that had been at depths of several tens of kilometres during the early stages of the formation of the Alps.

See Also

Europe: Mediterranean Tectonics; Variscan Orogeny; Permian to Recent Evolution. **Moho Discontinuity**.

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Mediterranean Tectonics

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Introduction

It is commonly accepted that Mediterranean geology has been shaped by the interplay between two plates, the African and European plates, and possibly also smaller intervening microplates. The Mediterranean was mainly affected by rifting after the Variscan Orogeny (*see* **Europe:** Variscan Orogeny): during the Mesozoic, oceanic Tethys areas and passive continental margins developed, where widespread carbonate platforms were formed. During the Late Mesozoic, the Mediterranean area was dominated by subduction zones (from east to west, the Cimmerian, Dinarides, and Alps–Betics), which inverted the extensional regime, consuming the previously formed Tethyan oceanic lithosphere and the adjacent continental margins. The composition (oceanic or continental), density, and thickness of the lithosphere inherited from the Mesozoic rift controlled the location, distribution, and evolution of the later subduction zones. The shorter wavelength of the Mediterranean orogens relative to other belts (for example, the Cordillera and the Himalayas) is due to the smaller wavelength of the lithospheric anisotropies inherited from the Tethyan rift.

The Mediterranean basin was, and still is, a collector of sediments derived from the erosion of the surrounding continents and orogens: the best examples are the Nile and Rhone deltas. In the past, other deltas deposited sediments in the bottom of the Mediterranean, and their rivers were later disconnected or abandoned: an example is the Upper Oligocene–Lower Miocene Numidian Sandstone, which was derived from Africa, deposited in the central Mediterranean basin, and partly uplifted by the Apennines accretionary prism. It is well known that, during the Messinian eustatic lowstand, the Mediterranean dried up several times, generating a salinity crisis during which thick sequences of evaporites were deposited in the basin. This generated a pulsating loading oscillation in the Mediterranean, because the repetitive removal of the water led to significant isostatic rebound across most of the basin, particularly where it was deeper, as in the Ionian, the Provençal, and the central Tyrrhenian seas.

The direction of the relative motion between Africa and Europe since the Neogene is still under debate.

Most reconstructions show directions of relative motion between north-west and north-east. Recent space geodesy data confirm this overall trend, in which Africa has a north–south component of convergence relative to Europe of about 5 mm $year^{-1}$, but they also show that the absolute plate-motion directions of both Europe and Africa are north-east and not north or north-west as is usually assumed (see the NASA database on present global plate motions, http://sideshow.jpl.nasa.gov:80/mbh/series.html).

The main Cenozoic subduction zones in the Mediterranean are the Alps–Betics, the Apennines–Maghrebides, and the Dinarides–Hellenides–Taurides. Closely related to the Mediterranean geodynamics are the Carpathian subduction and the Pyrenees (Figure 1). The Mediterranean orogens show two distinct signatures, which are similar to those occurring on opposite sides of the Pacific Ocean. High morphological and structural elevations, double vergence, thick crust, involvement of deep crustal rocks, and shallow foredeeps characterize eastwards- or north-eastwards-directed subduction zones (Alps–Betics and Dinarides–Hellenides–Taurides). Conversely, low morphological and structural elevations, single vergence, thin crust, involvement of shallow rocks, deep foredeeps, and a widely developed back-arc basin characterize the westwards-directed subduction zones of the Apennines and Carpathians. This asymmetry can be ascribed to the 'westward' drift of the lithosphere relative to the mantle, at rates of about 49 mm $year^{-1}$ as computed from the hotspots reference frame. All Mediterranean orogens show typical thrust-belt geometries with imbricate-fan and antiformal-stack associations of thrusts. The main factor that varies between orogens and within single belts is the depth of the basal décollement. The deeper it is, the higher is the structural and morphological elevation of the related orogen.

Extensional basins are superimposed on these orogenic belts: on the western side are the Valencia, Provençal, Alboran, Algerian, and Tyrrhenian basins, on the eastern side is the Aegean Basin, and to the north is the Pannonian Basin (Figures 2 and 3).

The Mediterranean can be divided into western, central, and eastern basins. The western Mediterranean is younger (mainly less than 30 Ma) than the central Mediterranean and eastern Mediterranean, which are mainly relics of the Mesozoic to possibly Cenozoic Tethys Ocean.

Positive gravity anomalies occur in the deep basins (the Provençal, Tyrrhenian, and Ionian seas), where the mantle has been uplifted by rifting processes. In contrast, negative gravity anomalies occur along the subduction zones.

Western Mediterranean

A characteristic feature of the western Mediterranean is the large variation in lithospheric and crustal thickness (Figure 5). The lithosphere has been thinned to less than 60 km in the basins (50–60 km in the Valencia trough, 40 km in the eastern Alboran Sea, and 20–25 km in the Tyrrhenian Sea), while it is 65–80 km thick below the continental swells (Corsica–Sardinia and the Balearic promontory). The crust mimics these differences, with a thickness of 8–15 km in the basins (Valencia trough, Alboran Sea, Ligurian Sea, and Tyrrhenian Sea) and 20–30 km underneath the swells (Balearic promontory and Corsica–Sardinia), as inferred by seismic and gravity data. These lateral variations in thickness and composition are related to the rifting process that affected the western Mediterranean, which is a coherent system of interrelated irregular troughs, mainly V-shaped, that began to develop in the Late Oligocene–Early Miocene in the westernmost parts (Alboran, Valencia, Provençal basins), becoming progressively younger eastwards (eastern Balearic and Algerian basins), culminating in the presently active east–west extension in the Tyrrhenian Sea (Figures 1, 2, 3, and 4). Heat flow data and thermal modelling show that the maximum heat flows are encountered in the basins: 120 mW m^{-2} in the eastern Alboran Sea, 90–100 mW m^{-2} in the Valencia trough, and more than 200 mW m^{-2} in the Tyrrhenian Sea. All these sub-basins appear to be genetically linked to the back-arc opening related to the coeval 'eastwards' rollback of the westward-directed Apennines–Maghrebides subduction zone. Extreme stretching generated oceanic crust in the Provençal (20–15 Ma), Algerian (17–10 Ma), Vavilov and Marsili (7–0 Ma) basins. Between 25 Ma and 10 Ma, the Corsica–Sardinia block rotated 60° counterclockwise (Figures 1, 2, 3, and 5).

