

# A Case of Abnormal Deciduous Tooth Morphology of a Late Miocene Hipparionine Horse

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**Abstract:** A hipparionine horse mandible of a young individual from the Turolian fossiliferous site of Kryopigi bears the third right deciduous premolar showing abnormal enamel development. The appearance of this anomaly can be seen as random and represents less than 1% of total third deciduous premolars in the Kryopigi hipparionine material. The description, illustrations and dimensions of the specimen are given here.

**Keywords:** Turolian, hipparion, enamel, paleopathology, Kryopigi

## Introduction

Abnormal enamel morphology of fossil equid teeth has rarely been described. Examples of enamel abnormalities, such as dystrophies and failures of enamel formation, cement or enamel hypoplasia, and damage due to traumas have been reported (THENIUS 1952, SONDAAR 1968, HUSSAIN, SONDAAR 1968, FORSTEN 1973, ROONEY 1997).

The vertebrate fossiliferous site of Kryopigi is located in the northern part of the Kassandra Peninsula of Chalkidiki in northern Greece. The Kryopigi preliminary fauna list consists of at least twenty species which are under study in the PhD dissertation by Georgios Lazaridis. The following *Hipparion sensu lato* species have been determined: *Hippotherium* cf. *brachypus*, *Cremohipparion matthewi/nikosi*, ?*Cremohipparion* sp. cf. *C. mediterraneum* and a new species *Hipparion phlegrae* Lazaridis and Tsoukala, 2014. The Kryopigi deposits can be attributed to Triglia Formation according to the stratigraphical regime of the area (SYRIDES 1990). The age of the locality is discussed as Late Miocene-Turolian indicated by the presence of *Mesopithecus pentelicus* (TSOUKALA, BARTSIOKAS 2008) and of the equid assemblage (LAZARIDIS 2010).

Among the hundreds of hipparion teeth found *in situ* or isolated in the Kryopigi material, only

one mandible of a young individual with abnormal enamel morphology has been noticed. This specimen is described here in detail and its peculiar morphology is compared with the normal one.

## Material and Methods

The description is based on an incomplete hipparion mandible, accession no. KRY4515 (Fig. 1). The measurements follow the recommendations of the 'Hipparion Conference', New York, November 1981 (EISENMANN *et al.* 1988). The nomenclature used to describe the occlusal morphology follows EISENMANN *et al.* (1988) and EVANDER (2004) (Fig. 2).

## Results

The incomplete mandible lacks branches and bears the slight to middle worn deciduous cheek teeth, as well as the left and right first deciduous incisors (Fig. 1). The right third incisor is developed, but not yet fully erupted. In recent horses, the deciduous first incisors and the cheek teeth are already erupted at birth or within the first eight days of life. The second deciduous incisor erupts at 4.5 to 6 weeks after birth or during the second week and the third – in six

to nine months (PENCE 2002). This growth stage can be considered similar to that of mandible KRY4515. The deciduous cheek teeth length is 75 mm for the left and 77.6 mm for the right side. The height of the corpus is 31.2 mm in front of p2, while the length and the minimal breadth of the symphysis are 46.54 and 29.46 mm, respectively. The dimensions of the teeth are given in Table 1.

The occlusal morphology of the left deciduous tooth row is considered normal, in contrast to the morphology of the teeth on the right side (Fig. 2).

The *dp2* is characterised by a long and pointed anteriorly paraconid giving a triangular shape to the tooth. The linguaflexid is shallow, rounded, and bears a *pli* linguaflexid. The ectoflexid is shallow in relation to the isthmus, without a *pli* caballinid. The metaconid is elliptical and slightly pointed anteriorly. The metastylid is elliptical to sub-triangular in shape. The protostylid, ectostylid and hypostylid are absent. The entoconid is more or less rounded with a strong spur towards the mesio-buccal side. The hypoconulid is well-developed and pointed towards the lingual side. The preflexid and the postflexid are not significantly crenulated and they have no plications.

The *dp3* has a relatively more quadrangular shape as compared with the previous one. The parastylid reaches the middle of the tooth width. The linguaflexid is shallow and rounded and a barely perceptible *pli* linguaflexid is present. The ectoflexid is deeper than in the *dp2* and reaches the isthmus. A *pli* caballinid is absent. The metaconid is approximately elliptical and the metastylid is rounded to sub-triangular in shape. The protostylid and the ectostylid are isolated. The entoconid is rounded and slightly pointed towards the mesio-buccal side. The hypoconulid is well developed and pointed towards the disto-lingual side. The preflexid and postflexid are not significantly crenulated. Postflexid is longer than preflexid.

