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A NEW MARINE FOSSIL ASSEMBLAGE FROM THE PLIENSBACHIAN OF CONDEIXA (VALE DAS FONTES FORMATION, PORTUGAL)

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ABSTRACT

We report the preliminary finds of an unknown marine fossil assemblage located in Condeixa (Portugal), corresponding to Pliensbachian (Early Jurassic) marine deposits of the Vale das Fontes Formation, in Portugal. This marine fossil assemblage is characterized by the presence of ammonites, belemnites, bivalves, brachiopods, and crinoids. A jaw fragment of an indeterminate ichthyosaur was also recovered, making it the first described cranial material referred to Ichthyosauria from the Pliensbachian of Condeixa. The fossil record of ichthyosaurs in the Iberian Peninsula is quite scarce and poorly known compared to that of some other regions of Europe. The discovery of these ichthyosaur remains gives us additional information regarding the distribution of ichthyosaurs in the Iberian Peninsula, although the assemblage where these remains were recovered is currently endangered due to human activity and intrusive natural vegetation.

Keywords: Ichthyosauria, Ammonoidea, Lower Jurassic, Lusitanian Basin.

1. INTRODUCTION

Ichthyosauria is one of the most successful clades of Mesozoic marine reptiles, notable for their iconic fish-like to dolphin-like silhouettes, with their earliest members emerging in the Early Triassic (Olenekian). They dominated and diversified through the seas worldwide, up to their extinction during the early Late Cretaceous (Cenomanian-Turonian) (Motani *et*

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al., 1999, Maisch & Matzke, 2000; Sander, 2000; Motani, 2005; Fischer *et al.*, 2016; Moon, 2019; Moon & Stubbs, 2020; Sander *et al.*, 2021).

The ichthyosaur fossil record is known for its worldwide distribution and exceptionally well-preserved specimens from all ontogenetic phases, some even preserving soft tissues, providing us with valuable insights regarding their biology, such as their viviparous life cycle, and behavior and social dynamics, for example (Sander & Mazin, 1993; Maisch & Matzke, 2000, Eriksson *et al.*, 2022; Kelley *et al.*, 2022; Miedema *et al.*, 2023). However, ichthyosaurs are poorly represented in the of the Iberian Peninsula, (Crespo, 2002, Bardet *et al.*, 2008). The recovered materials typically consist of very sparse and isolated material, including skull remains (e.g. rostrum), dentition, vertebrae or limb bones, and often found in a very fragmentary state (Sauvage, 1898; Bardet *et al.*, 2008; de Miguel Chaves *et al.*, 2015; Sousa & Mateus, 2021). In Portugal, the ichthyosaur record is represented by fragmentary material recovered exclusively from the Lusitanian Basin and aged from the Early to the Middle Jurassic (Sinemurian - Aalenian), tentatively assigned to the genus *Ichthyosaurus* or *Stenopterygius*, as summarized by Sousa & Mateus (2021, see references therein).

Here we describe a new and endangered palaeontological locality in Condeixa (south of Coimbra, Portugal), characterized by a Pliensbachian marine fossil assemblage from the Vale das Fontes Formation. Amongst the recovered fauna, mainly comprised of ammonites, belemnites, and crinoids, we recovered a three-dimensional ichthyosaur jaw fragment, including the maxilla, dentary and dentition, including visible replacement teeth, making it the first confirmed ichthyosaur cranial material recovered from Condeixa.

2. GEOLOGICAL SETTINGS

The Lusitanian Basin, situated on the western Iberian margin, is linked to the formation of the North Atlantic Ocean, where during the Early Jurassic underwent significant sedimentary changes, from carbonate sedimentation, represented by the peritidal facies of the Sinemurian, to the Pliensbachian hemipelagic deposits of the Vale das Fontes Formation (Duarte & Soares, 2002; Azerêdo *et al.* 2003; Pereira *et al.*, 2014). The Vale das Fontes Formation is characterized by marl alternating with marly limestone benches and deposited in a distal ramp environment. This formation is known from being abundant in benthic (brachiopods, bivalves, crinoids) and pelagic (ammonoids, belemnites) fauna, randomly scattered throughout the sediment (Duarte & Soares, 2002; Azerêdo *et al.* 2003; Soares *et al.* 2007). These lithological and paleontological features are observed in this new fossil-site, located approximately 8km south of Condeixa, with all collected specimens being randomly exposed throughout the surface of the assemblage. The presence and abundance of the ammonite *Uptonia* cf. *jamesoni* allows us to tentatively infer that this new assemblage is most likely of Pliensbachian age, with the age limited to the lower Pliensbachian, i.e., Jamesoni Biozone, which corresponds to the lowermost level of Vale das Fontes Formation (Duarte & Soares, 2002; Soares *et al.* 2007).

