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AN *ICHTHYOSAURUS* (REPTILIA, ICHTHYOSAURIA) WITH GASTRIC CONTENTS FROM CHARMOUTH, ENGLAND: FIRST REPORT OF THE GENUS FROM THE PLIENSBACHIAN

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ABSTRACT

A well preserved ichthyosaur specimen from the paleontology collection of Doncaster Museum and Art Gallery, England is described with a focus on the gastric material scattered around the ribs and throughout the matrix. The gastric material comprises coleoid cephalopod hooklets. The ichthyosaur has been dated from the Pliensbachian Stage of the Lower Lias rocks of the Charmouth coastline, Dorset, England. The specimen is identified as *Ichthyosaurus* sp. and thus extends the geologic range of the genus into the Pliensbachian. The specimen comprises a complete skull, articulated vertebrae, ribs and a fully articulated forefin. The specimen may also contain coprolites preserved within the posterior end of the matrix.

INTRODUCTION

The Doncaster Museum and Art Gallery was originally opened on March 23rd 1910 as The Beechfield House Museum. It officially reopened in 1964 as the Doncaster Museum and Art Gallery for the purpose of displaying the artifacts in the museum's collections, including several geological specimens. The ichthyosaur that is the focus of this study (DONMG:1983.98) was excavated in the 1970s and originally owned by Hilary Corke Minerals of Surrey, England. The Doncaster Museum purchased it with the aid of a Science Museum grant in 1983. As the specimen was accessioned into the paleontology collections, it was placed on display in the main galleries of the museum. The ichthyosaur was taken off display during the mid to late 1980s due to retirement of the geologist on staff and subsequent changes in personnel.

The ichthyosaur (DONMG:1983.98) was erroneously identified as a very good cast but further analysis and comparisons with additional specimens of real and replicated ichthyosaurs and other fossils revealed that it is a well preserved, genuine ichthyosaur. DONMG:1983.98 was identified as *Ichthyosaurus communis* (Conybeare, 1822), to which it bears a resemblance in the skull, rostrum and paddle morphology (McGowan and Motani, 2003). The specimen consists of a fairly complete skull and anterior post-cranial portion, along with scattered bones from the posterior region where the matrix is uneven (Figure 1). The specimen includes gastric material throughout the ventral region and lowest portion of the ribs, as well as isolated material scattered across the posterior on the lightly colored matrix. The matrix also contains numerous bivalves and possible coprolites. The focus of this paper will be on the gastric material which has not been previously recognized. The accession registers, archives, and additional information indicate that the ichthyosaur allegedly derived from the Kimmeridgian (Upper Jurassic) of Dorset. This paper will present evidence that the specimen was more likely from the Lower Lias deposits near Charmouth, Dorset, England.

DETERMINATION OF THE PROVENANCE

As the collection information associated with the fossil is unreliable, research was carried out to determine the correct provenance of the specimen. Information obtained from reference collections and catalogued specimens in other museums suggested that the ichthyosaur was not discovered in the Kimmeridgian (Upper Jurassic) but rather it was more likely from the Hettangian, Sinemurian or Pliensbachian stages of the Lower Lias region around Lyme Regis and Charmouth because of the

FIGURE 1. DONMG:1983.98. Note the dark area of gastric content between the ribs. Scale bar = 20cm .

Lower Lias	Pliensbachian	Charmouth Mudstone	Green Ammonite	187
			Stonebarrow Marl	189
	Sinemurian		Black ven Marl	192
			Shales-with-Beef	195
	Hettangian	Blue Lias		199

FIGURE 2. Stratigraphy of the Lower Jurassic Charmouth Mudstone and Blue Lias along the Dorset coast. The last column indicates the geological age in millions of years.

sheer numbers of ichthyosaurs discovered and described from those strata (Dineley and Metcalf, 1999).

The Lower Lias consists of layers of blue and gray argillaceous limestone in the very lowest portion. Woodward (1893) remarked that these layers occur in even and irregular bands, often nodular and interbedded with blue and brown marls, clays and shales. Dineley and Metcalf (1999) described the layers as consisting of dark and light shales, mudstones and marls. The matrix of DONMG:1983.98 matches the descriptions of both Woodward (1893) and Dineley and Metcalf (1999) suggestive of the Lyme Regis-Charmouth location. However, the extensive repetition of similar lithologies throughout the Lower Lias of this area makes pinpointing the exact horizon difficult. Black Ven, part of the Charmouth

FIGURE 3. Belemnite specimen in the matrix of DONMG:1983.98, identified as *Bairstowius junceus*. Scale bar = 6cm.

