Romanian Society of Paleontologists

Acta Palaeontologica Romaniae (VII), 2011

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## Foreword

The present volume of Acta Palaeontologica Romaniae groups some of the contributions to the 7th Romanian Symposium of Paleontology. The symposium was organised by the Romanian Society of Paleontologists together with the Department of Geology, Babeş-Bolyai University in the autumn of 2009, at Cluj. This volume is dedicated to Prof. Ovidiu Dragastan at his 70th anniversary. Professor Dragastan is a remarkable personality of Romanian paleontology; at the same time, he was the organiser of the first National Symposium of Paleontology (Bucharest, 1997) and the editor of the first issue of Acta Palaeontologica Romaniae. This initiative has been continued since then on a biennial basis, at Cluj, Iaşi and Bucharest; here we are now, closing the issue containing the contributions of its 7th edition.

The current volume contains 32 scientific contributions. All the papers have been submitted to peer-review for enhancing their quality. Most of the authors have updated their manuscripts based on the suggestions of the reviewers; however in some cases, the authors have taken the liberty to decline significant part of their major remarks. This, besides the original quality of the manuscripts, as well as our intention to publish all the submitted papers, with no exception, has finally led to certain heterogeneity throughout the volume. However, we consider that the current issue represents a faithful illustration of the present level reached by paleontological research in Romania.

At the end of this short preamble, we would like to express our special gratitude to our main sponsor, ROMGAZ S.A., who supported financially both the symposium, and the publication of this volume.

Cluj-Napoca, November 22, 2010

**Prof. Dr. Ioan Bucur**
**Corresponding Member of Romanian Academy**

# PROFESSOR OVIDIU DRAGASTAN AT 70 YEARS

The period after the Second World War was extremely prolific for studies related to carbonate rocks, in direct correlation with the discovery of large reserves of hydrocarbons hosted by this type of reservoirs. Jean Cuvillier was the first to publish, at the beginning of the '60es, microfacies studies, while Erik Flügel has perfected this type of investigations by elaborating a new, complex methodology. In the 7th and 8th decades of 20th century numerous papers and some valuable monographs have been published focused on carbonate microfacies; several PhD theses were also dedicated to this topic.

In Romania, following a few sporadic approaches of regretted Dan Patrulius, the beginning of systematic microfacies research is undoubtedly related to Professor Ovidiu Dragastan. The first step was represented by his doctoral thesis on the carbonate deposits of Upper Jurassic – Lower Cretaceous in Hăghimaş Mountains (the thesis was subsequently published as the first microfacies atlas in Romanian references). This was followed by more detailed studies on carbonate rocks, on larger stratigraphical intervals (from Paleozoic to Cenozoic, however the most important contributions being still related to Mesozoic), as well as on the investigated subjects (from micropaleontological studies on the carbonate shelf microfossils to synthetic works on the evolution of large areas of carbonate platforms and their integration in structural frameworks).

Nevertheless, the most important contributions of Professor Dragastan are still the ones resulting from his studies on calcareous algae. Practically, no fossil algae group was left behind in this enterprise: from dasycladaleans, to bryopsidaleans and charophytes within green algae, to corallinaceean red algae and marine and freshwater cyanobacteria. Based on his studies on calcareous algae, Professor Dragastan was acknowledged as one of the experts in this field, worldwide. He is the author of numerous new species and genera of fossil calcareous algae (especially of cyanophyceans and green algae) but also of new suprageneric taxa. Through his activity, Professor Dragastan has underpinned the study of calcareous rocks in Romania; additionally to his personal valuable contributions, he has also provided a favourable environment for the approach of this type of studies by other researchers.

Personally, I consider myself as a disciple of Professor Dragastan. I benefited of his effective support at the beginning of my activity as a researcher; subsequently I was honoured to become his collaborator for several papers on calcareous algae. And I was not the only one: his numerous undergraduate students (when working at their diploma theses), Master students (dissertation theses) and PhD students (doctoral theses) have, on their turn, benefited of his vast knowledge and experience.

If at the beginning of the 7th decade of the last century, in Romania the knowledge on carbonate rocks was at least precarious, today there is a multitude of published data and an extended knowledge on limestone formations; with no doubt, the activity of Professor Dragastan has to be acknowledged as the greatest merit for this achievement.

The 70th anniversary represents, for each person, a time to summarize achievements; at the same time, it also represents a motivation for synthetic and monographic approaches. For Professor Dragastan this approach is not a new one: he has applied it already in the last years, and we are sure that he will not stop from doing this in the future.

Happy birthday, dear Mr. Professor with lots of good health, and with new achievements in scientific research!

**Prof. Dr. Ioan I. Bucur,**
**Corresponding member of Romanian Academy**

# PROFESSOR OVIDIU N. DRAGASTAN: A CAREER IN GEOLOGY AND PALEONTOLOGY

Professor Ovidiu N. Dragastan was born in Bucharest in 1939, the same year the French Centre National de Recherche Scientifique (CNRS) was founded, raised and educated in Bucharest, in a city he witnessed in a troubled time interval for the whole Eastern Europe, that of the communist rule. To understand his career and his professional achievements, such a difficult time period has to be taken in consideration, when ideology, suspicion and reversed values ruled, and when human quality was quite a burden. Only after 1989 his achievements began to be acknowledged in his native country, and his place among valuable, senior Romanian geologists could be found. Certainly, it is very difficult, if not impossible, to outline such an outstanding career, but I think that a series of remarkable traits should be underlined about the career of Professor Ovidiu Dragastan. First, his contributions in fossil algae and carbonate microfacies were the result of a pioneering, deep scientific activity, in the pursuit of a profound passion for these fields, as they are witnessed by a long, substantial list of seminal publications. Secondly, he managed to organize and to express in publications such a scientific career in a hermetically sealed country, such as communist and later savagely stalinistic Romania was during the Ceausescu's regime, gaining an international status even before 1989, a rare performance for Romanian geologists. And last but not least, he loved teaching, and he always gave memorable courses and talks, as all of his students, me included, can easily acknowledge.

Professor Dragastan was a student of "Ion Neculce" highschool, and since 1957 an undergraduate and respectively a graduate student in 1962 of University of Bucharest in Geology (then Faculty of Geology and Geography, School of Geology). Professor Dragastan received his PhD title in 1971, with a thesis on Jurassic and Cretaceous calcareous algae from Bicaz Valley, in the Eastern Carpathians. He received his full professorship in 1993, as a recognition of his academic activity that encompassed all university levels, from Demonstrator (1962-1968), Assistant Professor (1968-1975), Lecturer (1975-1990), and Associate Professor (1990-1993). He retired in 2004, but today he continues his research activity as usual, in fields he soon became a classic: Paleoalgology and carbonate microfacies.

Professor Dragastan's scientific contributions are expressed in more than 140 research papers and 11 books, covering mainly fossil calcareous algae and carbonate microfacies, as well as Paleobotany and Paleozoology, published since 1963 until today. Actually, his first paper, on Jurassic and Cretaceous nannoplankton was published together with Acad. Miltiade Filipescu, mentor and supervisor for his early works. His interest was first drawn by Tintinids and nannoplankton but soon and without leaving these topics, his attention shifted to Jurassic and Cretaceous calcareous algae of the Romanian Carpathians. This is how his first contributions on fossil calcareous algae of Chlorophyta (Dasycladales, Bryopsidales), Rhodophyta and Charophyta (Charales) were produced, describing and defining key associations of such organisms for the Upper Jurassic – Lower Cretaceous carbonate platforms of the Carpathians, Moesian Platform, Central and Southern Dobrogea. In the same time with his studies on the fossil calcareous algae, Professor Dragastan always kept an attentive look to carbonate microfacies, as a powerful tool for deciphering the reef environments and paleoecology of all structural units of Romania. He always correlated microfacies with biofacies, as undisputable tools for increasing the stratigraphic resolution and for paleoecological reconstructions. He also began to identify the lithostratigraphical and biostratigraphic units which will be refined during his later studies, for the special benefit of the oil, limestone and bauxite industry. All these fields of research were pioneered in Romania as well as abroad in that period of time. His early papers covered such topics in Apuseni Mountains, East Carpathians, South Carpathians and central Dobrogea, while the Moesian Platform followed quickly in investigations. Selected areas for his research were especially the Bicaz Gorges, the Haghimas Moutains, East Carpathians (subject for his PhD thesis defended in 1971 and published in English in 1975), Padurea Craiului (Apuseni Mountains), Bucegi (South Carpathians), and Central Dobrogea. Since the seventies, he began correlating carbonate platforms of Romania with those of Czech Republic and Slovakia, Spain, and Pakistan, as the Romanian carbonate platforms proved to be key sections for understanding the Tethyan paleobiogeography and evolution. As the number of research papers increased, and as their topics diversified, so was his national and international status, and by 1989, a fundamental year in Romanian recent history, Professor Dragastan had published already more than 75 research papers and books. Fortunately, until 1989 his papers were published predominantly in English and French, also in international periodicals, so their impact was substantial in his research fields, a rare ability and a rare outcome during those times of intellectual isolation and communist ideological pressure. His scientific productivity and his major contributions until 1989 should be understood in this precise historical and ideological context, in a country which would appear surrealistic and incomprehensible by today's social and democratic standards. Those were years of isolation, with short if inexistent literature exchange and access to mainstream scientific information. A positive role was played by the Alexander von Humboldt scholarship awarded yearly to Professor Ovidiu Dragastan between 1980-1990 with scientific help of Professor Erik Flugelfrom from Erlangen University, enabling him to contact the western scientists and to become familiar with their science and with their literature. Apart of this scholarship, the scientific results of Professor Dragastan in such a difficult environment can only be explained by his dedication and abilities for the subjects he researched, keys for success in any intellectual environment and in any type of society.

After 1989, the career of Professor Dragastan took a natural and expected impetus, as the social and ideological barriers were lifted and a new Romanian

society was already on its own way. His contacts with the international researchers were intensified, as well as his abroad trips and collaborations. An important step was the Fulbright Scholarship awarded in 1993 by the US State Department, for researching fossil algae in Boston with Professor Stejpko Golubic. His American experience was continued later with new collaborations and projects, such as those with Dr. Diane S. Littler and Dr. Mark M. Littler (Smithsonian Institution, Washington DC and Fort Pierce, FL) on algae from Palau (Pacific Ocean), with Dr. Lwellya Hillis-Colinvaux (Woods Hole), Professor Paul Silva (Berkeley), among many others. Germany was also the place for fruitful collaborations with Professor Detlev Richter (Bochum University), Professor Jorg Trappe (Bonn University) and Professor H.G. Herbig (Köln University), Professor Felix Schlagintweit (München University), as well as Slovakia, with Professor Milan Misik (Comenius University) and with Dr. Jan Sotak (Slovakian Academy), Egypt, with Professor Hassan Soliman (Assiut University), Greece and Turkey, among many other countries. In all these countries, he undertook paleoalgological and microfacies studies, with significant publications regarding systematics, taxonomy, paleoecology and stratigraphy of fossil calcareous algae and microfacies environmental reconstructions. In 1997 and 2000 he introduced three new families, Pseudoudoteaceae, Avrainvilleaceae and Rhipiliaceae, changing the status of the Mesozoic Porostromata algae, in peer-reviewed papers well received by the scientific community and recording a high number of citations.

His Romanian collaborators belong to universities of Bucharest, Iasi and Cluj-Napoca, as well as to research institutes, such as the Geological Institute of Romania. Professor Ioan Bucur, from Babes-Bolyai University was always a close collaborator in the field of microfacies and fossil calcareous algae, a true continuator of his work. Professor Theodor Neagu, member of the Romanian Academy, Professor Aurelia Barbulescu, Professor Ioana Pana are close collaborators and co-authors for an important monograph related to Central and Southern Dobrogea carbonates. Professor Justinian Petrescu, and Professor Razvan Givulescu, from Babes-Bolyai University in Cluj-Napoca, together with Professor Leonard Olaru, from A.I. Cuza University in Iasi, were also close collaborators in various fields of Paleobotany, co-authoring both research papers and textbooks in Paleobotany. Professor Dragastan's contributions in mainstream Paleobotany are related mainly to plant compressions systematics and taxonomy, as well as to silicified plants.

Membership to highly significant professional organisations such as IOP and AAPG consolidated his status, as well as the prizes he received, such as the "Grigore Cobalcescu" Prize of the Romanian Academy. Lots of taxa are bearing today his name, as well as many taxa dedicated to him too. Undoubtedly, in Paleoalgology and carbonate microfacies, he succeeded to put Romania on the map and to receive international visibility and recognition.

Professor Dragastan enjoyed teaching, and I always remember his course in Paleobotany, as he would use not only up to date information, but teaching tools as well. In a time when the overhead projector was barely known, he managed to show us color slides with recent and fossil plants and algae. He taught a lot of disciplines, but his most beloved were always Paleobotany and Palynology. Today, although retired, he still gives a course in Microfacies and Biostratigraphy for graduates, for the great gain of his graduate students. His textbooks in Paleobotany, with Professor Justinian Petrescu, and in Palynology, with Professor Leonard Olaru and Professor Justinian Petrescu are still unequaled in Romanian language textbook landscape, and I only regret that the language barrier hindered their international acknowledgement they deserved.

For his 70th anniversary, I wish him a Happy Birthday!

**Associate Professor Mihai E. Popa**
**University of Bucharest**
**Faculty and Geology & Geophysics**
**Department of Geology & Paleontology**

# L A U D A T I O

## UNIVERSITY PROFESSOR DOCTOR OVIDIU DRAGASTAN AT 70 YEARS

The 70th anniversary in the life of a university professor and researcher represents a threshold of scientific maturity and a solid basement for the assignment of the title of "**senior**" in the profession – in the case of Professor Dragastan, a career that was built with devotion and passion during 47 years.

Prof. Dragastan was born on February 22 February 1939 in Bucharest, where he has graduated the elementary and high school; between 1957–1962 he was a student of the Faculty of Geology and Geography, Section of Geology, of the University in Bucharest.

Given his remarkable skills as a student, firstly his passion for research and learning, after his university graduation he was invited to join the faculty, as trainer (1962) in the Chair of Paleontology and Stratigraphy of the same faculty. It was in this department that Prof. Dragastan performed afterwards his teaching and scientific activity, including today.

He has gradually occupied all the academic positions, which he has honoured with special teaching and scientific results; all these lead to the assignment, in 1993, of the title of **University professor**. Starting with 2004 he is **Consulting Professor (retired).**

In 1971 Prof. Dragastan has defended his PhD thesis on **"Upper Jurassic and Lower Cretaceous Microfacies from Bicaz Valley Basin", under the co-ordination of Acad. Prof. dr. Miltiade G. Filipescu**, his scientific mentor, finalized with the acceptance of the title of **"PhD in geology".**

**The thesis published in 1975, in English, in volume XXI of the series "Memorii" (Memoirs) published by the Geological Institute of Romania,** brought significant stratigraphical contributions concerning the Upper Jurassic–Upper Cretaceous carbonate deposits from the Bicaz Valley Basin, by the study of microfacies types and by the establishment of characteristic biozones based on dasycladalean algae and benthic and planktonic foraminifers, the latter being rare forms. The biozones established in this thesis provided new opportunities for regional correlations with other carbonate platforms, such as those from the Romanian Carpathians, Dinarides, Apennines, and Northern Calcareous Alps.

In parallel with his scientific activity, he performed **academic didactic activity**, starting with the first level, that of trainer, according to the old Romanian academic tradition; he achieved his "teaching training" under the co-ordination of Acad. Prof. dr. Miltiade G. Filipescu, who mentored him both didactically and scientifically. Among the disciplines that were taught by Prof. Dragastan, some following training stages abroad, we can mention: Paleobotanics, Palynology, Paleoecology and paleoenvironments, Elements of geology and paleontology, Stratigraphy and Reconstruction of paleoenvironments.

In order to allow a more detailed understanding and for scientific documentation in these topics, Prof. Dragastan has published – as single author or in collaboration, 11 books at different printing houses, among which we can mention: **Paleobotanică şi Palinologie** ("Paleobotanics and Palynology", multiplied, University of Bucharest, , 1975); **Palinologie - cu aplicaţii în geologie** – ("Palynology - applied to Geology"), in collaboration with Prof. dr. Iustinian Petrescu from Babeş-Bolyai University Cluj-Napoca and Prof. dr. Leonard Olaru from Al. I. Cuza University Iaşi (Editura Didactică şi Pedagogică, Bucharest, 1980); **Alge calcaroase din Mesozoicul şi Terţiarul Romaniei** ( "Calcareous algae from the Mesozoic and Tertiary of Romania", Editura Academiei Române, 1980); **Plante fosile** ( "Fossil plants")**-** in collaboration with Prof. dr. Iustinian Petrescu (Editura Dacia Cluj – Napoca, 1981); the chapters of **Paleontologie** ("Paleontology") (1984) and **Biogeochimie** ("Biogeochemistry") (1985) of Manualul Inginerului de Mine ("Treatise for Mining Engineers"), Editura Tehnică ; **Jurasicul şi Cretacicul din Dobrogea Centrală şi de Sud (Paleontologie şi Stratigrafie)** ["Jurassic and Cretaceous of Central and South Dobrogea (Paleontology and Stratigraphy)"] in collaboration with Acad. Prof. dr. Theodor Neagu, Prof. dr. Aurelia Bărbulescu and Prof. dr. Ioana Pană (Editura Supergraph, Cluj – Napoca, 1998), as well as **Miocene to Holocene calcareous algae of the Carribean area** (Editura Cartea Universitară, Bucureşti, 2007).

Additionally we can mention the scientific invited talks of Professor Ovidiu Dragastan at Ruhr University in Bochum (2000–2003) and Köln University (2004–2005), Germany.

**His scientific activity -** an essential component in the profile of a genuine university professor - was remarkably interrelated to his teaching interests. From the beginning, Professor Ovidiu Dragastan was interested in studying important and up-to-date fields of geology, which he continues to approach still today. Among these, one can include: **Microfacies, Carbonate platforms, Biostratigraphy** (Upper Paleozoic–Mesozoic–Cenozoic), **Reconstruction of paleoenvironments, Paleobotanics** and **Environmental geology.**

Related to these topics, Prof. Dragastan took part to several training stages at various institutions among which: Germany, as a grantee of Alexander von Humboldt Foundation, 1980–1990; at Ruhr University in Bochum, 2003–2003 and 2006, 2007, and recently in 2009; Köln University, 2004 – 2005, in USA through Fulbright Senior Awards, 1993–1994 at Boston University, and then at Berkeley University, 2001; at the Smithsonian Institution- Washington 2002 -2003, at Fort Pierce (Florida), 2003 and Smithsonian- Balboa, Panama, 2002.

The results of his research in these major areas of interest were published in 145 articles and studies, in Romania and abroad, among which 43 ISI-cited, and 11 books and treatises, among which some were already mentioned. Directly or via international collaborations, the 45 years of scientific activity of Professor Dragastan have contributed to the development of several new research trends in Romania, with theoretical or practical impact.

