

THE NEXT TASK OF RUSSIAN PALEONTOLOGY

by Prof. A. A. Borissiak*

with one chart and one map:

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STRATIGRAPHIC CHART OF VERTEBRATE LOCALITIES IN THE U.S.S.R.

Quaternary			Taman and others	
Tertiary	Pliocene	Upper	Tshim	
		Middle	Tsmail (Russillon fauna)	
		Lower		
	Meotic	Upper	Balta, Tiraspol, Odessa, Ishim, Tarakliia, Chobnuchi, Grebentic, Tudorovo, Nov. Elizabetovka	<i>Hipparion Fauna</i>
		Middle		
		Lower		
	Middle Miocene		Krivoi Rog, Stavropol, Grosulovo, Sebartopol, Elidar	
	Lower Miocene		Belomotchetsk	
	Oligocene		Dzhilanchik strata	
	Eocene		Indricotheria-beds	
Mesozoic	Cretaceous		Kalkan, Karacheka, Kok-Muinak, Sary-Agach, Amur, and others	
	Jurassic			
	Triassic		Bodgo, Luzay, Kobrar Vetluga	
Paleozoic	Permian		Northern Dvina, Kargala, Chirki, New Novgorod, etc.	
	?Carboniferous		Aulie-ata	

MAP OF FOSSIL LOCALITIES OF TERRESTRIAL VERTEBRATES IN THE U.S.S.R.

Circles — localities of mammals:

1 – Schastopol (middle Sarmatian); 2 – Odessa, Grosulovo (Upper Tertiary); 3 – Greheniki Nova Elizabetovka Meotic; 4 – Tarakliia, Tudorovo, Chobruchi (Meotic); 5 – Tsmail (Middle Pliocene); 6 – Balta (Lower Pliocene); 7 – Nikolaev (Upper Tertiary); 8 – Krivoi Rog (upper Sarmatian); 9 – Kerch, Taman (Upper Tertiary); 10 – Stavropol (upper Sarmatian); 11 – Belomechetskaia (Middle Miocene); 12 – Elidar (middle Sarmatian); 13 – Indricotheria beds (Upper Oligocene); 14 – Dzhilanchik (Lower Miocene); 15 – Kara-Turgai (Upper Oligocene); 16 – Ishim (Pliocene); 17 – Semipalatinusk (Lower Pliocene).

Squares - localities of reptiles and amphibians:

1 – Northern Dvina (Upper Permian); 2 – N. Novgorod (Upper Permian) 3 – Vetluga (Lower Triassic); 4 – Chirki (Upper Permian); 5 – Kobra (Lower Triassic); 6 – Luza (Lower Triassic); 7–8 – Kargala and others (Middle and Upper Permian); 9 – Bogdo (Lower Triassic); 10 – Karacheka (Cretaceous); 11 – Kalkan (Cretaceous); 12 – Kok-Muinak (Cretaceous); 13 – Sary-agach (Cretaceous); 14 – Amur (Cretaceous).

THE NEXT TASK OF RUSSIAN PALEONTOLOGY

PROF A. A. BORISSIAK

“...if anyone who should find in the ground some kinds of old things, namely: unusual stones, animal bones, fish or bird bones, different from those that we have now, he should bring them, and for that good reward will be given.”

– from the Order of Peter I

It has been a commonly known thing for a long time that of two great departments of paleontology, vertebrate and invertebrate, the history of each, and along with it the significance of each for the development of paleontology, developed differently. But perhaps, it is not known to many how far has this divergence gone. The misfortune of invertebrate paleontology was not only in the fact that its first steps discovered new ways of geology (not the opposite, as many believe), that its further progress conditioned the successes of the newly discovered region of geology, which we now call historical geology or stratigraphy; it was much more for that its successes gave more material for a solution for geological problems than for an illumination of the process of development of life. As a result, geology dominates this department of paleontology and uses it, in the full sense, in its service (*ancilla geologiae*). Like a real master, geology subdued completely the soul of this branch of paleontology, since actually the study of its material falls to the hands of the geologist. The form of the science changed, its tasks, its basic conceptions and reorganized, which of course are made in conformance with the aims of the investigation. Thereby alone is hindered the development of paleontology, as a biological science: one can say, in the field, worked out by a strange hand, the stream of real paleontological work comes out only in the form of a small channel — that stream which is among us cultivated energetically by our young Paleontological Society. As an illustration of this we mention the following fact. During the last forty years there has been observed a catastrophic decline in the number of paleontological works, — namely in those countries where the working out of stratigraphy has reached the degree of limitation in detail, for a given period, and where therefore the attention of the geologist

has been directed to other problems. And the paleontological works are still occupying a prominent place only in backward countries (in the sense of working out of geology).

