DANISH REVIEW OF GAME BIOLOGY Vol. 5. no. 6

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(Med et dansk resumé: Aldersbestemmelse af ræve *(Vulpes vulpes* L.) på grundlag af snit af hjørnetænderne.)

Резюме на русском языке:
Определение возраста лисиц *(Vulpes vulpes* L.) по срезам клыков.

COMMUNICATION NO. 71 FROM VILDTBIOLOGISK STATION
Vildtbiologisk Station, Kalø, 8410 Rønde, Denmark
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Introduction

In recent decades the population dynamics and production factors of the game animals have been the subject of rapidly growing interest. A prerequisite of many investigations within this field is a reliable method of sorting the animals which are to be studied into their age groups. It is particularly essential to be able to distinguish between adult and immature animals, but in many cases this rough division alone does not suffice.

In the case of immature mammals, work has been done on a number of characters which may be used with varying degrees of success for a more specific division into age groups. Foremost among these are secondary dentition, the fusing of the epiphyses of the limb bones and the closing of the sutures of the skull, the development of the baculum and the weight of the eye lenses. Where older, mature animals are concerned, however, it has proved difficult to discover such characters as would allow of a division into age groups with any degree af accuracy.

In recent years, however, the presence of annuli in the cementum and dentine of the teeth has been demonstrated in many species of mammals, making it possible to deduce the age of the animal from the number of these layers. Work on this method of age determination has been carried out chiefly in the United States and in the Soviet Union (SERGEANT 1967, KLEVEZAL & KLEINENBERG 1967), while only few works of European origin have appeared (HEWER 1964, MITCHELL 1967).

The structure of the layers has been studied either directly from the cut surfaces of teeth which have been sawn through, or from polished thin sections, or from microscope preparations of decalcified teeth. While the dentine is deposited within the pith cavity, gradually filling it, the cementum is deposited externally around the root of the tooth, and in most cases these cementum layers have proved to be the most suitable for counting. It is often difficult, however, and in some cases even impossible to judge with absolute accuracy the number of layers, and thereby the age of the animal.

There is as yet no clear understanding of the causes of fluctuations in the dentine and cementum deposits; the distinctness of the layers seems to fluctuate not only from species to species, but also within the same species from district to district. It is to be hoped that further investigations into the deposits on and within teeth will soon provide adequate material for a discussion of the causes of stratum formation and thus of the background for this important method of determining the age of mammals. It is in the hope of contributing to the collection of such material that an account is given here of the preliminary results of our work on age determination in the red fox (*Vulpes vulpes* L.) from canine tooth sections. We also hope that the detailed description of the preparation of sections

and their interpretation will be of practical aid to others who might wish to try this method of age determination.

The task of working out the most suitable technique and of preparing the specimens was carried out by one of the co-authors of this paper, L.B.N., at the Zoological Institute, Århus, and the investigation has come about as a result of collaboration between the Zoological Institute and the Game Biology Station.

The Material

When in 1964 rabies crossed the border from Germany into Denmark (MÜLLER 1966, 1967), the Game Biology Station at Kalø received a grant from the Danish Ministry of Agriculture for »game biological research in connection with the current campaign against foxes and badgers in South Jutland, with a view to preventing the spread of rabies« (JENSEN 1966). The investigatory work was concentrated on the fox, which must be regarded as the primary carrier of the disease among Danish game species. As a part of the investigations it has been sought to elucidate the factors governing population dynamics and in this connection a number of methods of age determination of collected foxes have been the subject of enquiry. Here, however, we shall describe only the work done on age determination of foxes from canine tooth sections.

With a view to reducing the fox population in the South Jutland region, and thus to reducing the risk of a spread of rabies, tail-money has been offered since the spring of 1964 for all foxes shot within a 60 km. wide zone north of the German-Danish frontier (MÜLLER 1966). The money is paid only on condition that the dead fox is handed over to one of the South Jutland incinerating plants where workers from the Game Biology Station have been able to examine the submitted foxes and so to collect material.

During the period from October 1967 to January 1968, the collected material included the front part of the lower jaw, containing incisors and canines, and the lower half of a fore limb, with ulna and radius, of all foxes submitted, about 500 in all. The canines and incisors of the lower jaw were extracted, then dried and stored. The bones of the forearm, ulna and radius, were cleaned in the usual manner by boiling and then bleaching with hydrogen peroxide.

In Denmark most foxes are born in March, and by means of the collected bones it was possible to distinguish between animals born the same year and older animals from the fusion of the epiphyses of the proximal part of the radius. It was sometimes difficult, however, to distinguish first-year animals from older ones, particularly with material received in the latter part of the period, but here, although the fusion of the epiphyses was completed and the thickening of the bone at the epiphysial margins had disappeared, it was possible in most cases to distinguish accurately between young and older animals from the surface structure of the bone. For this, the existence of skeleton material from foxes captured and marked as cubs and later recaptured (JENSEN 1968) was of substantial assistance.

