A Fossil Shark Tooth in Early Contexts of Cerro Casa de Piedra 7, Southwest Patagonia, Argentina 1

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Casa de Piedra hill is located in one of the highest glacial lake basins of Patagonia (900 masl) (Figure 1). Belgrano and Burmeister lakes are the most important ones in this basin. Cerro Casa de Piedra 7 (CCP7) is one of several caves and rockshelters located on the northern side of the hill. CCP7 has a stratigraphic sequence which begins at the Pleistocene-Holocene transition. A fossil shark tooth was found in archaeological deposits dated to about 9000–9700 RCYBP; it belongs to the genus *Isurus* (Elasmobranchii, Lamniformes, Isuridae). This species, unknown today in Santa Cruz marine coasts, lived in Patagonian seas during the Miocene epoch, at a time when there were sea ingressions. These ingressions flooded large areas within the present Patagonian territory and generated marine deposits in which abundant remains of extinct fauna (including shark teeth) can be found (Figure 1). In this paper, the recorded fossil tooth is described and its possible modification by human action is discussed. 4

Tooth Description 5

The tooth has a slender and straight crown. Both cutting edges are complete. Both mesial and distal

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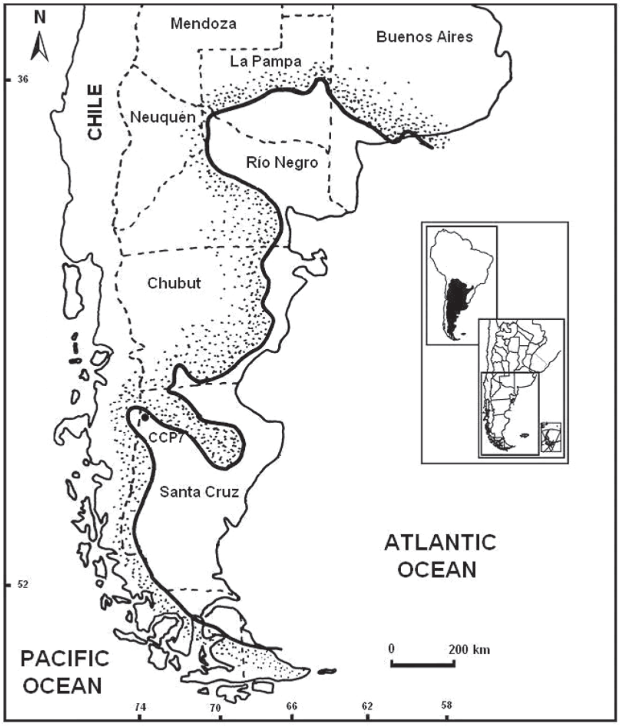

Figure 1. Map of Upper Oligocene and Lower Miocene
20 sea ingressions in Patagonia (modified from Parras and Casadío 2006) and Cerro Casa de Piedra 7 (CCP7) location.

cutting edges are straight. At the base, the crown becomes wider and the cutting edges are concave.
6 The labial crown base does not overhang the root. The crown labial face is transversely flat but the lingual face is slightly convex. There are no lateral cusplets. The root is badly damaged (Figure 2).

Traditionally (e.g., Leriche 1926), Cenozoic shark teeth similar to those of the living species *Isurus oxyrinchus* and *I. paucus* (i.e., lamnids without lateral denticles and serrations, commonly named makos) were included in this genus, as was *I. hastalis*, but this taxonomy is equivocal. The genus *Cosmopolitodus* recently has been used by some authors, assuming that the species *hastalis* is ancestral to the great white shark and is not closely related to the mako sharks (Siverson 1999; Ward and Bonavia 2001). Other authors, e.g., Purdy et al. (2001), continue to use the name *Isurus xiphodon* for broad-crowned specimens of *hastalis*; however, Ward and Bonavia (2001) consider *Isurus xiphodon* as a *nomen dubium*. *Cosmopolitodus*,
7 which includes several species, is a paraphyletic taxon. A different solution could be to assign the species usually included in this genus (*I. hastalis*, *I. xiphodon*, and *I. planus*) to the genus *Carcharodon*. Until a thorough study of the different species of lamnids is done, however, we prefer to refer to these species as *Isurus* because we do not accept the paraphyletic genus *Cosmopolitodus*. Besides, Whitenack and Gottfried (2010) demonstrated morphometrically that *I. hastalis* is different from *I. xiphodon*. Morphology and size of the tooth support the genus *Isurus* assignment, but it is difficult to assign it to a certain species.

8 *Isurus* teeth are common in Patagonia in early Miocene Leonian beds (Monte León, Chenque and Gaiman formations [Cione 1988; Cione and Expósito 1980]), and the middle-late Miocene Puerto Madryn and Paraná formations (Cione et al. 2000).

