

Geomorphological evidence of the Malta-Sicily land-bridge during the Last Glacial Maximum inferred from seismic profiles

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Abstract

The Last Glacial Maximum (LGM) witnessed substantial sea-level fluctuations profoundly impacting the geomorphological evolution of the Maltese Islands, located in the SW part of the Malta Plateau (central Mediterranean Sea). It is known that during that period, a land-bridge connected the Maltese Islands to Sicily. However, discerning detailed geomorphological evidence of past sea-level changes in offshore regions proves difficult due to the limited availability of high-resolution multibeam bathymetry data, subsurface seismic profiles and potential tectonic influences. By addressing these challenges, this study sets out to meticulously reconstruct the coastline of the Malta Plateau and to delineate the extent of the land-bridge connecting Malta to Sicily during the LGM. The study was conducted by exploiting 2D multichannel seismic profiles acquired during oil exploration seismic surveys carried out offshore Malta and EMODnet bathymetry data. This analysis enabled the recognition of the coastline of the western side of the land-bridge connecting Malta and Sicily during the LGM, at a depth ranging from 119 to 131 m b.s.l. Uncertainties about the location of the eastern coastline remain due to the quality and extent of the seismic profiles and to the more intense morphodynamics of the Malta Plateau. A coastal lagoon system, bounded offshore by a barrier corresponding to a structural high, was recognized. During transgressional phases, the emerged LGM landscape was progressively submerged and locally sealed by a thin layer of sediments, which still preserves the most significant geomorphological features. With reference to the stratigraphic sequence, two facies were distinguished, the lower one interpreted as the pre-Plio-Quaternary (pre-PQ) sequence outcropping in Malta, and the upper one consisting of Plio-Quaternary (PQ) deposits overlapping on the former one. These results provide valuable insights into the palaeoenvironmental history of the region, contributing to a broader understanding of sea-level dynamics and geological evolution in the tectonically complex Mediterranean area.

KEYWORDS

2D multichannel seismic profiles, Malta Plateau, Malta-Sicily Channel, palaeocoastlines, sea-level rise, submarine geomorphology

1 | INTRODUCTION

During the Last Glacial Maximum (LGM), the sea level was about 120–130 m lower than today, and most of the tectonically stable

shelves were emergent. In particular, the Malta Plateau, a shallow carbonate platform in the Sicily Channel stretching from southern Sicily to the coasts of Malta, was also emergent. In the Sicily Channel, the Maltese Islands were connected to each other and also to Sicily,

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through a land-bridge extending from the Hyblean Plateau (SE Sicily) to an area SE of the Maltese Islands (Lambeck et al., 2011, 2014). This land-bridge also acted as a passage for large quadrupeds moving from Sicily, across the Malta Plateau to the Maltese Islands, whose remains were found, for example, in Għar Lapsi and Għar Dalam caves (Furlani et al., 2013; Marriner et al., 2012; Pedley et al., 2002).

The evolution of the Malta-Sicily land-bridge has been well-documented in previous studies (Foglini et al., 2016; Lambeck et al., 2011, 2014; Micallef et al., 2013). However, identifying detailed geomorphological evidence of past sea-level changes in offshore areas remains a challenge, mostly because high-resolution geophysical data and sediment cores are not widely available. The former are fundamental to reliably identify the internal architecture of the LGM prograding wedges and the erosional surfaces associated with episodes of subaerial erosion and subsequent drowning. Examples of palaeogeography reconstruction come from Dalmatian coast (Brunović et al., 2024), south-western Sardinia (Deiana et al., 2021), the Adventure Bank (Lodolo et al., 2022), the Black Sea (Lericolais et al., 2009) and the Gulf of Lions (Jouet et al., 2006), where sparker and sub-bottom profiles coupled with sediment cores and samples were exploited to disclose Late Quaternary geomorphological evolution. Furthermore, the article by Fraile-Jurado et al. (2023) explores the reconstruction of the emerged areas of the Mediterranean Sea during the Last Glacial Period (between 110.8 and 11.7 ka BP) integrating bathymetric data and sea-level fluctuation curves.

In this context, the Malta Plateau preserves evidence of historical sea-level fluctuations and serves as a valuable geological archive for understanding the intricate interplay of tectonic forces, sedimentary processes and sea-level dynamics in the region.

The aim of this research was to reconstruct the Malta Plateau coastline during the LGM based on the interpretation of multichannel seismic profiles located north and east of the Maltese Islands and to

compare the results with the modelled LGM for the central Mediterranean Sea by Zickel et al. (2016). In contrast to what was done in other areas, high-resolution seismic data were not available; hence, we analysed 2D multichannel seismic profiles acquired during oil exploration seismic surveys conducted on both the western and eastern flanks of the Malta Plateau. Despite their low resolution, we were able to identify evidence of palaeoshorelines, thus confirming and redefining the LGM shorelines especially in the western part of the Malta Plateau. The outputs of this research are discussed and compared with evidence from other areas of the Sicily Channel and Malta Plateau, thus providing insights for a more detailed reconstruction of the palaeogeography of the south-western portion of the Malta Plateau.

2 | REGIONAL AND GEOLOGICAL SETTING

2.1 | The Malta-Sicily Channel and the Malta Plateau

The Malta-Sicily Channel is located between Tunisia and Sicily (Figure 1) and acts as a boundary between the African and European tectonic plates. After the emplacement of the Sicilian fold-and-thrust belt at the end of the Messinian Salinity Crisis (MSC, ca. 5 Ma), the Malta-Sicily Channel experienced extensional stresses that led to the formation of two nearly orthogonal fault systems affecting the geomorphology of the Maltese Islands (Catalano et al., 2008; Galea, 2019). The Sicily Channel Rift Zone consists of a set of three NW-SE trending grabens: the Pantelleria, Linosa and Malta grabens (Figure 1) that have been active since the Late Miocene and controlled the syntectonic sedimentation of the Malta-Sicily Channel together with the formation of the Gela foredeep as documented by Casero

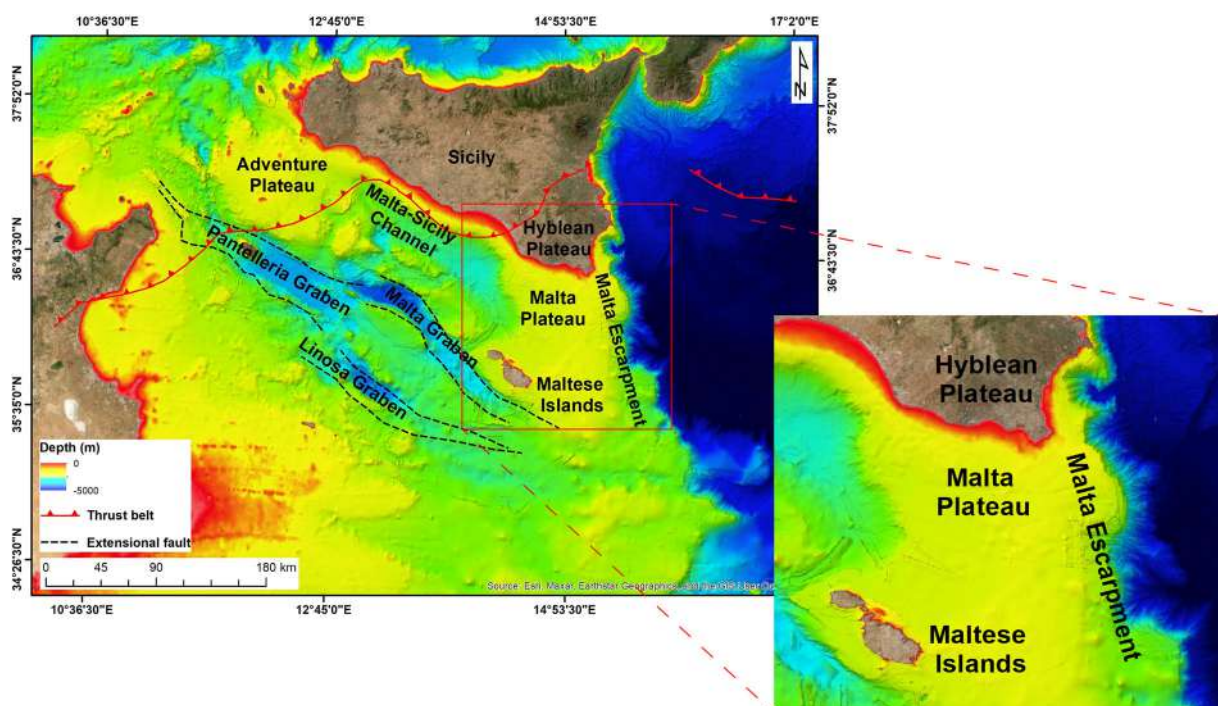


FIGURE 1 Morpho-bathymetry of the Malta-Sicily Channel (Central Mediterranean Sea) showing the principal structural elements in the region, with a focus on the Malta Plateau (Source: EMODnet Bathymetry, <https://emodnet.ec.europa.eu/en/bathymetry>).

et al. (1984), Pedley (1990), Gardiner et al. (1995) and Civile et al. (2010, 2014).

The shallow carbonate platform of the Malta Plateau is located in the Malta-Sicily Channel and stretches from the Hyblean Plateau (SE Sicily) to SE offshore Malta (Cassar et al., 2008) with a length of 150 km and a width of 120 km (Micallef et al., 2016). The water depths of the Malta Plateau vary from about 100 to 200 m (Osler & Algan, 1999). The pre-Plio-Quaternary (pre-PQ) succession of the plateau consists of shallow Messinian strata underlain by a thick stratigraphic sequence composed mostly of limestone, dolomite and volcanic deposits dating from the Late Triassic to the Late Neogene (Figure 2; Torelli et al., 1995; Micallef et al., 2016). The youngest limestone formations are intersected by regional normal faults associated with the development of the Malta Graben to the west (Micallef et al., 2011). During the MSC, the Malta Plateau experienced the deposition of an evaporitic sequence (Gessoso-Solfifera Formation) in its northern sector and erosion with no deposition of evaporites in its southern sector close to the Maltese archipelago. The base of the PQ sedimentation is represented by the Messinian evaporites in the northern Hyblean-Malta Plateau and by the irregular Messinian erosional surface in the southern Malta Plateau, where the pre-PQ succession sometimes outcrops at the seafloor (Micallef et al., 2018; Todaro et al., 2021). In the northern Malta Plateau, the deep water marly limestones of the Trubi Formation reach a thickness of 150 m (Todaro et al., 2021), while no coeval sedimentation is recorded in the south. The upper Pliocene–Pleistocene Ribera Group lies paraconformably above the neritic to littoral facies of the Trubi Formation.

Indeed, from the Middle Pleistocene, sea-level oscillations were the main factors influencing the sedimentation on the Malta

Plateau. At that time, the Hyblean Plateau was uplifting, the foredeep Gela Basin developed and the Malta Plateau emerged forming a large peninsula, which extended into the eastern Malta-Sicily Channel (Todaro et al., 2021 and references therein).

