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

Montserrat Torne [1], Tiago M. Alves [2], Ivone Jiménez-Munt [1], Joao Carvalho [3], Conxi Ayala [1], Elsa C. Ramalho [3], Angela María Gómez-García [1], Hugo Matias [4], Hanneke Heida [1], Abraham Balaguera [1], José Luis García-Lobón [5], and Jaume Vergés [1]

[1] Geosciences Barcelona, GEO3BCN, CSIC, c/ Lluís Solé i Sabarís, s/n, 08028, Barcelona, Spain.

[2] 3D Seismic Lab, School of Earth and Environmental Sciences, Cardiff University, Main Building, Park Place, Cardiff, CF10 3AT, United Kingdom 3

[3] Laboratório Nacional de Energía e Geología (LNEG), Estrada da Portela-Zambujal, apartado 7586, 10   2610-999 Amadora, Portugal

[4] CoLAB NET4CO2, Rua Júlio de Matos 828, 4200-355 Porto, Portugal

[5] Instituto Geológico y Minero de España, IGME, CSIC, c/ Rio Rosas 23, 28003, Madrid, Spain.

Correspondence to: Montserrat Torne (mtorne@geo3bcn.csic.es)

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
20 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
25 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 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 150ºC isotherm
30 at specific basins, as commonly used in geothermal exploration. The calculated trend suggests that, given constant measured surface heat flow and thermal conductivity, the 150ºC 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
35 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 Iberia's 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 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 for the

65 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 150ºC 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 1, 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.
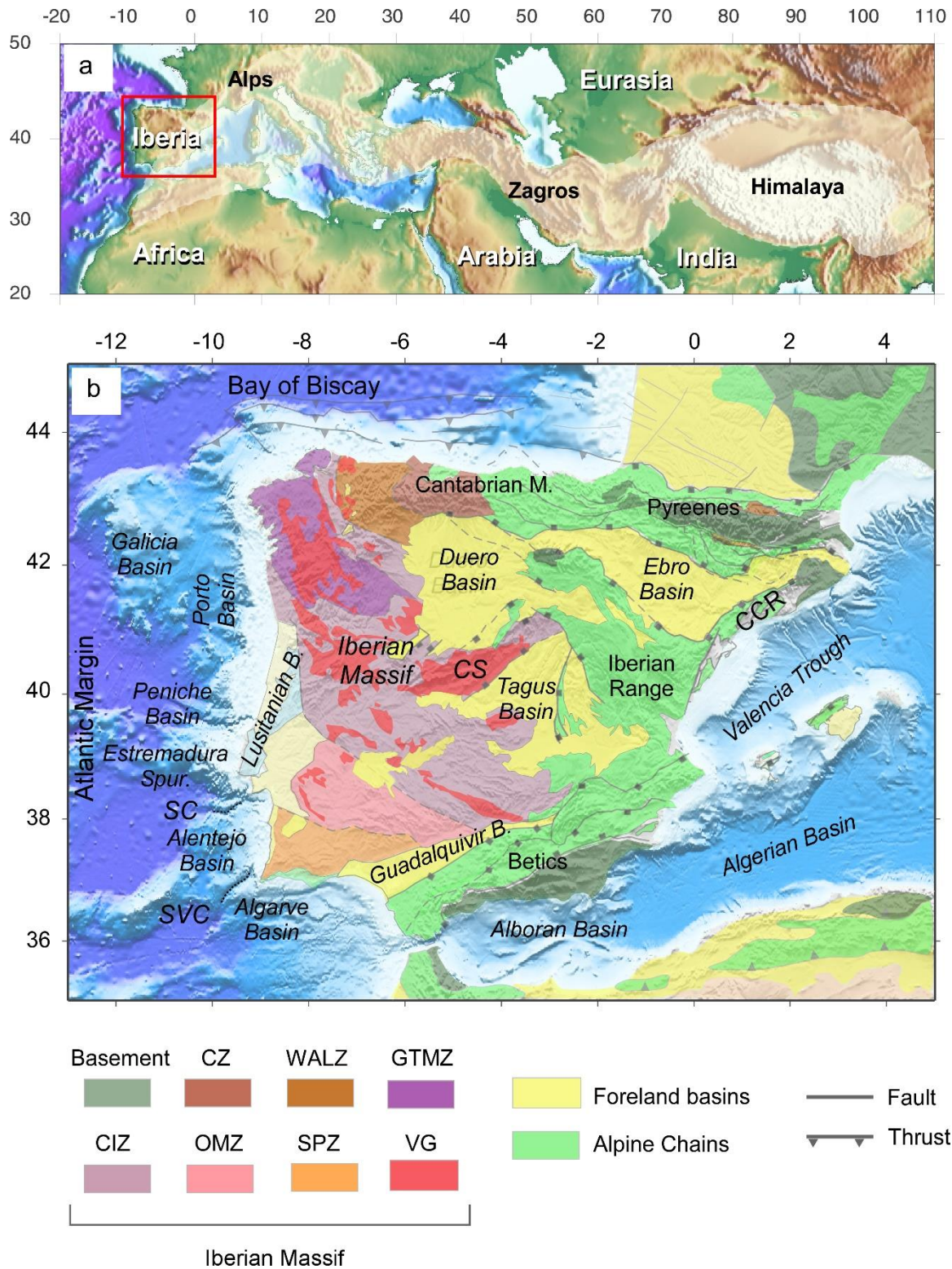
Figure 1 (a) Elevation map of the Alpine-Himalayan Orogenic Belt as shown by the shaded area. Red
square highlights the location of the Iberian Peninsula and surrounding margins. (b) Simplified geological
map of the Iberian Peninsula. Iberian Massif abbreviations: CZ: Cantabrian Zone, CIZ: Central Iberian

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. Red: 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 Fernàndez, 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).