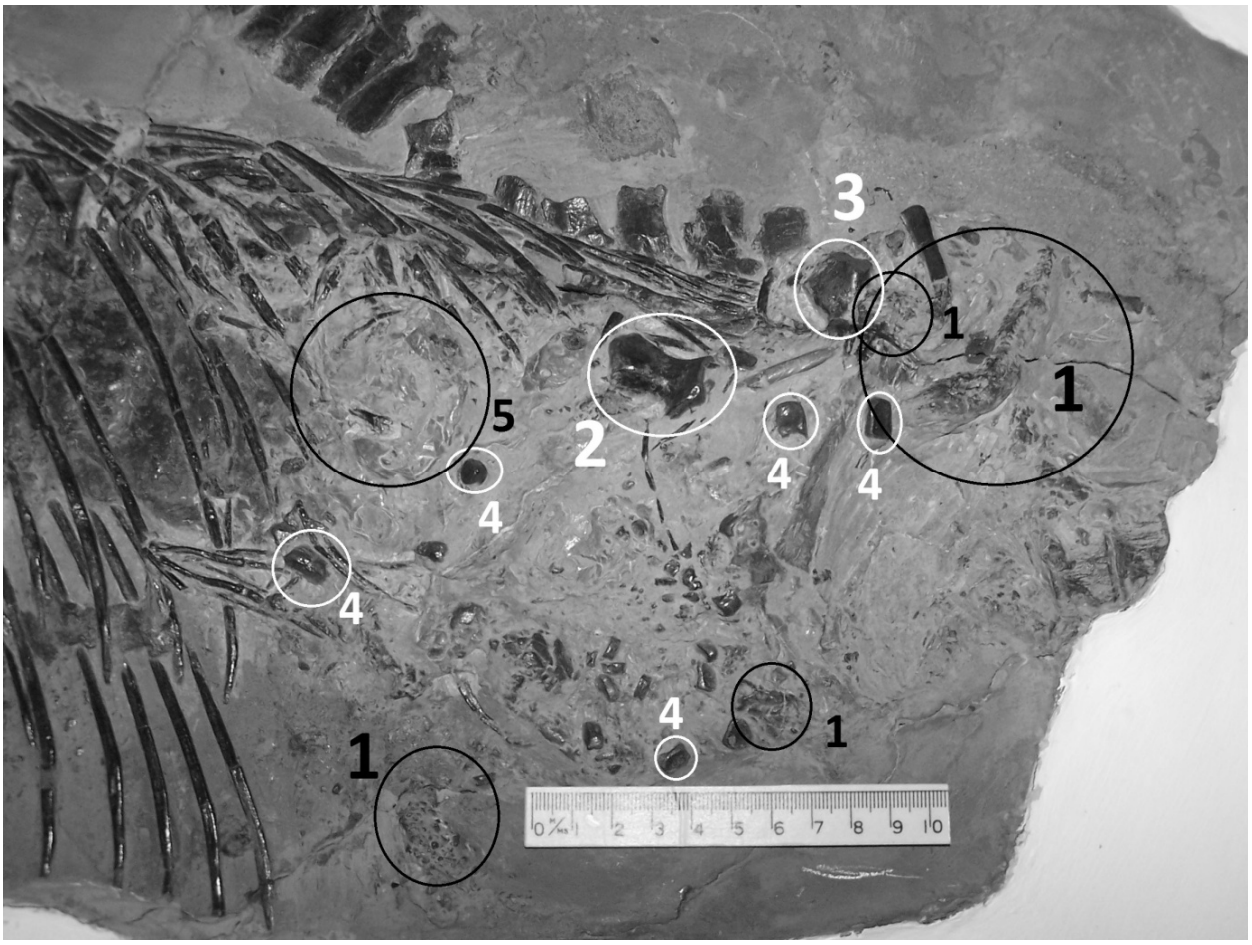


FIGURE 4. Distal end of DONMG:1983.98. 1. Putative coprolites circled in black, 2. Femur circled in white, 3. The probable ilium circled in white, 4. Several isolated phalanges (estimated 24 in total) circled in white, and 5. Bivalve specimens circled in black. Scale bar = 10cm.

coastline, is an illustrious collection site that has yielded thousands of fossil remains and is thus a potential source of the Doncaster Museum specimen. DONMG:1983.98 lies in a calcareous light grayish blue, mudstone matrix, similar to the lithologies in the Black Ven area.

There are several formations within the Lower Lias of Charmouth and Black Ven. It is possible that the ichthyosaur originated from one of three layers**:** from one of two members of the Charmouth Mudstone Formation or from the 'Blue Lias Formation' (Figure 2). The Charmouth Mudstone Formation is subdivided into four members (Gallois and Davis 2001; Gallois, 2008a), two of which are discussed here. The Shales-with-Beef Member (Sinemurian) consists of thinly interbedded organic-rich mudstones and calcareous mudstones with thin beds of fibrous calcite ('beef') and several beds of tabular and nodular limestone. The member crops out in cliffs below Black Ven, along the Charmouth coastline and continues past Lyme Regis (Gallois, 2008b). A second member within the Charmouth Mudstone Formation is the Stonebarrow Marl Member (Pliensbachian), previously known as the 'Belemnite Marls'. The Stonebarrow Marl Member is exposed in full thickness above The Spittles and Black Ven (Gallois and Davis, 2001). This member consists of bluish-grey mudstones that alternate in darker and lighter bands. It is capped by a thin limestone called the Belemnite Stone, which yields many belemnites (Lang *et al*., 1928). Reptilian remains are much rarer in this member than the others (House, 1993), but include the only known specimen of *Leptonectes moorei* (McGowan and Milner 1999).

Another possible layer is the 'Blue Lias Formation' (Hettangian). The majority of the marine vertebrates for which Lyme Regis is noted have been discovered in the Blue Lias series of the West Cliff and Church Cliffs and in the overlying dark shales and cement-stones of Black Ven (Woodward, 1893). The Blue Lias Formation consists of a sequence of laterally extensive, alternating thin-bedded (and nodular) limestones and shales (Dineley and Metcalf, 1999). The calcareous beds and the nodular and tabular limestones that occur within the beds of the Blue Lias Formation are richly fossiliferous. (Gallois and Paul, 2009; Simms *et al*, 2004). Its outcrops are exposed at a number of coastal and inland areas across southwest England.

The strong similarities between the three layers described above posed a difficult task in identifying the exact provenance of DONMG:1983.98 based on lithology. Fortunately a small complete belemnite lay in the matrix close to the dentary of the ichthyosaur. This was identified as *Bairstowius junceus* (P. Doyle, pers. comm., 2009) and is shown in Figure 3. The belemnite species is known only from the Lower Pliensbachian of the Stonebarrow Marls Member, specifically Bed 110, the *polymorphus* subzone of the *jamesoni* Zone (Lang *et al*., 1928; Doyle, 2010).

Although the correct age of DONMG:1983.98 has now been determined, the exact locale is unknown. The Stonebarrow Marls are 23 meters thick and extend throughout the coastline between Charmouth and Lyme Regis including an outcrop on the precipices of Black Ven (Lang *et al*., 1928). Lang *et al* (1928) described 19 subdivisions, denoted as Beds 103-121. Bed 110, from which DONMG:1983.98 originated, is estimated at 9 m thick. Although the matrix of the specimen is light, the bed is described as a darker marl; however it does include lighter layers (Lang *et al*., 1928). It is difficult to collect fossils from the Stonebarrow Marls of Black Ven because they are either covered in talus or the bed is high in the precipice, making it more difficult to remove the fossils, although the specimen may have fallen from the precipice and been discovered as a large slab at the base of the cliff. However, there are two other possibilities. Bed 110 of the Stonebarrow Marls Member is found at beach level below Westhay Cliff on the Charmouth coastline east of Stonebarrow Hill. The Stonebarrow Marls are neither as well developed nor as accessible at Black Ven as they are here (Lang *et al* ., 1928). Another possibility is about two miles to the east of Westhay Cliff on the foreshore west of Seatown, Dorset where *Leptonectes moorei* was discovered. *L. moorei* was described from the uppermost part of the Stonebarrow Marls, 1 m below the thin limestone, namely the Belemnite Stone band of the Lower Pliensbachian (McGowan and Milner, 1999). The belemnite genera preserved with *L. moorei* were identified as *Passaloteuthis* sp. and *Pseudohastites* sp. Both genera are only found in the Stonebarrow Marls in several Beds including Bed 110 (Lang *et al*, 1928; Doyle, 2010).