Todaro et al. (2021) investigated the NE edge of the Malta Plateau and interpreted the Malta Plateau as a back bulge depozone whose NW edge is characterized by a late Pliocene–Pleistocene shelf-slope clinoform system typical of a sedimentary shelf where the slope is a ramp of 3°. In such a depositional setting, continuous subsidence and water depths not exceeding 200 m allow the formation of a depozone infilled by moderate fluvial sediment supply, as shown by the subhorizontal trajectories of the shelf break.

2.2 | The Maltese Islands

The stratigraphic succession of the Maltese Islands consists of marine sedimentary rocks with an approximate thickness of 250 m, deposited between the Late Oligocene and the Late Miocene. This sequence is divided into four subhorizontal lithostratigraphic units (Baldassini & Di Stefano, 2017; Pedley et al., 2002; Scerri, 2019). From oldest to youngest, they are the Lower Coralline Limestone (LCL) Formation, characterized by bedded pale grey to light brown limestones; the Globigerina Limestone (GL) Formation, composed of bedded pale yellow limestones and light grey marly limestones; the Blue Clay (BC) Formation, which presents an alternation of clays and grey-blue marls; and the Upper Coralline Limestone Formation (UCL), composed of bedded light grey to light brown limestones (Figure 3).

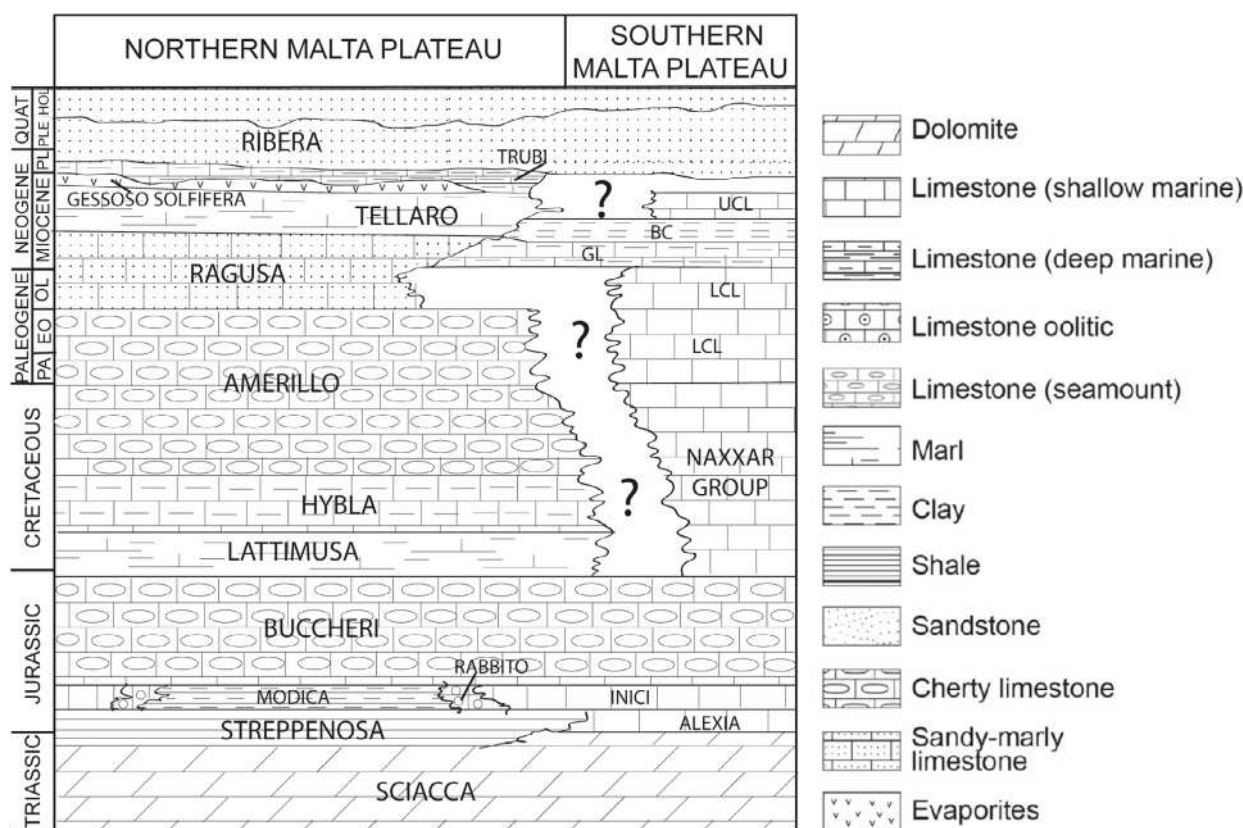


FIGURE 2 Lithostratigraphic correlation chart along the Hyblean-Malta offshore (modified from Todaro et al., 2021).

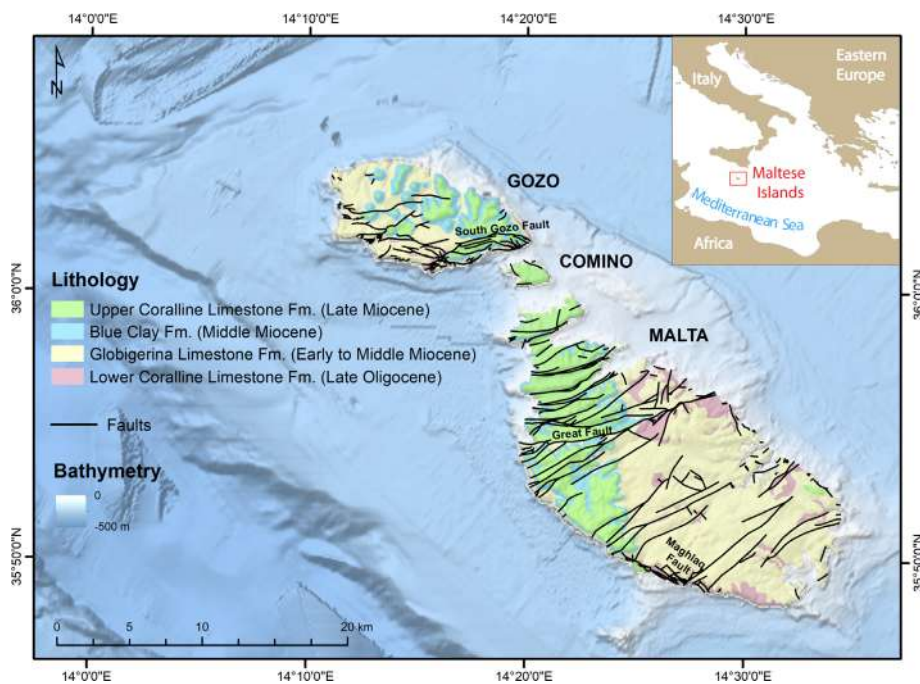


FIGURE 3 A geological sketch map of the Maltese Islands (Oil Exploration Directorate, 1993). The Greensand Formation is not depicted in the map because it is not visible at the map scale.

The structural framework of the Maltese Islands is influenced by two fault systems, linked to the tectonic evolution of the central Mediterranean and in particular to the continental rifting of the Sicily Channel Rift Zone (Biolchi et al., 2011), which is still active as evidenced by the current seismic activity (Galea, 2019; Rossi et al., 2024). The older fault system (Early Miocene) has a WSW-ENE orientation and is responsible for the horst and graben topography characteristic of the islands (Galea, 2019) both on a broad scale (South Malta Horst, North Malta Graben and Gozo Horst) and on a more localized scale (in the northern part of the island of Malta). The main manifestations of this system are the South Gozo Fault and the Great Fault (Baldassini & Di Stefano, 2017) (Figure 3). The younger fault system (Late Miocene–Early Pliocene) has a NW-SE orientation, parallel to Malta, Pantelleria and Linosa grabens located in the Malta-Sicily Channel. Its most evident feature is the Maghlaq Fault (Dart et al., 1993; Illies, 1981; Reuther & Eisbacher, 1985) (Figure 3).

Both fault systems have been active in the last 20 ka showing a dextral transtensional deformation that has created a pull-apart basin between the islands of Malta and Gozo. Micallef et al. (2019) noted that the faults displaced the most recent deposits and are now associated with escarpments visible on the seafloor. They also act as main pathways for fluid flow upwards migration (Micallef et al., 2019).

2.3 | Sicily

The island of Sicily acts as a key orogenic link between the African Maghrebides, the Calabrian arc and the southern Apennines (Catalano et al., 1989; Finetti et al., 2005; Milano et al., 2020). It forms part of the Alpine collisional belt along the Africa-Europe plate boundary stretching from the Corsica-Sardinia block to the Pelagian Platform (Catalano et al., 1996; Milano et al., 2020). Sicily represents a geologically complex region where multiple units originating from distinct palaeogeographic domains and intricate tectonic structures reflect the complex geodynamic processes that have shaped the Mediterranean

region (Finetti et al., 2005). The collisional complex of Sicily is thrusting towards the east and south-east and is characterized by three main geological regions (Figure 4): (i) a foreland area, outcropping in the Hyblean Plateau and extending into the Malta-Sicily Channel, which represents the largely undeformed North Africa-Pelagian basement; (ii) a northwest-dipping Pliocene–Pleistocene foredeep that extends from south-eastern Sicily to the Gela Basin, partially buried by the Gela Thrust Front; (iii) an orogenic wedge, composed of a fold-and-thrust complex, which includes European (Peloritani Units), Tethyan (Sicilidi Units) and African (Maghrebic-Sicilian Units) elements (Catalano et al., 1996, 2013; Milano et al., 2020). The Peloritani thrust units are placed in north-eastern Sicily and consist of displaced Palaeozoic igneous and metamorphic rocks overlain by Mesozoic–Cenozoic carbonate sediments (Catalano et al., 2013). Their western prolongation is now lying below the southern Tyrrhenian Sea (Catalano et al., 2013; Finetti et al., 2005). The Tethyan nappe units are composed of Jurassic–Oligocene deep water carbonates and sandy mudstones, covered by Oligocene–Miocene turbidites, and are thickest in north-eastern Sicily. These units, formed as part of the deformation of the Sicilide domain, represent the deep water sedimentation in the Tethys Ocean (Catalano et al., 2013). The African tectonic units comprise marine successions that were once part of a carbonate platform-basin system formed during the Late Permian–Early Mesozoic. These units include the Permian–Mesozoic–Miocene deep water carbonates and bedded cherts located in the Imerese and Sicilian basins, and the Mesozoic–Cenozoic platform-pelagic carbonates deposited in distinct and laterally connected facies domains (locally referred to as Panormide, Trapanese, Saccense and Iblean-Pelagian units).