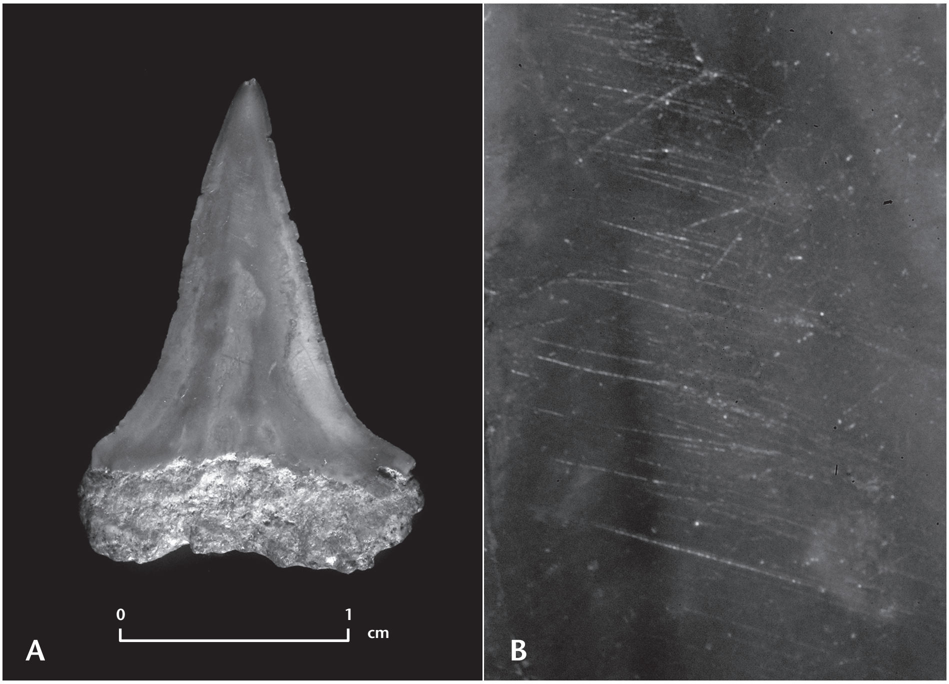

Figure 2. **A,** shark tooth (lingual view) found in CCP7 early archaeological contexts; **B,** striations 21
observed with metallographic microscope (280X) (right).

Lamnid sharks are strictly marine fishes (Compagno 2001). The two recent species of *Isurus*
are distributed in tropical and warm temperate seas, *Carcharodon carcharias* lives in a wider 9
range of temperatures, and the two recent species of *Lamna* are cold temperate sharks.

Tooth Microwear Analysis 10

With the purpose of determining the possible use of the shark tooth, we analyzed it with a metallographic microscope (280X) and binocular magnify glasses. To establish possible
differences and following functional protocols, distinctive paleontological shark teeth 11
specimens, with diverse sizes and colors, were observed as comparative references. Six fossil items were analyzed: two of *Carcharias taurus* coming from Punta Indio and Río de La Plata (Buenos Aires), and four of *Isurus hastalis* coming from Bryn Gwyn, Gaiman Formation (Chubut). All these present functional or micropolish-like surface alterations most probably due to taphonomic conditions.

Alteration of the Archaeological Specimen 12

The archaeological specimen shares the same superficial natural aspect of the paleontological specimens examined. Nevertheless, the tooth shows structural damages on the edges and the apex, which under the microscope are seen to be microfractures. The microsurface presents an
abraded surface due to natural agents; however, the occurrence of a large number of striations 13
and multidirectional forms distinguish it from the paleontological specimens. The striations on the archaeological specimen are thin, straight, regularly parallel, and transverse standing

out from the comparative samples (Figure 2). Therefore, it is possible that the archaeological tooth may have suffered alterations that are not taphonomically natural.

14 Discussion and Conclusions

Even though we do not have yet a precise diagnosis, it can be said that differences between the CCP7 tool and natural specimens exist. The tooth found in the archaeological context has abraded microsurfaces and striations, probably non-natural alterations. In discrepancy with other examples in the archaeological literature (Cione and Bonomo 2003), the CCP7 tooth does not present clearly oriented modifications which could suggest its use as an ornament. The preliminary findings presented here suggest that the tooth might have been used as a tool.
15 This hypothesis means that early humans selected certain objects that did not need further modification for use as tools because of the advantages of their morphology. These objects would have been kept as tools for future uses. Thus, the exaptation concept (Gould and Vrba 1982, adapted to archaeology by Borrero 1993) could be useful to explain the presence of the shark tooth in the archaeological context of the CCP7 site.

This unique finding in an early archaeological context of Andean Patagonia allows us to
16 investigate more deeply human behavior towards the use of raw materials other than those usually considered.

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