

DENTAL MORPHOLOGY OF THE HYBODONTOID SHARK *Lonchidion humblei* MURRY FROM THE UPPER TRIASSIC CHINLE GROUP, USA

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Abstract—We describe the morphology and histological structure of the teeth of the hybodontoid shark *Lonchidion humblei* from the Upper Triassic Chinle Group in Texas and New Mexico. The five morphotypes (symphyseal, mesial, anterolateral, lateral and posterior) previously applied to the teeth of other species of *Lonchidion* are applicable to *L. humblei*, which exhibits moderate heterodonty. The histological structure of the teeth also changes slightly posteriorly through the dentition. The function of the teeth of *L. humblei* was probably differentiated, from cutting in the symphyseal and mesial positions to crushing in the lateral and posterior ones.

INTRODUCTION

The Upper Triassic Chinle Group in the western United States is known primarily for its rich paleontological record, especially of petrified wood (e.g., Daugherty, 1941; Ash and Creber, 2000 and references therein) and tetrapod vertebrates (e.g., Long and Murry, 1995; Heckert and Lucas, 2002a). Less well-known, but still substantial, are the fish faunas of non-tetrapod vertebrates, including both freshwater sharks and diverse osteichthyans (reviewed by Huber et al., 1993; see also Johnson et al., 2002; Murry and Kirby, 2002; Milner et al., 2006).

Hybodontoid sharks are the most common non-xenacanth chondrichthyans in Chinle Group microvertebrate faunas (Murry, 1981, 1982, 1986, 1987, 1989a,b,c; Hunt and Lucas, 1993a; Kaye and Padian, 1994; Murry and Kirby, 2002; Heckert, 2004; Milner et al., 2006). Of these, the most common taxon is the lonchidiid *Lonchidion humblei* Murry, known from localities in Texas, Arizona, and New Mexico. The collections of the New Mexico Museum of Natural History and Science (NMMNH) include specimens from many of these localities, including *Lonchidion humblei* fossils from two localities near Kalgary, Texas, a locality near Ojo Huelos, New Mexico, and a locality from the Sloan Canyon Formation in northeastern New Mexico (Fig. 1). Other records of that species in the Chinle Group are from the *Placerias* quarry (Murry and Long, 1989), the “Dying Grounds” and “Crocodile Hill” localities (Murry and Long, 1989), Stinking Springs (Polcyn et al., 2002), and, possibly, the Otis Chalk *Trilophosaurus* quarry 1 (Murry, 1989). Figure 2 shows a generalized stratigraphic distribution of these localities.

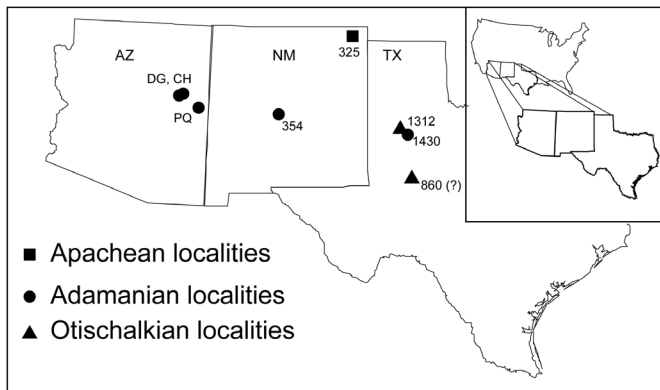


FIGURE 1. Geographic distribution of specimens of *Lissodus* from the American Southwest. Numbers refer to NMMNH localities (354 = Ojo Huelos, 324 = Sloan Canyon, 860 = *Trilophosaurus* quarry 1, 1312 = lower Kalgary, 1430 = upper Kalgary). Letters refer to other localities: CH = Crocodile Hill, DG = Dying Grounds, PQ = *Placerias* quarry.

