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Editorial

Neogene Park – Vertebrate Migration in the Mediterranean and Paratethys



The RCMNS Interim Colloquium “Neogene Park – Vertebrate Migration in the Mediterranean and Paratethys” was held in Scontrone (Abruzzo, Italy) on March 1–3, 2011. Its target was analyzing the faunal interactions between the Neogene terrestrial and marine domains in the Mediterranean and Paratethys. These areas are ideal to address issues related to migration and evolutionary mechanisms. An exceptional laboratory for the widest possible paleobiological and biological inquiry, where hypotheses and models developed not only by palaeontologists, but also by biologists, zoologists, eco-ethologists, and geneticists can be fruitfully tested. During the Neogene, the Scontrone territory was at the crossroads between central-eastern Europe and western Asia. It occupied a unique key position. The central Mediterranean was the pathway for many migrating life forms. It was where many faunal bioprovinces interacted. As the *wheel of time* turned, and ages came and passed, many memories were left behind. The dynamic interplay of sea level change, tectonics, sedimentation, and biological evolution created a tapestry blessed with the extraordinary geological and paleontological witnesses. Some of them are the charms of Scontrone’s surroundings (Fig. 1).

Over the last 20 years, several fossil taxa have been freed from the Miocene limestones that crop out in the outskirts of Scontrone (Fig. 2). The same taxa, plus many other species, had also been found in earlier years in the richly fossiliferous karstic fissure infillings of the Gargano Promontory. The new finds from Scontrone revived the debate on a number of unsolved issues, e.g., modes of island colonization by vertebrates, causes and mechanisms of insular endemization, methods for detecting the source areas and ancestors of insular species.

The fossil taxa from Scontrone and Gargano include crocodiles, chelonians, snakes, giant birds, small mammals, giant insectivores, small carnivores, as well as numerous artiodactyls. Most of them are endemic, proving the existence of a vast Abruzzo-Apulian paleobioprovince which resulted from the surfacing of a paleogeographic domain known as the Apulian Platform. The land remained isolated from the circum-Mediterranean mainland areas for long lapses of time. In the course of the Neogene, extensive paleogeographic disruptions, plus intense climatic-driven paleoenvironmental changes in the Paratethys and Mediterranean, caused radical modifications in all ecosystems. These were the background events that framed the migration of the taxa, as well as all the other local biological dynamics.

The idea of organizing such a far- and wide-ranging international conference at Scontrone was certainly not accidental. It was

meant to let the residents share in the extraordinary breakthroughs of the researchers. It also intended to make local inhabitants aware of the great patrimony they are called to protect and defend. Scontrone is a small mountain village in the Apennine of Abruzzo (Fig. 1). At the start of the twentieth century, most of its people emigrated, fleeing the poor conditions of the impoverished mountain areas. The population decreased from 1600 to 600. Heartbreaking stories, which are told by Scontrone’s world-famous murals. In spite of this intense emigration, the hamlet proudly maintained its cultural identity, built up through the long, respectful relationship with its territory.

The first fossils (a few rib fragments and a couple of crocodile teeth) were found in 1991 by Elmo Di Vito, a ranger of the National Park of Abruzzo, who lives in Scontrone. Mr. Di Vito reported the discovery to two paleontologists of the University of Florence (P. Mazza and M. Rustioni) who were there working on the extant bears of Abruzzo. Excavations started within the year, and then were conducted on a yearly basis. Several institutions collaborated in the recovery of the fossils: the National Park of Abruzzo, the Museum of Geology and Paleontology of the University of Florence, the Regional Board of the Ministry of Cultural Heritage and Cultural Activities, and the Municipality of Scontrone. Well aware of the scientific relevance of the discovery, the officers of the Regional Board of the Ministry of Cultural Heritage and Cultural Activities (S. Agostini and M.A. Rossi), with the collaboration of the palaeontologists of the University of Florence, did their best to protect the site. They also found an appropriate location to store and expose the numerous specimens that were being recovered.

