Quaternary Science Reviews 117 (2015) 135–151

Contents lists available at ScienceDirect

Quaternary Science Reviews

journal homepage: www.elsevier.com/locate/quascirev

On the discovery of a cave lion from the Malyi Anyui River (Chukotka, Russia)

I.V. Kirillova [a, *], A.V. Tiunov [b], V.A. Levchenko [c], O.F. Chernova [b], V.G. Yudin [d], F. Bertuch [c], F.K. Shidlovskiy [a]

[a] Ice Age Museum, "National Alliance of Shidlovskiy "Ice Age", 119 bld, Mira pr, Moscow, 129223, Russia
[b] Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, Leninskii pr. 33, Moscow, 119071, Russia
[c] Australian Nuclear Science and Technology Organisation, Locked Bag 2001, Kirrawee DC, NSW 2232, Australia
[d] Institute of Biology and Soil Science Far Eastern Branch, Russian Academy of Sciences, pr. Stoletiya Vladivostoka, 159, Vladivostok, 690022, Russia

ARTICLE INFO

Article history:
Received 10 December 2014
Received in revised form
30 March 2015
Accepted 31 March 2015
Available online

Keywords:
Cave lion
Skeleton
Chukotka
Diet

ABSTRACT

An incomplete postcranial skeleton (67 elements) of a cave lion, a lower jaw and a bundle of fine yellowish hair were found by a local resident in 2008 and 2009 washed out from the perennially frozen Pleistocene sediments in the lower reaches of the Malyi Anyui River (western Chukotka). This is the first skeleton of a cave lion (*Panthera spelaea* Goldfuss) to be found in Russia. The bone sizes are similar to finds of cave lion bones known from N–E Russia, but larger than East Beringian and smaller than West European ones. The remains have been studied using a variety of methods, including morphology, morphometry, SEM-examination, AMS-dating, and isotopic study, which included examination of over 100 samples of various members of the mammoth faunal assemblage (mammoth, wooly rhinoceros, bison, horse, bear, etc.). The results showed that the northeastern Asian cave lion hunted mainly bison and horses, but not reindeer, unlike its Western Europe counterpart. Bone and claw sheath dating showed an unexpectedly old geochronological age of over 61,000 years (OZQ290, OZQ291), while the hair was dated 28,690 ± 130 (OZQ292), which makes its affinity with the same individual as the skeleton questionable. Further studies to investigate possible unremoved contamination and obtain more reliable date are planned.

1. Introduction

Ex ungue leonem pingere (Latin): from the claw we may judge the lion.

In the summer of 2008, Leo Meskhe from the village of Anyuisk (Bilibino District of the Chukchi Autonomous Region) found a compact accumulation of fossil remains (67 items) 14 km upstream of Anuisk (68.18°N, 161.44°E) in a steep river bank (Fig. 1) below the water level.

From the curved claw phalanx covered by cornified sheath, the collector recognized the remains as belonging to the cave lion.

The river was washing out the mud-covered bones, which were arranged in a compact set, similar to an anatomic arrangement, with the ribs and spine visible, the latter oriented along the river-bank over about 1 m length. The limb bones were moved away from the main skeleton by the river current, and were located in the water using a testing rod. Fine mesh of metal wire was positioned downstream from the find to prevent any bones and associated objects being washed away by the river. The netted samples among others included a rounded horse vertebra and a bundle of red hair, which did not resemble the hair of an ungulate and looks more like a carnivorous fur. Remains of keratin skin derivatives of the cave lion have not previously been found. A year later, examination of the same site revealed two mandibles of the cave lion. The color and the preservation of all collected bones, as well as the anatomical structure indicated of belonging to the same individual.

The site of this locality is known as the Krasivoe Section (Mikhalev et al., 2006; Nikolaev et al., 2010), was studied for the first time by a PNIIS expedition in 1973 (Kaplina et al., 1978), and was re-examined in 1977–86 by the Northern Expedition of the Geography Faculty of Moscow State University (Arkhangelov and Konyakhin, 1978; Mikhalev, 1990). The river erosion exposed deposits of an accumulative surface 15–17 m high, which are mainly composed of frozen silt with ice lenses and ice wedge polygons. Large turf lenses up to 2–3 m thick and several meters long can be observed in the upper part of the section. The ^{14}C dating for the

* Corresponding author.
E-mail address: ikirillova@yandex.ru (I.V. Kirillova).

