

Hipparions of the Northern Black Sea coast area (Ukraine and Moldova): species composition and stratigraphic distribution

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Abstract. The hipparions of the Northern Black Sea coast area (Ukraine and Moldova) are reviewed. At present, twenty forms of hipparions are known from this area. The material analysed here comes from more than twenty localities of middle Sarmatian to late Kimmerian age. The author has used both unpublished and literature data. The hipparions in these faunas and their stratigraphic distribution are given. The presence in the middle Sarmatian of Ukraine (MN9) of two species of *Hipparion* is discussed. The relationships between some species from the region is also briefly discussed.

Key words: *Hipparion*, faunistic complex, subcomplex, Sarmatian, Kimmerian, Meotian, Pliocene, Ukraine, Moldova.

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I. INTRODUCTION

A strong trend toward detailed analyses of past faunal history is currently in effect. This trend is chiefly associated with an increased usage of paleontological data for the fine stratification of deposits, and for paleo-landscape and paleoclimatic reconstructions. From this viewpoint, the faunas existing during the climax phase of the Cenozoic terrestrial ecosystems, traditionally called hipparion faunas, are of special interest. In this connection, studies of faunas from particular regions are important to the evaluation of the hipparion fauna as a whole.

The resolution of this problem is based on study of the dominant mammal groups, particularly the ungulates. Among these animals, hipparions are especially important due to the high rate of evolution of the genus *Hipparion* (*sensu lato*), and its great species diversity and long temporal range.

The Northern Black Sea coast area and, in particular, Ukraine and Moldova, is characterised by numerous localities with *Hipparion* faunas. Hipparions are recorded from practically all localities in the studied region (KRAKHMALNAYA 1987, 1995), and is represented by large series in many of them.

The Northern Black Sea coast area is known not only for the number of *Hipparion* fauna localities but, which is especially important, for their stratigraphic position. A continuous succes-

sion of geological deposits (middle Sarmatian – late Sarmatian – Meotian – Pontian – Kimmerian) is characterised throughout the sequence by the presence of large mammal faunas incorporating hipparions. Fig. 1 shows the geological succession of faunal assemblages from particular oryctocoenoses within the faunistic complexes and subcomplexes and the stratigraphic distribution of *Hipparion* in the region. The names of the complexes and subcomplexes are after KOROTKEVICH (1988).

The first stratigraphic occurrence of hipparions in the Northern Black Sea coast area is in the early middle Sarmatian. The youngest finds of the group in this area come from the Middle Pliocene.

At present, hipparions of the Northern Black Sea coast area are known mostly from descriptions of particular species by BORISSIAK (1914), ALEKSEEV (1915), GROMOVA (1952), GABUNIA (1959), BARBU (1959), TARABUKIN (1968) and LUNGU (1973, 1984). Brief characteristics of these species, in particular *H. sarmaticum*, *H. moldavicum*, *H. verae* and *H. tudorovense*, with remarks on their systematic position and relationships, are given by FORSTEN (1968, 1979, 1980, 1983).

However, materials collected recently as a result of new excavations of the Ukrainian localities remain mostly undescribed. Moreover, the particular studied and published materials on which the species have been described require revision and redescription. Certain hipparion forms have not yet been identified to species and are here cited as *Hipparion* sp. The author intends a step by step study and description of problematic forms. At present, the hipparions of Novaya Emetovka 1 and 2 have been restudied (KRAKHMALNAYA 1989a, 1995), along with the ungulate fauna of these localities. Both oryctocoenoses are found to be of early Meotian age. However, the two faunas are still widely separated stratigraphically, and their species composition is different. In earlier studies, the mammalian remains found there were considered as belonging to a single fauna. Therefore, the hipparion from Novaya Emetovka was at first identified on the basis of mixed material and showed a close relationship to both *H. moldavicum* and *H. verae* (GABUNIA 1959). Current studies