Vertebrate paleontology presents an entirely different picture. It went along its road independently and it always played the main role in the development of paleontological thought¹. In the course of the entire 19th Century the dominant role in Russia belonged to invertebrate paleontology and consequently to stratigraphic paleontology. Even the works of Vl. Kovalevski (1870s) do not change this picture. Vl. Kovalevski is now generally recognized as the founder of contemporary evolutionary, and etiologic, paleontology. The greatest modern paleontologists, Osborn and Dollo, call him their teacher. We are now proud; we say that Russian paleontology paid its western teachers liberally in giving Vl. Kovalevski to the world science. But when it did so, it did not know at the time what it did. Kovalevski worked abroad and on foreign materials, and during that time he missed Russian paleontology. Therefore the statement remains correct that only during the last decade have we had an energetic development of works in the field of vertebrates.

Vertebrate paleontology, as mentioned, has always played an important role in the development of paleontological thought. In this last regard, speaking in general, the first place was secured, as it were, for the country that had the richest localities of vertebrates. From the middle of the last century North America has been such a country, and it has given us actually the greatest paleontologists. Not only that but also the technical paleontological work, laboratory and field work, it placed at a height unattained by Europeans. One of the greatest attainments of the Americans in this regard was the establishment of independent (not connected with the discoveries of the geologist) paleontological investigations that led to discoveries of ever newer localities, the existence of which could only be supposed.

Up to recent times the priority of the Americans in the field of vertebrate paleontology was uncontested. The discoveries of the last 15 years over-balanced the weights in this regard in favor of the Old World, and to our country must be given not the last place.

¹ See A. Borissiak; from *The History of Paleontology*, government edition, 1926.

This promises in the future shining successes for Russian paleontology, and at the present time upon it is placed a great and responsible task of preparing these successes. We must study the famous localities, mark and discover new ones, collect and preserve the material, organize its scientific preparation. We are at the very beginning of this colossal task.

We shall endeavor to give a short account on the subject — what do our riches consist of, what are we doing for them, and what we should do. We shall speak, consequently, about the localities of vertebrates, terrestrial vertebrates (fig. 1).

Kovalevski, as has been mentioned, worked on foreign materials. Fossil remains of vertebrates in our country were a great rarity, if the Quaternary fauna is not considered, which was widely known already in the “prehistoric” time of our science¹. The first great discovery in the regions of our country was the find of Amalitskii, in 1896, of Permian reptiles on the Northern Dvina. This find is now well known to every naturalist, and not only in our country: it acquired a well-deserved world fame. Among other things, it is conspicuous also in that it was not an accidental discovery; but — in the American fashion — it was the result of systematic searches in the locality where Amalitskii — on the basis of various signs, expected the presence of the forms consequently actually found by him.

Thereupon, after about ten years, unexpectedly, one after another a whole series of large localities of remains of mammals became accessible in the Upper Tertiary deposits on the southern Russian plains. There were discovered two faunas of different ages in Bessarabia, then in Sebastopol, in several places north of Odessa, in Transcaucasia (in the Eldarsk Desert) near Stavropol, on the Taman Peninsula — not counting small finds. A few years later (1912) were discovered our now so famous Turgai faunas of mammals in Upper Oligocene, then also in the Lower Miocene strata. Besides that, we know now of three more superimposed faunas, and altogether five faunas of mammals in the Turgai region.

