

**DISCOVERY OF A FAUNA WITH *PROCARCHARODON*  
*MEGALODON* (AGASSIZ, 1835) IN NEW CALEDONIA  
(PISCES, CHONDRICHTHYES, LAMNIDAE)\***

by

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During the MUSORSTOM 4 (N.O. "Vauban", September-October 1985), BIOCAL (N.O. "J. CHARCOT", August 1985) and MUSORSTOM 5 (N.O. "Coriolis", October 1986) oceanographic expeditions, numerous fragments and some teeth of *Procarcharodon megalodon* (Fig. 1) were dredged, sometimes trawled, north and south of New Caledonia and on the "Chesterfield Islands Plateau" at depths between 350 and 680 meters (Fig. 2 and Table I). At the same depths other shark teeth were collected (*Carcharodon carcharias*, *Isurus* cf. *oxyrinchus*, *Galeocerdo* cf. *cuvieri*) as well as abundant pharyngeal teeth of *Labrodon* sp. (Labridae) and *Diodon* sp. (Diodontidae), probably new species (Figs. 3 and 4). A similar association (teeth of *P. megalodon* and teeth of *C. carcharias*) has been recently observed by de Muizon and DeVries (1985) in the Pliocene sandstones of the Sacaco region (Peru).

A sample of about thirty teeth of *Procarcharodon megalodon* has been retained and deposited in the collection of the Laboratoire de Paléontologie du Muséum National d'Histoire Naturelle de Paris (MNHN number 1986-3). The collecting sites are indicated in Figure 2 and their coordinates in Table 1 (re: the detailed report on the MUSORSTOM 4 expedition by Richer de Forges, 1986).

The teeth are often broken and the cutting edges dulled. They constitute a large, thick, triangular crown, covered with enameloid, and a strong bilobate root. The crown exhibits a flattened or slightly concave labial side, smooth and yellowish-brown in color and a convex dark brown lingual side. The enameloid coating is thicker on the labial side than on the lingual one. On the lingual side, a chevron-shaped and non-enameloid-coated bourlette, separates the crown from the root. Vertical striations in the enameloid are observed on both sides. The convex side is generally more eroded and encrusted than the flat side, which suggests that the teeth sit on the bottom with their convex sides serving as a supporting structure for various sedentary organisms: sponges, bryozoans, corals, and tube worms. The largest collected tooth has a broken tip (Figure 6) but considering its width (106 mm), its total height must have been close to 135 mm. Although the tips and

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cutting edges are often broken off or dulled, some serrations are visible on the cutting edges of certain well-preserved teeth. The thickness of the largest tooth is 37 mm.

The ocean floor, consisting of the external slopes of the fringing reef around New Caledonia, is generally hard and sandy. The teeth were collected with a Waren rock dredge: some specimens were trawled, notably one block containing several teeth jumbled together in a sandy matrix (site CP 193). The sedentary fauna on the teeth testify to a weak sedimentation rate. In fact in the prospected zones the slopes are steep, the currents turbulent, and the terrigenous deposits unsubstantial. The teeth found at site DW 36 (BIOCAL) are black. They were quite probably buried in the sediment and they are the teeth collected at the greatest depth (650-680 m) of the combined expeditions.

*P. megalodon* was a cosmopolitan species for which Leriche (1936) provided a map of its geographic and stratigraphic distribution. The species appears in Miocene strata (around 25 million years ago) and disappears in the Pleistocene (one million years old or less according to estimates). The Pleistocene deposits are mostly offshore and have been exposed by the dredging of the Challenger and the Albatross off the coasts of the islands of Tubuai and Tahiti in the “polymetallic nodule” fields at depths over 4000 m.

*P. megalodon* is the largest of all known sharks. Various estimates of its size have been made by extrapolation from the “tooth dimensions-animal body size” relationship established for the great white shark, *Carcharodon carcharias*. Therefore, Leriche (1926) recognizes that *P. megalodon* could attain a length of 40 m! This exorbitant figure results from the fact that the size of *C. carcharias* used as a reference was, itself, overestimated. Randall (1973) demonstrated that the great white shark certainly reaches 6.4m in length and at the most 8 m. One projection of his “enamel height-*C. carcharias* body size” relationship produces a size around 13m for the largest fossil shark.