GENERAL DESCRIPTION OF SPECIMEN

DONMG:1983.98 has been partially prepared by the removal of excess mudstone matrix, although it may be in need of further preparation. The

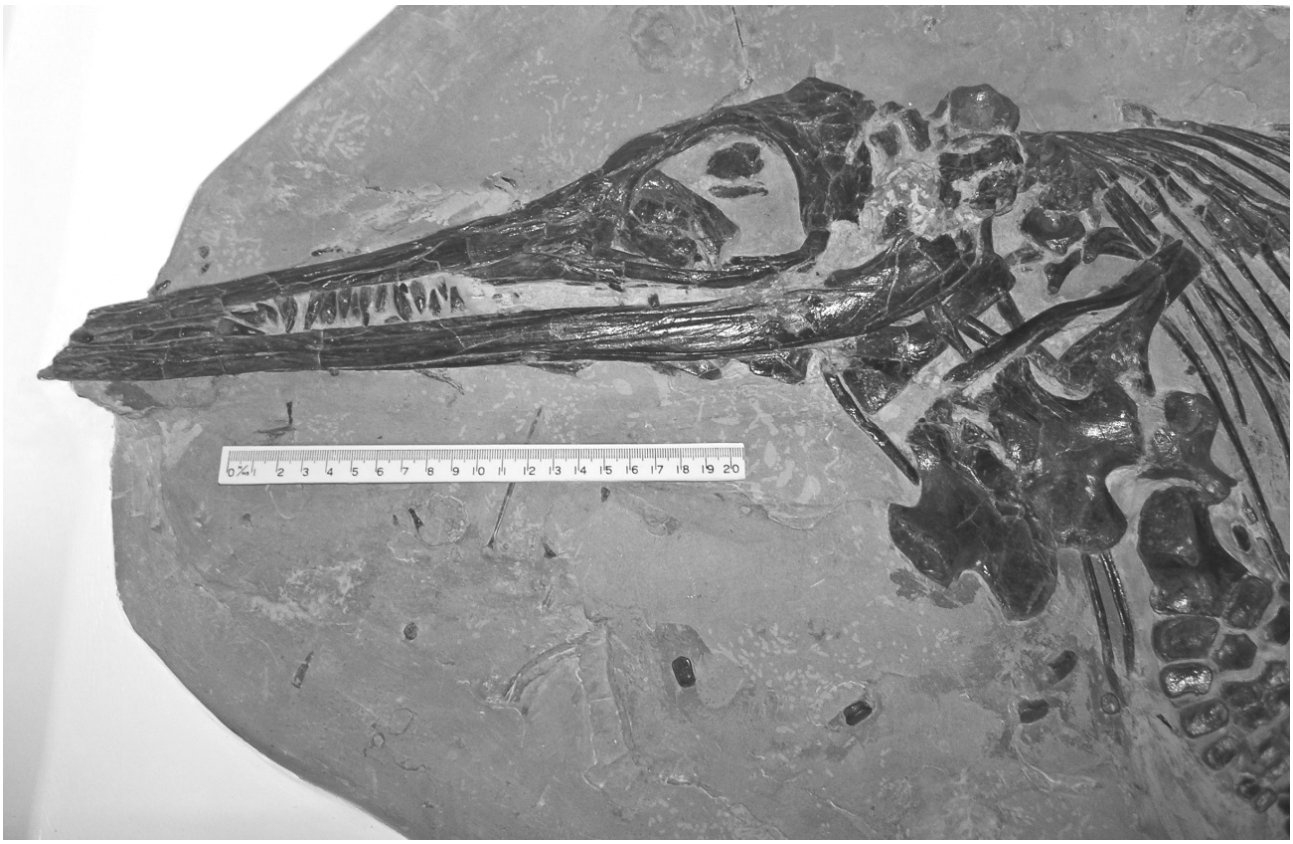


FIGURE 5. Anterior portion of DONMG:1983.98 showing the skull and pectoral girdle. Scale bar = 20cm.

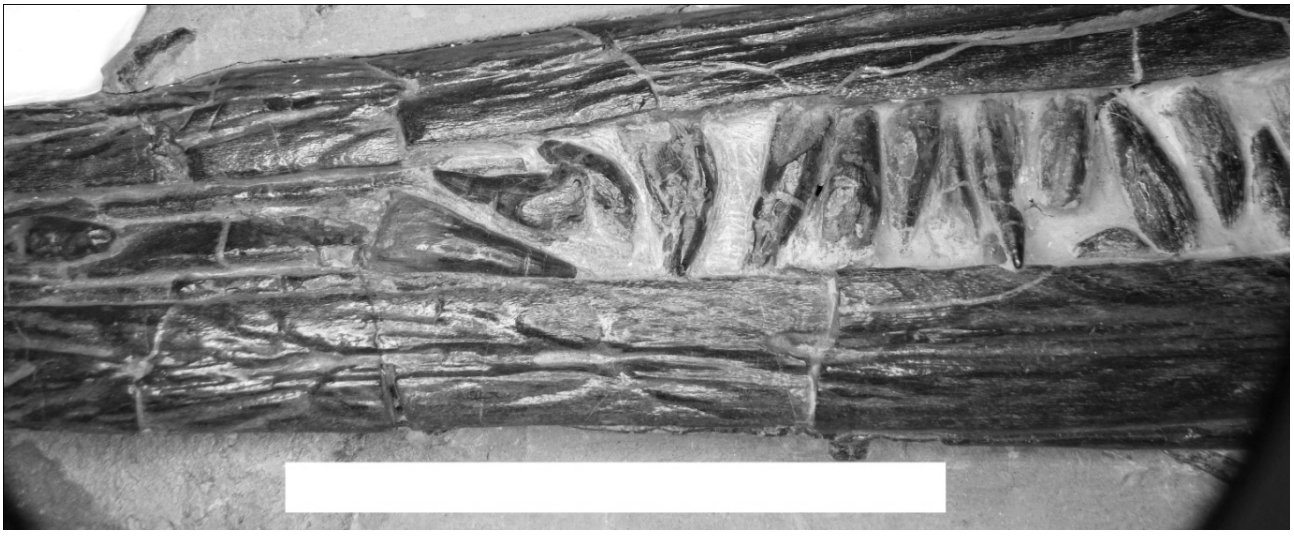


FIGURE 6. Close up of the dentary of DONMG:1983.98. Note that several of the teeth are pointed but have smooth surfaces. Scale bar = 8cm.

mudstone matrix is weak and two structural cracks run across the pelvic area and another above the orbit. The specimen is in a stable condition however, having been reinforced with plaster prior to its addition to the collections in 1983. This process of stabilizing fossils is now considered

dangerous because it can destroy or harm certain specimens (Cifelli, 1996). The specimen has undergone only a minimal amount of damage, although it is unclear whether this occurred after or before the reinforcement. Further removal of matrix could change the structural integrity of the specimen but it may prove necessary to identify the species.