***These trends concern the following***: - **Mesozoic**

**and Cenozoic microfacies and carbonate platforms, - Lithostratigraphical analysis and definition of new formations in the carbonate units of Romanian Carpathians, Moesian Platform and the Romanian shelf of Black Sea**, with an emphasis on reservoir rocks and the mother rocks for hydrocarbons, as well as the types of traps, **Biostratigraphy,** with an emphasis on **evidencing the main biozones in Mesozoic deposits and their use for correlating the carbonate platforms in the Romanian Carpathians, Moesian Platform, Northern Calcareous Alps, Apennines and Dinarides.**

Another area that Prof. Dragastan has developed is **Paleoalgology**, resulting in the description of 3 new families, 36 genera and 260 species new for science of Mesozoic and Cenozoic calcareous algae.

His contributions to **Paleobotanics**, summarized by the description of taxa of various flora represented by fossil leaves and wood, with insight on the phytostratigraphy of Upper Paleozoic, Jurassic or Upper Cretaceous deposits, from Reşiţa–Moldova Nouă area, Codlea (Southern Carpathians), in collaboration with Conf. dr. Mihai Popa, then from Central Dobrogea (Middle Jurassic flora), in collaboration with Prof. dr. Aurelia Bărbulescu, as well as from Northern Dobrogea (the flora from Babadag Basin), in collaboration with Prof. dr. doc Răzvan Givulescu and Acad. Th. Neagu.

**Paleoenvironment reconstructions** for Mesozoic carbonate platforms in the Alpine-Carpathian area, as well as studies and research work on **Environmental protection** concerning the impact of mining works for bauxite ores in the Apuseni Mountains and designing new methods for rehabilitation of the mining areas were other of his significant research trends.

It is worthy to mention that several scientific papers were published as a result of international collaborations in the frame of Alexander von Humboldt Foundation, DAAD at Ruhr Universität Bochum, University of Köln, Freie Universität in Berlin (Germany), as well as of Fulbright Foundation and Smithsonian Institution, Washington, Fort Pierce, Florida and Balboa, Panama, to which we can add Berkeley University, Boston University and Miami University (USA).

**As a result of individual studies or of international collaborations,** by promoting new research directions and specialisations in Romania, we can underline the following main achievements of Professor Ovidiu Dragastan:

- Study of Upper Jurassic and Lower Cretaceous calcareous microfacies in Bicaz Valley Basin and reconsidering the ammonite, corals, sponges, gastropods and bivalves faunal associations, as well as microfloral – especially calcareous algae, and benthonic and planktonic foraminifers associations;
- Synthetic studies on Mesozoic algae from Romania, Germany, Turkey, Greece, Slovakia, Caribbean area (USA), Pakistan , Egypt and Morocco;
- Research on stratigraphy of bauxite deposits from the Northern Apuseni mountains, as well as environmental protection and mining areas rehabilitation;
- Lithostratigraphy and biostratigraphy of Jurassic and Lower Cretaceous deposits from the carbonate platforms of Romanian Carpathians, as well as of the deposits on the Romanian Black Sea shelf area;
- Of taxonomic and systematic importance is the description of three new for science calcareous algae families: ***Pseudoudoteaceae, Avrainvilleaceae*** and ***Rhipiliaceae ;***

A series of significant international contributions is related to the study of non-marine carbonate facies at the Jurassic–Cretaceous limit in Weserbergland area, NW Germany and from the Western Carpathians, Slovakia, as well as the study of calcareous algae associations from Palau Archipelagos (Western Pacific), or those from Key Largo and Miami (Florida) limestones, in collaboration with experts from Smithsonian Institution and University of Miami, Florida (USA).

As part of his scientific research, Professor Dragastan was involved in an impressive number of scientific internal and international contracts and grants (in some of them as project director) under the umbrella of the Romanian Academy, of CNCSIS-Romania, Ruhr Uni-Bochum, Smithsonian Institution and University of Miami.

Professor Dragastan was one of the **organisers of the 1st National Symposium of Paleontology in Romania, in 1997**, which took place at the Faculty of Geology and Geophysics of the University of Bucharest, organised by the Society of Paleontologists from Romania. He was also **the editor of the first Romanian paleontology issue - of the journal Acta Palaeontologica Romaniae**, today a publication of international recognition, currently publishing its 7th issue.

At the same time, Professor Dragastan has took part at numerous national and international scientific reunions, symposia and congresses (**Capri, 1991 Chairman**; Vienna, 1992, New Orleans, 1993; Denver,1994; Rio de Janeiro, 2001; Athens, 2007), being elected at some of these meetings as **Chairman** or **Scientific Judge.** He is member of some international research groups (Mesozoic biostratigraphy from Alpine carbonate areas), and member of some national and international scientific associations, such as: Society of Paleontologists of Romania, International Organization of Paleobotany, London, Geological Society of France, American Association of Petroleum Geologists, Tulsa, Oklahoma, USA, American Association for Advancement of Sciences, USA, as well as Alumni Humboldt Foundation, Germany. In recognition for his scientific results, Prof. Dragastan has been awarded several important **diplomas and distinctions**, among which: **"Grigore Cobălcescu" Prize of the Romanian Academy (**1983); **Honorary Diploma of the AAPG (USA)**; **"Emil Pop" Prize of the Society of Paleontologists of Romania** (2007); **Honorary Diplome of the Rectorate of the University of Bucharest** (2008) **for international cooperation and research, published in Micropaleontology, New York – ISI acknowledged, in collaboration with Prof. dr. Hans Georg-Herbig from Köln Unviersity.**

Currently, Professor Dragastan co-ordinates four PhD thesis. He plays an important role in creating the Collection of fossil calcareous algae, microfacies and microflora, consisting of 3,000 thin sections; the collections also preserves the holotypes of the 36 genera and 260 species new for science described from Babadag Basin, Central Dobrogea and Southern Dobrogea, as well as from other areas in the Romanian Carpathians, or other areas from Europe, Asia or

Caribbean (USA).

Besides these remarkable didactic and scientific results, Professor Dragastan has also been involved in **managerial tasks**, being Head of Department between 1996–2004 and Director of research in the topic Microfacies and geological environment protection.

At the celebration of seven decades of life and activity of our colleague, **Professor dr. Ovidiu Dragastan**, at the time when his whole activity is summed up, we can firmly state that he is an outstanding scientific researcher, with impressive didactic and scientific achievements, a symbol of professional devotion and one of the most notable experts of the Romanian School of Paleontology.

On this occasion we wish him good health and strength to continue his deed, in order to finalise his work as researcher and investigator of life tracks still unrevealed by the Romanian underground, through the same hard, detailed but full of beauty scientific labor.

**Professor Dr. Emeritus Leonard Olaru**
**Department of Geology**
**Al. I. Cuza University Iaşi**

## REPLY OF PROFESSOR OVIDIU DRAGASTAN


**PROFESSOR OVIDIU DRAGASTAN**

Dear Professor Agachi, Dear colleagues, Dear students, Ladies and Gentlemen,

First of all, I wish to thank you very much for your kind words, the appreciations about my educational and scientific activities, also my achievements with the occasion of my 70 th anniversary.

In the same way, I wish to thank for the Laudatio my colleague and friend Emeritus Professor Dr. **Leonard Olaru**, a renowned palynologist from Alexandru-Ioan Cuza University of Iaşi, for his kind considerations and appreciations regarding myself.

I thank my colleague Professor Dr. **Ioan I. Bucur** from Babeş-Bolyai University in Cluj -Napoca for successfully organizing, together with his young team of collaborators, two International Symposia of Romanian Paleontology.

Professor Bucur has worked together with me in the field of calcareous algae, we co-uthored several papers on fossil algae, some of them including descriptions of new species ranging from Late Jurassic to Early Cretaceous of the Carpathians.

My colleague is now a highly appreciated expert in the scientific world of paleoalgology, micropaleontology and microfacies.

I also thank my younger colleague Associate Professor **Mihai E. Popa** from our Department of Geology and Paleontology, Faculty of Geology and Geophysics, University of Bucharest, for his words and presentation concerning my activities. I always considered him as my disciple. He has been very active in organizing, up to now, two international meetings on Paleozoic and Mesozoic floras, being also deeply involved in significant projects dealing with Paleobotany, Palynology and Environmental Sciences.

Before I finish my replica to the presentations of my colleagues, I want to recall some important steps that have influenced my educational and scientific career.

During my activity spanning over 47 years, I was „lucky" in meeting genuine, great personalities in my field of research. These personalities had directly influenced me in discovering my path in science, finding directions and helping to apply new methods of investigations in the field of Paleontology and Sedimentary Geology. With this occasion, here and now, I present my homage and my gratitude to all of them. My first step dates back to 1963, as a beginner in the field of study on limestones of the Romanian Carpathians, together and under the supervision of my PhD co-ordinator, Academician Professor **Miltiade Filipescu (Photo 1),** at that time Chief of the Chair of Paleontology and Stratigraphy, Vice-Rector of the University of Bucharest and also Director of the Geological Institute of Romania.

Professor Filipescu introduced me to the study of marine calcareous microplankton (calpionellids and nannoplancton, genus *Nannoconus*), giving me the opportunity to meet Professor **Jean Cuvillier (Photo 2**) and to obtain his paper published in 1951 *Étude et utilisation rationelle de microfacies*, in Revue de Micropaléontologie, 4/1, p.112-118, Paris.

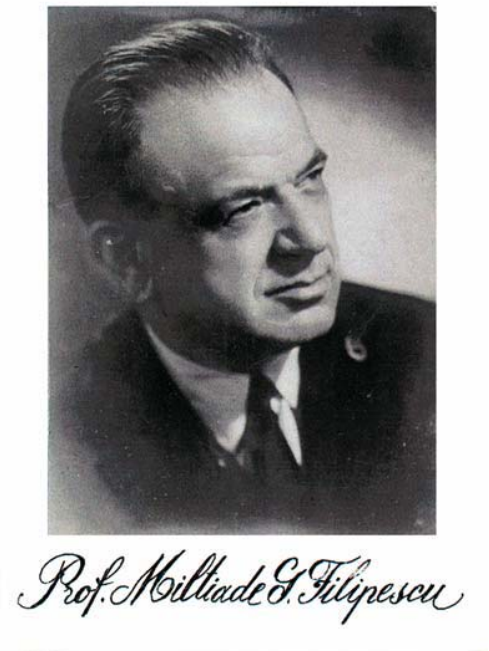


Photo 1 - Prof. Miltiade G. Filipescu


Photo 2 - Prof. Jean Cuvillier

Photo 3 - Prof. Erik Flügel

He also introduced me to the work of Professor **Michel Durand-Delga,** father of genus *Crassicollaria* - a genus with many species, who also described the stratigraphic value of calpionellids biozones from the Jurassic-Cretaceous boundary. Professor Filipescu aquainted me also to Professor **Marcel Lemoine,** a tectonician visiting the Geological Institute of Romania, in Bucharest. The last two were my tutors for becoming a member of the Société géologique de France, but only for 1969-1970, as at the time, I had no possibility to pay my dues to continue remaining a member of this professional organization.

The second important step forward in my scientific career was provided by a field trip organized in 1978, when crossing the Romanian Carpathians with a group of undergraduate students and geologists from Erlangen University (Germany) lead by **Professor Erik Flügel (Photo 3)** and his team including Professors Zeiss and Groiss.

On this occasion I have met Professor Flügel, a remarkable personality and a high profile geologist, editor of famous scientific journals such as ***Facies*****,** who also published two essential books on Microfacies and Limestones: *Mikrofazielle Untersuchungs- methoden von Kalken*, 1978, 454 p., Springer Verlag and *Microfacies of Carbonate Rocks*, 2004, 976 p., Springer Verlag. In *Facies* (Vol. 4, 1981), I have published a synthesis paper entitled *Mesozoic Dasycladaceae from Romania, distribution and biostratigraphical importance*, a paper launching me in the field of calcareous algae and microfacies. I am indebt to Professor Flügel for his confidential recommendation for obtaining a Humboldt scholarship in 1980; I acknowledge his support a lot, and I always remember meeting him, his family and his collaborators in Erlangen.

Starting with 1981, until today I was involved in many international projects dealing with Mesozoic carbonatic deposits, with emphasis on their micropaleontological content (Jurassic - Early Cretaceous algae, foraminifera, microproblematics). I was involved in such projects with Professor **Hans Mensink** and his collaborators, Professor Dorothee Mertmann and Dr. Eleonore Juber, from the Bochum University. I wish to recall the collaboration with Professor **Jörg Trappe** (Bonn University) regarding the Sinemurian algae of North-East Iberian Chain (Spain), a project finalized in 1986, the one with Professor **Hans-Georg Herbig** (Köln University), with whom I have published two papers on species of the *Halimeda* Group (2005, 2007) from the Paleogene of Central High Atlas (Morocco) and with Emeritus Professor **Milan Misik,** of Jan Comenius University (Bratislava) as well as with Dr. Jan Sotak, of the Slovak Academy. Together with the latter I have published *Non-marine calcareous Lower Cretaceous algae and Cyanobacteria from Czorsztyn Unit, Western Carpathians* (2001) and *Calcareous algae of the limestone pebbles from conglomerates of Western Carpathians* (2008).

Also, I have cooperated with Professor **Musa Kazim Düzbastillar,** of Izmir University**,** Professors **Diakantoni, Fotini Pomoni** and **Evanghelos Velitzelos,** of Athens University**,** as well as with Professor **Hassan Soliman,** of Assiut University, with whom I have published a paper in Micropaleontology, *Palaeogene calcareous algae of Egypt*, 2002, New York.

Photo 4 - Dr. Diane S. Littler and Dr. Mark M. Littler (at Smithonian, Fort Pierce, Florida).

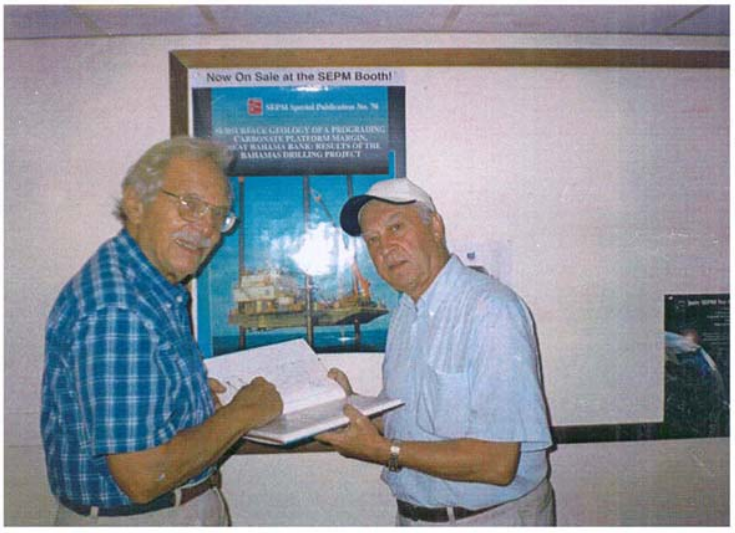


Photo 5 - Prof. Robert N. Ginsburg together with Prof. Ovidiu N. Dragastan.

In USA during my Fulbright Scholar Award (1993-1994, I had the privilege to collaborate with Professor **Stejpko Golubic** from Boston University, a well known personality in the field of Cyanobacteria and shallow marine microbialites. We published in 1996, also in collaboration with Professor **Detlev K. Richter** (Bochum) a paper entitled *Rivularia haematites, a case of Recent versus Fossil morphology, taxonomical considerations*. During my visit in North America, I have met two other personalities, Dr. **L. Hillis-Colinvaux**, owner of an impressive collection including Recent *Halimeda* of all reef-marine realms, and Professor **Paul Colinvaux,** a high profile ecologist and a tropical rainforest researcher. Together with Dr. L. Hillis-Colinvaux I have visited the Smithsonian Institution in Balboa, Panama, and we have collected numerous calcareous algae from reefs occurring along the Atlantic coast.

When visiting Washington DC in 2000, I have met two high profile researchers in algae and reef ecosystems, from the Smithsonian Institution, Dr. **Diane S. Littler** and **Mark M. Littler (Photo 4).**

This encounter gave me the opportunity to gain two more scholarships at the Smithsonian, in 2002 and 2003. During my first scholarship there, I worked on the **Harlan J. Johnson** collection. This collection, donated by one of the greatest American paleoalgologists, includes thin sections obtained from various drillings in the Pacific islands. During my second scholarship I

worked in Florida, at Fort Pierce Station of the Smithsonian, on samples collected from Pliocene–Pleistocene limestones of the Key West Peninsula, publishing with the two Littlers two papers regarding the carbonatic facies and the role of the calcareous algae in reef ecosystems. During a visit to the University of Miami, I was introduced to Professor **Robert G. Ginsburg (Photo 5)**, a great personality in the field of carbonate deposits, who offered me for study the cores of Clino and Unda drills, from the Bahamas carbonate platform.

The results of the study of these thin sections were published in 2007, in Analele Universităţii din Bucuresti, Seria Geologie, Special Publication No.2, for which I received the Emil Pop Prize of the Society of Romanian Paleontologists. I wish to thank Professor Ginsburg for his hospitality and his trust in offering me the cores and the thin sections from these very important drillings.

In this context I wish to remind Professor **Paul C. Silva (Photo 6),** from the Berkeley University, a great personality in the difficult field of taxonomy and systematics.

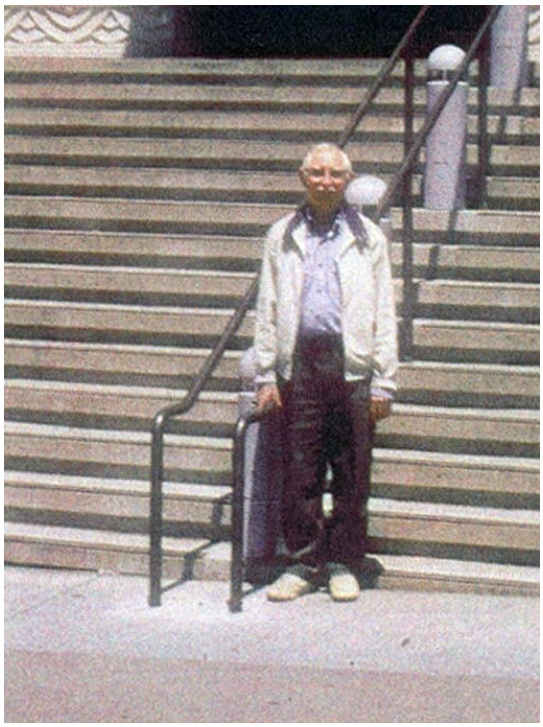

Photo 6 - Prof. Paul C. Silva

I learned from him "the rule" and the special conditions for defining a new species or a new genus, in the field of Phytoecology and in that of Paleoalgology. Recently, in his work *Historical Review of Attempts to Decrease Subjectivity in Species Identification, with Particular Regard to Algae*, Protist vol.159 (2008), Prof. Silva recommends to reduce the subjectivity for correctly identifying or revising a taxon by a group of researchers. Such an analysis must be admitted only if it includes a correct revision of the original illustrations, to which he adds that „ the genomic analysis is a very important tool, but its application should not be assumed to be free of subjectivity". I wish to thank him for his suggestions and very useful comments for some of the papers in work, and especially for his honouring recommendations written for my funding applications; such "heavy" recommendations have increased my chances in the tough competition for research grants.