2.4 | Holocene sea-level fluctuations

The landforms and landscapes of the Maltese Islands, resulting from the tectonic setting (Galea, 2019) and widespread erosional processes

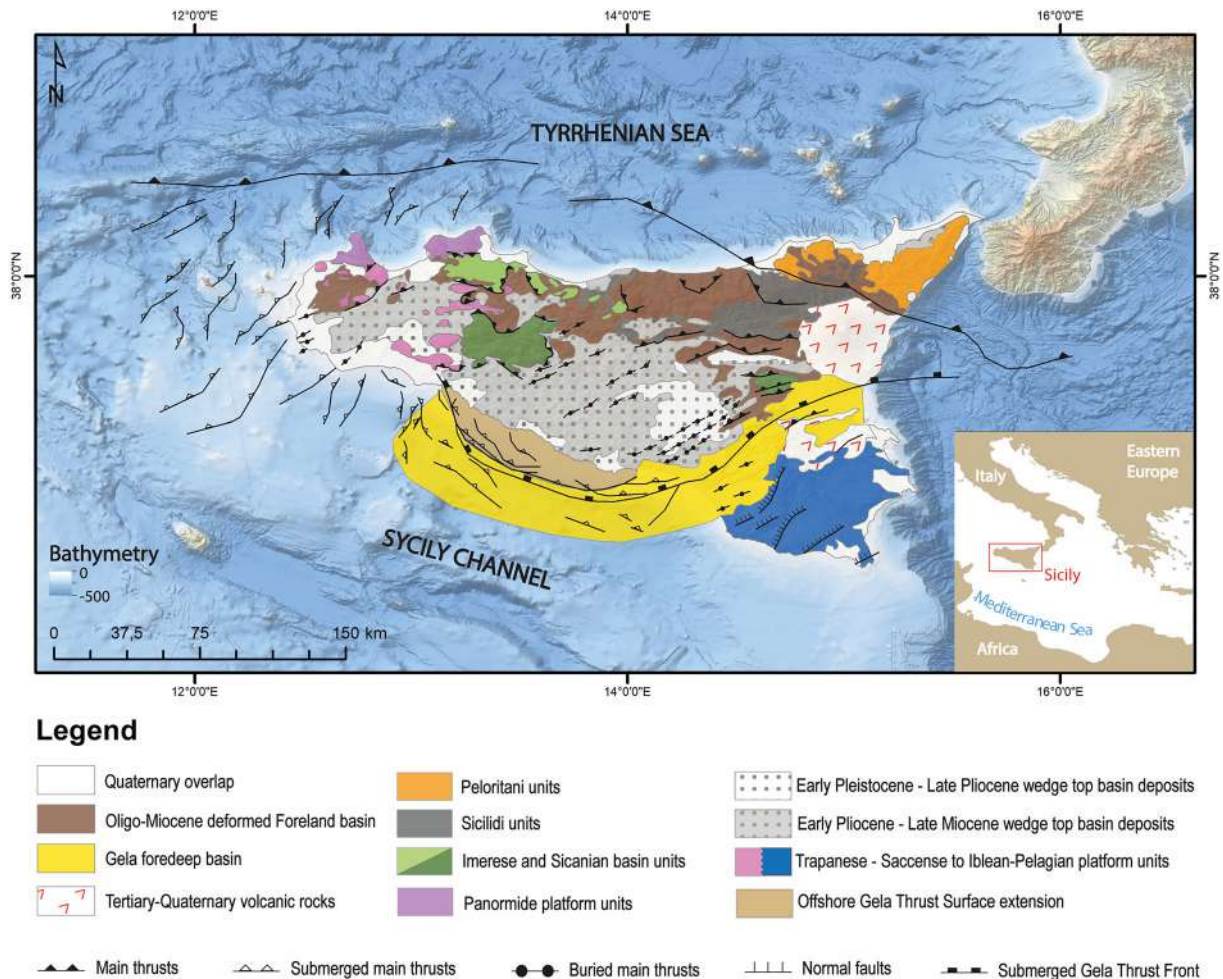


FIGURE 4 A geological sketch map of Sicily (modified from Catalano et al., 2013).

that have acted differently on the rock strata (Scerri, 2019), have been significantly influenced by climatic and sea-level fluctuations, especially in coastal areas. As depicted in Figure 5, during the LGM, the sea-level dropped significantly to about 125 m below its current level. At that time, the land-bridge connecting the entire Maltese Islands reached its maximum extension: it stretched about 105 km in length and 40 km in width, connecting the eastern part of offshore Malta to southern Sicily (Foglini et al., 2016; Lambeck et al., 2011, 2014; Micallef et al., 2013). Lowstand sediments were deposited in the NW marine sector of the land-bridge above a subaerial erosional surface (Todaro et al., 2021, 2022).

After the LGM, as the climate warmed up and transitioned into the current interglacial period, due to deglaciation, the land-bridge started to be progressively submerged as the sea-level started to rise between 18 and 14 ka at an average rate of 5 mm per year, according to Lambeck et al. (2011, 2014). This rise resulted in the deposition of transgressive facies and backstepping of the shoreline (Todaro et al., 2021, 2022 and references therein). The postglacial eustatic sea-level rise was not constant, but involved periods of rapid increase, which probably played a role in the preservation of submarine features and deposits associated with the palaeocoastlines (Micallef et al., 2013).

About 12.9 ka years ago, the land-bridge had mostly disappeared, leading to the isolation of the Maltese Islands from Sicily. The islands of Malta, Gozo and Comino remained connected until approximately

8.6 ka years ago, when the limestone plateau of Sikka I-Bajda became a separate island. By the time of the Mesolithic period, around 11 ka years ago, the shape of the Maltese Islands evolved to closely resemble its present-day morphology (Foglini et al., 2016; Furlani et al., 2013; Gauci & Scerri, 2019; Prampolini et al., 2017), mainly due to the continuous sea-level rise. The upper Holocene sequences are characterized by highstand deposits that occurred during the last 6 ka (Todaro et al., 2021, 2022). Currently, Malta is 80 km away from the southernmost point of Sicily.

The Malta Plateau is considered stable or slightly subsiding (0.1 mm/year) from the Middle Pleistocene Transition (MPT, 0.8 Ma; Gauchery et al., 2021) to present day.

3 | MATERIALS AND METHODS

This study examined both the western and eastern regions of the Malta Plateau. The interpreted western portion extends from 7 to 47 km from the NE coast of Malta, with depths between 70 and 140 m. It presents a predominantly flat morphology (slope <2°), with structural elevations reaching approximately 40 m in height and about 8 km in diameter. This area shows an alignment parallel to the ENE-SWS fault system. The investigated eastern region of the Malta Plateau represents a portion of the outer shelf 23 km wide and 105 km long. Located approximately 50 km east of the Maltese Islands, close

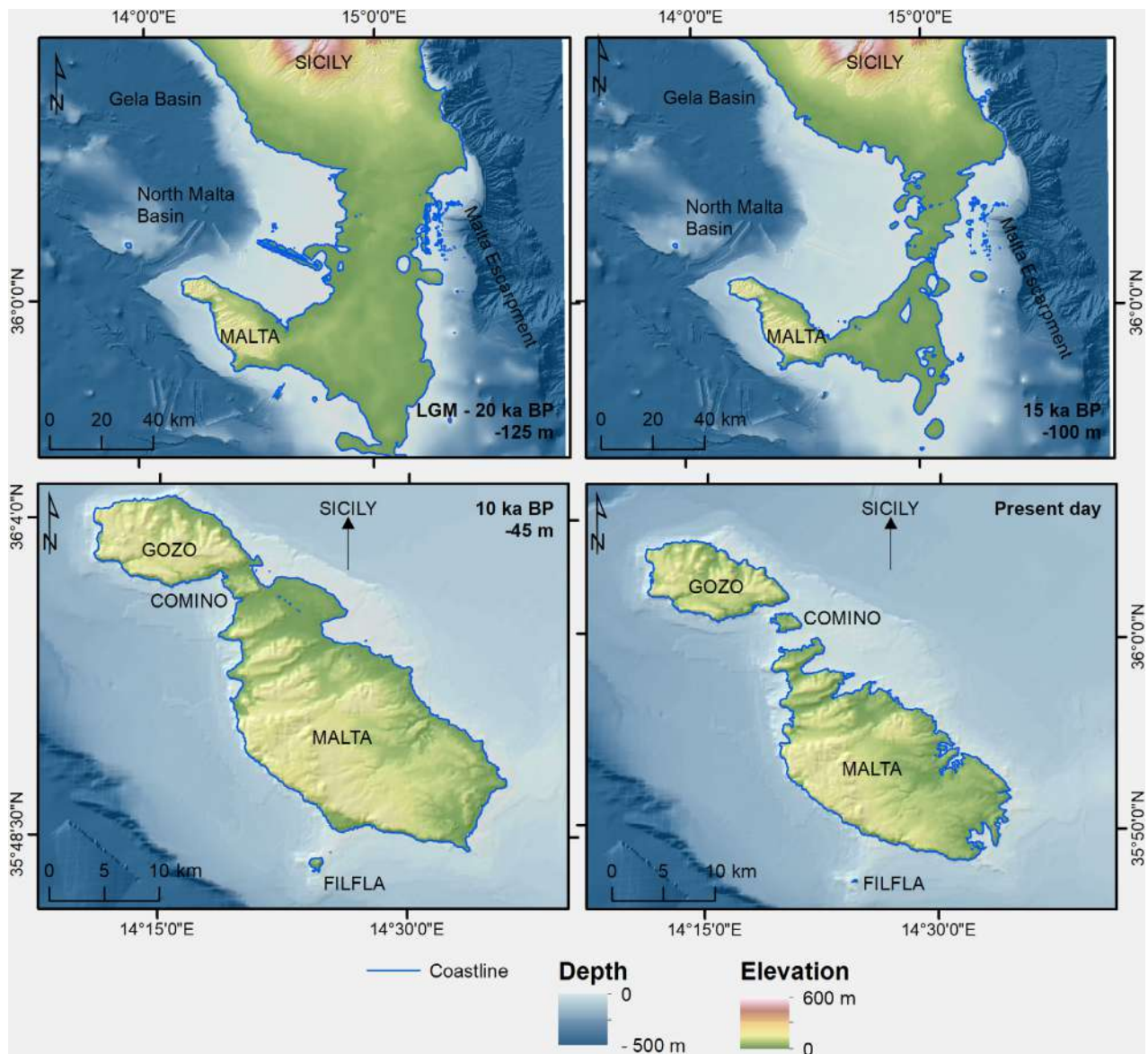


FIGURE 5 Reconstruction of the evolution of the Maltese landscape after the LGM, from 20 ka to date. In the upper part of the figure, the land-bridge connecting Sicily to Malta during the LGM can be clearly identified.

to the Malta Escarpment, this region offers a distinct geomorphological context.

The mapping and analysis of the coastline of the Malta-Sicily land-bridge during the LGM is based of two sets of data:

- Bathymetric data provided from the 2020 version of EMODnet Bathymetry in gridded form on a DTM grid of $1/16 \times 1/16$ arc minute of longitude and latitude (ca 115×115 m) (<https://emodnet.ec.europa.eu/geonetwork/emodnet/eng/catalog.search#/metadata/ff3aff8a-cff1-44a3-a2c8-1910bf109f85>).
- 2D multichannel seismic profiles, namely, CRN14, RWE06, HDM00 and TX91 (Figure 6 and Table 1), which were collected during various oil exploration seismic surveys conducted offshore Malta on both the western and eastern sides of the Malta Plateau.

The seismic profiles analysed in this study were processed by the oil company that carried out the acquisition. We visualized and interpreted the processed profiles through S&P Global (2023)

Kingdom v23.0 employing visual enhancements to ensure the highest quality of data interpretation, including bandpass filtering to remove random noise. This approach resulted in clearer and more detailed images, aiding the seismic profile interpretation process. In our analysis, we conducted a comparative study by closely examining different seismic profiles within the study area, integrating them with EMODnet bathymetric data and precise sea-level fluctuation curves published in literature (Furlani et al., 2013; Lambeck et al., 2011, 2014; Prampolini et al., 2021; Siddall et al., 2003; Zickel et al., 2016).

