

SedDARE-IB: An open access repository of sediment data for Iberia and its continental margins

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Abstract

Sediments provide valuable information for geologists and geophysicists whenever they strive to understand, and reproduce, the geological evolution, lithology, rock properties, seismic response, and geohazards of a region. The analysis of sedimentary sequences is thus useful to the interpretation of depositional environments, sea-level change, climate change, and to a recognition of the sediments' source areas, amongst other aspects. By integrating sedimentary data in geophysical modelling, such interpretations are improved in terms of their accuracy and reliability. To help our further understanding of Iberia's geological evolution, geological resources and geohazards, this work presents to the scientific community the SedDARE-IB data repository. This repository includes available data of the depth to the Base Cenozoic and Top Paleozoic stratigraphic markers for the Iberian Peninsula and surrounding West Iberian Atlantic Margin and Mediterranean Neogene basins, or to the acoustic basement as interpreted for the Valencia Trough and Alboran Mediterranean basins. As an example of the broad applicability of the data included in SedDARE-IB, we investigate how sediment thickness affects the depth to the 150°C isotherm at specific basins, as commonly used in geothermal exploration. The calculated trend suggests that, given constant measured surface heat flow and thermal conductivity, the 150°C isotherm becomes shallower as the sediment thickness increases, until a critical threshold value is reached for the latter.

SedDARE-IB database has been built thanks to a Portuguese-Spanish collaboration promoting open data exchange among institutions and research groups. SedDARE-IB is freely available at <https://doi.org/10.20350/digitalCSIC/16277> (Torné et al., 2024) bringing opportunities to the scientific, industrial, and educational communities for diverse applications.

1. Introduction

40 Sediments are crucial in our understanding of the geological evolution, lithology, rock properties, subsurface structure, georesources and geohazards affecting particular regions. By analyzing strata and their architecture, geologists can decipher past environmental conditions, changes in the sea level, climate variability and the nature of the rocks in source areas, amongst other factors. Their thickness is often indicative of the presence of important resources such as oil, gas or minerals. Also, sedimentary rocks
45 encompass a wide range of lithologies with distinct physical and mechanical properties, a detailed knowledge is essential in geophysical models. Incorporating sedimentary data in geophysical modelling enhances the accuracy and reliability of subsurface models for subsequent resource exploration. In addition, sediments can contribute to the triggering or amplification of multiple geohazards, e.g. landslides, soil liquefaction and local seismicity. By studying properties such as cohesion, shear strength
50 and degree of compaction in sediments, one can assess potential geohazards in a region and develop proper mitigation strategies.

Sediment data curation contributes to scientific research and holds cultural significance, offering glimpses into human history and the development of morphotectonic landscapes over time. Overall, sediment data curation is integral for advancing knowledge, sustainable resource management, environmental
55 protection, and making informed decisions in diverse scientific, economic and social fields. To facilitate our understanding of Iberian geology, resources and hazards, this work presents SedDARE-IB as a comprehensive repository of: a) depth to the Base of Cenozoic strata deposited in both extensional and compressional basins, and b) the Top of the Paleozoic units for the majority of sedimentary basins spanning the onshore and offshore of Iberia. SedDARE-IB includes sedimentary data on onshore basins
60 as varied as the foreland basins of the Pyrenean-Cantabrian Orogen (Ebro and Duero basins) and Betic Cordillera (Guadalquivir Basin), the Tagus Basin and the Lusitanian and Lower Tagus basins, and many other small basins whose location is shown in Figs. 1b and 2. Offshore, SedDARE-IB comprises data from the West Iberian Atlantic Margin (Alentejo, Peniche, Northern Lusitanian Basin and deep offshore depocentres), the Gulf of Cadiz region (Algarve Basin and its surroundings) and the Base of the Cenozoic
65 for the Western Mediterranean Neogene basins, e.g., Valencia Trough and Alboran Basin, also comprising the acoustic basement for the rest of the Western Mediterranean region (see Figs. 1b and 2 for location).

As an example of the potential uses of the SedDARE-IB data we analyze the depth of the 150°C isotherm for different surface heat-flow values. Sediments play a crucial role in geothermal energy assessments as they serve as a natural insulating layer, regulating heat transfer between the subsurface and Earth's
70 surface. Hence, we examine in this work how sediment thickness influences subsurface temperature.

SedDARE-IB can be used in geothermal studies as sediments influences heat conduction, reservoir evaluation, temperature distribution, drilling considerations, thermal conductivity, heat flow modeling, resource assessment, and environmental impact assessments. Understanding sediment thickness is therefore essential for an effective planning, development and use of geothermal energy resources.

75 The data included in SedDARE-IB are summarized in Table S1, which details the primary sources of the data, the geological areas covered, and key attributes such as the minimum, maximum, and average thickness ranges, and key references associated with the datasets.

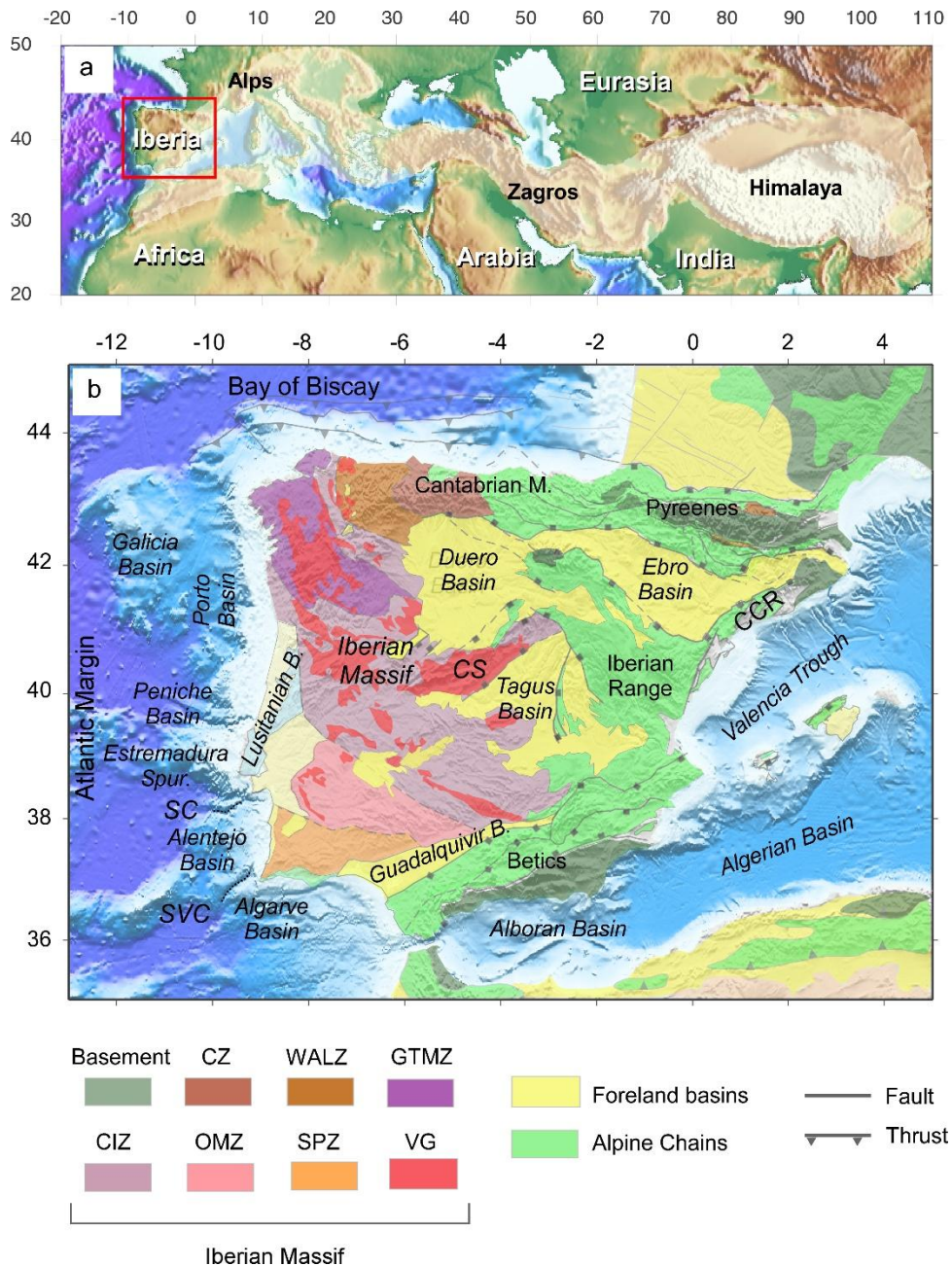


Figure 1 (a) Elevation map of the Alpine-Himalayan Orogenic Belt as shown by the shaded area. Red square highlights the location of the Iberian Peninsula and surrounding margins. (b) Simplified geological map of the Iberian Peninsula. Iberian Massif abbreviations: CZ: Cantabrian Zone, CIZ: Central Iberian Zone; GTMZ: Galicia-Tras-Os-Montes Zone, OMZ: Ossa Morena Zone; SPZ: South Portuguese Zone; VG: Variscan Granitoids, WALZ: Western-Asturian-Leonese Zone. Other abbreviations: Cantabrian M.: Cantabrian Mountains, CCR: Catalan Coastal Ranges, CS: Central System, Guadalquivir B.: Guadalquivir Basin, LTB: Lower Tagus Basin. SC: Setubal Canyon; SVC: Sao Vicente Canyon. Adapted from Torne et al. (2015, 2023).

2. Geological outline of the Iberian Peninsula and its adjacent continental margins.

2.1 The Iberian plate during the Alpine Wilson Cycle

The Iberian Plate, presently attached to Europe along the Pyrenean orogenic system, constitutes the westernmost segment of the 12,000 km long Alpine–Himalayan Orogenic Belt, which was shaped as a result of the Late Cretaceous–Cenozoic closure of the different branches of the Tethys Ocean. Such a process resulted in the continental collision of Africa, Arabia and India with Eurasia (e.g., Dercourt et al. 1986; and many others). During the Variscan Orogenic Cycle, the relatively small Iberian Plate was located in a hinge region between Pangea and Gondwana, with its northern and southern boundaries marked by large transfer faults - currently the Pyrenees and Betic orogenic systems. In spite of having been relatively bound by the larger Africa and Eurasian plates, the Iberian Plate evolved independently for hundreds of millions of years, a character that shaped its fairly complex Variscan and Alpine systems of basins and mountain chains. Comprehensive data on Iberia’s Variscan evolution are given in Friend and Dabrio (1996), Gibbons & Moreno (2002), Vera et al. (2004) and Quesada & Oliveira (2019).

Permian and Triassic continental rifting in the proto-Atlantic domain culminated with the opening of the Central Atlantic Ocean south of Iberia, with subsequent transtensional motion of Africa and opening of the Ligurian-Tethys starting at c. 156 Ma (Late Jurassic - Vergés and Fernández, 2006). This Jurassic oceanized lithosphere shaped the boundaries of Iberia by developing the rift-related Algarve, Prebetic and Subbetic basins to the south, and also the Catalan basin to the east. Such basins were later included as part of the Betic and Catalan Coastal Ranges orogenic systems. The northern propagation of the southern North Atlantic starting at about 118 Ma (Early Cretaceous) occurred along the Iberian Atlantic margin and led to the formation of large rift-related basins of Permo–Triassic and Jurassic–Lower Cretaceous age. Such basins were developed along the Iberian Atlantic margin and form the Alentejo, Lusitanian, Peniche, Porto, Galicia Bank basins (Fig. 1).

110 The opening of the Central and Southern North Atlantic segments initiated the fairly synchronous
eastwards drift of both Africa and Iberia with respect to Eurasia along the inherited Variscan northern
boundary of Iberia, a phenomenon that started in the Early Cretaceous and ended in the late Santonian
time at around 83.5 Ma (Macchiavelli et al., 2017). The salt-rich, transtensional Basque-Cantabrian basin
mostly evolved during this time (Cámara, 2017), together with the Organyà (Casini et al., 2023) and the
115 North Pyrenees basins (Ford and Vergés, 2021).

North-south convergence between Africa and Eurasia started at 83.5 Ma and is still active at present.
Africa-Eurasia convergence resulted in significant deformation within Iberia, and affected the previous
Iberian Mesozoic rift-related basins. Along the northern margin of Iberia, the Pyrenees Range emerged
because of continental collision and limited northward subduction. In the southern margin of Iberia - a
120 more complex region involving the Betics and Rif Mountain ranges, the Alboran Sea, and the Gulf of
Cadiz - formed the subduction-related Betic-Rif orogenic system. The interior of Iberia was also
shortened, mostly along relatively weak intra-continental regions associated with Mesozoic rifting. This
triggered tectonic inversion in the E-W Basque-Cantabrian Basin, the NW-SE Iberian and Altomira
ranges, the NE-SE Central System and the NE-SW Catalan Coastal Ranges (Muñoz-Martín and De
125 Vicente, 1998; Vergés and Fernández, 2006; Casas-Sainz and Faccenna, 2001). All these inversion-related
fold-and-thrust systems are linked at their respective connection zones where distinct fold trends coexist.
The smooth variations in structural trends among compressive fold-and-thrust belts, as illustrated in the
Iberia Geological Map at the 1:1,000,000 scale (Rodríguez-Fernández et al., 2015), suggest their
simultaneous development, at least to some extent (Anadón and Roca, 1996; Casas-Sainz and Faccenna,
130 2001; Vergés and Fernández, 2006). In such a regional context, the western margin of Iberia along
Portugal also shows mild inversion tectonics, which becomes more significant towards the south (e.g.,
Alves et al. 2003; Zitellini et al. 2004; Terrinha et al, 2009; Ramos et al., 2016; Cunha et al., 2019; Alves,
2024).

2.2 Iberia mainland

135 In mainland Iberia, the SedDARE-IB data were organized in six (6) major areas: a) the Pyrenees and Ebro
Basin (PE), b) the Duero and the Basque-Cantabrian basins (DB), c) the Iberian Range and the Tagus and
Almazán basins (ITA), d) the Guadalquivir Basin and the External Betics (GB), and the Lower Tagus
Cenozoic Basin (LTCB) (Fig. 2). For the Top of Paleozoic, the Ebro Basin domain and Tagus and
Almazán basins area have been expanded to the Southern Pyrenees and the Iberian Range, respectively.
140 (Fig. 2). Figures 3 and 4 show the location of the points and seismic profiles included in the database,
while Figs. 5 and 6 are an example of the grids generated from the database.