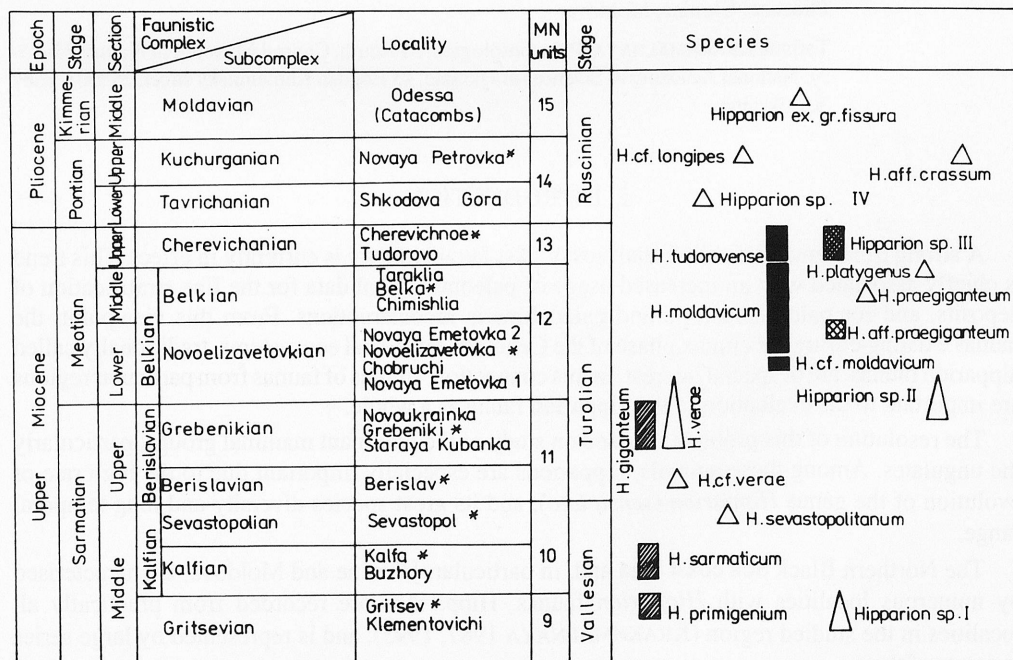


Fig. 1. Diagram showing the stratigraphic distribution of the faunas and hipparion forms discussed in this review. Asterisks indicate type localities.

have allowed me to describe four *Hipparion* species. In Novaya Emetovka 1, *H. verae* and *Hipparion* sp. (a small form), are present, while in Novaya Emetovka 2, *H. moldavicum* and *H. aff. praegiganteum* are found (KRAKHMALNAYA 1989a, 1995).

Material of the hipparions from the Odessa catacombs has also been published (GABUNIA & KRAKHMALNAYA 1993). Material of hipparions from Gritsev has, however, been only briefly discussed (KRAKHMALNAYA 1994a-c). Publications on *H. primigenium* from this locality and *Hipparion* sp. from Shkodova Gora are now being prepared for publication.

II. MIDDLE SARMATIAN HIPPARIONS

The oldest hipparions of the Northern Black Sea coast area are from the lower middle Sarmatian. At Gritsev, which belongs to the Gritsevan complex, two *Hipparion* forms of different sizes are present (Fig. 1). The large-sized *Hipparion* has a relatively long, oval protocone and moderately plicated enamel; to this species apparently belong massive limb bones. It is at present identified as *Hipparion* sp. (in this article as *Hipparion* sp. I) (KRAKHMALNAYA 1994a).

Other, smaller, material with shorter teeth and a protocone of triangular to round shape undoubtedly represents *H. primigenium* (MEYER, 1929).

A separation into two species is mainly based on examination of isolated teeth, since the metapodia do not provide reliable data. Perhaps only material from future excavations will make it possible to determine the systematic position of the Gritsev hipparions.

