

## ***Palorchestes* from the Pliocene Hamilton Local Fauna, Victoria, Australia**

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### **Abstract**

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The early Pliocene Hamilton Local Fauna of Victoria is one of the best-dated and diverse Pliocene mammal faunas of Australia. One member of this fauna is the unusual diprotodont *Palorchestes* (Fam. Palorchestidae), a left dentary and isolated teeth of which are described and figured. In both size and morphology this material is similar to the specimens from the Nelson Bay Local Fauna. It is referred to *Palorchestes pickeringi* Piper 2006. The radiometric date of  $4.46 \pm 0.1$  Ma for the Hamilton Local Fauna is older than the date on the Nelson Local Fauna (0.78–1.77 Ma) and has implications for the persistence of the species.

### **Keywords**

*Palorchestes*, Hamilton fauna, Pliocene

### **Introduction**

The Hamilton Local Fauna from western Victoria is one of the best-dated and most diverse Neogene faunas in Australia. However, in the initial collections the genus *Palorchestes* was poorly represented, with only one specimen, a lower molar (FM PM 16801), being reported (Turnbull and Lundelius, 1970). Subsequent collecting produced additional material, which was not available to Piper in her 2006 study of *Palorchestes* from Nelson Bay, although she listed the specimens, with measurements supplied by Dr. Tom Rich of the National Museum of Victoria. Here I provide descriptions and figures of the new material.

The locality is located on the Grange Burn, 4.5 miles (7.24 km) west of Hamilton, Victoria. The locality and stratigraphy were described in detail by Turnbull and Lundelius (1970) and is summarized briefly here. The faunal material was recovered from the “A” zone of a soil that directly underlies a basalt flow. The unit that yielded the fossils overlies a calcareous near-shore marine unit, the Grange Burn Formation that is referred to the Kalimnan stage (Gill, 1957; Ludbrook, 1973). A K/Ar date of  $4.35 \pm 0.1$  Ma was obtained on the basalt (Turnbull et al., 1965). That date was later revised using the new decay constants to  $4.46 \pm 0.1$  Ma (Rich et al., 1982, p. 449). Subsequent work by Whitelaw (1991) on the remnant magnetism of the Hamilton and Forsyth’s Bank section has demonstrated that the paleosol horizon that produced the Hamilton faunal material falls in the 4.40–4.47 Ma normal event of the Gilbert Chron.

### **Material**

These specimens are cataloged in the collections of Museum Victoria, Melbourne (NMV). All measurements are in

millimeters. NMV P158429, right I<sup>2</sup>; NMV P158427, left I<sup>3</sup>; NMV P158059, right M<sup>1</sup>; NMV P158064, worn molar; NMV P158066, buccal fragment of left M<sup>1</sup> or M<sup>2</sup>; NMV P158067, M<sup>2</sup> or M<sup>3</sup>; NMV P158074, palate with right P<sup>3</sup>, M<sup>1-4</sup> and left M<sup>3-4</sup>; badly damaged two right I<sup>2</sup>s; NMV P158076, molar fragment; NMV P54180, left P<sub>3</sub>; NMV P54131, right dentary with P<sub>3</sub> (unerupted), M<sub>1-3</sub>, M4 (unerupted); NMV P158452, right talonid molar fragment; NMV P158473, right trigonid and anterior half talonid of lower molar fragment; NMV P158476, left M<sup>2</sup>; NMV P249850 left M<sup>1</sup>.

### **Description**

The family Palorchestidae contains some of the more unusual animals of the Australian extinct fauna. A few of the better-preserved specimens, such as *P. painei* show much reduced and retracted nasals indicating the presence of a proboscis. That has caused the group to be termed “marsupial tapirs” (Piper, 2006). The record of the family goes back at least as far as the late Oligocene. Two genera and seven species are currently recognized from sparse material (Archer and Hand, 2006).