FIGURE 7. The right forefin of DONMG:1983.98. Note the short, wide humerus, without a constriction in the shaft. Scale bar = 10cm.

Pliensbachian ichthyosaurs are rare and poorly known (Maisch and Reisdorf, 2006), with only three species recognized: (1) *Leptonectes moorei*, a partial skeleton including skull and some postcranial material from England (McGowan and Milner, 1999), (2) *Leptonectes tenuirostris*, a three dimensional skull and parts of the postcranial skeleton from Switzerland (Maisch and Reisdorf, 2006), and (3) *Temnodontosaurus nuertingensis*, a large, fragmentary skull from Germany (von Huene, 1931). The latter is poorly known, and its generic assignment has been questioned (McGowan and Motani, 2003). Isolated bones and fragmentary material have also been reported from the Pliensbachian of Switzerland, United Kingdom, Germany, Belgium, and Canada (Maisch and Reisdorf, 2006).

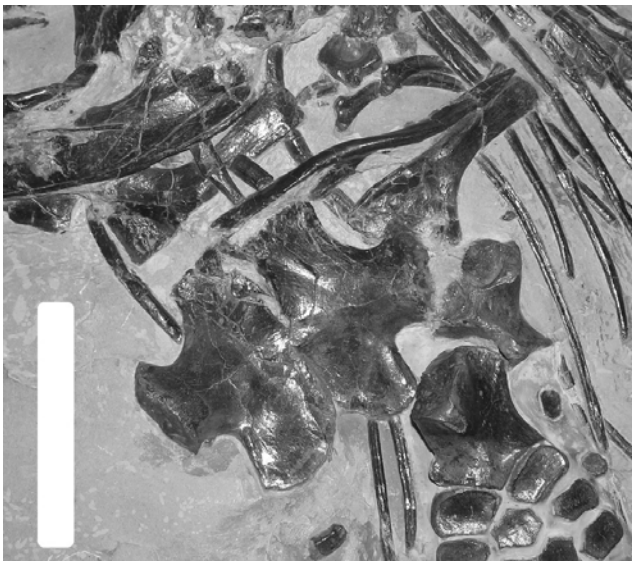


FIGURE 8. Articulated coracoids and scapulae of DONMG:1983.98. Scale bar = 7cm.

DONMG:1983.98 is covered by a synthetic resin that coats the bones and gastric material but not the matrix. This has resulted in the preservation of fine morphological details but also allowed for examination of the matrix itself. The matrix is very fossiliferous and includes belemnites and bivalves, some of which have already proven useful in determining the provenance. Also scattered throughout the matrix are isolated limb material and teeth (Figure 4).

The specimen measures 1.1 meters long, a third of which is the skull (Figure 1). The post cranial elements consist of an almost complete string of 15 articulated pre-sacral vertebrae including the atlas-axis, cervicals and dorsals, and 7 associated vertebrae scattered across the specimen. Five articulated preflexural caudal vertebrae are present in an isolated section lying dorsal to the main skeleton, in the upper section of the slab. Some posterior elements including disarticulated femora and a probable ilium, are present in the pelvic region of the specimen. Two isolated articulated dorsal vertebrae occur at the most posterior end of the

FIGURE 9. DONMG:1983.98. Close up image of the entire mass of gastric contents. Note the large structural crack. Scale bar = 10cm.

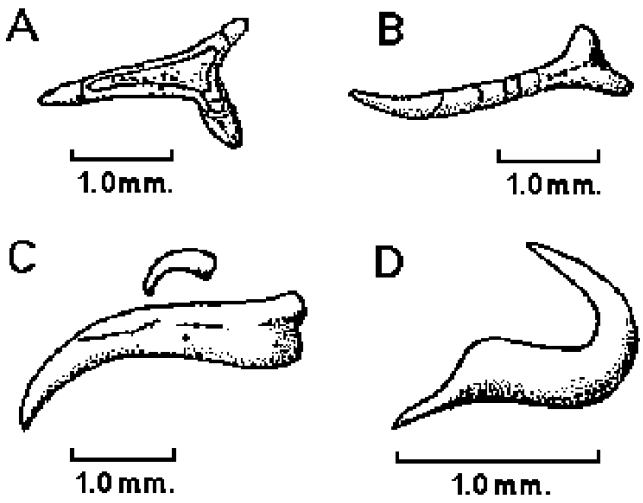


FIGURE 10. Comparison of the varieties of hooklets discovered within the gastric contents of several ichthyosaurs reprinted from Pollard, 1968 with permission of the author.

matrix suggesting that there may have been more vertebrae associated with the specimen but not collected.

The skull material articulates with a string of associated vertebrae described above. The skull and rostrum exhibit great details. The maxilla is preserved along with an almost complete premaxilla; however, the end of the premaxilla is broken and it is unclear whether or not the rostrum was complete when discovered. Even though the rostrum is incomplete, it appears to be longer than that of *Leptonectes moorei*. The orbit is visible and some of the sclerotic ring is present, as well as the lachrymal and prefrontal. The posterior section of the skull seems to have undergone slight changes with several elements dislodged or damaged during taphonomic processes, including the anterodorsal edge of the surangular (Figure 5).

The rostrum includes eighteen teeth, five of which have dislodged, perhaps during diagenesis (Figure 6). The base of the teeth are quite robust with a conical shape. The teeth of DONMG:1983.98 are pointed, but some have

rounded tips because of wear. Worn teeth of ichthyosaurs usually have a polished or pitted apex rather than the rough surface, suggesting abrasion with hard prey (Massare, 1987). The blunt apex and tooth wear of the ichthyosaur suggest that this type of tooth shape was used for grasping prey with a somewhat hard exterior such as the internal shell of cephalopods or the thick scales of fish (Massare, 1987).