Velocity data from various sources were used to calibrate the depth of the interpreted reflectors including the seabed (first acoustic reflector) and to compare with the depths coming from EMODnet bathymetry. Available velocity data consisted of a check-shot survey of the Valletta-1 well and velocity analyses result from seismic processing along several seismic profiles. These data were also used to compare the depth of the interpreted palaeocoastline identified on the seismic profile, with the EMODnet bathymetry, the only bathymetric data available for this area.

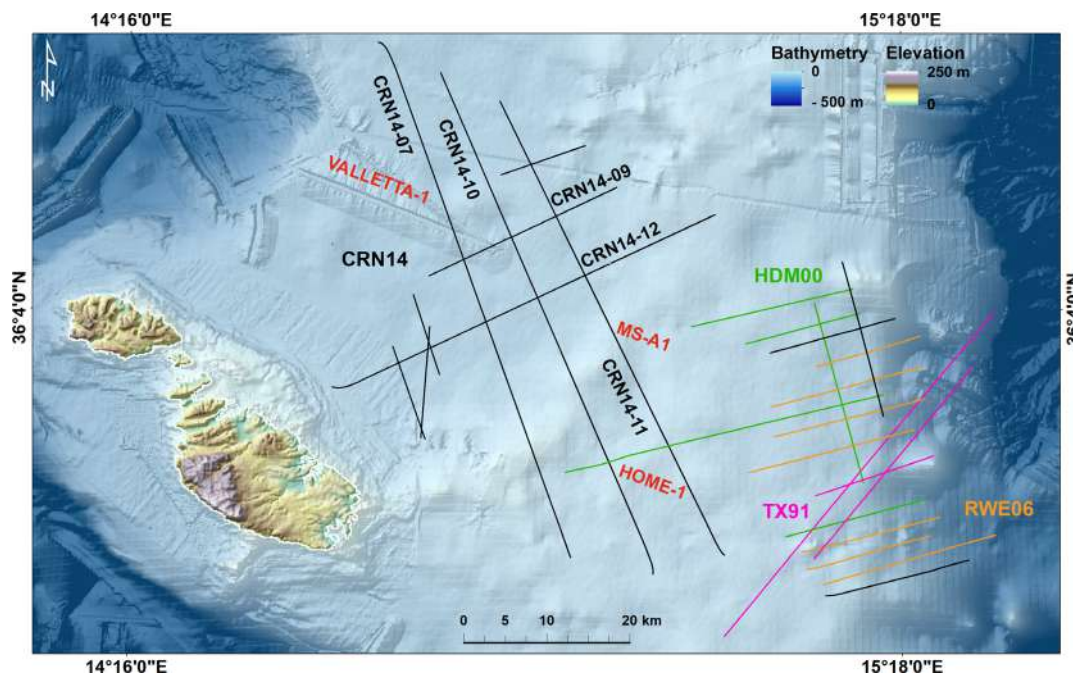


FIGURE 6 Location of 2D multichannel seismic profiles offshore Malta, and names of the respective seismic surveys (provided by the Continental Shelf Department of Malta). Bathymetry from EMODnet bathymetry.

TABLE 1 Acquisition details of the 2D multichannel seismic profiles analysed in this study.

Survey name	Year of acquisition	Source type	Source pressure (psi)	Streamer length (m)	No. of channels	Final processing product
CRN14	2014	Air Gun	2000	8000	640	Pre-stack time migration
RWE06	2006	Air Gun	2500	8100	648	Pre-stack time migration
HDM00	2000	Air Gun	2000	4500	360	Time migration
TX91	1991	Air Gun	2000	4500	240	Time migration

Analyses of seismic facies and internal geometry of seismic reflectors for each seismic profile were used to identify the point where the LGM coastline is likely to have been located. Following the extraction of the corresponding geographic coordinates from S&P Global (2023) Kingdom v23.0 we integrated these data into a Geographic Information System (GIS) environment and manually interpolated them along a line, thus ensuring a precise and accurate spatial representation of the LGM coastlines.

4 | RESULTS AND DISCUSSION

4.1 | Western side of the Malta Plateau

The western portion of the Malta-Sicily land-bridge described in literature was interpreted through the analysis of the seismic profiles acquired during the CRN14 survey, the interpretation of which made it possible to distinguish two main seismic facies. The lowermost one, Facies A, shows internally folded and faulted reflectors parallel to each other and topped by a very rugged surface. The uppermost acoustic facies, Facies B, which has a thickness ranging from 0 to 170 m, shows an internal subhorizontal stratification, and onlaps on the top surface of Facies A. Facies A was interpreted to correspond to the pre-PQ geological sequence (Figure 7) outcropping in the Maltese Islands, ranging from the oldest LCL Formation (Chattian) to the

youngest UCL Formation (Early Messinian). The top surface of this carbonate sequence underwent erosional processes due to sea-level fall during the MSC (Micallef et al., 2018). The high amplitude continuous reflector just above the UCL represents its top, constituted by a major regional unconformity due to the subaerial erosion related to the MSC. It represents the base of marine PQ deposits (Facies B) (Figure 7) that constitute a wedge with a maximum thickness of ca. 170 m onlapping on the Maltese pre-PQ sequence (Figure 7).

This interpretation is confirmed from the velocity check-shot data from the Valletta-1 well and from seismic velocity analysis results along seismic profiles at the location of the Home-1 and MS-A1 wells.

The seismic profile CRN14-10 is interpolated from the Valletta-1 (projected) and the Home-1 wells (Figure 8). At Valletta-1 (projected), the seabed is at a depth of 137 m, and the base of the PQ succession is 267 m deep. At the location of Home-1, the seabed is at a depth of 98 m, and the contact between the PQ deposits and the pre-PQ sequence is located at ca. 117 m below sea level, resulting in a PQ thickness of about 19 m that cannot be resolved on the seismic line. In this seismic profile, the LGM shoreline was then interpreted to be located at a depth ranging from 123 and 128 m, corresponding to a structural high that acted as a barrier at the time, behind which a coastal lagoon developed.

The seismic profile CRN14-11 in Figure 9 shows the same situation, with a barrier lagoon system bounded by a coastline located at a depth ranging from 119 and 122 m during the LGM. There, the

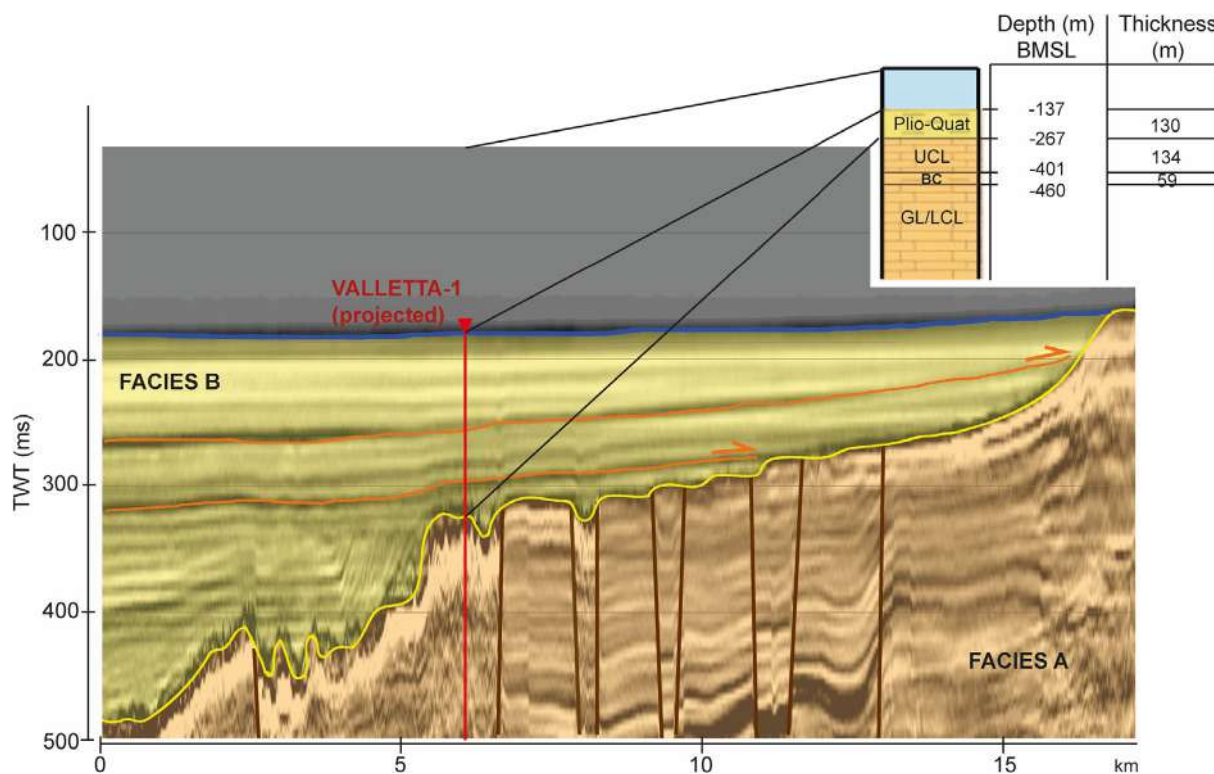


FIGURE 7 Sketch of the Facies A (light orange) and B (light yellow) identified in the seismic profiles, together with faults (brown) affecting Facies A and internal reflectors (deep orange) of Facies B onlapping on the top of Facies A. The stratigraphy of the uppermost section of the Valletta-1 well is shown in the inset at the top right of the figure. The deeper stratigraphy of the well is confidential.

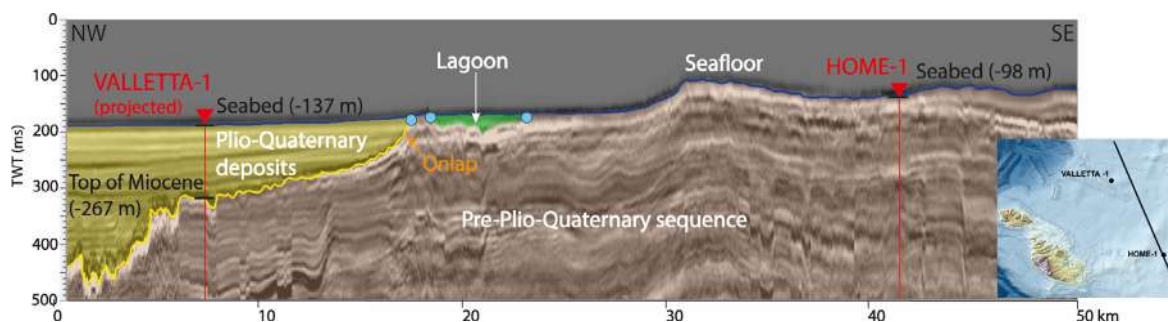


FIGURE 8 The CRN14-10 seismic profile, oriented NW-SE, allowed the distinction of an underlying facies consisting of the pre-PQ sequence, and an upper facies characterized by the PQ deposits. The base of the PQ deposits (depicted in yellow) coincides with the irregular Messinian erosional surface discussed above. This seismic profile is interpolated from Valletta-1 (projected) and Home-1 wells, providing detailed insights into key depth markers, such as the seabed (-137 m at Valletta-1 and -98 m at Home-1) and the contact between PQ deposits and pre-PQ sequence (-267 m at Valletta-1 and -117 m at Home-1). The thickness of the PQ deposits at Home-1 is only 19 m, too thin to be resolved by the seismic method. Three interpretation points (represented in light blue) of the Last Glacial Maximum (LGM) coastline were interpreted at a depth ranging from 123 to 128 m. At this depth, it was possible to recognize a structural high at which the PQ deposits onlap on the pre-PQ sequence. The structural high acted as a barrier during the LGM, favouring the development of a coastal lagoon behind it.