The presence of two *Hipparion* species in the lower middle Sarmatian raises the question of the timing of the migration of *Hipparion primigenium* from the New World into Eurasia, as well as the tempo of its radiation. The possibility of the immigration of two rather than one species into southeastern Europe can not be excluded.

The Kalfian subcomplex of the Kalfian complex is characterised by the occurrence of *H. sarmaticum* LUNGU, 1973 (LUNGU 1973, 1984), which is similar to *H. primigenium* and probably a member of the primitive hipparion lineage of the region.

H. sebastopolitanum BORISSIAK, 1914 is the last middle Sarmatian hipparion in the area. Stratigraphically it belongs to the Sebastopolian subcomplex of the Kalfian complex. It differs from the middle Sarmatian primitive hipparions (*H. primigenium* and *H. sarmaticum*) in its smaller size, less massive limb bones and, apparently, stronger enamel plication of the upper cheek teeth (GABUNIA 1959). We have not compared *H. sebastopolitanum* with *Hipparion* sp. I, since the latter is almost unstudied.

It should be pointed out that the Sevastopol hipparion (*H. sebastopolitanum*) appears adapted to more arid environmental conditions. This confirms the co-occurrence of two ecological forms of hipparions in the middle Sarmatian. *H. primigenium* and *H. sarmaticum* were adapted to wet habitats, while *H. sebastopolitanum* was a form inhabiting drier habitats.

III. LATE SARMATIAN HIPPARIONS

Late Sarmatian hipparions characterise the Berislavian and Grebenikian faunal assemblage subcomplexes, which are united into the Berislavian complex. *H. giganteum* GROMOVA, 1952, *H. verae* GABUNIA, 1979, *H. cf. verae* and *Hipparion* sp. II have been identified in them. *Hipparion* from Berislav apparently represents the first appearance of hipparions closely related to *H. verae* in the Northern Black Sea coast area (KRAKHMALNAYA 1987, 1995). This species is quite common in the Grebenikian subcomplex faunas stage, where it occurs together with *H. giganteum*.

H. verae differs from *H. giganteum* in its smaller size, strongly variable preorbital fossa that is less distinct from the orbit, considerably weaker plication of the enamel in the upper molars, slender limb bones and poor development of the side-toes (GABUNIA 1959). The latter character indicates an adaptation to a drier habitat as compared to the large Grebenikian hipparion. *H. verae* developed in parallel with *H. giganteum*, which apparently is the terminal form of the *H. primigenium* lineage in the area (KRAKHMALNAYA 1987; KOROTKEVICH 1988).

The giant hipparion does not occur in the Meotian, and should be considered a typical representative of the late Sarmatian faunas. Along with *H. giganteum* and *H. verae*, a third species, of the small hipparion group, *Hipparion* sp. II, has been recorded in these faunas. An immigration of this form into the Northern Black Sea coast area at the end of the late Sarmatian is possible. A detailed study and description of *Hipparion* sp. II material of this age is required.

IV. MEOTIAN HIPPARIONS

The Meotian stage is subdivided into the Belkian (Novoelizavetovkian and Belkian subcomplexes) and Cherevichanian complexes. The Novoelizavetovkian subcomplex includes early Meotian faunas. Among them, the faunistic assemblages of Novaya Emetovka 1 and 2 (KOROTKEVICH & KRAKHMALNAYA 1983, 1984; KRAKHMALNAYA 1985, 1986, 1987, 1989, 1991, 1994b, c, 1995; KRAKHMALNAYA et al. 1993) have been studied in detail.

