Spondyloarthropathy in cervical vertebrae of late prehistoric black bear from northwestern Oregon, USA

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Abstract: Spondyloarthropathy has been reported among modern individuals of several species of ursid. Prehistoric cervical vertebra of black bear (*Ursus americanus*) recovered from an archaeological site in northwestern Oregon are fused and distorted, indicating spondyloarthropathy in this species has some time depth. Inventory of this disease among paleozoological remains may reveal unknown details of disease history.

Key words: American black bear, archaeological remains, cervical vertebrae, Oregon, prehistory, spondyloarthropathy, *Ursus americanus*

Ursus 19(2):194–197 (2008)

Skeletal pathologies and healed injuries have occasionally been reported among historic-era North American black bears (*Ursus americanus*; Fox 1939, Courville 1953, King et al. 1960). Here I describe an apparent instance of spondyloarthropathy (an inflammatory joint disease of the spine that may mimic rheumatoid diseases such as rheumatoid arthritis) of cervical vertebrae evidenced by prehistoric remains of a black bear recovered from an archaeological site in northwestern Oregon, USA.

Materials

The Meier archaeological site (official state site 35CO5) is located in the Portland Basin (locally known as the Wapato Valley) about 15 km north of Portland, Oregon. Excavations under the direction of Dr. Ken Ames of Portland State University took place from 1987 through 1991. Temporally diagnostic artifacts and a series of radiocarbon dates indicate the site was occupied from AD 1400 to AD 1800. The first European contact in the area was in the late eighteenth century; Meriwether Lewis and William Clark passed nearby in 1805 and 1806 (Ames and Maschner 1999).

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Faunal remains recovered from the Meier site include numerous specimens (bones, teeth, and fragments thereof) of mammals (Lyman and Ames 2004). I identified more than 5,900 bones and teeth of 25 mammalian genera by direct comparison with skeletons of known taxonomy in natural history museums. Among the mammal remains are 84 bones and teeth of *Ursus* sp. (Table 1). All canines and molars were measured, and all fall within the size range of modern black bear (Gordon 1977). Brown (including grizzly) bears (*U. arctos*) are larger in some dimensions than black bears; for example, the m1 of the grizzly is >20.4 mm long and >10.5 mm wide, and the M2 is >31 mm long. The three M2s in the collection from Meier (Table 1) are all <27mm long, and the two m1s are both <17.6 mm long and <8.3 mm wide. It is likely that the particular remains described here represent a black bear rather than a grizzly bear as all specimens from skeletally mature adults closely match the size of modern adult black bears and tend to be smaller than adult grizzly bears. The size of three canines indicates they are from female bears, whereas three other canines are from males; the seventh canine cannot be sexed (Poelker and Hartwell 1973; Gordon and Morejohn 1975). Both adult (dentitions fully developed) and subadult (tooth roots not fully formed, epiphyses of limb bones not fused) bears are represented.

The Meier site is not in a cave but is in the open; archaeologists refer to this as an "open site." Many of the faunal remains, including the black bear remains, were recovered from either the floor of the prehistoric house that dominated the site (Ames et al. 1992) or from trash middens associated with the house. Ethnohistoric data indicate that local American Indians hunted bears (Ray 1938). These observations suggest that the black bear remains represent animals that were killed elsewhere by human hunters and brought to the site for human consumption. Six of 66 bones (9%) that have the potential to display butchering marks (teeth do not have this potential, and some bones had eroded surfaces from which butchering marks may have been removed) in fact display butchering marks made by stone tools. These include two astragali and one each of a humerus, femur, calcaneum, and metatarsal. The specimens with butchering marks

Table 1. Black bear remains from the Meier Site (35CO5). NISP = number of identified specimens.

Skeletal part	NISP
Maxilla	2 (with various teeth)
Jugal	1
Isolated M1	1
Isolated M2	1
Canine	5*
mandible	5 (with various teeth)
Isolated m1	1
Isolated m2	4
Isolated m3	4
Atlas vertebra	1
Cervical vertebra	2 (fused)
Thoracic vertebra	1
Scapula	1
Humerus	3
Radius	3
Ulna	5
Metacarpal	4
Innominate	1
Femur	4
Tibia	1
Calcanea	5
Astragalus	3
Tarsal	1
Metatarsal	2
Metapodial	3
First phalanx	7
Second phalanx	1
Third phalanx	12
TOTAL:	84

*includes 2 modified into artifacts

indicate black bear carcasses were skinned and dismembered by the human occupants of the site.