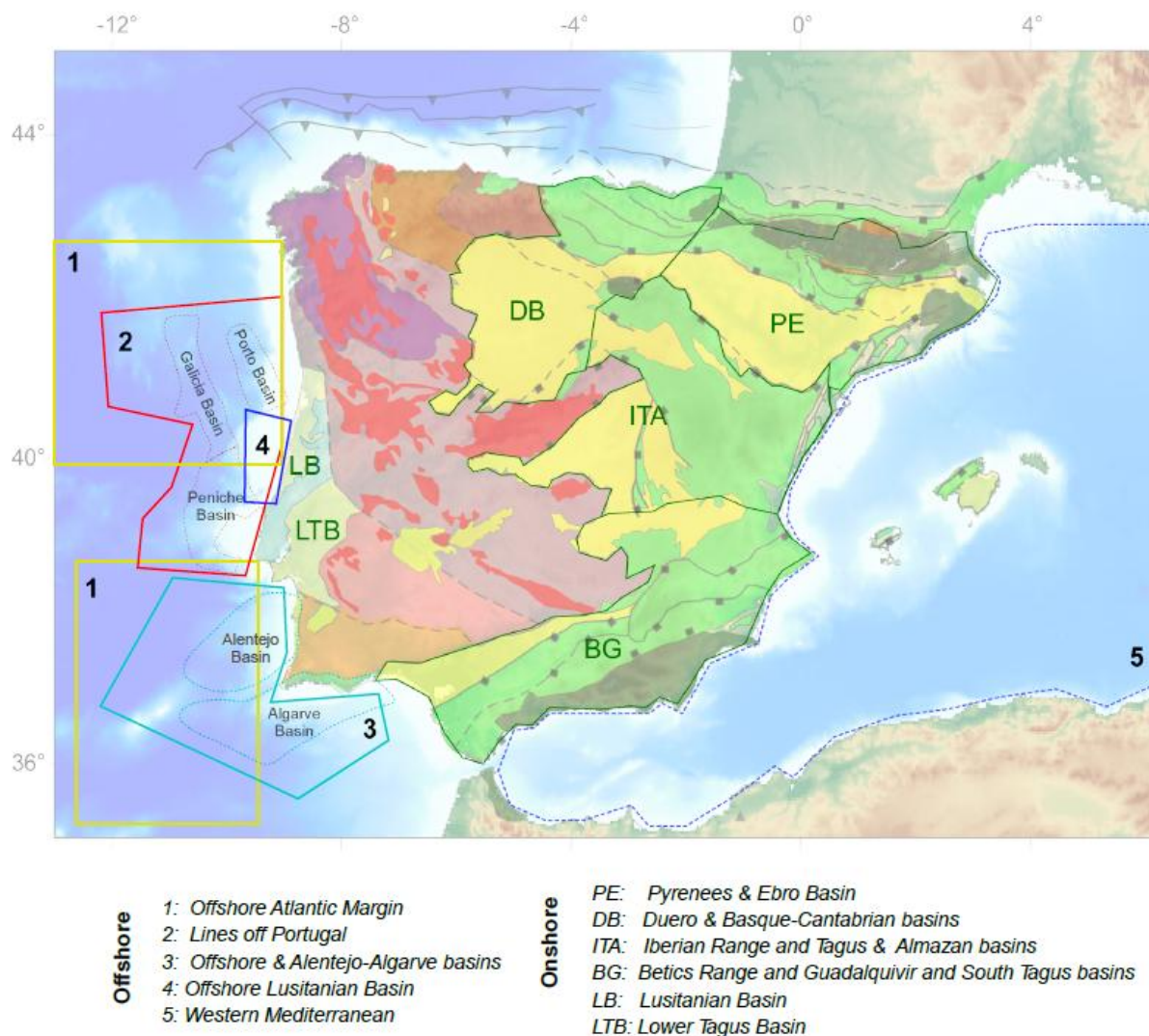


Figure 2 Simplified geological map showing the location of the data sets listed in Table S1. Modified from Torne et al. (2015).

145 2.2.1 Ebro Foreland Basin (EB)

The Ebro Foreland Basin, spanning approximately 85,500 km², is limited by the Pyrenees and the Basque-Cantabrian Fold Belt to the north. The basin represents the latest evolution stage of the long-lived evolution of the Southern Pyrenean foreland basin, which has lasted from the latest Cretaceous until the present day. The Ebro Foreland Basin reached a 5-6 km thick Paleocene-Oligocene sedimentary infill, displaying an irregular geometry in map view, as it is also bounded by the Catalan Coastal Ranges to the SE and the Iberian Range to the SW. The basin records a long-lasting evolution; was first originated as

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the Pyrenean foreland basin, and was later filled with shallow- to deep-marine deposits along a tectonic trough that was subparallel to the southern front of the Pyrenees (Puigdefàbregas et al., 1992). The basin changed to an endorheic system at approximately 36 Ma as the Western Pyrenees marine gateway was closed (Costa et al., 2010). Alluvial, fluvial, and lacustrine depositional systems prevailed until the middle to upper Miocene (García-Castellanos et al., 2003).

The Ebro Foreland Basin remained endorheic for about 27 million of years until the Oligo-Miocene opening of the Western Mediterranean basins. This opening triggered the formation of a Mediterranean river system, leading to the capture of its drainage network (Lewis et al., 2000). It also caused significant denudation; an area of 25,000 to 45,000 km² was eroded at a rate of 47-80 mm/kyr, a phenomenon that resulted in the subsequent isostatic rebound of the basin by up to 630 m (García-Castellanos and Larrasoaña, 2015). The depositional record of this erosion is found in the Castellón Group of the Valencia Trough (Martínez Del Olmo, 1996; Arche et al., 2010).

2.2.2 Duero and the Basque-Cantabrian basins (CD)

The intermontane Duero Basin, with an area of approximately 98,500 km², is bounded by several mountain ranges and is one of the highest Alpine intra-mountain basins in Europe (Casas-Sainz and De Vicente, 2009) (Fig. 1B). Its average altitude is in excess of 800 metres. It contains a thicker sedimentary infill in its northern sector, associated with the Alpine fronts of the inverted Basque-Cantabrian Basin and the Alpine reactivation of the Variscan Cantabrian Range. This fill gradually thins out towards the southern and western boundaries of the basin, on Variscan basement rocks (Civis and Vera, 2004; Herrero et al., 2004; Quesada et al., 2019). Sediment infill above Mesozoic deposits varies across different geological epochs, with changing thicknesses and areal extents. The Paleogene to late Miocene sedimentary infill generally exceeds 2500 meters in the basin centre. Notably, the youngest sedimentary infill in the basin correlates to the top of the fluvial–lacustrine carbonates of the Páramo Formation, which are dated to about 9.6 Ma (Krijgsman et al., 1996; Cunha et al., 2019). The opening of the Duero Basin to the Atlantic Ocean occurred in late Pliocene to Pleistocene times, with further incision occurring later. The exact timing of this opening is still debated, with some suggesting it occurred around 1.1–1.9 Ma, while others propose it might have happened earlier, in the middle Tortonian. Regardless of its age, the opening of the Duero Basin to the Atlantic Ocean marked a significant reorganization of fluvial networks within it (Antón et al., 2012, 2019; Silva et al., 2016; Struth et al., 2019 and 2021).

2.2.3 Tagus and Almazán basins (TAB)

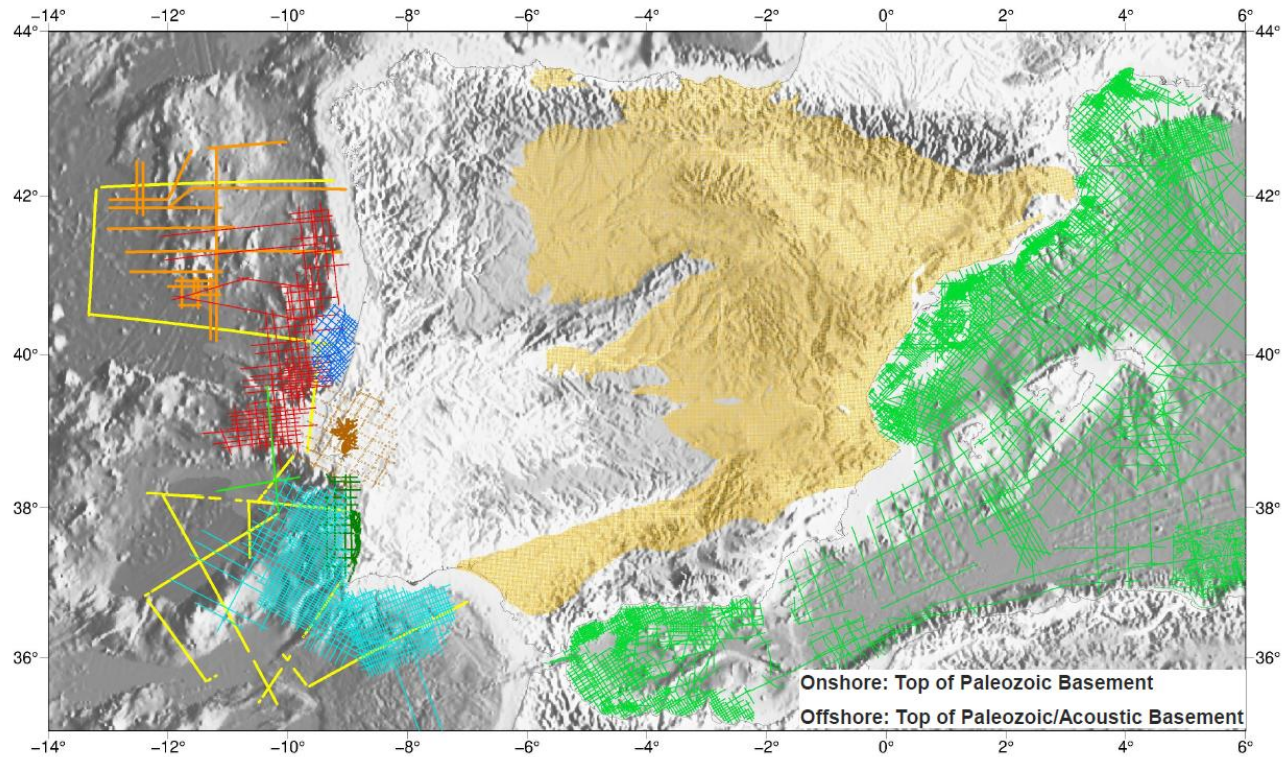
The Tagus Basin, located in the center of the Iberian Peninsula and covering approximately 20,000 km², is bordered by the Central System to the north, the Iberian Range to the northeast, and the western sector of Toledo Mountains to the south. It comprises two distinct sub-basins: the intra-mountainous Madrid Basin and the Loranca (also known as the Intermediate Depression), which comprises a piggy-back depocenter in the eastern part of the Tagus Basin (Muñoz-Martín (1997). These basins were individualized due to tectonic uplift of the Sierra de Altomira during the late Paleogene, and their Cenozoic evolution was influenced by tectonics and climate change (Alonso-Zarza et al., 2004). Sediments in the Tagus Basin consist of Paleogene shales, gypsum, conglomerates and limestones predominantly formed in alluvial fan systems alongside evaporitic lakes and lacustrine marls. The estimated thickness is of up to 3000 m and its maximum deposition occurred during the Miocene period. Miocene sediments comprise alluvial fan and lacustrine facies, which are capped by lacustrine limestones and Pliocene detrital sediments. The Intermediate Depression is a narrow depocentre located to the east of the Madrid Basin, and contains Upper Cretaceous shales and gypsum, younger alluvial and lacustrine fan intervals, fluvial and floodplain sediments, and Pliocene lacustrine sands and limestones (Paramo limestones) alongside other detrital materials (Alonso-Zarza et al., 2004; De Vicente et al., 2004).

2.2.4 Lower Tagus Basin (LTB)

The Lower Tagus Basin is surrounded by Mesozoic sediments of the Lusitanian Basin to the west and pre-Mesozoic igneous and metamorphic rocks to the east. The basin is exclusively Cenozoic in age and sits on Cretaceous strata in its southern part, Middle Jurassic units in its northern part, and Paleozoic rocks in its eastern part. Paleogene continental strata, 200-400 m thick, accumulated first in the basin during the Late Eocene and Oligocene in response to NNE-SSW convergence of Iberia and Africa (Carvalho, 1995; Cabral et al., 2003). Miocene tectonics overprinted the Paleogene structures, with the LTB evolving as a compressive foredeep basin related to tectonic inversion of the Lusitanian Basin under NW-SE compression. Miocene strata, exceeding 800 m in local depocenters near Lisbon (Cabral et al., 2003), include sandstones, clays and limestones deposited in shallow marine, mixed lagoonal, shallow water and continental environments (Pais et al., 2012). Tectonic subsidence in the basin slowed down during the Pliocene, as marked by the deposition of about 300 m of fluvial sediments, mainly sands and clayey or silty sands. Tectonic uplift predominated after the Early Pleistocene, while sands and clays topped by levels of pebbles are typically found in Pleistocene strata. These are overlain by Holocene alluvium deposited by the Tagus River. Tectonic compression continues to the present day, with maximum horizontal compressive stress trending NW-SE to WNW-ESE (e.g., Ribeiro et al., 1996; Borges et al., 2001).

2.2.5 Guadalquivir Foreland Basin (GB)

215 The Guadalquivir Foreland Basin, located in the southern part of the Iberian Peninsula and spanning c.
57,000 km², is a foreland basin bounded to the north by the Iberian Massif and to the south by the Betic
Cordillera, which continues into the Rif Chain of northern Africa. Like the westernmost part of the Betics,
it was influenced by post-Cretaceous tectonic movements between Africa and Eurasia. Studies suggest
significant N-S convergence to have affected the Guadalquivir Basin from mid-Oligocene to the late
220 Miocene, followed by WNW-directed oblique convergence until the present day (Macchiavelli et al.,
2017). According to Barnolas et al. (2019) and references therein, the basin can be divided into two zones.
The northern one is filled with autochthonous sediments, whereas the southern zone also contains chaotic
masses of Mesozoic and Cenozoic allochthonous materials that slid from the Subbetic units during the
late Miocene compression in the external Betics. The autochthonous sedimentary infill involves six
225 Miocene seismic-stratigraphic sequences, ranging in age from middle Miocene (the late Langhian-early
Serravallian) to the late Miocene (Messinian). Overlying these Miocene sequences are Pliocene-
Quaternary strata that record westward sediment progradation along the basin axis (Berástegui et al.,
1998). The southern border of the basin involves several salt diapirs, with Triassic evaporates in their
cores, that were tectonically compressed during the Cenozoic. They form multiple frontal imbricate
230 wedges. The frontal imbricates involve late Serravallian to late Tortonian sediments (sequences 3 to 5, as
described by Berastegui et al. (1998). In particular, Sequence 6, which spans from the late Tortonian to
the late Messinian, clearly postdates all the structural features. This indicates that significant shortening
in the External Betics was concluded by approximately 6.3 Ma (Messinian). Tectonic activity, including
normal faulting at basement level, occurred during early to middle Serravallian times. The basin primarily
235 originated through orogenic wedge accretion along its active southern margin, with flexural subsidence
propagating towards the foreland basin per se (García-Castellanos et al., 2002). The Guadalquivir
Foreland Basin depocenter is 600 m thick in the east but is up to 1800 m thick in its western region.
Readers are directed to the work of Civis et al. (2004) and Barnolas et al. (2019) for further detail on the
basin's sedimentary infill and evolution



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Figure 3 Offshore: Location of seismic profiles used for interpreting and gathering data for the Top of Paleozoic, or Acoustic Basement for most of the Western Mediterranean region. Exceptions are the Valencia Trough and the Alboran Basin (see Fig. 1 for location), where the Acoustic Basement corresponds to the Base of Cenozoic or the so-called Oligocene unconformity. Onshore: location of x,y,z

245 data obtained from available seismic, log data and geological information

2.3 Iberian offshore basins

2.3.1 West Iberian Atlantic Margin

The West Iberian Atlantic Margin is, essentially, a divergent margin reactivated tectonically since the end of the Cretaceous. It witnessed continental rifting from the Late Triassic to the Early Cretaceous.

250 Diachronous continental breakup along this margin occurred over a period spanning from the latest Jurassic to the Albian/Cenomaniann (Alves and Cunha, 2018). Breakup propagated from southwest to north Iberia, extending towards the Bay of Biscay (Grevemeyer et al., 2022). Two main episodes of magmatism are recorded during this process: the first around 200 Ma (Hettangian) associated with the Central Atlantic Magmatic Province (CAMP), and the second during the Valanginian period at 135-130
255 Ma (Martins et al., 2008).

Post-rift magmatism occurred after 80 Ma (Campanian) and was predominantly alkaline. It is recorded onshore by sub-volcanic complexes near Sintra, Sines, and Monchique, with volcanic complexes also present near Lisbon and offshore Algarve (Terrinha et al., 2009). Also, onshore, Lower Cretaceous magmatism has been dated as spanning 94 to 69 Ma in Portugal, and occurring at c. 79 Ma in northeast
260 Spain (Ubide et al., 2014).