Almost synchronizable with the Turgai fauna, the fauna of dinosaurs was discovered in the Cretaceous deposits on the Amur River. Approximately at the same

¹ Besides, the comparison of the jaw of the Russian mammoth with the jaw of the modern elephant gave Cuvier for the first time the idea of the existence of fossil faunas, different from the modern. See *Priroda*, VIII, 1919, Nos. 10–12.

time were made small, but in several places, finds of Stegocephalia in the Lower Triassic deposits of the Russian plain. Later than others were discovered colossal localities of Dinosauria in the Cretaceous deposits in various parts of Turkestan. Finally, during the last year, there was made a small find of bones in the Carboniferous massif of Turkestan.

From this survey it is evident (fig. 2) that essentially all Systems (except the Jurassic in which we can hope to find remains of land vertebrates) in the regions of our country gave more or less abundant localities.

Almost all of these localities, except the Northern Dvina, were discovered accidentally. Systematic searches would undoubtedly double their number rapidly. Only a few of them have been really excavated, and even these excavations were of very small dimensions in comparison with the volume of localities. The collected materials have been prepared to a considerable degree.

That which this work gave shows consequently only an inconsiderable part of that which our localities could give. Nevertheless it allows for a scientific evaluation of our localities, although along general lines. For convenience we shall divide the entire material into two parts. The time of formation of numerous groups, often ending without offspring dying out rapidly, with mixed traits. The time when mammals were separating or just separated. If these groups often represent great difficulties for the investigator in the sense of a phylogenetic systematization, they nevertheless give the richest material on the morphology of the skeleton, which is being elaborated as it were before our eyes, for an exposition of the significance of its parts and their combination.

The material that we have collected in our Permian localities, in an enormous mass, in thousands of poods¹, is still in the stone or is being prepared. Nevertheless, not a smaller quantity of material is already accessible to a scientific working out. Its systematic description, which was begun by the late Amalitskii is at present being continued. This, so to say, registration of our scientific material. In recent years a series of highly valuable morphological investigations has been done on this material, by which have been explained also interrelations of various groups and their biology. These works, one can say, allowed us for the first time to touch on the significance of these materials of ours. As is known to many, we have here representatives of the stegocephalian

¹ 1 pood — 36 lbs.

herbivorous reptiles (pareiasaurs), predatory reptiles, scavenger-reptiles, peculiar amphibians, and others of quite special significance are the very rare transitional forms with mammalian traits. It is characteristic that the closer we study this fauna, the better are torn asunder the ties connecting it with the synchronous fauna of South Africa, with which it was earlier considered to be almost identical. And at the same time ever more definitely extend from it ties westward — to Europe and North America. Not a little has also been done for the elaboration of younger faunas of reptiles, of the Triassic and Cretaceous, which came to our hands much later, a few literally the other day.

We shall not pause at the exposition of the results of all of these investigations and we will turn to the perspectives of further work in the region of lower vertebrates, again not touching the scientific themes, the range of which in itself cannot be exhausted. Possibilities of works in the field are also very great. Here is in the first place the elaboration of the already known localities, and then the problem of systematic searches for new localities. These searches must be directed on the one hand to deeper strata, which should give the most interesting materials — that is to say, bring us close to the beginning of all problems. And it should be said that our deposits, which are both partly Lower Permian and to a considerable degree Carboniferous in their surface composition, give all the basis to hope for positive results from a future hunt for fossils in them. As I have already said, we have a find in the Carboniferous massif that unfortunately has not yet been explained¹.

On the other side, our higher Triassic deposits, which have already given as yet small but excellently preserved material, promise that the searches will not be without results. The Jurassic deposits apparently give less hope, in the sense of land fauna. The finds mentioned, and very abundant, in the Cretaceous continental deposits of Turkestan, one can say — represent the occurrence of recent days still little explained. We do not even know whether we have here one or several horizons. Here in Turkestan an extensive expansion are developed conglomerations, overfilled with bones, washed down and, of course, mixed up. Whether these were deposits (i.e., deltas) of large rivers of that time, or whether they are shore deposits of the largest freshwater or sea basins (there is a reason to think even of the sea), we as yet do not know. Be that as it may, we have here

¹ It is possible that the bones found will prove to belong not to land but to water vertebrates.

representatives of such groups of reptiles, which up to the present time have not been known in Asia (stegosaurs, ceratopsians, etc.). The material is diverse so far, according to the conditions of deposition. But we are hoping that our “fossil hunters” will find the basic localities of entire skeletons.