In the southern Apennines, the choking of the subduction zone with the thicker continental lithosphere of the Apulia Platform slowed the eastwards migration of the subduction hinge (Figure 6), whereas in the central and northern Apennines and in Calabria subduction is still active owing to the presence in the foreland of the thin continental lithosphere of the Adriatic Sea and the Mesozoic oceanic lithosphere of the Ionian Sea, allowing rollback of the subduction hinge.

The western Mediterranean basins tend to close both morphologically and structurally towards the south-west (Alboran Sea) and north-east (Ligurian Sea; Figures 1 and 6). The eastwards migration of the arc associated with the westwards-directed subduction generated right-lateral transpression along the entire east–west-trending northern African belt

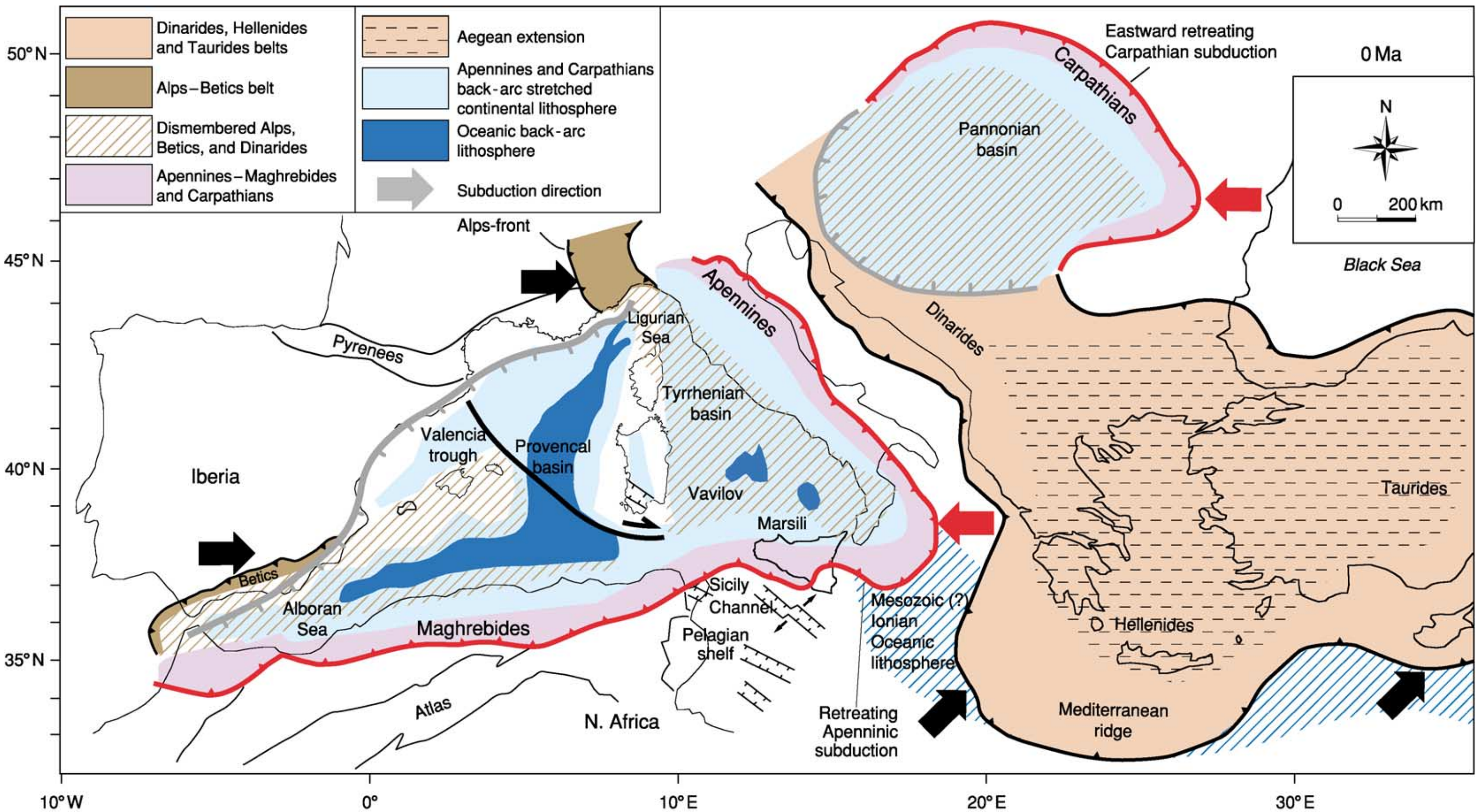

Figure 1 Present geodynamic framework. There are four subduction zones with variable active rates in the Mediterranean realm: the westwards-directed Apennines–Maghrebides; the westwards-directed Carpathians; the north-eastwards-directed Dinarides–Hellenides–Taurides; and the south-eastwards-directed Alps. The Apennines–Maghrebides subduction-related back-arc basin of the western Mediterranean stretched and scattered into segmented basins most of the products of the Alps–Betics orogen.