Microscope preparations were then made from the canine teeth of all animals which had been judged to be more than a year old, as well as of all doubtful cases, for further age determination. In addition, preparations were made from the teeth of a number of older animals which had been collected during the period from May to September, 1967, and from January to May, 1968.

Methods

For several reasons which will be explained later, it was the canines of the lower jaw which were selected for the histological age determination. In the laboratory the pieces of jaw were boiled for about 20–30 minutes so as to allow the teeth to be extracted without damage to the cementum layer, particularly that in the tip of the root.

The following procedure is an adaptation of that of E. REIMERS, Zoological Laboratory, University of Oslo, Norway, who kindly made available his unpublished notes on procedure in age determination of reindeer. It will be seen that the method resembles those adopted by other authors in age determination of various mammals (KLEVEZAL & KLEINENBERG 1967).

In the following, the technique of preparing and staining sections will be given in such detail as to enable even biologists with only limited experience of histological work to obtain acceptable results. Readers skilled in histological technique are advised to skim through this description.

The teeth are decalcified in about 30 ccm of 5 % HNO_3; this takes about 48 hours. The more slender canines from females are often decalcified in less than 24 hours, while teeth of male foxes may take another 24 hours. To test whether decalcification has been completed, the teeth should experimentally be cut transversally with a sharp knife near the border of the enamel. When decalcification is completed, the acid is removed by placing the teeth in tap-water; this may be either running water for about 24 hours, or a bath, which is changed 3–4 times within the next 3 days. Careful washing is essential, as remnants of the acid will rapidly blunt the microtome knife. Decalcified and washed teeth should be kept in water to which a few crystals of thymol have been added to restrain growth of bacteria.

The roots of the teeth are sectioned by means of a freezing microtome. Longitudinal sections parallel to the symmetrical plane should be preferred as one and the same section may then show zones in the tip of the root and in the walls of the pulpa, and as will be shown later, it may be important to be able to compare these two systems of annual zones. The dense zones of the cementum layer are most clearly visible in the tip of the root, so that only the sections which strike either this, or the end of the nerve in the pulpa, need be retained. About 15–20 sections are required; 30 μ is a suitable thickness. Usually only one canine need be sectioned, the other should be kept in reserve.

As the sections are cut they are removed gently with forceps and placed in a dish of water, where they immediately unroll. As the succession of the sections is immaterial for this investigation, for convenience all the required sections of a tooth may be cut before mounting starts.

Mounting is best performed as follows: The slide, which has been rubbed with a trace of albumen glycerol, is held in a sloping position half submerged in the water bath. The sections, which are actually very robust, are then placed on the slide by means of a fine brush. In order to save time during the later procedures it is advisable to mount two or more sections on each slide. The slides are then dried for at least half an hour (if required, however, they can be kept for several months) and they are now ready for staining.

On the advice of REIMERS, Mayers

Haemalun was used, being a quick and satisfactory stain:

a. Haematoxylin, 1 gm.
b. Distilled water, 1000 ccm.
c. Sodium Iodate ($NaIO_3$), 0.2 gm.
d. Potassium Aluminium Sulphate ($KAl(SO_4)_2$), 50 gm.
e. Citric acid, 1 gm.

a is solved in b and shaken vigorously, then c, d and e are added in succession. Usually chloral hydrate (50 gm.) is added to Mayers Haemalun, but in REIMERS opinion the contrast is better without this.

This stain may be used again and again and improves with use. After preparation it should be allowed to stand exposed to the air for about a week, otherwise the first few slides will be inadequately stained. Staining with a fresh stain may take 10 minutes, whereas a much-used, old and strong stain may overstain in 6–7 minutes. Should the stain get too strong it may be diluted with distilled water. After staining, the slides are washed in tapwater for about 10 minutes, the stain then turning blue.

Finally, the slides are mounted with liquid (warm) glycerol-gelatine. If the cover slip is warmed gently over a spirit flame this mounting method is very quick. Slides which are to be kept for years should have the edges of the cover slip sealed with Canada balsam or enamel.

Mention was previously made of reasons for selecting canines in preference to other teeth for age determination purposes. Incisors are, of course, more easily decalcified and can be used also (Plate IV, Fig. 17), but as there is some relation between thickness of cementum layer and size of tooth, the zones in the slender incisors may be so closely packed as to complicate counting them. Furthermore, the stout canines are easier to handle than the delicate incisors. However, in some cases where the roots of both canines were defective for some reason, incisors served as a valuable substitute.