Another fruitful and long collaboration is the one with Professor **Detlev K. Richter (Photo 7)** from the Bochum University. This collaboration started after 1992 and it continues today, almost without interruption. I consider this collaboration as extremely fruitful, leading to the publication of more than 12 papers, together with him and with his collaborators, especially with his PhD students (Dr. **Gielisch, Dr. Kaziur,** Dr. **Kube,** Dr. **Radusch,** Dr. **Beck** and Dr. **Zuhl)**.

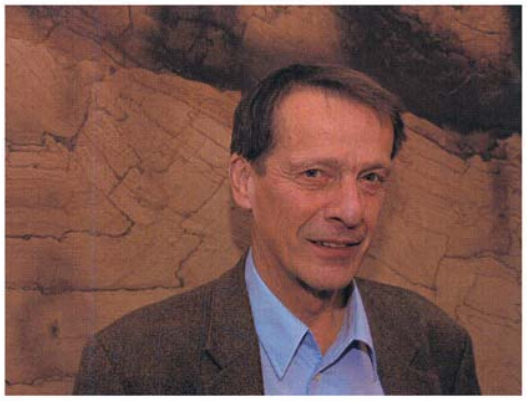

Photo 7 - Prof. Detlev K. Richter

Professor Richter was the leader of a group of graduate and undergraduate students from Bochum University who visited Romania during the summer of 1996, in a field trip through the Romanian Carpathians and Dobrogea. This fieldtrip tha tlasted 25 wonderful days was lead by a Romanian team consisting of myself, Associate Professor **Mihai E. Popa and** Geologist **Ioan Coconu**. I consider this scientific collaboration both a tribute and a friendly appreciation of Professor Richter, an important researcher in the fields of marine, brackish or freshwater carbonates and speleothemes.

I have also collaborated with a team from University of Leoben (Austria), represented by Professor **H.J. Gawlick,** and Dr. **Felix Schlagintweit**, resulted in the publication of two common research papers during a very fruitful and promising collaboration.

I am also grateful to **Louis C. Bortz,** exploration geologist with Pan American-Amoco in Denver between 1959-1986, currently an independent expert working with different companies. I owe him financial support for some of the research projects, for publishing of various papers such as *Miocene to Holocene calcareous algae of the Caribbean area* (2007), and for helping me becoming an Active Member of the American Association of Petroleum Geologists (AAPG) from 1990 until today.

Also, I cooperated with many Romanian scientists: Professor **Aurelia Bărbulescu,** Professor **Ioana Pană,** working with them under the leadership of Professor **Theodor Neagu,** member of the Romanian Academy, publishing together the monograph: *Jurasicul şi*

*Cretacicul din Dobrogea Centrală şi de Sud- Paleontologie şi Stratigrafie* (1998), a work which took us more than 10 years of research on Jurassic and Cretaceous deposits from Central and South Dobrogea. This monograph was on high demand also abroad, in Germany, Italy or Poland, being considered an essential contribution to the understanding of the lithostratigraphy and especially of the biostratigraphy of these deposits. The study includes 54 plates illustrating the main fossil groups of these important units belonging to the Moesian Platform. A constant collaboration involved my younger colleagues from the Chair of Geology and Paleontology, with whom I have published research papers in the frame of various international (EU) and national (CNCSIS – NURC) research grants: Associate Professor **Iulia Lazăr,** Associate Professor **Răzvan Damian,** Associate Professor **Mihai E. Popa,** Associate Professor **Marius Stoica** and Associate Professor **Zoltan Csiki.**

I also would like to recall with sincere regrets the personalities of two high profile researchers and professors in the fields of Geology, Paleobotany and Palynology: the late Professor **Răzvan Givulescu,** Honorary member of the Romanian Academy, and the late Professor **Justinian Petrescu** from Babeş-Bolyai University Cluj-Napoca. To them I address my homage, and I express my faith that they will never be forgotten by the young generations.

I wish to thank all the participants to this symposium, with the hope that we will meet again in similar meetings organized by the Society of Romanian Paleontologists; I also wish that Acta Palaeontologica Romaniae will survive any crisis.

I thank the organizers, and all fellow participants to this meeting, which was so well organized by our colleagues from Babeş-Bolyai University in Cluj-Napoca, Transylvania.

Finally, I will just add my motto: ***I love limestones, calcareous algae and fossils.***

Cluj-Napoca, October 22, 2009.

## LUCRĂRI ŞTIINTIFICE ŞI CĂRŢI ALE PROFESORULUI OVIDIU DRAGASTAN (SCIENTIFIC PAPERS AND BOOKS)

**1963 - 1970**


1. Asupra prezenţei unor depozite cu *Nannoconus* în sedimentele jurasico-cretacice din R.P.România (On the presence of some deposits with *Nannoconus* in Jurassic-Cretaceous sediments from R.P. Romania). Studii şi cercetări de geologie ale Acad. R.P.R., no. 2/1963, p. 185-193, 2 fig. Bucureşti (in co-operation with Acad. M.G. Filipescu).
2. Sur la présence de certains dépôts *Nannoconus* dans les sediments Jurassico-Crétacées de la Republique Populaire Roumanie. Revue roumaine de geologie et geographie de l'Acad. R.P.R. t. 7/2, 1963, p. 191-197, 2 fig. Bucureşti.
3. Resturi de Tintinnide în depozitele tithonice şi neocomiene din R.P. Română (Tintinnide remnants in Tithonian and Neocomian deposits from R.P. Romania). Studii şi cercet. de geologie ale Acad. R.P.R., t. 7/3, 1963, p. 333-356, 1 fig., 2 tab., 5 pl., Bucureşti (in co-operation with Acad. M.G. Filipescu).
4. *Saccocoma* şi *Globochaete alpina* în microfaciesul jurasicului superior din Bucegi şi Banat (Saccocoma and Globochaete alpina in the Upper-Jurassic microfacies from Bucegi and Banat), Analele Universităţii Bucureşti, Seria Geologie, nr. 2, 1964, p. 95-107, 5 pl., Bucureşti.
5. Restes de Tintinnides dans les dépôts tithonique et neocomiens de la Republique Populaire Roumanie, Recueil en l'honneur de l'Acad. Smilo Iovtchev, p. 247-261, 3 tab., Sofia (en collaboration avec Acad. M.G. Filipescu); 1964, Sofia.
6. Stratigraphic and paleontological considerations upon Tintinnids in some Jurassic and Cretaceous deposits of Romania. Proceed of section 8, XXII Inter. Geological Congress, p. 428-437, 1 fig., 5 tab., 1 pl., 1964, India (in co-operation with Acad. M.G. Filipescu), Lucknow.
7. Micrographic study of limay-marls from the Sinaia Beds (Eastern Carpathians), Carpatho-Balkan Geological Assoc. VIII Congress, p. 61-85, 3 fig., 1965, Sofia (in co-operation with C. Vinogradov).
8. A new Serpulid species in the Upper Jurassic of Romania, Paläont. Zeitschrift, 40, p. 147-150, 3 fig., 1966, Stuttgart, ISI - 0.333
9. Microfaciesurile jurasicului superior şi cretacicului inferior din Munţii Apuseni (Upper Jurassic and Lower Cretaceous microfacies from the Apuseni Mountains - Western Carpathians), Analele Univ. Bucureşti, Seria Geologie, 15/2, p. 37-47, 3 fig., 5 pl., 1966, Bucureşti.
10. Etude du niveau á Charophytes d'âge Crétacé inférieur des Monts Apuseni (Roumanie), Revue de Micropaleontologie, nr. 1, p. 23-28, 2 pl., 1966, Paris (en collaboration avec D. Istocescu et M. Diaconu),.
11. Données sur les microfaciès du Jurassique supérieur et du Crétacé inférieur de la région des Gorges de Bicaz (Cheile Bicazului), Revue de Micropaleontologie, 11, p. 71-76, 2 fig., 2 pl., 1966, Paris-
12. Alge calcaroase în jurasicul superior şi cretacicul inferior din Munţii Apuseni (Calcareous Algae in the Upper Jurassic and Lower Cretaceous from the Apuseni Mountains - Romania), Studii şi cercet. de geol. ale Acad. R.S. România, 12/2, p. 441-454, 8 pl., 1967, Bucureşti
13. Algues calcaires du Mésozoïque de Roumanie et leur importance stratigraphique, Association Carpatho-Balkan. VIII Congress, p. 509-517, 1 fig., 1967, Belgrad.
14. Algues calcaires dans le Jurassique supérieur de Roumanie, Geologica Romana, VII, p. 59-73, 3 pl., 1968, Roma.
15. Sedimentological study of the Upper Jurassic sequence of limestones in the Pui Zone (Romania), Sedimentary Geology, 2, p. 291-304, 2 fig., 3 pl., 1968, Amsterdam (in co-operation with Al. Stillă and I. Dumitru), ISI. 1.444
16. Triassic calcareous algae from the Apuseni Mountains (Romania), Rev. of Paleobotany and Palinology, p. 63-101, 10 pl., 1969, Amsterdam (in co-operation with M. Diaconu).

17. Micro-oncolithes dans le Jurassique supérieur de la Vallée du Bicaz (Carpathes Orientales, Roumanie). Bull. de la Societé Géologique de France, p. 655-659, 2 pl., 1969, Paris, ISI .0.757
18. Algues calcaires du Jurassique supérieur et du Crétacé inférieur de Roumanie, Revue de Micropaleontologie, 1, p. 53-62, 3 pl., 1969, Paris.
19. New species of Dasycladaceae (calcareous algae) in the Lower Cretaceous of the Eastern Carpathians (Romania), Rev. of Paleobotany and Palynology, p. 117-129, 3 fig., 3 tab., 2 pl., 1970, Amsterdam.
20. *Durandella*, un nouveau genre de Tintinnide de Jurassique supérieur de Roumanie. Bull. de la Societé Géol. de France, p. 937-939, 1 pl., 1970, Paris, ISI. Cota 0.757
21. Date noi asupra depozitelor triasice din Pădurea Craiului (Munţii Apuseni) (New data concerning the Triassic deposits from Pădurea Craiului (Apuseni Mountains - Romania), Dări de seamă ale şedinţelor Inst. Geologic, LVI, p. 43-50, 1970, Bucureşti (in co-operation with M. Diaconu).
22. Une nouvelle éspece de *Tintinnopsella* du Valanginien des Carpathes Meridionales, Banat, Revue de Micropaleontologie, p. 234-236, 1 pl., 1970, Paris (en collaboration avec Acad. M.G. Filipescu).

**1971 - 1980**

23. Rezultatul cercetărilor asupra unor resturi de trunchiuri din Terţiarul României (The results of the researches upon wood remnants from the romanian Tertiary), Studii şi cercet. de geologie ale Acad. R.S. România, p. 265-269, 3 pl., 1, 1971, Bucureşti (in co-operation with J. Petrescu)
24. New Algae in the Upper Jurassique and Lower Cretaceous in the Bicaz Valley, Eastern Carpathians (Romania), Revista Espanola de Micropaleontologia, Vol.3/2, p. 155-192, /1971, Madrid.
25. Consideraţii stratigrafice asupra faciesului carbonatat recifal din zona Pui (Carpaţii Meridionali)-(Stratigraphic considerations upon the carbonate reef facies from the Pui zone (southern Carpathians - Romania), Dări de seamă ale şedinţelor Instit. Geologic, p. 124-129, LVIII, 1972, 2 fig., 3 pl., Bucureşti (in co-operation with Al. Stillă and I. Dumitru)
26. Cretacicul inferior din Dobrogea de nord (The Lower Cretaceous from Northern Dobrogea - Romania), Studii şi cercetări de geologie ale Acad. R.S. România, 17/1, p. 77-85, 1 fig., 4 pl., Bucureşti (in co-operation with V. Mutihac and A. Lăcătuşu)
27. Asupra unor lemne de Icacinoxylon Shilkina din oligocenul de la Telega (Prahova) (Upon some Icacinoxylon shilkina woods in the Oligocene from Telega (Prahova-Romania), Studii şi cercetări de geologie ale Acad. R.S. România, 17/2, p. 445-451, 3 fig., 1972, Bucureşti (in co-operation with J. Petrescu)
28. Correlation of the Upper Jurassic faunas in Central Dobrudja and the Hăghimaş Massif (Romania), Rev. roum. de Geol., Geophys., Geogr. Acad. R.S.R., 16/1, p. 41-57, 9 fig., 1 tab., 1972, Bucureşti (in co-operation with Aurelia Bărbulescu)
29. Un nouveau genre d'algue dans le Crétacé inférieur du bassin de Babadag-Dobrogea (Roumanie), 7/2-3, p. 82-87, 3 fig., 1973, Bull. Sc. Nat., Geneva.
30. Alge şi foraminifere (Anisian-Ladinian) din estul Pădurii Craiului (Munţii Apuseni)(Anisian-Ladinian Algae and Foraminifera from the east of Pădurea Craiului (Apuseni Mountains - Roumania)), Studii şi cercet. de geol. ale Acad. R.S.R., 18/2, p. 425-442, 1 fig., 12 pl., 1973, Bucureşti, (in co-operation with Elena Popa).
31. Zonele microfaciale şi limita Jurasic-Cretacic în Carpaţii Orientali (Masivul Hăghimaş) şi Platforma Moesică (Microfacial zones and the Jurassic-Cretaceous boundary in the Eastern Carpathians (Hăghimaş

Massif) and the Moesic Platform - Romania), Studii şi cercet. de geol. ale Acad. R.S.R., 18/2, p. 509-533, 8 fig., 1973, Bucureşti (in co-operation with R. Muţiu and C. Vinogradov).

32. Les zones micropaléontologiques et la limite Jurassique-Crétacé dans les Carpates Orientales (Massif du Haghimas) et dans la Platforme Moesienne, Colloque sur la limite Jurassique-Crétacé, Lyon, BRGM, 86, p. 236-298, 5 fig., 2 tab., 1973, Paris (en colaboration avec R. Muţiu et C. Vinogradov).
33. Upper Jurassic and Lower Cretaceous microfacies from the Bicaz Valley Basin - East Carpathians (Romania). Memorii, vol. XXI, 89 p,. 110 pl., 10 tab., Institutul de Geologie şi Geofizică - Ph. D. thesis, 1975, Bucureşti
34. *Verticillodesmis clavaeformis* - n. gen. n. sp. in the Upper Jurassic of Czorstyn Series - Klippen Belt (Czechoslovakia). Revista Espanola de Micropaleontologia, 7/2, p. 215-220, 1 fig., 1 pl., 1975, Madrid (in co-operation with Prof. M. Misik, Univ. Jan Comenius).
35. Asupra unor alge, foraminifere, sphinctozoare şi microproblematice din triasicul din Carpaţii Orientali şi Dobrogea de Nord (Upon some Algae, Foraminifera, Sphinctozoans and Microproblematicae in the Triassic of Easthern Carpathians and Northern Dobrogea - Romania). Studii şi cercet. de geol. ale Acad. R.S.R., 20, p. 247-254, 2 fig., 6 pl., 1975, Bucureşti (in co-operation with E. Grădinaru)
36. Microfacies du Malm et du Crétacé inférieur de la région des Gorges de Bicaz (Roumanie), Guide to the 14th European Micropaleontological Colloquium, p. 123-128, 2 tab., 1 map., 1975, Bucureşti
37. Sur le contenu micropaléontologique des Couches de Sinaia. Guide to the 14th European Micropaleontological Colloquium, p. 183-184, 1975, Bucureşti
38. Microfacial study of the Upper Jurassic and Lower Cretaceous deposits from the central part of the Moesic Platform (Romania), Revue roumaine Géol., Géophys. et Géogr., Géologie, t. 19, p. 105-118, 6 fig., 1975, Bucureşti (in co-operation with C. Vinogradov)
39. La Dobrogea Centrale et du Sud pendeant le Jurassique et le Crétacé, Revue roumaine Géol., Géophys. et Géogr., Géologie, t. 21, p. 145-153, 1 tab., 1977, Bucureşti (en collaboration avec M. Chiriac, Aurelia Bărbulescu et Th. Neagu)
40. Biostratigraphie de la série des calcaires éocrétacés de l'aire Cernavodă - Alimanu - Ostrov (Roumanie), Revue roumaine Géol., Géophys. et Géogr., Géologie, t. 21, p. 137-144, 1977, Bucureşti (en collaboration avec Th. Neagu et Ioana Pană)
41. New species of the genus Diversocallis in the Jurassic and Cretaceous from Romania, Revue roumaine Géol.,

Géophys. et Géogr., Géologie, t. 22, p. 185-187, 3 pl., 1978, Bucureşti (in co-operation with I. Bucur)
42. *Munieria grambasti* Bystricky în senonianul de la Corniţel (Bazinul Borod) (Munieria grambasti Bystricky in the Senonian from Corniţel (Borod Basin - Romania)), Dări de seamă ale şedinţelor Instit. Geol. şi Geof., LXIV, p. 341-346, 2 pl., 1978, Bucureşti.
43. Date noi privind biostratigrafia depozitelor barremian-albiene din partea central-estică a zonei Reşiţa-Moldova Nouă (Banat), obţinute prin forajul de referinţă de la Şopotul Nou (New data concerning the biostratigraphy of the barremian-albian deposits from the central-eastern part of the Reşiţa-Moldova Nouă zone (Banat-Romania) - from the Şopotul Nou borehole), Dări de seamă ale şedinţelor Instit. Geol. şi Geof., LXIV, p. 17-36, 2 fig., 2 tab., 20 pl., 1978, Bucureşti (in co-operation with I. Bucur and I. Demeter).
44. Les occurences Triassiques du Basin de Beiuş (Monts Apuseni - Roumanie), Dări de seamă ale şedinţelor Inst. Geol. şi Geof., LXIV, p. 137-145, 1 fig., 5 pl., 1978, Bucureşti (en collaboration avec D. Istocescu).
45. Contribution à la connaissance de la géologie du Mont Lespezi (Massif de Bucegi - Romania), Analele Univ. Bucureşti, XXVII, p. 25-36, 3 pl., 1978, Bucureşti (en collaboration avec Eugenia Manoliu et C. Dinu).
46. Microfacies de la serie calcaire Crétacée inférieur d'Aliman (Dobrogea de Sud - Roumanie), Dări de seamă ale şedinţelor Instit. Geol şi Geof., LXIV, p. 107-136, 1978, Bucureşti.
47. Upper Aptian microfossils from the Cameniţa Valley - Sasca Română (Reşiţa - Moldova Nouă Zone, Banat - Romania), Revue roumaine Géol., Géophys. et Géogr., Géologie, 23/1, p. 111-115, 1979, Bucureşti.
48. La flore du Crétacé supérieur (Turonien) du Bassin de Babadag (Dobrogea du Nord - Roumanie), Revue roumaine Géol., Géophys. et Géogr., Géologie, 24, p. 157-170, 1979, Bucureşti (en collaboration avec R. Givulescu et Th. Neagu)
49. Biostratigraphy of the Triassic deposits from the Pădurea Craiului Mountains - Eastern Sector (Romania), Dări de seamă ale şedinţelor Inst. Geol. şi Geof., 40 p. 1980, Bucureşti (in co-operation with M. Diaconu et Elena Popa).

