

3 days of Field Trips

Iberia Geopark Project

A three-day field programme through the aspiring Iberia/Ibérica UNESCO Global Geopark (Huelva–Val do Guadiana). Three linked days that read the landscape as a single sequence, crossing between two ancient continental plates and the remains of an ocean more than 300 million years old. Based in Aracena; coach transfers arranged on request.



Río Tinto. Photo courtesy of turismosevilla.org

TRIP DETAILS

Format	3 day programme (2 nights)
Group size	8–18 people
Level	Undergraduate, postgraduate, learned societies and professionals
Languages	Spanish / English
Base	Aracena (Huelva); coach transfers on request
Season	Year-round; spring and autumn are best
Guide	Helena Chacón, PhD geologist

GEOLOGICAL SIGNIFICANCE

Over three days, we trace the complete story of the closure of the Rheic Ocean during the Variscan orogeny.

On the first day, at Riotinto, we explore the South Portuguese Zone, where late Devonian–Carboniferous volcanism produced one of the largest massive sulphide concentrations on the planet. We enter a landscape shaped by more than 5,000 years of mining, and get to know the Río Tinto — a Mars analogue here on Earth.

On the second day, we visit the scar of the collision itself: the Acebuches metabasites, a sliver of MORB-affinity oceanic crust caught literally in the suture between the South Portuguese Zone and the Ossa-Morena Zone — physical evidence of the ancient Rheic Ocean.

For the third day, we offer two options for exploring the Ossa-Morena Zone further: Peña de Arias Montano, a natural viewpoint within the Aracena Metamorphic Belt, or a visit to the northern strip of the Sierra, where little-altered Cambrian pillow lavas and stromatolites can be seen thanks to low-grade metamorphism. The choice depends on the group's interests.



View from Cerro de San Cristóbal. Day 2 visit.

RIOTINTO

10:00 - STOP 1: Peña de Hierro

Peña de Hierro sits at the north-eastern end of the Riotinto anticline, within the Iberian Pyrite Belt (South Portuguese Zone) — known as the largest concentration of volcanogenic massive sulphides (VMS) in the world. At this first stop we see an open-pit working flooded by water from the Río Tinto aquifer, its colours drawn from a rich mineral palette. Here we learn how the ore deposits mined since antiquity were formed.



Peña de Hierro. Photo courtesy of turismonerva.com

10:30 - STOP 2: Anticline

The Riotinto anticline, formed during the Variscan orogeny, has folded the Volcano-Sedimentary Complex — of late Devonian to early Carboniferous age — up to the surface, exposing sulphide deposits rich in pyrite, chalcopyrite, sphalerite and galena. Peña de Hierro sits at its north-eastern closure. This fold is what brings the region's mineral wealth to the surface, and gives the river its distinctive red colour.

11:00 - STOP 3: Gossan

Gossan is the iron oxide and hydroxide residue left by the weathering of sulphide deposits. As pyrite and chalcopyrite oxidise at the surface, they leave behind this iron-rich residue (goethite, hematite, limonite, jarosite). Historically, the gossan cap was mined for its gold and silver content. The geochemistry of the gossan is what gives the Río Tinto its iron, its acidity and its colour.



Gossan cap. Photo courtesy of huelvabuenasnoticias.com



Gossan. Photo courtesy of Francisco Javier Garcés Aso

12:00 - STOP 4: Nacimiento del Río Tinto

We visit the source of the Río Tinto, where the water runs red and acidic (pH ~2) as a result of natural acid drainage from sulphide oxidation. Iron- and sulphur-oxidising chemolithotrophic microorganisms thrive here, studied by NASA and other institutions as a Mars analogue. The colour of the water, together with slopes stained yellow-ochre by oxyhydroxides, gives the setting a striking character.



Río Tinto. Photo courtesy of huelvabuenasnoticias.com

13:30 - STOP 5: Ferrocarril minero

The mining train runs 22 km (there and back, in an hour and a half) along the historic commercial line laid by the Río Tinto Company Limited in the 19th century to carry ore down to the port of Huelva. The route runs alongside the Río Tinto, stopping at Los Frailes station so passengers can walk down to the riverbed. From November to April, on the first Sunday of each month, the train runs under steam.