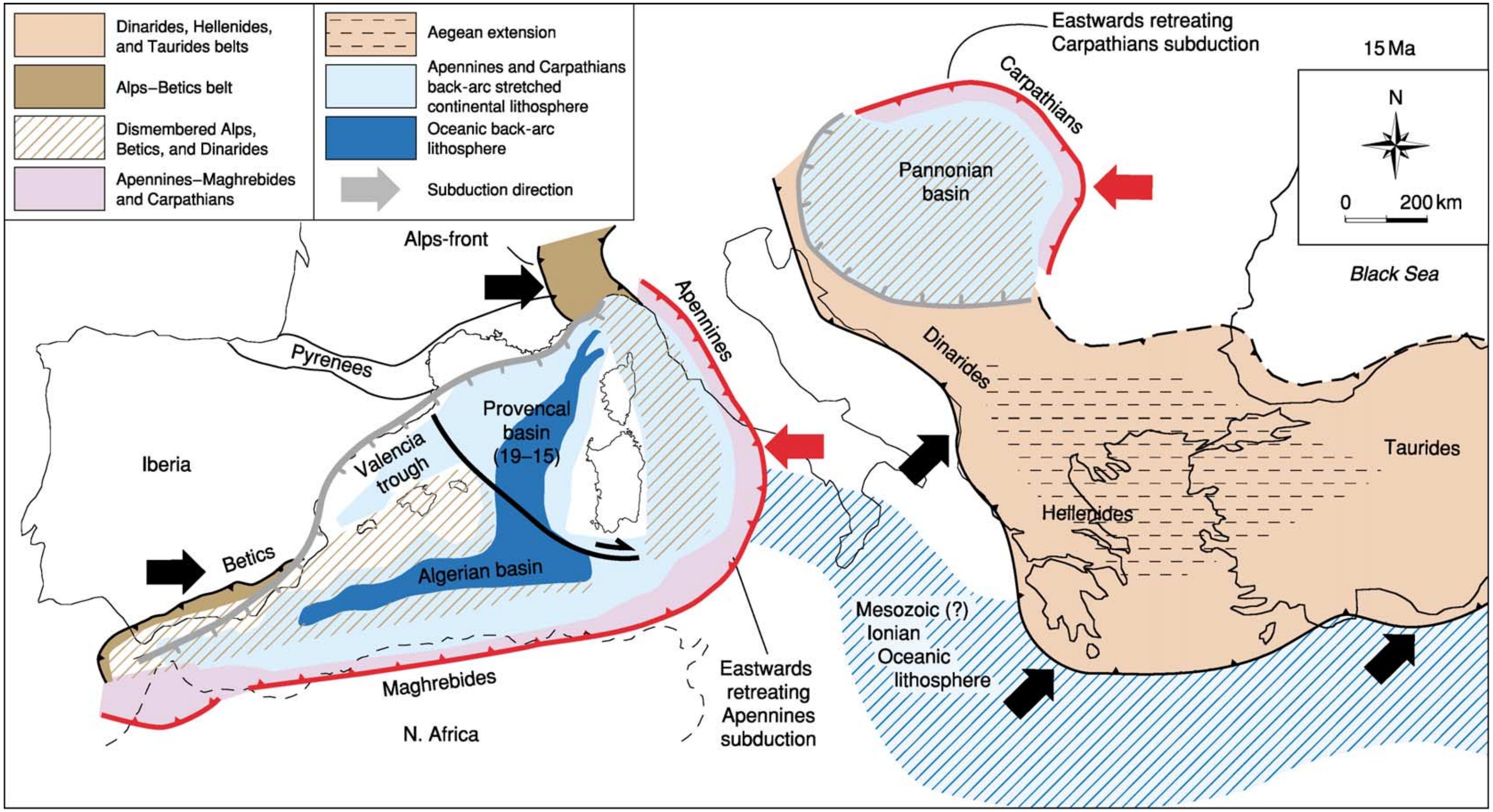

Figure 2 Palaeogeodynamics at about 15 Ma. Note the 'eastward' vergence of both the Apennines–Maghrebides trench and the back-arc extensional wave. The Liguro-Provençal basin, the Valencia trough, and the North Algerian basin were almost completely opened at 10 Ma. The Dinarides subduction slowed down, owing to the presence of the thick Adriatic continental lithosphere to the west, whereas to the south the Hellenic subduction was very lively owing to the presence in the footwall plate of the Ionian oceanic lithosphere. The Carpathians migrated eastwards, generating the Pannonian back-arc basin, with kinematics similar to those of the Apennines. Provencal basin (19–15) = Age of the oceanic crust.

