Historical background

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ABSTRACT
The Küçükçekmece vertebrate locality yielded a well-preserved and diverse fauna that was the first Turkish fossil assemblage to be adequately studied by its discoverers, Ahmet Malik and Hamit Nafiz (1933) at that time geology professors at Istanbul University. Indeed, the Marmara Region, where the city of Istanbul and Küçükçekmece are located, is mostly covered of Cainozoic deposits. A review of vertebrate fossil investigations in this region reveals that since the mid-1800s several scholars discovered vertebrate fossils when they explored the region during their "voyage d'étude" in search of evidence concerning the poorly known archaeological, natural and social treasures. Many well-known explorers such as Ami Boué, Auguste Viquesnel, Petr Alexandrovich Tchihatcheff, Franz Toula and later on Nicolae Arabu and Ernest Chaput undertook these "voyages d'études" and they were the first to mention the sporadic occurrence of vertebrate fossils along their itineraries. Since the study of the Küçükçekmece vertebrate fauna by Malik & Nafiz (1933a, b), many other localities have been found, but only a few of them have been the subject of detailed studies. The great extent of Cainozoic deposits in this region indicates great potential for yielding rich vertebrate faunas. In addition, this region is in the transition zone between the Mediterranean and Paratethyan marine realms, on the one hand, and is at the crossroads between the major landmasses of the Old World, on the other. This particular situation is of great interest for palaeobiogeographical research as well as for the dispersal history of many ancient organisms. However, it is also the most populated part of Turkey, and consequently natural outcrops and quarries progressively disappear, being covered by factories and settlements. It is high time that palaeontological research in this region received a new impetus.

KEY WORDS
Küçükçekmece,
Marmara Region,
Vertebrates,
Cainozoic,
history.

RÉSUMÉ
Contexte historique.
Le gisement de vertébrés de Küçükçekmece, qui a livré une faune diverse et bien documentée, est le premier à être étudié en détail en 1933 par ses découvreurs, Ahmet Malik et Hamit Nafiz, alors professeurs de géologie à l'Université d'Istanbul. En effet, la région de Marmara, où se trouvent la ville d'Istanbul et le site de Küçükçekmece, est en grande partie recouverte de sédiments cénozoïques. Bien avant la découverte de ce site, des explorateurs naturalistes du 19e et du début du 20e siècle ont découvert occasionnellement des fossiles de vertébrés dans de nombreux autres sites de la région de Marmara, lorsqu'ils ont exploré la région pour leur « voyage d'étude ». Leur but principal était de mettre en évidence les trésors archéologiques, naturels et sociaux mal connus, mais aussi de décrire la géologie de ces contrées, encore peu ou pas du tout explorées. De nombreux explorateurs bien connus tels que Ami Boué, Auguste Viquesnel, Petr Alexandrovich Tchihatcheff, Franz Toula et plus tard Nicolae Arabu et Ernest Chaput ont entrepris ces « voyages d'études » et ils sont les premiers à parler de la découverte, souvent occasionnelle, des fossiles de vertébrés le long de leurs itinéraires. Depuis le travail de Malik & Nafiz (1933a, b) sur la faune de vertébrés de Küçükçekmece, beaucoup d'autres localités ont été répertoriées, mais seules quelques-unes ont fait l'objet d'études détaillées. La vaste extension des dépôts du Cénozoïque dans cette région présente un grand potentiel pour la découverte de riches faunes de vertébrés. En outre, cette région est, d'une part, à la zone de transition entre les domaines marins de la Méditerranée et de Paratéthys, et d'autre part elle est au carrefour des masses continentales de l'Ancien Monde. Cette situation particulière est d'un grand intérêt pour les recherches en paléobiogéographie ainsi que pour l'histoire de la dispersion de nombreux organismes. Cependant, cette région est aussi la partie la plus peuplée de Turquie, et par conséquent des affleurements naturels et artificiels disparaissent progressivement, étant couverts par les usines et les lotissements. Il est temps que les recherches paléontologiques reprennent, dans cette région, un nouvel élan.

MOTS CLÉS
Küçükçekmece,
région de Marmara,
Vertébrés,
Cénozoïque,
histoire.

INTRODUCTION

To highlight the palaeontological importance of the Küçükçekmece fauna for mammalian systematics, regional biostratigraphy and palaeobiogeography, it is appropriate to write a historical review of research in vertebrate palaeontology of the Marmara Region where the site is located. The "Marmara Region" refers to the areas surrounding the Sea of Marmara and the Straits of Bosphorus and Dardanelles, as well as Turkish Thrace. This region approximately corresponds to the regional administrative division of the Republic of Turkey, called "Marmara Bölgesi". This region not only has a rich history, having been the locale of several successive states and civilizations, but also has a wealth of geological phenomena, being in the transition zone between the Afro-Arabian and Eurasian continents on the one hand, and the Neo-Tethys and Paratethys marine realms, on the other. More than half of its surface is covered by marine and continental Cainozoic formations which have a great potential for yielding vertebrate fossils (Fig. 1). The first remains of vertebrate fossils in Turkey were discovered in this region in the mid-19th century, and many others were found later, as detailed below.

The discovery of the locality of Küçükçekmece is an important landmark in the history of vertebrate palaeontology in Turkey, and this for two particular reasons. Firstly, it was the first vertebrate fauna to be entirely studied and published in a single volume of 119 pages and 16 plates by Malik & Nafiz (1933b) (Fig. 2). Before this study, only a few isolated and sporadic discoveries of vertebrate fossils were published in short notes. The second reason is that it was the first vertebrate palaeontology study done by Turkish scholars. Before 1933, all discoveries and studies of vertebrate fossils were done by foreign researchers as we will see below. This is due to the fact that during the 19th century and the first quarter of 20th century, Earth Sciences were poorly developed in the Ottoman Empire and its successor the newly born Turkish Republic. During that period, universities and institutions did not manifest any interest in palaeontology. This science was briefly taught in the context of mineralogy and geology lessons in the Istanbul Darülfünun (= university) (see in particular Malik 1926, 1932). In addition, some attempts to form natural science collections and to open a natural history museum in Istanbul, including palaeontology, were all thwarted by fires that Istanbul suffered during the 19th and 20th centuries.

The present volume is intended to update our knowledge concerning the rich mammalian fauna of Küçükçekmece and the geological and stratigraphic context of Neogene deposits that yielded this fauna. The progress of knowledge regarding the systematics of fossil vertebrates since Malik & Nafiz (1933b) studied the Küçükçekmece fauna, has rendered out-of-date the systematic status of most taxa described by these authors. In addition, Father Jean Nicolas, when he lived in Istanbul during the years 1951-1968, collected abundant vertebrate remains around the Küçükçekmece Lagoon, and most of this material remains unpublished, except for a note of four pages in which Nicolas (1978) gave a commented list of taxa that are represented in the new collection. Furthermore, progresses in the geology of the Marmara Region and particularly in the stratigraphy and sedimentary environments of Cainozoic

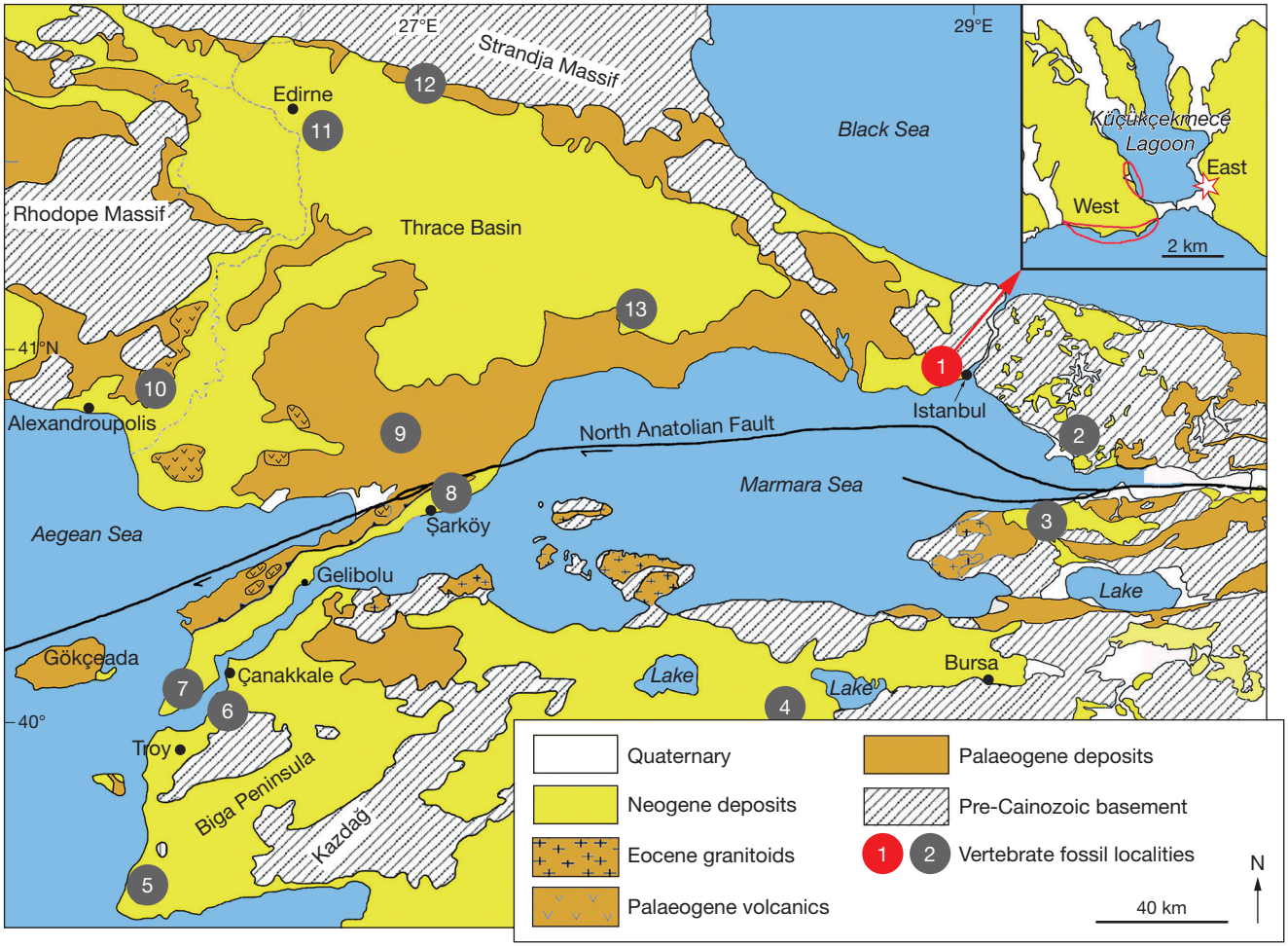

FIG. 1. — Simplified geological map of the Marmara Region (modified from Siyako 2006 and Atri *et al.* 2012) showing the spatial distribution of Palaeogene and Neogene deposits, and the most important Palaeogene and Neogene vertebrate localities: **1**, Küçükçekmece and other late Miocene mammal localities in and near Istanbul city; **2**, Eskihisar; **3**, Esadiye and Safran; **4**, Pasalar; **5**, Gülpinar; **6**, Erenköy and Bayraktepe; **7**, Middle-late Miocene localities in the Alçitepe Formation; **8**, Middle-late Miocene localities near Şarköy; **9**, Several Oligocene localities with small and large mammals between the towns of Kesan, Malkara and Uzunköprü; **10**, Balouk Koie (= Pylaia); **11**, Edirne; **12**, Dolhan; **13**, Yulafli. On the cartridge upper right, the location of the vertebrate localities of Küçükçekmece East (Malik & Nafiz 1933a, b) and Küçükçekmece West (Nicolas 1978).

deposits that occupy large areas around the Sea of Marmara, provides an opportunity to focus on the stratigraphic position of fossiliferous deposits that yielded the Küçükçekmece fauna.

