



Cave bears of the Ural Mountains – a survey based on direct radiocarbon dates, aDNA and morphometrical analysis

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Introduction

The Ural Mountains, forming the boundary between Europe and Asia, extend north to south in a relatively narrow band from beyond the Arctic Circle to approximately latitude 50° N. Cave bears are known from about forty sites including Secrets (Tayn) Cave, Medvezhiya Cave, Geologov Cave and Asha Cave (KOSINTSEV, 2007; KOSINTSEV & VOROBIEV, 2001). The cave bears of the Urals pose several interesting questions that need further investigation:

1) The typical species of cave bear *U. spelaeus* (based on genetic analysis an “*U. ingressus*”-type was identified at some sites) occupied an isolated distribution area in the Urals approximately 2000 km from the nearest cave bear sites to the west, and 1000 km from sites to the south in the Caucasus, from where a distinct species of large cave bear *Ursus kudarensis* has been described (BARYSHNIKOV, 1998). The general absence of cave bears in the plains south and west of the Urals probably reflects the lack of karstic areas in these regions, as nearly all remains of this species have been recovered from caves. The only exception is the isolated population of *U. spelaeus* from the karstic area of the Zhiguli Hills on the right bank of the Volga River near Samara city (VERESHCHAGIN, 1959). *U. spelaeus* is recorded from many Ural caves, up to more than 60° north, but it has not been found east of longitude 60° E; **2)** Cave bears have been regarded as the only extinct megafaunal species or group of species essentially confined to Europe, with the Urals defining the easternmost limit of distribution. However, recent studies both based on aDNA and morphology suggest that related forms of cave bear were present in the Altai, and even in Siberia (KNAPP et al., 2009). Clearly much more research is needed into the taxonomy, geographical ranges and chronological occurrences of the several forms of cave bear that have been recognized; **3)** In addition to “typical cave bear” *U. spelaeus*, a significantly smaller cave bear *U. rossicus* was first described from Krasnodar, a loess site north of the Caucasus (BORISSIAK, 1932). The Urals form *U. rossicus uralensis* can be regarded as a sister form of the Krasnodar small cave bear *U. rossicus rossicus* (VERESHCHAGIN & BARYSHNIKOV, 2000). The only known large assemblage of *U. r. uralensis* is from Kizel cave, on the western flank of the Middle Urals although scattered finds are known from several sites in the steppe zone in the southern part of Eastern Europe to southern Siberia and as far as Transbaikalia (VERESHCHAGIN & BARYSHNIKOV, 2000). The Siberian finds indicate that this taxon occurred as early as the Middle Pleistocene (BARYSHNIKOV & FORONOVA, 2001). We intend to test if some of these finds are within the limits of radiocarbon dating. The analysis of dental morphology led BARYSHNIKOV (2007) to suggest a close relationship between *U. rossicus* and *U. savini* and to unite these taxa into a single species of smaller cave bears; **4)** On the basis of stratigraphical



evidence and a few ¹⁴C dates from the early 1970s (e.g. KOSINTSEV, 2007) it has been suggested that the Urals were one of the areas where cave bears survived the longest, even into the Holocene (MUSIL, 1981).

As part of the Megafaunal Extinction Project (STUART et al., 2004; STUART & LISTER, 2007; STUART et al., 2009) M. Pacher and A. Stuart began research on the intriguing issue of cave bear extinction (PACHER & STUART, 2009). Following on from this work we have now studied material housed in St. Petersburg, Moscow and Ekaterinburg, with the aim of determining the distribution of cave bears in the eastern part of their range, to compare morphological and size differences with other cave bears, and to reconstruct their chronological occurrence based on direct radiocarbon dates.

First results

As mentioned above, a distinct form *U. rossicus* is considerably smaller than other cave bears. A series of direct AMS radiocarbon dates that we obtained from Oxford (ORAU) shows that most, but not all, of the specimens from Kizel cave are younger than other dated cave bears from the Urals (Fig.1). The exceptions are one Oxford date OxA-19565 46250±700 BP and two samples dated at Vienna (VERA) that gave “older than” dates.