MS-A1 well, located on a structural high, shows the seabed at a depth of about 89 m and the contact between the PQ sediments and the pre-PQ sequence estimated at 127 m below sea level. A thickness of PQ of 38 m is too thin to be resolved using the available seismic data.

The features identified in Figures 8 and 9 are recognizable also on the profile CRN14-09 shown in Figure 10 and oriented NE-SW. Here, the interpreted palaeocoastal lagoon shows two different sectors bounded by a palaeocoastline located at a depth ranging from 119 to 124 m. These two segments are separated by a structural high of ca. 50 m, which is the morphological continuation of Hurd Bank, identified in the profile CRN14-07 and visible in Figure 9.

The CRN14-07 seismic profile runs parallel to the profiles in Figures 8 and 9, and is located 7 and 15 km, respectively, southwestward from them. In Figure 11, there is no evidence of the palaeo-lagoon, probably because the barrier had a limited extension. However, as depicted in the previous profiles, in Figure 11, the PQ deposits onlap the pre-PQ Maltese sequence. The possible LGM shoreline was interpreted to correspond to this contact, a depth of approximately 130 m.

Profile CRN14-12, depicted in Figure 12, is NE-SW oriented and shows that the palaeo-lagoon identified in Figures 8, 9 and 10 has a morphological boundary in its NE part, where the PQ deposits are

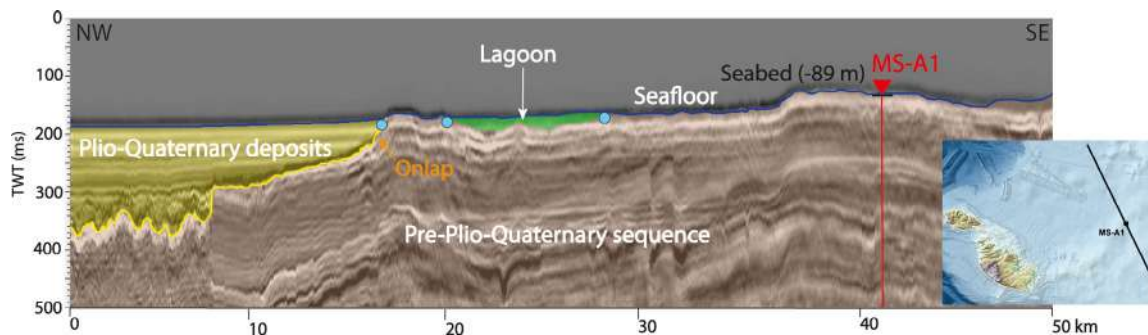


FIGURE 9 The CRN14-11 seismic profile, oriented NW-SE, allowed the distinction of two facies: an underlying one, comprising pre-PQ sequence and an upper one consisting of PQ deposits. The irregular erosive surface of the Messinian, discussed above, produced the basis for the PQ deposits (shown in yellow). The interpolation of this seismic profile from the MS-A1 well provides precise information on important depth markers, including the seabed (–89 m) and the contact between the pre-PQ series and the PQ deposits (–127 m). The thickness of the PQ deposits at MS-A1 is only 38 m, too thin to be resolved by the available seismic data. Three interpretation points (depicted in light blue) of the LGM coastline were interpreted at a depth of 119 to 122 m. At this depth, a structural high was identified where the PQ deposits onlap on the pre-PQ sequence. During the LGM, the structural high acted as a barrier, promoting the growth of a coastal lagoon behind it.

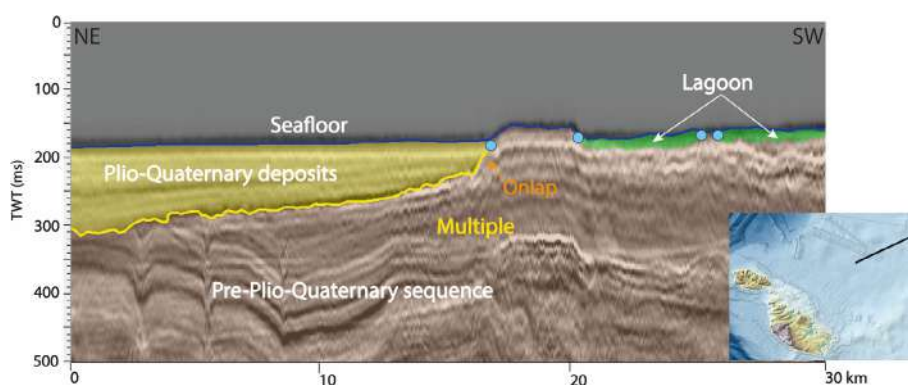


FIGURE 10 The seismic profile CRN14-09, oriented NE-SW, made it possible to distinguish between an underlying facies made up of the pre-PQ sequence and an upper facies characterized by the PQ deposits. The base of the PQ deposits (represented in yellow) coincides with the irregular Messinian erosional surface discussed previously. This seismic profile made it possible to interpret four interpretation points (depicted in light blue) of the Last Glacial Maximum (LGM) coastline at a depth ranging from 119 and 124 m. At this depth, the LGM environment consisted of a structural high in which the PQ deposits onlapped the pre-PQ sequence. The structural high served as a barrier, favouring the development of a coastal lagoon behind it, consisting of two distinct sectors.

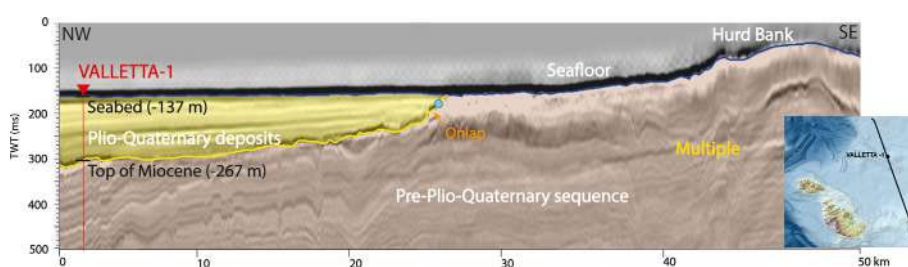


FIGURE 11 The seismic profile CRN14-07, oriented NW-SE, allowed the distinction of an underlying facies consisting of the pre-PQ sequence, and an upper facies characterized by the PQ deposits. The irregular erosive surface of the Messinian, discussed above, defines the base for the PQ deposits (shown in yellow). This profile enabled the interpretation of one interpretation point (depicted in light blue) of the Last Glacial Maximum (LGM) coastline at a depth of approximately 130 m. At this depth, it was possible to recognize a structural high of limited extent at which the PQ deposits onlap on the pre-PQ sequence.

very thin and cannot be resolved by the seismic method used. In this case, the palaeoshoreline was interpreted at a depth of between 122 to 131 m.

The LGM coastline was interpreted mainly at the location where the PQ deposits onlapping the pre-PQ sequence thin out, corresponding to structural highs on the Malta Plateau, made of the

Maltese sequence. The shoreline was also recognized along the coastal lagoon formed behind the structural highs. Following the Messinian morphology revealed by the seismic profiles and the present seabed morphology, we interpolated the interpretation points of LGM coastline from the seismic profiles into a single line representing the LGM coastline on the western side of the Malta Plateau. It results

that the sea-level was from 119 to 131 m lower than at present, confirming the estimate of 125–130 by Lambeck et al. (2011, 2014) and refining the model by Zickel et al. (2016) for the western boundary of the Malta-Sicily land-bridge (Figure 13).

During the LGM, we can imagine the western part of the Malta Plateau as characterized by a low-lying coast with a coastal lagoon and a barrier island bounding the lagoon on the west (Figures 13 and 14).

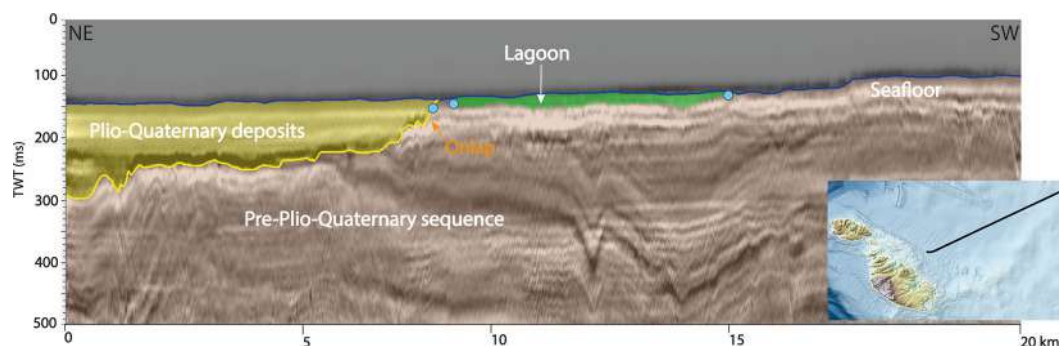


FIGURE 12 The seismic profile CRN14-12, oriented NE-SW, allowed the distinction of an underlying facies consisting of the pre-PQ sequence, and an upper facies characterized by the PQ deposits. The base of the PQ deposits (depicted in yellow) is defined by the irregular Messinian erosional surface discussed above. This seismic profile allowed the localization of three interpretation points (depicted in light blue) of the Last Glacial Maximum (LGM) coastline at a depth between 122 and 131 m. At this depth, it was possible to recognize a structural high at which the PQ deposits onlap the pre-PQ sequence. The structural high served as a barrier during the LGM, favouring the formation of a coastal lagoon behind it.

