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GENERAL BIOLOGY

Validity of the Spiral-Horned Antelope Species of the Genus *Spirocerus* (Mammalia, Artiodactyla) in Central Asia

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The fossils of spiral-horned antelope, from the Pleistocene deposits of Central Asia, have been attributed to various species of the genus *Spirocerus* (Bovidae family): *S. wongi* Teilhard et Piveteau, 1930; *S. peii* Young, 1930; *S. kiakhtensis* Boule et Teilhard, 1928. They are usually encountered in the form of single finds in the Upper Pliocene and Pleistocene deposits, as well as the Paleolithic man sites in Kazakhstan, Russia (Eastern Sayan, Southeastern Baikal, and Western Transbaikalia), Mongolia, and North China (Fig. 1). On the basis of these finds, independent species were identified; their systematic features mainly reflect the morphological types selectively involved into taphocoenosis and extant within orycto-coenosis, rather than biological species.

The fossils of spiral-horned antelope *Spirocerus wongi* have been found out in North China, North Mongolia, Southeastern Baikal, and Western Transbaikalia [1–6], where they were spread from the Late Pliocene to the end of Early Pleistocene (Eopleistocene). In the second half of Early Pleistocene (Late Eopleistocene), *S. wongi* inhabited Southeastern Baikal, the Itantsa River, and the southern part of the Ulan-Burgasy Ridge (Zasukhino locality) along with the mammals of the orders Lagomorpha, Rodentia, Carnivora, Proboscidea, Perissodactyla, Artiodactyla [7].

In Western Transbaikalia, the spiral-horned antelope along with *Canis, Equus, Coelodonta*, and *Bison* inhabited the Hillock River valley and the slopes of the Yablonevy Ridge (Ust'-Obor locality) [8].

Early in the Middle Pleistocene (Lower Pleistocene), another species of spiral-horned antelope *Spirocerus peii* populated the Ivolginsky Depression and the southern slopes of the Khamar-Daban Ridge (Tologoi locality) along with *Sorex, Ochotona, Citellus, Cricetulus, Allactaga, Ellobius, Eolagurus, Microtus, Myospalax, Ursus, Archidiskodon, Equus, Coelodonta, Cervus*, and *Bison* [4, 7]. This species was widespread throughout Western Transbaikalia and North China in the Middle Pleistocene.

In the Late Pleistocene, another species of the spiral-horned antelope, *Spirocerus kiakhtensis*, inhabited a vast area from Altai (Kazakhstan) on the west to the Liaodong Peninsula (North China) on the east and Lake Baikal on the north [4, 8, 9]. In the mountains framing Lake Baikal this species inhabited the foothills of the Eastern Sayan and Selenga midlands. On the southern and southwestern slopes of the Tamir Ridge and in Chikoy Depression (Podzvonkaya site), the species was surrounded by mammals of the genera *Ochotona, Marmota, Canis, Vulpes, Ursus, Meles, Martes, Mammuthus, Equus, Coelodonta, Cervus, Capreolus, Rangifer, Bison* aut *Bos, Gazella*, and *Ovis*. The species inhabited the valleys of the Bryanka River (Kamenka and Varvarina Gora sites) and Uda River (Sannyi Mys site) along with *Lepus, Marmota, Vulpes, Mammuthus, Equus, Coelodonta, Camelus, Cervus, Megaloceros, Gazella, Bison*, and *Capra* [10].

Recent paleontological excavations in the Lake Baikal basin yielded new material on spiral-horned antelopes of the genus *Spirocerus* (Fig. 2), which casts doubt on the validity of the species and subspecies of this genus. Analysis of this material leads to the problem of species in paleozoology. A species is defined on the basis of fossil remains, which characterize various morphological types rather than a biological species in a wide sense. In paleontological reports, diagnosing of many fossil mammalian species is conducted on the basis of the more or less successful "aphorisms" rather than a certain clear-cut principle of taxonomy. The recommendations generally used for species description [11–14] are beyond the nomenclatural field; therefore, diagnosing on the basis of some distinguish-

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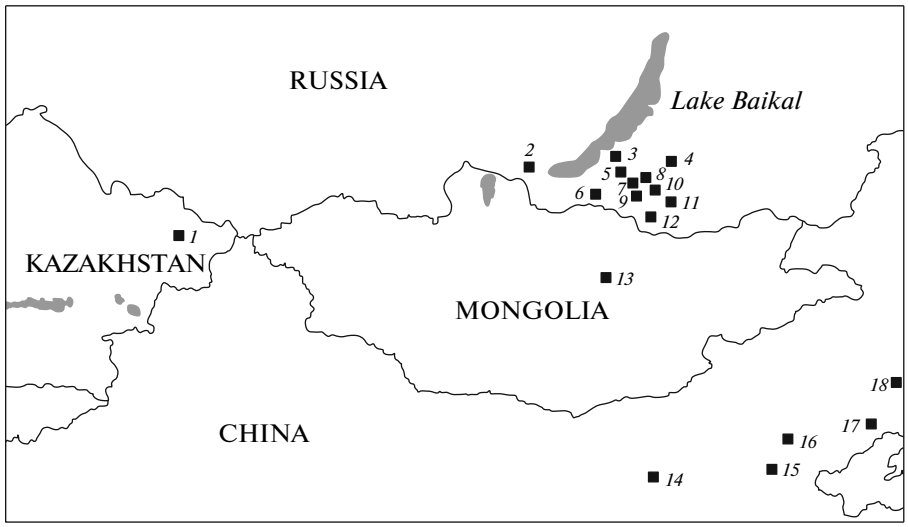

Fig. 1. The main localities of the spiral-horned antelope *Spirocerus kiakhtensis* in Central Asia: *1*, Altai (Kazakhstan); *2*, Eastern Sayan; *3*, Zasukhino; *4*, Sannyi Mys; *5*, Tologoi; *6*, Kyakhta; *7*, Nadeino; *8*, Kamenka; *9*, Bol. Kunalei; *10*, Varvarina Gora; *11*, Podzvonkaya; *12*, Ust'-Obor (Russia); *13*, Nalaikh (Mongolia); *14*, Ordos; *15*, Nihewan; *16*, Zhoukoudian; *17*, Miaohoushan; *18*, Jinniushan (North China).

ing traits is almost impossible. To describe a new species, researchers use, as a rule, their experience and tact; the very approach to the problem is determined by the practical goals, such as clarifying the stratigraphic scale or constructing phylogenetic schemes, which are permanently varying and depend on the reality of a taxon.