**1981 - 1990**
50. Mesozoic Dasycladaceae from Romania, distribution and biostratigraphical importance, Facies, 4, p. 165-196, 1981, Erlangen,ISI, 1.106
51. Lower Cretaceous marine algae and calpionellids from Candas (San Pedro), Asturias Province (Spain), Cuadernos Geologica Iberica, vol. 8., p. 125-143, 1982, Madrid
52. Biostratigraphy of the Triassic formations in the east of the Pădurea Craiului Mountains (Romania), Dări de seamă ale şedinţelor Inst. Geol. şi Geof., LVII, 4, p. 29-61, 1982, Bucureşti (in co-operation with M. Diaconu şi Elena Popa).
53. Paleozoic carbonate platform in the eastern part of the Moesian Platform (Romania), Revue roumaine Géol., Géophys. et Géogr., Géologie, 10 p., 1983, Bucureşti
54. Practical potentialities of Palaeontology, 75 years Lab. of Paleontology, Special volume, Editor Neagu Th., p. 15-22, 1983, Bucureşti
55. Stratigrafia depozitelor neojurasice şi eocretacice din Dobrogea de Sud (Stratigraphy of the Neojurassic and Eocretaceous deposits from Southern Dobrogea - Romania), St. cerc. geol., geof., geogr., 29, p. 80-87, 1984, Bucureşti (in co-operation with Th. Neagu)
56. Review of Tethyan Mesozoic algae of Romania, in Palaeoalgology Contemporary Research and Applications (eds. D.F. Toomey and N.H. Nitecki), p. 101-161, Springer Verlag, Berlin, Heidelberg, N.Y., 1985.
57. Upper Jurassic and Lower Cretaceous Formations and Facies in the eastern area of the Moesian Platform (Southern Dobrogea included) - Romania, Analele Univ. Bucureşti, Geologie, XXXIV, p. 77-85, 1985, Bucureşti
58. Relationship between Paleozoic algal communities and depositional environments in the Moesian Platform, Revue roumaine Géol., Géophys. et Géogr., Géologie, t. 29, p. 55-64, 1985, Bucureşti (in co-operation with C. Vinogradov)
59. Contribution à la biostratigraphie des dépôts jurassiques du Bihor Central (Apuseni de Nord - Roumanie), Dări de seamă ale şedinţelor Inst. Geol. Geof., LXIX/4, p. 39-56, 1985, Bucureşti (en collaboration avec E. Popa et M. Bleahu).
60. Foraminifères, Algues et Microproblematicae du Trias de Messopotamos, Epire (Grèce continentale), Revue du Micropaléontologie, 27/4, p. 244-248,1985, Paris (en collaboration avec D. Papanikos et P. Papanikos).
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# OCCURRENCES OF *STEPHANORHINUS KIRCHBERGENSIS* (JÄGER, 1839) (MAMMALIA, RHINOCEROTIDAE) IN EURASIA – AN ACCOUNT

**EMMANUEL M.E. BILLIA**[1]

**Abstract.** A report on the presence of *Stephanorhinus kirchbergensis* (JÄGER 1839) in Eurasia is proposed here. As yet, *S. kirchbergensis* appears rarely recorded on this wide territory. As a whole, its occurrences are more frequent in Western than in Eastern Europe and in Asia. Unfortunately, well-dated both cranial and postcranial *S. kirchbergensis* remains are very few. Moreover – at least at present – the fossil material described in literature and assigned to this taxon is only partly available in Eurasian museum collections.
Among the Plio-Pleistocene rhinoceros, *S. kirchbergensis* is one of the most distinctive species being characterized by unique odonto-morphological traits. Furthermore, it is useless to deny when faced with facts that *S. kirchbergensis* seems to be a rhinoceros still little investigated, and consequently, not well-known yet.
History, general characters, anatomical and odontological features of *S. kirchbergensis* have been discussed in previous works by the author.

**Keywords**: *Stephanorhinus kirchbergensis,* Middle Pleistocene, Eurasia, "nosorog Merka".

*Institutional abbreviations*

AN ArmSSR - Akademya Nauk Armyanskoy SSR (= Academy of Sciences of Armenian SSR), Erevan.
AN AzerbSSR - Akademya Nauk Azerbaydzhanskoy SSR (= Academy of Sciences of Azerbayjan SSR], Baku.
AN KazSSR - Akademya Nauk Kazakhskoy SSR (= Academy of Sciences of Kazakh SSR), Alma-Ata; at present, Academy of Sciences of Kazakhstan, Almaty.
AN MoldSSR - Akademya Nauk Moldavskoy SSR (= Academy of Sciences of Moldavian SSR, Kishinev); at present, Academy of Sciences of Moldova, Chisinau.
AN SSSR - Akademya Nauk SSSR (= USSR Academy of Sciences), Moskva/Leningrad; at present, Russian Academy of Sciences (RAN), Moskva/Skt-Peterburg.
AN UkrSSR - Akademya Nauk Ukrainskoy SSR or Akademia Nauk Ukrains'koï Radyans'koï Sozialistichnoï Respubliki (AN URSR) (= Academy of Sciences of Ukrainian SSR, Kiev); at present, Ukrainian Academy of Sciences, Kïv.
GIH - Geologischer Institut, Heidelberg.
HAZU - Hrvatska Akademija Znanosti i Umjetnosti (= Croatian Academy of Sciences and Arts), former Yugoslavian Academy of Sciences and Arts (JAZU), Zagreb.
IGUP- Istituto di Geologia, Università Statale, Padova.
IPE - Institut für Paläontologie, Erlangen.
IQW - Institut für Quartärpaläontologie (Senckenberg Forschungsinstitut), Weimar.
Izd-vo - Izdatel'stvo (= Publishing House).
IZiF - Institute of Zoology and Fisiology, Academy of Sciences of Moldova, Chisinau.
JAZU - Jugoslavenska Akademija Znanosti i Umjetnosti (Academia Scientiarum et Artium Slavorum Meridionalium = Yugoslavian Academy of Sciences and Arts); at present, Hrvatska Akademija Znanosti i Umjetnosti (= Croatian Academy of Sciences and Arts), Zagreb.
LNK - Landesmuseum für Naturkunde, Karlsruhe.
MCSN - Museo Civico di Storia Naturale, Vicenza.
MCSN-TS - Museo Civico di Storia Naturale, Trieste.
MNH - Museum of Natural History (ex British Museum of Natural History, BMNH), London.
MPP - Museo Paleontologico, Priabona near Monte di Malo (Vicenza).
MPUR - Museo di Paleontologia, "Sapienza" Università di Roma.
MZ - Muzeum Ziemi (= Museum of the Earth), Polska Akademia Nauk (= Polish Academy of Sciences), Warszawa.
NMM - Naturhistorisches Museum, Mainz.
OPS - Branch of Palaeontology and Stratigraphy, SSR Moldavian Academy of Sciences; at present, Academy of Sciences of Moldova, Chisinau.
PAN - Polska Akademia Nauk (= Polish Academy of Sciences), Kraków/Warszawa.
PM OGU - Palaeontological Museum, Odessa State University, Odessa.
PNHM - Prähistorische Abteilung des Naturhistorischen Museums, Wien.
RAN - Rossiyskaya Akademya Nauk (= Russian Academy of Sciences), Moskva/Skt-Peterburg.
SAN - Srpska Akademija Nauka (= Serbian Academy of Sciences), former Yugoslavian Academy of Sciences and Arts (JAZU), Beograd.
SAZU - Slovenska Akademija Znanosti i Umetnosti (Academia Scientiarum et Artium Slovenica = Slovenian Academy of Sciences and Arts), Ljubljana.
SMN - Staatliches Museum für Naturkunde, Stuttgart.
UkrAN - Ukrains'koïa Akademia Nauk (= Ukrainian Academy of Sciences), Kïv.
ZIN ANU - Zoological Institute, Branch of Palaeozoology, SSR Ukrainian Academy of Sciences, Kiev; at present, Ukrainian Academy of Sciences, Kïv.
ZIN RAN - Zoological Institute, Russian Academy of Sciences, Skt-Peterburg.

*Other abbreviations*

ESR - Electron Spin Resonance.
MIS - $\delta\ ^{18}O$ Stage (Marine Isotope Stage = OIS, Oxygen Isotope Stage).

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## INTRODUCTION

*Stephanorhinus kirchbergensis* (JÄGER 1839) (= *Rhinoceros mercki* JÄGER 1839 = *Dicerorhinus kirchbergensis* [JÄGER 1839]) – better known in Russia and in all the former Soviet Union as "nosorog Merka" (literally, Merck's rhinoceros) – together with *Palaeoloxodon antiquus* (FALCONER & CAUTLEY 1847) was one of the most characteristic members of the West-European late Middle Pleistocene interglacial fauna (Czyzewska, 1962), later called "*Palaeoloxodon antiquus* faunal assemblage". It also includes *Stephanorhinus hemitoechus* (FALCONER 1868), *Hippopotamus amphibius* L. 1758, *Bos primigenius* BOJANUS 1827, *Megaloceros giganteus* (BLUMENBACH 1803), *Capreolus capreolus* (L. 1758), *Dama dama* (L. 1758), *Sus scrofa* L. 1758, and *Bubalus murrensis* (BERCKHEMER 1927) (= *Buffelus murrensis* BERCKHEMER 1927) (Kahlke, 1986; Stuart, 1991; Koenigswald & Heinrich, 1999; Bradshaw & al., 2003, inter alios).

The *S. kirchbergensis* spreading areal would include a large part of the Eurasian landmass – from France up to China – in this context excluding the areas situated at both high and low latitudes, except for only one case close to 64° N in Siberia (Dubrovo, 1957) which represents the northernmost *S. kirchbergensis* Eurasian record.

Mostly frequenting forests, *S. kirchbergensis* supposedly inhabited Europe in the time span from MIS 15-13 up to the Eemian Interglacial (substage 5e). At present, on the basis of fossil evidence – unlike other Plio-Pleistocene rhinoceroses – the "tandem-horned" *S. kirchbergensis* seems to be barely represented within this enormous geographical extension. On the whole, its records are more frequent in Western than in Eastern Europe and in Asia. Remains ascribed to this taxon come from England, France, Germany, Austria, Italy, Slovenia, Croatia, Hungary, Czech Republic, Slovakia, Poland, Romania, Moldova, Russia, Kazakhstan, Korea, China, and possibly from Ukraine, Armenia, Azerbaijan, Tajikistan.

Furthermore, very few well-dated *S. kirchbergensis* cranial and postcranial remains are available. As a matter of fact, a great amount of such skeletal material found without macro-microfaunal and/or stratigraphic data does not allow inferring any chronological hypothesis.

Unfortunately – at least at present – the *S. kirchbergensis* material described in literature and taken here into consideration is only partly available in Eurasian museum collections.

Both Russian and Italian *S. kirchbergensis* material has been revised using morphological and non-metric characters (Billia, 2008a, 2008b; Billia & Petronio, 2009).

The reasons for *S. kirchbergensis'* rarity have not been unraveled yet. According to Loose (1975:21), the reasons are twofold: either its ecological niche was unfavourable for fossilisation, or it was really a rare animal.

Its rarity may also probably be due to the fact that *S. kirchbergensis* is usually found in interglacial faunal associations. As a general rule, during the interglacial periods the fluvial beds are characterized by erosion while within karst cavities sedimentation is very rare.

We must also consider another possible reason, which may justify the scarcity of the reports on *S. kirchbergensis:* very often, when the finds concern postcranial specimens only, these are frequently not taken into consideration because they are not recognised or because of their difficult specific determination.

De facto, *S. kirchbergensis* has very often been diagnostically misidentified with other rhinoceros species: *Stephanorhinus megarhinus* (DE CHRISTOL 1834), *Stephanorhinus elatus* (CROIZET & JOBERT 1828) (= *Rhinoceros etruscus* Falc. var. *astensis* SACCO 1895 = *Dicerorhinus jeanvireti* [GUÉRIN 1972]), *Stephanorhinus etruscus* (FALCONER 1868), *Stephanorhinus hundsheimensis* (TOULA 1902) (= *R. etruscus heidelbergensis* FREUDENBERG 1914 = *Dicerorhinus handzellensis* WANG 1928 = *Dicerorhinus hemitoechus intermedius* CIGALA-FULGOSI 1976 = *Dicerorhinus etruscus brachycephalus* GUÉRIN 1980), *S. hemitoechus* (FALCONER 1868), *Coelodonta antiquitatis* (BLUMENBACH 1799). Besides, for a long time too many palaeontologists believed that *S. kirchbergensis* and *S. hemitoechus* represented a sole species.

From the author's personal point of view, one of the basic problems is represented by the fact that too often the diagnoses are based exclusively on postcranial material so that errors of identification among the species are frequently possible, whereas the attribution by means of teeth is unequivocal.

In the author's opinion, in *S. kirchbergensis* – among postcranial elements – the third metacarpals, the astragali, and the calcanea may be liable to an exception presenting some unique morphological features which would make a difference from the other Pleistocene rhinoceros species (Billia, 2008b; Billia & Petronio, 2009).

As Heissig (1981) previously asserted, rhinoceroses (particularly, the Plio-Pleistocene ones) are a highly-stereotyped group with little morphological divergence. This means that, morphologically, substantial intraspecific differences and, conversely, interspecific likenesses may usually be found among them.

As it is well-known, some of the most prominent palaeontologists expressed their frustration on issues related to the identification of the rhinoceros species (vide, *e.g.*, Toula, 1902:92).

In the course of the last two centuries, *S. kirchbergensis* has been previously identified with at least thirty-one other synonyms:

*Rhinoceros incisivus* MERCK 1784
*Rhinoceros tichorhinus* BRONN 1831
*Rhinoceros megarhinus* DE CHRISTOL 1834
*Rhinoceros minutus* DE SERRES DUBREUIL & JEANJEAN, 1834
*Rhinoceros leptorhinus* CUVIER 1836
*Rhinoceros kirchbergense* JÄGER 1839
*Rhinoceros mercki* JÄGER 1839
*Rhinoceros Schleiermacheri* H. VON MEYER 1839
*Rhinoceros Merckii* (or *merckii, mercki, merki, Mercki*) KAUP 1841
*Rhinoceros mercki* KAUP 1841
*Rhinoceros incisivus* BLAINVILLE DE DUCROTAY 1846
*Rhinoceros leptorhinus* OWEN 1850
*Rhinoceros lunellensis* GERVAIS 1852
*Atelodus leptorhinus* POMEL 1853
*Rhinoceros protichorhinus* DUVERNOY 1853
*Rhinoceros mesotropus et velaunus* AYMARD 1853
*Rhinoceros Aymardi* POMEL 1854
*Rhinoceros priscus* FALCONER 1858
*Rhinoceros mesotropus* GERVAIS 1859
*Rhinoceros leptorhinus* BOYD DAWKINS 1867
*Rhinoceros Merckii Jäger* BRANDT 1877

*Rhinoceros* (*Atelodus*) *Mercki* WOLDRICH 1886
*Rhinoceros sinensis* OWEN 1870 (= *Rhinoceros sinensis* OSBORN 1898)
*Rhinoceros Mercki* (*Merckii*) var. *Brachycephala* SCHROEDER 1903
*Rhinoceros Mercki Jäger* var. *Vindobonensis* TOULA 1907
*Rhinoceros Mercki* var. *Krapinensis* GORJANOVICH-KRAMBERGER 1913
*Coelodonta merckii* ABEL 1919
*Rhinoceros oweni* RINGSTRÖM 1927
*Rhinoceros choukoutiensis* WANG 1931 (= *Dicerorhinus choukoutienensis* [WANG 1931])
*Dicerorhinus kirchbergensis* HOOIJER 1947
*Dicerorhinus mercki* (*kirchbergensis*) (JÄGER) var. *Brachycephalus* Schroeder vel *Dicerorhinus merckii* MAYER 1971

The *S. kirchbergensis* taxonomical position is as follows (in compliance with the criteria proposed by McKenna & Bell, 1997, except for the genus):

classis – **MAMMALIA** - LINNAEUS 1758;
subclassis – **THERIA** - PARKER & HASWELL 1897;
infraclassis – **EUTHERIA** - GILL 1872;
grandordo – **UNGULATA** - KAUP 1766;
mirordo – **ALTUNGULATA** - PROTHERO & SCHOCH 1989;
ordo – **PERISSODACTYLA** - OWEN 1848;
subordo – **CERATOMORPHA** - WOOD 1937;
infraordo – **TAPIROMORPHA** - HAECKEL 1866;
superfamilia – **RHINOCEROTOIDEA** - GRAY 1825;
familia – **Rhinocerotidae** - GRAY 1821;
subfamilia – **RHINOCEROTINAE** - GRAY 1821;
tribus – **RHINOCEROTINI** - GRAY 1821;
subtribus – **RHINOCEROTINA** - GRAY 1821;
infratribus – **RHINOCEROTI** - GRAY 1821;
genus – *STEPHANORHINUS* - KRETZOÏ 1942;
species – *S. KIRCHBERGENSIS* - JÄGER 1839.

History, general characters, anatomical and odontological distinguishing features of *S. kirchbergensis* have been extensively discussed in previous papers (Billia, 2008b; Billia & Petronio, 2009). In any case, there is no doubt that *S. kirchbergensis* is characterized by very suggestive odonto-morphological traits (fig. 1–a, b) and is therefore one of the most distinctive species among the other Plio-Pleistocene rhinoceros species.

The DF (dental formula) – similarly to other European Pleistocene rhinoceros species – is 0-0-3-3 in both upper and lower dentitions. Both occlusal model and occlusal mechanics of the molars of a rhinoceros such as *S. kirchbergensis* are well-represented by Fortelius (1982).

The attempts to reconstruct this species are extremely rare. In the author's opinion, the one made by Flerov (Flerov & al., 1955) (fig. 2–a) seems to be very close to reality. The Kojamkulova's reconstruction (Kojamkulova & Kostenko, 1984:56) (fig. 2–b) shows a too short skull. On the other hand, it appears very interesting because, in the light of the hypothesis advanced by this author, *S. kirchbergensis* had a derma covered by a sparse fuzz, *e.g.* as that of the living Sumatran "tandem-horned" *Dicerorhinus sumatrensis* (FISCHER V. WALDHEIM, 1814). However, we may consider both reconstructions as significant; this witnesses the current scarce knowledge of the anatomy of this species.

## *STEPHANORHINUS KIRCHBERGENSIS* EURASIAN FINDS – LOCALITIES AND MATERIAL

*1. Europe*

*S. kirchbergensis* is represented in this area by five available skulls only – those from Daxlanden, Mosbach, Steinheim an der Murr (Germany, § 1.4), Husnjakovo Brdo at Krapina (Croatia, § 1.9), and Warsaw (Poland, § 1.13) – in addition to other dental and postcranial material. The vexata quaestio concerning the systematic positions of the three German skulls has been treated in Billia (2008a).

*1.1. England*

The first appearance of *S. kirchbergensis* in Britain seems to be represented by the remains coming from Barnfield Pit at Swanscombe (Kent) (Sutcliffe, 1964). The event was correlated with MIS 11 (ca 400 kys BP) (Schreve, 1996, 1997, 2001).