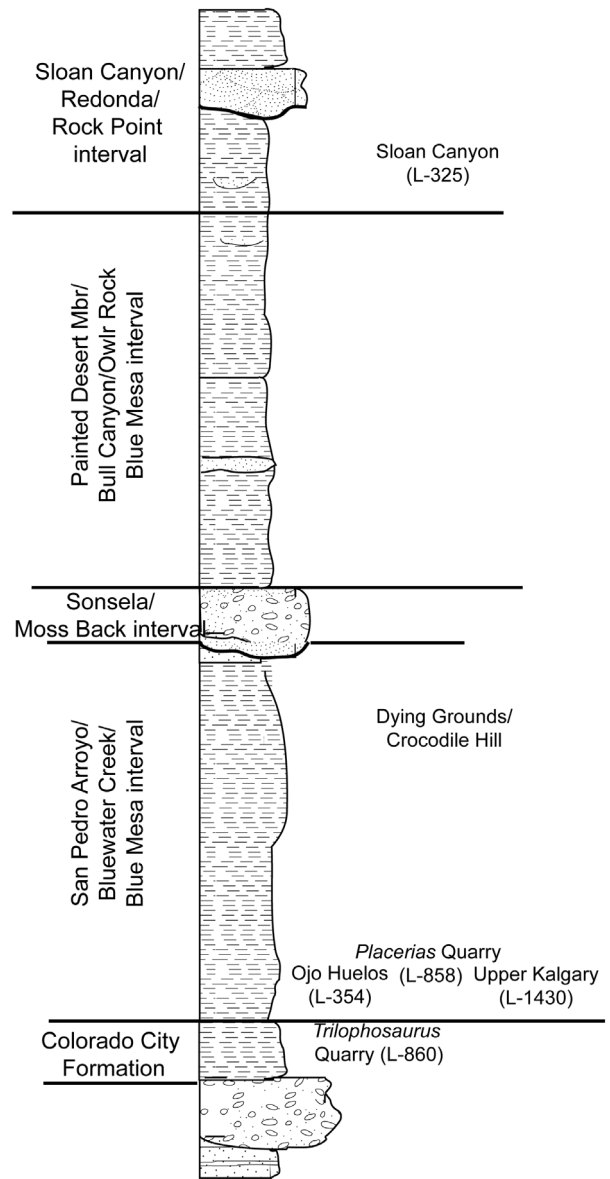


FIGURE 2. Generalized stratigraphic distribution of *Lonchidion* localities in Figure 1.

