

# Jurassic Fish and their Stratigraphic significance from the Hengyang Region of Lingling Co., Hunan Province

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*Vertebrata Palasiatica*

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## Description of Specimens

**Palaeonisciformes**

**Palaeoniscidei**

**Coccolepididae**

***Plesiococcolepis* gen. nov.**

**Diagnosis:** A moderately small, spatulate-shaped palaeonisciform with a total length of over four times the length of the skull. Cranial length is larger than the greatest height of the body. Skull is broad with rostrum projected slightly anterior. Orbit is large and situated anteriorly. Otic capsule is large and triangularly shaped and the suspensory apparatus is inclined. Alternating sized conical teeth lie on the maxilla and dentary, with large teeth loosely spaced and small teeth compressed together. Opercular is slightly larger than subopercular. Subopercular is higher than long. Lepidotrichia outnumber their corresponding radials, have a split basal nodes and are bifurcated at their terminations. Small and delicate fulcra at the anterior margins of the fins are absent. A pelvic bone is well developed, long, and thin. The caudal is askew and deeply bifurcated with the dorsal lobe longer than the ventral lobe. A single long spatulate shaped fulcra is located at the base of the ventral lobe on the caudal. Scales are round and thin.

***Plesiococcolepis hunanensis* sp. nov.**

**Type:** A nearly complete individual lacking a large portion of the caudal fin.

**Hypodigm:** Over 30 portions of individuals

**Diagnosis:** As for genus.

**Locality and age:** Early Jurassic of Yumushan, Zhoushi mining region, Hengnan Co., Hunan Province.

**Description:** Specimen V5219 is moderately small, with a total length of approximately 108 mm, or over four times the length of its skull. Skull is moderate in size, is longer than high, and has a rostrum that is slightly anteriorly projected. Orbit is large and sits anteriorly. Skulls of all specimens have been laterally compressed. Although some cranial specimens have been subjected to dorsal or dorsolateral compression, which obscures the morphologies and arrangements of the dorsal dermoplates, at the same time this indicates that the dorsal cranium was relatively broad. The Suprascapular is large, long, and triangular shaped with a nearly level and

straight lateral margin. Anteromedially the suprascapulae display some overlap and contact the extrascapular. Each side of the extrascapular is composed of two pieces. On the medial side there is a small and rectangularly shaped element while on the lateral side the element is large and nearly square. The sensory canal on the suprascapular traverses the center of the lateral piece of the extrascapular. The parietal is small and square with a slightly oscillating anterior margin that contacts the frontal. The frontals are long and large and the midline suture between them meanders slightly. Lateral to the frontal lies a relatively large dermopterotic with a broad medial section and osteal plates that gradually taper toward both ends. Anteroventral to the frontal lies a postrostral, but the boundary between these two elements is obscure. The postrostral is a large and arched element that forms the anterior margin of the rostrum. The Nasal lies lateral to the postrostral as a narrow and arched bony plate that forms the anterior margin of the orbit. The external nares between the postrostrals and nasals are very distinct. At the posteroventral border of the nasal lies a small impression that may represent a second narial opening (na2). At the posteroventral region of the postrostral lies a small linear rostro-premaxilla. Dorsal to this element lies a square antorbital. There appear to be three infraorbitals that form the posteroventral margin of the orbit. On specimen V5219,8 a sclerotic ring composed of approximately 4-5 crescentic pieces is visible (Plate I, Fig. 1,3,6,7).

The maxilla is typically palaeonisciform and is recognized as an anterior and posterior section: the anterior section is low, narrow, and thin, gradually attenuating anteriorly, while the posterior section is round and highly arched. The dentary is narrow, long, and large with a sensory canal that traverses very close to its ventral margin. The boundary between the angular and the dentary is not easily distinguishable. On the type specimen and specimens V5219,7 and 4-2 large and loosely spaced conical teeth are observable at the oral margins of the maxilla and mandible. Concurrently, small and densely packed conical teeth are also visible at the oral margins of the mandible. Despite these minute teeth being unobservable on the maxilla, the vacuities present between the large maxillary teeth suggest that this species possessed maxillary and mandibular teeth that alternated in size with a numerous amount of small densely packed teeth and loosely spaced large teeth (Plate I, Figs. 1,6,8).

The preopercular is recognized as an anterior and posterior section. The anterior section is slightly broadened and gradually narrows posteriorly, while the posterior section is small, narrow, and lies against the anterior section at an approximate angle of 120°. The entire element lies posterodorsal to the maxilla and possesses a sensory canal that penetrates the posterior margin and traverses close to the anterior margin. (Plate I, Fig. 1,8).