Let us turn to mammals. It is difficult to say which of the groups, reptiles or mammals, gives richer and more interesting materials, so numerous and interesting also are the localities of mammals. They can be roughly divided into two types, European and Asiatic. In the regions of the European part of the Union, the above-enumerated localities belong mainly to that fauna that in Upper Tertiary time, after the completion of the formation of the continent in Europe (after the Alpine folding) moved to its regions from before — Asia through Asia Minor and the Black Sea, which at that time did not exist. This is the *Hipparion* fauna, known also under the name of Pivernuian. It at first inhabited the plains and forests of south Russia, and then all of southern Europe close to Spain. From Europe it migrated to Africa, where its descendants live now. Besides *Hipparion*, which lived in large herds, various rhinoceroses came here, mastodonts, deer and antelopes, several species of giraffes, rodents, predatory animals, among them hyenas, and finally monkeys.

While this fauna in western Europe belongs to one geological age, namely to the beginning of Pliocene time, in our regions it worked out its history beginning with the Middle Sarmatian to the Pontian age. Consequently, here is one of the advantages of our localities: they give material for the history of this fauna. A second advantage is that our faunas are richer in forms than Western European: evidently, the migration to the west was not complete — some forms remained behind. Besides that, in our country there has also been discovered in the Middle Pliocene the so-called Russillon fauna, i.e. we can study a further stage in the development of the fauna, after its population of western Europe — the stage that is not more richly represented in the West than in our country. Finally, in the last year in the northern Caucasus there was discovered an older fauna, i.e. pre-Sarmatian, which preceded the *Hipparion* fauna. Thus the range is ever increasing.

The tree of all these faunas is in different conditions. From the successive stages of development of the *Hipparion* fauna, the oldest Middle Sarmatian and the younger Meotic have been well explained. Some groups and forms have been treated in more

detail. Here belong: deer, camels, hyenas, and some others. Nevertheless it must be remembered that if we already have collected much material, much more is still in the ground and awaits treatment. Finally, undoubtedly not all existing localities are known, as is shown by yearly discoveries of new ones that sometimes give unexpected material. Thus, last year was discovered the pre-Sarmatian fauna mentioned, which gave an entirely new type of mastodons and others.

We shall not stop at Quaternary finds in the European part of the U.S.S.R., which are represented mainly of zoogeographic significance. Some of them, however, are of an exceptional interest. Thus for instance the Lower Quaternary locality on the Taman Peninsula gave an unusual variety of elephants and, unexpectedly, *Elasmotheria*, whose main region of distribution was apparently not in the north, as was believed earlier, but in the south.

Our localities of mammals in Asia are of incomparably greater interest than the European. Asia is a continent par excellence. If the history of the Earth's crust in the history of continent formation their gradual growth laterally and elevation in height — than this history knows of a process of dismemberment of continents and reduction of their surface, which conditioned periodical transgressions, turning the land into the sea bottom. And Asia above beginning with the end of the Paleozoic, on an enormous part of its area remains a continent up to our days at first in form of the old Angara, still separated by the Asiatic Mediterranean Sea from its southern peninsulas, and then, from the Tertiary Period on, in its contemporary outlines. But this continent, which *a priori* should have been the main center of development of the land-fauna, up to 10–15 years, one can say, famed itself with a surprising poverty of remains of land vertebrates in its central and northern parts, i.e. in its oldest parts.

The first heralds here were our above-mentioned finds: a fauna of dinosaurs on the Amur (I am leaving out small finds), and faunas of mammals at the same time in several successive horizons in the Turgai region, and our first publications on the results of the study of these finds pointed to the necessity of searches for new localities, to the undoubted abundance in remains of vertebrates of the continental deposits of Central Asia. The quickest realization of this idea, unfortunately, did not fall to our lot: everybody naturally knows about the colossal successes, of the American Expedition (of

the New York Museum of Natural History) that worked in Mongolia from 1923 through 1926¹.

??? studied with great care by the Americans, according to their recognition, directed their investigations.