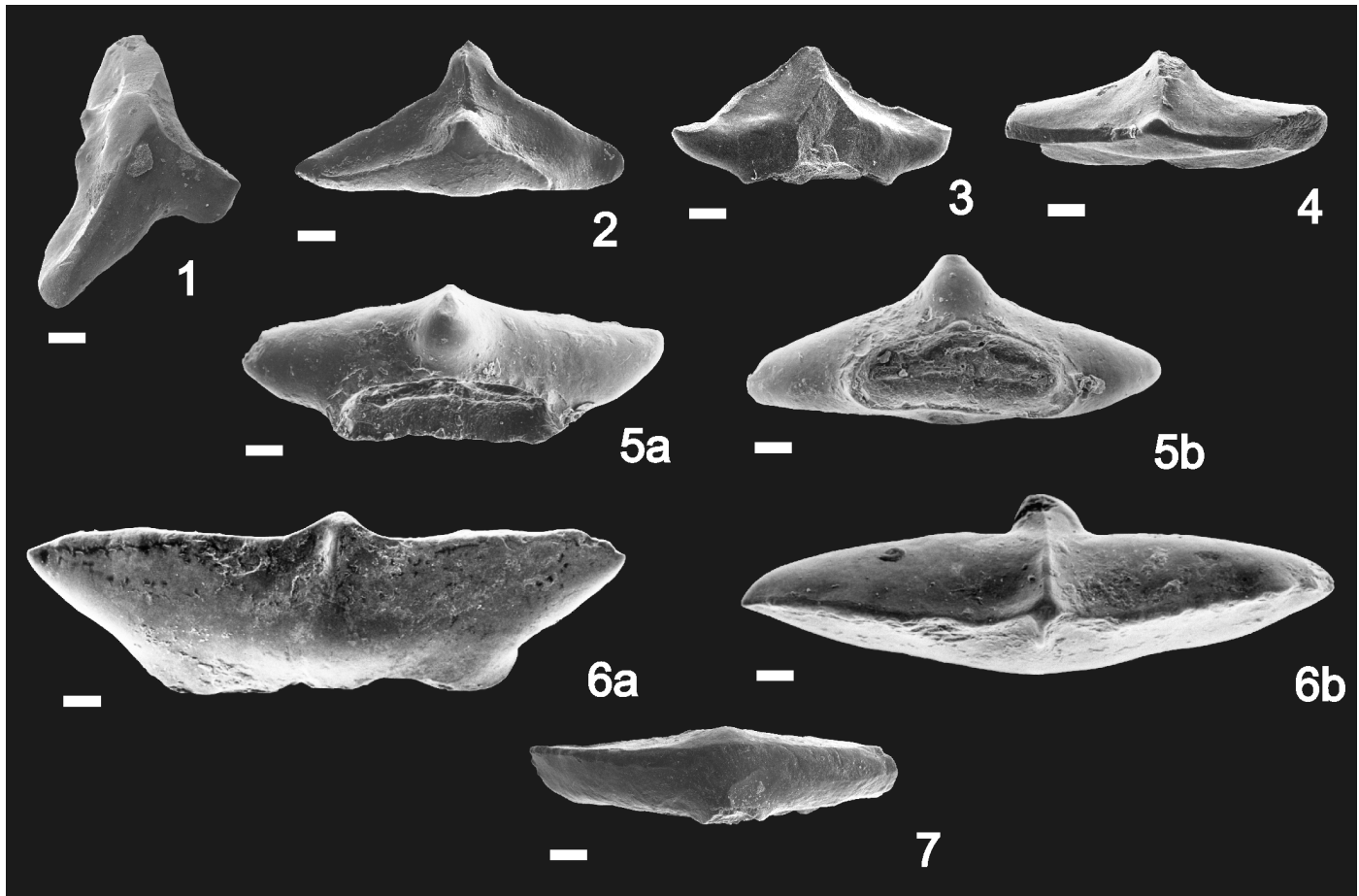


FIGURE 3. Scanning electron micrographs of tooth crowns of *Lonchidion humblei* Murry. **1**, probable symphyseal tooth with the living abrasion on the central cusp, in oblique lateral view; NMMNH P-31620, locality L-354. **2**, symphyseal tooth in occlusal view, NMMNH P-10086a, locality L-354. **3**, symphyseal or mesial tooth in labial view, NMMNH P-10086b, locality L-354. **4**, mesial or anterolateral tooth in occlusal view, NMMNH P-10086c, locality L-354. **5**, anterolateral tooth in **a**, labial view, and **b**, basal views, NMMNH P-26429a, locality L-01430. **6**, lateral tooth in **a**, lingual view, and **b**, occlusal views, NMMNH P-26429b, locality L-01430. **7**, posterior tooth in oblique occlusal view, NMMNH P-10086d, locality L-354. All scale bars = 100 microns.

STRATIGRAPHY AND AGE

The upper Kalgary microvertebrate locality is stratigraphically low in the Tecovas Formation of West Texas. This site is of Adamanian age, as the bulk of the Tecovas Formation, including sites in this area at this level, yields a typical Adamanian fauna of the phytosaur *Rutiodon* (= *Leptosuchus*) and the aetosaur *Stagonolepis* (see Heckert, 2004 for additional information).

The Adamanian Ojo Huelos Member represents a freshwater carbonate setting (Heckert and Lucas, 2002b), a depositional environment that is relatively rare in the Chinle (Tanner, 2003). The Ojo Huelos Member of the San Pedro Arroyo Formation is stratigraphically low in the Chinle Group (Lucas, 1991; Heckert and Lucas, 1997, 2002b). The localities sampled here range from approximately 2 to 8 m above the base of the “mottled strata,” a pedogenically modified horizon that, with the Shinarump Formation, marks the base of the Chinle Group regionally (Lucas, 1993; Heckert and Lucas, 2003).

DESCRIPTION

The remains of *Lonchidion humblei* are represented by numerous isolated teeth and some fragments of fin spines (e.g., Murry, 1981; Heckert, 2004). Here we provide scanning electron microscope images (Fig. 3) and photographs of teeth immersed in aniseed oil (Fig. 4). Almost all of teeth lack the base, and the labial peg is not preserved in some teeth. However, the preservation of crown tissue is very good and allows us to

study the structure when immersed in aniseed oil under the optical microscope.

Small teeth of *Lonchidion humblei* possess a smooth crown with a strong occlusal crest and a transverse ridge on the labial peg; they lack accessory cusps and vertical ridges. The crown comprises orthodontine covered by a considerably thick layer of enameloid. The narrow vascular canals pass into the lower part of the crown, along the base/crown junction. The dentine tubules run up from those canals to an enameloid layer. They are equally distributed over most of the crown and concentrated only in the crown shoulders. Such histological structure of the crown is similar to that described for the teeth of *Lonchidion breve* Patterson (1966). However, it differs from the internal structure of the teeth of *Lissodus angulatus* (Stensiö) documented by Błażejowski (2004) in the absence of osteodentine in the crown in any of the tooth morphotypes.

Duffin (2001) proposed five morphotypes depending on tooth position: symphyseal, mesial, anterolateral, lateral and posterior. Most morphotypes appear applicable to *Lonchidion humblei*, which exhibits moderate heterodonty. The variations of the crown are expressed in size and proportions, in the height of the central cusp, the length of the labial peg, the curvature of the occlusal crest, the direction of the crown shoulder, and in the degree of convexity in the lingual side. The articulated dentition is known in only two lonchidiid forms— *Lissodus africanus* (Broom) (Brough, 1935; Duffin, 1985; Rees and Underwood, 2002) and *Lissodus johnsonorum* Milner and Kirkland (2006).