*Upper dentition.* There are four upper incisors (a left I<sup>3</sup>, P158427; three right I<sup>2</sup>s including two that bear the number, P158074, and a third with the number P158429). The two right upper incisors have the same catalog number as the palate (P158074) but it is not clear which, if either, belongs to the palate.

The left I<sup>3</sup> (P158427, fig. 1A, B) is slightly worn. It is slightly wider along the occlusal surface toward the medial end. The medial end bears an inter-dental facet but the lateral end does not. It is not as strongly tapered from crown to root as the I<sup>2</sup>s. The length along the occlusal surface is 13.9 mm.

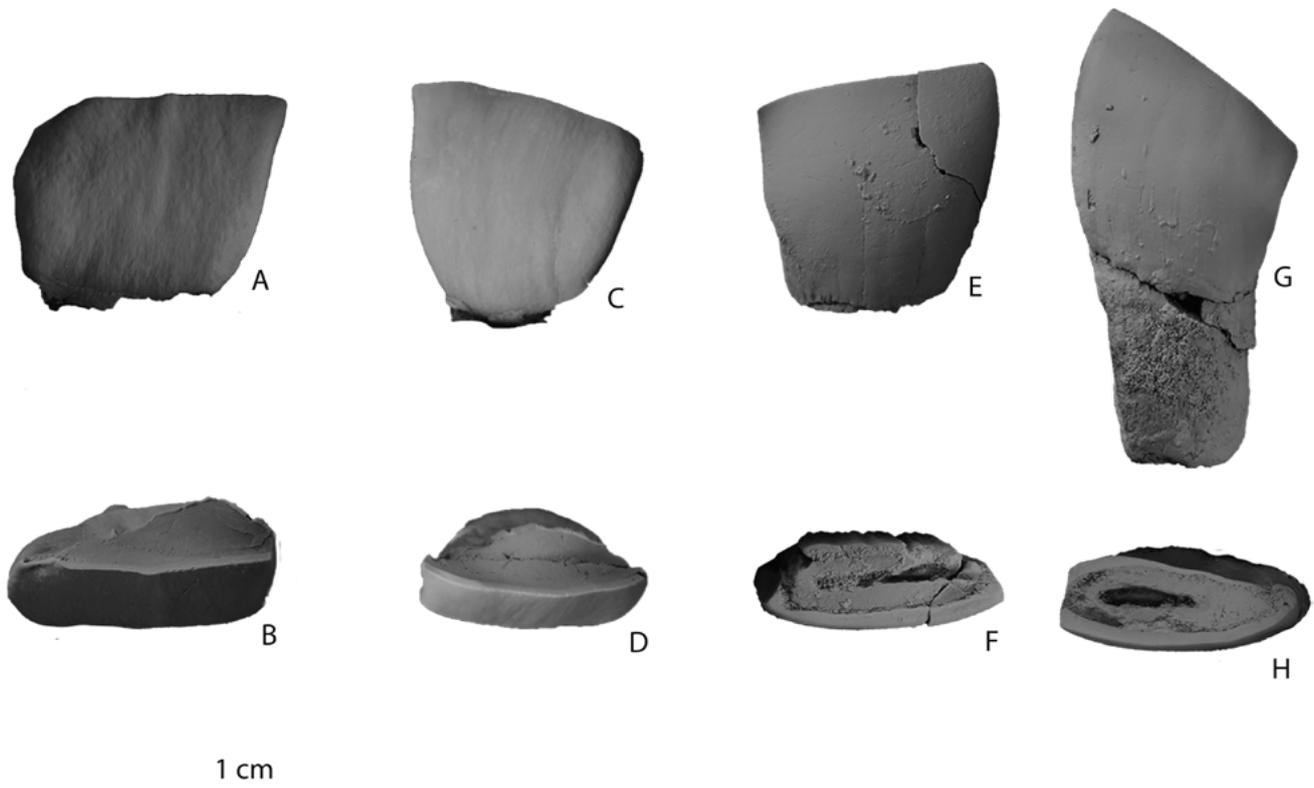


Figure 1. A-H. Upper incisors of *Palorchestes pickeringi* from the Hamilton fauna. A, B left I<sup>1</sup> (NMV P158427) anterior and occlusal views. C, D right I<sup>1</sup> (NMV P158429) anterior and occlusal views. E, F right I<sup>2</sup> (NMV P158074A) anterior and occlusal views. G, H right I<sup>2</sup> (NMV P158074B) anterior and occlusal views.