During the taphonomic processes the right forefin of the specimen has been partially disarticulated and turned over; it is completely associated and includes the humerus, radius, ulna and carpals (Figure 7). The forefin is similar to that of the genus *Ichthyosaurus* (McGowan and Motani, 2003, figs. 26, 29, 49; Motani 1999a, figs. 3, 6). The humerus of *Leptonectes* has a constricted shaft and a more expanded distal end then that of DONMG:1983.98 (McGowan and Milner, 1999; Motani, 1999a). The distal end of the forefin is disarticulated but the post axial and accessory digits are still associated. A number of phalanges are spread throughout the specimen, including some anterior to the forefin. The orientation of the ichthyosaur exposes only the ventral side of the humerus of the left forefin. Further preparation may reveal the rest of the left forefin.

The pectoral girdle of the ichthyosaur presents articulated coracoids. Both scapulae are present, however only the left is associated with the coracoids by the slight contribution to the glenoid. The clavicle is articulated with the left scapula and the coracoids. The scapulae and coracoids are comparable to the genus *Ichthyosaurus* in size and structure, although the peripheral edges of the coracoids are more squared than curved (McGowan and Motani, 2003; Motani, 1999b). However, the differences in shape may be due to flattening (Figure 8). The entire post-cranial portion of the specimen is covered by numerous ribs extending towards the rear of the specimen. At the rear, ribs become disarticulated and begin to split into sections.

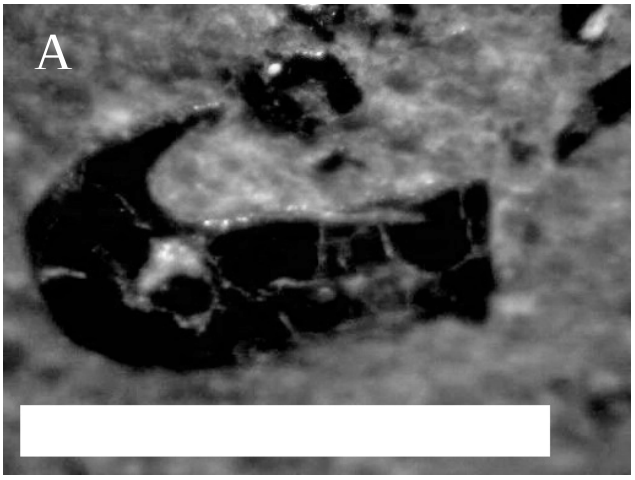
DESCRIPTION OF GASTRIC MATERIAL

Preserved stomach contents from several genera of ichthyosaurs were first noted over 150 years ago (Pollard, 1968). Most of the specimens with stomach contents are described from the Lower Jurassic of southern England and southern Germany (Pollard, 1968; Keller, 1976; Böttcher, 1989; Bürgin, 2000), although several ichthyosaur specimens containing gut contents have been discovered in other areas such as Switzerland (Reiber, 1970), Wyoming (Massare and Young, 2005) and Australia (Kear, *et al*., 2003). The first description of small cephalopod hooklets associated with ichthyosaur bones was by Coles in 1853, though he misinterpreted the gut contents as ‘setiform or bristly scales’ (Pollard, 1968). In 1856, Moore was able to accurately identify stomach contents of ichthyosaurs, which contained small cephalopod hooklets (Pollard, 1968). Pollard (1968) described stomach contents in three ichthyosaur individuals from the Oxford University Museum and six from the Natural History Museum, London, and reported on a new specimen from the Lower Lias of Lyme Regis. The described gastric material contain fish remains and cephalopod hooklets. Most gastric contents found in ichthyosaurs are cephalopods or fish remains indicating a low variety in their diets (Massare 1987; Massare and Young, 2005). The exception is the described gastric contents of a Cretaceous ichthyosaur that included the remains of a protostegid sea turtle hatchling and an enantiornithine bird, along with fish (Kear et al, 2003).

The gastric contents of DONMG:1983.98 is a large dark mass, extending between the 9th and 22nd ribs. The mass measures 19.6cm in length and 11.9cm at its widest point. The whole gastric mass covers a large section around the ribs. Some hooklets are complete and others are compacted as fragments within the mass. Still other sections of the mass are just dark with no identifiable content (Figure 9).

Hooklets are widely scattered throughout the specimen and are most visible scattered on the light coloured matrix near the most ventral point of the ribs. The majority of the complete hooklets appear in the vicinity of the ventral region of the mass, between the 14th and 16th ribs, where a high number of small hooklets are evident. The hooklets are 1.7mm or less in size, as estimated from measurements of ten hooklets. Jeletzky (1966) noted that all belemnites of the order Belemnitida possessed eight or ten arms with hooklets attached, and Pollard (1968) concluded that there must have been at least 300 hooklets on a simple ten-armed belemnite from the Lias. The number of hooklets within the gastric material of DONMG:1983.98 is difficult to assess.