We assigned the teeth studied here to potential positions based on

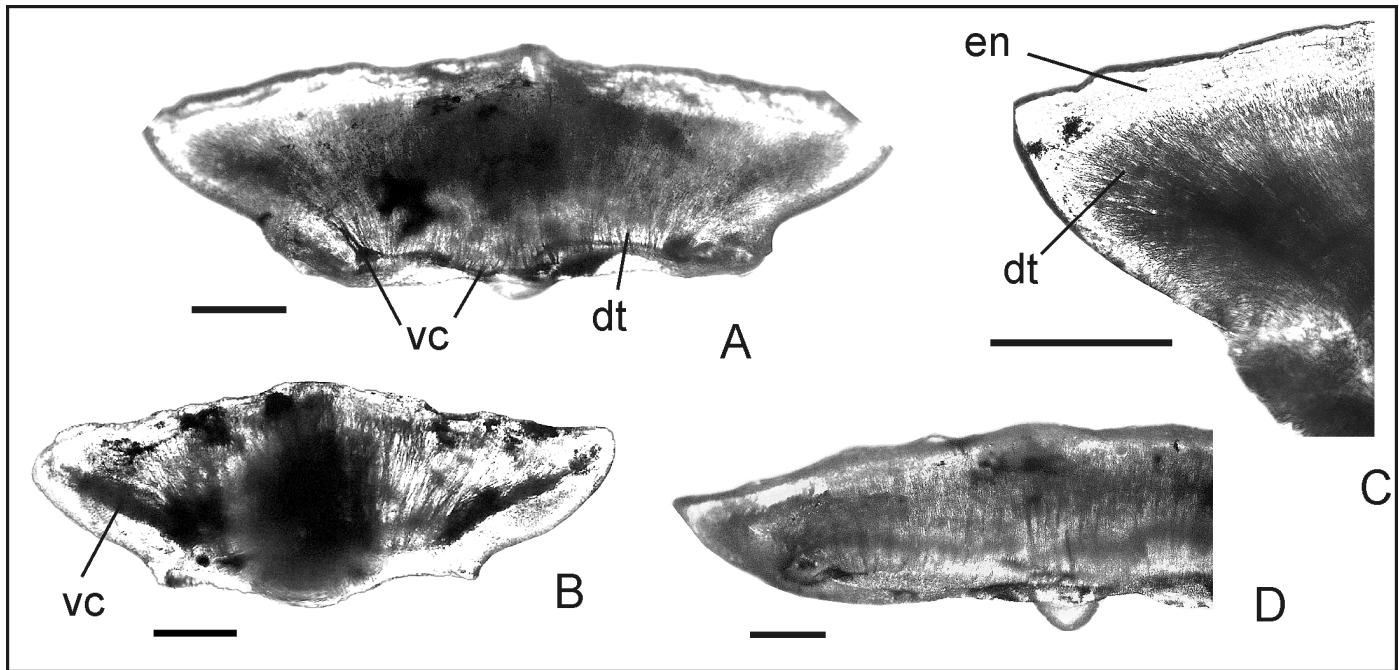


FIGURE 4. Internal structure of *Lonchidion humblei* crown immersed in aniseed oil, labial views. **A**, lateral tooth; **B**, mesial or anterolateral tooth, **C**, crown shoulder of lateral tooth, **D**, posterior tooth. Abbreviations: dt – dentine tubules, en – enameloid, vc – vascular canals. All scale bars = 200 microns.

comparison to the reconstruction of the dentition of *Lissodus nodosus* (Seilacher) suggested by Duffin (1985) and Duffin's extrapolation of tooth arrangement for some lonchidiids (Duffin, 2001) with regard to complete dentitions. The teeth hypothesized to be symphyseal and mesial are characterized by moderate length and a high crown bearing a long labial peg, a well developed central cusp, and acute occlusal crest. Such crowns have a shape close to an equilateral triangle in occlusal view. The central cusp in some specimens is inclined labially. The teeth of the anterior dental position possess the narrow base/crown junction ("neck"). Extending distally from the symphyseal to posterior teeth the crowns become lower and more mesiodistally extended, a central cusp increases in that direction, the occlusal crest becomes smooth, and the labial peg shortens. The internal structure of the teeth changes slightly posteriorly through the dentition. The teeth of the anterior position contain the vascular canals running along the crown shoulders and a considerable

concentration of dentine tubules in those parts of crown. The vascular canals are located only near the base/crown junction of the lateral and posterior teeth. The dentine tubules are more equally distributed in the crowns of such teeth. The enameloid layer is rather thickened posteriorly in the dentition.

The function of the teeth in the jaw was probably differentiated, from cutting in the symphyseal and mesial positions to crushing in the lateral and posterior ones. The traces of living abrasion in some specimens are observed on the central cusp of the anterior teeth and on the occlusal crests of lateral and posterior teeth.

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Susan Harris and Ken Kietzke originally picked specimens illustrated here from screenwash concentrate. The NMMNH Foundation funded A.I.'s visits to the collections.

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