

# Bone pedicle development and their association to tooth germ in acrodont chameleons

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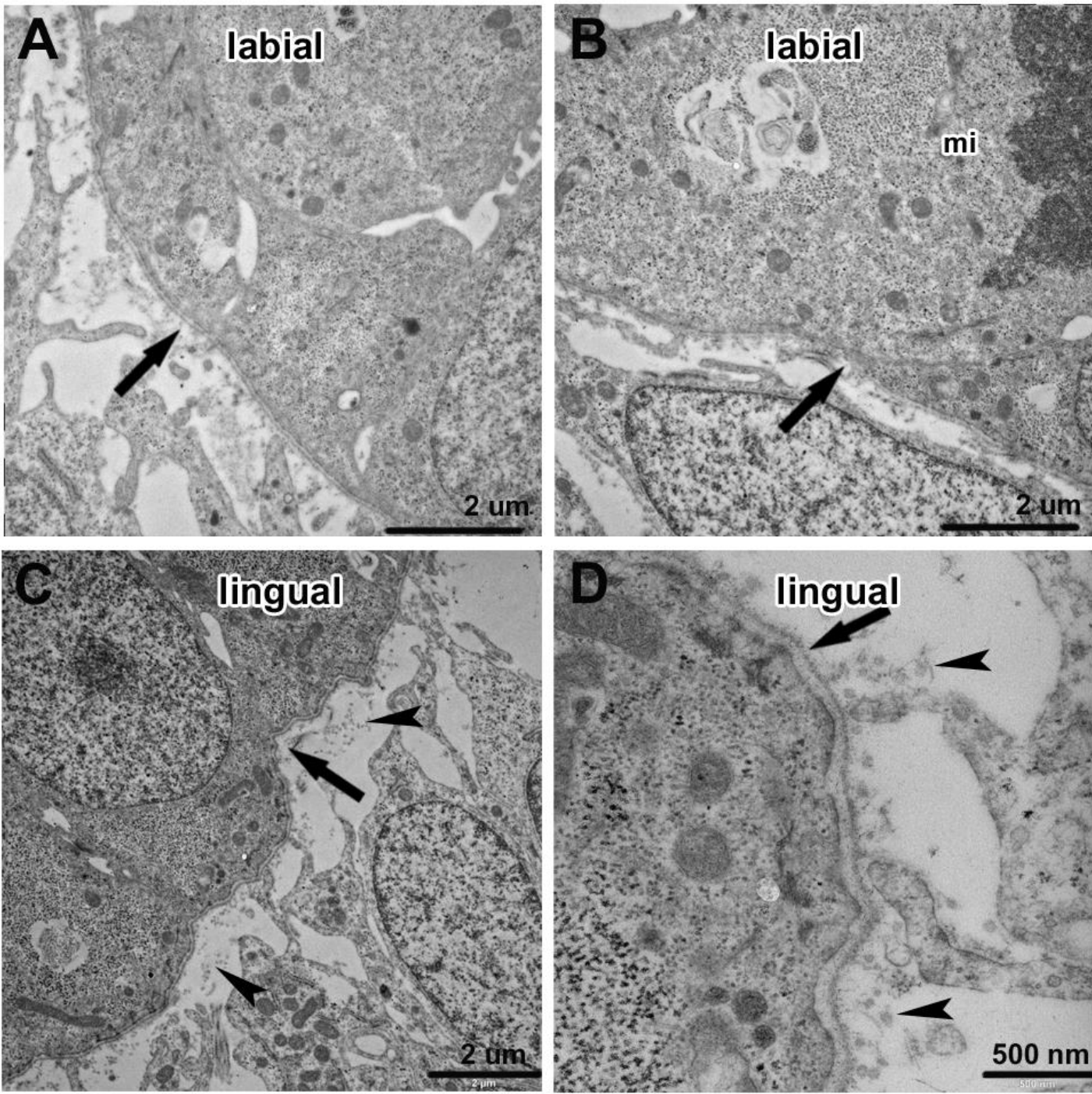
## Introduction

Most lizards and snakes exhibit teeth ankylosed to the underlying bone. Chameleon teeth are firmly attached on the top of the tooth-bearing bone pedicles (acrodont teeth). However, at early stages of embryo, acrodont dentition in chameleons resembles pleurodont dentition with distinct size asymmetries on the side of cervical loops of the tooth germ as well as attachment bone of the jaw. The aim of our study was to reveal the developmental processes contributing to the formation of tooth-bone interface in acrodont dentition and to describe what are the differences in labial and lingual parts of the bony pedicles.