In the palaeontological literature, Küçükçekmece is regularly cited as a key to late Miocene mammal fauna (see especially Ozansoy 1957, 1965; Sickenberg *et al.* 1975; Yalçınlar 1983; de Bruijn *et al.* 1992; Pickford 2015). All authors agree that it correlates to the late Miocene epoch, but its detailed age is controversial and varies, according to the authors, from early Vallesian to middle Turolian with respect to the continental Neogene stages, or from the Sarmatian to Pontian in the Paratethys stratigraphy (see discussion in Ozansoy 1957, 1966; Sickenberg *et al.* 1975; Nicolas 1978; Yalçınlar 1983). In addition, the ages based on mammals and molluscs are controversial (Chaput 1936; Chaput & Gillet 1939; Gillet *et al.* 1978). However, our knowledge of the mammalian fauna of Küçükçekmece, in its present state, is so poor that it is not possible to suggest a more precise age. The systematics of vertebrates that this site has yielded has not been updated since Malik & Nafiz (1933a, b), except for a short attempt by Nicolas (1978) based on his new discoveries and the study of the few suid specimens by Pickford (2015) who attributed them to *Hippopotamodon major* (Gervais, 1848) and correlated the site to MN 11 (early Turolian). The articles in this volume provide detailed systematic analyses of all mammalian species that are recognized at Küçükçekmece, which in turn provide a reliable basis for the correlation of this fauna within the European Land Mammal Ages (ELMA, Sen 1997).

Research in vertebrate palaeontology in the Marmara Region dates back to the mid-19th century. In this article, we present a summary of stratigraphic observations and vertebrate fossil discoveries in this region since the 1850s. At present there is no work providing an account on the history of palaeontological research in the Marmara Region. The discoveries of the 19th and first quarter of the 20th century are mostly embedded in the geological and/or geographical literature of the contemporaneous authors. This requires consulting thousands of pages before finding the mention of some vertebrate fossil discoveries

among various observations of any kind. Later discoveries are mostly published in Turkish journals, and often in Turkish, so they are not easily accessible to non-Turkish speakers. Here, I provide an historical overview, as complete as possible, on palaeontological discoveries of vertebrates in the Marmara Region. To do this, I consulted all available documents and archives in Istanbul and in Paris, and I interviewed collection managers as well as Professor Cazibe Arıç-Sayar, the widow of Ahmet Malik Sayar who discovered the vertebrate locality of Küçükçekmece.

THE BEGINNINGS

During the 19th century there was a fashion for "voyages d'études". Many travelers roamed the roads of "the Orient" to discover peoples, past and present civilizations, landscapes, and the natural and economic wealth of these countries, some going as far as China. Investigation in Earth Sciences and particularly in palaeontology started in Turkey in such a context in the 1800s by European investigators, who were diplomatic or commercial agents, hunters of archaeological objects or grave robbers, geographers, geologists, and some of them even spies for their countries, in order to gather knowledge concerning the Ottoman Empire and on the declining power of the 'Sublime Porte'. In these circumstances, some of these European travelers did active geological and geographical studies in Turkey. Among these investigators were Hugh Edwin Strickland, William John Hamilton, Abel Brimage Spratt, Edward Forbes, William Francis Ainsword (Great Britain), Petr Alexandrovic Tchihatcheff (Russia), Charles Texier, Ami Boué, Hommaire de Hell and Auguste Viquesnel (France), all of whom made important geological observations in the countries that comprised the Ottoman Empire. Curiously, the First World War (1914-1918) brought an end to these "voyages d'études" in the territories that were governed by the Sublime Porte, as was the case for the collapse of the Ottoman Empire. After the First World War and the foundation of the Turkish Republic (1923), among the rare travelers to pursue "voyages d'études" were the Romanian geologist and palaeontologist Nikolae Arabu, and the French geographer and geologist Ernest Chaput.

They all contributed to laying the foundations of the geology in the regions that were inside the borders of the Ottoman Empire at the time, in particular in Asia Minor, Thrace and the Balkans. In addition to their geographic and geological investigations, they also reported on the occurrence of invertebrate fossils, and exceptionally of vertebrate fossils. The names of fossil taxa that they found are listed in their books or articles, but the fossils themselves were generally not described nor illustrated. The authors of these "voyages" were not experts in palaeontology, so they often requested the expertise of palaeontologists in European universities or museums. These travelers aimed at collecting fossils to determine the age of sedimentary deposits that they observed (biostratigraphy), to identify their depositional environments (marine, brackish or terrestrial), and to evidence spatial dispersal of fossil plants and animals in relation to what was known from other regions, in particular from Europe and the Mediterranean realm (palaeobiogeography).

In the following chapters, the regions explored by these travelers around the Sea of Marmara and their main discoveries are presented in four parts: Kocaeli Peninsula (Bythınıa), Southern Marmara and the Dardanelles, Thrace, and Küçükçekmece and Istanbul.

KOCAELİ PENINSULA (BYTHİNİA)

In the Kocaeli Peninsula, the first vertebrate fossil locality was found in 1873 near Eskihisar village about 50 km SE of Istanbul. During building activities of the Constantinople-Baghdad railway, the Turkish, German and Austrian engineers and geologists were active in the study of the geology of the terrain to be crossed by this railway line. The construction of a line from the Haydarpaşa District of Istanbul (called Constantinople at that time) to Anatolia started in 1871 under the reign of Sultan Abdulaziz, and the line reached Izmit in August 1873. The region between Istanbul and Izmit is rugged and jagged, which means that, to cross this region, it was necessary to open trenches and to build bridges and viaducts. In this context, fossil mammal bones were discovered in March 1873 in the excavations at 8 m below the surface for the foundations of the feet of a large viaduct over 30 m high at Eskihisar (Fig. 1[spot 2]). Halil Edhem Bey (1861-1938), from Constantinople, learned about this discovery, and he was aware of the scientific interest of these fossil bones. At that time, Dr. Halil Edhem Bey was studying natural sciences and chemistry at Zurich and Vienna universities, and later on he prepared a PhD at Basel University. After his return to Constantinople in 1885, he occupied important positions as civil servant near the court, but was also a naturalist particularly interested in palaeontology and he taught Earth Sciences at the Istanbul Darülfünun (https://tr.wikipedia.org/wiki/Halil_Ethem_Eldem). He was also involved in the construction of this railway line between Haydarpaşa and Izmit, and his family had a house at Gebze, a town close to Eskihisar.

He obtained the fossils from Eskihisar and sent them on loan to the Austrian geologist and palaeontologist Franz Toula (1845-1920). The end of 19th century was a period during which many Austrian and German geologists studied geology and palaeontology in many regions of Turkey. Toula was principally active in western Turkey, and his main work concerning Turkey is "Eine Muschelkalkfauna Am Golfe Von Ismid in Kleinasien" (1896), in addition to a dozen short papers on the sedimentary successions in western Turkey. In a short paper, Toula (1891) tentatively identified the Eskihisar fossils as "*Mastodon pandionis* (Falc.), *Stegodon Clifti* (Falc.), *Aceratherium Blanfordi* (Lyd.), *Hippotherium antilopinum* (F.u.C.), *Equus* sp., *Equus namadiens*", without any description or illustration. In the light of our present knowledge, such an association is impossible. Either the fossil bones were derived from several horizons, or Toula did not pay enough attention to obtain a reliable identification of the Eskihisar fossils. What is astonishing is that Toula revisited the same

FIG. 2. — **A**, Hamit Nafiz Pamir (left) and Ahmet Malik Sayar (right) in the years between 1933 and 1935 (Courtesy of Professor Cazibe Sayar, Istanbul); **B**, cover page of their monograph on the Küçükçekmece fauna, dedicated to Professor Camille Arambourg.

area in June 1895 and, in his following papers (Toula 1896, 1899), there is no mention of any attention he paid for the Eskihisar mammal locality.

Apparently Toula sent the Eskihisar fossils back to Istanbul. According to Malik & Nafiz (1933b: 19), the material was preserved at the Institute of Geology of Istanbul University until 1918, but was completely destroyed or lost in the 1918 fire. We will see that this was the common fate of natural science collections in academic institutions of Istanbul, which went up in smoke during repetitive fires since the mid-1850s (Viquesnel 1868; Malik & Nafiz 1933b; Yalçınlar 1983; and see also http://www.ibb.gov.tr/sites/itfaiye/workarea/Pages/istanbul_yanginlari).

Yalçınlar (1983: 12) found in the same area some fossils of *Hipparion* and *Gazella*. More recently, Kahraman (1998) reported on the discovery of a "*Deinotherium* jaw" in a new mammal locality at the Yenibağlar district, about 1 km east to Eskihisar village. It will be interesting to undertake new research of vertebrate fossils in the Neogene deposits around the village of Eskihisar by prospecting all available outcrops; the region is being increasingly urbanized with the development of the city of Gebze, and consequently natural outcrops disappear year after year.

SOUTHERN MARMARA AND THE DARDANELLES

The earliest discovery of vertebrate fossils in the southern Marmara Region was incidental to the search for the mythical Homerian city of Troy by a scholar named Frank Calvert (see below) and was in part a consequence of the Crimean War (1853-1856). The Calverts were an expatriate English family who held a number of consular appointments in the eastern Mediterranean region. They came to Çanakkale from Malta in the 1840s. Among the six Calvert brothers, Frederick was the most successful, both in economic and consular activities (for a detailed history of Calvert's family, see the books by Susan Heuck Allen [1999] and Marcelle Robinson [2006]). The Calvert family owned large properties in and around Çanakkale: a mansion along the waterfront in Çanakkale with tennis courts, stables and orchards behind the formal consular house, a country house and fields at Erenköy and a farm of over 2000 acres at Akca Köy which included Mount Hisarlık, where Frank Calvert would discover the antique city of Troy. The youngest brother Frank Calvert was helping his brothers Frederick and James with farming and their consular duties, and starting from 1858, he replaced his brother Fred-

erick as consul of Great Britain. He spent all his life in Turkey and, when he died in 1908, he was buried in the cemetery of Çanakkale (the newspaper *Çanakkale Olay*, 30.10.2012). Frank Calvert was particularly interested in archaeology, and thus he explored the southern parts of the Dardanelles and the neighbouring Biga Peninsula for archaeological sites. Among other sites, being convinced that Mount Hisarlık corresponded to the antique city of Troy, that Homer described in his book, The Iliad, Calvert undertook some excavations at Hisarlık in 1853 and 1856. However, being busy with consular duties and the family enterprise led by his brother Frederick, he had not enough time and inadequate funds to pursue excavations. Heinrich Schliemann, a German amateur archaeologist, visited F. Calvert in Çanakkale in August 1868, to report the results of his work at Hisarlık with his opinion on its equivalence to the antique City of Troy. Schliemann, having more time and money, pursued excavation at Troy until 1893, and he discovered there, among other things, the famous 'King Priam's Treasure'. In summary, Frank Calvert discovered Troy and did the first excavations there, but Schliemann carried out the major excavations and took all of the glory.

The Crimean War (October 1853 to February 1856) was another event that helped Frank Calvert with the discovery of vertebrate fossils. The war was initiated by Russia against the Ottoman Empire, when the Russians occupied Crimea and large parts of the Balkans, still under the governance of the Sublime Porte, benefiting from its progressive economic and political decline and internal troubles in its territories in Europe as well as in North Africa. For the Russians, the main pretext was protecting orthodox populations of the Balkans that had suffered from Ottoman domination for several centuries. In fact, the main objective of the Russians was to conquer the ports which have access to the Mediterranean and to possess the Straits of Bosphorus and the Dardanelles. France and the United Kingdom were concerned that the Ottoman Empire would become a vassal of Russia, which would disrupt the balance of powers in Europe and would harm the interests of these countries in the Empire. They allied with the Ottomans, later joined by Sardinia and Austria, to fight against Russia. The famous battles of Sebastopol, Iena, Balaclava, Taganrog and Kurekdere opposed Russian troops against the allies. At the end of the war, Russia agreed to surrender. The Treaty of Paris signed on March 30, 1856, guaranteed the integrity of the Ottoman Empire and obliged Russia to abandon the territories occupied in the Balkans and southern Caucasus but not Crimea. This war had a permanent impact, through nationalist movements, on the emergence of the present-day states of Ukraine, Moldova, Bulgaria, Romania, Greece, Azerbaijan, Armenia and Georgia.