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 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 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 Vicente, 1998; Vergés and Fernàndez, 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, 2001; Vergés and Fernàndez, 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

In mainland Iberia, the SedDARE-IB data were organized in six 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. (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.
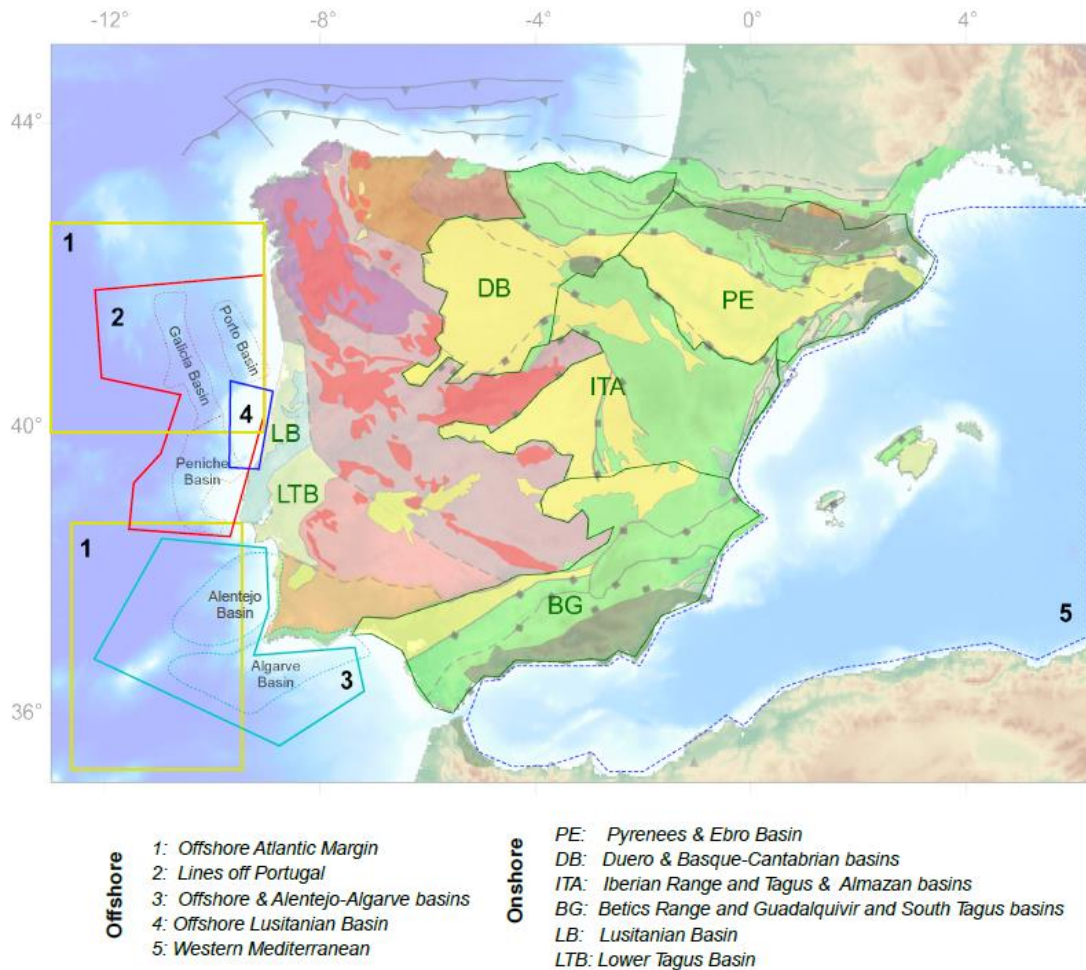
Figure 2 Simplified geological map showing the location of the data sets listed in Table 1. Modified from Torne et al. (2015).

2.2.1 Ebro Foreland Basin (EB)

The Ebro Foreland Basin, spanning approximately 85,500 km^2, 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 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 outs 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 System to the east, and the western sector of the Montes de Toledo 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. 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 The Guadalquivir Foreland Basin (GB)