## Materials and Methods

Animals were obtained from private breeder. To demonstrate bone pedicle development, five pre-hatching stages were collected. MicroCT measurement for analysis of bone pedicle initiation was performed by GE Phoenix v|tome|x L 240 laboratory system equipped with 180 kV /15 W nanofocus tube. Wall thickness analysis and 3D visualizations were carried out in VG Studio MAX 3.3 software. TRAP analysis was performed to detect osteoclasts distribution during pedicle formations. Transmission electron microscopy was used to analyze submicroscopic changes in cells in area between tooth and bony pedicles.

## Ultrastructure of labial and lingual part of cervical loop displays significant differences



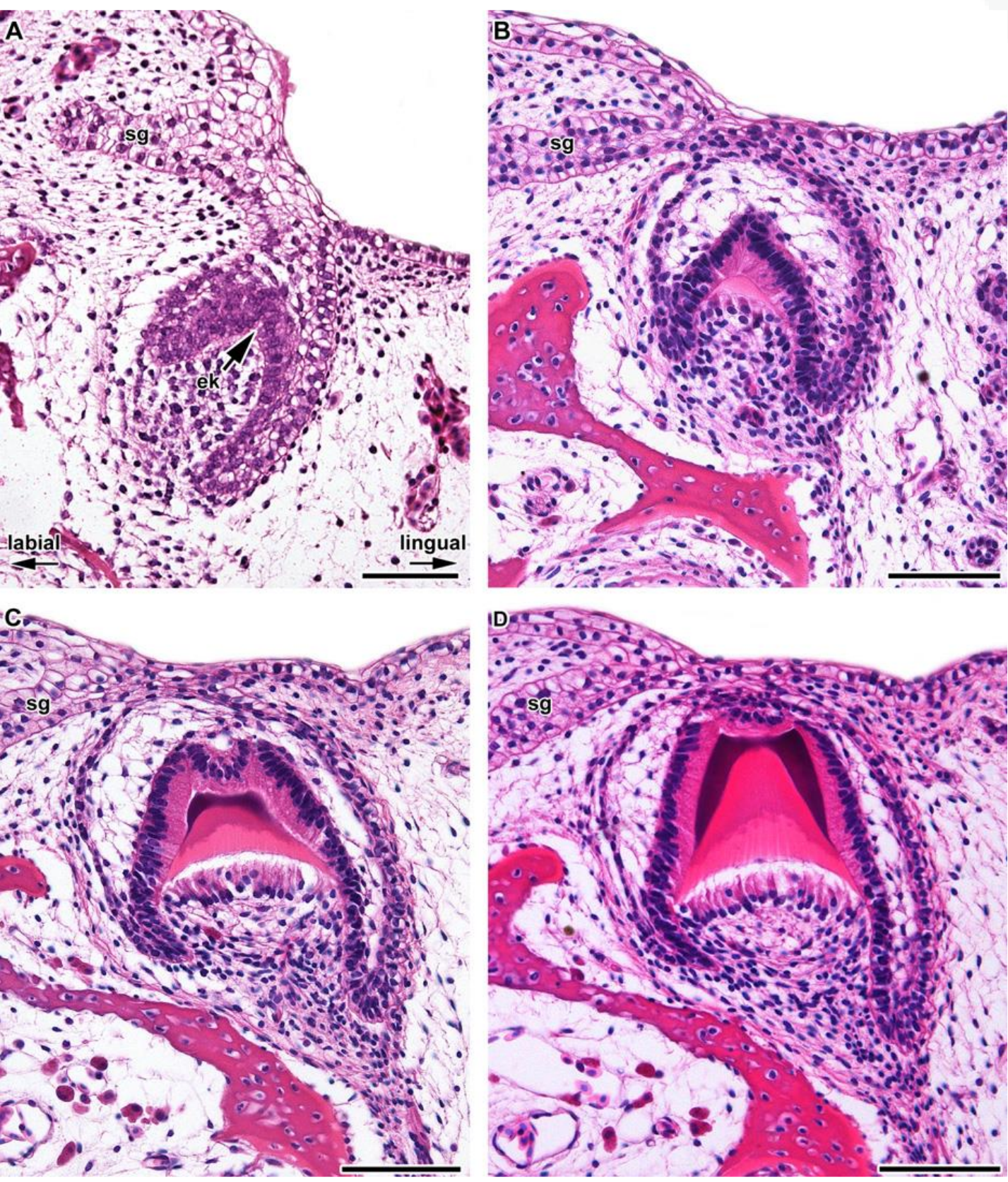
**Lingual side** of the cervical loop: basal membrane was irregularly woven and clearly subdivided into lamina lucida and lamina densa, numerous collagen fibrils were located directly beneath the basal membrane.  
**Labial side** of the cervical loop: basal membrane was smooth, lamina lucida and lamina densa are not so discrete in this area, only small amount of collagen fibrils were located beneath the basal membrane.