For the soldiers of the allies, sick or injured during this war, Great Britain opened a hospital in the old Selimiye Barracks of Üsküdar, on the Asian side of Istanbul. In this hospital, injured men contracted illnesses, including cholera, dysentery, typhoid and malaria, due to the poor conditions in the hospital and unhealthiness of the district. Under the media pressure from Florence Nightingale (1820-1910), an English social reformer and statistician, and also the founder of modern nursing, who served during the Crimean War, the British government decided to build a new hospital in a safe area. The town of Erenköy near Çanakkale, along the southern shores of Dardanelles Strait, was retained because of ease of access via the Dardanelles. In fact, this option of a hospital at the south of the Dardanelles was suggested by the Calvert family thanks to close relationships and influence of Frederick Calvert with British authorities, and to their knowledge of the fact that the region of Çanakkale is safe and suitable for such a hospital. Indeed, the Calverts owned a farm at Erenköy and Frederick Calvert was an important personality in its diplomatic and trade relations with both Europeans living in Turkey and the Ottoman authorities.

Since his arrival in Çanakkale, Frank Calvert showed a great and continuous interest to the history and the geological and archaeological treasures of this region. Whenever he had the possibility, he went to prospect lands and sites to collect plants, to find rocks, fossils and in particular archaeological items. As the family had a farm at Erenköy, he was alerted by the villagers to the presence of fossil shells and bones in the region a few years after his arrival at Çanakkale (1846 or the year before). He oversaw their exploitation and made a rich collection of several hundred specimens. He continued doing this more intensely during the building activities of the British hospital at Erenköy (1854-1856) that the Calverts partly concerned. He amassed a large collection of fossils, yet without publishing any of them. This was apparently the first vertebrate fossil collection made in Turkey.

However, according to the geological literature, the earliest mention of vertebrate fossils in the southern Marmara Region is apparently that of Thomas Abel Brimage Spratt (1811-1888; Fig. 3A), an English vice-admiral, hydrographer and geologist. In a short paper on the geology of "freshwater deposits of the Levant", Spratt (1858) reported on Calvert's discovery of vertebrate fossils near "Arenkeui" (Erenköy, in Turkish). In his military career, Spratt was attached to the surveying branch on HMS *Victory.* He was engaged almost continuously until 1863 in surveying the Mediterranean. As a commander of the *Spitfire*, he rendered distinguished service in the Black Sea during the Crimean War. As a natural scientist, Spratt investigated the caves at Malta and obtained remains of the pygmy elephant (*Elephas melitensis* Falconer, 1862, which were later described by Hugh Falconer), the geology of several Greek islands, Dobrudja, the western regions of Asia Minor, and the Nile Delta. In addition to several papers on his geological observations in these regions, he published a book, *Travels in Lycia* (1847), together with Edward Forbes, a marine biologist and professor at London and Edinburgh universities.

Spratt visited Erenköy in June 1857, where he met the Calverts, and explored the surroundings for geological purposes. In the related paper (Spratt 1858: 216) he notes that "In a walk up to the village of Arenkeui, over the site of our hospital, I found the deposits to be precisely similar to those on the north side of the Dardanelles […] The fossil teeth, found by Mr. Calvert, were taken from the lower part of the group of sandy marl immediately below the village". In the

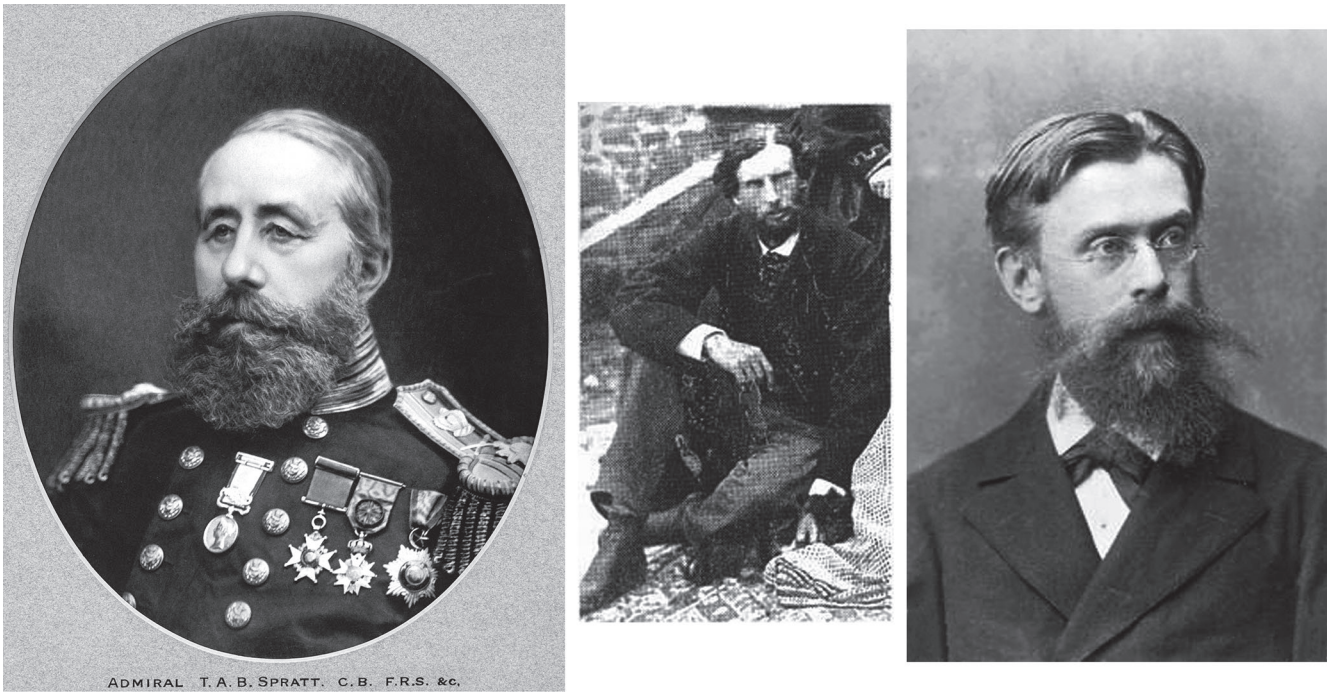

FIG. 3. — Portraits of Admiral Abel B. Spratt (**A**), Frank Calvert (**B**) and Melchior Neumayr (**C**). Spratt's portrait is borrowed from http://drdudsdicta.com/2015/02/07/thomas-spratt-antiquarian-traveller-to-crete/; those of Calvert and Neumayr from https://fr.wikipedia.org.

vicinities of Erenköy, he discovered himself "an elephantine jaw, with two teeth in place" and "some fragments of fossil ivory". Spratt (1858) did not describe or illustrate these fossils.

Frank Calvert (Fig. 3B) continued to collect vertebrate and invertebrate fossils from the Neogene deposits of the Erenköy region (Fig. 1[spot 6]). He briefly mentioned their occurrence in a note on some archaeological sites near Erenköy (Calvert 1860), but he studied nothing.

Tchihatcheff (1869: 175) wrote in his book "Asie Mineure-Géologie volume III" that "The people of Eren Koï assure me that all around this town, the calcareous marl deposits contain many fossil bones of gigantic dimensions" and "They taught me that at the request of the British consul, they had provided him repeatedly lot of these bones which the consul sent successively to England. The interest attached to palaeontological monuments of this nature, regardless of their origin, acquires a special significance when such things come from Asia Minor, where Eren Koï is the only place that has ever provided remains of mammals because their absence in the Tertiary and Quaternary deposits of the peninsula marks a contrast to the abundance of similar debris in similar deposits of Europe. It is therefore understandable how important must be the Calvert collections for palaeontology in general and geological knowledge of Asia Minor in particular. Therefore, one can only be astonished and deeply regret that in England they have not been the subject of a special study" (translation by the author). More than 150 years later, I would express the same regrets and wishes that Tchihatcheff did.

In fact, the invertebrate and vertebrate fossils that Calvert collected from the vicinity of Erenköy were partly studied by Melchior Neumayr (1845-1890; Fig. 3C), a German palaeontologist who was involved in the studies of fossil invertebrates of the Eastern Mediterranean. Calvert & Neumayr (1880) co-authored a paper in which Calvert reports on the stratigraphy of deposits in the Erenköy area, and Neumayr describes some vertebrate and invertebrate fossils. In the foreword of this paper, Neumayr notes that "In a visit to the Dardanelles in 1874 I had the opportunity to learn about these fossils and to check their importance; last year Mr. Frank Calvert had, at my request, the extraordinary generosity to send me the whole series of animal remains to study, a task which is of so much greater interest because these are the first Tertiary vertebrates from Asia Minor" (translation by the author). In addition to a detailed stratigraphy of Cainozoic deposits in the Erenköy area, Calvert & Neumayr (1880) mentioned the occurrence of a dozen species of mammals from different horizons in the local stratigraphy, including some marine mammals ("*Mastodon angustidens*, *M. longirostris*, *Deinotherium bavaricum*, *Rhinoceros*, *Hippotherium gracile*, *Sus erymanthius*, *Listriodon splendens*, *Camelopardalis attica*, *Tragoceros amaltheus*, *Palaeoreas*, Antilope, *Prodremotherium elongatum*, *Phoca pontica*, *Cetotherium*, *Delphinus*"). However, they only described and illustrated three beaver teeth as "*Castor* cf. *subpyrenaicus* Lartet, 1851, *C.* aff. *jaegeri* Kaup, 1832 and *Castor* new form", in addition to molluscs from the same deposits. Calvert & Neumayr (1880) also mentioned that the fossil collection from Erenköy would be stored at Owens College in Manchester. In 1880, Owens College joined the Victoria University of Manchester, which later merged with the University of Manchester. This university includes a Natural History Museum. David Gelsthorpe, curator of Earth Science Collections, informed me that the

Erenköy fossils are still preserved in this museum under the spelling Renkioi. Fabien Knoll, who is associated to this Museum, sent me pictures of Erenköy fossils, as preserved in their drawers, which show many remains of proboscideans, rhinos, horses and antelopes in addition to beaver teeth illustrated by Calvert & Neumayr (1880).

Later on Toula (1899) investigated the stratigraphy of the Neogene deposits of the area and he illustrated the Erenköy section (Fig. 4), and many others in the southern Dardanelles, noting clearly that "the vertebrate remains, which were discussed by Calvert and Neumayr, originate from the bottom complex, i.e. horizontal sandstone beds with *Cardium*", that he correlated to the Sarmatian. More recently, Martin Pickford visited these collections and observed that the fossils are probably originated from several horizons, some as old as middle Miocene but some others from the late Miocene.

Malik & Nafiz (1933b: 89-93) noted some similarities of the mammalian taxa from Erenköy with that of Küçükçekmece, and they compared both faunas in a comparative table. Ozansoy (1957) commented on the stratigraphy of the deposits and the age of the fauna, and stated that the Erenköy fossil mammals are derived from three different horizons all dated to the late Miocene. Yalçınlar (1983) also reproduced the same list without comment. It is astonishing that this collection has never been subjected to a detailed study and that nobody went to prospect vertebrate fossils in the Erenköy area since Frank Calvert.

In 1968, a team of palaeontologists from the Geological Survey of Turkey (MTA), under the guidance of Professor Fikret Ozansoy, including the author, prospected the region between Çanakkale and Gülpınar, without being, however, aware of Calvert's discoveries at Erenköy. They discovered a rich vertebrate locality at Bayraktepe, about five km SE to Çanakkale and about ten km NE of Erenköy. The MTA team intensively excavated this locality in 1976 and found that vertebrate fossils also occur, sparsely, in two other horizons. These localities yielded abundant terrestrial and some marine vertebrate remains. Ozansoy (1973) published a short description of the stratigraphy, and established a preliminary list of vertebrates from Bayraktepe 1 and 2. Tekkaya (1973a) provided a composite preliminary list in which taxa from the two different horizons are mixed, and he described some postcranial bones of "*Hyaena eximia*" from Bayraktepe 2. Kaya 1986, 1992) described the perissodactyles of Bayraktepe 1 and 2, Ünay (1976, 1980, 1981) and Sen (1977) studied the rodents from the three horizons (see stratigraphic column in Ünay 1980: fig. 1), and Erdoğan (1978) some fish remains. Ünay (1981) correlated the lower fossiliferous level (Bayraktepe 1) to the latest middle Miocene (late Astaracian, MN7/8), and the other two localities to the late Vallesian (MN10). After these studies, the faunal lists of mammals from these localities can be reliably established as follow:

Bayraktepe 1: Hyaenidae indet., Mustelidae indet., Proboscidea indet., *Anchitherium* sp., *Aceratherium* aff. *simorrense*, *Listriodon splendens* von Meyer, 1846, *Dorcatherium* sp., *Chalicomys jaegeri* Kaup, 1832, *Trogontherium minutum* von Meyer, 1838, *Albanensia grimmi* (Black, 1966), *Miopetaurista gaillardi* (Mein, 1970), *Atlantoxerus* sp., *Spermophilinus bredai* von Meyer, 1848, *Byzantinia ozansoyi* Ünay, 1980, *B. bayraktepensis* Ünay, 1980, *Cricetulodon* sp., *Sinapospalax çanakkalensis* (Ünay, 1981) and *Megapedes aegaeus* Sen, 1977.