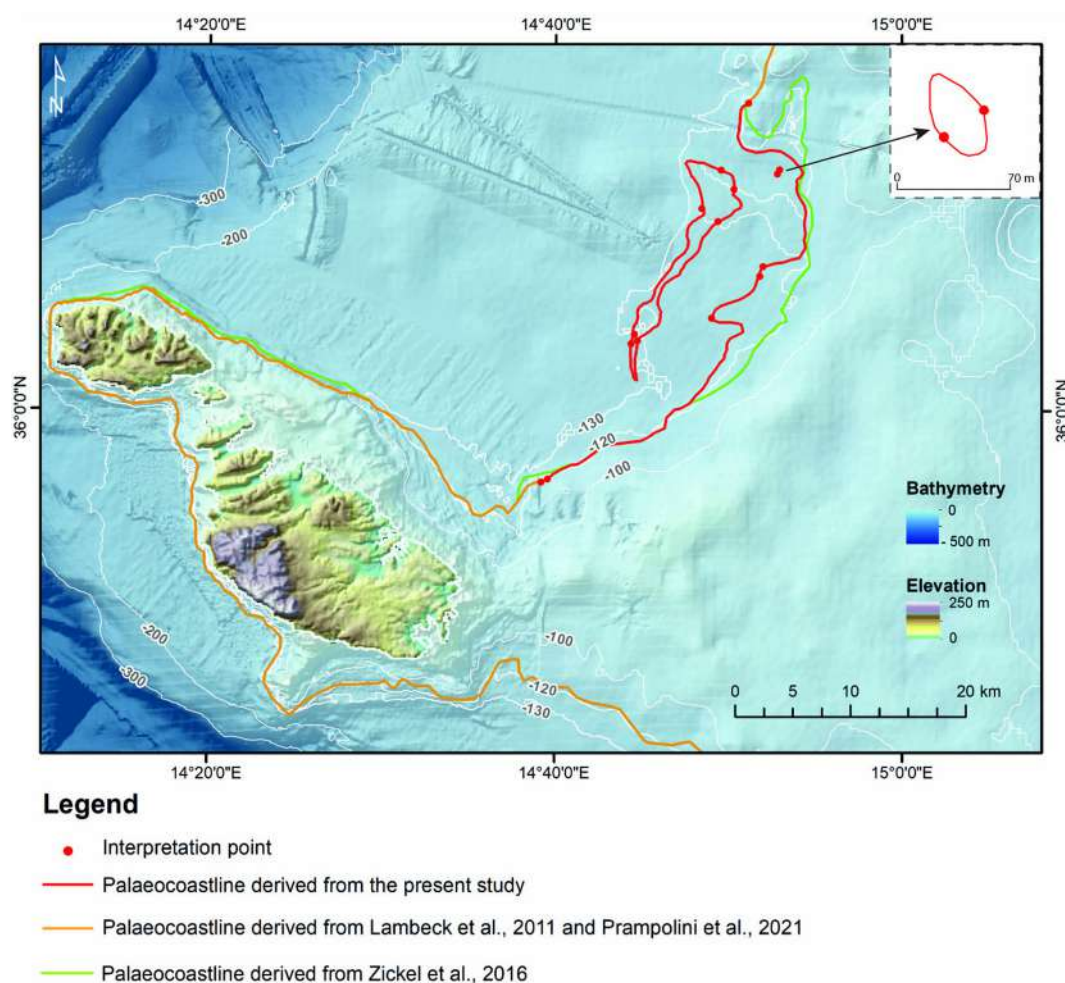


FIGURE 13 Location of the interpreted Last Glacial Maximum (LGM) coastline on the western margin of the Malta Plateau, compared with Lambeck et al. (2011), Prampolini et al. (2021) and Zickel et al. (2016). The zoom represents an interpreted islet off the coastline derived from the present study.

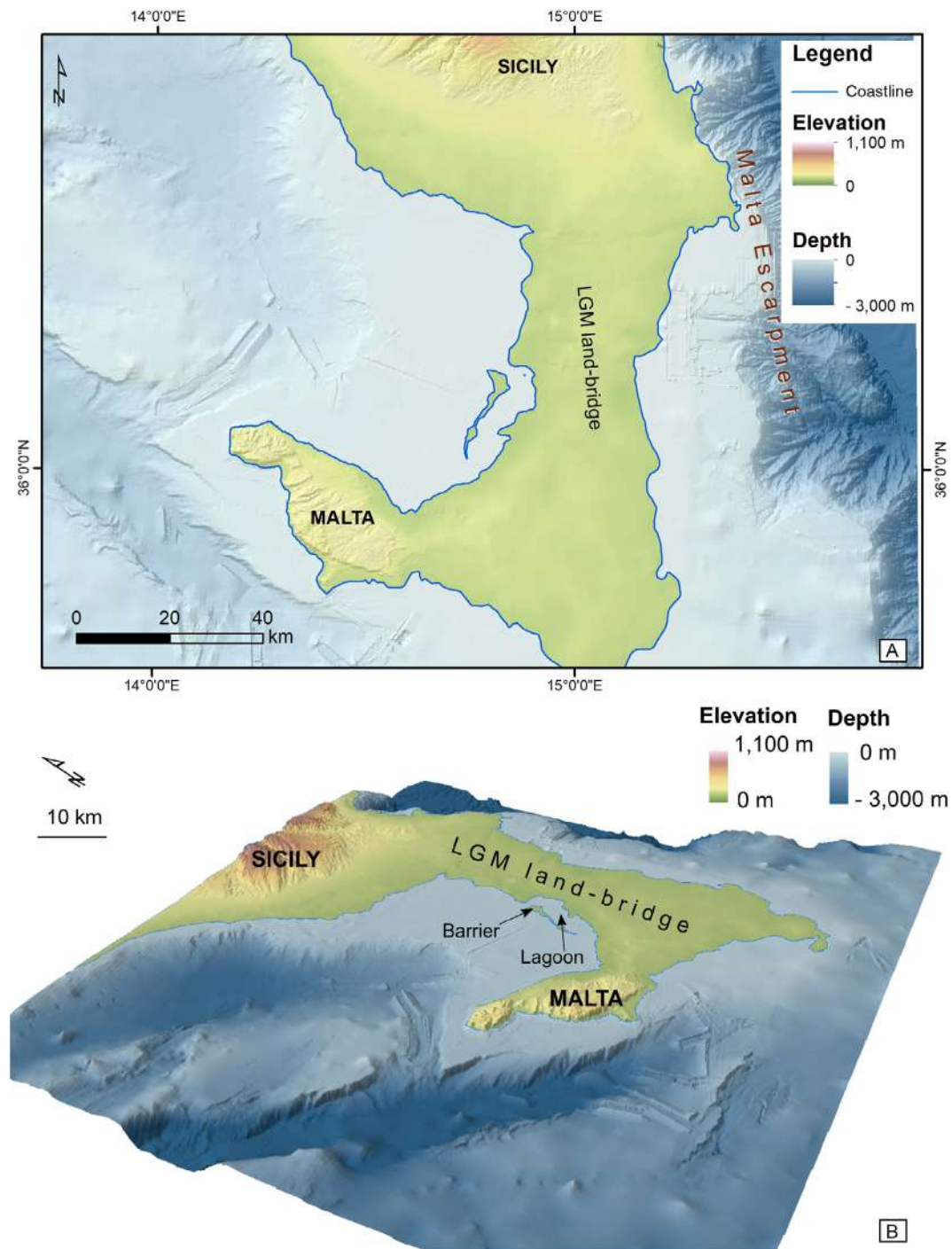


FIGURE 14 Last Glacial Maximum (LGM) configuration of the western side of the Malta Plateau represented in (a) two dimensions and (b) three dimensions. At that time, a structural high that likely included a portion of the pre-PQ basement acted as a barrier, which encouraged the development of a coastal lagoon behind it.

4.2 | Eastern side of the Malta Plateau

From the seismic profiles acquired during RWE06, HDM00 and TX91 surveys, it was not possible to fully interpret the eastern portion of the investigated area. These seismic profiles show the same acoustic facies as those of CRN14 survey: the lowermost Facies A, interpreted as the pre-PQ sequence, and the uppermost Facies B, interpreted as the PQ sequence and constituting a prograding wedge with an inner

stratification with variable inclination. However, the seismic profiles do not extend far enough in their NE end mainly due to their limited extent on the eastern part (Figures 15 and 16). Both the limited extent that prevents from understanding the geometry, contacts and relationships among the identified acoustic facies, and the fact that the Malta Escarpment located at their NE end is continuously reshaped by mass transport deposits, preclude the confident recognition of the location of the LGM coastline.

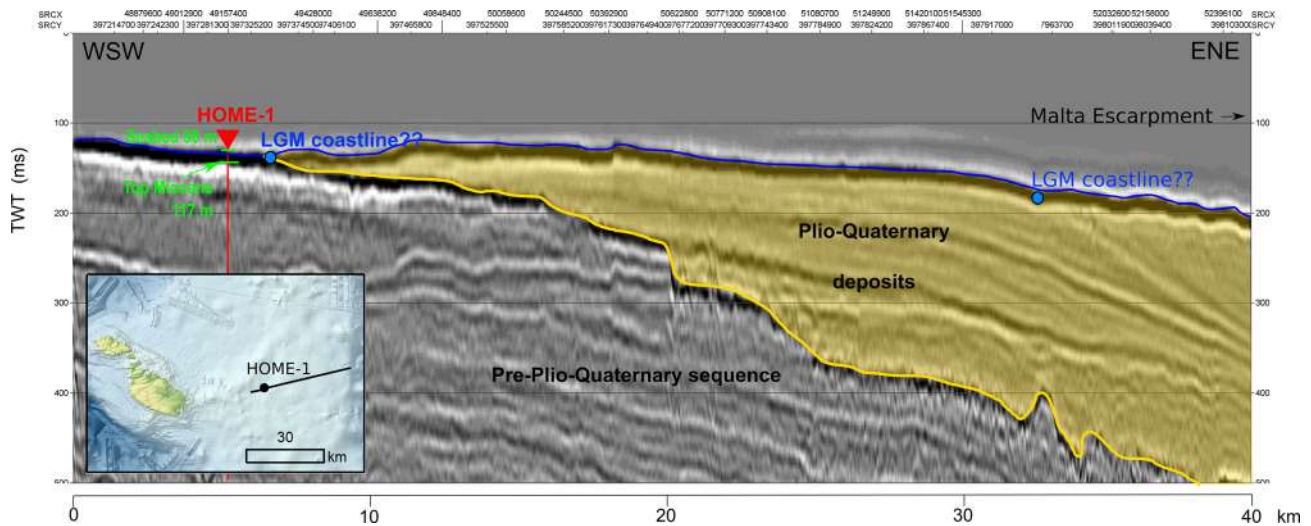


FIGURE 15 The HDM00-05 seismic profile, oriented WSW-ENE, allowed the distinction of an underlying facies consisting of the pre-PQ sequence, and an upper facies characterized by the PQ deposits. The base of the PQ deposits is produced by the irregular Messinian erosional surface discussed above. This seismic profile is interpolated from Home-1 wall, providing detailed insights into key depth markers, such as the seabed (−98 m) and the contact between PQ deposits and pre-PQ sequence (−117 m). The thickness of the PQ deposits at Home-1 is only 19 m, too thin to be resolved by the seismic method. It was not possible to fully interpret the position of the Last Glacial Maximum (LGM) coastline, because the ENE end of the profile is at 155 m depth and does not reach the shelf break of the Malta Escarpment.