Complications may arise at various stages in the procedure. One of the most serious ones, fortunately not occuring very frequently, was the presence of grains of sand in the pulpa through damage to the crown while the animal was alive. As but a single grain of sand is enough to damage the edge of the knife, teeth with damaged crowns were not sectioned if it could be avoided. If, however the other canine should also be damaged or otherwise useless, the following method was successfully adopted: The tooth is fastened to the microtome and cut until a few sections from the pulpa (i. e. sectioning should be stopped when the pulpa shines clearly through a thin wall of dentine). These sections are as usually discarded. The pulpa is then opened with slender forceps and scraped free of sand, after which sectioning can be resumed. Obviously this rough handling will damage the walls of the pulpa, and the fine zones seen here are destroyed, but the zones of the cementum, which are usually more distinct, are left undamaged.

Teeth consist of very hard material, even when decalcified, and the microtome knife blunts quickly. If many teeth are to be sectioned it is therefore necessary to have several knives, or to have easy access to honing. Fortunately with this material it is not imperative to have a perfect knife to get usable sections. Attempts were made at using razor blades in a specially recommended holder, but the edge of the blades was too flexible for this material.

Plate I

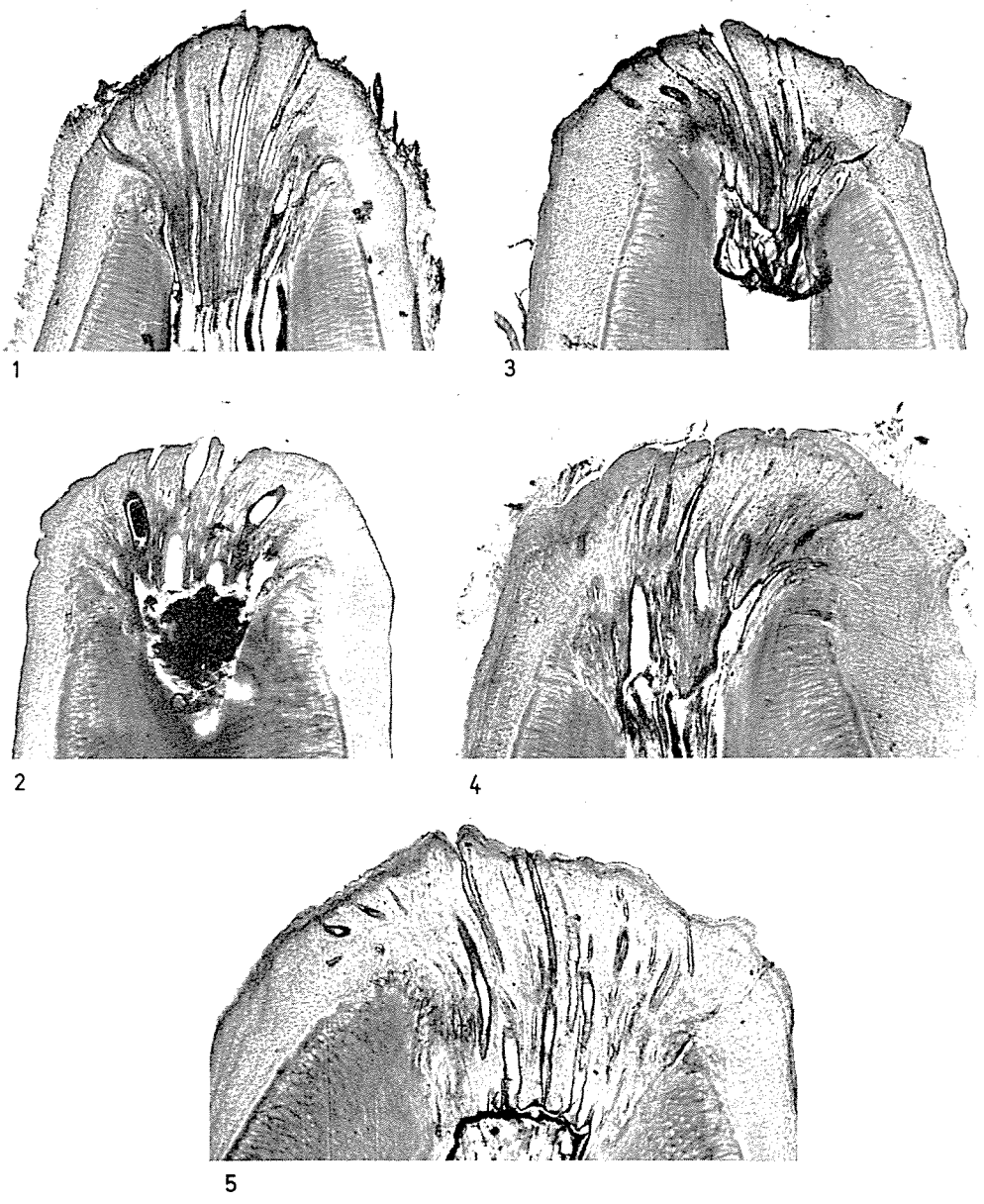

Plate I. Canines of 5 foxes of known age (ear-marked as cubs).