At present, the continental slope of Iberia tilts abruptly to the west in its northwest part but is gentler in its central and southwest parts due to the accumulation of thick Cretaceous-Cenozoic strata (Alves et al., 2009). Late Cretaceous-Cenozoic exhumation and erosion are evident, particularly on the proximal part of the slope (Terrinha et al., 2002; Pereira et al., 2013; Alves, 2024). The Estremadura Spur, separating
265 southwest Iberia from its northwest part, has experienced significant post-rift tectonics and magmatism (Miranda et al., 2009), associated with compressional tectonics and tectonic inversion (Ribeiro et al., 1990) (Fig. 1).

In summary, the West Iberian Atlantic Margin features a relatively narrow, westerly-tilted continental shelf, with major rivers contributing sediment north of 41°N. Sediment accumulation is significant in
270 estuaries south of this latitude (Dias and Nittrouer, 1984). During sea-level lowstands, sediment bypass the shallower zones of the margin through large submarine canyons, leading to reduced terrigenous sediment contribution to the outer shelf region (Dias and Nittrouer, 1984, Dias et al., 2002). Sediment composition on the shelf varies with depth, from fine micaceous sand at shallow depths to biogenic carbonate at greater depths (Dias and Nittrouer, 1984). The shelf edge comprises rocky outcrops and fine-
275 grained sediment, resembling the gentler Alentejo continental margin (Drago et al., 2000). The continental slope is narrow and steep, bounded by north- to north-northeast-trending faults (Mougenot, 1989), except for the wider and structurally deformed Estremadura Spur. The continental rise is relatively wide, featuring multiple seamounts and prominent fault-bounded depressions between seamounts where sediment transported by submarine canyons is accumulated (Mougenot, 1989; Alves et al., 2003).

280 2.3.2 Alentejo Basin

The offshore Alentejo region is characterized by its broad continental shelf, which blends with a gentle continental slope ($\sim 0.5^\circ$) due to thick Cenozoic sediment deposition west of 10°W (Mougenot, 1988). Steeper gradients ($>2^\circ$) occur near seamounts in areas of localized deformation (Coppier and Mougenot, 1982, Mougenot, 1988; Alves et al., 2003). Alves et al. (2003) recognized three main types of Cenozoic
285 deposits on the Alentejo Margin: shelf-related, turbidite, and contourite/canyon-fill. A wide range of sedimentary deposits, from deep marine turbidites to fluvial/deltaic sequences (Shanmugam and Muiola,

1988) have been identified on seismic data crossing the continental slope of Alentejo. However, dredge samples near the shelf break contain shallow marine to shelf-break limestones rich in foraminifera (Mougenot et al., 1989). Deep-marine deposits, including mass-flow and channel-fill deposits, are
290 common in more distal parts of the margin, while shallow-marine breccias are common on the continental slope (Mougenot et al., 1989, Coppier and Mougenot, 1982).

The Alentejo Basin, structured during the Upper Jurassic, is delimited by the Setúbal and São Vicente canyons. Limited exploratory drilling has revealed Hettangian-Triassic evaporites, suggesting the Alentejo Basin to constitute the southern continuation of the Lusitanian Basin (Mougenot, 1989).
295 Extensive Late Cretaceous magmatic activity led to the emplacement of the Sines and underwater Côvo igneous complexes (Neres et al., 2023) when crustal extension shifted to compression tectonics, reactivating crustal faults (Alves, 2024). Several compressional pulses with different directions affected the region, driven by interactions between Iberia, the Nubia microplate, and the larger European and African tectonic plates (e.g., Juarez et al. 1998; Rosenbaum, 2002; Vissers and Meijer, 2012).

300 **2.3.3 Algarve Basin**

The Algarve Basin, located in southwest Iberia, originated during Mesozoic rifting due to the Atlantic/Neo-Tethys opening; it later experienced tectonic inversion during the Alpine orogeny (Terrinha et al., 2019). This basin trends E-W and extends for about 150 km, reaching a maximum width of 25 km in its onshore portion and about 100 km offshore. Bounded by Carboniferous basement rocks to the north
305 and the Guadalquivir Bank to the south, crustal extension was accommodated by N-S and NE-SW structures in the westernmost part of the basin and ENE-WSW to E-W structures in the central and eastern parts. N-S to NW-SE striking faults bound main grabens and half-grabens (Terrinha et al., 2019; 2022). Five main extensional episodes occurred from Late Triassic to Cenomanian times and were interspersed with transient compressive events that resulted in depositional hiatuses throughout the basin.

310 Paleozoic rocks below the Algarve Basin consist of low-grade metamorphic rocks (shales and graywackes) part of the Baixo Alentejo Flysch Group. In the basin per se, the oldest deposits are Lower Triassic in age (red mudstones) overlain by conglomerates and red clays of the "Silves sandstones" (Palain, 1976). Sedimentation continued through the Mesozoic and was characterized by the accumulation on alternating carbonate and siliciclastic units, indicating shallow marine to continental environments. It
315 was interrupted in the Cretaceous by tectonic inversion, resulting from oblique convergence between northwest Africa and Iberia, causing important depositional hiatuses and unconformities. The oldest

offshore Cenozoic deposits in the Algarve Basin are dated Paleocene to Oligocene, lying unconformably over folded Lower Cretaceous strata (Terrinha, 1998; Lopes et al., 2006; Roque, 2007, Matias, 2007).

In summary, Cenozoic strata overlay folded and thrust older units, suggesting that tectonic inversion
320 occurred predominantly after the Cenomanian and lasted until the late Oligocene-Aquitania. Nevertheless, present-day compression is still recorded in the Algarve Basin, being NW-SE oriented, and driven by oblique collision between northwest Africa and southwest Eurasia (Ribeiro et al., 1996).

Figures 3 and 4 show the location of the points and seismic profiles included in the database, while Figs. 5 and 6 are an example of the grids generated from the database.

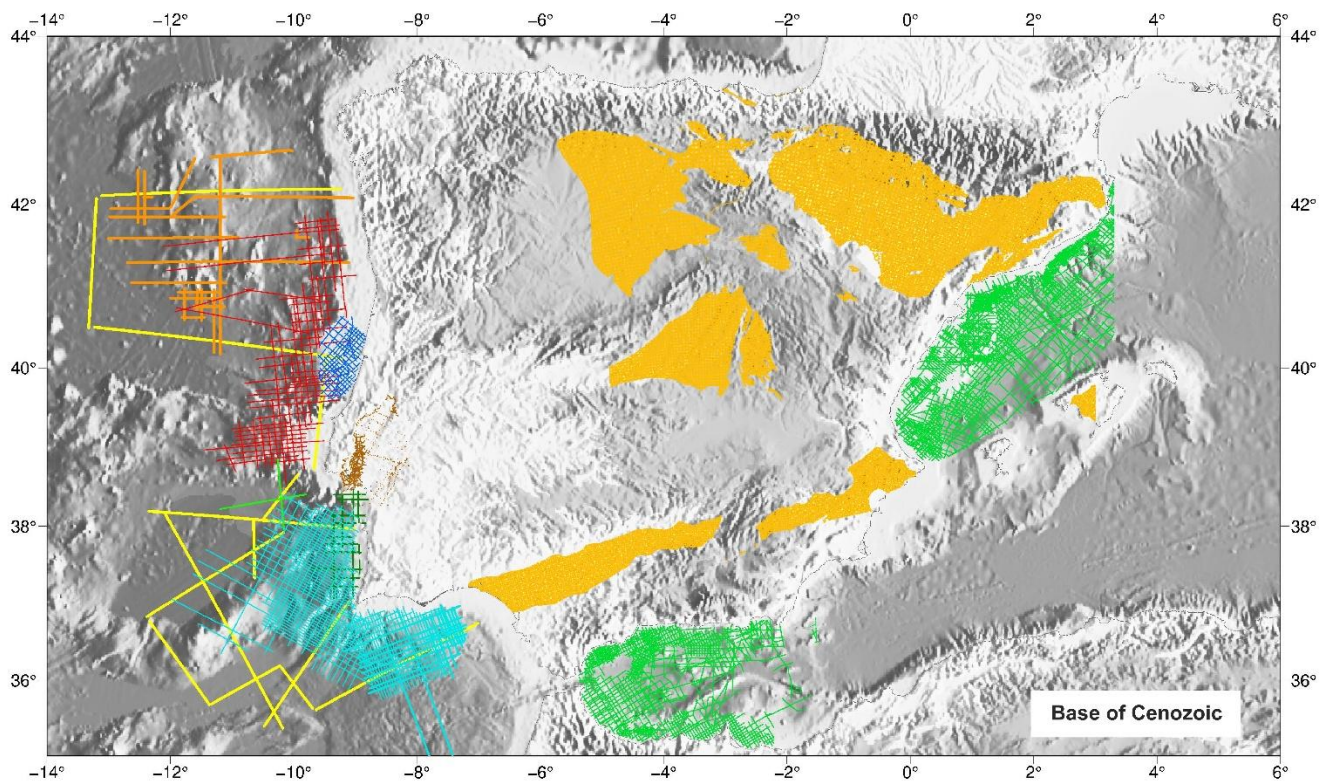


Figure 4 Offshore: Location of seismic profiles used for interpreting and gathering data on the Base of Cenozoic. Onshore: location of x,y,z data obtained from available seismic, well log data and geological

information. Main references from which data have been gathered are shown in Table S1. Additional references can also be found throughout the text.

330 **3. Technical aspects of the data**

3.1 Iberia mainland

The compilation of the Top Paleozoic and Base Cenozoic stratigraphic markers for the Spanish sedimentary basins has been carried out by the Instituto Geológico y Minero de España (IGME), complemented with a significant number of subsurface information from the Hydrocarbons Service of the
335 former Ministry of Industry, Tourism, and Commerce (ATH), as well as studies from Empresa Nacional de Residuos Radioactivos SA (ENRESA), Universities, Associations, Working Groups, and Research and Development projects stemming from the ALGECO2 project (García-Lobón, 2010a). The objective of the project was the selection and characterization of areas and structures favorable for CO₂ storage of in Spain. Location of data points and seismic profiles included in the database are shown in Figs. 3 and 4.

340 For that purpose, the analysis and geoscientific information included a review of about 50,000 km of seismic lines and 400 exploration wells, in addition to the available regional cross-sections and subsurface maps largely derived from historical petroleum exploration. For further details on the digital geological reference mapping, data from oil wells, seismic data, reference surfaces, and other information, the reader is referred to the work of García-Lobón et al. (2010a) and references therein.

345 **3.1.1 Ebro Basin**

Data on the Ebro Basin was extracted mainly from regional and geological studies at various scales (García-Lobón et al., 2010b), including the MAGNA Projects, and from geological maps at a 1:400,000 and 1:50,000 scale. Additionally, geophysical information and deep drilling data were considered together with information gathered in the "Documents on the Subsurface Geology of Spain (IGME 1992)" (7
350 documents) and the Subsurface Geology of Spain (ITGE). IGME's geophysical information include all drilling documentation (Composite and Master logs) from hydrocarbon exploration in the Technical Archive of the Ministry of Industry (which contains information of mining boreholes with depths up to 2500 m and oil boreholes with depths up to c. 5400 m), as well as the deepest boreholes from the Database of the Ebro Hydrographic Confederation, with depths up to 1658 m, which were re-analyzed in this work.
355 In addition, over forty PhD and MSc-level theses, along with more than a hundred research articles were re-examined, with particular focus on those completing regional structural analyses and geological cross-sections. This approach was especially relevant in regions with limited well data such as the shoulder

areas of the Ebro Basin. Other data sources such as the databases of CHE (Ebro Hydrographical Confederation), Gessal, Repsol, Enresa, Union Texas, etc., were also consulted, providing relevant data
360 for updating previous published maps. Subsequently, the interpretation of seismic lines and wells, in accordance with these cross-sections, led to the generation of maps of the depth contours (isobaths) presented in this study.

As pointed out by García-Lobón et al. (2010b), the isobath map of the Base of Cenozoic is not consistently defined due to discrepancies arising from both multiple unconformities in syntectonic depositional
365 sequences and potential blind thrusts along the boundaries of the basin. These makes difficult the correlation between subsurface and surface outcrops. For a complete list of references and technical details, the reader is referred to the work of García-Lobón et al. (2010b).

3.1.2 Duero and Basque-Cantabrian basins

Isobath maps for these two basins were compiled based on information from 239 hydrocarbon exploration
370 wells reaching depths between 500 m and >2500 m. The available borehole data allowed the identification of multiple stratigraphic tops in the Mesozoic sequence. Additionally, reference points from regional cross-sections and isobath data from previous works were used to create new isobath maps. Using these same data sets, contour lines were generated and later edited to test the presence (and effect) of multiple geological structures based on the existing geological and structural data for the Basque-Cantabrian and
375 Duero Basins. This process allowed the creation of isobath maps for the Base of Cenozoic base and Top of Paleozoic, adjusting them to main faults and structures identified in regional geological maps. For the eastern and northeastern part of the Duero Basin, the calculated isobaths include subsurface information from oil exploration wells. For a complete reference list and additional technical details, the reader is referred to García-Lobón et al. (2010c).

380 3.1.3 Tagus-Almazán basins

For the creation of isobath maps in the Iberian Chain and the Tagus and Almazán Basins, two different approaches were developed based on the available data on these two Tertiary basins, their reliability, and spatial distribution. Thus, data presented in this study for these areas were mainly constrained by geological cross-sections, as there was a scarcity of subsurface data and from available reflection seismic
385 cross-sections and borehole information. An effort was made to ensure the consistency of all final products at the regional scale considered in this work.

Geological cross-sections were primarily sourced from pre-existing or new cross-sections, with the latter predominantly derived from boreholes and pre-existing isobath maps. Where there was a scarcity of data and structural information, i.e. in the Iberian Range, an effort was made to increase data density from surface cartography, boreholes and regional cross-sections. For a complete reference list and additional technical details, the reader is referred to García-Lobón et al. (2010d). Additional data can be found in de Vicente and Muñoz Martín (2012).

3.1.4 Guadalquivir Basin

Stratigraphic information from the Guadalquivir Basin was gathered after re-assessing of surface and subsurface exploration data. Primary sources of this information consisted of reports and databases from the IGME. This dataset was further enriched by substantial subsurface documents and data acquired from the Hydrocarbons Service of the former Ministry of Industry, Tourism, and Commerce, together with contributions from various public entities, universities, associations, and working groups participating in research and development projects, including the ALGECO2 project (García-Lobón, 2010a).

400

In addition to these data, regional geological cross-sections were compiled using the available geological maps and subsurface data, particularly those where seismic profiles and boreholes exist. Notably, the Guadalquivir Basin has limited seismic grid coverage and borehole control, particularly when one considers the stratigraphic markers of interest to this work. Consequently, the accuracy of these isobath maps is variable across different locations. For a complete reference list and additional technical details, the reader is led to García-Lobón et al. (2010e).

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3.1.5 Lower Tagus Basin

The depth to the Base of Cenozoic in this area was obtained using seismic reflection data calibrated by exploration boreholes, by modeling land gravimetric data, and via geological outcrop data. Seismic reflection data comprise legacy surveys acquired with distinct geometries and sources for the oil industry from the mid 50's until 1982. These surveys were reprocessed and reinterpreted in Carvalho et al. (2005, 2017). Gravimetric data of the national Portuguese grid were also used to increase the geographical coverage of the existing seismic data, which was limited to the western part and central part of the Lower Tagus Basin (Carvalho et al., 2017).

