Histological Observation of *Paleoparadoxia* Incisor from the Noto Peninsula, Japan

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**Introduction**

Desmostylias, comprising six genera (*Ashoroa*, *Behemotops*, *Cornvallius*, *Desmostylus*, *Paleoparadoxia*, and *Kronokotherium*) are extinct marine mammals found in late Oligocene and Miocene deposits in the northern Pacific coastal region (1, 2). *Desmostylus* and *Paleoparadoxia* have been found in Miocene deposits in several localities on the Noto Peninsula in central Japan (3-5).

We performed histological analysis of *Paleoparadoxia* incisors that were found by one of the authors, Yamamoto, at two Middle Miocene sites in Shiga Town, Ishikawa Prefecture. The root of an incisor was previously collected at another locality (5). The specimens described in this paper are housed in the Department of Oral Medicine (Biology), Nihon University School of Dentistry at Matsudo.

**Materials and Methods**

Two incomplete *Paleoparadoxia* incisor specimens assumed to be *P. tabetai* were obtained from the Middle Miocene Sekinohana Calcareous Sandstone (about 14 Ma) in Shiga Town, Ishikawa Prefecture. One of the samples provided for histological observation had lost a significant amount of enamel on one side. It was cut longitudinally and horizontally into two pieces with a diamond cutter for three-dimensional observation. After polishing with a diamond paste and slight etching with 1/20 N HCl for 20-30 s, the specimens were sputter-coated with Au-Pd. The specimens were observed by reflective light microscopy and by scanning electron microscopy (Hitachi S-2700).

**Results and Discussion**

Two fragments of *Paleoparadoxia* incisor were detected in the marine deposits in 2004. They were flat in shape and bilateral enamel around the dentin. One of the samples had two layers of enamel over the dentin, and had a mesiodistal diameter of 6 mm, a labiolingual diameter of 2 mm and length of 16 mm (Fig. 1-3). The other sample had lost significant amounts of enamel on one side. It had a mesiodistal...
diameter of 11 mm, a labioliingual diameter of 2 mm, and length of 22 mm. The dentin was exposed with an uneven surface (Fig. 4, 5). Shallow depressions of various sizes were observed on the enamel surface in both specimens.

The maximum thickness of enamel was 1.2 mm in the middle part of the specimen. Hunter–Schreger bands (HSB) ran through the whole width of the enamel showing a moderate curve (Fig. 6). The inclination of the HSB to the dentinoenamel junction (DEJ) was about 30° upward and about 20° near the surface of the enamel (Fig. 6). The HSB changed gently in a horizontal direction about 500 μm from the enamel surface and several incremental lines (striae of Retzius) were observed in this region (Fig. 6). Each band was seen to unite and break up in the vicinity of 100 μm from the DEJ (Fig. 7). The boundaries of the bands could be observed clearly by light microscopy. However, they were indistinct on scanning electron microscopy because they changed gradually from each band to the adjacent band (Fig. 8).
Thick inter-prismatic substance filled up the gap and buried the prisms with orthogonal direction of the crystals (Fig. 9). In the molar, HSB ran through the whole width of the enamel showing an S-shaped moderate curve (3).

The enamel prisms were seen to meander in the tangential section (Fig. 10). The enamel prism was almost elliptic or rectangular in shape, 6 µm along the long axis and 3 µm along the short axis. The inter-prismatic substance was distinctive and surrounded the prism to a thickness of 1-2 µm and the direction of the crystals was almost orthogonal to the prism (Fig. 11).

The dentinal tubules were preserved and thin
peritubular dentin was observed inside (Fig. 12). The
dental fibers were also preserved in the tubules,
which included main and lateral branches, with a
diameter of 0.2–2 μm (Fig. 13). The mineralizing
layers (calcification lines) of the dentin were ob-
erved in the deep area of the dentin (Fig. 14).

This description of the *Paleoparadoxia* incisor
found on the Noto Peninsula enables comparisons
with the molar (6) and premolar (7), and with the
teeth of *Desmostylus*.

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