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Identification of Pups and Yearling Wolves by Dentine Width in the Canine

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ABSTRACT. One hundred and thirty-nine wolf (*Canis lupus*) skulls and mandibles were collected from hunters and trappers of northern Quebec and Labrador during the winters of 1980-81 through 1983-84. The maximum width of the dentine-cementum wall in wolf canine teeth was used to separate pups killed late in their first year from yearlings killed early in their second winter of life. Both age classes may have a closed foramen at the apex of the root and a clear deposit of cementum with no opaque annulus.

Key words: wolf (*Canis lupus*), canine teeth, dentine width, pups versus yearlings

RÉSUMÉ. Au cours des hivers de 1980-81 à 1983-84, 139 crânes et mandibules de loups (*Canis lupus*) furent recueillis chez des chasseurs et des piégeurs dans le nord du Québec et au Labrador.

L'épaisseur maximale de la paroi de la dentine et du cément des canines des loups servit de donnée aidant à séparer les louveteaux nés plus tard durant l'année et vivant leur première année, et les loups âgés d'un an tués durant le deuxième hiver de leur vie. Les deux classes d'âge ont un orifice fermé au sommet de la racine dentaire et un dépôt transparent de cément sans anneau opaque.

Mots clés: loup (*Canis lupus*), canines, épaisseur de la dentine, louveteaux contre loups âgés d'un an

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INTRODUCTION

External visual criteria, tooth eruption and wear patterns, or epiphyseal cartilage of the long bones have been used to separate wolf (*Canis lupus*) pups from older wolves, especially yearlings (e.g., Rausch, 1967; Van Ballenberghe *et al.*, 1975; Fuller and Keith, 1980; Fritts and Mech, 1981; Gasaway *et al.*, 1983; Peterson *et al.*, 1984). Matson (1981) found that the first opaque cementum layer (first annulus) in the canine of wolves appears late in the second year of life. Most recently (after this study was completed) Goodwin and Ballard (1985) reported on the use of annulations in the dental cementum for age determination of wolves and found that first annulus deposition occurred between 20 and 22 months of age.

This report deals with a method for separating wolf pups from yearlings (or older wolves) using only the canine tooth. The method is especially useful when formation (or detection) of the first annulus is critical in terms of the date of death of the wolf (first versus second winter of life).

MATERIALS AND METHODS

During the winters of 1980-81 through 1983-84, 139 wolf skulls and mandibles were collected from hunters and trappers of northern Quebec and Labrador. The assignment of wolves to age classes was necessary to determine survival rates, growth, productivity and other population characteristics to evaluate their impact upon the George River population of caribou (*Rangifer tarandus caribou*) (Parker and Luttich, 1986 — this issue). Most wolves had been shot by caribou hunters, many during the winter months of January-March, when caribou became accessible to hunters in coastal communities of northern Quebec. Teeth from 73 wolves collected earlier and aged independently by cementum annuli criteria were not available for these analyses.

A canine was extracted from each mandible and cross-sectioned by saw at the gum line with a diamond saw. The root tip was examined for closure of the apical foreamen. The maximum thickness of the dentine and cementum was recorded, as was the maximum width of the pulp cavity. Other measurements included total tooth length and root width and thickness. All measurements were made to the nearest 0.1 mm by means of a vernier caliper. The other canine was extracted from those mandibles in which the foramen at the apex of the root was closed. The tooth was again cross-sectioned at the gum line. The root portion was decalcified and stained, and histological sections were mounted on microscope slides (Parker, 1981). Tooth sections were examined for the presence of annuli in the cementum.

RESULTS AND DISCUSSION

Thirty-six (26%) of 139 canines had an open root apical foramen and were considered pups that were probably ≤ 9 months old (shot prior to February). Sixty-two canines (45%) showed a closed root tip but contained no distinguishable cementum annuli. These specimens could have been 1.5 years old or pups killed in late winter (> 9 months < 12 months old) after cementum deposition had covered the apical foramen. Representation of wolves aged 2.5, 3.5 and 4.5+ years by cementum annuli was 12%, 9% and 8% respectively. Clearly the 1.5 year cohort (based solely on the closed foramen and no annulus) was overrepresented, either through error in aging or a biased sample (we believe the former possibility the more probable).

As the width of the pulp cavity of canines from carnivores is known to decrease, and the thickness of the dentine-cementum wall to increase, over the first several years of life (Klevezal' and Kleinenberg, 1967), we plotted those measurements and analyzed for statistical differences. We found the best relationship between age and the thickness of the dentine-cementum wall (Fig. 1).