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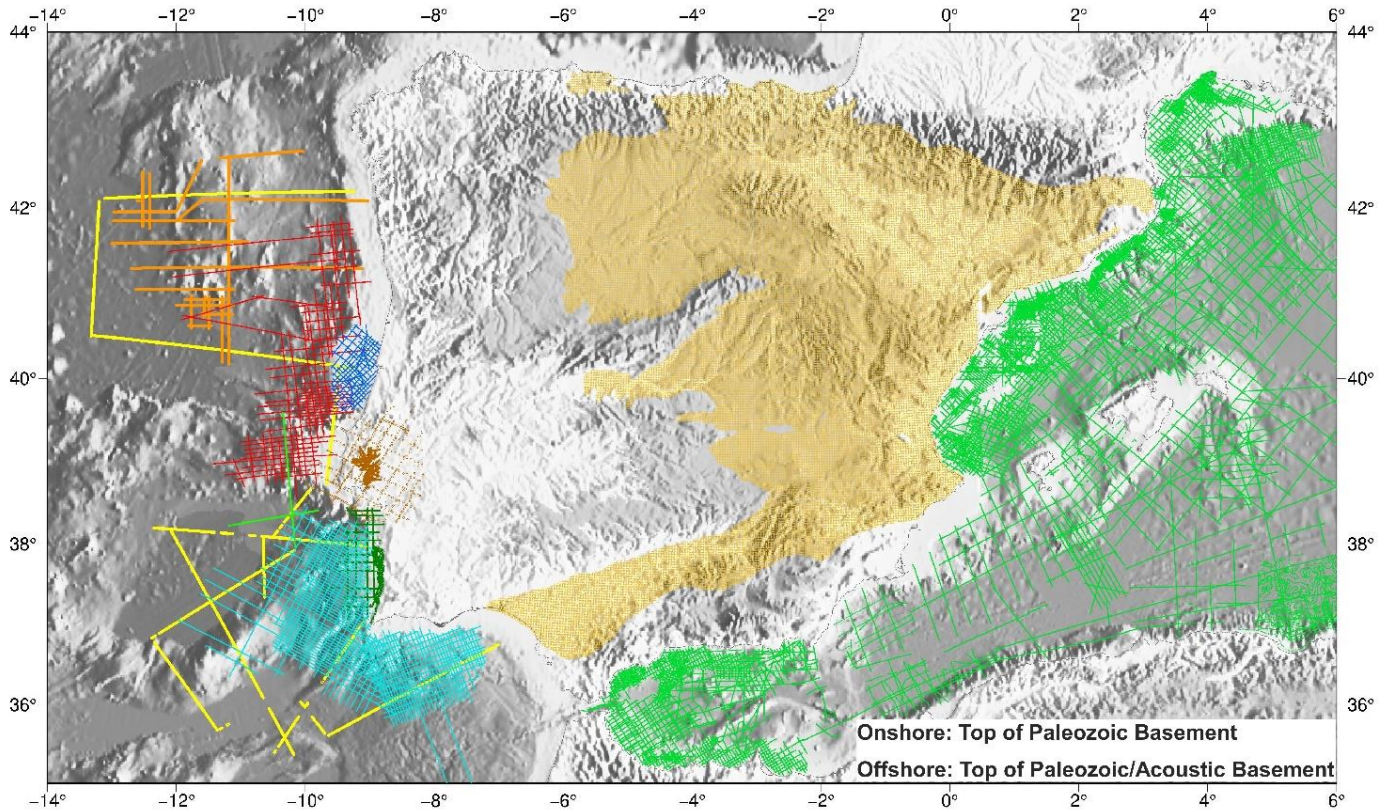
Figure 3 Offshore: Location of seismic profiles used to interpret and gather data for the Top of Paleozoic, or Acoustic Basement for most of the Western Mediterranean region. Exceptions are the Valencia Trough and the Alboran Basin, where the Acoustic Basement corresponds to the Base of Cenozoic or the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

2.3 Iberian offshore basins

2.3.1 Iberia Atlantic Margin

The Iberia 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. 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 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 Spain (Ubide et al., 2014).

At present, the continental slope of Iberia dips 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 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 Iberia Atlantic Margin features a relatively narrow, westerly-tilted continental shelf, with major rivers contributing sediment north of 41°N. Sediment accumulation is significant in 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-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).

2.3.2 Alentejo Basin

The offshore Alentejo region is characterized by its broad continental shelf, which blends with a gentle continental slope (~0.5°) due to thick Cenozoic sediment deposition west of 10ºW (Mougenot, 1988). Steeper gradients (>2°) 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 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 Moiola, 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 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). 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).

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 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.