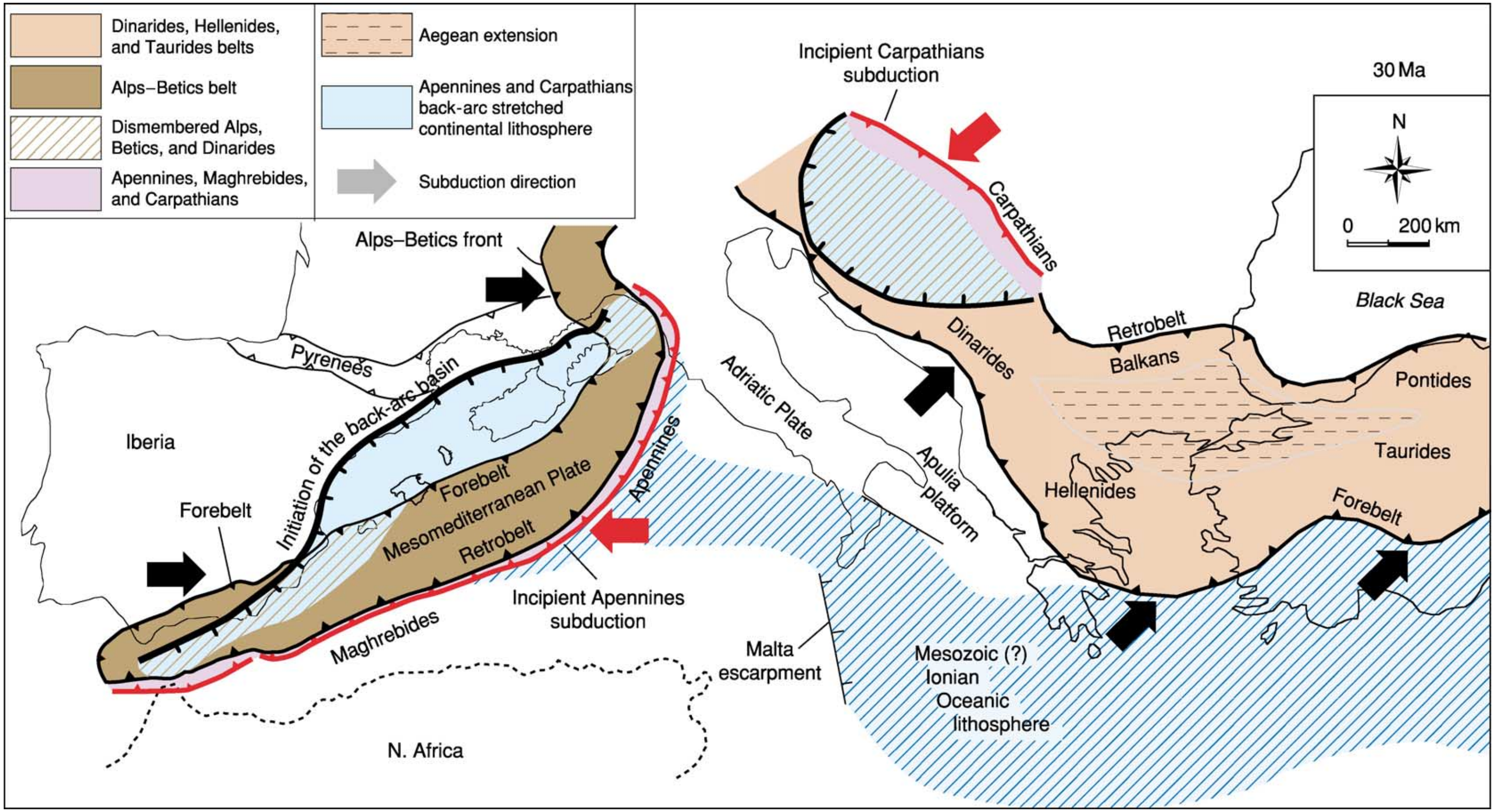

Figure 3 Palaeogeodynamics at about 30 Ma. The locations of the subduction zones were controlled by the Mesozoic palaeogeography. The Alps–Betics formed along the south-eastwards-dipping subduction of Europe and Iberia underneath the Adriatic and Mesomediterranean plates. The Apennines developed along the Alps–Betics retrobelt to the east, in which oceanic or thinned pre-existing continental lithosphere was present. Similarly, the Carpathians started to develop along the Dinarides retrobelt (i.e. the Balkans). The fronts of the Alps–Betics orogen were cross-cut by the Apennines-related subduction back-arc extension.

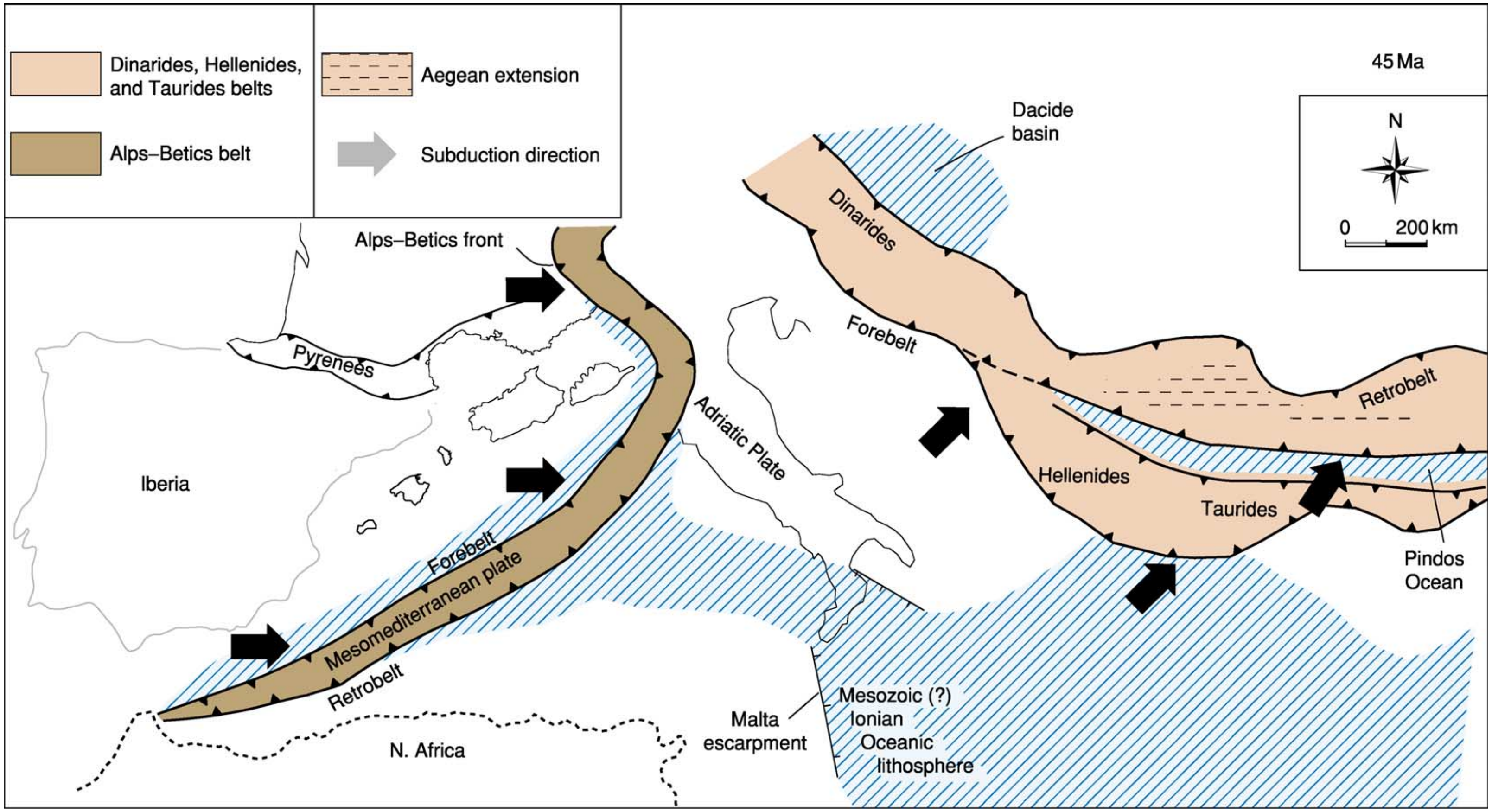

Figure 4 Palaeogeodynamics at about 45 Ma. The Alps were continuous with the Betics to Gibraltar, consuming an ocean located to the west.

(Maghrebides) and its Sicilian continuation, whereas left-lateral transtension occurs along the same trend in the back-arc setting just to the north of the African margin. The opposite tectonic setting is found in the northern margin of the arc.

Subduction retreat generated calc-alkaline and shoshonitic magmatic episodes – particularly in the western margins of the lithospheric boudins – which were followed by alkaline-tholeiitic magmatism in the back-arc to the west.

