# THE PERI-TETHYAN BASIN PALEOGEODYNAMIC RECONSTRUCTIONS: THE RESULTS OF THE PERI-TETHYS PROGRAMME

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The Peri-Tethys Programme is now completed. It involved several hundreds scientists from more than 25 countries over a time span of 5 years and it was sponsored by 13 oil companies and research institutes.

The basic idea was to analyse how the continental platforms bordering the Tethys reacted and evolved during the Tethys evolution. The area of study is from Atlantic to Urals and Aral Sea to the north and from the Atlantic to the Gulf in the south, over a time span of 300 Ma, from Late Carboniferous to the Pleistocene. 24 palaeogeographic maps at the scale 1:10.000.000 were produced, including paleoenvironments, facies, tectonics and paleostress. 3 maps are concerned with the late Paleozoic, 14 with the Mesozoic and 7 with the Coenozoic. Basin analysis for 11 selected basins was also performed. 13 special volumes of memoirs and notes are issued or presently in press, whilst several hundred papers were published on international journals, with financial support from the Peri-Tethys Programme.

The whole period could be subdivided in three major intervals, that we might define as the Pangea Time, the Tethys Time and the Alpine Time.

The Pangea time includes the interval from the Moscovian to the Late Triassic, about 90 MA long. It is though to be mostly a time of convergence and important lateral displacement along the northern margin of Tethys, whilst the southern shore was largely under a passive margin conditions. Also sea level was at its low, resulting in a major continental encroachment. Consequently, the Peri-Tethyan regions were largely under continental conditions. A number of mountain ranges bounded the Peri-Tethyan regions or were elevated within the Peri-Tethyan regions, supplying and feeding a large amount of debris to the foredeep, back arc or pull-apart basins. Fluviatile and lacustrine deposits are very widespread. When the coastal relief was over or became more gentle because of progressive erosion during the Permian and Triassic, interfingering with marginal brackish seas developed, on very wide flats. The most typical is the flat of Arabia towards Neo-Tethys, which was about 1000 km wide. Along the margins of the Tethys, epicontinental seas extended on not very deep floors, sometimes as wide as 1000 km, like the Mid European Basin and the Precaspian Basin during the Middle Triassic.

The climate evolved from the severe gradients of the Moscovian, when everwet forests flourished in the Eurasian belt, and glaciogenic deposits laid down in Oman, to the increasingly arid weather of the Permian and eventually to the arid/semiarid climate of the Triassic. The continental basins were consequently filled also by playa deposits. In particular conditions, huge salt deposits filled up the depressions. The Kungurian salts of the Precaspian Basin, the Late Permian Zechstein in the Polish Trough, German and North Sea basins, the Bellerophon basin in the Southern Alps and the Khuff Member B to D in the Arabic peninsula are examples of such enormous subtractions of salts to the sea water.

In the epicontinental seas, algal and coral assemblages were able to build up significant carbonate banks. After the Permo/Triassic crisis, since the Middle Triassic, the “carbonate

factory" was fully at work. Most of the marginal seas were in low-temperate to equatorial conditions, consequently carbonate banks and ramps are wide-spread. In the Norian, peculiar geochemical conditions of the sea-waters allowed to formation of wide carbonate platforms, from Betic margin to the Peri-Gondwanan Fringe and Oman.

The Tethys time interval from Late Triassic to the very beginning of Cretaceous, a period of about 90 Maa, was mostly a time of extension in the considered area. An exception is the active margin from Pontides to Caucasus, resulting in island arc volcanic complexes and back-arc extensional basins, like the Great Caucasus basin. The significant rising of sea-level caused large ingressions on the marginal basins of Peri-Tethys. On the northern side, during the Early Jurassic, large areas of the Western Europe were inundated, establishing a connection between Boreal and Tethyan waters. By the Middle Jurassic also the connection between the Barents-Petchora and the Tethyan was opened along what was the former foredeep of the Urals and the Caspian-Aral area. Europe was mostly a sea punctuated by large and small islands, the larger being the Fennoscandian Shield.

The strong asymmetry between the Mediterranean side and the Arabian-Somali side of the African continent persisted on the southern shore of the Tethys. The epicontinental platform and the marginal basins were small or transtensional to the north, linked to the opening of the Ligurian ocean and its connection to the Central Atlantic ocean. Instead, on the eastern side of the African continent wide inundated areas produced epicontinental ramp carbonates, evaporitic and marginal clastic deposits.

Because of the moving northwards of the whole plates complex of Eurasia and Africa, the regions of the northern Peri-Tethyan belt, largely in tropical position during the Triassic, shifted to temperate conditions, encompassing wetter climate. To the south, being now in the tropical and equatorial latitudes, but lee-ward of a very large continental mass, arid and semi-arid conditions prevailed, accounting for the wide evaporitic deposits, largely diffused in Arabia, Egypt, Lybia and Maghreb at different time during the Jurassic.

The Alpine time, the most recent interval, is mostly a period of convergence and inversion. It could be subdivided in two periods. The first was during the Cretaceous, in which the convergence progressively involved most of the European side, with the onsetting of the Eo-alpine orogeny. The marine links between the North Sea and western Europe basins and the East European Platform basins along the Polish Through were time to time interrupted. Only the world wide maximum high standing of the sea-level restored these communications. To the south, geodynamic activity in the Mediterranean area, with definite oceonisation of the Eastern Mediterranean, opened new basins, deeply entrenching into the African margin, in Tunisia, Lybia and Egypt. Also there, the high standing of the mid Cretaceous time allowed wide marine ingressions onto the African land.

The second subperiod, during the Cenozoic, was dominated by the convergence and collision that progressively raised the Alpine – Dinarid – Hellenic – Taurid mountain system. The Peri-Tethyan areas were progressively cut of from the marine connections to the south and the Peri-Tethyan basins of western and central Europe were inverted from the Oligocene onwards. Peculiar and wide-spread anoxic facies developed, linked to a high organic productivity. Also to the south, the convergence regime induced a progressive inversion of several basins. From the Oligocene, extensive volcanic activity lined the rifting and subsequent opening of the Red Sea.

The collision of the Syrian Spur against Anatolia eventually closed W-E marine connections along the Tethys, further fragmenting the possible connections between the marginal basins.