Fig. 1. No. 3151–52. ♀ shot 17.2.1967, 11 months old.
Fig. 2. No. 3103–04. ♂ shot 16.11.1967, 8 months old.
Fig. 3. No. 3128–29. ♀ shot 29.1.1968, 22 months old.
Fig. 4. No. 3215–16. ♂ shot 6.2.1968, 23 months old.
Fig. 5. No. 3113–14. ♂ shot 19.12.1967, 21 months old.

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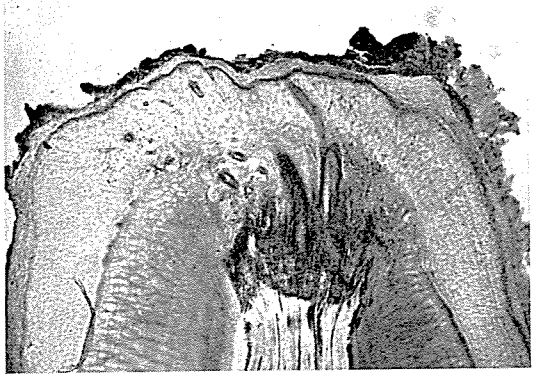

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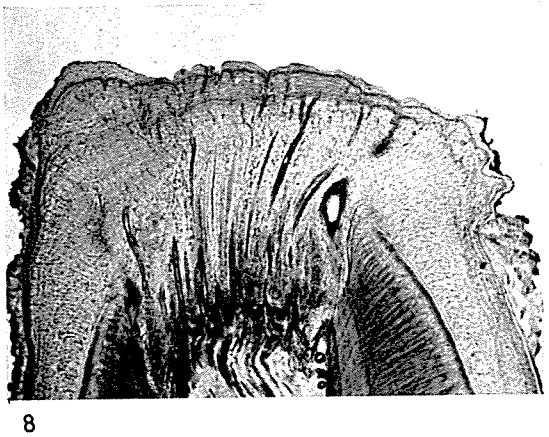

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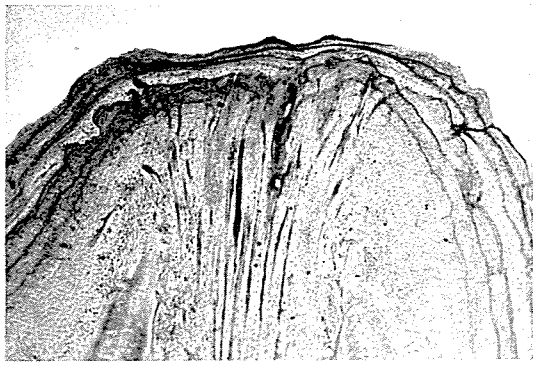
Plate II. Canines of 5 foxes of unknown age showing the different number of layers in the cementum.

Fig. 6. No. D3601. ♀ shot 7.11.1967. No dense zones in the cementum; from the epiphysial closure of the radius judged to have been born in the same year, i. e. 8 months old.
Fig. 7. No. D3445. ♂ shot 23.10.1967. One dense zone in the cementum; presumed age 1½ years.
Fig. 8. No. H404. ♀ shot 21.10.1967. Two dense zones in the cementum; presumed age 2½ years.
Fig. 9. No. D3535. ♂ shot 30.10.1967. Three dense zones in the cementum; presumed age 3½ years.
Fig. 10. No. D3568. ♂ shot 6.11.1967. Five dense zones in the cementum; presumed age 5½ years.