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Seismic reflection data were used, where available, to determine the depth of the Base of the Mesozoic, which was only reached by a few exploration wells. In contrast, aeromagnetic data were used across the entire basin (Carvalho et al. 2014). These datasets do not allow a precise estimate to the depth of pre-

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Mesozoic rocks; in fact, the acoustic basement in seismic data is often coincident with the Top Dagorda salt member (Hettangian) (e.g., Watkinson, 1989; Carvalho et al., 2005; Alves et al., 2003) and, occasionally, the Triassic Silves Formation. In the areas where the basement was estimated via magnetic data models, errors are also expected due to the non-uniqueness of potential-field methods. Despite the calibration of seismic and magnetic data with some sparse boreholes, depth errors in the top of the pre-Mesozoic rocks may reach a few hundred meters in some areas.

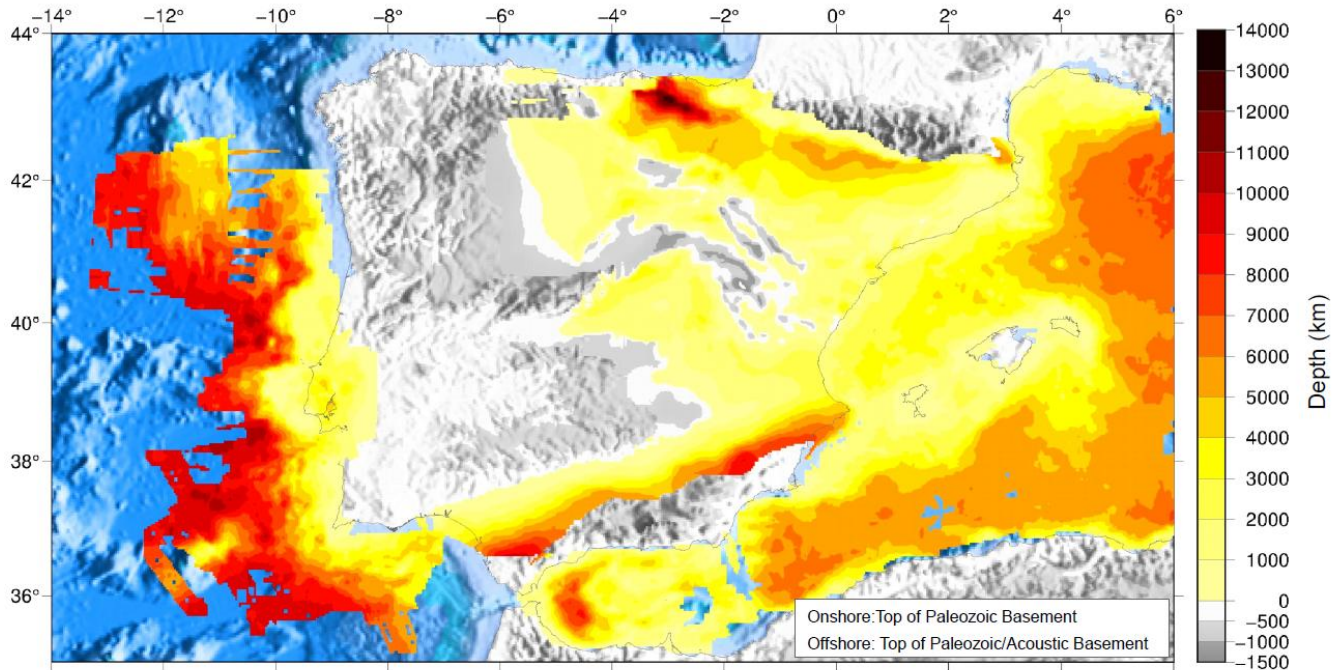


Figure 5 Offshore: Depth to the Top of Paleozoic, or Acoustic Basement for the majority of the Western Mediterranean region. Exceptions are the Valencia Trough and the Alboran Basin (see Fig. 1 for location), where the top of the basement corresponds to the Base of Cenozoic or the so-called Oligocene unconformity. Onshore: Depth to the Top of the Paleozoic Basement interpreted as the Paleozoic-cover sequence boundary or Hercynian discordance (Garcia-Lobón et al., 2020 and references therein).

3.2 Offshore Iberia

3.2.1 West Iberian Atlantic margin

The interpreted 2D multi-client seismic reflection data corresponds to a reprocessed seismic grid acquired from TGS during the PDT00 and PD000 cruises and from the IAM seismic survey profiles (IAM-4, 5, 8, 9, 10, 11, T1, T2, GB1, GB2, GB3). Details on the acquisition parameters and processing data for the two

435 cruises can be found in TGS (2001), Banda et al. (1995) and Torne et al. (2018), respectively. Figures 3 and 4 show the location of seismic profiles included in the database.

The interpretation of the Base of Cenozoic and Top of Paleozoic is based on regional (2-D) seismic data together with unpublished outcrop and well data (Figs. 5 and 6). The new data are of good enough quality for interpreters to mark a Top Basement stratigraphic marker with confidence, though the real morphology
440 of such a basal horizon is somehow masked by the poor resolution of the data at its depth of occurrence. Nevertheless, the Base of Meso-Cenozoic strata is clear on the new, reprocessed TGS data (see Alves (2024) for details). In this work, the criteria of Driscoll et al. (1995), Sinclair et al. (1995), Alves et al. (2009) and Soares et al. (2012) were used in the identification of key tectonic events affecting the North Atlantic region. Therefore, the two stratigraphic markers mapped in the available dataset were correlated
445 with borehole and outcrop data acquired from published and unpublished information from the Lusitanian Basin (Atrops and Marques, 1986; Wilson et al., 1989; Hiscott et al., 1990; Alves et al., 2002, 2003; Dinis et al., 2008), Porto Basin (Moita et al., 1996), Iberia Abyssal Plain (Wilson et al., 1996, 2001; Eddy et al., 2017), and proximal NW Iberia (Groupe Galice, 1979; Boillot et al., 1989; Murillas et al., 1990, Tucholke et al., 2007).

450 Unpublished information from exploration wells Pe-1, Go-1, 20B-1, 5A-1 and Lu-1 in West Iberia, together with dredge data published in Mougenot et al. (1989), were used locally to corroborate our seismic-stratigraphic interpretations. DSDP Site 398 and ODP Sites 637-641, 897-901 and 1065-1070 provide important information used to correlate seismic-stratigraphic units across the study area (Fig. 1b). These data are complemented with information from DSDP Site 120 and IODP Sites U1385, U1391 and
455 U1588 which recently drilled the SW Iberian margin (Hernández-Molina et al., 2013; Hodell et al., 2023) (Fig. 1). All data were integrated in a Schlumberger's Petrel® project so that structural, magnetic and seismic stratigraphic data could be analyzed together.

3.2.2 Alentejo Basin (continental shelf)

The Top of the Paleozoic Basement and the Base of Cenozoic were gathered from the interpretation of
460 the 1984 acquired GSI seismic reflection profiles (Carvalho, 1995), calibrated by available well data (GPEP, 1986), and geological outcrop information obtained from dragging and multi-channel seismic reflection data of Mougenot (1989). The seismic reflection data interpretation was assisted with gravimetric data (free air anomaly data collected also along the GSI profiles) and aeromagnetic data acquired in 1969 by Fairey Surveys Limited. Descriptions of the seismic and potential field datasets can

465 be found in Carvalho (1995). Location of seismic lines included in the database are shown in Figs. 3 and
4.

Potential field data allowed the identification and separation of basement uprisings or lows (pre-Mesozoic
units), from salt and igneous structures. The structural interpretation obtained from seismic data was also
compared with derivative maps of the gravimetric and magnetic anomaly maps, such as analytical
470 continuations to several altitudes, horizontal derivatives, vertical derivatives, shaded relief, etc. Seismic
interpretation was used afterwards as a starting point for the joint 2.5D forward modeling of magnetic and
gravimetric data using freeware software (Webring, 1985). The base of the Mesozoic horizon was further
corroborated by 3D gravimetric modeling using the software of Broome (1991), which uses the method
of Plouff (1976).

475 **3.2.3 Algarve Basin**

The geophysical data used to define the Top of Paleozoic Basement and Base of Cenozoic consist of a
high-resolution marine gravity survey and a 2D regional seismic reflection survey (TGS, 2001) and
represent a total coverage (58 lines; 5,820 km) of 17,890 km², extending from the shelf to the deep part
of the Algarve Basin (Fig. 2). The gravity data provided by TGS has been used to further constrain the
480 top of basement data in areas where seismic data coverage was poor or lacked resolution. Well data
provided by DGGE (Direcção Geral de Geologia e Energia) and from Lanaja et al. (1987) were used as
constraints.

The seismic-stratigraphic framework was simplified and divided into four seismic–stratigraphic units
based on their seismic character and well to seismic calibration (Matias, 2005; 2007), spanning from the
485 Paleozoic basement to Late Cenozoic sediments. Mapping of the top of the basement was aided by the
results from gravity enhancement maps and inversion (Matias, 2007). A time-to-depth conversion of the
interpreted horizons was performed using a layer-cake approach, as detailed in Matias (2007). Location
of seismic lines included in the database are shown in Figs. 3 and 4.

3.2.4 Western Mediterranean

490 Data of the depth to the acoustic basement for the Western Mediterranean region have been downloaded
from SEOANE (Sea Scientific Open Data Publication; Bellucci et al. (2021), [https://doi.org/
10.17882/80128](https://doi.org/10.17882/80128)). These data derive from the compilation and reprocessing, and in some cases
digitalization, of available industry and academia multichannel seismic profiles and well log suites. All
these data have been acquired since the 1960's and cover the westernmost Mediterranean Neogene basins,

495 namely the Valencia Trough and the Algerian and Alboran basins. As detailed in Belluci et al. (2021), the interpretation of the Top of Basement extends across all geomorphological domains, ranging from the shelf to the deep basin (Fig. 2). It is identified as the boundary separating the chaotic seismic facies of the substratum from the stratified seismic facies of the sedimentary column. In the Alboran and Valencia basins, the top of the acoustic basement coincides either with the Base of Cenozoic or the so-called
500 Oligocene unconformity, as documented in studies such as Do Couto et al. (2014), Pellen et al. (2016), and Etheve et al. (2016) (Figs. 3 and 4). For more detailed information the reader is referred to the work of Belluci et al. (2021) and references therein.

As the original data file presents different information relative to the age of the acoustic basement, we split the original file into three subfiles corresponding to the Valencia Trough and Alboran Basin regions
505 (Base of Cenozoic or the Oligocene unconformity) and the Algerian basin (boundary between chaotic and stratified seismic facies). For more details, please refer to Table S1. Location of seismic lines included in the database are shown in Figs. 3 and 4.

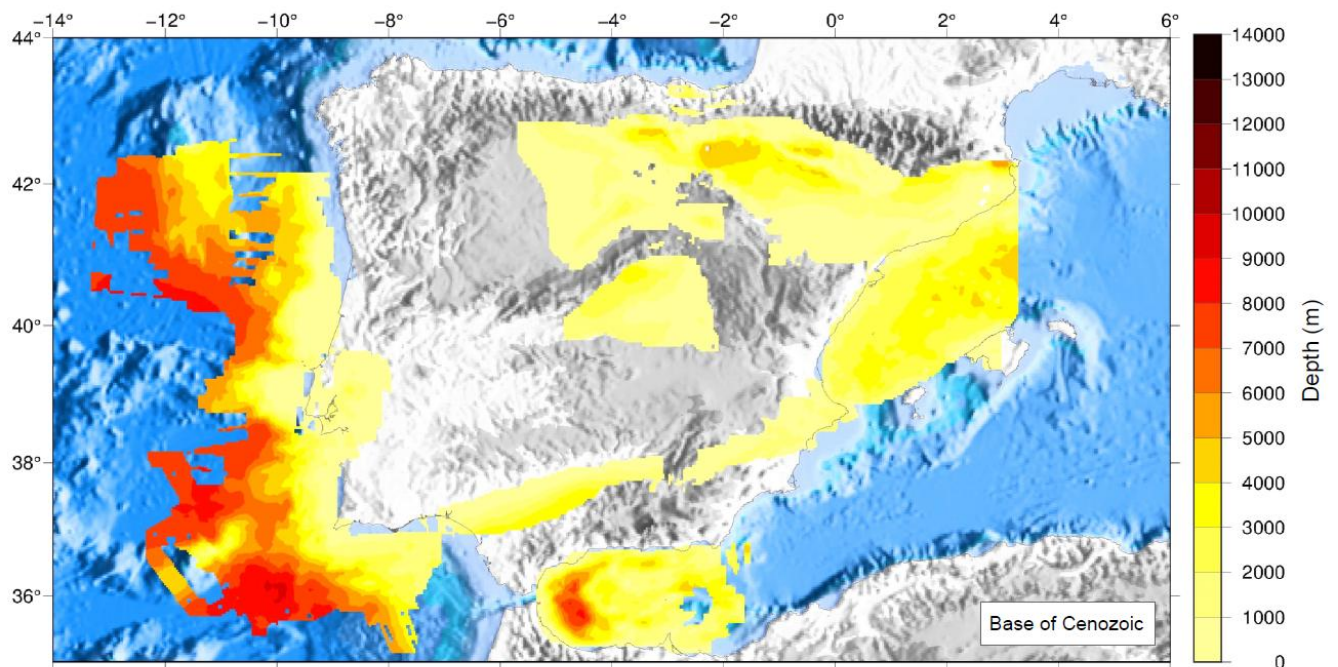


Figure 6 Offshore and onshore depth to the Base of Cenozoic. Main references from which data have
510 been gathered are shown in Table S1. Additional references can also be found throughout the text. Data from the Western Mediterranean have been taken from (Belluci et al., 2021, and references therein).

4. Influence of sediment thickness and nature on geothermal potential

Sediments are widely recognized for their capacity to act as thermal insulators, thereby attenuating the vertical transfer of heat from deeper geologic strata. However, the thermal regime at a given site is governed by a complex interplay of factors, including surface heat flow, the thermal conductivity of both sedimentary deposits and underlying lithologies, and the radiogenic heat production of these materials. Collectively, these parameters exert a significant influence on the thermal gradient and subsurface temperature distribution. To assess the influence of sediments on the thermal field, we systematically calculated the depth variability of the 150°C isotherm under different conditions. These conditions included variable surface heat flow values, sediment thickness, thermal conductivity variations, and a fixed radiogenic heat production rate. Temperature profiles have been computed in one dimension, considering surface heat flow values ranging from 40 to 120 mW/m² (e.g., Fernández et al., 1998) and the International Heat Flow Commission (Fuchs et al., 2023), a range that is representative of the mean and maximum heat-flow values recorded in the Iberian Peninsula. We have also considered standard values of radiogenic heat production for sediments and crust at, respectively, set at 1 μW/m³ and 3·e^(z/10) μW/m³, respectively, where z is depth in km. Other parameters considered were a constant crustal thermal conductivity of 3.1 W/m·K and a constant mean surface temperature of 15°C.

Figure 7 shows the variations in the depth of the 150°C isotherm in relation to sediment thickness, surface heat flow, and four different thermal conductivity values for the sediments (panels Fig. 7A to D). The calculated trend indicates that, for a constant measured surface heat flow and constant thermal conductivity, the isotherm depth decreases as sediment thickness increases until it reaches a critical threshold depth. Beyond this depth value, the isotherm becomes stable. Our results also show that, as expected, for a given thermal conductivity, an increase in surface heat flow leads to a relative shallowing of the isotherm, while a decrease in surface heat flow produces the opposite effect. Notably, an increase in thermal conductivity is associated with greater deepening of the 150°C isotherm for the same heat flow and sediment thickness values. The crustal thermal conductivity value of 3.1 W/m·K, which is within the upper range of typical values, was selected to provide a broader range for assessing the influence of sediment thermal conductivity on subsurface thermal gradients. Importantly, this threshold depth is independent of the crustal conductivity. However, lower crustal conductivity values would result in a shallower depth of the 150°C isotherm in regions where the sediment thicknesses are below the threshold depth.