Ríotinto mining railway. Photo courtesy of trainvelling.com

15:00 - 16:00 LUNCH

17:00 - 18:00 STOP 6: Corta Atalaya

Once the largest open-pit mine in Europe, Corta Atalaya is today an emblem of Ríotinto. Across its long history of copper, sulphur, gold and silver extraction, we uncover a mining past stretching back 5,000 years.



Corta Atalaya. Photo courtesy of wikipedia.org

DAY 2: SUTURE BETWEEN CONTINENTS

09:30 - STOP 1: Views of the village

We walk the start of the trail across the metabasites of the Acebuches Formation, which we examine in detail later in the afternoon. At this stop we interpret the landscape, the village, and the church crowning the quartzites of the Pulo do Lobo Formation.



10:30 - STOP 2: Continental Domain

We move from the oceanic domain into the continental domain, where we find anatectic granites, norites, marbles, gneisses and calc-silicate rocks. These rocks are the signature of the high-temperature, low-pressure metamorphism that characterises this belt.



Examples of outcrops encountered on the climb up the hill. Left to right, top to bottom: 1. Norites; 2. Marble; 3. Migmatite; 4. Leucogneiss

11:30 - STOP 3: Summit viewpoint

From the summit we can appreciate karst relief in carbonate and calc-silicate rocks, and enjoy views that let us pick out the Gondwanan continental margin (Ossa-Morena Zone), the suture (Rheic Ocean), and the South Portuguese Zone, home to the Pyrite Belt.

At this stop we produce a geo-sketch: a panoramic landscape drawing, marking the landscape's lines and mapping out the domains, to help us remember the most interesting aspects of the visit.

We then begin the descent, taking in the beauty of the dehesa, its medicinal plants, and birds such as the bee-eater.



Views from the ascent and from the upper reaches of Cerro de San Cristóbal



Views from the Cerro de San Cristóbal

14:00 - 16:00 LUNCH

16:00 - 17:00 STOP 4: Touching oceanic crust

The Beja-Acebuches metabasites include amphibolites and greenschists derived from a MOR basalt, metamorphosed and made up of hornblende and plagioclase. They mark the suture between the Ossa-Morena Zone and the South Portuguese Zone during the Variscan orogeny. At this stop we can appreciate the intense deformation of the amphibolites, with folds and foliation marking the direction of deformation. Metamorphism in this region reached temperatures of around 750–900 °C, marking a high-temperature, low-pressure regime

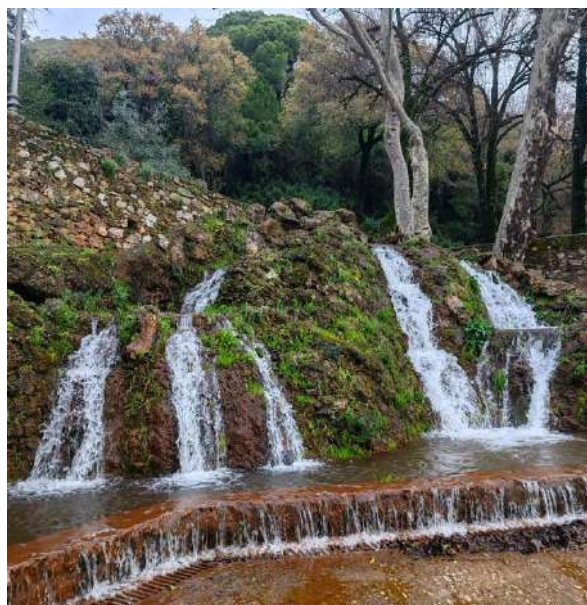


Photographs of the Acebuches metabasite outcrop. Left to right, top to bottom: 1. Broad folds; 2. Light and dark banding; 3. Outcrop; 4. Mecanical contact