The right incisors are more deeply worn. I<sup>2</sup> (P158429, fig. 1C, D) is strongly tapered from the crown to the root. It bears inter-dental facets on each end indicating another tooth on both sides. Like P158427 it tapers postero-laterally along the occlusal surface. There is no groove on the anterior side of the tooth. The two right I<sup>2</sup>'s bearing the same number (P158074, fig. 1E, F and G, H) show different stages of wear.

The upper incisors are similar to those of *P. painei* described by Woodburne (1967). Both are compressed anteroposteriorly. They taper postero-laterally. There is no groove on the anterior surface. The enamel does not extend as far root-ward on the posterior side as it does on the anterior side of the teeth. Both taper strongly from crown to root so the length along the occlusal surface diminishes with wear. The lengths along the occlusal surfaces of the incisors from the Hamilton specimens (P158427-L. 13.9, P158429 - 13.5) are slightly greater than those of the specimens from the Alcoota Fauna (12.4-12.6) given by Woodburne (1967).

There is a poorly preserved palate, P158074, with right P<sup>3</sup>, M<sup>1-4</sup> and left M<sup>3-4</sup>. The palate, along with several teeth, was unfortunately badly damaged after collection. Only five teeth and fragments remain and the positions of the intact teeth are uncertain. Two right upper incisors, mentioned above, bear the same catalog number but it is not clear which, if either, belongs to the palate.

There is a damaged right P<sup>3</sup> (P158074-A, fig. 2 A, table 1). This tooth is roughly triangular in outline. The anterior end is broken away and the central cusps are both worn and partly missing. There is an interdental facet on one end, the posterior end.

One right M<sup>2</sup> (P158074 E, fig. 2B) is damaged. The central part of the tooth is missing and restored. The midlink is located slightly labial to the centerline of the tooth. There is a basin formed by the midlink and a cingulum lingual to the midlink. This is seen in the M<sup>2</sup> of *P. pickeringi* from Nelson Bay (Piper, 2006; Fig. 2G).

There is a right M<sup>3</sup> (P158074 B, fig. 2C). There is a weak, single forelink located labial to the midline of the tooth. There is a strong midlink located at the midline. The posterolabial corner is missing. There is an interdental facet on both ends of the tooth. This plus the single forelink suggests it is an M<sup>3</sup>.

A right M<sup>4</sup> (P158074-AC fig. 2E) is present. The two forelinks are small, close together and labial of the midline of the tooth. The anterior cingulum is low with a narrow cingular basin. The midlink is at the centerline of the tooth. The posterolabial corner of the tooth is broken away. Only one end of the tooth has an interdental facet indicating that this tooth is an M<sup>4</sup>.

A left M<sup>4</sup> (P 158074-D fig. 2D). This tooth has a low anterior cingulum with a narrow cingular basin. The forelink is low and lingual to the midline of the tooth. The midlink is

