A SHARK TAIL FROM THE MIOCENE OF PALOS VERDES HILLS, CALIFORNIA

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Imprints of sharks are among the rarest of fossils, particularly in Tertiary sediments. Therefore, the discovery of such an impression in the fossil fish collection of the Los Angeles County Museum was considered worthy of description and it is hoped that this description will aid in the discovery of other shark impressions.

The slab with the tail impression was a part of the California Institute of Technology collection, which was purchased for the Los Angeles County Museum. The specimen bears the Cal. Tech. number 10212 and it is an impression of the right side of a shark's tail. None of the original organic material is present. This fossil was collected at the Cal. Tech. locality 388, the quarry of the Dicalite Company one half mile southwest of Walteria in the Palos Verdes Hills, California.

The diatomite in the Dicalite Company quarry was placed in the upper part of the Valmonte member of the Monterey shale by Woodring, *et al.* (1946). According to Kleinpell's (1938) correlation chart, the Valmonte member of the Monterey formation would belong to the Mohnian stage of the late Miocene.

The fossil impression consists of approximately 65 caudal vertebrae, 55 of which are quite distinct. Below these vertebrae, there are a number of hemal arches, the first 11 of which are very clearly imprinted. Surrounding these elements is a faint impression of the edge of the tail, visible in Figure 1. A reconstruction of the tail is given in Figure 2, in which supposed missing parts are indicated by dotted lines.

The vertebrae represented as impressions on my specimen are typically asterospondylic (Fig. 1). Such vertebrae are discussed by Hasse (1882) and are restricted to the Tertiary families Heterodontidae, Orectolobidae, Rhincodontidae, Carchariidae, Alopiidae, Cetorhinidae, and the Isuridae. The shape of the tail with the presence of a deep lower lobe eliminates from consideration the Heterodontidae and Carchariidae. The short upper lobe eliminates the Alopiidae as well as the family Rhincodontidae (Bigelow and Schroeder, 1948).

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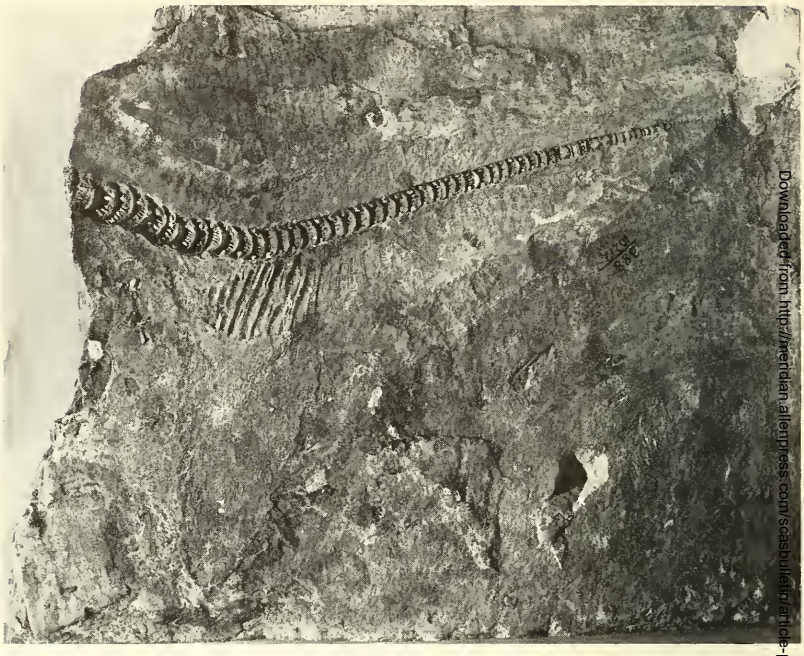

Figure 1—Imprint of *Isurus* tail from the Miocene Valmonte Diatomite at Wilteria. There is no indication of a cutwater.

The Cetorhinidae lack the deep lateral incisions on the vertebrae (Fig. 1).

Within the family Isuridae (all others being eliminated) there are three known genera with a Tertiary record: *Isuris*, *Lamna*, and *Carcharodon*. The caudal vertebrae in *Lamna* have reduced the number of radiating lamellae (Hasse 1882, pl. 38, figs. 1-4). In the recent great white shark, *Carcharodon carcharias* (Linnaeus), the spaces made by the radiating lamellae are subdivided. This subdivision results in a honeycombed effect quite distinct from the imprints on the museum specimen (Fig. 1).

