Introductory note to Neogene paleoenvironments in the Mediterranean realm

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Four papers of the present issue (Antonarakou *et al.*, Kostopoulos *et al.*, Merceron *et al.* and Zidianakis *et al.*) as well as two others (Deng and Spassov *et al.*, already published in *Geodiversitas* 28 (3) 2006) were all presented during the "5th International Symposium on Eastern Mediterranean Geology" which was held in Thessaloniki in 2004. All these papers deal with the Neogene terrestrial and marine paleoenvironments of the Mediterranean realm. The material concerned by these studies differs from one to the other (plants, forams, mammals), but the aim is similar: how to characterize the environments of an area considering the interval of time in which diverse fossil groups are sampled? Plants, invertebrates or vertebrates are all concerned by the environment, and its climates, to develop best adaptations and to have the best chance to survive. The faunal and floral fossil associations are good proxies to reveal the message of the past. This is what each of these papers develops, using different taxa and methodologies.

At the beginning of the 21st century, the climatic changes became a major concern of our societies because they modify, gradually or brutally, the natural and anthropic environments. Indeed, any change in environments has a direct impact on the human life. In other words, we are therefore particularly sensitive to all changes in environments and climates (variation in temperature values, vegetation, sea level, ice melting, desertification, etc.). This question became the main subject of national or international meetings that discuss how to act to prevent the consequences of climatic changes and/or to protect natural and anthropized landscapes. Then, a crucial question arises: is the climate of the Earth something stable, having fixed climatic belts along the latitudes, seasons more or less marked depending on these belts and limited fluctuations in temperature and moisture, after all of weak range? Or, does the climate of the Earth naturally change in time depending on various parameters (obliqueness, precession, plate tectonics, oceanic circulation, volcanic activity, etc.) which control the distribution of the climatic zones on the Earth and consequently the environments that they generate?

The archives on the recent climates of the Earth for the last few centuries show that the climate fluctuates, such these "small ice ages" during the 14th and 15th centuries and during the 17th century. For older times, the only climate archives are polar ice sheets for some last hundred thousands years, and sediments and remains of organisms that they preserved for earlier periods. Research on past climates uses all the elements of these archives to detect as well as the evolution of the global climate of the Earth during geological times and its local variations. For a few decades, many approaches were developed to measure the various parameters indicative of past climates: isotopic ratios of carbon, oxygen and nitrogen, organic matter preservation, clay minerals, and even all the composition of the sediments, the geochemistry of various rocks, etc. On its proper side, paleontology contributes more particularly to this research in conveying the biotic dimension of the climate. The development of the life, the evolution of organisms and of their community structures are directly influenced by the nature of their environments. In return, the remains of fossilized organisms provide messages revealing the characteristics of the environments in which they lived. The four papers of this fascicle provide good examples on how paleontologic data are efficient to recover the elements forming past environments; each of these papers concerns a group of plants or animals of the Mediterranean area, a key region for the understanding of the Old World Tertiary climates.

The Mediterranean realm is situated at middle latitudes and has at present a temperate climate. How was it in the past, and in particular during the last 20 or 25 million years (my)? It is obvious that the present-day environments and their inhabitants were settled in this area during this interval of time. It is generally accepted that its latitude was almost the same during the last 25 my, but its climates were not. Many proxies indicate that this area underwent several fluctuations of temperature, moisture and precipitation, and consequently its flora and its marine conditions (sea level, salinity and temperatures) changed.

During Early Cenozoic times, the collision of the Afro-Arabic plate with Eurasia greatly modified the geography of the Mediterranean area, and consequently its climates and the distribution of environments. The first consequences were the reduction of marine areas between these continents and their fragmentation. During Mesozoic and Early Cenozoic times, the marine realm was considered as of oceanic type (Tethys Ocean). Whereas since the late Eocene, the marine areas progressively reduced to form the present-day intercontinental seas (Mediterranean, Caspian and Black seas). This tectonic collision also increased the amount of land masses in the Mediterranean region at the expense of marine realm, created various topographies, and mainly the Alpine chain, and modified the geography of seas. This is probably the main reason why the oceanic type wet climate before late Eocene progressively transformed to seasonal temperate climates producing various environments from wet forested to open dry. How was their distribution in time and space? The papers published here try to provide some answers to that crucial question. But we are conscious that more studies and approaches are necessary to reconstruct the evolution of past environments in the Mediterranean realm.

The continuous increase of our knowledge on fossil organisms, their systematics, phylogeny and adaptational features as well as the large databases concerning them, make that paleontology is one of the best proxies to rebuild past environments and climates. Therefore, paleontologists should be aware that they possess the best tool to reconstitute the past worlds.