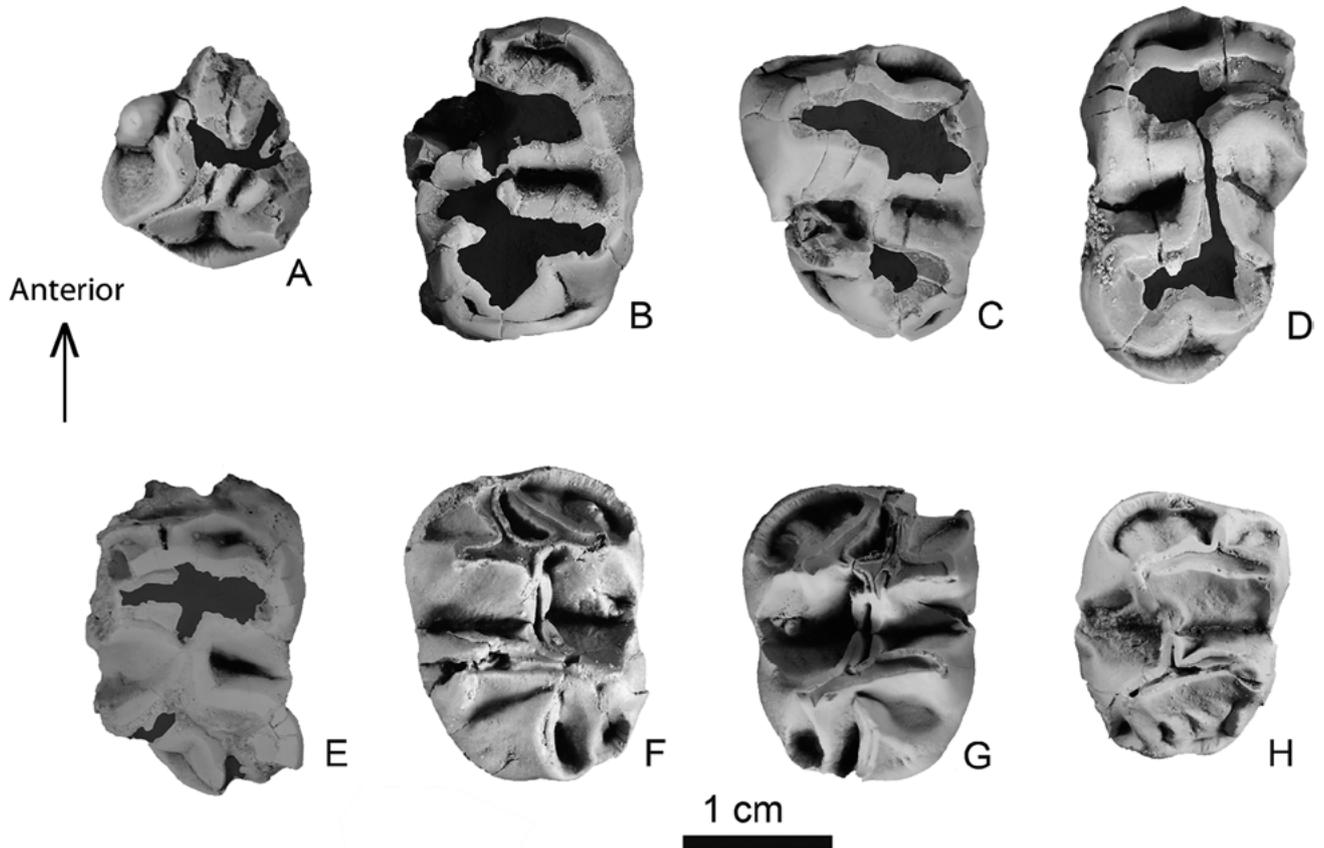


Figure 2. A-H. Upper premolar and molars of *Palorchestes pickeringi* from the Hamilton fauna. A-E, Teeth from damaged palate. A right P<sup>3</sup> (NMV P158074) in occlusal view. B right M<sup>3</sup> (NMV P148074E) in occlusal view. C right M<sup>3</sup> (NMV P158074B) in occlusal view. D Left M<sup>4</sup> (NMV P158074D) in occlusal view. E Right M<sup>4</sup> (NMV P158074A) in occlusal view. F right M<sup>1</sup> (NMV P158059) in occlusal view. G left M<sup>1</sup> (NMV P249850) in occlusal view. H left M<sup>2</sup> (NMV P158476) in occlusal view.

Table 1. Measurements of *Palorchestes* upper teeth.