In 1993, the protection of the site of Scontrone was granted by a specific decree of the Ministry of Cultural Heritage and Cultural Activities. Then, in 1994, an exposition of the fossils from Scontrone was held at the Center for Visitors of the National Park of Abruzzo, at Pescasseroli. In those years researchers of the University of Pisa were involved (E. Patacca and P. Scandone) and started studying the geology of the area. Their aim was defining the stratigraphical position and age of the fossil-bearing levels, but also the paleoenvironmental contexts wherein the bone-beds had formed. Since 2001, the collaboration benefitted greatly from the active support, encouragement and participation of the Municipality of Scontrone (Mayor P. Melone). Between 2003 and 2006, a museum facility was created in the village of Scontrone. The facility was called “Center of Paleontological Documentation *Hoplitomeryx*”, and was meant to store all the specimens recovered from the site. In this structure, explanatory panels illustrate the



Fig. 1. Panoramic view of Scontrone.

site's stratigraphy. An eye-catching diorama, made by A. Mangione, with a reconstruction of Scontrone's original Miocene habitat, is also exposed in the Center. The diorama attracted the attention of the National Geographic magazine (April 2007 issue). A "Geological and Territory Trail", i.e., an about 1 km-long open air pathway, leads from the Center to the fossiliferous site. Panels and explanatory notice boards, with information on the local geology and on the surroundings, are positioned at specific stops along the trail. The site is exposed to visitors and is protected by a movable cover. The museum facilities, the trail and the fossiliferous site protection were made possible by financial aid from the Region of Abruzzo, the Province of L'Aquila, the Mountain Community Alto Sangro and Altopiano Cinquemiglia, the Territorial Agreement Sangro-Aventino, and the Ministry of Cultural Heritage and Cultural Activities, but also from the Integrated Territorial Projects. When the Center of Paleontological Documentation

was inaugurated, the Municipality proposed to organize an international conference at Scontrone, to appropriately inform the scientific community of its extraordinary geo-paleontological assets. The proposal started to come true already in 2005, when a scientific conference meant to address the many issues of Neogene land vertebrate migrations in the Mediterranean began to be planned.

In 2006, an excursion to the paleontological site of Scontrone was included in the 83rd Summer Meeting of the Italian Geological Society, which was held in Chieti. The site elicited a great interest and was very much appreciated by the attendees. This was read as an encouragement to take decisive steps towards the organization of an international meeting. Hence, an Organizing Committee was generated and the targets were clearly specified. The first goal was creating a forum for paleontologists and geologists to exchange opinions and possibly find joint solutions to open issues, such as



Fig. 2. The Scontrone fossil site as it appeared during summer excavations (above) and conference excursion on March 2011, 4th, (below).

the age of colonization of the Abruzzo-Apulian land, the source areas of the faunas, the ways of immigration. With the generous financial aid of local authorities, many of the problems that are usually met when organizing scientific meetings were solved. At the end of the summer 2009, Giorgio Carnevale kindly accepted to collaborate in this endeavour as Secretary of the Organizing Committee. He gave notice of the meeting and of its agenda, kept in touch with the attendees, and personally collaborated in the editing of the conference Proceedings.

On March 1, 2011, the small village of Scontrone, which was already covered by a thick layer of snow, welcomed the RCMNS Interim Colloquium attendees under an intense snowstorm. Nonetheless, the villagers offered their warm and generous convivial hospitality, creating the most friendly atmosphere for productive discussions among researchers of different fields and with different and often opposite opinions. A popular illustration of the sites of Scontrone and Palena was given on the last evening of the Conference. Many villagers participated in the event, showing that the meeting was of great cultural interest also to laypersons.

The RCMNS Interim Colloquium “Neogene Park – Vertebrate Migration in the Mediterranean and Paratethys” confirmed the importance of basing inferences upon different, mutually supportive records. Modern scientific research is increasingly relying on multi-proxy and interdisciplinary investigations. The Scontrone meeting can rightfully represent a first step in the direction of the implementation of multi-proxy research programs in the analysis of geological and paleobiological topics.

While the main focus was on central Mediterranean continental vertebrates, examples from other areas, including Africa, Middle East, Armenia, Russia, Turkey, and United States added a broader comparative perspective to the discussion. By integrating evidence across multiple geo-paleontological disciplines, including systematics, evolutionary paleobiology, functional morphology, ecology, paleoclimatology, stratigraphy, sedimentology, isotope geochemistry and regional geology, the speakers provided a rich and multifaceted overview of the Mediterranean and Paratethyan terrestrial and aquatic diversity, paleobiogeography, and paleogeography.