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"
315 (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 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
320 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 thrusted older units, suggesting that tectonic inversion occurred predominantly after the Cenomanian and lasted until the late Oligocene-Aquitanian. Nevertheless, present-day compression is still recorded in the Algarve Basin, being NW-SE oriented, and
325 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.
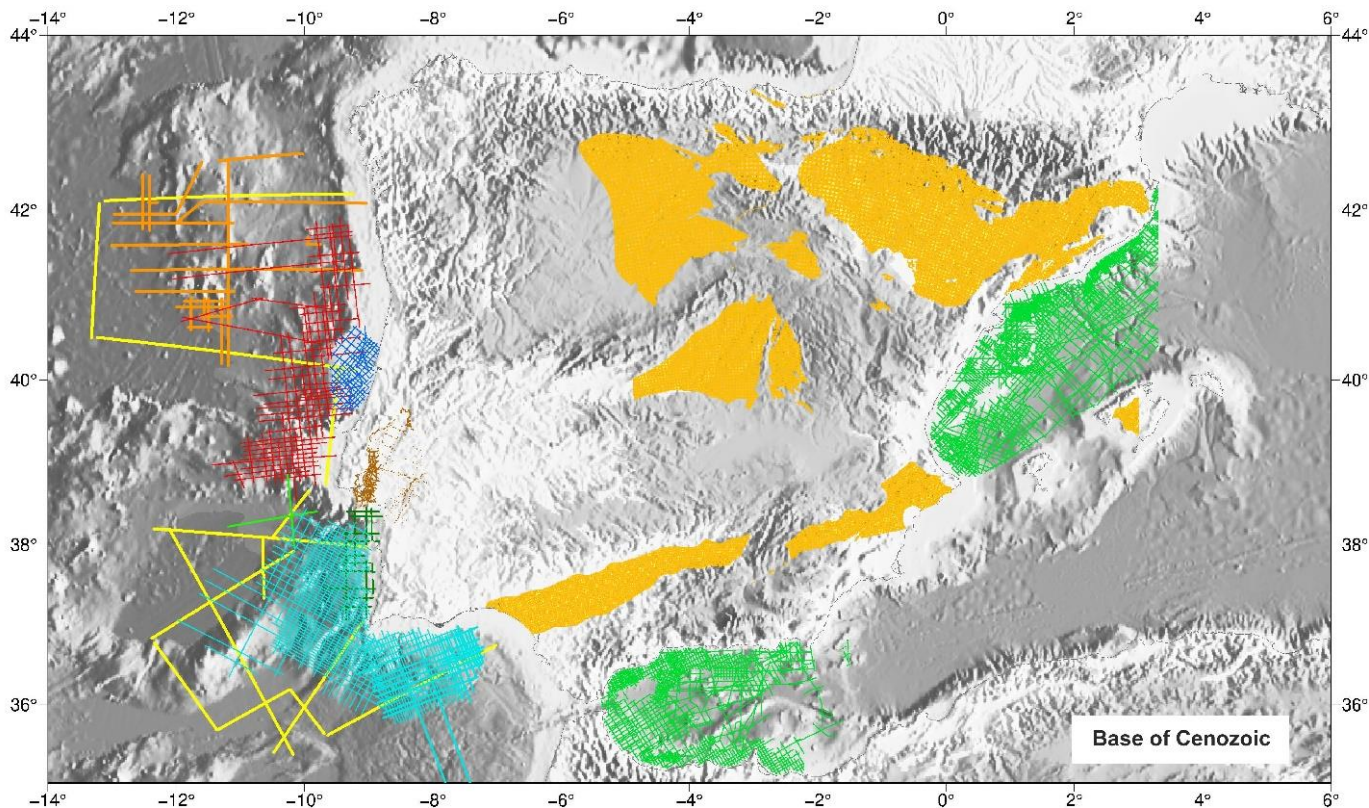
Figure 4 Offshore: Location of seismic profiles used for interpreting and gathering data on the Base of
Cenozoic. Onshore: location of x,y,z data obtained from available seismic, well log data and geological
information. Main references from which data have been gathered are shown in Table 1. Additional
references can also be found throughout the text.

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
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
340   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 CO_2 storage of in
Spain. Location of data points and seismic profiles included in the database are shown in Figs. 3 and 4.

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
345   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.

3.1.1 Ebro Basin

Data on the Ebro Basin was extracted mainly from regional and geological studies at various scales
350   (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
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
355   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.
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-
360   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
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)
365   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
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
370   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
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
375   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
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
380   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).

3.1.3 Tagus-Almazán basins

For the creation of isobath maps in the Iberian Chain and the Tagus and Almazán Basins, two different
385   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
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.

390   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).

395   **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
400 contributions from various public entities, universities, associations, and working groups participating in research and development projects, including the ALGECO2 project (García-Lobón, 2010a).

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
405 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).

3.1.5 Lower Tagus Basin

410 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
415 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).

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-
420 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-
425 Mesozoic rocks may reach a few hundred meters in some areas.
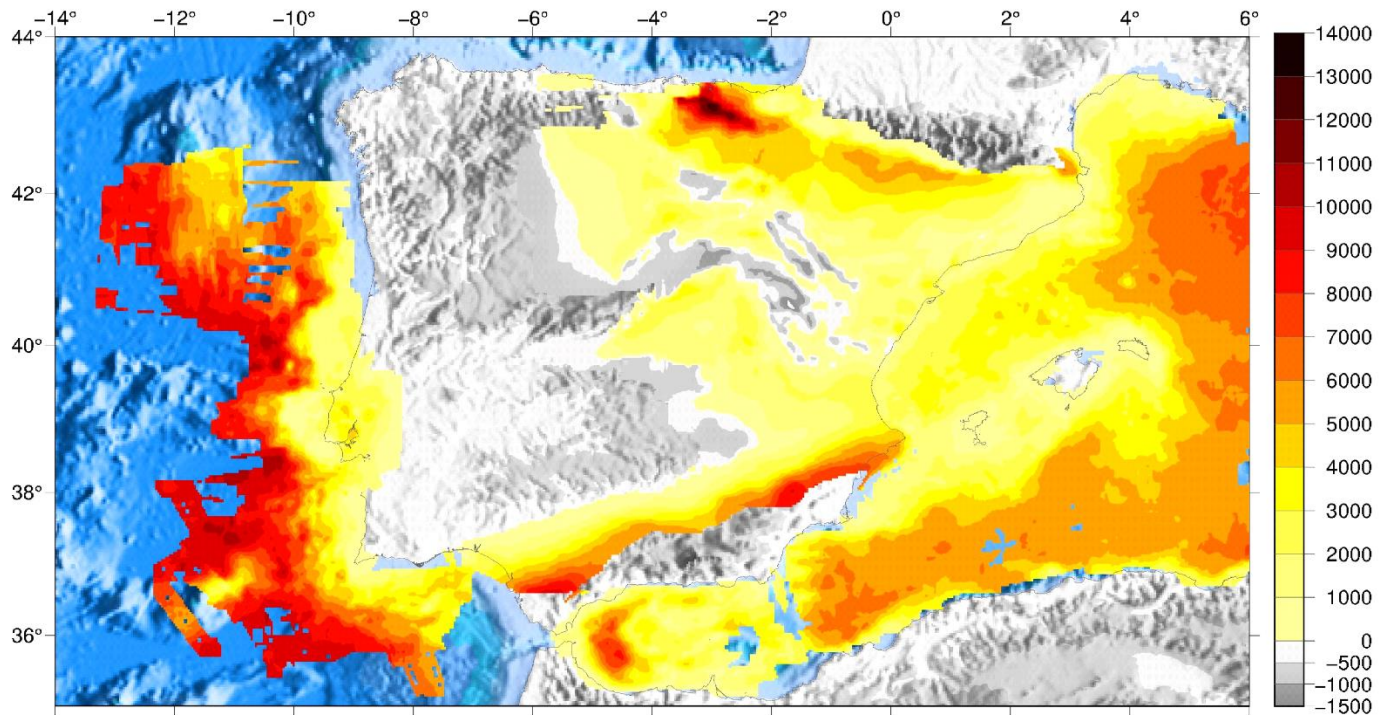
Figure 5 Offshore: Depth to the Top of Paleozoic, or Acoustic Basement for the majority of the Western Mediterranean region. Exceptions are the Valencia Trough and the Alboran Basin (see Fig. 1 for location), where the top of the basement corresponds to the Base of Cenozoic or the so-called Oligocene 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 Iberia 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 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