	P158074R	P158074L	P249850	P158059	P158476
P <sup>3</sup> L	-----	-----	-----	-----	-----
W	13.6	-----	-----	-----	-----
M <sup>1</sup> L	-----	-----	18.1	18.1	-----
AW	-----	-----	13.0	14.3	-----
PW	-----	-----	13.3	13.2	-----
M <sup>2</sup> L	21.4	-----	-----	-----	17.4
AW	14.6	-----	-----	-----	13.3
PW	-----	-----	-----	-----	12.7
M <sup>3</sup> L	19.9	-----	-----	-----	-----
AW	-----	-----	-----	-----	-----
PW	14.4 est	-----	-----	-----	-----
M <sup>4</sup> L	20.5	20.4	-----	-----	-----
AW	-----	-----	-----	-----	-----
PW	29.0	13.0	-----	-----	-----

Table 2. Measurements of *Palorchestes* lower teeth.

	P 54131	P 45180
P <sub>3</sub> L	12.3	12.0
W	10.0	9.0
M <sub>1</sub> L	17.4	-----
AW	10.9	-----
PW	9.6	-----
M <sub>2</sub> L	16.8	-----
AW	10.8	-----
PW	10.3	-----
M <sub>3</sub> L	17.3	-----
AW	10.5	-----
PW	9.8	-----
M <sub>4</sub> L	17.5	-----
AW	10.5	-----
PW	10.5	-----

slightly lingual to the midline of the tooth. There is no postlink and the posterior cingulum is low. The tooth is moderately worn. There is an interdental facet on the anterior end.

The  $M^1$  is represented by two specimens not associated with the palate, a right  $M^1$  (NMV P158059, fig. 2F) and a left  $M^1$  (NMV P249850, fig. 2G). The  $M^1$  is rectangular in occlusal outline. The proto-loph is oriented at right angles to the long axis of the tooth, the metaloph is slightly angled posteriorly lingually. There are double forelinks; double midlinks that are very close together and double hindlinks, the labial one of which has a low ridge on the labial side. The forelinks and midlinks are located slightly labial to the centerline of the tooth. The forelinks merge as they join the anterior cingulum. The anterior cingulum, which is well developed lingually, is broken away labially in P249850 just where the forelinks join. The hindlinks join near the base of the tooth to form a small basin. A small basin is formed on the posterolingual corner of the tooth by a cingular ridge that joins the lingual hindlink. The measurements of these specimens are: P158059—L 18.1; AW 14.3; PW 13.2. P249850 —L 18.1; AW 13.9; PW 13.3. These two specimens are close in length to the specimens from Nelson Bay but slightly larger in both anterior and posterior widths.

There is a left  $M^2$  (NMV P158476, fig. 2H) also not associated with the palate. The metaloph is angled about 20 degrees posteriorly to the long axis of the tooth. A large forelink is located on the labial side of the proto-loph; a small forelink is located lingually. There is one midlink. The hind link is small. There is a well-marked interdental facet on the posterior end of the tooth and a less well-marked facet on the anterior face.

*Lower dentition.* There is a partial right  $I_1$  (P158077, fig. 3A, B). This specimen is strongly convex ventrally. The dorsal part of the tooth is broken away. The medial edge has a small interdental facet where it was in contact with the left  $I_1$ . The ventral surface has five shallow grooves near the base of the enamel. Most of the root is missing. The crown does not have the elongate shape of the *P. pickeringi* specimen from Nelson Bay. It more closely resembles the lower incisors of a specimen of *P. azael* from Queensland figured by Woods (1958, fig. 3). Although the specimen figured by Woods is a juvenile ( $M_4$  still in the crypt) the lower incisors show what appears to be wear on the anterior ends. The specimen from the Hamilton fauna shows considerable wear on the anterior end. It is probable that the incisor from the Hamilton fauna is very deeply worn to produce the resemblance to the specimen of *P. azael* figured by Woods.