## **Nomenclature**

The species *P. megalodon* was originally described by Agassiz, who assigned it to the genus *Carcharodon* Smith in Muller and Henle, 1838. The study of the origin of the forms within Lamnidae drove Casier (1960) to divide the genus *Carcharodon* into three genera: *Palaeocarcharodon*, *Procarcharodon*, and *Carcharodon*. The genus *Procarcharodon*, to which the species *megalodon* is assigned, is defined by Casier as follows: “teeth large and wide, not very compressed, generally regular marginal serrations, sometimes pectinate; lateral cusplets present in Eocene and Oligocene forms, disappearing in the more recent species as a rule. Root very developed.” The genus *Carcharodon* is monospecific and represented in the modern world by the great white shark, *C. carcharias* (Linnaeus, 1758). The publication date of the species name *megalodon* currently encountered in the paleontological literature is 1843. Yet, what caught our attention was the mention of “*Carcharias megalodon* Agass.” in Charlesworth (1837). “Recherches sur les Poissons fossiles” by Agassiz in which the description of *megalodon* appears, was published in 18 parts scattered between 1833 and 1843. The name, “*Carcharodon megalodon*,” appears on page 147 of the third part with reference to an illustration, “Vol. 3 Tab. 28” of the atlas. It turned out to be that the *megalodon* teeth

were illustrated in plate 29 of volume 3 of the atlas and entitled “*Carcharias megalodon*.” On an additional insert regarding the explanation of the plates of the fifth installment Agassiz points out (page 72): “Tab. 29 large fossil species of *Carcharias* to which I give the name of *C. megalodon*.” Jeannet (1928) established the publication dates of the different installments of the Agassiz work, so the text pages 247 to 249 of volume 3 were submitted in 1843, but plate 29 of volume 3 of the atlas and the additional insert (pages 65 to 74) were submitted in June 1835 (fifth installment). Therefore, it is necessary to admit in accordance with the Code of Zoological Nomenclature (Article 21) that the publication date of the species name megalodon is 1835.

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## Figure and table captions:

Fig. 1: Freshly collected teeth of *Procarcharodon megalodon*.

Fig. 2: Map of New Caledonian sites at which teeth of *Procarcharodon megalodon* were collected.

Table I: Coordinates of the sites at which teeth of *Procarcharodon megalodon* were collected.

DW = Waren rock dredge

CP = 4 meter beam trawl

Fig. 3: Lower pharyngeal teeth of *Labrodon* sp., DW 230 site, width of the dental plate: 47 mm. A: dorsal view; B: ventral view; C: posterior view.

Fig. 4: Lower pharyngeal teeth of *Diodon* sp., DW 230 site, width of the dental plate: 31 mm. A: dorsal view; B: ventral view; C: lateral view.

Fig. 5: Tooth of *Procarcharodon megalodon*, CP 193 site, total height: 111 mm. A: labial side; B: lingual side.

Fig. 6: Tooth of *Procarcharodon megalodon*, DW 355 site, maximum width: 106 mm. A: labial side; B: lingual side.

## Translator's Notes

The author appears to assume that readers would have a familiarity with deep-water expeditions and the equipment involved as certain terms were neither explained to any degree, illustrated even in part, nor put into a context to make them more easily intuitable (particularly for translation into another language). One other word he used might be misinterpreted by a 21st century reader. What follows is a glossary of sorts:

MUSORSTOM = a joint research project between the Muséum National d'Histoire Naturelle (National Natural History Museum of Paris) and L'Institut français de Recherche pour le Développement en coopération (French Research Institute for Development in Cooperation). The number following (e.g. MUSORSTOM 4) refers to a particular expedition.

N. O. "Vauban," N. O. "J. Charcot," and N. O. "Coriolis" are research vessels.

BIOCAL = I have been unable to identify this entity but it appears to be another joint research project separate from MUSORSTOM.

“Chesterfield Islands Plateau” = a direct translation of a feature for which I cannot find a match on a USGS map of the area. The Chesterfield Islands are loosely clustered on an apparent plateau according to the map but it is not named.

Waren rock dredge = I am assuming that “Waren” is the company that makes the rock dredge or is the brand name (“Waren” is not a French word—likely a surname of Germanic origin). I was unable to define it.

Beam trawl = device used to harvest benthic (ocean bottom) organisms larger than 2 cm. It is composed of a wooden pole attached by two metal shoes, forming a rigid structure (further reinforced by metal bars) on which the trawl net is attached.

Terrigenous (adj.) = that which is “formed by the erosive action of currents, especially on the ocean bottom.” It has had a more general meaning, “that which is deposited in or on the earth’s crust,” but the first one applies best.

“atlas” (used in the last paragraph of the article)—in this sense, an atlas is a bound collection of tables, charts, and plates. Many publications from the 19th century were made up of two separately bound sections: the text and the atlas.

“insert” (used in the last paragraph)—the author used the word, “feuillet,” which can mean “page,” but in the paragraph it says the “feuillet” contains “pages 65 to 74,” so it is more like a folio (generally a sheet or a few sheets of paper—often a lighter type of paper than the rest of the publication—folded in half), which may be the closer translation, but since that word also exists in French (though it is unclear whether it has the same range of meanings as in English) and he elected not to use it, I chose a more general term.