Plate III



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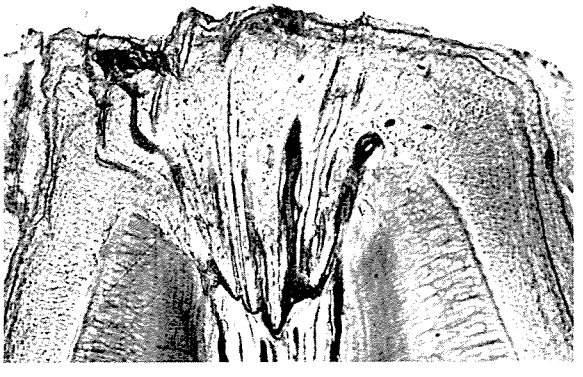

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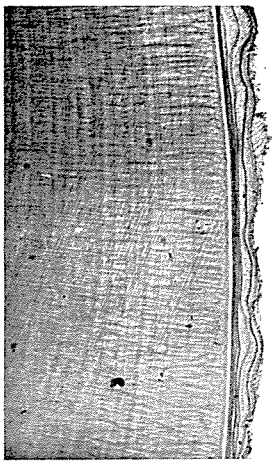

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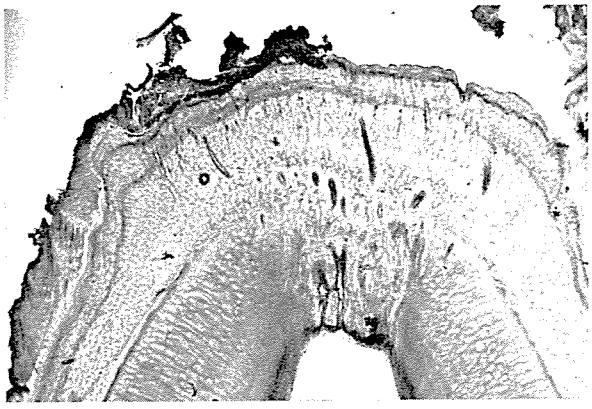
Plate III. Canines of foxes of unknown age, illustrating problems in counting cementum layers.

Fig. 11. No. D3854. ♀ shot 12.1.1968. The cementum layer is partly destroyed between the 3rd and 4th dense zones. To the right in the picture the cementum layer is, however, intact and the dense zones (5) can be counted.

Figs. 12, 13 and 14. No. D3665. ♂ shot 22.11.1967. At the tip of the root the cementum layers have partly been destroyed (12). On the side of the tooth the cementum layers are undisturbed, and five dense zones can be counted (13 and 14).

Fig. 15. No. D3688. ♂ shot 29.11.1967. Two dense zones are visible in the cementum; proximal to the inner one a fine line is situated, seemingly formed during the first autumn of the animal. Presumed age 2½ years.



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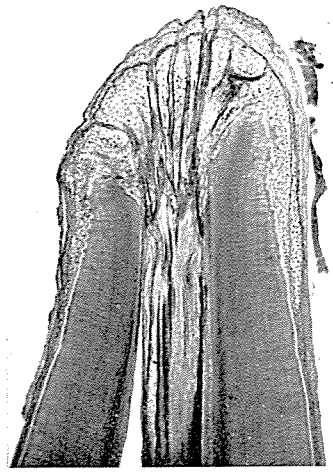

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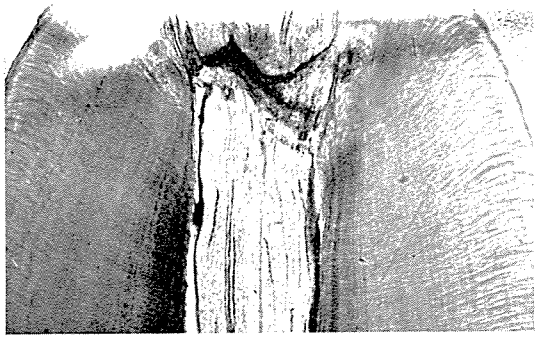

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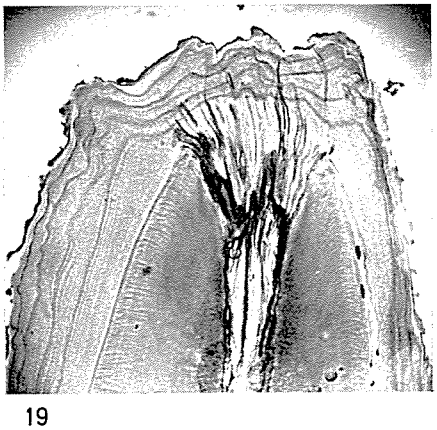

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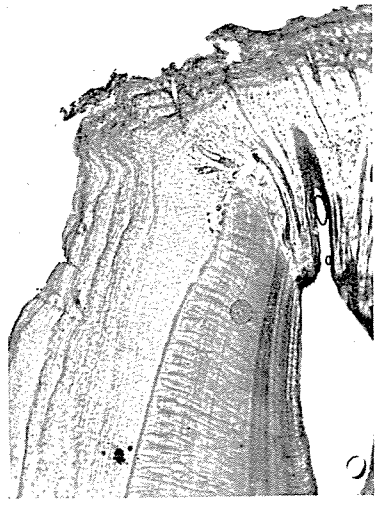

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Plate IV. Canines and incisors of foxes of unknown age showing cementum and dentine layers.