Bayraktepe 2: *Phoca* sp., *Adcrocuta eximia* (Roth & Wagner, 1854), *Protictitherium intermedium* Schmidt-Kittler, 1976, Proboscidea indet., *Begertherium grimmi* Heissig, 1974, *Aceratherium* sp., *Hipparion* cf. *primigenium* (von Meyer, 1829), *Ceratotherium neumayri* (Osborn, 1900), *Palaeotragus* sp., *Dorcatherium* sp., *Tragocerus amaltheus* (Roth & Wagner, 1854), *Gazella* sp., *Chalicomys jaegeri* Kaup, 1832, *Trogontherium minutum* (von Meyer, 1838), *Atlantoxerus* sp., *Byzantinia nikosi* de Bruijn, 1976, *B. dardanellensis* Ünay, 1980, *Progonomys* cf. *cathalai*, Ochotonidae indet., *Schizogalerix* sp., *Plesiosorex* sp.

Bayraktepe 3: *Trogontherium minutum* (von Meyer, 1838), *Byzantinia* sp. and *Paralactaga* sp.

Atabey *et al.* (2004) distinguished in this region two sedimentary units, the Sarıyar and Çanakkale formations. According to these authors, the fossiliferous horizons are included in the upper part of the Sarıyar Formation.

South to this region, near antique Troy, Arabu (1925: 149) mentioned the occurrence of Oligocene mammals. He noted that "in Troad, these series are mainly nummulitic. These deposits, which in places display sandstone and flysh facies, yielded some bone fragments of mammals, appearing to have belonged to a *Prodremotherium* or a *Gelocus*, both being Oligocene forms" (translation by the author). Unfortunately he did not provide further precision on the locality, neither what kind of specimens he found, and where they are stored. It is amazing that recent geological maps do not mention the presence Paleogene deposits in this region (see Fig. 1).

Further south in this peninsula, a team of palaeontologists from MTA discovered the locality of Gülpınar and excavated it in 1968 and subsequent years (Fig. 1[spot 5]). Two horizons interbedded with marine deposits yielded abundant remains of mammals that Tekkaya (1973b), Tuna (1987), Kaya (1982, 1986, 1994) and Forsten & Kaya (1995) have partly studied. The Gülpınar fauna is certainly of Turolian age (late Miocene), but its main interest lies in the fact that the two vertebrate-bearing horizons are intercalated in a thick pile of marine deposits, and that it occurs in the transition zone between the Mediterranean and Paratethys marine realms (see the stratigraphic column in Forsten & Kaya 1995). Consequently, it may provide key arguments for a direct correlation between the marine and continental biochronologies on the one hand and, on the other, between the stratigraphies of these two marine realms.

West of the city of Bursa, the German team, which was active in Turkey during the 1960s, discovered the rich mammal locality of Paşalar (Fig. 1[spot 4]), which is dated to the early middle Miocene (MN5; Sickenberg *et al.* 1975). Later on, Gaziry (1976), Heissig (1976), Schmidt-Kittler (1976), Andrews & Tobien (1977), and Engesser (1980) studied several groups of mammals from Paşalar. Since 1983, a team from Ankara University, under the leadership of Prof. Dr.

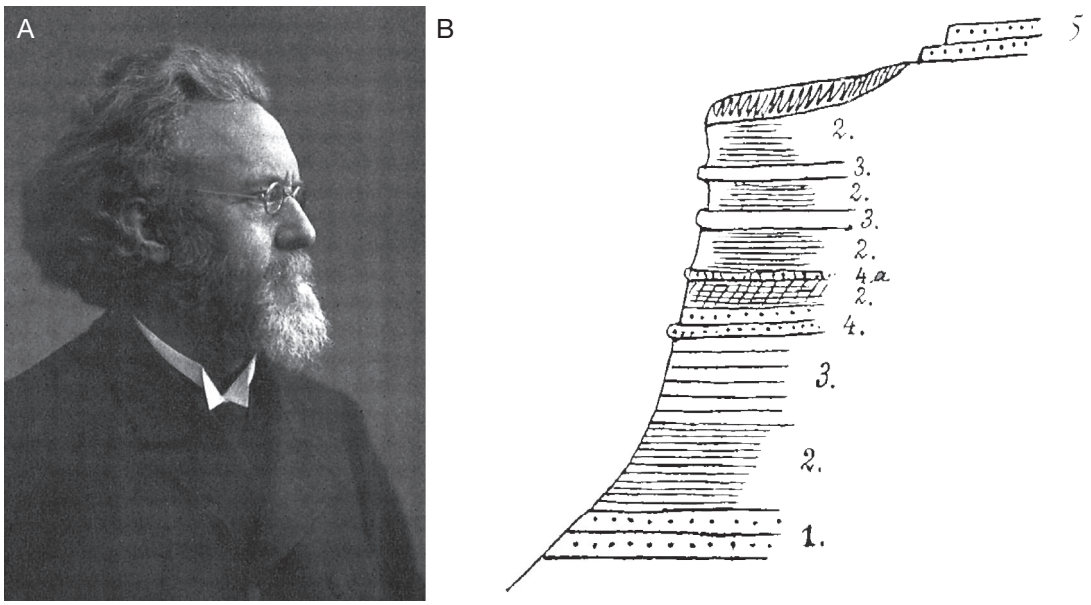

FIG. 4. — **A**, Portrait of Franz Toula (after Rosiwal 1920); **B**, Erenköy section as it was logged by Toula in 1895. Toula (1899) described the stratigraphy as follows: **1**, horizontal sandstone beds with *Cardium* and vertebrate fossils; **2**, marl with scarce plant remains; **3**, hard layers protruding between the friable marl; **4**, sandy layers; **5**, limestone roof.

Berna Alpagut, excavated this locality each year as a summer school. The results of new investigations were published in a joint volume edited by Andrews & Alpagut (1990) and in several other papers in later years. This is one of the richest mammal localities known in Turkey, and is the only one in the Marmara Region to have yielded anthropoid primate fossils: *Griphopithecus alpani* (Tekkaya, 1974) and *Kenyapithecus kizili* Kelley, Andrews & Alpagut, 2008 (Kelley *et al*. 2008). To the northeast of Bursa city, Akartuna (1968) reported on the discovery of late Miocene mammalian remains south of Esadiye village (Fig. 1[spot 3]), listed as "*Hyaena eximia*, *Hipparion mediterraneum* and *Helladotherium* cf. *duvernoyi*". A few kilometres to the north of Esadiye and 5 km south to Yalova city, Rückert-Ülkümen *et al.* (2006) collected a rich fish fauna associated with some turtles, a rodent cf. *Eliomys intermedius* Friant, 1953, and abundant mollusc shells from the lignite quarry of Safran (see also Rückert-Ülkümen & Yiğitbaş 2007). The fossiliferous horizon is included in the Yalakdere Formation, and its age is defined as being close to the Khersonian-Maeotian boundary, i.e. *c.* 7.6 Ma. The fish assemblage indicates freshwater to slightly brackish water environments.

To the north of the Dardanelles, in the southwestern edge of the Gelibolu Peninsula, Kaya (1989) reported on the discovery of three localities with middle and late Miocene large mammals (Nebisuyu, Sığındere and Değirmendere), all in the Alçıtepe Formation (Fig. 1[spot 7]). Also in the Gelibolu Peninsula, near Gelibolu and Şarköy towns, Ünay & De Bruijn (1984) discovered eight sites with middle-late Miocene rodent assemblages (Fig. 1[spot 8]). In these papers, the authors provided preliminary lists, but the material has not yet been the subject of a detailed study, except the Cricetidae by Rummel (1998).

THRACE

Geological research on the Cainozoic deposits of Thrace started in the mid-1800s. The fashion in 19th century is to "voyages d'étude" to explore unknown regions or poorly known territories to report on their landscapes, peoples and monuments. Some explorers also interested in the geology and exceptionally palaeontology of the countries they visited. Among the scholars who crossed the land of Thrace, two deserve special mention because of their contribution to the knowledge of Cainozoic deposits and to their palaeontological content: Tchihatcheff and Viquesnel. Their observations primarily concerned all aspects of human and physical geography of the countries they visited, the botany, the archaeology of past civilizations ,and also the geology and palaeontology of the itineraries they followed. Concerning the Cainozoic deposits of Thrace, they distinguished Palaeogene deposits ("nummulitic") from Neogene deposits, and for the latter they recognized depositional environments varying from marine to coastal to continental on the basis of sedimentological and palaeontological criteria. In support of their observations, they described the lithology and stratigraphy of the deposits, and provided the names of invertebrate fossils (and exceptionally vertebrates) that they discovered in several horizons. Tchihatcheff mainly investigated the regions close to Istanbul, but not the other parts of Thrace. Consequently, his results will be better given in the next section on the Istanbul area.

Aguste Viquesnel (1800-1867) traveled several times in the European part of the Ottoman Empire between the years 1836 and 1848, and he reported on his observations in several papers and memoirs, in particular in *Voyage dans la Turquie d'Europe. Description physique et géologique de la Thrace* (two volumes + atlas) published in 1868.

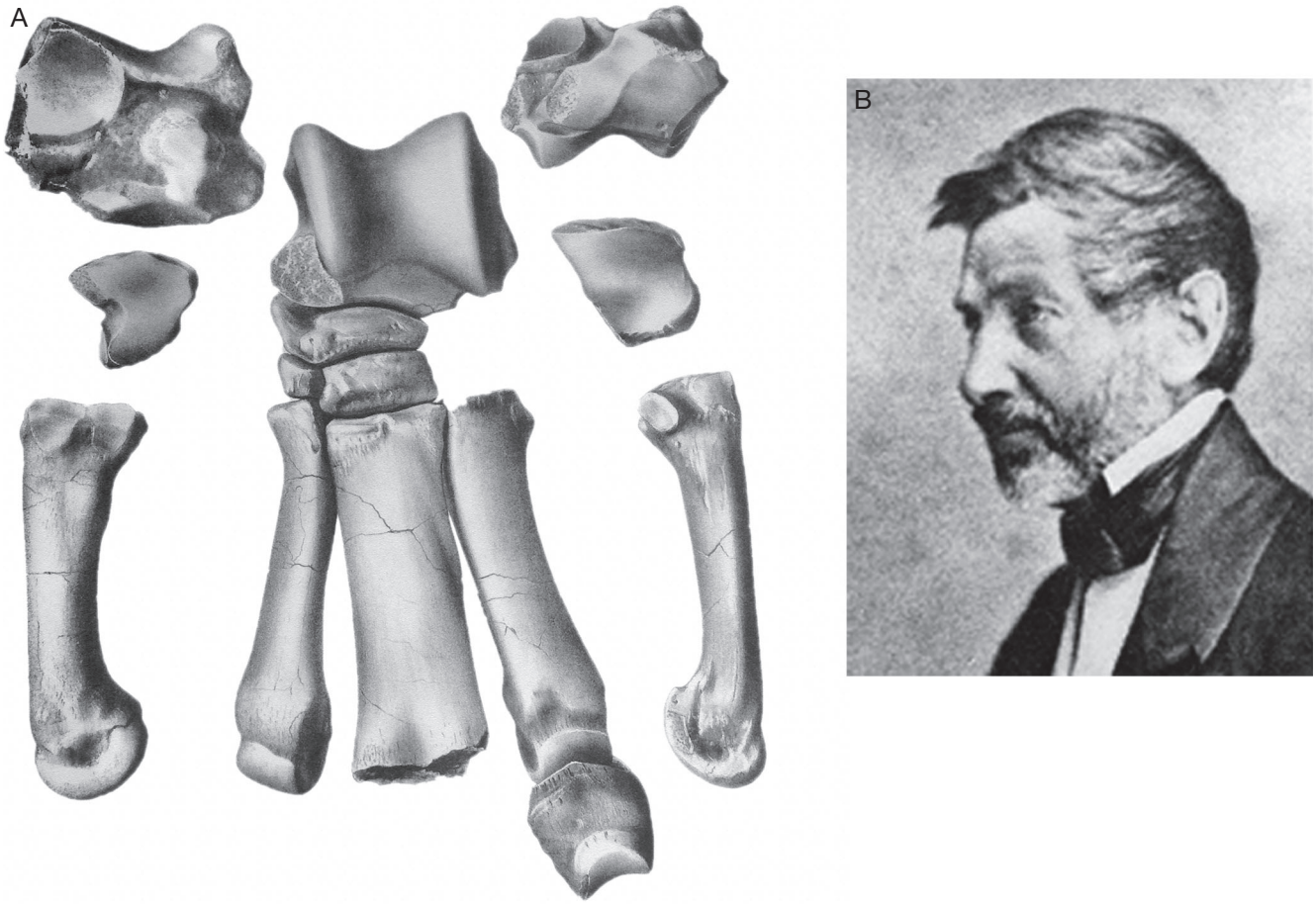

Fig. 5. — **A**, Foot bones of a *Palaeotherium* sp. (in Viquesnel 1868: atlas, pl. 21); **B**, portrait of Auguste Viquesnel (after Gaudant 1985).