Results

All ursid remains recovered from the Meier site are of normal appearance and size relative to modern comparative specimens, with two notable exceptions. The exceptional ursid remains include a sixth and seventh cervical vertebrae and a first thoracic vertebra, all recovered from the same excavation unit and very likely from the same individual animal. The zygapophyses and neural arches of the two cervical vertebrae are ankylosed (Fig. 1); the vertebral centra do not appear to be fused together, but the two vertebrae are immobile relative to one another. The first thoracic vertebra has a normal appearance except that relative to the neural arch the sagittal axis of the centrum is slightly offset to the right in a caudal-to-cranial direction. This offset is likely because the anterior surface of the centrum of the sixth cervical vertebra faces to the left of perfectly anterior or cranially. The angle defined by the posterior articular surface of the centrum of the seventh cervical vertebra relative to the anterior articular surface of the centrum of the sixth cervical vertebra is approximately 32° (Fig. 1). The individual bear represented would have been perpetually facing to the left of straight ahead, but this was at least partially offset by a realignment of the anterior articular surface of the centrum of the first thoracic vertebra.

There is no indication that the fusion of the two cervical vertebra and the offset alignment of the centra of the three vertebrae was the result of trauma. There is no woven bone or evidence of a healed fracture. The vertebrae seem to represent a skeletally mature individual given that the articular surfaces of the centra are fused. The vertebrae are, however, noticeably smaller than those from a modern adult black bear from northwestern Wyoming (Fig. 1). Similarly, the Meier site specimens are a bit smaller than a modern immature male black bear about 4 years old from Washington. Measurements of the Meier site specimens were not taken because of their pathological distortion. Perhaps as a result of the stiff neck or a related infection, the individual was a less efficient forager than conspecifics and thus attained a smaller than normal adult size. None of the other adult black bear remains from the Meier site are small relative to modern black bear skeletons. Similarly, none of the 98 bones and teeth of black bear recovered from excavations of the contemporaneous Cathlapotle archaeological site 7 km northeast of the Meier site were small or pathological (Lyman, unpublished data; Lyman and Ames 2004). Overall, the two samples of black bear remains indicate a population of healthy, or at least well nourished, black bears in the Portland Basin between about 1400 AD and 1850 AD. The specimens in Fig. 1 are exceptional among the total sample of prehistoric black bear remains from the Portland Basin.

Discussion

Skeletal pathologies have been documented among several collections of Pleistocene-age European cave bear (*U. deningeri* and *U. spelaeus*) remains (Capasso 1998, Stiner et al. 1998) and among the extinct North American late-Pleistocene giant short-faced bear *Arctodus simus* (Rothschild and Turnbull 1987). A sample of 55 modern black bears from New York revealed numerous skeletal pathologies and abnormalities, most of which were

Fig. 1. Dorsal view of Meier site pathological sixth and seventh cervical vertebrae (left) and modern normal sixth and seventh cervical vertebrae of a healthy modern black bear from Wyoming (right).

attributed to gunshot wounds (King et al. 1960). The individual black bear skeleton with ankylosed lower thoracic vertebrae illustrated by Fox (1939:132) was reported by him to display "shot damage" (Fox 1939:93), and this may be the cause of the fused vertebrae. A number of individuals (exact frequencies are not reported) in a series of 243 modern North American adult ursid skeletons (both *U. americanus* and *U. arctos*) housed in natural history museums displayed various bone erosion features as well as zygapophyseal fusion (Rothschild et al. 1993). Rothschild et al. (1993) argued that this was strong evidence for spondyloarthropathy and that the disease may have been sexually transmitted. Kompanje et al. (2000) reported spondyloarthropathy in one each of three species of Indomalayan bears. They argued that the evidence that the disease is sexually transmitted is weak. They agree with Rothschild (1997) that the fusion of vertebral zyapophyses could be the result of rheumatoid spondyloarthropathy (see also Rothschild and Martin 1993:235, 255).

The fused cervical vertebrae of a black bear recovered from the Meier archaeological site represent, so far as I know, the first instance of prehistoric spondyloarthropathy in North American black bear. Pelton (1982, 2000) and Larivière (2001), for example, fail to mention skeletal abnormalities in this species. Spondyloarthropathy is not unusual in ursids of the present and the past, but its frequency in most species is unclear. Study of additional paleozoological remains of ursids may reveal frequency of occurrence of this affliction as well as its history.

Acknowledgments

I thank K. Ames for access to the Meier site and Cathlapotle site collections. B. Rothschild and an anonymous reviewer provided helpful comments on an early draft.

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Received: 20 June 2008
Accepted: 2 August 2008
Associate Editor: K. Foresman