Pollard (1968) identified four types of hooklets (Figure 10). There are three different types of hooklets in the gastric contents of DONMG:1983.98, here referred to as Type 1, Type 2 and Type 3. Type 1 hooks maintain a very pronounced and tightly curved uncini that has an aciculate point and tight curve that is swept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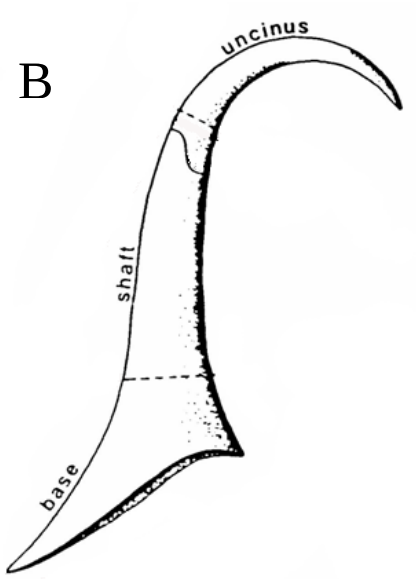
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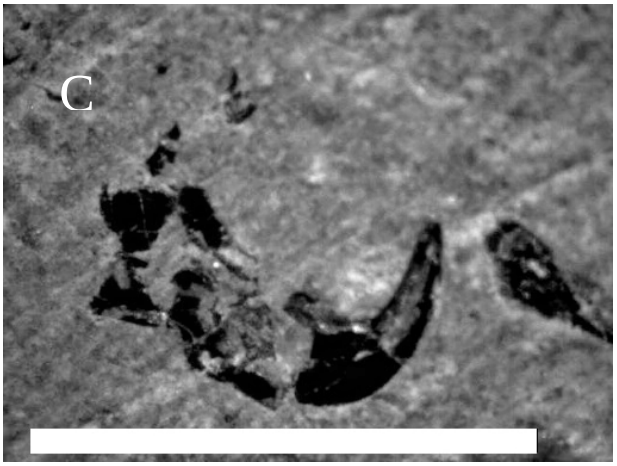
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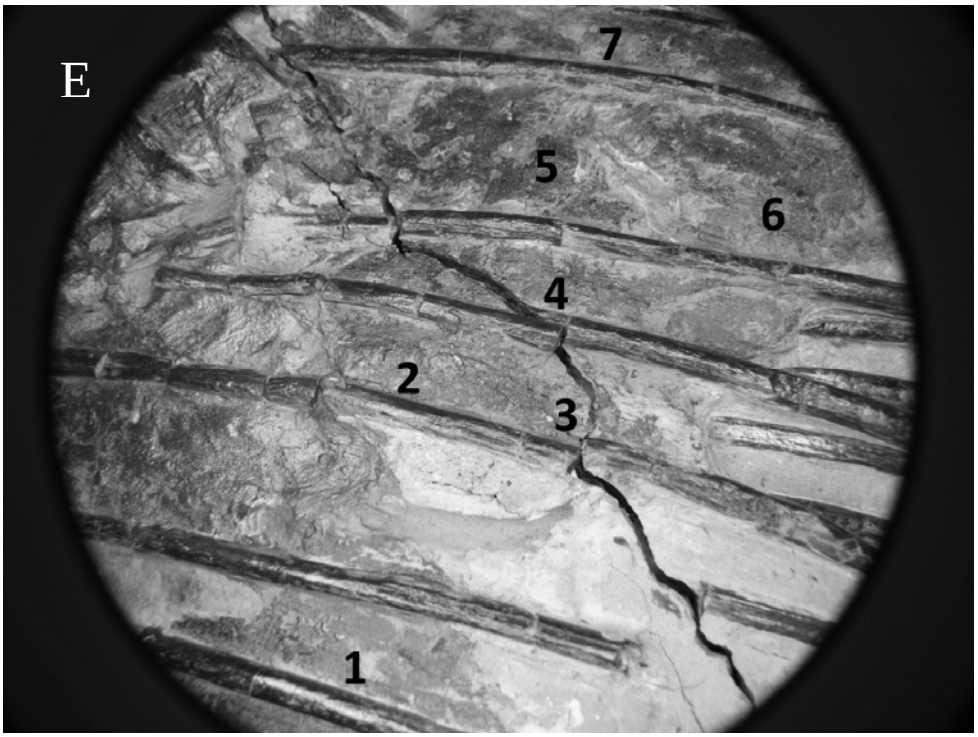
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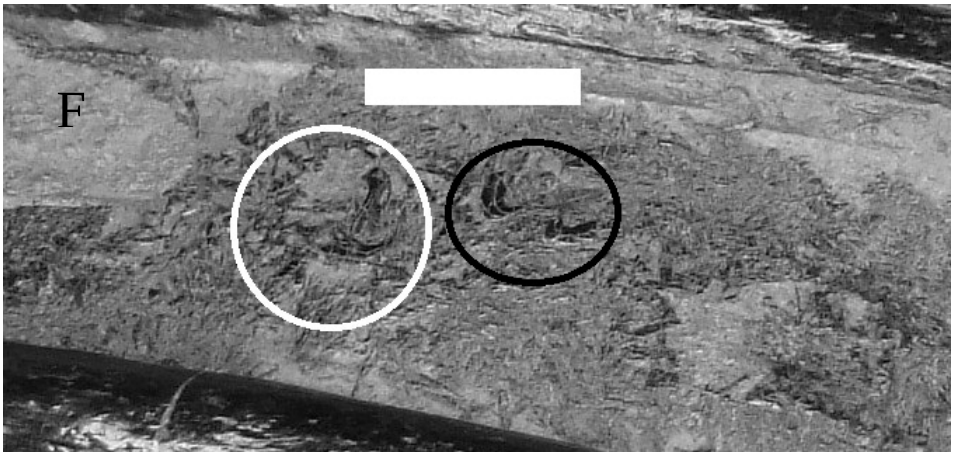
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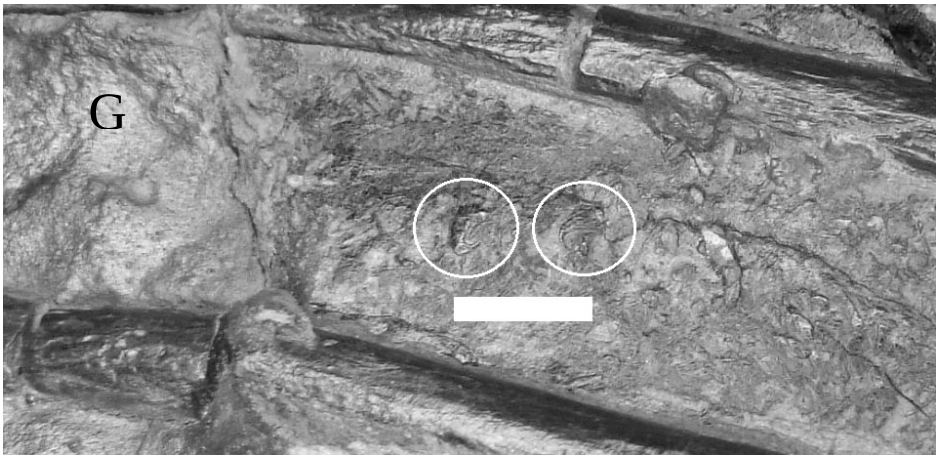
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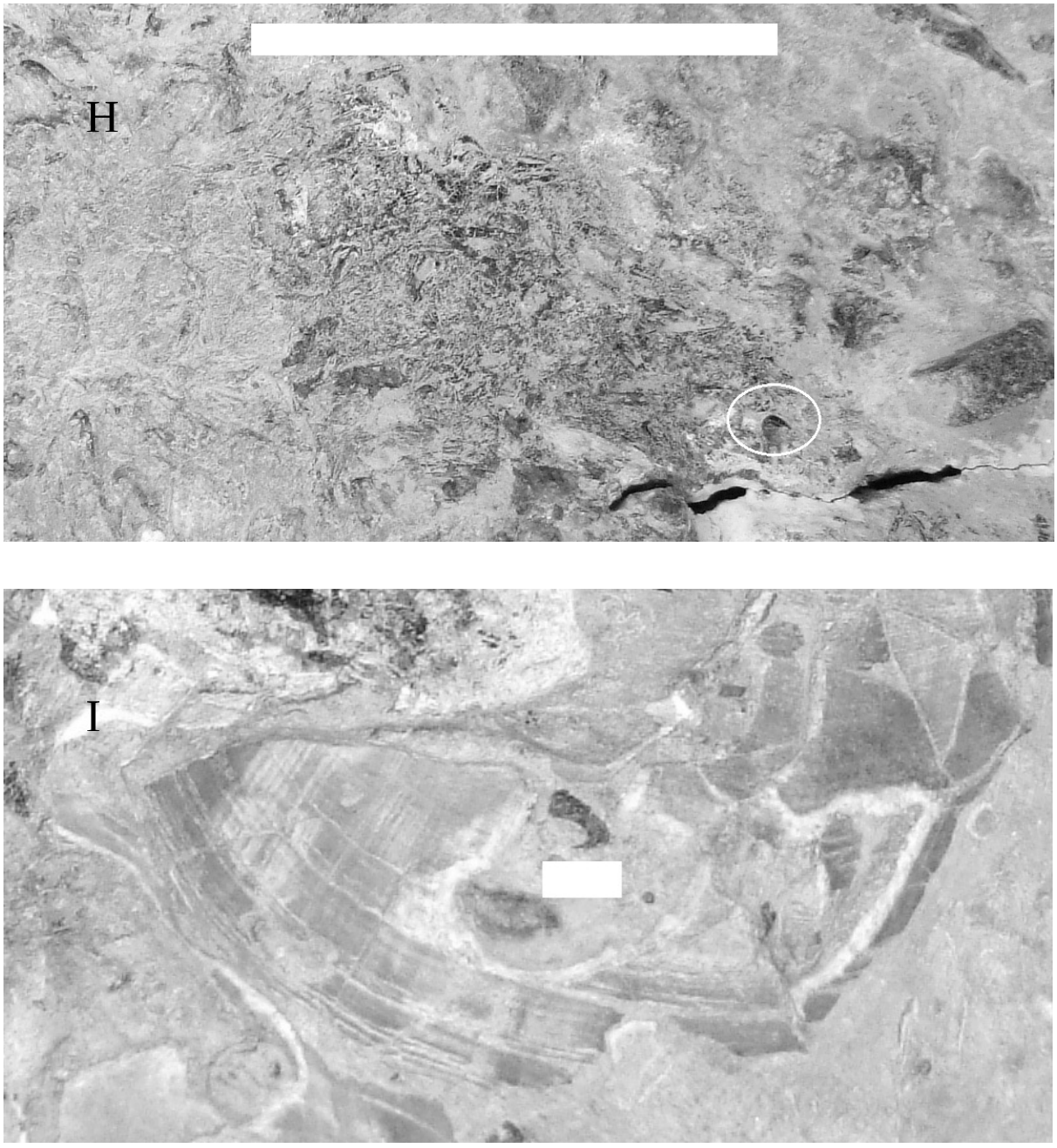