Auguste Viquesnel (Fig. 5B) was a French businessman, and also a traveler, geographer, meteorologist, ethnographer and geologist. In 1836 he accompanied the geologists A. Boué and F. de Montalembert on a trip to Serbia, Moesia and Macedonia. Two years later, he began a second trip with A. Boué in Albania, Epirus and Thessaly. Finally in 1847-1848 he explored alone the areas situated between the cities of Sophia, Thessaloniki and Istanbul for 13 months.

Viquesnel described the stratigraphy of rock units along his itinerary and, in particular, the stratigraphy and sedimentary characteristics of Tertiary deposits of Thrace. He reported on the extent of "nummulitic" deposits in Thrace as well as on the Neogene successions. In many places, he found invertebrates to date these deposits and in one locality near "Balouk Keui" he discovered the foot bones of a perissodactyl mammal (see below). He was also interested in forming a mineral and fossil collection in an institution in Istanbul. In the "Préface" of the first volume of his books (1868: XXIV), Viquesnel notes that "His Highness Rechid Pasha, then Grand Vizier, had accepted our proposal to appoint us a pupil of the school Galata Sarai charged with making, under our direction, a collection of rocks and fossils [...] Mr. Caliga should also serve as interpreter. He performed his double mission with zeal and intelligence". In a footnote on the following page, Viquesnel (1868) laments that this rich collection gathered by this student went up in smoke during the fire which devoured the School of Medicine and Pharmacy of Galata Saraï in 1848.

The oldest reference to the discovery of fossil mammals in Thrace is apparently by Viquesnel (1868). He discovered eight bones of a left foot of a perissodactyl mammal about four kilometers east to Balouk Keui (today Pylaia) on the road to Feredjik (today Feres). This site is today in Greece, a few kilometres west of the border with Turkey (Fig. 1[spot 10]). Viquesnel sent these specimens to the Museum of Paris for study by Albert Gaudry (1827-1908). In a letter to Viquesnel (1868: 470), Gaudry hesitated in the identification of these fossils: "The specimen collected by Viquesnel is from a small rhinoceros or *Palaeotherium*, because there are no consistent differences between the feet of these two genera". All the bones of this Balouk Keui foot (Fig. 5A) are still preserved in the collections of palaeontology at the Paris Museum. I asked Albert Remy (Nîmes), expert on Palaeotheriidae, and Pierre-Olivier Antoine (Montpellier), expert on Rhinocerotidae to examine them. It appears that this foot belonged to a large sized palaeothere similar in size to *Palaeotherium magnum* Cuvier, 1804 or *P. crassum* Cuvier, 1805 both from middle and late Eocene localities of Western Europe. The occurrence of a palaeothere in Thrace is of great interest, because this genus has a geographic distribution in Western and Central Europe, and it is not known in Eastern

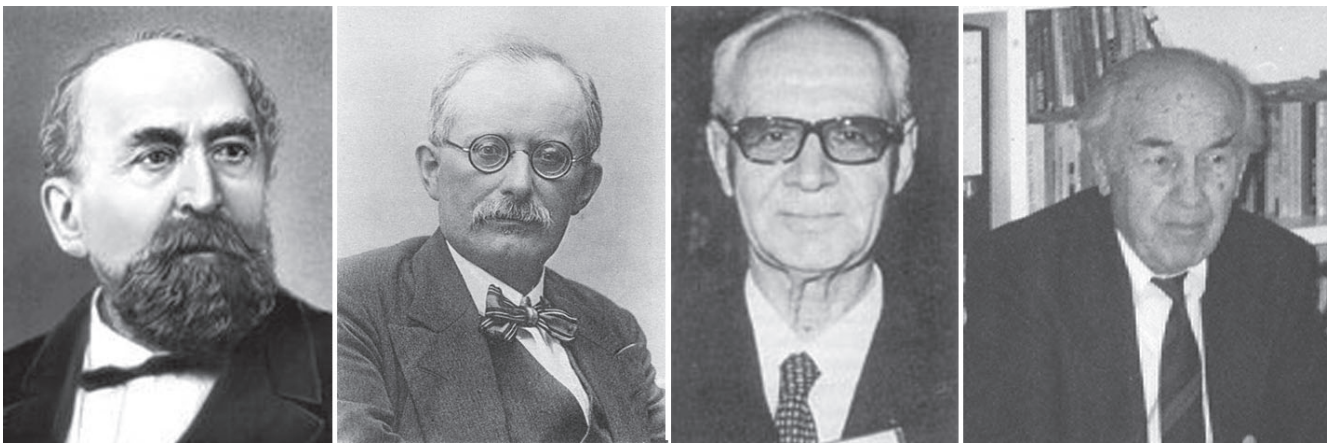

FIG. 6. — Portraits of Petr Alexandrovic Tchihatcheff (**A**), Ernest Chaput (from Akyol 1944) (**B**), Sevket Aziz Kansu (**C**) and Ismail Yalçınlar (**D**). These photos are taken from: **A**, http://www.findagrave.com/; **C**, http://www.kimkimdir.gen.tr/kimkimdir.php?id=3596; **D**, http://edebiyat.istanbul.edu.tr/cografya/?p=6522.

Europe. The only occurrence of a palaeothere in the Balkans (near Tscherno More, Bulgaria) is a lower jaw that Nikolov & Heissig (1985) identified as *Plagiolophus* cf. *minor* (Cuvier, 1804). This small sized late Eocene palaeothere is well known from the late Eocene of Western and Central Europe. The palaeothere of Balouk Keui confirms that the palaeogeographic extension of this group reached the Balkans during the late Eocene. The Balouk Keui foot will be described soon by Grégoire Métais (CNRS-MNHN, Paris).

The Palaeogene deposits of Thrace yielded many more vertebrate fossils. The first discovery during the twentieth century was a lower jaw of *Anthracotherium* by English (1904) at the Masatlı lignite mine (Malkara, Tekirdağ). Newton (1904) identified this specimen as *Anthracotherium* cf. *minus*. The specimen is preserved at the Natural History Museum in London. English (1904) presented an account on the stratigraphy of Tertiary deposits in Thrace, providing a stratigraphic table of the units that he recognized and dated by the fossils, which are either discovered by previous geologists or collected by himself and studied by Newton. Indeed, the Palaeogene deposits of Thrace are richly fossiliferous (Fig. 1[spot 9]), and vertebrate remains are well represented. In later years, geologists and palaeontologists went to collect abundant remains of large vertebrates in a dozen localities in coal mines and surrounding horizons, and they described *Anthracotherium* and *Elomeryx* among the mammals (Ozansoy 1962, 1963, 1964; Lebküchner 1974, Russell *et al.* 1982). Ünay-Bayraktar (1989) recorded rodent fossils from five localities that she studied for her PhD Thesis. All these localities are included in the Danişmen Formation of the Thrace Basin. Its age is considered to be Oligocene without further precision (Siyako 2006).

Saraç (2003a) discovered another Palaeogene locality in coastal marine deposits near Dolhan Village (Kirklareli Dept.; Fig. 1[spot 12]), which yielded some cranial and postcranial remains of a rhinocerotid, *Protaceratherium albigense* (Roman, 1912), dated to mid-Oligocene, *c.* 28 Ma.

Neogene and Quaternary deposits in Thrace also cover large areas (Fig. 1), and they include marine, coastal and terrestrial facies. Although vertebrate remains have been occasionally discovered in several localities, these deposits have not yet been the subject of extensive research in vertebrate palaeontology.

The oldest discovery of a Neogene mammal in Thrace was made by an Austrian geologist, Franz X. Schaffer (1876-1953) from the Naturhistorischen Museum in Vienna. In autumn of 1902, he studied the geology of Turkish Thrace and established a detailed geological map of its sedimentary units (Schaffer 1904). He discovered in a sand quarry situated between Edirne and Mustafa Pasha (today Svilengrad, in Bulgaria) "a mandible of rhinoceros, leg bones and a vertebra of *Elephas*, and a poorly preserved antler-like specimen, in addition to numerous silicified woods". Otto Abel (1904), from the same institution, described the "antler-like specimen" as a left ossicone fragment of a large giraffid, *Sivatherium giganteum* Falconer & Cautley, 1836. This was the first record of this giraffid in Europe, previously known from the Indian subcontinent and North Africa. According to the distances given by Schaffer (1904), this locality should be situated along the east bank of Maritsa River, about 4 km south to the village Kemal. In the same area, Saraç (1987) found some proboscidean bones at the Yıldırım sand quarry.

In 1959, the Turkish Historical Society entrusted Şevket Aziz Kansu (1903-1983; Fig. 6C) to undertake prehistoric and archaeological research in Thrace. Kansu was first a medical doctor in several hospitals in Turkey. With a grant from the Turkish Republic, he studied anthropology in Paris (1927-1929), and on his return to Turkey, he pursued anthropological research at Ankara University. His studies cover the areas spanning social and physical anthropology to prehistory. During his investigations in Thrace, he discovered late Miocene mammals at several spots (Kıyık, Sabuncubeli, etc.; Fig. 1[spot 11]), a few kilometres east to Edirne city, where he was born. In his paper, which presents the results of his investigations in Thrace, Kansu (1963) briefly described and illustrated some remains of large mammals from these localities.

Sickenberg *et al.* (1975) and Saraç (1987, 2003b) reported on the discoveries of several late Miocene mammal localities in Thrace. These authors provided preliminary lists, but the fossil material has remained undescribed. The only late Miocene

mammalian fauna that was adequately studied is that of the Yulafli locality (Fig. 1[spot 13]) in the department of Tekirdag (Kaya & Heissig 2001; Geraads *et al.* 2005). It yielded a rich assemblage of mammals composed of the following species: *Indarctos arctoides* (Depéret, 1895), *Deinotherium giganteum* Kaup, 1829, *Tetralophodon longirostris* (Kaup, 1832), *Choerolophodon anatolicus* Ozansoy, 1965, *Amebelodon grandincisivus* (Schlesinger, 1917), *Aceratherium incisivum* Kaup, 1832, *Acerorhinus zernowi* (Borissiak, 1914), *Dihoplus schleiermacheri* (Kaup, 1832), *Hippotherium* cf. *primigenium*, *Hippopotamodon antiquus* (Kaup, 1832), *Dorcatherium* cf. *jourdani*, ?*Palaeogiraffa* cf. *macedoniae* and Bovidae indet. The fauna is correlated to the late Vallesian, *c.* 10 Ma (Geraads *et al.* 2005). This assemblage is quite similar to that of Küçükçekmece, as noted in several papers of the present volume (Peigné 2016; Tassy 2016; Antoine & Sen 2016; Kostopoulos & Sen 2016; Koufos & Sen 2016).

