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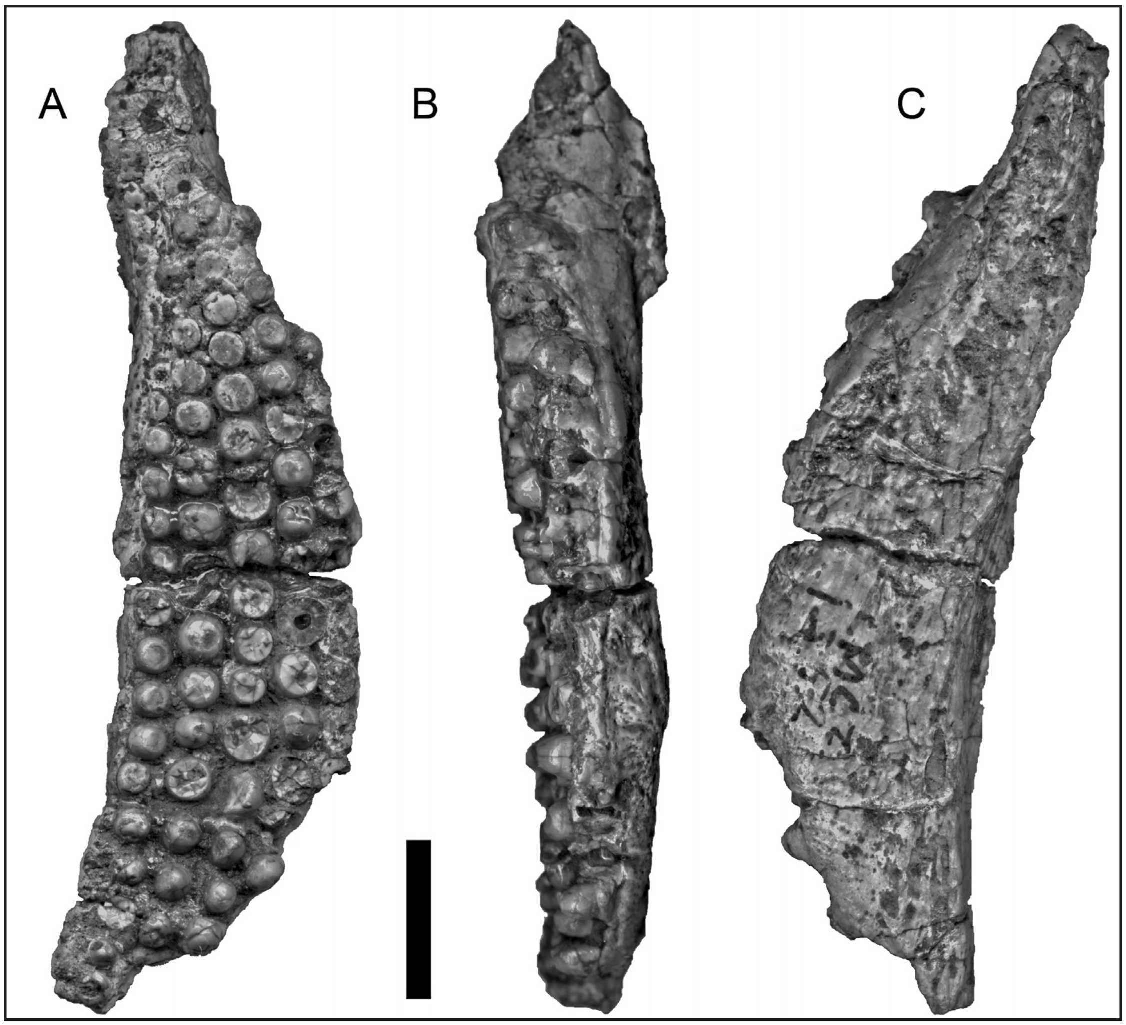

Jason P. Jung and Stuart S. Sumida 2017. A juvenile of the multiple-tooth-rowed reptile *Labidosaurikos* (Eureptilia, Captorhinidae, Moradisaurinae) from the Lower Permian of north-central Texas.