FIGURE 11. Cephalopods hooklets discovered on DONMG:1983.98. A. Microscopic view of the most complete Type 1 hooklet identified. Scale bar = 2mm. B. An illustration of a general belemnite hooklet. Note the sharp backward curve. Modified from Engeser, 1988. C. Type 2 hooklet at microscopic view. Note that it has begun to separate into sections, but still maintains the ontogenic shape and structure. Scale bar = 2.5mm. D. A patch of hooklets outside the large dark mass, made visible on the lightly colored matrix, Type 1 and the possible Type 3 (circled in black) hooklets visible. Scale = 2cm. E. Section of gastric content from the center of the mass measured at 5.5cm in length with the patches of hooklets numbered throughout the section. F. A section of the gastric content showing compaction of hooks (circled in white) as well as complete hooklets (circled in black). Scale bar = 10mm. G. Two hooklets (circled in white) fossilized together between the ribs with disassociated fragments of hooklets. Scale bar = 8mm. H. A section of gastric content visible on the distal end of the matrix away from the large tightly packed mass. Only one complete hook identified (Type 1). Scale bar = 4cm. I. A well-preserved Type 1 hooklet with the bivalve remains. Scale bar = 1.5mm.

backwards posteriorly from the base, which is flat and straight (Figure 11A). Several of the hooks appear to be crushed and cracks run throughout. Pollard (1968) referred to a similar type of hook shape, his type D hooklet. He indicated that it was extremely rare in the gastric contents of the ichthyosaur specimen (OUM.J.14800) from the Upper Lias mudstone of Dumbleton, Gloucestershire. However the shape of the hook may be ontogenic. Although similar to Pollard's (1968) 'type D', the Type 1 hooklets from DONMG:1983.98 have a much tighter inward curve. However, they have the same sharp backward curved point and a flat, straight shaft and base (Figure 11B). The Type 2 hooklet, of which only two have been identified, have a similar structure to the Type 1 hooks but has a less tightly curved uncini and an irregularly shaped base (Figure 11C). The Type 3 hooklets are very thin and resemble Pollards (1968) Type C hooklet shape. They have a very straight shaft with the uncini (if present) bearing a slight curve. (Figure 11D**)**, although the majority of the Type 3 hooklets are very fragmented. One notable point is that the complete cephalopod hooklets seem to fossilize together in small pockets (Figure 11E). This may reflect the morphology of the gastrointestinal tract. For every one isolated hooklet, there are at least two or three complete hooklets fossilized together in a small assemblage, although compaction of many fragmented sections of hooklets are prominent throughout the specimen (Figure 11F and 11G). Patches of hooklets are spread across the matrix and hooks are visible in the posterior, including the area with the bivalves (Figure 11H, 11I). The variety of different shapes of hooklets may suggest an ontogenetic range of belemnites that were fed upon. The hooklet shape may have changed with growth of the belemnite or the hooklets may have changed shape along the length of the arm. On the other hand, the hooklets shape may reflect a taxonomic variation.

An unusual hooklet-bearing cephalopod, *Belemnoteuthis mayri*, was described from a Solnhofen Limestone in Bayern, Germany (Engeser and Reitner, 1992). The hooklets of *Belemnoteuthis* are similar to the Type 3 hooklet shape of DONMG:1983.98 in respect to their elongate shaft. The Type 3 hooks are thinner, however, and could be fragmented sections of the Type 1 hooklets. A specimen of *Phragmoteuthis* from the Austrian Alps was described with arm hooklets that were small (less than 1 mm), slender, and almost straight (Doguzhaeva, *et al*., 2007). They compare in shape with the Type 3 hooklets.