Figs. 16 and 17. No. D3460. ♂ shot 25.10.1967. Canine (16) and incissor (17) showing two dense zones.

Fig. 18. No. D3627. ♀ shot 20.11.1967. Canine showing four dense zones in the dentine at the end of the pulpa.

Fig. 19. Section of the same tooth as in Fig. 18. Four dense zones in the cementum are seen.

Fig. 20. No. D3782. ♂ shot 12.12.1967. Canine showing four dense zones both in the cementum and in the dentine near the pulpa.

Interpretation of the sections

As previously mentioned, several authors have found a relation between dense zones in the cementum layer of the teeth and the age of various mammals. However, the red fox has not previously been the subject of such an investigation; the nearest relatives for which annuli are known being the polar fox *(Alopex lagopus)* (KLEINENBERG & KLEVEZAL 1966) and the coyote *(Canis latrans)* (LINHART & KNOWLTON 1967). The primary aim of this investigation was therefore to show the presence of dense zones in the cementum layer and to prove or disprove some relation between these zones and other age characters of the animal, particularly the epiphysial junction of the limb skeleton.

No captive foxes of known age were available, but in the course of the investigation some foxes which had been earmarked as cubs during the initial stages of the investigation were shot (JENSEN 1968). The age of 5 marked individuals examined is shown below:

No.		*Born*	*Shot*	*Age*
3103–04	♂	March, 1966	16.11.1966	8 months
3151–52	♀	March, 1966	17.2.1967	11 months
3113–14	♂	March, 1966	19.12.1967	21 months
3128–29	♀	March, 1966	29.1.1968	22 months
3215–16	♂	March, 1966	6.2.1968	23 months

On Plate I photographs of the roots of canines of these 5 animals of known age are shown. It will be noted that the teeth of the first two cubs, which are under a year old, lack dense zones in the cementum layer (Figs. 1 & 2), this layer being characteristically uniform. In all the last three, however, which are nearly two years old, a dense layer has been formed.

From these 5 foxes of known age it is seen that in the red fox the first dense cementum layer is laid down between the first and second autumn of life of the animal. Supporting evidence for the assertion that the first annulus is formed during that period was obtained by sorting the material according to the epiphysial junction of the limb skeleton. In the material from October and November in which foxes born the same year could easily be recognised, canines from the young animals showed no dens layers and older ones showed one or more dens layers. This is in accordance with the findings of KLEINENBERG & KLEVEZAL (1966) for the polar fox, but in contrast to the findings of LINHART & KNOWLTON (1967) for the coyote where the first dense cementum layer does not appear until the age of nearly 24 months.

The present investigation gives no information as to the time interval between two successive layers of cementum. However, it seems reasonable to assume that the dense layers are formed by annual increments as has been found with other mammals examined.

On Plate II, sections from the teeth of 5 foxes of unknown age are shown. Fig. 6 is the canine of a fox shot on 7.11.1967 and according to the degree of epiphysial fusion in radius it is a cub of the same year, i. e. it is about 8 months old. Fig. 7 is interpreted as being about 1½ years old (shot 23.10.1967), Fig. 8 about 2½ years old (shot 21.10.1967), Fig. 9 about 3½ years old (shot 30.10.1967) and Fig. 10 about 5½ years old (shot 6.11.1967). Fig. 8 also clearly demonstrates that the first layers often consist of many faint layers, these seeming to become packed together as the animal grows older. This phenomenon may also be seen in Figs. 3–5 and 9.

Unfortunately not all sections are so easily interpreted as the four examples shown in Figs. 7–10. However, with some experience most of the sections are inter-

pretable. In the present material of about 200 sectioned teeth only 4 were rejected and about 10 are dubious.

On Plate III, Figs. 11 & 12 show a phenomenon which was seen in about 7 % of the teeth examined. Here the cementum layer had been destroyed for some reason when the animal was about 3–5 years old, and new cementum had subsequently been deposited. As a destruction of this nature is usually found in both the canines as well as in the incisors of the animal, it is reasonable to suppose that it is caused by some form of general debility. Of course a disturbance in the cementum layer will influence the dense zones as well, often making such teeth difficult to interpret. Frequently, however, only the tips of the roots have been destroyed, while the layers on the sides of the root may be undisturbed, as is seen in Fig. 11, right. In Figs. 13 & 14 the more lateral part of the tooth shown in Fig. 11 is seen, here the zones are quite distinct and easily counted. In using this method it is important to check the fact that the oldest layer on the side of the root is identical with the oldest layer in the tip of the root, as the first dense zone formed is often of less extension than the following zones.