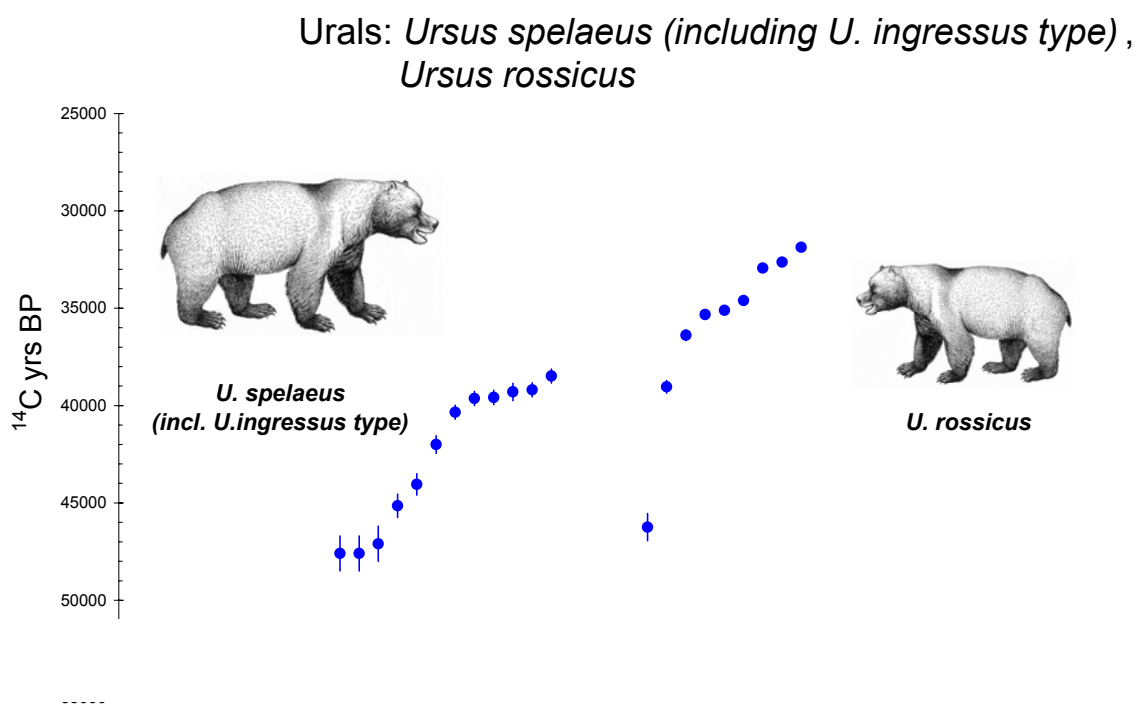


Fig.1. Direct dates on large cave bear *U. spelaeus* (including ‘*ingressus*’ type) from several sites in the Urals and *U. rossicus* from Kizel cave.

The latter two samples were also used for a first aDNA analysis. In spite of their apparently great age, both samples yielded surprisingly well-preserved and amplifiable DNA, allowing the determination of 285 bp of mitochondrial control region sequence. Interestingly, both specimens exhibit an identical, but so far unique, sequence variant (haplotype) of the cave bear group. Strictly speaking, they are most closely related to the “*ingressus*” bears



described from Central Europe (RABEDER & HOFREITER, 2004), but are still genetically as distant as e.g. the “*spelaeus*” bears are to the “*ladinicus*” bears.

Our results so far, do not indicate that cave bears survived latest in the Urals region. On the contrary, our newly acquired radiocarbon dates (made directly on cave bear material) strongly suggest that they disappeared significantly earlier here than anywhere else. Much further work, including morphological studies, radiocarbon dating, and more detailed aDNA analyses of additional samples are needed to fully reconstruct and interpret the complex spatio-temporal patterns for cave bears in the Urals and throughout their range.

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ABSTRACT BOOK



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