Extension partly originated in areas previously occupied by the Alps–Betics Orogen, which formed in the Cretaceous due to the 'eastwards'-directed subduction of Europe and Iberia underneath the Adriatic Plate and a hypothetical Mesomediterranean Plate (Figure 4). If Sardinia is restored to its position prior to rotation, it can be seen that during the Early Cenozoic the Alps were probably joined with the Betics in a double-vergent single belt. The western Alps, which are the forebelt of the Alps, were connected to the

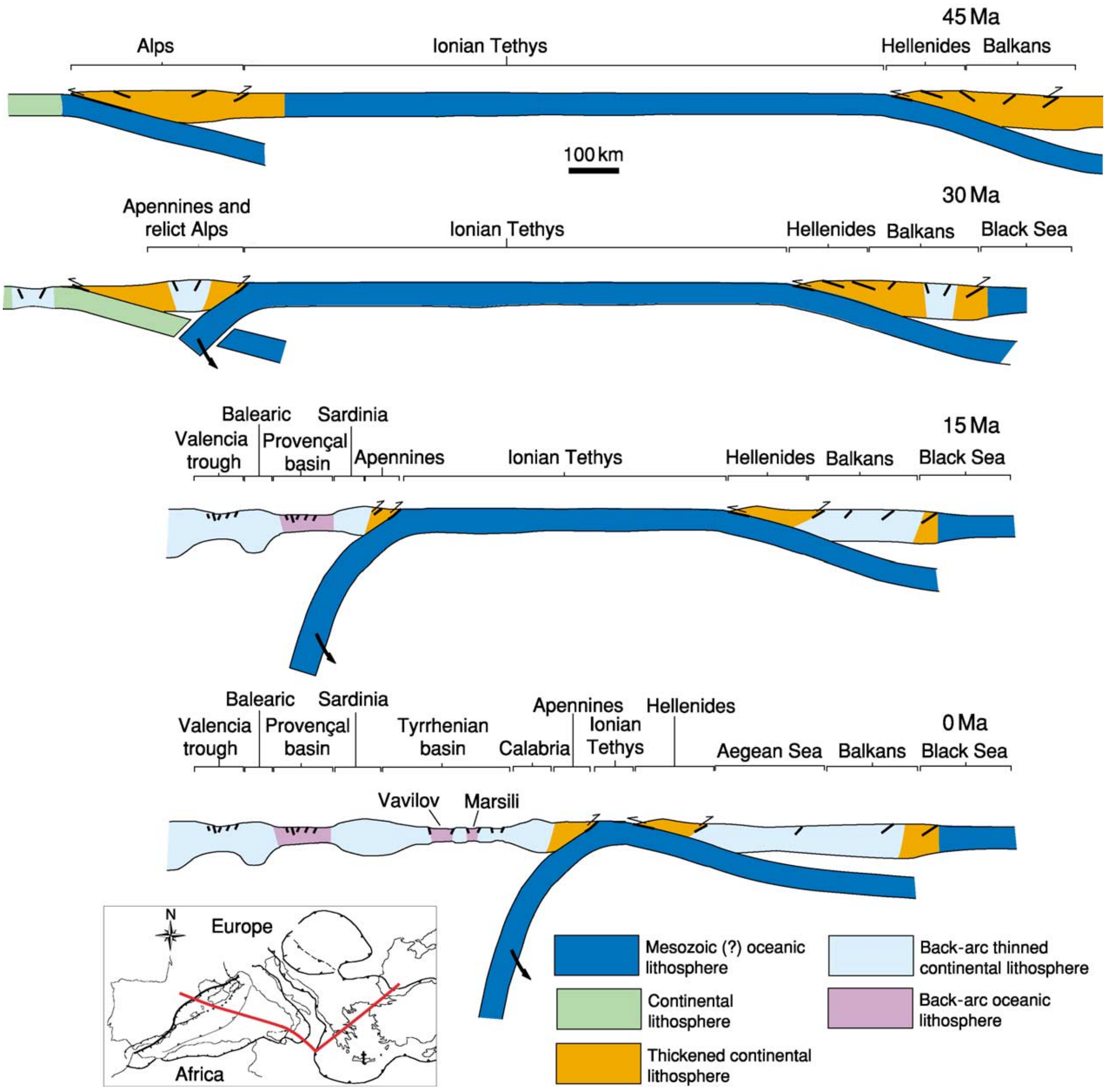

Figure 5 During the last 45 Ma, the evolution of the Mediterranean along the trace shown on the map (inset) is the result of three main subduction zones: the early eastwards-directed Alpine subduction; the Apennines subduction switch along the Alps retrobelt; and the Dinarides–Hellenides subduction. The last two slabs retreated at the expense of the inherited Tethyan Mesozoic oceanic or thinned continental lithosphere. In their hanging walls, a few rifts formed as back-arc basins, which are progressively younger towards the subduction hinges. The slab is steeper underneath the Apennines, possibly owing to the westwards drift of the lithosphere relative to the mantle.