KÜÇÜKÇEKMECE AND ISTANBUL

The French geologist Édouard de Verneuil (1805-1873) is apparently the first to establish the geological map of Istanbul region, and to draw on Tertiary deposits west of the city. De Verneuil (1837: 271, 272) notes that " The city of Constantinople is founded on a Tertiary formation of which I do not know the western extension […] Between Daoud Pasha and Makrikoï, the ground is completely disrupted by old abandoned open quarries [...] which, provided the stones used in the constructions of Constantinople from its foundation until today". He observed the occurrence of many bivalves and gastropods, which are not preserved well enough to determine the age of these deposits.

The occurrence of vertebrate fossils in the present day city borders of Istanbul was first mentioned by Tchihatcheff (1851), and later by Arabu (1913, 1916, 1925), Hubbard (1931), Malik & Nafiz (1933a, b), Yalçınlar (1952a, b, 1983), Arıç (1955), Arıç-Sayar (1957), Sayar (1976, 1987) and Nicolas (1978).

Piotr Alexandrovich Tchihatcheff (1808-1890, Fig. 6A) was a Russian diplomat, naturalist and geologist. He started his career as secretary of the Russian Embassy in Constantinople (1841-1844), but resigned his position in order to study natural sciences at Freiberg Mining Academy (Bergakademie Freiberg) in Germany (1844-1845). On his return to St Petersburg, he was engaged for a scientific trip in the Altai Mountains. He published his observations in a book published in 1846: *Voyage scientifique dans l'Altaï et dans les contrées adjacentes*. One of the Altai mountain ranges is named after him (Wikipedia.org). On his return from Altaï, he abandoned any official position, retired from his usual status of gentleman in charge near the emperor, sold all the properties he had inherited from his family and went to Constantinople with the sole aim of exploring Asia Minor. He then left without any official protection but with a firman from the Sublime Porte allowing him to explore all the country, without an interpreter, without guide, only accompanied by a Tatar and a French domestic who soon succumbed to the fatigue of the journey. Between 1847 and 1857, he traveled the entire country and, after ten years of labors and dangers, he undertook to publish between the years 1853-1869, the most complete physical picture of Asia Minor. His studies on Asia Minor were published in eight volumes and three atlases, in addition to several papers in scientific journals. Tchihatcheff traveled across all regions that are today in the borders of Turkish Republic, and also beyond such as the Middle East, and his geological observations were used by later geologists as first indications of many geological structures that they later studied in greater detail. Concerning the region west of Istanbul, Tchihatcheff crossed it in multiple directions and observed many natural and artificial outcrops in order to understand the geological structure of the region and the succession of sedimentary formations. He established the first geological map of this region, distinguishing Eocene and Oligocene deposits from the Miocene and later units, all substantiated by the palaeontological content of the sediments. For the region of Küçükçekmece he gives the following details in a paper published in 1851 (1851: 304): "Between St. Stefano (today Yesilköy) and the Gulf of Petit-Pont (Kuchuk-Tchékmédjé), the coast of the Propontid also has cliffs composed of sandstones and siliceous limestones; near the village Küçükçekmece, these rocks form horizontal layers that continue to crop out along the coast till the village Ambarli, located six hours far from Constantinople. Near this village, the sandstones and siliceous limestones contain silicified trunks of dicotyledon plants, of which I gave a few samples to Mr. Ad. Brongniart, who had the extreme goodness to undertake the identification. Sometimes these rocks are stained reddish, and layers, almost always horizontal, locally show a slight tilt to the NE. Finally, continuing to skirt the coast to the Gulf of Grand-Pont (Büyükçekmece today), we see the cliffs and rocks progressively disappearing, and diluvial deposits composed of sand and pebbles hiding all denudation. However, as we have seen, observations along the coast, from the gate of the Seven Towers (today Yedikule) to the Gulf of Grand-Pont, evidence an almost uninterrupted succession of lacustrine deposits, characterized either by shells or by plants" (translation by the author) (Fig. 7A). Almost in the same years Visquesnel also observed the succession of Palaeogene and Neogene deposits west of Istanbul and he illustrated his stratigraphic descriptions with several figures (Fig. 7B, C). Present day geologists cannot be as lucky as Tchihatcheff and Viquesnel were. Intense urbanization of this area over the last 50 years has covered all natural outcrops and filled all quarries that were exploited at that time to furnish raw material for Istanbul buildings. Tchihatcheff and Viquesnel identified *in situ* fossils or collected when possible many invertebrate fossils that they sent to the Paris Museum for identification. Their geological descriptions also include the names of these fossils and the age that they may indicate. They worked as structural geologists, stratigraphers and sedimentologists who understood the utility of fossils. Unfortunately, they did not discover many vertebrate fossils, except foot bones of a rhino near Edirne by Viquesnel (see above) and some fish imprints near Istanbul by Tchihatcheff

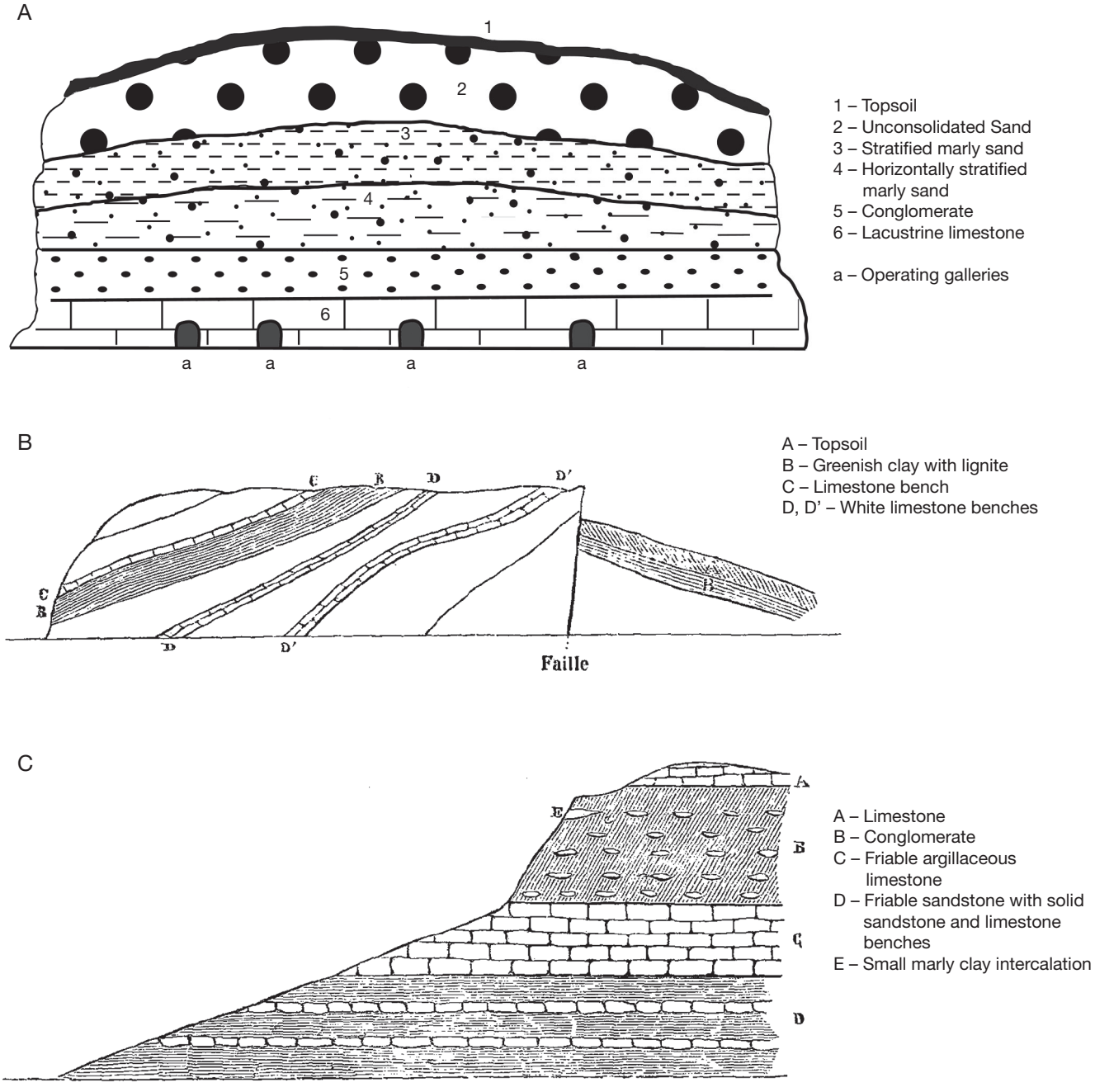

FIG. 7. — Lithostratigraphic sections around the Küçükçekmece Lagoon published by Tchihatcheff (1864) and Viquesnel (1868): **A**, section in a limestone quarry at Bakirköy (Makrikoï) where the rock is quarried for building, as given by Tchihatcheff (1864: 532); **B**, section between the western coasts of Küçükçekmece Lagoon and the Sea of Marmara, as given by Viquesnel (1868: fig. 10); **C**, section between Küçükçekmece and Büyükçekmece lagoons, as given by Viquesnel (1868: fig. 11).

(see below). Tchihatcheff explained the absence of vertebrate fossils in the last volume of his work Asie Mineure (1869: 498-500): "Anyway terrestrial vertebrates appear to be almost completely absent from the Tertiary and Quaternary deposits of Asia Minor [...] It is not impossible that this feature should hold, at least in part, to the absence of glacial epochs in all these countries, whose passage elsewhere was marked at once by the destruction of the existing fauna and flora and the conservation of their debris. Moreover, the huge volcanic disturbances that have repeatedly disrupted Asia Minor since well before the Quaternary period, have contributed to make it harder in this country than elsewhere to preserve land animal remains" (translation by the author).

In Turkish Trace, Palaeogene deposits, both marine and terrestrial, cover large areas. In the last volume of Tchihatcheff's memoirs, Archiac *et al.* (1866-69) described many invertebrate fossils that this explorer collected all around Asia Minor. For the vertebrates, Tchihatcheff (1851) reported on the presence of fish imprints that he obtained from the workmen who extracted stones from the underground galleries at Makrikoi (today Bakırköy) (Fig. 7A). Tchihatcheff would have insisted on going to see the layers in which these fish remains are

found. But the operators of the quarries refused him access to these galleries because of his large body size and inappropriate attire. Tchihatcheff sent these fossils to the Museum of Paris, where the ichthyologist Professor Achille Valenciennes (1794-1865) studied them and reported back to Tchihatcheff. Valenciennes recognized in the Bakirköy material the following taxa: *Euripholis sulcidens* Pictet, 1831, *E. boissieri* Pictet, 1831, *Clupea brevissima* Blainville, 1818 and *Strymonia sirica* Valenciennes, 1851. Valenciennes compared these fossils with material from Lebanon, and hypothesized that the fossil fishes from Bakirköy could come from two different layers, the one containing *Strymonia sirica* from a soft limestone dating from the "Nummulitic", i.e. Eocene or Oligocene, while the other fossil taxa preserved in a hard limestone could date from the late Cretaceous. Tchihatcheff (1851) did not illustrate these fossils, and I could not find them in the Palaeontology collections of Paris Museum.

An important figure in the investigations of Tertiary deposits and in the discovery of fossil vertebrates in the Marmara Region is Nicolae Arabu who worked there during the 1910s and 1920s. I intensely searched on the internet and in the libraries of the Museum for any information about this geologist, without finding a word anywhere. Professor Vlad Codrea from the Babes-Bolyai University in Cluj came to my rescue by sending me the information he found in the posthumous memoirs of Mircea Pauca, a geologist who worked on the Oligocene and Neogene fishes of Romania. In his book published in 1998 (*Mi-am retrăit viaţa : amintrile unui geolog)* Pauca provided a short biography of Arabu: "Nicolae Arabu, of Armenian origin, was born in Botoşani (extreme NE of Romania) in a family rich enough allowing him to pass a fairly easy youth. He made geological studies in Iaşi (Romanian Moldova), than he went to the West. At one time he was an assistant at the University of Strasbourg. He carried out geological research in Turkey. In the 1930s, he returned to Romania (without his PhD) and he was collaborator of the Geological Institute of Romania. He published, in particular, a geographical and geological monograph on the city of Ploieşti (1938) and several articles on the Triassic ammonites and ceratites of Romania. He died in 1948, during the great famine that ravaged Romania. His tomb no longer exists, because as he had no descendants, no one paid for its place in the cemetery" (translation by V. Codrea).