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. In this work, the criteria of Driscoll et al. (1995), Sinclair et al. (1995), Alves et al. (2009) and Soares et al. (2012) were

445 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 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

450 Iberia (Groupe Galice, 1979; Boillot et al., 1989; Murillas et al., 1990, Tucholke et al., 2007).

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).

455 These data are complemented with information from DSDP Site 120 and IODP Sites U1385, U1391 and 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)

460 The Top of the Paleozoic Basement and the Base of Cenozoic were gathered from the interpretation of 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

465 acquired in 1969 by Fairey Surveys Limited. Descriptions of the seismic and potential field datasets can 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 uprises or lows (pre-Mesozoic units), from salt and igneous structures. The structural interpretation obtained from seismic data was also

470 compared with derivative maps of the gravimetric and magnetic anomaly maps, such as analytical 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).

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 km^2, 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 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 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

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), doi: 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, 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 bof the acoustic basement coincides either with the Base of Cenozoic or the so-called 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
(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 1. Location of seismic lines included in
the database are shown in Figs. 3 and 4.
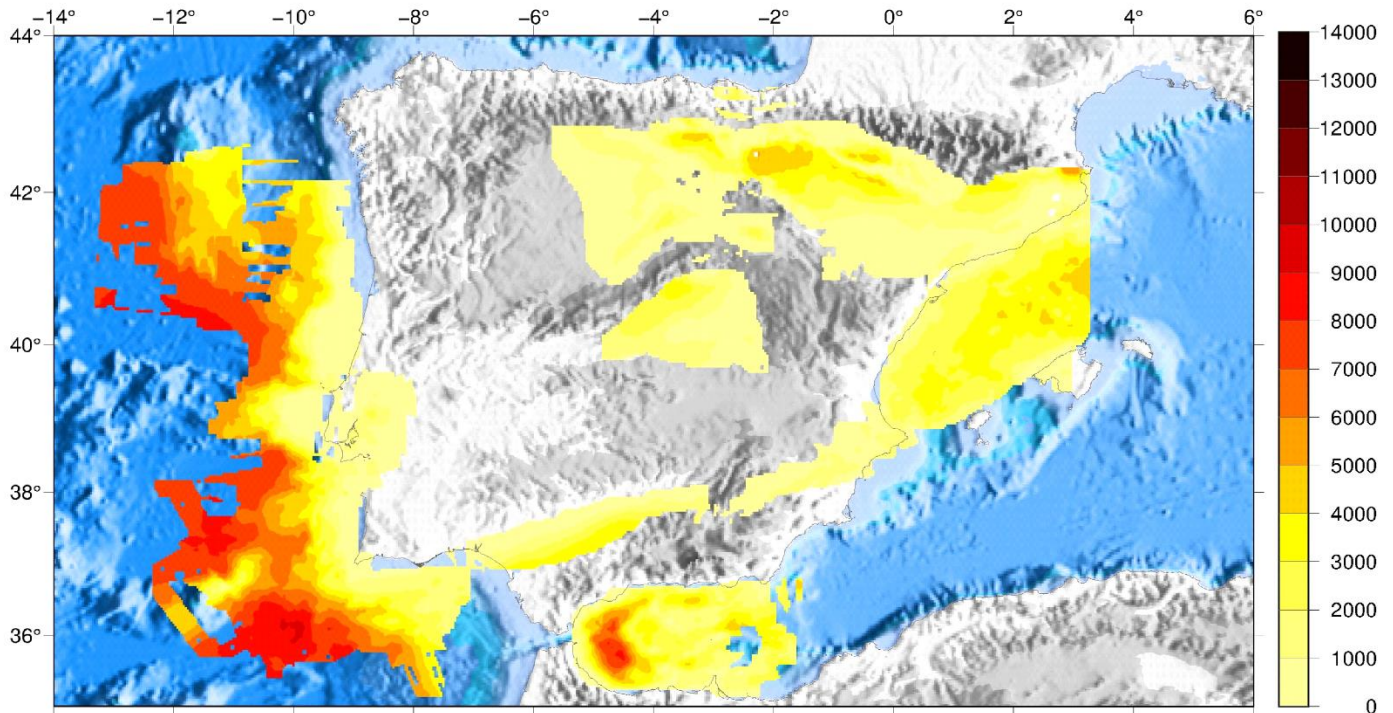
Figure 6 Offshore and onshore depth to the Base of Cenozoic. Main references from which data have
been gathered are shown in Table 1. Additional references can also be found throughout the text. Data
from the Western Mediterranean have been taken form (Belluci et al., 2021, and references therein).