Plate III, Fig. 15 shows another phenomenon which may complicate counting the annuli. The tooth shown has two distinct dark zones; however, proximal to these a faint line is seen, seemingly formed during the first autumn of the animal.

As previously mentioned, annuli may also be found in the dentine which slowly fills up the pulpa. In the red fox these annuli are usually quite indistinct; however, in a few individuals they are seen clearly and can be counted (Plate IV, Fig. 20). As will be seen in Fig. 18, annuli may also be visible at the end of the pulpa; unfortunately these annuli are not distinct in all individuals, either. Thus it is clear that only the annuli of the cementum layer provide a character sufficiently constant as to be usable for age determination of a population. However, distinct annuli in the dentine may by mere chance be found in just those animals in which counting of the cementum annuli presents difficulties, so that this alternative should not be overlooked.

Special interest pertains to the physiological background for the forming of annuli in the teeth or skeleton of various mammals. The reason for the annual rhythm in the laying down of the material is not yet understood. To throw light on this problem it is essential to find out exactly at what time of year the dark and light zones respectively are laid down in the cementum. The bulk of the present material was collected during the period October to January, but also canines from foxes shot in other seasons of the year have been examined.

It should be noted that it is rather difficult to decide which zone is the last formed: a narrow, dark one, or a broader, light one. The results clearly show that the light zones are laid down from September – October onwards. Unfortunately the dark zones are more problematical, being less easily discernible than the light ones; an added complication is that the stain may tend to concentrate at the outer edge of the cementum, even though there is no dark zone there (Fig. 2). An outer dark zone is distinctly seen in teeth of animals shot during the period June – September. However, the teeth of some animals shot 2–3 months earlier (February – May) do seem to show a similar zone.

Results

The tested technique clearly offers valuable possibilities for absolute age determination of Danish foxes. The technique is not unduly demanding, and can therefore be used for a material consisting of a large number of animals, the more so if it is possible to sort out in advance the large percentage of animals less than a year old. The method calls for considerable experience, particularly in the interpretation of sections; here prior possession of material comprising teeth of known age for comparison is a very valuable asset.

The prime object of this paper was to describe the tested technique of age determination; it is the intention to incorporate the present biological results in a future treatment of a larger material designed to elucidate factors of population dynamics. For this reason only brief comments are appended to the findings on age distribution of the material examined.

From mid October, 1967, to mid January, 1968, material was collected from 522 foxes killed in the South Jutland region. From the degree of fusion of the epiphyses of the radius and from sections of teeth prepared for the microscope it was possible to relate 518 to their age groups; distribution was as shown in Table 1. In a number of instances the exact age classification was not without some degree of uncertainty, but in only 4 cases was it found to be impossible to determine the age on the basis of the collected material.

Age in years	♂	♀	♂ + ♀
1/2-1	255	134	389
1 1/2-2	33	25	58
2 1/2-3	20	18	38
3 1/2-4	11	6	17
4 1/2-5	2	3	5
5 1/2-6	5	2	7
6 1/2-7	3	1	4
?	3	1	4
	332	190	522

Table 1. Age distribution of the 522 foxes collected.

Noteworthy is the fact that the majority of the animals received (75 %) were 1/2 to 1 year old; this corresponds to 7 young animals for each adult vixen. However, experience from previous investigations within the field of game biology has shown that the toll from hunting and shooting or from trapping does not comprise a representative section af a population, and the same is undoubtedly true of the foxes collected in this case. It is to be presumed that the chances of survival are better for foxes over a year old, but the age distribution shown in Table 1 suggests that but a small percentage of foxes attain ages exceeding 5 years.

Dansk Resumé

Aldersbestemmelse af ræve (*Vulpes vulpes* L.) på grundlag af snit af hjørnetænderne

En teknik til aldersklassificering på grundlag af lagstrukturer i tandcementen omkring tandroden er blevet prøvet på et materiale af ræve (*Vulpes vulpes* L.) fra Danmark. Til undersøgelsen benyttedes en hjørnetand, der blev afkalket i 5 % HNO_3 og snittet på frysemikrotom (30 µ); hvorefter snittene blev farvet med Mayers Hæmalun.

Tavle I viser snit fra ræve af kendt alder. Tavle II viser snit fra ræve af ukendt alder med forskelligt antal tydelige lag i tandcementen. Tavle III og IV viser snit fra ræve af ukendt alder, hvor en optælling af lagstrukturer er vanskelig. Til tider kan man også iagttage en lagdeling i dentinen ind mod pulpahulen svarende til den, man finder i cementen (fig. 18 og 20).

De brede, lyse lag i tandcementen dannes om efteråret. Det er vanskeligt at afgøre, hvornår de smalle, mørke lag dannes. De findes tydeligt hos dyr skudt i forsommeren, og måske dannes de allerede i februar–marts.