DAY 3: TWO OPTIONS TO CHOOSE FROM

OPTION 1 - PEÑA DE ARIAS MONTANO: Travertines of Alajár

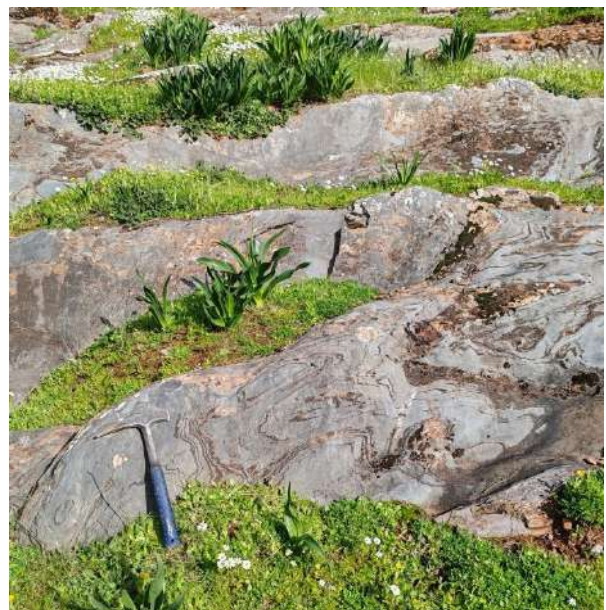
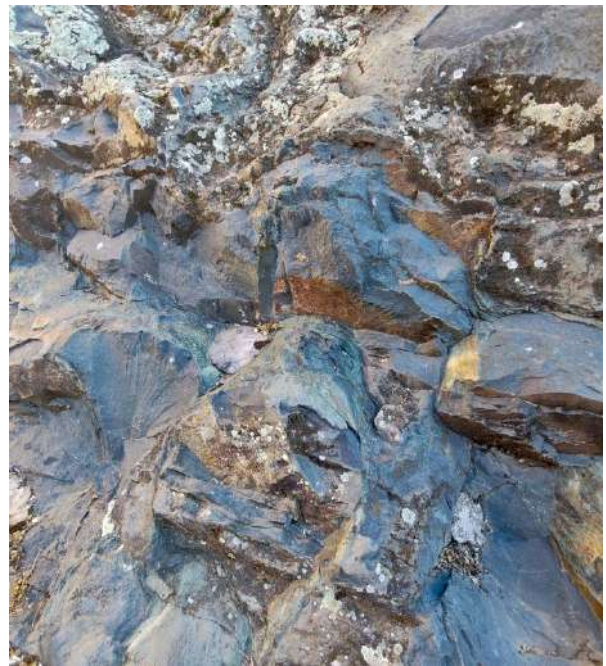
We visit a complex karst structure formed by calcareous tufa and travertine, deposited where water rises at the intersections of major faults. This geosite is listed in both the Andalusian and the national geosite inventories (IELIG AND375). Of particular interest is its hydrogeological significance: its springs and seeps, at 746 m elevation, represent the discharge of a karst aquifer hosted in Cambrian limestones and dolomites, structurally controlled by gneisses. Surface precipitation of calcium carbonate, aided by microorganisms and vegetation, has built up a thick layer of ancient travertine.



Photographs of the Travertines at Peña de Arias Montano

OPTION 2 - PILLOW LAVAS AND STROMATOLITES:

In the northern part of the Sierra, where metamorphism is low-grade, we find two outcrops of palaeogeographic interest. The first is a pillow lava outcrop in the village of Cumbres Mayores: submarine basaltic flows solidified into pillow shapes, telling us about the ancient Gondwanan margin during a phase of Cambrian rifting. A few kilometres away, at Cañaveral de León, a sedimentary sequence lets us reconstruct past marine environments and their evolution (shales, conglomerates), structural features of the tectonic model, and lower Cambrian stromatolites. The local hydrogeology, shaped by the dominant lithologies, is also of interest.



Photographs of Pillow Lavas, conglomerates and stromatolites in the northern Sierra de Aracena

WHAT'S INCLUDED · HOW IT WORKS

- ✓ Three days — two full days and a morning — guided by a geologist with a PhD, in Spanish or English.
- ✓ A programme tailored to the group's level and interests.
- ✓ Activity materials are not included. We recommend bringing a notebook, pencil, eraser, coloured pencils or a portable watercolour set, a compass and a hand lens.
- ✓ On request, the quote can include accommodation in the Sierra, coach transfers, and admission to the Riotinto tourist railway and Corta Atalaya.

LEARNING OUTCOMES (academic groups / CPD)

- In-situ observation of rocks from the Aracena metamorphic belt, the Ossa-Morena Zone and the South Portuguese Zone.
- Positioning the Sierra within the Variscan Orogen, the Armorica and Avalonia terranes, and the suture between them.
- Understanding geological processes of karstification, metallogeny, structural geology, deformation and hydrogeology.
- Understanding the extreme environment of the Río Tinto as a terrestrial analogue for Mars.
- Practising field observation and geological sketching as tools of interpretation.