Comparing Fig. 7A (showing the minima in conductivity values) and Fig. 7D (representing the maxima in conductivity values), one observes that for a constant heat flow value, say 70 mW/m², the 150°C the isotherm is significantly deepened as conductivity increases. Additionally, we observe that changes in sediment thickness wield more influence at lower thermal conductivity values. For instance, is one

assumes a thermal conductivity of $1.27 \text{ W/m}\cdot\text{K}$ and a surface heat flow of 70 mW/m^2 , the isotherm depth is reduced until sediment thickness reaches approximately 3.5 km . Beyond this point, the isotherm stabilizes at a constant depth (Fig. 7A). Conversely, when assuming higher conductivity values, e.g., approaching the conductivity of the crust (e.g., $3.0 \text{ W/m}\cdot\text{K}$), the effect of any increase in sediment
550 thickness is notably reduced (Fig. 7D).

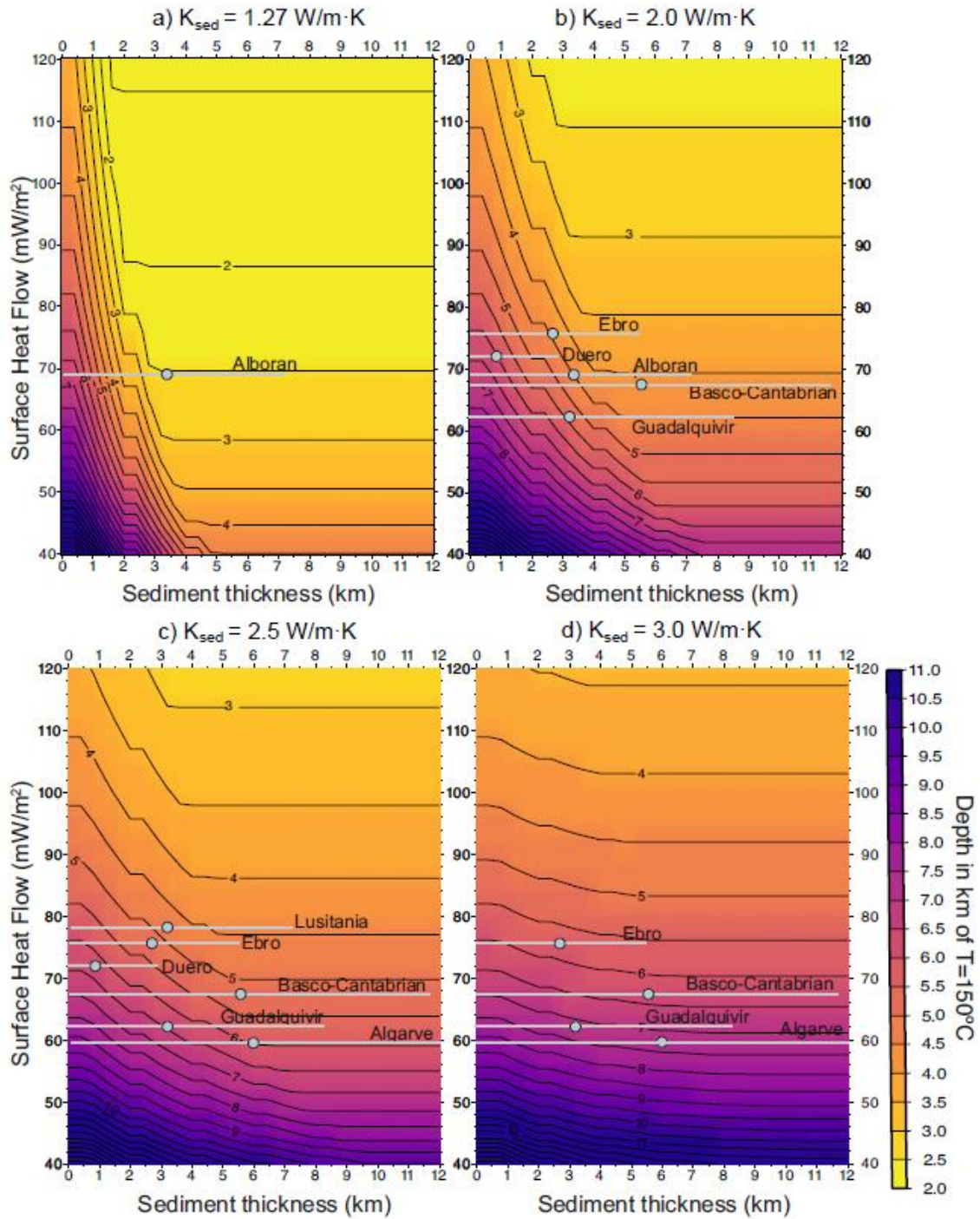


Figure 7 Depth to the 150°C isotherm as a function of sediment thickness and surface heat flow, assuming four different thermal conductivities for sediments: (A) 1.27 W/m·K, (B) 2.0 W/m·K, (C) 2.5 W/m·K and (D) 3.0 W/m·K. Crustal conductivity is kept constant at 3.1 W/m·K. Radiogenic heat production is 1 $\mu\text{W}/\text{m}^3$ and $3 \cdot e^{(z/10)} \mu\text{W}/\text{m}^3$ for the sediments and crust, respectively. Each basin is shown by a horizontal

grey line indicating the average surface heat flow value and average sediment thickness at the calculated site (grey dot). The minimum to maximum sediment thickness in the basin is indicated with the grey line.

Based on the findings presented in Fig. 7, we have computed an initial estimate of the depth of the 150°C isotherm for the onshore basins presented in this study, where surface heat flow is known, following the published values from Fernández et al., (1998) and compiled in the International Heat Flow Commission (Fuchs et al., 2023). As for thermal conductivities, we have taken the average thermal conductivities values in Torne et al. (2023). For instance, considering the Ebro Basin and the Guadalquivir Basin as end-members for relatively high and low average heat flow values, respectively 75 mW/m² and 62 mW/m², we observe that for a constant conductivity of 2.0 W/m·K, the depth of the isotherm in the Ebro Basin is considerably shallower (ranging from 6 km with no sediments to 3.75 km for a sediment thickness of 3.75 km) compared to the Guadalquivir Basin. In the Guadalquivir Basin, for equivalent sediment thickness values, the isotherm depth fluctuates between 7.75 km and 4.50 km, respectively. This difference is attributed to the higher average heat flow values observed in the Ebro Basin compared to the Guadalquivir Basin. Additionally, increases in thermal conductivity led to an increase in the isotherm depth, shifting to 6 km and 4.6 km in the Ebro Basin and to 7.75 and 5.70 km in the Guadalquivir Basin. However, it is important to stress that in both basins the impact of increasing conductivity results in the isotherm being situated at a greater depth, with it being less sensitive to variations in sediment thickness; this is clear when one compares panels A to D in Fig. 7. Such an observation generally confirms the impact of sediment thickness and thermal conductivity on the spatial distribution of the 150°C isotherm, with a heightened significance in areas characterized by lower heat flow values and low thermal conductivities.

5. Data availability

The SedDARE is available in the Spanish National Research Council repository, DIGITAL.CSIC (<https://doi.org/10.20350/digitalCSIC/16277>, DIGITAL.CSIC, 2024). A detailed list of the datasets can be found in Table S1.

580 6. Conclusions

Analyzing sediments is crucial for understanding a region's geological history, subsurface structure, and potential resources. The thickness and properties of sediment layers play a crucial role in subsurface exploration, providing valuable insights for building more accurate geophysical models. Additionally, studying sediment properties is essential for assessing and mitigating geohazards, and informing infrastructure planning and engineering. In summary, curating sediment data is essential for advancing

knowledge and sustainable management of resources, protecting the environment, and making informed decisions across various scientific, economic, and social domains.

SedDARE-IB database has been created to facilitate the reuse and preservation of existing data by future generations of geoscientists. It achieves this by hosting sediment data in the online institutional repository
590 DIGITAL.CSIC. The database accomplishes the international mandates of open-access data and the FAIR principles of data management. The database is a result of close collaboration between Portuguese and Spanish research teams, aiming to make available sediment data of the Iberian Peninsula easily accessible. Presently, SedDARE contains 29 datasets of isobath maps depicting the Top of Basement and the Base of Cenozoic of the Iberian Peninsula and its surrounding margins.

595 As an example of the use of the data set, we conducted a systematic thermal analysis examining the influence of the sediment thickness on the depth location of the 150°C isotherm. The obtained results indicate a complex relationship between isotherm depth and sediment thickness. While an increase in sediment thickness initially results in higher temperatures at relatively shallow depths, there is a critical threshold value in sediment thickness beyond which the 150°C isotherm stabilizes at a constant depth.
600 Moreover, an increase in thermal conductivity correlates with a deepening of the 150°C isotherm, while an increase in heat flow leads to the opposite effect.

When comparing the Ebro and the Guadalquivir basins as end-members of basins with relatively high and low average heat flow values (75 mW/m² and 62 mW/m², respectively), one records differences in the depth of the 150°C isotherm between 1 and 1.5 km. The trend is one of a deeper 150°C isotherm whenever
605 a relatively higher thermal conductivity is recorded.

The spatial distribution of the 150°C isotherm is notably affected by variations in thermal conductivity, with a heightened significance in those basins characterized by lower heat flow values. Here, the impact of thermal conductivity is particularly pronounced, influencing the isotherm depth to a greater extent than variations in sediment thickness.

610 **Author contributions**

MT, IJ-M, AM-GG, TA, JC and ER conceived the idea. MT, CA, HH, AB worked on the data curation and collation of the datasets of the Iberia Alpine foreland basins (JLGL, CA, MT, AB) and Western Mediterranean basins (HH, MT). TS, JC, ER, HM worked on the data curation and collation of the datasets of the deep offshore Atlantic Margin, Alentejo and Algarve basins. IJ-M and MT conducted the thermal
615 calculations. JC, JV, TA, HH, and ER prepared the geological section of the paper. MT and AB managed

the uploading of datasets into DIGITAL.CSIC. MT prepared the original manuscript; all authors contributed to the review and editing. TA handled English editing of the manuscript.

Competing interests

The contact author has declared that none of the authors has any competing interests.

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References

Alonso-Zarza, A.M., Clavo, J.P., Silva, P.G., and Torres, T.: Cuenca del Tajo, in: Geología de España,
650 edited by Vera, J.A., SGE-IGME, 556-561, ISBN: 84-7840-546-1, 2004.

Alves, T.M.: Networks of geometrically coherent faults accommodate Alpine tectonic inversion offshore
southwestern Iberia, *Solid Earth*, 15, 1, 39-62, <https://doi.org/10.5194/se-15-39-2024>, 2024.

Alves, T. M. and Cunha, T. A.: A phase of transient subsidence, sediment bypass and deposition of
regressive–transgressive cycles during the breakup of Iberia and Newfoundland, *Earth Planet. Sci. Lett.*,
655 484, 168-183. <https://doi.org/10.1016/j.epsl.2017.11.054>, 2018.

Alves, T. M., Gawthorpe, R.L., Hunt, D. H., and Monteiro, J. H.: Jurassic tectono-sedimentary evolution
of the Northern Lusitanian Basin (offshore Portugal), *Mar. Pet. Geol.*, 19, 727–754,
[https://doi.org/10.1016/S0264-8172\(02\)00036-3](https://doi.org/10.1016/S0264-8172(02)00036-3), 2002.

Alves, T. M., Manuppella, G., Gawthorpe, R. L., Hunt, D. H., and Monteiro, J. H.: The depositional
660 evolution of diapir- and fault-bounded rift basins: Examples from the Lusitanian Basin of west Iberia,
Sediment, Geol., 162, 273–303, [https://doi.org/10.1016/S0037-0738\(03\)00155-6](https://doi.org/10.1016/S0037-0738(03)00155-6), 2003.

Alves, T. M., Moita, C., Cunha, T., Ullnaess, M., Myklebust, R., Monteiro, J. H., and Manuppella, G.:
Diachronous evolution of Late Jurassic–Cretaceous continental rifting in the northeast Atlantic (west
Iberian margin), *Tectonics*, 28, TC4003, <https://doi.org/10.1029/2008TC002337>, 2009.

665 Anadón, P. and Roca, E.: Geological Setting of the Tertiary basins of Northeast Spain, in: *Tertiary Basins
of Spain: The Stratigraphic Record of Crustal Kinematics*, edited by Friend, P.F. and Dabrio, C.J.,
Cambridge Univ. Press, ISBN 10: 0521461715, 1996.

Antón, L., Rodés, A., de Vicente, G., Pallàs, R., García-Castellanos, D., Stuart, F. M., and Bourlès, D.:
Quantification of fluvial incision in the Duero Basin (NW Iberia) from longitudinal profile analysis and
670 terrestrial cosmogenic nuclide concentrations, *Geomorphology*, 165, 50-61, 2012

Antón, L., Muñoz-Martín, A., and de Vicente, G.: Quantifying the erosional impact of a continental-scale drainage capture in the Duero Basin, northwest Iberia, *Quat. Res.*, 91(2), 457-471, 2019. Arche, A., Evans, G., and Clavell, E.: Some considerations on the initiation of the present SE Ebro River drainage system: Post-or pre-Messinian?, *J. Iber. Geol.*, 36, 73–85, 2010.

675 Arenillas, A., Mediato, J. F., García Crespo, J., Nita, R., Molinero, R., García Lobón, J.L., Heredia, N., Marín, C., López, F.L., Pueyo, E.L., Martínez-Orio, R., et al.: Atlas de estructuras del subsuelo susceptibles de almacenamiento geológico de CO₂ en España, ISBN: 978-84-7840-935-8; 211 pp, 2014.

Atrops, F. and Marques, B. : Mise en évidence de la zone à platynota (Kimméridgien inférieur) dans le massif du Montejunto (Portugal); conséquences stratigraphiques et paléontologiques, *Geobios*, 19, 537–
680 547, [https://doi.org/10.1016/S0016-6995\(86\)80053-5](https://doi.org/10.1016/S0016-6995(86)80053-5), 1986.

Ayala, C., Torne, M., and Roca, E.: A review of the current knowledge of the crustal and lithospheric structure of the Valencia Trough Basin, *Bol. Geol. Min.*, 126 (2-3), 533-552, ISSN: 03660176, 2015.

Banda, E., Torne, M., and The Iberian Atlantic Margins Group: Iberian Atlantic Margins Group investigates deep structure of ocean margins, *Eos*, 76, 25–29, <https://doi.org/10.1029/E0076i003p00025>,
685 [1995](https://doi.org/10.1029/E0076i003p00025).

Barnolas, A., Civis, J., Larrasoaña, J.L., Pujalte, V., Scmitz, B., García-Castellanos, D., Sierro, F.J., and van den Berg, B.C.J.C.: Alpine Foreland Basins, in: *The Geology of Iberia: A Geodynamic Approach, Regional Geology Reviews*, edited by Quesada and J. T. Oliveira, Springer, Cham., https://doi.org/10.1007/978-3-030-11190-8_2, 2019.

690 Bellucci M., Pellen R., Leroux E., Bache F., Garcia M., Do Couto D., Raad F., Blondel S., Rabineau M., Gorini C., Moulin M., Maillard A., Lofi J., Del ben A., Camerlenghi A., Poort J., and Aslanian D.: A comprehensive and updated compilation of the seismic stratigraphy markers in the Western Mediterranean Sea, SEANOE, <https://doi.org/10.17882/80128>, 2021.

Berástegui, X., Banks, C.J., Puig, C., Taberner, C., Waltham, D., and Fernández, M.: Lateral diapiric
695 emplacement of Triassic evaporites at the southern margin of the Guadalquivir Basin, Spain, *Geol. Soc. Lond., Spec. Publ.*, 134, 49-68, <https://doi.org/10.1144/GSL.SP.1998.134.01.04>, 1998.

