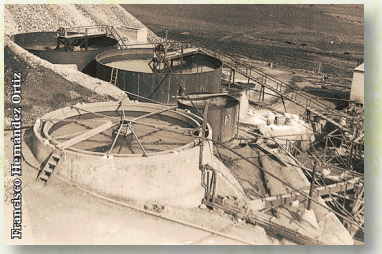

Francisco Hernández Ortiz
Denver plant in 1964

Rodalquilar Gold

In 1864, a rumour flew as to the existence of gold in Rodalquilar, though not officially confirmed until 1915. At the time, Juan López Sóler confirmed the presence of free gold in the María Josefa mine. In 1925, at the foot of this mine, the company Minas Auríferas de Rodalquilar set up the first smelter to extract gold by amalgamation with cyanide.



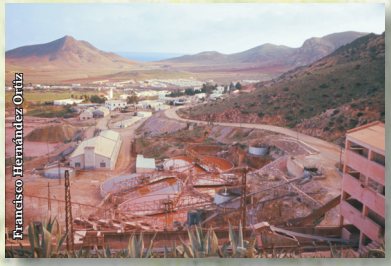
Ruins of the treatment plant at the María Josefa mine



Gold recovery by cyanide amalgamation at the Dorr plant in 1935

Various technical and economic problems were the downfall of this and other gold-mining attempts in Rodalquilar. Finally, in 1931 the Minas de Rodalquilar company financed the Dorr plant (known as the Englishmen´s), which successfully remained in operation until the outbreak of the Spanish Civil War (1936).

After several years of inactivity, in 1940 the government seized the most important mines in Rodalquilar. In 1942, a company was created (Empresa Adaro de Investigaciones Mineras SA) and charged with researching and exploiting the mines. After several years of investigation, in 1956 the modernized Denver plant was put into operation and it continued to run at full capacity until 1966.

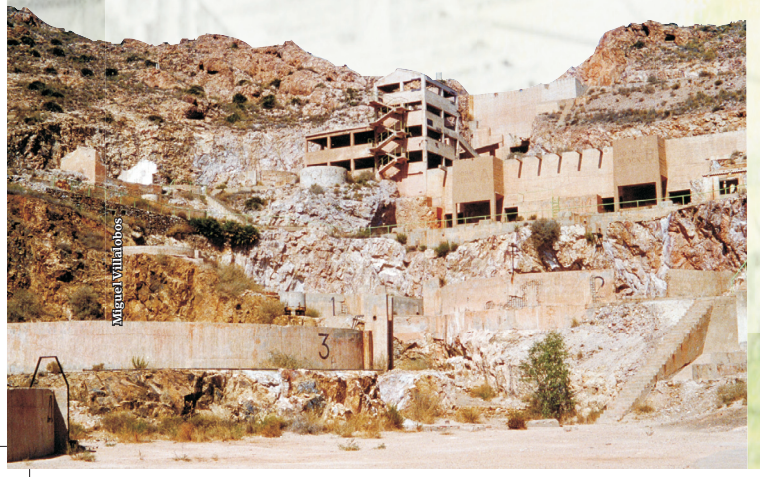


Denver plant operating in 1964

From 1956 to 1966, the mining village of Rodalquilar lived its best moments of splendour. The permanent population numbered over 1400 and could lay claim to nearly unknown services for the time: a medical clinic, pharmacy, four schools, supermarket, social club, church, and more.

This dream lasted only a decade. Denver plant ceased operations March 9, 1966, and the mines closed in September of the same year. Rodalquilar's population dropped to only 75 inhabitants. All that remains from that period is its history and a rich archaeo-industrial heritage. It was the end of a legend.

Visit of the King Juan Carlos I to the Cerro del Cinto mines in 1958



Sustainable Development: Rodalquilar Today

It was not until the start of the 1990s that Rodalquilar began to rejuvenate. As a site of extraordinary geoenvironmental interest and beautiful scenery, it was taken in hand in a process of rehabilitation and transformation linked to Nature Conservation and sustainable use that would be neither exploitative nor environmentally taxing. Thus, the Cabo de Gata–Níjar Land and Sea Nature Park was created and subsequently classified as a Biosphere and Geopark Reserve.

In the Cabo de Gata Geopark, work proceeds on a new model of sustainable rural development in which Rodalquilar is the centre for operations and services of one of the most emblematic nature sites of Andalusia, Spain, and Europe. It is a modern administrative, technical, and logistic centre that englobes the basic installations and infrastructures necessary for administration of the Geopark.