Cover photo: Views of a juvenile partial maxillary toothplate of the basal reptilian *Labidosaurikos.* Harvard Museum of Comparative Zoology specimen MCZ 1352, scale bar=1 cm.

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A juvenile of the multiple-tooth-rowed reptile *Labidosaurikos* (Eureptilia, Captorhinidae, Moradisaurinae) from the Lower Permian of north-central Texas

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Harvard University Museum of Comparative Zoology (MCZ) 1352 is a partial maxillary toothplate of a basal reptilian from the Lower Permian of Baylor County, north-central Texas. The specimen displays the straight rows of teeth characteristic of the subfamily Moradisaurinae (family: Captorhinidae) and is nearly identical in shape to the maxilla of *Labidosaurikos meachami*. Larger, more mesial individual teeth conform to the dental pattern previously determined for adults of the genus. Adults of *L. meachami* are known to possess six maxillary tooth rows, whereas MCZ 1352 has only five. Although only a partial specimen, it appears MCZ 1352 is most likely a juvenile specimen of *L. meachmi*. If correct, the comparative sizes suggest isometric growth of this element. The orientation of the lingual-most row of teeth, and the five as opposed to six maxillary tooth rows, suggest either new tooth rows may move labially during development or bone growth and remodeling occur lingually, resulting in the development of a margin of maxillary bone between the fifth row and the lingual edge.

Keywords: basal amniote, Permian, multiple tooth row, captorhinid, Eureptilia

INTRODUCTION

The Captorhinidae Case, 1911 were one of the most successful eureptilian groups of the Late Carboniferous to Late Permian. The group has a global distribution, likely because of its lack of specialized post-cranial morphology and its putative ability to exploit several different ecological niches (Modesto et al. 2007). The captorhinid record is spread throughout the Permian world, with specimens found in Niger (O'Keefe et al. 2005), Tanzania (Gaffney and McKenna 1979), central North America (Modesto et al. 2014), South Africa (Modesto and Smith 2001), Europe (Müller et al. 2006), and China (Reisz et al. 2011). The captorhinid subfamily Moradisaurinae Ricqlès and Taquet, 1982 was recently reviewed by Modesto et al. (2014), who were able to improve the resolution of its internal phylogeny and more clearly define its relationships within the Captorhinidae. Their revised phylogeny recovered a hypothesis of relationships that confirmed the monophyly of Moradisaurinae and placement of *Labidosaurikos* Stovall, 1950 within that subfamily: [*Captorhinikos valensis* Olson, 1954 [*Labidosaurikos* Stovall, 1950 [*Moradisaurus* Taquet, 1969 [*Rothianiscus* Kuhn, 1961, *Gansurhinus* Reisz et al., 2011]]]] (Modesto et al. 2014).

Along with caseid and edaphosaurid pelycosaurian-grade synapsids and diadectid diadectomorphs, moradisaurines are thought to be amongst the first experiments of the Amniota into high-fiber herbivory (Sues and Reisz 1998). In association with this, the group possesses, but is not defined by, multiple maxillary and dentary tooth rows (Modesto et al. 2014). Multiple tooth rows have classically been assumed to correlate with an herbivorous lifestyle (Olson 1956), and this relationship was more conclusively demonstrated in analyses comparing tooth wear patterns to other contemporaneous herbivores (Hotton et al. 1997, Modesto et al. 2014). Propaliny in derived capthorhinids has been suggested as a functional necessity for the multiple tooth rows to act advantageously in the oral processing of plant matter before digestion (Dodick and Modesto 1995, Modesto et al. 2014). Modesto et al.'s (2014) most recent hypothesis of relationships of the Captorhinidae suggests multiple tooth rows evolved independently at least twice, and possibly three

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times. Either, it evolved in '*Captorhinikos*' *chozaensis* Olson, 1954 and the last common ancestor of the Moradisaurinae + *Labidosaurus*, with a reversal in *L. hamatus* Cope, 1896, or it evolved in the Captorhininae (e.g., *C. aguti* Cope, 1882), in the last common ancestor of the Moradisaurinae and '*C. chozaensis*' (Modesto et al. 2014).