The 14 papers published in this *Geobios* issue reflect the broad spectrum of research approaches and perspectives explored by the authors to describe the Neogene paleogeographic, paleobiogeographic and paleobiodiversity patterns of the Mediterranean area. Nine of these papers are focused on the Abruzzo-Apulian paleobioprovince.

Patacca et al. (2013) present an accurate stratigraphic and paleoenvironmental analysis of the Miocene vertebrate-bearing Scontrone calcarenites. According to the new data presented, the vertebrate remains accumulated in marginal marine deposits within a complex wave-dominated river-mouth setting developed over a flat and semi-arid carbonate ramp. The Tortonian age of the fossil vertebrates is demonstrated based on a regional stratigraphic correlation.

Delfino and Rossi (2013) provide a description of the crocodylid remains found at Scontrone, documenting what appears to be the oldest evidence of the genus *Crocodylus* in the European record, and also demonstrating that this reptile reached Europe during the Tortonian.

Mazza (2013) revises the phylogenetic relationships of the Hoplitomyzidae and hypothesizes that these enigmatic mammals are not closely related to the cervids and likely represent the sister group of two large clade, one formed by the Bovidae, Cervidae, Moschidae, and Palaeomyzidae, the other formed by Antilocapridae, Giraffidae and Climacoceridae.

Pavia (2013) describes the anseriform and charadriiform remains from the Terre Rosse fissure fillings, recognizing two taxa of the family Anatidae and two taxa belonging to the Scolopacidae.

A new Miocene small mammal assemblage from the Terre Rosse fissure fillings of the Gargano is documented by Masini et al. (2013). This new assemblage represents the oldest evidence of the Gargano faunal assemblage, thereby providing new perspectives for a more reliable interpretation of the tempo and mode of dispersal of the forerunners of the Gargano fauna.

Villier et al. (2013) describe a new species of the giant hedgehog *Deinogalerix* from Gargano and discuss the affinities of this genus with *Parasorex*.

Savorelli (2013) discuss in great detail the taxonomy of the endemic cricetids of the Terre Rosse fissure fillings of Gargano, providing further evidence of their remarkable increase in size through time.

Masini and Fanfani (2013) present a new genus and species of endemic galericine moonrat from the Terre Rosse fissure fillings of Gargano and suggest that it derived from a carnivore *Parasorex*-like ancestor.

A paleobiogeographic discussion about the colonization of the Gargano is presented by Freudenthal et al. (2013) who suggest that rafting constitutes the most plausible way for the colonization of this Mediterranean large island.

Colombero et al. (2013) present the rodent assemblage from the Messinian post-evaporitic deposits cropping out close to Verduno, in the Tertiary Piedmont Basin, and discuss its stratigraphic, paleoenvironmental and paleobiogeographical significance.

Palombo et al. (2013) provide a comprehensive review of the fossil endemic bovids of Sardinia and Balearic Islands, evidencing the relevant evolutionary and paleobiogeographic differences that characterized these insular districts during the Tertiary.

Using multiple techniques, Winkler et al. (2013) infer the paleodietary regimes of four chronospecies of the extinct bovid *Myotragus*, endemic to Mallorca and Menorca Islands, and identify a dietary change resulting from a gradual adaptation to the limited resources of the insular environment.

Agustí et al. (2013) analyze the environmental and ecological causes that triggered the Late Miocene Vallesian mammal turnover in Europe, excluding any linear relationships between climate change and faunal turnover, and proposing that the final decline of the Vallesian chronofauna was in some ways related to critical conditions at ecosystem scale.

Last, Sen (2013) reviews the Eurasian record of mammal taxa that originated in Africa, and discusses the dispersal dynamics related to the colonization of Eurasia throughout the Cenozoic.

In conclusion, this *Geobios* volume includes the results of new geological and paleontological researches and demonstrates their relevant interest for a better and more detailed understanding of the paleobiodiversity, paleogeography and paleobiogeography of the Mediterranean realm during the Neogene.

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