Boillot, G., Féraud, G., Recq, M., and Girardeau, J.: Undercrusting by serpentinite beneath rifted margins, *Nature*, 341, 6242, 523-525, 1989.

- Boillot, G., Girardeau, J., and Winterer, E.L.: Rifting processes of the west Galicia margin, Spain, in:
700 Extensional Tectonics and Stratigraphy of the North Atlantic Margins, edited by Tankard, A.J., and
Balkwill, H. R., AAPG Mem., 40, 363–377, 1989.
- Borges, J. F., Fitas, A.J., Bezzeghoud, M., and Teves-Costa, P.: Seismotectonics of Portugal and its
adjacent Atlantic area, *Tectonophysics*, 337, 373-387, 2001.
- Broome, J.: G3D: A Three-dimensional Gravity Modelling Program for IBM-Compatible Micro-
705 Computers, Geological Survey of Canada, pp 53, 1991.
- Cabral, J.: Neotectónica em Portugal Continental, 1rst edn., Mem. Inst. Geol. Min., Lisboa, 31, 1995.
- Cabral, J., Moniz, C., Ribeiro, P., Terrinha, P., and Matias, L.. Analysis of seismic reflection data as a
tool for the seismotectonic assessment of a low activity intraplate basin- the Lower Tagus Valley
(Portugal), *J. Seismol.*, 7, 431-447, 2003.
- 710 Cámara, P.: Salt and strike-slip tectonics as main drivers in the structural evolution of the Basque-
Cantabrian Basin, Spain, in: Permo-Triassic Salt Provinces of Europe, North Africa and the Atlantic
Margins, edited by Soto, J.I., Flinch, J.F., and Tari, G., Elsevier, 371-393, [https://doi.org/10.1016/B978-
0-12-809417-4.00018-5](https://doi.org/10.1016/B978-0-12-809417-4.00018-5), 2017.
- Carminati, E., Lustrino, M., and Doglioni, C.: Geodynamic evolution of the central and western
715 Mediterranean: tectonics vs. igneous petrology constraints, *Tectonophysics* 579, 173–192,
<https://doi.org/10.1016/j.tecto.2012.01.026>, 2012.
- Carvalho, J.: Study of the South Portuguese Zone and Adjacent Atlantic Margin using Geophysical Data,
Msc thesis, University of Lisbon, pp 154, 1995.
- Carvalho, J., Matias, H., Torres, L., Pereira, R., Manupella, G., and Mendes-Victor, L.: The structural and
720 sedimentary evolution of the Arruda and Lower Tagus sub-basins, Portugal, *Mar. Pet. Geol.*, 22, 3, 427-
453, <https://doi.org/10.1016/j.marpetgeo.2004.11.004>, 2005.
- Carvalho, J., Matias, H., Rabeh, T, Menezes, P. T., Barbosa, V., Dias, R., and Carrilho, F.: Connecting
onshore structures in the Algarve with the southern Portuguese continental margin: The Carcavai fault
zone, *Tectonophysics*, <https://doi.org/10.1016/j.tecto.2012.08.011>, 2012.

- 725 Carvalho, J., Rabeh, T., Dias, Rui, Dias, Ruben, Pinto, C.C., Oliveira, T., Cunha, T, and Borges, J.: Tectonic and Neotectonic Implications of a New Basement Map of the Lower Tagus Valley, Portugal, *Tectonophysics*, 617, 88-100. <http://doi.org/10.1016/j.tecto.2014.01.017>, 2014.
- Carvalho, J., Pinto, C., Rabeh, T., Dias, R., Torres, L., Borges, J., Torres, R., and Duarte, H.: Tectonic Evolution of an Intraplate Basin: The Lower Tagus Cenozoic Basin, Portugal, *Basin Res.*, 29 (5), 636-730 557, <https://doi.org/10.1111/bre.12193>, 2017.
- Casas-Sainz, A., and de Vicente, G.: On the tectonic origin of Iberian topography, *Tectonophysics*, 474, 214-235, <https://doi.org/10.1016/j.tecto.2009.01.030>, 2009.
- Casas-Sainz, A.M., and Faccenna, C.: Tertiary compressional deformation of the Iberian plate, *Terra Nova*, 13, 4: 281-288, <https://doi.org/10.1046/j.1365-3121.2001.00355.x>, 2001.
- 735 Casini, G., Vergés, J., Drzewiecki, P., Ford, M., Cruset, D., Wright, W., and Hunt, D.: Reconstructing the Iberian Salt-Bearing Rifted Margin of the Southern Pyrenees: Insights from the Organyà Basin, *Tectonics*, 42, 7, <https://doi.org/10.1029/2022TC007715>, 2023.
- Civis, J. and Vera, J. A. (2004). Cuencas cenozoicas, in: *Geología de España*, edited by Vera, J.A, SGE-IGME, 531-533, ISBN 84-7840-546-1.
- 740 Clavell, E., and Berastegui, X.: Petroleum geology of the Gulf of Valencia, in: *Generation, Accumulation and Production of Europe's Hydrocarbons*, edited by Spencer A.M., Spec. Publ. EAPG, Oxford University, 1, 355-368, 1991.
- Comas, M.C., García-Dueñas, V., and Jurado, M.J.: Neogene tectonic evolution of the Alboran Sea from MCS data, *Geomar. Lett.*, 12, 157–164, 1992.
- 745 Coppier, G., and Mougénot, D.: Stratigraphie sismique et evolution geologique des formations neogenes et quaternaires de la plate-forme continentale portugaise au sud de Lisbonne., *Bull. Soc. Geol. Fr.*, S7-XXIV (3), 421–431. <https://doi.org/10.2113/gssgfbull.S7-XXIV.3.421>, 1992.
- Costa, E., Garcés, M., López-Blanco, M., Beamud, E., Gómez-Paccard, M., and Larrasoaña, J.C.: Closing and continentalization of the South Pyrenean foreland basin (NE Spain): magnetochronological 750 constraints. *Basin Res.*, 22, 6, 904-917, <https://doi.org/10.1111/j.1365-2117.2009.00452.x>, 2009.
- Cunha, P. P.: Cenozoic Basins of Western Iberia: Mondego, Lower Tejo and Alvalade Basins, in: *The Geology of Iberia: A Geodynamic Approach*, edited by Quesada, C. and Oliveira, J.T., 4, 105-130.

- https://doi.org/10.1007/978-3-030-11190-8_4, 2019. de Vicente, G., Muñoz-Martín, A.: *The Madrid Basin and the Central System: A tectonostratigraphic analysis from 2D seismic lines*, *Tectonophysics* 602, 259–285. <https://doi:10.1016/j.tecto.2012.04.003>, 2013.
- 755 de Vicente, G., Muñoz-Martín, A., Guimerà, J., Vegas, R., and Cloetingh, S.: Estructura Alpina del Antepaís Ibérico, in: *Geología de España*, edited by Vera, J.A., SGE-IGME, 589-534, ISBN 84-7840-546-1, 2004.
- de Vicente, G., Cloetingh, S., Van Wees, J.D., and Cunha, P. P.: Tectonic classification of Cenozoic Iberian foreland basins, *Tectonophysics*, 502, 38–61, 2011.
- 760 Dias, J.M. and Nittrouer, C.A.: Continental shelf sediments of northern Portugal, *Cont. Shelf Res.*, 3,2, 147-165, [https://doi.org/10.1016/0278-4343\(84\)90004-9](https://doi.org/10.1016/0278-4343(84)90004-9), 1984.
- Dias, J.M., Jouanneau, M., Gonzalez, R., Araújo, M.J., Drago, T., Garcia, C., Oliveira, A., Rodrigues, A., Vitorino, J., and Weber, O.: Present day sedimentary processes on the northern Iberian shelf, *Prog. Oceanogr.*, 52, 2-4, 249-259. [https://doi.org/10.1016/S0079-6611\(02\)00009-5](https://doi.org/10.1016/S0079-6611(02)00009-5), 2002.
- 765 DIGITAL.CSIC: (Geo3Bcn) SedDARE-IB: An open access repository of sediment data for Iberia and its continental margins, available at: <https://doi.org/10.20350/digitalCSIC/16277>, last access: May 2024.
- Dinis, J. L., Rey, J., Cunha, P.P., and Callapez, P.: Stratigraphy and allogenic controls of the western Portugal Cretaceous: An updated synthesis, *Cretaceous Res.*, 29, 772–780, <https://doi.org/10.1016/j.cretres.2008.05.027>, 2008.
- 770 Do Couto, D., Popescu, S. M., Suc, J. P., Melinte-Dobrinescu, M. C., Barhoun, N., Gorini, C., and Auxietre, J. L.: Lago Mare and the Messinian salinity crisis: evidence from the Alboran Sea (S. Spain), *Mar. Pet. Geol.*, 52, 57-76, <https://tel.archives-ouvertes.fr/tel-01148777>, 2014.
- Drago, T., Jouanneau, J. M., Weber, O., Naughton, F., and Rodrigues, A.: Environmental factors controlling the depositional facies characteristics of Minho, Douro and Tejo mud patches, in: *3rd Symposium on the Iberian Atlantic Margin*, Faro, 217-218, 2000.
- 775 Driscoll, N. W., Hogg, J. R., Christie-Blick, N., and Karner, G. D.: Extensional tectonics in the Jeanne d'Arc Basin, offshore Newfoundland: Implications for the timing of break-up between Grand Banks and Iberia, in: *The Tectonics, Sedimentation and Palaeoceanography of the North Atlantic Region*, edited by Scrutton, R. A. et al., *Geol. Soc. Spec. Publ.*, 90, 1–28, 1995.
- 780

Eddy, M.P., Jagoutz, O., and Ibañez-Mejía, M.: Timing of initial seafloor spreading in the Newfoundland-Iberia rift, *Geology* 45, 527-530, 2017.

Etheve, N., de Lamotte, D. F., Mohn, G., Martos, R., Roca, E., and Blanpied, C.: Extensional vs contractional Cenozoic deformation in Ibiza (Balearic Promontory, Spain): Integration in the West
785 Mediterranean back-arc setting, *Tectonophysics*, 682, 35-55, 2016.

Fernandez, M., Marzan, I., Correia, A., and Ramalho, E.: Heat flow, heat production, and lithospheric thermal regime in the Iberian Peninsula, *Tectonophysics* 291, 29–53, [https://doi.org/10.1016/S0040-1951\(98\)00029-8](https://doi.org/10.1016/S0040-1951(98)00029-8).

Ford, M. and Vergés, J.: Evolution of a salt-rich transtensional rifted margin, eastern North Pyrenees,
790 France, *J. Geol. Soc.*, 178, <https://doi.org/10.1144/jgs2019-157>, 2001.

Friend, P.F. and Dabrio, C.J. (Eds.): *Tertiary Basins of Spain: The Stratigraphic Record of Crustal Kinematics*. Cambridge University Press, ISBN 10: 0521461715, 1995.

Fuchs et al.: Quality-assurance of heat-flow data: The new structure and evaluation scheme of the IHFC Global Heat Flow Database, *Tectonophysics*, 863, <https://doi.org/10.1016/j.tecto.2023.229976>, 2023.

795 García-Castellanos, D., and Larrasoña, J.C.: Quantifying the post-tectonic topographic evolution of closed basins: The Ebro basin (northeast Iberia), *Geology*, 43(8), 663-666. <https://doi.org/10.1130/G36673.1>, 2015.

García-Castellanos, D., Fernández, M., and Torne, M.: Modeling the evolution of the Guadalquivir foreland basin (southern Spain), *Tectonics*, 21, 3, 1018. <https://doi.org/10.1029/2001TC001339>, 2002.

800 García-Castellanos, D., Vergés, J., Gaspar-Escribano, J., and Cloetingh, S.: Interplay between tectonics, climate, and fluvial transport during the Cenozoic evolution of the Ebro Basin (NE Iberia), *J. Geophys. Res.*, 108(B7), 2347, <https://doi.org/10.1029/2002jb002073>, 2003.

García Lobón, J.L., Reguera, M.I., Martín León, J., Rey Moral, C., Berrezueta, E.R.: Plan de selección y caracterización de áreas y estructuras favorables para el almacenamiento geológico de CO₂ en España:
805 Resumen ejecutivo, IGME, pp 76, https://info.igme.es/SidPDF/149000/047/149047_0000001.pdf, 2010a.

García-Lobón, J. L., (director del Proyecto), Alcolea, M., Bastante, R., Escalante, S., Hermida, E., Morante, M., Ruíz, G., Pardos, M., Juez, F. J., Muñoz, J. A., Mencos, J., Roca, E., Gratacós, O., Bello, D. A., Bausá, J., Arbués, P., Arche, A., Cardona M. A., Cortés, A. L., Baceta, J. I., Murelaga, X., Larrasoña,

J. C.: Primera Fase del Plan de Almacenamiento Geológico de CO₂ del IGME (Proyecto ALGECO₂).
810 Volumen II-1- Cadena Pirenaica y Cuenca del Ebro. Geología. Edición: IGME, MADRID, ESP, 2010.
Título de colección: Proyecto: Selección y Caracterización de Áreas y Estructuras Geológicas
Susceptibles de Constituir Emplazamientos de Almacenamiento de CO₂ (ALGECO₂), 47 pp y anexos,
Código 64046, https://info.igme.es/SidPDF/146000/830/146820_0000001.pdf, 2010b.

García-Lobón, J. L., (director del Proyecto), Heredia, N., Gómez, J. A., Molinero, R., León, C., Pineda,
815 A., Delgado, B., Varea, R., Álvarez-Pulgar, J. y Navas, M.: Primera Fase del Plan de Almacenamiento
Geológico de CO₂ del IGME (Proyecto ALGECO₂). Volumen I-1- Cadena Cantábrica y Cuenca del
Duero. Geología. Edición: IGME, MADRID, ESP, 2010. Título de colección: Selección y
Caracterización de Áreas y Estructuras Geológicas Susceptibles de Constituir Emplazamientos de
Almacenamiento de CO₂ (ALGECO₂). 43 pp y anexos, Código 64044,
820 https://info.igme.es/SidPDF/146000/828/146828_0000001.pdf, 2010c.

García-Lobón, J. L., (director del Proyecto), López, F. L., Hernaiz, P. P., Mediato, J., Peropadre, C.,
Monleón, O., García, S., Horno, C., Gómez, M., Iribarren, L., Moreno, F., Huerta, P., Biete, C., Hermida,
E., Ruiz, G., Gómez, J. J.: Primera Fase Del Plan De Almacenamiento Geológico de CO₂ del IGME
(Proyecto ALGECO₂). Volumen III -1- Cadena Ibérica y Cuencas del Tajo y de Almazán. Geología.
825 Título de colección: Selección y Caracterización de Áreas y Estructuras Geológicas Susceptibles de
Constituir Emplazamientos de Almacenamiento de CO₂ (ALGECO₂). 246 pp y anexos, Código 64048,
https://info.igme.es/SidPDF/146000/832/146832_0000001.pdf, 2010d.

García-Lobón, J. L., (director del Proyecto), Marín, C., López, F., Motis, K., Huerta, J., Navaro, J. J.,
Martínez del Olmo, W., Plaza, J., Portero J. M.: Primera Fase Del Plan de Almacenamiento Geológico de
830 CO₂ del IGME (Proyecto ALGECO₂). Volumen IV -1- Cadenas Béticas y Cuenca del Guadalquivir.
Geología. Título de colección: Selección y Caracterización de Áreas y Estructuras Geológicas
Susceptibles de Constituir Emplazamientos de Almacenamiento de CO₂ (ALGECO₂), 33 pp y anexos,
Código 64050, https://info.igme.es/SidPDF/146000/834/146834_0000001.pdf, 2010e.