Like its namesake, *Labidosaurus*, *Labidosaurikos* is a large captorhinid (Olson 1962). However, it is now recognized to be more distantly related (Modesto et al. 2014) to *Labidosaurus* than thought when it was first described (Stovall 1950). Specimens of *Labidosaurikos* are known from three localities: the Lower Permian Hennesey Formation of Oklahoma, and the Vale and Choza Formations of north-central Texas (Vaughn 1958). Olson (1962) described *Labidosaurikos* as possessing tooth rows arranged in straight lines; however, examination of other Moradisaurine genera clearly shows this character is not diagnostic. Denticulation of the pterygoids is exhibited in some captorhinid species, from the most basal through the most derived. Denticulation is also known to be present on the vomers of more basal members of the clade (Modesto et al. 2014).

Harvard University Museum of Comparative Zoology specimen MCZ 1352 was first described by Romer and Price in 1940, and was discovered in the Arroyo Formation of Texas, part of the Clear Fork Group, Undivided (Hentz 1988). They assigned it to the pelycosaurian-grade synapsid genus *Trichasaurus* (Williston 1910). The description included a simplified line drawing of the element and a brief description of the specimen. In one of the most thorough studies of a moradisaurine genus to date, Dodick and Modesto (1995) provided a detailed study of the species *Labidosaurikos meachami*, but did not include MCZ 1352 in the construction of their phylogenetic tree. They did however suggest *L. barkeri* Olson, 1954 "probably represents a junior synonym of *L. meachami*" (Dodick and Modesto 1995).

MATERIALS and METHODS

Following gross examination, MCZ 1352 was photographed and measurements taken with calipers. Minimal preparation was performed simply to clean some areas of the element of the surrounding matrix. The element was then illustrated and compared against literature descriptions and illustrations in Dodick and Modesto's (1995) paper on *Labidosaurikos meachami*.

RESULTS AND DISCUSSION

MCZ 1352 (Figs. 1, 2) measures approximately 63.5 mm anteroposteriorly and approximately 16.3 mm labiolingually. The element, unlike the adult of the species includes five rather than six rows of parallel teeth. The rows curve slightly, with the peak of their curvature at approximately two-thirds the length of the element anteroposteriorly. The line of curvature of the tooth rows is at an angle of approximately 30° from a coronal plane, inclining anteriorly. The element exhibits very little damage on its lingual aspect, precluding the existence of additional lingual rows of teeth. The lingual-most row of teeth at the anterior end likely protruded into the internal naris, with the teeth situated at an angle approximately 20° from the vertical. The internal naris appears to have extended as far posterior as the third lingual tooth.

The anterior-most two teeth are significantly larger than those found in the multiple rows, with diameters of 3.9 mm and 2.9 mm anteroposteriorly. Unfortunately, the height of the single-rowed anterior teeth cannot be assessed as they are broken off near their bases. Most of the teeth in the multiple rows are also broken, the crowns sheared off. However, some are intact retaining a bullet-like shape with no visible indication of wear and no visible cusp or ridge on the chewing surface. Intact teeth range in height from approximately 1.5 mm to 4.5 mm, and range in diameter at the bases from approximately 2.0 mm to 3.4 mm. As a general trend, the tooth bases decrease in diameter from posterior to anterior in the multiple rows.

MCZ 1352 is much smaller than *L. meachami* as described by Dodick and Modesto (1995). As illustrated in Fig. 2, the specimen shares the approximate proportions of the specimen described by Dodick and Modesto (1995); however, MCZ 1352 is only about 40% of its size. It also differs from their specimen in the number of tooth rows, possessing five rather than the six they observed (Dodick and Modesto 1995). However, the overall shape of the element and the teeth closely match the description they provided. The teeth are conical without notable clefts, ridges, or cusps. In the multiple row region of the element, the teeth also follow the pattern described by Dodick and Modesto (1995), decreasing in diameter in the four labial rows moving anteriorly. The teeth in this region are approximately 20% and 45% smaller in MCZ 1352 when compared with Dodick and Modesto's (1995) specimen photographs and reconstruction (Fig 3.).