Excellently equipped with a full complement of technical workers, the Americans, finding here exactly the same conditions as in the “bad-lands” of their western states, found in the course of one year over ten horizons [from Jurassic to Quaternary strata] with a fauna of vertebrates in those regions, which were not once cut by the geologists, without any results in paleontological regard, a needless, at the same time evident, proof of the fact how different sometimes can be the points of view of a geologist and a paleontologist...

And what have we accomplished on the Asiatic continent within the regions of our Union? One can say that, in mammals we have incomparably richer and more varied material than the Americans in Mongolia, with exception of the lowest horizons, which we as yet do not have. Of the remains of mammals we know, as mentioned, at the present time not less than five horizons. The two oldest of them are the most interesting, and we shall pause at them. The oldest are the *Indricotheria* beds of Upper Oligocene age. We have only begun to treat them. All that has been obtained has been treated. From them we have *Indricotherium*, the gigantic rhinoceros, the largest known elephant. Much has been written about it, to repeat. This find, in words of the famous Viennese paleontologist Abel, belongs to discoveries of such kind as are not repeated in the history of paleontology more often than once in a quarter century. Its colossal skeleton, which we were able to put together almost entirely (there are besides remains from about ten other individuals), is interesting in its surprisingly primitive traits, and together with those traits of a high specialization, which led this special group (subfamily) of rhinoceroses to a quick extinction. Remains of these gigantic rhinoceroses have been found now — partly not earlier than ours and partly later — in various parts of Asia, and they have been described under various specific names. We know now that they lived over all of Asia from the Middle Oligocene to the first half of the Miocene and gave very few forms. Along with the *Indricotherium*, from the same strata, we have another rhinoceros,

¹ See *Priroda*, XIV, 1925, Nos. 4–6.

Epiceratherium, of small size, primitive structure, the real ancestor of Upper Tertiary hornless rhinoceroses (*Aceratheria*). Of *Epiceratherium* we likewise have a complete skeleton; like the skeleton or the *Indricotherium* this is likewise unique. For the first time, in bone after bone is shown the differences of rhinoceroses from hyracodontids — American fast-running rhinoceros-like animals, which were earlier regarded as representatives of the oldest rhinoceroses, and which actually form a special side branch of Perissodactyla. There is still a third, quite a small rhinoceros, not larger than a pig, probably related to American *Diceratheria*. Thus, in regard to rhinoceroses, the little we obtained from the Indricotheria strata has already uncovered several new pages of their history. From the remaining fauna of the same strata (we have here lophodonts, Anthracotheria, Schizotheria — peculiar burrowing ungulates) few remains are known. This entire fauna is almost entirely foreign to the synchronous fauna of Europe. At the same time, its individual representatives connect it with America.

Of an entirely different character is the following in time Lower Miocene Dzhilanchik fauna. Here again rhinoceroses play a large role. We can collect their skeletons, in large part entirely complete, probably in large quantity. Of several species as yet two have been treated: one of them is on short curved legs, with a long barrel-like body, the real rhinoceros-taxon, and the other a long-logged, mobile cursorial form. Both fill the definite links in the genealogy of two branches of the European Upper Tertiary rhinoceroses. Their complete skeletons — a luxury that is seldom found in Europe — give rich material, especially in limb adaptations — material that we almost do not have in Europe.

Along with the rhinoceroses of the European type, this fauna is also represented by mastodonts. In such an early epoch they disclose here a considerable variety of forms and a high differentiation. This we do not know in Europe, where, as we considered earlier, the mastodonts went first of all from their native land of northern Africa. Now their path will probably have to be traced through Asia, which evidently gave a favorable basis for their radiation, and this material which has already been partly prepared, is in our hands.

Further upward there are three more faunas, as yet little known — the *Hipparion* fauna and two more younger ones.

As for the further study of mammals, here too lies ahead an unbroken corner of the work: the study and treatment of famous localities — in itself a colossal work — and systematic searches for new ones. On the one side, perhaps they should be concentrated in the northern and southern Caucasus: here, where a continuous migration took place, not only of nations but also of faunas, the most interesting materials can be expected in the oldest Upper Tertiary faunas. On the other side searches must proceed along the untouched area of the continental Tertiary deposits of Asia: individual finds, individual objects in local museums bear evidence that a hunt for fossils will give here an abundant crop.