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 150ºC 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/m^2 (e.g., Fernàndez et al., 1998) and the International Heat Flow Commission (Fuchs et al., 2023), a range that is representative of the mean
525 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, 1 µW/m^3 and $3{\times}e^{(z/10)}$ µW/m^3. Other parameters considered were a constant crustal thermal conductivity of 3.1 W/mK and a constant mean surface temperature of 15ºC.

Figure 7 shows the variations in the depth of the 150ºC isotherm in relation to sediment thickness, surface
530 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
535 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 150ºC 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
540 independent of the crustal conductivity. However, lower crustal conductivity values would result in a shallower depth of the 150ºC 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/m^2, the 150°C the
545 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 W/mK 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.
550 approaching the conductivity of the crust (e.g., 3.0 W/mK), the effect of any increase in sediment thickness is notably reduced (Fig. 7D).
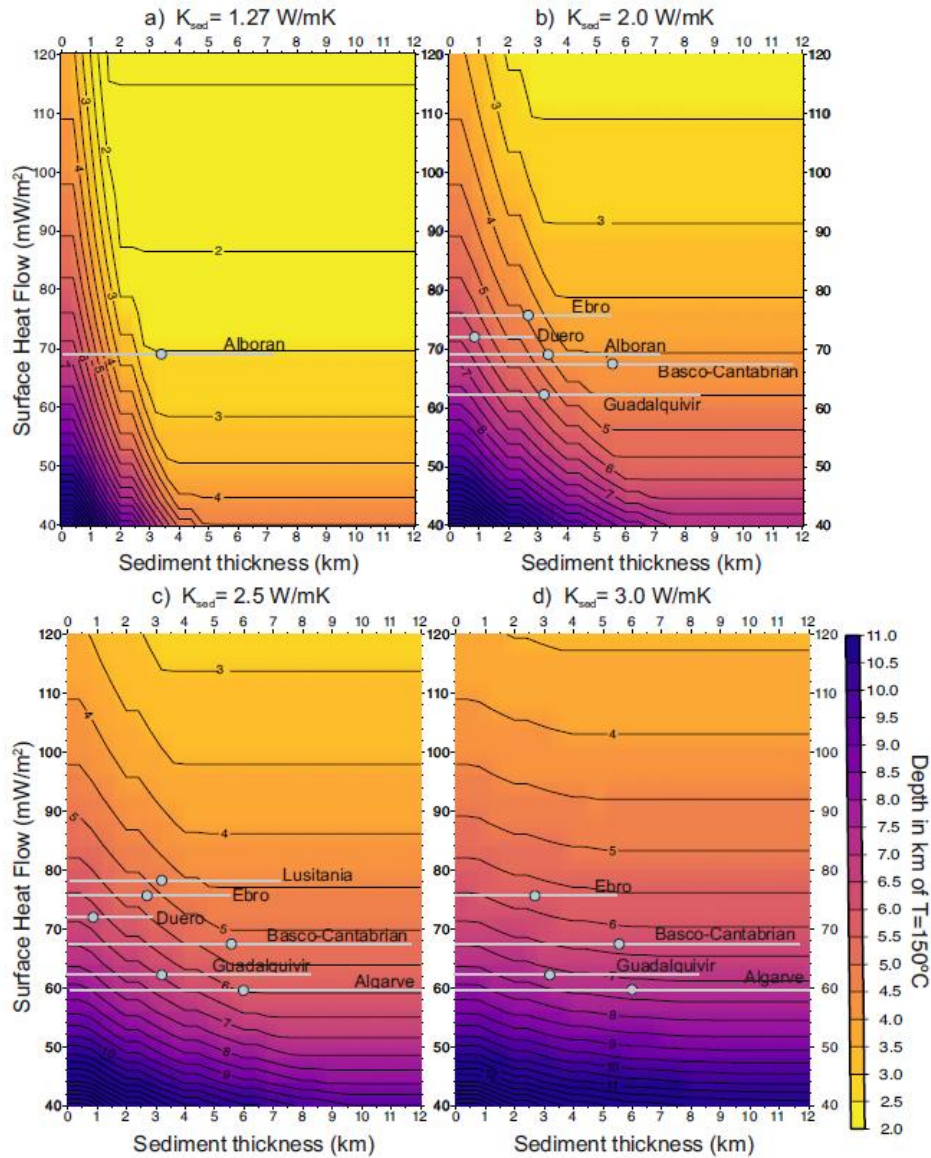
Figure 7 Depth to the 150°C isotherm as a function of sediment thickness and surface heat flow, assuming four different thermal conductivities for sediments: (A) 1.27 W/m K, (B) 2.0 W/m K, (C) 2.5 W/m K and (D) 3.0 W/m K. Crustal conductivity is kept constant at 3.1 W/m K. Radiogenic heat production is 1 μ W/m3 and 3×e(z/10) μ W/m3 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 Fernàndez 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/m^2 and 62 mW/m^2, we observe that for a constant conductivity of 2.0 W/mK, 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 150ºC 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 1.