Gibbons, W. and Moreno, T., (eds.): The Geology of Spain. Geol. Soc. London, 1-349, ISBN 1-86239-
835 127-0, <https://doi.org/10.1180/0680834>, 2002.

Gómez de la Peña, L., Ranero, C.R., Gracia, E., and Booth-Rea, G.: The evolution of the westernmost
Mediterranean basins, Earth Sci. Rev., 214, <https://doi.org/10.1016/j.earscirev.2020.103445>, 2021.

GPEP.: Gabinete para a Pesquisa e Exploração de Petróleos, now DPEP. Petroleum Potential of Portugal, Ministry of Environment, Planning and Energy, Lisbon, Portugal, pp 62, 1986.

- 840 Grevemeyer, I., Ranero, C. R., Papenberg, C., Sallares, V., Bartolomé, R., Prada, M., Batista, L., and Neres, M.: The continent-to-ocean transition in the Iberia Abyssal Plain, *Geology*, 50, 615-619, <https://doi.org/10.1130/G49753.1>, 2022.

Groupe Galice: The continental margin off Galicia and Portugal: Acoustical stratigraphy, dredge stratigraphy and structural evolution, *Initial Rep. Deep Sea Drill. Proj.* 47, 633–662, 1979.

- 845 Hernández-Molina, F. J., Stow, D., Alvarez-Zarikian, C., and Expedition IODP 339 Scientists: IODP Expedition 339 in the Gulf of Cadiz and off West Iberia: decoding the environmental significance of the Mediterranean outflow water and its global influence, *Sci. Drilling*, 16, 1–11, <https://doi.org/10.5194/sd-16-1-2013>, 2013.

- 850 Herrero, A., Alonso Gavilán, G., and Colmenero, J.R.: Estratigrafía del subsuelo en el sector noroeste de la cuenca del Duero (provincia de León), *Rev. Soc. Geol. Esp.*, 17, 3-4, 199-216, ISSN: 0214-2708, 2004.

Hiscott, R. N., Wilson, R. C. L., Gradstein, F. M., Pujalte, V., Garcia-Mondejar, J., Boudreau, R. R., and Wishart, H. A.: Comparative stratigraphy and subsidence history of Mesozoic rift basins of North Atlantic, *AAPG Bull.*, 74, 60–76, 1990.

- 855 Hodell, D. A., Abrantes, F., Alvarez Zarikian, C. A., and the Expedition 397 Scientists: Expedition 397 Preliminary Report: Iberian Margin Paleoclimate, *International Ocean Discovery Program*, <https://doi.org/10.14379/iodp.pr.397>, 2023.

Inverno, C. M. C., Manupella, G., Zbyszewski, G., Pais, J., and Ribeiro, M. L.: Notícia explicativa da folha 42- C Santiago do Cacém, *Serviços Geológicos de Portugal*, Lisboa, 1993.

- 860 Iribarren, L., Vergés, J., and Fernández, M.: Sediment supply from the Betic–Rif orogen to basins through Neogene, *Tectonophysics*, 475, 68–84, 2009.

Juarez, M.T., Lowrie, W., Osete, M.L., and Meléndez, G.: Evidence of widespread Cretaceous remagnetization in the Iberian Range and its relation with the rotation of Iberia, *Earth Planet. Sci. Lett.*, 160, 729-743, 1998.

- 865 Jurado, M.J. and Comas, M.C.: Well log interpretation and seismic character of the Cenozoic sequence in the northern Alboran Sea, *Geomar. Lett.* 12, 129–136, 1992.

Krijgsman, W., Garcés, M., Langereis, C.G., Daams, R., van Dam, J., van der Meulen, A.J., Agustí, J., and Cabrera, L.: A new chronology for the middle to late Miocene continental record in Spain, *Earth Planet. Sci. Lett.*, 142, 3–4, 367-380. [https://doi.org/10.1016/0012-821X\(96\)00109-4](https://doi.org/10.1016/0012-821X(96)00109-4), 1996.

870 Lanaja, J.M., Navarro, A., Martínez, J. L., Del Valle, J., Rios, L. M., Plaza, J., Potro, R., and Rodríguez de Pedro, J.: Contribución de la exploración petrolífera al conocimiento de la geología de España, Instituto Geológico y Minero de España, Madrid, pp 465, 1987.

Llave, E., Hernández-Molina, F., Stow, D., Somoza, L. and Díaz del Rio, V.: The contourite depositional system in the Gulf of Cadiz: an example of drifts with reservoir potential characteristics, in: XXV Aniversario Asociación de Geólogos y Geofísicos Españoles del Petróleo, edited by Martínez del Olmo, 875 W., 53-73, 2006.

Lopes, F., Cunha, P. P., and Le Gall, B.: Cenozoic seismic stratigraphy and tectonic evolution of the Algarve margin (offshore Portugal, southwest Iberian Peninsula), *Mar. Geol.*, 231, 1-36, 2006.

Lustrino, M., Duggen, S., and Rosenberg, C.L.: The Central-Western Mediterranean: anomalous igneous activity in an anomalous collisional tectonic setting, *Earth Sci. Rev.*, 104, 1–40, 880 <https://doi.org/10.1016/j.earscirev.2010.08.002>, 2011.

Macchiavelli, C., Vergés, J., Schettino, A., Fernández, M., Turco, E., Casciello, E., Torne, M., Pierantoni, P.P., and Tunini, L.: A New Southern North Atlantic Isochron Map: Insights into the Drift of the Iberian Plate Since the Late Cretaceous, 122, 12, 9603-9626, *J. Geophys. Res. Solid Earth*, <https://doi.org/10.1002/2017JB014769>, 2017.

885 Maillard, A., Mauffret, A., Watts, A.B., Torné, M., Pascal, G., Buhl, P., and Pinet, B.: Tertiary sedimentary history and structure of the Valencia trough (western Mediterranean), *Tectonophysics*, 203,1–4, 57-75, [https://doi.org/10.1016/0040-1951\(92\)90215-R](https://doi.org/10.1016/0040-1951(92)90215-R), 1992.

Martínez del Olmo, W.: E3 depositional sequences in the Gulf of Valencia tertiary basin, in: Tertiary basins of Spain: The stratigraphic record of crustal kinematics, edited by Friend, P. and Dabrio, J., 55–67, 890 Cambridge, Cambridge Univ. Press, <https://doi.org/10.1017/CBO9780511524851.012>, 1996.

Martinez del Olmo, W., Garcia Mojonero, C., and Torrecusa, S.: The Guadalquivir and Gulf of Cadiz gas basins (SW Spain), in: XXV Aniversario Asociación de Geólogos y Geofísicos Españoles del Petróleo, edited by Martinez del Olmo, W., 105-120, 2006.

- Martins, L.T., Madeira, J., Youbi, N., Munhá, J., Mata, J., and R. Kerrich: Rift-related magmatism of the
895 Central Atlantic magmatic province in Algarve, Southern Portugal, *Lithos* 101, 102–124, 2008.
- Matias, H.: Hydrocarbon Potential of the Offshore Algarve Basin: PhD Thesis, Faculdade de Ciências da
Universidade Nova de Lisboa, pp 324, 2007.
- Matias, H., Barbosa, V., Menezes, P., Sandnes, F., Matias, L., Santos, F., and Reidun, M.: Offshore
Algarve Basin, Portugal: Morphology of Paleozoic Basement and Influence on Mesozoic Sedimentation,
900 AAPG Conference & Exhibition, Calgary, 2005.
- Matias, H., Mohriak, W.U., Menezes, P., Sandnes, F., Barbosa, V. C. F, Matias, L., Santos, F.: Salt
distribution and morphology in the offshore Algarve Basin, in: *Petroleum Systems of Divergent
Continental Margin Basins*, edited by Post, P. and Rosen, N., Proceedings of the 25th Annual Bob F.
Perkins Research Conference, Gulf Coast Section SEPM, 481-509, 2005.
- 905 Matias, H., Sandnes, F., Cabrita Da Silva, V., Matias, L., and Santos, F.: Analysis of the Petroleum System
in the Western Gulf of Cadiz: Offshore Algarve Basin, AAPG Energy Conference & Exhibition, 18-21
November, Athens, Greece, 2007.
- Matte, P. and Ribeiro, A.: Former et orientation de l'ellipsoïde de déformation dans la virgation
hercynienne de Galice. Relations avec le plissement et hypothèses sur la génèse de l'arc Ibero-Armoricain.
910 *C. R. Acad. Sci. Terre, Paris*, 280, 2825–2828, 1975.
- Medialdea, T., Vegas, R., Somoza, L., Vázquez, J.T., Maldonado, A., Díaz-del-Río, V. Maestro, A.,
Córdoba, D., and Fernández-Puga ; M.C. : Structure and evolution of the "Olistostrome" complex of the
Gibraltar Arc in the Gulf of Cádiz (eastern Central Atlantic): evidence from two long seismic cross-
section, *Mar. Geol.*, 209, 173-198, 2004.
- 915 Mikeš, D.: The Upper Cenozoic evolution of the Duero and Ebro fluvial systems (N-Spain): Part I.
Paleogeography; Part II. Geomorphology, *Cent. Eur. J. Geosci.*, 2(3), 420–432,
<https://doi.org/10.2478/v10085-010-0017-4>, 2010.
- Miranda, R., Valadares, V., Terrinha, P., Mata, J., Azevedo, M. R., Gaspar, M., Kullberg, J. C., and
Ribeiro, C.: Age constraints on the Late Cretaceous alkaline magmatism on the West Iberian Margin,
920 *Cretaceous Res.*, 30, 575-586, <https://doi.org/10.1016/j.cretres.2008.11.002>, 2009.

Moita, C., Pronk, E., and Pacheco, J.: Porto Basin: Seismic interpretation report, Unpublished report, MILUPOBAS, Project, EU Contract JOU2-CT94-0348, pp 47, 1996.

Mougenot, D.: Geology of the Portuguese Margin (in portuguese), Instituto Hidográfico, Lisboa, pp 259, 1989.

- 925 Muñoz-Martín, A.: Evolución geodinámica del borde oriental de la Cuenca del Tajo desde el Oligoceno hasta la actualidad, Tesis doctoral Universidad Complutense de Madrid, 1-331, <https://hdl.handle.net/20.500.14352/62891>, 1997.

Muñoz Martín, A. and de Vicente, G.: Origen y relación entre las deformaciones y esfuerzos alpinos de la zona Centro-Oriental de la Península Ibérica, *Rev. Soc. Geol. Esp.*, 11, 1-2, 1998.

- 930 Murillas, J., Mougenot, D., Boillot, G., Comas, M.C., Banda, E., and Mauffret, A.: Structure and evolution of the Galicia Interior basin (Atlantic western Iberian continental margin), *Tectonophysics*, 184, 297–319, [https://doi.org/10.1016/0040-1951\(90\)90445-E](https://doi.org/10.1016/0040-1951(90)90445-E), 1990.

- Neres, M., Terrinha, P., Noiva, J., Brito, P., Rosa, M., Batista, L., Ribeiro, C.: New Late Cretaceous and CAMP Magmatic Sources off West Iberia, From High-Resolution Magnetic Surveys on the Continental Shelf, *Tectonics*, 42, 7, <https://doi.org/10.1029/2022TC007637>, 2023.

Pais, J., Cunha, P.P., Pereira, D., Legoinha, P., Dias, R., Moura, D., Silveira, A. B., Kullberg, J. C., and González-Delgado, J.A.: The Paleogene and Neogene of Western Iberia (Portugal): A Cenozoic Record in the European Atlantic Domain, 1st ed., Springer, pp 156, 2012.

- Palain, C. : Une série détritique terrigène, les "Grès de Silves": Trias et Lias Inférieur du Portugal, *Ser. Geol. Portugal, Memória nº 25*, Lisboa, p. 377, 1976.

Pascal, G., Torne., M., Buhl, P., Watts, A.B., and Mauffret, M.: Crustal and velocity structure of the Valencia Trough (western Mediterranean), Part II. Detailed interpretation of five Expanded Spread Profiles, *Tectonophysics*, 203, 1-4, 21-35, [https://doi.org/10.1016/0040-1951\(92\)90213-P](https://doi.org/10.1016/0040-1951(92)90213-P), 1992.

- Pellen, R., Aslanian, D., Rabineau, M., Leroux, E., Gorini, C., Silenziario, C., Blanpied C., and Rubino, J. L.: The Minorca Basin: a buffer zone between the Valencia and Liguro-Provençal Basins (NW Mediterranean Sea), *Terra Nova*, 28(4), 245-256, 2016.

Pereira, R. N. and Alves, T.M.: Tectono-stratigraphic signature of multiphased rifting on divergent margins (deep-offshore Southwest Iberia, North Atlantic), *Tectonics*, 31, TC4001, <https://doi.org/10.1029/2011TC003001>, 2012.

- 950 Pereira, R. and Alves, T. M.: Crustal deformation and submarine canyon incision in a Meso-Cenozoic first-order transfer zone (SW Iberia, North Atlantic Ocean), *Tectonophysics*, 601, 148-162, <https://doi.org/10.1016/j.tecto.2013.05.007>, 2013.

Plouff, D.: Gravity and magnetic fields of polygonal prisms and application to magnetic terrain corrections, *Geophysics*, 41, 727-741, 1976.

- 955 Puigdefàbregas, C., Muñoz, J.A., and Vergés, J.: Thrusting and foreland basin evolution in the southern Pyrenees, McClay, K. Thrust Tectonics, Chapman Hall, London, 247–254, 1992.

Quesada, C. and Oliveira, J. (eds): The Geology of Iberia: A Geodynamic Approach. Regional Geology Reviews, Springer, Cham. https://doi.org/10.1007/978-3-030-11295-0_1, 2019.

- Ramos, A., Fernández, O., Torne, M., Sánchez de la Muela, A., Muñoz, J.A., Terrinha, P., Manatschal, G., Salas, M.C.: Crustal structure of the SW Iberian passive margin: The westernmost remnant of the Ligurian Tethys?, *Tectonophysics*, 705, 42-62, <http://dx.doi.org/10.1016/j.tecto.2017.03.012>, 2017.

Rasmussen, E.S., Lomholt, S., Anderson, C., and Vejbaek, O.V.: Aspects of the structural evolution of the Lusitanian Basin in Portugal and the shelf and slope area offshore Portugal, *Tectonophysics*, 300, 199-225, 1998.

- 965 Ribeiro, A., Kullberg, M.C., Kullberg, J.C., Manupella, G., and Phipps, S.: A review of Alpine tectonics in Portugal: Foreland detachment in basement and cover rocks, *Tectonophysics*, 184, 357-366, 1990.

Ribeiro, A., Cabral, J., Baptista, R., and Matias, L.: Stress pattern in Portugal mainland and the adjacent Atlantic region, West Iberia, *Tectonics*, 15, 641-659, 1996.

- Rodríguez-Fernández, L. R., López-Olmedo, F., Oliveira, J. T., Medialdea, T., Terrinha, P., Matas, J., et al.: Mapa Geológico de España y Portugal a Escala 1:1.000.000, IGME-LNEG, 2015.

Roest, W.R. and Srivastava, S.P.: Kinematics of the plate boundaries between Eurasia, Iberia and Africa in the North Atlantic from the late Cretaceous to the present, *Geology*, 19, 613-616, 1991.