Systematics of the genus *Spirocerus* is a graphic example; it is based on the morphological traits, such as the relative length and torsion of the horn cores, their twistedness and the angle of divergence, massiveness of the posterior keel, and the ratio of horn length to the postorbital bar [1–4]. In addition, massiveness and flatness of the horn cores, as well as the number of keels on them, are also believed to be of great importance. Indeed, these traits allowed the researchers to diagnose individual species of the genus, when their fossils were scanty and they originated from different localities. Dmitrieva and Liskun were the first to doubt the validity of the species when the fossils of spiral-horned antelopes from North Mongolia (Nalaikh locality) have been described and assigned to subspecies *Spirocerus kiakhtensis wongi* [5]. They believed that a variety of changes could appear due to variability of the shape and massiveness of horn torsion bars and keel development. Because of this, they considered a single species *Spirocerus kiakhtensis* and two subspecies: *S. k. kiakhtensis* and *S. k. wongi*. Afew horn cores of the spiral-horned antelope from Zasukhino locality (Southeastern Baikal, Early Pleistocene) and Ust'-Obor (Western Transbaikalia, Early Pleistocene) have been earlier also defined as *Spirocerus wongi* [4]. Later on, a great number of horn cores have been found in this and other localities of Western Transbaikalia (Ust'-Obor, Tologoi, Podzvonkaya, Nadeino, Bol'shoi Kunalei); therefore, systematics of the genus *Spirocerus* has been elaborated using a wide range of trait variability.

Fig. 2. Horn cores of the spiral-horned antelope *Spirocerus kiakhtensis* from Southeastern Baikal and Western Transbaikalia: *1, 2, 3, 4*, Zasukhino; *5,* Ust'-Obor; *6*, Tologoi; *7*, Bol'shoi Kunalei; *8*, Nadeino.

The major morphological traits used to distinguish one species from another within the genus *Spirocerus* have been earlier described, but recent studies suggest that these traits are actually transitive. In *S. wongi* and *S. peii*, twistedness of a single horn core was consid-

ered one of the important species trait. Nevertheless, among the newly found horn cores of *S. wongi*, there are both twisted and straight ones, similar to those of *S. kiakhtensis*, which is indicative of a high variability of this trait. The degree of horn core twistedness is another taxonomic trait, which is poorly expressed in *S. wongi* and *S. peii* but strong in *S. kiakhtensis.* In the spiral-horn antelope from Southwestern Baikal, this trait is variable (from strong to weak heteronymous twistedness of the horn cores); therefore, it can hardly be considered a species trait. The degree of posterior keel development is also considered a taxonomic trait; it is missing in *S. wongi* and *S. peii*, or less developed than the anterior keel, while in *S. kiakhtensis*, the anterior and posterior keels are equally developed. The horn cores from Zasukhino locality demonstrate clearly that this trait is transitive; it is equally expressed in *S. wongi, S. peii*, and *S. kiakhtensis.* The differences were observed because of the small number of the horn cores found in a certain locality of Central Asia, which made it impossible to trace their variability. The shape of the horn core surface above the anterior keel was also considered taxonomically significant: they believed that this surface is convex in *S. wongi* and *S. peii* and concave in *S. kiakhtensis.* The new evidence refutes this assertion, because, on the horn cores of the spiral-horned antelope from Southeastern Baikal, this surface could be either convex or concave, depending on the number of specimens found. The angle of the horn core divergence is also hardly a distinguishing trait, in spite of the fact that it served earlier to identify spiral-horned antelope species; in *S. wongi* and *S. peii*, the angle was wider than in *S. kiakhtensis.* This trait depends to a greater extent on the age of an animal found in a given taphocoenosis and, then, thanatocoenosis and oryctocoenosis. Identification of a new species *Spirocerus hsuchiayaocus* in Salawusu fauna (Inner Mongolia) has not been accepted because the only poorly preserved horn identified earlier as that of *Spirocerus kiakhtensis* has been used to describe this species [15].

Thus, a sufficient number of specimens is required for both identification and definition of the species, because not only the presence or absence of a trait should be observed, but also an array of trait modalities. The taxonomic validity of a trait can be supported by the only criterion: disturbance of the continuity of its variability. As follows from the above, only single finds from Kazakhstan, Russia, and North China were used to identify species-rank taxa of the genus *Spirocerus.* They represent individual morphological types from an array of variability; therefore, we have obtained ungrounded descriptions of the new species that were used for stratigraphic correlations. The new evidence found out in the Southwestern Baikal region and Western Transbaikalia abrogates undoubtedly the validity of two species (*S. wongi* and *S. peii*) and two subspecies (*S. k. kiakhtensis* and *S. k. wongi*) of the genus *Spirocerus.* They actually represent the morphological types of *Spirocerus kiakhtensis* that lived in Central Asia from the Late Pliocene to the Late Pleistocene.

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