The width is 20.1 mm. that is somewhat greater than the specimen from Nelson Bay described by Piper (2006), 20.1 mm vs. ~14.5 mm) and is slightly smaller than *P. azael* from Darling Downs (Woods, 1958) at 22.8 mm. The Bluff Downs Local Fauna of early Pliocene age has produced a species of *Palorchestes*, *P. selestia*, based on a single  $M^1$  that is somewhat larger than the  $M^1$  of *P. pickeringi*. Should this taxon prove valid there is a possibility that the lower incisor from the Hamilton Local Fauna is derived from a larger species of *Palorchestes* and that there were two species of *Palorchestes* in the Hamilton Local Fauna.

The most complete specimen is a right dentary (P 54131, fig. 3C, table 2) with  $P_3$ - $M_4$  with  $P_3$  and  $M_4$  just erupting. The dentary extends from the symphysis to anterior edge of the ascending ramus. The symphysis is poorly preserved. The ventral edge is straight. The depth beneath the  $M_1$  is 26.6 mm, below  $M_2$  it is 21.3 mm. The base of the ascending ramus is located at the level of the  $M_3$ . This is an immature specimen and that position may well change with ontogenetic age. In an adult specimen of *P. painei* it is at the midpoint of the  $M_4$  (Woodburne, 1967). In the immature specimen of *P. azael* ( $M_4$  unerupted) it is at the midpoint of the  $M_3$  (Woods, 1958). The adult specimen of *P. parvus* figured by Woods (1958) has the anterior edge of the ascending ramus at the level of the posterior end of the  $M_4$ .

The  $P_3$  has a shallow talonid basin with a small postmetacristid. There are two small, low cusps on the posterior edge of the talonid basin. In this it differs from the holotype of *P. pickeringi* from the Nelson Bay Local Fauna figured by Piper (2006). In most respects the  $M_1$ - $M_4$  agree with the characters in the Nelson Bay specimens. The proto-lophid of  $M_1$  is concave anteriorly. It is somewhat less so in  $M_2$  and  $M_3$  but is strongly concave in  $M_4$ . The paracristid and premetacristid are strongly developed on  $M_1$  where they converge toward the cingulum. The  $M_1$  lacks the strong vertical groove on the anterolabial corner of the proto-lophid. In this it differs from the type of *Palorchestes pickeringi*. The midlink is slightly labial of the midline in all lower molars as in *P. pickeringi*. The midlink of the  $M_1$  is doubled. The two ridges join low in the central part of the tooth to form a shallow basin. All lower molars have hindlinks that join posterior cingulid, and all lack labial and lingual cingulids as in *P. pickeringi*.

The isolated left  $P_3$  (P54180, fig. 3D) is similar to the one in the dentary (P 54131) but has a somewhat deeper talonid basin than P54131 and is more like the specimen from Nelson Bay. It is similar in size to P54131 (table 2). This variation in the  $P_3$  is probably not significant in the light of the variation reported by Price and Sobbe (2011) for the  $P^3$  of *Diprotodon* and other diprotodontids.

## Discussion

The *Palorchestes* dentition from the Hamilton fauna is similar in both size and morphology to the material from Nelson Bay described by Piper (2006) despite it being older, 4.47 Ma for Hamilton vs. 0.78–1.77 Ma for the sample from Nelson Bay (Piper, 2007). Both the size and development of the lophs and interloph links is similar. The  $P_3$  of the material from Hamilton shows some variation in the depth of the posterior cingular basin. The morphological similarity of the specimens from Hamilton to *Palorchestes pickeringi* is consistent with assigning them to that species. The difference in age of the two deposits indicates longevity for this species of at least 3.19 Ma. This is consistent with data on North American eutherian mammals compiled by Prothero (2014) who found that large mammals have a species longevity ranging from 2.3 Ma to 4.3 Ma.