- Roque, A.C.F.P.: Tectonostratigrafia do Cenozóico das margens continentais sul e sudoeste portuguesas: um modelo de correlação sismostratigráfica: PhD thesis, Universidade de Lisboa. Faculdade de Ciências, 975 Departamento de Geologia, pp 310, 2007.
- Rosenbaum, G., Lister, G.S., and Duboz, C.: Relative motions of Africa, Iberia and Europe during Alpine orogeny, *Tectonophysics*, 359,117-129, 2002.
- Sawyer, D.: Processed multichannel seismic data from the Galicia Bank and Iberia Abyssal Plain, acquired during the R/V Maurice Ewing survey EW9705 (1995) as part of a joint US-German MCS and 980 wide-angle seismic experiment (ISE 97), MGDS, <https://doi.org/10.1594/IEDA/500143>, 2006.
- Shanmugam, G. and Moiola, R.J.: Submarine fans: Characteristics, models, classification, and reservoir potential, *Earth Sci. Rev.*, 24, 6, 383-428, [https://doi.org/10.1016/0012-8252\(88\)90064-5](https://doi.org/10.1016/0012-8252(88)90064-5), 1998.
- Silva, P. G., Roquero, E., López-Recio, M., Huerta, P., and Martínez-Graña, A. M.: Chronology of fluvial terrace sequences for large Atlantic rivers in the Iberian Peninsula (Upper Tagus and Duero drainage 985 basins, Central Spain), *Quat. Sci. Rev.*, 166, 188-203, 2017.
- Sinclair, I.K.: Sequence stratigraphic response to Aptian-Albian rifting in conjugate margin basins: A comparison of the Jeanne d'Arc Basin, offshore Newfoundland, and the Porcupine Basin, offshore Ireland, in: *The Tectonics, Sedimentation and Palaeoceanography of the North Atlantic Ocean*, edited by Scrutton, R.A. et al., *Geol. Soc. Spec. Publ.*, 90, 29–49, 1995.
- 990 Soares, D.M., Alves, T.M., and Terrinha, P.: The breakup sequence and associated lithospheric breakup surface: Their significance in the context of rifted continental margins (West Iberia and Newfoundland margins, North Atlantic), *Earth Planet. Sci. Lett.* 355, 311-326, 2012.
- Stampfli, G. and Borel, G.D.: A plate tectonic model for the Paleozoic and Mesozoic constrained by dynamic plate boundaries and restored synthetic oceanic isochrons, *Earth Planet. Sci. Lett.*, 196, 17-33. 995 [https://doi.org/10.1016/S0012-821X\(01\)00588-X](https://doi.org/10.1016/S0012-821X(01)00588-X), 2002.
- Struth, L., Garcia-Castellanos, D., Viaplana-Muzas, M., and Vergés, J.: Drainage network dynamics and knickpoint evolution in the Ebro and Duero basins: From endorheism to exorheism. *Geomorphology* 327, 554–571, 2019.
- Struth, L., García-Castellanos, D., Rodríguez-Rodríguez, L., Viaplana-Muzas, M., Vergés, J., and 1000 Jiménez-Díaz, A.: Topographic, lithospheric and lithologic controls on the transient landscape evolution

after the opening of internally-drained basins. Modelling the North Iberian Neogene drainage, *Bull. Soc. Geol. Fr.*, 192(1), 2021. Tapponier, P.: Evolution tectonique du système alpin en Méditerranée: poinçonnement et écrasement rigide-plastique, *Bull. Soc. Geol. Fr.*, 29, 437-460, 1977.

1005 Terrinha P.: Structural Geology and Tectonic Evolution of the Algarve Basin, South Portugal. PhD Thesis, Imperial College, London, pp 430, 1998.

Terrinha, P., Ribeiro, C., Kullberg, J.C., Rocha, R., and Ribeiro, A.: Compression episodes during rifting and faunal isolation in the Algarve Basins, SW Iberia, *J. Geol.*, 110, 101-113, 2002.

1010 Terrinha, P., Matias, L., Vicente, J., Duarte, J., Luís, J., Pinheiro, L., Lourenço, N., Diez, S., Rosas, F., Magalhães, V., Valadares, V., Zitellini, N., Roque, C., Mendez Vítor, L. and MATESPRO Team: Morphotectonics and strain partitioning at the Iberia–Africa plate boundary from multibeam and seismic reflection data, *Mar. Geol.*, 267, 156-174, [https://doi.org/ 10.1016/j.margeo.2009.09.012](https://doi.org/10.1016/j.margeo.2009.09.012), 2009.

Terrinha P. et al.: The Alpine Orogeny in the West and Southwest Iberia Margins, in: *The Geology of Iberia: A Geodynamic Approach*, edited by Quesada C. and Oliveira J., *Regional Geology Reviews*, Springer, Cham, <http://hdl.handle.net/10174/25763>, 2019.

1015 Torne, M., Pascal, G., Buhl, P., Watts, A.B., and Mauffret, A.: Crustal and velocity structure of the Valencia trough (western Mediterranean), Part I. A combined refraction/ wide-angle reflection and near-vertical reflection study, *Tectonophysics*, 203, 1–4, 1-20, [https://doi.org/10.1016/0040-1951\(92\)90212-Q](https://doi.org/10.1016/0040-1951(92)90212-Q), 1992.

1020 Torne, M., Banda, E., Sibuet, J. C., Mendes-Victor, L., Senos, M. L., Long, R., and Watts, A. B.: Iberian Atlantic Margins, IAM Project Final Scientific Report (JOU-CT92-0177), <https://doi.org/10.20350/digitalCSIC/8566>, 1995.

1025 Torne, M., Banda, E., and Fernandez, M.: The Valencia Trough: geological and geophysical constraints on basin formation models, in: *Peri-Tethys Memoir 2: Structure and prospects of Alpine Basins and Forelands*, edited by Ziegler, P.A. and Horvath, F., *Mém. Mus. Hist. nat.*, 170:103-128, Paris, ISBN: 2-85653-507-0, 1996.

Torne, M., Fernández, M., Comas, M.C., and Soto, J.I.: Lithospheric structure beneath the Alboran Sea Basin: Results from 3D gravity modeling and tectonic relevance, *J. Geophys. Res.*, 105 (B2), 3209–3228, 2000.

- Torne, M., Banda, E., Sibuet, J. C., Mendes-Victor, L., Senos, M. L., Long, R., and Watts, A. B.:
1030 Multichannel seismic reflection and wide-angle and refraction data acquisition along the Iberian Atlantic
Margins, DIGITAL.CSIC, <https://doi.org/10.20350/digitalCSIC/8549>, 2018.
- Torne, M., Jiménez-Munt, I., Negrodo, A. M., Fulla, J., Vergés, J., Marzán, I., Alcalde, J., Gómez-Rivas,
E., and de la Noceda, C. G.: Advances in the modeling of the Iberian thermal lithosphere and perspectives
on deep geothermal studies. *Geotherm. Energy*, 11(1), 3, <https://doi.org/10.1186/s40517-023-00246-6>,
1035 2023.
- Torne, M., Alves, T.M., Jiménez-Munt, I., Carvalho, J., Ayala, C., Ramalho, E. C., Gómez, A., Matias,
H., Heida, H., Balaguera, A., García-Lobón, J.L., and Vergés, J. SedDARE-IB: An open access repository
of sediment data for Iberia and its continental margins [Dataset], DIGITAL.CSIC.
<https://doi.org/10.20350/digitalCSIC/16277>, last access: May 2024. Tucholke, B. E. and Sibuet, J.C.: Leg
1040 210 synthesis: Tectonic, magmatic, and sedimentary evolution of the Newfoundland-Iberia rift, *Proc.
Ocean Drill. Program Sci. Results*, 210, 1–56, 2007.
- Ubide, T., Wijbrans, J. R., Galé, C., Arranz, E., Lago, M., and Larrea, P.: Age of the Cretaceous alkaline
magmatism in northeast Iberia: Implications for the Alpine cycle in the Pyrenees, *Tectonics*, 22, 1444-
1460, <https://doi.org/10.1002/2013TC003511>, 2014.
- 1045 Vacherat, A., Bonnet, S., and Mouthereau, F.: Drainage reorganization and divide migration induced by
the excavation of the Ebro basin (NE Spain), *Earth Surf. Dynam.*, 6(2), 369–387.
<https://doi.org/10.5194/esurf-6-369-2018>, 2018.
- Vera, J.A., Ancochea, A., Calvo Sorando, J.P., Barnolas Cortinas, A., Bea Carredo, F.: *Geología de
España*. ISBN 978-84-7840-546-6, IGME, pp 884, Madrid, 2004.
- 1050 Verati, C., Rapaille, C., Féraud, G., Marzoli, A., Bertrand, H., and Youbi, N.: $^{40}\text{Ar}/^{39}\text{Ar}$ ages and
duration of the Central Atlantic Magmatic Province volcanism in Morocco and Portugal and its relation
to the Triassic–Jurassic boundary, *Palaeogeogr. Palaeoclimatol. Palaeoecol.*, 244, 308–325, 2007.
- Vergés, J. and Fernández, M.: Ranges and basins in the Iberian Peninsula: their contribution to the present
topography, *Geol. Soc. Lond., Mem.*, 32(1), 223-234, 2006.
- 1055 Vergés, J. and Fernández, M.: Tethys–Atlantic interaction along the Iberia–Africa plate boundary: The
Betic–Rif orogenic system, *Tectonophysics*, 579, 144-172. <http://dx.doi.org/10.1016/j.tecto.2012.08.032>,
2012.

Vergés, J., Fernández, M., and Martínez, A.: The Pyrenean orogen: pre-, syn-, and postcollisional evolution, *J. Virtual Explor.*, 08, 55–74, 2002.

1060 Vergés, J., Kullberg, J.C., Casas-Sainz, A., de Vicente, G., Vítor Duarte, L., Fernández, M., Gómez, J.J., Gómez-Pugnaire, M.T., Jabaloy Sánchez, A., López-Gómez, J., Macchiavelli, C., Martín-Algarra, A., Martín-Chivelet, J., Muñoz, J.A., Quesada, C., Terrinha, P., Torné, M., and Vegas, R.: An Introduction to the Alpine Cycle in Iberia, in: *The Geology of Iberia: A Geodynamic Approach. Regional Geology Reviews*. Springer, Cham. https://doi.org/10.1007/978-3-030-11295-0_1, 2019.

1065 Vissers, R.L.M. and Meijer, P.Th.: Mesozoic rotation of Iberia: Subduction in the Pyrenees?, *Earth Sci. Rev.*, 110 (1–4), 93–110, <https://doi.org/10.1016/j.earscirev.2011.11.001>, 2012.

Watkinson, M. P.: Triassic to Middle Jurassic sequences from the Lusitanian Basin Portugal, and their equivalents in other North Atlantic margin basins, PhD thesis, Open University, Walton Hall, UK, pp 390, 1989.

1070 Webring, M.: Saki: Semi-automatic Marquardt inversion of gravity and magnetic profiles using Singular Value Decomposition, U. S. Geological Survey Open File-Report, 85-122, 1985.

Wessel, P., Luis, J.F., Uieda, L., Scharroo, R., Wobbe, F., Smith, W.H.F., and Tian, D.: The Generic Mapping Tools Version 6 [Software], *Geochem., Geophys., Geosyst.*, 20, 11, 5556–5564, <https://doi.org/10.1029/2019GC008515>, 2019.

1075 Wilson, R.C.L., Hiscott, R.N., Willis, M.G., and Gradstein, F.M.: The Lusitanian basin of west-central Portugal: Mesozoic and Tertiary tectonic, stratigraphy, and subsidence history, in: *Extensional Tectonics and Stratigraphy of the North Atlantic Margins*, edited by Tankard, A.J. and Balkwill, H.R., AAPG Mem., 40, 341–361, 1989.

1080 Wilson, R. C. L., Sawyer, D. S., Whitmarsh, R. B., Zerong, J., and Carbonell, J.: Seismic stratigraphy and tectonic history of the Iberia Abyssal Plain, *Proc. Ocean Drill. Program Scientific Results*, 149, 617–630, 1996.

1085 Wilson, R. C. L., Manatschal, G., and Wise, S.: Rifting along non-volcanic passive margins: Stratigraphic and seismic evidence from the Mesozoic successions of the Alps and western Iberia, in: *Non-volcanic Continental Margins: A Comparison of Evidence from Land and Sea*, edited by Wilson, R. C. L. et al., *Geol. Soc. Spec. Publ.*, 187, 429–452, 2001.

Zitellini, N., Rovere, M., Terrinha, P., Chierici, F., Matias, L., Mendes, V.L., Corela, C., Ribeiro, A., Córdoba, D., Dañobeitia, J.J., Grácia, E., and Bartolomé, R.: Neogene through Quaternary tectonic reactivation of SW Iberia passive margin, *Pure Appl. Geophys.*, 161, 3, 565-587. <https://doi.org/10.1007/s00024-003-2463-4>, 2004.

1090 **Figure captions**

Figure 1 (a) Elevation map of the Alpine-Himalayan Orogenic Belt as shown by the shaded area. Red square highlights the location of the Iberian Peninsula and surrounding margins. **(b)** Simplified geological map of the Iberian Peninsula. Iberian Massif abbreviations: CZ: Cantabrian Zone, CIZ: Central Iberian Zone; GTMZ: Galicia-Tras-Os-Montes Zone, OMZ: Ossa Morena Zone; SPZ: South Portuguese Zone; 1095 VG: Variscan Granitoids, WALZ: Western-Asturian-Leonese Zone. Other abbreviations: Cantabrian M.: Cantabrian Mountains, CCR: Catalan Coastal Ranges, CS: Central System, Guadalquivir B.: Guadalquivir Basin, LTB: Lower Tagus Basin, SC: Setubal Canyon, SVC: Sao Vicente Canyon. Adapted from Torne et al. (2015, 2023).

Figure 2 Simplified geological map showing location of the data sets listed in Table S1. Modified from 1100 Torne et al. (2015).

Figure 3 Offshore: Location of seismic profiles used for interpreting and gathering data for the Top of Paleozoic, or Acoustic Basement for most of the Western Mediterranean region. Exceptions are the Valencia Trough and the Alboran Basin (see Fig. 1 for location), where the Acoustic Basement corresponds to the Base of Cenozoic or the so-called Oligocene unconformity. Onshore: location of x,y,z 1105 data obtained from available seismic, log data and geological information

Figure 4 Offshore: Location of seismic profiles used for interpreting and gathering data on the Base of Cenozoic. Onshore: location of x,y,z data obtained from available seismic, well log data and geological information. Main references from which data have been gathered are shown in Table S1. Additional references can also be found throughout the text.

1110 **Figure 5** Offshore: Depth to the Top Paleozoic, or Acoustic Basement for the majority of the Western Mediterranean region. Exceptions are the Valencia Trough and the Alboran Basin (see Fig. 1 for location), where the Top of Basement corresponds to the Base of Cenozoic or the so-called Oligocene unconformity. Onshore: Depth to the Top of the Paleozoic Basement interpreted as the Paleozoic-cover sequence boundary or Hercynian discordance (Garcia-Lobón et al., 2020a and references therein).

1115 **Figure 6** Offshore and onshore depth to the Base of Cenozoic Main references from which data have been gathered are shown in Table S1. Additional references can also be found throughout the text. Data from the Western Mediterranean have been taken from (Belluci et al., 2021, and references therein).

Figure 7 Depth to the 150°C isotherm as a function of sediment thickness and surface heat flow, assuming four different thermal conductivities for sediments: (A) 1.27 W/m·K, (B) 2.0 W/m·K, (C) 2.5 W/m·K and

1120 (D) W/m·K. Crustal conductivity is kept constant at 3.1 W/m·K. Radiogenic heat production is 1 $\mu\text{W}/\text{m}^3$ and $3 \cdot e^{(z/10)} \mu\text{W}/\text{m}^3$ for the sediments and crust, respectively. Each basin is shown by a horizontal grey line indicating the average surface heat flow value and average sediment thickness at the calculated site (grey dot). The minimum to maximum sediment thickness in the basin is indicated with the grey line.

Table S1 Detailed list of the information included in the database presented in this work.