This ongoing, carefully planned effort aims at ending the despair suffered in this village at the end of the 20th century. Old mining buildings have been painfully restored in order to be the site from which new work is carried out, with novel aims and equipment, to make it possible for these people to remain here in their own territory and to guarantee their economic wellbeing. This time, though, other resources will be exploited, although also a product of nature. Not the worked-out minerals, but the Sierra de Cabo de Gata itself—its landscape, geology, flora, fauna, legacy, and its history. It is a new pattern, but a lasting one this time. It is sustainable and will still be there for the benefit of future generations. It can be exploited with no fear of suffering from the distress of exhausting this geopark resource—the Cabo de Gata–Níjar Land and Sea Nature Park and Biosphere Reserve.

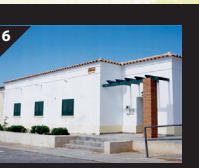

1 El Albardinal conservatory

2 Palm trees


3 Garages and workshops


4 Computer centre


5 Rodalquilar nursery


6 Rural lodgings


7 Rodalquilar exhibition centre


8 Parking

9 Display panel and exhibit hall

10 El Bujo nature and environmental education centre


11 El Cornical Museum

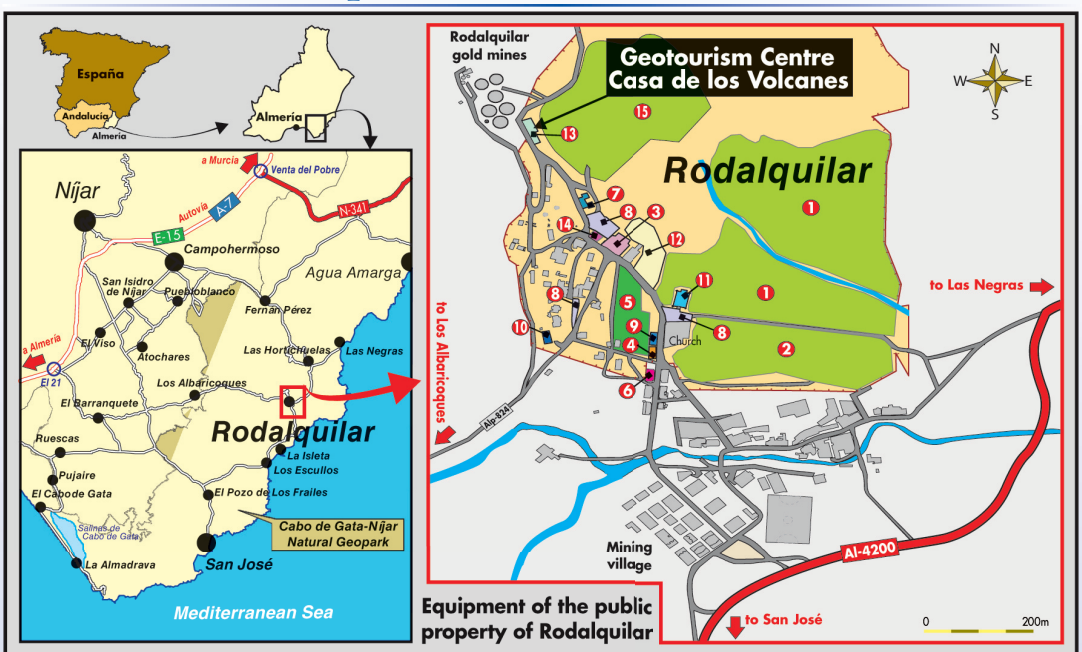

12 Camping grounds


13 Casa de los Volcanes Geotourism centre


14 Offices of the Cabo de Gata–Níjar Nature Park


15 Restored tailings pile

Map of location and access



1 El Albardinal conservatory. 2 Palm trees. 3 Garages and Workshop. 4 Computer centre. 5 Rodalquilar nursery. 6 Rural lodgings. 7 Rodalquilar exhibition centre. 8 Parking. 9 Display panel and exhibit hall. 10 El Bujo nature and environmental education centre. 11 El Cornical Museum. 12 Camping grounds. 13 Casa de los Volcanes Geotourism centre. 14 Offices of the Cabo de Gata–Níjar Nature Park. 15 Restored tailings pile

Addresses of interest

Consejería de Medio Ambiente
Delegación Provincial de Almería
C/ Reyes Católicos nº 43
04071 Almería
Tel: 950-012800 y 950-011150

Parque Natural Cabo de Gata – Níjar
Oficina Administrativa
C/ Fundición s/n
04115 Rodalquilar, Níjar (Almería)
Tel: 950-389742 y 950-389744

www.juntadeandalucia.es/medioambiente

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