The rhinoceros remains collected in the following sites must unquestionably be assigned to *S. kirchbergensis*:

– Grays Thurrock (Essex); odontological remains as well as a third metacarpal (BMNH M 22024a) and a third metatarsal of large dimensions (BMNH M 23761g) (Morris, 1836; Hinton & Kennard, 1900; Hinton, 1901) (MNH collections). Proposed MIS: 9 (ca 300 kys BP) (Schreve, 1997, 2001);

– Clacton-on-Sea (Essex); odontological remains (West & al., 1964; Stuart, 1982) (MNH collections). Proposed MIS: 11 (ca 400 kys BP) (Schreve, 1997, 2001);

– Ilford (Essex); odontological remains found in the interglacial deposits along the Thames (Hinton, 1902) (MNH collections). According to some authors (Sutcliffe & Kowalski, 1976; Bridgland, 1994), the deposits represent the third post-Anglian formation and are correlated with MIS 7 (ca 200 kys BP).

Other *S. kirchbergensis* remains come from:

– Purfleet (west of Grays Thurrock, Essex) (Schreve & al., 2002); MIS 9 (ca 300 kys BP) (Schreve & Bridgland, 2002a);

– West Thurrock (Essex); the *S. kirchbergensis* remains reported by Abbott (1890) were rediscovered in the collections of the Wellcome Institute for the History of Medicine in London by Carreck (1976) and are now housed in the MNH collections. At present, MIS 7 (ca 200 kys BP) for these remains is only supposed;

– Stanton Harcourt (7 km west of Oxford, Oxfordshire) (Scott, 2001). MIS 7 (ca 200 kys BP) is suggested by both the stratigraphical position and the fossils (Buckingham & al., 1996); this is also supported by amino-acid racemisation data (Bowen & al., 1989).

For more details on ages of fossil remains from British interglacial sites, on the Pleistocene fluvial stratigraphy and palaeogeography of Essex, on the insularity and Pleistocene faunas in Britain, on mammalian biostratigraphy of the Lower Thames see also Szabo & Collins (1975), Bridgland (1988), Stuart (1995), Roe (2001), and respectively Bridgland & Schreve (2004).

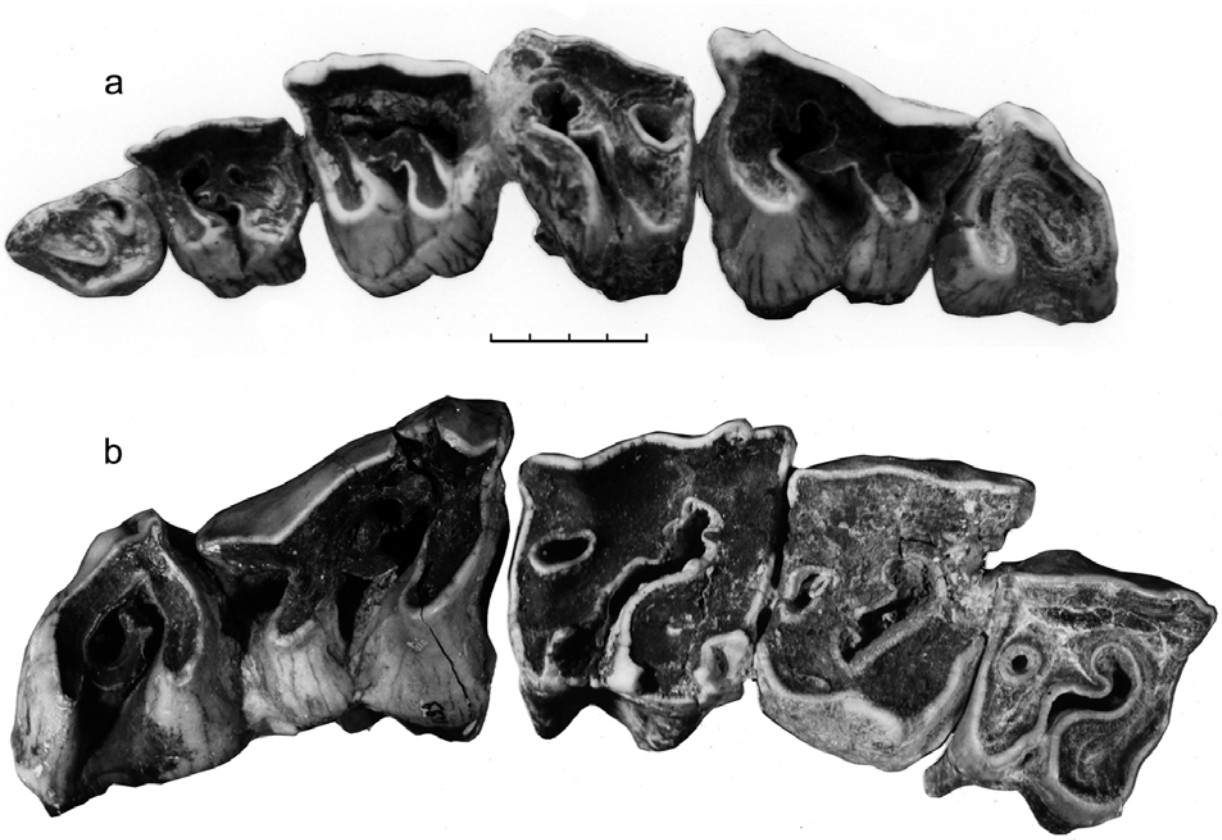


Figure 1 – *Stephanorhinus kirchbergensis* (JÄGER 1839); ? Middle Pleistocene; Latium, Central Italy. Suburbs of Rome (unknown localities); 1) upper half-jaw ($M^3$-$P^2$) (MPUR 1498), occlusal view; 2) upper half-jaw ($M^3$-$P^3$) (MPUR 1499), occlusal view (after Billia & Petronio, 2009) (coll.: Museo di Paleontologia, "Sapienza" Università di Roma).

*1.2. The Netherlands*

The report from Neede (Kolfschoten, 2001) does not appear to be reliable.

The presumed presence of *S. kirchbergensis* in the clay-pits of Tegelen (Limburg province) (Bernsen, 1927, 1932; Guérin, 1980; Hoek Ostende, 2003, 2004) is still object of debates. According to Loose (1975), the remains from Tegelen belong to *S. etruscus* (FALCONER 1868).

*1.3. France*

The localities where remains ascribed to *S. kirchbergensis* were found have, inter alios, diffusely been discussed by Guérin (1980) and Lacombat (2005).

*1.4. Germany*

The following material must certainly be assigned to *S. kirchbergensis:*

– the uncommonly well-preserved, relatively short skull (LNK Op/650) found at Daxlanden (Karlsruhe, Baden-Württemberg) in 1802. It represents the only complete skull existing in Germany. In the course of two centuries, it has been identified as *R. Merckii* by MEYER (1863-64; Pls. XXXV, XXXVI, XXXVII, XXXVIII, XXXIX), as *R. etruscus* FALCONER by Lartet (1867:180-181), as *R. Mercki* (*Merckii*) var. *Brachycephala* by SCHROEDER (1903, Pl. 2-fig. 2, Pl. 3-fig. 1, and 1930), as *R. hemitoechus* FALCONER by Toula (1906), as *R. merckii* JÄGER by Wüst (1922), as *D. mercki* JÄGER by Staesche (1941), as *D. mercki* (*kirchbergensis*) (JÄGER) var. *Brachycephalus* Schroeder by MAYER (1971), or as *D. kirchbergensis* JÄGER by Loose (1975, Pl. 5-fig. 1, Pl. 6-fig. 1, Pl. 8-fig. 3, Pl. 10-fig. 5, Pl. 13-fig. 1). Erroneously, Guérin (1980:623, 628) introduced for this skull the subspecies *D. etruscus brachycephalus* (= *S. hundsheimensis* [TOULA 1902] = *R. etruscus heidelbergensis* [FREUDENBERG 1914] = *D. handzellensis* WANG 1928 = *D. hemitoechus intermedius* [CIGALA-FULGOSI 1976]);

– the skull (NMM 1956/962) from the Rhine at Mosbach ("Mosbach–II", the main assemblage) (Heilbronn, Baden-Württemberg), the oldest *S. kirchbergensis* skull found in W-Europe. Seriously damaged in its splanchnocranium, it has been treated – among others – by Schroeder (1903, 1930), Freudenberg (1914), Wüst (1909, 1911, 1914), Loose (1975, Pl. 3-fig. 3, Pl. 4-fig. 3, Pl. 8-fig. 2, Pl. 10-fig. 4, Pl. 13-fig. 2), and Guérin (1980). Incidentally, the skull from Mosbach was not mentioned by Fortelius & al. (1993).

Isolated teeth and a third metacarpal (NMM 1956/520) were also recovered at Mosbach–II.

On the basis of the lithostratigraphy and the "*Palaeoloxodon* mammalian fauna" (Brüning, 1978; Igel, 1985; Koenigswald & Tobien, 1987) an interglacial age related to the second half of the "Cromerian Complex" (in this region assigned to MIS 15-13) is suggested (Koenigswald & Heinrich, 1999; Stuart & Lister, 2001). Consequently, MIS 13 (ca 500 kys BP) has been proposed for Mosbach–II by the above mentioned authors. An updated Mosbach-II faunal list is given in Hemmer & al. (2008).

– the SMN 16275 skull found along the Murr river (a small Neckar tributary) at Steinheim an der Murr (about 50 km north of Stuttgart, Baden-Württemberg).

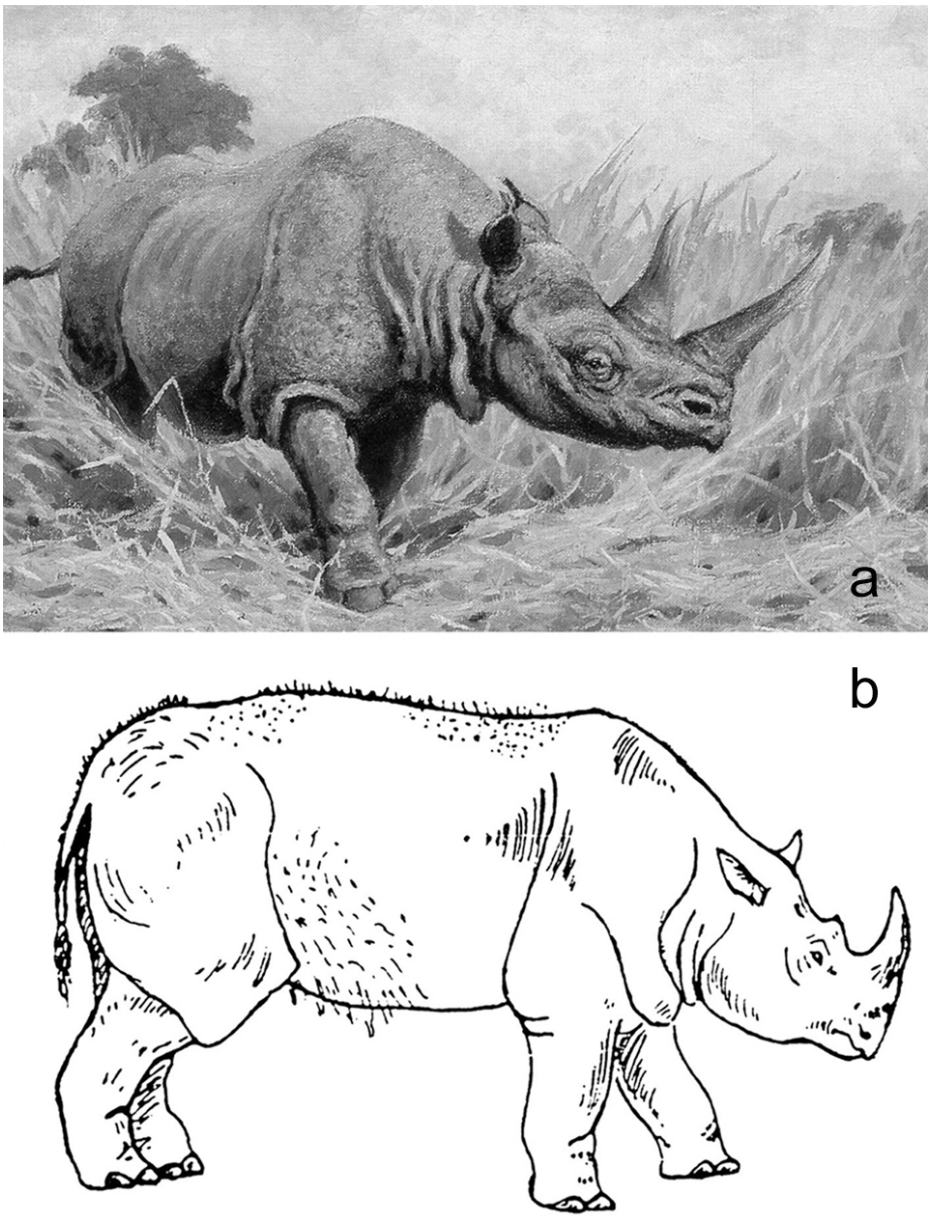


Figure 2 – Reconstructions of *Rhinoceros mercki* JÄGER, 1839 (recte *Stephanorhinus kirchbergensis* [JÄGER, 1839]); (a) after Flerov (in Flerov & al., 1955) and (b) after Kojamkulova (in Kojamkulova & Kostenko, 1984).

Used by Staesche (1941, Pl. 11-figs 1, 3) – in addition to the second one (SMN 16938), identified as *S. hemitoechus* and also coming from Steinheim – for his well-known comparative study, it has extensively been restored taking as a model (understandable, at least from my point of view) the one attributed to *S. hemitoechus.* Evidently, any comment seems here superfluous. In any case, Guérin (1980) agreed with Staesche in considering the SMN 16275 skull as *D. mercki.* According to Fortelius & al. (1993), both crania have to be ascribed to *S. hemitoechus.*

Three distinct layers may be recognised in this site indicating a glacial-interglacial-glacial transition (Koenigswald & Heinrich, 1999). A Holsteinian Interglacial (MIS 11, ca 400 kys BP) has been proposed for the "*Palaeoloxodon antiquus* horizon" including *S. kirchbergensis* (Adam & al., 1995). Schreve & Bridgland (2002a) correlated this horizon at Steinheim with the one at Swanscombe (Kent, England) referred to MIS 11 (ca 400 kys BP);

– the teeth from the Lower Travertines along the Ilm river (a Saale–Elbe tributary) at Weimar-Ehringsdorf (Thüringen) (Kahlke, 1974, 1975; Kahlke & al., 2002) (IQW collections).

The sequence – originally attributed by Kahlke (1974) to the Eemian (MIS 5e, ca 120 kys BP) – was later correlated with the pre-Eemian Interglacial (intra-Saale Interstadial; MIS 7, ca 200 kys BP) (Koenigswald & Heinrich, 1999) on the basis of small mammals. According to some authors (Schreve, 2002; Schreve & Bridgland 2002a; Bridgland & al., 2004), in comparison with the British sequence the large mammal assemblage

(*S. kirchbergensis* included) indicates MIS 7 rather than MIS 5e. This is also supported by Uranium-series dating which gave an age of 225 ± 28 kys BP (Blackwell & Schwarcz, 1986; Mallik & al., 2000).

Furthermore, U-series (Schwarcz, 1980; Schwarcz & al., 1988; Schüler, 1994) and ESR (Schüler, 1994) datings from the Lower travertines suggested that the Lower and Upper travertines represent successive parts of MIS 7 interglacial;

– the odontological and postcranial remains discovered at Taubach (a travertine site, 3.5 km southeast of Weimar, Thüringen) (IQW 1968/10610, Taubach 1207; IQW 1969/12075, Taubach 12788; IQW 1968/10692, Taubach 2632-2634-2639, etc.) (Kahlke, 1977a, figs 1, 4, 5, 6, 7, 8, 10, 12, 13, 14, 17, 20, 21, …. 41).

The deposit was correlated with the Eemian Interglacial (MIS 5e, ca 120 kys BP) (Kahlke, 1977b; Heinrich, 1994). Later, when radiometrically dated, it provided an absolute age of 116 ± 19 kys BP (Brunnacker & al., 1983).

At Taubach, 1224 *Stephanorhinus* sp. specimens were found. Most of them were ascribed to *S. kirchbergensis.* The assemblage, including at least 76 individuals, was characterized by a very high percentage of young or sub-adult animals (Bratlund, 2000). On the basis of this remarkable high percentage of mortality, Bratlund (2000) argued that such a copious accumulation has to be explained by selective hominid deliberate hunting activities (numerous cut-marks appear, especially on the *S. kirchbergensis* bones). Evidence from Taubach indicates that the megafauna exploitation (*S. kirchbergensis* included) constituted an important element of subsistence strategies during the Eemian Interglacial (Bratlund, 1999).

The faunal assemblage collected over several years at Taubach (*S. kirchbergensis* included) is represented by *Castor fiber* L. 1758, *Canis lupus* L. 1758, *Ursus arctos* L. 1758, *Ursus spelaeus* ROSENMÜLLER & HEINROTH 1793, *Meles meles* L. 1758, *Lutra lutra* L. 1758, *Crocuta crocuta* (ERXLEBEN 1777), *Lynx lynx* (L. 1758), *Panthera pardus* ssp., *Panthera leo spelaea* or cf. *spelaea* (recte *Panthera spelaea* or *P.* sp. cf. *spelaea* [GOLDFUSS 1810]), *Elephas antiquus* (FALCONER & CAUTLEY 1845), *Equus taubachensis* FREUDENBERG 1914, *Sus scrofa* L. 1758, *Megaloceros giganteus* (BLUMENBACH, 1803), *Dama dama* (L., 1758), *Cervus elaphus* L. 1758, *Alces latifrons* (JOHNSON 1874), *Capreolus capreolus* (L. 1758), *Bison priscus* BOJANUS 1827, *Bos primigenius* BOJANUS 1827, and *S. hemitoechus* (FALCONER 1868) (Bratlund, 2000);

– the dental elements found at Burgtonna (about 50 km west of Weimar, Erfurt, Thüringen) (Kahlke, 1978, figs 1, 2, 3; Kolfschoten, 2000) (IQW collections). The deposit was correlated with the Eemian Interglacial (MIS 5e, ca 120 kys BP); radiometrically dated, it provided an absolute age of 104-111 ± 7 kys BP (Brunnacker & al., 1983);

– the odonto-osteological remains from Weimar ("Travertine im Stadtgebiet") (Thüringen) (Kahlke, 1984, figs 1, 2, 3) (IQW collections);

– the mandible found in the Middle Pleistocene levels of a cave at Hunas (Pommelsbrunn, Bavaria) (Groiss & al., 1981, Pl. 3-figs 2, 4, 6) (IPE collections);

– the nine isolated teeth from Braunschweig (Niedersachsen) (? unpublished material);

According to literature, other *S. kirchbergensis* remains also come from:

– Lehringen (about 35 km southeast of Bremen, northwestern German plain), found with the following accompanying fauna: *Castor fiber* L. 1758, *Canis lupus* L. 1758, *Ursus* sp., *Equus* sp., *Equus hydruntinus* REGALIA 1904, *Cervus elaphus* L. 1758, *Dama dama* (L. 1758), *Capreolus capreolus* (L. 1758), *Megaloceros giganteus* (BLUMENBACH 1803), and *Bos primigenius* BOJANUS 1827. The site was originally excavated in 1948 (Adam, 1951; Deibel-Rosenbrock, 1960; Sickenberg, 1969, inter alios);

– the upper "Mauerer Sande" on the banks of the Elsenz river (a small Neckar tributary) at Mauer an der Elsenz (south of Heidelberg). The deposit yielded a relatively great number of fossil rhinoceros remains. Even if they were mainly assigned to *S. hundsheimensis* (TOULA 1902), in the case of some specimens (a radius, a second metacarpal, an astragalus, and a third metatarsal; GIH collections) *S. kirchbergensis* seems also to be attested (Koenigswald & Heinrich, 1999; Schreiber, 2002). For all rhinoceros remains, MIS 15 (ca 600 kys BP) is supposed only;

– Neumark-Nord (Halle, Sachsen-Anhalt), collected with an Eemian Interglacial faunal assemblage (Mania & al., 1990; Mania, 1992; Koenigswald, 1997). The age of this deposit is still object of debates;

– the right bank of Rhine at Reilingen (west of Heidelberg) (Ziegler & Dean, 1998);

– the open cast lignite mine at Schöningen (near Magdeburg, Niedersachsen), about 150 km north of Weimar-Ehringsdorf (Thüringen) (Kolfschoten, 1993, 1995; Koenigswald & Heinrich, 1999). Two different isotope stages have been proposed for this site: MIS 9 (ca 300 kys BP) (Urban, 1995; Urban & al., 1995) or MIS 11 (ca 400 kys BP) (Mania, 1996);

– Rabutz (Sachsen-Anhalt) where an upper dentition was found (Fritsch, 1880). An Eemian age has only been advanced by Eissmann (1990), but the age of this deposit is still object of debate.