Arabu published a dozen papers on the geology, in particular on the stratigraphy of Cainozoic deposits around the Sea of Marmara, all authored as "N. Arabu" without any institutional affiliation. In his first paper (Arabu 1913), he distinguished Neogene deposits west of Istanbul "in two units separated by a conglomerate". The second unit, "starts with a conglomerate 20-25 m thick composed of pebbles from crystalline and metamorphic rocks, which yielded vertebrate bones (*Camelopardalis attica*? (Gaudry & Lartet, 1856) and large samples of silicified woods at the littoral cliffs between the harbours of Büyük and Küçük Çekmece". In the same cliffs, he also recorded many mollusc shells and dated these deposits to the Sarmatian. In another paper (Arabu 1916), he wrote that he found these remains of mammals two kilometers west to Ambarlı Village, which consist of "*Camelopardalis attica* and a molar of an antelope", and he correlated this locality with the early Sarmatian based on the mollusc faunas in the local stratigraphy. As we will see below, Father Nicolas subsequently collected lot of vertebrate fossils along the same cliffs and in the same conglomerates.

It was in the context resumed above that interest in vertebrate palaeontology started in the newly born Turkish Republic, and the region of Istanbul was the first area to be investigated, because Istanbul was the unique city of Turkey having a university to develop scientific research. Indeed, Earth Sciences started to be taught in Istanbul at the Medical School by Karl Eduard Hammerschmidt (Vienna 1801-Istanbul 1874), also known in Turkey as Macarlı Abdullah Bey, after his arrival in Turkey in 1850. He is considered to be the first scientist to have introduced geology and its concepts and terms to Turkey. Toward the end of the 19th century, Dr. Halil Edhem Bey (see above) continued teaching geology at Istanbul Darülfünun up to 1908. At the same university, the first Institute of Geology in Turkey was founded in 1916 by Walter Penck and Hamit Nafiz (see below), in the middle of the First World War, with the mission to teach earth sciences and to establish a natural history museum. In later years, this institute welcomed Ahmet Malik and Ernest Chaput, who were, as we will see below, pioneers in vertebrate palaeontology.

It is necessary to insert here a short note concerning family names in Turkey. Up to 1934, the family name did not existed during the Ottoman Empire reign and first years of the Turkish Republic. Instead of the family name, people were carrying religious, social, professional or family titles (Bey, Pasha, Effendi, Hodja, etc.) or the father's first name was added to the first name of the person. For this reason, the books and papers of Ahmet Malik Sayar published before 1934 are authored as Ahmet Malik.

After the initial discoveries of Miocene mammals by Arabu (1913, 1916), Ahmet Malik became interested in vertebrate palaeontology. His first discovery was a proboscidean tusk in a limestone quarry near Bakırköy in 1925. However, he also knew that in 1922 a merchant from Bursa, Tayyar Hasan and his friend Dr. Fikri Servet recorded some remains of a "Mastodon" (two molars, a fragment of tusk and some postcranial bone fragments), near Alibey Farm, north to the Küçükçekmece Lagoon, and that a professor from the Istanbul Robert College, George D. Hubbard, had retrieved these specimens with the intention of studying them. In his books (1926, 1932) that he wrote for teaching purposes, Ahmet Malik included a chapter on vertebrate palaeontology, and he illustrated the tusk from Bakirköy and other mammalian fossils from elsewhere. Hubbard (1931) briefly announced the discovery of "*Mastodon*" remains from Alibey Farm. Ahmet Malik understood the potential of Neogene deposits west to Istanbul for yielding vertebrate fossils, and he went prospecting any time that he had the opportunity, alone or together with his students, in particular around Bakirköy, Küçükçekmece, Ambarlı and Çukurçesme, where several stone and sand quarries were still active (see map in Chaput 1936: fig. 20 for the geographic position of these quarries) or along

the shores of the Sea of Marmara and Küçükçekmece Lagoon where some natural outcrops existed.

Who is Ahmet Malik Sayar? He was born in Istanbul in 1892 to an intellectual family (his father Salih Zeki was a well-known professor of mathematics). After his studies at the renowned Galatasaray High School, he went to Lyon (1910-1913) to study geology with Professor Charles Depéret (1854-1929). He participated in the First World War as a reserve officer on the Sinai Front. From December 1918 until 1944, he taught earth sciences in various schools of the University of Istanbul, and later on at the Istanbul Technical University up to his retirement in 1963, where he also held senior positions as Director of the Institute of Geology and Dean of the Faculty of Mine. He died on March 11th, 1965 (Anonymous 1966). He wrote several books for teaching purposes on Mineralogy and Geology (in particular Malik 1926, 1932) and, together with Damat Kenan, another professor at Istanbul University, they established and published the first geological map of Turkey in 1920 at a scale of 1/1 500 000 (Timur 2012). This is a 70 × 92 cm colour map, printed at the workshop of Matbaa-i Amire in Istanbul and annotated in Arabic letters. The authors mention that the geological data are partly inspired from the studies of Tchihatcheff, Philippson and Tolani.

At the University of Istanbul, Hamit Nafiz Pamir (1892-1976) was another renowned professor, mainly dealing with structural geology. The papers on the Küçükçekmece locality and fauna resulted from their collaboration (Figs 2; 9).

Being a native of Istanbul, Ahmet Malik was particularly interested in the geology of the Istanbul area and thus, he was also informed about previous discoveries of Neogene vertebrates, being aware of their interest for dating sedimentary formations and to yield evidence regarding past biodiversity in the region. Let Ahmet Malik himself tell how he discovered the locality of Küçükçekmece. "These two important discoveries showed the presence of not only invertebrate fossils in Neogene deposits of Istanbul, but also vertebrate animals. To find the original beds of this fauna became the principal occupation of our institute, particularly during the last years. This research has been successful in the spring of 1932. During a field course with our students from the University of Istanbul on April 12th, 1932 in the morning, I observed *Mastodon* bones and tusk fragments in a trench near the Küçükçekmece village. From this moment, we started a systematic research and excavation campaign which resulted in the recovery of what we called the Küçükçekmece vertebrate fauna" (Malik & Nafiz 1933b: 4; translation by the author). The locality is situated on the eastern bank of the Küçükçekmece Lagoon about 15 metres above the lagoon level on the flank of a small hill. The railway line of the famous Orient Express passes at the foot of the hill, and the Küçükçekmece Station is 22 km from its terminus at Sirkeci station in Istanbul. From Istanbul University, it is possible to come daily to the site by train as well as by bus. Excavations started in April but lasted several months. The spring is a busy period for university members and students, and also a rainy season which hinders fieldwork. It was difficult to take out fossils from their cemetery

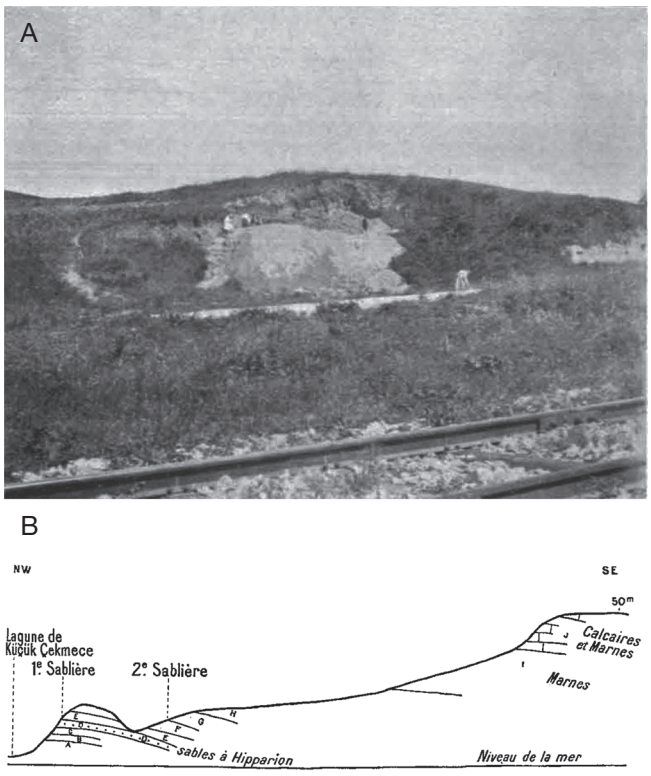

FIG. 8. — **A**, Fossiliferous site of Küçükçekmece during the excavations in 1932 (after Malik & Nafiz 1933b); **B**, Stratigraphy of the section across the fossiliferous horizon (after Chaput & Gillet 1939).

because they get fragile due to wet conditions. Consequently, they consolidated them with a sodium silicate solution and, if necessary, wrapped them in plaster jackets to carry them to the laboratory.

"Bones are preserved in a sandy horizon which overlies greenish plastic clays. The sandy horizon with bones is about two metres thick and is composed of loose quartz sands. Remains of a *Mastodon* skeleton were found lying at the bottom of these sands and adherent to the top of the clayey horizon. The lower part of the sands yielded well-preserved remains of animals similar to those of Pikermi, but different in including fishes and marine mammals together with teeth, jaws and bones of terrestrial mammals" (Malik & Nafiz 1933b: 14; translation by the author). The same sands also included, in addition to vertebrate bones, shells of abundant lake, sea and rarely land molluscs that Malik & Nafiz (1933b) identified as belonging to the genera of *Unio* Philipsson, 1788, *Mactra* Linnaeus, 1767, *Melanopsis* Férussac, 1807, *Hydrobia* Pennant, 1777, *Neritina* Lamarck, 1816, *Planorbis* Muller, 1774 and *Helix* Linnaeus, 1758.

The fossils were prepared in the laboratory of the Institute of Geology, mainly by Necmiye Hanim and, they were ready to be studied in autumn of 1932. How to study such a rich assemblage? Ahmet Malik and Hamit Nafiz were geologists and were not trained in vertebrate palaeontology. In addition, there was nothing in Istanbul to compare with the Küçükçekmece fossils, which is an absolute necessity for identifying the taxa represented in this fauna. Another problem was the literature

on Neogene vertebrates, which is almost totally absent from the libraries of Istanbul University. Ernest Chaput (1882-1943, Fig. 6B; Akyol 1944), then invited professor at this university, advised them to go to the Paris Natural History Museum. He knew well that at this museum there are rich collections of fossil vertebrates of similar age from Greece (Pikermi and Salonique), Iran (Maragheh) and France (Mont Lubéron) amassed during the past years by Gaudry, Mecquenem and Arambourg. At the Paris Museum, there are also renowned specialists of vertebrate fossils and a long tradition of receiving foreign colleagues. Chaput wrote letters to Professor Marcelin Boule, director of the Palaeontology Laboratory to ask advice and permission for his Turkish colleagues. The authorities of Istanbul University encouraged this trip with financial support. The Küçükçekmece fossils were packed into two large boxes and sent to the Natural History Museum of Paris. Ahmet Malik and Hamit Nafiz travelled there and stayed several months in Paris. I did not find in this Museum the records of 1932-1933 for visiting researchers. Their visit to Paris should be between September 1932 and March 1933. They studied the Küçükçekmece fossils and compared them with all similar fossils that this Museum housed. Professors Marcelin Boule and Camille Arambourg, both eminent specialists of fossil vertebrates, helped them with identifications. Before leaving Paris, they left a short note on their preliminary results that E. Chaput communicated at the meeting of the Geological Society of France, in March 20th, 1933 (Malik & Nafiz 1933a).

On their return to Istanbul, Malik & Nafiz (1933b) published the results of their studies in a fascicle of 120 pages with one map and 16 plates in the "Bulletin de la Faculté des Sciences de Istanbul». In both papers, the geological part is mainly done by Hamit Nafiz, while the palaeontological part is written by Ahmet Malik.