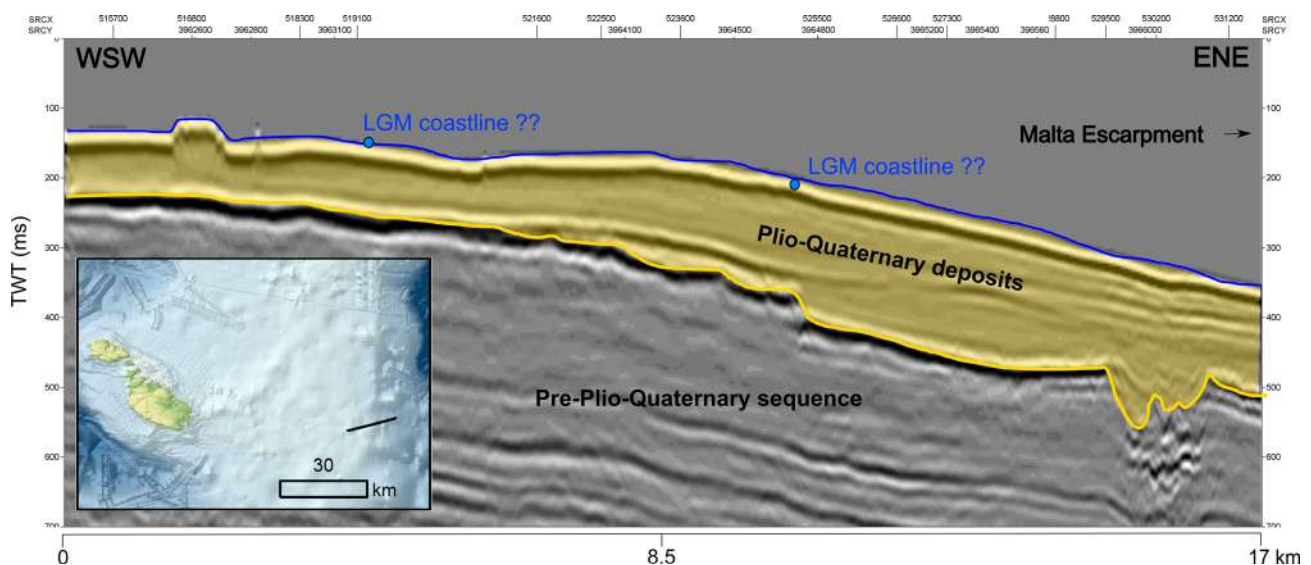


FIGURE 16 The RWE06-06 seismic profile, oriented WSW-ENE and located just above the Malta Escarpment shelf break. It allowed the distinction of an underlying facies consisting of the pre-PQ sequence, and an upper facies characterized by the PQ deposits. The base of the PQ deposits is defined by the irregular Messinian erosional surface discussed above. It was not possible to fully interpret the position of the Last Glacial Maximum (LGM) coastline, because the profile is too short.

5 | CONCLUSIONS

This study presents a detailed geomorphological and environmental reconstruction of the Malta-Sicily land-bridge during the LGM, mainly based on the interpretation of 2D multichannel seismic profiles and EMODnet bathymetric data. Our results provide new insights into the extent and characteristics of the LGM coastline on the western edge of the Malta Plateau, contributing to a broader understanding of sea-level dynamics and geological evolution in the central Mediterranean region.

The analysis of seismic profiles confirmed that the LGM sea-level fall did not produce lowstand wedges due to the absence of a defined shelf edge, as previously suggested by Todaro et al. (2021, 2022). The

Malta Plateau was identified as a low-gradient shelf with extensive emergent areas during the LGM. A coastal lagoon of ca. 20 km width developed on the western side of the plateau, bounded offshore by a barrier corresponding to a structural high likely composed of a horst from the pre-PQ basement.

The Malta Plateau, following the postglacial sea-level rise, was characterized by minimal sedimentation. The LGM landscape was submerged and sealed by a thin sediment layer, suggesting limited postglacial sediment input and highlighting the region's tectonic stability. The low presence or absence of sedimentation after the sea-level rise sealed the Malta coastal landscape that developed during the LGM.

The palaeoenvironmental reconstruction provided here is supported by and confirms the findings of Lodolo et al. (2020) and

Todaro et al. (2021, 2022) in other areas of the Malta-Sicily Channel and the Malta Plateau, respectively. The Malta Plateau landforms were shaped mainly during the Messinian sea-level fall and the last glacial cycle. Then, in a low-gradient shelf—such as the Malta Plateau—a barrier lagoon system may have developed when the sea-level rise was relatively slow, thus being drowned and preserved during an episode of rapid transgression.

This study revealed challenges in delineating the eastern palaeocoastline of the Malta Plateau due to the limited extent of the available seismic profiles and the dynamic nature of the Malta Escarpment and sets the stage for future investigations to build upon these foundational insights. To validate and further refine our proposed palaeogeographic reconstruction, future studies should include the interpretation of high-resolution sub-bottom profiles and sediment cores. These could elucidate the internal structure of the PQ deposits, verify sedimentation rates and investigate potential erosional processes within the sequence. Additionally, by expanding the seismic surveys to the eastern Malta Plateau and employing advanced geophysical techniques, the resolution and accuracy of this palaeoenvironmental interpretation will be enhanced.

AUTHOR CONTRIBUTIONS

(a) Sofia Rossi, Mariacristina Prampolini, Giacomo Dalla Valle, Charles Galea and Albert Caruana: Conceptualization. (b) Charles Galea and Albert Caruana: Funding acquisition. (c) Sofia Rossi, Mariacristina Prampolini, Charles Galea, Giacomo Dalla Valle and Albert Caruana: Methodology (including methodological development). (d) Sofia Rossi, Mariacristina Prampolini Charles Galea and Albert Caruana: Investigation (e.g., data collection). (e) Charles Galea and Albert Caruana: Resources (provision of data, etc.). (f) Sofia Rossi and Mariacristina Prampolini: Software (its provision and development). (g) Mauro Soldati: Supervision. (h) Sofia Rossi and Mariacristina Prampolini: Writing—initial draft. (i) Sofia Rossi, Mariacristina Prampolini, Charles Galea, Giacomo Dalla Valle, Albert Caruana and Mauro Soldati: Writing—reviewing and editing.

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CONFLICT OF INTEREST STATEMENT

The Authors declare no conflict of interests.

DATA AVAILABILITY STATEMENT

Multichannel seismic profiles and data from wells analysed in this paper are property of the Continental Shelf Department and considered as confidential.

The products of this paper—the seal level index points and the inferred LGM palaeocoastline—are part of the EMODnet database, are shared in shapefile format and follows the FAIR principles. The link to data and metadata are summarized in the table below.

Product	Link to access data	Metadata	Legal constraints
LGM palaeocoastline	Rossi_et_al_LGM_coastline	https://emodnet.ec.europa.eu/geonetwork/srv/eng/catalog/search#/metadata/a71199daca286878e0ebd00eee6b75d9b4cc7eec	CC-BY 4.0
Sea-level index points		https://emodnet.ec.europa.eu/geonetwork/srv/eng/catalog/search#/metadata/f40201c214bc5bc92200eba7c3b457c1ac3ed779	

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REFERENCES

- Baldassini, N. & Di Stefano, A. (2017) Stratigraphic features of the Maltese archipelago: a synthesis. *Natural Hazards*, 86(S2), 203–231. Available from: <https://doi.org/10.1007/s11069-016-2334-9>
- Biolchi, S., Gambin, T., Abela, R., Antonioli, F., Furlani, S. & Devoto, S. (2011) Late Holocene Relative Sea level change in Malta. *Alpine and Mediterranean Quaternary*, 24, 20–22.
- Brunović, D., Hasan, O., Miko, S., Georgiou, N., Geraga, M., Christodoulou, D., et al. (2024) High-resolution seismic record of the Quaternary palaeoenvironments along a Dalmatian-type coast (Lošinj Channel, Adriatic Sea). *Marine Geology*, 474, 107325. Available from: <https://doi.org/10.1016/j.margeo.2024.107325>
- Casero, P., Cita, M.B., Croce, M. & De Micheli, A. (1984) Tentativo di interpretazione evolutiva della scarpata di Malta basata su dati geologici e geofisici. *Mem. Soc. Geol. it.*, 27, 233–253.
- Cassar, L.F., Conrad, E. & Schembri, P.J. (2008) The Maltese Archipelago. In: Vogiatzakis, I., Pungetti, G. & Mannion, A.M. (Eds.) *Mediterranean Island landscapes: natural and cultural approaches*. Dordrecht: Springer, pp. 297–322 https://doi.org/10.1007/978-1-4020-5064-0_13
- Catalano, R., D'Argenio, B. & Torelli, L. (1989) From Sardinia Channel to Sicily Strait. A geologic section based on seismic and field data. In: Boriani, A.B., Piccardo, M. & Vai, G.B. (Eds.) *The lithosphere in Italy: advances in earth science research; Italian National Committee for the international lithosphere program, Rome, Italy*, pp. 110–128.
- Catalano, S., De Guidi, G., Romagnoli, G., Torrisi, S., Tortorici, G. & Tortorici, L. (2008) The migration of plate boundaries in SE Sicily: influence on the large-scale kinematic model of the African promontory in southern Italy. *Tectonophysics*, 449(1–4), 41–62. Available from: <https://doi.org/10.1016/j.tecto.2007.12.003>
- Catalano, R., Di Stefano, P., Sulli, A. & Vitale, F.P. (1996) Paleogeography and structure of the Central Mediterranean: Sicily and its offshore area. *Tectonophysics*, 260(4), 291–323. Available from: [https://doi.org/10.1016/0040-1951\(95\)00196-4](https://doi.org/10.1016/0040-1951(95)00196-4)
- Catalano, R., Valenti, V., Albanese, C., Accaino, F., Sulli, A., Tinivella, U., et al. (2013) Sicily's fold-thrust belt and slab roll-back: the SI.RI.PRO. Seismic crustal transect. *Journal of the Geological Society*, 170(3), 451–464. Available from: <https://doi.org/10.1144/jgs2012-099>
- Civile, D., Lodolo, E., Accettella, D., Geletti, R., Ben-Avraham, Z., Deponte, M., et al. (2010) The Pantelleria graben (Sicily Channel, Central Mediterranean): an example of intraplate 'passive' rift.