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 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.

595 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.

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 150ºC isotherm. The obtained results indicate a complex relationship between isotherm depth and sediment thickness. While an increase in
600 sediment thickness initially results in higher temperatures at relatively shallow depths, there is a critical threshold value in sediment thickness beyond which the 150ºC isotherm stabilizes at a constant depth. Moreover, an increase in thermal conductivity correlates with a deepening of the 150ºC 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
605 low average heat flow values (75 mW/m² and 62 mW/m², respectively), one records differences in the depth of the 150ºC isotherm between 1 and 1.5 km. The trend is one of a deeper 150ºC isotherm whenever a relatively higher thermal conductivity is recorded.

The spatial distribution of the 150ºC 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
610 of thermal conductivity is particularly pronounced, influencing the isotherm depth to a greater extent than variations in sediment thickness.

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
615 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 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.

620 **Competing interests**

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

Disclaimer

Data are published without any warranty, express or implied. The user assumes all risk arising from his/her use of data. Data are intended to be research-quality, but it is possible that the data themselves contain errors. It is the sole responsibility of the user to assess if the data are appropriate for his/her use, and to interpret the data accordingly. Authors welcome users to ask questions and report problems.

Publisher's note: Copernicus Publications remains neutral with regard to jurisdictional claims made in the text, published maps, institutional affiliations, or any other geographical representation in this paper. While Copernicus Publications makes every effort to include appropriate place names, the final responsibility lies with the authors.

Acknowledgments

This work has been performed using the facilities of the Laboratory of Geodynamic Modeling from Geo3BCN-CSIC. Figures 1 to 7 were totally or partly drawn using GMT software (Wessel et al., 2019). The authors thank two anonymous reviewers for their comments and suggestions that have improved the previous version of this manuscript. TGS is acknowledged for the provision of seismic data on the entire Atlantic Margin of Iberia.

Financial support

This research has been partly supported by the project funded by the Spanish Government GeoCAM (PID2022-139943NB-I00) and GEOADRIA (PID2022-139943NB-I00). The onshore Iberia data sets were compiled under the umbrella of the ALGECO2 project (IGME-CSIC). The Lower Tagus Basin and Alentejo datasets were prepared by JC under the scope of academic thesis and updated during projects SISMOD/LISMOT-Finite Seismic Source Modeling by Joint Inversion of Seismic and Geodesic Data and Strong Ground motion in the Lower Tagus Valley" (PTDC/CTE-GIN/82704/2006) and NEFITAG-Strong Ground Motion and Near Field Effects in the Lower Tagus Region" (PTDC/CTE-GIX/102245/2008), financed by the Portuguese Foundation for Science and Technology. AMGG received a grant (FJC2021-047434-I) funded by MICIU/AEI /10.13039/501100011033 and by "European Union NextGenerationEU/PRTR".

Review statement

This paper was edited by XXXXXXXX and reviewed by XXXXXXXX.

650 **References**

Alonso-Zarza, A.M., Clavo, J.P., Silva, P.G., and Torres, T.: Cuenca del Tajo, in: Geología de España, 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.

655 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., 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, 660 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 evolution of diapir- and fault-bounded rift basins: Examples from the Lusitanian Basin of west Iberia, Sediment, Geol., 162, 273–303, https://doi/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.: 665 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.

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.

670 Antón, L., Rodés, A., De Vicente, G., Pallàs, R., Garcia-Castellanos, D., Stuart, F. M., and Bourlès, D.: Quantification of fluvial incision in the Duero Basin (NW Iberia) from longitudinal profile analysis and 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, 675 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.

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.

680   Atrops, F. and Marques, B. : Mise en évidence de la zone à platynota (Kimméridgien inférieur) dans le massif du Montejunto (Portugal); consequences stratigraphiques et paléontologiques, Geobios, 19, 537–547, 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.

685   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/EO076i003p00025, 1995.

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, 690   Regional Geology Reviews, edited by Quesada and J. T. Oliveira, Springer, Cham., https://doi.org/10.1007/978-3-030-11190-8_2, 2019.

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 695   Sea, SEANOE, https://doi.org/10.17882/80128, 2021.

Berástegui, X., Banks, C.J., Puig, C., Taberner, C., Waltham, D., and Fernàndez, M.: Lateral diapiric 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, 700   Nature, 341, 6242, 523-525, 1989.

Boillot, G., Girardeau, J., and and Winterer, E.L.: Rifting processes of the west Galicia margin, Spain, in: 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-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.

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, 2017.

Carminati, E., Lustrino, M., and Doglioni, C.: Geodynamic evolution of the central and western 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 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.

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.

730 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), 636-557, 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.

735 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.

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.

740 Civis, J. and Vera, J. A.: Cuencas cenozoicas, in: Geología de España, edited by Vera, J.A, SGE-IGME, 531-533, ISBN 84-7840-546-1, 2004.

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.

745 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.

Coppier, G., and Mougenot, 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.

750 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 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.
755 https://doi.org/10.1007/978-3-030-11190-8_4, 2019.

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.

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, 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, 2002.

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., J. Rey, P. P. Cunha, 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.

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.

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.

Eddy, M.P., Jagoutz, O., and Ibañez-Mejia, 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 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, 1998.

Ford, M. and Vergés, J.: Evolution of a salt-rich transtensional rifted margin, eastern North Pyrenees, 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.