The Opercular has four bluntly rounded corners, and particularly the anterior corners which are nearly circular. The subopercular is rectangular, slightly smaller than the opercular, and is higher than it is long. Its anterodorsal margin is slightly anteriorly projected. Specimen 29 preserves eight to nine branchiostegal rays, and it is estimated that there are more present. Anterior to the branchiostegal rays is a small triangular gular. On several specimens dorsal to the branchial section and ventral to the maxillary plane there are several long small club-shaped elements that may represent branchial arches. These are particularly noticeable on the type specimen.

Worthy of note is that on the Type specimen and specimen V5219, 18 there is 1.5 mm triangularly shaped pocket anterior to the opercular that is filled with a material that differs in color from its surrounding bone or bone impressions. Its shape is probably not related to the postorbital, suborbital, or orbit as there are several specimens (such as V5219) that preserve the orbit. From its morphology, size, and the consideration that it occurs on each side of the skull, it is very possible that this is an otic capsule, and it is also extremely possible that the color differentiation is due to geochemical effects upon the ear matrix (Plate I, Figs. 3,7).

**Mid-axial skeleton:** This section is relatively well preserved on specimens V5219, 1, 2, 6, 26. The notochord is unrestricted. Some specimens display traces of a calcified notochord sheath. Neural arches are short and broad. Neural spines are club-shaped, gracile, and long. Posterior to the dorsal fin the neural spines are fused with their opposing neural arches. The base of the neural arch is expanded into a triangle.

The anterior haemal arches are extremely small, elliptical in shape, and do not support haemal spines. Haemal arches become well developed anterior to the anal fin with their basal sections expanded into a triangle. Neural spines are gracile and long and fused to the dorsal side of the haemal arches. On the ventral caudal lobe, haemal arches and spines are expanded and directly support the lepidotrichia anterior to the ventral lobe (Plate I, Figs 1,2,8).

Scapula and pectoral fins: These are clearly observable on specimens V5219, 1, 12, and 23. The cleithrum is broad and robust and lacks distinct dorsal or ventral bifurcated regions. The supracleithrum is elongated with a lower border that contacts the dorsal margin of the cleithrum. The sensory canal of the supracleithrum traverses the posterodorsal portion of the plate.

The pectoral fin is relatively small, with approximately 20 lepidotrichia. The anterior two to three become gradually elongated with unbifurcated distal ends, though the remaining lepidotrichia display bifurcated termini. Lepidotrichia bifurcated nodes are three times the length of their breadth (Plate I, Figs. 1, 8).

Pelvic region and ventral fin: On the Type specimen and specimens V5219, 11 and 24 a bluntly rounded and linearly shaped bone is present in the pelvic region that has a length consistent with the length of the base of the ventral fin. Particularly noticeable on the Type is an impression of a bone in the pelvic region and an impression of ventral fin lepidotrichia. A pelvic bone and lepidotrichia of this nature have also been observed during dissection of the extant *Acipenser*.

Ventral fins are relatively well preserved on specimens V5219, 1, 3, 11, 18, 21, 24 where they are large and triangular, and reside directly between the pectoral and anal fins. The fin base is long and at most contains 41 lepidotrichia. The most anterior seven are gradually elongated and have completely bifurcated nodes with node length twice the node breadth. Distal ends are bifurcated. Radials are relatively short, broad, and thin plates. At most they attain 20 in number. They gradually shorten anteroposteriorly. The most anterior radial is particularly broadened. On specimen V5219, 11 radial impressions are preserved on both sides. The morphology, size and degree of ossification of the ventral fin radials are the same as the dorsal and anal fin radials (Plate I, Figs. 1, 4).

Dorsal fin: The initiation point is anterior to the midpoint of the total body length, or precisely opposite the posterior half of the ventral fin. It is relatively large and triangular with a long base and approximately 39 lepidotrichia and 22 radials. Bifurcated nodes initiate at the base. Node length is twice its breadth. The most anterior seven lepidotrichia gradually increase in length. Posterior lepidotrichia have bifurcated terminations. Radials are gracile and long with expanded club-shaped distal ends and slightly expanded proximal ends. Radials gradually shorten and thicken posteriorly. On the anterior base of the dorsal fin there is a large and long laminar shaped fulcrum. (V5219,13) (Plate I, Figs. 1, 8).