Pollard (1968) identified the hooklets as belonging to dibranchiate cephalopods and concluded that the hooklets belonged to the family Belemnitidae. Since then, however the hooklets have been reassessed as belonging to belemnoteuthid coleoids (Valente, et al., in press). The taxonomy of the hooklets of DONMG:1983.98 is unknown but the low variety hooklet shapes suggests that they are likely to be from one particular species.

It should also be noted that an unidentified fish scale is present in the matrix of DONMG:1983.98, lying 0.5cm ventral to the gastric mass and measuring 1.2cm in length and 0.5cm at its widest point. The scale is probably part of the gastric contents and has been displaced from the general mass in a way similar to the many patches of hooklets which are dispersed throughout the ventral and distal regions of the matrix. (Figure 12).

FURTHER DESCRIPTION OF DISPOSITION

The matrix at the posterior end of the ichthyosaur exhibits an uneven surface with disassociated bones including small phalanges, hindfin material, an abundance of bivalve remains and possibly coprolites. Coprolites have been described from the Lias of Lyme Regis (Pollard, 1968). The shape and size of coprolites are an important characteristic in identifying the kind of animal that formed them (Chin, 2002). Spiral shaped coprolites were produced by fish with spiral intestinal valves such as sharks (Chin, 2002). Possible coprolites at the distal end of DONMG:1983.98 are elongated, irregular, and have a rounded shape with a rough surface. However, they show a circular pattern, not a spiral. Firtion (1938, as cited in Pollard, 1968) analyzed the contents of coprolites from the Lower Lias of Alsace, France. He found that the undigested contents included a large diversity of marine taxa such as crinoids, gastropods or bivalves, with less abundant foraminifera, ostracods, fish remains and brachiopod shells (Pollard, 1968). Furthermore, the coprolites Firtion studied rarely had spiral folds and were suggested to belong to marine reptiles such as ichthyosaurs (Pollard, 1968). Pollard (1968) disagreed with this, however, because gastric contents such as those described had never been discovered in ichthyosaurs. The possible coprolites on the matrix of DONMG:1983.98 are identified based solely on shapes similar to those described by Firtion (1938, as cited in Pollard, 1968). However no hooklets were discovered in the putative coprolites (Fig 4).

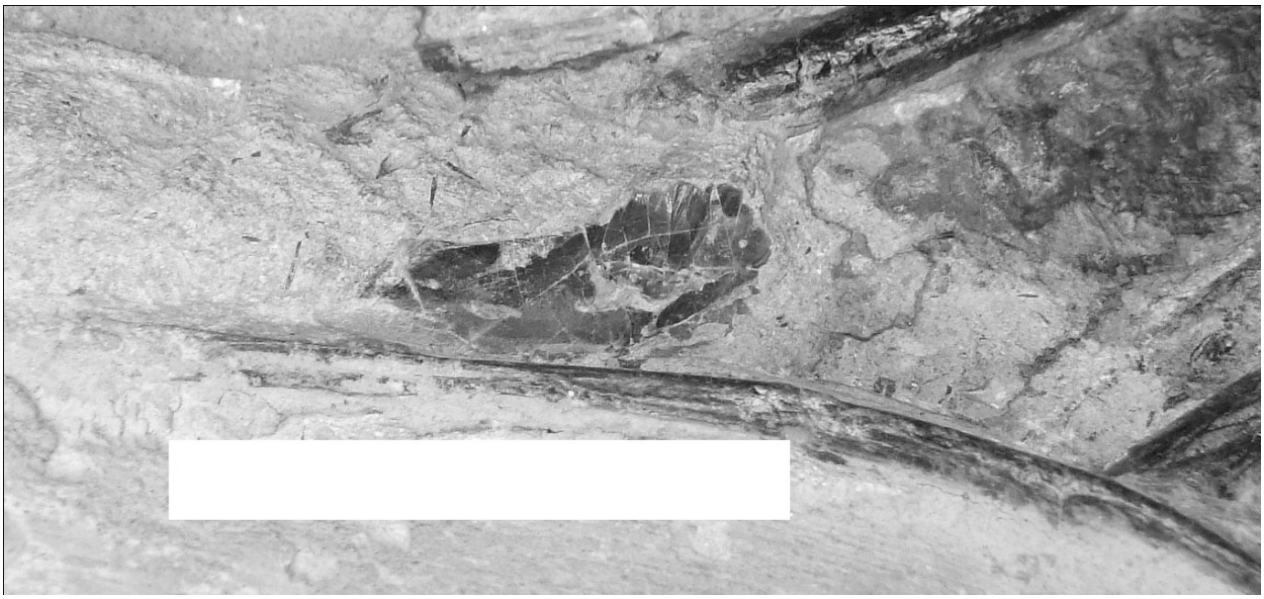

FIGURE 12. Fish scale directly beneath large gastric mass. Scale bar = 2cm.

CONCLUSION

The identification of one belemnite within the matrix of DONMG:1983.98 enabled the determination of its geologic age as Lower Pliensbachian. However, DONMG:19.83.98 does not appear to belong to any of the ichthyosaur genera described from the Pliensbachian**.** The humerus, scapula, and coracoid are quite different from the respective elements of *Leptonectes* and *Temnodontosaurus* (McGowan and Motani, 2003). The Doncaster specimen is similar to *Ichthyosaurus* in the paddle and pectoral girdle morphologies (McGowan, 1974; Motani, 1999a), and is herein identified as *Ichthyosaurus* sp., pending a more complete taxonomic analysis. This is the first report of *Ichthyosaurus* from the Pliensbachian, and extends the range of the genus. The Doncaster specimen may be a new species. Additional study is needed before the specific taxonomic assignment of the specimen can be determined.

The rediscovery of the ichthyosaur has enabled the specimen to be an asset to the paleontology collections of Doncaster Museum and Art Gallery. The discovery demonstrates that small regional museums may house important specimens that can warrant further work. Notable discoveries on DONMG:1983.98 include the gastric mass and the putative coprolites and possibly a new taxon. The low diversity of forms of the hooklets preserved in the gastric contents, suggests that this ichthyosaur could have fed on a single species of coleoid at a time. The uneven surface at the posterior end of the specimen has thin, rounded coprolite-like shapes that warrant further study.

The general preservation of the ichthyosaur is excellent, which will permit a more detailed taxonomic study. Further study of DONMG: 1983.98 may unveil new discoveries.

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