García-Castellanos, D., and Larrasoaña, 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, 2005.

García-Castellanos, D., Fernàndez, 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.

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: 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., Larrasoaña, J. C.: Primera Fase del Plan de Almacenamiento Geológico de CO2 del IGME (Proyecto ALGECO2). 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, A., Delgado, B., Varea, R., Álvarez-Pulgar, J. y Navas, M.: Primera Fase del Plan de Almacenamiento Geologico 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, 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. 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 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 1-86239-127-0, 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 globa linfluence, Sci. Drilling, 16, 1–11, https://doi.org/10.5194/sd-16-1-2013, 2013.

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

Hodell, D. A., Abrantes, F., Alvarez Zarikian, C. A., and the Expedition 397 Scientists: Expedition 397 855 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.

Iribarren, L., Vergés, J., and Fernàndez, M.: Sediment supply from the Betic–Rif orogen to basins through 860 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.

Jurado, M.J. and Comas, M.C.: Well log interpretation and seismic character of the Cenozoic sequence in 865 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, 1996.

Lanaja, J.M., Navarro, A., Martínez, J. L., Del Valle, J., Rios, L. M., Plaza, J., Potro, R., and Rodríguez
870   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., Fernàndez, 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, 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 Torrescusa, 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 Kerrich, R.: Rift-related magmatism of the 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, AAPG Conference & Exibition, 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.

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'éllipsoide de déformation dans la virgation hercynienne de Galice. Rélations avec le plissement et hipothèses sur la génèse de l'arc Ibero-Armoricain. C. R. Acad. Sci. Terre, Paris, 280, 2825–2828, 1975.

Medialdea, T., Vegas, R., Somoza, L., Vásquez, J.T., Maldonado, A., Diáz-del-Rio, V. Maestro, A., Córdoba, D., and Férnandez-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.

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, 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. 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.

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, 1990.

930 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 935 in the European Atlantic Domain, 1rst 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 940 Profiles, Tectonophysics, 203, 1-4, 21-35, 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 Mediterra-nean Sea), Terra Nova, 28(4), 245-256, 2016.

Pereira, R. N. and Alves, T.M.: Tectono-stratigraphic signature of multiphased rifting on divergent 945 margins (deep-offshore Southwest Iberia, North Atlantic), Tectonics, 31, TC4001, https://doi.org/10.1029/2011TC003001, 2012.

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.

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

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
955   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
960   the Lusitanian Basin in Portugal and the shelf and slope area offshore Portugal, Tectonophysics, 300, 199-225, 1998.

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
965   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.

970   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, 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.

975 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 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, 1998.

980 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 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,
985 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.

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.

990 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. 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,
995 554–571, 2019.

Struth, L., García-Castellanos, D., Rodríguez-Rodríguez, L., Viaplana-Muzas, M., Vergés, J., and 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.

1000   Tapponier, P.: Evolution tectonique du système alpin en Méditerranée: poinçonnement et écrasement rigide-plastique, Bull. Soc. Geol. Fr., 29, 437-460, 1977.

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
1005   and faunal isolation in the Algarve Basins, SW Iberia, J. Geol., 110, 101-113, 2002.

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, 2009.

1010   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.

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-
1015   vertical reflection study, Tectonophysics, 203, 1–4, 1-20, https://doi.org/10.1016/0040-1951(92)90212-O, 1992.

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.

1020   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., Fernàndez, M., Comas, M.C., and Soto, J.I.: Lithospheric structure beneath the Alboran Sea
1025   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.: 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.

1030 Torne, M., Jiménez-Munt, I., Negredo, A. M., Fullea, 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, 2023.

Torne, M., Alves, T.M., Jiménez-Munt, I., Carvalho, J., Ayala, C., Ramalho, E. C., Gómez, A., Matias, 1035 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 210 synthesis: Tectonic, magmatic, and sedimentary evolution of the Newfoundland-Iberia rift, Proc. Ocean Drill. Program Sci. Results, 210, 1–56, 2007.

1040 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.

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. 1045 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.

Verati, C., Rapaille, C., Féraud, G., Marzoli, A., Bertrand, H., and Youbi, N.: 40Ar/39Ar ages and duration of the Central Atlantic Magmatic Province volcanism in Morocco and Portugal and its relation 1050 to the Triassic–Jurassic boundary, Palaeogeogr. Palaeoclimatol. Palaeoecol., 244, 308–325, 2007.

Vergés, J. and Fernàndez, M.: Ranges and basins in the Iberian Peninsula: their contribution to the present topography, Geol. Soc. Lond., Mem., 32(1), 223-234, 2006.

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

Vergés, J., Kullberg, J.C., Casas-Sainz, A., de Vicente, G., Vítor Duarte, L., Fernàndez, 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.

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.

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.

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.

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.

1080   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.,

1085   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.

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; 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 the location of the data sets listed in Table 1. Modified from 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 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 1. Additional references can also be found throughout the text.

Figure 5 Offshore: Depth to the Top of Paleozoicr, 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., 2020 and references therein).

Figure 6 Offshore and onshore depth to the Base of Cenozoic. Main references from which data have been gathered are shown in Table 1. Additional references can also be found throughout the text. Data from the Western Mediterranean have been taken form (Belluci et al., 2021, and references therein).

Figure 7 Depth to the 150ºC 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 μ W/m3 and $3 \times e^{(z/10)}$ μ W/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 1 Detailed list of the information included in the database presented in this work.