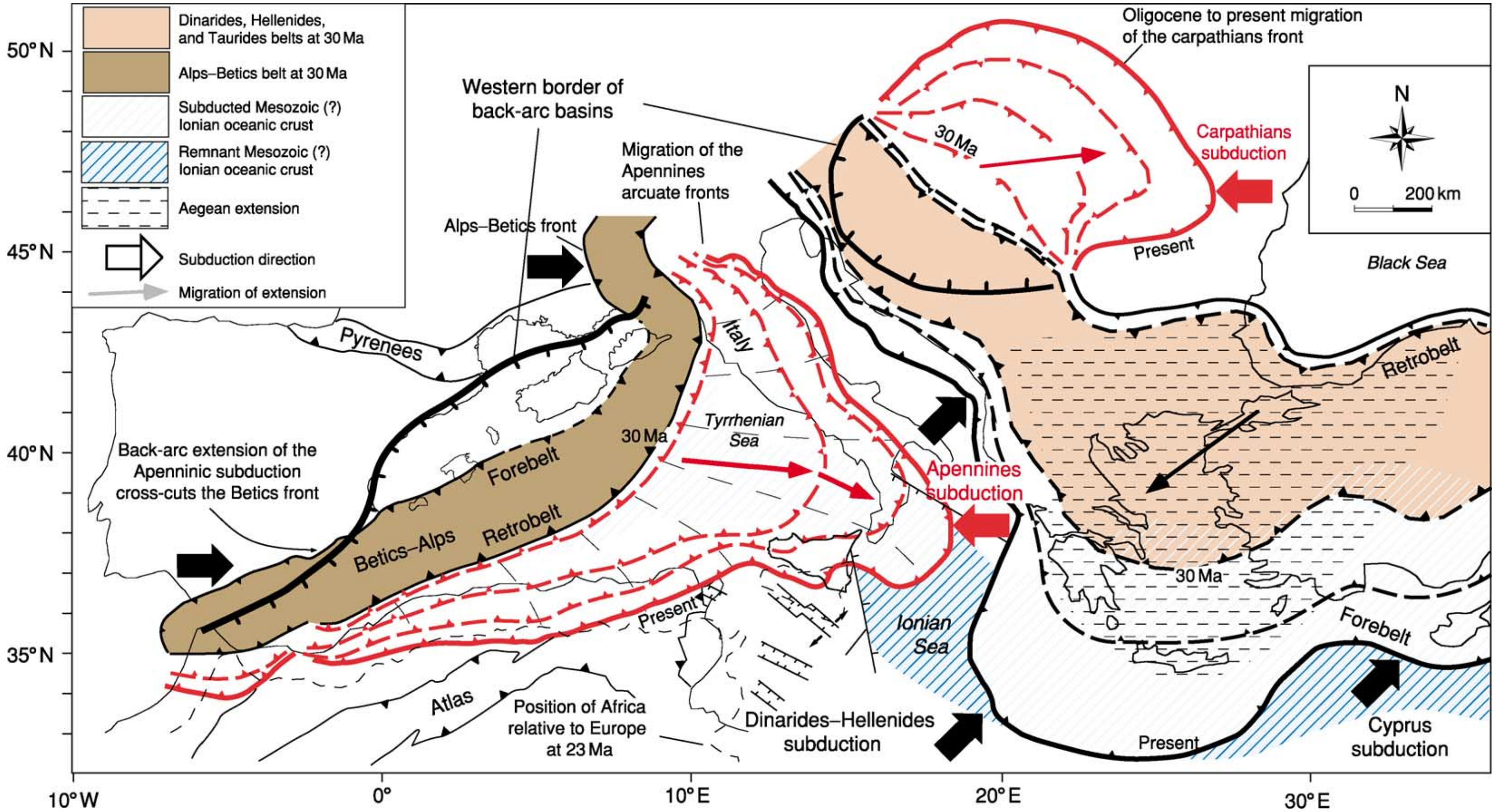

Figure 6 Main tectonic features of the Mediterranean realm, which has been shaped during the last 45 Ma by a number of subduction zones and related belts: the double-vergent Alps–Betics; the single eastwards-vergent Apennines–Maghrebides and the related western Mediterranean back-arc basin; the double-vergent Dinarides–Hellenides–Taurides and related Aegean extension; the single eastwards-vergent Carpathians and the related Pannonian back-arc basin; and the double-vergent Pyrenees.

Alpine Corsica; the Alps continued south-westwards into the Balearic promontory and the Betics. The retrobelt of the Alps, the southern Alps, also continued from northern Italy towards the south-west. In a double-vergent orogen, the forebelt is the frontal part, which is synthetic to the subduction and verges towards the subducting plate; the retrobelt is the internal part, which is antithetic to the subduction and verges towards the interior of the overriding plate.

The westwards-directed Apennines–Maghrebides subduction started along the Alps–Betics retrobelt (Figures 3 and 5), where oceanic and thinned continental lithosphere occurred in the foreland to the east. Subduction underneath the Apennines–Maghrebides consumed inherited Tethyan domains (Figures 5 and 6). The subduction zone and the related arc migrated 'eastwards' at a speed of 25–30 mm year^{-1}.

The western Late Oligocene–Early Miocene basins of the Mediterranean nucleated both within the Betics orogen (e.g. the Alboran Sea) and in its foreland (e.g. the Valencia and Provençal troughs; Figure 3). At that time the direction of the grabens (40°–70°) was oblique to the trend of the coexisting Betics orogen (60°–80°), indicating its structural independence from the Betics Orogeny. Thus, as the extension cross-cut the orogen and also developed well outside the thrust-belt front, the westernmost basins of the Mediterranean developed independently of the Alps–Betics orogen, being related instead to the innermost early phases of back-arc extension in the hanging wall of the Apennines–Maghrebides subduction zone. In contrast to the 'eastwards'-migrating extensional basins and following the 'eastwards' retreat of the Apennines subduction zone, the Betics–Balearic thrust front was migrating 'westwards', producing interference or inversion structures.

The part of the Alps–Betics orogen that was located in the area of the Apennines–Maghrebides back-arc basin (Figure 1) has been disarticulated and spread out into the western Mediterranean (forming the metamorphic slices of Kabylie in northern Algeria and Calabria in southern Italy). Alpine type basement rocks have been dragged up in the Tyrrhenian Sea.

Similarly, boudinage of the pre-existing Alps and Dinarides orogens occurred in the Pannonian Basin, which is the Oligocene to Recent back-arc basin related to the eastwards-retreating westwards-directed Carpathian subduction zone (Figures 1, 3, and 6). In the Pannonian basin, the extension isolated boudins of continental lithosphere that had been thickened by the earlier Dinarides orogen, such as the Apuseni Mountains, which separate the Pannonian basin from the Transylvanian basin to the east. The western Mediterranean back-arc setting is comparable with Atlantic and western Pacific back-arc basins that show similar large-scale lithospheric boudinage, in which parts of earlier orogens have been scattered in the back-arc area, like the Central America Cordillera relicts that are dispersed in the Caribbean domain.