Hvert år dannes et mørkt og et lyst lag, og dyrets alder kan derfor bestemmes udfra antallet af lag.

I tabel 1 er vist aldersfordelingen blandt 522 ræve skudt mellem midten af oktober 1967 og midten af januar 1968.

De fleste unge ræve var det muligt på forhånd at udskille, fordi der endnu var spor af vækstzonen i forbensknoglen spolebenet. Af sådanne individer blev der derfor ikke fremstillet tandsnit, men alle de øvrige blev aldersbestemt på grundlag af tandsnit.

Den fundne aldersfordeling tyder på en hurtig omsætning i den danske rævebestand, der er udsat for ret kraftig jagt. Ræve under 1 år udgør så stor en del af de skudte dyr (75 %), at man må antage, at de er forholdsvis lettere at komme til at skyde end ældre ræve.

Резюме на русском языке:

Определение возраста лисиц (*Vulpes vulpes* L.) по срезам клыков.

Методика определения возраста по слоистым структурам в зубном цементе вокруг корней зубов была испробована на материале лисиц (Vulpes vulpes L.) из Дании. Для исследования был использован клык, декальцинированный в 5% HNO_3 и резаный на замораживающем микротоме (30 мк), после чего срезы были окрашены гемалауном Майера.

Табл. I показывает срезы, полученные от лисиц известного возраста. Табл. II показывает срезы от лисиц неизвестного возраста с различным числом отчетливых слоев в зубном цементе, Табл. III и IV показывают срезы, полученные от лисиц неизвестного возраста. в которых трудно считать слоевые структуры. Иногда в дентине, смежном с полостью пульпы, также наблюдается разделение на слои, соответствующее тому, которое наблюдается в цементе (фиг. 18 и 20).

Широкие, светлые полосы в зубном цементе образуются осенью. Трудно определить, когда образуются узкие, темные полосы; возможно, что это происходит в конце зимы. В каждом

Results

The tested technique clearly offers valuable possibilities for absolute age determination of Danish foxes. The technique is not unduly demanding, and can therefore be used for a material consisting of a large number of animals, the more so if it is possible to sort out in advance the large percentage of animals less than a year old. The method calls for considerable experience, particularly in the interpretation of sections; here prior possession of material comprising teeth of known age for comparison is a very valuable asset.

The prime object of this paper was to describe the tested technique of age determination; it is the intention to incorporate the present biological results in a future treatment of a larger material designed to elucidate factors of population dynamics. For this reason only brief comments are appended to the findings on age distribution of the material examined.

From mid October, 1967, to mid January, 1968, material was collected from 522 foxes killed in the South Jutland region. From the degree of fusion of the epiphyses of the radius and from sections of teeth prepared for the microscope it was possible to relate 518 to their age groups; distribution was as shown in Table 1. In a number of instances the exact age classification was not without some degree of uncertainty, but in only 4 cases was it found to be impossible to determine the age on the basis of the collected material.

Age in years	♂	♀	♂ + ♀
1/2-1	255	134	389
1 1/2-2	33	25	58
2 1/2-3	20	18	38
3 1/2-4	11	6	17
4 1/2-5	2	3	5
5 1/2-6	5	2	7
6 1/2-7	3	1	4
?	3	1	4
	332	190	522

Table 1. Age distribution of the 522 foxes collected.

Noteworthy is the fact that the majority of the animals received (75 %) were 1/2 to 1 year old; this corresponds to 7 young animals for each adult vixen. However, experience from previous investigations within the field of game biology has shown that the toll from hunting and shooting or from trapping does not comprise a representative section af a population, and the same is undoubtedly true of the foxes collected in this case. It is to be presumed that the chances of survival are better for foxes over a year old, but the age distribution shown in Table 1 suggests that but a small percentage of foxes attain ages exceeding 5 years.

году образуется по одному темному и одному светлому слою, так что возраст животного можно определить по числу слоев.

В табл. I показано распределение по возрасту 521 лисицы, убитых от середины октября 1967 г. до середины января 1968 г.

Большинство молодых лисиц можно было предварительно выбрать, так как у них еще были следы зоны роста кости передней ноги (radius). От таких особей поэтому не было приготовлено зубных срезов, но возраст всех остальных был определен по срезам зубов.

Обнаруженное распределелеление по возрасту указывает на быстрый оборот датского состава лисиц, являющихся предметом довольно интенсивной охоты. Так как лисицы моложе 1-го года составляют очень большую часть всех убитых особей (75%), нужно предполагать, что охотникам легче удается добывать их, чем более стаых лисиц.

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