## Osteoclasts remodel bone pedicles during development

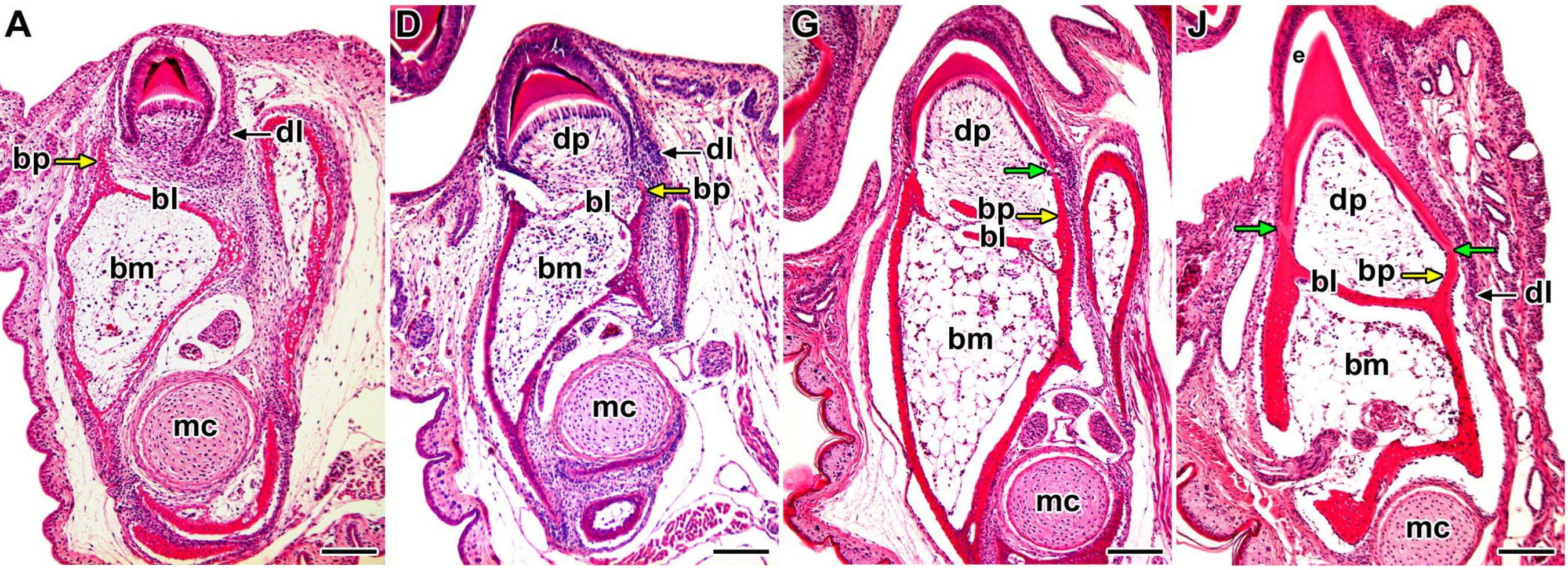
Osteoclasts were located not only on the inner surface of bony pedicles but also on the lamellae underlying the teeth.