We see, consequently, that our localities of land vertebrates represent a rare richness both in quantity and in diversity of both geologic age and systematic groups. They gave interesting material on systematics, morphology, phylogeny, zoogeography, paleogeography — already now when we know a small part of the obtained material, and only the tiny part has been gained of the whole that is in the ground.

A side observer can hardly get a different impression of this picture than that of something very crude. But our aim has been just this — to show our work in its present condition. This has been done very briefly, and therefore it is incomplete, but we believe sufficiently in order that the character of the work may be evident. What are so far the results? Separate sparkles, now larger, now smaller — as yet there cannot be a general ??? and should not be. Our work, as has been already mentioned, is barely begun. And then one should keep in mind special peculiarities of paleontological material: this material is above all flowing, in contrast, speaking in general, to the stationary contemporary material. Therefore in its systematic scientific treatment especially colossal is the work of systematization, evaluation of traits — inconspicuous work, but responsible, work of creation of facts of those stones from which will be constructed the history of life, which must be separated, while not knowing the building, but already anticipating the understanding of it. And here is a very clear example: it took about a decade of work on the rich paleontological materials of North America in order to have Cope's generalizations appear, and then about ten years that there might finally appear the concrete phylogenetic structure of Osborn — those structures that form the final aim of paleontological work. And we report that we are at the very beginning of our work.

Let us formulate our task once more: study of the well-known localities and systematic searches for new ones, their treatment (i.e. excavations), custody of materials, and organization of scientific work. We have already spoken about the great responsibility that is placed upon Russian paleontologists by this task: nature has uncovered before us its gifts, and it depends on us to take them or to lose them: in this case there is no third solution. Actually, some of the tasks mentioned have an urgent character — namely, the setting of proper excavations in necessary dimensions. Because a locality exposed by nature is at the same time, in the majority of cases, an already mined location: it is in a danger-free position only as long as contained in the stratum it is not exposed to the surface. In the Turgai region for many miles along the banks of ravines there extend heaps of billions of bony fragments — enormously valuable material on the Indricotheria fauna, perhaps lost forever. The same is true of many localities. The only way to save them is through urgent, widely set excavations.

That is why a proper organization of our work is so important. In the history of the Russian science the constructive role belonged mainly to a talented person. But there are tasks, such as this one, in which single efforts are not sufficient, here is absolutely necessary to create an entire staff of special scientific and technical workers. We have the beginning of such an organization in the Geological Museum of the Academy of Science of the U.S.S.R., which was created for this work, enormous part of all that has been exposed — is the work of the powers of the named Museum.

In the Geological Museum of the Academy of Science, during more than 15 years of work on the vertebrates, a corresponding scientific staff has also been found, and an excellent technical staff, there are five laboratories, and there have been formed already “fossil-hunters”. The fate of this organization is in the trustworthy hands of our Academy of Sciences, which will know how to give it the most expedient form and to develop its work to necessary regions.

Participation in this work of other scientific institutions was much smaller, it bore an accidental and, unfortunately, not always a systematic character.

Much valuable material has been lost and is being lost from the touch of perhaps a loving but unskillful hand. This refers especially to local scientific organizations, which often take turn after fossils, without necessary means and experience, neither for taking

the bones out of the matrix nor for further preservation. Because of this one can so far only wish for a greater respect for scientific material, which will cause people, in case of valuable finds, to turn immediately to an experienced specialist. A much more radical means would be the creation of a special organ at the Academy of Sciences that, while not hindering the activities of other institutions, would together with them regulate the corresponding task of excavations.

Giving a general account, we can say: if the Asiatic successes of Americans, who have been spoiled by their paleontological riches, allowed them to speak about a new era in vertebrate paleontology, then we have much more right, who until now have been quite poor in this relation, to speak now about the perspectives that are opening up before us as a new era of Russian paleontology. Along with that, we should not for a single minute forget the responsibility that lies with us for the preservation of valuable scientific material.