The overall shape of the element and tooth morphology matches those given by Dodick and Modesto (1995) but it differs in a couple of minor ways. The element has fewer teeth than the number they noted on Oklahoma Museum of Natural History specimen OMNH 04331. However, this likely suggests a juvenile condition in MCZ 1352. Additionally, it is not possible to ascertain with confidence articulations with any adjoining bones. The anterior and posterior ends of the bone appear broken. However, at other positions where the jugal, palatine, vomer, and pterygoid bones should come into contact with the maxilla, neither interdigitation nor scarf joints are visible. Therefore, no discussion of the relative

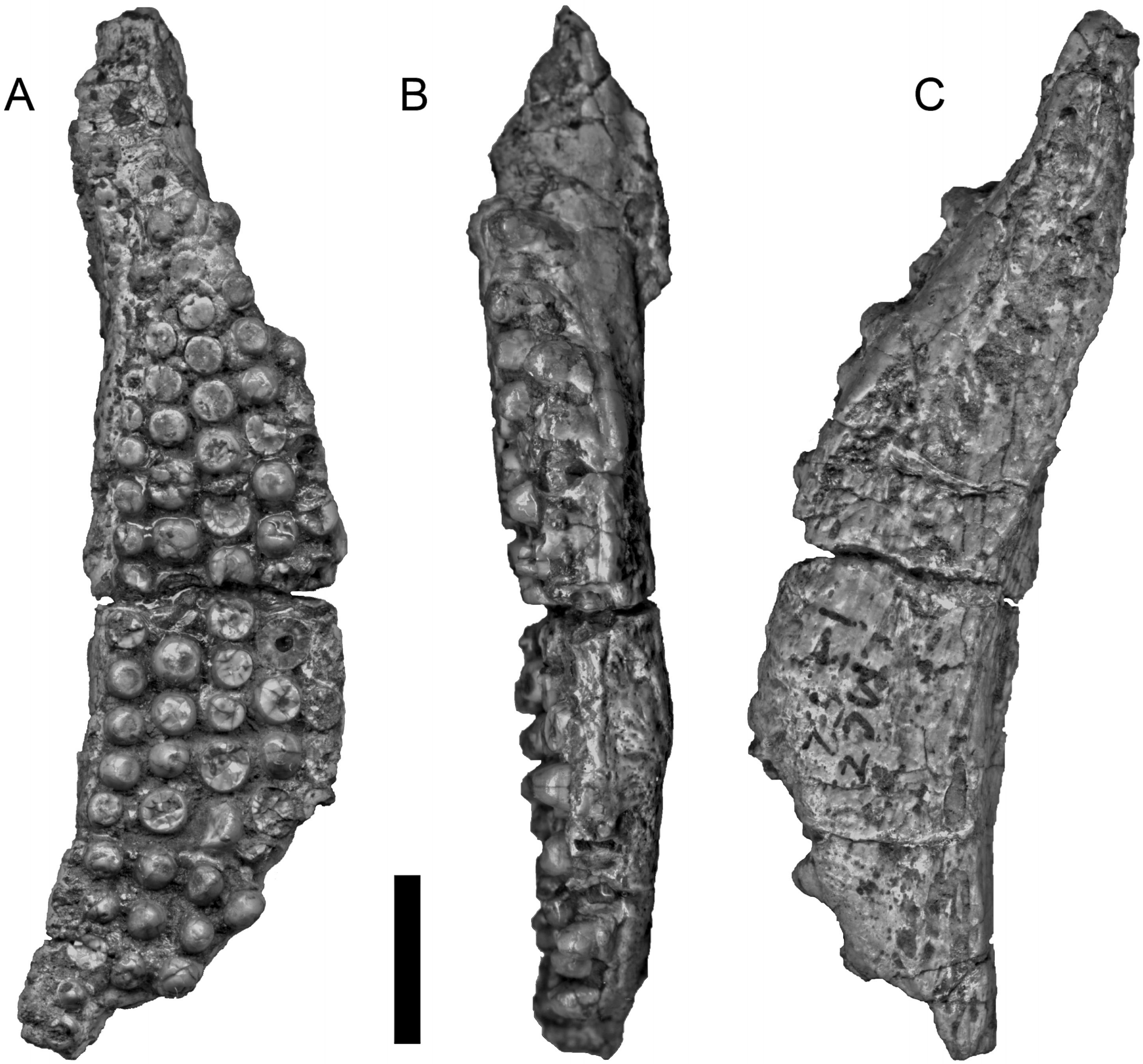

Figure 1. *Labidosaurikos* partial right maxilla, MCZ 1352. Occlusal/palatal (**A**), medial (**B**) and dorsal (**C**) views. Scale bar=1 cm.

sizes of the bones of the skull to the maxilla is possible. It is however possible to ascertain the element is, disregarding the one less tooth row, isometrically similar in size and proportion to the maxilla of *L. meachami* as described by Dodick and Modesto (1995). Further, the size of the teeth support the juvenility of the specimen.

Notably, the angle of the lingual row of teeth may support one of two possible interpretations of development in this animal. Either the multiple rows move labially as the animal grows, or bone growth and remodeling occur in a lingual direction resulting in a margin of maxillary bone between the fifth row and the element's edge. If this is the case, the projection of the labial-most teeth into the internal naris may also be an indicator of juvenility. Additional data are