The Apennines accretionary prism formed in sequence at the front of the pre-existing Alpine retrobelt, and, therefore, the central western Apennines also contain the inherited Alpine orogen of Cretaceous to Miocene age. There was probably a temporary coexistence of opposite subductions during the Late Oligocene to Early Miocene (Figure 5). Structural and geophysical data support the presence of an eastwards-migrating asthenospheric wedge at the subduction hinge of the retreating Adriatic Plate. The subduction flip, from the Alpine eastwards-directed subduction to the Apennines westwards-directed subduction, could be reflected in the drastic increase in subsidence rates in the Apennines foredeep during the Late Oligocene to Early Miocene. Westwards-directed subduction zones, such as the Apennines, show foredeep subsidence rates that are up to 10 times higher (more than 1 mm year^{-1}) than those of the Alpine foredeeps. The subduction flip (Figure 5) could also be reflected in the larger involvement of the crust during the earlier Alpine stages than in the Apennines décollements, which mainly deformed the sedimentary cover and the phyllitic basement. It has been demonstrated that the load of the Apennine and Carpathian orogens is not sufficient to generate the 4–8 km deep Pliocene–Pleistocene foredeep basins, and a mantle origin has been proposed for the mechanism (slab pull and/or eastwards mantle flow).

Paradoxically, the extension that determined most of the western Mediterranean developed in the context of relative convergence between Africa and Europe. However, it appears that the north–south relative motion between Africa and Europe at the longitude of Tunisia has been about 135 km in the last 23 Ma, more than five times slower than the migration of the Apennines arc, which has moved more than 700 km eastwards during the last 23 Ma (Figures 1 and 6). Therefore, the eastwards migration of the Apennines–Maghrebides arc is not a consequence of the north–south relative convergence between Africa and Europe but is instead a consequence of the Apennines–Maghrebides subduction rollback, which was generated either by slab pull or by the 'eastwards' flow of the mantle relative to the lithosphere deduced from the hotspot reference frame.

The western Mediterranean developed mainly after the terminal convergence in the Pyrenees at about 20 Ma, which resulted from the Late Cretaceous to Early Tertiary counterclockwise rotation of Iberia, which was contemporaneous with the opening of the Biscay Basin.

In northern Africa, south of the Maghrebides (and the related Algerian Tell and Moroccan Riff), the Atlas Mountains represent an intraplate inversion structure, in which extensional (north-north-east-trending) and left-lateral (about east–west-trending) transtensional Mesozoic intercontinental rifts were later buckled and squeezed by Cenozoic compression and right-lateral transpression in the foreland of the Apennines–Maghrebides subduction zone. This is also indicated by the Mesozoic sequences in the Atlas ranges, which are thicker than the adjacent undeformed *mesetas*.

Central Mediterranean

The Malta escarpment (**Figures 3** and **4**), along the eastern coast of Sicily, is a physiographic feature that has been tectonically controlled since Triassic times. Rocks dredged from the Malta escarpment range from Mesozoic to Tertiary in age. The escarpment represents a Mesozoic continental margin that has been reactivated as a transtensional feature since the Pliocene. In spite of the Apennines and Hellenides Neogene subduction zones, two conjugate passive continental margins are preserved at the margins of the Ionian Sea, along the Malta escarpment to the south-west and the Apulian escarpment to the north-east. Based on the low heat flows (18–40 $mW\,m^{-2}$) and the 4–8 km of sedimentary cover, the Ionian Sea is probably a remnant of the Mesozoic Tethys Ocean, confined by the two conjugate passive continental margins. The transition from continental crust to oceanic crust appears to be sharper to the north-east than to the south-west. The basin between south-east Sicily and south-west Puglia was about 330 km wide. The inferred oceanic ridge could have been flattened by thermal cooling and buried by later sediments.

Stratigraphic and structural constraints to the north in the Apennines belt suggest that the Ionian Ocean continued to the north-west (**Figure 5**). This palaeogeography is supported by the seismicity of the Apennines slab underneath the southern Tyrrhenian Sea, which implies subducted oceanic lithosphere. The adjacent absence or paucity of deep seismicity does not imply the absence of subduction but can be interpreted as a reflection of the more ductile behaviour of the subducted continental lithosphere.

The Sicily Channel and the Pelagian shelf off the coast of eastern Tunisia have been undergoing extension since at least Pliocene times; in other words Africa is moving south-westwards in relation to Sicily (**Figure 1**). This process is responsible for the two grabens of Pantelleria and Malta deepening the seafloor and for the generation of active alkaline magmatism (e.g. the ephemeral Ferdinandea Island). The lithospheric extension was active whilst the Apennines–Maghrebides accretionary prism advanced, generating an interplay of two tectonic settings working together, with thrusts advancing over an orthogonal extending area, generating both thrusts cutting normal faults and normal faults offsetting thrusts. The rifting of the Sicily Channel seems to be physically connected north-westwards to the rift in south-western Sardinia (Campidano graben) and south-eastwards to the Sirte Basin, off the coast of Libya. One possibility is that this rift is linked through transfer zones in Egypt to the Red Sea and the East African Rift.

Eastern Mediterranean

The Dinarides, Hellenides, and Taurides are a polyphase orogen, representing the coalescence of at least two or three subduction zones since Mesozoic times (**Figures 1, 4, 5,** and **6**). The orogen has a part synthetic to the north-eastwards-directed subduction, i.e. the forebelt verging south-westwards. The conjugate part of the orogen is the retrobelt, which verges north-eastwards and northwards (Balkans and Pontides). The existence of three subduction zones is supported by the occurrence of two distinct oceanic sutures, preserved as the ophiolitic suites of Vardar and the Sub-Pelagonian units, which represent two separated branches of the Mesozoic Tethyan Ocean and the present oceanic subduction of the Ionian Sea. It is commonly believed that the more internal (Vardar) suture zone is the older one.

The polyphase orogen exhibits a similar architecture to the Alps, but duplicated. The Rhodope–Serbo-Macedonian and Sakarya (northern Turkey) massifs mimic the internal massifs of the Alps, which represent the continental margin of the hanging-wall plate. On the other side, to the south-west of the Vardar oceanic suture, the Pelagonian (Macedonia–Greece) and Menderes (northern Turkey) massifs correspond to the external massifs of the Alps, representing the continental lithosphere of the footwall plate. The Pelagonian basement is at the same time the hanging-wall plate for the more external north-eastwards-directed subduction of the Sub-Pelagonian and Pindos Ocean, which was eventually closed by collision with the eastern margin of the Adriatic Plate.