- Tectonophysics*, 490(3–4), 173–183. Available from: <https://doi.org/10.1016/j.tecto.2010.05.008>
- Civile, D., Lodolo, E., Alp, H., Ben-Avraham, Z., Cova, A., Baradello, L., et al. (2014) Seismic stratigraphy and structural setting of the adventure plateau (Sicily Channel). *Marine Geophysical Research*, 35(1), 37–53. Available from: <https://doi.org/10.1007/s11001-013-9205-5>
- Dart, C.J., Bosence, D.W.J. & McClay, K.R. (1993) Stratigraphy and structure of the Maltese graben system. *Journal of the Geological Society*, 150(6), 1153–1166. Available from: <https://doi.org/10.1144/gsjgs.150.6.1153>
- Deiana, G., Lecca, L., Melis, R.T., Soldati, M., Demurtas, V. & Orrù, P.E. (2021) Submarine geomorphology of the southwestern Sardinian continental shelf (Mediterranean Sea): insights into the last glacial Maximum Sea-level changes and related environments. *Water*, 13(2), 155. Available from: <https://doi.org/10.3390/w13020155>
- Finetti, I.R., Lentini, F., Carbone, S., Del Ben, A., Di Stefano, A., Forlin, E., et al. (2005) Geological outline of Sicily and lithospheric tectonodynamics of its Tyrrhenian Margin from new CROP seismic data. In: *CROP project: deep seismic exploration of the Central Mediterranean and Italy*. Trieste, Italy: Elsevier, pp. 319–375.
- Foglini, F., Prampolini, M., Micallef, A., Angeletti, L., Vandelli, V., Deidun, A., Soldati, M. & Taviani, M. (2016) Late Quaternary coastal landscape morphology and evolution of the Maltese Islands (Mediterranean Sea) reconstructed from high-resolution seafloor data. *Special Publications*, 411(1): 77–95. <https://doi.org/10.1144/SP411.12>
- Fraile-Jurado, P., Mejías-García, J.C., Roldán-Muñoz, M.E. & Borja-Barrera, C. (2023) Reconstructing the emerged areas of the Mediterranean during the last glacial period: incorporating bathymetric data and sea level fluctuations. *Geografía Física e Dinámica Cuaternaria*, 46, 241–256. Available from: <https://doi.org/10.4454/hrffie9>
- Furlani, S., Antonioli, F., Biolchi, S., Gambin, T., Gauci, R., Lo Presti, V., et al. (2013) Holocene Sea level change in Malta. *Quaternary International*, 288, 146–157. Available from: <https://doi.org/10.1016/j.quaint.2012.02.038>
- Galea, P. (2019) Central Mediterranean Tectonics—A Key Player in the Geomorphology of the Maltese Islands. In: Gauci, R. & Schembri, J.A. (Eds.) *Landscapes and landforms of the Maltese islands*. Cham: Springer International Publishing, pp. 19–30 https://doi.org/10.1007/978-3-030-15456-1_3
- Gardiner, W., Grasso, M. & Sedgely, D. (1995) Plio-Pleistocene fault movement as evidence for mega-block kinematics within the Hyblean—Malta Plateau, Central Mediterranean. *Journal of Geodynamics*, 19(1), 35–51. Available from: [https://doi.org/10.1016/0264-3707\(94\)00006-9](https://doi.org/10.1016/0264-3707(94)00006-9)
- Gauchery, T., Rovere, M., Pellegrini, C., Cattaneo, A., Campiani, E. & Trincardi, F. (2021) Factors controlling margin instability during the Plio-Quaternary in the Gela Basin (Strait of Sicily, Mediterranean Sea). *Marine and Petroleum Geology*, 123, 104767. Available from: <https://doi.org/10.1016/j.marpetgeo.2020.104767>
- Gauci, R. & Scerri, S. (2019) A Synthesis of Different Geomorphological Landscapes on the Maltese Islands. In: Gauci, R. & Schembri, J.A. (Eds.) *Landscapes and landforms of the Maltese islands*. Cham: Springer International Publishing, pp. 49–65 https://doi.org/10.1007/978-3-030-15456-1_5
- Illies, J.H. (1981) Graben Formation — the Maltese Islands — a Case History. In: Illies, J.H. (Ed.) *Developments in Geotectonics*. Elsevier, pp. 151–168 <https://doi.org/10.1016/B978-0-444-41956-9.50018-6>
- Jouet, G., Berné, S., Rabineau, M., Bassetti, M.A., Bernier, P., Dennielou, B., et al. (2006) Shoreface migrations at the shelf edge and sea-level changes around the last glacial maximum (gulf of lions, NW Mediterranean). *Marine Geology*, 234(1–4), 21–42. Available from: <https://doi.org/10.1016/j.margeo.2006.09.012>
- Lambeck, K., Antonioli, F., Anzidei, M., Ferranti, L., Leoni, G., Scicchitano, G., et al. (2011) Sea level change along the Italian coast during the Holocene and projections for the future. *Quaternary International*, 232(1–2), 250–257. Available from: <https://doi.org/10.1016/j.quaint.2010.04.026>
- Lambeck, K., Rouby, H., Purcell, A., Sun, Y. & Sambridge, M. (2014) Sea level and global ice volumes from the last glacial maximum to the Holocene. *Proceedings of the National Academy of Sciences*, 111(43), 15296–15303. Available from: <https://doi.org/10.1073/pnas.1411762111>
- Lericolais, G., Bulois, C., Gillet, H. & Guichard, F. (2009) High frequency sea level fluctuations recorded in the Black Sea since the LGM. *Global and Planetary Change*, 66(1–2), 65–75. Available from: <https://doi.org/10.1016/j.gloplacha.2008.03.010>
- Lodolo, E., Galassi, G., Spada, G., Zecchin, M., Civile, D. & Bressoux, M. (2020) Post-LGM coastline evolution of the NW Sicilian Channel: comparing high-resolution geophysical data with glacial isostatic adjustment modeling. *PLoS ONE*, 15(2), e0228087. Available from: <https://doi.org/10.1371/journal.pone.0228087>
- Lodolo, E., Loreto, M.F., Melini, D., Spada, G. & Civile, D. (2022) Palaeo-shoreline configuration of the adventure plateau (Sicilian Channel) at the last glacial maximum. *Geosciences*, 12(3), 125. Available from: <https://doi.org/10.3390/geosciences12030125>
- Marriner, N., Gambin, T., Djamali, M., Morhange, C. & Spiteri, M. (2012) Geoaerchaeology of the Burmarrad ria and early Holocene human impacts in western Malta. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 339, 52–65. Available from: <https://doi.org/10.1016/j.palaeo.2012.04.022>
- Micallef, A., Berndt, C. & Debono, G. (2011) Fluid flow systems of the Malta Plateau, Central Mediterranean Sea. *Marine Geology*, 284(1–4), 74–85. Available from: <https://doi.org/10.1016/j.margeo.2011.03.009>
- Micallef, A., Camerlenghi, A., Garcia-Castellanos, D., Cunnaro Otero, D., Gutscher, M.A., Barreca, G., et al. (2018) Evidence of the Zanclean megaflood in the eastern Mediterranean Basin. *Scientific Reports*, 8(1), 1, 103061–8. Available from: <https://doi.org/10.1016/j.earscrev.2019.103061>
- Micallef, A., Foglini, F., Le Bas, T., Angeletti, L., Maselli, V., Pasuto, A., et al. (2013) The submerged paleolandscape of the Maltese islands: morphology, evolution and relevance to quaternary environmental change. *Marine Geology*, 335, 129–147. Available from: <https://doi.org/10.1016/j.margeo.2012.10.017>
- Micallef, A., Georgiopoulou, A., Mountjoy, J., Huvenne, V.A.I., Iacono, C.L., Le Bas, T., et al. (2016) Outer shelf seafloor geomorphology along a carbonate escarpment: the eastern Malta Plateau, Mediterranean Sea. *Continental Shelf Research*, 131, 12–27. Available from: <https://doi.org/10.1016/j.csr.2016.11.002>
- Micallef, A., Spatola, D., Caracausi, A., Italiano, F., Barreca, G., D'Amico, S., et al. (2019) Active degassing across the Maltese islands (Mediterranean Sea) and implications for its neotectonics. *Marine and Petroleum Geology*, 104, 361–374. Available from: <https://doi.org/10.1016/j.marpetgeo.2019.03.033>
- Milano, M., Kelemework, Y., La Manna, M., Fedi, M., Montanari, D. & Iorio, M. (2020) Crustal structure of Sicily from modelling of gravity and magnetic anomalies. *Scientific Reports*, 10(1), 16019. Available from: <https://doi.org/10.1038/s41598-020-72849-z>
- Oil Exploration Directorate. (1993) *Geological map of the Maltese islands*. 1: 25,000. Valletta: Office of the Prime Minister.
- Osler, J. & Algan, O. (1999) *A high resolution seismic sequence analysis of the Malta Plateau*. NATO Undersea Research Centre Report number changed (Mar 2006): SR-311-UU.
- Pedley, H.M. (1990) Syndepositional tectonics affecting Cenozoic and Mesozoic deposition in the Malta and SE Sicily areas (Central Mediterranean) and their bearing on Mesozoic reservoir development in the N Malta offshore region. *Marine and Petroleum Geology*, 7(2), 171–180. Available from: [https://doi.org/10.1016/0264-8172\(90\)90039-J](https://doi.org/10.1016/0264-8172(90)90039-J)
- Pedley, M., Clarke, M.H. & Galea, P. (2002) *Limestone isles in a Crystal Sea: the geology of the Maltese islands*. Malta: Publishers Enterprises Group, p. 120.
- Prampolini, M., Coratza, P., Rossi, S., Parenti, C., Galea, C., Caruana, A., et al. (2021) Geomorphology of the seafloor north east of the Maltese islands, Central Mediterranean. *Journal of Maps*, 17(2), 465–475. Available from: <https://doi.org/10.1080/17445647.2021.1957034>

- Prampolini, M., Fogliani, F., Biolchi, S., Devoto, S., Angelini, S. & Soldati, M. (2017) Geomorphological mapping of terrestrial and marine areas, northern Malta and Comino (Central Mediterranean Sea). *Journal of Maps*, 13(2), 457–469. Available from: <https://doi.org/10.1080/17445647.2017.1327507>
- Reuther, C.D. & Eisbacher, G.H. (1985) Pantelleria rift—Crustal extension in a convergent intraplate setting. *Geologische Rundschau*, 74(3), 585–597. Available from: <https://doi.org/10.1007/BF01821214>
- Rossi, S., Vandelli, V., Giona Bucci, M. & Soldati, M. (2024) Geoscience studies in the Maltese Islands: a gateway to the Central Mediterranean region. *Italian Journal of Geosciences*, 143(2), 299–313. Available from: <https://doi.org/10.3301/IJG.2024.15>
- Scerri, S. (2019) Sedimentary Evolution and Resultant Geological Landscapes. In: Gauci, R. & Schembri, J.A. (Eds.) *Landscapes and landforms of the Maltese islands*. Cham: Springer International Publishing, pp. 31–47 https://doi.org/10.1007/978-3-030-15456-1_4
- Siddall, M., Rohling, E.J., Almogi-Labin, A., Hemleben, C., Meischner, D., Schmelzer, I., et al. (2003) Sea-level fluctuations during the last glacial cycle. *Nature*, 423(6942), 853–858. Available from: <https://doi.org/10.1038/nature01690>
- Todaro, S., Sulli, A., Spatola, D., Basilone, G. & Aronica, S. (2022) Seismic stratigraphy of the north-westernmost area of the Malta Plateau (Sicily Channel): the Middle Pleistocene-Holocene sedimentation in a tidally influenced shelf. *Marine Geology*, 445, 106740. Available from: <https://doi.org/10.1016/j.margeo.2022.106740>
- Todaro, S., Sulli, A., Spatola, D., Micallef, A., Di Stefano, P. & Basilone, G. (2021) Depositional mechanism of the upper Pliocene-Pleistocene shelf-slope system of the western Malta Plateau (Sicily Channel). *Sedimentary Geology*, 417, 105882. Available from: <https://doi.org/10.1016/j.sedgeo.2021.105882>
- Torelli, L., Grasso, M., Mazzoldi, G., Peis, D. & Gori, D. (1995) Cretaceous to Neogene structural evolution of the Lampedusa shelf (Pelagian Sea, Central Mediterranean). *Terra Nova*, 7(2), 200–212. Available from: <https://doi.org/10.1111/j.1365-3121.1995.tb00689.x>
- Zickel, M., Becker, D., Verheul, J., Yener, Y. & Willmes, C. (2016) Paleo-coastlines GIS dataset. CRC806-Database. <https://doi.org/10.5880/SFB806.20>

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