With these differences in mind, my specimen can be compared to the genus *Isurus*, with which it agrees. The genus *Isurus* has a long geological record ranging from the Cenomanian of Europe (Woodward, 1889) to the Recent. Agassiz (1843) described a number of Miocene species, two of which are now known to be from California: *Isurus hastalis* Agassiz and *Isurus plana* Agassiz.

In the Valmonte member of the Monterey shale, at the Dicalite

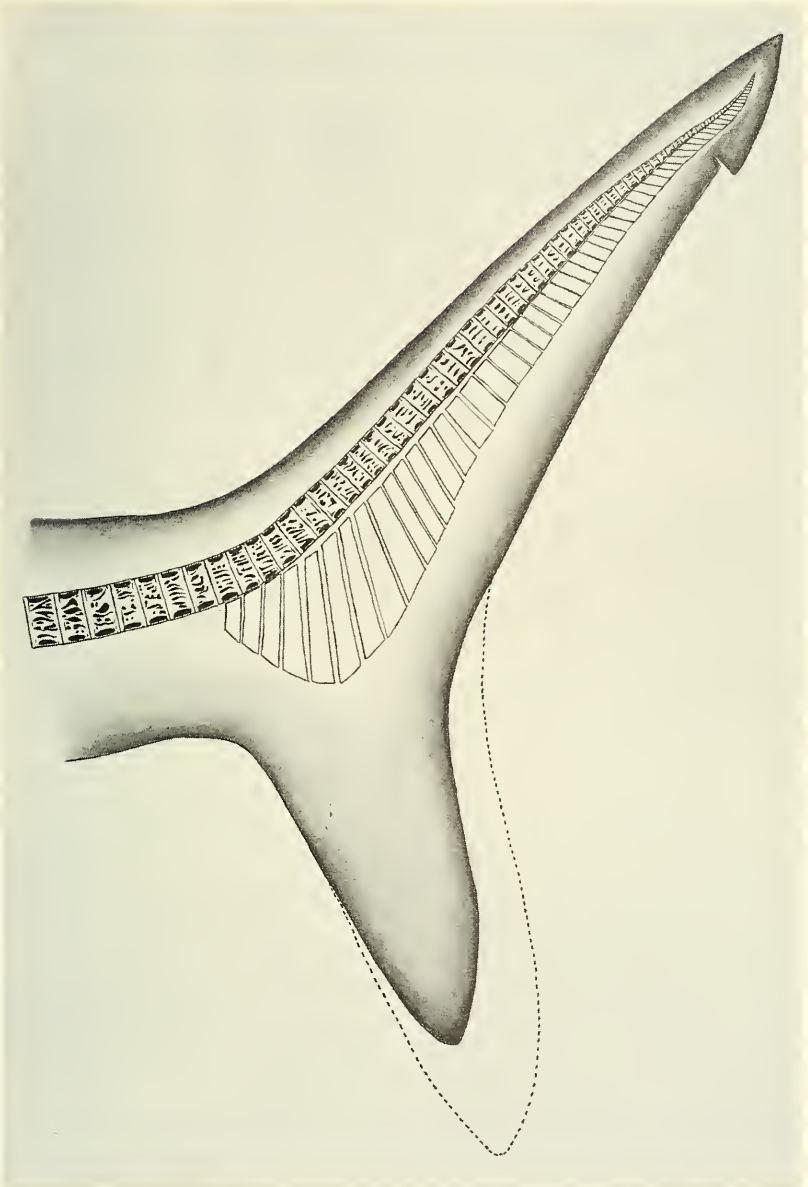

Figure 2. Reconstruction of fossil *Isurus* tail from the Miocene Valmonte Diatomite. The position of the dotted line is based on comparison with a recent isurus tail.

Company quarry, a number of fossil *Isurus* teeth have been found which are referable to *I. plana*. There is a good possibility that the tail we have under consideration may also be referable to the species. Except for the *Isurus* teeth and single tail, there is a singular lack of fossil shark material at the Walteria quarry. Perhaps this apparent lack of sharks is due to the extreme depth at which these beds were deposited and the original scarcity of sharks living in the area. Another possibility is that any shark material which had been buried was subsequently leached out by ground waters. The imprint of the shark's tail furnishes a fine example of such leaching.

The photograph used in Figure 1 was made by the Los Angeles County Museum staff photographer and the reconstruction of the tail (Fig. 2) was done by Mrs. Pearl Hanback.

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