http://dx.doi.org/10.1016/j.quascirev.2015.03.029
0277-3791/

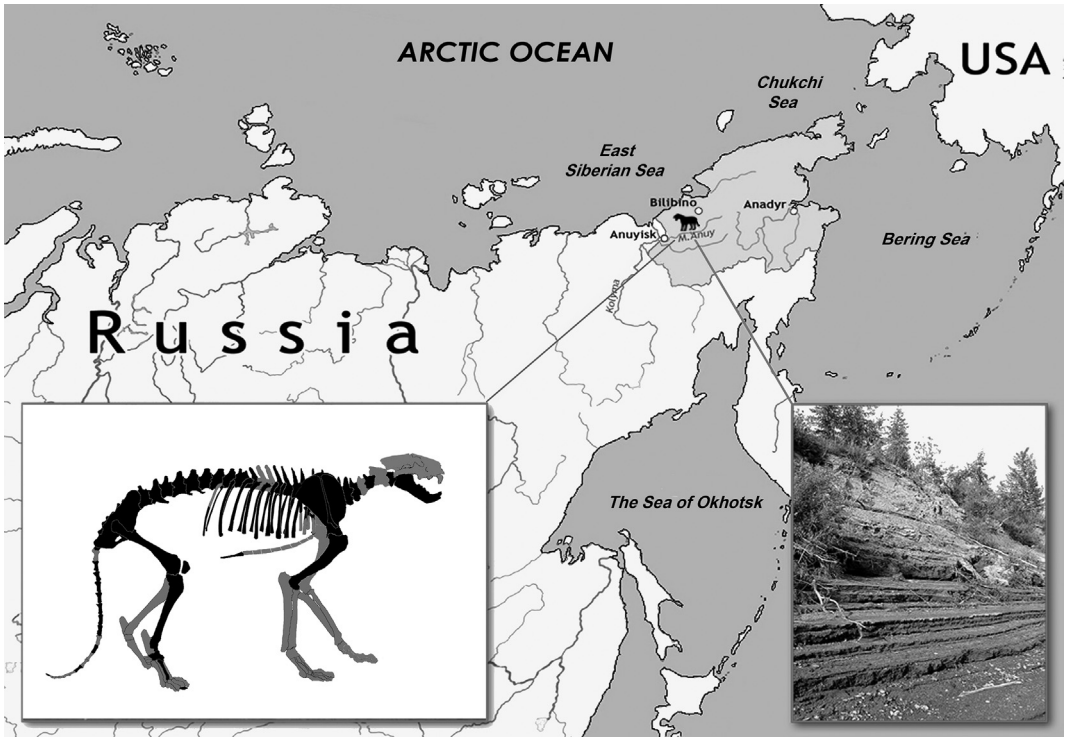

Fig. 1. Map showing the locality site. The right inset shows a stepped slope of the floodplain (the height of the upper step cutting into the slope reaches 6–7 m). The right bank of the Malyi Anyui River (Chukotka, Russia). The left inset show the composition of the Anyui lion skeleton. Preserved bones are shown in black. Collection no. F-2678/1-69. Ice Age Museum.

lower part of the section gave 27,300 ± 300 (GIN-3209) radiocarbon years, which corresponds to the Sartanian and is supported by the structural and isotope study of the ice wedges and palynological data (Tomskaya, 1982; Sher and Plaht, 1988; Konyakhin et al., 1996; Mikhalev et al., 2006).

Like other rivers of northeastern Russia, the floodplain of the Malyi Anyui River has a distinct micro-terraced topography, which is developed in the lower riverbank at the interval of about 7 m above the low water level (Fig. 1, right inset). This structure is produced by water level after spring flood dropping in stages of 5–10 to 30 cm, with erosion forming a step in loose deposits of riverbank at each intermediate water level.

The cave lion skeleton was found on the one of such freshly cut micro-terraces.

2. Material

(1) Cave lion skeleton F-2678/1-69, incomplete (Fig. 1, left) from right bank in the lower reaches of the Malyi Anyui river. The skeleton recovered includes 69 bones: 2 branches of the mandibulae – 2; vertebrae – 34; ribs – 20; corpus sternum – 1; scapula – 1; humerus – 1; coxae – 2; patellae – 2; femur – 1; tibia – 1; fibula – 1; III metatarsus – 1; astragalus – 1; phalanx III with a claw sheath – 1. Bones are in different state of preservation (from moderate to excellent).

(2) Cave lion remains from N–E Russia, previously unpublished: F-150, F-279, F-2450 (mandibles); F-2879 (atlas); F-755a (humerus).

(3) Analytical probes of animal remains (cave lion, canids, bear, mammoth, wooly rhinoceros, deer, bison, horse, and bighorn sheep) from northeastern Russia. A list of a total of 100 probes and the results of the isotope study are discussed in the section "Results" (Table 1).

The materials are kept in the Ice Age Museum (Shidlovskiy's National Alliance "Ice Age"), Russia.

3. Methods

3.1. Bone measurement and individual age estimation

We follow the taxonomy of Sotnikova and Nikolsky (2006) for the cave lion, and treat it as a full species *Panthera spelaea* Goldfuss.

The cave lion mandibles were measured using digital calipers SHCC-1-300 and SHCC-1-500, with an accuracy of better than 0.1 mm. von den Driesch's (1976) system of measurements and abbreviations was used. The radiographic imaging of the left side of the lower jaw was performed in the veterinary clinic "Sopiko" (Moscow) using the Sedecal APR-VET system. Measurements of the rest of the bones were taken with the measurement box with 0.5 mm accuracy again following von den Driesch's (1976) methodology.

The right canine, split longitudinally along the natural fractures, was strengthened using polyvinyl butyral resin (PVB), and its root was sectioned transversally. These surfaces (longitudinal polished section and transverse thin section) were studied in reflected light using a Leica StereoZoom 6 light Microscope. The age of the canine was calculated using the layers of cement on the longitudinal and transverse sections using Klevezal's (1988) protocol.

3.2. Geological Age determination

Geological Age determination was performed on three different samples – bone (rib), claw sheath and hair/wool – by radiocarbon AMS at the Australian Nuclear Science and Technology Organisation (ANSTO) on the STAR AMS 2 MV Tandetron on graphite targets (Fink et al., 2004). To remove possible contamination the samples