However, unlike the Alps, widespread extension developed in the Dinarides–Hellenides–Taurides orogen (**Figures 1** and **6**). This extension resulted in the low topography of the orogen in comparison with belts such as the Alps and the Zagros or the Himalayas. In the Balkans, the Rhodope, and the Serbo-Macedonian massifs, structural and stratigraphic data indicate an interplay of compressional and extensional tectonics. A Cretaceous to Eocene compressive deformation was followed by the generation of Eocene grabens. A later (possibly Miocene) compression inverted and uplifted these grabens, but it was followed by extensional tectonics that have affected the Balkan peninsula since Pliocene times, determining the north-west-trending normal faults and the related east–west right-lateral and north–south left-lateral transtensive transfer faults. North-eastwards-directed subduction is continuing along the eastern side of the Adriatic, in the Ionian Sea underneath the Mediterranean Ridge (the accretionary prism), and on the northern side of the Levantine Sea, i.e. in the eastern Mediterranean beneath Cyprus (**Figure 1**). The convergence rates are faster underneath the Mediterranean ridge (up to 40–50 mm $year^{-1}$), decrease eastwards along the Cyprus segment, and have minimum values along the Adriatic coast. The convergence rate appears to be controlled by the composition of the foreland lithosphere: where it is oceanic and dense, such as in the Ionian Sea, the subduction is faster than in the Adriatic and Cyprus segments, where the downgoing lithosphere is continental and transitional oceanic–continental, respectively. In the orogen, calc-alkaline and shoshonitic magmatism has accompanied most of the subduction since Cretaceous times. The later extensional process in the anomalously called 'back-arc' is possibly responsible for the transition to the alkaline magmatic signature.

One of the best-known ophiolitic sequences in the world crops out in Cyprus: a complete oceanic section is exposed (from harzburgites and peridotites of the upper mantle to gabbros, sheeted dykes, lavas, and pelagic sediments of the crust). The island is an anticline involving the whole crust, and its culmination coincides with the Erathostene seamount in the subducting foreland. The Erathostene seamount is a structural high inherited from the Mesozoic–Cenozoic rift.

Since at least Miocene times, there has been an independent and presently active subduction along the northern margin of the Black Sea, generating the Caucasus.

Geodynamic reconstructions of the eastern Mediterranean explain the extensional tectonics either by westwards Anatolian extrusion or by gravitational collapse of thickened lithosphere. However, these mechanisms can be ruled out because plate-velocity vectors increase from eastern Anatolia to the Aegean and Greece. This contradicts the basic rule that the velocity field decreases away from the source of the energy, i.e. the supposed squeezing of Anatolia by the Arabia indenter, or the collapse of the Anatolian orogen. Moreover, the topographic gradient between Anatolia and the Ionian deep basin is too small (less than 1°) to provide sufficient energy to explain the present deformation. Instead, the simplistic view of the westward Anatolian escape would close the Aegean Sea.

The plates involved in the geodynamic reconstructions of the eastern Mediterranean are Africa, Greece, Anatolia, Eurasia, and Arabia. Deformation is very active in all these areas. The most prominent geodynamic factor shaping the eastern Mediterranean is the north-east-directed subduction of Africa underneath Greece and the Anatolian Plate (Eurasia). Seismic lines across the Cyprus Arc at the southern margin of the Anatolian Plate show clear active compression and deformation of the seafloor.

The Aegean Sea is generally considered to be a back-arc basin resulting from the aforementioned subduction. However, the Aegean Sea is characterized by a relatively thick crust (20–25 km) in spite of long-standing subduction, which has probably been active since at least the Cretaceous. The subduction zone migrated south-westwards to the present position of the Cyprus-Hellenic subduction zone, and the associated orogen was later replaced by extension. In the Aegean Sea, Alpine-type crustal thickening with high pressures and low temperatures was followed by non-coaxial crustal-scale extension. This is consistent with the initial emplacement of thrust-sheets of basement slices, which were later cross-cut by extensional or transtensional faults. In addition, extension and associated magmatism were and are migrating south-south-westwards, and have developed particularly since the Oligocene, while subduction began much earlier. 'Normal' back-arc basins (e.g. the Tyrrhenian Sea) associated with westwards-directed subduction zones opened very fast (10–20 Ma) and are always contemporaneous with the subduction. Moreover, they are characterized by oceanization and eastwards migration of extension and related magmatism, features directly surrounded by a frontal accretionary wedge. In contrast, the accretionary wedge of the Hellenic subduction zone is the south-eastern prolongation of the Dinarides thrust belt, where no back-arc rift comparable to the Tyrrhenian Sea occurs.

The extension in western Turkey, the Aegean Sea, Greece, and Bulgaria appears to be the result of differential convergence rates in the north-eastwards-directed subduction of Africa relative to the hanging wall of disrupted Eurasian lithosphere. Relative to Africa, the faster south-eastwards motion of Greece than of Cyprus–Anatolia results in the Aegean extension. The differences in velocity can be ascribed to differential decoupling with the asthenosphere. In the back-arc basins of the western Pacific the asthenosphere replaces a subducted and retreated slab; however, the Aegean rift represents a different type of extension associated with a subduction zone, in which the hanging-wall plate overrides the slab at different velocities, implying internal deformation.

According to this geodynamic scenario, during the compressive events associated with north-eastwards-directed subduction, basement rocks (both continental and ophiolitic slices) in western Anatolia and the Aegean Sea were uplifted and eroded. Later extension caused subsidence in the area, and the basement slices were partly covered by continental and marine sediments.

During its development, the Aegean extension migrated south-westwards (Figures 5 and 6). The Aegean rift affects the Aegean Sea and all of continental Greece, and it can be followed to the east, where it is widely expressed in Turkey, and to the north-west in Bulgaria, Albania, Macedonia, Serbia, and Bosnia. At the same time, from the Oligocene to the present, to the north, the Pannonian basin developed as the back-arc of the Carpathians subduction, but migrating eastwards, and affecting mainly eastern Austria, Slovenia, Croatia, Hungary, and Romania. Therefore, in the central part of the former Yugoslavia, the Pannonian and Aegean rifts meet with opposite directions of migration.

See Also

Europe: Variscan Orogeny; Permian to Recent Evolution; The Alps; Holocene. **Plate Tectonics**. **Tectonics:** Convergent Plate Boundaries and Accretionary Wedges; Mountain Building and Orogeny.

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