In this work, they presented first of all the locality, its geological context and its position in the local stratigraphy, followed by a chapter on taphonomic conditions of fossils. Then, the vertebrate taxa included in this assemblage are described one after another and compared with their equivalents from elsewhere. They identified 23 species of mammals, four reptiles and some undetermined fishes. This chapter is completed with a discussion on the similarities of this fauna with those from classical late Miocene localities such as Pikermi, Salonique, Samos in Greece, Maragheh in Iran and Erenköy in Turkey. They concluded that this fauna accumulated in fluviatile deposits, its age is late Sarmatian, and the depositional environment of the fossiliferous sands was estuarine or deposited near the mouth of a river, where the remains of land and marine vertebrates and invertebrates are mixed. A few years later, Chaput & Gillet (1939) described the molluscs of Küçükçekmece and reached the same conclusions dealing with the age and environment of the fossiliferous sands (Fig. 8).

Beyond the description of a rich and diverse late Miocene fauna, the work of Malik & Nafiz (1933b) is remarkable in being the first complete work on a vertebrate fauna encountered in Turkey, and it is also the first vertebrate palaeontology work done by Turkish scholars. After their stay in Paris, Malik & Nafiz carried back the Küçükçekmece fossils to Istanbul and stored them at the Institute of Geology. Unfortunately the building of this institute was totally destroyed by a fire in 1942, and most of the fossils from Küçükçekmece were lost.

In later years Ahmet Malik, known as A.M. Sayar after the 1934 Surname Act, continued prospecting the Istanbul area for other vertebrate fossils. He succeeded in obtaining some new fossils from the same locality and others from the overlying Bakirköy limestones. In a short note, Sayar (1953) described some of them, i.e. an upper jaw fragment referred to *Machairodus aphanistus* (Kaup, 1832) (actually it belongs to a hyaena, see Peigné 2016), a series of upper cheek teeth referred to *Aceratherium* sp., and some vertebrae of Cetacea. The president of the Turkish Republic Celal Bayar visited Istanbul Technical University in June 1952, and on this occasion, Professor Sayar presented him with some elephantine cheek teeth and tusk fragments from Küçükçekmece. His student, and later on his second wife Cazibe Arıç-Sayar started under his supervision a PhD Thesis on the Neogene deposits of Istanbul Peninsula that she defended in 1955. In the context of this study, she established a detailed stratigraphy of Neogene deposits using all available artificial and natural outcrops, and she correlated them using lithological and palaeontological criteria (see Lom *et al.* 2016). During this study, she also discovered vertebrate remains in some of the studied outcrops, in particular at Küçükçesme, Çukurçesme (= Rami), Mahmutbey, Zeytinburnu Cement Factory and Vidos quarry. In her PhD Thesis (Arıç 1955), she illustrated some specimens of large mammals from these sites, however without description. In another paper (Arıç-Sayar 1957), she provided the list of mammalian taxa and molluscs from the same outcrops.

During the years 1944 to 1950, Ismail Yalçınlar (1915-2003, Fig. 6D) prospected Neogene deposits of the Istanbul Peninsula and collected vertebrate fossils in many quarries and natural outcrops. Yalçınlar (1951) found in the quarry of Çukurçeşme some tusk fragments and cheek teeth of "*Mastodon*", cheek teeth of rhinoceros and *Hipparion*, horn-cores and cheek teeth of antelopes and a molar of a carnivore, associated with the remains of turtles and fishes. Of these fossils, he described and illustrated some proboscidean teeth (Yalçınlar 1952a, b) and referred them to *Synconolophus serridentinoides* Viret & Yalçınlar, 1952. Later on, Yalçınlar (1983) listed all vertebrate localities known at the time in Istanbul city and its western suburbs, adding some others to the sites mentioned above, in particular Süleymaniye (near the name bearing mosque), Avcılar cliffs, Kemerburgaz and Halkalı. In this work, the geographic and approximate stratigraphic positions of sites are given, together with preliminary identifications of fossils.

Rückert-Ülkümen & Kaya (1993) also explored the region between the Küçükçekmece and Büyükçekmece lagoons and established a detailed stratigraphy of sedimentary units that cover this region. In the context of their work, they discovered a diverse vertebrate fauna in a quarry situated in the district of Bahçeşehir (coordinates 41°03'39.6"N and 28°41'52.1"E) about nine kilometres to the northwest of the Küçükçekmece vertebrate locality. From this locality and from five others along the coasts of the Sea of Marmara, they described several

Fig. 9. — After the founding of the Geological Society of Turkey in 1947, a delegation of geologists visited the Çankaya Palace to present the newly born society to the President of the Republic Ismet Inönü. In this picture we can recognize, standing from left to right, Fuat **Baykal**, Ihsan Ruhi **Berent**, Kemal **Lokman**, Ismet **Inönü**, Ahmet Malik **Sayar**, Hamit Nafiz **Pamir**, Recep **Egemen**, Nuriye **Pinar-Erdem**, Ihsan **Ketin** and Cevat Eyüp **Taşman**, and staying, Mehmet **Akartuna**, Samime **Artüz-Özkan**, Berrin **Özman** and Şakir **Abdüsselamoğlu**. All these geologists are well known in Turkey. They greatly contributed to the geology of Turkey and occupied high positions in Turkish institutions and universities. This picture was first published as cover page of Yeryuvarı ve Insan (1985, vol. 10, fasc. 1, 2), a popular journal published by the Geological Society of Turkey (courtesy of Prof. Mehmet Namık Yalçın, Istanbul University).

middle-late Miocene fish otoliths, and they provided a preliminary list of 33 taxa of mammals from Bahçeşehir, mostly indeterminate. This material is housed at the Natural History Museum of the Bayerische Staatssammlung für Paläontologie und Geologie, in Munich. Another work on fish otoliths is that of Çevik Üner & Özkar Öngen (2009) on the material from the Çukurçeşme Formation exposed at the southwestern shores of the Küçükçekmece lagoon and nearby seashores. These authors identified 24 species of fishes with a mixture of freshwater and brackish elements.

The best collection of vertebrate fossils from Küçükçekmece was assembled by Father Jean Nicolas (1923-1994). The National Museum of Natural History in Paris preserves this rich collection, composed of over a thousand specimens. Father Jean Nicolas assembled this collection over the years when he was priest and teacher in catholic churches and French schools in Istanbul. Nicolas was born in the Morbihan Department in western France. As a child, he lived in Brest because his father was captain of the three-masted long course ships, which furrowed the Atlantic in the early years of the twentieth century. After his religious studies, he got allied with the Capuchins doctrine, and his church sent him in February 1951 to Istanbul to be priest at the Saint Louis church. Also, in the following years he taught History and Latin at the French School that became later Lycée Pierre Loti. He stayed in Istanbul up to 1968. Next to his professional activities, Nicolas was also in the editorial team of the catholic magazine Flambeau that changed its name in 1992 to "Présence". He also undertook historical research and published a booklet on Saint Joseph de Leonissa (Bailly 1994). Nicolas (1978) published a short note on the material he collected around the Küçükçekmece Lagoon. In this note he mentioned (p. 455) that "In 1957 we discovered and until 1967 regularly explored the locality of Neogene vertebrates, west of the current lagoon of Kutchuk-Tchekmedjè […] The fossiliferous deposit includes a series of successive fossil pockets outcropping with interruptions for several kilometres. Except at the northern end of the lagoon and west along the sea coasts, where it descends to sea level,

it is between 15 and 20 metres, according to the undulations of the terrain. This is apparently the same layer, part of which was washed away by erosion, which could be extended westward beyond the coastal village of Ambarlı" (translation by the author). In other words, Nicolas collected this material in the cliffs along the western shores of Küçükçekmece Lagoon and sea cliffs between the lagoon and Ambarlı Village. Nicolas (1978: 456) also notes that the fossils are derived from a 6-8 m thick sandy level in which some horizons "composed of gravel and conglomerate (poudingue) […] cemented by iron oxide with traces of manganese […] are more productive in fossils, in particular at the contact with the underlying clay". Descriptions given by Nicolas (1978) for the stratigraphy as well as for the lithology of fossiliferous deposits on the western side of the lagoon agree perfectly with that of the initial site of Küçükçekmece on the eastern side of the lagoon as given by Malik & Nafiz (1933b). In other words, all vertebrate fossils collected by Ahmet Malik Sayar between 1932 and 1953, and later on by Father Jean Nicolas between 1957 and 1967, are derived from the same sand-gravel horizon, bracketed between the underlying green clays and the overlying sands and clays of the Güngören Formation (see Lom *et al.* 2016). The other papers included in the present volume describe the specimens housed at the Istanbul Technical University and Istanbul University (collected by Mr and Mrs Sayar), and at the Natural History Museum of Paris (collected by Father Jean Nicolas).

CONCLUSIONS

Geological research in the Marmara Region began during the first part of the 19th century by scholars who were doing their "voyages d'études" to discover as yet little known countries. Palaeontology was also included in their focus, and they occasionally discovered fossil vertebrates. However, no one undertook systematic research and excavation for vertebrate fossils in the Marmara Region before Malik and Nafiz did at Küçükçekmece. The extent of the Cainozoic sedimentary formations in this region has an exceptional potential for Cainozoic fossil vertebrates. As we have just read in the paragraphs above, vertebrate fossils were discovered in almost every part of this region, their occurrence was reported in many papers and monographs, which mainly dealt with the geology of sedimentary deposits, as preliminary lists of identifications, because the main aim of these geologists was to determine the age of the deposits. In other words, the discovery of most vertebrate fossils in the Marmara Region was incidental to geological investigations or quarrying activities. The material from most of these sites has not been studied and consists of a few specimens found in outcrops. The localities richly documented and having a diverse fauna are as few as the fingers of one hand. And among these localities, Küçükçekmece stands out by its richness in fossil remains and the diversity of its fauna as shown by the articles that are included in this volume.

Why do we know so little about the vertebrate faunas of this region? This is certainly not due to the lack of outcrops, neither the scarcity of vertebrate fossils in this region more than elsewhere as Tchihatcheff (1869) believed. More than half the country is covered with Cainozoic sediments, The steppes of Thrace and of Troad provide vast exposures of Cainozoic deposits for such investigations. These are also numerous quarries where lignite or building materials were extracted, and the construction of new roads exposes fresh outcrops with high palaeontological potential all over the region. In fact, the scarcity of palaeontological discoveries is mainly due to the lack of interest by palaeontologists, the absence of vertebrate palaeontologists at Istanbul universities, and in summary to insufficient field investigation to record fossil vertebrates. There are at present 10 state universities and many other private ones in Istanbul, and some other large universities in the cities of Edirne, Tekirdag, Çanakkale and Bursa. The natural sciences have been taught at the Istanbul universities since the second half of the 19th century and for several decades in other universities. However, in the history of all Istanbul universities, there were only two scholars who were interested in vertebrate palaeontology and conducted research in the Marmara Region. These are A. M. Sayar and I. Yalçınlar; the first was a geologist, the second a geomorphologist. At present, there is no vertebrate palaeontologist in any institution of Istanbul, neither at the universities of other cities.

Concerning the exhibition of natural history, it boils down to a small "Museum" inside the Avcilar Campus of Istanbul University and one room and the neighbouring corridor at the Faculty of Mines at the Istanbul Technical University. However, an Austrian geologist and palaeontologist Karl Eduard Hammerschmidt, *alias* Macarlı Abdullah Bey, who refugied in the Ottoman Empire in 1849 after being involved in the October 1848 Vienna insurrection, founded a natural history museum at the School of Medical Sciences of Istanbul in 1871 (Abdullah Bey 1873; Şengör 2010). This museum was later transferred to the Vefa Palace where the first Institute of Geology became active. This building was burned on August 28, 1918, and all the Museum specimens were lost. The city of Istanbul, as well as the other cities of the regions, deserve more than this when compared to equivalent cities elsewhere. As mentioned above, the attempts to form fossil and mineral collections and to establish a natural history museum in Istanbul, this since the mid-19th century, all failed due to the lack of interest or because of ignorance on the part of political and academic leaders. Worse, several collections of fossils and rocks that the geologists of these universities did assemble, in the hope that they would one day be preserved and/or exposed in a natural history museum, were devoured by fires that frequently ravaged the city of Istanbul.

It is time for palaeontological research in the Marmara Region to receive new impetus. It is the most populated region of Turkey, and is also economically the richest. Therefore, cities and villages are gradually extending, and the lands are being increasingly occupied by all kinds of public and private amenities (roads, factories, shops, offices, etc.), and outcrops are progressively disappearing. However, Istanbul is also the city which has a great concentration of universities and other scientific institutions with high potential for the foundation of a natural history museum and development of natural sciences. It is never too late to start.

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