3. RESULTS AND DISCUSSION

The fossil assemblage identified in this new locality is exclusively represented by marine invertebrates and vertebrates. The only known vertebrate remain found in the assemblage is a cranial fragment referred to an indeterminate ichthyosaur (Fig. 1A). This skull fragment, significantly eroded in its lateral right side, includes a section of its right and left upper and lower jaws, comprising the maxillary and dentary portions. Several teeth have been found in position, and they are characterized by its conical morphology, and posterior deflection. The enamel displays a well-developed striation, especially at the base of the teeth. The striation becomes apically smoother. A more detailed description will be performed elsewhere to provide a more accurate systematic approach. The recovered material is mostly comprised of ammonites, belonging to the genus *Uptonia* cf. *jamesoni* (Fig. 1B), cf. *Aegoceras* (Fig. 1C), cf. *Protogammoceras* and cf. *Reynoceras*, and belemnites, namely *Belemnites paxillosus* (Fig. 1D) and *Hastites clavatus* (Fig. 1E), the brachiopod *Tetrarhynchia tetrabedra* (Fig. 1F), the bivalve *Plicatula* cf. *spinosa* (Fig. 1G), and the crinoid *Chladocrinus basaltiformis*. A significant portion of ammonites are decayed due to pyritization (Fig. 1H). It is important to note that a significant portion of these remains are incomplete and fragmentary, preventing a more detailed taxonomic diagnosis (exemplified by Fig. 1I). This fossil assemblage is currently endangered mainly due to persistent human activity, namely due to the regular influx of vehicles throughout the area of the assemblage, resulting in irreparable damage to all fossil material. The encroaching growth of vegetation, covering most of the site, is another factor that helps in the deterioration of the site.

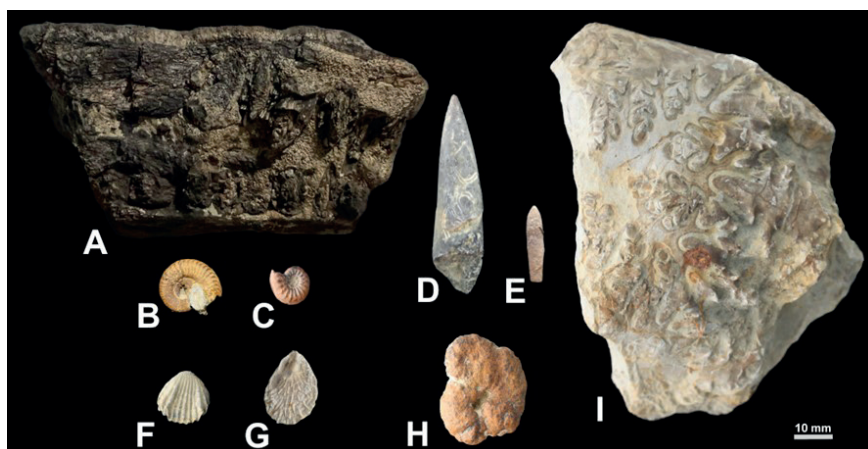


Figure 1. Selection of some of the recovered material from the Condeixa fossil-site. A - Ichthyosauria gen. et sp. indet., in lateral view; B - *Uptonia* cf. *jamesoni*, in lateral view; C - cf. *Aegoceras* sp., in lateral view D - *Belemnites* cf. *paxillosus*, in lateral view; E - *Hastites clavatus*, in lateral view; F - *Tetrarhynchia tetrabedra*, in dorsal view; G - *Plicatula* cf. *spinosa*, in dorsal view; H - Pyritized ammonite, in lateral view; I - cf. Ammonitida indet., in lateral view; Scale bar equals 10 mm.

4. CONCLUSION

A preliminary report of a new lower Pliensbachian fossil assemblage from Condeixa (Portugal) was performed, with a new record of Ichthyosauria in the Iberian Peninsula, represented by a jaw fragment, alongside with a relatively diverse marine invertebrate fauna, mainly represented by ammonites, belemnites, and crinoids, mostly in a fragmentary state, and less frequently by brachiopods and bivalves. This new ichthyosaur specimen is the first vertebrate remain found in this site. Its future systematic analyses will probably provide new data about the Pliensbachian ichthyosaur fauna of the Lusitanian Basin. Alongside some setbacks, this fossil-site is currently endangered due to regular human activity and natural vegetation, increasing the difficulty regarding to the study of this new assemblage, and the discovery of new materials there.

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