## Jaw bones develop in close relation to teeth

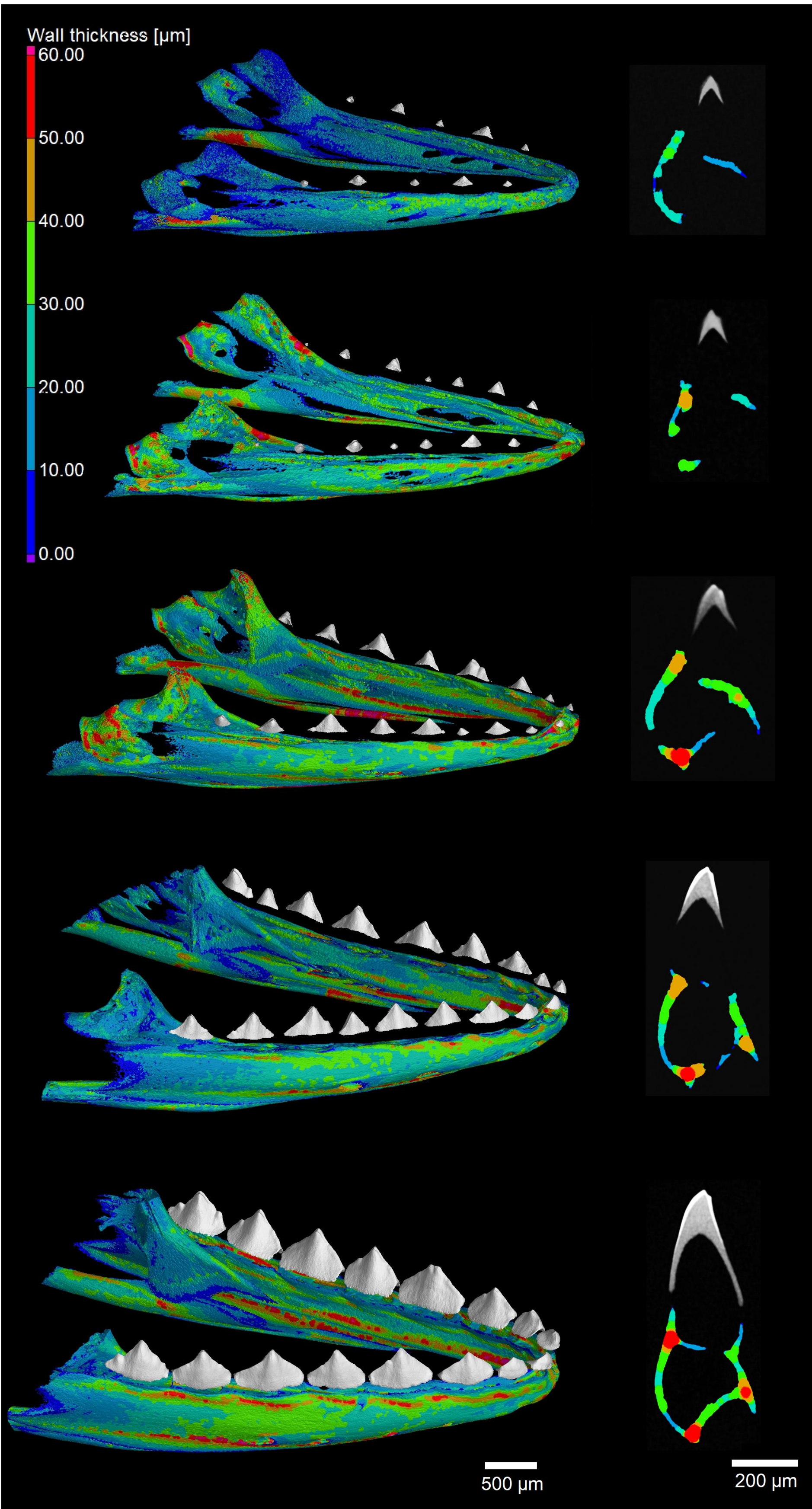
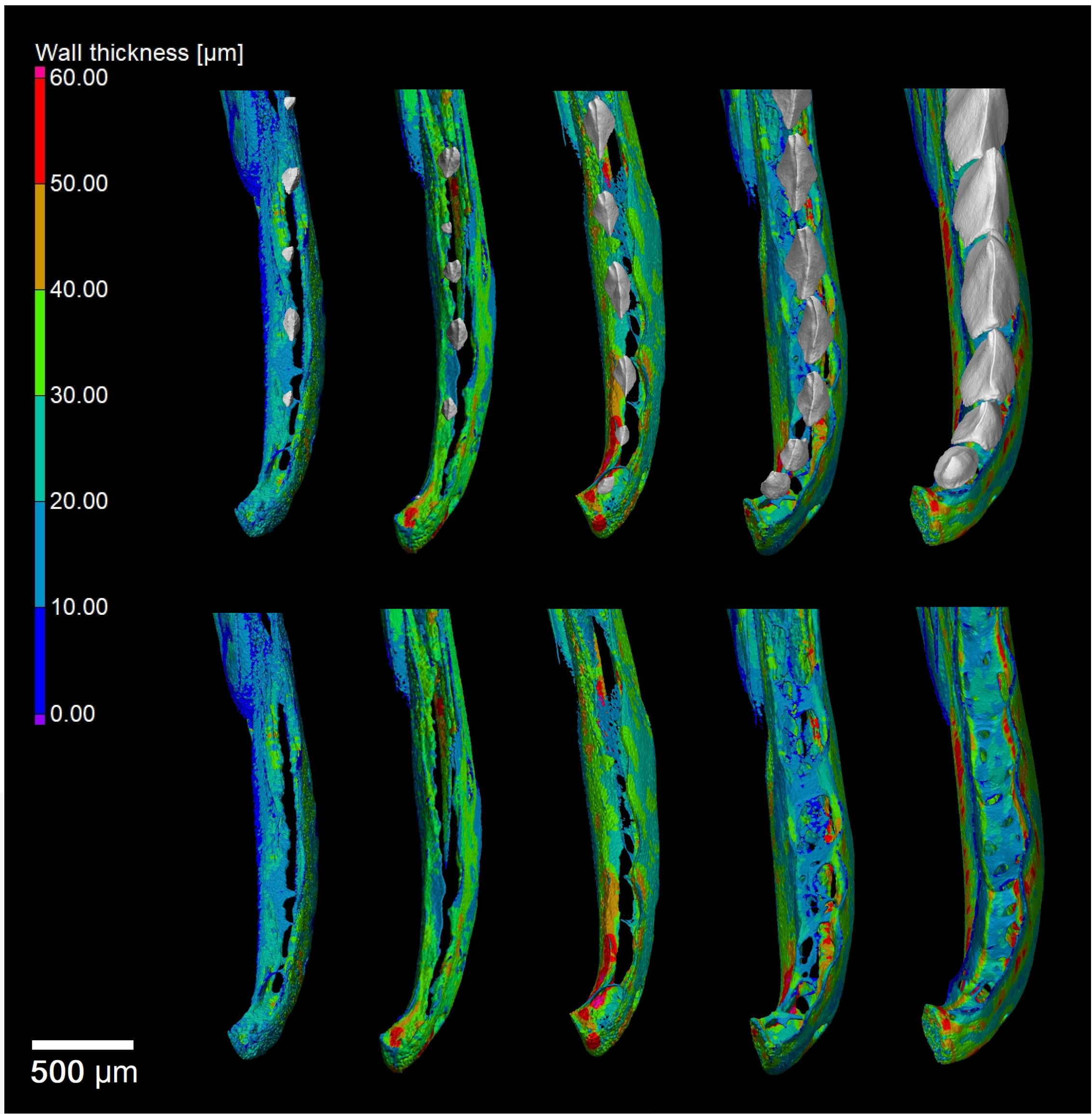


Tooth bases in chameleon are formed during the pre-hatching period. Early stages of tooth were located on the inner surface of the jaw bone, interestingly, tooth germs of acrodont dentition were also similar to pleurodont teeth. Bone and cervical loop shape did not match to each other at early stages. Later, the cervical loop elongated towards the bone. Progressively, small bony pedicles were directed towards the cervical loop and approached the dentin.



## Bone thickness analysis during pedicle formation

MicroCT analysis of bony pedicles development revealed their initiation on the labial side and later during development on the lingual side. Furthermore, the bony pedicle developed earlier on the rostral side than the caudal side. Round socket for the future fusion area is formed ahead of tooth mineralization. The bone matrix remained thicker on the labial part of the jaw in all analysed developmental stages of chameleon embryo.



## Conclusions

During the early development of chameleon their teeth grows asymmetrically with higher progress on the labial part of the cervical loop. The early tooth germ at cap stage are developing in large distance from the ossification center of mandible. Analysis of bony pedicles revealed that their initiation starts earlier on the labial side and later during development on the lingual side and furthermore that the bony pedicles developed earlier on the rostral side than the caudal side.

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