A part of the rhinoceros odonto-osteological remains from the Wipper river (a Saale–Elbe tributary) at Bilzingsleben ("Bilzingsleben–I") (northern margin of the Thuringian basin) referred to the post-Elsterian (MIS 11c, ca 430 kys BP) (Schreve, 2001; Schreve & Bridgland, 2002b) was formerly assigned to *S. kirchbergensis* by Mania (1983). Later, Made (2000) ascribed it to *Stephanorhinus* sp. aff. *S. kirchbergensis* (IQW collections).

On the reconstruction of the palaeoenvironment of Northwestern Europe based on fossil mammals, on the Eemian climate, on the Eemian Interglacial in Northern Europe, on the Eemian mammal fauna of Central Europe, respectively on the Eemian Interglacial in general see also Kolfschoten (1995), Zagwijn (1996), Turner (2000) and Gaudzinski (2004), Kolfschoten (2000, 2002), Gibbard (2000).

*1.5. Austria*

*S. kirchbergensis* remains come from two sites only: Nordwestbahn bei Wien-Heiligenstadt (Toula, 1907) and from Willendorf–I (about 4 km south of Spitz an der Donau, Niederösterreich) (Woldrich, 1893; Thenius, 1956-59; Frank & Rabeder, 1997:69).

From Wien-Heiligenstadt comes a hemimaxilla with six teeth found in 1870 by H. Wolf, described as *Rhinoceros Mercki Jäger* var. *Vindobonensis* TOULA 1907 (Toula, 1907:449-454, Pl. XI-figs 1, 2).

The three teeth from Willendorf–I (Thenius, 1956-59:160-162, figs 116-117-118) were recovered in 1893

by Woldrich who erroneously assigned the specimens to *C. antiquitatis* (BLUM. 1799) (Woldrich, 1893) (PNHM collections).

The Willendorf–I accompanying fauna (revised by Thenius in 1956) consists of: *Aquila chrysaëtos* (L. 1758), *Ochotona pusilla* PALLAS 1768, *Arvicola terrestris* (L. 1758), *Lepus* sp., *Canis lupus* L. 1758, *Vulpes vulpes* (L. 1758), *Alopex lagopus* (L. 1758), *Gulo gulo* (L. 1758), *Ursus* sp. cf. *U. arctos* L. 1758, *Panthera spelaea* (GOLDFUSS 1810), *Lynx lynx* (L. 1758), *Cervus elaphus* ssp., *Rangifer* sp., *Alces alces* (L. 1758), *Capra ibex prisca* WOLDRICH 1893, *Bison priscus* BOJANUS 1827, *Mammuthus primigenius* (BLUMENBACH 1799), and *Equus* sp.

In both cases, no stratigraphical data are available.

*1.6. Spain and Portugal*

In the older Spanish literature, rhinoceros material has often been referred to "*Dicerorhinus mercki*" (Obermaier, 1925, 1937; Meléndez, 1955; Fuentes Vidarte, 1979, inter alios). Altuna Echave (1972) reported on some remains of *D. kirchbergensis* from Lezetxiki (Guipúzcoa), while Pérez Ripoll (1977) referred to the presence of the same species at Cova Negra (Valencia).

At present, we may exclude that *S. kirchbergensis* lived in Spain, as well as in Portugal (Barandarian & Veiga Ferreira, 1971; Veiga Ferreira, 1975). On the other hand, as to the Spanish area, Cerdeño (1990) revised the "*Dicerorhinus mercki*" material concluding that it would have to be referred to *S. hemitoechus* (FALCONER 1868).

*1.7. Italy*

The twelve localities and the specimens (with their illustrations and measurements) have been discussed – using morphological and non-metric characters – in a previous paper (Billia & Petronio, 2009).

Afterwards, some additional *S. kirchbergensis* reports have been found in literature. The material was originally collected in the following seven other localities:

– along the Trieste-Venezia railway near Aurisina (Carso Triestino, Trieste, Venezia Giulia, Northeastern Italy): two upper molars (Leonardi, 1945-47, Pl. V-fig. 4, Pl. VI-fig. 2) (MCSN-TS collections);

– at Preluca (Venezia, Venezia Euganea, Northeastern Italy): one first upper molar referred to the Mindel-Riss by Fabiani (1919, Pl. XVII-figs 8, 8a) (Valle private collection, Trieste);

– at Cava "Calcara" (Monte di Malo, Vicenza, Venezia Euganea, Northeastern Italy): only one fourth upper premolar. It was recovered in 1955 in a rock crack of this quarry in which some other rhinoceros osteological remains (untraceable, at present) were contained (MPP collections);

– at Monte Zoppega (= Grotta di San Lorenzo di Soave, Soave, Verona, Venezia Euganea, Northeastern Italy) (Scortegagna, 1844; Molon, 1875; Fabiani, 1919, Pl. XVII): two mandibular branches (with $P^2$–$M^3$ and $P^4$–$M^3$), a few isolated upper teeth, and some skeletal remains belonging to only one individual. The remains were referred by Fabiani (1919) to the Mindel-Riss (odontological material – MCSN di Vicenza collections; skeletal remains – IGUP "A. de Zigno" collections);

– Grotta Valdemino (Borgio Verezzi, Savona, Liguria, Northwestern Italy): a fragmentary metapodial of large dimensions ascribed to *Stephanorhinus* cf. *S. kirchbergensis* (Sala, 1992). It was found together with a well-represented accompanying interglacial faunal complex: *Testudo hermanni* GMELIN 1789, *Oryctolagus burgi* NOCCHI & SALA 1997, *Mammuthus armaeniacus* (FALCONER 1857) (= *M. trogontherii* [POHLIG 1885]), *Sus scrofa* L. 1758, *Bos primigenius* BOJANUS 1827, *Macaca sylvanus* (L. 1758), *Canis mosbachensis* (SOERGEL 1925), *Panthera pardus* (L. 1758), *Felis* (*Lynx*) gr. *spelaea, Homotherium* sp., *Ursus* sp., *Microtus* (*Iberomys*) *brecciensis* (GIEBEL 1847), *Sorex* sp., *Talpa* sp., *Allocricetus bursae* SCHAUB 1930 (*Allocricetus* = *Cricetulus*), *Pliomys episcopalis* MÉHELY 1914, *Apodemus* sp., *Clethrionomys* sp., and *Microtus* (*Terricola*) sp. (Nocchi & Sala, 1998; Sala & Masini, 2007) (collections: Museo Civico, Chiostri di S. Caterina, Finale Ligure, Savona).

Excavated at the end of the 1980s, Grotta Valdemino was correlated with the Middle Galerian. It represents one of the few Italian cave sites provided with a well-known chronology (Sala, 1992);

– Caverna degli Orsi (San Dorligo della Valle – Dolina, Trieste, Northeastern Italy). From this cave comes a dental gemma of a fourth lower deciduous molar referable to *S.* sp. cf. *S. kirchbergensis* (Berto & Rubinato, 2010) supposedly correlated with the Eemian (MIS 5e);

– Roma, Tiber at Ponte Molle (or Ponte Mollo, now called Ponte Milvio; at that time a suburb of Rome). The odontological material described in Billia & Petronio (2009) apart, a fouth upper premolar and a third upper molar were collected from the same site (the right Tiber bank) in the second half of the XIX century (Leonardi, 1947, Pl. II-figs 4, 9; IGUP collections). No more information is available.

Unfortunately, except for Grotta Valdemino, the other Italian *S. kirchbergensis* remains found without macro-microfaunal and/or stratigraphical data do not allow inferring any chronological hypothesis.

Toula (1907:447) reports on "ein Zahn aus einer Höhle nächst Matteria bei Cosina (zwei Meilen von Triest; *Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt,* Jhrg 1860, p. 114)" attributed to *S. kirchbergensis.* Unfortunately, no further information on this report is available.

At least a dozen of other reports on *S. kirchbergensis* in Italy (from north to south) may be found in literature, but they are related to nomenclatural misidentifications with other Pleistocene rhinoceros species (? *S. hemitoechus,* ? *S. hundsheimensis*). These rhinoceros remains – formerly attributed to *S. kirchbergensis* – come from Zandobbio (Trescore Balneario, Bergamo, Lombardia) (Vialli, 1957), from the lacustrine basin of Piànico-Sèllere (Bergamo, Lombardia) (Casati, 1968), from the Po near Portalbera (Pavia, Lombardia) (Cadeo, 1958), from Monte Giogo (Piacenza, Lombardia) (Simonelli, 1897-98), from the Grotta di Madonna dell'Arma near Bussana (San Remo, Liguria) (Isetti et al., 1962), from Monte Tignoso (Livorno, Toscana) (Del Campana, 1909), from Lecce Sole (Falciano Selice, Caserta) (Sorbini & Durante Pasa, 1974), from Cagnano Varano (Foggia, Gargano, Apulia) (Sorbini & Durante Pasa, 1974), from the "ventarole" karst cavities at Melpignano (Otranto, Lecce, Apulia) (Mirigliano, 1941; Barbera et al., 2006), from Torre Talao (Scalea, Cosenza, Calabria) (Bulgarelli, 1972; Mangano, 2007), or from S. Francesco-Contrada Corvo (Archi, Reggio Calabria, Calabria) (de Stefano, 1899, 1901; Flores,

1900; Bonfiglio & Berdar, 1986; Mangano, 2007).

*1.8. Slovenia*

In Slovenia, *S. kirchbergensis* was recognised at Dolarjeva jama near Logatec (about 25 km southwest of Ljubljana) (Rakovec, 1933) and at Kamnitnik (Skofija Loka, about 20 km northwest of Ljubljana) (Rakovec, 1942).

A *S. kirchbergensis* second deciduous molar (Ck 210) was recovered at Crni Kal (southeast of the Osp village, Koper Municipality, Northern Istria, Southwestern Slovenia) (Adam, 1958; Rakovec, 1958; Malez, 1986) (collections: Geological-Palaeontological Institute, Ljubljana University).

*1.9. Croatia*

Apart from the skull from Husnjakovo Brdo at Krapina (about 40 km north of Zagreb) – one of the five *S. kirchbergensis* skulls found until now in Europe – damaged at the right zygomatic arch and in illo tempore described as *Rhinoceros Mercki* var. *Krapinensis* by GORJANOVICH-KRAMBERGER (1913) (v. autem in Billia, 2010), mandibles and isolated teeth were also collected from the same site (Gorjanovich-Kramberger, 1913; Malez, 1970, 1986).

*S. kirchbergensis* is also represented by the dental elements discovered at Varazdinske Toplice (about 13 km southeast of Varazdin and about 45 km east of Krapina) (Gorjanovich-Kramberger, 1913) and by a fragmentary second lower molar and two phalanges from the Veternica cave (Medvednica Mountain, 9 km west of Zagreb). Malez (1963) dubiously correlated these remains with the Riss-Würm Interglacial.

The material coming from Husnjakovo Brdo and from Varazdinske Toplice is preserved at the Quaternary Institute of HAZU (Zagreb) and at the Museum of Geology and Palaeontology of SAN (Belgrade). Numerous illustrations of these remains may be found in Gorjanovich-Kramberger (1913; Pls. III, IV, V, VI, XI, XIII).

The two rhinoceros upper molars (MCSN-TS n.n.) from Volosko (Lussino island – at present, Losinj, Dalmatia) (Leonardi, 1945-47, Pl. VI-fig. 1) must be also assigned to *S. kirchbergensis*.

The two mandibular fragments (IGUP n.n. and MCSN-TS n.n.) – with two molars on both specimens – coming from the island of Lesina (at present, Hvar, Dalmatia) (Woldrich, 1882:455-456, Pl. X-figs 26, 27; Woldrich, 1886:178; Leonardi, 1945-47, Pl. IV-figs 2, 3; Leonardi, 1947, Pl. III-fig. 8) may tentatively be attributed to *S. kirchbergensis* (just as in Woldrich, 1882, 1886 and in Leonardi, 1945-47, 1947).

*1.10. Hungary*

Two *S. kirchbergensis* fragments of mandible and some postcranial remains of late Middle Pleistocene age – found together with *Bison* (*Urus*) *hungaricus* KRETZOÏ 1942 skeletal remains – come from the top of the strata at the "entrance N° 1" of the Ördöglyuk cave (about 1 km west of the Solymár village, eastern slope of the Zsíros Hill, northwestern border of Budapest, left side of the 10 highway, Budapest-Dorog axis, western side of the Danube; about 300 m a.s.l.) (Jánossy, 1986:111, 113–Pl. II-figs 2, 3, p. 188) (collections: Department of Palaeontology, Hungarian Museum of Natural History, Budapest).

Jánossy (1986) chronologically correlated the above mentioned strata with Steinheim (Baden-Württemberg) and Swanscombe (Kent).

Further data on the Ördöglyuk cave at Solymár are also available in Fostowicz-Frelik & Gasparik (2006).

M. Gasparik (2007, personal communication) does not exclude the existence of some other *S. kirchbergensis* remains found in Hungary but no data are available at present.

1.11. Czech Republic

*S. kirchbergensis* finds are very rare. This fact may be due to the arid continental climate (R. Musil, 2007, personal communication). In any case, the remains consist of small fragments of teeth only.

*1.12. Slovakia*

Only one *S. kirchbergensis* record is attested (P. Holec & M. Sabol, 2007, personal communications). The remains (skull fragments and some limb bones) come from a travertine mound at Gánovce-Hrádok (about 3 km southeast of Poprad, Poprad district, Presov region, Northeastern Slovakia) together with a cast of *Homo sapiens aniensis* (recte *Homo sapiens* var. *aniensis* SERGI 1929) (unpublished material). Presumed age: Eemian Interglacial (M. Sabol, 2007, personal communication).

*1.13. Poland*

The earliest occurrence of *S. kirchbergensis* in this area is represented by a mandible (ZIN 10743) of large dimensions with massive features (at present, de facto only a hemimandible) (Pusch, 1836; Brandt, 1875-76:81, Pl. XXI; Brandt, 1877:97, Pl. III-figs 2, 3, 4; Chersky, 1891:519-520; Pavlova, 1892-93; Gromova, 1935:95 and 102, Pl. I-fig. 3, Pl. II-fig. 7, Pl. III-fig. 10). In 1811, it was unearthed near the confluence of the Liur river with the Bug river not far from the town of Kamienczyk (or Kamieniec-Mazowiecki; in Brandt, 1877:97, Kamenetz-Mazowski) (Wyszków region, Central-Eastern Poland). "Poluchena iz Varshavy v 1832 g." (literally, "[remains] received from Warsaw in 1832"), as I found in an old ZIN Museum catalogue.

The present hemimandible (max lenght = about 590 mm) appears frontally and occipitally seriously damaged. Moreover, only four very worn dental elements were preserved.

The most significant *S. kirchbergensis* Polish record (Borsuk-Bialynicka & Jakubowski, 1972, Pls. I-V) concerns the almost complete skull (MZ VIII Vm-450) recovered in 1970 – with mandibular fragments – at the dept of 6-7 m in alluvial deposits of the Wisla (= Vistula) river bed, in the Siekierki district of Warsaw. Exhaustively described by the above mentioned authors, it represents one of the five *S. kirchbergensis* skulls found until to day on European territory. Some other skeletal remains assigned to *Equus caballus* L. 1758 (recte *Equus ferus* BODDEART 1785), *Bos primigenius* BOJANUS 1827, *Rangifer tarandus* (L. 1758), and *Cervus elaphus* L. 1758 were also found.

Between 1880 and 1882, at Szczesliwice near Warsaw, *S. kirchbergensis* odonto-osteological remains were collected by Slósarski (1882, 1884) together with remains of *Bison priscus* BOJANUS 1827, *Cervus elaphus* L. 1758, *Capreolus capreolus* (L. 1758), and *Elephas antiquus* FALCONER & CATLEY 1845. At first, the *S. kirchbergensis* remains were mistakenly assigned by Slósarski to *C. antiquitatis* (BLUM. 1799). Later, in 1935,

L. Sawicki revised this material ascribing it to *S. kirchbergensis.*

From a brickyard at the same locality (Szczesliwice) comes a well-preserved maxilla with nine teeth collected by Sawicki in interglacial deposits in 1935 (Czyzewska, 1962).

According to some authors, other *S. kirchbergensis* remains were allegedly found in Poland:

– along the Wisla (= Vistula) near Grudziadz; some teeth (Jentsch, 1901; Hermann, 1911; Schroeder, 1930);

– at Minieta (Sztum province); some teeth (Hermann, 1911; Schroeder, 1930);

– at Grupa (Swiecie province); a fourth lower premolar (Hermann, 1911; Schroeder, 1930);

– at Obornikach near Poznan; a mandible (Lubicz-Niezabitowski, 1926, Pl. 4-figs 11, 12);

– at Imbramowice (Swidnica province, Lower Silesia); a mandible (Gürich, 1908; Pax, 1921);

For more detailed data on these records, vide autem in Kowalski (1959:153-154), Czyzewska (1962), Jakubowski & al. (1968).