In Novaya Emetovka 1, which is of earliest Meotian age, a small form of *Hipparion* has been found (KRAKHMALNAYA 1987, 1989, 1994b, c, 1995). It is represented by upper teeth comparable in size to those of *H. matthewi* ABEL, 1926, *H. macedonicum* KOUFOS, 1984 and *H. nikosi* BERNOR & TOBIEN, 1989. A small hipparion from Novaya Emetovka 1 tentatively referred to *Hipparion* sp. is similar to *H. matthewi* and *H. nikosi* in molar crown width, but differs in the greater length of the crown. Judging from size, *H. macedonicum* (KOUFOS 1984, 1986, 1987) is the closest relative of *Hipparion* sp. A small hipparion from Novaya Emetovka 1 is here assigned to *Hipparion* sp. II. It is larger than *H. periafricanum* VILLATA & CRUSAFONT, 1957 and smaller than *H. sitifence* POMEL, 1897 and *H. gromova* PIRLOT, 1956 (KRAKHMALNAYA 1994c, 1995).

H. moldavicum is the most common and widely distributed of the hipparion species. One of its characteristic features is the round to diamond shaped preorbital fossa, well defined all around and distinct through its large size. *H. cf. moldavicum* first appears in Chobruchi, where *H. cf. verae* still occurs, and has already disappeared in Novoelizavetovka and Novaya Emetovka 2. It is thus characteristic of the earliest Meotian faunas.

In Novaya Emetovka 2, *H. aff. praegiganteum* appeared. The systematic position and relationships of this species are still open to discussion. At first the presence of *H. aff. praegiganteum* was associated with immigration events of Central Asian forms. This hipparion is characterised by a deep nasal slit which extends posteriorly to the level of the middle of P2 and a small, low, anteriorly open preorbital fossa. These features show its affinities with hipparions that have a deep nasal slit and reduction of the preorbital fossa (KRAKHMALNAYA 1989, 1995).

This hipparion cannot be identified as *H. hippidioidus* SEFVE, 1927, *H. urmiense* GABUNIA, 1959 or *H. platygenus* GROMOVA, 1952, since they all lack a preorbital fossa. It is close to *H. dermatorinum* SEFVE, 1927 and *H. forstenae* ZHEGALLO, 1971 in size. The hipparion of Novaya Emetovka differs from *H. dermatorinum* in the distinct contours (even anteriorly) of the preorbital fossa. The concept of *H. aff. praegiganteum* as a local descendant of *H. verae* may be correct and requires further consideration.

H. moldavicum reaches its acme in the Belkian subcomplex. It is known from all middle Meotian localities.

H. praegiganteum TARABUKIN, 1968, described from Chimishlia, bears certain similarities to *H. aff. praegiganteum* from Novaya Emetovka 2. However, the latter shows some morphological features that make it impossible to confirm this specific determination. It is difficult to imagine completely different species inhabiting the adjoining territories of Ukraine and Moldova.

H. praegiganteum also represents a hipparion lineage with a deep nasal slit, but it has a well developed preorbital fossa. Since this species was described on the basis of a deformed skull, it requires re-examination: important morphological characteristics of the original description such as the position of the preorbital fossa relative to the orbit and frontal ridge are unclear.

Besides *H. moldavicum* and *H. praegiganteum*, a third species, *H. platygenus*, which was described from Taraklia, is present in the Belkian subcomplex. This hipparion, with a completely reduced preorbital fossa, might be an immigrant into the Northern Black Sea coast area. According to ZHEGALLO (1978) a hipparion lineage that lost the preorbital fossa, the *H. hippidiodus* group, evolved in the late Sarmatian to early Meotian and gave rise to some geographic vicars, in particular *H. platygenus*.

The mammal faunas of the Meotian stage are concluded by the Cherevichanian subcomplex. A complete change in the hipparion species composition took place at this time. *H. moldavicum* is replaced by *H. tudorovense* GABUNIA, 1959, which differs from its predecessor in having weakly developed enamel plication of the upper cheek teeth, presence of an undulating protocone and development of accessory elements in the lower cheek teeth (GABUNIA 1959).

Nevertheless, *H. tudorovense* is undoubtedly a descendant of the *H. moldavicum* lineage, with common features in the morphology of the cranial and limb bones.