The dentine width was always below 2.0 mm in canines of pups with open apical foramina. The dentine width of canines from the apparent 1.5 year cohort (closed root tip; no cementum annuli) showed 2 distinct groupings, their means highly significantly different ($p < 0.001$). Those teeth in the category with dentine width significantly narrower than the second group were

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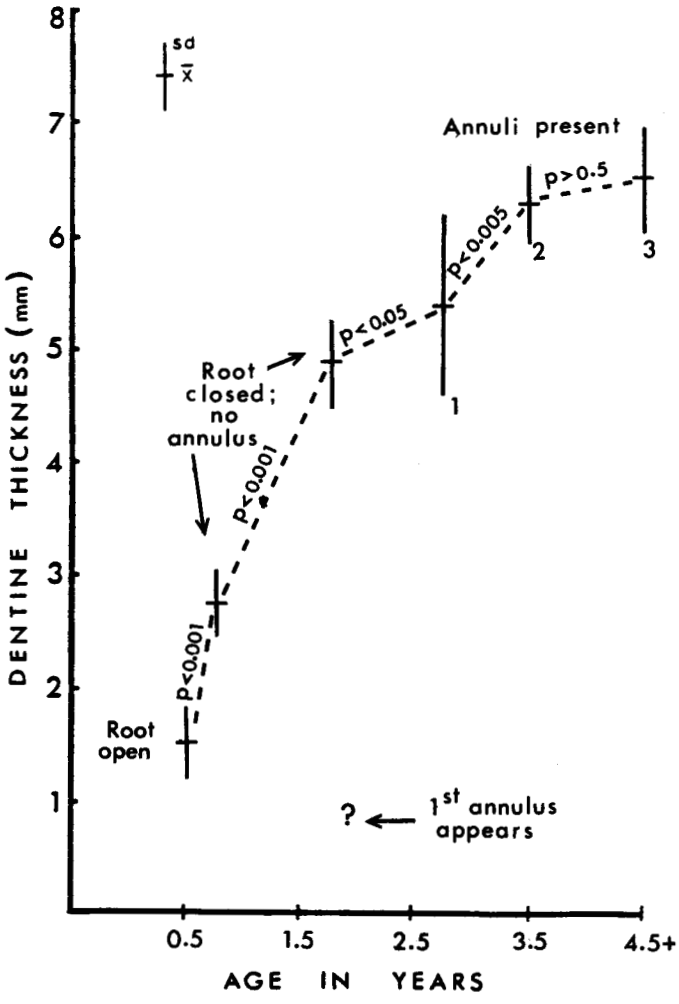

FIG. 1. The mean maximum dentine-cementum widths of canines from wolves of various ages collected in northern Quebec and Labrador.

assumed to be from pups collected in late winter after closure of the apical foramen. Using this criterion, over one-half of the pup cohort had a closed root tip and would have been incorrectly assigned to the 1.5 year cohort based on the open apical foramen criterion alone.

To see if sexual dimorphism may have influenced significant differences in dentine measurements (original analysis used all specimens, many of undetermined sex), 22 specimens of known sex and aged as 1.5 years old were examined separately. The sample contained 12 males and 10 females. There was no significant difference ($t = 0.64$; $p > 0.05$) in dentine width of male and female yearlings. We assumed, then, that sex had no bearing upon the original dentine width analysis.

We suggest that the apical foramina in canines of wolves from northern Quebec and Labrador and < 1 year old close over with cementum at about 9 months of age (February). Teeth with closed foramina but no cementum annuli may be from wolves collected late in their first year of life (10-12 months old) or be yearlings in their second winter. Yearlings and pups with closed apical foramina can be accurately separated by measuring the maximum width of the dentine after sawing the tooth in half at the gumline. Teeth with a maximum dentine width of less than 3.5 mm can be confidently classified as pups collected late in their first year of life. Teeth with a maximum dentine width greater than 4 mm are yearlings. The age of teeth (to the nearest 0.5 years) showing cementum annuli can be accurately determined by adding 1.5 years to the number of annuli.

In this study, without known-aged specimens, all canines showing a single annulus were aged as 2.5 years old (20 of 212; see Parker and Luttich, 1986). Goodwin and Ballard (1985) have since shown that the first annulus in wolves from Alaska normally appears at 20-22 months of age. The precise dates that wolves from Quebec-Labrador died are not known, although many are believed to have been killed in February and March. This creates the possibility that some wolves aged as 2.5 years may have actually been 1.5 years. More study is needed to determine synchrony of first annulus deposition in regional wolf populations.

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