*1.14. Romania*

*S. kirchbergensis* is reported from five localities:

– Reci-Comolău (Târgu Secuiesc Basin, Southeastern Transylvania); in "andesitic detrital deposit above the middle level A" with *Cervus elaphus* L. 1758, and *Bubalus murrensis* (BERCKHEMER 1927) (= *Buffelus murrensis* BERCKHEMER 1927) some not-specified *S. kirchbergensis* remains were collected (Kovács, 1981). The A level of Mindel-Riss/Holstein age is correlated with the Steinheim a.d. Murr "*antiquus*-Schotter" fauna (Rădulescu & Samson, 1985:91);

– Borsec (Borsec Basin, Harghita district, Eastern Transylvania); from travertines a *S. kirchbergensis* isolated upper molar was recovered (Samson & Rădulescu, 1969). From the same travertines also comes a *S. kirchbergensis* upper maxillary fragment provided with the fourth premolar, the first and second molars found together with an isolated fourth upper premolar belonging to the same individual (Samson & Nadisan, 1970; an illustration of the maxillary fragment is given in fig. 1, p. 247). According to Samson & Rădulescu (1969), a Mindel-Riss or Riss-Würm age may only be supposed. The isolated fourth upper premolar is housed in the Miercurea-Ciuc Museum collections;

– a Danube terrace deposit south of Plenița (Dolj district, Southwestern Oltenia, Southwestern Romania); here, an isolated fourth upper premolar of Mindel-Riss age was recovered (Ghenea & al., 1963:50, Pl. I). No descriptions of the specimen are available;

– "Peştera Cioarei" (Cioarei Cave) at Boroşteni (or Broşteni, Gorj district, Oltenia, Southwestern Romania); the *S. kirchbergensis* fragmentary remains were collected from bed IV as part of a mammalian assemblage including *Canis lupus* L. 1758, *Ursus arctos* L. 1758, *Putorius putorius* L. 1758 (recte *Mustela putorius* L. 1758), *Cervus elaphus* L. 1758, *Equus* sp., Bovidae indet. (Terzea, 1987). Unfortunately, this paper mentions a species list only, neither descriptions nor images of the remains are available;

– Grojdibodu (Olt district, Oltenia, Southwestern Romania); only one *S. kirchbergensis* isolated molar was found in this site (Bandrabur & al., 1963:122). Other data are not available.

In the author's opinion, the well-known rhinoceros "skull from Bessarabia" – without upper dentition and mandible – referred by Simionescu (1939-40) to *S. kirchbergensis* ("Nach den oben angeführter Einzelangaben glaube ich, dass der beschriebene Schädel mehr an *Rh. mercki* erinnert", Simionescu, 1939-40:430), on the basis of some of its morphological characters (vide in Simionescu, 1939-40:433, Pl. I ) would seem to belong to *C. antiquitatis* (BLUM. 1799). In any case, the specimen – found in an unknown locality in Bucovina (at present, in Ukraine) – previously preserved in the collections of the Palaeontological Institute of the University of Bucharest is unfortunately unavailable at present (no information is available about the collection in which it is housed; probably, in ? Cernauti [Chernivtsi], Southeastern Ukraine; V.A. Codrea, 2009, personal communication).

As regards hydrological details on Plenița and/or on the Danube terrace vide autem in Ghenea & al. (1963). For analogous details on Grojdibodu vide in Bandrabur & al. (1963).

*1.15. Moldova*

From the alluvial deposits ("tiraspol'skaya gravya" = "Tiraspol' gravel") of Kolkotova balka (near Tiraspol', southeast of Chişinău (= Kishinev) (Pavlova, 1925; Gromov, 1948; David & Vereshchagin, 1967; Belyaeva & David, 1971; David, 1963, 1966, 1969, 1980, 1983, 1995; David & al., 1990; Eremeyko, 2002), originated several *S. kirchbergensis* remains:

– a right hemimandible (OPS 1640) (Belyaeva & David, 1971, Pl. XV-fig. 2; David, 1980, fig. 3; David, 1983, fig. 16) provided with $P_3$–$M_3$ showing traumatological consequences at the level of $M_2$–$M_3$ (collections: previously, OPS – at present, IZiF);

– a right hemimandible (OPS 1-128, non OPS 1-218 as in Belyaeva & David, 1971:131) with $M_2$ and $M_3$ only (both teeth are seriously damaged) (collections: previously, OPS – at present, IZiF);

– a mandible (ZIN ANU 19-159) with seven teeth on the whole, without the left vertical branch (David & al., 1990, fig. 25) (ZIN ANU collections);

– a fragment of a right horizontal mandibular branch without teeth (ZIN ANU collections);

– two fragments (a proximal and a distal one) of humerus (inv. nrs. 1/221 and 1/224);

– a tibia fragment of great dimensions (ZIN ANU collections).

As a whole, the remains were generically assigned to the (? Russian) Middle Pleistocene (Eremeyko, 2002:8).

The rhinoceros remains from the "Tiraspol' gravel" were previously described by Pavlova (1925) – just as indicated by Gromov (1948:449) – as *Rhinoceros* aff. *hemitoechus* FALCONER (actually *S. etruscus* [Falconer 1868]).

Not less than 24 palaeontological sites are know on the Moldovian territory where Plio-Pleistocene rhinoceros remains were found, *S. etruscus* (FALCONER 1868), *Elasmotherium peii* CHOW MINCHEN 1958, and *Elasmotherium* sp. included (Eremeyko, 2001).

*1.16. Ukraine*

In the literature (Rogovich, 1875; Pidoplitschko, 1932; Gromova, 1935:96-97; Gromov, 1948:449), *S. kirchbergensis* – described by Rogovich (1875) as *Rhinoceros leptorhinus* CUVIER 1836 – would be attested

in five localities: near Kiev, at Kaniv (also Kanev, Cherkasy region, Central Ukraine) (? "*Rhinoceros Mercki,* skull"), at Tripol', at Pekarya, and at Ol'viopol'. According to Gromova (1935:97), in the 1930s the material was housed by the Geological Museum collections of the UkrAN.

According to David & al. (1990:101-102 and 2008, personal communication), fourteen *S. kirchbergensis* fragments of teeth and bones were recovered from Sinyakovo–1 (collections: Palaeontological Museum, UkrAN) while a *S. kirchbergensis* mandibular fragment with four teeth (inv. nr. 3675) (David & al., 1990:102, fig. 26) was found at Belyaevka ([Biliaivka], Odessa region) (PM OGU collections).

Logvynenko (2004) reported on some other poorly-characterised *S. kirchbergensis* skeletal remains from Morozivka (about 5 km south of Brusyliv, Brusyliv district, Zhytomyr region), Shutnovzi, and Tikhonivka (Zaporozhye province). No additional data are available.

Stepanchuk & Rekovetz (2008) referred to a discovery of "*Dicerorhinus*" cf. *kirchbergensis* JÄGER remains from the alluvial deposits of Medjibozh ([Medzhibizh], Lower Bug basin, Khmel'nits'ky region, Western Ukraine). Further information is not available.

*1.17. Russian Federation (European area)*

As far as the Russian-European area is concerned, the author recently revised all the *S. kirchbergensis* available material using morphological and non-metric characters.

Unfortunately – at least at present – *S. kirchbergensis* available remains come from some Russian European localities only. With reference to other localities mentioned in the literature where *S. kirchbergensis* remains were also allegedly found, the respective material is untraceable. However, all the localities and the available specimens (with their illustrations and measurements) have been discussed in a previous paper (Billia, 2008b).

*2. Asia*

As to the territories previously included in the ex Soviet Union, the most noteworthy *S. kirchbergensis* reports concern the skull from the Irkutsk region (Eastern Siberia) (Chersky, 1874; Brandt, 1877; Billia, 2008a, 2010), the only skull recovered until now on the whole Russian territory which has been re-identified by the author in a vault of the ZIN RAN Museum in St-Petersburg in 2004.

*2.1. Russian Federation (Asian area)*

Recently, a revision – using morphological and non-metric characters – has been performed on the Siberian *S. kirchbergensis* material by the author. Differently from the *S. kirchbergensis* remains recovered in the Russian European area, here the specimens – except for only one site – are available in museum collections. Moreover, other rhinoceros fossil material – discovered in the museum collections during revision works – has been ascribed to *S. kirchbergensis.* The six Siberian localities of the finds and the material (the famous "Irkutsk skull" included) – with their illustrations and measurements – have been treated in previous works (Billia, 2008a, 2008b).

*2.2. Armenia*

In the author's opinion, the horizontal left branch of a mandible (inv. nr. 29) described as "*Rhinoceros mercki* Jäg." (recte *S. kirchbergensis*) belonging to a sub-adult individual – found in 1928 at Kazach' (southern environs of Leninakan, Northwestern Armenia) besides remains of *Equus stenonis* COCCHI 1867, *Camelus knoblocki* NEHRING 1901, *Cervus* sp., and *Elephas* sp. (Avakyan, 1948, 1955, 1959:31-34, Pl. VIII-figs 18, 19, 20, 1961:389-390, Pl. 2-figs 1, 2, 3; Avakyan & Burchak-Abramovich, 1945:101; Vereshchagin, 1959:74), should only cautiosly be assigned to *S. kirchbergensis.* All the remains were collected by Bogachev (collections: Kapetyan Museum, Institute of Geology, Armenian Academy of Sciences, Erevan).

*2.3. Azerbaijan*

According to Vereshchagin (1959:129), "skull fragments and teeth of a juvenile rhinoceros – *Rhinoceros* cf. *mercki* (recte *Stephanorhinus* sp. cf. *S. kirchbergensis*) – found together with skeletal material assigned to *Equus* sp. and *Crocuta* sp. were allegedly found at Kishla (north of Baku, Apsheron peninsula)". Other *S. kirchbergensis* material probably originated from the Azikh cave (Alev, 1969; Mamedov & Aleskerov, 1988:106-107), also known as Azykh, Azokh or Azix magarasi (about 3 km northeast of the Tugh village, Fizuli district, Southern Karabakh). No further information is available for any of the finds.

*2.4. Tajikistan*

The following *S. kirchbergensis* remains were reported from two localities (Sharapov, 1980; Dmitreva & Nesmeyanov, 1982):

– from the left bank of the Obigarm river near the village of Obigarm (Obigarm basin, Roghun district, Central-western Tajikistan). On the basis of Khisarova's data, Kojamkulova (1969) assigned the remains to the (? Russian) Early Pleistocene;

– from both the right and the left banks of the dry bed of the Kuruksay river (? Dashtigulo or ? Shalash point; ? Kuruksay–3; ? 0.97 Mys BP), northeast of the Bal'djuan village (Eastern Tajik depression, Southern Tajikistan) with remains of *Equus stenonis* COCCHI 1867 and *Equus* sp. cf. *E. hydruntinus* REGALIA 1904 (attributions by Kojamkulova, 1969).

Even if the stratigraphy of Southern Tajikistan (within the Tajik depression, an intermontane basin) – based on data obtained by biostratigraphical, climatostratigraphical, geological-geomorphological, and physical methods (Dodonov, 1980, inter alios) – would seem to be well-known in the interval Late Pliocene/Late Pleistocene, we consider that in the second case (Kuruksay), the chronology for *S. kirchbergensis* is currently questionable.

*2.5. Kazakhstan*

*S. kirchbergensis* was certainly testified by twelve isolated teeth (eight of which – after Khisarova, 1963 – are figured in fig. 3, in this paper) coming from the village of Koshkurgan (14.5 km northeast of Turkestan,

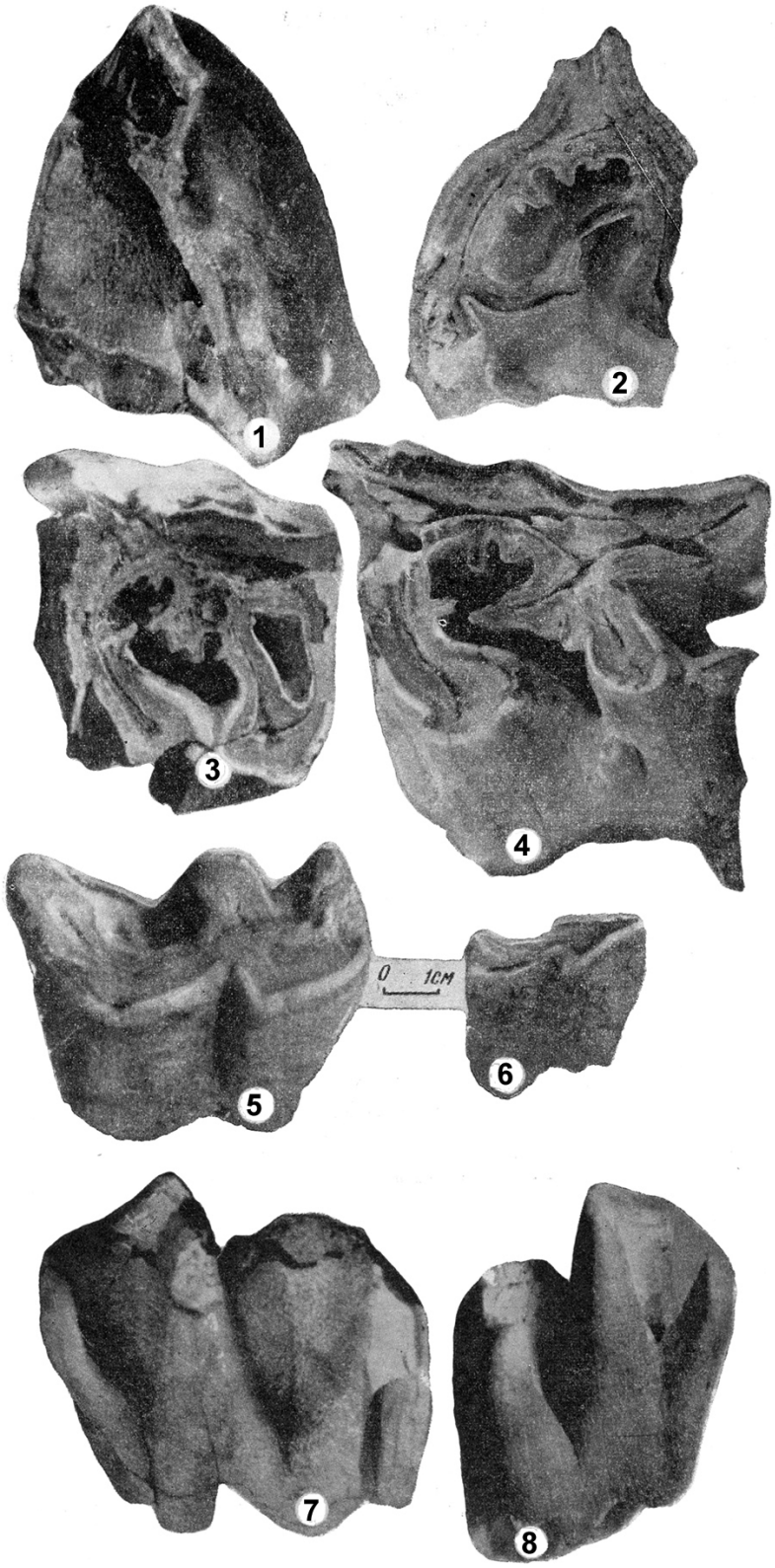


Figure 3 – *Stephanorhinus kirchbergensis* (JÄGER, 1839); Koshkurgan village (Turkestan, Turkestan district, Kara Tau Mountains, Chimkent region, Southeastern Kazakhstan); eight isolated upper and lower teeth; (1-2) third upper molars [729-14/55-K and 2/55-K]; (3) first upper molar [760-33/55-K]; (4) second upper molar [5/55-K]; (5) second lower molar [756-32/55-K]; (6) second lower premolar [758-32/55-K]; (7-8) third lower molars [754-30/55-K and 17/56-K] (scale bar for all the specimens = 1 cm) (after Khisarova, 1963, modified) (coll.: "G.V. Plekhanov" Gorny Institut [= Institute of Mines], St-Petersburg).

Turkestan district, Kara Tau Mountains, Chimkent region, Southeastern Kazakhstan) (Khisarova, 1963, Pls II, III). They have been collected from Middle Early Pleistocene (*sic*) alluvial and proluvial pebble beds, conglomerates, sands, limestones, and clays together with other fossil skeletal remains assigned to *Paracamelus gigas* SCHLOSSER 1903, *Equus caballus* cf. *mosbachensis* REICHENAU 1914 (recte *Equus* sp. cf. *E. mosbachensis* [REICHENAU 1914]), *Asinus hydruntinus* REGALIA 1904 (recte *Equus hydruntinus* [REGALIA 1904]) and *Bison priscus* ssp. In detail, they consist of: four upper molars ($M^1$, 760-33/55-K; $M^2$, 5/55-K; $M^3$, 729-14/55-K; $M^3$, 2/55-K), three lower premolars ($P_2$, 758-32/55-K; $P_2$, 757-33/55-K; $P_3$, 759-35/55-K), and five lower molars ($M_1$, 755-31/55-K; $M_2$, 756-32/55-K; $M_2$, 753-29/55-K; $M_3$, 754-30/55-K; $M_3$, 17/56-K).

At present, the twelve teeth – previously preserved at the Palaeobiological Branch, Zoological Institute, AN KazSSR – are housed at the "G.V. Plekhanov" Gorny Institut (= "G.V. Plekhanov" Institute of Mines) in St-Petersburg.

Some other Early Middle Pleistocene (*sic*) remains possibly referable to the same species could come from four other localities of Kazakhstan:

– in a ZIN old card-index, under "*Rhinoceros merckii* Jaeg."(*sic*), I found remains (ZIN 21007; ledger n. 368-1939) "discovered along the Irtysh river, near the village of Chernoyarka" (Chernoyarka or Pavlodar; in toponymy, Chernoyarka and Pavlodar represent two different localities, whereas – in literature – they must be considered as synonyms indicating the same palaeontological site). The Chernoyarka village is situated about 18 km north of Pavlodar (Pavlodar region, Northeastern Kazakhstan). No other data are available;

– Kojamkulova (1981) and Kojamkulova & Kostenko (1984) shortly reported on "a discovery of indeterminate remains referable to *Dicerorhinus mercki* (recte *S. kirchbergensis* [JÄGER]) at Zyryanovsk" (about 49° 55' N – 84° 25' E), about 150 km north of the Zaysan lake and about 120 km east of Ust'-Kamenogorsk (Vostochno-Kazakhstanskaya oblast') (= Northeastern Kazakhstan), without any other appreciable remarks;

– reports on finds of "*Dicerorhinus mercki*" (recte *S. kirchbergensis* [JÄGER]) at Novoiliysk (Alma-Ata [Almaty] region, Southeastern Kazakhstan) may be found in three other works (Kojamkulova, 1981; Kojamkulova & Kostenko, 1984; Tleuberdina & al., 1990). No additional data are available;

– finally, from a bank of the Ili river near the Kapchagay village (Tyan'-Shan' Mountains, Alma-Ata [Almaty] region, Southeastern Kazakhstan), Kojamkulova (1974, 1981) referred to the recovery of typical "Koshkurganskaya Fauna" (= Koshkurgan Fauna) remains: *Dicerorhinus mercki* JÄGER (recte *S. kirchbergensis*), *Elasmotherium sibiricum* FISCHER 1808, *Asinus hydruntinus* REGALIA 1904 (recte *Equus hydruntinus* [REGALIA 1904]), and *Archidiskodon* cf. *wüsti* M. PAVLOVA 1914, identified in the $Q_1$ levels (Russian Middle-Early Pleistocene).