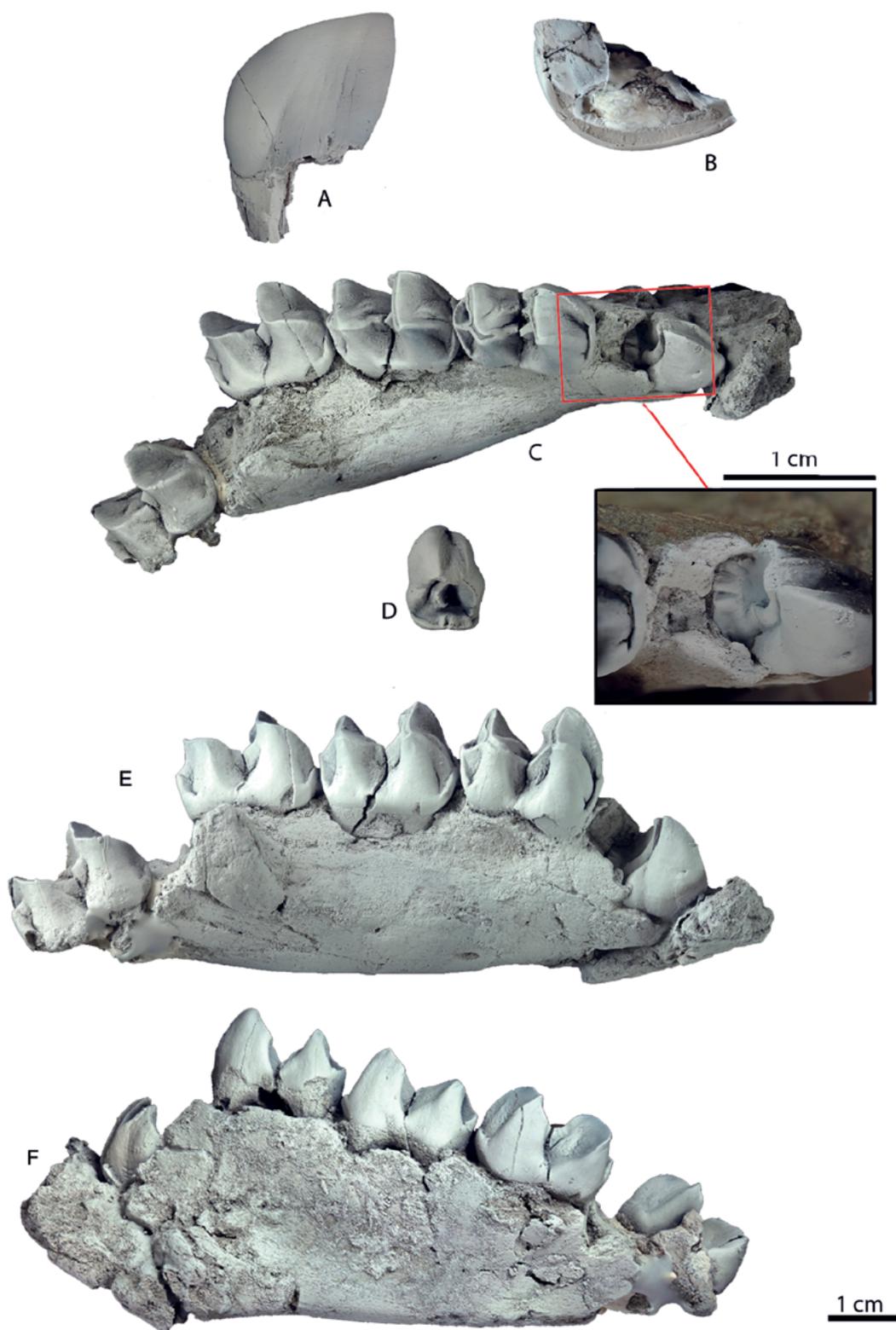


Figure 3. A-D. Mandible and lower dentition of *Palorchestes pickeringi* from the Hamilton fauna. A, B. right  $I_1$  (NMV P158077) anterior and occlusal views. C left mandible (NMV P54131) in occlusal view with the unerupted  $P_3$  in inset. D left  $P_3$  (P54180) in occlusal view. E, F left mandible (NMV P54131) in lateral (E) and medial (F) views.

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