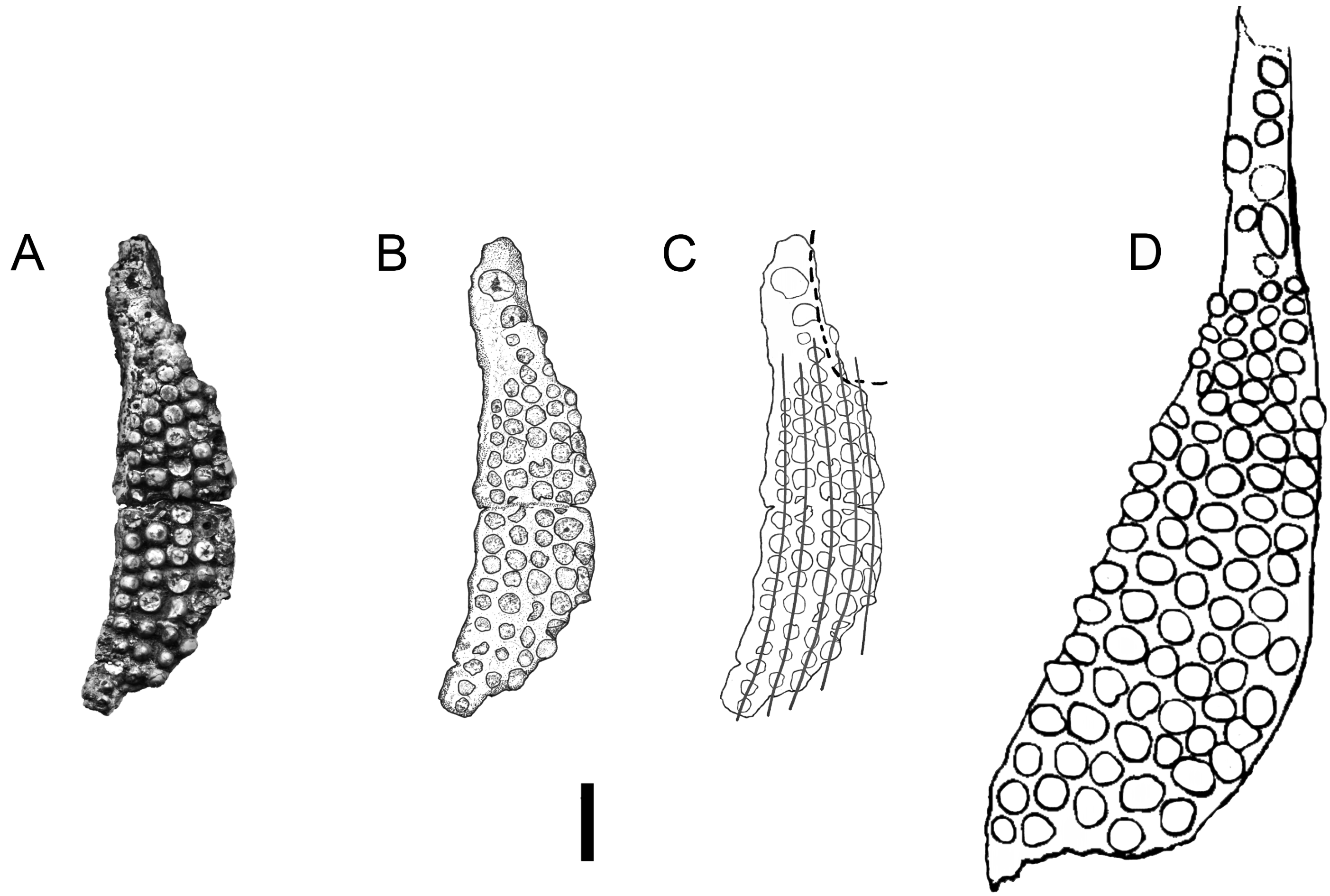

Figure 2. *Labidosaurikos* partial right maxilla, MCZ 1352. **A**. Image of the specimen. **B**. Drawing of the specimen. **C**. Outline including a partial outline of the internal naris (black dotted line), and the approximate lines of the tooth rows (grey lines). Scale bar=1 cm. **D**. Corresponding element in an adult for comparison to MCZ 1352, after Dodick and Modesto (1995). Scale bar=1 cm.

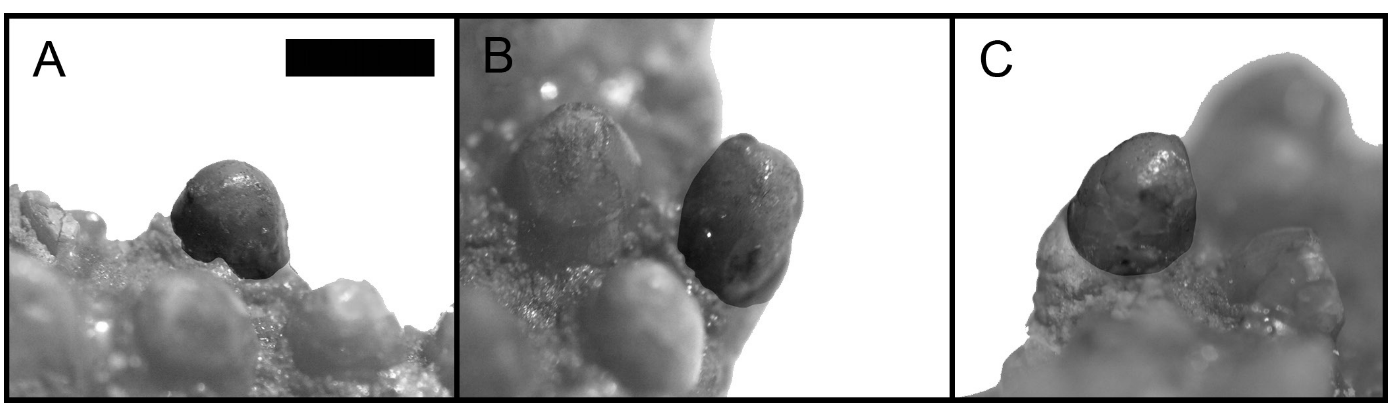

Figure 3. *Labidosaurikos* partial right maxilla, MCZ 1352. Detail of a single intact multiple rows tooth highlighted for focus and clarity in labiolingual (**A**), posteroanterior (**B**) and anteroposterior (**C**) views. Scale bar=5 mm.

required to conclude juvenility in this specimen with confidence; however, permission was not granted to section the specimen, precluding further analysis of the teeth and general bone histology in the rest of the specimen.

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