The *dp4* is, in general, of sub-triangular shape (at least in early wear) due to the strong development of the hypoconulid towards the distal side. The parastylid reaches the lingual side of the tooth. The linguaflexid is shallow and of obtuse V-shape. The ectoflexid is deeper than that in the *dp2* and *dp3*, and penetrates the isthmus. The metaconid and the metastylid are more or less elliptical. The entoconid is rounded to quadrate. The preflexid and postflexid are not significantly crenulated. Postflexid is longer than preflexid.

The right side shows some minor differences in the first and the last deciduous premolars when compared to the left ones. Among the differences between the left and right teeth, the most important is the development of a plication at the mesial side of the preflexid (Fig. 2: a,b). However, the mesial half of the right *dp3* is significantly different from that of the left side as described above and differs from any other known specimen.

The abnormal morphology includes presence of a plication in the buccal side of the metaconid (Fig. 2: c), which is developed toward the lingual side. As a result, an almost isolated rounded loop of enamel on the front of metaconid is formed. There is a large enamel loop in place of the parastylid (Fig. 2: e, f), as observed at the occlusal surface that probably corresponds to the parastylid. The protostylid may be considered confluent to the buccal side of the parastylid (Fig. 2: f), otherwise it is absent.

## Discussion

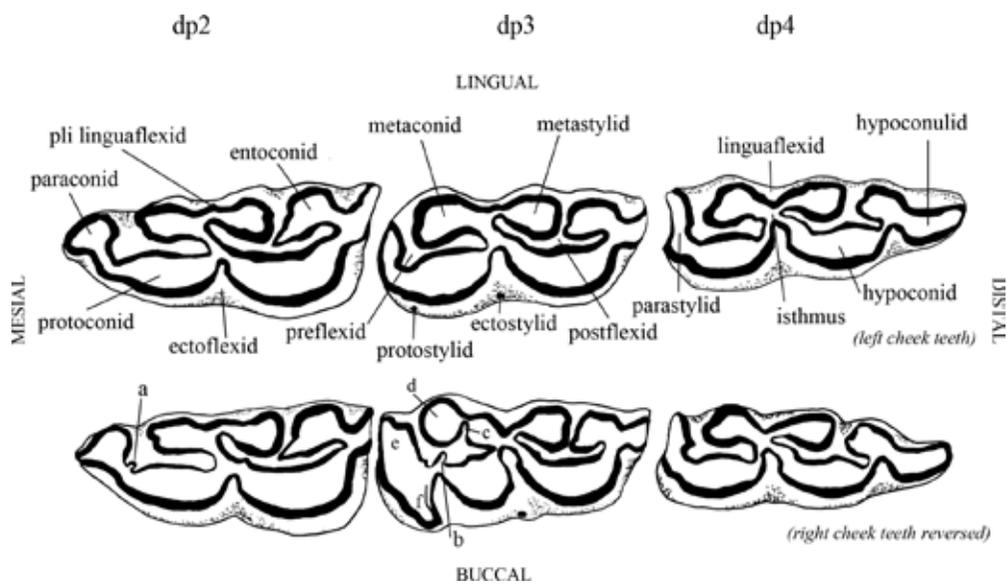
According to FORSTEN (1973), a malfunctioning of the mesodermal papillar cells results in abnormalities, accidentally and without adaptive significance, may be due to diet, mechanical damage or even genetic traits. Since the rest teeth in specimen KRY4515 are normally developed, it appears to be



**Fig. 1.** Mandible KRY4515 with left and right deciduous cheek teeth, first deciduous incisors and not fully erupted right third incisor; occlusal view

**Table 1.** Deciduous tooth measurements of mandible KRY4515

KRY4515	Side	Occlusal length	Preflexid length	Linguaflexid length	Postflexid length	Occlusal breadth
dp2	left	26.26	8.64	11.6	11.06	10.3
dp2	right	25.33	8	11.5	10.9	10.19
dp3	left	23.05	7.8	12.2	9.74	9.68
dp3	right	23.97	6.79	12.95	8.18	12.04
dp4	left	26.64	8.28	12.37	8.96	8.96
dp4	right	26.92	7.58	12	9.17	8.4
di1	left	14.16	-	-	-	6.06
di1	right	13.58	-	-	-	5.96



**Fig. 2.** Occlusal morphology of deciduous cheek teeth *dp2-dp4* (KRY4515) of left (above) and right (below; reversed) side (a-f: see text)

an accidental abnormality not related to adaptation.

Mandible KRY4515 corresponds to a young individual with the left and right deciduous cheek teeth. Although the occlusal morphology is typical and normal to the left tooth-row, the right *dp3* is abnormally developed. Among 61 specimens of *dp3* found *in situ* and among 120 specimens of isolated

*dp3* and *4* of the various Kryopigi *Hipparion* species, the right *dp3* of the KRY4515 specimen is the only deciduous tooth with abnormal enamel morphology, which corresponds to less than 1% of the total number of the third deciduous premolars. This abnormality seems to be random and not related to any adaptation.

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