Anal fin: These are most clearly observed on specimens V5219, 1, 9, 2, where they are smaller than the dorsal and ventral fins. They are triangular with an initiation point posterior to the base of the dorsal fin. 34 lepidotrichia are present. Split nodes and split bifurcated nodes are twice the length of their breadth. Distal ends are bifurcated. Radial morphology of the 16 elements resembles that of the dorsal fin. At the initiation of the base of the anal fin there are a single large and single small elliptically shaped fulcrum (Plate I, Fig. 1).

Caudal fin: This fin is askew and deeply bifurcated. The dorsal lobe is slightly elongated with approximately 61 lepidotrichia. Split node bifurcations are twice the length of their breadth. Lepidotrichia first bifurcate at their midpoint and then bifurcate again at their terminations. At the anterior base of the caudal there is a single long and elliptical fulcrum that resembles the fulcrum at the base of the dorsal fin. Long and gracile scales are present along the entire lateral margin of the dorsal and ventral lobes. Opposing the ventral lobe are approximately ten haemal arches and expanded haemal spines (V5219, 11-2). “caudal inversion angle” is nearly 160° (Plate I, a, 5).

Scales: These are not well preserved but are observable on specimens V5219, 9, 13, 28. They are round with concentric and radiating striations. Rhomboid scales are only preserved on the dorsal caudal lobe.

**Comparison and discussion:** The Yumushan specimens described above may be undoubtedly assigned to the palaeoniscid Coccolipidae based upon the morphology of the maxilla, the completely inclined suspensory apparatus, structure of the mid-axial skeleton, fin pattern, the series of dorsal fin radials, rounded scales, and other aspects. Prior to this description, there were two genera in the Coccolepididae: *Coccolepis* and *Sunolepis*.

Although the Yumushan specimens resemble *Coccolepis* in the condition of the split and split bifurcated lepidotrichia nodes, morphology of the dentition, and size of the caudal inversion angle, these specimens differ distinctly by the relatively higher lepidotrichia count, a large otic capsule, a well developed pelvic bone, morphology of the subopercular, and lacking scales with projected tuberosities.

The Yumushan specimens resemble *Sunolepis* in their morphology of their mid-axial skeleton, morphology of the maxilla, and structure of the scales. However they clearly differ by their lack of a preopercular (antopercular), opercular slightly larger than subopercular, relatively short ventral caudal lobe, a large otic capsule, and well developed pelvic bone. Consequently the Yumushan specimens are recognized as a new genus within the Coccolepididae: *Plesiococcolepis hunanensis*. The genus etymology is derived from the specimens resemblance to *Coccolepis* and species etymology is derived from the province from which it was produced.

The Coccolipidae was erected by Berg (1940) based upon a single sequence of radials supporting the dorsal fin, lack of numerous lepidotrichia and their corresponding radials, and rounded scales. For a long time the family was represented by the single genus *Coccolepis*, which is distributed in Europe, Asia, and Australia. Persisting into the Middle Cretaceous, it is the last representative of the Palaeonisciformes in geologic history.

Dongshen Liu (1957) established the genus *Sunolepis yumenensis* based upon a relatively large morphotype recovered from the Jiuquan Basin of western Gansu Province. It differs from *Coccolepis* by its relatively large dorsal fin and correspondingly small anal fin, radials short and gracile, radial count lower than lepidotrichia count, small caudal inversion angle, large caudal fin bifurcation, and scales lacking projected tuberosities. In this manner the family Coccolipidae to date is represented by three genera with their age distribution spanning Early Jurassic to the Middle Cretaceous, and recovered from both marine and fresh-water basins. Currently, *Plesiococcolepis* is an East Asian form representing the earliest coccolepid.

In addition to the presence of a large amount of *Hengnania gracilis* and several *Plesiococcolepis* in the Yumushan fauna, there are a small amount of taxonomically distinct but incomplete specimens which are described below in order to facilitate the understanding of the Yumushan faunal composition and nature.....

(**Palaeonisciformes**)  
(**Coccolepididae**)

(Plate II, Fig. 1)

**Specimen number:** V5225. Field No.: Huang 4802-37-2.

**Specimen description:** A complete round scale impression.

**Locality:** Pit 4802, Huangnetang, Qiyang Co., Hunan Province.

The specimen's surrounding matrix consists of grey-black silt. The scale is small, elliptical, and thin, with a length of 2 mm and breadth of approximately 1.5 mm. It has upon it concentric and radiating striations in addition to tubercles. There are generally eleven concentric striations, while radiating striations are extremely compact and begin at the center of the scale and vanish at the points of the tubercles. Tubercles are slightly pointed at the end (posterior end). There is a shallow depression in the center of the scale.