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A CHECK-LIST OF FOSSIL CHONDRICHTHYES FROM BRIELAS (LANGHIAN, PORTUGAL)

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INTRODUCTION

Located in a slope of the Costa de Caparica motorway, in the peninsula of Setúbal, West Portugal, the outcrop of Brielas stand out as one of the best Miocene sections of the Lower Tagus Basin to collect a great diversity of fossil Chondrichthyes, which are cartilaginous fishes also known as selachians.

The first mention regarding this outcrop was made by Antunes and Jonet (1970), in a study focused on the characterization of Serravalian to Tortonian shark fossil forms of Lisbon. The sediments present in Brielas can be correlated with the geological units Vc, VIa and VIIa traditionally used for the Miocene of Lisbon (Cotter in Dollfus *et al.*, 1903-1904). The samples studied were taken from the unit Vc, with approximately four meters thick and characterized by sandy-silt banks, intercalated with fossiliferous biocalcarenites. Through 87Sr/86Sr dating (H. Elderfield) of a Pectinid shell it was determined that the Vc unit has an age of approximately 14 ± 0,4Ma (Antunes *et al.*, 1999), and integrates the depositional sequence S1 (Antunes *et al.*, 2000). The planktonic foraminifera association found by Legoinha (2001) portrays the unit Vc as part of the biozone N9, correlative of the Langhian.

The present study aims to contribute to the improvement of the knowledge about Brielas section and its rich marine selachian fauna.

METHODS

The studied sediments were sampled in 1995 by Balbino, as suggested by Antunes. A total of 93,5 kg was taken to further preparation in the University of Évora; however, only recently the sediments were prepared. The methodology commonly used in Palaeoicthyology to clean and screen sediments was applied. It began with the desegregation of the material by mixing it with hydrogen peroxide and tap water to control de reaction, and frequently stirring the mixture during the first hours, when the reaction is most intense, breaking the chunks with the help of a small shovel. Then we left this mixture undisturbed for a couple more hours. The muddy sediments were then washed and screened through sieves of decreasing mesh (2.5mm, 1.0mm, 0.5mm), and the concentrates were put to dry inside an oven at a constant temperature of 60º C for 12 to 24 hours. When thoroughly dried, the sediments were handpicked and the fossils found were stored in numbered crystal boxes and Eppendorf tubes depending on their size.

All specimens were classified through the application of the traditional classification methodology of detailed descriptions and morphological comparison with the literature and collections of reference. The classification follows the work of Compagno (1973) modified by Cappetta (1987, 2012), and, whenever necessary, the taxonomy was confirmed in Naylor *et al.* (2012), Weigmann (2016, 2017), Last *et al.*, (2016a, 2016b), Pollerspöck and Straube (2018). Open nomenclature was assigned according to Bengtson (1988).

After description and classification of the fossil specimens, the best representatives of each species were recorded using three different types of equipment depending on their size. For the small ones, the VP-SEM-EDS HITACHI 3700N of HERCULES Laboratory (10kV a 20kV) was used. The medium-sized specimens were recorded with a Leica EZ4W Stereo Zoom Microscope Integrated Camera, while the big-size exemplars were photographed with a regular camera in a tripod. We coated all specimens with gold before the photographic record.

RESULTS

Through the picking of the prepared sediments, 2157 fossils were cataloged and stored, including 1370 not studied fragments of shark teeth, 331 shark teeth and 456 batoid teeth. The studied teeth were attributed to a total of 30 species, 11 of those left in open nomenclature at the light of the present knowledge. Also 19 families and 8 orders of Chondrichthyes are present in Brielas (Table 1).

CONCLUSIONS

The Vc unit of Brielas is plentiful in Langhian shark and ray fossil forms as expressed in Table 1. With five families accounted for (Table 1) and almost 45% of the total diversity of the sample, Carcharhiniformes is the most diverse Order, while Myliobatiformes is the most abundant with 49,17% of the studied material (Fig. 1). In this Order, we found two fossils worth of highlight: a wholly preserved tooth of *Mobula fragilis* Cappetta, 1970, which because of its specific morphological features rarely survives the fossilization process unscathed; and a complete dental plate of *Myliobatis* sp., which is also rare to find since the teeth usually fall off and scatter during the biostratonomic phase of fossilization.

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Order	Family	n	f (%)
Hexanchiformes	Hexanchidae	5	0,64
Squatiniformes	Squatinidae	9	1,14
Lamniformes	Odontaspididae	5	0,64
	Otodontidae	1	0,13
	Alopiidae	7	0,89
Carcharhiniformes	Scyliorhinidae	20	2,54
	Triakidae	20	2,54
	Hemigaleidae	113	14,36
	Carcharhinidae	147	18,68
	Sphyrnidae	4	0,51
Rhinopristiformes	Pristidae	1	0,13
	Rhinidae	28	3,56
	Rhinobatidae	5	0,64
Rajiformes	Rajidae	34	4,32
Torpediniformes	Torpedinidae	1	0,13
Myliobatiformes	Dasyatidae	307	39,01
	Myliobatidae	31	3,94
	Mobulidae	10	1,27
	Rhinopteridae	39	4,96
		787	**100,00**

Table 1. Checklist with the families and respective Order of the studied specimens, with quantitative distribution: absolute frequency (n); relative frequency (f).

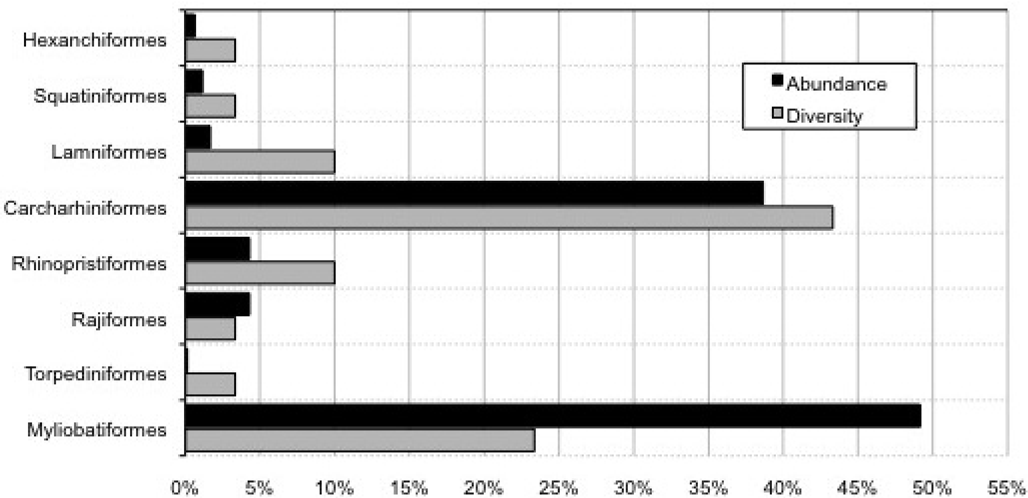

Figure 1. Percentual representation of abundance and diversity of each described Order of the studied material.

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