Hipparion sp. III belongs to the *H. aff. praegiganteum* lineage at a late Meotian stage. It is characterised by an ever deeper nasal slit, reaching the middle of P₃, a weakly developed preorbital fossa and a short distance between the orbit and the posterior margin of the fossa (KRAKHMALNAYA 1987; KOROTKEVICH 1988).

V. PLIOCENE HIPPARIONS

In the Pliocene, hipparion faunas are known from the Pontian and late Kimmerian. This material is not abundant, but has a certain interest.

A hipparion from the lower Pontian limestone of Shkodova Gora may contribute to our understanding of hipparion evolution across the Miocene-Pliocene boundary, in particular the lower Pontian, since information on this time period is highly fragmentary or almost completely lacking. The Shkodova Gora locality is of early Ruscinian age and is placed in the upper part of MN13. Unfortunately, this site has been destroyed and new material can not be collected. The hipparion from Shkodova Gora is here referred to *Hipparion* sp. IV.

The hipparion from this locality was originally identified as *H. crassum* GERVAIS, 1895 by E. L. KOROTKEVICH. The present author rejects this identification. A similarity of early Pontian hipparions to late Meotian ones is quite possible, but comparison with *H. tudorovense* shows that the lower teeth of *Hipparion* sp. IV have wider crowns.

The scarce material and lack of information on forms of similar age make it difficult to properly determine the taxonomic and systematic position of the Shkodova Gora hipparion. However, we may note the presence of two hipparion forms, *H. crassum* and *Hipparion* sp. IV in the lower Pontian of the Northern Black Sea coast area.

Two hipparion species, *H. cf. longipes* and *H. aff. crassum* were originally identified in the Kuchurganian faunistic complex. The present author has not studied the Kuchurgan material, but

notes the presence of two species in the upper Pontian, judging from the determinations of KOROTKEVICH (1988).

The hipparions from the Odessa catacombs are the final forms in this short review of the *Hipparion* fauna of the Northern Black Sea coast area. According to TOPACHEVSKY & SKORIK (1992), this locality is of upper Kimmerian age. Its fauna corresponds to MN15 and can be considered as belonging to the Moldavian faunistic complex.

This is the first hipparion find in the Odessa catacombs and provides data on the youngest hipparions in the area. Two *Hipparion* have been identified at this locality: one relatively small and the other large or even very large, both belonging to a thin-legged group (the large form is probably long-legged). These are mainly known from the second half of the Ruscinian (EISENMANN & SONDAAR 1989), equivalent to the Middle Pliocene of the eastern Parathetys Neogene. While we accept the presence in the Odessa catacombs of two *Hipparion* (the material is limited), we reject any attempt to identify them to the species level and consider them as belonging to *Hipparion* ex. gr. *fissura* (GABUNIA & KRAKHMALNAYA 1993).

VI. CONCLUSIONS

We have reviewed the Neogene hipparions of the Northern Black Sea coast area with respect to their systematic position and stratigraphic distribution. Twenty hipparion species existed in this region from the middle Sarmatian to the late Kimmerian. Six of these are not identified to the species level and some require revision.

The Sarmatian faunas are characterised by the presence of eight hipparion species, while a further nine are recorded from the Meotian and five from the Pliocene.

With regard to correlation with the western European stratigraphic scale, it is believed that the Gritsevian and Kalfian complexes with *H. primigenium*, *H. sarmaticum*, *H. sebastopolitanum*, *Hipparion* sp. I and *Hipparion* sp. II represent the Vallesian stage.

The Turolian is represented by the Berislavian and Belkian complexes, including *H. verae*, *H. giganteum*, *H. moldavicum*, *H. aff. praegiganteum*, *H. giganteum*, *H. platygenus*, *H. tudorovense*, *Hipparion* sp. I, *Hipparion* sp. III and related forms.

The Ruscinian stage is in this region represented by the Tavrichanian, Kuchurganian and Moldavian faunistic complexes, with *Hipparion* sp. IV, *H. cf. longipes*, *H. aff. crassum* and *Hipparion* ex. gr. *fissura* (two forms).

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