According to Tleuberdina & al. (1990), the *S. kirchbergensis* remains from Chernoyarka (or Pavlodar), Zyryanovsk, and Novoiliysk must be assigned to the Russian Middle Pleistocene.

The rhinoceros remains (mandibular fragment, ZIN 10742 and humerus, ZIN 3989) from Semipalatinsk (Semipalatinsk region, Northeastern Kazakhstan) discovered in 1869 by Gulyaev and erroneously assigned both by Brandt (1877:96) – "Mandibula speciminis juvenilis (pulli) Rhinocerotis Merckii Semipalatinsk 1864, Guliaew" (figured in Brandt, 1877; Pl. III-figs 5, 6) – and by Chersky (1891:608) to *Rhinoceros Merckii* JAEGER (recte *S. kirchbergensis* JÄGER) must be assigned to *C. antiquitatis* (BLUM. 1799).

Chernoyarka, Pavlodar, Semipalatinsk, and Zyryanovsk are located in the northeastern part of Kazakhstan, which geographically represents the extreme southern area of Western Siberia. Since 1992, Kazakhstan is an independent republic.

In the author's opinion, apart from the teeth from Koshkurgan, the other *S. kirchbergensis* skeletal material will have to be attentively evaluated as there are possibilities of misidentifications with other local rhinoceros species.

Differently from Siberia, during the Middle Pliocene very active tectonic movements affected Kazakhstan and the adjacent regions. Originally called the "Irtysh phase" (Kostenko, 1963), they later acquired the name "Irtysh-Tekes phase" implying the regional nature (Kostenko & Kojamkulova, 1980).

*2.6. Korea*

*S. kirchbergensis* is attested from two caves of the "Turubong Cave Complex" near Sinam village (8 km northeast of Cheongju, Chungbuk province, Central Korea, 36°30'31"N–127°31'21"E) by a very well-preserved mandible and some long bones collected between 1976 and 1983 in Middle Pleistocene levels (Lee, 2001:3-5, fig. 14–p. 16) (collections: Chungbuk National University Museum, Chungbuk).

*2.7. China*

Back in the past, a great part of the South Chinese Pleistocene rhinoceros material has been referred to *Rhinoceros sinensis* OWEN 1870 (= *Rhinoceros sinensis* OSBORN 1898). Furthermore, *Rhinoceros choukoutiensis* WANG 1931 (recte *Dicerorhinus choukoutienensis* [WANG 1931]) has been considered as a synonym of *S. kirchbergensis* by some authors (Teilhard de Chardin, 1933, 1936, 1941; Teilhard de Chardin & Leroy, 1942; Xu, 1986; Tong & Wu, 2010). Now, if one definitively assumes that *R. sinensis* and *D. choukoutienensis* must be considered as synonyms of *S. kirchbergensis,* four other skulls found on the Chinese territory must be ascribed to *S. kirchbergensis*. Two of them come from Choukoutien (= Zhoukoudjan), two others from Anping and respectively from Xiniudong.

According to Tong (2002), *S. kirchbergensis* is a common element of the North Chinese Fauna. Nevertheless, "although the studies on *S. kirchbergensis* have experienced more than one and a half centuries, the knowledge about this species is still not enough because of the lack of fossil material" (Tong & Wu, 2010:1165).

However, some reports regard *S. kirchbergensis* remains discovered in at least eight localities:

– Choukoutien (= Zhoukoudjan) locality 1 (CKT-1) (Beijing province). The first report concerning rhinoceros remains at CKT-1 (*Sinanthropus* deposits) is due to Zdansky (1928) who referred the material to *Rhinoceros* sp. Teilhard de Chardin & Young (1929) ascribed the same material to *R.* cf. *sinensis.* Wang (1931) erected for this material a new species, *R. choukoutiensis* (= *D.*

*choukoutienensis* WANG). Afterwards, other authors dealt with this material but pro parte only (Black & al., 1933; Teilhard de Chardin, 1936; Teilhard de Chardin & Pei, 1941; Teilhard de Chardin P. & Leroy, 1942; Pei, 1957; Chia L.P. & al., 1959; Chao & Li, 1960; Kahlke & Chow, 1961; Chow, 1963, 1978).

Chow (1979) was the first who examined all the rhinoceros material collected at CKT-1 from 1927 to 1959. In his work, he mentioned 271 specimens, 85% of which belonging to *D. choukoutienensis:* the damaged juvenile VM 555 skull (unavailable nowadays), several upper/lower jaws, isolated juvenile/permanent teeth, postcranial bones (some of them are figured in Pls I-II; measurements are given in pp. 238-239). These remains were recovered from the CKT-1 layers 4-1 and 12-6. For them, Chow (1979) proposed a late Mindel-early Mindel-Riss age. The rest of the material belongs to *Coelodonta antiquitatis yenshanensis,* the subspecies erected by Chow (1979);

– Choukoutien (= Zhoukoudjan) locality 20 (CKT-20) (Beijing province). From CKT-20 comes the very well-preserved V2682 skull (Chia & al., 1959; Chow, 1963) collected in 1951. Provided with complete upper cheek teeth, it represents the best rhinoceros skull found in the Choukoutien region (Chow, 1963, Pl. I; skull and teeth measurements on pp. 63-64). Chia & al. (1959) proposed a Middle Pleistocene age;

– Taiyuan (Shaanxi province). Remains were found in this locality (Wang, 1961);

– Xiaogushan, Haicheng (Liaoning province). Remains were discovered in the Late Pleistocene levels of this site (Zhang & al., 1985);

– Anping (Liaoning province). Xu (1986) reported on a damaged juvenile skull as well as several odontological and postcranial remains (LA7701-xxx; some of them – but not the skull – are figured in Pl I; some measurements are given in tabs 1, 2, 3);

– Tangshan (Nanjing province, Southern China). Remains were collected in this locality (Huang, 1996; Tong, 2001a, 2001b, 2001c, 2002);

– Dunbey territory (NE China). Unspecified remains come from Middle Pleistocene levels of the Dunbey territory (Fu, 2002:7, 9);

– Xiniudong (Shennongjia Forest District, Hubei Province, CS China). Very recent studies (Tong & Wu, 2010) attributed the Late Pleistocene rhino remains from the Paleolithic site of Xiniudong (or "Rhino Cave") (west of Hongping, Shennongjia Forest District, Hubei Province, Central-South China, 31°40'19.9"N–110°25'11.9"E) to *S. kirchbergensis.* Wu (1998) previously referred this material to *R. sinensis*.

The material consists of a fragmentary juvenile skull (H36), skull fragments belonging to an adult animal, four mandibles (the best *S. kirchbergensis* Chinese material), isolated upper and lower teeth, many other postcranial elements (atlas, axis and other cervical vertebrae, scapula, humerus, radius, ulna, carpals, metacarpals, basin bones, femur, patella, tibia, fibula, astragalus, calcaneum, metatarsal, phalanges, etc) (Tong & Wu, 2010, figs 1, 2).

Shennongjia represents the highest altitude locality (the cave entrance lies at 2102 m) of Pleistocene rhinoceros in Central-South China, being also the Chinese southernmost and the richest locality after Zhoukoudian in *S. kirchbergensis* remains (Wu, 1998). Furthermore, it is the first *S. kirchbergensis* find associated with the *Ailuropoda-Stegodon* fauna, the typical Pleistocene mammalian fauna in Southern China including *Ailuropoda melanoleuca*, *Stegodon*, *Hystrix*, *Atherurus*, *Rhizomys*, *Megatapirus*, *Cervus unicolor*, *Capricornis*, *Bubalus,* and others (Wu, 1998) (collections: Shennongjia Museum of Natural History and the Shennongjia local government office for cultural relics administration).

*3. Middle East and Africa*

*3.1. Lebanon and Israel*

Two reports (Hooijer, 1961) refer to the presence of *S. kirchbergensis* at Ksar' Akil (Lebanon) and at Tabun-Mont Carmel (Israel). Woldstedt (1958) reported on *S. kirchbergensis* remains from Ras-el-Kelb (Beirut, Lebanon) and from Umm Quatala near Jerusalem (Israel).

The reports of both authors are very probably based on misidentifications with other rhinoceros species.

As to the *S. kirchbergensis* remains from Jissr Banat Yakub near 'Ubeidiya (Jordan Valley, Israel) (Bar-Yossef & Chernov, 1972), Guérin (1986) revised the material concluding that it must be assigned to *S. etruscus* (FALCONER 1868). On 'Ubeidiya site, vide autem in Chernov (1987) and in Belmaker (2004).

*3.2. Algeria and Morocco*

The report on *S. kirchbergensis* remains from Algiers (Arambourg, 1950) and other reports from Algerian and Moroccan localities (Arambourg, 1938; Neuville & Ruhlmann, 1941; Balout, 1955; Biberson, 1955; Vaufrey, 1955, inter alios) are probably based on misidentifications with other rhinoceros species.

## REMARKS

The present study was partly motivated by the fact that *S. kirchbergensis* – when faced with evidence – is undeniably a rhinoceros still little investigated and consequently not well-known yet.

Though widely spread throughout Eurasia, *S. kirchbergensis* seems to be decidedly rare on this wide territory being reported from a relatively limited number of localities only.

On the other hand, Gromova (1932, 1935, 1965, 1967), Belyaeva (1935), Gromov (1948), Vangengeym & Zajigin (1965), Alekseeva (1980) also referred to the scarce presence of *S. kirchbergensis* in Russia and/or in Asia. Furthermore, according to N.V. Garutt (2004, personal communication), in Russia the rhinoceros remains ascribed to the genus "*Dicerorhinus*" are very rare.

As mentioned in the present paper, very often neither chrono- nor biostratigraphical data are available because of the lack of reliable data.

Currently, *S. kirchbergensis* represents a rhinoceros species which supposedly inhabited Europe from MIS 15-13 ("Mauerer Sande" and "Mosbach-II", in Germany, § 1.4) up to the Eemian Interglacial MIS 5e (Taubach and Burgtonna, in Germany § 1.4).

"Concentrations" of remains of this rhinoceros species are represented by the finds in England (§ 1.1), Germany (§ 1.4), Italy (Friuli-Venezia Giulia and Venetia Euganea, Latium, § 1.7), Slovenia and Croatia (§ 1.8, § 1.9], Poland (§ 1.13), and possibly Romania (§ 1.14), Moldova (§ 1.15), Ukraine (§ 1.16), Kazakhstan (§ 2.5), and China (§ 2.7).

As to the Russian distribution of *S. kirchbergensis* remains, the Middle-Lower Volga area (European Russia), as well as the southeast of Western Siberia represent other "concentration" areas of discoveries of material assigned to this species (Billia, 2008b).

At present, it seems that *S. kirchbengensis, C. antiquitatis, S. etruscus,* and – dubitatively – *Elasmotherium* constitute the Pleistocene rhinoceros group which is common to both European and Asian continents, even if the Asian occurrences of *S. etruscus* (Gromova, 1935, 1950; Gromov, 1939; Sokolovsky, 1958; Gabunya, 1959; Leybman, 1960; Babaev, 1962; Kahlke, 1966; Alekseeva, 1974, 1977; Liubin & Belyaeva, 2008; Nioradze & Nioradze, 2008, inter alios) seem to be very scarce.

According to Baryshnikov & Guérin (1986) and Baryshnikov & al. (1989), remains of *Dicerorhinus etruscus brachycephalus* GUÉRIN 1980 (recte *S. hundsheimensis* TOULA, 1902) were respectively found in the Acheulean layer of the Kudaro–1 cave (Georgia, Greater Caucasus) and in a Mousterian site in Erevan (Armenia).

Until to-day, the area of origin of *S. kirchbergensis* has not been identified yet, even if in the author's opinion the Central Asian area (? Kazakhstan, ? China) would seem fairly plausible.

The phylogenetic relationship between *S. kirchbergensis* and other ancestral rhinoceros species represents a problem still unresolved. On the other hand, there are some complex problems which lead to heated debates regarding the same relationship between *S. kirchbergensis, S. elatus, S. etruscus, S. hundsheimensis,* and *S. hemitoechus* whose position has been – and still is – decidedly controversial. Moreover, though subject of several systematic studies since some time, yet, no agreement has been reached so far by palaeontologists as to the relationship between the genus *Stephanorhinus* and the other Rhinocerotidae genera. For more detailed data on this theme, vide autem in Osborn (1900), Soergel (1914), Matthew (1931), Borissyak (1935, 1938), Gromova (1935:125, 1965:52, 1967:149), Wood (1941, 1949), Viret (1958), Thenius (1969), Heissig (1973, 1981), Rensberger & Koenigswald (1980), Guérin (1980, 1982), Groves (1983), Prothero & al. (1986, 1989), Fortelius & al. (1993), Cerdeño (1995, 1998, inter alios).

The Eurasian faunal and floral complexes reported by several authors do not seem to be very reliable because of the lack of certain stratigraphical and/or biochronological data. As a general rule, we may assume that *S. kirchbergensis* occupied palaeoenvironmental landscapes dominated by Conifera, but often also the open forest, as well as the extensive grasslands with sparse trees.

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## A D D E N D A

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Thanking so much Dan Ziegler (Section Editor, Rhino Resource Center) as well as Martin Sabol (Comenius University, Bratislava) and Jan van der Made (Museo Nacional de Ciencias Naturales, Madrid), after the delivery of the manuscript to the publisher, further data have come to my knowledge as follows:

1.1. England

In January 1909, twenty-nine *S. kirchbergensis* teeth and tooth fragments – together with some other fossil remains – were found in a swallet on Worlebury Hill (Weston-super-Mare, Avon) in presumed Hoxnian levels (= Holsteinian; MIS 11, ca 400 kys BP) by the Reverend J.H.H. Doorbar (Davies, 1920:24; Savage & Richards, 1980). The remains belong to two individuals. Some *Bos primigenius* BOJANUS 1827 remains were also recognised. Two newspaper reports (Anon., 1914 and Anon., 1925) also referred to this discovery.

At Hoxne (Suffolk) (Bed E, pollen zones Ho I-II), *S. kirchbergensis* remains were recovered in addition to a remarkable large interglacial mammal fauna: *Dama dama clactoniana* (FALCONER 1868), *Bos primigenius* BOJANUS 1827, *Megaloceros giganteus* BLUMENBACH 1803, *Capreolus capreolus* L. 1758, *Cervus elaphus* L. 1758, *Sus scrofa* L. 1758, *S. hemitoechus* FALCONER 1868, and *Palaeoloxodon antiquus* (FALCONER & CAUTLEY 1847).

Schreve (2004) and Ashton & al. (2008) correlated both Swanscombe (the Lower Gravel and the Lower Loam) and Hoxne with MIS 11c (ca 425-395 kys BP).

1.2. The Netherlands

The rhino material from Tegelen (a latest Pliocene locality, according to Freudenthal & al., 1976) has been assigned to *S. kirchbergensis* (*R. mercki* by Bernsen, 1927). Others suggested that the material belongs to *S. etruscus* (FALCONER 1868) (Loose, 1975; Kolfschoten, 1989). According to Made (2010a), "the rhinoceros from Tegelen resembles metrically *S. hundsheimensis,* though there are some specimens that differ morphologically".

1.4. Germany

Neumark-Nord (Sachsen-Anhalt, Germany) is a late Middle Pleistocene archaeo-palaeontological locality in sediments of a small interglacial lake which yielded a rich, typical interglacial mammalian fauna (deers, elephants, aurochs, rhinoceroses, and others) (Mania & al., 1990). On the whole, palaeontological data suggest MIS 7 (about 200 kys BP) (Mallik & al., 2000; Mania, 2000; Mania & al., 2003; Made, 2010a, 2010b). The geological situation of Neumark-Nord was described by Thomae (1990). From Neumark-Nord come the following *S. kirchbergensis* remains:

– a well-preserved skull (198) – lacking a fragment of the right zygomatic arch only – preserving both the right and the left P2–M3 (Made, 2010a, Pls 1, 3, 27; Made & Grube, 2010, figs 2, 3, 4, 5, 6);

– a second much damaged skull (193-NN 32) with both the right and the left P2–M3 coming from the "Untere Uferzone" (Made, 2010a, Pl 2);

– fragments of a large part of a third skull (200-E 24/241-243) (Made, 2010a, Pl 2);

– a fair number of dental elements (Made, 2010a, Pl 4) as well as postcranial bones (Made, 2010a, Pls 8, 10, 12).

The three skulls belong to adult animals. Exceptionally, the *S. kirchbergensis* dental fossette of the upper cheek teeth (as well as those of the two other rhinoceroses species found at Neumark-Nord, infra) were filled by plant remains such as: *Populus, Quercus, Crataegus, Pyracantha, Urtica, Nymphaea* as well as plants of the Betulaceae, Rosaceae, and Poaceae and others, suggesting that *S. kirchbergensis* from Neumark-Nord was a browser (Grube, 2003; Made & Grube, 2010:392).

Skull measurements are given in tab 1, those of the teeth in tabs 2, 3 (Made, 2010a).

Other noteworty rhinoceros remains (skulls included) found at Neumark-Nord belong to *S. hemitoechus* and *C. antiquitatis* (the last one is considered here as a peculiar presence; Made, 2010a, 2010b; Made & Grube, 2010). The whole material from Neumark-Nord is kept in the Landesmuseum für Vorgeschichte in Halle (LVH).

1.13. Poland

According to Król (unavailable date), in the collections of the National Museum of Natural History in Kielce (Central-southern Poland), three *S. kirchbergensis* remains are preserved: a humerus proximal epiphysis (MNKi/P/15) from Opatów (east of Tarnobrzeg, Podkarpacki), a radium (MNKi/A/631) from an unknown locality, and a tibia (MNKi/P/3423) found near Chmielnik (south of Kielce) in 1878.

0.0. Macedonia

*S. kirchbergensis* remains come from the Manastirec cave (Galerian in age), together with *Bison* sp., *Sus scrofa* L. 1758, *Pachycrocuta brevirostris* (AYMARD 1846), *and Ursus deningeri* V. REICHENAU 1906 remains (Kurtén & Garevski, 1989).

0.0. Greece

*S. kirchbergensis* remains come from the Megalopolis open site (Peloponnese) which also yielded *Bison priscus* BOJANUS 1827, *Bos primigenius* BOJANUS 1827, *Cervus elaphus* L. 1758, *Capreolus* sp., *Dama* sp., *Sus scrofa* L. 1758, *S. hemitoechus* FALCONER 1868, *Palaeoloxodon antiquus* (FALCONER & CAUTLEY 1847), *Hippopotamus* sp., and *Crocuta* sp.

This association is rather indicative of the late Galerian age in Southern Europe (Kahlke & al., 2010).

3.1. Lebanon and Israel

Two other reports (Martínez-Navarro, 2004; Rabinovich & al., 2007) would concern *S. kirchbergensis* remains from Gesher Benot Ya'aqov (Israel) (0.8-0.7 Ma BP, MIS 18).

3.2. Algeria and Morocco (and Lybia)

The remains from Algeria – as well as those from Haua Fteah (Libya), about 100 kys in age, described as *D. mercki* by Klein & Scott (1986) – "long referred to *S. mercki,* it is now believed to belong to *S. hemitoechus* …" (Geraads, 2010:672 and 677).

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